



California's High Mountain Fastnesses: The Alpine Zone *by Glenn Keator, PhD*



White heather (*Cassiope mertensiana*) growing with pink mountain heather (*Phyllodoce empetriformis*) on Kangaroo Mountain in the Siskiyou Mountains
Inset: pink mountain heather

Inset photo by Patrick Alexander

When lungs are strained by climbing high into the mountains, you pass from a wind-pruned subalpine forest to timberline, and higher yet into a vast rock “desert” called the alpine zone. Ecologists often refer to this rocky expanse as alpine fellfield or tundra, although not all vegetation above timberline is on rock scree (there are also meadows), nor is the ground permanently frozen underneath as it is in the true tundra of the Arctic region.

The word alpine originated from the Alps mountains in France, Switzerland, and Austria, where jagged mountains scrape the sky and hold melting snowfields that yield meadows with kaleidoscopes of colorful summer wildflowers. We celebrate the Alps by applying the name to mountains close to home, perhaps in the wish to evoke those stirring scenes. Our own mountains, mostly above 9,000 to 11,000 feet (higher in the south than the north), elicit these same reactions—a sense of

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Deadline for submission of announcements and editorial material for the winter issue is October 1, 2014.

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unblemished beauty unmarred by the inroads of civilization and with little evidence of the disturbance we so often encounter at lower elevations.

To complicate matters, many representatives of this otherworldly environment are not completely confined here; rather, shallow rocky soils on steep openings between mountain forests display similar conditions and are often home to plants typically deemed alpine. Several examples in this article fall into this category.

That loose boundary known as timberline is the demarcation between true alpine and everything below, and although there is no doubt about where tree growth ceases completely, the junction is not always well defined. For example, whitebark pine (*Pinus albicaulis*) grows upright below timberline but struggles mightily against the elements near its upper reaches, assuming tortured forms known as krummholz (low, wind- and snow-pruned shrubs) or sending out skirts at the base of trunks as a backup when those trunks are killed by the elements. Timberline also varies according to slope faces: higher on south-facing slopes, lower on north-facing ones. A combination of severe winds, mighty ice blasting in winter, and indefinite and challenging short growing seasons determine the exact elevation for timberline.

California's alpine regions, rather than being continuous over long distances, are instead broken into myriad islands, sometimes isolated by miles of intervening lower-elevation mountains, which helps promote species diversity. Unexpectedly, the largest contiguous alpine region in the state is the White Mountains east of Bishop, where the above-timberline region continues unbroken for several miles.

California's distribution of alpine habitats has interesting consequences for its flora. Whereas the Rocky Mountains in North America and the Alps in Europe are closely connected to mountains that veer into the arctic regions—forming a continuous habitat for plant migration—California's high mountains are not closely joined to a north-south mountain chain, so many arctic plants have failed to migrate south our way. By contrast most alpine plants from those other regions come from or are closely related to the true tundra of the arctic, giving rise to a suite of species that encircles the northern latitudes.

California's alpins (with some exceptions) have evolved from local sources to fill this ecological gap. Genera like *Phacelia*, *Eriogonum*, *Hulsea*, *Aquilegia*, *Penstemon*, *Chaenactis*, *Phlox*, *Linanthus*, *Polemonium*, *Sedum*, *Lupinus*, and many more have contributed to our alpine flora, giving us unique species not found in

many other places. As well, plants like fireweed (*Chamerion angustifolium*, formerly *Epilobium angustifolium*), arctic willow (*Salix petrophila*, formerly *Salix arctica*), and western anemone (*Anemone occidentalis*) have found a home here from farther away because of the efficient wind dispersal of their hairy seeds and fruits. (Some of these are indeed found across northern latitudes.)

What are the conditions alpine plants have to contend with? Only some of the most hostile conditions imaginable: challengingly short growing seasons often no more than six weeks long in conjunction with many nights below freezing, strong ultraviolet radiation from a thin atmosphere, heavy winter snows, strong winds any time of the year, and relatively low daytime temperatures. Thus alpine plants exhibit a panoply of fascinating adaptations, wresting a living from a potentially deadly environment.

For starters, alpine plants are typically long-lived perennials; annuals could easily perish in years when the growing season is so short that flowers are not pollinated and seed not set. To deal with extremely low winter temperatures and heavy blankets of snow, alpins grow low to the ground with flexible branches; densely matted leaves; and main stems, roots, and growing tips safely buried underground, where soils remain moist and temperatures warmer. Later in the year as temperatures climb, those growing tips rapidly expand, producing an abundance of new leaves and flowers as long as conditions permit before retreating into dormancy again.

