KALMIOPSIS

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Native Plant Society Of Oregon

The Native Plant Society of Oregon is an organization of lay and professional botanists interested in the Oregon flora. The work of the Society includes the preservation of the native flora and the botanical education of Society members and the public. The Society accomplishes the former goal by taking an active role in monitoring programs, by active participation in plant conservation issues, by helping establish botanical preserves and by protecting significant plant populations. We meet our educational goals through our local chapter meetings, field trips, and publications. The Society awards the Jean M. Davis Memorial Scholarship to students studying the Oregon flora and several modest research grants yearly. Membership includes participation in local chapter meetings, field trips, and subscriptions to the BULLETIN and KALMIOPSIS (also available separately at $5.00 per issue). The monthly BULLETIN includes notices of chapter meetings and activities, conservation issues and short articles of interest to the membership. KALMIOPSIS features longer articles of interest to lay and professional members of the Society.

Volunteers do the work of the Society. Money is raised by membership dues, sales of posters, notecards, and tee shirts. Additional donations, bequests, and memorial gifts greatly help the Society in its efforts.

EDITORIAL

Here is the first issue of the long-awaited journal of the Native Plant Society of Oregon. The Society hopes you find KALMIOPSIS interesting and useful. Its resemblence to FREMONTIA, the journal of the California Native Plant Society, is no accident. We are grateful to FREMONTIA and the California Native Plant Society for setting such a high standard for us to emulate.

Our first effort is modest. Future issues will have book reviews, a news and comments section, and a featured "plant of the year," besides longer articles. The Society discussed the issue of recycled versus archival paper. We hope that you do not want to recycle KALMIOPSIS; that you find it worth keeping. We chose archival paper.

In this final decade of the 20th Century we face an intimidating array of environmental issues, including a catastrophic decline in biodiversity and wildland habitat. We hope KALMIOPSIS will keep you informed and inspire you to action.

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 MEMBERSHIP CHAIR.

Student $8.00, Regular $12.00, Family $18.00, Sustaining $30.00, Patron $100.00, Life Member $500.00

THE COVER

Kalmiopsis leachiana (Henders.) Rehder. Illustration from Alfred Rehder's 1932 paper. Artist unknown.

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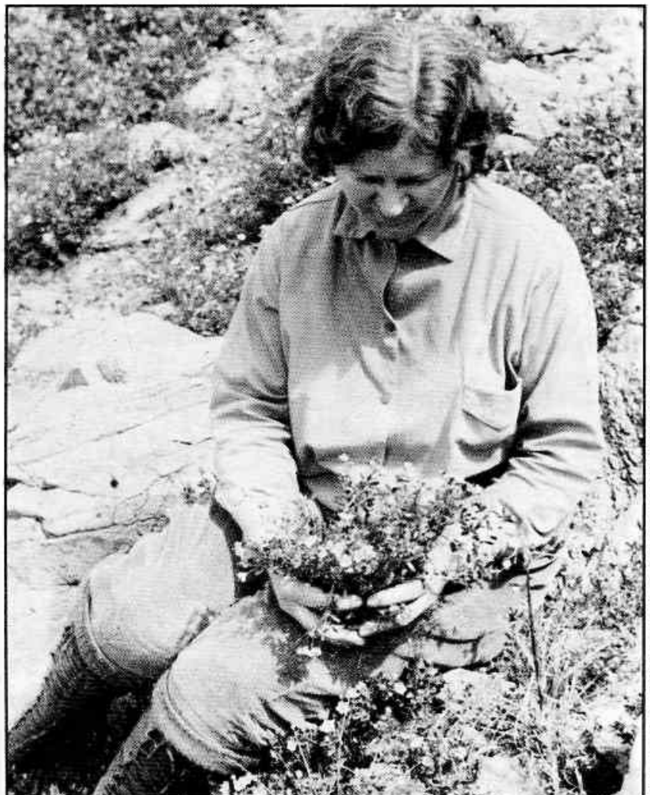
The Discovery and Naming of *Kalmiopsis leachiana* and the Establishment of the Kalmiopsis Wilderness

Rhoda M. Love

The Discovery of *Kalmiopsis leachiana*

The date was June 14, 1930. Botanist Lilla Irvin Leach and her husband John, a Portland pharmacist, were descending a ridge in the Siskiyou Mountains of Curry County, Oregon. With them were two pack burros, Pansy and Violet. The four had camped the night before at a small glacial lake on a bench near the summit of Pearsoll Peak, about 11 miles west of Selma at the boundary of what is now the Kalmiopsis Wilderness. It was a hot day and the trail was a steep one through rugged country. They had traveled several miles on the bare ridge when they came to a place where the hogback widened out and became Gold Basin, a high plateau with scattered pines. Lilla later described the next moments as follows: "I was in the lead where I usually walk in order to get the first chance over the burros to anything of interest that might be growing, when suddenly I beheld a small patch of beautiful, low growing, deep rose-colored plants. Because of their beauty, I started running and dropped to my knees... I had never seen anything so beautiful before. John came and started taking pictures while I examined the plant with a hand lens. I believed it was new."


LEACH COLLECTION U OF OREGON KNIGHT LIBRARY

Lilla Leach and Kalmiopsis leachiana at Horsesign Butte, May 1, 1931

Lilla Leach always spoke of the discovery of *Kalmiopsis* as her most exciting experience and the thrill of a botanist's lifetime. In an interview almost a quarter of a century later, Lilla again described her discovery of the new plant: "I suppose there must have been a little depression in the ridge there, a sort of saddle for moisture to gather in and soil to accumulate, for there beside the trail was a patch of evergreen bushlets simply covered with deep rose-colored flowers, vividly pink in the sun. The patch was about 30 feet square, at a rough guess. Thrilled? We certainly were! I felt sure it was something new. It looked like *Kalmia polifolia*, but it wasn't. I thought it might be a new *Kalmia*."

Lilla collected and pressed a specimen of the new plant. On the collection paper she wrote, "No. 2915. June 14, 1930. Gold Basin." The only flower on the whole ridge." The plant, a member of the heath family, Ericaceae, which was later named *Kalmiopsis leachiana*, was indeed new to science. Not only was it a new species, but it was later determined to be a new genus as well. Morton E. Peck (1941) describes the plant as follows: [*Kalmiopsis is*] "a low shrub with the aspect of kalmia, leaves evergreen, densely glandular-dotted beneath; flowers corymbose, corolla regular, broadly campanulate,... the tube without saccations; anthers opening by broad terminal clefts..." [*K. leachiana is*] "a slender, copiously branched shrub 1.5-2.5 dm high; leaves... dark green, strongly revolute... corymbs 5-10 flowered, calyx deep red, 3-5 mm high; corolla deep rose, paler toward the base, 12-15 mm wide... Mountains of Curry County."

