

Geraldine A. Allen

Professor Emerita
Herbarium Curator Emerita

Plant Systematics and Evolutionary Biology

CONTACT INFORMATION:

Department of Biology
University of Victoria
PO Box 1700 Station CSC
Victoria, British Columbia V8W 2Y2
Canada

Email: gallen@uvic.ca

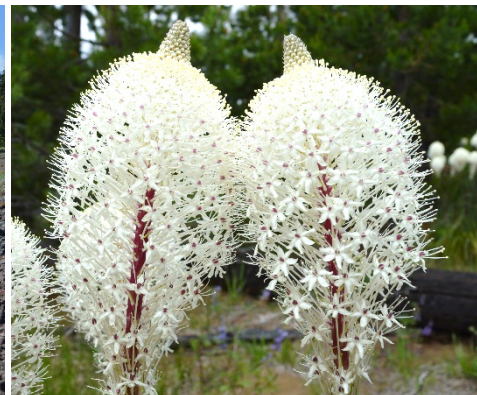
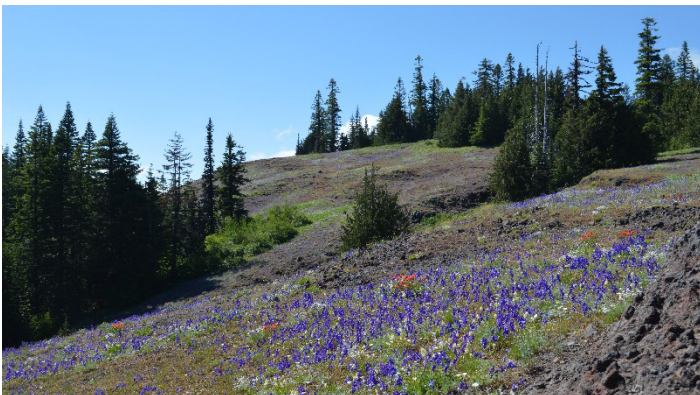


TEACHING AND RESEARCH

I am a field biologist at heart, and I think that time spent in the natural world is never wasted. I am broadly interested in plant diversity, plant evolution, floristics and conservation. I have used a great variety of field and lab approaches in my research over the years, most recently including phylogenomics.

I taught evolution and plant systematics at the University of Victoria for over 40 years. During that time I had 20 graduate students and over 30 undergraduate students doing research in my lab. I was also the Curator of the Herbarium. I officially retired from the University in the summer of 2022, but I continue to be involved in ongoing and new research projects.

I have done research on polyploid complexes; plant groups with extensive hybridization; patterns of geographic variation, especially in arctic plants; plant sex ratios and sex expression; and the genetics of both invasive and rare species. I have written taxonomic treatments for floras and plant manuals, and described several new species. I continue to be involved in assessment of species at risk.



RESEARCH PROJECTS

North American Asteraceae

Asters (in the broad sense) are one of my long-standing interests, and I have worked on several aster groups. I have been interested in western North American *Symphyotrichum* (formerly *Aster*) since doing my PhD work on these plants. They are a textbook example of a highly variable and taxonomically challenging polyploid complex, and hybridization has played a major role in their evolution.

Recently I have worked at a broader scale. Most North American asters belong to a single large, widespread clade whose evolutionary and biogeographic origins are not well understood.

I investigated the phylogenetic relationships of the closely related but disjunct genera *Doellingeria* and *Eucephalus*, which form the earliest branch of this large clade.

In 2022 I started a new phylogenomics project with a large group of collaborators; our goal is to understand the evolutionary and biogeographic origins of the whole New World clade of the tribe Astereae. This group includes ~1100 species and 120 genera broadly distributed across North and South America.



Symphyotrichum ascendens,
a dibasic polyploid of hybrid origin

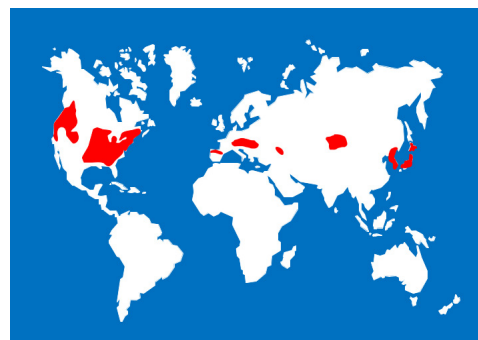
Evolutionary relationships in *Erythronium* (fawn-lilies)

Erythronium is a fascinating genus with a broad but highly disjunct distribution in the Northern Hemisphere. This group of beautiful small lilies includes both widespread species and rare endemics, and reaches its highest diversity in western North America. Many of the species hybridize where their ranges overlap. *Erythronium* offers all kinds of interesting evolutionary problems, and is also much admired by gardeners.



