

# destination Science 2010

## YELLOWSTONE NATIONAL PARK, USA

*The reintroduction of wolves has helped bring a severely damaged ecosystem back from the brink.*

**Just after midnight** on June 25, 1972, a man named Harry Eugene Walker, 24, was eaten by a bear at Yellowstone National Park. A ranger who saw the remains just before dawn said Walker looked as if he were sleeping, except that his midsection was missing.

It was not an isolated incident. Between 1950 and 1974, 1,060 people were injured by bears in Yellowstone, a symptom of an ecosystem out of balance. Easily available human foods and garbage caused bears to live too close to people, and they were not the only animals in Yellowstone with worrisome eating habits. For decades the world's oldest national park suffered from managerial missteps that altered what ecologists call trophic relationships—those of soil to plant, plant to plant eater, and plant eater to carnivore.

Today's Yellowstone is a much different place, but it takes some tips from experts to see how it has been changing. On a warm afternoon, William Ripple, an ecologist from Oregon State University, and I meet former Yellowstone superintendent Mike Finley near the steaming pools of Mammoth Hot Springs, five miles south of Gardiner, Montana. Instead of joining the families of tourists trooping up through the springs' white trav-

ertine terraces, we head toward the Lamar Valley, where a lesser-known drama is unfolding.

Yellowstone was created in 1872 to protect its geyser basins, Finley explains as he drives. But the 2-million-acre park put the government in the wildlife business, and unfortunately scientific wildlife management did not begin until more than half a century later. No detailed records exist of the area's animal population and feeding behavior at the time the park was established.

Early rangers fed elk and bison as one would feed cattle and began killing wolves. By 1926, following a federal directive, the last wolves had been eliminated. Then elk overpopulated the park, eating through grass, brush, and any part of a tree they could reach. So in 1934 the rangers began shooting them, too; records show that in 1962 alone, 4,619 were killed. In 1967 public distaste forced the Park Service to quit. But the park did not recover.

Meanwhile, open-fill garbage dumps became feeding grounds for generations of grizzlies. Black bears learned to beg from tourists along roadsides or take what they could get from campsites. Rangers put out natural fires, altering vegetation. Aspen forests were declining, and willows along creeks were eaten down,

some to the point of disappearing altogether.

In the 1990s park science hit its stride. Dumps were closed and bears were weaned off human food. Natural fires were allowed to burn sometimes. And then, in a momentous act by Department of Interior agencies, wolves were reintroduced.

Finley—a formidable man in a khaki shirt, jeans, hiking boots, and a floppy hat—has returned to Yellowstone to witness the effects of these changes since he left the park in 2001. He pulls the car over at an unmarked turnout next to the bridge across the Lamar River. Up the hill to our right is Crystal Creek Bench, where he and his fellow rangers set the first six wolves free in 1995.

Ripple, an affable outdoorsman in his midfifties, is particularly interested in the rebirth of the aspens; it is the result, he contends, of the wolves' effect on elk and the elk's on plants—a domino effect that Ripple, his research partner Robert Beschta, and others in the field call a trophic cascade.

A quarter mile up Crystal Creek through the sagebrush, Finley starts beaming. "There they are!" he says. To our left are mature aspens, their snow-white trunks and leaves quivering in the slightest breath of wind. Beneath them



**Mist from Yellowstone Falls, a small cluster of trees, and a cliff band highlighted by a sunbeam in the Grand Canyon of Yellowstone.**

is the cause of Finley's excitement, a thicket of new aspens 10 to 15 feet tall. "This is amazing," he exclaims, wading in to grasp one of the saplings. "When I was here these were all knee-high. They'd grow and get eaten off, grow and get eaten off. Look at them now!"

On another day, farther up the road with Ripple, the Lamar Valley opens up before us: a great green plain ringed with mountains and dotted with bison and elk. Ripple points out the brown buildings of the Buffalo Ranch. "That's where they raised bison like cattle in the early days," he tells me.

