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Erythronium Special

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A special issue: where the various articles by Ed Alverson from the SRGC website are brought together to give an overview of the discoveries of the species of western America for Ed's *Erythronium* travels in his "Big Year" and update them to present them to a new audience. The original articles were also translated into Danish and printed in "Den Alpine Have", the journal of The Alpine Garden Society Danmark, between 2008 and 2012. Ed Alverson is a field-botanist and ecologist based in Eugene, Oregon who has written a great many technical and popular articles about this region.

Cover picture: *Erythronium montanum* in Mt Rainier National Park Washington, photo Ed Alverson.

My *Erythronium* "Big Year" Text and photos by Ed Alverson

Part 1, March

My fascination with erythroniums began at an early age. When I was a teenager I stumbled across a small population of ***Erythronium oregonum*** in the hills near our home in the suburbs of Seattle. In the Seattle area, this species is very rare and local. I was fascinated by the idea that there could be a wildflower growing so close to my home with the same habit and form as the ethereal avalanche lily (***Erythronium montanum***) that carpets subalpine meadows in endless quantity in the Cascade and Olympic Mountains.

At some point I began to read about the amazing diversity of colour and form of *Erythronium* in western North America: Flowers of pink, lavender, and yellow, in addition to white; leaves mottled or plain; flowers single or profuse. And furthermore, western North America is the geographic centre of species diversity in *Erythronium*. Of the 40 (by my count) species, subspecies and varieties found worldwide, 25 species are found in western North America.

It was more than 25 years ago that I began my quest to see and photograph all of the western erythroniums in their natural habitat. This is not as easy as it sounds, many of the species are rare and local endemics, and seeing them requires a bit of sleuthing and difficult hiking, not to mention a good sense of timing to find them in flower.

This article will constitute a narrative of my explorations between March and July 2005, to see how many *Erythronium* taxa I could visit in the wild in a single calendar year. The title of this series is an allusion to Mark Obmascik's 2004 book, "The Big Year: A Tale of Man, Nature and Fowl Obsession". That book is an account of three bird watcher's quest to observe as many North American birds as possible in the span of a single calendar year. In this example of "extreme" birdwatching, one man spotted 745 bird species, setting a new record for what the author describes as either the greatest - or the worst - birding contest of all time.

By taking on western erythroniums, I was setting my sights much more modestly, and of course, much less obsessively.

My travels took me over many thousands of miles of highway in the states of Oregon, California, Washington, and Idaho. I won't spoil the ending by revealing how many species I actually did find, but suffice it to say that even though I may have set a world record (for number of *Erythronium* species seen in the wild in a single year), there is still opportunity for improvement, and the record is out there to be broken…

On March 16th, 2005, I began my quest by heading south on Interstate 5 (otherwise known as I-5). My home in Eugene, Oregon is in a central location to have easy access to Oregon's erythronium diversity - all of the 10 species native to the state can be found within a 2 or 3 hour drive of Eugene. Southwestern Oregon - specifically the Rouge River Valley - is one of the earliest places in the state to

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see flowering erythroniums. I actually made two visits to SW Oregon in March, on the 16th and 31st, in order to see all of the low elevation taxa.

Erythronium hendersonii is actually the most common species in SW Oregon. If you have good eyes, you can see it in bloom along the side of I-5 between Grants Pass and Medford. It is also the earliest blooming species. I found it first in the vicinity of the town of Rogue River, where it was growing in a dry woodland under oak (*Quercus garryana*), madrone (*Arbutus menziesii*), and ponderosa pine (*Pinus ponderosa*). Note in the photograph the side-by-side occurrence of a lighter and a darker colored form of this lovely lavender-flowered species. The flowers have purple styles and anthers, and the lower part of the petals (on the inside of the flower), form a deep purple ring.

Erythronium hendersonii

Another wonderful spot for *Erythronium hendersonii* is the trail to the "Enchanted Forest", in the nearby Applegate River drainage. Carpeting the ground under a lovely canopy of lichen-draped oaks are both *Erythronium hendersonii* and *Dodecatheon hendersonii*. Both have flowers in shades of pinkish lavender, and both species are named after Louis Henderson, an important early botanist in the Pacific Northwest.

Erythronium hendersonii beneath the oaks

Erythronium hendersonii has grown very well for me in my Eugene garden, where I was able to get the first flowers in the third year from seed. I suspect it likes my somewhat clayey soil and a lack of summer irrigation.

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Another taxon I wanted to study in more detail is ***Erythronium oregonum* subsp. *leucandrum***. Elmer Applegate described this subspecies as a form with white anthers, in contrast to the solid yellow anthers of typical *E. oregonum*. I was not able to find it at the type locality in Rogue River, but I was able to find it about 20 miles (32km) away in the town of Wolf Creek. Here is a close-up of a flower; notice the white anthers, and also the creamy-coloured petals.

Erythronium oregonum* subsp. *leucandrum

Shortly I will show photos of *E. oregonum* subsp. *oregonum*, which has pure white flowers and yellow anthers. "Pure" subsp. *leucandrum* is found only in SW Oregon, but the taxonomy is complicated by the fact that many populations further north in the Willamette Valley have the cream coloured petals but anthers that are pale yellow, that is, neither white nor deep yellow. This appears to be a case where the plants have outwitted the taxonomists.

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I first found ***Erythronium oregonum*** at Wolf Creek in 1980, and I was amazed by their abundance of wild erythroniums in the yards along Main Street. This species is still found in some quantity, but I was disappointed to see that their abundance had been reduced markedly, by a combination of excessive mowing, herbicide use, and (in the case of this yard, which had the greatest profusion in 1980), vehicle parking.

Erythronium oregonum

Illinois Valley

During my March 31st visit, I had time to explore the Illinois Valley, home to ***Erythronium citrinum* var. *citrinum*** and its close relative, ***E. howellii*** (***Erythronium citrinum* var. howellii)**

The Illinois River is a tributary to the Rogue River, and it is an interesting quirk of plant distribution that there is a very abrupt transition from the area where *E. hendersonii* occurs to the area where it is replaced by ***Erythronium citrinum* var. *citrinum*** which is very similar morphologically to *E. hendersonii*, except that E. *citrinum* var. *citrinum* has white flowers with a yellow centre and has white anthers rather than yellow.

I found a profusion of *E. citrinum* var. *citrinum* in the Star Flat area west of Selma. It was carpeting hillsides along with a little annual composite, *Crocidium multicaule*, a species of *Delphinium*, and the lovely little *Trillium rivale.*

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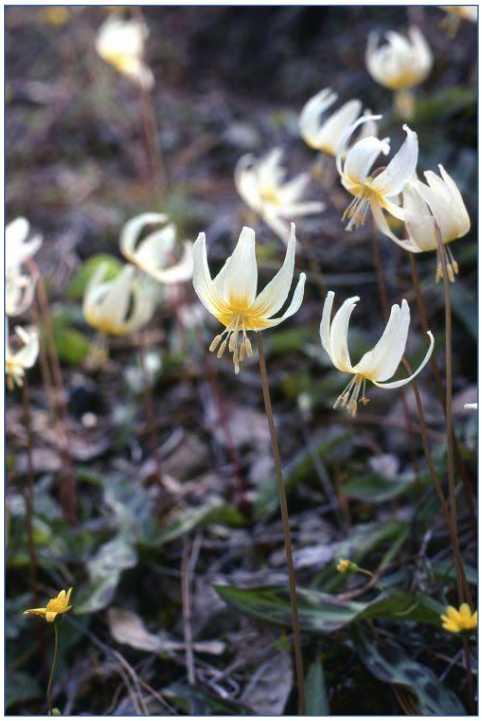
Erythronium citrinum* var. *citrinum

This area has become famous (or infamous) for the 2002 Biscuit Fire and its aftermath. Between August and November 2002 a large wildfire burned much of the *Kalmiopsis* Wilderness and the adjacent area. The perimeter of the fire occupied over 500,000 acres, and was the largest wildfire in Oregon's recorded history. After the fire, the burn area became subject to a furious political debate, and opportunistic politicians have used the fire as an excuse to expand logging into roadless areas and other sensitive habitats. The general public, having learned their fire ecology from Walt Disney, has been easily hoodwinked into thinking that the forests need human assistance to "recover". And to pay for the "recovery", the US Forest Service must first cut down the remaining trees. Well, I digress….



Erythronium citrinum* var. *citrinum

However, there is a point to be made here that is well illustrated by the *Erythronium citrinum* var. *citrinum* display at Star Flat. The paved road formed a fire break, the slopes above the road burned more or less completely, while the slopes below the road did not burn at all. There is a very marked difference in the abundance of *E. citrinum* var. *citrinum* between the burned and unburned areas. In the unburned area, the forest canopy is rather thick, the understory is well shaded, and as a consequence, a large percentage of the *E. citrinum* var. *citrinum* plants are vegetative. Flowering plants are mostly scattered here and there.

In contrast, on the uphill side of the road, between the charred trunks of burned trees (some living, some dead), is a profuse display of flowering *E. citrinum*. var. *citrinum.*

The point here is that for *Erythronium citrinum,* var. *citrinum* as well as many other native plant species, fires that occur in undeveloped areas are not the sinister force that people have come to fear.

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In fact, many flowers are adapted to occasional or even frequent fires, and the absence of fire from the landscape may actually have a detrimental effect on the native flora. Also, in the absence of frequent but low intensity fires, the forest becomes so dense that when a fire eventually does occur, the flames are much more intense and damaging that what would have occurred under a more frequent fire regime. I'll speak more to this issue later, but one could claim, with some justification, that the greatest threat to native populations of many western erythroniums is not development, or grazing, or removal of plants from the wild, but is actually fire suppression and the resulting ecological consequences.

Both *E. citrinum* var. *citrinum* and *E. hendersonii* have fairly restricted geographic ranges in SW Oregon and adjacent northern California. (The Oregon distributions of these and all other erythroniums can be found online at the Oregon Plant Atlas site.) But even more restricted is ***Erythronium howellii***, which is limited to a small corner of the Illinois River drainage near the old mining site of Waldo.

I visited the French Flat "Area of Critical Environmental Concern" (ACEC) to look for ***E. howellii*** in bloom. This is a 656 acre protected area owned by the US Bureau of Land Management (most of the adjoining lands are privately owned). The site is a mixture of wet meadows, ponderosa pine stands, and oak groves.

The site has a diverse flora with many wildflowers. I found *Erythronium howellii* growing near a seasonal stream under oaks.

Erythronium howellii

In general appearance it looks just *E. citrinum* var. *citrinum*, and the only apparent difference between the two species is the absence of nectariferous appendages at the base of the inner petals in *E. howellii*.

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This is a photo that compares **the inner sides of petals** of *E. howellii* (left), *E. hendersonii* (middle, which like *E. citrinum* var. *citrinum* also has the appendages), and *E. citrinum* var. *citrinum* (right).

Erythronium howellii and *E. citrinum* var. *citrinum* are so similar that some people consider them to be insignificant variants of a single species, *E. citrinum*. This is the approach that was adopted by Flora of North America author, Dr Geraldine Allen. I could see a rationale for considering them to be separate subspecies of a single species ("*E. citrinum* subsp. *howellii*"), but such a nomenclatural combination has not been formally proposed to date. Given that *E. howellii* is such a rare taxon, and that *E. citrinum* is pretty much identical from a horticultural standpoint, I personally don't see any need to bring *E. howellii* into wider horticultural prominence.

I should note that both *E. citrinum* and *E. howellii* are frequently found growing on soils derived from serpentine and other ultramafic rocks. These soils are naturally high in magnesium and low in calcium, and many plants are unable to survive on these soils. Species that are tolerant of such stressful conditions are often local endemics. However, in many cases (and these two erythroniums seem to be examples) they will grow just fine in normal garden soils, given suitable conditions of moisture and drainage.

On March 23rd, 2005, in between trips to SW Oregon, I made a day trip northward to the Columbia River Gorge. It is a three hour drive from Eugene, up the Willamette Valley, through the urban congestion of Portland, and then eastward through the Columbia Gorge National Scenic Area.

In this region the Columbia River divides the states of Oregon and Washington, and forms a narrow gorge as it cuts through the Cascade Mountains. The scenery is spectacular and the flora is also very interesting and diverse. This is another area where spring arrives early, especially at the drier east end of the Gorge. Typically the first flowers - *Olsynium douglasii* and various species of *Lomatium* - are in bloom by mid-February. Mid to late March is the time to see unusual low elevation populations of the yellow flowered ***Erythronium grandiflorum*** in bloom. *Erythronium grandiflorum* is an interesting species. It is the most widely distributed species in western North America, and also occurs across the widest elevation range, from lowlands to the subalpine. It also occurs in a number of geographic morphological variants. In the Cascades and westward, we find the variant with white anthers, which Elmer Applegate called **var. *pallidum***. However, Dr Allen has chosen to not recognize the white, red, or yellow anther forms as distinct varieties, even though they have fairly distinctive geographic distributions.

I revisited the Catherine Creek area in Klickitat County Washington, between the towns of Bingen and Lyle, where I had seen nice stands of *E. grandiflorum* during a previous visit. The habitat here is a mixture of Oregon white oak and ponderosa pine woodland or savanna, with numerous cliffs and outcrops. It is truly a rock gardener's (and botanist's) wonderland, with an abundance of *Delphinium, Fritillaria pudica, Lithophragma, Lomatium, Olsynium douglasii, Saxifraga, Zigadenus venenosus (Toxicoscordion venenosum*), etc.

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***Erythronium grandiflorum* habitat, Catherine Creek**

Erythronium grandiflorum grows here not in its more typical montane to subalpine meadow habitat, but as a spring ephemeral in oak and oak-pine woodland. The elevation here is only about 450 to 650ft (about 140 to 200m); the Columbia River Gorge is the only place where *E. grandiflorum* grows at elevations approaching sea level. Also interesting is the diversity of other woodland wildflowers, and the presence of the Pacific Northwest form of the Dutchman's breeches (*Dicentra cucullaria*) provides and interesting analogy to the spring flora of the hardwood forests of eastern North America.

Erythronium grandiflorum and Dicentra cucullaria

***Erythronium grandiflorum* carpet**

Further up the hill I came across a little side valley in which the oak forest understory was carpeted with thousands of yellow flowers of *Erythronium grandiflorum*. It was a lovely sight to behold.

What the photograph doesn't show is that the other dominant understory species is poison oak (*Toxicodendron diversilobum*), a western relative of poison ivy that causes a serious skin rash for those that are sensitive to it (including myself). In fact, poison oak is a constant companion of nearly all of the *Erythronium* species that occur at low elevations in western North America. Some might say that this is the only defence against destructive human intrusion that the erythroniums have.

