OREGON FLORA *Newsletter*

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Global Plants Initiative

by Troy Maddux and Aaron Liston

The Oregon State University Herbarium has joined the Global Plants Initiative, an international partnership of herbaria working to create a coordinated global database of information and images of plant specimens. With support from the Andrew W. Mellon Foundation, the OSU Herbarium has obtained a custom HerbScan machine and the resources to scan the 2,000-plus type specimens in the herbarium.

Type specimens are very important to plant taxonomists as the type is the physical representative and ultimate reference for every described species (or subspecific taxon).

Once described, type specimens will always represent that taxon unless lost or destroyed. Because they are so important, types are given special status in herbaria, along with extra protections to keep them safe. Once these important plant specimens are scanned they can easily be seen by botanists around the world. This is an opportunity that would be impossible for most researchers without the

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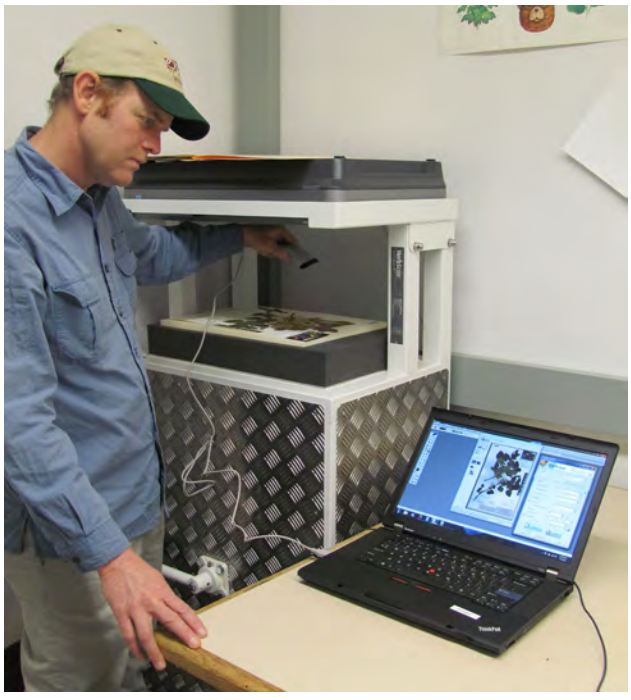

Photo: Linda Hardison

Troy Maddux scans a type specimen for the Global Plants Initiative project.

Writing the Poaceae Treatment for the *Flora of Oregon*

by Barbara L. Wilson, Carex Working Group

The Carex Working Group is thrilled and relieved. We have completed the grass treatment for the Oregon Flora Project!

Mystified that our work has taken more than a year, friends suggested that writing the grass treatment must be easy now that the *Flora of North America* (FNA) grass volumes have been published. We would reply that writing the Oregon grass treatment has not meant simply stripping all the non-Oregon grasses from the FNA treatment.

What did we actually do?

First, we sought to write a simple key to Oregon's grass genera. Early leads of the FNA key are intimidating, and grass keys from the *Jepson Manual* (JM) and *Vascular Plants of the Pacific Northwest* are workable but do not include all Oregon species. We started with the Jepson key and consulted FNA to add missing Oregon taxa.

Nick Otting and Richard Brainerd tested our key with all 299 Oregon grass species. Students in our grass identification mini-classes gave us their perspectives on the keys, causing us to tweak wording or rewrite sections. The final version of the key (number 23) is much different from the first.

For species within genera, we started with the key we liked best from FNA, JM, Hitchcock, or other sources. *Poa* expert Robert Soreng wrote a key to that complex genus. When there was no useful key for Oregon we wrote our own. Cindy Roché tested our draft keys, providing many helpful suggestions.

Writing our genus treatments was a multi-step process:

(1) I consulted floras or OFP's morphology database to write treatments for all species. Each treatment included a genus description, a key to species, species descriptions, and sometimes habitat, range, and discussion.

(2) Once first drafts for all species were completed, I worked through each genus, deciding where I might modify a key or description, write discussion sections, add habitat or range, or note problems needing further work.

