Sierra warming: Climate change puts heat on high country

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Standing atop Yosemite's tallest peak in August 1950, Hal Klieforth looked out across the Lyell glacier and marveled at how solid and unyielding it appeared.

"It was like Grand Canyon or the Sierra itself," the 81-year-old meteorologist said recently. "It had been there for many years and probably would be there for many more."

Today, as the boulder-strewn sheet of ice recedes in the summer sun, Klieforth is no longer so confident. "Now I guess there might be more people making a pilgrimage to these glaciers before they go," he said.

No longer is climate change a distant drama of shrinking polar ice caps. As year-round ice fades from the saw-toothed summits of the Sierra Nevada, as Klieforth and others watch a world change in their lifetimes, it's clear an unwelcome reality is at our doorstep: Global warming is local warming.

Just as rising worldwide temperatures are sowing problems in the far north and parts of Antarctica, so, too, are they bringing big changes to our own northern exposure in the Sierra and other mountain regions.

You can see it in the dead rust-red pines west of Yosemite National Park, the fading easel of wildflowers near Carson Pass south of Lake Tahoe and the parched bare banks of lakes and reservoirs. You can smell it in the acrid ash-gray smoke from a siege of early-season wildfires that has choked much of the region for weeks on end.

You can hear it in the quiet murmur of small streams that once rushed noisily downhill in July; in the whoosh of cars over Tioga Pass after Thanksgiving – a time when the white-knuckle road crossing, the highest in California, was always closed by snow prior to 1975; and in the voices and observations of scientists, resource managers and mountain residents.

Behind the counter at Sorensen's Resort, along Highway 88 in Alpine County, John Brissenden greets visitors with a walrus mustache and a Santa Claus smile. Ask about global warming, though, and his tone turns less jovial.

"My fan budget has gone through the roof," said Brissenden, co-owner of the rustic facility which advertises on a postcard that its air-conditioning is "aspen-powered."

"We just can't count on the aspens anymore," Brissenden said. "We have to have a fan in every cabin."

Ten years ago, S.P. Parker routinely guided climbers up an ice-filled chute in the high Sierra called the Mendel couloir. Now that icy staircase has turned to rock and dirt.

"Everything's melting more," said Parker, co-owner of the Sierra Mountain Center in Bishop. "It's kind of depressing to watch it happen."

Even underground, ice is not safe.

In his office near the Oregon border, David Larson keeps a picture of Merrill ice cave – located on the Modoc plateau north of the Sierra. The photo, taken in 1990, shows a giant punch bowl of ice in the cave's lower chamber, several feet thick, hard as a hockey rink. In the early 20th century, people ice-skated on it.

One afternoon this spring, Larson walked down a steep series of steps into the cave and directed the amber beam of his head lamp toward the cave floor. The ice had vanished, leaving behind a jagged jumble of rock.

"It's kind of shocking," said Larson, chief of resources at Lava Beds National Monument. "Ice is almost like a species that is going extinct."

Sierra's plight reflected across West

What's happening here is one ember in a larger fire. Higher elevation landscapes across western North America and the world are warming faster than the rest of the globe – and suffering the consequences.

In British Columbia, mountain pine beetles have devastated a swath of forest one-third the size of California, in part because winters are no longer cold enough to keep the pests in check. In Montana, Glacier National Park is expected to be glacier-free in 25 years.

"It's the far north and the higher elevations that are seeing the impacts first," said Joan Clayburgh, director of the Sierra Nevada Alliance in South Lake Tahoe. "And when it comes to California, it doesn't get any higher than the Sierra."

Starting today, The Bee will begin to chronicle this warming world, to explore an environmental meltdown scientists say is more far-reaching than any in recorded history.

In print and online at www.sacbee. com/sierrawarming, we will take you from the foothills to the timberline and beyond to reveal a landscape where the imprint of climate change is being detected in a surprising number of ways, from the growing rampage of unruly and destructive wildfires to the scamper of chipmunks and other species upslope toward cooler weather.

"When I started doing climate change research in the Sierra Nevada around 1990, it seemed like an abstraction," said Nathan Stephenson, a research ecologist with the U.S. Geological Survey in Three Rivers near Sequoia and Kings Canyon national parks.

Now, it's in sharp focus. "Over the last five years, the canary in the coal mine died," said Stephenson, whose research has tied a rise in tree mortality in the Sierra to rising temperatures. "It's almost a shock to find out how many things are changing and how rapidly they are changing."

