

NATURE

CONSERVANCY

The Burning Question

.....
CAN CONTROLLED
BURNS AND
LOGGING STOP
DEADLY MEGAFIRES?

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**ADVENTURE IN
APPALACHIA**

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**HUMBOLDT'S
NEW WORLD**

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**EXPLORE A TOP-
SECRET BOG**

JULY / AUGUST 2013



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PHOTOS: A DETECTION DOG RESTS AFTER A LONG DAY IN THE FIELD © CONSERVATIONBIOLOGY.NET; SALAMANDER © DAVID SOLIS
Dogs, like this one in New Mexico, are helping Conservancy scientists collect data on sensitive species. With their help, we can make more informed decisions around forest plans and habitat protection.

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30 **Catching Fire**

Loggers and conservationists are now working together, scrambling to restore Arizona’s overgrown forests before tinderbox conditions spark the next megafire.

BY PETER FRIEDERICI | Photographs by Chris Crisman

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In 1799, a Prussian scientist began a remarkable 6,000-mile exploration of Latin America—from the Amazon to the Andes—blazing a path for modern conservation.

BY JULIAN SMITH

50 **Appalachian Inspiration**

Over the past 75 years the Appalachian Trail has evolved to become the nation’s ultimate hike—and a driving force for conservation.

BY GRAHAM AVERILL

Above: An Appalachain Trail guidepost in Shenandoah National Park.

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JULY / AUGUST 2013

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Following in the footsteps of a forgotten science legend



On the cover: Mary Lata, a Forest Service fire ecologist, monitors a prescribed fire in Arizona. © Chris Crisman



© JEFF YONOVER/TANDEMSTOCK

in focus

In Living Color

Tourists visit the islands of Indonesia's Raja Ampat archipelago in search of colorful marine life. A new law—crafted with the Conservancy's help—creates a sanctuary for sharks, rays and other creatures divers love to see. See page 19.



© IAN SHIVE/TANDEMSTOCK

in focus

.....

Going the Distance

The Appalachian Trail covers roughly 2,186 miles from Georgia to Maine. More than 99.5 percent of the path is now on protected lands, such as the Great Smoky Mountains National Park (shown here). See page 50.

from
the
president

Hugging Trees



Tree-hugger: It's a label that critics sometimes use to imply that environmentalists are overly romantic or even naive. But The Nature Conservancy's tree-hugging is cleareyed and pragmatic. For half a century the Conservancy has worked diligently and with innovation to help secure the world's forests—from Canada's 23-million-acre Great Bear Rainforest to the tropical forests of Borneo and the Amazon. And the way we do so entails both a love for nature and a businesslike recognition that we need forests for the materials and services they provide. Forests harbor wildlife, and they also support livelihoods for countless people—providing the timber from which we build our homes, furniture and other necessities. In places around the world, we've been able to test and demonstrate sustainable methods of harvesting forest resources while keeping the forests themselves viable for wildlife habitat and recreation.

Now we are pioneering forest conservation that serves nature and people in a different way. In recent years megafires have ravaged forests around the world, from the Rocky Mountains to Australia's Outback. People and wildlife have paid the price. Ironically, it can be said that our love of forests is one of the causes of these devastating wildfires. Decades of fire suppression have produced forests that are too dense, with unnaturally high fuel loads. The solution: thinning and cool-season fires in smaller doses.

Some woodlands, in fact, have evolved with fire and require periodic burning to remain healthy. In the ponderosa

pine forests of Arizona and Colorado, the Conservancy is working with government agencies to use controlled burning to restore forests—and thereby prevent the kind of catastrophic megafires that also destroy homes and devastate communities. And where controlled fires are impractical or insufficient, we work with forestry companies to thin forests back to more natural densities (see "Catching Fire," page 30).

"Ironically, it can be said that our love of forests is one of the causes of these devastating wildfires."

Spirit of the Forest: Protecting forests, like the 23-million-acre Great Bear Rainforest, often requires innovative management.

We have seen that this work can save lives and property. For example, Arizona's 2011 Wal-low Fire—the state's largest on record—did not devastate areas where there had been previous thinning by a forest stewardship project. Our network of forest managers and fire crews is working to share these lessons and forest-management techniques, helping to counteract the growing

risk of megafires from hotter weather and droughts.

In Australia's Northern Territory, for example, we are partnering with Aboriginal communities to restore traditional, controlled-burning methods to vast areas (see "Home Country," 2012/issue 1). The process benefits local communities spiritually, physically and economically. In addition, the controlled-burning efforts help reduce carbon emissions when compared with wildfires.

While many of us embrace the tree-hugger moniker, our forests today often need "tough love." In a world where the human species has touched and changed just about every place on the planet, in many instances we now must intervene to help restore balance. And as our global population grows, we will have an ongoing obligation to manage our forests and all natural areas responsibly. The Conservancy's science-based conservation work can be a crucial tool for helping avert some disasters we know are on the increase—including rising sea levels, strains on our freshwater supplies, and the wildfires that threaten lives and livelihoods.



Mark R. Tercek

President & Chief Executive Officer
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Bear Rocks Preserve, WV © Kent Mason

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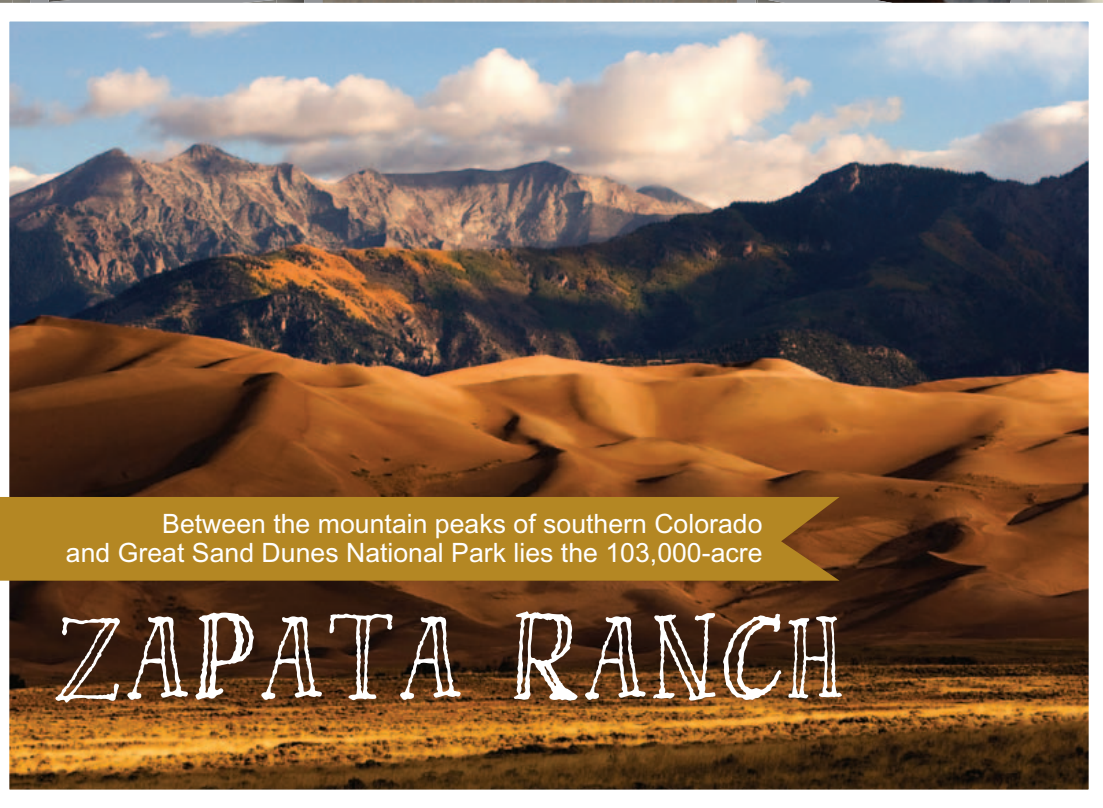
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COVER STORY

Chris Crisman

The first time photographer Chris Crisman traveled to Arizona to shoot crews working to restore healthy ponderosa pine forests ("Catching Fire," page 30), 2 feet of February snow delayed the controlled burns he had come to shoot. "Mother Nature did not want to cooperate," he says. Still, he came away with a portfolio

of portraits and was struck most, he says, by the compromises between the loggers and environmentalists involved in the project. Two months later, he returned to Arizona, this time with the weather on his side. Crisman's recent clients include AOL and Wells Fargo.



Ryan Donnell

Photographer Ryan Donnell spent the better part of two 16-hour days in a pickup truck with Conservancy fire manager Jeremy Bailey while on assignment to shoot controlled burns in Nebraska ("Interview," page 26). "It astonished me how much smoke cow patties (or in this case buffalo patties) produce after they've been set on fire," he says. Donnell's work has appeared in *Fortune*, *Bicycling* and *Black Enterprise* magazines. He is also working on a documentary project photographing America's most unusual voting venues.



Peter Friederici

"In the past, there were two irreconcilable camps: loggers on one side and environmentalists on the other," says Peter Friederici, a Flagstaff, Arizona-based writer who saw firsthand how these disputes led to the dense overgrowth that sparked the state's recent megafires. "Today, they both realize that they need the other side to do their jobs," he says. In his article ("Catching Fire," page 30), Friederici explains how these former adversaries are now working together to rehabilitate Arizona's ponderosa pine forests.



Julian Smith

Before landing in Ecuador, writer Julian Smith already knew a bit about 19th-century scientist Alexander von Humboldt ("Humboldt's New World," page 42). Smith had previously written a travel guide to Ecuador and had seen how Humboldt is memorialized in South America. Still, having the chance to follow in the footsteps of Humboldt—a man who revolutionized geology, physiology and biology—made for an "incredible" adventure, says Smith. Smith's recent work has appeared in *The Washington Post* and *Men's Journal*.

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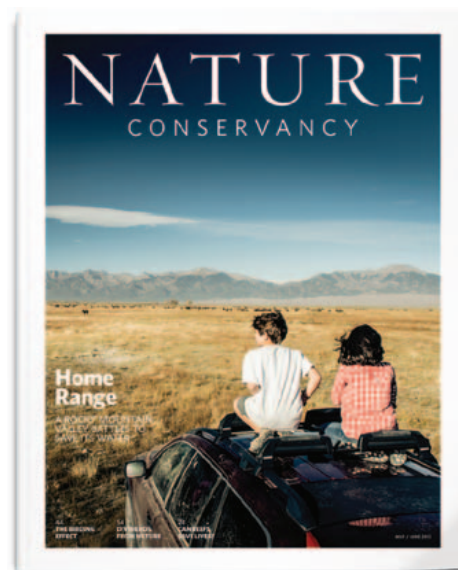
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Readers Respond to: May/June 2013



Sand's Up

Going to the Great Sand Dunes has been on my wish list. Thank you to all those who preserved this precious place. Reading the article "Shifting Ground" (page 30) opened my eyes to the tremendous story behind this victory. Now I will be able to visit with rich appreciation for those who worked so that I may admire and enjoy the land—and possibly try sand boarding!