(3) Nick and Richard then took over. They keyed every species, modified descriptions, provided habitat information, and wrote or rewrote summary discussions.

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online resources provided.

The Global Plants Initiative started as a regional project, the African Plants Initiative, after a 2003 meeting in Ethiopia where participants proposed a database of African type specimens online. Many of these specimens were housed in other countries and thus unavailable to the African botanists. The Mellon Foundation provided funding and by 2007, many of the African types were online. The success of this project led to its expansion to Latin America, and then globally in the past year. The OSU type specimens were previously photographed in 2005 in collaboration with the OSU Libraries, and the images are available via the OFP website and the OSU Libraries Digital Collection. However, these are at a relatively low resolution, and insufficient detail is present for precise taxonomic work.

The benefits of this project will be felt not just globally but locally as well. The high-resolution scanner is mounted in a specially designed frame which inverts the scanner, allowing the plant specimens to stay right-side up and maintain their integrity. In addition to scanning all of the type specimens housed at OSU (2,004 of them), the scanner system is being used in support of the Oregon Flora Project's goal to provide an online image of every taxon in the Oregon flora. When the scanner is not being used for these two important tasks it can provide data that visiting scientists can take home with them and use thereafter. So, whether it is for the botanist visiting Corvallis, the ongoing Oregon Flora Project work or botanists across the globe, this system will be a boon to botanical work for some time to come.

The *Oregon Flora Newsletter* is published two times a year by the Oregon Flora Project and the Oregon State University Herbarium.

The Editor is Rhoda Love and the Production Assistant is Rena Schlachter.

Erythronium oregonum logo and masthead designed by Tanya Harvey.

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The Consortium of Pacific Northwest Herbaria

by Linda Hardison

Herbaria are a cross between museum and research tool—precious, irreplaceable historical artifacts, as well as treasure troves of data that inform biologists, anthropologists, and plant enthusiasts. Providing researchers with access to the data available in specimens has typically required packing and mailing specimens to the scientist's institution. The shortcomings of this approach are clear—there is a monetary cost for the processing of a specimen loan, the lending herbarium is without a segment of their collection sometimes for years and— perhaps most significantly—the specimens are placed at risk of damage or loss.

Technology comes to the rescue in this situation as the increasing availability of high-resolution digital photography can be applied to generate images of herbarium specimens and make them available via the World Wide Web. There are two aspects to an effort like this—taking a photograph captures the visual information of the pressed plant specimen, as well as the label data. However, when the information from the label is also transcribed into a database, the result is a powerful resource—a searchable dataset.

Herbaria have organized into regional networks to accomplish this work. Oregon is part of the Consortium of Pacific Northwest Herbaria, which was initiated at the University of Washington in 2007. It encompasses the states and Canadian provinces of Oregon, Washington, Idaho, Montana, Alaska, British Columbia, and Yukon Territories. In 2010, four universities within the Consortium of Pacific Northwest Herbaria collaborated and received National Science Foundation funding to digitize ca. 2.5 million herbarium specimens throughout the Pacific Northwest. An important part of this is the inclusion of small herbaria, which often house specialized, regional collections. Researchers at the University of Washington Herbarium serve as the Consortium coordinators, maintaining the computer servers that host the website and consolidating the data provided by the participants. The images and label data gathered are thus presented collectively through the PNW Consortium portal. An important aspect of the project is that the data *as well as* the databases and software tools to maintain the information are available for the contributing herbarium's use and continued development.

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Lithocarpus is Asian, *Notholithocarpus* is American

by Kenton L. Chambers

The tanoaks of California and southwestern Oregon are familiar to us as the only North American representatives of *Lithocarpus*, a genus with some 300 species in southern China and Indomalasia. This extreme geographical disjunction is usually explained as the remnant of more widespread ancestors of the genus, which were part of a broad-leaved evergreen forest that spread over North America and Asia in the Early Tertiary Period, tens of millions of years ago. Other often-cited examples, also in family Fagaceae, are the chinquapins of genus *Castanopsis*, whose supposed relatives number about 120 species distributed in tropical and subtropical Asia. However, big changes are happening in the taxonomy of these genera, due especially to newly understood DNA relationships ("molecular phylogenetics"). Our two *Castanopsis* species, for example, are now separated and renamed as the strictly North American genus *Chrysolepis.* This note is to report a similar change of name for the tanoak *Lithocarpus*, which significantly revises its hypothesized Southeast Asian affinities.