Warming picks up speed

Climatic shifts have swept across the globe for millions of years, of course. But this warming pattern is more troubling, scientists say, because temperatures are climbing faster than in previous post-ice age warming spells.

"It's doing this not in tens of thousands of years but in decades," said Kelly Redmond, deputy director of the Western Climate Research Center. "We are going into new territory that has not been seen in a long, long time."

Redmond's Reno office is filled with snowdrifts of studies and data so deep he jokes about drilling into them like a glacier. In those piles of paper – and on his climate center's Web page – are nuggets that show the warming pattern already is under way.

For nine years in a row, the mean annual temperature in the Sierra has exceeded the historical mean of 51.6, the longest warm spell in recorded history. Over the past 35 years, average temperatures in the Sierra have risen 1.3 degrees – slightly above the global average.

It could, of course, turn colder tomorrow. But the direction of that seemingly modest change led climate scientists to form a new organization to focus exclusively on the problem: the Consortium for Integrated Climate Research in Western Mountains.

The group, based partly in California, said in a 2006 report: "Despite their imposing grandeur and apparent fortitude, mountains contain highly sensitive environments that support delicately balanced physical and natural systems. A warming of only a few degrees has major implications."

At higher elevations, no temperature is more critical than 32 degrees – the freezing point. Across the Sierra, freezing weather is a must. It fuels the economy, recharges the spirit, kills insect pests and turns the splash of rain into the miracle of snow – a kind of high-country investment account that drips out its dividends as water all summer long.

"Huge things happen at the freezing point," said Redmond. "It's like throwing a switch. You get water or you get ice."

Now, though, global warming is messing with the switch. A century ago, the average daily temperature in Tahoe City dipped below freezing about 80 days a year; today it reaches that mark only about 50 days a year. In 1969-70, the average winter low in Yosemite National Park was 28.1. In 1999-2000, it was 32.1. Such trends make many uneasy.

"This winter, there were a number of storms in Yosemite Valley where it was just kind of spitting snow, but it never really got cold enough to snow," said Greg Stock, a geologist with Yosemite National Park. "And I thought: Maybe this is the future."

It's not just the freezing point that matters either.

"A few degrees makes a fair amount of difference when sap starts rising, plants begin to grow and insects become active," said Redmond, whose data also show the average yearly nighttime low in the Sierra has climbed two degrees over the past 35 years.

Forests could shrink, ski season vanish

Resource managers don't know what to expect, in part because global warming is so new. But it's likely to make their jobs much tougher.

Imagine Tuolumne Meadows minus the meadow, or the shore of Lake Tahoe with foothill oaks intermingling with evergreens. It could happen, scientists say, as global warming reshuffles the complex layer cake of ecosystems found in the Sierra. Even the giant sequoia – the largest living thing on Earth and a symbol of the Sierra – may be in danger.

"It could very well be that giant sequoias become relics that survive for centuries where they are, as they gradually die off and are not replaced," said David Graber, chief scientist for the National Park Service in California.

"We are looking through a glass darkly," Graber added. "There is going to be a great deal of nail biting. There are going to be constant surprises for everyone."

Recently, the California Climate Change Center – the state's global warming clearinghouse – asked scientists for a global warming forecast for the state. Their projections were stark and unsettling.

By 2100, alpine and sub-alpine forests could diminish 50 to 70 percent. The ski season could shrink to a few weeks – or not open at all. "Minimum snow conditions … might never occur," one study says. "Resorts would be forced to rely entirely on snowmaking or move their operations."

Hydropower production is expected to decline; weeds, to run wild. The risk of large wildfires could increase 55 percent. And with more snow already falling as rain and melting earlier in the year, the Sierra snowpack – source of more than half of the state's freshwater – could shrink as much as 90 percent.

"This could impact 85 percent of California's population," says a paper published by the National Academy of Sciences in 2004.

Flowers fade – but weeds thrive

For many, that tomorrow is taking shape today. Talk to Michelle Tracey, office manager at Sierra Mountaineering International in Bishop. "When I was a kid, I used to spend close to nine months a year in my ski boots," she said. "Now you're lucky if you get three or four."

Just ask Kimball Chatfield who over the past two decades has watched heat and drought drain color from one of the Sierra Nevada's showiest pageants: its spring and summer wildflower bloom.

Fifteen years ago, the floor of Hope Valley near Carson Pass was a canvas of soft purple, sulfur yellow and misty blue. Now large daubs of color are missing as horsemint, lilies and other water-loving plants are snuffed out by heat and drought.

"I can see it happening – it's getting warmer," said Chatfield who has taught a class on medicinal plants at Lake Tahoe Community College. "The plants are losing ground."

