UNIVERSITY OF CALIFORNIA, DAVIS

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES
AGRICULTURAL EXPERIMENT STATION
COOPERATIVE EXTENSION
DEPARTMENT OF VITICULTURE AND ENOLOGY
TELEPHONE: (530) 752-0380
FAX: (530) 752-0382

ONE SHIELDS AVENUE
DAVIS, CALIFORNIA 95616-8749

Dear Members of the Search Committee, January 30, 2018

Please find my enclosed application for your Assistant Professorship in plant physiology. I am enthusiastic about joining the exceptional community of scholars at UC Davis, and believe that my research would complement the existing strengths of the Department of Viticulture and Enology. I am currently an NSF Postdoctoral Research Fellow in Biology in the VEN department, and recently earned my Ph.D. in Ecology and Evolutionary Biology from Yale University.

My research focuses on the evolution of functional and ecophysiological responses to climate and disturbance in both natural and agricultural systems, with the goal of generating a more mechanistic understating of how plants adapt to environmental gradients of stress. My work is both quantitative and integrative, combining field and natural history observations, experimental manipulations in the field and greenhouse, and molecular phylogenetics. While still early in my academic career, I have demonstrated my ability to publish high quality work and successfully raise funds for my research. I have authored several papers in top-tier journals, including first author publications in *New Phytologist* and *PNAS,* and have raised over $300,000 to fund my research efforts, including a number of nationally competitive grants, fellowships and awards.

As an NSF Postdoctoral Fellow in Biology, I am currently funded to conduct independent research using both wild and cultivated grapevine collections in the United States and France to study the physiological and functional basis of grapevine responses to drought and warming. This research includes extensive work with, and physiological characterization of, the germplasm at the Wolfskill Experimental Orchard (UC Cooperative Extension, USDA-ARS). Through public lecture series and seminars, my research program will continue to maintain a commitment to outreach and the communication of climate change impacts on agriculture, especially as it relates to viticultural practices and wine production.

Beyond research, I look forward to becoming an active member of the academic community at Davis through teaching, mentoring, research and outreach/extension. I am already an engaged and active member of the VEN community and have demonstrated that my interdisciplinary research would engage multiple labs and create unique research opportunities. My ultimate goal is to find a faculty position at an institution such as UC Davis, where I can integrate my interests in plant science and agriculture, and conduct research that can be directly communicated and applied to problems faced by growers and producers in the wine and grape industry.

I believe that my cross-disciplinary research and background in plant ecophysiology and evolution make me a strong candidate for this position.

Sincerely,

Elisabeth J. Forrestel, Ph.D.

National Science Foundation Postdoctoral Fellow in Biology
Department of Viticulture and Enology
2112 RMI, University of California, One Shields Avenue, Davis, CA 95616 USA
phone: 928-274-5580, email: ejforrestel@ucdavis.edu

Elisabeth J. Forrestel

CURRICULUM VITAE

Department of Viticulture and Enology
2112 Robert Mondavi Institute North
University of California, Davis, CA 95616
Phone (928) 274 5580
ejforrestel@ucdavis.edu

EDUCATION

Yale University, Ph.D., Ecology and Evolutionary Biology 2015
Advisors: Michael J. Donoghue & Melinda D. Smith
Committee: Erika J. Edwards, Walter Jetz, Carla Staver

Cornell University, B.Sc. 2004
Biology Major, with honors. Concentration in Molecular and Cellular Biology.

APPOINTMENTS

NSF Postdoctoral Research Fellow in Biology (Collections) 2016-Present
University of California, Davis
Sponsors: Andrew J. McElrone & M. Andrew Walker

Postdoctoral Fellow, Arnold Arboretum, OEB, Harvard University 2015-2016
Advisor: Elizabeth M. Wolkovich

PREVIOUS RESEARCH EXPERIENCE

Staff Research Associate, with Dr. David Ackerly, Univ. of California, Berkeley 2007, 2009
Evolution of functional, ecophysiological and anatomical leaf traits in response to seasonal flooding in vernal pool ecosystems of the Californian Central Valley

Biological Lab Technician, Agricultural Research Service/USDA, Albany, CA 2008
Developing protocols to culture, amplify and sequence E.coli strains present on green leafy vegetable crops and in agricultural fields

LEAVE

Maternity Leave from Postdoctoral Position April –July 2017

HONORS, AWARDS & FELLOWSHIPS

National Institute of Food & Agriculture Conference Grant (co-PI, $43,000) 2018
United States Department of Agriculture
Global patterns of grazer effects on plant biodiversity: the role of dominant plant species

Postdoctoral Research Fellowship in Biology (Collections, $231,000); 2016 -2019
National Science Foundation
Linking functional and physiological traits to climate responses in grapevines

Department Chair's Fund ($3,500)**,** Yale Ecology and Evolutionary Biology 2011, 2013

Conference Travel Grant ($750); Yale Graduate School 2012

Rosemary Grant Award ($2,000); Society for the Study of Evolution 2011

Lewis and Clark Research Fellow ($5,000); American Philosophical Society 2011

Graduate Research Fellowship honorable mention; National Science Foundation 2011

ECOSAVE Grant ($5,000); Yale Institute for Biospheric Studies 2011

Field Ecology Grant ($1,500); Yale Institute for Biospheric Studies 2010

Sterling Fellowship ($5,000); Yale University 2009

Honors, *cum laude*, Cornell University 2004

Presidential Research Scholar ($10,000); Cornell University 1999-2004

PUBLICATIONS

12. Archibald, S. & 23 co-authors (**Forrestel, E.J. co-author**). In press. Biological and geophysical feedbacks with fire in the Earth system. *Environmental Research Letters*.

