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Wildfire is a fact of life in California.

U. S. Forest Service photo

Understanding fire

Remember the fires of 1994? 1987? Every year in California is a fire year, and with every fire, the fear of fire mounts, fanned by ignorance and self-interest. John Buckley, a former Forest Service firefighter and "hot shot," wrote this guide to fire ecology and wildfire risk in the Sierra Nevada, but much of the information applies equally to other fire-prone parts of the state. This month part one, Fire Basics.

By John Buckley

What makes the difference between a small, slow-burning fire and a blaze that wipes out huge sections of the forest—killing wildlife and threatening homes? Does salvage logging really reduce fire danger? Learning the basics of fire helps us to predict what fires will do in certain situations and to lobby for fire and fuels management that best reflects the needs of nature as well as people in the Sierra Nevada region.

Let's start by imagining that in late August a lightning strike ignites a small fire on a very steep, south-facing slope in mixed-conifer forest in the Sierra National Forest. To understand what such a fire might do, let's say that the dry-lightning storm is breaking up, and as the sun breaks through the clouds, the late afternoon air begins to warm back up quickly. A breeze is blowing upslope and up-canyon at eight miles per hour. Most of the forest above the fire is filled with manzanita bushes, bearclaw, and thickets of small cedars in between the larger pines and firs. Snags and down logs are plentiful from the recent deprivations of drought and bark beetles.

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Faced with a dilemma, Shasta-Trinity activists stick by Bonanza King Roadless Area

By Ryan Henson

Like many of California's wildlands, the Bonanza King Roadless Area in the Shasta-Trinity National Forest was virtually unknown until the Forest Service, completed its second roadless area review and evaluation (RARE II) survey in the 1970s. At 19,600 acres, the Bonanza King was identified by conservationists as a small yet critical link in maintaining the ecological health of the Shasta-Trinity. Bonanza King might have returned to obscurity had not the Forest Service recently presented northern California conservationists with a painful choice: whether to sacrifice the roadless area in the hope of keeping loggers out of other, more popular wildlands. In the context of the current anti-conservation majority in Congress and recent appeals from the Clinton administration for activists to stop opposing the efforts of the new, supposedly more ecologically minded Forest Service, the dilemma was both immediate and complicated.

Looking at the Bonanza King, one would never guess that it is the center of a controversy. The wildland is a dry, steep region drained by the Trinity River, the East Fork Trinity River, Scorpion Creek, and several smaller streams. At its heart is a ridge, with 6,900-foot Bonanza King Mountain its highest point, which bisects the roadless area from north to south. Though there are pockets of old-growth ponderosa pine and mixed-conifer forests, gener-

ally the area is characterized by oak woodlands, chaparral, grasslands, and stands of knobcone pine. The frequent fires that burn through the area every few decades ensure the dominance of these fire-tolerant species.

Indeed, the Bonanza King Roadless Area and the lands around it are inherently fire prone. Many of the ecosystems in the region—chaparral fields, dense groves of knobcone pine, grey pine stands, and thickets of live oak—depend on fire to regenerate themselves and remain healthy. Major fires burned through the roadless area and surrounding lands for millennia, leaving small pockets of old-growth ponderosa pine only in deep, cool riparian areas and high on ridgetops.

Though these fires are natural and even essential for the health of the Bonanza King's ecosystems, combined with logging they can be devastating. Indeed, much of the land surrounding the roadless area was heavily logged decades ago, and many of the areas that successfully grew back after clearcutting burned completely in recent fires. At the same time, many of the old-growth groves that escaped high-intensity fires for centuries were destroyed by logging, leaving very little old-growth forest outside of the roadless area. This catastrophic loss of ancient forest pushed Scorpion Creek and other streams in the region to the ecological breaking point by increasing silt levels, removing streamside vegetation, and raising water temperatures.

In addition to the damage to the area caused by the combined effects of fire and logging, fire fighting itself has heavily damaged the area. To fight the Scorpion fire in 1994, the California Department of Forestry and Fire Protection constructed firebreaks directly along the banks of Scorpion Creek, thus heavily damaging the stream by clearing vegetation and cutting down trees. That such riparian areas are natural firebreaks without human alteration and often are the last refuge for wildlife seeking to escape forest fires did little to sway the agency. Ironically, raising money to repair the damage caused by fire suppression

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Coalition news

Monthly Report

Most foot trails are hard to distinguish from 33,000 feet. But my flight last month took me over Colorado's South San Juan Wilderness, where fresh snow highlighted the Continental Divide Trail. I saw the place where Wendy and I camped back in 1990, a spot near where a grizzly was killed some years before.

Earlier, I had flown over the Green River's Desolation Canyon, site of our float trip last summer.

Our wilderness trips had taken nearly two weeks each by foot or boat; I had but minutes to gaze at these wild places while I was zipping along in a Boeing 737.

My destination was Albuquerque, the new home of Nancy Morton and Dave Foreman. Although I like my house in Village Homes, I certainly envied theirs. Not necessarily for their lodge (an attractive passive solar home), but more for its location. A scant three blocks away was the Sandia Mountain Wilderness. Not bad for city living.

We were joined by David Johns and Rod Mondt, staff of the Wildlands Project (TWP), to discuss "franchising" the organization. TWP was never envisioned as a large, top-down group. Instead, we felt it should help coordinate the efforts of those throughout the continent who share our vision of restoring native biodiversity to North America.

We met to hammer out the nitty-gritty of working with regional organizations to fulfill our shared dream. California, it turns out, is a unique place (as we all know), with the CWC covering most of the ecoregion. Other ecoregions, such as the Great Basin, cover many states with no one group representing the entire region.

Refining TWP's regions and subregions, identifying the key players, identifying priorities, and developing a work plan ate up our days. But with Sandia Mountain beckoning to us through the living room window, we did find time to take some hikes in the adjacent wilderness.

Only a week earlier Ryan and I spent several days on the banks of the Klamath River at Orleans,

meeting with activists from the Klamath-Siskiyou bioregion. Felice Pace had brought us together to work out our differences, discuss options, and hatch strategies. We got in some short hikes by day, and by night Ryan and I joined Dave Willis for some dart throwing. Since I used to be a lot more accurate, I had to resort to blaming the poor condition of the aluminum "feathers" on the darts. Feathers indeed.

I guess I'm just a traditionalist. Despite my interest in video equipment, computer technology, and Internet communications, I do stick with the old tried and true.

I don't own any Lycra, Gore-Tex, or nylon taffeta. When it's too wet for jeans and a T-shirt, I switch to wool. I don't ski—I plod along on wood and rawhide snowshoes.

So another February weekend found me slog-ging alongside a bunch of skiers. Wendy and I now make an annual snow pilgrimage to Sorensen's resort, where Inyo is allowed (on his best doggie behavior). We joined friends Tom Suk, Alia Selke, Roland Knapp, and Sally Miller for a jaunt into Desolation Wilderness. Everyone but Inyo and me was on skis (Inyo's four-leg drive lets him trot along with the lead skiers). Since most of January was rainy or foggy, it was delightful to bask in the sun and see distant vistas.

That evening, while the aroma of Tom's cooking caused our stomachs to growl with anticipation, we discussed fish stocking in wilderness. We debated the latest missive from Canyon Fred and whether opposition to planting exotic trout in the wilds makes sense either biologically or politically. In that company, the fish had few friends.

But all agreed that debate was healthy, and the fish deliberation continues in this issue of the *Wilderness Record*. Too often scientists ignore political reality while pragmatists misconstrue changing values. By debating all these issues, we hope there may be an opportunity for reaching consensus on fish stocking.

By Jim Eaton

Coalition to honor Alan Cranston at annual fundraiser, May 14

On Mother's Day the California Wilderness Coalition (CWC) will honor one of the fathers of California's wilderness system—Senator Alan Cranston. During his 24-year Senate career, Senator Cranston labored on every major piece of wilderness legislation since the 1964 Wilderness Act and delivered 45 wilderness areas.

Join us in Davis on May 14 for the Coalition's annual fundraiser, a celebration of Senator Cranston's unparalleled legacy of wilderness. Tickets for the main event are \$10; patron's tickets, at \$35, include a reception with our honored guest. For information about ticket reservations, sponsorships, and volunteering, please call Lora Leerskov at the CWC office, (916) 758-0380.

Wilderness Trivia Question

Name the federal wilderness areas in California Senator Cranston didn't work on. (Hint: there are only three.)

Answer on page 7

Call for slides

We are assembling a slide show of California wilderness for the evening of Senator Cranston's visit. If you are willing to donate or lend slides for the occasion, please send your three or four best slides to the CWC at 2655 Portage Bay East, Davis, CA 95616 by April 10. Include a description of each slide, and your address if you want them returned. Slides from any wilderness except Hoover, San Gabriel, and Thousand Lakes—the only wilderness areas Senator Cranston *didn't* work on—are needed.

We ask; we receive

Several people responded to our February appeal for spare computer parts, but Ridge Builders Group of Davis surpassed our fondest hopes with the donation of a Macintosh SE30 and peripherals, which already have given us faster faxes and freedom from the surprises attendant on stuck option and shift keys. Our thanks to David Kane, Bob Schneider, Virginia Thigpen, Larry von Wald, and the folks who offered spare parts.

We're still looking for a Macintosh II.

Welcome aboard

Ryan Henson begins work as the California Wilderness Coalition's full-time conservation associate in March. He first came to us as a volunteer in 1989, when he was studying history and political science at U. C. Davis, and has been around sporadically ever since.

A native of Mendocino County, Ryan grew up with the Mendocino National Forest his refuge and backyard. While in high school, he grew incensed about clearcutting on the Eel River, and a conservationist was born.

A stint in the Navy and a flirtation with graduate school only delayed the inevitable for a man who is most at home in chaparral and oak woodlands and wants to make saving wildlands his life's work.

Though Ryan can point with pride to roadless areas in eight national forests saved from logging by his intervention, he also knows that "the agencies keep coming back." For Ryan as for all of us, "there are no permanent victories without wilderness designation."

