### Thesis Prospectus 2022-23

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**Student Final Submission (date):**

**Faculty Reader Approval (date):**

**MES Director Approval (date):**

1. Working title of your thesis[[1]](#endnote-1).

“Using passive acoustic monitoring to better understand lowland rainforest birds throughout Sarawak, Malaysia.”

1. In 250 words or less, summarize the key background information needed to understand your research problem and question.

Situated within the Sundaland biodiversity hotspot, the island of Borneo hosts a remarkable assemblage of fauna and flora. Over 670 species of birds occur on the island, of which 50 are found nowhere else on Earth. While the island is one of the most biodiverse in the world, there have been very few detailed studies on the life-history or ecology of Bornean birds and our understanding of them is still developing. Of the 430 resident species, nearly 30% are listed as Near Threatened, Vulnerable, Endangered, or Critically Endangered by the IUCN.

Coincidentally, this region is under incredible human pressures contributing to deforestation and there is a long history of forest products from this area. To alleviate the burden on threatened natural forest while still providing opportunities for economic wealth and biodiversity conservation, systems for sustainable management of forest resources have been adopted with support from Sarawak government and the timber industry itself. In an effort to strike a balance between timber production and conservation areas, Sarawak has moved toward planting

production forests with species like *Acacia mangium*, allowing areas of natural forest to regenerate throughout. While this provides benefits for wildlife, habitat fragmentation is unavoidable, and little is known about how this will impact local birds. Although halting this process is not possible, plantation management plans can support biodiversity conservation. Forest fragments have the potential to harbor impressive amounts of biodiversity and can serve as connectivity between areas of native forest in a monoculture setting.

1. State your research question(s).

How do birds move through a plantation? How does forest structure influence bird occupancy throughout a production forest landscape? Do planted forest fragments function as “suitable” habitat for birds that occupy native or secondary growth fragments? How does species richness and composition change between these fragments? Do planted forests function as corridors between native fragments? Do certain species prefer or avoid specific habitat variables in a production landscape? What species can be used as indicators for forest health?

1. Situate your research problem within the relevant literature. What is the theoretical and/or practical framework of your research problem?

Much of SE Asia’s primary forests have been logged and in recent years have been replaced by plantations of exotic trees for both industrial and agricultural purposes. As concerns arise that monoculture plantations will have unfavorable effects on biodiversity, research on animals within plantations is essential. Forest fragments dispersed throughout the production landscape have the potential for harboring impressive amounts of native forest birds and little is known about the species that inhibit them. My proposed research will provide insight to the poorly understood ecology of Bornean birds and gather data necessary to investigate disturbed landscape effects. This data can be used to identify management needs for rare and threatened species and inform conservation plans.

1. Explain the significance of this research problem. Why is this research important? What are the potential contributions of your work? How might your work advance scholarship?

We know relatively little about Bornean bird’s behavior, diet, or basic life history events. Additionally, there have been very few detailed studies on forest fragments within a plantation matrix and gaining a better understanding can help identify management needs for rare and threatened species, as well as establish a structure for long-term study and monitoring.

1. Summarize your study design[[2]](#endnote-2). If applicable, identify the key variables in your study. What is their relationship to each other? For example, which variables are you considering as independent (explanatory) and dependent (response)?

I deployed audiomoths in secondary forest fragments and river buffers, as well as groves of different ages of acacia, eucalyptus, and albizia forests. Moths were at least 150m from roads/trails and 150m from each other. They collected dawn chorus (0600-0830) and dusk chorus (1630-1900) recordings for a minimum of 8 days, although some ran for longer. Habitat surveys were also completed for each site. My independent variable is forest type /structure and my dependent variable is species occupancy. If possible, I would like to acquire data on forest fragment sizes (either through GIS, or collaborators knowledge, likely a combination of both). My hypothesis is that fragment size and structure, distance to other like-fragments, and surrounding habitat will influence species occupancy for each site.

1. Describe the data that will be the foundation of your thesis. Will you use existing data, or gather new data (or both)? Describe the process of acquiring or collecting data[[3]](#endnote-3).

I collected new data for my thesis, at Samarakan Nursery throughout June/July in 2022. I deployed audiomoths for several days at a time, completing a habitat survey upon initial deployment. After the recording period was finished, moths were then taken down, files were downloaded, and the moth was re-deployed at a new location. Original research plans included multiple moths for each fragment and surrounding area. Because of physical obstacles (road closures, forest flooding, etc.) our research plan was adapted to fit places that we could realistically deploy moths.

This research is contributing to a larger long-term research project focused on the conservation and ecology of Bornean birds. In addition to utilizing recordings collected at Samarakan, I will be utilizing recordings collected on previous research trips by collaborators.

1. Summarize your methods of data analysis. If applicable, discuss any specific techniques, tests, or approaches that you will use to answer your research question.

Audio files will be analyzed using Arbimon by Rainforest Connection. Using this platform, I will create templates for desired species calls and use a pattern matching analysis to generate an output of potential matches. I will then verify species presence/absence for everyday the moth was deployed. I will use the “unmarked” package from R to get true occupancy rates, considering probability of detection and changing habitat variables.

1. Address the ethical issues[[4]](#endnote-4) raised by your thesis work. Include issues such as risks to anyone involved in the research, as well as specific people or groups that might benefit from or be harmed by your thesis work, perhaps depending on your results. List any specific reviews you must complete first (e.g., Human Subjects Review or Animal Use Protocol Form).

