ROCK GARDEN *Quarterly*

Volume 66 Number 3 Summer 2008

Front cover: *Camassia leichtlinii*. Painting by Lyn Noble.

Back cover: *Vakriana rigida* and *Gentianella hirculus* in the Equatorial Andes. Photo by Jane Grushow

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ROCK GARDEN *Quarterly*

BULLETIN OF THE NORTH AMERICAN ROCK GARDEN SOCIETY

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Contents

From the Editor

Desperately seeking artwork. We currently have no art for the fall issue or the 2009 volume. Artists interested in having their work featured are encouraged to contact the editor. The criteria are as follows: the style should be reasonably representational but need not be strictly botanically accurate; work must be in color; work (normally submitted larger and reduced for printing) must fit into a space approximately 4 inches wide by 6 inches high; subjects should be plants suitable, in the broad sense, for a rock garden, with North American native species preferred but not required; the image should include some background rather than representing only the plant as a "herbarium-style" specimen; and, of course, the work should be attractive to a wide segment of our audience. Payment of $100 per cover for one-time use is offered, and originals and copyright remain the property of the artist.

We need writers, too. All too often, putting together an issue of this magazine is a cliff-hanger experience. Sufficient copy may arrive only at the last minute. If it doesn't, the editor has to buckle down and write thousands of words that may or may not appeal to you, the readers. Unlike some previous NARGS editors, she is neither a trained botanist nor a great gardener, so the available subject matter is limited. Unless you want to read more than you ever wanted to know about bulbs (the editor's particular hobby), please consider contributing information about *your* specialties.

Changes are being considered. Printing and mailing costs continue to rise, but raising dues to meet these has never been a popular option. We've been discussing the possibility of incorporating material now published in the *Bulletin Board* newsletter into the *Quarterly*, and also printing meeting registration information and forms as tear-out pages rather than drop-in brochures. Doing this could save $2000 or more per issue, as well as avoiding logistical problems that have plagued us. A trial run of the meeting information procedure will appear in the fall issue. If you have comments on these proposals, please send them to the editor (janemcgary@earthlink.net) and/or president Dick Bartlett (Abart@aol.com).

A diamond jubilee is coming. The year 2009 will be the 75th anniversary of the founding of the American Rock Garden Society, predecessor to NARGS. We hope to produce at least one special issue commemorating this. One suggestion is to reprint excerpts from the best writing of earlier years. If you have more suggestions, please pass them on to the editor!

Copies for chapter recruiting. Chapters recruiting for the national Society find that seeing our magazine interests potential members. If your chapter would like to receive up to 20 copies of back issues for this purpose, at no cost to you, please contact the editor.

The Alpine Look

Robin Magowan

I still recall my astonishment on hearing Panayoti Kelaidis refer to the rock gardening we do as an art. I had seen it more in the light of a hobby, or even, acknowledging the extent with which it had taken me over, an obsession. In any art form there are standards, and a garden that kept changing whenever I knelt to weed or resite a plant seemed too improvised to deserve such a designation. Wasn't rock gardening, as Caroline Pope once observed, an individual undertaking, with as many kinds of gardens as there are gardeners?

Yet I was flattered by the notion that anyone might detect a personal imprint in what I was putting together. A free-form development suited the garden I was establishing, drawn up around a small outcrop, with a series of raised boulder beds built up out of a flat lawn to meet it (photos, pp. 177–179). My experience of the world above the tree line was just beginning, and, not surprisingly, I viewed the "alpine" look on which many of our chapter members insisted as mere superstition. Wasn't the first American rock garden, at Smith College, one laid in the flat? For that matter, so were the beds Frank Cabot and Rex Murfitt produced at nearby Stonecrop, occupying the top of a raised cube. It was, I thought, the mountain plants, the miniature buns and cushions, that gave a garden its alpine identity.

All the same, I could see that rock gardening plays with effects different from the painterly swathes of a perennial bed. It is not the prospect that counts, but the plant arrangements, something minute, up close, immediate. Nor was I consumed by the mysteries of scent and touch that haunt a perennial gardener. Mine more resembled a botanical garden in that I was siting single plants—small, almost invisible ones—rather than masses. But unlike a botanical garden that gathers specimens by area to form a community, my synthesis brought together plants that would never have grown near one another in the wild. This made for a composition that was deliberate and even arbitrary, combining habitat considerations with the visual ideal of "the right plant in the right place." In this cooperative arrangement, the rocks, irremovable as they were, dictated where the plants went, and the plants made the garden geometry come alive.

Gardening is a craft we learn by trial and effort; a craft all the more problematic when the plants hail from habitats very different from the lowland conditions in

which we garden. In my ignorance I did a lot of moving plants about, as a seedling outgrew the space allotted, or something larger obscured it. Though I made a lot of mistakes, transplanting the truly immovable, often enough in the dog days of summer, I don't feel too repentant. To me, moving plants represents one of the great thrills of rock gardening, fully comparable to the way the act of revision shapes a poem. Here, however, the poem is the entire garden, a composition that, unlike a poem, can be endlessly tinkered with and enriched. If now and then an oversized conifer retaliates to this spinal readjustment, that too is part of the learning process.

In due course I came to see that the choice of "the right plant in the right place" was less mine than the plant's. By the same logic I can maintain that a plant has fulfilled its purpose and decided to leave the garden. While killing plants does create room in a limited setting, however, I'd rather see plants survive. The art lies in siting them where they may. At this point a simulacrum of an alpine environment becomes a structural necessity. Plants survive in the mountains because the steep slopes and loose soils give them the drainage they need. We have to replicate these conditions if our acquisitions are to survive.

Drainage at the top of a slope is far superior to that at the bottom. The steeper the incline, the more "natural" such plants as dianthus and saxifrages look. On a raised bed on the flat plants require a certain indulgence to be perceived as alpine. Suspended on an incline, their mere shape creates the illusion of a miniature alp. Raised thus, they may well be more visible. Even the weeding is easier. Lawn weeds seed easily into the first inches of a raised bed. A couple of feet higher and the soil becomes less accessible.

I've come to believe that the steeper the gradient, the greater the garden potential. I've had success with a collapsed wall in the form of a landslide careening toward a small pool (photo, p. 177). I use sempervivums—aptly named houseleeks—to stabilize the earth; then I gradually weed out these colorful distractions as the cliff-dwelling chasmophytes take hold. The rest of the descending tumble has overhangs under which I can tuck a number of winter-sensitive beauties. Gardening on such an incline allows for a longer seasonal extension, as an array of mats cascade into blossom.

A miniature art tends ultimately to plants so small as to be invisible to all but their acolytes. To some of us, these specks represent nothing less than the souls of the alpine plant kingdom. The troughs where they mainly reside, propped on rollers or on a wooden bench, or astride a wall, are our treasure chests, repositories of the sacred. Still, a gardener may be right in viewing a trough as a confession of failure, unintegrated as it usually is in the open design.

This is where a crevice garden comes into play. Inserted in a gleaming crack, an asperula astonishes and may well survive. In arresting the eye by its tininess, it brings into focus the surrounding micro-community. Face high, in an inch of soil atop a wall, the tiniest of drabas adds a staccato touch to a raft of succulents.

We rock gardeners are internationalists. Our ideal resembles the political one of the Czech writer Milan Kundera, "the greatest diversity in the smallest of spaces." How I pack in diversity without the garden becoming "itsy-bitsy," or

worse, an overgrown mess, is the challenge I constantly face. Seasonal succession demands that each surprise be layered on the heels of another. And a single weed can throw the entire composition off kilter. That's why considerations of scale are paramount, for the possibilities of balance and ultimately of order it creates. Scale does not have to be consistent everywhere, but the smaller I can set it, the more alpine the illusion.

In nature's meadow, tallnesses succeed one another. As I crawl about an alpine lawn, a new seedling in hand, I feel placing it as if I'm stitching another thread into the ongoing carpet; only in my composition it's bulbs and plants rather than so many knots per square inch. Still, the same principle obtains: the tighter the weave, the more intricate the design. But diversity provides cover for a variety of weeds. How do I distinguish an out-of-blossom trifolium from an invasive clover?

For that matter, how do I feel about weeds? I can't help but admire the ingenuity with which they infiltrate and insinuate themselves. Without them, would I ever be down on my knees, at one with a now visible flora? People might call what I'm doing "working," but for me it's more like playing in an adult version of a sandbox. Rising moments later to my feet, I stand like a hawk hovering, wondering where else I need to pounce.

I have been talking about the high-intensity alpine meadow. There is inevitably another kind of meadow, or mess if you want, that takes over as the garden matures. I can, to be sure, stand back and let my tap-rooted thugs battle it out, toe to toe. These collisions of form, of foliage, of blossom color, are what a boulder garden is about. But another sort of wind-rippled illusion can be created by adding a scattering of the two milk-white androsaces, *A. lactea* and *A. lactiflora*, to the buns, cushions, domes and small hummocks (p. 179). Since these biennials grow on the scantest of soil, by extending the gardenable space they make it more floriferous.

Though rocks have given their name to our vocation, we tend to accept them somewhat grudgingly, however essential they are to the plants we treasure. Tightly wedged in the stratified lines of a crevice garden, they provide the cool root run, winter warmth, and sharp drainage high alpines require. But the structure is one best concealed; I want to admire plants, not minerals—the orange flames of glaucium exploding from a high crack among boulders; a mat of gypsophila spilling over stone in a waterfall of color.

In the mountains a bare patch of earth offers relief to the flowering spectacle. In a garden, bare earth presents an accusation of insufficient imagination. I prefer to regard the rock work as a kind of punctuation: stopping, isolating, and lending color as contrast. Think of an artemisia's silvery foliage spilling over black granite; or white limestone in its starkness setting off the gray, green and pink of an asperula, a lamium, a prostrate prunus as it does on Parnassus. Useful in concealing stonework are plants such as *Erigeron scopulinus* and *Arenaria tetraquetra* that adhere so closely to a flat rock as to express its smallest ripples. A boulder will often contain a cleft where I can stop the eye with a sempervivum. An even more gorgeous transformation comes from releasing a squad of

saxifrages on a moss-drenched outcrop. I plaster them on flat, and somehow they manage to stay rooted and even seed themselves into soilless declivities.

What is it about these tiny plants that makes us their slaves? Much, I suspect, has to do with the mystery of the alpine kingdom they embody. In a shrinking universe, mountains still constitute a refuge for diversity. That this refuge is currently under attack from a number of quarters, not least climate change, makes it all the more imperative that we integrate all the threads of their being that we can into our daily lives. In growing the plants we are honoring their mountain world in all its remoteness and difficulty. If that places us on the gardening frontier, so much the better. Rock gardening, as we do it, is more about asking questions than finding solutions. However much we scheme with a design, a garden at its best has an accidental quality. Single plants form colonies and let you know where they are happy. We learn by putting ourselves on their level and listening to what they are trying to tell us. A rock garden is where all this activity happens; good enough reason to be out in it, taking it in, every single moment that I can.

Robin Magowan, a poet and travel writer, gardens on a gently sloping country property near Salisbury, Connecticut. He is active in chapter events and a frequent contributor to this magazine.

About the Artist

Lyn Noble is a Canadian botanical artist whose work has been widely exhibited and collected. It has appeared at such venues as the University of British Columbia, Strybing Arboretum in San Francisco, and the Royal Horticultural Society; at the last of these she was awarded three medals. She is a member of the American Society of Botanical Artists. To inquire about note cards and other reproductions of her work, you may contact her at gbnoble@telus.net or 5265 Gulf Place, West Vancouver, BC, Canada V7W 2V9.

Mt. Patscherkofel Alpine Garden and Its Plants

Peter Daniel Schlorhaufer

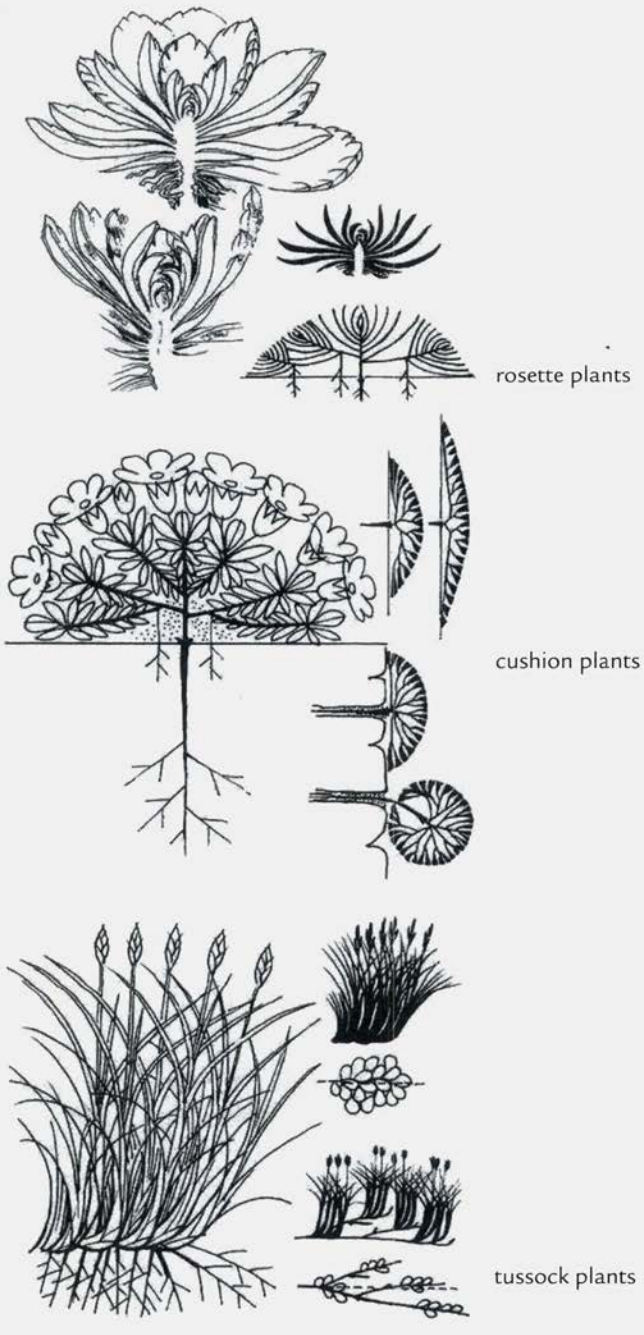
When the first alpine botanists of the sixteenth century explored the mountains, they discovered a previously unknown world. The Dutch genius Clusius, curator of the Imperial Gardens in Vienna, in 1575 returned from his excursion to the limestone Alps of lower Austria with new plants such as *Loiseleuria procumbens, Rhodothamnus chamaecistus, Dryas octopetala,* and *Primula minima*. It must have been the lowlander's enthusiasm for the very different alpine plants that led Clusius to grow them in his Viennese garden. A well-known example of his skill as an alpine gardener is the strain of primulas that descended from his cross between *Primula auricula* and *P. hirsuta* from the Stubai Valley.

As soon as it was realized that many alpine plants were difficult to grow and keep in valley locations, people began to create alpine gardens at or above the tree line. These gardens reached their peak of popularity in the nineteenth and twentieth centuries. Of the many alpine gardens made in those days only a few have survived, mostly administered by university botany departments. Unfortunately, collectors helped themselves too generously to a variety of plants, so that some rare species became almost extinct.

It is justified to ask whether alpine gardens today are anything more than a pastime, a dilettante attempt to imitate nature on a few hundred or a few thousand square meters, when at the same time many hectares of priceless alpine habitat are being destroyed by roads, ski runs, and dams. Despite this, we believe that alpine plants are of particular significance to public education: alpine gardens increase the understanding of nature; they provide information on the relationship between difficult living conditions and adaptive changes made by plants, and need to protect habitats; and they are used as research laboratories.