Belated inductions to Desert Hall of Fame

The Desert Hall of Fame that appeared in the November 1994 issue of the *Wilderness Record* was regrettably incomplete. Two Audubon activists who should have been included in that list of citizens who made extraordinary contributions to the passage of the California Desert Protection Act were omitted.

Rich Cimino in the Bay Area and Jim Middleton in Sacramento were instrumental in organizing Audubon's grassroots efforts on behalf of the desert bill and in attaining favorable editorials and endorsements for the legislation.

We apologize for the delay in honoring their work.

Help Save California's Native Wildlife Habitat. Fill in Line 50 on your tax form.

Dear Tax Preparer:

Please make my voluntary contribution in the amount of \$_____ to the **Rare and Endangered Species Preservation Program** on my California State Income Tax Return. Thank you.

Cut Along Dotted Line And Give This To Your Tax Preparer

Letters

Re "Go figure: taking the measure of wilderness": By Act of Congress in 1866, 1975, and 1988, the "metric" or SI system is the preferred United States system of measurement. Federal agencies are mandated to use SI (*systeme internationale*) units beginning October 1992. The California Department of Transportation (Caltrans) now requires construction bids to be submitted in SI units.

The U.S. Forest Service has been making the transition to SI units since 1977. There is no excuse for using a pre-1866 measuring system in 1995. Wood is measured in cubic meters because cylindrical logs leave considerable mill "waste" and cubic measurement is a better accounting of volume (versus dimensional lumber). Land is measured in square hectometers, not hectares.

Our money, cigarettes, alcohol, soft drinks, firearms, skis, film, paper, automobiles, and many other aspects of daily life are metric. NAFTA and the Uruguay Round that form the Western Hemisphere trade block mean we will increasingly use SI units. A system based on 10 is much easier to use than obscure archaic pre-1866 units. A gram of prevention is worth three kilograms of cure.

Scott Kruse
Fresno

Ancient forests

Bonanza King emerges from obscurity and into controversy

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sion efforts is one of the Forest Service's rationales for logging the Bonanza King Roadless Area.

Citing fire danger, the threat of insect infestations, and the need to recover the market value of the burned forests before they begin to decay, in late 1994 the Forest Service proposed to salvage log the area burned by the Scorpion fire, including hundreds of acres in the Bonanza King Roadless Area. In recognition of the watershed, wildlife, and recreational values of the region, the Forest Service proposed not to construct roads, use bulldozers, cut along streams, or leave vast clearcuts within the roadless area. Instead, the logging plan would cut only a small number of trees and remove them by helicopter.

In return for these significant concessions, the Forest Service declared at a meeting with the public in January 1995 that it is not required to write an environmental impact statement (EIS) before authorizing logging and that it is free instead to prepare only a smaller, less-detailed environmental assessment (EA). The conservation groups present at the meeting informed the agency that Forest Service regulations require an EIS for any project that would "substantially alter the primitive character" of roadless areas 5,000 acres or more in size. Since the Forest Service conceded that the Bonanza King is now at least 9,000 acres in size despite some logging since RARE II, the only justification the agency could offer for writing an EA is that salvage logging would not substantially alter the Bonanza King. Complicating things further, the Forest Service stated that if forced to do an EIS for the project, the agency would abandon its logging plans.

None of the conservation groups present at the meeting accepted the Forest Service's questionable interpreta-

tion of the EIS requirement, but they realized that the current anti-conservationist Congress would relish the chance to portray a rejection of so seemingly reasonable a proposal as a sign of environmental extremism and welcome an excuse to do away altogether with the EIS requirement. Though the conservation groups never seriously considered sacrificing the Bonanza King to the agency's plans, they agonized over the most politically astute way to save it in the new, highly sensitive post-election environment.

After a great deal of reflection and discussion, the California Wilderness Coalition, Citizens for Better Forestry, Klamath Forest Alliance, Wilderness Society, and South Fork Mountain Defense Fund decided to put aside byzantine political considerations and tell the Forest Service either to do an EIS as required by law or stay out of the Bonanza King. Though the conservation groups conceded that the Bonanza King is not the largest or most scenic roadless area



The Scorpion fire burns in the Bonanza King Roadless Area with the Trinity Alps Wilderness for a backdrop. Photo by Mark Arnold, USFS

Pilot Creek watershed analysis can't find its own roadless area

By Steve Evans

One of the key components of President Clinton's plan for the forests of the Pacific Northwest (Option 9) is special management for designated "key watersheds" to provide refuges for declining salmon and steelhead stocks. The Forest Service now has completed a handful of watershed analyses for key watersheds in northern California, and unfortunately, it looks like business as usual.

Option 9's management direction for key watersheds prohibits new roads in roadless areas and requires that the existing road system outside of roadless areas be reduced (thereby reducing sources of erosion and sediment). At the minimum, the direction requires no net increase in road mileage. In addition, an analysis is to be conducted for all key watersheds before any major activities like timber sales are allowed. One of the primary purposes of the analysis is to identify opportunities for watershed restoration.

The Pilot Creek watershed analysis prepared for the Six Rivers National Forest fails to mention the existence of the Pilot Creek Roadless Area identified in the 1979 roadless area review and evaluation (RARE II). This omission perpetuates an unwritten Forest Service policy of ignoring roadless areas. It is impossible to comply with Option 9's prohibition against building new roads in roadless areas unless the existence of roadless areas is acknowledged by the managing agency.

The system of roads and associated clearcuts in the Pilot Creek watershed have contributed to the decline of the creek's native steelhead population. Since the 10,210-acre Pilot Creek Roadless Area was inventoried in 1979, road building and logging have reduced the size of the roadless area by 53 percent. As the roadless area has declined, so has the watershed's sensitive steelhead fishery. In fact, steelhead stocks have declined so precipitously that they currently are under consideration for potential listing as a threatened or endangered species.

Option 9 also directs the Forest Service to reduce road mileage in the roaded portions of key watersheds. Out of

60 miles of existing roads in the watershed, the Forest Service identified only six miles that are "cost effective" for immediate decommissioning. Although the road inventories are not complete, it is doubtful that decommissioning 10 percent of the road system will significantly increase the viability of the watershed's degraded steelhead habitat.

Option 9's special direction for key watersheds was intended to reverse the decline of stocks of salmon and steelhead that are at risk. If the Pilot Creek watershed analysis is any indication, this direction may be little more than wishful thinking.

What you can do

Write a letter to Forest Supervisor Martha Ketelle, Six Rivers National Forest, 1330 Bayshore Way, Eureka, CA 95501. Ask how the Forest Service intends to comply with Option 9's mandate of no new roads in roadless areas without identifying what remains of the Pilot Creek Roadless Area in the key watershed analysis. Urge her to protect the roadless area as a refuge for the creek's steelhead population and pursue an aggressive road closure program in the watershed to reduce sources of erosion and sediment.

Modoc watershed analysis is very dry

The Forest Service has begun a planning process that will determine the future management of 85,000 acres of the Modoc National Forest in northeastern California, a strange landscape of lava flows, ice caves, craters, and ancient forests that is home to pine martens, goshawks, bald eagles, peregrine falcons, and northern spotted owls.

The presence of northern spotted owls meant that the area, which the Forest Service has dubbed Medicine Lake Highlands, is subject to the dictates of Option 9, the president's strategy for protecting ancient forest habitat in the owl's range. Option 9 ordinarily requires watershed analyses, but the absence of significant surface water flows

in the Trinity Mountains, it has inherent value by virtue of its undeveloped character. It is hubris, they concluded, for the federal government (or conservation groups for that matter) to place an economic, aesthetic, or other human value on wildlands like the Bonanza King and then declare them expendable. As for the EIS requirement, the conservation groups reaffirmed that it is no mere legal technicality but a hard-won recognition of the irreplaceable ecological, social, and spiritual value of roadless wildlands. Unless the Forest Service strictly adheres to the EIS requirement, roadless areas can be logged and developed almost at will as they were in the past.

Unfortunately, the Forest Service appears to be testing the dedication of conservation groups and the public to roadless area protection throughout the west. The agency's recently unveiled Western Forest Health Initiative targets thousands of acres of roadless wildlands for salvage logging and other development activities in the next few years (see January 1995 *WR*). Forest Service Chief Jack Ward Thomas and Clinton administration officials increasingly are promoting roadless area logging for "forest health" and economic reasons. Anti-conservation members of Congress, including California's Representative John Doolittle (R-Roseville), have announced their intention to make salvage sale proposals in roadless areas and other lands immune from federal environmental laws.

With these threats on the horizon, the dilemma of the Bonanza King Roadless Area may have import for activists in other regions. And the dilemma is by no means resolved. The Forest Service recently declared that it is still considering salvage logging the Bonanza King without preparing an EIS.

Ryan Henson is the California Wilderness Coalition's conservation associate.

in this western portion of the Modoc National Forest forced the Forest Service to create another geographic unit for its analysis.

The Medicine Lake Highlands unit includes two roadless areas, Mt. Hoffman and Burnt Lava Flow. The 12,500-acre Mt. Hoffman Roadless Area is dominated by Glass Mountain, a 7,600-foot volcanic monolith of pumice and obsidian that has been recommended for national natural landmark status by the Forest Service. The western half of the roadless area is heavily forested with red fir, western white pine, and lodgepole pine, forests that are

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Understanding fire

Fire Basics

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Under these conditions, fire usually would escape initial attack efforts. Such a fire first would consume ground covers, dead wood, and young trees. Then, as it grew in intensity, it could move quickly up into the canopy of the larger trees, blowing from crown to crown, preheating the forest upslope, and sending embers far ahead of the fire to further frustrate any suppression attempts.

The resulting slicked-off, burned-to-a-crisp mountainside would have few, if any, benefits for wildlife or humans. And clearly such a fire would cause many problems—air pollution, loss of habitat, eroded topsoil, at least a partial loss of timber value, loss of plant diversity, damage to recreation, and a threat to human lives and property. Through a clear understanding of fire physics and the basics of fire behavior, we can understand how to minimize such "bad" fires and how to create conditions where "good" (low-intensity) fires will be far more likely to occur.

