The myriad benefits of mountain meadows

Meadows are beautiful, yes. But did you know that they also are hotspots of biological diversity? Or that they can help regulate the timing of water released downstream and thereby reduce flooding? Meadows also filter water and improve water quality, provide forage for animals, are havens for sensitive species, act as natural firebreaks, are prime fawning areas for deer, supply material for basketry and other cultural uses, sequester carbon, reduce the need for dams, and will become even more important as the climate gets drier.

However, despite their critical importance and many benefits, Sierran meadows have been sadly neglected. Past land use and management practices, including overgrazing, rechanneling, poor logging practices, road and railroad construction, mining, and fire suppression, have severely degraded many mountain meadows. Damaged meadows no longer function properly, to the detriment of the plants, animals, and downstream water users that depend on them.

This issue of Forestland Steward will introduce you to mountain meadows and their restoration. In addition, read about cost-share money available to help landowners with a range of forest improvements (p. 9) and check out all the learning opportunities coming your way (p. 9). Finally, visit our new Forest Stewardship website, http://ceres.ca.gov/foreststeward (p. 10).
More than pretty flowers

Meadows are magical places. Visit one in the spring and you will be dazzled by the delicate colorful flowers and the symphony of insects working them for pollen and nectar. The sights, sounds, and smells make it a place of fairytale dreams and idyllic memories.

But the real magic is less poetic. It is found in a meadow’s complex hydrology and ecology, and in the amazing benefits provided by these beautiful fragile ecosystems.

Much of our clean water originates from mountain meadows (see illustration below). A healthy meadow is often compared to a sponge. It is able to absorb vast amounts of water and then release it slowly, extending flow later in the season.

In the wet season, water moves easily out of the stream channel and onto the floodplain where it slows and disperses over a large area. In the process, particulate matter and pollutants are filtered out before they reach the river. This dispersal can also help to reduce flooding downstream during heavy rains.

The easy movement between stream and floodplain is critical. As a stream channel deepens through erosion, it can carry more water without overflowing onto the floodplain, eventually losing the connection altogether. Once a gully develops, it acts much like a drain, speeding water and sediment downstream. The rapid loss of water lowers the water table, the meadow becomes drier, and the plant community changes with major impacts to wildlife.

Meadow vegetation plays its role in a healthy meadow. Dense plant cover helps slow water to increase infiltration. The roots hold the soil against erosion. These shallow-rooted plants tap into the high water table, but if the water table drops they cannot survive. Then plants with longer roots and those adapted to drier conditions can take over. Conifers may begin to grow into the meadow, which may eventually become a forest.

California has more than 10,000 meadows totalling about 300,000 acres, mostly located in the Sierra Nevada and Cascade mountains. These meadows have various ownerships—public and private—with multiple management objectives.
Moreover, no two meadows are alike. Each has its own size and shape, soil characteristics, underlying rock, depth, slope, etc. Restoration decisions must take all of these factors into account, as well as land use history.

About 40–60% of Sierra Nevada meadows are considered degraded (see illustration below). Much of this is legacy damage from past land use, including road building, overgrazing, railroad construction, mining, poor logging practices, channelization, fire suppression, and recreational use. Introduction of nonnative plants and animals, development pressure due to an increasing population, and changes in climate present new and ongoing threats.

Although current land managers are more aware of the activities that cause meadow degradation, the legacy effects from earlier practices are still with us. Once a stream becomes entrenched, the meadow cannot heal itself, at least on the scale of a human lifetime, so restoration becomes necessary and, given its many benefits, worth the cost and effort.

The goal of meadow restoration is to restore the hydrologic, geomorphic, and ecological functions of degraded meadows. This doesn’t change the amount of water in the system, simply its distribution and timing, which affects its availability to plants, animals, and people.

Meadow restoration is still an emerging science and involves a lot of trial and error. Many questions remain and numerous studies are currently underway to help us better understand these intricate systems.

