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MARCH / APRIL 2013

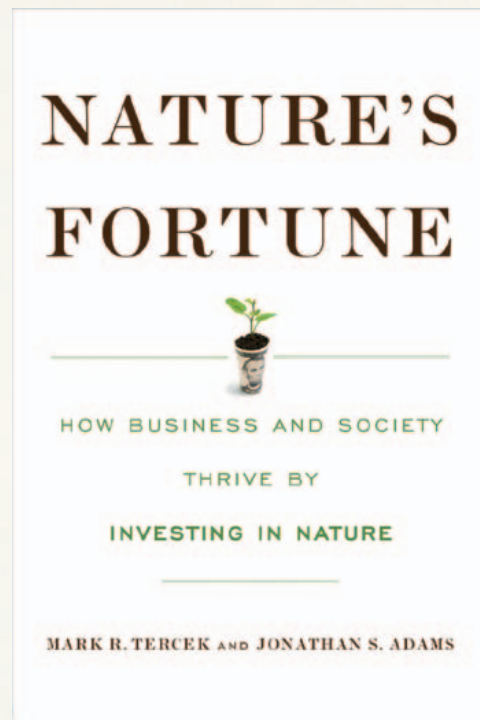
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VENEZUELA'S
SACRED GROUND

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HIDDEN
PRESERVES

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DOGS RESCUE
SALAMANDERS

“This is a critically important book that comes at just the right moment.”

—Walter Isaacson, President and CEO, The Aspen Institute, and author of *Steve Jobs*



“The environmental community needs to talk about nature using the language of business: assets, risks, and innovation. *Nature's Fortune* is the guidebook that can move environmentalism to this next level.”

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—Morton Schapiro, Professor of Economics and President, Northwestern University

From **Mark R. Tercek**, President and CEO of The Nature Conservancy, and science writer and conservation biologist **Jonathan S. Adams**.

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FEATURES



COVER STORY

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Palmyra Atoll may be a Pacific paradise, but it is also one of the most active shark habitats in the world—a living laboratory for researchers working in an unforgiving wilderness.

BY MATT JENKINS | Photographs by Tim Calver

46 **Hidden Gems**

These three wild places are alive and well and waiting for you, thanks to the work of The Nature Conservancy.

BY HAL HERRING | Artwork by Stan Fellows

54 **The Changing Land**

A new season has arrived in the vast Venezuelan prairies, where the Conservancy helped protect a million acres and the cultural heritage of local indigenous groups.

BY VIRGINIA GLASS | Photographs by Antonio Briceño

Above: Coconut palms seen from the water at Palmyra Atoll.

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On the cover: Kydd Pollock researching blacktip sharks. © Tim Calver



© ANTONIO BRICEÑO

in focus

Community Heritage

Conservancy researchers interviewed people in communities throughout Venezuela's Llanos grasslands—including in the village of Raicero—to support the designation of new protections for the region's cultural and ecological heritage.

Page 54: The Changing Land



© TIM CALVER

in focus

.....
**Under
the Weather**

On a rainy day in the waters around Palmyra Atoll, researchers track the ocean's salinity, temperature, carbon levels and acidity. A pole-mounted video camera is used to document the health of the corals below.

.....
Page 30: Kingdom of the Hungry

from
the
president

Investing in Nature



"Investing in nature is the smartest decision any business or government can make."

Water Source:
Protecting lands that supply drinking water in Ecuador supports people and nature.

Passionate supporters and generous philanthropists drive conservation forward. At The Nature Conservancy, we appreciate our supporters tremendously and are proud of all that you help us accomplish. Your commitment to conservation is vital. Nevertheless, to advance our ambitious mission, we'll need support that reaches beyond philanthropy.

We'll also need to persuade government and business leaders to invest in nature. Natural capital—the goods and services that nature provides—forms the foundation of all economies and all human well-being. Broad investments in natural capital will secure important benefits and will provide a powerful new source of funding and support for conservation.

Viewing nature through basic business principles focuses more attention on the benefits of conservation. In my new book, *Nature's Fortune: How Business and Society Thrive by Investing in Nature*, I argue that such a perspective makes clear that protecting nature is a central and important driver of economic activity—every bit as important as manufacturing, finance and agriculture.

Investing in nature is the smartest decision any business or government can make. The forests, floodplains and oyster reefs often seen as raw materials or as obstacles to be cleared in the name of progress are, instead, as important to our future prosperity as technology or law

or business innovation. With this book I hope to draw attention to the high returns available from investments in nature, and to broaden awareness of why the work of The Nature Conservancy is so important.

The Conservancy has long been a leader in developing innovative ways to finance conservation.

We continue to explore new strategies and to test new tools to pay for conservation and integrate it into our local and global economies. Water funds that we developed in Latin America, whereby urban water users pay to protect the forests and grasslands that hold and filter cities' freshwater, are now being replicated around the world—in Africa, Asia and the United States.

We are also working hard to pursue funding from "impact investment" sources of capital. An exciting new example is the Conservation Note, which allows individuals to invest

in Conservancy projects and generate a financial return—as well as a return for nature and future generations. The Conservation Note represents an expansion of opportunities for people who care about our natural heritage and want to put their money where their values are.

The need for innovation extends across all scales and all sectors of our work. With that in mind, this issue of *Nature Conservancy* magazine also marks a change. For the first time, we are accepting appropriate advertising to offset costs and to free up more of your contributions to support our mission. In addition, we are returning to our former bimonthly schedule to keep you better informed—and, we hope, inspired—about news and developments related to our work in your backyard and around the world.



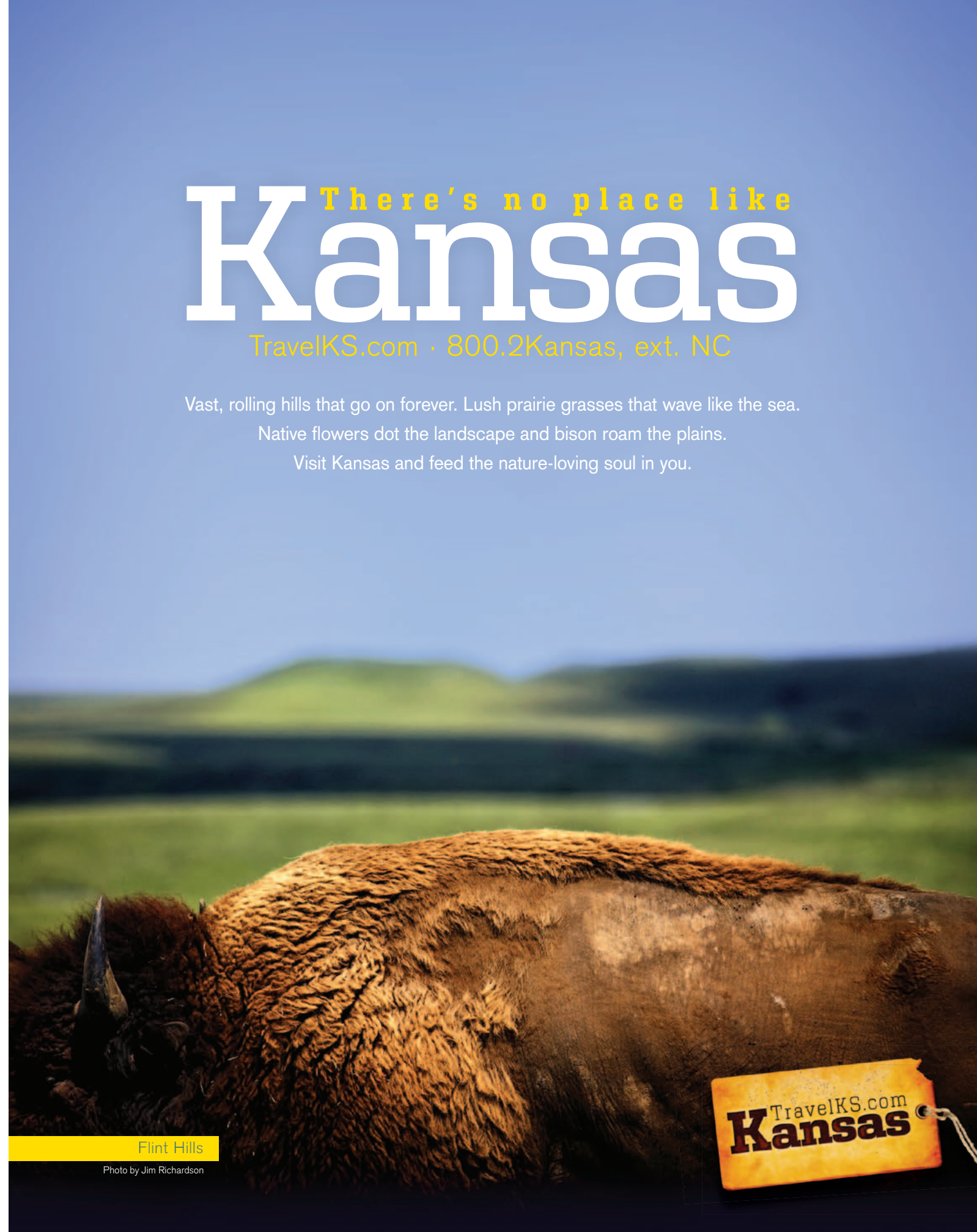
Mark R. Tercek

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Flint Hills

Photo by Jim Richardson



Top: Yosemite Valley; Yellowstone Falls; Jenny Lake, Grand Teton National Park

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at the
magazine



CONTRIBUTORS

COVER STORY
Tim Calver

Photographer Tim Calver began shooting underwater after meeting free divers at Bimini Biological Field Station in the Bahamas. There he spent six years assisting graduate students with shark research and free diving with his camera to capture their experiences—skills that proved valuable at Palmyra Atoll (“Kingdom of the Hungry,” page 30). “Free diving makes you quiet and quick underwater,” he says. Fish and other species come much closer to him that way, he says, because “there are no flashy bubbles.” Calver’s work has appeared in *Time* and *National Geographic* magazines.



Antonio Briceño
Antonio Briceño has photographed indigenous groups for many years. He turned his lens on the Pumé people of Venezuela to document the Conservancy’s partnership in the Llanos region (“The Changing Land,” page 54). “Normally, when we think about nomadic indigenous groups, we think about the Amazon forest,” he says. “It was fantastic to get in contact with people from the flat Llanos grasslands.” Briceño has had more than 30 solo exhibitions and more than 70 international group shows.



Hal Herring
As a child in northern Alabama, Hal Herring was fascinated by the glimpses of nature available to those willing to explore. “Some of my earliest memories are of wading in springs, catching the colorless crawdads and minnows that spend their lives underground and only briefly come out into the light,” he says. Visiting the 1,000 Springs Complex in Idaho (“Hidden Gems,” page 46) was a chance, on a grand scale, to rekindle that appreciation for hidden waters. Herring is a contributing editor at *Field and Stream* magazine.



Matt Jenkins
Senior Editor Matt Jenkins spent an unforgettable hour snorkeling with 10 baby blacktip sharks during his reporting trip to Palmyra Atoll (“Kingdom of the Hungry,” page 30). “The sharks were only several weeks old,” says Jenkins. “But they were full of curiosity, hovering face-to-face with us even as an adult blacktip patrolled the deeper channel just behind us.” Teaming with sharks and other predators, the remote island’s waters offer a rare glimpse into the past. “This is the edge of the truly wild,” he says.

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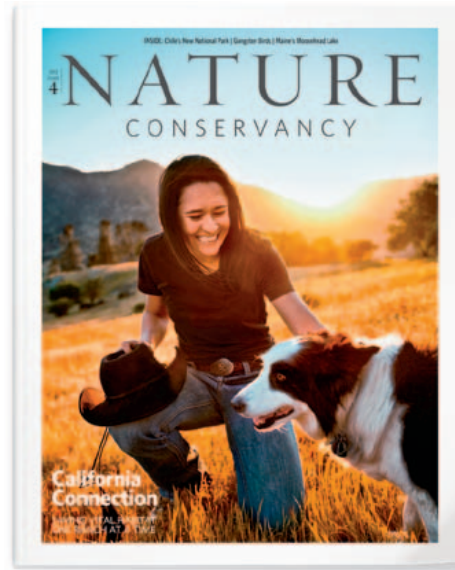
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Readers Respond to: 2012/ISSUE 4



On the Cover

While the lady and her dog on the cover of 2012 issue 4 are very photogenic, they were barely in the story, “The Missing Link” (page 46). I can go along with having people on the cover of the magazine, but it would be nice if they played a prominent part in the article to which the cover refers. Otherwise, the magazine was, as usual, wonderful.

