



FREMONTIA

A JOURNAL OF THE CALIFORNIA NATIVE PLANT SOCIETY



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CALIFORNIA NATIVE PLANT SOCIETY

Dedicated to the Preservation of the California Native Flora

The California Native Plant Society (CNPS) is an organization of laypersons and professionals united by an interest in the native plants of California and is open to all. Its principal aims are to preserve the native flora and add to the knowledge of members and the public at large by monitoring rare and endangered plants throughout the state; by acting to save endangered areas through publicity, persuasion, and on occasion, legal action; by providing expert testimony to government bodies; and by supporting financially and otherwise the establishment of native plant preserves. Much of this work is done by volunteers through CNPS Chapters throughout the state. The Society's educational work includes: publication of a quarterly journal, *Fremontia*, and a quarterly *Bulletin* which gives news and announcements of Society events and conservation issues. Chapters hold meetings, field trips, and plant and poster sales. Non-members are welcome to attend.

Money is provided through member dues and funds raised by chapter plant and poster sales. Additional donations, bequests, and memorial gifts from friends of the Society can assist greatly in carrying forward the work of the Society. Dues and donations are tax-deductible.

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CALIFORNIA NATIVE PLANT SOCIETY

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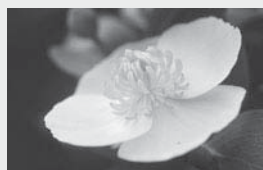
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With the knowledge that natural habitats continue to decline in both size and number, it is especially important to celebrate them and the beauty of their native plants. In this article, Marjorie Schmidt does just that, through the writings of John Muir, Alice Eastwood, Willis Jepson, and others.

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Part of understanding native plants is considering their habitat, which is diminishing with every setting sun. Jacob Sigg writes of the challenges to native species by exotic invasive plants, and asks us to especially watch those weeds that may be wiping out native populations as they claim habitat that once belonged to species native to California.



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With climate change comes a response from vegetation. This look at loss of meadow habitat to invading montane or subalpine trees and shrubs provides an overview of the Klamath Mountain meadow habitat and composition, as well as evidence and discussion of how these meadows are changing.

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Do you want to report a plant as new to the state or to a county in California? Do you want to find out why the scientific name of your favorite plant has changed, again? Tom Rosatti of the Jepson Herbarium (UC Berkeley) describes this new, comprehensive, and innovative online resource for reporting and obtaining information about the plants of California.

GROWING NATIVES IN THE GARDEN: ROMNEYA AND DENDROMECON (PAPAVERACEAE) <i>by Nevin Smith</i>	30
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*Learn to grow two of California's giant poppies, the matilija poppy (*Romneya coulteri*) and the tree poppy (*Dendromecon rigida*), with horticultural tips from Nevin Smith.*



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THE COVER: Mosaic carpet of wildflowers, including blue larkspurs (*Delphinium* sp.) against a field of yellow composites. Photograph by J. Game.

GUEST EDITORIAL

This issue begins on page five with achingly beautiful eyewitness accounts of California wildflower scenes in Marjorie Schmidt's "Through Other Eyes." Many of those scenes are no longer visible because of development or conversion to other uses, and those that remain are threatened by a more subtle force: invasive non-native weeds.

The best techniques for coping with invasive weeds are early detection and rapid response. Yellow starthistle (*Centaurea solstitialis*) serves as an example of what can happen if there is inadequate early response. It was detected as a contaminant of alfalfa seed mixes in the late 19th century, but there was no response as it slowly proliferated over the landscape. It wasn't until a century later, when yellow starthistle began having major economic, natural resource, and recreational impacts, that people began to do something. By the time invasions reach that scale—in California alone yellow starthistle now infests 22 million acres, a fifth of the state—they are much more expensive to manage.

What of the weeds that arrived in the late 20th century? Have we learned from experience? For the danger remains as clear and present now as before. The rate of accidental introductions as a result of rapidly increasing trade and travel or new plants being introduced casually by the horticultural industry has only increased, not fallen. Not all of these introductions succeed in naturalizing, but when they do, they may have drastic impacts. The result is a homogenizing of the world's flora and a corresponding loss of biological diversity paralleling the loss of cultural diversity.

There are some shining examples of early detection and rapid response of late. In an illustration of what should be routine operating procedure, scientists in southern California detected the invasive seaweed, *Caulerpa taxifolia*, and responded rapidly. *Caulerpa* has devastated Mediterranean ecosystems and was poised to do the same here, except that alert and concerned people noticed it and did an exceptional job of very quickly trying to limit its spread. Although it is too early to declare success, this action may have prevented an ecological disaster of major proportions.

Members of the California Native Plant Society can play a vital role in such efforts as frontline first-responders. If you notice new plants, enlist help by getting information and positive identification, and appeal to agencies or landowners to take control steps if necessary. The California Department of Food and Agriculture, unknown to the general public, has saved us much harm and grief by the early detection and rapid response function of its Weed and Vertebrate Program, which does exactly what it is supposed to do. Sadly, it never gets credit for being successful—how can the public know about problems averted? Ironically, this tremendously cost-effective approach—detection and response before the costs of control become exorbitant—was first on the chopping block in the 2003 and 2004 California budget imbroglio.

The article on page eight examines another little-noticed aspect of wildland weeds. It may strike a somewhat pessimistic note, and yet it holds out hope that a rapidly changing society will recognize that weeds are a problem that must be addressed, and will therefore devise clever solutions to what is widely recognized as a crisis. Meanwhile, bring back early detection and rapid response!

Jacob Sigg
Past President, CNPS

USEFUL WEBSITES AND CONTACT INFORMATION

Weed websites:

See "Notes and Comments," p. 34

California Native Plant Society:

www.cnps.org, with links to conservation issues, chapters, publications, policy, etc.

To sign up for "NPCC News," e-mail news on native plant science and conservation, send a request to npcc@cnps.org.

For updates on conservation issues:

Audubon Society www.audubon.org

Center for Biological Diversity
www.sw-center.org

Natural Resources Defense Council
www.nrdc.org

Sierra Club
www.sierraclub.org

Wilderness Society
www.wilderness.org

For voting information:

League of Women Voters
www.lwv.org, includes online voter guide with state-specific nonpartisan election and candidate information.

US Senate
www.senate.gov

US House of Representatives
www.house.gov

California State Senate
www.sen.ca.gov

California State Assembly
www.assembly.ca.gov

To write letters:

President George W. Bush
The White House
1600 Pennsylvania Ave. NW
Washington, DC 20500

Senator Barbara Boxer
or Senator Diane Feinstein
US Senate
Washington, DC 20510

Your CA Representative
US House of Representatives
Washington, DC 20515



Yellow violet, sometimes called Johnny-jump-up (*Viola pedunculata*). All photographs by L. Vorobik.

THROUGH OTHER EYES

by Marjorie Schmidt (1905–1989)

[Reprinted with permission from *Pacific Horticulture*, Volume 50, No.1, Spring 1989.]

The tragedy is that knowledgeable appreciation of California's flora came almost too late, and some plants have become rare or are facing extinction before their beauty has been widely recognized or their usefulness evaluated. Many a newcomer to this state has never seen a February field filled with coppery orange poppies, sky-blue lupines, yellow tidytips, rose-purple owl's clover, soft yellow cream cups, and many more. These free-flowering annuals once formed mosaic carpets stretching for miles from the great Central Valley to the foothills. The

few records of personal observation thus become increasingly precious.

Can you imagine, to begin with, the area now dominated by buildings to the south of San Francisco described by an observer during the mid-1800s:

"The first thing that arrested attention after leaving the sandy shores of San Francisco was the flowers . . . Here they have flowers in May, not shy, but rampant, as if nothing else had the right to be; flowers by the acre, flowers by the square mile, flowers as the visible carpet of an immense mountain wall. You can gather them in clumps, a dozen varieties at one pull. You can fill a bushel-basket in five minutes. And the colors are as charming as the numbers are profuse. Yellow, purple, violet, pink, and pied, are spread

around you, now in separate level masses, now two or three combined in a swelling knoll, now intermixed in gorgeous confusion. Imagine yourself looking across to a hundred acres of wild meadow, stretching to the base of hills nearly two thousand feet high—the whole expanse swarming with little straw-colored wild sunflowers, orange poppies, squadrons of purple beauties, battalions of pink—and then the mountain, unbroken by tree or rock, glowing with the investiture of all these hues, softened and kneaded by distance. This is what I saw on the road to San Mateo."

John Muir, one of the most quoted of our naturalists, found similar scenes further inland:

"The Great Central Plain of California, during the months of March, April, and May, was one smooth,

continuous bed of honey-bloom, so marvelously rich that, in walking from one end of it to the other, a distance of more than 400 miles, your foot would press about a hundred flowers at every step. Mints, gillias, nemophilas, castillejas, and innumerable compositae were so crowded together that, had ninety-nine percent of them been taken away, the plain would still have seemed to any but Californians extravagantly flowery. The radiant, honeyful corollas, touching and overlapping, and rising above one another, glowed in the living light like a sunset sky—one sheet of purple and gold, with the bright Sac-

ramento [river] pouring through the midst of it from the north, the San Joaquin from the south, and their many tributaries sweeping in at right angles from the mountains, dividing the plain into sections fringed with trees.”

In the 1940s, Alice Eastwood, a botanist at the Academy of Sciences in San Francisco, walked the hills frequently and wrote about her travels as well as about the plants seen by others more than half a century earlier. How sad to read her comments and the list of plants that once existed, most of which are now gone:

“In the 1850s the open country everywhere around San Francisco was a beautiful wildflower garden in the spring. In the region near Lake Merced the wildflowers were so thick that it was impossible to avoid stepping on them. There were California poppies, nemophilas, violets, cream cups, owls-clover, mouse-ear chickweed, Indian paintbrush, clovers, etc. The yellow violet, *Viola pedunculata*, was especially common, known to children as Johnny-jump-up. Today, new roads, golf links, vegetable fields, and human habitations have driven them away and it is doubtful if a single native flower persists. A solitary madrone grew in a gulch leading to the lake, the sides of which were covered with dense chaparral. *Ceanothus incanus* formed a thicket together with hazel, manzanita, low oaks, and other shrubs. Climbing over them was the Dutchman’s pipe, *Aristolochia californica*.

“The Bay View Hills near south San Francisco was the home of some flowers not found elsewhere in the city. These were the climbing nemophila [fiesta flower, *Nemophila aurita*, now in the genus *Pholistoma*]; the white flax-flowered gilia, *Linanthus liniflorus*; islay cherry, *Prunus ilicifolia*; the tall larkspur, *Delphinium californicum*; the stinging phacelia, *Phacelia malvaefolia*. On the rocky summit, now known as Bay View Park, were rose cress, *Arabis blepharophylla*; the downy-leaved paint brush, *Castilleja foliolosa*; pennyroyal, *Monardella villosa*; and later several composites and eriogonums. In the meadow below was a garden similar to that at Lake Merced. In some places near Visitacion Valley the ground was white with the pelican flower, *Orthocarpus versicolor* [now *Triphysaria versicolor*], and in other places the areas were pink tinged from owls-clover, *Orthocarpus densiflorus* [now *Castilleja densiflora*]. These common names were given to these flowers by Dr. Kellogg, the latter because each flower formed the face of an owl. Everywhere golden poppies and amsinckias.

“On the hills back of Ingleside, then

Fiesta flower (*Pholistoma auritum* var. *auritum*).



known as Sunset Heights, and on the hills rising from the mission, a great many flowers could be found. The Potrero Hills, too, were then covered with flowers. The white *Fritillaria liliaceae* grew there and in a wet place Miss Cannon discovered a long-lost species, *Sanicula maritima*. At Hunters Point, now entirely covered by a housing project, this fritillaria was found a few years ago by Lewis S. Rose, and I found the fragrant *Dodecatheon bernalinum* there in 1916. This was still on Bernal Heights a few years ago.

"In the early 1890s, the presidio was as beautiful a wildflower garden as Lake Merced . . . In olden times a low form of *Zigadenus fremontii* whitened the ground, the blue-violet as well as the yellow was common, as were also two species of *Orthocarpus* not found in any other part of San Francisco; and a dark red onion and clumps of the blue Douglas iris loved rocky ridges. Besides there were flowers common elsewhere. However, the yellow-flowered bush lupine, the blue-flowered Chamisso lupine, and the broad clumps of *Ceanothus thyrsiflorus* still hold their own. Not long ago, Lewis S. Rose even added a species of fern allies known as quillwort, *Isoetes nuttallii*. This had never been found in the San Francisco area and it was not a common plant. The wax myrtle too, may yet be growing along Lobos Creek or Mountain Lake."

Willis Linn Jepson is widely respected as the father of California botany, and his early *Manual of Flow-ering Plants* is now being revised [now *The Jepson Manual*, J. Hickman, Ed., 1993]. In addition to being a fine botanist, he was amazingly accurate in predicting the conservation movement among lovers of the native flora. He wrote in 1917:

"In the long run protection must come by the devices and resources of united effort, high intelligence, and careful handling. We must work for it, plan for it, strive for it. It is a noble object. If the beauty and glamour of the Golden Land in its youth can be preserved and harmonized with the prac-

tical phases of our civilization, then we may proudly say that our race was fit to enjoy it and to keep it, rising to the spirit and glad wonder of Nature in the valleys, mountains and canyons of our California."