When the Leaches returned to their home in Portland, Lilla sent a specimen of the plant to Louis F. Henderson, curator of the Herbarium at the University of Oregon in Eugene, who worked during the fall and winter, attempting to give a name to the new species. Meanwhile the Leaches prepared for another season of field work in the Siskiyous. By early 1931, they had heard from Henderson that, in his opinion, the plant was probably a new species of *Rhododendron*. Back in Curry County on May first, they found a new location for the plant. In John Leach's words: "We were going up a long trail at Horse Sign Butte (about 8 miles south of Agness). Here again Lilla saw a rose red patch on the hillside. The trail was steep and the switchbacks had to be made, so it was a more deliberate approach, but she experienced the same joy. This time she strongly suspected that it was her best flower "find" in a new location. There were many more plants here..." Later in the day, Lilla and John found more kalmiopsis: "We made camp at

Miner's Cabin, an old deserted log house, where we left our horses feeding in midafternoon, and started without wraps or food to botanize the nearby territory. We wandered down the zig-zag trail to Collier's Bar [on the Illinois River], a distance of nearly five miles, with a loss of 3000 feet altitude. Here again, growing at about 500 feet elevation, we found *Kalmiopsis*."

On that trip, the Leaches collected and pressed more specimens of the plant and during the remainder of 1931, Henderson and later Alfred Rehder of the Arnold Arboretum of Harvard University continued to work on naming the new species. By the time the Leaches began their next season's work in the Siskiyous, the plant had received its present name, *Kalmiopsis leachiana*, and, on June 12, 1932, the Leaches found the plant in yet another location in Curry County, this time on Big Craggy Mountain at an elevation of 5000 feet. John Leach later described the location as "... so inaccessible and brushy that six miles in 15 hours is the best we could do and we came back feeling as though we had been to Hell's Canyon."

The Discoverers, Lilla and John Leach

Lilla Leach was 44 years old when she and her husband John first found *Kalmiopsis leachiana* at Gold Basin. In all, the Leaches made nine summer trips to the wilds of Curry County between 1928 and 1938, over an estimated 1000 miles of primitive trails. They were usually accompanied by the two burros, Pansy, who carried the plant presses, and Violet, who carried the rest of the camping gear. The remote and mountainous parts of Curry County had not been seriously botanized before the Leaches arrived. Lilla is credited with the discovery of over 12 new Oregon species and two new genera.

Lilla Irvin was born in Barlow, near Oregon City, on March 13, 1886. She attended the Tualatin Academy and the University of Oregon where she received her B.A. in Botany under Professor Albert R. Sweetster who said of her, "She was my most distinguished pupil." Lilla taught botany for five years in the old Eugene High School until her marriage to John Leach in 1913. They were married for 59 years until his death at age 90 in 1972.

John R. Leach was born in Weston, in what he usually referred to as the "bunchgrass country" of eastern Oregon on March 26, 1882. He studied pharmacy at Oregon State College in Corvallis. He and Lilla had met at the Tualatin Academy where he tried unsuccessfully (at first) to woo her. Finally, as he wrote years later, "I told her I was a mountain man, knew the ways of pack mules, could talk the mule talk, see the mule's viewpoint, reason like a mule, throw the diamond hitch, and could pack her back where the flowers were different and cake-eating botanists could never get." And, in that way, the lady botanist was won by the muleskinning pharmacist! After their marriage they botanized together every summer until 1945 when, at age 59, Lilla began to be bothered by arthritis of the hips which prevented her from doing the grueling field work she had enjoyed for over 30 years. In 1911, John Leach had bought the Phoenix Pharmacy at Southwest 67th Avenue and Foster Road in Portland where he did business until he retired in 1946.

Lilla Leach made most of her important botanical finds in Curry County, but this was not the only area that she and John explored during her botanical career. They hiked and camped in Washington State's Olympic Peninsula, in Yellowstone Park, in Oregon's Wallowa Mountains, along the Columbia, Rogue and Umpqua Rivers, in the Steens, Hart and Blue Mountains and around Mt. Hood, Mt. Jefferson, Mt. Adams, Mt. St. Helens and Goat Rocks near Mt. Rainier. Some of the plants found by Lilla, in addition to *Kalmiopsis leachiana*, include: Fabaceae: *Sophora leachiana*, Crassulaceae: *Sedum moranii*, Iridaceae: *Iris innominata*, Scrophulariaceae: *Penstemon deustus suffrutescens*, Liliaceae: *Brodiaea dissimulata*, and *B. leachiae*, Fumariaceae: *Dicentra formosa breviflora*, Liliaceae: *Allium cascadense*, Scrophulariaceae: *Mimulus primuloides minimus*. In 1950 Lilla Leach became the first recipient

BRUNKOW LEACH BOTANICAL GARDEN

Lilla Leach at home

of the Garden Club of America's Eloise Payne Luquer Medal for achievement in botany.

In 1931 the Leaches purchased five acres of property at the foot of Mt. Scott on Johnson Creek, southeast of Portland. There they built a stone cabin and spent vacations on the property until they were able to move into their larger house which was completed five years later. They named the property Sleepy Hollow and lived there together until John Leach died in 1972. The Leaches had no children, and the year after John's death, Lilla deeded the property to the City of Portland, with the provision that it be maintained as a botanical area. Lilla Leach died in 1980 at the age of 94. She had presented her extremely valuable herbarium of approximately 6000 specimens to the University of Oregon Herbarium in January 1963.

Sleepy Hollow, now known as the Leach Botanical Garden, is open to the public. It features over a mile of trails, more than 1500 labeled plant specimens, valuable examples of northwest native species as well as some exotics, and a special area devoted to plants of Curry County including *Kalmiopsis leachiana*. The Garden is administered jointly by the City of Portland and a private interest group, Leach Garden Friends. The Garden's current curator is Bonnie Brunkow.

The Naming of *Kalmiopsis leachiana*

The story of the naming of *Kalmiopsis leachiana* is as fascinating as that of its discovery. When Lilla Leach first saw the plant on June 14, 1930, she thought it might be a *Kalmia*. The genus *Kalmia*, often called mountain laurel, was discovered by Peter Kalm, a student of Linnaeus, who explored eastern North America between 1747 and 1749. Linnaeus subsequently named the genus for its discoverer. The kalmias are pink-flowered shrubs which grow in boggy areas with acid soils. They are unique members of the Ericaceae, because their stamens fit inside ten little pouches in their petals. When the flower is disturbed, the stamens spring out suddenly to release the pollen. Lilla Leach's low, pink-flowered Curry County shrub had flowers which resembled those of *Kalmia* in size and color, but lacked *Kalmia*'s characteristic stamen pouches.

