12.2018

NATIONAL GEOGRAPHIC

THE SEARCH FOR SACRED TEXTS

"If you are dealing with antiquities, you must get your hands dirty."

EITAN KLEIN
ISRAEL ANTIQUITIES AUTHORITY

Are you **Totally Ready™** to meet her dad?

Colgate®

Colgate Total® fights bacteria on teeth, tongue, cheeks, and gums*, giving you the confidence of a healthier mouth.

Be Totally Ready™ for Life

*Colgate Total® toothpaste reduces bacteria on teeth, tongue, cheeks, and gums; helps prevent plaque and gingivitis; fortifies enamel. Not intended for prevention or treatment of more serious oral conditions.

CONTENTS

On the Cover
On this Torah scroll, which is hundreds of years old, a passage from the book of Exodus is visible.

PAOLO VERZONE; VAN KAMPEN COLLECTION ON DISPLAY AT THE HOLY LAND EXPERIENCE, ORLANDO, FLORIDA

PROOF

EMBARK

EXPLORE

A mother puma rests with her two young cubs at Lake Sarmiento in Patagonia, Chile.

FEATURES

SIERRA NEVADA®

Ride Share

ENJOY OUTDOORS™

Please recycle. ©Sierra Nevada Brewing Co. | **Please Drink Responsibly.**

TRACY R. WOLSTENCROFT

Our Commitment to a Planet in Balance

LEGENDARY CONSERVATIONIST Jane Goodall often says, "Only if we understand, can we care. Only if we care, will we help." For 130 years the National Geographic Society has inspired generations of people to better understand and care for our planet.

This enduring legacy underscores our role as changemakers who illuminate the wonders of our world, identify the threats, and discover solutions. Today our ultimate goal is to catalyze action to achieve a planet in balance.

The world we have celebrated is now changing in ways our founders could never have imagined. When the Society was established in 1888, there were roughly 1.5 billion people on Earth. Now there are more than 7.6 billion. The issues we face are significant: a race for resources to provide for a growing global population, a warming planet, and unprecedented biodiversity loss.

Working toward a planet in balance, one that provides for humanity and the untold millions of other species with which we live, will be the greatest challenge of our century. As an impact-driven global nonprofit, the National Geographic Society is committed to addressing this challenge.

We will harness the power of partnerships to support the world's best scientists, explorers, conservationists, educators, and storytellers—bold individuals with transformative ideas who drive innovation to ensure a healthy and sustainable future. We will invest in the tools, technology, and training to empower our international community of explorers and innovators to ignite change. And together with our strategic partners, we will scale solutions grounded in science to safeguard our planet.

Our success hinges on fostering an informed global public—individuals, policymakers, corporations, foundations, and other like-minded organizations—that believes in our mission, values the natural world, and is determined to protect it for generations to come.

As the National Geographic Society's new president and CEO, I am deeply inspired by our mission. I am confident that working together, we can advance toward our ultimate goal: a planet in balance. We hope you will join us.

Tracy R. Wolstencroft, President and CEO
National Geographic Society

PHOTO: MARK THIESSEN, NGM STAFF


That low groan
wasn't the branches.
It was the stealthy purr
of a jungle cat.
And the shrill songs
from overhead?
The distant shriek of
a prehistoric beast.
A brother's tall tales
turn little eyes large with wonder,
unleashing an explorer's secret power –
to truly see what some can only
imagine
Stay for a little or stay for a lifetime, **it never leaves you.**
Follow our story at palmettobluff.com. For real estate inquiries, call 866-321-3652.
For bookings at **Montage Palmetto Bluff**, call 866-321-2693.
PALMETTO BLUFF
Obtain the Property Report required by federal law and read it before signing anything. No federal agency has judged the merits or value, if any, of this property. This does not constitute an offer to sell or a solicitation of any offer to buy where prohibited by law. The complete offering terms are in an offering plan available from sponsor. File no. H-110005

*For compatibility details with the new optional adapter, please visit nikonusa.com/mirrorless
Nikon is a registered trademark of Nikon Corporation. ©2018 Nikon Inc.

Z 7™

Finally, a full-frame mirrorless camera with the optical excellence you've come to expect from Nikon. With precision optics, reliability and intuitive design, the new Z 7 is the first mirrorless that feels and acts like a Nikon camera. Its revolutionary new mount lets in more light than ever before, opening the door to groundbreaking new lens designs and boundless imaging possibilities. Take spectacular stills and 4K UHD video with the new NIKKOR Z lenses, or use approximately 360 NIKKOR® lenses with the new adapter.* Behold a future full of creative possibility with mirrorless, reinvented by Nikon.

MIRRORLESS
REINVENTED

CAPTURE TOMORROW

45.7MP | 64–25,600 ISO | 493 PDAF SYSTEM | UP TO 9 FPS |
4K UHD FULL-FRAME VIDEO | QUAD VGA ELECTRONIC VIEWFINDER

NIKONUSA.COM/MIRRORLESS

Nikon®

CONGRESSMAN JOHN LEWIS

‘We Can Lay Down the Burden of Race’

INTERVIEW BY **SUSAN GOLDBERG** PHOTOGRAPH BY **REBECCA HALE**

John Lewis is a recipient of the highest civilian honor in the United States, the Presidential Medal of Freedom.

Throughout 2018 *National Geographic* has produced special reports on diversity in America. We began in April—at the 50th anniversary of Martin Luther King, Jr.’s assassination—with an entire issue looking at race, including racist behavior in our organization’s history. To cap this year’s coverage, we sought the insights of **John Lewis.** In his youth he marched for civil rights with King; today, at 78, the Georgia Democrat has served 16 terms in the U.S. House of Representatives.

Susan Goldberg: It feels like discourse about race and diversity in the United States has taken on such a hard edge. I wonder if you share that feeling and if you could reflect on why that is.

John Lewis: I do share that feeling—and what made it so plain to me was what happened in Charlottesville, Virginia, a year ago. Since those early days of the civil rights movement we’ve made so much progress—with the Civil Rights and Voting Rights Acts, the election of President Barack Obama—and come so far. Then to witness [violent protests by white nationalists], it made me so sad that I cried. The climate is so toxic.

Why do you think it has become so much more toxic?

I think the political climate created a way for many individuals to believe that you can say anything or do anything and it’s OK. But it’s not OK.

After the election of President Obama we heard the suggestion that we’ve become a post-racial society. People wanted to believe that; they wanted to feel that way. But the scars and stings of racism are still deeply embedded in our society. From time to time we try to hide it, but we cannot

‘I BELIEVE IT IS POSSIBLE TO COME TO THAT POINT WHERE WE CREATE A SENSE OF ONENESS.’

THIS INTERVIEW WAS EDITED FOR LENGTH AND CLARITY.


85 YEARS
ALWAYS IN STYLE
TURKISH AIRLINES
WIDEN YOUR WORLD

sweep it under the American rug. We cannot dismiss it. It is real.

Do you think there can be such a thing as a post-racial society?
I've always believed, since the early days of the civil rights movement, that we could be what Dr. King called the "beloved community." That we can lay down the burden of race. I believe it is possible to come to that point where we create a sense of oneness.

If Dr. King could come back now, what do you believe he would think about how things are?
I think he would be somewhat disappointed that we've not gone much farther down that road to create a truly integrated society. He would say, "What happened to my dream?" And we *should* be much further along. There's been some interruption, especially in the political arena, but the religious and educational institutions are still trying to build this beloved community, still trying to redeem the soul of America. The whole debate about immigration and building a wall, trying to keep certain people out—that's not helpful, to turn against a group of people because of where their ancestors came from or where they're trying to come from.

Where do you see that things are better? What makes you feel hopeful?
I go back to where I grew up, in rural Alabama 50 miles from Montgomery outside a little town called Troy. I visit schools—and some of these elementary, middle, and high schools are among the most integrated schools in America. It gives me a great deal of hope to see how people in these small towns and rural communities know that they have to come together and work together.

At 23 you were the youngest person to address the 1963 March on Washington. Two years later, marching toward Selma across the Edmund Pettus Bridge, you were beaten by police. You've become a congressman and spokesman for civil rights. How do you see your role in history?
Well, I feel more than lucky. I really feel deeply blessed by the lives I've been able to live the past many years. People across America have been very, very good to me—and it doesn't matter whether they're black or white, Latino, Asian American, Native American people, newcomers. When they see me, they thank me. They come up, and they're crying and say, "You're my hero."

During a 1966 march through Mississippi to encourage African Americans to register and vote, civil rights activists John Lewis (in light-colored raincoat) and Martin Luther King, Jr. (at right) sing "We Shall Overcome."

Why do you think they cry?
People who've studied the civil rights movement…I don't know, I sound like I'm talking too much about myself! But it's this feeling that I represent something that's part of change in America.

I think they're reminded of that sense of hope that people had. What will it take to regain that?
We have to be taught to be unafraid—and political leaders must play a major role. We have to believe that we're one people, one family. And we cannot turn against each other. We have to turn to each other.

Subscriptions For subscriptions or changes of address, contact Customer Service at *ngmservice.com* or call 1-800-647-5463. Outside the U.S. or Canada call +1-515-237-3674. We occasionally make our subscriber names available to companies whose products or services might be of interest to you. If you prefer not to be included, you may request that your name be removed from promotion lists by calling 1-800-647-5463. To opt out of future direct mail from other organizations, visit *DMAchoice.org*, or mail a request to: DMA Choice, c/o Data & Marketing Association, PO Box 643, Carmel, NY 10512.

NATIONAL GEOGRAPHIC (ISSN 0027-9358) PUBLISHED MONTHLY BY NATIONAL GEOGRAPHIC PARTNERS, LLC, 1145 17TH ST. NW, WASHINGTON, DC 20036. $39 PER YEAR FOR U.S. DELIVERY, $44.00 TO CANADA, $51.00 TO INTERNATIONAL ADDRESSES. SINGLE ISSUE: $7.00 U.S. DELIVERY, $10.00 CANADA, $15.00 INTERNATIONAL. (ALL PRICES IN U.S. FUNDS; INCLUDES SHIPPING AND HANDLING.) PERIODICALS POSTAGE PAID AT WASHINGTON, DC, AND ADDITIONAL MAILING OFFICES. POSTMASTER: SEND ADDRESS CHANGES TO NATIONAL GEOGRAPHIC, PO BOX 37545, BOONE, IA 50037. IN CANADA, AGREEMENT NUMBER 1000010298, RETURN UNDELIVERABLE ADDRESSES TO NATIONAL GEOGRAPHIC, PO BOX 819 STN MAIN, MARKHAM, ONTARIO L3P 9Z9. UNITED KINGDOM NEWSSTAND PRICE £5.99. REPR. EN FRANCE: EMD FRANCE SA, BP 1029, 59011 LILLE CEDEX; TEL. 320.300.302; CPPAP 0720U89037; DIRECTEUR PUBLICATION: D. TASSINARI. DIR. RESP. ITALY: RAPP IMD SRL, VIA G. DA VELATE 11, 20162 MILANO; AUT. TRIB. MI 258 26/5/84 POSTE ITALIANE SPA; SPED. ABB. POST. DL 353/2003 (CONV L.27/02/2004 N.46) ART 1 C. 1 DCB MILANO STAMPA. QUAD/GRAPHICS, MARTINSBURG, WV 25401. SUBSCRIBERS: IF THE POSTAL SERVICE ALERTS US THAT YOUR MAGAZINE IS UNDELIVERABLE, WE HAVE NO FURTHER OBLIGATION UNLESS WE RECEIVE A CORRECTED ADDRESS WITHIN TWO YEARS.

PHOTO: HARRY BENSON, CONTOUR BY GETTY IMAGES

Character isn't made by machine.

Every bottle of Maker's Mark® Bourbon is still hand-dipped in our signature red wax.

Learn more at makersmark.com.

Maker's Mark®

WE MAKE OUR BOURBON CAREFULLY. PLEASE ENJOY IT THAT WAY.

PROOF

NATIONAL GEOGRAPHIC

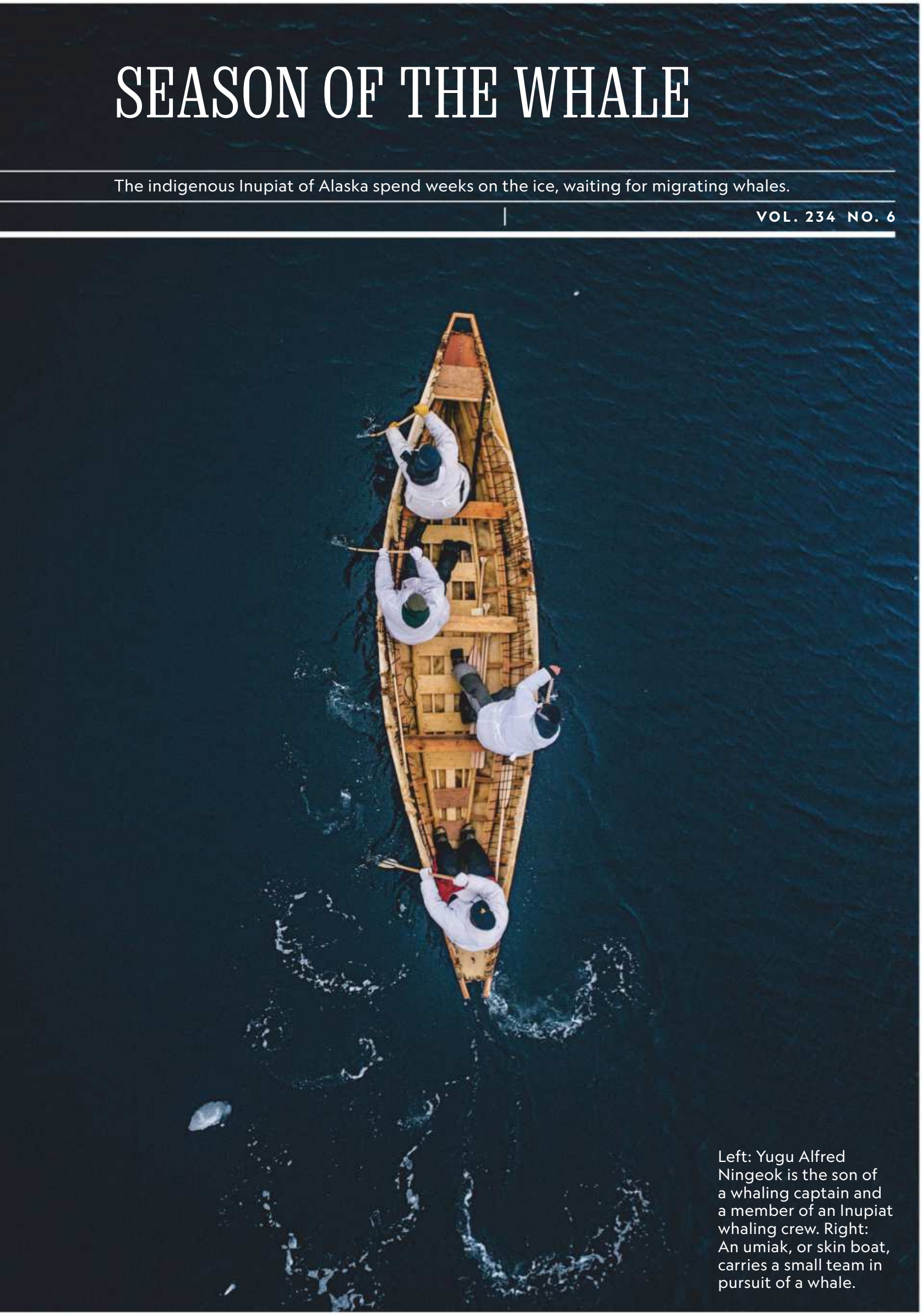
PHOTOGRAPHS BY **KILIII YÜYAN**

LOOKING AT THE EARTH FROM EVERY POSSIBLE ANGLE

SEASON OF THE WHALE

The indigenous Inupiat of Alaska spend weeks on the ice, waiting for migrating whales.

VOL. 234 NO. 6



Left: Yugu Alfred Ningeok is the son of a whaling captain and a member of an Inupiat whaling crew. Right: An umiak, or skin boat, carries a small team in pursuit of a whale.

A butchered bowhead whale can yield thousands of pounds of food. The *ninit*—community shares of meat and blubber—are apportioned equitably to ensure that everyone benefits from a successful hunt.

“The highest aspiration you can have is to become a whaling captain,” says photographer Kiliii Yüyan. “It’s a job that provides for the entire community.”

Thomas William Kingosak always carries a rifle during whale hunts to use in case a polar bear attacks. Polar bears have been known to approach hunting camps in search of food.

Bowhead whales are adapted to extremely cold water. On their annual migration through the Chukchi and Beaufort Seas, they have been observed breaking ice up to two feet thick to make space to breathe.

THE BACKSTORY

A 1,000-YEAR-OLD HUNTING PRACTICE ENDURES, BINDING TOGETHER A NORTHERN ALASKA COMMUNITY.

ON THE NORTH SLOPE OF ALASKA, the culture of the Inupiat centers on whales. Each spring, men and women spend weeks on the *tuvaq*—the ice near the water—watching for bowhead whales migrating north from the Bering Sea to the Canadian Arctic. When one is spotted, a team pushes an umiak onto the water. There is typically one chance to harpoon the whale. If the hunt is successful, each person in the village can receive a share of the meat.

This story of cultural continuity enthralled photographer Kiliii Yüyan. Yüyan is indigenous himself, a descendant of the Hezhe (Nanai in Russian) hunters and fishermen of northern China and southeast Siberia. Stories portraying indigenous communities as degraded or destitute miss their complexity, says Yüyan. "You have to be with them to see their full hope and their joy."

For 10 months in a span of five years, Yüyan lived among the Inupiat in Utqiaġvik (formerly known as Barrow). He camped with a crew on the sea ice to watch for whales, often volunteering for the night shift when the darkness and quiet set in. It's a silence quickly broken, he learned: When a whale comes, a spotter calls out its position, urging the crew to launch. "When they're close, [the noise] is not faint," he says. "It's notable. They sing songs. It's like a musical."

—DANIEL STONE

A hunter listens to the water for songs of nearby whales.

NGM MAPS

Lamington

EHRMAN NEEDLEPOINT KITS

LAMINGTON
16.5" x 12". 12 holes to the inch canvas
$115.00

This wonderful needlepoint kit was designed by Magie Hollingworth based on a picture supplied by Jeanette Newman. Jeanette has a farm in Australia with 1,000 Angus cattle, 5 stock horses to muster the cattle and 100 sheep to keep the grass down.

"Lamington was found near his mother who was killed by a fox. He was barely a few hours old and was bleating and distressed. Despite my encouragement the other ewes showed no interest in him and as a below zero night was fast approaching I tucked him inside my coat and walked back to the homestead.

He was kept by the open fire during the days and at night slept amongst the boots in our boot room with an oil heater keeping him warm and dry. After a few days of warm milk his sight developed, as did his balance. I loved his 4am feeds when he would fall asleep in my lap and I would tell him how special he would always be.

No matter how long we live I will never forget the love I feel for Lamington who found his way into my life. Because of Magie's brilliance and Ehrman tapestries our tiny lamb, who had the worst start in life, can now be stitched, recreated and loved by people all over the world."

The kit comes with everything you need: the 100% cotton canvas printed in full color, all the wools required (100% pure new wool), a needle, a color chart and an easy to follow guide to get you underway.

Ehrman

Order Line: 888 826 8600
www.ehrmantapestry.com

HUNDREDS OF TRIPS. EVERY CONTINENT. OVER EIGHTY COUNTRIES.
PRIVATE JET TRIPS. EXPEDITION CRUISES. FAMILY ADVENTURES. SAFARIS. AND MORE.

Every National Geographic Expedition is grounded in a legacy of exploration, the promise of an authentic travel experience and a commitment to giving back. With special trips for photographers, students, families, outdoor enthusiasts and independent travelers, and access to scientists and storytellers, our travelers deepen their knowledge of the world.

NATIONAL GEOGRAPHIC

EXPEDITIONS

For more information or to request a **FREE** catalog

NATGEOEXPEDITIONS.COM | 1-888-966-8687

THE DISCOVERIES OF TODAY THAT WILL DEFINE THE WORLD OF TOMORROW

NATIONAL GEOGRAPHIC | VOL. 234 NO. 6

The Global Peril of Inequality

LIFE ON EARTH IS AT RISK FROM CLIMATE CHANGE, NUCLEAR ATTACK, DWINDLING RESOURCES—AND THE CHASM BETWEEN RICH AND POOR.

BY **JARED DIAMOND**

THE WORLD'S RICHEST countries, such as Luxembourg and the United States, have average incomes per person about 100 times higher than in the poorest countries, such as Burundi and the Democratic Republic of the Congo. That's a tragedy for poor countries. Is it also a looming tragedy for rich ones?

Until recently all those poor people elsewhere were no threat to rich countries. "They" out there didn't know much about our lifestyle—and even if they did and became angry, they couldn't do anything about it.

But today, poor remote countries are able to create problems for rich ones, and the reasons can be summed up in a word: globalization. As a result of the increased connections among all parts of the world, people in developing countries know more about differences in living standards, and many of them can now travel to rich countries.

Globalization has made it untenable for such

dramatic inequalities between high and low living standards to persist. I see evidence of that everywhere, but three examples stand out.

The first is health. The spread of disease is an unintended result of globalization. Feared diseases now get carried to rich countries by travelers from poor countries where the diseases are endemic and public health measures are weak. The diseases include old ones like cholera and flu, plus new ones like AIDS, Ebola, and Marburg. For instance, in 1992, when an Argentine airliner picked up cholera-infected food in Peru and flew nonstop to Los Angeles, some passengers then flew on to Seattle, Alaska, and Tokyo, resulting in a trail of cholera cases from California to Japan.

Second: terrorism. Global inequality itself isn't the direct cause of terrorist acts. Religious fundamentalism and individual psychopathology play essential roles. Every country has its crazy, angry individuals driven to kill; poor countries have no monopoly on them. But in poor countries today, people are barraged with media visions of lifestyles that are available elsewhere in the world and unavailable to them. In anger and desperation, some become terrorists themselves; others tolerate or support terrorists.

Since the September 11, 2001, attacks on the Pentagon and New York City's World Trade Center towers, it's been clear that the oceans that formerly protected the United States no longer do. Americans now live under constant threat of global terrorism. I predict that there will be more terrorist attacks against the United States, Europe, Japan, and Australia—as long as big differences in living standards persist.

THE THIRD RESULT when inequality and globalization collide is that people with spartan lifestyles want affluent ones. In most developing countries, increasing living standards is a top policy goal. But millions of people in those countries won't wait to see whether their government can deliver higher living standards within their lifetime.

Instead they seek more affluent lifestyles now by immigrating to developed countries, with or without visas: especially to western Europe, the United States, and Australia; and especially from Africa, Asia, and Latin America. Whether immigrants are seeking economic opportunity, a haven from violence, or political asylum, it's proving impossible to control recent waves of migration around the world.

But it won't be possible for everyone to achieve the dream of the developed-world lifestyle. Just do the math.

An average consumption rate per person means the amount of oils and other resources that the average person consumes a year. In rich countries those rates are up to 30 times as high as they are in poor countries.

Multiply each country's current population by its average per-person consumption rate for a resource—say, oil—and add up those amounts over

Other Threats Facing Earth

In my forthcoming book, *Crisis and Change,* I identify four problems that threaten the human population and living standards around the world—and perhaps even the continued existence of civilization. Inequality is one; here are the other three.

Nuclear attack. Plausible scenarios include a preemptive strike by one nation to destroy a rival's arsenal (e.g., Pakistan and India), escalation through miscalculating a rival's response (e.g., North Korea and the United States), a false alarm of a rival's missile launch (we know of four times this happened to the U.S. and Soviet Union), and, especially likely, terrorists stealing a nuclear power's bomb or making their own dirty bomb.

Climate change. It's already causing rising average temperatures, droughts, increased weather variability, decreased food production, spread of diseases, and rising sea levels.

Resource depletion. We face decreasing stocks—or increasing costs of extracting less accessible stocks—of fossil fuels, some minerals, forests, fish, and freshwater. **—JD**

ILLUSTRATION: GÉRARD DUBOIS

the whole world. The resulting sum is the world's current consumption rate of that resource.

Now repeat that calculation, but with all developing countries achieving consumption rates up to 30 times as high as their current ones.

The result: World consumption rates increase by about 10-fold. That's equivalent to a world population of nearly 80 billion people with the current distribution of consumption rates. Some optimists claim that Earth can support 9.5 billion people. But no optimist is crazy enough to claim that the world can support the equivalent of 80 billion people.

WE PROMISE DEVELOPING countries that if they just adopt good policies such as honest government, they too can enjoy affluence—but that promise is a cruel hoax. The world doesn't contain enough resources. We're already having difficulty supporting a developed-world lifestyle now, when only about one billion people of the world's 7.5 billion enjoy it.

Americans often refer to growing consumption in China and other developing countries as "a problem" and wish that the "problem" didn't exist. Of course it will persist: People of other countries want to enjoy the consumption rates that Americans enjoy. They wouldn't listen if told not to do what Americans are already doing. The only sustainable outcome for our globalized world is one in which consumption rates are more nearly equal around the planet. But we can't sustainably support today's developed world at its current level, let alone raise the developing world to that level.

Does that guarantee that we will end up in disaster? No! We could have a stable outcome in which all countries converged on consumption rates below what developed nations enjoy now. Americans may object: We won't sacrifice our living standards for the benefit of those other people out there! As former U.S. Vice President Dick Cheney once said, "The American way of life is nonnegotiable." But cruel realities of world resource levels guarantee that the American way of life will change, like it or not. Those realities can't be negotiated.

As alarming as that may sound, I believe it wouldn't be a significant sacrifice. Why? Because consumption rates and well-being, although related, aren't tightly coupled. Much U.S. consumption is wasteful and doesn't contribute to quality of life. For example, per capita oil-consumption rates in western

THE ONLY SUSTAINABLE OUTCOME IS ONE IN WHICH CONSUMPTION RATES ARE MORE NEARLY EQUAL AROUND OUR GLOBALIZED WORLD.

Europe are about half those in the United States—and yet the average western European's well-being is higher than that of the average American by any meaningful criterion, such as financial security after retirement, health, infant mortality, life expectancy, and vacation time. When you finish reading this page, go out into any U.S. street, look at the cars driving by, estimate their gas mileages, and ask yourself whether those wasteful mileages contribute positively to any meaningful measure of quality of life.

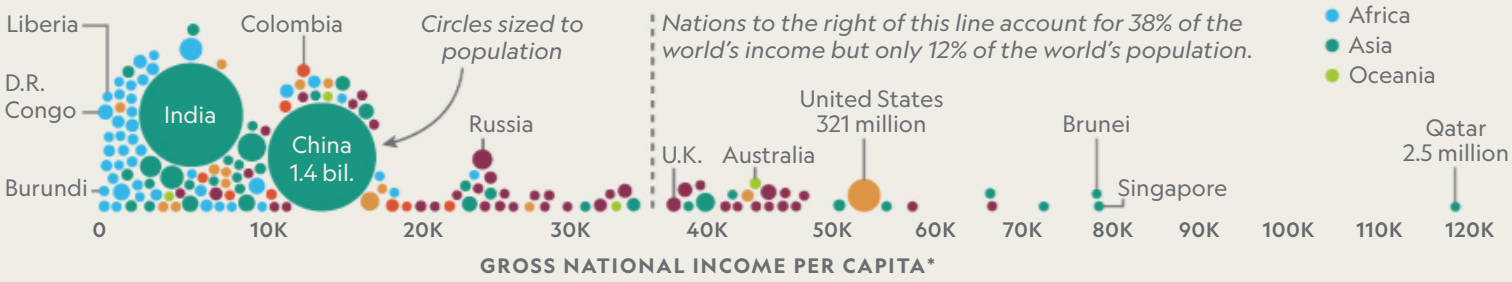
HERE'S THE BOTTOM LINE: It's certain that within our lifetimes, per capita consumption rates in the developed world will be lower than they are now. The only question is whether we'll reach that outcome by methods of our choice or by unpleasant methods not of our choice. It's also certain that within our lifetimes, per capita consumption rates in developing countries will no longer be one-thirtieth of developed countries' rates but will be more nearly equal to them. Those trends are desirable goals, rather than horrible prospects to be resisted. We already know enough to make progress toward achieving them; what's lacking is the necessary political will.

Should we be depressed by the consequences of inequality? Again, no! While problems are getting worse, potentials for solutions are getting better. Multinational or world agreements have already succeeded in solving some big problems. Hence I view our world as being engaged in a horse race between a horse of destruction and a horse of hope. The race isn't a normal one, in which both horses run at a constant speed. Instead it's an exponentially accelerating race in which each horse is running faster and faster. Within a few decades we shall know which of those two horses has won the race.

Jared Diamond, professor of geography at the University of California, Los Angeles, is the Pulitzer Prize–winning author of *Guns, Germs, and Steel* and other widely read books.

INCOME IMBALANCE

Today over a third of the world's income is generated by about a tenth of the world's population in wealthy countries. As incomes rise in poorer nations, consumption will rise also, thus depleting more natural resources to achieve a more affluent lifestyle.



TAYLOR MAGGIACOMO, NGM STAFF. SOURCE: WORLD BANK

*2015, adjusted for purchasing power parity (constant 2011 international $)

SUPERMICRO

Save Money.
Save Mother Earth.