Photo: Keir Morse

Notholithocarpus densiflorus*, male catkins and single female nut with bur-like involucre.*

The former *Lithocarpus densiflorus* is hence to be known as *Notholithocarpus densiflorus*, with the tree and shrub forms having separate varietal status as var. *densiflorus* and var. *echinatus*. The fruits of this species are very acorn-like—a single nut in a scaly cup—and now we know, from its DNA, that it is indeed closely related to oaks (*Quercus*), being linked to them morphologically by this kind of fruit (Manos et al. 2008). An acorn-type of single-nut fruit is also found in Asian *Lithocarpus*, but according to the new molecular phylogeny of Fagaceae, this is a case of parallel evolution from a long-ago ancestor having 2 or 3 nuts surrounded by bur-like bracts (as in *Chrysolepis*). The complex evolution of nuts, burs, and cupules in the female inflorescences of Fagaceae is discussed by Oh and Manos (2008), in support of their new molecular phylogeny of the family. The change from clusters of several nuts to single nuts in Fagaceae has occurred separately at least 5 times, by reduction in number of female flowers in the inflorescence. Spiny bracts (burs) have evolved 3 or more times (e.g. in *Castanea*, *Chrysolepis* and *Castanopsis*).

The new DNA-based phylogeny, which is now quite firmly established, still provides ancient Asian connections for our North American *Notholithocarpus* and *Chrysolepis*, but the pattern is not as previously believed. American *Chrysolepis* species (formerly *Castanopsis chrysophylla* and *C. sempervirens*) are instead more closely related to *Lithocarpus*. Further, the paired genera *Quercus* and *Notholithocarpus* are related to Asian *Castanopsis* and to the circumpolar genus *Castanea* (chestnuts), not to Asian *Lithocarpus*. These connections date back to the Tertiary Period (Manos & Stanford 2001), as we thought. The beech family Fagaceae is well represented in the fossil record through preservation of its distinctive nuts and cupules, staminate catkins, and pollen. Fossils from the early Eocene Period (56 million years ago) from North America provide good examples of evergreen, warm-climate genera like *Castanopsis* now limited to Southeast Asia. Fruits and leaves of *Quercus* from later in this Period represent the somewhat more temperate forests seen in the Clarno "nut beds" of central Oregon. The connection of *Notholithocarpus* with its Asian relatives probably dates from the Early Eocene, when warm climates world-wide favored the spread of subtropical forests throughout the Northern Hemisphere.

References

Manos, P. S., C. H. Cannon, and S.-H. Oh. 2008. Phylogenetic relationships and taxonomic status of the paleoendemic Fagaceae of Western North America: Recognition of a new genus, *Notholithocarpus*. *Madroño* 55: 181-190.

Manos, P.S. and A. M. Stanford. 2001. The historical biogeography of Fagaceae: Tracking the tertiary history of temperate and subtropical forests of the Northern Hemisphere. *International Journal of Plant Sciences* 162: S77-S93.

Oh, S.-H. and P. S. Manos. 2008. Molecular phylogenetics and cupule evolution in Fagaceae as inferred from nuclear *CRABS CLAW* sequences. *Taxon* 57: 434-451.

Correction

In the paper-published issue of *OFN* Volume 16 Number 1, Figure 2 was incorrectly included in the illustration accompanying Gerald Carr's article "Focus on *Bensoniella oregona*". The legend correctly describes the two illustrations labeled "1" and "3," with the addition of "S=sepals". The online, color version of this issue (*http://www.oregonflora.org/ofn/OFNv16n1.pdf*) has been corrected.