To adapt to ultraviolet radiation—the cause of harmful mutations—leaves of alpine plants are typically covered with a dense jacket of interlaced, woolly hairs that reflect away excessive light, intervene between the chlorophyll-containing leaves and the air, and provide dead air spaces in winter as

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Rosy buckwheat (*Eriogonum rosense*) in the High Sierra



Sierra columbine (*Aquilegia pubescens*)

insulation. Or the leaves may be covered with a thick waxy cuticle that seals in leaf moisture and reflects strong light from the violet end of the spectrum.

Alpine plants bury vulnerable parts beneath the soil to remain warm in winter, and the cells in their leaves and stems often contain a high solute concentration: Dissolved sugars and other substances lower the freezing point like antifreeze does in car radiators.

Many alpiners hedge their bets for reproducing and increasing their success not only by making seed but by co-opting more territory through vegetative means: stems rooting as they travel along the soil's surface, or underground stolons and rhizomes spreading to carpet large areas from a single pioneer plant.

Alpine plants produce unusually large, brightly colored flowers that rise above leaf mats in order to make the most effective use of "advertising" time to pollinators. Because of their saturated colors and alluring blossoms, alpiners make prime choices for gardeners lucky enough to have the right conditions to successfully grow them.

Sadly for those of us who wish we could bring a bit of the mountains back home after our alpine journeys by attempting to grow the plants in our gardens, few truly thrive. While many survive for a time with tender loving care, they gradually wane away after a few years' struggle. Better to leave these beauties where they are happy.

Nonetheless, trials show that some plants do adapt, even thrive, giving daring gardeners a reason

to rejoice, even though few are readily available in the trade. At the Regional Parks Botanic Garden, our granite mound is a testing place for the alpiners, although we still have a long way to go to try them all. So far the greatest successes include several species of wild buckwheat, particularly Wright's buckwheat (*Eriogonum wrightii*), purple false horkelia (*Horkeliella purpurascens*), some potentillas or cinquefoils, including shrub cinquefoil (*Dasiphora fruticosa*, formerly *Potentilla fruticosa*), rose spiraea (*Spiraea splendens*), rock spiraea (*Petrophytum caespitosum*), Sierra columbine (*Aquilegia pubescens*), and an assortment of rock ferns. For those plants that languish, the most important reason seems to be the lack of winter dormancy, which requires chilling weather and a lack of water (water in the alpine region is tied up as snow). Because the Brits are such fanatic gardeners—going to any lengths to grow plants—some have actually installed refrigerating coils in plant beds to chill the roots, but few of us are willing to make such an exaggerated effort.

PLACES TO GO TO SEE THE ALPINES

I chose these areas as representative examples of high-elevation landscapes to display a wide range of alpine and subalpine plants. If you're hoping to see wildflowers, keep in mind that peak bloom times can vary significantly from year to year, so it's always a good idea to check with the local ranger station when planning your visit.

CARSON PASS-WINNEMUCCA LAKE

For a minimum of physical effort, I recommend hiking from Carson Pass (Hwy 88) to Winnemucca



Leichtlin's mariposa lily (*Calochortus leichtlinii*)

Lake, a rambling walk from the summit of the pass through a subalpine forest of mixed conifers, later weaving in and out of meadows, rock scree, and clumps of wind-tortured whitebark pines. The highlight of the one-and-a-half-mile hike is the “hanging meadows” display, a kaleidoscope of colorful wildflowers from steep rocky skirts to snow-melt streamlets. At peak bloom—usually in mid-July—the vivid pink and red spires of meadow paintbrush (*Castilleja miniata*) vie with the tall spikes of blue tower larkspur (*Delphinium glaucum*) and bog lupine (*Lupinus polyphyllus*), and the meadows are embroidered with short-growing red columbine (*Aquilegia formosa*), the blue flags of mountain iris (*Iris missouriensis*), the blue bells of streamside bluebell (*Mertensia ciliata*), and the creamy, roselike flowers of sticky cinquefoil (*Drymocallis glandulosa*, formerly *Potentilla glandulosa*). In particularly wet spots, look for the curious pink-purple flowers of elephant snouts (*Pedicularis groenlandica*), with its whimsical elephant trunk-like upper lip.

