

A view from Sequoia National Park on a clear day, left, contrasts sharply with a view from Yosemite National Park, below, on a day when a dense layer of smog is visible. As the air warms during the day, much of the pollutant air mass rises from the Central Valley into the mountains.



# AIR

## Once-crystal Sierrasky is choked by pollutants

Second of five parts

"The air up there in the clouds (at Lake Tahoe) is very pure and fine, bracing and delicious. And why shouldn't it be? It is the same the angels breathe."

— Mark Twain, from "Roughing It," published in 1872

By Tom Knudsson  
 Lead Sierra Bureau

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**L**AKE TAHOE — Thirty-three years ago, amateur photographer Jim Hildinger set out on a mission to capture on film the majesty of this world famous mountain lake.

In the process, he also documented a disaster.

"You notice it particularly with the color slides," said Hildinger, owner of Angora Lakes Resort near Echo Pass. "The ones from the '50s are just crystal clear. You can pick out individual trees across the lake. You can't do that anymore."

"There was a time when a hazy day was rare. And it's quite the reverse now. To those of us who know what it used to be like, it's a disaster."

Sadly, Lake Tahoe is not alone.

Throughout much of the Sierra Nevada, the "air the angels breathe" is fouled by a not-so-heavenly cloud of contaminants — ozone, sulfur dioxide, polycyclic aromatic hydrocarbons, carbon monoxide, nitrogen oxide, particulates and other chemicals.

Few parts of the range have been spared. During the summer, west-facing foothills and canyons are immersed in great ashen clouds of pollution that blow in from the Central Valley and the San Francisco Bay Area. In the winter, ozone-sparking skies are smudged with yellow, brown and gray — the signature of too many woodstoves, automobiles and people in the mountains.

For years, the problems drew little attention, in part because the Sierra Nevada, by its very nature, seemed somehow above it all. The Sierra, after all, has long been known for its cobalt blue skies and clean mountain air — a place so luminous, so bathed in brilliance that John Muir called it the Range of Light.

But in recent years, as California's population has swollen, a much different picture has emerged.

Today, scientists come to the Range of Light not to study its clean air, but to investigate its airborne poisons. Warning signs are numerous: Forests are dying, amphibians are disappearing and world class views are a memory.

In Sequoia National Park, the situation is so serious that scientists worry the park's ecosystem may one day be shaded not by natural forces, but by air pollution. Ultimately, scientists say, the entire Sierra Nevada — including its forests, wildlife and water — may wither beneath a pall of poisons.

"Important resources such as watershed quality, recreational amenity, wildlife habitat and overall ecological stability are at risk," said a 1987 California Air Resources Board report on ozone.



Smoke puffs out of a chimney in Quincy. Wood smoke has become a major pollutant in the Sierra.

protest Sierra forests.

"Right here, we have recorded the highest 24-hour ozone level of any unit in the national park system," said David Parsons, research scientist at Sequoia National Park. "And I find that frightening."

On winter days, some of the dirtiest air in California can be found in Sierra communities such as Mammoth Lakes and Truckee, where pollution from wood smoke routinely exceeds state health standards and may pose a threat of cancer.

"It's very striking," said Russell Roberts, air pollution control officer of the Northern Sierra Air Quality Management District. "You start with this brilliant white filter and at the end of 24 hours, it's black. And it smells like wood smoke. And everything on that filter you are breathing into your lungs."

In the lonely country around Owens Lake, where large areas of lake bed have dried up because water has been diverted to Los Angeles, heavy winds whip up enormous toxic dust storms of sulfur, mercury, arsenic and lead. The concentrations of dust are among the highest ever recorded in North America.

"If this was happening in an industrial area, gas masks would be required," said Thomas Gill, an earth scientist with the Crocker Nuclear Laboratory's air-quality group at the University of California, Davis.

Scientists have known for years that mountains are not immune to air pollution. Earlier this century, sulfur dioxide from copper smelters in Montana and British Columbia defoliated large stands of forest. As recently as 1952, emissions from an aluminum ore plant in Washington killed and injured trees across a 50-square-mile area.

But concern about air pollution in the Sierra Nevada is much more recent. The first cluster of scientific papers on the subject appeared in the 1970s, followed by a cloudburst of articles, presentations and proceedings in the 1980s.

Today, scientists are beginning to sort out a mystery. And like any good thriller, this one is marked more by questions than answers.

"There are large gaps in understanding (how) forests respond to pollutants," wrote the editors of "The Effects of Air Pollution on Western Forests," a collection of scientific papers presented at an Anaheim symposium in 1989.

"Air-quality data for forested areas are limited. Long-term measurements of forest growth and conditions are even rarer."

In the Sierra, scientists often have had to play catch-up. Despite steady population growth at Lake Tahoe, the first formal study of its ozone problem did not take place until 1987, and was not published until 1989. Even today, scientists have yet to study ozone across the entire Tahoe basin.

