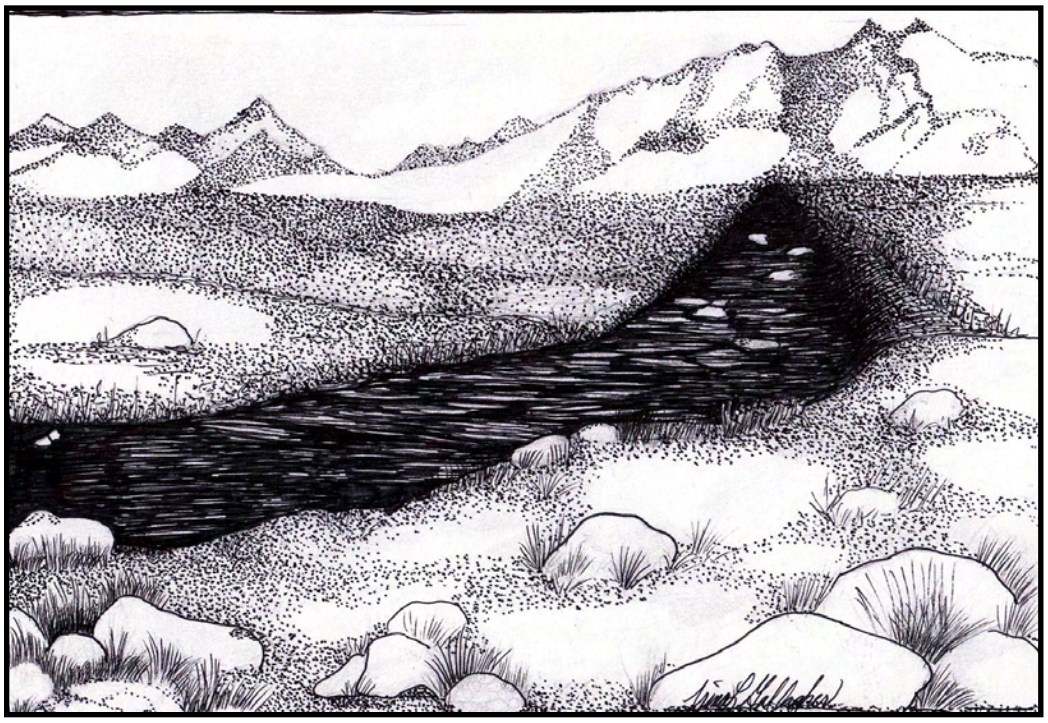
Tree Rings

THE JOURNAL OF THE YUBA WATERSHED INSTITUTE



Special Issue

Sierra Meadows

Number Twenty-One FALL 2008

TREE RINGS

NUMBER TWENTY-ONE FALL 2008

IN THIS ISSUE

*** This issue of Tree Rings is made possible by a grant from the Bella Vista Foundation.***

YWI, BLM and the 'Inimim Forest
The YWI is dedicated to the ecologically sustainable management of the Yuba River watershed on the west slope of the Sierra Nevada. **S**ince 1990, we have worked with the Bureau of Land Management on joint management of the 'Inimim Forest, 1,813 acres of federal land on 10 parcels on the San Juan Ridge. **O**ur agreement calls for restoration of the forest to an old-growth condition; management of its timber on an ecologically sustainable yield basis; and protection of its wildlife, cultural, historical, recreational, educational and scenic values.

Cover: *Taboose Pass Meadow* by Trina Gallagher

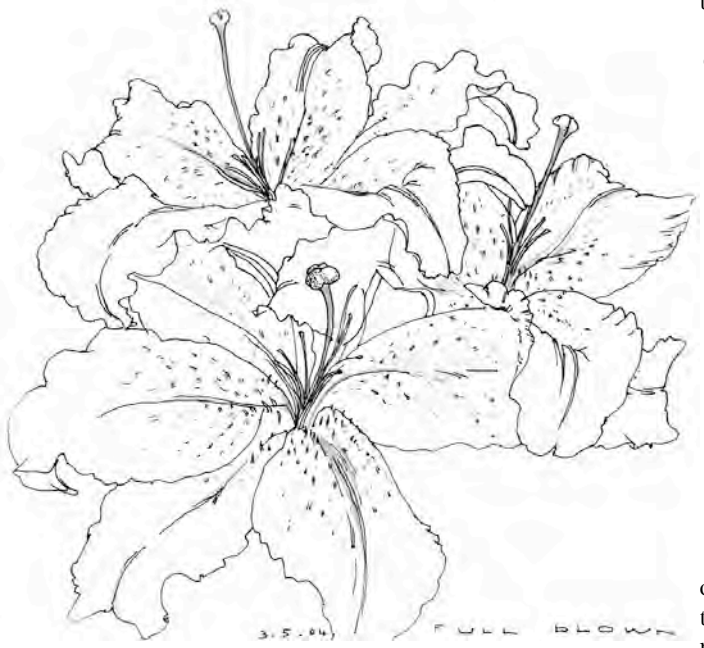
Notes from the Director by Tania Carlone

THIS past Labor Day weekend, my family of three and our dog headed to Grouse Ridge in the upper Yuba Watershed for our three-year-old daughter's first foray into high-country backpacking. Instead of riding in her baby backpack, for the first time she wore her own – a gift from her grandparents, pink and bedecked with three Disney princesses. The contrast made for a priceless family photograph. But it turns out the camera had been left behind in the interest of keeping things light (or at least lighter).

After parking the car, we stood at the Grouse Ridge Lookout drinking in the panorama: a picturesque backdrop of cool gray granite and craggy buttes sloping into a lush forest of red fir, white fir and upright lodgepole pines; and of course… the alluring lakes, everywhere you look: lakes.

We awoke the next morning and set out for an adventure in search of the Crooked Lakes. We scrambled across plateaus of granite outcroppings and meandered through sculpted boulder forts, descending into forest patches until we met a dry seasonal creek bed that would lead us to our lentic destination. Intuiting another opportunity for a vista, we scurried over a fallen log and climbed out of the forest. As we ascended the granite plateau, we were greeted by a scene of forests, granite and lakes … and a sweeping meadow that was our inviting entrance to this magnificent place. I found the setting exhilarating.

We settled upon a granite ledge as an ideal spot for our picnic and watched a carpet of yellow pond lily pads flap in the breeze. On the opposite shore lay another grassy opening in the woods. My husband, Jason, in an awareness of the timeless quality of the view, commented that he imagined at any moment to see a grizzly emerge from the forest's shadows into the meadow, an environment described by one of this edition's contributors as, "a bright oasis of grasses [and] hotspots of biodiversity, havens of distinction," and by another as a "glad" place. And while the lakes themselves constitute a central feature in the Grouse Ridge area, the



Jacquie Bellon

distillation of my experiences on that trip is represented in that single snapshot within my mind's eye of that sweeping meadow and the utter feelings of joy it inspired.

This fall edition of *Tree Rings* is solely dedicated to these extraordinary oases that dot the landscape of the Sierra Nevada. We aim to celebrate mountain meadows for their natural beauty and their spiritual and cultural significance throughout the ages; for the rich biodiversity they nurture and habitat they support; for their capacity to attenuate floods and cleanse and store precious freshwater; and for their ability to prevent erosion and downstream sedimentation. But this issue also has been compiled to bring to light how the degradation of Sierra meadows has hampered their ability to function optimally and has diminished their capacity to act as buffers against the loss of snow pack in a changing climate, as explained by Steve Rothert in his article herein.

This collection of articles and artwork by esteemed scientists, naturalists, artists and writers has been compiled as an integral aspect to a project funded by the BellaVista Foundation entitled *Headwater Restoration in a Changing Climate: the Meadows of Bear Valley*. Hence, the YWI has joined a collective of project partners consisting of American Rivers, the Tsi-Akim Maidu tribe, the South Yuba River Citizens League and the Stockholm Environment Institute to provide this information as an educational resource toward the restoration of mountain meadows in the Sierra Nevada. Jim Steele puts it so succinctly in his article on the restoration of Carman Valley's meadow when he writes, "In my opinion, wetland restoration is the greatest contribution we could make to the environment."

I would like to extend sincere gratitude to the Bella Vista Foundation for its generous funding of this project, to our many talented contributors, and to Liese Greensfelder, *Tree Rings* editor, for her astute abilities as editor and writer, her artistic eye and her overwhelming generosity.

Tania Carlone *is executive director of the YWI.*

Observing Meadows

by David Lukas

The meadow in front of my house seems devoid of life today. I look out over the dried grasses and don't see a single living creature. In a moment like this it is hard to reconcile the dazzling greens of April with the sere tans of September, but I remember that a meadow is both of these things.

