

PERSIAN
EMPIRE
MAP

NATIONALGEOGRAPHIC.COM/MAGAZINE | AUGUST 2008

NATIONAL GEOGRAPHIC

Ancient Iran

INSIDE A NATION'S
PERSIAN SOUL

African Monkey Island 68

Japan's Premier Park 92

Moscow Never Sleeps 106

Target Earth 134

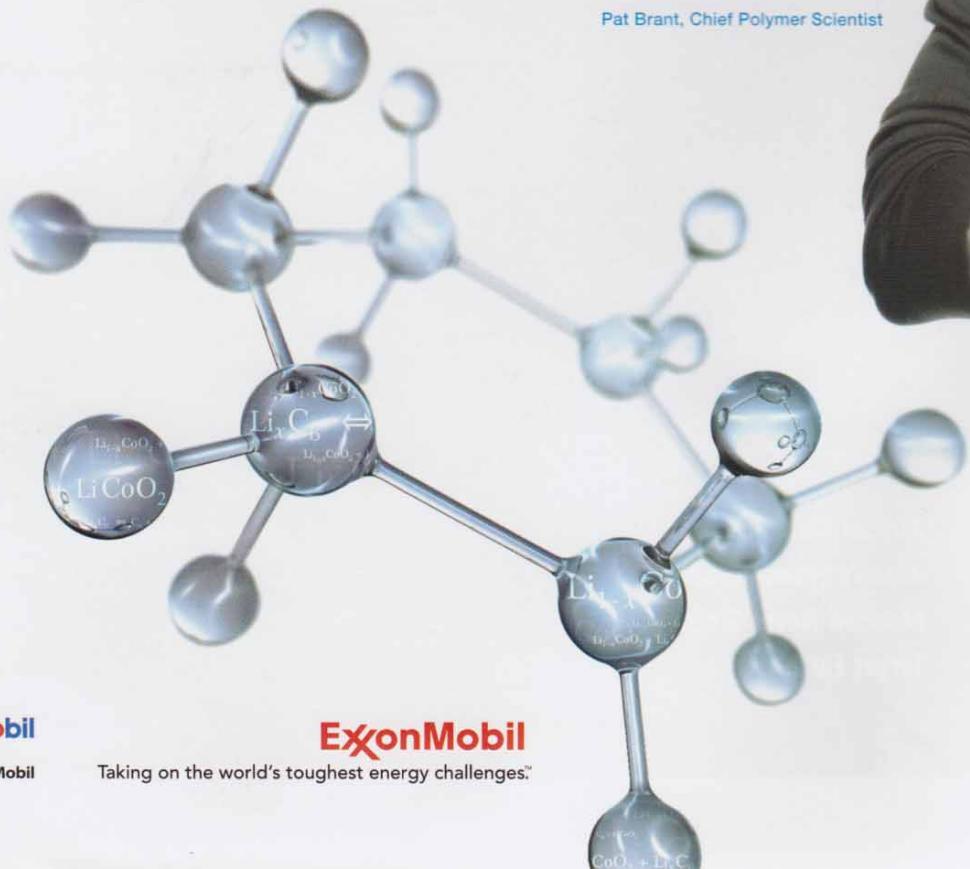
if you like hybrids, you'll love our new separator film.

ExxonMobil's scientists are continuously searching for ways to improve fuel economy and reduce emissions. One recent innovation is a new separator film that enables powerful lithium-ion batteries to be used in hybrid and electric vehicles. By making the batteries safer, more powerful and more reliable, it could well put many more hybrid and electric vehicles on the road faster, boosting fuel economy and dramatically reducing emissions. And what's not to love about that?

The story continues at
exxonmobil.com

"Lithium-ion batteries transformed cell phones because they were smaller, lighter and more efficient. Now they have the chance to transform hybrid and electric vehicles, too."

Pat Brant, Chief Polymer Scientist



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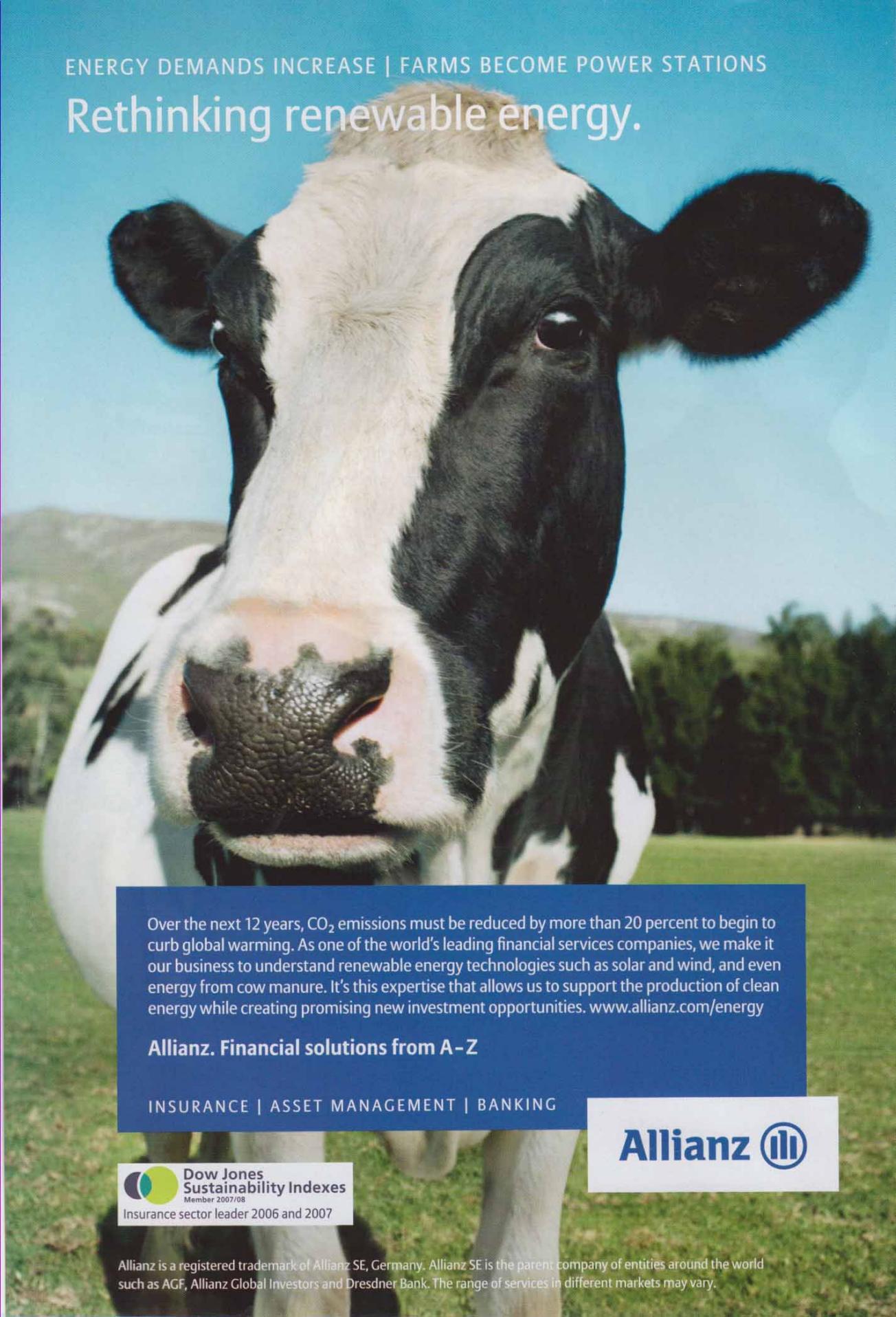
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"In Europe, if just 10% of the petrol vehicles were replaced with hybrids, you're talking about reducing CO₂ emissions by the equivalent of taking more than three million petrol vehicles off the road."

Nazeer Bhore, Engineer

ENERGY DEMANDS INCREASE | FARMS BECOME POWER STATIONS

Rethinking renewable energy.



Over the next 12 years, CO₂ emissions must be reduced by more than 20 percent to begin to curb global warming. As one of the world's leading financial services companies, we make it our business to understand renewable energy technologies such as solar and wind, and even energy from cow manure. It's this expertise that allows us to support the production of clean energy while creating promising new investment opportunities. www.allianz.com/energy

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NATIONAL GEOGRAPHIC

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Moscow Never Sleeps

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By Martin Cruz Smith Photographs by Gerd Ludwig

Target Earth

134 A killer asteroid may be headed our way.

By Richard Stone Photographs by Stephen Alvarez

Special Supplement: Iran/Persian Empire



Visitors to Moscow pay top ruble for a hotel room with this Red Square view. Suites go for as much as \$9,000 a night. Story on page 106.

GERD LUDWIG

NATIONAL GEOGRAPHIC

AUGUST 2008



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Letters

Your Shot

Photo Journal

Visions of Earth



HISTORY

Birth of a Sign

The peace symbol is 50 years old.

FOOD

Pedigreed Pizza

The EU wants you to know your pie.

CONSERVATION

The Vicuña's Golden Fleece

This story is all fluff.

LANDSCAPES

Dead-End Road

In Bolivia, consider an alternate route.



WILDLIFE

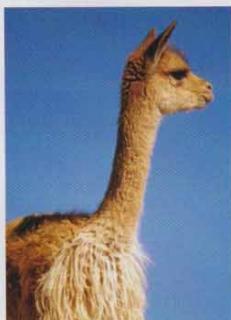
Why Bees Can Fly

They shouldn't be able to. Yet they do.

ENVIRONMENT

Sea Glass

The ocean turns trash to treasure.



Follow Up

Inside Geographic

Flashback

On the Cover

Persia in profile: A stone relief of a royal guard stares across the ages in Persepolis, Iran.

Photo by Simon Norfolk

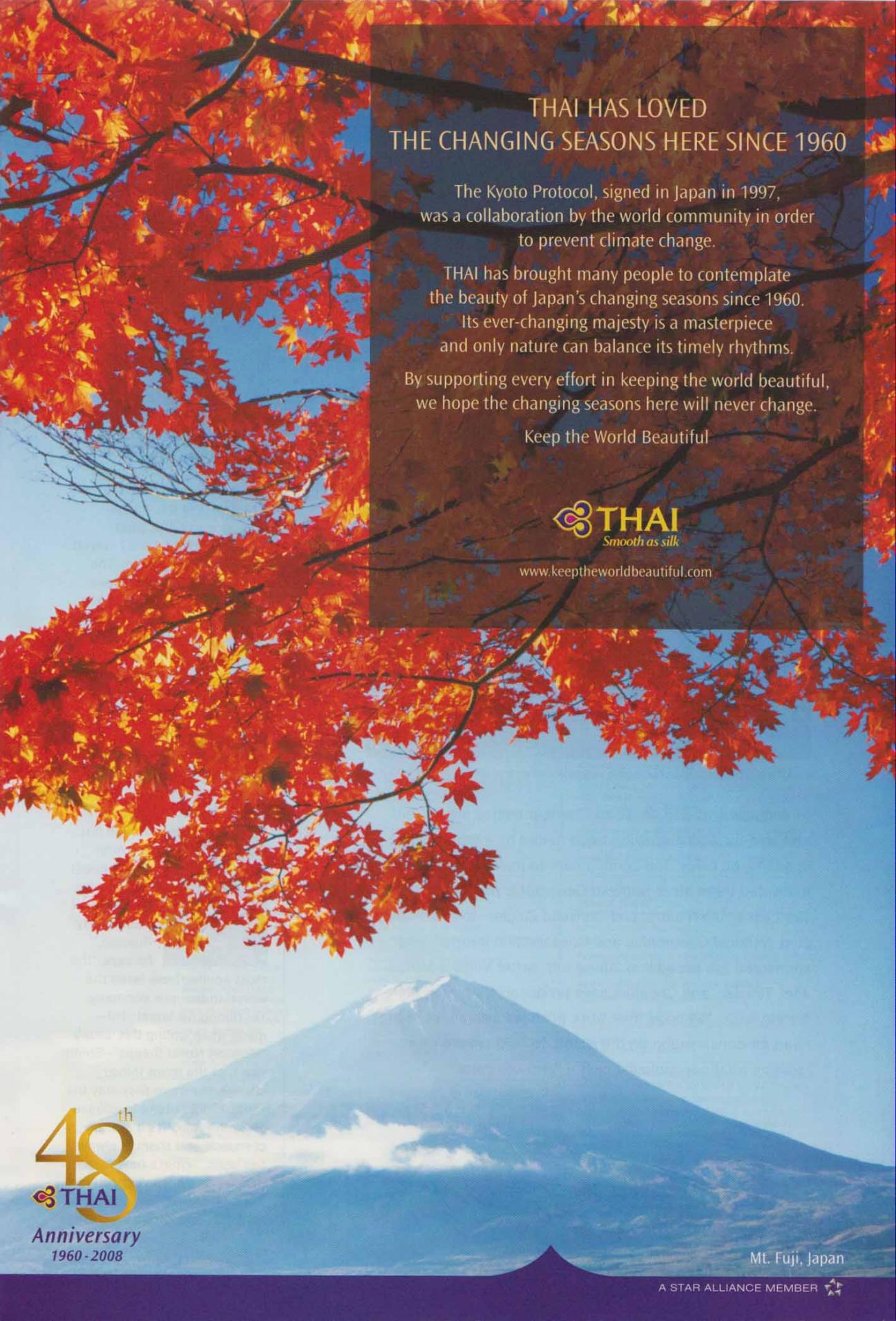
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Off and Shooting

The 2008 International Photo Contest starts accepting entries August 1. Last year's winners are on display, and a selection of new entries will be posted in daily galleries.

LARRY LOUIE



THAI HAS LOVED THE CHANGING SEASONS HERE SINCE 1960

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EDITOR'S NOTE

The hand singed by the blowtorch looks human. Close inspection reveals that it belongs to a drill, a baboon-like primate, for sale in the bush-meat market in Malabo, the Bioko Island capital of Equatorial Guinea. Scorching flesh brings a higher price for monkey meat, a delicacy in this part of the world. Photographer Joel Sartore captured this alarming scene, hoping to provoke change. He was part of an International League of Conservation Photographers project called a RAVE (Rapid Assessment Visual Expedition)



Bioko's bush-meat trade threatens animals like this young drill.

to document wildlife on Bioko. There, primates are hunted and sold through a growing trade fueled by money earned in nearby oil fields. The commitment to make a difference motivated three other *National Geographic* photographers—Tim Laman, Ian Nichols, and Christian Ziegler—to accompany Joel. *National Geographic* and Conservation International sponsored the expedition. Along with writer Virginia Morell, Joel, Tim, Ian, and Christian have produced a startling story for this issue. We hope their work will raise awareness of the need for conservation on the island, to help ensure Bioko remains what one biologist calls a “monkey paradise.”

PEOPLE BEHIND THE STORIES

■ **Richard Stone** While reporting “Target Earth,” science journalist Stone saw plenty of heavenly sights—and

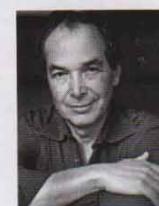


missed a few too. Trying to glimpse the 900-foot-wide asteroid Apophis that could one day hit Earth,

he and astronomer David Tholen ran afoul of Hawaii’s rainy season. “Dave stuck it out in the control room, hoping for a break in the weather,” says Stone of one soggy November night, “and I stayed up, on call at the hotel. The skies didn’t clear, and Dave had to call it a night at 3 a.m. I was crushed: I had lost not just a great opportunity to observe an infamous asteroid, but also to observe a master of the art of asteroid detection.”

■ Martin Cruz Smith

A Russia observer and the author of many novels, Smith says the former Soviet Union is changing all the time—



though not to everyone’s benefit. “Those who are the most traditionally Russian,” he says, “the most soulful, have fared the worst” in the new economy.

Yet during his latest visit—made while writing this issue’s “Moscow Never Sleeps”—Smith saw that the more things change, the more they stay the same. From Potemkin villages to Putin’s rule, “it’s a system of muscle and sham. It always has been.” What’s next for Russia? Smith won’t speculate. “It’s a bit like Hollywood,” he says. “No one knows anything.”



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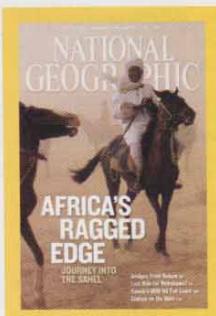
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LETTERS



April 2008

Lost in the Sahel

It took courage for author Paul Salopek to return to a place that caused him pain. Though this article describes horrific scenes and great injustices, I was comforted by the compassion shown by Fatim, who fed a struggling stranger even though she had so little herself.

EMILY McMAHON
Bellingham, Washington

Your story profoundly moved me. This is a story of the human condition: day-to-day survival in a land without guarantees, health care plans, minimum wages, unemployment insurance—without any insurance, actually. A land with a high mortality rate, rampant poverty for most, and a high birthrate.

PETER VANWERDEN
Westlock, Alberta

I was puzzled by the author's puzzlement over Mr. Abakar's Arab ways. In other African countries with Arab influences, like Mauritania, where I've lived, it can be mandatory to practice Arab customs and speak Arabic. You did as your rulers did or faced severe consequences.

LISA ENGLERT
Buellton, California

I don't know whether to laugh or cry looking at the photograph in which the U.S. Special Forces sergeant is teaching Nigeriens the art of maintaining their machine guns. Because of the circumstances in areas like the Sahel, changes of government are unpredictable. Sooner or later, those well-oiled and well-prepped machine guns will have the power.

MIGUEL ÁNGEL MÉNDEZ
Panajachel, Guatemala

My only sense of the borders of the Sahara has come from childhood readings of *The Little Prince* and *Tintin*. Your journalism shows reality yet appeals to a sense of wonder, as those fictions do.

COLIN SHELTON
Winnipeg, Manitoba

Almost Human

I learned a great deal about chimps—but just as much about the sociology of primatologists. Kudos to Jill Pruetz for her graceful handling of the fact that colleagues dismissed or downplayed her observations about a chimp "sharpening a branch with her teeth and wielding it like a spear" to stab prey. Pruetz is what science needs—a researcher enamored of her subject and not academic recognition, especially from chest-thumping males who believe publishing papers is what makes the world of science turn.

PHYLLIS D. THOMAS
Ridgeland, Mississippi

It was interesting that Pruetz wasn't always credited for her reported observations about the use of tools by chimpanzees. While it is unfortunate that her work was at times

overlooked, when I read these articles with their constant references and credits to nature, it makes me wonder: How does God feel?

GARY KEES
Wyomissing, Pennsylvania

It was edifying to read how intelligent chimpanzees and other primates are. Conversely, it's mortifying to know that chimps, gorillas, bonobos, and other apes are being massacred to the verge of extinction in many of their homelands. Maybe we should spend more time and money rescuing them rather than studying them.

BRIEN COMERFORD
Glenview, Illinois

Your article on chimps sharpening and using sticks to stab bush babies for a meal is interesting, but to say we are "watching time-lapse footage of human evolution" is absurd. How is this any different from an otter opening a clam for a meal by hitting it with a rock or a beaver cutting sticks to make a dam?

GEOFFREY LINDSAY
Ridgecrest, California

Author Mary Roach makes the comment: "Humans share... maybe 40 percent [of their gene sequence] with lettuce." I don't know about you, but that explains so much to me.

BRUCE HOFFMAN
Albuquerque, New Mexico

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**Peninsular
Bighorn Sheep**
(*Ovis canadensis
cremnobates*)

Size: Head and body length, 1.5 - 1.9 m; shoulder height, 81.3 - 91.4 cm

Weight: 48 - 115 kg

Habitat: Eastern slopes of peninsular mountain ranges in Southern California in the US and Baja California in Mexico

Surviving number:
Estimated at fewer than 3,200

Photographed by Patricio Robles Gil



WILDLIFE AS CANON SEES IT

Head for the hills! That's exactly what the peninsular bighorn sheep does when a predator threatens, fleeing to higher ground where its uncanny ability to navigate rocky terrain gives it an advantage. It even gives birth to single offspring from the relative safety of steep slopes, as vantage points let the sheep spy out danger before it gets too near. The new generation is entering an increasingly uncertain world, however, facing not

only age-old nemeses such as mountain lions, bobcats and coyotes, but also threats brought on by human encroachment. From automobile strikes to entanglement in fences, perils are mounting.

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This is a mission we at Canon feel called to share. One prominent vehicle of our commitment has been our "Wildlife As Canon Sees It" advertising series, which has raised the profile of endangered species for more than 27 years. We have brought over 300 species to the attention of *National Geographic* readers to date — and there are still many more awaiting their turn.

In a world where there is always more to show and more to do, it's comforting to know the National Geographic Society is here. We salute you on the occasion of your 120th anniversary.



Fujio Mitarai
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WILDLIFE AS CANON SEES IT



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A photographic heritage for all generations.



Wildlife as Canon sees it:
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Wildlife as Canon sees it:
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Wildlife as Canon sees it



Wildlife as Canon sees it



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Since April 1981, Canon Inc. has supported National Geographic magazine with advertising highlighting different endangered species. Researched and created in conjunction with a National Geographic photographer, the information is verified by leading wildlife experts. Unique in the history of advertising, we feel this campaign has contributed to the public's understanding of threats to wildlife.

On the occasion of National Geographic Society's 120th anniversary, we wish to thank Canon for their support and look forward to prolonging our partnership.

Gilbert Grosvenor

Gilbert Grosvenor
Chairman, Board of Trustees
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 NATIONAL
GEOGRAPHIC
MAGAZINE

LETTERS

Biomimetics: Design by Nature

I was amused by the author's designation of evolution's experiments as "inelegant" from an engineering viewpoint, albeit wonderful and fabulous. What is inelegant about a gecko that can do just about whatever it wants on just about any surface, or a blowfly that can execute a 90-degree turn quite literally in a flash?

LINDA GINGRICH
Issaquah, Washington

I began the article with fascination, until I reached the photograph of the severed whale flipper. My horror was not lessened by the caption and its attempt at a disclaimer. It does not matter where it came from. Your decision

to show the bloody flipper, suspended by ropes from a hook, was inappropriate.

MICHAEL SUTCLIFFE
Glendale, Arizona

Nā Pali Coast

I am shocked you would discuss the harm that humans have done to the Kalalau Trail and Valley but not present visuals of the trash that has accumulated in such a beautiful place. If you showed the horrible decay, perhaps we could expect some sort of action to fix the problem.

ERIC FRIESE
San Francisco, California

Last summer I visited Kaua'i and hiked on the Kalalau Trail to Hanakāpīai Beach. As I rounded a sharp bend, the

whole Nā Pali Coast stretched out before me, and I definitely got "chicken skin"—the Hawaiian phrase for goose bumps. It was nothing short of a religious experience.

KELLY CHAMBERS
Glendale, Arkansas

In the People Behind the Stories section you write about "a former marine who'd been... repairing the trail and helping injured hikers." This ex-marine and veteran of Desert Storm, a stonemason by trade, has been fixing the most dangerous parts for ten months. Treacherous sections that used to be called Terminal Traverse and Chivalry Pass (ladies go first) are now among the safest on the trail.

ARIUS HOPMAN
Hanapēpē, Kaua'i

When you have the time to travel

will you have the money?

Last Days of the Rickshaw

As a person who grew up in Kolkata, I read with interest Calvin Trillin's excellent article on the rickshaw pullers. The rickshaw is a legacy of India's shameful colonial past. Introduced in Japan in the 1860s, rickshaws were brought to India in 1880. In the beginning they were used mainly by Chinese traders in Kolkata to transport goods but were soon used to transport people. It is an inhuman and degrading form of transport that rightly and justifiably should be banned. The only remaining option in navigating the narrow lanes of Kolkata may be the most economical and eco-friendly: walking.

SOUMITRA SARKAR
Arcadia, California

Twenty-four years ago I found myself on a cycle rickshaw in Malang, Indonesia. The driver was much older than I and didn't seem up to the task. After a couple of minutes, I told him to stop. I couldn't stomach watching another human being toil so hard to move me and some carry-on supplies. I paid him handsomely and walked away on my own legs, carrying my supplies on my shoulder. No human should undergo such a humiliating toil. I hope the great nation of India will muster the strength to break this cycle of human exploitation.

HABTE ASFAHA
Oakland, California

Why should it be the last ride for rickshaws? The government of Kolkata should

look into subsidizing light-weight, high-gearing pedal rickshaws. That way, the rickshaw *wallahs* get to keep and improve their livelihood, and the already congested streets of Kolkata will not be burdened with yet more pollution.

NICK JENKINS
Fribourg, Switzerland

Corrections, Clarifications

April 2008:

Last Days of the Rickshaw

The word *mishti*, on page 94, is Bengali for any sweet, not just "sweetened yogurt." *Mishti doi* is the term for sweetened yogurt.

Biomimetics

The photo on page 75 is of a burdock fruit, not a cocklebur.

Aristotle lived in the fourth century B.C. not the fifth century.



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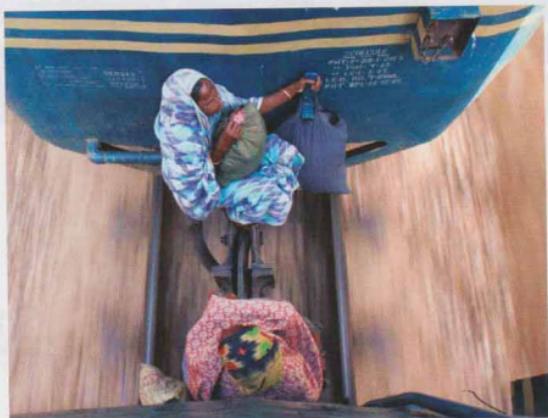


Just a Minute Are you ready for your close-up? Every week the Your Shot editors compile a new selection of reader-submitted images in a themed video with musical accompaniment called the My Shot Minute. Look under the Video tab on *ngm.com* to see if your photograph made the final cut. Get guidelines, a submission form, and more information at *ngm.com/yourshot*.



Thaddeus Bowling Key Largo, Florida

Just east of Guymon, Oklahoma, last year, storm chaser Thad Bowling caught this huge cloud after a four-hour pursuit. "This cell did not spawn a tornado," he says. "What you see in the center is a dense rain shaft." The photo was voted an *ngm.com* audience favorite.



Wahid Adnan Chittagong, Bangladesh

"Poor people from nearby villages get on buffers in between compartments, or on the roof, or on the walkway of the locomotive," explains Wahid Adnan, 28, a lawyer turned photographer who saw these women traveling the hard way on the route to Nazir Hat. "These kinds of riders are common, though railway police try to keep them out."



At the heart of the image

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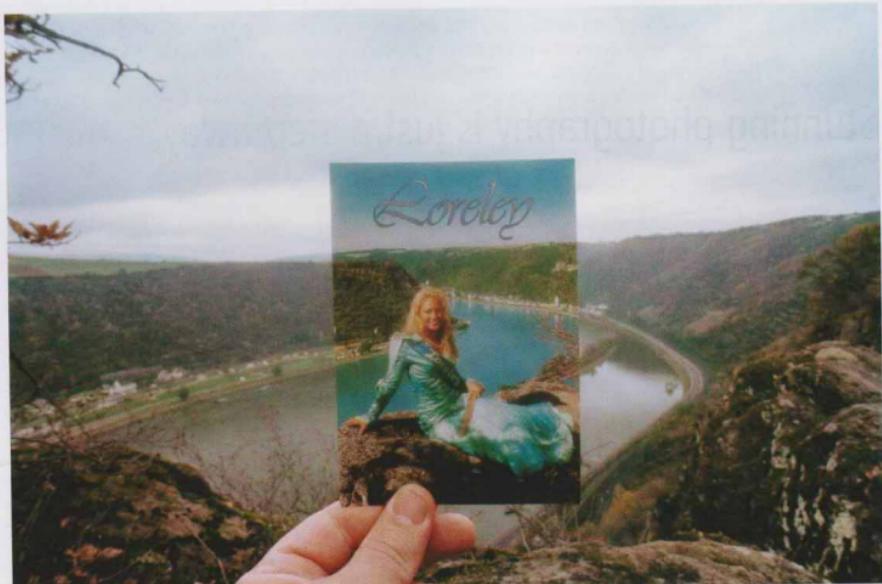
Great features, professional ergonomics and lightweight - all good reasons to jump for joy over the new D60. Thanks to its VR NIKKOR lens with built-in Vibration Reduction, you'll still be able to shoot steady and get pin-sharp images even in the murkiest conditions. Combine all this with the integrated dust reduction system and in-camera editing, and you've got the camera that is the best choice in its class.

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A postcard beauty sits in for Loreley, a mythical Rhine maiden who lured boatmen to their deaths with her songs.

London-born photographer Michael Hughes has lived in Germany since 1982.

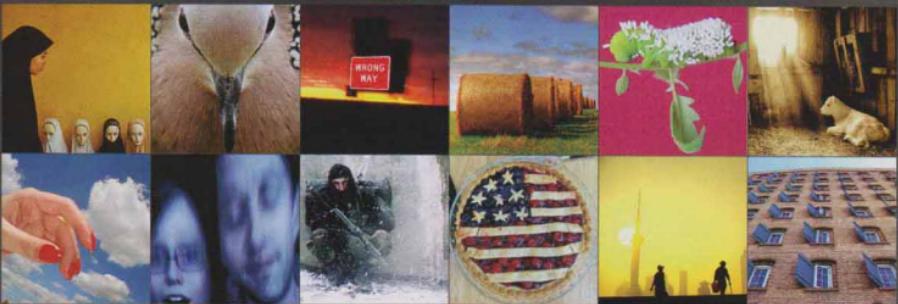
Fitting Memento Picture a cold November day at the Loreley cliff on the Rhine near Koblenz, Germany. I was on assignment for a Finnish newspaper, but the light was terrible—flat and gray. A postcard I'd bought for my daughter looked much better than the drab scenery before me. I pulled it out of my pocket and realized I was standing in exactly the spot where its image had been made (above). I held the postcard in my left hand, and my camera in my right. A millimeter up or down, left or right, in or out, made a difference in how perfectly reality and memento aligned. I filled an entire roll of film getting this one scene just right. The Germans say *wie das Meikeln einer Maus*—like milking a mouse.

Of course souvenirs can be staggeringly awful. Tacky. Mundane. And they lose much of their charm once they're collecting dust on a shelf. But everyone collects souvenirs, whether they call them that or not. They're evidence that we've taken part in the great dance of life—been places, seen things. They're connections between us and something grander and more eternal than we are. And they belong to us. Tourists shooting blurry mobile-phone-camera snapshots of the "Mona Lisa" or Niagara Falls want to prove they were there, not to have art to hang on their walls. The camera itself becomes a kind of souvenir machine.

My photography has come to have a sort of sporting aspect. Can I find just the right souvenir? Can I find the precise location to frame it? I hope to get to Egypt soon. That should be fabulous.

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NATIONAL
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VISIONS OF EARTH



India Decorated in pink powder, a bull dives through a crowd of men who hope to hang on to the animal long enough to win a prize. The sport, *jallikattu*, is part of harvest celebrations in the Tamil Nadu town of Alanganallur.

