

by Paul Tolmé

# NO ROOM AT THE TOP

High-mountain species are particularly susceptible to global warming—and North America's cold-loving pikas may be the most vulnerable of all

**Biologist Chris Ray** felt something tug at her shoe as she sat in a steep boulder field at 10,000 feet in Montana's Gallatin Range waiting for a female pika to emerge from the rocks. Pikas are fuzzy, potato-sized herbivores that inhabit the tops of Western mountains. Frantic workers, they collect large piles of wildflowers and grasses during summer—a process called haying—to eat during winter.

Ray, who has studied pikas in the rugged mountains outside Bozeman for 16 years, looked down to see a pika nibbling at her sneaker. "It was trying to hay my laces," she says, laughing at the recollection. "They also like backpack straps, the more colorful the better."

With round bodies, prominent ears, no visible tail and weighing just 5 ounces, pikas are unmercifully cute. But despite their cuddly appearance, American pikas, the smallest members of the rabbit family, are among North America's toughest animals—and they have to be. Pikas are one of the few mammals in the lower 48 states

GEORGE D. LEPP (CORBIS)

**SPOTTING A PREDATOR,** *an adult pika in the Colorado Rockies emits an alarm call. Pika predators, which primarily hunt juveniles, include weasels, ravens and coyotes.*





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that can survive their entire lives in alpine terrain, the windswept no-man's-land above tree line.

But biologists like Ray now fear that these hearty creatures may not survive global warming. Unlike many wildlife species that are shifting their ranges north or to higher altitudes in response to changing climate, pikas and other alpine animals have nowhere else to go. In some locations, entire pika populations already have disappeared. Scientists say the animal's decline, like the proverbial canary in a coal mine, may

presage problems for other species, from butterflies and birds to large mammals.

Windswept, treeless and frigid, the alpine zone, like frosting atop a cake, covers less than 5 percent of the planet's surface. In a book about the Colorado Rockies, *Song of the Alpine*, author Joyce Gellhorn describes these isolated mountaintop ecosystems as "islands in the sky."

Over the past century, the interior West, which includes the lion's share of the country's high-mountain habitats, has warmed about 1 degree F. Com-

puter models show the region heating up an additional 4.5 to 14.4 degrees F during the next 100 years.

As the alpine warms, scientists expect snowpack to shrink, a phenomenon already observed in the Pacific Northwest, the Southern Rockies and the Sierra Nevada. Reduced moisture would dry alpine soils, spur the invasion of lower-elevation conifers and grasses, and crowd out native species.

In Rocky Mountain National Park, which has more than 100 square miles of alpine habitat, Colorado State Uni-



versity researchers estimate the tree line would rise 1,200 feet—eliminating half the park's tundra—if temperatures warm by 5 degrees F. Trees are already on the move. A paper published in the July 2005 *Western North American Naturalist* shows that the low-elevation distribution of Engelmann spruce, which thrives in the subalpine zone, moved 575 to 650 feet upslope in three of four watersheds studied in Nevada's Great Basin National Park between 1992 and 2001.

Trapped at the top, alpine wildlife is

vulnerable to several of global warming's damaging effects, including vegetation changes, the invasion of new predators and pests, reduced winter snowpack and increases in extreme weather events. For pikas, one serious problem is heat itself. To survive in summer, they must descend into the cool, moist talus—rock piles at the base of mountain slopes—on hot afternoons.

As temperatures rise, researchers say pikas will abandon lower-elevation talus slopes and migrate higher into the mountains until they can go no far-

**IN GREAT BASIN** National Park, the distribution of low-elevation Engelmann spruce (left) moved more than 500 feet upslope in less than a decade—a consequence, biologists believe, of higher temperatures. Across North America's alpine, such "conifer encroachment" threatens wildlife species adapted to open habitat. One problem is that trees provide cover for predators like lynx (opposite), which may also benefit from increased hunting opportunities as alpine summers grow longer.

ther—much like living on the highest point of a sinking island. "All other mammal species in continental North America have greater heat tolerances," says Colorado College alpine mammalogist Barry Rosenbaum, who is studying pikas on Colorado's Niwot Ridge.

In the Great Basin—the arid region between the Rocky Mountains and California's Sierra Nevada—pikas already are disappearing. According to National Park Service biologist Erik Beever, the mammals have recently disappeared from 8 of 25 mountainous locations where they were documented in the early 1900s. Beever, who published his discovery in the *Journal of Mammalogy*, says the die-off indicates that suitable habitat is shrinking.