RESOURCE-SAVING SERVERS

Build your data center with technology that is
BIG on **SAVINGS** and **LOW** on environmental **IMPACT**

60% Space Savings | 50% Energy Savings | e-Waste Savings

25 Years
OF GROWTH & INNOVATION

Learn more at
www.supermicro.com/WeKeepITGreen

intel XEON PLATINUM inside

SUPERMICRO

THE YEAR OF THE BIRD

Throughout 2018, National Geographic used science and storytelling to focus attention on Earth's birds—how important they are to the planet and how a changing environment is putting them in jeopardy.

Parrots Crack Each Other Up

New Zealand's naturally playful keas get their funny bones tickled when other parrots make a specific call, *Nature* reports. The gentle, low warble sends keas into fits of "laughter," making them the first non-mammal known to show contagious emotion, as rats, chimps, and humans do.

BIRDS, 2018

The Year Flew By

Amid mounting losses of bird species, National Geographic joined the National Audubon Society, BirdLife International, and the Cornell Lab of Ornithology to declare 2018 the Year of the Bird. For avians, the year's news was mixed: threats from habitat loss, predators, climate change—but also success stories such as the Asian crested ibis (below), which has rebounded from 12 in the wild in 1981 to more than 500 today.

—THE EDITORS

ANIMALS

OPEN-CONCEPT NESTS ARE BACK IN STYLE

BIRDS TODAY ARE BUILDING MORE BASIC HOMES.

There's a perception that evolution moves from simple to complex, but bird nests are an exception. Scientists have discovered that bowl-shaped nests (above right) probably evolved from roofed nests (above left) at least four separate times in the history of bird species. A study in the *Proceedings of the Royal Society B* found that the common ancestor of the passerine group—which encompasses 60 percent of species, including all songbirds—constructed domed nests. Today three-quarters of them build open nests, which are generally easier to fashion but expose the eggs to predators and the elements. This finding, says study author Jordan Price of St. Mary's College of Maryland, illustrates how a trait's current prevalence "does not necessarily indicate the order of events during its evolutionary history." —NINA STROCHLIC

FROM TOP: JOEL SARTORE, NATIONAL GEOGRAPHIC PHOTO ARK, PHOTOGRAPHED AT WELLINGTON ZOO; SHARON BEALS, PHOTOGRAPHED AT CSIRO AUSTRALIAN NATIONAL WILDLIFE COLLECTION; WANG LIQIANG, SHUTTERSTOCK

HERE'S TO

TAKING YOUR TIME.

SMOOTH AND FULL-FLAVORED JIM BEAM BLACK®.
TASTE WHAT A FEW EXTRA YEARS IN THE BARREL CAN DO.

JIM BEAM
BLACK®
EXTRA-AGED
— BOURBON —

GENIUS

BOLORTSETSEG MINJIN

BY **RACHEL HARTIGAN SHEA** PHOTOGRAPH BY **REBECCA HALE**

She Brings the Fossils of Dinosaurs Home

In the Gobi, dinosaur fossils abound. Scientists have discovered 76 dinosaur genera—one-seventh of those known to science—in this Mongolian desert. Yet few Mongolians are aware of these treasures. "Fossils leave the country," says paleontologist Bolortsetseg Minjin, "and knowledge leaves with them."

Bolortsetseg joined her first excavation as a cook, even though she had a master's degree and the support of her father, Minjin Chuluun, one of Mongolia's first paleontologists. But she managed to sidestep meal preparation to look for fossils—so successfully that she was invited to enroll in a joint Ph.D. program with the American Museum of Natural History and City University of New York.

After earning her degree, Bolortsetseg didn't want to return to a place where she felt scientists weren't valued—unless she could change it. She decided to help fellow Mongolians learn about their natural heritage and fight to protect it, establishing the Institute for the Study of Mongolian Dinosaurs. At first the institute was little more than a name; now it sends a mobile dinosaur exhibit around the country. Bolortsetseg—now a National Geographic emerging explorer—is working on creating seven permanent museums, one in each region where fossils have been found. She has also helped repatriate more than 30 scientifically significant fossils: "Reversing the movement of fossils out of the country will bring the knowledge back."

WE MAKE MORE HOLIDAY DELIVERIES TO MORE HOMES THAN ANYONE ELSE IN THE COUNTRY, WITH ONE NOTABLE EXCEPTION.

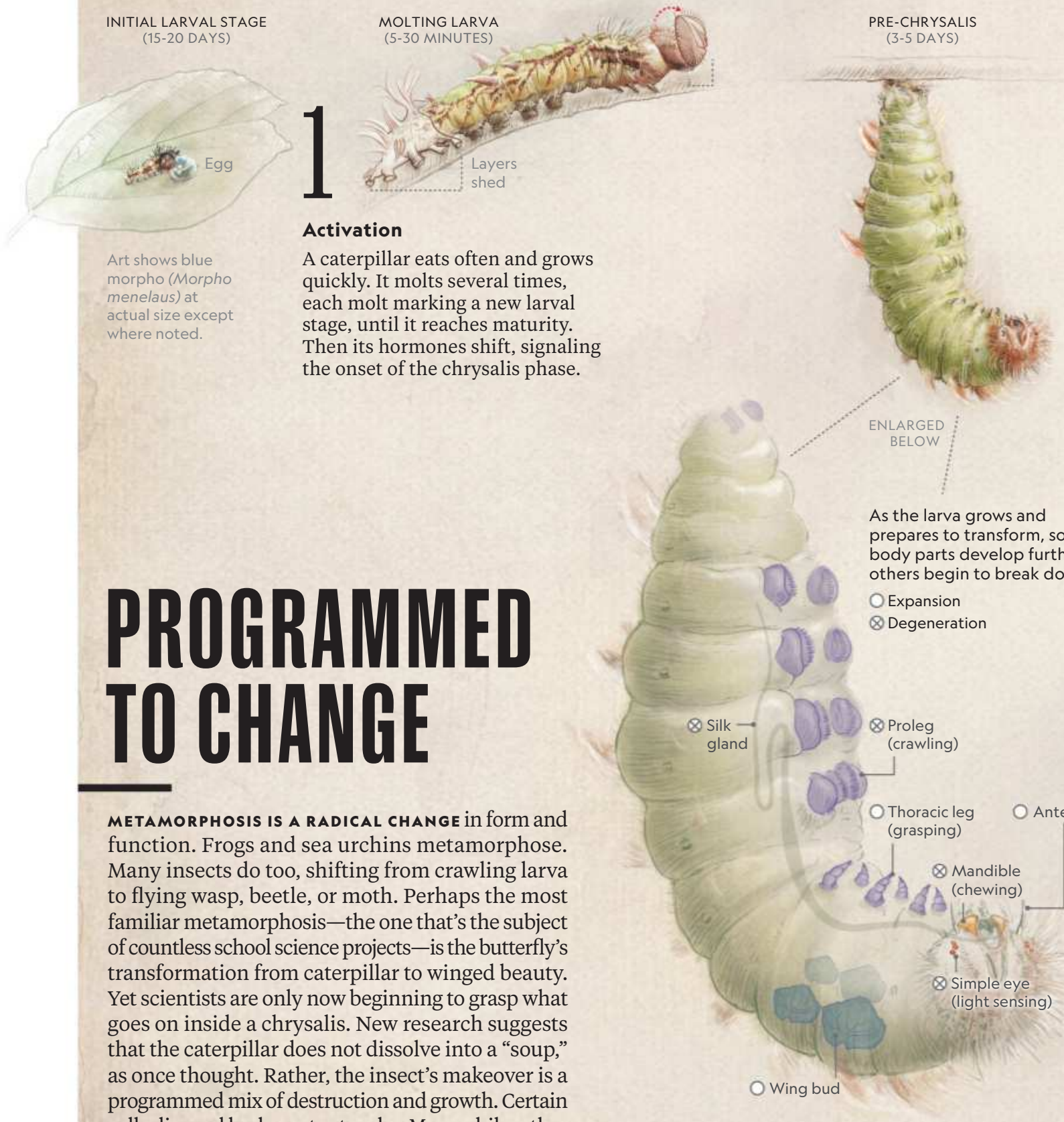
Santa and the United States Postal Service® both know holiday deliveries need to show up on time – for everyone. That's why we deliver to every single address in America.

Ship now at usps.com/merry

UNITED STATES POSTAL SERVICE®

PRIORITY:YOU

ILLUMINATING THE MYSTERIES—AND WONDERS—ALL AROUND US EVERY DAY
NATIONAL GEOGRAPHIC | VOL. 234 NO. 6



Art shows blue morpho *(Morpho menelaus)* at actual size except where noted.

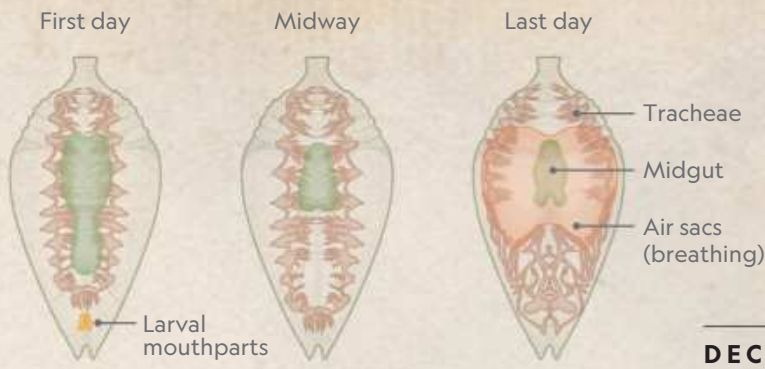
Activation

A caterpillar eats often and grows quickly. It molts several times, each molt marking a new larval stage, until it reaches maturity. Then its hormones shift, signaling the onset of the chrysalis phase.

Caterpillars are born with four internal buds that are genetically programmed to grow into wings.

PROGRAMMED TO CHANGE

METAMORPHOSIS IS A RADICAL CHANGE in form and function. Frogs and sea urchins metamorphose. Many insects do too, shifting from crawling larva to flying wasp, beetle, or moth. Perhaps the most familiar metamorphosis—the one that's the subject of countless school science projects—is the butterfly's transformation from caterpillar to winged beauty. Yet scientists are only now beginning to grasp what goes on inside a chrysalis. New research suggests that the caterpillar does not dissolve into a "soup," as once thought. Rather, the insect's makeover is a programmed mix of destruction and growth. Certain cells die, and body parts atrophy. Meanwhile, other cells, in place since birth, rapidly expand. In as little as two weeks, the adult emerges entirely remodeled, capable of flight—and bent on finding a mate.



A NEW WAY TO SEE INSIDE

Until recently, the only way to study a chrysalis's development was to cut it open or x-ray it—with fatal results. Now 3D models from harmless micro-CT scanning reveal details: The trachea expands to allow increased oxygen intake, and the gut shrinks to adjust to a diet that switches from plants to nectar.

DECODER

BY **DAISY CHUNG**

CHRYSALIS
(10-15 DAYS)

2

Transformation

Once it's big enough, a caterpillar finds a safe spot and often attaches itself to it with silk. A final molt reveals a shell called a chrysalis; inside, the insect changes dramatically in preparation for adult life.

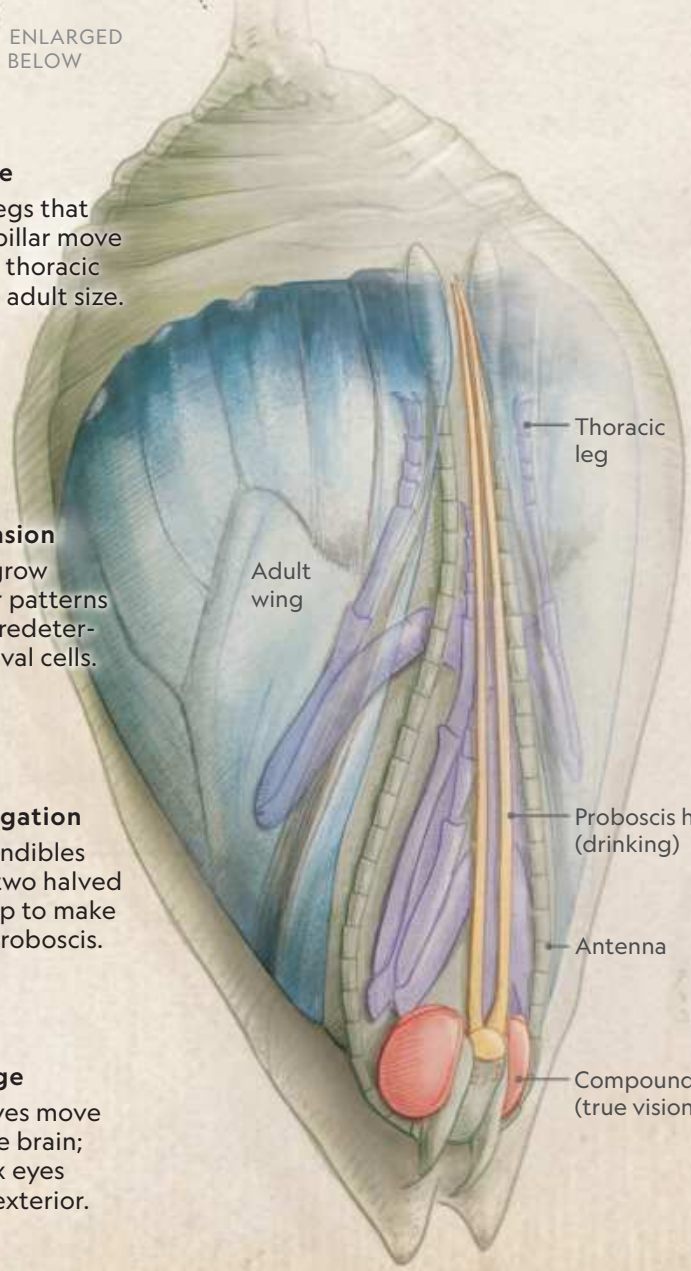
EMERGING BUTTERFLY
(0.5-2 HOURS)

3

Emergence

The butterfly sucks in air until its chrysalis breaks open. It then flaps its wings for several hours to dry them and to circulate blood before flying off in search of a mate.

ENLARGED BELOW



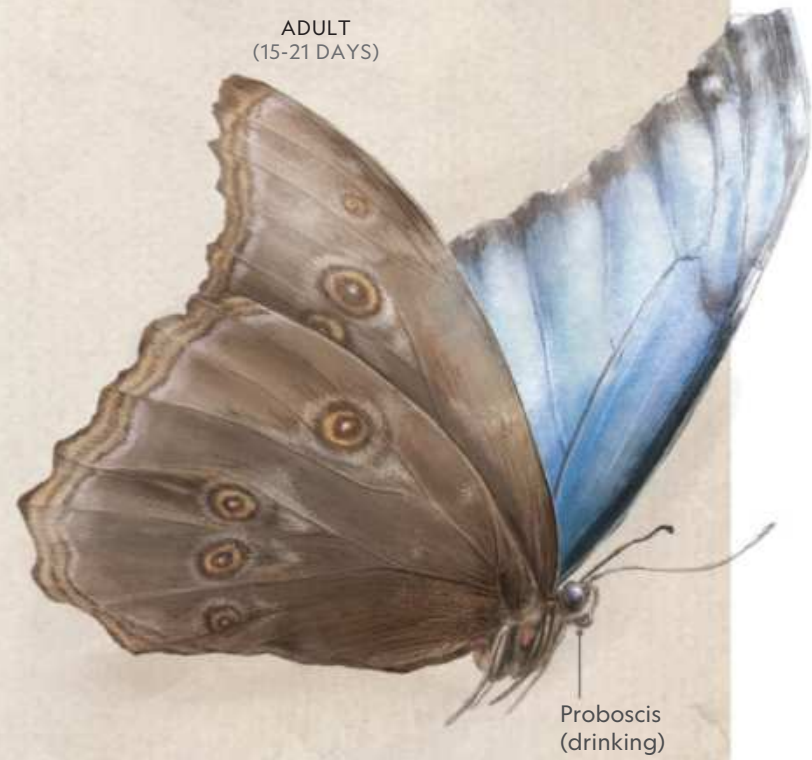
Leg upgrade
Stubby prolegs that help a caterpillar move degenerate; thoracic legs grow to adult size.

Wing expansion
Four wings grow rapidly, their patterns and colors predetermined by larval cells.

Mouth elongation
Chewing mandibles morph into two halved pipes that zip to make a strawlike proboscis.

Eye exchange
Six simple eyes move inward to the brain; two complex eyes form at the exterior.

ADULT
(15-21 DAYS)



Butterfly brains are almost completely rewired to meet the flying insect's new needs, but they may retain some olfactory memories from the larval stage.

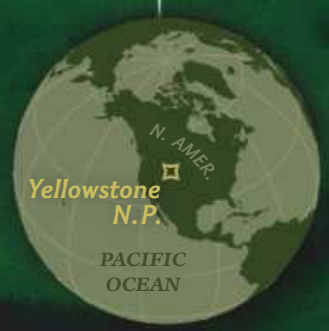
ART: DAISY CHUNG, NGM STAFF. CATHERINE ZUCKERMAN, NGM STAFF; MESA SCHUMACHER. SOURCES: MARK GRECO, CHARLES STURT UNIVERSITY; DOUGLAS BLACKISTON, TUFTS UNIVERSITY; ANTÓNIA MONTEIRO, NATIONAL UNIVERSITY OF SINGAPORE; ADRIANA BRISCOE, UNIVERSITY OF CALIFORNIA, IRVINE; MARTHA WEISS, GEORGETOWN UNIVERSITY

BY THE NUMBERS

7,732
LAKE'S ALTITUDE IN FEET

32°F
WINTER WATER TEMPERATURE

11,000
SPIRES' AGE IN YEARS

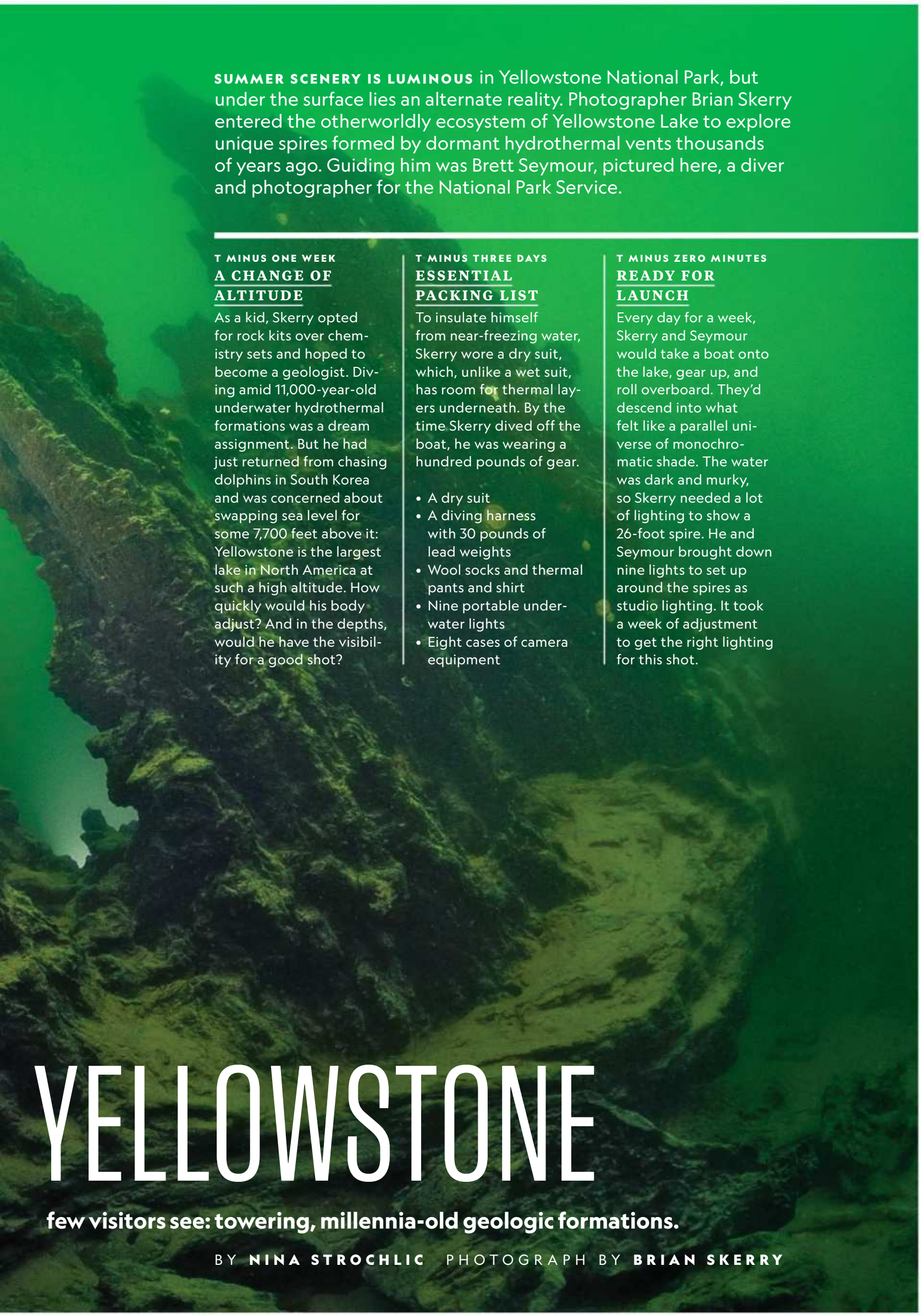


Yellowstone National Park straddles Wyoming, Idaho, and Montana.

UNDER

Beneath the national park's surface is a world

NGM MAPS



YELLOWSTONE

few visitors see: towering, millennia-old geologic formations.

BY **NINA STROCHLIC** PHOTOGRAPH BY **BRIAN SKERRY**

SUMMER SCENERY IS LUMINOUS in Yellowstone National Park, but under the surface lies an alternate reality. Photographer Brian Skerry entered the otherworldly ecosystem of Yellowstone Lake to explore unique spires formed by dormant hydrothermal vents thousands of years ago. Guiding him was Brett Seymour, pictured here, a diver and photographer for the National Park Service.

T MINUS ONE WEEK

A CHANGE OF ALTITUDE

As a kid, Skerry opted for rock kits over chemistry sets and hoped to become a geologist. Diving amid 11,000-year-old underwater hydrothermal formations was a dream assignment. But he had just returned from chasing dolphins in South Korea and was concerned about swapping sea level for some 7,700 feet above it: Yellowstone is the largest lake in North America at such a high altitude. How quickly would his body adjust? And in the depths, would he have the visibility for a good shot?

T MINUS THREE DAYS

ESSENTIAL PACKING LIST

To insulate himself from near-freezing water, Skerry wore a dry suit, which, unlike a wet suit, has room for thermal layers underneath. By the time Skerry dived off the boat, he was wearing a hundred pounds of gear.

- A dry suit
- A diving harness with 30 pounds of lead weights
- Wool socks and thermal pants and shirt
- Nine portable underwater lights
- Eight cases of camera equipment

T MINUS ZERO MINUTES

READY FOR LAUNCH

Every day for a week, Skerry and Seymour would take a boat onto the lake, gear up, and roll overboard. They'd descend into what felt like a parallel universe of monochromatic shade. The water was dark and murky, so Skerry needed a lot of lighting to show a 26-foot spire. He and Seymour brought down nine lights to set up around the spires as studio lighting. It took a week of adjustment to get the right lighting for this shot.

MARINE MARS?

Massive volcano Olympus Mons and the deep canyons of Valles Marineris—iconic physical features of modern Mars—had not yet formed 3.8 billion years ago.

ICY THEORY

Ancient water may have been frozen into thick ice sheets blanketing the landscape. Imprints of flowing material on the surface would then be the result of seasonal warming and geothermal activity leading to melting.

CARVED CHANNELS

Gullies like these, found in the canyons of Gorgonum Chaos, show clear evidence of flowing material. Whether they were formed by water is still unknown.

In July 2018 scientists argued for the existence of a 12-mile-wide subsurface lake using radar evidence from a European mission.

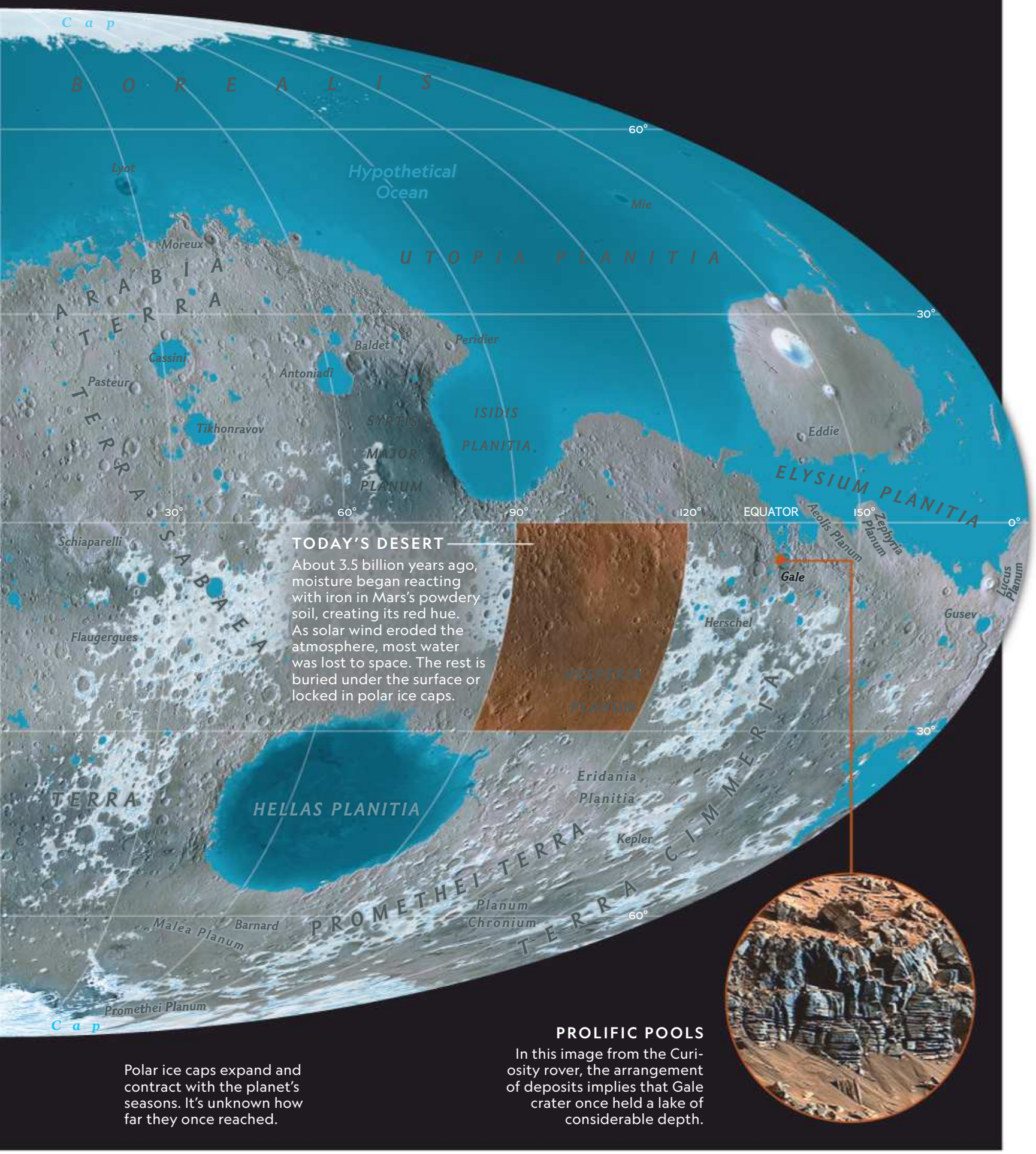
TELEVISION

Progress on *MARS*

Watch season two of the docudrama series *MARS*. Episodes air Mondays at 9/8c through December 17, on National Geographic.

Ancient Mars looked very different from today's parched, crimson landscape. Around 3.8 billion years ago, the planet may have had enough surface water to fill an ocean or bury much of it in ice. Missions like NASA's Curiosity have found clues to the mystery: Did abundant water once cover the red planet?

BY **MATTHEW W. CHWASTYK**



TODAY'S DESERT

About 3.5 billion years ago, moisture began reacting with iron in Mars's powdery soil, creating its red hue. As solar wind eroded the atmosphere, most water was lost to space. The rest is buried under the surface or locked in polar ice caps.

Polar ice caps expand and contract with the planet's seasons. It's unknown how far they once reached.

PROLIFIC POOLS

In this image from the Curiosity rover, the arrangement of deposits implies that Gale crater once held a lake of considerable depth.

SOURCES: BETHANY EHLMANN, CALECH; CALEB FASSETT, NASA MARSHALL SPACE FLIGHT CENTER; MICHAEL MANGA, UNIVERSITY OF CALIFORNIA, BERKELEY; ROBIN WORDSWORTH, HARVARD UNIVERSITY; NASA/JPL, UNIVERSITY OF ARIZONA; NASA GODDARD SPACE FLIGHT CENTER; USGS ASTROGEOLOGY SCIENCE CENTER

BASIC INSTINCTS

HE LIKES HIS MATES OLDER. SHE APPRECIATES HIS TASTE.

WHEN SEEKING SEX, why wouldn't the male *Latrodectus geometricus* spider go for the nice young females? They're more fertile than their elders. They'll mate more quickly, without an elaborate courtship. Last but not least: Young *L. geometricus* females don't cap off a copulation by cannibalizing their date—while older females do. (That's what gave the species its common name: the widow spider.)