And by the stream and in the canyons, Charles Francis Saunders, another of my favorite nature writers, observes fall's first rains in southern California in the 1920s:

"Hard upon this first substantial storm, which may last for two or three days with varying intensity, and soaks the ground to the root of things, the canyons awake. Dormant springs renew their waters; brooks move more briskly; their sluggish pools, clogged with the summer's accumulation of leaves and fallen acorns, overflow and fill again with musical tinkle the stretches of gravelly channel long silent. Under the magic of the rain the selaginella beds, which throughout the dry season were as shriveled rags and tatters upon the sunburnt sides of the canon, are transformed in a night to bright green mats; the clenched fists of the goldback ferns as quickly become outstretched palms, and the polypody ferns, Western cousins to Thoreau's 'cheerful colonists' of New England woods, thrust up eager croziers from the mould, and uncurl their whole length in an incredibly short time, elbowing and overlapping till the shady sides of the canyon have the appearance of being shingled with the massed fronds."

In the San Fernando Valley, in 1913 already being surveyed for the coming rush of building, J. Smeaton Chase, on a slow-paced horseback trip from the Mexican border to Oregon, describes flower scenes, a few of which might exist today in remote places:

"The summer was . . . full of flow-ers. The beautiful tree-poppy grew freely in many places, bearing shallow cups of palest gold twice a man's height. By the roadside bloomed the great golden Mariposa tulip, flecked with brown, a truly magnificent blossom. Mountain lilac was just breaking into clouds of fragrant azure, and wild roses, daintily simple,



Blue flowers of lupine (*Lupinus nanus*) (top). • Flower of tree poppy (*Dendromecon rigida*) (bottom).

gleamed from every thicket. Poppies, mimulus, brodiaeas, and many more added their cheerful colors to the summer show."

For their appreciation of what the wild flora means to countryside and to the enjoyment and enrichment of our lives, many more authors deserve inclusion here. Young activists of today who are putting their deep love of nature into fresh, beautiful phrases will, no doubt, be excerpted in future anthologies. There is now great concern for all wildlife and for fragile natural resources which, up to now, we have gobbled up with little thought for renewal. Maybe if we can imagine what we have lost, we may be more eager to preserve those lovely and flower-filled places that remain intact.



A fairly advanced stage of a grassland invasion by hairy dandelion (*Hypochaeris radicata*) and English plantain (*Plantago lanceolata*). There will be no grasses at this site within a decade or two. All digital images by M. Bors.

CONSIDER THE WEEDS OF THE FIELD— MY, HOW THEY GROW!

by Jacob Sigg

“There is a trend toward uniformity in environment, people, and ways of life all over the earth. This trend is inimical to life, including human life. . . . Diversity has always characterized the biosphere to which man belonged. In living systems, complexity brings stability and ability to withstand change. The future survival of man may well depend on the continuing complexity of the biosphere . . .”

Raymond Dasmann,
A Different Kind of Country

It is difficult to pinpoint exactly where or when people became aware of the ecological consequences of moving organisms from one ecosystem to another. A hundred years after Charles Darwin and other 19th century naturalists began to articulate the problem, British ecologist Charles Elton published a landmark synthesis. His 1958 work, *The Ecology of Invasions by Animals and Plants*, remains insightful today. Weeds had long been

known to humanity—think of the biblical parable of the tares, a weed of eastern Mediterranean wheat fields now thought to be *Lolium temulentum*—but after Elton, our understanding of weeds expanded beyond the field and garden to the woods and wilds.

I have had intimate knowledge of weeds ever since I chose the gardening profession in 1957—just a year before Elton published his great work. Nevertheless, it took

me thirty years before I began to really see how wildland weeds were transforming those natural areas of San Francisco that I had come to know and love. I became active in the California Native Plant Society (CNPS) in large part because of my newfound concern about impacts of weeds on the native flora. My odyssey was paralleled in the larger world, as government programs and grassroots activism focusing on wildland weeds expanded rapidly. By 1993, my singular preoccupation with invasive exotic species pushed other conservation issues to the margins; since that time the study of weeds has grown from a preoccupation to the major focus of my life.

Once again, the world seemed to mirror my inner perception. Dramatic as the increase in awareness was up to 1993, the ten years after represent an explosion in terms of public awareness, programs, education, and funding to combat the havoc created by invasive weeds. It is worth remembering and celebrating such accomplishments. Unlike ten years ago, one now might tell a parable of the iceplant and not be misunderstood.

But I write today, sadly, not to sing praise. Instead, I must sound a warning. I ask you to consider the little things, not the bugs and other invertebrates that turn the world, in E.O. Wilson's nice phrase, but the microweeds that through sheer numbers may be playing a significant role in the decline of native species. Unlike Wilson, I am not a scientist reporting results, just a gardener sharing some observations based on ongoing intimate experience working directly with the land.

For simplicity's sake, I will illustrate my points using a single system: coastal grasslands. They have taken lots of abuse in the last few centuries, but even in San Francisco they still harbor dozens of native species. Weed management in grasslands is currently focused on

human-scale weeds that pose obvious threats such as brooms, gorse, fennel, and yellow starthistle. This makes sense, of course, particularly at the present level of funding. I wish to draw your attention, however, to what I see happening on the gardener-scale. Here, down on hands and knees in a coastal grassland, the microweeds are taking over. Sheep sorrel (*Rumex acetosella*), hairy dandelion (*Hypochaeris radicata*), English plantain (*Plantago lanceolata*), and others are increasing their numbers at the expense of native species.

I first noticed this dynamic on Bernal Hilltop, site of a long-running volunteer stewardship program now in its 17th year. Every month we would go out and keep the fennel and wild radish at bay from its coastal prairies of shooting stars and other forbs. In this we have largely succeeded. Meanwhile, a less visible invasion was imperceptibly transforming the grassland. A half-dozen years ago I visited one wonderful population of shooting stars and marveled at its steadfast beauty. Just a few years later, it was gone, and in its place were a knitted weave of several perennial forbs—sheep sorrel, hairy dandelion, English plantain, and yellow oxalis (*Oxalis pes-caprae*). Every San Francisco gardener knows these plants, but I never expected them to be capable of creating such havoc.

Time-lapse photographs might easily document such invasions, but I was far more focused on human-scale weeds, like fennel, to worry about microweeds. In retrospect, the invasion is most visible when they are flowering. The plants listed above all flower prodigiously, on stalks standing well above the herbage, and hence show up in photographs. I don't think that anyone has tried to document the phenomenon using repeat photographs.

Once I became aware of such dynamics involving microweeds, I began noticing it elsewhere in San

Francisco grasslands. Invasions by annual grasses from the Mediterranean have been well-documented, but I grew concerned when I witnessed an annual grass move into rocky grasslands that had been previously relatively untouched by annual grasses. Previously unreported in San Francisco, false brome (*Brachypodium distachyon*) materialized overnight, exploding in the thousands this year in these vital rocky grasslands as if seeded by helicopter. Such areas had provided a refuge for natives such as buckwheats, dudleyas, and various species of *Lomatium*, especially lace parsnip (*L. dasycarpum*). False brome went from unreported to unstoppable in just one year. In this case, even early detection and response—one of our best tools for combating

Native plants present in this picture: rein orchid (*Piperia elegans*), coast buckwheat (*Eriogonum latifolium*), blue-eyed grass (*Sisyrinchium bellum*), purple needlegrass (*Nassella pulchra*), plus the weedy hairy dandelion and English plantain. In a few years the dandelion and plantain will displace the native plants.



invasions—would not have worked.

The last decade has been mostly wet, and that's good for weeds. The long-present perennial velvet grass (*Holcus lanatus*) exploded in Bay Area wildlands during the El Niño year 1998 and suddenly ratcheted up in our awareness. Velvet grass has been around for many decades in cultivated parks and other disturbed places, but had not been considered a wildland problem. Its overnight appearance in large numbers in widely scattered locations in the San Francisco Bay Area drew attention from everyone concerned with grasslands and scrublands. It has a wide range of cultural tolerances: it can survive much drought, but also enjoys having its roots in water-

logged soil. Its perennial nature means that it can increase by tillering as well as by seed and assures that roots are able to penetrate to deeper levels, thus ensuring greater durability and competition with deep-rooted natives. In dry years young plants will persist in a semi-dormant state, then burgeon in a wet year, when the dormant seedbank also explodes.

Of all the microweeds, only invasive annual grasses have been studied thoroughly. Among the many studies is a recent one by Dr. Stuart Weiss who investigated invasion dynamics in a coastal grassland at Edgewood Natural Preserve in San Mateo County. He studied the decline and disappearance of the fed-

erally-listed Bay checkerspot butterfly (*Euphydryas editha bayensis*). The study identified the weedy annual Italian ryegrass, *Lolium multiflorum*, as the culprit because of its displacement of the butterfly's larval food plant—the tiny dwarf plantain (*Plantago erecta*) and other plants vital to the system's fabric—through shading and root competition. He found that Italian ryegrass and other weedy annual grasses are proliferating because of nitrogen deposition from auto exhaust on Interstate 280, which cuts through the preserve.

These invasions are less dramatic and less visible than gorse gone wild, but it seems to be happening nevertheless. Losing a grassland to a fast and furious invasion by yellow

This red fescue (*Festuca rubra*) is probably many decades old on this harsh, windy site, pictured here with author. The thatch buildup in the grass clump makes an ideal nursery for weeds, such as the hairy dandelion shown below it, whose seeds are wind-dispersed. Once there, the dandelion rosette will produce offsets and spread its leaves flat on the grass, while its taproot will compete with the grass for soil resources.





The diversity portrayed here by farewell-to-spring (*Clarkia rubicunda*), dudleya (*Dudleya farinosa*), coast buckwheat (*Eriogonum latifolium*), native dandelion (*Agoseris apargioides*), and bunchgrass (purple needlegrass, *Nassella pulchra*) will trend to the simple as the English plantain claims more and more of the available resources; the natives will slowly drop out, one by one.

starthistle is no different than losing one to the slow and stealthy displacement of native herbs and grasses by other, less noticeable weeds. Our landscapes and our lives are either way impoverished.

Attempting to save tiny urban remnants of the original landscape may strike some as being quixotic. But what is happening in San Francisco may be a harbinger of things to come. I've witnessed it myself in the more extensive grasslands of San Bruno Mountain, where oxalis, hairy dandelion, and other micro-weeds are contributing to ecosystem decline.

Such dynamics are not limited to urban coastal grasslands. Even redwood forests, where you'd think that the dim light and thick acidic litter would spare them from invasives, are being overwhelmed in places by English and Algerian ivy (*Hedera belix*, *H. canariensis*) and English holly (*Ilex aquifolium*). Can't believe that English ivy can harm a 350-foot redwood? Well, given time, it will climb into the crown, cutting off light and weighing it down with biomass, in addition to competing fiercely with the redwood's own shallow root system. Other aggressive invaders that



Documentation of the thesis of this article would not be difficult: Take a series of snapshots over time of scenes like this and watch the English plantain (*Plantago lanceolata*) slowly gain the upper hand over the tough native bunchgrass. The grass must share its energy with the foodchain, whereas the plantain shares little or none, giving it a competitive advantage.

thrive in this environment are ehrharta (*Ehrharta erecta*) and windborne Cape ivy (*Delairea odorata*).

Deserts, too, are not immune. Saharan mustard (*Brassica tournefortii*) is usurping vital desert washes, and of even greater concern are two species of *Schismus*—annual grasses from the Mediterranean—that cause widespread destruction by carrying fire from one widely-spaced shrub to another, like cheat grass (*Bromus tectorum*) in the Great Basin.

Of all the invasive species that I've mentioned, only two, Cape ivy and English ivy, are on the California Exotic Pest Plant Council A-list. I'm not arguing that these others should be included on that list, or that smaller weeds receive as much attention and funding as the more troublesome plants. I am just trying to draw your attention to the less visible invasions that are also transforming California plant communities.

Some will think me too pessimistic, perhaps citing studies that may indicate other conclusions. I report what I see, and my experience can be corroborated by many resource managers. I do not think

the picture is exaggerated, only unpopular, and one we would rather deny. Call me Cassandra—but remember that, despite the current pejorative intent, she was right, to the Trojan's rue. After all, Troy did fall.

So why am I adding yet another depressing note to the long list of problems threatening to overwhelm us? I have tremendous respect for human creativity. The same creature that caused the problem may be capable of fixing it; only recognition and will is required. I am impressed with the strategies, the thinking, and the research that have already occurred. Members of the California Native Grass Association, for example, have been ingenious in meeting some of the challenges of grassland restoration. The California Exotic Pest Plant Council, an organization devoted exclusively to wildland weeds of California, is gathering steam in its ability to organize political support for wildland weed control. Researchers are showing tremendous creativity in ferreting out the achilles heel of troublesome plants. Give them money and institutional support and see what they can do.

Hairy dandelion, a.k.a. cat's ears (*Hypochaeris radicata*), like the lawn dandelion, has a deep taproot and offsets prodigiously, its many rosettes smothering most plants growing adjacent to it.



There are not many technologies presently known for controlling microweeds on a landscape scale. Manual or mechanical methods are not applicable on this scale. Fire and herbicides have their own problems, but both are tools that can be used in an integrated manner to help address the problem (see for example "The Role of Herbicides in Preserving Biodiversity" in *Fremontia*, October 1998). It follows that we should consider biocontrol. Many weeds have become so widespread and all-pervasive that only one technology offers hope to control them: biological agents. But it too is not a panacea. Although classical biocontrol has a good record, it is not without its critics. To the extent that the criticisms are valid, concerns can and should be addressed, even if that means increasing the costs of an expensive technology. I see biocontrol as the only hope for controlling many invasive plants.