The drier moraines surrounding Winnemucca Lake feature thousands of mountain mule’s ears (*Wyethia mollis*), with furry gray leaves and large yellow sunflowers, mingled with the similar-looking mountain balsamroot (*Balsamorhiza deltoidea*) and the bushy, pale blue sicklekeel lupine (*Lupinus albicaulis*). The display is punctuated with the hummingbird favorite, scarlet gilia (*Ipomopsis aggregata*); the woolly-leaved clumps of sulfur buckwheat (*Eriogonum umbellatum*), featuring umbels of bright yellow flowers; and the white chalices of Leichlin’s mariposa lily (*Calochortus leichlinii*), with a smoky gray exterior and yellow and black markings inside.

If your energy holds out, cross the log over the outlet stream to a sloping wet meadow at the base of a steep scree slope that pushes its way skyward above timberline. Along with masses of the pale creamy flowers of marsh marigold (*Caltha leptosepala*) and pink-purple alpine shooting stars (*Primula tetrandra*, formerly *Dodecatheon alpinum*), you’ll see a trio of heather relatives that climb over granite rocks near snow melt: red heather (*Phyllodoce breweri*), with needlelike leaves and magenta saucers; white heather (*Cassiope mertensiana*), forming cushiony mounds with noddling, white, bell-shaped flowers trimmed with pink sepals; and bog laurel (*Kalmia polifolia*), sprawling its woody branches close to the soil and raising shallow cup-shaped rose-purple blossoms rimmed with puckered glands. You’ll also find fanleaf cinquefoil (*Potentilla gracilis* var. *flabelliformis*), with golden yellow blossoms; more elephant snouts;

and the surprise of the dwarfed alpine willow (*Salix petrophila*), whose creeping, woody stems hug rocks and carry short upright catkins of petalless male or female flowers. As the climb steepens, the melting snow trickles underneath jagged rocks, irrigating the soils beneath and providing the ideal home for the spreading woody mats of Sierra primrose (*Primula suffrutescens*), with its golden-eyed magenta flowers; alpine buttercup (*Ranunculus eschscholtzii*), with oversized pale saucers; and the tuberous western roseroot (*Rhodiola integrifolia*), a sedum relative with fleshy leaves and flat-topped clusters of starry, dark red flowers.

ELLERY LAKE

For even easier access to alpine country, stop at Ellery Lake just a few miles east of the Yosemite National Park boundary on Hwy 120. Depending on snow pack from the preceding winter, peak bloom time here can vary from July to mid- or late August. Immediately across the dam, a raised rock outcrop on the left is home to several low-growing cushion plants including rosy buckwheat (*Eriogonum rosense*), with balls of clear yellow flowers, and King’s sandwort (*Eremogone kingii*, formerly *Arenaria kingii*), featuring open clusters of tiny white flowers.

Rounding the corner on an abandoned road through a willow thicket, steep slopes are strewn with granite rocks studded with shrub cinquefoil (*Dasiphora fruticosa*), sporting pinnately cut leaves and masses of bright yellow single-rose-like flowers (this species is widely available in nurseries). Draping over rock outcrops is the beautiful, seldom grown mat juniper (*Juniperus communis* varieties), with its dense, needlelike, silvery leaves. Where snow melt waters trickle, rock pockets are home to spectacular clumps of Sierra columbine (*Aquilegia pubescens*), an 18-inch-tall plant with horizontally held white to pale yellow flowers visited by hawk-moths. Because the red columbine grows nearby,



Alpine fellfields near Ellery Lake

Pussy paws (*Calyptidium umbellatum*)

hybrids display a series of beautiful intermediate colors in their rose-, purple-, or pink-tinted blossoms.

Beyond these columbine gardens, the moist edges of the road, often under white-bark pines, shelter red heather and white heather. The drier areas are given over to the creeping alpine penstemon (*Penstemon davidsonii*), with oversize purple flowers. In this habitat, alpine penstemon accompanies its slightly taller, bushier sister, mountain pride (*P. newberryi*)—a beautiful rose-red-flowered gem—and the two produce progeny of intermediate stature and flower color, leading to a host of flowers with lovely shades of purple. As the landscape opens out, look for the mounded rosettes of hair-

covered leaves and startling golden yellow daisies of alpine gold (*Hulsea algida*). This is the most accessible stand of this mountain pioneer, which usually requires a stiff hike at very high elevations.

