

WATCH BIG CAT WEEK STARTING SUNDAY, DECEMBER 11, AT 8 P.M. ON NAT GEO WILD

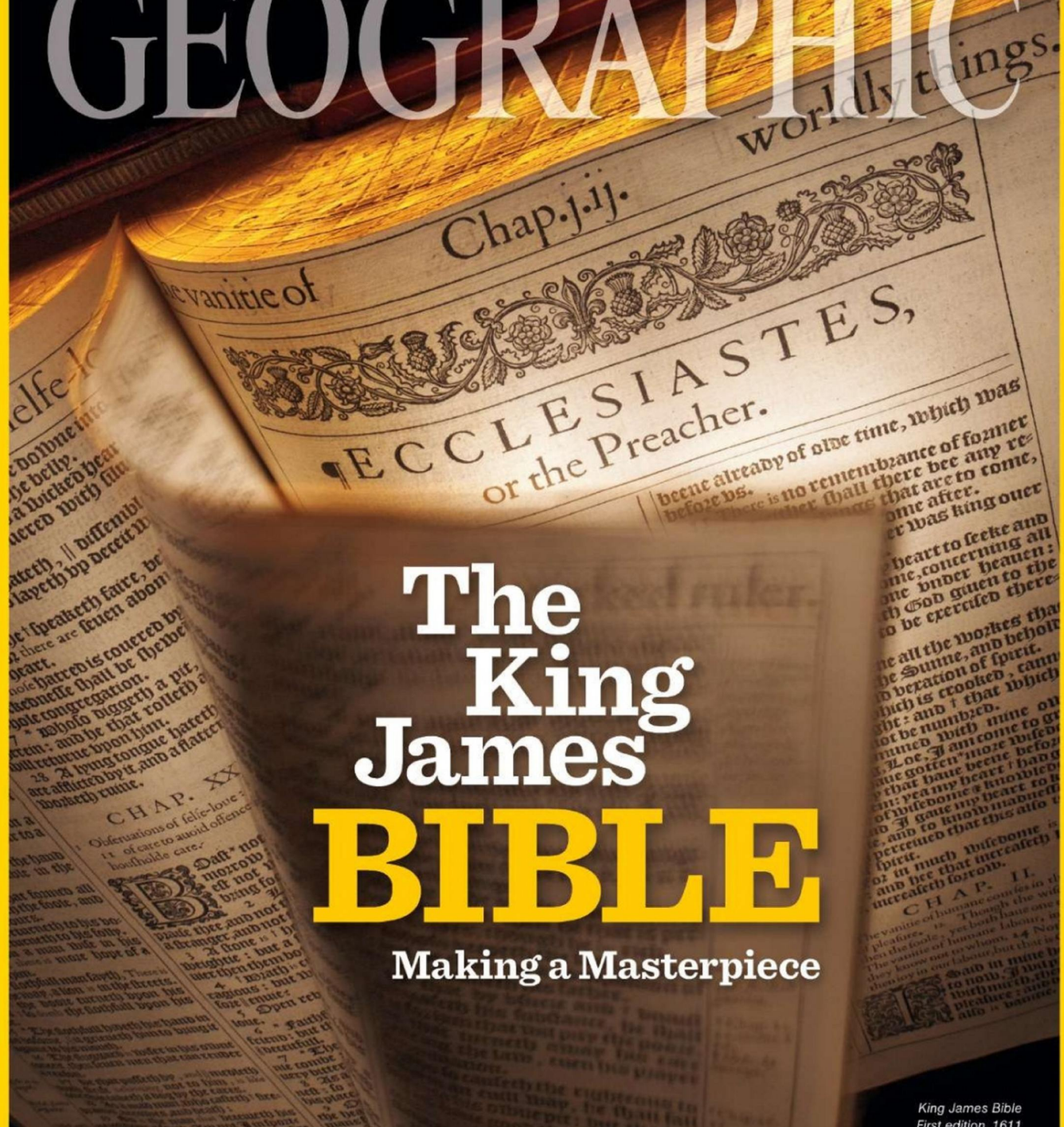
BIG CATS

NGM.COM DECEMBER 2011



FREE POSTER

NATIONAL GEOGRAPHIC



The King James BIBLE

Making a Masterpiece

NUCLEAR ZONE

Japan's Abandoned Towns

SPACE CLOUDS

Bound for the Milky Way?

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First edition, 1611
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at the cleaner head.

December 2011

36 Miracle of the King James Bible

The power and beauty of its words touch churchgoers and cowboys, poets and Rastafarians.

By Adam Nicolson Photographs by Jim Richardson

62 Cry for the Tiger

The mightiest of cats faces annihilation. We have the means to save it. But do we have the will?

By Caroline Alexander Photographs by Steve Winter

88 Politics Is Killing the Big Cats

The world-renowned field biologist lays out a bold new approach to keep them from vanishing.

By George B. Schaller

Special Poster: Big Cats

92 Japan's Nuclear Zone

Thousands fled the meltdown. Exclusive photos show the eerily empty world they left behind.

By Lucille Craft Photographs by David Guttenfelder

114 Upstart Galaxies

Satellites of the Milky Way usually perish in its grasp. Why are the Magellanic Clouds thriving?

By Timothy Ferris

124 Cities Are the Solution

They may be the best way to lift people from poverty and preserve the environment.

By Robert Kunzig

Tiger experts at India's Bandhavgarh Park hadn't seen this male before he was photographed for our story.

STEVE WINTER

DEPARTMENTS

- 4 **Editor's Note**
- 6 **Letters**
- 8 **National Geographic on TV**
- 10 **Explorers Journal**

12 **VISIONS** ▶

- 18 **Field Test**
- 20 **Your Shot**



22 **NOW**

Georgia's Chopsticks

Each week the town of Americus creates ten million sets to export to Asia.

Hook, Line, and Orangutan

The forest dwellers have gone fishin'.

Probing a Gobi Murder

Why was a family of nine strangled in the desert some 500 years ago?

Power Cities ▶

The Big Apple is the big cheese in a ranking of urban influence.

Global Gestures ▶

A nod or a thumbs-up can mean very different things in different countries.



30 **NEXT**

Blue Goo vs. Toxic Waste

A superabsorbent, polymer-based hydrogel can swiftly and safely suck up radioactivity.

Telltale Heart ▶

The latest artificial version doesn't beat. It spins as it keeps you alive.

Extraterrestrial Veggies

There's no sun, no rain, no soil. What's the secret to space station farming?



- 148 **NG Connect**
- 150 **The Moment Flashback**

E-GEOGRAPHIC

Here are the coolest extras in our electronic editions.

Big Cat Poster, Part I

Tap on a photo and find out how Vincent J. Musi snapped the cat.

ngm.com + iPad

Big Cat Poster, Part II

What does it take to paint a lion? Eight trips to the zoo, plenty of photos, and a scale model were part of the process for graphics editor Fernando G. Baptista, who tells all in a video.

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Photo Contest

View submissions for the 2011 National Geographic Photo Contest at "See All Entries." Deadline for entries: November 30. Winners will be named on December 15.

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On the Cover

This 1611 King James edition is part of the Quayle Bible Collection at Baker University in Baldwin City, Kansas.
Photo by Jim Richardson

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Guardian Spirit

*But where is what I started for so long ago?
And why is it yet unfound?*

—Walt Whitman

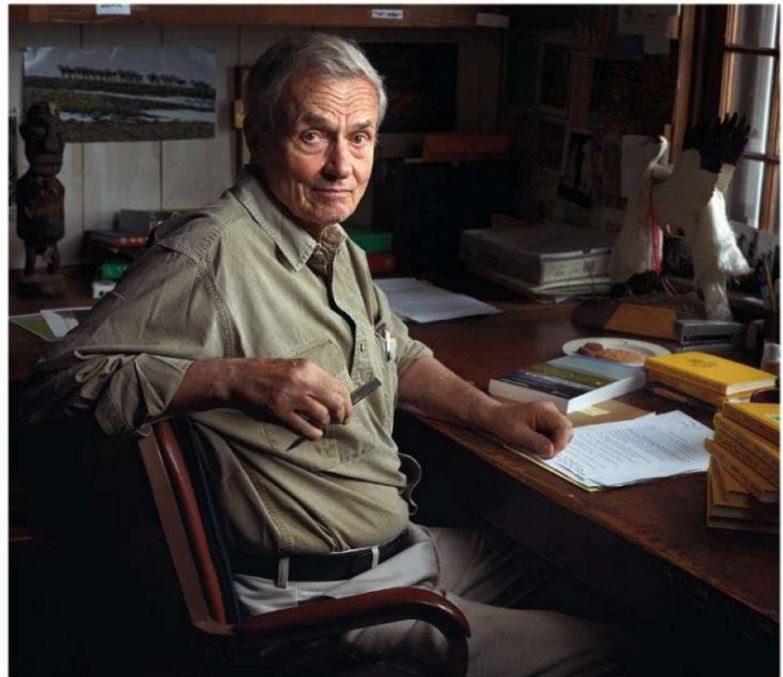
I came across Whitman's words in the introduction of George B. Schaller's most recent book, *A Naturalist and Other Beasts: Tales From a Life in the Field*.

Whitman's lovely lines have a touch of the wistful—something I don't ordinarily associate with Schaller, one of the world's preeminent conservationists. In this month's issue, he takes stock of what he's seen in more than a half century of wildlife field studies. He ticks off the changes: world population more than doubled, forests mowed down for fields, rangeland given over to livestock instead of wildlife.

The impact of these changes on megafauna such as great cats has been profound. His most alarming example is tigers. They now occupy less than 7 percent of their original range. Barely 4,000 may remain in the wild, compared with some 5,000 in captivity in the United States and China each.

Fortunately for us, Schaller, at 78 years of age, remains committed to the things in nature, as he once put it, that uplift the spirit. "I have chosen a never-ending path—but one where I can make a difference," he writes. "I still strive to protect something that will outlive me, some small achievement that matters."

Schaller has inspired me for more than 20 years. As we mature I believe we become more selective about whom we choose to call heroes. George Schaller is one of mine.



George Schaller, photographed in his Connecticut home, has spent decades fighting for tigers.



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Apennine Chamois (*Rupicapra pyrenaica ornata*)

Size: Head and body length, approx. 125 - 135 cm (49.2 - 53.1 inches); shoulder height, 70 - 80 cm (27.6 - 31.5 inches) **Weight:** Males average 30 kg (66 lbs); females average 20 kg (44 lbs) **Habitat:** Prefers alpine meadows, forested valleys and lower slopes in mountainous regions **Surviving number:** Estimated at 1,100



Photographed by Bruno D'Amicis

WILDLIFE AS CANON SEES IT

Living on the edge. The Apennine chamois has been to the very brink of extinction, as populations fell to a few dozen in the 1940s. It is a great leaper and runner, and extremely sure-footed; its hooves are hard on the outside and soft and elastic on the inside, with third and fourth toes that can spread up to 90 degrees to help on steep slopes. Males make use of their marvelous horns, too, in aggressively defending their harems

during breeding season. Though numbers have climbed back thanks to strict protection, this species is still at risk due to low genetic variability and competition for food and space.

As we see it, we can help make the world a better place. Raising awareness of endangered species is just one of the ways we at Canon are taking action—for the good of the planet we call home. Visit canon.com/environment to learn more.



Spirit Bear

When my *National Geographic* arrived, I exclaimed out loud, "The ghost bear!" Among my earliest memories of my grandfather is his bedtime story of a "ghost bear" that he encountered while fishing up north years before. The story of a great white bear chasing him through the forest as he stumbled back to his boat filled me with awe (and kept me awake some nights). Although I passed the story on to my three-year-old grandson, I'd concluded that it was just a story. But when I opened the August issue, there he was. The picture on pages 44-5 of the bear in the tree was the image I have held in my memory for years, after my grandfather told of how the bear seemed to wave goodbye to him as he rowed away. Now I have your pictures to show my grandsons that the story is true.

DAVID M. BLANTON
Roebuck, South Carolina

Should we continue promoting knowledge of spirit bears? Yes, of course, if we want to continue awareness, funding, and preservation. Should we pinpoint exactly where the general public might find them on a map? I think not.

MICHEL ROURE
Parsippany, New Jersey

How long have the Gitga'at and other First Nations considered killing the spirit bears taboo? If it can be traced back long enough, we'd find the answer as to why they are so prevalent in that area. Even hunting black bears only occasionally would add up over time. Also, wouldn't the ban on hunting the white

(recessive-trait) version eventually lead to extinction of bears with black fur?

DANIEL WOITULEWICZ
Detroit, Michigan

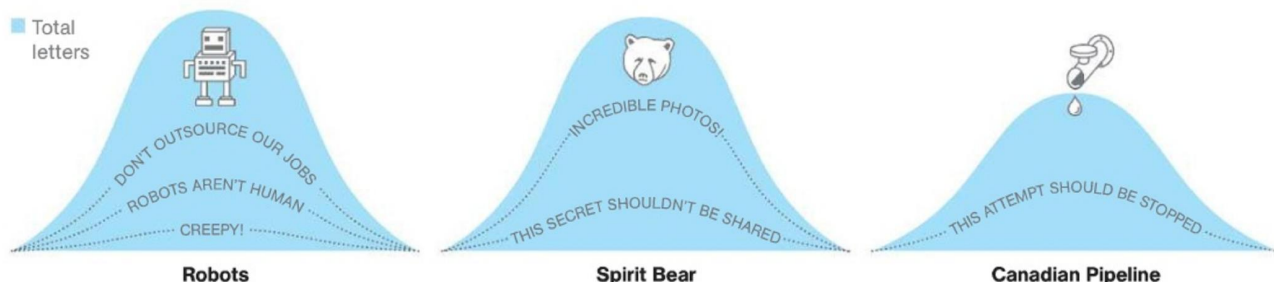
The black variant bears are not in danger of extinction because there are large populations of them on the adjacent mainland. They often swim across the waters to find new home ranges.

Pipeline Through Paradise

It is appalling that Canada would consider allowing Enbridge to proceed with plans to route an oil pipeline through some of the most sensitive geography in western North America. Regardless of safety measures, an accident is bound to happen. This would result in loss of wildlife and habitat. The way of life of the indigenous population would be forever changed for the worse. Is the money really worth it? There is no way to restore the ecology of this area once it is sullied.

MICHAEL ALBRICH
Sequim, Washington

FEEDBACK Here are some of the most common sentiments shared about the three stories that received the most letters.



EMAIL ngsforum@ngm.com **TWITTER** @NatGeoSociety **WRITE** National Geographic Magazine, PO Box 98199, Washington, DC 20090-8199. Include name, address, and daytime telephone. Letters may be edited for clarity and length.

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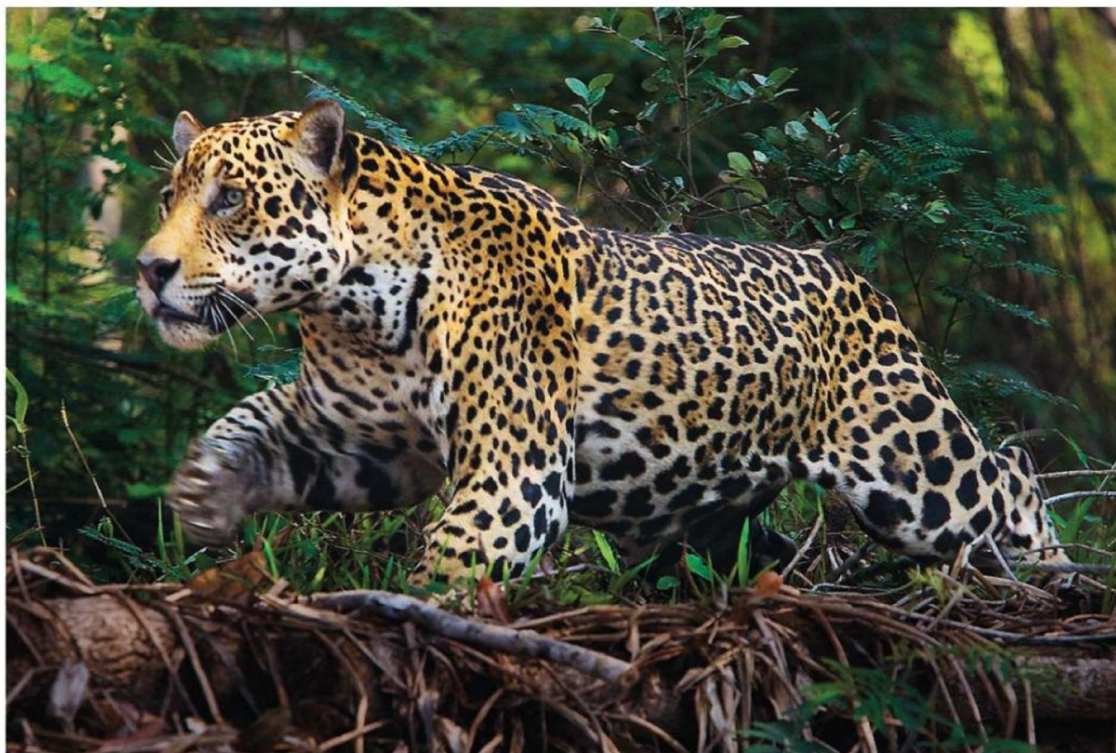


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THIS MONTH

Big Cat Week

Nat Geo WILD shows its support this month for National Geographic's Big Cats Initiative with seven days dedicated to nature's exotic and endangered felines. Witness never before seen footage, shot in the Serengeti, of lions attacking cheetahs. Then dissect the scene with experts and learn why interaction between these two predators can turn violent. From cougars in Wyoming to jaguars in South America to India's rare clouded leopards, this weeklong event has the inside world of big cats covered.

A jaguar (top) hunts for caimans along a riverbank in Brazil's Pantanal.



NATIONAL GEOGRAPHIC CHANNEL

Alaska State Troopers
Sergeant Bryan Barlow (above) and the team are back on patrol in season three of the series.

For listings go to natgeotv.com and natgeowild.com.



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The 2011 *Energizer* Ultimate Photo Contest – Finalists

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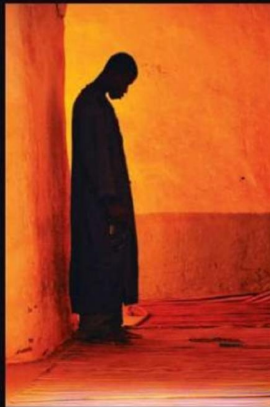
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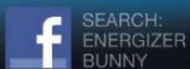
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JONATHAN CLARK – OAKLAND, CA



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*in digital cameras vs. *Energizer*®, *MAX*®. Results vary by camera.

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Congratulations to our Grand-Prize Winner

EVAN PEERS – SAN CARLOS, CA



A Few Words From Jim

“What a great set of images for finalists. Such wonderful images make life tough on the judge who has to choose only one. Each time I saw the powerful scene—colorful, aerobatic airplanes flying full-tilt, straight into the lens—I fell in love with the image even more. Although color, light and composition helped this picture win, it was also the great spectacle of the moment, captured tack-sharp and without a scrap of wasted space or energy that made this image stand out. Congratulations to our winner. (And congratulations to all our finalists. Your images were a joy to see.)”

—Jim Richardson, National Geographic photographer and judge
in the Energizer Ultimate Photo Contest

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MISSION To protect endangered sea turtles along Nicaragua's Pacific coast

Turtle Defender

Every winter in Nicaragua's Río Esca-lante Chacocente Wildlife Refuge, I wait for olive ridley turtles to come out of the Pacific to nest on the beach. The event, called an *arribada* (arrival), is a frenzy as thousands of turtles compete for space and start to dig. When it's over, the beach is full of turtle tracks and nests. Everyone's exhausted. But my work is just beginning.

On land the main threat to olive ridley turtles, and to critically endangered leatherbacks and hawksbills, comes from the poachers who steal their eggs. Eating sea turtle eggs has been illegal in Nicaragua since 2005, but there's still an appetite for them. For a poacher, it's quick, easy money—\$30 a nest. The

average local income is \$100 a month.

Since 2002, my team and I have monitored thousands of nests and relocated many to hatcheries. Some rangers who work with me are former poachers. We've protected nearly every leatherback egg—we're lucky if we count 40 nests a season—and more than 90 percent of olive ridley nests.

The olive ridley hatchlings all emerge 45 days after the mothers lay the eggs. That's the moment I like best—all these tiny turtles on their way to the ocean. Some will make it; some won't. It's a hard world they have to face, but they've been doing it since the time of the dinosaurs. In 15 years they'll come back to nest here, in the same place where they were born. —José Urteaga



Marine biologist José Urteaga (left) and his Fauna & Flora International team monitor a nesting leatherback turtle.

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VISIONS



Pakistan

Finely dressed in military costumes, two brothers prepare to accompany their sister across a neighborhood street on a winter's morning in Islamabad. The children were headed to a photo studio for a family portrait.

PHOTO: MUHAMMED MUHEISEN, AP IMAGES





**Democratic Republic
of the Congo**
Healthy vegetation in
a verdant area of South
Kivu Province appears
reddish when captured
with infrared photography.
Such imagery aids
foresters, cartographers,
and the military.

PHOTO: RICHARD MOSSE, INSTITUTE

Visions of Earth—the book—is available in stores now.







China

As if swimming in a fantasy aquarium, a school of decorative fish hovers inside Beijing's renovated Water Cube. Where Olympic swimmers used to compete, visitors now frolic in a wave pool and on elaborate water-park rides.

PHOTO: MATTHEW NIEDERHAUSER, INSTITUTE

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Greek God Invents **FREE** Love

Inspired by a mythological romance, this stunning 170-carat amethyst bead necklace is yours for the taking!

She was Amethyst, a maiden devoted to virtue. He was Dionysus, the notorious Greek god of intoxication and revelry. He loved her, but she wanted to wait for someone more suitable. He was a god, used to getting what he wanted. The chase was on. But once Diana saw that Amethyst was serious about keeping her heart pure, the goddess transformed her into a statue of perfect stone. Dionysus stopped partying for a moment and wept. He spilled his wine and infused the statue with the rich violet color we now know as amethyst.

It's not what you would call a happy ending. Luckily we discovered that something good came from their ill-fated romance. Specifically, this spectacular 170-Carat **Amethyst Maiden Necklace**. And the incredible price may just have you shedding tears of joy. For a limited time, you can get 170 carats of polished purple gems valued at \$249...absolutely FREE (you pay only for basic shipping and processing).

Drape yourself in purple perfection. Each rounded bead retains its own unique shape and just the right amount of translucence to let the light ignite the velvety, violet hues. Each gem is hand set on double-knotted jeweler's thread. The entire length secures with a .925 sterling silver lobster clasp layered in gold. The 18" necklace (with 2" extender) hangs with the same weight and elegance as similar strands that sell for hundreds more.

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VISIONS | FIELD TEST

SKY TECH | Photographer Michael “Nick” Nichols weighs in on the 2.6-pound micro-copter, a flying machine with a 30-inch wingspan, modified by National Geographic to carry his two-pound camera:

..We have had two successful sunrise flight sessions, flying 65 feet over gigantic wildebeest migrations. This gives us an image that could be made no other way. Not by helicopter—too noisy, too costly. Not by balloon—too scary and only goes where the wind goes. Traditional airplane—too fast and has to fly too high. And I suspect the animals will tolerate the micro-copter as a huge tsetse fly.”

Field Journal Follow more of Nichols’s adventures in Africa at ngm.com.

“I suspect the animals will tolerate the micro-copter as a huge tsetse fly.”



How It Works

A team of three deploys the micro-copter, which carries a digital camera. The goal is to use it to photograph lions and their prey.

1 A video feed from the camera on the copter is transmitted to the tripod, then to the goggles worn by team members.

2 Nathan Williamson pilots with hand controls. Another aide checks vital signs (below) via laptop. Batteries last 6 to 10 minutes. If they die, the copter crashes.

Copter vital signs during this photo

Altitude
5 FEET

Distance from pilot
6 FEET



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Nichols (with goggles) is testing the micro-copter cam on wildebeests and elephants and will use it in an 18-month project documenting predators and prey in the African Serengeti.

THE PHOTOGRAPHER

TK is an TK photographer based in TK. More of his work can be seen at url.com.

Odi autem nis et ut lamemis simi, isit earcimi nctur? Quia nulparum aut quam dolorum et, ut aut enditestes poratur sit alitiquo et eni invent eveles magnite mperiore volecat iumquamus conet litatis aciti rerum id modia cor miliam et hilitatis num alisciis serro essequa. Ut velecto restios et audaecea voluptatus illaccae. —Writer Namehere



328 ft

1,640 ft

3 In their fieldwork Nichols and his crew have sent the copter as high as 328 feet and let it roam about a third of a mile from their base.

Battery life



PHOTO: KEN GEIGER, NGM STAFF. GRAPHIC: LAWSON PARKER, NGM STAFF

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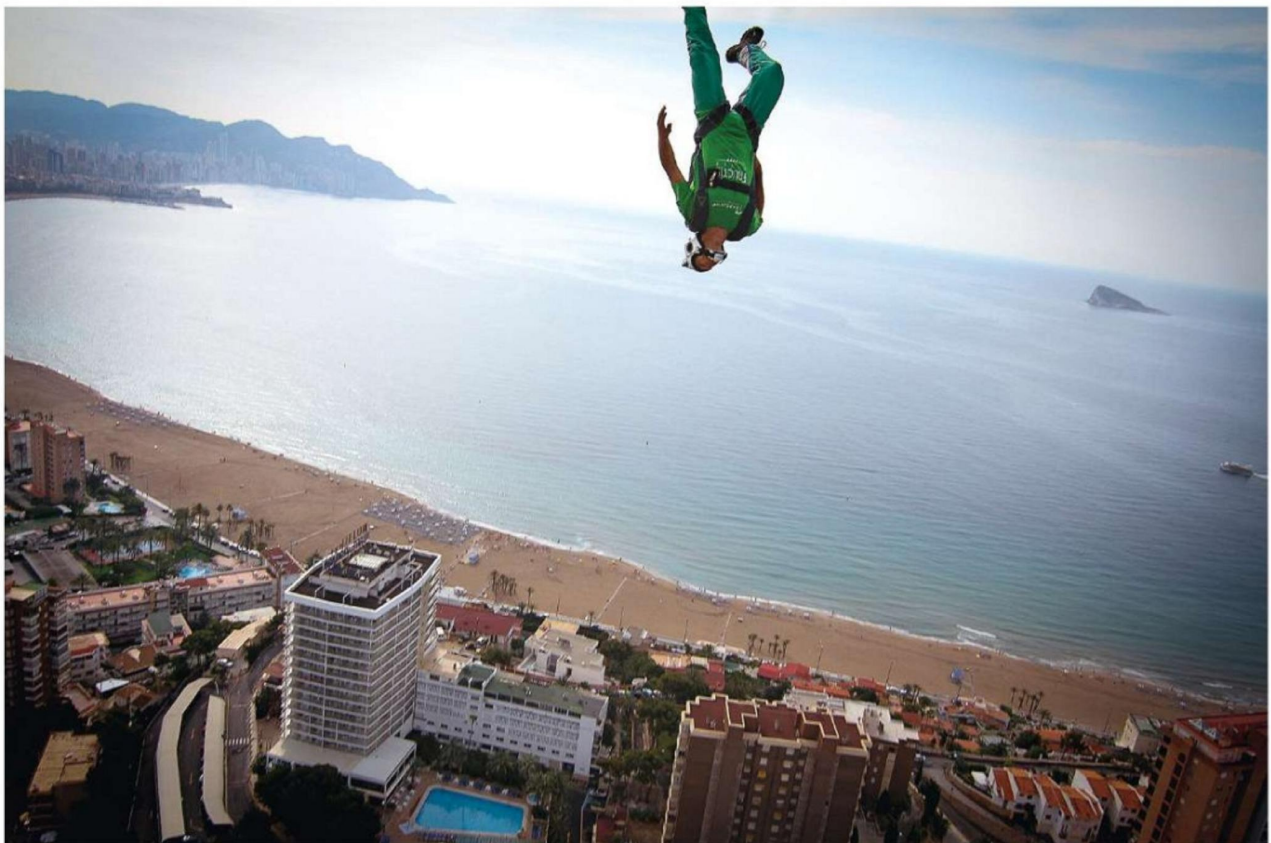
will run on

JABBER.

There are countless predictions about the future of fuel, and every automaker has made its pick. Some will tell you it's hydrogen. Others claim "clean" diesel is the answer. But prototypes and press releases won't solve the alternative-fuel debate. So Lexus asked a new question: What if the best alternative isn't a fuel at all? What if you engineered a system that could optimize any fuel on the planet, even those we don't use yet? So we did. We developed the most advanced hybrid system in the world. It's called Lexus Hybrid Drive. When you pursue the car of tomorrow, you don't just engineer a future-proof hybrid system. You engineer amazing. lexus.com/engineeringamazing



Send Us Your Cities As part of our yearlong series on sustainable cities, *National Geographic* is looking for city-themed photographs for the March Your Shot section. Take a look around your city—and take a picture of what catches your eye. Then send it to us at ngm.com/yourshot.



EDITORS' CHOICE

Xavier Coll Sola Barcelona, Spain

Dario Barrio plunges earthward during the BASE Jump Extreme World Championship in Benidorm, Spain. "He really seems to be enjoying his flight," notes Coll, 34, who snapped this shot of Barrio parachuting from Europe's tallest hotel—the 610-foot-high Gran Hotel Bali.

READERS' CHOICE

Richard W. J. Koh Singapore

Two nights after a heavy rain fell on his parents' Singapore garden, Koh, 39, found fungus growing on an old log "and fuming with what I think are spores dispersing—an amazing display of new life." A black velvet backdrop sets off the image.

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Jeffrey Chua de Guzman Manila, Philippines

De Guzman, 41, took this photo on a night dive at the Anilao Pier in Batangas, Philippines. "I was scanning the seafloor when something shiny glittered in the distance," he says. He swam over to find a discarded, broken soda bottle with an octopus curled up inside.