Given the obvious advantages, a research team in Israel expected *L. geometricus* males to prefer young females. To test that assumption, researchers set up spider orgies, offering males access to consorts of all ages. Their findings were published in *Animal Behaviour.*

To get sex with an older female, a male might fight off many rivals or perform courtship gestures for up to six hours. At the magical moment, he'd place one of his two sexual organs into one of her two sexual openings—and she would start to eat him alive. If he survived, he might try to mate again or be too maimed to do so.

In the study, when males had one-on-one time with females of different ages, the males mated with fewer than half the youngest females—but 100 percent of the oldest ones. Not one of the males that mated with the youngest females died from cannibalism—but more than half those that mated with the oldest females did. "We really don't understand" males' suicidal lust for older mates, says study co-author Shevy Waner. One theory is that mature females exude stronger sex pheromones, compensating chemically for what they lack in fertility and youth. **—PATRICIA EDMONDS AND KATIE WATKINS**

NATIONAL GEOGRAPHIC PHOTO ARK JOEL SARTORE

This brown widow spider was photographed at the Audubon Nature Institute.

INSIDE THE ALMANAC

A Galactic Directory

Curious about our place in the universe or at least the Milky Way? National Geographic's *Almanac 2019* lists Earth's distance from other celestial bodies, in miles or light-years (LY):

ASTEROID: 26,000 MILES
An asteroid known as 2012 TC4, just 50 to 100 feet long, flew that close to Earth on October 12, 2017.

COMET: 1.4 MILLION MILES
In July 1770, comet Lexell (aka D/1770 L1) was six times as far away as the moon—but that's still the closest recorded passage by a comet.

NEXT STAR: 4.25 LY
Proxima Centauri, our second nearest star (after the sun), forms a three-star system with Alpha Centauri A and B in the constellation Centaurus.

HABITABLE WORLD: 4.25 LY
In our nearest star's orbit, an exoplanet—Proxima Centauri b—could have liquid water, based on its location and size.

POSSIBLE SUPERNOVA: 150 LY
The supernova candidate nearest to Earth is the smaller star in a binary system known as IK Pegasi. But at the velocity at which the system's moving away from the sun, it should be safely distant if it explodes millions of years from now.

PLANETARY NEBULA: 650 LY
Not actually home to planets, this celestial object is the glowing remnant of a sunlike star. The Helix Nebula, in the constellation of Aquarius, is likely the closest to us.

Beyond our Milky Way, the closest galaxy—if *close* is the right term—is Canis Major, 25,000 light-years from Earth.

AVAILABLE AT *SHOPNG.COM/BOOKS*

PHOTO: JOEL SARTORE. ILLUSTRATION OF BLACK HOLE: NASA/JPL

Dewar's®

DOUBLE AGED

· FOR EXTRA · SMOOTHNESS

WE AGE

WE BLEND

WE AGE AGAIN

LIVE TRUE

Elegy for a Lion

FOR AN AFRICAN LION, C-BOY LIVED A LONGER-THAN-AVERAGE LIFE—LONG ENOUGH TO BE FAMOUS IN THESE PAGES AND ADMIRED FOR HIS TENACITY AND FIERCE SPIRIT.

BY **DAVID QUAMMEN**
PHOTOGRAPHS BY **MICHAEL NICHOLS**

Deceased: Adult male lion, roughly 14 years old, with a dark mane, known to researchers—and to readers of National Geographic *magazine—as C-Boy. Dead of natural causes, his body discovered by a tour driver in the back-country of Serengeti National Park, Tanzania, in early June 2018. His demise mourned by those who knew and read about him; his longevity and force of character a marvel to same.*

THE CATEGORY "NATURAL CAUSES," in the case of African lions, includes the kind of murder and mayhem that occurs routinely among competing members of the species. As the lion expert Craig Packer once told me, "The number one cause of death for lions, in an undisturbed environment, is other lions." This was about five years ago, when photographer Michael "Nick" Nichols and I were in Tanzania, doing field-work for a story on lion behavior and ecology. C-Boy, a handsome male in his prime, with a black-fringed mane, became the central figure of that story—"The Short Happy Life of a Serengeti Lion"—because he stood as an exception to this mortal rule.

Several years prior, C-Boy had barely survived a

gang attack by three other males, who tried to kill him over mating rights to a pride of females. Those three ambitious males, along with one other, were known as the Killers. A field assistant on Packer's long-term study, Ingela Jansson, witnessed the three-on-one brawl from nearby in her Land Rover, saw C-Boy's wounds, and figured he was a goner. (It was Jansson who, after earlier observations of another trio, had "boringly" named them A-Boy, B-Boy, and C-Boy, not realizing then how extraordinary the third member of that alphabetical list would be.) But C-Boy slouched off the field of battle and, with his sole coalition partner, a less disputatious lothario known as Hildur, wandered elsewhere to seek new territory, new females, and new prospects. That was nine years ago.

Myth holds that cats have nine lives. C-Boy had at least two. He endured the immediate attack, escaped a lingering death from infected wounds, and later became the starring character of our story. Why did Nick and I choose to focus on him? Because he was everything an African lion should be: resourceful, cantankerous, patient, proud but pragmatic, seemingly indestructible, continually imperiled, and gorgeous to behold.

During our fieldwork, the Killers turned up in an adjacent area, showing interest in another pride among whom C-Boy and Hildur had been fathering

C-Boy snarls a rejection at a female who approached him to mate. His dark mane, which indicated that he was healthy and strong, attracted females—and served as a warning to rival males.

cubs. They were pushing again for new conquests, the Killers, threatening to expand their domain. Another assistant on the Packer study, a young Swede named Daniel Rosengren, spotted them at dawn one morning, as I rode along, where they lay on a grassy stream bank, nursing facial wounds from a recent fight. Whom had they fought? Our guess was C-Boy, again. Had he survived once more? If so, in what condition?

There were no answers through a long day of fruitless searching. Nick's team couldn't find him, and neither could we. Late that evening Rosengren and I equipped ourselves with night-vision binoculars and sleeping bags, then rolled slowly overland behind the Killers in his Land Rover for the entire night, trading shifts of sleeping and watching, while the lions prowled, rested, and moved again. I called it the Night of the Long Follow.

These ambitious lions were on the march through C-Boy and Hildur's territory, and we wanted to see where they went, what they did, and whether their daring incursion—plus their battle wounds—meant that they had killed their way to preeminence hereabouts as well. Dawn came, the Killers walked boldly away down a two-track road, and for two days afterward, there was still no sign of C-Boy. In a journal entry, I recorded him as "missing, suspected dead."

But he wasn't dead. On the third morning, near a group of rock outcrops known as the Zebra Kopjes, we found him, unscathed and lusty, mounting a ready female. In the journal for that day, December 17, 2012, I wrote: "O happy lion!" His mane showed dark and virile in the early morning light. He was very much alive.

BUT EVEN C-BOY COULDN'T live forever. Last summer I got an email from Rosengren, now employed as a roving wildlife photographer by the Frankfurt Zoological Society. He confirmed what I'd heard elsewhere. "Yes, C-Boy was found dead by a tour driver who knew him well," he wrote. "I can't really say much more than that. He had apparently already been dead for a couple of days when they found him (following the vultures that ate the carcass)." There was no sign he'd been speared by a Maasai herdsman—intent on protecting cows—or shot by a poacher.

"He was about 14 years old," Rosengren wrote, "touching the record age for a male lion in all the history of the lion project." Twelve years is generally the maximal expected lifetime for a male. C-Boy's partner Hildur, also pushing the limits, was amazingly still alive.

It was saddening, Rosengren said, to realize that C-Boy is gone. "But at the same time, he lived a longer life than expected for a male lion. A life that almost ended close to a decade ago when the Killers got him. He got a second chance and certainly made the best of it." Rosengren added: "I wish that I could have seen him one more time."

I wished the same, and knew I couldn't, so I did the next best thing. I opened the August 2013 issue of the magazine, and there was Nick's magnificent black-and-white portrait of C-Boy (shown here, pages 34-5), with his dark-fringed mane, staring back at me through the Tanzanian night. It consoled me with the reminder that C-Boy's life, short or long, happy or fraught, embodied a magisterial will to survive.

Michael "Nick" Nichols has photographed more than two dozen stories for *National Geographic* and is the subject of the 2017 biography *A Wild Life*. **David Quammen** is a *National Geographic* contributing writer and author; his most recent book is *The Tangled Tree*.

He was everything an African lion should be: resourceful, cantankerous, patient, seemingly indestructible, continually imperiled, and gorgeous to behold.

NGM MAPS

Wrapping your head around the blockchain, not easy.

Rolling over your old 401(k) with TD Ameritrade, easier than you think.

Rolling over can seem complicated. At TD Ameritrade, we make it easier. We can help you decide if a rollover is right for you and provide a fee comparison. Our financial consultants will help you every step of the way. We'll even call your old 401(k) provider with you. Now about the blockchain…

Get up to $600 when you roll over a 401(k) into an IRA.

TD Ameritrade®

Visit **tdameritrade.com/rollover** to get started today.

Legal Notice

Consumers with Public Records on Their Experian Credit Reports

Could Be Affected by a Class Action Settlement

Experian agreed to settle litigation claiming it included inaccurate tax liens or civil judgments on its credit reports and failed to disclose its public record information vendor. Experian denies that it did anything wrong.

Are you included?

You are included if: (a) you requested your Experian credit report between January 15, 2011 and September 21, 2018, and it included a public record (such as a bankruptcy, judgment, or tax lien); or (b) Experian sent your credit report to a third party between January 15, 2014 and September 21, 2018, and the report contained a tax lien or civil judgment that was inaccurate or did not belong to you.

What does the Settlement provide?

Experian will stop reporting tax liens and civil judgments for a period of time, implement new procedures when reporting such public records, and disclose its public records vendor, if it uses one. Class members may claim two years of credit monitoring. Experian will establish Mediation and Arbitration Programs for consumers who have claims against Experian related to such public records. If you meet certain requirements, you will be eligible to request a payment, but no payment is guaranteed.

How can I participate?

The Mediation and Arbitration Programs and the credit monitoring product will be available for 18 months after the effective date.

What are my rights?

This Settlement releases the right to bring these claims on a class action basis. It will not impact individual claims. However, if you accept a payment in the Mediation Program or participate in the Arbitration Program, you will release your individual claims as well. Even if you do nothing, you will be bound by the Court's decisions. You may object to the Settlement by **January 15, 2019**. The Court will hold a hearing on **February 1, 2019** to consider whether to approve the Settlement and requested attorneys' fees. You or your own lawyer may appear and speak at the hearing at your own expense.

For More Information:
1-866-893-8437
ExperianPublicRecordSettlement.com

STATEMENT OF OWNERSHIP, MANAGEMENT, AND MONTHLY CIRCULATION OF

NATIONAL GEOGRAPHIC

OWNER AND PUBLISHER:
National Geographic Partners, LLC

GARY E. KNELL, CEO

SUSAN GOLDBERG, EDITOR IN CHIEF

HEADQUARTERS OF PUBLISHER AND PUBLICATION:
1145 SEVENTEENTH STREET N.W.,
WASHINGTON, DC 20036

STOCKHOLDERS; BONDHOLDERS; MORTGAGE; OTHER SECURITY HOLDERS:
National Geographic Society and 21st Century Fox

	AVERAGE NUMBER COPIES EACH ISSUE DURING PRECEDING 12 MOS.	SINGLE ISSUE NEAREST TO FILING DATE
A. TOTAL COPIES PRINTED (Net Press Run)	Oct 2017 - Sept 2018 3,460,605	Sept 2018 3,124,812
B. PAID CIRCULATION		
1. Outside-County Mail Subscriptions	2,354,074	2,121,459
2. In-County Mail Subscriptions	–	–
3. Single-Copy Sales/Non-USPS Paid Distribution	728,910	682,633
4. Other Classes Mailed Through USPS	–	–
C. TOTAL PAID CIRCULATION	3,082,984	2,804,092
D. FREE DISTRIBUTION (Includes samples, no news agents)		
1. Outside-County	50,144	42,835
2. In-County	–	–
3. Other Classes Mailed Through USPS	–	–
4. Free Distribution Outside the Mail	8,407	2,810
E. TOTAL FREE DISTRIBUTION	58,551	45,645
F. TOTAL DISTRIBUTION (Sum of C and E)	3,141,535	2,849,737
G. OFFICE USE, LEFTOVERS, ETC.	319,070	275,075
H. TOTAL (Sum of F and G)	3,460,605	3,124,812
I. PERCENT PAID	98%	98%

THEIR FUTURE CAN BE YOUR LEGACY

Given the range of threats facing our wildlife and their habitats, our work is more important than ever. When you leave a gift to the National Geographic Society in your will, trust, or by beneficiary designation, you can protect critical animal species for generations to come. There is no minimum amount and **your gift costs you nothing now.** It's an easy way to make a lasting difference.

Won't you Join us?

NATIONAL GEOGRAPHIC

CREATE A LEGACY OF YOUR OWN

- ☐ Yes! Please send me information on leaving a gift to the National Geographic Society.
- ☐ The National Geographic Society has already been included in my estate plans.
- ☐ I would like to speak to someone about making a gift. Please call me.

Mail to: National Geographic Society
Office of Planned Giving
1145 17th Street, N.W.
Washington, D.C. 20036-4688

Contact: legacy@ngs.org
(800) 226-4438
natgeo.org/give/future-gifts

NAME

ADDRESS

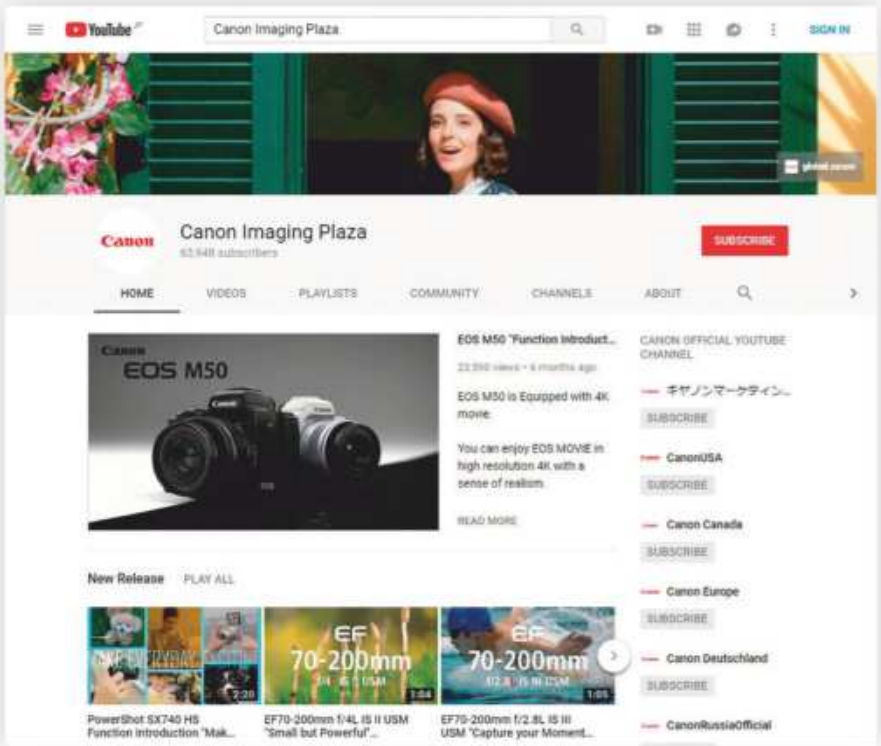
PHONE EMAIL

The National Geographic Society is a 501(c)(3) non-profit organization. Our federal tax ID number is 53-0193519.

18PGFC12B

WORLD BEAT

| EVENTS | OPPORTUNITIES | ADVERTISING | PROMOTIONS |



CANON IMAGING PLAZA

Canon offers the Canon Imaging Plaza YouTube channel as a resource for photo enthusiasts to learn more about digital photography, Canon products, and the fun and joy of capturing images and videos with a digital camera. Canon believes that dedicated digital cameras provide users with the best means of capturing life's special moments.

LEARN MORE AT YOUTUBE.COM/USER/CANONIMAGINGPLAZA

Canon

DEWAR'S DOUBLE AGED SMOOTHNESS

What's in a name? In a word, standards. At Dewar's, we've made a name for ourselves by living true to our standards for over 130 years. That's about how long we've been double aging our whisky. Why? For extra smoothness.

LEARN MORE AT DEWARS.COM

LIVE TRUE Dewar's

HELP THE WORLD SEE CLEARLY

1 in 7 people around the world need a pair of glasses but have no way to get them. Help OneSight solve this problem for good. You have the power to give clear sight – and hope – to those without access to vision care and glasses.

DONATE OR LEARN MORE AT ONESIGHT.ORG

OneSight

FEATURES

76

'OIL PALMS, WITH GIANT BUNCHES OF RED FRUIT GROWING BENEATH UNRULY FRONDS, ARE AN ANCIENT STAPLE CROP. OVER THE PAST FEW DECADES, HOWEVER, PALM OIL USE HAS EXPLODED.'

PHOTO: PASCAL MAITRE

IN THE CLOAK-AND-DAGGER WORLD WHERE RELIGION MEETS ARCHAEOLOGY, SCIENTISTS, COLLECTORS, AND SCHEMERS ARE RACING TO FIND SACRED TEXTS.

—

The Bible Hunters

By ROBERT DRAPER | *Photographs by* PAOLO VERZONE

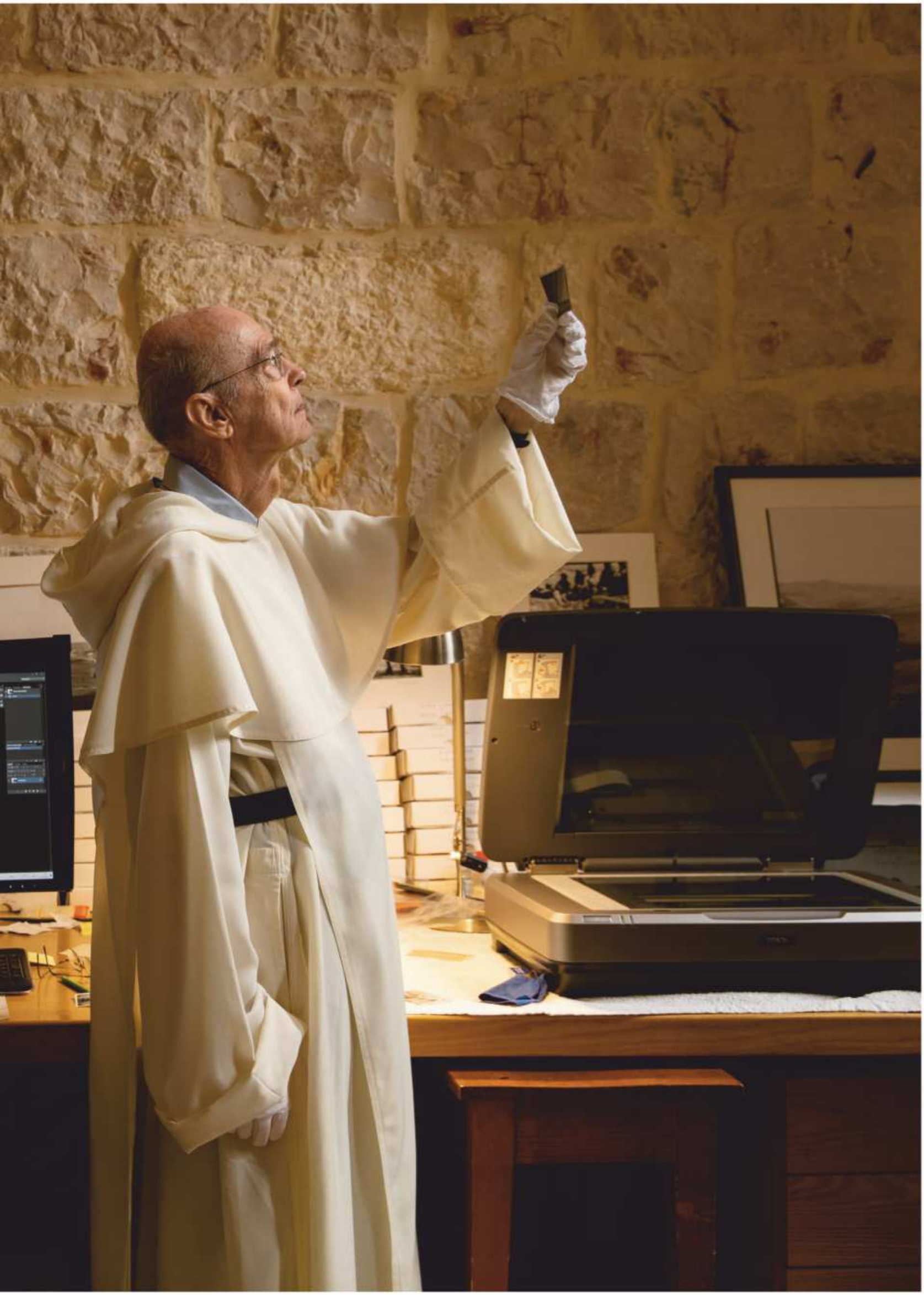
Graphics by FERNANDO G. BAPTISTA *and* MATTHEW W. CHWASTYK

Dominican Father Jean-Michel de Tarragon studies archival photographs at the French École Biblique in Jerusalem. Its scholars led the search for the Dead Sea Scrolls, the oldest biblical texts ever discovered.

PREVIOUS PHOTO

Hand copied around 1400, a Wycliffe New Testament on exhibit at a Christian theme park in Florida gets white-glove treatment. English theologian John Wycliffe championed translating the Bible from Latin into the common language, an innovation church officials denounced.

VAN KAMPEN COLLECTION ON DISPLAY AT THE HOLY LAND EXPERIENCE, ORLANDO, FLORIDA



A conservator at the Israel Antiquities Authority prepares a fragment of the Dead Sea Scrolls for display. Seen here upside down, the fragile document is being placed between layers of mesh that are first pinned, then sewn together around the edges of the fragment.

The heat is merciless among the barren hills of the Judaean desert near the shore of the Dead Sea.

Searching for more Dead Sea Scrolls, Israeli archaeologist Oren Gutfeld peers into a cave where he found bits of ancient parchment. "It was blank," he says, "but next time maybe it won't be."

But it's mercifully cool inside the cave where Randall Price lies on his stomach, staring at the crevice where just yesterday he discovered a 2,000-year-old bronze cooking pot.

"This cave was robbed by Bedouins maybe 40 years ago," explains Price, an American archaeologist and research professor at Liberty University in Virginia. "Fortunately for us, they didn't dig very deep. Our hope is that if we keep digging, we hit the mother lode."

Anyone who's heard of these famed caves near the ancient Jewish settlement of Qumran knows what mother lode Price has in mind. In 1947 young Bedouin goat herders peered into a nearby cavern and made one of the biggest archaeological discoveries of the 20th century:

seven rolled parchments covered in ancient Hebrew script, the first of the famous Dead Sea Scrolls. Members of the separatist Qumran sect likely stashed the scrolls in the cave around A.D. 70, as Roman troops closed in to crush the First Jewish Revolt. Hundreds more scrolls eventually would come to light. Dating as far back as the third century B.C., they are the oldest biblical texts ever found.

The Qumran caves are in the Israeli-occupied West Bank, and many people consider Price's work illegal under international law. But that hasn't dissuaded him or the dig's Israeli director, Oren Gutfeld of the Hebrew University of Jerusalem, from pursuing a research agenda derived from an earlier, equally controversial exercise.

In 1993, after signing the Oslo Accords—which provided a framework for returning disputed territories to Palestinian control—the Israeli government launched Operation Scroll, an urgent survey of all the archaeological sites the country potentially stood to lose. The inventory was rushed and cursory, and the surveyors found no new scrolls. But they mapped dozens of caves that had been damaged by earthquakes and possibly overlooked by Bedouin treasure hunters. The one cataloged as Cave 53 caught the attention of Price in 2010 and later Gutfeld, who described it as a "juicy" cave. "They found lots of pottery from a range of periods of time—from early Islamic to Second Temple to Hellenistic," he says. "There's

Conservator Emma Nichols examines a Hebrew text at the Cambridge University Library, which houses some 200,000 Jewish manuscripts discovered at a medieval synagogue in Cairo.

Licensed by the Israeli government to sell antiquities, Khader Baidun visits a storage room below one of his family's shops in Jerusalem's Old City. To help stop the sale of looted objects, dealers must now register artifacts in a digital database. But secrecy persists, one seller says. "It's an old custom not to mention names or sums."

reason to hope something else might be there."

Two years ago, during their initial probe of Cave 53, the archaeologists discovered a small roll of blank parchment and broken storage jars—tantalizing evidence that the cavern might have housed scrolls. Today, after nearly three weeks of digging, their finds are arrayed across a folding table outside the cave. They include Neolithic arrowheads, an obsidian blade from Anatolia, and the bronze cooking pot. But no scrolls. And so the digging continues.

PEOPLE OF MANY FAITHS venerate religious relics. But for those who believe that God speaks through words written down by prophets and apostles in past ages, ancient texts are foundational to their faith. From artfully adorned medieval manuscripts to humble fragments of papyrus, revered texts represent tangible links to God's appointed messengers, whether Muhammad, Moses, or Jesus Christ.

Reverence for holy writ is integral to the faith of evangelical Christians, who have become a driving force behind the search for long-lost biblical texts in desert caves, remote monasteries, and Middle Eastern antiquities markets. Critics say that the evangelical appetite for artifacts is fueling demand for looted objects—a charge borne out to some degree by recent investigations and by reports from legitimate dealers.

"Evangelicals have had a tremendous impact on the market," says Jerusalem antiquities seller Lenny Wolfe. "The price of anything connected to the lifetime of Christ goes way up."

Whatever their religious commitments, wealthy collectors and deep-pocketed benefactors have long played a supporting role in the search for ancient exotica. Among those helping to underwrite Price and Gutfeld's Qumran expedition is a foundation established by Mark Lanier, a well-heeled Houston lawyer and avid collector of theological texts. Another archaeological dig, this one at Tel Shimron in Israel, is being supported by the new Museum of the Bible in Washington, D.C. The museum's chairman, Steve Green, is president of the craft store giant Hobby Lobby and one of the biggest supporters of Christian causes in the United States. His enthusiasm for Bible hunting is unabashed.

"There's a lot to find out there—imagine how much more there could be," Green tells me when I meet him inside the gleaming, $500 million, 430,000-square-foot museum. "We're excited about turning over every rock." But as Green, a devout Southern Baptist, has come to learn firsthand, not everyone in the Bible-hunting business is a saint. Turning over rocks may uncover scrolls but also snakes.

ENCOUNTERING SERPENTS and other dangers—burning deserts, blinding sandstorms, armed bandits—went with the territory trodden by pioneering Bible hunters of the 19th and early 20th centuries. Egypt was among their favorite destinations; its dry climate is ideal for preserving fragile manuscripts. Many of the trailblazers were sturdy scholar-adventurers, and accounts of their travels and discoveries conjure up images from *Raiders of the Lost Ark*.

Take, for example, Konstantin von Tischendorf, a German scholar who in 1844 made a long, dangerous journey through Egypt's Sinai desert to the world's oldest continuously inhabited Christian monastery, St. Catherine's. There he encountered "the most precious biblical treasure in existence." It was a codex—an ancient text in book form instead of a scroll—dating to the mid-fourth century. Known today as the Codex Sinaiticus, it's one of the two oldest Christian Bibles surviving from antiquity, and the oldest complete copy of the New Testament.

The discovery made Tischendorf "the most famous and most infamous textual scholar in history," notes biographer Stanley Porter. According to his own account of events, Tischendorf first spotted some pages from the codex in a basket of old parchment the monks planned to burn. He rescued the pages and requested permission to take the entire codex back to Europe for study. The monks, alerted to its value by the foreign scholar's excitement, would part with only a few dozen pages.

Tischendorf made the arduous trek back to St. Catherine's in 1853 but left with little to show for it. He returned a third and final time in 1859 after securing the sponsorship of the Russian tsar, considered the "defender and protector" of the Eastern Orthodox Church, to which the Sinai monastery belongs. This time Tischendorf's doggedness paid off. After signing a pledge to return the codex once he'd made exact copies, he delivered it to his royal patron in St. Petersburg.

From there the chain of events becomes tangled in controversy and accusations of

imperialist power plays. The monks eventually "donated" the codex to the tsar, but whether they did so willingly or under pressure is still debated. In any event, the priceless Bible remained in St. Petersburg until 1933, when Joseph Stalin's government, facing financial crisis and famine, sold it to the British Museum for the equivalent of nearly half a million U.S. dollars.

Tischendorf wasn't the first manuscript hunter to visit the remote monastery at the foot of Mount Sinai, nor would he be the last. Those who followed in his steps included Agnes Smith Lewis and Margaret Dunlop Gibson, Scottish twins and self-taught scholars who between them mastered some dozen languages. In 1892 the plucky Presbyterian sisters, both middle-aged widows by then, crossed the Egyptian desert on camelback and arrived at St. Catherine's. They'd been tipped off that works in ancient Syriac—a dialect of Aramaic, a language Jesus spoke—were stashed in a dark closet. The sisters were eager to investigate.

'Evangelicals have had a tremendous impact on the market. The price of anything connected to the lifetime of Christ goes way up.'