Erythronium quinaultense
endemic of the Olympic Peninsula, WA

I and my students have studied the phylogeny and biogeography of the genus as well as patterns of genetic variation in western species. We have documented hybridization and speciation events. I have written taxonomic treatments for the group and described new species.



Worldwide distribution of *Erythronium*

Phylogenomics of the strawberry lineage

Strawberries (*Fragaria*) belong to a small clade of about 10 genera in the family Rosaceae, which also includes *Sibbaldia*, *Alchemilla*, and several genera formerly included in *Potentilla*. I spent a sabbatical leave in 2020 with Aaron Liston at Oregon State University, learning phylogenomic methods. Now we are collaborating, along with Torsten Eriksson, University of Bergen, on a phylogenomic study of the Fragariinae group (Rosaceae, tribe Potentilleae, subtribe Fragariinae).



Sibbaldiopsis tridentata, Algonquin Park, Ontario

Pleistocene glaciation and plant phylogeography

In North America, arctic-alpine tundra species occur mostly in regions that were covered by continental ice during the Last Glacial Maximum. Many of these species nevertheless have large, circumpolar ranges in formerly glaciated areas, and have undergone substantial range shifts during their history. Identifying the locations of refugia for these species and understanding how they achieved their present geographic ranges is relevant to understanding how the present-day ranges of many species are affected by climate change.



Oxyria digyna, Oregon

With colleagues from the Royal British Columbia Museum and Norway, my students and I have investigated geographic patterns in a number of widely distributed arctic-alpine plants. Species studied in my lab included *Oxyria digyna*, *Bistorta vivipara*, *Silene acaulis*, *Sibbaldia procumbens*, and *Rhodiola integrifolia*.

Patterns and timelines of dispersal turned out to

vary widely among these, indicating that species with similar present-day habitats and ranges can differ substantially in their evolutionary and geographic history.



Sibbaldia procumbens, Alaska



Pleistocene glaciation in North America and its associated climate shifts has also affected the geographic ranges of species far south of the glacial boundary. My students studied some of these, including the slimleaf onion (*Allium amplexans*) and Garry oak (*Quercus garryana*).

Sampling *Quercus garryana* along Puget Sound, WA

Sex ratios and gender differences in dioecious plants

Dioecious species constitute only about 6% of flowering plants, but have many interesting attributes. Sex expression can be controlled by genetic or environmental factors or both of these together. Sex ratios are often biased and males and females typically have unequal reproductive allocation. In collaboration with my spouse Joe Antos, I investigated sex ratio variation, reproductive allocation, and life history traits in the osoberry (*Oemleria cerasiformis*), a dioecious west coast shrub. We showed that differential reproduction allocation between males and females was the basis for male-biased sex ratios in this species.



Male flowers



Female flowers

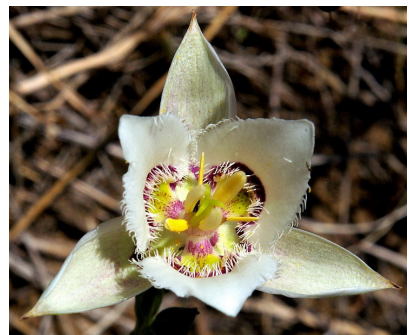


Twig with old fruit stalk

Oemleria cerasiformis has genetically determined sex expression. Recently I started a new collaboration with Aaron Liston and others to characterize the sex chromosomes in this species.

Species at risk

Knowledge of the life history and population biology of rare species is critical to effective protection. I and my students have worked with a number of rare plant species. Life history characteristics strongly influence plant population dynamics, thus the effectiveness of conservation measures. My graduate students Mike Miller and Allan Hawryzki studied two rare species with prolonged dormancy, in which plants remain below ground for one or more growing seasons. Recognizing dormancy patterns is critical for monitoring rare species abundance or understanding population dynamics.



Calochortus lyallii, a BC species at risk

Invasive species

At the other end of the abundance spectrum, invasive species are major problem in this changing world. Some invasive plants are closely related to and readily mistaken for native species, although their ecology may be very different. The common reed grass *Phragmites australis* has both native and introduced forms. The native form is a relatively uncommon plant in British Columbia, but the introduced form is a serious invasive. For the last 10 years I have worked with the BC Ministry of Forests to identify these two forms using DNA markers.

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RECENT REPORTS AND OTHER PUBLICATIONS:

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- Allen, G.A. and T.N. Kaye. 2018. Taxonomic evaluation of wayside aster (*Eucephalus vialis*) and related species in Oregon and California: a molecular and morphometric analysis. Contract report to Institute of Applied Ecology, Corvallis, Oregon. 13 pp.
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- Allen, G.A. 2009. Morphological and molecular variation in the endemic fawn-lily *Erythronium elegans* and its relationship to other Pacific Northwest fawn-lilies. Final contract Report to USDI Bureau of Land Management, Salem, Oregon. 19 pp.