S. Gelabert, New Smyrna Beach, Florida

The Land and the Furor

As a trustee of the Conservancy’s Vermont chapter, a longtime member (more than 35 years) and a Legacy Club member, I was happy and proud to read about the three large land-conservation ventures carried out as reported in the last issue of the magazine. These great initiatives included the Valdivian coastal range in Chile, Moosehead Lake in Maine and the Tollhouse/Tejon Ranch complex in California. Great maps, photos and writing!

I do believe, however, that the article about Chile, “An Abundance of Rarities” (page 28), was remiss in



one aspect: It leaves the impression that the land purchases in Chile by [businessman and conservationist] Doug Tompkins (who was not mentioned by name) had only negative consequences—“a furor.” The article [which focused on the difficult climate for private conservation in Chile in the

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READER SAYS

“With so much focus on grand-scale projects, it was refreshing to read about a small success story.”

—**Sondra Wolferman**

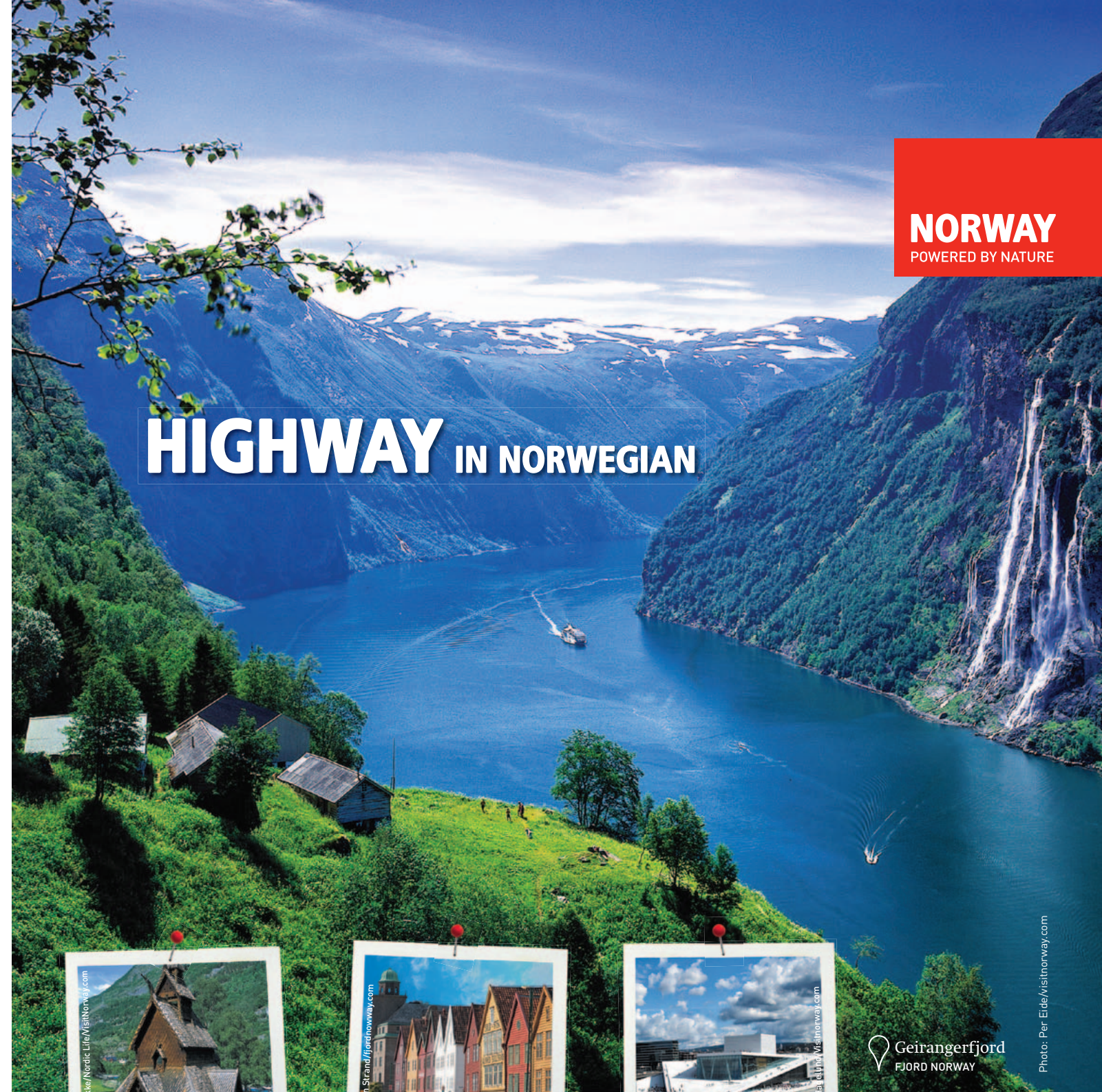
1990s] does not mention that thanks to those efforts, Chileans now have two new national parks: the magnificent Corcovado and Pumalín National Parks. Both of these gifts promoted the protection of additional government land to create very large parks. [Tompkins’s efforts have helped protect an estimated 2 million acres in Chile.]

While indeed there was some furor in early days, these two fine protected areas—plus other lands that Tompkins has conserved—have set a fine example of private conservation philanthropy.

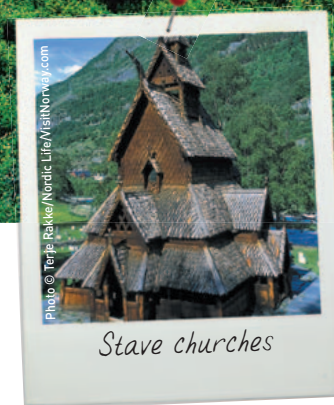
Larry Hamilton, Charlotte, Vermont (Professor Hamilton is an advisor to the International Union for the Conservation of Nature’s World Commission on Protected Areas.)

Correction

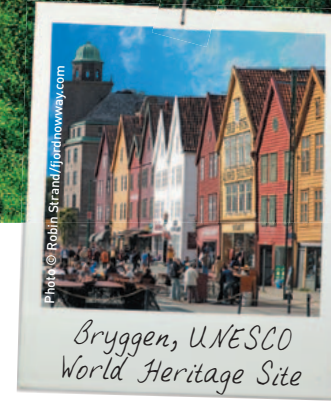
The Statement of Ownership, Management and Quarterly Circulation of Nature Conservancy magazine that appeared in 2012/issue 4 included an incorrect filing date. The date should have read September 28, 2012.



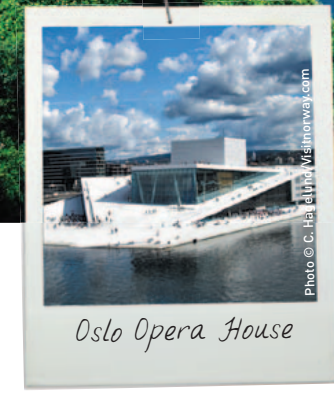
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 **CLICK:** Find a picnic location near you or sign up to host your own at nature.org/allhands.



Low-Tech Success

Kudos to the magazine for “The Mafia Birds” (page 40) on parasitic cowbirds versus songbirds in the Cache River Watershed of Illinois. With so much focus these days on grand-scale projects and high-tech solutions, it was refreshing to read about a relatively small, localized conservation success story that could have a big impact on future conservation decisions.

Using only “low-tech” equipment, such as empty milk cartons and a bicycle rear-view mirror attached to a paint-roller pole, scientists managed to peer into the nests of an elusive bird and solve the mystery of how cowbirds are contributing to the decline of songbird populations throughout the region.

Even better, the scientists were astute enough to realize that the solution lies not in trying to eradicate the cowbirds—they are simply doing what they are biologically programmed to do—but in restoring habitat disturbed by human activity so the songbirds have a fighting chance at survival.

Sondra Wolferman, Albrightsville, Pennsylvania

Another Perspective on Mafia Birds

While preparing for a bird-watching trip to Costa Rica, I read an article concerning the impact of cowbirds on Montezuma oropendola fledglings.

One cowbird chick in the nest increases the survival rate of oropendola chicks. Why? Because the large cowbird chicks are better at keeping the parasitic insects under control.

Jim Vokac, Willow Springs, Missouri

Out of Line

Vince Stanley’s letter (page 14) stating that sports fishermen are hounding bluefin tuna and swordfish to extinction is way out of line.

Sports fishermen’s catch and keep of those two species is tiny compared with commercial catches—one would have to call it insignificant in comparison. But what is significant is the positive effect that sports anglers have by providing the vast majority of information about these two pelagic fish that roam around the world. Sports fishing catch-tag-and-release programs for bluefin tuna and swordfish provide scientists with information they never would be able to acquire otherwise.

So please put a bit more research into making the kind of statements that can turn a very supportive group of people into nonbelievers.

Dick Pinney, Greenland, New Hampshire



Magical Conservation

I enjoyed reading about the establishment of reserves in Chile and California, but was perturbed that no mention was made as to the amount of monies spent. Conservation doesn’t just magically happen; without the dollar amounts, it all seems a bit abstract.

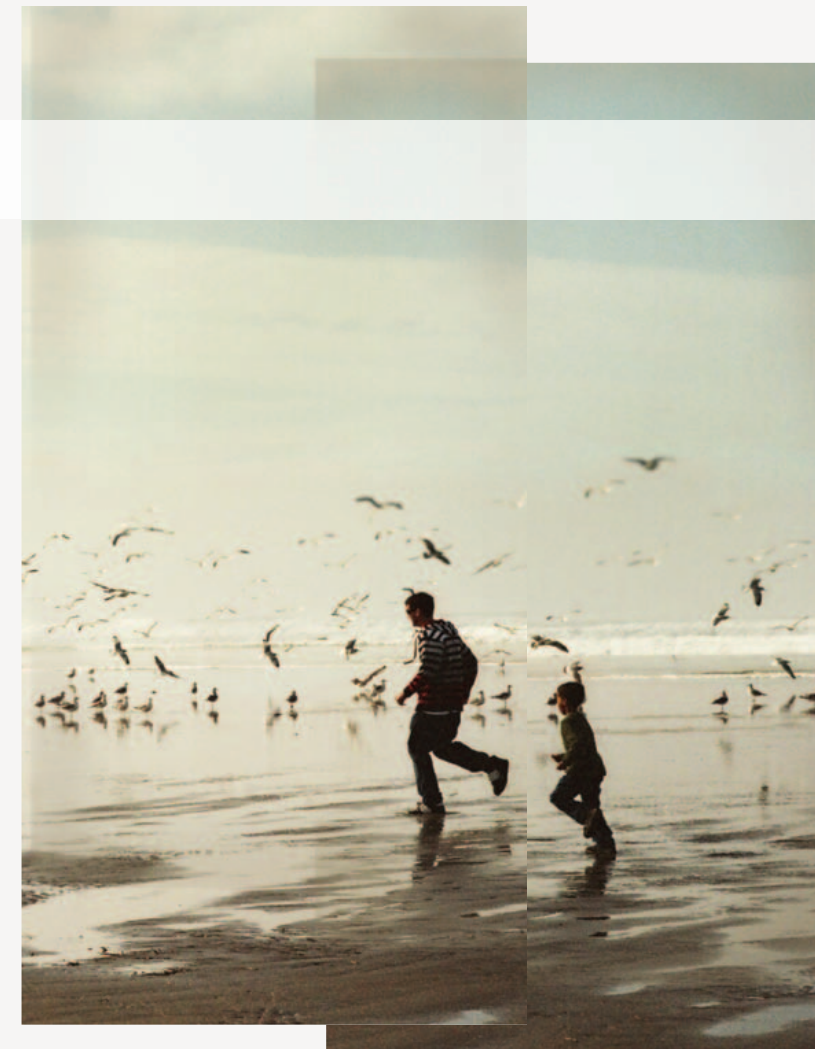
Tom Carroux, Menlo Park, California

The editor responds:

Thanks for the reminder to keep members fully informed. Here are the details from those deals: \$75 million for the 147,000-acre Valdivian Coastal Reserve in Chile, and \$19.2 million to protect the Caliente, Tollhouse and Parker ranches, a total of nearly 32,000 acres in Southern California.