The Patscherkofel Alpine Garden

The landmark Mount Patscherkofel rises 5 km directly south of the city of Innsbruck, Austria, on the northeastern border of the Wipp Valley. The peak is 2246 meters above sea level, and the Alpine Garden lies at about 2000 meters, on a



Life forms.

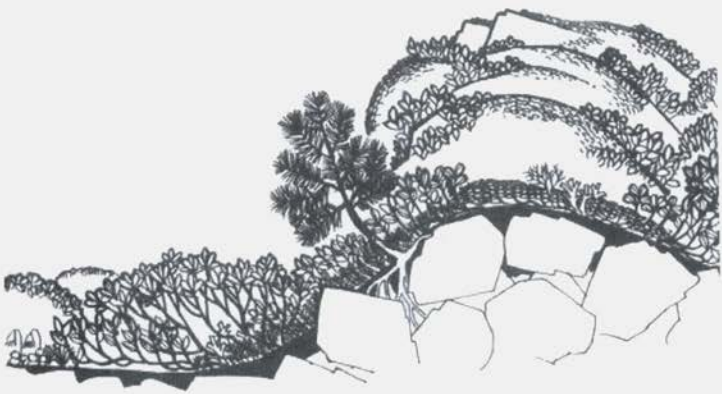
steep slope at the tree line, facing northwest with a varying gradient. It is easy to reach via the Patscherkofel cable car and can be visited from June through September, free of charge.

Exploring alpine flora has always played a pivotal role for the Department of Botany at Innsbruck University, and cultivating mountain plants is a long-standing tradition in the Tyrol. In 1864 Professor Anton Kerner published *The Cultivation of Alpine Plants,* in which he gave soil requirements and growing instructions for about 500 species. The rock gardens in the Innsbruck Sillgasse are among the earliest in the world and are well known throughout Europe. Kerner set up the first alpine garden above tree line in 1875 on the Blaser, but it was abandoned after his death.

On a tour of the Mont Blanc region in 1926, the then governor of the University Chancery, Dr. Georg Heinsheimer, visited the Alpine Garden Linnaea maintained by the Botany Department of the University of Geneva, which included the laboratory of the Bourg St. Pierre. Heinsheimer thought what had been achieved there would be possible in Innsbruck as well, so he began to encourage the creation of a similar garden on Patscherkofel, where the construction of a funicular (cable car) offered a good opportunity.

In 1930 the province of Tyrol and the city of Innsbruck donated two plots comprising 8700 square meters to Leopold Franzens University of Innsbruck for the creation of an alpine garden and later a biological research station. The area is now administered by the University of Innsbruck. The garden and a small gardener's cottage were opened in 1935, but when the gardener was conscripted to fight in World War II, the garden was left to itself.

It was not until 1946 that a new gardener arrived: Walther Buettner, an enthusiastic lover of alpine plants, at home on Patscherkofel and at one with his garden. For years he returned from mountain walks with plants for the garden, and he grew others from seed or exchanged plants with other growers. Spending even



In the snow-covered depressions the Alpenrose is protected; the wind-blown places are settled by Creeping Azalea.

the winters on the mountain, he also grew potatoes and added to his income by cultivating late-ripening mountain strawberries. When he retired in 1975, though, there were no funds to hire a successor.

Beginning in 1992, horticulturists from the university's Botanical Gardens in the city below have renewed some parts of the alpine garden. An extensive loop path was laid, making it possible to open the garden in September 1994 to the public, after a closure of 20 years.

The public part of the garden is 1 hectare (2.470 acres) in extent. Its favorable position at the timberline enables us to demonstrate different plant communities that occur naturally here. A new trail leading through the steepest area allows visitors a close view of communities such as timberline forests, "elfin wood" or Krummholz, tall alpine herbfield, and alpine tundra associations. Only understanding the sensitive balance of nature can help to save these endangered communities. In addition, we also want to exhibit plants from other alpine regions of the world.

The Natural Setting

The Inn Valley, particularly around Innsbruck, is typical of Central European dry valleys; the average annual rainfall of 860 mm evaporates rapidly owing to the frequent dry south wind known as the *Foehn*. In winter the snow on the southwest side of Mt. Patscherkofel melts in the strong, warm wind, with wind speed averaging 4–5 meters per second and often rising to 15–20 m/sec. Exposed sites are blown free of snow even during midwinter, while on the lee side the snow amasses; this occurs in the ditch at the lower end of the Alpine Garden, where snow can be found at the end of July. The Foehn also contributes a further stress factor to the vegetation because of its dryness.

Mt. Patscherkofel is the westernmost outpost of the Tux (Lower) Alps, forming part of the Northern Tyrolean Central Alps. Its peak was rounded off by ice age glacier erosion; in contrast, the Glungezer, a little to the east, rose above the glaciers and has a much craggier peak. The complete glaciation of Patscherkofel is one reason for its relative scarcity of alpine plant species, compared with higher peaks in the vicinity.

The geological structure of the mountain base is fairly consistent. The dominant mass consists of lime-free quartz phyllite, with local inclusions of basalt and chalk or dolomite. The peak, however, is composed of gneiss and feldspar. The dominant soil types in the high mountains and subalpine forests are acidic podsol brown soils. Above the present tree line, close to the peak, we find strongly acidic brown soils hinting at a former higher tree line, as well as iron humus podsol.

The Alpine Garden lies immediately on or above the present tree line, but owing to global warming this line has been pushed marked upward during the past few decades. The typical trees at this elevation are *Pinus cembra, Larix decidua,* and more rarely *Picea abies* (stone pine, larch, and Norway spruce). In earlier times the mountain was forested to its peak, but as in other alpine regions, historically the tree line was lowered by cultivation, especially for pasture, and by logging.

Today, the upper slopes are dwarf brushwood heath dominated by *Rhododendron ferrugineum* and then by *Loiseleuria procumbens*, providing the transition to alpine meadows. Rich alpine herb fields, particularly at the lower part of the garden, merge with the dense forest. Ski runs on either side of the garden are used as pasture during the summer months.

Concept and Management

It was initially planned to leave the natural vegetation of the site undisturbed and to enrich the garden with additional appropriate species. In order to be able to introduce plants from lime-rich soils, a chalk stone group was constructed. Since 1930, the garden has been fenced in, so that many species which have become rare elsewhere on Patscherkofel have been protected from grazing cattle.

Naturally occurring plant communities, such as timber forest, dwarf shrub heath, alpine herb field, and green alder thickets, are pointed out to visitors along the signed "exploration path." The aim is to further an understanding of the sensitive ecological balance of these communities, which is seriously threatened by development in alpine regions.

A modern laboratory, built in 1994, allows scientists to conduct research throughout the year and also is a facility for teaching. The Alpine Garden is part of the Botanical Gardens of Innsbruck University and is managed by that division. Peter Daniel Schlorhaufer is head of the Alpine Garden, and the current gardener is Stephan Ritzenfeld.

The Ecological Units

Rock and scree communities and alpine swards

Exposed slopes near the steps leading into the Alpine Garden are used to grow plants that would otherwise be found much higher in the mountains. These have been grown from seed collected in the wild. In their natural habitat, the alpine zone, they are perfectly adapted owing to their low cushion growth form, which protects them from ultraviolet light and drying during summer, and from snow and ice in winter. Facing a short growing period of fewer than 100 days, many of these plants have already "stored" the next spring's flower buds in autumn. Three growth forms—cushion, rosette, and tussock—survive particularly well in the alpine zone.

Various cushion types (flat, hemispherical, or spherical) spread through consistent growth and regular branching. A typical example is *Silene acaulis*, which forms dense, mosslike cushions covered at blossoming time with stemless, solitary deep pink flowers. It grows in the Alps in various communities in silicate rocks, and is found up to 3600 meters elevation across the mountains and high latitudes of Europe, Asia, and North America.

In rosette plants, slow growth of the main shoot ensures that the distances between leaves remain small, and a dense spiral of foliage results. This is illustrated by *Saxifraga paniculata*, common in the Alps and also found in arctic Europe and North America. During periods of high heat, drought, or cold, it can close its evergreen, fleshy rosettes for extra protection. This enables it to grow in places blown free of snow. The most conspicuous saxifrage in the garden is *S. cotyledon*. Its large rosettes (up to 15 cm/6 inches in diameter) form offshoots but a rosette dies after flowering. The fleshy, tongue-shaped leaves are lime-encrusted and have gnarled, serrated edges. The leaning, pyramidal panicles may be up to 60 cm (2 feet) long with as many as 100 individual flowers. Common in northern Europe and the Alps, it grows on damp silicate crags up to 2500 meters. The plants in our garden are a somewhat smaller subspecies from the Montafon, Vorarlberg.

Most alpine grasses are typical tussock plants. Along a short basal axis a large number of branching side shoots form a dense plant stem. Standing tussocks derive their strength from a dense stock of basal lateral buds. Wandering tussocks spread by sending out shoots from the stock.

Here are some representative plants to be seen along the garden's steps.

The Edelweiss, *Leontopodium alpinum* (p. 181), probably the best-known plant of the Alps, inhabits chalk soils up to 2800 meters and even higher. The much-sought, star-shaped flower is in fact a structure of felted white leaves surrounding the small, yellow-green true flowers in the center. Our Edelweiss, however, is not an indigenous Alpine species but an immigrant from the Siberian steppes that settled here after the last Ice Age. The center of this genus in the aster family is in Asia, where about 30 species of *Leontopodium* are found. The white pubescence (hairs), also seen on other mountain plants, serves a twofold purpose: it provides a protective air cushion that reduces evaporation, an adaptation to drought and wind; and the light-reflecting white upper bracts are a signal to honey-seeking insects. Although it is frequently assumed that Edelweiss naturally inhabits steep, inaccessible rock faces, in fact it also grows in lower alpine meadows, but because it has been picked by people for centuries, it has survived best in exposed crags.

Similarly well-known and threatened is the Bear's Ear, *Primula auricula*. It has a barrel-shaped, multi-branched root stock and, depending on habitat, grows 5 to 30 cm tall (3–12 inches). The ovate, fleshy leaves have a toothed edge and a very mealy surface. The bright yellow flowers are strongly fragrant. It ranges beyond the Alps to the Carpathian Mountains; particularly in the Southern Alps, less mealy and less fragrant variants are found. In the late sixteenth century, this primula became popular in gardens and could be bought in a thousand different varieties. A real mania for auriculas arose in England around 1900.

The beloved gentians grown in gardens include the stemless group, which gardeners find almost indistinguishable, but botanists distinguish at least six different species. *Gentiana acaulis* is always found on acid soil. From its pale green rosette of leaves, the stemless, dark blue bell flowers grow to a height of 6 cm (2.5 inches). The similar *Gentiana clusii* is distinguished by its spiked leaves and

calyx and prefers lime soil. Both species range from the Pyrenees to the Alps and Carpathians up to 3000 meters. Their flowers are mistakenly depicted on the labels of Enzian ('Gentian') schnapps bottles; this liqueur was originally made from the tall yellow *Gentiana lutea*, requiring about 100 kilos of root for one liter of schnapps. Unchecked digging and pulling, and especially the use of artificial fertilizers, has made it rare or even extinct in some areas.

Human activity also threatens the spring gentian, *G. verna* and at least three similar, barely distinguishable species popularly termed *Schusternägele* ('cobbler's nail). The deep blue flowers of *G. verna* rise up to 10 cm (4 inches) above the ground-level rosette. It inhabits scree and patchy meadow on chalk up to 2900 meters. The somewhat smaller *G. brachyphylla* grows on poor chalk soils, particularly in the Central Alps.

In fall we find densely flowering, red-violet gentians (e.g., *G. ramosa*) in the Alps. All of them are short-lived, frequently only annual, which is rare among alpine plants. Nearly all these small species close their flowers in cold or cloudy weather.

Widespread in horticulture is *Aster alpinus*, which grows to 20 cm tall and nearly always has a leafy, hairy stem bearing a single flower (p. 180). The flowers are large and showy, with blue-violet rays and golden disk flowers. Wormwood or *Artemisia* also belongs to the aster family and has at least ten species in the Alps. *Artemisia glacialis* is found on silicate and rarely on chalk slate. It is an aromatic herbaceous perennial up to 20 cm tall, covered in gray pubescence. It has lobed leaves and many tiny golden flowers on a stem. It occurs only in the Western Alps in crevices and "pioneer" meadow communities. *A. umbelliformis* ranges from the Pyrenees to the Alps; it has less segmented leaves and less densely placed, light yellow flowers. Often found with it is *A. genipi*, which has densely hairy leaves and gray "felt"; the inconspicuous flower heads are grayish brown. Wormwoods are rich in bitter compounds and essential oils; they have become rather rare because of collecting for use in vermouth and liqueurs.

Alpine poppies self-sow reliably along the steps. These often short-lived perennials form small cushions to 20 cm tall, with pinnate leaves and large solitary flowers. The yellow *Papaver rhaeticum* ranges from the eastern Pyrenees to the southwestern Alps. East of that range occur white-flowering species such as *P. burseri*. The species interbreed freely and numerous hybrids of varying hues have arisen. All of them have strong tap roots and are characteristic settlers in screes.

Also found on limestone screes but not in meadows or crevices is *Linaria alpina*, the toadflax (p. 181). Its smooth stems rise to 15 cm (6 inches) and often form small, loose cushions. It is a biennial, producing its blue-violet, orange or yellow-lipped flowers in its second year.

Some succulents of the family Crassulaceae have settled well above 2000 meters—for example, the houseleeks (*Sempervivum*), with ten species in the Alps. On silicates we generally find *Sempervivum grandiflorum*, whose dark green, short-pointed leaves form dense rosettes up to 15 cm (6 inches) in diameter. From this sprouts a stem up to 30 cm (12 inches) long with starry, rich yellow flowers. The very similar *S. wulfenii* is distinguished by its intensely blue-ringed leaves and is native to the Eastern Alps. On lime-poor soil in all parts of the Alps we find *S.*

arachnoideum forming much smaller, red rosettes covered with woolly white hairs like a spiderweb. All houseleeks have watery tissue inside the leaves, which are rough-surfaced with sunken crevices that prevent evaporation. All form fairly long runners (stolons), with daughter rosettes that in time separate, roll away, and root elsewhere. This is especially marked in *Jovibarba allionii*, which is planted in large numbers at the top end of the steps. The yellow-brown, spherical rosettes bear light yellow flowers. Found only in the southwestern Alps on lime and silicate substrates, *J. allionii* is easily propagated from its offsets. After flowering, the mature rosette dies and the very fine seed is spread far by the wind. More than 30 species in this genus occur from the Alps to the Caucasus, and because they hybridize easily, many natural hybrids arise, puzzling the botanist.

The roseroot (*Rhodiola rosea*) belongs to the same family. A perennial, it has multiple stems rising from a turnip-like root, with the red or yellow flowers in dense terminal cymes. It inhabits damp, humus-rich soil, crevices, and alpine herb fields on lime and silicate up to 3000 meters. The name "roseroot" refers to the rose-like scent of the root, which was used medicinally. This species, the only representative of the genus in the Alps, extends throughout the boreal and high mountain regions of Old and New Worlds.

In the buttercup family (Ranunculaceae) we find about six, mostly very similar species of pasqueflower in the Alps. *Pulsatilla vernalis* grows only in acid soils, flowering very early and setting seed quickly after snowmelt. Its leathery, pinnate basal leaves pass the winter pressed close to the ground, and new ones form after flowering. At first bell-shaped and nodding, the flowers later open widely and face upward. White inside, the outer surfaces are pale violet with dense golden-brown down. Each seed has a 5-cm-long hair that acts as a propeller and later forces the seed into the soil through hygroscopic (responding to moisture) movements. It can be found in dry, stony ground and sedge meadows above 2000 meters in northern Europe, the Pyrenees, the Alps, and Bulgaria.