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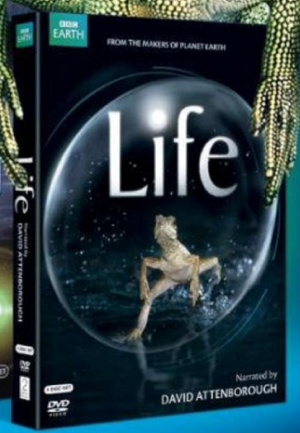
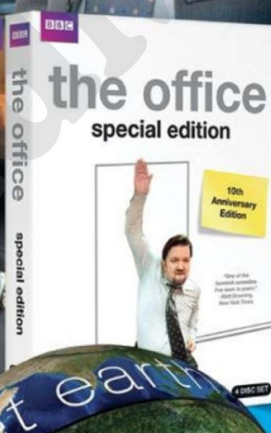
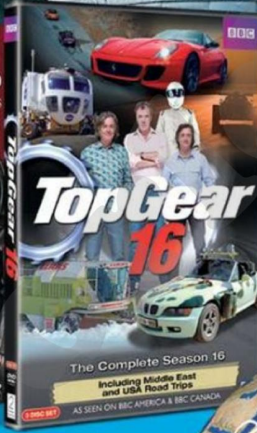
Captain

Driver

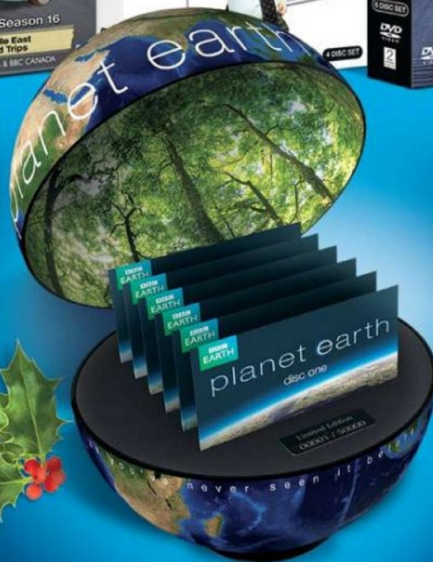
Boss

Doctor

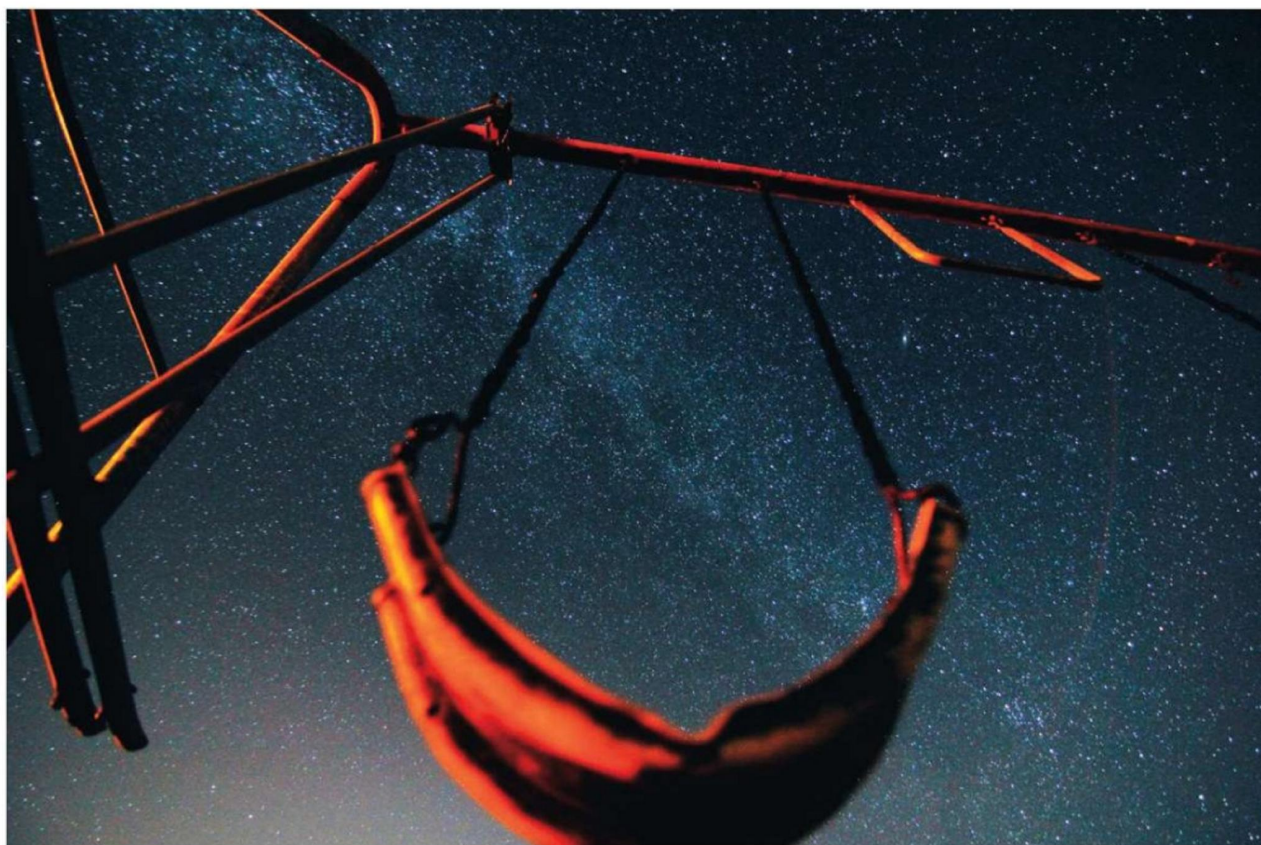
Lizard



Earth

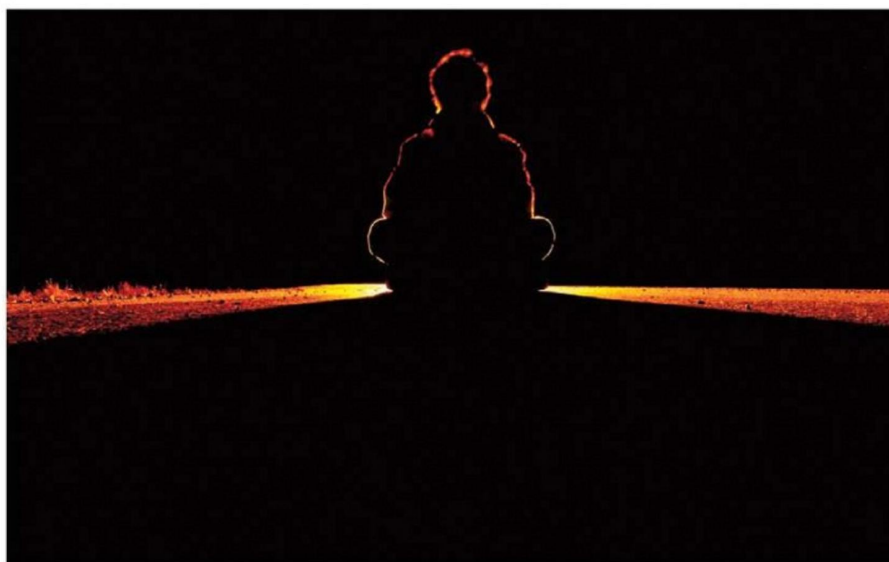


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Chris Multop Houston, Texas

"This picture makes you sit and think about those times when you would give the night sky a moment to soak in—like most of us do as children," says Multop, 31, a TV producer with a love for still photography. He shot this starry swing-set scene one evening at his brother-in-law's house.



Noah Puglisi

Mount Desert, Maine

"After stargazing for a little while, I turned on my car and saw an opportunity for an interesting photo," says Puglisi, 18. He then sat in the road and took a picture of himself. "The road was safe," he explains, although the night was "very, very cold and windy."

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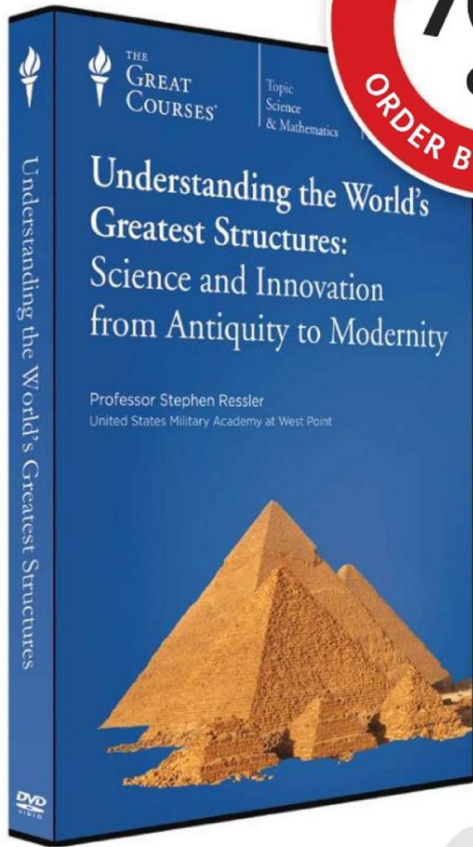


Vladimir Kudyakov Moscow, Russia

A building is wallpapered with strips of the sky in advance of the Seoul, South Korea, G-20 Summit in 2010. Kudyakov, 29, says passersby “couldn’t take their eyes off” the process.



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Made in Georgia Pull back the tag on a shirt, towel, or toy and you'll often see three words: Made in China. So it might seem safe to assume that chopsticks, of all things, are made there too. Except increasingly they aren't, due to a lack of raw materials. To feed Asian demand, a factory in Americus, Georgia—population 17,000—is cranking out ten million sets a week for export to China, Japan, and South Korea. Why Americus? For one thing, explains Georgia Chopsticks owner and Seoul native Jae Lee, real estate is cheap. For another, the area boasts an abundance of poplar and sweet gum trees, the wood of which is ideal for the disposable utensils. Yet environmental costs are minimal, says Lee. Open since May, the plant uses mostly scraps from nearby lumber and paper mills, meaning very few new trees are chopped to make these chopsticks. —Catherine Zuckerman



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In a Borneo sanctuary, ex-captive orangutans display a knack for fishing.

Ape Anglers Orangutans are clearly clever. They can saw wood, open locked doors, and drink from cups. But the fiery-haired “person of the forest” spends most of its time in trees, eating fruits and insects. So York University’s Anne Russon, who studies great ape intelligence, was surprised by the new skill she observed in several formerly captive orangutans in central Indonesian Borneo: fishing.

These enterprising apes—six among some three dozen now being reacquainted with the wild on a river island—use sticks to catch slower fish by hand, or simply steal lines laid by humans (above). After examining their catch, most decide it’s food. Some scientists think human brain evolution depended on the fatty acids in fish and shellfish rather than on a diet of meat, and Russon says her research may support that theory. “This indicates that the earliest hominins could have figured out how to catch fish with tools.” —Amanda Fiegl

Probing a Gobi Murder

Some 500 years ago a family of nine was strangled in the Gobi desert. The killers left the dead in the open, ropes dangling from broken necks. The corpses, mummified by desert air, were eventually placed in a cave, where herders discovered them in 1974.

Now these victims, ranging from infants to a man in his 40s (below), are helping scientists reconstruct the harsh lives—and deaths—of early Ming dynasty nomads. A full analysis will take years, but DNA and other tests offer clues.

This may have been a case of punishment, not crime, speculates Smithsonian Institution physical anthropologist Bruno Frohlich, who’s studied the mummies since 2004. One person’s wrongdoing may have led to retribution against his relatives—especially if a criminal’s execution would leave his dependents without support. —Hannah Bloch



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The Most Influential Cities

“New York City, the incomparable, the brilliant star city of cities.” So wrote author John Gunther in one of the many odes to the much loved—and maligned—metropolis. But what exactly gives the city its spark? According to one measure of urban power, the alignment of five major forces puts the Big Apple atop all others. With over half the world’s population now residing in urban areas, cities drive global dynamics more than ever, says Samantha King of A. T. Kearney. The management consultancy launched the Global Cities Index, a gauge of urban influence, in 2008 and issued an update in 2010. “The list at this stage is fairly intuitive,” says King,

7
SEVEN
BILLION

though she expects certain trends to show their impact over the next decade. These include the financial crisis that began in 2008 and the ability of cities like Singapore and Chicago to adapt their industry focus over time. Beijing and Shanghai exhibit rapid growth but not yet the infrastructure of other large cities, says King. Livability isn’t a factor. Although most cities enjoy strengths in specific areas, the four that lead the rankings shine across all dimensions. Business, culture, politics, information, and human capital all thrive in New York, London, Tokyo, and Paris. The fusion of these elements generates a vitality that in turn attracts more of the same. Brilliant stars indeed. —Luna Shyr

The 2010 Global Cities Index ranks cities based on their scores in five key areas.

Information exchange considers the number of foreign news bureaus and broadband subscribers, and level of censorship.

Names are colored to reflect each city’s dominant attribute. Beijing’s is business activity.



7 Los Angeles^{U.S.}



6 Chicago^{U.S.}



5 Hong Kong^{CHINA}



4 Paris^{FRANCE}



3 Tokyo^{JAPAN}



2 London^{UK}



1 New York City^{U.S.}



12 cities

North America
1 New York City

19 cities

Europe
2 London

25 cities

Asia
3 Tokyo

South America
22 Buenos Aires

5 cities

Africa
43 Cairo

4 cities

The full index covers 65 cities with populations greater than a million. At left they're grouped by region, with the top-ranked city noted in each.



Political engagement gauges influence on global policymaking. It includes embassies, think tanks, global organizations.



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A World of Gestures

Nonverbal cues help us overcome language barriers but are often fraught with cultural nuance. A nod, for instance, can mean “yes” or “no.” What seems like a friendly thumbs-up to an American may insult an Afghan. And in Mediterranean countries, hugs or kisses are a normal public greeting, while in Japan such close physical contact would offend.

Social scientists point out that context is crucial—who is gesturing, how, on what occasion—and generalized definitions go only so far in multicultural settings. When unsure, perhaps you’d better keep your hands to yourself. —Amanda Fiegl

Different motions are used to convey the same meaning, depending on culture and geography. But exceptions abound, even within a country.

Hello



U.S.



Hawaii, U.S.

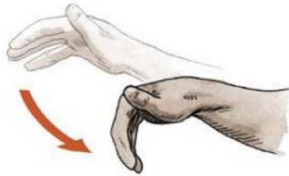


India

Come!



U.S.



Turkey

Don't tell



U.S.



U.K.

Look!



U.S.



Indonesia

No



U.S.

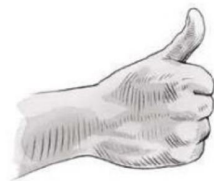


Greece

These gestures may look the same, but their meanings vary greatly based on how and where they're used.



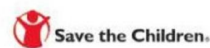
Country	Meaning
U.S.	Rock on!
Brazil	Good luck!
Italy	Vulgar insult



Country	Meaning
U.S.	Great!
Germany	One
Japan	Five
Afghanistan	Vulgar insult



Country	Meaning
U.S.	OK
Japan	Pay me
France	Worthless
Russia	Vulgar insult



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¹ U.S. Geological Survey, ² FORTUNE®, March 2011, ³ Ethisphere™ Magazine, April 2011
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Photo ©Mike Jensen/Heart to Heart International



In Port-au-Prince, Haiti, a man suffering from cholera lies in an improvised hospital.

Cholera Redux An ancient scourge keeps defying modern efforts to defeat it. Months after Haiti’s 2010 earthquake, cholera appeared in the island nation for the first time in more than a century. Despite intensive containment attempts, the epidemic has now killed more than 6,000 people there. Recurrent outbreaks are plaguing sub-Saharan Africa and Southeast Asia as well.

The bacterium, which causes severe diarrhea and can kill a person within hours, originated in the Ganges River Delta. In the 19th century *Vibrio cholerae* began to move around the world, spread by travelers. According to the World Health

Organization, the current global pandemic started in 1961. Infectious-disease experts suspect peace-keeping troops brought cholera to Haiti last year; DNA tests link it to strains in Southeast Asia.

People get cholera from contaminated food or water. But new research shows many environmental factors—including water temperature, flow, and pH—affect outbreaks. That makes them difficult to predict. And climate change may be having an impact. “We’re now seeing protracted epidemics,” says Peter Hotez of Houston’s National School of Tropical Medicine. To contain them, new predictors and a live vaccine are needed. —Nancy Shute

ET CETERA

A study using genetic molecules called microRNAs suggests turtles are **CLOSER KIN** to lizards than to crocodiles and birds. ■ To process low light levels at high latitudes, humans near the Earth’s Poles have evolved **BIGGER EYES AND BRAINS**—though not greater intelligence—research says. ■ A DNA study finds several populations of the **WORLD’S LARGEST SHEEP** are genetically connected despite mountainous international borders. ■ A **36-FOOT-LONG, HALF-TON MUSHROOM** has been found on a tree in China.

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— J. FROM CALIFORNIA



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JEWELRY SPECS:



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Bumper Beavers Seen from above, the vast forests flanking streams and lakes in South America's Tierra del Fuego show big gaps, as though they had been bombed. In fact these scars reveal the damage inflicted by imported beavers, which have officials in Argentina and Chile trying to control their numbers.

In 1946 Argentina introduced 25 pairs of beavers from Canada to develop a fur trade. The business fizzled, but the beavers flourished. They chewed their way across to the Chilean side and onto the mainland. By felling trees for dams and food, the beavers have changed riparian ecosystems and altered water flow and quality. Lacking natural predators, they now number around 100,000.

Officials in both nations want to eradicate the rodents and restore the forests. But the beavers have already made indelible marks on the slow-growing forests, often leaving grassy meadows in their wake. Says Leonel Sierralta of Chile's Environmental Ministry: "Even if we proceed with active restoration with an infinite amount of money, the landscape will never be the same." —Murray Carpenter



Imported beavers have proliferated across the archipelago of Tierra del Fuego and crossed over to the mainland.

AREA ENLARGED

PHOTO: LEONARD LEE RUE III,
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NEXT

FALLOUT CLEANUP

Need a swifter, safer way to mop up toxic waste? Blue goo may do.

Scouring radioactive waste usually means just that. Scrub with soap and water, pails and brushes. Repeat. If it sounds messy, it is—and dangerous too for those exposed to dust and contaminated wastewater.

Hawaii-based CBI Polymers says it's come up with a better way to clean up nuclear waste. The firm's blue goo may not look high-tech; all you do is pour it. But as the superabsorbent goo gels, its molecules act as a sponge, binding and encapsulating radioactive molecules. Peel the film off and you've got lightweight waste that can be rolled up and disposed of more cheaply and easily than vats of toxic water.

"It's the same concept as Silly Putty. It gets into every pore, nook, and cranny," says the Department of Energy's Hector Rodriguez, who used it to sop up beryllium, a hazardous metal, left over from weapons research at the National Energy Technology Laboratory in Oregon. The yearlong project cut the labor used in such efforts by 70 percent.

This year CBI donated 500 gallons to the nuclear cleanup in Japan, where it decontaminated 25,000 square feet of walls, sidewalks, and playgrounds. It's also good on toxic PCBs, asbestos, and heavy metals like mercury—on everything from battleships to power plants—as well as nonindustrial messes. That's heavy-duty work for such humble-looking goo. —Gretchen Parker

Blue goo is mostly for big toxic surfaces but works on germey keyboards too. The more porous the object, the more you need.





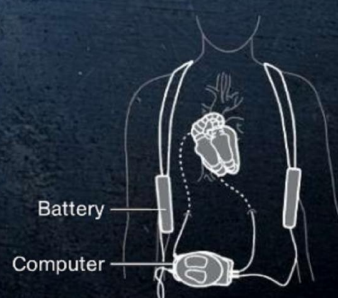
NEXT

Skipping a Beat

Signs of life tend to be, well, vital. So how did a man from Texas, told he was 12 hours from death due to cardiac amyloidosis, survive for five weeks this spring without a pulse?

The answer is pictured on this page. Still in development by Billy Cohn and Bud Frazier at the Texas Heart Institute, the “beatless heart” uses two spinning rotors to circulate blood nonstop. Few moving parts mean it won’t wear out like a larger, traditional implant, which has to pulse 100,000 times a day. Cohn calls his creation “arts and crafts”: For animal trials, he cobbled together two ventricular assist devices using sterilized hardware-store materials. For the human test, he substituted FDA-approved ones.

Cohn says 42 years after the first artificial-heart implant, it’s time to look past biomimicry. Wings that flap didn’t help mankind fly, so why must a substitute heart beat like a natural one? “Mother Nature,” he adds, “did the best she could.” —*Jeremy Berlin*



The first beatless heart (prototype above) is run by external batteries and a computer.

Italian Doctor Discovers Ancient “Love Drug”

Now available without a prescription!
Call now and get 250 carats of rich,
gorgeous garnet—for UNDER \$30!

Today if you want to learn about gemstones, you ask a jeweler or geologist. But back in the 16th century, Italians went to see the doctor. Respected men of science and medicine believed that precious stones did more than just look pretty. They believed the power of gems could cure almost anything. And if you needed serious help in the romance department, nothing worked better than garnet. Today you can get a massive dose of the legendary gem for an unbelievable price. Call now and this stunning **250-Carat Garnet Garland Necklace**, valued at \$179, is yours for **ONLY \$29.95!**

The color of passion. In 1502, Camillus Leonardus, M.D. published his *Speculum Lapidum (Mirror of Stones)* about the mystical and spiritual properties of gemstones. One of the superstars of that volume was the deep-red garnet. Few stones provoke more passion, fire and desire than glowing red garnets. Today the heat still smolders.

Your love isn't average. It deserves a remarkable necklace at a ridiculous discount. We were all set to offer this 28" rope necklace for \$179. But the Italian doctor inspired us to give garnets the big deal they deserved. After all, if a stone has been said to “dissipate sadness, avert evil thoughts and exhilarate the soul,” it begs for something special. If scholars once thought that garnets could “bring sleep to the sleepless, drive away the plague, and attract riches, glory, honor and great wisdom,” why stop at ordinary?

That's why, for the next four weeks only, you can wear this 250-Carat **Garnet Garland Necklace** for the unbelievable price of **\$29.95!** That's right, you get 250 carats for under \$30! The gorgeous necklace is an endless strand of polished garnets that perfectly complements any outfit from couture to casual. Deep color. Sparkling. Seductive. Can the legendary love powers of garnet rev up your romance? We can't say for sure, but taking your medicine has never felt like more of an indulgence!

Your satisfaction is guaranteed. The crimson sparkle of the **Garnet Garland Necklace** is something you really need to see for yourself. If you're not completely delighted, simply return it within 30 days for a complete refund of your purchase price.

A.

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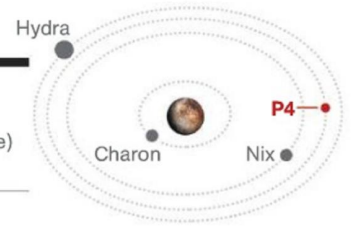
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Scientists have discovered a fourth moon orbiting Pluto. Temporarily designated P4, the moon is only about 8 to 21 miles in diameter. (Moons not to scale)



Mizuna, a mustard green, sprouts in a special growing chamber aboard the International Space Station. Peas and tomatoes also grew.

Off-World Greens On Earth veggies need sunlight, rain, and nutrient-rich soil, not to mention gravity to keep dirt and water from floating away. But none of these basics are easy to come by on the International Space Station, where Russian and American astronauts have been raising crops to test whether their brethren can grow food on deep space missions.

So scientists devised a shoe-box-size growth chamber sown with arcillite, grains of clay enriched with time-release nutrients and capable of holding water via surface tension instead of gravity. For safety reasons U.S. astronauts haven't yet been allowed to sample the bounty. But in 2008 a few lucky Japanese citizens got to taste beer made from space-flown barley seeds. The verdict: It was surprisingly similar to earthly brews. —Victoria Jaggard

ET CETERA

The Herschel telescope detected **OXYGEN IN OUTER SPACE** for the first time, in the constellation of Orion. • A **RECORD-STRENGTH "SPLIT MAGNET"** that can operate at 25 tesla, or 500,000 times the Earth's magnetic field, debuted in a laboratory at Florida State University. • Dyslexics may have trouble **DISTINGUISHING VOICES** as well as words, say MIT researchers. • In 2016 NASA's Juno spacecraft will reach Jupiter to search for **ATMOSPHERIC WATER** and clues to how the giant planet formed.

...nitie of all
...of laughter, It is mad:
...what doeth it?
...in mine heart to give
...with wisdom) and to lay
...till I might see what was
...the sonnes of men, which
...vnder the heauen fall
...their life.
...great workes, I built
...I planted mee vine
...gardens & orchards,
...in them of all kinde
...of water, to
...wise: then I said in my heart, This
...also is vanitie.
16 For there is no remembrance of the
...wise, more then of the foole for ever; see-
...ing that which now is, in the dayes to
...come shall be forgotten; and how dieth
...the wise man: as the foole.
17 Therefore I hated life, because
...the worke that is wrought vnder the
...Sunne is grieuous vnto mee; because
...vanitie, and veration of spirit.
18 A Pea I hated all my labour,
...which I had taken vnder the Sunne:
...because I should leaue it vnto the man
...that shall be after mee.
19 And who knoweth whether he
...shall be a wise man or a foole: yet shall
...he laboure, and wherein I
...laboured, I shall seeke vnto vanitie.
...I went about to cause
...all the labour
...of mine
...labour
...ledge, and
...that
...of all his

The Bible of

First printed 400 years ago, it molded the English language, buttressed the “powers that be”—one of its famous phrases—and yet enshrined a gospel

A time for all.

Chap. iij. iij.

Man a

Every thing there is a sea-
 son, and a time to every
 purpose vnder the heauen.
 2 A time † to be bozne,
 and a time to die: a time to
 plant, and a time to pluck vp that which
 is planted.
 3 A time to kill, and a time to heale:
 a time to breake downe, and a time to
 build vp.
 4 A time to weepe, and a time to
 laugh: a time to mourne, and a time to
 dance.
 5 A time to cast away stoues, and a
 time to gather stoues together: a time
 to embrace, and a time to be embraced.
 6 A time to keepe, and a time to
 cast away.
 7 A time to be silent, and a time
 to speake.
 8 A time to loue, and a time to
 hate.
 9 A time to warre, and a time to
 peace.

might manifest them, and
 might see that they them
 beasts.
 19 * For that which be-
 sonnes of men, befallerh
 one thing befallerh them
 eth, so dieth the other: y
 one breath, so that a ma
 ninnence aboue a beast
 20 All goe vnto the
 the dust, and all turn
 21 who knoweth
 that † goeth vnto
 the beast that goeth
 earth:

King James

of individual freedom. No other book has given more to the English-speaking world.

BY ADAM NICOLSON ¶ PHOTOGRAPHS BY JIM RICHARDSON



For a thousand years, music and ceremony have celebrated the Christian Gospel in Westminster Abbey in London. As the place where generations of English kings and queens have been married, crowned, and buried, this great medieval building embodied King James's cherished fusion of divine glory and regal authority—a visual and aural richness of which the new Bible was to be an integral part.



The 15th-century church of Rodel on the Isle of Lewis, built for the warlike chiefs of the MacLeods, towers over the sea lochs of Scotland's Outer Hebrides. Nothing in early modern Britain, from its cities to its remotest corners, was more political than religion. The church in every parish—nearly always the most imposing building—was as much a symbol of worldly control as a shrine to God.





ROME WAGER STANDS IN

front of the rodeo chutes on a small ranch just outside the Navajo Reservation in Waterflow, New Mexico. He is surrounded by a group of young cowboys here for mid-week practice. With a big silver buckle at his waist and a long mustache that rolls down on each side of his mouth like the curving ends of a pair of banisters, Wager holds up a Bible in his left hand. The young men take their hats off to balance them on their knees. “My stories always begin a little different,” Brother Rome says to them as they crouch in the dust of the yard, “but the Lord always provides the punctuation.”

Wager, a Baptist preacher now, is a former bull-riding and saddle-bronc pro, “with more bone breaks in my body than you’ve got bones in yours.” He’s part Dutch, part Seneca on his father’s side, Lakota on his mother’s, married to a full-blood Jicarilla Apache.

He tells them about his wild career. He was raised on a ranch in South Dakota; he fought and was beaten up, shot, and stabbed. He wrestled and boxed, he won prizes and started drinking. “I was a saphead drunk.”

But this cowboy life was empty. He was looking for meaning, and one day in the drunk tank in a jail in Montana, he found himself reading the pages of the Bible. “I looked at that book in jail, and I saw then that He’d established me a house in heaven... He came into my heart.”

The heads around the preacher go down, and the words he whispers, which the rodeo riders listen to in such earnestness, are not from the American West: They are from England, translated 400 years ago by a team of black-gowned clergymen who would have been as much at home in this world of swells and saddles, pearl-button shirts and big-fringed chaps as one of these cowboys on a Milanese catwalk. “Second



A life-size statue of King James dominates the most lavish room of this treasure-encrusted palace at Hatfield, north of London. Crowned and holding a sword and a scepter—symbols of his power—James is nevertheless flatteringly relaxed in his pose. Hatfield House was completed by Robert Cecil, the monarch’s loyal secretary, in 1611 as the King James Bible came off the presses.



Corinthians 5. “Therefore if any man be in Christ, he is a new creature: old things are passed away; behold, all things are become new.”

Here is the miracle of the King James Bible in action. Words from a doubly alien culture, not an original text but a translation of ancient Greek and Hebrew manuscripts, made centuries ago and thousands of miles away, arrive in a dusty corner of the New World and sound as they were meant to—majestic but intimate, the voice of the universe somehow heard in the innermost part of the ear.

You don’t have to be a Christian to hear the power of those words—simple in vocabulary, cosmic in scale, stately in their rhythms, deeply emotional in their impact. Most of us might

think we have forgotten its words, but the King James Bible has sewn itself into the fabric of the language. If a child is ever the apple of her parents’ eye or an idea seems as old as the hills, if we are at death’s door or at our wits’ end, if we have gone through a baptism of fire or are about to bite the dust, if it seems at times that the blind are leading the blind or we are casting pearls before swine, if you are either buttering someone up or casting the first stone, the King James Bible, whether we know it or not, is speaking through us. The haves and have-nots, heads on plates,

*Adam Nicolson’s book *God’s Secretaries* is about the makers of the King James Bible. Jim Richardson documented the Hebrides in the January 2010 issue.*

thieves in the night, scum of the earth, best until last, sackcloth and ashes, streets paved in gold, and the skin of one's teeth: All of them have been transmitted to us by the translators who did their magnificent work 400 years ago.

THE EXTRAORDINARY global career of this book, of which more copies have been made than of any other book in the language, began in March 1603. After a long reign as Queen of England, Elizabeth I finally died. This was the moment her cousin and heir, the Scottish King James VI, had been waiting for. Scotland was one of the poorest kingdoms in Europe, with a weak and feeble crown. England by comparison was civilized, fertile, and rich. When James heard that he was at last going to inherit the throne of England, it was said that he was like "a poor man... now arrived at the Land of Promise."

In the course of the 16th century, England had undergone something of a yo-yo Reformation, veering from one reign to the next between Protestant and anti-Protestant regimes, never quite settling into either camp. The result was that England had two competing versions of the Holy Scriptures. The Geneva Bible, published in 1560 by a small team of Scots and English Calvinists in Geneva, drew on the pioneering translation by William Tyndale, martyred for his heresy in 1536. It was loved by Puritans but was anti-royal in its many marginal notes, repeatedly suggesting that whenever a king dared to rule, he was behaving like a tyrant. King James loved the Geneva for its scholarship but hated its anti-royal tone. Set against it, the Elizabethan church had produced the Bishops' Bible, rather quickly translated by a dozen or so bishops in 1568, with a large image of the Queen herself on the title page. There was no doubt that this Bible was pro-royal. The problem was that no one used it. Geneva's grounded form of language ("Cast thy bread upon the waters") was abandoned by the bishops in favor of obscure pomposity: They translated that phrase as "Lay thy bread upon wette faces." Surviving copies of the Geneva Bible are often greasy with use. Pages

of the Bishops' Bible are usually as pristine as on the day they were printed.