For instance, those aren't dry withered grasses, but packets of stored energy which grew in the spring and now wait for the first winter rains before toppling over and feeding vibrant communities of underground microorganisms. No matter how dead a meadow feels above ground, every teaspoon of dirt under the surface teems with an average of five billion organisms.

Marsha Stone

Like gophers that rarely surface at their holes, things are hidden here. Among the tangled roots, tiny arthropod-like creatures called water bears are at home. Among the vertical stems, streaked meadowlarks are perfectly camouflaged. The imagination must seek them out.

Compared to the structural complexity and three-dimensionality of a forest, a meadow is a flat surface, a solar panel that collects and condenses energy from the sun with incredible efficiency. This accumulated energy isn't wasted – if anything, it feeds a prolific food chain: think of how much energy is required to sustain vast herds of bison, or the prairie dog colony in Texas that was estimated to contain 400 million individuals.

In comparison to these obvious displays of abundance, the life of our Sierra meadows is subtle, though no less prolific. Judging from the holes in my front yard and garden there must be an entire village of gophers living here, though I rarely see one. They are a nuisance, but guess what: each gopher brings over a hundred pounds of subsoil to the surface every week, and without them soil formation would slow to a virtual halt.

As a naturalist I am as fascinated by the strategies of life in a meadow as I am by the creatures that live here. For example, grasses are wind-pollinated, which means they depend on wind to carry pollen from grass head to grass head. But grasses can't afford to passively wait to see if the next gust of wind brings pollen to them, so they wave back and forth in the wind like nets, using the positive charge they get from being grounded in the earth to electromagnetically sweep negatively-charged pollen grains out of the air.

And when populations of voles – one of our most common herbivores – get out of control every couple years, grasses draw minerals out of the earth and manufacture sharp silica crystals in their tissues. When ingested, the crystals disrupt a vole's digestion, causing populations of these rodents to drop back down to reasonable levels.

These are some of the webs of energy that make meadows so interesting. And there are many more stories waiting to be told: ants, nematodes, rabbits, coyotes. All of them living in harmony in these islands of grass among the trees.

David Lukas *is a professional naturalist and writer. His books include the newly revised "Sierra Nevada Natural History" field guide.*

Meadow Restoration on the 'Inimim: Part Two

by Daniel Nicholson

Three years ago, a proposition was brought to the YWI board and the BLM to initiate an effort to restore a small meadow on the "Big Parcel" of the 'Inimim Forest. This pleasant little seep meadow lies on the north side of Bald Mountain surrounded by forest dominated by ponderosa pine. To date, volunteers have spent more than 350 hours removing invasive species, cutting encroaching pines, monitoring changes and searching for environmental data and clues to the site's historical boundaries. I went out to the meadow recently to see how it has responded to treatments.

The presence of camas root and yampah (*Perideridia parishii*), which were both important food sources for pre-European settlement peoples of California, allude to the possibility that this site was an ancient food repository or wild garden. Digging, replanting, and burning efforts to maintain this food "crop" could quite possibly have created and maintained the historic boundaries of the meadow.

The summer of 2008 has proven to be exceptionally dry as far as groundwater recharge is concerned. Some seasonal creeks and seeps have gone completely underground as much as two months earlier this summer than in "normal" years.

While the dry situation has exacerbated our fear of fire and made for algal-filled swims in the river, the Big Parcel meadow system has simply gone dormant. Perennials make up most of the vegetation there and they have grown shorter, produced less seed and gone dormant earlier than in a wet year. Many bulbs did not flower at all this year, and we did not add any new species to the plant list.

Our removal of Himalayan blackberry in 2006 and 2007 made space for a native floral display which began to establish itself almost immediately. The bright yellow flowers of *Lotus oblongiflora* have grown rampantly where the blackberry used to reign, which was in some of the wettest areas of the meadow. And now the sedges, rushes, grasses, and herbs have adequate moisture here to flourish through the summer. A new herb, one I had not seen before the project started, is *Agrimonia gryposepala* (rose family), tucked into the wettest spots. Herbalists and gardeners may have heard of a similar European plant known as agrimony.

We have wondered some about the tall, single-petal, pink roses that grace this and many other meadows and fields of our area. We originally believed them all to be the native *Rosa californica,* but are now recognizing them as potential hybridizations of the English dog rose (*R. canina)* with our wild rose, which have very much invaded local rose genetics. So where we originally thought we were doing well to keep the roses we are now faced with the possible takeover of the meadow by an aggressive, escaped garden plant. Who needs sci-fi horror movies with so much vegetative drama among us?

We endeavored to cut and haul away the small-diameter trees from the meadow in late 2007. This proved to require significant labor and we are less than 1/3 finished with the job. The sites that we cleared have not yet displayed any significant changes in vegetation, but this is a drought year. The premise is that the site will become wetter as transpiration (plant uptake of water) by hundreds of saplings is mitigated. And thereafter we will see wetland-obligate species returning and/or expanding to the meadow edges.

Robert Erickson

Volunteers Wendy Boes and Ruby Turple removing invasive blackberry plants during a workday to restore a small meadow in the 'Inimim Forest.

The drought year has again brought a significant flush of pine beetles to the foothills of the Sierra. Large-diameter, drought-stressed pines are dying across the landscape. On the edge of our pine-pole removal plot in the mid stretch of the meadow is a significant patch of beetle-killed trees – trees that were next on our list to remove. This seems to show that we are on the right track in selecting what to cut.

There are two drainage ditches in the meadow that directly affect its hydrology by draining and drying up the water that runs there in winter and spring. We intend to address these ditches with a check dam approach. We have been duly warned by a hydrologist to design this with an eye toward preventing a dam blowout during a high precipitation event.

Meadow Restoration Workdays
Save the dates!
Sat. Nov. 29, '08
Sat, Feb. 3, '09
Sun., Feb. 18, '09
Contact Daniel Nicholson for information: 530 292-3589 or danmadrone@yahoo.com

While the original excitement about the project and major volunteer effort have subsided, we hope to do more restoration this fall and winter. Our primary focus will be removal of more blackberries and small-diameter pines, and to "re-read" the vegetation plots.

I feel this experience of developing a plan, working with volunteers, becoming versed in the site, and watching vegetation recover to what we believe are its historic parameters has been one of the most valuable experiences of my adult life.

Please look us up if you want to get your feet wet!

A self-trained horticulturalist and professional naturalist, **Daniel Nicholson** *has served on the YWI board since 2001.*

Sierra Meadows
Hard-Working Landscapes
by Elizabeth Soderstrom

If you spend time hiking in the Sierra Nevada, there's a good chance that you will find your way to a mountain meadow. In total area, meadows occupy a fraction of the Sierra landscape, but their beauty and stark contrast to the surrounding forest make them favorite destinations. One need only step from dense conifers or granite outcroppings to a bright oasis of grasses and wildflowers to know that mountain meadows are hotspots of biodiversity, havens of distinction. Ecologists and hydrologists confirm this instinct: Sierra meadows provide many critical ecological functions – both biological and physical.

Jacquie Bellon

These functions derive from a unique underlying geology and topology. Mountain meadows occur at hydrologic convergence points in a watershed – that is, areas where topography and/or geology encourage sediment to be deposited and water to collect, resulting in high water tables. Thus, meadows represent areas of high moisture availability in what can be an otherwise water-limited landscape. This availability of water in combination with other factors, including shade and lower temperatures during the summer, a greater supply of food due to higher plant productivity, and special

plant structures such as willow thickets, make mountain meadows key habitat for Sierra plants and wildlife.

Plants within and across meadows are extremely diverse. Approximately 30 rare vascular plants and bryophytes are found solely in Sierra mountain meadows. In terms of wildlife, during summer months, meadows are considered the single most important habitat in the Sierra Nevada for birds. In addition, meadows with streams flowing through them are important habitat for trout and other fishes, while mid-elevation meadows have been shown to be critical habitat for several amphibian, mollusk and invertebrate species.

The availability of water in combination with other factors, including shade and lower temperatures during the summer, a greater supply of food due to higher plant productivity, and special plant structures such as willow thickets, make mountain meadows key habitat for Sierra plants and wildlife.

Mountain meadows also provide habitat for species that are considered vulnerable, threatened or endangered. Nineteen species that are considered of high vulnerability, including Swainson's thrush, long-eared owl, and western red bat, are dependent on Sierra Nevada meadow ecosystems. Twenty-seven moderately vulnerable animal species are also dependent on these meadows, and another 75 are known to use them sometime during their lifecycle. Threatened or endangered species that use these meadows include great gray owls, willow flycatchers and Yosemite toads. In fact, virtually all great gray owls recorded in California have been found in or near mountain meadows.