Consortium, continued from page 2

How does one gather information from 2.5 million specimens housed in more than a dozen different locations, and present it in a unified manner? The first step entails assembling the existing data. Several institutions entered the Consortium with their specimens already databased and/or imaged. For example, the Oregon Flora Project provided Oregon specimen data presented in its Oregon Plant Atlas; these include the OSU Herbaria as well as additional small collections. The Oregon collections being databased through the grant are at Reed College, Linfield College, H.J. Andrews Experimental Forest, Portland State University, and Southern Oregon University.

The second step, gathering new data from multiple institutions, has been addressed by going to the sources. Regional coordinators at Oregon State University (OSU), the University of Washington, and the University of Idaho have assembled portable imaging systems—a high-resolution digital camera and customized light box connected to a laptop computer—which are taken to the participating institution. The system is set up in the herbarium, local workers are trained, and the contents of the herbarium are photographed. Herbaria are encouraged to digitize all specimens within their collections, even those not from the PNW region, as a way to maximize the usefulness of the imaging system.

The next step entails capturing the specimen label data in a database. This is a centralized effort using teams of data entry workers at OSU and the University of Washington. The student workers become acquainted with the plants of the Pacific Northwest as well as herbarium practices. Lin Gu, an OSU student, says of his work experience: "The habitat and location of each specimen familiarizes me with collection sites, even though I haven't been to those places. I know that it's possible to find new species among herbarium specimens, so it is important to preserve specimens and their information well. I also feel a great responsibility to enter data as accurately as possible."

The final step is consolidating the information for presentation online. Ben Legler, the project informatics specialist, is creating tools for the public to access the data as well as a Web-based data entry system that can be used by the small institutions to maintain their database and enter future collections directly into the portal database.

The Pacific Northwest is not alone in its efforts to present herbarium collections data online—there are twelve similar networks throughout the country. The United States Virtual Herbarium was created in 2004 as an alliance of these networks and other herbaria with a mission "…to provide, using digital technologies, integrated access to all the nation's plant specimen information by the year 2020." Through the US Virtual Herbarium, participants connect and share expertise that will increase the availability and accessibility of plant collections information.

The importance of herbaria today is as real as it was centuries ago, when a personal visit to the herbarium cabinets was the only way to view a specimen. With the ability to digitally capture specimens and their information, the riches within herbaria can be both preserved and shared with the world.

Websites:

Consortium of Pacific Northwest Herbaria:
http://www.pnwherbaria.org
United States Virtual Herbarium:
http://usvirtualherbarium.org

Photo: Linda Hardison

There are almost always several students databasing specimens in the OSU Herbarium for the PNW Consortium. From left to right: Tamra Prior, Katrina Isch, Sierra Grunwald, Erica Nuth, and Megan Lamb.

Curiosities within the OSU Herbarium

by Stephen Meyers

I don't recall the exact reason I was looking through the Oregon State University Herbarium's out-of-state collections of the fern *Lygodium* last year. However, as I was examining the specimens, one in particular (*Lygodium palmatum*) caught my eye. While at first the specimen appeared to be yet another "old" and relatively unassuming collection (one of many OSU inherited from the University of Oregon Herbarium in 1993), an unusual name was listed as the collector. In Albert Sweetser's handwriting was written: "Coll. Thoreau".

Like many, I have long been familiar with Henry David Thoreau (1817 – 1872) as a writer and naturalist, but as a botanist? Unknown to me at the time, I have since learned that Thoreau was not only an adept botanist, but also a prolific collector.

According to collections Thoreau made, it appears his interest in botany began around 1850. (Perhaps not coincidentally the first edition of Asa Gray's *Manual of Botany* was published in 1848.) This interest continued until his death, by which time his personal herbarium contained over 900 pressed, dried and labeled specimens. The bulk of Thoreau's collection is now housed at Harvard University.

Conceding that the herbarium specimen I found does not have a label written by Thoreau, what evidence do we have that it was actually collected by Henry David Thoreau, and not by another botanist with the same surname? Clues lie in Thoreau's journal. While surveying in Concord Massachusetts, in 1851, Thoreau came upon an unusual and rare fern in New England, about which he noted: "It is a most beautiful slender and delicate fern, twining like [a] vine about the stem of the meadow-sweet, panicled andromeda [sic], goldenrods, etc., to the height of three feet or more, and difficult to detach from them...Our most beautiful fern, and most suitable for wreaths or garlands. It is rare."