Notably, the most recent pika losses occurred at the warmer, southern end of the animals' range. "This is what you would expect from rising temperatures—a loss at the margins of their distribution," says Beever. The finding represents "one of the first contemporary examples of a North American mammal exhibiting a rapid shift in distribution due to climate."

According to Ray, pikas also have disappeared from some talus slopes in Montana's Bridger Range over the past 30 to 40 years. While fossils show that pikas have been lost from several western mountain ranges over the past 10,000 years "the speed at which they are disappearing now is more rapid than ever before," she says.

Animals that, like pikas, depend on mountaintop ecosystems are called "alpine obligates." Another obligate is the white-tailed ptarmigan. These chicken-sized birds are difficult to spot

**WHITE IN WINTER**, the well-camouflaged white-tailed ptarmigan (right) turns speckled gray in summer. During cold months, this alpine bird uses snow as a ladder to reach high willow branches. Researchers have discovered that ptarmigan suffer population declines during warm winters with inadequate snow. Other alpine species, such as Dall sheep (below), may initially benefit from global warming as edible vegetation increases. But if trees encroach, the animals will ultimately lose their mountaintop habitat.







**ALPINE SUMMER  
SHORT, BUT SWEET**

SNOW-COVERED EIGHT months of the year, alpine habitat bursts to life in summer with colors that rival a coral reef. Wildflowers of violet, pink, yellow and blue burst forth between patches of dwindling snow. To cope with the short growing season, most plants are perennials that clone rather than disperse seeds. Low-lying cushion plants like moss campion (above) and alpine forget-me-nots have deep taproots that allow them to grow on gravelly, wind-scoured ridges. Magenta and scarlet Indian paintbrushes and yellow alpine avens flourish in sheltered meadows.



**THE AMERICAN PIPIT** breeds on mountaintops, migrating to warmer zones during winter. Biologists fear that if predicted increases in weather variability pan out, the bird's breeding success will drop. Already suffering are alpine butterflies such as *Parnassius smintheus* (opposite). At some study sites in Canada, more than 90 percent of the insects died when they encountered trees that had invaded mountain meadows.

because of camouflage—white in winter and speckled gray in summer—that disguises the birds from predators. During winter ptarmigan keep warm by roosting in snow caves. To feed, they use accumulating snowpack as a ladder to reach higher branches of willow shrubs. “If there is not a reliable supply of snow, they will come into spring in poor body condition and may breed later, with smaller clutch sizes,” says Kathy Martin, a biologist at the University of British Columbia who specializes in alpine birds. Studies show that ptarmigan already suffer population declines during warmer winters with less snow.

Other birds, including American pipits, horned larks and rosy finches, are considered “alpine specialists” because they breed atop mountains but migrate to warmer climates during winter. If predictions are true that global warming will cause more weather variability and extreme events, these species could also face breeding challenges.

Horned larks, for example, feed every 20 minutes. Exposed to freak storms or heat, they have trouble both incubating eggs and finding food. “Keeping eggs at a constant temperature is a huge challenge,” Martin says.

TOP: RICK AND NORA BOWERS (VIREO); LEFT: MARGARET WILLIAMS (NEVADA NATIVE PLANT SOCIETY / USDA); PREVIOUS PAGE, ADRIAN BINNS (VIREO)



Because of the short breeding season, alpine species generally have fewer offspring each summer, which means reproductive failures can dramatically impact populations. "It's always a disadvantage," Martin says, "to breed in the alpine."

Some animals, however, could benefit from an increase in mountain temperatures—at least at first. According to a Colorado State University study,

for North American Wild Sheep. Bighorns can adapt to hotter temperatures—desert bighorns, for example, inhabit arid canyon lands of the interior West. But Vic Coggins, an Oregon state wildlife biologist who studies bighorns in Oregon's Wallowa Mountains, says "they will not tolerate forested areas. There's nothing on the ground to eat in conifer stands, and they create a haven for predators." Meanwhile, predators

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elk numbers may double in Rocky Mountain National Park as the mammals forage higher and winters decrease in severity. Endangered greenback cutthroat trout populations could also increase as fewer lakes fill with ice, notes the same study.