We stop at a roadside display with the title "An American Eden." The display features a picture of the valley in front of us. There is a noticeable absence of small trees—big, old cottonwoods can be seen, some of them fallen, but no little ones growing up to replace them. "That's what

the fence around it, installed by other researchers. "That enclosure shows what this place would look like without grazing by elk and other plant eaters," he says. On our side, the ground is still virtually bare except for sagebrush.

Plants are not coming back everywhere yet, and elk are more numerous now than when the rangers stopped shooting them in 1967, Ripple says. "So?" I ask. Ripple points up the road and grins.

We stop at the Lamar River's junction with Soda Butte Creek, and Ripple takes out a photograph of the same place a decade ago. The transformation is remarkable. In front of us are tall stands of willow; in Ripple's photo the same willows are clumps of sticks, eaten off close to the ground. But why has regrowth happened here and not up the road at American



Aspens line the Lamar Valley, where the first six wolves were released into Yellowstone in 1995.

Bob [Beschta] noticed when he first came here, along with the river," says Ripple, who has been studying the valley for 14 years. Many areas along the Lamar lack streamside willows and other woody plants because they were stripped away by elk and other herbivores, he explains. Without the plants' stabilizing roots, the river cut away its banks, washing away topsoil that took centuries to build.

Back in the car and up the road, Ripple points to a thicket of young trees and brush on a hillside to our left. You have to look closely to see

Eden or outside the enclosure? I ask Ripple. He wondered about that too, he says. In 2001 he came up with a hypothesis he calls "the ecology of fear," which is now supported by his later research. "See all those channels, bluffs, and so on?" he asks, gesturing. "It's like a corral. If I were an elk, this is the last place I would be when the wolves arrive."

I look out across the river. An American Eden? Perhaps redemption is possible. Somewhere out there, wolves are doing their work. In 2009 the park had more than 3 million visitors, and no one was injured by a bear. Maybe we're learning.

JORDAN FISHER SMITH

## PARKS AND WILDERNESS

Shaped by glaciers, seismic uplifts, erosion, and volcanoes, the great outdoors offers spectacular, unique ecosystems and adventure. Here is a sample:

**POINT REYES NATIONAL SEASHORE, CA** The lighthouse is famous, but the best views of water crashing to the cliffs, sea lions, seals, and gray whales are at Chimney Rock. Then visit the herds of tule elk at Tomales Point.  
[www.nps.gov/pore](http://www.nps.gov/pore)

**DEATH VALLEY NATIONAL PARK, CA** Badwater Basin is the most extreme spot in an extreme and starkly beautiful geologic setting. Whatever you do here, you can say you did it at the lowest point in America.  
[www.nps.gov/deva](http://www.nps.gov/deva)

**YOSEMITE, CA** Hike the giant granite Half Dome, a 12-hour adventure. Bring work gloves to handle the climbing cables and the rock, along with plenty of water.  
[www.nps.gov/yose](http://www.nps.gov/yose)

**MUIR WOODS NATIONAL MONUMENT, CA** Marvel at the redwoods—renowned as the tallest trees in the world—but also take a moment to taste the clover-shaped redwood sorrel that makes up much of the ground cover and has a surprisingly citrusy flavor (though it's toxic in large doses).  
[www.nps.gov/muwo](http://www.nps.gov/muwo)

**WHITE SANDS NATIONAL MONUMENT, NM** Hike the Big Dune trail. Then rent a snow disk (don't forget the wax!) and slide down the amazing white gypsum sand dunes. It's like snow, except you can wear shorts and sandals.  
[www.nps.gov/whsa](http://www.nps.gov/whsa)

**CARLSBAD CAVERNS, NM** The Carlsbad Cavern—a justly famous limestone cave, one of more than 110 hidden below this vast desert park—is 1,000 feet deep with 30 miles of mapped passages lined with giant stalagmites and crystalline stalactites.  
[www.nps.gov/cave](http://www.nps.gov/cave)