River scientists are beginning to collect data that suggest that mountain meadows play a critical role in the watershed by acting as natural reservoirs. A healthy meadow river is connected to its floodplain, which means that when flooding occurs, the river overtops its banks and spreads over the plain. This action slows the water, giving it a chance to percolate into the ground. The natural capacity of a meadow to buffer large rain events, retain floodwaters and allow for groundwater recharge is similar to functions of a human-made reservoir in that it governs quantity and quality of flows to downstream reaches, as well as timing of flows.

Initial data from Clark's Meadow in the Feather River watershed indicate that the largest reservoir of water in the meadow is groundwater, containing as much as 80 acre-feet (which equals about 26 million gallons) during the dry summer months. This water is captured and stored during floods and released over time.

Stream reaches with high inflows of groundwater have lower daily maximum temperatures because groundwater remains cool relative to the stream. By providing stored groundwater over a long period of time, not only do meadows help lower water temperatures, they also increase dry season baseflows in downstream reaches. This cool, late summer water supply can be critical for life stages of many species of native fish and other aquatic life.

There is also initial evidence to support the idea that meadows act as natural filters, thereby protecting water quality. Currently, sediments are ranked as the number one pollutant of surface waters in the United States. Excessive sediments cause problems for aquatic life, drinking water treatment plants, industry, navigation, and other uses of the resource.

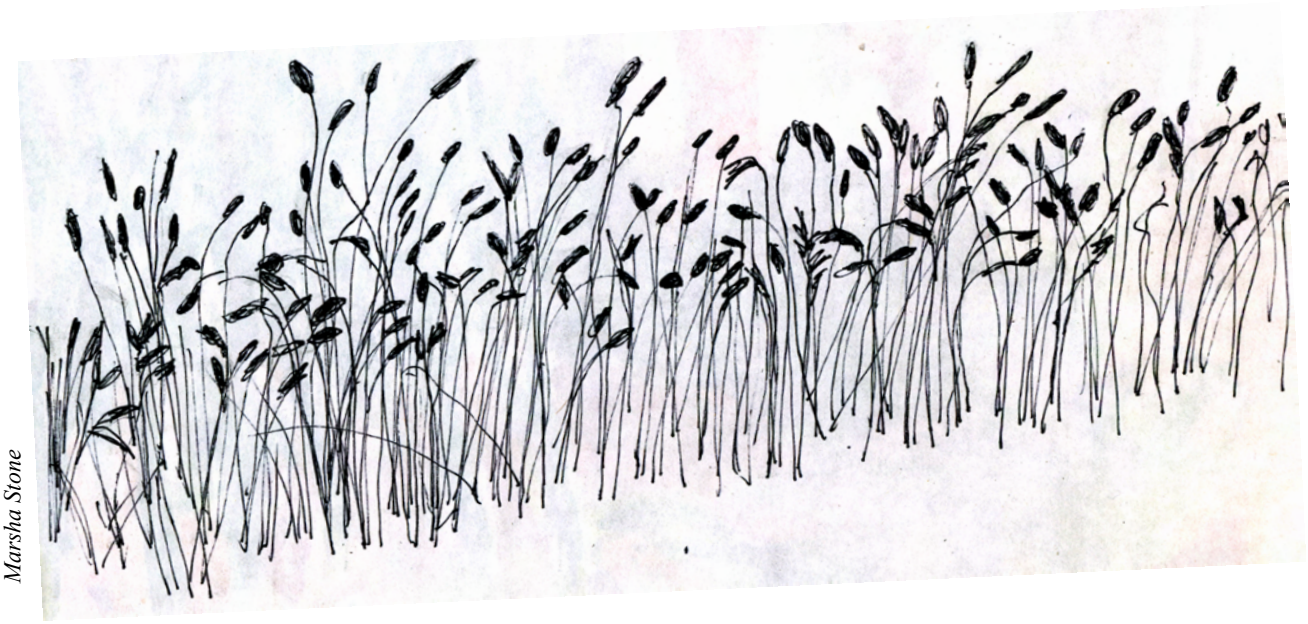
Meadows help reduce the amount of sediment transported downstream in several key ways. As described above, they retard flow velocities during floods by retaining water in soil, vegetation, streambanks, and subsurface aquifers. This curtails the cutting action of floodwater, which in turn reduces erosion. Further, native meadow sedges have extremely long, dense roots and rhizome networks that form a sod that is inherently resistant to erosion and can stabilize streambanks against cutting action.

In one project in the Feather River watershed, restored meadows showed a 17.5 percent reduction in annual sediment loading in rivers and streams. This in turn reduced the amount of sediment deposited in downstream reservoirs, thereby maintaining reservoir storage capacity. Thus, not only can healthy meadows potentially serve as natural reservoirs, they can also help retain the designed storage capacity – and attendant flood-control and hydropower benefits – of man-made reservoirs.

So, the next time you step from the shade of a dense conifer stand into a bright, open mountain scene, know that under that blanket of grasses, sedges and wildflowers is a hard-working meadow providing multiple benefits to local and downstream ecosystems.

Elizabeth Soderstrom *is senior director for conservation at American Rivers' California office in Nevada City. She has previously spent four years in southern Africa working on management and conservation of rivers. Soderstrom holds a Ph.D. in wildland resources science from UC Berkeley.*

Marsha Stone



Marsha Stone

Meadows
A Defining Moment

by Carrie Monohan

Mountain meadows have generally received less attention than wetlands at lower elevations despite the critically important ecosystem services they provide. Many meadows in the Sierra Nevada are still recovering from a long history of degradation resulting from such factors as overgrazing, unsustainable forest management, poorly designed/maintained roads and railroads, dams and diversions, mining, and invasion of alien plant species. It is likely that for some Sierra meadows, conditions causing degradation still persist, and in other cases, new conditions that lead to degradation are being introduced to the systems.

Despite the importance of Sierra mountain meadows for habitat and ecological services, there is surprisingly little comprehensive information on two elements crucial to their health: meadow flood plains and the streams they contain. These components of meadow systems are critical to defining meadow function and also to understanding the balance between ecological (biotic) and hydrologic (abiotic) conditions that meadows so precisely demonstrate.

Definition of a Meadow

Meadow ecosystems can be characterized by the interaction of landform, hydrology, soils and vegetation. The most significant prerequisite for meadow formation is the combination of suitable landform and hydrologic conditions. Where these factors result in creation of shallow water tables, meadows form. Landforms that favor the establishment of shallow water tables include 1) relatively impervious bedrock, 2) an upper drainage area of sufficient size to supply seepage, 3) a gentle gradient and/or 4) drainage area-to-slope relationship that can provide water in excess of the rate of natural drainage. In addition to a shallow water table, meadows require fine-textured soils to draw water to shallow-rooted meadow plants by capillary rise.

Some mountain meadows have developed through the succession pattern that gradually fills glacial or montane lakes with sediment and plants; many developed when the hydrology shifted due to major changes in climate; and others were created by geological uplift that

raised the water table along with the land.

Interestingly, logging can also create meadows. This can happen when logging occurs in places with poor water runoff, where the parent material is from rock types with mineral compositions favorable for clay formation, or where logging operations result in the deposition of fine-textured material that effectively prevents or slows the outflow of seepage water.

In his seminal report from 1985, *Meadows in the Sierra Nevada of California: state of knowledge*, (Pacific Southwest Forest and Range Experiment Station), Raymond Ratliff described meadows in the Sierra Nevada as "wetlands or semi-wetlands supporting a cover of emergent hydrophytes [*plants that grow in water*] and mesophytes [*plants that grow under moderate moisture conditions*] and dry herb-lands of the subalpine and alpine zones."

One montane meadow study concluded that, "meadow ecosystems are as stable as the surrounding vegetation." Not only does vegetation provide cover and food for vertebrates and invertebrates, it also stabilizes stream banks, controls nutrient cycling and reduces water velocity during flood events.

Baseline ecological studies show that the composition of plant communities in Sierra mountain meadows is determined more by drainage or water table than any other environmental factor. If a water table drops or fluctuates greatly, the abundance and type of vegetation may change significantly.

The definition of meadows must, therefore, be expanded beyond Ratliff's explanation to include hydrologic features that are responsible for the variation in conditions experienced by the plants, a definition that captures the delicate balance between the ecological and hydrologic features that make meadows unique.

