Personal Statement, Relevant Background and Future Goals Statement

An unexpected beekeeping apprenticeship sparked my interest in native pollinator conservation. In 2011, I spent the winter working in the tropics on an organic farm and beekeeping. Working with several holistic beekeepers and organic farmers, I was introduced to the overwhelming maladies affecting the introduced European honey bees (*Apis mellifera*) and witnessed the haunting lack of pollinators on fragrant blooming fruit trees. I discussed this apparent lack of pollination with local farmers and they responded with stories of diminishing crop yields. For me, these experiences underscored the ecological and economic consequences of pollinator decline and the need to promote and understand *native* pollinators, rather than relying on a single introduced species. Two years later, I am pursuing these research interests as a graduate student with significant field experience and real-world perspective.

**Relevant Background.** In 2008, I was a third-year business student when my life’s trajectory was redirected after a semester studying conservation and tropical ecology in Costa Rica. While abroad, I first began studying insect ecology during an independent research project on army ants entitled “*Eciton burchelli*: polymorphism of the submajor caste and foraging efficiency”. This study investigated the selective pressures shaping the polymorphism of the submajor caste in *E. burchelli*. The project included a proposal, one-month of data collection, data analysis, two written submissions, and a symposium presentation. In 2010, I presented my findings at the Invertebrates in Education and Conservation Conference held by the Sonoran Arthropod Studies Institute (SASI) and my paper was published in the *Invertebrates in Education and Conservation: Sonoran Arthropod Studies Institute Conference Proceedings*. Through this process, I ultimately realized I could transform my passion for the natural world into a profession.

Since graduating from the University of Rhode Island, I have worked on numerous conservation initiatives and developed several environmental education programs. In 2009, I interned for Lou Perrotti, Director of Conservation at the Roger Williams Park Zoo (RWPZ). This experience enlightened me to the world of invertebrate conservation through the American Burying Beetle Reintroduction Project, the longest on-going reintroduction program for this federally endangered insect. Working for both RWPZ and the Maria Mitchell Association, I conducted fieldwork on Nantucket, reared captive colonies in the lab, analyzed data, and reported on land management recommendations to restore beetle habitat. I also assisted in the first survey of burying beetles on Naushon Island, Massachusetts. I co-authored on a paper of the survey results and it was later published in the *Invertebrates in Captivity: Sonoran Arthropod Studies Institute Conference Proceedings.* Also during my internship with RWPZ, I visited Panama and assisted with the invertebrate rearing facility that supports the captive amphibian population at the El Valle Amphibian Conservation Center. Since finishing my internship with RWPZ, I have organized and given lectures to public groups and young adults about chytridiomycosis, a deadly fungus that is contributing to worldwide amphibian decline. In collaboration with RWPZ and a local middle school teacher, I guided young citizen scientists in the field to swab amphibians for the presence of chytrid. As a result, three new areas of chytrid infection have been detected in New England.

In 2011, as a Mountain Birdwatch Technician for the Vermont Center for Ecostudies, I mapped and established survey points for a long-term monitoring project of high elevation bird species. In 2012, I continued to work with birds as a Backcountry Field Biologist for the Institute for Bird Populations. This experience further underlined the need to collect long-term data on species, especially during a time of climate change. I coordinated field logistics with National Park biologists and rangers to conduct bird surveys throughout rugged wilderness areas of Mount Rainier National Park in Washington. These field jobs provided many self-reflective experiences where I gained confidence, learned to assess risk, and coordinate with others.

Mentoring and teaching has also offered many challenging yet rewarding experiences. As an environmental educator for the Audubon Society of Rhode Island in 2012, I was responsible for developing and presenting a weekly afterschool program for two inner-city middle schools in Providence, RI. Students in this ‘Urban Naturalists’ program learned to appreciate urban wildlife through the exploration of city parks and classroom experiments. By the end of the year, these city-dwelling students were describing the effects of pollution on watersheds, examining macro invertebrates through dissecting scopes, and identifying birds in neighborhood parks. This experience solidified my desire to inspire young adults through science. During the summer of 2013, I worked as an educator for the Ocean View Foundation on Block Island, RI. I independently developed and delivered weekly public education programs to promote native bees and their habitat. I also collaborated with a researcher from the American Museum of Natural History. Together, we recruited citizen scientists to assist with a native bee survey. Data from this survey will be used to identify changes in bee species composition since the last survey conducted in the 1970s. In developing this program I learned native bee natural history and collecting techniques and also made contacts with several bee experts.