SOUTH AND LONG LAKES NEAR BISHOP

A beautiful hike on the Bishop Pass Trail west of Bishop (take Hwy 168 west to its terminus at South Lake) is a steep uphill, two-mile slog from road's end to Long Lake for breathtaking scenery and the entrance to alpine country.

Where the trail trends uphill in open lodgepole pine forest, alpine columbine hybridizes with red columbine. As the trail turns and gently ambles through dry conifer forest to a junction overlooked by a whitebark pine that seems to be perched on a granite boulder, turn left and continue through gently undulating terrain and more dry forest with views of meadows below. Soon the real alpine drama unfolds as the trail follows a series of short, steep switchbacks among gigantic rocks. Look for the kidney-shaped leaves of mountain sorrel (*Oxyria digyna*), a circumpolar species with tiny red flowers; the trailing stems of the rare shrub rosy-petalled cliffbush (*Jamesia americana* var. *rosea*), with currant-shaped leaves and clusters of pale pink flowers; mountain pride penstemon,

which for the observant hiker occasionally bears snowy white flowers in place of the usual red ones; clumps of western roseroot; and in shaded corners, red heather, or in wet areas where snowmelt is long retained, the colonizing shrubby Labrador tea (*Rhododendron columbianum*, formerly *Ledum glandulosum*), with fragrant leaves and clusters of small creamy flowers.

At the top of the last rise, the landscape opens out onto a pond and wet meadow studded with the clear blue flowers of Sierra gentian (*Gentianopsis holopetala*), and later in the season, alpine gentian (*Gentiana newberryi*), with flared cup-shaped pale flowers dotted inside with green spots. Companions include elephant snouts, the magenta paintbrush (*Castilleja lemmonii*), and various cinquefoils. A short descent then brings you to Long Lake, well named for its long, narrow waters that undulate between steep granite ridges. The trail along the lake interweaves meadows and rocky outcrops, both home to many beautiful summer wildflowers usually at their peak in mid to late July, such as shooting stars, cinquefoils, larkspurs (*Delphinium* spp.), and the tall stalks with yellow daisies of owl's claws (*Hymenoxys*

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Rockfringe (*Epilobium obcordatum*)

hoopesii). The crevice-loving rock plants include pink alumroot (*Heuchera rubescens*), with its delicate panicles of tiny pink-tinted bells; more alpine columbine; Nuttall's linanthus (*Leptosiphon nuttallii*), a cushion former with snowy white phloxlike flowers that is often confused with its sister, the granite prickly phlox (*Linanthus pungens*), whose spine-tipped leaves easily distinguish it; and late in the season, the gorgeous rockfringe (*Epilobium obcordatum*), girdling granite with blue-green leaves and oversized rose-purple flowers with inverted heart-shaped petals.

At the far end of the lake, decide whether you have the energy to continue upwards through a series of additional alpine lakes and tarns. The higher elevations bring gems like alpine penstemon, Sierra primrose, dwarf sagebrush (*Artemisia arbuscula*), more rockfringe, and the densely cushioned clumps of cushion buckwheat (*Eriogonum ovalifolium*), whose short-stemmed heads feature flowers that open white and fade to rose pink.

For the intrepid hiker, the trail culminates in zig-zagging switchbacks up dark metamorphic rocks to Bishop Pass and sweeping views of the surrounding countryside, revealing the route you've followed and the amazing ascent you've conquered.

MOUNT SHASTA

Because timberline comes lower farther north, alpine zones can be enjoyed on Mount Shasta merely by driving to the end of the Everett Memorial Highway at a large parking lot. A meander across granite rocks brings you into a true alpine landscape with clusters of whitebark pine and mountain hemlock hunkered together in more protected spots. The plants here include species encountered elsewhere, such as the sprawling cushions of needle-leaved spreading phlox (*Phlox diffusa*) smothered in season with fragrant pink, pale purple, or white flowers. But the two special plants are the Shasta buckwheat (*Eriogonum pyrolifolium*), with its rounded green leaves (shaped like those of the wintergreen genus, *Pyrola*) plastered against the rocks and naked stems rising a few inches to display pink-in-bud white flowers; and the dramatic western anemone or pasque flower (*Anemone occidentalis*), sporting basal rosettes of feathery, fernlike leaves atop a woody taproot and stems carrying single large white flowers followed by heads of plumed seed pods, their styles covered with silky white hairs for wind dispersal.