But I digress. Returning to my gardener's eye, grown practiced over 46 years, I'm reporting what I see, and it's not cheering. I see species wink out one by one: first the shooting stars and saxifrages, then the violas and checkerbloom. The spunky survivors that are the last to go are the bunchgrasses, yarrow, morning glories, and buckwheats. Consider the lilies of the field, how they grow; they toil not, neither do they spin. To keep weeds from overtaking a field of lilies is neither toil nor joy, but simply a matter of existence, as important to me as health care, the economy, and other central human concerns.

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The Klamath Mountains prominently support a variety of high-mountain meadow systems, such as this ridgeline mosaic in the Marble Mountain Wilderness. All photographs by author.

TREE ENCROACHMENT ON KLAMATH MOUNTAIN MEADOWS

by Michael P. Murray

High mountain meadows are remarkable ecosystems of the Klamath Mountains. They are valuable habitat for wildlife such as mountain beaver, bear, elk, hummingbirds, lizards, and a variety of pollinating insects. Rare and diverse meadow flora include wing-seed draba (*Draba pterosperma*), mountain hairgrass (*Vahlodea atropurpurea*), Siskiyou sedge (*Carex gigas*), Klamath gentian (*Gentiana plurisetosa*), and long-

haired star-tulip (*Calochortus longebarbatus* var. *longebarbatus*). Overall, meadows support a higher diversity and richness of plants than neighboring high elevation forest, aquatic, or shrubland communities. People value meadows for their ease of passage and open campsites affording sweeping views of the mountain landscape and starry skies.

The distinct mountain agglomeration known as the Klamath-Siskiyou region straddles northwest-

ern California and southwestern Oregon. Often referred to as “the Klamaths,” the central location of these mountains explains, in part, the flora which is a convergence from the Cascades, Sierras, Great Basin, and Rocky Mountains. This intermixing of plants is probably the most important factor affording it a high species richness. In the north central portion of the Marble Mountain Wilderness, over 200 species of vascular meadow plants



Wing-seed draba (*Draba pterosperma*) is endemic to dry ridgecrest subalpine meadows underlain by marble. Photograph from the Marble Mountain Wilderness.

occur within a square mile. Corresponding to a high species diversity in the region, there is also an impressive system of montane and subalpine meadow community types.

At least six general meadow communities exist here, including sedge, dry meadow, sedge-bunchgrass, lush-herbaceous, corn-lily, and bentgrass. Sedge meadows are found on soils at the upper extremes of moisture. Places such as lake margins, microbasins, and late-lying snowbanks commonly support sedge communities, but in the Klamaths, these meadows do not reach the immense sizes of the sprawling Sierra sedgeland. The most abundant sedges are smooth-beaked (*Carex integra*), and Kellogg sedge (*Carex kelloggii*).

Dry meadows are common on upper slopes and ridge tops where low, matted plants resemble alpine tundra. Principal species are Idaho fescue (*Festuca idahoensis*), dwarf sagebrush (*Artemisia arbuscula*), large-fruited lomatium (*Lomatium macrocarpum*), spreading phlox (*Phlox diffusa*), bottlebrush squirreltail (*Elymus elymoides*), sulphurflowers (*Eriogonum umbellatum* var. *goodmanii* and var. *argus*), and Douglas buckwheat (*E. douglasii*).



Although meadows tend to be resistant to tree invasion, changes in the environment such as decreased snowpack or livestock grazing can cause prolific expansion of conifers including these Shasta red fir (*Abies magnifica* var. *shastensis*). Photograph from the Russian Peaks Wilderness.

Sedge-bunchgrass meadows support Idaho fescue, columbia stipa (*Stipa columbiana*), big sage (*Artemisia tridentata*), and sedges which have not been identified to species but probably include thick-headed (*Carex mariposiana*) and many-ribbed sedge (*C. multcostata*).

The remarkable lush-herbaceous meadows are verdant jungles of towering flowers set on soils that remain damp throughout the summer. Common species are angelica (*Angelica tomentosa*), blue stickseed (*Hackelia micrantha*), alpine knotweed (*Polygonum phytolaccaefolium*), Martin's paintbrush (*Castilleja martinii*), *Thalictrum's* meadow-rue

(*Thalictrum fendleri*), California brome (*Bromus carinatus*), and Oregon checker-mallow (*Sidalcea oregana*).

Corn-lily meadows are similar and are found on valley bottoms and wetter slopes. Typical species are corn-lily (*Veratrum californica*), horse-mint (*Agastache urticifolia*), yellow-staining collomia (*Collomia tinctoria*), California waterleaf (*Hydrophyllum occidentale*), and mountain thistle (*Cirsium calilepsi*).

During the mid-1900s, ecologists began to note young trees establishing along forest edges and as clumps well within meadows of the Pacific Northwest (Brink 1959;

Franklin and others 1971). We know that meadows have always supported occasional trees—either in patches or just a few hardy individuals scattered about. Woody pioneers are able to gain a toehold where most others have succumbed to fire, drought, deep snow, rodents, and a variety of other tree inhibitors which help maintain them. But recently we have seen numerous patches of young trees proliferating in pockets here and there on the open landscape. This phenomenon is not restricted to the Pacific Northwest, having been subsequently observed in the Rocky Mountains and Sierra Nevada.

The ostensibly recent incursion has important implications. Plants which thrive in meadows prefer their sunlight unfiltered by invading conifers. As trees mature and shade more area beneath their expanding canopies, we expect shade-intolerant plants to dwindle in numbers. Moreover, unlike mature trees, most middle-aged trees tend to grow a canopy right down to the ground surface. Meadow plants are simply unable to thrive in this new alien environment. Each tree creates a no-grow zone. Multiply this by the thousands of trees invading a meadow, and we begin to realize how meadows are losing ground. Tree establishment can also alter soil nutrient ratios, fire dynamics, and hydrology while generating the loss of wildlife habitat.

A FIRST LOOK AT THE KLAMATH MEADOWS

My interest in tree invasion was born doing graduate study of meadow species composition in the Marble Mountain Wilderness of the Klamath National Forest. While inventorying plots, I noticed patches of young Shasta red fir (*Abies magnifica* var. *shastensis*), mountain hemlock (*Tsuga mertensiana*), and

willows (*Salix* spp.) thriving in the meadows. Like any ecologist, I wondered what caused their seemingly recent establishment. But not being part of my study, I remained focused on classifying meadow vegetation.

Ten years later, I found myself looking at an aerial photograph of this same area taken in 1944. As I examined the timberline mosaic that I professed to know so well, I was astonished. My meadows appeared in a barely recognizable form! I was seeing broad expanses of open country vaguely familiar to me. Comparing closely with a recent photo, it was apparent how dramatic the mosaic had changed. Small inconspicuous saplings alone in the meadows had become patches of mature trees surrounded by new saplings. Meadowed lakeshores were now shaded with 30-foot tall firs. Forests, speckled with an understory of shrubs visible through the canopy, were now dense and shaded.

Such dramatic changes made an impression on me. I wanted to know just how extensive this shift had been across the surrounding mountain

landscape. Although the published literature contained numerous discussions of causation, there remained a conspicuous void of knowledge regarding the actual scope of invasion at a landscape-scale. Rapidly improving remote sensing and imaging technology afforded me the opportunity to effectively assess these changes across broad areas.

I randomly selected six meadow sites to examine. All were within the Marble Mountain Wilderness Area, except Morris Meadow which rests in the Trinity Alps Wilderness (Table 1, p. 17). The Klamath National Forest provided full access to their collection. Both sets (1944 and 1999) were 9×9-inch at approximately 1:16,000 scale, black-and-white and color respectively. Each photo was digitized, georectified, and analyzed within a geographic information system (GIS) utilizing ArcView software and the Image Analysis extension. Canopies of meadow trees (sq. meters) were calculated and compared between 1944 and 1999 to estimate meadow loss.

Since 1944, 4–26% of Klamath meadows have been converted to tree or willow cover as illustrated in this valley bottom mosaic. Photograph from the Marble Mountain Wilderness.





Invading conifers eliminate meadow plants and our scenic views, Paradise Lake, Marble Mountain Wilderness.

FINDINGS AND IMPLICATIONS

Based on comparing 1944 with 1999 photographs, tree cover has increased 2–13% among meadows (Table 2, p. 17). Although some occurrences of isolated tree mortality were observed, no meadows support an overall loss of tree area within their boundaries. The pattern of invasion is similar among

meadow sites. Scarce young trees which existed in 1944 have matured and are now surrounded by dense patches of progeny. While we would expect pronounced invasion along the forest edges, a significant amount of invading trees are well within meadow boundaries, thus affecting meadow loss near their centers.

Shrub change was not measured, but increases were observed on photographs. Rate of increase appears

to be slightly less than tree invasion. Whereas trees colonized previously unoccupied microsites, shrub cover has increased predominantly from existing 1944 patch edges. Combining shrub increases with tree results, meadow loss is approximately 4–26% among the six meadow sites.

An overall increase of 4–26% may not seem like a dramatic change; however, the actual footprint of impact is greater than the canopy measurement alone. We must consider a tree's ability to modify the immediate surroundings by shading, water uptake, litterfall, etc. Such changes can be detrimental to meadow flora. Groves of trees near lakes tend to attract recreationists who create campsites and tether packstock, thus intensifying damage to the herbaceous layer. Low-impact camping techniques, such as camping at least 100 feet from water and avoiding sensitive herbaceous vegetation, are seldom adhered to.

In Klamath Wilderness Areas there has been a shift in use from traditional campsites sited at appropriate distance from lakes in mature forest, to campsites set up at the invading lakeside groves. Findings also indicate that computer analysis is not necessary to detect meadow loss. Instead, casual observation of paired photographs can provide remarkable insight of tree invasion, even at low intensities (Figure 1, p. 18).

Besides measuring the overall percentage of invading trees, it is useful to understand precisely where trees tend to colonize within meadows. My results indicate that new trees tend to appear in somewhat discrete patches rather than a uniform dispersal. This is at least partly a reflection of pioneering trees moderating the environment, and thereby making conditions more conducive for new tree recruitment. Miller and Halpern (1998) document this in the Cascades and sug-

TABLE 1. CHARACTERISTICS OF SIX MEADOW SITES ANALYZED IN THE KLAMATH MOUNTAINS.

Meadow Site	Meadow Lifeform	Landform	Elevation (ft)	Location (UTM, NAD83)
Big Ridge	Bunchgrass – Sedge Mosaic	Ridgecrest	6,640-6,988	481270, 4610835
Cuddihy Lakes	Sedge – Thin Bentgrass	Cirque Basin	6,560-6,880	473005, 4600252
Meteor Lake	Sedge – Thin Bentgrass	Cirque Moraine	5,720-5,920	471093, 4597874
Morris Meadow	Mosaic	Glacial Valley Bottom	4,400	503935, 4535707
Paradise Lake	Thin Bentgrass	Cirque Moraine	6,080	482577, 4606787
Sky High Lakes	Thin Bentgrass	Cirque Moraine	5,760-5,900	485094, 4600175

gest that establishment may continue even during subsequent periods of unfavorable climate. Once invading trees are established within meadows, the rate of establishment can increase dramatically.

Patterns of established young trees may also be guided by pre-invasion biological and physical conditions. Meadow sites are typically mosaics of different plant communities and topoedaphic (relating to the soil surface) nuances. In all likelihood, these contrasting habitats also differ in their vulnerability to invasion. It would be useful to know where high vulnerability corre-

sponds with habitat for rare plants. For a separate long-term study in this region, I installed monitoring transects and discovered the very rare and unique bud saxifrage (*Saxifraga bryophora*). This population was actively being invaded by mountain hemlock.

What is causing this widespread encroachment? It is probably related to climatic shifts, domestic grazing, or fire suppression. Rather than assume one dynamic is responsible for the entire region, it is best to evaluate each site individually to reveal site-specific relationships. By determining ages of encroaching

trees, we can compare this data with historical records of land use and climate.

For example, the curtailment of heavy overgrazing between 1910 and 1935 likely provided the opportunity for seedlings to establish in denuded meadow vegetation. This has been suggested in the southern Cascades and Sierra (Miller and Halpern 1995, Taylor 1990, and Vale 1981). Two lake basins, Sky High and Paradise, appear to have been heavily denuded at one time. I'm confident that analysis of tree ages and grazing records would identify grazing as a

TABLE 2. PERCENT MEADOW LOSS TO TREE INVASION FOR SIX MEADOW SITES IN THE KLAMATH MOUNTAINS, 1949 TO 1999.