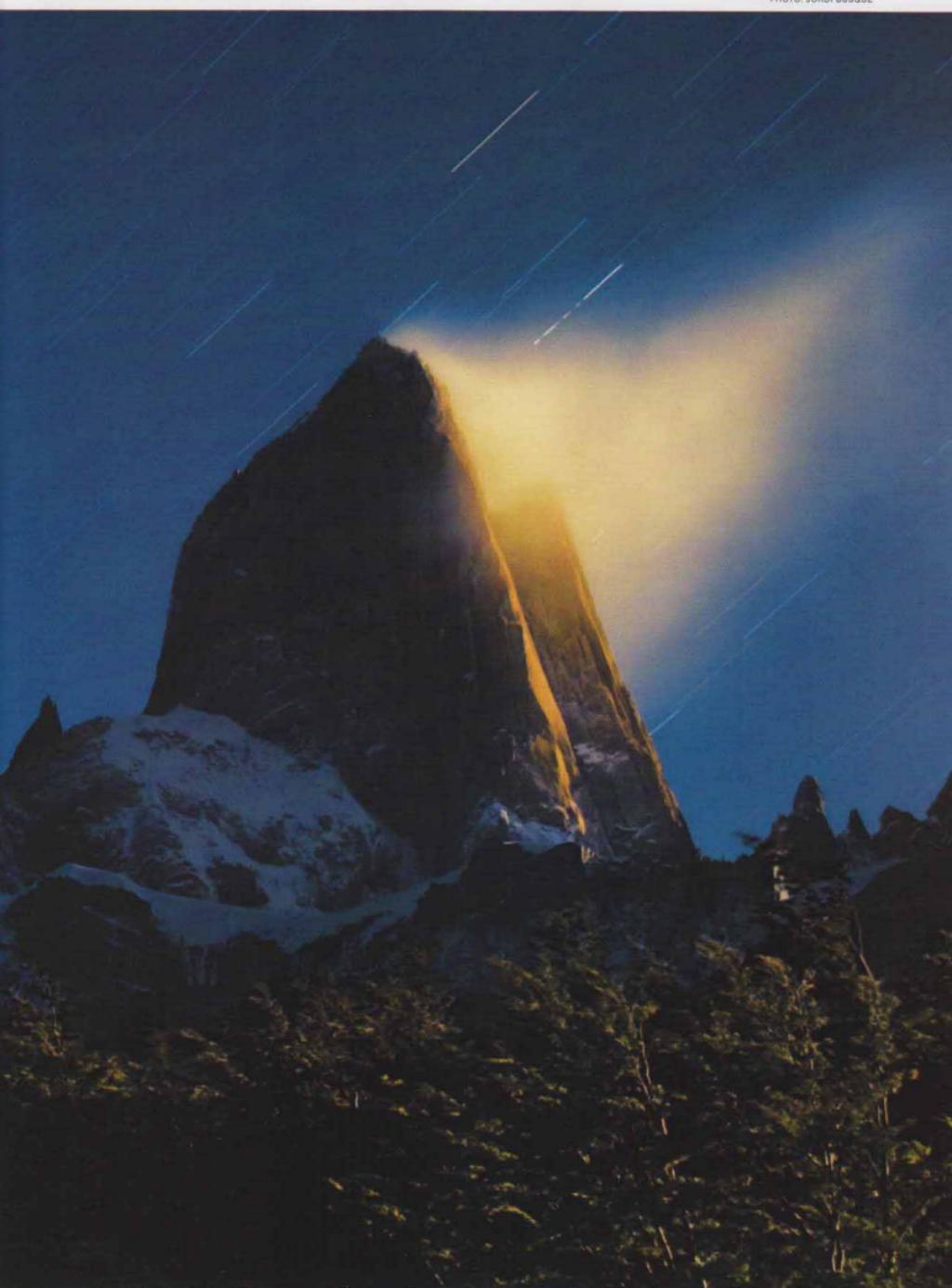
PHOTO: PALANI MOHAN, REPORTAGE BY GETTY IMAGES



 **Argentina** Moonlight sets mist aglow on the Patagonian peak of Mount Fitz Roy, known to local people as Cerro Chaltén, or "smoking mountain," because its summit is often capped in clouds.



PHOTO: JORDI BUSQUÉ



Gaza City Missing her claws, a few teeth, and the tip of her tail, a lion stolen as a cub from the Gaza Zoo is returned—two years later—in an SUV. Hamas police provide armed escort.



See more Visions of Earth images at visionsofearth.ngm.com.

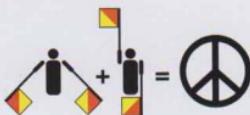
PHOTO: ABID KATIB, GETTY IMAGES



HISTORY



In 1958 marchers carried their new signs to the United Kingdom's Atomic Weapons Establishment.



N + D = Nuclear Disarmament

A British artist combined two semaphore letters to create an antinuclear symbol.

Sign Language On a rainy Easter weekend 50 years ago, a crowd of protesters set off from London on a four-day march for the fledgling cause of nuclear disarmament. A new movement needs a new symbol, so they waved signs bearing a simple logo that has since gone on to become a universal emblem for peace.

The peace symbol is neither the track of a dove nor a chicken, as hawks have sneered. Artist Gerald Holtom based it on the semaphore initials for nuclear disarmament (left), although he later said that it also represented himself in despair, palms out and down.

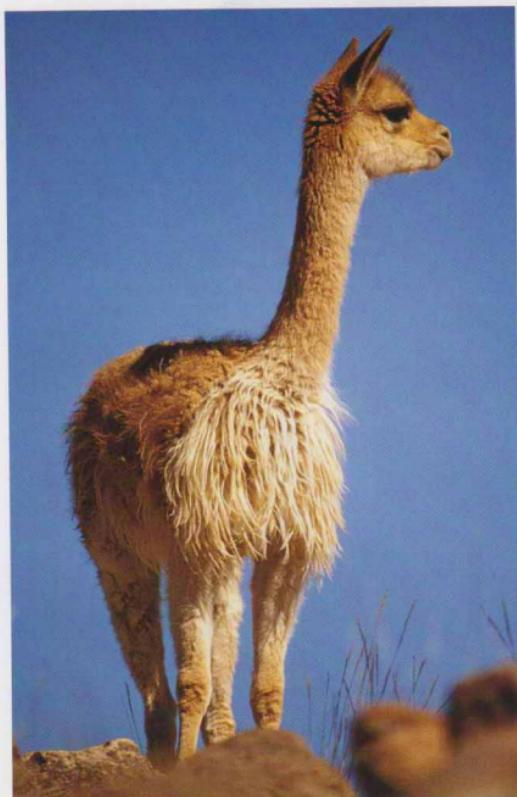
Purposely never copyrighted, used in everything from Vietnam War protests to cigarette ads, the symbol is easy to recognize—and to misdraw. Pat Arrowsmith, 78, helped plan the 1958 march and still goes to antinuclear and antiwar events. A common mistake—leaving out the middle leg—turns a peace sign into the Mercedes-Benz logo. She fixes that: "I get out my ballpoint immediately." —Helen Fields



Pedigreed Pizza

There is pizza, and there is Pizza Napoletana. The two, connoisseurs say, have as much in common as a *premier cru* Bordeaux has with the plonk in a screw-top jug. Soon pedigreed Neapolitan pizza will join the pantheon of European Union-certified edibles like Spanish serrano ham and English blue Stilton cheese. Warning: It takes longer to read the EU specs for Neapolitan pizza than to bake one. To bear the imprimatur of Guaranteed Traditional Specialty, pizza must not stray over 35 centimeters in diameter nor the crust exceed two centimeters in thickness; ingredients must include type 00 flour and up to 100 grams of tomatoes (preferably Marzanos) applied in a spiraling motion. The word "pizza" first appeared in an A.D. 997 manuscript from Gaeta, a southern Italian town. A millennium later, in 1997, separatist militants in northern Italy tried to boycott pizza—the icon of their southern nemesis. Neapolitans responded to the effect "Let them eat polenta," referring to the cornmeal-based mush dear to the wealthier, but allegedly culinarily impoverished, north. If only Naples had patented pizza, food writer Burton Anderson observed, "it would be among Italy's wealthier cities instead of one of its poorest." —Cathy Newman

CONSERVATION



THE MAKINGS OF A SWEATER

Starting at age two, a vicuña is sheared every two years or so, yielding seven to eight ounces of fleece—the finest and softest used commercially.



Merino
sheep



Cashmere
goat

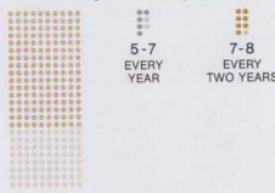


Vicuña

Fiber diameter (microns*)

18 — 27 15 — 19 6 — 13

Fleece per harvest (ounces)



160 - 240
EVERY
YEAR

Vicuña
pullover
\$4,575



Golden Fleece Fabulously expensive and buttery soft sweaters may help save the vicuña. Millions of the llama kin once capered in the Andes, warmed by fluffy coats ideal for high altitudes. The Inca clipped the wool for royal garments, but after the Spanish conquest vicuñas were killed for their pelts. By the 1960s only a few thousand survived. As countries protected their herds and international laws banned vicuña products, the animal began to rebound.

Vicuña couture is the latest boost. In 1994 Italian luxury clothier Loro Piana started a line using fleece sheared from Peruvian vicuñas. Styles are classic. The fabric, usually undyed to preserve its softness, makes even cashmere seem harsh. Other fashion firms have jumped in. The result is a boon for Peru's vicuñas—they now number about 150,000, up from 62,000 in 1981—and for villagers who sell wool from animals they've guarded and sheared. But some wild vicuñas are being fenced. Feeding and inbreeding are concerns; poaching is on the rise. Putting vicuña on the runway has its costs. —A. R. Williams

*ACTUAL SIZE NOT SHOWN

PHOTOS: MARK JONES; ANIMALS: ANIMALS (ABOVE LEFT); MARK THIESSEN, NG PHOTOGRAPHER. NGM MAPS. SOURCE: JERRY LAKER

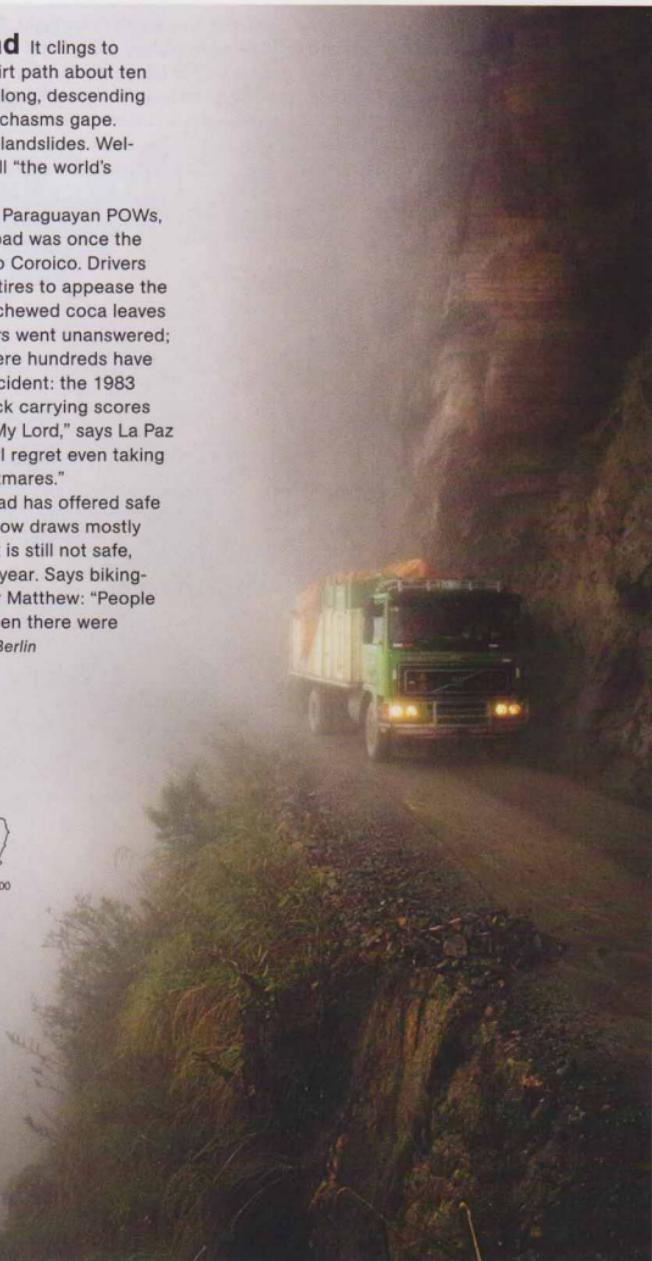
Dead-End Road It clings to the Andes: a winding dirt path about ten feet wide and 22 miles long, descending 6,500 feet. Cliffs loom, chasms gape. Few guardrails. Lots of landslides. Welcome to what some call "the world's most dangerous road."

Built in the 1930s by Paraguayan POWs, Bolivia's Nor Yungas Road was once the only way from La Paz to Coroico. Drivers poured booze on their tires to appease the goddess Pachamama, chewed coca leaves to stay alert. But prayers went unanswered; crosses dot ledges where hundreds have perished. The worst accident: the 1983 crash of a produce truck carrying scores of people. Most died. "My Lord," says La Paz native Diego Ballivian. "I regret even taking a peek. I still have nightmares."

Since 2006 a new road has offered safe passage. The old way now draws mostly bikers and tourists—but is still not safe, with cyclists dying this year. Says biking-company owner Alistair Matthew: "People were more cautious when there were [more] cars." —Jeremy Berlin



A truck negotiates Bolivia's "Road of Death," from high plains to cloud forest.



How Bees Wing It Don't tell the bees, but they aren't fit for flight. At least that's what a French mathematician concluded in 1934, so one story goes. C'est faux, of course: Bees fly just fine; early researchers simply had no way to gauge the insects' complex wing movements. Caltech biologist Michael Dickinson and colleagues report that while honeybees don't have it easy—their small wing-to-body-size ratio means they must work harder to fly than other insects—their unorthodox flapping method lets them hover, fight wind, evade predators, and get lift even when loaded up with nectar or pollen. —Jennifer S. Holland



BEAT

GENERATION

Studies show that many insects move their wings in long, sweeping strokes (145 to 165 degrees) at roughly 200 beats a second. But honeybees flap in short arcs (about 90 degrees), so they have to compensate with speed. How much? Up to 240 beats a second—nearly twice what you'd expect given their size.



WIND BENEATH (AND ABOVE) THEIR WINGS

To beat gravity, you need to generate an upward force. Fast flapping plus wing flipping does the trick for honeybees.

➡ Direction of wing flap
⬅ Air currents

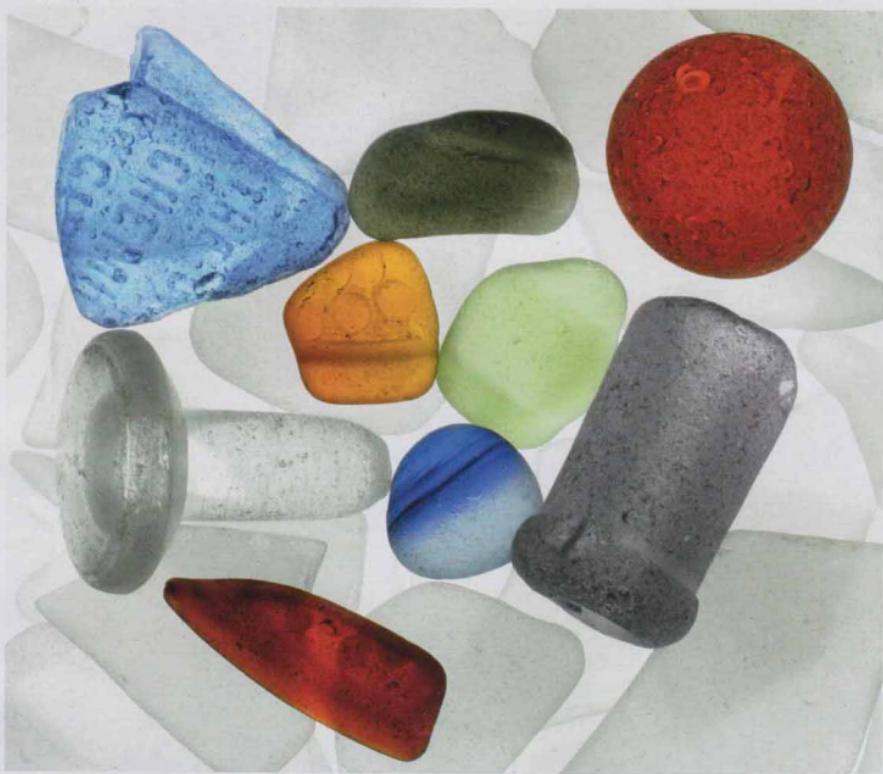


0.0 milliseconds
Wings flap forward, creating a vortex above the bee and generating lift.

0.8 ms Wings begin to rotate and slow down in preparation for the backward stroke.

1.2 ms Wings finish rotating and start sweeping backward, utilizing the previous stroke's wake.

2.0 ms Wings flap backward, creating a new vortex in the process. The cycle then repeats.



Sea glass is found worldwide. Red and orange are rare; white—which once was clear glass—is most common.

The Shard Way Blame it on plastic. Sea glass—the bright bits of old bottles scoured by sand and salt water—is getting increasingly difficult to find. "We're at the end of the sea glass window," notes Mary Beth Beuke, president of the North American Sea Glass Association. "There is less glass packaging now and more recycling." Much of the glass consigned to the waves decades ago, she says, "is tumbled so tiny it's almost not worth picking up."

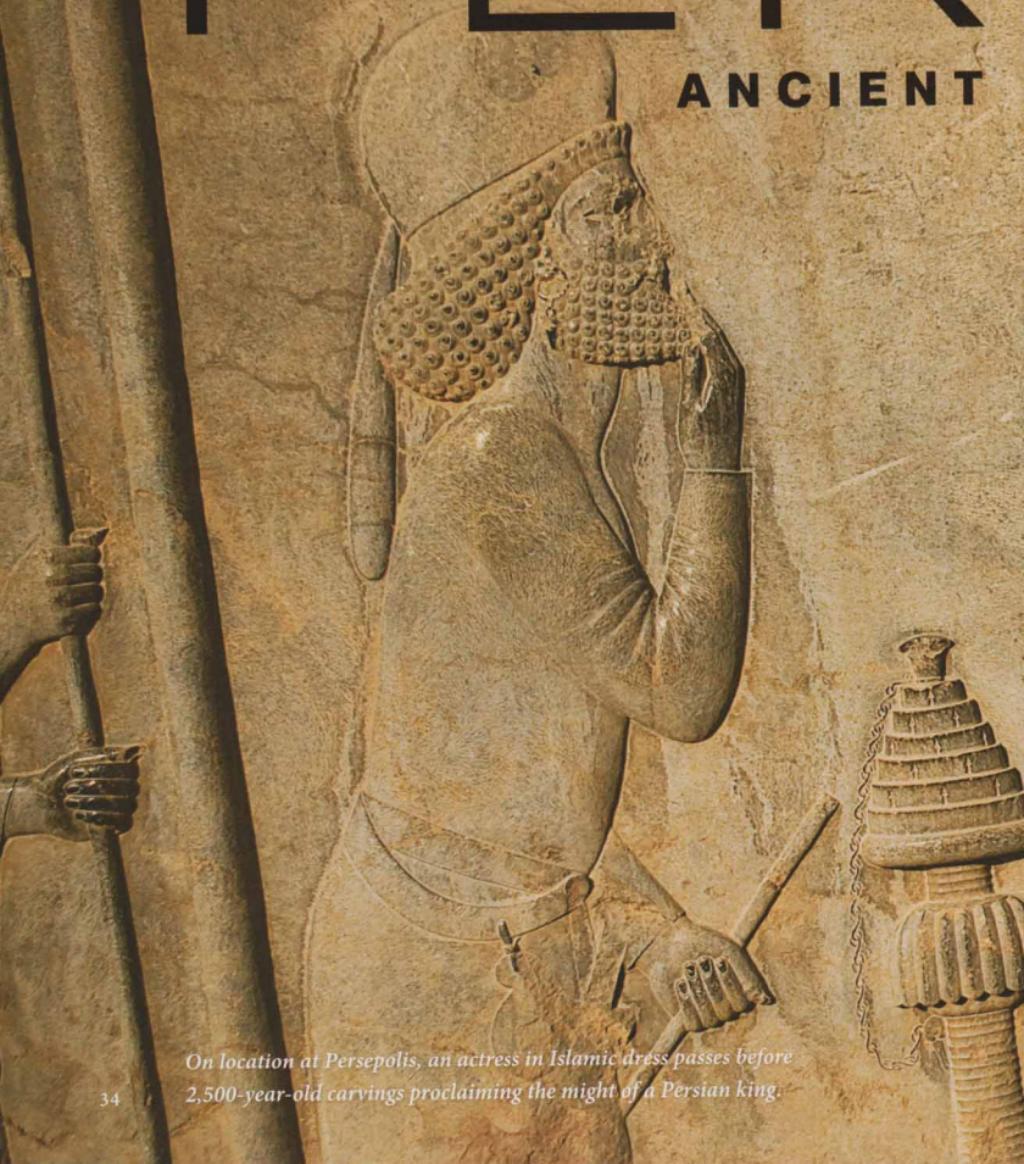
Of course, it started out as something not worth keeping. Trash tossed off ships or washed from dumps must spend years in the water to become good sea glass. Wave churn, shore terrain, water acidity, and composition of the glass itself all play a part in creating the smoothed shards' characteristic matte texture.

Beuke, who finds sea glass all over the world, offers these tips for fellow beachcombers: Search at low tide and after a storm. Rocky shores are better than sandy. And leave clear, jagged pieces where they lie, she says. "They're not finished yet." —Margaret G. Zackowitz



- 1 Chemist's bottle
- 2 Wine bottle
- 3 Shooter marble
- 4 Signal light
- 5 Bottleneck rim
- 6 Bottle stopper
- 7 End-of-day glass
- 8 Bottleneck
- 9 Car taillight

A GLORIOUS PAST INSPIRES A
PER
ANCIENT



On location at Persepolis, an actress in Islamic dress passes before 2,500-year-old carvings proclaiming the might of a Persian king.

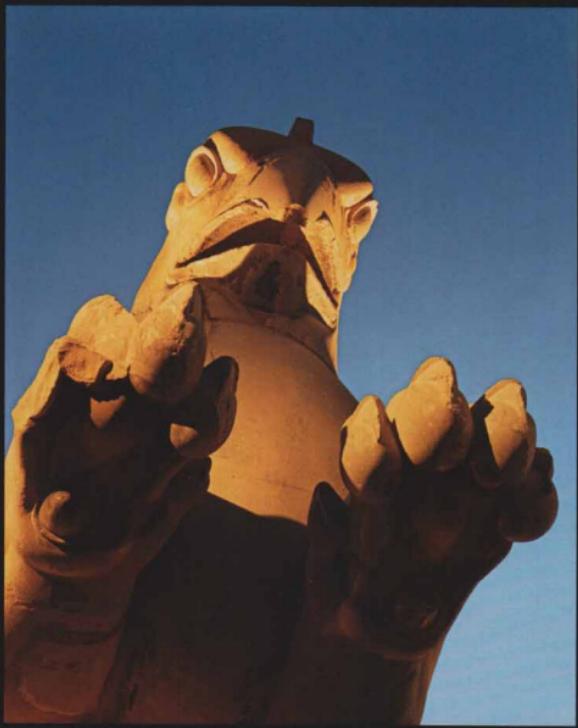
CONFlicted NATION

SIA

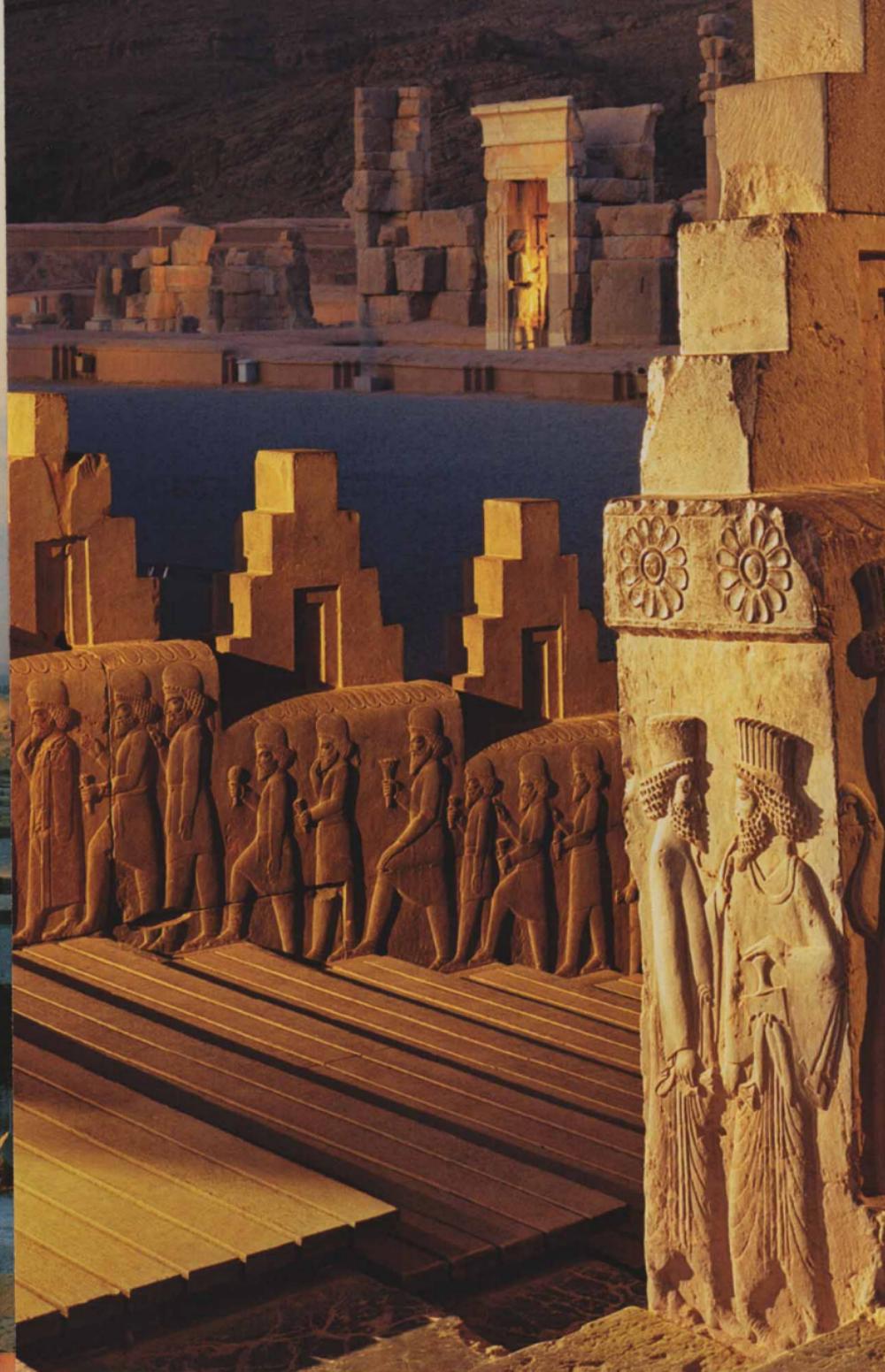
SOUL OF IRAN







PERSEPOLIS Testament to Persian power established by Darius the Great (522 to 486 B.C.), Persepolis awed dignitaries who came from the far ends of the largest empire of the age to present gifts. Jaw-dropping even in ruins (previous pages), its structures are rife with commanding motifs, like the griffin above. "The art of Persepolis was brilliant propaganda," says archaeologist Kim Codella. It played to aspirations: Persian nobles ascending stairs hand in hand to the Tripylon hall (right) may signal fraternity among the empire's elites.





BY MARGUERITE DEL GIUDICE

PHOTOGRAPHS BY NEWSHA TAVAKOLIAN

WHAT'S SO STRIKING about the ruins of Persepolis in southern Iran, an ancient capital of the Persian Empire that was burned down after being conquered by Alexander the Great, is the absence of violent imagery on what's left of its stone walls. Among the carvings there are soldiers, but they're not fighting; there are weapons, but they're not drawn. Mainly you see emblems suggesting

that something humane went on here instead—people of different nations gathering peacefully, bearing gifts, draping their hands amiably on one another's shoulders. In an era noted for its barbarity, Persepolis, it seems, was a relatively cosmopolitan place—and for many Iranians today its ruins are a breathtaking reminder of who their Persian ancestors were and what they did.

The recorded history of the country itself spans some 2,500 years, culminating in today's Islamic Republic of Iran, formed in 1979 after a revolution inspired in part by conservative clerics cast out the Western-backed shah. It's arguably the world's first modern constitutional theocracy and a grand experiment: Can a country be run effectively by holy men imposing an extreme version of Islam on a people soaked in such a rich Persian past?

Persia was a conquering empire but also regarded in some ways as one of the more glorious and benevolent civilizations of antiquity, and I wondered how strongly people might still

identify with the part of their history that's illustrated in those surviving friezes. So I set out to explore what "Persian" means to Iranians, who at the time of my two visits last year were being shunned by the international community, their culture demonized in Western cinema, and their leaders cast, in an escalating war of words with Washington, D.C., as menacing would-be terrorists out to build the bomb.

You can't really separate out Iranian identity as one thing or another—broadly speaking, it's part Persian, part Islamic, and part Western, and the paradoxes all exist together. But there is a Persian identity that has nothing to do with Islam, which at the same time has blended with the culture of Islam (as evidenced by the Muslim call to prayer that booms from loudspeakers situated around Persepolis, a cue to visitors that they are not only in a Persian kingdom but also in an Islamic republic). This would be a story about those Iranians who still, at least in part, identify with their Persian roots. Perhaps some millennial spillover runs through the makeup of what is now one of the world's ticking hot spots. Are vestiges of the life-loving Persian nature (wine, love, poetry, song) woven into the fabric of abstinence, prayer, and fatalism often

Marguerite Del Giudice wrote about Iceland in the March issue. Newshe Tavakolian, an Iranian photographer, documents women in the Middle East.



Schoolgirls in the city of Dezful cool their feet on a sweltering summer day. Physical reminders of Iran's long history abound, such as the foundations of the bridge in the distance, built to span the Dez River in the third century A.D.

associated with Islam—like a secret computer program running quietly in the background?

SURVIVING, PERSIAN STYLE

Iran's capital city of Tehran is an exciting, pollution-choked metropolis at the foot of the Elburz Mountains. Many of the buildings are made of tiny beige bricks and girded with metal railings, giving the impression of small compounds coming one after the other, punctuated by halted construction projects and parks. There are still some beautiful gardens here, a Persian inheritance, and private ones, with fruit trees and fountains, fishponds and aviaries, flourishing inside the brick walls.

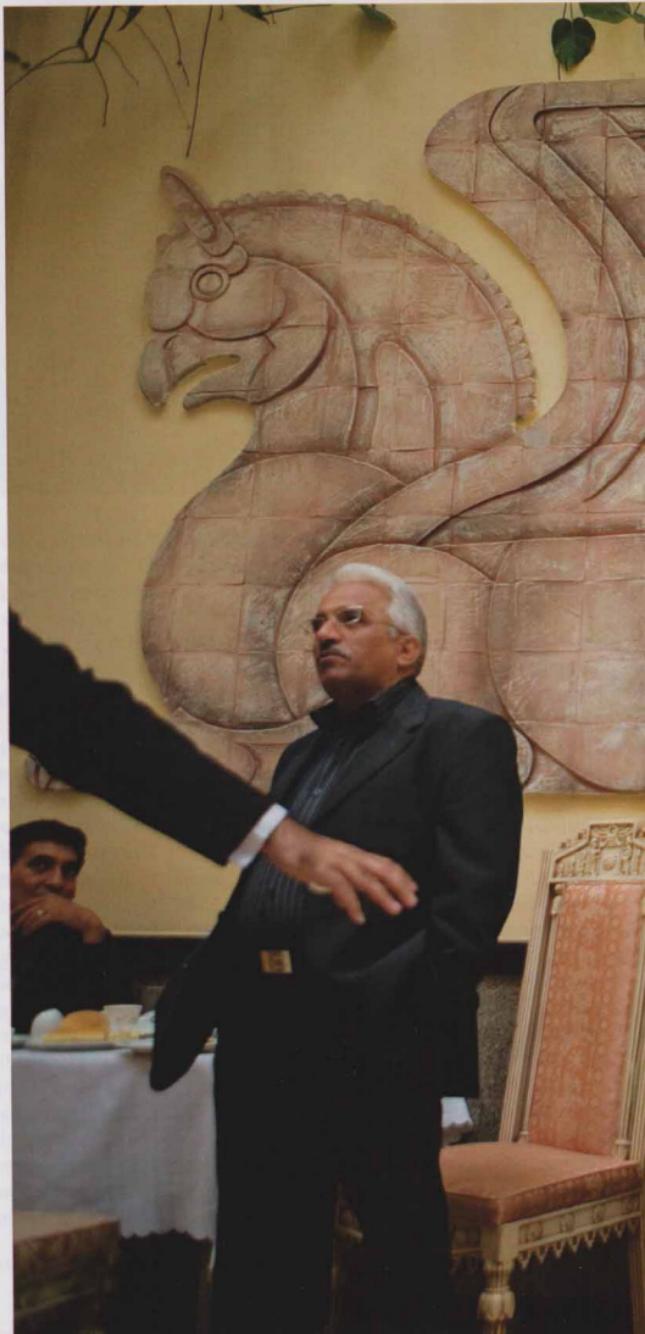
While I was here, two Iranian-born American academics, home for a visit, had been locked up, accused of fomenting a velvet revolution against the government. Eventually they were released. But back in the United States, people would ask, wasn't I afraid to be in Iran?—the

assumption being that I must have been in danger of getting locked up myself.

But I was a guest in Iran, and in Iran a guest is accorded the highest status, the sweetest piece of fruit, the most comfortable place to sit. It's part of a complex system of ritual politeness—*taarof*—that governs the subtext of life here. Hospitality, courting, family affairs, political negotiations; *taarof* is the unwritten code for how people should treat each other. The word has an Arabic root, *arafa*, meaning to know or acquire knowledge of. But the idea of *taarof*—to abase oneself while exalting the other person—is Persian in origin, said William O. Beeman, a linguistic anthropologist at the University of Minnesota. He described it as “fighting for the lower hand,” but in an exquisitely elegant way, making it possible, in a hierarchical society like Iran's, “for people to paradoxically deal with each other as equals.”

Wherever I went, people fussed over me and made sure that all my needs were met. But

A griffin and a winged goddess, representing a fanciful blend of Persian and Greek imagery from a time when Persia's rule stretched far and wide, accompany breakfast at the opulent Dariush Grand Hotel on the island of Kish.





they can get so caught up trying to please, or seeming to, and declining offers, or seeming to, that true intentions are hidden. There's a lot of mind reading and lighthearted, meaningless dialogue while the two parties go back and forth with entreaties and refusals until the truth reveals itself.