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***Erythronium grandiflorum* – making offsets**

I should also mention two atypical forms of *E. grandiflorum* that I found at Catherine Creek. In several spots I found clumps of *E. grandiflorum* leaves that were suggestive of vegetative increase by offsets. This phenomenon is well known if a few species and cultivars (such as *E. tuolumnense* and *E.* "White Beauty"), but it may well be that careful observation may result in the discovery of occasional individuals in otherwise non-offset forming species that are capable of vegetative increase. This character, of course, is valuable because it provides a more rapid means of increase in a garden or nursery setting.

Another interesting find was a single cream-coloured flower mixed in with the thousands of normal yellow flowered plants of *E. grandiflorum* at Catherine Creek. This was not an albino (which would be pure white), but rather creamy white, similar to the flower color of *E. oregonum* subsp. *leucandrum*. *Since E. oregonum* does not occur in the eastern part of the Columbia River Gorge, hybridization is not a possible explanation for this unusual flower colour.

***Erythronium grandiflorum*, cream coloured**

I should also note that the colour is not all that similar to *E. grandiflorum's* white relative, ***Erythronium idahoense***. In fact, ***Erythronium idahoense*** is one of the species I visited in April 2005.

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Part 2, April

The first few weeks of spring are the peak season of bloom for the native *Erythronium* that grow at lower elevations. At the same time, weather during late March and early April is still somewhat variable on the west coast, with sunny spells interrupted by episodes of rainy or showery weather. This presents a challenge to the erythronium explorer since soggy erythronium flowers do not display their charms to the fullest. In 2005 we experienced an unusually dry and mild winter in the Pacific Northwest, but as soon as spring arrived the weather turned and the next two months were unusually cool and wet. Still, I managed to find enough days of decent weather to continue my *Erythronium* quest.

Our local wild species of *Erythronium* in the Eugene area is ***Erythronium oregonum***. Most populations fit best under subsp. *leucandrum* because they have creamy to almost yellow tepals, and pale (usually cream to light yellow) anthers. In Oregon, populations that have clear white tepals and yellow anthers (subsp. *oregonum*) are more often found in the Cascades and Coast ranges rather than in the lower elevation valleys, but in Washington and British Columbia only subsp. *oregonum* is found.

While it is certainly not as abundant as it once must have been, *Erythronium oregonum* is still fairly common around Eugene in local woodlands and other undeveloped habitats. While it is easily grown in local gardens, few people have the knowledge or patience to grow it well. But suburbia is full of surprises and a mile or so from my home I came across an otherwise typical suburban yard that was literally bursting at the seams with *E. oregonum*. The entire front yard, except for the lawn and driveway (even the part outside the photo) is packed with thousands of erythroniums. Then, after the plants flower and go to seed, the yard returns to the monotony of a typical suburban landscape.

***Erythronium oregonum* in a garden, Eugene, Oregon**

For my first out of town trip during April I travelled to northern California. On April 5th I set out to find the local endemic, *Erythronium helenae*. This species is found only in the vicinity of Mt. St. Helena, a 4343ft (1323m) high peak located at the southern end of the Northern California Coast Ranges. This was a bit of a homecoming for me, since as a young child my family lived in Sonoma County, about 10 miles (16km) from Mt. St. Helena. Although the lower slopes are increasingly being cleared for vineyards (this is, after all, the famous Napa/Sonoma wine country), the upper slopes are still forested with a diverse mix of oaks and conifers.

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Mt. St. Helena

Unfortunately I did not have a lot of time to explore, but I did find several small populations of *E. helenae* at about 2300ft (circa 700m) elevation along a narrow country road on the north side of Mt. St. Helena. ***Erythronium helenae*** is one of the white flowered species with golden centres and mottled leaves; it differs from *E. californicum* with its yellow anthers (instead of white) and shorter style. In cultivation, *E. helenae* increases vegetatively from corm offsets. *E. helenae* is also distinctive in having fragrant flowers. It is a beautiful species for cultivation; let's hope its few remaining wild populations can be conserved.

Erythronium helenae

My next goal was a search for *Erythronium californicum*. On this day, as on many other days during this field season, I was following in the steps of Elmer Ivan Applegate (1867-1949), "Mr. Erythronium". Applegate was the grandson of famous Oregon pioneers of 1843, and spent much of his life exploring the west for erythroniums and other treasures of the native flora (a biography of Applegate can be found in volume 10 of the Native Plant Society of Oregon journal, Kalmiopsis). Applegate's 1935 monograph of the Western North American *Erythronium* is still the authoritative reference on the genus.

Much of Applegate's *Erythronium* field work was done later in his life, when he was in his 60's. On March 31, 1934, Applegate collected *E. helenae* at two localities on Mt. St. Helena, and then later in the day collected *E. californicum* in Lake County along the "Hopland Grade" between Clear Lake and Hopland (about 30 miles (48km) north of Mt. St. Helena). Seventy one years later (plus a week) I was also able to find ***Erythronium californicum*** along the Hopland Grade, growing on north-facing roadside banks at an

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elevation of about 1700ft (518m). The vegetation here was evergreen oak woodland and chaparral, difficult to explore away from the road because of the abundance of both poison oak and "no trespassing" signs. It was a bit of a challenge to take photographs with traffic whooshing close by.

Erythronium californicum **clinging to the slope at the side of Hopland Grade**

Erythronium californicum

The tepals of these plants appeared to be rather creamy, almost lemony in colour. Anthers are white. Note also the irregular red banding on the inside of the flowers; this is lacking in *E. helenae*. Also note the flower stalk with four flowers, branching from the middle of the stalk.
One clump in the population (not illustrated) was evidently forming offsets. *E. californicum*, while endemic to California, is actually one of the most widespread erythroniums in the northern part of that state.

The following day, April 6th, I crossed the Sacramento Valley to the foothills of the Sierra Nevada to look for *Erythronium multiscapideum*. There has been much discussion in print about a particular form of *E. multiscapideum* that has informally been called "*E. cliftonii*" (not a validly published name) or *Erythronium* "Pulga form". The former name would honour Glen Clifton, an intrepid field botanist who has made a number of important botanical discoveries over the past 20 years. The latter name indicates where one would find it.

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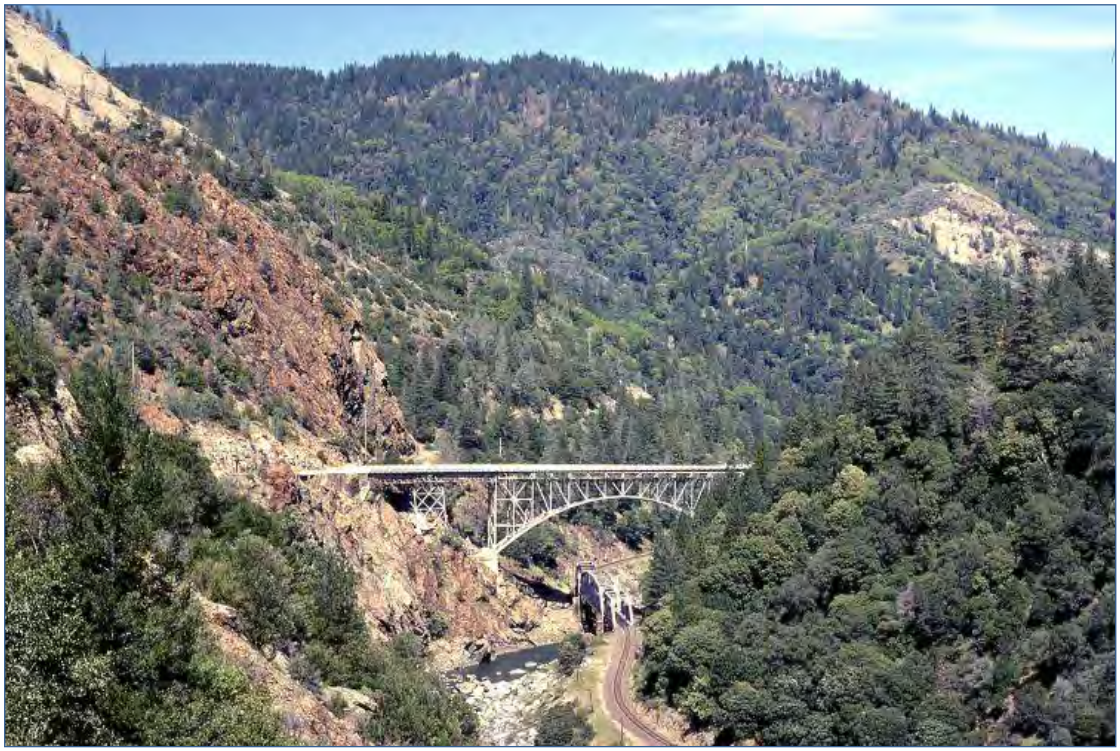
Pulga is a place name (there is no town to speak of) for a site along the Feather River miles east of Chico, in Butte County. The river flows in the bottom of a deep gorge, and the highway and railroad switch sides of the canyon at paired bridges. On the north side of the gorge are massive outcrops of ultramafic rock (serpentine or peridotite).



Pulga Bridges in the Feather River Canyon

I quickly found erythroniums growing along the side of the road. However, I was too late; at this low elevation of 1600ft (487m) the plants apparently flower in March. What a disappointment!

Even in fruit, one can see the distinctive feature of ***E. multiscapideum***: The inflorescence is branched below the ground level, making it appear that each flower is on a separate stalk or scape (hence the name "*multiscapideum*"). This character is unique to *E. multiscapideum.*

***Erythronium multiscapideum* in fruit**

The photo also shows a clump of leaves produced from offsets. This is confusing because, according to Applegate, typical *E. multiscapideum* reproduces vegetatively from the ends of long runners (and is similar to some of the eastern North American species in this regard).

This makes me wonder whether the offset character could be used to distinguish "*cliftonii*" from typical *E. multiscapideum*, but I do not have enough experience with the plants in the field or in cultivation to say with certainty. Otherwise, "*cliftonii*" is considered to be a vigorous version of *E. multiscapideum*, and has become popular among the erythronium cognoscenti.

Fortunately, I was not to leave disappointed, and found plants in flower on the shady, north-facing side of the canyon. In flower, it has real grace and charm.

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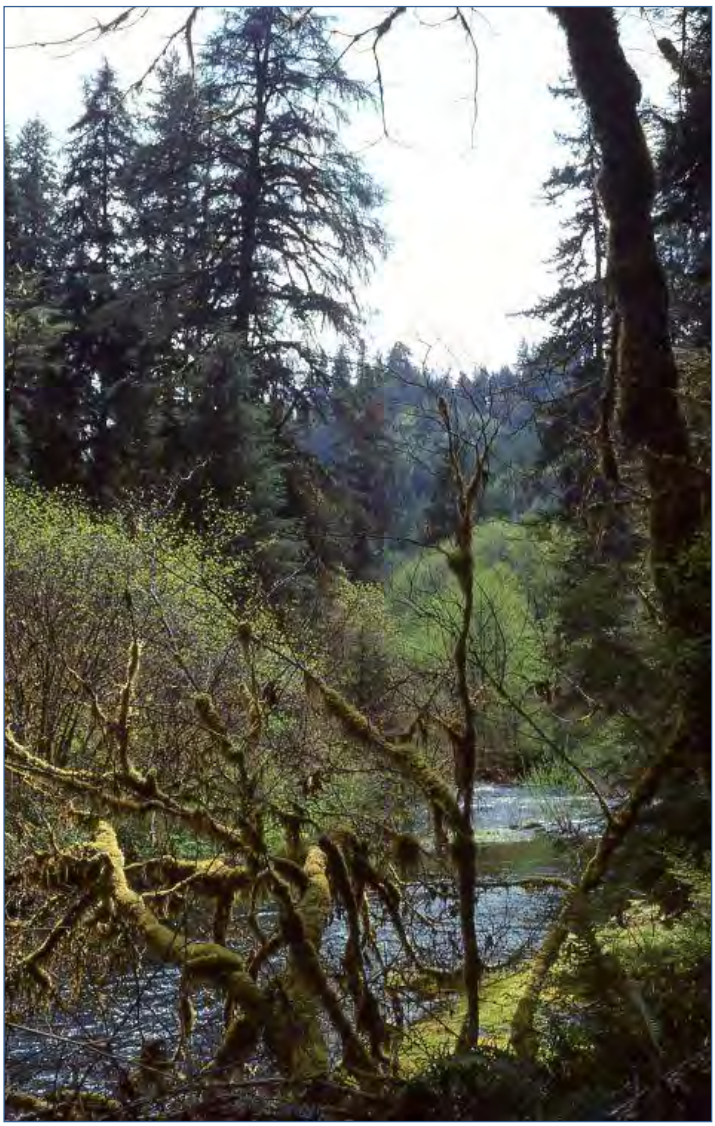
***Erythronium multiscapideum*, in flower**



Back at home, I found time for another day trip on April 11th to search for *Erythronium revolutum*. Despite its wide latitudinal range (northern California to Vancouver Island, B.C.), *E. revolutum* is found only within about 30 miles (48km) or so of the coast. This is a zone of high rainfall and mild temperatures, which helps to explain its greater tolerance of summer water in gardens, compared to other western species. Throughout most of its range, *E. revolutum* is actually a fairly uncommon plant in the wild. To find it, I headed in to the heart of the Oregon Coast Range about 40 miles (64km) west of Eugene. Though not lofty (peaks and ridgetops are generally between 2000 and 3000 feet (609 to 915m) the Oregon Coast Range forms an incredible rugged maze of ridges and canyons. You can hike up a remote canyon and feel you have landed in a lost world. It is an illusion, of course; the reality is that you are only a few miles away from highways and clearcuts, and the few designated wilderness areas are relatively small.

I made my way to a trailhead in the Siuslaw National Forest on the North Fork of the Smith River, which leads upstream through a lush canyon of mature and old-growth conifer forest. Epiphytic mosses grow especially prolifically in the humid atmosphere.

North Fork of the Smith River

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Erythronium revolutum seems to be somewhat particular in its habitat requirements. I found it growing either on the river bank close to the high water mark, or in brushy thickets of vine maple (*Acer circinatum*), seemingly avoiding the typical coniferous forest understory where other, more competitive understory species predominate. One advantage of living under hardwoods is the increased light that reaches the forest floor before the deciduous species leaf out.