Shortly after collecting her new plant, Lilla sent a pressed specimen to Louis F. Henderson (1853-1942), curator of the University of Oregon Herbarium. Not all the correspondence between Lilla Leach and Louis Henderson has survived. However, Henderson apparently decided quite early that the plant belonged to the genus *Rhododendron* and his first impulse seems to have been to name it *R. leachianum* in honor of its discoverers. But by April 1931, Henderson had changed his mind and decided that the plant was very similar to *Rhododendron lapponicum*, from Norway and New Hampshire. He wrote to the Leaches, "I know you are going to be disappointed when I tell you I had to revoke on that *Rhododendron* and rename it variety *leachianum* of *R. lapponicum*." Henderson cited lepidote or scaly glands on the leaves and flowers as the reason for this taxonomic decision. Here the matter stood until Lilla was able to send Henderson some good fruiting material collected in May 1931. At that point he changed his mind again, deciding that the fruit was unlike *R. lapponicum* and that the name would be *Rhododendron leachianum* L.F. Henderson.

But another player was about to enter the drama. This was Alfred Rehder (1863-1949) curator of the Herbarium of the Arnold Arboretum of Harvard University and author of <u>Manual of Cultivated Trees and Shrubs Hardy in North America</u>. It seems likely that Henderson, who, thirty years earlier, had spent a sabbatical year studying at the Gray Herbarium at Harvard, had sent a specimen of Lilla Leach's new shrub to Harvard where Rehder had seen it. Apparently some of the Leaches' 1931 collection from Horse Sign Butte and Collier's Bar was sent at once to Rehder who wrote to Henderson that the plant seemed unrelated to any species of American *Rhododendron*. Rehder felt Lilla's plant was more closely related to *Rhodothamus*, a European genus of rare montane shrubs. Despite Rehder's doubts, Henderson (1931) published the new plant as *Rhododendron leachianum*, in a brief note entitled New Plants from Oregon that appeared in the journal <u>Rhodora.</u>

Here, following the mandatory Latin description, Henderson wrote, "When first discovered in 1930 by Mr. and Mrs. J.R. Leach (their no. 2915), only a small patch was found, in the higher Siskiyou Mountains of Curry County, Oregon, and no good fruit was obtained. On a second trip this year (1931), it was found to be abundant in dry, rocky ground on Horse Sign Butte and along Collier Bar Trail, alt. 2000-4000 feet, in the same county; and in this collection is much good fruit of last year's crop. Type in the Herbarium of the University of Oregon; cotypes in the Gray Herbarium, Herbarium of the Arnold Arboretum and elsewhere. I take great pleasure in naming this unique plant for the discoverers, zealous collectors and mountain lovers of Portland, Oregon, who have discovered several new plants, including one new genus." (The genus referred to here is *Bensoniella* in the Saxifragaceae, first collected by J.W. Thompson.)

This is not the end of the story. With more fresh Oregon material to study, Rehder seems to have taken the matter of naming this unusual Oregon plant into his own hands. By this time, Rehder was apparently corresponding directly with Lilla Leach. Again, not all the correspondence survives; however, Lilla informed Rehder by letter in February 1932 that she planned yet another collecting trip to the Siskiyous during the coming spring. However, Rehder had already decided to place Lilla's discovery in its own unique genus, *Kalmiopsis*.

Type specimen of Kalmiopsis leachiana with Henderson's notes

LOVE/WAGNER U OF OREGON HERBARIUM

In 1932 Rehder's illustrated article, "Kalmiopsis, A New Genus of Ericaceae from Northwest America," appeared in the Journal of the Arnold Arboretum. Rehder wrote: "The discovery in Oregon by Mr. and Mrs. Leach of a new ericaceous shrub subsequently described by L.F. Henderson as *Rhododendron leachianum* is highly interesting, particularly as this shrub turns out to be a new genus...for which I propose the name *Kalmiopsis* referring to its general resemblance to *Kalmia*..." Rehder went on to say that, in his opinion, the new genus *Kalmiopsis* was related to the genera *Kalmia, Rhododendron, Phyllodoce* and the European genus *Rhodothamnus* as well as to some other less well known ericaceous genera. He expressed the opinion that *Kalmiopsis* represented "...a phylogenetically old type of the Tertiary." He based this opinion on the fact that the genus seemed to be monotypic,that is, contained only a single species. Rehder noticed a difference in style length among some of the Leach collections of *Kalmiopsis leachiana*, which he dealt with as follows: "The variation in the length of the style is interesting; it can hardly be explained as heterostyly which is unknown in Ericaceae and must apparently be considered a seminal variation." In his final paragraph, Rehder made a plea for conservation: "It is highly desirable that this little ericaceous shrub... should soon be introduced into cultivation, so that this genus may be preserved at least in cultivation if it should become extinct in its native habitat, which, owing to its limited distribution seems not impossible." Rehder's article was illustrated with a very handsome line drawing of the plant which is reproduced here. (See cover)

The Leaches were clearly pleased with the new genus designation. Lilla Leach wrote to Rehder in February of 1932, to thank him for a reprint he had sent them: "We are delighted with the new genus *Kalmiopsis leachiana* and thank you kindly for the separate. The plate is very fine indeed." The "type specimen" of *Kalmiopsis leachiana*, collected by the Leaches on June 14, 1930 at Gold Basin, is at the University of Oregon Herbarium in Eugene. The sheet is labeled "*Rhododendron leachianum*" in Louis F. Henderson's handwriting because this is the name Henderson originally gave to the new species before the name was changed by Rehder.

Some Taxonomic Considerations

While *Kalmiopsis leachiana* remains the accepted name for the plant discovered in 1930 by the Leaches, there has been sporadic interest in further investigation of the plant's taxonomic affinities. In 1977 Robert Marquis, a student at Oregon State University, wrote a lengthy unpublished master's degree thesis on the ecology and distribution of the plant. He called attention to a variant of *K. leachiana* which grows about a hundred miles northeast of the Curry County sites, near the North Umpqua River in Douglas County. This form appears to differ from the Curry County plants in some respects, including more mat-like growth and longer stamens. In the horticultural trade the name *K. leachiana* form 'M. Le Piniec' is sometimes used for clones of the North Umpqua *Kalmiopsis*, but this name has no official status. Marquis reported that *K. leachiana* is distylous (a breeding system in which some individuals have long styles, some short, believed to encourage cross pollination), this being the first reported case of heterostyly in the Ericaceae.

In 1943, Herbert F. Copeland reviewed the anatomy and taxonomy of the genera of Ericaceae. Copeland proposed dropping the genus name *Kalmiopsis* and placing *K. leachiana* in the older European genus *Rhodothamnus*, because of what he considered to be important anatomical similarities between the two groups. (Alfred Rehder had also pointed out similarities between *Kalmiopsis* and *Rhodothamnus*.) *Rhodothamnus*, a genus of Old World alpine shrubs, contains two exceedingly rare disjunct species, *Rhodothamnus chamaecistus*, and *R. sessilifolius*. P.H. Davis (1962), the discoverer of *R. sessilifolius*, disagrees with Copeland that *Kalmiopsis leachiana* should be moved to the European genus. Perhaps with our newly developed techniques for taking "DNA fingerprints" and for studying proteins via electrophoresis, the relationships between *Kalmiopsis* and other groups in the Ericaceae will one day be better understood.