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- Christine & David Vernier, Portland, Oregon

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Self-employed, Orly Yadin and Bob Summers needed to find a way to generate income for retirement. Using funds from an inheritance, they established a Nature Conservancy charitable remainder trust, which gives them lifetime income with growth potential and tax savings. [Read their full story at nature.org/truststory.](http://nature.org/truststory)



INSIDE: Protecting part of the Old West **PAGE 20**... Kenya's new home for hirola **PAGE 20**... Bulldozers restore a bay **PAGE 22**... Who's using Puget Sound? A closer look at species **PAGE 22**

worldview



WATER DIPLOMACY: A new deal will return more water to the Colorado River Delta, now 10 percent of its former size.

MEXICO

Colorado River Returns to the Sea

IN NOVEMBER THE NATURE CONSERVANCY HELPED NEGOTIATE a five-year pilot program between the United States and Mexico to allow more water to flow through the Colorado River to the Gulf of California. The deal will help restore northern Baja's and Sonora's fabled estuaries—a lush wetland area that once extended more than 1,500 square miles.

The two countries have long wrangled over the Colorado but agreed to revisit a treaty after a 2010 earthquake destroyed irrigation infrastructure in northern Mexico. The United States has also agreed to store some of Mexico's allotment of water until the damage can be repaired. —ERIK NESS

© PETER MCBRIDE/NATIONAL GEOGRAPHIC STOCK

INNOVATIONS

48

ENDANGERED HIROLA ANTELOPES GET A NEW SANCTUARY IN KENYA

When Africa's hirola population declined to less than 500 in 2011, conservation officials proposed a radical idea: Build a predator-free sanctuary ("Hirola Heroics," 2011 issue 3). In 2012 that plan became a reality when Kenya's Ishaqbini community, which considers the hirola sacred, worked with a coalition of Conservancy partners to fence off 10-square-miles and reshuffle the food chain—hirola in, cheetahs out. After the 6-foot-tall fence was completed, the Kenya Wildlife Service tranquilized and airlifted 24 hirola into the sanctuary, where they joined 24 already inside. Cheetahs were captured and moved safely outside the preserve. With support from the Conservancy, the Northern Rangelands Trust and others, the Ishaqbini will manage the sanctuary.



WESTERN CRITTERS: The plains leopard frog (above) and the Texas horned lizard thrive in eastern Colorado's grasslands.

COLORADO

Old West Lives On

YOU MAY NEVER VISIT THE 33,000-ACRE SMITH CANYON RANCH IN southeastern Colorado, but you know what it looks like. "This is the epicenter of Old West mythology," says the Conservancy's Matt Moorhead, who directs the Southeast Colorado program. The ranch is near the historic Sante Fe Trail, and countless movies have been shot depicting the region's grasslands and pinyon and juniper forests.

With its purchase of the ranch last October, the Conservancy has now protected more than 300,000 acres of shortgrass prairie east of the Rockies, much of it in the past five years. These large tracts support declining grassland birds and a host of other species, such as black bear, mountain lion, pronghorn antelope and bighorn sheep.

Local ranching families have kept the land intact, says Moorhead, and after a rest and the addition of a conservation easement to preclude development here, the ranch will be sold back into working hands. —ERIK NESS

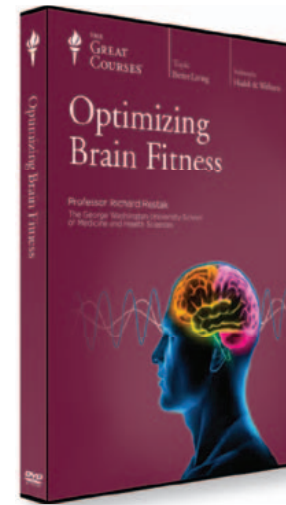


WHY WE CARE

Grasslands like those found in southeastern Colorado help to purify water and clean air—and host a broad array of wildlife—but they are one of the least protected habitats on Earth.

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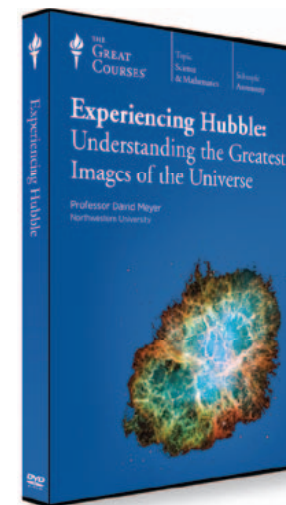
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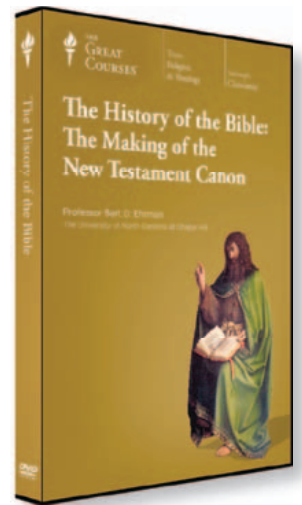
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WINTER STOPOVER: Thousands of shorebirds migrate through or overwinter in the marshes of Port Susan Bay, Washington. Surveys in the mid-1990s found more than 20,000 shorebirds regularly gathering here.

WASHINGTON

Building a Better Bay

NOT MANY ECOSYSTEMS GET REPAIRED BY BULLDOZER, BUT HEAVY machinery was the tool for the job this past year at The Nature Conservancy's Port Susan Bay Preserve in Washington.

At Port Susan Bay, the freshwater currents of the Stillaguamish River mix into the salt water of Puget Sound. Thousands of wintering shorebirds, juvenile salmon and young crabs feast in the relative safety of its marshes.

At least that's how things used to work. But in the 1950s, farmers diked an area at the mouth of the Stillaguamish, deflecting the river south. With that diversion in place, "not a lot of fresh water was getting into the northern part of the bay," says Kat Morgan, who manages the Conservancy's program at Port Susan Bay. As a result, salinity levels rose while the bay's native species declined.

The Conservancy launched a plan to turn things around. The first step, in 2001, was buying the 4,000-acre preserve. The next step: Lose the dikes.

In autumn 2012 bulldozers breached the barriers separating the river from the bay's northern reaches. Workers restored a nearby pocket estuary, a small backwater perfect for juvenile salmon looking for food and good hiding spots. They also reinforced a nearby dike to protect neighboring farms from flooding. Finally, the Conservancy purchased a bluff that feeds critical sandbar-building sediment to three miles of Port Susan Bay shoreline.

Morgan figures it will take four years for these changes to produce measurable results. But after decades of decline, this estuary is on its way back to health, she says. "This was the year of Port Susan Bay." —BETH GEIGER

PROTECTING PUGET SOUND'S SPECIES



The dunlin is one of dozens of shorebird species that migrate through Port Susan Bay, a stop along the Pacific Flyway. Between 2007 and 2011, annual counts ranged from 30,000 to 57,000 shorebirds, many of them the dunlin and the western sandpiper. With the arrival of spring, the migrants depart for Alaska.



Juvenile chinook salmon transition from river to sea at Port Susan Bay. After hatching in the Stillaguamish River, young salmon swim to the bay where they will stay for up to six months. In the marshes, youngsters find food to eat and places to hide as they adapt to salt water.



Young Dungeness crabs also prefer the shallow estuary, where they live among eelgrass beds and feed on the plentiful invertebrates found in the warm waters. The vegetation and debris of the estuary provide good cover from predators—including adult crabs, which are known to cannibalize juveniles.

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Boardman grasslands harbor Oregon's largest viable population of the endangered Washington ground squirrel. © Rick McEwan

By the Numbers

New deals and developments from the world of conservation



2,000

Acres protected along the Upper Mississippi River in Minnesota. The Conservancy provided critical support for an \$11 million deal brokered by The Trust for Public Land, Crow Wing County and other entities to protect the property—a haven for the state's beloved walleye (above).

40%

Proportion of the contiguous United States encompassed by the Mississippi River basin. The 1.2-million-square-mile landmass discharges water into the Gulf of Mexico at a rate of 600,000 cubic feet per second.

CLICK: Find out what's new in your neck of the woods at nature.org/wherewework.

\$10 million

Amount raised by The Nature Conservancy in the United States and The Nature Conservancy of Canada to help pay for the permanent retirement of oil and mineral development rights on the headwaters of the Flathead River, a project completed in September 2012.



31,000

Jobs in Iowa created by outdoor recreation activities, which inject \$717 million into local economies, according to a 2012 Iowa State University study funded by the Conservancy. The state legislature is considering a small sales tax increase to fund additional parks, trails and soil conservation projects.



2.1 MILLION

Trees planted by the Conservancy's Plant a Billion Trees campaign, thanks to contributions from cosmetics giant Avon and its customers. Avon launched its Hello Green Tomorrow program in 2010 and has since raised more than \$2.7 million for the Conservancy tree-planting project.

94,000

Acres encompassed by a new protected area established by Mexico on and around the island of Cozumel. With Conservancy help, local group Amigos de Sian Ka'an built the case for the September 2012 declaration.

2.5

Miles of Sulphur Creek in Idaho now safeguarded by a conservation easement agreement between the Conservancy and the Page family, owners of Big Creek Ranch. The easement secures permanent water flows for chinook salmon and native bull trout.

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Photo: Kenton Rowe



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Photo: Robert Granzow 



Stephanie Wear

The Conservancy's leading expert on coral reefs talks about her fear of scuba diving, nearly drowning and why she's hopeful about the future of coral reefs.

I was surprised to learn that you, a marine biologist, don't scuba dive; you only snorkel. Why is that? I am actually claustrophobic. I dove in grad school because I had to for my research. I didn't like it. It's not that I didn't like being underwater and seeing

all the reefs; it was that I didn't like the physical sensation. I didn't like breathing pressurized air.

Doesn't that make it hard to do your job? No. I actually know a famous marine biologist who doesn't even swim.

.....
 "It's irresponsible to call it quits on such an important habitat."

DETERMINED: Wear, a marine biologist with The Nature Conservancy, spends her time studying—and fighting for—coral reefs around the world.

Speaking of which, you've had close calls in the ocean, right? Yeah, I did have a near-drowning experience. I was working as an intern in St. Croix—my first job for The Nature Conservancy. I was out on my own—everyone was spread out across the reef—and I ended up getting cramps in both my feet and legs. Before then I had been a lifeguard for five years, and I always thought I would just float and relax in that situation. But it was excruciating, and I panicked.

I started yelling, and fortunately Rob Weary—a competitive swimmer who also works at the Conservancy—saw me and came over. He got me on my back and basically swam me 500 yards over to the boat. To this day he jokes that I should have named my firstborn after him.

And yet you haven't been put off by the oceans and coral reefs. What is it about them that you find so interesting? The diversity—it's hard to get bored. When I'm out in the water, I love looking under rocks for cryptic creatures. Turtles, sharks and dolphins are exciting, but I love to find the little things. It's so complex—the way everything interacts. As much as coral reefs have been studied, we still don't totally understand how they function.

You know better than anyone, however, that coral reefs are in trouble. What kinds

of challenges do they face? When you talk about losing a reef, you're ultimately losing it to seaweed. It's a battle between coral and seaweed, fighting for space. Seaweed and algae grow a lot faster [than coral], so corals are at a disadvantage. We humans have done a tremendous job of aggravating this by fishing the herbivores that keep the seaweed under control and by pumping nutrients into the system.

And these reefs are even more at risk as the climate changes? Corals don't live well beyond a very narrow range of temperatures. Even bumping temperatures by 1 to 2 degrees Celsius can be catastrophic for a reef.

That sounds fairly hopeless—but not too long ago you castigated a *New York Times* opinion writer who said it was a waste of time and money to protect coral reefs. Why? I strongly disagree with him that there is no hope, that it's a done deal. The respectable science is demonstrating lots of examples of recovery and reasons for hope. I think it's incredibly irresponsible to call it quits on such an important habitat that so many people depend on.

So what can be done for coral reefs? We as a global community have to figure out how to get carbon dioxide emissions down. That's a tough order. Not impossible. In the meantime, if we could solve some of the other problems affecting reefs—the way coastal areas are developed, the way fisheries are managed, sewage discharged—that would benefit other marine habitats as well. For me, it's not just about losing habitats; it's about losing all the things that those habitats provide to people—essential resources for human life.

