ECOLOGICAL IMPACTS OF FOREST DISTURBANCE ON RING-TAILED LEMURS (*LEMUR CATTA*) IN THE BEZA-MAHAFALY SPECIAL RESERVE REGION: IMPLICATIONS FOR CONSERVATION IN AN ALTERED LANDSCAPE.

by

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Ecological Impacts of Forest Disturbance on Ring-tailed Lemurs (*Lemur catta*) in the Beza-Mahafaly Special Reserve Region: Implications for Conservation in an Altered Landscape.

Thesis directed by Associate Professor Michelle L. Sauther

Forest disturbance, both natural and anthropogenic, has been recognized as a severe threat to primate populations on a global scale. Moreover, primates tend to vary, between species and between sites, in their tolerance and response to disturbances. Perhaps because of this variability, the effects of ecological perturbations on primates remain relatively poorly understood. Understanding disturbance effects and the ecological variables that are particularly potent for primates will provide sound data for effective conservation management. In this dissertation, I examine the effects of anthropogenic disturbance and a destructive cyclone on the ecology and behavior of the ring-tailed lemur (*Lemur catta*) at Beza Mahafaly Special Reserve in southwestern Madagascar. I present data from four study groups (two in the protected Reserve and two in anthropogenically disturbed, unprotected habitats). Cyclone Ernest affected this region when it made landfall in January of 2005, seven months prior to the beginning of this study. These natural and anthropogenic disturbances have altered forest structure and phenology. Groups inside the Reserve tend to eat more terrestrial herbs and vine leaves. Additionally, Reserve Groups also rely on a fewer number of species for the majority of their diet. It appears that in more marginal habitats, *L. catta* is able to diversify its diet and exploit foods that might not be their primary choice. Non-Reserve Groups also inhabited smaller home ranges, but had higher daily path lengths than groups residing in the Reserve. Additionally, Non-Reserve Groups utilize open canopy areas and habitats with higher degrees of disturbance to a

greater extent than Reserve Groups. Non-Reserve Groups spend more of their active time both feeding and traveling than groups inside the Reserve. Non-Reserve Groups devoted less of their time to resting compared to Reserve Groups. Groups in unprotected habitats have greatly reduced group cohesion, lower rates of grooming, and elevated levels of aggression. Preliminary data show higher rates of injury and mortality for groups living outside of the protected forest. Anthropogenic habitat alterations, coupled with stochastic changes from tropical storms, have changed the landscape both in and around BMSR and contributed to survival challenges for *L. catta* in the area.

This dissertation is dedicated to Jason and Aidan –
for living this project with me and finding the strength to help me through it.
And for Aamion, who will also know the wonder of Madagascar and its lemurs.

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I have been lucky, fortunate, and sometimes undeserving to have the biological anthropology faculty team at the University of Colorado at Boulder supporting, teaching, guiding, and prodding me along. To thank them appropriately, I need to step back a few moments in time to my first introduction to anthropology. I was 18 and working for a few weeks at a refugee camp in Thailand. I met a woman who was doing interviews, and focusing on mother/infant care in the camp. I was enthralled – who was this woman and what kind of job lets you embed yourself in a culture, learn the language, and then apply your work to help people? Her answer was simple, "I'm an anthropologist." Enough said. That fall, I took my first anthropology class and was hooked. I was drawn to anthropology's holistic look at biology, humanity, culture, and evolution. My path to focusing on primates was circuitous. Starting with my first field job living in a monastery with Buddhist monks in Indonesia, to digging up hominid fossils near Lake Turkana, I found myself shying away from directly engaging with people and needing something more dynamic than a toothbrush scraping away dirt on a fossil. One day, as I was pulling out my fiftieth ostrich eggshell bead of the day next to Lake Turkana, a troop of baboons sauntered past. That's the ticket, I thought – extant primates. This circuitous route has been my foundation to truly appreciating anthropology's multifaceted, multivariable approach to examining the natural world, and the interplay between humans and earth's natural history. My faculty support at CU has built on this foundation because they are all true anthropologists and scholars– while they are laser focused on the intricacies of their own research, they also fundamentally understand, and speak eloquently to, the larger picture, the holistic perspective and anthropological paradigm that is essential to true anthropology. Culture, biology, evolution, history, are all part of their anti-myopic views of the world. This perspective is invaluable to the