The Kalmiopsis Wilderness

Almost as soon as word spread of the new genus, *Kalmiopsis*, discovered by the Leaches in Curry County in the early 1930's, collectors began to take their toll on the more accessible populations. The Leaches noticed as early as 1933 that some patches were already being decimated. Lilla and John went to the Forest Service with their concerns. As they reported in a 1938 Mazama article, the Forest Service recognized the problem and, earlier that year, closed the area to all human travel, "for preservation of rare and vanishing species."

The Kalmiopsis, Oregon's third largest wilderness area, lies within the Siskiyou National Forest in Curry and Josephine Counties. First designated a Wild Area of 79,000 acres in 1946, wilderness status was achieved through the National Wilderness Preservation System Act of 1964. Later, with the passage of the American Endangered Wilderness Act of 1978, the Kalmiopsis was more than doubled to its present size of 180,000 acres. The Wilderness is administered by the Siskiyou National Forest and, according to the U.S. Forest Service, the area must "meet the conditions of a wilderness for the enjoyment of people for all time."

The Siskiyou and Klamath Mountains of southwest Oregon are home to a number of unique, endemic species which, in addition to kalmiopsis, include the pitcher plant, *Darlingtonia californica*, Port Orford cedar, *Chamaecyparis lawsoniana*, Brewer's weeping spruce, *Picea breweriana* and Sadler's oak, *Quercus sadleriana*. The geologic history of the area is a fascinating one, and undoubtedly its past history and the origin of its rocks and soils are related to the present flora. Around a hundred million years ago, these mountains apparently were an island or peninsula in the Pacific Ocean lying about 60 miles off the then-coastline of what is now Oregon. The parent rock of this land mass was derived from the sea floor which had buckled and risen above the ocean. Later, volcanic and sedimentary materials flowed in to connect the mountains with the continent. The Siskiyou and Klamath ranges are a patchwork of soil types, many of which were derived from the sea floor and are rich in heavy metals. Many Siskiyou soils, especially those derived from the rock type known as serpentine, are high in nickel, chromium, cobalt and magnesium. The same soils are frequently low in the major nutrients nitrogen, phosphorous, potassium and calcium. Plants growing on these soils are often noticeably stunted; however, over time, a number of serpentine endemic species have evolved, increasing the diversity and uniqueness of the area's flora. Although *Kalmiopsis leachiana* is not considered a serpentine endemic, a few populations do occur on serpentine soil.

Climate and fire history have also effected plant distribution and diversity in this area. The long-term climate trend has been from hot and wet to cool and dry. Within this general trend there have been shorter cooling and warming trends. Each climate change has tended to bring plant migrants from north or south, some of which have remained in specific niches. Fire has also shaped the Siskiyou flora. A number of fire-adapted plants such as *Ceanothus* species, some oaks and madrone are common in the area. *Kalmiopsis* itself seems to be one of these fire-adapted species. Populations of *Kalmiopsis leachiana* survived the recent Silver Fire well and seem to be increasing due to lack of competition. All of the above factors, and perhaps others that we do not yet recognize, have no doubt combined to make the Siskiyou region a floristically diverse one. However, I feel that, at this time, we cannot say precisely where *Kalmiopsis leachiana* came from or why it is present only in Southern Oregon.

A detailed map of the Kalmiopsis Wilderness is available from Siskiyou National Forest Headquarters in Grants Pass. The map indicates the following places within the Wilderness where the hikers may see *Kalmiopsis* in bloom in May or June: York Creek on the Illinois River Trail, Bailey Mountain, Dry Butte, Gold Basin, Vulcan Lake and Taggarts Bar. No plant collecting is permitted in the Wilderness.

My husband and I hiked a short distance into the Kalmiopsis Wilderness in June 1990. We found it to be a quiet, empty and beautiful place, with wonderful crisp, clean air. We forded rushing Horse Creek off Forest Service road number 1107 east of Brookings and then climbed up out of the valley onto a ridge top with views of wild and rolling hills and of Red Mountain to the north. Plant diversity was high. My notebook mentions rhododendron, beargrass, madrona, manzanita, tanbark oak, Sadler's oak, chinquapin, knobcone pine, the little ground cone, *Boschniakia* and the mycotrophic red and white candy stick, *Allotropa virgata*. We did not see kalmiopsis in this part of the Wilderness, but we are eager to return and backpack more extensively in the area. Someday we hope to visit the place where Lilla and John Leach made their wonderful discovery of *Kalmiopsis leachiana* 60 years ago this summer.

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(For a copy of the complete, annotated bibliography used to research this article, send a stamped, self-addressed envelope to the author.)

View north to Harney Lake and the Narrows from Stephanormeria Hill, Harney County, Oregon

The Malheur Wire-Lettuce: a Rare, Recently Evolved Oregon Species

Leslie D. Gottlieb

Winter snow and spring rainfall are erratic in the high desert of eastern Oregon, causing sharp annual fluctuations in the number of plants of many species. In a wet year a local site may display thousands of plants, but in a dry year only a few may be present. This is the case with *Stephanomeria malheurensis* (MAL), the Malheur wire-lettuce, a member of the sunflower or Compositae (Asteraceae) family, and one of three Oregon plant species listed as threatened or endangered by the U.S. government. MAL grows only on a single hilltop above the glistening white remains of Harney Lake, about 26 miles south of Burns on the road to Frenchglen. Actual counts in the 1970's demonstrated a near hundred-fold reduction in the number of MAL plants from one year to the next that correlated closely with a three-fold reduction in precipitation.

MAL in flower near adjacent head with developing akenes

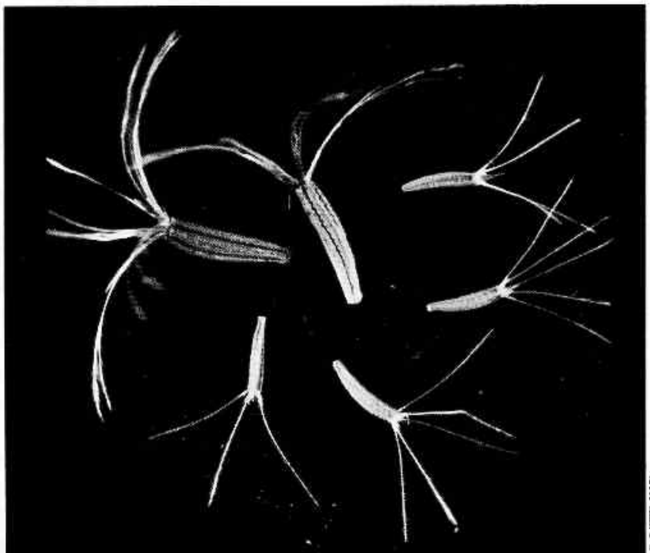
MAL is also difficult to identify because it resembles a closely related species on the same hilltop that is much more abundant. The resemblance is so strong that the two species are easily confused with one another. The combination of frequent absence caused by low rainfall and similarity to a more abundant relative delayed the discovery of MAL until 1966. After the initial sighting, MAL wasn't seen again for five years and its presence at Harney Lake remained in doubt.

