KALMIOPSIS

Journal of the Native Plant Society of Oregon

Yellow Cat's Ear (*Calochortus monophyllus*)

ISSN 1055-419X

Volume 15, 2008

KALMIOPSIS

Journal of the Native Plant Society of Oregon, ©2008

EDITOR

Cindy Roché, PhD

EDITORIAL BOARD

Frank A. Lang, PhD
Susan Kephart, PhD
Rhoda M. Love, PhD

NPSO WEB PAGE

http://www.NPSOregon.org

EDITORIAL

Long-time readers of *Kalmiopsis* will notice that this is the second appearance of *Calochortus monophyllus* on the cover. The first time was in 1993, shortly after Frank Callahan discovered it on Grizzly Peak. After leading field trips and diligently cataloging the plants of Grizzly Peak for eleven years, Jim Duncan is the local expert for our Oregon Plants and Places feature. For the Plant of the Year, Frank Lang helped me uncover the mysteries surrounding green-flowered wild ginger (*Asarum wagneri*), which was named for Dr. Warren (Herb) Wagner who, in his long career as professor of botany at the University of Michigan, influenced many students. Herb Wagner's discoveries of *Botrychium* in the Wallowa Mountains are described in the article on fern diversity in the Wallowa Mountains (explained A to Z) by Ed Alverson and Peter Zika. These two have devoted many weeks to exploring this rugged terrain of northeastern Oregon, and describe how the substrates are keys to habitat. The Plant Hunters article tells the story of Thomas Jefferson Howell, who without education, financial backing, or academic resources, wrote the first flora of the Pacific Northwest, an admirable feat of perseverance. Proving that botanical discoveries are still possible, Frank Callahan shares the story of Hinds walnut, a native tree visible from Interstate 5 that, to date, has not been recognized in Oregon by a published flora. I'm pleased to present each of these worthy articles in *Kalmiopsis*, and want to encourage NPSO members to contribute articles from all parts of Oregon for future issues.

Flower of *Asaram wagneri* on July 3, 2001, at the north end of Lake of the Woods near where Peck collected the type specimen. Photo by Bob Vos.

CONTACT INFORMATION

KALMIOPSIS EDITOR: Cindy Roché, P.O. Box 808, Talent, OR 97540-0808, kalmiopsis@NPSOregon.org
BULLETIN EDITOR: Tanya Harvey, 40237 Reuben Leigh Rd., Lowell, OR 97452-9712, bulletin@NPSOregon.org
MEMBERSHIP CHAIR: Clayton Gautier, 3927 Shasta View St., Eugene, OR 97405-4442, membership@NPSOregon.org
WEBMASTER: Norm Jensen, webmaster@NPSOregon.org
EMAIL DISCUSSION LIST LOGIN: See NPSO web page, select subscribe to list under membership.
WEB PAGE: http://www.NPSOregon.org

Cover Photo: Yellow cat's ear (*Calochortus monophyllus*) on Grizzly Peak. Photo by Bob Vos, June 2000.

Kalmiopsis: ISSN 1055-419X. Volume 15, 2008. Published annually. Subscription $18 per year.
Native Plant Society of Oregon
General business address: PO Box 902, Eugene, OR 97440-0902

Grizzly Peak
Jackson County, Oregon

Jim Duncan
692 B Street, Ashland, Oregon 97520

Winter view from Ashland of Grizzly Peak with a thin layer of snow above 3,000 feet. The highest point visible is the extreme southwest corner of the Grizzly Peak plateau, indicated on the map by a solid circle in Block 7. From this point (5,750 feet elev.), there is an equally impressive view of Ashland and the Bear Creek Valley. Photo by Jim Duncan.

As the highest point on the ridge directly across the Bear Creek Valley from Ashland, Grizzly Peak serves as a focal point for the town, inviting both residents and visitors to find a way to its summit. Grizzly Peak is part of a long ridge of the western Cascades that extends another 12 miles northwest through Payne Cliffs and Mt. Baldy to Roxy Ann Peak, just east of Medford. The ridge is flanked by two tributaries of the Rogue River, Antelope Creek on the north and Bear Creek on the south. Grizzly Peak, so the story goes, was named in honor of a well-known grizzly bear that inhabited a large territory around Ashland during the second half of the 19th century and was the last known grizzly in this area. It was called Old Reelfoot as a result of having been crippled by the loss of several toes in a trap. The animal was killed by hunters around 1890, apparently after many failed attempts.

Topography and Geology

The Grizzly Peak plateau is a relatively flat area about a quarter of a square mile. The highest point (5,920 feet) is near the northeast corner, with the plain sloping gently to the south and west. The plateau is shaped somewhat like a "mutton-chop," with the pointed end at the southwest corner. This is the point from which one can look down nearly 4,000 feet into the Bear Creek Valley, and at 5,750 feet this is the part of Grizzly Peak that, from Ashland, appears to be the summit. (This point shows clearly in the photo of the peak as seen from Ashland, and it is marked on the map by the solid circle in Block 7.) The rest of the plateau and the actual peak are out of the line of sight.

Geologically, Grizzly Peak's volcanic formation dates from about 25 million years ago. Among the various kinds of volcanic activity that contributed to its mass were basaltic lava flows known as the Roxy formation (Begnoche 1999). Late in this period of volcanic activity, a large strato-volcano, called Mount Grizzly, formed near the present-day Grizzly Peak. It probably rivaled Mt. McLouglin (9,495 ft.) in size and appearance. The high part of Mount Grizzly has long since eroded away, but a remnant of one of its lava flows survives as the plateau around the summit of Grizzly Peak. Starting about five million years ago, volcanic activity returned to create the current High Cascade Range, which includes Mount McLoughlin. These new eruptions were about twenty miles east of the earlier ones, and their outpourings did not reach Grizzly Peak. Today the peak remains the highest point for a considerable distance, from the Siskiyou (Klamath) Mountains to the south or the High Cascades to the east.

Plant Community Overview

From the northern and eastern edges of the plateau the land slopes down steeply. The dense old growth conifer forest on this slope consists almost entirely of a population of fir that is intermediate between white fir (*Abies concolor*) and grand fir (*Abies grandis*). The two species hybridize here as elsewhere in Oregon, such as in the central Oregon Cascades (Zobel 1973). Great variation exists in this population, ranging from trees that look nearly like pure grand fir to ones that look nearly like pure white fir. Along the west edge of the plateau, the slope is equally steep, but the forest is more open and contains a mixture of conifers and oak (see the list starting on

page 7). In August 2002 this slope, along with the western part of the plateau, burned in a fire that I will discuss further on. On a gentle slope just below the northwest corner of the plateau, a permanent wetland lies in the central part of a large meadow. Some species on the list occur only in this wetland. The best view of the geological composition of the plateau is at its southern edge. There, bedrock that forms the plateau is exposed at the surface, and along much of its length the edge drops off abruptly for ten to twenty feet. Vegetation on the steep slope below this small cliff is a mix of oaks, conifers, shrubs, and open grassland.

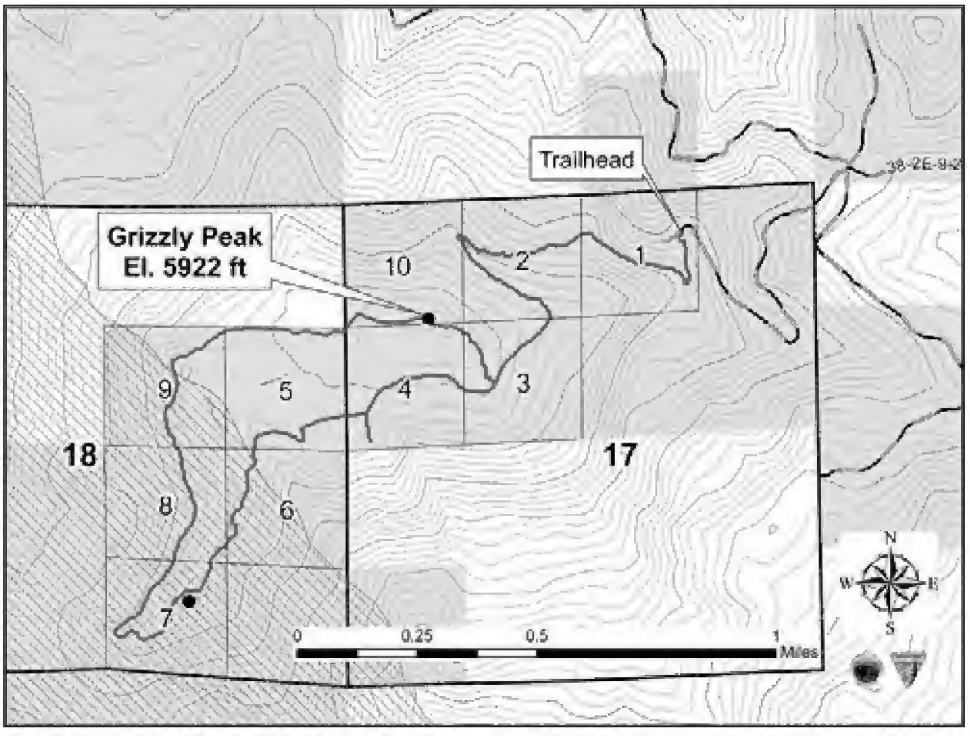
On the plateau the vegetation varies in response to changes in soil depth. Along the southern edge where the soil is mainly very shallow or the rock is directly exposed, plants grow in joints and cracks of the rock, or annuals grow in thin soil that is vernally wet from snow melt. These rocky areas represent about 10% of the plateau and harbor a distinctive mix of perennials and shrubs that varies from east to west along the edge. Similar vegetation grows on other rocky outcrops scattered in the interior of the plateau. Deeper soils support large areas of open grassland or a combination of grass and low shrubs. These grassy openings cover 50 to 60% of the plateau. Mixed conifer forest covers the rest of the area, forming discontinuous patches scattered across the plateau. Presumably these forested regions mark the areas of the deepest soil.

Grizzly Peak Trail

The Grizzly Peak plateau is Federal land administered by the Bureau of Land Management (BLM) out of its Medford District office. The plateau has become a popular hiking area since the BLM constructed a fine access trail in the 1990s. The trail begins on the north slope and winds up through dense fir forest, to the northeast corner of the plateau, where it first enters open, grassy areas (about where the trail crosses the line between Blocks 2 and 3 on the map). The trail then makes a large loop around the plateau and back to the northeast corner. The idea for the trail was conceived and promoted by John Ifft of the BLM during the 1980s. His concept was to build a trail to the far point that overlooks Ashland (the dot in Block 7 on the map) so that people could hike up there to enjoy the view. Ifft retired in 1989, but his efforts finally paid off in 1991 when the trail was built according to his plan. The trail was such an immediate success that in 1995 it was extended to form the loop as we know it today. To get to the trailhead from Ashland, go east from exit 14 of Interstate 5 on State Route 66 for less than a mile and turn left on Dead Indian Memorial Road (Jackson County Road 722). Continue east for 6.8 miles, then turn left on Shale City Road (BLM Road 38-2E-27). Go north on Shale City Road about four miles, and turn west on BLM Road 38-2E-9.2. In a little less than two miles the road ends at a parking area for the trailhead. The elevation there is about 5,200 feet.

Plants of Grizzly Peak

Although my first trip up to the Grizzly Peak plateau was in September 1993, it was not until the fall of 1996 that I began systematically compiling a list of plant species in the area. The impetus was to help the Oregon Flora Project build the database for the Oregon Plant Atlas. As I gradually began to think of Grizzly Peak as a study area, I defined its limits to be the entire Grizzly Peak plateau, the north slope true fir forest (starting at the trailhead), as well as the section of the loop trail that drops below the southwest corner of the plateau and runs north along the slope until it leads back up to the northwest corner of the plateau. All plants on the list occur somewhere within this area, which ranges in elevation from 5,200 to 5,920 feet (trailhead to summit).



Map of the Grizzly Peak area in parts of Sections 17 and 18, Township 38 South, Range 2 East. Shaded blocks are public land; unshaded, private land. The hatched area (lower left) burned in the August 2002 wildfire. The solid line winding through the numbered squares is the trail. The dot in Block 7 marks the viewpoint for Ashland and the Bear Creek Valley. The contour interval is 40 feet. Map prepared by Dennis Glover of the BLM Medford District.

To facilitate recording plant locations, I divided the study area into ten numbered blocks each one-quarter-mile square (see map). Each block is therefore a quarter-quarter section of either Section 17 or Section 18 of Township 38 South and Range 2 East in Jackson County, Oregon. The numbers in the "Location" column of the plant list correspond to the block or blocks where I have found each taxon. (Note: Only those portions of each block that are on the plateau or are close to the trail have been surveyed.)

After eleven years, my list numbers almost three hundred taxa, for

which I have collected voucher specimens of nearly all. Naturally, the list is not yet complete; nearly every visit uncovers additional taxa, and there are other species that occur nearby and should be expected in the study area that I have not yet encountered there. That said, I estimate that I have documented about 90% of the flora of Grizzly Peak as of the end of the 2007 season. The list at the end of this article is preceded by a legend that explains the notations and the terminology. I have followed *The Jepson Manual* (Hickman 1993) for the scientific names, updated as necessary with the Oregon Plant Atlas of the Oregon Flora Project (www.oregonflora.org) or published volumes of the *Flora of North America*.

Analysis of the Flora

Not surprisingly, the flora of Grizzly Peak closely resembles that of the Cascade Range, of which it is a westward extension. It has less in common with the Klamath Range (Siskiyou Mountains) to the southwest. The Cascade-Siskiyou National Monument serves as a bridge between these two regions. A plant species list for the Monument compiled by Frank Lang from numerous sources, including his own work (Lang 2002), contains more than 600 species for an area of approximately 83 mi^2 where the elevation ranges from about 3,000 feet to just over 6,000 feet. The degree of similarity between the floras of the Monument and Grizzly Peak is high: 75% of the species on Grizzly Peak also occur in the Monument. In contrast, differences are greater between the Grizzly Peak flora and that of the high Siskiyou Mountains south and west of Ashland. Species lists I have compiled during the last decade for three areas along the Siskiyou Crest show the following amounts of overlap with the Grizzly Peak list: 1) Mount Ashland to McDonald Peak, 23%; 2) Big Red Mountain, 24%; and 3) Dutchman Peak to Observation Peak to headwaters of Cow Creek, 23%. Curiously, owing to differences in the species mix of these three Siskiyou Crest regions, 38% of the Grizzly Peak plants occur on at least one of these lists. Yet this is still only half the overlap compared to the Cascade Monument list.

One consideration in these comparisons is elevation. The elevation range of the Grizzly Peak study area is completely within that of the Monument. In contrast, elevation of the Siskiyou Crest sites ranges from 6,800 to 7,500 feet. Thus, there is no elevation overlap between the two collection areas: the lowest points of the Siskiyou Crest sites are nearly a thousand feet higher than the highest point of Grizzly Peak. These elevation differences may be partially responsible for differences in the flora, but geological differences are probably of greater importance. Grizzly Peak is of the same volcanic origin as the rest of the Cascade Range, including major parts of the Cascade-Siskiyou National Monument. The Siskiyou Crest sites are different rock and differ from each other in geological origin. Mount Ashland and McDonald Peak are composed mostly of quartz diorites grading to granodiorites, part of a great mass of igneous rock known at the Ashland pluton. Dutchman Peak is a complex mixture of metamorphic rock. Observation Peak and upper Cow Creek consist of a complex conglomeration of old igneous and sedimentary rocks. Big Red Mountain is composed of ultramafic rock. None of these resembles the volcanic rock of Grizzly Peak and the Cascades. These plutons of the Klamath/Siskiyou mountains are closely related to those of the Sierra Nevada. It is widely recognized that geological differences result in floristic differences (Kruckeberg 2006).

Rare and Unusual Species

Grizzly Peak harbors some species that are rare in Jackson County. The two robust populations of *Lomatium hendersonii* on the plateau (one in Block 7 and the other in Block 9) constitute the only report of this species in Jackson County (Duncan 2007). According to the Oregon Plant Atlas, the next closest population is in eastern Klamath County, with all other sites farther east and north of there. Based on the known distribution of this species, the population of *L. hendersonii* on Grizzly Peak appears to be a western "outlier." Its presence is an example of the range of eastern Oregon species extending west of the Cascade crest in southern Oregon. Henderson's lomatium is one of six species of *Lomatium* on Grizzly Peak, and with its large, bulbous root it is one of several such species of *Lomatium* that were valued by Native Americans who harvested the roots for food.

The two robust populations of *Lomatium hendersonii* on Grizzly Peak are the only known populations in Jackson County. A low plant with a large tuberous root, Henderson's lomatium grows in open rocky places. Its clusters of small, golden-yellow flowers open in early May, soon after snow melt. Photo by Elaine Plaisance.

The Grizzly Peak *Calochortus monophyllus* is one of only three populations in the state, all of which are in Jackson County. Bright yellow flowers are borne on stems 4 to 8 inches tall that grow up through cracks in rock outcrops from deep-seated bulbs. It blooms in mid-June, but flowers have not been seen for several years. Photo by Bob Vos.

About 30 plants of Warner Mountains sulphur flower (*Eriogonum umbellatum* var. *glaberrimum*) grow in one location along the southern edge of the plateau. This uncommon variety of *E. umbellatum* was not expected on Grizzly Peak because it was previously known only from Lake County, Oregon, and Modoc County, California. Here, Jim Duncan examines its clusters of small cream-colored flowers in mid-summer. Photo by Connie Battaile.

In 1990 Frank Callahan discovered a small population of *Calochortus monophyllus* on Grizzly Peak, one of only three populations of the species in Oregon. Voucher specimens were deposited in the herbaria at Oregon State University and Southern Oregon University (SOC7830). The other two populations are also in Jackson County, but grow on ultramafic (serpentine-influenced) soil. On Grizzly Peak, I saw the plants in flower once, in mid-June 2000, but I have not seen any sign of them since that time, despite visits to the site at the expected flowering time. Either these plants flower only rarely or something has happened to the population. I continue to look for it and hope that the August 2002 fire, which burned through the site, did not damage the bulbs.

Eriogonum sphaerocephalum variety *halimioides*, a small shrub superficially similar to Warner Mountains sulphur flower, but clearly different upon close inspection. The flowers of this round-headed wild buckwheat are the same cream color, and the two species bloom at the same time; but in this species the leaves are much narrower, and the whole plant is very hairy, particularly the flowers and leaves. In contrast, the Warner Mountains wild buckwheat is quite glabrous, and the leaves are broad and shiny. Photo by Connie Battaile.

A substantial population of *Eriogonum sphaerocephalum* var. *halimioides* grows along the western edge of the plateau in an open rocky corridor, mainly in Block 8, but extending into Blocks 7 and 9. It is known from only two other sites in Jackson County, both in the Cascade-Siskiyou National Monument. *Eriogonum umbellatum* var. *modocense* grows abundantly on the plateau, as it does elsewhere in the county. This is a new name (Reveal 2005) for a common plant, which formerly keyed to variety *polyanthum*. An uncommon variety of *E. umbellatum*, variety *glaberrimum*, also occurs at one site on the Grizzly Peak plateau, along the rocky southern edge in Block 5 (Duncan 2007). This variety is known mainly from the Warner Mountains of Modoc County, California, and Lake County, Oregon, and this is the only report of it in Jackson County. The nearest sites reported in the Oregon Plant Atlas are all in Lake County. Here is another example of an outlier population of an eastside species in Jackson County.

Two other uncommon species are worth mentioning for their presence on Grizzly Peak. When I began inventorying plants there, wild hollyhock or globe mallow, *Iliamna bakeri*, occurred at one small site in Block 7. Since the wildfire in 2002, new stands have appeared at several sites in the burned forest. Although uncommon in Jackson County, tall bugbane (*Cimicifuga elata*) grows in a robust and well known population in the dense fir forest on the north slope of Grizzly Peak, a site very close to the southern limit of its distribution. Recently, this Jackson County population was described as variety *alpestris* (Lee and Park 2004), while the plants farther north are assigned to variety *elata*. Thus, the Grizzly Peak bugbane has been recognized as taxonomically distinct.

Wildfire!

On a very hot day in mid-August 2002, sagging high voltage power lines shorted against each other in the wind creating sparks that started a fire in the upper Antelope Creek Valley. The fire burned vigorously uphill through oak savanna and open coniferous woodland on the west slope of Grizzly Peak. The fire continued up onto the plateau, completely burning the forest stands interspersed with open grasslands and rocky outcrops on the western 10 to 15% of the plateau. The burned area is shown on the map. The fire

Wildfire rages up the southern flank of Grizzly Peak, August 2002. Photo by Diane Fassler Chasmar.

burned all of Blocks 7 and 8, about 75% of Block 9, about half of Block 6 and a small portion of the southwest corner of Block 5. The photo above shows the fire in progress as seen from high in the hills of Ashland. The photo below, taken just three weeks after the fire, illustrates some of its effects. In the five years since the fire, I have been observing the regrowth in the burned areas.

During the first season after the fire (2003) growth of herbaceous perennials in the open grassland and rocky areas was typical of pre-fire years. Although the above-ground part of many shrubs had burned completely, some of these species, such as Brewer's white oak, bittercherry, western chokecherry, and mountain maple were resprouting from their roots. In contrast, growth was sparse throughout the burned forest areas, where the fire presumably burned hotter. The trees had all been killed. The few perennial herbs that appeared, mainly *Pseudostellaria jamesiana*, *Hydrophyllum fendleri*, and *Claytonia sibirica*, had been present before the fire. Large areas of bare ground suggested that heat from the fire had either killed some perennial roots or so damaged them that they failed to grow the first season. Surviving plants grew large and sprawling, taking advantage of reduced competition and abundant mineral nutrients in the ash-covered soil. A few annuals appeared, also widely scattered but vigorous, especially *Agoseris heterophylla*, *Cryptantha* species and *Gilia capitata*. A surprise to me was finding several large patches of rough-leaved aster (*Eurybia radulina*) in abundant flower in mid-August at the edges of a few burned forest areas (see photo). I had never previously seen the species up there. Clearly these rhizomatous plants were present before the fire, but in the denser plant mass of pre-fire years they may have mainly grown vegetatively and rarely flowered. In the burned forest I found several tiny seedlings of *Ceanothus velutinus*, easily recognizable by their distinctive leaves. Although this species had not been present in the ten years before the fire, its emergence was clear evidence of its presence in the soil seed bank, awaiting a fire to trigger germination. As a result, there are now many healthy young *Ceanothus velutinus* plants in the burned forest (see photo of one taken in 2007).

The view in the southeast corner of Block 8, looking northeast at burned trees in Block 6, three weeks after the fire (September 2002). Note the trail, lower right, and the remains of a large greenleaf manzanita in the center-left foreground. This shrub was killed by the heat, even though parts of it did not burn and appeared to be still alive shortly after the fire. None of the burned Grizzly Peak plants of this species resprouted from roots after the fire. This is consistent with the Cascade form of the species. The form in the Siskiyou Mountains and south into California typically has a burl and resprouts after fire. Photo by Jim Duncan.

Rough leaved aster (*Eurybia radulina*) flowered abundantly, exactly one year after the fire, in an otherwise barren area near the edge of burned forest. Although I had not seen these asters on the plateau before, the rhizomes must have been there all along. Photo by Jim Duncan.

During the 2004 season vigorous herbaceous growth was more general in the burned forests. This included about eight weedy alien species which had been absent or less abundant before the fire. These non-native species are indicated on the plant list. Some of them, especially the grasses, may have come from the seed mix broadcast by the BLM after the fire to help reduce erosion. Additional native species also appeared in the burn area in 2004: *Hazardia whitneyi*, *Calystegia occidentalis*, *Mentzelia dispersa*, *Chamerion angustifolia,* and *Iliamna bakeri*, of which there is now a huge population in the southeast corner of Block 8 as well as some smaller groups elsewhere in Blocks 6-8 (see photos). Baker's globe mallow is well known for germinating after fire, so clearly there was a large seed bank of it in parts of the now-burned forest near the western edge of the Grizzly Peak plateau.

Five years after the fire, vegetation is abundant in the burned forest. In additional to the conifers planted by the BLM soon after the fire, many young conifer seedlings are growing vigor-

ously throughout the area. These latter must represent natural regeneration from local native species. Native shrubs are appearing, especially species of *Ribes* and *Rubus*, but also *Symphoricarpos* and *Arctostaphylos*. Weeds are distressing, especially bull thistle (*Cirsium vulgare*), prickly lettuce (*Lactuca serriola*), and woolly mullein (*Verbascum thapsus*) that seem to be taking over some areas. But these are short-lived, early seral species, that represent a part of the way that ecological systems work. Change is continuous, and it will be interesting to follow the further changes in the coming years.

New seedlings of snowbrush (*Ceanothus velutinus*) appeared in the burned forest along with scattered herbaceous plants the first year after the fire. This seedling was several years old at the time of the photograph in July 2007. This species is heavily browsed by deer and elk. Photo by Connie Battaile.

Baker's globe mallow or wild hollyhock (*Iliamna bakeri*) appeared in several places among the burned trees during the second growing season after the fire. By mid-September, as seen in this photo, most of the flowers had already gone to seed. Photo by Jim Duncan.

Acknowledgements

I am grateful to Don Begnoche for his generous efforts to educate me about the geology of Grizzly Peak and other local areas, as well as for reviewing my geological discussions and making valuable suggestions. I thank Frank Lang for helping me to clarify further my understanding of the geology of the Siskiyou Crest. Thanks to Kenton Chambers for carefully checking the plant list for recent name changes, for calling my attention to the recent taxonomic work on the genus *Cimicifuga* and for putting me in touch with Don Zobel, to whom I offer much thanks for helping me sort out the identity of the true fir trees of the Grizzly Peak plateau and the north slope forest. I respectfully acknowledge the work of the late Scott Sundberg in identifying *Lomatium hendersonii* from Grizzly Peak. Thanks also to James Reveal for confirming the identity of *Eriogonum umbellatum* variety *glaberrimum* from Grizzly Peak. I am grateful to Leslie Gottlieb for fruitful discussions about the differences between the mix of plant species on Grizzly Peak and other nearby areas. Thanks to Dennis Byrd of the Medford BLM office for his help in getting a copy of the Grizzly Peak map for me, and an especially heartfelt thanks to Dennis Glover, also of the BLM, for his patient and skillful work modifying the map to my specifications. Thank you to John Ifft, now long retired from the Medford BLM office, for telling me about the creation of the Grizzly Peak trail and his role in bringing it into existence.

References

Begnoche D. 1999. Siskiyou Sundays: A Tour of Southwest Oregon. Tour 2. Ashland to Hyatt Lake and Tour 3. Ashland to Observation Peak. pp. 15-36. Ashland (OR), privately printed.

Duncan JT. 2007. Noteworthy collections, Oregon. Madroño 54:208.

Hickman JC, ed. 1993. The Jepson Manual: Higher Plants of California. Berkeley (CA): University of California Press.

Kruckeberg AR. 2006. Introduction to California Soils and Plants: Serpentine, Vernal Pools, and Other Geobotanical Wonders. California Natural History Guides 86. Berkeley (CA): University of California Press. 280 p.

Lang FA. 2002. Plant Species in CSNM. Cascade-Siskiyou National Monument: Draft Resource Management Plan/Environmental Impact Statement, Volume 2 – Maps and Appendices, Appendix E. pp. 67-81. Medford (OR): USDI Bureau of Land Management, Medford District Office.

Lee HW, Park CW. 2004. New Taxa of *Cimicifuga* (Ranunculaceae) from Korea and the United States. Novon 14:180-184.

Reveal JL. 2005. *Eriogonum*. Flora of North America North of Mexico, Volume 5, pp. 221-430. New York (NY): Oxford University Press.

Zobel DB. 1973. Local variation in intergrading *Abies grandis* – *A. concolor* populations in the central Oregon Cascades: needle morphology and periderm color. Botanical Gazette 134: 209-220.

Jim Duncan is Professor of Biology Emeritus from San Francisco State University where he taught developmental biology, mainly, for 30 years prior to his retirement in 1991. Following that he moved to Oregon where, always a closet plant guy and already a long time grower of native plants from seed, he switched his biological interests to systematic botany. During the past fifteen years he has learned a lot about the plants of Oregon, especially Jackson County. In this time he has also been an eager volunteer for the Plant Atlas of the Oregon Flora Project, submitting many site reports, mainly from Jackson County but also from other parts of the state that he has explored, including in particular his "adopted" Plant Atlas Block 170 in the southwest corner of Harney County and adjacent Lake County.

Close view of flowers of *Iliamna bakeri*. The pink flowers, up to 2½ inches in diameter, resemble hollyhock and create quite a sight when encountered en masse among blackened trees. Photo by Connie Battaile.

Legend for Plant List

A solid circle ● preceding a plant name indicates a non-native, introduced species.

LOCATION: The numbers in this column correspond to the one-quarter-mile square numbered blocks outlined on the map of the Grizzly Peak area. The set of numbers for each species therefore indicates the extent and pattern of its distribution in the study area.

HABITAT: The seven terms explained below represent the habitats I designated in the Grizzly Peak area to describe the environment(s) where I found each species.

FOR: Forest. In all cases the forest is almost entirely coniferous, and its density can range from a completely closed canopy (dense) to less than 50% crown cover (open). The north slope from the trailhead up to the edge of the plateau is the most continuously forested part of the study area, and this forest is mostly dense. There are also substantial patches of forest scattered on the plateau itself, both dense and open.

FOR edge: This term indicates sites at the interface between forest and open herbaceous areas.

Burnt FOR: This term refers to forested areas that burned in the August 2002 fire. (Approximately the western ten to fifteen percent of the plateau, as well as the western slope below, burned.) This term highlights species that I had not seen in the burned area prior to the fire, or in a few cases, found in greater abundance and/or at new sites after the fire.

HRB: Herbland. The herbaceous habitat is the most common one on the Grizzly Peak plateau. There are extensive open grassy areas as well as smaller openings within forested areas. In some cases there are shrubs scattered in these areas. The soil is generally shallow in the herbaceous areas, and bedrock is exposed in some places. (See "Rock") Some parts of this habitat can be very wet in the spring, and it includes a wetland just below the northwest edge of the plateau.

SAV: Savanna. This habitat occurs in only a small part of the study area, down slope from the far southwest point of the plateau and below its western edge. The scattered trees are a mixture of oak and conifer with abundant open grassy or shrubby areas between.

SHR: Shrubland. Regions that are predominantly shrubby are uncommon in the study area. Some parts of rocky outcrop areas are dominated by shrubs, and occasionally a sort of "lawn" of low shrubs covers an area that at first seems to be herbland. There is a substantial understory of shrubs in parts of the forest, but this is not counted as shrubland.

Rock: These are places where areas of bedrock are exposed at the surface and where soil is nearly absent except in joints between rocks or in shallow pans. Such sites are common along the southern edge of the Grizzly Peak plateau where the old lava rock substrate forms a ledge with an abrupt edge. Rocky outcrops also occur scattered in the interior of the plateau. The highest point of the plateau, the actual Grizzly Peak, is such a site.

DATES SEEN IN FLOWER: The pairs of dates given show the earliest and latest dates I have seen the species in flower on a visit to the study area. If only one date is given, then I have recorded flowering only on that date. If no date is given, I have not seen it in flower but have identified the species vegetatively. No dates are offered for ferns or conifers. In two cases only seedlings of woody perennials have been seen, and they are so marked. If "fruit" is offered before the date, then the species has not been seen in flower but only in fruit.