The importance of water cannot be overstated. While California forests produce a variety of valuable products, including timber, fish, wildlife, livestock, recreation, and more, the economic value of water equals or exceeds that of any other forest resource.

Meadows are a form of groundwater banking. They store water in the soil, vegetation, streams, and underground aquifers. This will become increasingly critical as the climate warms and less water is stored in the winter snowpack.

Luckily, meadows appear to respond quickly to restoration efforts. And, once restored, maintenance costs are low. Other benefits that come from restoration, such as wildlife values and beauty, are priceless.

### Meadow Restoration Lingo

As you delve into meadow restoration you’ll learn some interesting and useful new words.

- **alluvial**—fine-grained soil deposited by water.
- **entrenched**—incised; cut into the plain.
- **fluvial**—relating to a river or stream.
- **geomorphology**—study of the nature and evolution of landforms.
- **gully**—a deep ditch or channel cut in the earth by running water.
- **hydrology**—study of the properties, distribution, and effects of water on the earth’s surface, in the soil and underlying rocks, and in the atmosphere.
- **remnant channels**—portions of the historic stream channel that carried water in a meadow.
- **riparian**—relating to or located on the banks of a river or stream.
- **xeric**—characterized by, or adapted to, an extremely dry habitat.
The toolbox of meadow restoration techniques continues to grow. Pond and plug is a relatively new method that uses local fill material to plug the gully and reconnect the stream channel with its floodplain. This method is becoming increasingly popular because it is relatively inexpensive and has demonstrated great success.

The Upper Big Bear Flat Meadow restoration project was initiated by the Fall River Resource Conservation District (RCD) in Shasta County. The RCD had concerns about sediment going into the Fall River and, after a watershed assessment, identified six meadows to be restored as a step toward addressing that problem.

Upper Big Bear Flat is a privately owned meadow that became entrenched in the 1950s, causing the stream channel to become disconnected from the floodplain. With a gully 15 to 20 feet deep in places, water didn’t overflow onto the floodplain; it was carried quickly downstream causing the meadow to dry out. Conifers encroached and the meadow eventually became a forest.

To restore the meadow, the RCD chose to use the pond and plug method. This involves excavating near the stream, which creates ponds, and filling in the gully with that material, which becomes the plug. This is much more economical than transporting fill material from farther away—a major benefit of this technique.

In preparation for the project, grazing was suspended from Upper Big Bear Flat Meadow for three years and permits readied. Permitting turned out to be a major effort. Two separate permit processes were required: a Timber Harvest Plan (THP) to remove the 60 acres of lodgepoles and California Environmental Quality Act (CEQA) to fill the gully.
The permitting process was complicated because the Forest Practice Rules don’t address stream channel restoration. This project helped clarify the issue, and the Rules on aspen and meadow restoration are expected to be updated in January.

With permits finally in hand, the landowner and RCD were ready to go into action when funding became available.

The work took three months. Scrapers and excavators were used to dig the ponds and plug the gully. A new stream channel was created that redirected the creek into remnant channels.

The meadow has responded beautifully and the project achieved its goals: the stream was reconnected to the floodplain, erosion and sediment reduced, water quality improved, and there is an increase in forage and meadow plants. When the meadow is stabilized, cows will be reintroduced to graze.

Engineering a meadow restoration project is a complex undertaking. It requires technical understanding of meadow geomorphology, hydrology, ecology, engineering, and more. And then, after all the work is done, the planners must sit back and wait patiently to see how nature responds to the restoration. Hopefully, the meadow will function as predicted.

Most of the dozens of pond and plug projects have been successful, but there have been a few failures, usually due to design flaws.

Despite the success of pond and plug projects, there have been complaints that pond and plug projects do not adequately consider fishery needs. Finally, meadow restoration can change the timing of water flows to downstream users, potentially leading to water rights conflicts. All these issues need further study.