This was the divided inheritance King James wanted to mend, and a new Bible would do it. Ground rules were established by 1604: no contentious notes in the margins; no language inaccessible to common people; a true and accurate text, driven by an unforgivingly exacting level of scholarship. To bring this about, the King gathered an enormous translation committee: some 54 scholars, divided into all shades of opinion, from Puritan to the highest of High Churchmen. Six subcommittees were then each asked to translate a different section of the Bible.

Although the translators were chosen for their expertise in the ancient languages (none more brilliant than Lancelot Andrewes, dean of Westminster), many of them had already enjoyed a rich and varied experience of life. One, John Layfield, had gone to fight the Spanish in Puerto Rico, an adventure that left him captivated by the untrammelled beauty of the Caribbean; another, George Abbot, was the author of a best-selling guide to the world; one, Hadrian à Saravia, was half Flemish, half Spanish; several had traveled throughout Europe; others were Arab scholars; and two, William Bedwell and Henry Savile, a courtier-scholar known as "a magazine of learning," were expert mathematicians. There was an alcoholic called Richard "Dutch" Thomson, a brilliant Latinist with the reputation of being "a debosh'd drunken English-Dutchman." Among the distinguished churchmen was a sad cuckold, John Overall, dean of St. Paul's, whose friends claimed that he spent so much of his life speaking Latin that he had almost forgotten how to speak English. Overall made the mistake of marrying a famously alluring girl, who deserted him for a presumably non-Latin-speaking courtier, Sir John Selby. The street poets of London were soon dancing on the great man's misfortune:

*The dean of St. Paul's did search for his wife
And where d'ye think he found her?
Even upon Sir John Selby's bed,
As flat as any flounder.*

This was a world in which there was no gap between politics and religion. A translation of the Bible that could be true to the original Scriptures, be accessible to the people, and embody the kingliness of God would be the most effective political tool anyone in 17th-century England could imagine. “We desire that the Scripture may speake like it selfe,” the translators wrote in the preface to the 1611 Bible, “that it may bee understood even of the very vulgar.” The qualities that allow a Brother Rome Wager to connect with his cowboy listeners—a sense of truth, a penetrating intimacy, and an overarching greatness—were exactly what King James’s translators had in mind.

They went about their work in a precise and orderly way. Each member of the six subcommittees, on his own, translated an entire section of the Bible. He then brought that translation to a meeting of his subcommittee, where the different versions produced by each translator were compared and one was settled on. That version was then submitted to a general revising committee for the whole Bible, which met in Stationers’ Hall in London. Here the revising scholars had the suggested versions read aloud—no text visible—while holding on their laps copies of previous translations in English and other languages. The ear and the mind were the only editorial tools. They wanted the Bible to sound right. If it didn’t at first hearing, a spirited editorial discussion—extraordinarily, mostly in Latin and partly in Greek—followed. A revising committee presented a final version to two bishops, then to the Archbishop of Canterbury, and then, notionally at least, to the King.

The King James Bible was a book created by the world in which it was made. This sense of connection is no more strikingly felt than in a set of rooms right in the heart of London. Inside Westminster Abbey, England’s great royal church, the gray-suited, bespectacled Very Reverend Dr. John Hall, dean of Westminster, can be found in the quiet paneled and carpeted offices of the deanery. Here his 17th-century predecessor as dean, Lancelot Andrewes, presided over the subcommittee that translated the first five

books of the Old Testament. Here, in these very rooms, the opening sentence “In the beginning God created the heaven, and the earth” was heard for the first time.

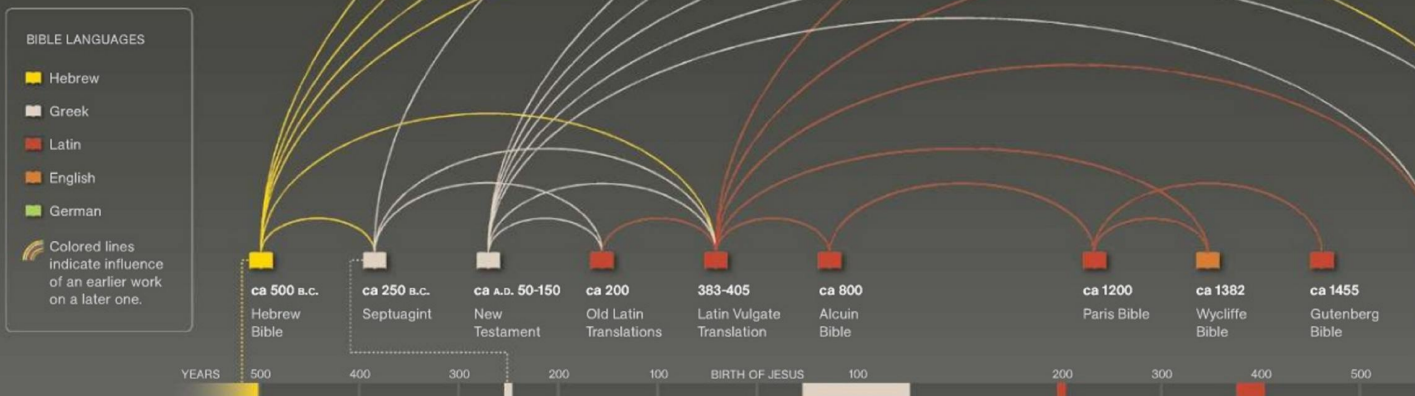
John Hall is the man who conducted the marriage of Prince William and Kate Middleton in the abbey earlier this year, and as we talk, thousands of people are queuing on the pavements outside, wanting to get into the abbey and retrace the route the new duchess took on her big day. It is the other end of the world from Rome Wager’s sermon to the cowboys in the New Mexico dust, but for Hall there is something about the King James Bible that effortlessly bridges the gap between them. He read the King James Version as a boy, and after a break of many years he took it up again recently. “There are moments,” he says, “which move me almost to tears. I love the story, after Jesus has been crucified and has risen, and he appears to the disciples as they are walking on the road to Emmaus. They don’t know who he is, but they talk together, and at the end they say to him, ‘Abide with us, for it is toward evening, and the day is far spent.’ That is a phrase—so simple, so direct, and so powerful—which has meant an enormous amount to me over the years. The language is full of mystery and grace, but it is also a version of loving authority, and that is the great message of this book.”

THE NEW TRANSLATION of the Bible was no huge success when it was first published. The English preferred to stick with the Geneva Bibles they knew and loved. Besides, edition after edition was littered with errors. The famous Wicked Bible of 1631 printed Deuteronomy 5:24—meant to celebrate God’s “greatnesse”—as “And ye said, Behold, the Lord our God hath shewed us his glory, and his great asse.” The same edition also left out a crucial word in Exodus 20:14, which as a result read, “Thou shalt commit adultery.” The printers were heavily fined.

But by the mid-1600s the King James had effectively replaced all its predecessors and had come to be the Bible of *(Continued on page 54)*

Roots of the King James Bible

It was not a new book but a polishing of the best of many old ones. From the Hebrew Scriptures and the Greek texts of the New Testament, a braided stream of Bible versions had flowed through Europe and the Middle East for more than 2,000 years. Martin Luther's Reformation begat translations in the 1500s that were key to the 1611 Bible.



The Bible Through Time

ca 500 B.C.

The Scriptures of the **Hebrew Bible**—the law, the prophets, psalms, and other writings—are thought to have been completed by this date.

ca 250 B.C.

A Greek translation of the Hebrew Bible, called the **Septuagint**, is compiled by Jewish scholars living in Alexandria, Egypt.

ca A.D. 50-65

Paul's letters to Christian churches around the Mediterranean are the earliest known writings of the **New Testament**.

A.D. First and Second Centuries

The Gospels and other writings that will form the **New Testament** are set down in Greek.

Fourth Century

Scriptures are translated into vernacular languages of the Middle East, such as Coptic and Syriac.

383-405

Commissioned by the pope, a translation of both testaments into Latin later becomes known as the **Vulgate**.

Origins of the Bible in Hebrew and Greek

For centuries Jewish Scriptures were copied by hand on scrolls of animal skin—leather or parchment. Christian writings that became the New Testament were likely first inscribed on scrolls of papyrus. By the early second century A.D., Christian Scriptures were copied on pieces of papyrus bound together so that the pages could be turned: a new format called a codex, or book.

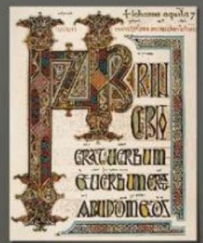


COMPLETE SCROLL: 10.5 IN X 24 FT (FRAGMENT SHOWN)

The Isaiah Scroll, one of the Dead Sea Scrolls, was copied in Hebrew on parchment ca 100 a.c.

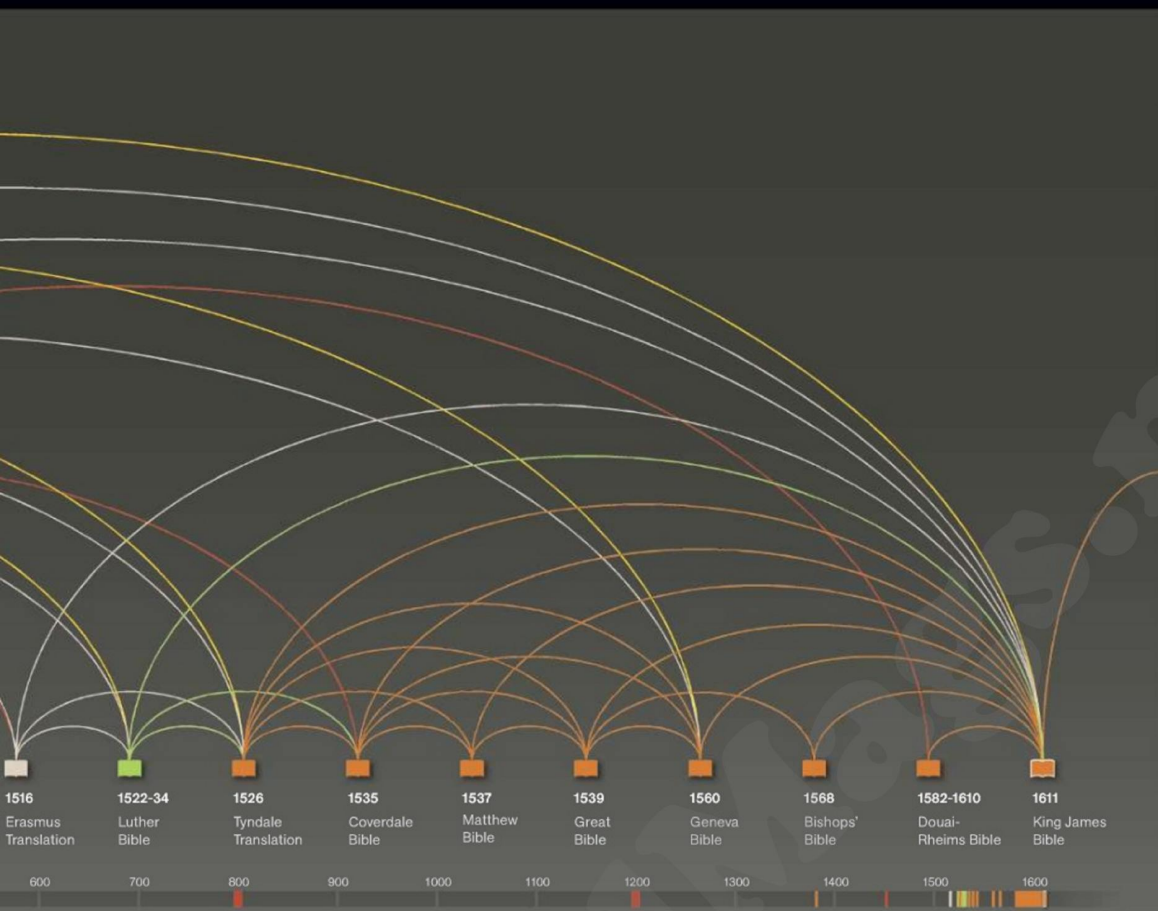
Latin and Early Vernacular Translations

With Rome as head of the Western church, Latin became the chief language of Christian Bibles. The fifth-century Vulgate translation was the standard for a thousand years. It was used by a monk at England's Lindisfarne monastery around 700 to create illuminated Gospels (right). About 960, one of the earliest English translations of Scripture was inscribed within its pages.



13.5 IN X 9.75 IN

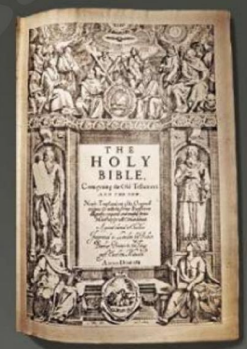
The Lindisfarne Gospels and other illuminated manuscripts elevated the Latin text to art.



1516 Erasmus Translation
 1522-34 Luther Bible
 1526 Tyndale Translation
 1535 Coverdale Bible
 1537 Matthew Bible
 1539 Great Bible
 1560 Geneva Bible
 1568 Bishops' Bible
 1582-1610 Douai-Rheims Bible
 1611 King James Bible

King James Bible

Pillars of the Old Testament—Moses and Aaron—and New Testament apostles decorate the title page of the 1611 edition (below). The 1769 edition, which modernized spelling and punctuation, remained the dominant English-language Bible into the 20th century. Subsequent English translations reflect new scholarship in ancient documents but aim mainly to update language for modern readers.



1525 IN X 10 IN

ca 800

Charlemagne, the Holy Roman Emperor, orders a standardized version of the Vulgate translation, the Alcuin Bible.

ca 1382

The first major Bible translation in English is begun by followers of dissident theologian John Wycliffe.

1408

To preserve church authority, the Roman Catholic Archbishop of England forbids English translations of the Bible.

1516

Dutch scholar **Erasmus** produces Latin and Greek translations; the latter affects reformers such as Martin Luther.

1526

William **Tyndale**, "father of the English Bible," translates the New Testament, which leads to his execution.

1534

Henry VIII breaks with the Roman Catholic Church and becomes head of the Church of England.

1560

The English-language **Geneva Bible** is published by Scottish and English Protestants living in Switzerland.

1603

Elizabeth I dies. In 1604 her successor, James I, commissions a new English translation. It is published in 1611.

European Influence

By the mid-1200s, Dominican and Franciscan friars in Paris and Bologna were copying complete Bibles, in Latin, that could fit into a pocket (right). They standardized the order of the Bible's books and divided books into chapters. The practice of numbering each verse dates to a 1553 French-language Protestant edition published in Geneva.



6 IN X 4.25 IN

Paris Bibles were the first complete Bibles bound as a portable book.

Revolutions in Bible Publishing

Gutenberg's movable-type press in the mid-1400s and the aims of the 16th-century Protestant Reformation coupled to put Bibles in the hands of ordinary people, in their own language. English-speaking Protestants treasured the 1560 Geneva Bible; English Roman Catholics had the Douai-Rheims Bible. By the mid-1600s, Protestants embraced the King James Bible.



16 IN X 11.5 IN

Johannes Gutenberg was the first to print the Bible, about 1455. Perhaps 180 were printed; 49 remain.

AMANDA HOBBS, NGM STAFF; ALEJANDRO TUMAS
 SOURCES: GORDON CAMPBELL, *BIBLE: THE STORY OF THE KING JAMES VERSION 1611-2011*; CHRISTOPHER DE HAMEL, *THE BOOK: A HISTORY OF THE BIBLE*
 PHOTOS (FROM LEFT): JIM HOLLANDER, EPA/CORBIS; BETTMANN/CORBIS; LIBRARY OF CONGRESS; PIERPONT MORGAN LIBRARY/ART RESOURCE; JIM RICHARDSON (TOP)

A Bible's Gift to Language

The King James translation introduced 18 classic phrases into the English language and made famous some 240 more from earlier English translations. Google searched 2.4 million of its digitized English-language books with its Ngram Viewer for the 18 original phrases and a selection of the others. The larger each phrase appears on these pages, the more popular it has been over the past 200 years. "From time to time" is the leader, coming up nearly 4.6 million times in the survey.

Scripture in red: phrase originated in the King James Bible
Scripture in blue: phrase popularized by the King James Bible
Citations are given, but many phrases occur multiple times.

Higher popularity

Matter

The root of the matter
Full length of phrase:
27 inches

Job 19:28

Lower popularity

Lay up for yourselves treasures in heaven

Matthew 6:20

Suffer little child

Luke 18:16

East of Eden

Genesis 4:16

Get thee hence

Luke 4:8

Let us now praise famous men

Ecclesiasticus 44:1 (Apocrypha)

Turned the world upside down

Acts 17:6

Know for a certainty

Joshua 23:13

Whom

Titus 1:15

As a lamb

Isaiah 53:7

Beat their swords into plowshares

Isaiah 2:4

A man after his own heart

1 Samuel 13:14

No small stir

Acts 12:18

A

2 Corinthians 12:7

World upside
into the pure

to the

How

thorn

Fell flat on his face
Numbers 22:31

ren

ehind

down

To every thing there is a season
Ecclesiastes 3:1

all things are pure

The skin of my teeth
Job 19:20

slaughter

But marches in his mouth
Exodus 4:15

are the mighty fallen

in the flesh

Be horribly afraid
Jeremiah 2:12

Set thine house in order
Isaiah 38:1

A still small voice

1 Kings 19:12

Much study is a weariness of the flesh
Ecclesiastes 12:12

Pour out your heart
Psalms 62:8

me

The most popular of the phrases surveyed can't be printed at full scale: The F would be 35 feet high, and the phrase would stretch 188 feet. The towers of Westminster Abbey are shown for comparison.



Ngram Viewer adjusts data to account for the increasing number of books published since 1800.

JOHN BAXTER AND AMANDA HOBBS, N3M STAFF
SOURCES: GOOGLE BOOKS NGRAMS DATA SET; JEAN-BAPTISTE MICHEL AND EREZ LIEBERMAN AIDEN, HARVARD UNIVERSITY; JON ORWANT, GOOGLE; DAVID CRYSTAL, BEGAT: THE KING JAMES BIBLE & THE ENGLISH LANGUAGE

Stand in awe
Full length of phrase:
14 inches

Stand in awe





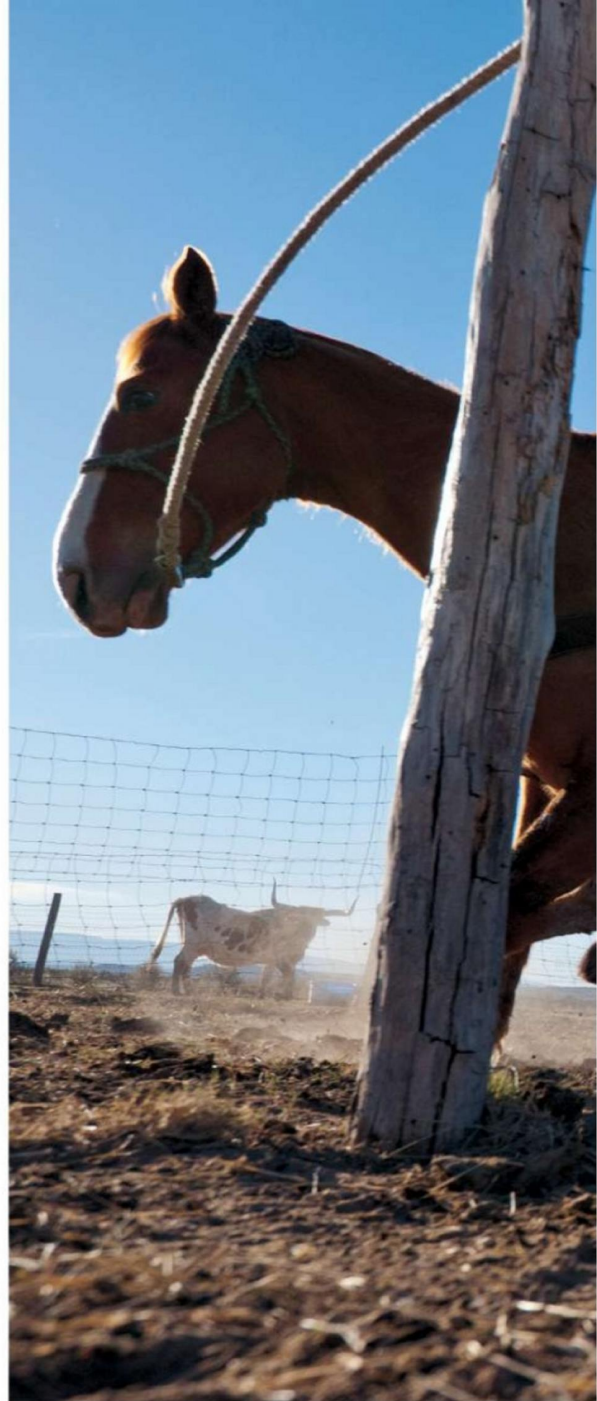
Fueled by the Bible-led ideals of the Reformation, 17th-century Puritans loathed nothing more than the grandeur of “pomp-fed prelates” and other religious trappings for which there was no scriptural basis. But the English church, with the King James Bible at its core, always loved ceremony as much as the word. Here in the giant Gothic cathedral of York Minster, High Church services continue to relish “the beauty of holiness.”

(Continued from page 45) the English-speaking world. As English traders and colonists spread across the Atlantic and to Africa and the Indian subcontinent, the King James Bible went with them. It became embedded in the substance of empire, used as wrapping paper for cigars, medicine, sweetmeats, and rifle cartridges and eventually marketed as “the book your Emperor reads.” Medicine sent to English children during the Indian Mutiny in 1857 was folded up in paper printed with the words of Isaiah 51 verse 12: “I, even I, am he that comforteth you.” Bible societies in Britain and America distributed King James Bibles across the world, the London-based British and Foreign Bible Society alone shipping more than a hundred million copies in the 80 years after it was founded in 1804.

The King James Bible became an emblem of continuity. U.S. Presidents from Washington to Obama have used it to swear their oath of office (Obama using Lincoln’s copy, others, Washington’s). Its language penetrated deep into English-speaking consciousness so that the Gettysburg Address, *Moby Dick*, and the sermons and speeches of Martin Luther King are all descendants of the language of the English translators.

But there was a dark side to this Bible’s all-conquering story. Throughout its history it has been used and manipulated, good and bad alike selecting passages for their different ends. Much of its text is about freedom, grace, and redemption, but those parts are matched by an equally fierce insistence on vengeance and control. As the Bible of empire, it was also the Bible of slavery, and as such it continues to occupy an intricately ambivalent place in the postcolonial world.

AMID THE RUBBLE and broken cars of Trench Town and Tivoli Gardens in West Kingston, Jamaica, every property is shielded from the street and its neighbors by high walls of corrugated iron nailed to rough boards. This is one of the murder capitals of the world, dominated by drug lords intimately connected to politicians and the police. It is a province of raw dominance, inescapable poverty, and fear. Its social structure, with very



The circuit-riding Baptist minister Rome Wager breaks a horse on ranch land he leases at the southern end of the Jicarilla Apache Reservation in northern New Mexico. A multiple prize-winning saddle-bronc, bull-riding, and bareback pro, Wager now bases his life on preaching the King James Bible. Here in the dry lands around the Apache Nugget Casino, he is planning a new church for ranchers, oil field workers, and casino staff.



few privileged rich and very many virtually disenfranchised poor, is not entirely unlike that of early 17th-century England.

This is one of the heartlands of reggae—the Rastafarian way of life that gave birth to it—and of the King James Bible. As the Jamaican DJ and reggae poet Mutabaruka says, “The first thing that a Rasta was exposed to in this colonial country was this King James Version.” Rastafarians are not Christians. Since the 1930s they have believed that the then emperor of Ethiopia, Haile Selassie, is God himself. His name was Ras Tafari before 1930, when he was called “King of Kings, Lion of Judah, Elect of God.” Those echo the titles the Bible gives to the Messiah. The island had long been soaked in Baptist Bible culture. In the

mid-20th century, as Jamaicans were looking for a new redemptive Gospel, this suddenly made sense. Ras Tafari was the savior himself, the living God, and Ethiopia was the Promised Land. For Rastafarians, intensely conscious of the history of black enslavement, Jamaica was Babylon, their equivalent of the city where the people of Israel had been taken as slaves. Liberty and redemption were not, as the Christians always said, in the next life but in this one. “The experience of slavery helps you,” Mutabaruka says, “because there is this human need for salvation, for redemption. The Rastas don’t believe in the sky god. Their redemption lies within the human character. When the Europeans came and say, ‘Jesus in the sky,’ the



Rasta man reject that totally.” (Jesus in the sky being Rasta shorthand for the whole story of the Resurrection.) “The man say, ‘When you see I, you see God.’ There is no God in the sky. Man is God, Africa is the Promised Land.”

Michael “Miguel” Lorne is a Rastafarian lawyer who for 30 years has been working for “the poor and the needy” in the toughest parts of Kingston. The walls of his office are filled with images of Africa and the Ethiopian emperor. But the windows are barred, the door onto the street triple locked and reinforced with steel. “The Bible was used extensively to subjugate slaves,” Lorne says. It seemed to legitimate the white enslaving of the black. “Your legacy is in heaven,” he says, not smiling. “You must accept this as your lot.”

The Bible has been an instrument of oppression—or “downpression,” as they say in Jamaica, because what is there “up” about oppression?—but it has also been the source of much of what the Rastafarian movement believes. “The man Christ,” Lorne says, “that level of humility, that level of conquering without a sword, that level of staying among the poor, always advocating on behalf of the prisoners, the downpressed, setting the captive free, living for these people. What is the use of living if you are not helping your brother? It is a book that gives you hope.”

Lorne exudes a wonderful, tough-minded goodness. “We hope for a world where color does not play the dominant role it plays now,” he says. “We want the lion and the lamb to lie down



On Bobo Hill outside Kingston, Jamaica, Rastafarians chant psalms from the King James Bible as they do every morning, facing east into the early sun. They are members of the Bobo Shanti “mansion”: The term comes from John 14:2, “In my Father’s house are many mansions.” Not Christian, but believing in the divinity of Haile Selassie, the last emperor of Ethiopia, they follow a strict regimen modeled on Old Testament laws.

together. That is one of the beauties of Rastafari. We who have suffered and been brutalized and beaten, we have been agitating for compensation and reparation for years, but we don’t think we will stick you up with a gun to get it.”

Pious Rastafarians read the King James Bible every day. Lorne has read it “from cover to cover.” Evon Youngsam, who is a member of the Twelve Tribes of Israel, a Rastafarian “mansion” in Kingston, its headquarters opposite Bob Marley’s old house in the city, learned to read with the King James Bible at her grandmother’s knee. She taught her own children to read with it, and they, now living in England, are in turn teaching their children to read with it. “There is something inside of it which reaches me,” she says, smiling, the Bible in her hand, its pages marked with blue airmail letters from her children on the other side of the ocean.

The adherents of another, strict Rastafarian mansion, Bobo Shanti, in their remote and otherworldly compound high in the foothills of the Blue Mountains outside Kingston, rhythmically chant the psalms every day. The atmosphere in Bobo Camp is gentle and welcoming, almost monastic, but there are other Rastafarians whose style is the polar opposite of that, taking their cue from some of the more intolerant attitudes to be found in the Bible. Several Jamaican reggae and dance hall stars have been banned from performing in Canada and parts of Europe for their violently antigay lyrics. The justification is there in the Bible (“If a man also lie with mankind, as he lieth with a woman, both of them have committed an abomination: They shall surely be put to death,” Leviticus 20:13), but this is a troubling part of the King James inheritance: a ferocious and singular moral vision that has become unacceptable in most of the liberal, modern world.

NOT ONLY AT ITS ROOTS in the heart of Westminster but also in some of the most obscure corners of the English-speaking world, this book remains complicatedly and paradoxically alive. Not that it any longer holds universal sway. From the late 19th century onward, revisions





It's a midweek Prayer Meeting in the Church of Scotland at Leurbost on the Isle of Lewis in the Outer Hebrides. No image, not even a cross, is allowed in the church. The word rules alone.



and new translations began to appear with increasing regularity. Scores of new versions of the Bible or of substantial parts of it have been published in the past 50 years. But the 1611 version remains potent in places where a sense of continuity with the past seems important.

With the cool summer rain of the Hebrides in northwest Scotland spattering the glass of his windows, John Macaulay, elder of his church in Leverburgh on Harris and a boatbuilder at home in Flodabay, muses on the double inheritance of authority and liberty that the King James Bible has given him and people like him. He was brought up in the strict way of Scottish Presbyterianism. “Everything for the Sabbath was prepared on the Saturday,” he says, sitting now

by the same hearth he sat by 60 years ago. “You had to bring extra water into the house—you didn’t have piped water in those days. Buckets of water from the loch across the road. Peats were taken in from the peat stack so that you had all the peats that you needed for the fire. Potatoes were peeled, meals prepared. My father always shaved on the Saturday evening, and I did too when I got older. The Bible said you must not work on the Sabbath, and so we did not.”

No one was allowed to drive on a Sunday. “The only person with a car going to church was the minister, and he would drive, but he would never pick anyone up on the road. You had old men tottering along—howling gale, driving snow—but no, even if he stopped and was to



The fallow deer in the park at Knole, Kent, have looked down at the world with long-nosed lordliness since the days of King James. The deer park is a rare survival from the roughly 700 in early 17th-century England. The grandeur of this aristocratic style seeped into every corner of King James's England—and into the language used by the translators of his Bible. It was an age in which social hierarchy was considered a reflection of the divine order of the universe.

offer anyone a lift, they would not step into a car on a Sunday.”