**ARCHES NATIONAL PARK, UT** In this part of Utah's canyon country, more than 2,000 natural arches are carved out of red sandstone high above the Colorado River. You'll also see spires, pinnacles, and slickrock domes.  
[www.nps.gov/arch](http://www.nps.gov/arch)

**BISCAYNE NATIONAL PARK, FL** Explore nearly 200,000 protected acres within sight of downtown Miami—only 5 percent of which is land. Snorkel through a wonderland of colorful fish and the beginning of the world's third-largest coral reef. Or explore the mangrove coastline and the barrier islands—just watch out for the snakes!  
[www.nps.gov/bisc](http://www.nps.gov/bisc)



## CAYMAN TRENCH, CARIBBEAN

*Scuba diving into the abyss.*

**The Cayman Trench**, a nearly five-mile-deep, 155-mile-wide basin running from the southeastern tip of Cuba toward Guatemala, is many things to many people. To veteran divers, it is a not yet fully explored mystery zone. To oceanographers, it is one of the deepest parts of the Caribbean. To geologists, it is a volatile subduction trench, part of the geologically complex boundary between the North American and Caribbean tectonic plates.

To me, the Cayman Trench is an irresistible zone of impenetrable blue. My son and I approached it from the surface, diving through Byzantine crooks and tunnels. We moved carefully so as not to bump fauna or fragile coral; it was a difficult technical swim. Rounding a corner, Ben saw

something and raced ahead. He looked to be taking a leap into nothingness.

We had reached the trench. My reaction was a crazy, heart-stopping moment of maternal worry that, despite his buoyancy control device and several laws of physics, Ben would plummet the 25,000 feet to the bottom. Instead, he floated quietly, apparently as awed as I by the uninterrupted stillness. Devoid of feeding grounds and hiding places for fish of any size, the trench seems empty. Our only visual pleasure was a boundless expanse of azure. We hung weightless, disoriented, as surprised as we might have been to find ourselves in outer space.

Eventually we turned around, discovering an entirely new scene. The face of the

ridge from which we had swum teemed with hundreds of fish and sponges.

At its easternmost end, the Cayman Trench branches into two fault systems. One runs along the northern side of Hispaniola. The other runs along that island's southern side. It is the southern fault system—the Enriquillo-Plantain Garden Fault system—that triggered the terrible Haitian earthquake last January 12. The Cayman Trench is unforgettable for its vertigo-inducing cliffs and stark, extraordinary scale, but that beauty is made only more powerful by an appreciation of the relentless forces that created, and that continue to reshape, the earth's surface, sometimes with devastating effects.

REBECCA COFFEY



## NEW YORK, NY

*Science clubs untangle the mysteries of nature and cure what ails you.*

**The words *science* and *nightclub*** don't seem to belong together. Yet every month in Brooklyn, the meeting of the Secret Science Club ([secretscienceclub.blogspot.com](http://secretscienceclub.blogspot.com)) is packed with science scenesters, draft beers in hand and eyes affixed to the researcher onstage—part of a burgeoning after-hours world that has a surprisingly academic mind-set.

Inside the club's current headquarters, the Bell House in the Gowanus section of Brooklyn, more than 250 enthusiasts fill the hall each time a noted scientist holds court onstage. This 1920s warehouse, converted into a bar in 2008, once sported a plaque on the wall that defined the club's vision: "Passing the torch of enlightenment with cocktails."

The Bell House's drink menu is always apropos to the night's lecture. Speakers have included famed NASA climate

scientist James Hansen (paired with the Dark and Stormy—dark rum and ginger ale), astrophysicist Neil deGrasse Tyson, and paleoanthropologist Donald Johanson.

A similar buzz has taken hold on Manhattan's Upper West Side, where the SciCafe at the American Museum of Natural History ([www.amnh.org/programs/scicafe](http://www.amnh.org/programs/scicafe)) blends informal Q&A sessions with cocktails and conversation the first Wednesday of each month. Recent talks there have included Why Humans Have Sex by evolutionary psychologist David M. Buss.

