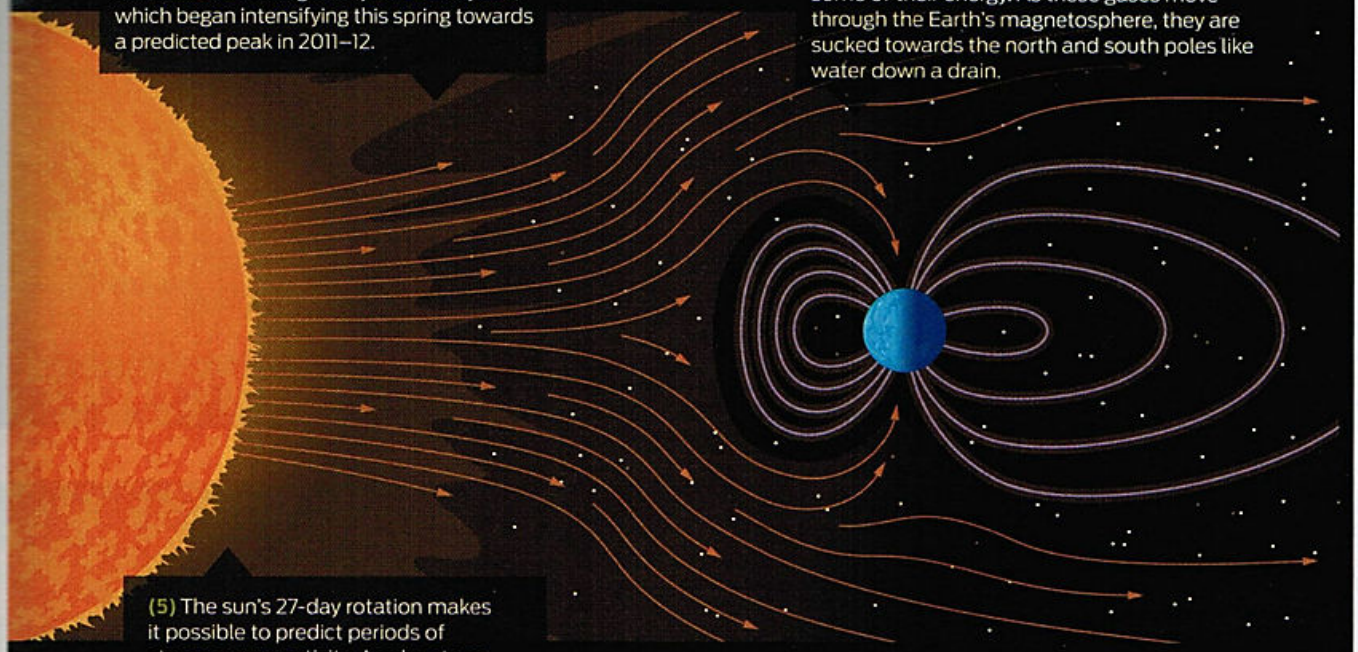
# PHENOMENON

## [Northern Lights]

Dream of seeing the aurora borealis, but can't afford a trip to the Arctic Circle? Try Minnesota's Boundary Waters. The aurora is visible in the Lower 48 several times each year, usually in northern states during the spring. Dark and mild March and April nights are the best for viewing the display; that's when the Earth's seasonal tilt aligns the magnetic field to capture more of the solar radiation that creates the glow. Here's how the sun lights up the night sky, and where you can see it.

(1) Violent storms on the sun's surface (the corona) expel a high-velocity stream of charged subatomic particles known as solar wind. The frequency of these storms fluctuates according to 11-year solar cycles, which began intensifying this spring towards a predicted peak in 2011–12.

(2) When solar wind nears the Earth, the powerful (and potentially harmful) particles are deflected by our planet's magnetic field—but not before the protective sheath absorbs some of their energy. As these gases move through the Earth's magnetosphere, they are sucked towards the north and south poles like water down a drain.



(5) The sun's 27-day rotation makes it possible to predict periods of strong aurora activity. A solar storm that generates northern lights on April 1 will likely cause more electromagnetic disturbances on April 28, when the same side of the sun faces the Earth again.

(3) The charged particles enter the atmosphere above the poles and collide with gas molecules to emit green, red, and blue light. "It's the same reaction that illuminates a neon light," explains Patricia Reiff, an astrophysicist at Rice University. The magnetic field guides the charged particles through the atmosphere 50 to 200 miles above the Earth, creating the aurora's distinctive curtainlike shape.

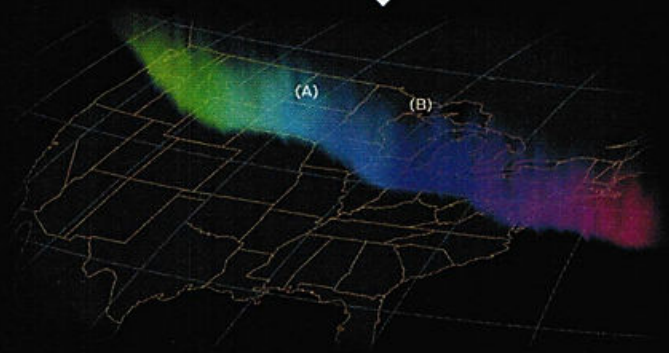
(HOW TO CATCH THE NORTHERN LIGHTS)

Go dark Ideal aurora viewing conditions require clear skies, minimal light pollution, and a view of the northern horizon. The best time to observe is between 9 p.m. and 1 a.m., when the tail of the magnetosphere extends away from the sun.

Shoot long You'll need a tripod to photograph most displays. Start with a shutter speed of 15 seconds, an aperture of f2.0, and an ISO between 400 and 800. Use a remote shutter release, or set digital cameras on a timer to avoid jostling the camera during exposure.

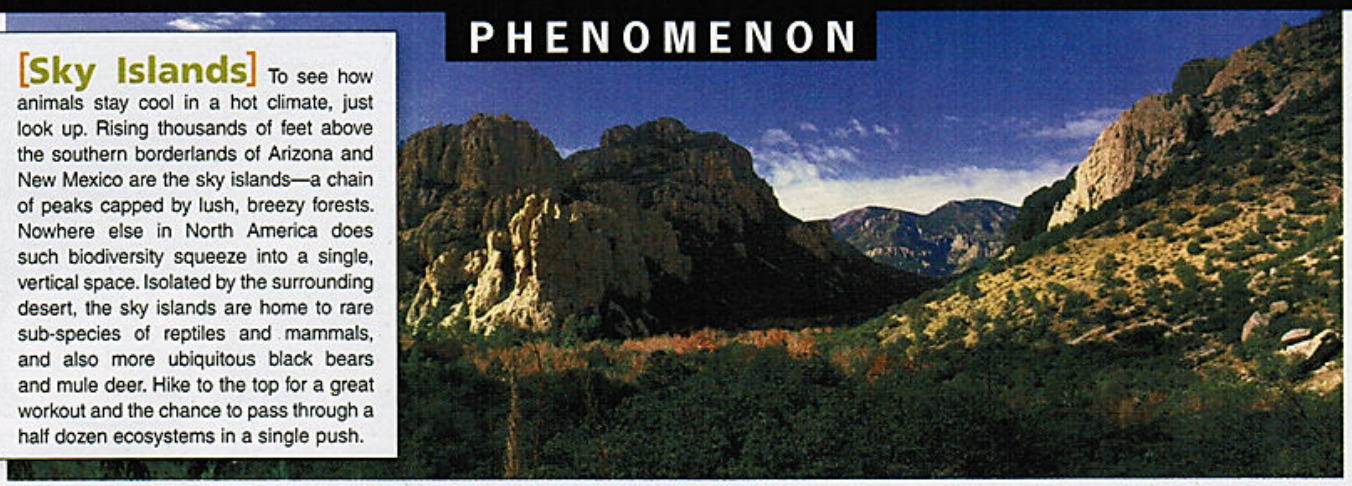
(AND A 30 PERCENT CHANCE OF AURORA...)