"We have conventionally put our air-quality monitoring efforts into urban

areas," said Donald Peterson, author of a 1988 study on ozone and forests for the California Air Resources Board. "So we have a very poor understanding of what the air quality is in a lot of these mountain areas actually."

"One problem is the complexity and variety of mountain topography. Because of the extreme variability in mountain terrain, you also get extreme differences in air quality over very small areas."

Add to that a host of other factors known to harm forests — including drought, insects, road salt, soil erosion and fire — and you get a first-class scientific jigsaw puzzle.

"These are still evolving areas of science," said Thomas Cahill, professor of physics and head of the air-quality group at the Crocker Nuclear Laboratory. "We all know little pieces. But none of us knows everything. That's the key."

Solutions are elusive, caught up in a web of politics, economics, science and the relentless swell of humanity moving to California. Throughout the Sierra Nevada — and the West — a sense of urgency is building.

As the American Forestry Association put it in a December 1987 white paper on forests and air pollution:

"The quest among some policy-makers for complete understanding and a magically irrefutable scientific explanation of the problem — undertaken as a substitute for additional pollution controls — is shortsighted and foolhardy."

Nowhere is the urgency greater than in the southern Sierra Nevada, where scientists fear everything from giant sequoia trees to tiny foothill yellow-legged frogs may be suffering the effects of air pollution.

To understand the problem, though, one must first turn not to the mountains, but to the source of the dirty air — the San Joaquin Valley.

Once a rural backwater, this southern half of California's Great Central Valley is now one of the state's fastest growing — and most

polluted — regions.

Every summer morning, the pageant of pollution begins. Cars, trucks, power plants, tractors and industries from Sacramento to Bakersfield all do their part, filling the sky with a foglike layer of sulfur dioxide, organic acids, nitrogen oxide, ozone and other compounds so thick it dims the sun.

To make matters worse, the valley also acts as a sump, a receiving station for air pollution blown in from the San Francisco Bay Area. Hemmed in by mountains on three sides, this enormous cloud of poisons swirls slowly about, growing dirtier as it bakes in the torrid valley sun.

Then, like clockwork, the cloud rises each day, creeping up the Sierra slopes to the east. Hour by hour, the pollution thickens, effectively fumigating a large band of forest from Bakersfield to Lake Tahoe, including three national parks.

Rock in Sequoia National Park where, historically, tourists have raved about the views: To the east, the jagged, knife-like Great Western Divide; to the west, a carpet of forest stretching to the valley, and beyond, the pencil-line scrawl of the Coast Range, some 100 miles distant.

Today, Moro Rock is enveloped in a veil of pollution that has stolen the lenscap views and replaced them with the toxic frosted glass. These days, you are lucky to see five miles down the canyon.

"You just have to wonder what it does to the trees and the wildlife," said Stephanie Henrietta, one of many tourists squinting through the haze at Moro Rock last fall.

"It's too bad," she said. "I grew up in the San Fernando Valley, near Los Angeles, but there's no way to get away from it now. There's no place to go."

A short distance down the trail stands a park display, the kind normally used to describe plants, animals, hiking trails and so forth. The subject of this display, however, is air pollution.

"Air pollution obscures our views, impairs human health, damages forest trees and acidifies our waters," the display says. "If not controlled, it will change these forests in ways we do not yet understand."

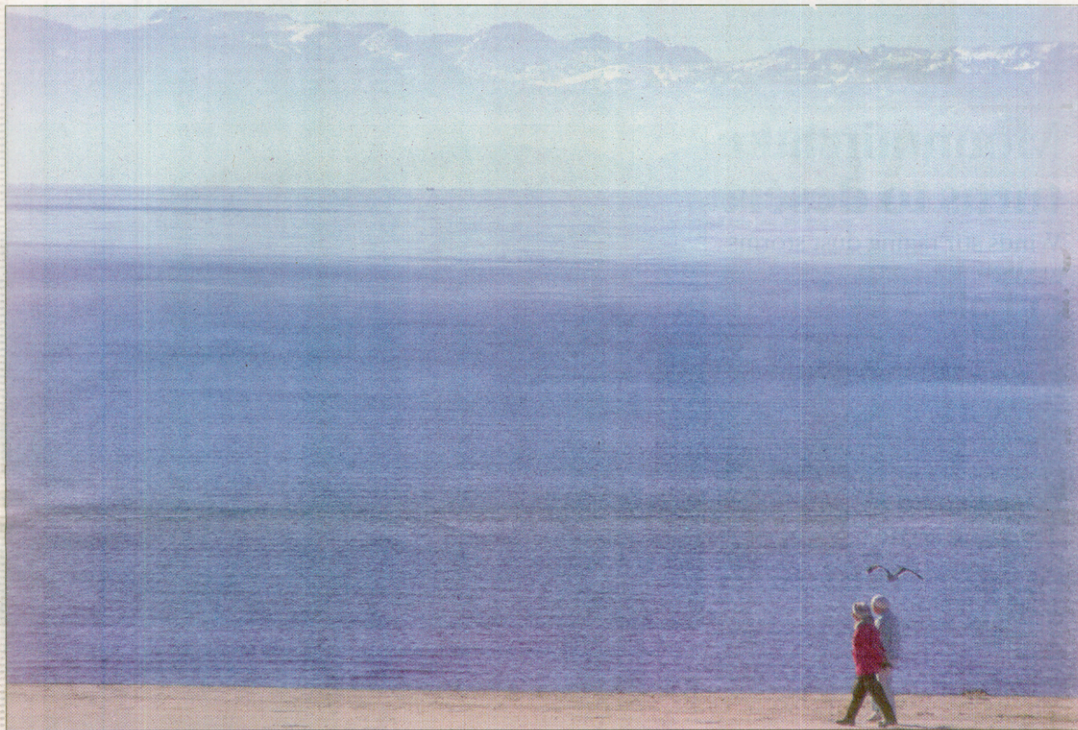
Ten years ago, Germany woke up to such a nightmare: Norway spruce, Scotch pine and silver fir were suffering extensive damage. Parts of the Black Forest turned brown. In Germany, one word has come to define the disaster: *Waldsterben* — forest death.