Alison Tamborlane, Lakewood, Colorado

Walk—and Drive—the Talk

I have driven through the San Luis Valley for many years on my way from North Carolina to Lake City, Colorado, where I work as a fly-fishing guide. In recent years, my mode of transportation has been a Prius. Given the advent of such planet-friendly vehicles, I was concerned to find two mentions of a gas-guzzling Suburban in the "Shifting Ground" story. Be this a Conservancy or Park Service vehicle, either organization can do better.

A Prius wouldn't work for the chores of the Baca Refuge, but certainly there are more Earth-friendly choices.

James Hendrix, Cashiers, North Carolina



18-Hour Adventure

Thank you for the article on the Great Sand Dunes National Park. We stumbled upon this park early last October as the first big cold front of the season was blowing in, resulting in dramatic skies and stunning light displays on the mountains and dunes.

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After an amazing sunset and a pleasant night in the campground, we took an early-morning hike for some great views and then attended a ranger-led program at the base of the dunes before having to pull ourselves away to make a flight in Denver.

We spent less than 18 hours in the park, but its beauty made quite an impression on us, and we hope to go back. Since reading this article, we now also appreciate the struggles of local residents to preserve this area in the face of huge obstacles. Thanks for reminding us of our unexpected, but memorable, end-of-trip surprise.

*Donna and Pete Cantrell
Greenville, South Carolina*

Remember the Rio Grande

Your superb article about the San Luis Valley water only tells half the story. Unless I missed it, the article overlooked the effect of the valley's ground water on the flow of the Rio Grande into New Mexico and Texas. I suspect that if the water-development scheme had been successful, the effect on the flow into New Mexico would have been disastrous.

Monte Shriver, Las Cruces, New Mexico

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Feedback on Bird Calls

I was surprised to see a mention without comment of Tim Boucher being prepared to use audio playback to attract birds ("The Birding Effect," page 44). I don't know if it is an organization-wide position or not, but in the state where I live, the use of audio playback to attract birds is banned on Nature Conservancy properties. Shouldn't someone representing the Conservancy adhere to the anti-playback position, even on non-Conservancy properties?
Mark Stevenson, Tucson, Arizona

Tim Boucher responds:
No doubt, when using audio playback one needs to be careful and considerate. The ethics of using audio playback have been debated at length, and I agree that it should not be used in areas that are birded heavily, in the territory of a breeding bird or especially in the event that the bird is threatened or endangered. I consider using playback only for legitimate research purposes or in isolated situations, such as in a remote tropical forest where finding a bird would be impossible without it, and disturbance is negligible. I never use it for everyday birding in popular places. When taking others on outings, I explain what playback is, when it is appropriate and what not to do (like playing calls loudly or continuously).

In Arizona, the Conservancy's Ramsey Canyon, Hassayampa River and Sonoita Creek preserves all prohibit use of audio-playback devices, but the Aravaipa Canyon, Muleshoe and Hart Prairie preserves do not. The first three preserves get a lot of birding traffic, so the prohibition is a precaution against a barrage of calls, particularly during breeding season, when a bird unnecessarily enticed off a nest could harm eggs or nestlings.

Lay Off Librarians

While reading the "The Birding Effect," I was shocked to see on page 49 the comparison of a non-descript bird to a "mousy librarian." The people who work with me at the library are hardly mousy.

It's disappointing to see stereotypes and clichés about librarians in an otherwise-good publication.
Rachel Wolfe, Charlotte, North Carolina

A Passion for Birding

I was drawn to the article on Tim Boucher and his dedication to birding. For decades and into her 80s, my mother was a 365-day-per-year birder on the Columbia River Trail at Richmond in eastern Washington. The city borders the Hanford Reach National Monument, which remains in pristine desert condition because of its isolation dating back to the 1940s nuclear Manhattan Project. She saw mostly ducks and geese, and often bald eagles. One unexpected sighting was a flamingo, which had found its way north from a zoo in Oregon.

Peter D. Beaulieu, Shoreline, Washington



Corrections

The book Longleaf, Far as the Eye Can See was published by the University of North Carolina Press, not the University of California Press.

The mountains visible while traveling east from Boise, Idaho, toward Box Canyon Springs ("Hidden Gems" March/April 2013) are the Boise and Soldier mountains, not The Lost River Range.



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Image credits: © Robert Granzow (Yeager Flats, Montana); Courtesy of Peter and Kathy Metcalf.



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INSIDE: Block party in Alabama **PAGE 20** ... Tanzania's Lake Tanganyika **PAGE 20** ... The next nasty weed **PAGE 22** ... Montana's pronghorn paths **PAGE 22** ... Painting sheep **PAGE 23**

worldview



ATTRACTIVE INVESTMENTS: A new law protects sharks, manta rays and other species that bring tourists to Indonesia's Raja Ampat islands.

INDONESIA

Wanted: Live Sharks

IN FEBRUARY, INDONESIA'S RAJA AMPAT ARCHIPELAGO—A CHAIN of 1,500 islands near New Guinea—declared its 18,000 square miles of ocean a sanctuary for sharks. The new law, which Nature Conservancy scientists helped draft, comes as shark populations are declining world-wide because of fishing activities that target sharks or accidentally ensnare them. Yet several studies have found that live sharks, which attract tourists, bring in millions of dollars annually—far more than shark fishing.

© JEFF ROTMAN/NPL/MINDEN PICTURES

ALABAMA

35

BLOCK BY 35-POUND
BLOCK, VOLUNTEERS
BUILD AN OYSTER REEF

In a spectacle more reminiscent of a fitness challenge than an environmental restoration project, nearly 900 people—including 246 volunteers from Keesler Air Force Base and Gulfport Naval Base in Mississippi—helped the Conservancy and its partners build 224 feet of submerged reefs in Mobile Bay, Alabama, this April and May. The new reefs, made up of 13,000 interlocking concrete blocks, each weighing 35 pounds, help to break incoming waves and reduce erosion on the shore. Over time, juvenile oysters will latch onto the solid surface of the blocks and build a habitat that supports fish, birds and a variety of marine life. The project is part of the 100-1000: Restore Coastal Alabama initiative, a partnership between the Conservancy, Alabama Coastal Foundation, Mobile Baykeeper and the Ocean Foundation.



CLICK: See a time-lapse video of the reefs taking shape at nature.org/pelicanpoint.

PARTNERS IN PROGRESS: Mahale villagers are working with conservation and healthcare organizations to protect their lands and waters from overuse. Below, Nkonkwa village girls carry water to their homes.



TANZANIA

Healthy Habitats

IN 2011, WHEN THE CONSERVANCY JOINED FORCES WITH HEALTH-care nonprofit Pathfinder International, the Frankfurt Zoological Society and the Tanzanian government, the partners hoped to disrupt a deepening cycle of over-fishing, habitat destruction and poverty around Tanzania’s Lake Tanganyika (see “Habitat’s Humanity,” 2012/issue 3). They aimed to improve access to healthcare and help Mahale villagers plan ways to best manage their fisheries and forests. Two years later, the partners have made progress: Fourteen villages have developed land-use plans, a step toward zoning some areas for conservation. Baseline assessments of lake habitats, chimpanzee populations and socioeconomic conditions are also complete. Meanwhile, 25 healthcare workers have been trained.

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MONTANA

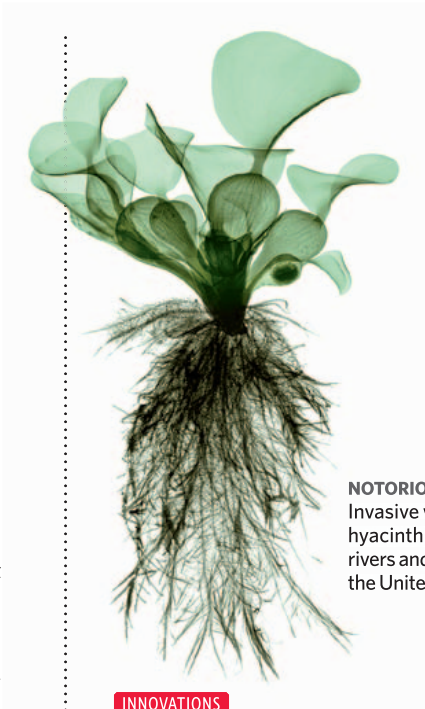
Make Way for Pronghorn

PRONGHORN ANTELOPE ARE FREE TO CONTINUE THEIR MIGRATIONS through southwest Montana’s Big Hole Valley thanks to the Conservancy’s negotiation of an easement on a 2,013-acre private ranch. The deal, which closed in December, prevents future real estate development on a half-mile-wide strip of land that serves as a vital corridor for pronghorn moving between the valley and the Pioneer Mountains. The property also includes a stretch of Steel Creek, which is a tributary of the Upper Big Hole River. The cold, clear waters of the river are home to the last remaining wild population of fluvial Arctic grayling in the lower 48 states, which the U.S. Fish and Wildlife Service has placed on a wait list for endangered status. The Conservancy will hold the easement for the property, which is currently owned by Beartooth Capital, a private firm that buys and restores land in need of conservation before reselling it. In the meantime, work is being done to further revitalize the landscape and improve grazing practices on the property.



WHY WE CARE

The Conservancy helped protect a ranch between Montana’s Big Hole Valley and the Pioneer Mountains, securing a half-mile corridor crucial for migrating pronghorn.



NOTORIOUS: Invasive water hyacinth jams rivers and lakes in the United States.

INNOVATIONS

Weeding Out Invaders

Watch out, water weeds. Nature Conservancy scientists and others have developed a tool to identify which aquatic plants introduced into the United States are likely to become invasive. The tool can distinguish probable invaders from noninvaders with 91 percent accuracy, says Doria Gordon, who directs the Conservancy’s conservation program in Florida. Efforts to control the worst offenders and repair the damage they cause already costs the nation about \$110 million annually. “The bottom line is we could prevent the import of the species likely to cause the largest economic and environmental impacts,” says Gordon. “Preventing the introduction of likely invaders is much more cost-effective than trying to control these species after they have escaped.”