Jennifer Rain

Trends in Meadow Health

A pervasive trend that is disrupting the balance between ecological and hydrologic conditions and adversely affecting the health of Sierra meadows is an increase in land and water use practices that can cause disturbances of vegetation and soils. This in turn can leave uplands and streambanks barren and vulnerable to erosional processes.

Once erosion has started it can trigger a series of hydrologic changes that leaves meadows disconnected from the water table. This occurs when erosion causes down-cutting of the stream channel, thus lowering water levels in the channel and surrounding water tables. These changes drastically alter the hydrologic environment throughout the meadow that was once dependent on the rise and fall of a shallower water table. Down-cut channels are no longer connected to historically wide floodplains but instead are confined within narrow, incised banks. Also, water that was once stored in the meadow can now drain deeper – into the lowered water table – where it is subsequently released from storage through the eroded channels. These losses of water storage capacity and decreased groundwater recharge can cause perennial streams to become intermittent or dry.

When streams no longer flow on top of meadows, they no longer replenish meadow soils with fine silt particles, further limiting the system's ability to recharge groundwater. Additionally, when the energy of a stream during high flows is confined to the smaller, incised channel, runoff is more concentrated, and flow velocity and stream bank erosion are higher: conditions that produce destructive flood flows.

When this happens, water passes through meadows more quickly and remains on the flood plain for shorter periods, if at all.

The reduction in the amount of water stored in meadows can result in the loss of many meadow-dependent species. A healthy meadow ecosystem supports mesic vegetation such as grasses, sedges, willows and other riparian plants that can fortify stream banks and withstand naturally occurring erosive conditions. There are numerous documented cases in which the mechanical breakdown of soils on a stream bank resulting from overgrazing or other poor land uses have led to erosive action.

In the most severe cases, upland plant communities replace meadow communities, and perennial streams are transformed to intermittent streams unable to attenuate flood flows, thus contributing to increased sediment loads downstream. What was once a wetland meadow brimming with life now becomes a dry and barren meadow that conveys water as if it were an open ditch.

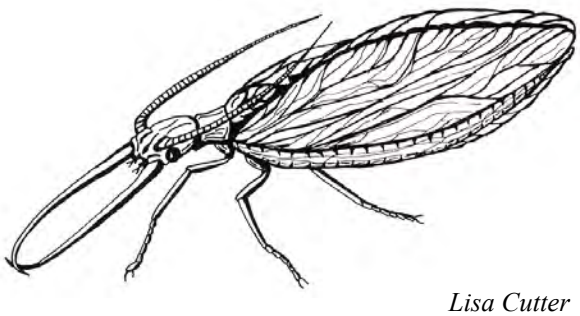
A Balancing Act

The Sierra Nevada supports a diverse set of natural communities with many endemic species and extraordinary habitats. Meadows and the niches they create are biodiversity hotspots, a diversity that is directly related to seasonal fluctuations of the water table.

The health of a meadow can be determined by an examination of physical site conditions and biotic conditions such as plant and animal species composition and habitat structure. Considering that the processes that lead to meadow formation and degradation are hydrologic in nature, physical site conditions are perhaps the most informative parameters for the meadow ecologist. These assessments use characteristics such as depth to groundwater, channel condition and seasonal patterns in soil saturation as indicators of hydrologic function.

Meadow restoration is a relatively new art form that combines best available science with trial and error. It remains an open question whether the balance between the biotic and abiotic components of a living system once disrupted by human induced land or water uses can be restored. Thus it is imperative that the metrics we use to quantify restoration efforts reflect both the hydrologic and ecological integrity of a site. It is by understanding the balance between them that true restorative actions can be accomplished and the resiliency of meadows realized.

Carrie Monohan *holds a Ph.D. from the College of Forest Resources at the University of Washington. She is currently serving as project manager for the Natural Heritage Institute's Mountain Meadows Integrated Regional Watershed Management Plan. She also consults for a number of environmental organizations in the areas of water quality, stream restoration and data analysis. Monohan makes her home in Nevada City.*



Lisa Cutter

Dobsonfly
Dobsonfly larvae, known as hellgrammites, spend up to four years living among pebbles and rocks on the beds of clear-flowing streams.

WHO NEEDS THE DISCOVERY CHANNEL WHEN YOU HAVE A MEADOW RIGHT OUTYOUR BACK DOOR?

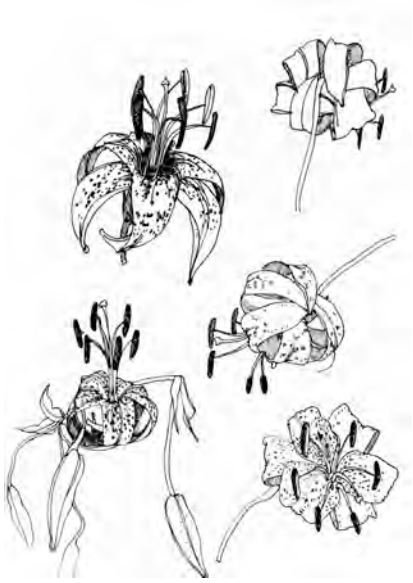
NOH WAY MEADOW – EPISODES 1 - 3

BY MARILYN MOCIUN

EPISODE 1

The other evening, while sitting on the deck breathing in a peaceful sunset, I was startled by Puck, my 30-year-old mule, trumpeting an alarm. I followed his gaze down the slope, over dry grasses crackling in the breeze, past the ancient black walnut tree and around clumps of wild roses until I saw the threat partially hidden in the shade of a ponderosa pine by the fence: bear.

Bear, however, was more interested in the healthy blackberry patch growing near the small spring than it was in the mule, or me, for that matter. It calmly wandered along the same trail used by the indigenous people of yore – who had also been attracted to the spring and the shade of cedars, pines and oaks as evidenced by the bedrock mortars, grinding stones, flakes, and points they left behind here—until it disappeared in the brush.



Jacquie Bellon

EPISODE 2

Certainly the first inhabitants on this land also observed events like what happened the other day while I was sharing our meadow with a friend from out of town. She was just mentioning how serene this place was when we heard the distress call of an animal followed by loud thrashing in the bushes about a hundred yards away. A moment later, a doe burst through the foliage with a large yapping coyote in hot pursuit. My friend cried out for me to do something. "Save the deer!" she implored. (I can forgive her since she was from the city.) Then two fawns emerged and took off in the opposite direction, springing in huge bounds for such little creatures. That's when I realized that Mom was leading the predator away from her charges. I tried to console my friend with the suggestion that this story might have a happy ending, for the deer anyway.

EPISODE 3

Sometimes an event occurs right at your feet, like today. While hacking wild rose branches from the ten-foot-high wire fence that keeps deer from decimating our modest garden, I witnessed a racer trap a deer mouse in its slender jaws. I watched in wonder as the serpent wound and unwound its body around its struggling prey until the little animal eventually stopped moving. Was it dead? The snake relaxed, ever so slightly, and seemed just as surprised as I was when the mouse leaped into the air and took off running, blood staining its head. The last I saw of them was a slithering and a scurrying deep into the thicket.

HERE, in Noh Way Meadow, these episodes provide only a glimpse into stories that have no heroes or villains, stories in which the prey of one species may convert into the predator of another. Neither do they have clean conclusions as they might on a television show, yet they present a world of possibilities, challenging the observer to engage the imagination and become involved in the drama of quotidian survival in this foothill meadowland that I call home.

Marilyn Mociun *lives at the edge of a meadow on the San Juan Ridge.*

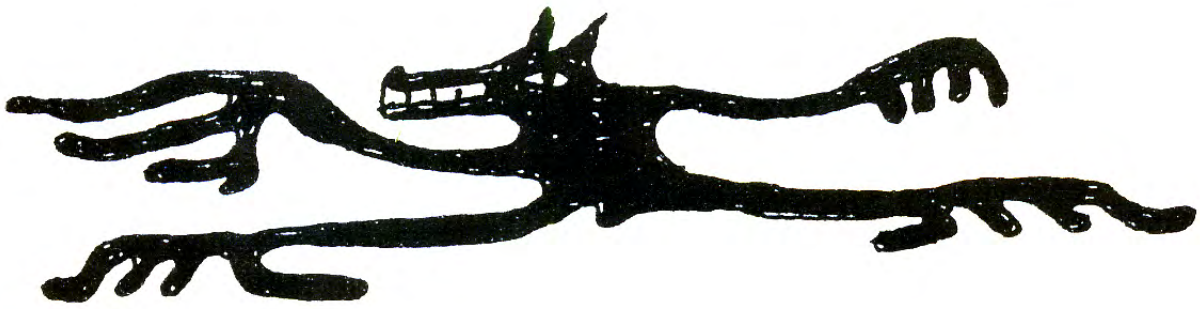
Papam

by Farrell Cunningham

Worldmaker and **C**oyote thought and sang this world into existence. For this reason thought has power and everything has song.