Today, the Sierra Nevada has its own *Waldsterben*. Up and down the range, trees are dying in record numbers. In some areas, one of three trees is dead. The U.S. Forest Service said there are estimates that the Sierra is checked with a record 6 billion or more board-feet of dead or dying timber, enough to build more than a half-million homes.



MaryAnn Rankin and Trent Procter of the U.S. Forest Service, far left, examine chambers, designed to fumigate branches with various levels of ozone, on giant sequoias in Sequoia National Park. The pair are standing atop a 102-foot-high scaffolding. At left, Diane Ewell, an air-quality specialist at Sequoia, examines pine tree needles for evidence of ozone damage.

Bee photographs by Jay Mather



Continued from previous page, 4

No one knows what is killing the trees. Traditionally, the Forest Service has pointed to drought and bark beetles. But in the Sierra Nevada, as in Europe, many people are looking to the sky for answers.

The most likely suspect is ozone — a stepchild of California's love affair with the automobile. Born in the clash of sunlight and auto fumes, ozone travels in bad company, the same pack of dirty air that lifts out of the Central Valley toward the mountains every summer morning.

Ozone's harmful effects are well known: It attacks the respiratory system, especially in unhealthy people. But even healthy people can be stricken with nausea, headaches and fits of coughing.

Ozone's effect on forests is no less kind. Absorbed through pine needles, ozone starts a chemical chain reaction that starves the tree of nutrients. First, needles begin to die. That, in turn, cuts back on photosynthesis — the process by which trees convert sunlight to energy and synthesize nutrients. Later, root growth is restricted. Ultimately, the tree may die.

Today, scientists can identify ozone damage — transparent yellow blotches on pine needles — in forests throughout much of the Sierra.

"The most severe damage is on our western slopes, those closest to the San Joaquin Valley," said Diane Ewell, an air quality specialist at Sequoia National Park. "But you can go pretty much anywhere in the park and find trees with ozone injury."

Even Yosemite National Park has been hurt. A 1988 study found that 58 percent of the trees in the park showed signs of ozone injury — and that the symptoms were getting worse. Farther north, ozone's impact lessens but remains significant. The 1987 Lake Tahoe study, for example, found that of 1,150 pines sampled, nearly one-quarter had ozone injury.

And that brings up an even bigger source of concern: California's ozone standard, set to protect human health, is not protecting trees. At Lake Tahoe, ozone levels in 1987 did not exceed the state health standard of 90 parts per billion — yet the forest still suffered.

On the face of it, those ozone levels wouldn't be considered violating the state health standard," said Cahill of the

Crocker Nuclear Laboratory. "But they're certainly trashing the trees."

Another complicating factor: Ozone does not seem to kill trees directly, merely weaken them. It may, in effect, open the door to other unfriendly forces, such as drought and bark beetles.

"The bark beetle is an effect, not a cause," Cahill said. "A good growing tree can handle bark beetles perfectly well. It pushes through enough sap to drown them. But as it is stressed by drought, as it is stressed by ozone, its ability to outgrow its problems becomes less and less."

Unlike many air pollutants, ozone remains a kind of mystery, acting in curious ways that seem to put the Sierra Nevada at special risk. For one thing, although ozone is conceived primarily in urban areas, its concentrations at high elevations often exceed those found in cities.

At Blue Canyon, for example, a rugged spot in the Sierra Nevada about 70 miles northeast of Sacramento, ozone concentrations are frequently higher than downtown Sacramento — sometimes three to four times higher.

"All day long, pollutants push out of the city," Cahill said. "But ozone is a secondary pollutant, one that takes time — and heat and sunlight — to form. Ozone really forms more downwind of urban areas."

And therein lies an irony of no small consequence: Sunlight, one of the very forces that has made the Sierra Nevada famous, is today turning it toxic. Sunlight, it seems, is no longer a simple blessing. Today, it is a blessing and a curse.

