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## 32 Canada's greatest explorers

100 Canadians who best embody the spirit of exploration

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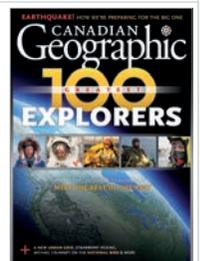
A glimpse at what life as a strawberry picker is like for the Indian men and women working at a produce farm in British Columbia's Fraser Valley

Photography by Rick Collins with text by Jessica Finn

COVER, BACKGROUND IMAGE: LOOPST/GETTY IMAGES; INSET PHOTOS: LEFT TO RIGHT: RICHARD WEBER; NASA/Flickr (CC BY-NC 2.0); MYLÈNE PAQUETTE; CRISTINA MITTERRMEIER; ERIK BOOMER. THIS PAGE: IMPOSSIBLE2POSSIBLE

### ON THE COVER

Some of Canada's top explorers, including (left to right) Richard Weber, Chris Hadfield, Mylène Paquette, Paul Nicklen and Sarah McNair-Landry.



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## GREAT MODERN EXPLORERS

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[mag.cangeo.ca/jun15/tv](http://mag.cangeo.ca/jun15/tv)



## GEOGRAPHY TV

Ten shows that have played a significant role in geographic education.

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## GROUNDWATER GUIDE

How can you protect your groundwater? Get tips and additional resources from our handy guide.

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## EXPLAINING EARTHQUAKES

Watch a stop-animation video to get a glimpse into what happened when a megathrust earthquake rocked Canada's West Coast in 1700.



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## Living on the edge

**PITTING ONESELF** against the unknown might just be the boldest action a person can take. In essence, that's the life of an explorer. But being an explorer requires more than venturing into unfamiliar territory; explorers must also widely share what they've learned to make their adventures truly resonate. The 100 modern-day geographic trailblazers we've gathered in this issue's cover story ("Canada's greatest explorers," page 33) have not only faced the unfamiliar but also opened up our world in fresh ways, be it by sharing new insights into places we thought we knew or by actually charting new ground. When it comes to geography, there are perhaps no greater stars.

Of course, you're likely already familiar with some of them, such as astronaut Chris Hadfield (ABOVE) and film director-cum-deep-sea diver James Cameron, though we suspect there are many you don't know. And given their importance, we feel it's important you do. This magazine's publisher, The Royal Canadian Geographical Society, has long been Canada's centre for exploration, a mission it has supported through expeditions of its own, as well as by funding the expeditions of others. It's only natural, then, that the magazine share the stories of those great adventurers who continue to literally and figuratively map our world. Indeed, there are undoubtedly names here that will one day rank among the world's greatest explorers ever. Discover them now.

—Aaron Kylie



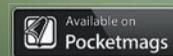
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PHOTO BY PAUL COLANGELO

A blue-eyed damner dragonfly flits through Stanley Park in Vancouver. The species, which can be seen throughout southern British Columbia from early June to October, usually around lakes, ponds and marshes, hunts smaller flying insects such as mosquitoes, moths, flies and butterflies.



Think you've got a keen eye? Then enter your best wildlife shot in *Canadian Geographic's* annual Canadian Wildlife Photography of the Year contest at [wpy15.canadiangeographic.ca](http://wpy15.canadiangeographic.ca).

# big picture

CELEBRATING CANADA'S GRANDEUR



# exposure

SHOWCASING CANGEO'S PHOTO CLUB

PHOTO BY RYAN DICKIE

A hiker stands in early morning mist and sunbeams in Vancouver Island's Gowlland Tod Provincial Park. Stretched along the east side of Saanich Inlet near Victoria, the park protects part of the small yet rugged Gowlland Range, a particularly species-rich area of British Columbia.



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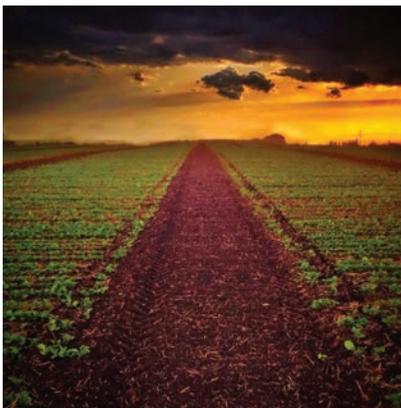
**@SavageTravels** Kristin Savage  
View of Detroit from Windsor, Ont.



**@Levartz** Cliff Hagstrom  
Mountain goat, Icefields Parkway, Jasper, Alta.



**@irongiantbc** Laurie Kinsman  
A ride at the Pacific National Exhibition, Vancouver



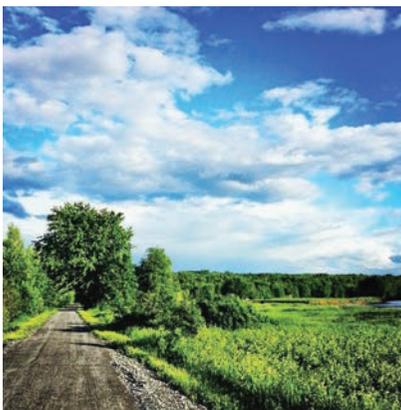
**@Edmonton\_Snaps** Steve Rumsby  
Stormy sunset, north of Edmonton



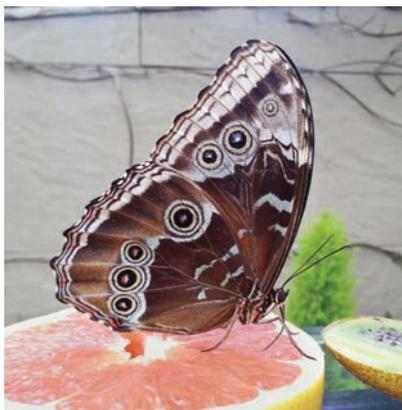
**@\_bozlo\_** Ron Bauer  
Barn near Arrowwood, Alta.



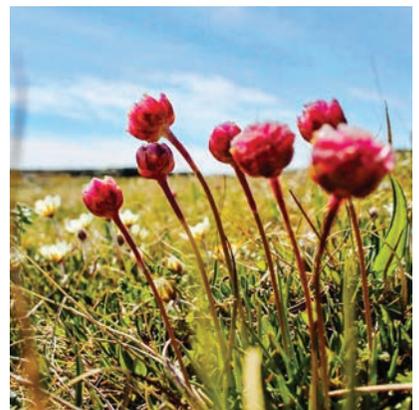
**@sup4life** Lech Dolecki  
Handstand, Sunset Beach, Vancouver



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**@nantrax** Martin Provost  
Butterfly, Botanical Garden, Montreal



**@findtruen** Sara Statham  
Flowers, Frobisher Bay, Nunavut



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Photo courtesy of Glenn Bartley, [glennbartley.com](http://glennbartley.com)  
Read Glenn's full review at [vistek.ca/go/glennbartley](http://vistek.ca/go/glennbartley)

## “This camera is definitely for the birds.”



High praise indeed from one of Canada's leading and internationally-renowned nature photographers, Glenn Bartley. A Canon loyalist for years, Glenn talks about his latest acquisition, the Canon 7D Mark II.

“I was ready for an upgrade. But I'm pretty demanding. So in order for me to buy a new APS-C camera, Canon had to deliver a lot of camera, one that's not just perfect for shooting fast-moving subjects, but subjects that move in and out of shadows in the blink of an eye. My subjects are also known not to sit still, so I need a high burst rate of say 10 frames per second. And because I hike for miles at a time, the camera absolutely had to be lightweight. Correction, make that rugged and lightweight. Most important, because I make my living on my pics and prints, the camera had

to offer impeccable hi-resolution. Somehow Canon knew what I wanted. Because the 7D Mark II delivers all that and more.”

Here's the “more” Glenn is referring to: 20.2 megapixels, 65-point all cross-type autofocus, Dual DIGIC 6 Image processors for faster processing and for shooting Full HD video at 60p. USB 3.0 connectivity, a built-in Speedlite transmitter for controlling off-camera flash. And even built-in GPS for automatic location tagging – ideal for use in remote jungles.

And because it's a Canon, Glenn can continue to use his stash of EF lenses, including the new Canon 100-400mm L.

Get the lowdown on the 7D Mark II. Talk to a Vistek camera specialist. Find out why the 7D Mark II is great for the Great Outdoors.

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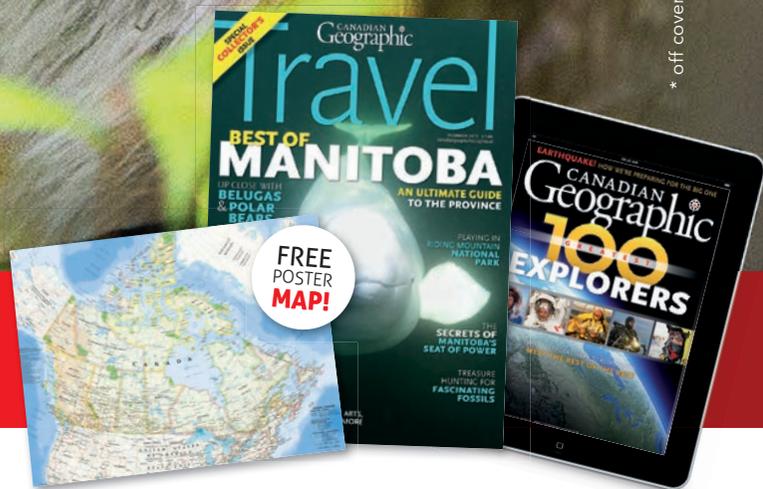
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# Alex & Tyler Mifflin

The brothers raising awareness about worldwide water conservation one episode at a time talk about making entertaining TV, water use in Canada and working together

Alex (right) and Tyler Mifflin film a wave-power generator near Scotland's Orkney Islands for an episode of *The Water Brothers*.

INTERVIEW BY CARYS MILLS

Alex and Tyler Mifflin grew up in Toronto, less than a minute's walk from Lake Ontario, and remember being told they couldn't swim in the lake because it was too polluted. Today, the Mifflins travel far from home to places such as the middle of the Pacific Ocean, the Arctic and the Ganges River to report on water issues as the hosts of TVOntario's award-winning *The Water Brothers* documentary series, now in its third season.

#### On making educational TV entertaining

Alex Mifflin: We try not to forget it's a travel and adventure show. You're taking people to places they've never been. Last season, we sailed to the middle of the Pacific Ocean to see the great Pacific garbage patch. We also try to do fun things in every show. For example, in the episode about Asian carp entering the Great Lakes, we showed all these amazing ways people have come up with to catch the fish, including using a

bow and arrows to kill them as they jump out of the water.

#### On why they chose to focus on water

Tyler Mifflin: We try to make the viewer understand environmental issues by looking through the lens of water because it's such a connecting element. We believe it's easier for people to relate to.

#### On water use in Canada

AM: We have that myth of abundance, so we tend to turn a blind eye to water use in Canada. We think we can use as much as we want, which is why this country is one of the top water users per capita in the world. It's also why we have serious water-quality issues, such as algal blooms. Also, a lot of big industries don't really have to pay much, if anything, for the water they use, because traditionally the need to charge them has never been seen.

#### On working together

TM: We grew up in a big family, so we have lots of experience fighting and making up. We're often just two people on the road, so we have to rely on each other and we can't have little arguments get in the way.

#### On the trips that have most affected them

AM: When we see there's no access to clean water and sanitation, it's always a big moment for us. You meet people who don't have the luxury of just turning on their tap or who don't have a toilet. We often forget that there are places in Canada like that, including a disproportionate number of First Nations communities. We face the same problems here that every other country on Earth faces. We just face them in a different way.



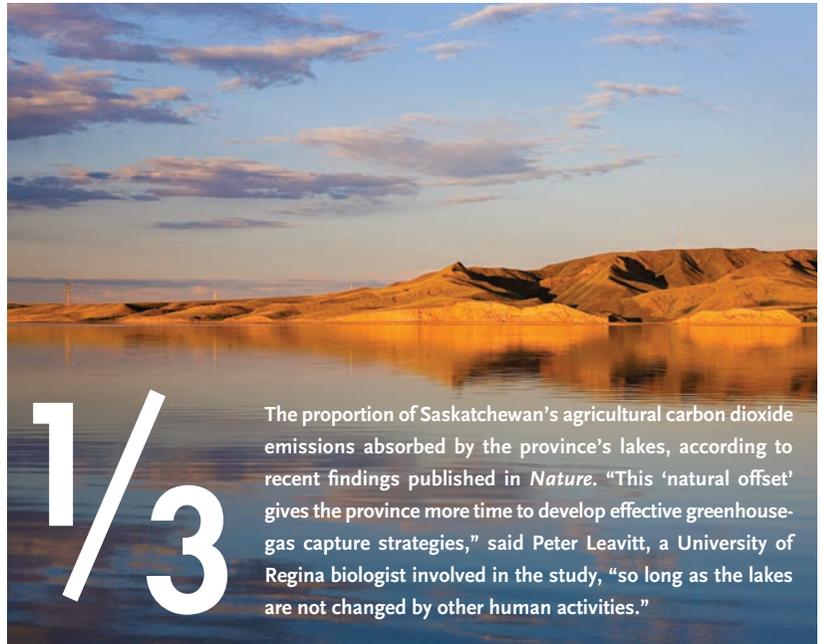
Check out a list of television shows that can teach you something about Canadian geography at [mag.cangeo.ca/jun15/tv](http://mag.cangeo.ca/jun15/tv).



## SWIM UP to THE MIC

Pacific Wild, a conservation group, and Sitka, an outdoor lifestyle retailer, hope to raise \$60,000 to set up a permanent network of hydrophones (microphones that record underwater sounds) off the coast of central British Columbia to assess the impact of ships on the marine ecosystem. The goal of the two groups is to use the recordings to convince the provincial government that a portion of what is becoming known as the Great Bear Sea should be made a marine acoustic sanctuary, free of tanker traffic.

**3** The number of days the blackpoll warbler takes to fly more than 2,400 kilometres non-stop across the Atlantic Ocean, according to a study in *Biology Letters*. Scientists tracked the migration journey of the songbird — which weighs 12 grams, or slightly less than two loonies — from North to South America by using tiny 0.5-gram “backpacks” containing a light and clock sensor that determined latitude and longitude, respectively. Other bird species travel similar distances during migration, but the blackpoll warbler is the only one known to do so across open water without stopping, in what Ryan Norris, a University of Guelph ecologist, calls a “fly-or-die journey.”



**1/3**

The proportion of Saskatchewan’s agricultural carbon dioxide emissions absorbed by the province’s lakes, according to recent findings published in *Nature*. “This ‘natural offset’ gives the province more time to develop effective greenhouse-gas capture strategies,” said Peter Leavitt, a University of Regina biologist involved in the study, “so long as the lakes are not changed by other human activities.”

## MEET THE ‘NEW NOAH’

Patrick Moldowan, a biologist and recent graduate of Laurentian University in Sudbury, Ont., is the latest recipient of Wildlife Preservation Canada’s New Noah scholarship and will spend four months in Mauritius helping endangered species on the African island nation in the Indian Ocean recover. Wildlife Preservation Canada says previous recipients of the scholarship have helped save three of the island’s species, including the Mauritius kestrel (pictured), from almost certain extinction.



## ‘Cougars are on the move’

That’s what Jay Honeyman, a human-wildlife conflict biologist with Alberta Environment and Sustainable Resource Development, told an audience in Canmore in April. Conflicts between the big cats and people have been increasing as the animals spread out across the province and into developed areas in search of food. In 2012, the Alberta government introduced a management plan to curb the rising population of cougars, but this has not stopped the animals from entering cities and towns, including Canmore, where 63 cougar-human interactions were reported in 2013, an increase from fewer than 10 a decade earlier.



Read more about each of these stories at [mag.cangeo.ca/jun15/wildlife](http://mag.cangeo.ca/jun15/wildlife).



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# Plotting Prince Edward Island

The map that helped give shape to Canada's smallest province celebrates a major milestone

By Harry Wilson\*



**CALL IT A CARTOGRAPHIC HOMECOMING** 250 years in the making. Back in June 1765, Samuel Holland was busy producing the earliest version of the map shown here, a copy\*\* of the result of his labours: the first truly modern and accurate map of Prince Edward Island. This summer, his original three-metre by four-metre creation will return to the island for the first time since it was completed (it's normally held in the United Kingdom's National Archives), the main attraction in an exhibition celebrating the map's 250th anniversary at Charlottetown's Confederation Centre for the Arts from July 5 to Dec. 31.

Holland began surveying what was then known as St. John's Island in October 1764, not long after the British had appointed him the surveyor general of the northern district of North America. He paid great attention to the island's coastline (perhaps because of the good commercial prospects of its fishing industry) and rivers, but left parts of its interior blank because, as Stephen J. Hornsby notes in his book *Surveyors of Empire: Samuel Holland, J.F.W. Des Barres, and the Making of The Atlantic Neptune*, "When Acadians or Mi'kmaq were unavailable to guide surveying parties inland, areas were left unsurveyed."

By the time Holland's map was complete in October 1765, the island had been neatly divided into three counties of about 500,000 acres each, 14 parishes of about 100,000 acres each and 67 townships, or lots, of about 20,000 acres each. Holland received one of the townships, number 28, in the island's 1767 land lottery. It was, perhaps, a suitable prize for the peripatetic surveyor-cartographer, who noted in the description of number 28 that appears in the table on the map "from Cape Traverse is the shortest cut to the continent."

\*with files from Sara Viinalass-Smith, early cartographic archivist, Library and Archives Canada

\*\*The map shown here has been digitally stitched together from 12 separate sheets that are copies made in 1931 of Holland's original map. Later versions of the map look slightly different.



## FOR THE RECORD

A look back through the archives as *Canadian Geographic* turns 85

"On June 23, 1940, the *St. Roch* left Vancouver, British Columbia, beginning the historic voyage which was to make the 80-ton schooner the first ship to complete the elusive Northwest Passage from west to east."

So wrote J. Lewis Robinson of Henry Larsen's start to crossing the passage, the 75th anniversary of which is this year, in the February 1945 issue of *Canadian Geographical Journal*. In "Conquest of the Northwest Passage by R.C.M.P. Schooner *St. Roch*" (headlines played it pretty straight in 1945, as evidenced by the titles of other features in this issue, including "Ontario's Summer Estates"), Robinson explained that Larsen (pictured ABOVE) was a seasoned RCMP officer with 14 years of Arctic experience when he set out to transit the passage, which was meant to be a "side activity while successfully carrying on with their other police duties" and "keeping contact with our migratory Eskimo population." Larsen and his crew completed their voyage when they sailed into Halifax Harbour in October 1942, having bettered Roald Amundsen's 1903-1906 east-to-west transit of the passage by 11 months.

Less than two years later, in July 1944, Larsen and crew set sail "for another history-making voyage," noted Robinson, this time leaving Halifax to cross the Northwest Passage from east to west, with the goal of maintaining Canada's Arctic sovereignty. The successful journey took just 86 days, making the *St. Roch* the first ship to complete the passage in a single year. "We were lucky and had the breaks," Larsen told Robinson. "No one can predict ice or navigation conditions in the Arctic."

—Michela Rosano



See a larger version of this map and read more about the impact of Samuel Holland's work on Prince Edward Island at [mag.cangeo.ca/jun15/holland](http://mag.cangeo.ca/jun15/holland).



Read more stories from the magazine's archives at [cangeo.ca/blog/throwback](http://cangeo.ca/blog/throwback).

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■ **Even after TURP prostate surgery** and microwave therapy had to get up many times. Now down to 1-2 times. Tea is 100% better than drugs. Robert G. Stocker, Eustasis, FL ■ **After 1st year drinking tea** my PSA went down to 4.5; after 2nd year to 2.9; after 3rd year to 2.3. I highly recommend the tea. A real life saver. Thomas M. Thurston, Forsyth, GA. **Women** Ask for #4b Bladder Control Tea for Women. **It seems so unbelievable, most women don't know there is a delicious tasting herbal tea available in all health food stores that stops incontinence, bladder infections, UTIs** within days and women keep on wearing costly pads and diapers. Try the tea. It is guaranteed. Go shopping and travelling again worry free. We have helped tens of thousands of women.