11. Lagomarsino, L.P., **Forrestel, E.J.**, Muchhala, N., and C.C. Davis. 2017. The repeated evolution of vertebrate pollination syndromes in a recently diverged Andean plant clade. *Evolution 71-8: 1970-1985*.

10. **Forrestel, E.J.,** M.J. Donoghue, E.J. Edwards, Jetz, W., DuToit, J. C. O., and M.D. Smith. 2017. Different clades and traits yield similar grassland functional responses. *Proceedings of the National Academy of Sciences* 114(4) 705-710.

9. Dornburg, A., **Forrestel, E.J**, Moore, J.A., Iglesias, T. L., Jones, A. Rao, L., and D.L. Warren. 2016. Fish at night: What we don't know. Assessing sampling biases across studies of diel activity patterns in marine ray-finned fishes (Actinopterygii) *Journal of Marine Science* 93.

8. Smith, M.D. & 14 co-authors (**Forrestel, E.J. co-author**). 2016. Shared drivers but divergent ecological dynamics: insights from long-term experiments in savanna grasslands. *Bioscience* 66 (8): 666-682.

7. **Forrestel, E.J.,** M.J. Donoghue, and M.D. Smith. 2015. Functional differences between dominant grasses drive divergent responses to large herbivore loss in mesic savanna grasslands of North American and South Africa. *Journal of Ecology* 103 (3): 714-724.

6. **Forrestel, E.J.**, D.D. Ackerly and N.C. Emery. 2015. The joint evolution of traits and habitat: ontogenetic shifts in leaf morphology and wetland habitat specialization in *Lasthenia*. *New Phytologist* 208 (3): 949-959.

5. Griffith, D.M., T.M. Anderson, C.P. Osborne, C.A.E. Stromberg, **E.J. Forrestel**, and C.J. Still. 2014. Biogeographically distinct controls on C_3 and C_4 grass distributions: merging community with physiological ecology. *Global Ecology and Biogeography* 24 (3): 304-313.

4. **Forrestel, E.J.,** M.J. Donoghue, and M.D. Smith. 2014. Convergent phylogenetic and functional responses to altered fire regimes in mesic savanna grasslands of North America and South Africa. *New Phytologist* 203(3): 1000-1011.

3. Kraft, N.J., G.M. Crutsinger, **E.J. Forrestel,** and N.C. Emery. 2014. Functional trait differences and the outcome of community assembly: an experimental test with vernal pool annuals. *Oikos* 123 (11):1391-1399.

2. Emery, N.C., **E.J. Forrestel**., G. Jui, M. Park, B.B. Baldwin. and D.D. Ackerly. 2012. Niche evolution across spatial scales: climate and habitat specialization in California *Lasthenia* (Asteraceae). *Ecology* 93(8) Supplement, pp. S151-S156. *Invited submission for Special Issue*.

1. Sargent, R., S.W. Kembel, N.C. Emery, **E.J. Forrestel**, and D.D. Ackerly. 2011. Effect of local community phylogenetic structure on pollen limitation in an obligately insect-pollinated plant. *American Journal of Botany* 98(2):283-289.

IN REVIEW OR REVISION

3. Avolio, M.L., **Forrestel, E.J**., Chang, C.C., La Pierre, K.J., Burghardt, K.T. & M.D. Smith. In revision. Dominance—hiding in plain sight. *New Phytologist*.

2. Koerner, S.E., Smith, M.D., Burkepile. D.E., Hanan, N., Avolio, M.L., Collins, S.L., Knapp, A.K., Lemoine, N.P., **Forrestel, E.J.**, Eby, S., Thompson, D., and the Grazing Exclosure Consortium. In revision. Resolving variation in herbivore effects on plant biodiversity - dominance as a global mechanism. *Nature Ecology and Evolution*.

1. Jardine, E.C., **Forrestel, E.J.**, Lehman, C.E.H., Thomas, G.H., and C.P. Osborne. In revision. The global distribution of functional traits within grassy biomes.

IN PREPARATION (expect to be submitted within 3 months)

2. **Forrestel, E.J**., Edwards, E.J., Donoghue, M.J. & W. Jetz. A phylogenetic perspective on the biogeography of grasses. *For submission at Global Ecology and Biogeography*.

1. **Forrestel, E.J.** & S. Federman. Biogeography, evolution and adaptive potential of crop wild relatives. *For Submission at Nature Plants*.

PEER-REVIEWED BOOK CHAPTERS

2. **Forrestel, E.J**. & E.J. Edwards. In press. "The future biogeography of C4 grasslands." *In* D. J. Gibson and J. Newman, editors. Grasslands and Climate Change. British Ecological Society, Ecological Review Series, Cambridge University Press.

1. Emery, N.C., L.T. Martinez, **E.J. Forrestel**, B.G. Baldwin and D.D. Ackerly. 2011. "The ecology, evolution and diversification of the vernal pool niche in *Lasthenia* (Madieae, Asteraceae)." Pp. 39-58 *in* D. G. Alexander and R. A. Schlising, editors. Research and Recovery in Vernal Pool Landscapes. Studies from the Herbarium, Vol. 16, Chico State University: Chico, CA.

