Professional Leave Report Cover Sheet

Name: Katherine Waselkov

Department: Biology

College: Science & Mathematics

Leave taken: ◉ Sabbatical ○ Difference in Pay ○ Professional Leave without Pay

Time Period: ◉ Fall 2022

○ Spring

○ Academic Year

○ Other

Your report will be sent to your Dean for your PAF and to the Library Archives.

Sabbatical Report for Fall 2022 Sabbatical

Dr. Katherine Waselkov, Department of Biology

1. The accomplishments of the leave in relation to the goals of the original proposal

Objectives of the original proposal:
(1) To write and submit two manuscripts for publication
(2) To conduct research and acquire data/material that cannot be acquired at Fresno State
(3) To expand my lab's research into answering a broader eco-evolutionary question
(4) To write and submit a collaborative NSF IUSE grant proposal for an herbarium-based CURE

(1) One manuscript has been written and submitted for publication:

Galvan, K.*, **K. Waselkov**, and A. Shrestha. Common waterhemp (*Amaranthus tuberculatus*) germination as influenced by water potential, salinity, and pH, and plant tolerance to salinity and postemergence herbicides. In review at *Agronomy*, manuscript AJ-2023-03-0229-A.

*denotes Fresno State graduate student co-author.

(2) And (3): The bulk of my sabbatical was spent conducting taxonomic research and acquiring data and material that could not be acquired at Fresno State, to expand my lab's research into answering the broader eco-evolutionary question, "what makes a plant a weed?". I visited and conducted taxonomic research at two herbaria, at the Missouri Botanical Garden and associated taxonomic library (St. Louis, MO), and at the New York Botanical Garden. A visit to another institution, Harvard University, was postponed to summer 2023 due to renovations occurring at their facilities. I was able to view type specimens and many other early collections of species in my study group, the plant genus *Amaranthus*. I came to preliminary taxonomic conclusions during these visits, which I then tested by conducting my own fieldwork in the Southwestern U.S.

My field work in the Sonoran and Chihuahuan deserts (Arizona, New Mexico, and west Texas), researching ~7 poorly-known Southwestern native non-weedy *Amaranthus* species, resulted in new seed and herbarium specimen collections of *Amaranthus torreyi* (12 populations), *A. retroflexus* (4 populations), *A. blitoides* (1 population), *A. fimbriatus* (2 populations—one possibly the hybrid species *A. x. tucsonensis*), and *A. powellii* (3 populations). Two of these species are non-weedy, and the other three species were collected in places where they were not agricultural weeds. My preliminary taxonomic conclusions based on herbarium work were also supported by my subsequent field work: I believe that one widely-cited wild species of *Amaranthus*, *A. wrightii*, is not really a species, as every previous herbarium collection and revisited population better matches other species morphologically (*A. torreyi*, *A. powellii*, *A. retroflexus*, or some mixture of these species). As this species is reputed to be the nearest relative of the important agricultural weed, *A. retroflexus*, it is surprising to find that in the 150 years since it was originally described, no one has taken a closer look at it! Two other species have much smaller geographic ranges than previously thought: *Amaranthus watsonii*, last collected about 100 years ago in southern California near the border with Mexico, now only occurs in Baja California and BCS, and *Amaranthus obcordatus* only occurs in northern-central

Arizona, which is ironic, since its common name is the Trans-Pecos amaranth and it was originally described from west Texas. The extremely rare *A. viscidulus*, which only ever occurred in a small section of the White Mountains in Lincoln Co., NM, either never was a species (just a rarely occurring variant of *A. powellii*), or no longer exists, as it has not been observed or collected since 1909. I also observed a complete morphological gradation in between two very closely related species from Texas, *A. crassipes* and *A. scleropoides*, suggesting that they should be considered a single species. On the other hand, *Amaranthus torreyi*, which occurs across the entire Southwestern U.S., is much more common than previously reported, and should not be listed as a species of conservation concern in Arizona.

Publication of these taxonomic conclusions will be forthcoming, possibly as a monograph revising the Southwestern U.S. species of *Amaranthus* in the journal *Systematic Botany Monographs*. A portion of each of the new seed collections will be deposited at the USDA Germplasm Repository in Ames, IA, where they will be available to any U.S. researchers who would like to use them in studies. The remaining portion of each seed collection will be used in upcoming research by undergraduate and graduate students in the Waselkov lab, performing phylogenetically-controlled studies of the traits involved in weediness.

(4) An NSF IUSE grant was not submitted during my sabbatical period (for reasons explained below); however, a smaller CSU STEM-Net grant on the same topic was submitted and funding was obtained.
PI: K. Waselkov; Co-PIs: E. Walter (Biology), J. Pryor (Anthropology), B. Agbayani (Linguistics). Native Plants, Places and People in Central California: Linking STEM Education to Local Cultural and Linguistic Diversity. STEM-Net Faculty Interdisciplinary Collaborative Research SEED Grant: $24,820, FY 2023-24.

