Personal Statement, Relevant Background and Future Goals Statement

A beekeeping apprenticeship sparked my interest in native pollinator conservation. In the winter of 2011, I worked in the tropics with several holistic beekeepers and organic farmers. I was introduced to the overwhelming maladies affecting European honey bee (*Apis mellifera*) hives and witnessed the haunting lack of pollinators on fragrant blooming fruit trees. Local farmers told 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. Now, I am excited to be pursuing these research interests as a graduate student with significant field experience and a real-world perspective.

**Relevant Background.** In 2008, I was a third-year business student. My life’s trajectory was redirected after a semester studying conservation and tropical ecology in Costa Rica. While abroad, I conducted an independent research project on army ants entitled “*Eciton burchelli*: polymorphism of the submajor caste and foraging efficiency”. During this study, I investigated the selective pressures shaping the polymorphism of the submajor caste in *E. burchelli*. 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*. It was then I realized I could transform my passion for the natural world into a profession.

Since graduating from the University of Rhode Island, I 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). The experience enlightened me to the world of invertebrate conservation through the American Burying Beetle Reintroduction Project. Begun in 1990, the project is now the longest on-going reintroduction program for a 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 wrote land management reports 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.* Later during my internship with RWPZ, I was sent to Panama to assist with the invertebrate rearing facility that supports the captive amphibian population at the El Valle Amphibian Conservation Center. Later, I organized and gave 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, I worked 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 birds. In 2012, I worked as a backcountry Field Biologist for the Institute for Bird Populations. The work further ingrained in me the critical need to collect long-term data, 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 and collaborate 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 by exploring city parks and conducting classroom experiments. By year’s end, 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 1970s.

As a graduate student entering my second year, I have developed new skills and demonstrated aptitude as a teacher and researcher. Already, I have served as a TA for three different undergraduate courses. I have found the experience fun and my teaching has been well-received. Last summer, I was awarded money to develop an undergraduate lab entitled: “Evolution of antibiotic resistance” in which students will use their own *Staphylococcus* bacteria to test for antibiotic resistance.

Last year, my **NSF** **research fellowship proposal received an honorable mention**. Reviewers suggested that I include more mechanistic approaches within my proposal. Since then, I have been awarded four competitive grants totaling $8500 to develop the approaches I will use to mechanistically test the transmission and effect of RNA viruses in bumble bees. Support from the Garden Club of America, Pollinator Partnership, The Natural Science Museum, and the Roger Williams Park Zoo, has encouraged me that my work is broadly applicable to both the scientific and lay community. With the money received, I successfully reared bumble bee colonies from wild-caught queens, developed molecular protocols for isolating and detecting three RNA viruses from bees, conducted a survey of bumble bees and honey bees throughout northern Vermont, and performed several pilot experiments using captive colonies.

**On-going Collaborations, Outreach and Broader Impacts.** I recently identified a gap in communication between private, commercial, and governmental groups within Vermont that all share the goal of maintaining healthy bees. Although beekeepers in VT wish to partake in hive disease monitoring programs, the VT department of agriculture has not yet offered the opportunity to do so. Thus, I will be spearheading Vermont’s involvement with the National Honey Bee Survey (NHBS), an ongoing national 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 honey bee 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 (VBA), and VT’s largest commercial beekeepers. As a result of my communication with Bee Informed Partnership, a Farm Bill proposal was submitted this October that includes, for the first time, the state of Vermont in the National Honey Bee Survey. In January, I will present a formal proposal to VBA and the state outlining the course of action for Vermont’s involvement. Through my collaboration with NHBS, I plan to visit USDA’s Bee Research Lab in Beltsville, MD to standardize my lab protocols and learn new molecular techniques.

As a student in the biology department at UVM, I am fortunate to be supported by experts in my field of study. Firstly, my Ph.D. Advisor, Dr. Alison Brody, is a renowned field biologist and has provided her expertise in experimental design and helped me develop the intellectual merit of my ideas. Secondly, Dr. Joseph Schall, expert in the evolution and ecology of malaria parasites, has helped me to develop molecular protocols and allowed me access to his lab and equipment. A new postdoctoral fellow, Dr. Brandon Ogbunuga, who recently finished a joint postdoctoral fellowship at MIT and Harvard studying viral ecology and evolution, has agreed to mentor me in the lab and his enthusiasm for my project has been invaluable.

**Future Goals.**

*Intellectual Merit:*Graduate school is providing me with the skills necessary to pursue a career in conserving biodiversity and natural resources through research and education. Through my research and collaborations, I am learning methods necessary to implement long-term monitoring programs. I am also 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 will combine my skills as a field biologist and a molecular biologist 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 focusing my doctoral research in Vermont, I am maximizing my ability to network and communicate with the community. I established contact with beekeepers through the Vermont Beekeepers Association and I am actively testing honey bee hives for viral infection. In addition to spearheading Vermont’s involvement with the National Honey Bee Survey, I proposed a major overhaul of the current database on registered beehives in VT. Updating this database is an important step in monitoring honey bee 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 a more complete set of field measurements, as well as assist in collections for the National Honey Bee 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 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 a first-generation college student, I always viewed higher education as a privilege and have worked very hard at being successful. While gaining diverse experience, I have never lost sight of my passion for conservation through scientific research and education. Now as a Ph.D. student, research and education focused on conservation of pollinators occupies my attention as I work to improve my skills for a future career that will allow me to pursue meaningful research that will also benefit the broader community.