

are both working with the senator to ensure the final language of the legislation includes incentives for voluntary efforts to address NPS pollution.

The Rangeland Watershed Program has been involved in other water quality issues as well, such as when the San Francisco Public Utilities Commission and Contra Costa Water District considered moratoriums on livestock grazing in their watersheds because they feared cattle might contaminate their drinking water supplies with *Cryptosporidium parvum*. Key faculty in hydrology, microbiology, ecology, animal health and other disciplines have supplied science-based information to such controversies. In addition to George and Tate, they include Rob Atwill, a veterinarian and environmental health specialist with the Veterinary Medicine Teaching & Research Center; Randy Dahlgren, a UC Davis biogeochemist; and Barbara Allen-Diaz, a UC Berkeley range ecologist. Atwill and Tate are analyzing the links between grazing and

waterborne pathogens including *Cryptosporidium parvum*. Dahlgren's laboratory is quantifying nutrient flow processes that directly affect rangeland water quality. Allen-Diaz is studying biodiversity in riparian areas under various grazing schemes.

Related research is taking place on nine coordinated experimental and demonstration watersheds at the Sierra Foothill and Hopland research and extension centers and the San Joaquin Experimental Range, where different grazing, fire and other treatments are under study. This summer UC will be evaluating all its projects dealing with watershed management and will conduct focus group interviews with several of the state's many watershed groups to assess current research and extension efforts. Additionally, an inland fisheries specialist will join the team to work on inter-related water quality and endangered species issues.

— John Stumbos



Research update

New direction for Sierra Nevada forests

Prompted by concerns about the health of the Sierra Nevada, Congress requested in 1993 that the entire ecosystem be reviewed by a panel of independent scientists. The result was the \$6.6 million Sierra Nevada Ecosystem Project (SNEP). Led by UC Davis water resources specialist Don Erman, the approximately 140 scientists who analyzed existing knowledge of the Sierra Nevada delivered the SNEP report to Congress in 1996.

While Congress has done little with the SNEP report, it has had far-reaching consequences for the Sierra Nevada. Notably, SNEP led to fundamental changes in the way the U.S. Forest Service manages the region's 11 national forests, which encompass 13 million acres. SNEP concluded that one reason for the Sierra Nevada's troubles is that conservation issues cross the boundaries of individual forests and land ownerships. Accordingly, rather than managing these 11 forests individually, the Forest Service is developing a rangewide plan de-

signed to protect and restore the land as well as to provide benefits for people. This new approach is called the Sierra Nevada Framework for Conservation and Collaboration, or Framework for short.

"We are heading towards broader, ecosystem management with sustainability of all resources as our primary motivating force," says Chris Holmes, a Forest Service spokesman in Washington DC. "We will work across the whole landscape in the Sierra Nevada and coordinate with nonfederal lands."

One of the first steps of the Framework was the 1998 Sierra Nevada Science Review. Based on SNEP and other current scientific information, seven scientists at the Forest Service's Pacific Southwest Research Station identified the most urgent rangewide conservation issues for national forests in the Sierra Nevada.

Based on the Science Review, the Forest Service is developing an Environmental Impact Statement (EIS), which is due out this summer.

"Many of the forest plans are out-of-date and inconsistent," says Sacramento-based Framework EIS team leader Steve Clauson. "We are bringing the plans up-to-date in five problem areas." These areas are old-growth forests; aquatic, riparian and meadow ecosystems; fire and fuels management; oak woodlands in the western foothills; and noxious weeds.

One instance of inconsistency in Sierra Nevada forest management is riparian standards. The EIS management plan amendments will require analyzing the cumulative effects of the many factors that affect the health of riparian ecosystems, which include the width of buffer zones and the capacity of roads to withstand torrential rains. Another instance of inconsistency is the conservation plans for carnivores such as fishers, which are declining in part due to the fragmentation of the old-growth forests where they live. By coordinating the forest plans, the EIS amendments will help ensure that corridors link the fishers' habitat throughout the Sierra Nevada.

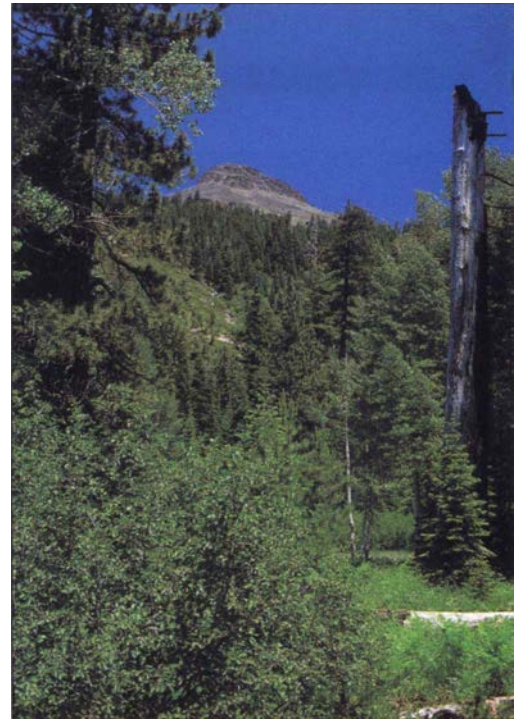
Ultimately, the Framework will go beyond the EIS and address issues ranging from conserving biodiversity to recreation to timber

management. To help coordinate the research needed to make sound management decisions, the Sierra Nevada Network for Education and Research will be established at UC Merced, which is expected to open 2005.