But while some flowers are suffering, other vegetation is expanding, including desert-dwelling sagebrush and Russian thistle, a noxious, heat-loving weed. "It's a great time to be a thistle," Chatfield said.

Mammals are on the move, too, a change scientists have uncovered by scouring century-old journals of Sierra naturalist Joseph Grinnell, who trapped animals across the range in the early 19th century and meticulously recorded where he caught them.

Today, many of those mammals are AWOL from Grinnell's carefully charted camps and trails. They've migrated upslope to cooler locales – a likely sign, scientists say, of a warming climate.

In Yosemite, the shadow chipmunk and piñon mouse have moved up 3,000 feet, more than half a mile, in 90 years. Other species also are on the move and some could even disappear from the park.

"You can only go up so far before you run out of mountain," said Shelton Johnson, a Yosemite ranger. "If you don't have wings, you're out of habitat."

Fires get worse as snows grow scarce

There are signs of trouble at lower elevations, too. From his deck near El Portal, west of Yosemite, federal scientist Jan van Wagtendonk has watched hundreds of ponderosa pine slowly die out, one by one, over the past 35 years.

Pointing out the most recent victim – a brownish-red, clearly dead tree, he said: "It's just a single pine. That's the insidious part. Sometimes you don't notice it because it's a tree here and a tree there. But there used to be a lot more there. And today there are very few."

Now 68, van Wagtendonk also sees the signature of climate change in the ever-more-destructive fires sweeping across the Sierra. "The less snow you have, the more severe the fire becomes," he said. "If the snow melts earlier, the fuels are available for a longer period of time."

"Global warming is real," he said. "The evidence is here on the ground."

You also can discover it in the visitor logbooks and spreadsheets at Lava Beds National Monument on the Modoc Plateau where words and data dovetail to reveal the end of a little-known subterranean ice age.

"What a great experience! What a jumble of fascination. Great ice pool," one group of visitors wrote after touring the park's remote Frozen River ice cave in 1995.

By 2001, the cave was running a fever: 32.9. "First half of ice river is gone!" wrote a couple from San Rafael.

Two years later – at 33 degrees – Frozen River was frozen no more. "Pond gone," a visitor wrote. "Cave too warm."

This May, park scientist Shane Fryer clambered into the inky depths of the cave and plopped down on a sofa-size rock that not long ago was encased in ice. In all, at least nine caves across the monument have melted out.

"There used to be a massive tongue of ice here," Fryer said. "The key thing is all the ice loss is occurring about the same time … All these caves are being influenced by a common factor which is more than likely global climate change."

Glaciers could be gone this century

An estimated 100 glaciers – some large, others small – are wasting away, too. "On the whole Sierra Nevada glaciers have retreated roughly 50 percent from a century ago," said Stock, the Yosemite geologist. "If those rates continue, we will probably be without glaciers in something like 50 years."

Every fall, Pete Devine hikes south out of Tuolumne Meadows to check on one of the most majestic of them all: the Lyell glacier. "The glacier of Mount Lyell," the legendary photographer Ansel Adams wrote in 1932, "floats as a pale ship on a sea of desolate granite."

Not anymore. "The east lobe is almost invisible. You see a thin flake of ice like the stuff in a refrigerator that doesn't defrost," said Devine, director of educational programs for the nonprofit Yosemite Association.

"The west lobe is more healthy, but it has shriveled and shrunken the way a pumpkin does four weeks after Halloween," he added. "It won't be long until the Lyell glacier is no more – two or three more decades, maybe."

No one was more intrigued by the Sierra's icy eaves than John Muir, the renowned naturalist and a founder of the Sierra Club, who discovered the first glacier in 1871 in the rugged back country east of Yosemite Valley.

At the time, Josiah D. Whitney, a professor of geology at Harvard University and state geologist of California, dismissed Muir's conviction that glaciers had carved Yosemite's valleys and sculpted its canyon walls. So as Muir tramped up patches of snow between Red Peak and Black Mountain one October morning, following a creek filled with gray glacial silt, he was elated.

"I set out to trace the ancient ice current back to its farthest recesses," he wrote in Harper's New Monthly Magazine in 1875. Finally, scrambling to the top of a moraine of loose rocks, he spotted it: "a small but well-characterized glacier swooping down from the somber precipices of Black Mountain."

After awed descriptions of sunbeams and serrated ridges, Muir wrapped up his essay with a sliver of worry. "How much longer this little glacier will live, of course, depends on climate," he wrote.

Today, Muir's glacier is gone.

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