Other pasqueflowers bloom later. *Pulsatilla montana* has flowers that are blackish violet inside and hoary gray outside, with finely dissected leaves. It grows on very dry silicate and chalk soils up to 1800 meters from the Pyrenees to the Balkans. We always find white-flowered *P. alpina* on lime soils, as well as red-violet *P. halleri*. Exclusively on acid soil is sulfur-yellow *P. alpina* subsp. *apiifolia*, taller than other species (to 40 cm/16 inches). All these plants love full sun and dry, neglected grassland; they vanish abruptly where fertilizer is used, particularly artificial fertilizer.

Dwarf Shrub Heath

At the bottom of the steps we encounter the dwarf shrub heath, a transitional community leading from the forest to the unwooded high alpine meadow. In closed forests the blueberry (*Vaccinium myrtillus*) dominates along with cowberry (*V. vitis-idaea*) and bog whortleberry (*V. uliginosum*). In the less dense woodland at the tree line, as here, we find the tall shrubs of *Rhododendron ferrugineum*, which flowers in early July, covering the forest margin with brilliant red. From its ancestors in the cool, damp mountain forests of the Himalaya it has inherited its

susceptibility to drought. As an evergreen thicket, it can thrive only in places with sufficiently long, deep snow cover along the tree line.

The deciduous *Vaccinium uliginosum*, crowberry (*Empetrum hermaphroditum*), and *Loiseleuria procumbens* are the only woody plants that grow higher up. On windswept, snow-free places, *Loiseleuria* is the only dwarf shrub to grow up to 3000 meters, surviving temperature extremes from +45° to –40° C (110° to –38° F). It is the only species of its genus; the simple shape of its flowers and its circumpolar distribution point to a great age, certainly back to the Tertiary Period. It can be seen in its natural habitat west of the Alpine Garden.

Timber Forest

Following the path east, we reach the "timber forest." Particularly on silicates, as here, the upper forests of the continental, low-precipitation, sunlight-rich inner Alps are dominated by pine (*P. cembra*) and larch. Especially impressive are the "weather pines," scarred by storm and lightning and up to 1000 years old; beautiful examples can be seen along the pine path toward the Glungezer. Larch seeds are spread by wind, but pine seeds exclusively by a bird, the nutcracker. Rowan (*Sorbus aucuparia*), birch (*Betula pendula*), and blue-berried honeysuckle (*Lonicera caerulea*) form a bushy understory in this forest.

Alpine Herb Field

The most conspicuous plant community in moist sites at and above the forest margin is the alpine herb field, or tall forb meadow. Nearly all its plants are dormant in winter, and in summer they require ample moisture or shade. The soil must be loose, aerated, and rich in fine humus and minerals. In the Alpine Garden, the following tall forbs are showy during July and August.

Monkshood (*Aconitum napellus*), found naturally on silicates, is an expansive colonizer here. It is a perennial, 50–60 cm tall, with a thickened black rootstock and a dense stalk of bright violet flowers. Another plant in the buttercup family is the alpine larkspur (*Delphinium elatum*), which can reach 2 meters in favorable locations. Its bright blue-violet flowers have a long spur and are borne in loose racemes. It is the main ancestor of garden delphiniums and can be found, in various subspecies, from the Alps to Siberia and Central Asia.

Also plentiful is *Epilobium angustifolium*, known in Britain as rosebay willow herb and in North America as fireweed. Its fluffy seeds are wind-distributed, and it is common in the Alps and throughout nearly all of northern Europe, Asia, and North America. It spreads by rapidly running roots.

The parsley family (Apiaceae) is represented here by the masterwort (*Peucedanum ostruthium*), with almost bare stems rising up to 150 cm tall. It has tripartite leaves and large umbels of white flowers. It has been used for medicinal purposes since at least the ninth century. Originally found only in the Alps, it has been cultivated for that reason in many regions and has become widely naturalized.

Worldwide the genus *Gentiana* comprises about 800 species, of which about 50 are found in the Alps. In the tall forb community we see *Gentiana lutea* (p. 180),

an impressive 60–140 cm tall, with greenish yellow flowers and large, broad leaves. Its roots contain the highest concentration of bitter compounds in the genus; it has been eradicated in some areas by people digging it to prepare schnapps, but it remains widespread from the Alps through the Balkans to Asia Minor. Two other gentians in the meadows are *G. punctata*, whose flowers are light yellow with dark dots or stippling inside, and *G. purpurea* (p. 180), whose deep violet flowers have a fine rose scent. In the Alpine Garden the latter two have crossed and we find dotted types in light violet. Sadly, these species too have been decimated by digging for the preparation of bitters. The bitter glycosides in all parts of the plant protect gentians from being grazed, and alpine herders view them as weeds. All three of these species grow very slowly, taking ten years to first flowering; they can live about 60 years. The gentian has particular significance in Austria; it was depicted on the Austrian schilling and now appears on the country's version of the eurocent.

Monk's rhubarb (*Rumex alpinus*) is a substantial knotweed or dock up to 2 meters tall, producing its red-brown flowerheads wherever manure is deposited. Around alpine huts it forms large colonies together with nettles. Rich in oxalic acid, rumex is shunned by cattle. The young leaves are eaten in some regions. It is an introduced weed in North America.

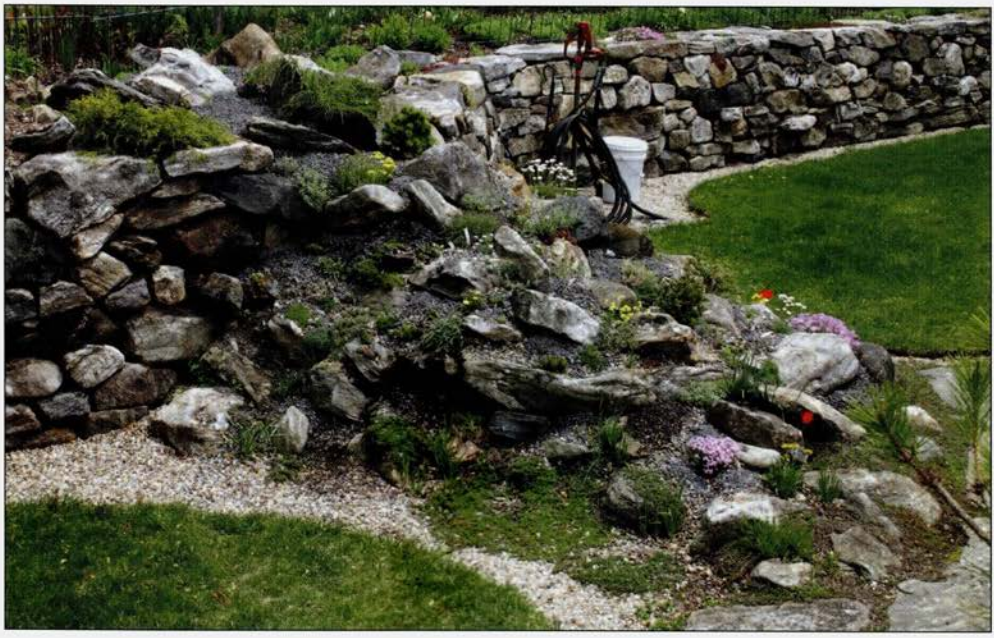
Almost any alpine meadow has louseworts (*Pedicularis* spp.), and here we have two. All louseworts are semi-parasites on a variety of plants, but they have their own chlorophyll. Their roots use special cells (haustoria) to draw water and nutrients from the host, so they fade quickly when picked. *Pedicularis foliosa* is a tall plant (to 70 cm) with long-stemmed, feathery leaves and bright yellow flowers. Equally tall is *P. recutita*, distinguished by its conspicuous dark blood-red flowers.

In the daisy family (Asteraceae), *Senecio nemorensis* subsp. *fuchsii* has a stem covered with dense, lance-shaped leaves, to 1.5 meters tall, bearing an umbel of dark yellow flowers. Avoided by cattle, this groundsel is one of the few plants to compete with nettles and rumex in manured pasture. The Austrian leopard's-bane (*Doronicum austriacum*) has broad leaves and large (to 7 cm in diameter), many-rayed bright yellow flowers. It grows on both lime and silicate substrates and is frequent in the Alps. *Rhaponticum scariosum* is a large perennial with woolly stems and broad basal leaves, downy on the underside; its flowerhead is reminiscent of an artichoke in rosy pink. It is a rather rare plant.

The Old Rock Garden

Opposite the alpine herb field, in a long ditch, we come across an area that has been cultivated since the early days of the Alpine Garden. Where it begins, to the right of the path, are the majority of plants established in the early days. In sunny spots where snow melts early, plants that prefer dry ground have survived. *Centaurea uniflora* is a white, woolly plant to 40 cm tall, with solitary flowerheads of reddish purple. Its spherical, hairy fruiting heads are conspicuous well into autumn. It inhabits dry, stony meadows and pastures to 1500 meters and higher in the southwestern Alps. The silver or weather thistle, *Carlina acaulis*, likes sim-

Drystone retaining wall in Robin Magowan's garden (p. 163), with the "landslide" feature shown below. (Photos, Juliet Mattila)



Two views of Robin Magowan's crevice garden (p. 164). (Juliet Mattila)

The "androsace meadow" in Robin Magowan's rock garden (p. 165). (Juliet Mattila)

Plants in the Magowan garden: left, a *Dianthus* wedged between rocks; right, *Draba rigida*.

Some typical plants of the Mt. Patscherkofel Alpine Garden: above, *Aster alpinus* (p. 173; photo, Zdenek Rehaček); below, yellow *Gentiana punctata* and purple *G. purpurea* (p. 176; photos, Wiert Nieumann).

Two tiny plants that can be seen in the Mt. Patscherkofel Alpine Garden are *Leontopodium alpinum* var. *nivale* (above; p. 172; photo, Wiert Nieumann) and *Linaria alpina* (p. 173; below; photo, David Dobak).

Cajas Lake in the equatorial Andes (p. 195). (Photos, Jane Grushow)

Plants representing interesting South American genera in the equatorial Andes include *Chuquiraga jussieui* (left, p. 197) and *Halenia weddelliana* (right, p. 197).

Oritrophium crocifolium (left, p. 197) and *Viola pygmea* (right, p. 196) in the equatorial Andes. (Jane Grushow)

puya clava-herculis (p. 197).

The cushion-forming *Plantago nivalis* in Ecuador (p. 196). (Jane Grushow)

Details of the alpine house renovation in the E. H. Lohbrunner Alpine Garden (p. 199): left, construction of interior wall; right, detail of irrigation system. (Brent Hine)

The Lohbrunner Garden alpine house before the renovation. (Brent Hine)

The renovated interior of the alpine house, looking north from the south end.

Two special plants grown in the Intermountain Habitat under glass are *Astragalus newberryi* (above, p. 202) and *Lepidium ostleri* (below, p. 203). (Brent Hine)

Gentianopsis crinita and stages in raising this and related species from seed under lights (p. 209). (Photos, Gene Mirro)

Silene acaulis in the Bighorn Mountains, a form praised as an "architectural" plant (p. 207). (Photo, Iza Goroff)

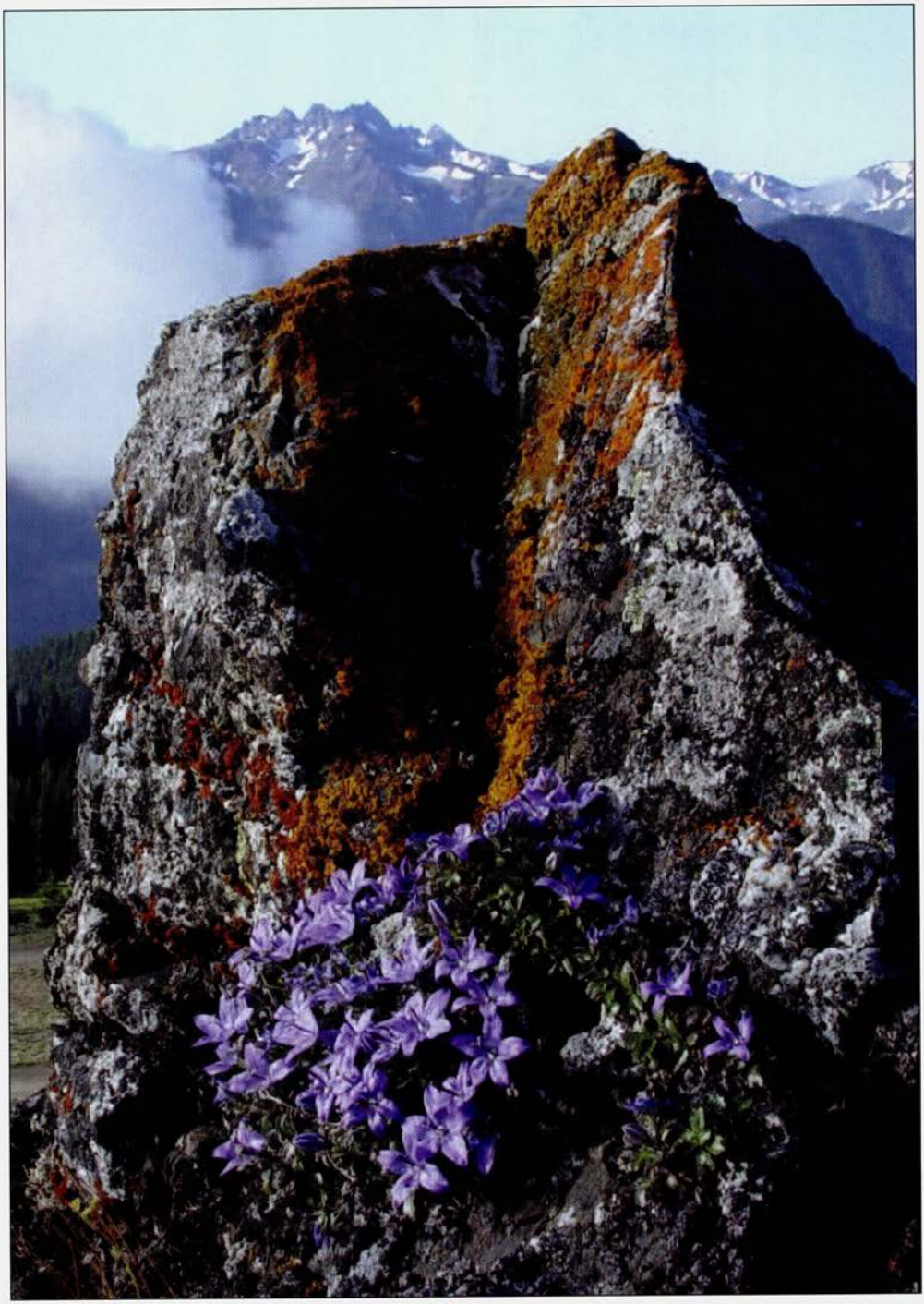
Alpine meadow of *Geum triflorum* (p. 219); note the characteristic small plant and reflexed petals distinguishing it from *G. rivale*. (Iza Goroff)

Aquilegia saximontana (above) and *A. scopulorum* (below), here in the Denver Botanic Gardens, are names often mistakenly applied to other species or hybrids in the Seed Exchange (p. 218). (Photos courtesy of Denver Botanic Gardens)

Compare flowers of all-blue *Aquilegia bertolonii* (left; David Sellars) and typical blue-and-white *Aquilegia flabellata* (right; Ruth Happel) (p. 218).

The real *Allium narcissiflorum* (above left; p. 220; photo, Zdenek Rehacek) and *Bellevalia pycnantha* (above right; p. 218; Jane McGary).

Often confused in seed exchanges (p. 218) are *Geum montanum* (above left; photo, Stefania Wajgert); *Paradisea liliastrum* (above right; David Sellars); *Anemone multifida*, red form in the Tetons– the yellow form is more common in gardens (p. 219; below left; Jane McGary); and *Ourisia coccinea* (p. 220; below right; Ruth Happel).