Bighorn and Dall sheep may also benefit initially from increased vegetation, but over time "conifer encroachment" would harm their populations, says Neil Thagard of the Foundation

themselves—including foxes, coyotes, lynx and weasels—could benefit from increased hunting opportunities as alpine summers lengthen, at least in the short term.

Unfortunately, predictions are difficult to make because relatively little is known about the life histories of many alpine animals, particularly small species such as shrews, pocket gophers, voles and mice. "There's a reason they are not well studied," Martin says. "It's

#### PIKA PRIMER

#### SURVIVAL AT THE TOP

PIKAS, WHICH ONCE lived across North America, have been retreating upslope over the past 12,000 years. The species is believed to have evolved from Siberian ancestors that crossed the former land bridge between Asia and Alaska.

American pikas are found in Colorado, Oregon, Washington, Idaho, Montana, Wyoming, Nevada, California and New Mexico as well as western Canada. Their thick fur and round bodies conserve heat, and furry paws provide traction on snow. Though most pikas in the Lower 48 inhabit alpine ecosystems exclusively, some survive at lower altitudes where deep, cool caves are available, such as the ice tubes in California's Lava Beds National Monument.

Telltale signs of pika territory are the hay piles the animals amass in summer to eat during the winter. The piles, which can encompass a bushel of vegetation, resemble dried flower arrangements. In addition to nutritional plants, hay piles often contain scat from other species, particularly marmots.

Like their rabbit relatives, pikas are prolific: Females can deliver two or three litters of as many as five pups per season. Gestation lasts three weeks. Fast growers, pika pups reach adult size in just three months—if a predator does not eat them first.

The most common pika predators are weasels, which primarily hunt juveniles. To protect their offspring, adults will climb up to lookout rocks and emit distinctive "weasel calls" when they spot the predator. Pikas also produce alarm calls for avian predators such as ravens and for coyotes.

Initially, juveniles attempt to establish territories close to their parents but are soon chased away. Fiercely territorial, pikas squeak at invaders. "They will come out and yell at you if you get too close," says pika researcher Chris Ray.







**"MAKING HAY** while the sun shines" is classic pika behavior. Throughout summer, the industrious mammals collect grasses and wildflowers for hay piles they place among rocks at the base of cliffs, storing the food for sustenance over the winter. As warming forces the retreat of alpine pika habitat, the animals are disappearing from some locations they once inhabited.

challenging to get a good safe study area in the alpine."

At her study site in Montana's Gallatin Range, Ray returns to the talus zone near Hyalite Peak every August. She spends her days trapping, tagging and monitoring the roughly 300 pikas that inhabit her two-square-mile research area. Pikas make good subjects because they are easy to observe, and unlike many other species, biologists can get close to them. "If you sit quietly, you can watch them go about their business," says Ray. In addition to tugging scientists' shoelaces, pikas sometimes lick sweaty sneakers for salt.

In future years, Ray plans to compare her data on population fluctuations with temperature changes in the region. She suspects decreasing snowpack is at least part of the problem. Snow that covers talus slopes in winter insulates pikas from subfreezing temperatures. "If they

are shivering through winter, that certainly would affect their fitness," says Ray. Ironically, global warming could be causing some pikas to freeze.

In the past, pikas could disperse between mountain ranges. But warmer temperatures make that journey a death march now. "If an isolated population blinks out today," Ray says, "it's nearly impossible for that habitat to become recolonized."

Asked if pikas could be the first mammal to disappear from the Lower 48 because of climate change, Ray hesitates. "That's a reasonable hypothesis," she says. "When you see a systematic decline in pikas, that tells you dramatic changes are taking place in the alpine."

*Colorado writer* **PAUL TOLMÉ** wrote about efforts to protect endangered native plants in the June/July issue.

#### **NWF PRIORITY FIGHTING GLOBAL WARMING**

BEYOND ITS EFFECTS on high-altitude habitats, global warming is expected to wreak havoc with virtually all of the world's ecosystems and their wildlife inhabitants—undermining decades of conservation achievements.

Combating this problem is one of NWF's top priorities. The federation's activities include supporting House and Senate bills to reduce greenhouse gas emissions, publishing an ongoing series of studies on global warming and its effects on wildlife, and working with state affiliates to address local global warming issues.

To learn more about these and other related programs, go to [www.nwf.org/globalwarming](http://www.nwf.org/globalwarming).