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BEST OF CANADIAN Geographic



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WOLVES

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ALGONQUIN

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secrets of

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Contents

BEST OF 2017



30 TITANS of the Great Lakes

What's life like aboard the fast-paced freighters behind a multi-billion dollar business most of us never see?

By Ian Coutts with photography by Thomas Fricke
JULY/AUGUST 2017

38 HARVEY WANTS HALF

Harvey Locke, founder of the monumental Yellowstone to Yukon Conservation Initiative, talks about how Y2Y continues to evolve as it turns 20 and why the Nature Needs Half conservation edict is gaining momentum

Interview by Nick Walker
JANUARY/FEBRUARY 2017

44 RIVER OF THE ICE GRIZZLIES

Every fall in the northern Yukon, ice-covered grizzlies gather to feast on salmon spawning in the Fishing Branch River

Photography by Michelle Valberg
with text by Michela Rosano
SEPTEMBER/OCTOBER 2017

52 'LISTEN TO WHAT THE LAND WANTS, LISTEN TO WHAT THE LAKE WANTS, LISTEN TO WHAT THE ANIMALS WANT.'

How the Sahtuto'ine Dene of Délaine created the Northwest Territories' Tsá Tué Biosphere Reserve, the world's first such UNESCO site to be managed by an Indigenous community

By Laurie Sarkadi with photography by Angela Gzowski
JANUARY/FEBRUARY 2017

58 THE CALL OF ALGONQUIN

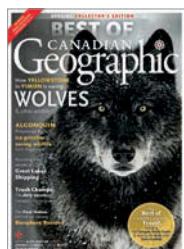
A celebration in words and pictures of Canada's oldest provincial park

Photography by Megan Lorenz
with text by Roy MacGregor
JANUARY/FEBRUARY 2017

ON THE COVER

The alpha male of the wolf pack that ruled the upper Bow Valley in Banff National Park from 2009 to 2014. Photo by John E. Marriott.

JANUARY/FEBRUARY 2017



Contents

BEST OF 2017



18

64 TRASH NATION

Canada leads the developed world in per capita production of garbage. An exclusive investigation into the country's dirtiest secret.

By Charles Wilkins with illustrations by Guy Parsons

MAY/JUNE 2017

72 BIODIVERSITY APOCALYPSE

An estimated annual \$175-billion business (and growing!), the illegal trade in wildlife is the world's fourth-largest criminal enterprise. It stands to radically alter the animal kingdom.

By Leslie Anthony with photography by Peter Power
SEPTEMBER/OCTOBER 2017

80 PLACE OF SPIRITS

A glimpse into the stunning Torngat Mountains National Park, and how a unique cooperative management approach between local Inuit and Parks Canada enriches the experience.

By Andrew Findlay with photography by Pat Morrow
CANADIAN GEOGRAPHIC TRAVEL SPRING 2017

86 ASTRONAUT MEETS ARCTIC

Insights on Canada's Far North from the country's most famous spaceman, Chris Hadfield

Interview by Alexandra Pope

with photography by Paul Colangelo

CANADIAN GEOGRAPHIC TRAVEL SUMMER 2017

92 ISLANDS OF THE PEOPLE

Celebrating the magnificent sights of Haida Gwaii, B.C.

Photography by Javier Frutos

with text by Nick Walker

CANADIAN GEOGRAPHIC TRAVEL SUMMER 2017

8 BIG PICTURE

Celebrating Canada's grandeur

12 EXPOSURE

Showcasing Can Geo's photo club

14 IN A SNAP

Sharing Can Geo via Instagram

DISCOVERY

17 INTERVIEW

Artist Alex Janvier shares insights into his latest masterpiece

18 WILDLIFE

Belugas, birds, butterflies, Sable Island horse safety, salmon-snacking bears, salamander sanctions and more

20 HISTORY

Historical maps of early Ottawa show a rapidly changing capital, and the story of an obsessive search for the blue goose's breeding grounds

22 PLACE

A unique way to explore Montreal's history during its 375th anniversary, and eight settlements in Alberta that are still the only recognized Métis land base in Canada

24 INFOGRAPHIC

The Canadian technology steadyng the world's skyscrapers, and how Canadian scientists are unlocking the secrets of an insect-killing fungus that could help grow healthier crops

26 ON THE MAP

Exploring cartography

98 OUR COUNTRY

Canadian comic book hero Johnny Canuck reminisces about his first encounter with the northern lights, and Cree singer-songwriter Buffy Sainte-Marie reflects on Saskatchewan's beautiful Qu'Appelle Valley



digital

CONTENTS

BEST OF CANADA 150

From a corn maze map of Canada to a coast-to-coast-to-coast expedition, check out some of the cool, creative and crazy ways Canadians celebrated the 150th anniversary of Confederation.

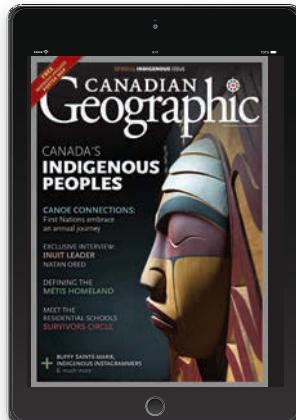
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ALONE ACROSS THE ARCTIC

In mid-September, explorer Adam Shoalts completed his boldest expedition yet: a four-month, 4,000-kilometre trek across the Canadian Arctic — completely alone. Read our exclusive interview with Shoalts about his adventure.

cangeo.ca/best17/shoalts



WILD WAYS

This year, we celebrated the protection of Lancaster Sound, probed the troubling deaths of endangered right whales and bid a sad farewell to the famous Banff grizzly Bear 148. Read these and other top wildlife stories from 2017.

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EDITOR'S NOTEBOOK



A great year

WHAT A CELEBRATION! Throughout 2017, many Canadians feted the nation's sesquicentennial. The 150th anniversary of Confederation gave us the opportunity to reflect on and salute the best parts of Canada's history — from a nation-building railway to a national coming-of-age during the First World War to our place in the modern world as one of the planet's most envied countries, to name but a few highlights.

Canadian Geographic honoured the anniversary by dedicating each 2017 issue to a different theme of importance to Canada and its readers: January/February to protected areas; March/April to the North; May/June to urban communities; July/August to Canada generally; September/October to wildlife; and November/December to Indigenous Peoples.

Now, as the year winds down, we want to celebrate Canada 150 in one last way: by collecting the best of our 2017 stories in one magazine. Think of it as a snapshot of exactly what our country is and where we're at as a nation. The result is in your hands.

From "Titans of the Great Lakes" (page 30), the feature revealing secrets of a big-business shipping industry, to "Listen to what the land wants..." (page 52), which details the creation of the Tsá Tué Biosphere Reserve, the world's first such UNESCO site managed by an Indigenous community, this special collector's edition covers the gamut of the most interesting, important and spectacular parts of our nation. Revel on. ☀

—Aaron Kylie



To comment, please visit cangeo.ca or email editor@canadiangeographic.ca.



For inside details on the magazine and other news, follow editor Aaron Kylie on Twitter (@aaronkylie).

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Founded in 1929, the Society is a non-profit educational organization. Its object 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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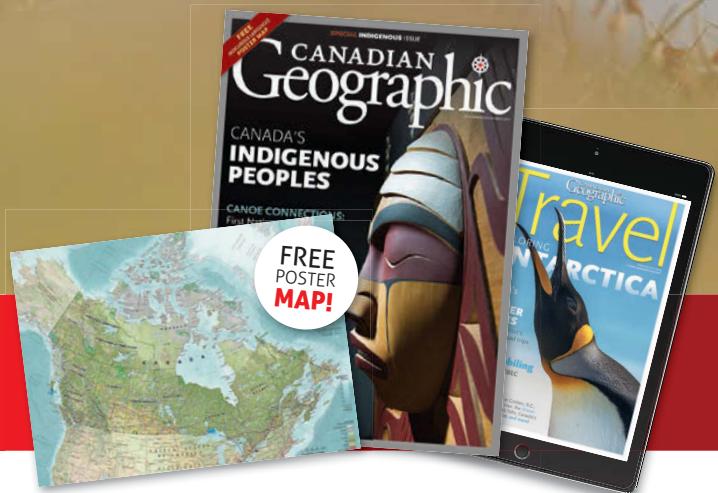
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* OFF COVER PRICE PHOTO: MEGAN LORENZ/CAN GEO PHOTO CLUB

PHOTO BY "JENNY" JANET STEVENS

A grizzly rests on a bed of sedge in the Khutzeymateen Grizzly Bear Sanctuary, B.C. From the Coast Tsimshian peoples' word *K'tzim-a-deen*, Khutzeymateen translates to "sheltered place of fish and bears." Founded in 1994, the refuge is co-managed by the province and local First Nations.



This picture appears on a coin in the Royal Canadian Mint's Celebrating Canada's 150th series. In collaboration with the Mint, *Canadian Geographic* sourced images for the 13-coin set. For more information, visit mint.ca/canadiangeographic.





big picture

CELEBRATING CANADA'S GRANDEUR



PHOTO BY MISSY MANDEL

Peyto Lake in Alberta's Banff National Park—the nation's busiest—is much photographed thanks to its distinctive turquoise hue. Suspended particles of glacial rock flour lend the lake its brilliant colouring.



This picture appears on a coin in the Royal Canadian Mint's Celebrating Canada's 150th series. In collaboration with the Mint, *Canadian Geographic* sourced images for the 13-coin set. For more information, visit mint.ca/canadiangeographic.



exposure

SHOWCASING CAN GEO'S PHOTO CLUB

PHOTO BY GARY CUMMINS

A child runs along the exterior of Toronto's Aga Khan Museum on a chilly day in early April. The museum, designed by acclaimed Japanese architect Fumihiko Maki and opened in 2014, is home to collections celebrating centuries of Muslim artistic, intellectual and scientific heritage.



This image won the "Urban Canada" category in *Canadian Geographic's* 31st Annual Photo Competition. See the other winners at annual16.canadiangeographic.ca.



PHOTO BY YI JIANG

Even with Emerald Lake Lodge aglow in British Columbia's Yoho National Park, the stars are bright enough to reveal 2,696-metre Michael Peak on this cold night in 2016. Just three kilometres east of Emerald Lake lies the Burgess Shale, a rich Cambrian-period fossil bed considered one of the most — if not the most — significant fossil finds ever made (see page 50 for more on these fossils).



This image won the Canadian parks category in *Canadian Geographic's* 31st Annual Photo Competition. See the other winners at annual16.canadiangeographic.ca.



in a snap

SHARING CAN GEO VIA INSTAGRAM



@jesse.tamayo Jesse Tamayo
Peyto Lake, Banff National Park, Alta.



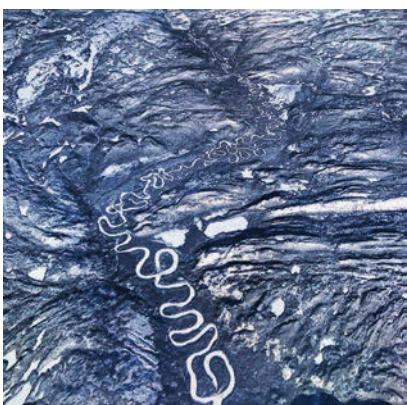
@josianestcoeur Josiane St-Coeur
Hopewell Rocks, N.B.



@_steve_neufeld_ Steve Neufeld
View from Natural Bridge, Yoho National Park, B.C.



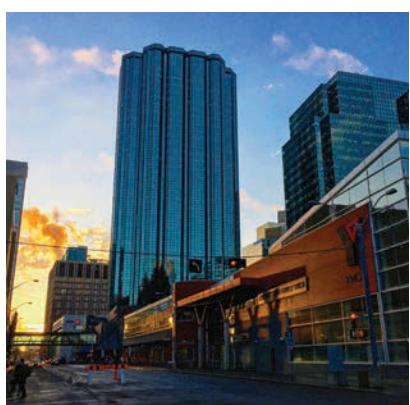
@raymondjtaylor R.J. Taylor
Yukon Cinema Centre, Whitehorse



@julianocruz Juliano Da Cruz
Aerial view of Labrador, near Rigolet



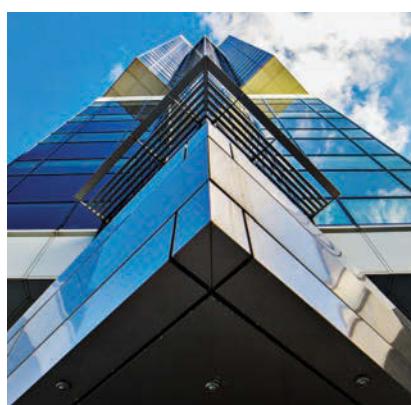
@langdon_eric Eric Langdon
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Sunrise on 102 Avenue, Edmonton



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Gardiner Expressway, Toronto



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St. Martins Sea Caves, Fundy Biosphere Reserve, N.B.



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Double rainbow over the Wind River, Yukon



@not.just.another.matt Matthew Schwab
Hot-air ballooning over Saskatoon



@bradjames_photography Brad James
Woodland caribou, near Terrenceville, N.L.



@kevinandsheryl.wildlife Kevin Minnett
Grizzly bears, Banff National Park, Alta.



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Harbour seal, Victoria



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Hereditary chiefs, Wet'suwet'en First Nation, B.C.



@trishab223 Patricia Bourque
Traditional Mi'kmaq dancer, Cavendish, P.E.I.



@photolaliberte Amanda Laliberte
St. Michael's Indian Residential School, Alert Bay, B.C.



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INTERVIEW

Alex Janvier

The renowned artist and master of the circle painting discusses his life and works

INTERVIEW BY AMBER BRACKEN

The art world of the mid-20th century was no welcoming space for young Indigenous artists — even those as prodigiously talented as Alex Janvier. Yet nearly 70 years since he first used a brush, the Alberta-born painter is considered a founder of contemporary Indigenous art. The National Gallery of Canada celebrated Janvier with a major retrospective in 2016 and early 2017, and his newest creation, *Thirteen Moons*, was exhibited at Ottawa's 50 Sussex Drive (The Royal Canadian Geographical Society's new headquarters) last summer. Here, he explains the significance of the work and the continual growth of his art.

On the symbolism of *Thirteen Moons*

It's about the way our nations, the native people, keep track of the years. It follows the cycle of the moon: 13 times the moon comes over in the year, and that was how natives demarcated their time and space. Maybe this can be a form of healing for

native people because, like a lot of other stuff, the 12-month calendar was foisted on us. We were never asked about how we kept time. I've talked to elders about the old wisdom, and they think those things need to be revisited. This painting tells me what I've missed out on, the native way of thinking.

On the circular canvas

I think the circle is really the best form. The moon is a circle; the sun is a circle; the natives have always used four directions, moved in a circular way. Our whole system is in circular motion. I'm trying to address life on Earth as it is. Most paintings are done in rectangles, but I do a lot of circles because I was given this space and I'm living in it for the time being. I believe that's where my heart has come from, from the land, from the sky, and I look at them as the great influences of my life and the base of my art.

Alex Janvier, a pioneering force in contemporary Indigenous art, is known for his organic, intricate, abstract style and circular paintings.

On how his upbringing shaped his art

When I was a child, every time there was a rain and the ground was nice and smooth, I would take a stick and draw on it. That's our natural slate. I did all kinds of drawings of what was around me. Once I drew a horse breeding, and my sister ran home and tattled on me. But when my dad came he just shook his head, smiled and walked away.

Art doesn't just come from the physical, though; there's the spiritual aspect of life on Earth. We're all tuned to it one way or another, and I believe that's the part that has given me the strength to carry through. I managed to survive because of the strength of the beliefs that my parents gave me before I was forced into a residential school for 11 years. But the good thing that I got out of it was that I was able to do artwork with good materials. There's always a good side and a bad side if you want to make it that way. ☺

DISCOVERY

WILDLIFE



17 square kilometres

The size by which Toronto's Rouge National Urban Park is set to increase after MPs approved Bill C-18 in February. "We're talking about a national park that is 21 times the size of Central Park in New York where we'll be protecting the ecosystems, as well as wildlife, and where working farmers will continue to grow crops," Catherine McKenna, minister of environment and climate change and the bill's sponsor, told the CBC after the bill passed.



POLLINATOR PATCHES

A key element of the Butterflyway Project, which aims to establish these tracts of wildflowers, plants and shrubs in five Canadian cities to help provide food and shelter for butterflies and bees. The David Suzuki Foundation is behind the initiative, which started in March and April in Victoria, Richmond, B.C., Toronto, Markham, Ont., and Montreal.

12

The number of years the Vancouver Aquarium's new on-site beluga whale conservation program will last. The program will centre on a small group of non-breeding belugas that will "participate in an expanded Marine Mammal Research Program," said the aquarium in a news release. Two beluga whales died of unexplained causes at the aquarium in November 2016. The aquarium said it intends to discontinue its beluga display and the on-site program by the end of 2029.



'MAKING A GLASS BUILDING COMES WITH RESPONSIBILITIES TO THE BIRDS.'



Jennifer Mallard, the lead architect on a project to renovate the National Arts Centre in Ottawa, tells the CBC that the building's new glass facade has been designed to deter birds from crashing into it. Mallard told the CBC that she and her team have created bird-safe glass that's a "custom-tailored recommendation for the NAC" and based on mandatory guidelines used by the city of Toronto.

THE GOOSINATOR

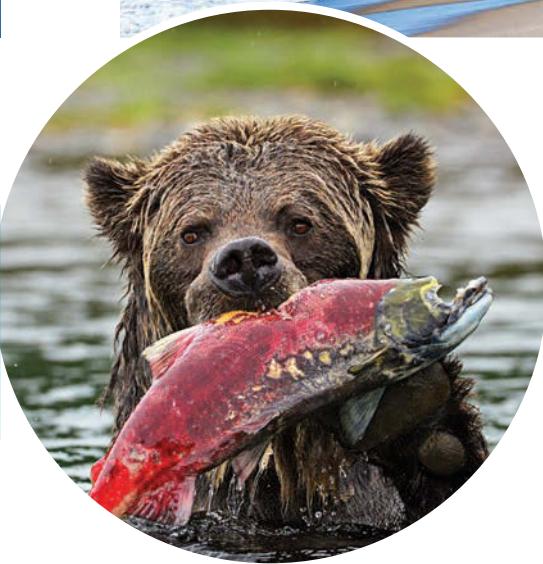
The name of a 91-centimetre-long motorized propeller-nosed contraption that glides through the water on foam skis, scaring nuisance Canada geese away from green spaces in Denver, Colo. "If you go at them too fast, they recognize it as a human machine, so you stalk and herd them slowly, like a predator," Randy Clausen, the machine's inventor, told the *Los Angeles Times*. "There's a lot of psychology at work here."



Read more about each of these stories at
cangeo.ca/mj17/wildlife.

Not horsing around

As claims to fame go, being able to say you helped create a device designed to keep the renowned horses of Sable Island wild isn't a bad one — especially if you're barely into your teens. That's what a group of students from Halifax's Oxford Junior High School did when they built the Animal Deterrent System, which uses pressure sensors and high-frequency sound to keep the horses away from humans and buildings on the island. The group and their Dalhousie University mentors hope to meet with Parks Canada to discuss using a prototype of their invention.



'Devourer of salamanders'

The translation of *Batrachochytrium salamandrivorans*, the skin-eating fungal disease that has devastated populations of salamanders in Europe and that prompted Canadian officials to announce new rules last May that would "prohibit the import into Canada of every salamander species, unless authorized by a permit, for a period of one year," Maclean's reported.



'It's like CSI, but for bears.'

Megan Adams, the lead author of a new study that examined and mapped the long-term salmon-eating habits of black and grizzly bears in British Columbia, describes to the CBC the process of collecting tufts of bear hair from barbed-wire corrals. The study identified precisely where more than 1,400 bears fed on salmon and found that, overall, grizzlies ate more salmon than black bears.

Loke

The nickname of the great cormorant used in a recent study that showed the animal can hear under water — the first time researchers have documented the ability in a marine bird. Scientists from the University of Southern Denmark showed that Loke was able to hear sounds at a frequency between one and four kilohertz — the same range as cetaceans.



29,848

The number of species assessed for *Wild Species 2015: The General Status of Species in Canada* report, the most recent version of which was published in June. The report, which the Species at Risk Act requires to be published every five years, found that 80 per cent of the species assessed are secure and 20 per cent are at some level of risk of extinction.



Read more about each of these stories at cangeo.ca/so17/wildlife.

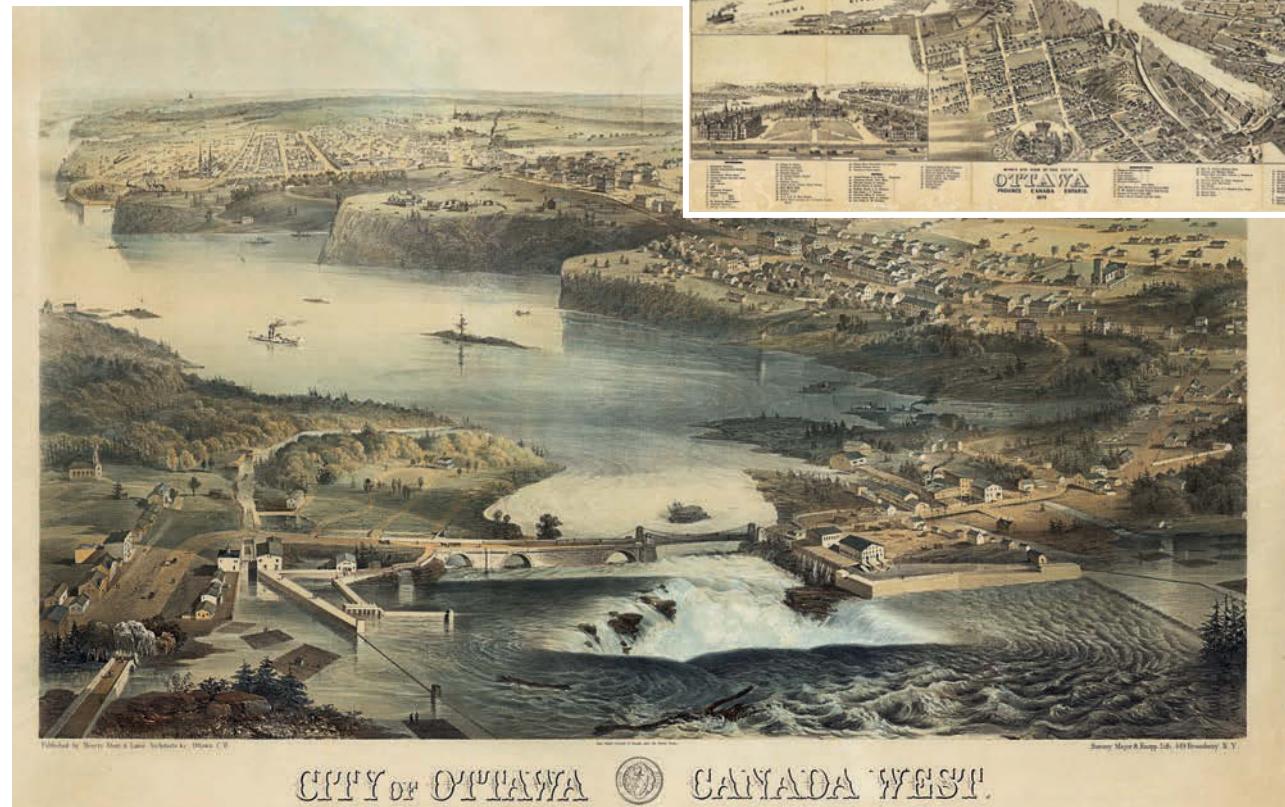
DISCOVERY

HISTORY

A tale of two cities

Bird's-eye-view maps of Ottawa show how the capital evolved over a 17-year period

By Harry Wilson*



LEFT: CITY OF OTTAWA, CANADA WEST, MESSRS STENT & LAYER, CA. 1859, LIBRARY AND ARCHIVES CANADA, ACC. NO. R11188.3, E011154421 V8; RIGHT: BIRD'S EYE VIEW OF THE CITY OF OTTAWA, PROVINCE OF CANADA, CHARLES SHOBER & CO., 1876, LIBRARY AND ARCHIVES CANADA, NO21081 KV.

PERSPECTIVE, goes the hoary cliché, is everything.

It's certainly true of cartography, a practice rife with examples of map-making malfeasance both purposeful and ignorant, whether it was Britain's ham-fisted demarcation of the India-Pakistan boundary in 1947 or the multiple maps that from the 1500s to the late 1800s illustrated the misguided theory of an open polar sea in the Arctic.

More often than not, though, perspective is a subtle thing when it comes to cartography, shifting over time and with the ebb and flow of history.