Overall, however, pond and plug has proven to be beneficial to both the landowner and downstream water users. The landowner gets more forage that lasts later in the season, an abundance and diversity of wildlife, potential increase in property values, and a beautiful meadow. The benefits to people downstream include improved water quality and quantity, decreased sediment, attenuated floods, and other invaluable ecosystem services.

—Many thanks to Todd Sloat for patiently answering endless questions for this article.

Who to contact?

Meadow restoration is a major project that requires a lot of technical expertise. Depending on where your meadow is located, you may want to talk to your local RCD or NRCS office. In Plumas County, the Coordinated Resource Management (CRM) group has a lot of experience with pond and plug projects. Pond and plug has recently been approved for EQIP funding in certain circumstances.
The Van Vleck meadow was burned in 2009. After the fire, groundcover increased 30 percent, diversity exploded, and the air buzzed with insect life. Numerous studies are underway to document the results of this model burn.

When the Forest Service took control of the Van Vleck property in 1997 through a land exchange, they made the decision to actively maintain the 700-acre meadow. They began cutting conifers immediately, but it took many years before a prescribed burn could be implemented.

Something had to be done. There was a very real danger that the meadow could be gone within two generations. Conifers, especially lodgepole and red fir, were invading as the meadow dried, a consequence of several factors including fire suppression, loss of grazing pressure, and climate change.

Valerie Hendon, Pacific Ranger District Fuels Specialist, advocated strongly for using fire to restore the ecosystem. “We dug a pit 3 meters deep and it was layered with charcoal,” she noted.

Frequent fire is the historical condition for Sierran meadows, largely due to thousands of years of fire management by Native Americans. Studies of the soil and trees show that this meadow burned approximately every 10–15 years in pre-European times, a practice that was continued by early ranchers to provide fresh forage for their animals in the summer.

The natural fire return interval, without human intervention, is a stand-replacing fire in the surrounding red fir forest on the order of every 75 years, and no fire in the wet meadow. After fire suppression began in the 1920s, the ecosystem returned to this fire regime.

Since most meadow plants were adapted to more frequent fires, the lack of fire caused major changes to the ecosystem. Fire resets the successional clock; it takes out decadent trees, provides better forage for deer, removes conifer...
seedlings, and opens up areas for recolonization. However, scientific data about meadow burning is scarce and not all agreed that a prescribed burn was a good solution to the problem at Van Vleck. There were concerns about possible adverse effects on sensitive species and invasion by nonnative species.

So the Van Vleck prescribed burn became an experimental study to learn about the effects of fire on a mountain meadow.

“We had lots of hypotheses going into the fire,” says Valerie, “but the results were well beyond our expectations.”

The burn was done at the driest time of year at the driest time of day to get a fast-moving fire that didn’t linger. The objectives were to consume conifer seedlings, reduce decadent brush, and stimulate dormant forbs and grass seeds, while protecting woody species such as willows.

The fire was a wonder in itself. While carefully controlled, it traveled with a mind of its own. The fire avoided certain plants, like sedges, but some very wet areas mysteriously burned. Most of the burn was of low intensity, but there were also areas of moderate and high intensity. At the end of the day, “the mosaics were just crazy.”

In all, 168 acres were burned. After the fire, vegetation filled in and diversity increased. Grass in the burned area grew half a foot taller than areas that didn’t burn; waves of vegetation are evident where water flowed and pushed nutrients. There were many surprises about what came back; 171 species have been identified in the area, including two new species since the fire. What the fire didn’t do is get rid of conifer seedlings. Fortunately, loppers can take care of that oversight.

This project was supported by a grant from the California Deer Association because meadows are so important to deer. Some of the most important browse plants reseed or sprout following fire. Fire increases nutrients availability for these plants and improves the quality of meadows for fawning. In addition, regular fires prevent the build-up of fuels that can result in intense large wildfires that can harm the meadow value for deer and other wildlife.