Campanula piperi, an endemic of Washington's Olympic Mountains, photographed by David Sellars, received third prize, class 2, in the 2007 Photo Contest.

ilar locations. It forms a basal rosette of spiny, serrated leaves. An individual flowerhead is up to 12 cm wide, straw yellow surrounded by shiny white bracts. Only during sunny, dry weather do the bracts open up, closing in the evening or in wet weather, hence its common name. Even when detached from the plant, the seedhead continues to do this. It is a monocarp, dying after seeding.

At the lowest point of the garden, before we enter the timber forest, we find a great mass of *Arnica montana*. From a basal rosette of leaves, a stem to 60 cm tall rises in July and August with big, orange-yellow flowers. This is the only species of *Arnica* in our region, but more than 30 species are found in Eurasia and North America.

A small pond forms the end of this area. Here we find different bog plants well adapted to these wet places. In spring the banks of the pond are covered with the yellow-flowering globeflower (*Trollius europaeus*), followed by the woolly tufts of different cottongrasses (*Eriophorum* spp.).

Green Alder Brushwood

The green alder, *Alnus alhobetula*, forms persistent, very dense thickets 3–4 meters in height. It requires much water and survives only where that is available. These areas are generally too wet for the mountain forest trees or are snow-covered for too long. Clay soils are prone to erosion on steep slopes, so green alder plays an important role as a soil-holder and pioneer. The undergrowth of an alder thicket is a motley mixture of tall forbs, depending on available sunlight and moisture.

Here the white helleborine, *Veratrum album*, is particularly in evidence. Up to 1.5 meters tall, it has a shaft composed of leafy sheaths folded one into the next. The deeply pleated leaves are felted underneath. Individual flowers are star-shaped and funnel-form, white and held in a very large branching panicle. It is very poisonous and, out of flower, can be confused with the yellow gentian. It is a much-hated pasture weed because calves, kids, and lambs frequently die from eating it.

Limestone Rock Garden

Beyond a small bridge we find another feature, created in the 1930s with limestone from the other side of the valley, laboriously collected, transferred to the valley station, and brought up by cable car. Some plants have chosen limestone for its high pH and fast drainage and have adapted to this special habitat. While lime-loving plants are not competitive on acid soils, acid-loving species can occur in lime regions with a sufficiently thick humus layer. Lime-seeking plants are encouraged here by substantial use of limestone rubble (and concrete) in the building of the steps.

Pinus mugo, a dwarf pine, can settle on patchy, dry, stony silicate slopes but is far more conspicuous in the impenetrable brushwood communities typical of the limestone Alps. It can achieve 3.5 meters in height and can even grow on vertical cliff faces. The same applies to *Juniperus communis* subsp. *alpina*, which forms its most impressive colonies on lime. This alpine subspecies is distinguished from the common juniper by its shorter needles and grows to 60 cm. The fruits of both species are

used to season food and gin. Only in the western Alps and on limestone do we find *Pinus uncinata*, which replaces *P. cembra*. It grows up to 2400 meters on hot, dry, stony slopes and is especially resistant to being buried in moving screes: one finds plants whose trunks have gradually become covered by meters of scree.

A Snowmelt Site

Leaving the limestone group, the path leads across a ditch back to the foot of the steps. Here a lot of snow is dumped in winter, so even at the end of June parts of the ditch retain snow. Although we find more colonies of the dwarf snowbell, *Soldanella pusilla*, a member of the primrose family, here in high summer, they are overgrown and replaced by some of the tall forbs mentioned above. The delicate snowbell is one of the most impressive alpine flowers because it can grow through the snow. Its ability to do this results not so much from the heat of respiration than by the absorption of solar heat through the red-violet buds and flower stems. The flower is split about a quarter of the way into a fringed bell. Growing on lime-free humus saturated with water, the plant is hard to find.

Visit the Alpine Garden and the Botanical Garden

The Alpine Garden is open daily from June through September, from 9 a.m. to 5 p.m., and entrance is free. For further information, visit the Botanical Garden in the city of Innsbruck, Sternwartestrasse 15. The public park can be visited free daily and includes a collection of medicinal and poisonous plants, a geographically and geologically arranged rock garden, and the systematic area, where different hardy plants are ordered according to taxonomic families. The huge tropical greenhouses are open every Thursday from 1 to 4 p.m. and each first Sunday in the month at the same time. Visit our home page, http://bot-garden.uibk.ac.at, for more information and pictures.

Peter Daniel Schlorhaufer is Head of the Alpine Garden at Mt. Patscherkofel and associated with the Botanical Garden, Institute for Botany, University of Innsbruck, Austria. This article was adapted from the English-language version (translated by Philip Herdina) of the informational booklet he wrote for visitors to the Alpine Garden.

Mr. Schlorhaufer has kindly sent copies of similar booklets describing nearby alpine botanic gardens in the Tirol region: Alpengarten Hahnenkamm Reutte and Alpengarten Kitzbüheler Horn. Innsbruck is a good base to visit these sites as well. Just across the border in Italy is another group of alpine botanic gardens at Cansiglio, Monte Faverghera, Monte Corno, and Monte Civetta. These are described in another handsome color booklet, Una rete per i giardini botanici alpini della montagna veneta (A network of alpine botanic gardens in the mountains of the Veneto), in three languages. It's a little difficult to tell how to get it, but one might inquire of the e-mail address given on the copyright page: foreste.cansiglio@venetoagricoltura.org

A Visit to the Equatorial Andes

Jane Grushow

While visiting Ecuador in December of 2006, my husband, Ira, and I took a side trip to the lovely old colonial town of Cuenca in the southern highlands. We had been staying in Guayaquil at sea level, and on the way out to Cuenca, we were too stunned by the cold and quick ascent to 12,000 feet to pay much attention to the country we were passing through, other than to notice there was some pretty spectacular scenery outside the car windows.

After a few days in Cuenca we were better adjusted to the altitude and ready to pay more attention to the mountains we were to pass through on our way back to Guayaquil. Our guide was Genaro Palacios, who, besides having excellent English, was very knowledgeable about the plants of the Cajas National Park, which we about to explore. The park is part of a neotropical ecosystem called the *paramo*, consisting of grassland and dwarf forests. This vegetation community occurs at or above the treeline and can be found at different elevations from Venezuela to Peru. Although we were only 2.5° south of the Equator, it was quite chilly at 12,000 feet. However, we were prepared for the cold, and I had my camera at the ready, not knowing quite what to expect. The day was not sunny, and the surrounding mountainsides had a bleak, heathlike appearance. The ponds and lakes we saw did not look inviting (photo, p. 182).

Our first stop was the park office, from which there was a short trail. Though from a distance the ground looked quite barren, at my feet were some very interesting compact plants, many of them in bloom: I was in Rock Garden Paradise. The trail round the office was short, but it offered a multitude of fascinating flowers. The first was a compact rosette hugging the ground with a central cluster of many small, creamy white flowers. Genaro told me that it was *Valeriana rigida* (back cover); the paramo is home to at least 12 species of *Valeriana*, both herbaceous and shrubby. At first I didn't understand his pronunciation, so he would write down the genus and sometimes the species as well. The next plant was a sort of orange-and-yellow-striped balloon flower. "Gentian," Genaro declared, and I later discovered that it was *Gentianella hirculus* (back cover). A little farther down the path was a little, starry, clear blue flower which even I recognized as a gentian; it turned out to be *Gentiana sedifolia*.

Another easily recognized plant was the bromeliad *Puya clava-herculis* (p. 183). Nearby was an odd-looking fern, *Jamesonia goudotii*, which had single foot-long fronds emerging from the ground with a fiddlehead at the top.

Our next stop was a strange place indeed, which Genaro called the Paper Tree Forest. This particular ecosystem, dominated by *Polylepis reticulata,* is quite rare now, having been reduced to a few remaining patches. It is a sort of elfin forest with tangled undergrowth, and the paper tree seldom reaches more than 25 feet. I felt as though I had been transported into an Arthur Rackham illustration and quite expected to find goblins and elves nestling in the hollows under roots and rocks, so magical was this place. Next we came across a shoulder-high shrub with amazing blue berries, a member of the *Polygalaceae*, *Monninia crassifolia*. As we emerged from the forest, we saw a *Bomarea* with drooping orange flowers, very like its close relatives in the genus *Alstroemeria*. Farther on there was what looked like a holly, but even Genaro was stumped by it.

The trouble with serendipitous botanizing is that, delightful as it may be, one is totally unprepared and has neither background information on the ecosystem nor useful flower guides. Our ultimate destination on this trip was the Galapagos Islands, for which we had a whole library of guides, but not a word on the paramo. My camera was to be the main tool of identification. If the photos were good enough, I would have a chance of identifying what I had seen when I got home. In Quito I was able to pick up a copy of *Flores Silvestres del Ecuador*, mainly pictures of flowers, and though the text was in Spanish, most of the plants had botanical names given. It was a start. On returning home I discovered that the Missouri Botanical Garden (MOBOT) website has a special page on plants of the paramo, and specifically of Cajas National Park. Using the illustrations on this site, I was able to find the genus and species of almost all the plants we saw at Cajas and at Cotopaxi National Park, another paramo site we visited later. And what was that mysterious holly? The MOBOT site listed a *Berberis*, and although the specimen I saw was not in bloom, I suspect that was what it was.

Emerging from the elfin forest, we went along a trail flanked by cushion plants I took for an *Azorella* and came upon a familiar plant, a *Castilleja.* I am not sure of the species, as *Flores Silvestres del Ecuador* lists *C. arvensis* whereas the MOBOT site lists only *C. fistulosa.* All of this underscores the trouble one has with identifying plants from pictures. Botanists get quite exasperated by us photographers, who expect genus and species from a picture when we should be quite grateful just to discover the family. The cushion plants I had identified as *Azorella* are a case in point. Genaro was shaking his head at this pronouncement and wrote down *Plantago rigida* in my notebook, which I promptly forgot about. When it came time to label pictures of the cushion plants, they all got labeled *Azorella* because this was a plant I was familiar with. When I finally looked up Genaro's notes, there was *Plantago rigida* (p. 184). *Azorella* is present in the paramo, and I did see it later in bloom, but the pictures I took at Cajas were definitely of *Plantago*. The shots were close enough to see that the leaves fit the description of *Plantago* on the MOBOT, site so I could make a positive identification.

Along the path were exquisite alpine tapestries, dense sheets of an unidentifiable succulent with other alpine gems pushing through. One ericaceous plant I was able to identify was *Disterigma empetrifolium*. As we were wandering down this path, I thought of Kim Blaxland, the *Viola* expert. She had traveled to South America and always brought back wonderful pictures of rosulate violets, so I asked Genaro if there were any *Viola*. I was answered with a smile and "Yes, at the next stop."

The next stop was a pull-off from the road with a large sign announcing that this was the Continental Divide. There was as short trail up to the top of the ridge, and along the trail, nestled against a pile of rocks, was a charming clump of Violets, *Viola pygmea* (p. 183). It was not a rosulate violet, but a thrilling find nevertheless. While I was busy photographing the violets, Genaro was searching among the short grasses for something far more important. Finally he found the signature plant of Cajas. I had seen a picture of what looked like a yellow *Aquilegia* on the park signs, and here it was. But when I said "*Aquilegia*" to Genaro, he shook his head—"No, it's a gentian"—and wrote very firmly in my notebook "gentian *Halenia weddelliana*." Oh, sure! But he was right; it was the first thing I checked on the MOBOT site, although there it is listed as *Halenia serpyllifolia*. Its spurred flower form is an amazing example of convergent evolution (p. 182). Cajas had many more interesting plants as well as interesting birds and other wildlife; we saw a few llamas frolicking in the long grass as we left the park, but it was time to move on.

After a wonderful week cruising around the Galapagos Islands, our group, organized by the Sierra Club, was back on the mainland, and our group leader, Viv Spielbichler, had arranged an excursion to Cotopaxi National Park. The volcano was wreathed in cloud that day, but Viv had organized the trip mainly for the birdwatchers in the group. There was a small museum at the entrance to the park with exhibits showing some plants we might find in the park, many of which I had already seen in Cajas. In fact, outside on a bank next to the parking lot was a lovely clump of *Gentiana sedifolia*. The park was another example of the paramo community and had a gentian I hadn't seen before, *Gentianella cerastioides*, and some of the shrubby valerians. There was an abundance of cushion plants; both *Plantago rigida* and *Azorella pedunculata* grew on the bank along the trail, and the latter was it bloom so it could be positively identified. Many members of the Asteraceae (composites) were present. One plant looked very much like a *Bidens* and another was reminiscent of a dandelion; the latter was *Hypochaeris sessiliflora*, but the *Bidens* lookalike remains a mystery. *Oritrophium crocifolium* (p. 183) reminded me of the celmisias I had seen in New Zealand. It had dark green leaves thickly covered with silky hairs, and a single white flower. Also present and in bloom was *Geranium multipartitum*. As I was busy photographing all my new finds, the rest of the group got well ahead of me and started shouting to me to catch up because there were interesting plants ahead. When I joined them they proudly showed off a lovely shrub with big orange flowers that reminded me of proteas or perhaps banksias that I had also seen in the Southern Hemisphere, but later research showed that it was another composite, *Chuquiraga*

jussieui (p. 182). Once that was recorded for posterity, I was shown a little yellow flower in the grass; it was the renowned *Halenia*, so I got one last shot of that. Our trip to Cotopaxi was a great success, not least because a group of avid birders had become interested in plants.

I would recommend highly a botanizing trip to this part of the world, especially because the flora is so diverse. Six different ecosystems are described in *Flores Silvestres del Ecuador*. Go fully informed about the ecosystems you are to visit, and take the proper guidebooks.

Jane Grushow gardens in Ephrata, Pennsylvania, and is well known for her garden and botanical photography.

Polemonium pulcherrimum. Drawing by Doretta Klaber.

The Intermountain Habitat in the E. H. Lohbrunner Alpine Garden

Brent Hine

Ever since the first botanical gardens were created, there has been an accompanying need to practice good stewardship. In spite of the mindful efforts of many along the way, there has likely never been one that has evolved along a straight and narrow path from sod turning to distinguished repository of horticultural diversity. For example, in the early 1980s a stormy recession blew across North America. Its financial fallout affected the University of British Columbia's botanical garden and forced the sudden layoff of approximately one-third of its staff. Unfortunately, it also compelled the closure of the glass display house at the E. H. Lohbrunner Alpine Garden, part of the University of British Columbia Botanical Gardens in Vancouver (photo, p. 185).

Thirty years onward, a new garden exhibit has emerged out of the remnants of the former alpine house. From the beginning, we needed to work out the most appropriate destiny for the long dormant structure. Discussion ran the gamut from razing to renovation. If renewed, what form should it take? Points to bear in mind were long-term maintenance costs, research appropriateness, and of course public interest. Fortunately, the enlightened choice provided for its metamorphosis into a one-of-a-kind exhibit that we hope will become a visitor destination: a permanent habitat for representative flora of the Intermountain region of western North America.

In elementary outline, the Intermountain region comprises a dryland biome within the physiographic boundaries of the eastern Rocky Mountain chain, the severely arid southern deserts, the northern mountains and forests, and the essential precipitation-blocking Pacific Coast and Sierra Nevada/Cascade mountains to the west. Within this massive rain shadow exist many well-defined environments. One of these, the shrub-steppe grassland, is evocative of the American "wild West." British Columbia province's southern interior biome is unique in Canada in also containing a stub of Intermountain provenance. Within this truncated landscape of northern aridity, numerous plants sharing affinities with those in the south are found. *Calochortus macrocarpus* and *Ipomopsis aggregata* are just two examples of perennials found both in southern B.C. and throughout the Intermountain region. *Pinus ponderosa* is a distinctive conifer whether in B.C. or

Utah. Once examined, the list of north-south botanical similarities is surprisingly deep, and an intriguing basis for closer investigation.