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■ **Regained virility in 3 days.** My libido was restored for good sex. I've given it also to friends with the same results. One of them is a diabetic and overweight. Dr. Louis Rolland, 72, St. Hyacinthe, QC. ■ **Wonderful to feel like a man again.** It's wonderful to feel close to my wife again. God bless you! Charles E. Palen, 77, Burnaby, BC.

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University of Toronto professor states that 69% of adults have sleeping problems. Bad sleep reduces physical and creative energy all next day. Almost all families are affected. Sleep apnea may cause high blood pressure, strokes, heart attacks and irregular heart beats. Can be very destructive in relationships. **Hundreds of true testimonials on the Bell website from people like you.**

■ **I really didn't snore** or gasp for air anymore. I sleep through the night and feel rested and refreshed in the morning. Mark Wilson, 40, Hudson, NH ■ **Sleep apnea capsules worked first night.** For 15 years I had sleep apnea and my doctor made me buy a CPAP machine, which I could not use. Finally Bell #23 helped the first night and every night thereafter. Like a miracle. Unbelievable. Karen Braun, 67, Glace Bay, NS ■ **For 20 years I was waking up frequently** gasping for air. During the day I would start napping every time I would sit down, because I was tired. Since taking #23 sleeping 6 hours is heaven. It made a substantial change in my life. Mary C. Myrick, 62, Jackson, MS ■ **It is such a joy** not having to use the CPAP machine anymore. Wayne Burse, 63, Beamsville, ON.

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**Truthful actual experiences from real people:** ■ **Reflux gave me a sore throat and I could not sing in the church choir anymore.** After taking Bell #39 I have no more reflux and rejoice in singing again. Helene Giroux, 65, Quebec, QC. ■ **Have family history of heartburn.** For last 10 years I suffered a lot with acid reflux. I told all family members about #39 being all natural, giving quick relief with no side effects and no antacids needed anymore. Michael Fasheh, 49, Port Ranch, CA. ■ **Heartburn, acid reflux, stomach trouble for many years.** Doctors gave me different pills, but I had no lasting relief. Had every test known to man. I finally talked to my health food store and they said Bell Acidic Stomach/Alkaline Balance really works. It sure does. I had my husband and son take it and they all had the same results. I can now eat even spicy food with no problems. Verna Conti, 80, London, ON.

## High Blood Pressure?

High blood pressure is called the silent killer. If your BP is higher than normal, try to get it down to about 120/80. For many people it is easy to control. On our website you will find over 50 testimonials with full names and towns from all over USA and Canada. Most of them have listed phone numbers and are happy to talk about the relief they had. No money was paid for testimonials. Dr. C. Hammond M.H., Ph.D. recommends this effective fish peptide blood pressure natural product. **Truthful actual experiences from real people:** ■ **I was on 3 blood pressure drugs** that did not work well. After starting Bell #26 my readings are generally well below 120/80. Dona A. Anderson, 76, Sooke, BC. ■ **My blood pressure was 157/90** and I had side effects from prescription drugs. I bought a monitor. After 6 months on Bell #26 I was down to 120/80. Toni L. McCuiston, 52, Elizabethtown, PA. ■ **Blood pressure went from 170/110 down to 110/70.** Was on three medications that didn't help. Within a month on Bell #26 my BP dropped to 110/70. I thought I didn't need it anymore and the BP went up to 170/110 again. I will now stay on Bell. I am surprised about its effectiveness without side effects. Bell exceeds my expectations. Patrick McManus, 52, Edmonton, AB ■ **At work my driver's medical test** was too high at 170/100. After taking Bell #26 for a few days I went down to 128/84 which allowed me to pass my work medical. Kris Geier, 48, Windsor, ON.



#26 NPN 80053068

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**Actual Results.** ■ **After 1 week** my severe acne became quite mild and after 2 weeks it had completely vanished. I

suffered for 5 stressful years of having acne and extremely dry, irritated skin. Bell Help for Skin Disorders "saved my life". My skin is now beautiful and you would never know I suffered from acne and other skin problems for years. Zach Lustgarten, 18, Oshawa, ON.

**RED NOSE/CHEEKS ROSACEA** gone in less than a week. Was fighting it for 30 years with topical creams and prescriptions without getting satisfaction. I live a healthy life, don't smoke and don't drink. People thought a reddish face comes from drinking. This is a myth. Will take it for the rest of my life when needed. Donald E. Gillespie, 56, Innisfil, ON.

**PSORIASIS** ■ **I had severe psoriasis** over 95% of my body. Last 5 years I have stilled every doctor and dermatologist. I spent tons of money on remedies. After I got Bell Help for Skin Disorders, I've never seen anything work as fast in my life. Within 2 days I saw my skin clearing up. I'm speechless. It was inexpensive compared with what I spent before. Jessica Shanziz, 25, Dawson Creek, BC.

**ECZEMA** For 6 years my family doctor and dermatologist tried many medications and creams. After taking Bell Help for Skin Disorders for just a few days my eczema itching stopped and my face started to clear up. After suffering so long I am amazed with the results. Andy Yuen, 58, Vancouver, BC.



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## Theatre of The Rock

In Newfoundland, the play's the thing to help replace the cod once king

By Melanie Chambers



A performance of the Rising Tide Theatre company's *New Founde Lande Trinity Pageant* (LEFT) and *February* (ABOVE).

**AMID PROPS THAT ARE** quintessential 1960s Newfoundland kitchen — including Purity hard bread and a wringer washing machine — a widow named Terese recounts her life in an isolated fishing community. “And I didn’t want him to go, for there’s no other man in this cove would have launched his boat in a gale like that.” She points to her husband’s photograph, wipes her tears away and turns back to the laundry.

“It’s not to say she doesn’t feel, but she decides not to indulge those emotions,” says Donna Butt, the lead in *Terese’s Creed* and the artistic director of the Rising Tide Theatre in Trinity, N.L., on the Bonavista Peninsula. “She has to move on.”

It’s an apt metaphor for rural Newfoundland communities struggling since 70,000 islanders left after the cod moratorium in 1992. And while theatre isn’t the economic behemoth that the fishery once was (near its peak in 1989,

fishing directly employed 37,000 in Newfoundland; in 2014, seasonal theatre employed between 500 and 600), it’s become a small yet vital part of life in towns such as Trinity, drawing those who might not otherwise visit.

“Theatre is the new fish plant,” says Jeff Pitcher, the artistic director for Theatre Newfoundland Labrador, the Corner Brook-based company that started the town of Cow Head’s Gros Morne Theatre Festival in 1996. “It’s been tough for Newfoundlanders during the last 20 years, but theatre keeps the pride alive. Years ago, people were just passing through; now, theatre is part of their journey because they know they’re going to get part of the culture and the story.”

In Trinity, for instance, Rising Tide Theatre’s *New Founde Lande Trinity Pageant* recounts local history during an outdoor walkabout performance. In *Cupids*, meanwhile, by the western shore of

Conception Bay, Perchance Theatre performs Shakespeare with a nod to the Newfoundland dialect, which retains elements of Old English. You’d be just as likely to hear “Have you ever seen the like?” at the town post office as in *Richard III*.

The plays can also be polemical. When the *Globe and Mail*’s Margaret Wente wrote in 2005 that former premier Danny Williams reminded her of a deadbeat brother-in-law, it inspired Pitcher’s *Ed & Ed — Trapped!* In the play, the Eds, anticipating negative reaction from visiting press, take a CBC journalist hostage and use her camera to make demands for control of the fishery and the return of their provincial brethren working in Alberta. “First and foremost,” says Pitcher, “these are Newfoundlanders’ stories.”



See an interactive map of Newfoundland’s theatres that highlights this summer’s must-see shows at [mag.cangeo.ca/jun15/theatre](http://mag.cangeo.ca/jun15/theatre).

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# The Kuukpak house

A buried Inuvialuit dwelling is opening up a piece of Arctic history

By Nick Walker

At a place called Kuukpak, where the East Channel of the Mackenzie River spills into the Beaufort Sea west of Tuktoyaktuk, N.W.T., University of Toronto archaeologist Max Friesen unearthed the finest example of an Inuvialuit (Inuit of the western Arctic) driftwood house yet found. The collapsed 400-year-old structure is very different from the modest snow and sod houses built elsewhere in the Arctic: these large semi-subterranean wood lodgings were unique to this spot, where the Mackenzie spits out copious driftwood and

up to 1,000 Inuvialuit gathered to hunt belugas during the whales' annual migration. "At its peak, I suspect it was the most populous site ever inhabited in the Canadian Arctic," says Friesen, "stretching for almost a kilometre along the riverbanks."

It's the first such house to be fully excavated — up to a metre of thawed overburden (collapsed roof, walls and other debris) was removed — and it's now yielding clues to the Inuvialuit past. Here, based on the remains, is an artist's depiction of the Kuukpak house.

"THIS IS AN ICONIC FORM, of great symbolic importance for Inuvialuit," says Friesen, who adds that houses in this style have not been built for more than a century.



**LOCATION** The dwelling faced south, dug into a steep slope on the shore of the Mackenzie's northern reaches. The hillside anchored the structure and helped shelter it from the harsh environment.

**STYLE** The oldest-known Inuvialuit driftwood-and-sod houses, dating back about 700 years, were smaller, with one, not three, sleeping platforms. Like this one, they were winter residences, but had to be constructed in the summer or fall before the top ground layer froze.

**INSULATION** Evenly cut sod chunks were stacked over the first driftwood layer, then possibly more driftwood for stability, topped by a thick blanket of snow.

**LIVING SPACE** Between 15 and 30 people would have lived here — three families each occupying a separate log-walled and -roofed alcove (two side and one rear). The main floor featured a large hearth, and smoke escaped from a square opening in the flat roof.

**ARTIFACTS** The Kuukpak house is full of beluga bones, harpoon tips and arrowheads, fishing net weights, a copper fish hook, combs and more. When the archaeologists return in 2016 (for now their focus is on other sites), they'll pull up the floor to look for more items. At other locations, entire older houses have been found buried under the top structures.

**ACCESS** The entrance tunnel was crawling height, at least five metres long and possibly extended by a wind-breaking "porch" made from snow blocks. The tunnel is lower than the floor of the living area, so colder, denser air would have been trapped in the passageway.

**PERMAFROST PLIGHT** Friesen and other archaeologists working in the Arctic are racing the changing climate. The active layer of permafrost (the part that thaws in the summer) is deepening with every year, and sites never before at risk are suffering from coastal erosion and decay. As Friesen says, "That brilliant preservation, which marks the Arctic as different from nearly everywhere else on Earth, is going to be gone."

The most affected area is the Mackenzie Delta. "Some of the archaeological sites there have already disappeared," says Friesen. "We have started excavating a second house, to which we will also be returning in 2016. It's at much greater risk; we're not sure if it will still be there in two years."



For pictures of the excavation and an interview with the researcher who discovered the dwelling, visit [mag.cangeo.ca/jun15/house](http://mag.cangeo.ca/jun15/house).



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# Bear watch

## INNOVATIVE TECHNIQUES MONITOR POLAR BEARS WITHOUT DISTURBING THEM

BY JOHN BENNETT

**HOW IS CHANGING** Arctic sea ice affecting polar bears? That's just one of many questions Queen's University biologist Peter van Coeverden de Groot is hoping to answer with innovative non-invasive research techniques. Inuit hunters — who are often skeptical of invasive polar bear research methods — are giving de Groot's methods a chance, and those from the Gjoa Haven Hunters and Trappers Organization in M'Clintock Channel, Nunavut, are working with him.

There are 13 distinct polar bear populations in the Canadian Arctic, but apart from Hudson Bay bears, which have been relatively well studied, little is known about them. Surveying these animals usually meant tranquillizing them from a helicopter, and although this is changing (with less invasive methods such as counting animals from airplanes), studies are still limited to relatively small areas over two or three years. "Because

most bears are unmonitored at any given time due to the expense," says de Groot, "researchers make a lot of inferences based on scarce information."

The methods de Groot is evaluating with his hunter colleagues don't require seeking the bears out; they simply col-

### Techniques capitalize on hunters' experience and knowledge of polar bears.

lect and analyze what has been left behind: hair samples (from snags baited with seal meat), footprints and feces.

The hunters first record sex and age by examining tracks. Analysis of hair samples confirms sex and enables genetic identification of individual bears. With enough sampling stations and genetic data, de Groot can estimate the minimum number of bears alive in the area.

Polar bear tracks in Nunavut, where Inuit hunters are working with scientists to use non-invasive methods to monitor the animals.

"With feces," says de Groot, "we can track what a bear has been eating. We can postulate how stressed the bears are by determining levels of stress hormones and how healthy they are by identifying gastro-intestinal tract diseases."

This study also has economic benefits for local Inuit, who have not been able to work as guides in the polar bear sport hunt since it was curtailed in 2001. De Groot's techniques capitalize on the hunters' experience and knowledge of polar bears and sea ice, and they're paid to spend time on the land.

De Groot's work on the viability of his new methods is nearly finished. "We need more complete information on polar bears, and we need alternative ways to get it," he says. "This is a different way of doing polar bear surveys, and its backbone is hunters on snow machines. It's their knowledge and their effort that make it work."



This is the latest in a continuing blog series on polar issues and research presented by *Canadian Geographic* in partnership with the Canadian Polar Commission. The Polar Blog appears online every two weeks at [cangeo.ca/blog/polarblog](http://cangeo.ca/blog/polarblog), and select blog posts are featured in this space in each issue. For more information on the Canadian Polar Commission, visit [www.polarcom.gc.ca](http://www.polarcom.gc.ca).

# on the map

EXPLORING CARTOGRAPHY

## Water lies beneath

A look at what we know about Canada's groundwater resources

BY NICK WALKER

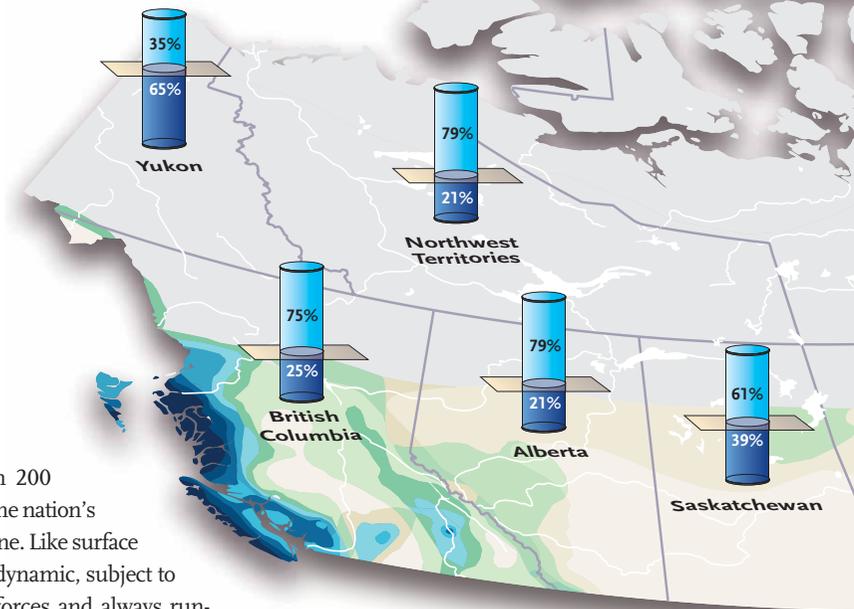
Chances are almost one in three that you rely on groundwater daily. That's 30.3 per cent of Canadians, or about 10 million people, flushing it, bathing in it, drinking it, and cooking and cleaning with it. Some two-thirds of those are rural dwellers, because wells are often more reliable — and less expensive — than pumping from nearby lakes and rivers. And those numbers don't take industry and agriculture into account, which in some provinces are the heaviest users of groundwater.

Nevertheless, most Canadians probably don't cast a thought to the staggering amount of fresh water moving beneath their feet, and even researchers are cautious about estimating reserves. Alfonso Rivera, chief hydrologist for the Geological Survey of Canada, however, has dared to do just that, and believes at least 70,000 cubic kilometres of the stuff (around three times as much fresh water as fills the Great Lakes)

lies within 200 metres of the nation's surface water. Like surface water, it's dynamic, subject to the same forces and always running toward an ocean (just sometimes many thousands of years more slowly). "Part of the reason for our ignorance is that it's difficult to explain groundwater," says Rivera. "It's not visible, so it can't be understood in a two-dimensional way like surface water, and it's subject to time in very different ways."

Rivera is on a mission to combat the general lack of understanding and a national dearth of scientific data surrounding this precious resource. His recent book,

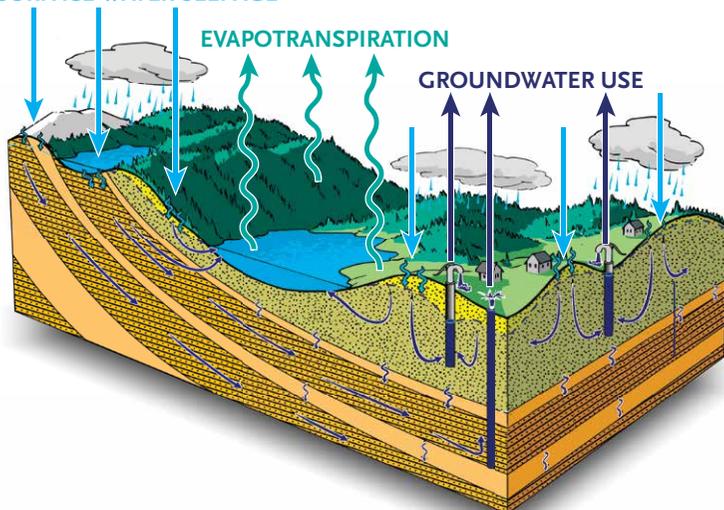
*Canada's Groundwater Resources*, for example, is the sum of Canadian experts' knowledge about our sub-surface H<sub>2</sub>O. Purposely written in accessible language, Rivera's target is the public, not just other scientists. The figures shown here, adapted from the book, illustrate a few groundwater basics — and nod at how much we still have to learn.