Vine maple thicket along North Fork Smith River trail

Erythronium revolutum is the only pink-flowered species in western North America. It is, however, closely related to *E. oregonum,* sharing with it the character of flattened anther filaments. Natural hybrids between the two species have been found on Vancouver Island, B.C. (Allen and Antos, 1988). *E. revolutum* was also the first western species to be collected by European botanists, having been collected by Archibald Menzies in the vicinity of Nootka Sound, Vancouver Island, possibly as early as 1788. Lost in this mini-wilderness of the Smith River, one can easily imagine the landscape that presented itself to Menzies, David Douglas, and other early botanical explorers in western North America.

Erythronium revolutum

Returning to civilization, the next stage in my journey was visit a series of urban natural areas to look for *Erythronium oregonum* subsp. *oregonum.* On April 13th I headed back to the interstate freeway, this time driving north to western Washington State. I had been wanting for some time to explore Lacamas Park, a city park in Camas, Washington, located just east of Portland Oregon and Vancouver Washington. One has to appreciate a town that is named for a wildflower (in this case, the camas lily, *Camassia quamash*). Lacamas Creek, which flows over a waterfall and through a miniature gorge in Lacamas Park, is also named for the camas lily, in this case the term that was used by French-Canadian trappers. Camas was an important wild food plant for Native Americans (who dug the bulbs in huge quantities, roasted them in underground pits, and then dried the cooked bulbs for long-term storage; erythronium corms were also a common food item).

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A portion of the park is called the "lily fields", where camas grows in abundance on an open, rocky slope. Fringing the lily fields, with the camas just starting to bloom, was a band of Oregon white oaks (*Quercus garryana*), transitioning beyond in to Douglas-fir forest.

Lily Fields, Lacamas Park

Erythronium oregonum* subsp. *oregonum

I found ***Erythronium oregonum* subsp. *oregonum*** growing in several large drifts under the oaks. The plants were just coming in to bloom so the flowers were not completely open to show the contrast between the white petals and the deep yellow anthers that distinguishes subsp. *oregonum* from subsp. *leucandrum*. As far as I know, only subsp. *oregonum* is found in the northern part of the species' range, from Washington north to British Columbia.

The substrate here is woodsy humus and soul pockets over bedrock. This provides good drainage, but given its ease of cultivation in normal garden soils, I suspect that the relative scarcity of *E. oregonum* in the northern part of its range is more a function of competition from other more vigorous native understory species.

Heading north toward Seattle, I made another stop at Fort Steillacoom Park near Tacoma. During the Pleistocene the retreating ice sheets left extensive plains of glacial outwash in the vicinity of Tacoma

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and Olympia, and these excessively drained soils developed into prairie and oak savanna vegetation. This area is now the last stronghold for prairie and oak habitats left in western Washington.

I had first found ***Erythronium oregonum*** in Fort Steillacoom Park in 1986, and I was curious to see whether the population had survived (hopefully in this case, through benign neglect) over the past two decades. Fortunately, I readily found the same spot and there was still a thriving population of *E. oregonum* growing under an open canopy of oaks.

Oak savanna, Fort Steilacoom Park

Not only is this a vigorous population, but the leaves seem especially strongly mottled. Some of the plants show a slight brownish-purple tinge on the base of the outer side of the tepals, a character that seems to be correlated with the strong leaf mottling.

Erythronium oregonum* subsp. *oregonum

A brief visit with family in Seattle was really just a staging point for the next leg of my travels, to far eastern Washington to see *Erythronium grandiflorum* and its white-flowered relative, *E. idahoense.*

View east from Steptoe Butte

Erythronium idahoense is a local endemic of the Palouse region of eastern Washington and adjacent northern Idaho. The Palouse is a rich agricultural region underlain by very deep loess soils. The natural vegetation was grassland and Ponderosa pine savanna, but most of the natural vegetation has been cleared for agriculture. The view from Steptoe Butte, in Whitman County, Washington, provides a good view of the lay of the land. This is a rather arid region, with a continental-type climate, cold in the winter and hot in the summer. Steptoe Butte proper is too steep to farm, and has been protected as a state park. On the north side of the butte I found the white flowers of *Erythronium idahoense*, growing amongst native bunchgrasses and a few other early flowers such as *Fritillaria pudica* and *Olsynium douglasii*. This species has plain (un-mottled leaves), white flowers with a yellow centre, and (usually) white anthers, although I did find a few plants with yellow anthers as well.

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Erythronium idahoense

Elmer Applegate collected erythroniums in the Palouse country in April 1931, just two years after ***Erythronium idahoense*** was described as a full species by Harold St. John and G.N. Jones in 1929. Applegate visited the type locality for *E. idahoense* near Worley, Kootenai County, Idaho, which is about 5m (8km) over the state line from Washington. I was curious to see if *E. idahoense* could still be found in Worley, so I headed into Idaho. Amazingly, I found easily a nice patch of *E. idahoense* growing along the main highway right at the edge of town. The conditions were very windy, and a big thunderstorm was heading towards me, so I quickly took some photographs.

From Worley I headed back west to Spokane to spend the night. I was curious to see if I could observe the transition zone from *E. idahoense* to *E. grandiflorum.* This is how Applegate described the distribution of the two species in this region in his 1935 paper:
"In passing southward from Coeur d' Alene Lake, the whole country is yellow with *E. grandiflorum* to a point just south of Ford, where the species abruptly ends at the edge of an east and west road. On the opposite side of the road *E. idahoense* appears as suddenly and in as great abundance, everywhere – in the woods, in the open pastures, and in wheat and alfalfa fields, extending southwards without interruption for perhaps fifteen miles to the edge of the treeless plains in the vicinity of Tekoa in the north eastern corner of Whitman County, Washington. Even along the point of contact there is practically no intermingling of the two species of the region."

***Erythronium idahoense* at the type locality.**

Sad to say, erythroniums no longer occur "in great abundance, everywhere" in this region, but instead are confined to patches of remaining suitable habitat here and there. I was not able to find a spot where *E. idahoense* abruptly ended and *E. grandiflorum* picked up on the other side of the road. However, driving NW from Worley towards Spokane, I only had to travel about 10 miles before I started seeing *E. grandiflorum* instead of *E. idahoense*.

Spokane has a wonderful urban natural area, the 500 acre Dishman Hills Natural Resources Conservation Area. A series of glacially scoured ridges and ravines rises to an elevation of 2400ft (730m), about 400ft (120m) above the city. Vegetation is a mix of Ponderosa pine and grassy meadows, ideal habitat for erythroniums. My timing was perfect; it was April 14th and *Erythronium grandiflorum* was in full bloom. I arrived about an hour before sunset and was thrilled to find thousands of *E. grandiflorum* carpeting the ground in the glow of the setting sun.

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Ponderosa pine savanna with *E. grandiflorum*

Erythronium grandiflorum* var. *grandiflorum

In contrast to white-anthered population of *E. grandiflorum* I visited in the Columbia River Gorge in March, populations in the Spokane area belong to the variety with red anthers. This happens to be var. *grandiflorum,* because the first collection which represents the type specimen for the species is the form with red anthers.

This is a good point to mention that the taxonomy of western erythroniums is still somewhat up in the air. While Applegate recognized *E. idahoense* as a separate species from *E. grandiflorum*, and also recognized the three anther colour variants of *E. grandiflorum* as separate varieties, the author of the recent treatment of *Erythronium* for Flora of North America, Dr Geraldine Allen, took a more conservative approach. Dr Allen did not recognize the anther colour forms as good varieties, and treated *E. idahoense* as *Erythronium grandiflorum* subsp. *candidum.*

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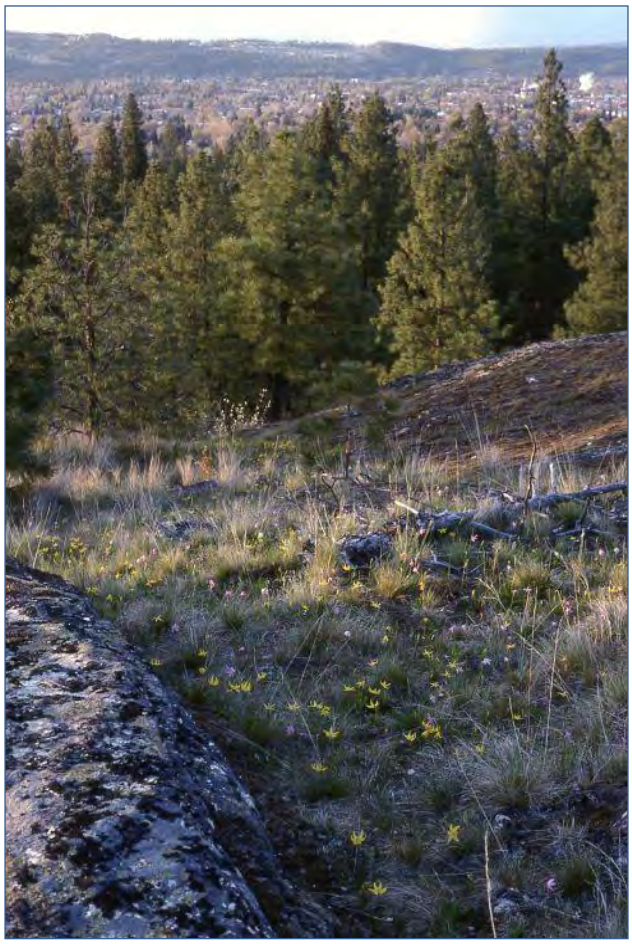


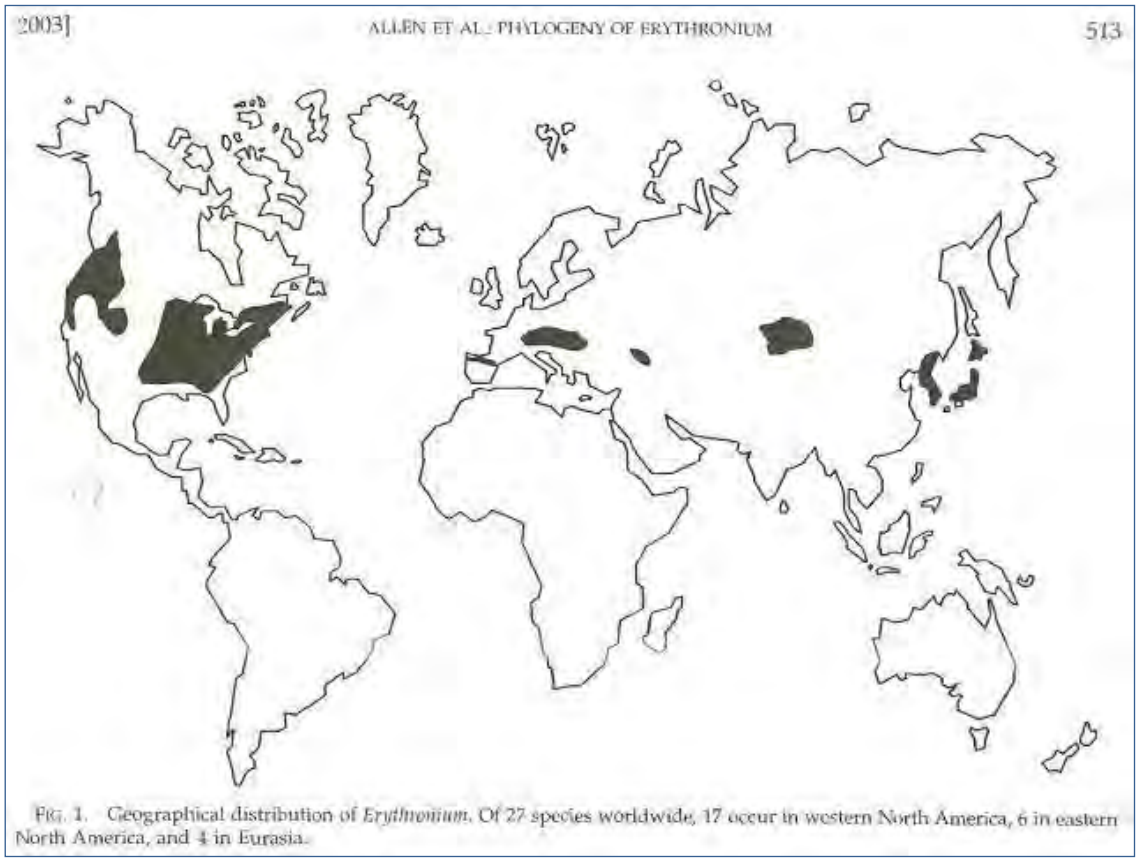
I am personally inclined to agree with Applegate; the three anther colour forms of *E. grandiflorum* (red, white, and yellow) have rather discrete geographic ranges (although they may mix in areas where the ranges come together).
The differences between *E. idahoense* and *E. grandiflorum* are no less than the differences between *E. hendersonii* and *E. citrinum,* which are morphologically identical except for aspects of petal and anther colour. I might attribute the viewpoint of lumpers to a lack of experience with the plants in the field, for studying populations in nature is an important aspect of really understanding the species.

This brings to a close the first half of "My *Erythronium* Big Year". Starting in May, one must go into the mountains to follow the *Erythronium* season as moves up to progressively higher elevations.

Dishman Hills, Spokane, Washington

Part 3, May

I thought I would start this entry by stepping back to place the western species of *Erythronium* in their larger evolutionary, ecological, and biogeographic context. Any comparative discussion is essentially a history. By stepping back in time, we can better understand how and why we have the wonderful diversity of erythroniums all around the northern hemisphere.



Geographic Distribution of *Erythronium* (ex. Systematic Botany)

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An analysis of the geography and evolution of *Erythronium* was published in 2003 by Drs Gerry Allen, Doug Soltis, and Pam Soltis. The paper was published in the American scientific journal Systematic Botany, and may not be easily located by people outside of North America unless they have access to a university library. In addition to a rather technical description of the genetic variation in *Erythronium* and related genera found in the matK gene in the chloroplast, and the internal transcribed spacer (ITS) region of the nuclear rDNA, the paper has some interesting maps and figures.

The illustration from that paper, shown on the previous page, shows the native distribution of *Erythronium*, which is consists of a series of disjunct populations in Asia, Europe, eastern North America, and western North America. This distribution most likely reflects a more continuous distribution around the northern hemisphere at some time in the past. Many plant groups, both herbaceous and woody species, show a similar pattern, which reflects the influence of past land bridges between North America and Eurasia, as well as a history of changing climate patterns, culminating in the Pleistocene ice ages.

For example, in all three regions of the northern hemisphere where erythroniums occur, at least a portion of the natural distribution lies in regions south of the southern limit of Pleistocene glaciation.

