

Megan Bontrager

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Research interests My research focuses on understanding the factors that shape geographic ranges, how populations adapt to their environments, and how species will respond to climate change. I approach these questions using a variety of methods, including large-scale field experiments, meta-analysis, landscape genetics, and climatic niche modelling.

Academic positions **University of California, Davis** 2018–
Postdoctoral researcher
Faculty advisors: Sharon Strauss, Jennifer Gremer, Johanna Schmitt

Education **University of British Columbia** 2012–2018
Ph.D. in Botany
Title: *Pollination, genetic structure, and adaptation to climate across the geographic range of Clarkia pulchella.*
Advisor: Amy Angert
Committee: Sally Aitken, Michael Whitlock, and Jeannette Whitton

University of California, Santa Cruz 2008–2011
B.Sc. in Plant Sciences
B.Sc. in Molecular, Cell, and Developmental Biology
Undergraduate research advisor: Ingrid Parker

Cabrillo Community College 2007–2008
Prerequisites for transfer to B.Sc.

Manuscripts in prep (available upon request)

15. **M. Bontrager**, J. A. Lee-Yaw, T. Usui, A. L. Hargreaves, D. Anstett, H. A. Branch, and A. L. Angert. Local advantage is greater near climatic niche margins but not geographic range margins. Expected submission in May 2019.
In this paper, we use a database of transplant experiments to investigate whether local adaptation declines or increases near the margins of species' geographic distributions. We found that climatic marginality was a stronger predictor of local advantage than geographic marginality. Our results indicate that populations that are at the margins of a species' climatic range likely harbor unique adaptations and that geographic peripherality is an imperfect predictor of local adaptation.

14. **M. Bontrager**, C. D. Muir, C. Mahony, D. E. Gamble, R. M. Germain, A. L. Hargreaves, E. J. Kleynhans, K. A. Thompson, and A. L. Angert. Climate anomalies are disrupting local adaptation. Expected submission in February 2019.
In this paper, we built a large database of transplant studies and combined them with climate data to examine the effects of climate variability on fitness and local adaptation. Our results show that fitness is strongly affected by climate anomalies, that this can weaken local adaptation when foreign populations are better matched to experimental conditions, and that anomalies that affect local adaptation are increasing over time.
13. A. L. Hargreaves, R. M. Germain, **M. Bontrager**, J. Persi, and A. L. Angert. Biotic interactions affect fitness but not local adaptation among populations. Expected submission in January 2019.
In this paper, we test whether the frequency or strength of local adaptation varies depending on whether populations are experiencing natural biotic interactions. We built a database of studies that experimentally manipulated biotic interactions during reciprocal transplant experiments. While biotic interactions frequently affect fitness, they do not appear to affect local adaptation at the broad geographic scale of our data.

Preprints

12. **M. Bontrager** and A. L. Angert (2018). Genetic differentiation is determined by geographic distance in *Clarkia pulchella*. bioRxiv 374454. In revision for resubmission to The American Journal of Botany.
11. **M. Bontrager**, C. D. Muir, and A. L. Angert (2018). Geographic and climatic drivers of reproductive assurance in *Clarkia pulchella*. bioRxiv 372375. In revision for resubmission to Oecologia.

Publications

10. **M. Bontrager** and A. L. Angert (2018). Gene flow improves fitness at a range edge under climate change. *Evolution Letters*. Early view: <https://doi.org/10.1002/evl3.91>.
9. D. E. Gamble, **M. Bontrager**, and A. L. Angert (2016). Floral trait variation and links to climate in the mixed-mating annual *Clarkia pulchella*. *Botany*, 96(7):425–435.
8. **M. Bontrager** and A. L. Angert (2016). Effects of range-wide variation in climate and isolation on floral traits and reproductive output of *Clarkia pulchella*. *American Journal of Botany*, 103(1):10–21.
7. J. A. Lee-Yaw, H. M. Kharouba, **M. Bontrager**, C. Mahony, A. M. Csörgő, A. M. Noreen, Q. Li, R. Schuster, and A. L. Angert (2016). A synthesis of transplant experiments and ecological niche models suggests that range limits are often niche limits. *Ecology Letters*, 19(6):710–722.
6. I. M. Parker, M. Saunders, **M. Bontrager**, A. P. Weitz, R. Hendricks, R. Magarey, K. Suiter, and G. S. Gilbert (2015). Phylogenetic structure and host abundance drive disease pressure in communities. *Nature*, 520(7548):542–544.
5. **M. Bontrager**, K. Webster, M. Elvin, and I. M. Parker (2014). The effects of habitat and competitive/facilitative interactions on reintroduction success of the endangered wetland herb, *Arenaria paludicola*. *Plant Ecology*, 215(4):467–478.

4. J. M. Yost, **M. Bontrager**, S. W. McCabe, D. Burton, M. G. Simpson, K. M. Kay, and M. Ritter (2013). Phylogenetic relationships and evolution in *Dudleya* (Crassulaceae). *Systematic Botany*, 38(4): 1096–1104.