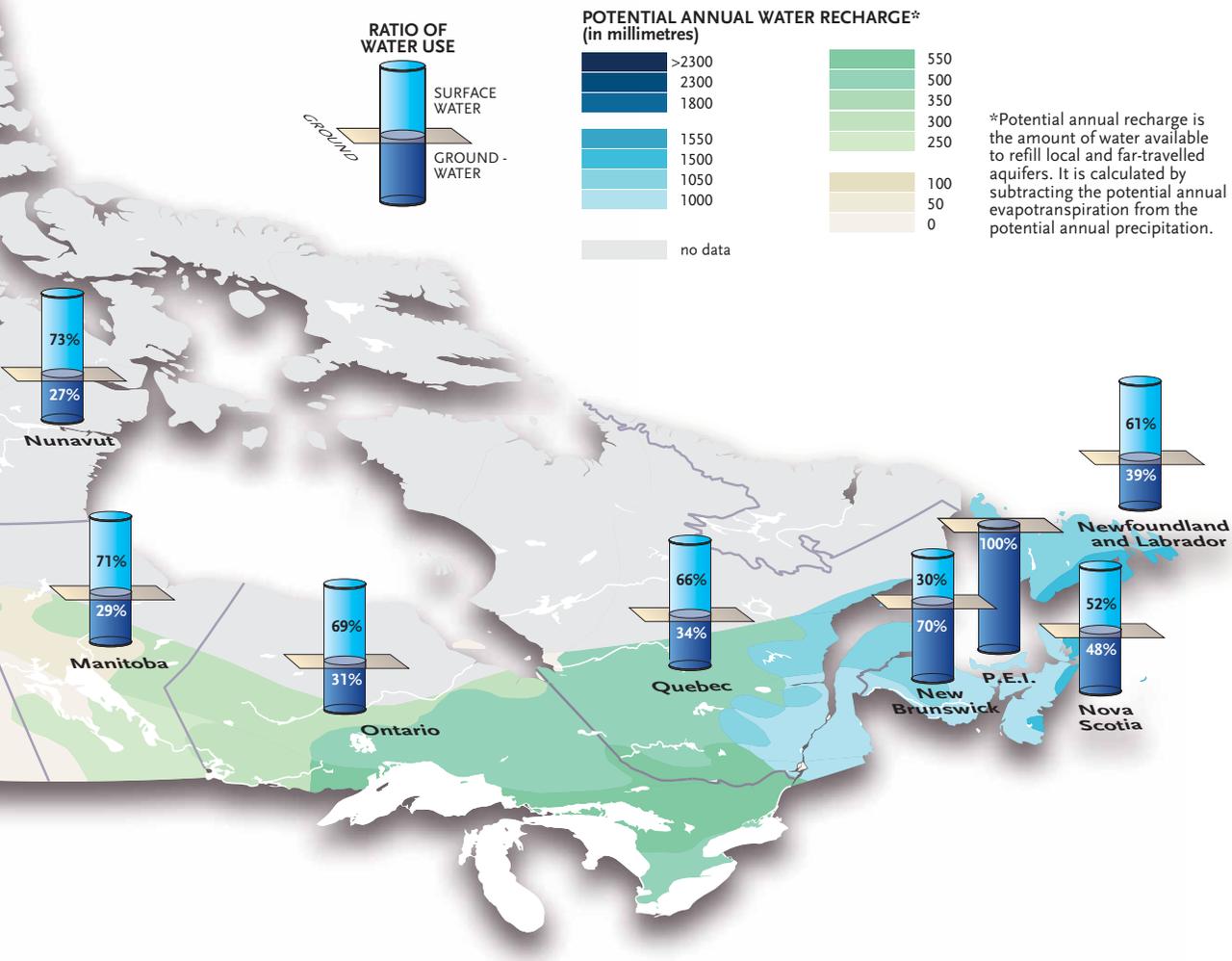
### PRECIPITATION AND SURFACE WATER SEEPAGE

### EVAPOTRANSPIRATION

### GROUNDWATER USE



**LOCATION** Water in the Earth's saturated zone, which is everything below the water table, is groundwater. Groundwater is naturally filtered as it moves, and is usually free of dangerous micro-organisms.



## POTENTIAL GROUNDWATER RECHARGE AND GROUNDWATER USE

**RECHARGE** Groundwater is replenished by a process called recharge (see map and graphic). Water works its way into aquifers (areas of permeable material that hold enough groundwater to be tapped for human use) directly from rainfall or snowmelt, or indirectly from streams and rivers or other concentrated sources. It's estimated that about seven per cent of Canada's annual precipitation — about 400 cubic kilometres of water — recharges groundwater reserves.

**EVAPOTRANSPIRATION** Water is lost to the atmosphere both by evaporation from water bodies and soil and by transpiration

(the "exhalation" of water from plants), a process known as evapotranspiration. By comparing precipitation and evapotranspiration, scientists can judge the volume of annual recharge, which tells them, roughly, the sustainable yield for groundwater.

**CONTAMINATION** Aquifers are vulnerable to pollution, "and," notes Rivera, "they're in contact with rivers, lakes, wetlands and whole ecosystems." Contamination can stem from landfills, septic systems, road salt, agricultural and industrial products and waste and many other sources.

**SUSTAINABLE USE** When it comes to determining the volume of groundwater used by Canadians, hydrologists are mostly in the dark. In places such as the American Southwest, unsustainable groundwater use is resulting in land subsidence, saltwater intrusion and contamination. "We don't have these problems," says Rivera. "And if we collect more data, so we're better able to measure how much we have and where, what we use and how vulnerable it is, we'll be better off than anywhere else."



How can you protect your groundwater?  
Get tips and additional resources from our handy guide at [mag.cangeo.ca/jun15/water](http://mag.cangeo.ca/jun15/water).

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## THE GREATEST EXPLORERS TODAY

are astronauts, deep-sea divers and polar adventurers. But then they're also paleontologists, historians, conservationists and photographers. It's hard to find one who fits the classic "new lands" definition (think Champlain, Mackenzie, Amundsen or Shackleton), but with every new expedition, adventure, field-research breakthrough, environmental effort and invention, this living generation is questing to better our geographic and scientific knowledge of Canada, Earth and everything beyond.

The beauty of the term "explorer" is that the people labelled as such are constantly helping to evolve its meaning. We can't put many restrictions on a word that drives discovery, that constantly reframes the world, introduces us to new places, peoples and species or shows them again in ways not yet imagined.

What follows is *Canadian Geographic's* collection of the nation's best explorers, determined with the help of Fellows of The Royal Canadian Geographical Society — in particular renowned ocean explorer Joe MacInnis, who provided the definition of "exploration" that guided the whole project (see next page). We also looked for world and national firsts, and individuals who have made significant and lasting impacts in their fields. Several of these trailblazers have been spotlighted, with the others described in brief. Save alphabetical order (for the long list), there is no hierarchy here. All have performed great feats.

## WHAT IS AN EXPLORER?

**E**xploration is an extremely hard word to unravel. (My first expedition, the American Man in Sea project supported by the U.S. Navy and *National Geographic*, took place in 1964. I've been struggling with a definition of exploration ever since.) Here's a version that came from our team on the recent James Cameron-*National Geographic* Deepsea Challenge expedition:

"Exploration is about forging dramatic new relationships with the natural world and telling essential stories to accelerate our understanding of the critical importance of these relationships."

In a story about American astronaut Dave Williams, I wrote: "Exploration is a way of thinking and acting, a way of living that fully engages you in the wonder and beauty of natural and human-made worlds. Exploration keeps you asking questions, accepting challenges, and developing the mental dexterity needed to solve 21st-century problems."

Exploration keeps you young. There are a lot of ways to define this essential human principle. There may be as many forms of exploration as there are explorers."

—Joe MacInnis

## JAMES CAMERON

Deepest diver



One of the highest points in James Cameron's career was also his lowest. In March 2012 he became the first human to travel solo to the bottom of the western Pacific Ocean's Mariana Trench, which at almost 11 kilometres below sea level is the deepest place on Earth. Cameron and his engineering team spent more than seven years designing the submersible *Deepsea Challenger* to do the job.

A formidable mix of director, environmentalist and ocean explorer, Cameron has led dozens of dives and submersible explorations, most notably to the wreck of *Titanic*. In addition to directing box office behemoths such as *Titanic* and *Avatar*, he founded Earthship Productions, a company dedicated to creating documentaries about ocean conservation and exploration and to bringing the deep ocean to life for a global audience.

—Leah Gerber

## WADE DAVIS

Culture explorer



David Suzuki calls him "a rare combination of scientist, scholar, poet and passionate defender of all of life's diversity." As an explorer-in-residence for the National Geographic Society, Wade Davis has focused his long career on studying indigenous cultures around the world, from Borneo to Haiti to the High Arctic. He started his career as a "plant explorer," however, having earned degrees in biology and anthropology as well as a PhD in ethnobotany from Harvard, later living with aboriginal groups in the Amazon and Andes as he collected some 6,000 plant specimens. The Vancouver native has written 17 books and is a professional photographer, documenting and celebrating the places and people he visits.

—Michela Rosano

## JILL HEINERTH

Cave swimmer



Most days start with a swim in a spring near her home in High Springs, Florida — an unassuming activity for this Mississauga, Ont.-born woman who has explored places less frequented than the moon, according to director James Cameron. She was the first diver to explore and film Antarctic iceberg-cave ecosystems and has pushed deeper into underwater caverns than any woman in history. "I get to swim through the veins of Mother Earth within the lifeblood of the planet," says Heinerth, and she's proudly working to spread water literacy through the We Are Water Project. Last year, to highlight the issue of disappearing sea ice, she snorkelled with all-female Team Sedna from Labrador to Western Greenland.

—Jessica Finn

## THE LONG LIST CANADA'S 77 OTHER GREATEST EXPLORERS

### MARK ANGELO

River conservationist, paddler and writer; founded BC Rivers Day and World Rivers Day

### OWEN BEATTIE

University of Alberta anthropologist known for his investigation of bodies from the 1845 Franklin expedition

### MIKE BEEDELL

Wilderness photographer, conservationist and guide; has led groups through Canada's Arctic, Antarctica, Greenland and other remote areas for nearly 40 years

### JEAN BÉLIVEAU

Walked more than 75,500 kilometres around the world (Montreal to Montreal) between 2000 and 2011, to promote peace

### EDWARD BURTYNSKY

Photographer and artist; documents nature transformed through industry

### KEVIN CALLAN

Camping and canoe guide, adventurer and author of bestselling books such as the *Paddler's Guide* series

### JOHN J. CLAGUE

Leading authority in Quaternary studies, specializing in geological hazards such as earthquakes, tsunamis, landslides and floods

### JAMES COLERIDGE

Summits of Canada expedition leader; educates youth about geography, the environment, technology and cultures through mountain climbing

## FRED ROOTS

Polar pioneer



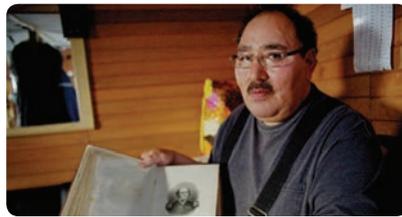
There aren't many Canadians alive today who have a mountain named after them. Sorry, make that an entire mountain *chain*: Antarctica's "Roots Range" was dubbed in honour of this explorer, geologist, geophysicist and diplomat.

Fred Roots, now 92, has been part of dozens of scientific expeditions in the Arctic, Antarctic, Himalayas and Rockies — notably as senior geologist for the first international scientific study of the southern polar region, the famous Norwegian-British-Swedish Antarctic Expedition of 1949-52. A few years later, he came up with the idea for the Polar Continental Shelf Program, which collected, for Canada, the first solid data about its own Arctic. Then he helped write the Antarctic Treaty, the reason the entire continent has been set aside for peace and scientific research, and for 30-plus years was science advisor to the Department of the Environment (later Environment Canada). Even those already acquainted with him may not know that he holds the record for the longest unsupported dogsled journey ever (189 days) and that once, when he was speaking on continental drift at Princeton, Albert Einstein sat in the front row. "Fred Roots" should be a household name.

—Nick Walker

## LOUIE KAMOOKAK

Inuit historian



Louie Kamookak's great-grandmother Hummahuk used to tell him stories and legends as they travelled the Arctic region around Gjoa Haven together. It was only during a classroom history lesson a few years later, however, that he realized some of the matriarch's stories, including one of a white-man's grave on King William Island's north coast, matched the tale of Sir John Franklin's catastrophic expedition. That spurred the Gjoa Haven historian and teacher into a hunt for the British explorer that has lasted more than 40 years, and would see him sitting with Inuit elders while they poured out their oral histories; locating known graves and discovering artifacts and remains strewn across the land; and comparing findings to journals from many Franklin search parties. In the first years of the federal government's renewed search for HMS *Erebus* and *Terror*, Kamookak acted as a consultant, recommending that the search be focused on what turned out to be the correct area. Thanks to his help, *Erebus* was found in 2014, but that doesn't mean Kamookak's search is over. His next task? Finding Franklin's grave.

—N. W.

### EXPLORER EXPERTISE

	ADVENTURE
	ASTRONOMY
	CAVING
	CLIMBING
	DIVING
	EDUCATION
	ENVIRONMENT
	FLORA, FAUNA
	GEOLOGY
	HEALTH
	INVENTION
	PALEONTOLOGY, ARCHEOLOGY
	PHOTOGRAPHY, FILM, ART
	TREKKING
	SOCIETY
	SPACE SCIENCE
	WATER TRAVEL

#### KATHLEEN CONLAN

Canadian Museum of Nature marine biologist and deep-sea diver, with more than 20 field expeditions in the Arctic and Antarctic

#### MICHAEL COOK

Urban explorer and photographer; documents hidden infrastructure, making it visible to the public

#### FRÉDÉRIC DION

Became the first person, by kite-ski in 2014, to reach the southern pole of inaccessibility (the most remote and challenging point to reach in Antarctica) on their own

#### AARON DOERING

Arctic adventurer and educator, speaks on sustainability and climate change; since 2004 has dogsled and pulked 8,000 kilometres across the circumpolar Arctic

#### STEVE DONAHUE

Sahara Desert adventurer and author; uses adventure storytelling to inspire corporate change

#### SIMON DONATO

Geologist, world explorer, TV host and founder of Adventure Science, which combines field-based research with ultra-endurance athletics

#### FIN DONNELLY

MP for New Westminster-Coquitlam, B.C.; founded the Rivershed Society of BC and raised awareness by swimming 32,000 kilometres of B.C. waterways

#### JOHN DUNN

Arctic and Canadian wilderness traveller, writer, photographer and lecturer; has led expeditions since immigrating to Canada from England

#### SUSAN R. EATON

Geoscientist and conservationist; leader of the all-woman 2014-2017 Sedna Epic Expedition, which will snorkel the Northwest Passage

#### JOHN ENGLAND

Expert in environmental change in Arctic environments and NSERC Northern Research Chair at the University of Alberta; has led Arctic field studies for more than 45 years



**An explorer** takes calculated risks to achieve something that's never been done before. Explorers have to embrace failure as part of discovery. In some ways I have chosen a difficult path in life, but the rewards outweigh the challenges when you are doing **something you truly love.**"

—Jill Heinerth

## PHILIP CURRIE

Fossil finder



Ever heard that **dinosaurs** were likely the feathered ancestors of birds? Or seen illustrations of huge carnivorous dinosaurs such as Tyrannosaurus rex or albertosaurus hunting in packs? Credit Philip Currie's key field and lab work for these and other now widely accepted theories.

Currie, a University of Alberta professor and Canada Research Chair in Dinosaur Paleobiology, also has a gift for international relations — between dinosaur scientists, at least. He's unearthed new fossils in Canada, China and Mongolia, Antarctica, Argentina and Australia, and has named no fewer than 25 dinosaur and dinosaur-predecessor species since the early 1980s. And not only is he a founder of the famed Royal Tyrrell Museum of paleontology in Drumheller, Alta., he's got another museum named after him. The Philip J. Currie Dinosaur Museum, a spectacular, angled abstraction of a building next to a mass horned-dinosaur grave 20 kilometres west of Grande Prairie in northern Alberta, is slated to open this fall.

—N. W.

## JOHN POLLACK

Nautical surveyor



After nearly 50 years of leading expeditions in hard-to-reach places, John Pollack says he's starting to look for easier projects. It's unclear, however, whether his recent trip to Laos to map more of the gigantic Xe Bang Fai River cave qualifies as "easy." As a GPS surveyor and researcher with the Institute of Nautical Archaeology, Pollack specializes in difficult conditions both underwater and underground. For instance, his skills are useful in the silty waters of the Yukon River, where he has helped lead a multi-year mission to find, study and map a collection of century-old sternwheelers that were abandoned after the Klondike Gold Rush. Easy? Not necessarily. Fascinating? Absolutely.

—Sabrina Doyle

## RYAN HARRIS

Underwater archeologist



We all know this story: Ryan Harris and his team of Parks Canada underwater archeologists made a historic breakthrough in 2014 when they, with the help of experts ranging from ice analysts to Inuit historians, discovered the wreckage of HMS Erebus, one of Sir John Franklin's lost ships, in the southern waters of Canada's Arctic Archipelago. Harris likened the once-in-a-lifetime experience to winning the Stanley Cup, but the achievement had been many years in the making. He spent six summers on this project, surveying more than 1,200 square kilometres in search of the two elusive vessels from the failed 1845 expedition. Harris has been with Parks Canada since 1999, exploring waters across Canada on dives that include the discovery of the sunken HMS Investigator (sent in search of Franklin in 1850). Now he's returning to his latest and greatest discovery to comb the wreckage for clues to its history.

—Calvin Dao

### ALAN EVANS

McGill University-based pioneer of "BigBrain," the first 3D cellular-resolution model of the human brain

### MAX FINKELSTEIN

Canoe explorer, author and environmentalist; retraced the 1793 cross-North America route of explorer Alexander Mackenzie

### DEREK FORD

Leading academic cave explorer; studies caves as records of climate and geomorphic evolution

### COLIN A. FRANKLIN

A pioneer of Canada's space program; as chief electrical engineer, played a leading role in the 1962 design, construction and application of Canada's first satellite, the Alouette-1

### JEFF FUCHS

First westerner to trace the Tea Horse Road and the nomadic salt route, both ancient Himalayan trade routes

### WILL GADD

Ice and mountain climber and paraglider pilot; formerly held the paragliding world distance record

### DAVID GRAY

Arctic wildlife behavioural biologist, historian, writer and national museums research scientist and curator; led the 2013 search for the remains of the 1913-1918 Canadian Arctic Expedition

### NATHAN GRAY

Youngest person (10 years old at the time) to discover a supernova

### GEOFF GREEN

Arctic and Antarctic adventurer and educator; founder and executive director of Students on Ice Expeditions

### NORMAN HALLENDY

Arctic explorer and Inuit ethnohistorian; leading authority on inuksuit



WHAT EXPLORATION MEANS TO ME

**People who explore,** I think, go places where most people don't go ... but I think what changes an inveterate traveller into somebody who might be called an explorer, is the **storytelling and reporting back."**

—James Raffan

## JOE MACINNIS

Diving luminary



Whatever you do, don't call Joe MacInnis an aquanaut. "The word means everything and nothing," the godfather of Canadian deep-sea explorers told *Canadian Geographic*. Indeed, the cartoonish term doesn't even come close to encapsulating MacInnis's numerous accomplishments, many of which can read like something out of a Clive Cussler novel: leader of the first team to explore the waters beneath the North Pole; the discovery in 1980 of *Breadalbane*, the world's northernmost known shipwreck, which sank in 1853 off Beechey Island in the Canadian Arctic; and among the first to dive the wreck of *Titanic*. So no, not aquanaut — but legend should do nicely.

—Harry Wilson

## PAUL NICKLEN

Polar photojournalist



Given that Paul Nicklen is an Arctic ecosystem specialist and marine biologist turned wildlife photojournalist, it might surprise you that he has no formal photography training. A *National Geographic* photographer for almost two decades, he travels 10 months a year on assignment in a bid to promote conservation efforts for endangered wildlife — though he is perhaps best known for his underwater photography of Arctic and Antarctic species. He credits the Inuit of Baffin Island, where he grew up, for teaching him the survival skills, knowledge and appreciation of wildlife required for his job.

—J.F.

## JAMES RAFFAN

World backcountry explorer



When people conjure up images of climate change in the North, they might only picture polar bears or melting ice and snow. Writer, geographer, paddler and world trekker James Raffan wanted to change that. "The North is very much a people place as well," he says. "The human face of the Arctic is not one we see a lot." To put that face on climate change, Raffan spent three years traversing more than 17,000 kilometres to write his 16th book, published in 2014, *Circling the Midnight Sun: Culture and Change in the Invisible Arctic*. As Raffan travelled and lived along the Arctic Circle — in Greenland, Iceland, Scandinavia, Russia, Alaska and Canada — he uncovered stories of changing societies and landscapes.