Although the technical details may sound incomprehensible, the analysis of patterns of mutations in genes such as matK, and the ITS region of the nuclear rDNA, can be used to uncover the evolutionary sequence that has led to the present-day diversification of *Erythronium* throughout the northern hemisphere. One interesting point that this analysis confirms is that the plants most closely related to erythroniums are tulips, and that both are among a half dozen genera closely related to the genus Lilium.

Within the genus *Erythronium,* the species found in each of the three main geographic regions in which they occur (Eurasia, eastern North America, and western North America) represent separate lines of evolution.

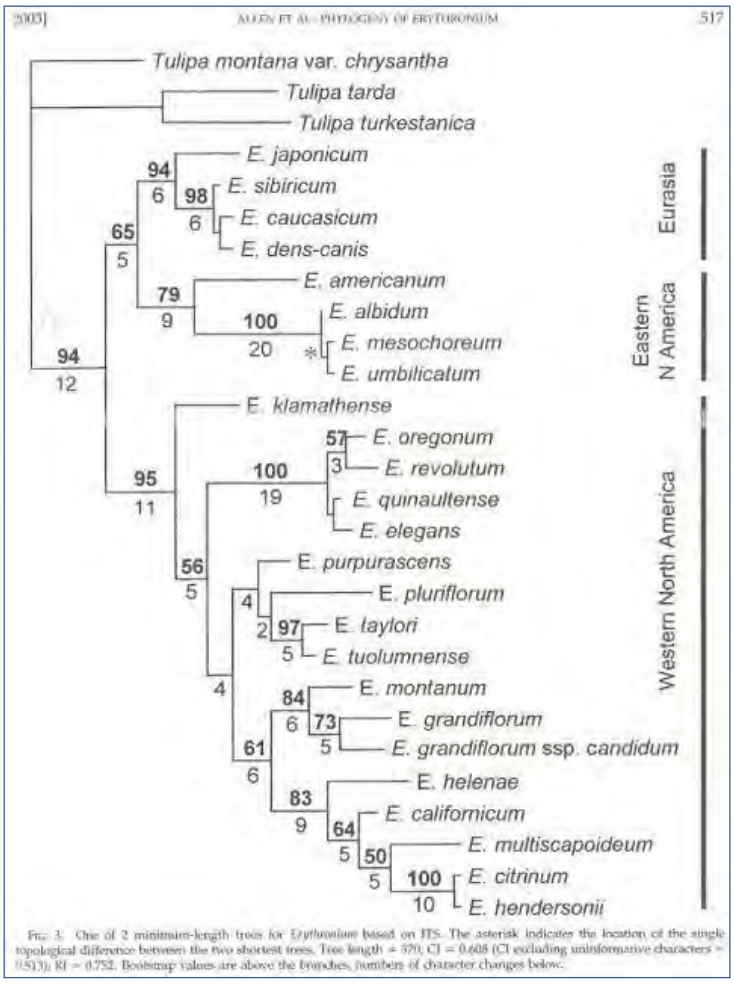

Fig. 3. One of 2 minimum-length trees for *Erythronium* based on ITS. The asterisk indicates the location of the single topological difference between the two shortest trees. Tree length = 570; CI = 0.608 (CI excluding uninformative characters = 0.513); RI = 0.752. Bootstrap values are above the branches, numbers of character changes below.

Phylogeny of *Erythronium* species based upon ITS data

This next figure is a phylogenetic tree that was constructed from the data on mutations in the ITS region of the nuclear rDNA. Ideally one would want to construct a tree from a combination of data from multiple genes as well as morphological data, this ITS tree by itself is very informative. It suggests, for example, by the branching patterns in the tree, that the eastern North American species are more closely related to the Eurasian species than they are to the western North American species. This matches well with a variety of morphological characters, such as the pattern of leaf mottling, in which the "dappled" leaf markings in eastern North American and Eurasian species are similar, and contrast with the "marbled" leaf markings of some western North American species.

More pertinent to our exploration of the western North American erythroniums is the way in which

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western species are grouped in the tree. *Erythronium klamathense* (a species with white flowers and plain leaves) is shown as the species which is most similar to the common ancestor of all western erythroniums.

From this common ancestor, four separate lineages or species groups have evolved. One group includes *Erythronium oregonum* and *E. revolutum*, both low elevation species with mottled leaves and wide, flattened anther filaments.

A second group consists of five species from the Sierra Nevada of California, all of which have plain leaves and white or yellow flowers. *Erythronium purpurascens* is fairly widespread, but the remaining four species are all local endemics. These species range from low to high elevations.

The third group consists of the avalanche and glacier lilies, *E. montanum* and *E. grandiflorum* and its segregates. They have plain leaves, white or yellow flowers, and most typically occur at high elevations in the more northern latitudes of western North America (although *E. grandiflorum* can also occur at low elevations, as we have already seen).

The fourth group consists of *E. californicum* and its relatives. These are low elevation species with mottled leaves, found in California and adjacent SW Oregon. In contrast to the *E. oregonum* group, these species do not have wide, flattened anther filaments.

A couple of general points stand out. The first is that similarity in some morphological features does not necessarily imply a close evolutionary relationship. For example, each of these four groups contains species with different flower colours. White flowered species are not necessarily closely related to all other white flowered species, nor are yellow flowered species. In fact, each of the four group mentioned above includes species with different flower colours.

This type of information can also be of practical value to gardeners and plant breeders. For example, there is great potential to develop new hybrid erythroniums for the horticultural trade. Closely related species are more likely to hybridize successfully than more distantly related species, and hybrids between closely related species are more likely to produce viable seed. Thus this knowledge can help to inform a more deliberate strategy to unlock the potential of breeding of new erythroniums for the garden.

Now that we've had our classroom lesson, let's get out in the field.

Calapooia Divide, Oregon

I am going to cheat a bit and start the May narrative with an entry from late April; 27 April to be exact. As the months progress, the *Erythronium* season (that is, early spring) moves up to higher elevations. But the flowering of montane and subalpine species is not so tied to the calendar, but is more of a function of the melting of the snowpack. In 2005, Oregon and much of the Pacific Northwest experienced an extremely dry winter, with very little snow in the mountains. As such, I was anticipating that I would need to plan my site visits several weeks earlier than when one would visit a site in a normal year.

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Upper Elk Meadows, late April

So on April 27th I headed up to Upper Elk Meadows in the Calapooia Mountains, about 40miles (64km) SSE of Eugene. The Calapooia Mountains are an east-west running spur of the Cascades that form a rather important biogeographic boundary between the California Floristic Province (which reaches its northern extent in the Umpqua River drainage) and the Pacific Northwest of Vancouverian Floristic Province, which begins with the Willamette River Drainage. The Elk Meadows are right on the top of the divide, some meadows drain to the Willamette and some drain to the Umpqua.

The elevation of the meadows is about 4200ft (1280m); high enough for a substantial snowpack to develop in most winters. I wanted to visit this site because of a herbarium report of *Erythronium klamathense*, which if legitimate, would be at the northern limit of the species range. However, the plants turned out to be specimens of *E. grandiflorum* which had faded to white when dried, and had been misidentified because of the very short stigma lobes.

In late April, there were still a few snow banks that had not yet melted out, and the yellow flowers of *E. grandiflorum* were just beginning to poke up above the brown turf. At this early stage of development, some of the plants of *E. grandiflorum* had upward facing flowers, suggestive of close evolutionary relationship between erythroniums and tulips. Note the white anthers, which show that this population is ***E. grandiflorum* var. *pallidum***.

Emerging flowers of *Erythronium grandiflorum* var. *pallidum*

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Upper Elk Meadows, late May

I returned to Upper Elk Meadows on May 23rd. In addition to re-visiting the population of *E. grandiflorum*, I had seen mottled *Erythronium* leaves emerging from the ground on April 27th, and wanted to find this second species in flower as well. By late May, the meadows had turned bright green, contrasting nicely with the sombre green of the conifers (mostly *Abies grandis* and *Pseudotsuga menziesii*) ringing the edge of the meadow.

By now, all the snow had melted, *E. grandiflorum* was in the late stages of flowering, and looked much more like a typical *Erythronium* than the "pseudo-tulips" I found in late April.

Typical flowers of *Erythronium grandiflorum* var. *pallidum*

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***Erythronium oregonum* subsp. *oregonum*, Upper Elk Meadows**

As I suspected, the mottled leaves I had seen during the late April visit were ***Erythronium oregonum***. These plants have white tepals and yellow anthers, placing them in **subsp*. oregonum***. It is actually rather unusual to find two species of *Erythronium* in one locality. While *E. oregonum* is typically a low elevation species, there are occasional populations at middle elevations in the Oregon Cascades. It was interesting to see how strongly reflexed the tepals are in this population. I suspect that this is a function of the air temperature on that particular day, rather than a genetic characteristic of this population, but the only way to find out would be to try to grow plants from seed.

On May 12th, in between visits to Upper Elk Meadows, I ventured again into the Cascades to the North Umpqua river drainage, again in hopes of finding *Erythronium klamathense*. This is a fascinating area, and as I mentioned previously, represents the northern extent of the California floristic province. My route took me along the crest of what is called "Ragged Ridge", which is accessed by a nice gravel road. Below the ridge to the south is the Limpy Rock Research Natural Area, and at the end of the road is Illahee Rock, which overlooks the Boulder Creek Wilderness.

As I was driving along the ridge, a flash of pink appeared out of the corner of my eye. I stopped, to find a colony of the rare Ericaceous shrub, *Kalmiopsis leachiana,* in full flower on a rock outcrop.

The Umpqua populations of *Kalmiopsis* are geographically disjunct from the main range of the species in Josephine County, Oregon, and rumour has it that it will be described scientifically as a second, distinct species of ***Kalmiopsis*.****

Just to show readers that I am not blinded by my pursuit of *Erythronium*, I include a photograph of *Kalmiopsis*.

****Kalmiopsis*, Umpqua drainage form - this was described as a separate species, *Kalmiopsis fragrans*, in 2007.**

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A few miles farther down the road, I came across a wonderful patch of *Erythronium oregonum*. Notice how the flowers are outward facing and nicely curved-reflexed. Again I can't say whether this is a function of weather conditions (especially temperature and humidity) or some intrinsic genetic qualities, but it is certainly a nice form. These plants were flowering in mid-May at an elevation of about 4000ft (1219m).

***Erythronium oregonum* subsp. *oregonum*, Ragged Ridge**

A few miles farther east, I parked the car at the base of the short trail to the top of **Illahee Rock.** This is a former fire lookout site with a wonderful view east toward the crest of the Cascade Range and its line of still-snowy volcanoes.

Looking east from Illahee Rock

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The summit of Illahee Rock is nearly 5400ft (1645m) above sea level, and even in mid-May it was too early in the season for the early spring flowers such as *Erythronium* to be blooming. I did see emerging growth of both a plain-leaved *Erythronium* (presumably *E. grandiflorum*) and a mottled-leaved *Erythronium* (presumably *E. oregonum*). Some of the mottled-leaved plants had extremely pronounced mottling, accompanied by a reddish-purple band all around the leaf margin.

Mottled *Erythronium* at Illahee Rock presumably *E. oregonum.*

Assuming that this is ***Erythronium oregonum*** (and no other mottled species are known from this area), at over one mile above sea level this is perhaps the highest elevation occurrence of this typically low elevation species.

My final *Erythronium* expedition for the month of May was the 25th, when I drove to the northern Oregon Coast Ranges to see *Erythronium elegans*. This is a fairly recently described species (published in 1985) is an Oregon endemic that has been found in only a handful of mountaintop sites occurring over a geographic distance of about 30 miles (48km) (Hammond and Chambers, 1985).

The Oregon Coast Ranges are for the most part a series of rounded ridges dissected by steep river valleys, in no way dramatic as mountains go. The summits are mostly between 3000 and 4000ft (915 to 1220m) and as such there is no true alpine zone. However, some of the higher peaks and ridges support open meadow habitats and natural rock gardens. Because of this area's biogeographic history and location south of the limit of the Pleistocene ice sheets, this region supports a number of disjunct and endemic plants, of which *Erythronium elegans* is only one of a series.

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Summit Ridge of Mt. Hebo

Mt. Hebo, which supports the largest populations of ***E. elegans*****,** has a 2+ mile (3.5km) long summit ridge which consists of a series of meadows and openings left from a major forest fire that occurred about 100 years ago. The summit of Mt. Hebo is only about 3200ft (975m) but because it is located only about 12m (19km) from the Pacific Ocean, precipitation is high and a significant snowpack accumulates during the winter in most years. I had visited Mt. Hebo on at least 3 previous occasions, and every time the weather had been rainy or wet, resulting in soggy erythroniums that were just not at their best. This year, for the first time, I visited the site on a warm, sunny, dry day. At first I was afraid that my timing was off - a nice colony growing in a natural rock garden was well past flowering. The plants were growing at the crest of a cliff, in the company of *Lilium columbianum* and *Amelanchier alnifolia*.

Erythronium elegans **with developing seed pods, near** ***Lilium columbianum*** **and** ***Amelanchier alnifolia,*** **on Mt. Hebo**

Fortunately, in a more protected location where the snow had lingered longer, I found some nice colonies of *E. elegans* in full bloom. This is an enigmatic species. Most plants have white flowers and un-mottled leaves and resemble *E. montanum*, which is found in the Cascade Mountains but not in the Oregon Coast Ranges. Also the tips of the tepals are nicely recurved as in *E. montanum.*

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***Erythronium elegans* on Mt. Hebo, top view**

However, a small percentage of individuals in populations of *E. elegans* show some features reflecting the influence of *E. revolutum*: a pinkish tinge to the flowers, leaf mottling, or flattened anther filaments (none of the plants I saw at Mt. Hebo had pinkish flowers, except for aged flowers just about to wither.) These features suggest that *E. elegans* may have originated out of hybridization between *E. montanum* and *E. revolutum* at some time in the past when the two species ranges overlapped in NW Oregon (their ranges and habitats do not currently overlap). However, lacking definitive evidence, Hammond and Chamber declined to speculate further about this.

