

Douglasia



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WASHINGTON NATIVE PLANT SOCIETY

To promote the appreciation and
conservation of Washington's native plants
and their habitats through study, education,
and advocacy.



President's Message: The View from Here

by Keyna Bugner

Dear WNPS Members,

WNPS developed a three-year Strategic Plan in 2021. We just completed the second year of this plan; as we move into the third year of this plan, I would like to share an update from the Implementation Committee on where we are.

Strategic Goals 2021-2023

Create Programs and Resources for Everyone: We will provide entry points for a wide range of audiences—from beginners to professionals—including audiences currently underserved by WNPS.

- Define the programs and resources we currently have and their intended audiences; identify gaps; then develop or refine programs and resources to fill those gaps.
- Design an intentional sequence of programs to ratchet up people's engagement over time.
- Identify and share at least one introductory program that every chapter can offer locally.
- Provide K-12 resources that meet Next Generation Science standards and expand the materials to include Eastern Washington.

Become a More Inclusive Organization

- Establish a Diversity, Equity, and Inclusion Committee to identify and recommend ways WNPS can be more inclusive and be an effective promoter of racial, social, and environmental justice.
- Each chapter builds a connection with at least one group that is not well represented in WNPS.

Build Leaders

- Have all chapters and committees thriving and reactivate the Northeast Chapter.



JOURNAL OF THE WASHINGTON NATIVE PLANT SOCIETY

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* The WNPS Arthur R. Kruckeberg Fellow is the highest honor given to a member by our society. This title is given to those who have made outstanding contributions to the understanding and/or preservation of Washington's flora, or to the success of WNPS.

** Deceased

Douglasia Staff

Managing Editor

Alaina Kowitz
douglasia_editor@wnps.org

Layout Editor

Mark Turner
douglasia_layout@wnps.org

Technical Editor

David GIBLIN
douglasia_tech@wnps.org

Editorial Committee Chair

Walter Fertig
douglasia@wnps.org

WNPS Staff

Business Manager

Denise Mahnke
206-527-3319
wnps@wnps.org

Office Coordinator

Vacant
206-527-3210
info@wnps.org

Send address and similar changes to:

Washington Native Plant Society
6310 NE 74th St., Suite 215E
Seattle, WA 98115
206-527-3210
wnps@wnps.org

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Members and others are invited to submit material for publication in *Douglasia*. We now accept scientific manuscript submissions that will be peer-reviewed. Other articles, book reviews, poetry, photography, or illustrations are welcome. All materials submitted should relate to the study of Washington's native plants. Acceptance will be based on space and appropriateness, and materials are subject to copyediting (substantive editing with author's permission). Contributors are reminded that the *Douglasia* audience ranges from the professional botanist to the interested enthusiast. For more information about how to contribute, see: www.wnps.org/publications/douglasia/douglasia_contributors.html.

Email submissions to Douglasia@wnps.org.

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- Form chapter and committee councils to share ideas and identify ways WNPS can support its chapters and committees; put at least three of these ways into practice.
- Design on-boarding tools for new chapter leaders, committee leaders, field trip leaders and presenters.
- Improve leadership succession planning throughout the organization.

So, how have we done? In brief, we made good progress on the first goal—"Create Programs and Resources for All." We've struggled with the second goal—"Become a More Inclusive Organization." And we've made a good start on the third goal—"Build Leaders."

What's been accomplished?

- Defined current programs and resources
- Identified gaps
- Offered training on how to do introductory plant walks
- Created resource sheet for introductory plant walks
- Completed first-year pilot program for The Youth Ecology Education Through Restoration program
- Updating Starflower curriculum materials to Next Generation Science Standards
- Established DEI Committee
- Reactivated Northeast Chapter
- Instituted Chapter Council meetings
- Held two Committee Council meetings

Article references are available on the WNPS website here: wnps.org/douglasia.

On the cover: Mountain hemlocks (*Tsuga mertensiana*) buried under snow at Artist Point near Mt. Baker. PHOTO: MARK TURNER

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What hasn't been accomplished?

- Identify and recommend ways WNPS can be a more inclusive and effective promoter of racial, social and environmental justice
- Have all chapters and committees thriving
- Design on-boarding tools for new chapter leaders, committee leaders, field trip leaders and presenters
- Improve leadership succession planning throughout the organization

The strength of WNPS is our members and we would like to focus this final year on how we can strengthen our chapters and support our members.

Suggested Focus for 2023

- DEI— The DEI Committee needs a leader, provide training opportunities for board members and chapters
- Offer "vibrant chapters" training
- Develop a chapter "how-to" handbook
- Improve leadership succession planning at chapter and state levels
- Building organizational capacity to support WNPS programs

Please share your thoughts on where you think we should focus our efforts in the final year of our strategic plan by contacting me at wnpspresident@wnps.org.



WNPS Will Award \$24K in Grants for 2023

WNPS is opening the 2023 Grant Cycle with applications due by March 1, 2023 for Conservation, Education, and Research Grants for projects that promote native plants and their habitats within the State of Washington. WNPS grant funding is provided by generous donations to the WNPS Endowment Fund and to our general fundraising campaigns each year. Thank you for your generous contributions providing the support needed to increase our grant funding each year.

Successful project applications must provide public benefit and support the WNPS mission to promote the appreciation and conservation of Washington's native plants and their habitats through study, education, and advocacy. \$500–\$2,000 grant awards are available. Please review each committee's grant requirements to find the right fit for your project.

- <https://www.wnps.org/conservation-grants>
- <https://www.wnps.org/education-grants>
- <https://www.wnps.org/research>

What is the Most Common Plant Species in Washington?

(Answer: It depends.)

by Walter Fertig

It seems like a very straightforward question. What species of vascular plant is the most common in the state of Washington?

The answer is surprisingly tricky. This is due, in part, to the many ways of defining “common.” But the answer is also complicated by the difficulty in measuring plant abundance, especially at broad geographic scales (like an entire state). Our tools for assessing the “common-ness” of species may be incomplete or strongly prone to sampling biases, often yielding wildly contradictory results.

And yet understanding common-ness (or the lack of it) is an essential question for ecologists and conservation biologists. Ecologists use proxies of species’ common-ness to classify and characterize vegetation communities. Vegetation classification is critical in making order out of the chaos of the natural world and in studying ecosystem functions, energy transfer, nutrient cycling, environmental relationships, and other fundamental questions of ecology. Conservationists need to recognize which species are the least common and thus potentially most vulnerable to extinction through natural or anthropogenic impacts, so as to expend scarce resources most effectively for their preservation.

The simplest way to measure common-ness is to count the number of individuals of a species within a population. In practice, this can be challenging if a species is hard to observe growing amid other plants; occurs over large areas; or has a clonal growth form involving subterranean rhizomes, making it difficult to discern individuals. A good example of the latter is a stand of aspens, which may cover hundreds of acres and consist of countless numbers of boles connected below ground. Perennial grasses that spread by rhizomes can be just as difficult to assess. But even if individual plants are easy to detect, conducting a full census of even one species at one site is extremely time-consuming (not to mention potentially hazardous to the study plants due to trampling). Ratcheting up census work to all populations of a species across the entire state (and doing this for nearly 3,800 native and naturalized plant taxa in Washington) is simply not feasible.

There are three available datasets that can potentially answer the question of what species is most common in the state: ecological plot data, herbarium specimens, and iNaturalist records. Each of these has potential merits and important flaws. And surprisingly, each gives a very different answer.

Ecological plot data and vegetation mapping

Ecologists have derived a number of surrogate measurements to get at the abundance and importance of plant species with-



Immature Douglas-fir cone among foliage (*Pseudotsuga menziesii*).
PHOTO: MARK TURNER

out resorting to full counts. These are typically done through subsampling a fraction of the total area occupied by a species using standardized plots or transects. Common measurements include density (the number of individuals per unit area), cover (the percentage of ground or canopy space occupied by the target species), and frequency (the percentage of sample units inhabited). Each of these traits can be compared across species to derive “relative” scores (i.e. relative density, cover, and frequency) and to determine which species make the greatest contributions to the community (referred to as dominance or importance). Ecologists might also make quantitative measurements of the weight of each species (sum of all the leaves, stems, and roots) to determine biomass, or the change in biomass per year (productivity). Combining results of presence, cover, and density data can also allow ecologists to derive species richness and diversity values for their study plots and systems.

How sample units are chosen can greatly affect the outcome of these studies. Ideally, an adequate number of plots and transects should be selected at random to reflect the diversity within a given area (also known as stratified random sampling). The number, size, and shape of plots and their distribution across the study area can have important ramifications if they are not chosen carefully. Some ecologists prefer to subjectively select larger plots (called relevés) that are more representative of the community of interest to record information on cover,

dispersion, and vigor of each species and other important environmental characteristics. No matter the method, ecological sampling is a powerful tool for describing vegetation at local scales and assessing relative abundance of species.

One interesting discovery from ecological sampling is that the abundance of species is not equal across plots or transects. Regardless of the vegetation type being sampled, very few species are highly abundant, while the majority may be of intermediate abundance or rare. Ecologists have tried to explain this pattern through niche partitioning among species, with habitat generalists often being more numerically abundant than specialists. But abundance may also be impacted by the longevity of individuals, the ability of species to disperse, competition among species, and unpredictable environmental events resulting in shifts in species composition in the past and present. Determining the relationship between abundance, distribution, and patterns in species richness is an area of active research among theoretical ecologists.

Plot data are the building blocks of vegetation classification systems used to describe and map plant cover at various scales, ranging from local natural areas to states or countries. Numerous regional, continental, and global classifications have been developed to depict vegetation, each varying in specificity and scale. Since the early 1990s, The Nature Conservancy Heritage Network (now known as NatureServe), the Ecological Society of America, and federal land management agencies have been collaborating to develop a standardized classification system, called the US National Vegetation Classification, or NVC. The NVC is a nested hierarchy of vegetation types ranging in scale from fine-grained local classifications that emphasize dominant species and floristic composition (associations and alliances) to increasingly broad and generalized categories (formations) based on dominant growth forms and macroclimatic factors.

Most plot data can be assigned to an association or alliance using the NVC. Thus, abundance data from plots can help identify the most common species at local scales. Extrapolating abundance information to broader geographic areas, such as the state of Washington, is more challenging, because wall-to-wall mapping at the association or alliance level has not been completed (there are also over 1,000 recognized natural plant associations in Washington and probably many more still to be described). The most detailed vegetation map available for the entire state is the one developed by the US Geological Survey for the National Gap Analysis Program, using a vegetation classification based on 119 natural and anthropogenic ecological systems. The gap classification is analogous to the “division,” a mid-level category in the NVC based on aggregations of alliances and associations with similar geographic and landscape features.

“Common-ness” can be estimated for plant species from the Gap vegetation map based on extrapolating species composition within each ecological system by the total area occupied by these systems. Unfortunately, complete species checklists are not available for each ecological system, so only the “dominant”

species (those that are the most conspicuous on the landscape, not necessarily the species that are most numerically abundant) can be readily assessed. Using this method, it appears that Douglas-fir (*Pseudotsuga menziesii*) is the most “common” species in Washington, appearing as a dominant or co-dominant species in ecological systems covering 29% of the state (Table 1). Rounding out the top five are other dominant and wide-ranging tree and shrub species: western hemlock (*Tsuga heterophylla*, 19%), western red cedar (*Thuja plicata*, 14%), ponderosa pine (*Pinus ponderosa*, 12.3%) and big sagebrush (*Artemisia tridentata*, 11.4%). Bluebunch wheatgrass (*Pseudoroegneria spicata* or *Elymus spicatus*) is the most common grass, dominating 7.5% of the state, but coming in at number nine in overall dominance. No herbaceous forb species cracked the top ten.

An alternative to deriving common-ness based on vegetation mapping would be to aggregate all of the ecological plot data from the state into one common, digital, database. Ideally, such a database would employ a common taxonomic standard (and have a robust thesaurus of synonyms to cross-link records), be accurately geo-referenced, and include quantitative measurements of abundance or their proxies (percent cover, density, frequency, etc.). Creating such a database will be a logistic challenge, as many plot records are not digitized, many languish in half-forgotten file cabinets scattered across government offices and college campuses, and no organization has stepped forward to take on (or fund) the task. Ecological datasets are also not without their limitations, which include lack of vouchering of specimens to confirm identifications, biased sampling towards

Table 1. Dominant vascular plant species in Washington State based on ecological systems recognized in Gap land cover data (USGS 2011) and Rocchio and Crawford (2015).