—Carys Mills

### KATE HARRIS

Adventurer, writer, photographer and conservationist; encourages thinking "beyond borders" through expeditions such as 2015's Borderski

### CHRISTOPHER HOPKINSON

National leader in the use of remote sensing technologies for environmental and natural resources assessments and applications

### BRUCE KIRKBY

Wilderness adventurer, writer and photographer; has journeyed through more than 80 countries, connecting nature to contemporary human issues

### GEORGE KOUROUNIS

Host of *Angry Planet* and storm chaser; specializes in documenting natural disasters and extreme weather

### BILL LISHMAN

Ultralight-aviation pioneer; conducted the first aircraft-led bird migration study with Canada geese; leader in whooping crane conservation

### KARSTEN HEUER AND LEANNE ALLISON

Husband-and-wife adventure team, authors and filmmakers with a focus on wildlife conservation issues

### DAVID JONES

First Canadian climber over 8,000 metres (on Makalu, Himalayas); has made dozens of first ascents

### EVA KOPPELHUS

Palaeobotanist and palynologist (expert on plant pollen and other microscopic palynomorphs); has studied prehistoric flora around the world

### ADAM KREEK AND MARKUS PUKONEN

Canadians on the four-person CWF Africa to the Americas Expedition; their boat capsized after 2½ months of rowing and collecting ocean data

### T.A. LOEFFLER

Educator, climber and author; reached the highest points of Nepal, North Africa, Greenland and Antarctica



**My mentors and heroes** are people who have gone out and then shared their explorations to further awareness about the environment. For example, Jacques Cousteau or Sylvia Earle, who exposed the beauty of the oceans **but also the challenges they face.**"

—Julie Angus

**JEAN LEMIRE**

Global sailor



There are certainly more inviting waters in which to get your sea legs than the daunting polar regions, but don't expect to find Jean Lemire anchored off sunny Saint-Tropez anytime soon. The biologist-turned-filmmaker first made his name with his 2002 Arctic Mission expedition, a five-month, Montreal-to-Vancouver schooner journey through the Northwest Passage that chronicled the effects of climate change in the Canadian Arctic, as seen in his subsequent documentary film *The Great Adventure*. Three years later, Lemire was at the opposite pole for Antarctic Mission, a 430-day epic of modern adventure that yielded another stunning film, *The Last Continent*. In 2014, Lemire and his crew completed a nearly three-year global odyssey, sailing around the world to document the state of the planet's biodiversity for the TV series *1000 Days for the Planet*.

—H. W.

**COLIN AND JULIE ANGUS**

Dynamic documentarians



Colin and Julie Angus once rowed 10,000 kilometres in 156 days across the Atlantic Ocean together, surviving two hurricanes. The documentary-making and bestselling-author duo completed the journey as part of Colin's human-powered, 43,000-kilometre trip around the world, which started in 2004 when the husband-and-wife team (and a third teammate) cycled from Vancouver to Alaska.

Colin began his adventures by sailing across the Pacific, and was a member of the first crews to raft the length of both the Amazon River and central Russia's Yenisey River. He is currently preparing for the Race to Alaska — a motorless, 1,200-kilometre rush from Washington to the northernmost state. Julie, who has a background in molecular biology, is the first woman to row across the Atlantic Ocean. She has also cycled, sailed and rowed tens of thousands of kilometres around the world. Among the pair's latest adventures? Sailing ancient Mediterranean trade routes to research the mysterious history of the olive tree.

—L. G.

**SARAH AND ERIC MCNAIR-LANDRY**

Super siblings



During an unsupported expedition with her older brother, Eric, in 2004-2005, Sarah McNair-Landry became the youngest person to ski to the South Pole. She was 18. Since then, the Nunavut-born siblings haven't stopped breaking records during their many expeditions. In 2006, Sarah became the youngest person to reach both poles when she dogsledded to the North Pole. In 2011, the duo kite-skied 3,300 kilometres through the Northwest Passage, following the route Roald Amundsen took in 1903-1906; it was during this adventure that Eric established the world record for longest distance kite-skied in 24 hours. The duo have also kite-skied across the Greenland ice cap, dogsledded across Ellesmere Island and piloted three-wheeled kite-buggies over Mongolia's Gobi Desert.

—M. R.

**MEAGAN MCGRATH**

Only Canadian woman to climb two versions of the Seven Summits; first Canadian to ski solo to the South Pole

**DANA MEISE**

Trekled the 16,500-kilometre east-west Trans Canada Trail; currently working to complete the more than 4,000-kilometre northern trail

**ELON MUSK**

Entrepreneur, engineer and inventor; CEO and chief designer of SpaceX, CEO and product architect of Tesla Motors, the electric car company

**SIR CHRISTOPHER ONDAATJE**

Author and adventurer; has retraced the routes of Victorian-era explorers to try to determine the source of the Nile River

**STEWART B. PECK**

Canadian Museum of Nature entomologist; has likely collected more insects throughout the world than any other living person

**MATTY MCNAIR**

Arctic adventurer; led the first-ever all-female expedition to the geographic North Pole

**PAT AND BAIBA MORROW**

Mountaineers, photojournalists and filmmakers; Pat was the first climber in history to reach the Seven Summits

**JEN OLSON**

Mountain guide and climber; represented Canada in the cultural event of ice climbing at the 2014 Winter Olympics in Sochi

**PASCALE OTIS**

Biologist, polar adventurer and videographer; wintered in Antarctica on a yacht; shares adventures with a global audience

**DAVID PELLY**

Since the 1970s, has lived in and explored the cultural landscape of the Arctic, documenting traditional Inuit knowledge



WHAT EXPLORATION MEANS TO ME

**Exploration is about** pushing boundaries, but also about satisfying curiosity. It's a means of revealing answers in many different ways, whether through science research, the study of geography or literally **exploring remote parts of the world.**"

—Colin Angus

**JERRY KOBALENKO**

Arctic adventurer



"I'd heard that the North was barren, cold, uncomfortable, harsh, empty. These sounded like assets," writes Jerry Kobalenko about his decision to visit the region in the introduction for his latest book, *Arctic Eden: Journeys Through the Changing High Arctic*. Now, more than two decades after his first trek, Kobalenko has travelled more than 6,000 kilometres by foot, ski and kayak on 20-plus expeditions through Canada's High Arctic. Through his writing and photography, Kobalenko shares his passion for the North and has earned himself a spot among the world's top Arctic adventurers.

—M. R.

**MYLÈNE PAQUETTE**

Atlantic rower



"I won't beg you to leave me alone; it was me who asked for it." So begins the letter that Mylène Paquette wrote to the sea on Nov. 11, 2013, the day before she touched France's shore and became the first North American woman to row solo across the North Atlantic from west-to-east, a route considered more difficult than its reverse. She endured four months of solitary travel, not to mention the ravages of Hurricane Humberto halfway through her journey. Paquette, who is also the ambassador of the St. Lawrence River for the David Suzuki Foundation, hopes this and her other rowing expeditions serve as a bridge between the public and environmental activism.

—S. D.

**RAY ZAHAB**

Ultra marathoner



It's hard to think of a landscape on Earth that hasn't felt the relentless patter of Ray Zahab's sneakers. The accomplished ultra-runner has jogged across places as varied as Mongolia's Gobi Desert, Siberia's Lake Baikal, California's Death Valley and Antarctica. Zahab measures success not by kilometres logged (though there have been thousands) but rather by the number of young people he has inspired to push their limits. In 2008, he founded impossible2Possible, which funds and organizes a series of empowering and educational adventures for young people. Throughout the expeditions, youth ambassadors use satellite tracking, interactive multimedia and daily communication to engage classrooms around the world.

—S. D.

**THIERRY PÉTRY**

Arctic and Antarctic explorer (often with Bernard Voyer); has been on a number of missions for Doctors Without Borders

**WAYNE POLLARD**

Investigates massive ground ice in the Canadian High Arctic and Antarctica; director of the McGill Arctic Research Station on Axel Heiberg Island

**TODD REICHERT AND CAMERON ROBERTSON**

Human-powered flight pioneers. Reichart was the first to fly a human-powered helicopter longer than 60 seconds at an altitude of three metres

**MARK ROBINSON**

Host of *StormHunters* and meteorologist for The Weather Network; storm chaser, severe weather expert and educator

**HEATHER ROSS**

Mountaineer, polar trekker and head of the Cardiac Transplant Program at Toronto's Peter Munk Cardiac Centre; expeditions raise awareness for heart health and research

**PETER ROWE**

Wilderness adventure, exploration and wildlife documentarian, creator of TV series *Angry Planet*

**FRANCOIS-XAVIER DE RUYDTS**

Leading adventure photographer; specializes in shooting in remote locations such as on climbing and caving expeditions

**NATALIA RYBCZYNSKI**

Canadian Museum of Nature paleobiologist; discovered that camels lived in the High Arctic, highlighting climate change in the region from the Pliocene to the present

**DAVID SCHINDLER**

World-renowned environmental scientist known for his research on acid rain and protection of freshwater resources around the world

**MIKE SCHMIDT**

Geodesist, science coordinator at the Kluane Lake Research Station; led the 1992 expedition to determine the height of 5,959-metre Mount Logan, Canada's highest peak



**Exploration to me** has a whole bunch of definitions. It's not just those people who charge into jungles where no one's gone before, etc. But it is that same feeling... it's the armour of technology that allows us to go way beyond our design specifications. And that's the kind of explorer that I believe I am. In many ways I'm just a blacksmith who makes these devices that allow us to go outside of our design specifications **and come back safely.**"

—Phil Nuytten

## RAPHAEL SLAWINSKI

First ascender



**Being a mountain climber** is dangerous: avalanches, exhaustion and injuries are all risks, as is — at least for Raphael Slawinski and climbing partner Ian Welsted — the threat of Taliban militants. In 2013, just days before the veteran alpinist became the first to summit the north-west face of 7,040-metre Himalayan peak K6 West in Pakistan, members of the Taliban had executed 11 people at a nearby base camp.

"We had put our lives on hold for two months. So while this gave us pause, it was not something that turned us around," Slawinski later told the *Calgary Herald*. It's that perseverance that has led the physics and astronomy professor at Calgary's Mount Royal University to dozens of first ascents, many in Canada's Rockies, during his two-decade climbing career.

—M.R.

## BERNARD VOYER

Winter's friend



"I realized very early that winter and me, we were close friends," says Bernard Voyer. The Québécois explorer has demonstrated his close relationship with the cold season through his many achievements, which began in 1978 when he embarked on his first Arctic expedition. Voyer became the first person to ski across Ellesmere Island in 1992, and the first Canadian to ski to the North Magnetic Pole in 1993 and east-to-west across Greenland in 1995. Today he is also a motivational speaker, travelling the world to lecture at schools and other institutions, where he shares his journeys and his life of being "everywhere cold lives."

—C.D.

## RICHARD WEBER

North Pole chaser



**Imagine stepping onto the frozen** Arctic Ocean, knowing there are several weeks of hard trekking and potentially brutal weather ahead of you. Now imagine doing that again and again until you've spent a combined 600 days of your life travelling that ice. That has been Richard Weber's reality. On different expeditions, the Arctic explorer has become the first known Canadian to reach the North Pole on foot and the first recorded person to stand at the exact geographic North Pole (his GPS confirmed "90 degrees N"), and he and teammate Misha Malakhov made it to the pole and back with no outside help, an achievement that has never been repeated. Weber, it's believed, has trekked to the North Pole more than anyone in history.

—Breanna Adams

### CHIC SCOTT

Mountaineering great, guide and historian; founded the Canadian Himalayan Foundation to promote Canadian expeditions

### ADAM SHOALTS

Seeks out remote waterways without recorded history of exploration; best known for discovering uncharted waterfalls on the Again River in 2013

### LAURIE SKRESLET

Mountaineer, now motivational speaker; in 1982 became the first Canadian to summit Mount Everest

### JOHN SMOL

Acclaimed Arctic researcher and pioneer in paleolimnology (study of lake sediment to track environmental and ecological change)

### IAN STERLING

Scientist and author; has studied polar bear populations, effects of climate change and conservation of the species for decades

### ROB STEWART

Conservationist, photographer and filmmaker; best known for documentary films *Sharkwater* and *Revolution*

### MARK ST-ONGE

Mineral exploration of remote regions of Canada; lays groundwork for mining companies to explore for mineral wealth

### LES STROUD

Survival expert and filmmaker; Canadian Screen Award-winning producer, creator and star of the TV series *Survivorman*

### DAVID SUZUKI

Geneticist, environmental activist and broadcaster; creator and host of CBC's *Quirks and Quarks* and other science programs

### MARK TERRY

Science and nature documentarian; in *The Polar Explorer* (2010), became the first filmmaker to cross the Northwest Passage via the Prince of Wales Strait

**CHRIS HADFIELD**

Space station commander



“Almost everything worthwhile carries with it some sort of risk,” said Chris Hadfield in a NASA interview before Expeditions 34 and 35 (Nov. 2012 to May 2013), “whether it’s leaving home, whether it’s getting married or whether it’s flying in space.” The Sarnia, Ont., native’s modest, “everyday Canadian” personality shone through in a video series called *An Astronaut’s Guide to Life in Space*, filmed during his final expedition. That, coupled with his social media savvy, catapulted the astronaut to fame. His many prior achievements, however, speak for themselves: Hadfield, who has logged nearly 4,000 hours in orbit, was the first Canadian to operate Canadarm, board Russian space station *Mir*, walk and float freely (and film a music video) in space and command the International Space Station.

—C.D.

**ROBERTA BONDAR**

Canada’s first spacewoman



For eight days in 1992, Roberta Bondar left Earth. Canada’s first female astronaut, the first non-American woman to fly on a U.S. space shuttle and the first neurologist in space, she was aboard NASA’s shuttle *Discovery* to conduct scientific experiments for 14 nations and help us learn about how humans react to space. In one experiment, since immortalized in the Imax movie *Destiny in Space*, cameras recorded Bondar’s eye and inner ear responses to her body spinning in a chair in microgravity. She was able to use her artistic side while in orbit as well, snapping stunning photos while flying over Canada. Back on Earth, Bondar headed an international space medicine research team, finding new connections between recovering from floating in space and neurological illnesses, and continues to publish books of her landscape photography.

—C.M.

**PHIL NUYTEN**

Deep sea innovator



Phil Nuytten couldn’t stay in high school — he was too anxious to explore the ocean. So he quit and began his commercial diving career. Decades later, in 1983, his most famous dive was to the *Breadalbane*, the world’s northernmost known shipwreck.

He is best known, however, as an inventor and builder of deep-sea diving equipment and submersibles, and he established world-leading companies Can-Dive, Oceaneering International and Nuytco. His hard-suits, the Newtsuit and the Exosuit (“one-atmosphere systems”), are used by explorers and navies around the globe, having made it possible for humans to dive deeper for longer, more safely. He and his team are also training astronauts to operate their DeepWorker submersibles for asteroid work, and however far-fetched it may sound, he is designing Vent-Based Alpha, an undersea one-atmosphere colony dedicated to extracting minerals from deep ocean heat vents.

—L.G.

**CANADA’S SPACE EXPLORERS**

The Canadian Space Agency has fielded nearly 15,000 applications from would-be astronauts during its three recruitment campaigns since 1983. Including Roberta Bondar and Chris Hadfield, only 12 of those applicants have been successful, and have combined to build Canada’s space program and fly on 16 missions: **MARC GARNEAU, BJARNI TRYGGVASON, STEVE MACLEAN, ROBERT THIRSK, KEN MONEY, JULIE PAYETTE, DAVE WILLIAMS, MICHAEL MCKAY, JEREMY R. HANSEN** and **DAVID SAINT-JACQUES**.

**JER THORP**

Digital artist whose data visualizations make huge volumes of information (such as the 2,300 new planets discovered by NASA) comprehensible

**NICHOLAUS VIEIRA**

Cave guide and world cave explorer, spending 200-plus days underground each year; leader of the expedition to map B.C.’s Raspberry Rising cave

**MIKE WIEGELE**

Heli-skiing pioneer and guide; founded the Canadian Ski Guide Association and initiated B.C.’s Blue River Avalanche Research Centre

**ANDREW WONG**

Photographer, artist and climber; highlights sustainable livelihoods of people, particularly in indigenous cultures, around the world

**SHARON WOOD**

First North American woman to reach the summit of Mount Everest and the first woman to have done so by a new route (along the west ridge)

**CORY TREPANIER**

Painter and filmmaker; currently exploring Canada’s North and will subsequently create 50 oil paintings for the *Into the Arctic* project

**SAM WHITTINGHAM**

Cyclist and multiple world speed-record setter (on recumbent bicycles); first unpaced cyclist to go one-tenth the speed of sound, reaching 132.50 km/h

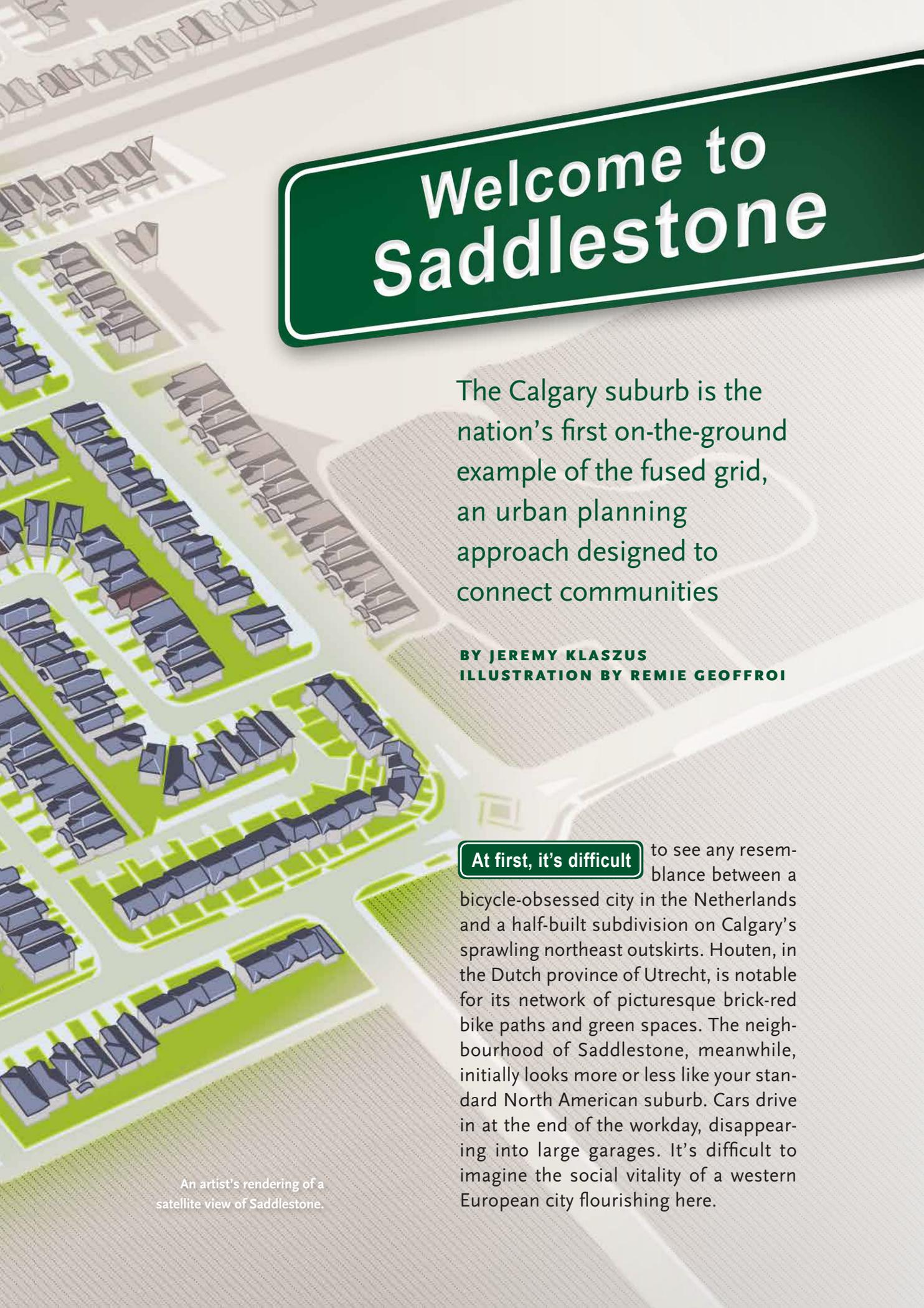
**FRANK WOLF**

Wilderness adventurer, filmmaker and writer with a northern and environmental focus; first to canoe across Canada in a single season

**ROB WOOD**

Mountaineer, waterfall-ice-climbing pioneer and outdoor educator; made numerous first ascents in Canada and the U.S.