More recently, Dr Geraldine Allen discussed the possible origin of *Erythronium elegans* as part of a study of novel *Erythronium* populations on the western side of the Olympic peninsula in Washington State, some 160 to 170 miles (257-273km) to the north (Allen 2001). On the Olympic Peninsula she found a very similar situation to the Oregon Coast Ranges, with populations of plants that combined characteristics of *E. revolutum* and *E. montanum*. Her chromosome counts showed that the Olympic Peninsula populations were tetraploid, with double the chromosomes of diploid *E. revolutum* and diploid *E. montanum.* Also, an analysis of enzyme molecules showed a parental influence of both *E. revolutum* and *E. montanum* in these tetraploid Olympic Peninsula populations. Because these Olympic Peninsula populations had not been previously documented, and in her morphological analysis they did not exactly match any of the other related species, (i.e. *E. revolutum, montanum*, and *elegans*), Dr Allen proposed the name *Erythronium quinaultense* for these Olympic Peninsula populations. Dr Allen proposed that *E. quinaultense* had originated from past hybridization between *E. revolutum* and *E. montanum*, followed by chromosome doubling, which would have the effect of normalizing chromosome pairing during meiosis (the type of cell division that leads to pollen and ovule production), and would lead to the ability to produce fertile, viable pollen and seeds.

Isotype of *E. quinaultense*

In her study, Dr Allen confirmed that *E. elegans* is also a tetraploid species. She did not have enzyme data for *E. elegans*, but the morphological evidence suggest that *E. elegans* also originated in a similar manner, with initial hybridization between *E. revolutum* and *E. montanum* followed by chromosome doubling to produce a fertile tetraploid species. However, subtle morphological differences between *Erythronium elegans* and *E. quinaultense* suggest that they originated from separate hybridization and polyploidy events. It is even possible that the white flowered, plain leaved parent of *E. elegans* was not modern *E. montanum* but some other white flowered, plain leaved species, or even an extinct progenitor of the white flowered, plain leaved lineage. Further research is needed to resolve this question.

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***Erythronium elegans*, side view**

According to Dr Allen, the primary difference between *E. elegans* and *E. quinaultense* is the pattern of pinkish colouring on the tepals. When *E. elegans* has pinkish colouring on the tepals, it is found on the outer set of 3 tepals and not on the inner set. In contrast, the tepals of *E. elegans* are white at the base and shade to pink toward the margins and tips of the tepals. *E. quinaultense* also has larger flowers than *E. elegans*, with tepals average 42.3mm in length, compared to 32.3mm for *E. elegans*.

In 2005 I had not had a chance to observe *E. quinaultense* in the wild, but I hoped to do so, so I could observe these differences for myself.

That year I was also unable to re-visit several Californian May-flowering species that I have seen in previous years.

Erythronium citrinum var. *roderickii* occurs in the Trinity Alps section of the northern California Coast Ranges, where it grows mostly on serpentine soils and flowers in early May.

It is similar to *E. citrinum* but has purplish anthers, and may in fact be an allopolyploid species (like *E. elegans* and *E. quinalutense*) that originated from initial hybridization between lavender flowered *E. hendersonii*, and a white flowered species such as *E. citrinum* or *E. californicum*. More research is needed to look into this, but I can say that *Erythronium citrinum* var. *roderickii* is a fertile species, and not a direct hybrid, as no other *Erythronium* species occur in the same localities.

The second May flowering Californian *Erythronium* to note is *Erythronium taylorii.* This is a species with plain leaves and white flowers that have a large yellow centre. It is related to *E. tuolumnense* and is a very local endemic of Tuolumne County and was only collected for the first time in 1996. Ian Young has grown this species from seed and has displayed photographs of its flowers in his Bulb Log on several occasions. I was fortunate enough to have the opportunity to see this species flowering in the wild in May 1999; it is a truly remarkable species.

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Part 4, June and July

By June, early spring is just a distant memory in our home gardens and local natural areas. The seeds of erythroniums that bloomed in March are beginning to ripen. Our thoughts turn to the pleasures of summer, the warm temperatures and long evening twilight.

But up in the mountains, the snow is still melting. Wildflowers that have been under a white blanket for seven or eight months are just beginning to awaken. And by traveling up in elevation, we can go back in time to have another chance to experience the pleasures of spring. At least, in most years……

In the Pacific Northwest, the winter of 2004-2005 was unusually dry, and the snowpack was only a fraction of its average depth. As a consequence, spring came early to the mountains. This was problematic for my *Erythronium* quest, for it made it much more difficult to know when to time my visits. Flowering time data from "normal" years may not be so useful for planning my travels. So I just had to make my best guess for the timing of my visits.

On June 1st, I drove south to Ashland, Oregon. On the western rim of the Cascade Range is Grizzly Peak, home of *Erythronium klamathense*, and an outpost of montane flora overlooking the Bear Creek Valley, with the Siskiyou Summit and an endless series of botanically interesting ridges and valleys extending to the south.

Siskiyou Mountains and beyond from Grizzly Peak, Oregon. Mt. Shasta on the left, the road I-5 ascending to Siskiyou Summit on the right. Pilot Rock is the small bump in the centre.

The summit of Grizzly Peak is more of a gently rolling plateau, a mixture of forest and open meadows, with a wonderful display of wildflowers. The elevation is nearly 6000ft (1828m), but on June 1st the meagre winter snowpack had nearly all melted. A few years ago a forest fire burned through some of the meadows and forest, leaving areas of silvery snags backing the colourful rocky meadows.

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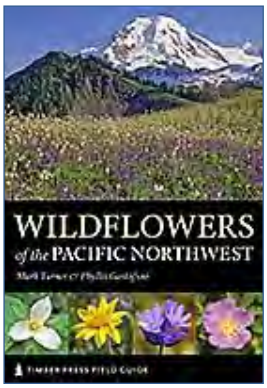
Meadows on Grizzly Peak

Unfortunately, nearly all of the erythroniums had finished blooming weeks earlier. In one little area, where the snow had taken longer to melt, I found a few remaining flowers of *Erythronium klamathense*. Though the specimens were rather scraggly, they were sufficient to show the pertinent characters: white flowers with a yellow centre, fading to a slight purplish tint; yellow anthers; and (if you look closely) an undivided style. Not visible are the sac-like folds or appendages that are found at the base of the inner three tepals. Note also the plain, wavy-margined leaves, a feature that links *E. klamathense* to the Sierra Nevada species such as *E. purpurascens.*

***Erythronium klamathense*, Grizzly Peak**



If you prefer, you can see super *Erythronium* photos on Mark Turner's web site.

Mark is the photographer for the book, with Phyllis Gustafson, "Wildflowers of the Pacific Northwest" ISBN-10: 0881927457 ISBN-13: 978-0881927450. Mark's photos were taken at nearby Pilot Rock in May 2004. Note also that he also photographed a putative *E. klamathense x hendersonii* hybrid, and unusual combination that could only occur where the upper elevation limit of *E. hendersonii* overlaps with the lower elevation limit of *E. klamathense*.

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You may recall from previous discussion that *Erythronium klamathense* is thought to be most similar (genetically, at least) to the common ancestor of all of the western erythroniums. This is perhaps another way to say that it is not a particularly distinctive species, with its plain green leaves and white flowers with yellow centres. Elmer Applegate noted that "this species is easily grown and very responsive to cultivation" (Applegate 1935), though because his garden was in Klamath Falls, Oregon, which has a rather arid montane climate, his results may not be typical of gardens in other temperate climates.

Fig. 1. Geographic range of *Erythronium montanum* (shaded area) showing locations of sampled populations. The hatched line indicates the maximum extent of the Wisconsin Cordilleran ice sheet.

The crown jewel of western erythroniums has to be ***Erythronium montanum***. "Montanum" is an appropriate specific epithet, for this species is never found below an elevation of about 3000ft (915m). Despite the fact that it occurs in the millions in suitable habitats, it actually has a somewhat limited geographic distribution. It is common in both the Cascade and Olympic Mountains of Washington, but occurs only in four counties in the Oregon Cascades, and is known from only two disjunct localities in British Columbia. Interestingly, *E. montanum* occurs primarily south of the southern limit of the continental ice sheet during the late Pleistocene, as shown on this map from a paper by Dr Geraldine Allen and co-workers:

Geographic range of *Erythronium montanum*, from Allen et al. 1996

The map shows how the occurrences in British Columbia, on Vancouver Island and in the mainland Coast Ranges, are considerably disjunct from the main range of the species and are well north of the limit of the continental ice sheet. The evidence that Allen et al. (1996) gathered suggests that the B.C. populations arose by long-distance dispersal from southern refugia after the climate moderated during the Holocene.

I have seen *E. montanum* many times while hiking in the mountains in Washington, but was curious to see where it grows at the southern limit of its range in Oregon. I had heard about a locality in the Cascade Mountains of Marion County (east of Salem) at a place called Dogtooth Rock. With a name like "Dogtooth Rock", I figured that I had to check out - there aren't many places named after a biogeographically significant *Erythronium* population!

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It had been a rather rainy May, but on June 3rd the forecast was for dry weather and I figured I had a pretty good chance of finding the erythroniums in good condition. Dogtooth Rock is a 4500ft (1370m) rocky knob along a steep sided ridge line. The precipitous topography affords excellent views, in this case looking southeast toward Mt. Jefferson and the crest of the Cascade Range. Dogtooth Rock is the outcrop on the left.

Dogtooth Rock, Cascade Mountains of Oregon

Dogtooth Rock itself does sort of resemble in shape the outline of a dormant *erythronium* corm. It lacks the subalpine meadows that are the typical habitat of *Erythronium montanum*. Instead, *E. montanum* occurs in small forest openings and north-facing rocky scree.

It makes sense that *E. montanum* would be found in shady habitats and on north facing slopes at a site that is very close to the southernmost limit of the species' range, which only extends about 17 miles (27km) further to the south. It is curious that even at its southern limit, *E. montanum* occurs at a relatively low elevation (for this species). Such lower elevation populations may be useful as seed sources for plants that have a better chance of succeeding in gardens

***Erythronium montanum* along the trail near Dogtooth Rock**

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Fortunately the timing of my visit was good in terms of flowering phenology, but as there had been a rain shower overnight, the damp flowers were a bit droopy, and not quite in prime condition. However, if you pick a bouquet and let them dry out for a day, you can see their full charm.

Bouquet of *Erythronium montanum* flowers

Erythronium montanum is probably the largest-flowered of the western species. Note that the flowers show a bit of a "pinwheel" twist at the tips of the tepals, which is a unique characteristic of *E. montanum*. The leaves of *E. montanum* are of course plain and not mottled, and often exhibit an abrupt taper from the leaf blade to the petiole.

Granitic landscape, Loch Leven Lakes trail

You will recall from the earlier comments that the genetic studies show that *E. montanum* is most closely related to *E. grandiflorum* and *E. idahoense.*

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I waited until late June to undertake my final road trip to California. In contrast to the Pacific Northwest, the winter of 2004-2005 was one of unusually high precipitation, and the mountains had a much deeper snowpack than usual. I wanted to find ***Erythronium purpurascens***, a subalpine species of the northern Sierra Nevada, and my research indicated that it could be found in the mountains along I-80 west of Lake Tahoe.

Erythronium purpurascens is one of the more widespread of the Sierra Nevada erythroniums, and was one of the earliest western erythroniums to be collected and described. Recall from May's discussion that the five species of plain-leaved erythroniums form a closely related group of species that includes *E. purpurascens, E. pluriflorum, E. pusaterii, E. tuolumnense*, and *E. taylorii.*

On June 29th I set out up the **trail to Loch Leven Lakes** amidst the magnificent granitic landscape of the high Sierra. This area is in the Tahoe National Forest of Placer County, about 170 miles (273km) east of San Francisco. The montane forest is dominated by red fir (*Abies magnifica*), with a number of other firs and pines mixed in.

The trailhead is at an elevation of 5700ft (1738m), and the erythroniums at this elevation had bloomed some weeks earlier. However, once I was about 2/3 of the way up to the ridge crest (about 6400ft /1950m) there were still a few snow banks, and drifts of flowering *Erythronium purpurascens* appeared in areas where the snow had recently melted out.

The flowers of *E. purpurascens* are white with yellow centres. The tepals develop a pink or purplish tinge as they age, thus the epithet "*purpurascens*". What sets this species apart from others, however, is the diminutive size of the flowers. They are tiny! "Dainty" is a good word to use to describe the flowers of this species.

***Erythronium purpurascens* flowers**

While the stems of "average" plants bore only one or two flowers, I found many vigorous plants with five, six, or even eight flowers on a stem.

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Closer to the top of the ridge, there were sizable drifts of *E. purpurascens* growing in openings in the conifer forest, and even some nice patches in natural rock gardens, such as in this crevice between granite outcrops:

***Erythronium purpurascens* on granite rocks**

A clump of *Erythronium purpurascens*, presumably increasing from offsets.

While this species is said to lack reproduction by vegetative offsets, I did find a few clumps that looked very much like they were the result of vegetative increase from a single plant.

This particular plant had nine flowering stems, with mostly five to eight flowers per stem!

Although *E. purpurascens* itself is probably not particularly amenable to cultivation, it could be a useful species for hybridizers to use to increase floriferousness in cultivars for the garden. And even though *E. purpurascens* is not a rare local endemic, it was certainly was enjoyable to spend a day in its presence in the granitic terrain of the Sierra Nevada Mountains.

It had been my intention from the outset to end my tour in Mt. Rainier National Park, Washington. At 14410ft (4392m), Mt. Rainier is the second highest mountain in the 48 contiguous states. *Erythronium montanum* is common here in the subalpine zone, and *E. grandiflorum* occurs as well, though less abundantly.

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***E. montanum* habitat on Mt. Rainier**

In a typical year in early July the subalpine meadows are finally melting out after eight or nine months of snow cover, and *Erythronium montanum* is prominent in the picture-postcard landscape. However, as this was an unusually light snow year, I was probably pushing it when I headed up on July 10 to look for flowering *Erythronium montanum* on Mt. Rainier. The weather was also iffy on that day, with thick clouds in the lowlands that portended rain and mist higher up on the mountain. Even on the NE (rain shadow) side of Mt. Rainier, along the trail to the meadows of Summerland, the ridges were shrouded with mist.

And yes, when I finally reached an area where the snow had only recently melted, and the erythroniums were in full flower, they were a sad, soggy, droopy lot.

Hillside with *Erythronium montanum* in the rain

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The remarkable thing about mountain weather is that it is so changeable. If you have a little patience, conditions can change from miserable to ideal in only 24 hours. Fortunately that was the case for me the following day, July 11th, when I drove up to Paradise Meadows, an extensive area of subalpine parkland on the south side of Mt. Rainer. The weather was sunny, the sky was blue, and the glaciers tumbling down from the summit of the volcano were reflected in the few remaining patches of *Erythronium montanum.*

***Erythronium montanum* in Paradise meadows, Mt. Rainier National Park**

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While the extensive meadows of blooming *Erythronium montanum*, which I had viewed at Paradise in previous years, were long past flowering, being in the presence of such scenic grandeur and botanical beauty gave me cause to reflect on my explorations of the four months since I began my quest on March 16th. Finally, here was *Erythronium montanum* showing its true personality, its jaunty demeanour under the subalpine sunshine.

