THE KLAMATH KALEIDOSCOPE

A Newsletter of the Klamath Network
Inventory and Monitoring Program
Spring/Summer 2004

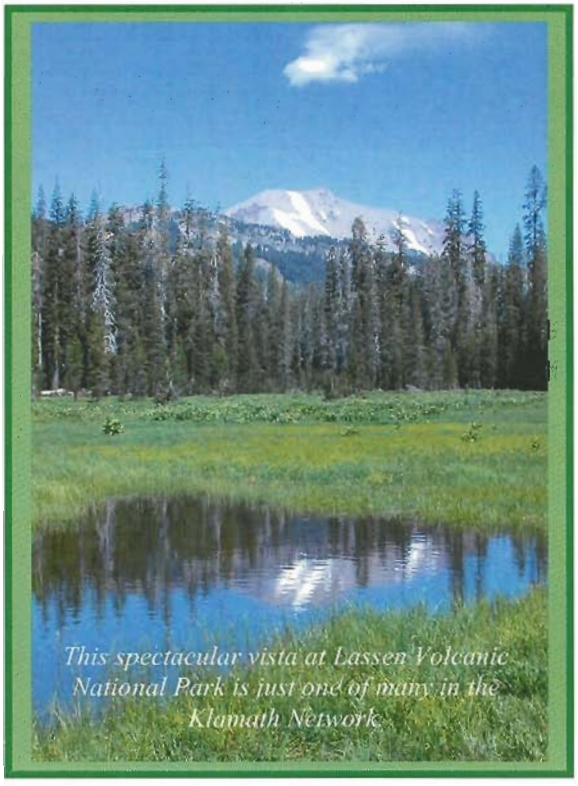
Learning from Old Friends: Inventory and Monitoring in the Klamath Network Parks

By **Daniel Sarr**, Klamath Network Inventory and Monitoring Coordinator

To see the world in a grain of sand
And heaven in a wildflower
To hold infinity in the palm of your hand
And eternity in an hour
-- *William Blake*

The Klamath Network, which includes six National Park Service units in northern California and southern Oregon (see map, p. 2), spans a landscape of exceptional geographic and biological diversity. The Klamath region is characterized by complex, mountainous topography and extraordinary geologic variegation, and across this physical landscape runs one of the steepest climate gradients in North America. The region is truly a kaleidoscope of physical and biological environments.

The Klamath Network parks are as varied as the landscape. Though the parks are small to medium-sized by national park standards, they collectively encompass an astounding array of habitats, including lagoons, dunes, and rocky intertidal zones along the Pacific shore, wet coastal forests, subalpine forests, meadows, and lakes, alpine environments, and semi-arid sagebrush steppe. These varied habitats are home to many fascinating and unique plants and animals. Some of the tallest trees in the world, for example, shade visitors along Redwood Creek, while less imposing but equally distinctive species occur in most of the parks. *(cont'd on p. 2)*



This spectacular vista at Lassen Volcanic National Park is just one of many in the Klamath Network.

The Klamath Network of the National Park Service
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The Parks of the Klamath Network:

Crater Lake National Park
www.nps.gov/crla/
(541) 594-3100

Lassen Volcanic National Park
www.nps.gov/lavo/
(530) 595-4444

Lava Beds National Monument
www.nps.gov/labe/
(530) 667-2282 Ex.232

Oregon Caves National Monument
www.nps.gov/orca/
(541) 592-2100

Redwood National Park
www.nps.gov/redw/
(707) 464-6101

Whiskeytown Natl. Recreation Area
www.nps.gov/whis/
(530) 246-1225

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(cont'd from p. 1) Most natives of the region probably are already well aware of its unique biological richness, and probably also realize that Klamath Network parks such as Crater Lake, Lassen, and Redwood have long been familiar cornerstones of this natural heritage. Yet as Blake observed, the immensity of nature's mystery often hides behind familiar faces. Despite decades of protection, the Klamath Network parks still hold their share of mysteries, which park staff and their science partners are only beginning to unravel. It may be surprising to most people that such cherished lands are neither fully understood nor safe from impacts.

