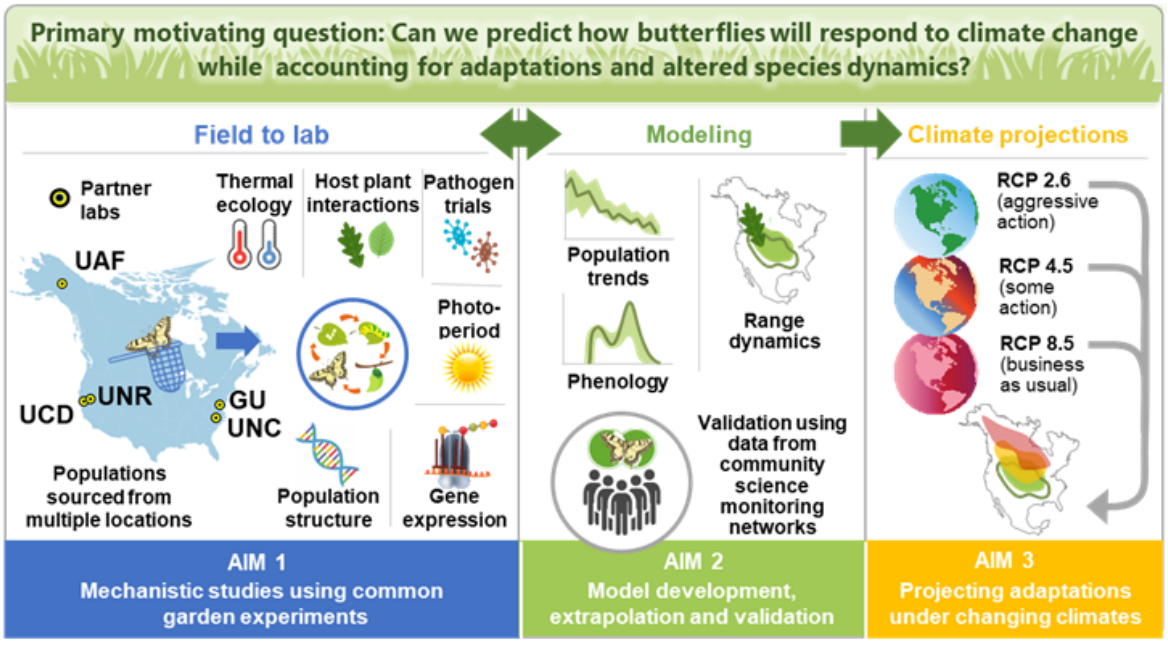
Opportunities for graduate students and post-doctoral fellows to participate in a multi-institutional collaboration examining adaptive potential of butterflies to climate change

A new NSF-funded initiative to examine how climate impacts population dynamics of butterflies throughout North America has funding for an integrative collaboration based at 5 institutions in the US (listed below). This project will study growth, survivorship, and immune responses of multiple butterfly species to different temperature profiles and variable host plant sources. Field and laboratory approaches (including rearing, population genetics, and gene expression) will study select butterfly populations throughout their range to understand local adaptations and evolutionary potential. We will use these mechanistic data to build dynamic models to project species' responses to climate change. Predictions of emerging models of large-scale population and range dynamics will be tested with data emerging from a network of community (citizen) science monitoring platforms and programs (e.g., the North American Butterfly Counts, route-based butterfly monitoring networks, opportunistic observations through portals like eButterfly and iNaturalist). Validated models will be projected into future climates to explore the potential biodiversity consequences of global change. The goals of this project are broadly represented in this figure:



There is a great deal of latitude for building individual projects and cross-lab collaborations within the scope of this project. Limited graduate student stipends are available in many participating labs (see below), but recent or current undergrads are also encouraged to learn more about the project and write individualized research proposals that could be separately funded by fellowship programs (e.g., NSF Graduate Research Fellowships). While there is no specific funding in the project for post-docs, the goals of the project align exactly with one current focus of NSF Postdoctoral Fellowships in Biology (area 2): "Integrative Research

Investigating the Rules of Life Governing Interactions Between Genomes, Environment and Phenotypes."

Our project is looking to support a large and diverse collaboration and we are particularly interested in recruiting candidates who have been traditionally underrepresented in the ecological and evolutionary sciences or who are passionate about broadening participation. As such, we also highly encourage interested upcoming and recent graduates who can also apply for NSF Biology Fellowships under area 1: "Broadening Participation of Groups Underrepresented in Biology"

Collaborative PIs and institutions

Georgetown University Biology Department: The Ries and Armbruster labs are seeking a graduate student to begin in fall 2022. Our labs are collaborating on studies of butterfly development and survivorship (focus of Ries lab). We are using RNA-seq and other bioinformatic approaches to examine gene expression (focus of Armbruster lab), especially related to adaptations associated with climate such as heat and cold tolerances and/or initiation and maintenance of diapause. Co-PI climatologist Naresh Neupane will lead efforts on climate modeling.

The Yang Lab at the University of California, Davis studies species interactions and community ecology from a temporally explicit (phenological) perspective. They use field, lab, and greenhouse experiments to examine how changes in seasonal timing and extreme climate events affect plant-herbivore interactions, and have also developed models to investigate the evolution of phenological cue strategies under changing environmental conditions.

The Kingsolver Lab at University of North Carolina, Chapel Hill integrates physiology, ecology and evolution to explore how organisms respond and adapt to variable, natural environments. We combine laboratory, field and modeling approaches, working primarily with herbivorous insects and their interactions with hostplants and parasitoids. Much of our recent work focuses on understanding and predicting the consequences of climate change and of invasive species for butterflies and other insects.

The Smilanich Lab at the University of Nevada, Reno studies the interaction between host plants, the immune response, and pathogens in herbivorous insects. We seek to understand the effect of host plant chemistry on the insect immune response and their ability to defend against entomopathogenic viruses. We use a combination of lab and field work to investigate these interactions and a suite of lepidopteran species. Related to the current funding, we are pursuing experiments that include thermal perturbation to understand how temperature plays a role in immunity and disease resistance.

The Breed Lab at the University of Alaska-Fairbanks focuses on the effects of an animal's behavior, movement, and dispersal on population dynamics and ecological interactions. In practice, we spend a great deal of time trying to understand how and why animals, from

individuals to populations, move. Movement is how animals interact with space and time as they seek to exploit heterogeneously distributed resources while minimizing risk. It is a multidimensional time-series process, and creates interesting and difficult applied and theoretical ecological problems. We try to balance the development of new analytical and theoretical approaches with empirical observations and manipulative experiments to address these problems. For this project, we will consider butterfly movement in the context of heterogeneous resources and microclimatic variability in polar to desert habitats.

See individual lab websites for PI contact information, or send a request for general information to Leslie.Ries@georgetown.edu.

Commitment to broadening participation through recruitment, training and collaboration

Our multi-institutional collaborators seek to develop a vibrant, multidisciplinary academic community where we will not only focus on scientific goals, but use best practices from research in the “science of team science” to create a collaborative, interdisciplinary research team that supports developing a more diverse research community. All participating institutions are an Equal Opportunity/Affirmative Action Employer fully dedicated to achieving a diverse workforce. All qualified applicants are encouraged to apply and will receive consideration for employment without regard to race, color, religion, national origin, age, sex (including pregnancy, gender identity and expression, and sexual orientation), disability status, protected veteran status, or any other characteristic protected by law.