Take the two bird's-eye-view maps of Ottawa shown here.

The larger map is believed to have been created in 1859, four years after the settlement once known as Bytown was incorporated as a city, a mere two years after Queen Victoria had named it the capital

of what would become Canada and the very year the construction of the Parliament Buildings began (they're not shown on this map but are included on a later version). Auspicious events, yes, but they belie how Ottawa was still largely a rural place, albeit one with a burgeoning lumber-and-sawmill trade at the centre of its economy. No wonder the Ottawa River and swirling froth of Chaudière Falls, the two natural linchpins of the business, are the foreground focal point of this map.

The smaller inset map, however, tells a very different story of Ottawa. It depicts an 1876 version of a city where the lumber-and-sawmill infrastructure has grown — no fewer than eight "manufactories" related to the industry are shown — but is no longer the literal focus, as it was of the 1859 map. Instead, the Parliament Buildings dominate, as they very likely had done for many

Ottawans since opening a decade earlier, almost a year before Confederation.

Now, 150 years after that event, Ottawa continues to evolve in ways that would astonish the citizens who trod and trundled its streets more than a century ago, whether it's the construction of the light-rail network inching its way across the city, the soon-to-be completed glittering glass facade of the National Arts Centre or the expanse of suburban communities such as Kanata. What the capital will look like in another 150 years will no doubt be equally as surprising. ☀

*with files from Erika Reinhardt, archivist, Library and Archives Canada

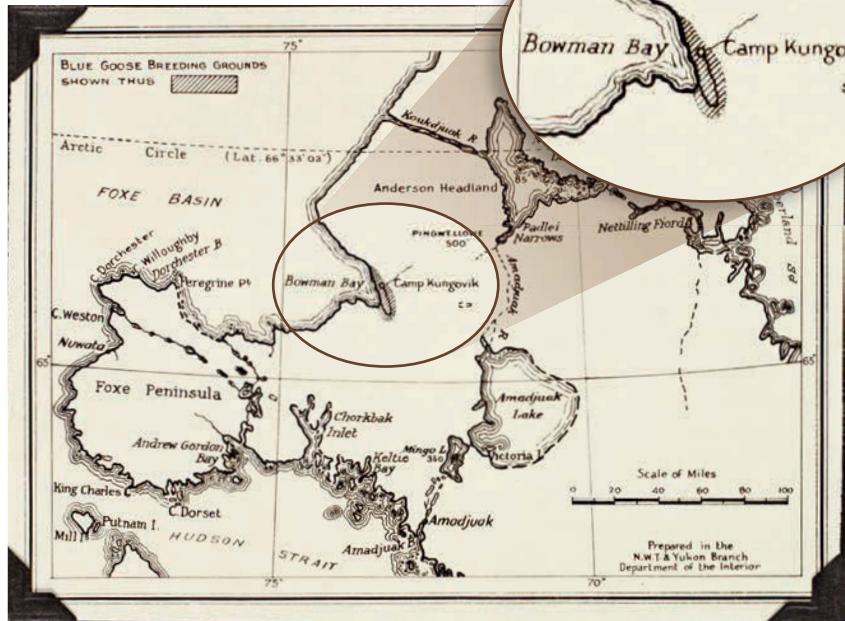


See a bird's-eye-view map of Winnipeg and read novelist Miriam Toews' essay about the city at cangeo.ca/mj17/winnipeg.

Search for the blue goose

The story of J. Dewey Soper's dogged pursuit of an ornithological mystery

By Joanne Pearce*



IT MAY BE TEMPTING to call J. Dewey Soper's search for the breeding grounds of the blue goose a wild you-know-what, but that groan-worthy quip would be a gross mischaracterization. After all, during his six-year, 50,000-kilometre odyssey, the Canadian naturalist tracked down and pinpointed a location that had long confounded ornithologists across North America.

The map above shows the site of the bird's breeding grounds, which Soper located on the southwest coast of Baffin Island in 1929 — but it doesn't tell the whole story.

Soper began his search for the blue goose (a colour variant of the lesser snow goose) in 1923, when he joined a federal government expedition to the eastern Arctic, visiting Greenland and Ellesmere, Devon and Baffin islands. "I resolved then," he wrote in a 1930 issue of *The Canadian Field-Naturalist* of his quarry, "to devote myself to the discovery of the Blue Goose nesting grounds insofar as I was empowered to do so."

Over the next three years, the last two of which were spent on another expedition to Baffin Island, Soper followed every lead he could unearth, to no avail. By the end of the winter of 1925-26, during which he'd travelled more than 1,600 kilometres across the island improving maps, collecting wildlife samples and speaking with Inuit about the blue goose, he remained stumped. "After a personal residence of nearly two years in the country," he wrote, "the species remained almost as great a mystery as before."

But he was getting closer.

In the summer of 1926, two Inuit in Cape Dorset told Soper the birds nested around Bowman Bay, about 200 kilometres to the northeast. It was too late in the season for Soper to investigate, however, and he didn't return until the summer of 1928, this time at the behest of the Northwest Territories and Yukon Branch of the Department of the Interior. By mid-May 1929, armed with a map of breeding grounds drawn the previous fall by an Inuk named Saila, Soper and five Inuit were heading to Bowman Bay

J. Dewey Soper (TOP) located the breeding grounds of the blue goose in 1929 and years later painted them in watercolour (ABOVE).

by sledge. About a month later and not far from their camp, which they'd named *Kungovik* — Inuktitut for blue goose — Soper and two of his Inuit companions found what they'd been searching for: blue goose nests and eggs.

Accounts of Soper's success appeared in newspapers and *Ripley's Believe It or Not!*, but in 1957 the Canadian government immortalized "Blue Goose Soper," as he'd become known, in a way that seemed more fitting: by establishing the Dewey Soper Migratory Bird Sanctuary on Baffin Island, today home to the largest known lesser snow goose colony in the world. Ⓢ

*with files from Erika Reinhardt, archivist, Library and Archives Canada



See the map of the blue goose breeding grounds that the Inuk Saila drew for Soper in 1928 at cangeo.ca/so17/bluegoose.

Bright lights, big history

Montreal chronicles 375 years with *Cité Mémoire*

By Andrew Gunadie and Harry Wilson



Cité Mémoire's projections include Joe Beef's Funeral (LEFT) and the tale of Marie-Josèphe Angélique, a black slave tortured and hanged for arson in 1734 (ABOVE).

IMAGINE STROLLING the narrow streets of Old Montreal on a warm spring evening, turning a corner and seeing Rocket Richard. Or Jackie Robinson. Or Éva Circé-Côté, the outspoken feminist, poet and journalist. Or the unnamed military drummer who in 1648 became New France's first executioner.

Now imagine seeing these and a host of other notable denizens of the city not as costumed performers cajoling passersby to part with their pocket change, but writ large, chapters of their lives projected onto everything from building walls and the cobblestones beneath your feet to the side of a clock tower and the trees that line the old port.

It might sound like a flight of fancy, but Montreal has made bringing its history to life a reality with *Cité Mémoire*, a spellbinding urban multimedia experience that takes the staid audio-guide concept and cranks it up a few big notches to help celebrate the city's 375th anniversary.

Created by Michel Lemieux and Victor Pilon in collaboration with Michel Marc Bouchard, *Cité Mémoire* showcases a range of milestones and people — some well-known, others less so — in Montreal's history. "We wanted to spark the imagination and awaken the curiosity of people walking in the street about the city's history," Lemieux says of the project, which started in May 2016. "We all think that history is a dusty book, something boring that we don't want to look at. But we wanted to inspire people to become modern-day *flâneurs* and see that they are a part of history, one link in its chain."

Lemieux says emotion is a key part of forging a connection between the past and present. "We see some crucial moments in the city's history, such as the burning of Parliament in 1849, through the eyes of the people that were there. Their emotions really help link people to our history. Our ancestors, after all, had the same kinds of emotions we do."

Stumbling across any one of the 23 nocturnal tableaus once they're activated after dusk (or upon one of three additional interior-only projections added last summer) can be a pleasant surprise, but a richer experience is available through the Montréal en Histoires-*Cité Mémoire* app, which supplies a soundtrack and additional context in English, French, Spanish or Mandarin for each projection to Apple and Android smartphones or tablets.

Mixing history and technology this way makes for an immersive, intimate experience, says Lemieux. "The most intimate object nowadays is our cellular phone; it has all my contacts, all my secret codes, all my messages, all my photos. And when you use the phone to hear what those giant characters are saying, it's like they're whispering their secret thoughts to you." ☀

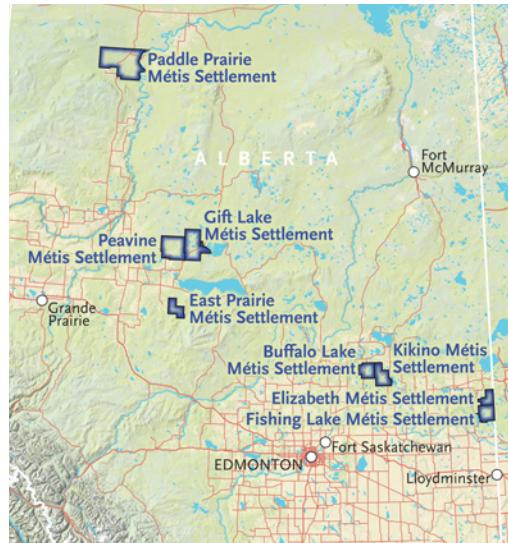


Watch YouTube star Andrew Gunadie (a.k.a. Gunnarolla) experience the sights and sounds of Montreal's *Cité Mémoire* at cangeo.ca/mj17/montreal.

Land of their own

Eight settlements in Alberta are still the only recognized Métis land base in Canada

By Stephanie Cram



Harold Blyan, the vice-chairman of Alberta's Buffalo Lake Métis Settlement, looks out over the water near his home.

THERE ISN'T MUCH to see along the stretch of Highway 855 about 150 kilometres northeast of Edmonton other than trees, tarmac and a sign welcoming you to a type of community that doesn't exist anywhere else in Canada but Alberta.

"Welcome to the Buffalo Lake Metis Settlement," it says, with no mention that along with seven other settlements scattered across northern Alberta — East Prairie, Elizabeth, Fishing Lake, Gift Lake, Kikino, Paddle Prairie and Peavine — it makes up the country's only recognized Métis land base, which with an area of 512,121 hectares is only slightly smaller than Prince Edward Island.

That this is the case would probably surprise most Canadians, given the prominence of Manitoba and Saskatchewan (site of the Red River and Northwest resistances, respectively) in Métis history. But it's Alberta and not its Prairie siblings, British Columbia, the Northwest Territories or Ontario (all of which are considered part of the Métis homeland) that has set aside land for a people who have long been without any.

At the beginning of the 20th century and in the wake of the failed Northwest Resistance of 1885, Métis across the Prairies had trouble finding a place to call home. They weren't permitted to live on First Nation reserves, and many felt they didn't belong in cities. They resorted to squatting on Crown land set aside for roads and railways, creating makeshift settlements known as Road Allowance communities. Recognizing that the living conditions in these communities were not ideal, in 1938 the government of Alberta passed the Métis Population Betterment Act, which set aside land for Métis.

The settlements helped preserve the traditional Métis way of life, which includes hunting, fishing, trapping and berry picking, says Gerald Cunningham, president of the Metis Settlements General Council, the governing authority for the eight communities and the body that holds the title to the land (an arrangement unlike the one between First Nations and the Crown, which holds title to reserve lands).

Even though the eight settlements remain connected through the council,

Cunningham says the history of each is unique. Buffalo Lake, for instance, was established in 1951 with the intent to provide land for Métis veterans of the First World War and Second World War.

Since then, Buffalo Lake has come a long way. Harold Blyan, vice-chairman of the community's council, recalls arriving as a four-year-old with his family in 1966. "There was just one gravel road, which came in from Caslan," he says. "From there, there were just wagon trails that went out in different directions."

Blyan says that living in Buffalo Lake now is no different than city living — "We have Wi-Fi and cable TV," he jokes — but he and his fellow Métis know that the settlements are about much more than modern conveniences.

"Without land, you will never have local autonomy and self-reliance," says Cunningham. "Without land, you won't have a place you can call home." ☀

See an interactive map of all eight Métis settlements in Alberta at cangeo.ca/nd17/settlements.

Sway solution

The Canadian technology steadyng the world's skyscrapers

By Nick Walker

TBy March, Toronto had already recorded two days in 2017 with 100 km/h winds. And when gusts that powerful buffet a city, there are condo owners and office workers who feel the sway. In some skyscrapers, the movement is imperceptible, but the worldwide trend of building ever higher and slenderer adds to the potential for oscillations of several centimetres on either side of centre. It's not dangerous, but it can be dizzying.

"Every building has a natural frequency in the wind," says Trevor Haskett, senior technical director and vibration control expert with Guelph-based engineering firm RWDI. "You can reduce the movement by altering aerodynamic form or adding mass, but that can be undesirable or costly."

Instead, developers from Manhattan and Chicago to Taipei and the Middle East are increasingly calling on RWDI to create damping systems that curb windy-day swinging. For buildings with long oscillations and limited space, a steel or concrete "tuned mass damper" (TMD) such as the one shown here, is often the best fit. Read on to find out how RWDI's massive, moving counterweights cut down skyscraper drift.

INSTALLATION Pistons, spring mounts and cables allow the TMD, mounted in the building's highest storeys, to respond passively to sway. No electricity or network connection is required.

TUNING TMDs are "tuned" to match a building's specific frequency of oscillation, countering the structure's energy with their own for the same period of time.

HOW IT WORKS When winds blow and the building drifts, the TMD shifts freely (in the opposite direction of each sway) pulling the tower back toward equilibrium and reducing the wind's effects by 40 to 50 per cent.

SHAPE Bigger sway, heavier counterweight — but *shape* depends on available space. The spherical steel TMD shown below is based on the 728-tonne design in Taipei 101, a 508-metre skyscraper. RWDI also designs huge sloshing liquid dampers.

SWAY If this 325-metre concept building didn't have a damping system, a once-in-10-years windstorm with gusts of 150 km/h could rock its top more than 20 centimetres in each direction.



THE SPECS New York's TMDs range from 250 to 800 tonnes and cost \$2 million to \$4.5 million (less than a luxury condo). RWDI has yet to install a TMD in Canada but recently completed a concept analysis for a Toronto building calling for a 1,000-tonne system — heavier than two fully loaded 747-8 jumbo jets.



Root wars

Canadian scientists are unlocking how an insect-killing fungus could be used to grow healthier crops

By Nick Walker

In the first few centimetres of topsoil, a battle for nutrients is raging that's bred a surprising alliance between plants and *Metarhizium* — a common but deadly "entomopathogenic" (insecticidal) fungus that grows at their roots.

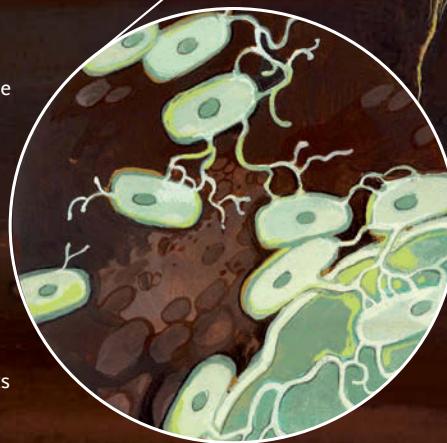
Because all 12 varieties of *Metarhizium* kill, mummify and feed on soil-dwelling, potentially destructive insects, agricultural companies mass-produce it as a biopesticide for use on crops. In 2012, however, researchers at Brock University in St. Catharines, Ont., discovered it also naturally fertilizes the plants above by feeding them nitrogen from insects' bodies. "That ecological aspect of *Metarhizium* was ignored for a long time," says Larissa Barelli, part of the Brock team studying the fungus. "We needed to know more about how it interacts with plant systems." And their work is still showing how much there is to learn: in 2017, they proved that the relationship is symbiotic — the plants give back. Here's how.

GLOBAL FUNGUS *Metarhizium* has a worldwide distribution and broad tastes. The variety tested by the Brock team, *M. robertsii*, alone infects more than 200 insect species, including moth larvae and beetle grubs (but is harmless to humans, bees and other animals). "If it's soil-dwelling, it's pretty much a target," says Barelli.

NITROGEN NEEDS Plants can't absorb nitrogen in its abundant atmospheric form, so it must somehow be "fixed" (bound to other chemicals). *Metarhizium* sucks usable nitrogen (**N**) from poisoned insects and pumps it into the roots. In return, the plants send down photosynthates — sugary, high-energy carbon compounds (**C**).

DOES THIS LOOK INFECTED?

Microscopic *Metarhizium* spores in the topsoil germinate when they make contact with an insect. They inject themselves through the bug's outer membranes and start growing rapidly, stealing nutrients and releasing toxins. The host dies in about five days and is then cocooned in spores and mycelia (masses of threadlike, nutrient-moving hyphae) that extend outward to form networks connecting the fungus and plant roots.



GREEN POWER *Metarhizium* strains have been tweaked to create more virulent, faster-working biopesticides often since the early 1900s. Brock's research is instead looking at how the fungus's natural role in the carbon and nitrogen cycles could also be harnessed — and at how widespread commercial fertilizers might be disrupting this beneficial plant-fungus relationship.



Teachers! Bring these and other science innovations into your classroom by visiting cangeoeducation.ca/resources.

on the map

EXPLORING CARTOGRAPHY

To preserve and protect

All of Canada's protected areas
on one map

BY NICK WALKER

When Prime Minister John A. Macdonald insisted in 1885 that the newly discovered Banff hot springs be kept out of private speculators' hands so the government could "frame such regulations as will make the springs a respectable resort," his reasons for establishing Canada's first protected area were purely commercial. Nevertheless, the stage was set for the addition of numerous nature reserves left "unimpaired for future generations," as the 1930 National Parks Act put it, and ecological integrity became the cardinal rule a few decades later.

As of January 2017, Canada's total network of more than 7,500 protected areas covers the equivalent of 11.5 per cent* of the nation's landmass — an area the size of Spain and France combined — with more added every year.

Outlined on this map[†], these areas fall into six main categories between I (strict nature reserves) and VI (protected areas with sustainable use of natural resources), as defined by the International Union for Conservation of Nature. More than 95 per cent of these national and provincial parks, wildlife areas, migratory bird sanctuaries, forest conservation reserves, marine reserves, privately owned natural areas and other land designations fall in categories I to IV, meaning no harvesting, mining or development is permitted.

Of Canada's provinces and territories, Nunavut (the largest by around half a million square kilometres) has the lion's share of the country's protected areas (21.4 per cent, covering 11.7 per cent of the territory), many of them spacious reserves such as the Queen Maud Gulf Migratory Bird Sanctuary and Quttinirpaaq National Park. Like Western Canada's and Labrador's mountain landscapes, intact Arctic wildernesses are well suited to conservation, while other regions, such as New Brunswick and Prince Edward Island, are smaller, more widely developed and heavily agricultural, resulting in a low ratio of protected land area.

Starting in the 1990s but especially as a key component of the Liberal government's platform

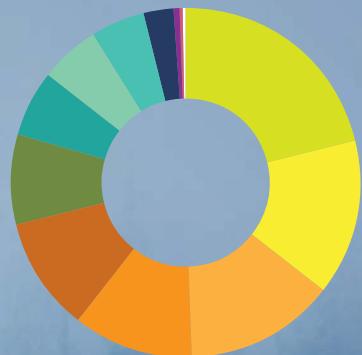
PROTECTED TERRESTRIAL

PROTECTED MARINE



since 2015, marine conservation is now in the spotlight. Given that Canada's current marine protection — including the ocean and Great Lakes portions of coastal terrestrial parks — adds up to 65,000 square kilometres (1.3 per cent of the nation's marine area), the addition this year of potentially more than 100,000 square kilometres in the Arctic Ocean's Lancaster Sound will go a long way in helping the feds reach their target of five per cent before the end of this year and 10 per cent by 2020. ☀

Share of Canada's protected area



- NUNAVUT | 21.4%**
Covers 11.7% of territory
- QUEBEC | 14.3%**
Covers 10.6% of province
- BRITISH COLUMBIA | 13.9%**
Covers 16.8% of province
- NORTHWEST TERRITORIES | 11.1%**
Covers 9.5% of territory
- ONTARIO | 10.5%**
Covers 11.2% of province
- ALBERTA | 8.4%**
Covers 14.5% of province
- MANITOBA | 6.3%**
Covers 11.2% of province
- SASKATCHEWAN | 5.5%**
Covers 9.7% of province
- YUKON | 5%**
Covers 11.9% of territory
- NEWFOUNDLAND & LABRADOR | 2.6%**
Covers 7.3% of province
- NOVA SCOTIA | 0.8%**
Covers 16.4% of province
- NEW BRUNSWICK | 0.3%**
Covers 4.7% of province
- PRINCE EDWARD ISLAND | 0.01%**
Covers 3.3% of province

*Statistic includes marine protected areas and marine portions of terrestrial protected areas.

†Protected areas smaller than roughly 0.5 square kilometres are not visible at this scale.



See an infographic comparing the protected area of the provinces and territories at cangeo.ca/jf17/protected.

Living languages

Where Canada's first tongues are being spoken today

BY NICK WALKER

These are the languages of the land beneath your feet.

The most recent Statistics Canada census data reveals the country's Indigenous linguistic landscape, the places where 60 languages belonging to 12 overarching families — Inuit, 10 First Nations and Michif (Métis) — are being used *now*. Most of these have been spoken, and have been evolving, for thousands of years — far longer than English or French.

The data used for this map* illustrates "Aboriginal language spoken at home," either as a first or secondary language. In Canada, nearly 229,000 people rely on one or more of these languages, including those who have retained their mother tongue, who have become fluent in their ancestral language later in life, or who have learned the languages of the Indigenous community or region they eventually settled in.

The precarious state of many of Canada's original languages is well documented. The UNESCO Atlas of the World's Languages in Danger project reports that three-quarters of the nation's Indigenous languages are "definitely," "severely" or "critically" endangered. The rest are classified as "vulnerable/unsafe." Today, only Cree, Inuktitut and Ojibwa are thought to have enough speakers to be sustained indefinitely.

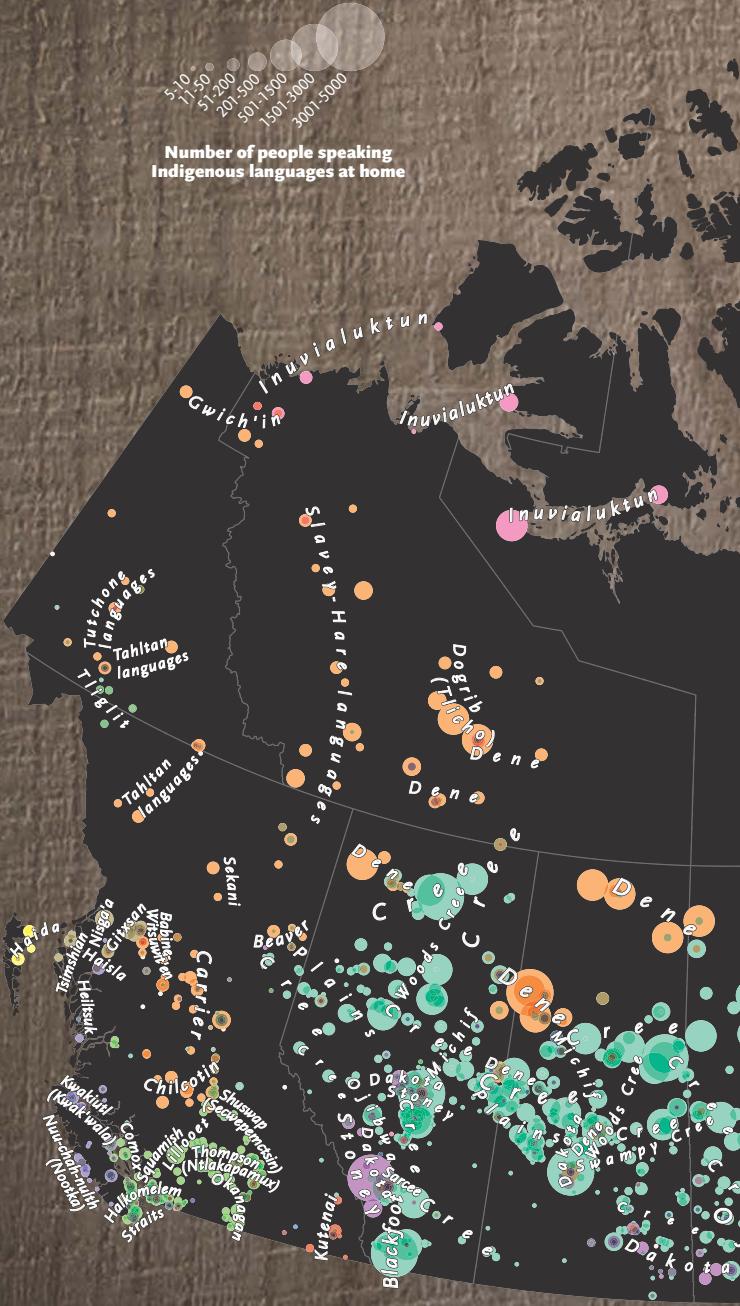
Residential schools severed languages across generations, while the reserve system and other colonial policies divided communities from others with shared languages and traditions. The aftermath includes ongoing, widespread language loss and injury to culture, personal identity and community health. Of Canada's approximately 1.5 million Indigenous people, just 15 per cent speak their heritage languages at home.