Being smooth and seeming sincere while hiding your true feelings—artful pretending—is considered the height of *taarof* and an enormous social asset. "You never show your intention or your real identity," said a former Iranian political prisoner now living in France. "You're making sure you're not exposing yourself to danger, because throughout our history there has been a lot of danger there."

GEOGRAPHY AS DESTINY

Indeed, the long course of Iranian history is saturated with wars, invasions, and martyrs, including the teenage boys during the Iran-Iraq war of the 1980s who carried plastic keys to heaven while clearing minefields by walking bravely across them. The underlying reason for all the drama is: location. If you draw lines from the Mediterranean to Beijing or Beijing to Cairo or Paris to Delhi, they all pass through Iran, which straddles a region where East meets West. Over 26 centuries, a blending of the hemispheres has been going on here—trade, cultural interchange, friction—with Iran smack in the middle.

Meanwhile, because of its wealth and strategic location, the country was also overrun by one invader after another, and the Persian Empire was established, lost, and reestablished a number of times—by the Achaemenids, the Parthians, and the Sassanids—before finally going under. Invaders have included the Turks, Genghis Khan and the Mongols, and, most significantly, Arabian tribesmen. Fired with the zeal of a new religion, Islam, they humbled the ancient Persian Empire for good in the seventh century and ushered in a period of Muslim greatness that was distinctly Persian. The Arab expansion is regarded as one of the most dramatic movements of any people in history. Persia was in its

inexorable path, and, ever since, Iranians have been finding ways to keep safe their identity as distinct from the rest of the Muslim and Arab world. "Iran is very big and very ancient," said Youssef Madjidzadeh, a leading Iranian archaeologist, "and it's not easy to change the hearts and identity of the people because of this."

They like to say, for instance, that when invaders came to Iran, the Iranians did not become the invaders; the invaders became Iranians. Their conquerors were said to have "gone Persian," like Alexander, who, after laying waste to the vanquished Persia, adopted its cultural and administrative practices, took a Persian wife (Roxana), and ordered thousands of his troops to do the same in a mass wedding. Iranians seem particularly proud of their capacity to get along with others by assimilating compatible aspects of the invaders' ways without surrendering their own—a cultural elasticity that is at the heart of their Persian identity.

WELCOME TO ARATTA

The earliest reports of human settlement in Iran go back at least 10,000 years, and the country's name derives from Aryans who migrated here beginning around 1500 B.C. Layers of civilization—tens of thousands of archaeological sites—are yet to be excavated. One recent find quickening some hearts was unearthed in 2000 near the city of Jiroft, when flash floods along the Halil River in the southeast exposed thousands of old tombs. The excavation is just six seasons old, and there isn't much to see yet. But intriguing artifacts have been found (including a bronze goat's head dating back perhaps 5,000 years), and Jiroft is spoken of as possibly an early center of civilization contemporary with Mesopotamia.

Youssef the archaeologist, an authority on the third millennium B.C., directs the digs. He used to run the archaeology department at the University of Tehran but lost his job after the revolution and moved to France. Over the years, he said, "things changed." Interest in archaeology revived, and he was invited back to run Jiroft. Youssef thinks it may be the fabled "lost" Bronze Age



Millennia of power struggles and cultural creativity have left thousands of important ancient sites scattered across Iran. More are now being unearthed by Iranians, thanks to increasing official support for homegrown archaeologists.

land of Aratta, circa 2700 B.C., reputedly legendary for magnificent crafts that found their way to Mesopotamia. But thus far there's no proof, and other scholars are skeptical. What would he have to find to put the matter unequivocally to rest? He chuckled wistfully. "The equivalent of an engraved arch that says, 'Welcome to Aratta.'"

Prospects for more digs at the thousands of unexplored sites seem daunting. In Iran the price of meat is high, there aren't enough jobs, the bureaucracy is inscrutable, bloated, and inefficient, and state corruption—as described to me by three different people—is "an open secret," "worse than ever," and "institutionalized."

"The country has many needs," Youssef said, "and certainly archaeology is not the main subject." But since Jiroft, "all the provinces are interested in excavating, and every little town wants to be known around the world like Jiroft. They're proud, and there are rivalries."

Youssef was slouched happily in a faux-leather chair in the offices of his publisher, munching tiny green grapes while musing about why Iranians are the way they are. As much as anything else, he thought, it was the geography, for when the Iranians were being overrun time after time, "where could they go—the desert? There was no place to run and hide." They stayed, they got along, they pretended and made taarof. "The tree here has very deep roots."

SUPERPOWER NOSTALGIA

The legacy from antiquity that has always seemed to loom large in the national psyche is this: The concepts of freedom and human rights may not have originated with the classical Greeks but in Iran, as early as the sixth century B.C. under

the Achaemenid emperor Cyrus the Great, who established the first Persian Empire, which would become the largest, most powerful kingdom on Earth. Among other things, Cyrus, reputedly a brave and humble good guy, freed the enslaved Jews of Babylon in 539 B.C., sending them back to Jerusalem to rebuild their temple with money he gave them, and established what has been called the world's first religiously and culturally tolerant empire. Ultimately it comprised more than 23 different peoples who coexisted peacefully under a central government, originally based in Pasargadae—a kingdom that at its height, under Cyrus's successor, Darius, extended from the Mediterranean to the Indus River.

So Persia was arguably the world's first superpower.

"We have a nostalgia to be a superpower again," said Saeed Laylaz, an economic and political analyst in Tehran, "and the country's nuclear ambitions are directly related to this desire." The headlines are familiar: A consensus report of key U.S. spy agencies—the National Intelligence Estimate—concluded last December that a military-run program to develop nuclear weapons in Iran was halted in 2003. Iran continues to enrich uranium, insisting that it wants only to produce fuel for its nuclear power plants, but highly enriched uranium is also a key ingredient for a nuclear bomb. As a deterrent, the UN has imposed increasing economic sanctions. But Iran's president, Mahmoud Ahmadinejad, a conservative hard-liner, is giving no ground while at the same time making frequent threatening remarks about nearby Israel, denying the Holocaust, and, according to the U.S. government, sending weapons and munitions to extremist militias

A

re vestiges of the life-loving Persian nature

(wine, love, poetry, song) woven into the fabric of abstinence,
prayer, and fatalism often associated with Islam?



Excavations at Konar Sandal, near Jiroft, have yielded signs of a vibrant civilization some 5,000 years ago. The little-known people who raised what may be an eroded citadel mound were contemporary with the builders of Mesopotamia.

in Iraq that are being used against Iraqis and U.S. forces there.

"At one time the area of the country was triple what it is now, and it was a stable superpower for more than a thousand years," said Saeed, a slender, refined man in glasses and starched shirtsleeves rolled to three-quarter length, sitting in his elegant apartment next to a lamp resembling a cockatoo, with real feathers. The empire once encompassed today's Iraq, Pakistan, Afghanistan, Turkmenistan, Uzbekistan, Tajikistan, Turkey, Jordan, Cyprus, Syria, Lebanon, Israel, Egypt, and the Caucasus region. "The borders have moved in over the centuries, but this superpower nostalgia, so in contradiction to reality," he said, "is all because of the history."

At the foundation of which, again, is Cyrus, and in particular something called the Cyrus Cylinder—perhaps Iran's most exalted artifact—housed at the British Museum in London, with a replica residing at UN headquarters in New

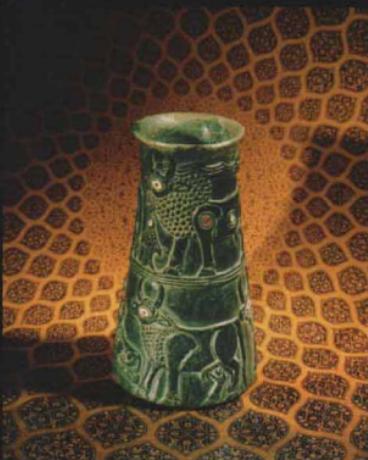
York City. The cylinder resembles a corn cob made of clay; inscribed on it, in cuneiform, is a decree that has been described as the first charter of human rights—predating the Magna Carta by nearly two millennia. It can be read as a call for religious and ethnic freedom; it banned slavery and oppression of any kind, the taking of property by force or without compensation; and it gave member states the right to subject themselves to Cyrus's crown, or not. "I never resolve on war to reign."

"To know Iran and what Iran really is, just read that transcription from Cyrus," said Shirin Ebadi, the Iranian lawyer who won the 2003 Nobel Peace Prize. We were in her central Tehran apartment building, in a basement office lined with mahogany-and-glass bookcases. Inside one was a tiny gold copy of the cylinder, encased in a Plexiglas box that she held out to me as if presenting a newborn child. "Such greatness as the cylinder has been shown many times in Iran," but the world doesn't *(Continued on page 62)*



GLORY

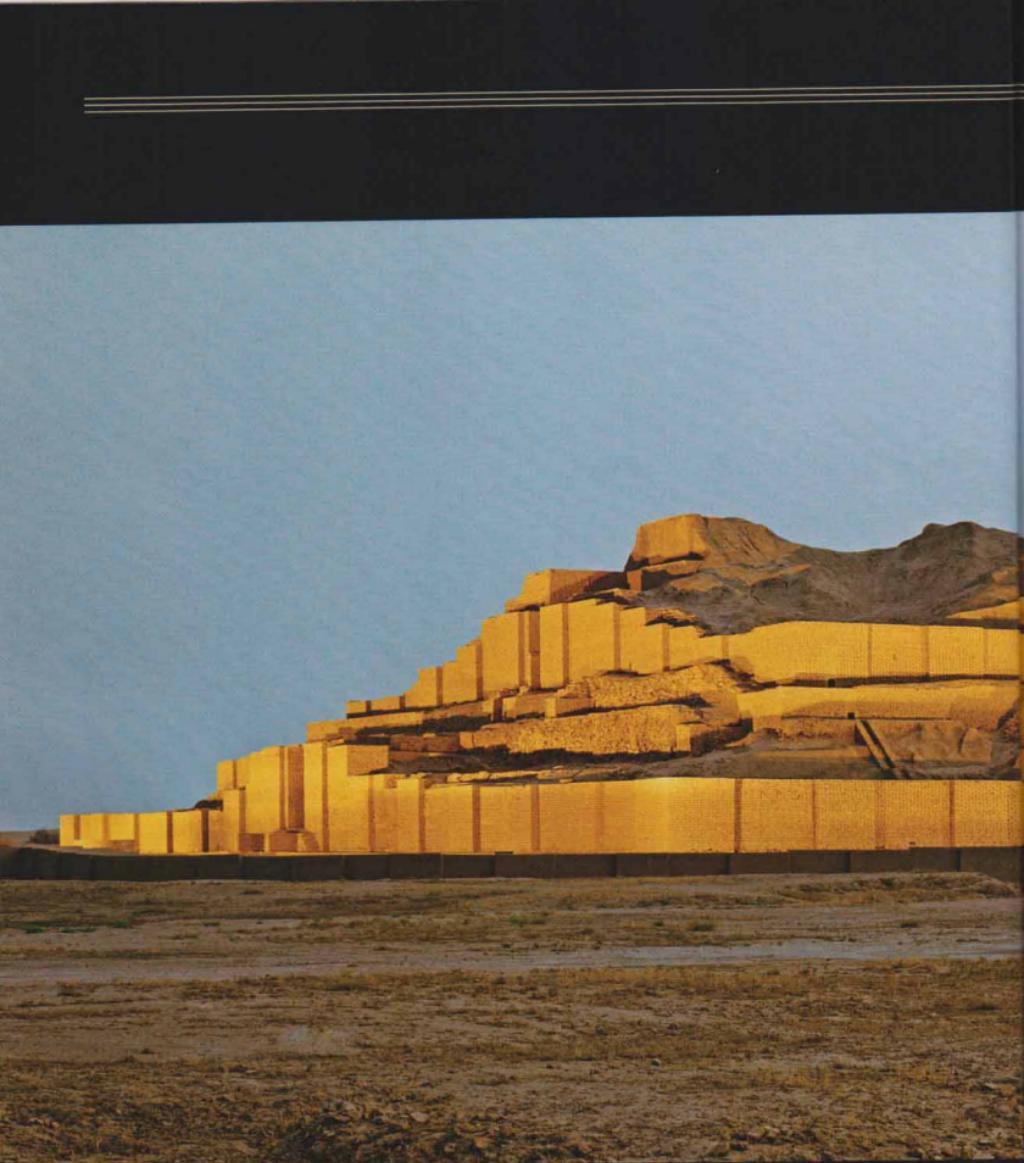
OF IRAN



PORTFOLIO BY SIMON NORFOLK

On a grand staircase in Persepolis, a ravening lion brings down a bull—an ancient cross-cultural metaphor for the power of the king. Under the Achaemenid rulers, who controlled numerous realms in a domain stretching from the Indus to the Mediterranean, Persia became the greatest empire the world had known. Even then, in 500 b.c., Persians looked to the distant past for universal imagery. Bull icons also appear on a chlorite vase from near Jiroft—where such items were crafted 2,000 years earlier.

Simon Norfolk's photographs of Maya monuments appeared in the August 2007 issue.



Konar Sandal
ca Third Millennium B.C.

The recently discovered site near Jiroft may hold clues to a legendary Bronze Age land, Aratta.

Elamites
ca 2400 B.C. to 539 B.C.

Elamites join the Persian Empire in 539 B.C. when Cyrus the Great takes their capital, Susa.

Achaemenids
ca 550 B.C. to 330 B.C.

Their realm—the first Persian Empire—expands to become the largest empire the world had seen.

Alexander and the Seleucids
ca 330 B.C. to 129 B.C.

Alexander the Great conquers the Persian Empire but soon dies. His general Seleucus wins control; a chain of successors gradually lose power to the Parthians.



CHOGA ZANBIL Long before Persians arrived, the Elamites (ca 2400 to 539 B.C.) had built one of the world's early civilizations in southwestern Iran. At a high point of their power in the 13th century B.C., the mighty ziggurat in the city of Dur Untash towered over the realm. Partly restored, it is one of the largest ziggurats in the world. The Elamites' cultural influence continued after their world was absorbed by Persia.



Parthians

ca 247 B.C. to A.D. 224

Tribal warriors from northeast Persia, the Parthians create what is often called the second Persian Empire and challenge Rome.

Sassanids

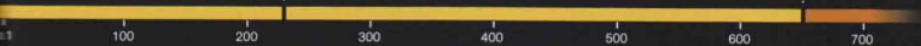
ca A.D. 224 to 641

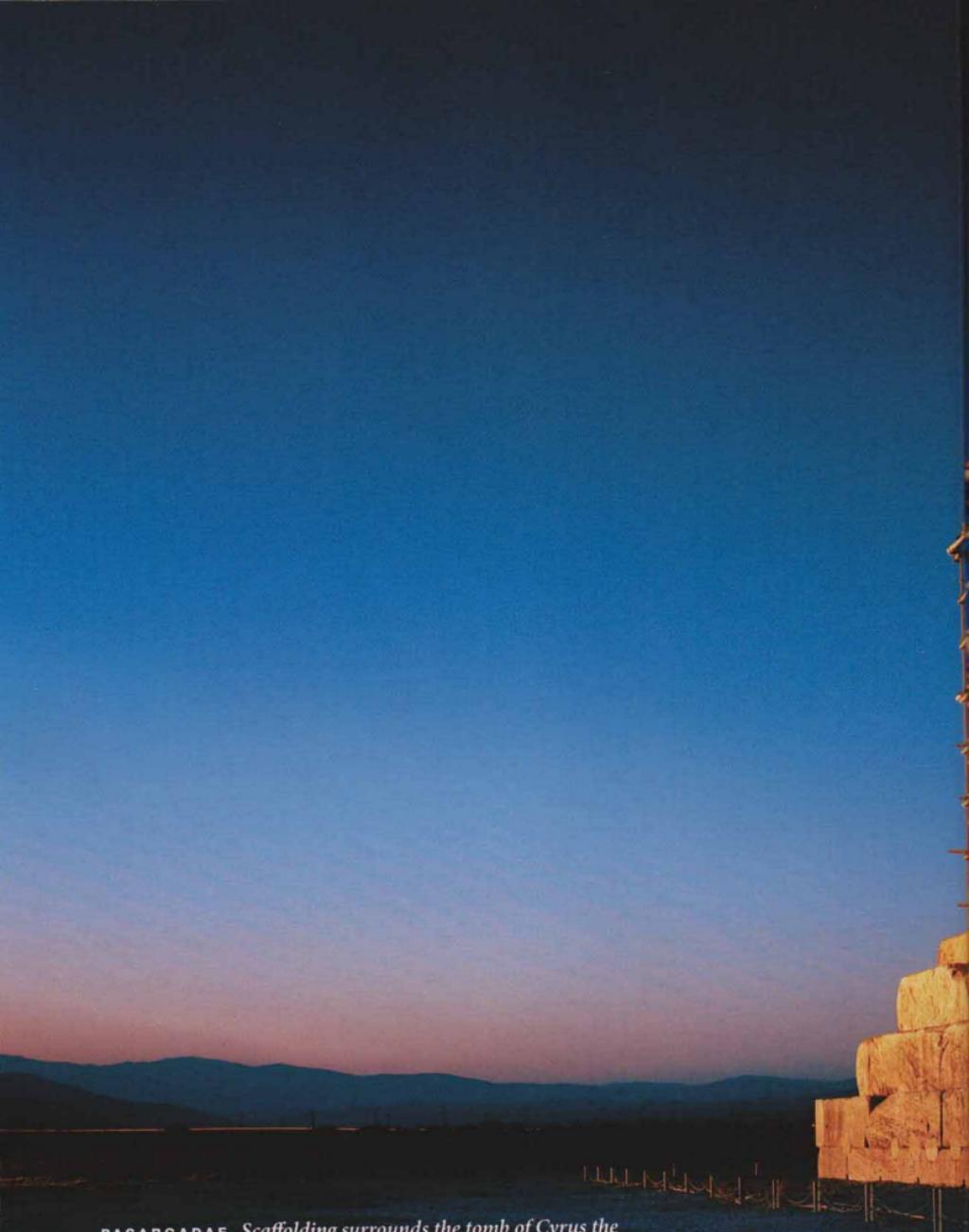
A new ruling family forms the third Persian Empire, a golden era of city building and grand art.

Arab Conquest

A.D. 641-42

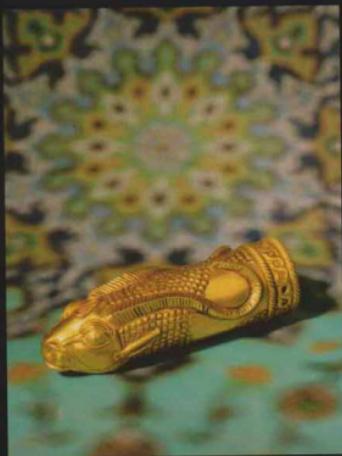
Armies spreading Islam bring Persia under Arab rule, but Persians remain a cultural force in the emerging Muslim world.



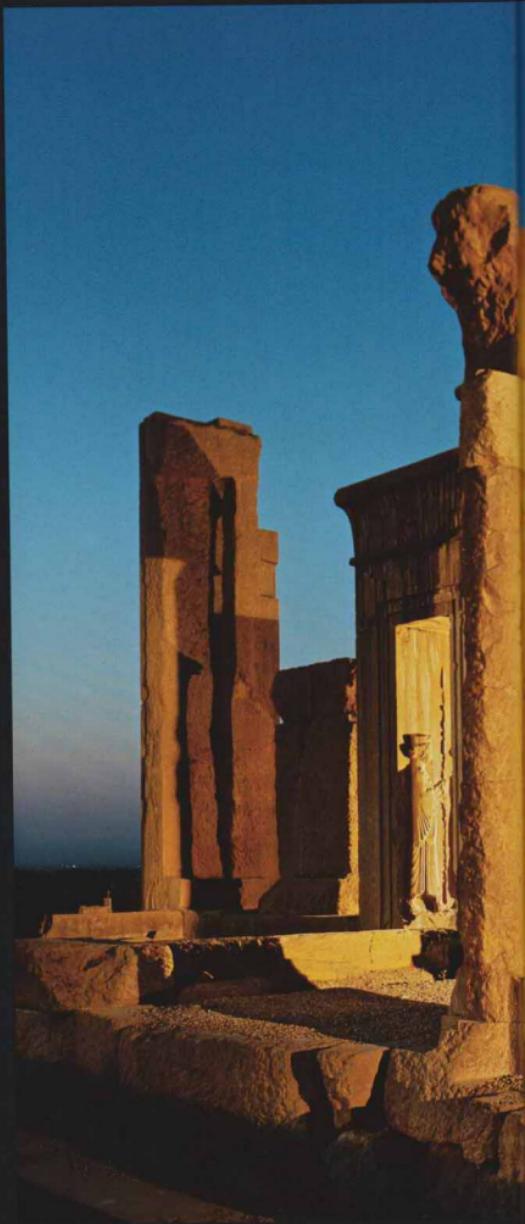


PASARGADE Scaffolding surrounds the tomb of Cyrus the Great (ca 559 to 530 B.C.), the first Persian emperor, while archaeologists strive to restore its roof. Admired as an early champion of human rights, Cyrus allowed religious diversity and respected the local customs of those he conquered.

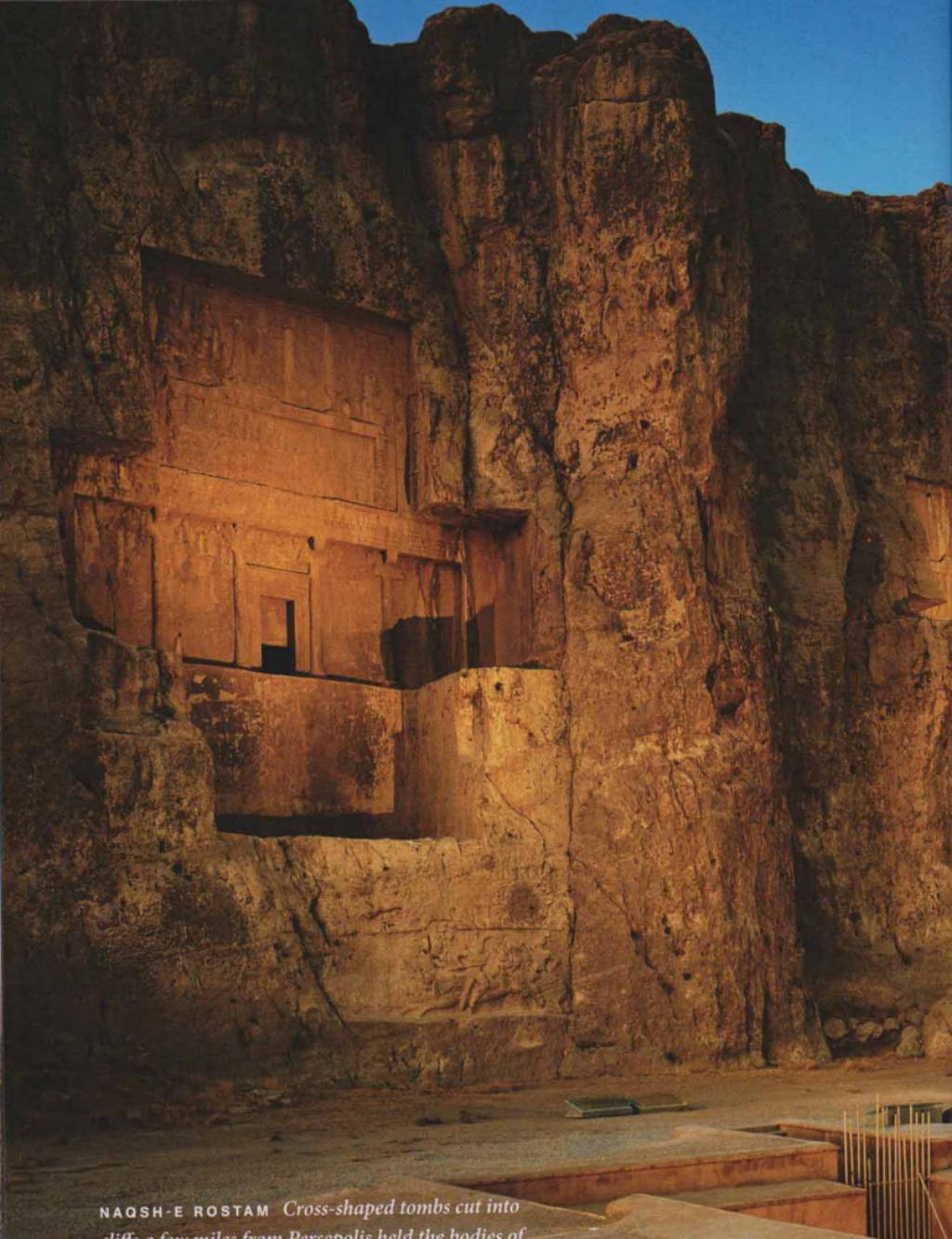




PERSEPOLIS Monumental doorways are nearly all that remain of Darius's palace, known as Tachara (right). Their design, with Egyptian-style cornices, underscores the cosmopolitan taste of the Achaemenids, whose artisans made works of lasting beauty. Artistic motifs as on a gold finial (above), which may have adorned a staff, spread throughout the empire.

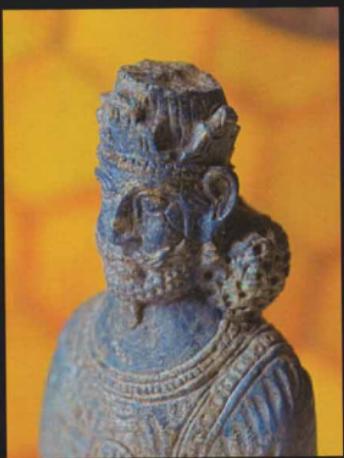




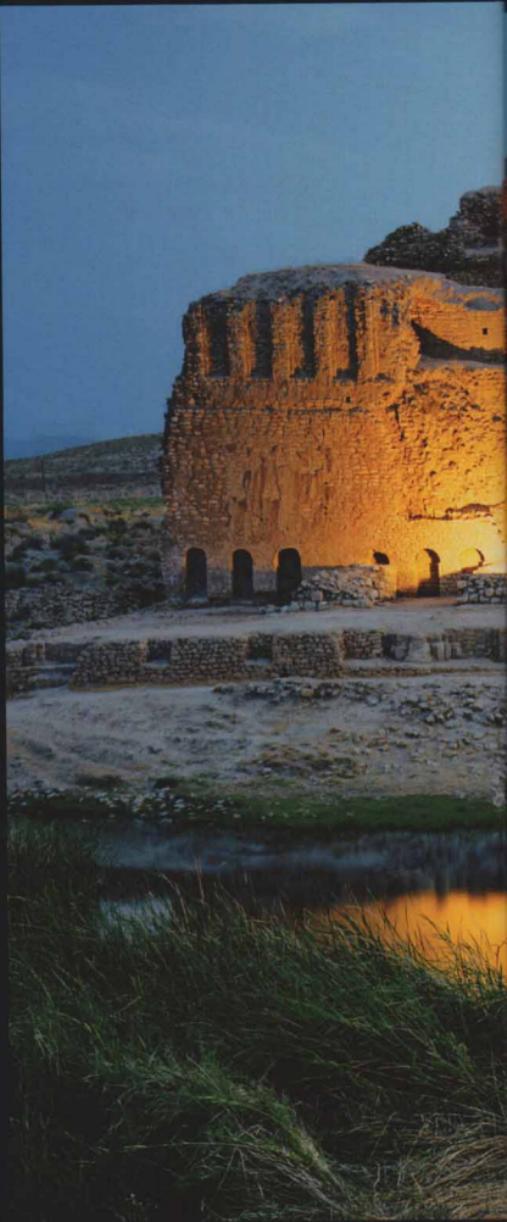


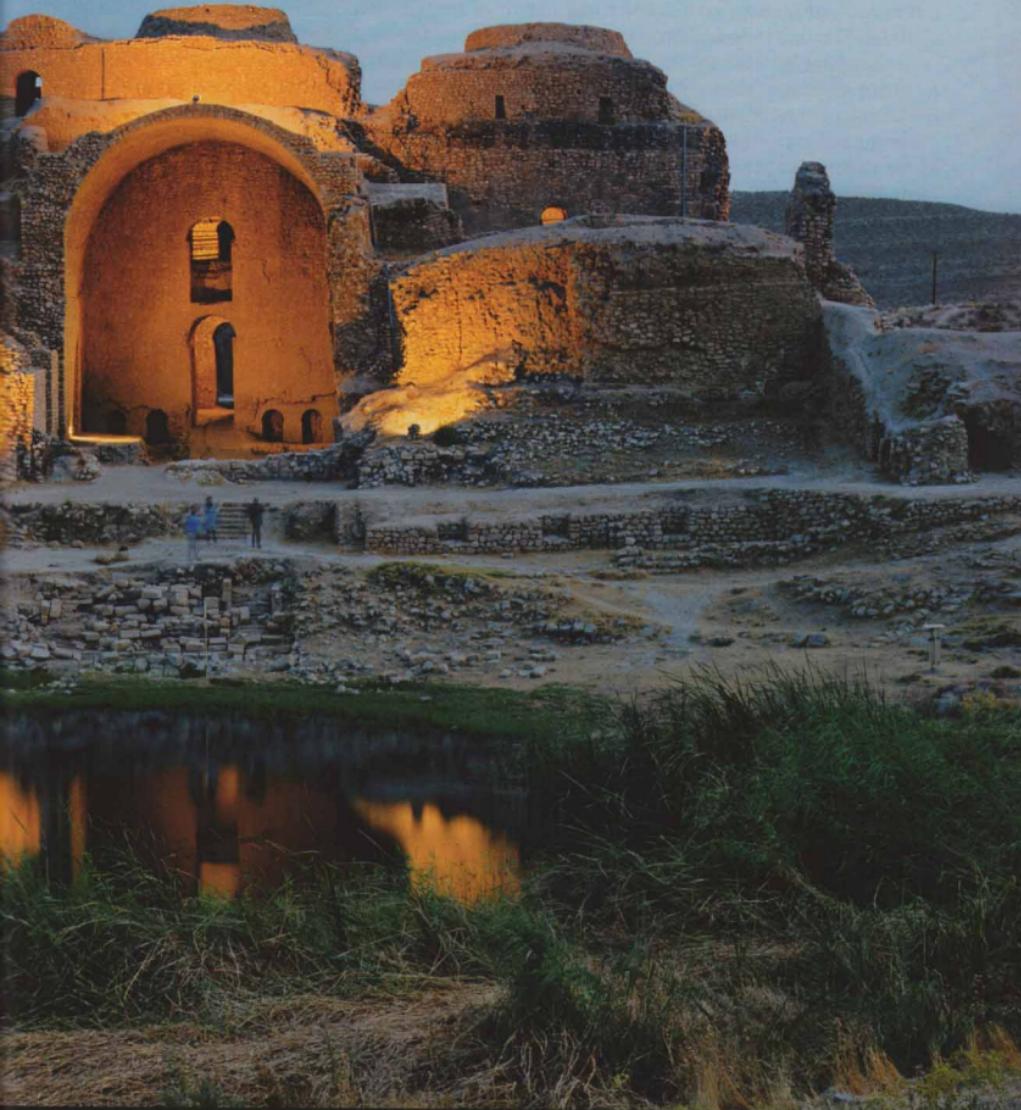
NAQSH-E ROSTAM Cross-shaped tombs cut into cliffs a few miles from Persepolis held the bodies of Darius and his immediate successors. The purpose of the cube-like building in front is a mystery; it may have played a role in Achaemenid coronations.





FIRUZABAD The ravages of centuries do not obscure an arched hall leading to an inner domed chamber in the palace of Ardashir I (right), built after A.D. 224. Such design elements were echoed later in classic Islamic architecture. Ardashir founded the Sassanid dynasty (lapis-colored bust of a Sassanid royal, above), the last flowering of ancient Persian culture before the Arab conquest.





(Continued from page 49) know it, she said. "When I go abroad, people get surprised when they realize that 65 percent of the college students here are girls. Or when they see Iranian paintings and Iranian architecture, they are shocked. They are judging a civilization just by what they have heard in the last 30 years"—the Islamic revolution; the rollbacks of personal freedoms, particularly for women; the nuclear program and antagonism with the West. They know nothing of the thousands of years that came before, she said—what the Iranians went through to remain distinct from their invaders, and how they did it.

For instance, she said, after the Arabs came, and Iran converted to Islam, "eventually we turned to the Shiite sect, which was different from the Arabs, who are Sunni."

They were still Muslims, but not Arabs.

"We were Iranian."

