

## MEET A GRASSLAND RESEARCHER **Daniel Toews**

*Ph.D. Candidate, Environmental Systems, University of California, Merced*

### **What is your study system? What are your primary research goals?**

My research is almost solely conducted on the 6,500-acre Merced Vernal Pools and Grassland Reserve (MVPGR) located adjacent to the University of California, Merced. Together, the UC natural reserve, surrounding private rangelands, and conservation easements comprise one of the largest and last contiguous networks of vernal pool grassland habitat that remains in California's Central Valley. This area represents a major component of the Eastern Merced County core conservation unit of the U.S. Fish and Wildlife Service Vernal Pool Recovery Plan (2005) and exhibits a great diversity and number of threatened vernal pool species. I use genetic and traditional survey approaches as well as classical experimental biology to understand patterns of biodiversity and local adaptation in California vernal pool plant species. My research can be distilled into two major components: 1) I use a combination of traditional vegetation survey approaches and genetic survey techniques, known as environmental DNA (eDNA) metabarcoding, to genetically characterize plant species' DNA found in vernal pool soil samples and track patterns of diversity across the MVPGR; and, 2) I use a combination of field and greenhouse experiments where I transplant vernal pool plant species across different vernal pools to test the effect of different habitat characteristics on plant growth and performance. Based on those performance and fitness measures, we can make some assumptions about local adaptation to specific soil and/or community types. Ultimately, this research will develop and improve methods for detecting special status species from vernal pool soil samples and provide insight into eco-evolutionary dynamics of vernal pool plant species that are relevant when considering conservation strategies.

### **Who is your audience?**

Although my research is targeted for the academic and non-academic science community, a primary purpose of this work is to provide government agencies, NGOs, and vernal pool grassland and rangeland conservation practitioners with information and improved survey protocols that can be used when making management decisions or

surveying for a species presence. So, I'd say our audience is anyone who wants to better understand plant diversity in vernal pool grasslands and is interested in the types of ecological and evolutionary questions we ask.

### **Who has inspired you, including your mentors?**

Wow, what a great question! I could write an entire article on this... with that said, I continue to be inspired by so many incredible people and I will only mention some of those key folks here. I initially became

interested in biology after taking an introductory biology course at Merced Community College with professor Carl Estrella. Carl was the first person that helped me connect concepts of ecology and evolution to the real world. He paired his lectures with field trips to tidepools along the central coast and the Sierra Nevada foothills, and that is really where I fell hard for ecology and developed a keen interest in plants. During my undergraduate at UC Merced, I took courses in ecology from Dr. Marilyn Fogel and conservation biology with Dr. Jason Sexton, both of whom became my advisors in graduate school. Dr. Fogel opened my eyes to the many different aspects of ecology and

gave me the freedom to explore and the tools needed to investigate all kinds of different projects. Dr. Fogel is the catalyst that has sparked my passion for research and influenced my current trajectory. Similarly, Dr. Sexton showed me that there are no real limits to pursuing research questions, and that it is possible to study plants for a living! The experiences I had while working as an undergraduate in the Sexton Lab continue to inspire my drive for research. My love for natural history was hugely nourished by Christopher Swarth (Director of UC Merced Reserve, now retired). I worked as an undergraduate with Chris on so many different projects that revolved around the Reserve's management plans (e.g., plant and animal surveys, special status species monitoring, rangeland health and property management, etc.). Not only was Chris's enthusiasm for the natural world infectious, but he was also an incredible teacher who honed my observational skills. My love for vernal pools can be attributed to days scampering across the grasslands with Chris, Jennifer Buck-Diaz, Carol Witham, John Vollmar, and Dr. Bob Holland.

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# CNGA Student Scholarships

## ***Grassland Research Awards for Student Scholarship (GRASS)***

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***-Yearly call for Applications: November 1.***

***-Application deadline: Jan 31.***

***-Awards announced: Mar 15.***

Photo: Prairies of Point Arena (see page 3 for article). Courtesy Jennifer Buck-Diaz

## **Daniel Toews** *continued*

**How has or will your research align with the mission of CNGA “to promote, preserve, and restore the diversity of California’s native grasses and grassland ecosystems through education, advocacy, research, and stewardship”?**

The chief purpose of my research is to improve conservation, restoration, and management of native vernal pool plant species. Specifically, I aim to develop and improve protocols for rare plant species surveys and enhanced community diversity estimates that can be used to prioritize vernal pools for management. Additionally, I hope my experimental-based investigations of adaptation will be used to guide vernal pool conservation and restoration decisions that are backed by experimental evidence. Lastly, not only do I advocate for vernal pool grasslands through professional and academic meetings, but also through outreach and education at public events, K-12 and community field trips to the UC Reserve. One of the greatest privileges I’ve been given is the opportunity to work with local educators to develop the Next Generation Science curriculum based on vernal pool phenomena for public schools in the Central Valley.

## **Why do you love grasslands?**

They are incredible! Grasslands are complex systems that represent some of the most productive, ecologically important, biologically diverse, and threatened ecosystems in the world. Unlike the grandeur of Yosemite’s towering granite monoliths and giant sequoias, California’s grasslands reveal themselves in very subtle and surprising ways that often require repeated visits across multiple seasons and your face in the weeds. I love the expansiveness, the “chi-chip” from the horned larks, and the distant songs of the coyote. It is a religious experience when you are immersed in the grasslands — when you are miles between fences, and even further from roads.



## **References**

USFWS (U.S. Fish and Wildlife Service). 2005. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Portland, Oregon. xxvi +606 pages. <http://www.fws.gov/pacific/ecoservices/endangered/recovery/plans.html>.