

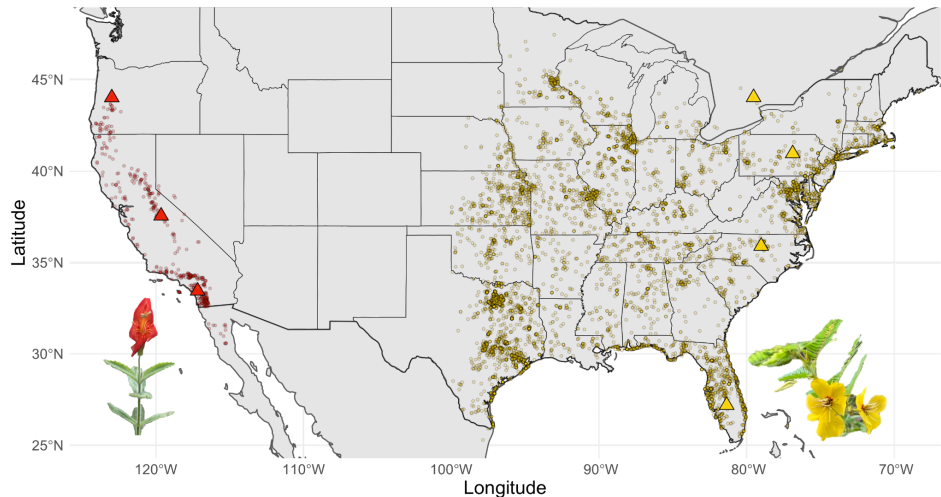


Ph.D. position in Plant Evolutionary Ecology

Department of Plant and Microbial Biology
North Carolina State University

The [Sheth plant evolutionary ecology lab](#) in the [Department of Plant and Microbial Biology](#) at [North Carolina State University](#) (Raleigh, NC) invites applications for 1-2 Ph.D. students beginning in Fall 2023. We combine field, greenhouse, and growth chamber experiments, demographic modeling, and quantitative genetics to examine constraints to adaptation to climate across species geographic ranges. We strive to foster an inclusive environment where people from all backgrounds are respected and we especially welcome applicants from groups that have historically been underrepresented or excluded. We value the safety of all team members in the lab and field.

Students will be funded through a combination of teaching assistantships and research assistantships associated with one of two collaborative, NSF-funded projects examining eco-evolutionary responses to climate change. Both projects involve large-scale quantitative genetic field experiments that are latitudinally arrayed: one with the annual legume



Chamaecrista fasciculata in the eastern United States, and the other with the perennial herb *Mimulus cardinalis* in the western United States (see page 2 and [our website](#) for descriptions of both projects).

NCSU and the Research Triangle

NC State's Department of Plant and Microbial Biology offers a highly-rated research environment and is situated in a collaborative and scientifically stimulating atmosphere in the Research Triangle, with both UNC Chapel Hill and Duke University nearby. There is a vibrant and growing community of ecologists and evolutionary biologists spread across multiple departments on campus, including Applied Ecology, Biological Sciences, Entomology and Plant Pathology, Forestry and Environmental Resources, Soil and Crop Sciences, and Biochemistry, among others. Raleigh is a lively yet affordable city with a high standard of living, and its surroundings offer numerous recreational activities.

To apply

Prospective graduate students should apply to the **Plant Biology Graduate Program**. Before submitting a formal application (**due January 15**), please send the following information to Dr. Sheth at ssheth3@ncsu.edu no later than **December 1**: 1) CV; and 2) a statement of your academic background and previous research experience, current research interests, and why you want to join the lab.



1) Integrating Evolutionary and Migratory Potential of *Chamaecrista fasciculata* into Forecasts of Range-Wide Population Dynamics Under Climate Change



The first project combines approaches from evolutionary biology, field ecology, and population genomics to forecast range-wide dynamics under climate change in a native legume (*Chamaecrista fasciculata*) that is broadly distributed across central and eastern North America. The Ph.D. student will join a highly collaborative team of researchers, including Drs. [Jill Anderson](#), [Megan DeMarche](#), (University of Georgia), [Susana Wadgymar](#) (Davidson College), [Emily Josephs](#) (Michigan State University), and [Jenny Cruse-Sanders](#) (State Botanical Garden of Georgia). Our studies will

examine the migratory potential of populations under climate change using population genomic estimators of historical gene flow. To evaluate adaptive potential, we will expose paternal half-sib families from 12 populations to contemporary climates and simulated climate change in common gardens across the range, including a common garden near Raleigh, NC. Finally, we will forecast eco-evolutionary dynamics under climate change using models that differ in the degree to which they incorporate data on species occurrence, additive genetic variance in fitness in response to climate, trait expression, sequence variation, and gene flow. Our work will provide a robust framework for predictions of range-wide responses to climate change in systems that are less amenable to manipulation. We will collaborate with conservation practitioners in the [Georgia Plant Conservation Alliance](#) and [Southeastern Grasslands Initiative](#) to produce risk assessment tools that project range dynamics under climate change for endangered plant species. The Ph.D. student will have the opportunity to forge connections with conservation practitioners.

2) Integrating Evolutionary Genetics and Population Ecology to Detect Contemporary Adaptation to Climate Change Across a Species' Range

The second project, in collaboration with Drs. [Chris Muir](#) at the University of Hawaii, [Lluvia Flores-Renteria](#) at San Diego State University, [Jay Sexton](#) at UC Merced, and [Jeff Diez](#) at the University of Oregon, examines evolutionary rescue across the geographic range of the scarlet monkeyflower, *Mimulus cardinalis*, a perennial herb that grows in riparian habitats in western North America. We are combining models from quantitative genetics and population ecology to ask whether evolution can rescue populations in decline when they encounter rapid environmental change. To address our objectives, we are performing a resurrection study comparing ancestors and descendants derived from seed collected before and after a period of severe drought and heat in western North America. We will transplant seedlings from leading-edge, central, and trailing-edge populations of the perennial herb, *Mimulus cardinalis*, into a northern-edge (near Eugene, OR), central (near Wawona, CA), and southern-edge (near Temecula, CA) common garden and quantify natural selection on traits, additive genetic variances for traits and fitness, and differences in population growth rates and traits between ancestors and descendants. The Ph.D. student will have the opportunity to engage high school students from underserved communities in San Diego in a tiered mentoring program where they learn the scientific process and STEM careers through monthly in-person and virtual meetings and field trips.