While the Framework's goal is finding cooperative solutions to wildlands issues throughout the Sierra Nevada, some stakeholders are feeling left out. "The [EIS] amendments will cover five wide-ranging issues that will affect everything including economics. Economics was not part of the dialogue and we think that's wrong," says John Hofmann, vice president of governmental affairs of the California Forestry Association, a trade association representing about 70% of California's timber interests.

Since 1993, the forestry industry has been subject to the interim guidelines designed to

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Dan Cheatham

The Forest Service is developing a rangewide plan for managing all of the Sierra Nevada's 11 national forests.

SNEP findings: Why the Sierra Nevada is in peril

The SNEP team was charged with three tasks: assessing the existing information on the Sierra Nevada, examining alternative management strategies and framing these strategies "to maintain the health and sustainability of this ecosystem while providing resources to meet human needs," says SNEP team leader Don Erman of UC Davis.

The SNEP team's major findings included that aquatic ecosystems, old-growth forests and oak woodlands in the western foothills are imperiled. Amphibians and small forest-dwelling carnivores such as fishers and martens have declined greatly, non-native plants and animals are invading the Sierra Nevada, and people are moving to the largely privately owned foothills in unprecedented numbers.

While the SNEP team agreed that these were major threats to the health of the Sierra Nevada, there was little consensus on the best way to address them. In many cases, this is due to gaps in our basic knowledge of the diverse ecosystems that comprise the Sierra Nevada. The many

questions about old-growth forests alone include: What was the structure of forests historically? What structural standards should we use for old-growth forests? And once we set those standards, what fire regimes should we use to achieve them?

While it is not clear exactly how to manage the Sierra Nevada, it is clear that we have to do something. The SNEP team predicted unless we actively address these problems, they will just keep getting worse.

As the SNEP report concluded, "Left unresolved is the question of whether our society has the will and the capability to correct such problems. Implementation of new approaches or possible solutions is the responsibility of the public and its institutions. The beginning is to acknowledge that problems exist: willing minds and able hands can find solutions."

The U.S. Forest Service's Sierra Nevada Framework for Conservation and Collaboration is a good first step to solving the mountain range's problems. — R.M.

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protect the California spotted owl. Intended to be in place for only 2 years, the rules are not suited for long-term management. For instance, a given stand of trees can be entered only once. And while the Forest Service develops the Framework, the forestry industry continues to wait for resolution. "We're caught between a rock and a hard place — we want to get out from under the interim guidelines but we want the plan done right," says Hofmann, adding, "We have a lot of confidence in the Forest Ser-

vice folks locally and will work with them throughout the process."

Framework EIS team leader Steve Clauson responds that the Forest Service has listened to forest industry concerns and that Sierra Nevada-wide management will balance the needs of all stakeholders insofar as they are compatible with conservation goals. "The Framework is the best thing to do for the forests — it's long overdue," agrees Framework staff member Steve Waterman. — Robin Meadows

Fighting fire with fire science

Fire is a constant challenge for the state's natural resource managers. For most of this century, fire suppression has been the rule at the state and federal levels. Each year, the California Department of Forestry puts out, on average, 7,500 fires; federal agencies suppress another 2,000, according to the California Forest Stewardship Program's recent newsletter. The result has been dramatically denser vegetation and greater risk of catastrophic wildfire.

Fire scientists generally concur that prescribed burning is one way of reducing this risk, in part by clearing land of dense undergrowth. But there is some potential conflict between agricultural and forest materials burning, primarily because of restrictions under the California Air Resources Board — which is now in the process of revising, and likely restricting, its agricultural and forest burning rules. At times, the complexity and controversy of fire management in California seem as ubiquitous as fire itself.

UC researchers are working to address these issues and provide scientific analysis for sound policy decisions.

UC Davis researchers David Rizzo (see page 17), Michael Barbour, Tom Cahill, John Reuter and others recently participated in a special watershed assessment of the Lake Tahoe Basin for the U.S. Forest Service. Part of the study deals with reconstruction of past fire regimes and predicting the effects of prescribed burns on air and water quality in the region, where fire suppression policies have prevailed for 75 years.

To determine which ecological factors have most affected the watershed, the researchers drew from the work of Richard Minnich, a UC

Riverside geographer and leading fire-ecology researcher who has been studying wildfires and their effects in chaparral and forest vegetation of the Sierra San Pedro Martir of Baja California. This landscape is ecologically similar to that of the Tahoe Basin but has no history of fire suppression. Minnich concludes that major understory wildfires still occur in Sierra San Pedro Martir two or three times each century.

By comparing vegetation in the Tahoe Basin with that at the Mexico site, the Davis team determined that fire suppression has affected the Basin's ecosystem more than any other single factor. And other work by these researchers suggests these effects are not beneficial.

As reported in 1995 and 1999 publications, and through their latest work in the Tahoe Basin, the scientists found that some herb, shrub and tree species reproduce, regenerate and grow better in the absence of periodic ground fires than in their presence. The plants' abundance changes the suitability of the forest for wildlife: for example, bird biodiversity declines, and the incidence of disease and mortality among trees of all ages increase significantly. These findings suggest that the absence of periodic fires is good for some species and bad for others — with dramatic implications for overall landscape and habitat.

The researchers acknowledge that prescribed burns can reduce the risk of catastrophic fire but have risks of their own, including emissions of gases and particulates that can travel long distances with implications for human health, air and water quality and visibility. A final report of the Tahoe Basin study should be issued in June.