# Welcome to Saddlestone

The Calgary suburb is the nation's first on-the-ground example of the fused grid, an urban planning approach designed to connect communities

**BY JEREMY KLASZUS**  
**ILLUSTRATION BY REMIE GEOFFROI**

**At first, it's difficult** to see any resemblance between a bicycle-obsessed city in the Netherlands and a half-built subdivision on Calgary's sprawling northeast outskirts. Houten, in the Dutch province of Utrecht, is notable for its network of picturesque brick-red bike paths and green spaces. The neighbourhood of Saddlestone, meanwhile, initially looks more or less like your standard North American suburb. Cars drive in at the end of the workday, disappearing into large garages. It's difficult to imagine the social vitality of a western European city flourishing here.

An artist's rendering of a satellite view of Saddlestone.

# FUSED GRID

And yet it does, to a degree. Wait a bit on a warm day and Saddlestonians re-emerge, carless, to converge on a central neighbourhood park. Rows of townhouses face the park, single-family homes back onto it and the streets are intentionally laid out in such a way that kids down the street have to cross as few roads as possible to walk or bike there. “We come, drop the bikes and play,” says Harry Cheema, a dad of two who lives around the corner from the park. When the weather’s good, there’s barely enough room to kick around a soccer ball in the two green play spaces that flank the playground. “In summertime, it’s totally packed,” says Cheema. “Too crowded.”

## At a time

when many playgrounds are bare of kids and it’s normal to not know your neighbours, “too crowded” is an enviable plight. Cheema’s family inhabits an urban experiment: Canada’s first fused grid neigh-

bourhood. The fused grid is a street pattern that amalgamates the traditional pre-war street grid with the curvilinear, loop-and-lollipop streets that wend through most post-war suburbs.

Designed to keep fast cars — including 50 km/h traffic — at the neighbourhood’s periphery, the fused grid minimizes auto traffic within by using short streets with elbow-bends to discourage shortcutting through communities. The design prioritizes safety and connectivity for cyclists and pedestrians, principles that have guided Houten’s growth since the 1960s. Today, more than half of all trips made by Houten residents are non-motorized.

The Canadian manifestation of the fused grid is the brainchild of Fanis Grammenos, an Ottawa-based planning consultant with some contrarian views on city planning. He developed the concept as a senior researcher for the Canada Mortgage and Housing Corporation (CMHC), where he spent two decades. In the early 2000s, as he researched housing affordability and sustainability, he grew weary of the anti-suburbs sentiment he found in a lot of planning literature. New Urbanism had taken off in the 1990s, a movement

says Grammenos. “Usually people line up the night before to get a house on a cul-de-sac or a loop because they appreciate the environment. But we know those two street shapes have a disadvantage of not being connected.” This design discourages non-motorized transportation, not just from the suburbs to the city but within the community as well. Often you need to walk north to get south (when leaving a cul-de-sac, for example). The layout favours driving, and the resulting inactivity contributes to myriad health problems including obesity, heart disease and hypertension.

The fused grid inverts — or, as Grammenos likes to say, *rebalances* — this, prioritizing walking and cycling over driving where possible. The goal isn’t just physical health but social connection as well. Paths guide people through central areas, such as the park in Saddlestone, where there’s a good chance you’ll

run into neighbours. “The open space is like your traditional village square,” says Grammenos. “Everybody on their way to or from something on foot will have to actually cross that space. And that’s how you build up participation. It’s the presence and accidental meeting of other people that encourages the sense of community.”

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*Jeremy Klaszus (@jeremyklaszus.com, @klaszus) is a freelance journalist and a winner of two National Magazine Awards. He lives in Calgary, where he writes a weekly urban affairs column for the city’s Metro newspaper.*

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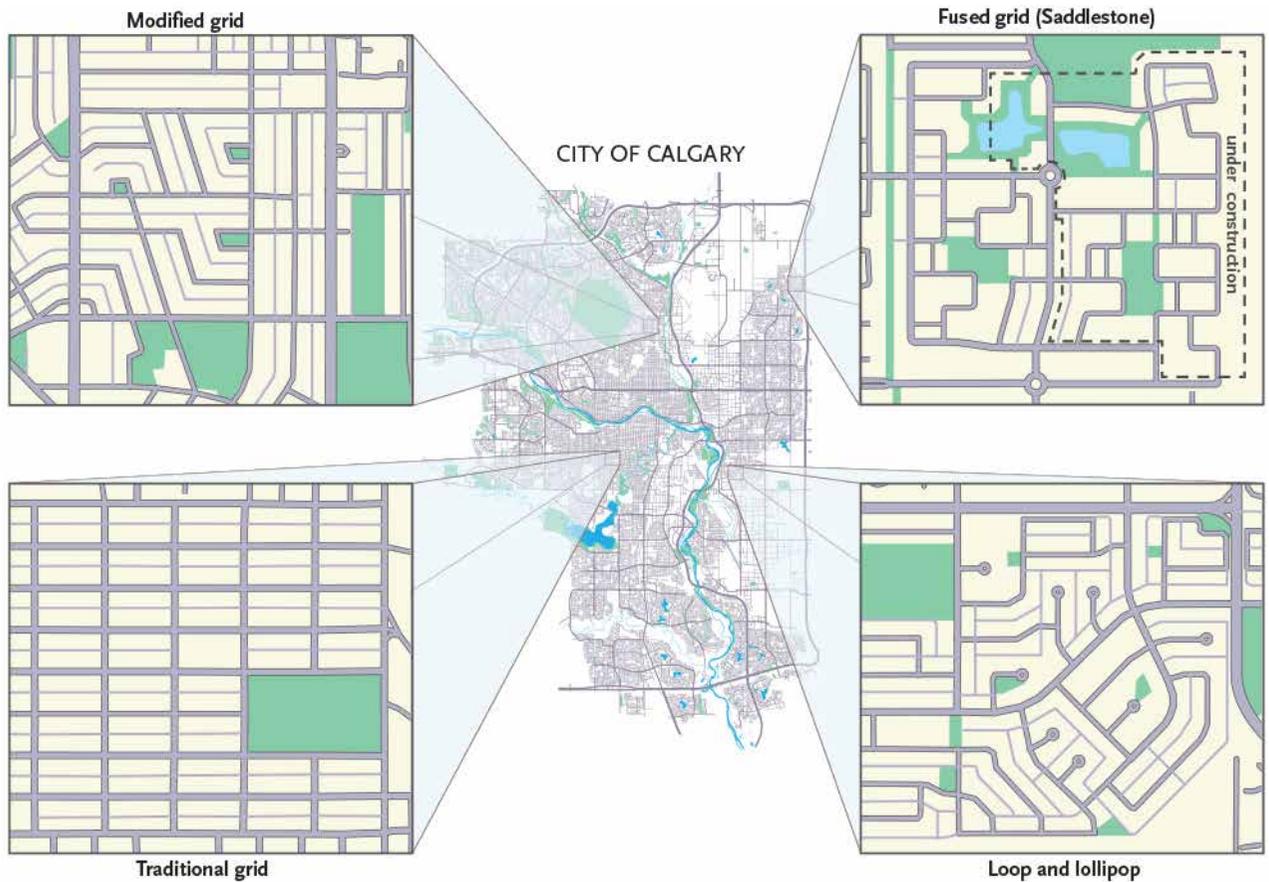
The fused grid prioritizes **WALKING** and **CYCLING** over driving where possible. The goal isn’t just **PHYSICAL HEALTH** but **SOCIAL CONNECTION** as well.

emphasizing compact development and walkability, viewing car-reliant suburbs as a disastrous failure.

“I sensed a distinct repulsion for what happened in the last 50 years in the development of cities,” says Grammenos. “I thought this was totally inappropriate. I believe essentially in an evolutionary approach to cities; I believe that nothing that happens is a mistake.” Grammenos saw redeeming virtues in the grid *and* the ‘burbs. The challenge, in his view, was to merge the peace and quiet of the cul-de-sac with the grid’s connectivity and convenience.

“We know from consumer surveys that the cul-de-sac is a preferred place to live,”





**It's too soon**

to tell how effective Saddlestone will be in achieving the aims of the fused grid. The builder, Genesis Land Development Corp., began construction in 2010, and completion is not expected until 2020. However, it should be safer, traffic-wise, than other subdivisions. The fused grid is expected to have 60 per cent fewer crashes than conventional street layouts, according to analysis by Gord Lovegrove, a University of British Columbia associate professor of engineering and a transportation engineer. (He plans on doing a follow-up study on Saddlestone once it's fully built.)

When he was completing his PhD in the mid-2000s, Lovegrove brainstormed with a friend about how to design the safest possible neighbourhood. They unknowingly sketched out something that looked like a fused grid: a street pattern of three-way intersections. He published a paper on this, which Grammenos discovered. Since then, the two have collaborated on advancing the fused grid (they recently co-authored a book, *Remaking the City Street Grid*, published earlier this year).

Lovegrove regularly uses Houten as a case study for his students. "Fanis and I will be the first to admit that actually, there is nothing new in the fused grid," says

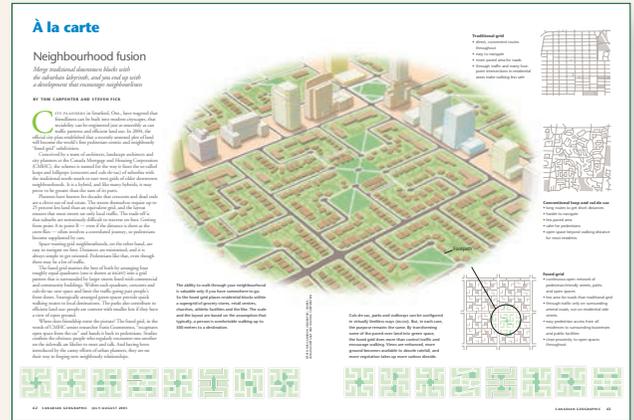
Lovegrove. "It's a bunch of pieces that have worked elsewhere, put together into a system." One such piece is the Dutch concept of "forgiveness" that allows for a certain degree of driver error without causing human carnage. This is incorporated into the Dutch streets known as *woonerfs*: people-friendly spaces with numerous traffic-calming elements to slow cars. "If somebody does make a mistake — whether it's a kid running after a ball in front of a vehicle or a person driving down the road not seeing a kid — the forgiving aspect is low speed," says Lovegrove. The short streets of the fused grid reflect this.



“The fused grid ... ‘recaptures open space from the car’ and hands it back to pedestrians.” So wrote Tom Carpenter and Steven Fick, quoting Fanis Grammenos, then a senior researcher at the Canada Mortgage and Housing Corporation, in “Neighbourhood fusion” in the July/August 2005 issue of *Canadian Geographic* (PICTURED). A year earlier, in 2004, city planners in Stratford, Ont., had annexed a plot of land to become the world’s first fused grid subdivision. Similar to this feature story, the piece went on

to describe the at-the-time unproven concept beyond the fused grid, complete with graphics and maps. Alas, 10 years later, Stratford has still not developed its fused grid community, leaving Calgary’s Saddlestone subdivision, the focus of the accompanying story here, as the first and only real-world example of the fused grid. A decade after that initial story, what new shape our urban neighbourhoods will take remains to be seen.

—Aaron Kylie



Other examples of neighbourhoods that contain fused grid principles include Vauban, a suburb of Freiburg, Germany, that encourages low car ownership (most trips are by bike or foot) and Stuyvesant Town, a high-density cluster of apartment buildings in Manhattan. “It looks very much like one of the quadrants in Saddlestone,” says Grammenos. “Four street loops, and the rest of the space is pedestrian walkways, fountains, open spaces — a beautiful environment to experience.”

Regardless of its inner connectivity, Saddlestone will not be neatly integrated with adjacent communities. To the east, it will be up against Calgary’s new ring road. To the west and south, existing roads and infrastructure limited the options for connection with adjacent suburbs. And because Saddlestone is so far from the city core, people have two options to travel there: car or transit. “A lot of people are going to be driving — that’s the problem,” says Lovegrove. Retrofitting an existing city area, he adds, would be a better opportunity to see the fused grid in action.

Saddlestone is an urban experiment:  
**CANADA’S FIRST FUSED GRID NEIGHBOURHOOD.**

**Since CMHC** first introduced the fused grid concept in 2003, a handful of developers have signed on. Stratford, Ont., was among the first cities to embrace it, but the development is crawling along incrementally because of slow city growth. Other cities with fused grid plans include Lethbridge, Saskatoon and Fort McMurray. Several other municipalities have integrated fused grid principles into their planning guidelines.

Many cities and developers, meanwhile, have re-embraced the old grid, but with different tweaks. “Modified grids” have the high connectivity of the gridiron street pattern, but adapt to topography and have more variety. In Calgary, city planners

say newer subdivisions with modified grids have higher levels of connectivity for all modes (including cars) than Saddlestone does.

Brent Toderian, a city-planning consultant who was formerly Vancouver’s chief planner and Calgary’s chief subdivision planner, says the conversation about better suburbs has progressed beyond the fused grid — of which he is both complimentary and critical. “My sense is that the fused grid is an example of doing the wrong thing better,” says Toderian, who is also president of the Council for Canadian Urbanism. “If a city said ‘no more loops and lollipops, we’re now going to do fused grids,’ that city would be improving things. But if a city really wants

to do the right thing with suburbs, the answer isn’t necessarily the fused grid. You can do suburbs that have better connectivity and have a stronger relationship to the street.” Toderian believes the modified grid has a number of

advantages over the fused grid, including being less convoluted for drivers. “A fused grid seems to continue this mindset that streets shouldn’t connect.”

As for safety, some cities have pursued other solutions. Last November, New York City dropped its residential speed limit to the equivalent of 40 km/h. In Ontario, Alberta and elsewhere, there has been talk of reducing residential speed limits. Even if cities lower speed limits, however, the design of existing streets remains the same. “If the geometry of the street allows it, people will break the limit,” says Grammenos. The fused grid deters this; speed up, and you’ll need to brake right away. “The configuration itself says: ‘Slow down. You’ve arrived.’”

Check out a timeline of housing trends and urban patterns in Canada at [mag.cangeo.ca/jun15/urban](http://mag.cangeo.ca/jun15/urban).

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# THE BIG ONE

The last megathrust earthquake to strike Canada was in 1700, and the clock is ticking. How we're preparing for the impact.

**BY ANNE CASSELMAN**





## KATE MORAN SLEEPS

with a pair of shoes and a flashlight by her bed in Victoria.

The president and chief executive officer of Ocean Networks Canada, an organization that operates two undersea cabled observatories off the coast of Vancouver Island, does this because odds are decent that what's coming will happen at night, and she doesn't want to cut her feet on broken glass when she has to get up and out of her house. Lucinda Leonard, a professor in the school of Earth and ocean sciences at the University of Victoria, got laser eye surgery several years ago, partly because she was worried about how her contact lenses would fare in an emergency and that she wouldn't be able to reach her glasses. Alison Bird, an earthquake seismologist with Natural Resources Canada who lives near Victoria, has a strong-motion sensor in her basement; it was installed as part of a larger network of sensors after the area in which she lives was determined to be a "weakly instrumented neighbourhood." Carlos Ventura has not yet installed an early-warning sensor in his backyard near the University of British Columbia, where he directs the school's Earthquake Engineering Research Facility, but he has put in a seismometer at his son's house in Tofino, on Vancouver Island, to measure the intensity of ground shaking during an earthquake. John Cassidy, meanwhile, knows where to "drop, cover and hold" in every room in his Victoria house and has a DIY earthquake kit that includes enough dog food to keep Winston, his English setter, in good shape for a week in the aftermath of the Big One; such is life as the head of earthquake seismology for the Geological Survey of Canada.

Say what you will about those obsessed with earthquake emergency preparedness, but Moran, Leonard, Bird, Ventura and Cassidy aren't your garden-variety "preppers." Rather, they're among the foremost earthquake experts in Canada, and they and their peers are working to better understand the seismic landscape at home and abroad to prepare for a potentially catastrophic event that could strike at any moment.

**THE GEOLOGICAL SURVEY OF CANADA** records and locates more than 4,000 earthquakes each year, an average of about 11 per day. They occur across the country, but most are smaller than magnitude 3 and are not felt. Chances are good, however, that if you live in southwestern British Columbia or southeastern Canada, you've experienced a tremor. That's because these regions, which are home to about 40 per cent of the nation's population, are two of the most seismically active zones in the country and have been the sites of most of the significant Canadian earthquakes (greater than

a magnitude of 5) of the last 300 years.

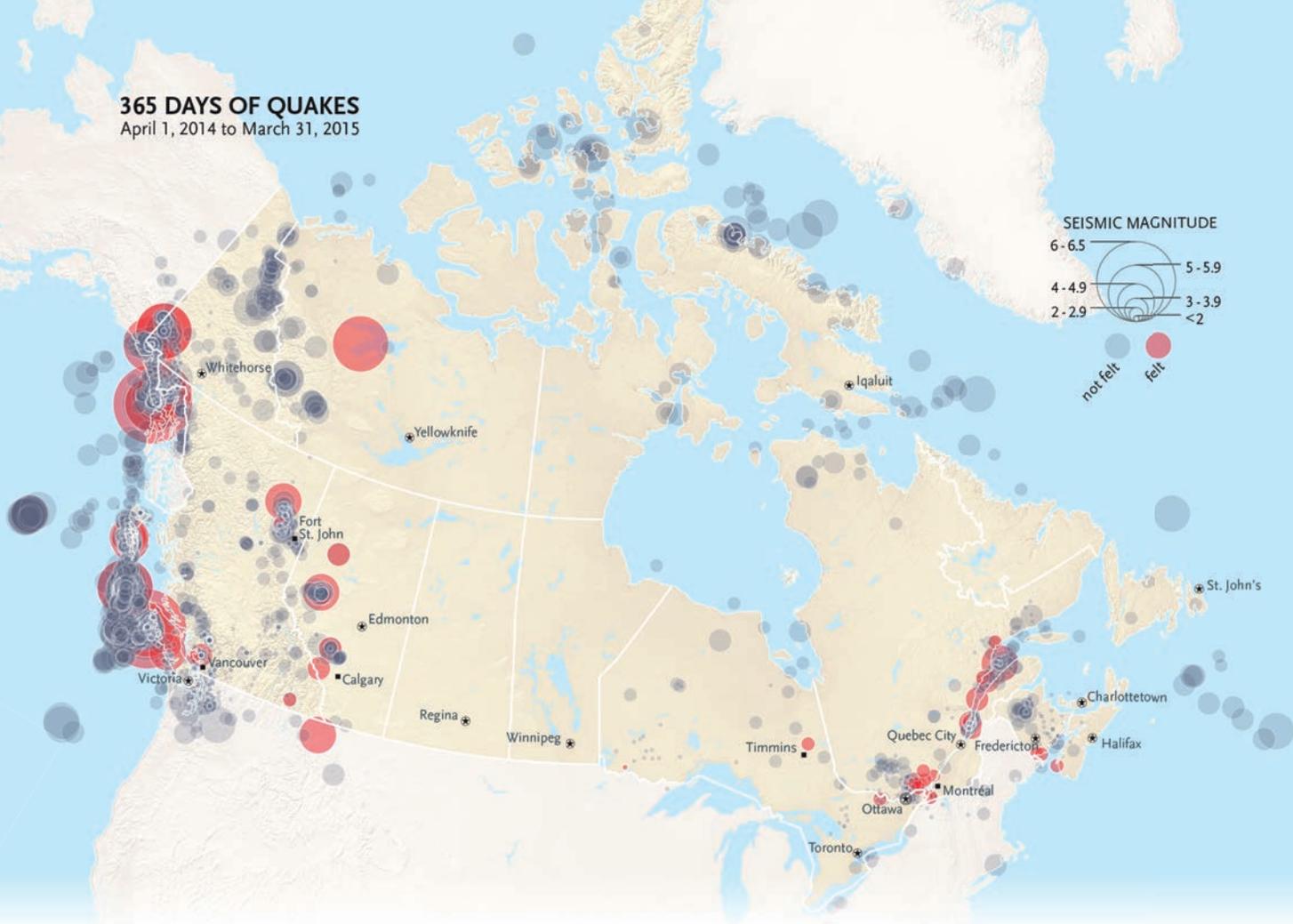
According to a 2013 study commissioned by the Insurance Board of Canada, there's at least a five to 15 per cent chance that a "strong earthquake" will hit in the next 50 years in the region from the St. Lawrence River Valley to the Ottawa Valley, an area that includes Quebec City, Montreal and Ottawa. In southwestern British Columbia, the study notes, the likelihood is even higher, with at least a 30 per cent chance of an earthquake strong enough to cause "significant damage" striking in the next 50 years. The financial cost in each scenario could be huge — \$60.6 billion in the southern Quebec-southeastern Ontario region, and \$74.7 billion in southwestern British Columbia, the IBC report estimates — but so too could the human toll. On the West Coast, for instance, emergency planners in Washington estimate that the death toll in Canada and the United States could exceed 10,000, with three times that number injured.