SERVICE, COMMUNITY & PUBLIC OUTREACH

Reviewer: *New Phytologist, Ecology, Oecologia, Ecology Letters, Journal of Biogeography, Oikos, Ecography, Ecological Monographs, Functional Ecology, Ecology and Evolution*

Organizing Committee & Mentor, Women in Life Sciences at Davis 2017-Present
Co-founder, Botany of a Feast 2016-Present
An annual public lecture series and food/wine events focused on sustainable agriculture and evolutionary perspectives on plant and food diversity
Grant Reviewer, Graduate Women in Science 2016
Grant Reviewer, National Science Foundation Career Award 2016
Scientist Mentor to high school students, NSF Planting Science Program 2010-2014
Volunteer, Adopt a Vernal Pool, Laguna Foundation, Sebastopol, CA 2008-2009
Student Advisor, Cornell Presidential Research Scholars 2002-2003
Member & Organizer, Society for Women Engineers 1999-2000

TEACHING EXPERIENCE

Invited Lectures
Grapevine Physiology, University of California at Davis Winter 2018
Conservation Biology, Harvard University Spring 2016
Ecosystems of California, University of California at Berkeley Spring 2009
Designed and led a day trip on vernal pool ecosystems of the Central Valley (Mather Regional Park, Sacramento), focused on plant identification and data collection for field-based research

Teaching Fellowships
Introductory Ecology & Evolutionary Biology (BIOL104), Yale University Fall 2014
Phylogenetics (EEB427), Yale University Fall 2013
Responsible for designing and teaching lab sections on phylogenetic and comparative methods
Plant Diversity & Evolution (EEB246/EEB247), Yale University Spring 2011
Responsible for organizing lab, greenhouse, and field sections on plant identification and botanical features of major plant clades

General Ecology (EEB220), Yale University — Fall 2010
Introductory to Ecology, Evolution & Behavior (EEB122), Yale University — Spring 2010
Introductory Biology (BIOG1105), Cornell University — Spring 2004

MENTORING

Molly Clemens, Ph.D. Student (2018)
Sara Tracy, Undergraduate Student (2017-Present)
Harold Eyster, Undergraduate Thesis **(**2015-2016**)**
Nicole Merrill, Northeastern Externship, (2016)
Innana Carter, Undergraduate Thesis (2014)
Arjun Potter, Undergraduate and Fulbright Fellow Research (2013-2014)
Plus 5 undergraduate research assistants, three of which were women, two of which went on to pursue PhDs in plant sciences & conservation biology

PROFESSIONAL DEVELOPMENT & WORKSHOPS

Licor 6800 Photosynthesis Training Course, Lincoln, NE — March 2018
Inclusive Mentoring & Diversity Workshop, UC Davis — Winter 2018
NSF Collections-Based Postdoctoral Fellowship in Biology Symposium & Workshop — Fall 2017
Reading Historic Cookbooks: A Structured Approach, Radcliffe Institute, Harvard University — Summer 2016
Grafting Techniques for Ornamental Trees, Arnold Arboretum, Harvard University — Winter 2016
Winegrapes: ID and Use, UC Davis Extension — Summer 2015
Course on the identification and use of popular California winegrape varieties taught by Dr. Andy Walker (VEN, UC Davis)
Bodega Applied Phylogenetics Workshop, Bodega Bay, CA — Spring 2010

INVITED WORKING GROUPS

NESCent – Catalysis meeting participant on "The co-evolution of plants and fire and consequences for the Earth system" — 2014
NESCent – *Member* Working Group on "Origins of C4 grasslands: a new synthesis of phylogeny, ecology, and paleobiology" — 2011-2013
NCEAS **–** *Member* Working Group on "Linking phylogenetic history, plant traits, and ecological processes at multiple scales" — 2011

INVITED TALKS

St. Louis University/Danforth Plant Center. Invited Seminar (*forthcoming*)	2018
Harvard College Wine Society	2016
Food Literacy Project, Harvard University Center for the Environment	2016
The Big Glou Natural Wines Conference, Brooklyn, NY	2016
Arnold Arboretum Seminar Series, Harvard University	2015
Research Skills Seminar, Grassland Society of Society of Southern Africa	2012
The Land Institute, Salina, Kansas	2011
Ecology Lunch Seminar, UC Berkeley, California	2009

SELECTED CONTRIBUTED PRESENTATIONS

E. J. Forrestel, B. I. Cook, I. Garcia de Cortazar-Atauri, T. Lacombe, K. A. Nicholas, A. K. Parker, C.van Leeuwen and E. M. Wolkovich. 2016. Projections of suitable wine growing regions and varieties. Oral presentation, *ClimWine 2016*. Bordeaux, France.

E. J. Forrestel, B. I. Cook, I. Garcia de Cortazar-Atauri, T. Lacombe, K. A. Nicholas, A. K. Parker, C.van Leeuwen & E. M. Wolkovich. 2015. Projections of suitable wine growing regions and varieties: Adaptation in space or place? Oral presentation, *American Geophysical Union*. San Francisco, California.

Forrestel, E.J., M.J. Donoghue,. and M.D. Smith. 2014. Cross-continental comparison of grassland phylogenetic and functional turnover along a precipitation gradient. Oral presentation, *American Society of Naturalists.* Monterey, California.

Forrestel, E.J. & M.J. Donoghue. 2013. How do measures of "signal" relate to patterns of traits . distributed on a phylogenetic tree? Oral presentation, *Evolution*. Snowbird, Utah

Forrestel, E.J, M.J. Donoghue, and M.D. Smith. 2012. Phylogenetic and functional responses to disturbance in mesic grasslands: a cross-continental comparison. Oral presentation, *Ecological of Society of America*. Portland, Oregon.

Forrestel, E.J., N.C. Emery, and D.D. Ackerly. 2010. Niche evolution and functional trait convergence in vernal pool endemics of the genus *Lasthenia*. Oral presentation, *Botany*. Providence, Rhode Island.