A trail leads downhill through copses of conifers, which are home to the diminutive longhorn steer's head (*Dicentra uniflora*), an inches-high bleeding heart relative with pale pink flowers whose two outer pet-

als turn up like a steer's horns. Panther Meadows below is crisscrossed with streamlets and highlights alpine meadow wildflowers including bog laurel, whorled penstemon, and the northern version of red heather (*Phyllodoce empetiformis*, pink mountain heather), which differs from its Sierran brother by having narrower bell-shaped flowers.

On the way back down the highway, plunging rock scree slopes on your left feature two more special alpine: Rothrock's fiddleleaf (*Nama rothrockii*), a colonizing shrublet burying hundreds of woody stems beneath loose surface rocks and covered with narrow wrinkled leaves and clusters of glowing blue-purple bell-shaped flowers, and satin lupine (*Lupinus obtusilobus*), with creeping stems, silver-haired palmately compound leaves, and short spikes of intensely blue-purple flowers. Peak bloom time here varies quite a bit from year to year and can range from mid-July to early August.

MOUNT EDDY

Mount Eddy is the high point of the northwestern Klamath Mountains at just over 9,000 feet elevation, a sugarloaf-shaped mountain west of Mount Shasta and the town of Weed. In this area the best wildflower bloom varies from early to mid July.

From I-5, the exit just north of Weed leads to Stewart Springs Road and up to a shoulder on Mount Eddy, where the nine-and-a-half-mile round-trip hike to the summit begins. Much of the hike passes through dry conifer forest, hanging meadows, and bogs, offering wonderful displays of high-elevation wildflowers, many of which are also found in the Sierra. Outstanding here is the curious, carnivorous cobra plant (*Darlingtonia californica*), which is typically found at lower elevations on serpentine seeps.

The last mile departs from the lower of several Deadfall lakes, rising in spurts to moraine terraces at ever higher levels. The scree in the first part is home to the beautiful Drummond's anemone (*Anemone drummondii*), whose fernlike leaves recall Mount Shasta's western anemone, although the flowering stalks stand much shorter and the flowers feature white to

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Cushion buckwheat (*Eriogonum ovalifolium* var. *nivale*)

Emerald Canary



Quill-leaved lewisia (*Lewisia leana*)

blue-purple petal-like sepals. Often joining it is the diminutive shorthorn steer's head (*Dicentra pauciflora*), a close relative to the long-horned steer's head of the Sierra, with a few dissected bluish green leaves arising from tuberous roots and a short flowering stalk with a few nodding, flesh-pink bleeding hearts whose outer petals are recurved into short "horns."

The wet meadows around the upper lakes are home to several gentians, including the colonizing mountain bog gentian (*Gentiana calycosa*), with clear blue cup-shaped flowers, and the Sierra gentian (*Gentianopsis holopetala*). Along a long, steep ascent to a ridge and the edge of a foxtail pine forest, the rocks are liberally sprinkled with quill-leaved lewisia, (*Lewisia leana*), with rosettes of succulent tubular leaves and open sprays of intensely pink-purple flowers.

The final ascent encompasses a series of switchbacks above the pines, where the true alpine country begins. Here you find rock gardens with several species of buckwheat; the sprawling pink-purple pompons of pussy paws (*Calyptidium umbellatum*); Sierra penstemon (*Penstemon heterodoxus*), with whorls of intensely blue-purple flowers; the Siskiyou version of rockfringe (*Epilobium siskiyouense*—Siskiyou fireweed); the Siskiyou version of alpine gold (*Hulsea nana*); the rare rough harebell (*Campanula scabrella*), with upright clear blue bells; and near the summit, the Siskiyou endemic Mason's sky pilot (*Polemonium chartaceum*), whose counterpart in the Sierra is *P. eximium*, both species displaying sticky, deeply pinnately dissected leaves and clusters of clear blue, saucer-shaped flowers. Be sure



Dwarf alpine gold (*Hulsea nana*) on red serpentine scree

to pause to breathe in the stunning view: Mount Lassen and Castle Crags in one direction, the Trinity Alps in another, and other ranges within the greater Klamath Mountains in yet another direction.

These forays to the high country are but a sample of what awaits the intrepid explorer, creating indelible memories of beautiful places with special flowers. 🌿

Glenn Keator is the chairman of the Friends Advisory Council. He is a popular instructor of botany and field trip leader in the Bay Area, and he teaches the docent training course at the Regional Parks Botanic Garden. He is the author of a number of books on native plants.