FROM LEFT: © JOE RIIS; JIM WEHTJE; PAGE 23: CODY TUTTLE (ALL)

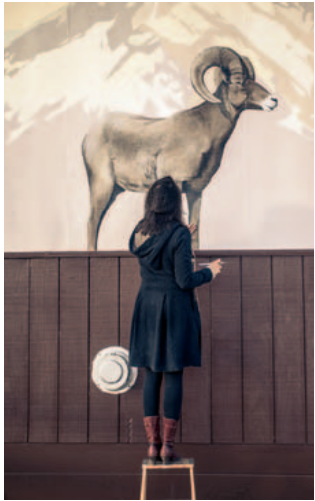
CALIFORNIA

Roadside Reminders

HIGHWAY MURALS HIGHLIGHT RARE BIGHORNS



WITH SO FEW SIERRA NEVADA BIGHORN SHEEP IN EXISTENCE, a hiker could spend a lifetime roaming California’s eastern mountain range without spotting one. But motorists can now catch a glimpse of the endangered bighorns’ likeness in a new series of murals painted on the side of four buildings along a 145-mile stretch of U.S. Route 395. The highway, which runs along the east side of the Sierra Nevadas, is “right in the shadow of where [the sheep] live,” says the artist, Jane Kim. The sheep paintings—some of them 20 feet tall—are the first installment of Kim’s migrating mural project, which aims to illustrate the life and behaviors of endangered migratory species. “It’s hard to spot Sierra bighorns,” she says, “which is one of the reasons that people don’t even know they’re around.” Kim herself needed the help of Sierra Nevada bighorn expert John Wehausen, who tracked the sheep with their radio collars and then used a spotting scope to show them to her. Kim plans to paint more endangered subjects that people rarely get to see, such as coho salmon, North Pacific blue whales and whooping cranes. Kim hopes the murals will raise the profiles of lesser-known fauna and promote awareness and conservation, she says. “The first step of conservation is getting an animal popularized.” —CARRIE MADREN



THE ART OF LIFE: Jane Kim’s murals evoke the wildlife hidden in the Sierra Nevada mountain range, where the Conservancy is helping protect habitats and water sources.

FAST FACT

500

Genetically distinct from Rocky Mountain and desert bighorns, Sierra Nevada bighorn sheep were listed as endangered in 2000 after disease and overhunting reduced the population to about 100 animals. Since then, conservation efforts have helped the bighorn start to recover: The current population is about 500.

By the Numbers

Deals and developments in the world of conservation



33%

Percentage of surveyed students from the Conservancy's youth internship program, Leaders in Environmental Action for the Future (LEAF), who have pursued careers in environmental fields. A new \$4 million grant from Toyota USA Foundation will help the Conservancy expand the program to 27 states this year.



CLICK: See how an internship changed life for New Yorker Josh Carrera at nature.org/leaf.

130

Acres purchased by the Conservancy along the border of the Bankhead National Forest in Alabama. The Conservancy plans to develop a research center on the property that will support studies of the area's diverse Appalachian forests, streams and extensive caves.



367%

Increase in the numbers of crabs and other arthropods on Palmyra Atoll one year after invasive rats were eradicated from the Pacific island. Researchers also observed a 130 percent increase in tree seedlings and are continuing to monitor growth. See life on and around Palmyra Atoll at nature.org/islandanimals.



15

Number of artists in New Mexico who celebrated "Picnic for Earth" with the Conservancy in April by creating works of art from picnic baskets. **GOOD WORK**

50

Years since the television show *Mutual of Omaha's Wild Kingdom*, which introduced a generation of children to nature and conservation, broadcast its first episode. The show is celebrating its anniversary by posting all-new episodes online for viewers.

565

Acres of open space on an Idaho property, the Empey-Johnson Ranch, now protected by conservation easements. The Conservancy worked with the ranch owner to protect the property, which borders Caribou-Targhee National Forest and is home to long-billed curlews, moose, bald eagles and Yellowstone cutthroat trout.

GLOVES: © VEER. BASKET: © PATINA GALLERY. CRAB: © THOR HAKONSEN

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ALIGHT: Jeremy Bailey manages what he calls “good fire”—a burn that helps restore habitat—at the Niobrara Valley Preserve in Nebraska.

“We want the right kind of fire in the right place at the right time.”

grabbed me by the collar and lit into me. I never did that again.

And I thought you were just going to say you incinerated ants using a magnifying glass outside. Insects are so important ecologically. I do not advocate burning insects.

Good to hear. But these days you do advocate burning certain forests and grasslands.

Why? For ecological restoration. Eighty percent of the vegetated areas in North America are fire dependent. When you allow good fire to roam across the greater landscape, it's better for plants, animals and the water supplies that support human communities.

I've never witnessed a controlled burn.

Describe the scene. One of the most magical moments I've had was on the White Mountain Apache Reservation in northeastern Arizona. We were just walking and flicking matches onto the ground in a forest that had been thinned. We walked miles through healthy, open stands. And those fires were small, moderate in intensity and doing really good work. When you see good fire moving through a forest or grasslands, it doesn't look destructive. It looks like rain and sunshine.

That sounds very peaceful. But starting a fire with matches is unusual; typically

you use a drip torch. What's that like?

A drip torch is a two-gallon can of diesel-and-gas mix with a wick that slowly drips out fire onto the vegetation. It's exhausting but it's still the best job in the business. Absolutely everybody wants to carry the drip torch.

How does starting a prescribed fire compare with your experiences fighting fires for 14 years? It's different. As a municipal firefighter, handling a structure fire is like a sprint. Wildland fire is more like a marathon. Now, as a burn boss, it's like I'm organizing a track event with both sprints and marathons embedded in it. I am responsible for both the success and failure of the process; my name is on the burn plan.

As the burn boss, you tell your crew, “eyes in the green, head on a swivel.” What does that mean? The area where we do not want fire, we call it “the green.” The area we are going to burn or recently burned is “the black.” We remind them to stop looking at that beautiful fire. Your head is on a swivel because you're always looking around for the next problem. When you're in the woods lighting fire or fighting it, you do not have room for error.

When you were introduced to the concept of setting controlled burns as a means of preventing catastrophic wildfires, what was your impression? When I moved to Santa Fe, I began using a lot of prescribed fire in the ponderosa pine forest. I remember realizing that this was the real answer to managing wildfire. Suppressing fire is clearly not the answer. The firefighting community has known that for at least 50 years. But it's hard to keep lighting fires and to allow fires started by lightning strikes to burn themselves out. It takes a lot of courage; you cannot be risk averse.

But you also can't ignore the real danger to people, right? There are certain reasons why we have to put some fires out as quickly as possible: We don't want homes to burn up, or fields or forage for cattle. We don't want big, hot fires that can hurt old-growth forest. That's not what we want. We want the right kind of fire in the right place at the right time of year.

You preach the gospel of “good fire” all across the country as a coordinator of the Fire Learning Network—a program run by the Conservancy, the Forest Service and various Interior Department agencies.



THE TRAINER: Often called a “matchmaker” for fire practitioners, Bailey spends much of his time teaching others and nurturing a network of fire professionals trained to safely burn natural areas.

I heard you even lobbied for a Winnebago to take your educational show on the road. On any day in any month, there's always someplace that's ready to be burned for some ecological reason. In January and February, we could be down in Texas on the central plains; in March and April, up in Minnesota. In September, New Mexico, Colorado and Idaho; in

November, back to Florida. If you had a 'bago, you could save airfare.

I take it that ploy failed. How are you doing on your mission to teach people that fire can be good? In 2012, I led a training session for firefighters, land managers and meteorologists from Argentina, Mexico and other Latin American countries. The crew spent two weeks conducting controlled burns in the Santa Fe National Forest. Then they took off a few days. Several people returned with stories of being thanked—for lighting the fire. As firefighters on wildfires, we're always thanked for our efforts

to protect homes and communities. But last year, when the New Mexicans thanked us for *starting* fires to protect their homes and communities, that was really powerful. I had the impression that maybe we are getting somewhere. ■

Read how forest thinning and burning saved an Arizona town in “Catching Fire,” page 30.

Jeremy Bailey

One of The Nature Conservancy's top burn bosses talks about his dramatic evolution from firefighter to fire lighter.

You began your firefighting career way back in middle school, volunteering for a city fire department and ultimately leaving college early to work as an elite “hotshot” for the Forest Service. Now, tell me about the first time you started a fire. I was probably 8 or 9 years old; I had

built a fort and some of the bigger boys in the neighborhood stole my fort material to build a treehouse. I found it and burned it down.

Wow. Were you caught? Yeah, when I told a neighbor to call 911. He

© RYAN DONNELL (2)

By Peter Friederici
Photographs by Chris Crisman

Catching

Fire

There's a new way of doing business in Arizona's
national forests. Conservationists, land managers
and loggers are collaborating to restore ponderosa
pine habitats, and to stop the next megafire
before it even starts.

THE BURN SPECIALIST

Mary Lata

The U.S. Forest Service is setting controlled fires in Arizona to clear brush and tinder, and to reduce fuel loads in overgrown forests.



A

AS HE DROVE AWAY FROM THE SUMMER CABIN HE'D built outside the small Arizona town of Alpine, Gary Fanning thought it was the last he'd see of the place.

"You could see the red coming over the mountain," he says. Fanning and his wife, Pat, had done everything asked of homeowners in what land managers call the wildland-urban interface: installed a metal roof, trimmed low branches, removed fallen pine needles. But with smoke filling the neighborhood and marshmallow-sized embers beginning to rain down, they doubted it would make a difference.

The Wallow Fire of 2011 burned more than half a million acres of Arizona's White Mountains region. It was the largest fire in state history. But when the Fannings were allowed to return nine days later, they found that their house had been spared—indeed, only one cabin in the town burned. The fire had torched the mountainside above, consuming every tree for acres. But when it reached the last tract of national forestland above their subdivision, a strip that logging crews had thinned two years earlier, its behavior changed.

"I'm convinced that saved my property," Fanning says. "That fire burned into the thinned area and dropped down to the ground. They just thinned about a quarter-mile strip, but that really is what saved this town."

The Fannings are beneficiaries of what amounts to a new paradigm for forest management in the Southwest—one that integrates ecological with social well-being. It stands old preconceptions on their heads, as conservationists argue for more tree cutting, and loggers harvest mostly small trees rather than taking the largest.

