

A few months ago, my family re-discovered a series of home films, “DK’s Nature Show.” A 9-year old boy bursting with knowledge and energy discusses a new organism in each film: this week, banana slugs in temperate rainforests; next week, the reptilian denizens of a local pond. From my first pet lizard to my current biogeographical research, my passion for ecology defines me and motivates **my mission to conserve the most threatened wildlife and wildlands.**

Intellectual Merit and Research Experience: Since those early days, I have maintained a keen interest in collecting and studying herpetofauna (reptiles and amphibians), and in college I began systematic study of them. Before my first classes at Dartmouth, I reached out to evolutionary ecologist Dr. Ryan Calsbeek and soon began investigating frog ontogeny. Collecting wild specimens to monitor physiology, we found that optimized tadpole fitness detracts from optimized adult fitness. After several years with this lab, I was accepted into the REU program at Louisiana Universities Marine Consortium (LUMCON). Under Dr. Brian Roberts, I investigated the grazing habits of the abundant snail *Littoraria irrorata*. Along with gaining skills such as GS/MC and biomass sampling, **I learned that intense commitment to research does not always yield positive results:** despite 80-hour weeks on my experiments, I found that our scales were not precise enough to capture snail grazing rates. Undeterred, I proposed analysis of snail grazing by filming snail behaviors instead. I brought this project back to Dartmouth as my senior thesis and **independently developed experimental methods.** After processing 1,320 hours of snail movements, my relentless commitment paid off. **I received High Honors** for my work and will soon submit my first-author manuscript to the *Journal of Experimental Marine Biology and Ecology*. Although the daily efforts were not always riveting, **my intense curiosity for ecological questions kept me engaged and inspired.**

The same curiosity led me to one of the most complex and biodiverse ecosystems: tropical rainforests. A high school research expedition to Honduras had piqued my interest in this fascinating biome, so I embarked to Costa Rica for the Dartmouth Biology foreign study program. I worked with my peers to compose experimental designs, collect field data, present findings and finally **publish all of our studies in a peer-reviewed school journal.** Months spent collaborating with other driven ecologists taught me when to stick to my ideas, and when to yield to the opinions of others. Less than a week after graduation I returned to the rainforest, this time for six months as the Resident Naturalist for the Alliance for a Sustainable Amazon (ASA) in Madre de Dios, Peru. Among other biodiversity surveillance, **I spearheaded an investigation of herpetofauna diversity** in forests and adjacent agricultural lands. I also mentored dozens of visiting students and interns on research project design and facilitated cross-cultural connections between Americans, Europeans, and Peruvians. Living in such a poor region I witnessed the struggles of those not born to the privileges of developed nations and learned first-hand how unsustainable development yields rampant deforestation. I became acutely aware of the need for forest management, and my travels **confirmed my intent to investigate tropical rainforests.**

Upon my return stateside I independently conducted a case study on the economic viability of replacing nutrient-intensive papaya with forest-integrated cacao in Peru and presented my findings to the International Society of Tropical Foresters at the Yale Forestry School. Undergraduate coursework in GIS had spurred my interest in spatial data, so I joined the Smithsonian Conservation Biology Institute’s GIS lab, where I used satellite imagery to measure forest loss in Myanmar. This work has **yielded a first-author paper that will be submitted to Remote Sensing** and another manuscript in progress. After obtaining my federal remote pilot license, I also piloted unmanned aerial vehicles (drones) to develop protocols for monitoring forest condition and structure. I am currently drafting a proposal for NSF funding to pursue

drone surveillance of plant phenology for the Smithsonian, which has further **sparked my interest in applying remote sensing to understand ecology and biogeography.**

Now I am the Research Technician for the Smithsonian's Coastal Carbon Research Coordination Network (CCRCN). I have refined my R-coding skills and taught myself various other coding languages (Bash, Git, HTML, VBD) to curate a data clearinghouse of global wetlands and soil carbon stocks, translate a heavily-cited model into an open-source R package, and **deliver R-coding and GitHub tutorials** to postdoctoral and faculty researchers. I also co-manage a working group of international experts that is modeling variance in national carbon stocks, which has **exposed me to high-level modeling and synthesis of scientific data.** I have gained a unique data management skillset that is still scarce in ecology and project management experience that many researchers do not acquire until at least graduate study, **preparing me for synthesis of complex datasets and international collaboration for my dissertation.**

Broader Impacts: If research is the eyes of the scientific community, outreach is its voice: positive change requires proper communication and motivation. Since high school, my approach to outreach has been to engage those within and outside of science. As a canvasser for Environment New Jersey, I **learned to discuss environmental issues with citizens of diverse political opinion and successfully raised over \$20,000** to rank as one of the most productive of Environment America's thousands of fundraisers nationwide. While at Dartmouth, I tutored for the introductory Ecology class and advised 5th-graders on wildlife projects at a local school. My time at Dartmouth was also an opportunity to demonstrate leadership outside of science. I led incoming students on wilderness trips as a First Year Trips leader, and I guided peers through academic, mental health and family troubles as Chaplain for my social society. As a 4-year D-I Ultimate frisbee player, I mentored teammates on resilience and skill-building, and through the Rockefeller Alumni Mentorship Program I am advising an undergraduate on a career in biology.