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Understanding Biological Diversity

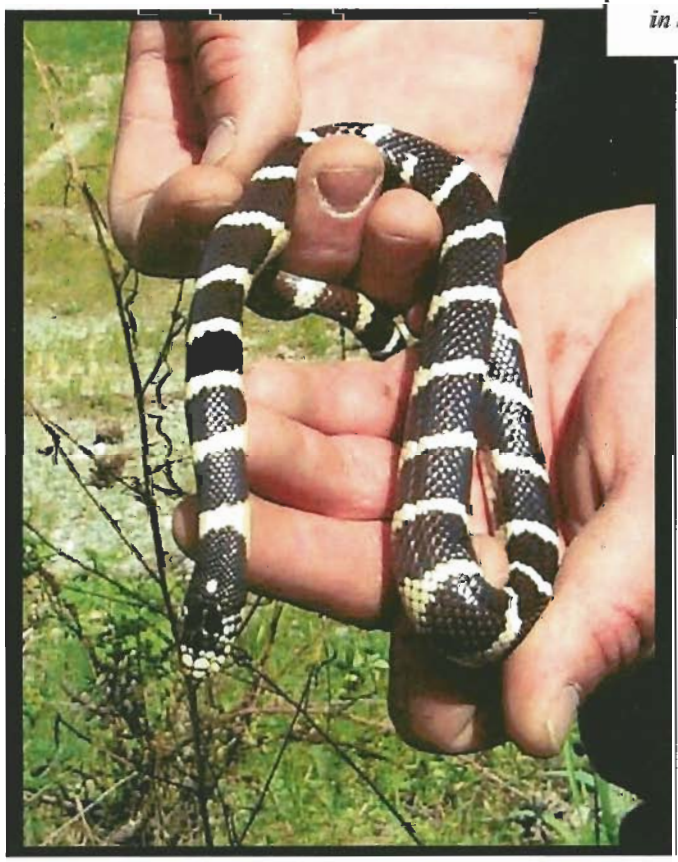
The concept of biological diversity has evolved steadily in American thought over the past century. Initially, park naturalists confined their interests to game or charismatic species such as deer, elk, salmon, trout, bear, and eagles, which were easily seen and enjoyed by park visitors. Predators, such as wolves and coyotes, were obstacles to be removed or at least controlled. Other less obvious species, including native rodents, amphibians, and songbirds, were largely ignored and assumed to be safe from threats. Today, park staff desire to more fully understand *all* species in the parks, and the processes that maintain them.

With the advent of the Inventory and Monitoring program, a broad-based initiative to document vascular plants and vertebrates in the national parks, the

(cont'd from p. 2) National Park service has launched its most comprehensive effort ever to understand biological diversity. In parks nationwide, biological inventories of vascular plants and vertebrate species are underway, thanks to the cooperative efforts of agency, university, and nonprofit scientists.

Beginning in 2002, the parks of the Klamath Network initiated inventories to better understand park biodiversity. Scientists hit the ground and surveyed for bats, small mammals, neotropical birds, reptiles, and amphibians. In last summer's inventory at Lassen, two new small mammal species were observed, the Merriam Shrew and the California Vole, that had not been previously documented in the park. Next year,

The parks of the Klamath Network include diverse landscapes in Southern Oregon and Northern California.