Farther uptown, the PicNic Market & Café hosts Café Science ([www.picnicmarket.com](http://www.picnicmarket.com)), a similar monthly series of laid-back evening discussions. And on the Upper East Side, the century-old, science-driven Explorers Club ([www.explorers.org](http://www.explorers.org)) has a series of members-only lounge nights.

If you are thirsty for science on an everyday basis, stop by Lower Manhattan's Apotheke, a cocktail bar located in what was once an opium den ([www.apothekebar.com](http://www.apothekebar.com)). You enter through a dark door on a small, bending street that tabloids once nicknamed the Bloody Angle because of the Tong wars in Chinatown. Inside, the drink offerings have a distinctly medical edge: stress relievers, euphoric enhancers, stimulants, and painkillers, which are made with tequila and hot spices. A team of mixologists—wearing white lab coats behind a tabletop of laboratory glassware filled with colorful infusions—will listen to your description of what ails you and recommend appropriate brews. Apotheke's decor includes a wall of medicine bottles and a beautiful ceiling lamp of glass spheres, like the Erlenmeyer flasks you'd find in an organic chemistry lab.

JANET FANG

Apotheke's cocktail bar, NYC.

## SCIENCE AFTER HOURS

Nightspots for boffins are showing up all around the country.

### CALIFORNIA ACADEMY OF SCIENCES, SAN FRANCISCO

Drink and dance, wander through a rain forest, visit a planetarium, or stargaze on the living roof.

[www.calacademy.org/events/nightlife](http://www.calacademy.org/events/nightlife)

### EXPLORATORIUM AFTER DARK, SAN FRANCISCO

Enjoy the legendary hands-on science activities, imbibe at the cash bar, then listen to a talk.

[www.exploratorium.edu/afterdark](http://www.exploratorium.edu/afterdark)

### UNIVERSITY OF NEBRASKA MEDICAL CENTER SCIENCE CAFE, LINCOLN AND OMAHA

Single-topic lectures, drinks, and chats with a scientific bent.

[www.unmc.edu/sciencecafe](http://www.unmc.edu/sciencecafe)

### ATLANTA SCIENCE TAVERN

Monthly meetings for nonscientists to discuss key topics with someone in the know. "No such thing as a silly question."

[www.atlantascience-tavern.com](http://www.atlantascience-tavern.com)

### MIRACLE OF SCIENCE BAR + GRILL, CAMBRIDGE, MA

A lot of scene: Nobel laureates mix with students, beer, and food at this renowned MIT hangout.

[www.miracleofscience.us](http://www.miracleofscience.us)

FOR MORE INFO, GO TO:  
[WWW.SCIENCECAFES.ORG](http://WWW.SCIENCECAFES.ORG)

## MUSEUMS

Hidden treasures and unique experiences inside America's top science museums.

### FORT WORTH MUSEUM OF SCIENCE AND HISTORY, FORT WORTH, TX

The new planetarium here is unlike any other. Its interactive, live-action software enables visitors to control the action as they travel to the edge of the known universe and back, making stops and asking questions along the way.

[www.fwmuseum.org](http://www.fwmuseum.org)

### EXPLORATORIUM, SAN FRANCISCO

Study live specimens, like mouse stem cells as they progress toward becoming beating heart cells, at the high-resolution Microscope Imaging Station. It has been called the most ambitious such facility available to the public; the controls are in your hands.

[www.exploratorium.edu](http://www.exploratorium.edu)

### AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY

While everyone else crams in to see the dinosaurs or the hanging blue whale, head to the third floor for the delicate taxidermy in the Sanford Hall of North American Birds and the quiet grandeur of the Margaret Mead Hall of Pacific Peoples. Then take in the dazzlingly beautiful minerals and gems at the out-of-the-way Gottesman Hall of Planet Earth on the first floor.

[www.amnh.org](http://www.amnh.org)

### JAMES S. MCDONNELL SPACE HANGAR, CHANTILLY, VA

This offshoot of the justly famous National Air and Space Museum is not as convenient (located near Dulles International Airport), but it is larger, less crowded, and spectacular in its own right—filled with hundreds of unusual items, from the space shuttle *Enterprise* to space-grown crystals to old tubes of borscht made for Soviet cosmonauts.