And once the sun goes down, ozone plays another cruel trick: It does not diminish nearly as much as it does in cities, where the same compounds that create ozone during the day — primarily nitrogen oxide — destroy it at night.

Cahill discovered that firsthand recently at Sequoia National Park. At night, two monitoring stations inside the park, at Ash Mountain and Giant Forest, recorded ozone levels about three times higher than in the valley. "That data was a stunner," Cahill said. "A lot of people looked at it and said, 'Oh, my God.'"

"If you look at the data, you see that daytime levels at Giant Forest, at 6,000 feet above sea level, are almost exactly what they are at Visalia on the valley floor, almost at sea level. But night-time levels at Giant

Forest are much higher.

"That means that when trees start opening their stomata (tiny openings in needles) at night and pulling in a lot of gases, they're pulling in a lot of ozone, too."

"To me, that's a great big red flag waving in the wind, especially when you can see ozone damage in almost 100 percent of the Jeffrey pine at the 6,000-foot level in Sequoia National Park."

Ultimately, though, scientists are worried — about more than the yellowing of pines. They are concerned that ozone pollution could begin a series of long-term, catastrophic ecological changes in the Sierra. Already, such changes — including soil erosion, increased fire damage and the proliferation of brush — have been noted in one of the world's most heavily ozone-damaged regions: the San Bernardino Mountains east of Los Angeles.

At Sequoia National Park, environmental specialist Tom Nichols talked recently about those concerns:

"There's no question that continual fumigation of a species with ozone, even at relatively low concentrations, will put pressure on certain sensitive trees. Trees are just like people. There will be certain trees within a species that will get the fallout first — the most sensitive individuals."

"So as you begin to see air pollution affecting all the park species, and individuals within a species, you begin to see a park which is effectively shaped by air pollution, by society."

"And that means we deflect further and further from the target we should be shooting for: which is a pristine, wild, natural park."

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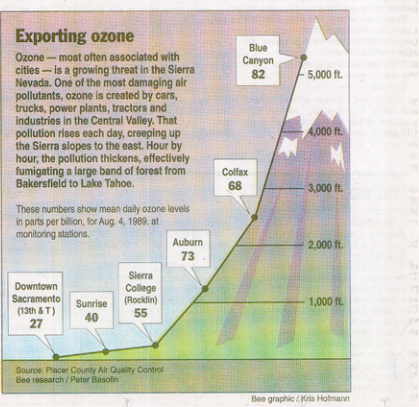
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From the north shore, Lake Tahoe's south shore is barely visible in late February because of automobile exhaust and smoke from woodstoves. The air is fouled by polycyclic aromatic hydrocarbons, carbon monoxide, nitrogen oxide, particulates and other chemicals.

**'Air pollution obscures our views, impairs human health, damages forest trees and acidifies our waters. If not controlled, it will change these forests in ways we do not yet understand.'**

— display in Sequoia National Park



MAJESTY AND TRAGEDY  
THE SIERRA IN PERIL

# Comfy woodstove fires bring cloud of ill health

By Tom Knudson  
Bee Sierra Bureau

**T**RUCKEE — As a real estate agent, Lois Nipic has heard a lot of talk about the joys of mountain life — the spectacular scenery, the fresh air and on and on.

The other day in Reno, she heard a different story.

"When I told her I was from Truckee, she said, 'Truckee? I hate to go through that town in the winter — the smell from the woodstoves just knocks you out.'"

Truckee, a picturesque mountain town that clings to the east side of Donner Pass about 100 miles northeast of Sacramento, is hardly unusual. Today, air pollution from woodstoves is fouling mountain skies from one end of the Sierra Nevada to the other.

At Mammoth Lakes, about 160 miles southeast of Sacramento, the glorious eastern wall of the Sierra is no longer so glorious, obscured by a foul-smelling layer of wood smoke. Step outdoors in Quincy, Nevada City or South Lake Tahoe on a winter morning, and you'll get the same.

The problem is more than an inconvenience and a stain on the majesty of the Sierra. To many officials who believe wood smoke is bringing a cloud of ill health to the mountains.

"The old statement that wood smoke is

good smoke isn't really true," said Thomas Cahill, head of the Crocker Nuclear Laboratory's air quality group at the University of California, Davis.

"You're looking at some mild carcinogens — cancer-causing chemicals — in enormous quantities. You've got to be concerned about the health effects."

Clearing the air is not going to be simple. Few things are more sacrosanct in the mountains than a cozy wood fire on a cold winter night. Mountain towns, though, have started to take action. Mammoth Lakes, for example, now bans wood burning when air quality is poor. But other communities, such as Truckee, have done little or nothing.

"Basically, the majority of days we sample in the winter in Truckee are violations of the state health standard," said Russell Roberts, air pollution control officer for the Northern Sierra Air Quality Management District.

"And it's not a borderline situation. In December, Truckee had a reading of 112 micrograms per cubic meter. That's actual field work that might link wood smoke to a rise in respiratory disease in the mountains. In fact, it's well above the standard."