LENNY WOLFE, ANTIQUITIES DEALER

With the monks' permission, they examined several volumes, including a dirt-encrusted codex that hadn't been cracked open for decades, perhaps centuries. Using their camp kettle to steam the grimy pages apart, they found that it was a biography of female saints dated A.D. 778. Then sharp-eyed Lewis noticed a faint underwriting beneath the top layer of text and realized that it was a palimpsest—a manuscript that had been partially erased and reused. Studying the text beneath the text, she was staggered to see that it was a translation of the four Gospels. Dating roughly to the early 400s, the Codex Sinaiticus Syriacus, as it's known today, is one of the oldest copies of the Gospels ever discovered.

Rather than try to "borrow" the Syriac codex—which remains at St. Catherine's to this day—the sisters took photographs of each page with a camera they'd brought along to document their discoveries. They also used a chemical solution in a successful attempt to enhance the faded undertext of the palimpsest. Their work anticipated by more than a century the use of multispectral imaging and other technologies to reveal ancient biblical texts hidden beneath more recent writing. (See "Digital Revelations," page 61.)

The remarkable manuscripts brought to the world's attention by Tischendorf and the Scottish sisters were made of costly parchment or vellum. But the vast majority of texts from Christianity's earliest centuries were written on papyrus, the paper of the ancient world.

In 1896 Bernard Grenfell and Arthur Hunt, rookie archaeologists from Oxford University, were prospecting for artifacts at the long-buried Egyptian city of Oxyrhynchus when they made an extraordinary find: an ancient garbage dump filled with layer upon layer of papyri. Over the next decade Grenfell and Hunt dug through a papyrus-filled pit some 30 feet deep and shipped half a million documents back to Oxford. Researchers have been painstakingly piecing together the fragments ever since.

Most of the papyri are the prosaic paperwork of everyday life: bills, letters, tax assessments, a deed from the sale of a donkey. But about 10 percent of the hoard is literary, including bits of works by classical authors such as Homer, Sophocles, and Euripides. Some of the most dramatic finds—such as lost gospels that didn't make it into the New Testament—have shed light on the formative years of the Christian faith. And more than a century after their discovery, thousands of fragments have yet to be studied closely. How many revelations await in those many boxes of ancient trash is anyone's guess.

FOR CLOAK-AND-DAGGER DRAMA, the Dead Sea Scrolls trump all other biblical discoveries. According to one version of the story, the Bedouin goat herders sold the seven parchments they'd found to two antiquities dealers in Bethlehem. A scholar from Jerusalem acquired three of the scrolls following a clandestine meeting through a barbed wire fence. A dealer named Khalil Iskander Shahin, also known as Kando, sold the four remaining scrolls to a Syrian archbishop in Jerusalem, who reportedly paid the equivalent of $250. In 1949, spooked by the Arab-Israeli War, the bishop smuggled the scrolls to the United States in hopes of selling them to a museum or university. After getting no *(Continued on page 69)*

THE BIBLE'S STORY

The Bible took shape—in form and word—over centuries of study, debate, technological progress, and worship. From handwriting on papyrus and parchment to words printed by mechanical press, these sacred texts have been passed on in many formats.

3000 B.C. 500 B.C. A.D. A.D. 500

CONSTRUCTING THE CANONS

The "divine library" is the work of more than 35 authors spanning at least a millennium. Determining which writings should be included in the official canon of holy Scripture took hundreds of years.

Moses and the Ten Commandments

OLD TESTAMENT
Hebrew Scriptures are written. Agreement on authoritative books takes several more centuries.

The Apostles decree at the **Jerusalem Council** that obeying Jewish ceremonial law isn't essential for non-Jewish followers of Jesus.

NEW TESTAMENT
Accounts of Jesus' life and teachings and records of followers are ascribed to his Apostles and their associates.

Claiming hidden knowledge of the divine, the **"Gnostics"** write additional books under the names of Jesus' Apostles.

The **Council of Laodicea** (in mod Turkey) rules that only texts confirm to be Scripture c be used in worsh

***ca 6 B.C.**
Jesus of Nazareth is born.

CA 363 393

RELIGION OF ANCIENT ISRAEL — JUDAISM

CA A.D. 50

CA 200
Muratorian canon includes 22 of the New Testament books.

382
St. Jerome begins Latin Vulgate translation.

CA 200–100 B.C.
The Septuagint, a Greek translation of the Hebrew Scriptures, is completed.

Era of writing · Point of divergence · Translation or religious text

MANUSCRIPT EVOLUTION

For thousands of years sacred Scripture was laboriously copied character by character. Tradition and location influenced what materials were used.

B.C. A.D.

SCROLL

Hebrew Scriptures were copied onto scrolls of animal-skin parchment or, occasionally, papyrus. Synagogues today continue to use handwritten scrolls.

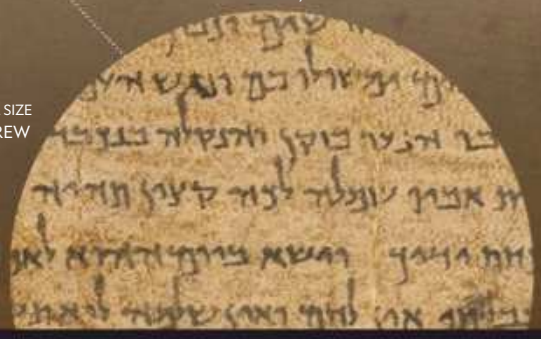
Hebrew is read right to left.

Pottery jars found in caves near the Dead Sea may have kept several of the ancient scrolls intact for centuries.

Sheets were sewn together, end to end.

24 ft

Great Isaiah Scroll
Dead Sea Scrolls
Second century B.C.



DETAIL ACTUAL SIZE
HEBREW

ALAMY STOCK PHOTO

Early codices

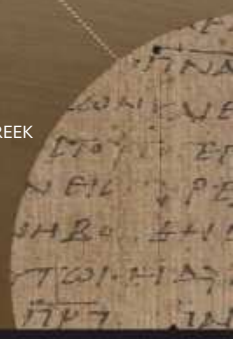
Early Christian texts were written mostly on papyrus and bound into single- or multi-quire codices, often with one column of text per page.

Sing
Leat

Stitching

Gospels
Chest
Thir

GREEK



CHESTER BEATTY LIBRARY

* THE SYSTEM OF DATING USING A.D.—*ANNO DOMINI*, OR "IN THE YEAR OF OUR LORD"—WAS DEVISED IN THE SIXTH CENTURY AND ESTABLISHED THE BIRTH OF JESUS AS THE PIVOT POINT OF HISTORY. MORE RECENT SCHOLARSHIP SUGGESTS THAT JESUS WAS

Medieval scribes were often monks who could spend weeks, months, or years working by hand on a single manuscript.

1000 1500 2000

The **Council of Hippo** (in modern Algeria) issues a list of the 27 books of the New Testament—in use today—as canon.

The rift between the eastern patriarch and western pope reaches a climax, leading to the Great Schism in 1054.

Reformers object to some Catholic doctrine and plead for changes in practice, ritual, and theology.

ROMAN CATHOLICISM

ROMAN CATHOLICISM

1517

Martin Luther writes his 95 Theses.

1455
Gutenberg Bible

CHRISTIANITY

1054

PROTESTANTISM

1611
King James Bible

EASTERN ORTHODOXY

JUDAISM

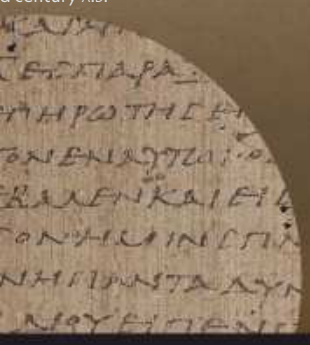
CODEX

PRINTED BOOK

le quire
her stay

Multiple quires

s and Acts Codex
er Beatty Papyri
d century A.D.



Later codices

Parchment grew more popular in the fourth century. Manuscripts tended to be larger, longer, and, starting in the fifth century, ornamented.

A variety of pigments, as well as gold leaf, were used to illustrate and illuminate text.

Codex Amiatinus
Early eighth century

LATIN

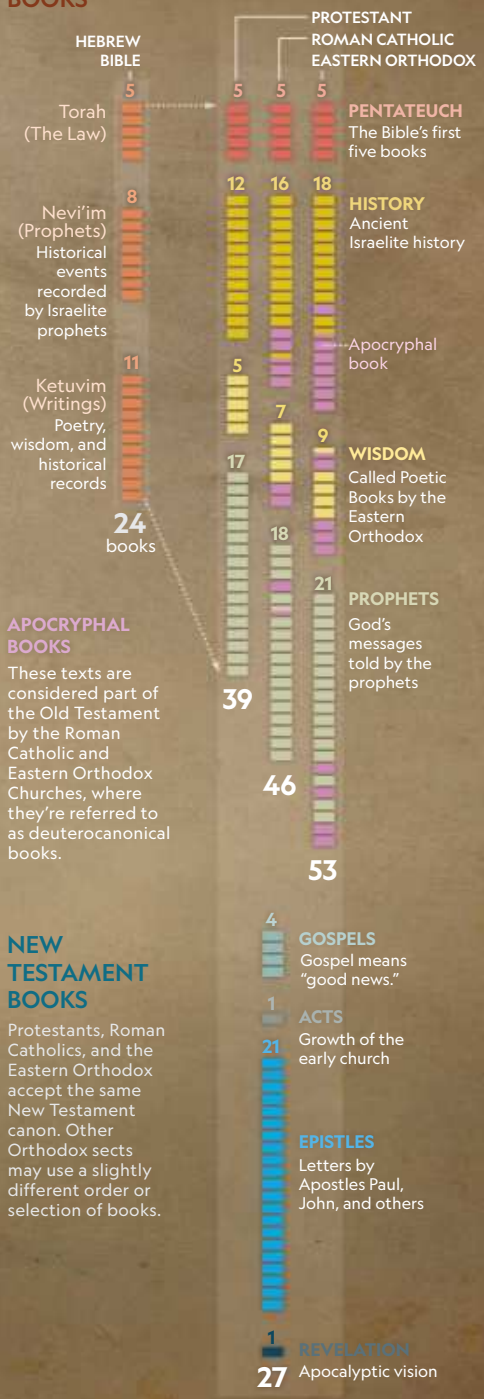
BIBLIOTECA MEDICEA LAURENZIANA DIGITAL REPOSITORY

SCRIPTURE SHARED

Jews and Christians share many sacred writings, but Jews don't regard the New Testament as Scripture. Neither Jews nor Protestants recognize the books of the Apocrypha as Scripture.

OLD TESTAMENT BOOKS

The 24 books of the Hebrew Bible are rearranged in Christian Old Testaments.



APOCRYPHAL BOOKS

These texts are considered part of the Old Testament by the Roman Catholic and Eastern Orthodox Churches, where they're referred to as deuterocanonical books.

NEW TESTAMENT BOOKS

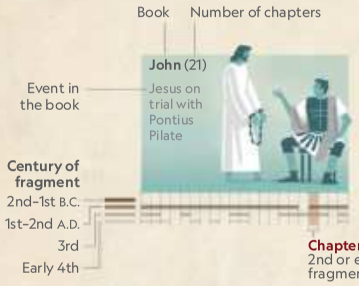
Protestants, Roman Catholics, and the Eastern Orthodox accept the same New Testament canon. Other Orthodox sects may use a slightly different order or selection of books.

OLDEST TESTAMENTS

How old are the earliest surviving copies of the stories of Noah's ark, David and Goliath, the birth of Jesus? While the oldest complete Bibles come from the fourth century A.D., many portions of Scripture endure from earlier times. This chart is based on some 400 of the oldest texts, including the Dead Sea Scrolls and early Christian writings, dating from the second century B.C. to the early fourth century A.D.

Earliest Texts, Illuminated

The 66 books illustrated here are included in Christian Bibles. Each chapter of each book is separated by vertical lines. Horizontal bars indicate the approximate time period of extant texts that contain at least a portion of the marked chapters. Many are fragmentary, such as the example at right. Unmarked chapters are known from later sources.



Chapter 18:
2nd or early 3rd century A.D.
fragment (verses 31–33; 37–38, shown)

Reconstructed text from other sources — Surviving text

JOHN 18:37-38 (Direct translation)

"For this I was born
and for this I came into the world, that I might bear witness
to the truth. Everyone who is of the truth
hears my voice." Says to him
Pilate, "What is truth?" And this
having said, again he went out to the Jews,
and he says to them, "I do not
find in him guilt."

PHOTO: THE JOHN RYLANDS LIBRARY, UNIVERSITY OF MANCHESTER (VERSO)

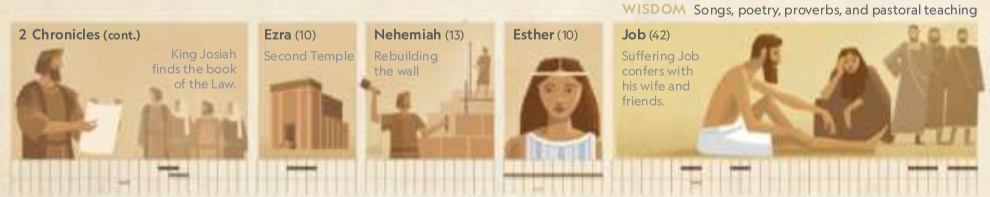
OLD TESTAMENT

The Hebrew Scriptures; creation to the end of the Israelite kingdoms

PENTATEUCH Legal, moral, and ceremonial code traditionally ascribed to Moses

HISTORY The rise and fall of the Israelite kingdoms

WISDOM Songs, poetry, proverbs, and pastoral teaching



1 Genesis Scroll Fragment
First century B.C.
Found: Qumran
Language: Hebrew

One of the oldest surviving copies of Genesis, this scroll fragment contains the first few lines of the Bible describing the creation of the world.

SHAI HALEVI, THE LEON LEVY DEAD SEA SCROLLS DIGITAL LIBRARY, ISRAEL ANTIQUITIES AUTHORITY

2 Rylands Deuteronomy Scroll Fragments
Second century B.C.
Found: Faiyum*
Language: Greek

Discarded and then reused as mummy wrappings, the original papyrus manuscript was likely created for Greek-speaking Jews.

THE JOHN RYLANDS LIBRARY, UNIVERSITY OF MANCHESTER

3 Schøyen Joshua Codex
2nd or 3rd century A.D.
Found: Oxyrhynchus*
Language: Greek

The 24 surviving pages of this codex are probably the oldest known manuscript of Joshua in Greek.

SCHØYEN COLLECTION, OSLO AND LONDON

4 Job Scroll Fragment
First century A.D.
Found: Oxyrhynchus
Language: Greek

This Greek fragment contains archaic Hebrew characters that spell the four-letter name of God. The characters 𐤉𐤄𐤅𐤄 (read right to left as YHWH) became Jehovah in English.

SACKLER LIBRARY, OXFORD UNIVERSITY

6 Chester Beatty Jeremiah Codex Fragment
2nd or 3rd century A.D.
Found: Faiyum*
Language: Greek

The two surviving leaves contain text from the Septuagint, a translation of the Jewish Scriptures into Greek.

CHESTER BEATTY LIBRARY, DUBLIN, IRELAND

Job (cont.)

Psalms (150)
King David wrote many of the psalms.
The LORD is my shepherd, I shall not want.
Psalm 23:1
This is the day that the Lord has made; let us rejoice and be glad in it.
Psalm 118:24

④

Psalms (cont.)
I will extol you, my God and King, and bless your name forever and ever.
Psalm 145:1

⑤

Proverbs (31)
Solomon the Wise
Keep your heart with all vigilance, for from it flow the springs of life.
Proverbs 4:23

Ecclesiastes (12)

PROPHETS God's messages to the Israelite people; prophecies

Ecc. (cont.)

Song of Solomon (8)

Isaiah (66)
Isaiah's vision of the throne of God
Sennacherib's army dies outside Jerusalem.
Sennacherib is killed by his sons.

Jeremiah (52)
People of Judah go into exile.

⑥

Jeremiah (cont.)
Jeremiah witnesses the temple burning.

Lamentations (5)

Ezekiel (48)
Ezekiel's vision

Daniel (12)

⑦

Dan. (cont.)

Hosea (14)
Hosea and his wife, Gomer, reconcile.

Joel (3)

Amos (9)
Amos the shepherd

Obadiah (1)

Jonah (4)

Micah (7)

Nahum (3)

Habakkuk (3)

Zephaniah (3)

Haggai (2)

Zechariah (14)
Vision of the lampstand

Malachi (4)

39 books

929 chapters

5 Great Psalms Scroll
First century A.D.
Found: Qumran
Language: Hebrew

One of the best preserved biblical scrolls from the caves of Qumran, this manuscript is one of 37 Psalms scrolls found there.

SHAI HALEVI, THE LEON LEVY DEAD SEA SCROLLS DIGITAL LIBRARY, ISRAEL ANTIQUITIES AUTHORITY

7 Chester Beatty Ezekiel-Daniel-Susanna-Esther Codex
2nd or 3rd century A.D.
Found: Faiyum*
Language: Greek

Comprising 236 pages, this unusually tall, narrow codex contains both biblical and apocryphal books.

CHESTER BEATTY LIBRARY

8 Bodmer Gospel of John Codex
2nd or 3rd century A.D.
Found: near Dishna
Language: Greek

Preserved in its ancient quires, this codex is among the earliest intact manuscripts from the New Testament yet found.

FONDATION MARTIN BODMER

NEW TESTAMENT Teachings, death, and Resurrection of Jesus; his Apostles' work and teachings

GOSPELS Eyewitness accounts of Jesus' life

Matthew (28)
Jesus and Mary
Sermon on the Mount

Mark (16)
Feeding of the multitude

Luke (24)
Jesus walks on water.

John (21)
Jesus is crucified.
Resurrection

Acts

⑧

ACTS Early work of the Apostles

Acts (cont.) (28)
Jesus' ascension into heaven
Holy Spirit comes at Pentecost.

EPISTLES Letters of instruction to early churches

Romans (16)
Apostle Paul

1 Corinthians (16)
For the wages of sin is death; but the gift of God is eternal life through Jesus Christ our Lord.
Romans 6:23

2 Corinthians (13)

Galatians (6)

Ephesians (6)

Philippians (4)

Colossians (4)

1 Thessalonians (5)

⑨

REVELATION Kingdom of God comes

1 Thes. (cont.) (5)

2 Thessalonians (3)

1 Timothy (6)

2 Timothy (4)

Titus (3)

Philemon (1)

Hebrews (13)

James (5)

1 Peter (5)

2 Peter (3)

1 John (5)

2 John (1)

3 John (1)

Jude (1)

Revelation (22)
Jesus' Second Coming

27 books

260 chapters

9 Chester Beatty Epistles of Paul Codex
2nd or 3rd century A.D.
Found: Faiyum*
Language: Greek

This well-preserved manuscript contains a collection of the Apostle Paul's letters but lacks 1 and 2 Timothy and Titus.

CHESTER BEATTY LIBRARY

*EXACT ORIGIN UNKNOWN

FERNANDO G. BAPTISTA, MATTHEW W. CHWASTYK, EVE CONANT, AND TAYLOR MAGGIACOMO, NGM STAFF; AMANDA HOBBS; LAWSON PARKER; MATTHEW TWOMBLY

BIBLE QUOTATIONS FROM THE NEW REVISED STANDARD VERSION

SOURCES: CRAIG A. EVANS, HOUSTON BAPTIST UNIVERSITY; LARRY HURTADO, PROFESSOR EMERITUS, UNIVERSITY OF EDINBURGH; BRENT NONGBRI; LAWRENCE H. SCHIFFMAN, NEW YORK UNIVERSITY; *THE DEAD SEA SCROLLS BIBLE*, MARTIN ABEGG, JR., PETER FLINT, AND EUGENE ULRICH

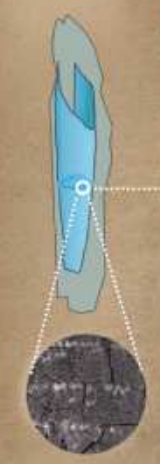
DIGITAL REVELATIONS

Powerful imaging tools are enabling researchers to see inside scrolls too fragile to unroll and recover texts too faint to see, making thousands of illegible manuscripts readable again.

READING THE ASHES

Computer scientist Brent Seales devised software to virtually unfurl a charred scroll discovered decades ago at the site of En Gedi in Israel.

1 A CT scanner reveals the scroll's internal structure in thin slices. Bright spots are denser points, such as ink containing metals.



2 Using the CT data, software creates a 3D model of a single wrap of the scroll and assigns density values to each point.

One of the five wraps (blue)

3 Software sorts the density values to produce a sharper rendering of the text.

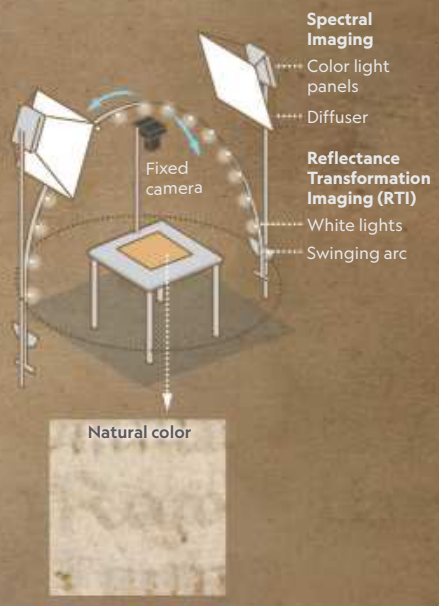
4 The 3D model and text data are mapped to a plane to create a flattened, 2D image.

5 Repeating the process for all five wraps reveals 35 lines from the Book of Leviticus. Dated to the third or fourth century, this is the oldest Hebrew text outside of the Dead Sea Scrolls.

5 pieces

THE BIG REVEAL

Digital archaeologist Todd Hanneken combined two imaging technologies that detect traces of color and texture to dramatically enhance faded texts.



1 Spectral

Ink reflects some wavelengths of light better than others, depending on its composition. Spectral imaging uses 16 colored lights to sharpen contrasts.

2 RTI

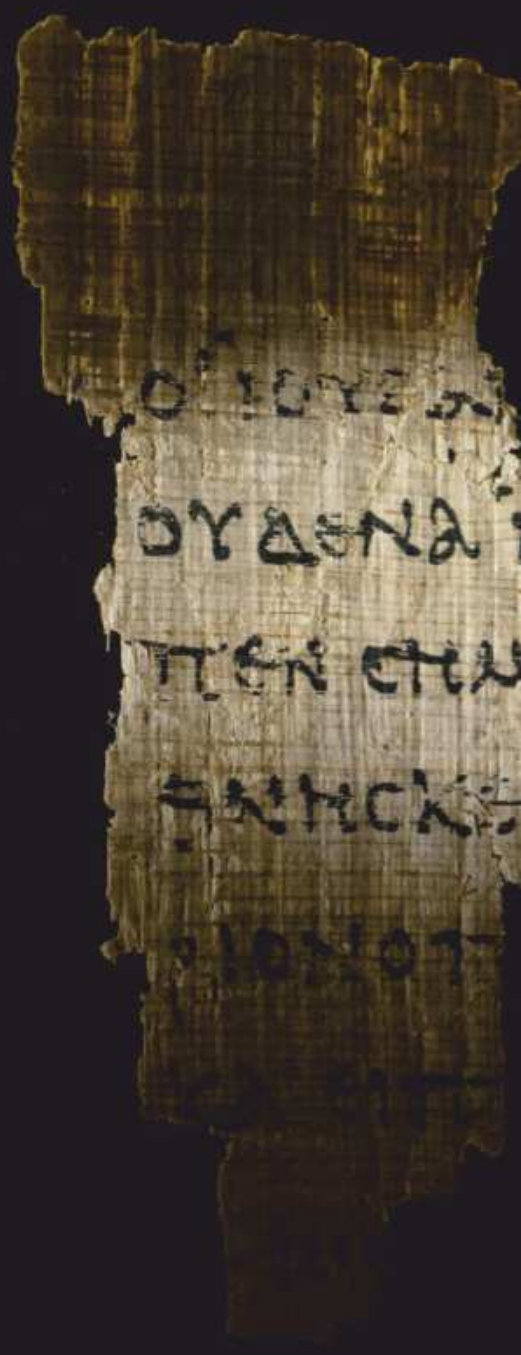
RTI lights a manuscript from several angles to show highlights, shadows, and texture, even if ink is entirely absent.

3 Spectral RTI

Spectral RTI merges the images, blending texture and color in a single amplified view.

PHOTOS AND SOURCES: SETH PARKER (IMAGES); BRENT SEALES; COURTESY THE DIGITAL RESTORATION INITIATIVE. UNIVERSITY OF KENTUCKY (LEFT COLUMN, FOUR). TODD R. HANNEKEN, ST. MARY'S UNIVERSITY (BOTTOM RIGHT, FOUR)

From humble fragments of papyrus to lavishly illustrated tomes, biblical tex reflect the eras in which they were cr



o
xts
reated.

Copied in Egypt and dated as early as the second century A.D., this papyrus fragment is among the oldest known surviving texts from the New Testament. Just a few lines in Greek from chapter 18 of the Gospel of John appear on each side.

THE JOHN RYLANDS LIBRARY AT THE UNIVERSITY OF MANCHESTER

BELOW

This Arabic translation of the Gospels was published in 1590 in Rome by Ferdinand de' Medici, a wealthy former cardinal, in hopes of converting Muslims to Christianity.

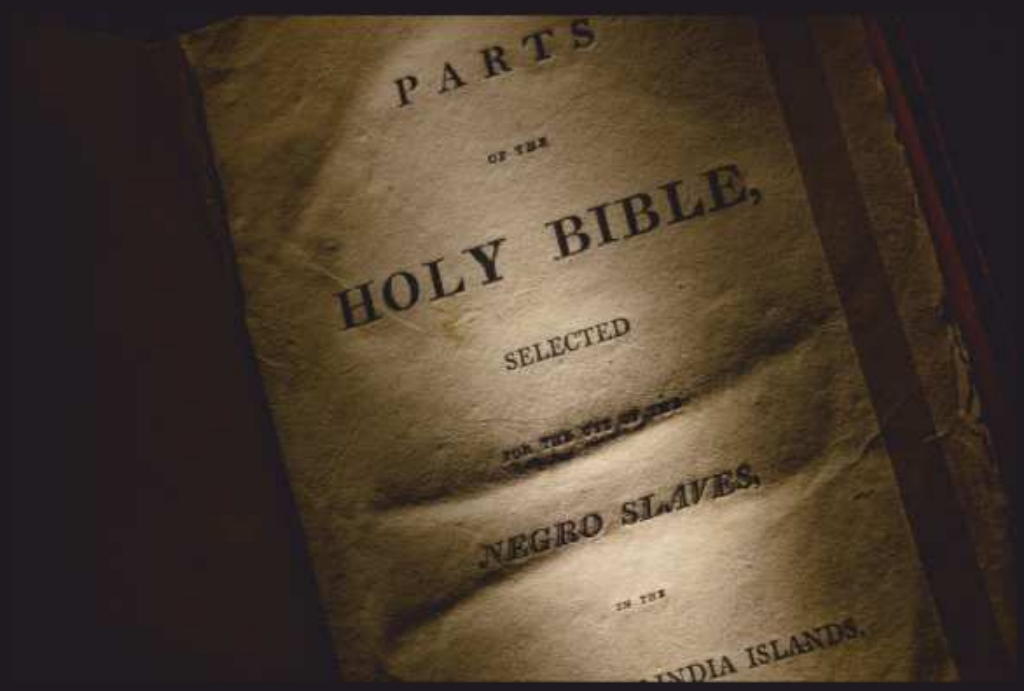
A woodcut depicts the Visitation, when the Virgin Mary goes to see Elizabeth, mother of John the Baptist.

HILL MUSEUM AND MANUSCRIPT LIBRARY, SAINT JOHN'S UNIVERSITY, COLLEGEVILLE, MINNESOTA

BOTTOM

So-called slave Bibles, like this one published in 1808 for the British West Indies, included only selected portions of the Old and New Testaments. References to freedom and escape from slavery were omitted; those encouraging obedience and submission were highlighted.

FISK UNIVERSITY COLLECTION, MUSEUM OF THE BIBLE, WASHINGTON, D.C.



The entire Bible has been translated into over 670 languages; the New Testament alone can be read in more than 1,500 additional languages.