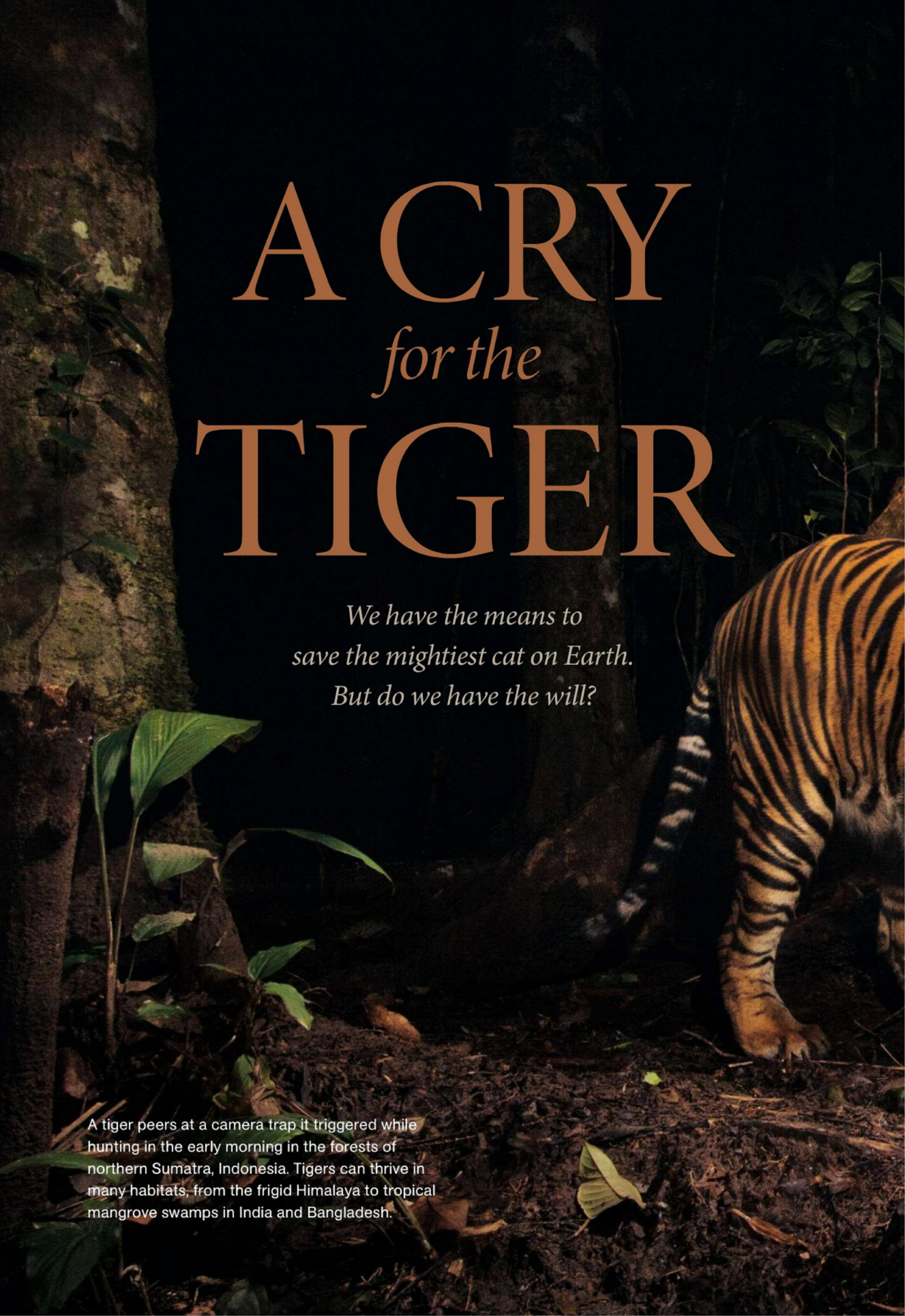
In this Gaelic-speaking family, the Bible was the frame of life. Every evening of the week they knelt for prayers in front of the fire and the reading of a psalm. On Sunday the only book they could read was the Bible.

Before he was four years old, Macaulay was taught by his mother to read English from the Bible. “It is literally true that the English I learned was the English of the King James Bible. But we didn’t use English at all in the house. Unless we had visitors who had no Gaelic, which was rare. I could read English from the book, but I could not have a conversation in it. I did not really know what it meant.”

In some ways his immersion in a sacred book has sustained him through life. “You were taught very early on that there was someone there looking after you, someone you could rely on, someone you could talk to. You knew his words. They were in your mind.” But there was another side to it. The authority of the church with this book in its hand also became a source of fear. “It is not just awe and reverence; it is fear. People are fearful of being seen to be doing something wrong. There are lots of people that go through life without ever expressing themselves or their feelings, and it is sad to see that.”

The reverence for the minister, the man in the pulpit explicating the supremacy of the Bible, remains potent. “The church is a refuge from the realities of life,” Macaulay says, “but there is also something else, which is a wee bit more sinister. Domination is a factor. The power of some of these preachers to really control their congregation. That has always been there.”

The King James Bible has always cut both ways. It had its beginnings in royal authority, and it has been used to terrify the weak. It has also brought an undeniable current of beauty, kindness, and goodness into the lives of rich and poor alike. Its origins were ambivalent—for Puritan and bishop, the great and the needy, for clarity and magnificence, to bring the word of God to the people but also to buttress the powers that be—and that ambivalence is its true legacy. □

A tiger is seen from the back, standing in a dark forest at night. The tiger's orange and black stripes are illuminated by a light source, possibly a camera flash. The background is filled with dark tree trunks and some green foliage. The overall mood is mysterious and somber.

A CRY *for the* TIGER

*We have the means to
save the mightiest cat on Earth.
But do we have the will?*

A tiger peers at a camera trap it triggered while hunting in the early morning in the forests of northern Sumatra, Indonesia. Tigers can thrive in many habitats, from the frigid Himalaya to tropical mangrove swamps in India and Bangladesh.





These men were apprehended in January 2011 while trying to sell a tiger skin near Chandrapur, India. Illegal trade in tiger bones, eyes, whiskers, penises, teeth, and other parts for Asian "cures" may generate up to five million dollars a year.



A poacher's snare cost this six-month-old cub its right front leg—and its freedom. The limb was amputated after the tiger had been enmeshed for three days in a snare in Aceh Province, Indonesia. Unable to hunt, the tiger now lives in a zoo on Java.





By Caroline Alexander

Photographs by Steve Winter

Ranthambore National Park, India

Dawn, and mist holds the forest. Only a short stretch of red dirt track can be seen. Suddenly—emerging from the red-gold haze of dust and misted light—a tigress ambles into view. First she stops to rub her right-side whiskers against a roadside tree. Then she crosses the road and rubs her left-side whiskers. Then she turns to regard us with a look of infinite and bored indifference.

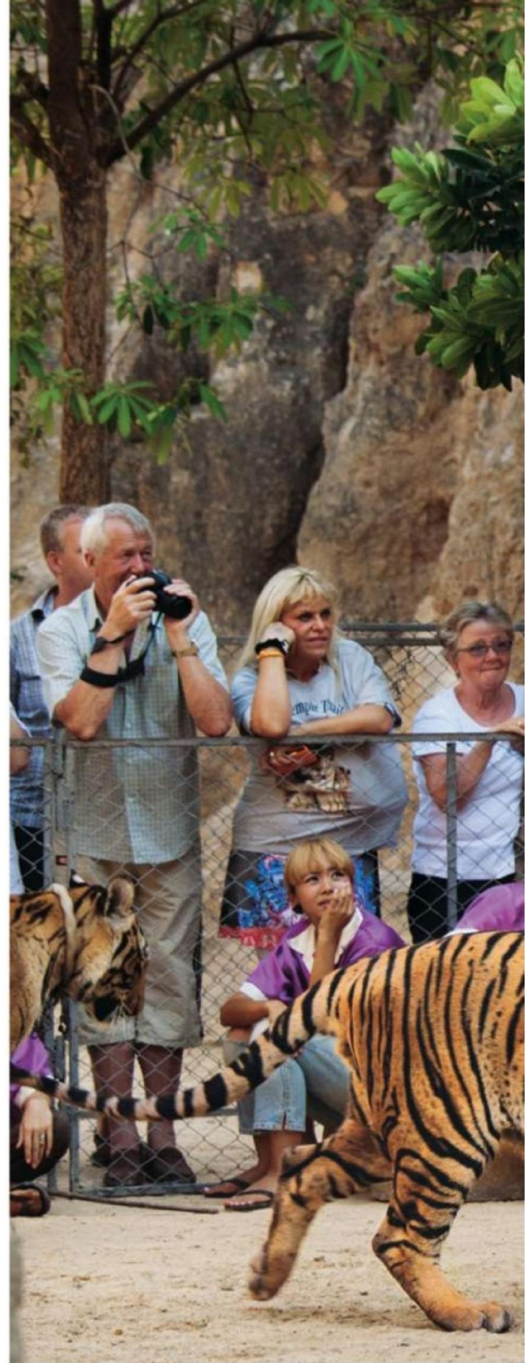
And then, as if relenting, she reaches up the tree to claw the bark, turning her profile to us, and with it the full impact of her tigerness—the improbable, the gorgeous, the iconographic and visibly powerful flanks.

The tiger. *Panthera tigris*, largest of all the big cats, to which even biological terminology defers with awed expressions like “apex predator,” “charismatic megafauna,” “umbrella species.” One of the most formidable carnivores on the planet, and yet, amber-coated and patterned with black flames, one of the most beautiful of creatures.

Consider the tiger, how he is formed. With claws up to four inches long and retractable, like a domestic cat’s, and carnassial teeth that shatter bone. While able to achieve bursts above 35 miles an hour, the tiger is built for strength, not sustained speed. Short, powerful legs propel his trademark lethal lunge and fabled leaps. Recently, a tiger was captured on video jumping—flying—from flat ground to 13 feet in the air to attack a

ranger riding an elephant. The eye of the tiger is backlit by a membrane that reflects light through the retina, the secret of his famous night vision and glowing night eyes. The roar of the tiger—*Aaaaauuuunnnn!*—can carry more than a mile.

For weeks I had been traveling through some of the best tiger habitat in Asia, from remote forests to tropical woodlands and, on a previous trip, to mangrove swamps—but never before had I seen a tiger. Partly this was because of the animal’s legendarily secretive nature. The tiger is powerful enough to kill and drag prey five times its weight, yet it can move through high grass, forest, and even water in unnerving





A tiger leaps for a plastic bag tied to a pole while tourists watch at the controversial Tiger Temple in Kanchanaburi, Thailand. Visitors can pay to bottle-feed cubs, walk with tigers, and pose for photos with animals chained to the ground.

silence. The common refrain of those who have witnessed—or survived—an attack is that the tiger “came from nowhere.”

But the other reason for the dearth of sightings is that the ideal tiger landscapes have very few tigers. The tiger has been a threatened species for most of my lifetime, and its rareness has come to be regarded matter-of-factly, as an intrinsic, defining attribute, like its dramatic coloring. The complacent view that the tiger will continue to be “rare” or “threatened” into the foreseeable future is no longer tenable. In the early 21st century, tigers in the wild face the black abyss of annihilation. “This is about making

decisions as if we’re in an emergency room,” says Tom Kaplan, co-founder of Panthera, an organization dedicated to big cats. “This is it.”

The tiger’s enemies are well-known: Loss of habitat exacerbated by exploding human populations, poverty—which induces poaching of prey animals—and looming over all, the dark threat of the brutal Chinese black market for tiger parts. Less acknowledged are botched conservation strategies that for decades have failed the tiger.

Caroline Alexander wrote about Anglo-Saxon treasure in the November issue. Photographer Steve Winter serves as Panthera’s media director.

The tiger population, dispersed among Asia's 13 tiger countries, is estimated at fewer than 4,000 animals, though many conservationists believe there are hundreds less than that. To put this number in perspective: Global alarm for the species was first sounded in 1969, and early in the '80s it was estimated that some 8,000 tigers remained in the wild. So decades of vociferously expressed concern for tigers—not to mention millions of dollars donated by well-meaning individuals—has achieved the demise of perhaps half of the already imperiled population.

MY DETERMINATION to see a wild tiger in my lifetime brought me to Ranthambore Tiger Reserve, one of 40 in India. My first tiger was spotted within ten minutes, and in a four-day excursion I gloried in nine sightings, including a repeat appearance of that first tiger, a three-year-old female. In high grass she stalked with such patient, focused, deliberateness—each paw raised in slow motion and placed so very gently down—that it was possible to *see* her stealth.

It didn't matter that in most cases my experience was shared with a queue of other vehicles. Seeing tigers in the wild is now mostly a tourist experience—the Bengal tiger is not only India's national animal but also one of the country's largest draws. Elsewhere, my tiger-seeking travels had been made on rough roads, by river, forest trails, and even elephant, but in Ranthambore I departed at dawn in a jeep that awaited me outside the Oberoi lodge. In the jeep were a ranger, a guide, and most necessary in a place where tiger viewing is a blood sport, an expert driver, who barged ruthlessly to the head of the queue, ensuring me of that first, mystical tiger sighting.

India is home to some 50 percent of the world's wild tigers. The 2010 census reported a maximum estimate of 1,909 in the country—up 20 percent from the previous estimate. While welcome news, most authorities regard the new figure as reflecting better census methods rather than growth of the tiger population: Tiger counts, in India or elsewhere, are still at best only estimates.

A modest 41 of these carefully enumerated tigers were living in Ranthambore. Conducting

me through the park one morning, conservator Raghuvir Singh Shekhawat pointed out the variety of wildlife that flourishes where the tiger is protected—langur monkeys, spotted deer, wild boars, collared Scops-owls, kingfishers, and parakeets. And he offered a ground-level glimpse of tiger conservation, stopping his jeep beside a canvas tent in a clearing. “Would you like to see the hard life the field officers lead?” he asked, lifting a tent flap to reveal three slender cots. “Here is their kitchen,” he said, gesturing to a pile of canned food and bowls. “In 30 years of service, at least five years is under the tent.” The rangers put in up to ten miles a day on early morning





A forest once stood here, and Sumatran tigers hunted wild pigs and deer in its glades. As forests are cleared for oil palm plantations, like this one near Longkib, Indonesia, tigers migrate in search of wild prey—or target farm animals.

foot patrol, taking plaster casts of any pugmarks they encounter and making notes of evidence of prey animals.

Ranthambore's history reflects in miniature the history of the tiger in India. Formerly the private hunting estate of the maharajas of Jaipur, its original 109-square-mile core reserve is ringed by a containing wall, within which undulating forest skirts romantic maharaja-era ruins. One evening I met with Fateh Singh Rathore, the assistant field director of Ranthambore after it became one of India's first Project Tiger reserves in 1973. Tiger hunting was legal in India until the early 1970s, and as a young man, in the days

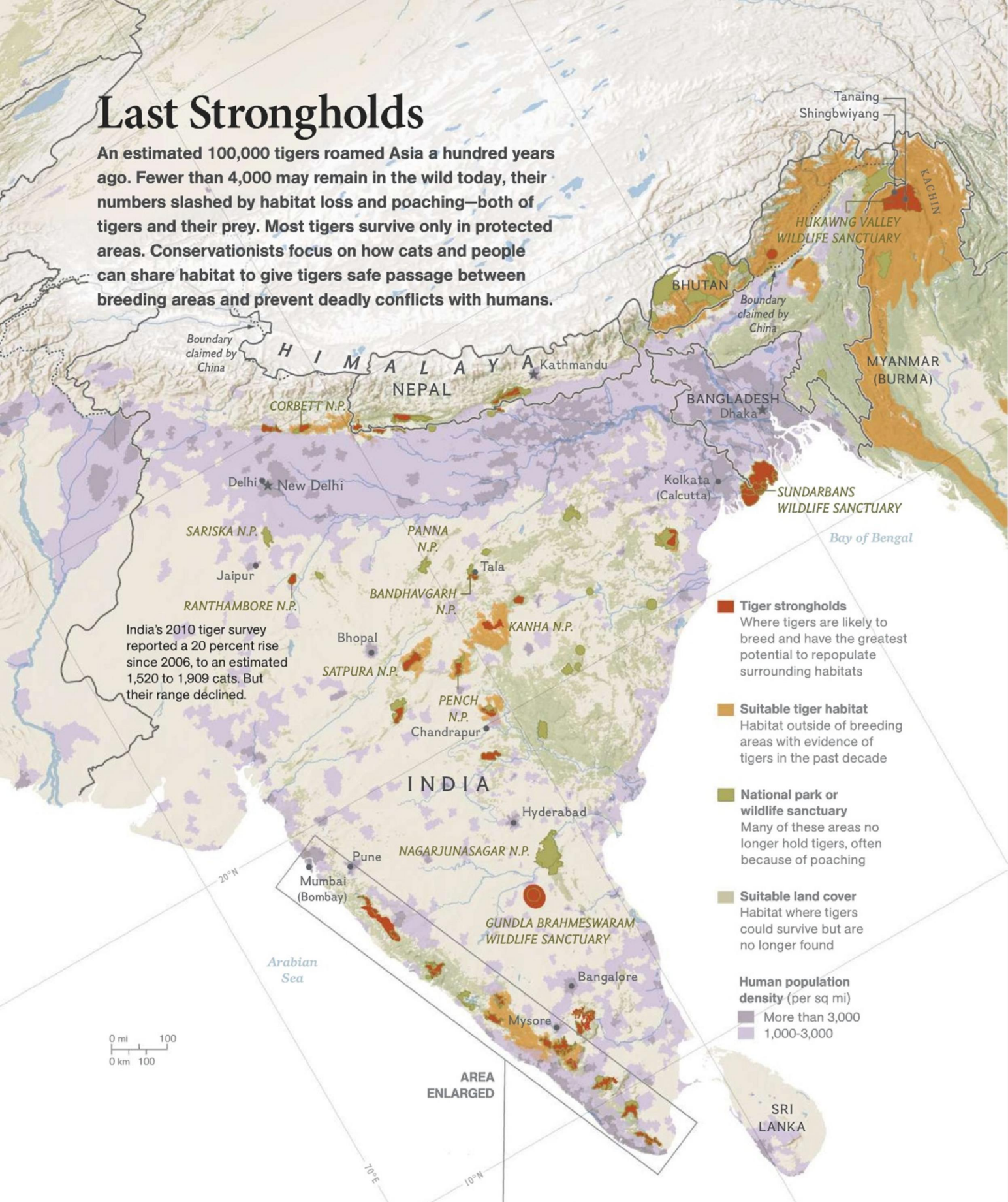
when Ranthambore had been a hunting estate, he had worked as a game warden. "To shoot a tiger, maybe a hundred rupees," he recalled—a couple of dollars.

Always fragile, tiger populations have fluctuated in recent years. Between 2002 and 2004, poaching of some 20 tigers in Ranthambore essentially halved its population. This was better than the fate of the nearby 300-square-mile Sariska Tiger Reserve, found to have no tigers at all: Every single one of its tigers had been killed

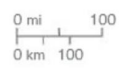
■ **Society Grant** Photographic coverage was funded in part by your National Geographic membership.

Last Strongholds

An estimated 100,000 tigers roamed Asia a hundred years ago. Fewer than 4,000 may remain in the wild today, their numbers slashed by habitat loss and poaching—both of tigers and their prey. Most tigers survive only in protected areas. Conservationists focus on how cats and people can share habitat to give tigers safe passage between breeding areas and prevent deadly conflicts with humans.



India's 2010 tiger survey reported a 20 percent rise since 2006, to an estimated 1,520 to 1,909 cats. But their range declined.

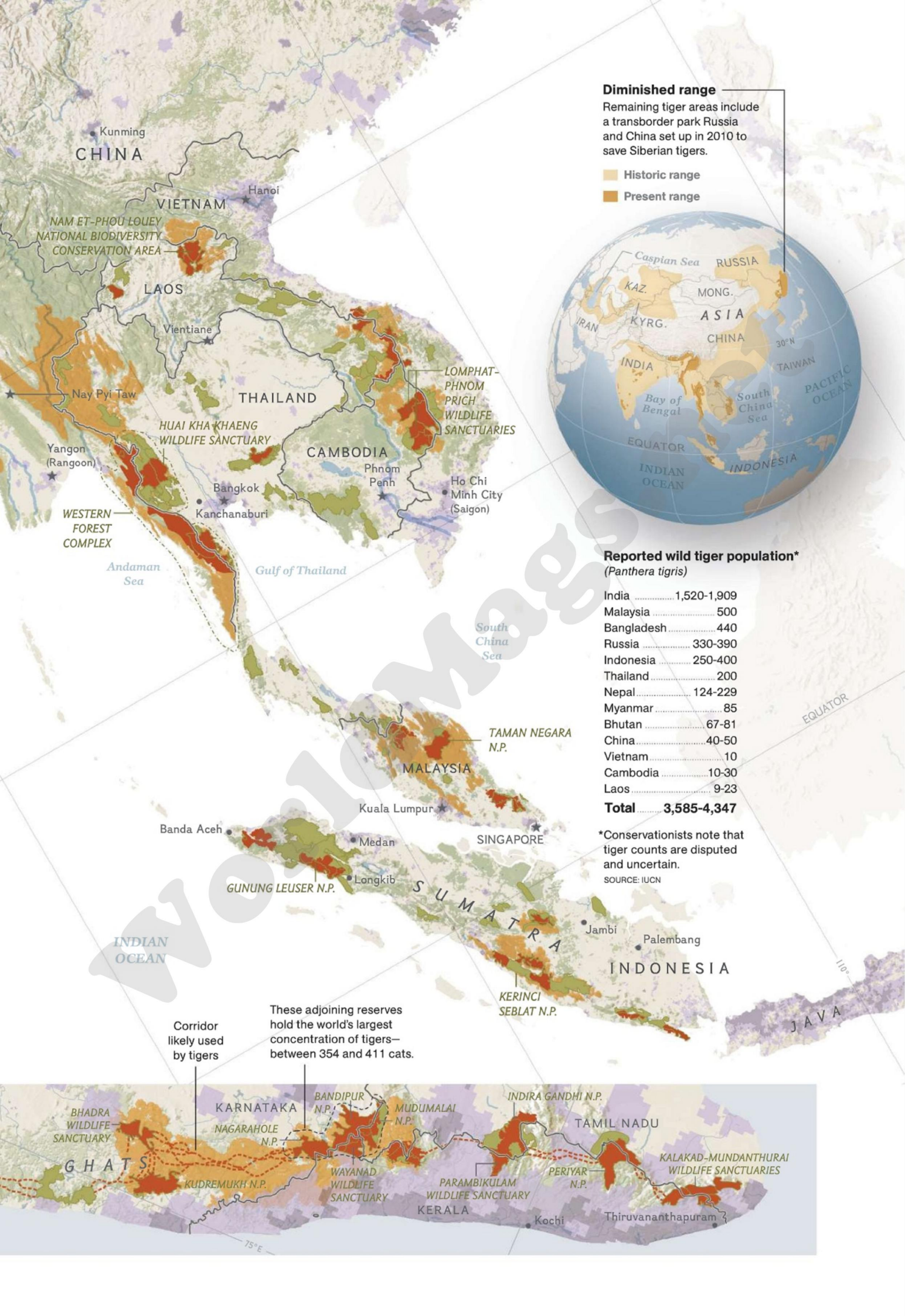


Vital corridors

India has roughly half the world's tigers. Many of them live along the Western Ghats mountains (right), where there is evidence that tigers are finding corridors between protected areas, vital to prevent inbreeding and maintain their range.



VIRGINIA W. MASON, NGM STAFF
 SOURCES: WILDLIFE CONSERVATION SOCIETY; PANTHERA; WORLD DATABASE ON PROTECTED AREAS; CENTER FOR INTERNATIONAL EARTH SCIENCE INFORMATION NETWORK



Diminished range
 Remaining tiger areas include a transborder park Russia and China set up in 2010 to save Siberian tigers.

Historic range
 Present range

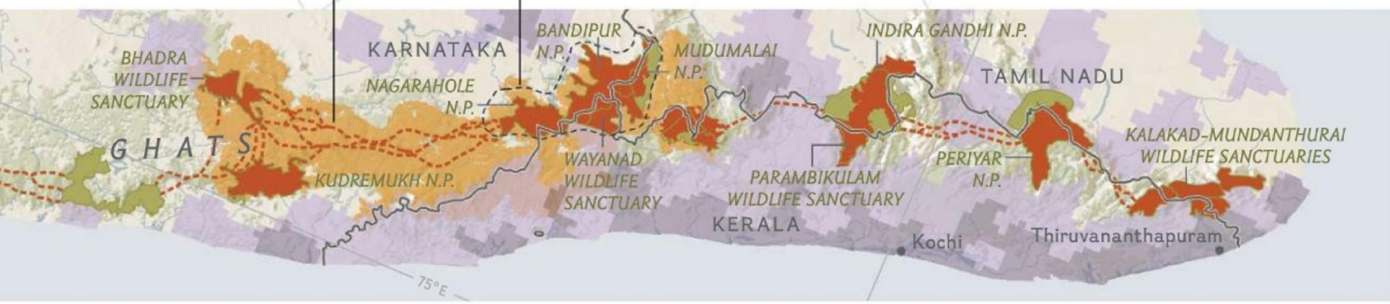


Reported wild tiger population* (Panthera tigris)

India	1,520-1,909
Malaysia	500
Bangladesh	440
Russia	330-390
Indonesia	250-400
Thailand	200
Nepal	124-229
Myanmar	85
Bhutan	67-81
China	40-50
Vietnam	10
Cambodia	10-30
Laos	9-23
Total	3,585-4,347

*Conservationists note that tiger counts are disputed and uncertain.
 SOURCE: IUCN

Corridor likely used by tigers
 These adjoining reserves hold the world's largest concentration of tigers—between 354 and 411 cats.





A tiger slips through a fence at India's Bandhavgarh National Park, a refuge that may be too small to support the nearly 60 cats living there. Gaps in the fence let tigers go outside to hunt but also let villagers in to poach deer—and occasionally tigers.





Relatives prepare a man for cremation after he was killed by a tiger in the Indian village of Tala. The tiger had left Bandhavgarh National Park to hunt, and park employees were trying to herd it from Tala. One swipe of a paw felled this villager.

by professional gangs—and in a reserve just 70 miles from India’s capital, New Delhi.

Ranthambore is a hub for a contentious new conservation strategy—the relocation of “surplus” tigers to places like Sariska. Only days before, at a wildlife conference in New Delhi, I had heard heated criticism and questions from India’s many outspoken watchdog organizations challenging the strategy: What constitutes a surplus tiger? Had the issues in Sariska and elsewhere been solved before importing new tigers? What research had been conducted regarding potential trauma to both the transported tiger and the home population from which it was taken? And

what effect might such trauma have on breeding?

So far, relocation has met with uneven success. Three tigers transported to Sariska were found to be siblings—undesirable for breeding. More eloquent than any of the valid scientific concerns was a story unfolding in the national media: The determined trek toward his home 250 miles away by a lone male removed from Pench Tiger Reserve to restock Panna National Park.

The trek of this solitary tiger highlights another crisis. Many reserves exist as islands of fragile habitat in a vast sea of humanity, yet tigers can range over a hundred miles, seeking prey, mates, and territory. An unwelcome revelation



of the new census is that nearly a third of India's tigers live outside tiger reserves, a situation that is dangerous for both human and animal. Prey and tigers can only disperse if there are recognized corridors of land between protected areas to allow unmolested passage. No less critical, such passages serve as genetic corridors, essential to the long-term survival of the species.

IT IS A HEADY EXPERIENCE to see an idealistic map of Asia's tiger landscapes linked by arteries of these not-yet-existent corridors. A spiderweb of green tendrils weaves tantalizingly among core populations to form a network that encompasses

brehtaking extremes of habitat—Himalayan foothills, jungle, swamp, deciduous forest, grasslands—that pay tribute to the tiger's adaptability. Close scrutiny breaks the spell. The places that have actual tigers—here-and-now, flesh-and-blood tigers—as opposed to hypothetical tigers, are represented by a scattering of mustard-colored blobs. The master plan represents a visionary undertaking, but is it feasible? Over the next decade, infrastructure projects—the kind of development that often destroys habitat—are projected to average some \$750 billion a year in Asia.

"I've never met a head of state who says, 'Look, we're a poor country, if it comes between tigers and people, you just have to write off tigers,'" said Alan Rabinowitz, a renowned authority on tigers and the CEO of Panthera. "The governments don't want to lose their most majestic animal. They consider it part of what makes their country what it is, part of the cultural heritage. They won't sacrifice a lot to save it, but if they can see a way to save it, they will usually do it."

Seeing a way has proved difficult amid the plethora of tiger strategies, programs, and initiatives jostling for attention—and funding. The U.S. National Fish and Wildlife Foundation's Save the Tiger Fund (which has now partnered with Panthera), Global Tiger Patrol, Saving Wild Tigers, All for Tigers!, WWF, Wildlife Conservation Society (WCS), Panthera, International Year of the Tiger Foundation, the National Geographic Society's Big Cats Initiative—the list is impressive. "Five to six million dollars is spent a year for tigers, from all philanthropic organizations," said Mahendra Shrestha, former director of the Save the Tiger Fund, which gave grants totaling more than \$17 million between 1995 and 2009. "In many instances the NGOs and tiger-range governments just fight each other."

Long-term conservation must focus on all aspects of a tiger landscape: core breeding populations, inviolate sanctuaries, wildlife corridors, and the surrounding human communities. In an ideal world, all would be funded; as it is, different agencies adopt different strategies for different components. With time running out,





Meet Smasher—the male in the background. That's the name Steve Winter gave this youngster, cooling off in a watering hole in Bandhavgarh National Park, after he slapped the automated camera trap until it stopped clicking. Both tigers are thought to have killed people, and Smasher is now in captivity.

In the early 21st century, tigers in the wild face the black abyss of annihilation. "This is about making decisions as if we're in an emergency room," says Tom Kaplan of Panthera. "This is it."

tough priorities must be set. "Since the 1990s, there has been what I would sum up as mission drift," said Ullas Karanth of the WCS, who is one of the world's most respected tiger biologists. The drift toward tiger conservation activities like eco-development and social programs, which possibly have greater fund-raising appeal than antipoaching patrols, siphons funds and energy from the single most vital task: safeguarding core breeding populations of tigers. "If these are lost," Karanth said, "you will have tiger landscapes with no tigers."

Decades of experience and failures have yielded a conservation strategy that, according to Rabinowitz, "allows any site or landscape to increase its tigers if followed correctly." Central to this protocol are relentless, systematic, boots-on-the-ground patrolling and monitoring of both tiger and prey in those sites assessed as harboring realistically defensible core tiger populations. Under the protocol, a population of a mere half dozen breeding females can rebound. Such, at least, is the hope for the largest single protected tiger reserve on Earth, a remote valley in northern Myanmar.

Hukawng Valley, Myanmar

MY FIRST ENCOUNTER with the Hukawng Valley Wildlife Sanctuary is not heartening. Arriving at the sprawling settlement of Tanaing in northern Myanmar, I scan with bewilderment the large and cheerful market; the bus stops, generators, and telephone posts; the bustling stalls and restaurants—all lodged within the sanctuary borders.

Conspicuous bites have been taken from the generous buffer zone that embraces the 2,500-square-mile original wildlife sanctuary. Land for a 200,000-acre cassava plantation has

been razed and burned so quickly that the diminishment of the forest could be charted not over weeks but days. The gold-mining settlement of Shingbuiyang in the west, where the land has been stripped raw and mountain rivers turned to mud, is home to some 50,000 migrants, and permanent concrete structures and power lines have sprung up among the rudimentary huts of thatch and wood. The rebel Kachin Independence Army controls the reserve's eastern edge.

Yet the sheer size of the 6,708-square-mile tiger reserve can accommodate even these intrusions. Cupped between three mountain ranges, the Hukawng Valley is defined by dense, dark, seemingly boundless jungle. As recently as the 1970s Hukawng villagers encountered tigers in the course of ordinary rural life, hearing their roars at night. Rarely did a tiger harm a human, their victims typically being livestock or cattle. Still, the fearsome potential of the world's largest cat inspired sufficient respect to enshrine the tiger in local mythologies. Among the Naga tribespeople in northwestern Hukawng, stories of tiger shamans still abound. Tigers were Rum Hoi Khan—the King of the Forest, with whom man had a *thitsar*, a natural bond or treaty. "Naga used to call male tigers Grandfather, and female tigers Grandma," an elderly Naga man told me. "They believe they are their ancestors."