"We've seen a lot of wood smoke in general is limited, in part because government agencies and universities tend to worry more about urban air pollution.

Today, though, mountain skies often are foggier than city skies. Consider:

- Levels of benzo(a)pyrene — a cancer-causing compound found in wood smoke, automobile exhaust and elsewhere — are 25 times higher in Mammoth Lakes in the winter than along the freeways of suburban Los Angeles, according to a California Air Resources Board study.

- The amount of respirable dust — dust so small you breathe it into your lungs — in mountain towns routinely exceeds the state health standard of 50 micrograms per cubic meter, often by two to three times. In February 1980, Truckee and Mammoth Lakes had higher average respirable dust levels than Los Angeles or Sacramento. Most of the dust comes from wood smoke.

- It's very striking, Roberts said. "You start with this brilliant white filter and at the end of 24 hours, it's black. And it smells like wood smoke. And everything on that filter you are breathing into your lungs."

The list of pollutants in wood smoke is long and worrisome. It includes carbon monoxide, benzene, dioxin, formaldehyde, arsenic, carbon dioxide and a complex family of chemicals called PAHs — short for polycyclic aromatic hydrocarbons — many of which are carcinogens.

On top of that you have billions of airborne dust particles, ranging from visible chunks of ash to microscopic specks of dust.

"The smallest particles are the biggest threat," said Bill Sessa, a spokesman for the Air Resources Board. "We're talking about particles smaller in diameter by several times than a human hair — small enough that you can bypass your body's natural filtering system and cause problems deep in the lung."

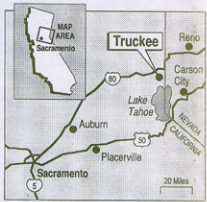
"If you live in one of these mountain areas, it makes sense to try to avoid being exposed," Sessa said.

"Anytime anyone is exposed to these pollutants above the health standard, there is ample reason for concern. But the people we are most concerned about are those who have existing respiratory problems and heart disease — and young children and the elderly."

In October 1980, the air resources board approved a list of suggested reforms, from requiring more efficient woodstoves to new homes to establishing voluntary no-burn days when air quality is poor.

In December, Mammoth Lakes went a step further, adopting a mandatory ban on wood burning when air quality is bad.

"Most people agreed we have an air quality problem," said William Taylor, associate planner for Mammoth Lakes. "You can see it



Bee graphic

and you can smell it. And they were willing to cooperate."

"In Truckee, progress has been slower. "What I hear is an unwillingness, a nervousness to proceed until the technical facts are in," said Roberts of the Northern Sierra air quality district. "There are demands to do more monitoring. The fact is people are voting with their woodstoves. Very clearly, they want to burn wood. How we deal with that desire and solve the air quality problem at the same time is going to be a very difficult proposition."

# Sierra lake turns to desert

## Winds stir raging dust storms

By Tom Knudson  
Bee Sierra Bureau

**O**WENS LAKE, Inyo Co. — Imagine a great silver lake, thick clouds of waterfowl and mountains hung like curtains on an indigo sky.

That is how settlers described this place, as a lonely Eden hatched to the dry south flank of the Sierra Nevada.

Ducks were by the square mile, millions of them," said one resident around the turn of the century. "When they rose in flight, the noise of their wings could be heard 10 miles away."

These days, Owens Lake remains a special place — special, that is, for toxicologists, air pollution control officers, epidemiologists and cardiopulmonary specialists.

Today, Owens Lake is one of North America's great environmental calamities.

Here's what has happened. Over the past 70 years, water diverted to Los Angeles has left large portions of Owens Lake dry, exposing its highly mineralized lake bed. During the fall, late winter and spring, heavy winds rip through the area, kicking up enormous, blinding — and toxic — dust storms.

"These storms can be some of the worst in North America," said Thomas Gill, an earth scientist with the Crocker Nuclear Laboratory's air quality group at the University of California, Davis. "A number of them have resulted in dust concentrations of the highest level ever recorded in California."

The numbers are startling. During one intense storm in February 1980, the concentration of dust was measured at 1,861 micrograms per cubic meter — 37 times higher than the California health standard of 50 micrograms per cubic meter.

"That was the highest concentration that's been measured in the country," said Duane Ono, a deputy air pollution control officer with the Great Basin Unified Air Pollution Control District, which includes Owens Lake.

Most heavily affected is the tiny Owens Lake community of Keeler, population about 100. But nearby Ridgecrest, which has about 30,000 people in Lone Pine, which has about 2,000, are also plagued by Owens Lake dust.

"It's definitely a problem. It's one of the biggest problems we have," Ono said.

High dust concentrations, however, are only part of the problem. The nature of the dust itself is even bigger concern.

"You could almost call it a 'witches' brew,'" said Ono. "We've seen unsafe levels of sulfur and we've found traces of selenium, arsenic, lead, mercury and salt."

"Mind you, we've only found trace amounts of some of these elements, but even a trace amount of arsenic can be dangerous. Various studies have shown it can cause cancer in humans."