FIRST ROW

1) The Pentateuch, the first five books of the Bible, from 1530, translated into English by William Tyndale; 2) book of hours and Psalter (book of Psalms) from the 1300s; 3) annotated Bible printed in Strasbourg, France, in 1481; 4) Codex Climaci Rescriptus written in Aramaic in the sixth century, then overwritten in Syriac in the late ninth or early 10th century

SECOND ROW

5) Ninth-century Coptic Psalter; 6) Latin New Testament circa 1300; 7) illuminated Morris-Cockerell Latin manuscript from 1225; 8) Torah scroll

THIRD ROW

9) Eliot "Indian Bible" translated into Wampanoag, 1663, first complete Bible printed in U.S.; 10) handwritten and illuminated Saint John's Bible, 2011; 11) Seville Bible in Hebrew, 1468; 12) parchment Ashkenazi Torah scroll, late 13th century

1

2

5

6

9

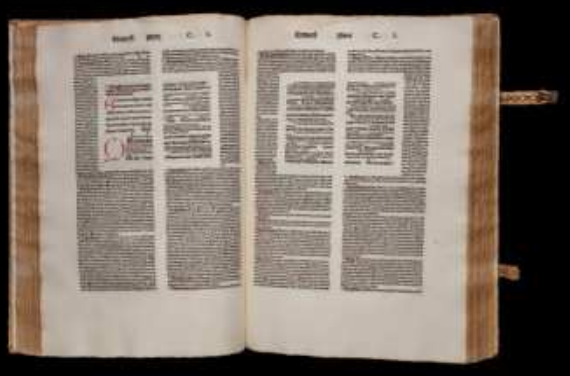
10

13

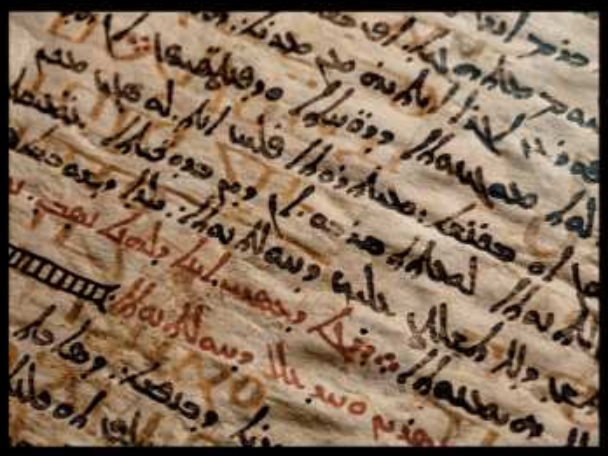
14

17

18



3



4

7

8

11

12

15

16

19

20

FOURTH ROW

13) Text detail from a Gutenberg Bible printed in 1455; 14) pocket-size Latin New Testament circa 1300; 15) German translation of Old Testament, 1560; 16) Greek New Testament, late 10th or early 11th century

FIFTH ROW

17) Greek New Testament from 1519, edited by Desiderius Erasmus, second edition; 18) ninth-century fragments of the Gospel of John; 19) Plantin Polyglot Bible showing Hebrew, Greek, Aramaic, and Latin from Antwerp, Belgium, circa 1570; 20) Ethiopian Psalter from the 18th or 19th century

Van Kampen Collection, on display at the Holy Land Experience, Orlando, Florida: 1, 7, 8, 9, 11, 13, 15, 16; Museum of the Bible, Washington, D.C.: 2, 4, 12; Hill Museum and Manuscript Library, Saint John's University, Collegeville, Minnesota: 3, 5, 6, 14, 17, 18, 19, 20; Saint John's University, Collegeville, Minnesota: 10

onely is excellent, and his praise aboue heauen and earth.

13 He shall exalt the horne of his people, all his Saints shall praise him: euen the children of Israel, euen the people that serueth him.

Cantate Domino. Psal. 149.

O Sing vnto the Lord a new Song: let the congregation of Saints praise him.

2 Let Israel reioyce in him that made him: let the children of Sion be ioyfull in their King.

3 Let them praise his Name in the dance: let them sing praises vnto him with tabret and harpe.

4 For the Lord hath pleasure in his people, and helpeth the meeke hearted.

5 Let the Saints be ioyful with glory: let them reioyce in their beds.

6 Let the praises of God be in their mouth, and a two edged sword in their hands.

7 To be auenged of the heathen: and to rebuke the people.

8 To bind their kings in chaines: and their nobles with linkes of yron.

9 That they may be auenged of them, as it is written: such honour haue all his Saints.

Laudate Dominum. Psal. 150.

O Praise God in his holinesse: praise him in the firmament of his power.

2 Praise him in his noble actes: praise him according to his excellent greatnesse.

3 Praise him in the sound of the trumpet: praise him vpon the lute and harpe.

4 Praise him in the cymbals and dance: praise him vpon the strings and pipe.

5 Praise him vpon the wel tuned cymbals: praise him vpon the loud cymbals.

6 Let every thing that hath breath praise the Lord.

FINIS.

Publication of the King James Bible in 1611 set the standard for English Scripture for some 300 years. This volume from the Museum of the Bible in Washington, D.C., is one of only two surviving first editions of the King James Bible's New Testament.


יהוה
THE NEW
TESTAMENT
of our Lord and Saviour
IESVS CHRIST.
¶ Newly Translated out of
the Original Greeke: and with the
former Translations diligently
compared and revised. By his
Majesties speciall Com-
mandement.
IMPRINTED AT LON
DON by Robert Barker, Printer
to the Kings most Excellent
Majestie. Anno 1611.
Cum privilegio.
Cor mundum crea in me Deus. Psal. 51.


THE FIRST LUNAR BIBLE
MICROFORM HOLY BIBLE
1245 PAGES
THE WORLD PUBLISHING CO. BIBLE NO. 715
TRADEMARK REG. U.S. PAT. OFF.
THE NATIONAL CASH REGISTER CO
A. D. 1971
14 - 8
D.F.
917
APOLLO 14
22K

(Continued from page 53) takers, he placed a classified ad in the *Wall Street Journal* on June 1, 1954. An Israeli archaeologist, working through an American intermediary, arranged to purchase the scrolls for the Israeli government for $250,000. All seven of the original scrolls now reside in their own wing of Israel's national museum in Jerusalem.

As word of the scrolls' discovery spread, a team led by archaeologist and Dominican priest Roland de Vaux descended on Qumran in 1949. By 1956 de Vaux and local Bedouin had found 10 more "scroll caves" containing scores of manuscripts, many of them disintegrated into thousands of fragments. It took decades for scholars, working in seclusion and secrecy, to reassemble and translate the tattered parchments. The long delay in publication spawned conspiracy theories that the powers that be—the pope? Zionists?—were deliberately suppressing the scrolls' contents.

Finally, by the mid-2000s, the translators finished publishing the bulk of their findings. The scrolls included legal texts, apocalyptic and ritual treatises, accounts of life in the Qumran sect, and remnants of 230 biblical manuscripts. Scholars were thrilled to learn that among them was a nearly complete copy of the Book of Isaiah from the Hebrew Bible. Its content was virtually identical to another copy of Isaiah dated almost a thousand years later. The Great Isaiah Scroll would become Exhibit A for scholars who defend the Bible against claims that its text was corrupted by scribes who, over centuries of copying by hand, introduced a multitude of mistakes and intentional changes. (More about this contentious debate later.)

THE HISTORY OF BIBLE HUNTING is one not only of buried treasures but also of fool's gold. As archaeologists began excavating in the Qumran caves, other Bedouin did their own digging and sold what they found to Kando. His greatest purchase was the nearly 30-foot-long Temple Scroll, the longest of the Dead Sea Scrolls. In 1967, during the Arab-Israeli Six Day War, Israeli intelligence officers seized the Temple Scroll from Kando's home, claiming it as government property. After the incident Kando reportedly started furtively moving his remaining scroll fragments to relatives in Lebanon and later to a bank vault in Switzerland.

In 2009 Steve Green began buying rare Bibles and artifacts at an unprecedented pace, eventually acquiring some 40,000 objects—one of the largest private collections of biblical material in the world. His multimillion-dollar shopping spree inevitably led him to the Kandos' doorstep. (Kando's son William took over the family business after his father's death in 1993.)

"Steve Green came to see me many times," William Kando tells me through a cloud of cigarette smoke the morning we meet in his Jerusalem shop. "He's an honest man, a good Christian. He offered me $40 million for my Genesis fragment. I refused. Some people say it is priceless." Green, through a spokesperson, says Kando set the price at $40 million, and he opted not to purchase it. Instead he bought more affordable scroll fragments.

The merchant offers me more coffee, then fumbles through a ledger. "Here, you can see," he says, pointing to a notation that he had sold seven Dead Sea Scroll fragments to Green in May 2010.

Today the Museum of the Bible has five scroll fragments on display. When I visit the museum a day before its official opening, I notice a sort of disclaimer accompanying the exhibit acknowledging that the fragments might be fakes. Kando indignantly denies that his family sold inauthentic fragments, suggesting that any forgeries must have come from less reputable dealers.

Green, for his part, seems a bit defensive when I ask about his prize acquisitions. "There've been some who've questioned some of our items, but it hasn't been conclusive," he says. "What's their evidence it's fake?" Still, Green concedes, "you would hope it would be different in the biblical world. But as it turns out, like in any other business, there are some shady people just trying to make a buck. All you can do is learn from your mistakes and not do business with them anymore."

One hundred tiny microform Bibles flew to the moon with astronaut Edgar Mitchell on Apollo 14 in 1971. The "lunar Bibles" were created by the Apollo Prayer League, NASA employees who prayed for the astronauts' safety. Later some were set in gold and sold to collectors.

MUSEUM OF THE BIBLE, WASHINGTON, D.C.

One of Green's mistakes—importing thousands of clay tablets and other artifacts that, according to experts, had likely been looted in Iraq—resulted in a fine from the U.S. Justice Department of three million dollars and forfeiture of the objects. "The fact is, most antiquities are looted, and most buyers don't ask where they came from," says Eitan Klein, deputy director of the Israel Antiquities Authority's anti-looting division, when we meet in his cramped office in Jerusalem. "Because in my view, if you are dealing with antiquities, you must get your hands dirty somehow."

Klein's phone rings. He listens, hangs up, and excuses himself, saying with a smile, "Our unit caught some looters, so I have to go."

BECAUSE THE AUTHENTIC Dead Sea Scrolls are "the most significant cultural treasure of a Jewish nature on Earth," as curator Adolfo Roitman puts it, the sacred documents are preserved with exquisite care. Meanwhile multitudes of other biblical manuscripts are left to molder in academic storerooms or be consumed by fire, flood, insects, looters, or war in countries wracked by political upheaval. Conserving and documenting them before their secrets slip away forever is "literally a race against time," says Daniel B. Wallace, head of the Center for the Study of New Testament Manuscripts in Plano, Texas.

Wallace and other globe-trotting textual scholars—most notably the Benedictine monk

Father Columba Stewart of the Hill Museum and Manuscript Library at Saint John's University in Minnesota—have logged tens of thousands of miles traveling the world on an urgent mission: to digitally document ancient biblical manuscripts in archives, monastic libraries, and other repositories and make them available to scholars everywhere via the internet. It's a daunting task. In the case of the New Testament, whose authors wrote in Greek, more than 5,500 Greek manuscripts and fragments have been found—more than any other ancient text. They total as many as 2.6 million pages, Wallace estimates, and like the Oxyrhynchus papyri, most of them have yet to receive scholarly attention.

"About 80 percent of already known manuscripts that would be of help for New Testament scholarship aren't published yet," says Father Olivier-Thomas Venard of the École Biblique et Archéologique Française, a Dominican research center in Jerusalem. "It's an embarrassment of riches," adds Venard's colleague Father Anthony Giambrone, "which frankly makes the challenges of textual criticism insurmountable. There are just not enough specialists to work on them."

The Institute for New Testament Textual Research in Münster, Germany, has sought to reduce the labor challenges by classifying biblical documents according to key passages, but such a system amounts to triage that wholly ignores numerous texts. A far more comprehensive solution may soon be technologically feasible, predicts Wallace, who hopes to use optical character recognition (OCR) software to digitize every volume of the Greek New Testament. "Right now it would take a scholar 400 years to read and collate all the known documents," he says. "With OCR, we think we can do the job in 10 years."

'If you are dealing with antiquities, you must get your hands dirty.'

EITAN KLEIN, ISRAEL ANTIQUITIES AUTHORITY

YOU'D BE FORGIVEN for raising an awkward question at this point: Why does any of this matter? Why all the fuss about old Bibles and older scraps of Egyptian papyrus? For folks like Wallace, who teaches at an evangelical seminary, and Green, who has invested much of the family fortune in a world-class museum dedicated to the Bible, it boils down to this: Is their faith based on fact or fiction?

"When visitors to our museum see an ancient text," Green says, "they're seeing evidence that

When biblical artifacts flooded the market after the 2008 global financial crisis, Steve Green, founder and chairman of the Museum of the Bible in Washington, D.C., went on a buying spree. He soon discovered the dark side of the antiquities trade, and paid three million dollars in a legal settlement for importing objects that experts said were likely looted from Iraq.

Billing itself a "living biblical museum," the Holy Land Experience in Orlando features period reenactors and a replica of the Dead Sea Scrolls caves.

what they believe isn't just a bunch of fairy tales."

But how good is that evidence? Assuming for the moment that the God of the Bible actually exists and that he somehow spoke to the authors of the ancient biblical documents—do we have now what they wrote then? After all, none of their original writings, what scholars call the autographs, have been found. Their words survive only because they were hand copied countless times until the invention of the printing press in the 15th century. And even conservative scholars admit that no two copies are exactly alike.

Few publishers would bet that such questions would produce a national best seller, but that's what happened in 2005 with the publication of the cleverly titled *Misquoting Jesus: The Story Behind Who Changed the Bible and Why*. The book's author, Bart Ehrman, argues that the "facts" about Jesus set forth in modern Bibles are based on centuries of copies, all of which say different things, so we may not know what the original texts actually said.

In person, the goateed evangelical turned atheist is even-tempered if subversively caustic. Over coffee near the University of North Carolina at Chapel Hill, where he's a professor of religious studies, Ehrman recites a host of scriptural passages that he views with scholarly suspicion. The last 12 verses of the Gospel of Mark, he says, were likely tacked on many years after the fact, as was the beginning of the Gospel of Luke, foreshadowing Jesus' birth in Bethlehem.

Many of Ehrman's assertions are debatable (literally so: he and Wallace have squared off in three public debates), but some scholars agree that Christian scribes deliberately corrupted certain passages over time. The question is one of degree.

"Broadly, I support what Ehrman is saying about this," says Peter Head, an Oxford scholar who studies Greek New Testament manuscripts. "But the manuscripts suggest a controlled fluidity. Variants emerge, but you can sort of figure out when and why. Now, it's in the earlier period that we don't have enough data. That's the problem."

The "earlier period" that Head refers to begins with the birth of Christianity in the first century A.D. and concludes in the early fourth century. And while it's true that more than 5,500 Greek New Testament manuscripts have been found, close to 95 percent of those copies come from the ninth to the 16th centuries. Only about 125 date back to the second or third centuries, and none to the first.

None of these figures rattle Ehrman's sparring partner Wallace, who considers Ehrman a friend and refers to him by his first name.

"Bart likes to point out that we don't have any autographs, only copies," Wallace says. "But the fact is, we don't have the autographs of *any* Greco-Roman literature, except possibly one fragment from one classical author."

Wallace acknowledges that the thousands of New Testament manuscripts contain myriad differences owing to scribes' errors, but he argues that because scholars have such a wealth of texts to study and compare, they've been able to identify those errors and largely recover the original wording. He also points out that an important measure of the trustworthiness of any historical document is its nearness in time to the events it purports to record.

"On average the earliest surviving copies of Greco-Roman literature are half a millennium removed from the time of composition," he says. "But in the case of the New Testament, the earliest copies are only a few decades after the fact. That's a huge difference."

Still, the lack of Christian writings from the first century would seem to be a point in Ehrman's column—a point Wallace is eager to eliminate. Too eager, perhaps.

DURING A DEBATE with Ehrman in February 2012, Wallace dropped a bombshell. A manuscript fragment of Mark's Gospel had recently been discovered that was authoritatively dated to the late first century—more than a century earlier than the oldest known text from the Book of Mark. It would be the only first-century New Testament document ever discovered, and the earliest surviving Christian text. A study of the ancient manuscript would likely be published in 2013, the Texas theologian said.

The Bible-hunting world went into hyperventilation over Wallace's disclosure. Who discovered the Mark manuscript? Where was it being kept? Was it on the market? How many millions would it cost to buy? But five years passed, and the document had yet to see the light of day.

I begin making calls in December 2017. A month later I show up at the Sackler Library

on the campus of Oxford University, which houses the world's largest collection of ancient papyri. An Italian woman in a laboratory coat leads me through a secure area. She is Daniela Colomo, a research associate at Oxford and curator of the legendary Oxyrhynchus papyrus collection excavated by Grenfell and Hunt around the turn of the 20th century.

In marked contrast to the regal Oxford townscape, the papyrology room containing one of the most vital repositories of biblical texts is a chaotic, fluorescent-lit assemblage of strewn papers, mislaid coffee mugs, and low-tech microscopes. Colomo produces a piece of acid-free paper, folded in the manner of an envelope. A brownish fragment of papyrus, not much bigger than my thumb, lies in the middle. Squinting, hovering a foot above it, I can make out a series of scratches across the ancient scrap.

Why all the fuss about old Bibles and older scraps of Egyptian papyrus? It boils down to this: Is faith based on fact or fiction?

"This is Mark," Colomo says. "The date is probably late second century, early third century. We never intended to take an official position, but there were all those blogs being written, and all the rumors. So, because of all the anonymous publicity, we have to publish it soon."

Colomo and her colleague Dirk Obbink, an American papyrologist and Oxford professor, published their findings last May. The fragment, cataloged as P.Oxy. LXXXIII 5345, was among the thousands unearthed by Grenfell and Hunt that had yet to be fully examined. The Egypt Exploration Society, which sponsored the Oxyrhynchus excavation and retains ownership of the collection, issued a statement that reads in part: "This is the same text that Professor Obbink showed to some visitors to Oxford in 2011/12, which some of them reported in talks and on social media as possibly dating to the late first century A.D. on the basis of a provisional dating when the text was catalogued many years ago."

The buildup and subsequent letdown over the much touted Mark fragment have obscured the actual importance of the discovery. Only two other fragments of Mark from before A.D. 300 are known to exist. Colomo chalks up the frenzy to first-century fever among some researchers who dream of unearthing a Gospel or epistle penned by an Apostle.

"Among the New Testament scholars, particularly in the States, there's this tendency to look for the earliest documents, hoping to find an autograph from people who met Jesus," Colomo says. "They tend to date a papyrus very early, using random similarities. This is not scholarly."

For his part, Wallace has apologized to Ehrman for announcing an unverified find. "I take full responsibility," he says. "I didn't vet it properly. It was naive on my part."

It may also be naive, Ehrman says, to expect a single, small fragment to settle the long-simmering debate over the Bible. "Would it change anybody's mind about anything?" he says. "My view is, almost certainly not. I've repeatedly said that if you find three or four early manuscripts from different places and they all say the same thing, then you have an argument. I just don't think that's likely."

RANDALL PRICE, the Qumran excavator, is also having to come to terms with long odds. In all but the rarest cases, archaeological feats are measured in increments rather than mother lodes. His and Gutfeld's team of students, friends, and family members are wrapping things up in Cave 53 one morning in late January when a shout rings out. Price's wife, Beverlee, emerges from a natural chamber, not quite a cave itself, that the team discovered recently. In her hand is a clay object about two inches long.

Price studies it. "Yep," he slowly murmurs. "That's a rim." Meaning: the rim of what might have been a scroll jar. Chances are, whatever else the sherd belonged to has long since been carted off by Bedouin. But the Bible that Price reads and believes teaches, above all else, to have faith. And where there are scroll jars...

"Hey, come on out!" he hollers into Cave 53. "We've got some digging to do!" □

Contributing writer **Robert Draper** reported on the surveillance boom in the February 2018 issue. Photographer **Paolo Verzone** is a three-time World Press Photo award winner.

THE OTHER OIL CRISIS

MALAYSIA

Bunches of oil palm fruit harvested by hand are trucked to a mill for processing in mainland Malaysia. Oil palms yield more oil per acre than do other crops. But soaring demand for the world's most popular vegetable oil has led to extensive deforestation and loss of wildlife in Indonesia and Malaysia, the biggest producers.

PASCAL MAITRE

THE WORLD'S APPETITE FOR ASIA'S **PALM OIL** IS HURTING THE ENVIRONMENT AND WILDLIFE. BUT IN AFRICA, **GABON** HOPES TO SHOW HOW TO BUILD AN INDUSTRY WHILE **PRESERVING ITS FORESTS.**

BY
HILLARY ROSNER

PHOTOGRAPHS BY
DAVID GUTTENFELDER
AND **PASCAL MAITRE**

DEMOCRATIC REPUBLIC OF THE CONGO

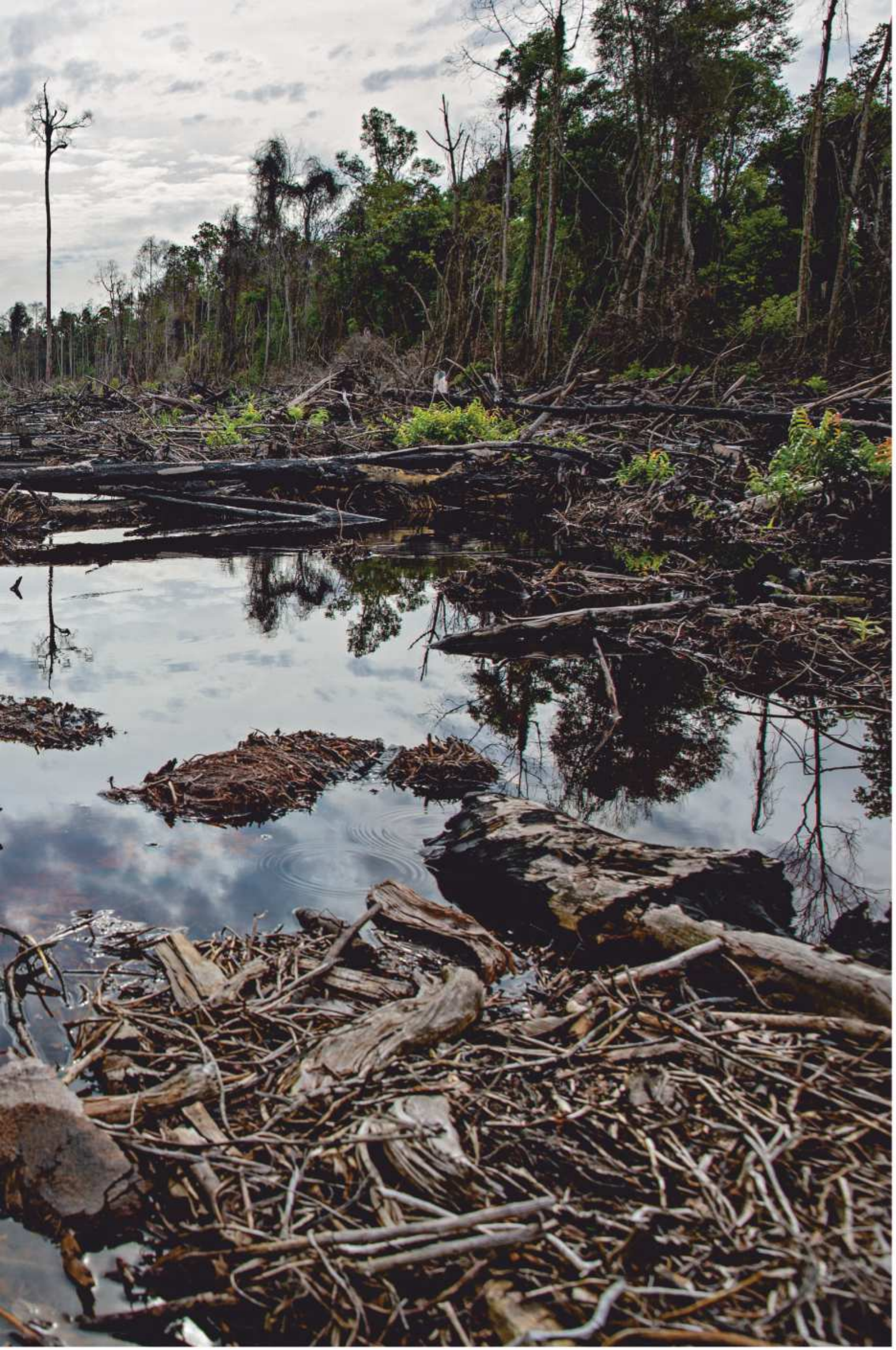
Workers at a mill in the Democratic Republic of the Congo move palm fruit from a steamer that has softened it up for pressing. The oil palm tree, *Elaeis guineensis,* is native to West and central Africa, and commercial plantations are now expanding in the region. If a full-scale boom developed, it could encroach on crucial habitat for great apes, forest elephants, and other threatened species.

PASCAL MAITRE

INDONESIA

In 2015 this forest growing on peatland on the island of Borneo was burned to clear the land for oil palms. Air pollution from fires in Indonesia that year—some natural, some not—contributed to at least 12,000 premature deaths. Nearly half of Indonesia's greenhouse gas emissions come from cutting or burning forests, including those on carbon-rich peatlands.

KEMAL JUFRI



IN southwestern Gabon, the old-growth forest stretches hundreds of miles. One January morning I disembark from a narrow boat on the shore of the Ngounié River with a few employees of Olam, a Singapore-based agribusiness company. Following elephant tracks, we plunge into the forest. We pass towering, ancient trees, chimpanzee nests, piles of day-old gorilla dung. Monkeys scamper overhead. A young Olam ranger yanks off his boots and climbs barefoot up a trunk, returning with handfuls of pink, plumlike fruits.

Wandering farther we find wild mangoes, kola nuts, bark that smells of garlic. At a sun-dappled clearing, fish splash in a watering hole. The trees around it have been scratched by elephant tusks.

To stand here in the slanting sunlight and imagine all this being razed is heart-stopping.

The place is not a park or a preserve but part of the Mouila oil palm plantation, operated by

BENIN

Palm oil is an ancient staple in West Africa, and its origins are artisanal rather than industrial. In Benin most palm oil is still produced by women for domestic use. The fruit is boiled and pounded to extract oil from the pulp. Here a woman separates the fruit fibers and shells from the oily mix, which will be boiled again to clarify the oil.

PASCAL MAITRE

Olam. If it were in Indonesia or Malaysia—the world's two largest suppliers of palm oil—loggers and bulldozers might be closing in to clear the jungle for uniform rows of oil palm trees.

Oil palms, with giant bunches of red fruit growing beneath unruly fronds, are an ancient staple crop. For millennia humans have boiled and pounded their fruit to extract cooking oil, burned their seed-kernel shells for heat, and woven their leaves into everything from roofs to baskets. Over the past few decades, however, palm oil use has exploded—in part because of the versatility and creamy texture of the oil (think Oreo filling) and in part because of the productivity of the trees. They require only half as much land as other crops, such as soybeans, to generate a given amount of oil.

Palm oil is now the world's most popular vegetable oil, accounting for one-third of global consumption. It's a common cooking oil in India and some other countries. As an ingredient, it has become difficult to avoid almost everywhere. It's in all manner of supermarket items: cookies, pizza dough, bread, lipstick, lotion, soap. It's even in supposedly eco-friendly biodiesel: In 2017, 51 percent of the European Union's palm oil consumption was to power cars and trucks.

Worldwide, demand for palm oil continues to rise. India uses the most, 17 percent of the

TREE OF PLENTY

The abundant oil from the fruit of oil palms can be found under different ingredient names in everything from cookies to soap to lipstick. A natural alternative to trans fats, it has many other advantages: It's cheap to produce, stable in processing, and slow to smoke—plus it has a long shelf life.

JASON TREAT AND RYAN T. WILLIAMS, NGM STAFF
ART: GABY D'ALESSANDRO
SOURCE: MALAYSIAN PALM OIL BOARD

Super olein
Industrial frying oils

Double stearin
Dry soup and cake mixes

Palm mid fraction
Confectionery fillings, frying oil

Mid stearin
Margarine

IE palm stearin
Pizza dough and other flaky fats

Fatty acids
Infant formula

Red palm oil

IE palm olein
Confectioneries, cookie filling

RBD* palm olein
Snack foods, cooking oils

RBD palm stearin
Pastry fats, margarines, soap, ghee substitute

Emulsifiers
Margarine, low-fat spreads, cookies, cakes, ice cream, bread

IE palm
Dry mixes

RBD palm-kernel oil
Confectioneries, ice cream, soap, cookie cream, margarine

RBD palm oil
Bakery fats, food-service frying oils

Tocotrienols
Nutritional supplements

Fruit residue
Biofuel

Crude palm-kernel oil

Crude palm oil

Palm kernel

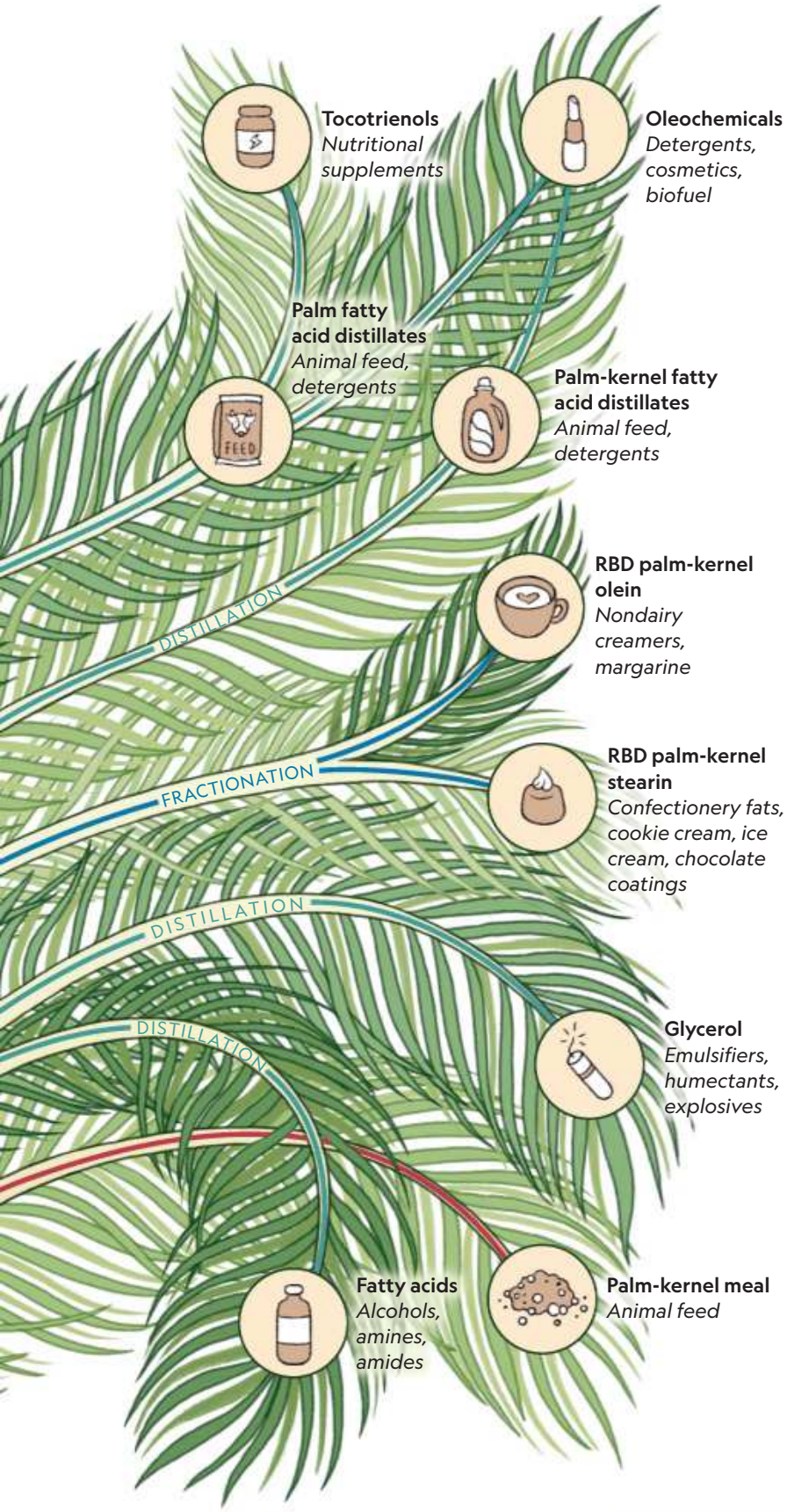
Fresh fruit bunch

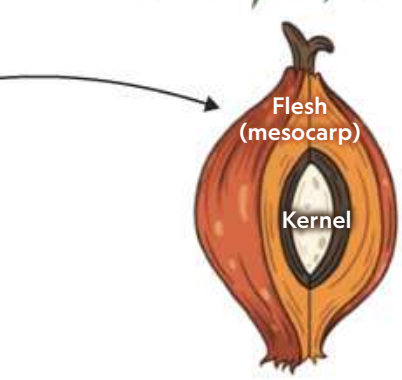
FRACTIONATION
INTERESTERIFICATION
DISTILLATION
GLYCEROLYSIS
REFINING
CRUSHING
MILLING

The palm fruit

The African oil palm *(Elaeis guineensis)* is native to Africa but has been introduced all over the world. The tree is an oil-producing machine with some 20 fruit bunches, found at the top of its trunk, each containing up to 3,000 palm fruits.