Following the prescription that exotic plants tend to thrive when grown in conditions similar to their native ones, the house is a suitable environment for growing steppe and semi-arid plants of appropriate scale. They are to be grown directly in beds containing soil 60 cm/24 inches deep, allowing most root systems to reach natural depths, while overhead cover keeps plants far drier than they would be in the open ground. Two wall vents, one along each entire side (12 m/40 feet), one full-length roof vent, and several ridge vents are left wide open throughout the year, allowing convection currents to escape and cooler air to be drawn in. Humid winter air is not a serious issue, and summer humidity averages about 65%, which is easily tolerated by most plants. All vents are left wide open all year except during extreme weather episodes. The controlled environment allows plants to remain winter-dry and summer-warm, fostering growth and habituation.

A major appeal of the habitat is that it is a new feature *within* the alpine garden landscape. This was accomplished by integrating the adjacent landscape right into the structure. A small upsloping hill immediately east of the house was backfilled with lean, gravelly loam. The hill then enters the house all the way along the east elevation, just under its glazing and wall vent, burying the foundation and ending in a low rock wall at the central path.

Before this could be achieved, however, the initial preparation involved gingerly removing old asbestos cladding as well as the two end doors and concrete pathway. All that remained was the stripped aluminum frame and glazing on the cement foundation. Then the rockwork began. Plenty of angular pyroxene andesite (the Alpine Garden's main rock type) was stockpiled from a nearby unused terrace. Two dry stack walls were built, 2 feet/60 cm high, along the length of the house on either side of the path. An exterior wall was added last to complete the west elevation, facing an adjacent trough courtyard. The two inner habitat walls provide many opportunities for niche plants. After more gritty soil was installed, the result was two inward-sloping beds, one facing the afternoon sun, the other receiving gentler morning sun (photo, p. 184).

An appropriate method for irrigating dryland plants in a humid climate needed careful consideration, as south coastal B.C.'s summers are barely warm by Intermountain standards. Local climate is further mellowed by the garden's site adjacent to the Pacific Ocean, so that daily temperatures rarely reach 30° C/86° F. Nevertheless, the habitat environment can exceed 40° C/104° F for short periods on summer afternoons. Most Intermountain plants aren't troubled by this, yet they must receive sufficient moisture at crucial growth stages. Imitating the sometimes sudden, dramatic Intermountain rainstorms inside the habitat was not suitable. The irrigation delivery system chosen is micro-irrigation, with low to moderate flow that allows sufficient water penetration into the soil while avoiding the runoff that can come with nature's offerings. Perhaps this is only a way of tweaking Intermountain precipitation to imitate our West Coast rainfall style—but it seems to be effective!

The layout and installation of the system itself was simple. A control box is set into a bed at one end, flush with the surface. It receives the main garden inflow, which is then reduced to a ½-inch diameter pipe. From there, a Y-junction diverts half the flow to the opposite bed. Flexible polyvinyl spaghetti tubing is laid out along the length of both beds, while 180° directional emitters 30 cm/12 inches high, with on/off valves, are attached every few feet. The tubing is buried close to the beds' inner edges to deliver an even spray coverage over the entire area, directed away from the central path. Installation was so straightforward that it has become easy to forget just how integral proper irrigation is to the long-term stability of this important plant collection.

Another significant question involved fulfilling the water needs of a wide variety of selected plant material. This is accomplished in two ways: first, through correct placement in any of the myriad niches in and around the rocky beds. While most plants require as much sun as available in the Pacific Northwest, others may prefer vertical shade. A few benefit from bright morning light, while still fewer profit from being nearer an irrigation emitter. Getting this right the first time and not having to disturb plants by removing them to better locations requires firm understanding of their ecological requirements. Once an entire collection becomes established, the water volume delivered will be between 300 to 650 mm/12–25 inches over each growing season. To a lesser degree, this is also based on local environmental conditions (drier or wetter growing seasons). Of the yearly total, an ample portion is applied to imitate the timing of spring rains (from early April), with sporadic applications through summer and into late fall. A final deep soaking is dispensed in mid-October before the main garden's irrigation system is shut down. From the first summer it has proven useful to monitor the habitat on warm mornings and during extended dry spells, eliminating the need for a timer. By late November, the typical local winter pattern of stationary low pressure just offshore settles in. This results in many short, dull, cool, humid days to cope with before spring. The soil is allowed to become almost dust-dry concurrently with decreasing light and daytime solar heating. It is then irrigated once more by hand, and yet it will dry again completely in another month. Although midwinter light levels are much lower than in the Intermountain region and temperatures remain mild, respiration continues and hand watering is done during dry weather breaks. Wetting the foliage is carefully avoided when irrigating at this time of year.

Finally, not as critical but worth mentioning in tandem with irrigation delivery is the timely application of correct fertilizers. At planting time (usually spring), plants are given a small dose of 6-8-6—something mild to stimulate development. Once a year from the second autumn, it is planned to spray them twice, about two weeks apart, with a solution of potassium sulphate. This will benefit the plants by helping them endure dry soil, form sturdier roots, start next year's flower buds, and generally toughening them against hard frosts.

As the renovation details were being planned, it was great fun to research the representative plant material. A crucial stipulation is that as much as possible should be of documented wild origin, in keeping with the garden's research

mandate. To keep the collection to scale, most of the choices are perennial, with some obvious exceptions—no big sagebrush just yet, thank you! Two prominent Intermountain plant families were investigated first, Asteraceae and Polygonaceae. *Antennaria umbrinella* was selected from seed collected at 8900 feet/2700 m on Steens Mountain, Oregon, and has already formed a broad silver mat. *Erigeron compactus* (seed collected in Emery County, Utah) is also a good fit; even in early February, it opened one pink bloom, and by April it is studded with them. Larger perennials are utilized also, but as perimeter plantings on the adjacent hill. *Balsamorhiza hookeri* was an obvious choice and has been installed just under the protection of an open side vent.

Among xerophytic shrubs, several choice *Eriogonum* taxa were considered. This important genus is so flush with beautiful and growable plants that it was a challenge to choose well! First among them were *E. caespitosum* (collected by me in Lamoille Canyon, Ruby Mountains, Nevada), *E. douglasii* var. *meridionale* (yet to be described), and *E. gracilipes*. Mostly I chose from the mat-formers of subgenus *Oligogonum* to begin with.

Another important family is Fabaceae (pea family), and from it *Astragalus*, *Lupinus*, and *Dalea* species were scrutinized. *Lupinus excubitus* subsp. *austromontanus* had already grown into a magnificent "antique pewter" garden ornament, but before it could outdo its foliage and flower, it suddenly departed for drier lands. I had been looking forward to it living up to its "grape soda lupine" moniker. Not to be outdone, Thompson's Dalea (actually *Psorothamnus thompsoniae*) is described in the Intermountain Flora as a "microphyllous shrublet with terminal racemes of vivid purple flowers." You can tell that I am really anticipating intense colors. This dalea may prove a bit large but could easily be propagated for future use around the perimeter. *Astragalus newberryi* var. *castoreus* (photo, p. 186) is a perfect Intermountain biome match. It had already rewarded my choosing it by producing beautiful pink blooms, yet by last winter it too imploded into a dry, moldy pile. So far it is evident that many plants will not be satisfied in cultivation here, but they are certainly useful to experiment with and learn from in the Pacific Northwest climate. And growing them under cover, I am always willing to try, try again.

The bulbous Intermountain flora is diverse and usually colorful, punctuating the landscape with cheerful notes. I began by investigating Liliaceae and *Allium* by choosing *A. nevii* (syn. *A. douglasii* var. *nevii*). It has small, narrow leaves; its umbel is not large but makes up for that by offering up to 30 pink flowers. It picks up early moisture near the habitat's edge and then disappears in the summer heat. *Fritillaria pudica* is a widespread plant, yet one that just doesn't thrive in the open garden. While visiting Steens Mountain in July 2007 I found seed of it and also of its swarthy cousin, *Fritillaria atropurpurea*.

Besides many good *Phlox* species that I chose, another unusual member of the Polemoniaceae that is already thriving is *Aliciella subnuda* (syn. *Gilia subnuda*), Coral Gilia, from southeastern Utah. It loves the extra warmth in the habitat. This biennial (for me) grows a dark green, filigreed rosette the first year and flowers and seeds profusely the second.

As for *Penstemon*, the throng of species (100 or more) in this dominant Intermountain genus made selection a challenge. To whittle down the possibilities, I studied the sections (variously subgenera and series). This led me into series Humiles, which links the B.C. native *P. pruinosus* with *P. tusharensis*, a restricted endemic in Utah. Both are now doing well in the habitat. *Penstemon pruinosus* technically does not exist within the Intermountain region, but it thrives in the drylands east of the coast mountains in southern B.C. and Washington. Other penstemons with interesting or unique qualities include *P. gairdneri*, *P. pachyphyllus*, and the Steens endemic *P. davidsonii* var. *praeteritus*. It would be a simple job to fill an entire habitat with choice dryland penstemons!

There are many more plants that I happily chose. A handful are *Arctomecon merriamii*, the brilliant white Bearpoppy; fleshy *Phemeranthus spinescens,* and *Lepidium ostleri* (p. 186). The last was supplying abundant creamy white, ground-hugging, softly fragrant blooms in early spring 2008. Even a modest assortment of cacti (e.g., forms of *Opuntia fragilis*) are being cultivated, evocative of the dry country and alluring to visitors.

Last on my list yet perhaps most intriguing to me personally are selections from the hemiparasitic genus *Castilleja*. As with Penstemon, its center of distribution is firmly within the drylands of western North America. Many of us who have seen them growing seemingly everywhere—in mountain meadows, among desert shrubs, or on roadsides—have been entranced by their eye-catching displays. Moreover, their study and culture could fill a volume, whether book or habitat. Their notoriety and scarcity in gardens lie in their resistance to easy cultivation, yet with experimentation, many should satisfy our efforts. I collected seed of several xerics, including *C. pallescens*, *C. elmeri,* and *C. linariifolia*, in the Intermountain region during 2007, along with seed of several potential host plants (*Festuca* or fescue, *Astragalus*, *Eriophyllum*, *Lupinus*, etc.). Recently on a late winter morning I began by combining a few of them in small pots, the first step in a cultivation strategy. Most are destined for inclusion within the habitat, but I'm also curious to try them in the open in reasonably fertile, summer-dry soil. Encouragingly, there is also some solid information available on cultivation techniques in the *Rock Garden Quarterly* and other sources. Without including a full and separate plant list, I hope this brief collections outline will help put some flesh onto the bones of the renovation I've described.

With Thanks

As the habitat's second spring arrives, it is thrilling to see its plants rise and bloom, slowly filling it with wonderful forms, textures, and colors. Turning this concept into reality was realized through a consensus of the botanical garden's management and staff. We agreed that something positive could be done with a sound structure that could enhance the alpine (and botanical) garden and its profile, engage the academic audience, and educate the horticulturally minded public visitor. The lion's share of funding was provided by an extremely patient NARGS Administrative Committee from the Norman Singer Endowment Fund.

Generous funds also came from the Alpine Garden Club of British Columbia and the UBC Botanical Garden's enthusiastic Friends of the Garden volunteer group. My humble thanks go out to all who contributed to this project's successful completion. The Intermountain Habitat is an addition to existing repositories of horticultural diversity built from the struggles of many along the way. Creating it has been a satisfying challenge. Come and see it sometime!

Resources

Flora of North America, http://hua.huh.harvard.edu/FNA/

Eriogonum as a Rock Garden Plant, http://www.plantsystematics.org/reveal/pbio/eriog/eriogarden.html

E-Flora BC: An Electronic Atlas of the Plants of British Columbia, http://www.eflora.bc.ca/

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Brent Hine works as curator of the E. H. Lohbrunner Alpine Garden, a part of the University of British Columbia Botanical Garden and Centre for Plant Research, Vancouver, B.C. (www.ubcbotanicalgarden.org). When he's not focused on alpines his eyes are on the skies through a telescope. His plant explorations have taken him not just to the North American West but also abroad in search of choice new introductions. He is a co-author of *The Jade Garden: New and notable plants from Asia* (Timber Press, 2005).

Architectural Plants

Sasha Borkovec

One of the criteria for selecting a plant suitable for the rock garden is its appearance before and after it blooms. Since for most plants this means the major part of the growing season, this question is an important one, sometimes even critical, for accepting or rejecting a candidate for space, which in every garden older than three years is invariably in short supply. Although almost any plant can look good in some setting, the settings available in most rock gardens are limited by aesthetic and practical constraints. Nature, which is frequently taken as a model and prototype to be followed, is seldom useful for lowland rock gardens where climatic conditions and general physical dimensions are vastly different. Intermingling of several different species in a small pocket or crevice is quite common in the alpine environment but usually deadly in the rock garden, where many of the same plants insist on some segregation to increase their share of light and decrease the incidence of disease.

Each plant then has to be judged on its own merit, and here is where the concept of **architecture** comes into play. It is a purely manmade notion that some plants but not others possess certain harmonies of shape, structure, and leaf texture that make them attractive even in the absence of flowers. In fact, for some architectural plants, such as certain artemisias and santolinas, it is frequently recommended to remove all flower buds because they detract from the plants' beauty. The colors of leaves and their changes through the season are also important factors in making the choice, but spatial considerations usually prevail. Most rock gardeners, whether they know it or not, are employing architectural criteria when selecting and growing many plants that have insignificant flowers or don't bloom at all. Dwarf trees, especially conifers, are perhaps the best-known examples that every rock garden contains. Even more interesting is that the choices made by many rock gardeners entirely innocent of architectural knowledge are nevertheless fairly uniform. Rock gardening itself seems to induce a certain sixth sense for what is right or wrong for a given plant, and what should or shouldn't be planted next to it.

There are, of course, notable exceptions resulting in equally notable disagreements, especially among influential but idiosyncratic writers. Take, for

example, the recognized dean, or perhaps patron saint, of rock gardening, Reginald Farrer. This is how he describes the genus *Hebe*, then called "Australasian veronicas": "repellent leathern bushes with hard dead-looking foliage often of a metallic cast-iron look," and then, "these almost indecent bushes—plants that are no plants, but lifeless imitations of living things, forged by Hephaestus out of dark metals in the underworld" (*The English Rock Garden*, repr. Theophrastus, 1975, vol.2, pp. 421–22). However, as he almost grudgingly admits in the same paragraph, there are some "rock-jewels" and "treasures" among them. In this country, few people are growing hebes for their flowers; it is their architecture that makes them attractive. Unfortunately, in the eastern United States, north of Washington, DC, most of them (if not all) are not reliably hardy.

What brought up the subject of architecture in these musings was neither a hebe nor a veronica, but a small scree bed in my garden which seldom shows any flowers but still remains attractive almost the entire year. On an area not larger than a dinner plate, six different plants, each at least five years old, grow in apparent peace with each other and the world around them. Three are arenarias: *A. hookeri, A. stellata*, and *A. tetraquetra* var. *granatensis*; the others are *Silene acaulis, Gypsophila aretioides*, and *Potentilla fruticosa* 'Nana'. The last, being a little shrub, has unquestionable architectural qualities, but can the same be said about the others, which are small buns or carpeters of almost negligible height? It can, if you don't mind taking a closer look.

Allow me a diversion here. Many, possibly most, rock gardens are overly shy in one of the three dimensions: height. In most rock gardens, when you want to look at a really small plant or flower, you have to go down on your haunches or knees, or prostrate yourself in some other usually unpleasant, sometimes intolerable or even indecent way. This should be corrected as much as possible. In contrast to nature, where planting is not done according to our wishes, a rock garden is our own construct, and it usually is in our power to create at least a small part of it in such a way as to bring the beds, pockets, and crevices reasonably close to our eyes. In a sloping rock garden, this can be done fairly easily by constructing small retaining walls whose top portion would be naturally elevated over the access path. With care and proper regard to the immediate surroundings, a wall with a series of inclined or flat raised beds can be constructed even on a flat area. There is, of course, an alternate solution. Instead of growing the very small plants in the rock garden, grow them in troughs or similar containers that can be placed anywhere. This is a good alternative, and its advantages or disadvantages depend more on individual circumstances than on some generalized prescription.