Sunlight upon leaves, stems, and blades. There are flowers.

I walk from pine-scented shade and into green and yellow brightness. Papam flowers form white fluffy clouds that enhance this glad place. I pause, pleased with the view before me and with the scents, sounds and feels of my surroundings.



Peter Blue Cloud

During a previous summer I had hidden a three-foot-long iron spike beneath a manzanita bush at meadow's edge. With spike in hand, I advanced into the yellow of dried grasses and forbs. Approaching another of the uncounted numbers of papam plants with stems that reached to my knees, I touched its mature seeds. I spoke to the papam of personal things. I spoke to the earth of some of the same and also some other things. I spoke mostly about future hopes for our relationships.

I thrust the spike into the red clay soil. Pulling back and down, I brought forth the peanut-sized root. Separating root from stem, I wiped it off and ate it. It was juicy, sweet, nutty, and chewy all at once – pretty good. Not too forcefully, I used my foot to push the soil back into place and then I took the seeds and scattered them around. Next, I took a step to my right, a dance step, and then I dug another root. Moving along, I sang a song.

The song I sang was a song of meaningful sounds but of no particular interpretation. I enjoyed moving and singing in this place. I felt all right – interconnected with my surroundings. I dug roots for a while. I ate some and I put more in my pockets. When my pockets were full I paused, rolled a cigarette, and dropped some tobacco. I lit the cigarette and squatted. Inhaling, I smiled and thought of papam.

Papam was scattered in this land by Worldmaker. He first scattered it at Papam Koyo, a place near Siapkum in Lassen County. That is how the storyline goes. Papam can now be found throughout Maiduland and beyond.

Eventually I rose and moved on toward the creek. From my distance, I saw red, green and gray willows forming wonderful vibrant mazes

along the bank. There were birds of all different types. Red-tailed hawks and swallows seemed to happily ignore each other but without indifference. The grasses grew thick as I approached creekside. They seemed healthy enough but I noticed a massive amount of dead and dry debris from past springs and summers. Without skipping a beat, I recited what has become an infuriatingly common prescription, "a fire applied to this area, in a careful and appropriate manner, would definitely benefit the ecosystem through plant release and rapid nutrient recycling as well as through reduced risk of catastrophic wildfire. The Maidu when free in this land would have used fire as a tool for ecosystem enhancement with this grass, and in many other ways, as a matter of course and common sense."

Passing decadent stands of willow and noticing heaping amounts of dead branches and trunks as well as crooked stems and diseases, I was reinforced in my conviction that Maidu traditional use of fire was necessary for optimum plant health, overall ecosystem function, and fire fuels reduction. A phrase I had used often in the past recurred to me, "humans have been and can be, again, positive contributors to this ecosystem."

The phrase still seemed aptly hopeful but it also seemed to me that I had moved beyond "how" in terms of perspective and methodology and had become trapped in the "how" of access and ability to make management decisions. I wondered if the plants had become confused, too. Empathetic humans and fire, integral components of their world systems, had been removed. The plants certainly appear to be confused what with their constant war of ascendancy, the declining numbers among some while others spread over unprecedented miles of acres – throw in non-native species, where no natural treaty has ever been negotiated, and I would have to say that, yes, the plants are confused.

Chewing papam, I swallowed and spoke, "Well plants, what are we gonna do?" The plants didn't bother to answer. I moved on. Like so many humans I had my answers, and one was that it is essential for humans, fire, and all ecosystem components to honor the natural treaties that exist among themselves or continue to perpetuate current conflicts. Catastrophic fires, extinctions, and overpopulations, as well as diseases will continue to be among the manifestations of these conflicts.

The idea that thought has power recurred to me and with it another phrase: "If we think of the world as a commodity it will begin to take on the characteristics of that limited thought pattern. When we, also, become no more than commodities we should not be surprised."

I certainly understand that we must use resources to survive but I also understand that we must use resources well – with optimum health, sustainability, and diversity as goals and thought patterns – guiding principles, or we too may face extinction or, perhaps, even worse, drastic reductions in our life options.

Arriving creekside, I begin a new song. I know I won't remember the song fifteen minutes after I leave the meadow but I am fine with that circumstance. I enjoy the song while I have it. It is another song made up of sounds with no particular interpretations. However, it causes me to feel hopeful and to see more clearly that, even with the challenges, the world remains exquisitely beautiful.

Small powder-blue butterflies move around me and I remember that my shoes are pretty ripe from the last time I went tromping around in mud and water. I laugh, ducks holler across the way, and I move on.

Farrell Cunningham *is Yamanim Maidu.*

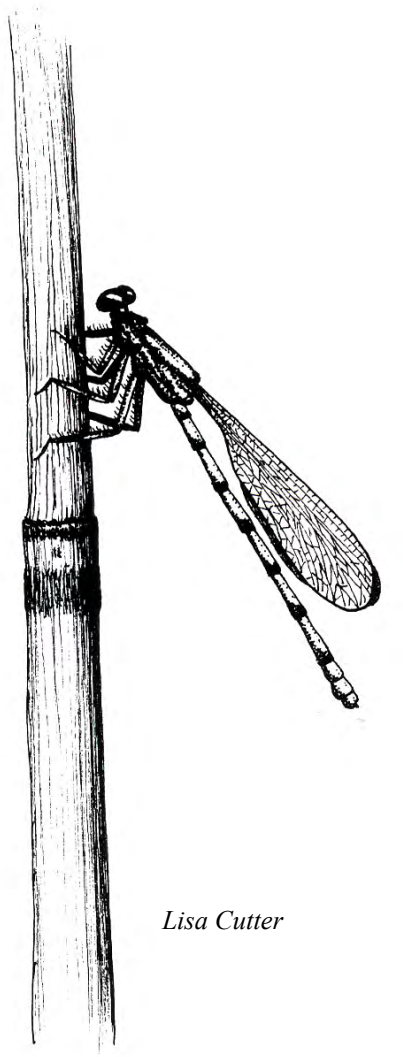
Drawing: Parish's yampah, Charles Ripper, from A Field Guide to Pacific States Wildflowers, 1976

Bear Valley Meadow

Past, Present, and Future

By Kelly Janes

As a first step toward restoring the meadows of Bear Valley, a diversity of partners are participating in a project called ***Headwater Restoration in a Changing Climate: the Meadows of Bear Valley.*** *The project includes an integrated monitoring protocol for river ecology, meadow habitat and cultural resources. Its overall goal is to restore both the cultural and ecological integrity of this critical Sierra system in the face of climate change.*



Lisa Cutter

Come meet the meadow

If you have ever traveled on Highway 20 between Nevada City and Lake Tahoe, you've crossed Bear Valley. Winding your way up the two-lane road about 20 miles northeast of Nevada City, you surely noticed that distinct moment when you dove out of the forest onto a flat, open stretch. Most likely you took this opportunity to speed past the slow, smelly truck you'd been tailing for miles or to gain a little momentum to make it up the next steep hill. Perhaps, however, you slowed a bit to enjoy the peaceful beauty of the place. You may have even stopped to take a stroll, admire the wildflowers or watch swallows weaving over the willows snapping up lazy dragonflies. If so, you'd have heard the gurgling of the Bear River and the wind sweeping across tall grasses in the 350-acre meadow that fills the entire floor of this broad valley.

Located about 4,500 ft above sea level between the Yuba and American river basins at the headwaters of the Bear River, Bear Valley was once a broad upland underlain by granite bedrock. As the Sierra crest was uplifted by convergence of continental plates, gentle streams cut dramatically into the landscape, creating deep canyons. Volcanic flows partially filled these rifts, eventually forming the parallel valleys of the American, Yuba and Bear rivers. During the last Ice Age, both the South Yuba and Bear river valleys were carved out by intrusion and retreat of glaciers over 200 meters thick, laying the ground for formation of the meadow we find there today.

Come now and visit the lazy Bear River as it rolls across the valley floor. In the spring and summer, sit amongst the sedges, grasses, and incredible displays of wild flowers or on the banks of the river beneath the shade of willows and alders. Here, the many bird species that depend on the surrounding meadow for habitat and forage will be singing their various songs. Some use the area for winter refuge, some rest here briefly during migration, while others will stay from spring through fall.