The fire triangle is the beginning point for understanding combustion (see Figure 1). Each side of the triangle must be in proper proportions for a fire to burn. Heat, fuel, and oxygen are right in the room around you as you read this. So why isn't there a fire?

In your room at this moment there's insufficient heat in contact with fuel. But raise the heat in your room to the ignition temperature for the fuels, and fire will immediately start to spread. How hot the fire burns would depend on the fuel. What the fuels are and how the fuels are arranged may stall the fire or make the whole room flash over with flames.

Oxygen is a critical component of fire. If your room is well-sealed, the fire might burn for a while, consume most of the oxygen, and then smoulder, nearly going out. But open the door or a window and give the smouldering fire a blast of oxygen (air), and you'll see that smouldering fire explode to life.

Likewise, any fire that burns in the forest depends on all three legs of the fire triangle being in the right proportion. Oxygen is a given. In our atmosphere, oxygen is normally about 21 percent. Fires in the forest environment are able to burn when oxygen levels are above 14 percent. So except for rare instances, there will be enough oxygen in any forest setting to allow combustion. Winds can increase the oxygen leg of the triangle by rapidly pushing fresh oxygen into the fire, or the fire itself can suck in air as the hot air rises.

Fuel is consistently available in wildlands, but not always in a state that allows it to be burned. Has it been

raining recently so that the fuels are soaked, or is the forest in the midst of drought conditions with fuels so dry they snap when broken? The condition of fuel (type, size, moisture content, and arrangement) is the only part of the fire triangle that can readily be manipulated by forest managers. Fuels may determine whether a fire will blow out of control or be easily managed.

Heat is only infrequently available in the forest at a temperature high enough to produce fire. Heat can come from lightning, careless campers, or accidents like car crashes or burning homes. But even though heat is not consistently available, if you combine thousands of lightning strikes each year with millions of tourists with campfires and cigarettes, enough ignition or heat sources are produced to start the thousands of wildfires that burn each fire season in the Sierra Nevada.

Heat is a form of energy that's measured by temperature in degrees. When fuel is exposed to heat, the fuel doesn't initially burn. Instead, the pine needle, grass, or twig begins to give off gases. The temperature at which gases are produced is called the vaporization point.

If heat continues to be applied, the fuel continues to heat and produce flammable gases. When the gases reach the ignition temperature, they burst into flame.

For most forest fuels, that ignition temperature is 500 to 750 degrees. Then the fuels continue to heat as they burn. The normal burning temperature of most forest fuels is 1,200 to 1,400 degrees.

A key to understanding the intensity of fires in the forest is heat output, which is measured in British Thermal Units (BTUs). If a pile of burning logs is stacked closely together and is engulfed in flames, it will produce great quantities of BTUs and be very, very difficult to put out, even with lots of water. But scatter those same logs around on the forest floor prior to igniting them, and their heat output will be far lower (far fewer BTUs) and the fire will be much easier to put out. The more BTUs produced, the harder it is to control the fire and the more that heat radiates out from the burning fire. The greater the amount of radiated heat, the more damage to surviving trees, other plants, and wildlife.

There's only so much a forest manager can do to break down the heat leg of the fire triangle. Fire prevention talks, Smokey Bear signs, and patrolling firefighters can only reduce ignitions, not stop them. And no one is likely in the near future to come up with any way to stop lightning.

So oxygen is always available, sufficient heat is provided by lightning or human ignition sources, and fuels usually are dry enough to burn from springtime through the end of fall. What we end up with is the assurance that the fire triangle will be in proper proportion for many, many fires every single year. As we'll see as we complete fire physics, the peak in recreational use from mid-July through mid-September coincides with the driest, hottest part of the fire season and is also the time when the fire triangle is in the very best balance for fires to burn. And accordingly, that's the time when the most devastation occurs.

The fire suppression operations of the Forest Service, California Department of Forestry and Fire Protection (CDF), and National Park Service have evolved to a point of technological advancement in terms of air retardant drop planes, incendiary devices for backfires, infrared imagery, equipment, communications, and training. But ask any experienced fire official if there ever will be a way



A fire burns in the Stanislaus National Forest. USFS photo

to stop all fires from burning in the Sierra Nevada and you'll get a vehement "Never!"

Because of the vastness of many Sierra Nevada national forests, the time it takes for the first fire engine to reach a new fire can range from a few minutes to over an hour. By then, many fires on steep slopes have burned completely out of control. Helicopter crews and drop planes often can get to a wildfire more quickly, but periodically "lightning busts" occur with many fires breaking out at once. A helitack crew can attack only one. At other times, fire crews all may be assigned to a single blaze that threatens homes or other private property. If a wildfire breaks out simultaneously far out in the forest, no one may even attempt to work the new fire until the property-threatening blaze is contained.

So if stopping all fires isn't the answer to damaging conflagrations, the alternative is to significantly reduce the intensity of fires that do burn. With knowledge of fire basics, the intensity of most fires can be reduced to a level where fire creates benefits for the ecosystem, rather than problems.

Fire behavior holds the key to fire intensity.

Fire Behavior:

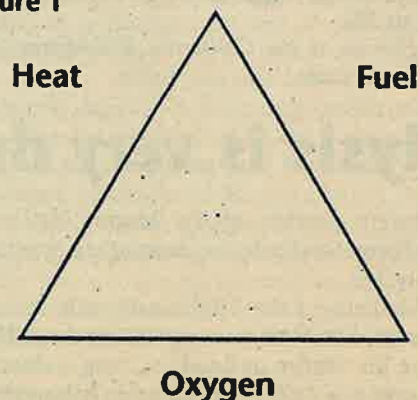
What makes the difference between a small fire and a conflagration?

Fire behavior may appear simple, but even the most advanced computer programs, fed by the best input, often can be fooled when they try to predict what a fire will do. Fire behavior is determined by fuels, weather, and topography.

During extreme fire behavior conditions, the heat from burning fuels generates such strong indrafts of rush-

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Figure 1



Each side of the fire triangle must be in proper proportion for a fire to burn.

Understanding fire

Fire behavior

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ing air and such erratic bursts of flame that fire whirls, similar to small tornados, erupt above concentrated hot spots. When exceedingly hot, dry weather conditions combine with the right fuels and the right topography, fires can grow to a size and intensity called a "blow-up" or "firestorm."

At the opposite end of the spectrum, when damp, cool, windless conditions prevail, the same fuels and topography may create fire behavior conditions that are perfect for a low intensity, easily controllable fire.

Topography

Before we look at fuels and weather, let's briefly highlight how topography affects fire conditions. Topography includes aspect, steepness, elevation, and landform shape. Each one of these conditions distinctly affects how a fire burns. For activists to understand the potential for destructive or beneficial fires in their local forest, it's important to understand the role topography plays.

Aspect

Picture a mountain in the Sierra Nevada that's shaped like a cone. First thing in the morning, the sun strikes the east or southeast aspect of the mountain. By noon, most of the sun's rays shine directly on the south-facing slope. By mid-afternoon, the sun's rays are striking mostly against the southwest-facing slope of the cone. And as the sun goes down, the west/northwest slope gets the fading sunlight.

Aspect affects fire intensity. A fire burning mostly on the north slope of a hill will burn in shadier, cooler conditions than one that burns on the south. Such a fire may smoulder, or burn slowly in contrast to the one on the hotter, drier, sunnier slope.

Aspect also comes into play with the time that the fire is burning. A prescribed burn lit on a southeast slope in late afternoon may smoulder all night, because the sun is gone from that slope for the day. During the night, cool conditions continue to prevail. Suddenly, late the next morning, when sunshine has directly heated and dried the fuels around the smouldering burn, the fire may heat up, spread rapidly, and roar upslope.

The south and southwest slopes are the driest, hottest exposures. This is important to remember as you consider the merits or flaws of projects like natural fuels treatment burns or wildlife habitat burns. A fire that just creeps around or hardly leaves any visible signs on the east or southeast side of a mountain may, when it moves around the mountainside onto the hotter, drier southwest aspect, burn in long, hot strips that kill many large oaks and conifers.

South- and west-facing slopes grow the flashier, hot-burning fuels like chamise, grass, pines, or brush. In low-

to-middle elevation forests of the Stanislaus National Forest, ponderosa pine, oaks, and sugar pine dominate the overstory of the dry, south-facing slopes, while white fir and mixed-conifer forests dominate the shadier north- and east-facing aspects.

Slope steepness

As a rule of thumb, fire burns approximately 16 times faster uphill than it does downhill. As a wildfire burns, hot air rises. As the hot air rises, it preheats the fuels above it on the slope, increasing their temperature, drying their fuel moisture level, beginning vaporization, and bringing them closer to their ignition temperature. Then, when the fire reaches the preheated fuels, they burst into flame, adding heat that preheats even more fuels farther up the slope.

The steeper the slope, the greater the preheating. The steeper the slope, the more difficult and dangerous it is for firefighters to work the fire. The steeper the slope, the greater the chance for pine cones, burning logs, or other burning debris to roll downslope out of the fire to start a new fire far below, and have that new fire come rushing upslope to threaten crews fighting the first fire.

If the fuel for a fire is dry grass 12 inches high, that fuel may produce a flame height of two feet or so when burning on flat ground. But put that same fire with the same fuel of 12-inch grasses on a steep slope, and flame lengths may extend four to six feet or longer as waves of flame surge upslope.

The Forest Service looks at slope in degrees. A one-foot rise in elevation in 100 feet equals 1 percent

slope. A 100-foot rise in elevation in 100 feet equals 100 percent slope. But seen in terms of degree, that 100 percent slope is a 45 degree slope (see Figure 2).