Meadow Site	Meadow Site Area (ha)	1944 Tree Area (sq.m)	1999 Tree Area (sq.m)	Meadow Loss
Meteor Lake	14.5	92	398	2.1%
Sky High Lakes	38.3	436	13,582	3.4%
Paradise Lake	4.5	690	2,212	3.4%
Cuddihy Lakes	31.0	625	1,936	4.2%
Morris Meadow	183.1	3,812	16,791	7.1%
Big Ridge	206.8	2,210	29,990	13.4%

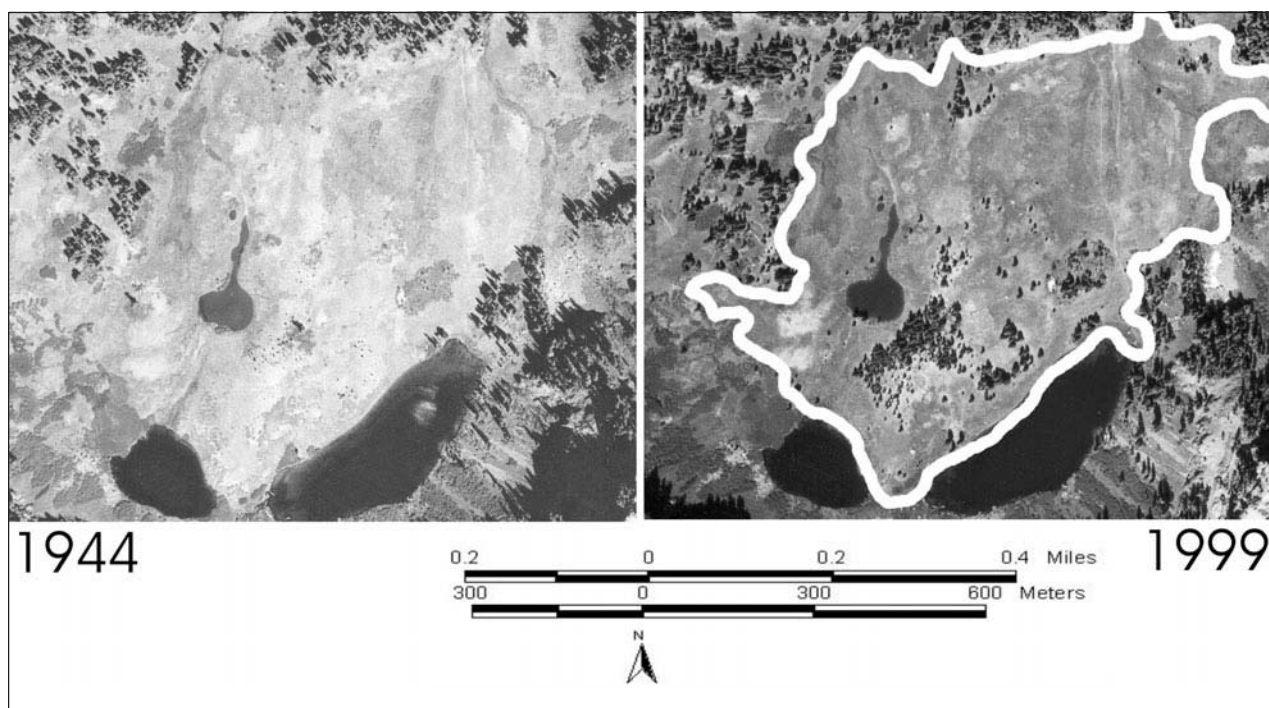


Figure 1. Comparison of aerial photographs shows that the meadow site at Sky High Lakes has lost about 3.3% of its area to invading Shasta red fir since 1944. Traditionally a popular destination for recreational visitors, new campsites have been created beneath the burgeoning canopies.

persuasive agent. Decreased snow-pack in the spring over the past several decades is a likely cause at north-facing meadows where late-lying snow has historically inhibited trees.

Fire exclusion is most important in meadow types with high natural fire frequencies, such as the lower elevation grassy meadows. In this regard, Morris Meadow deserves a close look. Many mountain meadows of the Klamaths are within federally protected wilderness areas. If human impacts are to blame, then appropriate management responses, including restoration, should be considered to protect the integrity of meadows.

CONCLUSION

This analysis verifies that the Klamath-Siskiyou Region shares the phenomenon of tree invasion with other subalpine regions of the western US. Based on six meadow sites examined, it is estimated that 2–

13% of meadow acreage has been converted to tree cover since 1944. A nearly equal additional amount has been usurped by increases in willow. Thus, total meadow loss is estimated to range from 4% to 26% among meadows. These sites are within Congressionally-designated Wilderness Areas managed to protect natural conditions. Further work is warranted to identify causes of invasion and impacts on meadow communities, and to predict future trends. Such additional insight will help managers understand and protect these vital plant communities.

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North Coast Chapter members replanting the rare western lily (*Lilium occidentale*) in January, 2001. Photograph by D. Imper.

THE NORTH COAST CHAPTER OF THE CALIFORNIA NATIVE PLANT SOCIETY

by *Elizabeth McGee*

You may already know that the north coast of California is home to giant redwoods, large stands of Douglas-fir, dune plant communities, serpentine mountains, and numerous endemic species, but did you also know it was home to the “Arcata Mafia?” During the early months of 1970, James P. Smith, John Sawyer, and Virginia Rumble met on the Humboldt State University (HSU) campus (in Arcata) to discuss organizing a chapter of the California Native Plant Society on the north coast. With enthusiastic support of

then statewide president Ledyard Stebbins, the chapter was established in March of 1970. The first North Coast Chapter president was John Sawyer.

All three of the founders worked at the state level in various capacities and implemented changes that were not always well received. While making changes to meeting times and places, formulating statewide field trips, and creating a rare plant botanist position, Jim, John, and Virginia were sometimes *not* so affectionately called the “Arcata Mafia.” However, their extraordinary

vision is what makes our chapter what it is today: a group of people excited about native flora and dedicated to conserving and educating others about native plant species and their habitats.

One of the best ways to share an enthusiasm for plants is to explore with other enthusiasts on field trips and share information through presentations by knowledgeable speakers. These educational activities have been the foundation of our chapter. At the very first meeting of the North Coast Chapter, new members were treated to a slide presen-

tation on local spring wildflowers by botany professor Dennis Anderson (who would later lead a trip to Hawaii in 1972). A total of 28 members signed up at this first meeting, and in April of 1970 several members attended the first field trip.

The Stony Creek trail off of State Route 199 in the Smith River area was their destination. Along with many other species, one of the highlights of this trail is a view of the California pitcher plant (*Darlingtonia californica*), a rare plant in California (CNPS List 4 species). This trip, although rainy, was enjoyable for all attendees and became an annual event in subsequent years.

Sometimes a sheet cake was packed along to celebrate the birthday of Earl Rumble (Virginia Rumble's husband). It was on some of these earlier excursions that folks learned the field survey method chapter members called "40 mph taxonomy," or the skill of identifying plants from a moving car. Earl, a truck driver on occasion, became so adept at this method that he would point out shrubs and flowers in bloom to other truckers over his CB radio.

Through the years we have had many outstanding field trips and evening programs. Several times during the 1970s and 1980s Ledyard Stebbins returned to the north coast to give a lecture on flowering plants. Our evening programs now occur

Western lily (*Lilium occidentale*), one of the special plants of northwestern California. Photograph by A. Pickart.



monthly and are always informative and entertaining. A February 2002 symposium that the chapter organized, titled "The Ecology and Management of Rare Plants of Northwestern California," was an ambitious full-day event that drew participants from all over the state and Oregon. With 31 speakers and over 200 participants, the symposium was an unmitigated success. In December of 2002 the chapter received an award from the state CNPS president, Sue Britting, for developing and organizing this informative event.

Other educational activities that the North Coast Chapter has sponsored include a monthly newsletter, the annual spring wildflower show, native plant gardening and school science fairs, and a display booth that is used at events to educate the public about CNPS and native plants. The chapter newsletter originally was called the "California Native Plant Society North Coast Chapter Newsletter" (whew!) but became the "Darlingtonia" in 1974.

Just recently we cosponsored the 20th Annual Spring Wildflower Show. We have been cosponsors of this event along with the Nature Discovery Volunteers since 1995 and have involved school groups, Friends of the Dunes, Redwood Interpretive Association, and California Indian Basketweavers Association. Each year we also give an award to the best Humboldt County science fair project that focuses on native plants. We helped to establish a native plant garden at Pacific Union Elementary School in 1994, which continues to be an educational tool for the students. In 2000 we sponsored a native plant propagation and restoration program at Winship Junior High School. Over the years we have worked at establishing native plant gardens on the HSU campus, at roadside areas, the Arcata community center, and the United Indian Health Services Potowat Clinic.



A rare wallflower of northwestern California, Menzies or Humboldt Bay wallflower (*Erysimum menziesii* ssp. *eurekaense*), named for its type locality near the city of Eureka. Photograph by A. Pickart.

Our display booth can be found at many of the fairs and events throughout Humboldt County, where it serves to educate people about native plants on the North Coast. At two of these events we also have a plant sale, our primary fundraiser. Although the idea for a chapter plant sale germinated during the 1980s, the first plant sale did not take place until 1992. John McRae, Chris Blumstrom (now Chris Jenican-Beresford), along with Steve and Carol Matthews spearheaded the first sale. It has been a great success ever since.

In addition to the many entertaining educational activities of the chapter, we also engage in the serious (and sometimes not so serious) business of conservation. The chapter has been active in the conservation of native plant species and their habitat throughout this region of Northern California. The chapter has been kept extremely busy dealing with the conservation needs of its varied plant communities, including hardwood and conifer forests, serpentine landscapes and meadows of the Klamath and

Siskiyou Mountains and Coast Ranges, beach and dune plant communities, and coastal prairies.

Some conservation efforts over the years have included establishing and expanding wilderness areas, taking inventories of rare plants, protecting delicate serpentine plant habitat, and using all means available to preserve individual species as well as the habitat of two endemic endangered plants. Throughout the 1970s and 1980s our chapter actively attended meetings and wrote letters to establish the Trinity Alps Wilderness area and to add acreage to existing wilderness areas through the Forest Service Roadless Area Review and Evaluation (RARE II) process.

At the Six Rivers National Forest the chapter influenced the establishment of several botanical areas including Horse Mountain, North Fork, Smith River, and Bear Basin Butte. During the 1970s, J.P. Smith spent many years collecting data in our area and throughout the state for the first edition of the CNPS *Inventory of Rare and Endangered Vascular Plants of California*. Many members, including many HSU botany graduate students, were kept busy filling out forms and traveling throughout the north coast to determine which plants warranted inclusion in the *Inventory*. This effort continues today with the participation of many area botanists on the state CNPS

Rare Plant Scientific Advisory Committee.

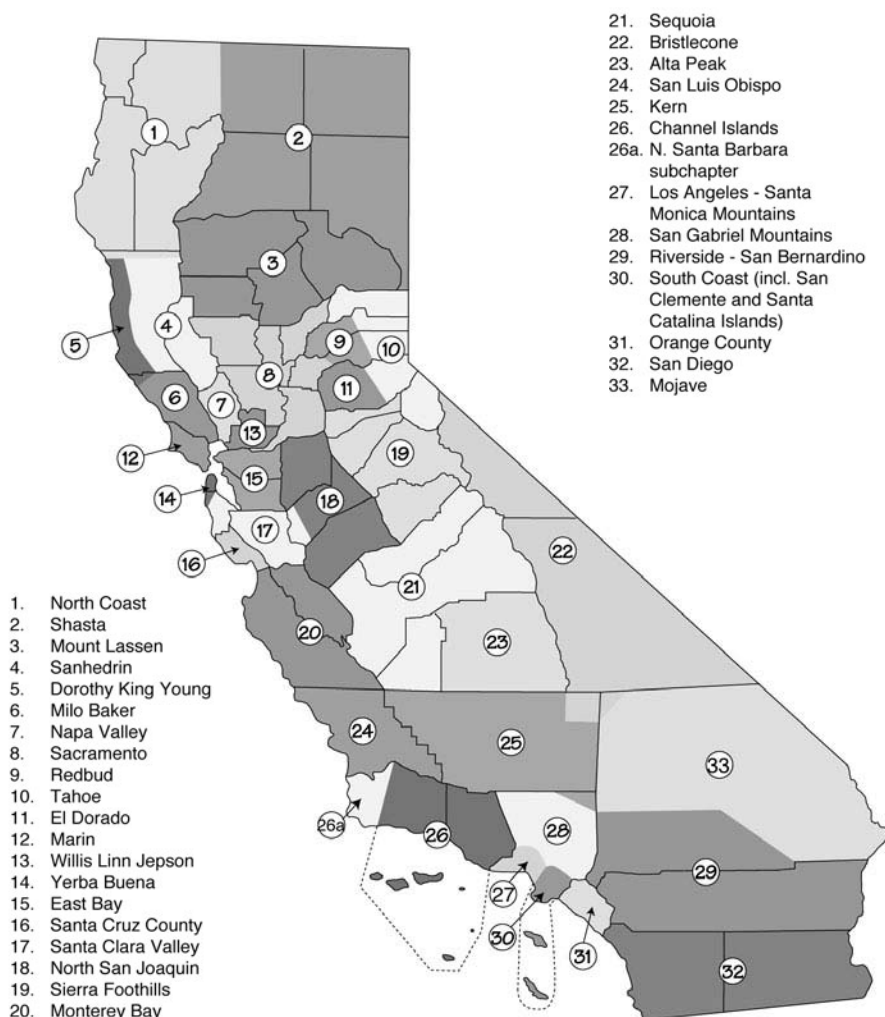
The largest areas of serpentine habitat in the state are found in the Smith River area just south of the Oregon border. On Gasquet Mountain, the site of 40 CNPS-listed species, Cal-Nickel Corporation planned a mining operation to strip the mountain for nickel, cobalt, chromium, and magnesium deposits. In 1977 the chapter was alerted to these plans, and in 1979 joined with the Smith River Alliance to head off the project. In 1984 Dwain Goforth resigned from his position as chapter president to work on this issue full-time. Although this land is still owned by Cal-Nickel, it is now protected in many ways by the Wild and Scenic status of the Smith River and the establishment of the Smith River National Recreation Area in 1990.