Such beliefs are fading with the tigers, recalled now only by the elderly. Myanmar youth know the tiger more from educational conservation stories than from life. The Myanmar Forest Department, for instance, sponsors a mobile education team that tours villages performing a skit about a tiger killed by a wicked poacher. The grief of the tiger "widow" reportedly moves all the women in the audience to tears. There is perhaps no more eloquent testimony to the tiger's imperiled status than this adjustment of its mythology from Rum Hoi Khan to weeping widow.

TWO DAYS AFTER ARRIVING IN TANAING, I joined the Myanmar Forest Department's Flying Tiger and guard teams as they headed up the Tawang River to the Forward Guard Post. The sun had

burned off the morning mist, and the river flowed glacial blue under the hard blue sky. Close to shore, banana groves cast green shade on the water. Flocks of mergansers skimmed ahead and waited, while an occasional white-bellied heron sailed by. Hukawng Valley has elephants and clouded leopards, gaur (an ox), and sambar (an Asian deer)—favorite tiger prey; and it has a still unsatisfactorily assessed scattering of tigers.

Upriver, at the Forward Guard Post, a rattan-and-wood house on stilts in a clearing by the water, the head ranger, Zaw Win Khaing, gave an overview of the teams' survey work for the current season. The tiger team spent a third of each month on patrol, looking for tracks or scat of tigers, along with evidence of prey animals such as sambar, gaur, and wild pig. Rangers looked for evidence of human activities. In the previous month they had disbanded a hunter's camp and dispersed or apprehended 34 people involved in land clearing and cultivation, mostly for opium poppies.

Saw Htoo Tha Po, who bore the attractive title of tiger coordinator and is a seasoned veteran of this tough field, described the patrols. "Sometimes if it is sunny, you can see the sky," he said, conjuring what it was like to operate under triple-canopy forest for up to six weeks. The worst days are when it rains, and the trees spill water from their saucerlike leaves, and dripping mists chill the bone. Then the leeches get bigger and "make more blood." The local strain of malaria is particularly vicious and has killed team members. In all, 74 forest department personnel and wildlife police officers, in rotation, are responsible for patrolling a 700-square-mile strategic area of dense forest.

The head ranger, Zaw Win Khaing, once saw a tiger, in 2002. He had sat down to measure bear tracks in a muddy wallow when he saw something move to his right. As he stood up, the tiger's face appeared from the grass. "It was about as close as that chili plant," the ranger said, pointing to a vegetable plot some 15 feet away. "I do not know how long I looked at the tiger, because I was trembling." Eventually, the tiger turned back toward the forest.

By authoritative estimate, there may be 25 tigers in the Hukawng Valley—the authority in this case being an old Lisu tribesman not long retired from tiger poaching, who from time to time agreeably shares information with the tiger teams. Official, scientific evidence of the tigers' existence is harder to come by. In 2006-07 the only trace was several paw prints of a single tiger, and in the 2007-08 season, DNA tests of collected scat indicated the presence of three tigers.

This season a clean line of pugmarks by the river was cause for both celebration and a SWAT-team-worthy follow-up: News of the discovery was radioed in at 8 a.m., and by 6 p.m. the tiger team had arrived from Tanaing. Measurements and plaster casts of the tracks were made over a five-day period, and three camera traps were placed in the area, which had so far yielded only a picture of a pied hornbill. About the same time, fresh tracks were discovered nine miles upriver, which proved to belong to the same tiger. This, then, was payoff for another hard field season—a line of tiger paw prints in the pale yellow sand.

Later I spoke with Alan Rabinowitz, whose decade-long work with the Myanmar Forest Department lay behind the creation of the Hukawng Sanctuary. Was the expenditure of so much effort justified for so few tigers? As part of his answer, he pointed to a map that showed Hukawng's key position in the northern web of tiger landscapes. "Hukawng's potential is so huge," he countered. And he had witnessed habitats that had been turned around. "Huai Kha Khaeng was in terrible shape when I was there in the 1990s, and now it's one of Asia's best tiger reserves."

Huai Kha Khaeng, Thailand

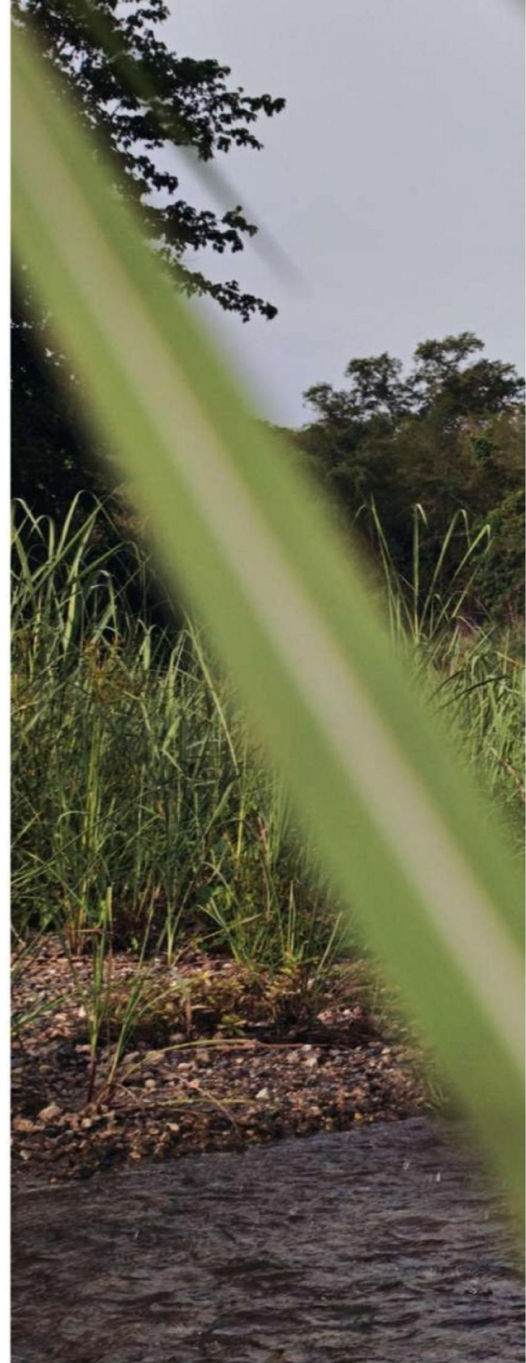
"I FIRST WORKED HERE IN 1986, when every night there were gunshot noises, every day dead animals," Alan Rabinowitz told the group of 40 rangers, the team leaders who represented the park's 170 ranger personnel, gathered at the headquarters of the 1,073-square-mile Huai Kha Khaeng Wildlife Sanctuary in western Thailand. The ravaged landscape Rabinowitz described was one his audience could no longer



recognize—Huai Kha Khaeng as it had been a mere two and a half decades ago. “What you have done here,” Rabinowitz said, “is you have turned Huai Kha Khaeng from a site whose future was in grave doubt into one of the world’s best tiger sites.”

Two decades ago, perhaps 20 tigers roamed Huai Kha Khaeng. There are now an estimated 60 in the sanctuary alone and roughly 100 in the rest of the Western Forest Complex, which has six times the area. The improved health of the forest and the rise in prey (50 animals, or 6,600 pounds of living prey a year for each tiger, is a general rule) suggest that the tiger population could continue to accelerate upward.

The feasibility of bringing tigers back from the razor’s edge of survival relies not only on human actions in the immediate future but also on the tiger’s own remarkably resilient nature. Tigers are not finicky about diet or habitat or, like the panda, dependent on a particular ecosystem. Tiger tracks have been found in Bhutan above 13,000 feet, an altitude overlapping the domain of the snow leopard, while tigers in the saltwater mangrove swamps of the Bangladeshi



and Indian Sundarbans are powerful swimmers and have learned to supplement their diets with marine life. And tigers reproduce well if given a chance. An average female can rear some six to eight cubs over her 10- to 12-year lifespan—which helped a population like that at Huai Kha Khaeng triple in 20 years.

Dedicated, by-the-book monitoring at Huai Kha Khaeng gave tigers a fighting chance, and the animals responded. At the ranger meeting I watched each of the 20 patrol leaders step up and make a ten-minute report of his team’s work. Multimedia presentations showed maps of the




Members of the Smart Patrol (above) search for poachers in Thailand's Western Forest Complex, habitat for up to 200 tigers but able to hold hundreds more. The patrols use handheld global positioning systems to map illegal activity. Indonesian poachers use a barking puppy (opposite) as bait to lure tigers into a trap.

patrol area, specific paths followed, man-days spent in each, and locations of trouble spots. No less revealing were images that showed interest beyond the call of duty—photographs rangers had taken of flowers in the forest loam, footage of a lone ant dragging the body of a lizard spread-eagled like a fallen warrior. Rare footage of a mother Asian tapir leading her cub across a river drew murmurs of appreciation from the audience. Burning interest and personal investment, professional pride, motivation, high morale—all were manifest in this room. In so many tiger landscapes, rangers make do with threadbare

clothes and third-generation equipment, but the rangers of Huai Kha Khaeng were dressed in smart camouflage uniforms that flagged their status as members of a respected profession.

“Thailand's biggest asset is a national guarantee of salaries, the commitment of the national government,” one conservationist told me. The operating budget for Huai Kha Khaeng's 2008-09 season amounted to \$670,000, two-thirds paid by the Thai government, and the remaining third coming from WCS, the U.S. government, and various international nongovernmental organizations (NGOs). This covered office



A photograph of a mother tiger and her two-month-old cub resting in a forest. The mother tiger is lying down, looking towards the camera with a pink tongue sticking out. The cub is sitting up next to her, also looking towards the camera. The background is filled with dense forest vegetation, including ferns and tree trunks.

A mother rests with her two-month-old in Bandhavgarh National Park, where—contrary to the global trend—managers have built up tiger numbers. Compensation for loss of life caused by cats outside the park gives villagers some consolation.



A zoo cage is no haven for a creature whose body parts are prized in the illegal trade. Dara Arista, eight, holds a photo of Sheila in front of her cage at the zoo in Jambi, Indonesia. Poachers had slaughtered the tiger during the night.

management, species monitoring, training, wildlife-trade monitoring, camera traps, and most important, 30,600 man-days of patrols.

Following the meeting I joined Anak Pattanavibool, director of WCS's Thailand Program; Rabinowitz; and a tracker named Kwanchai Waitanyakan for a walk in the forest. Far below the canopy, we threaded through towering bamboo. Twice we stopped to listen to the low, husky call of an elephant. After a few miles, we broke out onto the clear-flowing Huai Tab Salao stream. On the opposite bank we found a long line of tiger tracks, four inches wide, striding confidently amid the bird

scratches and lily-pad prints left by elephants.

"Lean all your weight on your hands," Rabinowitz instructed. Then he measured the depth of the impression my hand made in the sand. "One and a half centimeters," he announced—just over half an inch. The tiger's pugmark was an inch and a half deep. This, Pattanavibool estimated, was a male weighing more than 400 pounds.

In tiger landscapes outside India, most rangers have seen poachers but not tigers, and the hard days and nights they sweat in malarial forest or under canvas are for something they may never see. Even in Huai Kha Khaeng, tigers are less likely to be seen by foot patrols than captured by



the roughly 180 camera traps that hold selected areas of the forest under eerie surveillance. Displayed at the sanctuary's wildlife research station were images of tigers caught in all their secret ways—eyes glaring blue and luminescent in the dark, tigers lounging majestically on a bed of leaves under shafts of sunlight, a full-whiskered stare into the lens, or just the tip of a tail.

The goal in Huai Kha Khaeng is to increase the population by 50 percent, to 90 tigers, and eventually to 720 in the entire Western Forest Complex. This prompts more heady speculation: If the tiger population of one well-managed park could be increased threefold in 20 years...

“There is 1.1 million square kilometers of tiger habitat remaining,” said Eric Dinerstein, chief scientist and vice president of conservation science of the WWF. “Assuming two tigers for every 100 square kilometers, that’s a potential 22,000 tigers.”

FOR NOW THE UNNEGOTIABLE TASK is to save the few tigers that actually exist. And the story of the tiger's fate is relentlessly swift-moving. The Year of the Tiger, the celebration of which, in 2010, was the number one objective of a lauded tiger workshop in Kathmandu, has come and gone with no discernible benefit to the world's wild tigers. In November 2010 the 13 tiger countries attending the St. Petersburg Global Tiger Summit in Russia pledged to “strive to double the number of wild tigers across their range by 2022.” In March 2010 a mother and two cubs were poisoned in Huai Kha Khaeng, the first poaching casualties in four years. The deaths prompted the Thai government to offer a \$3,000 bounty for capture of the poachers. In the same month two young tigers were poisoned in Ranthambore, apparently by villagers who had lost goats to tiger attacks, while two new cubs were later born. And in Hukawng a new male tiger was caught by camera trap, a lone reminder of what this great wilderness could hold.

Most authorities agree that the fight to save the tiger can be won—but that it must be waged with unremitting professional focus that adheres to a proven strategy. It will require the human species to display not merely resolve but outright zealotry.

“I want it in my will,” Fateh Singh Rathore had told me in Ranthambore, his eyes burning bright behind his spectacles. “When I die, you spread my ashes on these grounds so the tiger can walk upon my ashes.” □



BIG CAT WEEK

In support of the National Geographic Society's Big Cats Initiative, Nat Geo WILD presents a week of nature's most exotic felines. Prime time; check local listings.





In one of the last places where wild tigers are thought to thrive, a Bengal tiger pauses in a river to listen to another tiger roar. Here on the Bay of Bengal, vast mangrove forests in the Sundarbans of India and Bangladesh provide rich habitat for the adaptable big cats.

STEVE WINTER



POLITICS
is
KILLING
the
BIG
CATS

*We need a new approach
to save them, says
preeminent field biologist
George B. Schaller.*

WHEN I BEGAN TO STUDY the great cats nearly half a century ago, their sheer magnificence enthralled me: Tigers striding on velvet paws through the forests of India's Kanha National Park, secure in their power, dignity, and flaming beauty; prides of Serengeti lions sprawling in the shade of acacias, poured like honey over the golden grass; snow leopards flowing as mere cloud shadows along Himalayan crags; and jaguars roaming



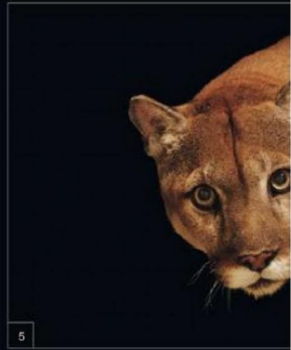
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CATS IN CRISIS

PHOTOGRAPHS BY VINCENT J. MUSI

Of the world's 37 species of cats, these eight reign as the big cats. All are top predators in their realm. All are losing ground. More people are living in their range. They face habitat loss, illegal hunting for skins and other body parts, and retaliatory killing when they prey on livestock. Yet conservationists see hope, if there's concerted effort. As field biologist George B. Schaller writes, "The great cats represent the ultimate test of our willingness to share this planet with other species."

Lion | 1

Panthera leo

The only wild cat that lives in large family groups once roamed all of Africa and into Asia. Tanzania has the greatest number of lions.

Estimated wild population: 20,000 to 30,000*

Population in zoos: 1,888

Status: Vulnerable

*All wild cat populations are uncertain.

Clouded Leopard | 2

Neofelis nebulosa

Smallest of the big cats—males may reach 50 pounds—it has canine teeth as long as a tiger's. An acrobatic climber, it hunts in trees as well as on the ground in forests across Southeast Asia.

Estimated wild population: 10,000

Population in zoos: 222

Status: Vulnerable

Jaguar | 3

Panthera onca

Revered as a god by the ancient Aztec and Maya, the most powerful predator in Central and South America weighs up to 250 pounds. It's the third largest cat, after tigers and lions.

Estimated wild population: At least 10,000

Population in zoos: 365

Status: Near threatened

Snow Leopard | 4

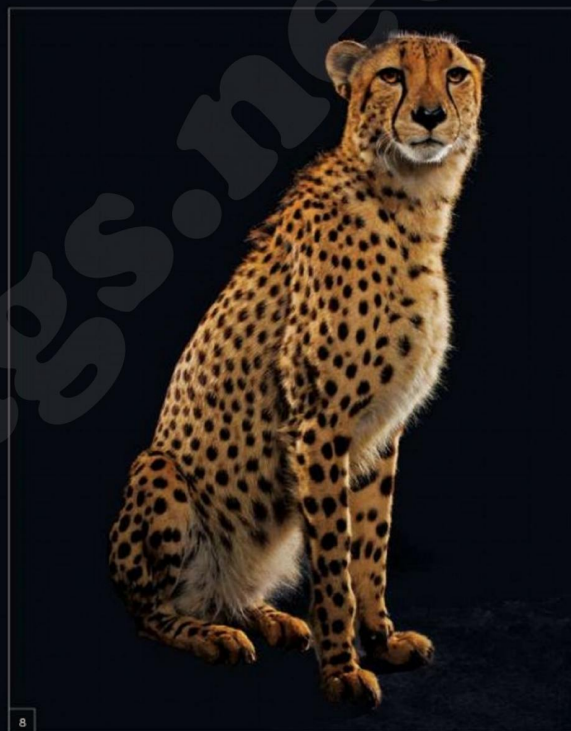
Panthera uncia

The "ghost of the mountains" is at home in the Himalaya and surrounding ranges of Central Asia. In 1971 this magazine was the first to publish photos of the elusive cat taken in the wild.

Estimated wild population: 4,000 to 6,500

Population in zoos: 414

Status: Endangered



Puma | 5

Puma concolor

Cougar, mountain lion, panther: The cat of many names ranges from Canada to the tip of Chile. It's returning to former lands in the U.S. Midwest, but overall population is thought to be falling.

Estimated wild population: 30,000 (U.S. only)

Population in zoos: 397

Status: Least concern

Leopard | 6

Panthera pardus

The most widespread of big cats—found from Africa to Southeast Asia—it is most abundant in sub-Saharan Africa. Black leopards are often called black panthers.

Estimated wild population: No reliable data

Population in zoos: 853

Status: Near threatened

Tiger | 7

Panthera tigris

No cat is bigger, with males topping 600 pounds. Three tiger subspecies have gone extinct since the 1930s. The Malayan (above) and four or five other subspecies hang on in Asia.

Estimated wild population: Fewer than 4,000

Population in zoos: 1,660

Status: Endangered

Cheetah | 8

Acinonyx jubatus

The fastest mammal can sprint 60-plus mph. East and southwest Africa are its remaining strongholds; 70 to 110 live in Iran. Targeted by lions and hyenas, few cubs reach adulthood.

Estimated wild population: 7,000 to 10,000

Population in zoos: 1,015

Status: Vulnerable

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Panthera leo

AFRICAN LION

Alertly she watches her prey,
 body tense, tip of tail twitching as
 she advances a step at a time.
 Then she crouches motionless,
 hugging the ground. Only the
 quivering of her flanks
 reveals her tension as she
 waits for the unsuspecting
 victim to drift closer.
 George O. Scharler
 waiting for the
 victim to drift closer.

— FIELD BIOLOGIST,
 GEORGE O. SCHARLER,
 IN THE SERENGETI



Adult male lion
 head and body length,
 4'7" to 5'9"
 2,650-4,000 pounds
 Adult female lion
 head and body length,
 3'7" to 4'2"
 1,300-2,500 pounds





NATIONAL GEOGRAPHIC
 ART AND DESIGN: FERNANDO G. BAPTISTA; ILLUSTRATIONS: BOB BRYAN; ADDITIONAL ART: BOBA KIM; LETTERING: JULIAN WATKINS; SOURCE: CHINA PAPER, UNIVERSITY OF BRITISH COLUMBIA; INK: INKLES AND CARRON P. LINDE; NATIONAL MUSEUM OF NATURAL HISTORY; BAHIAN MUSEUM; BRITISH MUSEUM OF NATURAL HISTORY; LABORATORY OF GENETIC DIVERSITY NATIONAL CANCER INSTITUTE (UMMS); PHOTOGRAPH: © DECEMBER 2011 NATIONAL GEOGRAPHIC SOCIETY; WATCH ARTIST FERNANDO BAPTISTA CREATE THIS PICTURE AND ORDER PRINTS AT NATGEO.COM/ART

mysteriously alone in the great swamps of Brazil's Pantanal. Yet today I behold these icons of wildness and wilderness with concern, knowing that their fates rest solely with humankind.

Back in the 1960s and 1970s, we did basic, and some would now say old-fashioned, natural history. There was no satellite imagery available to us to delineate suitable habitat. Radiotelemetry was primitive, though we did collar jaguars and trace their movements. We had no automatic infrared cameras to photograph any passing creature. To recognize a tiger with certainty, I looked closely at the stripe pattern of its face. I picked apart scats to determine what cats had eaten, followed their tracks in dust or snow to plot the extent of their travels, and examined each kill to find out its age and sex. Conservation depends on such information.

At the time I did not think that wilderness would so quickly become exhaustible. The human population has more than doubled since then, forests have given way to fields, and livestock herds have replaced wildlife on rangelands.

Lions, once so abundant, are vanishing outside of reserves. Shot, poisoned, and snared by pastoralists and farmers, partly because they kill cattle and occasionally a person, lions may ultimately survive only in protected reserves. Tigers now occupy roughly 7 percent of their former range. Fewer than 4,000 may be left in the wild, whereas, by sad contrast, China and the United States are thought to have some 5,000 each in captivity.

Tigers and leopards in Asia are threatened by networks of poachers that supply the East, particularly China, with skins, as well as bones and other body parts with supposed medicinal value. No wonder two of India's reserves, Sariska and Panna, lost all their tigers under the eyes of a complacent and unmotivated guard force.

I once followed the lone track of a rare Asiatic cheetah across its last home in the desert of central Iran. How can the world stand idly

by while natural treasures such as this vanish, country by country?

When I began fieldwork, it was with the aim not only of studying a species but also of promoting its safety within a protected area. Both such efforts remain essential. But I have had to change my mind-set. Most countries now lack the space to set aside large new areas to support a population of, let us say, 200 snow leopards or tigers. Most existing reserves are small, able to sustain only a few of the great cats—and these may become extinct due to inbreeding, disease, or some accidental event. And as ecosystems shift with climate change, animals will have to adapt, migrate, or die.

Instead of focusing just on discrete, isolated protected areas, conservation has enlarged its vision to manage whole landscapes. The goal is to create a mosaic of core areas without people or development where a leopard or jaguar can breed in peace and security. Such core areas are connected by corridors of viable habitat to enable a cat to travel from one safety zone to another. The remaining area of a landscape is designated for human use. This approach integrates ecological, economic, and cultural aspects. I am involved in such a landscape plan for snow leopards on the Tibetan Plateau in China. We map the distribution of the cat; census prey, such as blue sheep; train local people to monitor wildlife; and work with communities and monasteries to promote good land and livestock management. This work is coordinated by the Shan Shui Conservation Center at Peking University.

It's easy enough to outline landscape plans, pinpoint potential sites on satellite maps, and create a mental idyll of great cats and people living together in harmony. Many conferences have been held to define problems and set priorities—but rhetoric has far outstripped implementation. All great cats continue to fade in number. Most countries have simply lacked the political will and public pressure to save their wildlife. Even protection of reserves tends to be feeble, with poaching of animals and timber rampant and mining and other illegal activities common. Needed by each country are an elite

George B. Schaller serves as vice president of Panthera (panthera.org), an organization devoted to wild cat conservation.

guard force supported by police and even the army, rigorous regional cooperation to stop illegal trade of skins and bones, swift court action against offenders, and other deterrents. In the final analysis, conservation is politics—and politics is killing the big cats.

Humans and predators have for millennia confronted each other with fear and respect. Such conflict will continue. I have examined horses killed by snow leopards in Mongolia, cattle by jaguars in Brazil, and a family's sole milk buffalo by a tiger in India. All great cats kill livestock, especially if their natural prey has been decimated. Finding at least a partial solution to such killing is a critical conservation issue. Much predation is, however, the result of lax herding practices, as when cattle in India simply graze untended in forests.

Should governments or conservation organizations compensate households for such losses? The idea is seductive, but attempts in various countries have had little success. Aside from the fact that continued funding is never assured, there are fraudulent claims, difficulties in verification, delays in payment, and other problems. A community could establish an insurance program in which households pay a fee and later are compensated for losses. Tourism can benefit an economy greatly, as seen in Africa, where visitors eagerly crowd around lions and cheetahs. However, most communities near wildlife reserves derive few benefits because governments and tour operators fail to share profits.

I wonder if a positive approach might be more effective: Pay communities to maintain healthy great cat populations. After all, it is painfully clear that good science and good laws do not necessarily result in effective conservation. Communities must be directly involved as full partners in conservation by contributing their knowledge, insights, and skills. Aware of this, I have in recent years focused less on detailed science, something I enjoy most, and more on conservation. I have tried to become a combination of educator, diplomat, social anthropologist, and naturalist—an ecological missionary, balancing knowledge and action.

All great cats continue to fade in number. Most countries have simply lacked the political will and public pressure to save their wildlife. Even protection of reserves tends to be feeble.

But yes, I still collect snow leopard droppings for analysis. Much remains to be learned. We know only how to protect lions and tigers, not how to manage them in a human-dominated landscape. The density of a jaguar or other cat population in a given area is limited by the amount of prey. It is difficult to count prey animals, especially in forests, and little is known of how many a habitat can support. Indeed, we still lack solid data on the status and distribution of most cats, with estimates of numbers sometimes based on little more than intuition. Jaguars in the Amazon Basin and snow leopards in various ranges of Central Asia have never been censused.

Our greatest challenge is to instill national commitments to save the great cats. It's everyone's task. Communities need incentives to share their land with such predators. Benefits need to be based on moral values as well as on economic ones. The jaguar is a representative of the sun, the protector of all that lives among indigenous societies of Latin America; the tiger in China was an emissary of heaven and in Hindu India a force for good; and Buddhism stresses respect, love, and compassion for all living beings. Conservation is based on moral values, not scientific ones, on beauty, ethics, and religion, without which it cannot sustain itself.

The great cats represent the ultimate test of our willingness to share this planet with other species. We must act now to offer them a bright and secure future, if for no other reason than they are among the most wonderful expressions of life on Earth. □

■ **Educational Note** National Geographic has free educational resources about big cats for students, teachers, and families at natgeoed.org/bigcats.



Japan's Nuclear Refugees

After the disasters of March 11, tens of thousands were ordered to leave their homes in the vicinity of the damaged nuclear plant, their footprints now frozen in the mud. An exclusive look at the land they reluctantly left behind.

PHOTOGRAPHS BY DAVID GUTTENFELDER







Two dogs scarp on Okuma's empty streets. In the early days of the crisis the no-go zone was alive with roaming farm animals and pets: cows, pigs, goats, dogs, cats, even ostriches. Often defying police patrols and barricades, volunteer rescuers rounded up and decontaminated some pets, returning them to their owners, and fed others. But by midsummer, a number of the pets had perished of starvation and disease.





Futon bedding is usually folded and stored in closets each morning. But residents had no chance to put their homes in order before their hasty exodus, prompted by evacuation orders on televised news conferences before dawn on March 12. This bedroom is in Okuma, less than three miles from the damaged nuclear plant. Town officials in the area have accused power company Tepco of violating its duty to warn them of the crisis.



Evacuation drills are common in Japan's earthquake zones. So when the real thing happened in March, the children knew what to do—and expected to return in a few days. Months have gone by since the students fled. Still sitting in the classroom cubbies are the leather book bags that can cost several hundred dollars apiece and are one of a Japanese child's most valuable and cherished possessions. They will likely never be reclaimed.







A lone animal rights activist walks along the Fukushima coast. The power plant lies just over the hill, less than half a mile away. Weeks after other tsunami-hit regions were cleared of debris, cleanup crews hadn't yet been dispatched to this area because of radiation levels. Despite stiff penalties for illegally entering the zone, some animal rescuers defied restrictions as they sought to aid pets and farm animals that had been left behind.

Perhaps the most heartbreaking thing about the town of Namie is that at first glance nothing seems amiss. The blue-green meadows look lush. The gently flowing Takase and Ukedo Rivers glitter in the sun. The barbershop, train station, and fried-pork restaurant seem ready for business, a universe apart from the havoc and wholesale destruction visited on towns farther up the coast. In the states of Miyagi and Iwate, clocks washed ashore frozen at roughly 3:15 p.m., when the tsunami swallowed towns whole; in the humble fishing town of Namie the clocks go right on ticking.

Namie is one of five towns, two cities, and two villages that lie partially or wholly within a 12.4-mile radius of the Fukushima Daiichi nuclear power plant—designated by the government as a no-go zone. Like all the towns in the nuclear exclusion zone, it essentially no longer exists. Of its 21,000 residents, 7,500 have scattered across Japan. Another 13,500 live in temporary housing in the Fukushima region. They're among more than 70,000 "nuclear refugees" displaced by the world's worst nuclear accident since Chernobyl.

The de facto demise of Namie began in the chaotic hours after the quake struck on March 11.

Namie is shaped like a bow tie, radiating northwest from Fukushima Daiichi. Guided by news of the unfolding nuclear accident on TV and by local officials, townsfolk drove to the highlands, the center of the bow. Heading for the hills is a lifesaving instinct for Japanese conditioned by centuries of tsunamis, but in this case it turned out to be a terrible strategy. Residents fled smack into the plume of air carrying radioactive debris. They crammed into shelters with little food until the 15th, after another explosion sent them fleeing farther west to the city of Nihonmatsu.

"The forgotten town" was how the July issue of the popular magazine *Bungei Shunju* described Namie, which never received official orders to evacuate, even as hydrogen explosions at units 1 and 3 spewed toxic particles across the Fukushima area. "We weren't forgotten," says Naka Shimizu, the mayor's aide. "We were ignored."

Swathed in white protective masks and suits,

residents are bused into the zone on rare occasions to retrieve valuables and check on their homes. The trips are brief—roughly two to three hours—to minimize radiation exposure. Some families plan these forays with military precision, but Junko and Yukichi Shimizu, who shared their home with their son's family, including a two-year-old grandson, are plainly overwhelmed as they move slowly about their spacious home. On July 26 I spent half an hour with the couple during a day of driving and walking through the forlorn town.

Yukichi, 62, dejectedly tapes windows as he looks at his beloved garden, now gone to seed. Junko, 59, dusts the family's Buddhist altar and gathers the few small items they're permitted to bring out of the zone: photos, Chinese herbal medicines, her daughter's kimono. She leaves behind their Buddhist memorial tablets. "There's no one else to protect our house," she says.