The key to remember when considering the effects of fire and slope is that slope is seldom constant. Fires burn up one side of the ridge, across the top, and down the other side. They burn moderately on flatter terrain, then take off like a freight train when they hit a steep slope beyond the flat. However, steep slopes can be used to a fire manager's advantage when lighting a control burn or prescribed fire. A "backing" fire lit at the top of a steep slope usually will be very easy to control as it backs slowly down the slope, feeding steadily but slowly on the fuels below it. Without preheating, fire spread is slow, flame lengths are short, and heat to the canopy can be minimized.

Elevation

Given similar fuels, slope, and aspect, elevation can make a marked difference in fire conditions. Take a fairly flat ridgetop with brush burning in late afternoon on a hot summer day. If that fire occurs at 2,000 feet in elevation, it probably will burn far more intensely and create a greater threat than a fire in brush at 7,000 feet in elevation.

Lower elevation fuels dry out far earlier in the fire season than high elevation fuels, which have to wait until the snow melts to begin to dry. And higher elevations get far more moisture overall during the year, especially during late spring and summer when showers at higher elevation may not even dampen the lower elevation fuels.

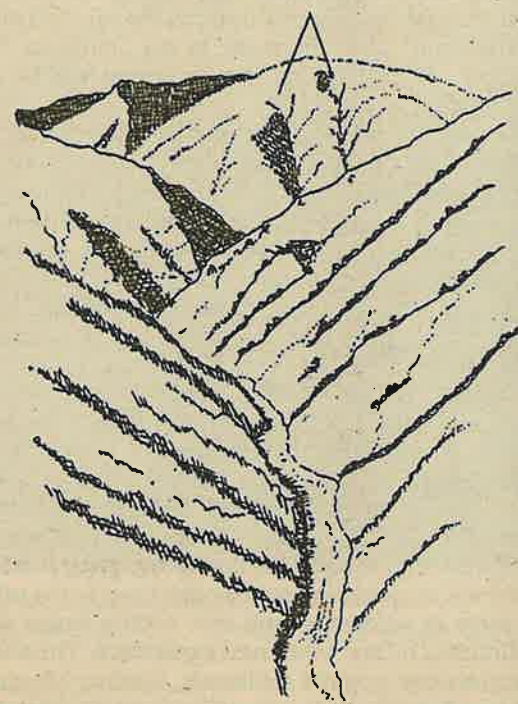
Low elevation fires also burn in hotter, drier conditions, since air temperatures cool down (roughly 5 degrees for each 1,000-foot rise) as you go up in elevation. Air temperature of 100 degrees at 2,000 feet may make fire conditions considerably hotter than an identical fire burning at 7,000 feet in 75 degree heat.

Landform shape

One of the more technical points of information about topography involves landform shape. Fire behavior is acutely affected by landforms and wind conditions. If a fire is burning along a ridge, the breeze flowing over that ridge often eddies on the back side of the ridge, creating a

Figure 3

Chimneys



Graphics by John Buckley

reverse flow that can be used to advantage by fire personnel. However, such eddying conditions also can create gusts and unstable conditions that can make fire behavior less consistent and more dangerous than on other terrain.

If a fire is burning in a low point along a ridgeline, it's burning in a saddle. Like water, wind flows toward the point of least resistance, so winds pushing against a ridge often flow in a more turbulent manner through the saddle than along the rest of the ridgetop. Accordingly, fire spread will increase and become more erratic when fires burn upslope into saddles.

A chimney is one of the most dangerous landforms when it comes to fire behavior. A chimney is a chute running up and down a mountainside (see Figure 3). If a fire burns laterally across a mountainside and creeps into a chimney, the potential exists for preheating and upslope winds to combine with the natural landform shape and funnel a sudden "run" of fire up the chimney.

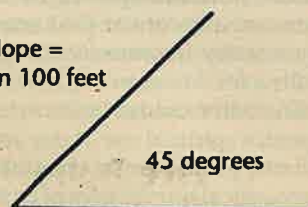
Once you've developed an eye for chimneys, you may be surprised to see homesites developed right at the top of such dangerous landforms. New homes often are built at the top of chimneys because the drop-off below provides a broad, open view that enchants property-owners—until a fire comes.

If weather conditions and fuels are similar, the variations of topography still will make a great deal of difference in whether the fire burns intensely or just creeps around. But topography, like oxygen in the fuel triangle, is a given. We can't change topography to adjust fire behavior. We can only predict fire behavior based upon topographical conditions.

John Buckley worked for the Forest Service as a firefighter and fire technician for 13 years, an experience that led to his book, *Hotshot*. He now monitors the Stanislaus National Forest as executive director of the Central Sierra Environmental Resource Center in Twain Harte.

Figure 2

100 percent slope =
100-foot rise in 100 feet



1 percent slope = 1-foot rise in 100 feet

Our series *Understanding fire* returns next month with more on **Fire Behavior: The Role of Fuels**

Wilderness news

Grazing reduction for Carson-Iceberg & Mokelumne

If the Forest Service has its way, cattle will remain in the Carson-Iceberg and Mokelumne wilderness areas near Ebbetts Pass, but in reduced numbers. An environmental assessment released in February outlines the agency's plan for the Highland Lakes allotment in the Stanislaus National Forest. Comments on the document will be accepted through March 27.

The Forest Service wants to reduce the number of cattle allowed on the Highland Lakes allotment, which includes national forest lands on both sides of Highway 4, for the first time in more than 50 years. In addition to reducing the number by 75 cow-calf pairs (the standard way of counting cattle on public lands), the Forest Service is proposing to build fences to divide the allotment into three units so a system of rest-rotation can be adopted, with each unit being rested every three years.

The agency rejected an alternative that would eliminate grazing from the area, despite finding that "at present, resource conditions within the allotment fail to meet some [Forest Service] standards and guidelines for range; soils; watershed; threatened, endangered, and sensitive plant and animal species; fisheries; recreation; and wilderness."

The Forest Service concedes that its preferred alternative would not allay recreationists' objections to the presence of cattle in wilderness and that adding fences will further diminish hikers' wilderness experience. The allotment includes two popular trailheads, Gardner Meadow and Ebbetts Pass, and also contains a portion of the Carson-Iceberg Roadless Area and the headwaters of the North Fork of the Mokelumne River which has been recommended for wild-and-scenic status.

Currently, the costs to the Forest Service of administering the allotment exceed what the agency collects in

grazing fees. Under the preferred alternative, the Forest Service would spend more on improvements and monitoring but collect less in grazing fees because of the reduction in cattle numbers. If grazing were eliminated, the agency would incur one-time costs to compensate the permittee, remove fences, and rehabilitate damaged areas.

The environmental assessment documents the many problems associated with current and historic grazing practices on the allotment. Meadows suffer from soil compaction and crusting, streambanks from trampling and loss of vegetation. A temporary electric fence was erected in 1994 to keep cattle out of a section of Milk Ranch Creek that supports a population of Lahontan cutthroat trout, a threatened species under the federal Endangered Species Act, but cattle chewed through the fence and degraded the habitat. Under the preferred alternative the permittee would be required to construct and maintain a permanent replacement fence.



Half Moon Lake, the origin of Arnot Creek, near Gardner Meadow in the Carson-Iceberg Wilderness. Photo by Jim Eaton

Dry Modoc analysis

continued from page 3

only partially protected from logging under the 1991 Modoc forest plan and the more recent Option 9.

All 8,500 acres of Burnt Lava Flow Roadless Area have long been protected as a special geologic area. Like Glass Mountain, it is recommended for natural landmark status that would entail its transfer to the National Park Service. Lava flows and barren expanses of rock have permitted only a sparse forest of white fir and sugar, ponderosa, western white, and lodgepole pine to grow in isolated stands. The lava flows are pocked with tree-shaped holes where trees caught in the lava rotted away.

The remainder of the highlands is heavily forested and serves to link the old-growth of the Modoc National Forest to ancient forests in the Klamath and Shasta-Trinity national forests and Lava Beds Wilderness. Medicine Lake itself is a popular recreation area and one of the region's few water sources.

The scarcity of riparian areas means a corresponding scarcity of riparian reserves, the protective category that ordinarily provides habitat linkages under Option 9. In the absence of sufficient reserves, a new approach to connectivity is needed.

What you can do

The Forest Service is soliciting public input as it develops a plan for the Medicine Lake Highlands analysis area. Comments should be sent to Bernie Weisgerber, District Ranger, Doublehead Ranger District, Modoc National Forest, P. O. Box 369, Tulelake, CA 96134, preferably by March 10. In your letter, request that the Forest Service make up for the lack of riparian reserves by:

- protecting Mt. Hoffman Roadless Area;
- designating large old-growth corridors between late-successional reserves and roadless areas;
- allowing previously logged areas to develop into old-growth;
- preserving all live trees and snags over 24 inches in diameter; and
- using prescribed fire as the primary fuels reduction tool in old-growth and late-successional stands.

BLM fencing Smoke Creek Desert to control cattle

By Jim Eaton

The Bureau of Land Management (BLM) is planning a number of range projects in the proposed Smoke Creek Desert Wilderness in northeastern California and northwestern Nevada. Over 19 miles of fence to enclose 179 acres of riparian land around springs would be built in six wilderness study areas—Skedaddle Mountains, Dry Valley Rim, Five Springs, Twin Peaks, Buffalo Hills, and Poodle Mountain.

The projects are part of a BLM's initiative to restore and maintain 75 percent of riparian areas in "properly functioning condition" by 1997. The fences would be transported by horseback or helicopter and built so pronghorn can crawl under them and mule deer can jump over them. To minimize their visibility, fences would be kept off ridge tops when possible and colored green.

Though the fence specifications are good and the wetland recovery project laudable, environmentalists are concerned about construction in a proposed wilderness. Specific questions include:

- Will grazing fees even come close to the cost of building and maintaining these fences?
- Would it be cheaper simply to buy back the grazing leases and leave the land cattle-free?
- Aside from pronghorn and deer, what effect does cattle grazing have on other animal and plant species in the region?
- Since other range developments have been allowed in the proposed wilderness in the past, what are the cumulative environmental and economic impacts of all of these projects?