Rank	Species*	Percentage of state where dominant or co-dominant
1	Douglas-fir (<i>Pseudotsuga menziesii</i>)	29.0
2	western hemlock (<i>Tsuga heterophylla</i>)	19.0
3	western red cedar (<i>Thuja plicata</i>)	14.0
4	ponderosa pine (<i>Pinus ponderosa</i>)	12.3
5	big sagebrush (<i>Artemisia tridentata</i>)	11.4
6	grand fir (<i>Abies grandis</i>)	9.7
7	silver fir (<i>Abies amabilis</i>)	7.8
8	red alder (<i>Alnus rubra</i>)	7.6
9	bluebunch wheatgrass (<i>Pseudoroegneria spicata</i>)	7.5
10	bitterbrush (<i>Purshia tridentata</i>)	4.4

*Only full species recognized (varieties and subspecies not distinguished)

forest and wetland habitats, and under-representation of uncommon species in small plots.

Herbarium collections and databases

Herbarium collections are a rich source of specimen records, reflecting sampling across the state since the early 19th century. Physical specimens are important because their identification can be verified by experts. Label information is even more valuable in documenting the presence of species over time—allowing researchers to track potential changes in floristic composition due to local extirpation or the spread of introduced species. For example, Wilhelm Suksdorf made thousands of collections from the Columbia River, Mount Adams, and Spokane areas from 1876-1932 that include species that have since disappeared or become quite rare. Over the past 30 years major herbarium collections in Washington and the Northwest have made great strides in digitizing and imaging specimens and in making these publicly available through online datasets like the Consortium of Pacific Northwest Herbaria (www.pnwherbaria.org). Nearly 300,000 herbarium records from Washington state are currently available through the Consortium.

Based on Consortium records as of November 2022, the most frequently-collected plant species in Washington is Sandberg’s bluegrass (*Poa secunda*), with 1,705 specimens. The complete list of ten most collected species is shown in Table 2. Note that eight of the ten most frequently collected species on the list are herbaceous forbs or grasses and none were among

Table 2. Most commonly collected vascular plant species in Washington based on herbarium specimens in the Consortium of Pacific Northwest Herbaria website.

Rank	Species*	Number of Collections
1	Sandberg bluegrass (<i>Poa secunda</i>)	1,705
2	Scouler’s willow (<i>Salix scouleriana</i>)	1,163
3	western serviceberry (<i>Amelanchier alnifolia</i>)	1,106
4	upland larkspur (<i>Delphinium nuttallianum</i>)	952
5	common yarrow (<i>Achillea millefolium</i>)	793
6	Sitka brome (<i>Bromus sitchensis</i>)	760
7	small-flowered blue-eyed Mary (<i>Collinsia parviflora</i>)	752
8	scarlet paintbrush (<i>Castilleja miniata</i>)	744
9	silvery lupine (<i>Lupinus sericeus</i>)	726
10	common woolly sunflower (<i>Eriophyllum lanatum</i>)	682

*Only full species recognized (varieties and subspecies not distinguished)



Scouler’s willow (*Salix scouleriana*) fall color along Shady Pass Road on the Okanogan-Wenatchee National Forest near Chelan, WA.
PHOTO: MARK TURNER

the ten most dominant species in the state based on ecological criteria!

Herbarium datasets are not without their limitations. The total number of collections in the Consortium database includes duplicates found at multiple herbaria and collections from the same locality made by different botanists over the years. For example, Suksdorf seemed to have a real fondness for collecting Scouler’s willow (*Salix scouleriana*, number two on the state list with 1,163 specimens), including more than 500 vouchers near his home base of Bingen in Klickitat County (Table 3). It would be more accurate to estimate the number of distinct populations, rather than total collections, represented by herbarium records (a task beyond the scope of this study!). Herbarium collections can also be biased, with botanists often over-collecting showy or rare species, or those that may be difficult to identify (such as *Delphinium* and *Erigeron*), while under-sampling trees, cryptic taxa, dandelions, and spiny or rash-inducing plants (such as cacti, poison ivy, and poison-oak).

Herbarium sampling also tends to be skewed towards public rather than private lands and sites that are more readily

Table 3. Most commonly collected and observed vascular plant species in Washington by county, based on collections from the Consortium of Pacific Northwest Herbaria (CPNWH) and image records from iNaturalist. Data current as of 12 November 2022.

County	Most Collected Species* (CPNWH)	Most Observed species (iNaturalist)
Adams	<i>Astragalus sclerocarpus</i> / <i>Lupinus leucophyllus</i> (tied, 21)	<i>Artemisia tridentata</i> (24)
Asotin	<i>Triteleia grandiflora</i> (55)	<i>Calochortus macrocarpus</i> (24)
Benton	<i>Elymus elymoides</i> (57)	<i>Ericameria nauseosa</i> (56)
Chelan	<i>Poa secunda</i> (118)	<i>Balsamorhiza sagittata</i> (234)
Clallam	<i>Androsace</i> (Douglasia) <i>laevigata</i> (75)	<i>Gaultheria shallon</i> (397)
Clark	<i>Lupinus polyphyllus</i> (20)	<i>Camassia quamash</i> (279)
Columbia	<i>Penstemon venustus</i> (32)	<i>Olsynium douglasii</i> (11)
Cowlitz	<i>Juncus diffusissimus</i> (16)	<i>Digitalis purpurea</i> (84)
Douglas	<i>Penstemon gairdneri</i> (53)	<i>Artemisia tridentata</i> (149)
Ferry	<i>Penstemon fruticosus</i> (38)	<i>Pinus ponderosa</i> (28)
Franklin	<i>Phlox longifolia</i> (26)	<i>Juniperus occidentalis</i> (48)
Garfield	<i>Delphinium nuttallianum</i> (34)	<i>Lupinus sulphureus</i> (8)
Grant	<i>Delphinium nuttallianum</i> (34)	<i>Artemisia tridentata</i> (118)
Grays Harbor	<i>Polygonum paronychia</i> (40)	<i>Picea sitchensis</i> (179)
Island	<i>Grindilia stricta</i> (G. <i>hirsutula</i>) (25)	<i>Gaultheria shallon</i> (227)
Jefferson	<i>Polystichum munitum</i> (64)	<i>Polystichum munitum</i> (384)
King	<i>Rubus spectabilis</i> (86)	<i>Polystichum munitum</i> (2,373)
Kitsap	<i>Arctostaphylos columbiana</i> (34)	<i>Vaccinium ovatum</i> (241)
Kittitas	<i>Poa secunda</i> (135)	<i>Pediocactus nigrispinus</i> (250)
Klickitat	<i>Salix scouleriana</i> (514)	<i>Triteleia grandiflora</i> (227)
Lewis	<i>Rumex acetosella</i> (31)	<i>Xerophyllum tenax</i> (217)
Lincoln	<i>Lupinus sericeus</i> (32)	<i>Pinus ponderosa</i> (37)

Mason	<i>Struthiopteris spicant</i> (63)	<i>Trillium ovatum</i> (147)
Okanogan	<i>Poa secunda</i> (75)	<i>Balsamorhiza sagittata</i> (137)
Pacific	<i>Rhododendron columbianum</i> (35)	<i>Gaultheria shallon</i> (127)
Pend Oreille	<i>Ribes lacustre</i> (40)	<i>Thuja plicata</i> (65)
Pierce	<i>Salix scouleriana</i> (60)	<i>Anemone occidentalis</i> (<i>Pulsatilla o.</i>) (874)
San Juan	<i>Bromus hordeaceus</i> (86)	<i>Arbutus menziesii</i> (305)
Skagit	<i>Polystichum munitum</i> (54)	<i>Arbutus menziesii</i> (284)
Skamania	<i>Poa secunda</i> (53)	<i>Castilleja miniata</i> (191)
Snohomish	<i>Polystichum andersonii</i> (45)	<i>Rubus spectabilis</i> (575)
Spokane	<i>Amelanchier alnifolia</i> (79)	<i>Pinus ponderosa</i> (518)
Stevens	<i>Oxytropis campestris</i> (46)	<i>Pinus ponderosa</i> (65)
Thurston	<i>Lupinus lepidus</i> / <i>Teesdalia nudicaulis</i> (tied, 38)	<i>Oemleria cerasiformis</i> (452)
Wahkiakum	<i>Impatiens pacifica</i> (18)	<i>Impatiens capensis</i> (16)
Walla Walla	<i>Phlox longifolia</i> (69)	<i>Asclepias speciosa</i> (36)
Whatcom	<i>Poa secunda</i> (61)	<i>Thuja plicata</i> (561)
Whitman	<i>Poa secunda</i> (232)	<i>Balsamorhiza sagittata</i> (92)
Yakima	<i>Poa secunda</i> (150)	<i>Achillea millefolium</i> / <i>Pinus ponderosa</i> (tied, 87)

*Only full species recognized (varieties and subspecies not distinguished)

accessible to major population centers. Twelve of Washington's 39 counties have more than 10,000 herbarium specimens from within their borders (Table 5). Highly-collected counties also tend to be near major universities (King, Pierce, Spokane, Whatcom, and Whitman) or contain extensive areas of National Forests (Chelan, Clallam, Kittitas, Klickitat, Okanogan, and Yakima). The exception to this generalization is San Juan County, which per unit area is perhaps the best collected county in the state, thanks in large part to recent efforts to systematically document the flora of each island by Peter Dunwiddie, Peter Zika, David Giblin, and others. By contrast, the least-collected counties (Wahkiakum, Adams, Franklin,

Cowlitz) are either farther from population centers and colleges or contain mostly private land or vast expanses of croplands with low species diversity. Due to under-collecting, the floras of most of these counties is inadequately documented and numerous county-records await those willing to make the effort.

One other drawback of herbarium records is that labels often do not indicate the relative abundance of a species. This could be easily rectified if collectors got in the habit of recording semi-quantitative abundance using standard conventions, such as the “ACFOR” system. ACFOR recognizes species as being Abundant (dominant species at site), Common (numerically abundant, though not dominant), Frequent (readily encountered within a given habitat, but often not common), Occasional (occurring sporadically), or Rare (found in low numbers or often missing from potential habitat).

iNaturalist records

iNaturalist (www.inaturalist.org) is an online social network program established in 2008 as a means for nature enthusiasts to share their photos and love of plants and animals with kindred souls across the planet. It has grown exponentially to now include 2.5 million users and over 115 million geo-referenced images. Users either provide an identification for the species in their images, or determinations are crowd-sourced to the iNaturalist community, which includes many amateur and professional biologists who are experts on their local biota or particular species groups. Thus, identifications can be verified, as with herbarium records, and erroneous reports are ultimately weeded out. The main advantage of iNaturalist is the volume of observations, which can be a proxy for species abundance or dominance.

On November 12, 2022, I ran a query of iNaturalist records for vascular plants in Washington to assess the most commonly reported species in the whole state and by county (Tables 3, 4). There were 586,196 records on that date (as I type this, the number is now 588,079. No, wait, it is now 588,080... you get the idea!). The most commonly photographed plant species in Washington is western sword fern (*Polystichum munitum*) with 6,200 images, followed by salmonberry (*Rubus spectabilis*, 5,563), western red cedar (5,419), salal (*Gaultheria shallon*, 5,000), and Douglas-fir (4,584). Interestingly, there is no overlap between the ten most photographed and ten most collected species in herbaria (Tables 2, 3). Sandberg bluegrass, the most commonly collected species in the state, had only 37 photos on iNaturalist (not even breaking the top 1,000 species!). The closest species in the top ten of collected species to crack the top ten in iNaturalist is common yarrow (*Achillea millefolium*) with 2,700 observations (good for 23rd place in iNaturalist). iNaturalist results are somewhat better at tracking results of ecological dominance data, with two species (Douglas-fir and western red cedar) making the top ten on both lists (Tables 1, 4).

Like herbarium collecting, iNaturalist is subject to biases in sampling. Showy and prominent species (such as trees) are especially well-represented in iNaturalist, and often better

sampled than in herbaria. Plants with small or drab flowers, such as grasses, sedges, rushes, and cryptic annuals, are significantly under-represented in iNaturalist. As with herbarium collecting, there are strong correlations between the number of posted observations in a county with human population centers and large areas of public lands. Not surprisingly, populous King County has the greatest number of plant reports on iNaturalist (over 138,000), while Adams County has just 310 observations. There is also strong representation of National Park lands in iNaturalist, especially Mount Rainier and Olympic National Parks (areas which actually are under-represented in herbaria due to restrictions on collecting). In general, public lands are well-represented in iNaturalist in western and central Washington, but less so in the eastern half of the state. Like herbarium specimens, iNaturalist reports rarely indicate actual abundance of a species. There are data fields in iNaturalist records where posters could include notes on abundance (using the ACFOR system), but these fields are not regularly populated.