Perhaps you'll glimpse one of the many creatures living in the meadow that hold threatened, endangered or other special-status designations: willow flycatchers, mountain yellow-legged frogs, coast horned lizards, peregrine falcons, northern goshawks, ospreys. Come inspect a track left by deer that use the meadow as winter range and the top of a migratory corridor that reaches all the way down to the Bear's confluence with the Feather River some 70 miles to the west.

On a hot summer day, come dip your feet in the river and imagine that one day the California

spotted owl will discover the surrounding forest perfect for nesting. Finally, contemplate the rich cultural history of the meadow that stands out as a place of particular sacred value to the Tsi-Akim Maidu tribe. The interplay of water, soil, plants and animals in mountain meadows like this one make these systems culturally and ecologically singular and significant.

Unfortunately, not all is well in these headwaters. After 140 years of detrimental human impacts, the Bear Valley meadow and riverine habitat no longer function as a healthy ecosystem, and culturally sacred places and artifacts located here have been compromised.

In an effort to restore the meadow as well as protect and celebrate its cultural significance, a diversity of partners including the Tsi-Akim Maidu tribe, American Rivers, the South Yuba River Citizens League, the Yuba Watershed Institute and the Stockholm Environment Institute are working to assess the health of the meadow in a project known as *Headwater Restoration in a Changing Climate: the Meadows of Bear Valley.* The assessment is the first step in a greater project that will work toward the restoration of this site. The project includes educational aspects for a variety of audiences, as well as an integrated monitoring protocol for such elements as river ecology, meadow habitat and cultural resources. The overall goal of the project is to restore both the cultural and ecological integrity of this critical Sierra system in the face of climate change.

Marsha Stone

Tracking human impacts into the present

To understand the current health of the meadow and its cultural sites, the history of human impact on them needs to be examined. The meadow first interacted with humans some 8,000 years ago, when Middle Archaic peoples used the area seasonally. Likely precursors of present-day Washoe of Nevada and California, these populations, along with those that followed, left clues of their existence through flaked stone artifacts. The significant role the meadow played for them can be seen in petroglyphs they carved into rocks in the valley depicting important spiritual or cultural aspects of their lives. More permanent occupation of the meadow by humans began perhaps 5,000 ago. Late Prehistoric humans left milling stations and more flaked stone objects. Probable ancestors of the Nisenan (Southern Maidu) also left their imprint in the meadow 1,500 to 150 years ago. To this day, there are many sites in this area sacred to the Tsi-Akim Maidu, a tribe that regards the meadow as an important place both spiritually and culturally. With such a rich history, the archaeological complex of the meadow likely qualifies for the National Register of Historic Places.

With the discovery of gold in 1848, white settlers started coming in droves over the crest of the Sierra Nevada on the California Trail. The first Euro-Americans to lay eyes on Bear Valley were likely settlers traveling west from Donner Pass through what is known as Emigrant Gap. Here the cliffs are so steep the travelers were forced to lower their wagons on ropes to landings in Bear Valley below. By 1860, stock raisers began to trail their animals from California's Central Valley to Sierra Nevada meadows to take advantage of green forage and water. Bear Valley was doled out mostly for grazing over the next 150 years until its current owners, Pacific Gas and Electric Company, discontinued all grazing in the 1990s.

In the 1960s, some of the original water and hydropower infrastructure erected as early as 1850 and used for hydraulic mining, power generation and water conveyance for agricultural uses was replaced or expanded by PG&E. Today, Bear

River's flows are augmented by releases from Spaulding Reservoir through the Drum and South Yuba canals. Present-day flows in the river rarely resemble those that occurred naturally.

Currently, PG&E manages the meadow in Bear Valley mostly for recreational activities such as horseback riding, hiking, and mountain biking. A group campground and two trails are located in or adjacent to the meadow. Although the meadow is closed to motorized vehicles, there have been reports of unauthorized off-highway vehicle activity, causing harm to cultural sites and the health of surrounding habitat.

In 2004, the Pacific Forest and Watershed Lands Stewardship Council was formed as part of a PG&E settlement agreement with the California Public Utilities Commission. This agreement established that 140,000 acres of PG&E's watershed lands – Bear Valley included – be conserved for outdoor recreation, sustainable forestry, agriculture, natural resource protection, open space preservation, and protection of historic and cultural resources.

As part of the Bear Valley meadows assessment project, the effect of all historic and current uses of the meadow will be analyzed to better inform decisions regarding its restoration and protection. Our current knowledge about the meadow's health and the condition of its cultural sites is limited but growing as the partners examine all aspects of the meadow ecosystem.

A model for restoration of Sierran meadows

Over time, the Bear River has cut into the meadow in several reaches between six and 15 feet below the floodplain. This down-cutting was probably initiated by human activities, including 150 years of over-grazing during which livestock depleted vegetation and compacted the soil, making the river banks ripe for erosion.

Additionally, the river's natural meandering channel was severed and abandoned in the lower part of the meadow when land managers excavated a new channel and constructed levees. Due to these drastic changes, the meadow no longer experiences the regular flooding that used to occur. Fewer floods have led to dry upland vegetation encroaching on – and sometimes replacing – native meadow species. PG&E's regulation of Bear River flows in the meadow, including rapid fluctuations from 10 to as much as 200 cubic feet per second, can also erode the river channel and adversely affect fish and other river organisms. Other significant impacts by humans that affect the meadow's health include timber harvesting, road building, and OHV use. Finally, the warmer temperatures and fewer snowfall events predicted to occur in the Sierra from climate change are likely to increase stresses on the meadow even further.

Marsha Stone

There is hope, however. One small project to create fish habitat by placement of woody debris in the river channel achieved its goal of slowing flows and allowing sediments to collect. These changes have already produced noticeable improvement in species diversity and habitat, demonstrating the great restoration potential at the site. With the success of the assessment project and initiation of the comprehensive restoration efforts that we hope it will generate, the meadow in Bear Valley should serve as a model for similar projects throughout the Sierra.

Kelly Janes *is a program associate with American Rivers' California field office in Nevada City. She holds a B.A. in environmental science from Scripps College in Claremont and has researched amphibian biodiversity in Costa Rica under a Mellon Grant and spent a year in AmeriCorps for the Natural Heritage Institute and American Rivers.*

Restoration of Carman Valley
by Jim Steele

Not only has California lost 50 percent of its wetlands, it is estimated that 99 percent of stream channels in the state have been degraded to varying degrees. As streams become more deeply channelized, the surrounding wet meadows inevitably dry up, with an attendant loss of organismal diversity and abundance. During our initial 10 years of monitoring the bird life in Carman Valley in Sierra County on the eastern side of the Sierra crest, we saw firsthand the effects of deeply incised stream channels as the willows steadily died back and the birds increasingly abandoned the meadows by early July.

Normal functioning streams that run through meadows are relatively shallow and narrow. During high water flows when snow is melting in the spring, streams overflow their banks and water sheets across the entire meadow. Once the water is out on these floodplains, its erosive cutting power is dissipated. Any sediments it carries are redistributed over the plain, maintaining the meadow's integrity. As spring floods soak into the soil the water table rises. Then throughout the summer the meadow serves as a "hydrologic sponge," slowly releasing its cool reservoir, which nourishes sustained vegetative growth, abundant insects and foraging birds. As summer drought dries up deserts and forests, birds like gray flycatchers and western tanagers move into these wet meadows to glean the summer's last insect offerings. Such areas serve as the last critical link for a wide range of bird species to complete their development and their molt and to add fat for the migration.

Carman Valley lies about 4,800 feet above sea level. Like many other meadows in the eastern Sierra, the string of meadows in this six-mile long valley were once part of a Pleistocene lake or the ancient Lahontan Sea, bodies of water that piled up ample layers of sediments. The consequence of such deep sediments is that when streams that flow across them are disturbed, the process of channel incision can quickly transform formerly shallow channels into deep gorges reminiscent of mini-Grand Canyons.

In the early 1900s as railroad logging cut across Carman Valley's wet meadows, laborers built berms to raise the tracks above floodwaters. Soil for these berms came from ditches excavated alongside them. And it was simply a few hundred meters of ditch that began an incision process that eventually worked its way throughout the entire meadow system. Once this ditch captured high springtime water flows, the erosive power of the water could no longer spread out. Instead, energetic flows dug the ditch even deeper. Eroded sediments were now shunted out of the meadow. As the channel deepened, it "unplugged" the water table. New side channels also began to incise, which further drained the meadows. In several places the channel grew 10 to 15 feet deep. Instead of staying moist all summer, these rich wet meadows slowly turned into dry fields of sagebrush and pines.