Planning a trip up north? Check the long-term aurora forecast up to four weeks in advance at this University of Alaska website: *gedds.alaska.edu/auroraforecast*.




(4) Most aurora activity occurs in a band at 60-65 degrees north latitude—the approximate zone between Anchorage and Fairbanks. But above 45 degrees in the Midwest and Great Plains, people can often witness the displays. For campsites with good views, stay at the (A)Juniper Campground in North Dakota's Theodore Roosevelt National Park (North Unit), or (B) the Lake Jeanette Campground in the Boundary Waters Canoe Area Wilderness.

## PHENOMENON



**[Sky Islands]** To see how animals stay cool in a hot climate, just look up. Rising thousands of feet above the southern borderlands of Arizona and New Mexico are the sky islands—a chain of peaks capped by lush, breezy forests. Nowhere else in North America does such biodiversity squeeze into a single, vertical space. Isolated by the surrounding desert, the sky islands are home to rare sub-species of reptiles and mammals, and also more ubiquitous black bears and mule deer. Hike to the top for a great workout and the chance to pass through a half dozen ecosystems in a single push.

### [High and Dry]

During North America's periodic ice ages, advancing glaciers pushed many plants and animals south. When the climate started warming 12,000 years ago, species acclimatized to the cold conditions retreated up the mountain slopes, where their descendents survive today.

### [Going Up]

The 10,000-foot Pinaleño Mountains in eastern Arizona contain the shortest hiking distance from desert to shady spruce forest in North America. Climbing 7,000 feet from base to summit, summer highs drop from 100°F to 75°F, precipitation levels triple, and soils grow richer. Animal species also exploit the compressed climate zones, evidenced by bear scat in spruce groves that's embedded with cactus fruit seeds the bruin consumed a vertical mile below.

### [Vertical Terrarium]

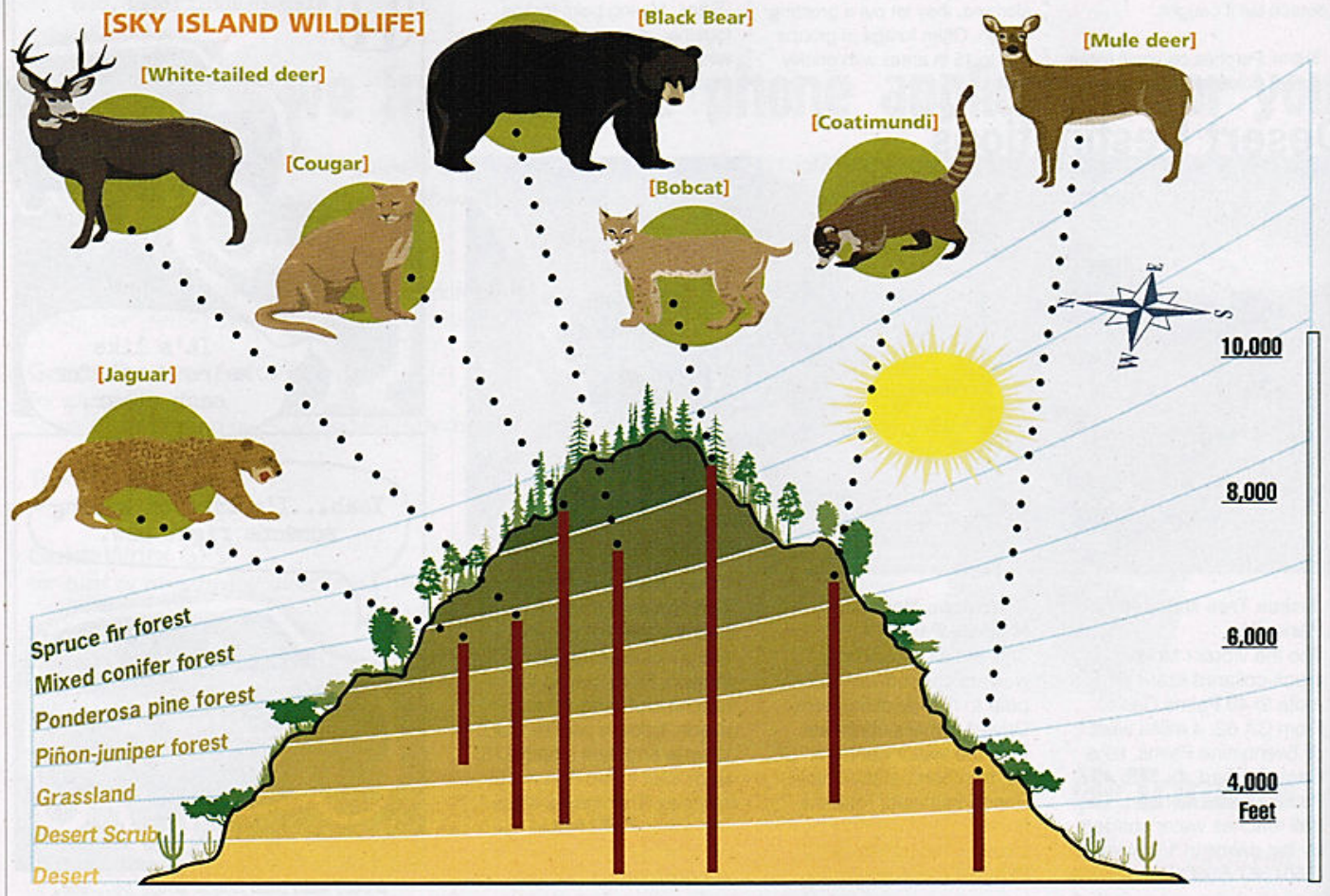
The sky islands are located at the confluence of two mountain ranges, the Rockies and Sierra Madre, and two deserts, the Sonoran and Chihuahuan. This biological intersection, combined with dramatic elevation change, supports the greatest range of mammal, ant, bee, snail, lichen, and rattlesnake species in North America, as well as 2,000 plant and 265 bird species.

### [Rare Regions]

Geographic isolation has enabled unique plants and animals to evolve; unfortunately, threats like habitat destruction, invasive species, and climate change are putting these rare subspecies at risk. Case in point: Only 300 Mt. Graham red squirrels survive in the spruce forests atop the Pinaleños, because the introduced Abert's squirrel competes for the same food.

### [Climate Threats]

As the mountains warm up and dry out (tree-ring records indicate the Pinaleños are experiencing their worst drought since 1280), bark beetles in the upper forests are killing thousands of trees, fueling larger wildfires that destroy even more habitat. "It's an ugly feedback loop," says John Koprowski, a wildlife biologist at the University of Arizona in Tucson. Many experts predict that global warming will erase the highest sky island zones within the coming decades.



## [Microbursts]

They develop within a few minutes and strike the ground with the force of a runaway freight train. They demolish forests, wreck houses, kill wildlife—and have even been responsible for a half-dozen plane crashes. But for years they were so mysterious that, until 1981, meteorologists didn't even have a name for them. They are microbursts: turbulent weather conditions that transform a mass of rapidly cooling air into a high-speed downdraft up to 2.5 miles in diameter. Fortunately, most backpackers only observe the aftermath of these violent events. If you ever come across a smashed-up forest with no obvious cause, here's what might have gone down.