The next step for the Van Vleck meadow is to remove the berm and culvert that created a pond for cattle. The Forest Service also plans to remove a rock road that bisects the meadow. There is discussion about introducing beavers, which create dams that increase flooding in the meadow. Most importantly, the meadow will be burned no less than every 10 years.
While mountain meadows cover only a small percentage of land in California, they are of major importance to wildlife. Mountain meadows have a number of attributes needed by wildlife. They provide water and shade through much of the dry season, reduce stream temperatures, create high plant productivity and insect availability, and offer special vegetation features like willow thickets and patches of alder and aspen. Plant diversity in meadows is extremely high and includes a number of rare species found only in this habitat. Meadows can be considered oases of special habitat. These oases are often linked by riparian corridors, which allow animals to move from one meadow to another for breeding and dispersal.

Amphibians rely on meadows because they remain wet throughout the year. Degraded meadows dry out earlier in the season, sometimes before tadpoles are fully developed into frogs. Nonnative species, like bullfrogs, are another major threat to native amphibians.

Meadows are considered the single most important habitat in the Sierra Nevada for birds, which use meadows for foraging and breeding. Four meadow species now have special status in California: Sandhill Crane, Great Gray Owl, Willow Flycatcher, and the Yellow Warbler. The most important characteristics of meadows to birds seem to be the dense patches of willows and alders, tall lush herbaceous vegetation, a large area-to-perimeter ratio, and soil moisture or standing water.

Deer use meadows for forage and fawning. Other mammals, such as voles, mice, gophers, and squirrels, are tasty prey for larger mammals such as weasels, pine martens, fishers, foxes, coyotes, and bobcats, not to mention raptors like owls and hawks.

Nine species of native fish require meadow habitat. Restoration can turn intermittent streams into year-round streams to improve fish habitat. The temperatures of restored meadows are lower by 3–5°C, which is vitally important to fish that require cool water. Fish expected to benefit from meadow restoration include natives such as the Eagle Lake rainbow trout, Lahontan cutthroat trout, McCloud River redband trout, and both the California and Little Kern golden trout.

And then there are the insects. Visit a healthy meadow in the summer and you’ll hear the air abuzz with insect sounds (including the unsoothing whine of mosquitoes). Dragonflies soar around looking for prey while other insects are busy with their jobs: pollinating flowers, feeding predators like flycatchers and western tanagers, aerating the soil, and all the other critical services that insects do.

For the large number of plant and animal species that rely on this special habitat, meadow restoration provides life-giving benefits. It is another major benefit of restoration.
Courses and funding opportunities for landowners

This is a good time to be a forest landowner. There are numerous workshops and webinars about important topics in forest stewardship, assistance to help you create a forest management plan, and cost-share money so you can implement your objectives on the ground.

Cost share for forest projects and a new plan outline

We want to remind you that there is a lot of money available right now for forest improvement projects. This includes creating a forest management plan, fuels reduction and fuel breaks, restoration, road work, pre-commercial treatments, and other management activities.

In order to receive funding you will need a management plan. A new one-size-fits-all management plan has been developed that will qualify for CFIP, EQIP, and other cost-share programs. Besides being a requirement for cost-share funds, the new plan outline is designed to help landowners learn about their land and clearly define their forest management goals and objectives.

You can find out more about these programs by contacting your local Forestry Assistant Specialist; go to http://www.fire.ca.gov/resource_mgt/downloads/ForestAdvisorList.pdf or call your local CAL FIRE unit.

Ties to the Land: learn succession planning

Forest landowners and their families are invited to learn simple techniques to help you pass your land and legacy on to the next generation. Succession planning is more than just having a will or an estate plan; those legal tools will only ensure that your heirs inherit the property, but not that they will carry out the vision for it or even want to keep it. Besides passing on the land, succession planning helps you and your family ensure that your values and plans are part of your current land management plans. The Ties to the Land workshops are designed to give you a firm understanding of the succession planning process and the tools to get started.