Erythronium montanum

I had driven many thousands of miles across the American west, and had hiked many miles to find erythroniums of all persuasions at their floriferous best. I had observed and photographed 15 *Erythronium* taxa in bloom (13 species and two additional subspecies/varieties), in a wide range of landscapes and habitats across the western states. I might venture to claim that this is a world record for the number of *Erythronium* taxa observed in the wild in a single year.

However, even while this claim is open to dispute, there is ample room for some other intrepid botanist to exceed this tally, if they feel so compelled.

The diversity of the genus *Erythronium* is a wonder of evolution, a wonder to be thankful for. The message that kept coming back to me, on each and every day of my journey, is that there is definitely more than one way to find Paradise.

Trailside near Paradise, Mount Rainier National Park

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Part 5, Epilogue

In the course of my travels from March through July 2005, I did not actually have time to visit wild populations of every single *Erythronium* species in western North America. I prioritized my visits to populations of species that I had never seen before, so many of the species I did not visit in 2005 were ones that I had seen in previous years. As a way of putting the final touches on this series, and to make it as complete of an overview of western erythroniums as possible, I've compiled this epilogue to describe my experiences of searching for additional taxa over the last 30+ years, other than in 2005.

All of the taxa I will describe below are Californian species, in fact, all are California endemics. Of the 15 *Erythronium* taxa known from the state of California, I've already covered in this series four endemics (*E. californicum, E. helenae, E. multiscapideum*, and *E. purpurascens*), as well as five species that are found in other states as well as California (*E. citrinum, E. grandiflorum* var. *pallidum, E. hendersonii, E. howellii,* and *E. klamathense*). There are, however, additional six more taxa that are endemic to California, some that are well known, others that are more obscure, that I would like to describe in this instalment.

I will start with the plant that has been named ***Erythronium citrinum* var. *roderickii.*** This taxon was described in 1991 (Shevock and Allen, 1991), although it was known to its namesake, Wayne Roderick, as early as 1961. It is a local endemic of the upper Trinity River drainage in the eastern portion of the Trinity Mountains in NW California.

Trinity Mountains, home of *Erythronium citrinum* var. *roderickii*

This plant resembles typical *E. citrinum* var. *citrinum* in many ways, with mottled leaves and white tepals with a yellow band at the base. However, closer examination reveals several differences from typical *E. citrinum.* Most noticeable is the colour of the un-dehisced anthers, which are purple instead of yellow as in typical *E. citrinum*. In addition, Shevock and Allen indicated that the yellow band at the base of the tepals is brighter than in typical *E. citrinum*.

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Left: ***Erythronium citrinum* var. *roderickii* in the type locality**

Right: ***E. citrinum* var. *roderickii* with pink tinge**

Also, some of the flowers take on a pinkish/lavender tinge as they age, and on some plants the styles have pinkish colouration. One plausible explanation for this combination of morphological characteristics could be that *Erythronium citrinum* var*. roderickii* is an allopolyploid species, having formed in the same manner as *E. elegans*. As you may recall from the May section, a variety of data suggest that *E. elegans* arose from a hybrid between the white flowered *E. montanum* and the pink flowered *E. revolutum*. At some time in the past the hybrid doubled its chromosomes and the plants became a fully fertile species with four sets of chromosomes rather than the "normal" two sets. Possibly "var. *roderickii*" arose in like manner from a hybrid between *E. citrinum* and *E. hendersonii*. In their original description of *E. citrinum* var. *roderickii*, Shevock and Allen mention the possible influence of the lavender flowered *E. hendersonii* in the origin of *E. citrinum* var. *roderickii*; however, no other erythroniums seem grow within the limited range of *E. citrinum* var. *roderickii,* so the morphological features cannot be easily explained as a result of local primary hybrids. Primary hybrids in *Erythronium* are not uncommon where the geographic ranges of certain *Erythronium* species overlap.

Further complicating the picture is the fact that Dr Allen, the second author of the paper describing *E. citrinum* var. *roderickii,* did not recognize this taxon in her more recent treatment of *Erythronium* for Flora of North America (Allen and Robertson, 2002) but instead placed it in synonymy under *E. citrinum*. This decision seems a bit opaque to me; having seen the plant in the wild, "var. *citrinum*" seems like a clearly distinct taxon, but perhaps Dr Allen has additional data that have not been published that would support her placement of var. *citrinum* as a synonym of *E. citrinum*.

If my allopolyploid hypothesis is validated by additional data (such as a chromosome count and molecular studies), *E. citrinum* var. *roderickii* should actually be treated as a full species, *Erythronium roderickii*. But this name has not been validly published so it cannot be used, even in the horticultural literature, until it is validly published.

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Erythronium citrinum var. *roderickii* grows primarily, if not entirely, in soils derived from ultramafic bedrock (serpentine and its igneous relatives such as peridotite), which are high in magnesium and heavy metals and low in calcium content. Such soils are so unbalanced that many plants are not able to grow on them. Although a number of other *Erythronium* species also occur on serpentine (including typical *E. citrinum* and *E. hendersonii*), *E. citrinum* var. *roderickii* may be the only *Erythronium* that is a true serpentine endemic.

The photographs on the previous page were taken on May 8, 1999, when I visited the upper Trinity River drainage, in the Shasta-Trinity National Forest, to search for this plant. My timing was perfect; because it grows at elevations of 3000 to 4000ft (about 915 to 1220m) its flowering season is somewhat delayed past the season of its lowland relatives. I found the plants mostly growing as scattered individuals in the understory of rather open conifer forest of Douglas-fir, incense-cedar, Jeffery pine, and California black oak. On the whole the plants were rather small, although this may be the result of suboptimal growing conditions rather than an inherent genetic trait. I would think this plant would grow well in gardens where *E. citrinum* var. *citrinum* and *E. hendersonii* are successful. However, it is such a local plant that bulbs should never be dug to transplant into the garden.

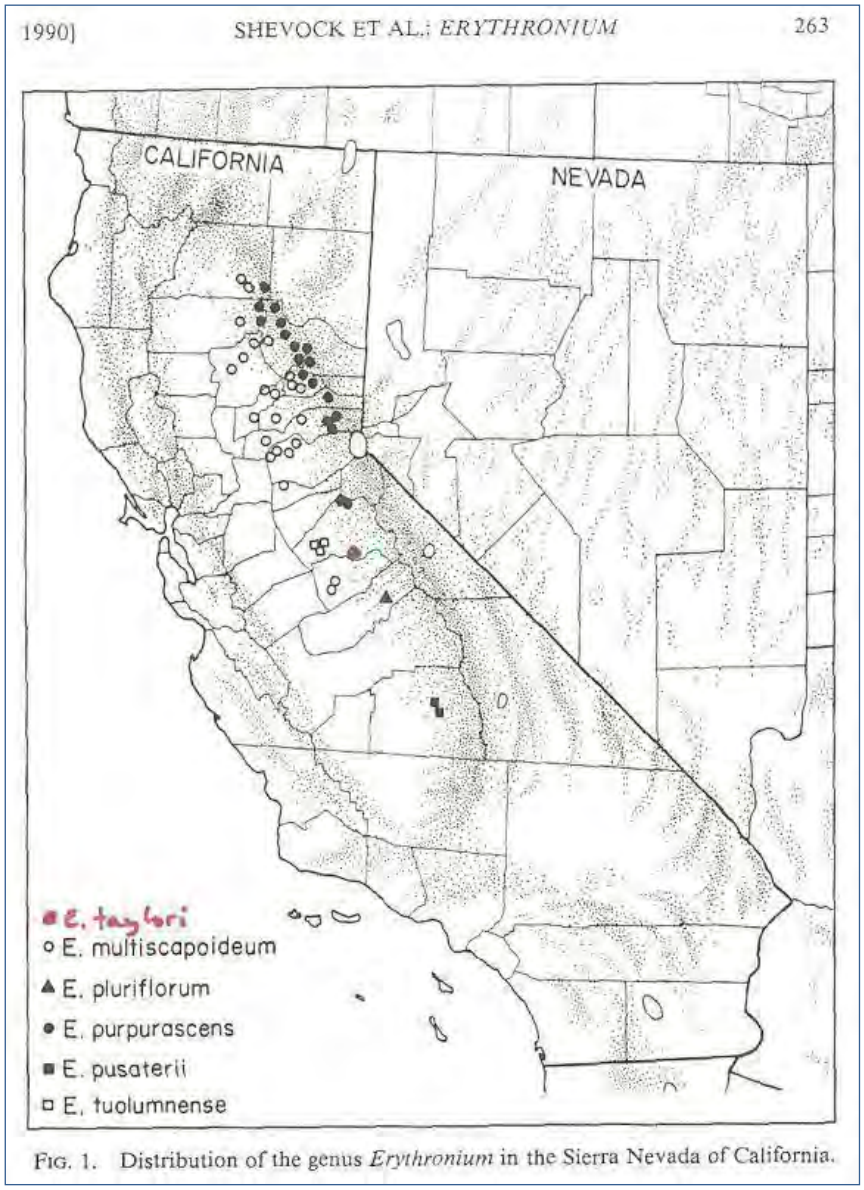

FIG. 1. Distribution of the genus *Erythronium* in the Sierra Nevada of California.

I was fortunate to have met Wayne Roderick, the doyen of California's native bulbs, in 1983. I attended the NARGS Winter Study Weekend that year, which was held in Port Townsend, Washington. Since Wayne was driving up from California he offered to pick me up at my home in Olympia and give me a ride to the meeting in his old van. It was interesting talking to him about his favourite spots in California, and it gave me a much better perspective when I was later able to visit the Tilden Park Botanical Garden in Berkeley, where he worked for many years.

California's Sierra Nevada Mountains support six *Erythronium* species, many of which are very local endemics. In previous instalments, I described two species that I visited in 2005, *E. purpurascens* and *E. multiscapideum*. The *Erythronium* flora of the Sierra Nevada has been detailed in several papers by Jim Shevock and several co-authors (Shevock et al. 1990, Shevock and Allen, 1997). Here is a map, taken from the 1990 Shevock et al. paper, which shows the distribution of each species. I have updated the map by adding a red dot to show the location of the most recently described species, *E. taylori.*

Distribution of the genus *Erythronium* in the Sierra Nevada of California, adapted from Shevock et al. 1990.

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Erythronium multiscapideum is the only Sierra Nevada species with mottled leaves. In the April section I described my visit to the locality along the Feather River east of Chico where it grows on serpentine rocks. This form, which is well established in gardens, has been called the "Pulga form" or has been known by the herbarium name (not properly published) "*Erythronium cliftonii*". This form is well established in cultivation and because it is so floriferous, it is clearly the more garden-worthy form of the species.

I thought I should also include a description of the typical forest or woodland form, which I observed in 1985. One interesting feature of the typical form of *E. multiscapideum* is that it produces new plants from stolons that creep out from the main corm, thus forming extensive colonies of single-leaved plants by vegetative means. In this habit it resembles species from Eastern North America such as *E. americanum* and *E. albidum*. Since I haven't grown the serpentine form myself I can't say whether it does the same, but where it grows in the wild, the serpentine form appears to increase more by offsets (forming clumps) than by spreading stolons. People who grow this form in their gardens may be able to clarify this distinction.

Here is a photograph of a colony of *E. multiscapideum* that I found on April 9th, 1985, near Georgetown in Eldorado County, California, where it was growing in a shady, sun-flecked understory of a big-leaf maple-California black oak forest. Among the thousands of single-leaved plants growing in soil rich in leaf mould, there was just this single flowering plant. Note that there is a bud on a second emerging flower stem, which clearly places this plant as *E. multiscapideum.*

Erythronium multiscapideum **in shady forest habitat, Eldorado County, California**

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Until recently there was a lingering question with *E. multiscapideum* - was it actually closely related to the stolon-producing species of eastern North America, or was this a morphological trait that has arisen separately in two geographically separate lineages? The genetic data from Allen et al. (2003) strongly suggest that the latter is the likely scenario, and that *E. multiscapideum* is actually most closely related to the non-stoloniferous *E. californicum*.

Also growing in the same site with *E. multiscapideum* was this beautiful trillium, *T. angustipetalum*. This is the only time I have ever seen this trillium in the wild, and what I remember, more than its appearance, captured in this photograph, was the spicy scent of its flowers.

Trillium angustipetalum

You will recall from the May 2006 part of this article that the five Sierra Nevada *Erythronium* species with plain leaves (all but *E. multiscapideum*) form a closely related (monophyletic) species group. Even though they exhibit a diversity of flower colours and sizes, these five species are believed to have evolved from a single common ancestor.

Erythronium tuolumnense is one of the most familiar of the Sierra Nevada species in gardens, primarily because of its prolific vegetative increase from offsets, which has made it easy for nurseries to sell at low cost. It is also a showy plant with large yellow flowers. In the wild, however, it is a very local endemic of Tuolumne County, in the foothills of the Sierra Nevada, and it was only in 1930 when Elmer Applegate described it as a new species.

I visited the type locality, Italian Bar on the South Fork of the Stanislaus River, on April 7, 1985. This is "Gold Rush" country, and all around are signs of mining activity that took place during the California gold rush in the mid 1800's, now abandoned and covered with vegetative regrowth. A view up the river shows the vegetation typical of this low elevation (1700ft/ 518m) river canyon, with chaparral on the sunny, south facing slopes and mixed conifer-hardwood forest on the north facing slopes.