Namie's town hall has decamped to makeshift offices in Nihonmatsu. Its officials continue to issue birth certificates, keep track of the increasingly far-flung inhabitants, and consult experts about the radioactive cesium that has rendered Namie's 86 square miles uninhabitable.

Many residents had held out hope they might return once Fukushima Daiichi is stabilized, but prospects are grim. While Tepco, operator of the crippled plant, hopes the complex will be brought under control by the New Year, residents will not be allowed back in the foreseeable future, and the government is mulling plans to buy their homes.

As the soft rays of dusk cast a warm glow over the downtown landscape, a cool ocean breeze ruffles our suffocating Tyvek suits. For just a moment it is possible to forget that the Geiger counter hit a level about 600 times normal, a few miles down Route 6. Yukichi Shimizu, who used to farm rice and work in construction, is plaintive as he surveys his lovely but lifeless hometown. "Could it really be that unsafe to live here?" □

*Lucille Craft covers Japan for NPR, PBS, and CBS. Tokyo-based Associated Press photographer David Gutfenfelder took these pictures between May 26 and July 26. He is featured in *The Moment*, page 150.*

FUKUSHIMA FALLOUT

The earthquake and tsunami of March 11 triggered a disaster at the Fukushima Daiichi nuclear plant. Cooling systems failed, leading to a meltdown of nuclear fuel and the release of radioactivity into the environment. Since then more than 70,000 residents have been ordered to leave their homes.

MAIN EVACUATION ZONE

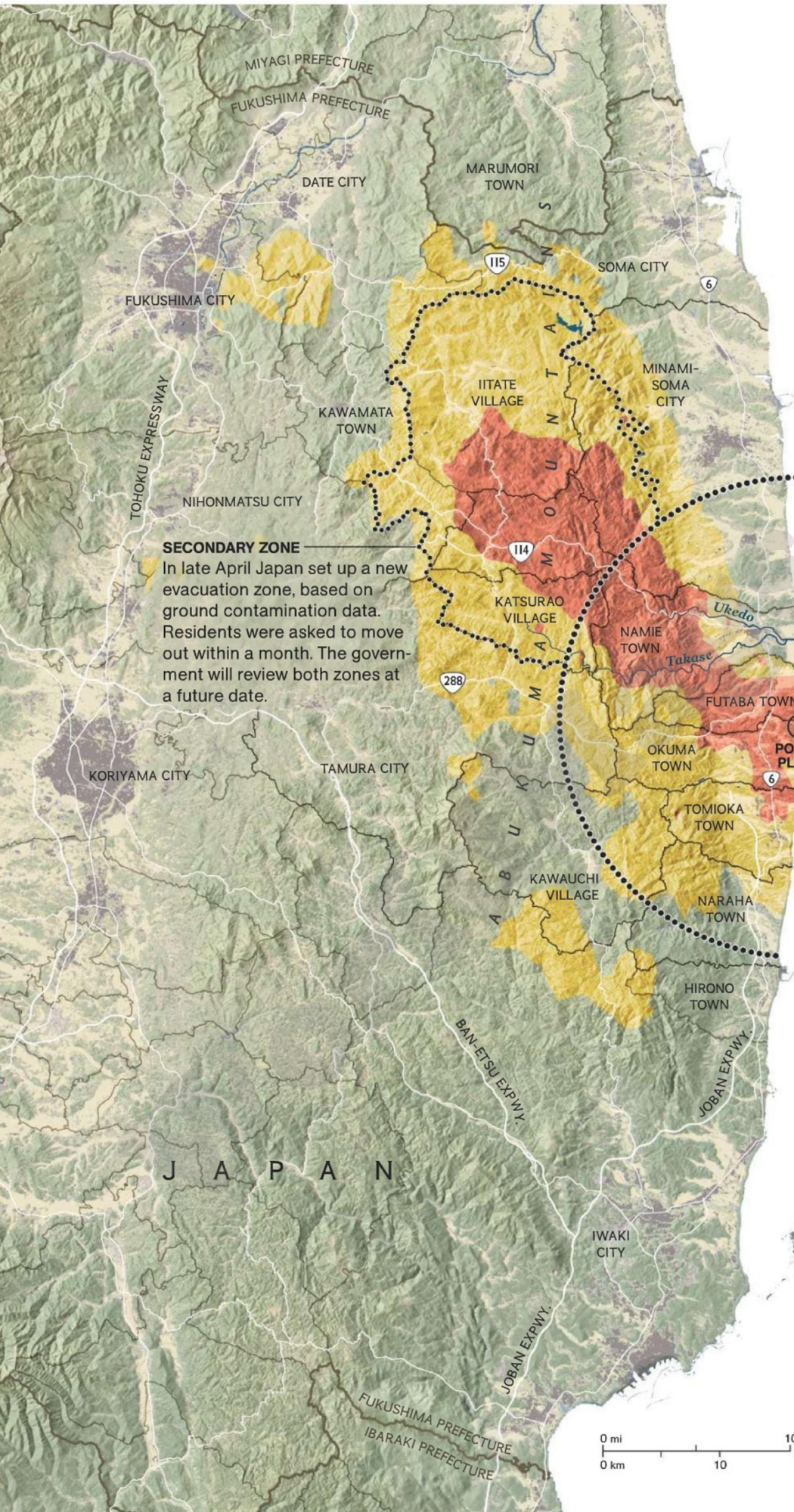
Established on March 12, the zone covers a 12.4-mile radius from the plant. Residents have only been allowed back for short supervised visits to retrieve some small possessions.

GROUND CONTAMINATION*

On March 15 winds shifted, and a rainstorm showered the toxic plume over communities northwest of the plant.

- Contamination levels could lead to radiation exposure exceeding what Japan deems acceptable over the course of a year.
- Soil shows low levels of radioactive contamination.

*As of April 29, 2011



WILLIAM E. McNULTY, NGM STAFF;
PATRICIA HEALY
SOURCES: JAPAN MINISTRY OF
EDUCATION, CULTURE, SPORTS, SCIENCE
AND TECHNOLOGY; U.S. DEPARTMENT OF
ENERGY; U.S. NUCLEAR REGULATORY
COMMISSION





In a gym in Hirono, residents in protective suits are briefed before being escorted to their homes for a June 8 visit and to retrieve a few small items. (There's no room on the bus for larger things.) Although the trips in were strictly controlled, a town official says that for the decontamination process—disposing of shoe covers, suits, caps, and masks and being screened for radiation—everyone and everything was waved through.



Nobuko Sanpei, 74, eats dinner in her cardboard-box home at the Big Palette Fukushima convention center in Koriyama. "It was sweltering, so I cut out a hole," she said. For months after the nuclear disaster, thousands of refugees lived in cardboard "houses" in inns, schools, and other public shelters. Sanpei, who has since moved to a small apartment, pines for the rice paddies she and her husband tended in Tomioka, south of the power plant.





An evacuee relaxes in her makeshift dwelling on the floor of the Big Palette convention center. The cramped emergency quarters lack privacy, and disease can spread rapidly. Older residents, who spent their lives in tight-knit rural communities, are often reluctant to move into temporary housing, isolated from friends and family. Social workers are trying to prevent a wave of *kodoku-shi*, or lonely death, among solitary seniors.






Tattooed Toyoo Ide, 69, is one of the men taking advantage of the bathing facility set up by the Self-Defense Forces outside the Big Palette evacuation center. A lifelong employee of the nuclear power plant and self-described wise guy, Ide misses his home deeply: "There's no water or electricity now, but if there were, I'd go back, radioactivity or not. I'd go back today. I can't live in a stranger's town."





At this home within the nuclear zone the earthquake dislodged and shattered a portrait of a family member. In Japan many families keep the memory of their forebears alive by displaying somber images of deceased patriarchs and matriarchs, who often stare down at a Buddhist family altar where incense is burned and prayers are offered to the dearly departed. Now the portraits preside over empty households.





The Magellanic Clouds—two gauzy patches of light (at far right)—share the sky above the Patagonian Andes with a streaking comet and the luminous band of the Milky Way.

MILOSLAV DRUCKMÜLLER

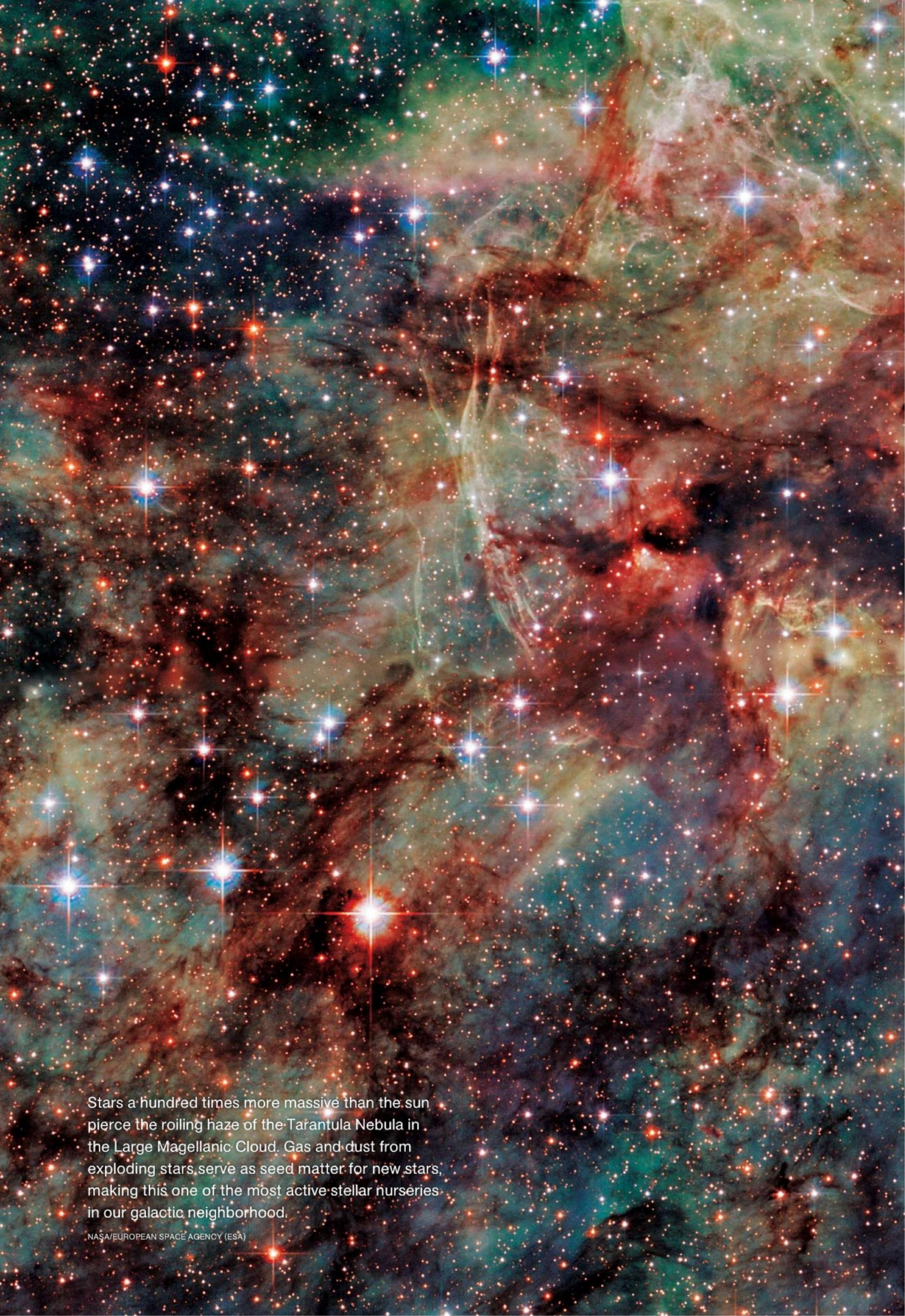
*Satellite galaxies of the
Milky Way usually perish in its grasp.
Why are two thriving?*

Dancing in



www.worldimages.net

the Dark



Stars a hundred times more massive than the sun pierce the roiling haze of the Tarantula Nebula in the Large Magellanic Cloud. Gas and dust from exploding stars serve as seed matter for new stars, making this one of the most active stellar nurseries in our galactic neighborhood.

NASA/EUROPEAN SPACE AGENCY (ESA)



By Timothy Ferris

LOOMING NEAR THE MIGHTY SWEEP

of the southern Milky Way, the Large and Small Magellanic Clouds resemble detached pieces of our galaxy. Astronomers once assumed they had always orbited the Milky Way at approximately their current distances, like the other, lesser satellite galaxies in the Milky Way's gravitational thrall. But new evidence suggests that the Magellanic Clouds have instead spent most of their careers farther away and are currently experiencing a rare close encounter with our galaxy. If so, we may be witnessing the onset of an intergalactic pas de trois—a dance of the sort that can shatter the composure of galaxies, forging billions of new stars and planets while flinging others into the depths of space.

With the clarity of hindsight, astronomers can now make sense of conspicuous clues that suggested a more regal status for the clouds all along.

For one thing, the clouds are much brighter than our galaxy's other satellites—bright enough to have captured the attention of naked-eye observers like Ferdinand Magellan's chronicler, Antonio Pigafetta, who remarked upon the "many small stars congregated together." They're bright because they're close by and contain lots of stars. The Milky Way's known satellites harbor up to ten million stars each. The Small Magellanic Cloud holds some three *billion* stars, and the Large Cloud perhaps 30 billion.

For another, the clouds don't look like the disheveled spheroidal dwarf galaxies that closely orbit the Milky Way and other major spirals. More likely, they're previously distant galaxies that have only recently ventured close enough to our galaxy to be perturbed by its gravitational field. Prior to its gambol with the Milky Way, the Large Magellanic Cloud may even have been a classic spiral like the Triangulum galaxy, M33, which looks imposing but is actually not much more massive than the Large Cloud.

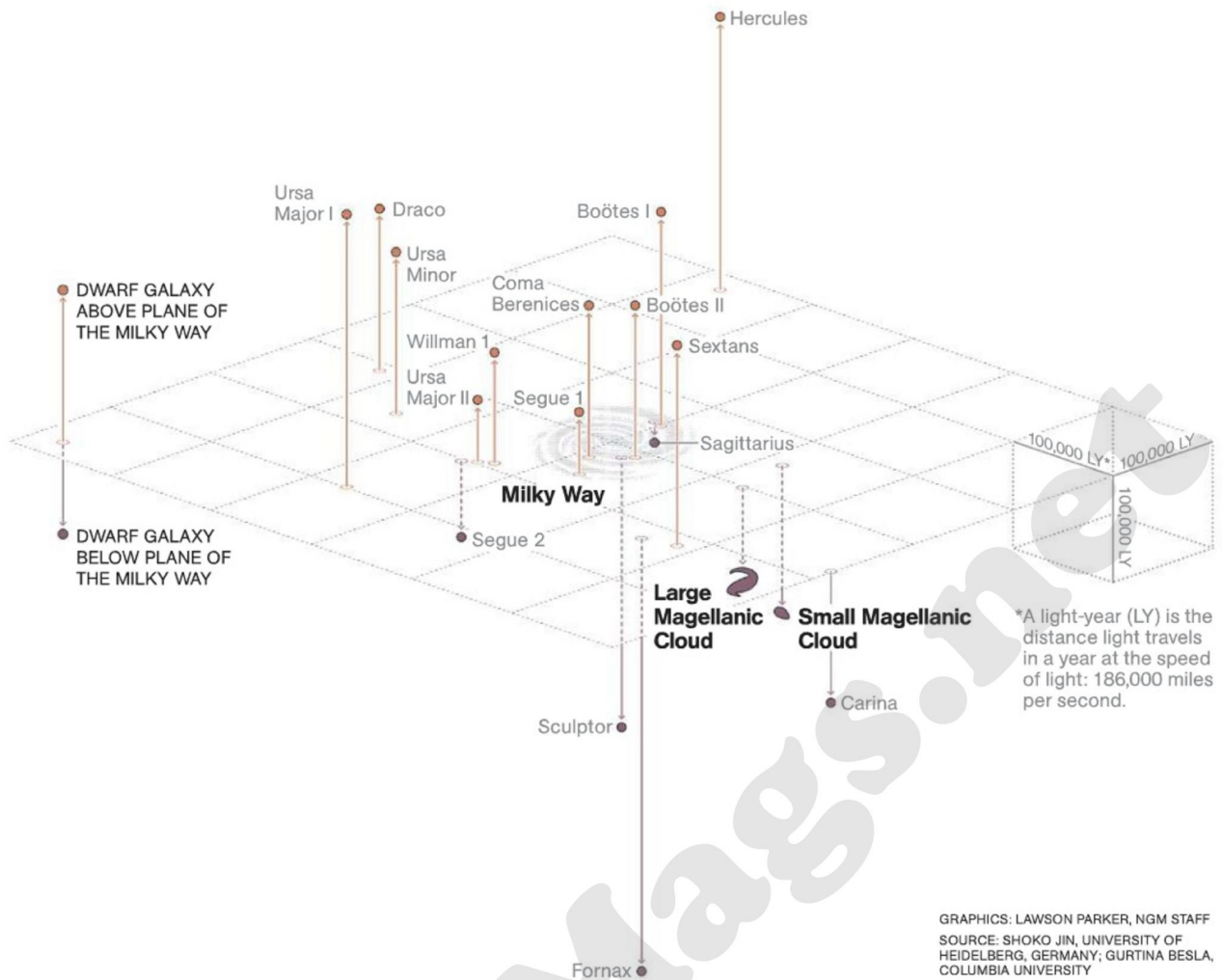
In 2006 a team of astronomers using the Hubble Space Telescope measured the motion of the Magellanic Clouds by clocking them against background quasars, which lie billions of light-years beyond and so approximate a static background in a universe where nothing really stands still. These measurements suggest the clouds are pursuing lanky, eccentric orbits that would have brought them into proximity with our galaxy only one time previously since the universe began.

The notion that the clouds have passed our way just once before gains support from the fact that both still contain ample amounts of gas from which to make new stars. Satellites that orbit close to major galaxies eventually forfeit their interstellar gas to the greater galaxy. Unable to fashion new stars, these satellites evolve into celestial retirement communities, inhabited by bald old stars and little else. In time, many of the spheroidal dwarfs circling the Milky Way will likely be cannibalized by it, as others like them have been in the past.

In contrast, astronomers have found that the Small Cloud is still making



Timothy Ferris has explored the cosmos in a dozen popular books. His last story for the magazine, on the search for other Earths, appeared in December 2009.



GRAPHICS: LAWSON PARKER, NGM STAFF
 SOURCE: SHOKO JIN, UNIVERSITY OF HEIDELBERG, GERMANY; GURTINA BESLA, COLUMBIA UNIVERSITY

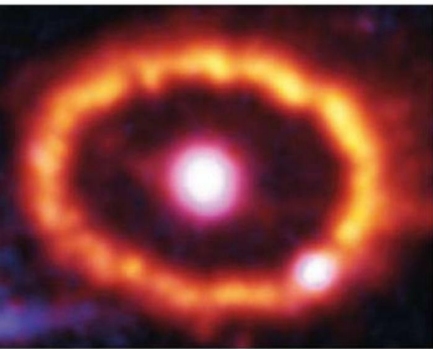
Galactic Suburbia

The Magellanic Clouds are the largest and brightest of the galaxies orbiting our own. The others (those within 500,000 light-years of the sun are shown) are star-poor dwarfs that have orbited the Milky Way multiple times. The clouds may have yet to complete a single orbit.

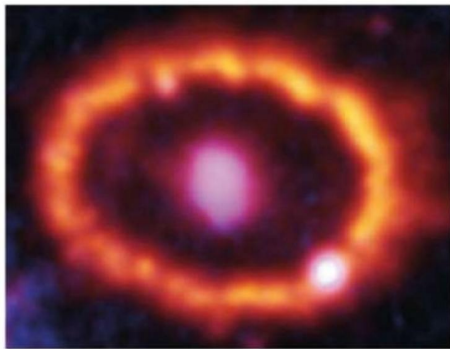
new stars in bursts, some within just the past few hundred million years. The Large Cloud, for its part, is a star-making factory, full of freshly minted star clusters and the soap-bubble skins shed by hot young stars that have exploded. Conspicuous in the Large Cloud is the glowing red Tarantula Nebula, a gigantic star-forming region that lies 160,000 light-years from Earth but shines so brightly that when observed through a big observatory telescope, its light pours out of the eyepiece like a flashlight beam.

The Tarantula's ruddy glow comes from what astronomers call excited hydrogen gas. The gas is excited by powerful light from giant stars burning furiously enough to deplete their nuclear fuel within only millions of years, rather than the billions of years it takes more modest stars like our sun. They then explode, as supernovae. When a blue giant star in the Tarantula region went supernova, seen on the night of February 23, 1987, it captured the attention of astronomers worldwide. They've been observing its remnants ever since.

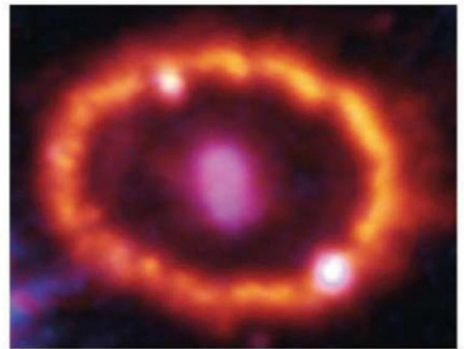
The Milky Way and the Magellanic Clouds appear destined to see a lot more of one another in the eons ahead. Will their dynamic dance eventually result in a merger? Or will the clouds just come and go, spending their careers as a quiet, composed couple that comes downtown for a star-making binge every couple of billion years? Nobody will live long enough to witness the fate of these galaxies, but sooner or later scientists should be able to learn their dance steps, and to catch faint echoes of the music. □



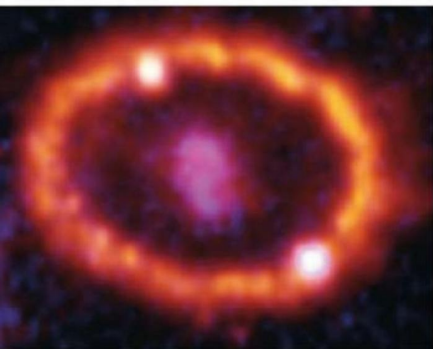
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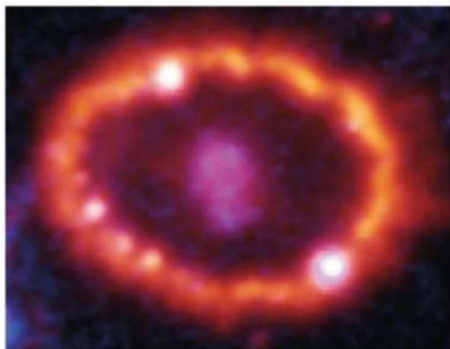
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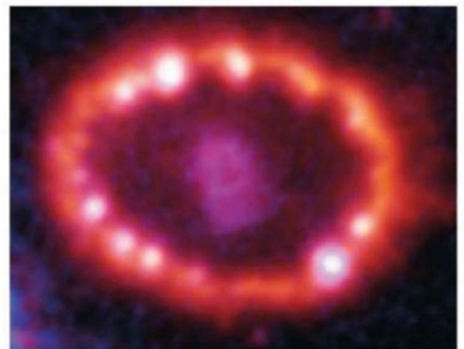
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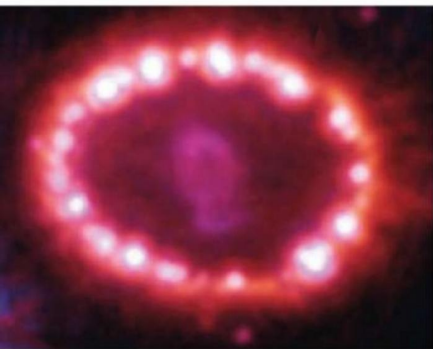
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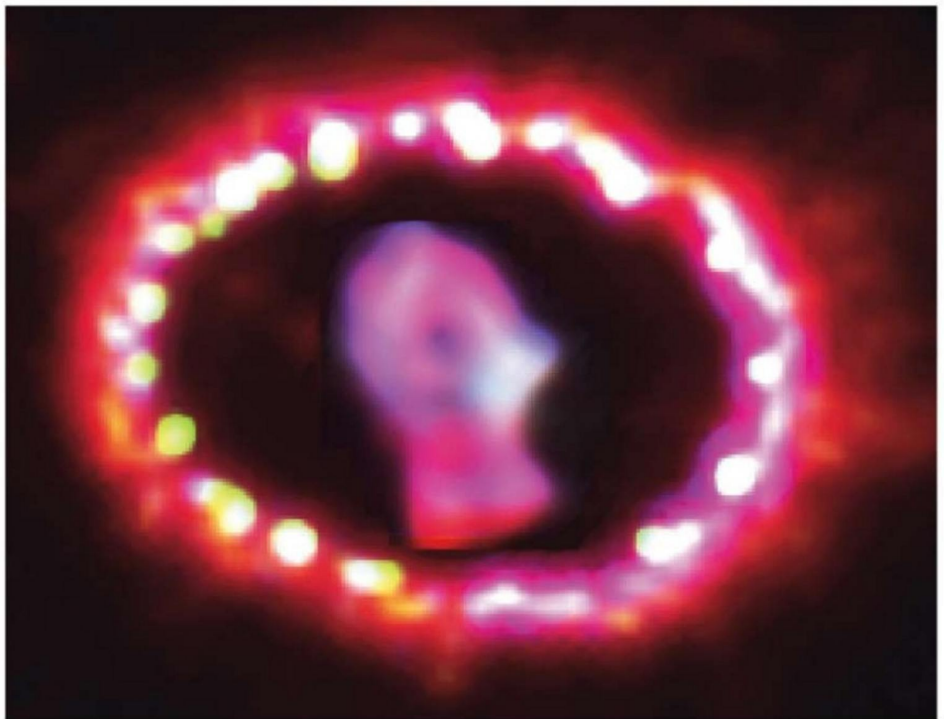
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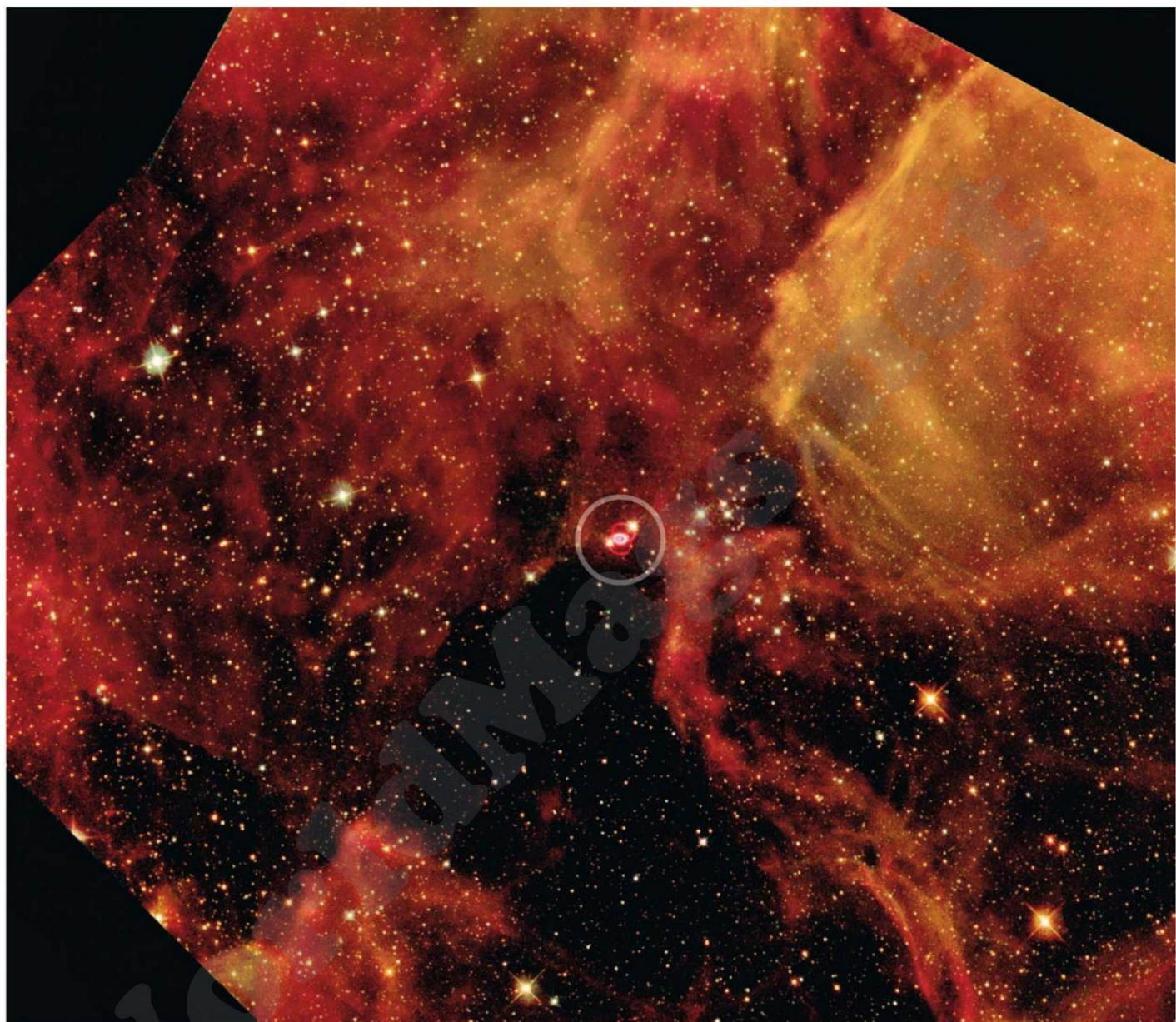


NOVEMBER 28, 2003



JUNE 8, 2011

SMALL PHOTOS: NASA/PETE CHALLIS AND ROBERT KIRSHNER, HARVARD-SMITHSONIAN CENTER FOR ASTROPHYSICS (CFA)/BEN SUGARMAN, SPACE TELESCOPE SCIENCE INSTITUTE (STSCI). JUNE 8 PHOTO: NASA/ESA/PETE CHALLIS, CFA. OPPOSITE: NASA/STSCI/ ASSOCIATION OF UNIVERSITIES FOR RESEARCH IN ASTRONOMY (AURA)



A Star's Brilliant Final Act

The brightest supernova in 400 years resembles a cosmic string of pearls. It was seen in 1987 amid vast billows of gas in the Tarantula Nebula within the Large Magellanic Cloud (above). Hubble Space Telescope images (left) show that as the supernova faded over time, debris from the explosion collided with a ring of material ejected thousands of years earlier by the dying star, generating x-rays that illuminate the ring. By 2011 debris in the center of the ring, which is about a light-year in diameter, was blazing more intensely as the supernova entered a new stage of stellar demise.