In fact, the first thing people said when I asked what they wanted the world to know about them was, "We are not Arabs!" (followed closely by, "We are not terrorists!"). A certain Persian chauvinism creeps into the dialogue. Even though economically they're not performing as well as Arab states like Dubai and Qatar, they still feel exceptional. The Arabs who conquered Iran are commonly regarded as having been little more than Bedouin living in tents, with no culture of their own aside from what Iran gave them, and from the vehemence with which they are still railed against, you would think it happened not 14 centuries ago but last week.

I met a woman at a wedding who gave off the air of an aging movie star, her dapper husband beside her wearing his white dinner jacket and smoking out of a cigarette holder, and it wasn't five minutes before she lit into the Arabs.

"Everything went down after they came, and we have never been the same!" she said, wringing someone's neck in the air. And a friend I made here, an English teacher named Ali, spoke of how the loss of the empire still weighed on the national consciousness. "Before they came, we were a great and civilized power," he said, as we drove to his home on the outskirts of Shiraz, dodging motorcycles and tailgaters. Echoing commonly stated (though disputed) lore, he added: "They burned our books and raped our women, and we couldn't speak Farsi in public for 300 years, or they took out our tongues."

THE CULT OF FERDOWSI

The Iranians spoke Farsi anyway. The national language has been Arabized to some extent, but Old Persian remains at its root. The man credited with helping save the language, and the history, from oblivion is a tenth-century poet named Ferdowsi. Ferdowsi is Iran's Homer. Iranians idolize their poets—among many, Rumi, Sa'id, Omar Khayyám, Hafez (whose works are said to be consulted for guidance about love and life as much as, if not more than, the Islamic holy book, the Koran). When the people were oppressed by the latest invader and couldn't safely speak their minds, the poets did it for them, cleverly disguised in verse. "Sometimes they were executed," said Youssef the archaeologist, "but they did it anyway." So today, although Iran is home to many cultural denominations (and languages) other than Persian—Turkmen, Arab, Azeri, Baluchi, Kurd, and others—"everyone can speak Farsi," he said, "which is one of the oldest living languages in the world."

The poet-hero Ferdowsi, a sincere Muslim who resented the Arab influence, spent 30 years

T

he first thing people said when I asked what they wanted the world to know about them was, "We are not Arabs!" (followed closely by, "We are not terrorists!"). They feel exceptional.

writing, in verse with minimal use of Arabic-derived words, an epic history of Iran called the *Shahnameh*, or *Book of Kings*. This panorama of conflict and adventure chronicles 50 monarchies—their accessions to the throne, their deaths, the frequent abdications and forcible overthrows—and ends with the Arab conquest, depicted as a disaster. The most heralded character is Rostam, a chivalrous figure of courage and integrity, a national savior and “trickster hero,” according to Dick Davis, a Persian scholar at Ohio State University who has translated the *Shahnameh* into English. “The stories of Rostam are their myths,” he said. “This is how the Iranians see themselves.”

The tales involve feuding kings and hero-champions, in which the latter are almost always represented as ethically superior to the kings they serve, facing the dilemmas of good men living under an evil or incompetent government. The work is haunted by the idea that those ethically most fitted to rule are precisely the ones most reluctant to rule, preferring instead to devote themselves to humankind’s chief concerns: the nature of wisdom, the fate of the human soul, and the incomprehensibility of God’s purposes.

The original *Shahnameh* is long gone, and all that’s left are copies, including one in Tehran’s Golestan Palace museum. Its caretaker, a sweet-faced young woman named Behnaz Tabrizi, cleared a large table and covered it with a green felt sheet. She retrieved a black box from a safe in an adjoining bulletproof room equipped with fire and earthquake alarms and climate control and laid a red velvet cloth on top of the green felt cloth, because the Iranians like to make little ceremonies out of everything, if they can. I had to wear a surgical mask to protect the manuscript from stray saliva and the condensation from my breath, and Behnaz put on white cotton gloves. She gently lifted the book, which dates to about 1430, out of its box and gingerly turned the pages with the tips of her fingers while I examined its 22 illustrations with a magnifying glass. They depicted scenes the collective cultural memory is steeped

in—someone tied to a tree while awaiting his fate; Rostam unwittingly killing his own son, Sohrab, in battle; men on horseback with spears fighting invaders on elephants—all precisely drawn and vibrantly colored, using inks that were made from crushed stones mixed with the liquid squeezed from flower petals.

It is said that just about anybody on the street, regardless of education, can recite some Ferdowsi, and there are usually readings going on at colleges or someone’s apartment or traditional Persian teahouses, like one in south Tehran called Azari. The walls were covered with scenes from the *Shahnameh*, among them the one of Rostam killing Sohrab. A storyteller did a one-man dramatic reading, and afterward musicians played traditional music and sang about yearning for the love of a woman or for the love of Allah. People sat together at long tables or stretched out on platforms covered with Persian rugs, smoking their tiny Bahman cigarettes and clapping to the music, while waiters brought dates and cookies and tea in delicate little glasses with little spoons, followed by kebabs, yogurt milk, pickles, and beet salad. Children danced on the tabletops as the patrons cheered them on and took pictures with their cell phones.

“THEY CAN’T CONTROL WHAT’S INSIDE US”

Thanks to Ferdowsi, the Iranians always had their language to unite them and keep them different from the outside world—and they also took pains to safeguard their cultural touchstones.

Take the New Year: Nowruz, a 13-day extravaganza during which everything shuts down and the people eat a lot, dance, recite poetry, and build fires that they jump back and forth over. It’s a thanksgiving of sorts, celebrated around the spring equinox, and a holdover holiday from Zoroastrianism, at one time the state religion of the Persians. Zoroastrianism’s teachings—good and evil, free will, final judgment, heaven and hell, one almighty God—have influenced many religions, including the world’s three main faiths, Judaism, Christianity, and Islam. By the time the

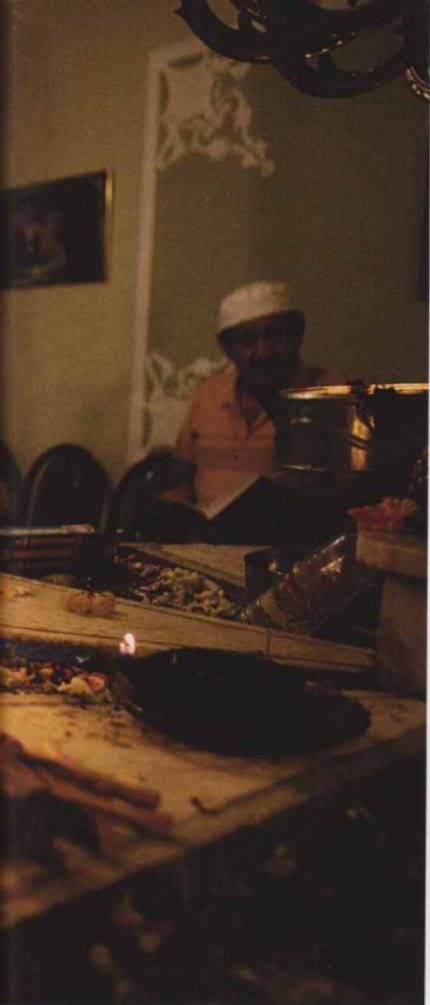


Arabs arrived, bringing what was for them the new idea of worshipping a single God, Persians had been doing it for more than a millennium.

These days some officials see the bond with antiquity as a focus for hope. "We are a nation with such a history that the world could listen to us," Iranian Vice President Esfandiar Rahim Mashaei told me. "We hope that by taking pride in our archaeological sites, the people realize their capabilities, and it imbues the soul of the nation." But conservative Islamists who have no interest in reviving Persian identity can still hold sway. At times the government has tried to diminish the importance of Nowruz or replace

it with a different New Year, such as the birthday of Imam Ali, the historical leader of the Shiite Muslims. "They would bring forces and arrest people," my friend Ali said. "But they couldn't get rid of Nowruz because we've been practicing Nowruz for 2,500 years! They don't really control us, because they can't control what's inside us."

That has never stopped Iran's leaders from trying, or foreign powers from interfering—particularly after the country was discovered, around the turn of the 20th century, to be sitting on what Iran claims is an estimated 135 billion barrels of proven conventional oil reserves, the second largest in the world after Saudi Arabia.



Candles illuminate the face of a Zoroastrian boy during Mehregan, an autumnal festival celebrated from the time of the first Persian Empire or earlier. Zoroastrianism survived the Arab conquest nearly 1,400 years ago and today has some 30,000 followers in Iran.

popular prime minister, Mohammad Mossadegh. Mossadegh had kicked out the British after the Iranian oil industry, controlled through the Anglo-Iranian Oil Company (later BP), was nationalized, and the British had retaliated with an economic blockade. With the Cold War on and the Soviet bloc located just to the north, the U.S. feared that a Soviet-backed communism in Iran could shift the balance of world power and jeopardize Western interests in the region. The coup—Operation TP-Ajax—is believed to have been the CIA's first. (Kermit Roosevelt, Jr., Teddy's grandson, ran the show, and H. Norman Schwarzkopf, the father of the Persian Gulf war commander, was enlisted to coax the shah into playing his part. Its base of operations was the U.S. Embassy in Tehran, the future "nest of spies" to the Iranians, where 52 U.S. hostages were taken in 1979.) Afterward, the shah, Mohammad Reza Pahlavi, was returned to power, commercial oil rights fell largely to British and U.S. oil companies, and Mossadegh was imprisoned and later placed under house arrest until he died in 1967.

To Iranians like Shabnam Rezaei, who has created the online magazine *Persian Mirror* to promote Iran's cultural identity, Operation TP-Ajax set the stage for later decades of oppression and Islamic fundamentalism. "I think if we had been allowed to have a democratic government," she said, "we could have been the New York of the Middle East—of all of Asia, frankly—a center for finance, industry, commerce, culture, and a modern way of thinking."

Adding to the drama is that the Persian Gulf is located along Iran's southern border. On the other side lies much of the rest of the world's crude, in the oil fields of Iraq, Kuwait, Saudi Arabia, and the United Arab Emirates. There's also a hairpin waterway in the gulf, the Strait of Hormuz, through which much of the world's oil passes every day. So Iran is in a unique position to threaten the world's oil supply and delivery—or sell its own oil elsewhere than to the West.

Oil was at the root of a 1953 event that is still a sore subject for many Iranians: the CIA-backed overthrow, instigated and supported by the British government, of Iran's elected and

FOR THE LOVE OF GOD

The shah had his own uses for Persian identity. He was big on promoting Persepolis and Cyrus while at the same time pouring Western

music, dress, behaviors, and business interests into Iran. One attempt to instill nationalistic pride, which backfired and helped turn public opinion against him, was the ostentatious celebration he staged in 1971 to commemorate the 2,500th anniversary of Persian monarchy. It featured a luxurious tent city outside the entrance to Persepolis, VIP apartments with marble bathrooms, food flown in from Paris, and a guest list that included dignitaries from around the world but few Iranians.

The shah's vision apparently involved too much modernizing too fast, and many Iranians bristled. "We were getting westernized," said Farin Zahedi, a drama professor at the University of Tehran. "But it was superficial, because the public had no real understanding of Western culture." Iranians experienced it as a cultural attack and rebelled in the press and with street demonstrations. The more paranoid the shah became, the more heavy-handed were his secret police—SAVAK, created in 1957 with the help of American and Israeli advisers. At least hundreds of people are believed to have been executed by SAVAK; many others were imprisoned, tortured, and exiled, and more than a thousand were killed by the army during demonstrations. So when Ayatollah Ruhollah Khomeini spoke in the late 1970s of liberating the people from this latest yoke, they were moved by his eloquence and moral rectitude, and for a time the reemergence of religion after the shah's relentless modernism felt like a cleansing.

Yet many Iranians by nature are not particularly religious, in the sense of being mosque-goers and fasters. "They have a powerful soul and spirit," said a carpet salesman named Arsha, "but that is not the same." There's a tendency to follow more of a Zoroastrian model from antiquity, with its disdain for rules and for the

presumption that an intermediary, such as a mullah, is required to know Allah. The spiritual journey has tended to be more inward, in keeping with the Persian proverb "Knowledge of self is knowledge of God."

So while Iranians at first were open to the idea of an increased role of Islam in public life, they weren't prepared for it to be forced on them with such rigor, especially given the Koran's specific instruction that there should be "no compulsion in religion." They certainly didn't expect the clerics to take over commerce, government administration, the courts, and day-to-day life, down to and including how to go to the bathroom and how to have sex. Punishments reminiscent of the Dark Ages—public stonings, hangings, the cutting off of fingers and limbs—were put into effect. The central government now discourages some of these archaic practices, but stubborn conservative mullahs out in the provinces cling to the old ways. Beneath it all is the spiritual aim to serve Allah and prepare for paradise.

"They're forcing heaven on me!" Ali said.

At his home one night, half a dozen friends sat in a circle and confided how awful it was to be trapped in an environment of fear and secrecy, not knowing if a friend or a loved one has been put in a position to make reports on what you're thinking and saying and doing.

"The ayatollahs and the ordinary people—everyone has to pretend," said a soft-spoken locksmith with a huge mustache named Mister D. "You don't know who is telling the truth; you don't know who is really religious and who isn't."

The Persians have a saying: The walls have mice, and the mice have ears.

"You can't trust your own eyes," Ali said.

"If you breathe in or breathe out," Mister D said, "they know."

An irony is that the Islamic revolution—at times referred to here as the "second Arab invasion"—appears to have strengthened the very ties to antiquity that it tried so hard to sever.

THE GENERATION OF THE REVOLUTION

As for the revolution's effect on Persian identity? A typically Iranian thing seems to have happened.

For ten years the doors to the West were closed, and conservative clerics running the government went about trying to minimize any cultural identification that was pre-Islamic, a period referred to in much of the Muslim world as *Jahiliya*, age of ignorance. In official documents, where possible, references to Iran were replaced with references to Islam. Zoroastrian symbols were replaced with Islamic symbols, streets were renamed, and references to the Persian Empire disappeared from schoolbooks. For a time it seemed that Ferdowsi's tomb—a big, pale-stone mausoleum outside the holy city of Mashhad, with a beautiful reflecting pool leading up to it and chirping birds racing about the columns—might be destroyed. Even Persepolis was in danger of being razed. "But they realized this would unite the people against them," Ali said, "and they had to give up."

The people had welcomed the removal of cultural junk from the West, said Farin, the drama professor, as we sipped tea in her tasteful Tehran apartment. "But we soon realized that the identity the government was introducing also was not exactly who we were." In the cultural confusion, "elements of the old culture"—traditional music, Persian paintings, readings from Ferdowsi—were rekindled. "We call it 'the forgotten empire.'"

A young underground Persian rap singer named Yas joined us then. He had black spiky hair, stylishly long sideburns, handsome eyebrows shaped like two black bananas, and around his neck he wore a silver *fravahar*, the Zoroastrian winged disk that signifies the soul's upward progress through good thoughts, words, and deeds. He's part of the Generation of the Revolution, who grew up after 1979 and account for more than two-thirds of the country's 70 million people. Various described as jaded and lacking belief in their futures—"a burned generation," as Kurdish filmmaker Bahman Ghobadi put it—they are increasingly leaving for Europe

and elsewhere. Some have a rich consciousness of their Persian past while at the same time supporting the idea of Islamic unity; some feel only Persian or only Islamic; and others immerse themselves in Western culture through television programming received on illegal satellite dishes. Farin said: "They're schizophrenic."

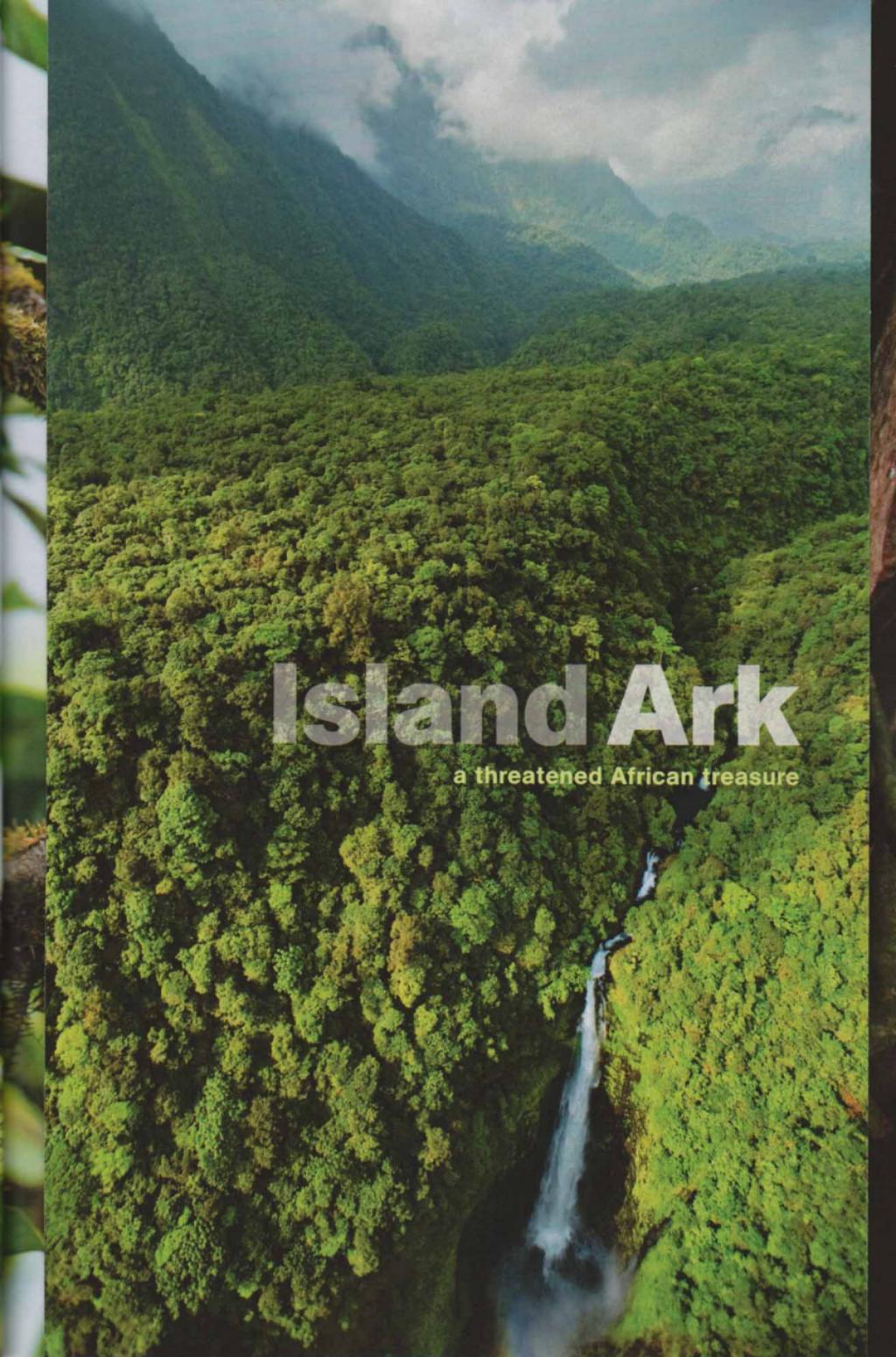
Yas raps about Persian poets, grandparents, and the history of Iran. One of his most popular cuts, "My Identity," was in response to the movie *300*, about the famous battle at Thermopylae between the Spartans of Greece and the so-called Persian immortals. "The Greeks were portrayed as heroic, innocent, and civilized," Yas said. "The Persians were shown as ugly savages with a method of fighting that was unfair." The movie set off a tirade from Iranians here and abroad, who experienced it as a cultural attack. In defense, Yas rapped about Persepolis and Cyrus but also chastised his fellow citizens for resting on the laurels of greatness past.

An irony is that the Islamic revolution—at times referred to here as the "second Arab invasion"—appears to have strengthened the very ties to antiquity that it tried so hard to sever; it has roused that part of the national identity that remains connected to the idea, memorialized in places like Persepolis and Pasargadae, of Iranians as direct descendants of some of the world's most ancient continuous people. A civil engineer named Hashem told me of a recent impromptu celebration at Cyrus's tomb. People text messaged each other on their cell phones, and a couple of thousand "coincidentally" showed up, buying multiple entrance tickets to support restoration of the tomb. The celebration was informal. No speeches, no ceremony. "Just to honor Cyrus and show solidarity."

As Farin put it, shaking her lowered head with an air of world-weariness, "there has been this constant onslaught on our identity, and the reaction has always been to return to that deepest identity. Inside every Iranian there is an emperor or an empress. That is for sure." □

◀ Persian Excursion Explore artifacts and ruins from bygone eras in our photo gallery at ngm.com.



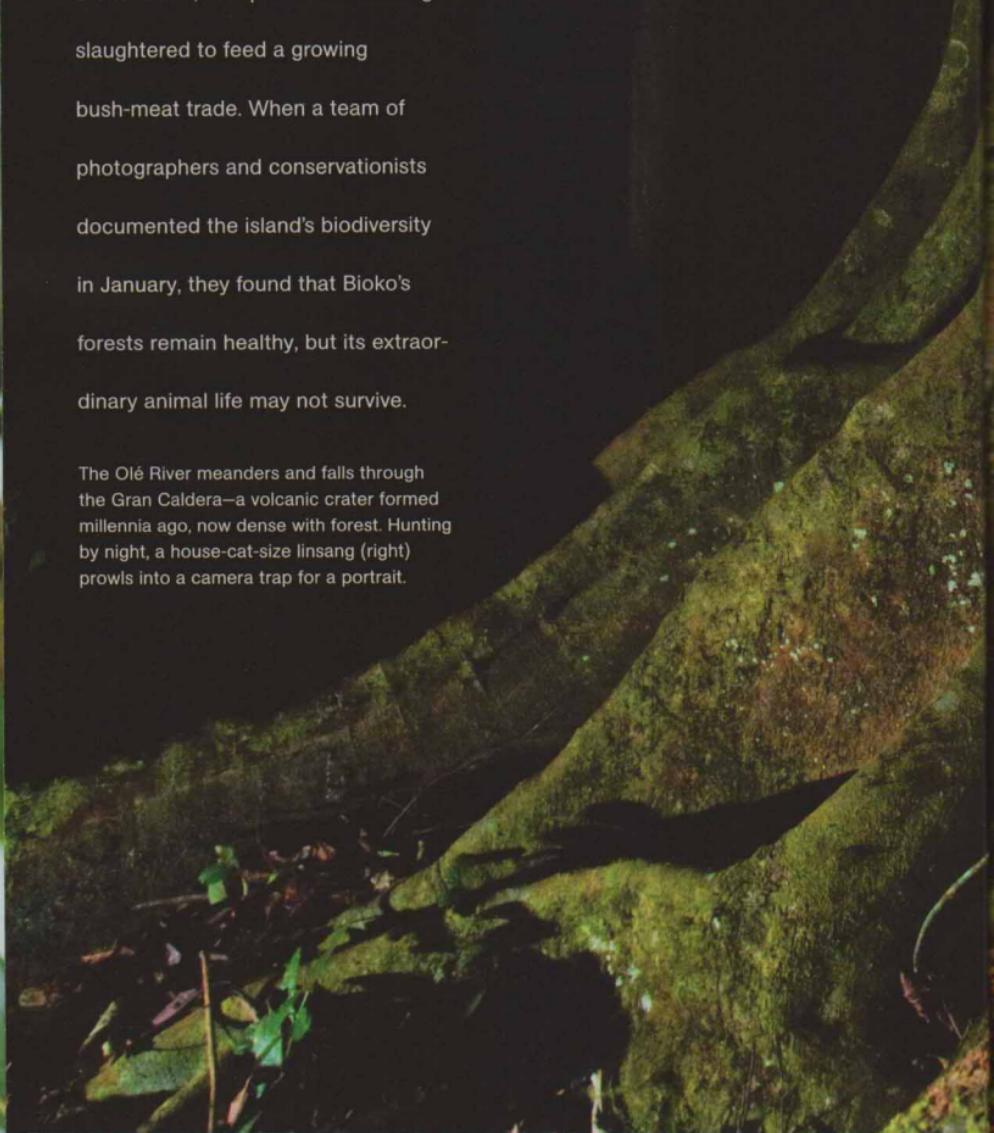
The background image shows a dense, green forest covering rolling hills and mountains under a cloudy sky. A waterfall is visible in the lower right foreground, cascading down a rocky cliff. The overall scene is one of natural beauty and environmental significance.

Island Ark

a threatened African treasure

On West Africa's stunningly diverse Bioko Island, rare primates are being slaughtered to feed a growing bush-meat trade. When a team of photographers and conservationists documented the island's biodiversity in January, they found that Bioko's forests remain healthy, but its extraordinary animal life may not survive.

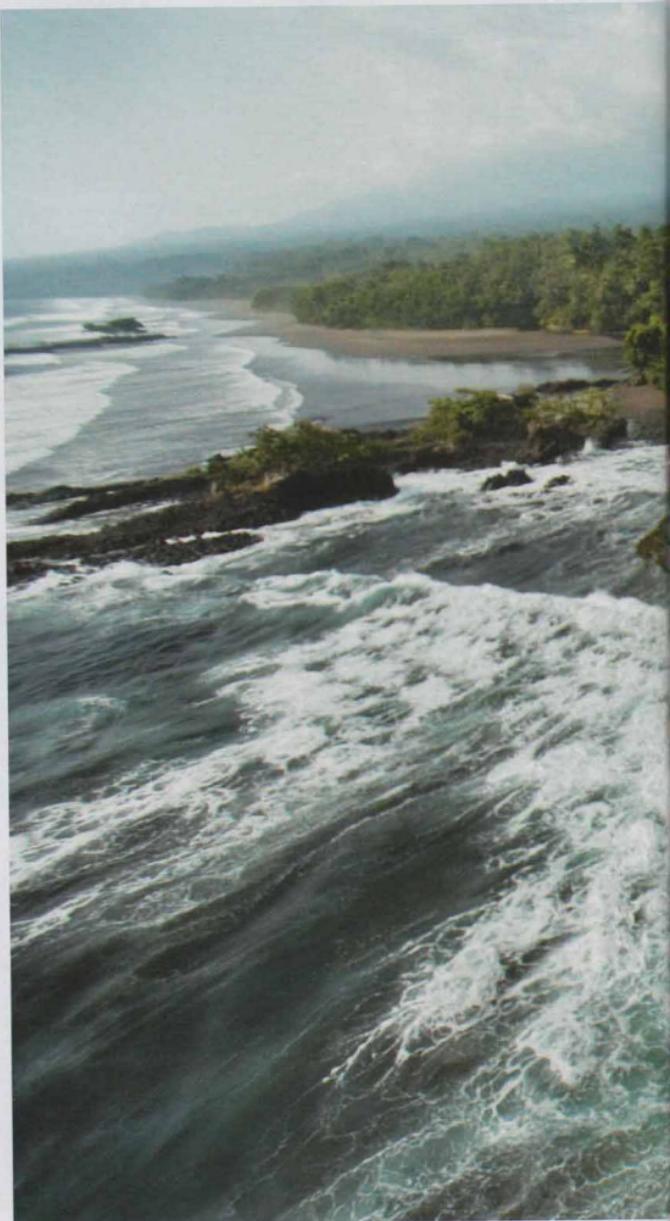
The Olé River meanders and falls through the Gran Caldera—a volcanic crater formed millennia ago, now dense with forest. Hunting by night, a house-cat-size linsang (right) prowls into a camera trap for a portrait.

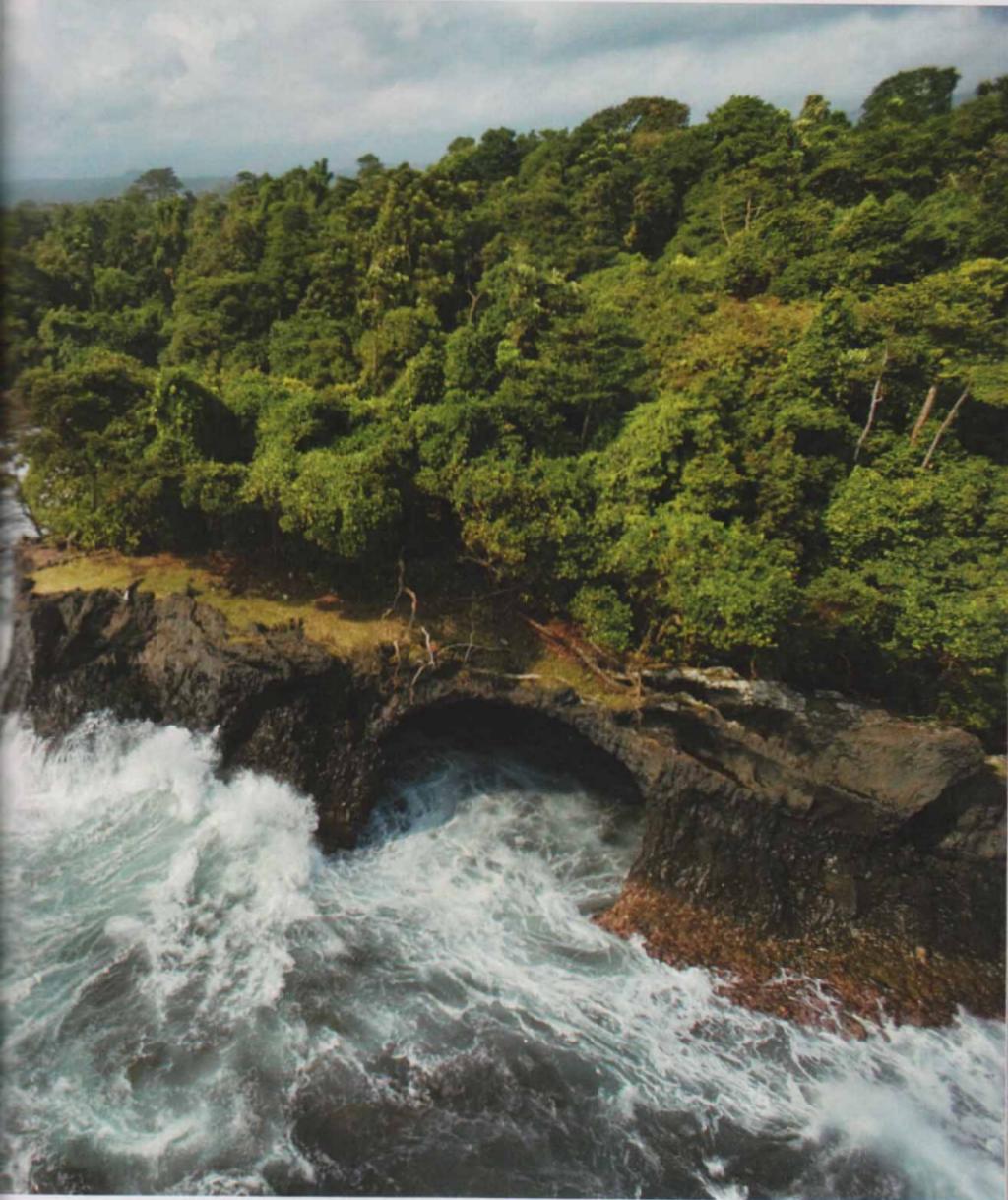




CHRISTIAN ZIEGLER; TIM LAMAN (FLAP, LEFT)

Twenty miles of ocean, rocky headlands, and boat-beating surf—like that pounding Point Dolores here on the southern coast—have helped keep Bioko wild. Most of the island's estimated 150,000 people live in Equatorial Guinea's capital city, Malabo, in the far north.





TIM LAMAN

By Virginia Morell

**Photographs by Tim Laman,
Ian Nichols, Joel Sartore,
Christian Ziegler**

NIN THE YEAR 1551 a strange male animal was put on public display in Augsburg, Germany. He had humanlike fingers on his hands and feet, observers noted, and a "cheerful nature," although he also had a tendency to turn his backside to viewers. Based on an illustration of the creature, biologists think it was most likely a drill (*Mandrillus leucophaeus*), a baboonlike primate. Even today, more than 450 years later, drills are studied so infrequently in the wild that when a small team of biologists recently spotted a troop of them on Equatorial Guinea's Bioko Island, they collectively gasped, then sat down on the rain forest floor to watch.

The drills, the largest primates on Bioko, were climbing and feeding in a fig tree at the floor of the island's 7,000-foot-high Gran Caldera. Earlier that morning the scientists had spotted troops (each five to thirty strong) of chattering monkeys: red-eared, black colobus, and red colobus, the latter one of the most threatened of all primates.

Biologists regard Bioko Island as a living laboratory for studying how plants and animals evolve in isolation. It lies in the Gulf of Guinea, 20 miles off the west coast of Africa, one of four islands in an archipelago. The three others—São Tomé, Príncipe, and Annobón—are deepwater isles formed tens of millions of years ago and colonized by plants and animals from Africa that arrived on their shores by chance.

Bioko, however, was connected to the African mainland during each ice age, most recently about 12,000 years ago. Like an exclusive ark, the island shelters an isolated set of subspecies evolved separately from those on the mainland. There are seven species of monkeys, including the drills; four galagos (bush babies); two small antelopes (duikers); one species of porcupine; one species of tree hyrax; one species of pouched rat; and three species of scaly-tailed squirrels. There are catlike linsangs (but no lions or leopards). The roster once included forest buffalo, but they were hunted to extinction a century ago.