Since the early 1980s, protection of the western lily (*Lilium occidentale*) and its natural habitats has been a part of our conservation goals. The western lily grows primarily along the coast in boggy areas, wetlands, and coastal prairies. It is threatened by housing development and by competition from the overgrowth of shrubs in bogs and in coastal prairie or coastal scrub. Key members of the North Coast Chapter have tended to the small populations of western lily in Humboldt and Del Norte counties.

Through the leadership of Dave and Kim Imper and a grant from the Nature Conservancy, a small patch of western lily habitat was fenced in Humboldt County in 1985. A larger area (1.5 acres) was fenced in 1994 and monitoring and habitat improvement projects continue today. Every winter Dave entices many of us to venture into lily habitat for shrub and tree removal, building fences, planting bulbs, and for the first time this year, burning.

Another species that has been at the forefront of our conservation

Map of CNPS Chapters; the North Coast Chapter is located in the far northwest corner of the state.





North Coast Chapter members join other conservation groups bashing invasive lupine (*Lupinus arboreus*) in coastal dune areas. Photograph by S. Van Hook.

program has been the Menzies or Humboldt Bay wallflower (*Erysimum menziesii* ssp. *eurekaense*). This is a state- and federally-listed species that is found in the fore dunes surrounding Humboldt Bay. In 1976 the Army Corps of Engineers planned to deposit the spoils from harbor dredging onto the sand dunes on the Samoa Peninsula.

In 1977, through the leadership of John Sawyer, seeds were collected and whole plants were moved to new locations at the Lanphere Christensen Dunes Preserve. The Army Corps of Engineers also agreed to preserve some of the habitat that would initially have been covered with dredged material. By 1979 relocated plants were doing well and the protected population was also thriving. The monitoring of the plant continued throughout the 1980s. An annual activity for chapter members has been to count individuals in each of the Menzies wallflower populations.

In 1984 our chapter celebrated when the wallflower was listed as endangered by the California De-

partment of Fish and Game, and again in 1992 when it was designated as endangered by the US Fish and Wildlife Service (USFWS). Presently, conservation issues are focused on addressing sensitive plant issues in the timber harvest review process in Humboldt and Del Norte counties, and reviewing county management plans. We also partner with the USFWS to collect monitoring data on several of the rare species in our area.

Part of our efforts to maintain rare plant populations and native plant habitat has been to control exotic plant species. With the CALTRANS development of the State Route 101 corridor throughout the 1960s and 1970s, many exotic species were introduced to stabilize the dunes and roadsides. Although the chapter has focused on many exotic plant issues, in the early years the main concern was the invasive plants in the dune communities at the Nature Conservancy's Lanphere Christenson Dunes Preserve. Pampas grass (*Cortaderia jubata*), English ivy (*Hedera helix*),

and yellow bush lupine (*Lupinus arboreus*) are threats to the native plants of the dunes.

In 1977 the chapter advertised a "plant destroying trip" to the dunes. In subsequent years these search-and-destroy trips with a "Pulaski" (axe) would be known as "lupine bashes." In the spring 1998 issue of *Darlingtonia*, it was suggested that the lupine bashes were no longer needed in some parts of the dunes because of all the work done in previous years. Dune restoration continues today with weed eradication workdays sponsored mainly by the Friends of the Dunes, a local dune conservation organization. In recent years we have formed partnerships with the Humboldt County Weed Management Area in educating the public about the invasive exotic species in their own backyard. We also have cosponsored California Invasive Weed Awareness Week and a guide to Humboldt County Weeds.

The success of our chapter comes from the many hard-working and dedicated volunteers that are found here on the north coast. We have had 21 presidents in the last 33 years with many serving more than one term. What started as an outgrowth of the HSU botany department has become a part of the surrounding community with meetings, field trips, and other activities held throughout Humboldt and Del Norte counties.

If you are ever in our area, please come and visit us. Our business meetings and evening programs are held the second Wednesday of the month, and always include a presentation. You can also check us out online at www.northcoast.com/~cnps/. We currently have 291 members, including 21 board members. Contact information for all of our board members, including our new chapter president, Carol Ralph, is listed within our website.

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JEPSON ONLINE INTERCHANGE FOR CALIFORNIA FLORISTICS

by Thomas J. Rosatti

The Jepson Online Interchange For California Floristics, developed and maintained within the Jepson Flora Project (JFP) at the University and Jepson Herbaria (UC/JEPS), University of California, Berkeley (<http://ucjeps.berkeley.edu/interchange.html>), is a place where knowledge about the flora of California is interchanged among all interested parties. It incorporates information from many sources, including but not limited to specimens, *The Jepson Manual: Higher Plants of California* (Hickman 1993), specialists in the plant groups involved, visitors to our website, and other online resources. It is an attempt to present what is currently known, as well as outline what remains to be determined, about the vascular plant resources of the state.

The Jepson Online Interchange essentially comprises all online information at UC/JEPS that bears on the flora of California. Its primary components are: the Index to California Plant Names (ICPN); *The Jepson Manual* (TJM), including taxonomic treatments, distribution maps, species lists, and corrections; MEKA (electronic, multiple-entry identification) Keys to California Plants; and links to data associated with about 350,000 specimens in UC/JEPS, as maintained in the Specimen Management System for California Herbaria (SMASCH). At present, the Jepson Interchange may be queried by plant name (scientific or common) or by geography (bioregion or county); additional search options are available through the SMASCH interface.

The Jepson Online Interchange includes links to various external

web resources as well, including: Cal Photos (Digital Library Project, UC Berkeley); International Plant Name Index (The Plant Names Project, a consortium of: The Harvard University Herbaria; The Royal Botanic Gardens, Kew; and the Australian National Herbarium); Tropicos (Missouri Botanical Garden); Flora of North America (many institutions); and the Inventory of Rare and Endangered Plants of California (California Native Plant Society).

INDEX TO CALIFORNIA PLANT NAMES (ICPN)

The Index To California Plant Names (ICPN) includes names that have been applied to California plants, for the most part in and since TJM. Of about 12,000 names presently included, nearly 3,500 are from sources other than TJM (e.g., specimens, checklists, and other floristic resources). The primary intention is to account for names people are most likely to encounter, from whatever source, and to characterize the status of such names with respect to the first printing of TJM (1993), as well as to the flora of California as we understand it today.

New names for taxa already known to occur in the state, reports of taxa previously known to science but not known from California, the publication of names for taxa new to science, and many other kinds of changes or potential changes appear in the literature of botany much more frequently than floras are published, or even more frequently than updated floristic treatments appear

online. Such activity, which has the potential to change the list of accepted names for plants occurring outside of cultivation in California, appears in ICPN as soon as we become aware of it, so that this index is as current as any such comprehensive resource can be. At present, names usually are added to the ICPN only as issues regarding them come up; inclusion of *all* names ever applied to California plants is a long-term goal of the Jepson Flora Project.

Each entry in ICPN includes the scientific name with author citation, the family in which the taxon is included according to classification adopted by the Jepson Flora Project (i.e., that used in TJM, as updated by subsequent advances in plant systematics), an Initial Editorial Analysis, and an Editorial Summary and Current Status (Figure 1, p. 26).

Editorial Summary is a more or less standardized account of the likelihood that a name will be accepted or rejected as representing a native or naturalized plant in California (i.e., as representing a member of the flora), followed by a statement summarizing the status of the name relative to TJM (e.g., addition, for taxon described since TJM; possible addition, minor variant in TJM; probable rejection, infraspecific taxa not recognized in TJM). Editorial Summary is an attempt to provide users with a quick way to put the name in context relative to TJM, and allows us to compute estimates of the kinds and numbers of changes that have been proposed or confirmed since TJM (Table 1, p. 24).

Whereas Editorial Summary addresses the status of a name relative to TJM, Current Status (Table

TABLE 1: A SELECTION OF EDITORIAL SUMMARIES IN THE INDEX TO CALIFORNIA PLANT NAMES (ICPN), WITH THE APPROXIMATE NUMBER OF NAMES INDICATED FOR EACH.

A. Names in ICPN representing changes or possible changes relative to TJM include:

- addition, minor variant in TJM: 1; e.g., *Helianthus exilis* A. Gray
- possible addition, minor variant in TJM: 255
- possible addition, possibly naturalized in CA: 147
- probable addition, evidently or probably or reportedly naturalized in CA: 101
- addition, in different genus since TJM: 92; e.g., *Ismelia carinata* (Schousb.) Sch. Bip., *Croton setigerus* Hook., *Funastrum cynanchoides* (Decne.) Schltr.
- addition, naturalized in CA: 52; e.g., *Dittrichia graveolens* (L.) Greuter, *Lasiospermum bipinnatum* (Thunb.) Druce, *Cabomba caroliniana* A. Gray
- addition, for taxon described since TJM: 19; e.g., *Lomatium observatorium* Constance and Ertter, *Deinandra bacigalupii* B.G. Baldwin, *Harmonia guggolziorum* B.G. Baldwin, *Packera buekii* Trock & T.M. Barkley, *Twisselmannia californica* Al-Shehbaz, *Pseudostellaria sierrae* Rabeler & R.L. Hartm., *Trifolium jokerstii* Vincent & Rand. Morgan, *Polygonum hickmanii* H.R. Hinds & Rand. Morgan
- probable addition, for taxon described since TJM: 17
- possible addition, for taxon described since TJM: 22
- addition, different rank since TJM: 7

B. Names in ICPN not or probably not representing changes relative to TJM include:

- rejection, treated as syn in TJM: 322
- rejection, infras not recognized in TJM: 258
- rejection, different rank in TJM: 160
- rejection, different position, rank in TJM: 102
- rejection, in different genus since TJM: 92
- rejection, based on erroneous report: 36
- rejection, not naturalized in CA, a waif: 21
- rejection, based on erroneous report and/or misidentification: 2; e.g., *Quercus toumeyii* Sarg. (see sidebar on page 28)

2, p. 25) has to do with the status of a name relative to the flora of California as we understand it currently, a different and more absolute concept. A name that has an Editorial Summary that reads, "addition, for taxon described since TJM" and one for which is indicated, "addition, in different genus since TJM" may both have a Current Status category of "JFP-1, accepted name for taxon native to CA." Conversely, names with the same Editorial Summary statements (e.g., "addition, in different genus since TJM") may have different Current Status categories (e.g., for *Tetranneuris acaulis* (Pursh) Greene, JFP-1, accepted name for taxon native to CA, or, for *Pericallis hybrida* B. Nord, JFP-2, accepted name for taxon naturalized in CA).

Some of the changes that have been proposed or confirmed since TJM result from changes in taxonomic philosophy, either on the part of individual specialists regarding their particular group or groups, or on the part of the editors of the Jepson Flora Project regarding plant systematics and the flora of California as a whole. Refinements in philosophy have been adopted in light of the importance of floristic information to the management of biodiversity in California, as such information is gathered and managed at UC/JEPS.

One of these refinements has to do with ever-changing ideas about the relationship between evolution and classification in plants. Opinions do and probably always will vary on this subject, but an attempt is being made within the Jepson Flora Project—insofar as is practical and to the extent that data bearing on this matter are available—to recognize only groups in which all members have evolved from a single, common ancestor (i.e., to recognize only monophyletic groups). Such a philosophy is in keeping with modern systematic practice as well as with the needs of society for classifications that are

predictive; that is, that allow us to predict or suspect characteristics (e.g., medicinal uses) of a plant by understanding its true genetic, evolutionary relationships. This criterion for recognition of taxonomic groups is not new, and it was certainly applied to some extent in TJM. What is new is the extent to

which it now is applied in the classifications we employ.

The entries in ICPN for *Eriophyllum nevinii* A. Gray and *Constancea nevinii* (A. Gray) B.G. Baldwin (Figure 1, p. 26) are examples of changes that have been confirmed since TJM, and that have resulted at least in part from the

increased emphasis on monophyly discussed above. In short, investigations by Baldwin (1999) indicate that not all species included in *Eriophyllum* in TJM evolved from a single, common ancestor (i.e., that *Eriophyllum* as circumscribed in TJM is polyphyletic).

In particular, phylogenetic analyses of evidence from morphology, cytology, and ribosomal DNA indicate that *E. nevinii* appears to be the sole representative of a lineage that diverged from related genera long ago, and that it therefore should be placed in its own genus. Since such a genus had never before been named and described, it was up to Baldwin to do so. He took the opportunity to name his new genus *Constancea* B.G. Baldwin, in honor of the late Professor Emeritus Lincoln Constance, world-renowned plant systematist (Ertter 2001), who had not only studied *Eriophyllum* as a dissertation topic (under Willis Linn Jepson), but recognized *E. nevinii* as a particularly distinct species even then (Constance 1937).

A more detailed account of the ICPN, including discussion of its components, development, and maintenance, is available at the Jepson Herbarium website (http://ucjeps.berkeley.edu/about_ICPN.html). Users are encouraged to visit the site, both for frequent updates and to submit their own contributions.