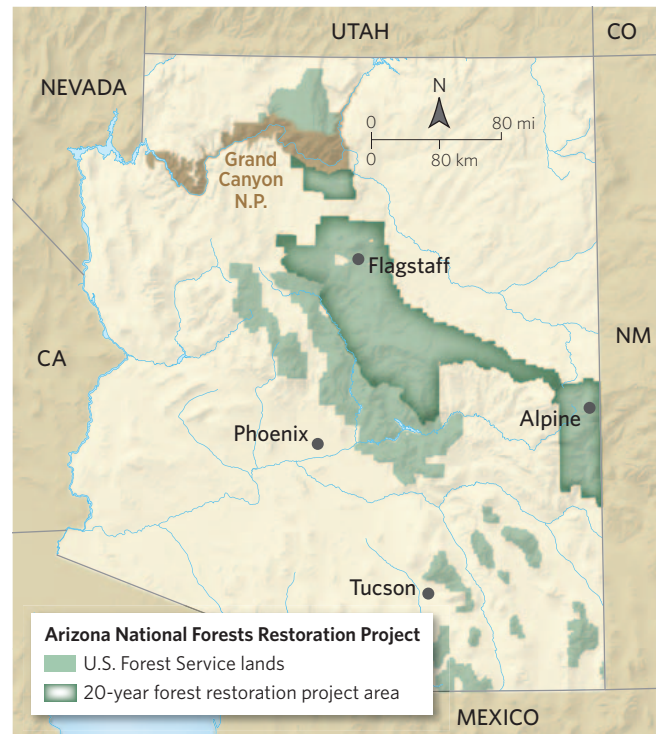
Take a look at the result: Hike up into those woods, as Fanning likes to do most days. Past a sagging barbed-wire

THE HOMEOWNER

Gary Fanning

Prior forest thinning helped save Fanning's home and the town of Alpine, Arizona, from the 2011 Wallow Fire—the largest in the state's history.





THE WORK AHEAD: During the next 20 years, the Four Forest Restoration Initiative will restore more than 2.4 million acres of ponderosa pine stands in the Kaibab, Coconino, Tonto and Apache-Sitgreaves national forests.

fence, stumps dot the ground under scattered, living pines. A bit farther uphill, the stumps are charred. But in late summer there's ample evidence that this is much more than a firebreak for the houses below. Waist-high bunch grasses, blooming wildflowers and resprouting oaks compete to hide the stumps. Warblers and juncos chirp in the bushes. What's here, three years after the logging equipment left and a year after the fire, is a lively native ecosystem.

What isn't so apparent is the painstaking collaborative work that produced this result. Ed Smith lived that. For 18 years, he served as a forest ecologist and program manager for The Nature Conservancy in Flagstaff, which lies in the same dry ponderosa pine forest as Alpine 200 miles away—and whose edges have been singed in recent years.

"Fire's just an inevitability here," says Smith, a soft-spoken ecologist and amateur mushroom hunter. But for much of the 20th century the notion of accepting fire as a natural, indigenous and even beneficial force was anathema. The Forest Service strove to extinguish every flame, even as loggers cut most of the forest's large, valuable trees. The result was a slow-motion ecological disaster. Open stands of big pines with fire-resistant bark were replaced by choked stands of small-diameter trees with far less value as wildlife habitat.

Such stands become a tinderbox under dry conditions. By the mid-1990s, uncontrollably severe fires were

growing in size and frequency. In 1996, the Horseshoe and Hochderffer fires burned about 25,000 acres near the Flagstaff city limits. An environmental lawsuit temporarily halted logging throughout the region. Most of the trees big enough to cut for a profit were gone anyway.

"We had a bad situation," Smith says. Stakeholders were creating a deadlock, and forest health suffered for it. "Fires were getting worse. We came to realize that we needed to do a number of things: reduce fuels, restore ecological functioning, figure out the economics—and earn the social license to do all that."

Smith earned that license by investing time with a broad grass-roots coalition formed in 1996: the Greater Flagstaff Forests Partnership. It set out to thin forest stands according to ecological criteria, such as evidence of how many trees per acre the land had once supported. A similar partnership cropped up in the White Mountains region. Thanks to countless meetings and field trips where conservationists, loggers, agency officials and others set aside differences and came to what Forest Service fire ecologist Mary Lata calls "violent agreement," those efforts bore fruit. Guided by the Greater Flagstaff Forests Partnership and other stakeholders, the Forest Service thinned tens of thousands of acres around Flagstaff. And in the White Mountains region in 2004 it initiated the nation's first long-term "stewardship contract," allowing the thinning of about 10,000 acres a year on Apache-Sitgreaves National Forest lands.

Most of those thinned acres have been near towns, like that strip of land near the Fannings' house in Alpine. But that's changing with the onset of a new, larger project—the

THE CONSERVANCY MANAGER

Ed Smith

Smith helped a coalition of loggers, land managers and conservationists develop a plan to restore Arizona's forests.

established in 2009 to provide support for landscape-scale projects that cross administrative boundaries and can affect entire ecosystems. The benefits will be manifold: Projections indicate that over 10 years, the Forest Service could save at least \$194 million in firefighting costs in Arizona if the 4FRI treatments are implemented.

"Treatments have been small, piecemeal," says Smith. "They've been strategically located near towns to limit fire

Four Forest Restoration Initiative, or 4FRI. It's an effort to restore ecological health to not thousands but millions of acres across four national forests in northern Arizona. And the 4FRI itself is only one of several large, collaborative efforts funded by the federal Collaborative Forest Landscape Restoration Program,



MAP: © XNR PRODUCTIONS; PAGE 30 © ISTOCK

THE LOGGERS

Rick and Dale Walker

With the days of clear-cutting long gone, the Forest Service is training loggers to thin clustered ponderosa pines down to healthy densities.



“I AM CONVINCED THAT [LOGGING] SAVED MY PROPERTY.”

—Gary Fanning, Alpine, Arizona

effects on human habitation. They work. But it’s been a narrow band around towns. What 4FRI is all about is going from narrow bands to wider swaths. And what’s critical about doing these larger treatments is having fire be able to roam the landscape again.”

In the White Mountains, much of the thinning work has been done by crews overseen by Dale Walker, an understated fireplug of a man who’s a fifth-generation logger. It’s an efficient operation, and a far cry from the bad old days when loggers clear-cut old-growth stands with chain saws. Agile feller-bunchers—vehicles on wide tires that can cut and stack multiple trees at the same time—spiral through the woods like whirligig beetles, cutting pines marked in blue paint by Forest Service crews. Skidders haul them to a landing, where a technician in an excavator equipped with a grapple and flail strips the branches and in the blink of an eye cuts the trees into 10- to 16-foot lengths.

“Most of my guys are under 30,” Walker says. “They have really good hand-eye coordination because they’ve been playing Nintendo.” Logging here is a work of precision and joysticks.

Logs larger than about 8 inches in diameter are cut into lumber. Skinny or warped logs are turned into wood pellets for stoves. Even the thinnest branches and green needles find a use: Shipped to a nearby power plant, they produce enough electricity to power thousands of homes.

“We pretty much use the whole thing,” says Walker. “We try to get maximum value out of these trees.”

What’s left is a fair bit of churned-up ground, but as the area around Alpine shows, plants with access to more light and other resources quickly hide logging scars. The remaining trees thrive, replicating the way the ponderosa pine forest once grew: a “groupy-clumpy” structure featuring bunches of variably sized pines and oaks separated by openings. It’s a forest resilient to fire, since flames typically remain on the ground rather than racing through the trees’ crowns. The Forest Service plans periodic low-intensity burns in thinned areas because they’ll help maintain an open forest structure.

Under 4FRI protocols, loggers will cut small, highly flammable—but commercially worthless—trees. That will open the forest floor and reduce fire danger. But loggers will



Tree of Fire

The ponderosa pine has several traits that help it survive fires. The species' deep-running roots and thick bark protect mature trees from heat damage. And its high branches help the tree's needles avoid flames.

Decades of fire suppression and logging allowed the trees to grow more densely, disrupting the forest's ability to survive fires. Evidence shows a healthy ponderosa pine forest has a density of about 20 to 50 trees per acre, but today many stands run closer to 500 to 1,000 trees per acre. Thick stands of young trees allow fires to burn hotter and climb into the crowns of the mature trees, creating wildfires that can move quickly and incinerate entire forests. By selectively logging, forest managers are able to restore space between the mature trees, forcing fires back to the ground and allowing mature pines to survive.



THE FOREST

Densely packed ponderosa pines create a fire risk in the Coconino National Forest's Oak Creek Canyon. Forests like these are slated to be thinned under 4FRI.

THE PRESCRIBED BURN

While megafires often kill mature ponderosa pines, tree-ring studies show that low-intensity fires accelerate the trees' growth by returning nutrients to the soil.



History of the Controlled Burn

By Blane Heumann, Director of Fire Management

When The Nature Conservancy set its first prescribed burn more than 50 years ago, the idea of using fire as a management tool was still new. On April 26, 1962, at the Helen Allison Savanna Preserve north of Minneapolis, Don Lawrence, a founding member of the Conservancy's Minnesota chapter, sought to do what had never been attempted at a Conservancy preserve.

Lawrence hoped a burn would help undo the damage caused by decades of zero tolerance for fire in this savanna ecosystem. A prescribed fire, he calculated, would promote prairie grass and wildflower growth and drive back brush that was degrading conditions for wildlife.

A radical concept? Not really. For millions of years fire has shaped the world's forests and grasslands. Many landscapes have grown to depend on fire almost as much as they depend on rain and sunshine. Some

trees, for instance, can only reproduce after fires melt the resins that seal shut their pine cones; other plants with deep roots can regenerate quickly after fires kill their competitors.



MORE

Photographer Chris Crisman takes you behind-the-scenes with his audio commentary in our digital edition for iPad.

Lawrence knew his natural history and sought to bring this natural process back to the preserve. In doing so, he pioneered a cost-effective land-restoration tool that is safely and methodically applied

today. Since 1988, the Conservancy has burned more than 1.5 million acres in more than 1,000 places to spur the growth of native plants and wildlife, reduce invasive species, and eliminate the dead matter and underbrush that can fuel megafires.

More than 50 years after Lawrence's first burn, the Helen Allison preserve is no longer choked by scrub and brush, but is a healthy savanna mix of high grasses and oak trees. And with proper forest management and prescribed fires, the ponderosa pine forests in Arizona will eventually look as healthy as they did in the past as well.

also be able to cut a limited quantity of larger, more valuable trees. The proceeds from the sale of those trees will help offset the project's cost. The economics are promising. A Montana-based firm plans to build a new mill in Winslow, Arizona, designed to produce finished wood products from 300,000 acres of national forestland in the next 10 years.