Statistics can look grim, but a richer, more nuanced story is hidden within the numbers, says Onowa McIvor, associate professor of Indigenous education at the University of Victoria and an expert in language revitalization. She was an adult learner of *nēhiyawēwin* (Swampy Cree), the language of her maternal grandparents in northern Manitoba, and there are others doing likewise. "In my lifetime," she says, "I'm seeing new generations born and raised as first language speakers because their parents took it upon themselves to learn their language."

The University of Victoria is home to nationally renowned undergraduate and graduate programs based on Indigenous language revitalization, and McIvor points to numerous examples of success across the country: on-reserve and urban-centre adult language societies, grade-school immersion and bilingual programming, and "language nests," which are early-childhood immersion programs guided by older speakers.

With legislation, strong policies to support its implementation and stable funding, many of the country's original tongues can be rejuvenated and become part of the fabric of wider society. To that end, the 2017 federal budget dedicated \$90 million to help "preserve, protect and revitalize Indigenous languages and

Number of people speaking Indigenous languages at home



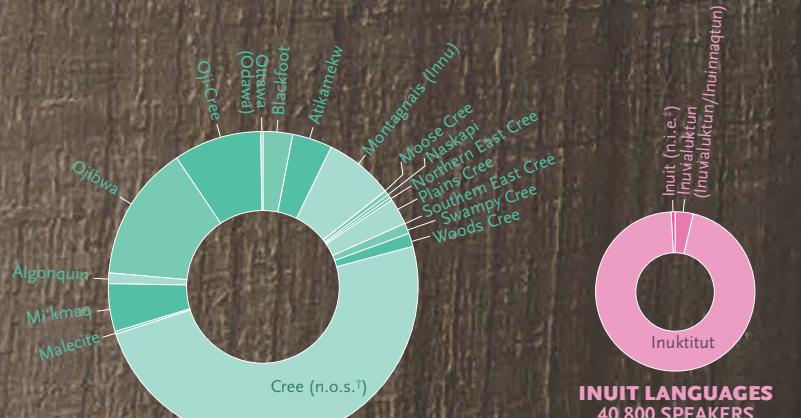
cultures." The federal government has also promised to pass an Indigenous languages act by 2018 — the first step in offering any level of protection for Canada's Indigenous languages.

This is not just an Indigenous issue, says McIvor: all Canadians can benefit from the revitalization of Indigenous languages. "If you call yourself Canadian, then Indigenous languages are part of your heritage, even if you aren't Indigenous yourself." During early settlement, she says, Canada was for a time a multilingual nation that included Europeans learning and speaking Indigenous languages as well as their own languages.

"Let's celebrate that and be reminded of that history, because it predates a 150-year anniversary. That is the real foundation of *Canada*." ♦

INDIGENOUS LANGUAGES OF CANADA

LANGUAGES SPOKEN AT HOME IN CANADA



ALGONQUIAN LANGUAGES 153,620 SPEAKERS



ATHABASKAN LANGUAGES 19,715 SPEAKERS



SIOUAN LANGUAGES 4,595 SPEAKERS



SALISH LANGUAGES 3,670 SPEAKERS



IROQUOIAN LANGUAGES 2,065 SPEAKERS



INDIGENOUS LANGUAGES N.O.S. 775 SPEAKERS

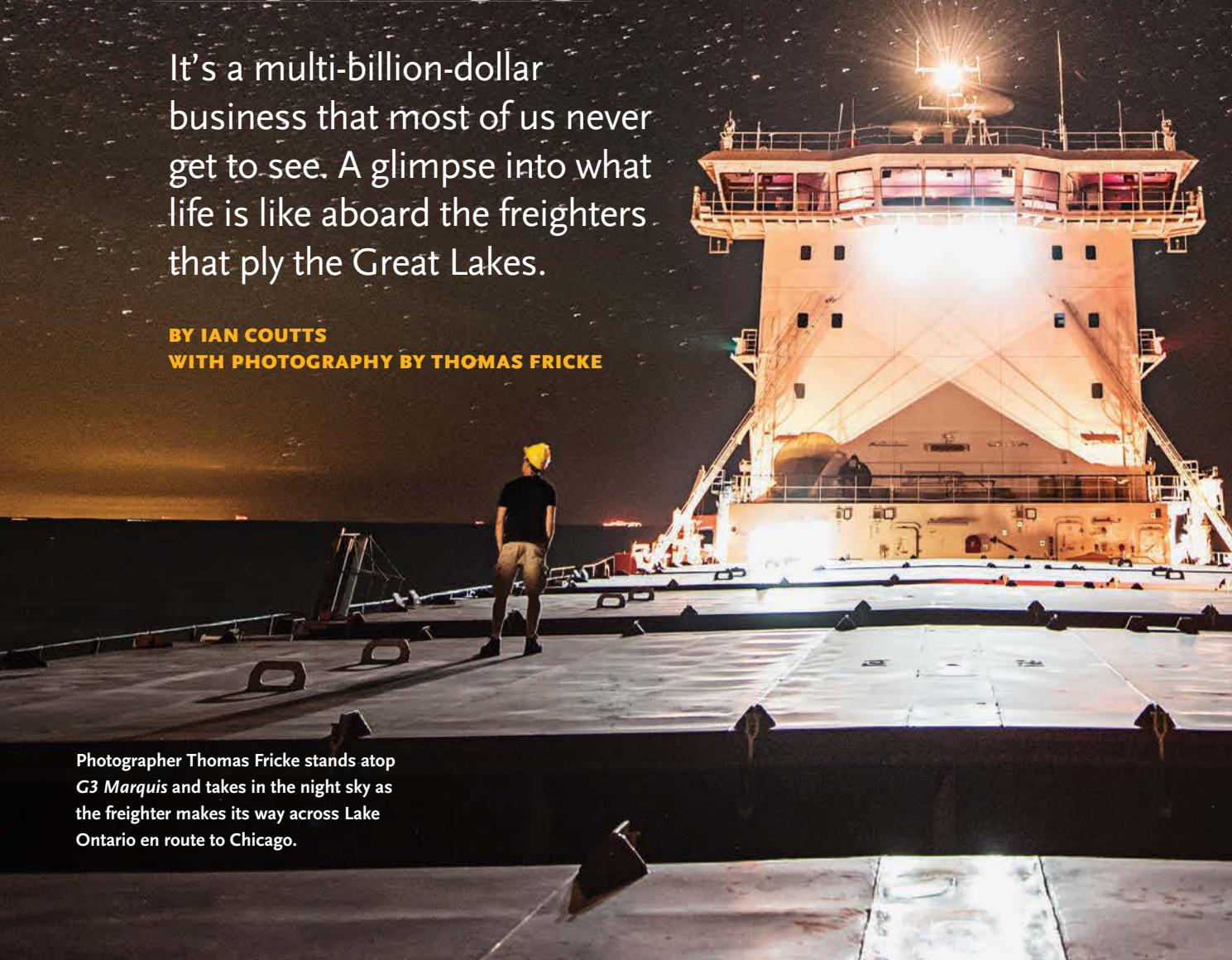
* Map shows the generalized distribution of Canada's Indigenous languages based on 2016 census data.
† n.o.s. means "not otherwise specified"
‡ n.i.e. means "not included elsewhere"

TITAN of the Great Lakes

It's a multi-billion-dollar business that most of us never get to see. A glimpse into what life is like aboard the freighters that ply the Great Lakes.

BY IAN COUTTS
WITH PHOTOGRAPHY BY THOMAS FRICKE

Photographer Thomas Fricke stands atop *G3 Marquis* and takes in the night sky as the freighter makes its way across Lake Ontario en route to Chicago.





WATCH ALGOMA CENTRAL Corporation's bulk carrier *G3 Marquis* easing herself into Montreal's St. Lambert Lock, and you quickly come to the conclusion that Great Lakes navigation must largely be a case of a captain's ability to squeeze a very big object into a very small space. *G3 Marquis* is 226 metres long — roughly the same size as Toronto's TD Bank Tower laid on its side. The St. Lambert Lock, like all locks in the St. Lawrence Seaway, is 233.5 metres long. That's tight enough, but factor in the ship's maximum beam and the lock's maximum width, and it leaves about 30 centimetres of clearance on either side. As the ship's fat bow slowly edges into the lock, pushing a mass of water in front of her, it's easy to imagine everyone on board sucking in their stomachs to make enough room.



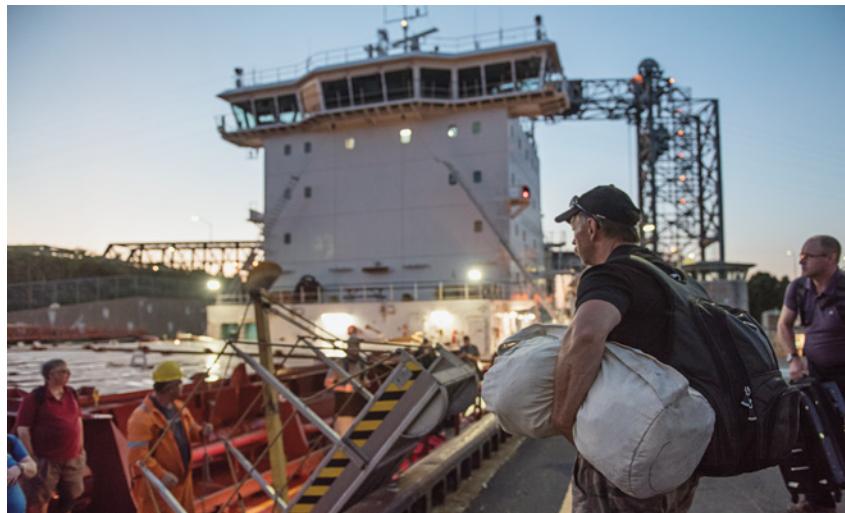


Tight squeeze: *G3 Marquis* enters Montreal's St. Lambert Lock (THIS IMAGE), where new crewmembers come aboard as part of a regular rotation (OPPOSITE).



Laden with 30,000 tonnes of iron ore taken on in Port Cartier, Que., G3 Marquis is one of a new generation of freighters on Canada's Great Lakes fleet. Before the likes of G3 Marquis, plenty of crews for Algoma Central and its major rival, Canada Steamship Lines, sailed in ships older than they were. But in 2010, the Canadian government removed a 25 per cent tariff on foreign-built ships, and both companies embarked on ambitious programs using yards in China and, later, Croatia. CSL began bringing its Trillium class into service. Algoma Central announced its Equinox class, which included G3 Marquis. These new lakers are built to the absolute maximum size the seaway allows and are faster and less polluting and require smaller crews than their predecessors.

The common name for these ships, bulk carriers, sums up the kinds of cargoes they carry — iron ore pellets, wheat, soybeans, gravel, cement, even road salt. These ships can carry these bulky commodities, still key products of Canada's economy, more cheaply and efficiently in terms of energy use than any other means of transportation. In 2010, Canadian-flagged freighters carried more than 142 million



tonnes of cargo on the lakes; about 48,000 jobs depend on them directly. The business was worth more than \$16 billion that year. But sailing as they do far out on the lakes, we don't often see them. It leaves one to wonder: What's life like aboard these fast-paced freighters where the world shrinks to the size of a ship?

MONTREAL'S ST. LAMBERT LOCK, on the south shore of the St. Lawrence, is a common spot for crew changeovers, close to the city and the airport. Many of

Algoma's crewmembers follow the established Great Lakes pattern of two months on board and one month off during a shipping season that runs roughly nine months. On this warm August evening, five of the crew are waiting to board G3 Marquis, including captain Mike Jolliffe and chief officer Rolly Abaigar. As the ship rises in the lock, a narrow aluminum walkway with handrails is dropped to lock side with a clatter — half a dozen crew members carrying suitcases scramble off, and the fresh crew scramble on. It's like getting



on and off a commuter train at rush hour. A minute or two later, as the ship continues to rise, the gangway is hauled in. The fresh crew members race to drop off their luggage. There's no time for settling in. In a few minutes, the lock doors will open and *G3 Marquis* will be on her way to Chicago. (Just two days earlier, the ship had been slated to go to Thunder Bay; however, as Peter Winkley, Algoma's chief financial officer, notes, a ship isn't like a bus, showing up on a precise schedule with a given destination.)

Five decks up on the bridge, faint red lights illuminate the computer screens that show the ship's course and monitor different systems — everything from engine to bilge pumps. There is a constant radio crackling, a stream of comments and requests from the seaway staff and other ships, to which Les Comrie — the skipper Mike Jolliffe will be relieving — constantly replies. Off to the north, Montreal is beginning to light up.

Ian Coutts has written for Toronto Life and Canada's History. Thomas Fricke's work has appeared in Forbes and the New York Times.

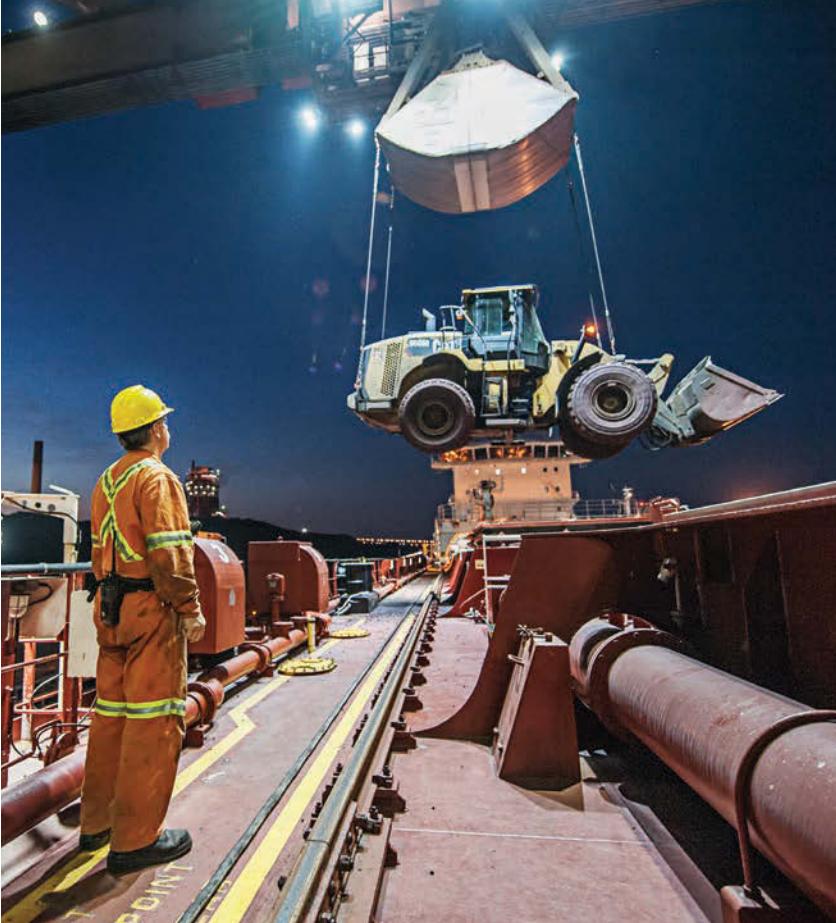


By the next afternoon, the ship has cleared the last of the seven locks on the St. Lawrence River and is making its way through Ontario's Thousand Islands toward Hamilton, threading past small rocky islands and improbable castles built by Gilded Age millionaires. Small power boats are constantly racing by the ship, often coming nerve-rackingly close, perhaps forgetting that *G3 Marquis* is nowhere near as nimble as they are. Before dark, the river

widens out into the broad expanse of Lake Ontario.

G3 Marquis ties up early the next morning alongside the Dofasco steel company dock in Hamilton, where its cargo from Quebec will be added to the sloping drumlin of purplish iron ore pellets, each about the size of a Skittle, running the length of the dock.

Because *G3 Marquis* will be here until well past nightfall, Victor Gordynskii, the chief engineer, wants to take



advantage of time at dock to replace the piston ring on the number two cylinder, which sensors in the control room show has been running hot. Maintenance on a ship is a non-stop affair, but when the shipping season is in full swing, there aren't many chances to carry out more thorough repairs.

While one engineer climbs *into* the crankcase to help replace the piston ring (with three other engineers on two separate decks positioning the three-metre-long rod), far above the engine room two enormous gantries are dipping their clamshell buckets into *G3 Marquis'* open holds. Pellets dribble from the buckets as they rise and zip inland to dump their load on the dock.

Loading continues into the night — at one point, one of the gantries lowers a front-end loader into the holds, and a crew of sweepers climb down to gather every last possible bit of ore with brooms. As it gets darker, the ship's surroundings take on a grimly ominous appearance: on the shore across the slip from where *G3 Marquis* is tied up, glowing molten metal dribbles down the side of a slag pile; on the other side of the iron pellets, fire spouts from the Dofasco mill's dark chimneys, lighting

up clouds of white smoke. "Mordor," someone says, evoking the hellish blackened wastelands of J.R.R. Tolkien's Middle-earth. Quite a contrast to the bucolic Thousand Islands.

TWO DAYS LATER, Detroit's affluent suburbs lie off the ship's port side as she crosses Lake St. Clair. Third mate

**A narrow walkway is
dropped to lock side — half
a dozen crew carrying
suitcases scramble off, and
the fresh crew scramble on.
It's like getting on and off a
commuter train at rush hour.**

Ayla Berry presses the button for the horn — one long and two short blasts, the standard short courtesy salute. Coming toward *G3 Marquis* is *Baie St. Paul*, a modern self-unloader belonging to CSL. Berry steps onto the walkway that surrounds the bridge and waves. A figure standing on the

Clockwise from ABOVE: Engineers work on *G3 Marquis'* engine; a crew member eats in the mess hall; the *Algowood* unloads coal in Hamilton, Ont.; a front-end loader is lowered into *G3 Marquis'* hold.

walkway of *Baie St. Paul*'s bridge waves back. It's her husband, Jason, a deck officer. They met while at school at Georgian College in Owen Sound, Ont. In the off-season, they live on a 12-metre sailboat moored on Lake Ontario in Whitby.

Growing up on the shores of Georgian Bay, Berry had been interested in boats and the water for as long as she can remember. She sailed, she was a sea cadet, and after contemplating joining the coast guard, she went to school to become a deck officer. She's not the only female deck officer on the lakes, but women in this line of work remain uncommon. The crew, she says, are "like a bunch of uncles."

The crew hail from a variety of hometowns across Ontario, Quebec and the Atlantic provinces, with some originally from farther afield — Ukraine, Philippines and Barbados. Five come from Newfoundland, two of them from the village of Burnt Islands. From a population of about 600, nearly half of the

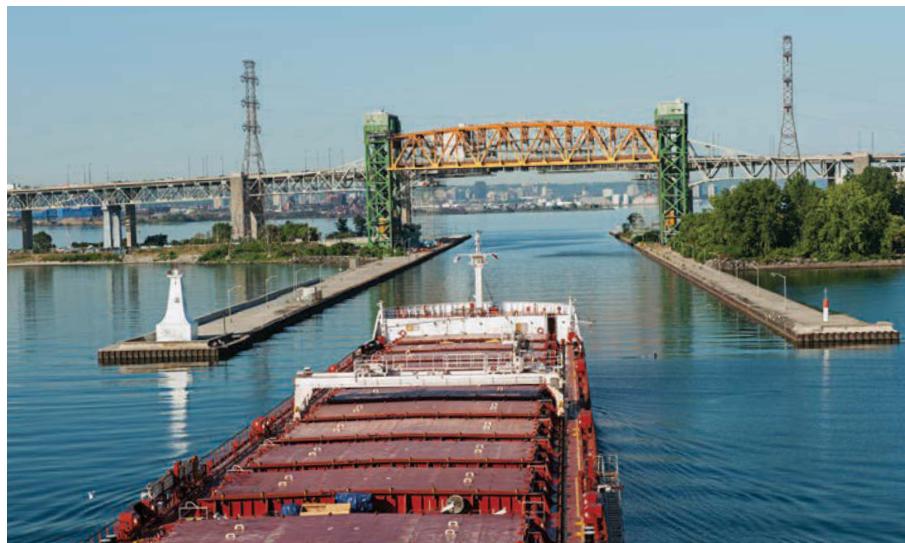
FREIGHTERS



men from Burnt Islands are working the Great Lakes, says islander Calvin Chaulk.

What do these diverse crew members have in common? Often it's a strong connection with the water. Like Berry, Captain Les Comrie sailed from childhood, in his case on Lake Ontario's Bay of Quinte. Many of the guys from the Atlantic provinces are the sons and grandsons of sailors. One of the Burnt Islanders, ordinary seaman Art Seymour, was even born on a boat. Jolliffe, the captain, was in the naval reserve. Even before he first visited Georgian College's marine studies program with the reserves, he had decided to make lake boats his career. "I've never looked back," he says.

They are away a lot, six or seven months a year, but with email, Skype and cellphones, the isolation isn't as bad as it once was. Jolliffe still remembers the days when, once a ship had tied up, "You'd have a long lineup standing in front of a pay phone in the rain yelling at the guy ahead to hurry up." Unlike going to work in Fort McMurray, Alta., say, there's no need to relocate to work on the Lakes. The company flies you to and from anywhere in Canada. (The pay is good too — junior crew can make around \$60,000 a season, a captain more than \$150,000.)



And yet, life on board still feels very separate from life on shore. This is particularly true at night, especially on a long run, such as north on Lake Huron after leaving the relatively tight confines of the St. Clair River. Around midnight, there might be three people awake on board — two on the bridge, one other several decks down in the engine control room. The auto-pilot is on. The wheelsman and the officer on watch pace slowly back and forth, looking out into the darkness and checking the radar and the chart

on the display screen. They also keep an eye on the ship's course, which shows a scattering of triangles in the vicinity, each a ship. Roll over one with your finger, and a pop-up box tells you the vessel's name, type and size. It's quiet on the bridge, pitch black outside and dimly lit inside. It's oddly soothing — if you aren't responsible for just over 24,500 tonnes of lake freighter, that is.

FAR PAST THE BOW of G3 Marquis, the central section of Chicago's Norfolk



Southern Railroad Bridge is sliding back down into place, while ahead of the ship's stern, the Victorian lift bridge at 100th Street is starting to open.

There's a joke that Ginger Rogers did everything that Fred Astaire ever did, except in heels and dancing backward. This morning, Captain Jolliffe is attempting something similar. To get to the Nidera grain elevators on Chicago's South Side, the ship needs to thread its way up the city's Calumet River, which is just wide enough for two ships to pass and crossed by no less than five lift bridges. Like Ginger Rogers, *G3 Marquis* is doing it backward, with the help of two tugs that joined the ship near dawn.

Now one tug is pulling the ship stern-first down the river, yawing first this way, now that, and churning up brown water, while the other pushes against her bow. Down on deck, Rolly Abaigar, the first mate, and Berry, the third mate, are watching the ship's sides, constantly telling the captain by radio how far *G3 Marquis* is from shore. Perhaps because it's rush hour, the lift bridges seem to wait until the last possible minute to open and then close quickly as the ship slips past.

Jolliffe stands on one bridge wing with his wheelsman on the other, occasionally

switching sides. If there is one disappointing feature to *G3 Marquis*, it is her wheel. No spoked wooden affair worthy of a windjammer, the wheel wouldn't look out of place on the console of a video game. The remote wheel on the bridge wing is even smaller — maybe 12 centimetres across. Still, it gets the job done. "Once we're past 106th Street, I think

If there is one disappointing feature to *G3 Marquis*, it is her wheel. No spoked wooden affair worthy of a windjammer, the wheel wouldn't look out of place on the console of a video game.

"we're fine," says Jolliffe, about the last bridge to cross.

By 9:21 that morning, the ship is pulling alongside the Nidera grain elevators, where *G3 Marquis* is to pick up 30,000 tonnes of soybeans. A few minutes later, Calvin Chaulk and then John Keeping

Clockwise from ABOVE: A *G3 Marquis* crewmember takes a break; the ship approaches Hamilton Harbour; Captain Mike Jolliffe; the ship in the Welland Canal.

from the deck department are swung out over the side via the landing boom and lowered 10 metres or so to the pier, seated on a wobbly board secured to a rope.