The U.S. Forest Service made several earlier attempts to stop degradation in the valley with check dams. However, they lacked funding to treat the whole watershed. After the floods of 1997, several check dams failed; the incision process continued, the water table drained, and we watched the willows begin to die and saw that birds abandoned the meadows earlier and earlier each summer.

In an effort to prevent the loss of such a biologically rich wet meadow, we sought help from knowledgeable hydrologists. With a grant from the EPA, the expertise of Jim Wilcox of Plumas Corporation, **(**Plumas County's non-profit economic development organization**),** and the efforts of the Forest Service's Randy Westmoreland, a series of plugs (dams) were designed to raise the stream out of these deep channels and divert water back to its historic shallow channels. Ponds were created adjacent to the planned site of each plug and the excavated soil was used to dam the incised channels. A simple change of concept meant the difference between success and failure. In the old way of thinking, check dams and plugs were used to stop the flow of water and drop sediments. The new intent of

"plugging and ponding" was to spread the water out onto the flood plains. And here it is certainly working.

For the past five years we have watched the willows regain their vigor as the water table has risen. Each spring, floodwaters from snowmelt have spread across the entire valley, re-watering the meadows. Throughout the summer, ponds maintain a water level that keeps the meadow moist with subsurface flows that were non-existent when the stream was incised. Bird populations have increased in both abundance and length of stay because the meadow now supplies the resources the birds require. Each pond has an island that usually holds a Canada goose family and a spotted sandpiper. Rails and soras now move into Carman Valley as nearby Sierra Valley wetlands dry up. We now have had a few willow flycatchers—a threatened species – singing in the valley for over a month this summer (although they have yet to find a mate). And we have observed that this species is increasingly using the meadow during migration.

Ditches excavated in Carman Valley's vulnerable soils in the early 1900s triggered decades of erosion and ever-deepening stream channels, transforming once-wet meadows to dry plains of sage-

I cannot foresee what climate change will bring. Historic records reveal centuries of droughts and periods of floods. Temperatures have risen and fallen. But I do foresee that whatever changes might occur, restoring our wetlands would mitigate many problems. Restored wetlands would moderate local temperatures and provide resources for a tremendous array of wildlife. In my opinion, wetland restoration is the greatest contribution we could make to the environment.

Jim Steele *is director of San Francisco State University's Sierra Nevada Field Campus on the Tahoe National Forest in Sierra County. He has been principal researcher for 16 years of a project funded by the Forest Service that monitors bird populations in riparian habitat.*

Since 2003, Jim Steele has led a team that has been restoring Carman Valley's meadows. Above, willows and other meadow species are thriving thanks to dams built to divert water out of deeply incised channels back onto the historic floodplain. Photo: Jim Steele

Meadow Restoration Approaches

By Simeon Caskey

The natural productivity and utility of meadows prompted settlers and other groups to put them to use, which eventually led to the degradation that plagues many of these grassy expanses today. Meadow ecosystems have been adversely affected by grazing, logging, roads, rails, channelization and other human influence. Where such activities compact meadow and stream-bank soils, instead of infiltrating into the earth, water runs into nearby streams. If

riparian vegetation that once stabilized the banks has also been removed, these swollen streamflows quickly erode the river channel. As the channel grows deeper and wider it can carry more and more water, a phenomenon that seriously curtails one of the most important processes for rivers and meadows, flooding.

The primary goal of meadow restoration is to return the natural functions of these dynamic ecosystems, and that often means restoring beneficial flooding by raising the base level of the stream channel. Accomplishing this task will *re*-water the meadow because it serves to increase the frequency, duration, and magnitude of inundation of meadow surfaces, which, in turn, increases percolation and groundwater recharge. Augmented groundwater levels increase late summer streamflows and sustain riparian and mesic species – such as grasses, sedges and rushes – as opposed to the xeric (dryland) species that are often characteristic of disturbed meadows.

Every meadow ecosystem is unique and must be well understood before designing or implementing any restoration project. Thorough physical/geomorphologic surveys and a hydrologic analysis are important components of the planning process. In cases where livestock grazing will continue in a meadow after restoration, a grazing management plan is also necessary.

Monitoring is a vital part of every meadow restoration project. Unless monitoring is conducted both pre- and post-project, there is no way to measure or characterize whether goals have been met. A solid monitoring program will also inform future projects and advance the important new field of meadow restoration biology.

Restoration Approaches

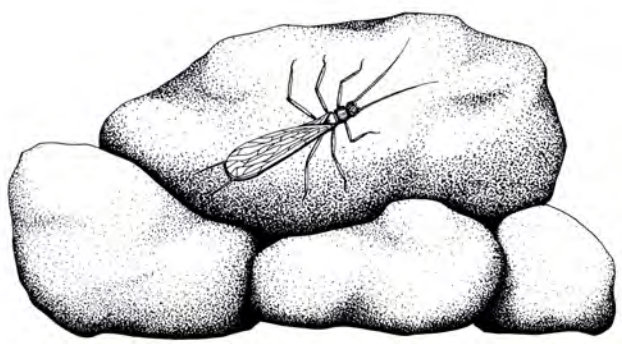
There is no single method or combination of methods that can be applied to restoration of every meadow. Described below are the three most common approaches of re-establishing a more natural hydrologic dynamic in a degraded meadow stream. The primary goal of each of these strategies is to elevate the channel bed and water surface of the stream.

Check dams - These small dams are built throughout the channel, at a frequency dictated by stream gradient. The intention is for water to pool behind the dams and trap sediment. Ideally, sediment then begins to fill the channel, promoting inundation of the surrounding floodplain. Check dams can be constructed using rock, a mix of rock and large woody debris, or wood only.

Some check dams are designed to be permeable. Under high flow conditions, water can flow over and through these structures, thereby reducing hydraulic forces on them, which gives them a better chance to stabilize. Fish and aquatic insects benefit from this design because it does not obstruct their travel. Permeable dams are often made of thatched and interwoven willows. This woody material can take root and stabilize banks, becoming a more robust structure over time.

Pond and plug - As opposed to check damming, which is intended to function within an existing channel, the "pond and plug" restoration method is designed to obliterate incised gullies. Ideally, this is done by redirecting water out of the gully to "remnant" channels where the stream historically flowed over the meadow. (Where no remnants are available, new channels must be artificially created.) The pond and plug approach is based on the excavation of a series of pits that widen and deepen the gully in strategic locations. Excavated material is then used to construct "plugs" to fill in portions of the gully and divert the stream out of it. Once this occurs, the pits usually fill with groundwater, becoming ponds that provide excellent wildlife habitat.

Gravel augmentation – In this approach, substrate (sediment) is added to the channel to raise the streambed and decrease channel area. This strategy is limited because it is less effective when incision depth is greater than three feet. Additionally, costs associated with transport of large amounts of material make less economic sense. This method is often combined with other techniques or used where channel incision is less severe.



Adult stonefly *Lisa Cutter*

Simeon Caskey *holds a B.S. in environmental sciences with a focus on fluvial ecosystems and aquatic ecology from the University of Michigan. He is currently an AmeriCorps service member working on river trails and restoration projects through the California field office of American Rivers.*

Sierra Meadows and Climate Change

by Steve Rothert

Big Meadow at Dusk *Brian Lotti*

The Sierra Nevada is considered one of the most vulnerable regions to climate change in the continental United States due to its relatively warm snow pack. Indeed, existing information suggests the beginning of climate change has already arrived in the Sierra. Measurements of snow at one location in the upper Yuba River watershed on April 1 each year show a 20 percent decrease in the amount of water contained in the snow since record-keeping started 70 years ago. This observation is consistent with predictions of global warming models for the Sierra region – warmer temperatures, more rain and less snow, higher flood peaks, an earlier snowmelt and lower streamflows in summer. All of these changes will add stress to the Sierra's ecosystem, including mountain meadows. But healthy meadows can also play an important part in reducing the negative impacts of global warming.

Marsha Stone

The Sierra snowpack acts like an enormous natural water storage system, accumulating precipitation over the winter and then slowly releasing it in spring and early summer. The 1000-plus dams in the Sierra were designed to take advantage of this predictable and manageable inflow of water to ultimately provide over 60 percent of California's water supply. The snowmelt-driven hydrology is also the foundation of the rich aquatic ecosystems in the region's rivers and streams. Climate change could dramatically diminish this natural storage system, further straining aquatic and riparian ecosystems, primarily by reducing streamflows and increasing water temperatures during the state's long, hot summer months. This is where healthy mountain meadows come in.