(VERTICAL HURRICANES)

Microbursts can develop anywhere across the United States; they often appear as wet microbursts in the East and South, and as dry microbursts over the Great Plains, Rocky Mountains, and the Western Plateau. The two types differ dramatically. In the East, microbursts are spawned by large thunderstorms producing heavy rain, lightning, and hail. Their drier, Western counterparts are more subtle, often arising inside small, innocent-looking, cottonball clouds that lack visible precipitation. Swirling dust storms beneath these clouds are sometimes the only clue that downdrafts are occuring.

(DRY)

In the West, rain often falls from high cumulonimbus clouds into lower, drier air, where it evaporates. This creates virga—misty curtains that hang from cloud bottoms but never reach the ground. Like all liquids, the rain loses heat as it transforms into a vapor. (The same process causes fuel bottles to cool when powering stoves.) This evaporative cooling produces a dense mass of colder air within the cloud.

(WET)

In the South and East, heavy rain generated by powerful thunderstorms drags cold, dry air from high in the cloud to lower layers of the storm. As the water and ice suspended in that mass evaporate, the cooling air descends faster through the cloud.

(DESCENT)

In both types of microbursts, the cold, dense air mass sinks because it is 20 to 50 percent heavier than the surrounding air. As it descends, it continues to cool and accelerate, eventually plummeting toward the ground at speeds between 15 and 50 mph—and in rare cases up to 150 mph. The entire process can occur in five minutes.

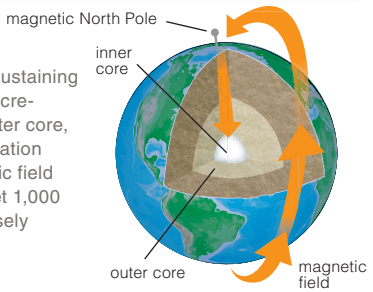
(IMPACT)

When the fast-moving air strikes the ground, it acts like a bucket of water poured on a concrete floor, says Steven Vasiloff, a meteorologist at NOAA's National Severe Storms Laboratory in Norman, Oklahoma. The blast effect and resulting vortexes can flatten trees at the impact site, as well as strip branches and damage vegetation and soil up to several miles away. Unlike tornadoes, which twist and scatter wreckage, microbursts create a radial pattern of destruction, with downed trees and debris oriented outward from the impact zone.

# PHENOMENON

**[Which Way North?]** Current Magnetic Declination in the United States


**[Earth's Magnetic Field]** The next time you pull out a compass, stop and give thanks for the massive storms of molten iron that churn up the earth's core. Because of them, our planet has a magnetic field, which, like oxygen, is invisible, all-encompassing, and vital for our survival. Without it, there'd be nothing to deflect deadly solar radiation, guide migrating animals, or steer compass needles.




### [Subterranean power plant]

Our planet's magnetic field works like a massive self-sustaining dynamo. The 8,500°F heat of the solid iron inner core creates convection currents in the surrounding molten outer core, spawning a giant hurricane of liquid iron. Planetary rotation roils the outside layer even more, producing a magnetic field from the vortex of spinning iron as if from a bar magnet 1,000 miles long. The two poles of the resulting field are closely aligned with the earth's rotational axis.

### [GPS generator]

Accurate navigation depends on this magnetic field. Compass needles align themselves with the force lines connecting the north and south magnetic poles. It takes several seconds for the needle to find north because the planet's internal magnet is relatively weak on the surface (1/20 the power of a refrigerator magnet). An electronic compass uses electromagnets instead of a needle to measure the local magnetic field. Not to be outdone by humans, loggerhead sea turtles, honeybees, and salmon are among many animals that use internal compasses to find their way.

### [Flux and flips]

The magnetic field has waxed and waned in intensity over its 3-billion-year history. From time to time, disruptions in the outer core weaken the field and cause the north and south magnetic poles to reverse polarity. The field flips every 200,000 years on average, but the interval can vary widely—in fact, the last about-face happened more than 700,000 years ago. Some scientists believe the earth is overdue for a reversal, but before you paint the other end of your compass needle red, realize that it can take 5,000 years for the poles to realign themselves. During that interim period, the magnetic poles could wander all over the planet—even to the equator.

### [Wayward poles]

The magnetic North Pole is on the run, moving 6 to 25 miles per year. Right now it's in northwest Canada, 600 miles from the geographic North Pole. To compensate for this gap, hikers need to calculate the declination angle between true north on a map and magnetic north on a compass. As the magnetic pole continues to move, local declination shifts as well. In Seattle, the angle changed by 1°36' in the last decade (see map above), while declination in Maine shifted 0°53'. To make sure your map's declination is current, punch in your destination's zip code or lat/long coordinates on NOAA's declination calculator (ngdc.noaa.gov/seg/geomag/magfield.shtml).

ILLUSTRATIONS BY REMIE GEOFFROI; TEXT BY KELLY BASTONE

# PHENOMENON

**[Wildfire]** All it takes is a spark. Every summer in the United States, an average of 6 million acres—nearly the size of Vermont—goes up in smoke. Some fires creep a few feet a day, while others gallop at 15 mph and char whole counties. The most intense and active fires, with temperatures as high as 1,400°F, engulf entire forests, prairies, and sometimes neighborhoods. But wildfires also invigorate ecosystems and promote species diversity, benefiting many plants and animals even as their flames destroy others.

**[IGNITION]** Humans cause more than 80 percent of the average 70,000 annual U.S. wildfires, a quarter of which are set intentionally. Lightning ignites the remainder. While the number of fires is declining, incidents are larger in size, says Geoff Bell, a fire official with the USDA Forest Service. The bigger fires are fueled by drought in the West and a resulting buildup of dead fuel. The recent dry winter across the lower Southwest didn't help, creating higher-than-normal fire risk this summer in New Mexico and Arizona. Land managers try to predict where blazes will occur by measuring indicators such as "fuel moisture content"—the percentage of water weight found in dead materials like trees and brush. Very low fuel moisture readings, below 10 percent, mean a tossed cigarette can start a major burn.

**[SPREAD]** Once a fire starts, terrain, weather, and fuel influence how far and fast it will spread. Roads and ravines act as firebreaks; flames spread more quickly uphill than downhill. Rain can douse flames, while high winds cause burning embers to ignite spot fires ahead of the main blaze. The only factor humans can influence is fuel quantity. Firefighters will clear brush or set backfires to starve a fire of burnable material. Uncontrollable fires often exhibit extreme behavior as they spread, including whirls (violent flame tornadoes), crowning (flames spreading among treetops), and blowups (rapid expansions in intensity).

**[SUPPRESSION]** Modern firefighting is equal parts science and heroics. Land managers analyze weather patterns, fuel and moisture levels, and statistical models before deciding to issue fire-danger ratings or fight a blaze. Since the late 19th century, however, forest fires have been automatically suppressed, creating huge stockpiles of dead wood. This fuel kindled some of the country's most destructive wildfires, including a 2-day blaze in 1910 that devoured 3 million acres in Montana and Idaho. New policies developed in the last 20 years mean that only the most dangerous fires are fought by engine crews supported by smokejumpers and tankers. Fires started by lightning in remote areas are sometimes allowed to burn themselves out.