This is not a move the captain likes. "It is," he says, "the most dangerous thing we do." Ashore, they grab long lines, called wires, that are in fact heavy steel cables. They'll slip the loops in the wires over the bollards. Aboard *G3 Marquis* they will wind these in until the ship is secured. At 9:51 a.m., three hours after they started hauling her down this 12-kilometre stretch of river, the tugs are sent on their way.

The crew, meanwhile, are already pulling the hatches from the holds and loading for the next run, back to Port Cartier, Que., and from there to Hamilton, and then on to Thunder Bay, or Chicago again, or maybe somewhere in Minnesota. The cargoes can't wait and neither will *G3 Marquis*. ☀



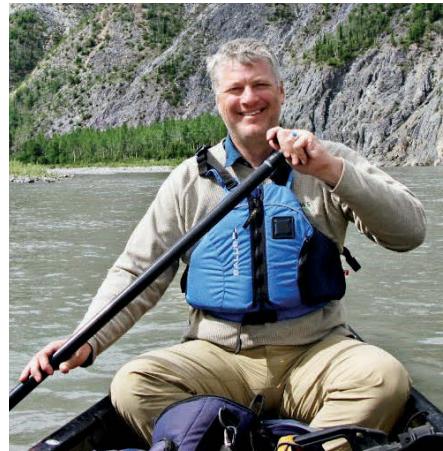
See more photos of life aboard the *G3 Marquis* at cangeo.ca/ja17/freighter.

Harvey wants half

Harvey Locke, founder of the monumental Yellowstone to Yukon Conservation Initiative, talks about how Y2Y continues to evolve as it turns 20 and why the Nature Needs Half conservation edict is gaining momentum

INTERVIEW BY NICK WALKER

The Trans-Canada Highway transects Banff National Park, Alta., but the wildlife-crossing structures implemented here are a prime example of how people and wildlife can coexist, says Y2Y founder Harvey Locke (OPPOSITE TOP).



Harvey Locke thinks big — continentally, actually — but most importantly, he follows through. In 1997, he and an ensemble of conservationists and scientists founded the Yellowstone to Yukon Conservation Initiative with the unprecedented idea of not just protecting but connecting as much of the intact temperate and boreal mountain ecosystem between southern Wyoming and the northern Yukon as possible. Twenty years on, they've more than doubled the park and conservation-land area in this critical 3,500-kilometre-long corridor, facilitating the movements of countless species across its channels and improving how humans and wildlife coexist on the landscape. The idea of "large landscape conservation" has caught on around the world, and Locke is now also promoting his Nature Needs Half movement, which as the name might suggest is the same transformative idea writ on an even grander scale.

On getting the scope right

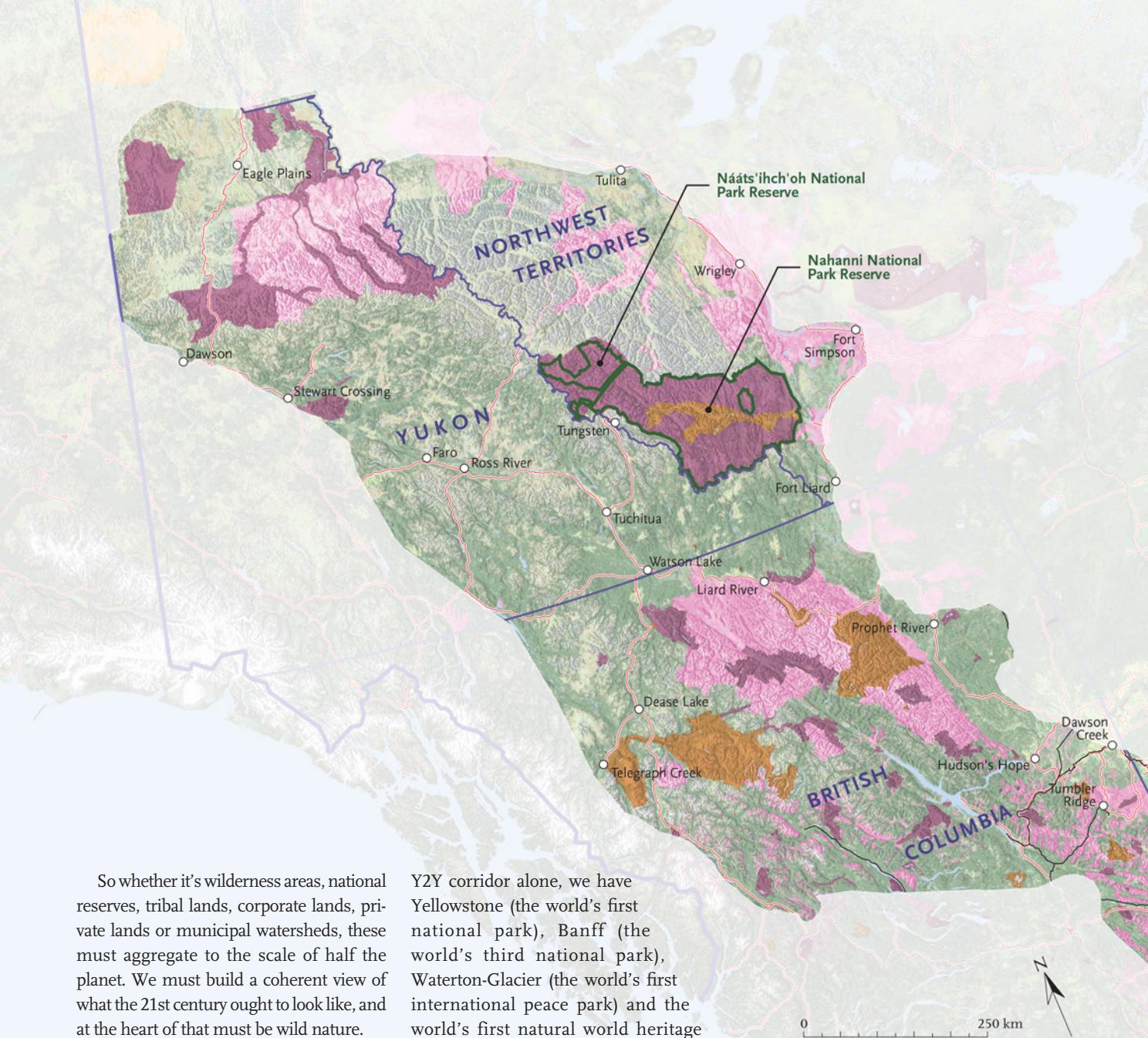
The huge scale of Yellowstone to Yukon was a hypothesis at our first meeting in 1993 and the topic of a discussion piece I wrote for *Borealis* magazine the next spring. The response from scientists and conservationists in Canada and the United States was, "This is the right scale!" and they even went so far as to say we should add a bit more on each end and to the west. Then it was like that high school science experiment where you

drop a string into a solution and everything crystallizes on it right away.

The corridor is important not only because of the species that are in it and its stunning natural beauty, but also because it's part of the public's imagination about what wild nature is: "Yellowstone" stands for natural park; "Yukon" stands for wilderness. I chose those words deliberately. And Y2Y is adapted to *our* places and cultures — it's not a template you can take and shove somewhere else. No one is saying, "We have the magic recipe: pay me." We're saying that this is the scale we need to work at, but it needs to occur on your terms and work for your culture.

On Nature Needs Half

People all over the world are interested in applying large landscape conservation to their own countries and on their conditions. They're looking to Y2Y for inspiration, which is why I've given talks everywhere from Kathmandu, Nepal, to Anchorage, Alaska, southern Chile, and Darwin and Sydney, Australia. This gave rise to the Nature Needs Half movement, which is simply Y2Y gone global — a truly transformative vision for humanity. It's the idea that we must protect in an interconnected manner at least half of the surface of the Earth, land and sea. If all we can manage is isolated fragments, we know it isn't going to make it through time. If it's a big, connected system of at least half of the world, there's a chance that the functions of life can stay with us, that we can still have fresh water, pollination, a stable climate.



So whether it's wilderness areas, national reserves, tribal lands, corporate lands, private lands or municipal watersheds, these must aggregate to the scale of half the planet. We must build a coherent view of what the 21st century ought to look like, and at the heart of that must be wild nature.

On national parks as centrepieces of large landscape conservation

Y2Y is about keeping all wildlife on the landscape along with people, including the “inconvenient” species like wolves and bears. Look all over the world and you’ll see an astonishing correspondence between the places where those species persist and national parks, from grizzlies and wolves in Yellowstone and Banff to elephants, lions and mountain gorillas in Africa to tigers in India. You take away the parks, and those animals will cease to exist.

The national park was one of the great ideas of the 19th century, the gold standard of conservation. But we know they are not enough on their own — that they must be both big and connected. In the

Y2Y corridor alone, we have Yellowstone (the world’s first national park), Banff (the world’s third national park), Waterton-Glacier (the world’s first international peace park) and the world’s first natural world heritage sites (Yellowstone and Nahanni). From these building blocks, we were able to engage the public in imagining conservation biology connected over a vast area and were thus able to create the global icon of large landscape conservation.

On the importance of connectivity

As soon as we decided on the Y2Y scale, a flood of information started coming in that both informed and validated the idea. There was a wolf, for example, radio collared by American biologist Diane Boyd in Montana’s Flathead Valley, that travelled to Mile 0 of the Alaska Highway at Dawson Creek, northeastern British Columbia. Another from that pack went down to Yellowstone. Boyd and Canadian biologist Paul Paquet, who had a project right on the

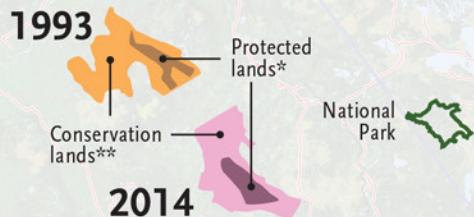
edge of Banff and Kananaskis, found that wolves were moving between Banff and the Flathead Valley in Montana as part of their normal lives.

The avalanche of evidence kept coming in. After I gave a talk in Yellowstone in 1997, two trumpeter swan researchers came out of the audience and told us to add these birds to our list. They had just banded baby swans in Nahanni National Park Reserve, N.W.T., that ended up in Yellowstone. At the same time, an Alberta naturalist named Peter Sherrington

Yellowstone to Yukon Conservation Initiative



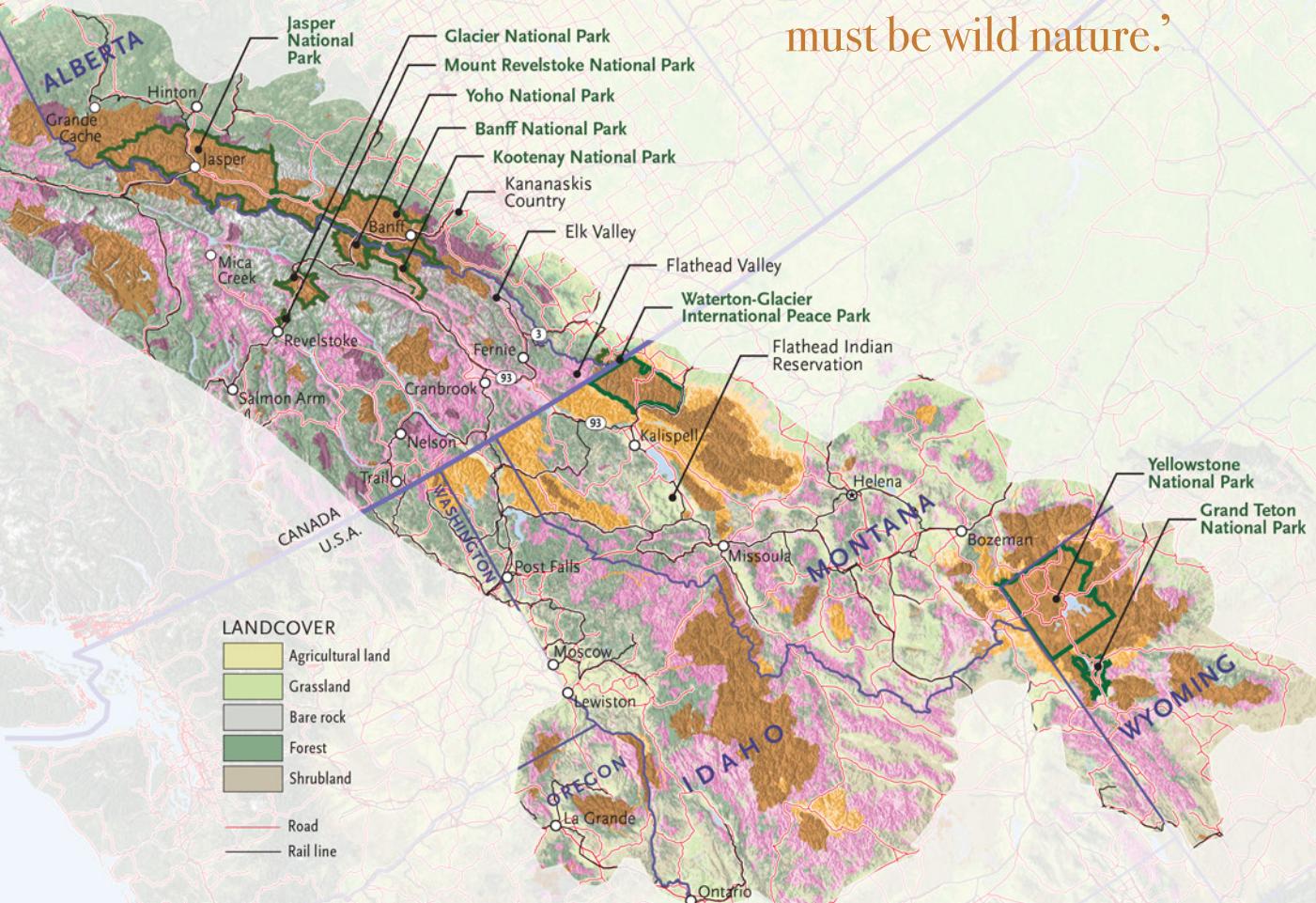
CONNECTING YELLOWSTONE TO YUKON



* Protected lands include all Canadian national, provincial and territorial parks and reserves, wilderness preserves, conservancies and parcels of conservation interest, as well as U.S. national parks, wildernesses and national monuments.

** Conservation lands refers to all other designations, including but not limited to national recreation areas and "wild and scenic" rivers, provincial natural areas, special management zones such as U.S. grizzly bear recovery zones, restricted-use wilderness areas, roadless rule lands and private conservancy lands.

'We must build a coherent view of what the 21st century ought to look like, and at the heart of that must be wild nature.'



- LANDCOVER
- Agricultural land
 - Grassland
 - Bare rock
 - Forest
 - Shrubland
- Road
- Rail line



discovered a golden eagle migration that goes up and down the Rockies — 5,000 birds every spring and fall that no one had ever noticed before! It was like a 19th-century discovery by Charles Darwin and Alfred Russel Wallace.



On learning from Indigenous Peoples

When we rolled out Y2Y, the response from Indigenous Peoples was essentially, "It's about time you guys figured this out." The Dehcho Dene of the Northwest Territories have always called this landscape the *Dene etene*, which means "the people's trail," and the Blackfoot call it the Old North Trail. We know obsidian from the volcanic cliffs in Yellowstone was traded as far north as Edmonton.

The traditional Indigenous view, which is also what biologists will tell you, is that humans are just one species among many. The confusion lies in the western mind that thinks humans aren't part of nature. To think we manage the world is a form of profound delusion. We don't even know how.

Grand Chief Herb Norwegian of the Dehcho Dene really influenced Nature Needs Half because he and his nation came up with the same idea on their own culturally. When he and I were travelling

across the country working on the Nahanni National Park extension [announced in 2009], he was calling for the entire South Nahanni watershed to be a national park. They wanted to protect half their territory.

On lessons from other nations

Did you know Canada has only protected between 10 and 15 per cent of its Mackenzie Basin [a largely intact, globally important watershed and biological hot spot covering parts of the Yukon, Northwest Territories, British Columbia, Alberta and Saskatchewan]? We hear the Amazon is falling apart, but Brazil has still protected about *half* its rainforest — an astonishing 25 per cent in national parks and formally designated protected areas and 25 per cent in tribal areas that will maintain their forest cover. They've been protecting land hand-over-fist in Colombia, Peru and Suriname as well. Why doesn't anybody know this?

In February I was a guest of the government of Bhutan, where they've



protected 51 per cent of the country and employed interconnected corridors that extend from 90 metres to almost 8,000 metres in elevation, with national parks at the centre of it all. It's one of the great reserve systems on Earth. Here in Canada, we are leading on this idea of interconnectedness, but in terms of overall protection of our landscapes, where we were once leaders we're now laggards.

On what Canada is doing right

We have the most extensive system of highway-crossing structures and other mitigations for wildlife moving across highways in the world. It's not accidental. They were actively discussed and implemented in the Y2Y context because they were intended to increase landscape connectivity, not just reduce roadkill. The most extensive system in the United States, on Highway 93 between Glacier National Park, Montana, and Missoula, is on the Flathead Indian Reservation. They sent their landscape architects up

to study the structures in Banff, saying, "We need those here before you put your highway through our reservation."

Once you can imagine that humans are not the only species flowing around the landscape, taking highways east-west to meet their life needs while animals move north-south to do the same, we can accommodate that, and we can keep doing it right across the country.

On Canada's next steps

Ground zero for the Y2Y corridor is between Waterton-Glacier and Banff parks, particularly on the British Columbia side from the Flathead Valley and the Elk Valley and up to Banff. That's the great connectivity challenge of North America. It's the missing piece of Waterton-Glacier International Peace Park, bisected by Highway 3 and railway, little towns like Fernie, B.C., open-pit coal mines, forestry, some suburban sprawl. It's also the most biodiverse part of the Y2Y region in Canada and one of

Y2Y encompasses lands such as (clockwise from **OPPOSITE MIDDLE**) Waterton Lakes National Park, Alta., Nahanni National Park Reserve, N.W.T., and Yellowstone National Park, Wyo. British Columbia's Purcell Mountains (**OPPOSITE BOTTOM**) and other critical habitats still require protection.

the great biodiversity hot spots on Earth. And the Flathead Valley has few people living in it right now. It's a real conservation opportunity, and we need a wildlife management area, or corridor, that connects it to Banff National Park.

We were able to keep coal mining and oil and gas out of that realm, but we have not yet been able to protect it. And there's a big difference between stopping development and protecting. This area is not yet getting the special management treatment it deserves, to ensure that these values persist into the future. ☈



Explore an interactive version of the Y2Y map at cangeo.ca/jf17/y2y.





RIVER OF THE ICE GRIZZLIES

Every fall in the northern Yukon, ice-covered grizzlies gather to feast on salmon spawning in the Fishing Branch River

PHOTOGRAPHY BY MICHELLE VALBERG
WITH TEXT BY MICHELA ROSANO



ONLY THE BUBBLING of the Fishing Branch River and the delicate jingling of ice on the fur of a nearby female grizzly bear can be heard in this spruce forest in northwestern Yukon's Ni'iinlii Njik Ecological Reserve. There isn't even a click of a camera shutter as the bear inspects a pair of awestruck photographers, poised on a ramshackle platform of snow and fish carcasses, before galloping into the shallow water to pull out a fat salmon.

She is one of up to 30 grizzlies — the largest congregation of the species this far north — that gorge on the chum salmon that flood the Fishing Branch River (or *Ni'iinlii Njik*, Gwich'in for "where fish spawn") each year from September to November. The salmon are drawn from the Bering Sea to spawn in this 12-kilometre stretch of river, which remains open year-round thanks to a pock-marked karst topography that percolates just-above-freezing, oxygen-rich water from the gravel river bed. Water freezes on the bears' fur starting in October when the mercury dips below -20 C, and for a few weeks they become "ice grizzlies."

Located within mountainous Vuntut Gwitchin First Nation Traditional Territory and surrounded

In late fall, up to 30 grizzly bears (PREVIOUS PAGES, ABOVE and RIGHT) gather to feast on spawning chum salmon in Yukon's Fishing Branch River, which remains ice-free even in sub-zero temperatures.

by the roughly 6,500-square-kilometre Ni'iinlii Njik (Fishing Branch) Territorial Park and adjacent habitat protection area, the ecological reserve and neighbouring settlement lands protect a unique forest habitat and microclimate straddling the Arctic Circle with exceptional biodiversity, attracting species such as grey wolves, wolverines, eagles, moose, Dall's sheep and the Porcupine caribou herd. For thousands of years, the region has been the cultural landscape of the Vuntut Gwich'in, who jointly manage the protected lands with the territorial government.

The reserve grants entry to just four visitors per day from September 1 to October 31 to protect the bears and their habitat. But for more than 10 years, guide Phil Timpany of Bear Cave Mountain Eco-Adventures has provided wildlife-viewing tours for handfuls of adventurous photographers.

By early November, the spectacle is over. The sun hovers close to the horizon, the visitors are gone, and the salmon, having laid their eggs, are dead. Fattened grizzlies, heavy with ice and fish, meander up the slopes of craggy Bear Cave Mountain to their denning caves to bed down until spring. ►



Michelle Valberg (@michellevalberg) is Canadian Geographic's Photographer-in-Residence. Michela Rosano is the magazine's associate editor.







A grizzly stampedes into the shallows to catch a chum salmon. The bears usually fish three to four times per day and can catch up to five salmon each time.





Nii'linlii Njik Territorial Park and the surrounding areas (ABOVE) help protect the bears (TOP, LEFT and OPPOSITE) and the Vuntut Gwich'in cultural landscape. ☈



See more of Michelle Valberg's photos of ice grizzlies in northwestern Yukon at cangeo.ca/s017/grizzly.



Stella Mackinzo, a Délîne artist whose creations include beadwork and traditional clothing, hangs up a moose hide to dry.



*'Listen to what the land wants, listen to what the **lake** wants, listen to what the **animals** want'*

How the Sahtuto'ine Dene of Délina created the Tsá Tué Biosphere Reserve, the world's first such UNESCO site managed by an Indigenous community

BY **LAURIE SARKADI**

WITH PHOTOGRAPHY BY **ANGELA GZOWSKI**

IN 1865, more than a century before computer models began pointing toward a future where drought, heat waves and hurricanes bring the world's population to its knees, an eight-year-old boy from Délina, a small community on the southwestern shore of Great Bear Lake in the Northwest Territories, began having visions. The story goes that the boy, Louis Ayah, was visited by angels throughout his lifetime who rolled out glimpses of the future, prompting him to issue some 30 prophecies, several of which came to pass: white men discovered shiny, glass-like rocks (diamonds); something that's not a cigarette but is rolled by twisting the paper ends became harmful to kids (marijuana); and Délina came to be led by one united body, the Délina Got'ine government — the administration that as of Sept. 1, 2016, oversees the Northwest Territories' first independently self-governed community.



One of Ayah's prophecies that hasn't yet been fully realized, however, is Délîne's role in a looming climate change apocalypse: Great Bear, the world's eighth largest lake, will be the last place on Earth people can fish; parched and hungry migrants will flock to its deep, clear waters; boats will jostle for space; Délîne must prepare.

