ROCK GARDEN *Quarterly*

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Front cover: *Erythronium hendersonii*. Painting by Paula Fong.

Back cover: *Penstemon eatonii* and Wheeler Peak. Photograph by David Sellars.

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ROCK GARDEN *Quarterly*

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Contents

From the Editor

This spring 2009 issue is thinner than you have been used to seeing in recent years, but we hope it contains plenty of substance, with articles on design, cultivation, conservation, garden selections, and North American wild plants. Falling membership dictates that we reduce our publication budget, and so most issues from now on will be 64 pages rather than 80.

It has also become increasingly difficult to obtain submissions from our members, with a few stalwarts carrying most of the burden. Most of those contributing to this issue are among them. David Sellars, Gene Mirro, and Lola Lloyd Horwitz are newer names to us; Panayoti Kelaidis, Marcia Tatroe, and John Stireman have been sending in material faithfully since the explosion of rock gardening in the Rocky Mountain area in the 1980s; and two, Norman Deno and Don Jacobs, are very longtime NARGS members who first published here in 1974 and 1985, respectively. (The record for longest history of contributing to our journal, incidentally, belongs to Irma Gourley, whose first article appeared in 1950, and her most recent in 2007!)

We will continue to feature a 16-page color section, and we will probably have longer issues in fall, when NARGS business matters must be included.

We are pleased to announce that a computer-searchable cumulative index of volumes 1 through 66 is now complete. We hope it will be posted on the new NARGS website when it's up and running. In the meantime, members wishing to obtain copies on CD may buy one from the Editor for $5 postpaid. We regret that the index is too large (over 17,000 entries) for us to provide paper copies. It is divided into author/title, subject, and plant name sections, and the plant name section contains many current synonyms for plants that were mentioned under names no longer used.

While editing the *Quarterly* and preparing the index, I've also been chairing the committee that is putting on the 2009 Western Winter Study Weekend and Annual General Meeting. Its theme is "Revitalizing the Rock Garden." Revitalizing our Society, our website, and our publications is NARGS's top priority. Let's begin today!

In Defense of Nonconventional Rock Gardens

Panayoti Kelaidis

I possess a classic sort of rock garden, chockablock full of androsaces, primulas, saxifrages, gentians galore, and all the other card-carrying members of the Bona Fide Alpine Plant Club. In fact, I suspect I grow as many of these as just about anyone else. I love them, of course. I would not want to be without them. You can find most plants in this garden represented in many of the several hundred rock garden books I have accumulated in the course of my lifetime: it's pretty conventional, really. I still like it.

And yet I have another garden where nary a saxifrage grows, let alone a primula, much less an androsace. Here you will find more than 100 kinds of miniature cacti, South African succulents, penstemons, eriogonums, ten species of *Talinum*, *Oncocyclus* irises, Juno irises, crocuses, and strange cushion plants like *Satureja spinescens*. These are grown in crevices and among rocks just as they might occur in nature. Probably half the plants in this garden have never appeared in a single rock garden tome. In my heart of hearts, I love both gardens very much, and would be hard put to choose between them: the dryland rock garden has one stellar quality, however. It is utterly novel and fresh in every way.

But what would we make of the blue grama grass meadow filled with fritillarias, calochortus, and alliums? Or the twin berms, one filled with tiny carpeting treasures from western America (the usual steppe rabble) and the other from the Old World: veronicas, acantholimons, tulips and a jillion tiny mints and composites. And hardly a single rock in any of these gardens, which comprise many thousands of square feet. They would hardly qualify as rock gardens, technically. They sure as heck aren't perennial borders.

Or what about my little bog, filled with *Sarracenia*, *Drosera* and treasured *Dionaea*, with blazing spikes of *Lobelia cardinalis* and mats of cranberries and *Mimulus primuloides*, encrusted with *Dodecatheon*, *Primula frondosa*, and *Spiranthes cernua* still blooming alongside the piercing blue of *Gentiana sino-ornata*? Are these to be excommunicated too?

I have but a few shady strips of garden here and there, but these are crowded with hepaticas, six or seven species of *Polygonatum*, lots of epimediums from Darrell Probst, a few treasured rhododendrons, and as many woodland waifs as I can

persuade to join me in our godforsaken steppe. These are some of my favorite miniatures, and there are rocks among them in several beds. I brashly think of them as my woodland rock gardens (fool that I am).

I have always thought that rock gardening was the last great refuge of the little plants of the world, the rock ferns that are so precious to us, and so easily ignored by the masses. I realize it's hard to define rock gardening, but while you're at it, give me an airtight definition of music, love, God, poetry, or friendship. Show me a rock gardener who doesn't grow (or wouldn't like to grow) *Cardiocrinum* and *Meconopsis* and I will show you a paragon of purism: pin a rose on his nose, please, and call him rosy nose.

Of course we pay special honor to the treasures of the highest crags, but I would think that any rock gardener worth his or her salt would bow down to worship bluets in a New England lawn just as fervently. And I would hope they would marvel as I have at *Rhodohypoxis* and *Helichrysum* and *Craterocapsa* on the bona fide Sani Pass tundra in South Africa, the very homeland of Mother Flora. And what about those Mediterranean hills, once so brimming with bulbs and tiny shrubs and herbaceous plants (now more and more replaced with barracks of beach homes for northern European retirees)? Or the vast stretches of semi-arid steppeland on four continents, filled with tens of thousands of species of miniature gems, few of which have ever been cultivated (many even new to science), chomped on for millennia by sheep and goats, now ground underfoot by guerillas, blasted by bombs, and demolished hourly by the acre for oil and gas development? Who is to notice, to cherish, to champion these, if not rock gardeners? Are we to turn our back on the vastest treasure trove of rock plants on the planet, because they are not in Farrer or Sampson Clay or don't happen to grow in the Dolomites?

Perish the thought!

Panayoti Kelaidis of the Denver Botanic Gardens wrote this essay on Alpine-L, the Internet rock gardening forum, in response to a heated discussion in November 2008 on whether a "real" rock garden should contain only alpine plants, and whether a rock garden society should embrace enthusiasts of woodland gardens, Mediterranean plants, and plants not fully hardy in northern gardens.

The Answer Was Blowing in the Wind

David Sellars

"There are no flowers up there." The advice from the crisp couple from Colorado was succinct and unequivocal. The Denver pair continued on down the mountain, and above us the steep slope of coarse talus blocks leading to the summit appeared devoid of vegetation and interest.

We were at about 12,000 feet on Wheeler Peak in Great Basin National Park in Nevada (photos, pp. 97, 98, back cover). We had seen many beautiful plants on the ascent: *Lewisia pygmaea* was poking its narrow leaves and tiny white flowers from the stony slopes; *Fritillaria atropurpurea* was hiding among the taller plants; and *Ranunculus adoneus* was emerging in the wet soils from recently melted snow. Beside a small stream, hundreds of *Dodecatheon jeffreyi* were decorating the grassy banks. The crowning glory on the ridge was *Polemonium viscosum* with its delicate laddered foliage and deep blue flowers displaying a lushness we had never seen before. As we had climbed higher, the flowers had become scarce and a waste of stones was the only decoration on the steep ridge. The air was thin. The trail was stony and steep. The sun blazed down from a baking sky. Was there any point in continuing the exhausting climb?

We had left Vancouver a few days earlier and headed south to escape the long winter and cold spring. The cool, wet conditions in 2008 seemed to have affected all the mountains of western North America. We bypassed Steens Mountain, where the road was closed because of deep snow, and still found snow covering the trails in the Ruby Mountains farther south. Fortunately, we found an exposed ridge above Angel Lake where the snow had long disappeared because of wind action. The ridge was particularly floriferous, with the beautiful emerging flowers of *Eriogonum caespitosum* and even flowers on the ball cactus, *Pediocactus simpsonii*. But there was still too much snow elsewhere in the Rubies, and June 28 found us farther south in Great Basin National Park, with most of the snow melted and flowers in abundance. We had set off from the campsite at 9,900 feet to climb Wheeler Peak in the Snake Range, which at 13,063 feet is the highest mountain entirely within Nevada. Wheeler Peak is famous for ancient bristlecone pine (*Pinus longaeva*) groves and a small glacier covered with rockfall below the northeast face.

One of the joys of mountains is their capability to surprise. You never know what you might find at high elevations; a waste of stones can contain a few alpine gems secure from competition in their ecological niche. So we continued upward on the trail through the coarse blocks of talus, scanning the crevices for any plant that had managed to establish a living in the harsh environment.

The last plant we expected to see high up on Wheeler Peak was *Primula parryi* (photo, p. 98). Standard habitat descriptions for *Primula parryi* emphasize stream banks and boggy areas, not coarse talus slopes at over 12,000 feet. *Primula parryi* is not a diminutive alpine gem huddling into a tiny crevice. The plant has lovely maroon flowers and erect leaves over a foot (30 cm) long and was growing in large clumps among the blocks over a wide area. We scrambled over the boulders to investigate and found that in this area, *P. parryi* was the only plant that had established a niche among the rocks.

The presence of *P. parryi* at this elevation is contrary to the marked zonation of alpine vegetation noted by Good and Millward (2007). Tall herbaceous plants such as this primula are normally found at or below the tree line, and increasing elevation brings a gradual change toward shorter, more compact vegetation. Cushion plants are characteristic of the highest elevations, and lower down we had seen fine specimens of *Silene acaulis*, but they had petered out.

Clues to the conditions that allow *P. parryi* to grow in this unlikely location can be found in Christian Körner's book *Alpine Plant Life* (2003). We tend to think of talus slopes as being the covering layer for underlying bedrock, with blocks of loose rock on top of solid rock. However, talus slopes are infilled with silt, mostly from wind-borne particles (loess) which settle into the spaces between the rocks and build up a fine substrate within the talus over thousands of years. The technical term for this process is aeolic sedimentation. Measurements of this phenomenon reported by Korner indicate deposition rates of about 0.08 mm per year, though in dry areas such as the Great Basin, deposition rates are likely to be much higher. The *P. parryi* growing on Wheeler Peak has roots into the fine silt within the talus. The talus forms a coarse mulch, keeping the silt moist, and the boulders are effective at trapping any snow and rainfall that occur. The north-facing slope also reduces the potential for drying out of the fine material.

Primula parryi produces copious foliage that dies back every year. This is likely another factor that assisted the colony to establish on Wheeler Peak. The dead foliage adds organic matter to the silt, which provides additional sustenance for new plants.

Another interesting question is how the first seeds arrived at over 12,000 feet to create this locally disjunct population. According to Good and Millward, wind is the most common agent for alpine plant seed dispersal, though seeds do not normally travel very far by this method. The Snake Range is noted for high winds, so it is possible that wind carried the primula seed from low elevations, allowing a population to establish where local conditions were favorable despite the high altitude.

The contribution of wind to alpine plant ecology is clearly substantial and can transform talus slopes apparently devoid of vegetation into spectacular

high-altitude gardens. Wind blows the snow off ridges to allow early flowering, deposits silt in talus to provide fine material for rooting, and disperses seed. At first it was puzzling that large clumps of *Primula parryi* grow contentedly on blocky talus at high elevations on Wheeler Peak rather than the expected cushion plants. The answer was indeed blowing in the wind.

References

Good, John, and David Millward. 2007. *Alpine Plants: Ecology for Gardeners.* Timber Press.

Körner, Christian. 2003. *Alpine Plant Life: Functional Plant Ecology of High Mountain Ecosystems.* Springer.

David Sellars, an engineer, gardens just south of Vancouver, B.C. He and his wife are avid travelers and hikers, and he is developing a website describing good flower hikes.

Growing *Physoplexis comosa*

Gene Mirro

In his recent book *Dwarf Campanulas and Associated Genera* (Timber Press, 2006), the English nurseryman Graham Nicholls calls *Physoplexis comosa* (formerly *Phyteuma comosum*; photos, pp. 99–100) "the weirdest and yet most beautiful flower of all the Campanulaceae. . . . it cannot be described accurately. All you can do is look at it in wonder and agree that the common name, devil's claw, suits it admirably." His description:

From a fat, fleshy rootstock grow tufted rosettes of shallow to deeply toothed, reniform leaves . . . The erect to decumbent stems have smaller, short-stalked, lanceolate leaves and are 5–10 cm long. Tight, globular heads of 20 or more flowers, each to 2.5 cm [1 inch] long, are held at the ends of each stem, and each flower is a delicate object in itself . . . a pale lilac inflated flask or club-like base that, as it tapers to a very thin neck, changes colour to a deep or almost blackish purple. From the end of the thin neck protrudes the deep purple forked and twisted stigma. . . . It grows in narrow, lofty crevices of limestone cliffs in the southern Alps and the Dolomites to around 2000 m, where the roots creep through any narrow cracks and anchor the plant firmly to the rocks. There is no humus in the crevices, but a very sandy substratum. Franz Hadacek observes: . . . "It prefers to grow on shady, damp, limey rocks. . . . It does not like low winter temperatures nor dry, hot summers, but a humid and cool climate. Very rarely white forms or red coloured may occur."

Growing plants from seed

For background, see the articles "Patience without Risk: Propagating Difficult Small Seeds" in the summer 2007 *Quarterly*, and "Gentianopsis and Gentianella from Seed" in the summer 2008 issue. For *Physoplexis*, I follow the procedure described in the *Gentianopsis* article nearly step by step. Note that I do not sterilize the seed mix or the growing-on mix. I can't guarantee that this will work for you, since your soil may have troublesome critters in it.

I have found that gibberellic acid (GA-3) improves germination in both *Gentianopsis* and *Physoplexis*. I make a 1000 ppm solution, per the instructions from the J. L. Hudson company (where I buy my GA-3). I surface-sow the seed and moisten the mix with a fine spray of water. I then drip the GA-3 solution onto the surface of the potting mix, enough for thorough coverage. This is probably a much weaker treatment than is usually recommended, but it seems to do the trick and does not cause stem elongation. Both *Gentianopsis* and *Physoplexis* will also germinate without GA-3, but the percentage will be lower.