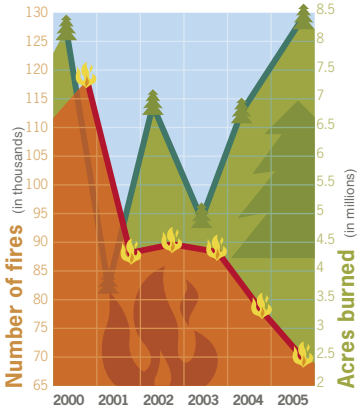
## Friendly Fire

### The case for letting it burn

As nature's harshest housekeeper, fire eradicates insect pests, parasites, and diseases that plague plants and animals. Periodic small burns clear fuel levels, preventing catastrophic blazes. Fires also trigger forest rebirth by infusing the soil with nutrients and allowing sunlight to reach seedlings through a thinned forest canopy. Some species depend on fire to grow, including fireweed, a fuchsia-petaled flower that carpets recently charred forest floors. Flames also melt the resin that seals seeds inside the cones of jack pines and some lodgepole pines.

## Wildfire Trends

Fewer blazes – More acres



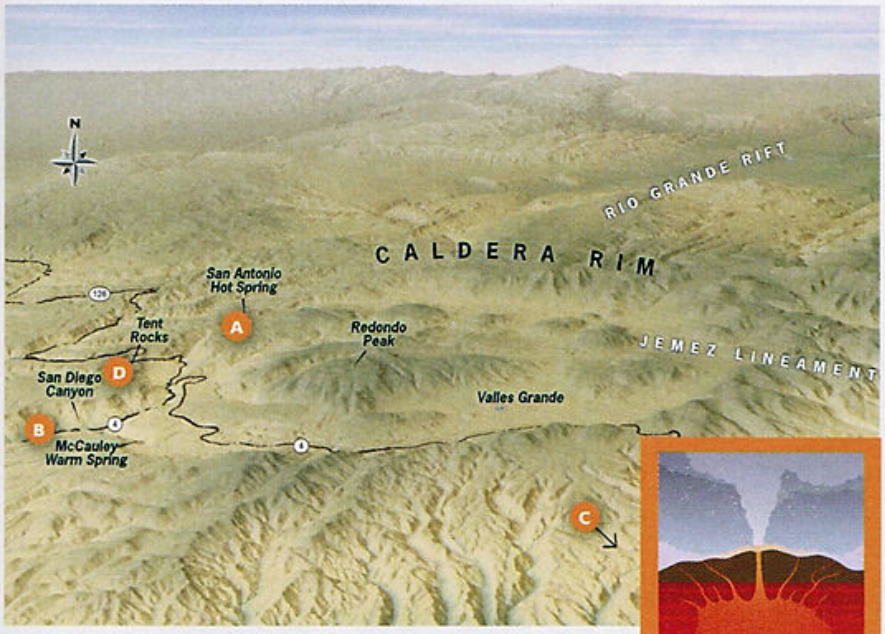

## Smoke Alert

**Call 911 if you see a wildfire—investigators review call logs to determine how fires spread.**

PHOTO BY JEFF VANUGA; ILLUSTRATIONS BY BRYON THOMPSON; TEXT BY SHARON GUYTON

# PHENOMENON

**[Valles Caldera]** Hike into the Valles Caldera today, and you'd never guess that this sunken oval of ponderosa forests and trout streams 40 miles northwest of Santa Fe was the epicenter of a cataclysmic explosion. But 1.25 million years ago, a sudden and massive eruption created not only this 14-mile wide crater, but also the orange-rock landscape of northern New Mexico. Numerous hot springs in the area indicate that Valles Caldera is dormant, not extinct—which is all the more reason to get to know this geothermal gem before she blows again.





**[Sinking ground]** (A) As the volcano erupted, it began to collapse. (B) Gas vents fractured the crater floor, dropping it into the now-empty magma chamber. More eruptions spawned landslides around the rim. (C) Rain and snowmelt filled the caldera, while magma oozing from the crater floor swelled into small peaks that rose above the lake.

**[Hot rocks]** Valles Caldera's volcanic history is a consequence of its location above two intersecting cracks in the Earth's crust: the north-south Rio Grande Rift, and the Jemez Lineament, an east-west crease of weakened crust. These deep fissures enable magma to rise close to the surface.

**[Big blast]** Exploding with 100 times the force of Mt. St. Helens, the volcano that became Valles Caldera ejected a fiery cloud of ash, steam, and gases. While some particles drifted as far as Iowa, most debris poured out like a giant pancake, burying hundreds of square miles under ash as thick as 3,000 feet. Over several decades, the cooling ash welded into a rock layer now known as the upper Bandelier Tuff.

**[Rising anew]** Over time, fresh magma pushed up the caldera floor to create new volcanic domes, including Redondo Peak, which today rises 3,000 feet above the valley. The cycle of eruption, collapse, and rebirth makes this volcano a resurgent caldera, similar to others in Yellowstone National Park and California's Long Valley.

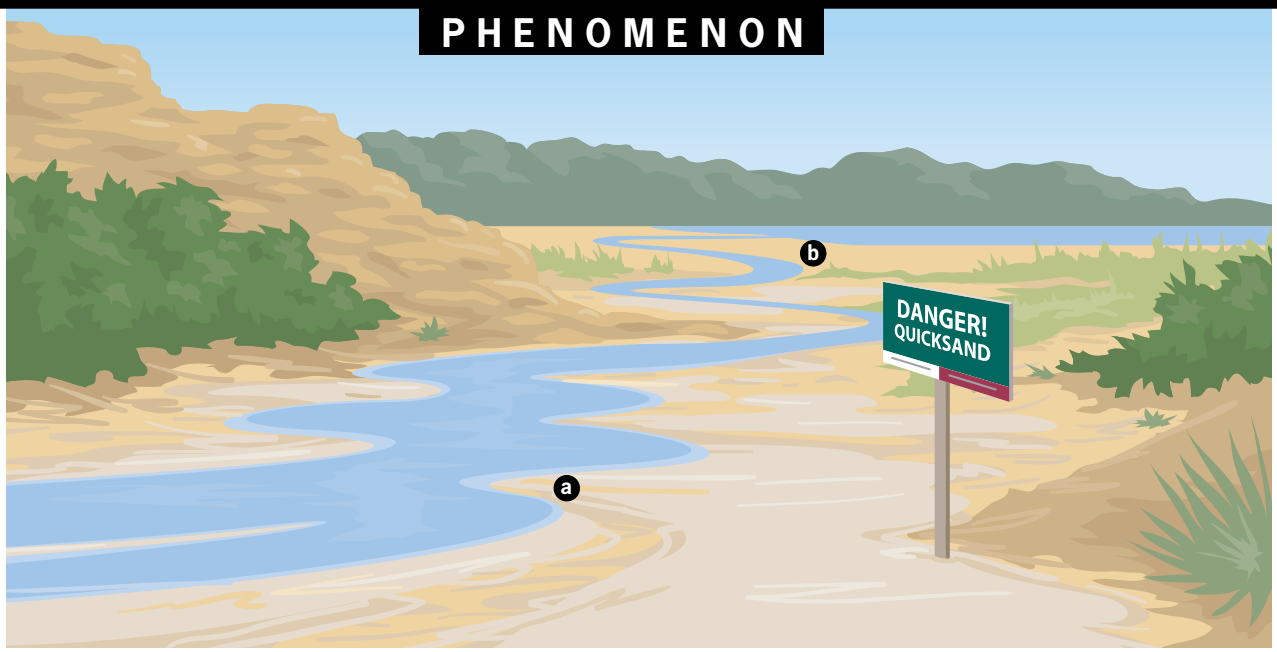
**A. [Hot springs]** Groundwater heated by hot rock beneath the caldera supplies the region's numerous hot springs.