Family: Genus and Species	Family: A Common Name	Location	Habitat	Dates Seen in Flower
FERNS				
Dryopteridaceae	**Wood Fern Family**			
Cystopteris fragilis	Fragile Fern	9	Rock	
Polystichum munitum	Western Sword Fern	1, 2	FOR	
Pteridaceae	**Brake Fern Family**			
Cheilanthes gracillima	Lace Fern	4, 5, 9	Rock	
CONIFERS				
Cupressaceae	**Cypress Family**			
Calocedrus decurrens	Incense Cedar	2, 4, 6, 7, 8, 9	FOR	
Juniperus occidentalis var. *occidentalis*	Western Juniper	7	SAV	
Pinaceae	**Pine Family**			
Abies concolor x *A. grandis*	White Fir / Grand Fir hybrid	1, 2, 3, 4, 9, 10	FOR	
Pinus ponderosa	Ponderosa Pine	4, 5, 6, 7, 9	FOR	
Pseudotsuga menziesii	Douglas Fir	1, 4, 5, 6, 7	FOR	
FLOWERING PLANTS: DICOTS				
Aceraceae	**Maple Family**			
Acer glabrum var. *torreyi*	Mountain Maple	1, 2, 7, 10	FOR, SAV	8 Jun - 18 Jun
Acer macrophyllum	Big-leaf Maple	1	FOR	(seedling only)
Apiaceae	**Carrot Family**			
Angelica arguta	Angelica	1, 9	FOR	1 Aug
●*Conium maculatum*	Poison Hemlock	1	SHR	23 Jul
Heracleum lanatum	Cow Parsnip	1, 2, 5	FOR	12 Jul - 26 Jul
Lomatium dissectum var. *dissectum*	Fern-leaved Lomatium	6, 7, 8, 9	FOR edge, HRB	8 Jun - 14 Jun
Lomatium hendersonii	Henderson's Lomatium	7, 9	Rock, HRB	11 May - 14 Jun
Lomatium macrocarpum	Gray Lomatium	4, 5, 6, 7, 8, 9	Rock, HRB	18 May - 11 Jun
Lomatium nudicaule	Pestle Lomatium	7	Rock, HRB	27 Jun
Lomatium piperi	Piper's Lomatium	4, 8	HRB	10 May - 11 May
Lomatium utriculatum	Foothill Lomatium	4, 7	HRB	31 May - 27 Jun
Orogenia fusiformis	Mountain Orogenia	3, 4, 5	HRB, SHR	11 May - 18 May
Osmorhiza berteroi (*O. chilensis*)	Mountain Sweet Cicely	1, 2, 4	FOR	11 May - 18 May
Osmorhiza occidentalis	Western Sweet Cicely	1, 2, 4, 5, 6	FOR	11 May - 11 Jun
Perideridia bolanderi	Bolander's Yampah	4, 9	HRB, FOR	2 Jul - 30 Aug
Perideridia gairdneri ssp. *borealis*	Common Yampah	1, 2, 5, 9	HRB, FOR edge	1 Aug - 10 Sept
Sanicula graveolens	Sierra Snakeroot	4, 5, 6	HRB, FOR	11 May - 11 Jun
Aristolochiaceae	**Pipevine Family**			
Asarum caudatum	Long-tailed Wild Ginger	1, 2	FOR	18 Jun - 3 Jul
Asteraceae	**Sunflower Family**			
Achillea millefolium	Yarrow	4, 5, 6, 7, 8, 9	HRB, FOR	2 Jun - 1 Aug
Adenocaulon bicolor	Trailplant	1, 2, 3, 4	FOR	8 Jul - 26 Jul
Agoseris grandiflora	Large-flowered Agoseris	1, 4, 8	HRB	2 Jul - 30 Aug
Agoseris heterophylla	Annual Agoseris	4, 5, 6, 7	Rock, burnt FOR	2 Jul - 1 Aug
Agoseris parviflora (*A. glauca* var. *laciniata*)	Sagebrush Agoseris	6	HRB	2 Jul
Arnica latifolia	Broad-leaved Arnica	1	FOR	11 Jun - 2 Jul
Balsamorhiza deltoidea	Deltoid Balsamroot	7	SAV	8 Jul
●*Cirsium vulgare*	Bull Thistle	6, 7, 8, 9	FOR, burnt FOR	13 Aug - 30 Aug
Crepis bakeri	Baker's Hawksbeard	1, 4	FOR, HRB	18 Jun
Crepis occidentalis	Western Hawksbeard	4	HRB	2 Jul
●*Crepis pulchra*	Small-flowered Hawksbeard	6, 7, 8	Rock, FOR	18 Jun - 2 Jul
Ericameria nauseosa var. *speciosa*	Rubber Rabbitbrush	7	Rock	30 Aug - 14 Sept

Family: Genus and Species	Family: A Common Name	Location	Habitat	Dates Seen in Flower
Erigeron aliceae	Alice Eastwood's Fleabane	1, 2, 4, 5, 9	FOR, HRB	31 May - 30 Aug
Erigeron bloomeri var. *bloomeri*	Scabland Fleabane	5, 6	Rock	2 Jun - 27 Jun
Erigeron eatonii var. *villosus*	Eaton's Fleabane	1, 4	FOR, HRB	18 Jun - 12 Jul
Eriophyllum lanatum var. *achillaeoides*	Yarrow-leaved Oregon Sunshine	3, 4, 5, 6, 7, 8	Rock, HRB	18 Jun - 30 Aug
Eurybia radulina (Aster radulinus)	Rough-leaved Aster	8, 9	burnt FOR	1 Aug - 30 Aug
Hazardia whitneyi var. *discoidea*	Whitney's Bristleweed	9	burnt FOR	1 Aug
Hieracium albiflorum	White-flowered Hawkweed	1, 2	FOR	23 Jul
●*Hypochaeris radicata*	Rough Cat's Ear	1, 2	FOR	26 Jul - 30 Aug
●*Lactuca serriola*	Prickly Lettuce	6, 7, 8	burnt FOR	13 Aug - 14 Sept
Madia glomerata	Stinking Tarweed	5	Rock	12 Jul
Madia gracilis	Slender Tarweed	4, 6, 7, 9	Rock, HRB	11 Jun - 10 Sept
Madia minima	Least Tarweed	4, 7	Rock, HRB	11 Jun - 2 Jul
Microseris nutans	Nodding Microseris	4, 5, 6, 8, 9	HRB	22 May - 11 Jun
Pseudognaphalium thermal (Gnaphalium canescens ssp. *ther.)*	Slender Cudweed	9	HRB	11 Sept
Rudbeckia occidentalis var. *occidentalis*	Western Coneflower	9	HRB	1 Aug - 30 Aug
Senecio integerrimus var. *exaltatus*	Tall Western Groundsel	1, 4, 6	FOR, HRB	11 Jun - 2 Jul
●*Senecio vulgaris*	Common Groundsel	8	burnt FOR	31 May
Symphyotrichum foliaceum var. *parryi (Aster foliaceus* var. *parryi)*	Parry's Aster	9	HRB	30 Aug
●*Taraxacum officinale*	Common Dandelion	1, 2, 4, 5	FOR, HRB	11 Jun - 1 Aug
●*Tragopogon dubius*	Yellow Salsify	1, 2, 6, 7	HRB	2 Jul - 30 Aug
Wyethia angustifolia	Narrow-leaved Mule's Ears	8	HRB	27 Jun - 8 Jul
Berberidaceae	**Barberry Family**			
Berberis aquifolium	Oregon Grape	5	FOR	11 Jun
Berberis nervosa	Long-leaved Oregon Grape	1	FOR	31 May
Vancouveria hexandra	Inside-out Flower	1, 2, 3	FOR	18 Jun - 2 Jul
Boraginaceae	**Borage Family**			
Cryptantha intermedia	Common Cryptantha	8	HRB	8 Jul
Cryptantha simulans	Pine Woods Cryptantha	5	FOR edge	12 Jul
Cryptantha torreyana	Torrey's Cryptantha	5, 8	FOR edge, HRB	12 Jul - 23 Jul
Cynoglossum grande	Great Hound's Tongue	1	FOR	16 May - 4 Jun
Hackelia micrantha	Jessica's Stickseed	1, 2, 4, 5, 6, 8	FOR edge, HRB	11 Jun - 3 Jul
Brassicaceae	**Mustard Family**			
●*Alyssum alyssoides*	Small Alyssum	7	HRB	2 Jul
●*Arabidopsis thaliana*	Mouse-ear Cress	4, 7	HRB, burnt FOR	2 Jun - 18 Jun
Arabis glabra var. *glabra*	Tower Mustard	4, 5, 8	HRB	11 Jun - 2 Jul
Arabis holboellii var. *retrofracta*	Holboell's Rock Cress	8	HRB	2 Jul
Athysanus pusillus	Sandweed	8	HRB	13 May
Barbarea orthoceras	American Winter Cress	9	HRB	11 Jun
Cardamine californica var. *integrifolia*	Milk Maids	5, 9	FOR	16 May - 4 Jun
Cardamine nuttallii var. *dissecta*	Nuttall's Bitter Cress	4, 5	HRB, FOR edge	11 May - 8 Jun
Descurainia incisa ssp. *incisa*	Mountain Tansy Mustard	5, 9	FOR edge	2 Jul - 12 Jul
Descurainia pinnata ssp. *intermedia*	Western Tansy Mustard	7	Rock	18 Jun
Draba verna	Vernal Whitlow-grass	8	HRB	18 May
Erysimum capitatum ssp. *capitatum*	Western Wall Flower	8, 9	HRB, burnt FOR	27 Jun – 1 Aug
Noccaea fendleri ssp. *glauca (Thlaspi montanum* var. *montanum)*	Rock Penny Cress	4, 5	HRB	4 Jun – 18 Jun
●*Sisymbrium altissimum*	Jim Hill Mustard	7	SAV, burnt FOR	1 Aug - 14 Sept
Campanulaceae	**Bellflower Family**			
Campanula scouleri	Scouler's Harebell	2	FOR	12 Jul - 23 Jul

Family: Genus and Species	Family: A Common Name	Location	Habitat	Dates Seen in Flower
Caprifoliaceae	**Honeysuckle Family**			
Sambucus mexicana	Blue Elderberry	4, 5, 6	FOR edge	27 Jun - 8 Jul
Symphoricarpos albus var. *laevigatus*	Snowberry	4, 5, 6	SHR, burnt FOR	11 Jun - 30 Aug
Symphoricarpos mollis	Trip Vine	5	FOR	
Symphoricarpos rotundifolius var. *rotundifolius*	Round-leaved Snowberry	6, 9	SHR, FOR	2 Jul - 8 Jul
Caryophyllaceae	**Pink Family**			
●*Arenaria serpyllifolia* ssp. *serpyllifolia*	Thyme-leaved Sandwort	7, 8	Rock, HRB	11 Jun - 18 Jun
●*Cerastium fontanum* ssp. *vulgare*	Common Chickweed	9	HRB	2 Jul
Eremogone congesta var. *congesta* (*Arenaria congesta* var. *congesta*)	Ball-headed Sandwort	4, 6, 8	Rock	11 Jun – 18 Jun
Moehringia macrophylla	Large-leaved Sandwort	4, 6, 7	HRB, burnt FOR	16 May - 11 Jun
Pseudostellaria jamesiana	Sticky Chickweed	1, 3, 4, 5, 8	FOR, HRB	11 Jun - 2 Jul
Silene campanulata ssp. *glandulosa*	Red Mountain Catchfly	8	FOR	2 Jul
●*Spergularia rubra*	Red Sand Spurry	5	FOR edge	12 Jul
Stellaria obtusa	Clustered Mountain Starwort	1	FOR	
Convolvulaceae	**Morning Glory Family**			
Calystegia occidentalis ssp. *occidentalis*	Western Morning Glory	6	burnt FOR	8 Jul - 1 Aug
Crassulaceae	**Stonecrop Family**			
Sedum oregonense	Creamy Stonecrop	4, 5, 7, 8, 10	Rock	11 Jun - 2 Jul
Sedum stenopetalum	Narrow-petaled Stonecrop	4, 5, 6, 7	Rock	27 Jun - 23 Jul
Cucurbitaceae	**Gourd Family**			
Marah oreganus	Oregon Wild Cucumber	1	FOR	12 Jul
Ericaceae	**Heath Family**			
Arctostaphylos patula	Greenleaf Manzanita	1, 4, 5, 6, 7, 8, 9	SHR, FOR edge	11 May - 8 Jun
Pyrola picta	White-veined Wintergreen	3	FOR	1 Aug
Fabaceae	**Pea Family**			
●*Lathyrus latifolius*	Perennial Sweet Pea	1	SHR	23 Jul - 30 Aug
Lathyrus nevadensis ssp. *nevadensis*	Sierra Nevada Wild Pea	4, 5	HRB	18 Jun
Lupinus albicaulis	Sickle-keeled Lupine	3, 5	HRB, FOR edge	12 Jul - 23 Jul
Lupinus lepidus var. *lobbii*	Dwarf Lupine	4, 5, 6, 7, 8	Rock	11 Jun - 18 Jun
Trifolium cyathiferum	Wide-collared Clover	9	HRB	23 Jul
●*Trifolium pratense*	Red Clover	2	FOR	23 Jul
●*Trifolium repens*	White Clover	5	FOR edge	12 Jul
Vicia americana var. *americana*	American Vetch	1, 2, 3, 4	FOR	11 Jun - 2 Jul
Fagaceae	**Oak Family**			
Chrysolepis sempervirens	Bush Chinquapin	5	SHR	(no flower date offered)
Quercus garryana var. *breweri*	Brewer's Oak	1, 4, 6, 7	FOR, Rock	
Quercus garryana var. *garryana*	Oregon White Oak	4, 7, 9	FOR, SAV	
Geraniaceae	**Geranium Family**			
Geranium oreganum	Oregon Geranium	8	FOR edge	27 Jun - 26 Jul
Grossulariaceae	**Gooseberry Family**			
Ribes binominatum	Trailing Gooseberry	1, 2, 3, 6, 10	FOR, Rock	18 Jun - 2 Jul
Ribes lacustre	Prickly Currant	1	FOR	18 May - 2 Jun
Ribes lobbii	Gummy Gooseberry	2	FOR	18 Jun
Ribes sanguineum var. *sanguineum*	Red Flowering Currant	1	FOR	18 May - 24 May
Ribes viscosissimum	Sticky Currant	2, 9, 10	SHR, FOR edge	18 May - 31 May
Hydrophyllaceae	**Waterleaf Family**			
Hesperochiron pumilus	Dwarf Hesperochiron	4, 8, 9	HRB	18 May - 4 Jun
Hydrophyllum capitatum var. *alpinum*	Dwarf Waterleaf	1, 7	FOR, Rock	11 May - 13 May
Hydrophyllum fendleri var. *albifrons*	Fendler's Waterleaf	1, 2, 4, 5, 6, 8, 9, 10	FOR	11 Jun - 2 Jul
Nemophila menziesii var. *menziesii*	Baby Blue-eyes	5	HRB	4 Jun

Family: Genus and Species	Family: A Common Name	Location	Habitat	Dates Seen in Flower
Nemophila parviflora var. *austinae*	Small-flowered Nemophila	1, 4, 5	FOR, HRB	11 Jun - 12 Jul
Phacelia humilis var. *humilis*	Low Phacelia	8	HRB	18 Jun
Phacelia mutabilis	Variable Phacelia	2, 3, 4, 7	FOR, Rock	2 Jul
Phacelia peckii	Peck's Phacelia	4	Rock	2 Jul
Hypericaceae	**St. John's Wort Family**			
●*Hypericum perforatum*	Klamath-weed	3	HRB	23 Jul
Lamiaceae	**Mint Family**			
Agastache urticifolia	Nettleleaf Horsemint	1, 2, 9	FOR edge	2 Jul
Monardella odoratissima ssp. *odoratissima*	Coyote Mint	9	FOR edge	2 Jul
Scutellaria antirrhinoides	Snapdragon Skullcap	4, 5, 7, 8	HRB	27 Jun - 27 Aug
Stachys rigida	Rigid Hedge Nettle	9	HRB	1 Aug - 10 Sept
Trichostema oblongum	Downy Bluecurls	8	HRB	12 Jul
Limnanthaceae	**Meadowfoam Family**			
Floerkea proserpinacoides	Floerkea	8	HRB	18 Jun
Linaceae	**Flax Family**			
Linum lewisii var. *lewisii*	Western Blue Flax	4, 5, 10	HRB	18 Jun - 8 Jul
Loasaceae	**Loas Family**			
Mentzelia dispersa	Nevada Stickleaf	6	burnt FOR	14 Sept
Malvaceae	**Mallow Family**			
Iliamna bakeri	Baker's Globe Mallow	6, 7, 8	SAV, burnt FOR	26 Jul - 1 Aug
Sidalcea oregana ssp. *spicata*	Mountain Checkerbloom	5, 9	HRB	12 Jul - 1 Aug
Onagraceae	**Evening Primrose Family**			
Chamerion angustifolia	Fireweed	5, 7, 8, 9	HRB, burnt FOR	1 Aug - 30 Aug
Circaea alpina ssp. *pacifica*	Enchanter's Nightshade	2, 3, 4, 5	FOR	23 Jul - 13 Aug
Clarkia rhomboidea	Common Clarkia	3, 4, 7	HRB, FOR edge	27 Jun - 27 Aug
Epilobium brachycarpum	Tall Annual Willow Herb	1, 2	FOR	23 Jul - 30 Aug
Epilobium ciliatum ssp. *ciliatum*	Common Western Willow Herb	1, 5, 9	HRB, FOR edge	12 Jul - 30 Aug
Epilobium densiflorum	Densely-flowered Boisduvalia	8	HRB	23 Jul - 30 Aug
Epilobium minutum	Small-flowered Willow Herb	1, 2, 4	Rock, FOR edge	18 Jun - 30 Aug
Gayophytum diffusum ssp. *parviflorum*	Spreading Gayophytum	3, 4, 6	Rock, burnt FOR	2 Jul - 30 Aug
Gayophytum humile	Dwarf Gayophytum	4	Rock	2 Jul
Orobanchaceae	**Broomrape Family**			
Orobanche uniflora	Naked Broomrape	5, 6	Rock	11 Jun
Papaveraceae	**Poppy Family**			
Dicentra uniflora	Steer's Head	5, 9	Rock	10 May - 18 May
Plantaginaceae	**Plantain Family**			
●*Plantago lanceolata*	English Plantain	1	FOR	27 Jun
●*Plantago major*	Common Plantain	1	FOR	27 Jun
Polemoniaceae	**Phlox Family**			
Collomia grandiflora	Grand Collomia	9	HRB	2 Jul
Collomia tinctoria	Staining Collomia	8	HRB	27 Jun
Gilia capitata ssp. *capitata*	Blue-headed Gilia	4, 5, 6, 7, 8	HRB	8 Jun - 1 Aug
Ipomopsis aggregata ssp. *formosissima*	Scarlet Gilia	4, 5	HRB	26 Jul - 14 Sept
Leptosiphon harknessii *Linanthus harknessii)*	Harkness' Flaxflower	4, 5, 8, 9	HRB, FOR edge	27 Jun - 12 Jul
Navarretia divaricata ssp. *divaricata*	Mountain Navarretia	4	Rock	27 Jun
Navarretia intertexta ssp. *intertexta*	Needle-leaved Navarretia	8	HRB	12 Jul
Navarretia sinistra ssp. *sinistra* *(Gilia sinistra* ssp. *sinistra)*	Smooth-leaved Gilia	8	HRB	12 Jul
Phlox gracilis	Pink Annual Phlox	4, 5, 6, 7, 8	Rock, HRB	10 May - 2 Jul
Polemonium carneum	Royal Polemonium	1, 2, 4	FOR	18 May - 18 Jun

Family: Genus and Species	Family: A Common Name	Location	Habitat	Dates Seen in Flower
Polygonaceae	**Buckwheat Family**			
Eriogonum compositum var. *compositum*	Arrowleaf Wild Buckwheat	1, 6	FOR, Rock	12 Jul - 23 Jul
Eriogonum nudum var. *oblongifolium*	Naked Wild Buckwheat	7, 8, 9	Rock	2 Jul - 13 Aug
Eriogonum sphaerocephalum var. *halimioides*	Round-headed Wild Buckwheat	7, 8, 9	Rock	2 Jul - 1 Aug
Eriogonum umbellatum var. *glaberrimum*	Warner Mountains Sulphur Flower	5	Rock	1 Aug - 30 Aug
Eriogonum umbellatum var. *modocensis*	Modoc Sulphur Flower	3, 4, 6, 7, 8, 9	HRB, Rock	11 Jun - 30 Aug
Polygonum douglasii ssp. *douglasii*	Douglas' Knotweed	4, 7	Rock, burnt FOR	2 Jul - 14 Sept
Polygonum douglasii ssp. *spergulariiforme*	Fall Knotweed	4, 7	Rock	30 Aug - 14 Sept
Polygonum minimum	Leafy Knotweed	4, 6	Rock	27 Jun - 1 Aug
Polygonum polygaloides ssp. *kelloggii*	White-margined Knotweed	9	HRB	2 Jul
●*Rumex acetosella*	Sheep Sorrel	2, 4, 5	HRB, FOR edge	12 Jul
●*Rumex crispus*	Curly Dock	9	HRB	1 Aug
Portulacaceae	**Purslane Family**			
Claytonia perfoliata ssp. *perfoliata*	Miner's Lettuce	1, 2	FOR	11 Jun - 3 Jul
Claytonia rubra ssp. *rubra*	Red Miner's Lettuce	4, 5	Rock, HRB	10 May - 14 Jun
Claytonia sibirica	Candy Flower	1, 2, 4, 6, 7, 8	FOR, burnt FOR	11 Jun – 20 Sept
Lewisia nevadensis	Nevada Lewisia	5, 9	Rock	24 May - 14 Jun
Lewisia triphylla	Three-leaved Lewisia	4, 8, 9	Rock, HRB	31 May - 18 Jun
Montia chamissoi	Toad Lily	9	HRB	11 Jun
Ranunculaceae	**Buttercup Family**			
Actaea rubra	Baneberry	1, 2, 4	FOR	31May - 27 Jun
Anemone deltoidea	Western White Anemone	1, 2	FOR	2 Jun - 18 Jun
Anemone lyallii	Little Mountain Anemone	1, 2, 3, 4	FOR	10 May - 14 Jun
Aquilegia formosa	Western Columbine	1, 2, 3, 4, 5	FOR, HRB	8 Jun – 23 Jul
Cimicifuga elata var. *alpestris*	Tall Bugbane	1, 2	FOR	3 Jul - 30 Aug
Delphinium glaucum	Tower Delphinium	1, 2	FOR	23 Jul - 14 Sept
Delphinium nuttallianum	Two-lobe Larkspur	1, 2, 3, 4, 5, 6, 7	FOR, HRB	10 May - 18 Jun
Ranunculus occidentalis	Western Buttercup	9	HRB	11 Jun
Ranunculus orthorhynchus var. *orthorhynchus*	Birdfoot Buttercup	9	HRB	11 Jun
Ranunculus uncinatus	Little Buttercup	1	FOR	18 May
Thalictrum fendleri var. *fendleri*	Fendler's Meadow Rue	2, 4, 5	FOR	11 Jun
Rhamnaceae	**Buckthorn Family**			
Ceanothus velutinus	Snowbrush	6, 7, 8	burnt FOR	(seedlings only)
Rhamnus purshiana	Cascara	1	FOR	
Rosaceae	**Rose Family**			
Amelanchier alnifolia var. *semiintegrifolia*	Western Serviceberry	1, 2, 3, 4, 5	FOR, SHR	11 Jun - 18 Jun
Cercocarpus betuloides var. *betuloides*	Birch-leaf Mountain-mahogany	6	FOR edge	18 May
Fragaria vesca	Wood Strawberry	1, 2, 3	FOR	11 Jun - 3 Jul
Geum macrophyllum	Large-leaved Avens	2, 5	FOR edge	12 Jul
Holodiscus discolor	Oceanspray	1, 4, 5, 6, 7, 8	Rock, SHR	2 Jul - 13 Aug
Holodiscus microphyllus var. *microphyllus*	Rock Spiraea	4, 9	Rock, SHR	26 Jul - 13 Aug
Potentilla glandulosa ssp. *reflexa*	Sticky Cinquefoil	9	HRB	2 Jul
Potentilla gracilis var. *fastigiata*	Slender Cinquefoil	9	HRB	1 Aug
Prunus emarginata	Bitter Cherry	5, 7, 8	Rock, FOR edge	11 Jun
Prunus virginiana var. *demissa*	Western Choke Cherry	5, 8	SHR, FOR edge	11 Jun - 18 Jun
Rosa bridgesii	Bridge's Wild Rose	4, 9	FOR, HRB	2 Jul - 12 Jul

Family: Genus and Species	Family: A Common Name	Location	Habitat	Dates Seen in Flower
Rosa gymnocarpa	Wood Rose	1, 2, 3, 4, 5	FOR	2 Jul
Rubus leucodermis	Blackcap Raspberry	1	FOR	(fruit) 4 Aug
Rubus parviflorus	Thimbleberry	1, 7	FOR, burnt FOR	3 Jul - 23 Jul
Sanguisorba occidentalis	Annual Burnet	1, 8, 9	FOR, HRB	12 Jul
Rubiaceae	**Madder Family**			
Galium aparine	Goose Grass	6, 7	FOR	2 Jul
Galium triflorum	Sweet-scented Bedstraw	1, 5	FOR edge	12 Jul
Saxifragaceae	**Saxifrage Family**			
Heuchera cylindrica var. *alpina*	Lava Heuchera	4, 5, 7	Rock	11 Jun - 2 Jul
Lithophragma campanulatum	Hill Star	1, 4, 5, 8	FOR, HRB	11 Jun - 2 Jul
Lithophragma glabrum	Bulblet Woodland Star	5, 9	Rock, HRB	18 May
Lithophragma parviflorum var. *parviflorum*	Small-flowered Woodland Star	1, 2, 5, 6	FOR, HRB	11 Jun - 18 Jun
Mitella diversifolia	Angle-leaved Mitrewort	1	FOR	11 Jun
Mitella trifida	Three-toothed Mitrewort	1, 2, 4	FOR	11 Jun - 18 Jun
Saxifraga aprica	Sierra Saxifrage	5	HRB	11 Jun
Tellima grandiflora	Large Fringe Cups	1, 2	FOR	18 Jun
Scrophulariaceae	**Snapdragon Family**			
Castilleja pruinosa	Frosty Paintbrush	4, 6, 7	Rock, FOR edge	11 Jun - 2 Jul
Castilleja tenuis	Hairy Owl Clover	9	HRB	2 Jul
Collinsia linearis	Narrow-leaved Collinsia	4, 6, 7, 8	HRB, FOR edge	11 Jun - 2 Jul
Collinsia parviflora	Small-flowered Collinsia	1, 2, 4, 5, 6, 8	FOR, HRB	10 May - 18 Jun
Mimulus breweri	Brewer's Monkey Flower	4	Rock	18 Jun
Mimulus guttatus	Seep-spring Monkey Flower	8, 9	HRB	11 Jun - 2 Jul
Orthocarpus imbricatus	Mountain Owl Clover	4, 5, 8, 9, 10	HRB	31 May - 30 Aug
Penstemon deustus var. *pedicellatus*	Hot Rock Penstemon	7, 8	Rock	11 Jun - 8 Jul
Synthyris reniformis	Snow Queen	1	FOR	24 May - 8 Jun
●*Verbascum thapsus*	Woolly Mullein	6, 7	SAV, burnt FOR	1 Aug - 30 Aug
Veronica americana	American Speedwell	1, 9	HRB	11 Jun - 1 Aug
Veronica serpyllifolia ssp. *humifusa*	Thyme-leaved Speedwell	5	FOR edge	12 Jul
Valerianaceae	**Valerian Family**			
Plectritis congesta	Rosy Plectritis	4, 5, 6	Rock, HRB	11 Jun - 2 Jul
Valeriana sitchensis ssp. *sitchensis*	Mountain Valerian	1, 4	FOR, HRB	18 Jun - 2 Jul
Violaceae	**Violet Family**			
Viola adunca	Western Dog Violet	1	FOR	18 Jun
Viola bakeri	Baker's Violet	4, 5	HRB, FOR edge	8 Jun
Viola glabella	Stream Violet	1, 2, 3, 4	FOR	8 Jun - 11 Jun
Viola sheltonii	Shelton's Violet	5, 6	FOR	10 May - 18 Jun
FLOWERING PLANTS: MONOCOTS				
Cyperaceae	**Sedge Family**			
Carex hoodii	Hood's Sedge	3, 4, 5, 9	HRB	23 Jul
Carex pachystachya	Chamisso Sedge	9	HRB	(fruit) 30 Aug
Scirpus microcarpus	Small-fruited Bulrush	9	HRB	2 Jul
Juncaceae	**Rush Family**			
Juncus ensifolius	Dagger-leaved Rush	9	HRB	23 Jul
Liliaceae	**Lily Family**			
Allium falcifolium	Sickle-leaved Wild Onion	1	FOR	27 Jun
Allium siskiyouense	Siskiyou Wild Onion	4, 5, 6, 7	Rock	18 Jun - 27 Jun
Calochortus monophyllus	Yellow Star Tulip	8	Rock	18 Jun
Calochortus tolmiei	Pussy Ears	7	SAV	8 Jun
Camassia quamash ssp. *breviflora*	Small-flowered Common Camas	4, 5, 8, 9	Rock, HRB	31 May - 18 Jun
Clintonia uniflora	Queen Cup	2	FOR	8 Jul
Dichelostemma capitatum ssp. *capitatum*	Blue Dicks	7	SAV	8 Jun

Family: Genus and Species	Family: A Common Name	Location	Habitat	Dates Seen in Flower
Dichelostemma congestum	Oocow	6, 7	HRB	18 Jun
Erythronium klamathense	Klamath Fawn Lily	2, 4, 5, 8, 9, 10	HRB, FOR, rock	10 May - 18 Jun
Fritillaria affinis var. *affinis*	Checker Lily	3, 4, 6, 7	HRB, FOR	2 Jun - 18 Jun
Fritillaria atropurpurea	Spotted Mountain Bells	4, 5	HRB	2 Jun - 18 Jun
Fritillaria pudica	Yellow Bells	4, 5, 6	HRB, Rock	10 May - 8 Jun
Lilium washingtonianum ssp. *purpurascens*	Washington Lily	1, 4, 9	FOR	(fruit) 30 Aug
Maianthemum racemosum ssp. *amplexicaule* (*Smilacina racemos.*)	Feathery False Solomon's Seal	1, 2, 3, 4, 5, 6, 7, 10	FOR	13 May - 18 Jun
Maianthemum stellatum (*Smilacina stellatum*)	Star False Solomon's Seal	1, 2, 3, 4, 5, 6, 7, 10	FOR	13 May - 18 Jun
Prosartes hookeri (*Disporum h.*)	Hooker's Fairy Bells	1, 2, 3, 10	FOR	18 Jun
Trillium ovatum ssp. *ovatum*	Western Trillium	1, 2, 3, 4, 10	FOR	8 Jun - 18 Jun
Trillium albidum	Giant Trillium	5	HRB	31 May
Triteleia hyacinthina	White Brodiaea	4, 7	Rock, SAV	8 Jun - 18 Jun
Toxicoscordion venenosum var. *venenosum* (*Zigadenus v.* var. *v.*)	Death Camas	8	HRB	2 Jul
Veratrum californicum var. *californicum*	California Corn Lily	9	HRB	12 Jul
Orchidaceae	**Orchid Family**			
Calypso bulbosa	Calypso Orchid	1	FOR	18 May
Cephalanthera austinae	Phantom Orchid	1, 3	FOR	12 Jul
Corallorhiza striata	Striped Coral Root	1, 2, 3	FOR	18 Jun
Piperia unalascensis	Short-spurred Rein Orchid	1, 4	FOR	12 Jul
Platanthera leucostachys	White-flowered Bog Orchid	9	HRB	12 Jul
Poaceae	**Grass Family**			
Achnatherum lemmonii	Lemmon's Needlegrass	4	Rock	8 Jun
Agrostis exarata	Western Bent-grass	8, 9	HRB	12 Jul - 23 Jul
●*Agrostis stolonifera*	Creeping Bent	1	FOR	(fruit) 1 Aug
●*Arrhenatherum elatius*	Tall Oat Grass	6, 7, 9	HRB, burnt FOR	12 Jul - 1 Aug
●*Bromus briziformis*	Rattlesnake Brome	6	burnt FOR	8 Jul
Bromus carinatus var. *carinatus*	California Brome	1, 4, 5, 7, 8	FOR, HRB	2 Jul
●*Bromus tectorum*	Cheat Grass	6, 7	HRB	2 Jul
●*Cynosurus echinatus*	Hedgehog Dogtail	8	HRB	2 Jul
Deschampsia danthonioides	Annual Hairgrass	4, 5	FOR	2 Jul
Deschampsia elongata	Slender Hairgrass	1, 5	HRB, FOR edge	12 Jul
Elymus elymoides ssp. *californicus*	Squirreltail	1	FOR	12 Jul
Elymus elymoides ssp. *elymoides*	Squirreltail	4	HRB	2 Jul
Elymus glaucus ssp. *glaucus*	Western Ryegrass	5, 9	HRB, FOR edge	12 Jul
Festuca californica	California Fescue	1	FOR	12 Jul
Festuca subulata	Bearded Fescue	1, 2, 5	HRB, FOR edge	2 Jul - 12 Jul
Glyceria elata	Fowl Mannagrass	9	HRB	13 Aug
Melica aristata	Bearded Melicgrass	7	burnt FOR	(fruit) 1 Aug
Melica fugax	Small Oniongrass	9	HRB	18 May
Melica subulata	Alaska Oniongrass	1, 2	FOR	18 Jun - 2 Jul
●*Phleum pratense*	Cultivated Timothy	9	HRB	13 Aug
●*Poa pratensis* ssp. *pratensis*	Kentucky Bluegrass	5, 9	HRB, FOR edge	12 Jul
Poa secunda ssp. *secunda*	One-sided Bluegrass	4, 5	HRB, FOR edge	2 Jul
●*Thinopyrum intermedium* (*Agropyron intermedium*)	Intermediate Wheatgrass	1	HRB	(fruit) 14 Sept
●*Triticum aestivum*	Wheat	8	burnt SAV	(fruit) 14 Sept

Plant of the Year

Green-flowered Wild Ginger

(*Asarum wagneri* Lu & Mesler)

Cindy Talbott Roché
P.O. Box 808, Talent, OR 97540
and
Frank A. Lang
535 Taylor St., Ashland, OR 97520

Green-flowered wild ginger (*Asarum wagneri*) grows in the southern Oregon Cascades in the vicinity of Mt. McLoughlin. Photo by Norm Jensen.