Photos by the author except as noted.

My Favorite Mountains

by Bart O'Brien, Garden Director

Although I have lived in both the Santa Cruz and San Gabriel mountains and I've botanized in many other ranges up and down the state, I suppose that my favorite set of California mountains is the Clark Range. It is there, at the eastern edge of the Mojave Desert in California, that I have probably spent more time and made more interesting collections and discoveries than any other place in the state. Why? There are many answers to that question.

Botanically, the Clarks are remarkably diverse, especially for their relatively small size. I always like botanizing there because most parts of the range are very rarely visited by anyone and, because of summer monsoonal activity, there are multiple seasons of floral activity. In fact, there are two distinct floras of this region: those that germinate and prosper with winter-spring rains and those that sprout and grow only with summer rainfall.

Horticulturally, the Clark Range in particular and the eastern Mojave ranges in general have much to offer. Plants from this area are cold hardy and well adapted to extreme heat and drought conditions, but they thrive with the occasional summer monsoon. This makes them especially well suited for growing in seasonally dry, hot/cold inland gardens with well-drained soils, where gardeners often want to water their plants at least a few times over the long dry months of summer and fall. Here in the near-coastal, mild climate of the Regional Parks Botanic Garden, many of these plants can be grown but require more effort to keep them a bit drier than what our usual winter rains deliver. I look forward to growing more of them here and to seeing them outdoors, at least seasonally, in some of our troughs or other containers, and to having gardener Don Fuller try his luck with them in the ground in our soon-to-be-constructed Desert section rock gardens.

The Clark Mountains have significant limestone outcrops that are home to many unusual plants, and their abrupt, north-facing scarp has created deep, cool canyons that harbor some of the rarest plants in the state. Jaeger's ivesia (*Ivesia jaegeri*) and pungent glossopetalon (*Glossopetalon pungens*) are only found in two places on the entire globe: here in Forsellesia Canyon and also in the Sheep Mountains in the state of Nevada. Both species are cremnotic chasmophytes (cliff-dwelling plants that grow in rock crevices).

Despite such restrictive wild-habitat requirements, the *Glossopetalon* was not especially difficult to grow as a container plant in the nursery at Rancho Santa Ana Botanic Garden (RSABG). As long as we watered them carefully, kept their root zone cool, and provided quick-draining soil, the plants thrived. Those specimens were grown from cuttings, and they grew very slowly, yet they flowered more than once before they expired during an especially brutal heat wave. Plants rarely grow more than two to three inches tall and can very slowly spread up to a foot or more across. Their blue-grey-green narrow leaves are spine tipped and, at least in cultivation, are nearly evergreen. The usually narrow-petaled, white flowers are roughly half an inch across and typically appear in May. They do not last long and are not especially showy, but they are beautiful and welcome nonetheless.

So many of the plants from the Clark Mountains are the perfect size and shape for a drier alpine-like rock garden. Our two species of *Menodora* are found here, and they look nothing like one another. Rough menodora (*M. scabra*) is a small, tufted, evergreen perennial subshrub with six-inch erect stems that carry clusters of small, bright yellow flowers (the vegetative plant itself grows to a foot across and about three inches tall). The other species, spiny menodora (*M. spinescens*), is well named: It grows as a dense low mound of arching, sharp-spined green stems with small, creamy-white flowers that are rather insignificant (plants are less than one foot tall and spread to three feet or so across). When not in flower, this species looks remarkably similar to some species of broom from the Mediterranean (like the dwarf broom *Genista lydia*, for example).

Growing on a particularly unusual substrate overlooking the now-abandoned and somewhat restored former Coliseum Mine site are three superb short-lived small perennials. One of these, Thompson's beardtongue (*Penstemon thompsoniae*), just happens to be the best desert-dwelling dwarf penstemon in California. With its tiny, ashy-grey foliage and darkest purple-violet trumpet-like flowers, it is a diminutive knockout. We grew it at RSABG, but like so many of our beautiful penstemons, it never persisted for long and we never planted it out in the garden.