But there aren't enough trained loggers in Arizona to thin that much forest. Nor does the Forest Service have enough staff who can mark trees for cutting across that many acres. If 4FRI is to succeed, a new generation of log-

gers trained as foresters will be needed. Guided by stakeholders who have been hashing out what Arizona's renewed pine forests should look like, the Forest Service will write general guidelines; then the loggers will choose the individual trees to be cut. They will, for example, pick which trees in a clump to remove, though an overall size cap will prohibit cutting of the largest, and the prescriptive details will dictate how large and dense clumps should be.

"It's hard for us to think about letting go," says Smith. "But it's going to be the worker in the woods, with a crew

of people who will be foresters, making decisions. Those will be good, skilled jobs." To that end, the Conservancy is helping regional community colleges find resources to develop training courses for forest workers.

The Conservancy is also collaborating with a Forest Service lab in California to integrate more advanced technology into logging operations. A system of in-cab GPS units, computer tablets and infrared sensors will enable loggers and land managers to communicate and share data on the trees that are cut and those left standing.

The result should be a healthier, more fire-resistant ponderosa pine forest across broad stretches of the Southwest—with global implications. Matt Hurteau, a forest ecologist at Penn State University, points out that a forest in which trees largely resist fire is a carbon sink, whereas one that burns severely can release carbon into the air for a long time.

"We've done the ponderosa pine forest a real disservice by suppressing fire for so long," he says. "In order to restore it at a scale that is ecologically meaningful, something like the 4FRI will get us a long way there." ■



HUMBOLDT'S NEW WORLD

Two hundred years ago, a young scientist set off on a voyage of scientific discovery that would inspire the likes of Thomas Jefferson and Charles Darwin—and sketch a road map for the future of conservation.

BY JULIAN SMITH

At 13,000 feet in Ecuador's Andean highlands, two bumpy hours' drive from Quito, stands a decrepit building with an astonishing view. Sitting on land The Nature Conservancy helps protect, the structure is crumbling, and its rafters are covered with guano deposited by two resident owls. Outside, the ice-covered vision of the 18,874-foot Antisana Volcano, just four miles away, is enough to stop conversation. A plaque by the door explains why the building has not been torn down: In 1802, one of the most famous scientists in the world slept here, no doubt having marveled at the same view. >>

The Prussian naturalist and explorer Alexander von Humboldt was midway through a five-year, 6,000-mile voyage of scientific discovery through Latin America that would revolutionize thinking in fields from astronomy to zoology. Charles Darwin himself called Humboldt “the greatest scientific traveler who ever lived,” and when Darwin set off on his own journey aboard the *Beagle* three decades later, he took a copy of Humboldt’s seven-volume travel narrative.

Two hundred years later, it’s no coincidence that Humboldt’s route leads through many places the Conservancy is working to protect. His quest to collect enough information to assemble a unified theory of the natural world led him to some of the most biologically distinct regions in the Americas: over icy peaks, through wild grasslands, up jungle rivers and across rich ocean currents. Today, many of the landscapes that inspired one of the world’s greatest thinkers are under threat, and together they form an atlas of much of the Conservancy’s work in the northern parts of South America.

“ALL THIS IS MY OFFICE,” SAYS BYRON MOSQUERA as he sweeps his arm across the view of the towering peaks surrounding Humboldt’s humble lodging. Mosquera works as a guard for the Quito Water Protection Fund, the first of its kind in Latin America. Launched in 2000 with funding from the Quito Water Company and the Conservancy, the fund addresses one of Ecuador’s most serious conservation issues: protecting the water supply for the 2 million people who live in its booming capital.

Quito’s residents consume 7 cubic meters of water every second, enough to fill 242 Olympic swimming pools every day. Almost all of this water originates high in the Andes, in places like this. But not all of these places are protected.

Mosquera points to a hillside covered with short grass, site of a recent restoration project. “That used to be all sheep.” Before the water company bought and protected the land, its private owners grazed thousands of sheep here, which left the high-altitude grassland denuded and prone to erosion.

“You can imagine it was not in good shape,” says Oswaldo Proaño, a project coordinator for the fund.

Several of the old hacienda buildings near Humboldt’s shack have been converted into guards’ quarters. The new entrance gate is under construction, requiring vehicles to drive around it to visit the preserve. A short drive away, clouds slide over gray-green hillsides around Lake Micacocha, which supplies drinking water to 700,000 Quiteños, making it one of the city’s largest water sources.

By most measures, the water fund has been a rousing success. The initial capital investment to start the fund (\$20,000 from the Quito Water Company and \$1,000 from the Conservancy) has grown to \$10.8 million thanks to prudent investments and ongoing support from the water company, as well as additional contributions from the Conservancy, the city’s electric utility, the Swiss government, a local brewer and a water-bottling company. The fund now provides \$1.5 million every year for conservation projects like the one near Antisana. The Conservancy has since established water funds elsewhere in Ecuador as well as in Colombia, Brazil and Mexico. The goal is to have 32 funds in operation by 2015, protecting the water supply for 50 million people.

BORN IN 1769 TO AN ARISTOCRATIC PRUSSIAN family in Berlin, Humboldt was fascinated with the natural world from childhood. Thanks to his voracious intellect, he researched and published scientific papers on subjects as seemingly unrelated as the distribution of plants across different geographies and the physiology of electrical nerve impulses—all while working as a mine inspector.

Several encounters with famous scientists of the day planted the seeds of Humboldt’s distinctive scientific mindset: that the only way to understand the world was to look at it as a whole, using all the physical sciences together, instead of breaking everything down into isolated parts and disciplines—equal parts Gaia and Grand Unified Theory. “Knowledge and comprehension are the joy and justification of humanity,” he wrote. Data were key; the more the better.

In 1799, Humboldt and the French botanist Aimé Bonpland set sail for South America aboard the frigate *Pizarro*. Along with 42 of the finest scientific instruments available—including barometers, telescopes and chronometers—they carried a commission from King Charles IV of Spain to make the first detailed scientific exploration of Spain’s mostly uncharted colonies in the Americas. Even if the king’s motives were purely commercial—the better he knew his colonies, the more wealth he could extract from them—for the scientists it was a once-in-a-lifetime opportunity.

After a six-week voyage, the ship landed on the Caribbean coast of Venezuela in mid-July. (At the time, Venezuela, Panama, Ecuador and Colombia were joined in the Spanish Viceroyalty of New Granada.)



PORTRAIT OF A SCIENTIST: A print published in 1814 depicts Humboldt and his companions exploring Ecuador’s Cayambe Volcano (previous spread). Humboldt’s bold journeys, careful analyses and devotion to data collection laid the foundation for a new generation of scientists. Charles Darwin wrote regarding Humboldt: “My whole course of life is due to having read and re-read as a youth his *Personal Narrative*.”



The scientists set out on the Orinoco River, the world’s fourth largest by flow. They spent the next 75 days struggling upriver in canoes, choking on mosquitoes and eating everything from ants to manatees. They documented the lives of native peoples, such as the Maipures, and conducted the first scientific experiments on electric eels. They determined the creatures could aim their 600-volt charge and found that holding hands transmitted the teeth-rattling shock.



AMERICAN ODYSSEY: In 1799, Humboldt and his companion Aimé Bonpland began a five-year, 6,000-mile journey through much of Spain’s colonial territory in the Americas. Their work to chart out and explore the Amazon and the Andes has been called the scientific discovery of South America.

MAP: © XNR PRODUCTIONS. OPPOSITE PAGE: © BIBLIOTHEQUE DES ARTS DÉCORATIFS, PARIS, FRANCE/ARCHIVES CHARMET/THE BRIDGEMAN ART LIBRARY; THE ART ARCHIVE/PRIVATE COLLECTION/CCI. PAGES 42-43: © BIBLIOTHEQUE NATIONALE, PARIS, FRANCE/GIRAUDON/THE BRIDGEMAN ART LIBRARY

In two and a half months, Humboldt and Bonpland traveled 1,500 miles to the river’s source, where they made the first of many major geographic discoveries: The Orinoco and the Amazon, South America’s two mightiest rivers, were connected by the Casiquiare canal.

Humboldt’s Orinoco journey took him through the “sea of grass” of the Venezuelan Llanos, one of the richest tropical grasslands in the world. Today, much of this expanse of rivers, marshes and seasonally flooded savannas is as wild as it was in Humboldt’s time. Jaguars, anacondas and giant anteaters share the forests with 700 species of birds, more than are found in the entire continental United States. The rivers teem with more than 1,000 fish species, including a 300-pound catfish called the lau-lau, as well as the endangered Orinoco crocodile, reduced to an estimated 1,500 in the wild.

Unlike in Humboldt’s era, this riot of life is now facing incursions from oil and gas developers, large-scale agriculture

In Humboldt’s time Ecuador’s Chimborazo (20,702 feet) was thought to be the tallest mountain in the world. Humboldt and Bonpland tried to climb the mountain, struggling so high their noses bled. Although they turned back at 19,286 feet, they had set a new altitude record.

and illegal wildcat miners. In response, the Conservancy has teamed up with governments and local communities in both Venezuela and Colombia to help protect biodiversity and guide environmentally sustainable development.

In 1999, in one of its largest land donations ever, the Conservancy transferred more than 180,000 acres to the Venezuelan government for inclusion in Aguaro-Guariquito National Park, along the Orinoco. In 2012, Venezuela’s municipal government of Romulo Gallegos designated, in collaboration with the Conservancy, more than 1 million acres for “cultural and ecological protection” (see “The Changing Land,” March/April 2013). Other municipalities have expressed interest in copying the project, says Conservancy anthropologist Eduardo Ariza. “More than 20 indigenous peoples occupy large areas in the Llanos,” he says, “but still have no ownership over their territory.”

AFTER A BRIEF DETOUR TO CUBA, HUMBOLDT and Bonpland arrived in Cartagena and in April 1801 started paddling up the Magdalena River, Colombia’s main waterway. They made the first chart of the river as they

ascended, covering 600 miles in six backbreaking weeks to reach the settlement of Honda. From there it was 50 steep miles of walking to Santa Fe de Bogotá, capital of the Vice-royalty of New Grenada, at 8,660 feet in the Andes. Over the next two months, Humboldt ventured out from the city to measure the heights of mountains and examine fossilized mastodon bones while Bonpland recovered from malaria.

Although the Magdalena River basin covers only a quarter of Colombia, today it supports 80 percent of the country’s population and generates 86 percent of its gross domestic product. The lush riverside vegetation that Humboldt and Bonpland struggled through at the height of the rainy season is now three-quarters gone, and fish catch has fallen 80 percent in the past 15 years.