On a 28 C day in August in Délîne, just before the new government takes over, Ayah's prognostication doesn't seem far-fetched. "When I was a kid, the hottest it ever got here in summer was about 15 degrees," says Walter Bezha, integrated resource management advisor for the new government's lands, resources and environment department. Bezha has managed the sprawling boreal lands surrounding Délîne for years, first under the region's 1993 Sahtu Dene and Metis Comprehensive Land Claim Agreement and now as a member of Délîne Got'ine's nascent bureaucracy. More than 20 years in the making, the self-government agreement that led him to this point lifts the nearly 500 mostly Indigenous people of Délîne out of Canada's Indian Act, quashes the territorial government's designation of Délîne as a charter community (a blend of band

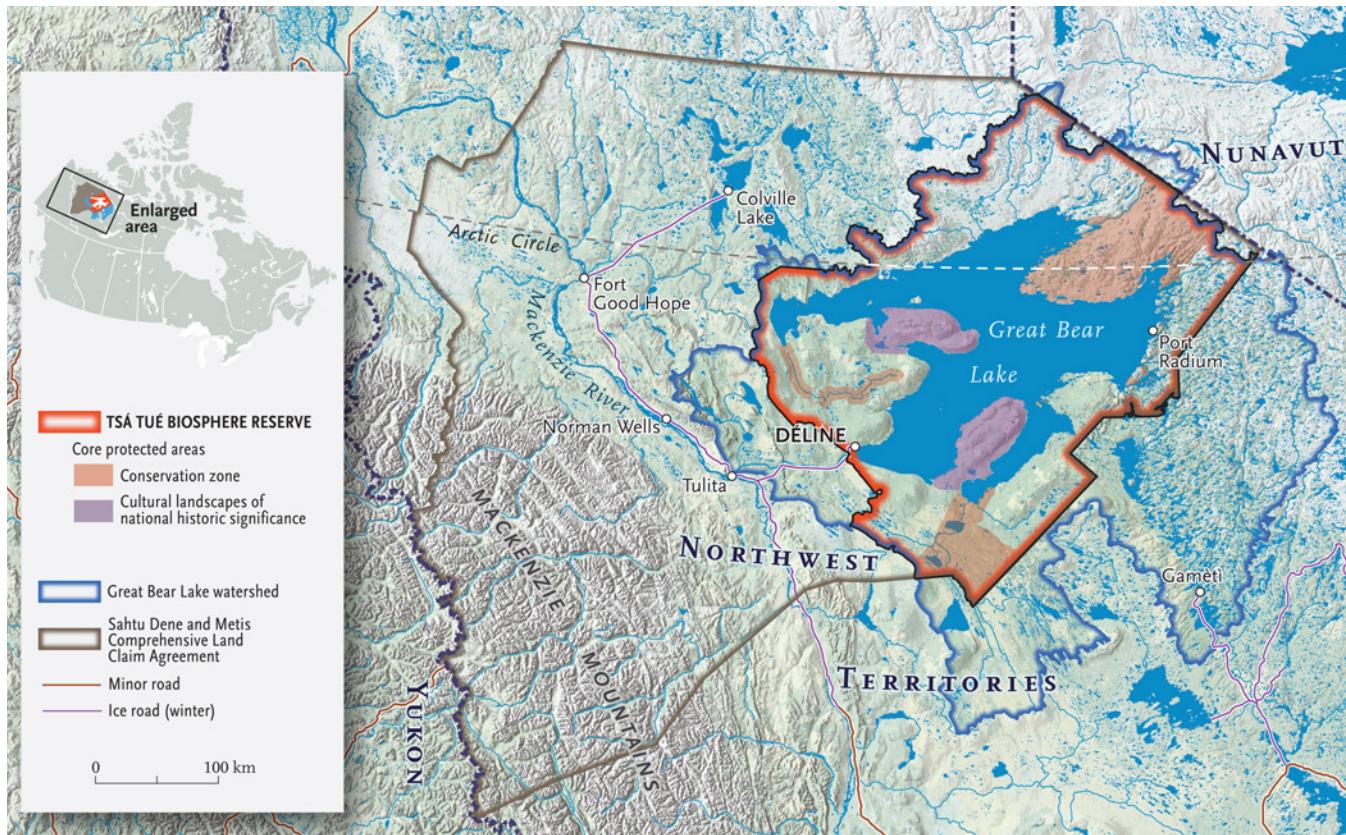


and municipal governments) and integrates the Deline Land Corporation from the region's land claim agreement into one government with decision-making powers in areas such as education, health, justice, language and community lands.

It also explains why he's trapped in his office sorting out how to shrink three levels of government into one. His job is to "listen to what the land wants, listen to what the lake wants, listen to what the animals want," and make decisions using scientific data and the Sahtuto'ine

Clockwise from ABOVE: Gordon Taniton (right) and other drummers help celebrate Délîne's UNESCO status; a fishing boat on the lake; Roberta Dolphus cuts moose ribs.

Dene people's giant body of knowledge on the area's ecology and biodiversity, amassed over eons. Outside Bezha's office, men wrestle the imposing antlers off a moose they've hunted, women slice fresh red meat from a caribou leg for a funeral, and on what UNESCO calls "the last pristine Arctic lake," people motor



small aluminum boats to their nets, where glittering trout await.

To keep the lake thriving, in 2005 a working group of elders, young leaders, stakeholders and representatives from the federal and territorial governments created “The Water Heart,” a watershed management plan explicitly informed by the Sahtuto’ine Dene’s deeply held spiritual belief that *Tudzé*, a sacred water heart, beats at the bottom of the lake. Its critical life force connects all living things and must be honoured and protected for eternity. The Water Heart later was included in the region’s Sahtu Land Use Plan, which prohibits development in core protected areas and creates buffer zones where limited development can occur, providing it doesn’t threaten the lake’s ecology.

With these efforts to regain governance and stewardship over their traditional territory, the Sahtuto’ine Dene of Délina have created what is possibly the most cohesive and comprehensive Indigenous-led water conservation plan of modern times — one that UNESCO held up as a model for the rest of the world in March 2016, when Délina became the first Indigenous community to achieve UNESCO biosphere

THE SAHTUTO’INE DENE OF DÉLINE HAVE CREATED POSSIBLY THE MOST COHESIVE AND COMPREHENSIVE INDIGENOUS-LED WATER CONSERVATION PLAN OF MODERN TIMES.

reserve status for its management of the Great Bear watershed. The Tsá Tué Biosphere Reserve, which spans more than nine million hectares — an area the size of Maine — and has a core protected area of two million hectares, is the largest in North America and the first in Canada’s North. While the designation is more an award of excellence, it endorses and promotes Délina’s management tools internationally as the gold-star standard for balanced relationships between humans and the biosphere.

GINA BAYHA HELPED initiate Délina’s UNESCO application in 2013. When elders learned of the 669 biosphere reserves in UNESCO’s global network, they insisted Délina apply.



“I’ve never heard elders being so forceful before — they’re usually so kind and patient,” she says. The fact the biosphere designation holds no regulatory teeth didn’t diminish their stridency.



"They didn't care about enforcing rules. They wanted a strong voice, and I said, 'What's the point?' And they said, 'If other people hear our stories, it's sharing, it's networking.' It's sharing how they've lived this way so long, their connections, not just to the water, but to the air, the animals."

Bezha says Ayah's doomsday divination and the belief in *Tudzé*, the sacred water heart, underpin his people's sense of urgency to keep the lake writhing with trout, cisco, whitefish and Arctic grayling while sustaining species such as muskox, wolves, caribou and wolverines. "People will say, 'Oh these are just legends,'" says Bezha. "Not so. It's our history, the Dene history, and there's a lot more to a lot of the things they're talking about."

The Water Heart management plan stresses the interconnectedness of all things and the necessity of caring for the world and all its people — Dene and non-Dene alike. The elders profoundly

understand this, many of them having unwittingly carried the uranium used in the atomic bombs that devastated Hiroshima and Nagasaki — events Ayah had also prophesied prior to 1942, the year his people began working at the federally owned Eldorado Mine at Port Radium on Great Bear Lake's eastern shore. There, they hauled dusty sacks of radioactive material without protective clothing or warning of the harm it could do. Many died of cancers. Decades later, survivors travelled to Japan to apologize, but the entire painful era, including ongoing remediation at the mine and in the lake — and the failure of the government to safeguard workers from health risks — strengthened Délîne's resolve to control what happens in their homelands.

DÉLINE NEEDS TO convey such history, along with the hundreds of encyclopedic entries unilingual elders have in their heads about trails and burial sites or the ecology of a bay during fish spawning or caribou migratory habits, so future generations can integrate that knowledge into biosphere management. Using a combination of geographic information

Clockwise from ABOVE LEFT: Russel Kenny pulls a trout from his nets; Kí Karkigie cuts moose meat; elder Charlie Neyelle in his teepee; elder Rosie Mantla prays during the celebration of Délîne's UNESCO status; Mandy Bayha wrings out a moose hide.

systems, Google Earth and software that allows you to simultaneously see and hear a Sahtu Dene language place name along with its English translation, the Dene Mapping Project is doing just that. "It's a linguistic gold mine here," says Phoebe Tatti, a Délîne native with a master's degree in language and education who heads the project. "Each one of the 250 place names we have so far is associated with a story or a legend as to how the name came about."

That innovative approach to conservation education is part of why Délîne's biosphere bid is backed by The Pew Charitable Trusts, the U.S.-based public-policy nonprofit. Pew is helping Délîne develop eco-tourism and meet its UNESCO obligation to research and monitor water quality and wildlife populations — especially dwindling caribou herds.

Steven Kallick, Pew's director of international lands conservation, says

Laurie Sarkadi lives near Yellowknife. Her first book, *Voice in the Wild*, was published in October. Angela Gzowski lives in Yellowknife and is the former photo editor of Up Here.



Déline is ripe to formalize its role in Indigenous stewardship through a guardianship program that uses private and public money to hire locals as land managers.

Australia's \$100-million annual investment into its "smashingly successful" rangers program pays more than 700 Indigenous people, many of them youth, to manage their conservation lands, Kallick says. "It's funny how Canadian governments, when they do invest in a park or a wildlife area, bring in non-Indigenous people from Toronto or Vancouver to work in these places. If you hire locals, you don't have to teach them how to run a boat, how to stay alive if they run out of gas and the engine conks out. You can't teach a lifetime's worth of knowledge that kids have growing up in a community."

That's music to the ears of elder Leon Modeste, 83, who believes Déline must eschew large-scale development in favour of conservation jobs for Great Bear Lake to survive. But this is a resource-rich area; besides uranium, there's coal, diamonds, iron, silver, copper and possibly oil and gas and gold deposits. The pursuit of any of these could spark the hot-button

**THE UNESCO DESIGNATION
ENDORSES AND PROMOTES
DÉLINE'S MANAGEMENT
TOOLS INTERNATIONALLY
AS THE GOLD-STAR STANDARD
FOR BALANCED RELATIONSHIPS
BETWEEN HUMANS AND
THE BIOSPHERE.**

jobs-versus-the-environment debate. Modeste says climate change alone will bear tremendous pressures on *Tudzé*, the lake's water heart. "It's a gift to us to take care of it and it's not even ours," he says. "It's for all people. Eventually a lot of people will come and we'll offer our food, we'll offer whatever we have, and we're going to talk about how to respect it, how to honour it, how to keep it so it can sustain us for as long as it's capable."

This global outlook, with parallels to chemist James Lovelock and microbiologist Lynn Margulis's famed Gaia hypothesis, has served Déline well as a guiding light toward a sustainable future, even though people here say the climate



change apocalypse Ayah foresaw is inescapable. If they're right, there's at least some comfort knowing these expert conservationists have taken on the self-designed role of "water keepers 'til eternity" with such fervency, determination and heart. ☺



See more of Angela Gzowski's photos from Déline and the Tsá Tué Biosphere Reserve at cangeo.ca/jfl7/tsatue.

THE CALL OF Algon

A photograph of a serene lake scene. In the foreground, tall grasses and fallen logs are visible along the shore. The middle ground shows a calm lake with a thin layer of mist. A dense forest of evergreen trees lines the background, their reflections visible in the water. The sky is a soft, warm color, suggesting sunrise or sunset.

An early morning mist shrouds a lake
that lies alongside one of Algonquin
Provincial Park's many portage routes.

quin



A celebration in words and pictures
of Canada's oldest provincial park

**PHOTOGRAPHY BY MEGAN LORENZ
WITH TEXT BY ROY MACGREGOR**

This being the year of anniversaries — Canada's 150th birthday, a century since Vimy — it will also very quietly mark my 70th summer in Algonquin Park. At the age of four days, I was taken to my grandparents' log home on Lake of Two Rivers, where I spent every summer to teen years, and in the decades since, I have paddled and portaged over so much of the park that I have probably seen... well... a small percentage of it. It's that big: 7,630 square kilometres, significantly larger than Prince Edward Island.

ALGONQUIN PARK



Clockwise from ABOVE: Spruce Bog Boardwalk Trail; Kent Nonomura (left) and Jeff Manser photographing grey jays; a great blue heron; a pine marten; a portion of the Logging Museum Trail; a black bear on alert; the remains of an “alligator” boat, an amphibious steam-powered vessel once used to move felled trees, sits alongside the Logging Museum Trail.



SOMEWHERE IN THAT VASTNESS lies my very favourite spot. You can reach this special place only by canoe or hiking. It includes falling water, rock slides where children can play like otters and hollowed out “bowls” in the granite where you can spend a delightful day swimming and playing. Sorry, no directions — you’ll have to find it yourself, I’m afraid.

This year will also mark the 100th anniversary of the passing of artist Tom Thomson, whose body surfaced on Canoe Lake on July 16, 1917. Thomson and his friends, who later formed the Group of Seven, found their inspiration in the Algonquin landscape. This photo essay explains why far better than any words could. What Tom Thomson saw 100 years ago is still readily available today to any visitor.

That is not to suggest Algonquin Park never changes. Since the now-provincial park was established as the country’s largest national reserve in 1893, the tinkering has been endless. They brought in an adviser from Niagara Falls’ Queen Victoria Park who recommended an all-out war on loons, as they were stealing the fish. They told the rangers to trap, shoot and poison the wolves. Today, the call of the loon symbolizes Algonquin and the top tourist attraction is the summer wolf howls. They introduced small-mouth bass, which took off. They planted fruit trees, which died. They brought in pheasants and elk, which vanished.

Alexander Kirkwood, the founder of Algonquin Park, envisioned “a million or more of people” sustaining themselves in the area. Never happened. To this day, debates rage over wilderness protection or managed logging, over whether the few hundred leaseholders should be allowed to retain their cottages and camps. Personally, I have always considered the leaseholders as much a part of the flora and fauna of Algonquin as the whisky jacks (grey jays) that would take bread from my grandmother’s hand or the moose grazing in the wetlands on the side of Highway 60. But then, I’m obviously prejudiced.

How could I not be? My mother was born, in a tent, on the shores of Brûlé Lake. My grandfather was a ranger, my father a logger. Visitors to that fantastic two-storey log home — long since gone — at Lake of Two Rivers included Ralph Bice, the legendary trapper and guide. A proudly religious man, Ralph used to say, and say it often, that “Anyone who has been to Algonquin Park will be disappointed when they get to heaven.” ►

*Roy MacGregor is a National Newspaper Awards and National Magazine Awards winner and the author of several books that touch on Algonquin Provincial Park, including his latest, *Canoe Country: The Making of Canada*.*



Ottawa

Toronto

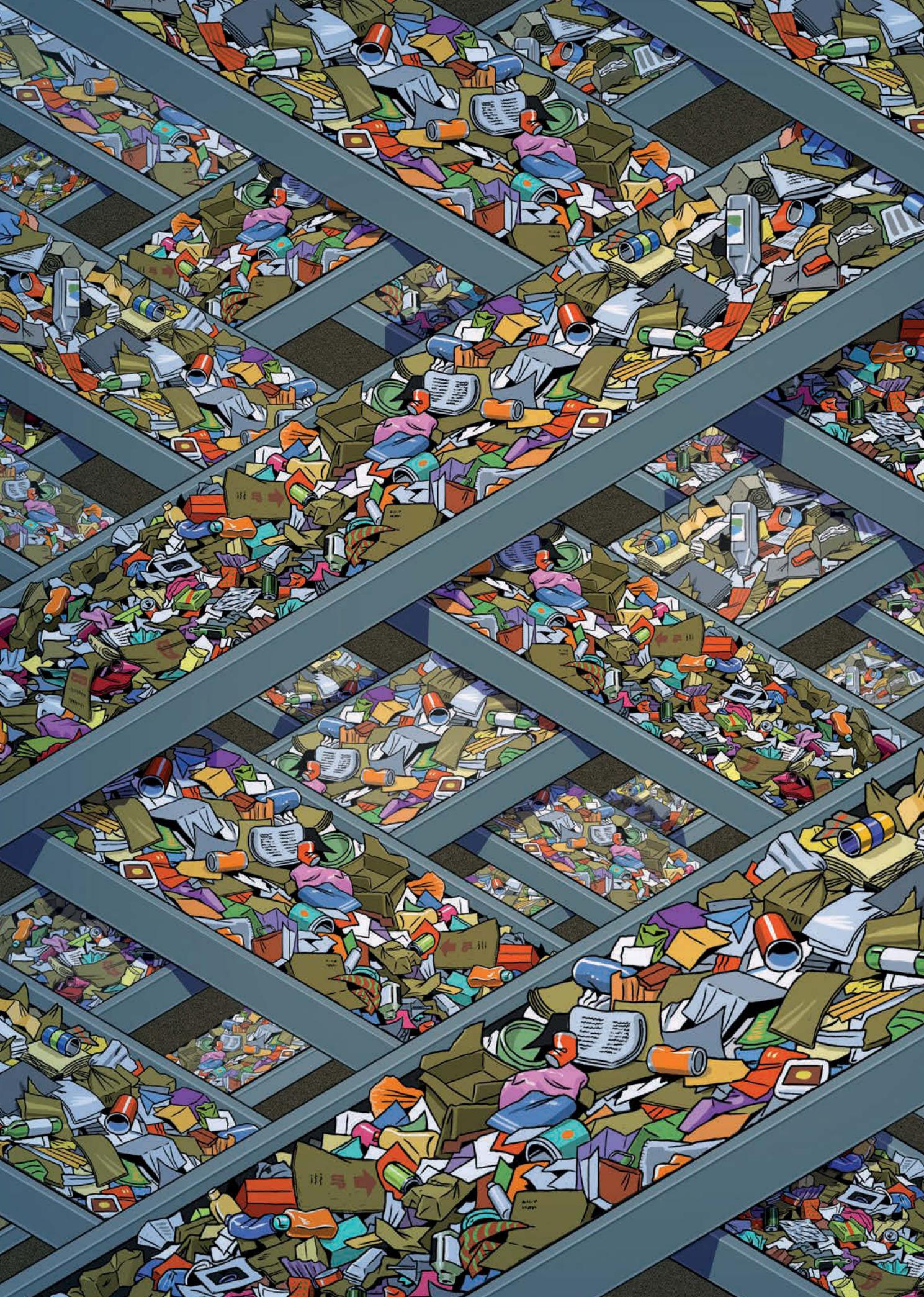
ALGONQUIN PARK



Clockwise from OPPOSITE: A moose watches passers-by from the brush at the side of a road; a young red fox; a grey jay; a steam locomotive at the Logging Museum; two canoeists return to the Lake Opeongo dock after a weekend of backcountry camping.



See more of Megan Lorenz's stunning photos of Algonquin Provincial Park at cangeo.ca/jfl7/alonquin.



TRASH NATION

Canada leads the developed world in per capita production of garbage. An exclusive investigation into the nation's dirtiest secret.

BY CHARLES WILKINS
WITH ILLUSTRATIONS BY GUY PARSONS

ON THE MORNING of May 3, 2016, at the Canada Fibers plant on Arrow Road in northwest Toronto, a worker spotted something abnormal and quickly sounded the alarm. The cavernous echoing facility is the separation site for the 800 tonnes of “recyclables” that Toronto’s waste management department collects daily from blue bags and bins around the city. As the impressive tonnage rattles and roars through the plant, high-tech machinery winnows steel cans from aluminum cans, from glass, from paper, from cardboard, from Styrofoam, from numerous other kinds of plastic. The mountains of separated detritus are then compressed into bales the size of pianos and are shipped off to buyers... who break them down and sell them to manufacturers... who build them up again and sell them to consumers... who break them down again, and put them in recycle bins, from which they are picked up by one of the 800 curbside collection trucks used by the city, and the whole surreal process begins again... and then begins again.

But all of this went kerflooey on May 3, when the machinery at Arrow Road failed to recognize and “sort” what police later described as “a human body part.” Within

minutes, the rumbling of the plant came to a halt, and the site was summarily shut down. And remained so for some 24 hours.

For Derek Angove, the city’s amiable and devoted director of solid waste management, the problem was not so much the macabre presence of the body part (decidedly a matter for the police) but rather that for an indefinite period of time the plant would be out of commission, and there would be no place to unload or winnow the never-ending avalanche of recyclables that pours into the facility at a rate of about two tonnes a minute, aboard 18-wheelers that pick up the goods from any of seven municipal transfer stations across the city.

Within minutes of the shutdown, Angove was on the phone securing alternative sorting sites in nearby Burlington and other parts of southern Ontario. “My job,” he said an hour later, “is to make sure that every item of waste we collect — from kitchen scraps to Christmas trees to mattresses to old carpeting and toilets — keeps moving. If for any reason the stream begins to back up, the transfer stations are full before you know it, the collection trucks can’t unload, and we’re in big trouble fast.”

IN A WORLD increasingly inclined toward “suicide by garbage,” as the late American novelist Jim Harrison phrased it, Toronto might seem to be a mere whistle stop on the road to global self-destruction.

“Toronto is deceptive,” says Myra Hird, who teaches at the Queen’s University school of environmental studies in Kingston, Ont., where she is a specialist in waste management. “It tends to deal with its municipal waste so efficiently that the average person doesn’t see how much of it there is or where it goes. Out of sight, out of mind, sort of thing.”

The last time Torontonians glimpsed the realities of their garbage habit was during the five-week municipal workers’ strike in 2009, when many of the city’s parks and outdoor rinks (devoid of ice in July) were buried up to four metres deep in stinking refuse. The previous glimpse came after 9/11, when U.S. border authorities temporarily stopped shipments of about a thousand tonnes per day of Toronto’s garbage to the Carleton Farms landfill in Michigan. At the time, another 4,000 tonnes of the city’s trash was being deposited daily in the Keele Valley landfill, Canada’s largest garbage dump, just north of Toronto in



Vaughan — a site that was itself under pressure and about to close its drawbridge on Toronto's daily outpouring of rubbish.

Any outsider granted a behind-the-scenes peek at that outpouring is likely to be struck by its volume and variety and cost — more than a million dollars a day to keep it all moving. But what really hits the uninitiated, and hits hard, is the flow of it all, the river — the nightmarish relentlessness with which the waste keeps coming, keeps needing a place to go, to hide, to die, sometimes to be reborn. All of which echoes the relentlessness of the country's garbage production as a whole. Despite what anyone might believe about the country's oft-cited ecological values and its liberal ambitions for the planet, Canada leads the developed world in per capita production of garbage.

"We tend to think that if other countries were more like Canada, the planet could be saved," says Hird. "But if every country was like Canada in terms of all-out con-

what's happening, or not happening, with domestic waste throughout the country."

Beyond the city's annual processing of 200,000 tonnes of recyclables, its residents produce household garbage (the stuff we put in green bags) at a rate of 10,000 tonnes a week, or half a million tonnes a year. For maximum efficiency, tractor trailers, each bearing nearly 40 tonnes of compacted garbage, are meticulously clocked out of Toronto so as to arrive at the city's Green Lane landfill near London at a rate of one every 10 minutes, hour by hour, weekday after weekday.

Relative to most rural settings in southwestern Ontario, and despite its pastoral name, Green Lane is not so much a parcel of land, or even a dump in any typical sense, as another planet. Located just north of Highway 401, about 200 kilometres west of Toronto, the 130-hectare public landfill (Canada's biggest) throws a memorable pong across the surrounding countryside but is otherwise barely discernible to anyone who does not actively seek it out. A grassy berm separates it from the 401, and the side road to the site passes a hardwood forest and creek remediated by the City of Toronto, in part as a kind of thank-you to Southwold Township for taking on Toronto's garbage at a time when other constituencies wanted nothing to do with it.

The landfill's relatively dressy exterior is significantly influenced by its manager, Anne Hiscock, a one-time lawyer, whose office, on the site's north side, is in a faux-residential building surrounded by a riot of yellow gardens that, a year ago, earned the site a place on the local Communities-in-Bloom tour.

However, as Angove and Hiscock accompany a first-time visitor up the long ramp to the lip of the landfill proper, Angove offers a gentle caution about what lies ahead — an experience perhaps unimagined, or even unimaginable. And he is well justified in doing so. The visitor and his chaperones come over the last

incline in the road, out onto a dusty mesa from which the valley beyond might be mistaken for a vast archeological dig, one that has unearthed a somehow familiar civilization, or more precisely what remains of that civilization when it bags up the leftovers from its pillaging of the planet and tosses the bags into an 11-million-cubic-metre hole. Seeing the place for the first time is a moment for which no convenient hyperbole is too big (think Cortez, gazing at the Pacific, "silent on a peak in Darien," as John Keats put it). Except that the ocean here is not of course water but garbage, fathoms of it, a sea on which 18-wheelers and Caterpillar landfill compactors move about like small ships, the sound of their engines silenced by distance and the persistent howl of the wind.

Typically, such a place would be host to legions of scavenging birds (Vancouver's Ladner landfill, at Delta, hosts several thousand gulls and a thousand bald eagles). But on this day at Green Lane there are just two birds — rentals, of all things — both perched on the viewing promontory: an aging golden eagle and a Harris hawk, a kind of missile with wings, that Angove says is "the work horse" of the pair. Green Lane hires the tamed raptors from Predator Bird Services to come and sit by the site on perches, within metres of their handler's vehicle. From there, the hawk takes an occasional tour over the garbage, to remind gulls that the landfill is not the paradise they might have assumed (the old eagle is more an implied threat these days). "So, we have no birds," says Hiscock.