Next I put the container in a sealable plastic food bag, which is placed about 5 inches (7.5 cm) under fluorescent fixtures in an air temperature of 60° F (about 15° C). The lights are on for 10 hours per day. The seeds germinate in two to three weeks. It is helpful for these tiny seedlings to start photosynthesizing as soon as they germinate. This is a great advantage of germinating them under the lights. Once a good stand of seedlings has emerged, I give them a sprinkling of pulverized dolomite lime (to make them feel at home) and an application of dilute liquid fertilizer. The *Physoplexis* seedlings start out very small but grow much more quickly than *Gentianopsis*, and will develop several true leaves within six weeks of sowing. I take them out of the plastic bag at this stage, and grow them on under the lights.

In another month or so, they will be ready for transplanting. For the growing-on mix, I use equal parts loam, half-rotted bark, pumice, perlite, and peat, with a little vermiculite, lime, and bone meal thrown in (see step 13 in the Gentianopsis article). I place the transplants under fluorescents for a couple of weeks to get them established before exposing them to outdoor conditions. For small numbers of plants, I place them in sealed plastic bags for this step. For larger numbers, I place a clear plastic propagation dome over the plants (see photo), to provide a humid environment while they rebuild their root systems. This also greatly reduces the amount of watering that needs to be done.

Now they are ready for the greenhouse or a shaded area outdoors. They do not like full sun and high temperatures, but too much shade will result in weak growth and few if any flowers. Also, keep in mind that slugs are the mortal enemy of these plants. So far, I have not tried them in the garden. I grow them in a cool greenhouse with 50% shade cloth. Make sure to plunge the pots to keep the roots cool and moist. If the plants go dormant in midsummer, don't panic; cut back on watering until late fall. In winter, I do not allow the containers to freeze hard. I start heating the greenhouse when it gets down to 30° F (−1° C).

My plants usually flower in two years from seed. It will take several more years to develop a "show" specimen with dozens of flower clusters. The photos on p. 100 show plants at these stages.

Hand pollination

To assure good seed set, I hand-pollinate these plants. There is nothing complex about this, once you know where the pollen is located. The flowers are ready

for pollination when the stigma is reflexed into a spiral shape (photo, p. 99). The pollen is scattered like dust all along the style below the stigma and needs to be transferred to the stigma. Since all my plants are in pots, I simply lift one and rub the stigma along the style of another plant. You may be able to achieve the same result by removing a flower and using it to pollinate another plant, or by using an artist's paintbrush or some similar implement. To ensure that the pollen is ripe, this process should be repeated over several days. Make sure that the pollen is not washed off the stigma by rain for the next week or so. It is generally preferable to cross-pollinate genetically distinct plants—that is, clones, grown from two different seeds. Plants that have been vegetatively propagated, such as by cuttings, are genetically identical.

The seed pods are similar to those of campanulas, but much smaller. They look like a slightly thickened stem. When they turn brown, carefully remove them from the stem, let them dry indoors for a few days, then roll them between your fingers over a receptacle for catching the seeds. The seeds are very tiny, but if your eyes are good, you will be able to see them falling. I let them dry at room temperature for about two weeks, then either sow them or place them in an airtight container and freeze them for later use.

So why on earth is the pollen distributed along the style? Where are the pollen sacs? I got the answer from Pierce Simon and Bruno Cerabolini, Associate Professor of Botany at the University of Insubria, Varese, Italy, close to where these plants are native. They believe that the pollen originates "from the anthers that are enclosed within the base of the corolla. As the style develops it grows along inside the tube of the corolla, pushing everything in front of it, until it finally sticks out from the end of the corolla, and at this point the stigma reflexes. So, as the style elongates it also pushes outwards against the anthers and the corolla, and at this point some pollen can become 'pasted' onto the style and is transported out of the corolla with the developing and elongating style. For the plant to avoid self-pollination it is only important that the stigma does not come into contact with the pollen, but at that point it is still immature, and losing some pollen in this way does not appear to be a problem for the plant. If you wanted to get larger quantities of pollen I would suggest removing part of the corolla, and the anthers can be found inside. They look just like the anthers of other flowering plants, so they should be fairly obvious once exposed, but they are very short in relation to the style and corolla."

I suspect that this plant shares its habitat with a highly specialized pollinating insect. I wouldn't be surprised if that insect is not found in North America. If you are serious about collecting seed, hand-pollination is probably in order.

Gene Mirro, an engineer, gardens in Portland, Oregon.

Short and Shorter: Grasses and Grass-like Plants

Lola Lloyd Horwitz

In searching for lawn substitutes and filler between stepping stones, I have trialed various plants that I thought could stand up to light to moderate foot traffic. My love of rock gardening led me to plants other than Irish "moss" (*Sagina subulata*) and chamomile (*Chamaemelum nobile*), commonly offered as lawn substitutes. In this article I'll discuss tufted, short plants that are hardy in my Brooklyn, New York, zone 7 neighborhood—plants that somewhat resemble the grass that I removed from my clients' gardens. As a gardener who has long since parted from a working lawn mower, I was looking for plants that are sturdy and have that "grassy" look, but don't require mowing. I was also looking for contrasts of color and texture, and for a growth cycle as close as possible to evergreen. Realistically, probably none of these plants under discussion would be suited to mass planting as lawn substitute, but they are worth trying out if you don't know them yet.

Starting with some of the taller of these short grasses, *Carex appalachica* (photo, p. 102) is a fine-leaved, 30-cm-tall (1 foot) sedge that I acquired from Seneca Hills Perennials. It wants a moist, partly shady site and has thrived in an irrigated ex-lawn. (My goal is to reduce or eliminate the automatic irrigation my clients installed years ago.) Its foliage turns tawny gold on the upper portion of each blade in the fall while keeping its summer bright green closer to the ground. This gives us a handy point for cutting it back in the spring. It can be increased by lifting the seedlings in its vicinity each spring; fortunately, there aren't too many of these.

Ellen Hornig's description in the Seneca Hills catalog of the next plant, *Carex eburnea* (p. 101), drew my attention: "A native cutie from the private collection of Tony Reznicek, with extremely fine, soft bright green upright foliage. This tidy mat-forming sedge occurs naturally from Newfoundland to British Columbia, south to Virginia, Missouri, Nebraska and parts of Texas, in dry sandy soils and on limestone bluffs." Although this sedge has not been as adaptable to Brooklyn as *C. appalachica*, it is a standout in my zone 6, upstate New York rock garden, where its chartreuse foliage drapes elegantly over a rock in full sun. Even in winter it boasts bright, gracefully arched leaves, topping out at 15–20 cm (6–8 inches).

I have seen it used on a "green roof" in Manhattan, where it gave bright foliage contrast. It can be divided or grown from seed, yet is not a strong self-seeder. I look forward to having a large patch of it in a well-drained, sunny spot.

I like these two sedges very much, but they aren't maintenance-free. They benefit from a spring cutting back, and, being so fine-leaved, do not suppress weeds as well as a broader-leaved sedge such as *C. platyphylla* or *C. pensylvanica*. They can take moderate foot traffic.

There are a number of fescues (*Festuca* spp.) that would fit into this article, but none of the really short ones have survived more than one season in my garden, except for the lovely and fragile *Festuca ovina* 'Golden Toupee', sometimes listed as *F. cinerea* 'Golden Toupee'. I've had it at least ten years, and it's no thicker than when I planted it, perhaps because it needs to be divided regularly to thrive. Mine is a genuine gold color. It wants perfect drainage and no chance of winter wet. If it stood tall it might reach 15 cm (6 inches). I cannot report yet on my newest acquisition, *Festuca* 'Pic Carlit', except to say that it's a charming 12-cm (4.75-inch) green fescue that Mike Peden grows well in very upstate New York.

Ophiopogon chingii is not often seen in the trade. You might say it is just a taller dwarf mondo grass (*Ophiopogon japonicus*), but it has more grace and is slightly finer-textured, besides being all of 13 cm (5 inches) tall. It came through last winter undamaged, fully evergreen, and offered perky small white blossoms this summer, which its shorter cousin often fails to do. I wouldn't let this dry out much when you site it, but it seems adaptable to both part sun and shade. I recommend it.

A marginally hardy plant that is worth trying to grow if your winter temperatures don't go below 15° F (−10° C) for long is *Luzula ulophylla*. I first saw this in the Wave Hill (New York City) alpine house, and later saw it used in the open at the Brno Arboretum in the Czech Republic, beautifully placed between small granite pavers. When seed was available through NARGS, I gave it a try and have a few young plants that will require protection their first winter, if not every winter. Characteristic of wood rushes (*Luzula* spp.) is their hairiness, which can outline the leaves most attractively. The hairs on *L. ulophylla* are so small that they are hard to see but for the silvery sheen they give to the back and edge of each leaf. This is a tufted 8–15 cm (3–6 inch) tall, slow-growing plant, another one not likely to spread into a walkable turf substitute but possible between pavers and stepping stones.

Now back to a well-known mondo grass, *Ophiopogon japonicus*. (We're getting shorter—2–3 inches, or 5–7 cm.) In my area this is available as plugs—unlike any of those mentioned above—indicating that growers know of its popularity with a wide spectrum of gardeners. It was the plant of choice when I pulled out the first bit of obnoxious lawn years ago in a little Brooklyn front yard. It spreads very slowly [faster in warmer climates —*Ed.*] but can be helped along by pulling it apart every spring, thus creating your own plugs at a great saving. It looks good next to stepping stones in the shade, and, once established, can take short-term drought and competition from tree roots. In addition, it holds up well to moderate foot traffic.

Acorus gramineus 'Minimus Aureus' has such a different shape from *O. japonicus* that whether it is shorter or the same height as the latter is hard to ascertain. Its

leaf blades are all quite straight and lateral-growing, with plants fanning out concentrically, barely skimming the ground. Like *Carex eburnea*, it catches your eye from a distance with its gold leaves, yet its texture is all neat, defined brightness while the *Carex* is tousled and loose. I've been impressed with this plant's ability to hold its own and slowly increase in a hot, sloping, well-drained location in my garden as well as in an irrigated, loamy, flat garden elsewhere. It can tolerate some shade, growing well in both zones 6 and 7, and doesn't mind limited stepping-on.

We've arrived at the shortest grass-like plant, another sedge: *Carex berggrenii*. It is best suited visually for growing in a trough, where you'll be able to see it well and appreciate its tufty shortness (1–2 inches/3–5cm) and variety of colors. But you could lose it in a trough, because it apparently wants a good moist root run. For me, growing it at the edge of stepping stones in a moist, partly sunny location has been the key to its survival. Forget that I have to get down on all fours to admire it or even to find it because it blends in so well with surrounding soil! This year I discovered that it was spreading, sending out tiny, almost invisible plantlets on short runners. This is one that shies away from self-advertisement. If you like that in a plant, give it a try; and if you like a plant that manages to be gray, green, and brown simultaneously, grow it. On top of all these qualities, it actually blooms, but you could easily miss the whole show. It has left all the strutting and showing off to its cousin, *C. eburnea*. And that's what I love about plants: their differences and how they grow on you.

I couldn't leave this discussion of little grassy plants without mentioning two that are either annual or too tender for zone 7. The annual is *Mibora minima*, the early sand grass. This came from Larry Thomas, a Manhattan terrace rock gardener *par excellence*. It is actually a true grass, but ever so small and ever so quick to come and go. Seedlings from the previous year appear in midsummer, with very gold, delicate leaves. In full sun with good drainage they will grow no higher than 2–3 inches (5–7 cm) but might reach 6 inches (15 cm) in richer, shadier soil. By August they have produced seed and begun losing their bright look, and can be easily scuffed out. But their seed will come back next year, perhaps in too great abundance, but never threatening other plants. I find it charming.

Arthropodium candidum 'Purpureum Nanum' was offered in the seed exchange, where the "nanum" ("dwarf") part attracted me. I had grown the larger form and loved its speckled purple foliage. You look at its shape and leaves and you say "What a nice grass!" whereupon it sends up little white blossoms that speak of a different lineage. Now classified in the Laxmanniaceae, it is actually a lily relative with little white bulbs. Native to New Zealand, the larger form is frequently used in zone 8 American Pacific coast gardens. My 10-month-old seedlings are only 3 inches (7 cm) tall, yet sport the same leaf coloration and blossom type as their 10- to 12-inch big brother. Like *Carex berggrenii*, this little one needs to be viewed up close; otherwise you are unlikely to differentiate the softly speckled foliage from its surroundings. By November it has become a cute indoor plant in its 3-inch pot.

Perhaps I will complete this exploration of short and shorter grass-like plants by arranging all of them in small and smaller pots next summer, to take a family

picture. As with many such forced gatherings, there will be some members who shout out their otherness and some who settle into family harmony quite nicely. It will be a fun project.

Lola Lloyd Horwitz gardens primarily in Brooklyn, New York, but has had the good fortune to learn about many more plants in her Warwick, NY garden. She organized the Eastern Winter Study Weekend 2006 while she was the chairperson of the Manhattan Chapter.

Rock Mulches

Marcia Tatroe

Rock mulch is critical to keeping the crowns of rot-sensitive alpines dry, improving drainage, stopping erosion, and replicating, at least somewhat, the natural conditions found in the alpine, montane, and desert habitats where most saxatile plants originate. Everyone agrees that the well-dressed rock garden wears mulch. However, only a few gardeners have given much thought to the aesthetics of mulch.

Charles V. Cresson cautions us to use "gray gravel mulch with gray stone and brown gravel with brown stone" so the mulch looks like it was "derived from the same geologic source as the rock" (Burpee's *Rock Gardening*, Prentice Hall, 1994). Louise Parsons describes the tossed salad of rock till, the particles unrelated by size, type, or composition, left after glaciation. She says that "you could use a dump truck load of unsorted rock, gravel, sand and soil—even some mud—to create a rock garden faithful to natural geologic environments in the mountains" (*NARGS Rock Garden Design and Construction*, Timber Press, 2003). But Louise is speaking in the abstract in a discussion of soils, rather than advocating such a model for building a garden.