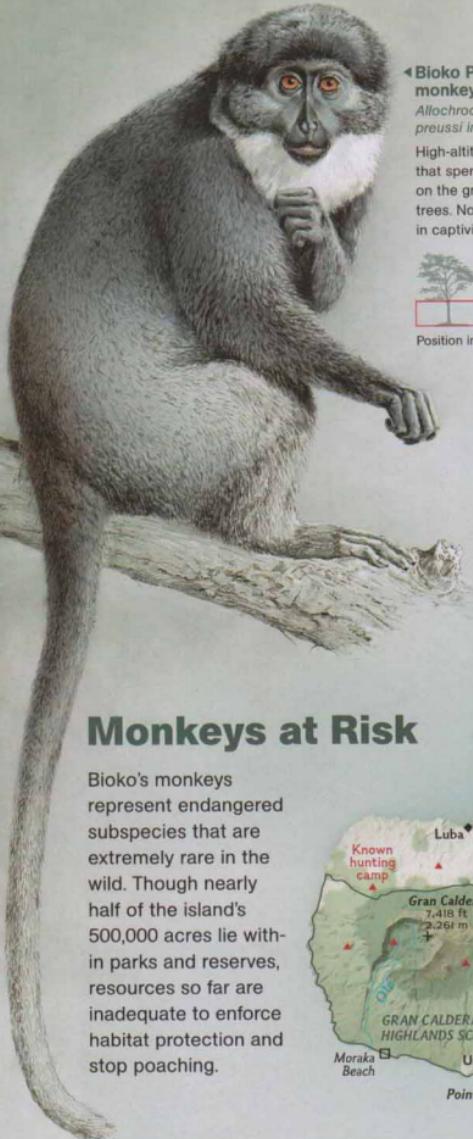
Add orchids, land snails, freshwater fish, amphibians, spiders, and insects—all evolving apart from their mainland relatives. In the island's interior, woodlands, grasslands, and rain forest remain much as they were when the first Portuguese explorers stepped ashore in the

■ Society Grant This research project was funded in part by your Society membership.



Island residents help land supplies on Moraka Beach in preparation for biodiversity surveys and the photographic blitz. Eyes trained on the treetops, Drexel University biologist Gail Hearn has been tracking Bioko's primate populations for a dozen years. "It's so lush here it's overwhelming," she says, "a real monkey paradise." And unlike so many ecosystems worldwide, "humans are still in a position to save it."

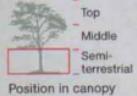




◀ Bioko Preuss's monkey

Allochrocebus preussi insularis

High-altitude monkey that spends more time on the ground than in trees. No populations in captivity.



Position in canopy

Bioko red-eared monkey

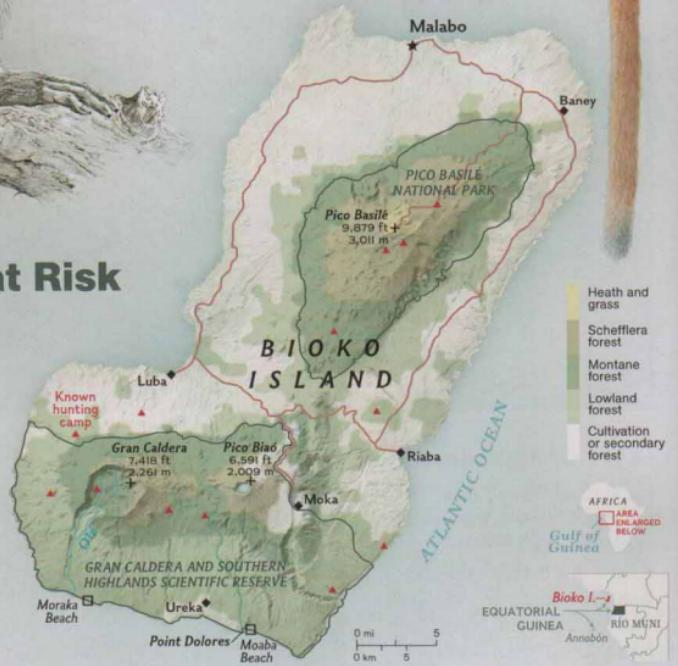
Cercopithecus erythrotis erythrotis

Tolerates light farming and selective logging. Common on Bioko, but mainland range very limited.



Monkeys at Risk

Bioko's monkeys represent endangered subspecies that are extremely rare in the wild. Though nearly half of the island's 500,000 acres lie within parks and reserves, resources so far are inadequate to enforce habitat protection and stop poaching.



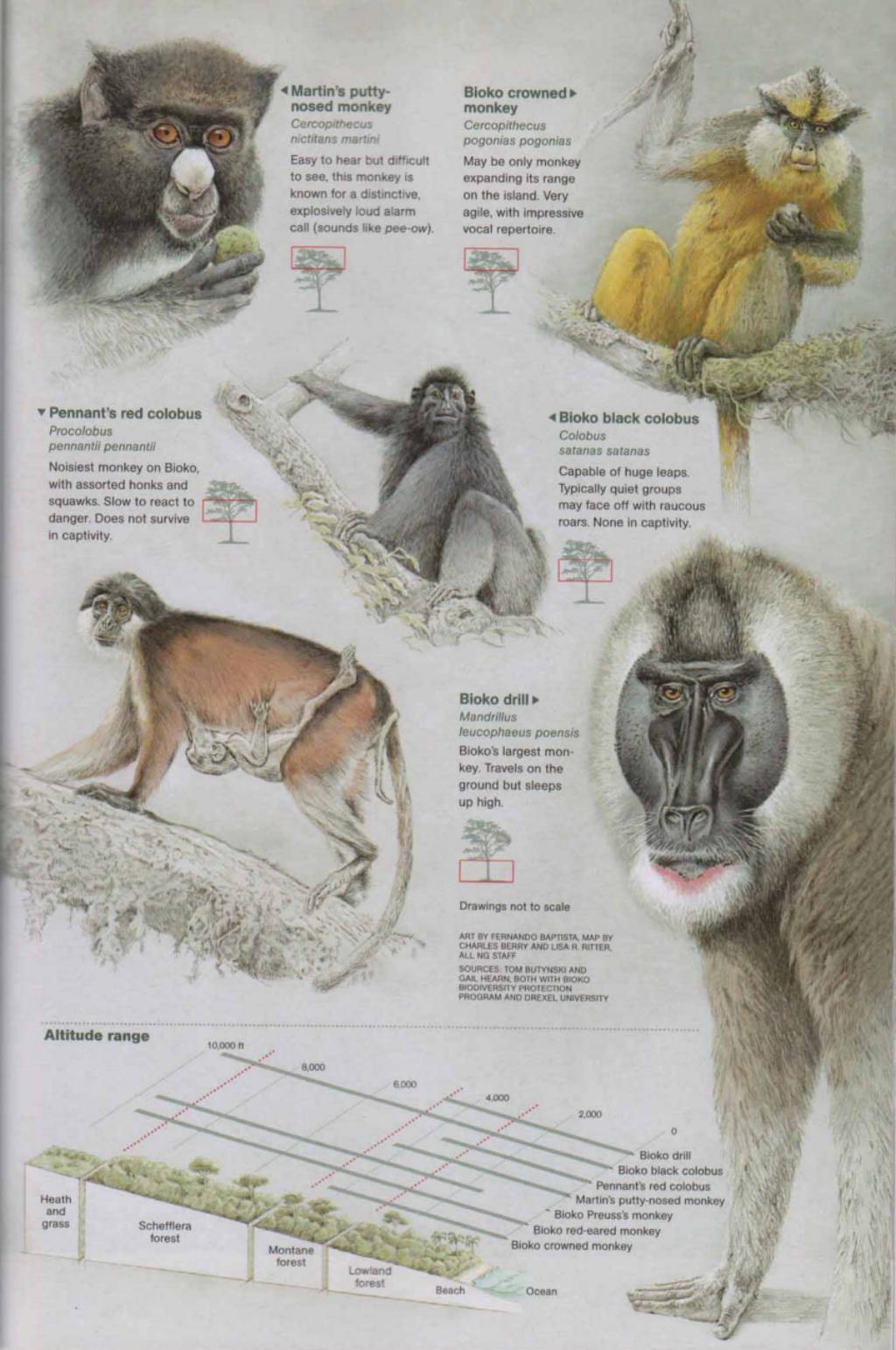
Distribution



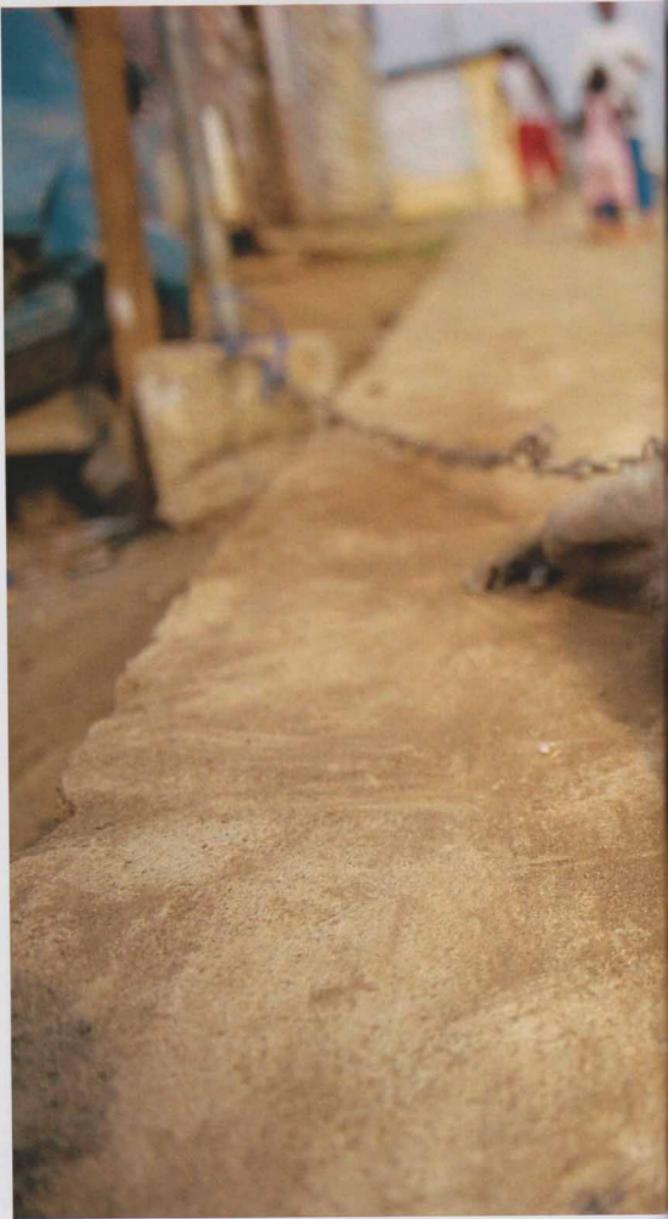
Group size

	5-25	5-25	2-12	5-25	5-25	3-12	8-30
Size							
WEIGHT (lb)	7-11	5-7	7-12	5-7	10-14	6-10	16-29
BODY (in)	15-18	14-16	15-20	14-17	17-21	15-17	20-27
Male							
Female							





Chained to a post in Malabo, where the bush-meat trade thrives, this orphaned drill may be sold as a pet, or become dinner for its captors. Bioko's drill population shrank by a third from 1986 to 2006.





Oil and natural gas have brought new wealth to the island.



Shoppers spend over \$200 for a large male drill at the Malabo market, paying extra to have the fur singed off on-site. Chicken and other protein sources are readily available, and far cheaper than bush meat.

15th century: largely untouched and beautiful.

"It's as close to pristine as any place I've seen," said Gail Hearn, one of the researchers leading the expedition into the Gran Caldera—her 13th trip into its forested depths. A primatologist at Pennsylvania's Drexel University, Hearn made her first trip here in 1990, intending to start a long-term study of the Bioko Island drills. Instead, "I just fell in love with the whole place," she said. "We've done so much damage to this planet. Here it's undamaged and impossibly beautiful. It feels like a place where one person could make a difference."

Hearn organized the Bioko Biodiversity Protection Program (BBPP). Each January she brings together teams of scientists and

American and Equatorial Guinean students for comprehensive biodiversity surveys. This year a team sponsored by *National Geographic* magazine, Conservation International, and the International League of Conservation Photographers joined her for a 12-day RAVE (Rapid Assessment Visual Expedition) to document as many monkeys as possible, along with the rest of Bioko's stunning variety of other species—a richness protected by the island's history but now threatened by rampant hunting.

Bioko's flora and fauna so impressed the first European visitor, 15th-century Portuguese explorer Fernão do Po, that he named the island Formosa, "beautiful." Europeans who followed wanted to plant their first African colony here.

People who love the taste of monkey meat now have the cash to buy it.

The indigenous Bubi people, however, who had arrived from mainland Africa, refused to cooperate with the white-skinned arrivistes, scuttling every attempt at European settlement until 1827. That year Britain established a base at Malabo (now Equatorial Guinea's capital) to combat the West African slave trade. Spain, which later colonized the neighboring mainland region of Río Muni, ultimately gained control of both colonies. The two together, called Spanish Guinea, gained independence from Spain in 1968 and emerged as the Republic of Equatorial Guinea.

Settlers from the mainland belonging to the Fang ethnic group took control from the Bubi, and since the Spanish left, Bubi separatists have clashed often with government forces. Neither the Fang nor the Bubi locals, accustomed to hunting the island animals for food, share the scientists' appreciation of Bioko's unique biodiversity. Further thwarting conservation efforts is a burgeoning offshore oil industry. Vast stores of oil and natural gas were discovered in the last decades of the 1900s, and now American corporations are pumping some 400,000 barrels of oil and natural gas a day, bringing new wealth to the island. More and more people who love the taste of monkey meat have the cash to buy it.

PRIMATOLOGIST TOM BUTYNISKI, senior conservation biologist on the expedition, first visited Bioko in 1986 in response to an International Union for Conservation of Nature report that identified the island as an important place to survey for monkeys. At the time, no biologist had visited for more than two decades, and Butynski expected to find the monkeys hunted nearly to extinction.

Instead, he found them thriving. It turned out that to prevent Bubi uprisings the Fang government had confiscated the islanders' shotguns from 1974 to 1986, which had given the primates a reprieve. Further, large tracts of lowland rain forest that the Spanish had cleared for cocoa plantations were returning to forest after the plantations were abandoned.

Monkeys were busy recolonizing the forests.

"We saw about two troops a kilometer in the Gran Caldera transect," Butynski said. The monkeys were abundant, and they were fearless. "I remember thinking how naive they were. We were able to get good, close-up looks."

But there were ominous signs as well. During the same ten-week survey, Butynski spotted 14 Fang hunters with shotguns and saw numerous traps set for duikers, monkeys, and smaller mammals. Around the same time, bush-meat sales increased in Malabo. As in much of West Africa, bush meat, from wild animals in the forest, particularly from monkeys, is prized as a delicacy, even though it costs much more than chicken in local markets.

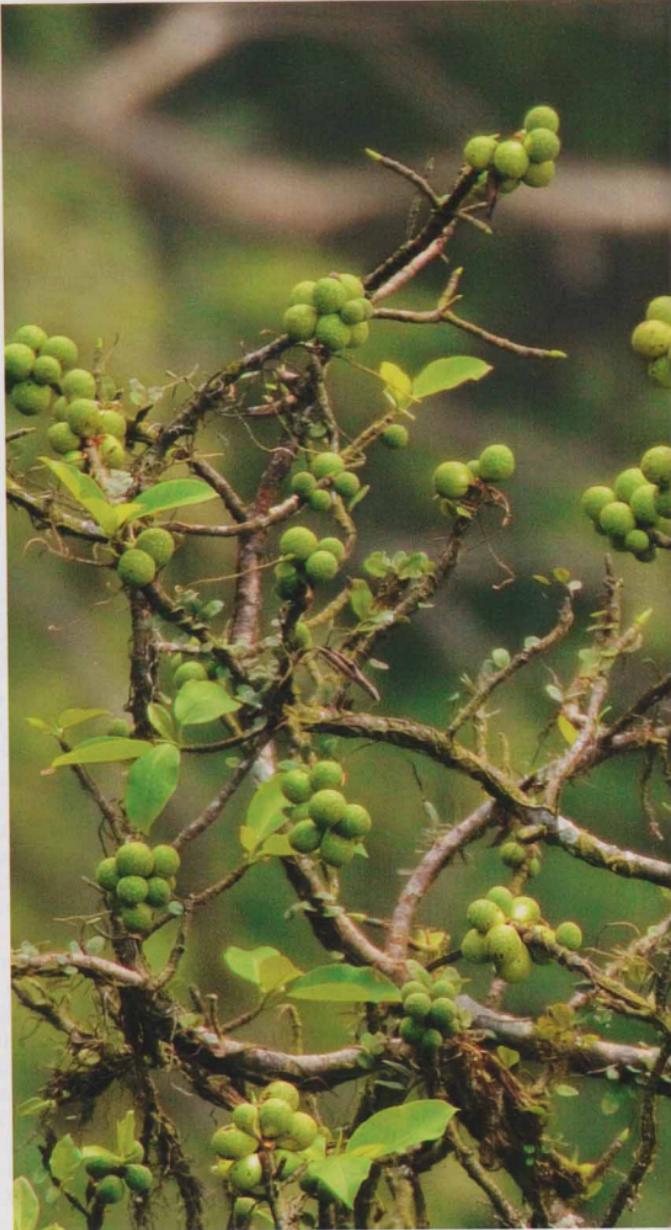
The steady slaughter of monkeys has taken its toll. By the time of this year's BBPP survey, hunters had wiped out many of the monkeys at the northern end of the 780-square-mile island, including those in a national park. They had also started shooting the monkeys in the Gran Caldera and Southern Highlands Scientific Reserve at the south end of the island, where villagers aided by the BBPP monitor monkey numbers.

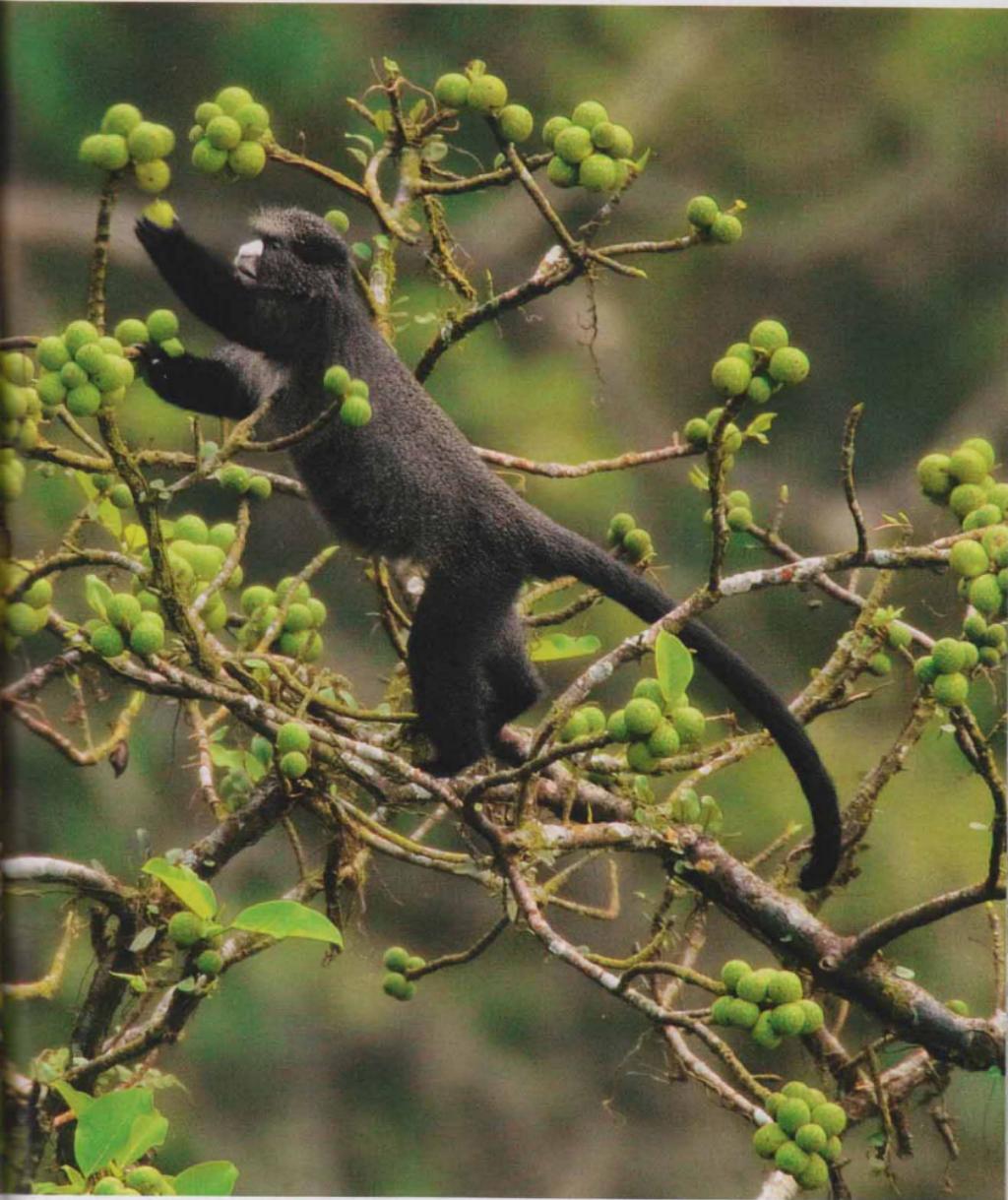
Over the past decade BBPP staff have recorded the number of monkeys in the meat markets, and the tally had reached more than 20,000 by the end of March 2008. Tens of thousands of other animals have ended up there too. It is clear that all seven monkey species are in danger of becoming extinct, and that the Equatorial Guineans could well eat their way through the island's fabled biodiversity.

Documenting the carnage has had some effect. In October 2007 the BBPP convinced Equatorial Guinea's president, Teodoro Obiang Nguema Mbasogo, to issue a ban against the hunting, selling, and consumption of primate meat. It had been in place for two months

Author Virginia Morell writes regularly about science and natural history. Christian Ziegler specializes in ecology and conservation of tropical rain forests. Joel Sartore and Tim Laman are veteran shooters for the Geographic; Ian Nichols is currently on assignment photographing chimpanzees in Congo.

A thickly fruited fig tree provides nourishment for a Martin's putty-nosed monkey. The rainy season lasts nearly all year in Bioko's south; more than 400 inches of annual rainfall in some spots help a diverse garden grow.





TIM LAMAN

"Here it's undamaged and impossibly beautiful. It feels like

when the BBPP team arrived in January. How were the monkeys faring? And how would they react to humans who wanted to count rather than shoot them? It didn't take long for the biologists to find out.

IT WAS DUSK, A TIME WHEN monkeys chatter as they settle in for the night, but the caldera forest was oddly quiet. Butynski had anticipated an especially lively chorus because all seven monkey species live in the caldera. But there was little to hear aside from the trilling hum of insects and frogs. Butynski kept to a trail, stopping every 50 feet or so to look and listen. "Well," he said at last, clearly baffled, "maybe the monkeys have moved to another part of the forest for the night."

No sooner had he finished speaking than two fur bombs the size of large dogs hurtled overhead. They splashed into the leafy crown of a nearby tree and then plunged into another, as if diving from one green pool to the next. Finally, having uttered not a single call, they disappeared over the edge of a river gorge and into the forested twilight.

Butynski, who has made dozens of primate surveys throughout Africa, pulled out his notebook to record the sighting. "That's a surprise—two drills," he said. "They must have been in the trees sleeping when they heard my voice."

The next morning Butynski set out into the caldera again. The instant he spotted a troop of red-eared monkeys, they began to give *hak* calls and chirps, eyes wide with terror. Mothers clutched babies to their breasts; branches bounced and limbs heaved as the monkeys scurried to get away.

Such fleeting glimpses were all the scientists came to expect. In the first three days of the survey, as the team hiked from the island's southern shore 2,000 feet up the caldera, all the monkeys they spotted gave alarm calls before vanishing into one of the steep river gorges that cut through the caldera.

On the fourth day, however, the monkeys were less afraid. After hiking up and down steep, muddy trails littered with rough lava cobbles,

the team reached the caldera's northern end, its inner sanctum. Bioko receives more than 400 inches of rain a year, and although this was supposed to be the dry season, daily thunderstorms unleashed torrents. Between storms, the sun shone fierce and bright, and large beads of sweat rolled off everyone's foreheads and noses.

Despite increased hunting, the forest canopy in this distant part of the crater fairly exploded with monkeys. In their leafy shelter a dozen red-eared monkeys leaped in alarm, trailing their long copper-colored tails along the branches and shouting their nasal call of warning. Forty feet farther on, a smaller group of gnomelike black colobus interrupted their leaf breakfast to race away. Just beyond them, a single charcoal-colored Preuss's monkey jumped from a low bush where he'd been feeding into a towering mahogany tree, then leaped into a neighboring tree, his dark tail curled in a shepherd's crook over his back. In the distance troops of red colobus gave *honk* calls, and crowned monkeys made their throaty *booms*.

Occasionally, red Ogilby's and blue duikers crashed through the tangled undergrowth. Dozens of butterflies in brilliant hues and patterns to rival a Missoni gown flitted along the trail, while *Jurassic Park*-size earthworms and millipedes slithered into damp ravines, and pairs of gray parrots pirouetted in the sky.

Butynski jotted down each monkey troop and duiker, and stopped to inspect flowers, leaves, and fruits that monkeys had nibbled. Sometimes a strong, ammonia scent filled the air—the calling card of a troop of red colobus, one of the rarest of Bioko's monkeys. But it was the drills—even scared drills—that we all most wanted to see.

Finally we spotted a small troop of drills below us on the far side of a river feeding in a tree. The distance and rushing water extinguished the sounds and smells of our little clutch of humans, and the drills went about their business as if we weren't there. This was when we sat down to watch.

All had bushy, gray-brown pelts, and all but one were adult females or adolescents. The

a place where one person could make a difference.” —GAIL HEARN



As tiny leatherback turtles scramble from their nest on Moaba Beach, researchers Daniel Fitzgerald and Shaya Honarvar count 48 hatchlings. Instinct sends the young seaward (right). Those that manage to elude hungry shorebirds and crabs face a gauntlet of predators in the open ocean. Isolated Bioko Island is an ideal research site—and a haven—for the four endangered sea turtle species that nest on its shores.





FRUIT BAT (*LYSSONYCTERIS* SP.)



GECKO (*HEMIDACTYLUS FASCIATUS*)



TUSSOCK MOTH CATERPILLAR (FAMILY LYMANTRIIDAE)



FLOWER (*ROTHMANNIA* SP.)



BIOKO ALLEN'S GALAGO (*SCIUROCHEIRUS ALLENI ALLENI*)



A bush baby gazes from its sleeping tree with eyes that suit its nocturnal lifestyle. This one-pound primate subspecies is unique to Bioko. Hunters rarely take them, but biologists can't ignore them. "They'll sit on top of your tent and screech all night," says Gail Hearn. Bats (left, at top) share the bush babies' hours. Daylight brings out geckos, bugs, and blooms.

It was dusk, when monkeys chatter as they settle in for the night.



Slow to leap, and an easy target for poachers, the Pennant's red colobus ranks among the world's most endangered primates. Preserving its island sanctuary demands good science—and law enforcement.

sole adult male was nearly twice as big as the others. He was simultaneously muscled and rotund, his Buddha belly at odds with his sharp-featured, obsidian black face. So sculpted were the angles of his cheeks, brows, and nose that he looked as if he wore a mask. White fur bristled around his face; his rump shone red, blue, and purple. Whenever he moved, the other drills got out of his way. At last, when they had eaten their fill, the troop clambered down the tree and vanished into the shadowy forest.

"Isn't it remarkable?" Butynski said after the last drill was gone. For nearly 30 minutes the biologists had been able to observe monkeys that weren't frightened of humans. "No one has studied the ecology and behavior of these

animals in the wild," he said. "But that might be possible here now: Someone could habituate a troop of drills to humans and start a long-term study."

Even with the number of dead monkeys that the BBPP staff had counted in Malabo's market, the northern caldera survey revealed a substantial and healthy primate population. "They're certainly not naive anymore, and they're not as abundant as in 1986, but they're still in relatively good numbers," Butynski said. His calculations suggested that the caldera's forest shelters a little more than one monkey troop a kilometer. "It's a much lower rate of encounter than what we recorded in 1986," he noted. That year there were almost twice as many monkeys.

but the forest was oddly quiet—just the trilling of insects and frogs.

Nevertheless, Butynski remains hopeful. "The forest is still intact, even in places where there aren't monkeys now," he said.

Intact habitat is key for Bioko's monkeys. Most species go extinct for one of two reasons: overhunting or loss of habitat. It's far easier to control the first problem, Butynski said, than to rectify the second. "Bioko is not like parts of East Africa, where people have cleared the forest to the mountaintops for agriculture. Even still, in East Africa people seldom hunt monkeys."

"I'm an optimist," he continued, taking a seat on a slope overlooking the caldera's rugged rim and vine-draped woods. Recent monsoon winds and rainstorms had left parts of the forest flattened like wilted salad. Above the rumpled greenery, red-brown African mahogany trees rose at random, their trunks tall and straight, their limbs sagging with the weight of orchids and ferns. "Just look at those mahoganies. Anywhere else, they would have been logged long ago. This place is just too remote and difficult for large numbers of hunters to get to. It's what keeps the monkeys relatively safe."

Hearn, who hiked into the caldera a few days later, is not so sure. "We used to think the monkeys were safe here, that it was just too far for the hunters to travel. But it isn't."

On a camp table she unrolled a topographical map of the Gran Caldera and surrounding area. "See this area? It's not that far from the northern edge of the crater."

Hearn thinks the hunters probably use some of the trails the BBPP has cut over the years. "They know it's a protected area, but there's no law enforcement, so they come right in and shoot monkeys and duikers," she said. "In the Malabo market they'll even tell you brazenly, 'It's a Gran Caldera monkey.'"

For the first two months after the ban on primate meat was announced, monkey carcasses vanished from the market. You could still buy all the duikers, pangolins, pythons, pouched rats, and porcupines necessary to make a fancy stew—but not monkeys.

Part of the presidential edict explains that monkey meat is unsafe because "primates are

carriers of epidemics and other pathologies" that can infect people. (Indeed, epidemiologists have found several simian immunodeficiency viruses in western and central Africa primate species, among which the precursors of HIV-1 and HIV-2 have been identified.) Hearn thinks the health risk may have discouraged the trade. "No one is going to serve their family meat that could make them sick," she said.

Back in Malabo, Felix Elori, a former monkey hunter now employed in the oil industry, shook his head at Hearn's suggestion. "Monkey meat is something we've eaten since we were young; it has a good flavor and isn't bad for you," he said. "It's never made us sick."

Elori doesn't eat monkey meat himself, though. Two female drills he'd killed had babies, a male and a female. He had nursed and raised them; now his sister keeps them in a cage. "I can't eat monkeys anymore. They look like people. And anyway, it's more economical to eat chicken."

Did we want to buy the two young drills? he wondered.

Elori thinks the whopping fine—as much as a thousand dollars—is the best reason to forgo hunting monkeys. But after the two-month lull, the trade in monkey meat may be resuming. The day after Hearn and Butynski returned with the expedition to Malabo, a drill and two red colobus went up for sale. They'd probably been killed near the caldera.

Hearn's face fell at the news. "It shows the ban alone is not enough. It's going to take law enforcement and armed forest patrols," she said. "At least they've taken the first step."