MAL is important in understanding how plants evolve, because it appears to have recently originated as a new species. It is also important as a test case to determine if a rare and endangered plant can be protected in its natural habitat.

A Related Wire-Lettuce On The Same Hilltop

The more abundant wire-lettuce on the hilltop is *S. exigua* subsp. *coronaria* (COR). COR is a very wide-spread species common in the South Coast Ranges and southern Sierra Nevada of California, that reaches its northern geographical limit in eastern Oregon. Both Stephanomerias are annual herbs. After germinating when the temperature warms up in early spring, their seedlings grow as rosettes. By late June, each rosette bolts up to a single branched stem (bolts) with small flowering heads. Flowering usually starts by early July and seeds are produced until the plants die in late August.

In their natural habitat, the seed differences are the most reliable key character to separate MAL and COR. MALs average about 1/3 longer and are two times heavier than COR, and they bear longer and more numerous pappus bristles (Gottlieb, 1973, 1978).



Stephanomeria Malheureusis (MAL) and S. exigua subsp. coronaria (COR) Large akenes MAL, small akenes COR

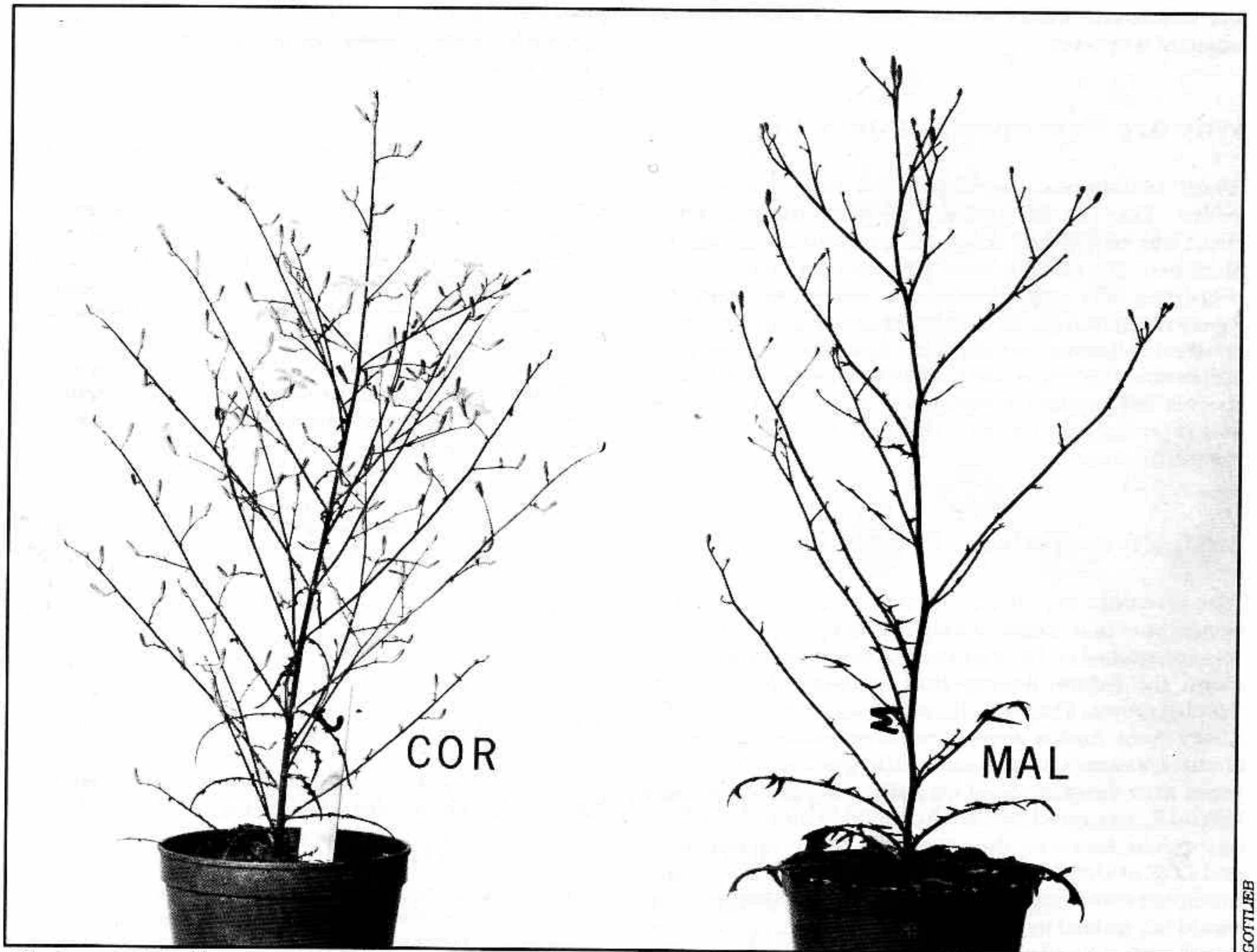
Other differences can be seen only when the two species are grown side by side in a uniform garden. The provision of a uniform environment makes it possible for genetic differences to become apparent in traits whose expression is influenced by micro-environmental variation, for example, in soil type and depth, shading, or moisture level. Perhaps the most interesting of these differences is that MAL seedlings develop a larger root and bolt about 10 to 14 days later than COR seedlings (Brauner and Gottlieb, 1989; Gottlieb, 1977, 1982). Both plants have the same number of nodes (sites of lateral buds from which branches grow) counted from the cotyledons to the topmost branch. The difference in bolting time results in about half the nodes in a MAL plant being in its seedling rosette whereas in COR only about a quarter to a third are. The nodes raised above the rosette produce branches with flowering heads and eventually seeds. With more stem nodes, COR produces more branches, more heads and more seeds than MAL. Presumably this is an advantage and contributes to COR's greater abundance.

The deeper and larger taproot of MAL may provide an alternative advantage by adapting it to some unusual or inapparent microhabitat feature. But if such a "safe-site" for MAL does exist, it must be rare because even in the best years the number of MAL plants is only a tiny fraction of that of COR. In nature the average MAL plant is only half as large as the average COR plant, suggesting that MAL responds less well to the hilltop habitat than COR (Gottlieb, 1982).

I have called attention to several differences between the two species, but in most ways they are remarkably similar. Biochemical and genetic studies showed that most of the gene products sampled in MAL are also present in COR (Gottlieb, 1973). Usually 10-30% of the products would be expected to differ even between closely related species.