At the county level, iNaturalist records show a few surprises. Perhaps the most unexpected was Kittitas County (number eight in number of reports in the state) in which the rare hedgehog cactus (*Pediocactus nigrispinus*) was the most commonly reported species. This is likely an artifact of participants in the 2022 Washington Native Plant Society Study Weekend field trips submitting images at the request of trip organizer Ron Bockelman who has been studying this species for several years at the Wild Horse wind farm (see *Douglasia*, Spring 2021). I suspect that osoberry (*Oemleria cerasiformis*)

Table 4. Most commonly observed vascular plant species in Washington based on records from iNaturalist (<https://www.inaturalist.org/>)

Rank	Species*	Number of Observations
1	western sword-fern (<i>Polystichum munitum</i>)	6,200
2	salmonberry (<i>Rubus spectabilis</i>)	5,563
3	western red cedar (<i>Thuja plicata</i>)	5,419
4	salal (<i>Gaultheria shallon</i>)	5,000
5	Douglas-fir (<i>Pseudotsuga menziesii</i>)	4,584
6	western white trillium (<i>Trillium ovatum</i>)	4,363
7	thimbleberry (<i>Rubus nutkanus</i> [R. <i>parviflorus</i>])	3,834
8	bigleaf maple (<i>Acer macrophyllum</i>)	3,823
9	common snowberry (<i>Symphoricarpos albus</i>)	3,632
10	Cascade Oregon-grape (<i>Berberis nervosa</i>)	3,618

*Only full species recognized (varieties and subspecies not distinguished)



Frost on sword fern (*Polystichum munitum*). PHOTO: MARK TURNER

is similarly over-represented in Thurston County, though in this case it may be a combination of growing in a population center and being the first showy plant to appear after a long, gray, rainy winter and people being overly zealous in submitting its image! Jefferson County was the only county in this analysis where the same species (western sword fern) was the most collected and most photographed (Table 3).

So what is the most common species in Washington?

Three datasets (ecological plots, herbarium specimens, and iNaturalist records) came up with three very different answers to this fairly basic question. Is at least one of them correct? Are all of them correct, if taken in the aggregate?

Given our current state of knowledge and capacity for databasing, the answer to this question will remain elusive. Creating a master database of locality information incorporating ecological plot data, herbarium samples, and iNaturalist reports could help determine what the most common species is in the state, but would be a significant undertaking and still suffer from problems of biased or incomplete sampling. Standardized criteria for determining population occurrences, such as those employed by NatureServe in recognizing distinct occurrences of rare plants and animals, would be beneficial in reducing noise from duplicate sampling.

Table 5. Washington counties with the total number of herbarium collections and iNaturalist records of vascular plants. Data current as of 12 November 2022.

County	Number of Herbarium Collections (CPNWH)	Number of iNaturalist observations
Adams	1,653	310
Asotin	4,936	1,159
Benton	4,782	2,686
Chelan	21,039	18,044
Clallam	11,607	29,126
Clark	1,957	18,187
Columbia	3,529	749
Cowlitz	1,769	3,403
Douglas	2,919	1,577
Ferry	4,979	1,027
Franklin	1,755	1,032
Garfield	2,376	463
Grant	7,600	4,456
Grays Harbor	5,094	8,042
Island	3,216	9,937
Jefferson	5,721	23,840
King	13,991	138,236
Kitsap	1,879	13,070
Kittitas	17,212	20,868
Klickitat	21,720	11,013
Lewis	3,347	10,787
Lincoln	3,114	804
Mason	3,147	8,147
Okanogan	13,534	10,731
Pacific	2,867	5,674
Pend Oreille	6,099	2,484
Pierce	20,090	47,010
San Juan	10,470	14,325
Skagit	7,912	20,600
Skamania	8,646	14,300
Snohomish	6,352	26,764
Spokane	11,400	17,433
Stevens	5,734	2,222
Thurston	4,230	30,433
Wahkiakum	948	758
Walla Walla	5,989	2,070
Whatcom	16,615	47,641
Whitman	13,486	6,162
Yakima	15,457	10,626
TOTAL	299,171	586,196

Rather than focusing on exact numbers of occurrences, relative “common-ness” could be derived for species using abundance categories, analogous to the S and G ranks used by NatureServe to assess the conservation priority of species and community elements. The ranking system used by NatureServe is based on multiple criteria that include estimates of the number of individuals and discrete occurrences of a species, the extent and area of its range, habitat specificity, threats, and trends. These criteria could be modified to emphasize abundance and used to identify species that are extremely common (found widely across the state in multiple ecological systems), common (abundant or dominant in ecological systems in either the west or east sides of the state along the Cascade divide, but not both), uncommon or local (frequently encountered, but never dominant), uncommon (widely scattered and infrequently observed but not rare), and rare (low population numbers, few occurrences, and restricted to specialized habitats or small geographic ranges).

Of the three candidates for most common species in Washington (Douglas-fir, Sandberg’s bluegrass, and western sword-fern), I suspect that Sandberg’s bluegrass has the largest number of individuals, Douglas-fir has the greatest biomass, and western sword-fern is the most obvious species in the western half of the state. The overall most common species may well be a taxon that did not make the top of any of these lists. It would likely be a species with a broad ecological tolerance found widely on the east and west sides of the state and over a large elevational range. It would also need to be locally abundant, though not necessarily the dominant species on the landscape. Based on these criteria, it does not seem far-fetched that Sandberg bluegrass might be numerically the most common species in the state. Or perhaps yarrow. Or small-flowered blue-eyed Mary (*Collinsia parviflora*). Or one of the ubiquitous weeds, like spring whitlow-grass (*Draba verna*) or cheatgrass (*Bromus tectorum*). Or maybe Douglas-fir.

I guess the answer really is “it depends.”

Walter Fertig is a plant geographer by training, now based at the Marion Ownbey Herbarium at Washington State University, and is kept up late at night pondering unanswerable questions, like this.



Spring whitlow grass (*Draba verna*). PHOTO: MARK TURNER

Hiding in Plain Sight: Goji Berry Naturalized in Port Townsend

by Katherine Darrow

In early September this year, while walking near Port Townsend Marine Science Center, I noticed a bramble with pale lavender flowers flourishing next to a trail above the Cascadia Marine Trail campsite. “How strange,” I thought, “that a desert plant is growing here.” Having lived in the Sonoran desert of central Arizona for 14 years, I was very familiar with wolfberries, aka genus *Lycium*, since there are about a dozen species native to that region. The five-petaled, tubular flowers and slender, thorny branches are characteristic of the genus, members of the tomato family, or Solanaceae. There are 70–80 species of *Lycium* around the world, especially in warmer sub-tropical regions, but none are native to the Pacific Northwest.



Lycium barbarum thicket at Fort Worden State Park, Port Townsend.
PHOTO: KATHY DARROW

The wolfberry growing at Fort Worden is a native of China, also known as goji berry, box-thorn, or matrimony vine. Two species from China are naturalized in Washington and across the US: *L. barbarum* and *L. chinense*. Both have become popular hedgerow species thanks to the horticultural ambitions of the Scottish Duke of Argyll, Archibald Campbell, who introduced plants to the UK in the 1730s, purportedly for the medicinal qualities of the leaves and berries, as well as to decorate the Chinese section of his royal gardens. Colonists from the UK likely introduced these plants to North America. In some regions they are regarded as invasive or noxious weeds, depending on the situation. In Butte, MT, for instance, one blogger reports that the origin of the common name Matrimony Vine is “because once you have it growing, ‘you’re married to it.’”

More recently, these species became popular as the source of goji berries (goji is the anglicized pronunciation of *gōuqǐ* (pinyin for 枸杞), marketed as a “super-fruit” by Western nutritionists who had learned of the anti-aging and other



Lycium barbarum flowers, Fort Worden State Park, Port Townsend.
PHOTO: KATHY DARROW

beneficial effects that have been an element of Chinese medicine for thousands of years. In the early 2000s, goji berries were featured in everything from granola bars to smoothies to vitamin supplements. But in 2010, a lawsuit settlement against claims of goji's medicinal and nutritive values pretty much quashed the U.S. market for the miracle fruit. During my recent search in stores around Port Townsend, there were no goji infused products available.

That is, except for the brambles at Fort Worden State Park. And, as it turns out, another thicket at the foot of the bluffs along Water Street, a little west of Port Townsend's ferry terminal. The Water Street patch was documented by botanist Peter Zika in 2009, and identified as *L. chinense*. Our recent collection at Fort Worden has a few differing characteristics that led botanist Fred Weinmann to determine the species as *L. barbarum*, which is the most common of the two wherever they have naturalized in the US. Thus, we have not just one, but two species of goji berry growing wild in Port Townsend!



Lycium chinense, Water Street, Port Townsend. PHOTO: KATHY DARROW

The most puzzling thing about the population at Fort Worden, however, is that it had never been noticed before this year. Even though it is a tall shrub with branches up to more than six feet long, it was hiding in plain sight in a block-long roadside thicket among blackberries, snowberries and wild

roses. Shortly after Fred, his wife Ann, and I collected specimens for the Burke Herbarium at UW, iNaturalist enthusiast Wendy Feltham noticed it too, and logged photos from the same location. So far, there are no other documented occurrences on the Olympic Peninsula, although there are several in other Washington counties. Because of their somewhat cryptic nature, it's possible other populations have gone unnoticed around the region.



A handful of *Lycium* berries. (These are from *Lycium andersonii*, a Sonoran desert species, but the berries are basically the same as those on our non-natives.) PHOTO: KATHY DARROW

How long have they been growing here? Could they have been introduced by Chinese immigrants a century ago? Or were seeds dropped by birds that ate berries in nearby gardens? Or were they introduced more recently by people who hoped to cultivate some of the miracle fruit? No one knows, or at least no one is sayin'!

At this time of year, the long slender branches are barren except for a few lingering leaves and berries, and many sharp thorns. Look for them again in late summer when they are in bloom, or in October when the berries have ripened. If you can beat the birds that forage for these tiny, tart, succulent red berries, you might be able to gather a handful and see if you experience a flush of good health.

Katherine Darrow is a natural history writer and freelance botanist living in Port Townsend. She is a member of the of the Olympic Peninsula Chapter and serves on the State Board of WNPS. This article was previously published in the OP Chapter Winter 2022 newsletter.



Douglasia Wants Your Stories!

Submissions for *Douglasia* from WNPS members or other native plant enthusiasts are always welcomed and encouraged. Have something interesting to share? Email douglasia@wnps.org with your ideas or drafts, or go to wnps.org/douglasia for more information.

Tall Western Penstemon Being Considered for Endangered Species Listing

by Walter Fertig

True to its name, tall western penstemon (*Penstemon hesperius*) is atypically tall, reaching a height as great as five feet (most other penstemons rarely exceed 2.5 feet). The species is also unusual in having a small range, centered on seasonally flooded wet meadows in the vicinity of Portland, OR, and Vancouver, WA. Now *P. hesperius* has another distinction—it is being considered for federal protection under the Endangered Species Act after the US Fish and Wildlife Service (USFWS) agreed to conduct a 12-month review of its potential listing in response to a formal petition from two conservation groups.



Penstemon hesperius. PHOTO: MARK EGGER

Penstemon hesperius is one of 30 beardtongue or penstemon species native to Washington. It is characterized by having erect, glabrous stems 2–5 feet tall arising from rhizome-like, sprawling roots, sessile, opposite, lance-shaped stem leaves, and 3–7 leafy whorls of pale blue, two-lipped flowers that are about

0.5 inch long. The tall stems and spreading roots are unique among northwestern penstemons, but the flowers closely resemble Rydberg's penstemon (*P. rydbergii*), a low-growing, mountain meadow species found in the Rocky Mountains and reaching southeastern Washington.



Penstemon hesperius. PHOTO: MARK EGGER

Intrepid botanical explorer David Douglas made the first scientific collection of *P. hesperius* near the “Grand Rapids” on the north side of the Columbia River in 1825 (an area now inundated by Lake Bonneville). Douglas noted the distinct height of the plant and considered it a distinct species, though it would remain unnamed for nearly a century. Morton Peck, an expert on the flora of Oregon and penstemons, rediscovered the species in Washington County, OR in 1930 and formally described it as a new species in 1932.

The species remained poorly-known and infrequently collected. Arthur Cronquist considered it a variant of *P. rydbergii* and reduced it to synonymy in volume 4 of *Vascular Plants of the Pacific Northwest* (Hitchcock et al. 1959). *Penstemon hesperius* remained in obscurity until it was rediscovered by Oregon botanists John Christy and Ginny Maffit in 2008, nearly 75 years after the last known collection. Penstemon experts Craig Freeman and Noel Holmgren have re-examined the known specimens and concluded that *P. hesperius* should be resurrected as a distinct species. The revised second edition of the *Flora of the Pacific Northwest*, published in 2018, recognizes it as such (Hitchcock and Cronquist 2018).