You also are re-evaluating your approach to coral reef protection and are looking

to involve corporations. How? I haven't figured it out yet. I'm used to working with fishermen, people in the tourism industry, governments. Now we're trying to identify the global drivers that are affecting reefs, like pollution. An example would be a sewage treatment company. Maybe we partner with a company like that to make it more affordable to bring sewage treatment to countries that need it—protecting reefs and helping people.

You've traveled for work to many of those places—Palau, India, Guam—frequently with your two small kids in tow. Short of

When you were a kid, your family moved from Washington state to Virginia for what your father described as work and church reasons. How did that affect you? My dad would never put it this way. I was born in a hippie Christian commune. He would say it was "intentional living." We moved for a church that was really focused on outreach in the community, doing good things for people, helping the weak and poor. I was raised in this environment. Social causes were my foundation. That continues to be my moral compass. My focus just happens to be the environment.



ALL IN THE FAMILY: Wear's husband Brian Silliman—a marine ecologist himself—and two young children frequently travel with her to coral conservation projects around the globe.

knocking them out with Benadryl, I'm not sure how you survive those trips. We haven't drugged them. My husband travels with me, and most of the time the trips work out. One of the biggest challenges is being OK with the fact that your baby might cry, and it's going to bother other people. But everyone around you was once a baby, too.

Moral compass I get, but you've said before that the ocean provides you with balance—even after all the trouble it's given you? It's not a simple relationship; it's complex. I've had a few bumps and scrapes and close calls, but nothing that would send me to the mountains. The ocean makes me feel more good than bad—any day. ■

Hot on the Trail

Conservationists call in the dogs to help track down elusive salamanders.



→ **CLICK:** See Frehley the dog in action at nature.org/canines.



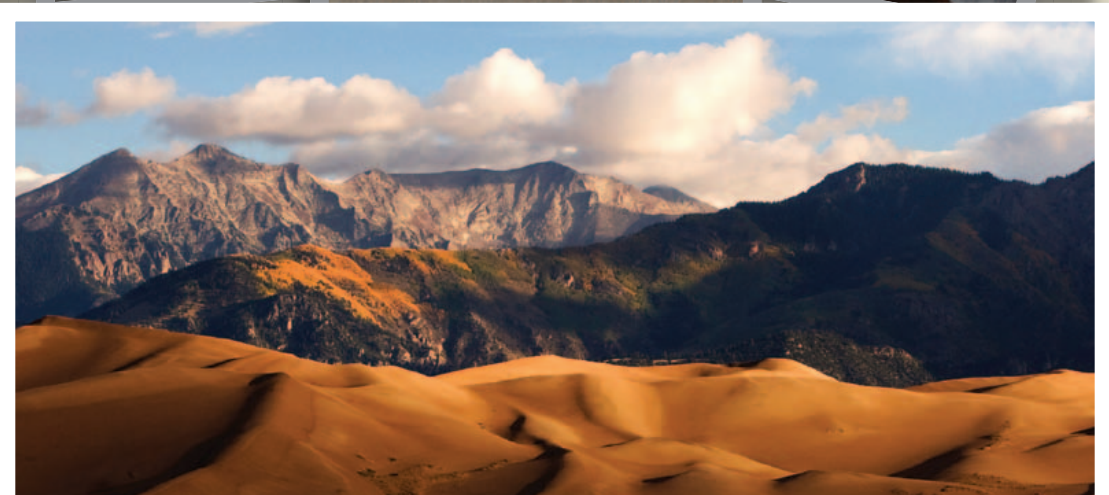
CONSERVATION CANINES: A border collie named Frehley helps field technician Nathaniel "Bud" Marks look for Jemez Mountains salamanders in the Santa Fe National Forest in New Mexico. Frehley is one of many dogs rescued from shelters and trained to sniff out species from mice to orcas.



Medieval lore has it that salamanders thrive in fire.

If the legends were true, New Mexico's endangered Jemez Mountains salamander wouldn't be struggling now that climate change has brought bigger, more intense wildfires to the region. To help the species weather the changes, scientists working with the Conservancy first need to know how many salamanders there are and where they live. But finding them isn't easy—if you are human, that is.

Yet for a canine tracker from the Center for Conservation Biology, tailing salamanders can become second nature. Assisted by dogs trained to sniff out hard-to-find species, a forestry team is surveying the salamander population in New Mexico so that controlled burns and other work to reduce the threat of intense wildfires won't harm the salamanders' habitat. —HEATHER SISAN



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KINGDOM OF THE *HUNGRY*

The Conservancy's Palmyra Atoll
has become the ultimate living laboratory
for researchers who spend their days working
in some of the healthiest—and
most dangerous—shark habitat in the world.

ALL HANDS ON DECK: Scientists aboard a research boat implant
a tracking transmitter on a gray reef shark at Palmyra Atoll.

BY MATT JENKINS / PHOTOGRAPHS BY TIM CALVER

F

FOR YEARS, KYDD POLLOCK HAS DIVED WITH SHARKS. Yet even now he is awed by the animals' ability to gather together, like specters, seemingly from nowhere.

"I'll scan around and see nothing," he says. "And only moments later, I can look up again, and they're right there. They're just amazing creatures."

But on November 11, 2010, Pollock got a terrifying glimpse of just how wild the animals can be. That day, Pollock, the chief of marine operations at the Conservancy's Palmyra Atoll preserve in the central Pacific, accompanied several researchers as they boated to the outskirts of the islands.

The scientists hoped to corral a cantankerous Napoleon wrasse they called Big Eddie with a net. Once the group moored their boats, the scientists pursued the fish with scuba gear. Suddenly, a pregnant six-and-a-half-foot gray reef shark appeared—and, to everyone's alarm, swam straight into the researchers' net.

Pollock, who grew up working on his dad's charter fishing boat in New Zealand and fishing and diving in the South Pacific's Cook Islands, has been a big-fish wrangler all his life. While the scientists worked to untangle the shark, Pollock removed his scuba gear and snorkeled above to serve as a safety backup. Once free, the disoriented shark swam straight for another section of the net.

Pollock kicked through the water to pull the net out of the way, and the shark turned away, as if she were going to swim off. Then, as he gathered the net in his hands, Pollock looked over his shoulder and saw a terrifying sight.

"She had spun around and was coming at me, mouth wide open," he says. "I was the only thing in her way."

The shark closed her jaw over Pollock's head, grabbing his face mask and skull with her teeth, and began forcing him deeper, violently shaking her head as she went.

"His entire head was in her mouth," says Amanda Meyer, a U.S. Fish and Wildlife Service refuge manager, who was scuba diving nearby. "You could hear the crunching underwater."

Then, unexpectedly, the shark backed up, spat him out, made one more glancing blow at his head and disappeared.

The other divers heaved Pollock into one of their boats and raced back to the atoll's research station, where they improvised an emergency room in the science lab. Pollock was in shock and shaking, and covered in blood. "Both his eyelids were sliced," says Meyer. "It was just a torn, ripped mess."

The nearest professional medical help was 1,000 miles away in Hawaii. Via satellite phone, research station manager Ned Brown reached doctors, who then coached Meyer and other Conservancy staff through the delicate process of closing his wounds with stitches and surgical staples.

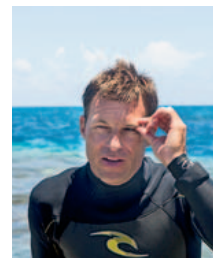
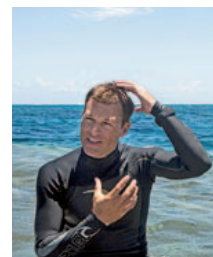
Miraculously, Pollock's injuries were light enough that he was able to remain on the island for another month—and resume diving—before finally flying out to Hawaii. But New Zealand's *Sunday News* wasted no time in splashing grisly photos of Pollock under a headline that screamed, "Kiwi's Horror Shark Attack."

For Pollock, though, getting bitten was simply the cost of trying to understand a world where sharks, not humans, are in charge. "Even the minute it happened, I've never seen it as an attack," he says. "Sure, the shark bit me. [But] it was us that put the net down. It wasn't the shark's fault."

Pollock was back in the water just 21 days after being bitten. Since then, he has racked up lots more dive time helping scientists carry out their research on Palmyra.


There is, in many ways, a sense of rare opportunity on this group of islands that make up the atoll. Nearly 40 million sharks are killed worldwide each year, and the planet's coral reefs have suffered widespread destruction. Yet Palmyra is different.

>> CONTINUED ON PAGE 37



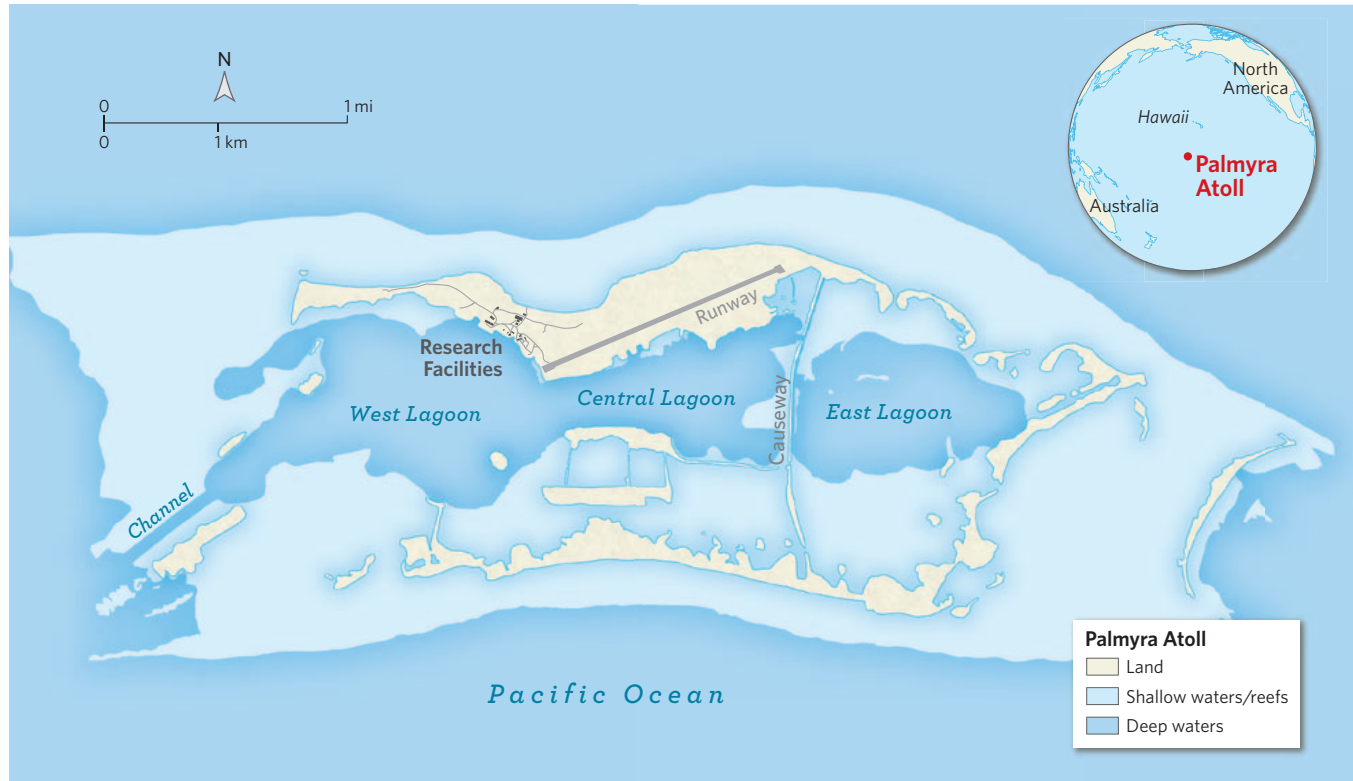
Occupational Hazards

Kydd Pollock recounts the shark bite he sustained while working at Palmyra. He isn't alone when it comes to heart-stopping run-ins with animals in the wild. We asked several Conservancy scientists to describe their wildlife close-encounters and how the experience intensified their commitment to conservation.

 **CLICK:** Read these stories and share your own close encounters at [nature.org/close-encounters](https://www.nature.org/close-encounters).