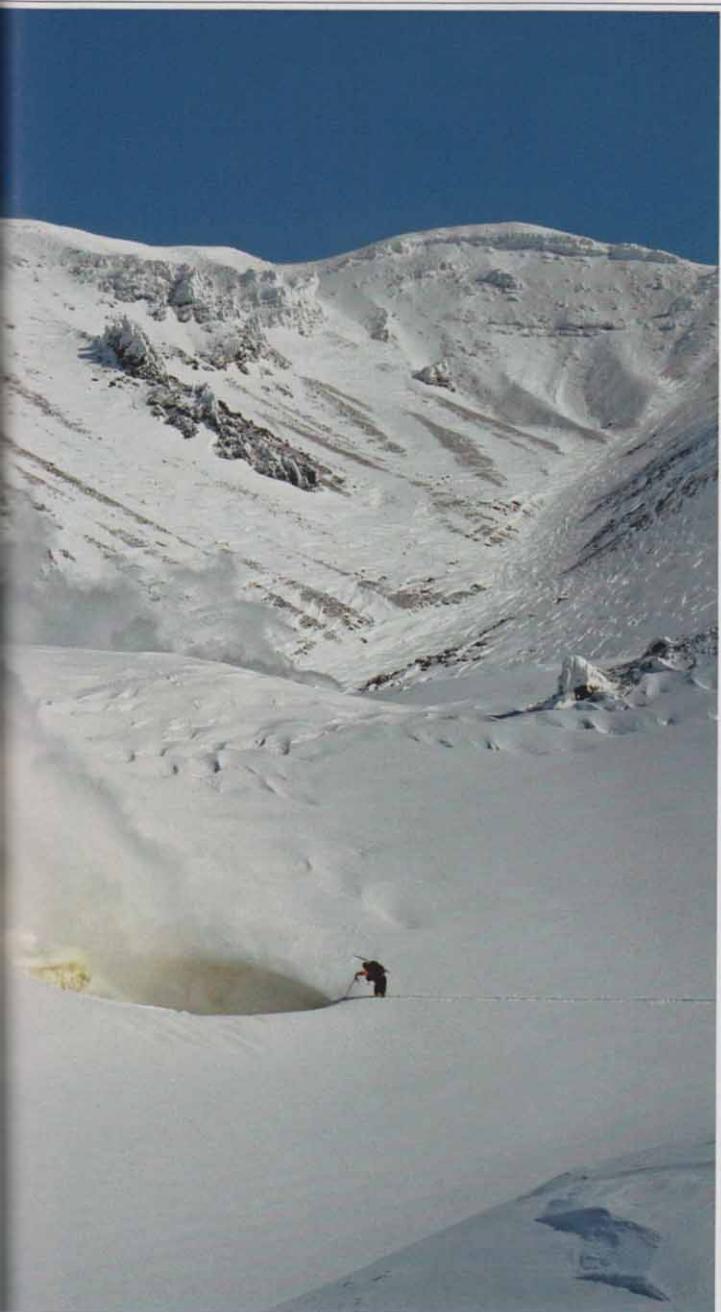
If the hunting can be stopped for good, monkeys may return to all of Bioko's forests. The caldera populations will serve as the source, Butynski says, and scientists, students, and the people of Bioko will have a rare chance to watch a natural experiment take place: monkeys reclaiming their ranges of old. □

► **RAVE Reviewed** Follow four National Geographic photographers on the Rapid Assessment Visual Expedition to Bioko Island in a video, at ngm.com.

daisetsuzan



(big snow mountain)

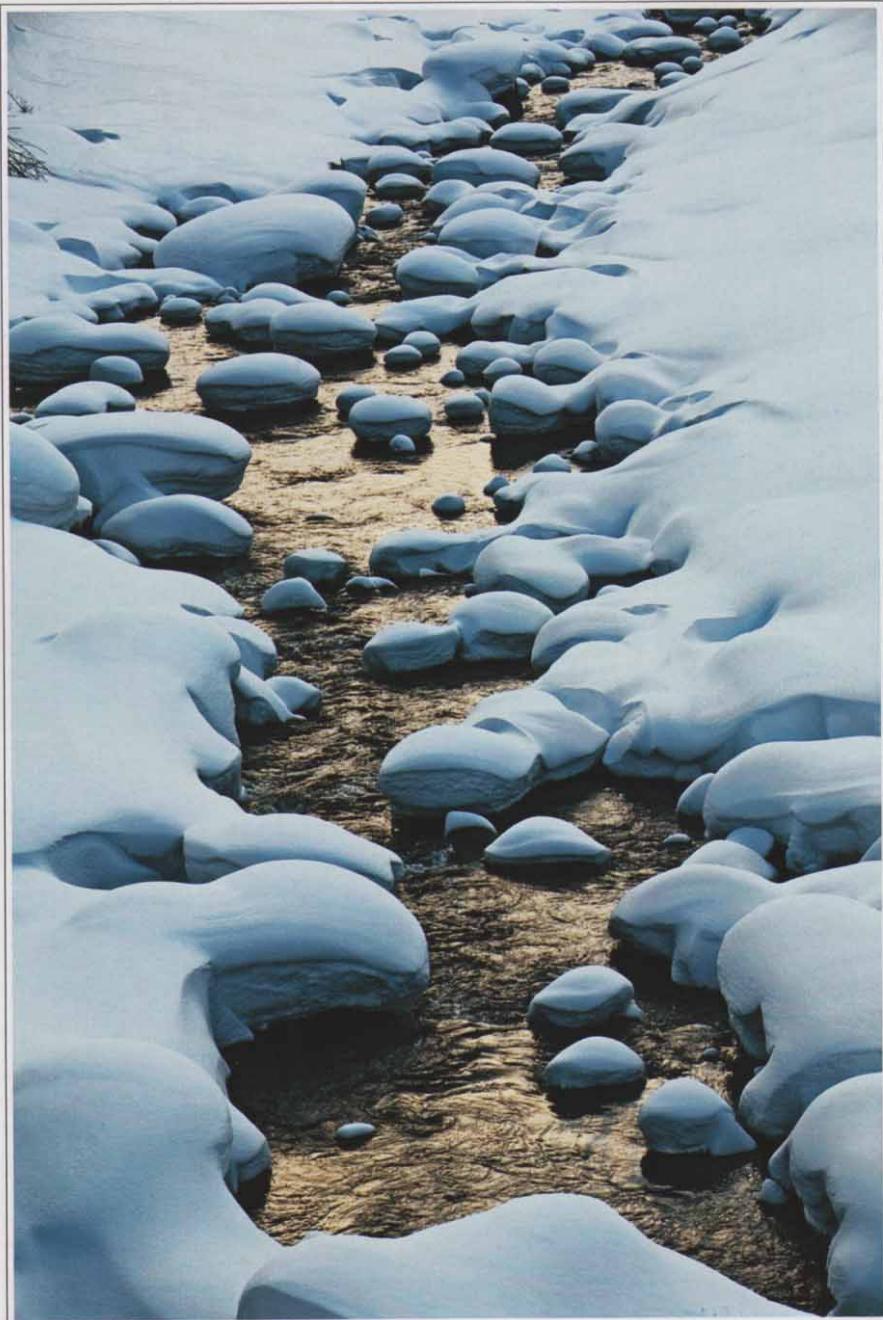


SULFUROUS FUMAROLES ON ASAHI DAKE MARK THE FIERY HEART OF JAPAN'S LARGEST AND WILDEST NATIONAL PARK.



FRIGID WINDS FROM SIBERIA SWEEP DAISETSUZAN IN WINTER, ETCHING FAIRIES IN FROST ON A TRUCK WINDSHIELD.







SNOWMELT NOURISHES THE CHUBETSU RIVER, AND MOUNTAIN SPRINGS FEED THE ANGEL'S ROBE WATERFALL

Fire and water collide in Daisetsuzan. Two massive volcanoes pin the national park at the center of Japan's northernmost island, Hokkaido, their steaming peaks dropping off into forested, snow-pillowed, river-washed slopes—half a million acres churned green, orange, red, and white by the seasons.

Japan rose from the sea in seismic violence. Tectonic plates slid and were subducted, mantle rock melted and pooled underground, volcanoes erupted. Quiet for centuries, Asahi Dake, the highest peak in Hokkaido, rises to the north. Tokachi Dake, to the south, last erupted in 2004. In the cold, wet climate of Hokkaido, summits built by Earth's internal fires draw snow, and snow turns to rushing water, forest, moss, and flower. Daisetsuzan means "big snow mountain."

Thick ground cover makes much of Daisetsuzan impenetrable, a self-preserving preserve, untrammeled except for the few specified trails. In a crowded island country—one of the most industrialized and densely populated in the world—the park offers rare open space, its peaks and forests bounded by neatly cultivated fields. The park is a haven for deer, birds, hares, and bears as well as trees, shrubs, and flowers. Japanese backpackers move in silent respect through the massif.

Occasionally in the summer and fall, Michiko Aoki, the daughter of a Buddhist priest, hikes eight hours up and over Asahi Dake, crosses a windy ridge, and descends into a secret valley to visit her boyfriend, who helps monitor the park's Hokkaido brown bears.

Early on a warm autumn day, I join her. As we approach Asahi Dake, the hollow breathing of volcanic vents tells us there is a mountain ahead, but, cloud-wrapped, it eludes us. In the mirrored face of a pond called Sugatami-ike, a distant patch of snow mingles with steam; strings of steam tie Asahi Dake to the *kamuy*, the Ainu spirits that live everywhere.

During the glacial maximum 18,000 years ago, Hokkaido was linked by land bridges to Asia, not Japan, and the ancestors of the Ainu

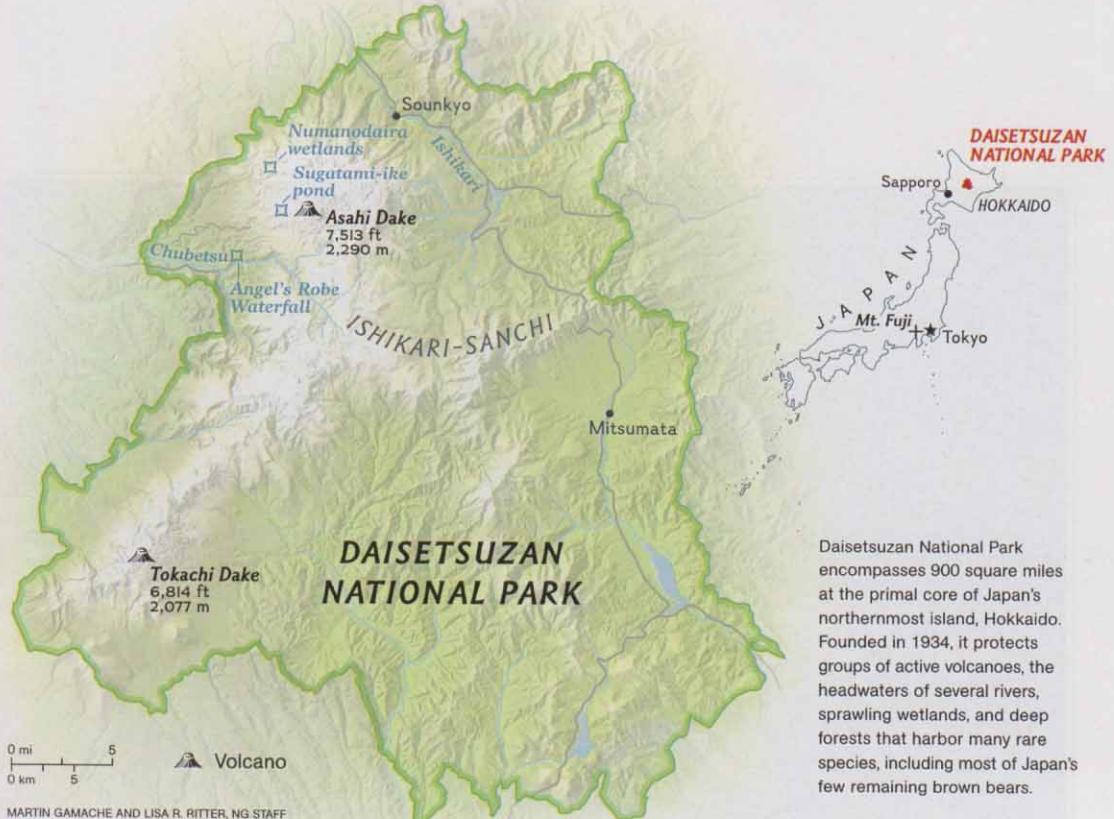
people crossed to Hokkaido. Few indigenous Ainu remain, their forebears having been dispossessed and assimilated by the Japanese. Yet it is impossible to look at these rivers and mountains without thinking of their sacred view of the place.

The Ainu divided their lands into village gathering grounds, or *iwor*, where they fished for salmon, hunted bear, and gathered wood and berries. The living things that sustained them were gods in disguise, spirits visiting the earthly world. Kamuy came as inanimate objects as well: hunting knives and bamboo houses. To return kamuy to the spirit world, the Ainu performed rituals, with gifts of food and prayer. Their central ceremony honored the bear—provider of food, fur, and bone for tools. They called Asahi Dake peak Nutap-kamui-shir, which means "the god mountain which contains the inside area of the bend of the river."

Asahi Dake used to be a perfect cone, but an eruption long ago blew out its flank. The path skirts a chaotic cleft torn by eight sulfur-collared vents issuing steam. An 80-year-old man coming off the mountain tells us that during World War II people gathered the yellow mineral for gunpowder. Michiko and friends, a more fortunate generation, ski the concavity in winter. Now the path is steep with lingering patches of snow. Above, cloud swallows mountain; volcano swallows cloud. Finally the top of Asahi Dake stands clear.

Weekend hikers crowd the summit. They eat ham sandwiches and rice wrapped in seaweed, drink cold tea, and rest rock-sore feet. Fewer come here than to many of Japan's 29 national parks, far fewer than to Mount Fuji. That iconic peak draws a hundred million visitors a year. Daisetsuzan sees just six million, many of whom arrive by bus to soak in autumn's colors. Others test themselves on the slopes of Asahi Dake.

Gretel Ehrlich's most recent book is *This Cold Heaven: Seven Seasons in Greenland*. Michael Yamashita photographed the Basho article in the February issue.



MARTIN GAMACHE AND LISA R. RITTER, NG STAFF

High above the fog, the domed top gives a 360-degree view of the park: mountains and rivers as numberless as dragonflies. One of the rivers is the Ishikari, which a local mayor, Ryutaro Ota, explored in 1910. He begged the government to set aside these mountains and forests lest they be sold to private buyers. Because of Ota's passionate entreaty, in 1934 Daisetsuzan became one of Japan's first eight national parks. No other had wildlife to match Daisetsuzan's, nor backcountry more remote.

The way down is red dust and weathered rock. But soon dappled sun reveals thickets of blue and red berries, flowering white tiger tails, and purple, bell-shaped blossoms that the Ainu once used to make poison for their arrows. A river flows alongside the trail, past *basho* (thread banana) and *fuki* (sweet coltsfoot). Beyond lies the hidden heart of these mountains.

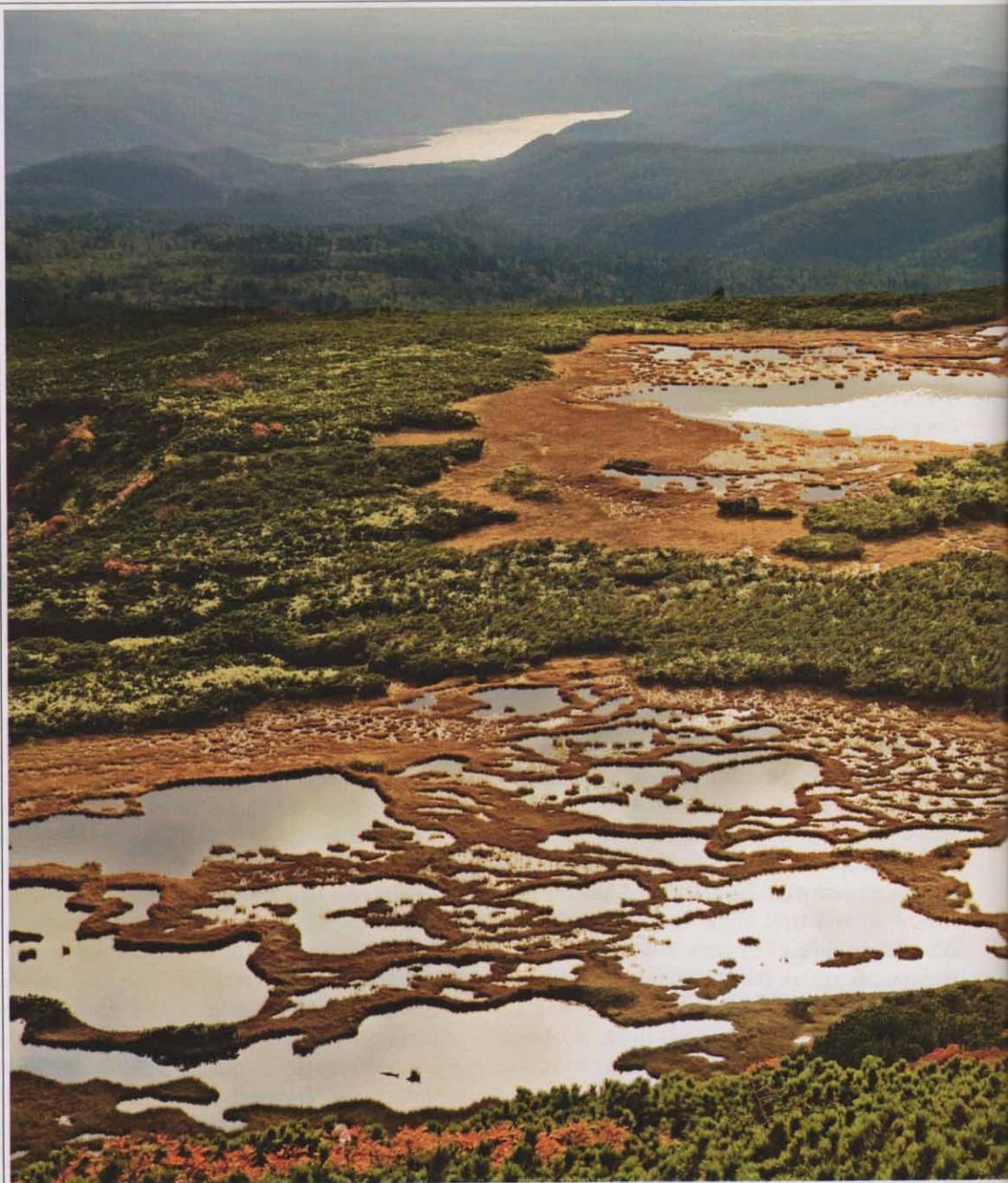
The trail opens into a clearing. A hiker's lodge appears, and then Michiko's boyfriend, Tomohisa Matsuno. "There's one female bear with two cubs

up there," he says, pointing to a far revetment.

Early the next morning we hike up toward the bear pastures. Beyond a last pitch lies an open bowl where the bear has just gone over the mountain. Waiting for her return, we sit all day at the edge of a drying pond, living in Daisetsuzan's trance, brought on by the sweet intimacy of this place. Bears are like mountains—they cannot always be seen. But their presence can be felt. Hours go by. The bear does not appear. Water bugs skate the pond. Time unspools: Preparations for the Ainu's reverential bear-sending ceremony took three years.

A cool breeze spins pond water into spirals, a reminder of typhoons to come. Splotches of red and orange appear in the trees. It is getting too late in the season to call this time summer, and too late in the day to stay. —Gretel Ehrlich

Hike the Backcountry See more images from the trail as photographer Michael Yamashita explores Daisetsuzan National Park, at ngm.com.



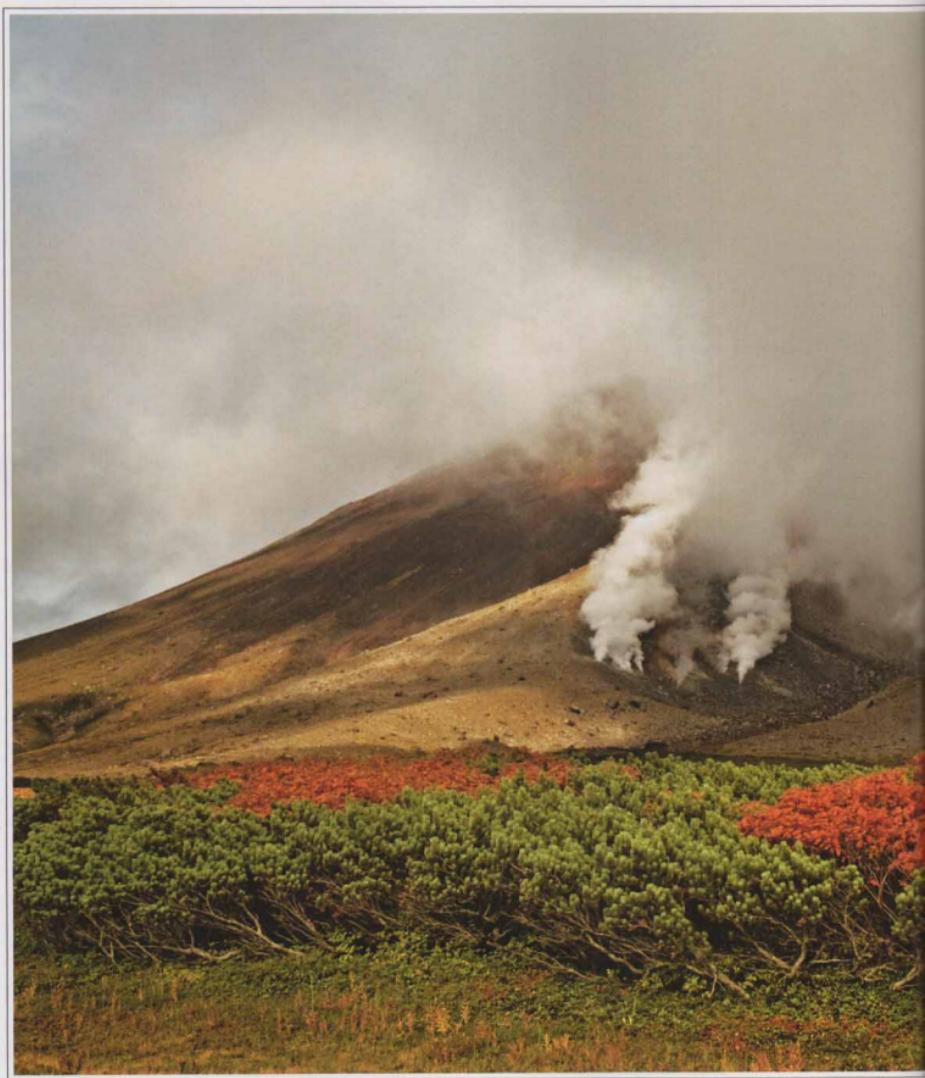


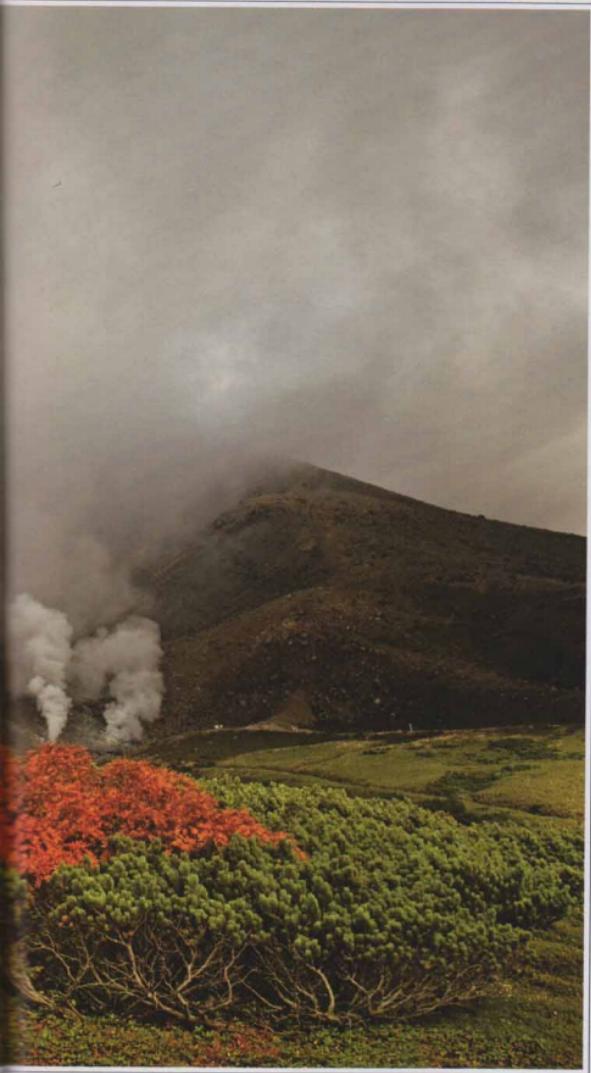
THE NUMANODAIRA WETLANDS' SWIRL OF LAKES, BOGS, AND BEECH FORESTS EMBODIES THE SPIRIT OF A JAPANESE GARDEN.





JAPAN'S LAST WILDERNESS HAS MANY FACES: WHITE BIRCH GLADES, FIELDS OF WILD PRIMROSE, MOUNTAINS VEILED IN MIST.





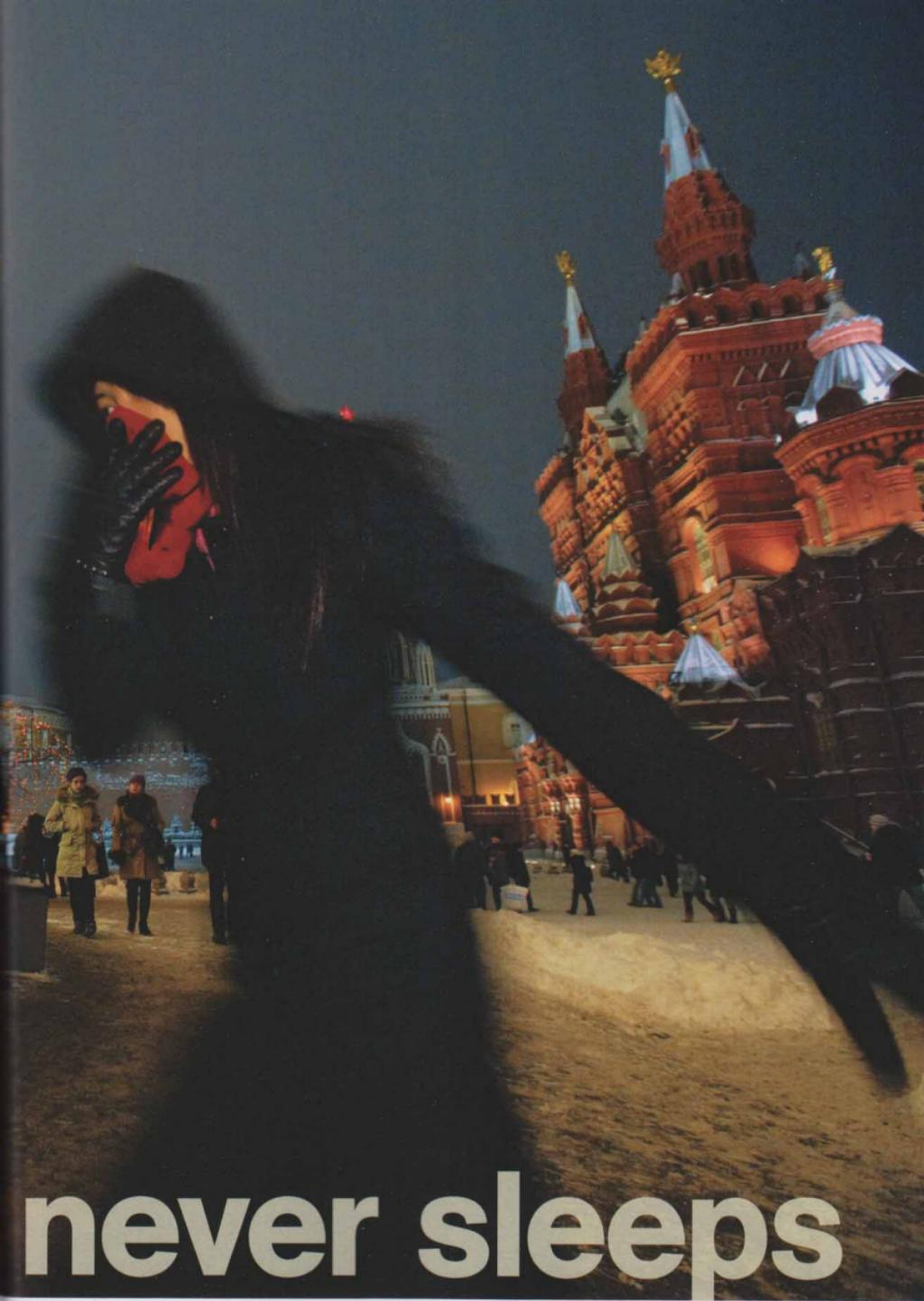
AT THE FOOT OF ASAHI DAKE VOLCANO, MOUNTAIN ASH TREES ERUPT IN AUTUMN CRIMSON AMID THICKETS OF CREEPING PINE. □



Novelist Martin Cruz Smith
and photographer Gerd Ludwig
discover the sinister magic of a city
that reveals its true colors at night.

moscow

6:01 P.M. A shopper scythes through bitter cold to reach a boutique on Red Square. These materialistic days,



never sleeps

Marx and Lenin can't compete with Dior and Armani for the hearts of Moscow's consuming class.

107



1:44 A.M. The dance floor heats up at Propaganda, one of hundreds of clubs throbbing until dawn in liberated



Moscow. Elite clubs practice ruthless "face control," admitting only the beautiful and the connected.



4:52 P.M. Darkness falls as a building rises along the Moscow River. Laborers, most from former Soviet republics,



toil round the clock in a new business district that will boast the tallest skyscraper in Europe.



7:30 P.M. Friends Yevgeny, Anatoly, and Viktor polish off an evening with fistfuls of beer and smoked fish at



the 200-year-old Sanduny baths, traditional gathering place for Moscow's workaday crowd.



10:59 P.M. In the opulent Turandot restaurant, Mozart is merely background to conspicuous consumption that



has fueled Moscow's abrupt ascent to the ranks of the world's most expensive cities.

By Martin Cruz Smith

Photographs by Gerd Ludwig

Moscow at night is a fairy tale with menace. A Cinderella who doesn't leave the Kremlin by midnight could lose more than a glass slipper.

At midnight the city is a brilliant grid of light that includes the gilded dome of the Cathedral of Christ the Savior, the Stalinist horror of the Ukraine Hotel, and a dark loop of the Moscow River. Downstream the lights of round-the-clock construction hang in the air while steel and concrete disappear. The clutter of the day is gone. The night brings clarity, and lights trace the future.

On Sparrow Hills, however, all eyes were on an unsanctioned rally of motorcycles: Japanese bikes as bright as toys, dour Russian Vostoks, "monster" Ducatis, Harleys with exhaust pipes of polished chrome. Hundreds of bikers and admirers filled the vista terrace to see machines that posed on their stands in the negligent fashion of movie stars. A Harley merely had to clear its throat to thrill the crowd.

Some bikes were so customized it was difficult to determine what they started as. A Ural that usually hauled sacks of potatoes in its sidecar had been transformed into a stealth-black predator bristling with rockets and machine guns. As the machine-gun barrels were chair legs and the handlebars were crutches, the effect was more theatrical than threatening. Despite the display of leather and studs, the same could be said of the bikers. I asked an ogre with a shaved head and bandanna what his day job was.

Martin Cruz Smith's latest novel about Moscow Investigator Arkady Renko is Stalin's Ghost. Gerd Ludwig has been photographing Russia since 1980.

In a growl, "I sleep."

To which his girlfriend added, "Fievel's a computer programmer."

Geek by day, bandit by night.

My friend Sasha was along. Sasha is so soft-spoken he seems shy, when in fact he is a homicide detective who weighs his words. In the army he competed in biathlons, the sport of racing on skis with a rifle and then stopping to shoot at a target as his heart pounded against his ribs. He still has that calm.

We first met years ago in an Irish bar in Moscow. My highly intelligent colleague Lyuba and I were celebrating the end of two weeks of on-the-ground research and interviews for one of my novels. Sasha had just dragged some dead mafia from a swamp and was in no mood for fictional heroes. Now that he is married to Lyuba, he is forced to endure my constant questions, although he gripes that my Investigator Renko should be a regular detective like him.

Racing began across the boulevard. Competitors were a blur between spectators, the smaller bikes accelerating with a whine while the heavyweights produced a roar that made the ground tremble. The finish line was negotiable, anywhere from a hundred meters to a circuit of the Garden Ring, the peripheral road around the center of Moscow, where bikes could reach 120 miles an hour, depending on traffic. Car races also took place, or did until the crackdown after YouTube featured videos of drivers weaving in and



12:03 A.M. Bikers roost at midnight on Tver Square. They flaunt rebellious leather, show off Harley and Honda choppers, and brag of outracing cops. Ilya (at left), a real estate dealer by day, explains the appeal of a big bike in Russia: "It's power you control in your hands."

out of Ring traffic at three times the speed limit.

A biker in a padded leather outfit—more a belief system than actual protection—mounted a Kawasaki, maybe 750cc. What did I know? I once rode a Vespa scooter from Rome to the south of Spain; that's the extent of my expertise, and I worried when a teenage girl wearing little more than a helmet hopped on behind. As soon as she had a grip, they glided toward the race lanes. The girl looked so frail I had to ask, Who is in charge? Where are the police?

Sasha pointed at a group of militia officers who stood bashfully to one side.

"It's out of their control."

The bikes blasted off the mark. In seconds the kids were taillights that faded away.