While in Peru, I **served as the Teaching Assistant for a six-week Wildlands Studies tropical ecology and conservation course.** I used mixed methods to teach my students, such as an interactive plant taxonomy quiz, a workshop on developing research questions, and lectures on the competing practices and philosophies of conservation. Here at the Smithsonian, I built an interactive online map for visualizing and downloading CCRCN data, which has gained the endorsement of Conservation International as a primary interface for its Blue Carbon initiatives. I orally presented this map to the Restore America's Estuaries 2018 Blue Carbon National Working Group, which led to discussions with researchers, practitioners, and carbon credit economists that **broadened my understanding of how these stakeholders coalesce to advance science and application.** I have also recently joined RESET (Raising Excitement for Science, Engineering and Technology) to inspire hundreds of children about the importance of soil and carbon through my interactive (and edible) soil science exhibits.

Although my outreach efforts are diverse, I specialize in multimedia storytelling. On the Wildlands Peru course, I used my long-standing interest and skills in filmmaking to produce an outreach video that engages college students in the importance of ecological study. Upon viewing my film, the Wildlands director immediately hired me as a multimedia contractor, and I have since created four more course films. I also produce films on Smithsonian STEM education as a volunteer at the Natural History and Air & Space museums. Years of writing for my research blog developed my creative writing, and after a competitive hiring process I was selected as a contributing journalist for the environmental news hub Mongabay. **My specialized reporting on cutting-edge technologies relevant to conservation** has reached a broad audience through Mongabay's 2.5 million monthly viewers, and my work has been re-circulated by news

sources such as Fast Company, Pacific Standard, and New York Magazine. My simultaneous research, education, and outreach efforts testify to my commitment to science and conservation.

Research Plan and Career Goals: This past March I reached out to Dr. Brett Scheffers at the University of Florida to express my interest in joining his lab for graduate study. I did not plan to begin for another 18 months, but Dr. Scheffers' research on how tropical forest diversity, especially the herpetofauna of Madagascar, will be impacted by global change was a perfect match with my passions. Fiscally poor, yet biologically rich, Madagascar has been written off as a lost cause by many ecologists— but not all. Recognizing my potential, Dr. Scheffers shared a multi-year dataset of global forest microclimates in tropical and temperate forests. I curated and analyzed this data, noting a fascinating trend: the onset of forest foliage in the temperate summer reduces thermal variance, thereby climatically isolating forests at different elevations and increasing the difficulty for an organism to traverse an elevation gradient. Just six months later, **my first-author manuscript is now in review at *The American Naturalist*** as an update to Daniel Janzen's seminal "Mountain passes are higher in the tropics" (1967). This study has spurred my understanding of biogeography and how it influences ecological phenomena. My dissertation, building on this work, will apply novel tools to revisit fundamental ecological theory and improve forest restoration. The integration of high resolution remote sensing into ecology makes *now* an incredibly exciting time to explore global change through biogeography. **My ecological and geospatial skills prepare me to study how we can improve land management as we face anthropogenically-induced mass extinction.**

As an NSF Fellow, I would maintain my commitment to outreach far beyond the minimum expectations of involving undergraduates and presenting at conferences. As part of my ongoing training as a Data Carpentry instructor, I plan to offer coding and open-source collaboration workshops to fellow students and faculty. Capitalizing on my filmmaking expertise during fieldwork in Madagascar, I will produce films spotlighting both my research and the courageous reforestation work of some Malagasy villages. Via YouTube Kids, I plan to distribute films (perhaps again "DK's Nature Show") to expose children to the wonders of the natural world. The director of Wildlands Studies has **asked me to design and lead its inaugural Madagascar undergraduate course**, once I am a PhD candidate. Finally, my commitment to journalism is lifelong, and I have made plans with my Mongabay editor to continue reporting on conservation technology and, when in Madagascar, on local environmental news.

The joy of ecological research has cemented my intent to attend graduate school, but the spectrum of my conservation involvements— working beside farmers, fundraising, and engaging a broad audience through teaching and multimedia— has convinced me of **the need for meaningful connections between research and society**. Rather than merely observing the constant struggle against global threats, I will fight at the front lines: working with the most endangered systems, the most deprived communities. I see myself one day as the Executive Director of a research station in a developing tropical nation and an adjunct professor at an American university. I will coordinate long-term forest monitoring research that directly informs land management and conservation, fundraise to support education programs, and oversee outreach to local communities to collaboratively develop sustainable forestry and agriculture. As an American scientist working with global stakeholders, I am aware I will act as ambassador for my funding agency, country, and the research community, and **I seek to promote exchange of knowledge and resources between researchers and practitioners of different nationalities**. True to my mission, I hope to preserve the biodiversity that makes our planet so wonderfully complex and the forest resources that both localized communities and global economies rely on.