Tall western penstemon was rediscovered in Washington in 2014 in Clark County, east of Mill Plain. This population is found in small openings in a forested wetland dominated by Oregon white oak (*Quercus garryana*) and Oregon ash (*Fraxinus latifolia*) in low depressions of fine clay-loam that are seasonally flooded. The area is protected within the Lacamas Prairie Natural Area Preserve, managed by the Washington Department of Natural Resources (DNR). The population consists of about 200 individuals scattered in several small subpopulations. DNR

staff are attempting to increase the population with out-plantings along the margins of oak-ash forests and wet meadows occupied by several other rare plants, including the recently delisted Bradshaw's lomatium (*Lomatium bradshawii*).

Presently, only four other small populations of *Penstemon hesperius* are known, all in wetlands in Washington County, OR in the Portland metro area. Additional historical occurrences were found in Clackamas and Multnomah counties in Oregon (Douglas's collection would be from Skamania County, WA). The extant Oregon populations are found in Tualatin River National Wildlife Refuge and two protected natural areas.

In December 2020, the Center for Biological Diversity and the Native Plant Society of Oregon petitioned the USFWS to list *P. hesperius* as Endangered. The petition notes that the species has likely declined significantly due to habitat destruction along the Columbia River and in the Willamette Valley, as its wet meadow and swampy forest habitat has been converted to agriculture, urban sprawl, or flooding by dams. Additional threats include potential over-collection (*Penstemon* species are popular garden plants), competition from introduced weed species, and increased drought stress from climate change. The species currently lacks formal state protection in Oregon and Washington.



Penstemon hesperius. PHOTO: MARK EGGER

On October 19, 2022, USFWS responded to the petition with a notice in the Federal Register ([bit.ly/FWS-register](https://www.federalregister.gov/documents/2022/10/19/2022-20841)) announcing its decision to conduct a 12-month review of the status of *P. hesperius* for potential listing under the Endangered Species Act. The Service is requesting information from knowledgeable individuals about the abundance, threats, trends, and life history of *P. hesperius* to inform its final decision. Information on how to submit comments and additional background on this species and the listing process are available in the Federal Register notice (cited above) or the Federal eRulemaking Portal: [regulations.gov](https://www.regulations.gov).



Conservation Impacts: Elections, Voting... and Feral Holly?

by Becky Chaney, WNPS Conservation Committee Chair

This day of writing is election day 2022—more specifically, mid-term election day—across the United States. *We the People* will decide which candidates remain in office, are replaced, or fill empty seats. A heavy duty, taken with varying levels of interest and commitment. The outcome will influence how our country and state responds to economic, social, and environmental issues. The results impact WNPS's ability to carry out its mission to promote the appreciation and conservation of Washington's native plants and habitats through study, education, and advocacy.

Washington's elected officials have created numerous boards, including those that oversee implementation of environmental policy and regulations in Washington state. Board members typically serve out of a sense of duty, attempting to represent the variety of interests that make up our communities. I serve, by appointment of King County Executive Dow Constantine, on two of these boards, the Snoqualmie Watershed Forum and the King County Noxious Weed Board. And in addition to representing my neighbors, I attempt to ensure Washington's native plants are part of our discussions and decision-making.

And here enters, creeping, seeding, growing, the issue of the feral holly.

In November, the Washington State Noxious Weed Control Board (hereafter referred to as the Board) considered the Whatcom County Noxious Weed Board proposal to list English holly (*Ilex aquifolium*) as a Class C noxious weed, as requested by Thomas and Tricia Morrel, owners of a designated Stewardship Forest in Whatcom County. The effects of holly on western Washington public and private lands, documented by numerous studies and mapping from multiple agencies and scientists, was presented to the Board during the November 1 public hearing. The information included statements regarding the negative impacts of holly, including its detrimental crowding out of understory vegetation and the increased forest fire risk resulting from this relatively recent addition of a non-native ladder fuel.

The information presented was quantitative and backed by scientific research from numerous studies. Eleven speakers, included botanists and land managers from a wide variety of agencies and environmental groups, spoke in favor of the state listing. Two speakers, the owner of Holly Hill Orchards and his son, spoke in opposition expressing concern that the listing would destroy their family business, a holly farm purchased in 2011. They are convinced the habitat risks are over-stated and

find the dollars spent on control (\$90,000 from 2007-2009 at a single Seattle site) inconceivable.

The Board considered the potential impacts to the holly farms and the floral industry. To ensure no harm to these small family businesses, a concurrent addition, developed with input from Washington Attorney General Bob Ferguson, was proposed and approved before taking a vote on listing holly. A new definition—feral—was added to Washington’s noxious weed laws. The definition reads: “Feral means where a plant species has escaped a managed landscape or is growing without human management or design. ‘Feral’ does not include any plants grown for agricultural or commercial purposes” (WAC 16-750-003).

The proposed Class C listing of feral holly only applies to escaped holly—holly existing outside of gardens and cultivated lands such as holly farms. It would allow wildland managers to fund control of invasive holly where it is negatively impacting forestland and for educational programs addressing why and where feral holly is a problem. Nothing in the listing would restrict farming holly, or selling it, either live or cut, within or outside of the state. A class C listing as feral holly would not require its removal from ornamental gardens or farms, or restrict its commercial uses.

This consideration wasn’t enough to ease the concerns of the Washington holly growers. The holly farmers argued that the image of holly would be tarnished, and that holly farming would no longer be economically feasible. No economic data was provided to back up their claim. Board Education Specialist Anne Schuster did provide information noting that Pacific Northwest holly growers supply 90% of English holly sold in the United States, export it to countries such as Japan, and that it has grown here for over 90 years.

Sadly (from my perspective), the listing of English holly as a Washington State class C noxious weed received only a 3-3 vote from the Board members present; passage of the listing needed a majority. There are nine voting positions on the Board, but the Northeast Tier is currently vacant. Two members, Randy Johnson and Brad White, did not attend the meeting, so only six members voted. The listing was supported by board members William (Bill) Agosta, Janet Spingath, and Allen Evanston. In opposition were members Jerry Hendrickson, Carey Caruso, and Ken Bajema. Bajema, in addition to being on the Board, is owner of Columbia Gorge Holly Farms, a multi-generational family farm growing holly since 1959. He is a long-term, vocal opponent of listing holly as a state noxious weed.



English holly (*Ilex aquifolium*) mixed with thimbleberries (*Rubus parviflorus*) in early winter in second-growth forest near Bellingham. PHOTO: MARK TURNER

Again, from my perspective, I can’t help wondering how conflict of interest (a thorny issue) may have affected the vote. At least one respondent to a 2022 survey provided to the Board ahead of the hearing expressed concern that the Board had a conflict-of-interest problem. As far as I know, this was not publicly addressed by the Board or staff ahead of the vote. After the vote, the question over conflict of interest was raised during public comment. The Chair responded “Obviously, there is a conflict of interest if you are talking about...a member of the Board being a holly grower, but there’s no law against that...he is a member of the Board and he is a holly grower and that’s perfectly legitimate. Yes, that creates at least one person with a conflict of interest but I’m afraid... there’s no law against that. We have no rules about recusal and so there’s no basis for requiring a person with a conflict of interest to recuse himself in this circumstance.” Staff indicated that it was important to have Board members who feel the impacts of these decisions and expressed the opinion that it is “rightfully so that Ken has a vote.” I agree that the boards are supposed to include representation from various affected interest groups and are mandated to consider

and mitigate impacts on business. However, I believe elevating special interests above the Board's legal mission is wrong.

A Capital Press article written in 2010, then updated in 2018, states that "Dee and Ken Bajema scoff at claims that English holly is invasive." It states that the Bajemas (say) it's difficult to remain positive about the fate of the requested "noxious" listing. Ken Bajema says nothing to correct this public record. He does not acknowledge that holly is invasive, is environmentally detrimental, or that it is a multi-county problem. Survey comments verify that holly is a concern in at least ten Washington counties. More than half of the survey respondents who note that holly impacts their county also stated that holly's unlisted status (negatively) impacts their ability to control it.

As a member of a county Noxious Weed Board, I realize that decisions are made and that disagreements may occur. Still, I question how this vote opposing listing holly upholds the Board's mission, as specified in Washington Administrative Code 16-750-110: "To serve as responsible stewards of Washington by aiding in the protection and preservation of the land, water, and resources from the degrading impacts of noxious weeds." I also question whether this vote upholds the values of the Ethical Guidelines for the Washington State Noxious Weed Control Board or the Washington State's Boards and Commissions Membership Handbook, which includes the admonition that "as a board member, you are expected to uphold a high ethical standard. It is extremely important that board members avoid conflicts of interest or even the appearance of conflicts of interest." At the same time, I remind myself that the people who serve on these boards typically do so with a profound dedication to upholding the interests of our state.

At writing, the holiday season is fast approaching. My holiday activities will continue an ongoing effort to ensure feral holly's future listing so that its removal from our forests and wildlands can be appropriately implemented. Additionally, these holidays will include giving thanks for all the people who choose to serve our many needs through elected and appointed government and community leadership. This includes our WNPS directors and local program leaders, our environmental advocacy leaders, and our noxious weed control board members. Choices that impact our native plants and their habitats will be made, some right, some wrong. And when the wrong choices are made, we will and must continue working for correction. Once again, I thank all WNPS members and *Douglasia* readers for doing your part to advocate and protect the native plants of Washington State.

Documentation of holly impacts from the hearing is public information. Please contact me if you are interested in copies of any of the information I used for this article. Becky can be reached via e-mail at conservation@wnps.org. She is always happy to hear your conservation interests, concerns, and comments. Ideas for conservation-oriented webinars are also welcome.



What's in a Name? Pursh and *Purshia*

by *Walter Fertig*

Frederick Pursh sought botanical fame in North America, but due to some unscrupulous deeds achieved greater infamy instead. Despite publishing one of the first floras to cover North America, he died penniless at the age of 46 with the reputation of a drunkard and a cheat. Perhaps it is no surprise that "bitterbrush" is a common name of the genus named after him.

Pursh was born in Saxony, Germany in 1774 and was educated in the ways of horticulture and taxonomy at the Royal Botanical Gardens in Dresden. At the age of 25, Pursh emigrated to the United States where he was employed at several botanical gardens in Baltimore and Philadelphia.

In 1805, Pursh was hired by Benjamin Smith Barton to work as a plant collector and assist with the preparation of Barton's planned Flora of North America. Barton had previously written the first American textbook of botany and was regarded as one of the young republic's leading botanists. Though only eight years older than Pursh, Barton was in poor health and no longer capable of extensive field work. Barton hired a number of capable young botanists (including Thomas Nuttall) to explore the wilds of eastern North America for new plant species. Pursh spent the next two years traveling from South Carolina to New Hampshire and the Great Lakes, collecting hundreds of specimens for his mentor and gaining valuable first-hand experience with the flora.

Barton had been recruited by President Thomas Jefferson to train Meriwether Lewis (of Lewis and Clark fame) in botany and medicine and to describe any new plant species collected by the Corps of Discovery. Lewis returned to Philadelphia in 1807 with about 150 botanical specimens in need of identification and publication. Unfortunately, Barton's declining health and low productivity (his proposed North American flora never came close to being finished) prevented him from naming the Lewis and Clark specimens. Lewis subcontracted Pursh (for the princely sum of \$70) to organize the collection, prepare illustrations, and write new species descriptions as part of a planned publication on the scientific findings of the Lewis and Clark expedition.

Alas, this publication was never completed. Lewis died under mysterious circumstances (probably suicide) in the fall of 1809. Barton failed to meet his obligations to publish the new Lewis and Clark species before his own death in 1815. Fortunately, Pursh continued to work on the specimens, but left Barton's employment and moved to England. Pursh ultimately published 94 of Lewis's collections as new species in his 1813 publication *Flora Americanae Septentrionalis* (Latin for "Flora of North America"). Forty of the names Pursh gave to these specimens are still accepted, including three new genera: *Lewisia*

(bitterroot) and *Clarkia* (clarkia) named for the explorers, and *Calochortus* (literally “beautiful grass” in Greek). Pursh’s book included nearly 3,100 species from North America and was well-received by the botanical community as the leading flora of its time.

Pursh’s professional downfall came from hurriedly publishing new names for species collected by others, without their knowledge or consent. In London, Pursh came into possession of collections made in North America by Thomas Nuttall and John Bradbury that had been mailed to London for safekeeping while they were still working in the field. Pursh’s ethical lapse prevented Nuttall and Bradbury from being able to publish their own names for these species. Nuttall would overcome the slight by publishing his own North American flora, the *Genera of North American Plants*, in 1818, which supplanted Pursh’s flora as the preferred reference for the continent. Bradbury never recovered and abandoned his botanical pursuits altogether. He remained bitter towards Pursh for the rest of his life and his angry correspondence did much to tarnish the German’s reputation.