Non-refereed contributions

3. K. R. Acierto, R. S. Hendricks, **M. Bontrager**, and I.M. Parker (12 December 2012). Transplant success for the endangered herb *Arenaria paludicola* at Golden Gate National Recreation Area: effects of site, propagation type, and competition. Technical report to the U.S. Fish and Wildlife Service and the California Department of Fish and Game.
2. I. M. Parker and **M. Bontrager** (29 February 2012). Propagation and establishment of new populations of marsh sandwort (*Arenaria paludicola*) in Santa Cruz County. Technical report to the U.S. Fish and Wildlife Service and the California Department of Fish and Game.
1. **M. Bontrager** and I. M. Parker (26 September 2011). Effects of serpentine soil on plant community composition in natural populations and seedling growth in a bioassay. Technical report to Midpeninsula Regional Open Space District.

Fellowships and awards

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| UBC Biology teaching award (500 CAD) | 2018 |
| Best research presentation, Brackendale Ecology and Evolution Retreat | 2016 |
| Li Tze Fong Memorial Fellowship (25000 CAD) | 2016 |
| Botanical Society of America Genetics Section Grad Research Award (500 USD) | 2016 |
| Botanical Society of America Graduate Student Research Award (500 USD) | 2016 |
| Washington Native Plant Society Research Grant (1200 USD) | 2016 |
| Vladimir J. Krajina Prize in Plant Ecology (2000 CAD) | 2013 |
| UBC Four Year Doctoral Fellowship (102400 CAD) | 2012 |

Selected presentations

M. Bontrager*, C.R. Mahony, D.E. Gamble, R.M. Germain, A.L. Hargreaves, E.J. Kleynhans, C.S. Leven, K.A. Thompson, and A.L. Angert. (6 January 2018) Climate anomalies drive local maladaptation. Presentation at the American Society of Naturalists meeting, Asilomar, California.

M. Bontrager* and A.L. Angert. (24 June 2017) Effects of gene flow on the performance of *Clarkia pulchella* at the species' northern range margin. Presentation at Evolution. Portland, Oregon. Video link.

M. Bontrager* and A.L. Angert. (9 May 2017) Effects of gene flow on the performance of *Clarkia pulchella* at the species' northern range margin. Presentation at the Annual Meeting of the Canadian Society for Ecology and Evolution. Victoria, British Columbia.

M. Bontrager* and A.L. Angert. (5 November 2016) Effects of gene flow on the performance of *Clarkia pulchella* at the species' northern range margin. Presentation at Ecology and Evolution Retreat. Brackendale, British Columbia.

M. Bontrager* and A.L. Angert. (16 April 2016) Effects of gene flow on the performance of *Clarkia pulchella* at the species' northern range margin. Poster presentation at Evo-Wibo. Port Townsend, Washington.

M. Bontrager* and A.L. Angert. (22 May 2015) Effects of range-wide variation in climate and isolation on floral traits and reproductive output of *Clarkia pulchella*. Presentation at the Annual Meeting of the Canadian Society for Ecology and Evolution. Saskatoon, Saskatchewan.

M. Bontrager*, K. Webster, M. Elvin, and I.M. Parker. (12 January 2012) Factors influencing growth and survival of a critically endangered plant, *Arenaria paludicola*. Presentation at the California Native Plant Society 2012 Conservation Conference. San Diego, California.

J. Yost, **M. Bontrager***, S. McCabe, K.M. Kay, and M. Ritter. (11 July 2011) A classification of California's diploid *Dudleya* species based on molecular phylogenetic data. Poster presentation at Botany 2011 Conference. St. Louis, Missouri.

* presenting author

Professional experience

Staff research associate 2011–2012

Supervisors: Ingrid Parker and Greg Gilbert

Trained and led crews in the field, greenhouse, and molecular biology lab. Designed greenhouse experiments and field monitoring protocols.

Undergraduate research assistant 2010–2011

Supervisors: Ingrid Parker, Kathleen Kay, and Jenn Yost

Developed and performed molecular protocols and greenhouse experiments. Assisted with field experiments.

Mentoring and teaching

Advisor to undergraduate thesis students 2018–2019

Leader of R workshop for undergraduate research assistants 2018

Head teaching assistant, Biostatistics 2017–2018

Teaching assistant, Plant Ecology 2017

Teaching assistant, Phytogeography 2016

Advisor to undergraduate honours thesis student 2016–2017

Supervisor of undergraduate research volunteers 2014–2017

Service and outreach

Grad representative, Biodiversity Research Centre postdoc search committee 2018

Co-organizer of Biodiversity Centre Women in STEM Workshop 2017

Coordinator of Forum, a weekly meeting of UBC plant ecologists 2013–2016

Modules in Ecology and Evolution Development, curriculum developer 2013–2015

UBC Let's Talk Science, visiting scientist in primary school 2012–2014

UBC Let's Talk Science, science fair mentor 2012–2013

Beaty Biodiversity Museum Nature Club, volunteer 2012–2013

Professional memberships

American Society of Naturalists

Botanical Society of America

Canadian Society for Ecology and Evolution

Society for the Study of Evolution

Washington Native Plant Society