Later in the same book, Gwen Kelaidis recommends that "for a more naturalistic look, mix several sizes of the same kind of rock in unequal proportions, a few scoops of larger gravel to a wheelbarrow of pea gravel." Nevertheless, not one of the gardens in the book actually illustrates this option. All of the photos that accompany the text feature gardens that are mulched with screened gravel of uniform particle size.

In formal rock garden elements such as planted walls, free-standing beds, and troughs on terraces, the uniformity of screened gravel makes perfect sense in what is obviously human construction. But once you've gone to the trouble to create naturalistic rock work, finishing it with the requisite ¼- to ½-inch gravel mulch screams artificiality. Nature is almost always irregular and at times—as in the case of glacial till—even chaotic. The contradiction between naturalistic stonework and fabricated mulch can be jarring. This may seem to be stating the obvious, but I admit that I never noticed the incongruity until a couple of creative rock gardeners in Colorado started breaking with convention.

Visitors to Rebecca Day-Skowron's Raven Ranch in Franktown, Colorado, have always remarked on her gardens' authenticity and intrinsic beauty. Rebecca is a skilled plantswoman whose gardens are filled with rare treasures from the high mountains. But this doesn't fully explain why they elicit such a strong response. What is unique about Rebecca's gardens is the way they reflect her love of rocks as completely as her passion for plants. When she and her husband, Bob, hunt seeds throughout the mountain West for their Rocky Mountain Rare Plants seed business, Rebecca brings back buckets of rock of every shape and size for her gardens, from "one-man" boulders to bits and pieces. At first, she collected gravel from the same locations so that mulch would match rock.

As Rebecca's gardens evolved, she decided it might be more interesting if the rock and the mulch did not always harmonize. In a small rock garden behind the house, lumpy, gnarled igneous rocks stand out against the gray crusher fines in the adjoining path, the dissimilarities of color and texture playing off each other. In the Badlands garden, a large berm is banded with several types of rock to re-create the striations of color and texture found in deserts of the West. Blocky stones at the top of the ridge simulate caprock. Next to the berm is a terrace of white tufaceous desert pavement. The entire Badlands garden is mulched with limestone chips and embellished with gypsum crystals and mineral anomalies, among them sandstone "mushrooms" from the canyonlands of Utah. Despite mingling minerals that would never be found together in nature, these rock and mulch combinations appear quite realistic—what Rebecca calls "a happy accident."

My own rock gardens have always leaned more heavily toward the "-istic" side of naturalistic. In the largest garden in the back yard, the "rock" is caliche, white and gray hardened calcium carbonate deposits locally known as "lace rock" because of their heavily gouged, pocked and swirled surfaces. Caliche looks more like fossilized bone than lace, but this mineral *is* iconic of the Western landscape. For mulch I chose orange decomposed granite collected in buckets from alongside Highway 285 near Bailey, Colorado, when Randy and I go to the mountains to hike. We had always been careful to exclude large pieces, resulting in mulch that was approximately ½ inch throughout. Although attractive, it did not have the same appeal as the mulch in Rebecca's gardens.

I finally realized why when I visited Dare Bohlander's garden in Littleton, Colorado. Like Rebecca, Dare does not use screened gravel as mulch. Xeric rock gardens in front of his house are covered with a casual array of river stones and chunks of various types and sizes of rock, proving that, in an artist's hands, even glacial till can be aesthetically pleasing. In his back yard a garden of lace rock is mulched with irregularly sized pieces of the same material. Knowing that you cannot buy lace rock mulch, I asked him where he had gotten his. It turns out that Dare's mulch is the sweepings he collected from the stone yard when he purchased the larger pieces (photos, pp. 106–107).

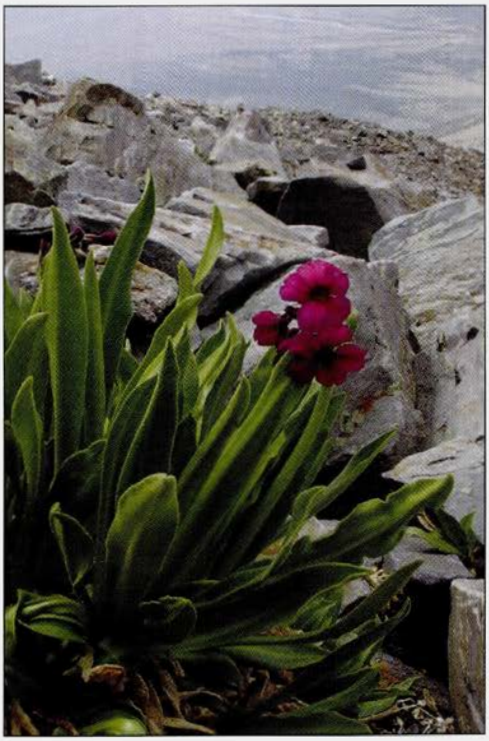
Newly inspired, Randy and I returned to the roadside in Park County, this time to fill our buckets with an assortment of larger lumps of granite. These we scattered and blended as randomly as possible into the existing decomposed granite mulch. Although our garden is still more stylized than natural, the

Trail on Wheeler Peak (p. 85). (photos, David Sellars)

Plants high on Wheeler Peak are dwarfed by constant winds. (p. 85)

Fritillaria atropurpurea flowers on shorter stems in high, windy places (p. 85). (D. Sellars)

Primula parryi growing high in deep talus (p. 86).



Growing *Physoplexis comosa* seedlings under lights (p. 88). (photos, Gene Mirro)

Young plants of *Physoplexis comosa* in nursery pots.

Mature *Physoplexis comosa* combined with other alpines in a trough and presented as a show specimen (p. 88). (G. Mirro)

Carex eburnea in a Zone 6 rock garden (p. 91). (photos, Lola Lloyd Horwitz)

Left, *Luzula ulophylla* in the Brno Arboretum; right, *Carex berggrenii* in an irrigated garden (p. 92).

Carex appalachica in a Zone 7 rock garden (p. 91). (L. L. Horwitz)

Left, *Acorus gramineus* 'Minimus Aureus'; right, *Ophiopogon chingii* with autumn fruits (p. 92).

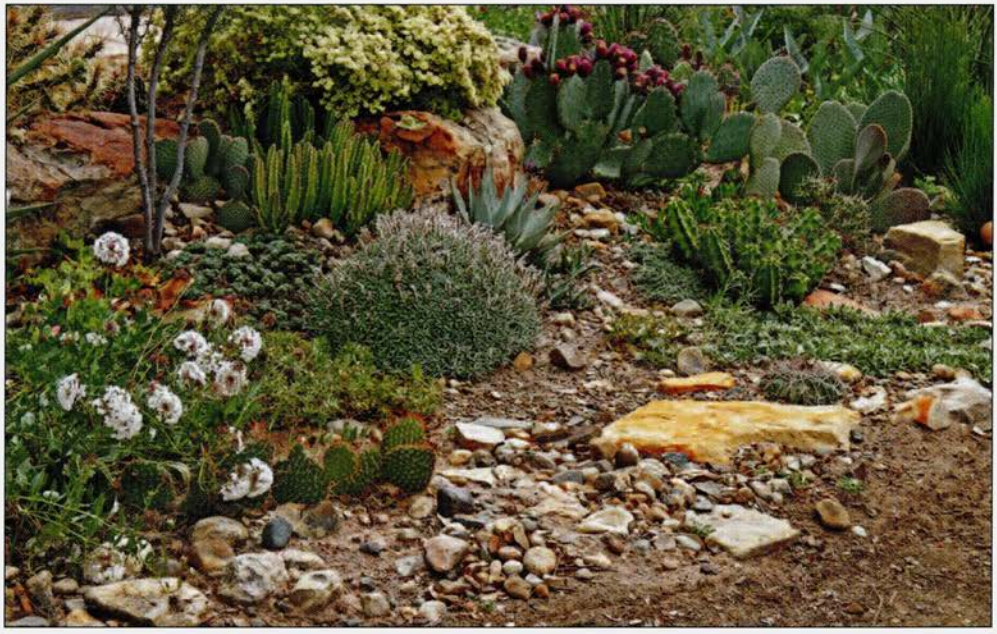
Above, *Erythronium umbilicatum*, stoloniferous bulbs and capsule; below left, comparison of stolons from *E. americanum* and compact bulbs of *E. umbilicatum* non-stoloniferous form; below right, leaves and capsules of *E. rostratum* (p. 115). (photos, Don Jacobs)

Trout lily selections made by Don Jacobs at Eco-Gardens: above, *Erythronium rostratum* 'Eco Sun Watcher'; below, *Erythronium umbilicatum* 'Eco Lutino' (p. 117). (D. Jacobs)

More sophisticated trout lilies (p. 117): above, *Erythronium umbilicatum* 'Eco White Beard'; below, *Erythronium umbilicatum* 'Eco Big Brilliant' and 'Eco Marble Decor'. (D. Jacobs)

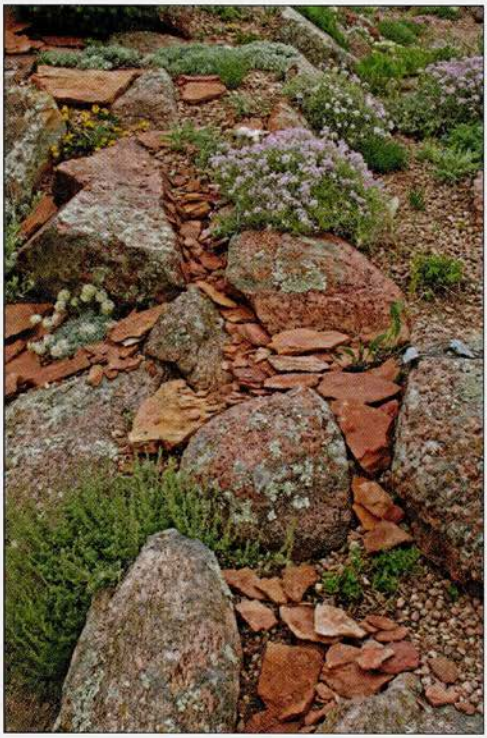
Penstemon caespitosus in mixed rock mulch in the garden of Marcia and Randy Tatroe (p. 95). (photos, Randy Tatroe)

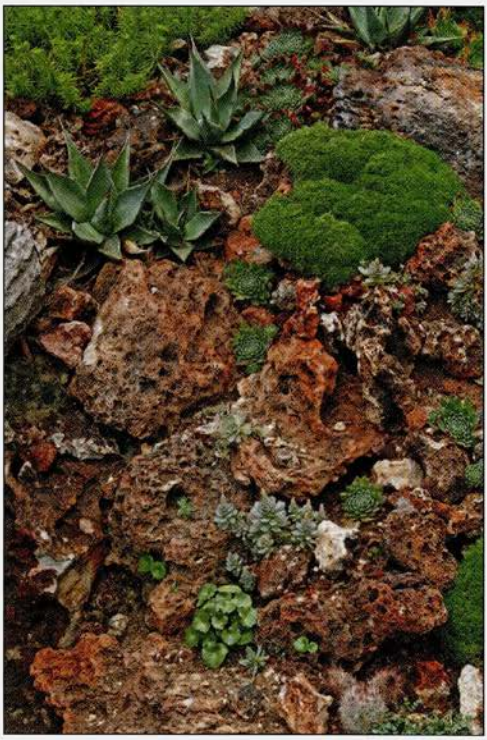
Sensitive handling of variously sized rock in Dare Bohlander's garden (p. 96).

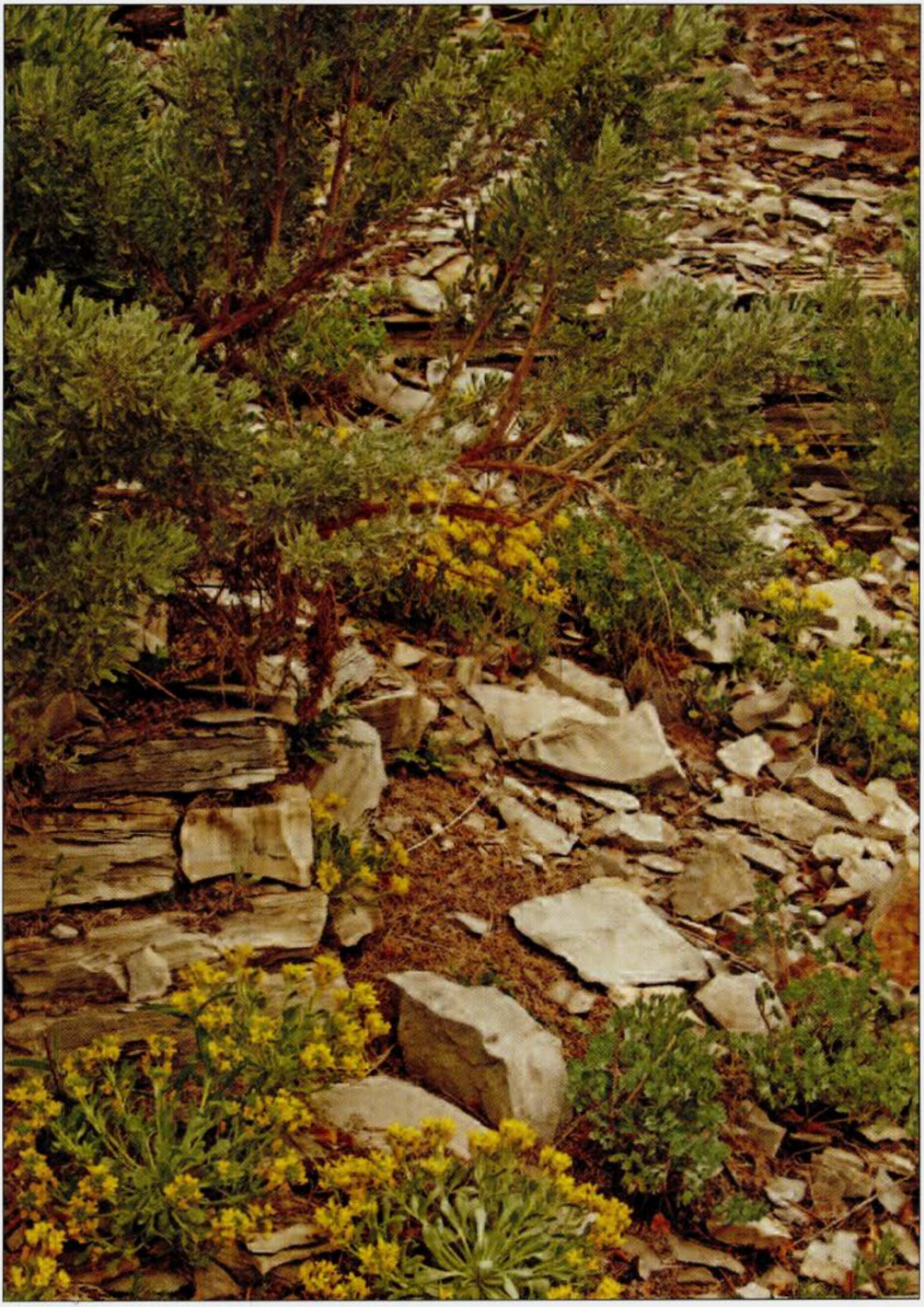


Decomposed granite used as mulch in the Tatroe garden (p. 96). (R. Tatroe)

Left, rock arrangement in the garden of Hugh MacMillan (p. 113); right, "lace rock" in the Bohlander garden (p. 96).