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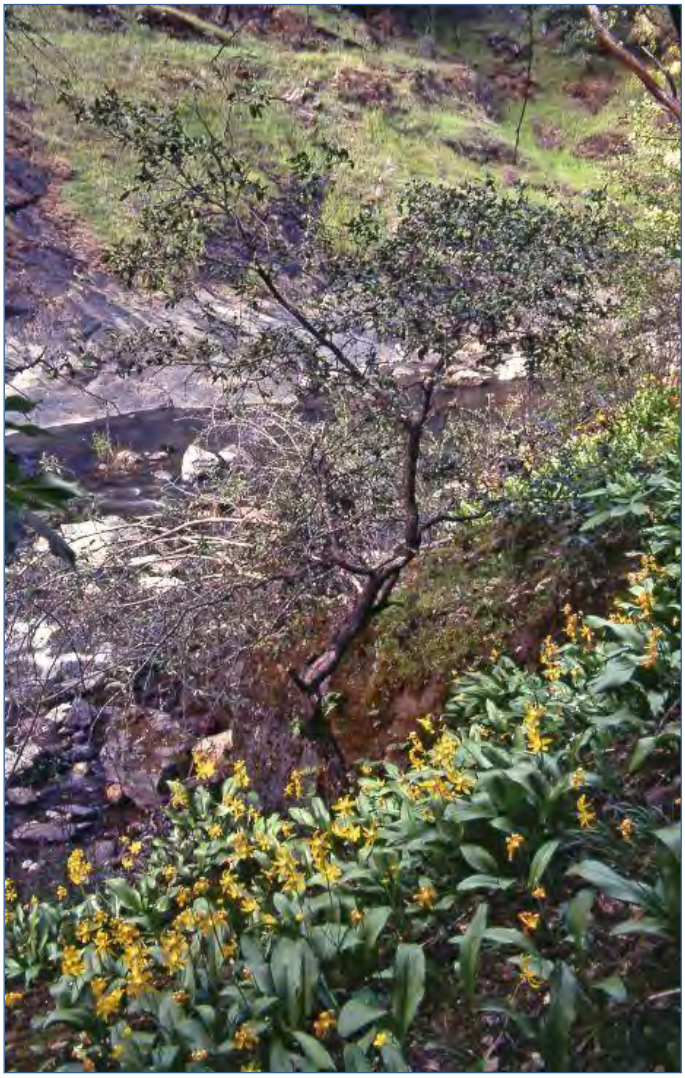
South Fork Stanislaus River



***Erythronium tuolumnense* along the South Fork Stanislaus River**

It is truly a remarkable experience to travel hundreds of miles to a specific place where you hope to find a rare endemic in flower. It is almost a surprise when you round a bend in the road, and all of a sudden, there it is, miraculously, just like it was supposed to be! One might say that this is still gold rush country, only the treasure is a different kind of gold.

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Erythronium tuolumnense colony

Erythronium tuolumnense

My visit was perhaps a week after the peak of bloom, but there were still plenty of flowers in prime condition, covering large swaths of ground on north-facing slopes just above the river. However, the colony was very limited, and ended at a point only about 800ft (245m) down the road. I wondered why this would be the case. Is it because this species relies primarily on vegetative reproduction from offsets to maintain its colonies, and is apparently less successful at producing seed in the wild, that it has not been able to disperse away from this favoured habitat?

Apparently the type locality is at the lower elevational limit for *E. tuolumnense*, which extends as high as 3800ft (1158m). All of the known populations occur within a distance of about 15 miles (24 km). Interestingly, Shevock et al. hypothesize that *E. tuolumnense* is now confined to local "cold air drainage microhabitats", which explains its presence at such low elevations, and may also restrict its ability to expand beyond its current localized geographic distribution.

I have noted Ian Young's comments about the value of obtaining different forms of *E. tuolumnense*, especially seed-grown forms, for garden use. The two forms that I have been able to obtain from commercial sources have been rather disappointing, especially compared to the wild plants I saw in 1985. I can only surmise that the forms that are commercially available have been selected more for ease of vegetative increase, rather than floriferousness or flower form.

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While the story of *E. tuolumnense* is remarkable, in and of itself, the story of *Erythronium taylorii* is even more amazing. You only need to go about 30 miles (48km) (as the bird flies) to the southeast of the type locality for *E. tuolumnense* to get to the type locality of *E. taylorii*. When I visited Italian Bar in 1985, *E. taylorii* had not been discovered, let alone described; it was only found for the first time in 1996, and its description was published in 1997 (Shevock and Allen 1997). Even more amazing is that *E. taylorii* grows only a couple of miles from the main highway to Yosemite National Park. How could it be that this distinctive flower could go unrecognized for so long?

The story of its discovery begins with Dean Taylor, intrepid field botanist who has played a role in many of the amazing botanical discoveries in California in the last 30 years. For example, he was co-discoverer, with Glen Clifton (erstwhile namesake of "*Erythronium cliftonii*"), of the rosaceous shrub, *Neviusia cliftonii*. In April 1996, Dr Taylor was exploring an interesting looking outcrop of metamorphic rock along Pilot Ridge in southern Tuolumne County. Although there are no trails accessing this area, he just "happened" to be at the right place, at the right time, to find an unusual *Erythronium*, which he did not recognize, in full flower.

When I read the description of *E. taylorii* in the journal Madrono, I knew that I had to see it in the wild, but it wasn't until May 1999 that I was able to make the trip. The plants grow at an elevation of 4400 to 4600ft (1340 to 1400m), so their flowering is slightly delayed as compared to low elevation species such as *E. tuolumnense.* The habitat of this species is on north-facing slopes in proximity to large rock outcrops along Pilot Ridge.

Habitat of *Erythronium taylorii*, Tuolumne County, California

The surrounding forest here is a mixture of conifers, especially ponderosa pine, and hardwoods such as California black oak. *Erythronium taylorii* is very much at home growing in crevices and ledges of vertical cliffs, high out of reach. The bedrock here is apparently metamorphic rock of marine origin. It is possible that *E. taylorii* is restricted in the wild to exposures of this certain type of bedrock, which could explain the very limited geographic distribution.

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Looking up a cliff face to clumps of *Erythronium taylorii.*

Fortunately, *Erythronium taylorii* also grows on ledges at the base of the cliffs, so I was able to see and photograph it up close. You may be able to see in this photo a bit of the "clumping" of plants that is produced by its ability to form vegetative offsets from existing corms. This ability to increase vegetatively is a character that *E. taylorii* shares with *E. tuolumnense*.

Erythronium taylorii is similar in size to *E. tuolumnense,* and like *E. tuolumnense*, the leaves are un-mottled, and healthy plants typically produce 2 to 4 flowers on a stem. However, the flower colour is strikingly different, with white tepals that are yellow at the base, forming a large yellow centre. The anthers are cream coloured but the anther filaments are a darker yellow colour. Also, inner three tepals each have sac-like folds or appendages at the base.

Seeds of this species have been made available to growers, and Ian Young featured his flowering plants in his bulb log in 2005 and 2006. I'm not sure, however, if visitors to his bulb log have really appreciated how remarkable the story of *Erythronium taylorii* truly is.

Given its native habitats, there is a good chance that this is a species that will grow well in typical garden conditions where other erythroniums are successful. I just hope that demand for garden specimens can be met by seed produced from plants already in cultivation, rather than deplete the limited population of wild plants. In this regard, exchanges of garden produced seed can be a valuable tool for conservation.

Close-up of *Erythronium taylorii* flower

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Colony of *Erythronium taylorii* on mossy humusy ledges

My personal opinion is that *E. taylorii* species will prove to be even more valuable as a future parent of hybrid erythroniums which are an even better focus of general horticultural demand.

Think of what could be produced by crossing *E. taylorii* with *E. purpurascens*, *E. klamathense*, or even *E. idahoense*: a vigorous garden plant, increasing from offsets, and producing numerous yellow-centred white flowers, but with the grace and charm of the wild species.

Yet, the wonders do not stop here. Another recently described local endemic, found only in Madera County (50 miles / 80km to the south), is ***Erythronium pluriflorum***. From the summit of Shuteye Peak, elev. 8350ft (2545 m), one can view Chiquito Ridge running to the north for about 10m (16km), and the entirety of the range of *E. pluriflorum*. Like many places in the Sierra Nevada, this is a landscape of dramatic granite domes.

As the winter snows melt (in this case, on May 31, 1997), the granite ledges and understory of the open subalpine forest on Shuteye Peak are carpeted with millions of tiny yellow flowers of *Erythronium pluriflorum.* The epithet "*pluriflorum*" (many-flowered) is most appropriate, as this species typically has 3 to 6 tiny yellow flowers, but commonly up to 10 flowers on a single flower stalk. The tepals are typically only about ¾ in (2 cm) long.

***Erythronium pluriflorum* type locality, looking north from Shuteye Peak.**

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The effect, compared to a larger flowered species such as *E. tuolumnense*, is analogous to the contrast between *Narcissus jonquilla* (with its many small flowers) and *Narcissus pseudonarcissus* (with its few, large flowers).

Erythronium pluriflorum is, in many ways, a yellow flowered version of *E. purpurascens*, however, the range of *E. purpurascens* does not extend this far south. Not only does *E. pluriflorum* have numerous small flowers on each stalk, but (like *E. purpurascens*) the inner three tepals lack appendages, in contrast with the other yellow-flowered *Erythronium* of the Sierra Nevada, *E. tuolumnense*. The tepals are highly reflexed into a "turk's cap" shaped flower. Also note the wavy-margined leaves, a feature of many of the Sierra Nevada erythroniums.

***Erythronium pluriflorum* colony**

One unique feature of *E. pluriflorum* is the colour of the tepals as the flowers age. Unlike *E. purpurascens*, and other white-flowered species, which age to pink or purple, the flowers of *E. pluriflorum* age to an orangy-red colour.

Another noteworthy feature is the production of a second "flush" of flowers on the more vigorous plants, which emerge as the first flush of flowers of the first stem pass anthesis and begin to develop seed capsules. As a result, the most vigorous plants can produce up to 21 flowers on a single stalk! Specimens of *Erythronium pluriflorum* were first collected in 1907, but it went unrecognized as a distinct species (even by Applegate) until the 1980's, and it was formally described by Shevock et al. in 1990. This is a very local endemic, and the entire known distribution is only 7 miles (11 km), but the plants are locally very abundant. The primary threat to this species would seem to be global climate change, which could result in the current habitat being unsuitable, and leaving it with no opportunity to migrate to higher elevations.

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Close view of *Erythronium pluriflorum* flowers

Since this is a subalpine species which grows in habitats that are covered with a deep snowpack until late spring or early summer, *E. pluriflorum* is likely to be difficult to grow in typical garden conditions, though I have no personal experience with this plant to speak from. However, if it could be grown, it could be a valuable parent for producing unusual, multi-flowered garden hybrids with other yellow species such as *E. grandiflorum*.

All in all, *E. pluriflorum* is a unique and appealing plant, and I consider myself fortunate to have been able to see it. Here is a nice composition with *E. pluriflorum* forming carpets in the foreground and also in the distance, accompanied by a nice shrubby evergreen oak.

***Erythronium pluriflorum* with evergreen shrub oak in subalpine fir-pine woodland.**

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The final entry of the five Sierra Nevada erythroniums, *Erythronium pusaterii*, is the one that eluded me for the longest time. It wasn't until 2006 that I was finally able to see it in flower. *Erythronium pusaterii* is yet another local endemic of the subalpine zone of the southern Sierra Nevada mountains. It is only found in four localities in roadless areas of Sequoia National Park and Giant Sequoia National Monument. To see it, one must hike.

My first attempt, in mid-June 1998, was foiled by an unusually deep and late melting snowpack which obscured the trail and prevented me from reaching my destination, which on that trip was the type locality at Hockett Lakes.

2006 was also a deep snowpack year so I hedged my bets and waited until the very end of June to time my visit. My first stop, on June 30th, was the trail up the North Fork of the Middle Fork of the Tule River to Moses Mountain, where the population of *E. pusaterii* reportedly consists of several million plants. But when I reached the base of Moses Mountain, I realized that I was actually late in the season, and if I was going to find *Erythronium pusaterii* plants in flower I would have to climb, off trail, over 2300 vertical feet (700 m) to the top of Moses Mountain, which is over 9300ft (2834m).
I happened to meet a climber who had just returned from the summit, and he commented on how difficult a climb it was, especially because of having to bushwhack through brush fields. From this pleasant spot in the giant sequoia forest, I figured there must be an easier way.

Luckily, there was another option, Jordan Peak, which is about 4 air miles SE of Moses Mountain. The summit of Jordan Peak is nearly as high as Moses Mountain, (9115ft / 2778m), but is easily reached by hiking a ½ mile (800metre) trail from the end of an old logging road. Much easier than climbing Moses Mountain!

View from giant sequoia forest along the Tule River up to the summit of Moses Mountain.

Once I reached the summit of Jordan Peak the next day (July 1, 2006), I noticed that the snow was nearly all melted and quickly realized that I was actually several weeks past the time when erythroniums had been in full flower. Would I be skunked again?

Fortunately, the answer was no, and after a half hour scrambling on the talus on the north side of the summit, I found a sheltered spot where the snow had lingered later into the summer than elsewhere. Finally, the elusive *Erythronium pusaterii* had been found!

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***Erythronium pusaterii* habitat below the summit of Jordan Peak**

Erythronium pusaterii is yet another species with large white flowers prominent yellow centres. *Erythronium pusaterii* was described in 1964 as a variety of *E. grandiflorum*. It really has little in common with *E. grandiflorum* (other than the plain leaves and tepals with appendages), so it was elevated to full species status by Shevock et al. in 1990.

It is perhaps closest to *Erythronium taylori*, but the yellow "egg yolk" in the centre of the flowers is even larger. The most obvious difference is that *E. pusaterii* has yellow anthers and white filaments, in contrast to the cream anthers and yellow filaments of *E. taylori*. The stigmas of *E. pusaterii* are more likely to have short lobes. Like many other species, the flowers of *E. pusaterii* fade to pink.

Flowers of *Erythronium pusaterii*

Ecologically these two species are very different, with *E. pusaterii* occurring in subalpine habitats, and *E. taylori* a lower montane species. Geographically, *E. pusaterii* is separated from *E. taylori* by about 120 miles (195 km). *E. pusaterii* is also a local endemic; the distance between the northern and southern-most of the four known populations is only about 17 miles (28 km). In optimal habitats, *E. pusaterii* is extremely prolific, forming large clumps of leaves, presumably from vegetative offsets. One might even say it is a bit "cabbagey" in appearance. It is odd to think that this species can grow so vigorously, and yet be so restricted in its distribution. Why has it not spread more widely?

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A most remarkable feature of *Erythronium pusaterii* is the extreme elongation of leaves and fruiting stalks after anthesis. While it is typical for erythroniums to elongate their stalks after flowering, *E. pusaterii* takes this to another level. On one part of the hillside, individual clumps were up to 30in (76cms) tall, with dozens of fruiting stalks arising above clumps equally as wide. Presumably each clump is a single plant, having increased vegetatively from offsets.

Flowering clump of *Erythronium pusaterii*

Fruiting clumps of *Erythronium pusaterii*

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Being a plant of the subalpine zone, *Erythronium pusaterii* is unlikely to be an easy plant to grow in typical garden conditions. While it is a nice plant, I frankly don't think it would be a choice garden species, even if it could be grown - the volume of leaves to flowers is a bit excessive, and the flowers themselves don't seem to have the grace and charm of some of the other species (not that I would ever say anything bad about an *Erythronium*!) So perhaps it is just as well that is such a rare endemic, something to be south by the connoisseur who is willing to travel to the far ends of the earth (or at least the far ends of California) to be in its presence.