COMMITMENT: Even after a gray reef shark bit him on the face and head, Pollock's enthusiasm for working at Palmyra has not diminished. As the Conservancy's chief of marine operations for Palmyra, he continues to dive the reefs (top) and helps guide researchers who are studying sharks and ocean conservation.



SHAPED BY CONFLICT: To convert the atoll into a World War II air base, the U.S. Navy used a dredge ship to carve out the western channel and shape an island long enough for a runway. Since then, damaged corals have rebounded, and there's far more shallow reef acreage at Palmyra than dry land.

Little Atoll, Big History

Named after a U.S. ship that accidentally discovered the atoll in 1802, Palmyra has a movie-worthy back story. A few years after its discovery, a Spanish pirate ship called the *Esperanza*—reputedly loaded with Incan gold—wrecked on the island. Legend has it that the treasure remains there today. The island was annexed by Hawaii in 1862 and in 1922 was sold to the Fullard-Leo family for \$15,000. With the outbreak of World War II, the U.S. Navy commandeered the island and turned it into an air base. Even then the atoll remained a lonely outpost. The only action came in 1941, a few weeks after the attack on Pearl Harbor, when a Japanese submarine shelled the island.

In 1968, the *Apollo 8* crew splashed down not far from Palmyra, but the atoll is probably best known for a whodunit that made national headlines six years later. Two American sailing aficionados, Mac and Eleanor Graham, disappeared while visiting Palmyra aboard their yacht. Seven years

later, Eleanor's bones were found stuffed inside a metal trunk at the atoll. Buck Walker, a yachtsman and former marijuana grower who had also been on the atoll at the time, was eventually convicted of her murder. The case was immortalized in celebrity lawyer Vincent Bugliosi's book *And the Sea Will Tell*.



ADOG'S LIFE: Palmyra's resident mascot, Dadu, came as part of the agreement when the Conservancy purchased the atoll in 2000.

Things stayed plenty strange in the next few decades largely because Palmyra lives in a kind of legal limbo as a separate U.S. territory (it was not included as part of the Hawaiian Islands when they became a state). Thus Palmyra has drawn proposals for a casino, a spaceport and a nuclear waste dump.

In 2000, The Nature Conservancy paid the Fullard-Leo family \$30 million for the atoll, which scientists had identified as a rare patch of largely pristine marine habitat. Part of the deal stipulated that several resident cats and a wizened, shark-eating dog named Dadu be permitted to live out their lives on the island. In 2001, most of the islands and the surrounding reefs were transferred to the U.S. Fish and Wildlife Service, which created the Palmyra Atoll National Wildlife Refuge. The Conservancy retained the largest islet as a nature reserve, and shares management of the atoll with the Fish and Wildlife Service. Dadu keeps watch over the atoll to this day.

MAP: © XNR PRODUCTIONS



RECLAMATION: Most of the 100-plus buildings constructed by the U.S. Navy at Palmyra have decayed beyond repair; several now support research work.



SCENES FROM A LIVING LABORATORY: Divers measure a transect to study fish feeding on coral (top, left). Scientists observe, measure and sample DNA from young blacktip sharks (right). An undergraduate research assistant carries tubes for a floating lab that pumps samples of water from various parts of the reef and measures the alkalinity (bottom, left).

Halfway between San Francisco and Auckland, the tiny necklace-shaped atoll is home to some of the most pristine coral reefs on the planet. A volcanic pinnacle that rises more than 16,000 feet from the ocean floor and is crowned with more than 130 species of coral, Palmyra is fringed with sprawling reefs filled with a psychedelic profusion of fish. Yellow-and-black convict tangs shimmer in the water like butterflies, while turquoise, lemon peel and star-eyed parrotfish, moon and sunset wrasses, neon damselfish and goldrim surgeonfish brighten the reefs.

The atoll's relatively undisturbed waters offer surprising new ways of thinking about sharks and a rare window into the way that predators shape entire ecosystems. Yet

museums and conservation organizations that have banded together as the Palmyra Atoll Research Consortium.

The three scientists aboard the *Zenobia* banter about the collapse of the Greek economy and the giant hole in Papastamatiou's shorts. Pollock, meanwhile, plunges his hands into a cooler full of ripe fish carcasses and threads the bait onto a giant, barbless fishhook. He appraises his creation with obvious pride—"a tuna-mackerel slam!"—and then casts off the stern.

Almost instantly, Pollock begins furiously reeling the taught line back in. As Caselle prepares a set of Tootsie Roll-sized radio transmitters, Friedlander, Pollock and Papastamatiou hang over the starboard gunwale, oblivious to the boat's

“WE ACTUALLY GET TO DO FOCUSED, EXPERIMENTAL, LONG-TERM RESEARCH HERE. AND WE CAN'T DO THAT KIND OF SCIENCE ANYWHERE ELSE IN THE WORLD.”

JENN CASELLE, BIOLOGIST, UNIVERSITY OF CALIFORNIA, SANTA BARBARA

Palmyra has also always been a wild and sometimes savage place. Eighteenth-century seafarers brought home reports of “sharks innumerable,” so voracious that they attacked the oars of visiting boats. Not much has changed here in all the years since.

Pollock spends considerable time diving in Hawaii as well and has made roughly 700 dives there over the past several years. “Out of all those dives, I’ve basically seen one shark,” he says. “Whereas here, you could potentially see up to 100 sharks on a single dive.”

“This,” he adds, “is a predator-dominated ecosystem. You are not at the top of the food chain here.”

Today, Pollock guides the 25-foot research boat *Zenobia* through choppy seas off Palmyra. Back on the sand-fringed atoll, coconut palms lean crazily from the bright green pisonia trees; farther out, a white line of breaking surf marks the edge of the reef. A ragged scrim of purple cloud hangs on the horizon.

On *Zenobia*'s working deck, a University of California, Santa Barbara, researcher named Jenn Caselle, University of Hawaii professor Alan Friedlander, and Yannis Papastamatiou, a postdoc from the University of Florida, prepare for the day's work. Many of the scientific studies on Palmyra are carried out by researchers from several universities,

gut-twisting rocking. The water explodes as a gray reef shark thrashes hard against the boat. Friedlander deftly loops a line around the animal's caudal fin, but the thrashing continues.

“Hey, chill out!” Pollock calls to the shark. “Relax.”

The three men finally flip the shark upside down and it instantly goes limp—a casualty of a temporary trance-like phenomenon called tonic immobility. Pollock grabs the shark's fins to keep it immobilized, and Papastamatiou goes straight to work.

“Knife, please,” calls Papastamatiou. Caselle carefully places a surgical blade in his hand, and he makes an inch-long cut through the thick skin just behind the shark's pectoral fin.

“All right, transmitter.”

Caselle palms off a transmitter, and Papastamatiou slips it under the animal's skin.

“Suture.”

With a swift motion, Papastamatiou sews closed the incision. Friedlander releases the tail, and with a quick snap of his wrist, Pollock deftly unhooks the shark. The animal rockets back into the deep, toward its first appearance on a web of moored electronic listening stations deployed to track sharks' movements.

This kind of work is the first step in learning how sharks shape the ecosystem in the waters around Palmyra. Understanding how sharks behave in a relatively pristine environ-



BLENDING IN: Bright colors are a must to survive in Palmyra's tropical setting. The islands' underbrush constantly crawls with coconut crabs (left). Purple storm snails (top right) and raccoon butterfly fish ply the waters for food—but every animal in this fast-churning food chain eventually becomes a meal.



POSTCARD PERFECT: A relative absence of human development since the Navy's departure after World War II has allowed Palmyra's islands and coral reefs to flourish. The atoll provides researchers a rare example of relatively pristine Pacific reef habitat by which to measure other, less-healthy reefs.

ment is giving scientists a baseline against which to compare reefs across much of the rest of the planet—ecosystems that have suffered widespread destruction and overfishing.

Friedlander, who has been coming to Palmyra since 2001, has dived stunning coral reefs all over the world. Most reefs, he says, are full of “pretty fish” but largely devoid of sharks and other predators.

“Here, you get a different vibe. You jump in the water and think, ‘This feels like I’m an intruder. I don’t really belong here,’” he says. “It’s life on the edge.”

Palmyra’s wildness is due, in part, to its remoteness. The atoll lies at the northern end of the Line Islands, an archipelago that stretches some 1,500 miles south across the equator. Auckland, Los Angeles and Tokyo are each more than 2,500 miles away. The only air service is aboard a Nature Conservancy-chartered Gulfstream jet, which is often crammed with so much scientific gear that even the lavatory is packed full. The wreck of a Lodestar propeller plane, which botched a landing in 1980, still

sits forlorn on the edge of Palmyra’s World War II-era crushed-coral landing strip.

But Palmyra’s remoteness has made it a special place. Born from the depths in volcanic fire some 65 million years ago, the island—which sits astride the Intertropical Convergence Zone, where the trade winds meet—was slowly beaten back into the sea by storms. Eventually, however, Palmyra was colonized by corals, which grow up toward the sunlight even as the remnants of the blown-out volcano sink into the ocean’s depths. The atoll is, in effect, a living island whose corals continue to grow to reach the surface of the sea.

Despite being blessed with plenty of white sandy beach, Palmyra is a tempestuous place even today. A rare “wet” atoll, the island is frequently raked with squalls that make the sea and the sky seem to melt together: 15 feet of rain falls here every year.

“I’ve been down here for two months of screaming 20-knot winds and rain every day, just hating life,” says Pollock.

Notwithstanding the sometimes-inhospitable weather, the island is a major mid-Pacific nesting ground—the only haven in nearly a half million square miles of open ocean

for red-footed and masked boobies, red- and white-tailed tropic birds, sooty and white terns, and great frigate birds. It is also home to legions of large, cranky-looking coconut crabs, the world’s largest terrestrial arthropods.

Palmyra may be one of the most remote islands in the world. It’s also one of the best protected. When The Nature Conservancy bought Palmyra in 2000 for \$30 million from the Fullard-Leo family of Hawaii, which had owned the island since 1922, it was the largest land deal the Conservancy had ever cut up to that time.

“I think people thought we were crazy,” says Suzanne Case, the Conservancy’s Hawaii executive director. “It’s so remote; it’s this little dot of land in the middle of the Pacific Ocean—how do you even get there?”

Recognizing Palmyra’s relative pristineness, the Conservancy quickly moved to transform the atoll into a long-term research station. The organization reopened the abandoned runway, set up a camp with a scientific laboratory, built a small fleet of research vessels and installed a six-person crew to support visiting researchers. The Conservancy also subsequently transferred much of the atoll, and the 16,000

acres of reef that surrounds it, to the U.S. Fish and Wildlife Service, which now manages Palmyra and its surrounding waters as a national wildlife refuge and part of the Pacific Remote Islands Marine National Monument. Today, the Conservancy owns and operates two of the atoll’s islands as preserves, maintains the Palmyra research facilities and supports the scientists while they are on the islands.

“It’s just spectacular. It gives us a whole different perspective on what healthy ecosystems should be,” says Susan White, the superintendent of the Fish and Wildlife Service’s Pacific Reefs National Wildlife Refuge and Monument Complex. “Everything [the scientists] are learning is something that we didn’t know before.”

Researchers may get the chance to see other relatively undisturbed reefs only once in their lifetimes, but the research station at Palmyra affords scientists the ability to return again and again and ask questions that may take years to answer.

“We actually get to do focused, experimental, long-term research here,” says Caselle. “And we can’t do that kind of science anywhere else in the world.”



THE HANDOFF: Pollock transfers a black-tip pup from a cast net to a makeshift data station. Researchers have studied the species' habits and distribution at Palmyra for more than a decade.



GO DEEPER:
Explore life on Palmyra—above and below the sea—in exclusive photo galleries in our digital edition for iPad.



ISLAND KEEPERS: A U.S. Fish and Wildlife Service volunteer releases a banded tropic bird (top). Amanda Meyer, who manages the wildlife refuge, uses a drill and herbicide to thin coconut palms. The trees are not native to Palmyra.

Sharks are a particularly challenging research subject, largely because—as Papastamatiou puts it—“I can’t bring a shark back to the lab.” Shark science has consequently always demanded a hefty dose of improvisation. Even today, researchers sometimes track sharks by tethering Ping-Pong balls to them, and they sample the animals’ feeding habits by inserting a PVC pipe in their throats, hanging them upside down and gently shaking out their stomach contents. But the new tools of the trade have become undeniably sophisticated. Today, the web of underwater radio receivers around Palmyra is allowing researchers to discern sharks’ movement patterns.