The BLM is accepting comments through March 9. Write to: Linda Hansen, Area Manager, Eagle Lake Resource Area, 705 Hall Street, Susanville, CA 96130.

Jim Eaton wrote about the Smoke Creek Desert Wilderness proposal in the April 1994 issue of the Wilderness Record.

In addition to Lahontan cutthroat trout, the allotment is within the range of two other listed species, the bald eagle and peregrine falcon, and numerous sensitive species, including fisher, great gray owl, goshawk, Sierra Nevada red fox, marten, willow flycatcher, wolverine, mountain yellow-legged frog, and Yosemite toad.

Comments on the environmental assessment and the agency's plan for the Highland Lakes allotment should be sent by March 27 to Denise Van Keuren or Debbie Colston, Stanislaus National Forest, 19777 Greenley Road, Sonora, CA 95370. For more information, call Van Keuren or Colston at (209) 532-3671.

Forest Service wants Mt. Shasta's Panther Meadows logged

The Forest Service plans to allow helicopter logging of wind-toppled trees near Panther Meadows on Mount Shasta, a site with ceremonial importance to Native Americans that has been judged eligible for inclusion in the National Register of Historic Places. The proposed logging, which would generate more than a million board feet of wood, is justified as a way of reducing fire hazard, producing income, and accommodating recreationists who find a landscape of downed trees displeasing, according to the Forest Service.

None of the trees targeted for logging lies in a roadless area, and the Forest Service already has completed the watershed analysis required for national forests within the range of the northern spotted owl. Consequently, the environmental assessment (EA) issued in February is the final opportunity for conservationists to provide input. The deadline for comments is March 26.

The EA addresses such issues as how logging will affect contemporary spiritual use of the area and its integrity as a historic site, protection of sensitive plants and animals, and the ecological importance of fallen and standing dead trees.

The logging proposal was developed in consultation with local environmental and Native American groups, and as a result there is little opposition to the plan, says Michelle Berditschewsky of Save Mt. Shasta. From her perspective, "the Forest Service is on its best behavior."

To comment on the EA, write to Bob Hammond, District Ranger, McCloud Ranger District, P. O. Box 1620, McCloud, CA 96057 by March 26. For a copy of the document, call the Forest Service at (916) 964-2184.

Letters on fish stocking

For some time, the California Wilderness Coalition (CWC) has been examining the issue of fish stocking in wilderness areas through a sporadic series of articles and letters on such topics as the problem with hatcheries, the disappearance of mountain yellow-legged frogs, how fish stocking impacts the recreational experience, and the role of the Department of Fish and Game. In October, we asked our readers for their preliminary thoughts on fish stocking in wilderness areas. Here are some excerpts from the letters we have received so far.

An ecosystem is biologically healthy when it is diverse and complex. Humans simplify ecosystems—we make them "brittle" and less stable. Non-native fish displace native fish and reduce, modify, or eliminate amphibians, aquatic insects, and invertebrates and alter mammalian pressure on riparian ecosystems.

We now understand that natural ecosystem restoration is important for long-term ecosystem health. We now look upon the removal of wolves and bears from wildland ecosystems in disgust and realize our actions were very short-sighted. We also realize that with the best of intentions, the introduction and planting of fish has also been short-sighted.

Constructive fish stocking discussions need to start with a geographical information system database: 1) areas originally without fish, 2) introduced fish, by species and watershed, 3) restored fisheries, 4) nonstocked areas, 5) areas with adventitious (non-native but established) fish, 6) fish-impacted areas, and 7) other concerns.

The my opinion vs. your opinion arguments concerning fish stocking make the same mistake as the debate over endangered species—the species in question is a symptom, not the cause. When we have more objective information to work with and can mutually discuss and understand the information from a biodiversity and whole ecosystem perspective, then we can work together for long-term ecosystem integrity.

I don't think the CWC should oppose fish stocking—it's mostly just a "stalking horse" ("stocking horse") issue to conceal other agendas anyhow, or at least that's my perception.

I do believe the CWC should oppose fish stocking in wilderness.

There are those who will protest that no stocking of fish will lead to a decline of a wilderness recreation opportunity (fishing), but those who make that protest miss the point. The purpose of protected wilderness is ecosystem protection, above all else. Species and activities which in any way compromise or endanger that ecosystem should not be allowed. Recreation should always be considered secondary to protection.

Under no circumstances other than fish stocking would we condone the intentional propagation of exotic species in wilderness. Such activity is counter to the most basic premise of wilderness: that these areas are set aside to preserve at least some parts of America where natural processes operate freely. Should we transplant wild boars in California wilderness because some people want to hunt them? How about partridges and pheasants and turkeys and elk and mountain goats and caribou and armadillos? Wilderness managers have moved away from such exotic introductions, not only because the exotic species often cause unforeseen problems, but because introducing unnatural components to wilderness ecosystems is counter to the very concept of wilderness.

Why are fish any different?

The CWC should continue to be a leader in the wilderness movement by adopting a policy against fish stocking in wilderness.

We welcome your thoughts on the issue. Send them to CWC/Fish Stocking, 2655 Portage Bay East, Suite 5, Davis, CA 95616.

Look like a hot shot in a CWC T-shirt

John (r.) models our six-tone landscape shirt now available in jade and fuchsia as well as the ever-popular light blue and pale green for \$15. Jeff wears a design by Bay Area cartoonist Phil Frank; it comes in beige or light gray for \$12. All shirts are 100 percent double-knit cotton. To order, use the form on the back page.

Wilderness Trivia Answer

Senator Cranston worked on every wilderness except Hoover, San Gabriel, and Thousand Lakes.
from page 2



Calendar

March 9 COMMENTS DUE on a BLM plan to fence springs in the proposed Smoke Creek Desert Wilderness of northeastern California (see article on page 6). Send to: Linda Hansen, Area Manager, Eagle Lake Resource Area, 705 Hall St., Susanville, CA 96130.

March 10 COMMENTS DUE on a management plan being developed for the western portion of Modoc National Forest (article on page 3). Send to: Bernie Weisgerber, District Ranger, Doublehead Ranger District, Modoc NF, P. O. Box 369, Tulelake, CA 96134.

March 18 MEETING for activists interested in the southern Sierra Nevada bioregion, in Porterville. For information, call John Hopkins at (916) 756-6455.

March 26 COMMENTS DUE on proposed logging near Panther Meadows on Mt. Shasta (article on page 6). Send to: Bob Hammond, District Ranger, McCloud Ranger District, Shasta-Trinity NF, P. O. Box 1620, McCloud, CA 96057.

March 27 COMMENTS DUE on a proposal to construct fences and reduce grazing in a Stanislaus National Forest allotment that includes parts of Carson-Iceberg and Mokelumne wildernesses (article on page 6). Send comments to: Denise Van Keuren, Stanislaus NF, 19777 Greenley Rd., Sonora, CA 95370.

April 1 MEETING of the California Ancient Forest Alliance in Davis. For more information, call Jim Eaton at (916) 758-0380.

April 11-13 CONFERENCE & WORKSHOP at U. C. Davis on Endangered Species: Resources, Law, and Potential Solutions. For more information, call (800) 752-0881.

May 14 CWC FUNDRAISER honoring Senator Alan Cranston, in Davis (article on page 2). For information about tickets, volunteering, or sponsorships, call the CWC office at (916) 758-0380.



**California
Wilderness
Coalition**

Purposes of the California Wilderness Coalition

...to promote throughout the State of California the preservation of wild lands as legally designated wilderness areas by carrying on an educational program concerning the value of wilderness and how it may best be used and preserved in the public interest, by making and encouraging scientific studies concerning wilderness, and by enlisting public interest and cooperation in protecting existing or potential wilderness areas.

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—John Buckley on *Understanding fire*

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Voices of the Desert

The Newspaper of the California Desert

Volume 1 First Edition 1995

California Desert Bill Passes!

PRESIDENT CLINTON SIGNS THE CALIFORNIA DESERT PROTECTION ACT

President Clinton signed the California Desert Protection Act into law on October 31, 1994. The final legislation passed by Congress created the 1.4 million-acre Mojave National Preserve. It also expanded Death Valley and Joshua Tree National Monuments by 1.3 million and 234,000 acres respectively and designated them as national parks. The Act designated 3.57 million acres of land as wilderness in 69 separate areas to be managed by the Bureau of Land Management. The Act also design-



President Clinton and Rep. Bruce Vento, D-Minn. look at tortoises during the president's signing of the California Desert Protection Act.

Associated Press

nated 95,000 acres of U.S. Forest Service and 9,000 acres of U.S. Fish and Wildlife Service lands as wilderness.

In signing the Act, President Clinton called the southern California desert "a resource of extraordinary and inestimable value."

The President said, "This is the first time since 1980 that the United States has set aside so rich and vast an area. The broad vistas, the rugged mountain ranges, and the evidence of the human past are treasures that merit protection on behalf of the American people."

MANAGING THE CALIFORNIA DESERT

Planning officials must manage the diverse activities that take place in the southern California desert, without sacrificing the plant and animal species listed as threatened or endangered. Ranching, mining, wind energy production and recreation are among the many activities taking place on desert public lands. Additionally, desert principalities must plan for expan-

sion through the development of private and public lands within their boundaries.

Recognizing the need to work together, 27 California local, state and federal government organizations charged with land management signed an Agreement on Biological Diversity in 1991. Building on this agreement, several ecosystem plans covering specific geographic regions are in various stages of development. These plans are being developed jointly by local, state and federal organizations who manage lands in the designated regions. For example, the West Mojave Ecosystem Management Plan covers 9 million acres and is nearing completion.

Congress recognized the desert to be a fragile, easily scarred, and slowly healed ecosystem and in 1976 mandated preparation and implementation of a comprehensive

long-range plan for the management, use, development, and protection of the public lands within the desert. The legislation designated the California Desert Conservation Area and in 1980 the first large-scale bioregional ecosystem management plan was released as a dynamic management "umbrella" document from which plans such as the West Mojave plan are derived.