As a graduate student entering my second year, I have already shown aptitude as an academic researcher and instructor. As a graduate teaching assistant, I have instructed labs for three different biology courses for undergraduates. Last summer, I developed an undergraduate lab entitled: “Evolution of antibiotic resistance” where students will use their own staphylococcus bacteria to test for antibiotic resistance. Last year, my **NSF graduate research fellowship proposal received an honorable mention**. Reviewers suggested that I include more mechanistic approaches within my proposal. Since receiving the honorable mention, I was awarded four different grants to develop the approaches I will use to mechanistically test the transmission and effect of RNA viruses in bumblebees. With the money I received, I successfully reared bumble bee colonies from wild-caught queens, developed molecular protocols for isolating and detecting three RNA viruses, conducted a survey of bumble bees and honeybees throughout northern Vermont and performed several pilot experiments using captive colonies. From the suggestion of last year’s reviewers, I have included my publication record within this proposal, which I had naïvely omitted in last year’s personal statement. Additionally, I am working on a review paper about the ecology of bee viruses and areas that are ripe for research.

**On-going Collaborations.** I have recently identified a gap in communication between private, commercial and governmental groups within Vermont that all share the same goal of maintaining healthy bees. Thus, I have taken the initiative to act as a liaison by spearheading Vermont’s involvement with the National Honey Bee Survey (NHBS), an ongoing nation-wide effort by the Bee Informed Partnership and USDA Animal Plant Health Inspection Service to collect data on bee disease to better inform research and management decisions. Maintaining healthy honeybee hives through this monitoring program will benefit commercial beekeepers as well as help to lessen pathogen spillover into wild bee populations. Already, I have received enthusiastic support from the program director of NHBS, the VT state apiculturalist, Vermont Beekeepers Association, and VT’s largest commercial beekeepers. In January, I plan to present a formal proposal outlining the course of action for Vermont’s involvement. Through my collaboration with NHBS, I plan to visit the honeybee lab in Beltsville, MD to standardize my molecular protocols and learn new techniques.

During the past year, UVM has gained two new faculty members who are experts in my field of study. Firstly, Dr. Brandon Ogbunugafor, a Henderson Scholar who recently finished a joint postdoctoral fellowship at MIT and Harvard has agreed to act as my mentor and collaborate with me on a few publications. As an expert who studies the evolution and ecology of viruses, Dr. Ogbunugafor’s enthusiasm for my project has been invaluable. Secondly, Leif Richardson, researcher of plant-pollinator-pathogen interactions and coauthor of “Bumblebees of North America” has joined UVM as a USDA funded postdoctoral fellow. As an expert in bumblebee identification and pathogens, Leif has already provided intellectual support on my project.

**Future Goals.** *Intellectual Merit:*Graduate school will provide me with the skills necessary to pursue a career focused on conserving biodiversity and natural resources through research and environmental education. Conducting species surveys is an integral part of protecting biodiversity. Through my research and collaborations, I am learning methods and taxonomy necessary to implement long-term monitoring programs. Also through my research, I am learning molecular techniques that will allow me to answer more in-depth questions regarding complex pollinator-disease-environment interactions. Measuring these interactions at the molecular level remains a research priority for understanding the pressures affecting insect pollinators. I intend to combine my skills as a field biologist and a molecular researcher to answer ecological questions pertinent to pollinator ecology and conservation. My long-term goal is to follow these systems throughout my career in order to integrate the effects of climate change on pollinator-disease-environment interactions.

*Broader Impacts:*By remaining local and focusing my doctoral research in Vermont, I am maximizing my ability to network and communicate with the community. I have established contact with beekeepers through the Vermont Beekeepers Association (VBA) and I am actively testing honeybee hives for viral infection. In addition to spearheading Vermont’s involvement with the National Honey Bee Survey, I have proposed a major overhaul of the current database on registered beehives in VT. Updating this database is an important step in monitoring honeybee disease and maintaining healthy pollinator communities. With its agrarian landscape and receptiveness to new sustainable farming practices, Vermont is an ideal arena to begin education programs aimed at pollinator conservation. Building upon the native pollinator program I developed for the Ocean View Foundation, I will develop a similar program in Vermont that will highlight the agricultural and ecological importance of native pollinators while providing recommendations to improve their habitat.

Receiving the NSF Fellowship would allow for a different and more flexible graduate school experience. Presently, as a graduate teaching assistant, my field season is restricted by the academic year. If granted the NSF Fellowship, I can extend the field season and collect higher quality data as well as assist in sample collecting for the National Honeybee Survey. It would also allow me to develop education and outreach programs for different age groups similar to “The Great Sunflower Project”, a project that utilizes citizen scientists to collect data on bee populations throughout North America. My past experiences as an educator and field researcher lead me to imagine a career working for an agency that incorporates both research and teaching. The NSF Fellowship will benefit this future career by increasing my ability to conduct quality research and allowing me to broaden my teaching experiences.

As the first member of my family to attend college, I always viewed the opportunity as a privilege and as a result, remained hardworking. While always building upon my experiences, I have never lost sight of my passion for conservation through scientific research and education.

Now as a Ph.D. student, this remains my passion as I work to improve my skills for a future career. While it is a great opportunity for self-improvement, graduate school is also a chance to pursue meaningful research that will contribute the broader community.