And no rats. And no bears.

Green Lane, like all landfills, does have a hellacious population of microbes, quintillions of them, that eat away at the dump's contents, producing methane

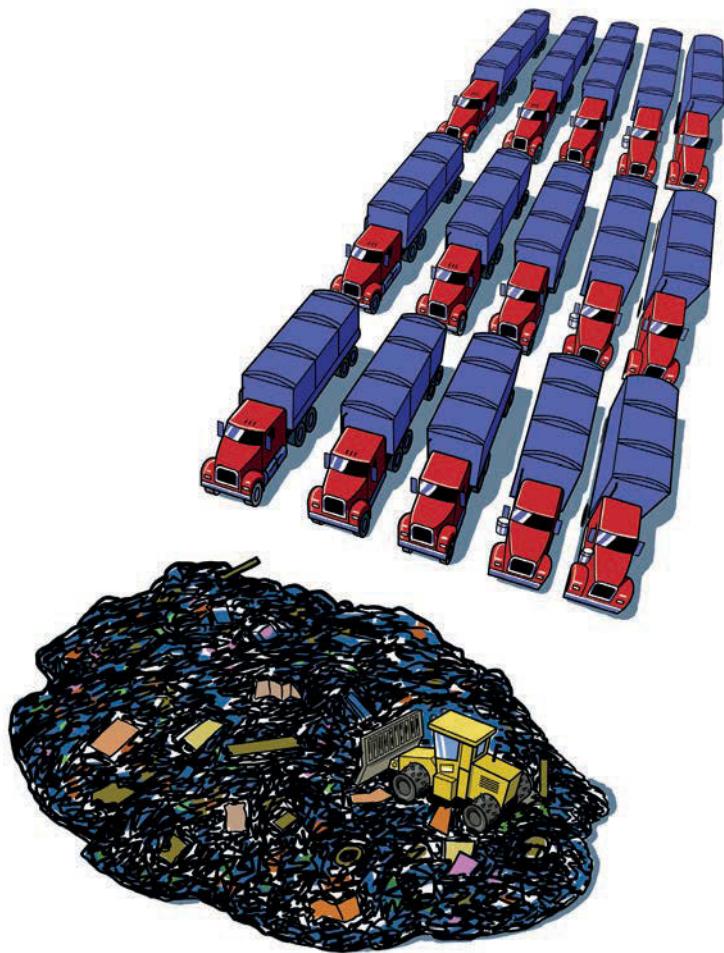
'The unfortunate reality is that diverting waste into recycling costs money.'

sumerism and waste, the planet would be even more messed up than it is."

The 720 kilos per capita of waste produced annually by every Canadian is about twice what is produced per capita in Japan and as much as 10 times what is produced by a half-dozen countries in Africa. More alarmingly, our production is seven per cent higher than per capita output of waste in the United States, which all but invented consumer excess.

"As our greatest concentration of people," says Hird, "Toronto is basically garbage central — a pretty fair representation of

Charles Wilkins (charleswilkins.ca) is the author of 15 books, including two international bestsellers. Guy Parsons' (guyparsons.com) illustrations have also appeared in The Globe and Mail and Sports Illustrated.



gas, a serious greenhouse offender, at a rate of 96 cubic metres per minute (enough to fill a two-car garage nearly 1,500 times a day). The gas is collected by dozens of vertical and horizontal gas wells and is burned off or “flared,” although plans are proceeding to construct a power plant that will convert the methane to usable energy. At Keele Valley, Toronto’s former landfill, which was decommissioned 16 years ago, methane still pours from the buried trash in sufficient volume to fuel a plant that provides enough electricity to supply 20,000 homes.

A natural clay underlay at Green Lane prevents toxic leachate from getting into the groundwater. “We know the clay is impenetrable,” says Angove. “Tests showed water molecules just above it that dated back 10,000 years”—in other words, to a time when the last of the Wisconsin glaciers was dragging its icy tail across the territory.

UNLIKE SOME landfills that are open for a specified period of time and then are closed, Green Lane will be a player

until the last bag of chemically contaminated lawn cuttings and busted Barbie dolls is rammed into it by a 60-tonne bulldozer. The facility’s closing date may be as far away as 2040, depending on Toronto’s ongoing attempts to divert ever-greater quantities of its garbage away from landfill and into recycling. At the moment, the city diverts 52 per cent of the waste it collects into recycling (compared with, say, 34 per cent for Calgary and an average of 55 per cent in many Canadian cities).

Canada is home to about 2,400 active landfills (large and small, public and private). Most of them stink; some leak chemicals and heavy metals into the ground and water table; some are prone to rats, some to fires; most create unwelcome truck traffic and dust. For perhaps obvious reasons, most are also politically contentious, particularly in the planning stages. Toronto negotiated for years to achieve its 2007 purchase of Green Lane, originally a private landfill that the city rebuilt and reopened for its own purposes in 2011. Prior to that, a decade of fractious negotiation went into the city’s

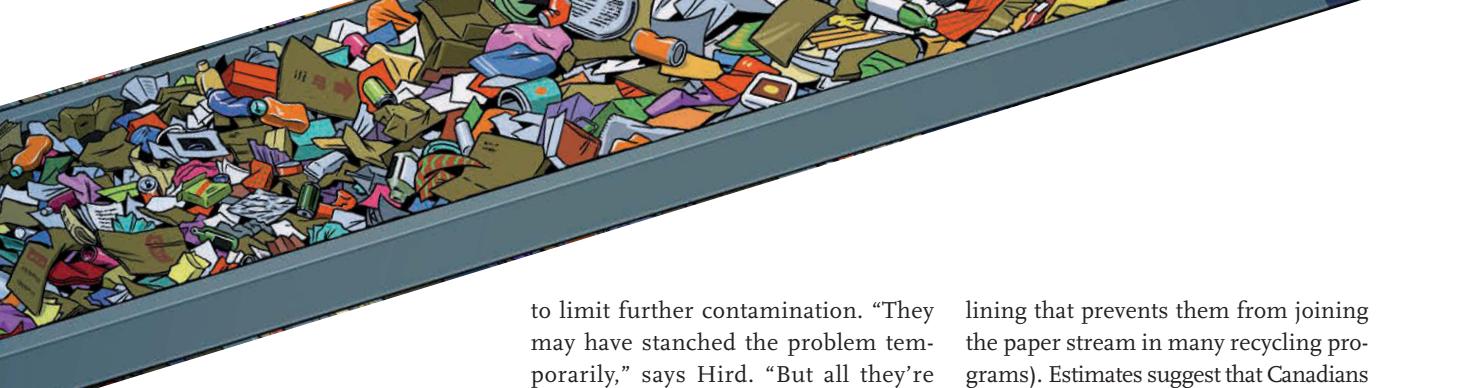
unsuccessful campaign to convert an abandoned mine near Kirkland Lake into its official trash hole. “Landfills are extremely difficult to locate,” says Angove, “and they should be, given their role and significance in the culture.” A number of Canadian cities, including Ottawa, Halifax and Vancouver, have in recent years witnessed strident debates over the siting of local landfills.

Meanwhile, the stench and toxicity and flaring, as well as the truck traffic and expense and socio-ecological disruption, are the *good* news about Canada’s waste and waste management efforts.

The bad news is a succession of inconvenient truths sufficiently disconcerting to send all but the most resolute ecologists swimming for the bottom.

Those truths begin with an awareness that in Toronto, for example, and in other cities, residential waste—basically, all of the rubbish discussed above, including recyclables—makes up little more than a third of total urban waste. The other two-thirds comes from industry, commerce and institutions—I.C.I., in the parlance of waste management—which is to say restaurants, schools, malls, factories and office buildings, as well as construction and demolition sites. “And on this stuff, we’re much more in the dark than we are on household garbage,” says Myra Hird. For one thing, I.C.I. waste is collected not by municipalities, which tend to run responsible programs, but by private waste haulers that, research has shown, divert only 13 per cent of what they collect into recycling, while the rest goes into private landfills or incinerators.

“The unfortunate reality is that diverting waste into recycling costs money,” says Daniel Hoornweg, a one-time waste management advisor to the World Bank and an associate professor of energy systems at the University of Ontario Institute of Technology in Oshawa. “The only thing the private hauler cares about is disposing of trash in the cheapest possible way. And the municipalities are partly responsible for



this. Their attitude toward factories and businesses and institutions is ‘We don’t care what happens to your junk as long as we don’t have to collect it or see it.’”

THE MORE DISTURBING news yet is that Canada’s urban waste in its entirety — including ICI — accounts for just a third of the country’s total waste. “A much larger part of our refuse,” says Hird, “comes from mines and agriculture and the military, and so on — and in most cases, this is the most toxic waste of all.”

Where mining is concerned, Hird explains that responsible companies have done an adequate, even honourable, job of cleaning up the waste around their mine sites, but that the tailings from many mines have simply been left leaking their poisons into the soil and water. “We’re talking chlorine, dioxins, furans,” says Hird, “some of the most toxic substances in existence.”

“When people think their stuff is **being recycled**, it clears their conscience, no matter what is actually happening **beyond the blue box.**”

Asked why the government doesn’t force mine owners to comply with remediation laws, Hird responds that there are 28,000 mine sites in Canada that have no owners — that have been abandoned by companies that took all they could from a mine and then declared bankruptcy or simply fled. As an example of the worst, she cites the Giant gold mine near Yellowknife, where waste containing a quarter-million tonnes of deadly arsenic trioxide has simply been frozen in an attempt

to limit further contamination. “They may have stanched the problem temporarily,” says Hird. “But all they’re really doing is passing it along to future generations.” Hird contends that agriculture in Canada is as guilty as mining of creating and spreading waste, mainly sewage containing nitrates, hormones and medications that leach into the water table and on into lakes and rivers.

“Given the limited access to military documents,” she says, “we don’t know what waste the military is producing just at the moment. But we’re gradually learning about what they left behind, say, up on the DEW Line in the Arctic” — namely, thousands of tonnes of old vehicles, housing units, batteries, infrastructure, fuel containers, PCBs ... various other highly toxic chemicals. “It’s taken 19 years to gather it into dumps, and still all the sites haven’t been fully remediated.”

Hird says the reason we as a culture focus so much on residential waste, as opposed to the larger picture, is that there’s far more data available on household garbage than on, say, mine or military waste. “And to a degree,” she says, “this suits our governments, in that they probably prefer not to focus on mines and nuclear or corporate waste. It’s a lot easier to convince households to change their habits than to convince global corporations.”

RECYCLING ITSELF can be an elusive factor in waste management. Studies indicate that in the United States more than 90 per cent of plastic, including much that goes into blue boxes, is never recycled.

A news story from mid-2016 revealed that Tim Hortons, while inviting customers to place their disposable coffee cups in recycling containers, was not in fact recycling the cups in most parts of Canada, but merely sending them to landfills (the cups have a thin plastic

lining that prevents them from joining the paper stream in many recycling programs). Estimates suggest that Canadians use between 1.6 billion and 2 billion disposable coffee cups a year. These represent up to 35,000 tonnes of paper, made from more than 70,000 tonnes of raw wood, harvested from thousands of hectares of forest. “So much for preserving your resources,” says Hoornweg.

Hird tells a story about a research project at Queen’s University, run by one of her grad students, Cassandra Kuyvenhoven, who tracked materials put into blue bins at Queen’s to see where they ended up. “While the system seemed functional and neat on the surface,” says Hird, “it certainly wasn’t that behind the scenes.” Kuyvenhoven found, for example, that when recyclable Styrofoam left Queen’s it was loaded onto trucks and taken to Toronto, where it was compacted chemically then trucked to Montreal where it was put on ships that took it to China, where it eventually ended up in landfill. “We might as well have landfilled it here,” says Hird, “and saved the tonnes of carbon that went into the atmosphere getting it to China.”

Electronics equipment made its slow way from the university’s loading docks to landfills in India and Mexico.

“When people think their stuff is being recycled, it clears their conscience, no matter what is actually happening beyond the blue box,” says Hird. “Our research shows that when their conscience is clear, they tend to consume more than ever. Since Canadians started recycling in earnest maybe 30 years ago, consumerism in this country has done nothing but climb.”

While recycling is barely a factor in residential construction in Canada these days, consumption and waste are rampant. “We see wreckers in Toronto and Vancouver blithely dumping whole houses, healthy livable buildings, into landfills,” says Hoornweg. “People talk about ‘tear-downs’ as if they were some sort of natural community renewal. [The



reference is to older houses purchased then trashed to make way for new houses.] And they're not! They're an ecological and ethical disgrace. In Europe and other less disposable cultures, old buildings tend to become part of the structure of new buildings. They're not just hauled off to the dump."

AMID WHAT ONE social critic called "the garbage nightmare," it is difficult to imagine a future in which even cities with the most efficient waste management programs will eventually need no landfills at all. But in many municipal waste departments, zero garbage — zero landfill — has become a kind of scriptural mantra and ambition: Thou shalt not dump.

"**SOLID WASTE — OUR HIDDEN TREASURE,**" proclaims a brochure published by Toronto's waste management department. The department's hope is that at some point, perhaps just 20 years away, every bit of the residential waste it collects will have a use, a buyer, a life beyond the garbage bag or blue box. The

plan, if realized, would render a landfill such as Green Lane redundant.

With the goal of total reclamation, the City of Toronto is making no plans at the moment to acquire property for its next landfill, which typically it would be doing at this point. Meanwhile, even a small city such as Whitehorse, where recycling is in its infancy, hopes to have a use for every trace of its solid waste by 2040.

"Which is all well and good," says Hoornweg, "but even 100 per cent recycling isn't going to slow down the production of all the junk our culture makes and buys, which is of course the real source of waste; and it won't do anything to clean up all the overloaded dumps of the world."

Hird notes that recycling in the form of "urban mining" may indeed reduce some of the world's existing waste. She cites Swedish research showing that "there is as much valuable metal in defunct infrastructure beneath our cities as there is in many of the world's mines." With resources running out at traditional mine sites, new possibilities exist for

recovering buried resources from their urban tombs.

Landfills, too, shelter valuable metals and minerals, except that "mining" them puts at risk the impermeable barriers that prevent leachate from getting into groundwater and soil.

WHEN HE WAS advising the World Bank, Hoornweg concluded that the relative volume of waste produced by a country is "pretty much a perfect proxy" for the state of that country's ecological and moral stature. "A high production of solid waste is one of the most visible and visceral symptoms of a troubled economy and a troubled society — right up there with carbon production and poverty," he says. "I guess you've got to ask yourself what this says about Canada."

While acknowledging that recycling is still a meaningful front-line strategy for reducing solid waste, Hoornweg is adamant that the ultimate cure for waste lies not at the "back end," in recycling, but in reducing "front end" consumerism.

"By the time waste gets recycled," he says, "95 per cent of the environmental damage has already occurred — in manufacturing, in oil extraction, in the poisoning of our rivers and air ... the output of carbon."

Asked if there is an ultimate solution to proliferating waste, Hoornweg pauses and says quietly, "People have to buy less." The problem, he adds, is that "our economy is based on endless growth, endless production of what our landfills tell us is basically junk. The stuff wouldn't be in them if it wasn't junk! I mean, nobody wants our economy to fail; we can't tell the companies that employ Canadians to just stop producing stuff, or the stores to stop selling it. Then again, our economy is already failing us in the way it messes up the planet in the service of all this crap. The cycle just keeps going: manufacture, consume, discard."

Hird points out that economic boom times are invariably accompanied by increases in garbage. The coefficiency



is borne out in Toronto, where the surge in wealth in recent years has increased the city's output of solid waste ("tear-downs" are a prime example). Conversely, Calgary's recent economic shrinkage has resulted in a significantly

'A high production of solid waste is one of the most visible and visceral symptoms of a troubled economy and a troubled society — right up there with carbon production and poverty.'

reduced output of waste — this to a point where 29 jobs at the city landfill were recently eliminated (not enough work to keep employees busy), and the site's hours of operation were reduced by a day a week.

"In the waste management field," says Hird, "there's a repeating narrative: Well, we don't know how to conquer waste now, but eventually engineers and

scientists, or perhaps sociologists, will figure everything out ... One of my biggest concerns about this fantasy is that in spreading it, we're inadvertently burdening our children with a huge amount of guilt and responsibility for the future of

the world. We tell them, 'reduce, reuse, recycle,' when we as adults recycle a bit, reuse occasionally and reduce not at all. We just want to keep on consuming."

Hird is asked point blank if, in their agonizing over waste, those who care are perhaps merely fretting over a situation that has already gone too far.

"I wouldn't call myself an optimist," she responds. "But I do believe there's a future — mind you, a far more modest one than the present. Climate change alone is going to take care of that."

An interviewer suggests jokingly that maybe an alien species will arrive and take us all to a splendid new planet.

"I don't think we're going to be that lucky," laughs Hird. "Maybe the aliens

could just persuade everybody to smarten up. So far, the scientists haven't been able to persuade them."

MEANWHILE BACK in Toronto, it is six in the morning. Eight hundred waste collection vehicles are already on the streets — emptying green bins, gathering garbage, collecting bottles, cans and newspapers. At Green Lane, the first 18-wheeler has arrived with its 37 tonnes of rubbish. On the landfill's sea of rotting garbage, the Caterpillars are roaring, the methane is spinning into the wells. By 7, the Canada Fibers plant on Arrow Road is rumbling with beer cans and ketchup bottles. The transfer stations are all but bursting.

By 9:30, the malls are open. The first wave of shoppers moves purposefully toward the televisions and yoga pants and electronic gadgetry. And lawn ornaments and fleece blankets and revolutionary new kitchenware.

Because advertising is powerful.

Because consumerism is intoxicating.

Because retail therapy is easier and less costly than planetary therapy.

Some of the shoppers, it must be acknowledged, have brought their own tote bags. Others are conscientious about asking for a ceramic mug instead of a disposable coffee cup. Some drink at the public fountain rather than buying another plastic bottle of water.

Because the planet must be saved. ☽



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Senior wildlife officer Andrew Bruce holds an elephant tusk in the wildlife enforcement directorate's evidence room in Burlington, Ont.

Biodiversity Apocalypse

An estimated annual \$175-billion business (and growing!), the illegal trade in wildlife is the world's fourth-largest criminal enterprise. It stands to radically alter the animal kingdom.

BY LESLIE ANTHONY
WITH PHOTOGRAPHY BY PETER POWER

N OCTOBER 1994, I was on assignment in Vietnam's northern Truong Son Mountains, hard against the Laos border at an illegal logging camp on the remote Khe Moi River. I was accompanying a group of scientists conducting biodiversity surveys in previously unexplored areas. The primary forest here harboured a wealth of rare mammals, with remnant populations of elephant, tiger, gibbon, pangolin, barking deer and the just-discovered *saola* — or Vu Quang ox. After several weeks in the jungle, the scientists had extended this bio-bonanza to numerous undescribed species of snakes, frogs and insects, typically found during night excursions.

On reconnaissance one evening, I waded upriver, searching out entrances

to smaller streams to return to later. Rounding a bend, I surprised a clutch of men huddled around a fire on a sandbar. Clad in rags, skin darkened by smoke and grit, they radiated conspiracy — and with reason. Behind them sat a brace of ancient rifles and bamboo-frame packs on which were lashed the dried bodies of several gibbons and sun bears — both critically endangered species afforded the highest level of protection under the Convention on International Trade in Endangered Species, also known as CITES. As the men closed ranks to avoid eye contact, I waded past against the far bank, ludicrously pretending I hadn't noticed anything. The poachers were undoubtedly killing time until dark, when

they'd presumably make their way downriver to trade their booty along a pipeline to China, the beckoning maw into which most of the world's illegally obtained wildlife flows.

Though I'd never beheld such a scene, I knew precisely what I was looking at: if Southeast Asia's remaining forests were a gold mine of wildlife resources, then exotic outposts such as the Khe Moi were its cutting face, a tableau of lawless isolation where CITES was meaningless. What I didn't know at the time was that the same could be said of Canada's vast forests for the same reasons and, perhaps worse, that one could also buy the equivalent of a powdered gibbon smoothie on the streets of Vancouver.

THERE'S BEEN a significant increase in wildlife trafficking and poaching over the last decade," says Sheldon Jordan, director general of the wildlife enforcement directorate for Environment and Climate Change Canada and chair of Interpol's wildlife crime working group. Given his dual roles, Jordan has special insight into the reasons behind the surge. "Increased demand for wildlife products is driven largely by more disposable income in Asia and other parts of the world that have food, medicinal and spiritual traditions around these items."

With "wildlife trade" defined as the sale or exchange of any wild animal or plant (including trees), one might also finger both a rising population and sharp increase in the globalization of commerce over the same period. According to TRAFFIC — a network established in 1976 to monitor global wildlife trade — the value of legal wildlife products in the early 1990s hovered around US\$160 billion annually; by 2009 that had doubled to US\$323 billion, which includes everything from seafood to timber. A hint of the remainder lies in a CITES-compiled list of the 2005 to 2009 legal trade: 317,000 live birds, more than six million reptile skins, 1.1 million beaver pelts, 73 tons of caviar, a reef's worth of coral and 20,000 mammal hunting trophies. Though black-market trade in these same items is, by its very nature, difficult to assess, United Nations estimates of US\$7 billion to \$23 billion for fauna trafficking alone, and US\$57 billion to \$175 billion when flora and lumber are added, are staggering — enough that on the scale of illicit global enterprises, wildlife now ranks fourth behind drugs, counterfeiting and human trafficking.

Canada's substantial legal wildlife trade — forestry, commercial and recreational fisheries, wild plant harvesting, guided hunting — aids communities when undertaken sustainably. But continued unsustainable harvesting and illegal export and import of wildlife resources both here and abroad threatens to undermine any broader efforts at stewardship,



affecting communities and economies worldwide. "Like it or not, we're all dependent on the Earth for our survival," says Jordan. "The more that's taken without being regulated, the less ecosystems are able to continue the services they provide all life — including ourselves."

What Canada lacks in diversity of desirable species is made up in sheer numbers of organisms, distributed over 10 million square kilometres, an area that could comfortably fit 30 Vietnams. With just more than a third of the population of that small country famously concentrated in a few discrete areas, there are plenty of isolated areas where, for example, poaching bears to harvest gall bladders and paws — both in demand in Chinese traditional medicine — might go unnoticed. *The Rise of Environmental Crime*, a white paper published in June 2016 by a Norwegian think-tank and co-signed by Interpol, cites the troika of pollution, smuggling and poaching to be rising at five to seven per cent per year — double the pace of world economic growth.

Canada is in lock-step with this increase, notes Jordan. "And when you couple that with downward trends in government spending, that means more work for us and fewer resources to do it."

While Environment Canada's wildlife enforcement directorate is responsible for enforcing regulations of, among others, the Migratory Birds Convention Act, the Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act, the Species at Risk Act and the Canada Wildlife Act, it has only 75 field officers nationwide. Excluding the Department of Fisheries and Oceans, across all other government organizations and levels in Canada, less than 1,500 people attend to wildlife laws — compared with 70,000 police officers. That makes modern intelligence-gathering methodologies crucial to efficiency, as does using the resulting information to decide where the biggest problems are and how to leverage the right partnerships to deal with them — a sort of jurisdictional triage.



In practice, wildlife trade fits into a broader category of connected “environmental crime” that includes pollution, illegal fishing and logging (with up to one-third of the world’s paper obtained from illegally sourced wood, economic impacts accrue for countries such as Canada that strictly regulate such sectors). Jordan works both to squelch internal trade and to identify and cut off export and import routes of everything from butterflies to birds to fish to frogs.

Between 2015 and 2016, the wildlife enforcement directorate logged 4,900 inspections, 908 enforcement measures, 167 new prosecutions and 158 convictions, handing out a record \$1.1 million in penalties. Among the infractions: the illegal harvesting of migratory birds in Quebec, the illegal export of narwhal tusks by a Montreal auction house, a litany of bear parts turned up in a New Brunswick border blitz, a Dall’s sheep poached in the Yukon (where it’s protected) and smuggled into B.C. (where it isn’t) so hunters could claim that

province as its origin, and the illegal harvesting of endangered American ginseng, a slow-growing, low-seed plant whose colonies require 170 individuals to remain viable. “The reason for that particular trade is maddening,” laments Jordan. “A good wild ginseng root is 10 to 15 centimetres long; the more it resembles a human — with branches that approximate arms and legs — the more it’s worth, up to thousands of dollars.”