The plant appears to have become of great interest to Thoreau and he not only mentioned it thirteen more times in his journal (referring to either "lygodium" or "tree fern") but also included the location of the Concord population (marked "lygodium") on his botanical survey map of the area. Additionally, Thoreau frequently mentioned the fern in correspondence with other naturalists.

Lygodium palmatum, an eastern North American species, is generally rare and local, except on the Cumberland Plateau in Kentucky and Tennessee. In New England this species was, and is, very infrequently found. Due to the rarity of *L. palmatum*, as well as Thoreau's great interest and his *de facto* local status as an "expert" on the species, it seems entirely plausible that the U of O specimen was, in fact, collected by Henry David.

Yet how did this specimen come to Oregon? Here, a note attached to the specimen gives some tantalizing but cryptic hints. The note mentions that Thoreau collected the specimen in Connecticut. It was subsequently passed on to a Mrs. E. S. Rolfe who in turn sent it to Albert Sweetser (who established the University of Oregon Herbarium in 1903 and served as curator until 1923).

Assuming that Thoreau collected the specimen between 1851 and 1872, only to have it resurface again on the opposite coast of the United States in the early 20th century, is assuredly remarkable and lucky. The Oregon botanical community should consider itself fortunate to possess such a specimen, not only of a very rare species, but also collected by an iconic American writer. Additionally, that same gratitude should be extended to Albert Sweetser who did not heed the latter advice of Mrs. Rolfe, who in her note to Sweetser mentioned (referring to the specimen): "You may have it if you care for it...if not then the waste basket may come into service once more."

*A Henry David Thoreau specimen (*Lygodium palmatum*) discovered in the OSU Herbarium.*

Photo: Stephen Meyers

References

Angelo, R. 1985. Thoreau as Botanist: An Appreciation and a Critique. *Arnoldia* 45: 13-23.

Angelo, R. 1985. Thoreau's Climbing Fern Rediscovered. *Arnoldia* 45: 24-26.

Project News

by Linda Hardison

Progress on the new *Flora of Oregon* continues to be a priority for the Oregon Flora Project. The list of completed families available on our website (*www.oregonflora.org/flora.php*) now includes the gymnosperms, Acoraceae, Ericaceae, Iridaceae, Limnanthaceae, Nyctaginaceae, Papaveraceae, and Styracaceae. As our lead article by Barbara Wilson indicates, the Poaceae will soon be completed and available to the public. Rena Schlachter is completing the illustrations for the Ericaceae which, with the floristic treatment, will be paper published as a useful reference and example of the style of the upcoming *Flora*. For all the floristic treatments, we encourage readers to use the keys and give us feedback; your input will help the OFP create a better plant identification resource.

It is said that experience is the best teacher. In March I had the good fortune to visit with the staff of the Flora of North America Association in St. Louis, MO. Their experience in producing a 30-volume flora for the continent has generated a knowledge base that is unsurpassed, and their graciousness in sharing with the OFP some of that knowledge of organizing, editing, illustrating, and publishing a flora is greatly appreciated.

The migration of our website to our new host COSINe (College of Science Information Network) is now complete. Lee Hughes, COSINe Web Developer, facilitated the transition and serves as our contact. Thank you, Lee! We continue to work with him in improving the flow of information between our working databases and the online tools that communicate those data.

The Flora Project indicates in the Checklist whether each plant in Oregon is considered native or exotic. We are working now to expand the details about exotic species in Oregon. Staff member Thea Cook began this project by designating a list of fifteen subcategories of exotic status that can be used to more precisely define how and why an exotic species is part of our state flora. Examples of these categories include 'vegetatively spread,' 'recent waif,' 'noxious weed,' and 'persisting from cultivation.' OFP student worker (and recent Botany Department graduate) Katrina Isch has taken on this research project. Developing an exotic status for each non-native taxon will provide important information that can influence how agencies manage certain species, and will synthesize information about exotic and invasive species from diverse and disparate sources.