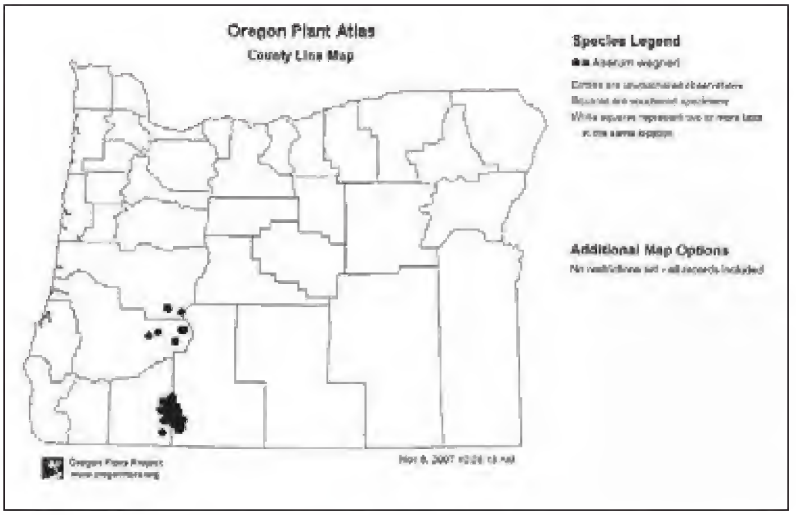
"It looks like it should be called elk lettuce," was my companion's first comment about a plant that was emerging from under boulders along the ridgeline overlooking Sky Lakes Wilderness. In the shadow of Mt. McLoughlin, Bob and I [Cindy Roché] were looking for evidence of elk foraging. The snow had not been gone long, but when I searched under the tightly clustered leaves, I found a few immature green flowers and knew it was ginger, and not lettuce.

Because the site was in the Cascade Mountains, I looked first in Vascular Plants of the Pacific Northwest (Hitchcock *et al.* 1964). They listed only one wild ginger, and clearly this one didn't fit the description for western wild ginger (*Asarum caudatum*). Next, I checked the Manual of the Higher Plants of Oregon, where I found that Peck (1961) had described a new variety of western wild ginger in the southern Oregon Cascades: green-flowered wild ginger (*Asarum caudatum* var. *viridiflorum*). After that, I consulted *Asarum* in Volume 3 of the Flora of North America (Whittemore *et al.* 1997) and learned that Peck's variety had been raised to species rank, as *Asarum wagneri*. Kozloff (2005) mentions green-flowered wild ginger in his key as a note under western wild ginger. Kelly (2001) also included it in his monograph of *Asarum* sect. *Asarum*. Because this taxon doesn't occur in California, green-flowered wild ginger is not included in the Jepson Manual (Hickman 1993).

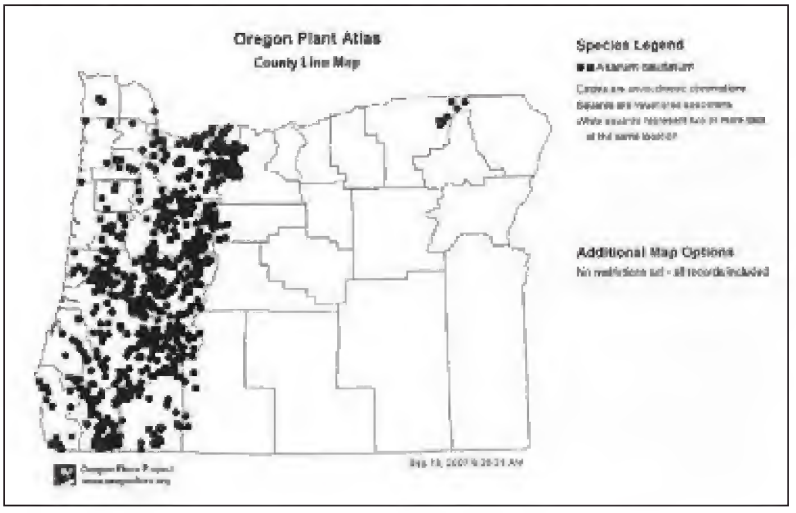
Despite the number of references I consulted to learn its identity, green-flowered wild ginger has been recognized as a species for nearly 25 years. Karen Lu and Michael Mesler (1983) stated that it was a distinct species, and not simply a green-flowered form of western wild ginger. They named it in honor of Professor Warren

H. (Herb) Wagner, Jr. (1920-2000), in recognition of his many contributions as a teacher of botany. Herb Wagner, Michael Mesler's advisor at the University of Michigan, was an expert on ferns. Morton Peck of Willamette University had collected the type specimen from the north end of Lake-of-the-Woods in Klamath County on 3 July 1931 (OSC[1]). However, Kelly (2001) noticed that Peck wrote "type" on the specimen at WILLU and "isotype" on the UC and OSC specimens. Larry Kelly (Cornell University) therefore considered the WILLU specimen to be the holotype.

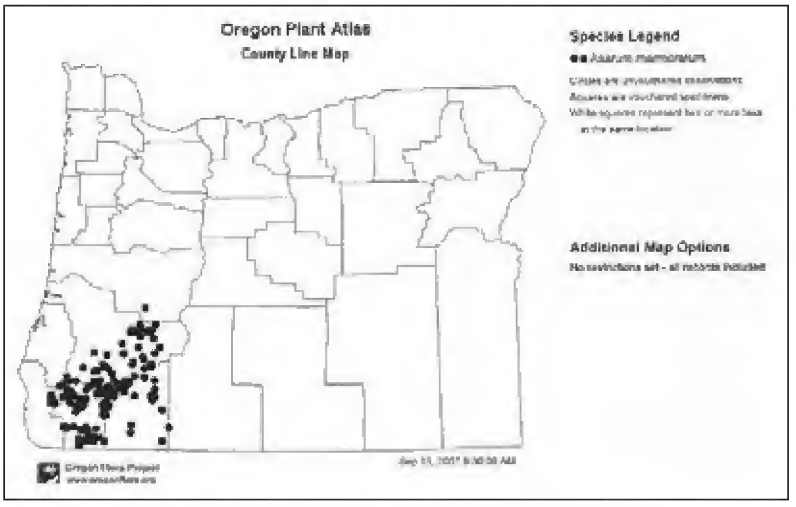
At one time, botanists considered green-flowered wild ginger rare enough to track locations for protection as a rare Oregon endemic (Lu and Mesler 1983). Originally known only from the area between Mt. McLoughlin and Lake-of-the-Woods in the southern Cascade Range (Jackson and Klamath counties), later collections (Oregon Flora Project) expanded the range to include Douglas and Lane counties. (see map) Previous reports from Josephine County were based on undocumented plant lists and were likely misidentifications.



Distribution map of *Asarum wagneri*, from the Oregon Atlas Project website (http://cladonia.nacse.org/platlas/jclass/OPAJava20.htm; Accessed 18 November 2007)



Distribution of *Asarum caudatum*, from the Oregon Atlas Project website.



Distribution of *Asarum marmoratum*, from the Oregon Atlas Project website.

Wild Gingers in Oregon

Asarum is the sole native representative of the pipe-vine family (*Aristolochiaceae*) in Oregon. Of the six species of *Asarum* in North America (Kelly 2001, Whittemore *et al.* 1997), two are widespread: one in the East (Canadian wild ginger, *A. canadense*) and one in the West (western wild ginger, *A. caudatum*). Two are California endemics (Lemmon's and Hartweg's wild gingers, *A. lemmonii* and *A. hartwegii*), another is an Oregon endemic (green-flowered wild ginger), and yet another (marbled wild ginger, *A. marmoratum*) grows in southwestern Oregon and northern California. Western wild ginger grows west of the Cascade Range from northern California to British Columbia, as well as in the Blue Mountains of northeastern Oregon, and in the northern Rockies (Idaho, Montana, BC). In the past, marbled wild ginger was commonly misidentified as Hartweg's wild ginger in Oregon. This confusion resulted from Peck's view that *A. marmoratum* was a synonym of *A. hartwegii*. Current opinion is that these two taxa are two distinct species with marbled leaves, with distributions that overlap in the Klamath Mountains, but not in the Cascade and Sierra Nevada ranges.

In southwestern Oregon, the ranges of three wild ginger species overlap. Marbled wild ginger, found in Lane, Douglas, Curry, Josephine and Jackson counties, is easily identified by its marbled leaves. Leaves of both western wild ginger and green-flowered wild ginger are uniformly green, but the two are generally not difficult to distinguish. Flowers of western wild ginger are dark red-maroon, with long attenuate calyx lobes. Flowers of green-flowered wild ginger are red or maroon only at the base of the short, bent calyx lobes and on top of the ovary. Some confusion exists over populations of western wild ginger with whitish or pale green flowers, especially in Josephine, Curry, and Coos counties.

[1]OSC is the abbreviation in Index Herbariorum (the international reference for herbaria) for Oregon State University herbarium. WILLU represents Willamette University (now the Peck herbarium at OSU) and UC, the Herbarium at UC Berkeley.

Flowers of *Asarum caudatum* are dark red-maroon with long attenuate calyx lobes. Photo by Norm Jensen.

Frank Callahan (pers. comm.) reports that pale flowered wild ginger appears to share a distribution range with Port Orford cedar, often on serpentine-influenced soils. Because the annual increment of shoot growth in green-flowered wild ginger is short (5-20 mm), individual plants usually form tighter clumps than the sprawling clones typical of western wild ginger. According to Lu and Mesler (1983), flowers of green-flowered wild ginger produce a faint foul odor, something like dish rags left wet for long periods of time. The foliage of green-flowered wild ginger has a gingery fragrance, albeit fainter and different than the fragrance encountered in western wild ginger. Odors of wild gingers likely vary among populations and during phenological development, but probably not nearly as much as the perception of odors among botanists!

Habitat

The preferred habitats of green-flowered wild ginger appear to be humus soils under forests of Shasta red fir (*Abies magnifica* var. *shastensis*) and white fir (*Abies concolor*) at moderate elevations (1360 to 1660 m [4,500 to 5,500 ft.]) as well as open boulder fields with mountain hemlock (*Tsuga mertensiana*) and subalpine fir (*Abies lasiocarpa*) near timberline (>1800 m [6,000+ ft.]) (Eastman 1990, Lu and Mesler 1983, Whittemore *et al.* 1997). This species is also known from a lodgepole pine stand near the intersection of the Dead Indian Memorial Highway, USFS Road 37 (1400 m [4,600 ft.]) in Jackson County (between Ashland and Klamath Falls), and in the Johnson Prairie area north of State Route 66 near the Klamath/Jackson county line.

Pollination

The dark maroon flowers of western wild ginger resemble flowers that are pollinated by carrion insects, but they lack the characteristic foul odor associated with the sapromyiophilous syndrome[2] (Lu 1982). Despite flower color, morphology, and location near the ground, Lu (1982) reported that western wild ginger primarily self-pollinates, and that flies or fungus gnats, the putative pollinators suggested by Vogel (1978a), play only a minor role. Lu (1982) described a three-phase pollination process: first, the six stigmas are apparently receptive for cross-pollination, while the twelve stamens remain recurved with their anthers adjacent to the top of the inferior ovary. After about a week, the filaments of the inner six stamens straighten, and deposit pollen on adjacent stigmas. In the third stage, two or three days later, anthers of the remaining six stamens dehisce and their filaments straighten to a position directly below the stigmas, also potentially contributing to self-pollination.

Pollination in Hartweg's wild ginger follows the same process, but its flowers emit a faint, musty frangrance and mushroom flies perform some cross-pollination (Mesler and Lu 1993). Green-flowered wild ginger probably primarily self-pollinates, but may also attract a suite of fungus-visiting flies, as in the cases of Hartweg's and western wild gingers.

Meeuse and Morris (1984) reported that female fungus gnats deposit eggs in the throat of flowers of western wild ginger and other *Asarum* species. The larvae that hatch from these eggs start eating almost immediately, but the tissues of the flower are so poisonous that the young insects quickly die. They observed that in some localities 35% of the flowers of western wild ginger contained eggs and larvae. This appears to be a case of 'ruthless' exploitation of a pollinator by a plant, comparable to the cases of *Stapelia* and certain water lilies (Meeuse and Morris 1984). If, as argued by Mesler and Lu (1993), self-pollination in *Asarum* was superimposed on a system fundamentally adapted for pollination by fungus flies, then perhaps it was because the host was too treacherous!

Procter and others (1996) discuss the sapromyiophilous syndrome in detail using a number of different species including Western wild ginger as example an example of brood site imitation without prolonged imprisonment. They cite Vogel's work (Vogel 1978a and b) with Western wild ginger without mentioning Mesler and Lu (1993) or Meeuse and Morris (1984).

Seed Dispersal

Apparently, seeds of all species in the Section *Asarum* (Kelly 2001) are equipped with fleshy glutinous structures called elaiosomes, which are rich in lipids and proteins. These structures are highly nutritious, and ants collect and carry the seeds to their nest. After feeding the elaiosomes to their larvae, the ants discard the seeds, which are still viable, in their waste disposal area. Thus, by transporting but not consuming the seeds, ants may play an important role in plant distribution for wild gingers. Other western wildflowers known to produce elaiosomes include the familiar western bleeding heart (*Dicentra formosa*) and miner's lettuce (*Claytonia perfoliata*). In contrast to ant behavior, rodents destroy a large number of fruits of western wild ginger (Lu 1982).

Chemistry

A plant's common name is often based on some noticeable morphological or chemical feature. Or, if there is no known colloquial name, it may be given a contrived common name based on its formal botanical name (Hartweg's wild ginger, *Asarum hartwegii*, for example). The crushed leaves of many species of *Asarum* emit an odor resembling that of the culinary herb ginger (*Zingiber officinale*), hence the common name "wild ginger." *Zingiber*, from

[2]Plants growing in humus whose reproductive structures resemble decaying organic material in order to attract flies that facilitate cross-pollination.


Both *Asarum hartwegii*, left (photo by Frank Lang), and *A. marmoratum*, right (photo by Norm Jensen), have marbled leaves.

Southeast Asia, is strictly a cultivated plant, no longer found in the wild. Because the leaves of green-flowered wild ginger are odorless and the flowers are foul-smelling, it is probably safe to assume that it has little or no culinary value. In addition, it is rare enough that digging its roots or rhizomes is strongly discouraged.

Rex Cates (1975), a student of B. J. D. Meeuse at the University of Washington, investigated banana slug (*Ariolimax columbianus*) predation on western wild ginger, which appears to have evolved two strategies to cope with herbivory. He found that natural populations of western wild ginger are polymorphic for seed production, growth rate, and palatability to these native slugs. In habitats where slugs were uncommon, wild ginger had individuals that invested more energy into early rapid growth and seed production and less energy to the production of an antiherbivore substance. When and where slugs were more abundant, natural selection had favored wild ginger that invested more energy into producing the anti-herbivore substance. These latter plants grew more slowly and produced fewer seeds, but were at a competitive advantage because less photosynthetic material was consumed by slugs.

Wild ginger is not culinary ginger, even though one encounters advice like this:

"Wild ginger tastes like commercially available gingerroot, with the exception that the leaves are more strongly flavored than the root… In other words, this plant is used in exactly the same manner as gingerroot" (Tilford 1997). "Native Americans apparently used roots of our species to make a tea for a variety of cures for ailments ranging from indigestion, coughs, colds, heart conditions, female ailments, throat ailments, nervous conditions, to cramps" (Moreman 1998).

Medical authorities strongly warn against all uses of species containing aristolochic acids because they may cause severe kidney damage (Lord *et al.* 1999) and urinary tract cancer (Norteir *et al.* 2000). In addition, a European species, *A. europeaeum*, contains a rich assortment of essential oils implicated in poisonings when used in folk medicine as an emetic, diuretic or abortifacient (Frohne and Pfänder 2005). One should remember that *Asarum* evolved toxic chemicals to deal with herbivores.

Horticultural Value

Asarum is well-known to garden plant enthusiasts as a low-growing woodland herb. An impressive array of species are available through nurseries and mail-order, either as seed or plants. The Royal Horticultural Society plant finder indicates 79 taxa for *Asarum* (http://www.rhs.org.uk/rhsplantfinder/PFGenera.asp), including several North American species: *Asarum canadense, A. caudatum, A. hartwegii,* and *A. lemmonii*. Wild gingers are particularly popular in rock gardens, especially those species with attractive evergreen leaves that contain chemicals that deter slugs. Some species, however, appear to lack these chemicals and growers of *Asarum* should be alert to the possibility of slug predation. Kozloff (1976) commented that our native banana slugs inflict little damage to garden plants; most is done by introduced slugs. Rathcke (1985), working with three alien slugs in Eastern North America, suggested that the velvety pubescence on leaves of Canadian wild ginger deters slugs from crawling and feeding on leaves. Slugs consumed less than 10% of leaf area, in contrast to 58% of the flowers on the same plants. Leaves of Western wild gingers are not as hairy as Canadian wild ginger, so may be more vulnerable to alien slug damage. Kruckeberg (1996) finds that *Asarum marmoratum* (*hartwegii*) is avidly sought by slugs. Because of the nomenclatural confusion surrounding the two taxa the wisest course of action would be to assume both are consumed by slugs. If using slug bait around garden-grown wild gingers, remember that the poison is lethal to native slugs, even though they are not causing the damage.

Leaves of green-flowered wild ginger are deciduous and not marbled, making the species less desirable for gardens. In addition, it would need to be started from seed, because plants should not be dug from the wild.

Flowers of *Asarum hartwegii* are also maroon-red, with long, attenuated calyx lobes. Photo by Norm Jensen.

Conclusion

With its limited distribution southern Oregon, green-flowered wild ginger is not as well known as its widespread relative, western wild ginger. Now that you know about it, look for it and other wild gingers when botanizing southern Oregon. (If you see elk eating wild ginger, let us know. We found no evidence that elk use it; and after what we learned of its chemistry, no longer expect to!)

Western wild ginger has solid green leaves and maroon-red flowers with long calyx lobes. Photo by Norm Jensen.

Acknowledgements

The authors extend their thanks to Michael Mesler, Rhoda Love and Ken Chambers for reviewing earlier versions of the manuscript, to Jerry Harmon, who guided us to *Asarum hartwegii* on Mt. Shasta, to Belinda Vos and Frank Callahan for information on the pale-flowered variant of *Asarum caudatum*, and to Bob Vos and Norm Jensen for excellent photographs of wild gingers in southern Oregon and northern California.

References

Cates RG. 1975. The interface between slugs and wild ginger: some evolutionary aspects. Ecology 56:391-400.

Eastman DC. 1990. Rare and Endangered Plants of Oregon. Wilsonville (OR): Beautiful America Publishing Company. 194 p.

Frohne D, Pfänder HJ. 2005. Poisonous Plants: a Handbook for Doctors, Pharmacists, Toxicologists, Biologists, and Veterinarians. 2nd Ed. Portland (OR): Timber Press. 469 p.

Hickman JC, ed. 1993. The Jepson Manual: Higher Plants of California. Berkeley (CA): University of California Press. 1400 p.

Hitchcock CL, Cronquist A, Ownbey M, Thompson JW. 1964. Vascular Plants of the Pacific Northwest. Vol. 2. Seattle (WA): University of Washington Press.

Kelly LM. 2001. Taxonomy of *Asarum* Section *Asarum* (Aristolochiaceae). Systematic Botany 26(1):17-53.

Kozloff EN. 1976. Plants and Animals of the Pacific Northwest: an Illustrated Guide to the Natural History of Western Oregon, Washington, and British Columbia. Seattle: University of Washington Press. 264 p.

Kozloff EN. 2005. Plants of Western Oregon, Washington & British Columbia. Portland (OR): Timber Press. 512 p.

Vegetative key to *Asarum* species in Oregon and adjacent California

Because of early taxonomic confusion (Peck 1961) and the possibility that *A. hartwegii* might occur in Oregon, it is included in this key.

1a. Upper leaf surfaces marbled with white or silvery lines, primarily along the veins.
  2a. Leaves with marginal cilia perpendicular to edge... *A. marmoratum*
  2b. Leaves with marginal cilia that angle toward apex... *A. hartwegii*

1b. Upper leaf surfaces uniformly green, not marbled.
  3a. Leaves heart-shaped, usually persistent, annual increment of shoot growth long (14-60 mm), upper leaf surfaces uniformly sparsely pubescent... *A. caudatum*
  3b. Leaves kidney-shaped (wider than long), deciduous, annual increment of shoot growth short (5-20 mm), upper leaf surfaces pubescent only on the veins... *A. wagneri*

Hairs along the edge of the leaf angle toward the apex in *Asarum hartwegii*. Photo by Norm Jensen.

Kruckeberg AR. 1996. Gardening with Native Plants of the Pacific Northwest. 2nd Ed. Seattle: U of Wash Pr. 282 p.

Lord GM, Tagore R, Cook T, Gower P, Pusey CD. 1999. Nephropathy caused by Chinese herbs in the UK. Lancet. 354:481-482.

Lu KL. 1982. Pollination biology of *Asarum caudatum* (Aristolochiaceae) in northern California. Systematic Botany 7(2):150-157.

Lu KL, Mesler MR. 1983. A re-evaluation of a green-flowered *Asarum* (Aristolochiaceae) from southern Oregon. Brittonia 35(4):331-334.

Meeuse B, Morris S. 1984. The Sex Life of Flowers. London: Faber. 152 p.

Mesler MR, Lu KL. 1993. Pollination biology of *Asarum hartwegii* (Aristolochiaceae): an evaluation of Vogel's mushroom-fly hypothesis. Madroño 40:117-125.

Moreman DE. 1998. Native American Ethnobotany. Portland (OR): Timber Press. 927 p.

Norteir JL, Martinez MCM, Schmeiser HH, Arlt VM, Bieler CA, Petein M, Depierreux MF, DePauw L, Abramowicz D. 2000. Urothelial carcinoma associated with the use of a Chinese herb (*Aristolochia fangchi*). New England Journal of Medicine 342:1686-1692.

Peck ML. 1961. Manual of the Higher Plants of Oregon. Portland (OR): Binsford & Mort. 936 p.

Procter M, Yeo P, Lack A. 1996. The Natural History of Pollination. Portland (OR): Timber Press. 479 p.

Rathcke B. 1985. Slugs as generalist herbivores: tests of three hypothesis on plant choices. Ecology 66(3):828-836.

Tilford GL. 1997. Edible and Medicinal Plants of the West. Missoula (MT): Mountain Press Pub. 239 p.

Vogel S. 1978a. Pilzmückenblumen als Pilzmimeten, erster Teil. Flora 167:329-366.

Vogel S. 1978b. Pilzmückenblumen als Pilzmimeten, Fortsetzung und Schluss. Flora 167: 367-398.

Whittemore AT, Mesler MR, Lu KL. 1997. *Asarum*. pp. 50-53 *in* Flora of North America North of Mexico. Vol. 3. New York (NY): Oxford University Press.

Cindy Roché joined the Native Plant Society of Oregon shortly after moving to Medford. She started editing *Kalmiopsis* in 2001 with Volumes 7 and 8, as an assistant to Linda Vorobik. With a background in invasive species and degrees from Washington State University and the University of Idaho, she honed her skills by writing extension bulletins at Washington State University. She began illustrating plants in graduate school and, more recently, was one of the illustrators of grasses for the Flora of North America (Volumes 24 and 25). She also teaches grass identification at the Siskiyou Field Institute each summer.

Frank Lang is Emeritus Professor of Biology, Southern Oregon University in Ashland where he taught Plant Ecology, Systematic Botany and Biological Illustration for many years. He served on the NPSO Board of Directors 1986-87, was President 1979-81 and 1985-86, and editor of *Kalmiopsis* from its inauguration in 1991 to 1994 and has served on the Editorial Board since 2004. He is a Fellow of NPSO. Botanical interests include the botanical exploration of the Pacific Northwest, the Flora of the Klamath Ecoregion, the genus *Polypodium* and ferns in general, and a recent enthusiasm for whitebark pine.

Ferns and Friends in the Wallowa Mountains, Oregon

Edward R. Alverson
The Nature Conservancy, 87200 Rathbone Rd, Eugene OR 97402

Peter Zika
Herbarium, Box 355325, University of Washington, Seattle, WA 98125

Calcareous headwaters of Middle Fork Imnaha River, a remote basin where Cusick found green spleenwort (*Asplenium trichomanes-ramosum*). Photo by Peter Zika.

The Wallowa Mountains are one of Oregon's most scenic mountain ranges, with snow-capped peaks, dramatic river canyons, and classic glacial topography. The diversity of the Wallowa flora is also well known, with its endemic and noteworthy species, as well as its significant Rocky Mountain floristic element. Some of the latter are disjunct species not known elsewhere in Oregon (Mason 1980). In contrast, few people know that the Wallowa Mountains are a diversity hotspot in western North America for ferns and other vascular cryptogams (non-flowering plants including horsetails, clubmosses, spikemosses, and quillworts), of which botanists have documented 55 species, subspecies, or varieties (Mason 1980, Zika and Alverson 1996). (See list at end of article.) This total includes 41 taxa of ferns, as well as an additional 14 species of horsetails, clubmosses, spikemosses, and quillworts. In addition to describing this diversity, we will suggest the reasons for it, and tell stories of botanists who explored the Wallowas.

The Wallowa Mountains trend northwest to southeast, between the Baker and Wallowa valleys in Baker, Union, and Wallowa counties of northeastern Oregon. The range is approximately 50 miles long and 20 miles wide, and with elevations from 3000 to 9838 feet (at the summit of Sacajawea Peak). The topography was extensively glaciated during the Pleistocene, and Wallowa Lake is considered a classic example of a lake formed by the moraine of a valley glacier.

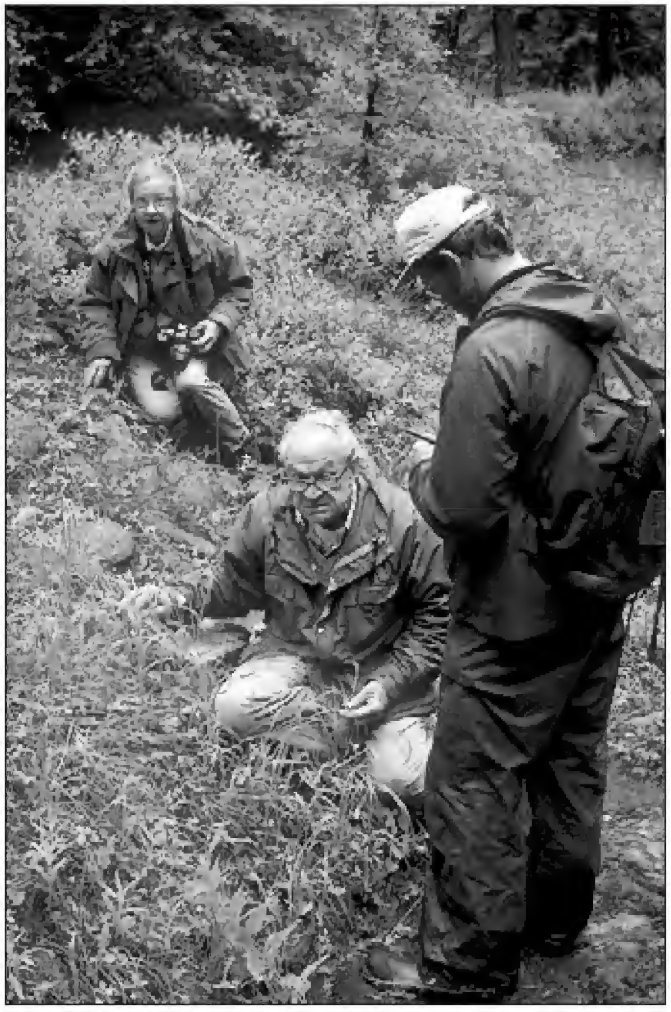
Geological Origins

According to geological researchers of plate tectonics, the Wallowa Mountains began as islands off the Pacific Coast. During the Permian era, some 260 million years ago, rocks that later became our inland mountains were part of an island arc in the Pacific Ocean called Wrangellia. The islands comprised volcanic, sedimentary (*e.g.,* limestone), and metamorphic rocks. Drifting eastward, the islands eventually collided (in slow motion) with the North

American Plate, 115 to 145 million years ago. That subduction at the margin of the North American Plate created granitic batholiths (coarse-grained rock formations created by melting of the earth's crust and subsequent slow cooling 2 to 20 miles below the surface, Bishop 2003). The largest of these, the Wallowa batholith, forms the central high country of the Wallowa Mountains. During the middle of the Miocene period (about 15 million years ago), extensive floods of liquid basalt flowed out over the Northwest. Rearranged by tilting, folding, and uplifting, these basalt flows formed the western and northern topography of the Wallowa Mountains. The complex geology of sedimentary, metamorphic, granitic, and basaltic rocks contributes to a variety of substrates (e.g., acidic, basic, calcareous) for diverse habitats.

Fern Diversity: Climate and Substrates

Mountain ranges typically have relatively high numbers of ferns in their floras, for several reasons. Altitudinal zonation produces a variety of climatic zones within a small geographical area. Mountain ranges typically have higher annual precipitation than adjacent lowlands; water is a critical factor for fern reproduction. An abundance of rocky substrates in mountainous areas also favors many fern species. Fern gametophytes face less competition during establishment on rock than on soils where other vegetation thrives. The great variety of bedrock types in the Wallowa Mountains fosters a diversity of ferns. Basic (high pH) rocks tend to be uncommon in Pacific Northwest mountains; limestone, marble, and other calcareous rocks are particularly important to the subset of ferns known as "calciphiles." More habitats are created by the presence of acidic rocks that form suitable habitat for species that avoid calcareous substrates: "calcifuges."



Peter Zika with Drs. Herb and Florence Wagner, viewing Paradox moonwort (*Botrychium paradoxum*) at the first known locality for Oregon in August 1993. Since then it has been found in several other localities in the Blue and Ochoco Mountains. Photo by Ed Alverson.

Fern Collectors in the Wallowas

The Wallowa Mountains were a favorite haunt of William C. Cusick, who collected there from about 1878 through 1910 (Love 2007). Cusick collected at least 13 fern species from the Wallowas, and was the first to document a number of rare or disjunct species, including green spleenwort (*Asplenium trichomanes-ramosum*). Although other collectors passed through during the early to mid 20th century, Georgia Mason (1910-2007) of the University of Oregon was Cusick's successor in thoroughly botanizing the region. Her 1975 flora (revised in 1980), "A Guide to the Plants of the Wallowa Mountains of Northeastern Oregon," was the culmination of over a decade of fieldwork. She recorded thirty ferns and other vascular cryptogams in the first edition of the book, and added five species in the second edition. David Wagner, Director of the University of Oregon Herbarium from 1976 to 1993, started collecting there in the late 1970s and provided many of the revisions in the second edition of Mason's book.

We began our fieldwork in the Wallowas in the 1980s: Zika as a botanist for the Oregon Natural Heritage Program, and Alverson by invitation to join Michigan botanists W.H. (Herb) and Florence Wagner (no relation to David Wagner) in their field studies of moonwort (*Botrychium*). [see Plant of the Year article (pages 15-20) on *Asarum wagneri*, named for Herb Wagner.] The Wagners, studying moonworts in North America, chose the Wallowa Mountains as one of their key localities because of the high diversity of moonworts. They ultimately published three new species of moonworts with type localities in the Wallowas; details are given later in this article. We were fortunate to join Herb and Florence during a number of their field trips in the Wallowa Mountains, and every outing was a wonderful learning experience. At the same time, we kept our eyes open for additional ferns that had not previously been collected in the Wallowas, and published our results in a paper in the American Fern Journal (Zika and Alverson 1996). Our personal documentation of 55 taxa of ferns and other vascular cryptogams in the Wallowa Mountains amounts to over half the taxa of ferns, horsetails, clubmosses, spikemosses, and quillworts found in Oregon. The number of fern species makes this one of the most diverse fern localities in western North America.

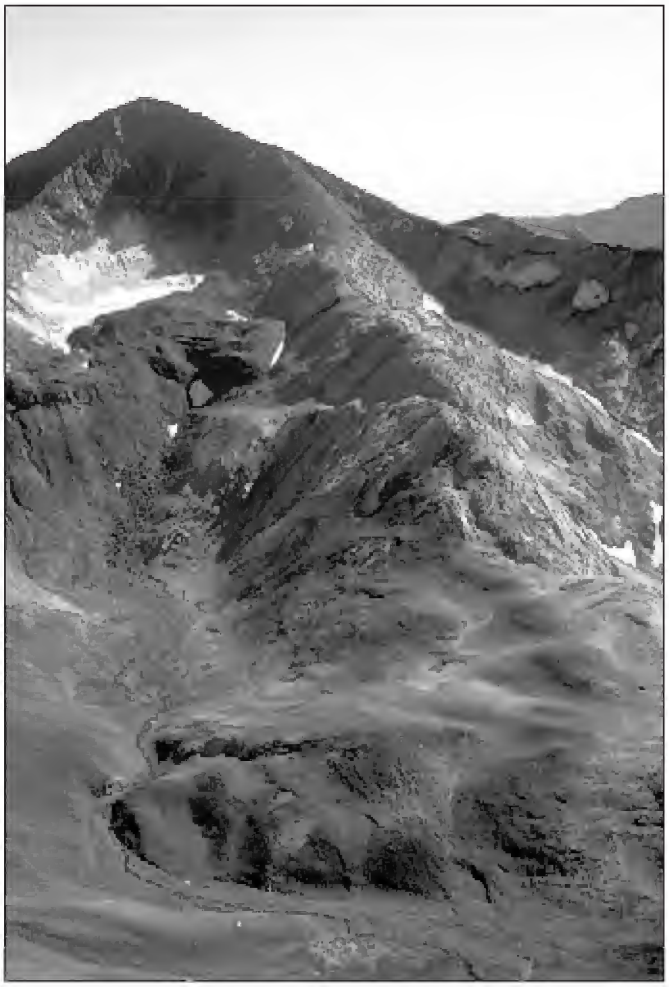
Hunting for Rare Ferns

Ferns reproduce by small, light spores, which have the ability to disperse long distances and form remote or disjunct colonies. As a result, ferns are often well represented on state rare plant lists. Several of Oregon's rare fern species were, until recently, known in Oregon only from historic records in the Wallowas. However, diligent field work by Peter Zika has confirmed that two of these are still extant

Martin Bridge limestone, shown here with a dark volcanic intrusion near Cusick Mountain, supports calciphiles like *Cryptogramma stelleri*. Photo by Peter Zika.

members of the Oregon flora. One of these species, which is known from throughout its range to be restricted to moist, usually calcareous, rocky habitats, is Steller's rock brake (*Cryptogramma stelleri*). Frye (1934) first reported this fern from the Wallowas, but we could not locate a voucher specimen in any herbarium to confirm this sole record of the species in Oregon. The mystery was solved in 1993 when Peter found a small population of Steller's rock brake on moist, north-facing limestone rocks in the Hurricane Creek drainage.