Also on Jordan Peak, there were plenty of interesting subalpine rock garden plants growing with *Erythronium pusaterii*, including abundant phlox and penstemon in bloom. In one area there was a nice colony of a fritillary (***Fritillaria pinetorum***?) which I thought I would include for Ian Young's sake!

***Fritillaria pinetorum*, Jordan Peak**

The Olympic Peninsula in north-western Washington State is well known for its impressive displays of avalanche lily, *Erythronium montanum*, carpeting subalpine meadows just after snowmelt. But another reason to visit the Olympic Peninsula is to see the rare ***Erythronium quinaultense***. This species grows only within a limited area on montane ridges above the temperate rain forest valleys for which the peninsula is well known.

These unusual *Erythronium* populations were first discovered in 1980, and due to the pinkish flowers were at first thought to be *E. revolutum* growing at higher elevations than is typical for that species. However, Dr Geraldine Allen studied these populations and determined that they had 4 sets of chromosomes (double the usual number), and combined the features of *E. revolutum* and *E. montanum*. The paper describing *Erythronium quinaultense* as a new species was published in 2001.

Readers will note this pattern is similar to the hypothesized origin of *E. elegans* from northwestern Oregon. However, Dr Allen suggested that *E. elegans* and *E. quinaultense* likely originated in separate hybridization events from the same two parental taxa. Her key to species separates the two species of hybrid origin on the basis of *E. quinaultense* having slightly wider anther filaments, and tepals that shade from pink to white from the tips to the base. *E. elegans* has narrower filaments, and the outer tepals are generally more strongly coloured than the inner tepals.

Ed at the age of 11, fishing in Lake Quinault below Higley Peak where *E. quinaultense* grows

Unlike many of my *Erythronium* destinations, this is not new country for me, having visited the area on many occasions when I was growing up in the 1970's, but I had not returned for many years. It was 22 May 2007 when I was finally able to return. The winter snows had melted off the 3000ft (915m) ridges above Lake Quinault, but the higher peaks in the interior of the Olympic peninsula were still snow covered.

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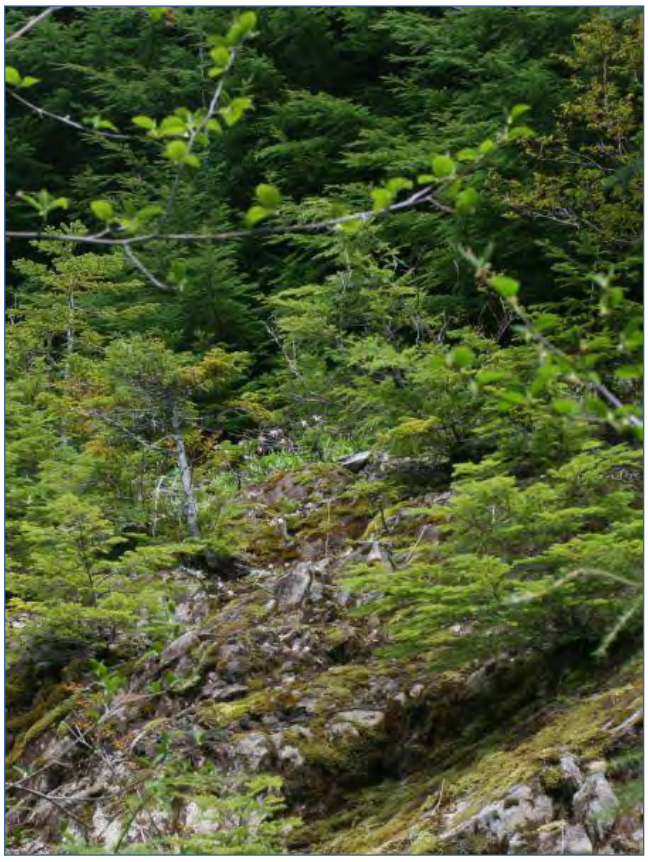
Higley Peak is part of a forested spur ridge well set off from the higher peaks in the centre of the Olympic Mts., still covered by snow.

Higley Peak, the type locality for *E. quinaultense*, is accessed by a series of gravel logging roads just outside of the boundary of Olympic National Park. However, I was still about a mile from my destination when I reached a point where the road was blocked by trees that had fallen during winter storms, so I had to walk the last stretch. My first sight of *E. quinaultense* was a patch located on a rock outcrop, too far above the road to access. Fortunately, when I reached the type locality, there were plenty of plants at eye level. In fact, most of the plants I saw were along the roadside. Most of the ridge crest is covered by dense conifer forest, which is not optimal habitat for erythroniums, and its "natural" habitat is probably rock outcrops within this forest matrix.

Conditions were quite damp as the day began, but as it progressed the *E. quinaultense* flowers began to dry out and open up. They did look to me like a rather pale form of *E. revolutum*. However, the leaves are only minimally mottled, and single leaves, in particular, are quite broad, narrowing abruptly to a petiole, as is typical for *E. montanum*.



In the morning, flowers of *E. quinaultense* were barely opened due to lingering moisture.

The first glimpse: *E. quinaultense* out of reach on an outcrop above the road.

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Pink flowers and flattened anther filaments show the relationship of *E. quinaultense* to *E. revolutum*.

Above right: ***E. quinaultense* flowers in the afternoon, beginning to open**.
Below left: **Foliage of *E. quinaultense* is lightly mottled but otherwise resembles *E. montanum*.** Here it is growing with the fern ***Blechnum spicant*,** a rather unusual association for an *Erythronium*!

Mountain lion track in Bear Valley

Erythronium grandiflorum* subsp. *nudipetalum is a local endemic to a small area of the headwaters of the Salmon River, about a 2 or 3 hour drive northeast of Boise, Idaho. This plant was first discovered by Elmer Applegate and formally described (as a full species) by him in 1933. Perhaps because it is poorly represented in herbaria, it has been pretty much ignored by recent monographers, and is not recognized as a valid taxon in Flora of North America (Allen and Robertson 2002). In 1991, extensive botanical surveys were done which determined that this taxon is only found within Bear Valley, at elevations of about 6500 to 7000ft (1980-2134m) within an area only 15 to 20 miles (20-32km) across (Mancuso and Mosely 1991). However, within this area, some populations are very large, with tens to hundreds of thousands of plants.

In mid-June of 2008 I made the long trip to central Idaho to explore **Bear Valley**. Bear Valley is covered by an extensive series of meadows, and though it was early in the flowering season, I could see that the flora is very diverse. It turned out that my visit was about 10 days past the peak of bloom for *Erythronium*, but I was still able to find plants in flower in areas where the snow had taken longer to melt. Fortunately it turned out to be a beautiful sunny day, and I was able to find *E. grandiflorum* subsp. *nudipetalum* soon after reaching Bear Valley without much difficulty.

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Bear Valley: a remote high elevation valley in central Idaho where *E. grandiflorum* subsp. *nudipetalum* carpets the ground in large numbers.

Erythronium grandiflorum subsp. *nudipetalum* looks much like *E. grandiflorum* subsp. *grandiflorum*, with yellow tepals and red anthers. However, it differs in lacking the appendages at the inner base of the petals that are found in the other forms of *E. grandiflorum* (as well as many other erythroniums). Also, the style is essentially un-branched at the tip. Most significantly, from a horticultural standpoint, the flowers are much smaller than most or all other forms of *E. grandiflorum*. Associated with this reduction in flower size is a propensity for plants to produce many flowers on a single flowering stem, and for individual plants to produce multiple flower stems.

***E. grandiflorum* subsp. *nudipetalum* is distinguished from other forms of *E. grandiflorum* by its unbranched style and lack of appendages at the base of the inner tepals**.

The largest concentration of *Erythronium grandiflorum* subsp. *nudipetalum* is found in "Big Meadows", which is up near the headwaters of Bear Valley Creek. I had to drive over a few small snowbanks on the dirt road to get to this area, as the area is not frequently visited this early in the season.

This is the place where *E. grandiflorum* subsp. *nudipetalum* carpets the meadows by the hundreds of thousands. Here, in the full sun of the open meadow, some of the plants had numerous flowers. Four-flowered stems were not uncommon, some had more.

Like other forms of the species, *E. grandiflorum* subsp. *nudipetalum* blooms just after snowmelt, before other meadow vegetation emerges.

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Above left: **This plant of *E. grandiflorum* subsp. *nudipetalum* has seven flowers, four on one stem and three on the other**.
Above right: **Growing among the thousands of yellow-flowered *E. grandiflorum* subsp. *nudipetalum* was this plant with cream coloured flowers.**

My conclusion, after seeing *Erythronium grandiflorum* subsp. *nudipetalum* in the wild, is that it is definitely a valid taxon and should be recognized as such in our floras. The small flower size, often with multiple flowers on a single stem, along with the un-branched stigma and missing appendages at the base of the tepals, is very reminiscent of *Erythronium pluriflorum*, a local endemic of subalpine habitats in the Sierra Nevada Mts. in California. In fact, the relationship of *Erythronium grandiflorum* subsp. *nudipetalum* to *Erythronium grandiflorum* subsp. *grandiflorum* is very reminiscent of the relationship of *Erythronium pluriflorum* to *E. tuolumnense*, a larger yellow-flowered species that grows at lower elevations in the Sierra Nevada.

The last entry in this epilogue brings our story back to a full circle of sorts. I had not mentioned this in the entry for April of my “Big Year”, but had seen reports of *Erythronium californicum* from the south-eastern Klamath Mountains in Shasta County, California and since this was a species I wanted to see and it was on my travel route, I spent part of a day driving the backroads on the northeast side of Shasta Reservoir to see what I could find. I did not see any blooming erythroniums, but there was a maidenhair fern (*Adiantum*) that caught my eye, especially because it appeared to be evergreen, with last year’s fronds still fresh through winter in to early spring. I continued on with my travels and found *Erythronium californicum* in bloom the next day in Lake County, California, as I previously reported.

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So it was with a mixture of surprise and recognition that, in 2014, I received the news through the botanical grapevine that a new maidenhair fern, ***Adiantum shastense*****,** was soon to be described from the southeastern Klamath Mountains. I knew immediately that it was the same plant I had seen in April 2005. Even more noteworthy was that the *Adiantum* was one of four new species in the process of being described, including a new *Erythronium*, ***E. shastense*** (York et al., 2015) So it turns out that the *Erythronium* I was looking for in April 2005, but was unable to find, was not actually *E. californicum*, but a new species!

The flowering dogwood *Cornus nuttallii* was in bloom in the mixed forest as we began our search for *E. shastense*.

In early April 2015 I travelled to Redding, California, to attend a day-long "Discovery Event" highlighting the four new species of plants from the south-eastern Klamath Mountains. In addition to the *Adiantum* and *Erythronium*, the new species include a monkeyflower (now *Erythranthe*, formerly placed in *Mimulus*), and a *Vaccinium*. All four are endemics with restricted ranges. I have described this event in greater detail elsewhere (Alverson 2015), but the afternoon portion of the event was a field trip to a site where we were able to see three of the four new species in the wild.

A sizable patch of *E. shastense* in the forest understory adjacent to limestone outcrops

The field trip site was a very diverse area of mixed forest and woodland with prominent limestone outcrops at an elevation of about 1300ft (396m). *Neviusia cliftonii*, the endemic rosaceous shrub discovered in 1992, was the dominant shrub in the forest understory here. Unfortunately *Erythronium shastense* was well past bloom at the time of the field trip due to the unusually dry and mild winter we had in 2015. However, there is a nice colour photo of the species in bloom in the York et al. paper. *Erythronium shastense* has very large leaves and is very strongly clumping (from offsets). My quick impression was that it is more strongly clumping than any of the western erythroniums with mottled leaves, perhaps with the exception of the cultivar of *E. californicum*, "White Beauty".

Erythronium shastense most resembles *E. helenae*, which grows in the California Coast Range several hundred miles to the southwest. Both species have yellow anthers and bent styles, but both the styles and stamens of *E. shastense* are longer than those of *E. helenae*. *Erythronium shastense* is extremely clumping, with larger leaves, and the flowers are outward-facing, rather than pendent. *E. californicum* is the closest species geographically, but it has white anthers and pendent flowers.

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Though already in fruit, we could readily see that *E. shastense* is a robust species with a strong clumping habit.

This particular part of northern California seems to be a hot spot for endemic species in part because of a large extent of limestone bedrock (generally uncommon in the state), and in part because it is a relatively high precipitation area (note all of the mosses growing on the tree trunks). While many erythroniums (including *E. helenae*) are partial to, or even endemic, to serpentine bedrock, *E. shastense* is the only western species restricted to calcareous bedrock.

Discussing *Erythronium* evolution in the field with Dean Taylor (l) and Dana York (r) - note the moss-covered trees.

Despite the ongoing drought we did find a few new seedlings of *E. shastense.*

At this site, *E. shastense* grows intermixed with the new fern species *Adiantum shastense*, as well as the endemic shrub *Neviusia cliftonii*.

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All in all this was, for me, a fitting conclusion to my *Erythronium* explorations. I was able to be in the field talking *Erythronium* evolution and biogeography with Dana York as well as Dean Taylor, who happens to have been the first person in modern times to collect *E. shastense*. Remember also that Dean is also the discoverer and namesake of *Erythronium taylorii* (see page 49) and co-discoverer of *Neviusia cliftonii*. I look forward to returning to the area in a future year to see *Erythronium shastense* in bloom.

It has now been a decade after since my initial *Erythronium* quest, and no one, as far as I am aware, has come forward to claim a new record for the largest number of *Erythronium* taxa to be observed in the wild in a single calendar year. But with one more species now recognized for the region, it should be even easier to break my record – anyone up for it?

I do want to thank Ian Young for his ongoing assistance and encouragement as I put my notes and photos together to create this series, and Margaret Young for her editorial work on this compilation. It has been a fun project. E. A.

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J.Ian Young is publishing chapters on "Erythronium in cultivation" in his Bulb Log over the course of 2015 and will gather them then to a single pdf for easy access.

***Erythronium pusaterii* from Jordan Peak, with high Sierra peaks in the distance.**

***Erythronium montanum* – in profusion in Mt. Rainier National Park.**

[As a series of articles by Ed Alverson, these were first made available on the SRGC site in 2006. You are welcome to share a link to this paper.]

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