[www.nasm.si.edu](http://www.nasm.si.edu)

### SCIENCE MUSEUM OF VIRGINIA, RICHMOND

On April 1 this family-friendly museum features its annual daylong Rat Basketball Playoffs. Teams of female rats representing different colleges face off as part of the museum's studies of operant and classical conditioning. A visit might even help you in your office pool: The results have coincidentally been a good indicator of who does well in the NCAA tournament.

[www.smv.org](http://www.smv.org)

### OREGON MUSEUM OF SCIENCE AND INDUSTRY, PORTLAND

Sampson, a 40-foot-tall *Tyrannosaurus rex*, is on display through the summer. The recently reconstructed skeleton is believed to be the third-most complete dinosaur of its kind, with 170 of its 330 original bones in place.

[www.oms.org](http://www.oms.org)

### FRANKLIN INSTITUTE SCIENCE MUSEUM, PHILADELPHIA

Instead of waiting in line to walk through the giant heart, take on the Sports Challenge to learn the science behind the fun—from reaction time to virtual skiing. Then ride along a one-inch cable 28 feet above the floor on the Sky Bike, one of only two high-wire bikes in the United States.

[www.fi.edu](http://www.fi.edu)

## SCIENCE IN ACTION

**Tired of sitting on the sidelines? Here are places where you can watch research as it happens.**

### LAWRENCE LIVERMORE NATIONAL LABORATORY, LIVERMORE, CA

Take a tour of the National Ignition Facility, a huge new nuclear fusion reactor. Then visit the world's fastest computer. Or go to Site 300 to check out some nonnuclear explosives testing.

[www.llnl.gov/llnl/visiting/tours.jsp](http://www.llnl.gov/llnl/visiting/tours.jsp)

### FERMILAB, BATAVIA, IL

Special behind-the-scenes tours reveal the inner workings of one of America's greatest physics facilities: See the

magnet factory, the accelerator complex, and the experiments that search for ghostly neutrinos.

[www.fnal.gov/pub/visiting/tours/index.html](http://www.fnal.gov/pub/visiting/tours/index.html)

### PALEONTOLOGY FIELD CAMP, HELL'S CREEK, MT

Dig for dinosaurs with top paleontologists in the legendary Hell's Creek fossil fields, one of the largest bone beds in the world.

[www.dinosaurdiscovery.com/dinosaur-fossil.htm](http://www.dinosaurdiscovery.com/dinosaur-fossil.htm)

### SEA EDUCATION ASSOCIATION, WOODS HOLE, MA

High schoolers spend three weeks as an integral part of the crew of a research ship, studying oceanography and marine biology along Cape Cod or off the coast of Southern California.

[www.sea.edu/academics/program\\_highschoolprograms.aspx](http://www.sea.edu/academics/program_highschoolprograms.aspx)

### MUSEUM OF NORTHERN ARIZONA, FLAGSTAFF

Seasoned naturalists lead daily treks into the wild from base camps or guide you into the depths of the wilderness to explore the vast Colorado Plateau.

[www.mnaventures.org](http://www.mnaventures.org)

**PASSPORT IN TIME** Volunteers in this program, run by the USDA Forest Service, survey archaeological sites, restore Native American rock art, and preserve historic structures with experts in the field.

[www.passportintime.com](http://www.passportintime.com)

**SIERRA CLUB** Study grizzly bears or go smoke jumping. The conservation society offers dozens of such offbeat wilderness activities year-round, both in the U.S. and abroad.

[www.sierraclub.org/outings/national](http://www.sierraclub.org/outings/national)

### EARTHWATCH EXPEDITIONS

From the coffee fields of Costa Rica to the edge of the Arctic, roll up your sleeves and help solve environmental problems along with scientists and experts in their fields.

[www.earthwatch.org](http://www.earthwatch.org)

JANET FANG, HEATHER MAYER, ALINE REYNOLDS