Pursh returned to North America in 1816 to establish a botanical garden in Montreal and to collect specimens for a flora of Canada. Those collections were destroyed in a fire and the project was never completed. He died in 1820 having never restored his reputation from that of a botanical charlatan.

One of the Lewis and Clark plants that Pursh described as a new species was *Tigarea tridentata*, a yellow-flowered shrub with three-lobed, wedge-shaped leaves in the rose family (Rosaceae), collected by the explorers west of Lewis and Clark Pass in western Montana in 1806. The genus name proved to be illegitimate under the technical rules of nomenclature and was replaced with *Purshia* by DeCandolle in 1816. Originally, the concept of *Purshia* was restricted to two species from western North America with one or two achenes lacking an elongated, feathery style. Similar plants with feathery styles were recognized as the genus *Cowania*. Genetic and hybridization studies in the 1960s demonstrated that the two genera were better treated as one genus, with *Purshia* taking priority as the older name.

Purshia tridentata, the bitterbrush or antelope bitterbrush, occurs widely across western North America, from southern Canada to northern Arizona and New Mexico. True to its name, the foliage of the plant is extremely bitter tasting to us, but quite palatable to deer, elk, and livestock. Across its range, bitterbrush can vary in appearance from being tall and erect (up to 6 ft) to stunted and crawling over the ground. Some of this variability may be due to browsing pressure, but in other cases local substrates or ecological adaptations may be at play. Besides its value as a forage species, bitterbrush is important ecologically for the nitrogen-fixing bacteria that live in specialized nodules on the plant’s roots and contribute to greater soil fertility.

In Washington, bitterbrush is found east of the Cascade crest, primarily in the foothills of the Cascades and the high mesas of the western Columbia Plateau. Scattered populations are also known from the mountains of northeastern Washington, along the Columbia River, and in the Blue Mountains. Bitterbrush is often found in dry, rocky shrublands dominated by sagebrush and in stabilized sand dunes, such as those in the



Shrubby penstemon (*Penstemon fruticosus*) forms a skirt below bitterbrush (*Purshia tridentata*) along Tronson Road on the Wenatchee-Okanogan National forest. PHOTO: MARK TURNER

Hanford area and the Juniper Dunes Wilderness. In spring, the shrubs may be covered in a mass of pale yellow flowers that attract swarms of pollinating bees and other insects, drawn by its strong and pleasing fragrance.

Cliffrose (*Purshia mexicana* var. *stansburyana* or *P. stansburyana*) resembles bitterbrush, but tends to be taller with one main trunk, five-lobed leaves, and creamy white petals. It is one of the species formerly segregated as *Cowania* based on having numerous achenes tipped with feathery remnant styles

Icicle Ridge Trail

by David E. Giblin, Ph.D.

Washington is notable for the large number of wildflower hikes spread across the state, often with many options centered around easy to reach areas: Mount Rainier and Olympic National Parks, Mount Baker, Cle Elum, Yakima, Winthrop—you get the idea. Included in this list of course is Leavenworth, located in the transition zone between the sagebrush desert, Wenatchee Mountains, and broader Cascades Range that includes the Chiwaukum Mountains, the Entiat, and the Enchantments. Those fortunate to live in that area could nearly spend a lifetime exploring trails within just a one-hour radius of town. For these reasons I always cherish my time near Leavenworth, whether it is for work or recreation.



Bitter Brush (*Purshia tridentata*) blossoms and foliage. PHOTO: MARK TURNER

that help disperse the ripe fruits. Cliffrose is a desert species, ranging from southern California, Nevada, Utah, and Colorado to central Mexico. The leaves of cliffrose are frequently coated in a resin-like varnish which makes them unpleasant tasting to humans, but less so to browsing animals. Indigenous cultures of the American southwest used the bitter leaves to induce vomiting, to make cough syrup, and to wash wounds or treat skin problems. Leaves and twigs were also used to make a gold dye and the shredded bark was valuable as stuffing for pillows and baby beds.

Bitterbrush and cliffrose can hybridize when they grow together and the two taxa are thought to have given rise to a third species, *Purshia glandulosa*, or desert bitterbrush of the Mohave Desert and Great Basin. This species strongly resembles *P. stansburiana* in flower and leaf characters but has the fruit traits of *P. tridentata*.

Cliffrose is a popular garden plant in the southwest, thriving in rocky soils and full sun. Bitterbrush is also used in cultivation and is hardier in colder winter climates, like those of eastern Washington. It can be grown from stem cuttings or seed that is cold stratified for three months. Because of its value for wildlife, *Purshia tridentata* is often used in habitat restoration projects. So while Frederick Pursh was unable to reclaim his professional reputation in his lifetime, his namesake plants at least can reclaim denuded landscapes in theirs.



Checker lily (*Fritillaria affinis*) from the Icicle Ridge Trail with its characteristic six spotted tepals, six anthers, and a 3-parted style. PHOTO: DAVID GIBLIN

On past trips up the Icicle Creek drainage, I had noticed the Icicle Ridge Trailhead sign, which shows up along the Icicle Road about 1.5 miles south from its junction with Highway 2. I had never been tempted to do the hike because most visits to the area were in summertime, and the thought of walking up a low elevation, southeast-facing slope in 90–100+ degree heat was not appealing. This past May my wife Julie and I, along with our dog Cedar, were there in early May, so we finally were able to do the hike. What a great walk!

There are many things that I like about this trail, but perhaps most is that it has many long switchbacks across the fairly steep slope that leads to the ridgeline above. This allows one to see plants at eye level when looking upslope. Looking

downslope one can take in the swaths of meadows that cover the extensive openings in the Ponderosa pine/Douglas-fir (*Pinus ponderosa*/*Pseudotsuga menziesii*) forest. The trail starts in complete forest canopy cover, where you'll encounter several of the usual suspects of this habitat, like starflower (*Maianthemum stellatum*) and trillium (*Trillium ovatum*). Breaking out of the forest and into the meadows you can find *Castilleja hispida* (harsh paintbrush), and *Delphinium nuttallianum* (Nuttall's larkspur). In some places there are rocky outcroppings that host taper-tip onion (*Allium acuminatum*) and lance-leaved stonecrop (*Sedum lanceolatum*). At many of the switchbacks there is space to sit and rest, enabling one to take in the views of the Wenatchee River valley and further east into the Columbia River Basin.

After a few miles of coursing back and forth upwards one makes it to the ridgeline, where I have to say I was fairly turned around directionally speaking. It was cloudy when we arrived at the ridge's saddle, so there were no mountains to orient by. From the ridgeline the west slope drops precipitously to the valley below, through which water courses. I thought to myself, wow, how did I not know what river this was given its size. Looking more closely I could see cars winding along the river's north bank. It finally dawned on me that we were looking at the Wenatchee River snaking its way through Tumwater Canyon. For some reason I thought we were much further south and in a different valley. Once at the ridgeline there is a spur leading to the right (north) for a couple of hundred yards that ends at a clearing with wonderful views in all directions, including the entire Icicle Ridge heading west (the clouds finally parted while we were up there). A great place for lunch.

There is a comprehensive plant list on the WNPS Plant List database, so be sure to take this with you when you go. Amazingly, we added a few species to it, including chocolate lily (*Fritillaria affinis*), which I recall finding where the trail begins to leave the forest canopy at the base of the slope. Because of the trail's southeastern exposure, it is probably snow-free as early as mid-April, but I would guess that peak wildflower

bloom is early-May (when we were there) to early June. There is an 1,800-foot elevation gain over the course of the trail's 3-mile ascent to the ridgeline, so this altitudinal gradient helps extend the flowering period nearly into summer. Things in bloom at the base of the trail in early May will be flowering higher up a few weeks later.

For those looking for additional mileage and elevation gain, one can continue south from where the trail makes the ridgeline and ascend the ridge that ultimately heads west. I have read that it reaches the 4th of July Trail in about 9 miles (not



Julie Monahan and Cedar near the ridgeline lookout along the Icicle Ridge Trail with the extended Icicle Ridge in the background leading into the heart of the Chiwaukum Mountains. PHOTO: DAVID GIBLIN

a day hike!). There was snow just above the ridgeline junction when we were there (you may recall spring 2022 was cool with a lot of late winter snow), so we didn't proceed any further. If you're interested in the geology of Icicle Ridge you can find a quick overview on Wikipedia) that includes several references for more detailed information (https://en.wikipedia.org/wiki/Icicle_Ridge).

In terms of logistics, there is no fee or permit required to park at the trailhead. The parking area is rather small, so you may want to get there early if going on a weekend or get a late afternoon start. For other details you can find a complete description at the Washington Trails Association website (<https://www.wta.org/go-hiking/hikes/icicle-ridge-1>). If you haven't done this hike before, then consider putting it on your calendar for next spring!



Antoine Etienne: The Man, his Namesake Creek, and its Flora

by Don Schaechtel

Etienne Creek is an interesting place, both botanically and historically. It is located north of Peshastin, WA, and is one drainage south of better-known Ingalls Creek. I first considered a trip there as an approach to the Three Brothers peaks, which were botanized in 1934–35 by *Vascular Plants of the Pacific Northwest* co-author J. W. Thompson and in 1961 by WNPS founder Art Kruckeberg. In the 1990s, it was known as Negro Creek, and Green Trails maps showed an unmaintained trail and no formal trailhead. I opted to approach the Three Brothers from the west via Navaho Pass instead.

When we put the WNPS plant lists into an online database, we wanted to rename the plant list that WNPS Fellow Don Knoke and Julia Bent had compiled for Negro Creek. That is when I learned the name had been officially changed to Etienne Creek. I didn't think more about it until 2020, when I was listening to a panel discussion about diversity in the outdoors. In response to a question for the panelists, Karen Francis McWhite suggested that it would be great to share stories about Black outdoors-people. She mentioned Etienne Creek and how she would like to learn more about Etienne, who she heard was a Black man. I made a note. Maybe I could help Karen bring this idea to life.

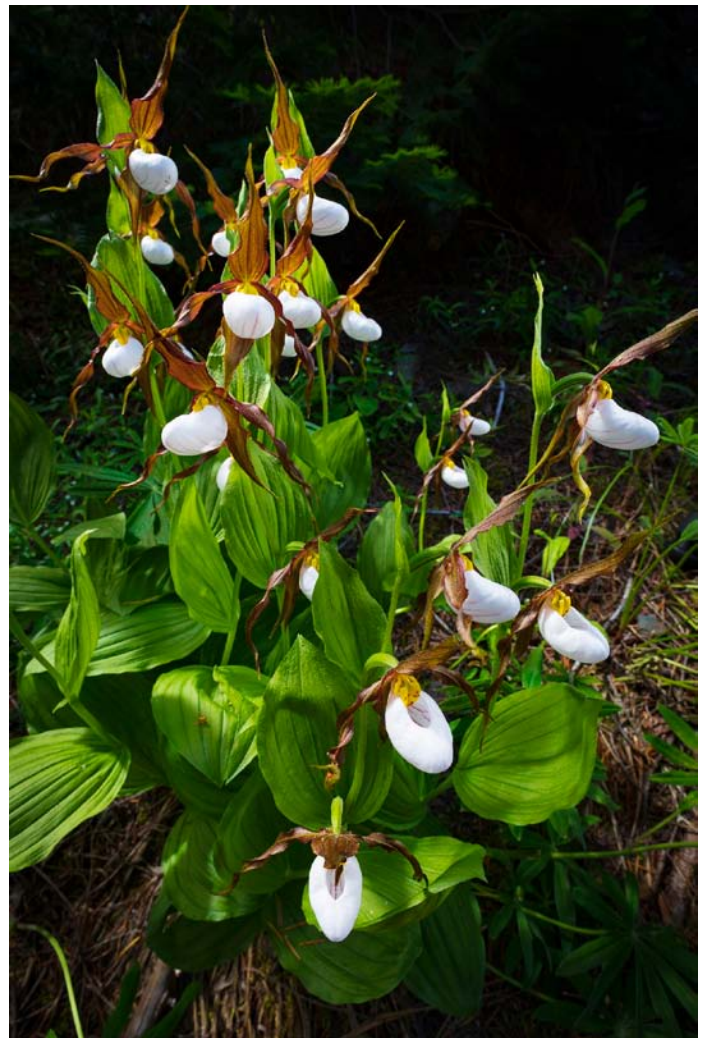
Antoine Etienne

With an internet search I discovered that Antoine Etienne was a Black miner, and the creek's name was changed in 2009 to acknowledge his name rather than his race. After some email exchanges, help from our local librarians, and genealogy research by fellow WNPS member Cindy Luksus, I was able to assemble a sketch of Antoine Etienne's life.

In several northcentral Washington history books, I found anecdotes about Antoine Etienne. Unfortunately, the anecdotes are inconsistent. Some say he came to Washington before the Civil War, some say after. Most said he had been a slave, but I found no evidence of that. Some said he came from Louisiana, another from the Caribbean or England. These anecdotes did, however, have five themes in common: he was educated; he was skilled with languages, which helped him interact with different tribes; he was in the military; he mined gold on the creek that now bears his name; and he became a skilled orchardist.