The wildlife enforcement directorate engages not only in enforcement but also in proactive training and joint efforts aimed at stemming illegal activity while protecting legal trade. For example, non-threatened Canadian populations of globally threatened wildlife provide economic opportunity to communities when managed sustainably. Emblematic is our most iconic large mammal, the polar bear. While Canada’s significant efforts to protect its populations ensure their continued health, polar bears continue to confer cultural, sustenance and economic benefits to

Bruce scans inventory in the directorate’s evidence room (OPPOSITE), which includes a taxidermied sea turtle (TOP LEFT), an elephant foot stool (TOP RIGHT) and carvings made from elephant ivory (ABOVE).

many isolated Indigenous communities. But when auction prices for hides spiked from \$5,000 to \$25,000 apiece several years ago, illegal harvest rose in tandem. In response, the wildlife enforcement directorate joined provincial, territorial and federal agencies to collaborate with Indigenous communities on an approach to identify and track legal polar bear hides from harvest through export, including DNA analysis and tagging with easily scanned microchips. These provide information on when and where a hide was obtained, helping thwart illegal trade while facilitating a more efficient tracking process for legal hides.

But while this system can help with non-compliant exports, the tide of illegal imports, according to Jordan, continues unabated.



IN THE EARLY 1980S, a curator at Ottawa's Museum of Nature invited me to tour a warehouse across the river in Gatineau, Que., where illegal wildlife items seized at Canadian airports, seaports and border crossings were stored. I recall a dimly lit mortuary of metal shelves stacked floor to ceiling with stuffed, glassy-eyed crocodilians and birds, sea turtle carapaces, conch shells, rolled snakeskins, numerous ivories, and the hides of lions and tigers and bears. Though this particular cache has long since been destroyed, the wildlife enforcement directorate currently maintains small exhibit rooms near Toronto and Ottawa stocked with similar items, plus a pharmacopoeia made from prohibited plant and animal species. While the sheer scope of material remains disturbing, a single rhino horn sitting on a shelf also can't help but conjure a gruesome image of its deceased owner, bleeding in the dirt, horn severed from its head. And that raises a troubling question: How long until these great beasts are gone from our midst?

Not long, considering what amounts to an 8,000 per cent rise in rhino poaching: in 2007, 13 of the animals were killed, while the past four years have each seen more than 1,000 removed from the wild, driven by black-market prices of up to \$350,000 per horn. "Ten years ago, someone started a rumour that powdered rhino horn cures cancer — except it's only keratin like hair and nails," notes Jordan. "You have as much chance of curing cancer or erectile dysfunction with rhino horn as you do chewing your fingernails."

Pangolins, scaly anteaters of Asia and Africa, are likewise slaughtered at the rate of one million or more annually for the whimsical properties of their scales. Elephant populations are decreasing annually by about 8.5 per cent (against a reproductive rate that optimally allows

A mounted turtle head in the wildlife enforcement directorate's evidence room.

for only a four per cent increase). In the Horn of Africa, ivory is smuggled from the lawless Democratic Republic of the Congo through unstable South Sudan into Somalia, whose ports are controlled by jihadist organization Al-Shabaab, which happily taxes its passage. "With upwardly mobile collectors in emerging economies paying top dollar for decorative ivory carvings, we could be down to very few wild elephants within a generation," says Jordan. "Many of those countries are at the stage we were at 50 years ago in terms of cultural taboos, so it'll take time."

Meanwhile, Asian enclaves in large North American cities will continue to keep to traditional beliefs despite the cultural — and legal — prohibitions of the West. "There's a large trade in any-

Vietnam's endangered species — and several that soon would be. When a single king cobra could net US\$200 — equivalent to Vietnam's average annual wage at the time — providing for a hungry family trumped all. The traffic I observed in consumable snakes and frogs alone was staggering — thousands crammed into burlap sacks crossing into China every day. Add in lizards, turtles, fish, birds, mammals and invertebrates, with the same occurring in a hundred other countries, and you had a major global crisis. This was the real China syndrome — not the nuclear meltdown of the eponymous 1979 Hollywood flick, but a biodiversity apocalypse now.

REPTILES ARE SURPRISINGLY common contraband. In 2009, an undercover operation involving the Ontario Ministry of Natural Resources, Environment Canada's wildlife enforcement directorate and U.S. agencies documented the illegal trade of more than 2,400 protected turtles and venomous snakes, charging two dozen people. Three Ontario men rounded up in the sting faced 34 charges for selling two protected species — eastern massasauga rattlesnakes and spotted turtles — across the border. American investigators posing as vendors at commercial reptile shows in New York and Pennsylvania befriended poachers and trawled Internet sites before nabbing one of the men with 33 rattlesnakes hidden in his van. The Pennsylvania show was so popular with Canadian reptile enthusiasts that wildlife enforcement directorate officers set up at the Queenston-Lewiston border crossing between New York and Ontario, charging several under the customs act for smuggling venomous snakes and frogs into Canada. Their \$1,000 fines, however, were mere slaps on the wrist

that didn't cover the time spent catching, charging and processing them. "Generally speaking, our laws go back many decades and need a tune-up," says Jordan. "It's a challenge to the

Pollution, smuggling and poaching are rising at five to seven per cent per year — double the pace of world economic growth — and Canada is in lock-step with this increase.

thing charismatic or useful in traditional medicines that mainly has Asian Canadians as clients," says Jordan, echoing news reports about what one might find during a tour of Chinese markets and apothecaries in Toronto and Vancouver, where all manner of live (turtles, fish), dried (geckos, sea cucumbers, shark fins) and powdered (endangered large mammal bits) contraband is transacted. China itself, however, may be coming around, having pledged, at least, to ban ivory by the end of the year. Jordan wishes them luck, knowing the trade will simply go underground for a few years.

Before encountering the Khe Môi poachers, I'd already seen how China's insatiable appetite for alimentation, wishful aphrodisiacs and traditional medicines accounted for many of



enforcement community when deterrents are mild. By and large, judges and prosecutors don't use the penalties available."

Though you can receive up to five years in jail for wildlife smuggling in Canada, Jordan has never seen more than a four-month sentence, attributable, he believes, to a perception of environmental crime as victimless among a judiciary hardened by drug crimes with clear human cost. For instance, if a smuggler brings in a kilo of fentanyl, it's assumed a certain number of people will die; not so with a kilo of endangered critters. But where Canadian law leaves things up to the discretion of a court system, U.S. legal

proscriptions are stronger, the penalties much harsher: a Waterloo, Ont., man caught heading south with dozens of turtles in his pants is now serving 57 months in an American jail.

'With upwardly mobile collectors in emerging economies paying top dollar for decorative ivory carvings, we could be down to very few wild elephants within a generation.'

bound for pet stores and private collections. Ontario averages four or five such files a year. "Of course, we don't know how much we're not detecting," Lonny Coote, the wildlife enforcement directorate's

director for wildlife enforcement in Ontario, told the Canadian Press in 2016.

According to documents obtained under warrant, Dennis Day, the man arrested, processed more than 18,000 illegal reptiles with a street value of \$700,000. Convicted of smuggling in 2013, his sentence was a \$50,000 fine and six months in jail to be served on weekends. The boat driver was charged and convicted by U.S. officials. A third conspirator, who owned a Montreal reptile store, received a \$45,000 fine and was successfully sued by the store's landlord after 250 reptile carcasses were discovered inside the building's walls.

Smuggling comes with such surprises. In another case, a Richmond, B.C., individual who'd been shunting iconic wildlife in and out of Canada was lured to New York for a buy and arrested there. "Then we called the officers waiting outside his

*Leslie Anthony (@docleslie) is a biologist and author. His latest non-fiction book, *The Aliens Among Us: How Invasive Species Are Transforming the Planet — and Ourselves*, is available now. Peter Power (@pjpower) has been shooting award-winning images for nearly 30 years.*

Busts can be dramatic — worthy of reality TV treatment. In a case near Cornwall, Ont., Canadian and U.S. authorities monitored a boat as it crossed the St. Lawrence River from New York to Ontario to deliver boxes to a waiting van. With officers descending on the smugglers, a woman took off with the boat, while the man driving the van was arrested. The boxes contained Chinese striped turtles, African sideneck turtles, South American red-footed tortoises and numerous lizards



antique shop in Richmond. They went inside to retrieve his computer on which all the evidence would reside — you know, who were the suppliers, who were the clients — but they also found ivory and coral, as well as ecstasy and marijuana,” says Jordan. “He was clearly involved in organized crime.”

According to Jordan, wildlife trade is attracting organized crime because of its outrageous profit margins — higher, in many cases, than for illicit drugs (see sidebar “Proceeds of crime,” RIGHT). “That element has definitely increased over the 15 years I’ve been working. Every couple of years, a bear gall-bladder ring is taken apart... One in Quebec involved 80 people.”

WHEN IT COMES TO ILLEGAL wildlife trade, stemming the tide of supply requires lowering the high-water mark of demand, a difficult proposition when you’re up against human nature, ingrained cultural beliefs and big money. Though this equation has always existed, it’s compounded by the nouveau riche of emerging economies who can now afford products previously seen as luxuries.

As long as someone is willing to pay good money, desperate people will continue to kill gorillas simply to cut off their hands. And demand for supposed aphrodisiacs is as likely to go away as traditional Chinese medicine that relies on animal parts, despite the largely superstitious basis of both. In late 2006, Zhang Gongyao, a medical history professor at Central South University in Hunan, ignited a furor in China when he wrote: “Chinese traditional medicine has neither an empirical nor a rational foundation. It is a threat to biodiversity. And it often uses poisons and waste as remedies. So we have enough reasons to bid farewell to it.”

On that Vietnam sojourn two decades ago, illegal wildlife trade was apparent everywhere: local markets sold putatively protected animals, restaurants specialized in them, the Hanoi hotel where I stayed had a snake dealer in the lobby, gift shops brimmed with animal contraband and illegal — yet state-sanctioned — logging was legion. Worst was the mid-coastal port of Vinh, where our group was guided on an incomprehensibly heart-wrenching tour to view live animals — sun bears, clouded leopards, pangolins, monitor lizards, pythons and birds kept under appalling conditions in hopes they could somehow be sold before they died. My biologist companions had tears in their eyes as we left town.

Canada’s task seems clearer in Jordan’s top three issues: the export trophy trade in vulnerable species, the import of high-value prohibited material such as ivory and rhino horn, and the emerging threat of invasive species, which can wreak havoc on ecosystems and also carry parasites and pathogens that can harm Canadian wildlife. The good news? Technology is aiding enforcement — drones and remote-triggered cameras have made it easier to identify and locate wildlife poachers both abroad and in Canada. The bad news is that environmental criminals are using the same technology — as well as the Internet, where you can purchase

The evidence collection includes fur coats, mounted native birds and mammals (OPPOSITE), as well as more unusual items such as bear gall wine (TOP LEFT) and snakeskin boots (BOTTOM LEFT).

anything and, perhaps in the near future, have it dropped at your house via drone.

Says Jordan: “These are the challenges we’re up against as a world community.”

PROCEEDS OF CRIME

THE STREET VALUE of an illegal live gyrfalcon? An estimated \$360,000. The value of a kilo of heroin, the most expensive narcotic by weight? About \$135,050. The following chart compares the prices (in Canadian dollars) of select illegal wildlife and drugs based on a recent report from the wildlife enforcement branch of Environment Canada — more proof wildlife crime is big business.

SPECIES/DRUG EST. PRICE

Gyrfalcon	\$360,000 alive
Bear bile	\$200,430 per kilo
Heroin, brown	\$135,050 per kilo
Methamphetamine	\$109,165 per kilo
Cocaine, salts	\$79,805 per kilo
Wild ginseng	\$46,110 per whole root
Opium	\$30,695 per kilo
Polar bear pelt	\$17,000
Hashish	\$14,735 per kilo
Ecstasy	\$8,045 per 1,000 tablets
Marijuana	\$7,365 per kilo
Narwhal tusk	\$3,935 per metre



Watch a new anti-poaching PSA from the African Wildlife Foundation aimed at saving rhinos at cangeo.ca/best17/poaching.

Place of SPIRIT



Sunlight breaks through the clouds
and across the rugged, remote landscape
of Torngat Mountains National Park,
on the northern tip of Labrador.



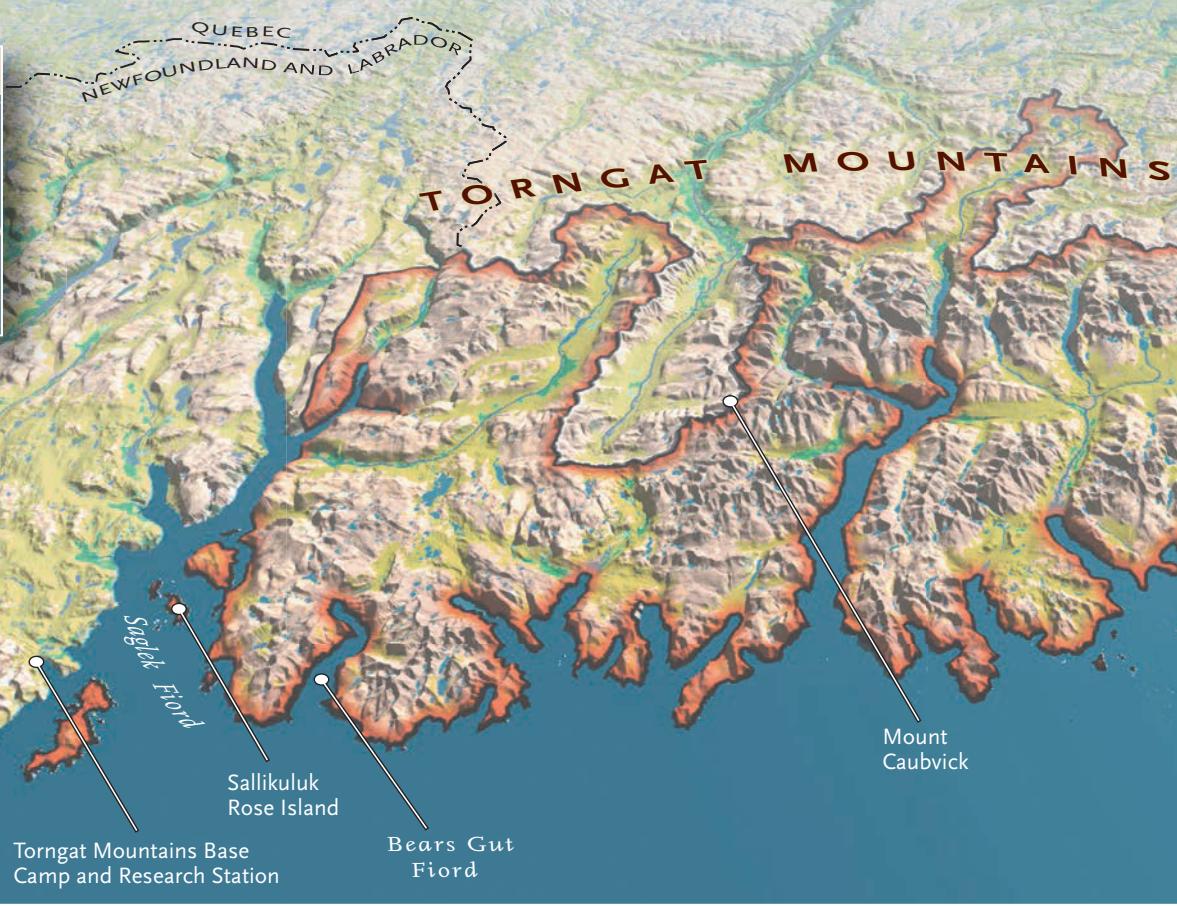
The
Best of
Canadian
Geographic
Travel

A glimpse into the stunning **Torngat Mountains National Park**, and how a unique cooperative management approach between local Inuit and Parks Canada enriches the experience

BY ANDREW FINDLAY
WITH PHOTOGRAPHY BY PAT MORROW

FAR BELOW a rocky alpine ridge, Bears Gut Fiord is calm and flat, save for the telltale dimple in the water where a minke whale surfaced before diving again. A solitary iceberg, incandescent in the morning sun, sits motionless near the mouth of the fiord. Somewhere out there I imagine *nanuq*, the polar bear, lying among intertidal boulders, waiting for an unsuspecting ringed seal or other prey.

That mental image is probably psychological residue from the bear safety video I was required to watch earlier in the week after arriving at the Torngat Mountains base camp and research station, the gateway to Torngat Mountains National Park, a 9,700-square-kilometre wedge of northern Labrador bounded by the Labrador Sea on one side and Quebec on the other. Named from the Inuktitut word *Torngait*, meaning “place of spirits,” the park is a wild place. There’s little in the way of infrastructure — no trails, tidy picnic sites or interpretive signage — and few have ever walked where Andrew Andersen, a Parks Canada visitor experience coordinator, and I are walking today. We traverse a shallow valley shin-deep in Labrador tea, the shrubby low-lying plant ubiquitous on the tundra, cross a stream that tumbles over an escarpment of brilliant ochre-coloured stone, then ascend a ridge green with moss. Mountain harebell blossoms among lichen-covered rocks, courageous splashes of purple in a treeless landscape.



Andersen kneels suddenly then hands me a toonie-sized chunk of opaque rock. "Ramah chert," he says. I roll the stone around in my palm. Its edges feel sharp enough for a close shave. Hard, durable and easy to work, it's unique to the Torngats, which is also home to some of the Earth's most ancient rocks, dated at 3.9 billion years old. Archeologists have uncovered tools fashioned from Ramah chert as far away as Maine and Trois-Rivières, Que. Though traces of humanity in the Torngats can seem as ephemeral as snow beneath spring sun, human presence dates back more than 7,000 years in this rugged landscape.

Andersen, 29, was born and raised in Nain, the northernmost of four contemporary Labrador Inuit settlements. He belongs to a young generation of Inuit reconnecting with a place that was previously known to them only through the stories of elders shared around kitchen stoves and campfires. In 2005, the people of Nunatsiavut, the Labrador Inuit's traditional territory, signed the Labrador Inuit Land Claims Agreement, which included provisions for the formation of Torngat Mountains National Park. In 2015, on its 10th anniversary, it became the only national park in Canada with entirely Inuit management and staff. It was a significant milestone for Parks Canada and for Andersen

and other Labrador Inuit who will shape the future of tourism and travel in this remote region. "I've been hearing stories about the old village sites in the Torngats all my life," he says, carefully replacing the chert as though it were a museum artifact that had been purloined then recovered.

THE FIRST ORDER of business when you finally arrive at the base camp (the journey involves a flight to an isolated airstrip next to a DEW Line station, followed by a 45-minute boat ride) is bears. An electric fence encircles the camp, which is situated at well-protected St. John's Harbour on Saglek Bay, just outside the park boundary. Neither tourists nor visiting scientists are permitted to venture beyond it without an armed Inuit escort, Gary Baikie, the park's superintendent and a Nain native of Inuit-Scottish ancestry, told me after base camp orientation on the first day.

In many ways, the park is still a blank slate in terms of developing the visitor experience. Base camp is open for just six weeks in the summer, and fewer than 700 people visited the park in 2015. While Baikie and his staff celebrated the park's 10th anniversary, they're also looking forward. Plans are in the works for a four- to six-hut backcountry hiking route starting north of base camp at Little Ramah Bay and heading inland

toward Mount Caubwick, the highest point in the park at 1,652 metres. Establishing the hut system and everything else in the park is underpinned by cooperative management between the Inuit and federal government. "Balancing science and Inuit knowledge is critical and a significant part of how we work up here," says Baikie.

Life at base camp quickly assumes a certain rhythm. By day, guests explore the park by boat and land with Inuit guides. By night, they eat with the Inuit staff who





Parks Canada's Andrew Andersen pauses to pick blueberries during a hike in Torngat Mountains National Park (OPPOSITE). Visitors photograph an iceberg from aboard the *Inuktitut* (RIGHT).

keep the solar panels functioning, the food hot and the soft-walled houses and insulated fibreglass domes (all raised on platforms) that serve as accommodation clean and comfortable.

One evening, Evie Mark and Akinisie Sivuarapik, two Inuit visiting from northern Quebec, treat us to a post-dinner throat-singing performance. I close my eyes and listen to their dissonant, guttural exchange. They are soon joined for another song by David Serkoak, a jovial former schoolteacher from Nunavut and now Inuit cultural ambassador whose drum-dancing performances have taken him from London, England, to the opening ceremonies of the 2010 Winter Olympics in Vancouver.

Later on I read in my fibreglass dome. The propane heater flickers in the corner. There's a knock on my door, a Hobbit-sized opening designed to be too narrow to permit the considerable girth of a polar bear. It's Baikie. "Hey, the northern lights are going off."



Outside, the sky is alive with light. Waves of blue, green and purple twist and turn upon one another in a spectacle of constant motion. I watch for 15 minutes and am on the way to the washroom when something startles me. It's a black bear, a member of the only population of that species on Earth known to live entirely above the treeline. Its eyes shine in the light of my headlamp, just metres away on the other side of the electric fence.

The next morning, Baikie, Andersen, Serkoak, Mark, Sivuarapik and I board the *Inuktitut*, the camp's diesel-powered passenger boat. We're bound for Sallikuluk, or Rose Island, one of the park's more significant cultural sites, a hauntingly

beautiful home to graves and traditional sod houses that were occupied as far back as the 1600s. We chug away, and from the top deck I see Mount Caubvick and some of its neighbours, where the only non-polar glaciers east of the Canadian Rockies cling desperately to the mountainsides.

I spot a ringed seal briefly poking its whiskered snout above the water off the starboard side, wisely circumspect. Two days ago, an Inuit staff member shot one of these animals, and we have been dining on seal stew and intestine ever since — a delicacy for the Inuit, a gamey, acquired taste for interlopers like me. The Labrador Inuit are the only ones allowed to carry firearms in





Watching the night sky (LEFT) at the park's base camp on Saglek Bay (OPPOSITE). Throat singers Akinisie Sivuarapik (BELOW, left) and Evie Mark perform with drum dancer David Serkoak on Rose Island.



the park. Though boats and snowmobiles have replaced kayaks and dogsleds, the Inuit retain the right to hunt within the park for seal, ptarmigan and, perhaps again one day, caribou, if the George River herd ever rebounds from its still unexplained decline. They also fish for delicious Arctic char that spawn in abundance in rivers and streams cutting through the mountains.

Yesterday, Serkoak and I watched a black bear foraging the hillside behind camp. I sized up the animal for my postcard memories; Serkoak sized it up for winter clothing. "That bear would make a great pair of pants," he said, with a cheeky

grin. Tongue in cheek or not, the comment was revealing. For the Inuit, living on the land is not an abstraction; it is reality. Their relationship with the Torngats is based on practicality, knowledge and respect rather than some sentimental notion of wilderness.

A few nautical miles from Rose Island, a flash of white against the velvet green of a shallow vale catches Baikie's eye. The *Inuktitut*'s engine must have startled this polar bear and sent it loping quickly away from the shoreline. Through binoculars, I see its muscular haunches rippling as it strides across the tundra and disappears over a knoll. I shudder at the thought of this animal trying to squeeze through the doorway of my little eggshell abode back at camp.

Once we're on Rose Island, it strikes me as an unlikely place for settlement, with its nearly uniform flat topography that offers little relief from the savagery of a winter storm. We follow Baikie in obedient single file on a brief cross-island walk

Andrew Findlay writes about adventure sports, travel, conservation and business from his home on Vancouver Island. Pat Morrow specializes in outdoor adventure and mountain-culture photography, work that has taken him around the world from his home in Wilmer, B.C.

to a low-lying bank, knee-deep in grass and sedges, and overlooking a sandy cove. It would be easy to miss the shallow depressions in front of us that once formed the floors of six sod houses. "Whale bones would have been like framing studs, and you can see a whale vertebra that probably held a seal oil lamp," Baikie says, pointing to one of the larger homes. A warm wind scuffs across the island. I imagine smoke from the seal oil lamp drifting lazily from the opening of a roof made from caribou hide, children collecting pebbles on the beach nearby, women cooking over peat fires and men beaching kayaks after a day of seal hunting.

Afterward, Baikie leads us to a windswept point jutting into the water, where rocks have been piled into a crude cairn. The remains of 113 Inuit now rest here, repatriated in 1995, more than two decades after archeologist Jacob Edson Way exhumed them for study before eventually storing them at the University of Toronto and then Memorial University in St John's. Mark and Sivuarapik kneel next to the grave and throat sing to Serkoak's simple rhythmic drumming. Andersen and Baikie stand quietly, listening to the melancholy tribute. The singing ends and Baikie speaks up. "I like to spend a few minutes of silence by myself at this spot."