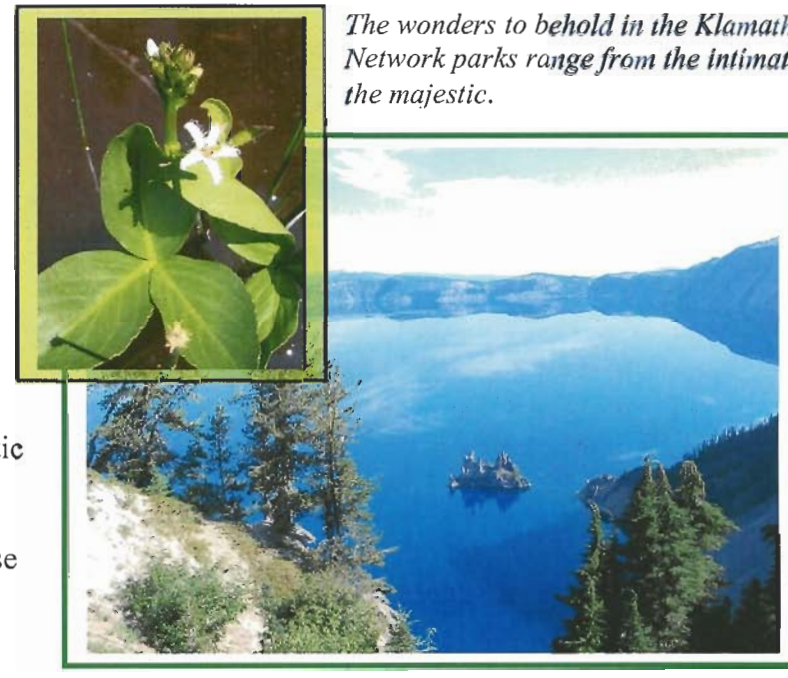
The king snake (left) and the carnivorous plant Drosera, or sundew (below), are two fascinating species found in the Klamath Network Parks.

(cont'd from p. 3) inventories will continue to look for new species and to better document the distribution and abundance of species of special concern in the parks.

Vital Signs Monitoring: Taking the Pulse of the Parks

Early park service administrators often assumed that the exclusion of logging, grazing, and mining would ensure that, in the words of Horace Albright, second director of the park service, parks would persist in "everlasting wildness". As early as the 1930's, however, scientific studies showed that this was a shaky proposition. Declines in native species (especially predators), introductions of exotic plants and animals, and impacts from roads were noted in the earliest investigations of California National Parks. Such threats pose an even greater danger to park biodiversity today.

As living landscapes, the Klamath Network parks undergo cycles of birth, death, and renewal on daily, yearly, and geological time scales. Park staff are working to understand these patterns and how the vital balance of ecosystem health is maintained. Threats to ecosystem health include pollution, climate change, fire suppression, non-native species invasions, and visitor impacts. Like a doctor tracking a patient's health, park scientists and managers are developing ways to gauge the health of park ecosystems through monitoring of park "vital signs". Ongoing examples of such vital signs monitoring include tracking of air and water quality, climate, and population dynamics of small mammals or waterfowl, and studying long-term photographs. Efforts are underway to develop a more comprehensive approach that covers the breadth of biodiversity in the parks.



The wonders to behold in the Klamath Network parks range from the intimate to the majestic.

In addition to the field activities, the Inventory and Monitoring Program is also building a more comprehensive information tracking and storage system within the National Park Service. As we enter the 21st century, the National Park Service is increasingly employing computer technology for the management and study of park biodiversity information. These Inventory and Monitoring databases will provide managers and researchers with more efficient access to information essential to monitor and protect park ecosystems.

Persons interested in learning more about the National Park Service's Inventory and Monitoring Program can visit the National Inventory and Monitoring Webpage at: http://www.nature.nps.gov/im/

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Recent Klamath Network Highlights

January 27-28, 2004 -- Marine Monitoring Scoping Workshop, Redwood NSP

March 1-5, 2004 -- Klamath Network Geology and Soils Scoping Meeting

May 4-6, 2004 -- Klamath Network Vital Signs Scoping Meeting

June 18, 2004 -- Flora Survey begins at Lava Beds National Monument

June, 2004 -- Fish and Amphibian Study begins at Lassen Volcanic National Park

Upcoming Klamath Network Events

August-October, 2004 -- Forest Bat Inventories *in Crater Lake NP, Redwood NSP, and Oregon Caves NM*

September, 2004 -- Non-native Species Scoping Workshop, *place and time TBA*

September, 2004 -- Wetland Inventory to begin *in Lassen Volcanic NP, Crater Lake NP, and Oregon Caves NM*

Kirlin Community Lecture Series Completes Second Season

This past spring, the Klamath Network and the ScienceWorks Hands-On Museum in Ashland presented the second year of their popular Kirlin Community Lecture Series.