But let us return to my plants, which, as you may have guessed, are situated in an elevated bed, on top of a stone wall, about 60 cm/2 feet above the path. Only a slight bending is required to view closely the individual plants. The six little plants are a source of delight for most of the growing season, each distinct in some way, the little buns inviting touch, the shrublet arousing curiosity by its congested growth. But let us examine more closely not only their appearance but also their geographic origins.

Of the three arenarias, the only Rocky Mountain American is *A. hookeri*, a curious conglomerate of short, woody stems ending in small brushes of dark green, needle-like leaves. When not in flower, the plant is only a few centimeters high, with no more than four stems that have developed in as many years. When and if flowering stems develop, the small white flowers in dense clusters sit right above the foliage. When it was planted, just a single stem with a paint brush of foliage, it was fitted into a crevice between two stones, where it still resides.

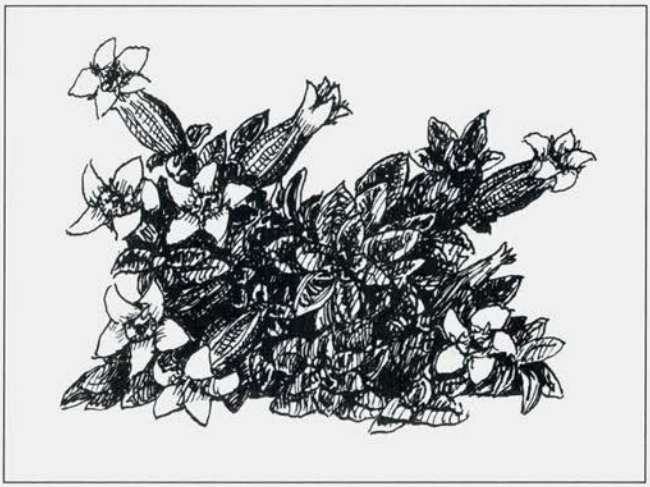
A. tetraquetra var. *granatensis*, as the name (from Granada) implies, is a Spaniard, quite different from most other arenarias in that its leaves, seldom exceeding 2 mm in size, are blunt and ovate. Since it happens to be in our bed just next to the gypsophila, I was amazed to note how similar these two plants were, the only difference discernible with naked eye being the color: rather pale green in the former and silvery gray in the latter. Not only the leaves that form tiny rosettes at the end of stems but also the general growth pattern and rate are identical—not to mention their reluctance to bloom. Both happen to be five years old, form rather irregular, flat cushions, and neither is wider than 5 cm/2 inches. The third arenaria is *A. stellata*, a brilliantly green, shiny, perfectly round cushion composed of tight rosettes of sharply pointed fleshy leaves up to 5 mm long. I don't know how much it blooms in its native Balkan mountains, but the few almost stemless flowers that have developed on one of my other plants were small, watery, and never fully opened—a typical example of flowers that detract from a plant's beauty. Somewhat similar to this arenaria is *Silene acaulis*, this particular variety originating in the Bighorns of Wyoming (p. 188). Its leaves are somewhat shorter and more needle-like, the leaf color is decidedly less sparkling, and the shape flatter and less regular. Although I cannot vouch for the origin of the nursery-bought *Potentilla fruticosa* 'Nana', it may well be from the same locality as the silene; in the Bighorns, these shrubby potentillas can be found in all sizes, from 1-meter giants to 1-cm trailers. Mine is over seven years old and has reached a height of 10 cm/4 inches and a width of 15 cm/6 inches. In winter it has lost all its leaves, showing the intricately dense skeleton that will be clothed in the spring with small, palmate, fresh green leaves. Unlike the regular-size species, this dwarf doesn't turn dark green later in the season.

Because *Gypsophila aretioides* is from the southern Caucasus and northern Iran, it might be concluded that as widely separated as the geographic origins of these six plants my be, they all are from high, sun-baked mountains and should therefore be given the hottest, fully open place in the rock garden. Such advice, however, would be only partly useful in lowland rock gardens with the hot and humid climate for which the entire eastern seaboard of United States is justly infamous. With the exception of *Arenaria stellata*, which does very well in full sun, the other plants I mentioned grow better and live longer with some shade during the hottest part of the day. It is true that the buns of *A. tetraquetra* var. *granatensis* and of the gypsophila are much denser if grown in full sun, but under such conditions they often die before the second summer is over. Besides being slightly shaded, this elevated bed contains rapidly draining, sandy soil, not overly rich in nutrients, and its surface is covered with a thick layer of crushed stone.

Probably it is the combination of soil and exposure that keeps this group alive and well.

The pleasure derived from appreciating architectural beauty of a plant is not exactly the same as that produced by full bloom. In most cases, flowering is a rather brief but almost explosive occurrence; watching a plant change almost imperceptibly through the entire year without any drastic variation in shape or color yields a quiet satisfaction: a difference between laughter and amusement. I wouldn't want to suggest that this little bed wouldn't be nicer if all its occupants burst from time to time into violent bloom, but that doesn't decrease the value of architectural plants. A rock garden wouldn't be complete without them.

Alexej "Sasha" Borkovec gardens in Maryland. His series "Rock Garden Musings" has appeared sporadically in this magazine for a number of years, always entertaining and informing readers about the many choice plants he grows in, as he writes above, a difficult climate for alpines.



Gentiana stragulata. Drawing by Doretta Klaber.

Gentianopsis and *Gentianella* from Seed

Gene Mirro

The fringed gentian, *Gentianopsis crinita*, is native over a vast area of eastern North America (see map). Annual or biennial, it reaches 1 to 3 feet (30–100 cm) when flowering in September or October. It grows naturally in moist areas in full or partial sun, in soils high in lime. It is becoming rare over much of its range.

I have seen several references to the great difficulty of growing this plant in the garden. After much trial and error, I have found a way to reliably grow it from seed with nearly 100% success. I find it much easier than the perennial gentians. This method has also worked with *Gentianopsis grandis* and *Gentianella detonsa*.

Germination

Nearly every Internet source I have read states that the seeds require winter chilling, after which germination occurs in spring. This seems reasonable, since the plant flowers and sets seed so close to winter. However, Norman Deno in his self-published manual *Seed Germination Theory and Practice* recommends 70° F with GA-3 (gibberellic acid) and darkness, with germination occurring in 2 weeks. Many years ago, I asked Jack Poff, head gardener at Portland's Berry Botanic Garden, about it, and he said it would germinate in one month at 60° F. I have tried the winter chilling approach and have had some seeds germinate, but the percentage has always been low. I have also tried sowing them in fall at around 60° F. The seeds then germinate strongly, but the tiny seedlings grow very slowly, and losses over winter are very high. I then decided to germinate them in fall and grow them on under fluorescent light over winter. This method has been very successful: in several lots of seed, 80% or more have germinated and grown to flowering size. They do not require darkness; I germinate them under fluorescent light, and thus, they do not have a chance to get elongated and weak. My experience with gentians is that warm temperatures will weaken or kill the seedlings, so I germinate and grow them at 55°–60° F. Remember that Deno's recommended temperature of 70° F is for germination and may not be the optimum for growing the seedlings.

I am using two techniques that may be new to some rock gardeners (photos, p. 187). First, I sow the seeds in a container and place it in a sealed plastic bag under fluorescent lights. The resulting "terrarium" environment is very conducive to germination. One would think that it would also be conducive to damping off, but I have observed that seedlings grown in the open air show damping off symptoms to a much greater extent than those grown in a sealed plastic bag. I can't explain this. After most of the seeds have germinated (in about one month), I open the bag slightly to allow some air flow. I do not want the tiny seedlings to be wet. Even a partially open bag will be very humid inside, which the seedlings seem to enjoy. After the first true leaves are well formed, I remove the container from the plastic bag and place it open under the light.

The second technique is the use of fluorescent lights in wintertime. I use cheap 48-inch (1.3 m) shop light fixtures with cool white lamps, set up in the basement or in a room that will not get warmer than 60° F. I recommend using some sort of white panels around the perimeter to reflect light back toward the plants; I use rigid white insulating foam sheets. I have been growing seedlings under fluorescents for over 20 years, and I highly recommend it to all serious growers. An endless variety of plants will do well under lights at 60° F. I have had some low-growing alpine plants bloom and set seed under lights in winter—they love the cool temperatures. When the lights are in your basement or living area, all waste heat goes toward heating the house. In any case, the energy cost is very reasonable. I get a lot of pleasure from caring for the plants without having to brave the elements. If you set up your growing area roughly 2.5 feet above the floor, you will find it comfortable to tend. The cheap folding tables available at office supply stores are exactly the right height, but should be covered with a moisture-proof sheet to prevent the surface peeling.

I keep the seedlings growing all winter under the lights. They are tiny and slow, and require several months before they are transplant size. Sometime in spring, I transplant them into 2.25- or 3.5-inch pots, depending on how big they are, and place them under the lights again until they are well established. I then set them out in a cool greenhouse in part shade for a couple of weeks to harden them off. After that, they can take nearly full sun, but do not allow the sun to heat up the containers and the soil. They must not be allowed to dry out, either: remember that they like lime and wet soil. Repot as needed to give them lots of room to develop. The most robust plants will bloom in that fall. Those that do not bloom the first year may be kept in an unheated greenhouse over the winter, to bloom the next fall. If you want to collect seed, you may need to hand-pollinate the flowers. Since the seed ripens very late, greenhouse growing is advantageous.

I find it very difficult to keep these plants alive in the garden in western Oregon. They cannot stand dry soil (summers here are often rainless), and they mysteriously disappear over winter. I grow them exclusively in the greenhouse.

Here is a step-by-step procedure:

1. Make a potting mix of 50% sphagnum peat and 50% perlite, or use your own favorite moisture-retentive mix; they don't seem to too fussy. To each

gallon of mix, add 3 teaspoons of dolomite lime and a teaspoon of bone meal. Place in a plastic bag with a little water, close the bag and knead vigorously until the medium is uniformly moist.

2. Select containers at least 3 inches deep. 4-inch Gage pots work well, and can be ordered from http://www.gageindustries.com. Fill with mix to the top, firm, and refill to within ¼ inch of the top.
3. Distribute seed on the mix, no more than 16 seeds per square inch.
4. Do not cover the seeds.
5. Water lightly to settle the mix around the seeds, using a fine spray, not a watering can.
6. Label the containers.
7. Place the containers in small transparent plastic bags, preferably the type that uses tie wraps.
8. Seal the bags.
9. Place the bags in a shaded place at 55°–60° F, protected from predators. I place them directly under fluorescent lights, about 5 inches below the lamps.
10. Check every few days for emerging growth. Make sure the mix is not getting dry. Some seeds will germinate in a couple of weeks, others in a month or more.
11. When growth commences, feed with a dilute liquid fertilizer and place in a cool (55°–60° F), bright location, such as under fluorescent lights in the basement or in a cool greenhouse. Do not expose seedlings to full sun. I usually leave the pots in the plastic bag until the seedlings are well established, but I partially open the bag for ventilation.
12. Apply liquid fertilizer every couple of weeks. Water regularly; don't let the mix dry out. As the seedlings grow stronger, they can take higher temperatures, but not full sun.
13. When the seedlings are big enough to handle, transplant them into individual pots for growing on to full size. The seedling roots must not be exposed to air for more than a minute, or they will dry and severely damage the plant's chances of survival. For growing on, I use a mix of equal parts soil, fir bark, peat, perlite, and ground pumice, with ¼ part vermiculite added, and some dolomite lime, bone meal, and Micromax trace element mix. If you don't have Micromax, buy some soluble fertilizer with trace elements added, and use it to feed your plants on a regular basis.
14. To minimize transplant shock, place the pots with the newly transplanted seedlings into transparent plastic bags and seal them shut, or cover with clear plastic for a few days.
15. Place the pots under fluorescents or in 50% shade. Water and fertilize regularly.
16. By fall, the plants should be 3–4 inches across, with a basal rosette of leaves.

If the seed does not germinate by winter, do not discard it. Keep the container in the sealed plastic bag in a cold, shaded, protected place over winter and watch for germination in spring. Keep the medium moist.

Those who do not want to bother with fluorescents, can store the dry seed in an airtight container in the freezer and then sow it in spring when the temperature gets up to 55° or 60° F. Follow the instructions given above. This method will produce smaller plants than the winter-growing method, but you can always keep them for an extra year if necessary to get them up to flowering size.

If you can grow other plants with tiny, slow-growing seedlings, you should be successful with these. I don't know why they have such a bad reputation. It may be because the seed is reputed to be short-lived, but I know from experience that this seed kept in the freezer will still be viable after 12 years or more. Or it may be that everyone is using the winter chilling method and losing most of the seedlings. Solution: don't do that. Sow and grow at 60° F.

Good luck!

Gene Mirro of Portland, Oregon, is an electronics engineer.

Gentiana hexaphylla. Drawing by Doretta Klaber.

Where There's Smoke . . . There's Germination

James L. Jones

The article "Smoke in the Water," by Michael K. Young (*Rock Garden Quarterly* 63(2): 124), proposed a method for aiding the germination of "pyrophiles," plant species adapted so thoroughly to the inevitability of grass fires that they have come to depend on the fires' byproducts—smoke and ash—to trigger germination. This situation is particularly prevalent in the South African veldt and the Australian outback, as well as in any other region where fire dominates the ecology. While growers in both Australia and South Africa routinely use commercial preparations that contain the chemical essence of smoke to spur on the germination of such species, as far as I know, and as Young indicates, such preparations are not available in the United States.

Young holds out hope for an alternative: the promising-sounding Liquid Smoke, a widely sold condiment (which is not to rule out other brands that share similar ingredients). His results seemed, to tell the truth, inconclusive. I suspected at the time that this was due to his ignoring the Fifth Law of Thermodynamics: if brute force doesn't work, you're not using enough of it. So I conducted my own brute-force experiments by increasing the strength to a ratio of 1:25 Liquid Smoke to water, rather than 1:100. I divided the seeds of several South African and Australian species into two groups. Group A was soaked in a 1:25 solution of Liquid Smoke in water for 2 hours; group B was sown untreated, direct from the packet.

For the 16 species tested, the results were as follows: in 7 species, group A seeds germinated but group B seeds did not; in 3 species, group A seeds did not germinate but group B seeds did; in 6 species, both groups germinated. Included in group A was *Protea cynaroides* (photo, p. XX).

So yes, I'm convinced that Liquid Smoke does indeed have an effect. What, then, should we use it on? No doubt growers in South Africa and Australia know, but lacking that information, I just go ahead and use it on a portion of seed of any woody plants from those two regions, with the other portion untreated. Extra effort? Well worth it, if it's going to get me the likes of the King Protea mentioned above.

Jim Jones of Lexington, Massachusetts, is a longtime member and former national president of NARGS.

How the Seed Exchange Works

Laura Serowicz

The Seed Exchange is one of the great benefits of your NARGS membership. It is run by a small number of dedicated members, all of whom are vital to the operation of the exchange. It is divided into four stages, or phases. All phases are overseen by the **Seed Exchange Director** (also known as the Seed Exchange Manager or Coordinator), who recruits and coordinates the volunteers from around the country who do the seed packaging (Phase Two) and the two chapters that fill the orders (Phases Three and Four). The Director works with the Seed Intake Manager in writing the instructions for donating and ordering seeds, including helping to find translators for the instructions (instructions are printed in English, Czech, French, German and Japanese). The Director orders and ships the supply of glassine envelopes for the seed packagers in Phase Two (as well as some for Phases Three and Four). The Director sets the target levels (number of packets for each item) for the seed packagers based on previous years' requests and arranges for the seed packet labels to be printed and sent to the appropriate seed packagers. The Director sets the timetable for all the various stages of the Seed Exchange.