MAL and COR Do Not "Recognize" Each Other As Ecologically Different

An ecological study (Gottlieb and Bennett, 1983) revealed that the species do not "recognize" each other as different. The formal question was: Do either of them respond differently to the presence of the other than to conspecific plants? To answer this question MAL and COR plants were grown in different densities either in pure or mixed cultures under a number of different conditions in a greenhouse. If either species bolted earlier or later, or grew larger and was more vigorous or was smaller when grown intermixed with the other species than when grown in pure stand, this would suggest that it responded differently to the other than to itself. The experimental results were unambiguous. Neither MAL nor COR changed appearance or vigor when grown alone versus in mixed cultures. Each behaved in the mixed stand as if it were in a pure stand; they responded to each other's presence much like they



Stephanomeria malheurensis (MAL) and S. exigua subsp. coronaria (COR) grown under uniform conditions. Both species are the same height, but MAL has a thicker stem with fewer, thicker branches. COR is flowering.

responded to themselves, and probably this is what happens in nature.

The Origin Of MAL

Why should MAL be so similar to its widespread congeneric relative? The best answer seems to be that MAL evolved as a species from the local population of COR. The possibility that MAL originated at a different site and then migrated to its present one is unlikely because the soil in which it grows is found only on widely separated outcrops. The Harney Lake hilltop where MAL and COR grow is derived from a volcanic tuff that rises above a cracked basalt. Because the nearest similar tuff is miles away, and because MAL appears to be restricted to the tuff soil type, the hilltop is an ecological island for MAL and one that probably limits successful migration to it or away from it.

COR's presence near Harney Lake results from a different circumstance. Widespread species such as COR are often limited at their geographical borders to atypical soils, perhaps because they do not compete as well on the locally common soils as species in the central part of their distributions (Billings, 1950). In eastern Oregon COR is generally found on volcanic tuff, sand, and even near bubbling mud hot springs, for example, at Mickey Hot Springs, east of Steens Mountain.

COR is an obligate outcrossing plant and must be cross-pollinated to set seed. In contrast, MAL is highly self-pollinating (Gottlieb, 1973). It is likely that MAL evolved following a mutation in COR that modified its breeding system. Such a change would have initiated a rapid and abrupt series of events in a descendent lineage that gave rise to MAL. Genetic variability would be reduced and certain traits of its particular progenitors would have been fixed in its genome. These traits may have been infrequent in the COR population as a whole. This is the best explanation for the few differences between MAL and COR. Along with a few other plant species such as *Clarkia lingulata* (Lewis and Roberts, 1956) and *Layia discoidea* (Gottlieb, et al. 1985) in California, and *Coreopsis nuecensis* (Crawford and Smith, 1982) in Arkansas, MAL is one of the few examples of the recent natural origin of a species.

Why Are New Species Interesting?

Plant evolutionists want to know how new species evolve. This can be studied only when the speciation event was recent and when the progenitor can still be identified. We want to learn how the particular genetic properties of a new species were assembled from the legacy received from its progenitor and which properties resulted following natural selection and chance processes since its origin. We wish to learn whether the new species has distinct adaptations that permit it to live and reproduce in habitats different from those of its parent (Gottlieb, 1979).

MAL Given Federal Protection

The scientific importance of MAL and the fact that it occurs only in a single locality and is sparse even there was recognized in 1974 by the Bureau of Land Management, the federal agency that manages the land on which it grows. The MAL site was designated a Scientific Study Area and a fence was constructed enclosing about 150 acres to prevent cattle grazing. MAL was listed with designation of its critical habitat under the federal Endangered Species Act on November 12, 1982. Since then, however, the number of plants of both MAL and COR at the site has declined precipitously and this prompted concern that MAL was already extinct or soon would be. Indeed in 1985 and 1986 no MAL plants were found and only a few COR individuals were seen. The disappearance was not simply a consequence of low rainfall, but was correlated with the aggressive increase of cheatgrass *(Bromus tectorum)* on the hilltop to almost 100% ground cover. The cheatgrass had first appeared in 1972 following a fire. The intense competitive abilities of this Eurasian weed are well known, suggesting that the decline of MAL, COR and many other native herbs at this site was probably caused by the increase of the grass.

Protecting MAL From An Invasive Cheatgrass

In 1987, the U.S. Fish and Wildlife Service and the Bureau of Land Management funded a study (Brauner, 1988) to provide background information to facilitate the recovery of MAL. The analysis included a comparison of MAL seedlings transplanted into small plots dominated by several large shrubs (Wyoming big sagebrush, green rabbitbush, Great Basin wildrye). In some plots, all of the cheatgrass was manually removed, in others 50%, whereas on other plots all of the cheatgrass was left intact. By the end of the growing season, MAL plants in the 50% and 100% cheatgrass plots were significantly smaller, slower to bolt and flower, and produced fewer seeds than the plants in plots in which the cheatgrass had been completely removed.

It appears that appropriate management to restore MAL at its native site will require removal of cheatgrass. Federal agencies are presently considering various options to accomplish this. Meanwhile The Berry Botanic Garden (Portland) is overseeing the establishment of a "seed bank" on the hilltop. MAL seedlings grown at the Garden in the spring of 1987 from seed stocks maintained by the author were transplanted to the site. From them, more than 20,000 seeds were harvested and placed in long-term cold storage in Portland, and an equal number were permitted to disperse naturally in an effort to reestablish the native population. Once a large seed bank is built up and if the invasive cheatgrass can be reduced or eliminated, MAL may be able to persist on its Harney Lake tuff with little further tinkering. Such effort represents an important change in our national attitudes towards threatened plants and animals. For MAL, it probably means the difference between survival and extinction.

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Native Plants, Native Ecosystems, and Native Landscapes[1]

An ecological definition of "native" will promote effective conservation and restoration

Mark V. Wilson, David E. Hibbs, Edward R. Alverson

Much of the worldwide conservation effort seeks to protect and sustain plants and animals in their native habitats. Conservation activities in Oregon and the Pacific Northwest contribute to this goal in many ways. For example, state and federal endangered species legislation protects several of our native plants and animals, such as Bradshaw's lomatium and the northern spotted owl. Biologists studying the population ecology of rare plants and animals help develop the scientific understanding necessary for effective restoration and management. Whole habitats are protected by the Nature Conservancy, who purchase and manage tracts of land representative of important ecosystems and their species. Central to all these activities is an understanding of what is meant by "native," yet the term is difficult to define precisely and remains poorly understood. In this paper, we discuss some of the ecological characteristics of native species, native landscapes, and explore the implications of these concepts to conservation and ecological restoration.

Native Species

Native means indigenous, originating in a certain place. Three issues complicate the application of this definition to native species: the geographical distribution of species, changes in species distributions through time, and genetic variability among individuals of the same species.