PROFESSIONAL SOCIETY MEMBERSHIPS

Society for the Study of Evolution
Graduate Women in Science
Ecological Society of America
Society of Systematic Botanists

SELECTED REFERENCES

Dr. Melinda Smith*
PhD co-advisor
Phone: 970-491-7155
Email: Melinda.smith@colostate.edu
Address: Colorado State University
Department of Biology
Fort Collins, CO 80523 USA

Dr. Michael Donoghue*
PhD co-advisor
Phone: 203-432-2074
Email: michael.donoghue@yale.edu
Address: Yale University
Dep't of Ecology & Evolutionary Biology
Environmental Science Center
New Haven, CT 06511 USA

Dr. Andrew McElrone*
Postdoctoral Co-sponsor
Phone: 530-754-9763
Email: ajmcelrone@ucdavis.edu
Address: University of California, Davis
Department of Viticulture & Enology
Davis, CA 95616 USA

Dr. Nancy Emery*
Mentor & Collaborator
Phone: 303-735-7548
Email: nancy.emery@colorado.edu
Address: University of Colorado Boulder
Dep't of Ecology & Evolutionary Biology
Campus Box 334
Boulder, CO 80309-0334 USA

Dr. M. Andrew Walker
Postdoctoral Co-sponsor
Phone: 530-752-0902
Email: awalker@ucdavis.edu
Address: University of California, Davis
Department of Viticulture & Enology
Davis, CA 95616 USA

Dr. David Ackerly
Mentor & Collaborator
Phone: 510-664-7868
Email: dackerly@berkeley.edu
Address: University of California, Berkeley
Department of Integrative Biology
3040 Valley Life Sciences Building #3040
Berkeley, CA 94720-3140 USA

* Please contact these references to request letters.

Plant ecology and evolution are fundamental, yet underutilized complements, to crop and agricultural sciences. **My research explicitly incorporates evolutionary and ecological perspectives to understand the physiological and genetic mechanisms underlying plant responses to diverse environmental pressures.** I am a broadly trained plant biologist whose research program lies at the intersection of plant ecology, evolution, physiology and genetics. I use a diversity of methods, including field observations, greenhouse studies, molecular lab work, plant trait measurements, and climate and physiological modeling. Though I consider my current research program to be firmly rooted in *Vitis*, the questions I address are broadly relevant in plant biology, as indicated by my work across wetlands, grasslands and now agricultural systems. My research has shown that integrating evolutionary perspectives into studies of plant and ecosystem function improves our understanding of how the coordinated evolution of ecophysiological traits enable plants to cope with a range of environmental stresses, and how different combinations of plant traits can result in similar physiological tolerances and ecosystem responses. **By understanding the coordination of functional and physiological strategies that have evolved among close relatives, I strive to improve predictions for how cultivars and species will respond to both natural and anthropogenic climate change.** In my current and future research, I leverage the range of adaptive strategies in wild and cultivated plants to develop practical solutions to problems in agriculture.

Evolution of plant functional traits in response to environmental stress

Plant functional traits – characteristics that influence the performance and fitness of an organism – are often used as proxies for important physiological functions including photosynthetic rates, and nutrient and water use efficiency. **A major theme throughout my research program involves testing if trait-function and trait-environment associations are conserved across species and clades, with the aim of understanding how species respond to environmental change.** My interest in these questions was established through studying the evolution of trait-habitat associations in vernal pool plants. This research led to several published manuscripts, including a first-author paper in *New Phytologist*. Using a novel modeling approach, I found correlated evolution between morphological and anatomical leaf traits related to flooding tolerance that varied across the plants annual life cycle, which highlights the importance of seasonal environmental changes driving the evolution of plant functional responses (Fig. 1).

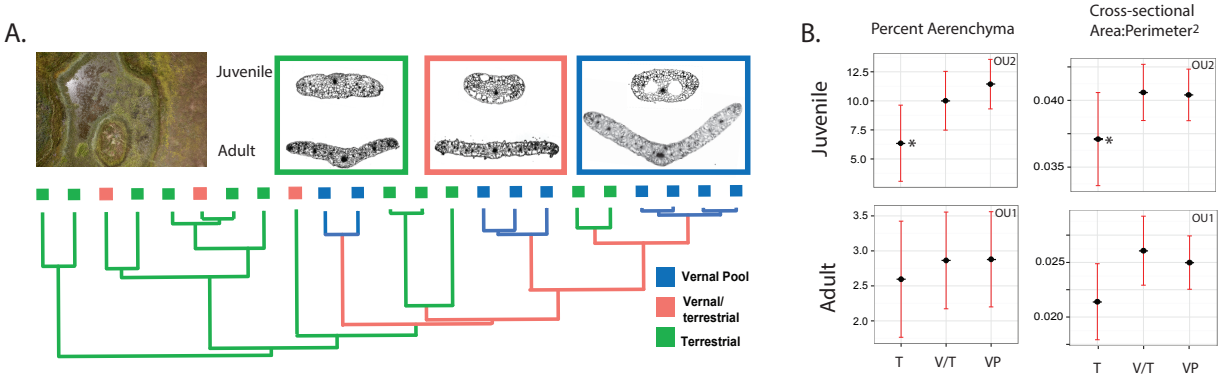

Fig. 1. The convergent evolution of leaf anatomical traits in response to seasonal flooding in *Lasthenia*. A) Phylogenetic reconstruction of wetland habitat states and leaf cross-sections illustrating the associated evolution of aerenchyma in juvenile leaves exposed to submerged conditions in the vernal pools. B) Mean trait values of species from different habitats, * indicates a significant difference (Forrestel *et al*. *New Phyt*. 2015).