Phase One: Seed Intake

(main activity, June through end of December)

The **Seed Intake Manager** receives all donated seeds, records them using the NARGS Seed Exchange Database, and prepares the Seed List Catalog. The Intake Manager also verifies the validity of all plant names in the database, often doing extensive research to insure that the names used in the database are accurate and up-to-date.

The donor form and instructions, which are mailed with the summer issue of the *Rock Garden Quarterly*, are reviewed and revised jointly by the Director and Intake Manager in June and sent to the printer. In order for our foreign members to contribute seed the Intake Manager also prepares copies of the Small Lots Seed Import Permit with the green/yellow APHIS Inspection labels and intake

address labels attached; which are included with the foreign members' donor instructions.

From July through the beginning of November, the Intake Manager receives and records all seed donations. Donors who supply their e-mail address are notified of their donor numbers and of any name changes to their donations. After all the seeds have been received, the seed list numbers are automatically generated by the database program. At this point all the seeds are in bins grouped alphabetically; all the seeds fit in one tall, 3-foot-wide bookcase. The seeds are filed into sleeves (like long manila envelopes open at one end); all the seed packets for each seed list number go in one sleeve. They are sent to the various seed packaging volunteers (Phase Two) in mid-November. The ordering instructions are reviewed and revised jointly by the Director and the Intake Manager before the Seed List Catalog is prepared and sent to the printer by early December. The printer mails out the finished catalogs to the members; foreign members' copies are sent about one week before those to U.S. members to allow for the longer transit time, but eventual delivery is subject to the vagaries of local postal service. All members should receive their catalogs by the end of December. The Seed Intake Manager also coordinates with an Internet Committee member to have the seed list published on the NARGS website once members have received their printed copies.

Phase Two: Seed Packaging

(mid-November to the end of December)

The Seed Packaging is done by eight to twelve groups around the country; some are small groups of members who do not have chapters in their area but wish to volunteer for the organization, and others are individuals within chapters, but it is not necessarily done as a chapter project. Many of the volunteers have done it for years; others may be new recruits. The groups can do it in sessions together and/or have each volunteer take home an allotment of seed to package. The Seed Exchange Director coordinates with the contact person within each group or chapter, making sure they have supplies, especially enough glassine envelopes, and that they understand the instructions for packaging seed. The groups are sent various amounts by seed list number depending on how many each group can handle; larger, more experienced groups get more (200–400+), while smaller groups or individuals get less (100–200). The Director will send each group its list of seed numbers with the target levels for number of packets to prepare for each seed number. The seeds are sent in seed sleeves and all seed packets for that seed number are in the sleeve; labels are printed by another volunteer and sent separately. Using various methods, depending on the type and size of the seed, the seed packagers fill as many packets as possible keeping in mind the target number. Of course the actual number they prepare will depend on how many people donated seed and how much seed each donor sent. The groups receive the seed in mid to late November and need to have them done and shipped to the Phase Three Chapter by January 1.

Phase Three: Main Seed Distribution

(early January to mid-February)

The Main Seed Distribution (First Round) is done by one chapter, which generally agrees to do it for three consecutive years. The chapter needs to be a fairly large, active one with 20 to 30 reliable volunteers who live within an easy distance of wherever the order fulfillment will be done. The seeds will start arriving from the Phase Two seed packagers the end of December, and set-up is usually the first week of January. The seed packets are arranged numerically in cardboard seed trays laid out on approximately 66 feet of table length. Mid-January is the peak time for orders to arrive, and order filling will run through mid-February. All members can order from the seed list they received in December. The number of seed packets they get depends on whether they are donors/volunteers (35 packets) or not (25 packets). Orders are filled in priority based on whether they are donors or not and whether they are overseas or U.S. members. Overseas members do not pay for seed in the main distribution, but U.S. and Canadian members do pay a small amount. One chapter worked three days a week during the six weeks; another worked seven days a week for three weeks (in either case, the final orders are done by mid-February). Scheduling depends on the availability of the volunteers; a dozen people at a time works well. At the end of the Main Seed Distribution (mid-February), the seed item numbers (but not quantities) are inventoried and the seeds are sent to the Phase Four chapter, which handles the Surplus Seed Distribution.

Phase Four: Surplus Seed Distribution

(early to late March)

The Surplus Seed Distribution (Second Round) is done by one chapter, which generally agrees to do it for three consecutive years. This can be a smaller chapter with 10 to 12 active volunteers. Surplus Seed Lists are sent only to members who request them on their Main Distribution order forms. The surplus seed list comprises only the item numbers of the seeds that are left over once the Main Distribution is finished, so members need to look up the numbers in the Seed List Catalog or on the NARGS website. The surplus seed list is formatted, printed and mailed by either the Director or the Intake Manager. The quantity of surplus seed varies from a few packets to many; they are arranged numerically in seed trays on about 24 feet of table space. Surplus order filling begins a couple of weeks after the Surplus Seed List is mailed out (those to foreign members are mailed a week before those to U.S. members) and runs until the last week of March. All members must pay for surplus seed; currently the charge is US $5 per 20 packets of seed, with a maximum of 80 packets allowed. Chapters have worked three to four days for two weeks and then two days the third week; it depends on the availability of the volunteers (4–6 people at a time works well). At the end of the Surplus Seed Distribution the remaining seed is split up and

sent to chapters that have requested it (Chapter chairpersons are notified via e-mail that they need to request the leftover seed before the Surplus Seed Distribution ends).

How to Volunteer

To volunteer for one of the phases or ask more about how the Seed Exchange operates, contact the Seed Exchange Director or Intake Manager. Chapters who have volunteered in the past find that it is a great way to get more active participation from their members, even those who are not NARGS members. Because of the restrictions on importing seed into the USA, it is best if all phases (except Seed Exchange Director) are done by U.S. members. Of course, the most important participants are the donors from all over the world who take the time to collect, clean, package up and send the seed in to the Seed Exchange. Without the seed donors, there would be no exchange. For more on collecting seed see the summer 2007 issue of the *Rock Garden Quarterly*.

Geranium farreri. Drawing by Doretta Klaber.

Misnamed Seeds: Oh No, It's That Again!

Compiled by the Editor

Having just discovered that I have been nurturing, if not in my bosom at least in my rock garden, seedlings of the noxious *Geum rivale* raised from NARGS Seed Exchange seed claiming to be the delightful *G. montanum* (photo, p. 191), I'd like to urge those donating to the exchange to verify the identity of their plants. I asked members of the online forum Alpine-L to help make up a list of frequently misidentified items.

In addition to the aforementioned *Geum* species, I'd start with aquilegias (I also nurtured *A. flabellata* 'Nana' as *A. bertolonii* (photos, p. 190), but the resulting plants are so miniature that I think I'll leave them where they are, and get the real *A. bertolonii* from the reliable Rocky Mountain Rare Plants), and such *Fritillaria* species as *F. acmopetala* and *F. crassifolia* (now disclosing themselves in the bulb frame under more enticing names applied to their seeds by several suppliers). Not to mention the all-too-enthusiastic *Muscari* hybrid recently sold commercially as *Bellevalia pycnantha*.

Note: *Aquilegia bertolonii* has *entirely blue* flowers; *A. flabellata* usually has blue outer segments and a white inner cup. *Bellevalia pycnantha* has *blue-black* flowers and one basal leaf is broad, and it does not increase rapidly by bulblets; the *Muscari* distributed under its name has *bicolored* flower spikes, all the leaves are narrow, and it increases very fast.

Diane Whitehead in British Columbia noted: "There is a short discussion on this topic in the Scottish Rock Garden Club forum, started by me when I realized the seedlings of *Tecophilaea cyanocrocus* I am growing from the AGS 2005 seed list have leaves that are 60 cm (2 feet) long. I am keeping them in a pot till I discover their true identity." Diane also suggested that the NARGS website include a page showing photos of frequently misidentified rock garden plants and their impostors.

Note: *Tecophilaea cyanocrocus* has leaves that are at most about 4 inches/10 cm long at maturity. I'd hazard a guess that Diane's plants are *Herbertia lahue*, a bulb (Iridaceae) with bright blue flowers that showed up here as *Pasithea caerulea* and is frequently misidentified.

MARK GRIFFITHS: "The ones I remember well regularly not being true are *Aquilegia saximontana* and *A. scopulorum*, some of the choicer drabas, *Omphalodes linifolia* substituted for *O. luciliae*, and various things for *Silene hookeri*. I wrote an article many years ago on the subject, proposing the existence of an unknown element, Transmutium, that caused seed to degrade from a rare species to something less interesting. It appeared in various places; anyone interested can go to http://markgriffiths.org/inspiringplants/misc/articles.html and download 'Transmutium.'"

Note: Many garden-collected columbine seeds will produce hybrids. *A. saximontana* can be difficult to distinguish from small hybrids; *A. jonesii* has very glaucous foliage and *up-facing* flowers; *A. scopulorum* has congested, very glaucous foliage and flowers with very long spurs. See photos on p. 189.

LIS ALLISON: "*Geum rivale* must be a very skilled impostor! It is being sold, and otherwise traded around, in Ontario under the name *G. triflorum*. Since people are keen to get anything labelled 'native,' *G. rivale* is getting into dozens of gardens. A pretty successful invasion strategy!"

Note: *Geum rivale* forms a substantial leafy clump; *G. triflorum* (p. 188) is a smaller, sparser plant, though both have nodding flowers that don't open fully. *G. montanum* has wide-open, bright yellow flowers.

LEE SLIMAN remarks on the process by which these errors get perpetuated: "I am prompted to comment by the belief that the tiny *Aquilegia* I have been nursing is also not *A. bertolonii*. Though a knowledgeable standard ornamental gardener/gardening professional in the Portland area for 16 years, I am a relative newbie to the alpine set. My new, out of the fog, shot-loam, sloped garden in the Oregon Coast Range at 500 feet seems to support this change. Knowing just enough to be dangerous and having no nearby mentors I try to be very careful about accurately naming seeds/plants. If I am anything but "bet the farm" certain about an ID, I name it with my belief and a large question mark on the tag. However, it is not just poor ID in wild collection that causes problems. I care enough to hand-pollinate and bag my garden seed, but if I have received mislabeled seed in the first place, on a plant new to me, an individual like myself may inadvertently extend the misidentification by distributing extra plants prior to a telltale flowering."

RUSSELL STAFFORD of Odyssey Bulbs, briefly and cynically: "*Anemone* anything is *A. multifida*."

Note: *Anemone multifida* (p. 191) is extremely easy to grow and the seed remains viable in storage (many species in the genus don't), and it comes in a range of colors from red to cream and yellow. It is very widely distributed in nature, too. Its flowers are small in proportion to the height of the stem, one reason rock gardeners tend to sniff at it.

Nurseryman ERNIE O'BYRNE was equally short: "*Corydalis nobilis* is often really *C. sempervirens*. *Allium narcissiflorum* is often really *Allium cyathophorum* var. *farreri*."

Note: *Corydalis sempervirens* is an annual with sprawling stems; its flowers are normally yellow and coral-pink, but a white form is widely cultivated. The elusive *Allium narcissiflorum* is well illustrated on p. 171 (American edition) of Phillips and Rix's *Bulbs*; the stem bears a close-set few-flowered cluster of almost globe-shaped pale pink bells.

CLAIRE COCKCROFT: "*Primula heucherifolia*: I've never received the real thing. It's usually *P. polyneura* or some other fuzzy-leaved primula. So-called *Primula prolifera* (*P. helodoxa*) is often some candelabra hybrid of unknown parentage. Strangely, it's hard to get the real *Primula vulgaris*; most seeds are Polyantha hybrids. *Codonopsis clematidea* is the usual impostor under the name *C. ovata*. [I got both species, each under the other's name. —*Ed.*]

"Many *Corydalis* species are weedy corydalis rather than choicer species like *C. malkensis* or *C. magadanica*; rarely do I get the right thing. (I was going to say "I never get the right thing," but I have yet another pot germinated. Hope springs eternal, indeed.) Surprisingly, *Ourisia macrophylla* is substituted for *O. coccinea* (p. 191), though they're very distinct colors. You can't mistake one for the other. I should add that I've been dipping into the seed exchanges for 14 years now and find most things are truly what they're labeled. Given that the seeds are donated in a large part by amateur growers, that's pretty incredible!"

With the resources now available on the Internet, one can often find a photograph of a particular plant, and often it's actually what the caption claims it to be. We also have some lavishly illustrated books at reasonable prices, such as the Random House paperback series and books on rock garden plants by Baldassare Mineo and Graham Nicholls. It's well worth checking your aquilegias, primulas, campanulas, and other large genera before donating seed. But don't let anxiety stop you from donating! For many members, the Seed Exchange is the Society's greatest benefit.

"Honey, I Just Dug Up the Cat"

Robert J. Nold

Maybe you're not like this, but I turn into a different gardener with the phases of the moon. No, not a were-gardener, but someone whose interests are constantly changing. My wife would say someone whose mind is constantly deteriorating, but I claim it's a desire to avoid fixating on any one thing.

Like, say, in October I'm obsessed with asters. The good ones, of course. Then a couple of weeks later I'm into cyclamen. They're all over the garden, and I try to key them out and imagine wandering around in the woodlands of southern Greece or Turkey. Maybe then I'll drift into crocuses for a while, and by late November I'm thinking about rock gardens, since nothing really equals them for what garden writers call "winter interest."

Come the first week of January and I'm usually sowing seeds—outdoors, of course, no matter what the weather. I start coals in the charcoal grill and keep it going on the patio if it's really chilly, or start a fire in the chimenea. Sometimes a Gardener's Beverage comes in handy, too. With seeds, I can be in the Peloponnese or Kurdistan or the Tien Shan or the mountains of Arizona without actually having to go there. I put as much detail as possible onto the labels, and let my mind, such as it is in mid-January, run riot.

One year I got some Central Asian pulsatilla seed from one of the exchanges. It said, "*Pulsatilla* sp., Death Lake." There was something totally irresistible to me about growing anything from a place called Death Lake—straight out of Tolkien. I imagined, as the seedlings grew under the fluorescent lights, grim nodding flowers of a funereal shade and possibly fell odor. Of course the plants died the moment I transplanted them, but that's not the point. Or at least I hope it isn't.

With my labels, I've been practically everywhere in the temperate world. I've been to the slopes of Mt. Aconcagua, and the Drakensberg. I've been to the Southern Alps in New Zealand, to the Elburz Mountains of northern Iran, and the Sierra Nevada in Spain. I'd rather stay at home anyway.

When I first started writing a lot of labels I got this fancy German pen that promised to be waterproof, not realizing at the time that I needed something more than just "waterproof." The writing on the labels disappeared within a

couple of days, allowing me to look forward to a whole bunch of surprises in spring, should the seed I had just sown actually germinate.

I tried metal labels; I tried pens proven to be able to write while held upside-down in outer space; but nothing lasted more than a couple of weeks, until I realized that the only instrument worth considering for label writing is an ordinary No. 2 pencil. I get my labels, plastic and white, from Nicke's in Pennsylvania, though you can get them locally too. It's just that I've always ordered from Nicke's, and why break one of the four good habits that I have? Sometimes I use red or green or yellow labels, but white are the best. One year I had the idea of using red for "needs water every five seconds" and green for "water once a week," but that was the same year that Meg Ryan became single and I thought I had a chance with her. All the plants that needed water died.

Then awhile back I went into autumn really into rock gardening and feeling especially Czech. I looked at the pictures in rock gardening books and magazines written in Czech and I got the message. This can be a bad sign, because it means that I will try to resolve only to grow the absolute best-of-the-best rock garden plants in the most sophisticated and stylish way possible. One of the aspects of this Czech angle is a refusal to allow labels in the garden.