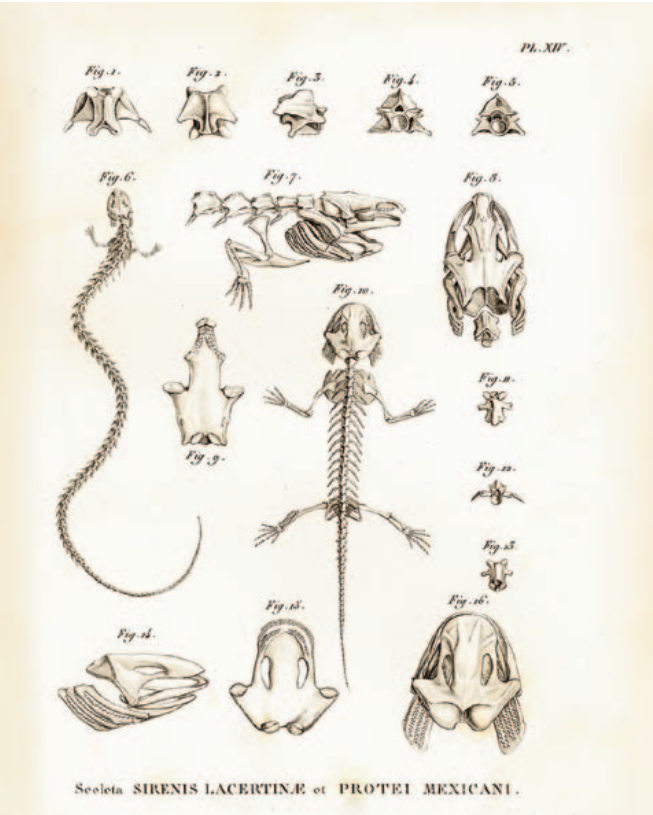
The Conservancy has made the Magdalena a priority at a critical time, says Rosario Gomez, the Conservancy’s Magdalena River project coordinator. The government agency responsible for managing the river has proposed a series of projects to channelize and dam the river for hydropower. Gomez and her team are working with officials to develop an alternative: a river-wide management plan that balances infrastructure development with conservation.

The effort is still in its early stages, but as of the end of 2012, nearly 2,500 ranchers had signed up for a project designed to boost productivity while reducing deforestation and water contamination from fertilizers and herbicides. And after the success of Quito’s water fund, the Conservancy in 2008 helped set up a similar fund in Bogotá to protect lands that supply water to the city’s 8 million inhabitants. More funds are planned for Cartagena, Medellín and Barranquilla.

Humboldt, of course, had drawn a connection between healthy landscapes and water supplies during his time in Venezuela: He attributed the falling water levels in Lake Valencia, west of Caracas, to the clear-cutting of nearby forests.

THE TWO EXPLORERS LEFT BOGOTÁ IN SEPTEMBER 1801 and headed south through the Andes. Four months later they arrived in San Francisco de Quito, now the capital of Ecuador. The city of about 40,000 filled a river basin at 9,360 feet at the base of an active volcano called Pichincha.

The Andes run down the middle of Ecuador like a knobby spine, with 10 peaks higher than 15,000 feet, including many active volcanoes. The main north-south route—today part of the Pan-American Highway—is an eye-popping slalom around gigantic peaks. Humboldt



© HUMBOLDT-UNIVERSITÄT, BERLIN, GERMANY/THE BRIDGEMAN ART LIBRARY (ALL)

CATALOGUE OF CREATURES: Humboldt collected and drew sketches of hundreds of animals he observed during his five-year journey. These engravings, based on drawings in Humboldt’s journals, depict the rich diversity he encountered, including (clockwise from top left) numerous species of butterflies; the golden-backed uakari; a species of piranha and a close relative called the pacu; and a skeleton of a greater siren.

dubbed this extraordinary passage the “Avenue of the Volcanoes,” a nickname that has endured.

The explorers spent most of their time in Ecuador scrambling up mountains. On his first try at Pichincha, Humboldt grew dizzy, passed out and had to be carried down. He was successful on his second and third climbs while lugging an array of instruments—barometers, hygrometers, electrometers—to study the 15,695-foot peak.

In Humboldt’s time the Andes were considered the highest mountain range in the world, and Ecuador’s Chimborazo (20,702 feet) was thought to be the tallest of them all. Humboldt and Bonpland tried to climb the mountain in June 1802, struggling so high their noses bled from the altitude. When they finally turned back at 19,286 feet, they had gone higher than anyone else in recorded history, even in a balloon. It was this record-breaking feat, as much as anything, that cemented Humboldt’s worldwide celebrity.

The most important legacy of the Chimborazo climb, though, is a diagram Humboldt made afterward showing which plants grew where on the volcano’s slopes, based on altitude, rainfall and soil type. In a single, richly detailed

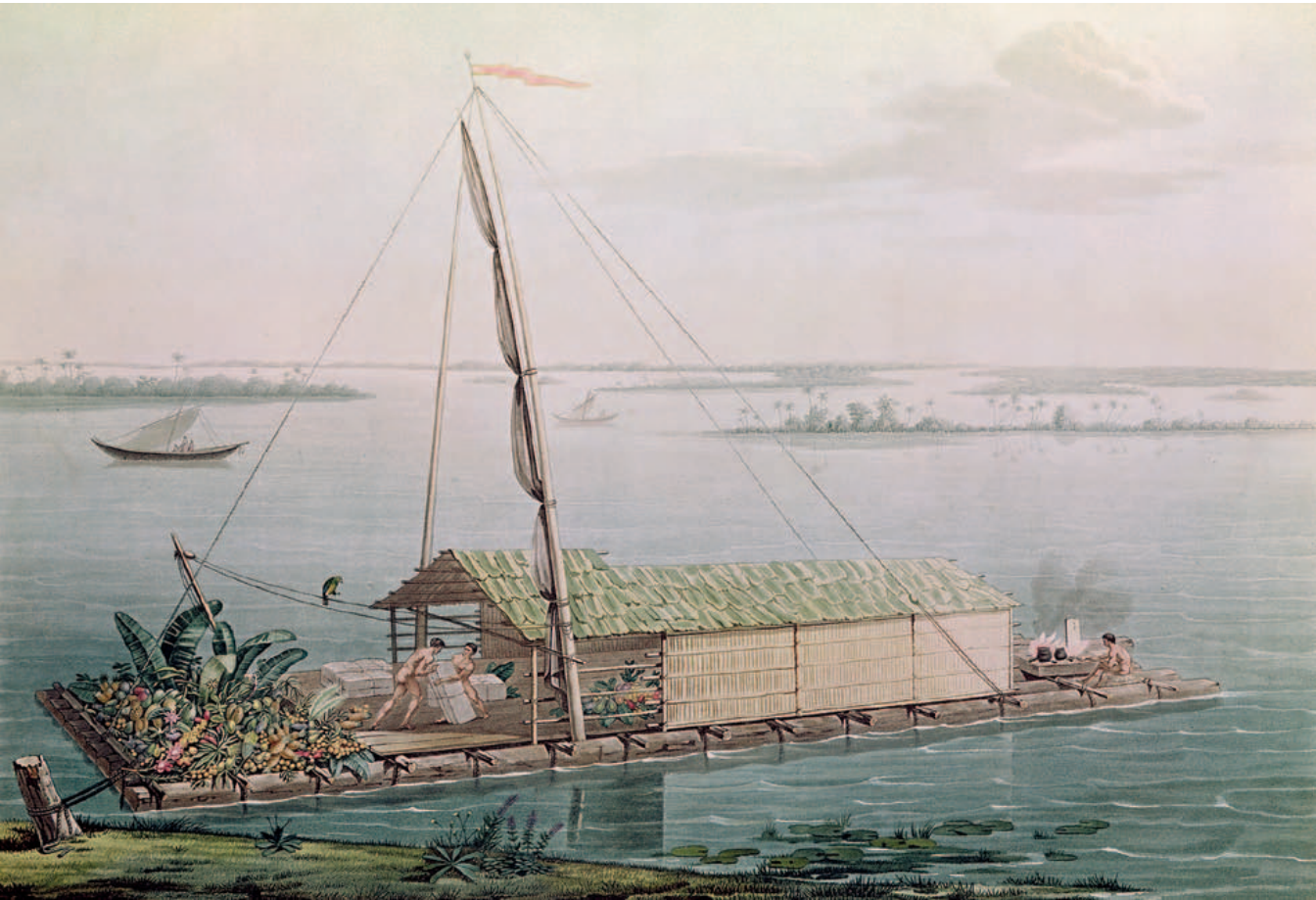
image, he showed that organisms at similar elevations and latitudes around the world tend to have similar traits and adaptations. It was classic Humboldtian science, blending concepts from biology, geology, climatology and ecology.

Today, fluffy llamas graze in the fields across from the new visitors center at the entrance to Chimborazo National Park on the mountain’s southern flank. The Conservancy helped design the buildings using local materials in a style that evokes chunky Inca stonework. The Conservancy also helped Ecuador’s Tourism and Environment ministries come up with a plan under which local indigenous communities will manage the center, benefit from the entrance fees and eventually run guided tours.

As the road climbs, the sound of the straining car motor sends vicuñas (smaller cousins of the llamas) bolting away across the barren slopes. At a climber’s hut at 15,900 feet, the icy air and the blinding sunlight are equally bracing. Families sit on rocks to pose for pictures, squinting into the wind. Behind the hut is a 20-foot stone pyramid bearing three plaques—one dedicated to Simón Bolívar, the George Washington of South America, and two to Humboldt.



FIELD OF DISCOVERY: Over the course of their five-year self-financed journey through the Americas, Humboldt and Bonpland collected a staggering number of plants. Of the 60,000 specimens they gathered, 3,000 were previously undocumented. Engravings published in the 1820s depict three plant species collected and preserved by Humboldt during his journey (left to right): *Myrtus bicolor*, *Weinmannia macrophylla* and *Melastoma discolor*.



ANTHROPOLOGY: This etching of a Humboldt sketch depicts a raft at port in Guayaquil. During his travels, the scientist was fascinated by the evidence of the great civilizations of the Inca and the Aztecs that had been dismantled and forgotten by the Spanish.

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AFTER DIPPING INTO THE UPPER AMAZON, Humboldt and Bonpland recrossed the Andes and reached the Pacific, spending two months in Lima before boarding a ship to Guayaquil and then Mexico. As Humboldt sailed north, he made the first measurements of the temperature and speed of the massive ocean current that now bears his name.