Because the ocean is such a challenging environment in which to work, marine biology is filled with big, basic questions that remain unanswered. That phenomenon is even more pronounced on Palmyra: Because there are so few pristine reef ecosystems left on the planet, scientists have little foundational knowledge from which to start.

“A lot of us have created our entire understanding of how systems function on highly degraded places,” says Caselle. “That’s why this one is so important to study.”

Now after eight seasons of research at Palmyra, scientists are gaining a new understanding of how life really works in the waters surrounding the island. Gray reef sharks tend to rule the atoll’s outer reefs, whereas smaller blacktip reef sharks are dominant in Palmyra’s lagoons. Blacktips tend to

“YOU ARE NOT AT THE TOP OF THE FOOD CHAIN HERE.”

KYDD POLLOCK, CONSERVANCY MARINE CHIEF AT PALMYRA

have relatively small home ranges, on specific parts of the atoll, and tend to be strongly faithful to those home areas—but researchers believe they may occasionally range farther afield to forage for fish in otherwise-unpopulated corners of the atoll. And observations have revealed that blacktip shark pups spend most of their time in shallow nurseries around the island to avoid being eaten by larger sharks.

One of the most remarkable discoveries so far is that life in Palmyra’s waters forms an inverted “trophic pyramid”: A large number of predators stand at the top of the



ON PATROL: An adult blacktip shark cruises over Penguin Spit Reef, located near the atoll’s western channel. Blacktips typically grow up to 5 feet long.

food chain—sharks make up to 60 percent of the total fish biomass here—with relatively fewer herbivorous fish at the bottom. Although the base of prey is seemingly too small to support the predators, new evidence suggests that a predator-heavy ecosystem is sustained by a kind of turbocharged production of smaller fish further down the food chain.

“Everything’s turning over much faster at the bottom,” says Friedlander. “That’s how you maintain all this biomass at the top. That’s the engine that allows these systems to exist.”

Researchers have also gained new insight into the energy flows between reef ecosystems and the open ocean beyond. Stanford researcher Doug McCauley and several colleagues have documented how seabirds, which forage more than 100 miles out at sea, bring the fish they catch back to the atoll; the nitrogen from the bird’s excreta then feeds plankton in the lagoons; the plankton, in turn, form the food base for manta rays.

Now, scientists are turning their attention to better understanding competition between shark species—and how the animals shape the entire ecosystem. Caselle, Friedlander

and other researchers have begun tagging gray reef sharks with acoustic transmitters. Those instruments mark a shark’s location every time it swims near a receiver or listening station moored on the reef and will help the scientists learn more about the animals’ movements offshore. They are also deploying tags designed to reveal not just where a shark is but what it’s doing. Accelerometers, for example, indicate when a shark suddenly speeds up—usually a sign that it’s hunting prey. Papastamatiou, meanwhile, has repurposed a new family of sensors, originally designed for penguins, to implant in sharks: They can detect the acidity of a shark’s gut, providing an even more reliable indicator of when it’s feeding.

Researchers who work at Palmyra are also beginning to compare predator-prey dynamics there with those in more altered reef ecosystems that are home to fewer predators, such as Hawaii. In a system where predators do compete for food, that fact alone completely changes the ecology of the system, according to Stuart Sandin, a researcher at the Scripps Institute of Oceanography in San Diego. “Any fish that’s sick, stupid or wounded is going to get eaten.”

In effect, intense competition between predators kicks natural selection into a higher gear than on predator-poor reefs—forcing prey to run what Sandin calls a “Darwinian gauntlet.” At Palmyra, he says, “these predators [are performing] at their maximum, doing a 100-percent-efficient job taking out everybody who’s vulnerable”—and they may ultimately be making the entire ecosystem much more robust.

How exactly that plays out across the entire reef is a question whose answer lies years in the future. But the research at Palmyra could be important for designing marine protected areas elsewhere in the world and establishing a benchmark from which to understand what critical functions have been lost in more degraded reefs—and, ultimately, how to restore them.

In a quiet corner of a shallow lagoon overhung by native pisonia trees, Pollock and the researchers slosh through ankle-deep water. A fleet of baby blacktip reef sharks moves like a shadow beneath the rising tide. Friedlander stops in his tracks.

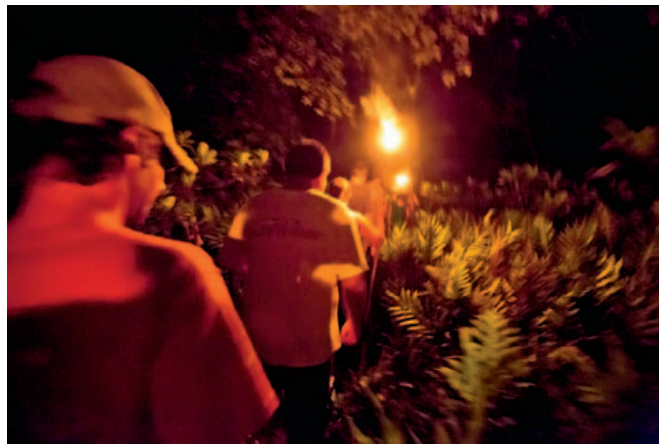
“Wow,” he says. “That’s a lot of blacktips.”

Caselle counts 57. Out in deeper water, the fin of a large blacktip suddenly breaks the surface. The water detonates as several blacktip pups dart into shallower water.

“You cannot be off your game for a minute in Palmyra,” she says, “or you’re going to get eaten.”

Pollock swiftly launches a cast net over the gaggle of baby sharks. The water froths furiously as two try to escape from the net. Quickly, Pollock scoops one of the sharks from the net and hands it off to Caselle, who has fashioned a flotation vest into a makeshift worktable. She takes a quick set of measurements. But when she moves to return the shark to the water, it sets its teeth into the life jacket. Caselle finally manages to gently pry the shark free. When she sets it back in the water, it zigzags off like a lightning bolt.

Pollock, meanwhile, looks on from Caselle’s side. “Dad always said, ‘One day, you’ll get over this whole shark thing,’ but I never have,” he says. “It’s afternoons like this when there’s nowhere else I’d rather be in the world.” ■



SIGNS OF LIFE: No one lives full-time on the atoll, but a population sign (top, left) denotes how many researchers and conservation staff are visiting. Flip-flops that washed up on the islands decorate the wall of the generator house. Researchers break away from the labs for a torch-lit night hike through the islands.

NO TIME TO PLAY: Conducting research at Palmyra is not cheap, so scientists often pursue extremely rigorous schedules to gather as much data as possible during their stays. This group from Stanford University samples the water passing over the reefs to study calcification and the metabolic health of the island’s corals.

BY HAL HERRING // ARTWORK BY STAN FELLOWS

HIDDEN GEMS

These tucked-away wild places could easily have been destroyed or developed—but they weren't, thanks to The Nature Conservancy. Outdoorsman Hal Herring takes a closer look at three natural treasures worth a visit.

OPPOSITE: EARL M. HARDY BOX CANYON SPRINGS NATURE PRESERVE, IDAHO





Driving east on I-84 from Boise, past the fields filled fencerow to fencerow with irrigated corn, wheat, beets and potatoes, past the large-scale hog and dairy cattle operations, a nature-oriented traveler might suspect that there's not much of interest in Idaho's Snake River plain.

The traveler would be wrong.

Look north, beyond the billiard-table plain, and you see a jumble of mountains, snow clad and rugged and wild. That's the Lost River Range, the birthplace of the Big Lost River, Little Lost River and other major waters. Those rivers emerge from the mountains onto the volcanic stones of the plain and then immediately disappear.

It is almost too much to imagine. Far beneath the bellowing herds of Holsteins and armies of hogs, cold rivers of crystalline mountain water seep and tumble in Stygian darkness, moving more than 100 miles southwest along faults and fissures in a slow fall—all underground.

And then they reappear, along the walls of the deep canyon cut into the plain by the Snake River. This dramatic reappearance is known as the Thousand Springs complex, and there once were at least a thousand of these cascades flowing into the Snake. As with the rest of the plain, most of the springs have been harnessed for human endeavors—but not all. The Nature Conservancy has worked here for more than two decades to preserve the last few free-running springs.

To find one of them, I join Matt Miller, a writer for the Conservancy and a longtime Boise resident. Twenty miles northwest of the city of Twin Falls, Matt and I park among austere wheat fields at the weathered kiosk of the Earl M. Hardy Box Canyon Springs Nature Reserve.

Driving east on I-84 from Boise, past the fields filled fencerow to fencerow with irrigated corn, wheat, beets and potatoes,

The canyon is invisible until you reach its edge, a sudden promontory where the plain collapses and cliffs of mahogany-brown columnar basalt drop away to a creek bottom-lit with new spring greenery. A pour of turquoise water—about 180,000 gallons per minute, say the experts—spills from the lower cliffs to our right, feeding an aquamarine river that pauses in a wide pool 50 feet across and then races away toward the Snake River.

Descending on an easy footpath, we come to the canyon floor, where a jumble of talus peters out into wide meadows and tangled birch and serviceberry thickets. Above us, the fortress of basalt towers, the nesting place of golden eagles. Along the ledges, marmots stand to watch us pass, giving their distinctive chirping alarm call before shambling calmly away to the safety of a million cracks and crevices. Trout rise in the eddies of the creek.

Aquaculture operations blossomed here throughout the second half of the 20th century, sustained by the bountiful spring water. By the early 1980s, the number of free-flowing springs had dwindled to a handful. Even then there were plans to capture and use what remained, including most of the flow at Box Canyon.

In 1986, the then-fledgling Conservancy program in Idaho took action. It purchased a 385-acre property that included an awe-inspiring set of spring-fed waterfalls and

Ritter Island, an old dairy operation in the middle of the river. The island is now a state park and open for picnicking and birding. When nearby Box Canyon came up for sale in 1999, the Conservancy bought the property for \$5 million and managed it until the state was ready to add it to the park system. Today, Box Canyon, Malad Canyon, Billingsley Creek and Ritter Island together protect almost two miles of Snake River frontage and constitute one of Idaho's most ecologically important state parks. People have room to roam, and the roaming is very good.

Yet the parks remain relatively undiscovered. As Matt and I unlock the car after our hike, a lone visitor stands at the kiosk with a baffled look. His small pickup shows the effects of a lot of miles, and his dogs have already leapt out. The man explains that he works at the local whey plant and is looking for a place to walk after a long day of working inside.

"What's down the trail there?" he asks.

"You really have to see it to believe it," I answer.

THIS EDGE OF THE WORLD

Block Island is a 9.7-square-mile chunk of glacial till and granite boulders overlain with pockets of towns and farms and summer homes about 12 miles off the Rhode Island coast. It lies within four hours of an entirely different planet: the megalopolis stretching from Boston to New York City, a landscape hive of 20 million people.

In this modern age of coastal investment properties and gated vacation communities, the preservation of open space and public access on the scale found on Block Island seems almost impossible. Unlike visitors to the more famous Nantucket and Martha's Vineyard, travelers on Block Island can wander every foot of every beach. Twenty-eight miles of trails traverse every landscape on the island, from farmland to ocean bluffs to thickets and ponds. This on a bit of land only seven miles long and three miles wide.

Such access comes thanks to an island tradition called walking cross lots, a kind of neighborly agreement that lets walkers travel on private property with the understanding that they'll leave nothing and take nothing beyond pleasure in their freedom. When the world—in the form of vacationers, yachtsmen and home builders—began to discover Block Island in the 1970s, descendants of the original settlers took it upon themselves to protect their open space. Islanders like Capt. John R. Lewis, who would form the Block Island Conservancy, teamed up with the state Department of Environmental Management, U.S. Fish and Wildlife Service and the Conservancy to purchase property—ensuring the land would remain essentially undeveloped.

Today, nearly half of Block Island has been preserved through these ongoing efforts, and the island still includes

ample farmland. The conservation partners on the island are steadily restoring habitat to keep native species abundant—including the endangered black-and-orange American burying beetle, which has, for reasons not quite clear, disappeared almost entirely from its former range across eastern North America. Except for here.