Well, they have a point. No matter how you look at them, labels are pretty ugly. You can push the plastic ones down into the ground if you have the kind of soil that allows for this, and if they're written in pencil they will last for ages, but if the labels are even millimeters above the surface and someone, say a photographer, takes issue with the labels and pulls them out, then there's no putting them back in, and you're basically sunk.

Or you may have a border collie puppy who thinks it's fun to pull out all the labels with his little front teeth and pile them up in a corner of the rock garden. It's only cute in theory.

One autumn I decided to get rid of all the labels because I wanted to be terribly sophisticated. When someone comes into the garden and looks at plants and wonders what they are, you go into the house and bring back a volume of the *Flora of Turkey* and drop it into his hands with the suggestion that he key it out himself instead of asking you—that's sophistication. Eventually people will stop asking you stuff and just stand in awe of your label-free garden representing an unbelievable knowledge of, and connection with, the floral kingdom.

There is a drawback to all this sophistication. If you started reading at the very beginning of all this, maybe you can guess what it is.

Bob Nold and his wife, Cindy, garden near Denver, Colorado. He is the author of the Timber Press books *Penstemons* and *Columbines*. His major new book on growing cold-hardy, drought-tolerant plants native to western North America and northern Mexico, titled *High and Dry*, will be published by Timber in summer 2008.

BOOKS

The Crevice Garden and Its Plants, by Zdeněk Zvolánek, edited by Joyce Carruthers and John Good. Pershore, UK: Alpine Garden Society, 2008. ISBN 978-0-90-004878-4. Available through NARGS Book Service, $12.

Reviewed by ROBERT NOLD, Lakewood, Colorado

I have no crevice garden. I have what I think are some good reasons for this lack: no real reason to build one, since Denver, where I live, has a climate that in theory allows for the relatively easy cultivation of many of the most "difficult" alpines; and absolutely no ability to envision a thing and then build it in such a way that I am happy with the results. And not only that: even if I wanted a crevice garden, the only way I figured I could get one into the garden involved a scenario that included a magic lamp and a genie.

I know that people build crevice gardens. I saw the beautiful one on Mt. Goliath a few miles from the summit of Mt. Evans, subtly integrated into the surrounding rock, built by Zdeněk Zvolánek and Joyce Carruthers. It took me a few minutes to see it, and suddenly the pattern of it appeared before my eyes like a magical vision.

After a few years of living in the house here and working in the garden, it was decided that I was no longer to be allowed to build anything at all. Instructions might as well be in Martian, and so my wife, Cindy, undertakes all the building, relegating the heavy lifting and digging to me.

This little book, *The Crevice Garden and Its Plants*, by Zdeněk Zvolánek, is a masterpiece of its kind. The first half is devoted to recounting briefly the history of crevice gardens, their purpose, design considerations, recommended soil mixes, and understandable instructions, including diagrams, for how to build one. Instructions, I should emphasize, understandable even to me. After reading this book once, I felt perfectly capable of building a crevice garden that my wife wouldn't insist I rip out the next day.

The second half of the book is a little catalog of plants for the crevice garden, with cultivation notes given for each one. Many of the plants are available from nurseries or from the various seed lists, so once you have read this book and

acquired the necessary rock, with smaller pieces to be used as top dressing, all you need is help lifting the rocks and setting them in place.

Cutting Edge Gardening in the Intermountain West, by Marcia Tatroe. Photographs by Charles Mann. Johnson Books, 2006. 224 pp., color. $24 from NARGS Book Service.

Reviewed by LEE CURTIS, Lakewood, Colorado

A basic assumption is that a garden should reflect the natural environment in which it exists. But the garden is not a wild space, it is contained and arranged; the human hand and eye have chosen this mix of earthly delights. Marcia Tatroe's new gardening book is a regional treatise, specifically designed for the dry western states of the Rocky Mountains and lavishly illustrated with Charles Mann's photographs of the natural environment juxtaposed with lush garden spaces.

Beginning with the challenging geography, weather and ecology, author and photographer gradually adjust the focus onto the specifics that frame the personal, private garden, zooming in on various microclimates therein, and finally scrutinizing the tiny plants themselves that thrive in the heat of the intermountain region. One of the six chapters is devoted to high and dry rock gardens, and the scavenger hunt for rocks and plants to populate them—rock gardens that bring the mountains in our hearts onto the plains. The garden is a decorative wonder where every angle and microcosm has been revised and adjusted for practical reasons and artistic effect and beauty. Among the various interesting rock garden paradigms presented are the overstuffed rock garden, the rock garden integrated with flower beds, a labyrinth of stone paths in a crazy quilt garden, the badlands rock garden, and even a rock garden without rocks. The photography tempts the reader to examine each rock crevice. The plant list for the dry rock garden is only one of many garden plant lists that pepper the second half of the book. Many plants you'll recognize with satisfaction, but there are plenty of new ones to hunt the nurseries for and try.

From finding the perfect birdbath or the ideally colored and textured mulch, to the perfect site for the saxifrages, this book illuminates one gardener's journey toward paradise. Marcia Tatroe's garden is scrutinized, but other gardeners' practical and innovative designs and gardens are revealed as well.

Cutting Edge Gardening is a new look at an old art, a book that traces a fine line between coffee-table volume, how-to garden manual, and design treatise. Perhaps this is not a book for the coastal states, although much about dryland plant culture can be gleaned from the text and the photos will tempt you unmercifully. But this book deals fairly and frankly with the vagaries of gardening in the intermountain West and presents a rich, alternative gardening style.

Endemic Plants of the Altai Mountain Country, by A. I. Pyak, S. C. Shaw, and 9 co-authors. Hampshire, UK: WildGuides, 2008. 368 pp., color photos throughout. ISBN 978-1-903657-22-5. £29.95.

Reviewed by JANE MCGARY, Estacada, Oregon

Rock gardeners became familiar with plants from the Altai Mountain ranges in Russia, Kazakhstan, and Mongolia during the past two decades largely through the efforts of Czech seed collectors, notably Josef Halda. Botanically oriented tours to the area are now offered by several companies. This volume is intended in part as a guide for educated but nonspecialist visitors to the plant communities, ecology, and conservation status of the endemic flora, which is said to constitute about 10% of the approximately 2800 species in the region. Though not the comprehensive field guide a visitor or gardener might want, it is a model of its type and well worth owning for that reason alone. The contributors include botanists from all the countries covered as well as the UK (the English prose is natively fluent), and there are four forewords in the different languages, a respectful touch.

The book begins with a thorough overview of the region (pp. 9–91), including numerous maps, landscape photos, discussion of conservation efforts, and suggestions for visiting, with a directory of useful contacts. The main section (pp. 92–295) describes about 100 of the 288 endemic species, giving each a description in language accessible to the knowledgeable nonspecialist, a discussion of "related and confusing species," excellent habitat synopsis, conservation status, a general range map, and large, clear color photo. A summary table by family includes a column indicating flower color graphically, even showing bicolor tones; this table lists both the illustrated species and those identified as endemic but not included in the main section. Appendices include a brief botanical glossary with graphic illustrations, a bibliography (mostly Russian-language literature and likely difficult to obtain in the West), a list of websites especially for travel information, and an index that includes plants listed in the summary table.

Botanical names generally follow the *Flora of the USSR*, and synonyms more generally used in the West for certain genera may or may not be given. This has been an ongoing source of confusion for those shopping from Czech seed lists. Each main entry has a "Cultivation" section, usually confined to "Not known to be in cultivation" or to a mention of a Russian botanical garden where the plant has been grown.

A few of the plants will be familiar to adventurous rock gardeners: *Dendranthema sinuatum* (syn. *Chrysanthemum s.*), a subshrub whose pink flowers recall the popular *Dendranthema weyrichii*; *Leiospora exscapa* (syn. *Parrya e.*), a scree-dwelling, fragrant crucifer that I believe has been introduced from seed; *Sedum populifolium*, a curious development in its genus with toothed leaves on erect stems, long in cultivation; *Corydalis nobilis*, one of the "woodland" species, and blue-flowered *C. pauciflora*; *Biebersteinia odora* with its aromatic foliage; tall yellow-flowered *Aconitum krylovii*, which surprised me by actually germinating, not a habit in its genus; and the sought-after *Daphne altaica*.

Some others that were new to me, at least, look very enticing: *Brachanthemum krylovii*, a little shrub with neat yellow daisy flowers; *Rhactinidia eremophila*, with big lavender flowers over a ground-hugging mat of hairy leaves, much like our *Townsendia*; *Silene turgida*, a cushion covered with inflated-calyx flowers on short stems; *Stellaria pulvinata*, shown as a perfectly dense hemisphere with barely protruding green flowers; *Dracocephalum bungeanum*—tiny, woolly, congested, big purple flowers, who could ask for more; *Lagopsis darwiniana*, a mint deserving to honor its namesake; *Iris ludwigii*, a rare plant close to *I. ruthenica*.

The pea family is particularly well represented among Altai endemics. Miniature plants with showy flowers illustrated here include *Astragalus gubanovii*, *Hedysarum tschuense, Oxytropis bungei* (I think it has been collected by Halda, and the photo looks like a model for Jarmila Haldova's artwork), *Oxytropis intermedia, O. oligantha, O. physocarpa, O. pumila, O. stenophylla, O. trichophysa,* and *O. tschujae*. If only these genera were easier to raise!

The publisher, WildGuides (www.wildguides.co.uk), has a small list focused on fauna rather than flora but does offer two other plant titles, *Plants of the Falkland Islands* and *Britain's Orchids*. They also have a few natural history guides to selected small regions in Europe that would probably appeal to those planning walking holidays.

Enter the Annual Photo Contest

If you enjoy photographing plants, why not share your enthusiasm with our readers—and perhaps win a prize? This issue features a number of award winners from our 2007 photo contest. In addition to fame and the gratitude of the editor, you may win a year's membership (for yourself or as a gift to a new member of your choice) in NARGS, offered for first in each class, or even the grand prize, a book of your choice.

To enter the 2008 contest, please read the following instructions. The **deadline** for entries is **October 1, 2008.** Send all entries to Jane McGary, Editor, 33993 SE Doyle Rd., Estacada, OR 97023, USA.

Entries may be submitted as digital images on CD, slides, or prints. Slides and prints will be returned after the contest or after publication; digitals will be archived for future publication. All published photos are credited, and copyright remains with the photographer. Entering the contest grants to NARGS permission for one-time use of all images submitted. You may enter a maximum of **ten images in each class.**

Digital images may be submitted in jpg or tif format. Please do not submit images in Microsoft Office Imaging System format, as this is problematic for our printer and for some judges. Submit all images on one CD, with each image named with the subject and your initials (e.g., Campanula raineri JM, Larch Mountain JM). If you are entering several classes, it is helpful to make a separate folder for each class. Include a text document listing your entries by class, with plant names fully spelled out and any other pertinent information you feel should appear in a caption when the photo is published. Please submit this list on paper and also on the CD.

Slides and prints should be accompanied by a list like that described above. If you need them back quite soon, please let us know in your cover letter. Be sure each slide or print is clearly labeled with the subject and your name.

Judging criteria are technical quality, aesthetic appeal, adherence to parameters of the class entered, and suitability for publication. Different judges are recruited each year in the editor's local region and remain anonymous.

Classes

Class 1: Portrait of a plant in the wild. Image focuses on a single plant in its native habitat.

Class 2: Natural scene with plants. Image includes both wild plants and their surrounding habitat and scenery. See an example on p. 192.

Class 3: Portrait of a plant in cultivation. Image focuses on a single plant in the garden.

Class 4: Rock garden scene. Image of a portion of a rock garden, owner identified please.

Houstonia caerulea. Drawing by Doretta Klaber.

NARGS Coming Events

2009 Eastern Winter Study Weekend: January 30–February 1. "Global Warming and the Rock Garden."

Hosted by the Potomac Valley chapter at Sheraton Reston Hotel near Washington, DC's Dulles Airport.

2009 Western Winter Study Weekend: March 13–15. "Revitalizing the Rock Garden."

Hosted by the Columbia-Willamette chapter at Doubletree Lloyd Center Hotel, Portland, Oregon. Registrar: Jan Dobak, 2921 NE 25th Ave., Portland, OR 97212; jddobak@pcez.com

Iberis pygmaea. Drawing by Doretta Klaber.

N·A·R·G·S BOOK SERVICE

NEW

High and Dry Gardening with Cold-Hardy Dryland Plants, Robert Nold. Illustrations by Cindy Nold. Bob's witty style makes this book a must, entertaining read. Years of experience in his Denver garden form the basis for recommendations of hardy, drought-tolerant native plants for the western garden. 420 pp., 209 color photos, 10 watercolors. **$28.00**

Hardy Succulents: Tough Plants for Every Climate, Gwen Kelaidis. Photos by Saxon Holt. Everything gardeners need to know to select, grow, and maintain hardy, low-fuss succulents including agaves, ice plants (*Delosperma*), sedums and sempervivums. Step-by-step growing instructions, practical care tips. Purchasing, planting, weeding, dividing, autumn color, and succulents to solve garden problems. 144 pp. **$16.00**

Saxifrages: The Definitive Guide to 2000 Species, Hybrids & Cultivars, Malcolm McGregor. Covers cushion, silver, and mossy *Saxifraga*. Botany, history, cultivation, and propagation. Advice on using saxifrages with a list of the top 100. 392 pp., 320 color photos. Due August. **$40.00**

Trees for the Small Garden, Simon Toomer. 100 best trees for small temperate gardens. Each entry includes photographs, growth rate, and care. Tree-selector table for quick comparison. 176 pp., 418 color photos. **$24.00**

The Crevice Garden and Its Plants, .Zdeněk Zvolánek. Crevice gardens, long used by Czech gardeners, are becoming popular outside the Czech Republic. This small book provides basics for building, selecting plants, and planting natural looking crevice gardens. 68 pp. Alpine Garden Society. **$12.00**

Planting Green Roofs and Living Walls, revised edition, Noël Kingsbury and Nigel Dunnett. Green roofs and walls reduce pollution and runoff, help insulate and reduce building maintenance, contribute to biodiversity, and provide food and habitat for wildlife. New edition includes latest techniques for design, implementation, and maintenance of a green roof or wall. Explains how roofs may be modified to bear the weight of vegetation, discusses options for drainage layers and seasonal interest. Growing media, and plants suitable for different climates and environments. 336 pp. 227 color photos. **$28.00**

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OTHER TITLES OF INTEREST

Alpine Plants: Ecology for Gardeners, J. Good **$28.00**
The Caucasus and Its Flowers, Holubec & Krivka **$98.00**
Ceanothus, Fross & Wilken **$32.00**
Complete Shade Gardener, Schenk **$19.00**
Garden Bulbs for the South, 2nd ed., Ogden **$28.00**
Gardening with Woodland Plants, Junker **$32.00**
Growing Penstemons: Species, Cultivars and Hybrids, Wilde & Lindgren **$14.00**
Land Above the Trees: A Guide to American Alpine Tundra, Zwinger & Willard **$16.00**
Native Plants of the Northeast, Leopold **$32.00**
Orchids of Europe, North Africa, and the Middle East, Delforge **$32.00**
Viburnums, Dirr **$32.00**

PLAN FOR SEEDEX DONATIONS

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The North American Rock Garden Society is pleased to announce its Gift Membership Initiative. Delight your gardening friends or relatives—perhaps those who are new to rock and alpine plants—with a year's membership in NARGS. This is a perfect holiday or birthday present, and a gracious remembrance to garden-loving hosts. It's also a good way for local chapters to honor helpful members who may not yet belong to the national society.

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Please take this opportunity to help NARGS grow—and to inform and inspire others.

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Specify "Gift membership for" and give the recipient's name and address, along with any message you wish written on the card. Enclose your check or credit card billing information. For annual membership fees in the U.S., Canada, and overseas, see the notice at the bottom of the inside back cover of this issue.

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