WHO IS IN CHARGE? Vladimir Putin? His successor, Dmitry Medvedev? The legendary oligarchs? The KGB disguised as a kinder FSB? (There does seem to be an active or former secret agent on the board of every major company.) Well,

A special suicide feature of several Russian avenues

as they say in Russia, "Those who know, know." What is certain is that Moscow is afloat in petrodollars; there are more billionaires in Moscow than in any other city in the world. More than New York, London, or Dubai. Millionaires are as common as pigeons. Together the rich and mega-rich constitute a social class who were loosely called New Russians when they first appeared in the 1990s. Half of them are survivors of industrial shake-ups like the "aluminum war" of ten years ago, when executives were killed left and right. Half have discovered that starting a bank is more profitable than robbing one. Half are young financial trapeze artists swinging from one hedge fund to another. (You can have three halves in Russia.)

But what a change. When I first visited Moscow in 1973, the entire population of the city seemed to retire to a crypt as soon as the sun went down. The few cars on the street were small, dyspeptic Zhigulis. A shop window display might be a single dried fish. Red Square was empty except for the honor guard at Lenin's Tomb, and billboards featured the stony visage of General Secretary Brezhnev. Banners declared, "The Communist Party Is the Vanguard of the Working Class!" That was the world that today's New Russians grew up in, and it is no wonder that their repressed energy and frustration have erupted with a passion.

Russians are over the top. They're not "old money" hiding behind ivy-covered walls. In fact, they often refuse old money. It's new money, crisp American \$100 bills flown in daily and spent almost as fast. Think about it. A billion dollars is a thousand million dollars. How do you celebrate success on such a scale? How much caviar can you eat? How much bubbly can you drink? Et cetera. That's why clubs were invented.

Clubs give the rich the chance to "flaunt it, baby, flaunt it," assured that "face control" will stop undesirables at the door. Face control is executed by men who in a glance can

determine your financial profile and celebrity status. And whether you are carrying a gun.

The first sign that the GQ Bar was hot was the number of Bentleys and Lamborghinis lined up at the curb. I was visiting with writer Lana Kapriznaya and journalist Yegor Tolstyakov. Lana is dark haired, petite, about a hundred pounds, including cigarette smoke. She is an acerbic chronicler of the follies of New Russians. Yegor has a voice meant for a dirge, but see him, and he's smiling.

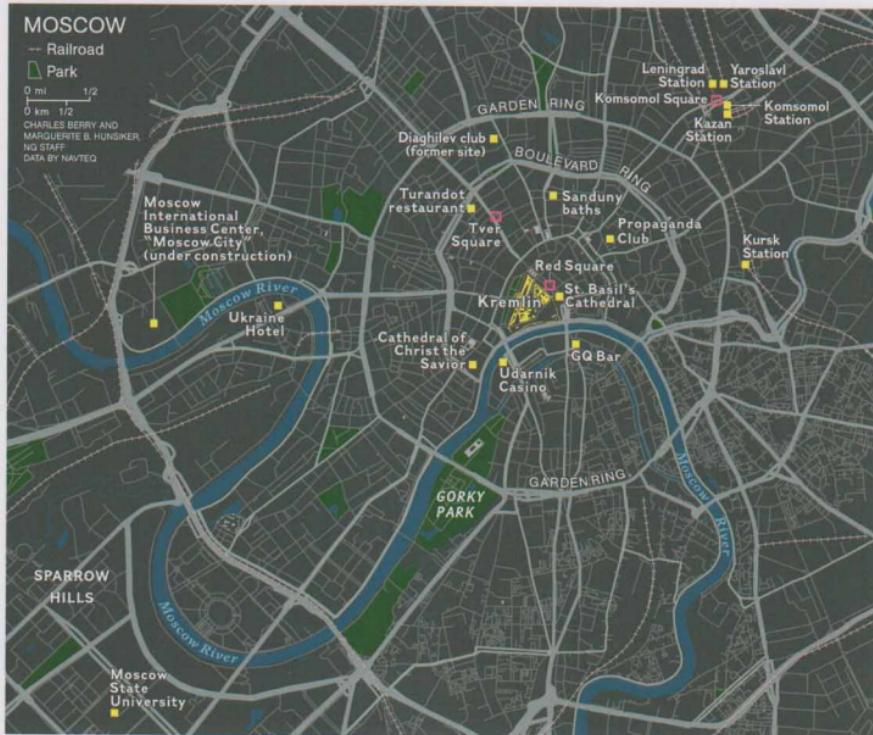
"Think of the GQ as a boy's club," Lana said. "A boy's club with bodyguards."

New arrivals were greeted by women who were beautiful on a surreal level. Big air kiss. Big air kiss. The GQ Bar is licensed by the magazine publisher Condé Nast International, which provides a steady supply of models who sip water at \$20 a bottle and pick at Kamchatka crab, a giant crustacean served with six sauces. The interior design is out of Somerset Maugham, all dark woods and lazy ceiling fans. Not hungry? Nyet problem. GQ's VIP lounge is a watering hole for lions only. Here a man can sip Johnnie Walker Blue, light a Cuban cigar, sip a brandy, unwind, and make more money.

New Russians are social animals; they squeeze business and pleasure together the way Russian drivers squeeze five lanes out of four. The office is full of petty distractions: meetings, phone calls, endless details. Billion-dollar deals await the cool hours of the evening. There is a Russian tradition that you can't trust or do business with a man until you have been drunk together. Food, vodka, money, they go hand in hand.

More astonishing than the grooming of men is the transformation of women. In the few years since the collapse of the Soviet Union, Russian women have metamorphosed from hefty builders of socialism to tennis stars who stand a head taller than the general population. During the day, clones of Maria Sharapova move from spa

and highways is a middle lane that runs in both directions.



BOOM CITY Gravitational center of Russian power and wealth, Moscow's sprawling domain houses ten million people and growing as the 900-year-old city reinvents itself from stagnant Communist capital to dynamic, profit-mad metropolis. Enriched by exports of crude oil and natural gas, the city core booms with construction, its biggest overhaul since the 1930s, when Stalin ordered the building of subway lines and parade-wide avenues. Preservationists rue the tearing down of hundreds of historic buildings. And commuters face gridlock as surging car ownership overwhelms the ring roads.

There are more billionaires in Moscow than in any

to spa. At night, they go from club to club in the giddy hope of meeting their own millionaire.

While a GQ deputy director named Sergei gave us a tour, Lana described the buy list of a New Russian: "a flat in Moscow, a town house in Belgravia, a villa in St.-Tropez, a ski chalet in Courchevel, foreign schools for his children, foreign banks for his money, and, finally, a private jet to fly away in."

This is a sore point in Russia. Even in the worst days under Stalin there was a general sense of classlessness. People didn't have money, they had perks: a larger ration of sausage, an extra week at a sanatorium, access to foreign films. The New Russians have emerged in a cloudburst of dollars, and they are, in the eyes of most people, thieves. Their lifestyle is both envied and abhorred, and since Moscow is the center, there are imitations of its club scene across the country. It is fair to say that for many young Russians, clubs define the night.

Sergei described the clubbing schedule: 10 to 12 is for pre-party socializing in the restaurant, 12 to 4 for partying in the clubs, 4 to 6 for post-party cooling off. He informed me that when Mickey Rourke is in Moscow, he parties at GQ. I can imagine Rourke partying until dawn. I imagine myself in bed, my head on a pillow.

We left GQ and hit a club that was launching either a new BMW or a new vodka or both. Then to a club in Gorky Park for a more democratic crowd where, besides playing Whac-A-Mole with a rubber mallet, you can walk on a man-made beach. Nice place.

Nonetheless, I felt that I was missing something. What was the very best club in Moscow? Which was the most fantastic?

"Well," Lana said, "there's Diaghilev."

"What makes it so popular?"

"No one can get in."

THREE STATIONS—PART ONE If Diaghilev is Moscow's Mount Olympus, Three Stations is its lower

depths. Officially Three Stations is Komsomol Square, but the locals know it by the railway terminals that converge there: Yaroslavl and Leningrad Stations on the north side and Kazan Station on the south. A statue of Lenin stands on a side plaza. The firebrand of the Russian Revolution holds the lapel of his coat with his left hand and with his right reaches for a back pocket. He appears to have just realized his wallet is gone. That's Three Stations.

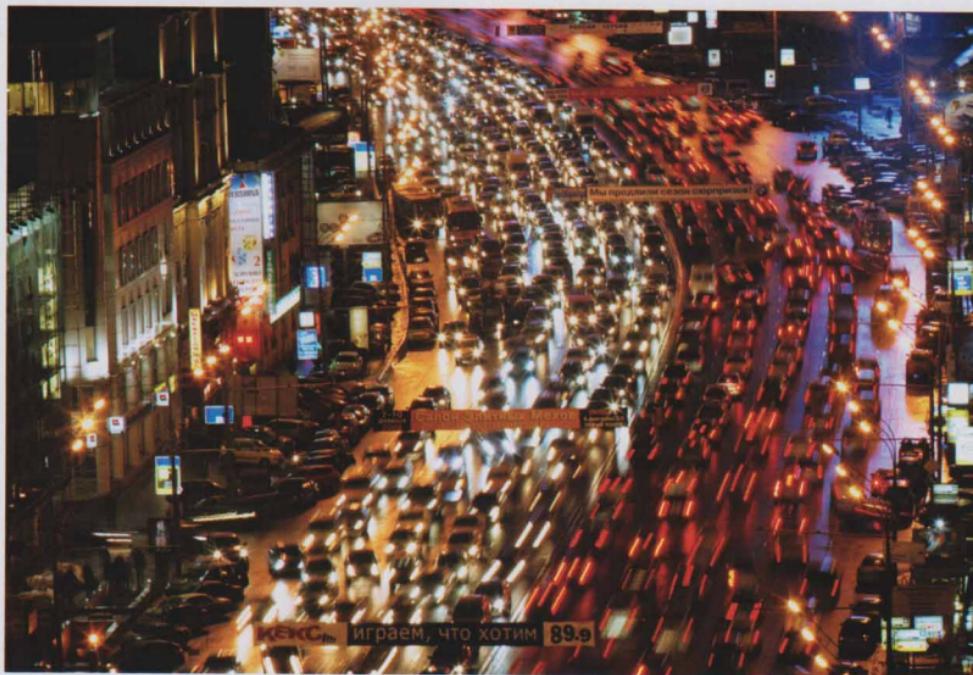
Every day thousands of commuters arrive and pour out onto the wide pavement against a counterflow of traders dragging in suitcases stuffed with clothes and shoes for resale in the provinces. Street vendors offer rabbit fur hats, Soviet kitsch, roses wrapped in cellophane, pirated CDs. Tourists stagger under backpacks. Women from Central Asia brush by in voluminous skirts the color of poppies, while soldiers search for game arcades.

Every kind of face surfaces. Blue-eyed Ukrainians, hawklike men from the Caucasus, Uzbeks in caps, Mongolians, and especially Tajiks. A demographic time bomb facing Russia is its declining population and the influx of Tajiks, who are known to be sober, hardworking, and willing to do jobs Russians won't.

But at 2 a.m. the square was vast and still. The misty light of streetlamps revealed what the traffic of the daytime, the coming and going of travelers and peddlers, had hidden. The drunks around Kazan Station were difficult to see at first because they were as gray as the pavement. These were not casual drunks or men on a bender but dedicated alcoholics literally pickled in vodka. So many were bandaged or bloody they could have been a battlefield tableau. One held up a cardboard sign that said "Give Us Money or We'll Die."

Behind the station lay a dark alley of shuttered kiosks and homeless people wrapped in rags and newspaper. Those capable of standing staggered

other city. Millionaires are as common as pigeons.



7:08 P.M. Traffic grinds and snarls at rush hour on the eight-lane Garden Ring, frustrating the growing number of Muscovites who have splurged on swift Western cars. Gone are the days, as recent as the early 1980s, when stolid homegrown Zhigulis and Moskviches ruled near-empty city roads.

sideways. In the faint light a woman dressed in rags tied a bouquet of lavender. The one kiosk that was open sold vodka, of course. Shadows dashed by. Street kids.

"These are free people," Sasha said.

"You mean homeless."

"No, there are shelters. They choose this. Free people."

We watched prostitutes in tight pants grind by. They have a reputation for breaking clonidine pills into soluble powder. Clonidine is a

powerful blood pressure medication. One spiked vodka and the customer passes out, ready to be stripped. When the victim wakes in his underclothes, he probably won't run to the nearest militia officer. Drunk or not, he should know that at Three Stations the police are the pimps.

As we moved farther into the shadows behind the station, we came upon a scuffle between two gangs, Russian versus Tajik, about eight on each side, ages from 10 to 20. No knives were in sight, although a Tajik had a (Continued on page 130)



9:39 A.M. Days begin in the dark for many commuters streaming through Moscow's subway. A Soviet-era



monument to the noble proletariat, palatial Komsomol Station now bustles with harried capitalists.



10:45 P.M. Angel of the night, volunteer Tatyana Sveshnikova attends to a battered homeless man near Kursk



Station. In recent winters, hundreds of homeless have frozen to death on city streets.



11:34 P.M. Artist German Vinogradov wields a blowtorch to season the look of his latest landscape. Active in



In the cultural underground during Soviet times, Vinogradov says, "Nothing is taboo now."



8:04 P.M. Strangers in a "flash mob" cued via the Internet show up to kiss amid the crowds near Red Square



From here they'll scatter into the night, reveling in the anything-can-happen world of Moscow after dark. 129

For their own protection everybody had a "roof." Don't think of it as

(Continued from page 121) Russian down and was pounding his face into the concrete.

Sasha told me to stay where I was and waded alone into the melee. The Tajik paused, his fist cocked, trying to figure who this interloper was. The Russian on the ground lifted his battered head, trying to work out the same thing. I heard Sasha give them the Russian equivalent of "Break it up and go home." But the gangs were home, both sides claiming the same turf; that was the problem. About the only thing they hated more than each other was an outsider.

They weren't innocents. They dealt drugs, rolled drunks, and swarmed over anyone they caught alone and unarmed. The Tajik picked up his hat, a jaunty fedora, and immediately I thought of the Cat in the Hat. The Russian got to his feet. He looked like an ingrate to me. Suddenly we were in Dirty Harry territory. Did Sasha have a gun? Did the gang feel lucky? Well, did they?

Not tonight. Instead, they beat a sullen retreat. I may have been an easy target, but Sasha was definitely not to be messed with. The Cat in the Hat saluted him and called him "brother," as if they'd meet again.

As a matter of fact, tucked into his belt, Sasha had a pistol that he's proud of because it was given to him as an award for meritorious service. One side of the gun frame is inscribed like a trophy with his name. He hates to use it.

CARS During the day the streets of Moscow are dominated by black Mercedes sedans with tinted windows so opaque they are against the law, which no one pays attention to. When Mercedes cluster at a ministry gate, I am reminded of a Roach Motel.

At night the BMWs and Porsches come out to play. Night traffic around the Kremlin has a centrifugal force that catapults them to speeds no police car can match, and even if a driver is caught, he simply bribes the police on the

spot. It's not unlike American fishing: catch and release. Russia has an alarming accident record. Considering that a driver's license can be had for a bribe instead of a demonstrated ability to operate a vehicle, the numbers aren't so bad.

A special suicide feature of several Russian avenues and highways is a middle lane that runs in both directions. This lane is reserved for cars with blue roof lights so that high officials can hurry to affairs of state. Such a light is a desirable item for New Russians in a rush; the going price for a blue light and official license plates is \$50,000. It is not unusual to see two motorcades speeding toward each other in a Russian version of chicken.

SOBRIETY It was late in the afternoon, the sun dissolving into afterglow by the time I arrived for lunch at Alexei's apartment (not his real name). Alexei and Andrew were halfway through a second bottle of vodka, and the best I could do was try to catch up. I was outclassed. Thin as a drinking straw, Alexei was an art critic, scholar, and collector of fine porcelains, an intellectual who became more animated with each round. Andrew was British but did business in Russia and stayed in practice vodka-wise, so to speak.

Right off the bat Alexei swore he had seen a video that caught the President of the United States as he stuck a wad of chewing gum under a table of inlaid stones at the Hermitage Museum. Alexei was sure that George W. Bush had declared war on Russian culture. It turned out he had just gone through the humiliating experience of being denied an American visa. He said the State Department as good as accused him of trying to sneak into the United States when it was the other way around. The United States was invading Russia through gentrification. There was even a neighborhood in Moscow that had banned Russian cars,

the mafia, think of it as alternative police.

he'd heard. Only foreign cars were allowed!

Anyway, why would he want to be American, he asked? Moscow was safer at night than New York. He could walk around the center of Moscow at any hour, drunk or sober.

Alexei gave an example. A week ago he had visited an artist's studio. This artist had an interest in Nazi art, in its narcissism and banality. It was a deep discussion, and around two in the morning they ran out of vodka. They were nearly drunk, but Alexei knew a shop across town that was open. They walked blocks and blocks discussing Fascist paintings, sculpture, and architecture. At the shop they bought a few bottles, turned to leave, and found their way blocked by four skinheads tattooed with swastikas and portraits of Hitler. The biggest of the lot demanded to know why they were bad-mouthing the Führer. Alexei expected to suffer a beating, at least a little kicking and stomping, when the artist, although nearly drunk, opened a bottle, tossed aside the cap, and invited the skinheads to his studio. On the way they passed the bottle around while the artist held forth on modern art, starting with Cézanne. The lecture was so boring and the skinheads became so inebriated they couldn't walk unaided. So Alexei and the artist dumped them one by one in various courtyards, and that was the difference between being drunk and being nearly drunk.

What this had to do with the safety of Moscow's streets escaped me; but I was in no condition to give chase. Somehow it had gotten dark. Alexei opened a window to the background din of the city, which prompted me to ask if he'd ever heard about late-night racing of cars or motorcycles in Moscow. It was a stretch, but I asked.

"On the Garden Ring?" Alexei said.

That he knew even that much surprised me.

"Yes. The record time for a car to go completely around is six minutes."

"Five minutes," he corrected me.

"Have you...?"

"Nine minutes." He sighed for the glory that might have been. "I stopped for red lights."

CASINO Andrei Sychev looked out over the 220 slot machines, 30 gaming tables, sports bar, and VIP hall and confided that he felt like the captain of a sinking ship. As an employee of the Udarnik Casino he did not understand why City Hall wanted to shut it down and "kill a goose that lays nothing but golden eggs." Each slot, for example, generated a generous profit every month, and yet the government accused casinos of "moral damage," having closed some already and vowed to relocate others to "Las Vegas zones" on the far borders of the Russian Federation by the end of next year. To some, a Moscow night without the bright lights of casino marquees may seem like a year without spring, but officials have already closed hundreds of gaming sites large and small. Who would be next?

Some of Sychev's dealers had already jumped ship for employment with better security. This created a ripple effect because regular customers like to play with a favorite dealer.

Was the Udarnik Casino a criminal enterprise? Absolutely not, according to Sychev. That is, no more than any other enterprise. Maybe 10 percent. For their own protection everybody had a "roof." Don't think of it as the mafia, think of it as alternative police.

Alexei had told me that Americans would never understand Russia because Americans saw things as black or white, nothing in between, while Russians saw a gray area of perhaps 80 percent.

Which brings us to...

THE MAYOR Not since Stalin has anyone left his stamp on Moscow as much as Mayor Yuri Luzhkov. A sawed-off colossus, he raises skyscrapers with one hand and flattens historic neighborhoods with the other. The floodlights

Americans will never understand Russia because they see

that illuminate Moscow's classical palaces at night are under his command. He garnishes the city with statues that infuriate the critics, whom he ignores. He is what Russians call a *muzhik*, a man of the earth, and, although he and Vladimir Putin have been rivals in the past, they seem to agree that gaudy casinos are out of step with Moscow's new maturity and dignity, even if Putin reportedly complains that he never knows what the skyline of Moscow will look like when he gets out of bed in the morning.

The feeling in Moscow is that Luzhkov may be corrupt, but he gets things done. When construction funds ran short for the behemoth Cathedral of Christ the Savior, the story goes, he didn't hesitate to shake down businessmen and mafia alike to finish the job. According to one estimate, in 2005 Russians shelled out \$316 billion in bribes. Why not a donation for a worthy cause?

It was a happy coincidence that a company owned by the mayor's wife, Yelena Baturina, landed so many construction contracts in the city. In fact, Baturina is the only woman among Moscow's billionaires.

THREE STATIONS—PART TWO Sasha and I took the pedestrian underpass from Kazan Station because the more distance between us and the Cat in the Hat the better, and it was reassuring to find two uniformed security men sitting in the walkway, even if one was reading a comic book and the other was asleep. The shop stalls in the tunnel were shuttered except for one window displaying mobile phones.

We emerged in front of Yaroslavl Station. It was 3 a.m., and all the civilians had retreated to the waiting rooms and ceded the night to vodka zombies, prostitutes, and teenage gangs too spaced from huffing glue to notice us.

► **How many billionaires** can you fit into a single city? Test your knowledge of today's Moscow at ngm.com.

Incredibly, with one step into the waiting hall we reentered the normal world. There were cafés, a bookshop, a playpen, closed, to be sure, but evidence of normal life. Normal people were asleep in chairs. Healthy babies curled up on their mothers' laps. In some parts of the world people share a river with crocodiles. You just had to be careful.

But there was more. Returning through the underpass we came upon two men robbing a drunk. One lifted the victim by the neck while the second went through his pockets, although the way the drunk flopped back and forth made the task difficult. We had to get around them to pass. Sasha placed himself on the inside, between the action and me. The security men stayed seated and watched with mild curiosity; they were paid to protect the window of mobile phones, nothing else.

What happened took ten seconds. Essentially, the thieves took the money and ran. They wrested a roll of bills from the drunk's inside jacket pocket, let him drop, and vanished up the stairs to the street.

The drunk spat blood and sighed. He rolled to a sitting position and waved off any help.

At night?

At Three Stations?

Nothing happened.

DIAGHILEV Amid clouds of smoke, strobe lights, and the deafening beat of house music, the new lords of oil, nickel, and natural gas arrived at Diaghilev with women as mute and beautiful as cheetahs on a leash.

In this cacophony a millionaire could expand and relax. For one thing, no guns are allowed inside Diaghilev. The club had a 40-man security force, and any customer who felt in dire need of protection was assigned a personal bodyguard. A bomb dog had sniffed the chairs, and a security briefing had alerted the staff about special needs,

things as black or white. Russians see a gray area of 80 percent.

such as guests from Iran who did not want to be photographed drinking champagne with scantily clad models. I had followed Yegor through a back door. How Yegor arranged my visit I did not know, but the chief of security was not pleased.

The club incorporated relentless sound, color, and motion. Psychedelic visions splashed across screens and vodka bars. A UFO and a crystal chandelier contested air space, and a contortionist added a touch of Cirque du Soleil. It was a simple system. Face control admitted more women than men and only enough guests to achieve critical mass. The more people who were turned away the more people who wanted to get in. The real Diaghilev was the fur-trimmed impresario who founded the Ballets Russes a hundred years ago. First of all, he was a showman. He would have loved this.

New Russians climbed to their VIP tables, waving to fellow New Russians and celebrities. Television personalities and Eurotrash leavened the mix, and soon the floor was so crowded people could only dance in place, something six-foot models in six-inch heels managed gracefully.

Yegor kept asking a question I finally understood over the din, "Are you happy? Did you get what you came for?"

I didn't know. Was this what millions of Russians died for in wars and prison camps? Had they faced down a KGB coup and dismantled an empire so a few gluttons could party through the night? Gogol had likened Russia to a troika of speeding horses, not a Bentley in a ditch.

Suddenly, the speakers went silent for a booming, "I love Moscow!"

On the runway an American singer had taken over the microphone. She was black—not many in Moscow—and she sang the blues. The boys on the VIP tier went on chatting at a shout and pouring each other cognac. Then the entire crowd joined in one refrain in English, "What are we supposed to do after all that we've been through?" I had no idea what song it was. They

sang it over and over. "What are we supposed to do after all that we've been through?"

Soon after Diaghilev was, in a time-honored tradition of nightclubs, gutted by fire. Now it is better than hot, it is legend.

LIGHTS On my last night in Moscow Yegor showed me the future.

We drove beyond the Garden Ring and followed the river to a dark industrial area, where we parked and walked along a chain-link fence. If this was the future, I wasn't impressed.

"Look up," Yegor said.

"I don't see anything."

"Look higher!"

Against the night stood a ladder of lights so high I couldn't be sure where it stopped, until a red beam crawled to the edge of an open floor somewhere near Mars.

"Moscow City," he said. "A city within a city."

It was a magic beanstalk, a complex of 14 buildings, including the Russia Tower, at 113 floors projected to be the tallest skyscraper in Europe. A giant crane performed a pirouette at the top of what will be the Moscow Tower, a mere 72 stories high. Work was going on day and night. A floodlight revealed figures in yellow vests clambering over the load the crane had delivered. From what seemed an incredible distance we heard the stutter of a rivet gun, the clap of metal plates, even voices, creating a curious intimacy.

Buildings were in every stage of construction. Those already completed resembled silver spaceships about to depart. The scale was enormous. The excavation alone could swallow the pyramids of Giza. The complex is planned to house City Hall, offices, and luxury apartments with views halfway to Finland.

This is the advantage of being in Moscow after dark.

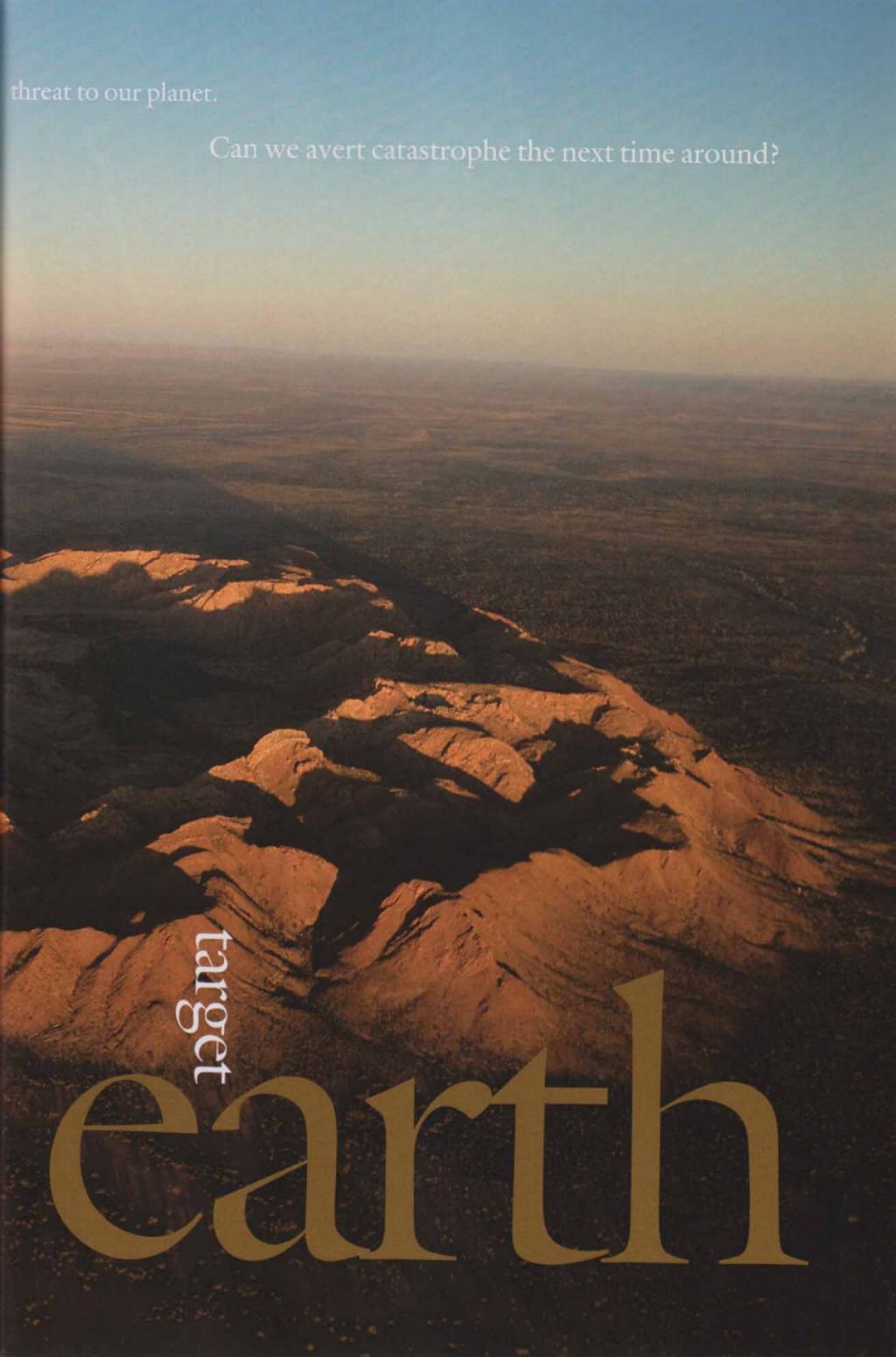
In the daytime you see only architecture.

At night you see blazing ambition. □

Asteroids and comets in nearby space pose a constant



About 140 million years ago, a comet or an asteroid smashed into the Australian outback, blasting a hole 14 miles in diameter. Today, Gosses Bluff is the two-mile-wide central remnant of the crater.

A wide-angle aerial photograph of a mountain range during sunset or sunrise. The mountains in the foreground are bathed in a warm, golden light, while the sky above transitions from a deep blue to a soft orange and yellow near the horizon. The terrain is rugged with many peaks and valleys.

threat to our planet.

Can we avert catastrophe the next time around?

target

earth

The first sign of the threat was no more than a speck on a star-streaked telescope image.

Just after 9 p.m. on June 18, 2004, as twilight faded over Kitt Peak National Observatory in Arizona, David Tholen was scanning for asteroids in an astronomical blind spot: right inside Earth's orbit, where the sun's glare can overwhelm telescopes. Tholen, an astronomer from the University of Hawaii, knew that objects lurking there could sometimes veer toward Earth. He had enlisted Roy Tucker, an engineer and friend, and Fabrizio Bernardi, a young colleague at Hawaii, to help. As they stared at a computer, three shots of the same swath of sky, made a few minutes apart, cycled onto the screen. "Here's your guy," said Tucker, pointing at a clump of white pixels that moved from frame to frame.

Richard Stone is Science magazine's Asia editor. Stephen Alvarez photographs expeditions and science for this magazine; his blog is at picturestoryblog.com.

Tholen reported the sighting to the International Astronomical Union's Minor Planet Center, a clearinghouse for data on asteroids and comets. He and Tucker hoped to take another look later that week, but they were rained out, and then the asteroid disappeared from view.

When astronomers got a fix on it again that December, they realized they had a problem. The rock, bigger than a sports arena, tumbles menacingly close to our planet every few years. As observations streamed into the Minor Planet Center, the asteroid, named Apophis after the Egyptian god of evil, looked increasingly sinister. "The impact hazard kept getting higher and higher," says Tholen. By Christmas, models predicted 1-in-40 odds that Apophis would smash into Earth on April 13, 2029, and a ripple of alarm spread to the public. "One colleague called it the grinch that stole Christmas," Tholen says.



SPOTTING DANGER

Asteroid hunters study time exposures of the sky, looking for objects that don't move with the stars. In 2004, they found one that came to be dubbed Apophis—the Destroyer in ancient Egyptian lore. This 900-foot-wide asteroid will zoom past the Earth in 2029 and again in 2036. Odds that pass will end in collision? Scientists now say 1 in 45,000.

Then on December 26, 2004, a real catastrophe struck: the Indian Ocean tsunami, which claimed hundreds of thousands of lives. The public forgot about Apophis. In the meantime, astronomers had dug out earlier images of the asteroid. The extra data enabled the scientists to calculate its orbit, and they discovered that it would actually whiz safely by Earth in 2029. But they could not rule out a slender chance that Apophis would strike with catastrophic effect its next time around, on Easter Sunday, 2036.

An estimated ten million rocky asteroids and ice-and-dirt comets pirouette in outer space, and once in a while their paths fatefully intersect our planet's. One such encounter took place a hundred miles from present-day Washington, D.C., where a 53-mile-wide crater lies buried beneath Chesapeake Bay—the scar left when a two-mile-wide rock smashed into the seafloor 35 million years ago. More notorious is the titan, six miles in diameter, that barreled into the Gulf of Mexico around 65 million years ago, releasing thousands of times more energy than all the nuclear weapons on the planet combined. "The whole Earth burned that day," says Ed Lu, a physicist and former astronaut. Three-quarters of all life-forms, including the dinosaurs, went extinct.