**B. [Dam break]** About 500,000 years ago, erosion caused the caldera lake to breach the rim and drain through San Diego Canyon.

**C. [Frijoles Canyon]** A million years of erosion cut the Bandelier Tuff into a maze of canyons and mesas, some of which are preserved at Bandelier National Monument, 30 miles northwest of Santa Fe. (505) 672-3861, ext. 517; nps.gov/band

**D. [Tent Rocks]** These pyramid formations develop when soft tuff is shielded from wind and rain by a top layer of more durable rock. Several dozen tent rocks of Bandelier Tuff sit inside Pueblo Canyon east of Los Alamos. (505) 662-8075; lac-nm.us

# PHENOMENON




**[Quicksand]** According to some B-movie Westerns, quicksand can consume an unlucky cowboy faster than you can say "howdy", leaving only his 10-gallon hat behind. In reality, you might lose your shoes, but not your life. Quicksand's typical density—much higher than the human body's—prevents people from sinking below waist level. Still, it's a hazard that hikers may encounter with little warning. And because no one wants to lose a brand new pair of boots, here's how to avoid the ooze.

### [Appearance]

Part of quicksand's menace is its deceptive resemblance to solid ground. Underneath the firm-looking crust—which can be sand, silt, clay, or other grainy soils—is a slurry of soft, wet, quivering earth nicknamed "jelly mud." Unlike regular mud, which compresses to support weight, this quagmire collapses easily. The water that saturates the soil (and creates the muck) often flows underground **[1]** and isn't visible on the surface, though quicksand also can develop beneath shallow pools.

### [Formation]

Quicksand requires only soil and water—in the right amounts. When the ground is dry, the constant friction between individual sand grains creates a stable, interlocking foundation. But when the ground becomes saturated, water molecules push apart the grains, reducing the intergranular friction and the soil's weight-bearing ability. The soil becomes "quick" when the water pressure supporting the sand equals or surpasses the weight of the sand, **[2]** creating a floating suspension with the consistency of wet concrete that will trap your leg, and won't let it go.

### [Catalyst]

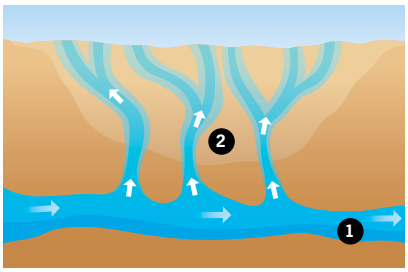
Salt makes quicksand less stable, especially in clay-like soil, by reducing the elasticity between sand grains. As a result, people generally sink deeper in ground saturated with saltwater than with freshwater. Salt eroded from sandstone canyon walls in southern Utah generates an ideal environment for quicksand when it accumulates in silt-filled arroyos.

### [Location]

Quicksand typically forms along the inside curves of rivers and sand washes, **[a]** where natural springs or runoff saturate an area of soft sediments. Other common spots include marshes, coastlines, and riverbanks. Quicksand can be persistent in canyons fed by spring water, and can appear rapidly after floods, spring run-off, or during low tide **[b]**. Post-flood conditions can be particularly dangerous, says Mike Salamacha, a BLM ranger in the Arizona/Utah Paria Canyon Vermilion Cliffs Wilderness. "Everything is wet, and you can't tell where the quicksand is until you walk on it." Quicksand can develop from Alaska to Florida, but hotspots include the marshy coasts of the Southeast, such as Florida and the Carolinas, and the canyons of southern Utah, northern Arizona, and New Mexico.

### [Escape]

Don't struggle. Since the human body is half as dense as quicksand, you won't sink much below your knees, or to your waist under rare circumstances. Fighting the suctionlike pull can be exhausting—especially if you're hauling a heavy pack—and can cause you to sink deeper by making the solution more fluid. To extract yourself, stay calm and lean backwards to spread out your weight while backstroking to firmer ground. Kick your legs slowly to loosen the surrounding sand, and move deliberately toward the edge. Ditch your pack if necessary. In areas prone to quicksand, like canyons and marshes, use a stick or trekking pole to probe the surface.





TO KEEP YOUR SHOES, SWIM TO SOLID GROUND WITHOUT TRYING TO EXTRACT YOUR FEET OR LEGS.

PHOTOS BY LEE COHEN (LEFT); ZACH ORNITZ. ILLUSTRATION BY BRYON THOMPSON. TEXT BY AMANDA LEIGH HAAG (PHENOMENON); JULIE CEDERBORG (BIG QUESTION)

SEE MORE

# BOBCATS AND COYOTES

One is elusive and solitary. The other is loud and gregarious. Two species with opposing temperaments: It's no surprise that Native American legends portray the bobcat and the coyote as rivals. But these clever predators often share the same habitat and prey. And while hunters and trappers almost wiped out their larger cousins—the mountain lion and wolf—more than one million bobcats and several million coyotes live throughout North America. Here's what enables these midsize hunters to thrive in a tough carnivore niche—and how to tell them apart from their less common relatives.

## BOBCAT

This quiet hunter is ferocious when cornered.

(Habitat)

Found coast to coast, bobcats inhabit woodlands, swamps, semi-deserts, and alpine zones. Their hunting territories fluctuate from 30 square miles in deserts to several hundred acres in forests where food is more plentiful. They maintain several dens—usually thickets, rock ledges, or crevices—throughout their range.

(Behavior)

Female bobcats are more territorial than males, though both are mainly solitary. Their brief, polygamous midwinter mating season is marked by the screams, yowls, and hisses from competing male suitors. In the spring, females alone raise two to four kits born fully furred, but blind, in a cave or burrow.

(Adaptations)

Sharp hearing, keen smell, and slitlike pupils that widen dramatically in low light help these cats hunt at night. Spotted fur keeps them hidden from their main natural predator—mountain lions. Long hind legs enable them to leap up to 8 feet high and 12 feet across.

(Hunting)

Bobcats hunt alone just after twilight or before dawn. They grasp prey with retractable claws and kill—like mountain lions—with a crushing bite to the neck. They prefer ambushes and short-distance chases. Healthy bobcats almost never attack humans, but can kill pets.

## COYOTE

This cunning canine finds refuge from national parks to Central Park.

(Habitat)

Supremely adaptable, coyotes range throughout North America, with more than 2,000 found in greater Chicago alone. They flourish in wild areas where wolves are absent, and can live in forests, grasslands, deserts, swamps, and near many metropolitan areas.

(Behavior)

These nocturnal canines dig burrows or enlarge badger dens. Breeding pairs remain monogamous for several years, producing annual spring litters of six blind, limp-eared pups. Coyotes are the loudest of North America's wild mammals, and communicate with pack members using yelps, falsetto howls, and short, sharp yaps.

(Adaptations)

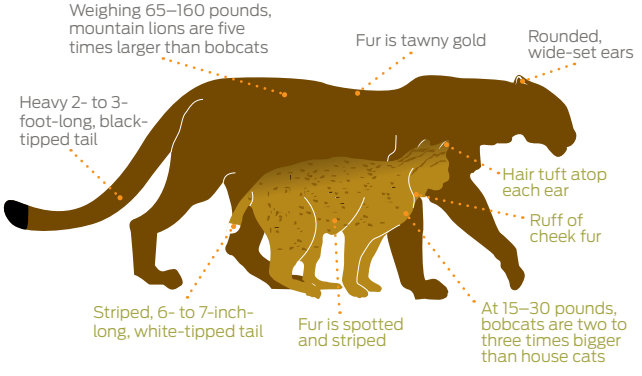
Coyotes are agile runners, reaching speeds up to 40 miles per hour and leaping distances of 14 feet. Primarily carnivores, they augment their diet of voles, rabbits, squirrels, birds, and deer with occasional reptiles, carrion, and garbage. They rely on sight to catch movement, but depend on their sharp hearing and smell to find and track prey.