If there is a trail on the East Coast that can rival Clayhead for grandeur of scenery, I have not walked it. I arrive at the trail on a bright but cold April morning, right on time for the mass flowering of daffodils planted over decades by a local family. The trees on the bluff line are sculpted and bonsaied by a relentless wind. I hike among them, on an easy path overlooking the tumult of the ocean 120 feet below. Schools of striped bass sweep through clear green waters behind the thundering surf. A strange leonine head cuts through the sea—a seal, bound for who knows where. Beyond it, thousands of miles of ocean yawn.

The canyon is invisible until you reach its edge, where the plain collapses and cliffs of mahogany-brown basalt drop away.

BOX CANYON SPRINGS NATURE PRESERVE, IDAHO

To descend with the trail to the beach is to walk on cobbles of pink granite, snowy quartzite and lumps of the namesake gray clays. Hundreds of the black skate egg cases, known as mermaid's purses, surround a quahog shell on the sand.

Geologists say the bluffs above the beach are eroding fast under the hammer and cold, blue chisel of the ocean. In 10,000 more years, Block Island will return to the sea entirely. In the here and now, however, we share the place with the thousands of migrating birds that stop to fuel up for their dangerous journeys north and south. We watch the seals, walk the paths and marvel: Sometimes, people really do work together to save the best of what they have, and pass it on to all of us.

GRAND CANYON OF THE SOUTH

Almost completely hidden within one of the last great forestlands of the southern Cumberland Mountains lies the canyon known as the Walls of Jericho. Swathed in shadowed woods on the border of Tennessee and Alabama, it cradles the headwaters of the Paint Rock River, whose watershed is one of North America's most biologically diverse.



The river is home to 50 species of mussels, experts say, including 10 that are threatened or endangered and one that is found nowhere else. Its pristine, cave-born waters are among the final planetary holdouts for odd little species of fish like the snail darter, the blotchside logperch and the palezone shiner. All told, and as far as biologists have determined, the Paint Rock holds a mind-boggling 150 species of native fish, mussels and snails.

All of this was unknown to me when I first reached the deep canyon back in 1976, when I was 15 years old. I grew up in a place called Sharp's Cove, northeast of Huntsville, Alabama, and directly west of the Paint Rock Valley. Mine was a life lived outside, and there was no place better to live it than among those low, flat-topped foothills of the Cumberland Mountains, with their deep hollers, hidden caves and old moonshiners' paths. It's a

country of legends, spirits and ghost stories, and no part of it was more legendary than the Walls of Jericho.

My first trip there was up an old road that followed Hurricane Creek, past where the road devolved to a trail and then to 8 miles of continuous axle-breaking rocks and mud holes. Finally, we parked our trucks and walked up-stream to the mouth of the Walls and were struck silent for the first time all day by the cathedral-like hush of the place.



We watch the seals, walk the paths and marvel: Sometimes, people really do work together to save the best of what they have, and pass it on to all of us.

BLOCK ISLAND, RHODE ISLAND

We threaded the narrow paths at the bottom of the canyon, the pale stone walls towering 200 feet above us, and we waded and swam in the big holes of the creek, the clear water such a change from the muddy lowland rivers back home. Schools of strange minnows abounded, and little rock bass with ruby eyes pursued them in the shallows. The yellow poplar trees that grew between the walls of the canyon—some of them 3 feet and more in diameter—soared straight up for the sun, limbless like the shafts of giant arrows.

I would visit a couple more times over the next few years, to fish and explore. Then the road was closed and all access ended. By the early 1990s, Mead Paper Company had acquired the Walls and the tens of thousands of acres around the canyon.

The following decade was a rollercoaster ride for America's paper companies, and the land went through a series of rapid changes in ownership—changes that The Nature Conservancy watched closely, says Gabby Lynch, who manages the Conservancy's land-protection program in Tennessee.

With each change in ownership at the Walls of Jericho, danger loomed: Owners tended to clear-cut or subdivide their new holdings, seeking to reap profit from their investments. The timber around the Walls was an asset, ripe



We waded and swam in the big holes of the creek, the clear water such a change from the muddy lowland rivers back home.

WALLS OF JERICHO, TENNESSEE/ALABAMA

for harvest. But luck prevailed, and in 2003 the land was acquired by Coastal Lumber Company, a business the Conservancy had worked with before. “We knew who to talk with there,” says Lynch. The Conservancy negotiated for the Walls and eventually got it: about 12,000 acres on the Alabama side of the state line and 9,000 on the Tennessee side.

The Conservancy’s hope was to turn the land over to the states for public recreation—a plan to which Alabama and Tennessee readily agreed. Today you can access the Walls from either Alabama’s Skyline Wildlife Management Area or Tennessee’s Bear Mountain Hollow Wildlife Management Area.

Nowadays, the preferred way into the Walls is from a parking lot off Highway 16 on the Tennessee side of the line. The trail down is well made and beautifully switch-backed across the long slope of the mountains. It’s still a bit hard on the knees on the way down and a thigh burner on the way back out. Despite the effort—or perhaps because of it—it remains one of the best day hikes in the Southeast. ■



➔ **MORE:** Get directions to visit these diamonds in the rough and other preserves in our digital edition for iPad or online at nature.org/gems.

A woman with dark hair and a serious expression stands in the center-right of the frame. She is wearing a light-colored, long-sleeved jacket over a floral-patterned dress. She has several colorful beaded necklaces. The background is a vast, rolling landscape of green grass under a sky with scattered white and grey clouds. The overall mood is contemplative and serene.

THE
CHANGING
LAND

A NEW KIND OF CONSERVATION PARTNERSHIP IN VENEZUELA'S LLANOS GRASSLANDS PROTECTS THE COUNTRY'S TROPICAL PLAINS AND PRESERVES THE CULTURAL HERITAGE OF ITS NATIVE PEOPLES.

BY VIRGINIA GLASS AND NATURE CONSERVANCY STAFF
PHOTOGRAPHS BY ANTONIO BRICEÑO

HIGHER GROUND: María Dolores Meteya stands atop a grassy dune—a sacred site—near the town of Boca Tronador.

A

small group of battered four-wheel-drive Toyota trucks advances across the relentlessly flat prairie in the Venezuelan district of Rómulo Gallegos. Periodically, the vehicles slow to traverse deep ruts carved in the wide dirt road—the main transportation artery

into this remote landscape. With the onset of the rainy season, swelling streams have begun to overtake some of the surrounding fields, and ibises wade in the flooded patches.

In a few weeks, most of this vast expanse of grasslands, known as the Llanos, will be under 4 or 5 feet of water as the tropical rains fall faster than the waters of the massive Orinoco Basin can drain. The annual transition of the Llanos from prairie to giant lagoon turns this land upside down, allowing fish, crocodiles and river dolphins to flourish where deer, jaguar and giant anteaters roamed only a few weeks earlier.

“It’s a place of extremes. It takes a special temperament to endure it,” says Nature Conservancy anthropologist

Eduardo Ariza as he wipes the sweat from his forehead. One of the few remaining intact tropical grasslands, it’s also a place of rare beauty and rich biodiversity.

Ariza and fellow anthropologist Gabriela Croes are leading this delegation of Conservancy staff and local government officials to the remote outpost of Boca Tronador to meet with the Pumé indigenous group. The visit is part of an innovative effort not just to protect these lands for their ecological importance but to help preserve the cultural heritage of the Llanos as well.

Many indigenous communities in the Llanos traditionally moved in response to seasonal flooding. And this semi-nomadic history has complicated efforts to determine land rights in the region. “For the Pumé, the land is alive. It belongs to no one,” says Croes. “They relate to it as they would with a living person.”

But now a new partnership between the Conservancy, the local government and indigenous communities is helping to move things forward by giving the Pumé and other groups in Rómulo Gallegos a greater say in how these lands are managed. It will help protect more than a million acres, says Lila Gil, who directs the Conservancy’s work in



LOCAL BOUNTY: Ezequiel Mujica, a member of the Pumé indigenous community, shows off a small harvest of tobacco leaves. Indigenous groups here have lived seminomadic lifestyles to adapt to the extreme seasonal swings from drought to flood.

There are local beliefs that need to be understood and respected. And concerns are raised about the need for economic opportunities in this community.

Venezuela. “This is unique in Venezuela,” she says. “We are helping protect this territory from both a cultural and an ecological perspective.”

Ariza calls for the trucks to halt where the rutted road ends, and the saddle-sore delegation boards narrow handmade canoes for the remainder of the journey. They float down a tributary of the Orinoco River, eventually arriving at the small Pumé settlement of Boca Tronador.

WHEN VENEZUELAN PRESIDENT HUGO CHAVEZ was first elected in 1998, he instituted changes to the country’s national constitution to strengthen the rights of indigenous groups. The constitution now mandates indigenous representation at all levels of government, as well as cultural protections and recognition of ancestral lands. But over the past decade, federal land-reform efforts have not gained much traction.

Starting about four years ago, Ariza, Gil and other Conservancy staff began working on an idea to jump-start some of those stalled efforts—this time by collaborating with local governments. The idea received financial support from the European Union, the oil company Total de Venezuela and the United Nations’ Global Environment Facility.

Although most land in Venezuela is privately owned, large blocks of territory are publicly controlled for communal use. Elected officials in the municipalities—equivalent to counties in the United States—have broad sway over deciding how these lands can be used and developed.

“We have been working on the local level to get some of the Llanos rezoned as ‘Area de Patrimonio Natural y Cultural,’” says Gil, naming a designation for lands that are managed with natural and cultural conservation in mind.

In the municipality of Rómulo Gallegos—a 4,700-square-mile municipality nearly the size of Connecticut—the



COMPETING INTERESTS: Indigenous hunters like Eliécer Araque saw deer and tapir populations drop after the arrival of recreational hunting.

Conservancy found an unexpected ally in Leopoldo Estrada, an agricultural engineer who was elected mayor eight years ago. Estrada determined he would try to turn Rómulo Gallegos into Venezuela’s first green municipality.

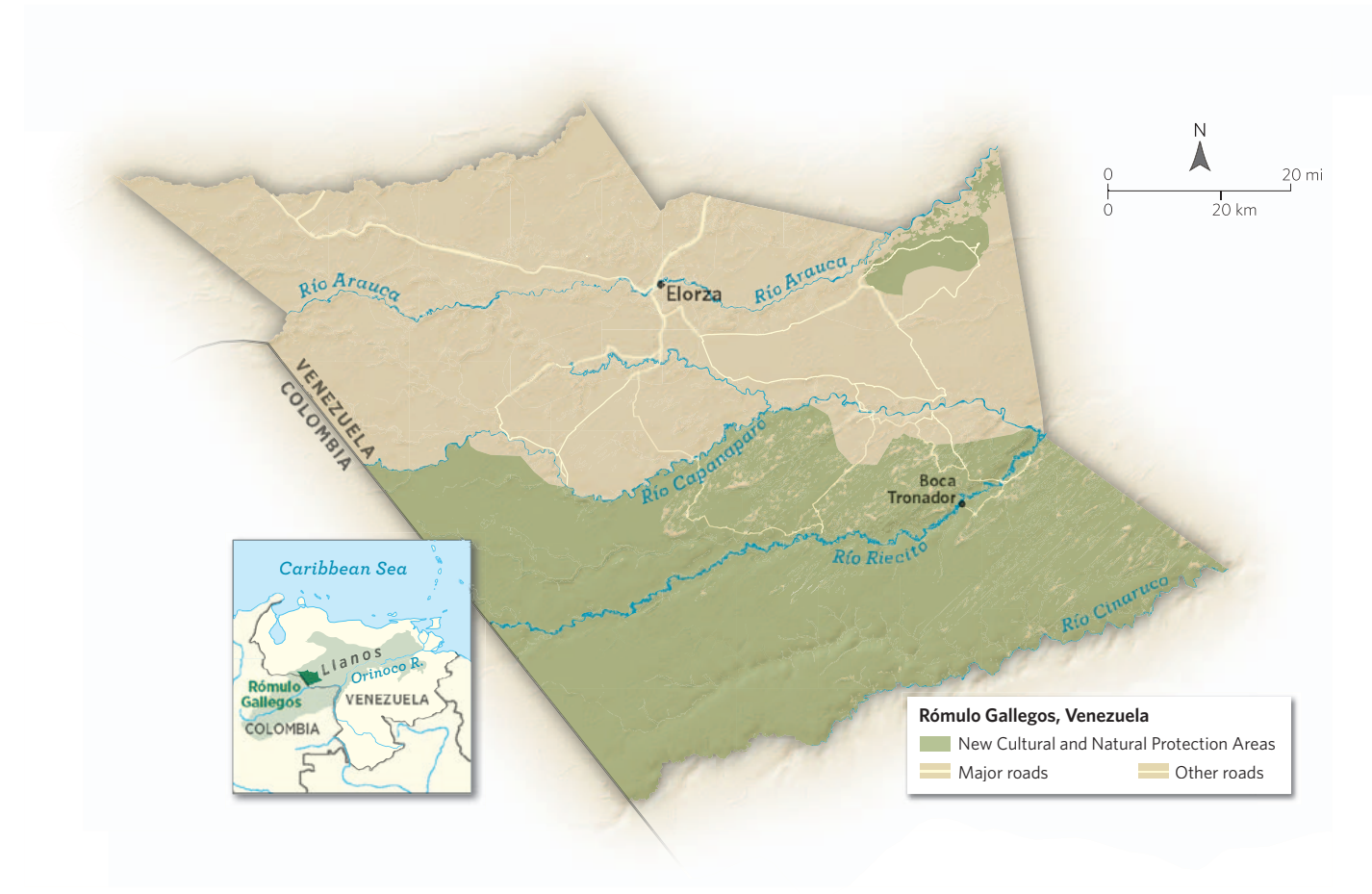
But transforming his vision into reality was another matter. “This municipality had the political will,” says Gil, “but at the technical, scientific and administrative level, Rómulo Gallegos was lacking the expertise the Conservancy could offer.”