THE JEPSON MANUAL (TJM)

The Jepson Online Interchange includes treatments from the first edition, third (corrected) printing of TJM (1996), plus corrections that have accumulated since, with particular emphasis on the verification of geographic data with voucher specimens. These treatments may be accessed from the main Interchange page or from entries within

TABLE 2. CURRENT STATUS CATEGORIES IN ICPN.

About 28 different Current Status categories are represented in the Index to California Plant Names, the most commonly represented of which are indicated below. For each category, the number indicates whether the name applies to a native plant (1), a naturalized plant (2), a waif and/or garden escape (3), an agricultural or garden weed (4), a greenhouse weed (5), etc. A letter, if present, indicates that the name is a taxonomic or nomenclatural synonym (a) or an unpublished, invalidly published, illegitimate, or rejected name (b). The absence of a letter indicates that a name is the accepted name for the plant. A Current Status designation is accepted (i.e., is non-tentative) if it is consistent with *The Jepson Manual* and there has been no subsequent challenge to it, or if it represents a change relative to *The Jepson Manual* that has been sanctioned either by the author of the group involved or by one or more of the editors of the Jepson Flora Project (JFP). The Current Status of approximately 495 names remains tentative (assignment to a likely Current Status category possible, but confirmation by the author involved pending), while another 1,430 are still unresolved (not even a tentative assignment made).

JFP-1, accepted name for taxon native to California, 7110 (plus 172 tentative)

JFP-1a, taxonomic or nomenclatural synonym (alternate but not accepted name) for taxon native to California, 1,348 (plus 161 tentative)

JFP-2, accepted name for taxon naturalized (not native to but occurring and reproducing outside of cultivation) in California, 1,171 (plus 161 tentative)

JFP-2a, taxonomic or nomenclatural synonym for taxon naturalized in California, 106 (plus 28 tentative)

JFP-3, accepted name for taxon occurring only as a waif and/or garden escape (i.e., not native and not naturalized but sometimes found outside of cultivation) in California, 31 (plus 78 tentative)

JFP-8, accepted name for taxon not occurring in California (erroneous reports, misapplication of names, misidentifications, other exclusions), 100 (plus 29 tentative); e.g., *Quercus toumeyii* Sarg. (see sidebar on page 28)

JEPSON FLORA PROJECT: JEPSON INTERCHANGE

Constancea nevinii (A. Gray) B.G. Baldwin ASTERACEAE

Initial Editorial Analysis, 9 June 2000

Notes on Publication of Name	<i>Madroño</i> 46:160. 1999
Source of Report for California	Added manually by Rosatti
Initial Editorial Comments	Treated as <i>Eriophyllum nevinii</i> A. Gray in <i>The Jepson Manual</i> , but as <i>Constancea nevinii</i> (A. Gray) B.G. Baldwin since <i>The Jepson Manual</i>

Editorial Summary and Current Status

Editorial Summary	addition, in different genus since <i>The Jepson Manual</i>
Current Status	JFP-1, accepted name for taxon native to CA
Current Status Authority	Bruce G. Baldwin, as Author, Jepson Flora Project
Current Status Date	9 Jun 2000
	List of names for the Current Status category
	List of all names in <i>Constancea</i>

Resources of the Jepson Flora Project



Index to California Plant Names



UC/JEPS specimen database (SMASCH)

External Links



Cal Photos images



[IPNI](#) Nomenclatural & bibliographic information (Internation Plant Names Index)



[Tropicos](#) Taxonomic information from the Missouri Botanical Garden

FEEDBACK

Figure 1. One of two entries in the Index to California Plant Names (ICPN) for names that have been applied to the same plant. *Eriophyllum nevinii* A. Gray was used in *The Jepson Manual*, but the plant subsequently has been placed in a different, new genus and currently is known as *Constancea nevinii* (A. Gray) B.G. Baldwin. In addition to a summary of such activity that has occurred since *The Jepson Manual*, each entry includes links to other relevant resources.

the ICPN. Treatments of some taxa may be accessed (on an experimental basis, to users with recently updated web browsers) from a hyperbolic tree in which the taxa are arranged hierarchically in two dimensions (hyperbolically) rather than one (as in a conventional, linear listing of families, genera, species, etc.).

The display for each species shows treatment not only of that taxon, but also of the genus and family in which it was placed in TJM; the display for each subspecies and variety shows, as well, treatment of the species in which it was placed. In addition, each display includes a map of California, on which is indicated the California distribution as given in TJM, or as subsequently revised.

The display for each species, subspecies, and variety also provides links to: the ICPN; a comparison of the map based on the treatment in TJM with the county distribution map based on specimens from SMASCH (Figure 2, p. 27); a listing of other taxa with the same California distribution; and a ready means (under FEEDBACK), with instructions, for users to submit their own contributions to our knowledge of the plant in question. In cases where proposed or confirmed changes in taxonomy or nomenclature have occurred since TJM, there is a link to the entry in ICPN for the other name(s) involved. Corrections to TJM, as published by Wilken and Wetherwax (1996, 1997, 1998), are also included in the Jepson Online Interchange as a separate listing.

As indicated by the discussion under Index to California Plant Names, there has been and continues to be a high level of activity regarding our knowledge of the flora of California. Revised treatments will appear on the Jepson Online Interchange as they become available, leading to publication of a second, revised edition of TJM.

The Jepson Manual was intended

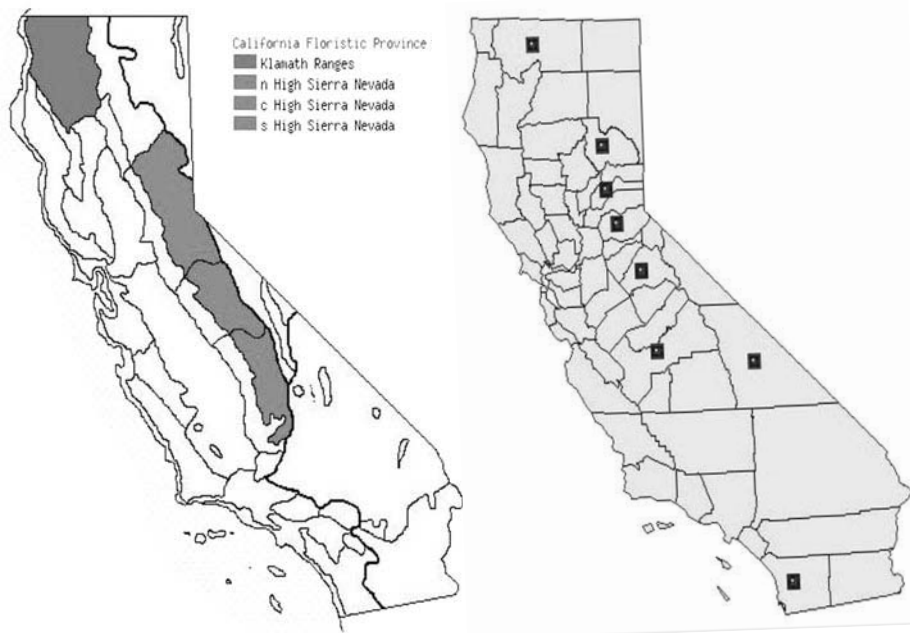


Figure 2. Maps of bioregional distributions of *Isoetes occidentalis* based on treatments in *The Jepson Manual* (left) and of county distributions based on specimens in SMASCH (right). Comparisons of the two kinds of maps are used to identify potentially significant discrepancies in geographic information. The county map indicates a specimen or specimens from San Diego County that, if confirmed, would significantly expand the range of this species as shown in *The Jepson Manual*. Clicking on the mark in San Diego Co. brings up one record from the SMASCH database. Examination of this specimen reveals that in 1998 it was annotated as *Isoetes occidentalis* by W. Carl Taylor, coauthor of *Isoetes* for *The Jepson Manual*, so that the bioregional map has been updated accordingly.

The maps shown also reveal other artifacts of the data. For example, occurrences of a plant in a given county are indicated by a mark that is usually placed near the center of that county, regardless of how widespread the plant is in that county. In this example, *I. occidentalis* is indicated for Inyo Co., most of which is included in SNE and DMoj, two regions not indicated in the bioregional map. In fact, the western edge of Inyo Co. is included in SNH, which is indicated for the species in the bioregional map. Similarly, indications that a plant occurs in a particular bioregion in California can be clarified by examination of a map of county distribution. Ultimately, specimen records in SMASCH each will be connected by geographic coordinates (latitude, longitude) to digitized maps of California, yielding a more accurate and informative depiction of geography.

to be a field guide, and as such was produced within some rather severe limitations of space. Production of a true flora of California and making it available online are other long-term goals of the Jepson Flora Project. An online flora offers users considerable advantages over a hardcopy version. Some of the elements that can be displayed more completely and extensively online include descriptions of morphology as well as of the habitats in which the plants occur, lists of alternate names (synonyms) under which the plants have been known, and citations of specimens belonging to each

taxon. Online treatments can be prepared so that users will be able to generate lists of taxa satisfying whatever criteria they wish (e.g., all plants with yellow flowers growing in vernal pools in GV), and to key out specimens using electronic, multiple-entry identification keys (see MEKA, below), with only a few key strokes and clicks of a mouse. These and other plans for the management and presentation online of information about the flora of California have been discussed in greater detail by Rosatti and Duncan (1995).

Geographic data about the

plants of California also are presented in the Jepson Online Interchange, in forms including distribution maps and species lists. Such depictions exclude any reports that are not documented either directly or indirectly by specimens. Indications that a plant occurs in a given area that are based on unsubstantiated reports in the literature or undocumented verbal interactions may appear, for example, under Correspondence in the ICPN, but such information is not included in our official maps and lists until the identity of underlying voucher specimens is confirmed.

The requirement that reports of the occurrence of plant taxa be based on properly curated specimens is critically important to floristic botany and responsible land management. Initial determinations that a plant occurs at a particular locality are subsequently modified or completely undone on a fairly regular basis, so that it is often necessary to re-examine material on which such reports are based. Reasons for this may be considered under two general categories: those involving mistakes of one kind or another, on one hand, and those due to advances in the science of plant classification, on the other (both types represented in the example in sidebar, p. 28). Under the first category, misidentifications of plant material and mismanagement of information (e.g., pasting the wrong label onto a correctly identified specimen, mistakes in transcribing field notes, computer glitches and other artifactual data) are, unfortunately, difficult to avoid completely, and obviously require re-examination of the plant material involved.

Other reasons for the requirement that plant occurrence data be vouchered by specimens have to do with the fact that botanists are continually asking questions about the plants they study—especially as they pertain to the genetic relationships

DOES *QUERCUS TOUMEYI* OCCUR IN CALIFORNIA? THE VALUE OF VOUCHER SPECIMENS.

In an attempt to identify potential additions to the flora of California, a comparison was made between the list of names accepted for California in *The Jepson Manual* and the list of names in the Index to California Plant Names. After eliminating differences between the lists that represent nothing more than “taxonomic noise” (e.g., a plant listed as a variety in one list, but a subspecies in another), hundreds of potentially more significant discrepancies remained.

One of these is the case of *Quercus toumeyi*. Two specimens of oak in UC/JEPS were entered in SMASCH (one of the sources of names for ICPN) under the name *Quercus toumeyi*, with data indicating they were collected in California. This species occurs only in Arizona, New Mexico, Texas, and Mexico according to the *Flora of North America North of Mexico*, Volume 3 (Nixon & Muller 1997). If the two UC sheets were actually *Q. toumeyi*, they would represent a significant range extension and an addition to California’s flora.

The first sheet bears a label with the header “Plants of California” and the collection location “Santa Rita Mtns.” The Santa Ritas are in Arizona and within the range of *Q. toumeyi* as cited above. Clearly that specimen has a label error and isn’t from California. The second sheet, annotated as *Q. toumeyi* in 1946, is correctly labeled as to the collection location (Descanso, San Diego Co.). However, careful determination of its identity, using keys and descriptions in *The Jepson Manual* (Hickman 1993) and *Flora of North America North of Mexico*, Volume 3 (Nixon & Muller 1997), as well as comparison with other specimens in UC/JEPS, shows that it is actually *Q. cornelius-mulleri*, a California species not recognized and named until 1981. *Quercus toumeyi*, among North American oaks known at the time of the annotation in 1946, was the most similar in appearance to this specimen. Therefore the annotator quite reasonably determined that the material belonged to that species. Without access to the voucher specimens on which these two reports were based, we would remain more unsure about whether or not *Q. toumeyi* is part of California’s flora. With the voucher specimens at hand, we are able to say definitely that these two reports do not document the occurrence of this species in California.

—Jeffrey Greenhouse

and evolutionary histories involved—and are finding new ways to answer them. Consequently, changes in taxonomic circumscription (e.g., deciding that a group of species comprise two genera instead of one, or that populations of a species in part of its range actually represent a second, separate species)

and/or the names by which plants are known occur on a frequent, ongoing basis. Thus, even in cases where plant material has been correctly identified and the pertinent data otherwise has been properly managed, it is sometimes necessary to re-examine the material on which a plant occurrence report is based.

MEKA KEYS TO CALIFORNIA PLANTS

The electronic keys included in the Jepson Online Interchange have been developed using the interactive Multiple-Entry Key Algorithm (MEKA and MEKAEDIT), as developed by Meacham (1994). They are based primarily on treatments in *The Jepson Manual*, but include modifications supported by specimens as well as other published taxonomic treatments. Multiple-entry keys of the kind provided are preferable to dichotomous ones in several (but not necessarily all) ways (Rosatti and Duncan 1995). The most important of these is the fact that they do not require that each of a fixed series of choices be made correctly in order to arrive at an identification; instead of having to make determinations about structures (e.g., flowers, fruits) that are not always present, it is often possible to arrive at a correct answer based on structures that are always or usually present (e.g., stems, leaves).