Similarly, green spleenwort (*Asplenium trichomanes-ramosum*, formerly *A. viride*) was known in Oregon from a single 1908 Wallowa Mountain collection by W.C. Cusick, but no one had been able to relocate the population. Cusick's enigmatic label read simply, "headwaters of the Imnaha, 9000 feet alt." In 1987, Peter Zika spent many days exploring the four upper forks of the Imhana, which included six peaks, many ridges, and roughly 6 square miles of wilderness terrain above 9,000 feet, looking for the green spleenwort without success. Eventually Peter spotted a likely cirque, in fact, the only cirque with limestone cliffs shaded at mid-day. On those steep and cool north-facing exposures, at a slightly lower elevation than expected (7,550 ft.) were 47 clumps of the little evergreen spleenworts, clinging to the cliffs with other boreal species like *Salix vestita* and *Saxifraga oppositifolia*. They were a welcome sight, which lightened Peter's steps considerably on the two-day hike back out to the trailhead.



One of the many trail-less peaks investigated in the high Wallowas while searching for Cusick's station of green spleenwort (*Asplenium trichomanes-ramosum*). Zika's tent is in foreground. Photo by Peter Zika.

Martin Bridge limestone cliffs with the long-lost population of green spleenwort at the headwaters of the Imhana River. Photo by Peter Zika.

Fern Families

Fern nomenclature has been in flux for the past several decades (Alverson 1993). Comparing the treatment of fern families in *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973) with *Flora of North America* (FNA) (1993), the most obvious difference has been the recognition in FNA of a large number of segregate families that were previously placed in the Polypodiaceae. These families include Aspleniaceae, Dennstaedtiaceae, Dryopteridaceae, Pteridaceae, and Woodsiaceae

Analysis of variation of mutations in DNA has greatly facilitated the circumscription of fern families in recent years. In 2006, Smith and others proposed a further refinement of family boundaries to create a new family (Woodsiaceae) composed of genera previously allied with *Dryopteris* and *Polystichum*.

Polypody Family (Polypodiaceae)

In the Pacific Northwest, we have only one genus in the now narrowly circumscribed family Polypodiaceae: *Polypodium*. In the Wallowas, this genus is represented by one species, western polypody (*P. hesperium*), which is found on mossy rocks and cliffs

at middle elevations, where its creeping rhizome can send roots down into sheltered rock crevices.

Maidenhair Fern or Brake Family (Pteridaceae)

Western maidenhair (*Adiantum aleuticum*) is a widespread western fern that has been recently split from the eastern maidenhair fern (*Adiantum pedatum*). It prefers moderately moist forested or rocky sites; most of the records from the Wallowas are from shady mossy stream banks and similar moist habitats.

Although substrate preferences are important determinants of fern distribution in the Wallowas and elsewhere, they are not always absolute indicators. The small rock fern known as Indian's Dream (*Aspidotis densa*) is strongly associated with ultramafic rocks (e.g., serpentine and peridotite), but is not restricted to this habitat. In the Wallowas, where there is no serpentine, it occurs on granitic rocks. Several other rock ferns that grow on granitic substrates include lace fern (*Cheilanthes gracillima*) and American and Cascade parsley ferns (*Cryptogramma acrostichoides* and *C. cascadensis*). Although Steller's rock brake (*Cryptogramma stelleri*) is a calciphile, *C acrostichoides* and *C. cascadensis* are calcifuges. Cascade parsley fern is not found in Mason's flora, or in *Flora of the Pacific Northwest*, because it was first described by Ed Alverson in 1989. It is a species primarily of the Cascade Mountains (the type locality is in the Cascades east of Seattle), but it also occurs in scattered sites in the northern Rocky Mountains. Sterile fronds are deciduous in Cascade parsley fern, compared to wintergreen fronds in American parsley fern. There are several microscopic differences, as well as strong genetic differences, seen in analysis of enzyme variation (Alverson 1989).

Cliff-brakes (*Pellaea*) are related to the lace fern and grow in similar dry, rocky habitats. These are generally small, densely tufted ferns with leathery, glaucous foliage and wiry leaf petioles. In the Wallowa Mountains, two cliff-brake species, Brewer's (*Pellaea breweri*) and Bridges' (*P. bridgesii*), grow in mid-elevation rocky habitats. Bridges' cliff-brake has oval, undivided pinnae, differing from those of Brewer's cliff-brake that are mostly divided into two or three lobes. Brewer's cliff-brake is widely distributed in the Great Basin and Rocky Mountain regions, extending westward to scattered locations in eastern Oregon and Washington. Over its range, it grows on a variety of substrates, but prefers calcareous rocks, its primary substrate in the Wallowas. In contrast, Bridges' cliff-brake grows primarily on granitic rocks, with a distribution centering in the Sierra Nevada Mountains of California, and disjunct populations in the Wallowas and nearby Idaho.

Wood Fern Family (Dryopteridaceae)

Wood ferns (*Dryopteris*) are typically large ferns of moist forest habitats. The two species found in the Wallowas are spreading wood fern (*Dryopteris expansa*) and male fern (*D. filix-mas*). Spreading wood fern is widespread in the Pacific Northwest, as well as elsewhere in northern latitudes in both the new and old world. In the Pacific Northwest it is most common in moist forests west of the Cascades. Male fern is also a widely distributed northern species, but in the Pacific Northwest is an uncommon fern of moist, rocky, mountainous terrain.

Eight species of sword or holly fern (*Polystichum*) grow in Oregon, and six occur in the Wallowa Mountains. The western sword fern (*Polystichum munitum*) is a typical fern of mesic forest habitats west of the Cascades, but is also widespread (though less common) in forested habitats east of the Cascades, and is known from several localities in the Wallowas. In 1992 we found a small colony of Anderson's sword fern (*Polystichum andersonii*), another moisture loving sword fern that had not previously been reported from the Wallowas. The small colony we found was growing at about 5,250 ft. elevation under Engelmann spruce (*Picea englemannii*) in a moist canyon bottom. This species has more finely dissected fronds than western sword fern and occurs primarily in British Columbia and southeastern Alaska. Anderson's sword fern also occurs in Washington, Idaho and Montana, but Oregon is the southern limit of its range.

Four species of *Polystichum* in the Wallowas are associated with rocky habitats, often on granitic substrates. Imbricate sword fern (*Polystichum imbricans*) is a once-pinnate species closely related to western sword fern, but grows in drier, more open habitats. Imbricate sword fern, rare east of the Cascades, is known from one collection in the Wallowas, where it grows on granitic rocks at 7,200 ft. elevation in the upper portion of the Eagle creek drainage in Baker County The teeth along the leaf margins of mountain holly fern (*Polystichum lonchitis*), another once-pinnate fern, are spiny, resembling holly leaves. It is found only at higher elevations in mountainous regions, and is widespread around the northern hemisphere. Although elsewhere it is considered a calciphile, most of the documented sites in the Wallowas are on granitic rocks. Two additional related species, rock sword fern and Kruckeberg's holly fern (*P. scopulinum* and *P. kruckebergii*) grow in rocky subalpine habitats near Ice lake and China Cap Peak, respectively. Both species are small ferns with pinnae that are incised or pinnatifid. The pinnae of Kruckeberg's holly fern are shorter than those of rock sword fern, and have teeth along the margins that are spiny like those of mountain holly fern. Both species often occur on serpentine soils elsewhere in their range, but in the Wallowas they occur on other rock types.

Bracken Fern Family (Dennstaedtiaceae)

Bracken (*Pteridium aquilinum* var. *pubescens*), the primary taxon found in the Pacific Northwest, is either one of the world's most widely distributed vascular plant species, or a global complex of closely related species and varieties. In the Wallowas it occurs in forests and meadows, mostly at middle elevations, on granite and possibly other substrates.

Cliff Fern Family (Woodsiaceae)

Genera in the Woodsiaceae are characterized by small to large, usually soft-textured fronds, including the lady ferns (*Athyrium*), oak ferns (*Gymnocarpium*), fragile ferns (*Cystopteris*), and cliff ferns (*Woodsia*). Our species of the latter two genera are often confused, being small, clumping, twice pinnate ferns with ovate-lanceolate frond outlines. Cliff ferns have firmer-textured, evergreen fronds, often grow in more exposed or xeric habitats, and have brown (rather than green or straw colored) stipe bases, as compared to fragile ferns. Both cliff fern species in Oregon (Laurentian cliff fern and Oregon cliff fern, *Woodsia scopulina* ssp. *laurentiana* and *W. oregana* ssp. *oregana* respectively), are found in the Wallowas, where they usually grow over basaltic rocks. Both species are widely distributed polyploid complexes, with their different chromosome races recognized as subspecies.

If the number of specimens in the OSU herbarium is a measure, fragile fern (*Cystopteris fragilis*) may be the most common fern in the Wallowa Mountains. It typically occurs on rocky slopes or cliff crevices where water seeps out, at least early in the growing season.

Northwestern lady fern (*Athyrium filix-femina* ssp. *cyclosorum*) is common and widespread in moist, shady locations. Some lady fern collections from the Wallowas have been determined as *Athyrium filix-femina* ssp. *californicum*, a subspecies with narrower fronds that is typically found in the Sierra Nevada mountains of California. A subalpine version (*A. alpestre*) grows in mountainous regions of the Pacific Northwest. The typical form of subalpine lady fern is found in Europe, and our plants are called var. *americanum*. Subalpine lady fern grows in concave microsites where snow drifts persist late into the summer; it has been reported from both granitic and basaltic substrates in the Wallowa Mountains.

Another fern on moderately moist sites is northwestern oak fern (*Gymnocarpium disjunctum*). This is a fern of moist, shady forest habitats, more commonly west of the Cascades, but occasionally in inland mountains as well. *Gymnocarpium disjunctum* is a diploid species that has recently been recognized as distinct species from the tetraploid common oak fern, *Gymnocarpium dryopteris*, which is not known to occur in Oregon.

Former Allies of the Ferns

Horsetails (Equisetaceae), clubmosses (Lycopodiaceae), spikemosses (Selaginellaceae), and quillworts (Isoetaceae) are vascular cryptogams that traditionally have been categorized as "fern allies." This term is now considered to be imprecise, because new evidence suggests that the clubmosses, spikemosses, and quillworts are only remotely related to the ferns, and in fact are a basal lineage that is sister to all of the other extant vascular plants. According to this view, however, the horsetails are fairly closely related to the true ferns (Smith *et al.* 2006).

Horsetails and Scouring Rushes

The Wallowa Mountains are home to four species of *Equisetum*. The common weedy field horsetail (*Equisetum arvense*) is widely distributed in moist habitats. Of the three species of scouring rushes, common, smooth and variegated (*Equisetum hyemale, E. laevigatum*, and *E. variegatum* ssp. *variegatum*), the first two are common and widespread in Oregon, but variegated scouring rush is rare. In Oregon, it seems to be associated with montane calcareous habitats, especially the silty floodplains of turbulent streams such as Hurricane Creek.

Quillworts

Four species of quillworts have been collected in the Wallowa Mountains: *Isoetes bolanderi, I. tenella, I. howellii*, and *I. occidentalis*. These entirely aquatic plants grow rooted in the bottom of shallow lakes and ponds. In the Wallowas great numbers of *I. howellii* can be stranded by falling water levels in late summer or early autumn, forming a green turf. Quillworts look like little tufts of linear leaves and are distinguished, in large part, by the ornamentation of the megaspores.

Clubmosses

Clubmosses (Lycopodiaceae) are mostly northern species that extend southward to Oregon. In the Wallowas there are two occasional species of clubmoss, stiff clubmoss (*Lycopodium annotinum*) and Alaska clubmoss (*Diphasiastrum sitchense*). In addition, Dave Wagner collected fir clubmoss, *Huperzia occidentalis*, in the Lostine River drainage in 1992. The fir clubmosses were previously included in *Lycopodium* but differ from other lycopods by lacking horizontal stems (rhizomes), having sporangia borne in the axils of un-modified leaves, and by producing gemmae from which new plants can be produced vegetatively.

Alaska clubmoss is a species of rocky subalpine parkland, while stiff clubmoss and fir clubmoss are found in shady, moist conifer forests at middle elevations.

Spikemosses

Spikemosses (*Selaginella*) are similar to clubmosses, but differ in being heterosporus, producing both relatively large megaspores along with smaller microspores. (*Isoetes* are also heterosporous.) Most North American *Selaginella* species are southern, and they are particularly diverse in the mountains of the American southwest and adjacent Mexico. Three species grow in the Wallowas: Wallace's spikemoss (*Selaginella wallacei*) is a lower elevation species. Alpine spikemoss (*S. watsonii*) and Rocky Mountain spikemoss (*S. scopulorum*) are primarily subalpine. All three grow in open rocky habitats, often on granitic rocks, where they form small moss-like mats. Distinguishing the different species is often difficult due to their compact growth, which obscures the critical leaf bases.

Grape Ferns, Moonworts, and Rattlesnake Ferns

Finally, the most fascinating species of ferns in the Wallowas are the grape ferns, rattlesnake ferns, and moonworts of the genus *Botrychium*. This genus of especially primitive ferns, along with

Although quillworts (*Isoetes*) are usually considered aquatic, they can be be found on dry ground when stranded by dropping lake levels in the granitic zones of the Wallowas. Here, hundreds of *Isoetes* form a thin turf to the right of the large sedge clumps. Photo by Peter Zika.

Triangle moonwort (*Botrychium lanceolatum*), which is widely distributed in the northern parts of North America, is one of the more common moonworts in the Wallowas. Photo by Ed Alverson.

the whisk-ferns (*Psilotum*), form the basal lineage that is sister to all other extant ferns (Smith *et al.* 2006). One of the reasons for high fern diversity in the Wallowa Mountains flora is the 15 species of grape ferns and moonworts. Thirteen of them are moonworts (subgenus *Botrychium*). This is possibly the greatest concentration of *Botrychium* species found anywhere in the world, including the type localities for three recently described species. A key aspect of the Wagners' research on *Botrychium* was the "genus community method" (Wagner and Wagner 1983) as a tool for comparative analysis to determine which morphological features have a genetic basis, as opposed to morphological variation resulting from differing environments. Because so many species of *Botrychium* occur together here, the Wallowas proved to be an important site for their research. In fact, 7 of the 15 species of *Botrychium* found in the Wallowas were described as new species by Dr. Wagner.

Two of the species are widespread and common throughout a broad geographic range, leathery grape fern (*Botrychium multifidum*) and rattlesnake fern (*B. virginianum*). Three moonworts that are rare elsewhere, triangle moonwort (*Botrychium lanceolatum*), northwestern moonwort (*B. pinnatum*), and least moonwort (*B. simplex*), are relatively common and widespread in the Wallowas.

In 1986, the Wagners described two new species of moonworts from the Wallowa Mountains (Wagner and Wagner 1986). Upswept moonwort (*Botrychium ascendens*), with its type locality along Hurricane Creek, is related to common moonwort (*B. lunaria*), but has cuneate rather than lunate segments on the sterile fronds (trophophores). Stalked moonwort (*Botrychium pedunculosum*), with its type locality in the Lostine drainage, is related to the northwestern moonwort (*Botrychium pinnatum*), but the stalk of its trophophore is decidedly longer Since their discovery in the Wallowas in the early 1980s, both *B. ascendens* and *B. pedunculosum* have been found in widely scattered locations across mountains of western North America, so they are not Wallowa endemics, but they are still rarities indeed.

Upswept moonwort (*Botrychium ascendens*) was described by the Wagners in 1986, based upon type material from the Hurricane Creek drainage in the Wallowas. Photo by Ed Alverson.

The third moonwort with a type locality in the Wallowa Mountains was described in 1994, thus post-dates the publication of the Pteridophyte volume of *Flora of North America*. In 1992, while surveying for moonworts in the Lostine River Valley, we found a small population of a very distinctive moonwort with odd, linear shaped segments on the trophophore. We called it the "skinny" moonwort. Certain that we were the first to discover this new species of moonwort, we reported our find to Herb Wagner. He replied that, unknown to us, he knew all about this undescribed moonwort and had collected it in the Hurricane Creek valley in 1981. He had

Slender moonwort (*Botrychium lineare*) was described in 1996, based upon material collected at the type locality in the Lostine River drainage in the Wallowa Mountains. Photo by Ed Alverson.

subsequently located herbarium specimens from scattered localities all over northern North America, from California to Idaho, Colorado, and Quebec. Because the Wallowa Mountain population was especially vigorous and showed the distinctive characteristics of the species quite well, the Wagners accompanied us to the site in 1993 and collected the specimen they designated as the type (Wagner and Wagner 1994) of the new species, slender moonwort, *Botrychium lineare*. A related species, the prairie moonwort (*Botrychium campestre*), is known primarily from the northern Great Plains, though a single disjunct population of *B. campestre* was found in the Hurricane Creek valley, which is 560 miles from the nearest site in Alberta (Zika and Alverson 1996).

Four other moonwort species found in the Wallowas are also relatively recently described or recently recognized taxa, and are not included in *Flora of the Pacific Northwest*. They include the scalloped moonwort (*Botrychium crenulatum*) and Mingan moonwort (*Botrychium minganense* (which form a group along with *B. lunaria* and *B. ascendens*); western goblin (*Botrychium montanum*), and western moonwort (*Botrychium hesperium*), which is most closely related to *B. pinnatum* and *B. pedunculosum*). All of these species typically occur in rocky meadows or open lodgepole pine woodland at middle elevations in the Wallowas.

By far the most unusual moonwort in the Wallowas is the paradox moonwort (*Botrychium paradoxum*). In this species trophophores have been entirely converted to a second fertile segment, with no sterile lamina to speak of. We observed one patch of *B. paradoxum* for several years and found that its morphology remained constant, showing it is not merely a mutant or odd growth form of another species (Zika and Alverson 1996). Our find of this species in the Lostine River drainage was the first locality where *Botrychium paradoxum* had been found in Oregon, but it has since been discovered in several other sites in the Blue and Ochoco Mountains, and also is known to occur in Utah, Montana, Saskatchewan, Alberta, and British Columbia (Ahlenslager and Lesica 1996). A recently described moonwort, *B. yaaxudakeit* (yah-KOO-dah-kit) described from the Yakutat, Alaska area (Stensvold *et al.* 2002), still needs verification in the Wallowas. This species is related to *B. lunaria*; a specimen exhibiting the chemical profile of this new species was included in a recent sample from Hurricane Creek, but field identification is needed before verifying that this taxon is a member of the Wallowas (and Oregon) flora. Clearly, the need continues for additional field investigations of moonworts in the Wallowas.

Over the years, we have puzzled over the question of why there are so many moonwort species in the Wallowa Mountains. For

Common moonwort (*Botrychium lunaria*) is the world's most widespread moonwort, occurring throughout the northern hemisphere, including the remote Azores and Commander Islands, as well as in scattered localities in the southern hemisphere. Photo by Ed Alverson.

Western moonwort (*Botrychium hesperium*) is a member of the Rocky Mountain floristic element that occurs in the Lostine River drainage in the Wallowas. Photo by Ed Alverson.

the most part, their habitats are not particularly unusual, but are typically montane meadows with a low growing grasses and forbs, usually with scattered trees nearby (particularly lodgepole pine and Engelmann spruce). Invariably we find extensive colonies of wild strawberry (*Fragaria virginiana*) in these meadows, so we call them strawberry meadows. We suspect that the presence of calcareous substrates promotes moonwort species richness in these meadows. Where moonworts occur, the substrate is typically composed, at least in part, of alluvially transported calcareous boulders that originated on the limestone outcrops of the high ridges. The populations along the Lostine River occur in particularly complex habitats, where the substrate is a mix of alluvium and glacially transported rocks that originated from the range of bedrock types that occur in the upper Lostine drainage. Still, it appears that the presence of limestone and other calcareous materials appears to be correlated with moonwort species diversity. We have noted this pattern elsewhere, for example, in northeastern Washington, another moonwort hotspot in the Pacific Northwest, where calcareous bedrock is also widespread.

Overall, we hypothesize that a variety of factors that promote the high number of fern species that occur in the Wallowas. First, the topographic diversity, from relatively low elevation valley bottoms to high peaks that are nearly 10,000 feet in height, provides for a variety of vegetation and climatic zones. Second, the variety of bedrock types, significantly more varied than other mountain ranges

The calcareous outcrops around and above Ice Lake support a number of unusual plants, including some *Botrychium* species. Photo by Peter Zika.

in Oregon, promotes diversity of species that are associated with different rock types. Third, the Wallowas occur in a transition zone between two floristic regions, the Cascadian (or Vancouverian) and Rocky Mountain floristic provinces. Thus the flora of the Wallowas includes species typical of both provinces. We have enjoyed our years of exploring the Wallowas, and hope that this journey of discovery will continue to yield further surprises.

Botrychium paradoxum, a rare species of the Rocky Mountain region, is unusual because it produces sporangia on the portion of the plant that would normally be the sterile leaf blade. Photo by Ed Alverson.

Ferns and Other Vascular Cryptogams of the Wallowa Mountains, Oregon

Lycopodiaceae

Huperzia occidentalis (Clute) Kartexz & Gandhi	western firmoss
Lycopodium annotinum L.	stiff clubmoss
Lycopodium sitchense Rupr.	Alaska clubmoss

Selaginellaceae

Selaginella scopulorum Maxon	Rocky Mountain spikemoss
Selaginella wallacei Hieron	Wallace's spikemoss
Selaginella watsonii Underw.	alpine spikemoss

Isoetaceae

Isoetes bolanderi Engelm.	Bolanders quillwort
Isoetes tenella Leman ex Desv.	spiny-spore quillwort
Isoetes howellii Engelm.	Howell's quillwort
Isoetes occidentalis L.F. Hend.	western quillwort

Ophioglossaceae

Botrychium ascendens W.H. Wagner	upswept moonwort
Botrychium campestre W.H. Wagner	prairie moonwort
Botrychium crenulatum W.H. Wagner	scalloped moonwort
Botrychium hesperium (Maxon & Clausen) W.H. Wagner & Lellinger	western moonwort
Botrychium lanceolatum (S.G. Gmel.) Ångstr. ssp. *lanceolatum*	triangle moonwort

Georgia Mason and the Flora of the Wallowas

by Rhoda M. Love

Georgia Mason (1910-2007) was a relative newcomer to the West when she set out in 1960 to compile a flora of the Wallowa Mountains in the northeastern corner of our state. Georgia had come to Oregon from her home state of New Jersey in 1958 to work on a Master of Science degree at Oregon State College (now OSU). At the time of her move to the far west, she had been teaching science in the New Jersey public schools for twenty-seven years. Georgia was the daughter of Greek immigrants. She changed her birth name, Mavropoulos, to Mason so it would be easier for the grade school children to pronounce. It seems likely that she intended to return to teaching when she had completed her advanced degree; however, something about the glorious scenery of our mountainous West must have tugged at her heart, for she remained here for the rest of her life, dying in Eugene last year at the age of 97.

Georgia Mason

Almost immediately after completing her Masters, Georgia began to collect specimens for her flora of the Wallowas. Dr. Kenton Chambers, who came to Oregon State University Herbarium in 1960, recalls Georgia at that time working on her earliest Wallowa collections. In the introduction to her well-respected book, *Guide to the Plants of the Wallowa Mountains of Northwest Oregon* (University of Oregon Museum of Natural History, 1975; 2nd printing with additions 1980), Georgia wrote that the work was "... based mostly on my own collections over a period of eleven years..." and Oregon Flora Project records verify that her heavy collecting there commenced at the beginning of the decade of the sixties.

In 1969 Georgia Mason became acting Director of the University of Oregon Herbarium in Eugene where she continued to work on her Wallowa flora. In all, she spent summers in northeastern Oregon for over a decade. Her heaviest collecting summers in northeastern Oregon were 1961 through 1963 and 1971, with over 300 specimens collected during each of these four years. As part of the work on her book during this period, she sent specimens to experts throughout the country for verification of her identifications. For example, Ken Chambers verified some of her composites, and Art Kruckeberg checked *Silene*. She sent her ferns to Conrad V. Morton and Warren H. Wagner. In addition to using the two Oregon herbaria, she also studied collections at the University of Idaho and Washington State University.

The fern taxonomy in Georgia's book is now out of date. Much detailed work on this group of plants has been done during the three decades that have elapsed since she was hiking and collecting in the alpine environments of the Wallowa range. Our authority for fern nomenclature today is *Flora of North America* Volume 2 (Oxford University Press 1993). Employing the taxonomy of her time, Georgia listed six families of Pteridophytes for the region she covered: Equisetaceae, Lycopodiaceae, Selaginellaceae, Ophioglossaceae, Polypodiaceae and Isoetaceae. The large family Polypodiaceae has since been broken asunder into five families. Here Peter Zika and Ed Alverson update the taxonomy and add species discovered after 1980 for the landscapes explored earlier by Georgia Mason, a native of the flatlands of New Jersey who came to Oregon in middle age and fell in love with the alpine beauty of our high Wallowas.

Guide to the Plants of the Wallowa Mountains of Northeastern Oregon, 2nd printing 1980, is available at the University of Oregon's Museum of Natural and Cultural History, at the very reasonable price of $10.00. Send inquiries to tachurch@uoregon.edu.

Botrychium lineare W.H. Wagner	slender moonwort
Botrychium lunaria (L.) Sw.	common moonwort
Botrychium minganense Vict.	Mingan moonwort
Botrychium montanum W.H. Wagner	western goblin
Botrychium multifidum (S.G. Gmel.) Trevis.	leathery grape fern
Botrychium paradoxum W.H. Wagner	paradox moonwort
Botrychium pedunculosum W.H. Wagner	stalked moonwort
Botrychium pinnatum St. John	northwestern moonwort
Botrychium simplex E. Hitchc.	least moonwort
Botrychium virginianum (L.) Sw.	rattlesnake fern

Equisetaceae

Equisetum arvense L.	field horsetail
Equisetum hyemale L. var. *affine* (Engelm.) A.A. Eaton	common scouring rush
Equisetum laevigatum A. Br.	smooth scouring rush
Equisetum variegatum Schleich. var. *variegatum*	variegated scouring rush

Dennstaedtiaceae

Pteridium aquilinum (L.) Kuhn var. *pubescens* Underw.	bracken

Pteridaceae

Adiantum aleuticum (Rupr.) C.A. Paris	western maidenhair
Aspidotis densa (Brack.) Lellinger	Indian's dream
Cheilanthes gracillima D.C. Eat.	lace fern
Cryptogramma acrostichoides R. Br.	American parsley fern
Cryptogramma cascadensis E.R. Alverson	Cascade parsley fern
Cryptogramma stelleri (S.G. Gmel.) Prantl	Steller's rock brake
Pellaea breweri D.C. Eat.	Brewer's cliff brake
Pellaea bridgesii Hook.	Bridge's cliff brake

Aspleniaceae

Asplenium trichomanes-ramosum L.	green spleenwort

Woodsiaceae

Athyrium alpestre Butters var. *americanum* Butters	alpine lady fern
Athyrium filix-femina (L.) Mert. var. *cyclosorum* Rupr.	Northwestern lady fern
Athyrium filix-femina (L.) Roth. var. *californicum* Butters	Southwestern lady fern
Cystopteris fragilis (L.) Bernh.	fragile fern
Gymnocarpium disjunctum (Rupr.) Ching	western oak fern
Woodsia oregana D.C. Eaton ssp. *oregana*	Oregon cliff fern
Woodsia scopulina D.C. Eat. ssp. *laurentiana*	Windham Laurentian cliff fern

Dryopteridaceae

Dryopteris expansa (C. Presl) Fraser-Jenkins & Jermy	spreading wood fern
Dryopteris filix-mas (L.) Schott	male fern
Polystichum andersonii Hopkins	Anderson's sword fern
Polystichum imbricans (D.C. Eaton) D.H. Wagner	imbricate sword fern
Polystichum kruckebergii W.H. Wagner	Kruckeberg's holly fern
Polystichum lonchitis (L.) Roth	mountain holly fern
Polystichum munitum (Kaulf.) C. Presl	western sword fern
Polystichum scopulinum (D.C. Eaton) Maxon	rock sword fern

Polypodiaceae

Polypodium hesperium Maxon	western polypody

The type locality for *Botrychium ascendens* is a montane meadow surrounded by groves of lodgepole pine end Engelmann spruce. Photo by Ed Alverson.

References

Ahlenslager K, Lesica P. 1996. Observations of *Botrychium x watertonense* and its putative parent species, *B. hesperium* and *B. paradoxum*. Amer. Fern J. 86(1):1-7.

Alverson, ER. 1989. *Cryptogramma cascadensis*, a new parsley-fern from western North America. Amer. Fern J. 79(3):95-102.

Alverson ER. 1993. Recent taxonomic changes for Oregon ferns and fern allies. Kalmiopsis 3:16-23.

Bishop EM. 2003. In Search of Ancient Oregon. A Geological and Natural History. Portland (OR): Timber Press.

Flora of North America Editorial Committee, eds. 1993. Flora of North America North of Mexico. Volume 2. Pteridophytes and Gymnosperms. New York (NY) and Oxford (UK): Oxford University Press.

Frye TC. 1934. Ferns of the Northwest. Covering Washington, Oregon, Idaho, British Columbia, Montana, Wyoming, Central and Northern California. Portland (OR): Metropolitan Press.

Hitchcock, CL, A Cronquist. 1973. Flora of the Pacific Northwest. An Illustrated Manual. Seattle (WA): University of Washington Press.

Love RM. 2007. Pioneer botanist William Cusick: his dark and silent world. Kalmiopsis 14:8-16.

Mason G. 1980. Guide to the Plants of the Wallowa Mountains of Northeastern Oregon. 2nd Ed. Museum of Natural History. Eugene (OR): University of Oregon.

Smith AR, Pryer KM, Schuettpelz E, Korall P, Schneider H, Wolf PG. 2006. A classification for extant ferns. Taxon 55(3):705-731.

Stensvold M, Farrar D, Johnson-Groh C. 2002. Two new species of moonworts (*Botrychium* subg. *Botrychium*) from Alaska. Amer. Fern J. 92(2):150-160.

Wagner WH, Wagner FS. 1983. Genus communities as a systematic tool in the study of new world *Botrychium* (Ophioglossaceae). Taxon 32:51-63.

Wagner WH, Wagner FS. 1986. Three new species of moonworts (*Botrychium* subg. *Botrychium*) endemic in western North America. Amer. Fern J. 76(2):33-47.

Wagner WH, Wagner FS. 1994. Another widely disjunct, rare and local North American moonwort (Ophioglossaceae: *Botrychium* subg. *Botrychium*). Amer. Fern J. 84(1):5-10.

Zika PF, Alverson ER. 1996. Ferns new to the Wallowa Mountains, Oregon. Amer. Fern J. 86(2):61-64.

Ed Alverson serves as Willamette Valley Stewardship Ecologist for The Nature Conservancy, a position he has held since 1991. He completed a Masters of Science degree in botany (biosystematics of the fern genus *Cryptogramma*) in 1989 at Oregon State University, and has been working as a field botanist in the Pacific Northwest for over 25 years. He has written over 40 technical and popular articles about the flora and vegetation of this region, and his photographs have appeared in a variety of publications including cover photos on Art Kruckeberg's book, "Gardening with Native Plants in the Pacific Northwest" and the cover of the recent book "Restoring the Pacific Northwest: The Art and Science of Ecological Restoration in Cascadia." Ed's interests include pteridology, floristics and biogeography of the Pacific Northwest, and the conservation and management of prairie and oak habitats in the Willamette Valley-Puget Trough-Georgia Basin Ecoregion. He lives with his family in a 100+ year old house in a former oak savanna in the suburbs of northwest Eugene.

Peter Zika is a taxonomist at the herbarium of the University of Washington in Seattle. He conducts biological inventories of National Parks and Nature Conservancy Natural Areas. His research interests include interactions between noxious weeds and native wildlife and diets of fruit-eating birds. Recent research has focused on jewelweeds (*Impatiens*), rushes (*Juncus*), fleshy-fruited Rosaceae, and holly (*Ilex*). For amusement he occasionally lectures on eco-cruises in the tropics and polar regions, and has visited more than 80 countries. Peter has written the treatments for *Botrychium* and several other genera for the Oregon Vascular Plant Checklist, and contributed to the forthcoming revision of the Jepson Manual, as well as the nearly completed Rosaceae volume of the Flora of North America.