Nature, it seems, is angry here, acting in ways that seem more fitting for the world of science fiction — like something out of Frank Herbert's "Dune." Here on Earth, the Dust Bowl comes to mind. Like Oklahoma during the 1930s, Owens Lake is a prisoner of dust, a hostage to the wind.

"The populace complains of coughing, sneezing and irritation of the eyes," said a report from the China Lake Naval Weapons Center, about 50 miles south of Owens Lake.

"Psychological problems emerge as some people become apprehensive because of difficulty in breathing. People become annoyed and anxious. Cats behave aberrantly."

The storms are large enough to be tracked by satellite. Some have been observed high above the Sierra, spiraling toward the San Joaquin Valley and Los Angeles. Some have even shown up over the Sierra, following the Edwards Air Force Base.

"In a series of storms in 1985, dust — washed from air by rain — fell as far south as Orange County, where it became a veritable mudfall, damaging paint and wax on vehicles and causing alarm to the public," the China Lake report said. "The major television networks announced that it was acid rain."

"The lake bed is actually growing its own dust," Ono said. "There's a lot of salt in the lake bed. And when they come to the surface, it forms these fine crystals."

"So when the wind and the sand start to blow, you get these horrendous dust storms with whitout conditions."

Even dust specialists are impressed.

"The Sahara is the biggest source of dust in the world, but on a per-square-foot basis, I suspect Owens Lake is just as good," said Dale Gillette, a scientist with the air resources laboratory at the National Atmospheric and Oceanic Administration in Boulder, Colo.

"There's a lot of vulnerable soil. And secondly, there are tremendously high winds. Places like White Sand in New Mexico, or the Great Plains during the Dust Bowl of the 1930s — maybe those places on occasion — may be stronger. But on a year-to-year basis, Owens Lake is probably the champion."

Bill Cox, director of technical services for the Great Basin air pollution control district, described his run-in with one of Owens Lake's monster dust storms.

"It was a massive storm, the largest we've ever seen for total suspended particulates. I actually drove out to turn on the sampler — so I was there when it started."

"Visibility was down to maybe one foot. When I got out to change a filter, breathing was difficult. And the dust was irritating. It was like someone taking salt and throwing it into your eyes — if you can imagine that."

It excites you. It gets you into a very tense, kind of irritable mood. It's not only the dust, but there's a lot of static electricity, too."

"The storms can last anywhere from a few hours to two or three days. But their impact on the landscape may be far more long-ranging."

"After these storms, the mountains look like they've been hit by a snowstorm," Cox said. "There's an eighth-inch of light powder over the entire area. That powder is salt. And it's a pretty safe bet that the salt is going into the ecosystem."

Concern is also growing for Owens Lake's twin to the north — Mono Lake — the largest natural saline body of water in California and one recognized worldwide for its bio-

logical abundance and eerie mineral deposits, or tufa formations.

Much like it did at Owens Lake, Los Angeles has dried up large portions of Mono Lake. And while a court order preventing further diversions was recently extended, Mono Lake continues to suffer.

One highly visible sign of trouble is a storm cloud of salt, sand and toxic chemicals that builds over Mono Lake during periods of high winds.

The dust storms "affect vegetation, tufa formations, wildlife and human activities," said a 1987 National Academy of Sciences report on Mono Lake. "Much more research is needed on all of these problems."

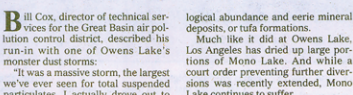
The same is true at Owens Lake, where scientists still are struggling to answer many key questions: How does the dust affect human health? How does it change the chemistry of desert soil? And how can it be controlled?

From this great tragedy, they hope to glean great lessons.

"Owens Lake is a wonderful natural laboratory, a classic example of desertification," Gillette said. "After all, it used to be a lake. And now it's a desert."

"It gives us some idea of what can happen when you're doing things like logging or grazing," he said. "It's an extreme example, but often we learn from studying the extreme — rather than something in between."

A toxic dust storm sweeps across Owens Lake. The dust has been found to include sulfur, selenium, arsenic, lead, mercury and salt.



Special to The Bee



Owens Lake has 110 square miles of lake bed and only 30 square miles of water

Bee graphic/ K/Is Hofmann

## THE SERIES

**SUNDAY:** California's Sierra Nevada — one of the world's great mountain ranges — is suffering a slow death.

The vulnerability was documented in an eight-month investigation by the Bee, involving more than 200 miles, 10,000 miles of air travel and the examination of a

small mountain of documents.

There are no official estimates of overall environmental damage to the Sierra Nevada for one simple reason: no government, university or environmental group has taken an exhaustive look at the entire range.

The Bee's investigation, though, uncovered plenty of reasons for concern. Across the range, one can find an assortment of threatening scenes, including heavily logged forests, barren, eroding soil, silty-choked streams and scenic vistas fouled by air pollution.