My research at Yale University built on my previous work at the interface of plant functional ecology and evolutionary biology. Specifically, I addressed questions of how divergence in biogeographic and evolutionary history (i.e., variation in species diversity, clade representation and disturbance history) influence plant, community and ecosystem function, and how knowledge of these differences can help us better predict responses of grasslands to environmental change. This work, which included plant specimen and functional trait collections across South Africa and North America, and extensive field and lab work, resulted in international collaborations and several publications. My first studies, published in *New Phytologist* and *The Journal of Ecology*, examined the evolutionary and functional basis of grassland responses to gradients of fire and grazing, both important drivers of ecosystem services provided by grasslands. I found that species with shared evolutionary history had similar plant functional and physiological responses to disturbance, and that there is a strong functional association between grazing tolerance and aridity (Forrestel *et al*. 2014; 2015). **Collectively, these studies have provided important insights into the utility of integrating phylogenetic and functional approaches. In doing so, I have improved our ability to identify general patterns and explain contingencies in the response of plants and communities to environmental change.**

Evolutionary and environmental drivers of productivity responses in grasslands

Recently, plant functional traits, such as the ratio of leaf area to dry weight (i.e., SLA) or plant height, have been used as general predictors of ecosystem function in response to climate and land use change. In a study published in *PNAS* (Forrestel *et al.* 2017), I tested the major underlying assumption that certain quantitative trait values confer specific function or response in a given environment, regardless of differences in other traits or interactions among traits. I did this by measuring aboveground biomass production, phylogenetic turnover and a set of plant traits associated with water and nutrient-use efficiency across broad precipitation gradients in grasslands of North America and South Africa. I found that different combinations of trait values can yield similar productivity-production relationships, highlighting that different evolutionary trajectories can lead to alternative physiological strategies to cope with similar environmental conditions. **This result is relevant to improving crop species, as there may be multiple means of optimizing physiology, or other desired traits such as disease resistance.**

A major goal of my research is to understand how plant distributions will change under future climate scenarios. I have addressed this imminent global crisis in the context of grasslands, which can be either dominated by species with standard photosynthetic machinery (i.e., C3) or with physiological adaptations to arid and open environments (i.e., C4). I modeled the current and future relative distributions of C3 and C4- dominated grasslands, and found the near disappearance of C4 grasses, despite the fact that they presently cover over 20% of Earth's terrestrial surface (Forrestel & Edwards, in press, Forrestel *et al*. in prep.). Yet, we know from my studies and others, that differences among physiological responses of grasses are also driven by shared evolutionary history, rather than photosynthetic pathway alone. With collaborators, I am working towards developing models of grass responses to climate change that, for the first time, incorporate phylogenetic history, in addition to photosynthetic subtype. **Importantly, my research illustrates the need to integrate evolutionary perspectives into our understanding of plant physiological responses and their impacts on productivity. This has important implications when working towards improving crop species' ability to adapt to environmental change, which my current and future research addresses in the context of winegrapes.**

Grapevines are increasingly used as a study system by biologists and are ideal for studying the functional and physiological basis of adaptation to varying climate. Varieties of winegrapes, or genetically distinct cultivars such as Pinot Noir or Cabernet Sauvignon, are tightly linked to specific soils and climate (i.e., 'terroir'), and exhibit an unprecedented amount of functional and genetic diversity. Further, the genetic and physiological knowledge of the crop is well-established and there are vast collections around the globe. As the earth warms, and precipitation and water availability become more unpredictable, it will be essential to grow better adapted varieties and breed grapes with greater resistance to—or tolerance of—drought and heat. **As an NSF postdoctoral fellow in the Viticulture and Enology Department at Davis, I am building on my current expertise to study the evolution of plant anatomical and physiological traits in response to climate – with a specific focus on responses to drought and heat stress.**

Linking functional and physiological traits to climate responses in grapevines

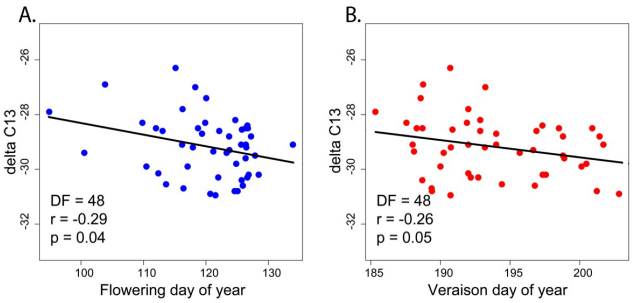

Figure 2. Relationship of C13 and phenology across a diverse set of winegrape cultivars; evidence for the coordination of functional and physiological responses across development in grapevines.

Matching the phenology and functional strategies of different winegrape varieties to a particular climate is a fundamental aim for every vineyard manager, especially in the face of significant climatic shifts in many growing regions. Phenology must be selected to complete maturity during the local growing season, and plant functional strategies for water use affect the accumulation of berry compounds including sugar, acids, anthocyanins, and tannins critical for wine taste, color, and texture. By measuring physiological traits related to water use and carbon assimilation across the growing season in a diverse set of winegrape cultivars, I found correlations between flowering time, veraison, and whole plant water use efficiency (i.e., drought tolerance) estimated using ^{13}C stable isotope abundance (Fig. 2). This result suggests there is important functional coordination between phenology and plant water use. Currently, I am mentoring a graduate student in VEN to analyze and write up these results, combined with gas exchange, water potential and anatomical leaf trait measurements collected across the growing season.

Evolution of the anatomical and morphological basis of drought responses in Vitis

Studying the physiological tolerances of wild species is central to my current and future research. Utilizing living germplasm collections, I am growing and collecting physiological and anatomical trait data from a set of 35 *Vitis* species and cultivars spanning the phylogenetic diversity of the genus. In collaboration with members of the McElrone Lab, using X-ray microtomography, I reconstructed the three-dimensional internal structure of leaf tissue. We employed novel machine learning algorithms to quantify traits such as mesophyll surface area, which has been found to be closely related to other important gas exchange and photosynthetic parameters relevant to water use and drought responses. I reanalyzed a phylogenetic dataset to infer relationships of the sampled *Vitis* accessions, and am using these data to assess whether there are varied strategies to dealing with warmer and/or more arid environments, or whether convergent patterns in suites of traits emerge in response to climate.