In 1994 Congress responded to the growing pressures on the desert and the public's desire to enhance the protection and preservation of the area's unique resources. Passage of the act compounds the effect of other new land-use constraints to protect ecological resources, such as the limits imposed by the Desert Tortoise Recovery Plan produced by the U.S. Fish and Wildlife Service.

The regional ecosystem man-

agement plans, such as the West Mojave, incorporate all of these land use restraints to provide managers with a comprehensive decision tool for developing the desert public lands remaining for multiple use, management plans for the new wilderness and park lands, and county and municipal land useplans. The 1994 California Desert Protection Act displaces a number of activities from the newly-designated park and wilderness areas, making these land-use decisions even more critical.

Planning on such a large scale with declining resources means that the agencies involved must shed themselves of any parochial attitudes and work together as partners. An excellent example of how these partnerships can benefit the agencies and the public is the joint

continued on page 7

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MAP INSIDE!
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What is Wilderness?



Mojave National Preserve

Photo Courtesy of the BLM

The California Desert Protection Act designated more than 7.6 million acres of wilderness to be managed by the Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service and U.S. Forest Service. What is wilderness?

To some people, wilderness is an escape to solitude and freedom. To others, wilderness means trees and birds and wildlife, or a wilderness is any piece of undeveloped land.

The 1964 Wilderness Act defines wilderness as federal lands officially designated by Congress and the President as part of the National Wilderness Preservation System. Wilderness Areas are (in part):

- * Lands that appear to be natural or undisturbed, and where human-caused changes are essentially unnoticeable;

- * Lands that offer a feeling of quiet and solitude, or provide outstanding opportunities for primitive and unconfined forms of recreation;

- * Lands that contain ecological, geological or other features of scientific, scenic, or historical value; and

- * Lands large enough to preserve and use as wilderness, generally at least 5,000 acres.

Wilderness designations are intended to help maintain biodiversity, conserve natural areas, provide habitat for wildlife, and promote opportunities for scientific and historic research. Beyond these purposes, the emotional appeal of the timeless natural splendors of a wilderness seems to touch the mind, heart and soul of everybody.

Wilderness Use

In a wilderness, visitors are on their own and are responsible for their own safety.

To maintain lands designated as wilderness in their natural state, some restrictions must be observed.

BLM Managed Wilderness

Motorized vehicles, bicycles, hang gliders, boats or aircraft are not allowed.

Hunting, fishing, and non-commercial trapping are allowed under state and local laws.

Pets are allowed.

Horses or other recreational livestock may require a special permit and you may be required to carry feed.

Campfires may be permitted. Wood gathering is limited to dead and down material. No live vegetation may be cut.

Hobby rock collecting is allowed only by non-mechanical means for non-commercial purposes.

Wilderness permits may be required.

What is the Difference Between a National Park, a National Monument and a National Preserve?

Death Valley and Joshua Tree were proclaimed as National Monuments in the 1930's. With the enactment of the California Desert Protection Act of 1994, these two areas are now National Parks. The third National Park system unit in the California Desert is the Mojave National Preserve. What's in a name?

The National Park Service manages over 20 kinds of parklands, each requiring congressional approval, except for national monuments which can be proclaimed by the President. The title "national park" has generally been assigned to the greatest national scenic attractions of the National Park system. The term implies a large, spectacular natural place having a wide variety of attributes. In recent years, areas with characteristics associated with national parks such as size, unique natural and cultural qualities and superlative scenery, but which also allow hunting or other commercial uses have been designated as "National Preserves."

Congress designated the first national preserve in 1974 when it established Big Thicket National Preserve in Texas and Big Cypress National Preserve in Florida. Congress labeled the two units as "national preserves" primarily because, in those units, non-federal oil and gas rights could be developed. Congress also authorized grazing, agriculture, hunting, trapping and off-road vehicle use in the two preserves. Because these activities are generally not consistent with park preservation, Congress decided to entitle the units as something other than "national parks" or "national monuments."

Congress named Mojave a national preserve because hunting and trapping are authorized in the unit. Hunting and trapping were not authorized in Death Valley or Joshua Tree National Parks. Except for hunting and trapping, Mojave National Preserve will be managed the same as Death Valley and Joshua Tree National Parks.



What are Public Lands?

The concept of public land goes back to our nation's earliest days. The framers of our Constitution agreed that those undesignated lands west of the colonies should not belong to individual states, but owned in common for the benefit of all Americans.

Accurate surveys were needed before the new public lands could be identified for sale or other disposition. In 1812, the General Land Office (predecessor to the present-day Bureau of Land Management) was established to oversee the surveying and disposal of public lands.

During the next 164 years these public lands were made available through a variety of means such as the Homestead Act, grants to establish railroads and roads, In-

dian reservations, national parks and forests, and military reservations.



Today more than 300 million acres, most of which lie west of the Mississippi River, remain in the public domain. These public lands are managed under the concept of multiple use by the Bureau of Land Management (BLM), an agency in the U.S. Department of the Interior.

Public lands include deserts, mountains, prairies and streams which are home to wildlife and provide opportunities for a variety of recreation. Camping, hiking, hunting, and recreational vehicle use are just a few of the recreational activities.

Public lands are bountiful as well as beautiful. Cattle and sheep



Vehicles must be street legal and drive only on established roads.
Mt. Bikes are allowed on established roads and designated trails only.

Back Country Byway		Wayside Exhibit	
Climbing		Long Term Visitoe Area	
Watchable Wildlife		OHV Designated Road/Recreation Area	
Information Center		Mountain Biking	
Ranger Station		Horseback Riding	
Motel		Hiking	
Restaurant		Designated Camping Area	
Fuel		Backcountry Camping	

Mojave National Preserve

								Aiken Wash
								Camp Rock Springs
								Caruthers Canyon
								Cinder Cone
								Cima Dome
								Clark Mountain
								Fort Paiute
								Government Holes
								Granite Mountains
								Hole-in-the-Wall
								Kelso Depot
								Kelso Dunes
								Lanfair Valley
								Mid Hills
								Nipton
								Providence Mountains
								Soda Springs
								Teutonia Peak
								Wild Horse Canyon

























































































Death Valley National Park

?											Beatty/Rhyolite
											Cottonwood Canyon
											Darwin Falls/Panamint Springs
											Eureka Dunes
?											Furnace Creek
											Greenwater Valley
											Hunter Mountain
											Racestrack Valley
											Nevada Triangle
											Saline Valley
											Saratoga Spring
?											Scotty's Castle
											Shoshone
											Stovepipe Wells
											Telescope Peak
											Titus Canyon
											Warm Spring Cnyn/Butte Valley
											West Side Road
											Wildrose

Joshua Tree National Park

									Barker Dam
									Belle
									Black Rock Canyon
									Cottonwood
									49 Palms
									Hidden Valley
									Indian Cove
									Jumbo Rocks
									Little San Bernardino
									Lost Horse Mine
									Lost Palms Oasis
									Oasis of Mara
									Queen Valley
									Ryan
									Sheep Pass
									White Tank

Bureau of Land Management

Legend										
     										
										Afton Canyon
										Big Morongo Preserve
										Bradshaw trail
										Calico Early Man Site
										California Desert Information Center
										Coachella Valley Preserve
										Corn Springs
										Dos Palmas Preserve
										Dumont Dunes
										Dunes Vista
										El Mirage
										Fossil Falls
										General Patton Mem. Museum/Camps
										Imperial Sand Dunes
										Interagency Visitor Center
										Jawbone/Dove Springs
										Johnson Valley
										Hot Springs
										McCain Valley
										Mecca Hills
										Midland
										Mule Mountain
										Pilot Knob
										Plaster City
										Rainbow Basin
										Rand Mountains
										Rasor
										Spangler Hills
										Stoddard Valley
										Tamerisk
										Trona Pinnacles
										Wilderness areas
										Yuha Desert

Visitor Information

Ridgecrest Resource Area
300 S. Richmond Road
Ridgecrest, CA 93555
(619) 375-7125

El Centro Resource Area
1661 S. 4th
El Centro, CA 92258
(619) 353-1060

Interagency Visitor Center
Junctions Hwy 395 & Hwy 136
Drawer R
Lone Pine, CA 93545
(619) 876-6222

Joshua Tree National Park
74485 National Monument Dr.
Twentynine Palms, CA 92277
(619) 367-7511

Lake Mead
National Recreation Area
601 Nevada Highway
Boulder City, NV 89005
(702) 293-8918

Mojave National Preserve
Barstow, CA
(619) 256-8313

Death Valley National Park
Death Valley, CA 92328
(619) 786-2331

Barstow Resource Area
150 Coolwater Lane
Barstow, CA 92311
(619) 255-8700

Needles Resource Area
101 W. Spike's Road
P.O. Box 888
Needles, CA 92363
(619) 326-3896

California Desert District Office
6221 Box Springs Blvd.
Riverside, CA 92507
(909) 697-5200

California Desert
Information Center
831 Barstow Road
Barstow, California 92311
(619) 256-8313

Palm Springs-
South Coast Resource Area
83-500 Garnet Avenue
P.O. Box 2000
North Palm Springs, CA 92258
(619) 251-4800

California Department of Parks
and Recreation
Mojave Desert Sector
1051 West Ave. M. Suite 201
Lancaster, CA 93534
(805) 942-0662