The Kirlin lectures are intended to create a forum for the presentation and discussion of scientific topics in the Rogue Valley. "Our region has such a wealth of knowledge and interest regarding science and nature,"explains Elib Crist-Dwyer, Program Coordinator for ScienceWorks, "we thought occasions to learn about and discuss scientific topics would be well-received." The lectures give our amazing local talent pool of scientists and naturalists an opportunity to share their insights with the public. They also give staff scientists at the Klamath Network parks the chance to present their current research, and they provide a forum for the community to exchange ideas and share its own passion and expertise.

Over its first two seasons, the Kirlin Lecture Series has been a hit, covering a fascinating breadth of topics and drawing enthusiastic audiences. Some lectures have touched on topics of especially urgent local importance, such as the health of the Bear Creek watershed and fire management policies at urban interfaces. Others have dealt with subjects, such as the history of women in science, that are more general but just as compelling. And the best part of these evenings has often been the discussion following the lecture, during which audience members have posed challenging questions and shared their own thoughts.

For more information, contact the ScienceWorks Hands-On Museum at (541) 482-6767 or on the web at www.scienceworksmuseum.org, or contact the Klamath Network at (541) 488-7910.

Whitebark Pine's Uncertain Future at Crater Lake

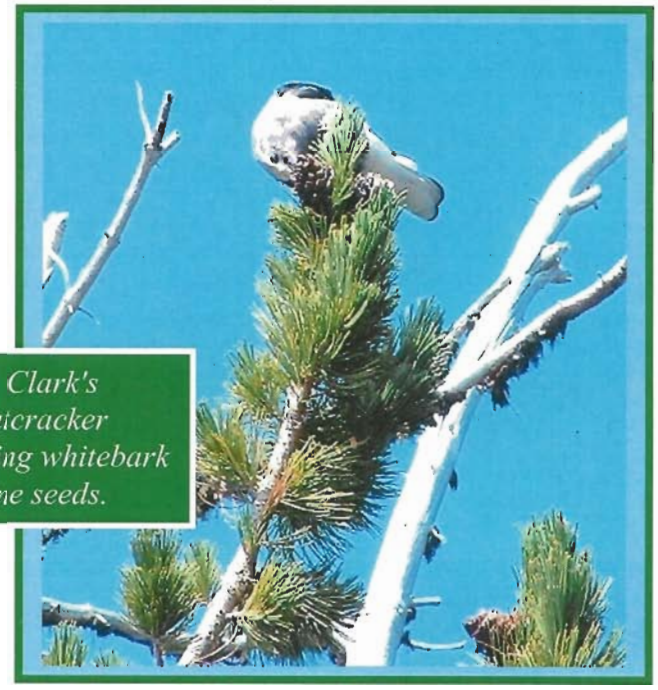
By Michael Murray, PhD, Terrestrial Ecologist, Crater Lake NP

Over 500,000 visitors mingle under the whitebark pine groves every year at Crater Lake. Few are aware of the pine's extraordinary value or its imperiled status.

Whitebark pine (*Pinus albicaulis*) is the only North American representative of the pine subsection *Cembrae*, or stone pines, an exclusive group distinguished by large, wingless seeds within cones that stay closed when ripe. Unable to rely on wind dissemination of seeds, stone pines have partnered with a genus of specialized birds (*Nucifera*) to accomplish seed dispersal. Our local representative, Clark's nutcracker, is skilled at prying open cones and burying seeds in the ground for later meals. Many forgotten seeds sprout into new seedlings. In fact, scientists believe that the pine would not be able to reproduce without the assistance of the nutcracker.

The pine thrives in mixed stands of the subalpine zone, sharing woodlands with mountain hemlock and fir. The harsh upper subalpine zone thins out all but the hardiest trees. In the Cascade Range, whitebark pine is often the only tree hardy enough to survive – often forming pure stands. Thus, the pine forms a forested ecosystem where otherwise only meadow or sparsely vegetated slopes would exist.