A very naturalistic effect achieved with mixed-size rock mulch for a planting of *Physaria bellii* in the Endangered Species Garden, Denver Botanic Gardens. (R. Tatroe)

Tony Reznicek rebuilding tufa beds at the Marie Azary Rock Garden (p. 129).

A winter view of the Azary Rock Garden, showing its structural bones.

Scene at the Lake Wilderness Arboretum (p. 132). (photo, Doris Taggart)

Presumed hybrids between *Castilleja rhexiifolia* and *C. occidentalis* in Glacier National Park (p. 134). (photos, Dave Nelson)

Castilleja occidentalis on Logan Pass (p. 134). (D. Nelson)

Castilleja rhexiifolia on Logan Pass.

Two award-winning photos from the 2008 Photo Contest exemplify the effects desired from naturalistic rock mulches (p. 95). Above, *Eriogonum* sp. in the White Mountains, California, by Jack Muzatko; below, *Erigeron compositus* with *Eriogonum* and other plants near Crater Lake, Oregon, by Tanya Harvey.

mulch now actually bears some resemblance to the hillside we've been quarrying all these years. And, while I have no real evidence to support my theory, I suspect my plants prefer the irregular mulch because it better replicates their natural conditions (photos, pp.106–107).

Sand dunes and some screes are composed of particles of uniform size. However, such situations are rare in nature. Nooks and crannies are the norm and the natural habitat of most saxatile plants. Another important consideration for those of us who live in arid and semi-arid regions is that a rough surface undoubtedly captures water better than screened gravel. Furthermore, I suspect a layer of larger pieces of rock is more stable and helps to prevent erosion, even on a fairly steep grade. There's no question, though, that the biggest appeal to me is aesthetic (p. 107).

Apparently this idea is catching on. Every time Hugh MacMillan of Sedalia, Colorado, visits Utah, he brings back a few pieces of red sandstone desert paving. He has started arranging them between granite boulders at one end of his largest rock garden. Is it natural? Not at all—but the juxtaposition of these two materials (desert and montane) does hint at the richness of the interior West, where environments as dissimilar as these two often lie close to one another.

I've given a lot of thought to why screened gravel mulch has been the accepted practice in rock gardens for the past 100 years. Probably the main reason is that you can't buy natural rock mulch. Stone yards carry rock and screened gravel. There is no market for anything intermediate. Dare was resourceful enough to recognize the value of otherwise unsaleable bits of lace rock, but it might prove difficult to find enough natural mulch to cover a large rock garden.

That leaves wild collection as the rock gardener's only real option. Collecting rock from roadsides can be dangerous, if not actually illegal. If you live in an area where rockslides are commonplace, the road department might be grateful for every bucket you haul away. But always check first with the local authorities (permits to collect rock for home use in some National Forests can be obtained from ranger stations). For safety's sake, find a location well out of the way of traffic. Respect private property and never take even one rock from a public park. Consider joining your local rockhound society. They go on mineral-hunting field trips and often have access to places individuals don't.

Even if natural mulch were widely available, I suspect many gardeners would prefer screened gravel for its practicality. Gwen Kelaidis advocates using the same mulch in paths as in rock gardens and storing extra mulch in the paths. Replenishing mulch is then really simple. With some envy, I've watched her scoop up a handful of rock chips from the path and toss them onto a bare spot in the garden. A hodgepodge of stone might make an attractive mulch, but it does not provide good footing for paths. Gwen's method would work if the material in the paths is a component of the mixture you use for mulch.

Adding plants or digging holes for bulbs in a garden mulched with screened gravel is unquestionably easier. If the larger particles of naturalistic mulch get mixed in, thereafter it can be difficult to get a trowel into the soil. Also, because naturalistic mulch comes home in buckets rather than in a dump truck, you

want to preserve as much of it as possible. This necessitates moving the mulch aside before digging a hole. (I lay a garbage can lid next to where I am working, throw the mulch into the lid and, after planting, spread the stone chips back over the bare spot.)

Despite these few impracticalities, I've come to believe that naturalistic mulch is worth the extra effort. None of my rock gardens is so large that it requires a huge amount of mulch. They are also widely enough separated that I see no need to use the same type of rock mulch throughout. It's never been my goal to create continuity across my gardens, but if it were I would stick to only one type of mulch in each contiguous area. I don't plan to replace all of the screened gravel right away. Rebecca's and Dare's model is more of a process than a project. As I follow their lead, eventually the spaces in between the plants in my gardens will be every bit as attractive as the plants themselves.

Marcia Tatroe's garden in Centennial, Colorado, near Denver, has been visited by many NARGS members. She is the author of *Cutting Edge Gardening in the Intermountain West* (Johnson Books, 2006; available from NARGS Book Service).

Sophisticated Trout Lilies

Don L. Jacobs

"The world is so full of a number of things
I'm sure we should all be as happy as kings."
But when you see one that doesn't conform
to the way that you think it ought to perform
respect it for its individuality
and don't doubt its long life and history.

The 25 or 30 species of *Erythronium*, commonly called trout lilies, are readily recognized by most gardeners for their pendent flowers with recurved tepals. Then what if you are met by one with wide-open, golden faces staring up at you? And what if these flowers close and turn downward as the sun lowers, only to rise again with the sun in the morning? And what if the flower stalk remains erect, with the spindle-shaped capsule ending in a rigid spike as it matures?

These features characterize *Erythronium rostratum* (pp. 103–104), a unique trout lily of our southeastern states, which I have grown and been puzzled by for some years. My initial few specimens from Arkansas grew and flowered annually without producing seeds, increasing only slowly by bulb offsets. I self-pollinated them in several seasons without results. The ovaries promptly shriveled, indicating self-sterility. This was the first clone I grew, but I now have two other clones, one from Arkansas and one from Alabama. Both are quite stoloniferous and seldom flower. In 2006 I liberated one of these colonies by removing competing vegetation. The following year their growth was more vigorous, but no flowers. In 2008, when I was desperately searching for unrelated flowering material to pollinate my self-sterile clone, this group began flowering—perfect timing!

I had six excellent flowers to work with at the time. I pollinated two with pollen from the stoloniferous clone, self-pollinated one as a control, and for the others used pollen from three different clones of *Erythronium umbilicatum*, another eastern American species. The results were fascinating. As before, the self-pollinated pistil soon shriveled, as did one with *E. umbilicatum* pollen. The remaining four enlarged to maturity.

When I examined their capsules, I found no viable seeds in the *umbilicatum*-pollinated specimens, but plump seeds in both stoloniferous *rostratum*-pollinated ones. These results suggest a positive hormonal effect on capsule development between *E. rostratum* and *E. umbilicatum* pollen, even when fertilization does not occur. Both of these are ancient primary species with 2n chromosome numbers of 24.

E. umbilicatum is basically a non-stoloniferous yellow-flowered species, but at upland sites from northern Georgia into North Carolina and Tennessee, stoloniferous colonies occur. *Erythronium americanum*, which ranges far to the north, is tetraploid (2n = 48). *E. americanum* may have had its origin in the Southeast as well. Its newfound running ability would have equipped it well for rapid invasion of northern habitats as the glaciers retreated. Unfortunately for gardeners, these plants exhaust their resources by producing long rhizomes, each terminating in a small bulb. Only those that bulk up for a few years will flower. Consequently, in a woodland colony of hundreds of leaf-bearing bulbs, only 2 to 3% may flower. When dug, the bulbs are often found 8–10 inches (20–25 cm) deep, but non-stoloniferous bulbs are usually only 2–3 inches (5–7.5 cm) deep.

Linc Foster, a consummate gardener, was frustrated by northeastern trout lilies' deep-seated bulbs and reluctance to bloom. He surmised that if they could be deterred from wasting resources in depth-seeking stolons, they would flower more freely. He suggested planting them over shallowly buried flat rocks. This proved a failure. After all, a kangaroo can't be convinced to walk when he is only capable of hopping.

The most intriguing species in this respect is *E. rostratum*. It also seems to be the least understood. The commonest stoloniferous species are tetraploids with 44 or 48 chromosomes, derived from diploids with 22 or 24 chromosomes and believed to have originated rather recently, in postglacial times. *E. umbilicatum* var. *monostolum* and *E. rostratum* are exceptions, both diploids with 24 chromosomes. The Pleistocene glacial period ended as ice sheets retreated during the past 25,000 to 10,000 years. Prior to this, at some point, there were probably only three basic kinds of *Erythronium* in eastern North America: *E. mesochoreum, E. umbilicatum*, and *E. rostratum*, as represented now. All present types can be derived from these.

Most current literature would lead us to believe that *E. rostratum* is strictly a stoloniferous species, and if we rely on Alabama material there is little reason to question this. Unfortunately, we have a problem of geography. Prior to the Pleistocene, the Ouachita Mountains represented an upland separated from the Appalachian foothills to the east by a flooded embayment in the present-day state of Mississippi, which was built up by vast sediment outflows from glacial rivers coming all the way from the Dakotas, Ohio, and Pennsylvania. If we compare present plants of the Georgia-Alabama Piedmont with those of the Ozarks, we find a number of rare species in disjunct distribution in these two refugia.

In the Arkansas uplands are vast colonies of both *E. rostratum* and *E. mesochoreum*. Some colonies flower so densely that at midday their foliage is scarcely visible. In contrast, colonies of *E. rostratum* in Alabama display sheets of foliage with only scattered flowers. To complicate the problem, if we dig into Arkansas patches, we may encounter abundant stolons at some sites. (*E. mesochoreum* does

not produce stolons.) When we untangle the stolons, we find most are coming from non-flowering *E. rostratum* bulbs, and most of the flowers from clusters of non-stoloniferous bulbs. Some observers insist that bulbs of this species can revert from one condition to the other. I'm not from Missouri, but I say, "Show me!" I grow them isolated from each other, and in more than 15 years I have never observed reversion.

I rarely encounter self-sterility in erythroniums, but it is prominent in this species. I have been unable to obtain seeds unless I use different clones. If stoloniferous and non-stoloniferous forms are grown together, the former soon swamp the latter. I find it remarkable that non-stoloniferous plants still prosper in Arkansas, especially since it takes 4 or 5 years for seedlings to mature, and bulb division is slow. I believe stoloniferous *E. rostratum* evolved during the Pleistocene and migrated in several directions. Only this form managed to traverse the Mississippi-Tennessee bridge to Alabama.

I see no close ties between this and other species and varieties. It is unique in several ways: (1) the pendent buds turn erect as they open at sunrise and turn back down as they close with the declining sun; (2) each tepal develops a pair of basal flaps that wrap around the adjacent stamen filament; (3) the peduncles are sturdy and erect, and after pollination they hold the developing capsules erect with rigid styles intact. I know of no other trout lily with this combination of traits, and both forms exhibit them. In fact, I have observed few clonal variants.

Like *E. rostratum, E. umbilicatum* is a basic diploid species, but it is highly variable, and I have been propagating more than a half-dozen cultivars. Typically it has maroon-marbled foliage, and yellow flowers with brown inner streaks and rose outer stripes; the anthers are usually brown. I have named an outstanding cultivar 'Eco Lutino' (p. 104). It owes its character to the absence of anthocyanin pigment production; consequently, the leaves are marbled silver and green rather than maroon and green, the anthers are pure yellow, and the tepals (petals and sepals) are pure yellow inside and out. All specimens of this cultivar were grown from a single plant found on a granite outcrop near my nursery, Eco-Gardens, in Georgia.

My other cultivars include 'Eco White Beard' with long white anthers; 'Eco Yellow Beard' with yellow anthers and maroon-marbled leaves; 'Eco Big Brilliant', a larger, brighter yellow; 'Eco Brown Eyes' with a dark brown throat and extremely recurved tepals; 'Eco Silver Leaf' with a plain silvery leaf; and 'Eco Round Leaf' with broadly oblong, rounded leaves (p. 105). All are non-stoloniferous, but upland stoloniferous forms of this species exist, with features intermediate between the typical *E. umbilicatum* and *E. americanum*. Nevertheless, they are diploids (24 chromosomes). Their extensive colonies produce very few flowers. In contrast, non-stoloniferous *E. umbilicatum* propagates so freely by seedlings and bulb division that it can develop into a ground cover of flowering plants.