* RBD refers to refined, bleached, and deodorized oil.





Processing palm

The flesh of the palm fruit and the kernel (once crushed) both produce oil. After refining, the different oils are modified into varying products.

Chemical

GLYCEROLYSIS
Chemical bonds broken with glycerol to keep oil from separating from water

INTERESTERIFICATION (IE)
Fatty acids rearranged to change melting point

DISTILLATION
Oil heated and cooled to extract fatty acids

FRACTIONATION
Oil separated into liquids (oleins) and solids (stearins)

REFINING
Impurities removed from oil

CRUSHING
Kernel cracked to remove shell and then crushed and pressed

MILLING
Palm fruit steamed and pressed to separate oil from kernel and fibers

Mechanical

global total, followed by Indonesia, the EU, and China. The United States currently ranks eighth. In 2018 global consumption is expected to reach 72 million tons, or roughly 20 pounds of palm oil per person.

Supplying that demand has taken a huge toll. Since 1973, nearly 16,000 square miles of rain forest on Borneo, the island shared by Malaysia and Indonesia, have been logged, burned, and bulldozed to make way for oil palm. It accounts for a fifth of the total deforestation on Borneo since 1973—and for 47 percent since 2000.

All that deforestation has been devastating for wildlife. Nearly 150,000 critically endangered Bornean orangutans perished from 1999 to 2015, and although the main culprits were logging and hunting, palm oil was a major factor. It also exacerbates climate change—nearly half of Indonesia's greenhouse gas emissions come from deforestation and other land-use changes—as well as acute air pollution. The haze from Indonesian forest fires, many deliberately set to clear land for oil palms, caused at least 12,000 premature deaths in 2015 alone.

People in the path of plantations have suffered in other ways. Human rights abuses such as child labor and forced evictions have been well documented. On the Indonesian island of Sumatra, palm oil companies have sometimes bulldozed entire indigenous villages, leaving their residents homeless and reliant on government handouts.

That kind of shortsighted ecological rampaging is precisely what Gabon is trying to avoid. The Eden I visited will not be razed: Olam has protected it as part of an agreement with the government that allows the company to grow oil palms elsewhere on its concession.

"What we're trying to do in Gabon is find a new development path where we don't cut all our forest down but keep a balance between oil palm, agriculture, and forest preservation," says Lee White, the conservation biologist who runs Gabon's parks agency. As the nation of fewer than two million people embarks on industrial-scale agriculture, the government is using scientific assessments to decide which parts of its expansive forests have high conservation value and which can be opened to oil palms.

In Africa as in Southeast Asia, the crop is here to stay. Producing countries depend on the income. Boycotting palm oil is unwise: Alternative oil crops would swallow even more land. It's also futile, because palm oil is so pervasive

INDONESIA

Indonesia's palm oil frontier is on the island of New Guinea; forests and peatlands on Borneo and Sumatra already have been logged extensively and burned to make way for oil palm plantations. According to Greenpeace, some of this new plantation in Papua Province violates an Indonesian moratorium on clearing peatland.

ULET IFANSASTI, GREENPEACE

and so often processed into ingredients, such as sodium lauryl sulfate and stearic acid, whose origins are opaque to consumers. We're not likely to cut palm oil consumption radically. The only way forward is to make its production less bad.

INDONESIA AND MALAYSIA are now the epicenter of palm oil, but the oil palm tree, *Elaeis guineensis,* is not native to Asia. It comes from West and central Africa, where archaeologists have found 3,000-year-old palm nuts buried in streambeds deep in the forest. Throughout the 1800s, British traders imported African palm oil, using it for a growing number of products, from soap to margarine to candles. Once scientists discovered how to isolate glycerin from the oil, its applications multiplied: pharmaceuticals, photographic film, perfume, even dynamite.

By the turn of the 20th century, oil palms had been shipped to Indonesia, and commercial plantations had taken hold. In the late 1930s they covered just 250,000 acres. Over the next half century or so, agricultural breakthroughs—breeding trees resistant to a common pathogen, introducing an African weevil for pollination—led to greater yields and a flourishing investment in oil palms.

Still, as recently as the 1970s, three-quarters of Borneo was covered in lush rain forests. But as global demand for palm oil grew, companies racing to supply it burned and bulldozed some of those forests. Health concerns over trans fats fueled the boom—palm oil replaced trans fats in many products—as did rising demand for biodiesel. By the early 2000s, the boom was in full swing, and thousands of square miles of lowland forests and peatlands across Borneo were planted with oil palms.

By then, pressure from international conservation groups over deforestation was growing, and WWF teamed with some of the biggest palm oil producers and buyers to begin creating standards for producing palm oil more responsibly. Plantations certified by the Roundtable on Sustainable Palm Oil (RSPO) can't clear "primary forests or areas which contain significant concentrations of biodiversity (e.g. endangered species) or fragile ecosystems." They must minimize erosion and protect water sources. They must pay a minimum wage and get "free, prior, and informed consent" from local communities.

Today the RSPO certifies roughly one-fifth of the global supply. Many consumer goods manufacturers that rely on palm oil—Unilever, Nestlé,

INDONESIA

Workers from the Borneo Orangutan Survival Foundation release an orangutan onto a protected island. Raised at the Nyaru Menteng sanctuary after losing its jungle home, the ape is being rehabilitated so it can be returned to the rain forest—if a large enough patch can be found. Deforestation and hunting killed nearly 150,000 Bornean orangutans from 1999 to 2015.

ULET IFANSASTI

Procter & Gamble—have pledged to switch their supply chains exclusively to certified palm oil over the next few years. That's a big step forward. But it's not enough.

What's essential and still mostly lacking is government intervention in producing countries. "We in the conservation community were vastly overoptimistic in thinking that market-based solutions alone could solve this," says John Buchanan, who runs the sustainable food and agriculture markets program at Conservation International. "If the government isn't on board or doesn't have the capacity or doesn't know what it's doing," he says, the rain forest still takes a hit.

ON A STICKY AFTERNOON near the northeastern tip of Borneo, small groups of elephants graze by a murky river. As the sun drops toward the treetops, the groups converge at a muddy riverbank. Soon more than 50 elephants are swimming in an orderly line across the wide, fast-moving Kinabatangan River, bobbing their giant heads and spraying water out their trunks.

The Kinabatangan is among the easiest places to see wildlife in Sabah, the Malaysian state that occupies northern Borneo. From boats on the river, tourists can view rare and iconic species—Borneo pygmy elephants, proboscis monkeys, rhinoceros hornbills, even orangutans—without getting their boots dirty.

It's a thrill to watch these animals in the open. But the reason they're so visible is that they have nowhere else to go. For endless, sprawling miles around the river, the forest has been obliterated and replaced by oil palms. You can drive for hours, passing a parade of tanker trucks carrying palm oil, and barely see another species of tree.

In Sabah in the 1970s, the government turned to agriculture to address its decades-long overdependence on timber. It earmarked large swaths of fertile flatland in lowland forests, including the Kinabatangan region, for growing crops. "The assumption was that all the best soil should be allocated for agriculture," says John Payne, a conservation biologist who has lived in Sabah since 1979.

Through the 1980s, Sabah's agricultural land was largely devoted to cocoa. But when falling world prices and a pest called the cocoa-pod borer made the crop less profitable, most plantations switched to oil palms. Land was cheap, so companies from the Malaysian mainland began snapping it up, building mills and other infrastructure. That made it easier for growers to get their fruit to market—and large-scale forest clearing began in earnest. Today one-fifth of the state is covered in oil palms. Sabah produces more than 7 percent of the world's palm oil.

The ecological cost has been astonishing. Many remaining forest fragments are disconnected from one another—islands of jungle that look intact but are largely empty of animal life. "What used to house the highest density of orangutans is now oil palm," Payne says.

Amid all the loss, it can be hard to find hope. But in Sabah, a group of scientists, activists, RSPO members, and government officials is trying to right past wrongs. Payne now runs the Palm Oil & NGO (PONGO) Alliance, an industry-NGO coalition that aims to convert 5 percent of the biggest plantations on Borneo back to forest for orangutans. (*Pongo* is the ape's genus name.) Hutan, the conservation organization that took me up the Kinabatangan, has over the past decade planted more than 100,000 trees of 38 species, trying to preserve a corridor for wildlife along the river.

And at the helm of the state's forestry department until recently was Sam Mannan, the chief conservator of forests. Under his leadership Sabah expanded its protected lands over the past decade from 12 to 26 percent of the state—more than 7,000 square miles. Mannan's goal was to increase that to 30 percent by 2025, linking up parks, wildlife reserves, and other blocks of state-owned forest with replanted corridors for animals to move through.

A gregarious man with a devilish streak—he once joked at a press conference that rhinos were going extinct because "they're stupid"—Mannan believed in collaborating with palm oil producers. "Without oil palm, conservation in Sabah would be in trouble," Mannan told me in his office in the seaside city of Sandakan, once the island's timber capital. Only petroleum contributes more revenue to Sabah's government than the oil palm industry. "The money is going back to conservation," Mannan said.

You could argue, I pointed out, that without oil palms you wouldn't need as much money for conservation.

"You could argue that way," Mannan said, "but you would be poor."

The palm oil boom has helped bring clear economic benefits to Sabah: paved roads, better schools, satellite television. In Kota Kinabalu, the state's capital, gleaming new shopping malls feature Western and Asian luxury brands.

This past August, Mannan was terminated by Sabah's new government, which had launched an investigation into possibly illegal logging deals made by the previous administration. Mannan had managed to annoy those on both sides of the palm oil debate in Malaysia during his nearly two-decade tenure. But many environmentalists had considered him a restraint on the industry—a "visionary, bold, and effective" government leader, Payne says.

ULTIMATELY, SAYS RSPO CEO Darrel Webber, a Sabah native, the culture of the palm oil industry must change. With Mannan's backing, Webber and a Malaysian activist, Cynthia Ong, launched an ambitious effort to do that in Sabah. Their goal is to teach everyone from smallholders with just a few acres to high-flying CEOs how and why to do palm oil better—and then to certify the state's entire supply as sustainable.

"As demand increases and Sabah wants to supply that, we have to put some lines in the sand," Ong says.

The state hopes to be certified as a whole by 2025, though exactly how is still a question. "We're building the plane while flying it," Ong says. Wild Asia, a Malaysian nonprofit, is organizing hundreds of smallholders in the

Kinabatangan and other regions into groups that can be certified together and sell palm fruit to a certified mill. Nestlé, a large palm oil consumer that doesn't own plantations itself, is helping to fund the project. Farmers get a better price; RSPO members such as Nestlé get a way to trace their oil. "We want to link this to the supply chain," says Kertijah Abdul Kadir of Nestlé.

Since 2011 she also has overseen the planting of some 700,000 trees along the Kinabatangan River, covering more than 6,000 acres. Elsewhere in Sabah, Wilmar, the world's largest palm oil supplier and another RSPO member, is replanting forests to protect watersheds and create wildlife corridors. Reforestation is labor-intensive, expensive, and slow—several lifetimes of waiting won't produce anything resembling an old-growth rain forest. But it's a start.

Critics of the RSPO complain that working with companies that caused the loss of forests renders the effort suspect. They say one of the main requirements for certification—no new deforestation—sets the bar far too low.

The RSPO's Webber, who once worked for WWF, responds by comparing the palm oil industry to St. Paul on the road to Damascus. "Do you forgive a huge sinner because that person could be your greatest missionary?" Webber asks. "Or do we keep all the sinners out, and then what change would we have? We have to find a way to bring on board the whole group."

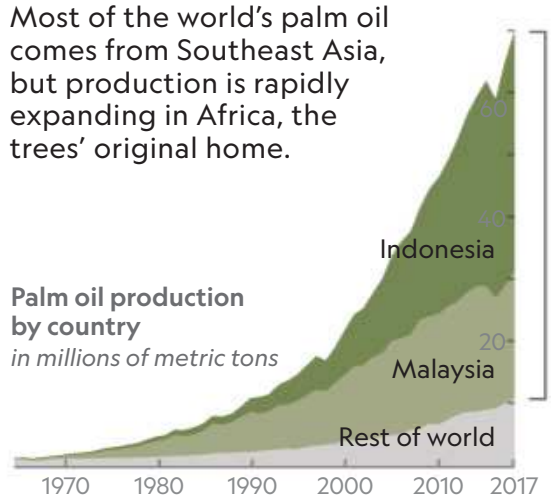
During the past decade, Webber says, a growing number of palm oil companies have accepted the need for change. "We've got quite a few in acceptance but also quite a few in denial. Our job is to push this long tail of producers into acceptance. It will take a while."

IN GABON, ONE OF AFRICA'S most forested countries, palm oil is coming home, and a boom may be on the horizon. Situated on the Equator and on the continent's west coast, Gabon is roughly the size of Colorado with a third of the people. More than 76 percent of the country is covered in forest, with 11 percent of its land area protected in national parks. It's a wildlife wonderland.

"It's exactly the kind of large, intact forest you want to protect from any kind of development," says Glenn Hurowitz, CEO of Mighty Earth, a Washington D.C.-based environmental organization that has criticized Olam's palm oil operations in Gabon. "There's so much

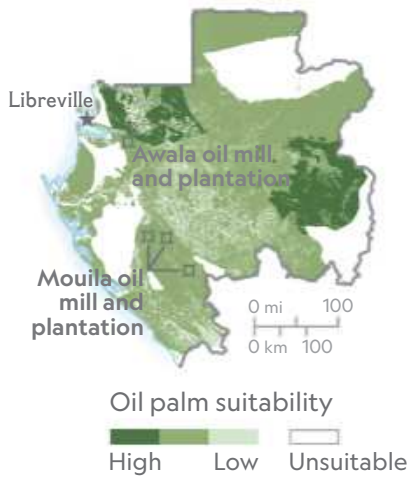
Hot Commodity

Oil palms grow best in the steamy tropics, where rainfall and sunshine are abundant. Most of the world's palm oil comes from Southeast Asia, but production is rapidly expanding in Africa, the trees' original home.



85% of palm oil is produced in Indonesia and Malaysia.

Borneo today
Industrial oil palm plantations have caused 47 percent of the deforestation on the island since 2000. Some 877,000 acres are currently lost each year.



Gabon's future
Little of Gabon's land is planted with oil palms. But as it looks to diversify its economy beyond petroleum, Gabon is exploring how to embrace the cash crop sustainably.

MATTHEW W. CHWASTYK AND RYAN T. WILLIAMS, NGM STAFF
SOURCES: USDA; DAVID GAVEAU AND OTHERS, BORNEO ATLAS, CENTER FOR INTERNATIONAL FORESTRY RESEARCH; INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS

MALAYSIA

A worker harvests palm fruit on a plantation in Sarawak, one of two Malaysian states on the island of Borneo. These mature trees are about 25 years old, which means they will soon be cut down and replaced. Oil palm trees produce less fruit as they age, and taller trees are more difficult to harvest.

PASCAL MAITRE

MALAYSIA

An excavator grabs palm-fruit bunches to load onto a conveyor belt, which will take them to a steamer. Palm oil production is far more mechanized in Asia than in Africa. This Malaysian mill, in Perak state, can process 44 tons of fruit an hour, which will yield 2.2 tons of crude palm oil. It runs 24 hours a day.

PASCAL MAITRE

degraded land [across the tropics]. Why would you send your palm oil plantations to countries that have so much existing forest?"

One answer is that Gabon wants them. The former French colony has the fourth highest GDP per capita in sub-Saharan Africa, but much of the revenue comes from petroleum. It needs to diversify. Hurowitz argues that Gabon should be developing ecotourism instead. A relatively safe country with spectacular parks and wildlife, it has few airstrips, barely passable roads, and scant lodging. There's a huge opportunity for more tourism—one that Gabon's parks agency, the Agence Nationale des Parcs Nationaux (ANPN), is pursuing.

Tourism is only part of what the country needs. Gabon imports much of its food: Wheat and milk come from France; beef is flown in from India and Brazil. The government of President Ali Bongo Ondimba, who won a controversial election in 2016 to a second seven-year term, wants to add commercial agriculture—including palm oil—to Gabon's economy. That requires cutting down trees.

Recognizing the conflicting demands on its land, the government has embarked on a project few other nations have tried: a national land-use plan.

Lee White, ANPN director and one of the president's closest advisers—British born, he

GABON

Singapore-based agribusiness giant Olam has opened two new oil palm plantations, each with its own mill, in this west-central African country. Three-quarters of Gabon is covered in forest, and commercial agriculture is close to nonexistent. The government wants to develop that sector with crops such as oil palms—but without doing the kind of environmental damage that was done in Southeast Asia.

DAVID GUTTENFELDER

has lived in Gabon since 1989 and has dual citizenship—oversaw the process of mapping the country's land and wildlife and determining which areas should be developed for agriculture. The government granted two new oil palm concessions to Olam and later sold the company an existing plantation. Olam now operates on 500 square miles, or 0.5 percent of Gabon's land area. Some 215 square miles are planted in oil palms.

On a bright January morning, Christopher Stewart, Olam's chief sustainability manager, maneuvers a Mitsubishi SUV along the potholed highway southeast from Libreville, the capital. Trucks whiz past carrying giant okoume logs—Gabon's chief timber export, bound in large part for China and Europe. Beyond Libreville's sprawl, tiny villages dot the countryside. Nearly every cluster of houses has a roadside stand, consisting typically of an overturned rusty metal drum and a wooden rack. The drums are covered with bananas or plantains, bowls of brightly colored jungle fruits, plastic water bottles filled with bathtub palm wine. Hanging from the racks, all along the highway, are furry and spiny carcasses: porcupines, blue duikers, the occasional monkey, a civet, a crocodile, the haunches of a gazelle.

Much of that bush meat is illegal—and also perhaps understandable, in a country without much domestic meat production. Illegal bush meat is offered at many restaurants in Libreville. Poaching is a big issue for Olam; locals and workers use the plantations as access points to the forest, where they have been known to hunt at-risk species. So Olam rangers patrol the protected forests. At the plantation gates, guards search exiting cars.

Two and a half hours from Libreville, we pull onto a red dirt road toward the Awala plantation. This area is secondary forest, one of the places where logging first began in Gabon. The government gave Olam roughly 50,000 acres here—of which the company has planted oil palms on about a third. Another third is conserved as one block of forest, and the rest remains standing in smaller parcels, some of it on steep hillsides.

Inside the plantation, it's easy to lose your sense of direction amid row upon row of palm trees, punctuated by indistinguishable dirt roads. At the end of each row, workers have piled fresh palm-fruit bunches and loose fruit. In the afternoon other workers will toss the fruit into dump trucks, which will deliver it to an on-site

GABON

More than half of Olam's Mouila plantation, where these workers are planting palm saplings, occupies savanna—a site chosen to avoid more deforestation. Gabon has developed a national land-use plan that attempts to "keep a balance between oil palm, agriculture, and forest preservation," says parks agency director Lee White.

DAVID GUTTENFELDER

mill that processes 50 tons of oil an hour.

At Olam's Mouila plantation, farther south, an even bigger mill is producing twice as much oil. More than half the planted area at Mouila was open savanna. Research here has revealed the presence of a rare antelope, the southern reedbuck. Photographed by a camera trap in 2017, the animal is helping White justify a new national park in the savanna.

Stewart, who has a Ph.D. in ecology, helped set up the RSPO program in Southeast Asia before joining Olam. On our boat trip back from the old-growth forest at Mouila, we talk about the devastation in Indonesia. He visited areas with biologists who had worked only a few years earlier in intact rain forest—and were returning to find it all destroyed. Stewart chokes up as he recalls this. He's immensely proud of Olam's conservation efforts in Gabon.

Atop a small hill within the plantation, we climb to the roof of Stewart's truck. For 180 degrees, the rows of oil palms stretch nearly to the horizon. In the scorching sun, the monochrome view is dizzying. The map Stewart holds is even more sobering. This section of plantation covers nearly 40,000 acres; what we're seeing is less than 7 percent of that.

As an ecologist, Stewart hates the idea of trees being cut. But, he says, "I know that this is actually in Gabon's long-term interest for these

GABON

At an oil palm nursery in Gabon, Olam gardeners tend to seedlings. Gabon's economy is largely petroleum based; it imports much of its food. The government sees industrial agriculture as an important part of the nation's future.

DAVID GUTTENFELDER

projects to be in the right place and managed well and to show what well-planned, well-managed agriculture can do." White agrees. Olam isn't undermining protected areas, he says: "Olam is helping me create more national parks."

SEVEN HOURS FROM LIBREVILLE, at the end of three hours of bone-jarring dirt roads, lies Lopé National Park—one of 13 national parks White helped create. He lived here for 15 years and still visits often to do wildlife research. One evening, sitting in the open-air living room of the research station, White sips whiskey as lightning makes purple streaks across the starry sky. In the forest around us, families of gorillas and mandrills are bedding down for the night. Leopards and caracals are waking up to hunt.

Once you start clearing forests for agriculture, it becomes easier to clear ever more. Does White worry about that? He smiles. "I'm not really a worrier," he says, before reframing the risk: "If in 50 years' time we can't feed the number of human beings we have on the planet, then highly productive, humid, tropical places where you can grow vast amounts of food are going to come under threat."

On hilltops near Lopé's western boundary, French archaeologist Richard Oslisly has uncovered evidence of Stone Age and Iron Age communities—chips from the making of quartz arrowheads, iron tools and furnaces. Three thousand years ago, Bantu peoples began to migrate along the Atlantic coast to Gabon from Cameroon. They brought oil palms with them. Wading in a stream in Lopé's forest, Oslisly scratches at the bank and pulls out domesticated palm nuts dating back two millennia.

By around 1,500 years ago, those early farmers had covered large parts of Gabon and northern Congo in palm groves. "Central Africa," White says, "probably looked like Indonesia does today." A drastic population crash—perhaps caused by an epidemic—wiped out those Iron Age people. The rain forest came roaring back.

"Now we are starting the cycle again," White says. "Our management actions will tell whether once again we destroy the forests or if we can maintain an equilibrium." For humans, balance is often an elusive goal. □

Hillary Rosner's last article for the magazine was about the pine beetle epidemic in western U.S. forests. **David Guttenfelder** and **Pascal Maitre** have both worked extensively in Asia and Africa.

NATIVE AMERICAN photographers are pushing back against portrayals of their culture by non-natives, capturing scenes that reflect alternative views of indigenous life.

RECLAIMING **OUR STORIES**

Diversity in America

A YEARLONG SERIES

Photo illustration by

CARA ROMERO

Tribal affiliation: Chemehuevi

In this staged photograph, Cara Romero has added red lighting and stars in the sky to reflect her view of the supernatural in daily life. Derek No-Sun Brown, a Shoshone-Bannock and Bois Forte Band of Chippewa, is Coyote, a Native American trickster. He poses, along with Dina DeVore (left), a Jemez and Kewa Pueblo, and Kaa Folwell, a Santa Clara Pueblo, in front of Saints and Sinners tavern in downtown Española, New Mexico, to show the connection between modern and traditional Native American experiences.

Previous photograph by

JOSUÉ RIVAS

Mexica and Otomi

Protesters fighting the construction of the Dakota Access Pipeline leave the Oceti Sakowin camp near the Standing Rock Indian Reservation after an order from law enforcement in February 2017. Photographer Josué Rivas founded the Standing Strong Project, which explores indigenous identity, sovereignty, and resilience. Activism over the pipeline helped inspire many American Indian political candidates to run for public office in 2018.

Photograph by

KALI SPITZER

Kaska Dena and Jewish

Sasha Taqseblu LaPointe wrote a memoir, "Little Boats," about growing up mixed heritage on a reservation, surviving sexual violence, and finding strength through her lineage. She's named after her great-grandmother, Vi Taqseblu Hilbert, a tribal elder, author, and cultural conservationist who worked to spread her tribe's language across the Pacific Northwest. LaPointe, who is Coast Salish, from the Nooksack and Upper Skagit tribes, says that "despite what we have endured as indigenous women, we're still able to hold our heads high, to look into the lens as if to say, We're still here. We're not invisible, and you can't ignore us." Her tintype portrait is part of photographer Kali Spitzer's "An Exploration of Resilience" project.

Photograph by

WILL WILSON

Navajo, Irish, Welsh

Enoch Kelly Haney is a celebrated artist, was principal chief of Seminole Nation, and served in the Oklahoma state legislature. "The Guardian," a statue Haney created using 4,000 pounds of bronze, stands on top of the Oklahoma State Capitol dome. Growing impatient with traditional portrayals, photographer Will Wilson began using a combination of old and new technologies—tintypes, a technique that reverses a photo image, and augmented reality—to create a new approach. As part of Wilson's "Talking Tintypes," Haney's photograph has been "given voice" through augmented reality. Scan the image with the Layar app on a smartphone to hear him speak.

Photograph by

MATIKA WILBUR

Swinomish and Tulalip

Hannah Tomeo, of the Colville, Yakima, Nez Perce, Sioux, and Samoan tribes, is a sophomore track standout at Portland State University in Oregon. The 2016-17 Northwest Indian Youth Conference princess, Tomeo stands in the traditional territory of the Methow, one of the 12 indigenous bands of the Confederated Tribes of the Colville Reservation. Tomeo says she was discouraged from running by teachers and coaches who made negative assumptions about Native Americans, but she motivated herself to become the top runner at her high school. The photograph is part of Matika Wilbur's "Project 562," an effort to collect portraits and oral narratives from tribal nations in the United States.

Photograph by

BRIAN ADAMS

Inupiat

Jonas Mackenzie, an Inuit musician, singer, and lover of rock-and-roll, blues, and classic country music, posed outside the high school in Kaktovik, Alaska, in 2015 for the "I Am Inuit" project. Photographer Brian Adams was inspired to use images and personal stories to connect the world to Inuit people and culture, because "for a half-Inupiat boy in a predominantly white town, it didn't take long for me to understand that who I was, was already decided for me by the community. I was an Eskimo, disconnected from his culture but expected to know what muktuk tastes like, even though my father's whaling village was over 600 miles away."

Photograph by

JENNY IRENE MILLER

Inupiat

Will "Kusiq" Bean, from the Inupiat, Aleut, Yupik, and Athabaskan tribes, lives in Anchorage, Alaska. Jenny Irene Miller took the picture for "Continuous," a portrait series that focuses on gender diversity, sexual orientation, and pride, to help the LGBTQ2+ indigenous community embrace their identity. (The "2" stands for two-spirit identity, for native people who feel they have both male and female spirits; the plus sign stands for acceptance of all.) "By increasing our visibility, I hope it will inspire other LGBTQ2 Alaska native persons to become more comfortable with their own identity," Bean says. "I've struggled with being queer and being Alaska native, but I'm realizing that I'm neither but both together, and I am proud to be a part of these beautiful communities."