Thomas Jefferson Howell and the First Pacific Northwest Flora

Robert Ornduff
University of California, Berkeley

Edited for publication by Rhoda M. Love, Cindy Roché and Art Kruckeberg
(Adapted from an essay that will appear in Plant Hunters of the Pacific Northwest, edited by A. R. Kruckeberg and R. M. Love)

Howell's mariposa (*Calochortus howellii*) in the Illinois River Valley, Josephine County; there are brown hairs above the greenish gland. Photo by David McClurg.

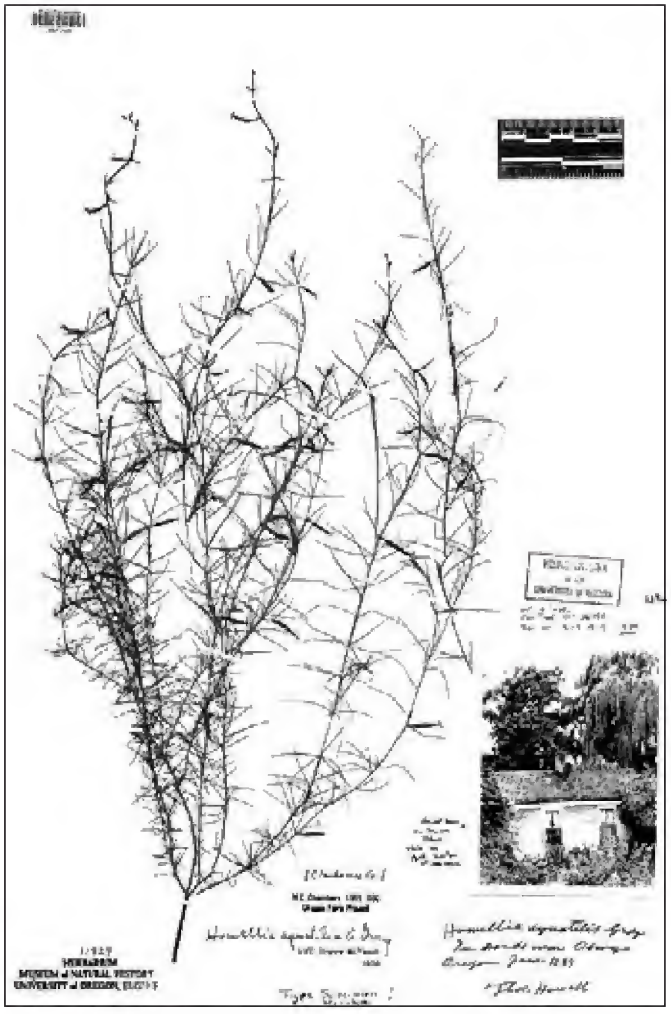
Thomas Jefferson Howell (1842-1912), Oregon's earliest pioneer botanist, was a man of great determination. Despite being desperately poor and only semi-literate, Howell created the first regional flora for the Pacific Northwest, self-published as a series of seven fascicles (Lange 1953). After years of gathering information for a compendium of the flora, he began writing in 1882 when he was 40 years old. The first fascicle appeared fifteen years later and the last was published in August 1903, nine years before Howell's death. The *Flora* consisted of 792 pages (plus a 24-page index) and described 3,150 species of which 89 were newly described by Howell. The seven-volume set was priced at five dollars and, although praised by fellow botanists, was a financial failure for its author.

Howell botanized extensively in Oregon and southern Washington, collecting tens of thousands of specimens, many of which he sent to Eastern herbaria (e.g., the Gray Herbarium at Harvard University) or sold to other botanists (later distributed to major herbaria of the US and Europe). As the last fascicle of his flora was being printed, Howell donated approximately 10,000 specimens from his personal collection (dating from 1875 to 1904) to the University of Oregon, and was paid $500 during the 1903-04 school year to curate his collection (Wagner 1994).

Having a keen botanical eye, Howell discovered numerous new species, including many from the Siskiyou Mountains of Curry and Josephine counties (Chambers 2002). Early in his botanical career Howell made two significant discoveries. The first of these (in 1878) was an aquatic annual he collected with his brother Joseph from a pond near the family farm on Sauvie's Island in the Columbia River west of Portland. It was described in 1879 as *Howellia aquatilis* (Campanulaceae) by Asa Gray, who dedicated this monotypic genus to its "discoverers who are assiduous collectors and acute observers and who have already much increased the knowledge of the botany of Oregon" (Gray 1879).

Thomas Howell's second major discovery was made in 1884, when he collected a new species of spruce along Happy Camp Trail in Siskiyou County, California. The following year this "most remarkable species...singularly different from... any other conifer" (Jepson 1909) was described by Sereno Watson, who named it *Picea breweriana,* after William Henry Brewer (1828-1910) with the California State Geological Survey, co-author with Watson of the *Botany of California* (1876-1880). Watson (1885) wrote that he named this conifer to "compliment" Brewer, who had an "especial interest in the trees of the coast." Ironically, in the fall of 1863 Brewer had visited Happy Camp and the surrounding region (Farquhar 1949), where he almost certainly encountered, but did not recognize as new, the spruce that was later to be named after him and not after its discoverer.[1]

[1]Other references (Sudworth 1908, Griffin and Critchfield 1976) indicate that the actual discoverer was Josiah Whitney who found the weeping spruce from near Castle Crags (California) in 1862 and gave a sample to Brewer, as recorded in Brewer's journal. The following year Brewer found the spruce near Mt. Shasta, and collected a branchlet. Because these collections lacked cones, Watson could not describe the new species. Perhaps the tree should have been named *Picea howelliana*, because Watson used Howell's specimen as the type for the species. On the other hand, a better name might have been *Picea pendula*, describing the distinctive drooping branches.



Herbarium sheet of *Howellia aquatilis* collected by T. J. Howell from the type site on Sauvie Island, with photo of the Howell family cabin on the island. (This house has since been demolished.) Courtesy of OSU Herbarium. Photo of Howell house by A. R. Sweetser, c. 1935.

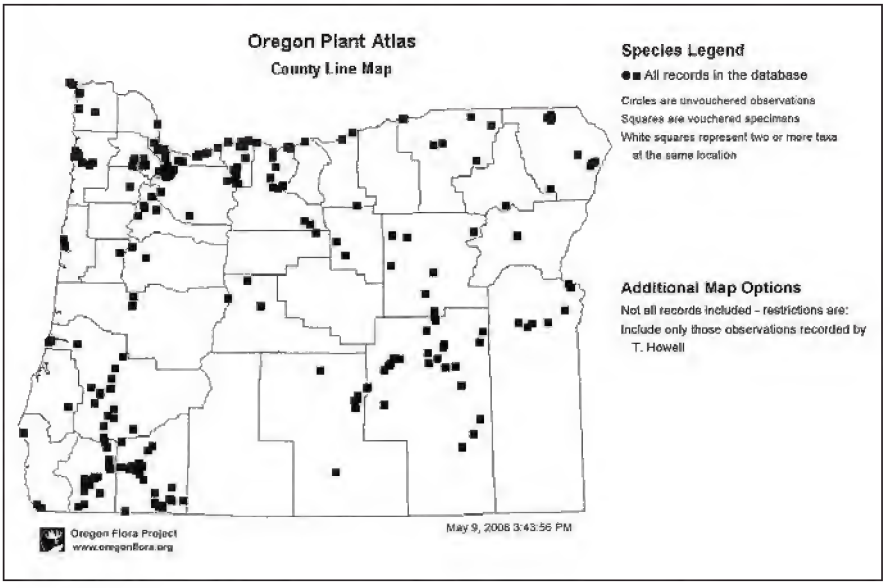
At least 27 taxa still bear Howell's name, although some are now varieties or subspecies (see side bar on page 40). The one genus named for him has only a single species, the federally threatened *Howellia aquatilis*. The range of this delicate annual extends inland from the northern Willamette Valley and the Pacific coast states to Idaho and Montana. In addition to the taxa named for him, Howell also named over 175 taxa, of which 57 are currently accepted by the Oregon Flora Project (pers. comm., Katie Mitchell, from the OFP database).

Three Months in School

Thomas Jefferson Howell was born in Cooper County, Missouri, on October 8, 1842, the youngest of five children of Benjamin and Elizabeth (Matthews) Howell: Joseph (b. 1829), John Benjamin (b. 1831), Sarah (b. 1833), Rebecca (b. 1839), and Thomas Jefferson. Benjamin's mother was Sarah Rittenhouse, a descendent of David Rittenhouse, colonial Pennsylvania mathematician and philosopher. Benjamin did not wish to live in a slave state, so in 1850 his family joined others in a small wagon train that left Missouri in April and arrived in Oregon in October. The family first settled at Hillsboro, then moved in 1851 to Sauvie's Island (the official name is Sauvie Island, but residents of the region refer to it as Sauvie's Island), where the Willamette River empties into the Columbia. Although Thomas's father was trained as a physician, he did not practice medicine, but instead assumed possession of a 240-acre land claim on the island in 1853, which he and his three sons further cleared and farmed. It was here that Thomas and his two older brothers, John and Joseph, lived for many years (Lange 1953, Vaughan 1974). John and Joseph lived on Sauvie Island for the rest of their lives, while Thomas later lived at various locations in and around Portland.

Thomas Howell's formal education consisted of only three months in 1855 at the first school built on the island. Otherwise, he and his brothers were self-taught via reading, with help from their father. As a youngster Thomas became interested in learn-

Brewer spruce *(Picea breweriana)* on Little Grayback Mountain between Happy Camp, California, and Cave Junction, Oregon. Photo by Timothy D. Ives, 2002.



Map of Howell's collection locations in Oregon. Howell collected multiple specimens at each site.

ing the names of plants that grew wild near his home on Sauvie's Island. As he began collecting and describing plants, he developed a strong interest in the science of botany (at the same time losing enthusiasm for farming). In 1877, at the age of 35, he published a 22-page *Catalogue of the Flora of Oregon, Washington, and Idaho*, a work that he later referred to as "an advertisement" because he was selling plants, both pressed and living. This was updated four years later and followed in 1883 by the *Catalogue of the Plants of N. Western America* and in 1887 by the 28-page *A Catalogue of the Known Plants (Phaenogamia and Pteridophyta) of Oregon, Washington, and Idaho* (price: 25 cents). According to the preface of the latter, it listed 2,152 species and 227 varieties (Lange 1953). Howell also learned from fellow botanists during collecting trips, as described in a 1929 letter from Louis F. Henderson to noted California botanist Willis L. Jepson:

> *"... We made many excursions in Oregon, going from the coast to the limit of vegetation in the mountains, and always friends. Though he read a great deal, owing to lack of early education, he was greatly handicapped. ... He was especially ignorant, as you tell me you realize, of Latin or Greek. So I used to spend a good deal of the time as we traveled about in our wagon in going over with him the common rules of English grammar and conversation, and in trying to at least teach him the three genders of the common Latin adjectives. Even in this I did not succeed very well, as you and many others have realized from his improper endings"* (Lange 1966).

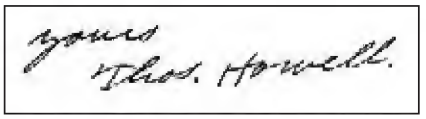
Although Howell's grasp of spelling common English words was deficient (as seen in letters below), he carefully taught himself to spell plant names and Latin descriptions.

Howell's Letters

Much of what we know of Howell comes from his correspondence with botanists who saved his letters, including E. L. Greene, Sereno Watson, W. N. Suksdorf, C. V. Piper, W. L. Jepson, George Vasey, and B. L. Robinson.

Howell corresponded with Greene (1843-1915) for nearly a decade and a half, starting when Greene headed the Botany Department at Berkeley. Approximately 90 letters from Howell to Greene are filed at Notre Dame. Greene was an important source of taxonomic information, identifications, financial assistance (as loans), and provided a journal for publishing some of Howell's articles. Greene was better educated and better situated academically than Howell, but on several occasions Howell's botanical opinions differed from Greene's, usually on matters of identification. Clearly, Howell was a keen observer of plants in the field and knew the flora of the Pacific Northwest intimately, whereas Greene did not. Throughout their voluminous correspondence, Howell addressed Greene as "Mr. Greene" and usually signed his letters "Thos. Howell." His letters seldom strayed from botanical matters, and since only one of Greene's letters to Howell apparently exists, one can only surmise from Howell's replies what Greene wrote to him. After leaving Berkeley in 1884, Greene went to the Catholic University of America in Washington, DC, then in 1915 (the year of his death) to the University of Notre Dame, which is where his correspondence is archived. The earliest letter from Howell preserved there is dated 10 December 1890, and was written from the National Hotel in Portland ("terms, $1.00 per day").

In April 1897, Howell wrote concerning the names of various lupines. He was apparently responding to Greene's comments on Howell's lupine manuscript. Howell admits his own errors, agrees that Greene is correct about some misidentifications, but also disputes Greene on some issues. A bit of Howell's taxonomic philosophy is inserted: "As I do not beleave [*sic*] in varieties I will leave No. 1918 to you." He concludes with "If you could put in one season here among the Lupines, I think you would find, as I have, that they are in grate [*sic*] confusion." In his rejection of varieties, Howell may have been heavily influenced by Greene, whose religious beliefs led him to regard each kind of plant as a separate species created by God; to acknowledge variation was to accept Darwin's concept of evolution. In the final version of his Flora, Howell included over 50 varieties, even though he writes in his preface that he has "raised nearly all published varieties of the region embraced in this work to specific rank" (Howell 1897-1903).



Characteristic signature of Thomas Jefferson Howell.

Botanical Specimens for Sale

Howell traveled widely throughout the Pacific Northwest collecting plants, which he pressed, labeled and sold. Because he lacked references and herbarium specimens with which to identify his collections, Howell sent them to botanists elsewhere for identification. His coterie of identifiers included George Vasey (1822-1893) of the U.S. Department of Agriculture in Washington, DC (grasses), L. H. Bailey (1858-1954) at Cornell University (sedges), Asa Gray (1810-1888; Gamopetalae) and Sereno Watson (1826-1892; Polypetalae), both at Harvard University (Lange 1953).

By 1887 Howell had enough confidence in his knowledge of the Northwest flora to write a chiding letter to America's botanical leader, Professor Asa Gray of Harvard, pointing out problems with Grays' recent treatment of the genera *Lewisia* and *Calandrinia* in the family Portulacaceae (Gray Herbarium archives, Harvard).

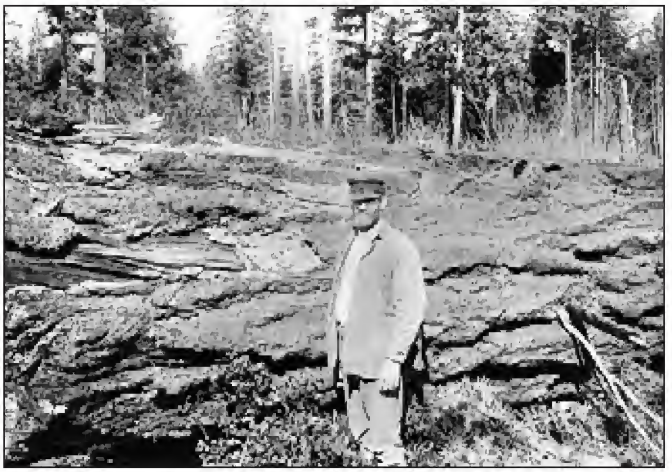


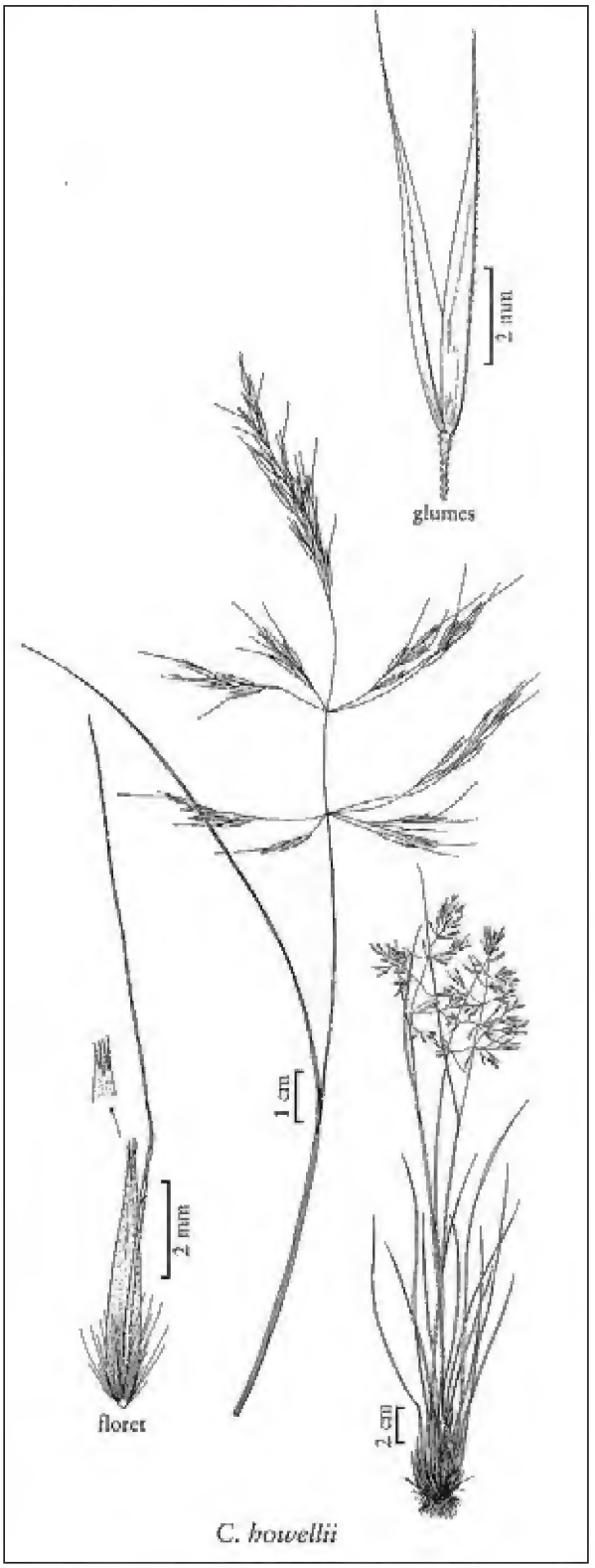
Photo of Thomas Jefferson Howell taken in the field standing in front of a giant Douglas fir log. The date, photographer and place are unknown, but the size of the log suggests a location near the Pacific coast. Photo courtesy of Hunt Institute for Botanical Documentation, Carnegie Mellon University, Pittsburgh, PA.

Modern botanists agree that Gray, who was only a year away from death at the time, was not "up to snuff" on these groups of plants (T. J. H. to A.G., March 28, 1887, Gray Herbarium, Harvard; K. Chambers to R. M. Love, October 2, 2007). Letters from Howell to Sereno Watson between 1884 and 1887 also take Watson to task for some of his identifications. By 1887 Howell had begun naming plants on his own: "I had these on hand and could not distribute them until they were named; and I have to sell all I can to pay the very heavy expense of collecting in this country" (Gray Herbarium archives, Harvard).

An important source of Howell's financial support, pressed specimens were offered for sale via a number of price lists that were sent to prospective customers. If relatively few specimens were ordered they were priced at 8 to 10 cents each, but larger orders reduced the prices to 4 to 8 cents per specimen. Howell's last price list was issued in 1896. If Howell kept field notebooks these have not survived (Lange 1953).

It is probable that Greene made Howell an offer to collect living plants for the new botanical garden of the University of California founded by Greene and W. L. Jepson in 1890. On April 11, 1892, Howell wrote:

> "*I cannot accept your offer to work exclusively for the University of Cal. I have always asked and received $5.00 per day and all expenses paid whenever I have done any of that work and I have done considerable of it; As none but dealers can afford to pay that price as a rule, and if they find I have worked for you at a low rate it will interfere with business. But I will make you this offer as I will be near Waldo* [Josephine County, Oregon] *during the latter part of this month I will collect and ship to you all the perennial plants and shrubs that I think will do to ship this spring and note the localities of others so that I can get them next fall. For this I will charge you 10 cents each for all that I send that is 10 cents for each plant and will send as many of each species as you want...I will also make you as many herbarium specimens as you want of anything that grows there at $4.00 per hundred.*"



Howell collected the type for cliff reedgrass (*Calamagrostis howellii*) at Hood River the year before Henderson wrote during their 1882 botanical exploration that they "discovered on the rocks that peculiar, light-colored grass, known as *Calamagrostis howellii*, and named by Vasey." Illustration by Cindy Talbott Roché and Annaliese Miller, copyrighted by Utah State University, reprinted with permission.

In a letter of June 28, 1892, Howell asked if Greene wanted living bulbs of species of *Erythronium*, *Camassia*, *Calochortus*, *Hastingsia*, *Lilium* and "anything else I can get." (There is no record of Howell having actually done this work for Greene.) Apparently, Greene persisted in his efforts to employ Howell for collecting herbarium specimens. On 22 March 1893 Howell responded:

> "*I have never been able to work for you because I did not think that you wanted to pay me what I could afford to take. As you know, traveling expenses are high in Oregon, and my time is worth something so if I worked for you I would not make ordinary wages unless you could pay me five dollars per day. Or I could work for you at two dollars per day and all expenses paid. ...for either of these prices I would go to any part of the Pacific coast States and collect anything that I could that you would want; and make as copious field notes as you would like...If you want me at the above price I will be at your service whenever you want me to go, but I would like to know what you think of it as soon as convenient.*"

(Because replies from Greene to Howell have not survived, we do not know if Greene contracted with Howell to collect plants.)

"Thus is the Breed of Botanists Recognized"

Fellow pioneer botanist, Louis F. Henderson (1853-1942), who at that time taught in the Portland public schools, described Howell as a "great friend of mine," and visited him frequently (Love 2001). In 1882 they traveled together by horse and wagon to Tillamook Bay, then to Mt. Adams. At Tillamook Bay, Henderson (1932) recalled they rowed out to the spit: "*Here we lived for 2 days, literally combing the dunes, tide-lands, and even shallows*

Thomas Jefferson Howell as a young man. Courtesy of Oregon Historical Society, #OHS54432.

for specimens. Most of the plants we gathered were already known to the books, but a few were new species, as we afterwards found out. Among these were the grasses Poa macrantha *and* Poa confinis*, both named by Vasey, and* Sanicula howellii*, of Coulter and Rose.*" [*Poa macrantha* was based on a later 1887 collection by Howell at the mouth of the Columbia River, but *P. confinis* was based on a collection made during the visit to Tillamook Bay. *Sanicula howellii* is now referred to *S. arctopoides* Hook. & Arn.] On their way up the slopes of Mt. Adams, fallen trees and dense brush impeded their progress until, as Henderson (1932) later recalled:

> *"Howell himself made a most surprising proposition. It was that we both get out and walk, he driving the team and I catching hold of a wheel and helping team and wagon over the logs!... Thus, by very exhaustive work, we were able to reach the snow line and a most beautiful camping spot by night. And the glory of those subalpine and alpine slopes.... Stock, especially sheep, had not ruined the native pasture at that time, and there were succulent bunch and other grasses up to your knees....Probably the most beautiful and succulent of these grasses is* Festuca viridula*, then a new species and found by us for the first time on Mt. Adams, though Suksdorf, who was up there at the same time with a band of sheep, first sent it to Vasey.* [*F. viridula* Vasey, however, is based on a California collection made by H. N. Bolander.] *This grass and some of the other bunch-fescues were then so abundant on the open slopes, that a horse when picketed amongst them by a 40-foot rope would eat his fill and lie down without finishing his forage within the radius of his rope. Now one has often to travel miles before he will see a stalk of these grasses and then only when protected by rocks or brush. On this same trip we found the then unpublished prickly Gooseberry, named* Ribes ambiguum *by Watson, but later changed to* Ribes watsonianum [by Koehne, since *R. ambiguum* had been pre-empted]*."*

It is probable that Henderson induced Howell to assign field numbers to the collections made on this trip, since the holotype of *Sanicula howellii* Coult. & Rose is Howell no. 16.

In 1895 Howell spent two months collecting along the southern coast of Alaska with his friend, Portland amateur botanist Martin W. Gorman (Bornholdt 2006). Seven years later, Gorman visited W. L. Jepson in Berkeley, describing for the latter some of their adventures. In his own field-book entry for 20 January 1902, Jepson noted that Howell used his

> *"… knowledge of engine-running in his trip to Alaska with Mr. Gorman. The two went in a little steamer. They anchored one day in a little inlet and went off to a mountain top which they saw in the distance to botanize. They returned at night to find that the 24 ft. tide had run out with such velocity that the anchor had (luckily) dragged and carried the steamer out into deep water where they managed to get aboard of her and resume their journeying. Mr. Gorman crossed the path of Tarleton who was collecting in Alaska. Some prospectors coming down the Yukon one day shouted to him 'Say, there's a fellow like you up the river!' Thus is the breed of botanists recognized. Gorman is a man of 50 or 55, gray hair, more or less bald, rather prominent features, blue eyes, clean decisive way of speaking and evidently a first-rate observer ."* [John Berry Tarleton (1849-1921), botanical collector in the Yukon, 1898-99. Tarleton's Yukon collections are housed at the New York Botanical Garden.]

Publishing his Finds

Howell sent his manuscripts to two western journals: *Erythea*, published by E. L. Greene and W. L. Jepson at the University of California, Berkeley, and *Mazama*, published by the Portland mountaineering club (The Mazamas). Howell's article in the first issue of *Mazama* on the flora of Mount Hood above 2,000 feet listed 272 species and was for decades the only published account of the flora of that peak (Lange 1953). Howell also published articles in the early numbers of *Erythea*. In a letter from Clackamas on January 2, 1895, Howell wrote to Jepson, accompanying a manuscript for *Erythea* describing some new species:

> "*My library is small, and some of the names I have suggested may be ocupied [sic] without my being able to find it out; if so that you know of please suggest others in their stead and publish without further advise [sic]. With this I send you type specimens of the new species described, for the University herbarium, but I see on packing them that* Mitella Hallii *is missing, and my herbarium is about 20 miles from here, so it is not possable [sic] to send it now, but will do so later.*"

On October 16, 1895, Howell responded in detail to Jepson's questions about *Darlingtonia*: "The geological formation there is a peculiar kind of serpentine and much of the lower parts of the mountain is well supplied with springs that run clear water all

the year round." Thus Howell went on record as one of the first western botanists to recognize the importance of edaphic factors in plant distribution.

"Never Saw a Man with So Much Fortitude"

Howell supported himself in various ways. During his early years he helped farm the property on Sauvie Island. From early 1873 until mid-1876 he served as postmaster of the Willamette Slough post office on Sauvie Island. This post office was later changed to Arthur, a name that appears as the place of publication of his early catalogues. After 1895 the catalogues and price lists were issued from Clackamas, Oregon. From early 1904 to early 1906 Howell was postmaster at the Creighton (later Oak Grove) post office. At other times he ran small grocery stores in Clackamas, Milwaukie, and Portland.

On November 12, 1893, when Howell was 51, he married Mrs. Effie McIlwane (née Hudson) who was a widow with one daughter. Howell and Effie had two sons: Dorsey Richard Howell, born October 28, 1894, and Benjamin Allen Howell, born May 29, 1904. Effie verified that the family moved frequently. She listed the following living places: Oregon City, Willamette Falls, Oak Grove, Hood Street, and Woodstock ("about an hour's ride from Portland") (A. R. Sweetser files, UO Archives and Special Collections.)

In the field-book entry mentioned above, Jepson wrote further of Gorman's visit to Berkeley:

Thomas Jefferson Howell and his older son, Dorsey Richard Howell, near the falls of the Willamette River in 1900. Courtesy of Oregon Historical Society, # OrHi88298.

Howell in 1910, proudly displaying a bound copy of his ground-breaking A *Flora of North America*. The photo was taken in Howell's small grocery store in Portland by Huron H. Smith of the Chicago Field Museum. Smith traveled west specifically to congratulate Howell on his remarkable achievement. AR. Sweetser papers, Ax75 Special Collections and University Archives, University of Oregon Libraries.

> *"Gorman said that 'Howell is very poor but he never saw a man with so much fortitude.' He is very poor, having lost the money he received from the sale of his share of his father's estate in 'unfortunate' investments. He was really taken in and fleeced by Portland sharpers. One man promised him an income of 300 a year, 25 a month, if he would put in 3000. Mr. Howell felt that he could live on $25 a month in his simple way and work on his flora. But he never got back a cent either in interest or principal. Another man who was looking for suckers got him into a laundry business scheme and in addition got his signature to certain notes for machinery and then skipped out."*

Later, at the end of July 1906, after Howell's complete Flora had been published, Jepson paid him a visit in Oregon, making the following entry in his field-book:

> *"called on Thos. Howell. He is building a house for himself and family in the 'woods' or clearing near Oregon City. … Howell is a man below medium height, his hair brown & gray, shortish full beard. reddish face, blue eyes, slightly Roman nose. … He is very very lame now and walks with a cane. Yet each day's bread must be earned he says. He has a wife - not a bad-looking woman, in fact rather comely - a* [step-]*daughter*

of 17, etc. I did not ask about his family but so much I saw - a boy of 12, doubtless of the family. [Howell's younger son was 2 at this time.]... *It is too bad to see him so miserably poor. He came into Portland with me and [I] insisted on his taking lunch with me but he would allow only a few simple things to be ordered for him."*

Four years later, Huron H. Smith of the Field Museum in Chicago traveled to Portland in order to spend a day with Howell. At that time Howell operated a small grocery-candy store on Hood Street, Portland, where he also lived. Smith reported that Howell was living under very reduced financial circumstances and in his spare time manufactured teamsters' mittens on a sewing machine, for which he received seven cents per pair. In spite of this, Howell was "very cheerful at all times and betrayed no impatience with depressing external conditions" (Lange 1953). At this time Smith took the photograph of Howell holding his completed Flora.

"Throwing away life itself"

Howell's surviving correspondence with E. L. Greene gives us a hint of the heroic efforts involved in completing his magnum opus, *A Flora of Northwestern America* (1897-1903). On 6 May 1896 (a year before his first fascicle appeared in print), he wrote:

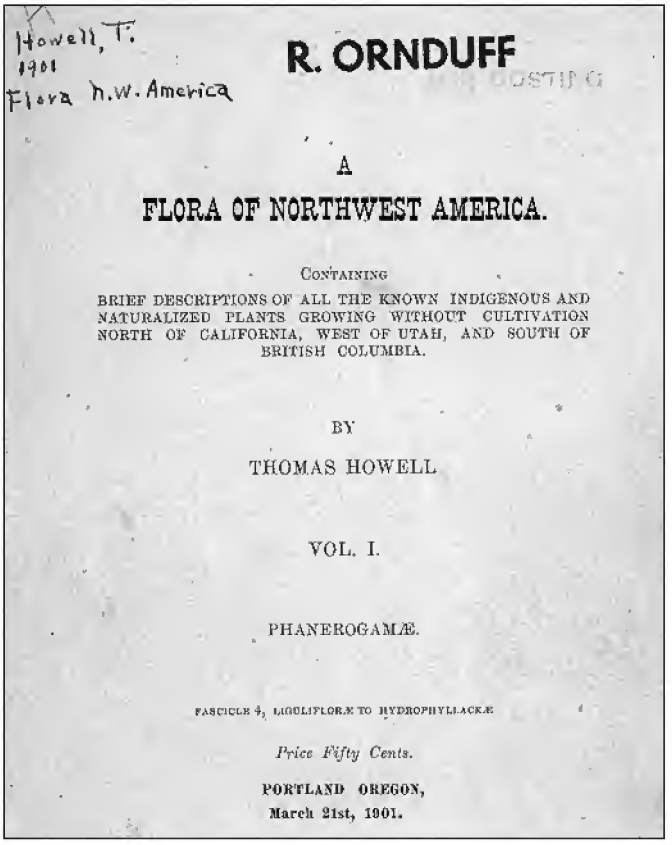
"*Your somewhat surprising though highly prized letter of April 30th has just come to hand and I hasten to answer it to disabuse your mind of any mistakes that you may labor under in regard to me and my work. ... Nothing would please me more than to have you pass upon every page of my proposed Flora before it gose [sic]to press; can you point out the way that this can be done* [as?] *can you show me how I can get it published at all? There is no one here that can do the work except under my direct supervision and then they want double price for doing it, and want their pay in advance and this I am unable to meet for I have been reduced to poverty by some unfortunate investments. As to the pages already printed they will probably never be distributed in their present form, for the parties that undertook to* [do?] *the printing have just gone back on their contract, and refuse to do any more of it on any terms that I can meet. This leaves me on the verge of despair[sic] for the manuscript that I have represents ten years work of the best part of my life and to loose [sic]it now looks to me like throwing away life itself. I shall next try the American Book Co., but I fear in order to get them to publish it I shall have to alter it so much that it will not be satisfactory to me or any other botanist. If you can siggest [sic] any better plan than this it will please me greatly*" (Lange 1955).