Cindy found an index card for Antoine Etienne in the Oregon Pioneer Index. The card says he was born in Lincoln County, MO on March 28, 1832. His ancestry was listed as African-Spanish-French. It also says that he left Missouri for Oregon in April 1849, via the "Plains." That would have made him 17 when he came west.

We couldn't find any records of what Etienne did for the next seven years. One has to wonder if he ran into the same issue that another Black pioneer, George Bush, met when he



Mountain Lady-slipper (*Cypripedium montanum*) may be found in a few places along the old mining road. PHOTO: MIKE POWER

reached Oregon in 1844: the exclusion law. At that time, Black settlers were not allowed in Oregon, so Bush and his party traveled north and established a farm near where Tumwater, WA is today. George Bush and his family were honored in 2021 with a plaque near the State Capitol Building.

In 1856, Etienne was living near The Dalles, OR. Years later Salem, OR's newspaper, the *Statesman Journal*, cited Etienne's recollection of an Indian attack on a White settlement downstream of The Dalles that year. He passed on a warning of the attack that he received from a member of the peaceful Cascade Tribe. However, the military authority didn't believe Etienne, and the next day the attack occurred and 15 people were killed.

That same year he joined Wilbur's Company B of the Oregon Volunteers during the so-called Indian Wars. He would have been 24.

The next anecdote places him at Peshastin Creek in 1860. An 1897 publication of the Seattle Post-Intelligencer states: "Mineral was first discovered in this district about 1860 by a party of miners returning from Fraser River, but they only worked the placers and gradually drifted away; one of them, a negro, who took out \$1,100 in a season from the bars at the mouth of Negro Creek, giving that stream its name." All



White shooting-star (*Dodecatheon dentatum*) grows in moist places in the old road bed. PHOTO: MIKE POWER

sources agree that this man was Antoine Etienne. Based on the price of gold in 1860, that \$1,100 would be worth over \$100,000 today.

In 1868, Etienne was living near what is now Entiat, WA. He was placer mining again and also growing peaches. He lived close to Chilcosahaskt, the Chief of the Entiat Tribe. Chilcosahaskt's great-grandson, Wendell George, relates a story told by his father, that Antoine took too much interest in Chilcosahaskt's daughters, whom the Chief felt were too young. As a result, the Chief told him to move away, so Etienne moved north to what became known as Antoine Creek (near the Wells Dam on the Columbia River).

In 1870, Etienne was back in Oregon, and according to the 1870 census he was living near The Dalles. His occupation was listed as farm laborer.

Harry Fisher, who was a Prosser, WA pioneer, reported in his journals that in 1905 he had seen Etienne bringing peaches for sale in Prosser. Etienne had a fruit orchard north of Byron, about six miles away, and he would walk those six miles with two buckets of peaches carried by a yoke over his shoulders. This must have been earlier than 1905, as Etienne's gravestone at the Tahoma Cemetery in Yakima says he died in 1904. He would have been 72 years old.

Renaming Etienne Creek

Jamie MacDonald was the man who proposed the name Etienne Creek. He was a geology graduate student at the time and doing field work in this area. He was studying ophiolites, which are rocks that were part of the ocean's crust that have since been uplifted. He needed a name for the geological formation he was studying, and decided on the "Iron Mountain Unit," as he did not feel it was appropriate to name it the Negro Creek Unit.

During his fieldwork, MacDonald was reading about the area's mining history, and learned that Antoine Etienne was the Black man for whom the creek was named. He took it upon himself to propose the new name of Etienne Creek to the US

Board of Geographical Names. After all, neighboring creeks were named after early explorers and pioneers: Ingalls Creek, Hansel Creek, Shaser Creek, and King Creek, to name a few. This was the key to getting the new name accepted. Geographical names in a region are supposed to be consistent with a theme. Earlier attempts to rename the creek were not successful because they were not names of local pioneers. In 2009 Etienne Creek was approved as the new name. By this time MacDonald was a professor at Florida Gulf Coast University, and he tells me that he has since had requests for tips about how to revise derogatory place names.

Gold Mining

Etienne Creek was the site of gold mining activity through the 1960s. A road extended from Peshastin Creek into the upper basin, but much of that road has since been washed away as the creek flooded and changed its course through the years. There are still signs of mining activity: claim markers, an abandoned backhoe, old cabin sites, an abandoned trailer, and mining artifacts. There are also abandoned mine shafts from the hard-rock mining era. I don't think anyone got rich mining in Etienne Creek, but they certainly tried.

The Flora

The lower portion of Etienne Creek is in a steep valley, so it stays cooler than you might expect for this far east of the Cascade Crest. Trees along the edge of the creek include Western red-cedar (*Thuja plicata*) and grand fir (*Abies grandis*), while not far above the creek is the more typical ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) forest. And as is typical for interior fir forests, there are abundant species of shrubs. The steep hillsides are drier, and there is some evidence of serpentine soils, which have their own unique flora. This combination of cool-moist and hot-dry landscapes means there is a lot of plant diversity.

In 2010, Don Knoke and Julia Bent made a "Rare Care" visit to Etienne Creek and compiled a plant list with 173 species. After four WNPS field trips in 2021–22 and some private trips, the plant list has grown to 217 species. Here are some highlights, starting from where Etienne Creek enters Peshastin Creek.



Seeps support plants like yellow monkeyflower (*Erythranthe guttata*). PHOTO: DON SCHAECHTEL



Tiger lilies (*Lilium columbianum*) are found along the old mining road in July. PHOTO: KATHRYN DEMERITT

The old mining road is still in good shape for the first half mile. It begins on a dry slope with the exception of some seeps that come through the road cut. There aren't lots of individual plants, but the diversity of species makes up for that. In these seeps we found yellow monkey-flower (*Erythranthe guttata*), naked broomrape (*Aphyllon purpureum*), and fragile fern (*Cystopteris fragilis*). In the dry and rocky areas we found northern buckwheat (*Eriogonum compositum*) and fern-leaved biscuit-root (*Lomatium dissectum*).

Past the road cut, one walks through open forest. Along the road we found enchanter's nightshade (*Circaea alpina*), white-flowered shooting star (*Dodecatheon dentatum*) and elegant rein-orchid (*Plantanthera elegans*). Mountain lady-slippers (*Cypripedium montanum*) bloom in late June and tiger lilies (*Lilium columbianum*) bloom in July.

After crossing Etienne Creek to its south side, the path continues through open forest. A highlight is the site that was once the Cedar Grove Campground. Few signs of the campground remain since the creek washed it out years ago, but the fine Western red-cedar grove remains. There are nice specimens of white-veined wintergreen (*Pyrola picta*) and also some surprises. We found a single rattlesnake fern (*Botrypus virginianus*) in a moist area once occupied by the creek and one single delight (*Moneses uniflora*) located in the creek bank. We searched for more individuals of both species, but couldn't find any. Nearby in the creek bed, in July we found purple monkey-flower (*Erythranthe lewisii*) and yellow willow-herb (*Epilobium luteum*).

After a mile the path recrosses Etienne Creek to reach dry slopes again. This is a good turnaround point for a day trip, but the path continues for those seeking a longer day.

I have hiked as far as the large open meadow that is five miles from Peshastin Creek. Just before the meadow, alpine

buckwheat (*Eriogonum pyrolifolium*) grows in a serpentine bald at 3,600 feet, which is a low elevation for this species. In the meadow there is still an old cabin and remnants of what was once an old-growth ponderosa pine forest. Iron Mountain and the Three Brothers rise above this meadow, which has a plant community of bluebunch wheatgrass (*Pseudoroegneria spicata*) and northern goldenrod (*Solidago multiradiata*).

If you want to go to Etienne Creek

Visiting Etienne Creek is not as easy as it could be, so here are a few tips for planning a trip. The current Green Trails "Liberty" map is a good reference.

First, be aware that both Peshastin Creek and Etienne Creek will be hazardous to cross in the springtime. You can still enjoy the lower parts of the creek, starting from the Ingalls Creek trailhead, which is accessed from US Highway 97 about seven miles south of US Highway 2. From there, you cross Ingalls Creek on a good bridge, which has a closed gate, and walk two miles on Old Highway 97 to reach a missing bridge across



Rattlesnake fern (*Botrypus virginianus*) was found in a moist area where the creek had flooded years ago. PHOTO: DON SCHAECHTEL

Etienne Creek and the mining road. The old mining road runs along the creek for about a half-mile, then it crosses the creek. If it is safe to do so, you can cross to the south side and continue another mile, past the old Cedar Grove campground, to a primitive bridge. After crossing, you can go another mile before you will encounter multiple creek crossings.

By mid-summer, less water is flowing, and you can use a shorter approach from the south, parking where Old Highway 97 meets the new highway at a pullout. From here it is a one-mile walk to the missing bridge. You can follow a faint trail down to the creek, cross by wading or hopping on rocks, and then scramble up to the mining road. If you are at all concerned about being able to cross safely, turn around and try again when the creek is lower.

Don Schaechtel is a past president of both WNPS and the Wenatchee Valley Chapter. He lives in Leavenworth and can be reached at don.schaechtel@gmail.com.



Shifting Baselines— Documenting Changes to our Landscape

by David E. Giblin, Ph.D.
University of Washington Herbarium, Burke Museum

I am fortunate in my work to travel throughout Washington and adjacent states for the purpose of documenting the diversity and distribution of vascular plants through specimens that are permanently archived at the University of Washington Herbarium at the Burke Museum. My nearly 200 collecting trips over the past 20 years have taken me to some of the most pristine landscapes in our region, but also to some of the most degraded (I have more than a passing interest in non-native species).

Through my efforts I have learned a lot about the Pacific Northwest flora, but perhaps more importantly I have observed how our landscapes are managed and how they change over time. Some of those changes are natural in cause (e.g., lightning-caused fires in forests and the sagebrush desert, flooding and wind events), but most of these changes I see are human-caused (e.g., land conversion for residential and industrial development, grazing, wind farms, agriculture).

In 2018 my colleagues and I produced a revision of Hitchcock and Cronquist’s one-volume *Flora of the Pacific Northwest*. In the introduction to the revision we included a summary table of the floristic and taxonomic changes between the two volumes, which I have recreated below (Hitchcock and Cronquist 2018). There are two lines in that table (yellow highlighted text) that I address in any presentation that I give about the book.

I have thought regularly about these figures over the past four years and why there has been a 100% increase in the non-native species in the *Flora* area. I do not think that Hitchcock and other Pacific Northwest collectors of his era were not interested in weeds and so didn’t collect them. I believe that they simply lived in a less weedy, less habitat-fragmented, less disturbed world.

This past September I was doing field work with Ed Alverson and Peter Zika when in the course of conversation Ed used the phrase “shifting baselines” in reference to our impressions of the landscape. It felt like a myriad of my own thoughts and impressions were crystallized by this term, which was presumably coined by landscape architect Ian McHarg in his book *Design with Nature* (McHarg 1969). It was later adopted by fisheries managers with respect to determining catch quotas. The basic concept is that landscape/habitat changes are compared against previous benchmarks, but those benchmarks themselves change over time relative to the original point of comparison.

In my case, the natural world of Hitchcock’s era likely looked very different than mine, though I still use the word “natural” to describe the places that I visit. We may have been using the same term, but we are not describing the same thing. Peter Kahn, a psychology professor at the University of Washington describes this as “environmental generational amnesia”: each generation perceives their environment as the norm, no matter how degraded it may be (Kahn and Weiss 2017). To me this is problematic. I sometimes shudder to think what will be described as natural 40 years from now when the undergraduate students that I work with reach my age.

I’ve been thinking recently about what can be done to somehow quantify or explicitly set the existing “natural” baseline beyond the specimens that I and my colleagues collect and make available online. Specimens are somewhat esoteric objects that don’t lend themselves to quick interpretation and visualization. They lack a visual context. One potential solution that has come to mind is to leverage the widespread use of cellphone cameras to take images of commonly visited natural areas across Washington using a set of created photo points.

One way to create such a set is for each Washington Native Plant Society chapter to select four photo point locations within its respective region. For example, in Kittitas County a few places that come to mind are Ginkgo State Park, Hayward Hill, Robinson Canyon, and Iron Peak. A point would be chosen, a text description for its location recorded along with a direction of focus (e.g., nearby hillside). Anyone could go to such a point at any time during the year, take a photo, and send it off to an email address monitored by a volunteer. That person would download the image and store it in a folder devoted to that site.

Table 1. Summary of changes between the 1st and 2nd editions of *Flora of the Pacific Northwest*.