In many cases, meadows can be considered underground reservoirs because they often store water that percolates into them from snowmelt or rain. Water also "leaks" into the meadow substrate from streams meandering across the surface. For example, in the meadow known as Bear Valley in the upper Bear River, recent corings have found soil depths in excess of 50 feet, 30 feet of which was saturated with water. This underground water remains cool, and only seeps back into streams when the water level in the stream channel drops below the level under the meadow. This return flow can help keep summer streamflows strong, cold and clean – conditions now supported by the snowpack but likely to deteriorate under climate change.

Unfortunately, many mountain meadows in the Sierra have lost this important storage function because they have been degraded by historic use. As described in more detail elsewhere in this issue, the most problematic impact has been a deepening of stream channels in relation to meadow surfaces. These incised channels effectively drain meadows and prevent them from providing the natural storage function that will become even more critical as the climate changes. Groundwater levels in Bear Valley are now more than 10 feet below the surface in certain areas where the Bear River has cut more than 12 feet into meadow soils. Sierra mountain meadows will be able to remain healthy – and provide some buffer against the loss of the Sierra's snowpack due to climate change – only if their natural functions can be protected, and, where necessary, restored.

Steve Rothert *has served as director of American Rivers' California field office since 2002. He has previously directed the Southern Africa program for International Rivers Network based in Botswana and served as a Peace Corps volunteer in a fisheries program in Sierra Leone. He holds a M.S. in river sciences from UC Berkeley.*

"Meadow Sampling" in the Yuba Watershed
Volunteers Lead the Way

by Wendy Thompson

Montane meadows call us to pass a quiet moment among lush green grasses and sprays of wildflowers in every color – a true feast for the senses. In April 2007, the South Yuba River Citizens League (SYRCL) jumped at the opportunity to complement our existing water quality and macroinvertebrate monitoring programs with a project designed to gather data to assess meadow health. With a grant from the Natural Heritage Institute and training in a protocol developed by scientists at UC Davis, we conducted a "meadow sampling" project in the summers of 2007 and 2008, gathering information that has provided marked improvements in our understanding of meadow function and our ability to produce scientific data that can inform restoration projects in the Yuba watershed.

Jacquie Bellon

Our initial goal was to study impacts on meadow health while training a subset of SYRCL's volunteer river monitors in protocols that offer a rapid and accurate measure of aquatic and terrestrial features, including reptiles, amphibians, fish, invertebrates, water quality, vegetation, physical habitat and geomorphology. With just one day of training, all seven members of our team were eager to get their feet wet, literally, measuring river-channel widths, bankfulls (the flow stage of the river where water completely fills the channel), discharge and water chemistry in 50-meter reaches at four sites in the Yuba watershed: Pierce Meadows, Round Valley, Grouse Ridge, and Austin Meadows.

Although we learned more than we could have imagined, first-year results of our invertebrate and vegetation sampling lacked overall reliability. With the "rapid sampling" technique we were using, our task was to collect aquatic insects, identify them to the family level only, then return them safely to the creek. This required recognizing intricate parts of every insect in seconds. However, with such brief training, we simply did not have this skill, so we ended up preserving these critters in alcohol in the field in order to identify them later in the lab, a very time consuming endeavor. To solve the issue, this summer, Christine Elder, a biological illustrator and naturalist, joined us in the field. She spent intensive hours cataloging samples of invertebrates, ensuring confidence in the abundance and diversity we found.

During the first summer, vegetation specialist Wendy Boes with the U.S. Forest Service identified for us hundreds of plant species throughout the meadows. She suggested that we limit our studies to representative plots along transects that cross the streams, and that we identify only the plants we found in each plot. So this year another expert came to the rescue. Dave Weixelman, also with the Forest Service, joined us the first day in Bear Valley's meadow. Using our handlenses, we were able to differentiate between sedges, rushes and grasses. His instruction proved fruitful as we identified and tallied from eight to 25 plant species at each of 10 transects in Castle Valley and Loney Meadows and then calculated the percent vegetative cover for each species.

Volunteer monitor Stephen Hein noted, "Our careful cataloging of plants imparted a rich experience in the depth and diversity of each small piece of the planet, the layers of over and understory and the minute inhabitants of the tiny, secret worlds underfoot."

An exceptional gain this summer was wildlife biologist Kristen Strohm. She conducted bird surveys at each of the three sites, recording species and numbers, evidence of breeding, and habitat characteristics. This work added immensely to our picture of meadow health.

With the benefit of experts to train and guide us, our group of citizen monitors has learned the value of examination with a critical eye, every analysis offering a window into meadow function. We learned to discern specific grasses instead of seeing just a field of green, to note soil characteristics such as the depth of red mottling, and to find clues as to causes of stream degradation.

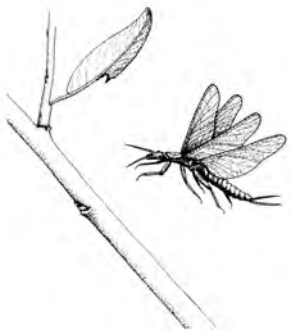
"As amateur scientists we seek a snapshot of meadow conditions," said Jim Wofford, another dedicated monitor. "We learn to name things … and we search for patterns, such as which grasses set down deep roots and which invade disturbed land. We observe how a stream can deepen its channel and starve the rest of a meadow of life-giving water."

Along with the science, Wofford said, he received an unexpected reward. "It is a gift to us," he observed, "to learn what any Maidu child would have known just by playing and living in the watershed."

Preserving the environment and its wild species is one of **Wendy Thompson's** *greatest passions. She holds a B.A. in social sciences and an M.A. in special education. For the past four years, she has served as coordinator for SYRCL's river monitoring program.*

ø *Wendy Thompson*

Naturalist Christine Elder, above left, helps AmeriCorps monitoring specialist Jen Hemmert identify aquatic insects – like larvae of the stonefly, right – as one arm of a project assessing the health of Sierra meadows.



Adult stonefly

Lisa Cutter

Camptonville Students Seek Research Meadow in the North Yuba Watershed

If you have a meadow on your property or have information about a meadow that middle school students might be able to study for an environmental research project, please contact the YWI.

The YWI is working with Downieville and Camptonville schools on a program funded by CALFED Watershed Program in the North Yuba watershed called *Bridging Schools and Communities in the CABY (Cosumnes, American, Bear and Yuba) Watersheds.* The central goal of the project is to assess various local watershed conditions, such as water supply, water quality, groundwater storage and climate change impacts. Camptonville students in grades six through eight are interested in identifying an accessible meadow on public or private land near Camptonville that drains to the North Yuba River for their field research site.

If you know of a possible site, please contact Tania Carlone at 530.265.4459 or tania@yubawatershedinstitute.org.

Wolverine update

In the last issue of *Tree Rings*, we ran a few short pieces about wolverines in celebration of the first documented evidence of these rare mammals in California since the 1920s: photos taken of a lone animal in February and March just over the hill from the Yuba watershed at Sagehen Field Station. Despite weeks of intensive searching, no one's seen the wolverine since then. DNA analysis of physical evidence that was found has shown that the elusive critter is a male and that he is not in the same genetic group as California wolverines whose remains are stored in various museum collections. Instead, he is more closely related to cousins roaming the Northern Rockies and Sawtooth Mountains of Idaho. This means that either humans had a hand in his celebrity appearance or he traveled some 500 miles on his own to get here. Though improbable, the second alternative is not impossible, scientists say. Studies have shown that wolverines will range hundreds of miles to reach new territory.

-- editor

Marsha Stone

Bear Valley's Maidu Heritage

The Tsi-Akim Maidu tribe is currently researching the pre-history of Bear Valley and surveying its natural and cultural resources to learn more about the Maidu's prehistoric and proto-historic relationship to the valley. These efforts should enhance our understanding of how the Indian people of this region utilized the valley and engaged in stewardship of the land. The tribe is conducting the work as a component of the Yuba-Bear Hydroelectric Project relicensing proceedings and as an integral partner with the YWI, SYRCL and others on the Bella Vista Foundation project *Headwater Restoration in a Changing Climate: the Meadows of Bear Valley*. We're looking forward to running an article about their findings in a 2009 issue of *Tree Rings.*

-- Tania Carlone

Join YWI Today!

The YWI welcomes new members and volunteers. We need your support and involvement. Members receive Tree Rings and timely announcements of Institute events and activities.

While donations of any size are welcome, annual dues are:

$100.00 Forest Steward or Business membership
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Liese Greensfelder, editor