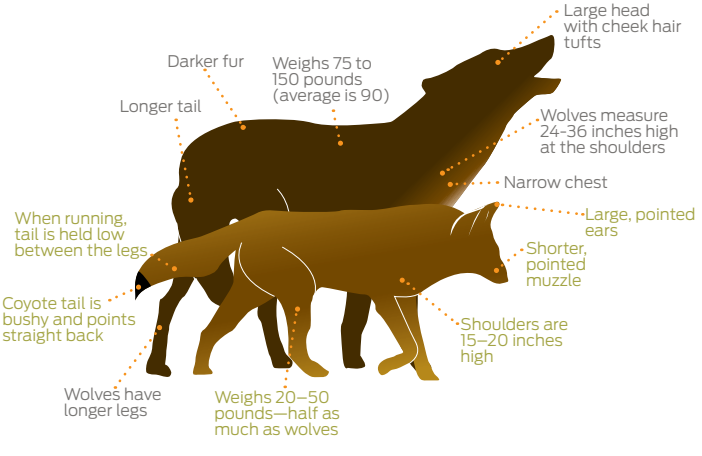
(Hunting)

Less likely to form packs than wolves, coyotes hunt alone, in pairs, or in family groups. They occasionally team up to tackle larger prey, like chasing a deer to exhaustion. To trap marmots and badgers, one coyote will dig into a burrow while another blocks the escape hole.

## WAS THAT A BOBGAR OR WOLVOTE?

How to distinguish small predators from big ones




PHOTOS BY (FROM LEFT) TIM FITZHARRIS / MINDEN PICTURES; DOUG LINDSTRAND / ALASKA STOCK LLC. ILLUSTRATIONS BY JACKIE MCCAFFREY; TEXT BY BECKY LOMAX.

SEE MORE

# OTTERS, MINK, MUSKRATS

A FURRY HEAD makes a V-shaped wake across a pond. Can you tell what animal it is? With torpedo-shaped bodies, brown fur, and partly webbed feet, these three semiaquatic mammals common to North America can be hard to tell apart. Fortunately, these versatile creatures—specially adapted to live in water and on land—leave unique clues such as dome-shaped lodges, riverbank slides, and muddy tracks to help you ID them.

## Northern River Otter

*Lontra canadensis*

Silver throat, with short legs and tube-shaped body tapering to a long, pointed, rudderlike tail

**Habitat** Rivers, ponds, and estuaries of the northern and eastern United States.
**Diet** Otters hunt at night, often in teams, for fish, crustaceans, turtles, amphibians, and small mammals.

## American Mink

*Mustela vison*

Pointy face, white throat, and a slender body with a furry, foot-long tail

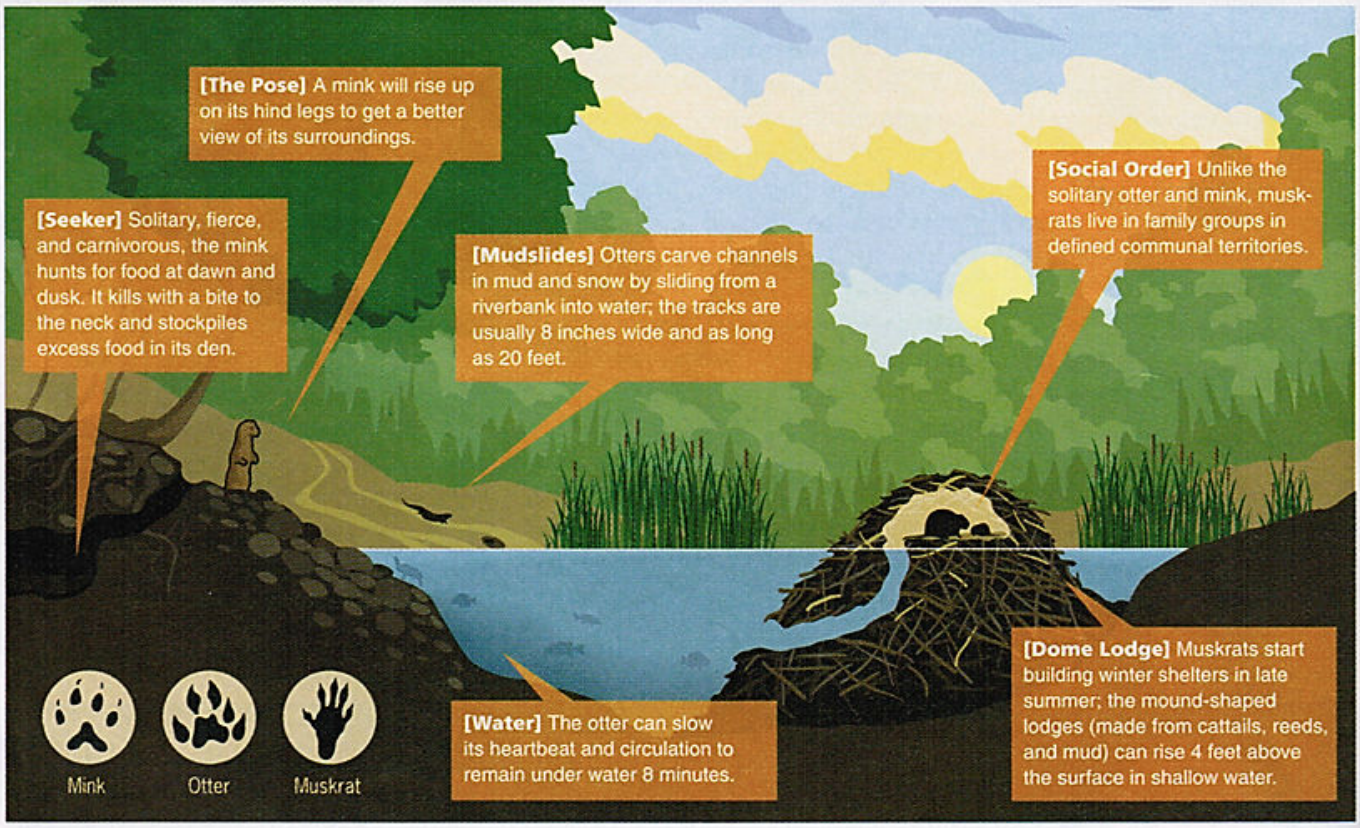
**Habitat** Brushy, rocky woodlands near fresh water; a mink seldom strays more than 100 feet inland.
**Diet** In summer, the mink pursues crayfish, frogs, and muskrats. In winter, it preys on mammals.

## Common Muskrat

*Ondatra zibethicus*

Orange, beaverlike teeth, a stocky, foot-long body, and a flat, scaly, 10-inch tail

**Habitat** Marshes and wetlands throughout North America, where water levels remain constant.
**Diet** The muskrat eats one-third of its body weight every day—mostly in sedges, irises, and weeds.