For example, the structures needed to completely distinguish *Chaenactis santolinoides* (within *Chaenactis*) using MEKA are fewer in number, more easily characterized, and more frequently present than those required in *The Jepson Manual*: in the MEKA key, two character states (longest primary leaf lobes near blade middle; primary lobes of largest leaves gen > 9 pairs) completely distinguish this species (within this genus), whereas in *The Jepson Manual* at least five character states, including technical aspects of the flowers, must be determined. Similarly, *Artemisia tridentata* subsp. *tridentata* may be distinguished by 3 character states with MEKA, but 34 character states must be determined using *The Jepson Manual*.

MEKA keys to most groups within the Asteraceae, from tribes to subspecies and varieties, are presently available. Contingent on additional funding, MEKA keys for the

A NEW ERA OF CALIFORNIA FLORISTICS

The Jepson Herbarium has initiated a major campaign to bring California floristics into a new era. Over the next five years, our goal is to produce a scientifically revised edition of *The Jepson Manual: Higher Plants of California*, one that is both taxonomically current and fully integrated with online resources. The new *Jepson Manual* will be enhanced with electronic resources such as interactive keys, improved distribution maps, phylogenetic interfaces, and searchable character and ecological databases.

Support through donations or volunteer work is welcome and needed. To learn more or to find out how you can be involved, call Staci Markos (510) 643-7008 or visit our web site (<http://ucjeps.berkeley.edu>).

remainder of the flora of California will be developed within the Jepson Flora Project, in collaboration with specialists in the groups involved.

SUMMARY AND CONCLUSIONS

The Jepson Online Interchange is a regularly updated resource in which issues regarding the flora of California and the various steps involved in their resolution are presented and maintained over time. Such activity is archived and made available to anyone with Internet access in order to minimize the extent to which effort is duplicated within the community of people interested in the plant resources of

the state. By consulting the Jepson Online Interchange, users are able to get answers, with supporting documentation, to many of the questions they would otherwise have to research themselves. Specialists contributing to the Jepson Flora Project, including future editions of *The Jepson Manual*, not only provide resolution to issues raised in The Jepson Online Interchange, but make use of such questions and answers themselves in developing and updating their treatments.

ACKNOWLEDGMENTS

The idea of distributing information about the flora of California over computer networks was first envisioned during the SMASCH project (1992–2000), which was conceived by Tom Duncan and funded by the National Science Foundation. Barbara Ertter deserves credit for refining the concept of a floristic “clearinghouse” and for giving it momentum in the years that followed. The Jepson Online Interchange would not have been developed without the generous support of the William R. Hewlett Revocable Trust; Dick Moe is the reason it works, from a technical standpoint; and Jeff Greenhouse and Margriet Wetherwax have been major contributors of information about the plants involved. Also greatly appreciated are the efforts of Bruce Baldwin, Kim Kersh, Staci Markos, Chris Meacham, Brent Mishler, Dan Post, Alan Smith, John Strother, Linda Vorobik, and other students of California floristics too numerous to list.

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WEBSITES

Cal Photos (Digital Library Project, UC Berkeley). <http://elib.cs.berkeley.edu>

Flora of North America (many institutions). <http://flora.hub.harvard.edu>

International Plant Name Index (The Plant Names Project, a consortium of: The Harvard University Herbaria; The Royal Botanic Gardens, Kew; and the Australian National Herbarium). www.ipni.org

Inventory of Rare and Endangered Plants of California (California Native Plant Society). www.northcoast.com/~cnps/

Tropicos (Missouri Botanical Garden). www.mobot.org

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Matilija poppy (*Romneya coulteri*), a colony-forming perennial herb, grows to be up to 2 meters tall and is sometimes called fried egg plant, named for its large flowers with white petals surrounding yolk-colored stamens. Photograph by L. Vorobik.

GROWING NATIVES IN THE GARDEN: *ROMNEYA* AND *DENDROMECON* (PAPAVERACEAE)

by *Nevin Smith*

[Reprinted, with updates, from *Fremontia* 19(4). October 1991.]

California is justly famous for its spring displays of annual poppies, such as *Eschscholzia californica* and its kind, which paint our hills and valleys with gold. Only native plant enthusiasts know it, too, as the home of some of the largest, least typical,

and most beautiful perennials of the poppy family. These “giant poppies” are far from being the easiest of our natives to manage in a typical garden, yet they are treasured by gardeners for their bold displays. Let us have a further look at them.

Romneya coulteri and *R. trichocalyx* share the common name of matilija poppy. Both belong primarily to coastal sage scrub and chap-

arral communities, the first from San Diego to Orange counties, the second from Baja California to Ventura County. Both form large thickets—often many feet across—from odd underground rhizomes, or rootstocks. Each shoot has a woody base, which may branch into a shrub-like scaffold, but its main body is an herbaceous, often well-branched stem usually four to eight feet tall.

Loosely set along the stems are blue-to gray-green leaves up to eight inches long, usually divided into three to five flat, conspicuously toothed leaflets. Specialized flowering stalks are borne at and near the shoot tips, each stalk bearing a single fat bud which opens into a snow-white, broad-petalled blossom, up to eight inches across. The petals open widely, exposing a central globe of golden stamens. Each petal is intricately crinkled, much like crepe paper. The total impression is breathtaking, even for people with little interest in plants or gardening. This pageant begins in early summer and goes on for many weeks, especially if the plants get an occasional, deep irrigation. Even the broadly urn-shaped seed capsules are decorative in dried arrangements.

Dendromecon rigida, bush or tree poppy, is another chaparral dweller, preferring dry, exposed sites and distributed from Sonoma County south to Baja California. It is a true shrub, up to ten feet or so tall (rarely fifteen feet or more), round to spreading in form and often closely branched. The slender twigs are clad in pale tan to grayish bark. Adorning them are stiff, pale green to gray-green, usually narrow leaves. It blooms much of the spring and summer (or most of the year in cultivation), at times lighting up whole hillsides with masses of bright yellow, broad-petalled blossoms. Individual blossoms are generally around two inches across and presented on individual stalks. The two- to four-inch pods which follow are narrowly cylindrical, with tapered ends, and rupture explosively when ripe.

Dendromecon harfordii, which has also been listed at times as *D. rigida* ssp. *harfordii*, is a similar shrub found on Santa Cruz and Santa Rosa islands, growing in more or less open chaparral. It differs from *D. rigida* in its broader, blunt-tipped, often dark green leaves and larger flowers. It also appears to

have a longer blooming season, though this could be due as much to a less stressful environment as to genetics. In any case, this species accounts for nearly all of the plants available commercially.

USES AND CULTURE

Like all too many of our showier natives, these are dubious candidates for the “postage stamp” garden. Once established, a matilija poppy will easily gallop over 20 feet of open ground and overpower any smaller plant in its path. Shoots of my own home plant are now bursting through the asphalt of an adjacent road. However, this same feature makes them valuable for covering large banks and untended lots. A sizeable colony in bloom is one of the world’s great floral spectacles, and even occasional trimming will produce an attractive show of foliage most of the year.

In the case of the bush poppies, we are concerned not with invasive potential but with the simple dimensions of the shrub. Some forms of *Dendromecon rigida* are relatively restrained, but a healthy plant of *D. harfordii* will easily spread eight to fifteen feet. Only in large country or commercial landscapes, where they can be grouped with the likes of large manzanitas, blueblossoms, and flannel bushes (*Fremontodendron*), can either of these giant poppies be said to blend with other shrubs in the landscape. In smaller plots, they are guaranteed to be the dominant feature and, if unrestrained, ultimately the *only* feature.

All this said, many gardeners find these plants irresistible regardless of limited space and restrain them through digging, in the case of *Romneya*, or frequent pruning, in the case of *Dendromecon*. The first technique is reasonably easy (*Romneya* should even be cut to the ground every couple of years, just to keep it lush and remove dead

stems). However, pruning of any *Dendromecon* should be limited to tip-pinching of the younger shoots and thinning of the old, or something resembling a pile of sticks will result.

Cultural tolerances are another matter. Both *Romneya* and *Dendromecon* are dryland plants, adapted to rocky or sandy soils. In cultivation their drought tolerance is guaranteed, as is heat tolerance for all save the island bush poppy. Once established, *Romneya* thrives in a wide assortment of soils, with a variety of watering regimes; irrigation simply encourages faster spread. Oddly enough, younger plants (which in most species are the more adaptable) are often lost to fungous rots before they can form their more durable structures, accounting for their reputation as “temperamental.” *Dendromecon* is more susceptible to these same organisms at any stage, especially with summer irrigation. Unfortunately, some such irrigation is unavoidable in establishing plants during their first year in the ground. However, *D. harfordii* is decidedly more adaptable than mainland, and especially interior, forms of *D. rigida*.

In other respects, both groups are quite easy to grow. There is no point pampering them with fertilizers, for they thrive in very lean soils. All are only slightly troubled by insects and animal pests, though spider mites are occasionally a cosmetic problem, discoloring the foliage.

PROPAGATION

Both matilija and bush poppies are challenging subjects to propagate, though both yield abundant material for us to try. Both are usually raised from seeds. Seed capsules of the matilijas are held upright and open at their summit.

Hundreds of tiny black seeds—about the size of coarse grains of



Tree poppy (*Dendromecon rigida*), a showy shrub for dry-land gardens, grows to be 1-2 meters tall. Photograph by L. Vorobik.

sand—are easily poured from each capsule when it dries. Pods of the bush poppies fling their shot-like seeds for several feet in all directions; your best chance of success will be with pods yellow to tan in color but not yet dried, plucked whole and put in closed paper bags. In both cases the seeds have a hard, dense coat which requires physical or chemical damage to permit absorption of water. This is accomplished by fire in the wild, and a traditional technique for gardeners and nurserymen has been to scatter seeds on the surface of flats or pots of planting soil, pile hay or pine needles over them, and light it. Both seeds and ashes are then covered with a little more planting mix and kept moist until sprouted. Of course, it is difficult to do just the right amount of damage to most of the seeds, so it pays to start with generous quantities. A somewhat more controllable but erratically successful technique (I have never figured

out why) involves soaking the seeds in drugstore-strength hydrogen peroxide for up to one hour, then rinsing and planting them in the normal manner; in the case of *Dendromecon*, agitating the seeds first in a bath of white (*never*-leaded) gasoline will help dissolve a dense wax covering the seed coat itself. A long, cool period, easily provided by fall planting, seems to boost germination.

Once the seedlings are large enough to pot, there comes the hurdle of transplanting. They should be teased apart with care not to break their delicate roots, potted with plenty of soil intact, and put in a cool, shady place to recover from the ordeal. The consequence of broken roots is nearly instant wilting and heavy losses.

A particularly successful method for the matilijas is division. One simply attacks an established colony after the weather cools in fall, digging up shoots with lengths of healthy

rhizome attached and replanting them in the ground or in containers. Broken sections of rhizome with incipient vegetative buds, planted shallowly in either soil or a commercial potting medium, often generate new plants; however, they require some faith and patience on the gardener's part, as new shoots may not appear until mid to late spring.

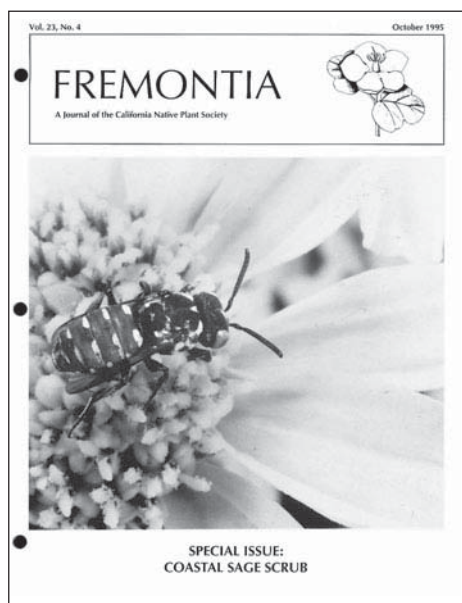
If you have a flair for experimentation, you might try stem cuttings, using shoots which have just completed a wave of growth and begun to "firm up." Each cutting should have three or four leaves intact and a couple of leafless nodes at the base. If kept moist in a shady, protected spot, some of these just may root and provide duplicates of superior parent plants. We nursery folk have found the results tantalizing but woefully erratic.

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FROM THE ARCHIVES: INSECTS AND PLANTS

If you enjoyed the recent issue on insects and plants (*Fremontia* Volume 30, Numbers 3 and 4, July and October 2002, with Convening Editor Gordon Frankie), there are many other *Fremontia* articles that deserve reading or re-reading. Several of these articles are listed here.

Butterflies of Northern California Serpentine, by S. Harrison (then graduate student of the Biology Department, Stanford University) and A.M. Shapiro (then professor of Zoology at UC Davis, and noted authority on California butterflies).



The cuckoo bee (*Holcopasites ruthae*) on the cover of *Fremontia* Volume 23, No. 4, the October 1995 special issue on coastal sage scrub.

Fremontia 15(4):17–20. January 1980. Learn that some of California's insects are endemic to ultramafic soils (serpentine), as are their plant hosts.