All species are limited in their geographical extent and in the ecological conditions under which they can survive. This biological fact leads to difficult questions. Is a species native to an area if it grows somewhere else in the same county, same state, same region, or same continent? Wild oat *(Avena fatua)* is a widespread weed in cereal crops and grazed grasslands over western North America (Holm et al., 1977). Few would consider wild oat, which before agricultural development lived in the wild only in southern Europe, to be a native Oregon plant. But consider the cases of common ragweed

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(*Ambrosia artemisiifolia*) and Oregon white oak (*Quercus garryana*). Common ragweed is native to the eastern United States but has recently reached Oregon, where it grows along roadsides and in waste areas (Hawkes et al., 1985). Oregon white oak grew in the Willamette Valley before Euro-American settlement in the 1830's and 1840's as scattered, large trees in a savanna setting, generally on hilltops (Habeck, 1961; Johannessen et al., 1971). Following the control of fire

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150 years of fire suppression and agricultural practice have allowed Willamette Valley Oak Savannas (foreground) to be invaded by dense, younger oak stands (background).

by settlers and the onset of widespread agriculture, white oak spread onto hillslopes and some flatlands and formed much denser stands. All three of these species are invaders, but on different geographical scales. Wild oat is an invader from Europe. Common ragweed, a native North American species, is an invader from the eastern states. White oak, although native to the Willamette Valley, is an invader of new habitats in the valley.

Is a species native if it grows in the same locality but under distinctly different ecological conditions? For example, Oregon stonecrop (*Sedum oreganum*) grows naturally on sunny boulders along the Santiam River in the western Cascade Mountains, but is never found under old-growth trees just meters away from its stony refuge. In an important sense, the stonecrop is native to boulders but not native to the forest understory.

Changing environments can lead to confusion about what is and what is not native. For example, the Pacific Northwest has shifted from arctic climates during Pleistocene glaciation to the temperate climates of today. Many plant species survived in glacial refugia and spread rapidly during the warming, post-glacial climates. Western red cedar (*Thuja plicata*) appears to have migrated from isolated populations just south of the ice boundary through northwestern Washington and eventually to northwestern British Columbia (Hebda and Mathewes, 1984). Are western red cedar and other migrating species really invaders, or are they just late-arriving natives?

Human activity is responsible for even more rapid changes. Tillage and grazing create opportunities for invading weeds to become established. In many cases, these invaders have also been introduced intentionally or inadvertently by humans. Cheatgrass (*Bromus tectorum*) made its way to the Pacific Northwest by 1900, where it thrived in overgrazed rangelands (Mack, 1981). Native grasses have decreased in many areas because of overgrazing and the invasion of cheatgrass. Few would call cheatgrass a native Pacific Northwest species, yet it differs from western red cedar only in its recent invasion initiated by human activity.
The differences between native and non-native invaders will become further blurred if the rapid release of carbon dioxide and other greenhouse gases into the atmosphere by human activities changes the global climate. Significant shifts in species distributions are likely to accompany climate changes. This movement of species into new territory will further challenge our understanding of what constitutes a native species.

Many plant and most animal species possess considerable intraspecific genetic variability. For example, individuals from one part of a species' range are often genetically distinct in some traits from individuals elsewhere in its range. Failure to recognize this genetic variability can lead to unforeseen consequences. Ponderosa pine (*Pinus ponderosa*) seed from trees growing in eastern Oregon have sometimes been planted in the

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Wounds of the Sequoia pitch moth on ponderosa pine in the Willamette Valley grown from eastern Oregon seed. Native Willamette Valley ponderosa pines are more resistant.

Willamette Valley. The pines establishing from these genetically-displaced seeds are frequently devastated by a pitch moth (*Synanthedon sequoiae*). In contrast, trees grown from native Willamette Valley seed stocks are relatively unaffected by the moth. This example shows that even within a species, some genetic strains are native and suitable to a site, while others are not. The practical lesson is that conservation efforts should preserve or restore the type, degree, and geographical distribution of genetic diversity that a healthy natural population would most likely possess (Millar and Libby, 1989).

Native Ecosystems

A key to preserving native species is preserving and maintaining suitable native habitat. But native habitat is more than a place in the ground; it is a functioning ecosystem. The continued success of many plant species depends on their interactions with other organisms (Perry et al., 1989). Mycorrhizal associations between fungi and plant roots are a particularly beneficial pairing, with the fungus providing enhanced nutrient and water uptake for the plant and the plant providing energy from photosynthesis to the fungus. Pollinating insects promote seed set (while eating nutritious pollen and nectar). Soil microorganisms help recycle dead plant and animal remains into nutrients that can be used by plants. Other species, although not necessarily beneficial to plants, depend on plants for their survival. Without plants, how would herbivores and plant pathogens survive? This network of organisms, coupled with their physical and chemical environment, defines the ecosystem. A definition of native ecosystem must consider not only the native species it contains, but also interactions and roles within the ecosystem.

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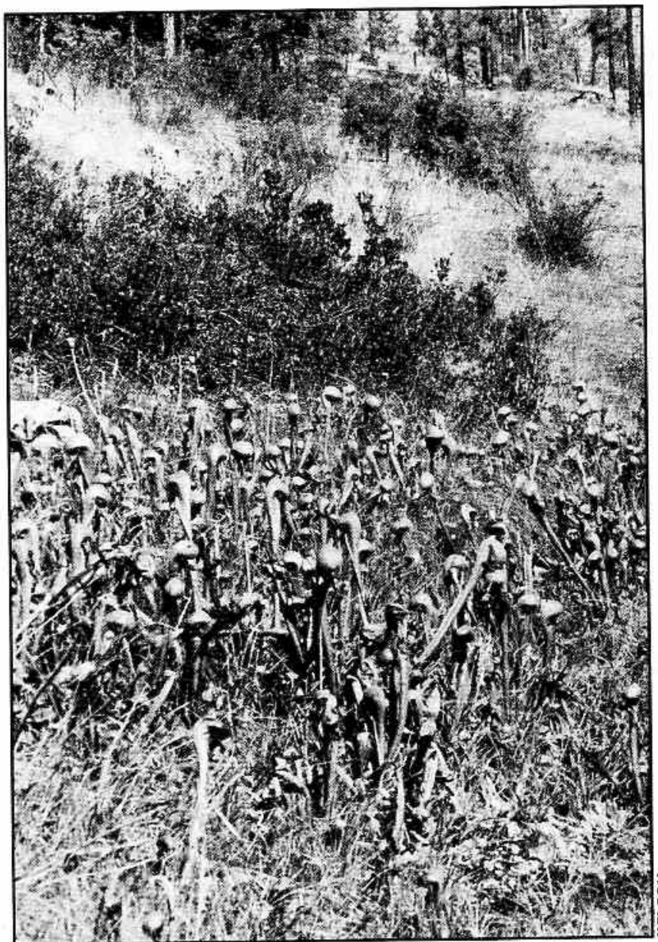
Willamette Valley's Kincaid's lupine, food for the recently rediscovered Fender's blue butterfly, grows in isolated remnant prairie patches. Prairie restoration requires consideration of the lupine's biology and the complex ecological links that define this native ecosystem.