• Learn the steps to succession planning
• Clarify your values and goals for your family forest or ranch
• Take home tools to determine your heirs’ interests
• Gain knowledge of legal and other business considerations
• Understand the financial impacts of transfer across generations

Each workshop will be presented in two parts, one in the fall before the holidays, when families often come together, and another in early winter, which will focus on financial and legal approaches and tools.

Multiple members of the same family are encouraged to attend. Even if you do not all live in the same location, you can attend the workshop location nearest to you, as the curriculum will be the same for all.

Registration is required. Cost is $25 per family. A workbook and DVD will be provided. For more information call your local Extension Office or 510-643-5429, or visit http://ucanr.org/tiestotheland/.

Workshop dates (first session), from 6–8 pm:
Sonora, Wednesday, October 19
Redding, Tuesday, October 25
Yreka, Wednesday, October 26
Quincy, Thursday, October 27
Ukiah, Tuesday, November 8
Garberville, Wednesday, November 9
Eureka, Thursday, November 10
Berkeley, Tuesday, November 15
Rohnert Park, Wednesday, November 16

Forest Stewardship Webinars

October 19, 2011 10:00 am–noon
Forest Landownership in California

October 26, 2011 10:00 am–noon
Forest Ecology and Disturbance

November 2, 2011 10:00 am–noon
Watersheds, Wildlife and Weeds

November 9, 2011 am–noon
Managing Your Forest

November 16, 2011 am–noon
Managing Forests for Carbon, Ecosystem Services, and Climate Change

November 30, 2011 am–noon
Financial Aspects of Forestland Management

December 7, 2011 am–noon
Forest Succession Planning

Free registration and details at http://ucanr.org/stewardshipwebinar
Special Announcement!
New Forest Stewardship website unveiled!!

We are pleased and excited to introduce our new Forest Steward website at http://ceres.ca.gov/forestellsteward. The simple easy-to-use layout hides the fact that this website is chock full of information.

The major sections include:
- Topics—these are major topics in forest management including fire and fuels, generational succession, wildlife, silviculture, and much more. Each page has an overview of the subject with links on the right to a greater depth of information. This section will continue to expand and we welcome suggestions for topics.
- Newsletter—every Forestland Steward issue since 1996 is included here in pdf format. In the right-hand column there is a listing of the articles in each issue (whew!).
- Treenotes—these are short papers that cover the major forest pests and other health issues. The latest Treenote is on the Goldspotted Oak Borer, an up-and-coming pest of concern in southern California oak woodlands.
- Landowner Assistance—this section will help you find contacts for technical assistance with links to the financial assistance programs available to forest landowners.

Drop by the website and look around. We welcome your comments and suggestions.
Calendar

October 19, 26; Nov 2, 9, 16, 30; Dec 7
Webinar: Forest Stewardship for Landowners—7 sessions (see page 9)
Location: online
Contact: Richard Harris, 707-678-3504, rrharris2464@sbcglobal.net
Website: http://ucanr.org/stewardshipwebinar

October 19
Ties to the Land Workshop
Location: Sonora
Contact: Susie Kocher, 530-542-2571, sdkocher@ucdavis.edu
Website: http://ucanr.org/tiestotheland

October 20
Webinar: Resilient Forests with Scott Stephens
Location: online
Contact: Tim Kline, 510-642-4934, tkline@berkeley.edu
Website: http://ucanr.org/sites/forestry/Events/

October 25
CLFA Fall Workshop: CA’s Forest Product Markets
Location: Anderson, CA
Sponsor: California Licensed Foresters Association
Contact: 707-964-4815; clfa@volcano.net
Website: http://www.clfa.org

October 26
Ties to the Land Workshop
Location: Yreka, CA
Contact: your local Extension office/510-643-5429
Website: http://ucanr.org/tiestotheland

October 27
Ties to the Land Workshop
Location: Quincy, CA
Contact: your local Extension office/510-643-5429
Website: http://ucanr.org/tiestotheland

October 27
SNAMP Annual Meeting
Location: 2800 Cottage Way, Sacramento
Contact: Kim Ingram, kcingram@ucdavis.edu
Website: http://snamp.cnr.berkeley.edu/events
Notes: Register through website; can also participate through a web conference (see website for details).