2. <u>Modifications, if any, to the original proposal and the circumstances that necessitated these modifications</u>

As mentioned above, a visit to Harvard University was postponed to summer 2023 due to renovations occurring at their facilities. Also, I could not collect plants in the Mojave Desert at the appropriate time period in Fall 2022, as planned, because of severe drought in this area until December 2022. I plan to visit the Mojave for short field trips in Fall 2023, to obtain herbarium specimens and seed collections of two more native *Amaranthus* species: the poorly known species *A. californicus*, and *A. torreyi* in the western portion of its broad range.

The biggest change to my original proposal was that I could not submit an NSF-IUSE grant in January 2023 as planned, due to my STEM education collaborator, Dr. Emily Walter, unexpectedly leaving Fresno State. She was going to facilitate or lead several crucial aspects of this project, including course design and implementation assessment for our planned educational interventions. My collaborators and I chose to apply for a STEM-Net Collaborative Grant in the short term, to collect data to allow us to apply for a larger grant in the next year: probably a Digital Humanities Advancement Grant (NEH) or an Infrastructure Innovation for Biological Research Grant (NSF). The proposed CURE and outreach activities that we had planned for the IUSE grant will be implemented as extensive Broader Impacts in the new larger grant we are working towards. In the period of my sabbatical, I formed a collaboration with Dr. John Pryor (Anthropology, College of Social Sciences), Dr. Brian Agbayani (Linguistics, College of Arts and Humanities), and Dr. Leece Lee-Oliver (American Indian Studies, College of Social

Sciences), and have been meeting weekly with this team since August 2022. We have involved 7 undergraduate students (three from Biology, two from Lingustics, and two American Indian Studies interns in Anthropology) in the ethnobotanical and specimen-based research funded by this STEM-Net grant. Last week, our faculty team met with interim Fresno State Library Dean Bernadette Muscat to discuss broader innovation in ethnobotanical data curation, access, and storage online through the Digital Services Division at the Library, using the online tribal platform Mukurtu. I hope to eventually involve other herbaria in the US (at South Dakota State University, the Museum of Northern Arizona, the University of Minnesota-Duluth, New York Botanical Garden, and possibly many more) in designing ways to incorporate cultural/ethnobotanical data in herbarium specimen databases.

3. The objectives of the original proposal (if any) that were not accomplished

Only one publication was submitted for publication during the period of my sabbatical, rather than two, as stated in the objectives. However, at least four other publications are currently in progress amongst myself, my former post-doctoral advisor, and my former graduate and undergraduate students. I will be an author on two manuscripts which are in preparation (and very near completion) from two former M.S. Biology students, Alexander Lopez (now in a Ph.D. program at the University of Illinois) and Reece Riley (now in a Ph.D. program at UC Merced). Their Ph.D. classes have been slowing down their other scholarly activities in their first year, but they were able to advance the manuscripts somewhat over the fall semester with my feedback, and I'm hoping they will have time to publish their masters work this summer. I also will be the lead author on a manuscript about *Phlox speciosa* population genetics, to be submitted to Western North American Naturalist this summer, including three undergraduates (who have all since gone to medical school) as co-authors. Finally, my post-doctoral advisor and I got back into contact over my sabbatical, and started a new grant-based collaboration extending some work we did when I was at Kansas State, examining the taxonomy of a rare Wyoming endemic species, *Phlox pungens*. In anticipation of this grant, we plan to publish an overview of *Phlox* phylogenetics that has been in the works for years, and is very close to being ready to submit.

4. Anticipated outcomes for the near future as a consequence of the leave's activities

As mentioned above: after a visit to Harvard University Herbaria and some additional Mojave Desert field work in summer-fall 2023, I will publish my taxonomic conclusions about the plant genus *Amaranthus* in the Southwestern U.S. My new seed collections will be deposited at the USDA Germplasm Repository in Ames, IA, and will be used in upcoming research by undergraduate and graduate students in the Waselkov lab, performing phylogenetically-controlled studies of the traits involved in weediness. My STEM-Net grant collaborators and I, and our 7 undergraduate student researchers, will be collecting data throughout the next year to allow us to apply for a larger grant (i.e., a Digital Humanities Advancement Grant (NEH)), and working out the terms of a collaboration with the Fresno State Library to host our new ethnobotanical database. And I anticipate at least 4 publications stemming from previous Fresno State undergraduate or graduate student research or ongoing collaborations, to be submitted in Summer 2023.