At Crater Lake, the pines cling to the caldera edge, forming the most extensive lakeside population in the world. Pure stands are found at the highest elevations of Mt. Scott, The Watchman, and Hillman Peak. A variety of animals and plants thrive in the Park's whitebark pine groves. These include black bear, golden-mantled squirrel, three-toed woodpecker, and Clark's nutcracker. Bats roost within old pines. Understory flora which benefit from the pine canopy include woodrush, arnica, and currant. The pines also stabilize loose slopes and retard snowmelt.



A Clark's nutcracker gathering whitebark pine seeds.

The pine has intense relationships with several agents of disturbance –especially fire, mountain pine beetle, and blister rust. Considerable attention has been focused on these issues during the past two decades; however, virtually all this attention has been directed at the Rocky Mountain region. Only in the past few years has Cascadian whitebark pine been studied. In fact, the non-native scourge known as blister rust was not formally detected on the Park's whitebark pine until 2000. Based on conservative estimates, infection ranges from zero on the east side to 20% on the west. Plenty of snags (dead trees) along the west rim indicate that the disease is not a

(cont'd from p. 6) newcomer; in fact, it is known to have been in the southern Oregon Cascade region as early as the 1930's. We estimate that up to 26% of the Park's westside whitebark pines have been killed by the disease. At current rates, about half of the westside pines will be gone by 2050.

In order to understand and respond to the pine's predicament, Park staff have a lot of catching up to do. Actions we are taking include mapping, community classification, monitoring, fire research, and disease resistance testing:

- ***During 2003, six permanent monitoring plots were installed. Yearly assessments will be made of 450 whitebark pines in these plots. We are particularly interested to gather data on the rates of death once pines are infected.***

- ***We have begun a fire history project, which includes research at Mount Rainier and North Cascades National Parks as well as adjacent US Forest Service lands. Objectives are to 1) gain an understanding of fire regimes associated with Cascadian whitebark pine, 2) describe historic and current stand conditions, and 3) estimate potential ecological effects of fire exclusion policies.***

- ***In 2003, we began a rust-resistance program. This long-term effort entails identifying naturally disease-resistant trees in the Park. We are collecting cone seeds and having them tested by the US Forest Service Dorena Tree Improvement Center. Resistant mother trees will be used for future collecting, nursery rearing, and eventual outplanting.***

By finding and protecting resistant mother trees, we hope to preserve a lifelink to the future.

While these biological investigations take place, the park is increasing its protective measures for the pines. Our new five-year fire management plan (2003-2007) acknowledges the tree's sensitive status and dictates that they will not be felled except when posing a direct threat to firefighter safety. Firelines are to avoid the immediate vicinity of pines. The plight of whitebark pine is discussed at all-staff meetings and is a routine topic for seasonal interpreter orientation.

Because Crater Lake National Park has only a single resident terrestrial ecologist, we have relied on the welcome cooperation and expertise of organizations such as the Oregon Natural Heritage Program, Joint Fire Sciences Program, and US Forest Service. Our outreach also includes public media. Most recently, Oregon Public Broadcasting's "Oregon Field Guide" television series showcased our whitebark pine.

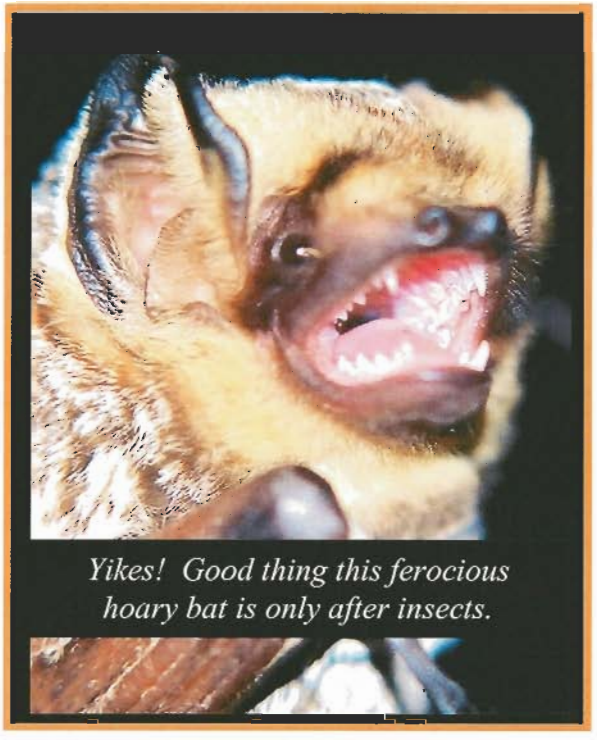
While progress is being made, overall pine numbers continue to decline in the Park. A mountain pine beetle epidemic detected in 2002 shows no signs of slowing. Rim Village, a central tourist destination, is losing its few remaining pines. Rather than throw our hands up in despair, we have become more resolute in conserving whitebark pine as an important element of Crater Lake National Park.