Don Jacobs is proprietor of Eco-Gardens, P.O. Box 1227, Decatur, GA 30031, founded for research and display of native and exotic plants growable in the Piedmont of the southeastern United States, and the propagation of endangered species. His first article in this magazine appeared in 1985.

Gentians and Plant Survival in Pennsylvania

Norman C. Deno

This article was inspired by seeing *Gentiana puberulenta* flowering in Harold Gardner's restored prairie near Carlyle, Pennsylvania. This gentian rivals any other in its genus. It produces a cluster of several stems about a foot (30 cm) tall, with upturned cups as large and blue as any gentian. It is native to the Midwest prairies, so one would think it would be a common and much treasured garden plant. The truth is that one never hears it mentioned, nor have I seen it offered for sale. Seeds do not appear in the seed exchanges, confirming that it is rarely grown.

What is wrong? Germinating the seed is no problem, as they germinated readily in outdoor conditions (unfortunately, oscillating temperatures under controlled conditions were not tried). The seedlings were healthy enough at first, but they soon died. The problem appeared to be that the roots rotted, leaving the rosette of foliage without attachment to the soil.

This raises the question of how to grow gentians. Perhaps no other genus is more desirable in the garden but so frustrating to cultivate. Yard-wide mats covered with flowers have been grown here of *Gentiana acaulis, G. scabra,* and *G. septemfida*, and good clumps of *G. decumbens, G. farreri, G. pneumonanthe, G. verna*, and others as well. *G. acaulis* flourished for 20 years; there was even a perfect flower on January 20. The plants were spread around in many places and grew vigorously all over our north-facing rocky slope, forming wide mats of bloom in spring. Then, over a period of two years, all died.

Today only *G. andrewsii, G. decumbens,* and *G. scabra* survive here. Seed is set naturally, and there is some self-sowing. However, the plants are much less vigorous than in former years. For example, there was a plant of *G. decumbens* with ten stems and 76 flowers, but nothing like that appears today. Incidentally, in my studies of seed germination that resulted in the several editions of *Seed Germination Theory and Practice*, I studied 40 species of gentians and determined their germination patterns. The patterns were often complex, and some required treatment with GA-3 (gibberellic acid).

The situation with our native gentians is similar to the experiences in the garden. Here in Centre County, Pennsylvania, three gentians are native. A large colony of fringed gentian (*Gentianopsis crinita*) appeared alongside a highway where the

trees and brush had been cut back 50 feet from the road. On one side the ground dipped 10 feet below the road and the ground was moist. The other side was 5 feet above the road. The gentians appeared equally on both sides. No other gentians occurred along this highway for 50 miles in either direction. The colony is dying out, though, and now, 30 years later, I could find only two plants, both on the dry side of the road. The germination pattern is described in my books. I have raised seedlings to flowering, but they were weak.

A park was developed near here and a forested area largely cleared. A few years later a large colony of *Gentiana andrewsii* appeared, with the most vigorous specimens I have ever seen. Ten years later the colony was gone, but a smaller, less vigorous colony appeared several hundred feet away.

The third gentian native to our county is *Gentianella quinquefolia*. A large colony developed on a remote gravel road in front of my friend Bob Gruver's cabin. The plants grew in the gravel 5 feet from the edge of the road and for a distance of 100 feet. They were vigorous—a foot high, and covered with flowers. The colony has now disappeared. Plants grown from its seed flowered but failed to establish.

Even plants native to our property, such as spikenard and bloodroot, will form a large colony over a number of years and then suddenly die. Fortunately, those two species self-sow so that there is continual renewal, but that is not always the case. *Hepatica americana* (syn. *H. nobilis* var. *obtusa*) died out with a rust disease, perhaps because of nearby plantings of pines (an alternate host). *Arisaema triphyllum* appears to have died out at least for the moment, but the very rare *Arisaema quinata* (with five leaflets) is spreading. Perhaps one could spray a fungicide every two weeks. Years ago I visited a garden in New Hampshire where this was done, and their orchids grew magnificently.

Even in the wild around here, orchids are notorious for a colony of flowering plants suddenly appearing and then suddenly disappearing a few years later. This has been excellently studied by orchid growers, and we know that the seedlings spend their early life underground, feeding on fungal mycelia. The first growth above ground is an adult plant, and usually a flowering one. Even on our own grounds fine flowering stems of *Epipactis helleborine* frequently appear one year and not again. Over the 60 years we have been here, in just one year a number of clumps of Indian pipe (*Monotropa uniflora*) bloomed, never to be seen since. Another year, a slope full of stinkhorn fungi appeared, but never again.

We are fortunate in having a variety of environments on our property. There is a cold trout stream, a constantly flowing spring, a marsh, a steep north-facing slope with rocky outcrops and a small cliff, dry clay banks, conifer woods, and experimental wet and dry sand beds. In retrospect, I should have tried plants in more of these environments. There have been many surprises. Bloodroot (*Sanguinaria canadensis*) self-sows in the dry sand bed. *Lobelia cardinalis* does not prosper in the wet sand beds, but self-sows just a few feet away on the north slope wherever there is bare ground. *Primula japonica* has been tried in several locations in the marsh, but thrives in only one of them. *Trillium albidum*, a Pacific Coast species, was not expected to prosper, but it self-sows down the slope. The flowers of this trillium stay in good condition for four weeks.

Perhaps the greatest surprise of all was with *Lilium auratum* × *speciosum* hybrids. I grow and hand-pollinate a number of these. Much seed is set, and much of this is allowed to blow around. So where has it germinated the most and grown most vigorously? The answer is the wet sand beds, despite the constant drumbeat in the horticultural literature that lilies require good drainage. The oldest seedling there is six years old, and this year it had two 5-foot stems, one with nine flowers and one with twelve. The flowers, 7 inches across, were the equal of any others grown here.

So what is the final conclusion? More than 99% of plants that die do so because of fungal attack. With the enormous number of species of fungi, there is no simple way of knowing which are present and which are harmful. Yet fungi can also be a prerequisite for growth, as in the case of terrestrial orchids. Roger Koide at Pennsylvania State University has demonstrated the important role that fungal mycelia play in transporting nutrients to the roots of plants. The conclusion is that until we learn more about the world of microflora, perhaps it is best just to try plants everywhere and resort to trial and error.

Norman C. Deno is a retired professor of chemistry, best known in rock gardening circles for his studies of seed germination and the resulting publications. His garden in State College, Pennsylvania, has inspired many people in his region over the years. His first article in this magazine appeared in 1974.

I Should Have Done That Years Ago

John Stireman

In early October 2007, I had just finished planting a handful of summer-grown seedlings into my front-yard rock garden in Sandy, Utah, when I noticed a determined-looking man walking across the street from his Salt Lake County truck. He stopped at the end of my driveway, and I took a few steps in his direction.

"The county will be putting sidewalks in along this side of the street," he said, after identifying himself as a county engineer. "We'll be at your house in about two weeks."

I expressed my displeasure at the short notice and the fact that residents had been given no opportunity for input, but it came out as tirade, so fierce that the engineer called the county sheriff. A brave deputy arrived minutes afterward, and I convinced him that I was not a threat and would listen peacefully to the engineer's apology. But the engineer offered only a few details. The 50-year-old honey locust would have to go, as well as the long berm-style rock garden at the front edge of the yard and a large Austrian pine on it.

All efforts to put the project on hold were futile.

Cold weather seems always to arrive at the end of October. What to do? The pine had provided shade for 200 *Lewisia cotyledon*, the honey locust for a large colony of encrusted saxifrages. Sempervivums had found perfect growing conditions all along the berm. There was no other good home for these and most of the other plants there.

The rocks! I had to save the rocks. My brother Tony and I spent a day salvaging rocks and stacking them to one side where I had removed part of the lawn.

Lawn? If all else was being ripped out, why not the lawn? I stripped the remainder of the front lawn and stacked a mountain of sod opposite the rock pile. The trees were removed. Another grand heap arose from 20 wheelbarrow loads of shredded roots scattered about by the grinding out of the two stumps.

By this time I had decided the future of my front yard. I would build the xeric rock garden that I had been considering for years. My anger with the sidewalk project was not about the annihilation of my garden, just the fact that there had been no due process in decision making that would disrupt the plans of so many residents. I was more than happy to lose the honey locust, which had produced

actual tons of pods over the years and created a vast network of near-surface roots that stole nutrients and water from every other plant. The Austrian pine shed its needles during most of the year, requiring hours to remove them from tiny rock garden plants. Good riddance!

The engineer had agreed to relocate my now rockless berm to the center of the front yard. (And he did eventually apologize for his insensitive approach to residents.) I had noticed, from active construction up the street, that the area under the sidewalk-to-be was being excavated much deeper than the concrete thickness required. The additional depth was being filled with road base for drainage. I asked that the excavated soil, all sand like that of my garden, be piled with the material from the berm. A few days later, as I drove home from work, I rounded a bend on Poppy Lane to the sight of a great volcano in my front yard. The conic mass of soil deposited by the county was 9 feet tall and 24 feet across. And studded with tree roots. I felt embarrassed that I had created this grotesque pimple on Poppy Lane. For the next 3 weeks, I spent all my free time digging and throwing soil and pulling and cutting roots. I gave away as much of the soil as I could and eventually created a long, smooth temporary berm, just before winter covered it in white and hardened the soil with ice.

The following March, as soon as the seemingly permanent snow cover had melted and the ground thawed, I began reshaping the soil and placing rocks, creating a vague imitation of a natural rocky ridge with strata lines running diagonally. It also kind of resembled a Martian landscape: no plants, save the few salvaged *Yucca harrimaniae* that had lain with bare and broken roots upon the ground and were hurriedly thrown into a corner late in the fall.

Planting

Now I was faced with populating a huge blank canvas. I was excited to learn, as soon as possible, how a great variety of plants would perform in that hot, dry environment. I did have plants on hand, because I always grow more seedlings than space in the garden can accommodate. There was a wooden box with a dozen little pots of pitiful *Opuntia polyacantha* seedlings I had kept for 4 years, seldom providing any water, not knowing what I would ever do with them. Also on hand were recently rooted pads of a dwarf, spineless *O. polyacantha* from high in the Wasatch Mountains, and pads of clear pink-flowered *O. basilaris* var. *heilii*. I had sadly removed a vigorous *Opuntia* 'Persimmon' from beside the driveway in September because its fabulous flowers did not justify the large space it consumed. I kept a pad for a nephew, but now I told him I could no longer give it up. Tony provided a start of huge, purple-hued pads of a fine *O. basilaris*. From among the large number of hardy cactus seedlings I grow on the patio in summer and overwinter in coldframes, I had a single seedling of the unusual *O. pottsii*. Now was the time to give that southerner a try in open garden. From the greenhouse I took two of the cholla-style *O. viridiflora*, a natural hybrid with apricot-colored flowers. Most of the opuntias were placed along the sidewalk edge of the new garden, just far

enough in to avoid endangering passers-by but close enough to delight them when in flower. They would eventually provide some barrier to free-roaming dogs and excite fear in over-adventurous children. Over the summer, all of the opuntias grew as though they had gone to heaven, thoroughly enjoying the heat and blazing sun and minimal water of this new environment.

Cacti need yuccas and their kin (*Agavaceae*) as complements, and I had been saving an array of such plants in pots, hoping to share with like-minded gardeners some day. Behind the opuntias, I placed narrow-leaved *Yucca glauca* from Cheyenne, Wyoming, and irresistible *Y. harrimaniae*—two small forms from southern Utah, sometimes referred to as *Y. nana*, and a larger form from Duchesne, Utah. I planted a tiny Joshua Tree (*Y. brevifolia*) without regard to its eventual size, many years in the future.

"And there is a Joshua Tree," I might point out to a visitor. "Where? Where? I don't see one," is the likely reply. One plants a seedling *Y. brevifolia* to elicit memories of those magnificent specimens seen in the Mojave Desert, not with any hope of actually realizing one.

A yucca relative, kicking around in a pot here for a few years, was *Dasylirion leiophyllum*, a very narrow-leaved plant of dubious hardiness. It is supposedly hardier than *D. wheeleri*, of which a small specimen has barely survived here in open garden for three years. Another yucca relative, *Nolina microcarpa*, was planted into a poor location at the same time but has done well. In its native habitat in New Mexico or Arizona, the species matures at 36 to 72 inches (1–2 m), resembling a big grass. It just enters Utah in Washington County. I poked another one into the spacious new garden.

Rummaging through other seedling pots, I found a half dozen of the "red yuccas," *Hesperaloe parviflora*, hardly the picture of health but alive; after a few years of slow establishment, they should present tall stems of brilliant red flowers like their predecessor, which was lost to the sidewalk project. From a never-ending supply of seedlings, I added two final members of the family, *Agave parryi* and *A. utahensis* var. *kaibabensis,* hoping for better luck this time around.

A few bedraggled shrubs in small pots were available, one a spindly Cliff Rose (*Cowania* [*Purshia*] *mexicana*), one equally spindly Winterfat (*Krascheninnikovia* [*Eurotia*, *Ceratodes*] *lanata)*, one Curl-leaf Mountain Mahogany (*Cercocarpus ledifolius*) and four little, aromatic *Salvia dorrii*. Six years earlier I had grown our native shrub, the Fremont barberry, (*Berberis* [*Mahonia*] *fremontii*), from seed and had given many away. Two had remained in one-gallon pots, hardly growing from one year to the next, but they were now unleashed. By this time, I was feeling good about having cared for (and hoarded) all these seedlings. Over the years, my wife, Dianne, had been questioning my Scrooge-like behavior. I felt vindicated. And there were many leftovers.