"If you really look at the risk, it's low probability but it has extraordinarily high consequences," says John Clague, a professor in the department of Earth sciences at Simon Fraser University in Burnaby, B.C., and Canada Research Chair in Natural Hazards Research. "It doesn't happen often, but when it does, it's catastrophic. Hardening our infrastructure, retrofitting suspect buildings and ensuring that the really critical elements such as bridges and airports will function in the event of an earthquake is expensive, but you can't prioritize what to spend money on until you fully understand the hazard."

Workers inspect a damaged road in Satte, Japan, after a megathrust earthquake and ensuing tsunami struck in 2011 (ABOVE). The same type of earthquake last hit in Canada in 1700, and were it to occur again would pose a threat to Victoria (PREVIOUS PAGES).

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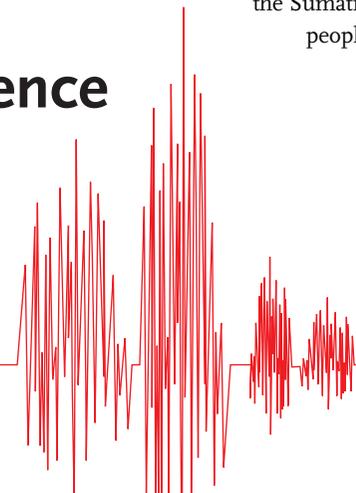
Doing so in a country as large as Canada is a huge task, and some of the most important work takes place at a complex of labs and offices in Sidney, B.C., on Vancouver Island. This is the home of the western division of Earthquakes Canada, which is part of the Geological Survey of Canada. The Sidney facility and its eastern division in Ottawa monitor information from the 168 Canadian National Seismograph Network stations scattered from St. John's in the east to Eureka, Nunavut, in the north to Haida Gwaii, B.C., in the west. It's also where

many of Canada's top earthquake scientists and researchers work.

Like the  
**tectonic  
plates**  
it studies,  
**earthquake science**  
never keeps still.

It was in part due to work done at the Sidney office that something called the Cascadia subduction zone was recognized as the sleeping tectonic monster it is. The zone, which stretches 1,000 kilometres from the northern end of Vancouver Island to Cape Mendocino in northern California, marks the point where one massive slab of the Earth's crust, the oceanic Juan de Fuca plate, is descending, or subducting, beneath another, the continental North American plate. Subduction produces three kinds of earthquakes: those within the subducting plate (typically at a depth of 30 to 60 kilometres); those within the North American plate (at a depth of up to 30 kilometres); and something called a megathrust earthquake, the world's largest type of earthquake (at depths shallower than 30 kilometres).

The earthquake and ensuing tsunami that killed 20,896 people and knocked out the Fukushima Daiichi nuclear power station in Japan in 2011, for instance, was a megathrust earthquake, as was the Sumatra earthquake on Dec. 26, 2004, which killed 227,898 people. In the lead-up to a megathrust earthquake, the tectonic plates move toward one another continually, but can get stuck when in contact, creating over long periods of time an immense build-up of strain that eventually exceeds the friction between them; when that point is reached, an earthquake occurs.





Houses in Natori, Japan, burn after being hit by the 2011 tsunami, which was caused by an earthquake.

As far as scientists have been able to identify, the Cascadia subduction zone has experienced 13 megathrust earthquakes in the last 6,000 years, but they do not happen like clockwork. Indeed, they have come as close together as 200 years and as far apart as 800 years. Randy Enkin, who runs the paleomagnetism and petrophysics laboratory at the Sidney facility, believes the window can be narrowed even further. “According to our off-shore work, these earthquakes come every 460 plus or minus 140 years,” he says, as he uses a multi-sensor core logger machine to examine a core sample brought up from the ocean floor off the west coast of Vancouver Island. “Here we go,” Enkin says. “*That* is the result of an earthquake. That’s our gold.” It doesn’t look like much, but the anomalous band of rock and chunks of wood debris that interrupt the core’s muted brown tells a violent story: thousands of years ago, a megathrust earthquake rumbled through Vancouver Island, triggering a landslide, the debris fingerprint of which had been captured in the core sample. “We get to solve problems that are really important to

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*Anne Casselman (annecasselman.com, @AnneCasselman) is a Vancouver-based science journalist whose work has also appeared in Vancouver and Discover magazines.*

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‘It doesn’t happen often, but **when it does**, it’s catastrophic.’

society,” Enkin says, gesturing to the digital readouts. “The National Building Code of Canada uses this information to determine the probability of ground shaking, which then goes to engineers who say, “This is how we need to build our buildings.”

“The goals of our research are to ultimately understand how the ground will shake during future earthquakes in Canada, and how often that shaking occurs,” says John Cassidy, who

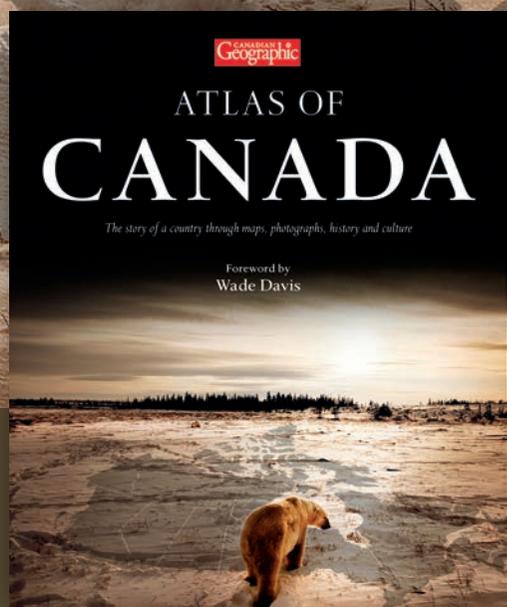
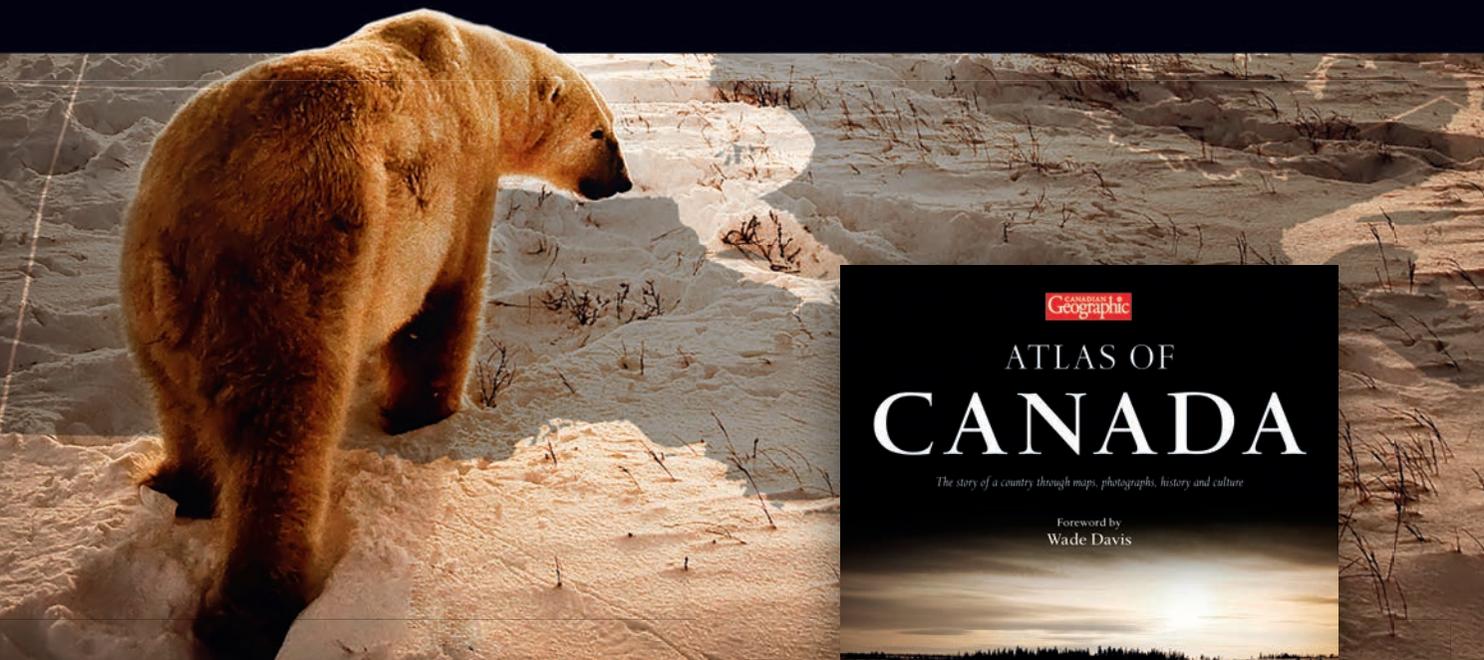
also works out of the centre.

The hope is that by building knowledge of the earthquake cycle — the period of time just before, during and just after an earthquake, as well as the time between earthquakes — and better understanding the seismic past, Cassidy and his colleagues can understand where the most significant shaking occurs and help pre-empt the worst of the damage.

The challenge is that, like the tectonic plates it studies, earthquake science never keeps still. Each new major quake builds on past research. Scientists didn’t anticipate the size of the 2011 Japan earthquake because they didn’t believe the region was able to produce anything stronger than a magnitude 8 (about 32 times less powerful than the magnitude 9 the earthquake was eventually determined to be). The magnitude 6.3 earthquake that struck Christchurch, New Zealand, in 2011 was a similar surprise; scientists didn’t even know there was a fault in the region until

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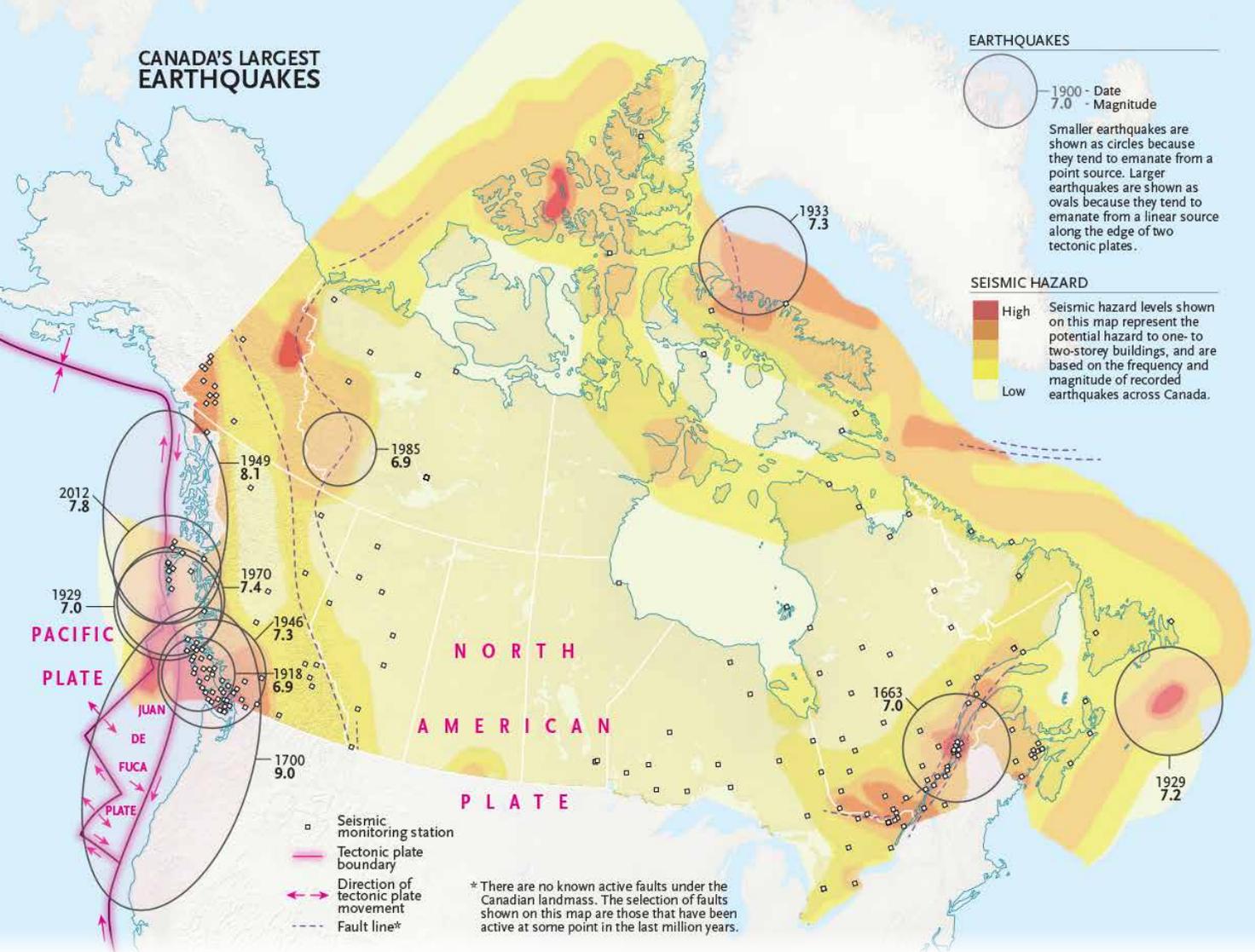


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# CANADA'S LARGEST EARTHQUAKES

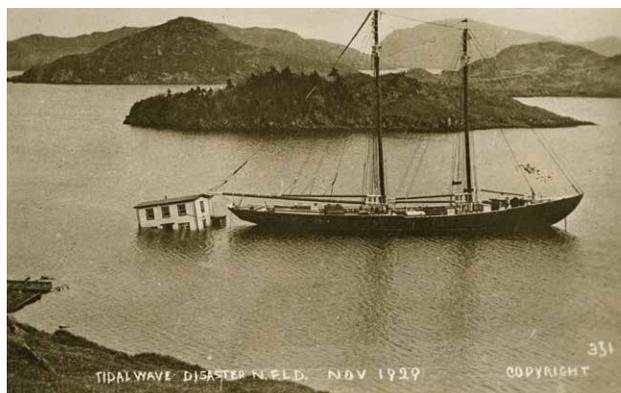


a much less damaging magnitude 7.1 earthquake occurred in September 2010. (The 2011 tremor was so destructive because it occurred at a depth of about four kilometres and about 10 kilometres outside Christchurch, whereas the 2010 quake happened at a depth of about 10 kilometres and about 40 kilometres outside the city). Then, in 2012, Haida Gwaii experienced a subduction zone earthquake in an area where scientists had suspected such an event was possible but previously had no evidence for it.

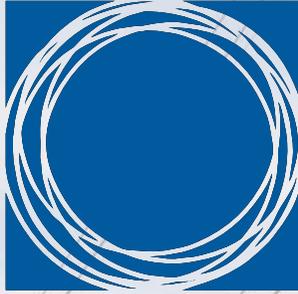
The good news is that each new earthquake that's studied helps fill in the picture of what to expect in Canada, whether it's in the Charlevoix seismic zone (the most seismically active region in southeastern Canada, about 100 kilometres downriver from Quebec City), in the Arctic (in places such as Baffin Island and the

Boothia and Ungava peninsulas, areas where seismic activity may be caused by the ground slowly rising thousands of years after the glaciers that once covered it melted, a movement known as post-glacial rebound) or on Vancouver Island. For the latter, observations on how the surface of the island is currently bulging up two millimetres per year on its western edge informs models of where the North American plate and Juan de Fuca plate are locked and storing the greatest amount of energy. That first view of the Pacific Ocean that greets you when you drive across the island on Highway 4? Thanks to a small army of GPS stations on the island, scientists now know that's the eastern edge of the potential rupture zone for a megathrust earthquake. It begins near the coast and extends 100 kilometres offshore. If you get out of your car to take in the view, 35 kilometres beneath you is where the two plates are stuck on each other, building up strain, waiting for something to give.

**WHEN A FAULT** such as the Cascadia subduction zone does finally rupture, triggering a massive earthquake, it may be possible to get a 10- to 90-second warning before the serious shaking starts, depending on your location. It's a small window of time, but it could allow infrastructure operators and utility providers to



A house from Port au Bras, N.L., tied to the *Marian Belle Wolfe* in 1929 (LEFT), shortly after the dwelling was swept out to sea by a tsunami that also killed 28. The wave was created by an earthquake that hit about 250 kilometres off Newfoundland's south coast.



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be warned. This is what happens in Japan, where information from a vast network of sensors is used to stop the country's famed bullet trains in the seconds preceding an earthquake's damaging seismic waves.

Ocean Networks Canada is currently prototyping a similar system by installing a dozen hypersensitive motion sensors across and offshore northern Vancouver Island; these will allow for a rapid detection and reporting of spreading seismic waves before they reach Vancouver and Victoria. The potential applications are myriad: airports could stop planes from taking off or landing; gas companies could turn off the supply at the flick of a switch; and bridge entrance lights could turn red. "The concept is to prevent the secondary impacts of the earthquake, which are really more damaging than the primary shaking itself," says Benoît Pirenne, the director of user engagement at Ocean Networks Canada.

A similar early-warning system run by the Earthquake Engineering Research Facility at the University of British Columbia is currently in operation in B.C. schools. Apart from getting a short-notice warning about imminent tremors, however, most schools simply need to be made more earthquake resistant. To that end, British Columbia has undertaken a massive seismic retrofit of its public schools, using guidelines purpose-built to optimize life-saving bang for public-taxpayer's buck. "We developed state-of-the-art guidelines that make use of the latest information about earthquake engineering based on lessons learned from earthquakes around the world," says Carlos Ventura. More than 200 schools have already been seismically retrofit using the new guidelines.

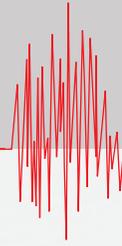
Raymond Afan is the Vancouver School Board's project manager for seismic upgrades. "Every time we finish a structural upgrade, I always go, 'Whew, that's one off the list. What's next?'" he says. "Because when I hear stories about Haiti or Japan or New Zealand suffering a catastrophic earthquake, I can't help but think, 'Jeez, we're sitting on a fault here.'"

**THE LAST TIME THE CASCADIA** subduction zone ruptured was on January 26, 1700, at about 9 p.m. Thanks to the rich oral histories of First Nations on Vancouver Island, historical records in Japan and paleoseismologists, it's possible to picture what must have been a terrifying event.

It's not known precisely where this occurred, but when the deadlock between the plates finally broke, it triggered a rupture that spread at two to four kilometres per second along the zone's 1,000-kilometre length. As the strained rock of the North American plate reached its breaking point and heaved past the subducting Juan de Fuca Plate, parts of the West Coast of North America

# Canada's largest Earthquakes

The **Geological Survey of Canada** keeps records on earthquakes dating back to 1660. Here's a list of the largest known to have occurred in Canada.