RECLAIMING OUR STORIES Native Americans are recasting narratives about indigenous culture, countering the racist fixations that have plagued views of Indian life throughout U.S. history.

By **TRISTAN AHTONE**
Photographs by **DANIELLA ZALCMAN**

Madeline Sayet grew up on native land in southern Connecticut, where Mohegans have lived for thousands of years.

The daughter of a tribal historian and a defense lawyer, she heard tales of Chahnameed, a Mohegan trickster character. When she turned seven, her grandfather gave her Shakespeare's complete works for her birthday. "Almost as early as I had traditional native stories, I also had Shakespeare," Sayet says, recalling her earliest encounters with the bard.

Sayet was 14 when she first acted in a Shakespeare play, appearing as Iris in *The Tempest*. Later she was in a production of *Macbeth* and played Juliet in *Romeo and Juliet*. Now, at 28, she's directing productions of everything from classics by Shakespeare and operas by Wolfgang Amadeus Mozart and Claudio Monteverdi to the work of William S. Yellow Robe, Jr., an Assiniboine playwright widely viewed as a pioneer in American Indian theater. Sayet's goal: to lift native voices in theater and incorporate indigenous and Mohegan worldviews into her work. She has become one of the country's most sought-after artistic directors and has received dozens of awards and accolades. The *New York Times* and *Wall Street Journal* have praised her work, which the *Journal* called "enchanting."

Yet Sayet, like many other Native Americans, says she often feels frustrated by efforts to erase or ignore indigenous people.

It's a common theme among the 5.6 million Native Americans in the United States. American Indians represent 573 federally recognized tribes. More than 70 percent live not on reservations but in urban areas. Many are active in civic life; this fall, more than a hundred Native Americans, a record number, ran for public office at the state and federal level. Two candidates from New Mexico, Deb Haaland, a Laguna Pueblo, and Yvette Herrell, a Cherokee, along with Kansas' Sharice Davids, of the Ho-Chunk Nation, sought to become the first indigenous women elected to the U.S. Congress.

Even so, most of today's narratives about indigenous Americans are cast through a negative lens, focusing on health disparities, economic disadvantages, poverty, or addiction, according to the First Nations Development Institute, a nonprofit that seeks to improve the economies of native communities.

"There's a real invisibility when it comes to Indian people," says Michael Roberts, a Tlingit who leads the Colorado-based institute. "We don't show up in the media, we don't show up in textbooks, we don't show up in everyday conversation. Folks don't know Indians or anything about Indians."

Yet signs of indigenous culture—and how Native Americans have helped shape the nation's history—are everywhere. Thousands of U.S. communities, schools, parks, streets, and waterways have names derived from Native American words. Images of American Indians—some flattering, many buffoonishly racist—have been used to sell cars, motorcycles, toys, hotel rooms, tobacco, and other goods. They still adorn the uniforms of some sports teams. The images are ubiquitous; the people they represent often forgotten.

But increasingly, Sayet and other American Indians are offering a counterview of indigenous culture and what it means to live in a country where the experiences of native people are often marginalized, distorted, or excluded.

Sayet is careful about what projects she chooses to direct, rejecting proposals that lean on stereotypes.

"I've said no to a lot of versions of *Last of the Mohicans,*" Sayet says, referring to productions of the 1826 novel by James Fenimore Cooper. The story takes place during the French and Indian War, as France and Great Britain fought for control of North American lands where indigenous people had lived for thousands of years. It's seen by many as playing into various

From performing a one-woman show in London to directing a play in Arkansas about the Dakota Access Pipeline, playwright, actor, and director Madeline Sayet challenges the invisibility and stereotypes indigenous people have had to endure. She hopes new, authentic Native American narratives can take root.

stereotypes—including the notion that Indians who cooperated with the British were good and noble, while those who did not were bloodthirsty savages. Sayet also rejects projects that involve using "red face" so that non-native actors can play native people.

"You don't even really get to begin to tell your story until you've dealt with the fact that there's these weird things walking around as identifiers of native culture," Sayet says of some popular negative images. "Which is what makes Americans feel like they own native culture in this really twisted way."

STORIES OF INDIGENOUS HISTORY and culture have been around for generations, in the elegant images made on hide calendars or carved into totem poles. Non-natives, however, barely acknowledge our past or our present, ignoring our lives by focusing on dominant, negative stereotypes.

I belong to Indian country, or at the very least, I was born from it. My mother was born in Odessa, Texas, and my father was born in Oklahoma. His mother was Choctaw; his father, Kiowa. In 1975 my father and Sarah Dye, a Shawnee, became the first Native Americans to graduate from Dartmouth College's medical school. My father was the third generation of college graduates in our family. His father was a teacher, a World War II veteran, and the first Kiowa to graduate from Oklahoma State University. His father, my great-grandfather, attended Carlisle Indian Industrial School and Hampton Institute. My great-great grandfather was one of more than two dozen Kiowa prisoners of war sent to prison in St. Augustine, Florida, at the end of the Red River War of the 1870s as we and other tribes of the Great Plains fought to stop the government's push to remove us from our traditional territories.


#IMWITHDEB
DEB
HAALAND
DEMOCRAT FOR CONGRESS
FOR CONGRESS. FOR US.

‘The stories we tell not only come out of the world that we live in. They help us create, and live, in the world that we want to live in.’

Kim TallBear, University of Alberta

Deb Haaland, a Laguna Pueblo, is among more than a hundred Native Americans who ran for state or federal office in 2018. Haaland won New Mexico’s Democratic primary in June; she’s one of three candidates hoping to become the first ever American Indian woman elected to the U.S. Congress. Two Native American men, both Republicans from Oklahoma, serve in the U.S. House of Representatives.

My tribe has always been a nomadic one, from our early days in the north to a "golden age" on the plains in the 1800s, as our Pulitzer Prize-winning author N. Scott Momaday calls it.

Today we remain Kiowa: artists, scholars, historians, lawyers, writers, soldiers, doctors, teachers. The same roles we have always had, before the United States, before the horse, before, before, before.

ON A COOL SUMMER NIGHT IN JUNE the London Plane restaurant in Seattle begins to fill with American Indians and others.

They wear patchwork-and-ribbon skirts, Pendleton bomber jackets, silver and turquoise jewelry, quillwork and shell earrings, bolo ties plugged with wampum, and pipe-bone bead necklaces that clink, click, and clack.

They've arrived for the $125-a-person dinner, a fund-raiser for the I-Collective, made up of indigenous cooks, activists, herbalists, and knowledge keepers.

"Nawa, akitaaru'," says Hillel Echo-Hawk, a noted cook and cohost of the gathering, welcoming the evening's diners before retreating to the clattering of pots, plates, and silverware to finish her work. Born and raised in the town of Delta Junction, her mother's hometown in the interior of Alaska, Echo-Hawk grew up in a family that actively hunted and fished.

"It was one of my favorite memories, just being in the kitchen," she says.

At 14 years old she had her first grand mal seizure. A trip to a Fairbanks neurologist revealed the bad news: Echo-Hawk would never be able to live alone, she would never be able to travel alone, and she would never be able to cook.

"I was crushed," she says. Six years later, with the right medication and with the seizures under control, Echo-Hawk left first for a brief college stint in Seattle, then for missionary work in New Zealand. She later returned to Seattle to pursue her original dream: culinary school.

Today Echo-Hawk's catering company, Birch Basket, offers traditional, precolonial meals—free of European foods such as flour, processed sugar, pork, beef, and chicken—while showcasing her deep knowledge of indigenous foods, customs, beliefs, and culinary innovations.

She is one of five chefs and assistants who've prepared a traditional meal featuring foods from Alaska and the Pacific Northwest. The first course is a pickled seaweed with cured salmon roe and smoked seaweed broth. Second course: watercress with salmonberry and cranberry gelée on a swoosh of hazelnut puree, and then, moss-steamed littlenecks.

"This next dish is a cedar-braised caribou," Echo-Hawk announces to the 50-plus guests as the fourth course makes its way to the tables.

"The caribou was donated by a family friend in Alaska and brought down by my mom, who's sitting right there." She nods in the direction of Yvonne Echo-Hawk, her beaming mother.

Within minutes, the plates are empty.

The fifth course, smoked king salmon, is followed by a sixth course, Alaska moose stew. And for dessert, huckleberry and honey sorbet with nine-leaf parsley and alderwood smoked salt.

Echo-Hawk says that non-native diners are often surprised by her cooking, primarily, she says, because they think American Indians have long had rudimentary diets.

"The three sisters [squash, corn, and beans], buffalo, and salmon," Echo-Hawk says, with a hint of sarcasm. "That's it. That's all we had. We didn't eat anything else. It's frustrating."

Echo-Hawk explodes those notions.

With every dish, she tries to explain its ingredients in a way that challenges how others see indigenous people—and that reminds diners that some of the foods on their plates may be unfamiliar because 500 years of colonialism and the decimation of Native American culture made many of those foods "disappear," she says.

Echo-Hawk acknowledges that for some diners, hearing about genocide and colonization doesn't sit well, but that understanding indigenous people's experiences in America requires learning more about certain hard truths.

"People are reluctant to use the word 'genocide,' " says Kim TallBear, an associate professor of native studies at the University of Alberta. "But if you look at the UN definition of genocide, every single federal policy toward native people can come under that."

THE DELIBERATE REMOVAL of indigenous peoples in the Americas began shortly after the arrival

Gregg Deal, a Pyramid Lake Paiute, uses performance art to challenge misconceptions of Native American identity. He often asks people to confront their misunderstandings and reconsider stereotypes. The handprint on Deal's face is part of a performance piece, "The Last American Indian on Earth."

of Columbus in 1492. Wars, diseases brought by Europeans and others, and government efforts to kill or contain Indians combined to wipe out tens of millions of Native Americans.

One of the last and most notorious Indian massacres in the U.S. occurred in 1890 at Wounded Knee, in what is now South Dakota, when at least 200 Lakota were slaughtered by the Army's Seventh Cavalry. Members of the regiment were awarded medals of honor for their actions at Wounded Knee.

Beginning in 1879, indigenous children were forcibly removed from their homes to be educated and assimilated in boarding schools that required students to give up indigenous culture, language, and even their names.

From 1973 to 1976, more than 3,400 indigenous women in the care of the U.S. Indian Health Service were sterilized without their consent. Many native people assert that the efforts to marginalize them into nonexistence continue. Today, with the government's support, oil companies are drilling and running pipelines that could endanger tribal water and food supplies.

"MATT, CAN YOU GO BACK to 'Dear Mr. President' for me?" Madeline Sayet says, halting a rehearsal of *Crossing Mnisose,* a new play by Cherokee playwright and lawyer Mary Kathryn Nagle that focuses on the Mnisose—also known as the Missouri River—and the story of Sacagawea, Lewis and Clark, and the Dakota Access Pipeline all crossing the river.

Sayet warns actor Matt Cross to not "get ahead of where you are at in the letter. This is your letter. You wrote this letter to the president, so all of your heart is in each of these words."

In Nagle's play, a character named Travis, played by Cross, reads a letter about the impending construction of the Dakota Access Pipeline to President Barack Obama.

Set in the early 1800s and the 2010s, the play chronicles Meriwether Lewis and William Clark as they "discover" the Mnisose. The play also addresses the recent protests to protect that same river from the construction of the Dakota Access Pipeline, which runs from North Dakota to Illinois. Several tribes say it crosses native burial grounds and threatens water quality.

Cross, a Kiowa actor, has two roles: Coyote, a Dakota tribal member in the 1800s, and Travis, a modern Dakota tribal member and possible reincarnation of Coyote, fighting to protect the river from the pipeline. Next year *Crossing Mnisose* will have its world premiere at Portland Center Stage in Oregon. For now the cast is rehearsing for the Arkansas New Play Festival.

Shalaine Bouvier walks designer Evan Ducharme's catwalk at the inaugural Indigenous Fashion Week in Toronto in 2018. The native-led festival included runway shows, exhibitions, panel discussions, workshops, and a marketplace.

"Treat it less like it's a letter you're reading and more like if you were coming up with the exact, perfect words to say to the president," Sayet suggests. "They're coming from you, right in this moment."

"Dear Mr. President," Cross says with renewed fervor. "It's been two years already since I met you during your visit to Standing Rock. When you were here, you sat and listened to what we had to say. You made us feel like we mattered."

A few hours before another rehearsal, Sayet enjoys a cup of black coffee in downtown Fayetteville, Arkansas, and speaks of the importance of storytelling.

"We all benefit from hearing more kinds of stories," Sayet says. "More kinds of stories mean we have more potential. We have a greater comprehension for what might be possible, for empathy building and learning and recognizing there are many paths. I am working to dismantle the idea that there is only one Native American narrative by asking questions and bringing people together to interrogate what stories we want to tell."

The stories and images that have plagued indigenous cultures—including America's fixation on feathered costumes and reservation life—serve a purpose, Kim TallBear says. They allow Americans to forget their role in genocide.

Those appropriations of our stories, she says, prevent a different story from taking root, one that indigenous people have been telling for centuries: Live in a good way here. Live in a good way with us. Live in a good way with all our other relatives.

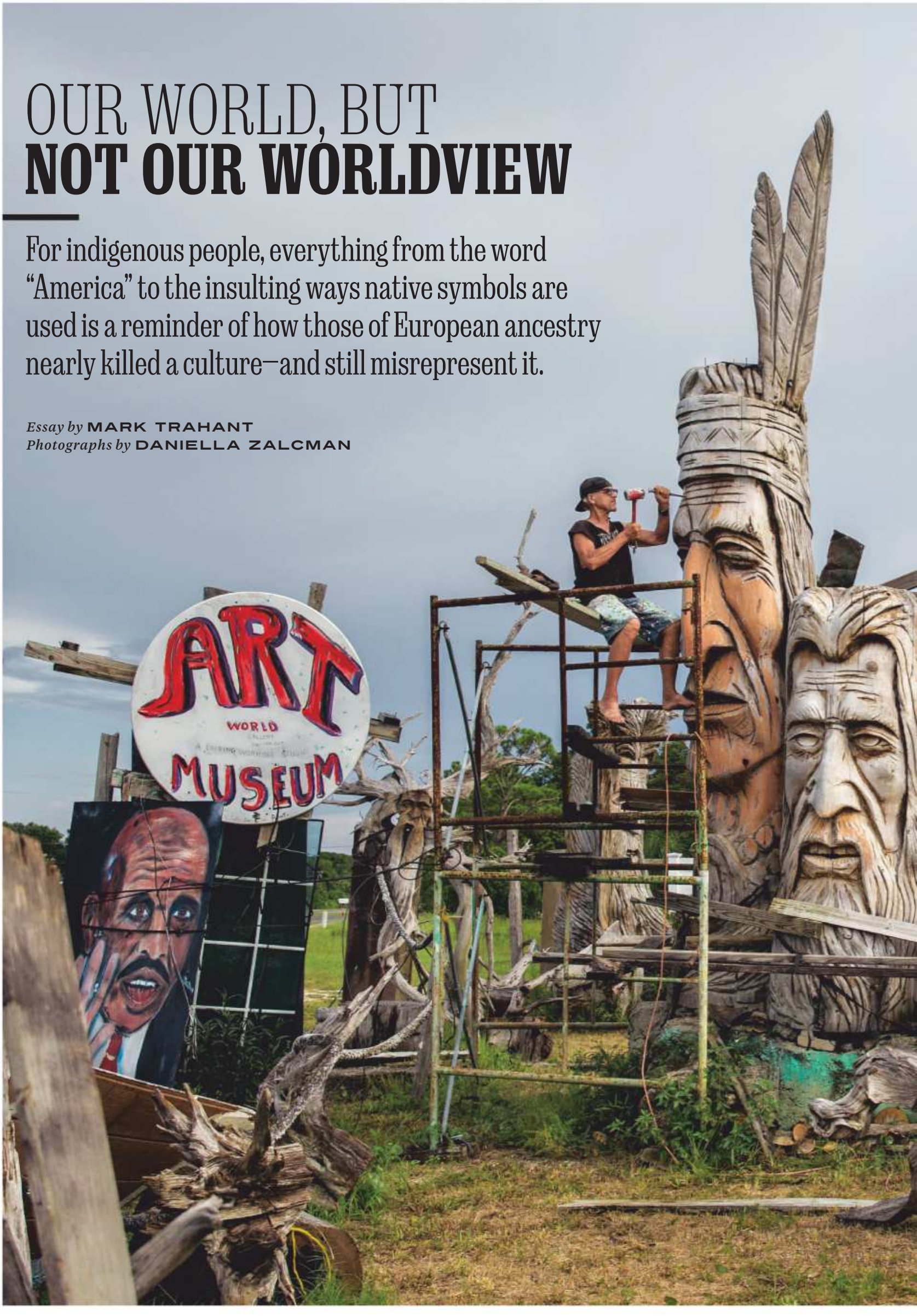
"The stories that we tell not only come out of the world that we live in," TallBear says. They also "help us create, and live, in the world that we want to live in." ▯

Tristan Ahtone is tribal affairs editor for High Country News and president of the Native American Journalists Association. This is his first feature for *National Geographic*.

OUR WORLD, BUT **NOT OUR WORLDVIEW**

For indigenous people, everything from the word "America" to the insulting ways native symbols are used is a reminder of how those of European ancestry nearly killed a culture—and still misrepresent it.

Essay by MARK TRAHANT
Photographs by DANIELLA ZALCMAN



Hungarian-American sculptor Peter Toth, at his Florida studio, has created 74 statues of native peoples in North and South America, part of his Trail of the Whispering Giants collection. Some say the images are rooted in physical stereotypes and caricature. While Toth's work raises questions about authenticity, he says his work honors native culture.

The problem began with one word: "America."

That word, honoring Italian explorer Amerigo Vespucci, was coined in Europe in 1507, when it was used on a map of the New World. But back then, the only Americans were indigenous. It was our world, but it wasn't our word.

By the time the Declaration of Independence was signed in 1776, white people were simply referred to as "the Americans." My ancestors were called American Indians. It's a label twisted by accidents of history: The Italian explorer who gets his name on two continents and another Italian, Christopher Columbus, who dubbed indigenous people "Indians," presumably because he thought he was in the East Indies.

American Indian: Two labels we didn't choose. We might have been called something else. Columbus wrote on October 11, 1492, of encountering handsome people who "are of the color of the Canarians [Canary Islanders], neither black nor white; and some of them paint themselves with white, and some of them with red, and some of them with whatever they find."

Canarians. Imagine if that name had stuck. These days American Indian symbols are everywhere. Think about all those college and high school football teams and their mascots. Think of Washington, D.C.'s National Football League team and the Major League Baseball teams in Cleveland and Atlanta. Think of boxes of butter. Or motorcycles. Or beer.

They are caricatures, symbols of the European-American narrative that ignores the genocide, disease, and cultural devastation brought to our communities.

Our ancestors built indigenous cities such as ancient Cahokia (east of St. Louis, Missouri) and Double Ditch (north of Bismarck, North Dakota). But the First Nations often are dismissed as "rural," or not urbane. Benjamin Franklin, for one, saw the richness of the native culture—and government—that was already here. He wrote in 1751, praising the Iroquois confederation of Indian nations, that "has subsisted ages and appears indissoluble; and yet that a like union should be impracticable for ten or a dozen

Ohio's Cuyahoga Heights Middle School football team, the Redskins, gather after a game. Thousands of U.S. schools and collegiate and professional sports teams use native themes, including the Braves, Blackhawks, Chiefs, and Indians. Ohio ranks high among the states with the most Indian mascots.

English colonies, to whom it is more necessary, and must be more advantageous, and who cannot be supposed to want an equal understanding of their interests."

The image of the American Indian as a marketing tool is partly rooted in the trade networks between indigenous people and European Americans. Native people excelled at trade. My favorite story about that comes from my own tribe's encounter with the Lewis and Clark expedition in the early 1800s. The journal for the Corps of Discovery, as the expedition was called, mentions trading weapons to the Shoshone for horses. Days later, the journal complains that nearly every horse had a sore back. The pistols, ammunition, and knives were the better score.

But the story sold to the new Americans was

the fiction that endured, enhanced by dime-store novels, shows such as Buffalo Bill's Wild West, and eventually, Westerns on TV and film.

Wars and diseases such as smallpox destroyed the world that was. With that destruction came invisibility. A recent study said that "contemporary Native Americans are, for the most part, invisible in the United States." The report, called "Reclaiming Native Truth," cited "the impact of entertainment media and pop culture" and "the biased and revisionist history taught in school." It also noted "the effect of limited—or zero—experience with Native peoples."

The ideals and people of the United States are better than this history. Yet it often still seems OK to mock the first Americans. A president can slur a woman with "Pocahontas," and it's not career ending. When my son played high school football, I would cringe when his team played a team called the Indians, knowing that ordinary, good people would chant silly, made-up songs and wear cartoonish paint and feathers. It's beyond imagination that such disrespect would be shown to any other group.

Americans need to evolve. We need to think about why Civil War monuments are falling, yet Kit Carson, Andrew Jackson, and other Indian-killers remain celebrated.

It's time to make Native Americans more visible. Explore the richness of our history and culture. Quit supporting insulting imagery and labels. It's time to be real Americans. □

Mark Trahant, of the Shoshone-Bannock Tribes, is editor of Indian Country Today. Photographer **Daniella Zalcman**'s work focuses on the modern legacies of Western colonialism.


ESPRESSO
COFFEE
COFFEE

Signs of indigenous culture are ubiquitous in America. But the people they represent are often forgotten.

The teepee, traditionally used by Plains Indians, is a popular—and sometimes co-opted—symbol of Native American identity. Images here include an Indian-owned, now closed espresso shop in Browning, Montana, top left; a rest stop in Spearfish, South Dakota, top right; a camping space for rent in Cody, Wyoming, bottom left; and a gift shop, Tee Pee Curios, on Route 66 in Tucumcari, New Mexico.

‘Indians are less than one percent of the population. **Yet images and names of Indians are everywhere.’**

–Smithsonian National Museum of the American Indian, “Americans” exhibit, on display in Washington, D.C., until 2022.

1

2

3

4

5

6

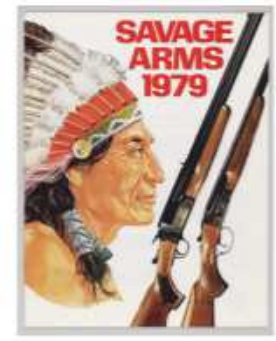
7

8

9

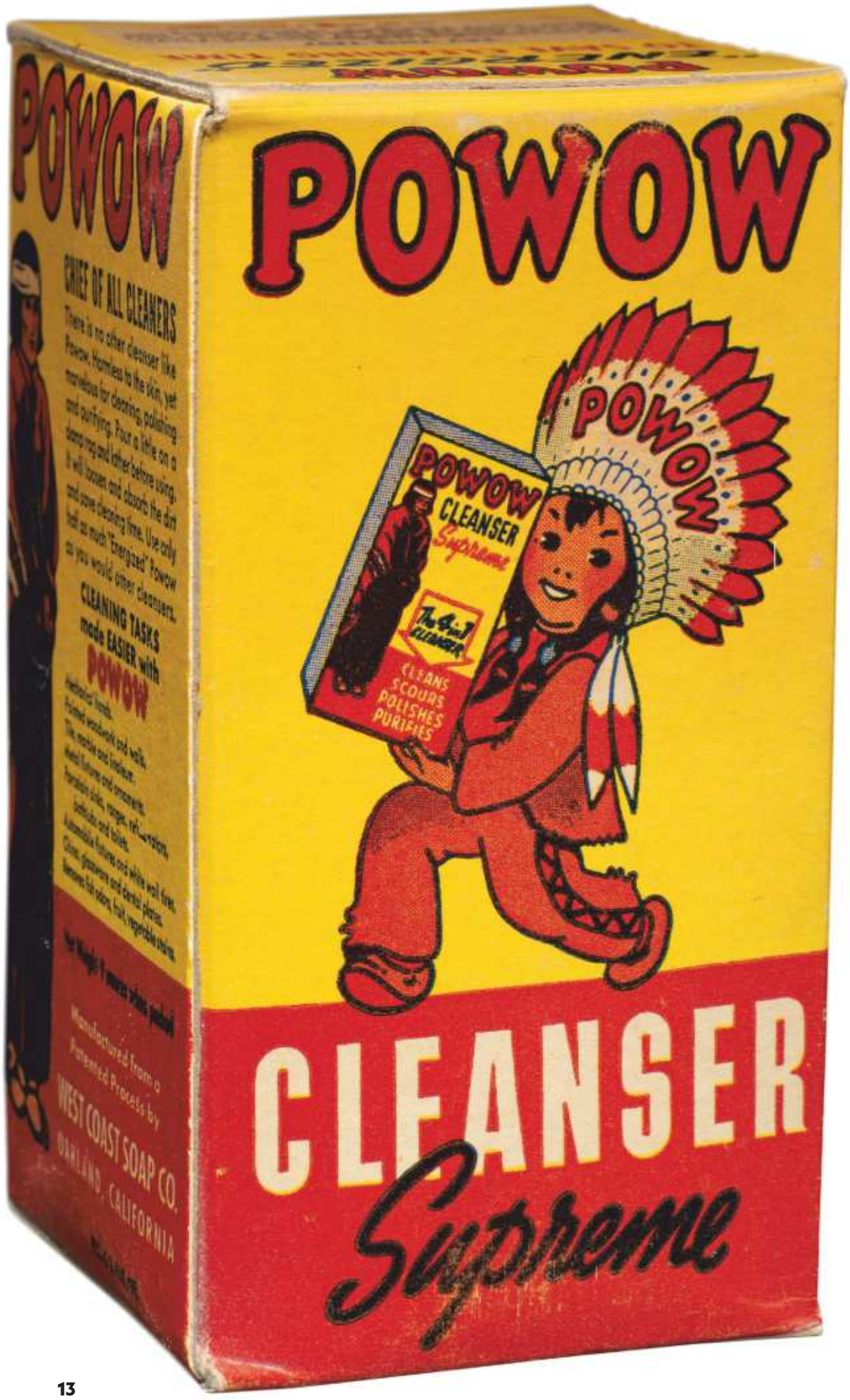
10

11



12

ERNEST AMOROSO, NATIONAL MUSEUM OF THE AMERICAN INDIAN, SMITHSONIAN INSTITUTION (ITEMS 2, 9, 11, 13-15); MARK THIESSEN, NGM STAFF (1, 3-8, 10, 12)



13

14

15

1. Coppertone Sun Tan Oil, 1945-1953. The face of Coppertone was once an Indian in a feather headdress; its slogan was "Don't Be a Paleface."

2. Decorative candles of an Indian couple at Thanksgiving, 1960.

3. Lego figurines of Indian characters, 1997.

4. General Motors' Pontiac brand authorized service logo. Pontiac featured an Indian-head hood ornament from 1926 to 1955. Pontiac was an Ottawa chief.

5. A 1907 Indian-head penny created by the U.S. Mint.

6. Florida State University Seminoles infant onesie, 2018. Florida State has worked closely with the Seminole tribe to develop authorized merchandise and programming.

7. Indian Head Yellow Corn Meal, 2018.

8. Land O'Lakes butter. In one of the most iconic images of a Native American, a maiden knelt before green meadows and blue lakes. Wearing buckskin, beads, and red, white, and blue feathers, she holds a box of butter, meaning she holds an image of herself. A 2018 redesign no longer shows the maiden kneeling.

9. Iroquois Indian Head beer label, 1940.

10. Mattel's Native American Barbie, 1996, was part of their Dolls of the World collection.

11. Savage Arms gun catalog, 1979.

12. American Spirit cigarettes, 2018.

13. Powow Cleanser Supreme, 1955.

14. Plastic cowboy and Indian figures, 2018.

15. Hanker Chiefs, 1982. The cigar-styled box holds handkerchiefs.

THE PUMAS OF PATAGONIA

PROTECTING CHILE'S BIG CATS HAS COME AT A STEEP COST TO ITS SHEEP RANCHERS. IS TOURISM THE SOLUTION?

BY **ELIZABETH ROYTE**

PHOTOGRAPHS BY **INGO ARNDT**

PREVIOUS PHOTO

Pincushion shrubs and shards of rock don't trouble the puma known as Sarmiento, at center, or her 11-month-old cubs, huddled up at the end of a winter's day above Lake Sarmiento, near Chile's Torres del Paine National Park. The matriarch, who has raised several generations of cubs, spends most of her time hunting—and napping—along this waterfront.

LEFT

Oblivious to brutal winds tossing the lake, Sarmiento seems to enjoy—and even initiates—tussling with her cubs on the white limestone formations known as stromatolites. The rocks hold the sun's warmth, and the shoreline's numerous caves and doughnut-shaped rings provide the cats with excellent cover—though Chilean pumas have no predators other than humans.

Photography for this article was supported by the sports brand Puma.

The first mountain lion I set eyes on was a heavily muscled creature, snarling with fear, 20 feet up a pine tree in central Utah. Treed by hounds, the animal was shot by a federal employee protecting a rancher's sheep. If that encounter was pure Sam Peckinpah, my next sighting of the elusive cats—in Chile, where they're known as pumas—would be straight out of a storybook.