October 27
Webinar: Resilient Forests with Malcolm North
Location: online
Contact: 510-642-4934, tkline@berkeley.edu
Website: http://ucanr.org/sites/forestry/Events/

November 9
Ties to the Land Workshop
Location: Garberville, CA
Contact: your local Extension office/510-643-5429
Website: http://ucanr.org/tiestotheland

November 10
Ties to the Land Workshop
Location: Eureka, CA
Contact: your local Extension office/510-643-5429
Website: http://ucanr.org/tiestotheland

November 15
Ties to the Land Workshop
Location: Berkely, CA
Contact: your local Extension office/510-643-5429
Website: http://ucanr.org/tiestotheland

November 16
Ties to the Land Workshop
Location: Rohnert Park, CA
Contact: your local Extension office/510-643-5429
Website: http://ucanr.org/tiestotheland

November 9
California Board of Forestry Meeting
Location: Sacramento
Contact: 916-653-8007
Website: http://www.bof.fire.ca.gov/

November 26
Ties to the Land Workshop
Location: Garberville, CA
Contact: your local Extension office/510-643-5429
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Website: http://ucanr.org/tiestotheland

December 7
California Board of Forestry Meeting
Location: Sacramento
Contact: 916-653-8007
Website: http://www.bof.fire.ca.gov/

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Check the calendar on our website for the most up-to-date information on events. http://ceres.ca.gov/foreststeward/calendar.html

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email _______________________________________________________

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Fill out this box and send it to CAL FIRE, Forestry Assistance, P.O. Box 944246, Sacramento, CA 94244-2460. Fax: (916) 653-8957; email: jeff.calvert@fire.ca.gov
For address changes, please send this box or contact Jeff Calvert via e-mail, standard mail, or fax…be sure to reference Forestland Steward newsletter.

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Forestland Steward
Chris Zimny is the new Deputy Chief in charge of Forestry Assistance at CAL FIRE. That puts him in the thick of many of the most important programs to forest landowners: State Forests, Urban Forestry, Pest Management, and Forestry Assistance Programs such as Forest Legacy, Forest Stewardship, and the California Forest Improvement Program (CFIP).

Chris comes into his new position at a time when environmental and financial challenges abound. On the environmental front there are new forest pests, like the Goldspotted Oak Borer in Southern California, along with the continuing efforts to reduce wildfire by managing vegetation and address the spread of Sudden Oak Death. On the financial front, the long-term outlook remains challenging. Ongoing state budget reductions and expiring bond funding will have significant impacts on forestry assistance programs. Exacerbating these challenges, CAL FIRE expects a high staff turnover due to retirements, with an accompanying loss of institutional memory and knowledge.

But Chris remains upbeat, especially because of the many positive things going on in forestry assistance. The next couple of years will provide landowners significant opportunities for state bond and federal grants from Propositions 40 and 84. This will allow them to develop small landowner management plans and accomplish many of the forest improvement and fuels reduction projects needed to make California forests healthier.

Chris’ current job is at CAL FIRE Headquarters in Sacramento, but his credentials include 20 years in the field. One of the perks of the new position is the opportunity to spend time out in the field again.

Career highlights include eight years with CAL FIRE as the Regulations Coordinator for the Board of Forestry and Fire Protection, three years as Project Leader for the CAL FIRE Forest and Rangeland 2003 Assessment, and over 18 years with the USDA Forest Service in the central Sierras focusing on large scale forest management projects, fire prevention, and wildfire operations. Chris is a Registered Professional Forester, has a MBA from California State University Stanislaus, and a BS in Forest Engineering from Oregon State University.

Chris is pleased to be back on the landowner assistance side. “In this new job I can support people’s needs and be closer to the forest again.”