## Cascadia subduction zone, B.C.

**Date:** Jan. 26, 1700  
**Location:** Off the southwest coast of British Columbia  
**Magnitude:** 9 (estimated)  
**Fact:** Officials in Japan recorded when the ensuing tsunami swept ashore

## Haida Gwaii, B.C.

**Date:** Aug. 22, 1949  
**Location:** Off the islands' west coast  
**Magnitude:** 8.1  
**Fact:** Largest earthquake ever officially recorded in Canada

## Haida Gwaii, B.C.

**Date:** Oct. 27, 2012  
**Location:** Off the islands' west coast  
**Magnitude:** 7.7  
**Fact:** Hot springs in Gwaii Haanas National Park ran dry after the earthquake

## Haida Gwaii, B.C.

**Date:** June 24, 1970  
**Location:** About 30 kilometres south of the islands  
**Magnitude:** 7.4  
**Fact:** Felt to a distance of about 350 kilometres on the adjacent mainland and on northern Vancouver Island

## Baffin Bay, Nunavut

**Date:** Nov. 20, 1933  
**Location:** About 250 kilometres east of Pond Inlet  
**Magnitude:** 7.3  
**Fact:** Largest known earthquake north of the Arctic Circle

## Vancouver Island, B.C.

**Date:** June 23, 1946  
**Location:** Just west of Campbell River  
**Magnitude:** 7.3  
**Fact:** Largest recorded onshore earthquake to have occurred in Canada

## Grand Banks, N.L.

**Date:** Nov. 18, 1929  
**Location:** About 250 kilometres south of Newfoundland  
**Magnitude:** 7.2  
**Fact:** Caused an underwater landslide, which in turn created a tsunami that killed 28 people

## Haida Gwaii, B.C.

**Date:** May 26, 1929  
**Location:** About 50 kilometres south of the islands  
**Magnitude:** 7  
**Fact:** Felt at Ketchikan, Alaska, 450 kilometres to the north, and at Terrace and Skeena, B.C., about 400 kilometres to the east

## Charlevoix, Que.

**Date:** Feb. 5, 1663  
**Location:** St. Lawrence River, near La Malbaie, Que.  
**Magnitude:** 7 (estimated)  
**Fact:** Felt over the entire eastern part of North America, an area of 1.9 million square kilometres

## Vancouver Island, B.C.

**Date:** Dec. 6, 1918  
**Location:** Near the island's central west coast  
**Magnitude:** 6.9  
**Fact:** Felt in northern Washington state and in Kelowna, B.C., more than 500 kilometres to the east

## Nahanni region, N.W.T.

**Date:** Dec. 23, 1985  
**Location:** In the Mackenzie Mountain range  
**Magnitude:** 6.9  
**Fact:** Recordings of shaking for this earthquake show it was the strongest ever documented in Canada



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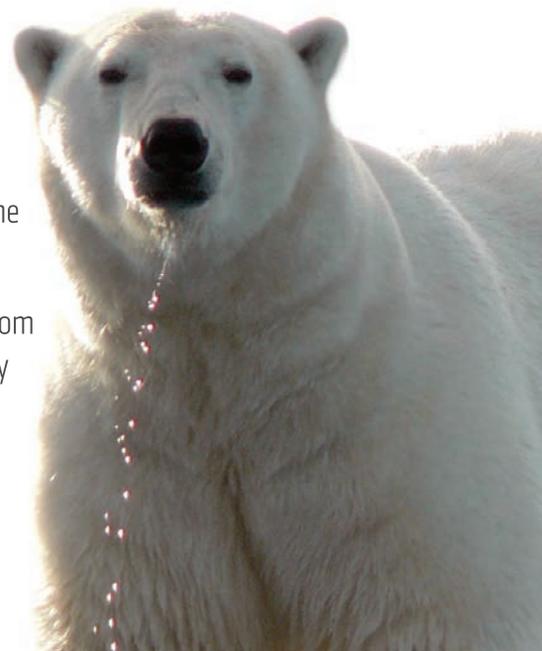
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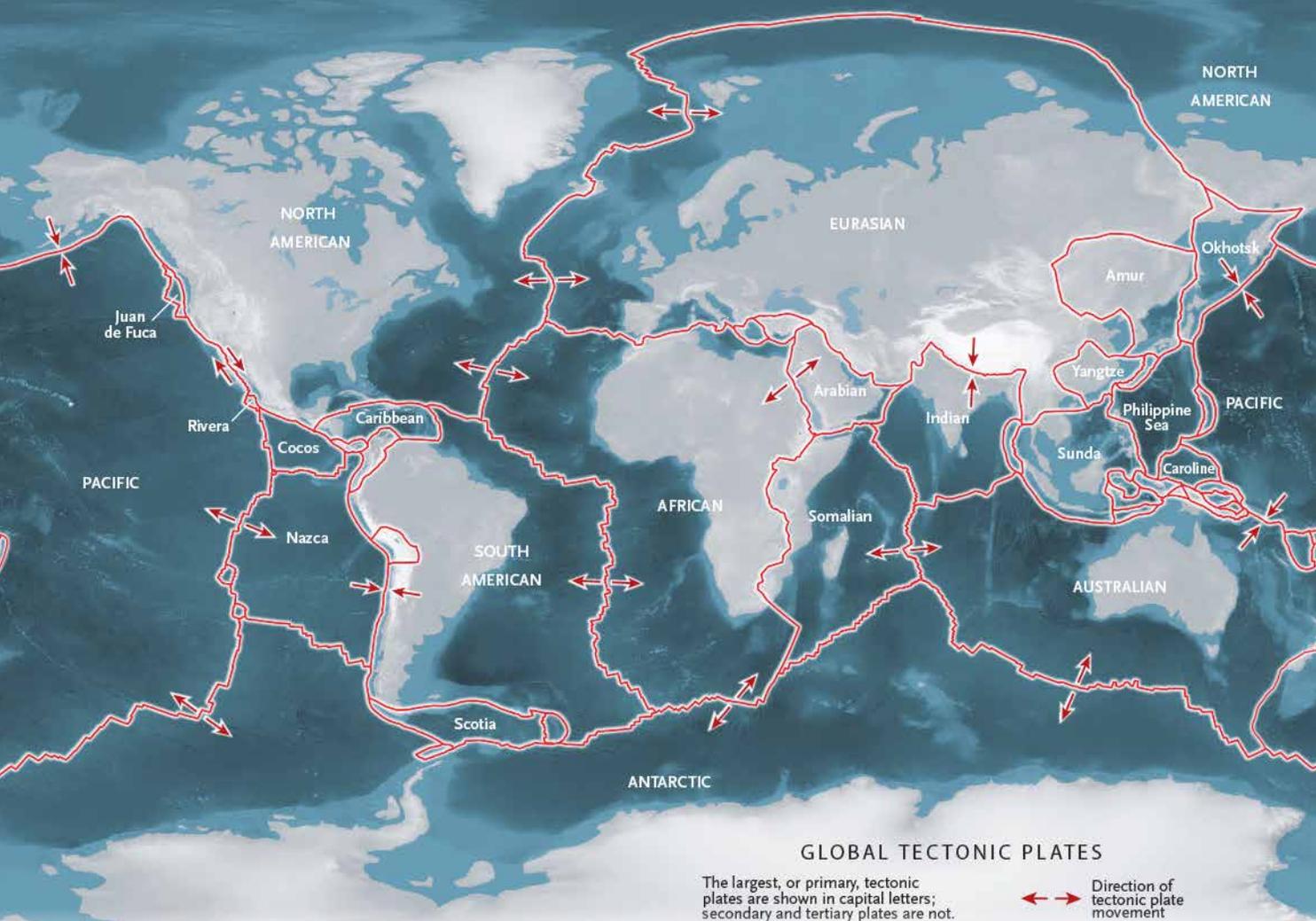
Arctic Kingdom's safari camp is located 45 minutes by boat from the remote hamlet of Qikiqtarjuaq on Baffin Island, just a four hour flight from Ottawa, the location affords extraordinary wildlife sightings.

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leapt up to 10 metres west in a matter of seconds. Oral reports describe shaking so strong that people were unable to stand, and so prolonged that it made them sick. At Kwakiutl, near today's Port Hardy, houses built of heavy timbers collapsed and landslides buried an entire Cowichan village.

Then there was the tsunami. The two plates clashed off Vancouver Island, deep under the sea floor. When the fault ruptured, the North American plate not only jumped west but also upsurged at this collision point, raising a wall of water that radiated across the Pacific. By the time it reached Japan some nine hours later, the wave was up to 3.6 metres high, and destroyed ships, washed away buildings and flooded rice paddies. When it struck the First Nations villages along Vancouver Island's west coast, however, it was between 12 and 15 metres high. In Barkley Sound, near Port Alberni, a stampede of fleeing tiny animals is said to have augured danger to the sleeping Hupacasath villagers, who followed them uphill to safety. Others were not so lucky. The entire village of Anacla, on Pachena Bay, just south of Bamfield, was washed away, leaving no survivors.

"We were part of the 1700 tsunami story," says Tom Mexsis Happynook, a councillor with the Huu-ay-aht First Nation, the group to which the Anacla villagers belonged. Today, Pachena Bay is once more home to the Huu-ay-aht people, and they are better prepared for a repeat of the 1700 quake. "We're very susceptible to a huge wave coming back into Pachena Bay," says

Happynook, "but we've built our Big House up on the hill across the river and we're in the process of building a subdivision there, too." The community's daycare centre often runs drills with the kids, who get 15 minutes to race to high ground.

The 1700 quake was 315 years ago, a number that's five years away from being within Randy Enkin's window of megathrust earthquake recurrence. "Buildings designed to modern building codes should not collapse during a major earthquake," says John Cassidy, the Geological Survey of Canada earthquake seismologist with dog food in his DIY earthquake kit. "And if people feel shaking and know what to do — for example, get under a table or a desk and hold on — then it's all very survivable. We're not afraid of the earthquake, but we are prepared for the earthquake."

According to the GPS units on the island that measure the buildup of stress in the Earth's crust, the earthquake cycle that Cassidy, his colleagues in Sidney and others elsewhere study could be nearing its end. Does that mean the Big One is about to hit? It's impossible to say. But what's certain is that it's not a question of if, but when. "Right now, the fault is essentially getting springloaded," says Lucinda Leonard, the University of Victoria professor who had laser eye surgery in preparation for a forthcoming earthquake. "It's ready to fire."



Watch a stop-motion video that recreates the Cascadia subduction zone earthquake of 1700 at [mag.cangeo.ca/jun15/earthquake](http://mag.cangeo.ca/jun15/earthquake).

# SABLE ISLAND

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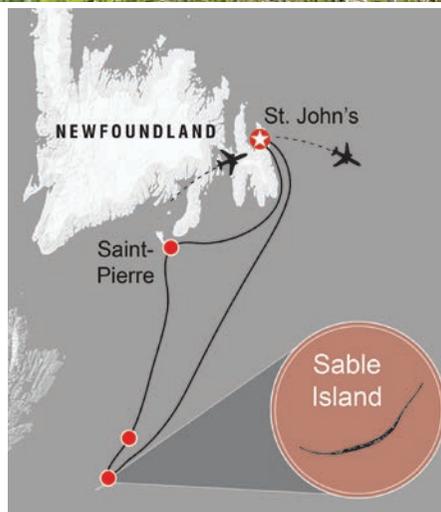
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This essay is the latest in a series in support of specific species for *Canadian Geographic's* National Bird Project — a campaign to have Canada recognize an official national avian emblem. Vote and submit your own essay at [nationalbird.cangeo.ca](http://nationalbird.cangeo.ca).



# Atlantic puffin

## Gorgeous, loyal and egalitarian

By Michael Crummey

**LET'S BE HONEST.** This “National Bird debate” would be no contest if the Atlantic puffin had a few colonies west of Nova Scotia. Everyone loves the puffin.

For starters, the puffin is adorable. As a national symbol, it would help instill a love of country in the young. The loon is too eerily gothic to make a decent plush toy. The raven would scare the bejeezus out of children. But that rainbow puffin beak? That tweedledum body in a tuxedo? Airport gift shops would make a killing. The government could pay down half the national debt on licensing fees.

Beyond the winning package it comes in, the puffin is a wholly admirable creature. Puffins mate for life. Male and female share in the incubation of eggs and feeding their chicks. They excavate a separate chamber in each burrow to use as a bathroom.

To recap: gorgeous, loyal, egalitarian and hygienic. What more could you ask for?

The only real hurdle facing the Atlantic puffin is this: it is,

by definition, an Atlantic creature. Regional. Newfoundland's provincial bird. Absent from the Rest of Canada.

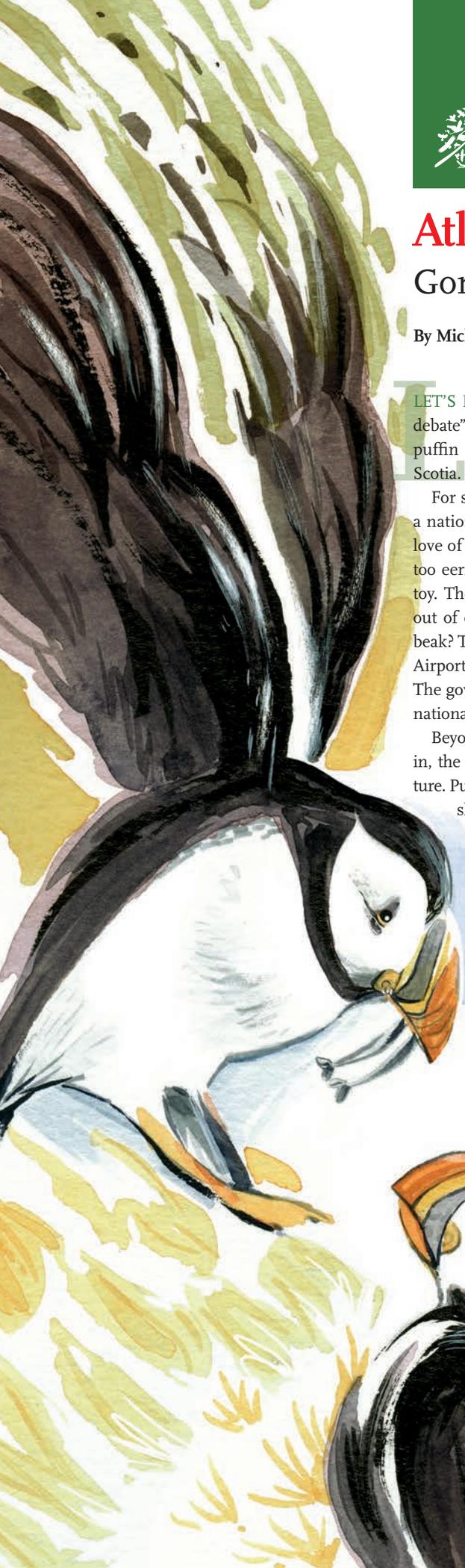
But nothing is more Canadian than taking something from one corner of the country and claiming it as a national treasure. British Columbia engendered the art of Emily Carr. Manitoba offered up Prairie folk-punkers the Weakerthans. Prince Edward Island gave us Anne of Green Gables. Quebec made poutine a national comfort food.

Why couldn't the national bird be a regional creature adopted by the entire country? It would be one more way of sewing Canada's disparate pieces into a national quilt. Canadians from every province and territory could make a once-in-a-lifetime pilgrimage to Witless Bay to see the unlikely critter in the flesh, to take a selfie with the St. John's IceCaps mascot, Buddy the Puffin. And enjoy some chips, dressing and gravy (move over, poutine!) while they're here. “That's our national bird,” kids in Ontario classrooms could say. “We got it from Newfoundland.”

---

*Michael Crummey (@MichaelCrummey) is a writer living in St. John's. His most recent book is Sweetland.*

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# *Fruits of their labour*



A glimpse of what life as a strawberry picker is like for the Indian men and women working at a British Columbia produce farm

**PHOTOGRAPHY BY RICK COLLINS  
WITH TEXT BY JESSICA FINN**





“**I**t’s not easy,” says Baljinder “Bob” Shoker of the work done by the strawberry pickers at Shoker Farms, the 182-hectare patch of prime agricultural land he co-owns and manages with his brother near Chilliwack, B.C., in the Fraser Valley. But, he says, “it’s hard to recruit guys who are 25. They don’t like to do this work.”

So instead, Shoker hires people such as those shown in this photo essay: a mix of temporary foreign workers from India and Indian immigrants who hail not only from British Columbia but also from as far away as Winnipeg and Toronto. And they are not young; indeed, almost 70 per cent of Shoker’s workforce is over 50, with many in their 60s and 70s. “There’s no other work available for them,” he says. “I think the industry relies on these older workers.”

The strawberry season is relatively short, generally beginning at the end of May, peaking in mid-June and over by the first weekend in August, but it involves long, tough hours of work. The men and women (the latter make up about 40 per cent of Shoker Farms’ workforce) may spend up to 11 hours a day in the fields, exposed to the elements and hoisting heavy white cardboard flats of berries atop their heads. They’re paid \$10.66 per hour — 41 cents more than British Columbia’s \$10.25 minimum wage — and Shoker believes they enjoy the work. “They’re content with what they make,” he says. “It’s just really a good environment.”



See photos of a similar scenario in Quebec’s agricultural industry at [mag.cangeo.ca/jun15/workers](http://mag.cangeo.ca/jun15/workers).



Almost *70 per cent* of Shoker's workforce is over 50, with many in their 60s and 70s.



Shoker Farms' employees are typically older men (ABOVE, OPPOSITE and PREVIOUS PAGES) and women (LEFT), with the latter group making up about 40 per cent of the farm's workforce. Younger men (TOP LEFT), however, also labour in the fields (TOP RIGHT) on the farm that Ajit Shoker (MIDDLE) started in the late 1970s.



'It's *hard to recruit* guys who  
are 25,' says Bob Shoker.  
'They don't like to do this work.'





Clockwise from OPPOSITE TOP: freshly-picked strawberries; a worker carries flats of the fruit on her head; a handful of berries; a picker checks the crop; a man carries berries and equipment across the field.



---

*Rick Collins' photographs have appeared in enRoute, Forbes, the New York Times, The Globe and Mail and the National Post. Jessica Finn is Canadian Geographic's photo editor*

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## **Embarking on a great adventure to Quebec!**

These lucky grade 8 students and their teacher are going on an all-expenses-paid trip to La Mauricie National Park and the Fortifications of Québec National Historic Site in the beautiful province of Quebec from June 1 to 5, 2015.

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### COMMENT

Your feedback

#### Great praise for the Great Hike

It was a pleasure to have met you, Dana Meise; we enjoyed your companionship during breakfast in Cape Tormentine, N.B. Loved reading this story ("The Great Hike," April) and revisiting your letters, stories and pictures.

*Reg and Kathy Richard  
Sackville, N.B.*

You are such an example of true grit! Dana's adventure made me laugh, cry, smile, pray and strive to have the determination to meet goals in my life. I love you, Dana! I trust that we will meet again.

*Juanita Nicholson  
Millville, N.B.*

A true modern-day explorer, trekking across Canada to inspire us all to walk a little or a lot, depending on our ability. I know I have walked more than I ever did because of Dana's commitment. If he can walk 20 kilometres in a day, I can surely walk one. Dana is my hero, my children's inspiration and a man truly connected to Canada. When I think of a vacation, I look to Dana to advise me on a Canadian destination, because he knows the whole country.

*Deanna Borgstad  
Prince George, B.C.*

#### Weighty issues

I really enjoyed the Editor's notebook, "Get out!" (April). When I first moved into our



neighbourhood we had a grocery store, bank, gas station and a doctor's and dentist's office within easy walking distance. In five years they were all gone, moved to the malls. They are now five kilometres from my home, and for a time walking wasn't an option because we had no sidewalks. After we sent emails and called the city, one of our mayors finally had a bicycle and walking path put on the main street that takes us to the mall, and another down one of the major arteries that runs the length of our suburb heading downtown.

*Marianna Eros  
Edmonton*

Isn't there an argument to be made that supermarkets stock mostly manufactured food ("The geography of obesity," April), which may not be healthy? Would you consider preparing a map that shows access to farmers' markets, where mostly raw or lightly manufactured homemade, homestyle food is sold? My town has both supermarkets and farmers' markets.