Sweeping north along the west coast of South America, the Humboldt Current brings cold waters from Antarctica that help keep the coasts of Peru and Chile cool and dry. The nutrient-rich flow also supports the largest and most productive fisheries on the planet, accounting for an estimated 12 percent of total world catch. Most of this consists of the anchoveta, a kind of anchovy that is the cornerstone of Peru’s industrial fishing industry.

This rich ecosystem is threatened by coastal development, overfishing and pollution. Every few years the El Niño climate phenomenon brings an influx of warm water that can disrupt marine ecosystems and the birds and mammals that depend on them, including Humboldt penguins.

In Peru, the Conservancy is working with the government and other partners to promote the creation of coastal marine reserves and improve fisheries management. In just the past five years, three reserves have been created. “The Conservancy’s success in improving the management practices [here] can be a tipping point for fisheries management worldwide,” says Conservancy project manager Fernando Ghersi.

It took Humboldt another year and a half to make it home. He made a transect through Mexico and a stop in the United States. He dined at the White House as a guest

NEXT STEPS

Humboldt’s Trail: Dig deeper by reading *Humboldt’s Cosmos* by Gerard Helferich (Gotham Books, 2004). Want to visit some of the places the Conservancy has helped protect along Humboldt’s path, including Caribbean marine sanctuaries and the slopes of the Andes?

VISIT: nature.org/newworld.

of Thomas Jefferson, who—inspired in part by news of Humboldt’s discoveries—had just dispatched Lewis and Clark on their journey.

When the scientists landed in France on August 1, 1804, Humboldt found that his travels had made him one of the most

famous men in the world. He spent the rest of his life analyzing and writing up his findings in dozens of books and papers.

When Humboldt died in 1859, the *New York Herald* called him “one of the greatest men of his age or of any other.” He popularized natural science as no one ever had before. Ironically, despite the hundreds of places, species, schools and natural features named after him, Humboldt has been largely forgotten today. But his essential insight is as relevant as ever: that only by combining detailed observations with big-picture thinking will we ever be able to grasp the fundamental unity of the natural world, including our place in it.

And the best way to do this, he knew better than most, is by experiencing the world firsthand—whether by visiting a neighborhood park or a distant snow-clad volcano. “The most dangerous worldview,” Humboldt wrote, “is the worldview of those who have not viewed the world.” ■



By Graham Averill

APPALACHIAN INSPIRATION

For more than 75 years, the Appalachian Trail has stood as the country's most famous footpath—and may be one of its greatest conservation allies.

CHOOSE YOUR OWN ADVENTURE: Every year, the trail lures millions of outdoor enthusiasts to reunite with nature: sheltering through a Tennessee snowstorm (upper left and right), summer hiking in Vermont (middle left), or soaking in the views of Virginia's McAfee Knob (bottom right) and the Great Smoky Mountains (this page).



In 1921, when Benton MacKaye introduced the concept of the Appalachian Trail in the *Journal of the American Institute of Architects*, hiking was just an afterthought for the regional planner. Disenchanted with the East's growing metropolises, MacKaye envisioned a series of work and study camps on the Appalachian ridgelines where weary citizens could escape rampant industrialization and immerse themselves in nature. For MacKaye, the extensive trail was a means to an end, simply a way to connect the camps. Those camps may not have materialized, but the hiking trail thrived.

Seventy-six years after its completion, the Appalachian Trail is the most famous footpath in the country, stretching roughly 2,186 miles from Springer Mountain, Georgia, to Mount Katahdin, Maine. Its proximity to major cities along the eastern seaboard means that half of the U.S. population, more than 150 million people, lives within a day's drive of the Appalachian Trail, giving it an outsized role in connecting people to nature.

Starting in the early 1900s, nationwide enthusiasm for land conservation saw national parks designated across the country. New parks like Glacier and the Grand Canyon became icons of the American West, while the Appalachian Trail gave Easterners a massive project of their own. Miles of path were quickly cut, and enthusiasm for the trail enabled the designation of Shenandoah and Great Smoky Mountains national parks soon after.

The Appalachian Trail was completed in 1937—just 16 years after MacKaye proposed the idea—thanks to a handful of dedicated hikers and public land managers who were galvanized by the idea of a “super trail” traversing the wild ridges and peaks in their proverbial backyards. The Appalachian Trail Conservancy steered the public-private joint venture, which was designed by private citizens and largely implemented by public works programs. At the time it was completed, roughly half the Appalachian Trail traversed private properties; today, 99.5 percent of it is on protected land.

The Appalachian Mountains are a conservation priority, and the trail threads together many Nature Conservancy projects across the region: In New Jersey, for instance, the Conservancy is working along the Kittatinny Ridge to preserve migratory bird flyways and improve forest connectivity in the region. In West Virginia, it leads efforts to restore red spruce forests. And in Georgia, the Upper Coosa River Basin Project secures land around headwaters that feed Atlanta's freshwater supply.

“The Appalachian Trail is like Yellowstone. People like the *idea* of it, and they're willing to stand up for it,” says Katherine Medlock, program director for the Conservancy's Eastern Tennessee office, which has roughly 278 miles of Appalachian Trail in its region. “If people hike even a little of this incredible trail, they become lifetime advocates for conservation.”

For many, the path offers the ultimate backpacking adventure, an opportunity to spend months walking the greatest wilderness complex in the East. For a glimpse of pure joy, look at the face of a “thru-hiker” standing on top of the trail's craggy, alpine terminus in Maine. The hiker is inevitably dirty. Worn. Tired. And always ecstatic from completing a defining outdoor pilgrimage.

TUNNEL VISION: Most of the Appalachian Trail passes through forest, and the scenery can stretch like this for miles.

Over the years, the Appalachian Trail has evolved to play a role as an environmental laboratory. According to the Appalachian Trail Conservancy, the trail helps protect 250,000 acres. The mountain chain is home to one of the most biologically diverse temperate forests in the world. It functions as a flyway and nesting habitat for more than 230 bird species. As climate change pushes cold-loving plants and animals northward, these mountain ridges are now playing a valuable role as an intact wilderness corridor where species can move and survive.

“MacKaye's vision of a wilderness belt where you could study nature away from the metropolises below has come back around,” says Brian King, publisher of the Appalachian Trail Conservancy's magazine. “The A.T. is now one of the most important natural resources in the National Park System. It was a gift that MacKaye and his colleagues came up with more than 90 years ago. The people who built the trail probably didn't think of it that way at the time. They just thought it was a neat idea—a really long trail.”

OPPOSITE PAGE: © MARC MUENCH, PAGE 50; BEN BENVIE (5); DAVID MUENCH (LOWER RIGHT), PAGE 51; IAN SHIVE/TANDEMSTOCK, PAGE 54; © JASON J. HATFIELD/TANDEMSTOCK



The Journey Starts Here

This thin ribbon of trail connects cities with national parks, humans with nature and biodiversity with its future.

IN THE BEGINNING...

The Appalachian Trail hits its 6,625-foot peak elevation in Great Smoky Mountains National Park, near the summit of Clingman’s Dome. A nearby observation tower offers a 360-degree view of one of the oldest mountain ranges in the world. Geologists believe the Appalachian Mountains began forming 480 million years ago as the supercontinents Gondwana and Laurasia shifted and eventually collided. According to the U.S. Geological Survey, the Appalachians likely stood the size of the Rockies. Recent surveys show the mountains’ river valleys are eroding faster than their peaks, creating a deeper relief within the landscape.

THE GATEWAY

The Appalachian Trail is not just a bucket-list adventure; it can be a quick weekend escape. The trail passes through small towns, skirts the skylines of larger cities and intersects with countless other side trails. According to the National Park Service, more than 2 million people set foot on the Appalachian Trail every year. If getting people outdoors is the most effective way to promote conservation, the trail has proven a successful ambassador.



GROUP EFFORT: The trail is overseen by the Appalachian Trail Conservancy and maintained by a coalition of local, state and federal organizations. This expansive view at Blackrock Summit comes courtesy of Shenandoah National Park in Virginia.



THRU-HIKING VS. SECTION HIKING: Thru-hikers complete the trail in one continuous trip, which can take many months depending on the individual's speed. Section hikers can turn the trail into a lifelong journey, allowing portions to be completed in nonlinear order and at optimal times of the year.

© BEN BENNIE (2), PAGE 57. MAP: © XNR PRODUCTIONS. PHOTOS: © JOSÉ AZEL/AURORA PHOTOS (TOP); © BEN BENNIE (BOTTOM). PAGES 58-59: © MARK PICARD; GEORGE SANKER/NPL/MINDEN PICTURES



CHALLENGES AHEAD: Injury, fatigue and the constant diet of trail food are some factors that force 75 percent of thru-hikers to quit the 2,186-mile trek.



➔ **CLICK:** In 2002, the Conservancy helped protect 240,000 acres of forest near Maine's Baxter State Park. The deal safeguarded 14 miles of the Appalachian Trail. Plan your visit at nature.org/wildmaine.

THE HARD ROAD: Even in ideal conditions, the two northernmost states offer the Appalachian Trail's toughest hikes, known for rocky climbs and harsh weather. Below, New Hampshire's Presidential Ridge dishes out its worst.



FIVE MILLION STEPS

"I caught my brother talking to his Oreo cookies one day," says Ethan Kearns, manager of film and video for the Conservancy, describing their Appalachian Trail thru-hike. "Those first couple of states break your body down. Your mind, too. But it gets easier as you move north."

"Easier" is a relative term. In 2005, Kearns thru-hiked the trail with his younger brother in just 99 days. Most people take six months to complete the trek, typically starting in Georgia and walking north. It's a monumental feat. Only one in four would-be thru-hikers finishes; most northbound hikers quit before reaching Virginia. An estimated 13,500 people have walked the trail from end to end according to the Appalachian Trail Conservancy.

WALK THE LINE

Henry Ford gets to take some of the credit for the Appalachian Trail. Before the automobile, backpackers mostly hiked in loops because they had limited means of shuttling from the end of a linear trail back to the starting point. The first "long trail" to emerge from the automobile boom was Vermont's 270-mile Long Trail, which now joins up with the Appalachian Trail in southern Vermont—fitting since MacKaye was inspired to create the Appalachian Trail while summiting Stratton Mountain on Vermont's Long Trail.

The final leg of the Appalachian Trail, two miles between Spaulding and Sugarloaf Mountains in Maine, was completed in 1937. Conservationists have spent decades protecting the trail's corridor. In the 1980s, the Conservancy preserved a piece of hiking history, purchasing 12,000 acres in southern Vermont, including a shared section of the Long and Appalachian trails that features Stratton Mountain.