My pedagogical and mentoring philosophy for all levels is grounded in experiential learning, whether that be through working directly with plant material in the field, taking physiological measurements in the field and laboratory, engaging with primary scientific literature, or studying natural history collections. My primary aim as a teacher is to share my enthusiasm for plant biology and the cultural importance of plants – to inspire 'plant awareness', especially in the context of growing grapes and producing wine. Effective teaching and mentorship is central to my pursuits as an academic and plant biologist. To develop clarity in both my teaching style and public speaking, I have actively sought out opportunities to communicate my passion for plant biology and my interest in preserving and protecting our food systems. I endeavor to confer a firm grasp of the scientific method, critical thinking, writing and oratorical skills, regardless of future ambitions, career goals or major. Core to my teaching and mentoring philosophy is the notion that we must be adaptable and flexible in our interaction with students and colleagues. We all have different ways of navigating our worlds, integrating new knowledge and ideas, and interacting with others. It is through my past experiences in academia, as well as farming, culinary pursuits, and woodworking, that I have learned to teach, mentor and communicate effectively with people of diverse backgrounds.

Teaching Experience

Throughout my academic career, I have taught and given lectures in a variety of courses including botany, plant physiology and ecology, molecular phylogenetics and evolutionary biology. I have sought out opportunities to design and teach lab, field and computationally-based courses, and designed my own hands-on lab sections in addition to lectures. I believe in experiential and interactive learning and connecting concepts to practical examples, especially those from food and agriculture. In collaboration with Prof. Nancy Emery (CU Boulder, Ecology & Evolutionary Biology), I recently developed a teaching module called 'Phylofeast' that utilizes a phylogenetic tree of edible plants I constructed and food journals kept by students. We developed a series of exercises which teaches students general R code to explore several diversity measures related to the plants we eat. This lab module has been used in undergraduate courses at UC Boulder and Washington University, and is an excellent way to connect basic principles of plant biology to the importance of preserving diversity in our food systems. The study of grapevines and wine provides excellent opportunities to engage students in concepts of plant biology and physiology, and the prospect of teaching basic plant science in an applied fashion is especially exciting.

Mentoring

I consider mentoring and training future generations of scientists and members of the wine industry to be one of the most important undertakings as a professor. It is the experiences of one's lab members and students that greatly influence their development as teachers, mentors, and practitioners in the field. To build a sense of humility, openness, confidence and respect for all is essential to a healthy lab. To that end, I plan to develop explicit mentoring plans tailored to the unique needs of my students, contingent upon differences in learning/working styles, and career stage. I have already begun this with both graduate and undergraduate mentees, and it has been extremely helpful. I am flexible in my approach and expect the mentee to guide the process of developing a mentoring plan that is appropriate and ensures fulfillment of the goals and

expectations of the mentee. My ultimate goal as a mentor is to have students leave my lab as independent thinkers, take intellectual ownership of their project and work, feel a sense of accomplishment, and have the confidence to succeed and excel in academia, industry or other pursuits.

As a graduate student and postdoctoral fellow, I have mentored a diverse group of undergraduate students in the field and lab. I mentored two students through their honors theses, which included the design and implementation of field and greenhouse experiments, as well as the analysis, presentation and writing of results. I assisted another student in developing a research project on grazing dynamics in agricultural lands of Indonesia, for which he was successfully funded as a Fulbright Scholar. He since has gone on to pursue a Ph.D. in ecology at Princeton University. Since coming to Davis, I have taken advantage of the resources available to recruit undergraduate students in the life sciences, by developing a relationship with the Undergraduate Research Center. I am currently mentoring three women in our lab at diverse career stages, including an undergraduate, a masters student, and a Ph.D. student in viticulture and enology. A priority of mine as a mentor and member of the UC Davis community is to provide mentorship opportunities to young women pursuing STEM careers. I am an organizing and active member of the Women in the Life Sciences at Davis (WiLD), and currently co-organizing a mentorship program that matches first and second year graduate students with postdocs to provide support for professional development and managing the stresses of academic life. I am also taking part in an Inclusive Mentorship Program through the Professors for the Future Program at UC Davis, as it is a priority of mine to make intentional and guided efforts to embrace and foster diversity in my lab, department and institution. As a dedicated teacher and mentor, I am especially excited by all the opportunities, support and resources offered to UC Davis students and faculty to develop mentoring skills and foster diversity across the institution.

Future Teaching

My goal is to teach courses focused on the biology and function of grapevines, while fostering an appreciation for their diversity, rich history and adaptive capacity. My experience lecturing and leading discussions in Grapevine Physiology, as well as my current research studying the effects of environment and climate on grapevine physiology, will prepare me to teach grapevine physiology. Further, I expect that it will be an excellent way to recruit undergraduates to join the lab, and participate in ongoing research projects.

I have taken courses in ampelography and grafting, and have gained extensive knowledge of wild species, rootstocks, cultivars, phenology and the botanical diversity of grapevines through my current research. With this knowledge and breadth of experience teaching botany and plant biology I would be well suited to teach basic viticulture courses. Additionally, in collaboration with enology faculty, I would like to develop and co-teach a graduate course on wine and climate change, that combines cultural, historical and scientific context to changes in agricultural practices, grape growing and wine production.