And on 1 Oct 1896:

"I see you still have the impression that I intend to have illustrations in my proposed book, which I wish to assure you is not the case for I never had any intention of illustrations at all: the plates spoken of are book plates that is electroplates of the text and not illustration plates. There are two ways of making a smaller book of it. One is to condense the descriptions and thereby make them worthless. The other is to leave out a large part of the species and make an incomplete work. There are about 3500 species of plants in the teritory [sic] that I propose to cover, and nine tenths of them grow in Oregon so you see that it will not reduce the book much to reduce the teritory [sic]. I have made a careful estimate and find that I can have 1000 copies of 100 pages published here for $1000. I can do this so cheap because I have a pretty fair printing outfit of my own And I have orders on hand now to assure the sale of 1000 copies in less than two years at $2.50 per copy. With $500.00 I could get the book out next spring but I have no way of getting that amount now..." (E. L. Greene files, Notre Dame).

Portland printers apparently were unwilling to cope with the technical terminology of the flora and with Howell's often illegible handwriting, so Howell himself set the type at home in sets of eight pages, which he then took to a printer (Kruckeberg and Ornduff 2003). As noted earlier, Howell's scanty formal education was reflected by his idiosyncratic and inconsistent spellings of words; he was more accurate with technical terms than with ordinary English. Gorman assisted Howell by reading copy and correcting proofs, but numerous errors slipped by him. On March 15, 1897, the first paperbound fascicle of *A Flora of Northwest America* appeared, consisting of 112 pages and priced at 50 cents. As a reflection of Howell's difficulties with spelling and proof-reading, the title page read *A flora of northwhst [sic] America*, but this error was caught and quickly remedied and the phrase "Entered according to Act of Congress..." was added.

The only known surviving letter to Howell from Greene was the latter's May 17, 1897 reaction to the first published fascicle. Greene included a gift of forty dollars, but provided a long, harsh, and basically negative review. He pointed out a plethora of perceived


Howell, T.
1901
Flora N.W. America

R. ORNDUFF

A

FLORA OF NORTHWEST AMERICA.

CONTAINING
BRIEF DESCRIPTIONS OF ALL THE KNOWN INDIGENOUS AND NATURALIZED PLANTS GROWING WITHOUT CULTIVATION NORTH OF CALIFORNIA, WEST OF UTAH, AND SOUTH OF BRITISH COLUMBIA.

BY

THOMAS HOWELL

VOL. I.

PHANEROGAMÆ.

FASCICLE 4, LIGULIFLORÆ TO HYDROPHYLLACEÆ

Price Fifty Cents.

PORTLAND OREGON,
March 21st, 1901.

Cover of *A Flora of Northwest America* by Thomas Howell, Vol. 1, Fascicle 4. This fascicle was formerly in the libraries of botanists Henry Oosting of Duke University and Robert Ornduff of Berkeley.

errors which he stated were, "...born of your too great hurry [which] will tell against your book.... [These]...are so innumerable that I shall not be surprised if reviewers ... say that a great book was presumptuously undertaken by a man who could not spell... if they review it at all" (A. R. Sweetser Papers, University of Oregon Archives).

Jepson (1897) reviewed the first fasicle much more positively in *Erythea,* commenting editorially on a few matters, noting that the work was "cyclopedic rather than critical," and that Howell's "personal observations color the completed product." Otherwise, he was sympathetic to Howell and his work, stating that "What he [Howell] has done has been to bring together in a usable form, in the light of his field knowledge (and no other botanist knows so well the plants of these states) all that has been published concerning the flora of the region…The author has not spoken of difficulties, but difficulties must have been many in a region in which library and herbarium facilities are meager."

Darlingtonia in Thomas Jefferson Howell fen near Kerby, Illinois Valley, Oregon. Photo by AR Kruckeberg.

He concluded that "Mr. Howell, therefore, deserves no small meed of praise for the courage and resolution necessary in the face of such circumstances." The second fascicle was published about a year later, on the first of April 1898, the third fascicle on August 21, 1900. Subsequent fascicles appeared at irregular intervals, and the last one (#7) was published on August 10, 1903 (Stafleu and Cowan 1979). The print run was 1,000 copies; the few that remain are now collector's items. (Oregon State University and the University of Oregon own full bound sets.)

Howell's Legacy

On December 3, 1912, Thomas Howell died at the age of 70 at Woodstock, after a long illness. His older brother Joseph died two months before Thomas; both are buried in the family plot at Vancouver (Greene 1913). At the time of Howell's death his sons were 18 and 8 years old. Later his widow Effie remarried and moved to Filer, Idaho, becoming Effie M. Faust or Mrs. G. W. Faust. Apparently, troubles plagued the *Flora* even after Howell's death. In a letter to A. R. Sweetser in December 1935, Effie wrote:

> "*After Howell died I got an order for books from J. K. Gill at $5.00. The oldest boy and myself put them in book form and carried them to the binder. The rest we put in boxes and nailed them up. My health became so poorly that the doctor sent me to Tillamook. When I got back somebody broke into the house and destroyed all of them. Just think of it, five thousand dollars of books, so I had nothing left. It sure was a hard hit for me as I had to care for the two boys.*" (A. R. Sweetser Papers, University of Oregon Archives, copies in OSU Herbarium files.)

Where does Thomas Jefferson Howell fit in the pantheon of Western botanists? Per Axel Rydberg (1904), author of the *Rocky Mountain Flora*, highly commended Howell's *Flora*: "*Few can imagine what such an undertaking means, what difficulties are met with and what an amount of work is needed… Mr. Howell had to work far away from libraries with scarcely any other facilities than those afforded by his private library and collection [and thus] the excellence of the work is really surprising.*"

After Howell's death, Greene wrote that Howell "accomplished the greatest amount of meritorious and valuable scientific work that was ever done by any man of any epoch, on so very rudimentary an education in letters." Jepson added that Howell had "organized diagnoses of genera and species scattered in the works of many writers into a pioneer flora which, considering the circumstances of its production, is balanced, judicious, and highly useful. Few men leaving so durable a contribution to American botany have led so obscure an existence as did Howell." The words of Louis F. Henderson, in a letter to Willis L. Jepson, give Howell high praise: "Had he a good college education, I think he might have been one of the great systematists of the United States" (Lange 1966). Although in subsequent years, state and regional floras were issued in the area covered by Howell's Flora, 60 years elapsed before it was fully superceded, by *Vascular Plants of the Pacific Northwest* (Hitchcock *et al.* 1955-1969).

Howell will thus be remembered as one who advanced the study of botany despite conditions of extreme hardship. Forever impoverished, barely able to support his family, he nevertheless made outstanding contributions to the botanical knowledge of the Northwest. Alice Eastwood (1898) summarized Howell's publication of his pioneering and encyclopedic *Flora of Northwest America*:

> "*The conscientious striving for truth which distinguishes the work of this botanist, his independence in asserting his own views, and his thorough, careful work, command our respect; while the enthusiasm and self-denial which have resulted in the publication of a work of this magnitude by an author comparatively poor in money, at his own expense, commands, again, our admiration.*"

Acknowledgements

The editors thank Kenton L. Chambers for his close reading of the manuscript and many helpful suggestions. Susan Kephart and Frank Lang also contributed to the review.

T. J. Howell's itineraries in Oregon based on Oregon Flora Project records

Compiled by Rhoda Love

1875: Clackamas County, base of Mt. Hood.

1876-1880: Douglas, Columbia, Washington, Multnomah, Hood River, and Wasco counties.

1881-1885: heavy collecting throughout much of Oregon; Douglas, Curry, Jackson and Josephine in SW, most Willamette Valley counties, Deschutes, Wasco, Umatilla, Grant, Harney, Lake, Wheeler, and Jefferson counties in E. (including the long trips with Henderson to the Oregon coast and Mt. Adams in 1882).

1886-1890: Douglas, Jackson, Josephine, Willamette Valley counties, Umatilla, Grant, and Harney.

1891-1895: Douglas, Jackson, Josephine, northern Willamette Valley, Harney County; Columbia River near The Dalles.

1896-1900: Douglas, Jackson, Josephine, Multnomah, Clackamas and Umatilla counties.

1901-1903: Linn and Clackamas counties; in 1903 Howell deposited his personal herbarium at the University of Oregon.

1904-1912: single specimen of *Aster hallii* (now *Columbiadoria hallii*) from Marion County in 1905.

Known Publications of T. J. Howell

1873 "Howell's price list of plants"

1877 *Catalogue of the Flora of Oregon, Washington, and Idaho*

1881 Catalogue of the Flora of Oregon, Washington, and Idaho

1883 *Catalogue of the Plants of N. Western America*

1883 The geological distribution of North American forests. Popular Science Monthly 23:516-524.

1887 *A Catalogue of the Known Plants (Phaenogamia and Pteridophyta) of Oregon, Washington, and Idaho.*

1893 A rearrangement of American Portulaceae [*sic*]. Erythea 1:29.

1893 New Plants of Pacific Coast. Erythea 1:109.

1893 Note on *Sedum radiatum*. Erythea 1:144.

1895 New species of Pacific Coast plants. Erythea 3:32.

1895 Distribution of *Darlingtonia* in Oregon. Erythea 3:179.

1895 The flora of Mt. Hood. Mazama 1:28.

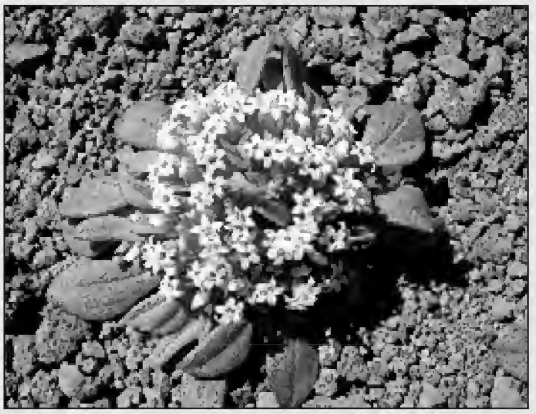
1895 The flora of Mt. Adams. Mazama 1:68. (Co-author, William N. Suksdorf)

1897-1903 A Flora of Northwest America. Portland, Oregon

Some plants named for Thomas Jefferson Howell

V: currently valid S: sunk in synonomy

Aconitum howellii A. Nelson & J. F. Macbr. – S
Agoseris howellii Greene – S
Agrostis howellii Scribn. – V
Allium howellii Eastw. – S
Alopecurus howellii Vasey -- S
Antennaria howellii Greene – V
Arabis howellii S. Watson – S
Arctostaphylos howellii Eastw. – S
Astragalus howellii A. Gray – V
Boechera howellii (S. Watson) Windham & Al-Shehbaz -- V
Brodiaea howellii S. Watson – S
Calamagrostis howellii Vasey – V
Caltha howellii Greene – S
Camassia howellii S. Watson – V
Dimeresia howellii A. Gray -- V
Draba howellii S. Watson – V
Erigeron howellii A. Gray – V
Erythronium howellii S. Watson – S
Festuca howellii Hack. ex Beal -- S
Haplopappus howellii A. Gray – S
Hieracium howellii Rydb. – S
Horkelia howellii (Greene) Rydb. – S
Howellia aquatilis A. Gray – V
Isoetes howellii Engelm. – V
Juncus howellii F. J. Herm. - V
Lewisia cotyledon var. *howellii* (S. Watson) Jeps. – V
Lilium howellii I. M. Johnst. – S
Limnanthes howelliana Abrams – S
Lomatium howellii (S. Watson) Jeps. – V
Microseris howellii A. Gray – V
Minuartia howellii (S. Watson) Mattf. -- V
Montia howellii S. Watson – V
Pedicularis howellii A. Gray – V
Perideridia howellii (J. M. Coult. & Rose) Mathias – V
Poa howellii Vasey & Scribn. – V
Polygonum howellii Greene – S
Ribes howellii Greene – V
Sanicula howellii (J. M. Coult. & Rose) -- S
Saxifraga howellii Greene – V
Senecio howellii Greene – V
Streptanthus howellii S. Watson – V
Tauschia howellii S. Watson – V
Thelypodium howellii S. Watson – V
Viola howellii S. Watson – V



Dimeresia howellii (Asteraceae) is a low annual up to about 2 inches across that grows on open slopes of fine gravel or sand in southeastern Oregon. Howell collected it on Steens Mountain on June 2, 1885. Photo from Devil's Garden in Klamath County by Ron Larson.

References

Bornholdt MD. 2006. Martin Woodlock Gorman (1853-1926): Outdoorsman Extraordinary. Kalmiopsis 13:21-31.

Chambers KL. 2002. Thomas Jefferson Howell discovers *Calyptridium monospermum*. Oregon Flora Newsletter 8(3):17-18.

Cleaver JD. 1986. Island Immigrants: Sauvie Island Heritage Series 2. Oregon Historical Society Press. Portland.

Eastwood A. 1898. Untitled review. Erythea 6(5):58-60.

Farquhar FP, ed. 1949. Up and down California in 1860-1864: the journal of William H. Brewer, professor of agriculture in the Sheffield Scientific School from 1864 to 1903. U. of California Press, Berkeley, pp. 482-83.

Gray A. 1879. *Howellia aquatilis*. Proc. Amer. Acad. 1:43.

Greene EL. 1913. The Two Howells, Botanists. Obituary. American Midland Naturalist 3:30-32.

Griffen JR, Critchfield WB. 1976. The Distribution of Forest Trees in California. Pacific Southwest Forest and Range Experiment Station, Berkeley, CA. Washington, DC: US Govt. Printing Office. 118 p.

Henderson LF. 1932. Early experiences of a botanist. Archival material published December 1981 in the NPSO Bulletin 14(12):5-6.

Hitchcock CL, Cronquist A, Ownbey M, Thompson JW. 1955-1969. Vascular Plants of the Pacific Northwest (5 vols). Seattle (WA): University of Washington Press.

Howell TJ. 1897-1903. A Flora of Northwest America. Portland (OR): self published.

Jepson WL. 1897. Reviews and Criticisms - A Flora of Northwest America by Thomas Howell Vol. 1, Fascicle 1. Portland, Oregon March 15, 1897. 50c. Erythea 5(5):66.

Jepson WL. 1909. The Trees of California. San Francisco: Cunningham, Curtis and Welch. p. 87.

Kruckeberg AR, Ornduff R. 2003. Thomas Jefferson Howell (1842-1912): the untutored, impoverished botanist. Oregon Flora Newsletter 9(2):1,12.

Lange EF. 1953. Thomas J. Howell, pioneer Oregon botanist. The Scientific Monthly. October: 199-204.

Lange EF. 1955. Edward L. Greene and Howell's Flora of Northwest North America. Madroño 13(1):1-4.

Lange EF. 1966. The untutored botanist. Pacific Discovery 19(2):12-15.

Love RM. 2001. Louis F. Henderson (1852-1942): the Grand Old Man of Northwest Botany. Native Plant Society of Oregon Occasional Paper 2. 58 p.

Rydberg PA. 1904. Reviews: Howell's Flora of Northwest America. Torreya 4:70.

Stafleu FA, Cowan RS. 1979. Howell, Thomas Jefferson, Bibliography and Biography References. Taxonomic Literature Vol. II, H-Le: 350-351.

Sudworth GB. 1908. Forest Trees of the Pacific Slope. USDA Forest Service. Washington DC: US Govt. Printing Office. 441 p.

Vaughan T. 1974. Bybee-Howell House on Sauvie Island. Portland (OR): Oregon Historical Society.

Wagner DW. 1994. History of the University of Oregon Herbarium (1903-1993). Kalmiopsis 4:6-11.

Watson S. 1885. *Picea breweri*. Proc. Amer. Acad. 20:378.

Howell's letters to E. L. Greene are archived at the University of Notre Dame Library, Notre Dame, Indiana. The plant collections of E. L. Greene are in the university herbarium there. Howell's personal herbarium is now part of the Oregon State University Herbarium collection in Corvallis. Copies of Howell's papers (letters, publications, lists of plants for sale) are deposited in the A.R. Sweetser papers, Collection AX75, Box 3 Folders 7-10, University of Oregon Archives and Special Collections in the University of Oregon Knight Library, with a number of copies in the Oregon State University Herbarium biography files.

Robert Ornduff (1932-2000) was born in Portland, Oregon, and carried out his undergraduate studies at Reed College in that city. During the summer of 1952 Bob (along with Rhoda Moore Love and others) took part in the University of Washington's full summer field course under the tutelage of CL Hitchcock and AR Kruckeberg, botanizing at sites in eastern Washington, Oregon, and Idaho, as well as Arizona, Utah, and Colorado. Back at Reed, Bob worked with anthropologist David French and his wife Kay on the ethnobotany of the Warm Springs Indian Reservation in eastern Oregon. Young Ornduff provided most of the plant identifications for this project, receiving his BA in biology from Reed in 1953 based on this floristic work. Bob spent the year after graduation from Reed as a Fulbright Scholar in New Zealand where he collected material for his University of Washington MSc thesis on the systematics of a group of New Zealand *Senecio* species, under the directorship of Dr. Kruckeberg. In 1956, Bob entered the graduate program in Botany at the University of California at Berkeley, completed his PhD there in 1961, and taught biology for a year at Reed College and at Duke University, before returning to Berkeley in 1963. There, he assumed the faculty position of his retiring major professor, Herbert Mason. As a botany professor, Ornduff taught a popular course on California's flora for 30 years, based on which he published *An Introduction to California Plant Life* (UC Press 1974). While at Berkeley, he also held positions of Curator of Seed Plants, Director of the Botanic Garden, Director of the University Herbarium (1967-1982), Director of the Jepson Herbarium (1968 to 1982), and Chair of the Department of Botany (1986-1989). He retired in 1993 and died seven years later of melanoma at the age of 68. A more complete description of Bob Ornduff's life and accomplishments is posted at http://www.berkeley.edu/news/media/releases/2000/10/03_ornduff.html.

Hinds Walnut (*Juglans hindsii*) in Oregon

Frank Callahan
PO Box 5531, Central Point, OR 97502

It was the summer of 1965. I had graduated from Marshfield High School in Coos Bay and moved to West Vilas Road in Central Point, where I began exploring nearby Bear Creek. There I encountered scattered populations of walnut trees that followed the riparian zone as far north as the Rogue River. This intrigued me because Peck listed no walnut in his *Manual of the Higher Plants of Oregon*, which I had just purchased at J.K. Gill's bookstore for $6. Shortly after this discovery, my botanizing took a tropical detour, as in Vietnam. More than three years later, after a 13-month stint in South Vietnam and a year and a half in Hawai'i, I returned to Central Point. Having left seedy *Musa* species (bananas), jackfruit (*Artocarpus heterophyllus*) and *Semper Fidelis* (the USMC) behind me, I began college on the G.I. bill. Classes and work left little time for botanical treks, but in June 1976 I collected a specimen of *Juglans hindsii* from the Kirtland Road site for the herbarium at Southern Oregon College (SOC5260). I also discovered that 30 to 40 of the trees I'd seen in 1965 were gone; an aggregate operation (gravel extraction) had taken their place.

In September 1977, I traveled to Orange County, California, to collect *Juglans californica* (SOC4142) in the Santa Ana Mountains for comparison with my former collection of *Juglans hindsii*. At the time, there was only one other specimen of Hinds walnut in the SOC herbarium, by J. Athey, Stiehl, & Callan, 19 May 1968, north of Ashland, Oregon (SOC5840).

Frank Callahan standing next to a Hinds walnut (*Juglans hindsii*) along Meyers Creek, Jackson County. Photo by Bob Korfhage, June 2008.

Decades later, Hinds walnut is still not recognized by current floras as occurring in Oregon (Kozloff 2005, Wittemore and Stone 1997). Determined to learn the status of Hinds walnut in Oregon, I planned a survey of the entire Bear Creek drainage and its tributaries, as well as the Rogue River from Gold Hill to Grants Pass. I walked at least 40 miles, mapping walnut trees, all the way from Emigrant Lake north to Gold and Blackwell hills. I covered the entire Greenway path on foot, from south of Ashland to the fairgrounds at Central Point, including the equestrian trails to lower Bear Creek. Beyond that, I surveyed numerous parcels of private property and landowner cooperation was positive. A myriad of questions were asked, and the terms "Greenie" and "Tree hugger" came up at several points. Conversations with local, somewhat defensive, ranchers were usually kept on a positive note. I completely avoided the squatter camps off the equestrian trails.

Why do I have such an enduring interest in Hinds walnut? Perhaps because of my fascination with trees, and my amazement that a native plant this large growing on the valley floor among us could have been overlooked by botanists for so many years! As my grandfather Walter LaMinter remarked to me when I was 10 years old: "you are from a long line of pioneers, you need to go out and make discoveries."

Walnut (*Juglans*) Taxonomy

Worldwide, *Juglans* comprises 21 species, ranging from Europe to east Asia and from North to South America (Mabberly 1993). *Juglans* derives from two Latin words *jovis glans* "Jupiter's nut;" and walnut derives from the Germanic *wal* "foreign," noting it is not a nut native to northern Europe. The genus is closely

allied to *Carya*, from which it differs by having a chambered pith with uniform diaphrams and a husk that does not separate from the nut. In *Carya*, the pith is homogeneous and the husk is usually dehiscent along four sutures (Harlow and Harrar 1958). In North America, *Juglans* is represented by six species, ranging from large shrubs to tall trees. Only two species are known in the Pacific Coast States: California black walnut (*Juglans californica*) and Hinds walnut (*Juglans hindsii*). Hinds walnut is sometimes known as northern California black walnut, but the Oregon Flora Project prefers the name Hinds walnut, which is also used commercially (although the lumber is also called "claro walnut").

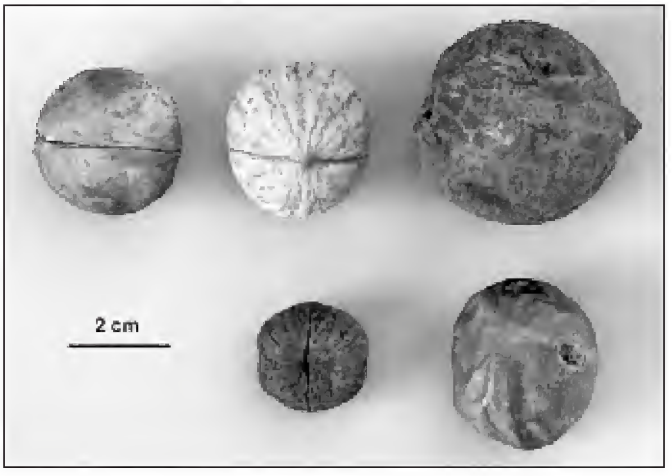
Nomenclature in this article follows the Oregon Flora Project, which concurs with Flora of North America (Vol. 3, Wittemore and Stone 1997) and the 6th edition of the California Native Plant Society (CNPS) Inventory of Rare Plants of California. However, in the Jepson Manual Hinds walnut is treated as a variety of California black walnut, *J. californica* var. *hindsii* (treatment by Dieter H. Wilken in Hickman 1993).

The history of the two taxa is an interesting story. *Juglans californica* was described by Sereno Watson (1875). The type specimen, collected in December 1860 by W. H. Brewer (#65) from Sierra Santa Monica, California, is now stored in Gray Herbarium at Harvard University. Hinds walnut was discovered in 1837 by Richard Brinsley Hinds (1812-1847), the botanist traveling on the British ship HMS Sulphur during the exploration of 1836-1842. Willis Jepson described the expedition in his journal, quoting from the preface to George Bentham's *Botany of the Voyage of HMS Sulphur* (1844): "It was late in the autumn of 1837 when an expedition up the Rio Sacramento [from the HMS Sulphur] penetrated from San Francisco some distance into the interior. The country exhibited a vast plain, rich in deep soil and subject to periodical immersion. Occasional clumps of fine oak and planes [sycamores] imparted an appearance of park land. They were already shedding their leaves; a small grape was abundant on the banks; and we sometimes obtained a dessert of the fruit of *Juglans*." After this first reference to northern California walnut, over 70 years passed before it was formally named. Ironically, although Richard Brinsley Hinds discovered his walnut 23 years before Brewer collected California black walnut, Jepson (1908) described the former as a variety of the latter, *Juglans californica* var. *hindsii* (obviously recognizing who first collected it). After this, R.E. Smith pointed out the distinct morphological differences between it and California black walnut, and the following year, Smith and Jepson elevated Hinds walnut to species status: *Juglans hindsii* Jepson ex R.E. Smith (Smith and Jepson 1909, Little 1953, 1978, 1979). However, Jepson failed to designate a type specimen for Hinds walnut. John Thomas Howell, noting this oversight, formally designated a lectotype specimen: "W.L. Jepson No. 2189, May 3, 1903, on the east slope of the Napa Range near Wooden Valley, Napa County, JEPS 58696 (Howell 1973). The original collection by Richard Hinds is at the Kew Herbarium in England, among his herbarium specimens from the expedition, which were dated at the time of accession, 1854 (Luscombe, pers. comm. 2007).

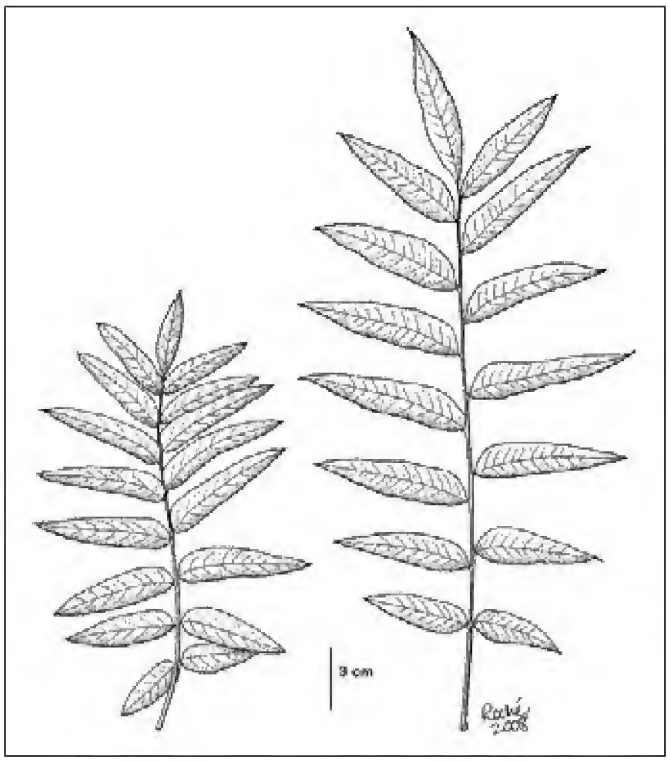
Scan of the original collection of *Juglans hindsii* by Richard Brinsley Hinds in 1837 at Rio Sacramento, accessioned as Herbarium Benthamianum in 1854. Image ©The Board of Trustees of the Royal Botanic Gardens, Kew. Reproduced with the consent of the Royal Botanic Gardens, Kew.

Morphological Differences

Because there has been some confusion over the taxonomic status of *Juglans hindsii*, a brief discussion of morphological differences is warranted. Both taxa have round nuts, nearly smooth, with fine, subtle longitudinal grooves and a small distal point. The defining



Nuts and fruits of California black and Hinds walnuts. Top row: *Juglans hindsii* side and top views of nuts, side view of fruit (showing dried husk). Bottom row: *Juglans californica*, top view of nut and side view of fruit. Photo by Bob Korfhage.



Leaves of California black walnut (*Juglans californica*), left, and Hinds walnut (*Juglans hindsii*), right. Illustration by Cindy Roché, based on collections by Frank Callahan at SOU Herbarium.

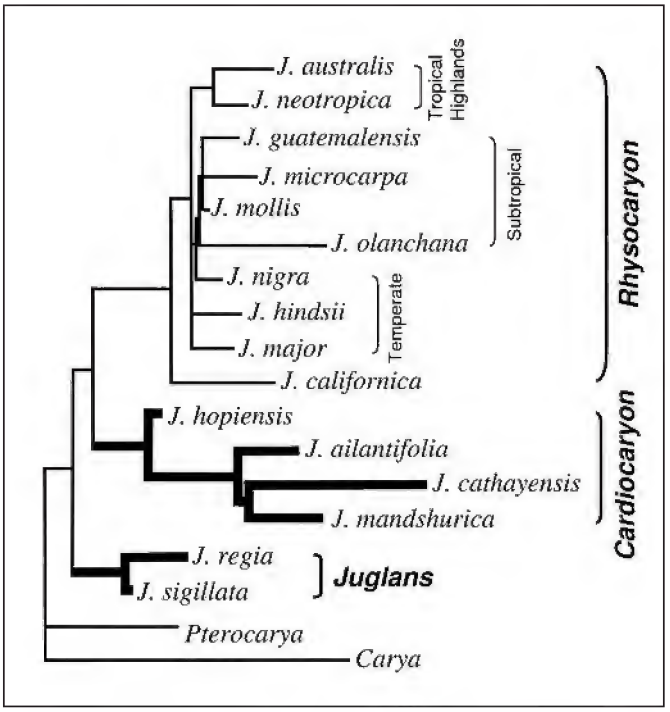
difference is size. California black walnuts are smaller, up to ¾ inch in diameter compared to 1.1 to 1.3 inches in diameter for Hinds walnuts. Leaflet length is also diagnostic. California black walnut leaflets are 0.8 to 2.6 inches long, compared to 2.4 to 4 inches long in Hinds walnut.

California black walnut trees are not as tall nor as robust as Hinds walnut trees. McMinn and Maino (1974) described California black walnut as "an arborescent shrub or small tree, 15 to 30 feet high, commonly with several stems from the ground or a single stem branching within one to four feet of the ground, forming a shrub-like growth as broad as high." In contrast, Jepson's report gives some credence to the arboreal stature of this species: "The largest tree yet reported in southern California stands in the upper Ojai Valley, in very deep and rich soil, at an altitude of 1300 feet. The diameter of the crown is 92 feet and all the lower limbs creep on the ground. The circumference of the trunk is 12 feet 8 inches" (Jepson 1910). Thus, Jepson's tree was just over 4.5 feet in diameter at the base. E.N. (Gene) Anderson (2002) reported a tree with "a spread of 51 feet. It branches a foot off the ground; the trunk below that is 102 inches around." At 2.7 feet in diameter and 51 feet tall, his tree was much smaller than Jepson's giant. Jon E. Keeley measured the largest walnut he encountered during his surveys in southern California: it was 49 feet tall and 3 feet in diameter (Keeley 1990). Based on these reports and my own field observations, I conclude that California black walnut is the smallest of the North American walnuts. The data given in American Forests Big Tree Register for *Juglans californica* are incorrect; that tree is actually Hinds walnut, an identification I verified in 2007.

Hinds walnut is the robust, heavyweight giant of western North America. It would score as the largest walnut in the US, if not for the record-holding eastern black walnut, *Juglans nigra*. The nation's largest Hinds walnut reigns from Napa, California. In 1986, this tree measured 25.3 feet in circumference at 4.5 feet above the ground, 76 feet tall and 107 feet diameter crown spread (Kearns 2006). However, an Oregon tree measured in 1947 (see History section) was over 9 feet total diameter and over 29 feet in circumference with a certified height of 80 feet. To date, the Oregon tree is the largest known Hinds walnut ever measured. The largest Hinds walnut located in my recent survey is 18 feet in circumference (5.7 feet in diameter).

Genetic Differences

DNA found in chloroplasts (cpDNA) is used to study plant phylogeny, the evolutionary relationships among taxa. By comparing mutational changes at a molecular level researchers separate taxa and identify closer and more distant relatives in plant family trees. Aradhya *et. al.* (2007) reported on the relationships among *Juglans* species using cpDNA. To test the strength of the relationships in the *Juglans* complexes, they used *Carya* and *Pterocarya* as outgroup taxa. Old and New World taxa separated into different clades (groups), affirming that distances between them are not only geographic, but also genetic. New World black walnuts form a group (Section) called Rhysocaryon, and Old World walnuts are in Cardiocaryon and Juglans (see sketch of family tree). Interpretation of the sequence of evolution is complicated by extinct lineages that are well represented in the fossil records, but the lack of survivors leave gaps in the evolutionary family tree. The phylogenetic cladogram (family tree) for *Juglans* shows a closer relationship between *J. hindsii* and *J. major* in the North American



A sketch (modified by David Oline from Figure 2 in Aradhya *et al.* 2007) showing the evolutionary relationships within the genus *Juglans* based on chloroplast DNA sequence data. Bold lines indicate Old World species, thin lines, New World species. There is no close relationship between *J. californica* and *J. hindsii*, as *J. californica* is the most divergent of all the New World species, having branched off earliest from the common ancestor.

walnuts, both of which are more distantly related to *J. californica*. *Juglans nigra* branched from a common ancestor at a later date. Because walnuts are distinguished by the surface architecture of the nuts, the degree of similarity of *J. californica* and *J. hindsii* nuts is perplexing. In contrast, the nuts of *J. major* are quite different, with deep furrows. But, according to Aradhya, "*Juglans californica* is well separated from its putative relatives *J. hindsii* and *J. major*; *J. hindsii* is definitely not a variety of the highly variable *J. californica*" (M. Aradhya, pers. comm., 2008). That California black walnut is genetically highly variable is consistent with its morphology. Variation in leaflet shape and hair characteristics require "care in identifying it" (Whittemore and Stone 1997).