## Favorite Watering Holes *Three scenic spots to watch these hydrophilic mammals*

### OREGON DUNES NRA, OR

See river otters frolicking along Oregon's central coast on the Threemile Lake Trail. From Reedsport, head 8 miles north on OR 101 to the trailhead at Tahkenitch Campground. Hike through spruce wetlands to reach Threemile Lake and the coastal sand dunes behind it. (541) 750-7000; fs.fed.us/r6/siuslaw

### VOYAGEURS NATIONAL PARK, MN

This isolated wildland is a haven for the people-shy mink. From International Falls, MN, head 12 miles east on MN 11 until the road ends at Rainy Lake Visitor Center. Catch a water taxi to Anderson Bay, then hike past dozens of ponds on the 9.5-mile Cruiser Lake Trail. (218) 286-5258; nps.gov/voya

### JEFFERSON NATIONAL FOREST, VA

Muskrats love marshes, including those along the Appalachian Trail in Virginia. From I-77, take exit 52 at Bland, drive 3 miles west on VA 42, then 2.6 miles north on VA 615 to the AT crossing. Hike 6 miles south on the AT to the Jenkins shelter; you'll cross Little Wolf Creek and hemlock marshes. (540) 552-4641; fs.fed.us/r8/gwj

STRENGTH IN NUMBERS: A DOZEN YEARS AFTER THEIR REINTRODUCTION, MORE THAN 700 GRAY WOLVES ROAM IDAHO.

PHOTO BY TOM & PAT LEESON

# The Wolf Watchers

Inside Idaho's largest wilderness, humans and wolves learn to co-exist. *By Jason D.B. Kauffman*

IT CAME FROM THE RIGHT, a pale shape zigzagging through the trees 100 yards upslope from where we were hiding. Entering a clearing, the fleeting blur materialized into a pure white adult wolf. It paused, glanced back in our direction, then vanished into the forest.

"They're like ghosts," Idaho biologist and noted gray wolf researcher Jim Akenson whispered as we huddled in a conifer forest 50 miles from the nearest paved road. Tall, red-bearded, and an avid hiker, Akenson has spent 25 years studying wolves and cougars from Montana to Oregon. Together with four undergraduates from the University of Idaho, we were several hours into a three-day backpacking trip to locate and count wolf pups

inside Idaho's 2.4-million-acre Frank Church-River of No Return Wilderness. Earlier in the day, Jim's wife Holly had dropped off supplies to sustain our search for a pack's well-hidden den and the litter of newborn pups it might contain. Then she'd led a string of pack mules back to Taylor Ranch, the off-the-grid research station that is their year-round home.

To Jim, the appearance of the all-white female was a good omen. He identified her as the omega wolf, the lowest-ranking member of the pack who often serves as a sentry when the alpha female is tending her pups. Find the omega wolf, Jim told us, and the den is likely nearby.

As carnivore biologists at the University of Idaho, the Akensons have conducted census forays in the rugged mountains surrounding Taylor Ranch since 1997, shortly after the U.S. Fish and Wildlife Service (USFWS) reintroduced 66 Canadian gray wolves to the northern Rockies. Today, wildlife biologists estimate that 700 animals roam the state. As Jim later told me, "We've watched them grow from day one." Because wolves had been missing from central Idaho for decades, the couple's field research has become the new baseline for understanding pack behavior—and is now producing important findings just as another wolf controversy flares up.

THE PACK'S GRAY-AND-WHITE 120-POUND ALPHA MALE SAUNTERED OUT OF THE TREES. EVEN FROM A DISTANCE, HIS LARGE SIZE AND CONFIDENT BEARING WERE IMPRESSIVE.

In the 12 years since wolves returned to Idaho, they've generated a backlash from some locals who fear the impact of these predators on the state's economy and customs—ranchers upset about attacks on livestock, hunters who believe the packs are thinning elk herds. The issue heated up again last February when the USFWS proposed removing the Rocky Mountain gray wolf from the Endangered Species List and turning management over to the states. In Idaho, that would place wolves under the jurisdiction of Gov. C.L. "Butch" Otter, who said earlier this year that he favors culling the state's population to 100 animals. But extreme positions like that have recently started to lose ground as Idahoans learn more accurate information about the role and behavior of wolves in their state. And the primary impetus for this attitude shift is the pioneering research by scientists like the Akensons.

So far, their findings have overturned one common perception about wolf and prey interactions: Wolves aren't decimating the state's elk population the way many hunters claim. As Holly explained from the living room of Taylor Ranch, elk began to decline five years before wolves were reintroduced to Idaho. "The herds were not at sustainable numbers," she said. In addition, the Akensons believe that the prowling packs are forcing elk to become more cautious. Fearing ambush, the game animals no longer graze in wide-open meadows, but retreat to thick timber and steep-sided canyons where many hunters can't find them. Still, the Akensons are not opposed to a wolf hunt. They believe large wilderness areas like the Frank Church should remain off limits, but agree that a limited cull could be directed at packs that prey frequently on livestock. "We need to target the problem wolves," she said, "not the packs out here."

On the second morning of our hike, we awoke early and staked out two positions on opposite sides of the forested basin where the white wolf appeared. Within an hour, the pack's gray-and-white, 120-pound alpha male sauntered out of the trees, the dark band of a radio collar visible around his neck. Even from a distance, his large size and confident bearing were impressive. Then he stopped, shot a wary glance at one of our hiding spots, and trotted over the ridge and disappeared. We tried to follow him, and staked out several more promising clearings, but saw no more wolves for the rest of the afternoon.

Disappointed, we walked slowly back to camp, hoping for a final glimpse. As we crested the grassy swell

## Research in the Rough

### The remote world of Idaho's Taylor Ranch

Jim and Holly Akenson have managed the University of Idaho's Taylor Ranch Field Station, a 65-acre enclave in the middle of the Frank Church-River of No Return Wilderness, for more than a decade. Located on the south bank of Big Creek, the largest tributary of the Middle Fork of the Salmon, the ranch is an ideal base for students, interns, and scientists seeking a wilderness setting for their research. This past summer, the ranch hosted projects investigating the habitat and behavior of prairie rattlesnakes, Chinook salmon, and steelhead trout. In May, a dozen high school students from McCall, ID, arrived at the ranch to spend several days assisting the Akensons with their research, including several hikes to track and locate wolves and cougars. This summer's active research season allowed the ranch to live up to its nickname as "American's wildest classroom."

Measured from the nearest road, Taylor Ranch is the most remote permanently inhabited residence in the lower 48 states. The shortest approach routes are a 32-mile jaunt along Big Creek from the west, or a 42-mile trek from the southeast (hiked by the author). Most scientists, supplies, and mail arrive by air, landing on a narrow airstrip maintained by a mule team. Several other grass landing strips lie within six miles of the station. The privately-owned research facility is located at the junction of several hiking trails, but does not provide lodging for recreational visitors. Find out more at www.cnrhome.uidaho.edu/taylorranch.htm.

where the alpha male had appeared, four tawny, marmot-sized animals scrambled for cover just 15 yards to our right. "Pups," Jim whispered. For all his decades of experience, he looked as excited as a first-year biology student. Remarkably, we had passed by the den several times, but hadn't noticed a telltale mound of dirt. Not wishing to disturb the pack any more, we dropped below the ridge to return to camp.

Arriving at our tents, we encountered the perfect epilogue: Plainly visible on a tent flap were two dusty paw prints with the distinctive four-toes-and-claw-pattern of *Canis lupus*. We concluded that a wolf, perhaps the elusive alpha male, had visited our empty camp and sat back on its haunches to shadowbox the tent. Despite the mysterious calling card, we all slept well that night. The wolves of Idaho, we realized, were conducting some research of their own.

PHOTO BY LUC STRUYF / GETTY IMAGES

## DANGER SIGNS

# WINTER STORM

Scan the slate-gray sky on a December morning, and you may be puzzled: Do those low clouds foretell a blizzard, or just an overcast day? The surprising answer: It depends where you are. According to Tom Moore, senior meteorologist at The Weather Channel, each region offers its own clues.