**TODAY:** Throughout much of the Sierra Nevada, the "air the angels breathe" is fouled by a not-so-heavenly cloud of contaminants — ozone, sulfur dioxide, polycyclic aromatic hydrocarbons, carbon monoxide, nitrogen oxide, particulates and other chemicals.

Few parts of the range have been spared. During the summer, west-facing foothills and canyons are immersed in great ash-colored clouds of pollution. In the winter, once sparkling skies are smudged with yellow, brown and gray.

The spectacle of too many woodstoves, automobiles and people in the mountains.

**TUESDAY:** The Sierra Nevada forest is dying. Logging is the most visible and controversial agent at work in the Sierra. But air pollution, drought and insects are inflicting great damage, too.

And there is one other problem — more subtle than the rest — causing enormous harm: fire suppression.

Like soldiers in a sleep, Sierra Nevada forests are falling and falling fast. The backgrounds are gray. North Mountain, Duncan Canyon, Black Mountain, Red Cow, Creek, in its toughest hour, the Sierra Nevada forest can find little mercy.

**WEDNESDAY:** Along the back roads of the Sierra Nevada is a battered and bleeding land, places where trees, grass and other vegetation have been peeled away and soil is washing into mountain streams at staggering rates.

The problem draws little attention — not enough, partly because gullies — unlike spotted owls — are not very glamorous. The Bee's investigation found that damage to soil and streams is perhaps the most serious and overlooked problem in the Sierra Nevada, one that threatens the essence of the range and the lifeblood of California — mountain watersheds.

**THURSDAY:** The Sierra Nevada, one of the world's great mountain ranges, is slowly dying — and no one seems able to help it.

Once majestic skies are filled with pollution. An emerald forest is sick and brown. Soil is washing away. Streams are lined with mud. People are moving in — and wildlife is moving out.

Today, though, things are starting to change. Concern is growing, rumbly like a summer thunderstorm along the Sierra crest. You can hear it in mountain towns from Quincy to Camp Nelson, over camrings along the John Muir Trail, even in some quarters of the U.S. Forest Service.

MAJESTY AND TRAGEDY  
THE SIERRA IN PERIL

# about what's left, what's vanishing, what's doing well

By Tom Knudson  
Bee Sierra Bureau

**N**EVADA CITY — Every autumn, the ritual begins. Somewhere in the high country, a deer takes a step, then another and another.

Soon, mule deer throughout the Sierra Nevada are on the move, drifting downhill, where hunters kill them they will find food, safety and shelter.

These days they are more likely to find trouble.

"We get calls about deer caught in runways, over fire roads, or deer leaping around subdivisions," said Jeff Finn, a California Department of Fish and Game biologist. "Some people want us to round them up and take them away," he said. "We can't do that. There's no place to take them."

Finn's story is not unusual. Throughout the Sierra — a land once rich in wildlife — mule deer and many other creatures are being pushed, squeezed and subdivided into oblivion.

The story is a familiar one: The grizzly bear — whose figure adorns the California state flag — was exterminated from the Sierra long ago. Within the past decade, the California condor vanished from the mountains. Today only a handful survive, all in captivity.

There are, however, a much broader range of wildlife in danger. The common loon no longer nests in the high country. The silver chub is being lost by people ever so often. The willow flycatcher is disappearing. The great gray owl almost gone. And the foothill yellow-legged frog — common until recently — is extinct in the southern Sierra.

"The need to act is urgent," said a 1990 California Policy Seminar report on biodiversity in California. The report was prepared by a joint group of state and University of California officials, went on to say:

"If we do not take immediate actions, it is likely that within decades ... not necessarily the habitat designations we have will lead to a massive wave of extinctions."

Each species has its own sad story of decline. But most have been common in every time they are imperiled by mankind.

And therein may lie a warning. "Every time I go into the mountains, it's like writing an obituary for wildlife," said Susan Sanders, a wildlife biologist and private consultant based in Berkeley.

"When you talk about development in the mountains," there is almost never anything good happening to wildlife. Wildlife always loses out."

California has lost this kind of thing before. Since the 19th century, the state has lost 80 percent of its coastal wetlands, 94 percent of its interior wetlands and 89 percent of its valley grasslands. Now the push is on in the Sierra.

In Yuba County, nearly all winter range for mule deer had been zoned for residential development. Already, deer had disappeared from many parts of the county.

In Fresno County, the North Fork Kings River had been zoned from 17,000 animals in 1950 to around 1,900 today — due largely to the development of winter range, roads and reservoirs.

Throughout the Sierra, more than 200 miles of riparian habitat have been damaged by livestock grazing, water projects and mining.

Often, government is itself an enemy. In recent years, county governments have paid more attention to the needs of developers than to the needs of the land and wildlife. But top officials now say that "is changing."

Science has not led the way, either. Across the range, data about wildlife — especially non-game species — is "scattered, piecemeal and incomplete," the existing text to highly technical and of little interest to the public.

Dear Mr. Deane, I would put it in a paper published by the Western Section of the Wildlife Society: "We currently know almost nothing about the extent, the intensity or the species, the organochlorine levels in the kidney fat of western leucis and other life history data, and infimum."