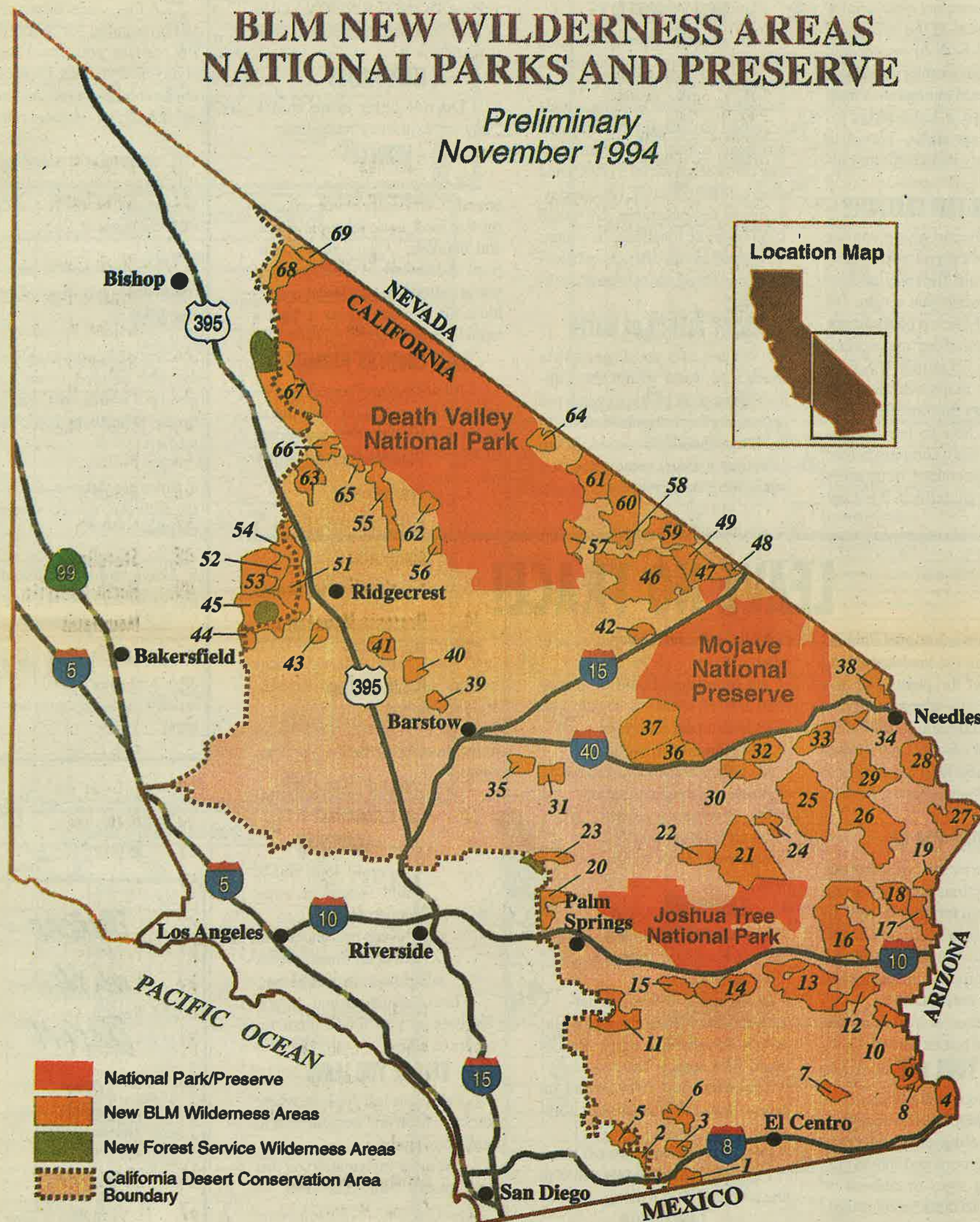
	East Mojave National Scenic Area	Mojave National Preserve
Camping	Yes	Yes
OHV	Green Sticker	designated road/street legal vehicle
Hunting	Yes	Yes
Camping	Yes	Yes
Grazing	Yes	Yes
Mining	Yes	existing claims only
Rock Collecting	Yes	No
Horseback Riding	Yes	Yes
Mountain Biking	Yes	only on paved and dirt roads
Target Shooting	Yes	No
Mojave Road	Yes	Yes - street legal vehicles

Numerical Listing of Wilderness Areas as of September 26, 1994

1. Jacumba
2. Carrizo Gorge
3. Coyote Mountains
4. Little Picacho
5. Sawtooth Mountains
6. Fish Creek Mountains
7. North Algodones Dunes
8. Picacho Peak
9. Indian Pass
10. Palo Verde Mountains
11. Santa Rosa
12. Little Chuckwalla Mountains
13. Chuckwalla Mountains
14. Orocopia Mountains
15. Mecca Hills
16. Palen/McCoy
17. Big Maria Mountains
18. Rice Valley
19. Riverside Mountains
20. San Geronio
21. Sheephole Valley
22. Cleghorn Lakes
23. Bighorn Mountains
24. Cadiz Dunes
25. Old Woman Mountains
26. Turtle Mountains
27. Whipple Mountains
28. Chemehuevi Mountains
29. Stepladder Mountains
30. Trilobite
31. Rodman Mountains
32. Clipper Mountain
33. Piute Mountains
34. Bigelow Cholla Garden
35. Newberry Mountains
36. Bristol Mountains
37. Kelso Dunes
38. Dead Mountains
39. Black Mountain
40. Grass Valley
41. Golden Valley
42. Hollow Hills
43. El Paso Mountains
44. Bright Star
45. Kiavah
46. Kingston Range
47. Mesquite
48. Stateline
49. North Mesquite Mountains
50. Saddle Peak Hills
51. Owens Peak
52. Chimney Peak
53. Domeland
54. Sacatar Trail
55. Argus Range
56. Manly Peak
57. Ibex
58. South Nopah Range
59. Pahrump Valley
60. Nopah Range
61. Resting Spring Range
62. Surprise Canyon
63. Coso Range
64. Funeral Mountains
65. Darwin Falls
66. Malpais Mesa
67. Inyo Mountains
68. Piper Mountain
69. Sylvania Mountains

BLM NEW WILDERNESS AREAS NATIONAL PARKS AND PRESERVE

Preliminary
November 1994



Boundaries subject to change upon receiving final Congressional maps.
Areas are designated in California Desert Protection Act.

DESERT SAFETY TIPS

Travel in the desert can be an adventure. It can also be a disaster if a breakdown or a sudden change in weather catches you unprepared. Be aware of the hazards of desert travel both in winter and summer. Harsh weather conditions can turn a desert outing into a tragedy. Acquire a knowledge of desert survival skills. Travel in pairs for safety in backcountry areas.

PLAN YOUR TRIP CAREFULLY

Tell someone where you are going and when you will return. Stick with your itinerary and let them know when you return. Do not travel in the desert backcountry without taking along appropriate maps such as 7.5 minute U.S.G.S. topographic maps which show land contours and specific features. Learn how to use a topographic map and a compass before you hike cross-country or on trails that are not well defined. It is easy

to become disoriented in the desert where many landmarks and rock formations look similar.

DRESS PROPERLY

In summer, layered clothing slows dehydration and minimizes exposure. Good hiking shoes, loose fitting natural-fiber clothing, a wide brimmed hat, sunglasses and sunscreen are a must. Desert temperature can reach over 90°F (32°C) and drop below 50°F (10°C) in one day. Summer temperatures can reach 125°F in some locations. In winter, temperatures can often drop below freezing. Bring extra warm clothing.

CARRY PLENTY OF WATER

There are no dependable sources of water within the California desert. A gallon of water per person, per day is the absolute minimum that should be carried. When planning a hike, remember that water weighs approximately eight

pounds per gallon. When the water is half gone, it is time to turn back. Don't forget extra water for your vehicle. **DO NOT RATION YOUR WATER.** It will only do you good if you drink it.

MINE SHAFTS

Do not enter mine shafts. They are extremely hazardous.

VEHICLES

Keep your vehicle well-maintained. Carry extra water and non-protein food, a shovel, tools, flares, and blankets. Check road conditions and beware of flash floods. If you are stranded, stay with your vehicle. It is much easier to spot a vehicle than a person on foot.

BACK COUNTRY PERMITS

A back country permit may be required for overnight camping or travel. Check with the appropriate BLM or NPS office for the area you will be in.

LEAVE NO TRACE!

The desert is a fragile environment. Scars on the land last a long time. Many of the plants and animals are specially adapted to living in this land of climatic extremes. By taking special care to **LEAVE NO TRACE**, we can help to insure that this fragile place remains healthy and unscarred.

BEFORE YOU GO

- * Obtain information about the area and use restrictions that may apply.
- * Plan your trip for "off season" or non-holiday times. If this is not possible, go to less popular areas.
- * Choose equipment in earth tone colors: blue, green, tan, etc.
- * Repackage food in containers that can be packed out or burned.

ON YOUR WAY

- * Stay on designated trails.
- * Do not cut across switchbacks.
- * When traveling cross country, hike in small groups and spread out.
- * Do not hang signs or ribbons or carve on trees to mark travel routes.
- * When meeting horseback riders, step off lower side of trail, stand still, and talk quietly.

WHILE YOU ARE THERE

- * In high-use areas, choose already existing campsites.
- * In remote areas, choose sites

which cannot be damaged by your stay.

- * All campsites should be at least 200 feet (1/4 mile in Death Valley) from water and trails.

- * Hide camp from view.
- * Do not dig trenches around tents.
- * Avoid building camp structures. If temporary structures are built, dismantle completely before leaving.

CAMPFIRES

- * Use a lightweight gas stove for cooking rather than a fire.
- * In areas where fires are permitted, use existing fire rings. Do not build new fire rings. Do not build fires against large rocks.
- * Use dead and down wood no larger than the size of your forearm.
- * Do not break branches off trees.
- * Put fire completely out (cold to the touch) before leaving.

SANITATION

- * Deposit human waste and toilet paper in "cat holes". Cat holes are six to eight inches deep and should be located at least 75 paces from water or camp. Cover and disguise cat holes when finished.

- * Wash dishes, clothes, and yourself away from natural water sources such as springs, streams, and lake shores.

- * Cover latrine and wash-water holes thoroughly before breaking camp.

- * Pick up all trash (yours and others) and pack it out.

COURTESY

- * Avoid loud music and voices or other loud noises.

- * Keep pets under control at all times. Better still, leave them at home.

- * Leave all natural and cultural features as you found them for others to enjoy.

BEFORE YOU LEAVE

Take one last look at where you have been and do your best to Leave No Trace!

For more information on this program call 1-800-332-4100.