›› **West** Be wary of wind blowing from the south, especially if it suddenly shifts to the northwest—and the mercury plunges. "Clouds can develop quickly over the mountains and release heavy snow," Moore says.

›› **Midwest** Below the Great Lakes—from Illinois to West Virginia and up to New York—frigid, moisture-rich air can produce lake-effect snow hours after a cold front (a low line of dark clouds) has passed.

›› **East** Atlantic storms spawn the most precipitation, "but it has to be sufficiently cold [for them] to produce snow," he says. Nor'easters develop when Arctic high-pressure air collides with southern low pressure. Watch for winds blowing from the east.

›› **Southeast** Warm, moist air from the Gulf of Mexico rises as it flows north, producing snow if there's frigid air at ground level. Clouds rolling in from the southwest indicate approaching storms.

›› **Cloud cover** No matter where you are, high-altitude cirrus clouds indicate precipitation within the next 24 to 36 hours, as does a ring around the moon or a sudden drop in the cloud deck.

THE MILKY WAY FLOWS OVER OWACHOMO BRIDGE IN UTAH'S NATURAL BRIDGES NATIONAL MONUMENT. FIND MORE STAR-FRIENDLY PARKS ON PAGE 44.

PHOTO BY WALLY PACHOLKA / ASTROPICS.COM

# Crusaders of Darkness

A special-ops team of national park scientists is working to save our night sky. *By Alison Fromme*

CHAD MOORE ISN'T AFRAID OF THE DARK. On moonless nights, while many backpackers are sitting around campfires, the 36-year-old park ranger is humping 65 pounds of specialized gear along inky mountain trails. He heads for high, open spaces—treeless ridgetops are perfect—and unloads a wide-field digital camera, motorized tripod, laptop, and enough wires and batteries to jump-start a bus. Moore assembles the gear quickly, his routine honed by forays into dozens of backcountry locales from Nebraska's Agate Fossil Beds to California's Lassen Volcanic National Park. He isn't a hobbyist pursuing astronomy, however. As head of the National Park Service's Night Sky Team, Moore is giving up his sleep so backpackers can enjoy

darker nights and more stars. When the tripod is aligned and level, he aims the camera at the North Star and taps a key on his laptop. With a soft whir, the camera slowly rotates to snap 45 images of the sky. Over the next few hours, he'll repeat the process several more times, taking notes and occasionally looking over his shoulder for mountain lions.

Although you can't slap it on a postcard like Half Dome or Old Faithful, a deep-black sky is an essential part of the outdoor landscape. National parks and wilderness areas were created to be havens from the noise, exhaust, and electric glare of human industry. But the glowing domes over our cities are starting to penetrate the backcountry. Hikers in Death Valley National Park can see the neon lights of Las Vegas, more than 100 miles away, shimmering like a second moon. Even deep inside Maine's Acadia National Park, the streetlights from nearby towns illuminate the horizon. "Our parks are supposed to be the best-preserved places in America," says Moore. "But even a casual visitor can see light pollution in all but a handful of them."

Preserving dark skies and quantifying light pollution has been Moore's focus for most of his 12 years as a ranger. When he founded the Night Sky Team in 1999, his goals were too ambitious for the available camera technology. So Dan Duriscoe, the project's technical leader, built a motorized tripod and camera mount that could be used to take sky surveys. This system has generated thousands of night-sky images to yield light-pollution baselines for many park units. Moore has presented these results at astronomy conferences, and published his data in a 2007 scientific paper and on the web (nature.nps.gov/air/lightscapes). For many park rangers and scientists, the team's description of widespread light pollution isn't new. But Moore's energetic campaign has won new converts, including bigwigs at NPS headquarters who responded by increasing the team's funding. After running his operation on a minuscule budget for several years, Moore received a $4 million, 4-year NPS grant in 2006. "I think the Park Service takes pride in being a leader in this fight," he says.

Reducing light pollution isn't as easy as switching off a few floodlamps. Light can travel hundreds of miles, spoiling views far from its source. And since no one's pulling the plug on Vegas, saving starry nights for backpackers in Death Valley calls for more creative solutions. Moore understands this challenge. "We're not here to tell people to turn off all lights," he says. Instead, his team wants to help the public adopt smarter, more efficient, and in the long run, more economical lighting options.

One of the first places to make changes was California's Pinnacles National Monument, Moore's first ranger gig and the place that hooked him on dark skies. Spend a night in this craggy landscape of spires 140 miles south of San Francisco, and you won't have to shield your eyes to see the stars. That's because the park removed all the lights from its parking lots and converted all outdoor lamps to low-wattage bulbs on timers. It also acquired an adjacent private campground last year just to tone down its glare.

Moore is optimistic about the impact his team can make. He plans to hire two new field technicians and a public-education staffer, and to retrofit the lighting at 10 to 20 small parks per year. Moore also wants to expand the night-sky surveys to more units. "Once we collect the data, we can compare the skies at a glance and see what's happened over time," he says. "In 5 years, after we assess and improve park lighting at small parks, we hope to move onto larger parks like Glacier." Like his colleagues racing to preserve endangered animals and plants, Moore knows he's defying the headlong rush of civilization. But there's one important difference, he notes. Darkness isn't subject to extinction, only a temporary loss of intensity. The night sky will always be recoverable; we just need to dim the lights.

## Where the Stars Come Out

6 of the Night Sky Team's darkest parks

**Natural Bridges NM, UT**
The world's first International Dark-Sky Park is just east of Glen Canyon.

**Cape Hatteras NS, NC**
Undeveloped beaches bring rare darkness to the Atlantic coast.

**Great Basin NP, NV**
Find a vast and arid land miles from city lights.

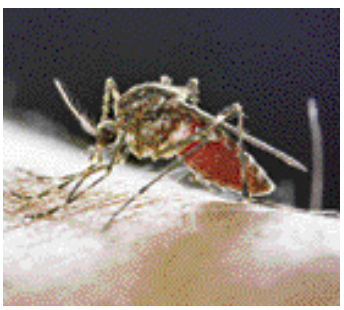
**Bryce Canyon NP, UT**
Check out the park's stargazing programs from May to October.

**Yellowstone NP, WY**
Lighting modifications have brought back the starry nights here.

**Crater Lake NP, OR**
You won't find a darker spot in the Cascade Range.

## DANGER SIGNS

# BLOODTHIRSTY INSECTS



We live in a bug's world. Mosquitoes sucked dinosaur blood 100 million years ago, and now their progeny feast on us. As a result, those itchy, red bumps are as much a part of summer camping as skinny-dipping and s'mores. You can't avoid biting bugs entirely, but you can reduce your exposure. Here's how.

›› **Feel the breeze** Mosquitoes can't fly in winds stronger than 2 mph. Select a campsite downwind from natural features that channel air, like hills and passes. Big lakes often generate onshore winds in late afternoon.

›› **Seek open spaces** Pitch your tent in a sunny clearing away from shade. Don't camp near standing water or wet grass.

›› **Watch the clock** Mosquitoes are most active at dawn and dusk, while blackflies mostly swarm in the afternoon. Both pests thrive for only a few weeks in spring and summer; check with rangers to find out when.

›› **Forget garlic** Folk remedies such as eating garlic, vitamins, and onions aren't proven to discourage bites. Apply one of the top-performing repellents from our test (page 86).

PHOTO BY KIM TAYLOR / NPL / MINDEN PICTURES; TEXT BY JASON STEVENSON (DANGER SIGNS)