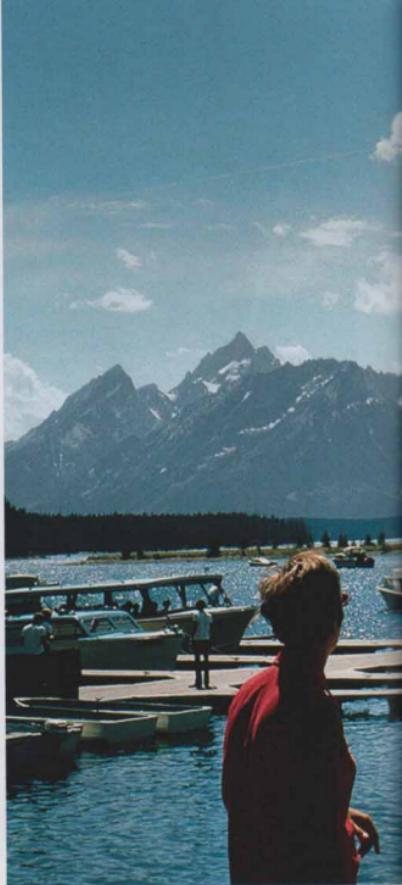
Astronomers have identified several hundred asteroids big enough to cause a planetwide disaster. None is on course to do so in our lifetimes. But the heavens teem with smaller, far more numerous asteroids that could strike in the near future, with devastating effects. On June 30, 1908, an object the size of a 15-story building fell in a remote part of Siberia called Tunguska. The object—an asteroid or a small comet—exploded a few miles before impact, scorching and blowing down trees across 800 square miles. The night sky was so bright with dust from the explosion, or icy clouds from the water vapor it blasted into the upper atmosphere, that for days people in Europe could read newspapers outdoors at night. On Tunguska's hundredth anniversary, it's unsettling to note that objects this size crash into Earth every few centuries or so.

The next time the sky falls, we may be taken by surprise. The vast majority of these smallish bodies, capable of wiping a city off the map, are not yet on our radar screens. "Ignorance is bliss, in that if you don't know about these things, you just go about your merry way," says Lu. Over the next decade, however, sky surveys like

Tholen's should begin filling that gap, cataloging asteroids by the thousands. "Every couple of weeks," says Lu, "we're going to be finding another asteroid with like a one-in-a-thousand chance of hitting the Earth."

The goal is not just to foretell the date and time of a potential catastrophe. The goal is to forestall it. With years or decades of warning, a spacecraft, using its own minuscule gravity, might nudge a threatening asteroid off course. For objects requiring a bigger kick, a kamikaze spacecraft or a nuclear bomb might do the job. Vexing dilemmas would attend this showdown in space. How will governments decide to act? "This is a class of problem that the world isn't set up to deal with," says physicist David Dearborn, an advocate of a nuclear strike against an incoming asteroid.

Two facts are clear: Whether in 10 years or





500, a day of reckoning is inevitable. More heartening, for the first time ever we have the means to prevent a natural disaster of epic proportions.

EVERY DAY, DOZENS OF TONS of detritus from outer space—dust from comets, tiny shards of asteroids—burn up in the Earth's upper atmosphere, leaving bright meteor trails at night. Most days a chunk or two of rock or metal, fist size or bigger, survives the fiery plunge.

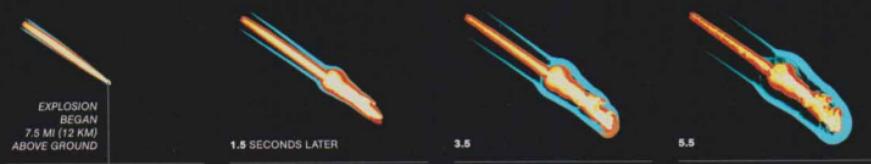
Yet the odds of seeing a meteorite hit the ground, let alone being struck, are phenomenally low. Only one is known to have hit a person. Around 1 p.m. on November 30, 1954, a meteorite tore through the roof of a house near Sylacauga, Alabama, across the street from the Comet Drive-in Theatre. The rock, about the size of a softball, caromed off a console radio and clipped

NEAR MISS

Streaking over Jackson Lake, Wyoming, in 1972, this 150-ton object skipped harmlessly off the atmosphere like a rock skipping off water. NASA classifies more than 950 much larger asteroids and comets as potentially hazardous because they stray uncomfortably close to Earth.

Ann Hodges as she snoozed on her couch, bruising her left hip and wrist. She was hospitalized to recover from the shock.

Since then, there have been some spectacular near misses. On August 10, 1972, an object around 15 feet across and weighing 150 tons skipped off the upper atmosphere. Hundreds of eyewitnesses



SPACE INVADER

A computer model of the 1908 event shows how an asteroid some 150 feet wide tore into the atmosphere at 32,000 miles an hour and began to explode.

INCANDESCENT TRAIL

As the asteroid ripped through the air and vaporized, it left a trail of ultrahot gases.

Siberian Blast

A new supercomputer simulation models the cataclysmic power of an asteroid strike.

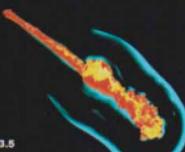
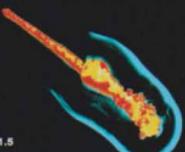
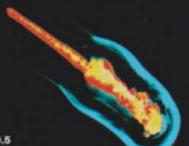
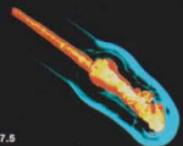


Just after 7 a.m. on June 30, 1908, an asteroid or comet exploded above Tunguska, Siberia, leveling trees (above) across 800 square miles. Models by Sandia National Laboratories researcher Mark Boslough show that the destruction could have been caused by an object—and an explosion—about half the size previously believed. Smaller objects strike more often, but Tunguska-level events are nevertheless rare.



SEAN MCNAUGHTON, NG STAFF

SIMULATION FRAMES: MARK BOSLOUGH, SANDIA NATIONAL LABORATORIES; TASS FROM SOVFOTO (ABOVE)



MIDAIR BLAST

Glowing gases billowed from the exploding asteroid, forming mushroom clouds.

SUPERHOT PILEUP

The increasing density of the atmosphere slowed the gases and debris. The remains of the asteroid dispersed well above the ground.



SHOCK WAVE

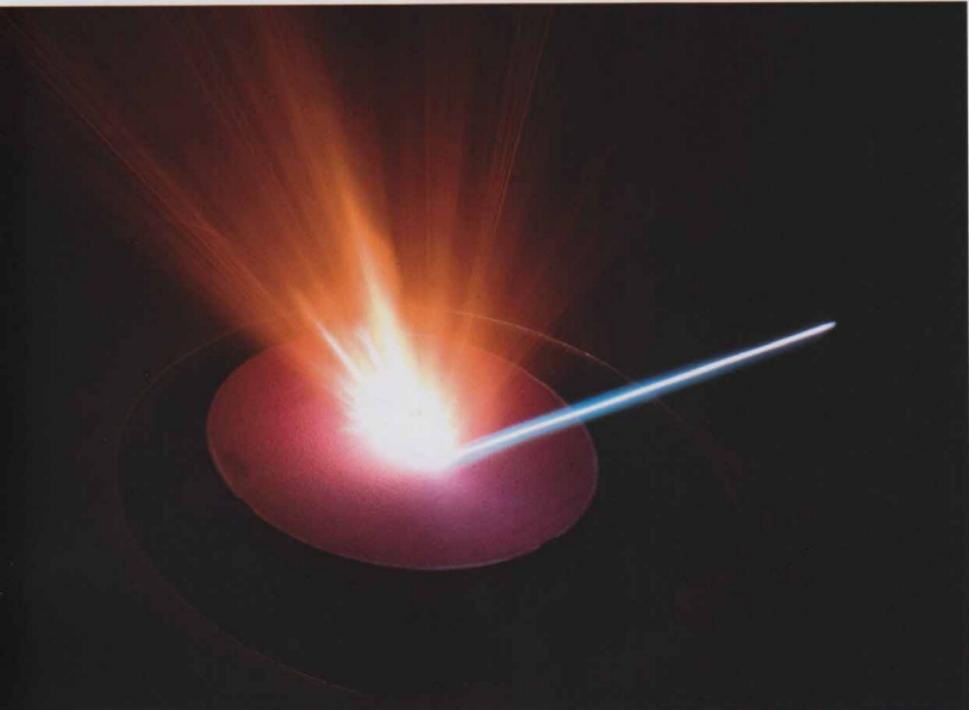
SHOCK WAVE

Although the object itself never hit the ground, the shock wave from the explosion generated winds that approached hurricane force over a wide area.

15.5 SECONDS AFTER EXPLOSION BEGAN

2.2 MI (3.5 KM) ABOVE GROUND





The number of experts working on deflecting objects would roughly staff a couple shifts at a McDonald's.

saw the glowing streak, dazzling on a sunny afternoon, as it traversed the sky from Utah to Alberta before whizzing back out into space. On March 22, 1989, a rock as much as a thousand feet across came within a few hundred thousand miles of Earth—an uncomfortably close shave.

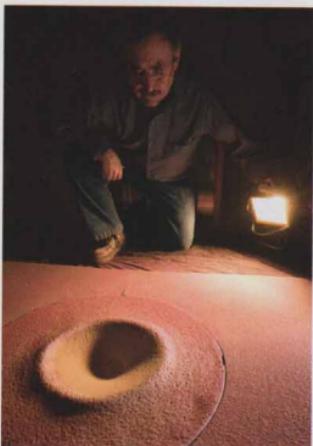
Erosion and vegetation have erased most of the scars left by impacts in the geologic past. Perhaps the best preserved lies about half an

hour east of Flagstaff, Arizona. On a late autumn morning Carolyn Shoemaker and I pull off Interstate 40 and wind through scrubby desert toward a low rise marking the rim of the crater. Fifty thousand years ago this was a forested plain inhabited by mammoths, giant ground sloths, and other Ice Age animals. Shoemaker, an asteroid expert with the Lowell Observatory in Flagstaff, imagines the day the sky fell. "Suddenly, there's a terrific, brilliant light," she says. In a flash, a searing-hot iron-nickel mass, 150 feet wide and weighing 300,000 tons, tears into the Coconino sandstone, flinging boulders and molten iron for miles. A blast of wind more powerful than any earthly tornado scours the landscape.

All that's left of the cataclysm now is a chasm three-fourths of a mile wide and 570 feet deep, fringed with Mormon tea bushes. At the turn of the 20th century, an engineer named Daniel Moreau Barringer was convinced that a massive iron meteorite lay beneath the crater and obtained

MODELING MAYHEM

Firing a tiny aluminum pellet into a sandpit at 12,000 miles an hour helps geologist Peter Schultz understand impact zones. "Standing downrange, you'd be broiled by the hot blast and pummeled by debris," he says. "Think of a hot landslide, without a mountain."



the mining rights to the land. But after a series of shafts revealed nothing, many prominent geologists concluded that a volcanic eruption, not a meteorite, had formed the crater.

Carolyn's husband, Gene, made Meteor Crater one of America's most recognizable landmarks. In the late 1950s he mapped the overturned rock around the crater and pointed out similarities to the Teapot Ess crater in Nevada, formed by a nuclear test. His data showed that Barringer was right: A meteorite had gouged the crater, although most of the iron had melted into tiny droplets. Several of Barringer's shafts can still be seen from the rim, along with a full-size cutout of a waving astronaut—a nod to NASA, which once used the crater as a training ground. Some visitors whisper and point at Carolyn, and one man plucks up the courage to come over and request her autograph. Carolyn is famous in her own right. She discovered a comet that, in 1994, vividly demonstrated the cosmic threat we face.

In 1980, their children grown and out the door, Gene suggested that Carolyn start a career as an asteroid hunter. "I'm a morning person," she says. "I had never stayed awake all night in my life. I didn't know if I could do that." But she decided to give asteroid hunting a shot. Gene had access to the Palomar Observatory near San Diego. "After a couple years, I learned how to discover things," she says, modestly. She has 32 comets and 367 asteroids to her credit. "Some are more interesting than others."

On March 25, 1993, Carolyn, Gene, and David Levy, an amateur astronomer, were at Palomar for their scheduled observation time. Snow was falling, and the night promised to be long and boring. Carolyn killed time by studying a batch of overexposed film from the previous night. Many frames were worthless. On one of the last images, however, she came across a smudge. "I said, 'It looks like a squashed comet.'" The team asked astronomers at Kitt Peak to take a look. It then occurred to Carolyn that her squashed comet might be a broken comet. Confirmation came that same night when Kitt Peak spotted a string of comet shards traveling together.

Other astronomers soon counted some two dozen pieces of comet Shoemaker-Levy 9 and worked out its strange history and fate. In July 1992, it seemed, the comet had swung so close to Jupiter that the giant's massive gravity had torn it apart. Now the remnants, some of them hundreds of feet wide, were destined to collide with Jupiter in July 1994. When the time came, most of the world's astronomers were watching.

The impacts took place on Jupiter's far side, out of sight of Earth, but the blows sent superheated gas billowing far above the atmosphere. The largest unleashed shock waves that roiled an area at least three times the width of Earth. "It was pretty awesome," Carolyn says. The Shoemakers basked in the glow of their discovery. Then tragedy struck. In 1997 they were in a head-on car crash in the Australian outback. Gene died at the scene. An ounce of his ashes traveled to the moon with NASA's Lunar Prospector spacecraft.

Carolyn scattered the rest at Meteor Crater.

IF THE SHOEMAKERS' NAMESAKE or the monster that annihilated the dinosaurs were bearing down on us, there would be little we could do. For every planet killer, however, there are thousands of smaller asteroids and comets—up to a mile

or so across—that could conceivably be deflected. First we'd have to see them coming.

In 1998 the U.S. Congress ordered NASA to identify at least 90 percent of the largest asteroids and comets in the inner solar system—objects six-tenths of a mile or more in diameter. To date, telescopes have pinpointed more than 700 out of an estimated population of 1,000. In 2005 Congress got more ambitious, directing the space agency to track down the far more numerous asteroids 460 feet or more in diameter—still big enough to take out a city or state.

A new telescope is about to begin scanning the sky for these dim, elusive objects. From a peak on Maui, the Panoramic Survey Telescope and Rapid Response System, or Pan-STARRS, will scrutinize the night sky with a 1.4-billion-pixel camera that produces images so detailed a single one, if printed, would cover half a basketball court. Computers will scan the data, flagging statistical curiosities that astronomers can check the old-fashioned way, by taking a look. The Maui telescope is just a prototype; ultimately, Pan-STARRS will include an array of four cameras. "We'll have catalogs of all the things that go bump in the night," says Ken Chambers of the University of Hawaii, including perhaps 10,000 potentially hazardous asteroids.

Within decades, the world's leaders may be forced to grapple with a momentous decision: whether and how to deflect an incoming object. Few experts are giving this much thought, says astronomer David Morrison of NASA's Ames Research Center: "The number would roughly staff a couple shifts at a McDonald's."

Lu, the former astronaut, is one. Now an executive at Google, he is helping design a massive database for a successor to Pan-STARRS, the Large Synoptic Survey Telescope, which will scrutinize the sky in even more detail starting in 2014. Lu is also the coauthor of a scheme for using a spacecraft to coax an earthbound asteroid off its dangerous path. "We were originally thinking about how you would land on an asteroid and push it," he says. "But that doesn't work well." If the surface is crumbly, the lander might skid off. Moreover, asteroids twirl through space. "If you're pushing and the thing is rotating, the pushing just cancels out," Lu says.

Then he and Stanley Love, a fellow astronaut, realized pulling would be much easier. A spacecraft could hover nearby and fire its thrusters,

BATTERED GIANT

A string of roughly 20 fragments of comet Shoemaker-Levy 9 (composite view, below) hit Jupiter like machine-gun fire in July 1994. The impacts left bruises on Jupiter's atmosphere (right), some of them wider than Earth, and gave astronomers their first look at a planetary collision.



gently tugging the asteroid along. No harpooning or lassoing would be required. "Rather than having a physical line between you and the thing you're towing, you're just using the force of gravity between them," Lu says. The "gravity tractor" would tug the asteroid off course at a mere fraction of a mile an hour. But this subtle shift, magnified over the vastness of space, could mean missing Earth by tens of thousands of miles.

Lu's scheme would work only for asteroids up to a few hundred yards across that could be engaged far from Earth. If a small rock sneaks up on us, we could try ramming it with a spacecraft. But there's a drawback, says Morrison: "If you hit an asteroid with enough energy to break it apart, but not necessarily enough energy to disperse it widely, you now have a flying collection of stuff. You have to ask how practical that is." When all else fails, and for large asteroids and comets, only one strategy has a chance of working: We'll have to bomb them back to the Stone Age.

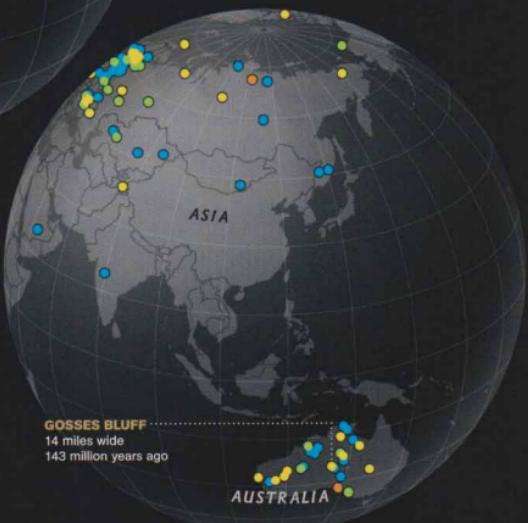


EARTH SCARS

Using tools from satellite imagery to microscopic analysis of rocks and minerals, scientists have found traces of 174 meteorite impact sites. Many more have been obliterated by surface changes or lie hidden under the seas. The largest impact scars (red dots) represent events that had the power to transform landscapes, climate, and life itself across much of the planet.

WIDTH OF CRATER

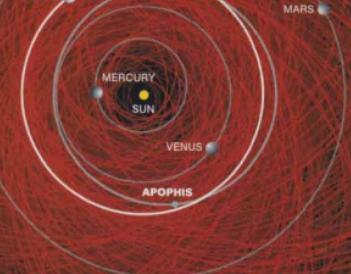
- More than 100 miles
- 51–100 miles
- 11–50 miles
- 5–10 miles
- Less than 5 miles



SEAN MCNAUGHTON AND LISA R. RITTER, NG STAFF

IMPACT SITES SOURCE: PLANETARY AND SPACE SCIENCE CENTRE, UNIVERSITY OF NEW BRUNSWICK. ORBITAL PATHS COURTESY PAUL CHODA, NASA/JET PROPULSION LABORATORY

JUPITER



Orbital diagram of potentially hazardous asteroids and comets. All orbits are to scale.

Heavy Traffic

Every year as the Earth loops through a solar system crowded with other bodies, there's a chance it could run into trouble.

So far more than 5,400 asteroids and comets have been spotted flying within 121 million miles of the sun—close enough to our planet for astronomers to classify them as near-Earth objects. Those that measure more than 460 feet across and pass within 4.6 million miles of Earth's orbit are considered potentially hazardous. As of April, astronomers had cataloged more than 950 such

bodies (red tracks)—including Apophis, an asteroid that will come within 21,000 miles of Earth in 2029. None of the known potentially hazardous objects are believed likely to collide with Earth. But observers are constantly monitoring their positions, recalculating their orbital paths and the impact risks they represent—and searching nearby space for new threats.

STANDS OF FROSTED FIRS and white birch cluster along the highway leading southwest from Yekaterinburg, the city in the Ural Mountains where Russia's last tsar, Nicholas II, and his family were murdered 90 years ago. Under a dull sun, fishermen huddle over holes on a frozen lake, floppy-eared fur hats hiding their faces. A road with a misspelled signpost for a tiny village marks the turnoff for the formerly secret city of Snezhinsk, code-named Chelyabinsk-70 during the Cold War. Snezhinsk is home to one of Russia's two main nuclear weapons laboratories. After the collapse of the Soviet Union, it fell on hard times; ten years ago, with Russia's economy in shambles, staff salaries went unpaid, and the director committed suicide.

Nowadays, with Russia prospering, the laboratory is humming with top secret work. Obtaining permission to enter proved impossible. But Vadim Simonenko, the deputy scientific director, and experimentalist Nikolay Voloshin agreed to meet at a sanatorium in nearby Dalnyaya Dacha. In a cool, dim, and empty dining hall, Voloshin opens a bottle of cognac, and over salmon canapés, cold cuts, and sliced cucumbers, the two weapons scientists discuss how their bombs could save the world.

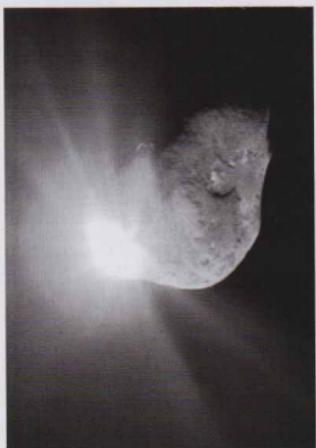
If Edward Teller is the father of the hydrogen bomb, Simonenko is the father of the asteroid bomb. In the mid-1960s the superpowers dreamed of using their nuclear arsenals for peaceful purposes, such as leveling mountains and digging canals. Simonenko, a new recruit to the lab, was asked to study the effects of a torpedo-shaped charge that would explode laterally, ideal for earthmoving. It occurred to him that such a device could also be used to deflect an object in space. He told his boss, who laughed and ordered the eager young physicist to get back to work.

Though nuclear excavation never became a reality, Simonenko went on studying nuclear asteroid deflection. He and Voloshin concluded that the best way to deflect an asteroid up to a mile or so wide would be to detonate a nuclear charge nearby. The intense radiation would fry the surface, driving off a "sacrificial layer" of rock. The expanding vapor would act as a rocket motor, nudging the asteroid onto a new trajectory. For a smaller, Tunguska-size rock, Simonenko says, "it would be simpler: We vaporize it."

Simonenko has a brother-in-arms in nuclear

DISASTER PLANNING

In 2005, a NASA spacecraft probed a comet by smashing into it (below) with the force of five tons of dynamite—yet barely shifted its path. Scientist James Szabo (right) develops plasma thrusters that could propel a "gravity tractor" to tug a threatening comet or asteroid to a safer orbit.



physicist David Dearborn of Lawrence Livermore National Laboratory in northern California. Dearborn's day job is determining whether the aging weapons in the U.S. nuclear stockpile are reliable. In his spare time, he ponders asteroid defense. He, too, favors a stand-off nuclear blast. "Not too close—then the blast is too intense, and things shatter too much. And not too far, or you don't get enough energy."

Although it may be technically straightforward to dust off a few warheads and sling them at an asteroid, deciding whether to press the red button—and which nation gets to press it—could be excruciating. First, the nation with its finger on the trigger would have to withdraw from the Outer Space Treaty, which bans the use of nuclear weapons in space. But if catastrophe looms, says Dearborn, "people would really have to say, 'Can we be brighter than the dinosaurs?'"

Apophis may pose the first real test of our collective intelligence. For now, scientists can give



For large objects,
only one strategy has a
chance of succeeding:
We'll have to bomb
them back to the
Stone Age.

only a range of probabilities for its future trajectory. As it swings past Earth in 2029, ducking under dozens of high-flying communications and spy satellites and appearing as a bright star lumbering across the night skies over Europe, there's a slim chance that Apophis will pass through a "keyhole." In this narrow corridor of space, maybe a few hundred yards wide, Earth's gravity would deflect the asteroid just enough to put it on a certain collision course with our

planet on the next pass, in 2036. The odds that Apophis will pass through this fatal corridor are currently estimated at 1 in 45,000. Continued tracking will almost certainly deliver an all clear a few years from now. If not, we might have to wait until weeks after its close approach in 2029 to learn whether Apophis has squeezed through a keyhole, leaving us precious little time to avert calamity in 2036.

In the prophesies of the Hopi of the American Southwest, the arrival of a spirit called Yellow Star Kachina will herald the end of the world. When Hopi elders heard about Apophis in 2004, they worried that Yellow Star Kachina was on its way. Carolyn Shoemaker tried to reassure them that it was not.

Let's hope she was right. □

► **Interactive Map** Learn where meteorites have crashed to Earth over geologic history and see the scars they left, at ngm.com.

FOLLOW UP

ISLAND ARK, PAGE 68 **Bioko Island Journal** Joel Sartore, with three other *National Geographic* photographers and a crew of students and scientists, spent two weeks on this speck of land documenting the region's rich array of wildlife. These are some of Sartore's notes from time spent in Malabo, Equatorial Guinea's capital city—and the center of a thriving bush-meat trade.

MY FIRST DAY IN MALABO

Today I got punched in the mouth by a monkey. It was a drill, actually, the largest primate species on Bioko Island. A hunting orphan, he'd been welded into a rebar cage behind a small café. I leaned in too close to get a photo, and he tore up my mouth with one jab. It served me right. The café's owner had recently died. There are no zoos around to take drills, and because they are an endangered species, they can't be exported without major paperwork. I have a feeling this drill may end up being eaten.

MY LAST DAY IN MALABO

This morning I went to the bush-meat market. I'm from Nebraska, and I've seen butchering. This was different. Here were baskets of hornbills, tables covered with pangolins, pythons, brush-tailed porcupines, and rats. I'd seen snares set everywhere in the forest; this was their harvest. A small blue duiker lay bound and alive. The woman selling it yelled when I brought the camera up to my face, so I took three shots from the hip using a trigger on the bottom of the camera, coughing each time to hide the sound of the shutter. Slaughtered animals would eventually be carried over to metal tables where men would torch the hide or feathers. The whole place smelled of burning hair. I bribed the torch men to let



Photographer Joel Sartore took this picture of a drill—and then took a punch in the face. See more of his Bioko journal at ngm.com.

me shoot; a four-dollar phone card bought me half an hour.

A law passed in 2007 made it illegal to kill, sell, or consume primates in Equatorial Guinea. But with a desperately poor populace and a single monkey selling for \$200 or more, how can this hold? As I stood in

the market, one of the torch men motioned to a big male drill, about the size of my four-year-old son. The dead animal's hand was held in the flame.

It looked just like mine.

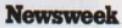
► You can support efforts to save Bioko's wildlife at bioko.org.

It's not just
what you say
that counts with
business **leaders**.

It's **where**
you say it.

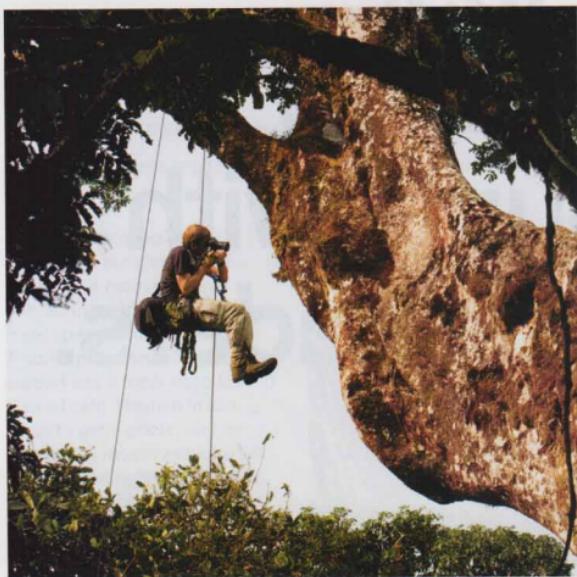


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Tim Laman uses tree-climbing gear to take a landscape shot.

ON ASSIGNMENT

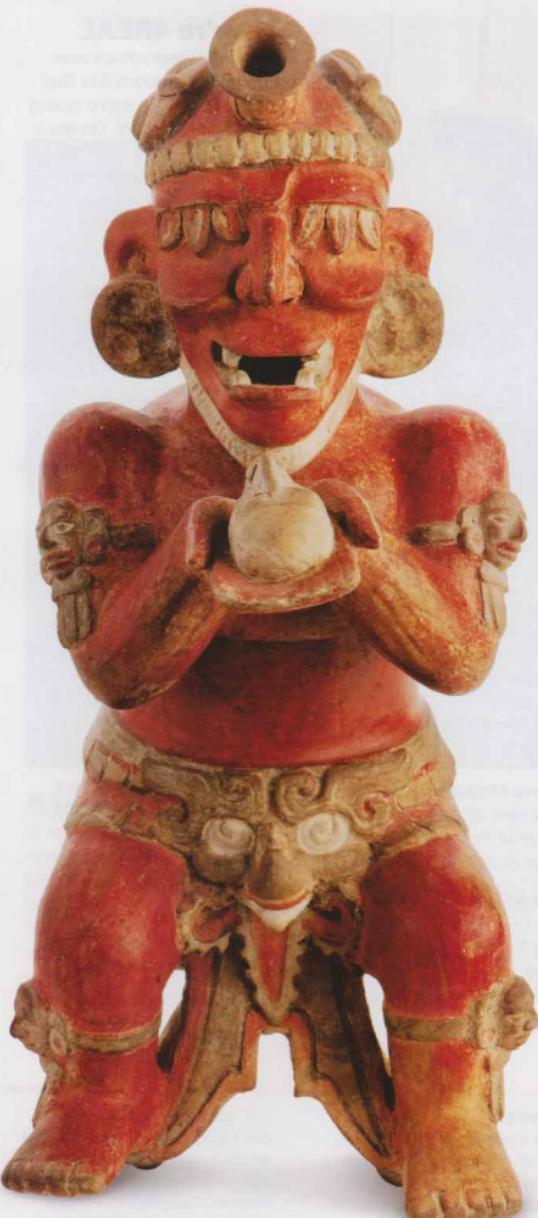
Photo Blitz

Taking pictures for the *Geographic* is often a solitary experience, but it wasn't so on Bioko. Four members (below) of the International League of Conservation Photographers took on the island off West Africa together. Tim Laman and Christian Ziegler hiked up into a caldera to look for primates, while Joel Sartore and Ian Nichols stayed near the beach.

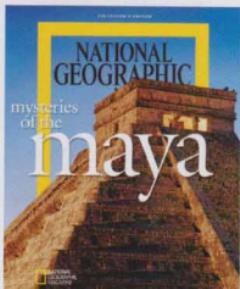
They still worked alone, but observed each other's techniques. "We all got along really well, and we enjoyed sharing ideas," says Laman. They also put their photos to work for conservation right away: Only days after finishing the shoot, they assembled a slide show about Bioko's biodiversity for local dignitaries.



Photographers Christian Ziegler, Ian Nichols, Joel Sartore, Tim Laman, and writer Virginia Morell take a rare break.



A fifth-century incense burner depicts a Maya god holding a human head.



COLLECTOR'S EDITION **Maya Wonders**

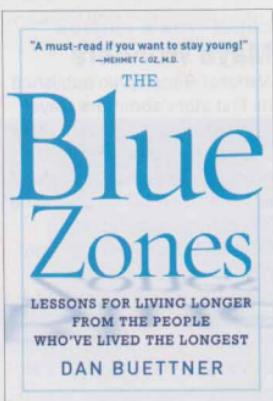
National Geographic published its first story about the Maya in its March 1913 issue, a report on the excavation of mysterious temples in the jungles of Guatemala. The lost civilization has continued to fascinate. Recent decades have brought new understanding of its culture. Far from the peaceful stargazers once imagined, the Maya had "a magnificent Classic civilization that went down in great violence and destruction," says *Geographic* senior writer Ann Williams, who worked on the new special issue, *Mysteries of the Maya*. It covers 2,000 years of Maya history, tracing the civilization's rise and fall, including its early agrarian days and the Postclassic flowering at sites like Chichén Itzá on the Yucatán Peninsula. The publication is on newsstands August 12 (\$10.95).



Josh Thome and
Sol Guy want to
change the world.

They're 4REAL

National Geographic's new Emerging Explorers Sol Guy and Josh Thome make saving the world look cool. On each segment of their TV series *4REAL*, Guy takes celebrities like Cameron Diaz and Joaquin Phoenix around the globe to meet community organizers who are making a difference. One program introduces a Quechua medicine man in Peru preserving his culture; another features an activist for children in postwar Liberia. *4REAL* airs internationally on National Geographic Channel and Nat Geo Adventure; check local listings for times.



NG BOOKS **Live Long and Happily** The stars of the new book *The Blue Zones* live in four places where people enjoy extraordinarily long lives: in a mountainous part of Sardinia, on Japan's subtropical Okinawa, on the Nicoya Peninsula of Costa Rica, and in the Seventh-day Adventist community around Loma Linda, California. Author Dan Buettner finds common threads among them and offers advice (below) for longevity (\$26).

- **Have Purpose** Nicoyans call it *plan de vida*—a reason to live makes life longer (and better).
- **Be Active** It doesn't have to be marathons. Many Sardinian men herd sheep, but anyone can make movement routine.

■ **Eat Plants** Blue Zoners eat little meat; historically, most didn't have access to it. Adventists advocate a vegetarian diet.

■ **Family First** Okinawans honor their ancestors daily and live with multiple generations.

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FLASHBACK



Banner Night Slogans honoring writer Maksim Gorky draped balconies at Moscow's Bolshoi Theatre in 1928. The photo appeared in the May 1930 *Geographic* article "Some Impressions of 150,000 Miles of Travel," by William Howard Taft. The former President—a long-time National Geographic Society board member—mentions seeing a "beautiful children's ballet" during a visit to the Bolshoi years before the Russian Revolution. But unrest was already in the air. During the same trip, he says of a military companion, "We never entered an anteroom where...the General, in humorous reference to the possibility of being blown up, did not suggest an examination of the ceiling to see whether it was of such material as to make our passage through it a comfortable one." —Margaret G. Zackowitz

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