NOTE: A portion of this article was previously printed in Nutcracker Notes: Newsletter of the Whitebark Pine Ecosystem Foundation.

Bat Research in the Klamath Network Parks of Northern California

By Tom Morrell, PhD, Professor of Wildlife Biology and Management, Ball State University, Muncie, Indiana

Though bats are common animals, relatively little is known about their status and distribution on public lands in northern California. This lack of information creates a problem for land managers, who find it difficult to adequately determine what impacts land use activities will have on bat communities. Because bats are widespread and secretive, and occur in many habitats, they are difficult to survey. Thus, it would be useful to biologists and managers if models could be generated that would accurately predict the potential occurrence of a species. Such models would be particularly helpful in remote areas that cannot be surveyed due to logistic or financial constraints.



Yikes! Good thing this ferocious hoary bat is only after insects.

During 2001-2003, research was conducted to monitor bats in three areas of northern California: Whiskeytown National Recreation Area, Lassen Volcanic National Park, and Lassen National Forest (Eagle Lake Ranger District). The objectives of the study were to 1) use mist nets to determine the relative abundances of bats in the three study areas, 2) determine the distributions of different bat species in the study areas, and 3) develop predictive species-occurrence models based on landscape-scale parameters.

Surveys were conducted over the summers of 2001-03. The resulting data are summarized in the accompanying table (p. 9). All three parks are home to a large diversity of bats, with Lassen National Forest yielding the highest species count, fourteen. Though most of the species found at any one park can also be found at one or both of the other parks, there are striking differences from park to park in the relative abundances of the different species. Most obviously, there is a different most common species in each park. In fact, three of the four most common species at the Lassen parks (long-eared myotis, little brown myotis, and long-legged myotis) are uncommon or totally absent from Whiskeytown. Meanwhile, several other species (the big brown bat, California myotis, and Mexican free-tailed bat) are several times more common at Whiskeytown than at either of the Lassen parks! Clearly, there are significant differences in species distribution patterns from park to park. These data are currently being analyzed in order to develop predictive occurrence maps for select species. Hopefully these efforts will aid in the conservation of these fascinating creatures, which are so widespread and ecologically important, yet also so elusive.

Bat Distributions at the Klamath Network Parks of Northern California

(numbers represent percentage of total captures in each park)

Whiskeytown N.R.A.	Lassen Volcanic N.P.	Lassen Natl. Forest
Yuma myotis (27.8%)	**long-eared myotis** (26.5%)	**silver-haired bat** (19.8%)
big brown bat (26.8%)	**Yuma myotis** (19.7%)	**long-eared myotis** (18.2%)
silver-haired bat (12.9%)	**little brown myotis** (19.7%)	**little brown myotis** (16.8%)
California myotis (11.2%)	**long-legged myotis** (14.4%)	**long-legged myotis** (14.4%)
Mexican free-tailed (10.2%)	**big brown bat** (7.0%)	**Yuma myotis** (13.5%)
pallid bat (4.7%)	**silver-haired bat** (5.9%)	**big brown bat** (7.1%)
long-eared myotis (3.2%)	**hoary bat** (4.4%)	**fringed myotis** (3.0%)
western red bat (2.0%)	**fringed myotis** (2.4%)	**California myotis** (2.2%)
hoary bat (1.2%)		**pallid bat** (2.1%)
fringed myotis (0.7%)		**hoary bat** (1.4%)
		Townsend's big-eared (0.1%)
		Mexican free-tailed (0.1%)
		western red bat (0.05%)