The name Sherry Pittam is probably familiar to many friends of the Oregon Flora Project—Sherry was the lead person in our collaborative grant with NACSE to develop a Digital Field Guide, and was key in developing a web presence for the OFP. She retired from her university position in February 2011, and, after a short hiatus, is again on board with the OFP as a volunteer to continue development of the multiple entry key. We are fortunate to have her continued expertise—thanks, Sherry!

Volunteers, colleagues, and financial supporters are the glue that holds the Oregon Flora Project together. We are extremely grateful for the myriad contributions from all. In June 2011, we received a grant from the Bureau of Land Management in continuing support of the OFP mission. Other sustaining supporters include the John and Betty Soreng Environmental Fund of the Oregon Community Foundation, the Native Plant Society of Oregon, and the many individual donors who contribute regularly. We also receive administrative support from the Agricultural Research Foundation and the Botany Department at Oregon State University. Each of these collectively helps create our vibrant program, and makes it a resource that is accessible to everyone. We value your participation and contributions.

Poaceae, continued from front page

Photo courtesy of Barbara Wilson

Dr. Barbara Wilson

(4) Finally we rewrote and retested until we were satisfied.

We found that published information was usually accurate, but not always. Perhaps *Flora of North America* reported awn length to be 8-15 mm, but we found some 20 mm long. Maybe the lemmas are longer elsewhere, so FNA reports them to be 5-10 mm long, but Oregon's longest are 8 mm long. Lemmas of *Festuca subulata* are reported to be "glabrous, sometimes sparsely scabrous" but occasional Oregon specimens have hairy lemmas. We found *Cynosurus echinatus* and *Scribneria bolanderi* individuals nearly twice as tall as reported in FNA. We corrected a flaw in the FNA key to wheatgrass genera.

We annotated more than 900 herbarium specimens from the combined herbaria at OSU. Some annotations confirmed identities; others corrected errors. We were able to remove taxa from the Oregon checklist (e.g. *Achnatherum occidentalis* ssp. *occidentalis*, *Festuca minutiflora, Hesperostipa comata* ssp. *intermedia*, *Podagrostis aequivalvis*, and *Thinopyrum junceum*). We added others such as *Agropyron fragile* and *Thinopyrum pycnanthum*.

Most of our range information came from the Oregon Flora Project Plant Atlas. When Atlas mapped seemingly out-of-range records, we examined the voucher specimens if possible, reporting apparently erroneous records to the Oregon Flora Project for correction.

We also made taxonomic judgments. We chose to recognize mountain brome, often called *Bromus marginatus*, as a subspecies of *B. carinatus*. FNA recognizes subspecies or varieties of *Bromus hordeaceus*, *Deschampsia cespitosa*, and *Vulpia octoflora*, but they are not distinct in Oregon;

we omitted them. However, we tentatively recognized the controversial subspecies of *Thinopyrum intermedium* and *Muhlenbergia mexicana*.

Calamagrostis gave us trouble. The *Flora of North America* key looks simple, but the traits are surprisingly hard to interpret. We rewrote the key in major ways. By comparing specimens, we learned that many Oregon specimens were misidentified. By the end, the ranges of most Oregon *Calamagrostis* species were radically reduced, and the description for *C. tacomensis* was significantly modified.

We fought our computers. Faced with spell-checking technical terms for grass morphology, Microsoft Word offered to import French and Portugese dictionaries! (Richard's computer preferred Italian.) We refused on the grounds that the treatments were English and we could teach the software how to spell culm, panicle, spikelet, glume, and others.

At last we were done. We had written treatments for Oregon's 299 grass species. (Except *Poa* – we were still working on *Poa*). Time to celebrate! We submitted our treatment to the Oregon Flora Project, but OFP reminded us that we must use the Flora Project template, so we went back and reformatted our treatments. We tried to shorten descriptions to the recommended 100 words, but that was difficult, especially in large genera. We cut *Elymus* descriptions over 25%, but they still averaged 175 words.

Near the end, one of us was inspired to include the most commonly occurring named wheatgrass hybrids. Nearly any two species of *Elymus, Hordeum, Leymus, Pascopyrum,* and *Pseudoroegneria* might cross if they grow together, and each hybrid is variable. We examined wheatgrass hybrids and I wrote a key that we hope will be helpful.