Walnut Hybrids

Hinds walnut crosses with eastern black walnut, which has been in cultivation since 1686 in England (Schopmeyer 1974). Widely planted in the West, eastern black walnut has naturalized in some places. It is North America's largest walnut, with maximum heights of 165 feet and diameters of 10 feet recorded (Elias 1980). Under favorable conditions trees have lived over 300 years. The largest eastern black walnut tree found in Jackson County grows in front of the Beall House on west Beall Lane in Central Point, just west of Highway 99. This tree is about 150 years old and measures 21 feet 10 inches in circumference and is 130 feet tall. Using a dated photograph (Warren collection), I determined that it was planted as a small tree in 1864. In contrast, the largest tree measured in England was 120 feet tall and 21.5 feet in circumference at 168 years of age (Mitchell 1996). The present owner of the Beall walnut, Irvin Warren, said that he once received an offer of $35,000 for the tree. The wood is highly prized for gunstocks, furniture and cabinetry. Although the offer was tempting, the tree was deeply rooted in his heart. Otherwise, the cost and effort of cleaning up the walnuts every fall as well as $1500 to have the tree pruned in 1982 would have led to the tree's demise (Sweet 1994). Despite its persistence around old farm houses and homesteads, eastern black walnut rarely escapes cultivation in the Rogue Valley. However, its pollen readily creates crosses with Hinds walnut. The resulting hybrid, known as 'Royal' walnut, grows at several locations in the valley. Walnuts have never been an agricultural commodity of any consequence in the Rogue Valley, especially compared to the Willamette Valley. Nuts of eastern black walnut have excellent flavor, but are difficult to extract. The nuts are round to oval in girth and widest at the equator, 1.4 to 1.6 inches in diameter, with a small blunt protuberance at the apex. The surface is harsh to the touch, with prominent longitudinal warty-rugose, keeled ridges.

Hinds walnut rootstocks have been widely used for grafting of Persian, English or Carpathian walnut (*Juglans regia*), which is the primary walnut of commerce. This walnut is rarely planted in the Rogue Valley, but I mention it because it also hybridizes with Hinds walnut; the offspring is known as 'Paradox.' This cross was championed by Luther Burbank, with promises of high nut production. Ironically, it has a high rate of sterility (poor yield of nuts), so that its greatest asset is its strong wood. A 'Paradox' walnut tree or hybrid Carpathian that I measured south of Redding, California, had a crown spread of 48 m (160 feet), a testament to the wood's extreme tensile strength!

Distribution of California Black and Hinds Walnuts

In California. California black walnut is restricted to southern California: Santa Barbara, Ventura, Los Angeles, Orange, southwestern San Bernadino, and northwestern San Diego counties. This walnut is very frost-sensitive, limited to below 3,500 feet elevation in its native range, and is relatively short-lived: maximum 150 years (Huxley 1992). There is a 275-mile gap between the northern end of the distribution of California black walnut and the southern end of the distribution of Hinds walnut.

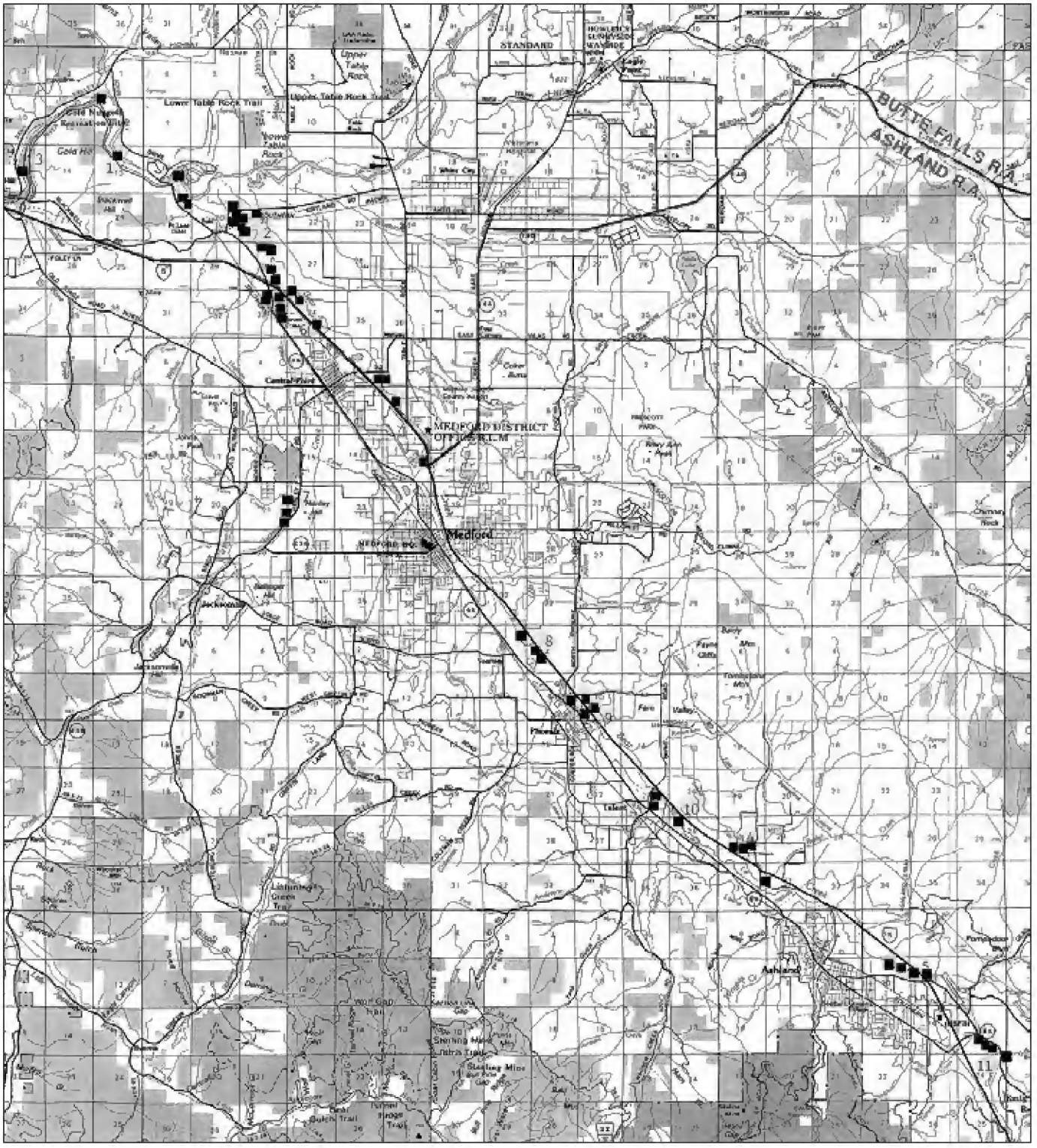
Hinds walnut ranges from north of Mt. Hamilton (in the Diablo Mountains east of San Jose in Santa Clara County), California, to Jackson County, Oregon. Jepson's concept of the native range of Hinds walnut was that it radiated inland (north, south and east) from the San Francisco Bay area, extending northeast along the banks of the Sacramento River just into Yolo County, north to the Wooden Valley region east of Napa, Napa County, and southward to Mt. Hamilton in Santa Clara County (Griffen and Critchfield 1972). Walnut Creek in Contra Costa County and Walnut Grove on the Sacramento River were named for fine old stand of Hinds walnut (Peattie 1953). When Jepson mapped the distribution of Hinds walnut, he apparently missed several vouchered collections that showed the northern range: Blankenship at Clear Lake, Lake County, Kelsey Creek, Lake County (1928); same location by Lyman Benson (1933, 1937, 1941) and Healdsburg, Russian River, Sonoma County by R. Hartwell (1938). Griffin and Critchfield (1972) underreported the northern distribution of Hinds walnut, suggesting that either Jepson would have known these locations or "there is the older question of Indian influence on walnut distribution." They were referring to an range extension by Native Americans purported by Jepson in his statement, "these northern trees are found about ancient Indian village sites and were probably introduced from the southern part of the state" (Abrams 1923). Thomsen (1963) questioned Jepson's conclusion, and used the fossil record to show that Hinds walnut is indeed indigenous to central California. She asserted that there was undoubtedly fortuitous use of walnuts by indigenous people because riparian areas were favorable both for trees and for encampments. She doubted that the presence of walnut trees at numerous non-riparian locations could be fully explained by "accidental seeding by man or rodents" (Thomsen 1963). Also, a fossil walnut from the Oligocene San Ramon formation, southwest of Walnut Creek, California, is about half as old as the Middle Eocene Clarno Formation in Oregon (see Paleobotany section). This seed cast is similar in size to *Juglans clarnensis*, but it more closely resembles *Juglans hindsii* (Manchester 1987). This gives further evidence that Hinds walnut (or its ancestor) presence in northern California predates human activities.

There is no doubt that Native Americans in this region carried seeds that were utilized for food on their travels. But there is little chance that this led to range extension for Hinds walnut. These tribes were hunters and gatherers, leaving no evidence of an agricultural base like the Pueblos in Arizona. In September 1977, I visited both Wooden Valley in Napa County and Kelsey Creek in Lake County and found large mounds (up to about a meter tall) of walnut shells at sites previously occupied by Native Americans. I discussed walnut use with several local landowners as well as members of the Elém Pomo Nation of Sulfur Bank Rancheria at

the east end of Clear Lake. I learned that intact walnuts were not carried far from the trees, but were processed on site using a hammerstone for crushing, after which the nutmeats were separated from the shells. The nutmeats were often added to dried fruits and jerky to form a very nutritious trail cake (pemican), much like the energy bars marketed today. This information was substantiated by the mounds of crushed shells still evident at the site.

Jepson also lacked adequate understanding of soils and geology, especially fossils. "If Jepson had only known a little more geology, he would have recognized that 'shale' for what it was—highly fractured and friable serpentenite rock" (Kruckeberg 1984). The current known distribution of Hinds walnut in California includes Glen, Shasta, Siskiyou, Sutter, and Tehama counties, with the northern-most populations along the Klamath River, not far from the Oregon border.

More recently, both species have been planted as landscaping or street trees in cities where they are adapted, outside their native ranges (Hoover 1970, Labadie 1978).



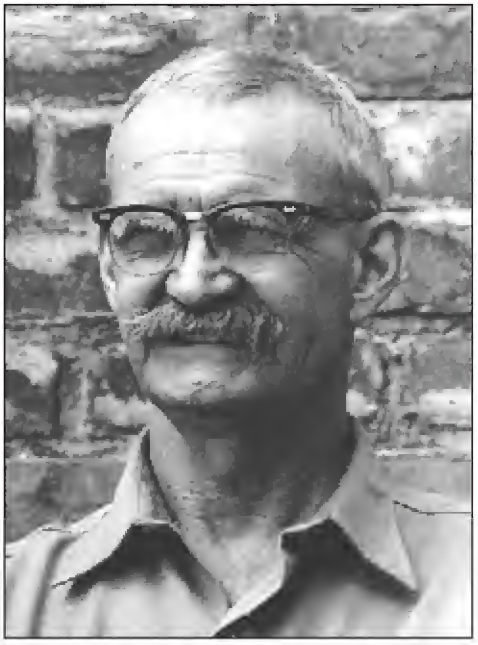
Distribution of Hinds walnut in Jackson County as mapped by the author in late 2007.

Hammerstones used by Native Americans, found along Bear Creek near Central Point, Jackson County, Oregon. Courtesy of the Ivan Skyrman collection. Photo by Cindy Roché.

Hinds walnut Heritage Tree near the Yellow Creek Bridge just south of Highway 138, northwest of Sutherlin, Douglas County, Oregon. This tree may be a hybrid with eastern black walnut. Photo by Frank Callahan.

In Oregon. No *Juglans californica* trees were found during my survey in Jackson County, Oregon; they are not hardy here. Our nursery trials conducted over several years proved the tree was very frost sensitive. Plants were killed outright when temperatures fell into the teens. These critical temperatures were also noted by Huxley (1992).

The major population of Hinds walnut in Oregon is in Jackson County. Most of the trees grow along Bear Creek which flows from Emigrant Lake (south of Ashland) northwest through Medford and empties into the Rogue River near Lower Table Rock north of Central Point. From there the population extends along the Rogue River to Gold Hill (see distribution map). Surveys along the Rogue River downstream from Gold Hill to Grants Pass yielded negative results. Neither did I find walnut trees in another survey conducted by raft and on foot from Lost Creek Dam to the confluence of the Rogue River and Bear Creek. There is a population in Douglas County along the south Umpqua River near Myrtle Creek. The largest Hinds walnut in Oregon has been designated a Heritage tree. It grows near the Yellow Creek bridge northwest of Sutherlin just south of Highway 138. Recent measurement indicated that this tree is 86 feet tall, 21 feet 5 inches in circumference, with a crown spread of 140 feet. No other Hinds walnuts grow nearby, but the area has been severely logged. In Josephine County, Keir Morse noted Hinds walnut in his inventory of plants on the Deer Creek Ranch near Selma (Morse 2008). Don Heinze reported Hinds walnut at Fish Hatchery Park near Grants Pass. Without historical data, it is not possible to determine whether the trees in Douglas and Josephine counties are native or were naturalized. Walnuts were planted by settlers throughout the Willamette and Umpqua river valleys and it is quite possible that crows are responsible for many of the trees that appear native along rivercourses. Based on nut morphology, it appears that some of the Douglas County trees may be hybrids with eastern black walnut. Hinds walnut trees have also been planted in parks in the Willamette Valley. Please report any additional locations to me, especially trees that might be native, so I can more accurately assess its rarity.



Ivan Skyrman, circa 1970. Photo courtesy of his son, Wally Martin Skyrman.

History of Hinds Walnut in Oregon

The best information I have on the history of Hinds walnut in Oregon is what I learned from conversations with the late Ivan Skyrman (1907-1988) during the late 1970s and early 1980s. Ivan's father, Carl T. Skyrman was a pioneer in Jackson County, who emigrated from Sweden in 1880 and eventually settled in 1889 when he established a cattle ranch nine miles up Trail Creek. The ranch still exists (Wally Skyrman, pers. comm., 2007). As a young man, Ivan had a keen interest in trees and their products, lumber and firewood. My first visit to the Skyrman property included a tour of his *Pinetum*, a collection of all of Oregon's known conifers and an introduction to his woodworking and metal fabrication shop. His goal was to have a representative of each of Oregon's native conifers. What began as a grand idea ended up as an experiment in natural selection: the high elevation species suffered under the high heat stress of summer in the valley. The best adapted species was gray pine (*Pinus sabineana*), which today stands as an Oregon State Champion Tree, the largest reported in the state. This tree grew from seed collected at Blackwell Hill near Central Point.

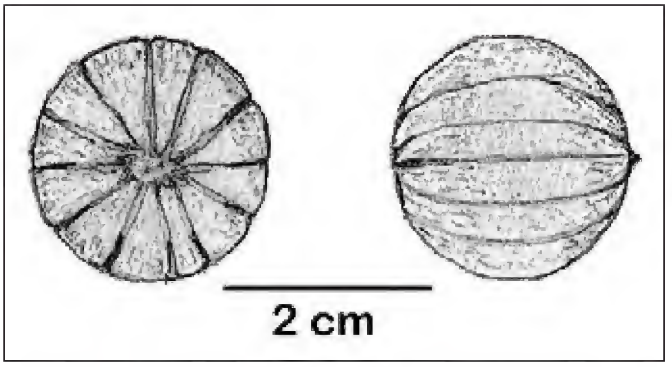
Following the tree tour, we returned to the shop where I discovered that Ivan was a highly skilled woodworker and

metal machinist. He handed me a finished gunstock carved out of walnut. I was impressed with his workmanship, however, the wood had dynamic color patterns unlike eastern black walnut, with which I was familiar. Four years of high school woodshop had not prepared me for the characteristics of this walnut wood; it was lighter, softer, and much easier to work than eastern black walnut. In the wood trade, Hinds walnut is termed "claro walnut" (*claro* means light or bright colored in Spanish, the first European language in much of California). The wood exhibits an array of colors: reds, tans, golds, browns and blacks. I later learned that John Bidwell propagated California Claro Walnut at Rancho Chico Nursery in Chico, California, in the late 1800s. I asked Ivan where his obtained his stock of walnut lumber. He replied, "This is the native Hinds walnut that grows all along Bear Creek." I responded, "How do you know that it is native?" He answered,

> *"My father Carl introduced me to this tree and its lumber when I was a teenager. The lumber was available when he settled in the valley. The trees were being logged along Bear Creek. Logging began in the 1850s, during the time of European settlement. The wood was similar to eastern black walnut that was familiar to the settlers. In my teenage years, I measured some very large walnuts in the Phoenix area that were six to seven feet in diameter, and the same was true for the black and white oaks. Most of the old growth hardwoods were taken out in the 1920s to 1940s; all the old growth trees in the [Rogue] Valley were logged by the 1950s. Mills were scattered from Ashland to Tolo, processing lumber for flooring in Medford to the milling of cottonwood for pear boxes. Hinds walnut commanded the highest prices for cabinet stock and gunstock blanks. In 1947, Delmar Smith (1911-1988) and I visited the largest known walnut in the valley.* [Delmar Smith was founder of the Crater Rock Museum and a member of the Rock Garden Society with Ivan and the two shared a keen interest in trees.] *A walnut broker had purchased the tree and it was in the process of being logged. The tree was north of Central Point and Weldon Downey (1920-1994), a scaler, was measuring the tree. Weldon measured the height at 80 feet and the diameter of the stump at 9.5 feet, not including the bark. Delmar tried to negotiate a sawn round off the log, but the price was exorbitant. We were unable to obtain any of the wood as the entire tree, including limbs, was shipped out by truck. The stump was solid and free of defects and our best efforts at a ring count indicated that the tree was at least 327 years old. We noted that growth had been rapid for the first 75 years, and the remainder of the rings had a uniform spacing, until the last 50 years when growth had slowed considerably*[1]*. Years later, the stump with doused with diesel and burned. The resulting cavity was so large that it took a small dump truck load of soil to level the site."*

For the record, the trunk was over 29 feet in circumference. The current national champion Hinds walnut is 25 feet 4 inches in circumference, 76 feet tall, with a 107-foot diameter crown spread, measured in 1986 (by author). It appears that the Central Point tree was slightly larger and taller, although the crown diameter was not given. The ring count of 327 years indicates that the tree was a seedling in 1720, long before European settlement in the valley.

[1] Delmar Smith's notes on the age and chronology of this tree agree with those of Ivan Skyrman.



Silicified nuts of fossil *Juglans clarnensis*. Pencil drawing by Frank Callahan.

Given the age of these trees and the strictly riparian distribution (human planting would have occurred around home sites), it is clear that Hinds walnut was not introduced by homesteaders. Neither have these walnut trees been found around known Indian campsites, just as the case in California (Thomsen 1963). All of this is strong evidence that Hinds walnut is native in Jackson County, Oregon.

Paleobotany—Is Hinds Walnut a Living Fossil?

As Thomsen (1963) pointed out, Jepson (1910), Griffen and Critchfield (1972) failed to consult the paleobotanical records of walnuts in western North America. The fossil record at the John Day Fossil Beds in eastern Oregon indicates the presence of silicified walnuts in the Clarno Formation of *Juglans clarnensis* Scott, dated in the Middle Eocene (49 to 41 million years ago). This small walnut, the earliest confirmed *Juglans* fruit known (Scott 1954), is nearly indistinguishable from *J. hindsii*. This is significant because in Juglandaceae, the most important structure for generic level determinations is the fruit: "Each modern genus is defined such that it can be recognized on the basis of its fruit, with or without information from other organs" (Manchester 1987). This raises the possibility that this branch of the Section Rhysocaryon (New World black walnuts) originated in northeastern Oregon and the mild climate of the Rogue Valley provides a refugia suited for survival in Oregon of its descendents. The fossil collection from the Clarno Formation ranges from moist tropical species of bananas (*Ensete oregonense*) and tree ferns (*Cyanthea pinnata*) to temperate species of walnut (*Juglans clarnensis*), sycamore (*Macginitea angustilobia*) and alder (*Alnus clarnoensis*). One could speculate that the former range of Hinds walnut may have extended southward from northcentral Oregon to western Oregon and central California. Volcanism and uplift that created the present Cascade range and subsequent harsher climatic conditions may have forced the walnut to retreat to milder climate regimes to the west. Throughout its modern range, Hinds walnut thrives in a Mediterranean climate with hot dry summers and cool moist winters, such as found in the Bear Creek Valley. The species is certainly not hardy east of the Cascade Mountains. Trees planted in Klamath Falls soon succumb to hard winter freezes (Gary Goby, pers. comm.). Even in areas where it can survive, heavy snowfalls break limbs off, creating open wounds, making it vulnerable to insect and disease damage. According to Gary Goby of Goby Wood Products, "The wood is lighter and softer than either eastern black walnut, or any of the orchard hybrid walnuts." Thus, the lower tensile strength of the wood of Hinds walnut is a disadvantage.

A black walnut fossil collection from Nevada, *Juglans nevadensis* Berry, dates to the Miocene, about half the age of the Oregon Clarno Formation material. Nevada is outside the present range of black walnuts, but this collection indicates their former presence there. "Since *Juglans* no longer occurs in Nevada, Berry (1928) suggested that the local population became extinct due to increasing aridity caused by the uplift of the Sierra Nevada Mountains" (Manchester 1987).

Similarly, California black walnut survives in the canyons and ravines of southern California, "as if it were clinging to all the shadow and coolness and moisture it could find in the bright aridity of this region. As soon as the summer droughts begin, the delicate-looking foliage is apt to turn to a dull gold or crisp brown, and by early autumn it may have dropped entirely… One cannot help feeling that this is a tree which must be left over from a different climate and now fights a losing battle with its environment" (Peattie 1953).

Alternatively, Hinds walnut may have migrated north from the Sacramento Valley, and arrived here as late as post-Pleistocene, during the warm Hypsithermal 4,000 to 8,000 years ago, a pattern suspected for California buckeye (Callahan 2005).

Is the Rogue Valley a Haven for Post-Pleistocene Relicts?

California's Gray Pine Belt and Oregon's Rogue River Valley are mapped as climatic Zone 7 (Brenzel 2001). Zone 7 in Oregon is the northernmost extension of a climatic zone that lies primarily within California, with sharply defined seasons of hot summers and mild, but pronounced winters. So it should come as no suprise that some of California's zone 7 plants are found in this small southwestern Oregon zone. That the most northern populations of Hinds walnut are in Jackson County is not an anomaly. A number of other trees reach their northern distribution limit here, including the indicator species for Zone 7–gray pine (*Pinus sabineana*), as well as California buckeye (*Aesculus californica*) (Callahan 2005), Baker cypress[2] (*Cupressus bakeri*), Brown dogwood (*Cornus glabrata*), blackfruit dogwood (*C. sessilis*) and California redbud (*Cercis occidentalis*). Oracle oak (*Quercus* x*moreheus*), the hybrid of California black oak (*Quercus kelloggii*) and Interior live oak (*Q. wislizenii*) has also been documented in the county. However, it ranges north to near Sutherlin, Oregon. The presence of this hybrid oak is strong evidence that Interior live oak recently resided here. Another southern tree species recently reported for Jackson County is Fremont poplar (*Populus fremontii*), based on a voucher specimen collected by Tonia Blum (SOC 8523) May 9, 1992 near Ashland and my 2008 collection of leaves below Gold Ray Dam (herbarium voucher sent to Oregon State University Herbarium).

Globose fruits develop from the female flowers, which often occur in pairs. Photo By Bob Korfhage.

[2]*Cupressus bakeri* has been found on Flounce Rock near Prospect, upslope from the Rogue River.

Male flowers (catkins) and newly emerged leaves of Hinds walnut. Flowers appear in May in the Rogue Valley. Photo by Cindy Roché.

Dispersal of Hinds Walnut Seeds

Stream activity, especially flooding, and American Crows (*Corvus brachyrhynchos*) disperse Hinds walnut seeds. Crows collect and cache individual nuts, some of which are forgotten, securing reproduction for the walnut. In California, Yellow-billed Magpie (*Pica nuttali*) also caches fruits of oaks, gray pine and walnuts. To date, this magpie has not been reported in Oregon (pers. comm., Stewart Janes, 2008). Oregon's native Black-billed Magpie (*Pica hudsonia*) also caches seeds, but does not range into the Bear Creek Valley.

Ecology

Hinds walnut is a long-lived species and restricted to riparian habitats throughout its range. From my surveys, I concluded that it is limited to depositional floodplain zones, a habitat described in California as riparian forest (Thompson 1961). Narrow, eroded riparian corridors are unsuitable. This may explain its

absence along the Rogue River, a waterway with few depositional floodplains to provide opportunity for seed germination and establishment. This depositional character applies to all of the habitats of Hinds walnut in California as well (Thompson 1961). The species appears to be quite sensitive to hydrology, requiring a consistent water supply, whether surface or subsurface. It was not found in ephemeral drainages. In the survey, two populations were found on islands in the Rogue River: one just above and one below Gold Ray Dam.

Hinds walnut grows in openings or as a subcanopy tree, but canopy closure by taller trees retards its growth or eliminates it from the site. Tall trees that form the overstory canopy above Hinds walnut include black cottonwood (*Populus trichocarpa*), white alder (*Alnus rhombifolia*), and Oregon ash (*Fraxinus latifolia*). Black cottonwood is the tallest, most conspicuous tree in the riparian landscape along Bear Creek, with heights of 150 feet. However, most of surviving trees are "second growth," much smaller than the potential height and size of this species[3]. It is a comparatively short-lived tree, with 250 years being about the maximum age (Carder 1995). A black cottonwood measuring 10 feet in diameter was recently felled along Wagner Creek near Talent. Unfortunately, the height and crown diameter were not measured. The second most common tree in the riparian forest is white alder, growing up to 120 feet tall with 4.5 ft. boles. Oregon ash is the tree most commonly found with Hinds walnut. In the Rogue Valley it often reaches 75 feet in height, but rarely over 3 feet in diameter. Bigleaf maple (*Acer macrophyllum*) is rare along Bear Creek.

The strategy of Hinds walnut is rapid juvenile growth, combined with individual longevity. Hinds walnut trees can live over 300 years. Its wood is much stronger than black cottonwood, which is susceptible to wind shearing. Lost limbs on cottonwood trees create gaps in the canopy that favor the walnut. Young trees are readily killed by fire but old growth Hinds walnuts are highly fire resistant. Mature trees will also resprout from the base.

Two vines, California grape (*Vitis californica*) and California smilax (*Smilax californica*) brighten the canopy, particularly after deciduous leaf fall. Several willows also grow in the river corridor. Shining willow (*Salix lucida*) is somewhat competitive with Hinds walnut. It grows as large and spreading trees, reaching 70 feet in height, but rarely living to 80 years. The other willows (narrow-leaved willow, *Salix exigua*, and sandbar willow, *Salix sessilifolia*) are even shorter lived (to 40 years), and rarely reach 40 feet in height. Both have narrow gray leaves and strictly upright habits. Arroyo willow (*Salix lasiolepis*) sprawls and rarely reaches 30 feet tall. Hawthorns are very rare in this riparian zone, with *Crataegus suksdorfii* being the sole representative. Both native oaks, Oregon white (*Quercus garryana*) and California black (*Q. kelloggii*) are found occasionally in the riparian zone, but are rarely a direct associate of Hinds walnut.

On Meyer Creek near Ashland, Hinds walnut is the climax species in a grove containing 25 walnut trees. Its deep taproot enables it to dominate the site by reaching the deep water table. Black cottonwood and white alder are shallow-rooted. However, along Bear Creek where water is closer to the surface, the taller black cottonwood easily dominates the riparian forest.

[3]Black cottonwood trees measuring 225 feet in height and 10 feet in diameter grew on the Olympic Peninsula (Henry 1915) and 200 feet tall, 9 feet in diameter along the Columbia River Flats (Jensen 1999).

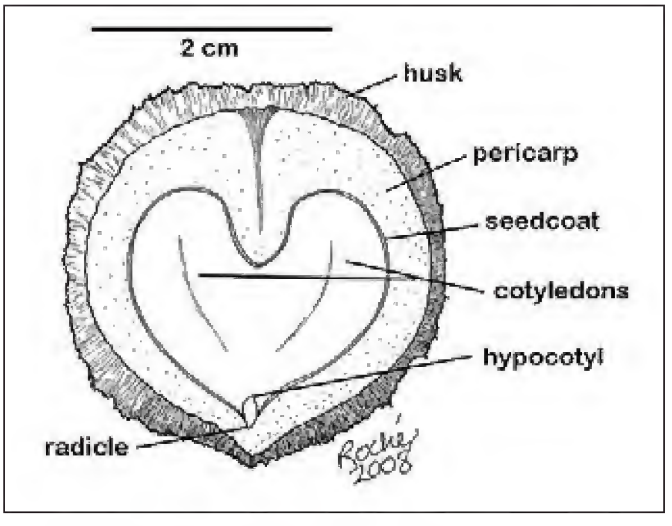
Hinds Walnut Cultivation—Grow Your Own

Walnuts are easy to grow from seeds. However, all species require a long period of cold stratification (up to six months) for germination. It is best to sow the cleaned nuts after harvest in the fall, and cover with about 1 to 2 inches of duff or topsoil. Protect them from rodents. If growing the seedlings in pots, use deep containers known as avocado pots. If growing them in seedbeds, remove the small plants for outplanting before they reach a foot in height. Walnuts quickly develop a vigorous taproot and resent transplanting. If buying container stock at a nursery, reject rootbound plants. Juvenile walnuts grow very vigorously and perform best in deep rich topsoil where ground water is available.

Walnuts can be grown in almost any horticultural setting, provided their cultural requirements are met. Within the genus *Juglans*, there are species adapted to climates ranging from cold temperate (lows of -30°F, *Juglans nigra*) to tropical (lows of 50°F, *Juglans guatemalensis*).

In Oregon, only two walnuts from North America survive east of the Cascades: eastern black walnut (which rarely produces nuts in the Bend area due to severe spring freezes that damage the catkins and flowers) and butternut (*Juglans cinerea*). Both of these walnuts also perform well west of the Cascades. The following walnuts are hardy in the major valley systems west of the Cascades: Hinds walnut, Nogal or Arizona walnut (*Juglans major*) and little walnut (*Juglans microcarpa*) which ranges as far west as New Mexico. California black walnut, a very tender species, freezes out in the Rogue Valley, but might be grown at Brookings. It is not hardy in the British Isles, although Hinds walnut thrives there (Bean 1978).

Walnuts should be planted away from buildings, concrete driveways, lawns, and gardens because they can be messy trees; they shed nuts that stain and give off the allelopathic chemical juglone that inhibits growth of other plants. Juglone occurs naturally in leaves, roots, bark and husks of all species of *Juglans* (Mabberly 1993). Open parks or field settings are optimal planting situations. Give these trees room to grow, or years later pay an arborist to cut



Longitudinal cross-section of a germinating Hinds walnut. The nut splits along the longitudinal grooves and the radicle emerges out the distal end. By the time of germination much of the original husk has disintegrated. Illustration by Cindy Roché.

The leaves of a seedling Hinds walnut emerge from between the two halves of the walnut. Photo by Cindy Roché.

off huge limbs overwhelming your residence. All walnuts need ample ground water or irrigation. Those native to desert regions, *Juglans major* and *J. minor*, grow only along watercourses.

Except for California black walnut, which tends to be limby and shrubby, all of the native walnuts can be grown for lumber production. Both eastern black walnut and Hinds walnut are grown commercially.

As food, nutmeats of all of our native walnuts have excellent flavor and are very nutritious. They are difficult to extract, hence the English walnut dominates the world market. Native walnuts provide food for crows and rodents. All walnuts are wind pollinated, but I have seen bees gathering the pollen and small birds foraging the catkins.

A Future for Hinds Walnut?

I found the entire riparian ecosystem in a state of chaos. Himalayan blackberry dominates nearly the entire streambank zone of Bear Creek. Escaped arboreal species included northern catalpa (*Catalpa speciosa*), golden weeping willow (*Salix alba tristis*), black locust (*Robinia pseudoacacia*), tree of heaven (*Ailanthus altissima*), eastern box elder (*Acer negundo*), silver poplar (*Populus alba*), and eastern black walnut (*Juglans nigra*). However, none of these exotic trees have prospered to the extent that they presently pose a threat to the riparian corridor. Human development into the Bear Creek floodplain is a disaster in the making: gravel and sand extraction, logging and land clearing for views and river access have severely reduced suitable habitat. During the survey, all classes except old growth were noted. Seedling establishment requires open floodplains, but these are rapidly being converted to development. Despite limited habitat, I found recruitment at a few sites, although the number of seedlings was not high. At the time of the survey, the entire population of Hinds walnut (14 mature trees) and associated Oregon ash was being logged to make way for storage units at the Interstate-5 interchange near Phoenix. Fortunately all the trees were milled on site for lumber. Oregon ash lumber is just as valuable as walnut.

When I surveyed Griffin Creek, I expected to locate potential habitat for Hinds walnut. However, both Griffin Creek and Jackson Creek have been artificially channeled, which almost completely destroyed the riparian habitat. At the intersection of Griffin Creek and Scenic Avenue in Central Point, the incised creek channel has vertical sidewalls cut through 20 feet of alluvial soil down to the quartz diorite bedrock. The channeling of creeks for flood control has been extremely detrimental to soils and hydrology, lowering the water table, obliterating a floodplain and any habitat for riparian species, both flora and fauna. Some of the best soils in the Valley (deep, rich soil that is productive farm land) are post-Pleistocene in origin, nearly 10,000 years in the making; now converted to planned urban sprawl of housing subdivisions and sports parks.