The other two, Chambers' twinpod (*Physaria chambersi*) and thickstem wild cabbage (*Caulanthus crassicaulis*), are a lot easier to grow, are naturally short-lived, and were successfully cultivated for a time in the desert garden at RSABG. The *Physaria* is among the earliest plants to bloom in the Clark Mountains. Plants form a basal rosette of narrow



Thompson's beardtongue (*Penstemon thompsoniae*)

grey leaves and produce from one to several nearly prostrate flowering stems that carry small clusters of yellow flowers. Oftentimes one never sees the flowers (as it blooms so early), but one always sees the showy inflated seedpods that never fail to call attention to themselves. In cultivation, this *Caulanthus* is generally a biennial. During its first year it will produce a tidy basal rosette of rather unremarkable, variously lobed leaves. But compare that to what happens its second (or sometimes third) year: An erect inflorescence rises over a foot tall, and its yellowish-green stem is slightly inflated. The showiest part of the actual flower is the whitish to purplish calyx that is densely covered with white hairs—while the four narrow purplish petals almost appear to be an afterthought. The overall effect is showy and reminiscent of a miniaturized desert candle (*Caulanthus inflatus*).

These four plants are just a tiny sample of the remarkable number of alpine-like plants of the Clark Mountains that can and should be sampled for our gardens. Look for these plants, perhaps along with several others, in our garden in the not-too-distant future. We will continue to push the envelope, trying to successfully grow and display more of California's great plants. ♀



Thickstem wild cabbage (*Caulanthus crassicaulis*) flowers

Alpines in Berkeley *by Michael Uhler*



Southern foxtail pines (*Pinus balforiana* var. *austrina*) at 10,500 feet at the southern entrance to Nine Lake Basin in Sequoia National Park. These treeline pines grow as high as 12,100 feet in the southern Sierra Nevada.

California's Sierra Nevada, at over 400 miles long and 50–80 miles wide, is one of the most beautiful and awe-inspiring natural features in the United States. It is also home to one of the most diverse collections of distinct plant species in the country. In fact, the Sierra Nevada is home to more than half of California's plant species, one-third of which are endemic to these mountains. At the Regional Parks Botanic Garden we are able to devote substantial energy and space to the display of this wonderful Sierra Nevada flora. Indeed, the garden's collection of Sierra Nevada plant taxa is likely the largest and most diverse to be found anywhere outside of the iconic "Range of Light" itself. Fittingly, it is also the largest, most diverse section of our Botanic Garden.

A portion of the Sierra Nevada known as the High Sierra is the exalted apex of this range. As defined by R. J. Secor, noted mountaineer and author of *The High Sierra: Peaks, Passes, and*

Trails, it is the region between the southern boundary of Sequoia National Park and the northern boundary of Yosemite National Park. In this region the rarefied atmosphere is punctuated by the loftiest of the lower 48's peaks, many in excess of 14,000 feet above sea level. It is satisfyingly devoid of trans-Sierra automobile highways and home to the state's largest alpine zone.

In his 1940 dissertation, noted pioneer alpine flora expert Carl William Sharsmith defined the alpine zone of the Sierra Nevada in California as non-forested areas at or above 3,500 meters (about 11,500 feet), a definition shared by current alpine scholar Dr. Philip Rundel. (This definition of the alpine zone applies to the southern and central Sierra Nevada and represents an averaged boundary.) The alpine zone is represented by a relatively continuous area along the crest of the central and southern portion of the range. This zone's northernmost post is Leavitt Peak (11,570 feet) near Sonora Pass, and it extends

virtually contiguously to Cirque Peak (12,900 feet) in Sequoia National Park. As the Clark's nutcracker flies, the alpine zone spans a length of 150 miles, and there are only two major subalpine interruptions in the continuity of the zone: one at Tioga Pass (9,944 feet) and the other at Minaret Summit (9,941 feet).

In his 2011 *Madroño* article, Philip W. Rundel compiled a checklist of Sierra Nevada alpine plant species that occurred at a slightly lower elevation—at or above 3,500 meters (11,480 feet)—and reported 385 species (409 taxa, including varieties and subspecies) that grow there. If the lower limit to the alpine zone were defined to be 3,300 meters (10,825 feet), the alpine flora would increase to 536 species (570 taxa). Our living collection at the Botanic Garden features 65 of the species listed by Dr. Rundel as occurring at or above 3,500 meters and a total of 92 alpine plant species if the elevational limit is set lower at 3,300 meters.