And it's then — with the Labrador Sea lapping at the island's shores, minke whales grazing on capelin and herring in clear bays, and polar bears prowling the tundra — that I realize the park is about much more than preserving a wild piece of the northeast coast of Canada. It's also about people such as Baikie and Andersen reclaiming their history, their landscape, their future. ☀

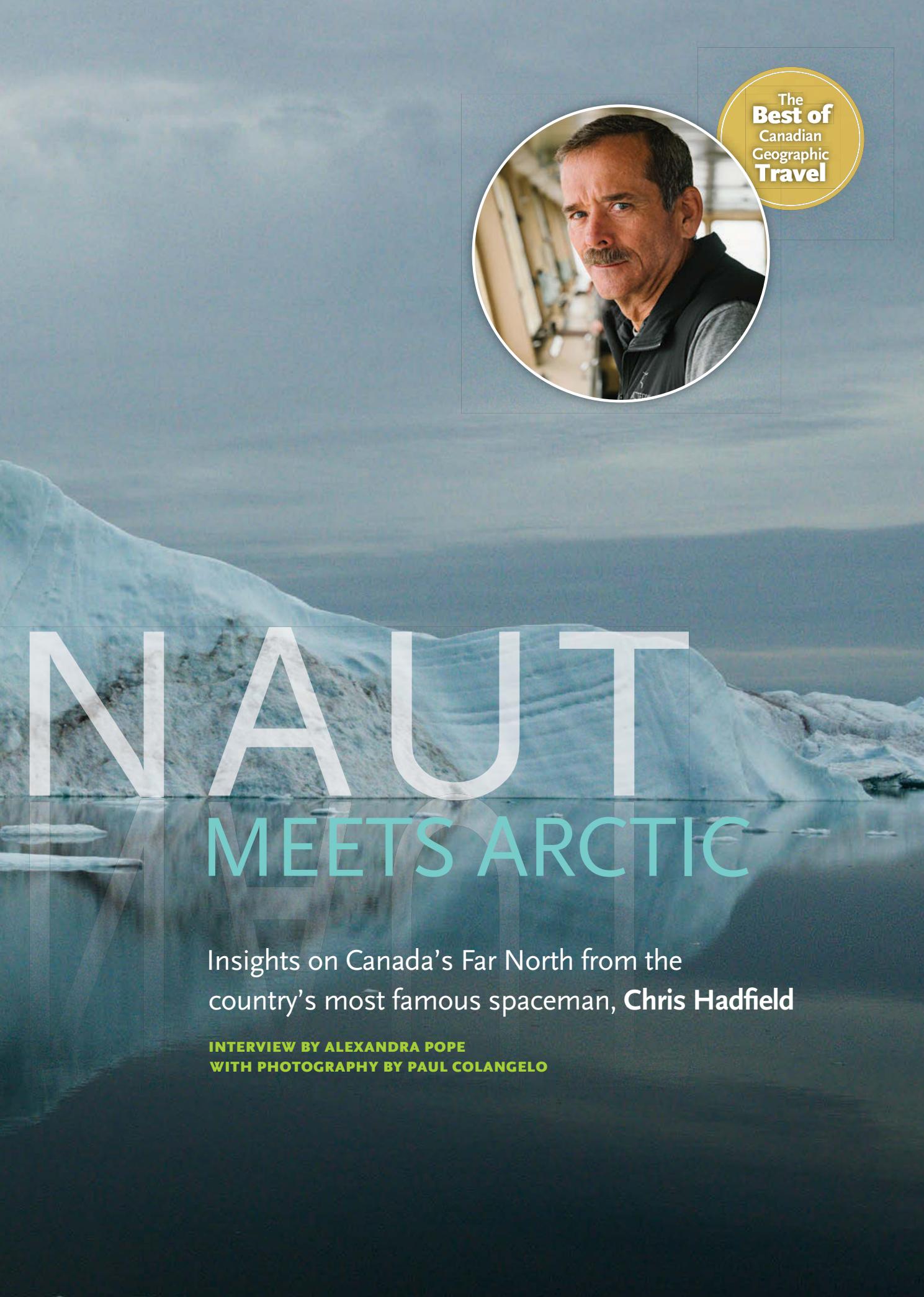


See more stunning images of the Torngat Mountains at cangeo.ca/mar17/torngats.



Greenland's Ilulissat Icefjord, one of
many sights experienced when astronaut
Chris Hadfield (RIGHT) took his Generator
program to the Arctic in 2016.

ASTRO HOLIDAY



The
Best of
Canadian
Geographic
Travel

NAUT MEETS ARCTIC

Insights on Canada's Far North from the
country's most famous spaceman, **Chris Hadfield**

INTERVIEW BY ALEXANDRA POPE
WITH PHOTOGRAPHY BY PAUL COLANGELO



CHRIS HADFIELD BELIEVES

in the power of ideas.

Since retiring from the Canadian Space Agency, the Canadian astronaut — who rocketed to global fame in 2013 thanks to his multimedia dispatches from orbit as commander of the International Space Station — has dedicated his seemingly boundless energy to the promotion of ideas that challenge and excite.

Two years ago, at the urging of his son Evan, Hadfield organized the first instalment of what has come to be known as Generator, a sort of 21st-century salon bringing together artists, musicians, inventors and thinkers for a celebration of creativity. The first show sold out Toronto's Massey Hall and set in motion discussions that would ultimately see Hadfield bring the Generator concept to the Arctic.

For 18 days in August and September 2016, the astronaut and a team of 10 multimedia storytellers from around the world, including Canadian photographer Paul Colangelo, traversed the Arctic Ocean, from southern Greenland to Resolute, Nunavut, aboard a cruise ship. Their goal? To create art that portrays the Arctic not as a symbol of climate catastrophe or a prize to be claimed, but simply as it is: a region of surprising beauty with a unique culture, worthy of exploration and understanding.



Here, Colangelo shares his photography from the trip for the first time in print, while Hadfield discusses his experience with Generator Arctic and why Canadians should strive to know their North.

On the impact of Generator Arctic

It's gone better than I ever hoped it would. We put on a show at the Art Gallery of Ontario. Danny Michel released an album that he wrote and recorded on board. Elmo

Keep is still writing about it. Simone Bramante in Italy is doing a travelling show based on it. And all sorts of people saw the Arctic through this work and realized that to visit it is an option.

On what surprised Hadfield about the Arctic

The lushness of it, and the richness and success of the life there. It was amazing, at 80 degrees north, to be walking across a meadow that was absolutely teeming



with life. It was like walking across a barnyard — there was so much animal manure in this big, mossy field, with muskox and rabbits and wolves and smaller dogs. At sea, we saw all sorts of wildlife as well, polar bears, whales, seals and narwhals and almost all the different breeds of birds that live up there. I was amazed at the prevalence of life everywhere and the ancient nature and balance of it. It's not as broad or deep as life in the south, but it's extremely evolved and much more intense. The Arctic doesn't feel barren at all. It feels incredibly rich and beloved, and that wasn't something I was expecting.

On the shared experience of exploring

You get a chance to get to know people and look into their lives. One of the ladies on the cruise was lovely, in her 70s; her husband had recently died, and she was kind of gathering herself and wondering what to do with the rest of her life. She swam in each place we stopped, in the super-cold

Alexandra Pope (@XelaEpop) is Canadian Geographic Travel's digital editor. Paul Colangelo (paulcolangelo.com) is a member of the International League of Conservation Photographers.

water, and treated it almost like a pilgrimage. As part of the evening lectures, each member of my Generator crew would get up and talk about their own experiences, what they'd seen so far and also where else they had been. To have all those different mirror reflections of the whole thing I think deepened it for everybody.

On connecting with the past

We visited Beechey Island and stood at the graves of the three men who died early in the Franklin expedition. There are not many places on Earth that give you the sense of eternity, of patience, of implacable geology and of beautiful time that you feel there. We get so frantically worried about the hurried nature of each of our individual existences that it's lovely to be in a place that reminds you of eternity. The Arctic helped put that back into my soul. I long to go back.

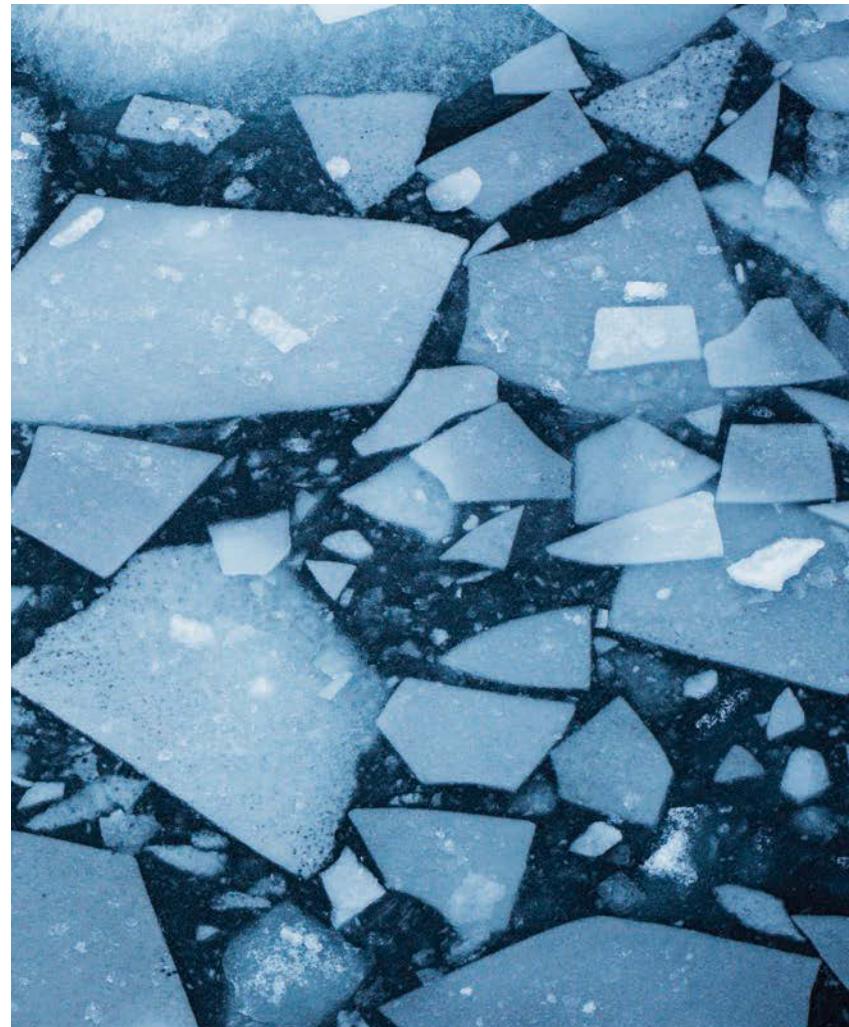
On why Canadians should care about the North

Many Canadians are the lucky beneficiaries of an extremely successful civilization: we are raised with an expectation of stability, we have one of the top education systems in the world, we have a great social welfare system. With that level of privilege also comes responsibility, and I think our number-one

Clockwise from OPPOSITE BOTTOM: An old building at Eureka Weather Station on Ellesmere Island; Qilaqitsoq, in west Greenland, a former Inuit settlement where 500-year-old mummies were found in the 1970s; Chris Hadfield and musician Danny Michel jam on board the cruise ship.

**'IT'S LOVELY
to be in a place
that reminds
you OF
ETERNITY.
The Arctic
helped put that
BACK INTO
MY SOUL.'**





responsibility is not to just understand the neighbourhood that each of us lives in, but to actually get to know the country and see how it all fits together. We're the second biggest country on Earth, and it's because of the enormous amount of Canada that is the Arctic. As the climate continues to change and sea ice becomes less prevalent, those waters are going to become more and more important. There is enormous untapped potential in the North — mineral and petrochemical wealth, tourism wealth and navigational wealth. We need to know it exists and see it in as multifaceted and complete a way as we can. Then we can start thinking about how it's going to become part of the future of all of us as Canadians over the next generations.

On striving for objectivity with Generator Arctic

What we did with the Generator concept in the Arctic is by no means

Clockwise from ABOVE LEFT: McKinley Bay, on northern Ellesmere Island off Tanquary Fiord; ice floes in Jones Sound, north of Devon Island; Uummannaq, a community of 1,500 in northwest Greenland.

unique or complete, but we did our absolute best to try to let people see the Arctic as it is, not through a filter. Much as I did with the photos I shared from the International Space Station, I want people just to see it and draw their own conclusions based on what they see, not on someone feeding them what they're supposed to be thinking about this part of the world. I think the more of that we can do, the healthier we'll be and the better we'll treat the Arctic. ☀



See more of Paul Colangelo's photography from the Arctic and some of the other work from the Generator project at cangeo.ca/may17/arctic.

'We NEED TO KNOW the Arctic exists. Then we can START THINKING about how it's going to become PART OF THE FUTURE of all of us.'

ISLANDS OF THE PEO



A traditional Haida canoe rests on the grounds of the Haida Heritage Centre at Kay Llnagaay in Skidegate, B.C.

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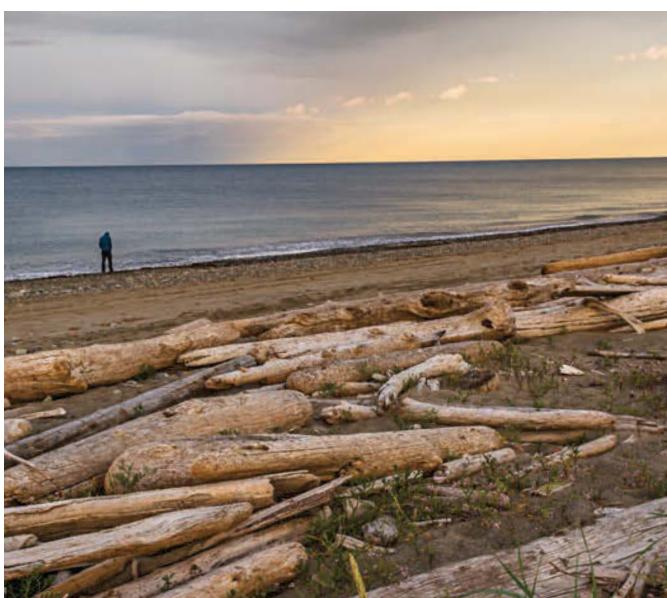
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Celebrating the magnificent
sights of Haida Gwaii, B.C.

**PHOTOGRAPHY BY JAVIER FRUTOS
WITH TEXT BY NICK WALKER**



Clockwise from THIS IMAGE: The remains of a 19th-century mortuary pole in SGang Gwaay (Ninstints); a human figure carved into a pole at Kay Llnagaay (Haida Heritage Centre); a sea lion haul-out on the Gwaii Haanas National Park Reserve coast; sunset at the Haida House at Tlaal, a lodge on Graham Island.



OF ANY PART OF HAIDA GWAI, you're most likely to know about the mortuary poles. The Haida raise these seaside memorials, each 10 metres tall and carved from a single giant red cedar, knowing they will decay, collapse and return to the Earth, often within 100 years. The most renowned poles, at UNESCO World Heritage Site SGang Gwaay in Gwaii Haanas National Park Reserve, are already approaching two centuries — powerful but fleeting expressions of a proud people.

Think of them as a gateway into almost 13,000 years of habitation and culture. "But it's not just about visiting ancestral sites and our past," says James Cowpar, who owns Skidegate-based Haida Style Expeditions with his identical twin, Shawn. "We're also talking about today, because we're living and thriving." As the Cowpars tour visitors through the national park reserve in their 8½-metre rigid-hull Zodiac, they convey the ancient principle of *Yahguudang* — a respect for all living things still at the root of the Haida's symbiotic relationship with the archipelago, long believed to be a deeply spiritual place.

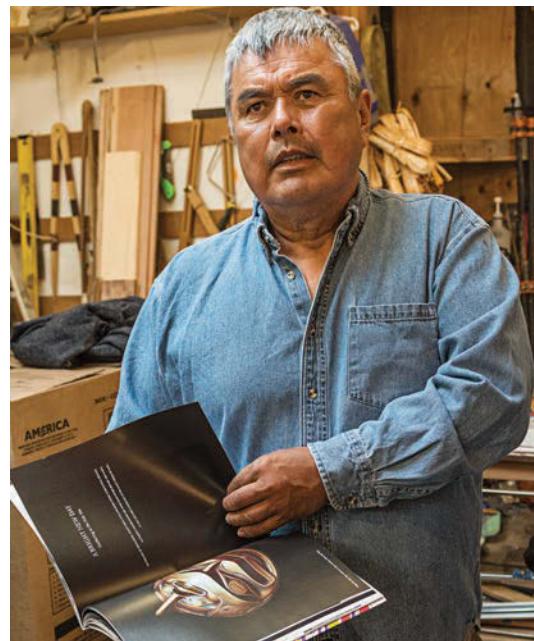
Haida Style's excursions are layered with traditional salmon feasts, songs and storytelling. Visits to ghost villages speak to how nearly 95 per cent of the Haida — once 8,000 strong — were wiped out in decades by smallpox and tuberculosis, the former brought ashore by Europeans in the 1860s. The resurrection of the Haida (they number in the thousands once again) is nothing short of miraculous, and has yielded a renaissance in arts and politics. Like the many historians, language experts, guides and lodge owners, carvers and other artists in the archipelago, the Cowpars are living proof of their people's vitality.

Today, the words "Haida Gwaii" are spoken with reverence by adventurers and researchers alike, and Gwaii Haanas is in the same sacred league as the Serengeti, Uluru (Ayers Rock) and Galapagos reserves. And it can take a pilgrimage to get to this roadless, wild collection of 138 islands and endemic wildlife, split from the mainland by the famously rough, 100-kilometre-wide Hecate Strait. Some fly Vancouver to Sandspit, joining Haida Style guides across the inlet in Skidegate before travelling south into the park; others wheel onto the eight-hour ferry from Prince Rupert, B.C., to Skidegate.

Those who journey are rewarded. "We welcome the world to our backyard," says Cowpar. "After visiting Haida Gwaii, people go home feeling like they've had a supernatural experience, but they also want to come back because here, they are treated like family." ▶

Javier Frutos (@Jav_Frutos) is Canadian Geographic's creative director. Nick Walker (@CanGeoNick) is the magazine's managing editor. Both live in Ottawa.





Clockwise from OPPOSITE: Local artist Thomas Arnatt's *Haida Gwaii Community Futures* mural in Masset; Balance Rock, near Skidegate; Haida artist Reg Davidson at his studio in Old Masset; the Haida Style Expeditions Zodiac at T'aanuu Llnagaay, a former Haida settlement; longhouses at Swan Bay Rediscovery Camp in Gwaii Haanas National Park Reserve. ☀



Read how Haida Gwaii's unique geography helped the Indigenous struggle for independence at cangeo.ca/best17/haida.

our country

REVEALING CANADA



Johnny Canuck

The comic-book aviator hero recalls his first encounter with the northern lights in Eagle Plains, Yukon

I've seen a lot of sights in my time. My adventures have taken me across Canada and all around the world. I don't think there's a country on the map that I haven't stuck a "visited" pin in. But when I have a scant moment of peace and think of what home really is, what I see are the northern lights over Eagle Plains in the Yukon.

The first time I saw them there was during a reconnaissance flight with my old pal Leo Bachle, late in the summer of '43. I was on leave from battling those nefarious Nazis over in Europe, and Leo and I had decided to fly up to the Yukon for some peace and quiet and to do a bit of fishing. Well, when I saw those lights roll out over the crimson forest and dance across that wide sky, I was filled with awe and a calm pride. I'd never really believed the lights actually existed when I was a kid; I thought they were just something you'd read about in storybooks. But once I saw them, I knew I'd never forget it because there was nothing that could ever match that sight.

I don't fly as much nowadays, so when autumn is on its way around, I'll drive halfway up the Dempster Highway and find a place to hike out, breathing in the cool, clean air and waiting for the sky to darken and unfold. I've never seen the lights the same way twice — they change from moment to moment and from night to night. Maybe that's what keeps me coming back. ☺

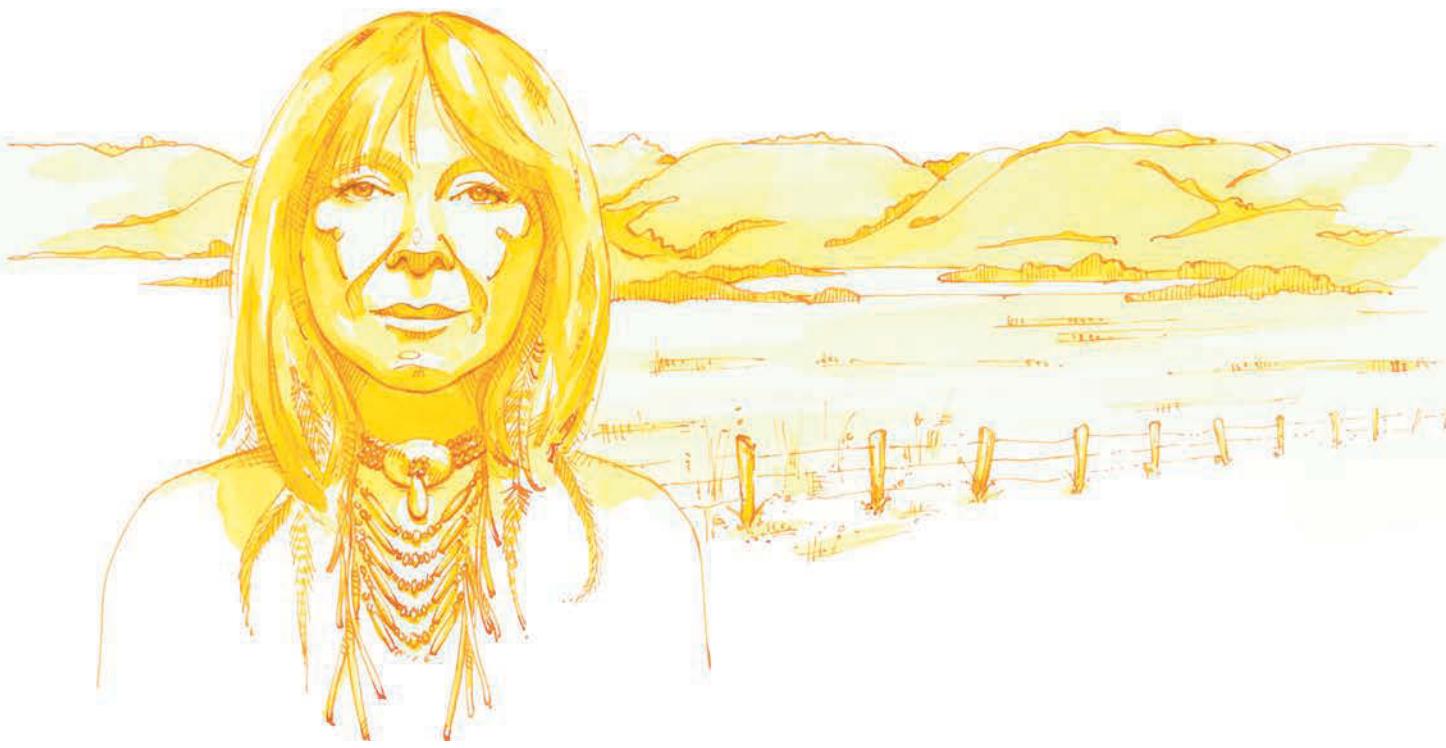
—As told to Ray Fawkes



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hashtag #ShareCanGeo.



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(facebook.com/cangeo).



Buffy Sainte-Marie

The Cree singer-songwriter explains what makes Saskatchewan's Qu'Appelle Valley so special to her

I'm originally from Saskatchewan, but I didn't grow up there, didn't have a consciousness of it until I was reunited with family in the Qu'Appelle Valley. My favourite season in the valley is summer because it's so very beautiful. I remember sunsets that were blue and purple and red, and a landscape golden with mustard and wheat. To have all that flat prairie and then see those rolling hills with those spectacular colours has always given me not only a sense of home and family but also of holiness.

I've always been interested in people's relationship to the creator, and when my dad and I would talk about that, he would always start by saying, "We'll go to a clean spot," which we'd do, then we'd pray and then we'd talk. But it wasn't like some stiff movie-Indian thing — it was always this precious, gentle, almost feminine feel for the mind behind all nature. There's so little that has been properly described to non-Indian people about our relationship to the land through a sense of the sacred, and that was something I always loved discussing with the people who had been raised with teepees and buckboards, the people who were old when I was young, as we sat surrounded by coulees where there was sweetgrass growing.

I've written quite a few songs about this area, but I think "Soldier Blue" has lyrics apropos to my dad's idea of going to a clean spot to enjoy the connection with nature:

*Yes this is my country
Young and growing
free and flowing sea to sea
Yes this is my country
Ripe and bearing miracles
in every pond and tree ☽*

—As told to Harry Wilson

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