

Geo-Spatial Methods, Mobile Frugivores, and Fieldwork in Tropical Forests

My previous research on fruit bats in Fiji and on sustainable forest management in Malaysia will permit me to conduct transformative research on intra-topical migration. Below I highlight how these experiences helped me to develop: **(i)** research skills that include geo-spatial data analyses and working with large frugivores; **(ii)** broader impacts throughout the research process; and **(iii)** leadership, teamwork and efficacy working with local researchers.

i) RESEARCH SKILLS: In 2006, Dr. Thomas Gillespie (UCLA) mentored my critical literature analysis of keystone seed dispersers on Pacific islands. I identified a lack of research on fruit bats in degraded systems, so I designed a study on the Pacific flying fox, *Pteropus tonganus*, on the deforested Yasawa archipelago in Fiji. The UCLA Undergraduate Research Department awarded my proposal the highest stipend of the year, funding a summer of independent fieldwork.

My field objectives in Fiji were to (1) map the habitat mosaic across the entire Yasawa archipelago; (2) establish the *P. tonganus* abundance per island; and (3) survey *P. tonganus* roosting and feeding habits. In summer 2007, I completed my independent fieldwork over 62 days of extensive exploration on the 16 largest islands and 190 evening transects.

When I returned from Fiji, I received the Stone Research Grant to complete my data analysis during two semesters of independent honors research courses, overseen by Dr. Harmut Walter. Combining material from my GIS classes with self-taught skills, I overlaid satellite images from Landsat ETM+ with my GPS coordinates and land use maps in ArcGIS. I digitally transformed the islands and habitat mosaic into custom geo-referenced polygons, and then used algorithms to calculate the areas and summaries. This spatial data was combined with *P. tonganus* data to assess densities and feeding patterns. Finally, I analyzed the relationships between roosting patterns, feeding densities, overall *P. tonganus* abundance, island size, and land cover types with linear regression models.

The results tell a novel story: Despite deforestation and hunting, *P. tonganus* is flourishing due to preferential foraging in farmland for sustenance. Nonetheless, it still requires primary native forest fragments for roost sites. In my manuscript, I discuss the ecological implications of the loss of forest seed dispersal and the effects of farmland phenology versus forest phenology on seasonal distributions of *P. tonganus*^{1,2}. *My geo-spatial analysis skills, as well as the field experience I gained studying large flying frugivores, directly bolster my unique capacity to complete my proposed research on modeling phenology and tracking hornbills.*

ii) BROADER IMPACTS: During my time in Fiji, I presented animated ecology lectures to K-12 classrooms at 14 village schools across the Yasawas. After discussing the native flora and fauna, I distributed posters on their local ecosystem created by Dr. Gillespie's Lab. I also made presentations to guests, employees and owners at six local eco-resorts. In these presentations I described the environmental impacts of tourism and the resorts role in conservation.

During my stay in each village, I initiated dialogues with the chief and elders about land management options. During extended kava* ceremonies, I enumerated the benefits of their forests to tourism, the economic driver and primary employer on the archipelago. These assemblies routinely agreed that deforestation was primarily a residual effect of uncontrolled farmland burns and that improved fire management should be practiced.

To put the knowledge I gained in Fiji into the appropriate hands, I directly disseminated my results to the apt scientific audiences, as well as personally communicating it to local

*Kava is a ceremonial drink made from crushed roots, widely revered across Pacific islands

researchers. In June 2008, I was recognized as the only undergraduate to give a presentation to the AAAS Pacific Division meeting in Hawaii^{3,4}. To reach a wider audience interested in tropical ecology, I submitted a manuscript to *Biotropica*. The manuscript was accepted in February 2009; I am the sole author. Finally, by personally meeting with Fijian researchers at the University of the South Pacific in Suva, Fiji, I directly conveyed my results to a local audience.

During my recent in Malaysia, the broader impacts of my project were immediately thrust upon me. While staying in a logging camp deep in the rainforest, each day I was in direct contact with loggers and indigenous Orang Asli tribes living there. Although each group has opposing resource management goals, they both depend on the forest for their livelihood. My outlook on poaching, logging and successful conservation was drastically expanded. The consequences of my research on a spectrum of stakeholders were strikingly overt.

iii) LEADERSHIP AND TEAMWORK: As soon I was accepted to UC Berkeley in February 2009, I joined Malaysia's Conservation of Biodiversity team (CBioD), working for Dr. Matthew Potts. CBioD is a UN sponsored project run through the Forestry Research Institute of Malaysia (FRIM) that seeks to improve biodiversity in production forests through improved harvesting methods.

I worked with Dr. Potts to determine parameters for a CBioD logging/biodiversity model. This required a meta-analysis of the literature on extinction rates following various levels of logging. Subsequently, I worked with the CBioD economics team to create a picture-based household survey to estimate local valuation of rainforest species and processes. Working beside Dr. Potts illustrated how a different background can influence approaches and conclusions to the same problem. My effectiveness working on the economic survey team was vastly improved.

This summer, I worked alongside FRIM and CBioD researchers in Perak, north Peninsular Malaysia, setting up control plots and collect pre-felling data for an experimental logging site. During the first stage of fieldwork I managed four field assistants to complete the installation of dendrometers on more than 600 trees. During the second stage I worked with US and Singaporean researchers, as well as Malaysian forestry students, collecting soil moisture data, woody debris, tree cores and canopy leaf samples for stable isotope and biomass analyses.

These projects required collaboration with foreign organizations and students in order to conduct a wide range of research and conduct remote tropical fieldwork. *To complete my proposed research plan, I will build on my relationship with FRIM and local researchers in Malaysia, as well as incorporating students in Thailand.*

PUBLICATIONS:

¹LUSKIN, M.S. In press. Flying Foxes Prefer to Forage in Farmland in a Tropical Dry Forest Landscape Mosaic in Fiji. *Biotropica*.

²LUSKIN, M.S. 2008. Farmland Impact on **Seed Dispersal** by Flying Foxes in Tropical Dry Forests. *Proceeding of the AAAS Pacific Division*: Vol 27, Part 1, p.43.

³LUSKIN, M.S. 2008. Deforestation = Fruit Bats? UCLA Senior Thesis, UCLA.

PRESENTATIONS:

⁴LUSKIN, M.S. "Farmland Impact on **Seed Dispersal** by Flying Foxes in Tropical Dry Forests" presented at the American Association for the Advancement of Science, Pacific Division; Waimea, Hawaii. June 2008.