RECENT PRESENTATIONS AT SCIENTIFIC MEETINGS

- Batten, R.W. and G.A. Allen. 2023. Were rare plants on Vancouver Island dispersed there by humans? Canadian Society for Ecology and Evolution/Canadian Botanical Association Annual Meeting. 13 June 2023 (poster).
- Zaborniak, T. and G.A. Allen. 2023. Improving MaxEnt Ecological Niche Models: assessment of some limitations and assumptions using virtual and real species. Botany 2023 Annual Meeting, Boise, ID. 24 July 2023 (poster).
- Allen, G.A., L.J. McCormick and B.N. Brown. 2022. Native and introduced *Phragmites australis* in British Columbia. National Phragmites Conference, Canadian Council of Invasive Species (online). 20 January 2022 (talk).
- Allen, G.A., A. Liston and L.T. Eriksson. 2021. Phylogenetic relationships of the strawberry subtribe Fragariinae inferred from whole genome sequences. Botany 2021 Annual Meeting (online). 21 July 2021 (talk).
- Allen, G.A., T.N. Kaye and J. Kierstead. 2020. Species boundaries and the conservation of rare asters (*Eucephalus*, Asteraceae). Northern California Botanists Symposium, Chico, CA. 13 January 2020 (invited talk).
- Allen, G.A., T.N. Kaye and J. Kierstead. 2019. Untangling taxonomic complexities and the conservation of rare asters (*Eucephalus*, Asteraceae). Botany 2019 Annual Meeting, Tucson, AZ. 31 July 2019 (talk).
- Allen, G.A. 2018. Origin, diversification and geographic spread of the genus *Erythronium* (Liliaceae). Botany 2018 Annual Meeting, Rochester, MN. 23 July 2018 (talk).
- Kanne, R. and G.A. Allen. 2018. Phylogeographic patterns and migrational history of Garry oak (*Quercus garryana*). Botany 2018 Annual Meeting, Rochester, MN. 23 July 2018 (poster).
- Allen, G.A., L.J. McCormick, K.L. Marr, J.R. Jantzen and B.N. Brown. 2017. Introduced common reed (*Phragmites australis*) in western Canada: a future problem or not? Canadian Society for Ecology and Evolution Annual Meeting, Victoria, BC, May 2017 (talk).

- Allen, G.A., L. Brouillet and J.C. Semple. 2017. Phylogenetic relationships and hybridization in the *Doellingeria-Eucephalus* aster clade (Astereae, Asteraceae). Canadian Botanical Association 53rd Annual Meeting, Waterloo, ON, 7 July 2017 (talk).
- Madsen, C. P., E.K. Brouard-John and G.A. Allen. 2016. Are plant geographic ranges in southern B.C. at equilibrium with climate? Canadian Botanical Association 52nd Annual Meeting, Victoria, BC, 17 May 2016 (talk).
- Marr, K.L., R.J. Hebda, G.A. Allen and L.J. McCormick. 2016. Altai fescue may have arrived relatively recently in the Altai Mountains. Canadian Botanical Association 52nd Annual Meeting, Victoria, BC, 17 May 2016 (talk).
- Allen, G.A. 2015. Phylogeography of arctic-alpine species in western North America: is there a common pattern? Botany 2015 Annual Meeting, Edmonton, Alberta, 29 July 2015 (talk).
- Allen, G.A. 2015. Preserving the research data of natural history collections. Research Data Management Workshop, University of Victoria, 27 August 2015 (mini-keynote talk).
- Allen, G.A. 2015. Colonization of North America by alpine-arctic lineages of Polygonaceae and Caryophyllaceae. Caryophyllales 2015 Conference, Botanischer Garten und Botanisches Museum Berlin-Dahlem, Freie Universität Berlin, Germany, 16 September 2015 (talk).
- Allen, G.A. 2014. Postglacial spread of arctic-alpine plants in North America: past patterns and predictions for the future. Department of Biology, Western Washington University, Bellingham, WA (invited seminar), 14 May 2014.
- Allen, G.A. and C.E. Sharpe. 2014. Variation and hybridization in Pacific Northwest fawn-lilies (*Erythronium*). Botany 2014 Annual Meeting, Boise, ID, 31 July 2014 (talk).
- Allen, G.A., K.L. Marr, L.J. McCormick and R.J. Hebda. 2013. Phylogeography of an arctic-alpine plant with a highly fragmented range. Canadian Society for Ecology and Evolution Annual Meeting, Kelowna, BC, May 2013 (talk).
- Marr, K.L., R.J. Hebda, G.A. Allen and L.J. McCormick. 2013. Genetic and floristic evidence for glacial refugia in northern BC and their implication for biogeography. Canadian Botanical Association Annual Meeting, Kamloops, BC, 4 June 2013 (talk).
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