The planting of non-native walnuts near the riparian corridor is also a problem, as noted by the presence of hybrids.

In conclusion, the human footprint has been an almost internecine element to the Bear Creek drainage in the Rogue Valley. Both humans and the natural environment will be losers if conservation measures are not taken to sustain and nurture what is left of our dwindling riparian forests. In the closing chapter of this play, Hinds walnut could play a starring role in restoration of these habitats. Managers at the Medford Parks Department and the Bear Creek Greenway are searching for that special riparian tree with longevity (Bill Harrington, Arborist, Medford Parks Dept., pers. comm.).

Acknowledgements

I would like to thank the following individuals for their suggestions, contributions and criticisms of this article: Frank A. Lang who prompted me to delve into my archival notes and get the data published; Cindy Roché who assisted me throughout the process and helped with the illustrations; Bob Korfhage with pictures; and David Oline and M.K. Aradhya for their advice on cpDNA. David Oline adapted the phylogenetic tree for this article. I am especially indebted to the late Ivan Theodore Skyrman for sharing his historical knowledge of the Hinds walnut and his son Wally for sharing the photograph of his father and filling in the history gaps. Their information was critical to this article. Ken Chambers reviewed the manuscript and corrected several errors.

References

Abrams L. 1923. An Illustrated Flora of the Pacific States, Washington, Oregon and California. Vol. 1, Stanford (CA): Stanford University Press. pp. 509-510.

Anderson EN. 2002. Some preliminary observations on the California black walnut (*Juglans californica*). Fremontia 30(1):14.

Aradhya MK, Potter D, Gao F, Simon CJ. 2007. Molecular phylogeny of *Juglans* (Juglandaceae): a biogeographic perspective. Tree Genetics & Genomes 3:363-378.

Bean WJ. 1978. Trees and Shrubs Hardy in the British Isles. 8th ed. Vol. II. St. Martins Press. p. 473.

Bentham G, Belcher E, Hinds RB. 1844. The botany of the voyage of H. M. S. Sulphur, under the command of Captain Sir Edward Belcher, during the years 1836-42. London: Smith, Elder.

Berry J. 1928. *Juglans nevadensis* Washington Acad. Sci. 18:158-160.

Brenzel KN. 2001. Sunset Western Garden Book. The West's Climatic Zones. Menlo Park (CA): Sunset Publ. p. 40.

Callahan F. 2005. California buckeye (*Aesculus californica* (Spach) Nutt.). Kalmiopsis 12:9-15.

Carder A. 1995. Forest Giants of the World—Past and Present. Markham (Ontario, Canada): Fitzhenry & Whiteside.

Elias TS. 1980. The Complete Trees of North America, Field Guide and Natural History. New York (NY): Times Mirror Magazines Book Division. Pp. 269-275.

Griffin JR, Critchfield WB. 1972. The Distribution of Forest Trees in California. Berkeley (CA): USDA Forest Service Pacific Southwest Experiment Sta. p. 22, 69, Map 31.

Harlow WM, Harrar ES. 1958. Textbook of Dendrology, covering the important forest trees of the United States and Canada. 5th Ed. New York: McGraw Hill Book Co. pp. 238-242.

Henry JK. 1915. Flora of Southern British Columbia and Vancouver Island. Toronto (Ontario): WJ Gage & Co. Ltd. p. 101.

Hickman JC, ed. 1993. The Jepson Manual, Higher Plants of California. Berkeley (CA): University of California Press. pp. 709-711.

Hoover RF. 1970. The Vascular Plants of San Luis Obispo County, California. Berkeley (CA): University of California Press. p. 102.

Howell JT. 1973. Notes and News. A Lectotype for the Hinds Walnut. Madroño 22:144.

Huxley A. 1992. The New Royal Horticultural Society Dictionary of Gardening. New York: MacMillan Press.

Jensen EC, Ross CR. 1999. Trees to Know in Oregon. Corvallis (OR): Oregon State University Coop. Ext. p. 80.

Jepson WL. 1908. Juglandaceae *Juglans californica* S.Watson var. *hindsii* Jeps. Bull. S. Calif. Acad. Sci. 7(1): 24.Jepson WL. 1910. The Silva of California. Memoirs of the University of California. Pp. 195-196.

Kearns E. 2006. Big Tree Register. American Forests 112(1):15, 42.

Keeley JE. 1990. Demographic structure of the California black walnut (*Juglans californica*; Juglandaceae) woodlands of southern California. Madroño 37:241.

Kozloff EN. 2005. Plants of Western Oregon, Washington & British Columbia. Portland (OR): Timber Press. 512 pp.

Kruckeberg A. 1984. The flora on California's serpentine. Fremontia 11:4.

Labadie EL. 1978. Native Plants for Use in the California Landscape. 1st Ed. Sierra City (CA): Sierra City Press. p. 128-129.

Little EL Jr. 1953. Atlas of United States Trees. 1st Ed. USDA Forest Service Misc Pub. Washington, DC: US Govt. Printing Office.

Little EL Jr. 1978. Atlas of United States Trees. USDA Forest Service Misc Pub. Washington, DC: US Govt. Printing Office.

Little EL Jr. 1979. Checklist of United States Trees. USDA Forest Service Handbook No. 451. Washington (DC): US Govt. Printing Office. p. 152.

Mabberley DJ. 1993. The Plant Book. Cambridge (MA): Cambridge Univ. Press. p. 301.

Manchester SR. 1987. The fossil history of the Juglandaceae. Monographs in Systematic Botany. Missouri Bot. Gard. 21:5, 81, 83, 105, 106, 107, 109, 117.

McMinn HE, Maino E. 1937. An Illustrated Manual of Pacific Coast Trees. Berkeley (CA): University of California Press. Pp. 156-158. Fig. 147.

Mitchell A. 1996. Trees of Britain. London: Harper Collins. p. 244-245.

Morse K. 2008. Plant Inventory of Deer Creek Property, Selma, Oregon. MS Thesis, Southern Oregon University.

Peattie DC. 1953. A Natural History of Western Trees. 3rd Printing. Boston (MA): The Riverside Press, Cambridge. Pp. 370, 373.

Schopmeyer CS. 1974. Seeds of Woody Plants in the United States. Washington (DC): USDA Forest Service Agriculture Handbook No. 450. p. 456.

Scott RA. 1954. Fossil fruits and seeds from the Eocene Clarno Formation of Oregon. Palaeontographica 96B 66-9.

Smith RE, Jepson WL. 1909. Juglandaceae *Juglans hindsii* (Jeps.) Jeps. ex R.E.Sm. in Univ. Calif. Agric. Exper. Stat. Bull. No. 203, 27.

Sweet R. 1994. Looking for Generals. Forest Log, May-June. Oregon State Department of Forestry, Salem, OR. Pp. 27-29.

Thompson K. 1961. Riparian forest of the Sacramento Valley, California. Ann. Assoc. Am. Geogr. 51:294-315.

Thomsen HH. 1963. *Juglans hindsii*, the central California black walnut, native or introduced? Madroño 17:1-32.

Watson S. 1875. Proc. Am. Acad. Arts Sci. 10:349.

Wittemore AT, Stone DE. 1997. *Juglans*. Pp. 425-428 *in* Flora of North America Vol. 3. Oxford University Press.

Frank Callahan, a member of the Siskiyou Chapter of NPSO, has reported over two dozen range extensions of California plants in Oregon. He has botanized extensively in California and Mexico. A writer and photographer, he wrote the *Calochortus* chapter for the *Bulbs of North America* published by Timber Press, furnishing some of the photographs. He discovered *Calochortus syntrophus* and was coauthor with the late Ray Godfrey for *Calochortus coxii*. He is presently working on five new taxa. He is a leading nominator of National Champion Trees, having reported the largest individual species for more than 80 trees. He works as a private consultant field botanist for the Forest Service and BLM and manages a business, Callahan Seeds, which markets tree and shrub seeds globally. He is presently preparing and transferring the Callahan Seeds Herbarium to the Oregon State University Herbarium.

Book Reviews

Calochortus: Mariposa Lilies and their Relatives

by Mary E. Gerritsen and Ron Parsons. 2007. 220 pages, 176 color photos, 2 line drawings, 1 color illustration. Timber Press, Portland (OR). ISBN 978-0-88192-844-0, $29.95, hardcover.

Elegant and exquisite, lacking only the perfume, describes the *Calochortus* in Gerritsen and Parsons' new book. The bountiful images that fill this long-awaited book make it a must-have for wildflower connoisseurs. In their description of the evolutionary relationships in this North American genus, the authors introduce chloroplast DNA in *Calochortus* for the first time in a popular book. Readers thus have the opportunity to look at the correlation between cpDNA and morphology and geography. Oregon and Washington readers will be shocked at the grouping of *Calochortus howellii* and *C. lyalii*, two species separated by large geographical distances. The book follows Ownbey's treatment of sections (Calochortus, Mariposa, and Cyclobothra), each with their own subsections. Although the book includes some dubious taxa; which according to conversations with Ron Parsons, will be relegated to other taxa: *C. panamintensis* is actually *C. invenustus*, and *C. foliosus* is *C. spatulatus*.

Chapter three covers the history of *Calochortus* discoveries and really brings the book to life. All that is lacking are portraits of some of the key individuals, Marion Ownbey and David Douglas, for example.

For the most part, the images are excellent, especially considering the difficulties of travel and field photography in Mexico. In spite of the hazards, Ron did a top notch job and my only criticism is that a stark, lifeless, black background detracts from some of the pictures, especially *C. tiburonensis*. Only a few photographs are poorly illuminated or too busy (*C. fuscus* and *C. cernuus* by Hugh McDonald and *C. nitidus* by Bob Weller). Winning the beauty contest, hands down, is *C. venustus*, with 23 photos of this species alone. Parsons realized that it takes that many photos to give readers an idea of its dazzling variety of color and patterns.

The final chapter discusses cultivation of *Calochortus* from seeds and bulbs, including advice on soil mixes. There is a list of sources for plant materials in the US, UK, Australia and Canada. Growing *Calochortus* from seed takes patience because many years may elapse before plants flower, but the final results are well worth the effort.

In summary, this book is a bargain considering the miles of jeep trails and mountains climbed, as well as the time and effort to get the perfect photos. The accurate descriptions of the species and engaging stories behind the scenes match the quality of the images. I can only congratulate the two authors on a job well done and Timber Press on producing this fine book.

–Frank Callahan, Siskiyou Chapter.

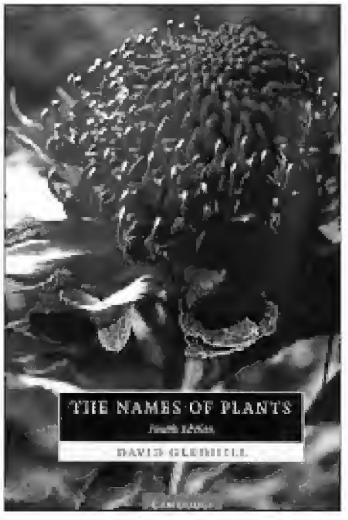
The Names of Plants, Fourth Edition

by David Gledhill. 2008. 426 pages, line drawings, maps, bibliography, index. Cambridge University Press. ISBN 978-0-521-68553-5, $45.00, paper.

In this reference book for botanists and horticulturalists, the glossary section has been considerably enlarged in the fourth edition. The book now includes over 17,000 names or components of plant names. The book has two parts.

The first 29 pages describe how naming plants has changed over time and why the changes were necessary, starting with the rich and imaginative language of common names and proceeding through the current international standards for botanical and horticultural plant names. The section on common names tells how some common (vulgar) names, considered too vulgar, were cleaned up for publication, e.g., "jack-in-the-pulpit" replaced "priest's pintle." The evolution of the current taxonomic system is explained, as well as the rules of the International Code of Botanical Nomenclature and the International Code of Nomenclature for Cultivated Plants. This section explains that generic names are nouns and the specific epithets are adjectives that must agree in gender, number and case, for those of us who did not have the opportunity to study Latin in school. Rules for categories below the rank of species (subspecies, varieties, subvarieties, and forma, and for hybrids, synonymy and illegitimacy are summarized. Although most of us are not actively involved in naming plants, an understanding of how and why it is done may help us avoid errors in using plant names.

The glossary that gives us the meanings of the names is the fun part of the book. It includes Latin and Greek descriptive names, as well as names that come from other languages, places, and people, everywhere on earth. The entries for people do little more than identify the persons and their period in history, because a more comprehensive treatment would greatly increase the size of the book. The author makes no claim that this section is all inclusive, but my cursory searches indicate that it lacks only recently named taxa in our flora. For example, among the taxa in this issue of *Kalmiopsis*, one will find that *hindsii* is named for Richard Brinsley Hinds, surgeon naturalist on the HMS *Sulphur* expedition (1836-42) under Sir Edward Belcher. *Asarum hartwegii* is named for Carl Theodor Hartweg (1812-71), who collected for the RHS in Central America. In *Asplenium trichomanes-ramosum,* the entry for *trichomanes* lists "hair scarcity (Theophrastus' name for maidenhair spleenwort) and (the protrusive soral axes)"; for *ramosum*: "much branched." However, the new *Botrychium* (little bunch, like a cluster of grapes), *yaaxudakeit* is not listed, nor is *wagneri* for green-flowered wild ginger.

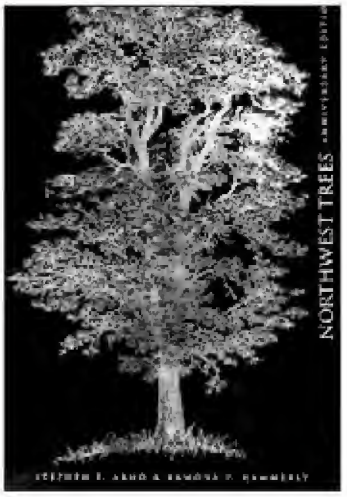


I find only two drawbacks to the book, neither serious. The print is so small that I had to dig out my reading glasses and turn up the light source. Second, the glossary is a one-way street. You cannot, for example, decide on an English meaning for describing a plant and look up a Latinized epithet for it. For that you might consult Stearn's Botanical Latin (2004, Timber Press). The Names of Plants can satisfy one's curiosity as a quick reference for the meaning or origin of a plant name, or provide many hours of casual browsing.

–Cindy Roché, Siskiyou Chapter.

Northwest Trees, Anniversary Edition

by Stephen Arno, drawings by Ramona Hammerly. 2007. 258 pages. Mountaineers Books, Seattle (WA). ISBN 978-1-59485-0410-7, $18.95, softcover.



The first thing you notice about the Anniversary Edition is the larger size and the gold on brown jacket drawing by Ramona Hammerly. Nothing on the front cover or the credit page identified the drawing as California black oak, but it just couldn't be anything else. That's how good Ramona Hammerly's line drawings are. (I confirmed this by finding the cover illustration again on page 188 in the entry for California black oak.) This new paperback is larger than the previous edition (1977): 7x10 inches compared to 3¼ x 8½ inches. The geographic range has also been expanded to what Arno calls "The Greater Northwest," which includes southern British Columbia, western Alberta, all of Washington and Oregon, most of Idaho, and parts of Montana and Wyoming (Yellowstone National Park). In addition to increasing the number of species, Arno also added new information on ecology, with the intent it be used for improved forest stewardship. Thus, the entry for each species has a brief general introduction, followed by a description of where it grows, its appearance and ecological role, and ends with a section of human history section that relates fascinating anecdotes.

There are two illustrated keys, one for conifers and one for broad-leafed trees. Both are well done, albeit a number of species are left out—but I'll get to that later.

In the conifer section, I was disappointed to see that the national champion Western white pine (*Pinus monticola*) near Lake of the Woods was omitted. The human history for sugar pine (*Pinus lambertiana*) includes David Douglas's description of an Oregon tree that measured 18.4 ft in diameter (this is the largest diameter for any pine species on the planet) and 215 ft tall. Unlike Arno, I don't doubt his figures, as Douglas also sketched the tree in his notes. A sugar pine cut in the 1950s near Nickel Mountain in Douglas County measured 15 ft. dbh, but was only 184 ft. tall. The largest sugar pine in the Prospect area was 12.5 ft. dbh (less bark) and 266 ft. tall. The largest western larch (*Larix occidentalis*) listed was over 7 ft in diameter and 162 ft tall. Oregon's Burnt Corral larch gets no mention, despite its diameter of 6.9 ft and height of 225 ft.There is also the "lumpfest" of grand fir (*Abies grandis*) with white fir (*Abies concolor*), and Noble fir (*Abies procera*) with Shasta red fir (*Abies magnifica* var. *shastensis*), which confuses readers and leaves them thinking that there is a hybrid swarm of Noble-Shasta firs in southwestern Oregon, when for the most part there are two distinct species. The maximum size attainable by Port Orford-Cedar (*Chamaecyparis lawsoniana*) is underestimated. In 1965 BLM timber cruiser Eric Rutquist and I measured a stump in Coos County 17 ft. in diameter 12 ft above the base. The Textbook of Dendrology (Harlow & Harrar, 5th ed.) lists a Port Orford-Cedar 16 ft in diameter and 225 ft. tall.

With the expanded geographical coverage of the book, Arno added several new conifers, including Jeffrey pine (*Pinus jeffreyi*), Brewer spruce (*Picea breweriana*), Modoc cypress (*Cupressus bakeri*), redwood (*Sequoia sempervirens*). It is slightly curious that the text is in a different font for the additional species, and the descriptions are shorter. Should Arno decide to do a third edition, he should include gray pine (*Pinus sabiniana*), which grows in southern Oregon and Washoe pine (*Pinus washoensis*), whose range extends from northern California and Nevada and southern Oregon north into southern British Columbia.

Among the broad-leaved tree species that could be included in the next edition are Suksdorf's hawthorn (*Crataegus suksdorfii*), western wax myrtle (*Myrica californica*), Hinds walnut (*Juglans hindsii*), California buckeye (*Aesculus californica*), whiteleaf manzanita (*Arctostaphylos viscida*), hairy or Columbia manzanita (*Arctostaphylos columbiana*), the silktassels—wavy leaf (*Garrya elliptica*) and Fremont's (*G. fremontii*), and Pacific rhododendron (*Rhododendron macrophyllum*). Lest you protest that Pacific rhododendron is just a shrub, I saw the 16½ ft-long bole of one on a log truck in Brookings, Oregon, that measured 3 ft in diameter at the base and 1½ ft in diameter at the top. It had been cut from the Winchuck River drainage in the redwoods.

This softcover book isn't built tough enough for field use; my copy already has a tear on the spine. However, I definitely rate this book as a best buy—the art is outstanding and the history of the trees and commercial logging are well covered. Reading it should fill you with wonder for our native trees, and inspire you to go out and explore what's still out there—let's go for a hike!

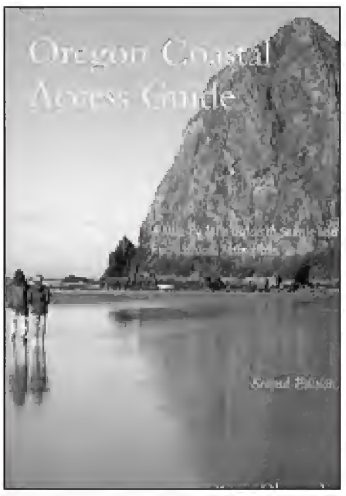
–Frank Callahan, Siskiyou Chapter.

Oregon Coastal Access Guide: A Mile-by-Mile Guide to Scenic and Recreational Attractions, 2nd edition

by Kenn Oberrecht. 2008. 368 pages, B&W photographs, maps, bibliography, index. Oregon State University Press (a co-publication with Oregon Sea Grant). ISBN 978-0-87071-293-7, $22.95, paper.

"It's like looking at a road map of the Oregon coast with a high powered microscope." That's what you will say after using this 0.1-mile by 0.1-mile guide of the spectacular Oregon coast line.

Whether you go to the Oregon coast on a regular basis or are planning a vacation, you will want to have this book close at hand (in your vehicle or backpack) for quick reference. A whole suitcase of resources bound into a single volume, this book covers hundreds of scenic opportunities and recreational attractions along the 363.1 miles of Oregon's Pacific coast.



The book follows U.S. Highway 101, beginning in Astoria (Astoria-Megler Bridge) and ending at the Oregon-California border. It is organized from north to south, with each county as a separate chapter. It includes maps, county history, "must stop" sites, interesting side trips, geologic and historic features, campgrounds, picnic areas, trail heads and viewpoints among a host of other information.

Kenn Oberrecht has undoubtedly spent many years and miles gathering detailed information on beaches, light houses, trails, natural areas, campgrounds, boat ramps, picnic areas and cultural and historical sites. Tucked in between the mile by mile information are informative narratives about Oregon's salt marshes, estuaries, marine birds, seals and sea lions, and some coastal Oregon history. There are even thirteen pages dedicated to locating, identifying, digging and preparing clams.

In addition to knowledge about the natural features of the coast, the author also shares information about coastal climate, weather, tides, sneaker waves, shoreline hazards, killer logs and tsunamis to assist the traveler in having a safe trip.

Next time you head to the Oregon coast to do some botanizing, take this book along. It will not only help reach your destination of floral interest, but the information about the surrounding areas will enrich your travels. In addition, following the book's suggestions may lead you to explore new areas and discover additional botanical treasures.

–Bob Korfhage, Siskiyou Chapter.

Northwest California, A Natural History

by John O. Sawyer. 2006. 264 pages, illustrations and color photographs. University of California Press, Berkeley (CA). ISBN 978-0-520-23286-0, $75.00, hardcover.

We now have a choice of three books that cover various aspects of the Klamath Ecoregion: Dave Raines Wallace's 1983 *The Klamath Knot*; John Sawyer's 2006 *Northwest California: A Natural History*; and James Agee's 2007 *Steward's Fork: a sustainable future for the Klamath Mountains* (also reviewed in this issue).

Of the three books, Sawyer's book seems to be have the most information about northwestern California (and adjacent southwestern Oregon). There are chapters entitled: The Klamath: Land of Mountains and Canyons; The North Coast: Land of Towering Trees; High and Low: Looking for Patterns in Vegetation; Beyond the Ancient Meeting Ground; Regimes of Fire; Agents of Change; The Status of Northwest California Today; and Northwest California's Biological Future.

Sawyer's 40-year experience of teaching and research as a faculty member at Humboldt State University shows. His personal, on-the-ground experience in the Klamath Ecoregion is evident in his discussions that often mention his graduate students who did thesis research about the subject at hand.

Sawyer writes: "Natural history books are always overflowing with facts. They introduce you to the richness and detail of an area. I hope my presentation has brought some order, and in doing so, has made the facts more accessible." That is true up to a point. There are 23 tables, 17 maps, 7 figures, and 26 color plates in the book. They are informative for the most part, mostly well selected, and mostly correct. That is the good news. The bad news is that there is no list of titles to tables, maps, figures, or plates anywhere in the book. However, in the index, entries with page numbers in bold face refer to a table. The author refers to maps, figures, and plates in the text. A titled list would have been very helpful in locating information.

There are some errors. In the prologue in the discussion of the Klamath Mountains, reference is made to Map 2: "They contrast strongly with the neighboring younger rocks of the Cascades (Map 2)." Map 2 is titled Watersheds of Northwest California (with no mention of the Cascades). Callahan is misspelled Callihan in Map 5. I did not continue proofreading.

Literature is not cited in the text, but the selected reading section is more or less divided up by chapter heading. When a statement is made in the text for which I would normally expect a citation there is nothing, and to devine a source I had to guess from the list in the selected reading section.

The selected reading lists good references that are not necessarily well known. The author does us the favor of listing 37 of his students' unpublished theses, available at the Humboldt State University library. Topics are ecological or floristic and most are specific to northwestern California.

As I read the book, I kept wondering if there was a race to publication with the Agee book; that might account for lack of tables and the large sections of white space that begged for illustrations below the major headings.

What is in it for Oregon botanists? The similar climate, geology, flora, and fauna continue north beyond 42°, so much of what Sawyer writes applies to southwestern Oregon as well as northwestern California. Of the three books mentioned above, Sawyer's book would be my choice for natural history and interpretation despite its shortcomings. What would stop me from buying the book is the $75 price tag. Wait for the soft cover edition, or try the downloadable eBook version at ebooks.com for $15.95.

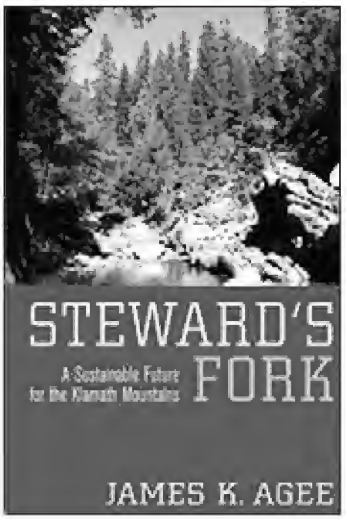
–Frank Lang, Siskiyou Chapter.

Steward's Fork: A Sustainable Future for the Klamath Mountains

by James K. Agee. 2007. 294 pages, 21 b/w photographs, 18 line illustrations, 7 maps. University of California Press, Berkeley (CA). ISBN 978-0-520-25125-0 $39.95, hardcover.

The title "Steward's Fork" is a play on words that underlies the premise of the book's main theme: "Stewardship" of a landscape that Agee clearly knows and loves. He uses fond childhood memories of the Stuart Fork of the Trinity River with considerable clarity and skill to tell about the physical and biological history of the Klamath Mountains.

Although the major area of concentration is the Trinity and Marble Mountains of California, much of his discussion is also of interest to people who care about the land beyond the Klamath Mountains.



To tell the truth, I nearly gave up on the book early on. When writing about the plants of the past (page 26) he wrote, "The primary conifer was bald cypress, and its angiosperm associates (plants that have seeds enclosed in a closed ovary, like a rose) fig, holly ..." Sorry, but all I could think was that he had the genus *Rosa* in mind. The "ovary" wall is the hypanthium and the "seeds" are individual fruits that do have a real ovary wall derived from the ovaries of the plant's many pistils.

In Chapter 4, *A Rose by Any Name*, Agee starts discussing the rich diversity of the Klamath flora, and then shifts to a favorite whinge of many ecologists I have known: common and scientific names of plants. "Plant names are often mysteries intended to throw the average person off the track and maintain a professional niche for taxonomists," writes Agee. Jim, to what audience are you pandering? Then he complains about common names based on names of states: Oregon grape, why not California Grape; Oregon ash, why not Washington ash. He does call Oregon white oak, Garry oak, for which he is to be applauded; but fails to champion Kellogg oak for California black oak which occurs in Oregon. I nearly tossed the book at this point, but fortunately forged on.

Chapter 5, *My Botanical Contest with Miss Alice Eastwood*, is a story about Agee's efforts in 1962 to retrace and duplicate or best Eastwood's collecting survey in 1900 along Canyon Creek, a tributary of the Trinity River. Agee is able to work in a lot of history and information about the region in his telling of the tale.

Other chapters cover wild creatures of the Klamath Mountains, the factors of change, indigenous peoples and their impact on the ecosystem, the impact of mining, livestock grazing, water issues, and modern myths and monsters (including murder, Bigfoot and other oddities). Final chapters cover the author's views on how humans can provide proper stewardship for a sustainable future for the Klamath Mountains. He does not paint a hopeless picture.

I found much of value in the book that makes it more than a regional piece, particularly in his descriptions of how humans have used and abused the land. Read it to learn about mercury use in early gold mining and its modern legacy, the impact of water projects, the history of land ownership and the railroads, plans for river restoration and more.

However, I was surprised that I could find no reference to David Raines Wallace's 1983 classic *The Klamath Knot*, a book that covers the natural history of the Klamath Mountains in a different way.

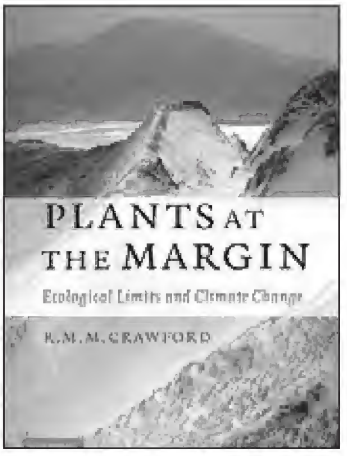
I liked his writing style, particularly things he witnessed, as this flood: "Redwood Creek, which one could easily wade in summer, was a raging 30 feet deep and perhaps 300 feet wide. A large redwood came down the creek broadside and swept into a red alder grove on the east bank. Without slowing down, it snapped off the stems of perhaps fifty or sixty alders. Even today, I get shivers when I remember the roar of the water and the explosion of the alder grove."

You know, I get shivers reading Agee's description. I also shiver at the price, but it is worth the investment if you are interested in the Klamath Mountains.

–Frank Lang, Siskiyou Chapter.

Plants at the Margin, Ecological Limits and Climate Change

by R.M.M. Crawford. 2008. 478 pages, color photos, graphs, maps, bibliography, indices. Cambridge University Press. ISBN 978-0-521-62309-4, $80.00, hardcover.



Are you interested in climate change, biogeography, demography, reproductive biology, physiology, and genetics of plants? How about plant ecology? Are you a traveler, armchair or not, who takes notice of what you see on the natural landscape and tries to make sense of it? If you are, this is the book for you.

R.M.M. Crawford has studied plant interactions with their environments around the world; Scotland, Scandinavia, North and South America, and the Arctic, particularly. He uses his vast experience and knowledge to illustrate how plants at the edges (margins) of their ecological range shed light on how they might respond to global climate change as they have in the past.

The book has many examples, illustrated with color photographs backed by well-chosen charts, graphs and maps from a vast array of references. The illustrations are mostly excellent with only a few pixelated charts and maps, to be forgiven, for they serve their purpose well. There are a few typographical errors (just enough to gladden the heart of prigs everywhere, but not enough to be an embarrassment). *Pinus moticola* not *monticola* or mixing the common name for holly and ivy with their respective botanical names, for example.

I enjoyed discussions and photographs of places I have been, Patagonia most recently. One of the first things I do when I get a new book is leaf through it looking at the illustrations. Figure 1.2 was a photograph of two natural treelines in Patagonia. The caption read, "Fig. 1.2 *Limes convergens* as seen in two…." I knew the genus *Nothofagus* but not *Limes.* Fig. 1.3 also featured *Limes convergens* from Vermont. It started to dawn on me that *Limes convergens* might not be a plant at all, but something else. A quick read of the text revealed that *Limes convergens* is a synonym for *ecotone*. Such is the nature of a worldwide approach to science.

Crawford divides the book in parts, *The Nature of Marginal Areas*, *Plant Function in Marginal Areas*, and *Marginal Habitats–Selected Case Histories*, including an interesting discussion of *Man at the Margins.* His world-wide interest brought me new perspectives and insights concerning the problems of climate changes and how plants and many animals including humans might cope in the future. I recommend the book to you in spite of its $80 price tag. It would look good on your coffee table, anyway.

– Frank Lang, Siskiyou Chapter.

NOTICE TO CONTRIBUTORS

Members of the Native Plant Society of Oregon and others are invited to submit articles, book reviews, artwork, and photographs for publication in *Kalmiopsis*. All materials submitted should pertain to Oregon's native vegetation and flora. Acceptance will be based on suitability (articles dealing with formal nomenclatural proposals or of a highly technical nature are not acceptable). *Kalmiopsis* publishes two series articles: *Plant of the Year*, and *Oregon Plants, Oregon Places*. We also publish articles about botanical history and features related to native plants or plant communities in Oregon.

Please consider that the readers of *Kalmiopsis* are people with varied educational backgrounds and all articles must be comprehensible to a broad, but relatively well educated, audience. The goals of *Kalmiopsis* are to disseminate correct information about and generate interest in native plants, thus each article is reviewed by the editorial board and selected technical reviewers before publication.

Contributions of artwork and photographs without accompanying manuscripts are welcome; color submissions must be suitable for publication in grayscale. Contact the *Kalmiopsis* editor to request a copy of Instructions to Authors, or to inquire about the suitability of an idea for an article.

Populations of *Asarum caudatum* with pale greenish flowers have been confused with green-flowered wild ginger. Photo by Bob Vos

MEMBERSHIP

Membership in the Native Plant Society of Oregon is open to all.
Membership applications, renewals, and changes of address (include old address and zip code) should be sent to the NPSO Membership Chair, Clayton Gautier, 3927 Shasta View St., Eugene OR 97405-4442.
Student $12; Regular $18; Family $24;
Sustaining $50; Patron $100; Life Member $500
Subscription Only (Bulletin and Kalmiopsis) $18

ACKNOWLEDGEMENTS

Kalmiopsis Logo: Linda Ann Vorobik (VorobikBotanicalArt.com)
Pagesetting: Fassler Graphics, Ashland
Printing: CDS Publications, Medford

TABLE OF CONTENTS

Kalmiopsis
Native Plant Society of Oregon
Clayton Gautier, Membership Chair
3927 Shasta View St
Eugene OR 97405-4442

NONPROFIT ORG
US POSTAGE
PAID
MEDFORD OR
Permit No. 101