"What we are deficient in," said Charrier, who recently retired from

## Sierra's vanishing wildlife

### Foothill yellow-legged frog



Gray, brown, reddish or olive above, often spotted with yellow on underside of hind legs onto lower abdomen  
SIZE: 1.5 - 2.8 inches  
HABITAT: Rivers and streams of woodland, chaparral and forest  
STATUS IN SIERRA: Extinct in southern Sierra

Today, another Sierra amphibian — the mountain yellow-legged frog — may be in trouble. "It's an animal that occurs in virtually every fishless pond in the high Sierra, from Tahoe to Sequoia," Graber said. "There are already a large number of bodies of water where we don't find it."

The foothill yellow-legged frog is now officially extinct in Sequoia — the first recorded extinction of a vertebrate animal since the grizzly bear disappeared in 1922.

The cause of the frog's demise remains uncertain, but one leading suspect is air pollution. "Mysterious things are happening to frogs — they're disappearing all over the world," said Graber. "And we really don't know why."

### Common loon

In 1974, Richard Stallcup saw something remarkable: a pair of common loons nesting at Twin Lakes in the eastern Sierra. "No one has seen such a thing since."

"They were so beautiful," said Stallcup, an amateur naturalist. "Their behavior was so unusual — they were nesting in a meadow. They were so beautiful, they chilled your soul."

Known widely as a bird of the arctic wilderness, the common loon still passes through the Sierra on its annual migrations. But it no longer nests here.

"Loons, in particular, seem to be very susceptible to human disturbance — things like motorboats, even backpackers," said Paul Kelly, a non-game biologist with the California Department of Fish and Game.

"They will abandon their nests when they are disturbed." "The loss of the loon," said Kelly, "is an indication that some fairly subtle changes took place 10 to 20 years ago that may foretell more dramatic changes to come for the Sierra."

arrived at Dinky Meadows one day after a heavy rain. "I was gone. Once common throughout much of the state, the willow flycatcher has nearly vanished as its nesting grounds — streams and meadows, have been converted to other uses. Today, only about 200 nesting pairs remain, all in the Sierra."

Last year, the California Department of Fish and Game warned that the end may be near. It declared the willow flycatcher an endangered species in California.

"These meadows are the last remnants of habitat keeping the bird alive," Valentine said. "Such stories can be found throughout the Sierra, where ranchers' livestock are wallowing into streams and meadows, uprooting meadows and systems, causing serious soil erosion and hurting vegetation from aquatic insects and other animals."

It is one of the oldest problems in the mountains, one that naturalist John Muir himself was deeply concerned about. "It is almost impossible to conceive of a devastation more universal than I produced by sheep," he wrote in 1873.

"When an animal is that rare, the ordinary rules of statistics don't apply. You can't say very much of anything. If you go from six sightings one year to four the next, does that mean the population has dropped by a third? I doubt it. For all we know, it could have gone up. On the other

The Sierra Nevada is no longer a refuge for wildlife. Throughout the range, logging, road building, urban development, water impoundment projects, pollution and tourism are exacting a heavy toll on mountain wildlife. The common loon no longer nests in the mountains. Nor does the harlequin duck. The great gray owl is hanging on — but barely. And the foothill yellow-legged frog already is gone.

Here's how some people describe the situation:

In 1988, David Graber noticed something unusual: the foothill yellow-legged frog had disappeared from Sequoia National Park.

"This is an animal that if it's there, it's very easy to see," said Graber, a research biologist with the park. "It's always right by the side of the stream, waiting to jump in."

"I sent my wildlife biologist out to look for them. I searched him out three times — and three times he denied me. And that was the end of the story."

"Damn it," said Graber, "these animals used to be here, they were common, and nobody has recorded one since 1971."

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### Harlequin duck

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One suggestion was put forth in "Birds of Special Concern in adjacent meadows and bog," a publication of the California Department of Fish and Game:

"Human disturbance along streams used for breeding and perhaps damming of rivers seem to be the only plausible reasons for the decline."

"No single reason fully explains the limited attention. A key factor, however, centers around regional agency consumptive uses of land."

The report took aim at another key issue: basic lack of information about wildlife on national forest lands. "This limitation," the GAO said, "prevents Forest Service managers from making an overall judgment on the health of wildlife."

By 1988, the GAO said, a deputy regional forester for the Forest Service in California, discovered:

"Wildlife is not caught the short shrift. Wildlife values and habitat will continue to improve."

"Over the past 15 years, we've had a major infusion of dollars. The staffing of wildlife and fisheries biologists has grown by several hundred percent. So we have much better data."

The GAO also noted the Forest Service is undergoing a process of change. But it added: "More experience is needed to determine how successful this effort will be."

Today, a idea has emerged that may help recapture some of the lost birds and plants of the Sierra. At its simplest, a wildlife corridor is a pathway for animals — patches of forest, meadow and river valley strung together like pearls on a string, guiding wildlife north to move from one habitat to another.

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