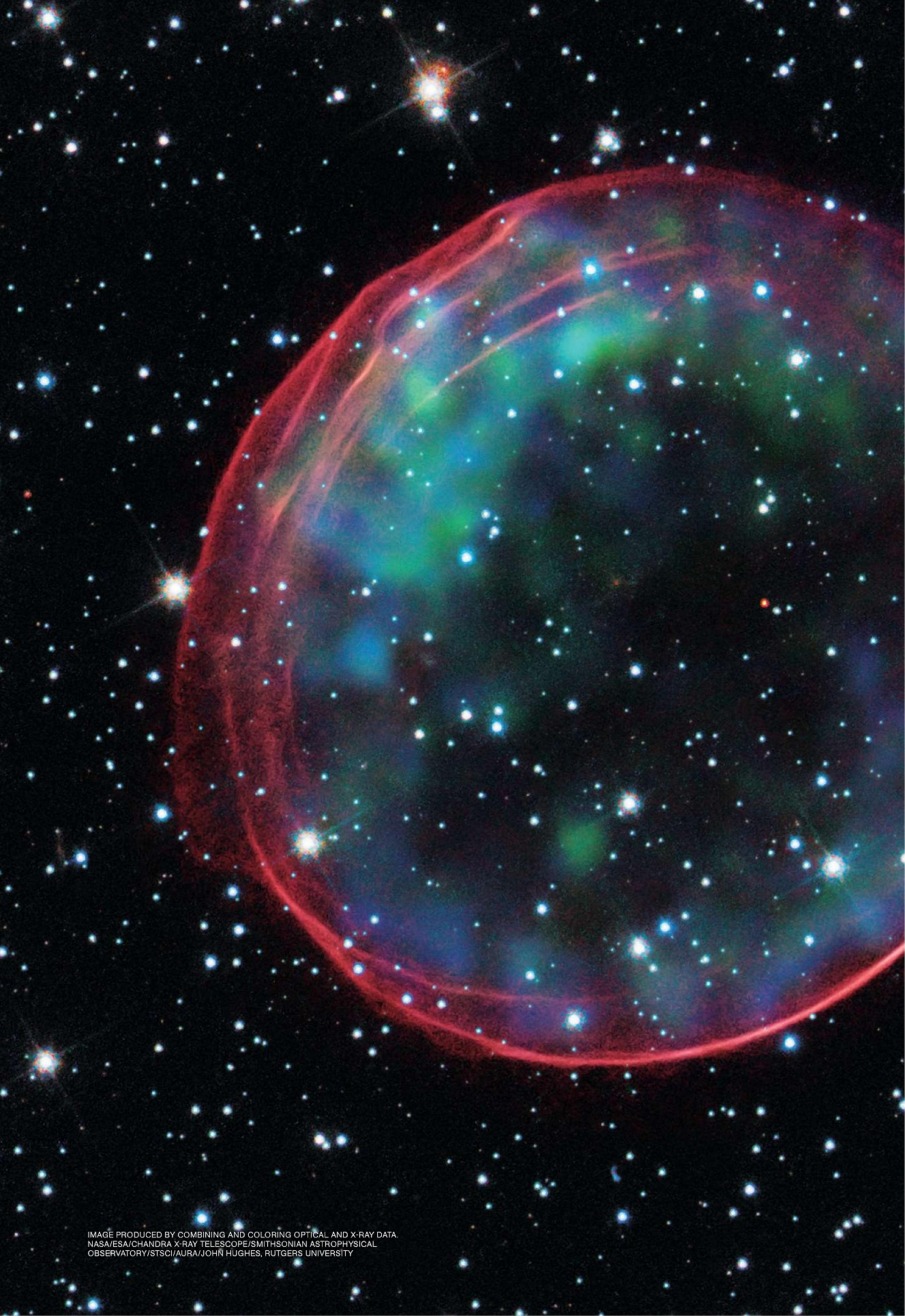
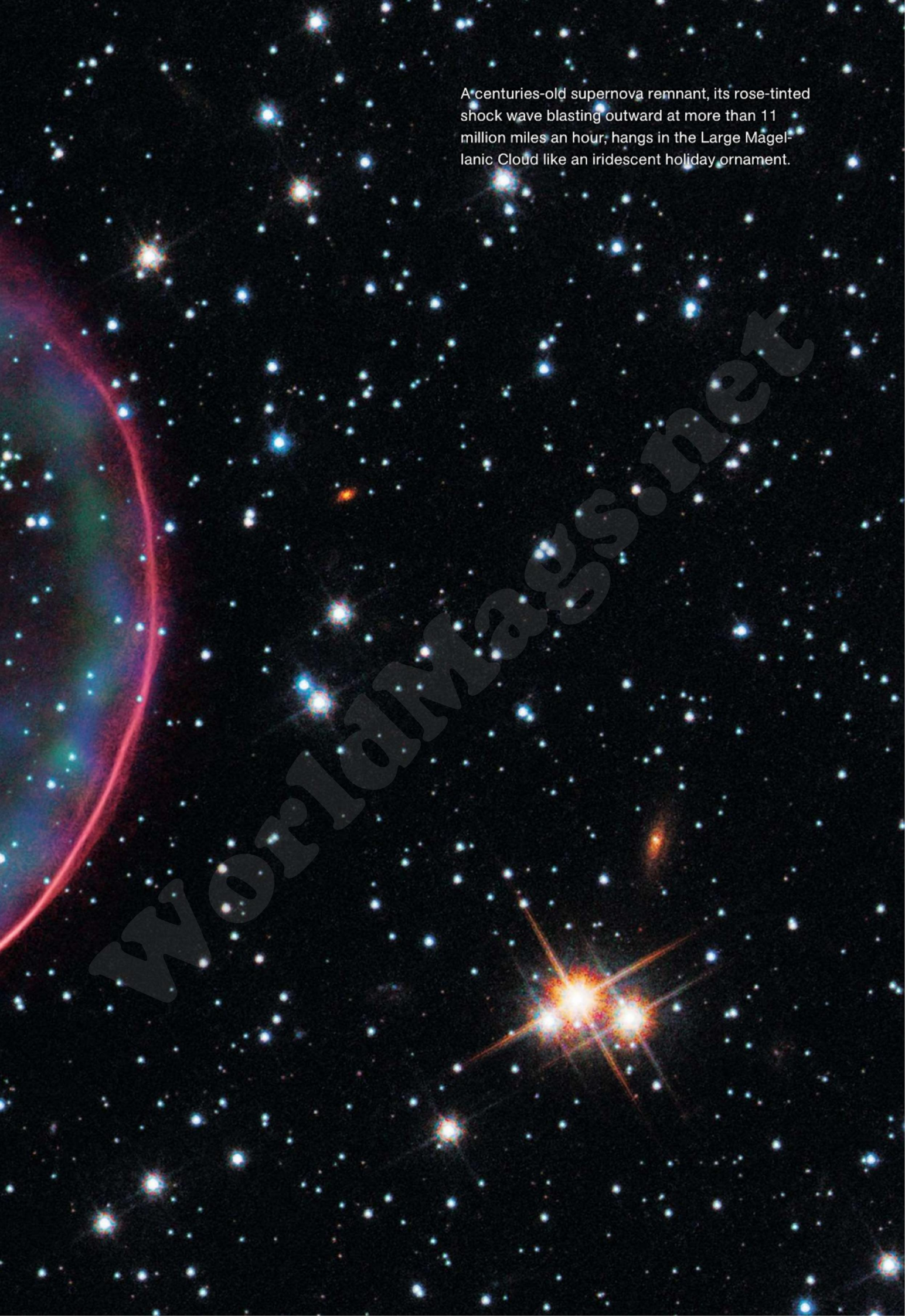


IMAGE PRODUCED BY COMBINING AND COLORING OPTICAL AND X-RAY DATA
NASA/ESA/CHANDRA X-RAY TELESCOPE/SMITHSONIAN ASTROPHYSICAL
OBSERVATORY/STSCI/AURA/JOHN HUGHES, RUTGERS UNIVERSITY

A centuries-old supernova remnant, its rose-tinted shock wave blasting outward at more than 11 million miles an hour, hangs in the Large Magellanic Cloud like an iridescent holiday ornament.



THE *City* SOLUTION

BY ROBERT KUNZIG

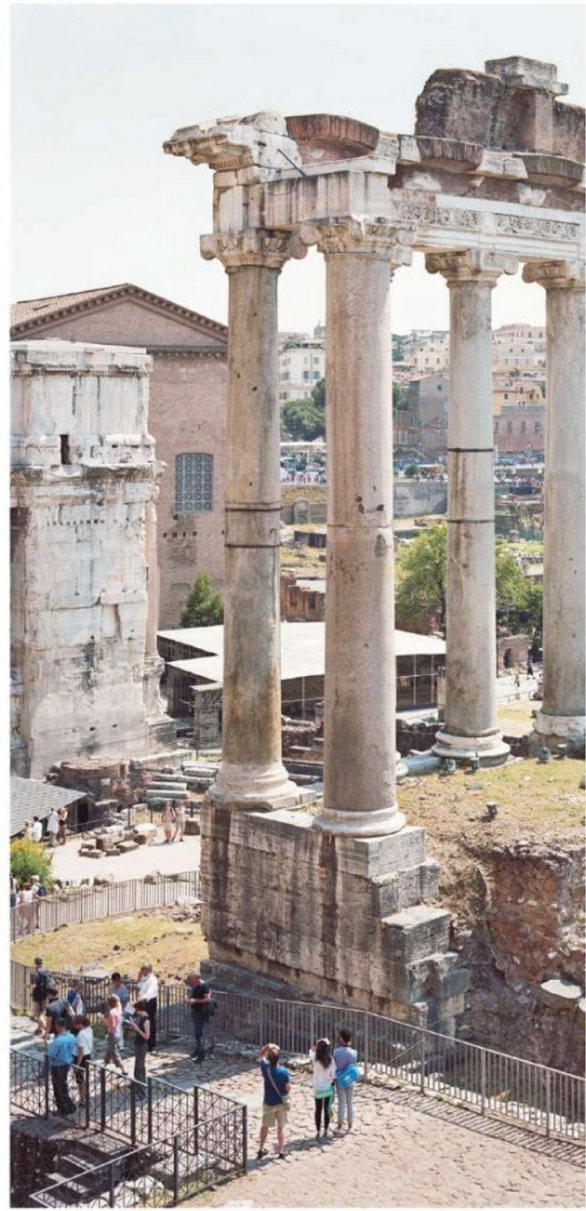
*Why cities are
the best cure for
our planet's
growing pains*

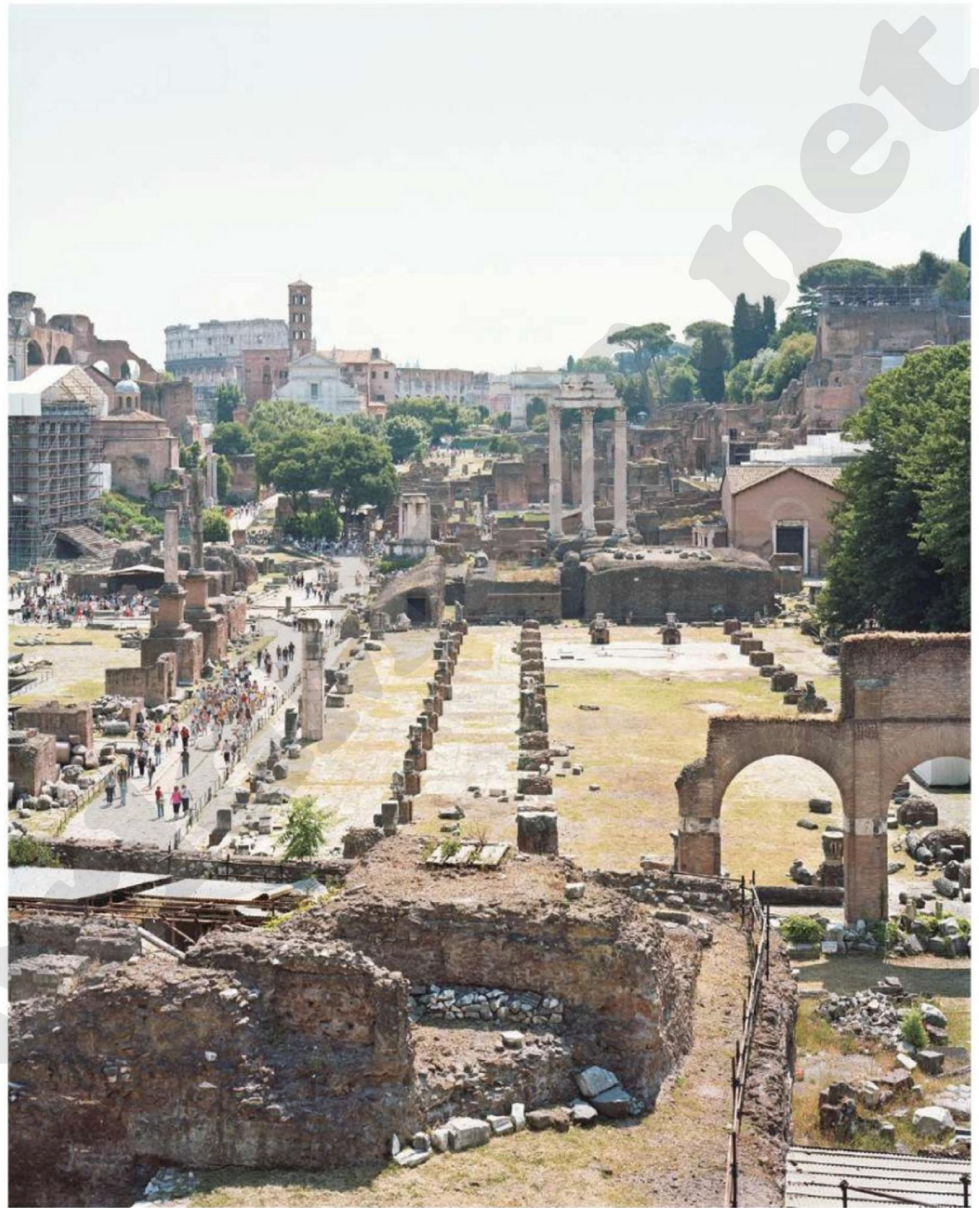




The vertiginous “infinity pool” at the Marina Bay Sands resort offers a sweeping view of Singapore, a country that’s achieved success while building up instead of out.

CHIA MING CHIEN





CIVIC SPACE | *Rome, Italy* | *Photograph by Massimo Vitali* | Great cities require a center where citizens openly meet, mingle, do business, and exchange ideas. The Forum, the heart of ancient Rome, set the standard for the public spaces that followed. Where tourists now walk among ruins was once a vital arena of law courts, temples, monuments, and markets that thrived for more than a thousand years.



SUCCESS SYMBOL | *Kuala Lumpur, Malaysia* | *Mario Weigt* | Skyscrapers exclaim urban innovation, few more boldly than the Petronas Towers in Malaysia's capital.





A PLACE CALLED HOME | *Seoul, South Korea* | *Yeondoo Jung* | These apartments in the 25-story Evergreen Tower are identical, but each family adds humanizing touches to its 150-square-foot living room—from trophies and wedding pictures to

a cross and a cuckoo clock. More than half of metropolitan Seoul's 24 million residents live in high-rises, deeming them safer, more energy efficient, and a better investment than single-family dwellings.

A t the

time of Jack the Ripper, a hard time for London, there lived in that city a mild-mannered stenographer named Ebenezer Howard. He's worth mentioning because he had a large and lingering impact on how we think about cities.

Howard was bald, with a bushy, mouth-cloaking mustache, wire-rim spectacles, and the distracted air of a seeker. His job transcribing speeches did not fulfill him. He dabbled in spiritualism; mastered Esperanto, the recently invented language; invented a shorthand typewriter himself. And dreamed about real estate. What his family needed, he wrote to his wife in 1885, was a house with "a really nice garden with perhaps a lawn tennis ground." A few years later, after siring four children in six years in a cramped rental house, Howard emerged from a prolonged depression with a scheme for emptying out London.

London in the 1880s, you see, was booming, but it was also bursting with people far more desperate than Howard. The slums where the Ripper trolled for victims were beyond appalling. "Every room in these rotten and reeking tenements houses a family, often two," wrote Andrew Mearns, a crusading minister. "In one cellar a sanitary inspector reports finding a father, mother, three children, and four pigs!... Elsewhere is a poor widow, her three children,

and a child who had been dead thirteen days." The Victorians called such slums rookeries, or colonies of breeding animals. The chairman of the London County Council described his city as "a tumour, an elephantiasis sucking into its gorged system half the life and the blood and the bone of the rural districts."

Urban planning in the 20th century sprang from that horrified perception of 19th-century cities. Oddly, it began with Ebenezer Howard. In a slim book, self-published in 1898, the man who spent his days transcribing the ideas of others articulated his own vision for how humanity ought to live—a vision so compelling that half a century later Lewis Mumford, the great American architecture critic, said it had "laid the foundation for a new cycle in urban civilization."

The tide of urbanization must be stopped, Howard argued, by drawing people away from the cancerous metropolises into new, self-contained "garden cities." The residents of these happy little islands would feel the "joyous union" of town and country. They'd live in nice houses and gardens at the center, walk to work in factories at the rim, and be fed by farms in an outer

SEVEN BILLION is a yearlong series on global population.

greenbelt—which would also stop the town from expanding into the country. When one town filled to its greenbelt—32,000 people was the right number, Howard thought—it would be time to build the next one. In 1907, welcoming 500 Esperantists to Letchworth, the first garden city, Howard boldly predicted (in Esperanto) that both the new language and his new utopias would soon spread around the world.

He was right about the human desire for more living space but wrong about the future of cities: It's the tide of urbanization that has spread around the world. In the developed countries and Latin America it has nearly crested; more than 70 percent of people there live in urban areas. In much of Asia and Africa people are still surging into cities, in numbers swollen by the population boom. Most urbanites live in cities of less than half a million, but big cities have gotten bigger and more common. In the 19th century London was the only city of more than five million; now there are 54, most of them in Asia.

And here's one more change since then: Urbanization is now good news. Expert opinion has shifted profoundly in the past decade or two. Though slums as appalling as Victorian London's are now widespread, and the Victorian fear of cities lives on, cancer no longer seems the right metaphor. On the contrary: With Earth's population headed toward nine or ten billion, dense cities are looking more like a cure—the best hope for lifting people out of poverty without wrecking the planet.

ONE EVENING last March, Harvard economist Edward Glaeser appeared at the London School of Economics to promote this point of view, along with his new book, *Triumph of the City*. Glaeser, who grew up in New York City and talks extremely fast, came heavily armed with anecdotes and data. "There's no such thing as a poor urbanized country; there's no such thing as a rich rural country," he said. A cloud of country names, each plotted by GDP and urbanization rate, flashed on the screen behind him.

Mahatma Gandhi was wrong, Glaeser declared—India's future is not in its villages, it's in

Bangalore. Images of Dharavi, Mumbai's large slum, and of Rio de Janeiro's favelas flashed by; to Glaeser, they were examples of urban vitality, not blight. Poor people flock to cities because that's where the money is, he said, and cities produce more because "the absence of space between people" reduces the cost of transporting goods, people, and ideas. Historically, cities were built on rivers or natural harbors to ease the flow of goods. But these days, since shipping costs have declined and service industries have risen, what counts most is the flow of ideas.

The quintessence of the vibrant city for Glaeser is Wall Street, especially the trading floor, where millionaires forsake large offices to work in an open-plan bath of information. "They value knowledge over space—that's what the modern city is all about," he said. Successful cities "increase the returns to being smart" by enabling people to learn from one another. In cities with higher average education, even the uneducated earn higher wages; that's evidence of "human capital spillover."

Spillover works best face-to-face. No technology yet invented—not the telephone, the Internet, or videoconferencing—delivers the fertile chance encounters that cities have delivered since the Roman Forum was new. Nor do they deliver the nonverbal, contextual cues that help us convey complex ideas—to see from the glassy eyes of our listeners, for instance, that we're talking too fast.

IT'S EASY TO SEE why economists would embrace cities, warts and all, as engines of prosperity. It has taken a bit longer for environmentalists, for whom Henry David Thoreau's cabin in the woods has been a lodestar. By increasing income, cities increase consumption and pollution too. If what you value most is nature, cities look like concentrated piles of damage—until you consider the alternative, which is spreading the damage. From an ecological standpoint, says Stewart Brand, founder of the *Whole Earth Catalog* and now a champion of (Continued on page 140)

Senior environment editor Robert Kunzig wrote the first article in the *Seven Billion* series in January.

| **GREEN ZONE**

London, England

Massimo Vitali

A world away from the nearby towers of central London, grassy Greenwich Park offers a refuge for city dwellers. One secret to designing cities that are good for the environment lies in luring nature lovers to urban green spaces instead of the suburbs.

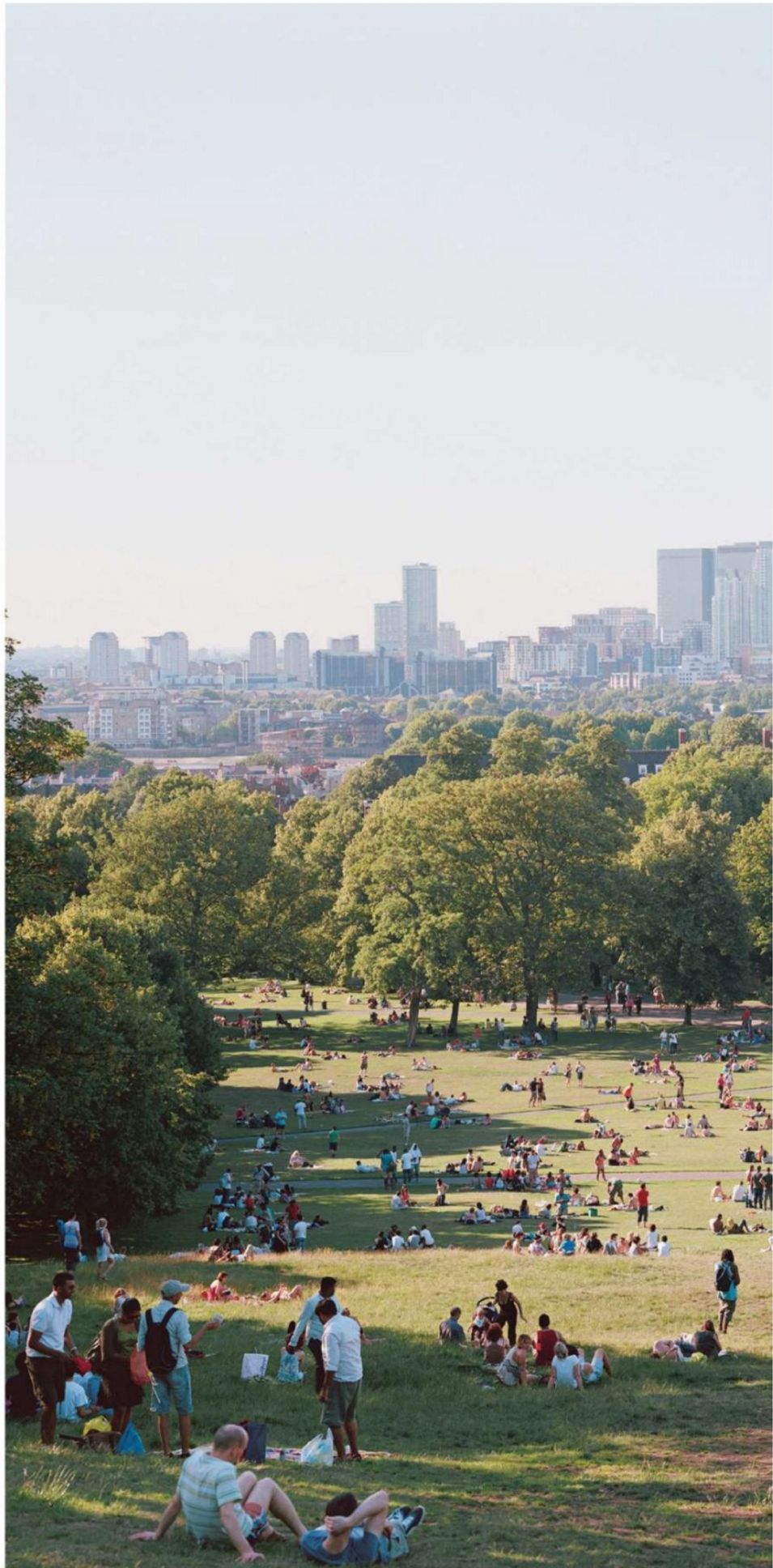
Following pages

| **AFFLUENT CITY**

Seoul, South Korea

Leon Chew

Seoul's electrifying growth, from impoverished war-torn capital in the 1950s to economic powerhouse, has turned its cityscape into a dense grid of housing and office towers. Its transformation proves that rapid growth can bring rapid wealth.









RISE OF THE CITIES

Urban centers of more than a million people were rare as recently as the early 20th century. Today cities of more than ten million are not uncommon; there are 21 of them, almost

1800

3

CITIES OF ONE MILLION OR MORE

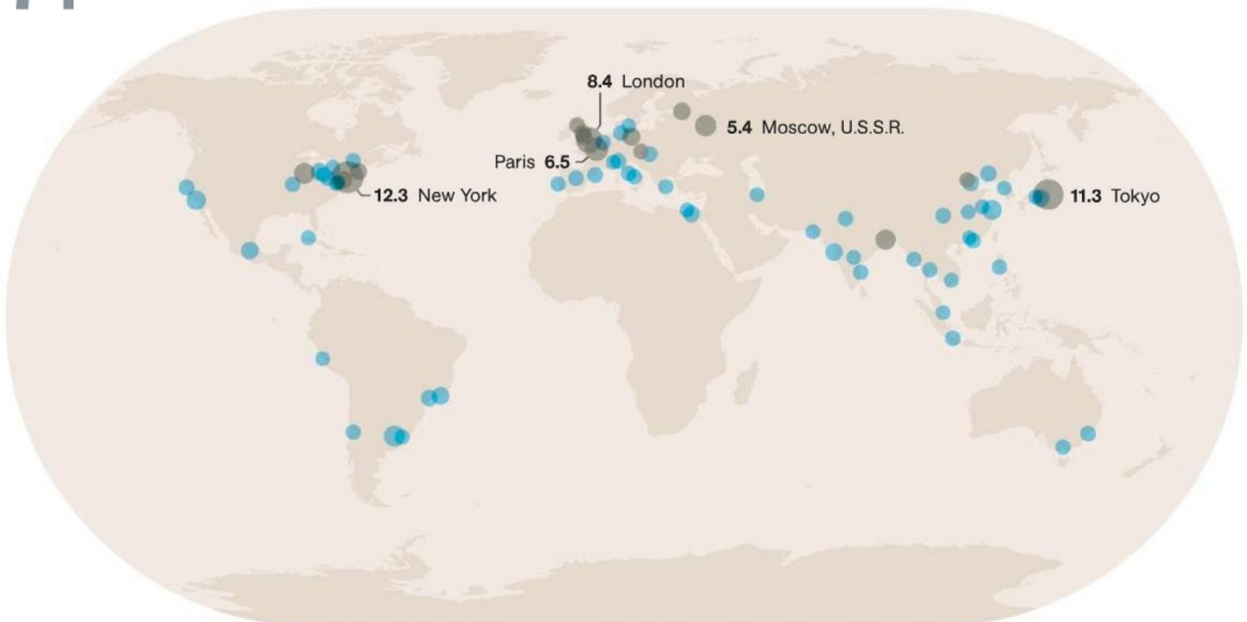


CITY NAMES AND POPULATIONS REPRESENT URBAN AGGLOMERATIONS; THE LARGEST ARE LABELED.

1950

74

CITIES

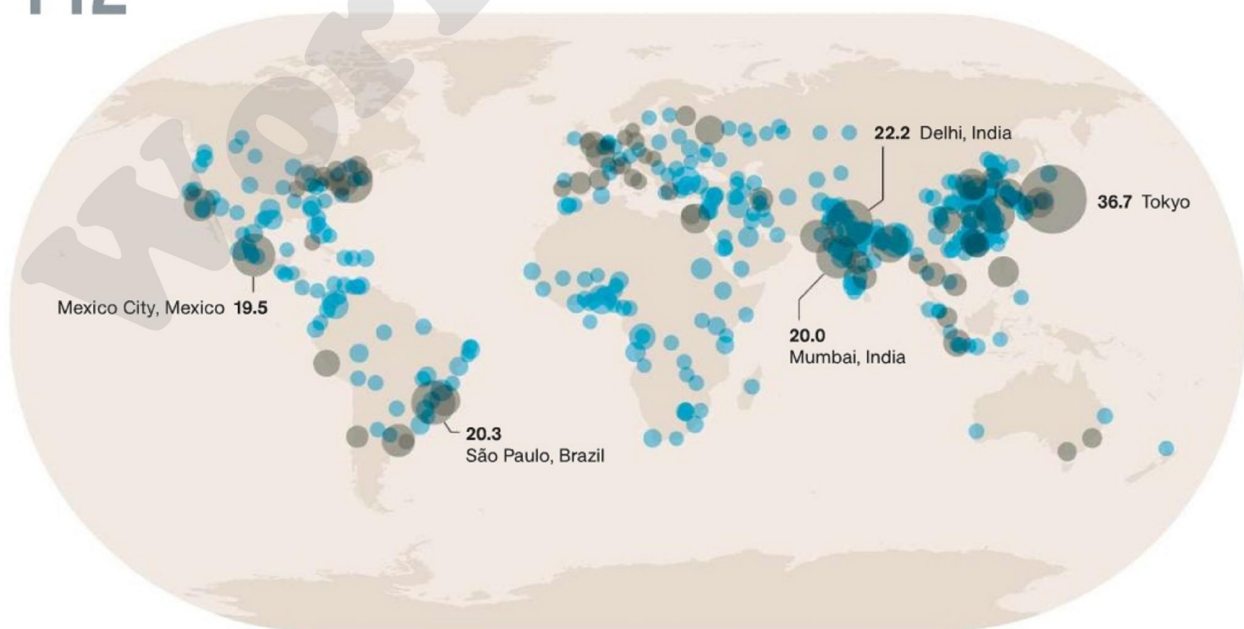


all in the developing regions of Asia, Africa, and Latin America, where population growth points to even bigger cities in the future. Metro areas have also overlapped to form huge urban networks; areas in West Africa, China, and northern India are each home to more than 50 million people.

1900
16 CITIES



2010
442 CITIES



THE FIVE NATIONS WITH THE MOST CITIES OF ONE MILLION OR MORE: China 89 • India 46 • U.S. 42 • Brazil 21 • Mexico 12

(Continued from page 133) urbanization, a back-to-the-land ethic would be disastrous. (Thoreau, Glaeser points out gleefully, once accidentally burned down 300 acres of forest.) Cities allow half of humanity to live on around 4 percent of the arable land, leaving more space for open country.