In February–joy of joys–we submitted all the treatments for Oregon grasses to the Oregon Flora Project Taxonomic Editor Stephen Meyers. Now Stephen will have the pleasure of reading 400+ pages of Oregon grasses!

How can I contribute?

Donations to the Oregon Flora Project are a critical part of our operating budget. Funds are routed to the OFP through the Agricultural Research Foundation (ARF). The ARF is a non-profit organization that raises funds to support scientific research and programs at OSU. All contributions are tax-deductible.

Your checks to the Oregon Flora Project can be made payable to the Agricultural Research Foundation. Please include "Oregon Flora Project—4482" on the memo line.

Mail your check to:
Oregon Flora Project
c/o Agricultural Research Foundation
Oregon State University
100 Strand Ag Hall
Corvallis, OR 97331-2219

With your contribution, please let us know if you do not wish your name listed in our newsletter "Thanks" column.

Thanks

We would like to acknowledge the volunteer help of the many individuals who provide data and images to the Oregon Flora Project, as well as those who contribute their time and talents. Special thanks go to recent volunteers Jeff Cook, Lin Gu, Rhoda Love, Troy Maddux, Gene Newcomb, Sherry Pittam, Tamra Prior, Rena Schlachter, Charlene Simpson, and Matthew Sundberg.

We thank the following individuals and organizations for their recent financial support:

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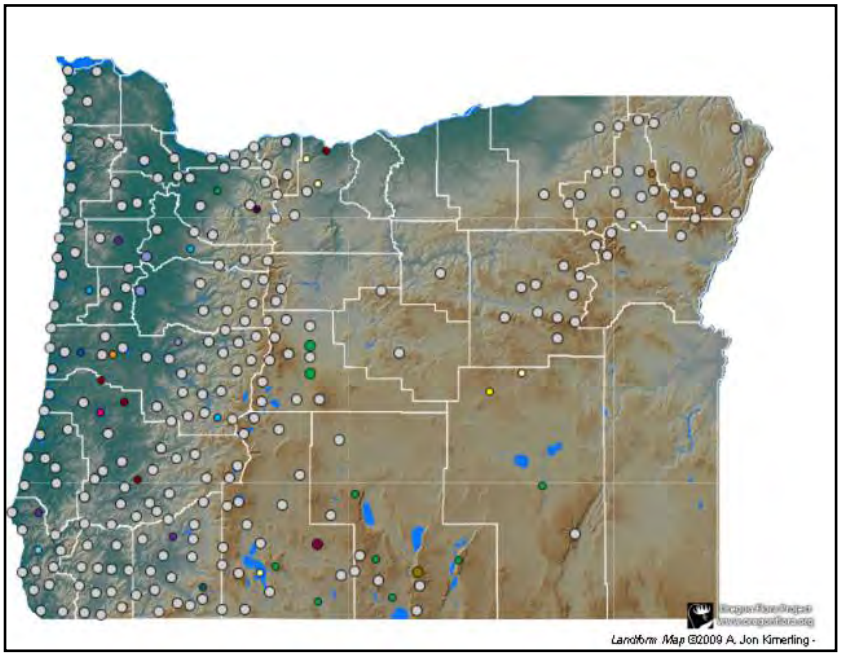
TIME DATED MAIL

Did you know?

- The Oregon Plant Atlas currently maps 4,122 specimens and 13,480 observations from the Ericaceae, or heath family. There are 32 genera and 65 species, subspecies and/or varieties within this family.
- The grass genus with the most taxa (44) is Poa; there are 38 established genera that have only one species occurring in Oregon.
- Tanoak (*Notholipocarpus*) shares the same family as oak trees—the Fagaceae. Its tannin-rich bark was historically used for the tanning of leather. The nut kernels also contain large amounts of tannins and, though consumed by squirrels, are said to require extensive leaching to make them edible for humans.



Occurrences of plants in the family Ericaceae. Light-colored symbols indicate multiple records at that site; almost all of these have more than one taxon present.