Jefferson Fish Society Off to a Swimming Start

By Joe Madden, Klamath Network Outreach Intern

When asked if fish biology and aquatic ecology hold a particularly compelling interest for residents of the Klamath region, Dr. Michael Parker, Professor of Aquatic Ecology at Southern Oregon University and a founding member of the Jefferson Fish Society, answers with an unequivocal "yes." Salmon, of course, are, as Dr. Parker puts it, "iconic" around these parts, a symbol of nature's bounty but also of its vulnerability to human interference. On a broader scale, our region's aquatic ecology in general is characterized by this same combination of biological richness and imperilment: We are heir to a remarkable complexity and diversity of river habitats, but these habitats are subject to severe stresses and threats from human impacts. Naturally, this situation generates a lot of concern among residents of the area.

It's no surprise, then, that the Jefferson Fish Society is off to a strong start. Still less than a year old, the Society already has over 100 members and so far has attracted about 40 or 50 attendees to each of its three quarterly meetings. The members include university faculty, government agency biologists, environmental consultants, members of conservation organizations, teachers, and other interested citizens from various walks of life. To include as many participants as possible, the group holds each of its meetings in a different location; the first three have been held in Medford, Ashland, and Grant's Pass.

The purposes of the JFS are several: to give professionals in fish-related sciences a chance to socialize and share ideas, to inform professionals and non-professionals alike of current developments in the field, and simply to stimulate interest in topics related to fish and aquatic ecology. Meetings are held over dinner and include two presentations of thirty minutes each.

For more information, please contact Dr. Michael Parker at parker@sou.edu

INVASION OF THE BULLFROGS!

Studying the Impact and Distribution of an Introduced Species at Whiskeytown National Recreation Area

By R. Bruce Bury, PhD, Ecologist, USGS Forest and Rangeland Ecosystem Science Center, Corvallis, Oregon

The bullfrog is the most conspicuous amphibian in Whiskeytown National Recreation Area. Unfortunately, it is an invasive species that doesn't naturally occur here; it's a native of eastern North America that was introduced to the West about a century ago. Until now, the impacts of this voracious predator on native amphibian species at Whiskeytown have not been studied.

Bullfrogs prefer still-water environments such as lakes and ponds. They are the dominant amphibian in Whiskeytown Reservoir, where on warm summer evenings the air is filled with the males' loud "broom-broom" or "jug-a-rum" calls. The bullfrogs reach their highest population density in the reservoir, though some occur in nearby ponds and streams. They become less common as elevation climbs and cooler conditions prevail (see table, p. 11).

Today the bullfrog is the largest frog at Whiskeytown, with adults measuring up to 6 inches long and sometimes weighing over a pound. Tadpoles are very large as well, up to 7 inches long. Because of their large size, bullfrogs can eat an amazing range of food, including small birds, hatchling turtles, and other frogs. (Although less dramatic, most of their diet actually consists of insects, crayfish and other smaller items.) The bullfrog has a reputation for preying on, and eventually completely displacing, native amphibians.

Some evidence now suggests that bullfrog survival is enhanced by the presence of introduced fishes, such as the sunfish and bass that have been stocked at Whiskeytown for years. This new information suggests that the introduced fish eat dragonfly nymphs, which prey on young bullfrog tadpoles. Thus, a decrease in the population of dragonfly nymphs means that more bullfrog tadpoles survive. Furthermore, the tadpoles themselves appear to be protected from sunfish and bass predation because of their noxious skin. The sum result of these interactions is that one invasive group (introduced fishes) enhances the survival of another invasive --- the bullfrog. If this is the case, the combined presence of bullfrogs and introduced fishes may deliver a 1-2 punch to native species of wildlife. Hopefully, the current research is the first step toward identifying and solving the problems that bullfrogs create for native wildlife.

AMPHIBIAN OCCURRENCE BY HABITAT AT WHISKEYTOWN N.R.A.