An example from Oregon illustrates the importance to species conservation of recognizing these interactions within ecosystems. The Fender's blue butterfly *(Icaricia icarioides fenderi)* was thought extinct, because it had last been seen in 1936. In the spring of 1989, however, a population was discovered in the Coast Range foothills (Chambers, 1990). The larvae of the Fender's blue butterfly appear to feed only on the leaves and flowering stalks of Kincaid's lupine *(Lupinus sulphureus ssp. kincaidii)*, which itself is threatened throughout its range. If so, the Fender's blue butterfly could not survive without this subspecies of lupine. Recent research (T. N. Kaye, in prep.) shows that the lupine flowers do not self-fertilize; pollinating insects are necessary for seed set. Thus, the survival of the lupine population ultimately depends on insect pollinators. Other relationships among species may be important. Butterfly larvae of species closely related to the Fender's blue are tended by ants. Ants extract sugar-rich exudates from the larvae and protect them from predators. This possible protection by ants might be the reason the Fender's blue butterfly has been able to survive for so many decades in small, isolated populations. In this example, the focus of conservation efforts-the Fender's blue butterfly-has strong links with organisms in the rest of the ecosystem. A conservation plan that focused only on the butterfly and that ignored the lupine, the pollinating insect, and the ant would surely be inadequate. Species conservation requires ecosystem conservation.

Native Landscapes

On serpentine soils in the Siskiyou Mountains, California laurel (*Umbellularia californica*) grows as a shrub on south-facing slopes and other hot, dry sites (Wilson, 1988). Pitcher plant *(Darlingtonia californica)*, on the other hand, grows only on wet serpentine seeps. These two habitats are so different that they support different sets of species, even though they might exist in close proximity. Not only do these sites differ in plant species composition, but they differ in the types of animals they support and the nitrogen and oxygen levels in their soils. The collection of these and adjacent ecosystems constitute the landscape.



Pitcher plant (foreground) grows in serpentine seeps in southwest Oregon. California laurel (background) grows in much drier soils, although sometimes just meters away. These and other habitat patches contribute to the heterogeneity of native landscapes.

The variability typical of native landscapes can help them escape disruption. For example, fires and epidemics are often less likely to spread through complex landscapes because organisms of different susceptibilities grow intermixed, acting as fire breaks and as "disease breaks." Likewise, the availability of a wide range of species speeds the recovery process after disturbance. For example, nitrogen-fixing trees, such as red alder *(Alnus rubra)*, can invade burned forest sites from nearby unburned areas within a native landscape. If the landscape does not include alder patches that serve as seed sources, adjacent burned sites would eventually be poorer in nutrients. The very complexity of native landscapes helps make them self-sustaining.

For humans, complex native landscapes also have aesthetic advantages. Our enjoyment of nature is enriched by the variety of native species and native ecosystems seen in the landscape. In contrast, recent human alterations tend to reduce the natural variability of native landscapes. For example, grazing on rangelands tends to produce more uniform landscapes than the native prairies they replace. Conifer plantations, because they are often planted with a single species, lack much of the variety in species composition and structure found among naturally regenerated forest stands. These simplified landscapes are often both ecologically and aesthetically less valuable. For all these reasons, the goal of native landscape preservation and restoration should be to maintain the diverse array of species, habitats, and ecological processes found in nature.

What Is Native?

Any definition of a native species, native ecosystem, or native landscape requires an historical benchmark. Consider the history of the Willamette Valley. In the past 20,000 years, since the latter stages of the Pleistocene, vegetation in the Willamette Valley has changed dramatically with changing climate (Barnosky et al., 1987). Vegetation in a single place has probably varied from boreal parkland, to conifer forest, to oak savanna, to prairie. Each climatic phase supported a different flora. As the climate turned cooler and moister in the last few thousand years, the oak savannas and prairie ecosystems were maintained only by the frequent fires set by the native people to stimulate food plants and to help in hunting. Today, after over a century of agricultural use, the prairies and oak savannas are nearly gone. Any of the species, ecosystems, and landscapes present now or during earlier periods can legitimately be called native to the Willamette Valley. But is this a useful approach?

For the Pacific Northwest, the period that ended with Euro-American settlement is a natural historical benchmark. This period lasted long enough to have significant impact on the vegetation of the region. The climates of much earlier times were different enough to limit their usefulness in defining today's ecosystems. On the other hand, the wholesale changes since Euro-American settlement are too convoluted and too dependent on human influence to serve well as an historical benchmark.

Any definition of native must also have geographical limits. It is correct to say that common ragweed is native to North America, because it grew on this continent just before European settlement. But it would be misleading to say it is native to Oregon, even though common ragweed has now reached the east slopes of the Cascades. Likewise, Sitka spruce *(Picea sitchensis)* is native to Oregon. but because its distribution is limited to the fog belt within a few kilometers of the coast (Franklin and Dyrness, 1973), it would be wrong to call Sitka spruce native to other parts of Oregon. Nor is Oregon stonecrop, limited as it is to sunny, rocky areas, really native to old-growth forest understories just meters away.

These historical and geographical perspectives suggest a working definition for native species (cf. Lees, 1988; Maser, 1990). In the Pacific Northwest, any species that had occurred in a particular ecological habitat before Euro-American settlement is a species native to that habitat.

A native ecosystem, then, is one dominated by native plants, animals, and microorganisms that occurred together before the time of Euro-American settlement. Key species - for example, the dominant photosynthesizing plants, the top carnivores, the important decomposers, the nitrogen-fixers - must be present for a native ecosystem to persist and function on its own. To artificially maintain a conserved or restored ecosystem without all of its crucial components is both difficult and expensive. The species of a native ecosystem must also occur together in nature. For example, landscaping with an artificial mixture of native species like vine maple *(Acer circinatum)*, bluebunch wheatgrass *(Agropyron spicatum)*, and Jeffrey pine *(Pinus jeffreyi)* does not produce a native ecosystem. These species are native to different areas within Oregon, but they would not naturally grow together in the same ecosystem. Restoration of native ecosystems must also account for proper structure and appearance. For example, a red fescue *(Festuca rubra)* lawn does not have the structural complexity and species diversity exhibited by native bunchgrass prairies.

Finally, a native landscape is one composed of an array of native ecosystems and their species encompassing the variety seen in nature during the historical benchmark.

Conservation efforts should recognize the geographically variable and highly interactive character of native species, native ecosystems, and native landscapes. Piecemeal protection of just a few genotypes of a rare plant, of just a single species within an ecosystem, or of just a small tract of prairie or old-growth forest entails extensive and costly management. We should instead aim to protect whole systems, both to represent the full grandeur and complexity of our natural heritage and to promote the ability of these native systems to sustain themselves.

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