Most physiological research in viticulture, and crop science at large, is conducted on a narrow set of species or cultivars, often limited in genetic and phenotypic diversity in comparison to their wild relatives. Yet, the wild species are crucial to developing disease resistant rootstocks and harbor important genetic and functional diversity critical to adapting grapes to changing climates and disease pressures. As Earth warms, and precipitation and water availability become more unpredictable, it will be essential to breed grapes with greater resistance to—or tolerance of—drought and heat. Wild species are critical to understanding how crop species will respond, and will be an essential repository of adaptive traits, genes and breeding potential. Crop breeders can take advantage of existing trait variation in crop wild relatives to enhance or develop new varieties/cultivars for sustainable agriculture. I am particularly interested in how the study of environmental tolerances in crop wild relatives can help address the challenges crops face with changing climates. **Importantly, the study of the evolution and physiological function of crop relatives provides context for understanding how specific crop species may vary in their adaptive potential due to functional constraints and/or flexibility in assumed functional and ecophysiological trade-offs.**

My future research program in grapevine physiology will investigate the genetic and functional basis of physiological responses to drought and heat stress in wild and cultivated grapevines. Building on my postdoctoral work, I will continue to leverage living collections of grapevines, and employ a combination of greenhouse and field experiments, functional and physiological trait measurements, molecular phylogenetics and modeling approaches to understand how grapevines will respond to the projected drought and heat stress in California.

Evolution of the anatomical and morphological basis of drought responses in Vitis

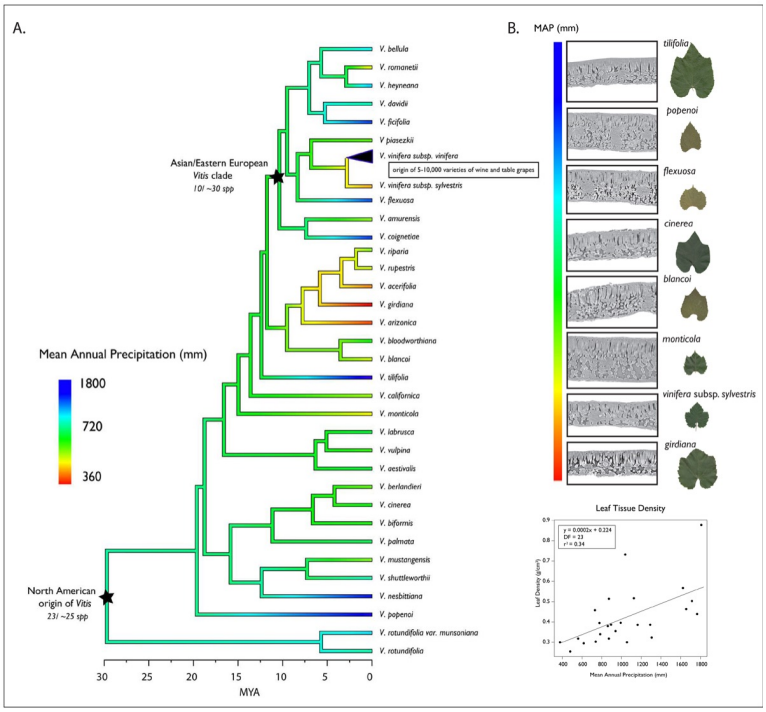

Figure 1. The evolution of leaf anatomical traits and climate across *Vitis*. A. Reconstructed precipitation niche across Vitis. B. Leaf cross-sections from microCT scans of *Vitis* leaves and the modeled relationship between Mean Annual Precipitation and leaf tissue density.

Photosynthetic function and plant environmental responses are directly linked to leaf and whole plant anatomical differences. Utilizing state of the art imaging X-ray microcomputed tomography (microCT) and new computational approaches to reconstruct and analyze the internal structure of three dimensional leaf tissue data, in collaboration with Andrew McElrone (VEN) and Mason Earles (Yale), I am relating several plant anatomical traits, such as mesophyll surface area, cell thickness and size, and stomatal traits to physiological drought responses in the greenhouse, as well as to the native climates of these species. My preliminary evidence shows that there is

correlated evolution between leaf functional traits, such as tissue density, and the precipitation niche of *Vitis* species (Fig. 1), yet the underlying mechanisms for these relationships are unclear. There is evidence in model species, such as *Arabidopsis*, that changes in cell size to airspace ratio of mesophyll cells can significantly influences photosynthetic capacity via a variety of mechanisms, such as reduced mesophyll conductance and alternations in biochemical pathways. I plan to follow up on these initial findings, by testing whether the same anatomical-trait function relationships drive photosynthetic efficiency across *Vitis*, as well as within winegrape cultivars. Future directions would also include collaboration with plant physiologists and geneticists in the Plant Sciences Department (e.g., Matt Gilbert, Pat Brown, Tom Buckley) to find the underlying genetic mechanisms that drive these changes in structural and functional relationships.

Physiological responses to heat and drought stress across winegrape cultivars

The predicted future of more extreme climate events, including heat waves, will have dire consequence on winegrape production and quality. Building on my current research, I plan to set up experiments in the field testing the effects of extreme heat events of varying duration, in combination with different drought treatments, to assess the physiological and biochemical responses of maturing grapes in different cultivars. The Oakville Station is an ideal site for this work, and I plan to have a lab that maintains active collaborations with Kaan Kurtural and UC Cooperative Extension. This work would also tie into a proposal, in collaboration with Andrew McElrone, Kaan Kurtural, Brian Bailey and Andrew Walker, to update the Winkler Index, a widely used approach based on growing-degree day models for classifying the climate of winegrowing regions. For this project, I will be contributing my skills in climate and physiological modeling with the aim of improving predictions of ideal growing conditions for different grape cultivars.