The previous summer I had produced a wide variety of hardy and possibly hardy mesembs (Mesembryanthemaceae, South African succulents) from seed and had wintered cell packs in cold frames. I planted *Delosperma sphalmanthoides*, *D. karooicum*, *D. floribundum*, *D. sutherlandii*, *D. basuticum* and *D.* 'Ruby Stars.' I tucked in *Aloinopsis spathulata*, *Nananthus transvaalensis*, *Rabiea albipuncta* and a

Rabiea species of exceptional hardiness from west of Molteno, South Africa (Mesa 1841.81). I had plenty of *Ruschia indurata*, *R. pulvinaris*, and *R. hamata* and yellow-flowered *Bergeranthus jamesii* and *B. katbergensis*. I had chasmatophyllums and herreroas and malephoras of alleged hardiness.

I had made cuttings the previous summer of *Iberis candolleana*, *Arabis bryoides*, and *A. drabiformis*, and the little rooted plants spent the winter in cell packs fully exposed to the weather. There were tiny-leaved dianthus of long-ago, misidentified seed-exchange origin, labeled "*D. simulans* NOT." The cutting plants and dianthus went onto the slightly cooler east-facing slope. I had a couple dozen penstemons of various species, some of which had lost their labels, and plenty of erigerons. Three *Campanula coriacea* were placed on the shady side of rocks.

Over a large area, I poked and raked into the soil hundreds of seeds of *Lesquerella fendleri* while spring rains continued. Surely a few would germinate. Lesser amounts of seed of *Mirabilis multiflora*, *Oenothera caespitosa*, *Physaria chambersii*, *Townsendia incana*, and a couple dozen other species were directly sown, mostly surplus seed but small amounts of difficult subjects as well. Nothing to lose but a little time!

When May arrived and seedlings began crowding the season's coldframe seed pots, I began transplanting to individual pots to grow over summer. Since spring weather had remained on the cool side, I ventured putting many of those seedlings directly into the new garden. The Blackfoot Daisy (*Melampodium leucanthum*) and the Woolyleaf Daisy (*Eriophyllum lanatum*) had failed in previous attempts when transplanted from seed pots to individual pots, languishing until disappearing entirely. This time around, they went directly into garden soil. *Eriogonum ovalifolium* has always been risky to grow through summer in pots, so all seedlings were transplanted directly. I continued bare-root planting of other species.

As June got underway, I could no longer risk inserting delicate bare-root seedlings into soil that would soon be drying out quickly under a high, blazing sun and increasing temperatures. For one kind of plant, though, transplanting season had just begun. Cacti have no trouble going into hot, dry soil, even though growth might stall until moisture is available again. I placed a few Patagonian *Maihuenia poeppigii* cuttings and Bob Johnson gave me two little *Maihuenia patagonica*, absolute treasures. I was especially happy to find a home for more than a hundred seedlings of globular and short-columnar cacti. There were numerous species and varieties of *Echinocereus*, *Escobaria*, *Mammillaria*, *Sclerocactus*, and others.

Performance

I did water this xeric garden. Many plants had yet to become established, and last summer was a dry one. I watered at 10-day intervals through the peak of summer's heat and then twice more at 14-day intervals. Each watering was about 0.3 inch—not much water at all. I watered again in the fall in the midst of planting out hundreds of summer-grown seedlings.

I've already mentioned that the opuntias enjoyed the new garden. The yuccas and their relatives made themselves at home but put on only modest growth. I am sure they were concentrating on developing deep roots before investing in too many leaves. *Yucca harrimaniae*, while not much to look at in little pots, developed beautifully formed, blue-gray juvenile rosettes by the end of one summer in the open ground. The Cliff Rose and Mountain Mahogany put on a few leaves, but the Winterfat grew slowly and steadily all through summer and responded to the cool of fall by producing wands of flowers densely covered in white hair, very pretty when backlit. Garden photos that I have seen of the species show floppy stems from over-rich soil and too much water. My poor soil and low water yielded a natural-looking specimen. That was a good sign.

Delosperma floribundum grew into good-sized, non-spreading, pink-flowered bushes but suffered later in summer from constant heat and low water and seemed to be waiting for another spring to refresh it. *D. sutherlandii* grew especially well and produced a heavy crop of its large, deep pink daisies, pausing only during the worst summer heat before perking up in late summer. *Delosperma* 'Ruby Stars' is a plant that I originally thought required a semi-shady location and regular water. Three, in differing locations, grew steadily over the seasons to make very compact, deep green mounds with little, very deep pink flowers. I saw its special beauty for the first time. White-flowering *Delosperma karooicum* made nice daisy-studded mats, but then some died and others died back partly from heat. A few remained whole, and new growth in survivors became vigorous in fall. A few of the tiny-leaved *D. sphalmanthoides* died, but most persevered through summer. Three-quarters of the compact, yellow-flowered *D. basuticum* perished in the heat. It is an alpine plant, accustomed to a reasonable supply of moisture and much less warmth. I planted more in fall on the slightly shaded side of rocks and in locations that might retain a little more moisture.

The *Bergeranthus* did wonderfully despite coming from moister natural habitats. All the other mesembs handled summer with ease, although some *Nananthus* went completely dormant. I discovered that when I decided to remove the yellowed remains of one and found a firm, thickened root, which I promptly reinserted. *Ruschia indurata* and *R. pulvinaris* formed low, dense mats of succulent gray leaves, as I have seen them in the past. *R. hamata*, however, makes twiggy little shrubs of tiny green leaves. They are especially appealing in fall when all but the newest leaves develop a deep red color, so pretty that I decided to continue to grow it as an annual if it proved less than hardy. I have a packet of seeds ready to sow this month. Winter-hardiness, not summer heat and drought, is the true test of many of the mesembs I had planted.

All *Iberis candolleana* were lost to drought. Tiny gray *Arabis bryoides* lost a few rosettes but recovered in fall. *A. drabiformis* looked good all through the growing season, forming tight mats of little green rosettes. Even one *Draba parnassica* survived.

I was surprised to see that all the dianthus were never stressed and continued growing all summer. All of the penstemons grew to perfection and most flowered. *Penstemon grandiflorus* opened perfect fat flowers, *P. mensarum*'s were the deepest blue ever, and a single tiny *P. caespitosus* var. *desertipicti* ended the season as a congested half-inch mat, 6 inches (15 cm) across.

Something is right about this garden, and I hope it isn't the one-time magic of recently turned soil. I have no doubt that loose, well-aerated soil contributed to some degree to good performance, but there are two other factors to consider: the garden is now in full sun, and a network of tree roots no longer steals nutrients and water. I had been growing the brilliant orange *Gazania krebsiana* with mediocre success in a bed adjacent to the new construction but in soil that remained undisturbed. Over the past season, existing plants and new self-sown and direct-sown seedlings made vigorous, free-flowering plants, increasing to the point that many were removed to prevent encroachment on other plants. Nearby, salmon-flowered *Diascia integerrima*, in place for four years, began flowering in May and did not stop until well into November. That was a big improvement.

The newly transplanted erigerons all started out slowly, flowering in moderation and, as temperatures soared, seemed to shrink back some. As summer progressed, their root systems must have reached deep into the sandy soil, because they eventually renewed growth in August and increasingly in September and October. I look forward to Daisy City next spring. Another surprise was the trio of *Campanula coriacea*, two of which opened many pale blue bells. Our native pussytoes, *Antennaria dimorpha*, was clearly stressed over most of summer, but then, it does hail from 9500 feet elevation at the side of Boulder Mountain in southern Utah.

A few years ago, Jeff Brimley gave me seeds of the Devil's Claw (*Proboscidea parviflora*). If I was ever to grow it, now was the time. In May, I planted seeds in a single spot where there seemed to be plenty of room. The plants germinated but continuing cool weather kept them on the sickly side. When temperatures shot up, so did the devils, growing rapidly to resemble, from a distance, large zucchini plants. The flowers are pretty but hidden under the leaves. The interesting part of this desert Southwest native is its evil-looking seed pods, from which the plant derives its common name. I might have continued growing it all summer if it had slowed down, but there seemed to be no limit to its size. I removed it in early August and was puzzled that its root system seemed too weak to find the enormous amount of water it must require. If you have tired of zucchini, grow the Devil's Claw for ornament—once.

I had grown the Desert Four o'Clock (*Mirabilis multiflora*) in the past and removed it because of its great size, but I sowed seed into the new garden for another go at it. The resulting plant grew quickly and by August was covered in rosy flowers. By September, the plant was 4 feet (1.3 m) across and getting larger by the day. If I kept it, it would be at least 6 feet across next summer. If I removed it, I would have space for two dozen smaller plants. To the dismay of neighbors, I ripped it out, knowing that I could grow it another year as an annual.

There was a seed packet of *Mirabilis alipes*, a smaller species that I had collected years earlier south of Vernal, Utah. I direct-sowed some of those as well and now have different Four o'Clocks of more manageable size. Flowers will come next summer. One direct-sown plant of Sand Verbena (*Abronia fragrans*) grew to almost 5 feet (1.6 m) across, producing hundreds of spherical heads, each with about 75 small white flowers, and each evening filling the vicinity with sweet

fragrance. I picked and presented many heads to sidewalk strollers. Our most spectacular native evening primrose, *Oenothera caespitosa*, grew quickly from bare-root transplants and direct-sown seed to open a steady supply of huge white flowers until prolonged heat and drought put them into semi-dormancy. Tiny bare-root seedlings of *Salvia dorrii* sat still for a month before slowly adding new leaves. All survived. A quarter of the *Eriophyllum lanatum* transplants died, but even the remainder did not seem to appreciate the extreme conditions and, after initial growth, looked dormant until fall. *Melampodium leucanthum*, on the other hand, grew wonderfully into foot-wide mounds covered from late July until hard frost with white daisies. Three bare-root *Verbena wrightii* became wide mats of purple flowers all summer and fall. The Cushion Buckwheat (*Eriogonum ovalifolium*) was another bare-root success story, adjusting quickly to drying soil and slowly increasing in size all season.

Seed of *Gaillardia pinnatifida*, collected on the San Rafael Swell and scratched into a small area near the sidewalk, took its time germinating, and then the little seedlings spent weeks hardly changing in size before exploding into foot-high plants covered in yellow daisies. They must have known I would be stingy with water and spent the early weeks making deep roots.

Where the seed came from I don't know, but one *Sphaeralcea parvifolia*, a native globe mallow, germinated in the garden and quickly grew into a husky plant with stems lined with orange blossoms by late summer. Two more germinated in the fall—free xeric plants.

A large number of *Lesquerella fendleri* seed had been raked into a wide area in hope that there would be good-sized yellow mustard flowers on a scattering of gray-green mats the following year. The seed germinated and germinated and germinated, until I began half-joking that every seed had come up. The plants grew unabated on little water and began flowering in July. I thinned and thinned to allow room for other seedlings like the bladderpod *Physaria chambersii*, and to make room for fall planting. The mats grew larger, and I continued thinning until I had removed 90% by fall, leaving many for spring display. While this makes *Lesquerella fendleri* sound like a weedy plant, I had never experienced such exuberant growth in the past. I recommend it without reserve for any xeric garden.

The successes with bare-root planting and direct seeding have changed my strategy for adding new plants to my garden. I am confident that many of the potted seedlings that I lose have a better chance going into the garden directly than by staying in pots above ground through the heat of summer.

Through July and August most of the new garden appeared tired, though always evolving. There was always something new to watch. I was spending a lot of time in the front yard and had far more interaction with neighbors after the sidewalk went in. As cars drove by, I got continual "thumbs up," and some people would stop just to say they had been watching the garden's progress and really liked what I was doing. Passers-by on the sidewalk almost always stopped to talk about this unusual new garden and to relate stories of their own experiences in the desert. Even schoolchildren, usually preoccupied with video games, would tell me, "I like your garden, mister." Kids like cactus. Mrs. Deam, up the street,

said she normally did not like this sort of garden, but she liked mine and she wasn't sure why. I pondered long over all the favorable response. I had worried that traditional minds would think the rock garden unsuited to the neighborhood. Why was there overwhelming approval of this garden? For one thing, it differs radically from the repetition of stressed, browning lawn, bland shrubs, and the same old trees—it is something novel. And I think people see in it a reproduction of our natural desert surroundings that they enjoy. Some have expressed a desire to create similar gardens of their own, but why bother? Just take a walk by the Stireman residence. Once a lawn is removed, one can no longer get away with simply mowing the weeds. Weeds? No, they haven't been a problem for me.

In the 6 mild weeks from the middle of September on, I transplanted hundreds of new seedlings into the garden and was beginning to run out of space—not that it was obvious to the eye but, considering that every survivor will become much larger, crowding can be an issue in a xeric garden.

This garden should be on the list of gardens for the next Wasatch Rock Garden Society (Utah NARGS chapter) spring tour and will present a dramatic change from the nearly bare soil seen last April.

Winter, be kind. So far, −7°F on January 2nd.

John Stireman gardens near Salt Lake City, Utah, with a special interest in cacti and succulents.

Renewal of the Marie Azary Rock Garden

at the University of Michigan Matthaei Botanical Gardens and Nichols Arboretum

David Michener

Visitors to the Marie Azary Rock Garden at the Matthaei Botanical Gardens in Ann Arbor, Michigan, will see a renovated and refocused garden that celebrates plant diversity. Thanks to funding from the North American Rock Garden Society in 2007, a small planning team led by Dr. Tony Reznicek (Great Lakes Chapter) has worked with our staff to significantly rebuild the garden. (website: http://www.mbgna.umich.edu)

Marie Azary was an active gardener with many botanical interests. Her rock garden was built over decades, and parts of it were moved to the Gardens shortly before her death in 1985. Its role continues to be to engage and inspire visitors, much as her home garden did, by showcasing natural plant diversity, by demonstrating the importance of special soil mixtures to plant health, and by featuring plants with multiple seasons of beauty. This aesthetic consideration includes their winter growth forms as seen in many rosette and cushion plants. Although the garden was relocated in 1998 owing to major facilities work, increasing devastation by deer prevented the garden from attaining its full potential until 2006. At that time the entire display garden area was protected by a deer fence. The recent NARGS funding allowed us to rework and slightly expand the garden so that it is aesthetically pleasing, displays a dramatic range of plant diversity, reflects the demands of gardening in our low-elevation and alkaline-soil setting, and is environmentally low-impact. It now demonstrates our institution's commitment to environmental stewardship through appropriate garden practices. It is structured to be at a key entrance to our in-development and multi-acre Great Lakes Gardens, featuring the distinctive habitats and plants of our bioregion—the Marie Azary Rock Garden will be adjacent to our alvar garden ("alvar" is a term used in the Great Lakes region for a flat area with shallow limestone soil, typically inhabited by sparse, stunted conifers and shrubs and some showy perennials; see http://en.wikipedia.org/wiki/Alvar).