	1st edition	2nd edition	Net change	% Increase/Decrease
Families	129	159	30	23.3%
Genera	826	1,141	315	38.1%
Species	3,555	4,818	1,263	35.5%
Infraspecies	1,393	1,329	–64	–4.6%
Native taxa	3,559	3,891	332	9.3%
Exotic taxa	722	1,444	722	100%
Total taxa	4,281	5,335	1,054	24.6%
Excluded taxa	134	210	76	56.7%



View looking east from lower end of Bethel Ridge in the Oak Canyon State Wildlife Area taken in May 2022 with scattered big sagebrush (*Artemisia tridentata*), Carey's balsamroot (*Balsamorhiza careyana*), and cheatgrass (*Bromus tectorum*). What will this area look like in 10, 20, or 40 years? PHOTO: DAVID GIBLIN

Ultimately a webpage could be developed for displaying the images and making them available for viewing or for download, along with the metadata (date, geocoordinates). Hopefully such an idea resonates with others, and a group could be formed to bring this idea to fruition for the coming season. I certainly would be willing to help get it started.

Why engage in such an activity? Mostly it is for future members of WNPS and the broader public who may be trying to inform a local, state, or federal land agency about how changes to the landscape have negatively impacted native plants. Perhaps it is for someone who would like to know what to restore an area to. Or perhaps it is for someone like me, who would just like to see what a place like the Palouse prairie looked like before it was plowed under or what a sagebrush community looked like before it disappeared to repeated wildfires. Or perhaps it is simply to join in community with the late Aldo Leopold who wrote indirectly about shifting baselines in *Sand County Almanac* (Leopold 1949):

“One of the penalties of an ecological education is that one lives alone in a world of wounds. Much of the damage inflicted

on land is quite invisible to laymen. An ecologist must either harden his shell and make believe that the consequences of science are none of his business, or he must be the doctor who sees the marks of death in a community that believes itself well and does not want to be told otherwise.”

How much difference can one photo or one year of photos make? Probably not much, but hundreds of photos over decades of time would make a huge contribution to tracking local and landscape level changes to plant communities. One has to start somewhere, even if one may not directly benefit from their endeavors. Someone, some time ago, thought it was a good idea to create lists of birds that they saw in the places they visited. The idea spread. Decades later amateur and academic ornithologists have used these records to chronicle changes in bird abundances and migration patterns. I am optimistic that images taken over time from locations across Washington would have a similar value in the future.



In Search of the Clodius Parnassian Host Plant East of the Cascades

by Cheryl Bellin

Searching host plants for immature butterfly stages can be a fun pastime while waiting for spring flight season. Sometimes, even finding the host plant can be a challenge. *Dicentra uniflora* (steer's head) is a plant that can often go unnoticed in sagebrush-steppe habitat. It emerges soon after snow melt and is quite small. Photos of it often include a coin to highlight how small it really is. One look at this uniquely beautiful flower confirms how its common name came to be. The entire plant senesces and essentially disappears fairly quickly before adult butterflies fly, further complicating locating it. Why the interest? It was assumed that steer's head was the host plant for the clodius parnassian (*Parnassus clodius*), east of the Cascades in Washington state, though not confirmed.



Dicentra uniflora. PHOTO: CHERYL BELLIN

I observed *P. clodius* at my residence in Winthrop, WA the last several years. A freshly mated female was observed in my front yard (note the white sphragis at the abdomen tip) May



The habitat near Winthrop, WA where the author observed *Parnassus clodius*. PHOTO: Cheryl Bellin

22, 2019, indicating close host plant proximity. Reporting this observation to Jonathan Pelham resulted in his prompting me with, "Where's the host plant?" I'd not seen steer's head at my home, but knew it's a beauty found in the Methow Valley often cited as blooming in May. I began looking around my home in earnest in 2019, but found no plants that summer, nor the next.

The early bird gets the worm. In 2021, I started looking in February while a good portion of the hillslopes were covered in snow. On March 20, 2021, steer's head plants were observed on the sun-exposed, east-facing hillslopes amongst the rocks, bitterbrush (*Purshia tridentata*) and sage (*Salvia dorrii*). Of note, as of this date even the presumed earliest bloomers, spring beauties (*Claytonia* spp.) and yellow bells (*Fritillaria pudica*), were yet to bloom. Over the next few days the steer's head appeared in large numbers as the snow continued melting and the soil warmed. Notably, those areas with highest solar gain and protection were first to show emergence.

The close proximity to my residence made multiple daily forays convenient. On hands and knees I spotted one plant with nibbled leaves and that evening I went out several times to



A feeding *Parnassus clodius* caterpillar. PHOTO: CHERYL BELLIN



A basking *Parnassus clodius* caterpillar. PHOTO: CHERYL BELLIN

search for the crepuscular caterpillar per James and Nunnallee (2011). None were seen. Finally, at 9:30 AM, March 25, a *P. clodius* caterpillar was seen warming itself in the sun near the nibbled steer's head. The first few days after finding the nibbled plant, I continued looking periodically at night. But after several daytime sightings of caterpillars, I gave up on the cold evening explorations.



Parnassus clodius. PHOTO: CHERYL BELLIN

Over the next few weeks, four to five individuals were observed feeding in the same location until early April. All feeding observations were during the day from approximately 10:00 AM to 4:00 PM. I suspect the late evening to early morning temperatures being below freezing must send them burrowing for cover. They likely return to the surface to bask in the early morning sun to warm themselves prior to feeding. From 8:30–10:00 AM they were typically stationary, likely warming themselves in those protected sunny places. One larva was



Freshly-mated female clodium parnassian (*Parnassus clodius*). PHOTO: CHERYL BELLIN

seen in late afternoon burrowed into the adjacent leaf litter, its posterior end just barely visible.

Family obligations curtailed observations for a few weeks and upon my return in early May, many plants in the vicinity of where *P. clodius* had been observed had already senesced. The first *P. clodius* adult in 2021 was seen flying down our lane May 10; how fun to confirm they are residents.

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2023 Calendar



Washington Native Plant Society

2023 WNPS Calendar

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Ten Things You Might Not Know About Ferns, But Wish You Did

by Walter Fertig

Ferns are easily recognized by their intricately-divided or lacy foliage that makes an appealing accent in floral arrangements or shady gardens. But how much do you really know about ferns? The following annotated list of factoids will make you an expert on pteridology (the study of ferns) at your next dinner party, or whenever you might be tipping one back at a Fern Bar.

1 Ferns are basically just big leaves.

Fern leaves (also called fronds) may be simple with entire margins, but more frequently are pinnately compound and divided into numerous leaflets (or pinnae) arranged in two rows along the axis of the leaf. Individual pinnae are often lobed themselves (and these smaller lobes may also be pinnately lobed or toothed), accounting for the filigree-like appearance of the leaf. In most ferns, the leaflets are all in the same plane, but the moonworts (*Botrychium*) and their relatives (Ophioglossaceae) have leaves split into separate sterile and fertile (spore-bearing) blades from a forked petiole. Technically, ferns have roots and stems, too, but these are not as obvious as the fronds. Fern stems are called rhizomes and grow horizontally at or below the soil surface. Rhizomes are covered by scales, hairs, or old leaf bases. Roots are present on the underside of the rhizome and tend to be slender and wiry. In the tropics, some ferns have thick, upright stems and resemble palm trees, but never produce true wood or bark.

2 Ferns reproduce by spores rather than seeds.

Ferns are distant cousins of the flowering plants (angiosperms) and conifers (gymnosperms) and share some features, such as multi-veined leaves and complex, internal plumbing of water-conducting xylem and food-transporting phloem. They differ, however, in the way they reproduce. Flowering plants and conifers produce seeds, which contain a diploid embryo enveloped in nutritive tissue and protected by a hard seed coat. Seeds germinate into miniature versions of their parent plant. By contrast, ferns and other primitive vascular plants (including the club-mosses [*Lycopodium* and relatives], spikemosses [*Selaginella*], quillworts [*Isoetes*], and horsetails [*Equisetum*]) reproduce by spores. Although they may look superficially like seeds, spores are microscopic, haploid, and do not pack much food or contain an embryo. Upon germination, the spore gives rise to a nearly microscopic filament of cells or a tiny, heart-shaped blob called a gametophyte that bears little resemblance to its parent plant.

3 Ferns alternate between separate, free-living gametophyte and sporophyte generations.

Like the spore it germinated from, the gametophyte phase of a fern is haploid, containing a single set of chromosomes, or half the complement of genetic material of a mature (diploid)



Deer fern (*Struthiopteris* [formerly *Blechnum*] *spicant*), with separate fertile and infertile fronds. PHOTO: MARK TURNER

fern plant. The gametophyte gets its name because it produces two types of gametes, or sex cells. Numerous flagellated sperm are produced in a specialized structure called an antheridium found below the surface of the gametophyte, while an egg is formed in a flask-shaped body called an archegonium. Sperm swim in a film of water from the antheridium of one gametophyte to the archegonium of another, where one will fuse with the egg cell to form a diploid zygote (restoring the original chromosome number). The zygote is initially nourished by the gametophyte but eventually outgrows its parent and develops into a mature sporophyte—the phase of the life cycle that we recognize as a typical fern. Sporophytes produce spores, to begin the life cycle anew. The complex life cycle of the fern is called an “alternation of generations” because the gametophyte phase alternates with the sporophyte phase. Seed plants (angiosperms and gymnosperms) technically have an alternation of generations too, except that the gametophyte stage is reduced to pollen grains and unfertilized ovules, and are not free-living apart from their sporophyte parents.

4 One Washington fern only exists in the gametophyte form.

Wright's filmy fern (*Hymenophyllum wrightii*) has ribbon-like gametophytes less than two mm wide and grow on bark

and decaying wood of conifers. The gametophytes are able to reproduce themselves asexually through the formation of spore-like balls of vegetative tissue called gemmae. Wright's filmy fern belongs to a large family of primarily tropical ferns (Hymenophyllaceae) that are characterized by leaf fronds that are a single cell thick (thus the name, "filmy fern"). Sporophytes have never been documented in Washington (where the species is known only from a few sites on the coast of the Olympic Peninsula), but have been observed in British Columbia. The species is



Sori on unidentified fern foliage in the Bellevue Botanical Garden, Bellevue, WA. PHOTO: MARK TURNER

thought to be a relict from before the Pleistocene when the climate of western North America was wetter and warmer, but has been able to persist for generations in gametophyte-form only.

5 Those little brown spots on the underside of fern leaves are not bug eggs or a disease, but actually their reproductive parts.

Technically, the dots are called sori (singular = sorus) and consist of clusters of spore-bearing sporangia. Without the sporangia, the sporophyte would not be able to produce the spores that give rise to the gametophyte generation. Thus, there is no need to "help" a fern by scraping the sori off, or dousing it with insecticide. In many ferns, each sorus is partially covered by a membranous flap of tissue called an indusium or enclosed

within the inrolled margins of the leaflets. The shape and position of indusia is a useful characteristic for identifying ferns to genus or species.

6 Ferns invented the catapult.

The sporangia of most ferns are borne on a short stalk and have a prominent ridge of partially-thickened cells called an annulus. Under magnification, the annulus looks like the segmented body of a worm or arthropod. The annulus functions much like a medieval catapult in the forcible ejection of spores. As the sporangium matures, it begins to lose moisture, causing the outer cell walls to be sucked inward and the annulus to contract. Eventually, the sporangium is torn at a weak point and the thick annulus becomes pulled backward, like the cup of a catapult. As water is continually lost, the annulus comes under tremendous tension (about 300 atmospheres of pressure). When the tension is finally broken, the annulus snaps back to its original shape and in the process flings the spores out into the air, where they may be caught in the wind and moved a long distance from the parent plant. On dry, windy days you can watch the sporangia of a fern begin to recoil, though the actual release of the spores is too fast for the human eye to detect. There are several videos on YouTube showing this in slow motion!

7 Fern spores are capable of extremely long-range dispersal.

Spores usually land relatively close to their parent plant—which makes some sense since they require similar environmental conditions in order to germinate. In rare cases, however, spores can travel 500 miles or more if they are lofted high into the atmosphere by strong winds. Recent experiments have shown that fern spores remained viable after being adhered to the wings of commercial aircraft and exposed to high UV radiation and other extreme conditions above 30,000 feet. Ferns are often common on remote islands, suggesting that they are not limited by dispersal barriers. The black spleenwort (*Asplenium adiantum-nigrum*) occurs primarily in Eurasia and Africa, but widely disjunct populations are also found in shady canyons in northern Mexico, Arizona, Colorado, and Zion National Park in Utah. Although sometimes considered a separate species, the North American populations are indistinguishable from those of the Old World. This species is not cultivated, and so the most likely explanation for its unusual geographic distribution is the long-distance dispersal of spores from Asia to North America in the distant past. Bracken fern (*Pteridium aquilinum*) is found on nearly every continent and has one of the largest global distributions of any plant (or animal!). Its ability to spread readily is attributed to strong atmospheric winds blowing its tiny spores.