Code: *-common or widespread; **-typical; *-rare or limited**

Species:	Lake	Ponds	Streams		Terrestrial
			Warm	Cold	
Pacific treefrog	**	***	**		*
Bullfrog (introduced)	***	**	*		
Western toad	*	**	*		**
Yellow-legged frog			***	*	
Tailed frog				***	?
Rough-skinned newt	**	**	**		**
Giant salamander			*	***	*
Black salamander					**
Ensatina					***

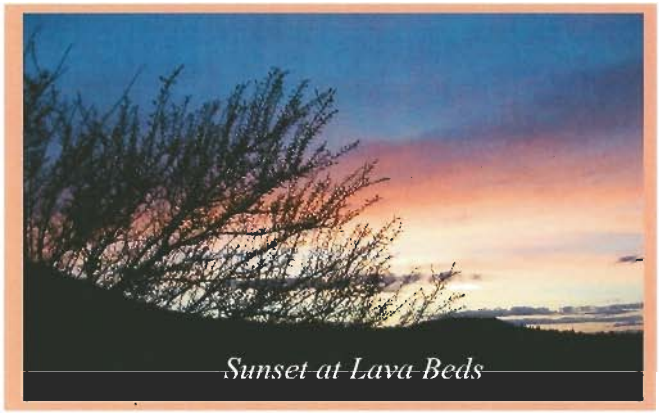
The research summarized above yielded the first recorded sightings of **tailed frogs** at Whiskeytown! This species was found at two sites in cool, cascading streams flowing off Shasta Bally, a 6200 ft. mountain in the park. This denizen of the Pacific Northwest is considered one of the most primitive frogs in the world -- its direct ancestors were present during the Age of Dinosaurs!

Botanical Survey Begins at Lava Beds National Monument

By Joe Madden, Klamath Network Outreach Intern

Lava Beds National Monument is a unique and valuable component of the Klamath Network. Millions of years of volcanic activity have created many geological marvels here. Not only does the Monument abut the largest volcano (by area) in the Cascade Range (the Medicine Lake shield volcano), it also houses the highest concentration of lava tube caves in the U.S. Many other fascinating volcanic formations are also present, including cinder cones, spatter cones, maar volcanoes, and rugged lava flows.

Despite its cataclysmic origins and austere-sounding name, Lava Beds is home to a surprising diversity of plant life. This is partly because the region in and around Lava Beds lies at the junction of the Cascade, Great Basin, and Sierra-Klamath physiographic provinces, where species from all three provinces are represented. Furthermore, the lava tube caves enhance diversity by providing a cool, moist microclimate for species that otherwise could not survive in the semi-arid, high desert environment of Lava Beds. There are cave mouth populations of several moss and fern species that are many miles disjunct from their normal ranges near the coast.



Sunset at Lava Beds

Starting in summer 2004, this plant diversity will be subject to a comprehensive survey as part of a master's thesis at Southern Oregon University by student Sean Smith under the guidance of Dr. Steve Jessup, Associate Professor of Botany. Their goal will be to develop a comprehensive and up-to-date picture of the vascular plant species within Lava Beds National Monument. The team will also be developing a professional floristic manual with an identification key for the plants of Lava Beds, which they intend to publish and make available to the public.

On a warm, sunny Friday in June, I was lucky enough to accompany Sean, Dr. Jessup, and Daniel Sarr, Klamath Network Inventory and Monitoring Coordinator, on a tour of the Monument. Our guides, David Larson and Kristin Riebeling of Lava Beds, seemed thrilled to indulge a few fellow "plant geeks" in a day of exploration. Besides the vibrant wildflowers, high desert trees and shrubs such as Ponderosa pine, mountain mahogany, and green-leaf manzanita, and fragrant juniper-sage scrubland, some other highlights of the trip included an encounter with a western rattlesnake and a visit to the historic Captain Jack's Stronghold, a rock formation where the Modoc Indians held off U.S. Army forces for five months during a conflict in 1872.

Best of all, however, the expedition discovered three plant species -- *Crepis bakeri*, *Epilobium angustifolium*, and *Alyssum alyssoides* -- that had never before been documented in the Monument! Not bad for a first day's work. What promises to be an exciting project is off to a fast start!