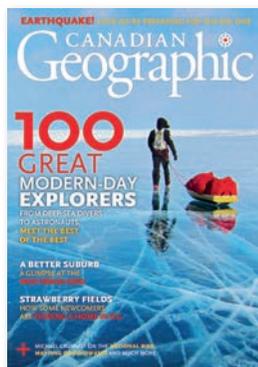
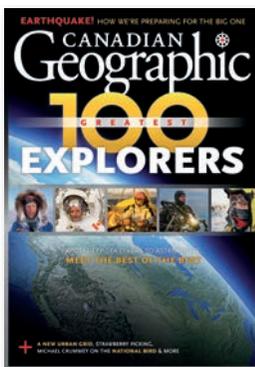
*Lorne White  
Port Colborne, Ont.*

How would travel time (versus distance) change the food desert map ("The geography of obesity," April)? I think many places with terrible transit systems might make for similarly bad travel times (e.g., more than a half-hour travel).

*Steve Peterson  
Peterborough, Ont.*

### COVER VOTE

How we chose this issue's cover



Your reactions to the options in our regular cover vote are hugely important. Our team works hard to present three (sometimes four) strong choices to get your opinion, and we typically side with voters on the final call. Still, we often have our favourites. So when voters overwhelmingly agree with our internal preference, as happened with the June 2015 tally, we were excited. It also made us think we might be on to a particularly great cover. Like voters, the *Canadian Geographic* team was especially keen on option one — it took 43 per cent of the vote, compared to 34 and 23 per cent for options two and three. We liked that it featured a selection of the individual great explorers included in our feature story, and it seems outstandingly bold, clear and simple. And judging by voter comments, readers shared our reaction.



Not already receiving our cover vote email? Visit [cangeo.ca/newsletter](http://cangeo.ca/newsletter) and sign up for the *Canadian Geographic* newsletter to get in on the action.

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# YOUR SPACE

## ENGAGING WITH US

### TRENDING

The buzz from CanGeo's social media sites

"A fabled frontier" (Spring Travel 2015), a story about a cruise to Sable Island, featured some of famed photographer Roberto Dutesco's images of the island's wild horses. Dutesco reflected on this fragile place — and the possibility of eventual "low impact petroleum exploration" there — for [canadiangeographic.ca/travel](http://canadiangeographic.ca/travel). Here's a selection of feedback on his article.



I have always wanted to visit Sable Island, but would gladly give up any chance of doing so to know it would remain safe and free. The island should be kept in its natural state with minimal visitors and definitely no oil exploration.

—Lindsay Casey

It takes passion and dedication to be able to stand up to those who try to destroy or jeopardize that which is important and has significant benefit to the beauty and character of Canada. I am grateful for Roberto's commitment and for his devotion to a cause that is not measured by some dollar value.

—Meredith Kost

Sable Island has long been identified with mystery and beauty; it's a place stuck in time, to be appreciated by future generations. It's a Canadian treasure, and should be a UNESCO World Heritage Site to preserve its history and wild horses.

—Mike Moen



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### PULSE

The geography poll

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## WHAT'S THIS?

Recognize this mystery object and how it relates to Canadian geography and history?



- Visit [cangeo.ca/whatsthis](http://cangeo.ca/whatsthis) for a hint, to enter your guess and for a chance to win one of five copies of *Canadian Geographic's* special 2015 bird issue.\* Follow @CanGeo for more hints.
  - The deadline is June 29, 2015.
  - The correct answer will appear in the July/August 2015 issue.
- \* Five winners will be randomly selected from all correct responses.

*Canadian Geographic* and the Canadian Heritage Information Network have partnered to showcase important artifacts from Canadian history and geography. Each object comes from a museum across the country that is part of CHIN's network.

## LAST ISSUE'S OBJECT: INUIT ROPE GAME

Inuit strung a seal-skin rope between two-metre high boulders for gymnastic competitions. This structure was found at Aklungiqtarvik, or "place of the rope game," an archeological site on Wager Bay in Nunavut's Ukkusiksalik National Park. As evidenced by numerous tent rings, meat caches and fox traps surrounding the structure, Inuit and their ancestors gathered here every spring for hundreds of years.



With files from Parks Canada. Learn more about the natural and cultural history of Ukkusiksalik National Park by visiting [pc.gc.ca](http://pc.gc.ca).



Explore more stories from Canada's past through [cangeo.ca/whatsthis](http://cangeo.ca/whatsthis).

LEFT: VANCOUVER AQUARIUM; RIGHT: © PARKS CANADA/DW RODGER

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# WHERE'S THIS?

Identify this landmark using the following three hints

1. Looking out at the ocean, all of North America is behind you.



2.

3.



- ▶ Need a clue? Visit [cangeo.ca/wheresthis](http://cangeo.ca/wheresthis) for another hint, then enter your guess for a chance to win a copy of the new *Canadian Geographic Atlas of Canada*.\*
  - ▶ The deadline is June 29, 2015.
  - ▶ Want more help? Follow us on [@CanGeo](https://twitter.com/CanGeo) and [f](https://www.facebook.com/cangeo) ([facebook.com/cangeo](https://www.facebook.com/cangeo)) and watch for the hashtag #hint.
- \* Five winners will be randomly selected from all correct responses.

BRAD JAMES/CG PHOTO CLUB; MAP: CHRIS BRACKLEY/CANADIAN GEOGRAPHIC

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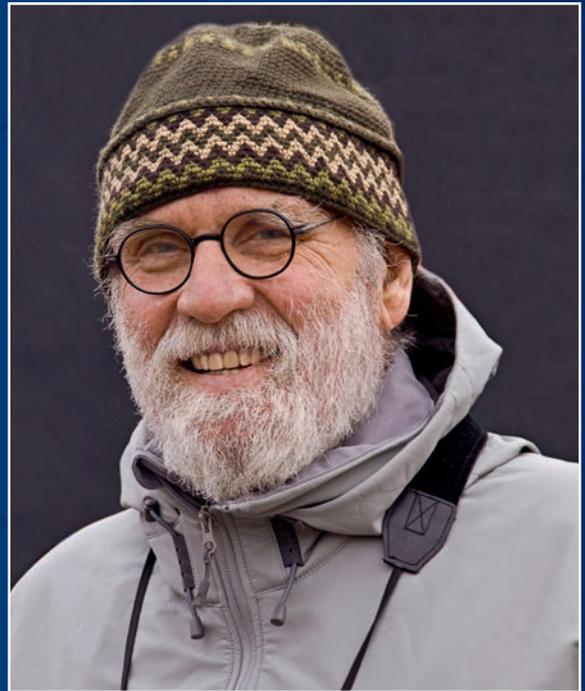
Gold Rush! El Dorado in British Columbia is organized by the Royal BC Museum, Victoria, BC, Canada, in collaboration with Canadian Museum of History, Gatineau, QC, Canada /  
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NEWS FROM THE ROYAL CANADIAN GEOGRAPHICAL SOCIETY



Brian Osborne with former RCGS president Giséle Jacob in 2007.

## BRIAN OSBORNE AWARDED MASSEY MEDAL

Queen's University professor emeritus Brian Osborne, a scholar of historical and cultural geography, has been awarded the 2015 Massey Medal — The Royal Canadian Geographical Society's annual award recognizing outstanding career achievements in the exploration, development or description of the geography of Canada.

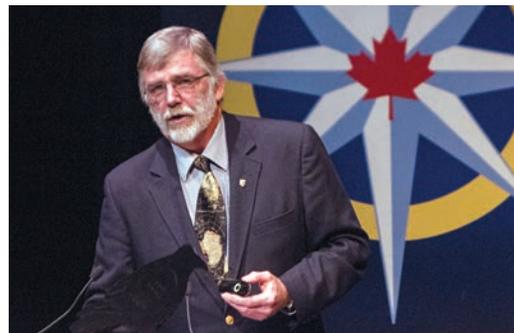
Osborne, 76, has worn many hats over the years: RCGS vice-president, president of the Ontario Historical Society and president of the Kingston Historical Society. He was awarded the Camsell Medal for his volunteer work with the RCGS in 2007 (ABOVE), and says he's proud to receive his latest prize from the Society. "It reflects both my professional interest as a geographer and also recognition by an organization, the RCGS, that I have a high regard for," he says. "It's a recognition by my colleagues in my profession."

As well as inspiring students with his enthusiasm for geography since he started teaching at Queen's in 1967, Osborne has published extensively about Kingston's history, and has researched settlement in Wales, Colorado, Western Canada and Ontario. He enjoys studying where he lives — "In some ways, I think of myself as a local scholar, a public scholar," he says — and has also served as a consultant for the National Capital Commission, Heritage Canada, Parks Canada, Canada Post and the National Film Board.

RCGS Awards Committee chair Helen Kerfoot highlighted Osborne's scholarship in aboriginal history, settlement history, cultural landscapes and the development of a Canadian sense of place. She says he was instrumental in the inclusion of Fort Henry and the Martello tower fortifications in Kingston as part of the Rideau Canal's 2007 designation as a UNESCO World Heritage Site. "Brian," she says, "has shown the ability to use his expertise as an ambassador of the discipline and interest a wide range of individuals in the geography of Canada."

—Carys Mills

## SPRING SPEAKER SERIES



"Everyone who lives in the North can list off [climate] changes that are happening," said James Raffan (ABOVE) to a packed theatre at the Canada Aviation and Space Museum on April 15 during his Royal Canadian Geographical Society Speaker Series talk. But it's the cultural change as a result of this, he noted, that is killing the northern people.

During his heartfelt presentation, Raffan, an author, Arctic explorer, geographer and community activist, recounted stories from his latest book, *Circling the Midnight Sun: Culture and Change in the Invisible Arctic*. The cultural explorer's tales cast light on the modern experiences of many of the Arctic's indigenous peoples and the related environmental shifts felt so keenly across the North.

Raffan is the executive director for the Canadian Canoe Museum and a Fellow and former governor of the RCGS. He was awarded the Queen's Golden Jubilee Medal in 2002, the Society's Camsell Medal in 2009 and the Queen's Diamond Jubilee Medal in 2012.

—Michela Rosano

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### WHY I DONATE

My wife and I were finally able to see the part of the Arctic [where HMS *Erebus* was found] on a Northwest Passage cruise in September 2014, the day after the RCGS returned from the Victoria Strait Expedition. Joining the Compass Rose Club is one of the very few ways one can feel personally involved in this ongoing saga.

Bill Moure Jr.  
Falun, Alta.



STUDENTS CROSS BORDERS WITH OPEN WATER

There's a big difference between learning about the environment while sitting in a classroom and hands-on experiments outdoors. For two days last April, 11 students from three high schools in the border-crossing Lake Winnipeg watershed had the opportunity to conduct scientific tests on the waters nearest Brandon, Man., and discuss their findings with other students — all part of the OPEN Water planning project.

“Our water testing activities and citizen science offered the kids a hands-on look at geography in action,” says Connie Wyatt Anderson, a governor of The Royal Canadian Geographical Society and OPEN Water’s project leader.

The three schools that participated in the workshop, representing three distinct areas of the watershed, were from Minot, N.D., The Pas, Man., and Brandon. Some students

collected scientific data (LEFT) while others focused on the geography of the region, and they all converged to share their findings on an interactive map. “This is my first time going into science, in-depth, and I’m enjoying it,” says Yasmine Mojica, a Grade 10 student from Minot High School’s central campus. “I never thought of going into the STEM fields [science, technology, engineering and mathematics], but I might reconsider.”

OPEN Water (which stands for Observe, Participate, Experience, Network) is an international initiative of Canadian Geographic Education, the North Dakota Geographic Alliance and the Minnesota Alliance for Geographic Education, and is funded by the National Geographic Education Foundation. One of its goals is to give students the chance to explore and understand the watershed both in the classroom and in the field by collecting and analyzing data and sharing findings with other students from the four provinces and four U.S. states in the basin.

“The overarching goal,” says Mary Jane Starr, the director of strategic partnerships for the RCGS, “is to engender a sense of environmental stewardship among those of the next generation.”

—Calvin Dao

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## THE ROYAL CANADIAN GEOGRAPHICAL SOCIETY

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.

Primary fields of interest include our people, resources, environment, heritage and the evolution of our country. In short, the aim is to make Canada better known to Canadians and to the world. *Canadian Geographic*, the Society's magazine, is dedicated to reporting on all aspects of Canada's geography — physical, biological, historical, cultural and economic — and on major issues of concern to Canada in which geographical dimensions play a significant role.

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YOUR SOCIETY | FELLOWS NEWS AND MORE

### FEATURED FELLOW: ÉLISABETH NADEAU



Élisabeth Nadeau, an RCGS vice-president, has worked tirelessly for the Society.

For her entire adult life, Élisabeth Nadeau has been working to serve Canadians, and not just in the context of her position as an RCGS Fellow and vice-president. It started with her work in the federal government for Transport Canada, her passion for public service already stoked by her father, who brought home transcripts of parliamentary debates, which she would promptly steal and read enthusiastically. She was able to delve into her other passion, geography, in 1997, when she crossed paths with Denis St-Onge, the former president of the RCGS who had been the head of the geography department at the University of Ottawa when Nadeau studied there. He invited her to join the RCGS, and since becoming a Fellow in 1997, Nadeau has worked tirelessly for the Society, donating her time and expertise through a number of committees. Nadeau served as a governor for the organization from 2003 to 2009 and received the Queen Elizabeth II Diamond Jubilee Medal on the recommendation of the Society.

Most recently, she became chair of the policy and planning committee and helped steer the Society through the development of its first strategic plan, which, once finalized, will serve as a guidebook of sorts for the next five years. Her federal government experience certainly helped: strategic planning may not be the most exhilarating of tasks, but it's crucial, and calls for a special type of person. Since the autumn of 2014, Nadeau has spent countless hours collaborating with the Society's various committees, collecting ideas and thoughts from each on the future of the RCGS and organizing this information into a cohesive plan. But while she'd done this type of work during her three decades in the government, she says doing it for the Society was much more fun.

"It's probably the first time I really enjoyed doing strategic planning," Nadeau says with a laugh. At the end of the day, it comes back to the Society's mandate. Just as Nadeau's father inspired her to learn more about the country through public service, she hopes to use the Society to share her love of Canada.

—Sabrina Doyle

THIS PAGE: COURTESY ÉLISABETH NADEAU. OPPOSITE: BRYAN WEISSMILLER



### DISSERTATION HONOURS

Lynn Moorman's dissertation title is a mouthful: *Reciprocity of representation and geospatial literacy* (though the accompanying plain-language paper, "Children's use of Google Earth as a knowledge enabler," might be a better clue). The study, which looked at young students' geographic practice, skills and knowledge as they used virtual (satellite-image-tiled) globes rather than static maps, has won the Salvatore J. Natoli Dissertation Award from the U.S.-based National Council for Geographic Education. Moorman, an assistant professor in Earth sciences at Calgary's Mount Royal University and a Canadian Geographic Education executive, will receive the award at the 100th anniversary of the NCGE in Washington, D.C., in August.

### CANADA'S COOLEST CLASS

Students from across the country uploaded creative, funny videos about Canadian national parks to the Canada's Coolest School Trip contest website. In the end, however, Melanie Doucet's Grade 8 students, from Caledonia Regional High School in Hillsborough, N.B., took the prize with their video about Fundy National Park, winning a trip to explore La Mauricie National Park and the historic sites of Quebec City this June.

### CHALLENGE CONTENDERS

And then there were 20. That's how many provincial-level champions — from 10 provinces and territories and grades 7 to 10 — came to Ottawa for the Canadian Geographic Challenge nationals on May 4. After two rounds of tough competition, including a fieldwork component at Rideau Hall, just five reached the third and final round.

—Nick Walker

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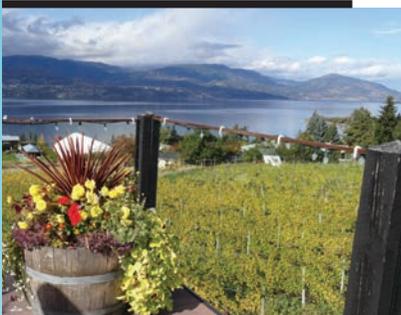
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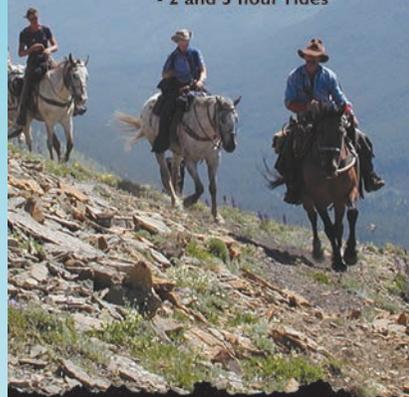


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## Canadian Geographic explores Wood Buffalo National Park



An aerial view of the Peace-Athabasca delta in the Alberta portion of Wood Buffalo National Park (TOP), which is also home to wild bison (ABOVE).

It's Canada's largest national park, and one of the largest protected areas in the world. It's home to one of the last herds of wood bison and the only nesting site for endangered whooping cranes on the planet, not to mention the largest beaver dam anywhere. It's the largest dark-sky preserve and contains the largest inland freshwater delta on Earth. Wood Buffalo National Park is a big deal. For the feature in the upcoming July/August issue, *Canadian Geographic* sent documentary photographer Paul Colangelo, who specializes in environmental and wildlife images, to the park last summer and fall to capture many aspects of its greatness (glimpses of his handiwork are shown here). We also tapped travel writer Karan Smith to explore the park's amazing environment, wildlife and landscapes for the piece. The result is a big tribute to the big remote wilderness park that many may only ever experience through the pages of a magazine. But what an experience!



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# our country

REVEALING CANADA



## Lawrence Hill

The author of *The Book of Negroes* and *Blood: The Stuff of Life* reveals why he loves Woody Point, N.L.

I was invited to a literary festival in Woody Point, N.L. [surrounded by Gros Morne National Park], in 2010. I took my wife and children and we fell in love with the place. We kept going back. Finally, we were so smitten, we bought a house there.

When I want to really feel a place in my bones, in my psyche, I need to feel the geography. I like to move through it physically. Woody Point is ideal for hiking, biking or kayaking. The biking is particularly fantastic; you see bays and mountains, the Gulf of St. Lawrence, and traffic is quiet.

Newfoundland, we're discovering, has a special tone of activity, especially with artists, painters and sculptors. Every block seems to have a writer. I'm not so much inspired by the geography to write, but it gives me licence to write because it gives me time and space. There are not a lot of distractions, except during the week of the writers' festival.

And that's one of the things we love most about the village — this fabulous literary festival called Writers at Woody Point. People come from hours away to take part. It brings in fantastic writers and attracts passionate, devoted audiences. It's quickly turning into one of the most attractive and sought-after literary festivals.

The place makes me feel quieter, calmer and much more focused on what's really important: writing, taking time with my family, slowing down to read. It makes me feel like seizing the best parts of life.

—As told to Siobhan McClelland



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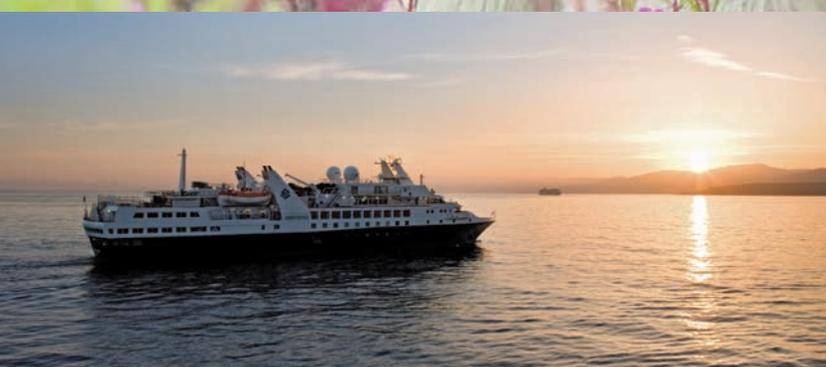
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