Visitors can't help noticing that the Marie Azary Rock Garden is an extremely diverse garden suitable in scale for a home garden and a busy contemporary lifestyle. The distinctive tufa rocks (more below) provide a naturalistic setting with myriad microclimates, while the rearrangement of the original tufa into a sweeping,

sloping arc around a "doughnut hole" rockery "hill" creates both a dramatic stage and a perfectly draining heat sink. (There are several dry wells over 2 m/yards deep beneath the beds and walks to provide excellent drainage.)

Rebuilding the garden required a vision, and Tony Reznicek and Mike Palmer (horticultural supervisor at MBGNA) articulated one of ecologically appropriate diversity. Species in the original gift were desired, as well as others not familiar to Marie Azary. Visual diversity in form, texture, scale, and color are all desired, and as broad a taxonomic range as possible. No particular genus is to be collected at the loss of overall diversity. The one major limitation is the alkalinity of the rocks, soils, and water (our untreated well water has a pH of over 8.0). Based on the experience of Great Lakes Chapter members, a target list was developed.

Creating the new rockery required more rocks—more tufa. The calcareous tufa of the Great Lakes region is a post-glacial chemical precipitate related to travertine (see http://en.wikipedia.org/wiki/Tufa) that forms near the surface where cold springs bring super-saturated water into contact with oxygen. The calcium-rich precipitate forms a highly porous lightweight rock looking like a deranged sculptor's nightmare of fused and lithified sclerotic worm holes. In the Great Lakes, the high iron content of the water makes the tufa dark rusty red, unlike the light gray typical of tufa deposits elsewhere.

Creating a range of microsites with an array of soils was the next step. Tony and Mike restructured the site over two intense July work sessions. Rebuilding the rockery allowed the rocks to be set in a slightly more moisture-retentive soil mix better suited to the exposed site. The rocks were also intentionally arranged to create aspects facing all compass directions, with the bulk having some degree of afternoon shade. Tony's decades of prior experience in arranging the tufa were essential to the final aesthetic success (photos, p. 109).

We (and no doubt this was true for Marie) want people to become interested in *plants* and their habitats in nature, whatever their interests were before seeing the garden. As shown in the photos, and from the attached list, this renovated garden is well on its way to engaging a broad range of visitors. In order to help make the idea of rock gardening accessible, few of the plants are particularly difficult to grow (given the correct conditions). Many were procured from Arrowhead Alpines (http://www.arrowheadalpines.com/), less than an hour from Ann Arbor. We do want visitors to go home and "try this."

Interpretation is critical for any public garden, and labeling the previous version of the Marie Azary Rock Garden provided us insights. Instead of myriad individual plant labels that would turn the garden into a label ribbon along tufa cracks, we worked with a student intern and opted for a few signs about the types of plants seen here. The next step, which is well underway, is creating an on-line plant finder where more detailed information and photographs will be provided. Given the peak bloom in April and the year-round interest, we're expecting the web-based system to provide most visitors the information they seek. After all, persons new to rock gardening don't necessarily understand the specialized ecological relationships of these plants, including the fact that in nature the bloom period begins with snowmelt.

Come visit the Marie Azary Rock Garden and see how the NARGS has been instrumental in reestablishing this rock garden for its original inspirational and educational goals. The Gardens are located at 1800 N. Dixboro Road, Ann Arbor, Michigan. For more information, feel free to contact us at michener@umich.edu. Please include "rock garden" in the email subject line.

David Michener is Associate Curator of the Matthaei Botanical Gardens and Nichols Arboretum.

Backbone rock garden plants for the Azary Rock Garden revision

Core species:
Achillea tomentosa
Aethionema 'Warley Rose'
Allium beesianum
Allium senescens 'Glaucum'
Allium thunbergii
Alyssum (dwarf species)
Androsace sarmentosa
Aquilegia bertolonii
Aquilegia flabellata 'Nana'
Arabis bryoides
Arenaria montana
Armeria caespitosa (=*A. juniperifolia*)
Aubrieta species
Campanula carpatica selections
Campanula cochleariifolia
Dianthus (dwarf species)
Dodecatheon (small species)
Draba aizoides (or other yellow *draba*)
Dryas octopetala
Erysimum 'Orange Flame' or other *Erysimum* (e.g. 'Sprite')
Eunomia oppositifolia
Globularia repens
Gypsophila repens
Iberis 'Little Gem'
Inula ensifolia 'Compacta'
Orostachys spp.
Penstemon hirsutus 'Pygmaeus'
Penstemon davidsonii
Phlox 'Sileniflora'
Potentilla alba
Primula sieboldii
Pulsatilla vernalis
Saponaria ×olivana
Saxifraga (encrusted spp.)
Scutellaria orientalis
Sedum sieboldii
Sempervivum spp.
Silene schafta

Ferns:
Cheilanthes lanosa
Pellaea atropurpurea
Woodsia obtusa
Woodsia polystichoides

Rock Garden Bulbs:
Allium insubricum
Allium thunbergii
Bellevalia forniculata
Corydalis solida (select forms)
Crocus (species only)
Crocus speciosus
Fritillaria. acmopetala
F. meleagris
F. michailovskyi
F. pyrenaica
Iris 'Katherine Hodgkin'
Iris reticulata cultivars
Narcissus scaberulus
Scilla autumnalis
Scilla mischtschenkoana
Tulipa saxatilis
Tulipa tarda
Tulipa turkestanica

Some easier specialties for impact:
Gentiana dinarica
Saxifraga paniculata 'Minuta'
Saxifraga ×apiculata

Lake Wilderness Arboretum

Doris Taggart

In 1965 a group of volunteers with little financial backing, but with lots of enthusiasm and determination, gathered to establish an arboretum in Maple Valley, south of Seattle, Washington. Today the Lake Wilderness Arboretum, started by this core of volunteers, is managed by the Lake Wilderness Arboretum Foundation (LWAF) in partnership with the City of Maple Valley. Paths meander through the 42 acres devoted to native forest, cultivated gardens, and botanical collections.

The water feature in the photograph (p. 110) leads into the Smith-Mossman Garden, once a dense mass of blackberries and weeds. In the 1950s and early 1960s, Britt Smith and Frank Mossman explored the Siskiyou Mountains in southwestern Oregon and northern California and there found fragrant *Rhododendron occidentale*. The two adventurers took cuttings (an accepted practice at that time), brought them home, assigned a number to each clone, and cared for them in their own gardens. Some years later the mature shrubs were transplanted into the Smith-Mossman Garden, given as a donation from the two collectors to the Arboretum. The garden, dedicated in 2000, has now one of the largest collections of *R. occidentale* in the world. Here can be seen the diversity of the species, blooming in different shapes, sizes, and colors including pink, white, and yellow. Some are frilly, some single and some double, all flowering over a long period in June and July. The garden is in a slightly low-lying area where the plants tend to get their feet a little wet, just as they do in their native habitat. Companion plants have been added to the garden: *Acer circinatum*, *Cornus stolonifera*, *Chamaepericlymenum canadense*, *Arctostaphylos uva-ursi*, *Iris douglasiana*, *Camassia quamash*, and *Polystichum munitum*.

Several large ant mounds are found in the Smith-Mossman Garden. *Formica obscuripes* Forel is the most common "thatching ant" in the western United States, a natural part of the forest environment. Above ground the nest is about 1 foot (30 cm) high and up to 5 feet wide. The above-ground portion is made of thatch, fragments of plant debris that help to regulate temperature and humidity in the nest. Azalea-type rhododendrons are very susceptible to attacks by small green caterpillars that defoliate the plants. The Arboretum volunteers wondered

why there was no such damage in the Smith-Mossman Garden until they noticed the ants carrying the caterpillars back to their mounds. No documentation on this subject could be found, so the volunteers are now doing their own informal study.

Doris Taggart of Kirkland, Washington, is active in the Northwest Chapter and a frequent award-winner in our annual photo contest.

Corrections

Two readers have sent corrections related to "Saddle Mountain: Oregon's Vertical Botanic Garden," by Nathan Miller (fall 2008, p. 248).

Judith Jones of Fancy Fronds Nursery in Washington writes: "The photo identified as *Polypodium scouleri* on p. 262 of the fall 2008 issue is not that species. The blade shape, texture and the number of pinnae are incorrect for *P. scouleri*. The closest *Polypodium* in appearance to *P. scouleri* is *P. californicum* in the form that occurs near the coast, but its range does not extend into Oregon [where our photo was taken]. It is difficult to tell from the photo whether this species is *P. amorphum* or *P.* × *hesperium* (*amorphum* × *glycyrrhiza*), or possibly a hybrid of *scouleri* with *glycyrrhiza*. *Polypodium scouleri* is also known to hybridize with *P. californicum* and most likely *P. callirhiza* as well where their ranges overlap. I have a handful of hybrids found in California, Oregon, and Washington, and knowing where they are from is the best way to narrow down their parentage."

David Dobak of Portland, a longtime member of the Native Plant Society of Oregon, notes: "(1) *Synthyris missurica* is not on Saddle Mountain. The plant covering the hillside near the saddle, and visible up close with some scrambling through the shrubs near the trail, is *Synthyris schizantha*—actually a much rarer plant than *S. missurica*, and prettier, too. (2) *Dodecatheon hendersonii* does not occur in Tillamook or Clatsop county (although it is widespread in the Coast Range as far north as Washington County). The plant seen on Saddle Mountain is *Dodecatheon austrofrigidum*. Prior to publication of that species in 2006 (the name was proposed about 20 years ago, and has been in common usage ever since), specimens collected on Saddle Mountain had been identified as *D. pulchellum*. There is a fact sheet on *D. austrofrigidum* at http://www.oregonflora.org/rarepdfs/dodaus.pdf. There is a web page about *Synthyris schizantha* at http://biology.burke.washington.edu/herbarium/imagecollection/taxon.php?Genus=Synthyris&Species=schizantha."

Paintbrush Hybridization and Taxonomic Questions

Dave Nelson

Over many years of visiting Glacier National Park (GNP) in Montana with my wife, we have noticed a distal (tipped), bicolor (violet and white) paintbrush (*Castilleja* sp.; photo, p. 110). In particular, this *Castilleja* occurs near the top of the Hidden Lake overlook trail on Logan Pass (about 7000 feet). My interest was recently piqued when I came across 1958 GNP slides bequeathed by John Thorpe to our chapter of the Native Plant Society, with a very similar photo also taken near the Hidden Lake overlook. A further trip into Banff National Park in British Columbia confirmed this peculiar paintbrush as one of a series of "color variants" described on a kiosk display at the Peyto Lake viewpoint near Bow Summit. I purchased a 2007 Canadian wildflower calendar which had a beautiful photo of a similar paintbrush taken within the Banff area. Several wildflower guidebooks for GNP and British Columbia describe the plant either as a color variant of *Castilleja rhexiifolia* or a hybrid of *C. rhexiifolia* with either *C. occidentalis* or *C. sulphurea*. To complicate the identification further, *Intermountain Flora* (Cronquist et al. 1984:494) indicates that although *C. rhexiifolia* is morphologically indistinguishable from *C. sulphurea*, each requires a slightly different habitat. The paintbrush in the photo on p. 111, taken near the top of the overlook trail of Logan Pass, certainly appears to be *C. occidentalis*. The bracts are covered with long hairs (villous) and the corolla length is quite similar to that of its calyx, about 18–20 mm each. Both *C. sulphurea* and *C. rhexiifolia* have the corolla slightly longer than the calyx. I assume that these measurements (crude though they had to be in the field) may confirm that the majority of white paintbrushes at Logan Pass are *C. occidentalis*. I did not fully examine the specimens there of *C. rhexiifolia* or the presumed hybrids.

Evidently, *C. rhexifolia* can produce hybrids with *C. sulphurea*, as well as *C. miniata*. The bicolored bracts of *C. sulphurea* × *C. rhexiifolia* are quite similar to those noted for *C. occidentalis* (Schneider 2008). A recent investigation of *C. rhexiifolia*, *C. sulphurea*, and *C. miniata* was directed toward their hybridization and their role in diversification of paintbrush populations (Hersh and Roy 2007). In particular, the authors wanted to determine whether differential pollinator behavior could explain the patchy patterns of hybridization among the three paintbrush species.

It was found that two of the same pollinators that visited *C. rhexiifolia* also readily visited the other two—bumblebees to *C. sulphurea* and hummingbirds to *C. miniata*. The other two pollinators, flies and hoverflies, were not so discriminating. Nevertheless, this suggests that the barriers to hybridization are readily breached with specific pollinators.

Once interspecific pollination (anther to stigma) has been achieved, hybridization might be attained. Generally, the first-generation offspring of two different *Castilleja* species (F_1 or Filial 1) are more vigorous and have different qualities from those of the parents. However, the offspring of the F_1 hybrid are generally "mules" (sterile), and seed from the hybrid rarely produces a plant of comparable value. Hybrids often possess odd ploidy (number of sets of chromosomes), which generally causes low fertility or complete sterility. However, many genera (including *Castilleja*) frequently undergo spontaneous chromosome doubling (allopolyploidy), which stabilizes the genome (Hegarty and Hiscock 2005). More than half the species of *Castilleja* have polyploid populations, with ploidy levels from 4x to 12x (Heckard and Chuang 1977), whereas normal diploid (2x) levels would be expected. Apparent hybrid swarms and morphological intergradation are common between some species, especially those with polyploid characteristics (Tank 2006). Of interest to us, even a single hybrid may serve as the progenitor of a new species, provided it is at least partially fertile (Hegarty and Hiscock 2005).