Per capita, city dwellers tread more lightly in other ways as well, as David Owen explains in *Green Metropolis*. Their roads, sewers, and power lines are shorter and so use fewer resources. Their apartments take less energy to heat, cool, and light than do houses. Most important, people in dense cities drive less. Their destinations are close enough to walk to, and enough people are going to the same places to make public transit practical. In cities like New York, per capita energy use and carbon emissions are much lower than the national average.

Cities in developing countries are even denser and use far fewer resources. But that's mostly because poor people don't consume a lot. Dharavi may be a "model of low emissions," says David Satterthwaite of London's International Institute for Environment and Development, but its residents lack safe water, toilets, and garbage collection. So do perhaps a billion other city dwellers in developing countries. And it is such cities, the United Nations projects, that will absorb most of the world's population increase between now

rapid growth," he says. "I meet African mayors who tell me, 'There are too many people moving here!' I tell them, 'No, the problem is your inability to govern them.'"

THERE IS NO SINGLE MODEL for how to manage rapid urbanization, but there are hopeful examples. One is Seoul, the capital of South Korea.

Between 1960 and 2000 Seoul's population zoomed from fewer than three million to ten million, and South Korea went from being one of the world's poorest countries, with a per capita GDP of less than \$100, to being richer than some in Europe. The speed of the transformation shows. Driving into Seoul on the highway along the Han River, you pass a distressingly homogeneous sea of concrete apartment blocks, each emblazoned with a large number to distinguish it from its clones. Not so long ago though, many Koreans lived in shanties. The apartment blocks may be uninspiring on the outside, urban planner Yeong-Hee Jang told me, but life inside "is so warm and convenient." She repeated the word "warm" three times.

Every city is a unique mix of the planned and the unplanned, of features that were intentionally designed by government and others that emerged organically, over time, from choices made by the residents. Seoul was planned from

City dwellers tread lightly: Their roads, sewers, and power lines are shorter. Their apartments take less energy to heat and cool. Most important, they drive less.

and 2050—more than two billion people. How their governments respond will affect us all.

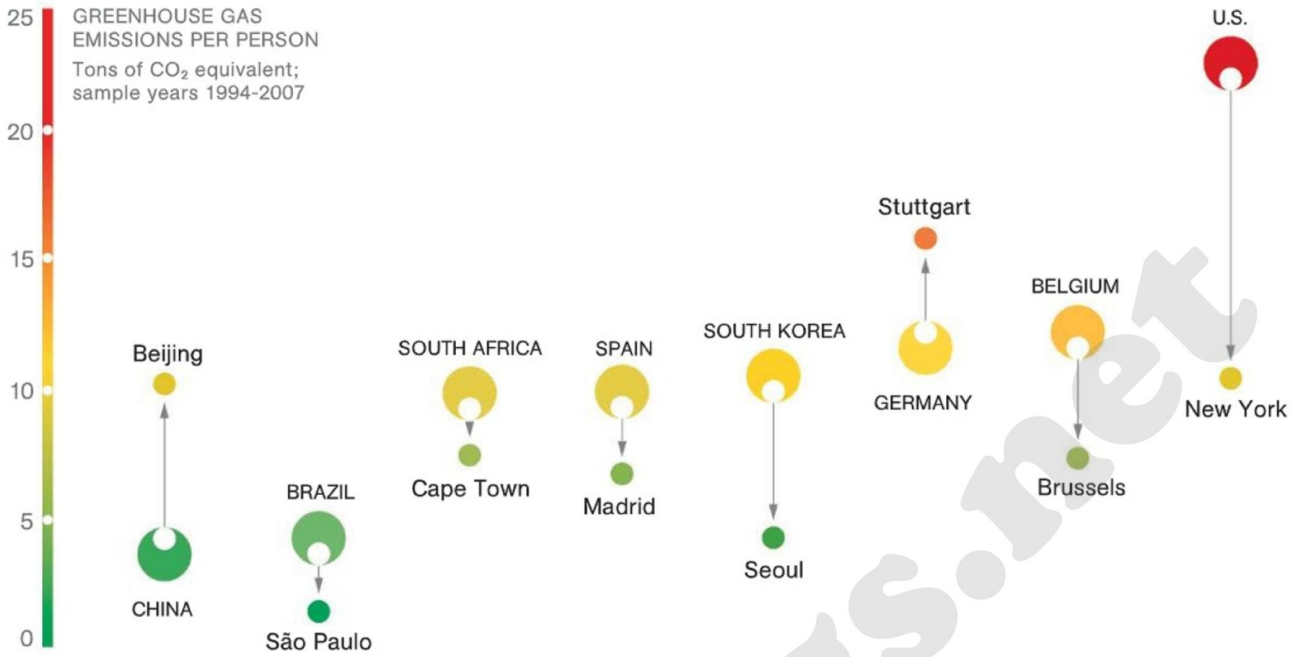
Many are responding the way Britain did to the growth of London in the 19th century: by trying to make it stop. A UN survey reports that 72 percent of developing countries have adopted policies designed to stem the tide of migration to their cities. But it's a mistake to see urbanization itself as evil rather than as an inevitable part of development, says Satterthwaite, who advises governments and associations of slum dwellers around the world. "I don't get scared by

the start. The monks who chose the site in 1394 for King Taejo, founder of the Choson dynasty, followed the ancient principles of feng shui. They placed the king's palace at an auspicious spot, with the Han River in front and a large mountain in back to shield it from the north wind. For five centuries the city stayed mostly inside a ten-mile-long wall that Taejo's men had built in six months. It was a cloistered, scholarly town of a few hundred thousand. Then the 20th century cleaned its slate.

World War II and then the Korean War, which

CITY-COUNTRY GAP

Not an urban myth: Dense cities tend to emit less CO₂ per person than the national average. Not always—a city's emissions depend also on its source of electricity and how much industry and public transit it has. But dense settlements emit less than scattered, sprawling ones.



Beijing's emissions exceed China's because much of the country is less developed. Brazil's São Paulo comes in low due to hydropower.

South Africa's emissions—and Cape Town's—are high given its development level, because its electricity comes almost entirely from coal.

Public transit and density put Madrid, Seoul, and Brussels below their national averages. But Stuttgart's auto industry makes it a high emitter.

Densely settled New York City is much greener than most American cities, where cars and sprawl lead to high emissions.

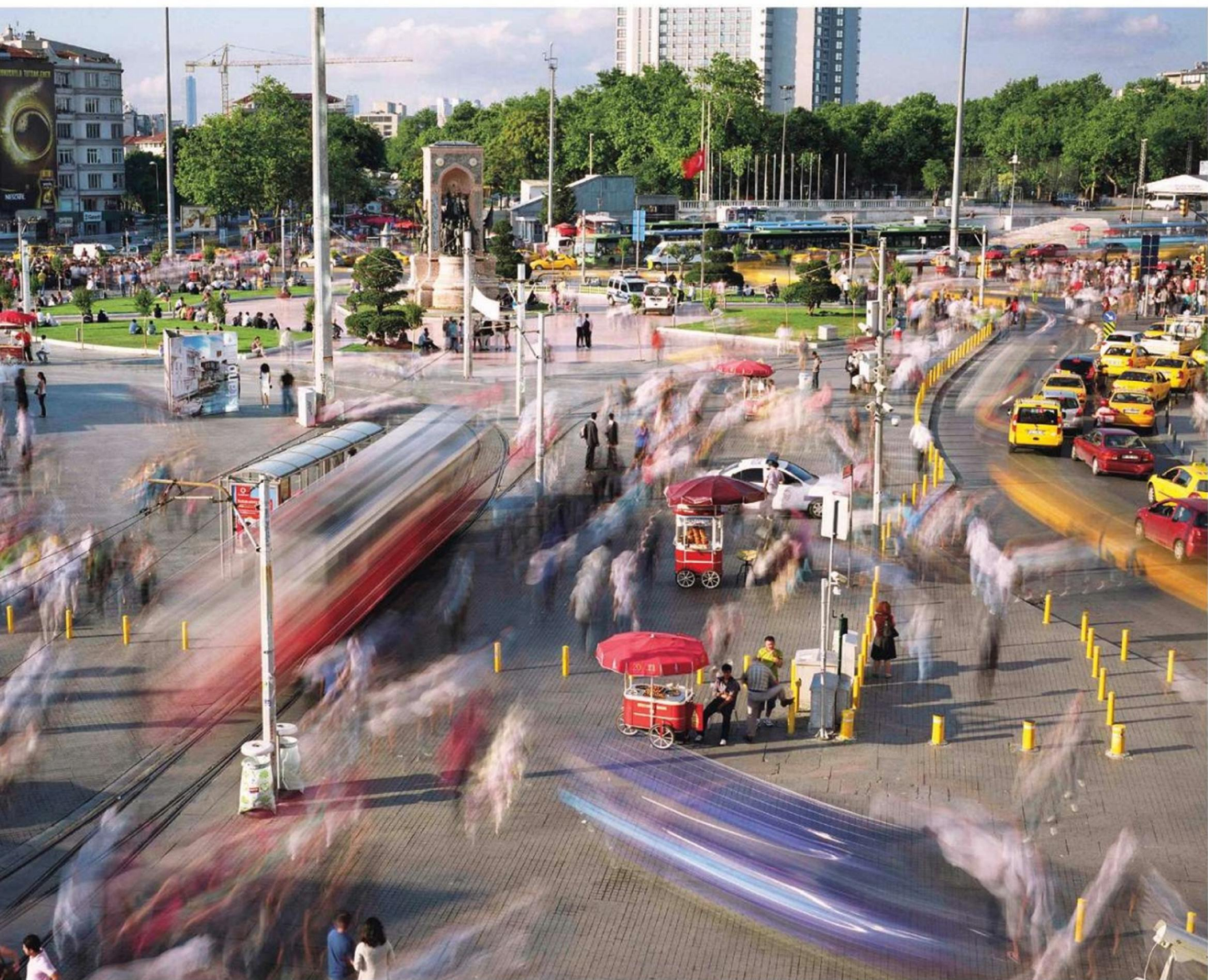
ended in 1953, brought more than a million refugees to the bombed-out city. Not much of Seoul was left—but it was filled for the first time with a potent mix of people. They were burning to improve their miserable lot. In their hearts, the ancient Confucian virtues of loyalty and respect for hierarchy fused uneasily with Western longings for democracy and material goods. “The explosive energy of my generation,” says Hong-Bin Kang, a former vice mayor who now runs Seoul’s history museum, dates from this period. So does South Korea’s population explosion, which was triggered, as elsewhere, by rapid improvements in public health and nutrition.

It’s an uncomfortable fact that a dictator helped organize all that energy. When Park Chung-Hee took power in a military coup in 1961, his government funneled foreign capital into Korean companies that made things foreigners would buy—knockoff clothes and wigs at first, later steel, electronics, and cars. Central to the process, which created conglomerates like Samsung and Hyundai, were the women and men streaming into Seoul to work in its new

factories and educate themselves at its universities. “You can’t understand urbanization in isolation from economic development,” says economist Kyung-Hwan Kim of Sogang University. The growing city enabled the economic boom, which paid for the infrastructure that helped the city absorb the country’s growing population.

A lot was lost in the bulldozing, high-rising rush. If you lived in old Seoul, north of the Han River, in the 1970s and 1980s, you watched an entirely new Seoul rise from verdant paddies on the south bank, in the area called Kangnam. You watched the city’s growing middle and upper classes leave sinuous alleys and traditional houses—lovely wooden *hanok*, with courtyards and gracefully curved tile roofs—for antiseptic high-rises and a grid of car-friendly boulevards. “Seoul lost its color,” says Choo Chin Woo, an investigative journalist at the newsweekly *SisaIN*. “Apartment high-rises all over town—it looks stupid.” Worse, the poor often got shunted aside as their makeshift neighborhoods were redeveloped with high-rises they couldn’t afford.

But over the years an increasing share of the



| **STREET LIFE**

*Istanbul, Turkey
Martin Roemers*

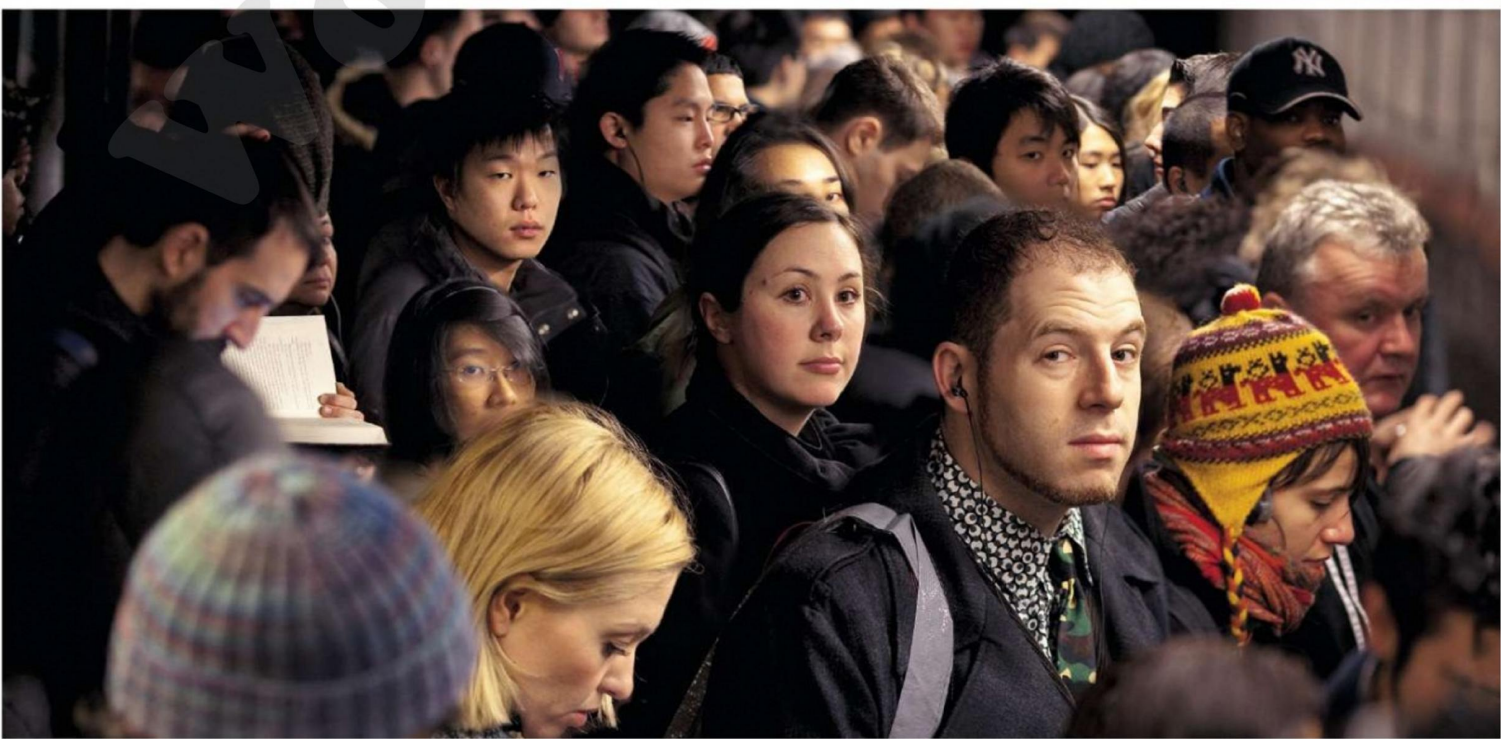
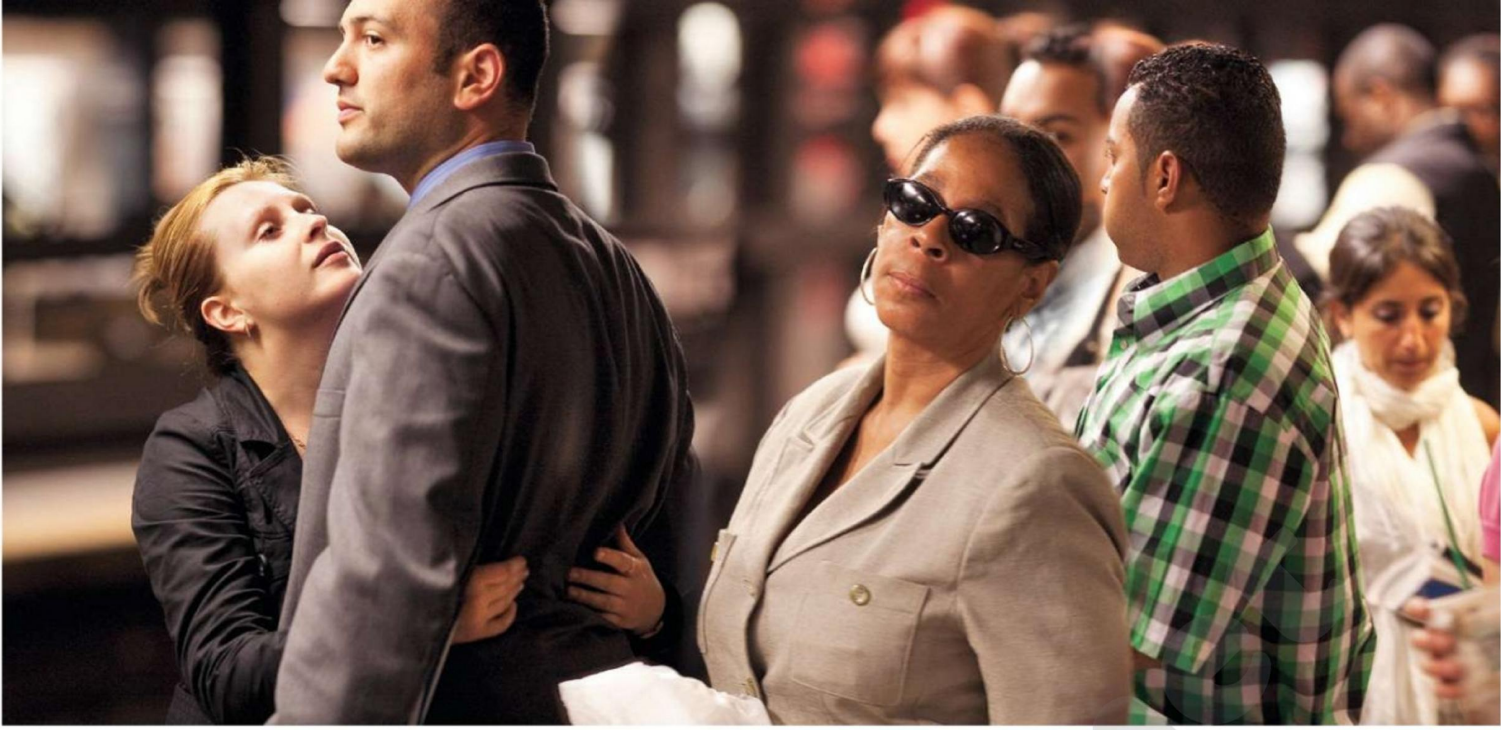
By foot, rail, and automobile, people pass through Taksim Square, animating the modern hub of Istanbul. Schemes to restrict the area to foot traffic worry planners who fear the famous crossroads could lose its creative energy.

| **TOGETHERNESS**

*New York, New York
Reinier Gerritsen*

Commuters kvetch about crowded trains, but New York's subway system helps account for a relatively low per capita energy use. For density and diversity—hallmarks of a vital city—look no further than rush hour on the line from Grand Central to Wall Street (right).

Gerritsen's "Wall Street Stop" images are assembled from photos taken in rapid succession with different focal points. He combines the results on a computer so most faces appear equally sharp.



| **REBIRTH**

New York, New York
Stephen Wilkes

The liveliest show in town, Times Square buzzes with reborn energy. A 30-year redevelopment project turned a seedy stretch of Broadway into today's neon-lit shopping and entertainment walkway. Some dislike the theme-park commercialism of the redo, but almost all applaud that the streets are alive with a city's most valued resource—people.

For his “Day Into Night” image, Wilkes shot for ten hours from a single point and digitally blended the stills to make a time-lapse scene within one frame.





population has been able to cash in on the housing boom. Today half the people in Seoul own apartments. Koreans like to heat their homes to 77 degrees, says urban planner Yeong-Hee Jang, and in their well-equipped apartments they can afford to do that. One reason the buildings in Kangnam line up like soldiers on parade, she adds, is that everyone wants an apartment that faces south—for warmth as well as feng shui.

Seoul today is one of the densest cities in the world. It has millions of cars but also an excellent subway system. Even in the newer districts the streets seem, to a Westerner, anything but colorless. They're vibrant with commerce and crowded with pedestrians, each of whom has a carbon footprint less than half the size of a New Yorker's. Life has gotten much better for Koreans as the country has gone from 28 percent urban in 1961 to 83 percent today. Life expectancy has increased from 51 years to 79—a year longer than for Americans. Korean boys now grow six inches taller than they used to.

South Korea's experience can't be easily copied, but it does prove that a poor country can urbanize successfully and incredibly fast. In the late 1990s Kyung-Hwan Kim worked for the UN in Nairobi, advising African cities on their staggering financial problems. "Every time I visited one of these cities I asked myself, What would a

institutions around the country, in the hope of spreading Seoul's wealth. The nation's efforts to stop Seoul's growth go back to Park Chung-Hee, the dictator who jump-started the economy. In 1971, as the city's population was skyrocketing past five million, Park took a page from the book of Ebenezer Howard. He surrounded the city with a wide greenbelt to halt further development, just as London had in 1947.

Both greenbelts preserved open space, but neither stopped the growth of the city; people now commute from suburbs that leapfrogged the restraints. "Greenbelts have had the effect of pushing people farther out, sometimes absurdly far," says Peter Hall, a planner and historian at University College London. Brasília, the planned capital of Brazil, was designed for 500,000 people; two million more now live beyond the lake and park that were supposed to block the city's expansion. When you try to stop urban growth, it seems, you just amplify sprawl.

Sprawl preoccupies urban planners today, as its antithesis, density, did a century ago. London is no longer decried as a tumor, but Atlanta has been called "a pulsating slime mold" (by James Howard Kunstler, a colorful critic of suburbia) on account of its extreme sprawl. Greenbelts aren't the cause of sprawl; most cities don't have them. Other government policies, such as subsidies

S *Seoul's population zoomed from fewer than three million in 1960 to ten million in 2000. South Korea went from being one of the poorest countries to being richer than some in Europe.*

visiting consultant have said to Koreans in 1960?" he says. "Would he have imagined Korea as it was 40 years later? The chances are close to zero."

THE FEAR OF URBANIZATION has not been good for cities, or for their countries, or for the planet. South Korea, ironically, has never quite shaken the notion that its great capital is a tumor sucking life from the rest of the country. Right now the government is building a second capital 75 miles to the south; starting in 2012, it plans to move half its ministries there and to scatter other public

for highways and home ownership, have coaxed the suburbs outward. So has that other great shaper of the destiny of cities—the choices made by individual residents. Ebenezer Howard was right about that much: A lot of people want nice houses with gardens.

Sprawl is not just a Western phenomenon. By consulting satellite images, old maps, and census data, Shlomo Angel, an urban planning professor at New York University and Princeton, has tracked how 120 cities changed in shape and population density between 1990 and 2000. Even

in developing countries most cities are spreading out faster than people pour into them; on average they're getting 2 percent less dense each year. By 2030 their built-up area could triple. What's driving the expansion? Rising incomes and cheap transportation. "When income rises, people have money to buy more space," Angel explains. With cheap transportation, they can afford to travel longer distances from home to work.

But it matters what kind of homes they live in and what transportation they use. In the 20th century American cities were redesigned around cars—wonderful, liberating machines that also make city air unbreathable and carry suburbs beyond the horizon. Car-centered sprawl gobbles farmland, energy, and other resources. These days, planners in the U.S. want to repopulate downtowns and densify suburbs, by building walkable town centers, for instance, in the parking lots of failed malls. Urban flight, which seemed a good idea a century ago, now seems in the West like a historic wrong turn. Meanwhile in China and India, where people are still flooding into cities, car sales are booming. "It would be a lot better for the planet," Edward Glaeser writes, if people in those countries end up "in dense cities built around the elevator, rather than in sprawling areas built around the car."

Developing cities will inevitably expand, says Angel. Somewhere between the anarchy that prevails in many today and the utopianism that has often characterized urban planning lies a modest kind of planning that could make a big difference. It requires looking decades ahead, Angel says, and reserving land, before the city grows over it, for parks and a dense grid of public-transit corridors. It starts with looking at growing cities in a positive way—not as diseases, but as concentrations of human energy to be organized and tapped.

WITH ITS QUIET commercial streets and Arts and Crafts houses, Letchworth, England, today feels a bit like the garden city that time forgot. Ebenezer Howard's ideal of a self-sustaining community never happened. The farmers in Letchworth's greenbelt sell their sugar beets and wheat to a large cereal company. The town's residents work

mostly in London or Cambridge. John Lewis, who runs the foundation that Howard started, which still owns much of the town's land, worries that Letchworth is "in danger of becoming a dormitory." Still, it has a key aspect of what many planners today think of as sustainability: It wasn't designed around cars. Howard ignored the new invention. From anywhere in Letchworth you can walk to the center of town to shop or take the train to London. The truth is, Letchworth looks like a very nice place to live; it's just not for everyone. No place is.

Thirty-five miles to the south, London remains unsurplanted. Eight million people live there now. All attempts to impose sense on its maze of streets have failed, as anyone who has crossed the city in a taxi can attest. "London wasn't planned at all!" Peter Hall exclaimed one afternoon as we stepped into the street in front of the British Academy. But the city did two sensible things as it ballooned outward in the 19th and 20th centuries, Hall said. It preserved large, semiwild parks like Hampstead Heath, where citizens can commune with nature. Most important, it expanded along railway and subway lines. "Get the transportation right," said Hall. "Then let things happen."

With that he disappeared into the Underground for his ride home, leaving me on the crowded sidewalk with a great gift: a few hours to kill in London. Even Ebenezer Howard would have understood the feeling, at least as a young man. When he returned after a few years in the U.S.—he'd flopped as a homesteading farmer in Nebraska—he was jazzed by his native city. Just riding an omnibus, he later wrote, gave him a pleasantly visceral jolt: "A strange ecstatic feeling at such times often possessed me... The crowded streets—the signs of wealth and prosperity—the bustle—the very confusion and disorder appealed to me, and I was filled with delight." □

The Pulitzer Center on Crisis Reporting and PBS NewsHour join us in reporting on population issues throughout the year.

The magazine thanks the David and Lucile Packard Foundation, the Wallace Global Fund, and National Geographic Society members for their generous support.

EXHIBIT

▶ **Paul Nicklen's Polar Obsession**

Follow *National Geographic* photographer Paul Nicklen (right) to the ends of the Earth in this exhibit of pictures drawn from his book *Polar Obsession*. See his work from the Arctic and Antarctic at the Cleveland Museum of Natural History until January 22. Visit cmnh.org for more information.



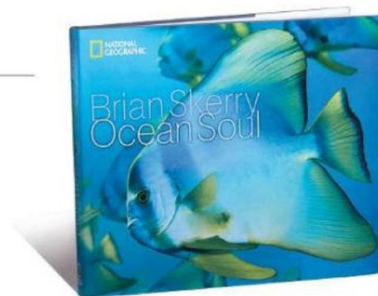
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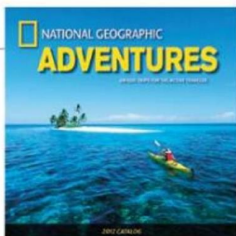
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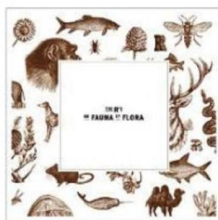


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The Dogcatchers A wafting grill attracts dogs in Okuma, Japan, as animal rescue workers Kei Asanuma (in cap) and Leo Hoshi try to lure them close enough to catch. The pets were abandoned when their owners fled high radiation levels in the town, located less than three miles from the Fukushima Daiichi nuclear plant. But many who left missed their canine companions. When they learned that the men—as well as photographer David Guttenfelder—planned to enter the radioactive zone to look for animals, evacuees gave the rescuers their old addresses to help find pets they'd left behind. —Margaret G. Zackowitz



Dogs in Okuma, Japan—part of the Fukushima nuclear plant exclusion zone—investigate a rescue team's barbecue.

BEHIND THE LENS

Why did you enter the radioactive zone?

DG: Nobody was really covering the disaster from the inside then. The government had shut everything down, and the Japanese press decided to go along with that decision. I felt people needed to see the hidden place to make informed decisions. I ended up making several visits. I went in both officially—with the help of a mayor's aide from the Namie town government—and unofficially.

How did you get in unofficially?

Just after the tsunami even authorities weren't going in, because of high radiation. As levels fell in early April, police entered to start searching for bodies. By April 21 they'd blocked

the roads and started patrolling the area. I first joined up with these animal rescue activists to cover them catching and feeding abandoned pets and farm animals. They knew all kinds of back ways in. Yes, they entered unofficially,

but they felt justified. I watched them catch a dog in the parking lot of the Daiichi nuclear plant, but there is also radiation where you least expect it. You come around a corner, and the radiation levels on your meter go up a hundredfold.

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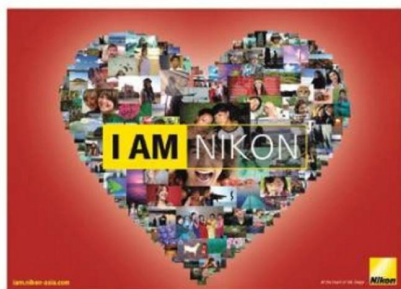
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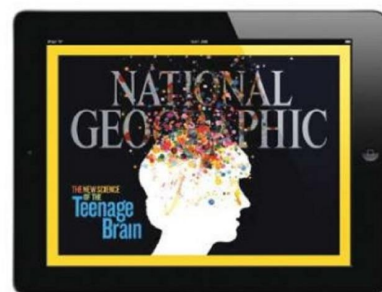
integrated campaign centers on real people in real-life scenarios, who reveal who they are with a Nikon camera. The diversity of experiences shared by individuals places the photographer at the heart of the image and gets to the core of how photography is used today—as a tool for play, socializing, and self-expression. To find out more, visit iam.nikon-asia.com.



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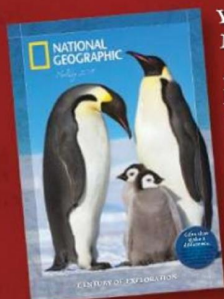
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Shady Ladies

Two carefully coiffed friends brave the sea—and one, without parasol, the sun—at a Japanese beach in the 1920s. They may have been geishas. The nape-revealing dip of their collars was considered quite alluring for the time, but the pair here show something even more shocking: The red skirts extending beneath their kimonos are actually their underwear.

It could be that no man noticed their daring but Kiyoshi Sakamoto, our photographer. According to a 1922 Japanese government document, out of 216 bathing beaches in Japan, 41 segregated male and female swimmers.

—Margaret G. Zackowitz

👉 **Flashback Archive** Find all the photos at ngm.com.

PHOTO: KIYOSHI SAKAMOTO, NATIONAL GEOGRAPHIC STOCK

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