Nominate your favorite trail: What's the best hike you've ever taken? Make the case for your top trek—it could be supremely scenic or seriously sweat-inducing. The most persuasive comment will run in an upcoming issue of *Nature Conservancy* magazine. **VISIT:** nature.org/myhike.



MANY MORE USERS: The Appalachian Trail cuts through the headwaters of 64 major watersheds, including Watauga Lake in Tennessee's Cherokee National Forest (above). A moose and American pine marten in Baxter State Park in Maine (opposite page).

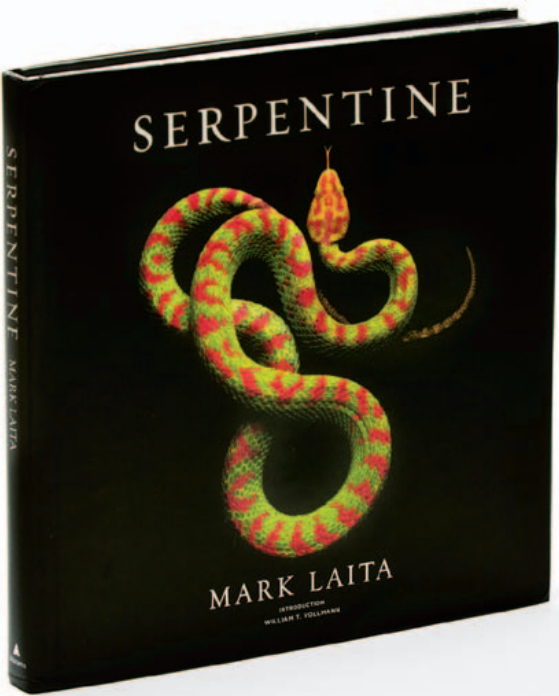
BANKING BIODIVERSITY

Mark Anderson, the Conservancy's regional science director in Massachusetts, sees the Appalachian Mountains as a bank of biodiversity, insurance in the face of climate change. He studied 156 million acres between Virginia and Canada, looking for landscapes that feature a series of microclimates that aren't fragmented by development. The Appalachians promise to be one of the most resilient landscapes in the East. Great Smoky Mountains National Park alone has more than 17,000 documented species (923 are recently discovered) according to an ongoing biodiversity inventory.

Protection of the Appalachian Trail has left a corridor that allows species to migrate into more hospitable ecosystems as conditions change. "The rest of the East is so fragmented, species will eventually be pushed through these mountains, turning the Appalachians and the trail into a natural stronghold for species," Anderson says.

And though the trail was built to reconnect urbanites with nature, its influence on surrounding lands may be what ultimately preserves Eastern forests and mountain habitats. ■





Reptilian Rainbows

PHOTOGRAPHER MARK LAITA HAS SEEN THE BEAUTY AND danger of snakes firsthand. While photographing the reptiles for *Serpentine*, he was bitten on the leg by a venomous black mamba in Central America. Laita lived to tell the tale and finish the book, which celebrates the simple swirling splendor of these maligned creatures in a remarkable collection of nearly 100 studio portraits.

Cobras, rattlesnakes, pythons and vipers arc and curl into colorful bow ties and figure eights across the pages. A pit viper expands after feeding. A reticulated python strangles a small alligator. A Mojave rattlesnake stretches beside its young. Notes on good and evil make the book more than a collection of reptilian photography. “Perhaps everything that frightens us is, in its deepest essence, something helpless that needs our love,” reads one note by poet Rainer Maria Rilke.

It’s that idea that Laita—both snakebite victim and snake admirer—pursues: “These exquisite predators embody our fears; they symbolize our mortality,” he writes. “But they are neither good nor evil unto themselves.” In recognizing their beauty, he suggests, perhaps we can begin to better understand them. *Abrams, February 2013*



A Human Race

Ed Ayres, the founder of *Running Times* magazine, knows a thing or two about endurance. He has run more than 600 races in the past 55 years, many of them marathons and ultramarathons. In his recent book, *The Longest Race*, Ayres takes readers with him as he sets out to break the record for the over-60 age group in the country’s longest-running ultramarathon, Maryland’s JFK 50 Mile.

But Ayres—who for more than a decade was the editorial director of the environmental think tank the Worldwatch Institute—is concerned with more than making it across a finish line. His story is an exploration of the endurance of the human race and the choices we will need to make to negotiate the environmental challenges ahead of us.

Ayres relates experiences from his lifetime of long-distance running and environmental writing to ponder what it might take to keep the human race thriving sustainably in the future. He parlays his insights from countless hours of training—thoughts about building endurance, conserving energy and using resources wisely—into analogies for his vision of a world where people base decisions on long-term sustainability. *The Experiment, October 2012*

Cell Phone Inspires Chicago Doctor to Design Affordable Hearing Aid

Outperforms Most Higher Priced Hearing Aids

Reported by J. Page

CHICAGO: A local board-certified Ear, Nose, Throat (ENT) physician, Dr. S. Cherukuri, has just shaken up the hearing aid industry with the invention of a medical-grade, affordable hearing aid. **This revolutionary hearing aid is designed to help millions of people with hearing loss who cannot afford—or do not wish to pay—the much higher cost of traditional hearing aids.**

“Perhaps the best quality-to-price ratio in the hearing aid industry” —Dr. Babu, M.D. Board-Certified ENT Physician

Dr. Cherukuri knew that untreated hearing loss could lead to depression, social isolation, anxiety, and symptoms consistent with Alzheimer’s dementia. **He could not understand why the cost for hearing aids was so high when the prices on so many consumer electronics like TVs, DVD players, cell phones and digital cameras had fallen.**


Since Medicare and most private insurance do not cover the costs of hearing aids, which traditionally run between \$2,000-\$6,000 for a pair, many of the doctor’s patients could not afford the expense. Dr. Cherukuri’s goal was to find a reasonable solution that would help with the most common types of hearing loss at an affordable price, not unlike the **“one-size-fits-most” reading glasses** available at drug stores.

He evaluated numerous hearing devices and sound amplifiers, including those seen on television. Without fail, almost all of these were found to amplify bass/low frequencies (below 1000 Hz) and not useful in amplifying the frequencies related to the human voice.

Inspiration From a Surprising Source

The doctor’s inspiration to defeat the powers-that-be that kept inexpensive hearing aids out of the hands of the public actually came from a new cell phone he

- **Designed By A Board-Certified Ear, Nose and Throat (ENT) Doctor**
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- **Save Up To 90%**
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- **Batteries Included! Comes Ready To Use**
- **100% Money Back Guarantee**



had just purchased. “I felt that if someone could devise an affordable device like an iPhone® for about \$200 that could do all sorts of things, I could create a hearing aid at a similar price.”

Affordable Hearing Aid With Superb Performance

The high cost of hearing aids is a result of layers of middlemen and expensive unnecessary features. Dr. Cherukuri concluded that it would be possible to develop a medical grade hearing aid without sacrificing the quality of components. The result is the MDHearingAid PRO®, starting well under \$200. **It has been declared to be the best low-cost hearing aid that amplifies the range of sounds associated with the human voice without overly amplifying background noise.**

Tested By Leading Doctors and Audiologists

The MDHearingAid PRO® has been rigorously tested by leading ENT physicians and audiologists who have unanimously agreed that the **sound quality and output in many cases exceeds more expensive hearing aids.**

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“BEST QUALITY SOUND”
“LOWEST AFFORDABLE PRICE”

*“I have been wearing hearing aids for over 25 years and these are the best behind-the-ear aids I have tried. **Their sound quality rivals that of my \$3,000 custom pair of Phonak Xtra digital ITE.**”*
—Gerald Levy

*“I have a \$2,000 Resound Live hearing aid in my left ear and the MDHearingAid PRO® in the right ear. **I am not able to notice a significant difference in sound quality between the two hearing aids.**”*
—Dr. May, ENT Physician

*“We ordered two hearing aids for my mother on Sunday, and the following Wednesday they were in our mailbox! Unbelievable! Now for the best part—they work so great, my mother says she hasn’t heard so good for many years, even with her \$2,000 digital! **It was so great to see the joy on her face.** She is 90 years young again.”* —Al Peterson

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An Elusive Catch



But the river also contains immense hydropower potential, and the various governments along the Mekong are building or planning dozens of dams to produce needed energy and revenue. Because so many of the Mekong’s fish species migrate long distances, poorly planned dam development would likely eliminate much of the river’s fish productivity and diversity.

People along the river shared many opinions for and against the dams. But I wondered why this issue needed a binary resolution—is it always energy or fish? Technical models point toward the potential for balanced solutions, in which dams avoid the most important migratory pathways. These solutions can be hard to get right in the real world, but Mekong countries can’t afford to get it wrong.

Family Vacation: Opperman’s family traveled 1,500 miles down the Mekong River.

During our first few days of casting grubs into the Mekong River with only a single bite, my fifth-grade son, Luca, and I were getting skunked by the fish of Laos. We carried a rod and reel for 10,000 miles on planes, buses and boats, and as my family’s trip down the river progressed, I became ever more determined to see the gear pluck a fish from the water. The Mekong has more fish species than any river besides the Amazon, but it doesn’t give up its bounty easily to relative novices from Ohio.

We watched in awe as local fishermen along the banks netted some keepers. But in the back of my mind was a fear that one day soon even their skills may no longer ensure a decent catch; plans are on drawing boards to dam and harness this river for hydropower.

I admit, a 1,500-mile vacation down the Mekong through Laos, Thailand and Cambodia may seem an unusual way to have spent our holiday break. But the Mekong River has become something of an obsession for me, winding its way through both my work as a freshwater scientist and the bedtime stories that I improvise for my kids.

The river boasts several of the world’s largest freshwater fish species, such as the bear-sized Mekong giant catfish. It supports by far the largest freshwater fish harvest in the world—the primary source of protein for 60 million people.



Jeff Opperman
Senior Freshwater Scientist
Follow Jeff Opperman on Twitter @jjopperman

As we floated down the river, I thought less about balanced hydropower development scenarios and more about the Mekong’s grandeur. The romantic in me pleaded, “Please don’t change this river.” It’s the same kind of wistful longing I felt as I watched my kids romp, tearing across its sandbars and splash-crashing into the shallows, “Don’t change. Stay like this.”

But they will change, both this still-unfettered river and my often-unkempt kids. The great challenge lies not in stopping that change, but in guiding it through the tough choices so the most important values endure.

We did eventually catch something during the trip. On the advice of fishermen, we left the main river for a side channel where hungry gourami, small fish with whiplike pectoral fins, fought for our bait. Luca used his rod, and my daughter, Wren, joined with just a stick and string. No casting required; they just lowered their hooks into the water and pulled out beautiful, magical little fish.

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