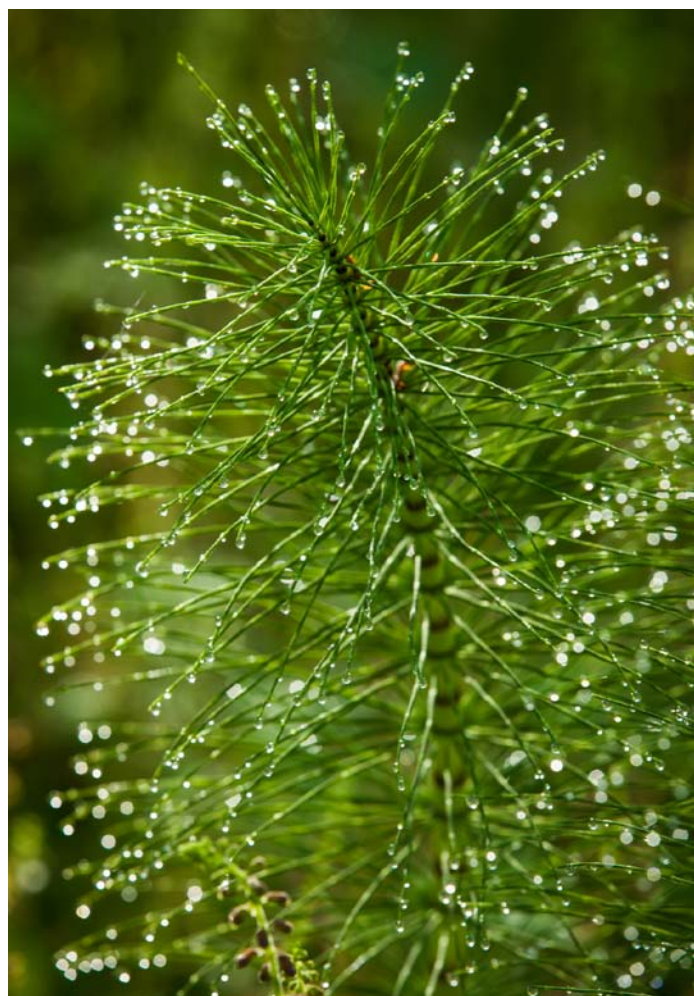
8 Among vascular plants, ferns are second only to the flowering plants in total number of species.

Taxonomists recognize at least 12,000 species of ferns worldwide. While this number pales compared to the estimated 300,000-320,000 angiosperms, it is much higher than the 1,100 or so known gymnosperm taxa. Ferns also greatly

outnumber other spore-bearing vascular plants (often called “fern allies”), such as lycophytes (clubmosses, spike-mosses, and quillworts). Fern species richness is greatest in the tropical regions of the world. There are 73 native fern species in Washington state, and another 33 fern allies (22 lycophytes: *Lycopodium*, *Selaginella*, *Isoetes*, and relatives and 11 horsetails: *Equisetum*). Washington has a rich pteridophyte flora relative to many other western states, though ferns and fern allies only comprise 2.9% of the vascular plant flora of the Evergreen State.

9 Recent molecular studies suggest that horsetails and whisk-ferns are actually ferns rather than separate groups of spore-bearing vascular plants.

Morphologically, horsetails (*Equisetum*) and whisk-ferns (*Psilotum*) bear little resemblance to true ferns. Modern horsetails have minute, scale-like leaves and hollow, fluted green stems capped by a cone-like collection of sporangia. Whisk-ferns (a common greenhouse weed, but not indigenous to the Pacific Northwest) are even stranger in appearance—resembling branched twigs and are often both leafless and rootless. Whisk-ferns are often thought to resemble the earliest known vascular plants (called rhyniophytes) that first colonized dry land in the late Silurian nearly 430 million years ago. Molecular studies now place *Equisetum* squarely within the true ferns alongside the tropical Marrattiales. *Psilotum* also appears to share



Giant horsetail (*Equisetum telmateia*) with dew drops. PHOTO: MARK TURNER

genetic traits with the grapeferns and moonworts (Ophioglossaceae). Its primitive characters are thought to be a modern adaptation to an epiphytic lifestyle (growing on other plants). The placement of the horsetails within the ferns remains controversial, however, as it is not well-supported by the fossil record (ancient, tree-like horsetails were common in the Coal Swamps of the Carboniferous Era, 325-345 million years ago).

Bonus Factoid 9a. Ferns have the highest known chromosome counts of any vascular plants.

The adder’s-tongue fern (*Ophioglossum reticulatum*) has more than 1,400 chromosomes, the highest number documented for any plant species (for comparison, humans have just 46 chromosomes). The high number is the result of whole genome duplications due to rampant polyploidy. One adder’s-tongue species (*O. pusillum*) occurs in Washington, where it is found in moist meadows and wetland sites scattered across the state. It is unusual for a fern in having an undivided vegetative frond paired with a fertile branch reduced to a single spike of sessile, grape-like sporangia that superficially resembles the rattle of a rattlesnake more than its tongue!



Hawaiian tree fern (*Cibotium glaucum*) in Hawaii Volcanoes National Park. PHOTO: MARK TURNER

Bonus Factoid 9b. Tree ferns have enormous genomes.

A team of researchers from China published a paper in *Nature* in May 2022 documenting the entire genome of the flying spider-monkey tree fern (*Alsophila spinulosa*) and found it contained more than six billion DNA base pairs. This count

is a billion more than the average angiosperm and double the human genome. The researchers believe that the fern's entire genome was duplicated about 100 million years ago. Whole genome duplications are not uncommon in plants, but typically the amount of DNA becomes reduced over time. The enormous genome of this southeast Asian fern may have provided useful mutations allowing for its unusual trunk-like stem.

10 Aquatic ferns may have helped trigger the Ice Age.

While most ferns live on land, several species and genera have become adapted to living in fresh water. One such group is the genus *Azolla*, also known as the mosquito-fern. (Two *Azolla* species occur in Washington.) Today, mosquito-ferns are widespread in warm areas of the world and are important for fertilizing rice fields because their pouch-like leaves support colonies of Nitrogen-fixing blue-green algae. About 15 years ago, researchers were shocked to discover thick beds of fossilized *Azolla* and its spores in sediment cores taken from the floor of the Arctic Ocean. The fossils were dated to 50 million years ago when the Arctic was ice-free and the entire planet was significantly hotter than today. Some geologists now suspect that the straits connecting the Arctic Ocean to other oceans were closed off at this time, allowing freshwater running off the surrounding continents to cover the surface. The freshwater and warm climate were hospitable for *Azolla*, and in fact the Arctic Ocean may have literally been a carpet of these plants. As the *Azolla* plants died, they would sink and carry their reserves of carbon produced from photosynthesis to the oxygen-depleted ocean floor, allowing thick beds to accumulate. This natural sequestration of carbon may have helped reduce the level of CO₂ in the atmosphere and initiated a period of cooling. By 47 million years ago, the Arctic Ocean had become frozen, as it has remained mostly to this day. Could tiny *Azolla* ferns help bind Carbon dioxide today and reduce the impacts of climate change?

Walter Fertig is a pteridophile of long-standing. After five years as state botanist with the Washington Natural Heritage Program, he recently started a new job as the collections manager of the Marion Ownbey Herbarium at Washington State University in Pullman.



Fragile fern (*Cystopteris fragilis*), Yellow Aster Butte near Mt. Baker.

PHOTO: MARK TURNER

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Effect of Soil Moisture on Arrowleaf Balsamroot, *Balsamorhiza sagittata* (Pursh) Nutt. Establishment

by Sarah Hill, Graduate Student, Biology, Eastern Washington University

Every spring, Arrowleaf Balsamroot (*Balsamorhiza sagittata* (Pursh) Nutt.) dots the landscape across the inland Pacific Northwest. Balsamroot's copious blooms, numerous leaves, long lifespan, and resilience once established, make it popular in restoration seed mixes, although balsamroot displays erratic germination in the restoration context (Gucker and Shaw 2018). Understanding the effects of variables, like the availability of soil moisture on the germination and establishment of balsamroot, could provide insights into the success of restoration plantings, or planning. With the help of WNPS, I have undertaken a study at Eastern Washington University to explore the relationship between soil moisture availability and balsamroot establishment.

I measured growth and survival of balsamroot seedlings during their first season, across a range of soil moisture treatments. Eleven treatment groups, corresponding to a percentage of the total water holding capacity of their pots (Dumroese, Pinto, and Montville 2015). Treatments changed every three weeks, with only one set of pots receiving a high or low treatment in each time frame (Figure 1). To shorten dormancy prior to planting, seeds were treated with gibberellic acid (Bujak and Dougher 2017) and cool/moist stratified for 65 days. Seedling emergence, true leaf development and plant health were tracked weekly, leaf area was measured every three weeks. At the end of 15 weeks, plants were harvested to measure taproot biomass.

I executed two iterations of this study due to greenhouse pests. When I determined that the project would need to be restarted, the initial experiment was moved outside to overwinter. This spring revealed an interesting phenomenon: all the original pots had several new seedlings emerging; all of which emerged before the one-year-old plants. These observations have led to the development of new research questions about the interactions of moisture and temperature during germination, potential bet hedging strategies in the inflorescence, the influence of seed size



Harvesting and cleaning roots took several days, and could not have been accomplished without the help of many volunteers. I am grateful to (left to right) fellow graduate students Erik Peterson and Joe Wierich, and to undergrads Hannah Coles and Michelle Anderson for all of their help with this process. PHOTO: SARAH HILL

on the timing of germination, and the competitive advantage of seedling emergence prior to bud break in established plants.

Results from the second iteration are providing insight into soil moisture's role into balsamroot establishment, but further analyses are ongoing. Unsurprisingly, seedling emergence data suggest soil moisture is critical in the first few weeks of a seedling's life. Over the first treatment period, more plants emerged in high moisture treatments than low, and both were significantly different than the medium groups ($P = 0.00462$ and $2.09e-06$, respectively). I have not yet analyzed the data that will parse the effects of higher or lower moisture on the timing of first leaf emergence, plant health, leaf area, and root biomass. These analyses will answer whether it is only the first few weeks where more or less soil moisture matters, or whether what happens in the first few weeks of a balsamroot's life sets the stage for how it grows throughout the season. I will use my results to make inferences regarding what this means for balsamroot in restoration projects. And, as climate change intensifies, changing the duration and timing of precipitation by bringing wetter winters and drier summers to the inland Pacific Northwest (Mote et al. 2014; Snover et al. 2013); I'll ponder what that means for balsamroot establishment in the future. I will be sure to update the WNPS of these findings.

I thank Washington Native Plant Society for helping to make this study possible, my advisor, Dr. Robin O'Quinn for her guidance and consultation, and Michelle Anderson who spent many an early morning in the greenhouse weighing pots.

Sarah Hill is a graduate fellow in the department of Biology at Eastern Washington University. In addition to researching balsamroot, Sarah spends her time propagating native plants, collecting wild seed, and conducting community outreach in an effort to spread knowledge and love of the Palouse prairie.



From left to right: Representative sample of a first iteration pot on March 9 with only newly emerging seedlings visible, a pot on April 3rd with both 1st year cotyledons and second year plants re-emerging, and pots on April 21 with both first and second year plants. PHOTO: SARAH HILL



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Contents

President’s Message: The View from Here, *Keyna Bugner*Inside Front Cover

What is the Most Common Plant Species in Washington?, *Walter Fertig*.....2

Hiding in Plain Sight: Goji Berry Naturalized in Port Townsend, *Katherine Darrow*.....8

Tall Western Penstemon Being Considered for Endangered Species Listing, *Walter Fertig* 10

Conservation Impacts: Elections, Voting . . . and Feral Holly?, *Becky Chaney* 11

What’s in a Name? Pursh and *Purshia*, *Walter Fertig* 13

Icicle Ridge Trail, *David Giblin* 15

Antoine Etienne: The Man, his Namesake Creek, and its Flora, *Don Schaechtel* 17

Shifting Baselines—Documenting Changes to our Landscape, *David Giblin*.....20

In Search of the Clodius Parnassian Host Plant East of the Cascades, *Cheryl Bellin*22

Ten Things You Might Not Know About Ferns, But Wish You Did, *Walter Fertig*.....24

Effect of Soil Moisture on Arrowleaf Balsamroot,
 Balsamorhiza sagittata (Pursh) Nutt. Establishment, *Sarah Hill*28

Washington Native Plant Society State Board Directory29

Subalpine firs (*Abies lasiocarpa*) coated with rime on Goat Mountain near Mt. Baker.
PHOTO: MARK TURNER