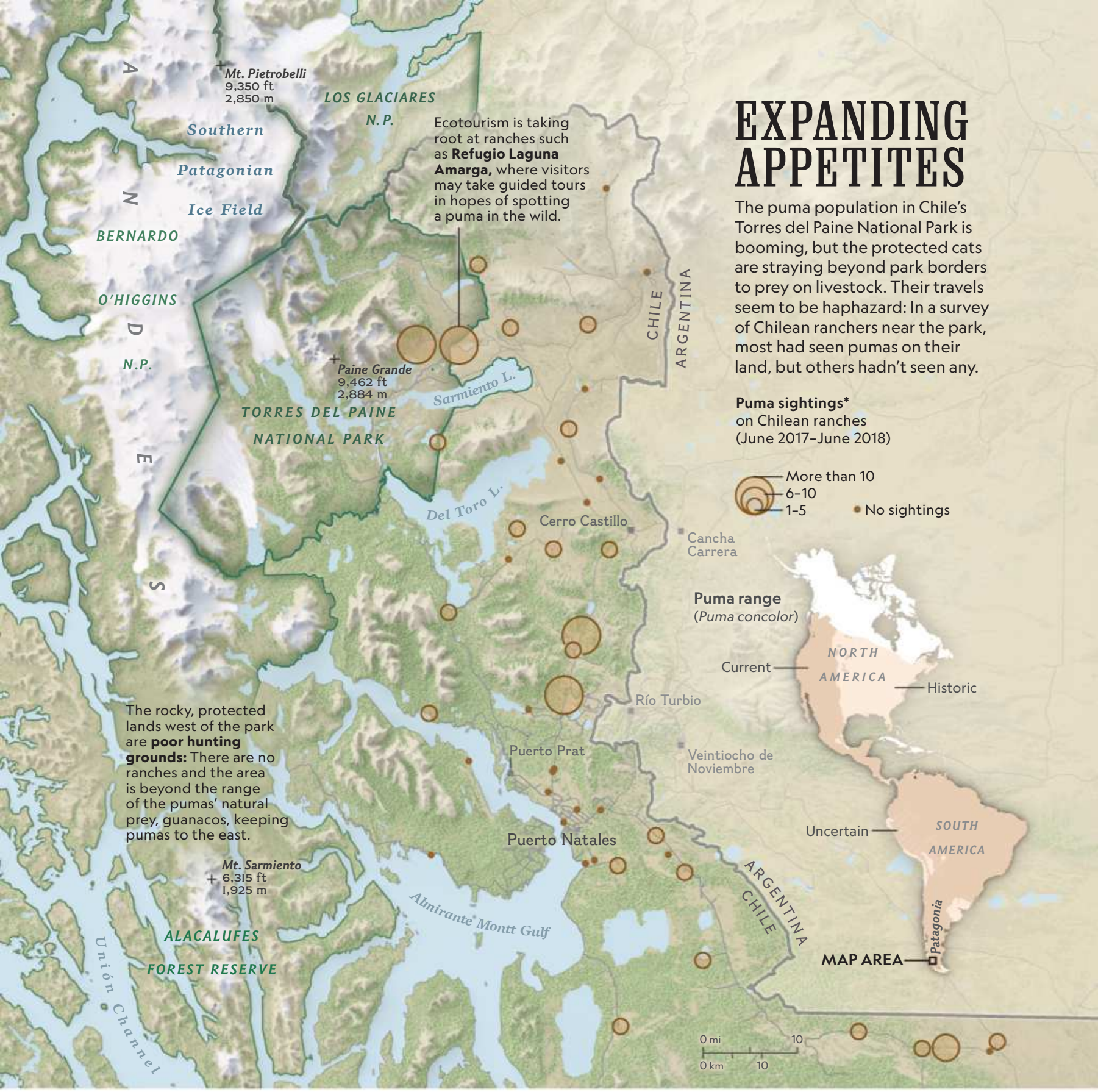
Wedged between shrubs on a wind-blasted slope just outside southern Chile's Torres del Paine National Park, I watch three tawny cubs tumble and race along the shore of an aquamarine lake, testing their strength, their teeth, their social status. Now and then their mother, known as Sarmiento, stops to assess the situation: Her green eyes, circumscribed with black eyeliner, are calm, her thick tail low. When the quartet reaches a peninsula studded with stromatolites, a puma timer apparently goes off: The mother and cubs curl up inside one of the doughnut-shaped rocks and do what cats do best. They nap.

Found all the way from southern Alaska to southern Chile, *Puma concolor* has the largest range of any land-dwelling mammal in the Western Hemisphere. Scientists suspect that there are higher concentrations of pumas around Torres del Paine than anywhere else. That's mostly because pumas have plenty of prey (guanacos, hares), are protected in the park, and lack competition from other mammalian predators, such as wolves.

For anyone bent on seeing this apex predator in the wild, Torres del Paine—more than half a million acres of granite peaks, grasslands, subarctic forests, and wind-whipped lakes—is the place to be. The landscape is wide open, and many of the pumas have become habituated to humans

EXPANDING APPETITES

The puma population in Chile's Torres del Paine National Park is booming, but the protected cats are straying beyond park borders to prey on livestock. Their travels seem to be haphazard: In a survey of Chilean ranchers near the park, most had seen pumas on their land, but others hadn't seen any.



as tourism has exploded. Like Sarmiento's cubs along the lakeshore, pumas stroll about, hunt, groom, mate, and play with apparent disregard for the grinning visitors who come upon them.

Itching for more puma action, my guide, Jorge Cardenas, and I track the predators over several days, our ears alert for the high-pitched alarm calls of guanacos—a giveaway that pumas are on the hunt. We see no puma kills, but later, at a gathering organized by the conservation group Panthera, I get a sharp sense of the havoc the region's expanding puma population can wreak. The meeting, held in a hotel in the hamlet of Cerro Castillo, is attended by government officials, biologists, tour guides, and ranchers.

Arturo Kroeger Vidal—a second-generation sheep rancher who operates a large estancia southeast of Torres del Paine—has taken a rare day off to voice his concerns. "Earlier in the month I sold 400 sheep," he says calmly. "Five days after the sale, I had only 370 for the buyer. A puma took 30 in one night." Fellow ranchers nod sympathetically.

For well over a century, men like Kroeger—riding horses, carrying guns, and aided by hounds—controlled the region's puma population. But when the Chilean government established Torres del Paine in the 1970s, hunting of

*PUMA SIGHTINGS DATA BASED ON INTERVIEWS CONDUCTED BY PANTHERA WITH 45 CHILEAN RANCHERS.
SOREN WALLJASPER, NGM STAFF. SOURCES: MARK ELBROCH, PUMA PROGRAM, PANTHERA; IUCN; INFRAESTRUCTURA DE DATOS GEOESPACIALES DE CHILE; SISTEMA DE INFORMACIÓN DE BIODIVERSIDAD (ARGENTINA); ©OPENSTREETMAP CONTRIBUTORS, AVAILABLE UNDER OPEN DATABASE LICENSE; GLIMS

pumas and guanacos was banned. Their numbers rose significantly, and both predator and prey, in search of sustenance, began migrating out of the park onto private ranchland.

"The creation of the park was terrible for ranchers," Kroeger says, because some pumas leaving the park began attacking sheep. Since the park's inception, ranchers estimate pumas have devoured some 30,000 sheep, representing substantial lost income from wool and meat sales.

Guides and some veteran park guards put the numbers of pumas in the park at 50 to a hundred. Outside the park, where pumas have yet to be accurately censused, ranchers collectively claim to kill a hundred of the cats a year. "Ranching is our economy," Victor Manuel Sharp says at the hotel meeting. "What are we going to do?"

ONE OPTION is to forgo sheep for cattle, which are too big for pumas to bother with. But sheep-herding is a tradition here, and not everyone has good forage for bovines. Or you can use dogs to protect sheep, says rancher and dog breeder Jose Antonio Kusanovic, who hunted pumas before he got into the dog-training business. But a guard dog costs about $1,500, aside from food and veterinary care, and you'd need several to watch flocks of 2,000 or 3,000 sheep. It's far cheaper, ranchers say, simply to hire a *leonero*—a lion hunter.

Charles Munn, an American who runs ecotourism companies, stands to speak. "I made an industry out of jaguar tourism in the Brazilian Pantanal. Pumas can bring you a lot of money."

The ranchers grumble. They know they can't

After lying in wait behind a wall of shrubs for an hour—then stalking her prey over a hundred yards of rough grassland for another half hour—Sarmiento leaps upon a guanaco. A strong and mature male, he moves sideways, escaping his sharp-clawed foe.

charge tourists to track pumas on their land while continuing to kill them. (Chile's government allows ranchers to kill a puma if they can prove it has taken a sheep, but most ranchers don't even try to get a permit.)

"You're saying we need to feed the puma so you have more pumas for tourism," another rancher says sharply. "I'm too old to become touristic."

Munn singles out the Goic brothers, Tomislav and Juan, sitting in the back of the room. Through the years their 5,500 sheep, which grazed along the park's eastern border, dwindled to about a hundred—victims of a wicked snowstorm and constant puma predation. Now some 800 puma tourists a year pay the Goics a hefty fee to drive and hike around their 24-square-mile property with a guide and tracker, equipped with powerful binoculars and walkie-talkies.

On the Goic ranch, guests are almost guaranteed to see Sarmiento and her cubs, the lanky Arlo, or the laid-back Hermanita, who likes to hang out near the fence that divides Goic land from Torres proper. The Goics opened their ranch for puma tracking in 2015, when the park began enforcing rules that kept tourists and guides on trails, limiting their chance of seeing pumas. "We were worried about people's security," park superintendent Michael Arcos explains. Under pressure from clients to produce a puma, independent guides would stalk their prey at night, using lights, and they crept too close to animals. Only one fatal puma encounter has occurred in Torres del Paine, Chile's most visited park, and they want to keep it that way.

The park's cautious approach to tourism will stay in effect until scientists can establish how many pumas live there, how far they roam, their eating habits, and their social behaviors. The research—in and out of the park—will take years and will involve thermal camera surveys, GPS-collared pumas, guard dogs on especially vulnerable ranches, and scat-sniffing dogs (DNA from poop can reveal how many pumas live in an area).

The resulting information will shape conservation plans and, it's hoped, make puma tourism safer for cats and people alike. Tourism fees could even help compensate ranchers for sheep killed by pumas. The idea is to make these keystone predators, which keep prey populations in check, as valuable to the region's economy as they are to its environmental integrity.

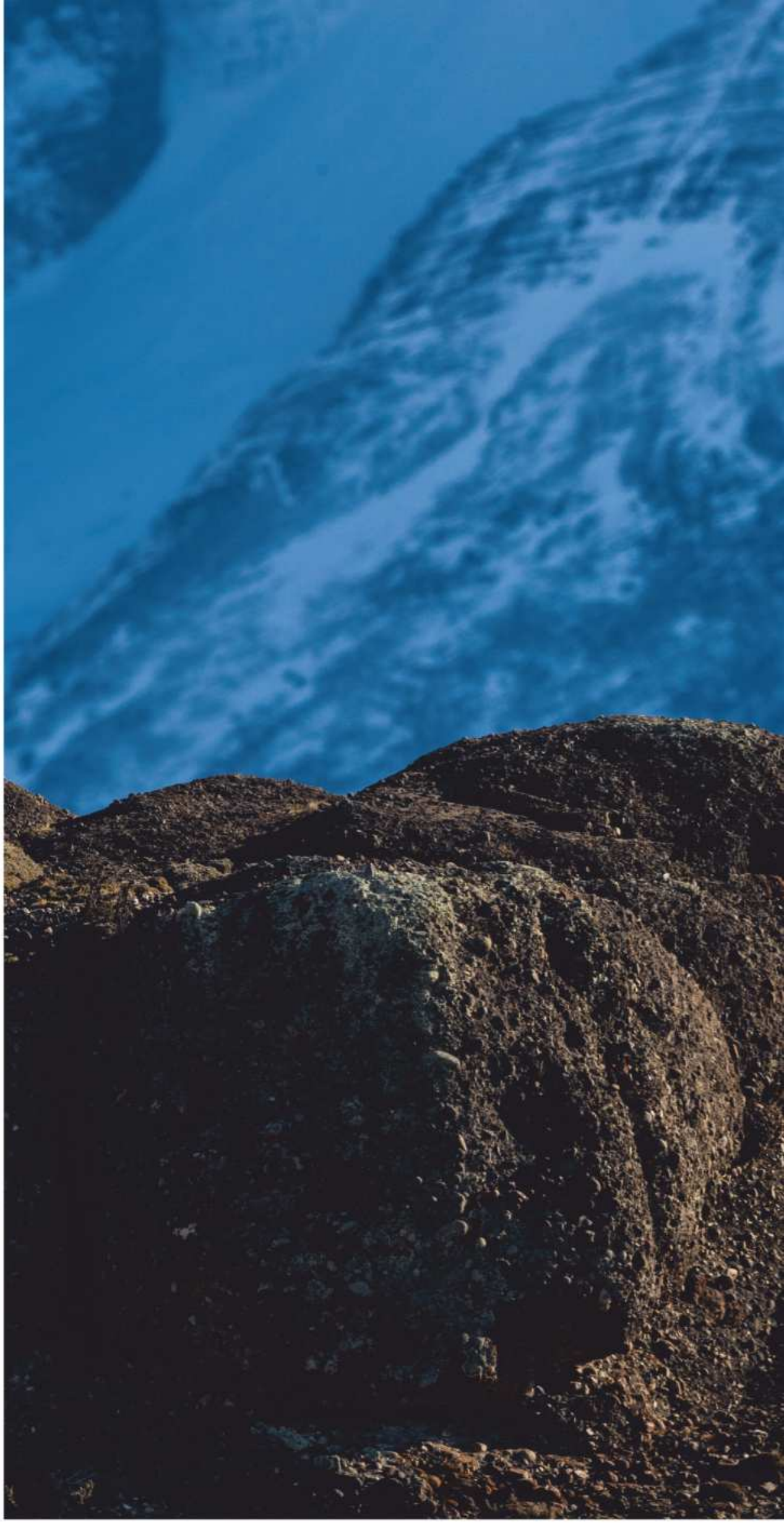
Pumas here most likely eat more guanacos than sheep. That's of little solace to ranchers such as Jorge Portales, who tells those at the hotel that he lost 24 percent of his sheep—600 animals—to pumas in one season. He switched to cattle, then reintroduced sheep along with guard dogs, but the pumas kept coming. "This is the cost of living near Torres del Paine," he says with a sigh. "Now we don't have any more sheep." Today he runs his estancia as a guest-oriented operation, offering scenic horseback rides and outdoor lamb roasts. Puma tourism, he says, is next.

His fellow ranchers make no comment. Defiant and proud, they'll hold out as long as they can. □

Elizabeth Royte wrote in the June issue about the potential for marine microplastics to harm humans. This is award-winning wildlife photographer **Ingo Arndt**'s first story for the magazine.

Big Cat Weekend on WILD

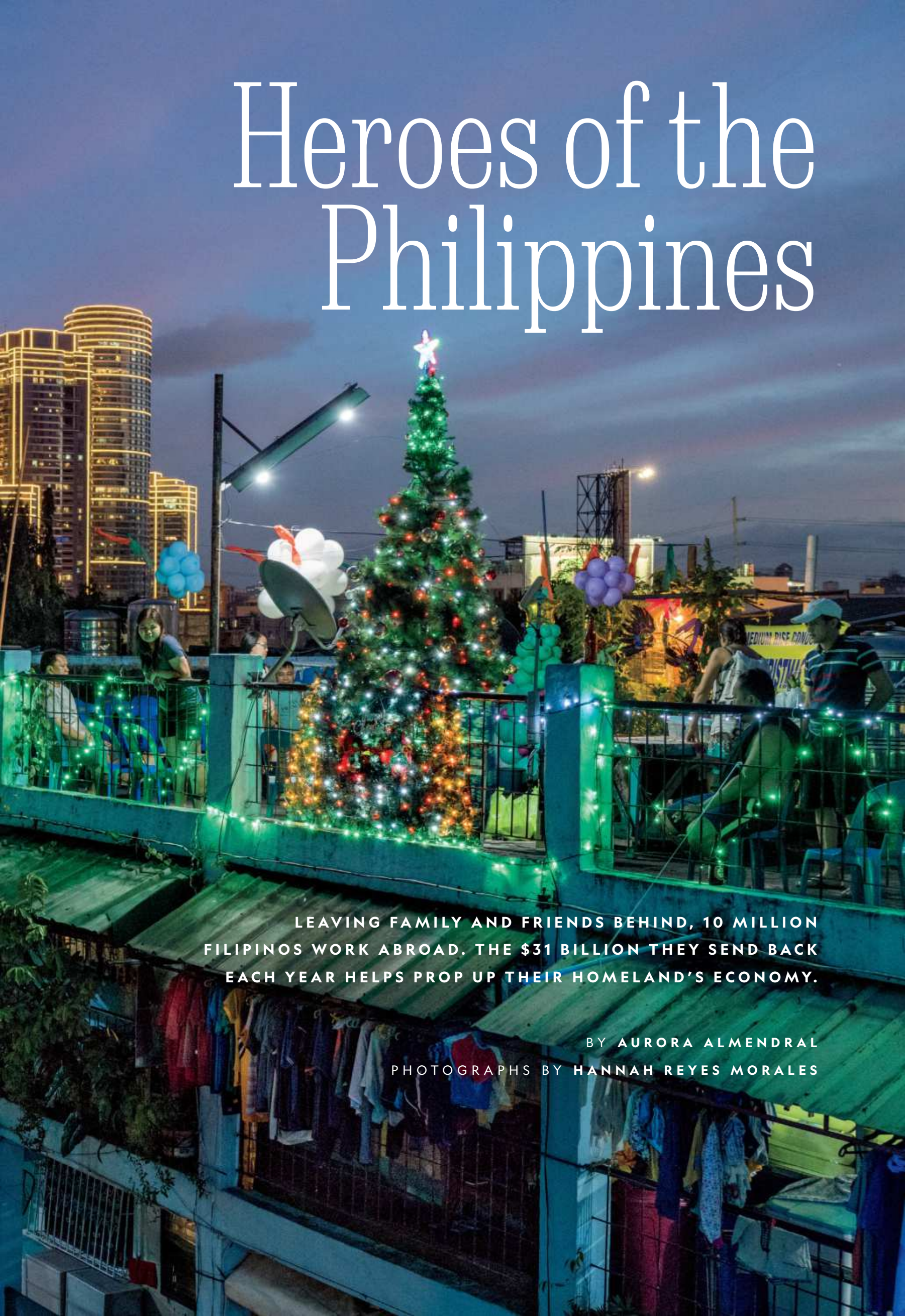
Join big-cat expert Boone Smith on a journey to track pumas in Patagonia. "Man vs. Puma" premieres Friday, November 30, at 9/8c, kicking off Big Cat Weekend on National Geographic WILD.



During an all-day courtship, Charqueado (at left), a four-year-old son of Sarmiento, pursues a female, gnashing his teeth and grunting. He mated with her five times over an hour and in a relatively exposed spot, according to photographer Ingo Arndt. Then, rather than retreating to safety, the pair strolled onto this promontory on private ranchland near Torres del Paine National Park.

The glittering skyscrapers of Manila's central district overlook the Christmassy rooftop of working-class tenements. Home for the holiday from her job as a nanny in Hong Kong, Bernardita Lopez (at the railing) takes in the scene. Lack of opportunity and low wages drive millions of Filipinos abroad. For many the ultimate goal is a better life at home.

Heroes of the Philippines



LEAVING FAMILY AND FRIENDS BEHIND, 10 MILLION FILIPINOS WORK ABROAD. THE $31 BILLION THEY SEND BACK EACH YEAR HELPS PROP UP THEIR HOMELAND'S ECONOMY.

BY **AURORA ALMENDRAL**

PHOTOGRAPHS BY **HANNAH REYES MORALES**

Recuerdo Morco was 22 when he first saw snow. Wrapped in four layers of coveralls and parkas, he looked up into the swirling sky as huge flakes settled onto the deck of his cargo ship.

NGM MAPS

He carved his girlfriend's name into the snow and circled it with a heart. Recuerdo had grown up in the Philippines on a tropical island rimmed with white sand and coconut palms. Standing on the cargo ship slicing through the icy waters near the Arctic Circle, snowflakes tickling his face, was a dream come true. "I'm really here," he thought.

They pulled into the port of Kemi, Finland, in the wake of an icebreaker, jagged blocks of white peeling off the sides of their ship. Recuerdo stepped ashore and went on what he calls the "seaman's mission": find the nearest shop and buy a SIM card so you can call your mother.

Now 33, Recuerdo has spent the past decade working as a merchant sailor on cargo vessels. He has called his mother, Jeannie, 66, from Finland, the Netherlands, Papua New Guinea, and nearly every country with a port between Sweden and Australia. Jeannie can't keep track of where her son calls her from, but she's always

Recuerdo Morco shares a beer with his shipmates in General Santos City after delivering a cargo of dried coconut from Port Moresby, Papua New Guinea. For Morco the freedom and adventure of life at sea are laced with homesickness.

happy and relieved to hear from him. Hearing her voice, Recuerdo says, "takes away the boredom, homesickness, and sadness." He adds, "She's the most important person in my life."

Recuerdo is one of an estimated 10 million Filipinos—roughly a tenth of the country's population—who work overseas as a way of escaping unemployment, low wages, and limited opportunities at home. The money sent back by overseas Filipino workers (known as OFWs) amounts to $31 billion a year—about 10 percent of the Philippines' gross domestic product. Filipinos are domestic workers in Angola and construction workers in Japan. They staff the oil fields of Libya and are nannies to families in Hong Kong. They sing on the stages of far-flung provinces in China and help run hotels in the Middle East. A quarter of the world's seafarers are Filipino.

It's a phenomenon that has reshaped the economy and the education system in the Philippines. Each year about 19,000 nurses, certified and fresh from language training, are deployed to hospitals around the world.

Meanwhile educational institutions and vocational schools in the Philippines funnel students into industries likeliest to get them a job abroad. Merchant marine academies, like nursing schools, churn out thousands of graduates yearly. Training centers for domestic workers school women in how to set a table according to different cultures' standards, fold a sheet into tight hospital corners, and whisper a greeting in Arabic or Chinese. Government agencies were founded to deal with the migration of registered workers, negotiate international labor terms, and rescue workers when a diplomatic row flares up or a war breaks out—as when a delegation of government officials traveled to Syria to find domestic workers and ferry them to safety.

Cadets at a merchant marine academy near Manila train for one of the most prestigious jobs for workers in the diaspora. Those who succeed are ensured a path to a middle-class life for their families. A quarter of the world's seafarers come from the Philippines.

In the Philippines, overseas workers are called *bagong bayani*—the new heroes.

For decades the Philippine government has facilitated migration abroad as a way to develop the country. A sprawling trade school industry helps give Filipinos needed skills. Nannies (top left) are trained to dote on babies without making mothers jealous. Nurses (bottom left) learn how to deliver care in foreign languages. Chefs (top right) prepare for jobs in hotels and restaurants, and domestic workers (bottom right) learn to cook foreign foods.


TOTALGAZ
ALL WOMEN PAWNSHOP
ABLAZA PAWNSHOP
VILMA
WESTERN UNION
MONEY TRANSFER
OFFERED HERE

Tens of billions of dollars a year in remittances from overseas Filipino workers, or OFWs, have propped up the country's economy. Recently, thanks in part to booming industries such as call centers, the economy has been growing at a fast pace.

Some of the Filipinos who go abroad with dreams come home in caskets. The mother (center) of Jessica Catiis weeps at her funeral. Catiis was a domestic worker in Saudi Arabia who allegedly died by suicide. Her body was sent back seven months later.

The steady stream of cash from Filipino workers abroad has helped edge poorer families out of poverty, and houses built with cash from migrant workers have sprouted up in the rice fields of backwater provinces.

In the Philippines, December is celebrated as the national month for overseas workers. Movies and television shows romanticize their hardships and dedication. Those who are part of the diaspora are called *bagong bayani*—the new heroes—for sacrificing themselves for the betterment of their families and the country.

EMBARKING ON A LIFE as an overseas worker, as the Morco family knows all too well, means entering a seemingly endless cycle of longing—forever reaching for your dream abroad and pining for the home you've left behind.

Four of Jeannie's five children are named for loss and longing: Memorie, Souvenir, Remembrance, and Recuerdo, a Spanish word that encompasses all three. She couldn't have known how prescient two of those names would become: Along with Recuerdo, Memorie, now 48, has been working abroad for years. In their sleepy hometown of Taytay, on Palawan, Jeannie has had to accept that she won't grow old surrounded by all her children and grandchildren.

The Filipino tradition of bringing home a gift from every trip has crowded Jeannie's dressers with bottles of scented soaps and lotions. Recuerdo's bedroom holds his collection of baseball caps, one from each country where he has docked. Meanwhile the plot he bought across the road sits empty, waiting for his house to be built.

Recuerdo is proud to be able to send his mother several hundred dollars out of the $1,300 he earns a month. He's now saving so she can have cataract surgery. Jeannie, a widow, had worked tirelessly running a streetside food

stall to send her children to school. Being able to give her what she needs is why Recuerdo left the Philippines. "I'm willing to take on any kind of hardship," Recuerdo says, "as long as I can save and send money."

Out at sea Recuerdo often dreams of going home to Palawan, the same way he used to stand on his beach and dream about working as a merchant sailor. But there's always a new reason he needs a few more paychecks, and the day he comes home to live in Palawan seems always to be just beyond the horizon.

"Masakit na masarap," Recuerdo says about life as an OFW. It's "a pain that gratifies."

His sister Memorie had originally studied to be a midwife, but the pay at hospitals is low in the Philippines, so she took a job at a pizza restaurant in Manila. She wanted to send her son, Ryamm, to a private school, wanted to be able to buy him uniforms and notebooks. She didn't want to depend on Recuerdo. "I wish I studied harder in school," Memorie says, "so I could have found a job in the Philippines." The only thing she could do was become an OFW.

Memorie lived in Morocco for six years working as a nanny, and before that she worked at a gas station in Palau. During the past year she's been raising someone else's baby in Abu Dhabi, in the United Arab Emirates.

As a live-in nanny in the Middle East, Memorie has one of the most perilous jobs in the Filipino diaspora. A 2011 study documented numerous testimonials of physical or psychological abuse from domestic workers in Saudi Arabia. Employers confiscate passports, and workers may be starved or forbidden from leaving their employer's house for months, if not years. Many Filipinas return with stories of rape. Memorie says she has not been abused by her current employer.

These dangers are part of what Filipinos weigh as they prepare to work abroad, but Memorie brushes them off. "When it's your time, it's your time," she says over the phone from Abu Dhabi. "But the homesickness—that never goes away, even if it's been a long time."

Ryamm is now 19. He's lived much of his life without his mother, and for Memorie the irony of having a son and then feeling compelled to leave him behind is inescapable. She says they send each other a few messages every day but that talking on the phone or by video is too sad: "We don't do anything but cry." She says Ryamm asked her not to call so often—he doesn't want her to see him crying.

Ryamm was accepted into an elite merchant marine academy but chose instead to study architecture, a choice he may not have had if Memorie hadn't worked abroad to pay for his education. When his time comes to enter the job market, he'll be searching in a much more prosperous Philippines than the one in which his mother came of age. That's in no small part because of the contributions—and sacrifices—of OFWs.

Memorie says that after Ryamm finishes college, she'll come home, back to the beaches of Palawan. She may use some of her savings to open a small dry goods shop and take care of Jeannie. □

Aurora Almendral is a Filipino-American journalist who reports on Southeast Asia from Manila. Photographer **Hannah Reyes Morales,** also based in Manila, is a National Geographic explorer. This is her first story for the magazine.

YOUR SHOT

OMAR AL-SAYED OMAR

PHOTOS FROM OUR COMMUNITY

WHO

Omar, 37, a wildlife filmmaker and photographer in Kuwait

WHERE

Greece's Lake Kerkini

WHAT

A Canon EOS-1D X Mark II with a 100mm lens

Omar, a nature photographer, visited Greece hoping to see Dalmatian pelicans, some of the world's largest freshwater birds. He went on an early morning boat trip in search of the pelicans, which are at risk in their Asian and European habitats, but at first the fog was too thick to make a good image. He headed to shore for another view and waited in the cold. As the sun started to lift over the water, he saw three birds and their reflections, aligned in the dawning light.

Join National Geographic's Your Shot community and share your photos at **YourShot.ngm.com.**

THE
WORLD'S
MOST
REFRESHING
BEER™

CELEBRATE RESPONSIBLY®

Hooded Crane *(Grus monacha)*

Size: Body length, approx. 100 cm (39.4 inches); wingspan, 160 - 180 cm (63 - 70.9 inches) **Weight:** 3.3 - 4.9 kg (7.2 - 10.7 lbs) **Habitat:** Grasslands, open wetlands and agricultural areas; breeds in forest wetlands and bogs **Surviving number:** Estimated at 11,600

Photographed by Neil Bowman

WILDLIFE AS CANON SEES IT

Wanted: A little peace and quiet. As its habitat is relentlessly converted to agricultural use, the hooded crane has to reckon with the noise and disturbance that human activity brings. This forces the sensitive bird to spend more time in vigilance and less time searching out its usual diet of aquatic plants, berries, insects, salamanders and frogs. During breeding season, human disturbance can even cause the crane to abandon its nest. With these challenges working against it, the crane may well be quietly disappearing.

As Canon sees it, images have the power to raise awareness of the threats facing endangered species and the natural environment, helping us make the world a better place.

EOS System

Canon

global.canon

ONE STOP HOLIDAY SHOPPING

There's something for everyone in these classic National Geographic genres. Give the gift of wonder this season!

AVAILABLE NOW FOR PRE-ORDER WHEREVER BOOKS ARE SOLD
and at NationalGeographic.com/Books

NatGeoBooks @NatGeoBooks

NATIONAL GEOGRAPHIC