students they reach every day in lecture, their graduate students, and the world they reach through their research. My committee, Dr. Covert, Dr. Dufour, Dr. Sponheimer, and my advisor, Dr. Sauther, are each true anthropologists, and I am indebted to them for instilling this quality in my own anthropological perspective and being able to apply it beyond the academic world. Dr. Armstrong, an exceptional teacher and source of knowledge, was instrumental in my training to placing primates within the wider context of mammals and the natural world, and asking the very important question, "why is a mammal?". Thank you for working with me over my graduate career and participating in my committee.

Dr. Michelle Sauther first introduced me to Madagascar and its lemurs. I remember standing next to her as dusk approached and looking up at a troop of brown lemurs scurrying through the canopy covering the red road we were traveling on. Our next sighting was a group of sifakas vertically clinging and leaping along the Mangoky river – I was hooked. I am indebted to Michelle for spending the time to coax the scientist in me along, sculpt my ideas into hypotheses, and guide me in crafting my project. She is a gifted scientist, teacher, mentor, and friend. I hope to take her perspective and channel it into my own niche. I'm not sure either of us knew how much of life happens while we are in graduate school, or how much the advisor is critical to the momentum of motivation: She flawlessly rose to the occasion and has never doubted my ability to achieve my goals. I have always been able to rely on her for support, friendship, sound judgement, and inspiration – even from far away. I admire her dedication to BMSR and firmly believe that sound conservation comes from passionate individuals who invest years in understanding the dynamics of their forests; The ring-tailed lemurs at Beza are lucky to have Michelle.

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During my fieldwork, several important people helped me with my research, and contributed to making daily life easier and full of tremendous memories. Hallie Jensen (now St. Onge) came on this wonderful adventure with my family and me and rose to the occasion every day helping me run after our 2-year old, collect data, search for hard to find lemurs, and is a great friend. James Loudon - fellow graduate student, primatologist, and all around great guy – helped

make a very long year in the field tremendously rich with laughter, conversation, music, and friendship. James is a true friend, and I am lucky to count him as one of mine.

Several people helped make the writing process move forward as a I took a position at a natural and cultural history museum before I had finished writing, and I thank them for their patience and motivation. Paul Thoma spent countless hours with me and my statistics - always with a helpful spirit and timely responses: Thank you for repeatedly explaining the same concepts. Janeanne Upp believed in me, motivated me, and has given me tremendous opportunities to apply anthropology in the museum world: thank you.

My parents, Eloise and Ed, have been influential forces in helping me explore the world and follow my passion. And, to this day, they are still excited about every detail of these endeavors. Their sense of adventure and interest in the natural world has inspired me to pursue this path. Moreover, their unfailing support of every decision (even dragging their first grandson across the world to live in a tent) is inspirational. I am lucky to have them in my cheering section. I hope to do the same for my children – they have set the bar very high.

While he won't remember every detail, my son Aidan was an integral part of this project, and I will always remember sharing fieldwork with him. He was two years old when we arrived in Madagascar and he spent the year making up his own Malagasy/English dialogue with Tsamsia, playing in dirt, eating mangos, spotting the lemurs when I couldn't, and keeping Jason and me on our toes as we potty trained and kept him safe from scorpions. Seeing Madagascar through his eyes was priceless.

I am saving the most important thank you for last. Jason, my husband, traveled and worked side by side with me, kept our son safe and having fun, and supported my dream of living with primates. I hope I can return this gift to him someday. My thanks can never be enough.

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