Whole plant genetic and ecophysiological responses to drought stress

The generation of genomic resources for crops and their wild relatives is quickly outpacing high quality phenotypic data, even though the latter is key to understanding how important physiological processes in plants are controlled and can be manipulated. Further, we have a limited understanding of how root and shoot level traits are integrated across grapevines. We know that there are important influences of belowground processes on gas exchange and stomatal conductance, however we lack a mechanistic understanding of these below and aboveground interactions. The expertise within the department on the physiology, function and genetics of grapevine rootstocks is essential to connecting my work on leaf-level physiology and drought to belowground responses. In collaboration with Kevin Fort, Andy Walker and Andrew McElrone (UC Davis, VEN), we are exploring the relationships between root architectural traits and abovegound plant physiology in response to drought. With these preliminary data, I plan to write a collaborative USDA-NIFA proposal integrating transcriptomic (i.e., RNAseq) and molecular studies and experimental irrigation treatments, with the aim of identifying genetic markers and candidate genes relevant to coping with future climate conditions in a diversity of wild and cultivated grapes. Further, based on hypotheses generated from these data, I will be able to examine the effects of grafting winegrape cultivars onto a set of wild species, which will advance our limited understanding of the role scion-rootstock interactions play in drought responses of different winegrape cultivars.

Outreach

Only through shifts in cultural paradigms and preferences can we change practices in the viticulture and wine industry. Thus it is of utmost importance that, as plant biologists, we clearly communicate our research to those beyond our own scientific and academic community, and that we can clearly extend our findings to agricultural practices and approaches of growers and winemakers. My past experiences in agriculture and food industries, and current outreach efforts (e.g., Botany of a Feast), demonstrate my ability to communicate my work to broad audiences, as well as effectively interact with industry. I have presented at a Natural Wines conference, started a seminar series on plant diversity and sustainable agriculture with botanists and chefs, and received positive feedback and interest from winegrowers and industry to participate in/present at public and industry events. I pride myself in being able to communicate to broad audiences about my research and its application to agricultural and cultural practices.

Through my work at the Wolkfskill Experimental Orchards (UC Cooperative Extension and USDA-ARS), as well as my plans to utilize the Oakville Station in Napa to conduct heat tolerance experiments, I am committed to engaging with UC Cooperative Extension and Agricultural Research Stations. I plan to actively be involved in UC Agriculture & National Resources' efforts to build climate change resistance and resilience in California through active engagement with growers, winemakers and the public. As a plant physiologist in the Department of Viticulture and Enology, I would maintain my commitment to advancing basic science in plant ecophysiology, while directly addressing questions relevant to the challenges of growing grapes in the face of environmental change and economic stresses.

Collaborations

My greatest strength as an academic is my ability to cross disciplines and bring together scientists with disparate backgrounds, perspectives and expertise. Since joining the department as a postdoc, I have established connections with faculty across diverse labs, including D. Cantu, A. McElrone, and A. Walker, and am excited by the opportunity to establish collaborations with other researchers in the department, and beyond. I am interested in promoting greater collaboration between labs studying viticulture and those studying sensory perception and biochemistry with the goal of testing how changes in viticultural practices directly influence the sensory, phenolic and biochemical properties of grapes and wine. The breadth of expertise and available resources in the Department of Viticulture and Enology and UC Davis more broadly, provides an ideal academic setting in which to establish an integrative research lab that addresses questions of importance to both applied viticulture and basic questions in plant biology and physiology.

"Few tragedies can be more extensive than the stunting of life, few injustices deeper than the denial of an opportunity to strive or even to hope, by a limit imposed from without, but falsely identified as lying within." Stephen Jay Gould

As an educator, mentor, and role model, I consider it my personal responsibility to actively and consciously promote the representation of diversity in both academia and industry. I firmly believe that embracing diversity, and surrounding oneself with those who have perspectives, backgrounds and experiences that differ from one's own results in greater innovation, productivity and overall the creation of a more positive environment. In a culture where one's abilities are not respected, one cannot effectively learn, advance, lead or participate in society in a fulfilling way.

I have personal experience as a women in science, with a disability. I believe this makes me better able to handle difficult situations, relate to others and mentor students with a diversity of experiences and backgrounds. Through the personal challenges I have faced, I realize the importance of having positive, compassionate and encouraging mentors and aim to serve in that role for my students and the broader academic community. Further, through personal experience in departments and fields that were largely dominated by men, I have come to recognize the importance of becoming a role model for those who struggle with the well-known and documented, inherent biases against women, minorities and those with disabilities present in academia and beyond. As a young woman and mother, living with a chronic disease, I recognize the important role I can play within the department and university as a role model and mentor. Throughout my academic career, I have strived to work with and mentor a diversity of students and colleagues, and through these interactions I have learned and grown tremendously. As a faculty member, I would continue my commitment to recruiting and promoting a diverse group of students and lab members.

Promoting Under-represented Groups in Higher Education and STEM

Since coming to Davis as a postdoctoral fellow, I have had the chance to dedicate myself to service and empowerment of women in the sciences by becoming an organizing member of Women in the Life Sciences at Davis. I have also taken interest in how I can actively promote the greater inclusion and support of those with disabilities and health issues through participating in an Inclusive Mentoring Workshop organized by UC Davis Professors for the Future Program. I value mentoring others through personal struggles with the knowledge that working through life's challenges generates resilience, perspective and balance, which are all extremely positive characteristics essential to a successful career in academia and beyond.

I have come to appreciate the unique educational opportunities UC Davis provides for first generation students and minorities, and look forward serving the UC Davis community as an advocate for women and under-represented groups in the sciences. As a faculty member in Viticulture & Enology, I aim to provide mentorship opportunities to under-represented groups and work towards generating greater support and resources for women pursuing careers in both research and industry.