For more than half a decade we have been improving the Sierra Nevada section's alpine habitat by building specialized plant beds to accommodate these mountain dwellers in the botanic garden. In one project, we placed 19.5 tons of granite boulders and gravel in the style known as a crevice rock garden. This was done to provide both sharp drainage and a deep, cool root space for these upland denizens. The results are promising, and several alpine species are now growing in these beds that have never been displayed in the garden's history.

Of the many outstanding alpine plants in the Sierra Nevada section of the garden, several stand out as my favorites to grow.

Sierra columbine (*Aquilegia pubescens*) is one of the easiest and showiest true alpine plants in the Regional Parks Botanic Garden. The species is endemic to California and can be found in all its glory just outside of Yosemite National Park at Ellery Lake, a few steps from Hwy 120. The large 1.5- to 2-inch-long flowers are held horizontally, which accommodates their native pollinator, the hawkmoth. Our collections at the garden are so far mostly a pleasant yellow; however, there are wonderful forms in nature that range from almost pure white to a mix of pink, lavender, yellow, and white. These color forms are attributed to the apparent hybridization of the alpine columbine with the more common lowland form (western columbine, *Aquilegia formosa*). Alpine columbine grows in full sun to part shade in our well-drained granite bed at the garden and should be available to the public at our upcoming fall plant sale on October 4 (www.nativeplants.org/fallplantsale.pdf).

Also at the top of my list is one of the few conifers that ventures into the alpine zone. The southern foxtail pine (*Pinus balfouriana* ssp. *austrina*) has populations in the southern Sierra Nevada that reach over 12,000 feet in elevation. These pines are most closely related to the long-lived Great Basin bristlecone pine (*Pinus longaeva*) and may live up to 2,500 years. I have about half a dozen growing in the Botanic Garden that are four years old and are just over three inches high. They are all growing in sharply drained raised planters that will keep excessive moisture and pathogenic fungi away from the sensitive root crown. In the future, I plan to graft a foxtail pine scion onto a more growable, compatible pine species root stock.

California has only one species of true primrose: the Sierra primrose (*Primula suffrutescens*). In nature it has brilliant magenta blooms that form large masses at the edges of boulder fields. In our garden it has yet to bloom after six full years of cultivation. The plants look healthy vegetatively in the nursery, and I am happy for that because the species has not been successfully grown in the Regional Parks Botanic Garden thus far. The trick to growing this species may be to keep it in a container sheltered from the heat of the day while providing perfect drainage. Growing the plants under the shelter of the greenhouse facilitates providing an obligatory winter dormancy.

The snow willow (*Salix nivalis*) has only a handful of populations in California even though it is widely distributed in the Rocky Mountains. For the past four years I have eagerly watched this diminutive willow return from its winter slumber in our nursery to put forth up to 40 leaves that measure a modest one-fourth to one-half inch in length. Yes that's right, I count the leaves on this one. It is yet another taxon that has never been attempted at the Regional Parks Botanic Garden. I have visited great, glorious patches of this species around Corridor Pass high above Upper Convict Creek; in the fall its brilliant yellow to orange-red foliage is stunning.

Please come visit our alpine beds at the Regional Parks Botanic Garden, and do tell me if you find or know of a larger collection of California's alpine plants. ♡

Michael Uhler is a gardener at the Regional Parks Botanic Garden. He maintains the Sierra Nevada and Seabluff sections. On his days off he likes to explore both Alta and Baja California.

Photographs by the author.




Above: The pika (*Ochotona princeps*) is not a rodent but a high-elevation relative of rabbits and hares. Below: A bumblebee collects pollen from a Sierra columbine (*Aquilegia pubescens*).

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BOTANIC GARDEN

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WE'RE COLLECTING BOTANIC GARDEN PHOTOS AND STORIES

In 2015, the Regional Parks Botanic Garden will be 75 years old. We'll be celebrating that momentous anniversary and would like to include you in the festivities. To begin, we're collecting photos and stories of the garden, especially from the garden's earlier years, from those who visit and love it. If you have pictures and/or stories to contribute from any time in the garden's history, please send them to info@nativeplants.org. By U.S. mail, send them to Rosie Andrews, c/o Regional Parks Botanic Garden, East Bay Regional Park District, P.O. Box 5381, Oakland, CA 94605-0381. Please send copies rather than original photos if you send them by U.S. mail. If you know the date your photo was taken, please provide it, along with a descriptive caption. We'd like to receive photos and stories by November 1, 2014.



Historic view including the garden's main bridge (pre-railings), looking east