Estrada asked the Conservancy to help pull together a zoning plan, required by Venezuelan law, for the entire municipality. The plan would determine which areas might be developed and which should be set aside and protected.

Led by Ariza, the Conservancy’s team worked for about 18 months conducting workshops with people across the municipality. The team met with indigenous groups,



A CLEARER PICTURE: Conservancy researchers met with three different indigenous groups in Rómulo Gallegos to document their use of the land. Seen here are some examples (clockwise from top left) of the plants they rely on: fruit of the merecure tree, yuca roots and acerola fruit. What also emerged was a more complete understanding of the residents within these oft-hidden communities, including families, workers, tradespeople and many others who are preserving traditions of the Llanos, a region known for its music and food.



IN THE ZONE: With input from the Conservancy, local legislators rezoned 40 percent of Rómulo Gallegos. This ruling gives communities and indigenous groups a say in how 1.2 million acres of traditional territory is used.

ranchers, city officials, business groups, scientists and other stakeholders to map activities and document how people were using the land.

From the outset, Estrada emphasized the importance of involving indigenous communities like the Pumé, Cuiba and Capuruchanos. “[They] are crucial actors in this process, and their vision needs to be incorporated into any plan,” he says. “Where we see merely a ‘morihe’ palm tree, they see half of what they need for sustenance.”

WHEN THEY ARRIVE IN BOCA TRONADOR, ARIZA AND his team begin meeting with the Pumé people to learn about their customs and understand how they relate to their lands in the Llanos. That night, they attend a ‘tonhé’ ceremony that is supposed to heal the sick and restore equilibrium to the land. The Pumé sing of a lonesome sand dune, or ‘medano,’ in the middle of prairies that extend endlessly into the horizon, a place where the Pumé hunt armadillos.

The day after the tonhé ceremony, Croes, Gil, Estrada and Ariza meet with village elders and several bilingual members of the village to chart the past and future use of

these lands. Toyakö, a young schoolteacher and one of the few Pumé who are literate and bilingual, helps draft maps and a seasonal calendar based on the information shared by the older members of the group.

“This is the time of flooding,” says Toyakö. “The ‘cabrillas’—the small goats—go into hiding, and soon food will be scarce. This is the time we collect palm seeds and caiman for food.” Other areas hold historical and religious significance, including a sacred lagoon where their mother-like deity dwelled and where they once fished. But this area has become a cattle ranch, where the Pumé have no access.

Nothing about this gathering is quick or easy. There are local beliefs that need to be understood and respected. And concerns are raised about the need for economic opportunities in this community. Finally, after hours of careful discussion, Croes and Ariza succeed in helping to pull together maps of the territory based on the input of several Boca Tronador elders. But as willing as they might be to share parts of their culture, some indigenous knowledge is simply off-limits. “What is sacred cannot be told,” says Alicia, a Pumé woman who has served as translator.

MAP: © XNR PRODUCTIONS



CONSIDERING CULTURES: Luisa in Raicero (above) wears traditional local jewelry. Below, Mavis Flores, a student, displays a map he helped create. It details the Pumé people's use of resources in the Llanos.

Mapping Culture

In this age of ubiquitous digital maps and GPS technology, scientists are using a low-tech but powerful conservation tool that has enabled many communities to capture a snapshot of how their people live and relate to their surroundings: hand-drawn maps.

Since 2008, Conservancy anthropologists in Venezuela have been working with indigenous groups in the country's remote Llanos grasslands to map out community living areas, hunting grounds, sacred sites and other important territories. This type of mapping, known as ethnocartography or participatory mapping, helps document a group's historical footprint and record people's interaction with their lands.

These participatory maps have helped lay the groundwork for protection of millions of acres as indigenous territory and conservation zones in countries including Brazil, Nicaragua and now Venezuela.

The Conservancy has also used participatory mapping to help chart out conservation priorities—such as protecting reefs or



restoring mangroves—for several island communities in the Caribbean and the Pacific. "The point of these projects is to get communities thinking about the impacts of climate change and how investments in nature can build resilience and adaptive capacity," says Steve Schill, a Conservancy computer mapping specialist who is planning similar projects in St. Vincent and Grenada.

Still, the maps will inform efforts to protect parts of this region. And the mapping project also has helped encourage a new generation of Pumé to search for their history. "We want to move forward, but without forgetting who we are," says Toyakö.



DIGITAL EDITION

View more of photographer Antonio Briceño's portraits in our digital edition for iPad.

WHEN THE CONSERVANCY TEAM returns from Boca Tronador, the research and maps facilitated by Ariza and Croes are merged with data from the past 18 months of meetings and workshops throughout Rómulo Gallegos. Together, they identify the areas that local land users want to protect—as well as areas where ranching and other types of economic development are the priority.

With the data in hand, the team works with Mayor Estrada, land users and the municipality's legislative chamber to facilitate a zoning plan for future use of the lands.

In December, Estrada signs an agreement to designate more than 40 percent of the municipality—an area totaling more than 1.2 million acres—as ecological and cultural conservation zones.

"This is very different from the way things are normally done in Venezuela and many other countries, where the central government usually decides where a cattle-ranching or agribusiness project will go. It is often a top-down approach," says Gil. "We changed that here—with cultural diversity and ecological values being integrated in a fully participatory process." Ultimately the zoning designations were the result of community input and had to be agreed on by land users, businesses, the government and other stakeholders. And future investments in this new zone must take natural and cultural conservation into consideration.

In addition to protecting sensitive habitats, the agreement has created a new way for indigenous groups to work with the government. Even though many locals do not own the community lands they inhabit, they now have a strong voice in how that land is used.

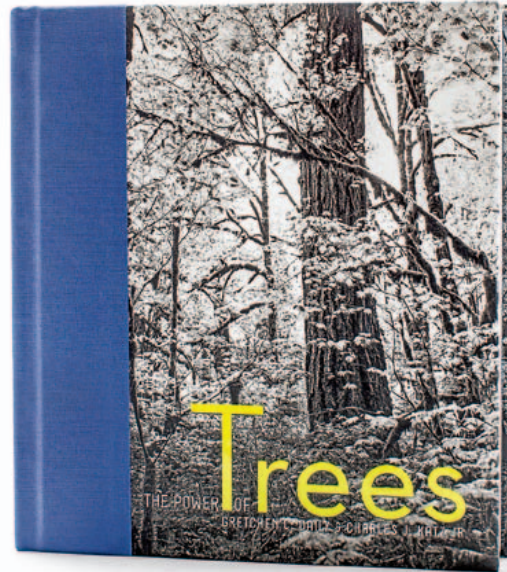
The zoning agreement has broken new political ground in Rómulo Gallegos, and the effects may be felt elsewhere in the Llanos. The land office in the Venezuelan Ministry of Environment asked the Conservancy to help systematize the methods used in Rómulo Gallegos for possible replication elsewhere in the country. This project may set the basis for future land discussions around the country.

"Throughout this process, we established a way for all the groups involved to understand and recognize the cultural and ecological effects of land use that were invisible before," says Gil. "For the first time, these indigenous groups' territorial aspirations are being heard."

Once again, seasons change in this part of the Llanos. ■



WATER WAYS: In the rainy season, the Capanaparo and other rivers will transform this landscape. Submersed prairies provide vast habitat for culturally important fish like the coporo (top).



The Power of Trees

By Gretchen C. Daily and Charles J. Katz Jr.

FOREST LOVERS, UNITE! IN ONE SMALL VOLUME, *The Power of Trees* delivers a treatise on these silent giants that satisfies tree-huggers and skeptical science types alike. Biologist Gretchen Daily, a co-founder of the Natural Capital Project at Stanford University and a board member of The Nature Conservancy, brings a quiet researcher's voice to the task of explaining the largely overlooked wonders of trees.

To wit: Trees do talk to each other—some species, when under attack by insects, emit chemical signals on the wind to nearby trees. Trees influence weather—just 200 trees can help produce a cumulus cloud. Trees probably helped make you—cooking with wood fires fed the evolution of our hominid ancestors, enabling jaw sizes to diminish and brain sizes to increase.

One would expect Daily to run out of such extraordinary facts, but each new page reveals another surprise. Interspersed among these observations are 26 black-and-white photographs by Conservancy trustee Charles J. Katz Jr. As the book progresses, his images of the Skagit River landscape in Washington become less an opportunity to admire beauty than an invitation to study and reassess the inscrutable, familiar forms of our neighbors the trees. *Trinity University Press.*



Moonbird

By Phillip Hoose

Few things in life can make a seasoned field biologist's heart pound, but the May 2012 appearance of a rufa red knot on the New Jersey shore had shorebird expert Patricia Gonzalez's adrenaline pumping as she reached for her camera.

The cause of her excitement is the subject of a new book, *Moonbird*, by Conservancy planner and National Book Award-winning author Phillip Hoose. Gonzalez had caught sight of B95, a rufa red knot first banded in February 1995 in Argentina. B95 was dubbed Moonbird because his annual migrations between Tierra del Fuego and Arctic Canada have taken him more than 350,000 miles, the distance to the moon and halfway back.

The book follows the challenges facing B95. Rufa red knots are now in danger of extinction because of dwindling food resources and habitat along their migration route, but the Delaware Bay remains a stronghold. Birders will be watching for B95 there this May. *Farrar, Straus & Giroux*

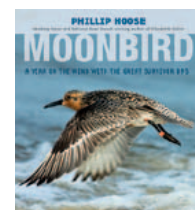


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Sandhill cranes. © Jim Ridley

TRICKY SHOT: Photographer Tim Calver swam alongside researchers tagging gray reef sharks in the Pacific Ocean.



From Palmyra

Photographer Tim Calver knew that documenting wildlife research around the Conservancy's remote Palmyra Atoll in the Pacific was likely to be a challenge (see "Kingdom of the Hungry," page 30). But things got a little tense when he found himself in the middle of shark-infested waters with the boat drifting away from him.

"The wind was blowing hard," Calver says. "This was deep water, so the boat wasn't anchored. It was drifting pretty quickly." Camera in hand, he worked to keep up. "The camera was kind of a big bulky thing to push in front of me while I swam," he says.

He wasn't alone, though. "They were worried about a shark investigating me while I was shooting," Calver says, so a crew member had been assigned to swim behind him, keeping an eye out for approaching sharks.

The scene wasn't entirely unfamiliar to Calver, however. An experienced free diver, Calver learned his craft during six years spent in the Bahamas assisting scientists as they researched sharks. When Palmyra researchers pulled a shark from the water, Calver got his chance and snapped the picture—one of thousands he would take for the story. "Definitely a big workout," he says. It was only his first day on assignment.

"They were worried about a shark investigating me while I was shooting."

© TIM CALVER



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—Darlene Chirman

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