Remember that the Leave No Trace guidelines are more than a set of rules. They are an attitude. They will help you, and all of us, preserve wild lands and open spaces for everyone.

Desert Driving Tips

A four-wheel drive vehicle is not required for desert driving, unless you travel extensively on dirt roads. High clearance vehicles are recommended for driving on unpaved roads.

1. Use common sense when driving on unpaved roads. Drive slowly and carefully and don't take chances.

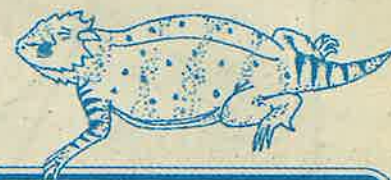
2. Vehicles should be well-maintained and in good working order.

3. Carry additional supplies that may be needed in an emergency: water, oil, radiator hoses, a fan belt, fuses, and a tool kit.

4. Since gas stations are few and far between, gas up whenever possible.

5. Leave word with friends or family where you are going and when you plan to return.

6. Vehicles in national parks and preserves must remain on designated roads, and must be street legal.



Voices of the Desert

Editors

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Layout and Artwork
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Harold Johnson, Lynn Nakata,
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THE SINGING SAND MOUNTAIN

Towering 900 feet above the Eureka Valley is one of the tallest sand dune fields in North America.

The dunes have a fascinating geologic story. At various times during the Ice Age, the basin contained a deep freshwater lake. As the climate changed, the lake dried and wind and other erosional forces started to break down the alluvial slopes of surrounding mountains, eventually creating sand. Dry desert winds push sand in one direction while oppos-

ing mountain winds keep the sand from traveling beyond its present location. These winds hold the sand prisoner creating the massive "sand mountain." Complex wind directions consistently change sand patterns. The different patterns caused by the wind can be seen on the dunes. Everything from the small ripples to the large collapsing slipfaces are visible evidence of constantly changing winds.

The Eureka Dunes are one of the rare "singing" dune fields of North America. If winds are active or if many people are walking on the dunes, the dry, sorted grains of sand which are spherical and polished, rub together and produce a sound similar to distant flying aircraft.

The unique flora and fauna inhabiting the dunes are as fascinating as the geologic story. The dunes



Eureka Sand Dunes

Courtesy of the BLM

are home to creosote bush, shadscale, and indigo bush, as well as many other plant species including two endemic species (found nowhere else in the world): Eureka Dune grass and the Eureka Dunes evening primrose. Both of these plants are federally-listed endangered species. The perennial dune grass is a "binding grass" that holds clumps of sand together. The dunes can hold enough water to supply the grass with the moisture it needs. The Eureka Dunes evening primrose blooms during the spring but only when enough rain has fallen during the winter.

Thirty six species of birds, 29 mammal species and nine reptile species call the dunes home. Countless insect species can be found in the dunes, including four endemic beetles. The pallid kangaroo mouse

also inhabits this region. Like the kangaroo rat, it adapts to hot, arid environments by being active at night, living in sandy burrows and metabolically producing water from food.

The animals living on or near the dunes leave their footprints as evidence of their passing, until the next wind erases them. Visitors, too, can explore the dunes on foot. Please take care not to step on the animal burrows or plants when climbing the dunes. Leave only your footprints to be blown away in the next shift of the wind.

The Dunes are located at the southern end of the Eureka Valley. A dirt road leaving the unpaved Death Valley Road, which connects California State Highway 168 east of Big Pine and Grapevine in Death Valley, provides access to the dunes. Remember that vehicles are not allowed on the dunes themselves.

The Eureka Sand Dunes are reached by dirt roads. High-clearance vehicles are recommended. Be sure to take precautions for desert travel. (See "Desert Safety Tips")



What are Public Lands?
continued from page 2

graze the public land in the western states, and mining provides energy and minerals needed in industry.

Multiple-use management strategies include the practice of "sustained yield" in managing the many renewable natural resources found on public lands. This practice will insure that today's demands do not diminish the resource base that will be needed by future generations of Americans.

Thanks to the wisdom and foresight of our forefathers, that has been and continues to be the role of America's public domain -- your public lands.

Managing the California Desert
continued from page 1

planning that the National Park Service (NPS) and the Bureau of Land Management (BLM) have been doing for several months to provide a smooth transfer of lands designated by the Act to move from BLM to NPS management. This planning is based on sound ecosystem management principles and is designed to fit into the larger regional ecosystem management plans.

The California desert recently was designated an Innovative Management Laboratory for developing and implementing bioregional ecosystem plans for the desert by Vice-president Gore's National Review team, which is working to streamline the workings of the federal government.



The Cima Dome

Cima Dome rises nearly 1500 feet above the floor of the desert in Mojave National Preserve. Best viewed from such locations as Cedar Canyon Road and the northern end of Mid-Hills Campground, this almost perfectly rounded dome covers approximately 75 square miles. Cima Dome is a small batholith (a molten mass of rock that stopped rising while it was still well below the surface), once covered with volcanic material, uplifted and since eroded to its present form. The rock outcroppings seen in the Teutonia Peak area of Cima Dome are composed of the same type of rock that forms the distinctive outcroppings in Joshua Tree National Park.

A large, dense forest of Joshua trees covers the top of Cima Dome. The Joshua tree is the symbol of the Mojave Desert and thrives at this elevation (around 4,000 feet). This large member of the lily family shelters a thriving community of plants and animals.

The Teutonia Peak Trail on Cima Dome offers an excellent opportunity to explore this unique area. The 4-mile round trip to the top of the peak takes two to three hours. The trailhead is located at the crest of Cima Road, 12 miles south of Interstate 15.



FLASH FLOODS!

The California Desert is flash flood country. Stay out of all narrow canyons and washes when the weather is threatening or raining. Be alert for lightning, especially in open areas. Storms can arrive quickly and unexpectedly.

Bradshaw Trail Backcountry Byway



The Bradshaw Trail

Courtesy of the BLM

The Bradshaw Trail provides present day desert travellers an opportunity to taste a little history. Constructed in the 1860's, the primary purpose of the Bradshaw Trail was to move supplies and gold more quickly between California and gold mines in Arizona.

Prior to construction of the trail, mining equipment and supplies were transported by ship from San Francisco to the gold mines at La Paz, Arizona, by way of the Gulf of California and up the Colorado River. To reduce the time required to move the supplies to Arizona, and the gold back to California, William Bradshaw searched for an overland route from San Bernardino. A stagecoach route which followed established Indian trails was developed and became known as the Bradshaw Trail. Beginning at Dos Palmas (near what is now the Salton Sea), the trail ran through the Chuckwalla Valley. It was used between 1862 and 1877.

Reduced gold output and the completion of the Southern Pacific Railroad track to Yuma, Arizona, in 1877 virtually eliminated the need for the trail.

Today, this 66-mile, four-wheel-drive historic trail can be reached from Indio in the west, or from Blythe at its eastern end. Several exits off Interstate 10 also provide access. One can also reach the trail by turning east off Highway 111, opposite the entrance to the Salton Sea State Recreation Area. This paved road ends about two miles from the highway. Turn left onto the trail. The trail offers spectacular views of, and access to, the Palo Verde Valley and the Orocopia, Chuckwalla, Little Chuckwalla, and Mule Mountains Wilderness Areas.

For more information on the trail and adjacent wilderness areas, please contact the BLM's Palm Springs/South Coast Resource Area at (619) 251-4800.

*Wilderness Use
continued from page 2*

NPS Wilderness

Motorized vehicles, bicycles, hang gliders, boats or aircraft are not allowed.

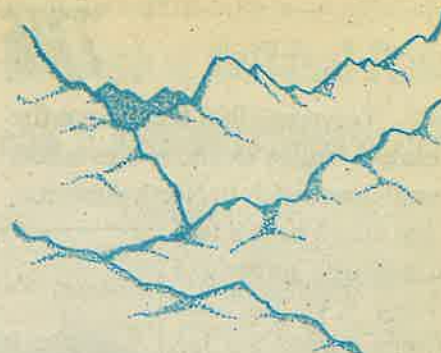
Hunting is not allowed in Death Valley and Joshua Tree National Parks. Hunting is allowed in Mojave National Preserve under state and local laws.

Target shooting is not allowed.

Horses or other recreation livestock may require a special permit and you may be required to carry feed.

Pets are not allowed.

Collecting firewood, rocks and minerals, and vegetation is not allowed.



INYO MOUNTAINS WILDERNESS AREA

The Inyo Mountains Wilderness is a spectacular high desert mountain area on the east side of Owens Valley in Inyo county. It is a vast, isolated desert range with peaks rising to elevations of 10,000 feet or more from the desert floor. A dramatic array of natural features is found here as the steep rugged slopes rise through a variety of life zones, from the low desert to alpine. From their heights, ancient bristlecone pine forests frame spectacular panoramic vistas of the Saline and Owens Valleys and the Last Chance and Sierra Nevada mountain ranges.

The Inyo Mountains have a rich legacy of use by 19th and early 20th century miners. Millsites and old mining cabins dot the landscape. The towers of an historic 13-mile tram that once carried men and salt from the salt mines in the Saline Valley across the mountains to Owens Lake can still be seen marching up the steep slopes and canyons of Cerro Gordo Peak.

Year-round streams and cascading waterfalls can be found in eight canyons on the rugged east side of the mountains. Rock climbers can find a variety of challenging routes in these steep walled canyons. The range's prominent peaks: Mount Inyo, Keynot Peak and New York Butte. Their summits challenge hikers, but reward with a view that can't be beat.

One hundred and three miles of unmaintained, historic trails cross the area. Only a few trail segments are shown on current topographical maps or can be readily followed. The adventurous can try the primitive, 40-mile Lonesome Miner Trail from Reward to Hunter Canyon. Trail and access information is available from BLM's Ridgecrest Resource Area office at (619) 375-7125, Death Valley National Park at (619) 786-2331, or the Interagency Visitor Center in Lone Pine at (619) 876-4252.



Hiker in the Providence Mountains

Courtesy of the BLM