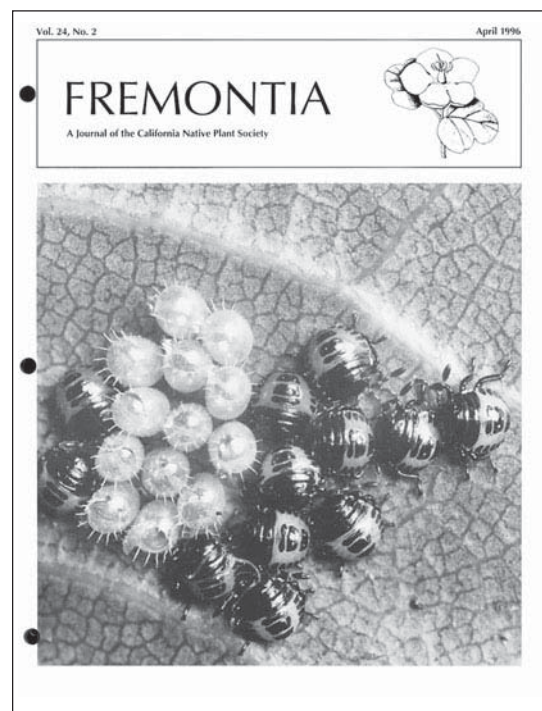
Oakworms and What to Do About Them, by C.S. Koehler (then entomologist with the Cooperative Extension, UC Berkeley). *Fremontia*

10(2):21–23. July 1982. A discussion of the California native moth, its larvae (oakworms), and their association with our native coastal oaks.

Native Bee Pollinators of Vernal Pool Plants, by R.W. Thorp (author of article in Volume 30, Numbers 3 and 4, mentioned above, and then emeritus professor of Entomology at UC Davis) and J.M. Leong (then post-doctoral student in Dr. Thorp's lab). *Fremontia* 23(2):3–7. April 1995. As there are endemic insects to serpentine regions and the plants they harbor, so are there endemic insect pollinators to vernal pool plants.

What's Bugging Coastal Sage Scrub, by G.R. Ballmer (then professor in the Department of Entomology at UC Riverside). *Fremontia* 23(4):17–26. October 1995. The article covers biodiversity, pollinators, carnivores, recyclers, and ends with comments on the vulnerability of the coastal sage scrub habitat. The article may inspire you to read this entire special issue on coastal sage scrub.

Insect/Plant Relationships: A Photographic Essay, by E.S. Ross (then curator emeritus in the Department of Entomology at the California Academy of Sciences, Golden Gate Park). *Fremontia* 24(2):3–22. April 1996. A beautiful series of illustra-



Eggs of spined predacious stink bug (*Podisus maculiventris*) on the cover of *Fremontia* Volume 24, No. 2, the April 1996 issue.

tions and comments including sections on foliage eaters, flower eaters, sap tappers, gall makers, beetles and flowers, legume tripping, bees and flowers, nectar seekers, nectar thieves, predation in flowers, predator avoidance in flowers, mating in flowers, insect mimicry, and events in a flower of bush monkeyflower (*Mimulus auranticus*).

COMPLETE YOUR SET

Back issues of *Fremontia* are available for sale from the CNPS Office, 2707 K Street, Suite 1, Sacramento, CA 95816; phone (916) 447-2677. Issues for Volume 28 and later (2000-present): \$5 each or \$10 for three. Issues before Volume 28: \$2.50 each or \$6 for three. Double issues priced as two single issues; shipping costs determined upon order placement.

NOTES AND COMMENTS

IN MEMORIAM: WAYNE RODERICK

Bulb specialist, CNPS Fellow, and *wonderful person* Wayne Roderick passed away on Sunday, August 10th, after two strokes within one month. CNPS expresses sympathy to his loved ones, and will honor Wayne with a tribute in *Fremontia* Volume 31, No. 4 (the October 2003 issue).

LEARN MORE ABOUT WEEDS

Websites with information on weeds and how they affect us are listed below:

Information on wildland weeds in California can be found at www.caleppc.org, including a definitive list of invasive plants, annual Symposia proceedings, and detailed species accounts from the book *Invasive Plants of California's Wildlands*.

The website of The Nature Con-

servancy's Wildland Invasive Species Team, <http://tncweeds.ucdavis.edu>, has a wealth of information on invasive plant biology and control.

The California website of the National Biological Information Infrastructure, <http://cain.nbii.gov>, has a good section on invasive species, including interactive GIS maps.

A gateway to information on all federal efforts regarding invasive species is www.invasivespecies.gov.

USDA Federal Noxious Weed Program website, www.apbis.usda.gov/ppq/weeds/, includes the Federal Noxious Weeds List, Action Plans, Fact Sheets, Weed Alerts, and other information, including links to an Invasive Weeds page, and to the Weed Science Society of America website.

The USDA Invaders Database System can be found at http://invader.dbs.umt.edu/Noxious_Weeds/, and provides a searchable database of the noxious weed lists for all the United States and for six southern provinces of Canada. The database can be searched by plant name, state name, or by clicking on a map.

The Bureau of Land Management hosts a site at www.blm.gov/education/weed/weed.html entitled, "What's Wrong with This Picture; Invasive Weeds: A Growing Pain." This site includes information on weeds and their impacts. The page, "Native or non-native?" outlines a series of activities useful for elementary school teachers wishing to educate their students about native versus non-native plants.

The University of California hosts a California Weeds and Restoration site at <http://groups.ucanr.org/calnatives/>, which is a new website that will feature different projects related to restoring California native plants to combat weeds.

Another starting point for learning more about weeds in your area is UC Davis's Agriculture and Natural Resources Department site called CommServe, found at <http://commserv.ucdavis.edu/>. This site can be used to find your local extension agency, Master Gardener's program, and links to sites of other related programs.

BOOKS RECEIVED

Native Plants for High-Elevation Western Gardens, by J. Busco and N.R. Morin. 2003. Fulcrum Publishing in partnership with the Arboretum at Flagstaff, Golden, CO. 352 pp., 250 color photographs. This book treats 150 plants with one or two photographs, written description, range, season of bloom, outstanding features, culture, landscape uses, wildlife attraction features, and historical and modern uses. Price \$29.95, paper.

California Natural History Guides. UC Press, Berkeley, has been revising their popular series of books on various aspects of the natural history of California, with new photographs, and revision of text. Congratulations to past *Fremontia* Editor, Phyllis M. Faber, who has been integral to the completion of this

project. The size for all is a handy 4.5 by 7.25 inches. The series includes:

Introduction to California Plant Life, by R. Ornduff, P.M. Faber, and T. Keeler-Wolf. Revised edition, 2003. UC Press, Berkeley. 176 pp., 156 color illustrations, 7 line illustrations, 4 maps, and 8 tables. Price \$29.95, cloth; \$16.95, paper.

Introduction to Trees of San Francisco Bay Region, by G. Keator. Revised Edition, 2003. UC Press, Berkeley. 264 pp., 250 photographs, 1 map. Price \$29.95, cloth; \$14.95, paper.

Introduction to California Mountain Wildflowers, by P.A. Munz. Edited by D. Lake and P.M. Faber. New introduction by R. Ornduff. Revised edition, 2003. UC Press, Berkeley. 154 pp., 187 color

photographs, 2 maps. Price \$39.95, cloth; \$16.95, paper.

Introduction to Shore Wildflowers of California, Oregon, and Washington, by P.A. Munz. Edited by D. Lake and P.M. Faber. New introduction by R. Ornduff. Revised edition, 2003. UC Press, Berkeley. 256 pp., 181 color photographs, 180 line illustrations, 2 maps. Price \$39.95, cloth; \$16.95, paper.

Pests of the Native California Conifers, by D.L. Wood, T.W. Koerber, R.F. Scharpf, and A.J. Storer. 2003. UC Press, Berkeley. 304 pp., 211 color photographs. D.L. Wood and A.J. Storer contributed an article to the special issue of *Fremontia* (Volume 30, No. 3 and 4) on plants and insects. Price \$48.95, cloth; \$19.95, paper.

BOOK REVIEW

The Sunflower Forest: Ecological Restoration and the New Communion with Nature, by William R. Jordan III. 2003. University of California Press, Berkeley, CA. 264 pages. Price: \$27.50, cloth.

Ecological restoration is a concept of land management that is fast becoming a recognized profession. It also figures prominently nowadays in discussions about various approaches to landscape protection and preservation.

Author William R. Jordan III, who coined the term "restoration ecology," has been in the forefront of this discussion for over 25 years. Jordan is the founding editor of the journal, *Ecological Restoration*, founding member of the Society for Ecological Restoration, and currently directs the New Academy for Nature and Culture.

In his book, Jordan presents his thoughts on the emerging role of restoration as a legitimate land management practice. This is clearly not a "how-to" book, but one that looks deeply into the philosophy behind humankind's relationship with the environment. As Jordan explains, "The aim of the restorationist is to erase the mark of his own kind from the landscape. Yet through the process of restoration he enters into a peculiarly profound and intimate relationship with it."

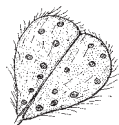
The key to understanding this book is in its subtitle: *Ecological Restoration and the New Communion with Nature*. This engaging concept provides some indication of the profound scope of its contents. Jordan states that "Only since the mid or late 1980s have environmentalists and conservation practitioners begun to take restoration seriously as a conservation strategy." He goes on to argue that "... restoration properly understood turns out to be the key to survival [or preservation] of all natural landscapes, not just those that have obviously been degraded or abused."

As you can imagine, this is not light reading, but a book that requires study and contemplation. In fact, there is not a single picture, map, or chart in its entire 264 pages. It is also heavily foot-

noted, drawing not only from technical references but also from sources that might be read in classes on philosophy, literature, ethics, anthropology, and the like. It offers readers a way past a sentimental approach toward nature by exploring the spiritual benefits of participating in the process of ecological restoration.

There is a possibility that years from now people will talk about this book as they still do about Aldo Leopold's *A Sand County Almanac*. There is a certain irony in this because Jordan's insight and understanding grew and developed while he worked for the University of Wisconsin Arboretum—the very place where, in the 1930s, Leopold and others pioneered systematic efforts to recreate several "historic" ecological communities.

Jordan spent 22 years guiding the



Arboretum's public outreach and was caught up in the question of what does, and does not, constitute successful restoration. While there he also noticed that only a handful of people had any interest in the Arboretum's restoration activities. "Environmentalists almost universally ignored it, seeing it at best as a distraction from the serious work of preservation, and at worst as a threat"—a false promise that could be used to undermine arguments for preservation." So the scene was set and an advocate emerged.

I agree with reviewer Ernest Callenbach's statement that this book "... proposes nothing less than to change the focus of [the environmental movement] from 'defense' to 'offense'." This is not to imply that this is a strident book, but it gives us new insights that should be in the forefront of the thinking of legislators, policymakers, practitioners, and those who care about the environment.

Norden H. (Dan) Cheatham
Santa Cruz County Chapter

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FROM THE EDITOR

Native plants versus weeds, sub-alpine trees marching into Klamath Mountain meadows, the North Coast Chapter of the California Native Plant Society (CNPS), an electronic interchange for taxonomic information on plants of the state: this is an eclectic issue of *Fremontia*! How can I, as editor, guide you through these articles?

The issue begins with an article by the late Marjorie Schmidt which looks through the eyes of Jepson, Muir, and others, to see a California that we-the-living only glimpse as shadows of the past, in areas where natural commu-

nities have been protected or otherwise survive the impacts of humans.

This article (reprinted with permission from *Pacific Horticulture*) was requested by Jacob Sigg as an “absolutely essential” lead-in and contrast to his article on weeds and their impact on native plants, an impact which can be slow, but in the end is far from subtle.

Michael Murray writes of another change in vegetation: montane meadow loss due to encroaching trees and shrubs, and not exotic species. Murray’s study sites are within the region embraced by the North Coast Chapter of CNPS, and the article which follows

that of Murray tells about this chapter, their people, and events.

Possibly one of the more challenging articles in this issue is Tom Rosatti’s thorough description of the Jepson Interchange, an online site where anyone with Internet access can either submit or obtain the most recent information about the plants of California.

The last article, Nevin Smith’s contribution on growing our largest native poppies, is full of valuable ideas about how to incorporate these gorgeous plants into your garden.

Linda Ann Vorobik, Editor

CONTRIBUTORS

Jeffrey Greenhouse, retired systems programmer, is now project research specialist for the Jepson Online Interchange at University and Jepson Herbaria, UC, Berkeley.

Jacob Sigg, past president of the California Native Plant Society (CNPS), is currently chair of the CNPS Invasive Exotics Committee and conservation chair of the CNPS Yerba Buena Chapter.

Liz McGee is membership chair of the North Coast Chapter of CNPS.

Michael P. Murray, PhD, is terrestrial ecologist at Crater Lake National Park in Oregon.

Thomas J. Rosatti, PhD, is one of six editors of the Jepson Flora Project, scientific editor of the Jepson Online Interchange, and editor of the Index to California Plant Names. He works at the Jepson and University Herbaria, University of California, Berkeley.

Marjorie Schmidt (1905-1989), author of *Growing California Native Plants*, was a frequent contributor of *Fremontia* horticultural articles.

Nevin Smith, member of the *Fremontia* Editorial Board, has contributed to *Fremontia* many articles about growing California native plants, and is working on a book covering the same topic.

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