Field studies in northwestern Washington have shown that *C. rhexiifolia* readily forms hybrid swarms, particularly with *C. hispida*, *C. elmeri*, and *C. parviflora* (Anderson and Taylor 1983). However, bract coloration in such cases is not as distinct as the distal, bicolored bracts formed between *C. rhexiifolia* and *C. occidentalis* or *C. sulphurea*. The serious question for taxonomists is "Are these various complex paintbrush just color variants, or are they hybrids, subspecies, or true new species?" Chuang and Heckard (1993) pointed out that the genus *Castilleja* appears to be undergoing an accelerated phase of evolution. Due to the early (1958) identification of the presumed *C. rhexiifolia* hybrid, and my observation of several plants in the same area for the past 15 years, I had hoped we might be seeing such a hybrid "founder event." Unfortunately, in August 2008 there were no hybrids present in that area (below a waterfall near the top of the Lost Lake overlook). However, much lower down the trail were three small groups of the bicolor paintbrush within 30 meters of the trail. Frankly, I did not stroll beyond the trail for fear of setting a bad example for other hikers. Thus, I leave my colleagues with a taxonomic mystery. These paintbrushes are extremely difficult to identify. Yet I feel that we may be seeing hybrids evolving toward new species. Whether or not that is true, the genus represents a very exciting area for both botanists and, it is to be hoped, gardeners who are just beginning to learn how to cultivate these showy but challenging plants.

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Dave Nelson of Richland, Washington, is engaged in ongoing studies of *Castilleja* cultivation, described in several previous issues.

Heathers in the Rock Garden

Nelson Watson

Most authorities point out that besides rocks and pretty alpines, no rock garden is complete without dwarf evergreen shrubs, which provide a vertical dimension as well as year-round interest, color, and texture to what often is a two-dimensional planting with scarce bloom after a brief flush in early spring. I would like to suggest a group of alternatives that offer color year-round, as well as texture and structure to the garden right away—plants that are hardy in most regions of North America, readily available, and for the most part easy to grow.

These are the heathers: cultivars of *Calluna vulgaris*, which range in size from small, dense buns through tightly spreading mats and loose 15-cm (6-inch) mounds to large, dense clumps up to 45 or 50 cm (18–20 inches) in height and width. Most bloom copiously sometime between mid-July and November, in shades ranging from deep crimson through mauve and pink to white. They are evergreen, woody-stemmed shrublets native to the cool peaty moors and rocky hillsides of glaciated northern Europe; they exist in a wide range of naturally occurring forms and so possess great inherent genetic plasticity. This variability and adaptation to poor acidic soils and a temperate climate moderated by the proximity of Atlantic currents make them especially good candidates for rock gardens in the Atlantic and Pacific provinces of Canada and the northern coastal U.S. states.

Heathers have been in cultivation for a long time both in Europe and in North America, most frequently in formal "heather beds" or institutional mass plantings, thanks to foliage that remains in top condition and often changes color in cold weather. The variety of growth habits among cultivars, as well as differences in size, make them prime candidates as specimen plants in a garden of almost any size or aspect. In addition, conspicuous, long-lasting flowers are present on most varieties at some time from midsummer to fall, followed through winter by spikes of spent blooms of some decorative value

Where I garden in Nova Scotia, the growth cycle of *Calluna* starts with a spurt in mid to late June, so late that one wonders whether some plants will make it. The first signs of life are the change in color from the winter hue and the presence of new growth at the tips of branches. As branches elongate, flower buds start to

appear on the stems just behind the tip, in a region with few leaves or branching, so that there is usually little new growth on the stems before flowers mature and the growing tip remains ahead of the region bearing flowers. There is often a period after flowering into fall when stem-tip growth resumes, but this new growth seems winter-hardy in most years. One consequence of this growth pattern is that the previous season's spent blooms drop, leaving bare stretches of stem below the newest growth. This makes pruning heathers an important topic (see below).

Recently a very dry summer and fall, followed by a very cold winter, resulted in a lot of winter kill the next season. Heathers have limited ability to tolerate hot, dry summers, especially when these are followed by cold winters without snow cover during the lowest temperatures, or by drying winds when the ground is frozen.This seems to be true because they continue growing well into winter, and are sensitive to lack of soil moisture. Adapted to peaty soils and moist temperate climates, they do not retain moisture well over long periods.

I'll now describe some of the heathers my wife and I have grown on our property in the Halifax area, on an east-facing slope with acidic clay soil. Most varieties were available as young plants propagated locally by one of the several nurseries growing both older, well-known selections and newer, locally developed ones. Planting involved amendment of the soil with generous amounts of peat and frequent watering through the first season. This attention to watering is especially important because of the fine, short root system of heather plants; damage shows up especially in winter kill. We usually cover those heathers growing on the top of an exposed terrace with evergreen boughs after the ground is well frozen, if snow cover is lacking. These are left in place until mid-April and removed in time for us to appreciate the vivid winter foliage color of many varieties.

The varieties we have grown are mostly typically upright, shrubby forms, except for a trio of really excellent dwarfs. The first of these dwarf forms is 'White Lawn', a ground-hugger whose branches spread radially to a diameter of about 30 cm (1 foot) in a year or two, and slowly thereafter. In August, short, fat clusters of white bloom grace the branch tips. The whole plant never exceeds a few centimeters above the soil, although it may mound up slightly in the center with secondary branching. The branches are somewhat brittle and may become damaged from much trampling, and ant colonies can cause root damage; otherwise this is a fine hardy plant and a unique open groundcover.

We have grown two other dwarf cultivars: 'Dainty Bess' and 'Foxii Nana'. The former is a real beauty, about 15 to 20 cm high and wide, with gray-green foliage on short branches and sturdy mauve flower clusters at the tips. The other is a very slow-growing green tuffet which increases in size over several years into a ground-hugging 15-cm cushion between rocks. There are a number of other very small selections that are increasingly available from specialty nurseries.

Other forms that we grow are taller and have a wide range of foliage colors, rates and patterns of growth, and ultimate height, so it is possible to design for specific long-term effects with these shrublets. Foliage color ranges through many shades of green and often differs on new growth and frequently intensifies

during winter. There are several varieties with yellow summer foliage that turns orange to red in fall and winter, such as 'Beoley Crimson' and 'Boskoop'. The presence of small, fine hairs on the leaves and stems of some cultivars, such as 'Silver Knight', lends a gray cast. It is easy to choose plants with a wide range of foliage hues during both summer and winter.

Flower color varies among the heathers, as noted above, but mauve seems to be the predominant hue of wild populations. The 2-mm, bell-shaped, drooping flowers are clustered near the tips of new growth. The length of the flower spike depends on the current season's growth, with new buds forming at the tip and in the open space below it. One variety, 'Tib', is especially capable of continuous flowering very late into fall, with the result that its foliage can become rather spindly.

There are many heathers with double flowers, often larger than singles, which make the spikes sturdier and more conspicuous. A few doubles we have grown are 'H. E. Beale', 'J. H. Hamilton' and 'Peter Sparkes' (pink) , and 'Alba Plena' and 'Kinlochruel' (white).

Growth habit can be prostrate, sprawling, congested, or upright. The most prostrate form I know is 'White Lawn', mentioned above, and a good example of a sprawler is 'Mrs Ronald Gray', with pink late-flowering blooms. This plant grows only 20 cm high but eventually covers a large area with its tangled, overlapping, supple, light green branches. Many other taller-growing heathers have a similarly confused, irregular branching habit with stems that are initially rather weak. As such a plant ages, the bases of the stems become woody and lose their leaves, and the plant fails to regenerate from the woody base.

In contrast, some taller varieties develop stiff, tall spikes that give them a strongly upright habit. These are generally strong growers and hence have quite long flower spikes. Examples include 'Spitfire', a yellowish-green plant that turns red in winter, 'Mullion', with long, dark red flower spikes, and 'Long White', which has mint-green foliage and long white flower spikes late in the season. These tall growers are also prone to developing woody bases and needing regeneration on a regular basis.

Thus, heathers need annual pruning to keep them reasonably "in shape" and to rejuvenate them. They have the one bad habit of bearing their flowers in a region just behind an active growing tip, so that an untrimmed shoot will have a section of the stem with spent flowers or quite bare, which at the least detracts from the appearance of the plant. Clipping the stems back can be done either just after flowering or at any time before new growth starts the next spring. One caution: if this is done as a superficial shearing, it can turn your individualistic heather into what Tony Avent has called a "green meatball" in just a few seasons, because the shearing stimulates surface branching and the initial natural shape is lost. Even worse, the inner branching becomes woody and few new shoots come from the center. I know because I have made this mistake and have too many old, gnarled plants with only wispy foliage on the top. In a word, prune them like the little shrublets they are; remember that in nature they are grazed by many birds and animals—grouse, deer, and sheep, to name a few. Annually

removing spent blooms and periodically cutting back a few stems to the base will stimulate new growth from the center.

I encourage gardeners to use some of the many diverse varieties of heather to provide permanent color, texture, and height variation in rock gardens. They prefer infertile, rocky, acidic soils and complement many choice earlier-blooming plants and provide a long period of summer color. Most cultivars are winter-hardy in the Atlantic and Pacific provinces of Canada and the New England states and Pacific Northwest, with the most critical factor being the vulnerability to summer drought of their fine, shallow root systems. They don't fare well in hot, humid summers, which limits their usefulness in the southern and mid-western parts of the continent. Yet a great many North American gardeners can take advantage of heather (and a wide palette of related ericaceous shrubby plants) to broaden the scope of our activities.

Sources and Further Reading

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Contact: Kathleen Pyle, kmpyle2@yahoo.com

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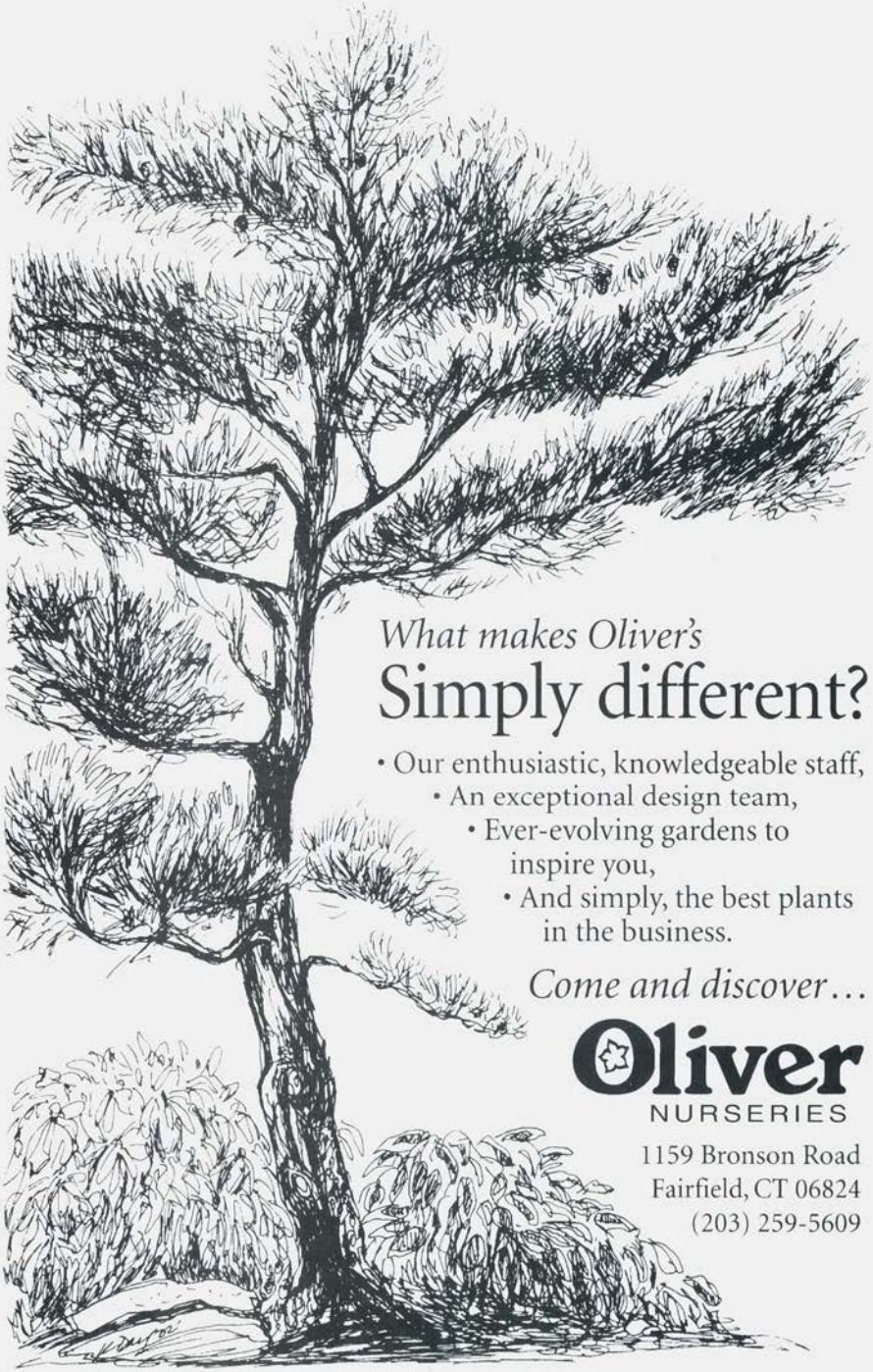
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