Ethical concerns raised by my thesis work include individuals and forest activities being captured on recording units unknowingly. Additionally, some birds are facing pressure from song-bird trade and recordings of certain species are restricted on many resources to protect them. To address both concerns, recordings with any sensitive species or human activities will remain private. Other ethical concerns arise when handling birds for banding efforts. We will follow the North American Bander’s Code of Ethics and release birds showing any signs of stress, design mist net set ups appropriately, and remain accountable throughout our process to ensure bird safety.

1. List specific research permits[[5]](#endnote-5) or permissions you need to obtain before you begin collecting data (e.g. landowner permissions, agency permits).

Permits were obtained through Sarawak Online Research Application System (SORAS, https://soras.sarawak.gov.my/soras/welcome).

1. Reflect on how your positionality as a researcher could affect your results and how you will account for this in the research process[[6]](#endnote-6).

My understanding of Bornean rainforests, the birds that inhibit them, and land use change in the area has been largely informed by working with datasets from and the region for the past two years and recently conducting fieldwork there. Through this work, I have learned a great deal about my own privilege as a western scientist and how my positionality as a researcher can influence the assumptions about the way we interact with our environment and relate to it. To account for this, I will have to be very intentional about my choice of data processing and interpretation of results. This will include transparency of data/results and ongoing conversation with collaborators. Furthermore, my positionality as a woman in science allows me to encourage social change through confronting inequalities and uplifting individuals struggling with factors and forces that constitute the politics of science.

1. Provide at least a rough estimate of the costs associated with conducting your research, if any.  Provide details about each budget item so that the breakdown of the final cost is clear.

International flight round trip~$2,500

AudioMoth batteries ~50

Food during fieldwork – $7/day provided by collaborators

Transportation/Fuel $9/day – provided by collaborators

Samarakan guest house $12/day – provided by collaborators

1. Provide a detailed working outline of your thesis.

Acknowledgements

Abstract

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1. Provide a specific work plan and a timeline for each of the major tasks in the work plan. Be as realistic and specific as you can at this point, including the deadlines for Spring quarter.

My goal is to have a complete rough draft before winter quarter begins. I am currently in good shape for this and will use time over break to wrap up the draft. I will spend a good portion of winter break and winter quarter analyzing my data. This includes searching recordings for target species and validating results. I will continue to work on my manuscript between species validations and running output in R. My goal is to have acoustic analysis completed before spring quarter.

1. Who (if anyone), beyond your MES thesis reader, will support your thesis (in or outside of Evergreen)? Be specific about who they are and in what capacity they will support your thesis. If you are working with an outside agency or expert, be specific about their expectations for your data analysis or publication of results.

Alison Styring will serve as my thesis reader. Additionally, Alison and I meet weekly with collaborator Dan Froehlich, and monthly with collaborators Fred Sheldon, HC Lim. Collaborators in Borneo include Sarawak Forestry, GPP, Universiti Malaysia Sarawak, and RIMBA. All of these individuals have greatly influenced me as a scientist and have provided advising in some aspect or another.

1. Provide the 5 most important references you have used to identify the specific questions and context of your topic, help with issues of research design and analysis, and/or provide a basis for interpretation. Annotate these references with notes on how they relate to/will be helpful for your thesis. For any other sources cited in your prospectus in other answers, provide a complete bibliographic citation here as well.

Styring, A. R., Unggang, J., Jukie, A., Tateh, O., Megom, N., & Sheldon, F. H. (2018). Bird community structure in native forest fragments and Acacia mangium plantations in Borneo. The Wilson Journal of Ornithology, 130(1), 112-130.

This study examines the interaction between native forest and plantation in relation to bird communities. Research was conducted in Sarawak, Malaysia throughout the Planted Forest Zone. The researchers conducted point count surveys with recordings. Although their methods are slightly different than what I plan to do, the research topic is applicable, and this article has been a great reference for context regarding forest fragment impacts on birds and study scope as a whole.

Campos-Cerqueira, M., & Aide, T. M. (2017). Changes in the acoustic structure and composition along a tropical elevational gradient. Journal of Ecoacoustics, 1(4).

Although this study looks at an elevational gradient, it has been extremely helpful in respect to technical methodology. The researchers collected acoustic data and analyzed it in a program called Arbimon, the platform I am using to analyze my acoustic data. The acoustic processing techniques they describe have been extremely helpful in figuring out the soundscape composition and navigating the Arbimon platform.

Burner, R. C., Styring, A. R., Rahman, M. A., & Sheldon, F. H. (2019). Occupancy patterns and upper range limits of lowland Bornean birds along an elevational gradient. Journal of Biogeography, 46(11), 2583-2596.

This study examines Bornean bird species distribution along an elevational gradient. It has been extremely helpful for methods of occupancy modeling and co-occurrence patterns. Additionally, the authors have shared some of the R code they used in this analysis, which will be great reference while I am running my analysis.

Jahn, P., Ross, J. G., MacKenzie, D. I., & Molles, L. E. (2022). Acoustic monitoring and occupancy analysis. New Zealand Journal of Ecology, 46(1), 1-11.

The researchers use Passive Acoustic Monitoring to determine occupancy of cryptic and elusive species, targeting for the Roroa-great spotted kiwi (Apteryx maxima) for a reintroduction effort. Although I am targeting more than one speices, some of the methods outlined in this paper will be helpful for my audio analysis. It has also been incredibly insightful for using acoustic data to monitor wildlife.

Balantic, C., & Donovan, T. (2019). Dynamic wildlife occupancy models using automated acoustic monitoring data. Ecological Applications, 29(3), e01854.

This article has been a main source for exploring methodology for using bioacoustics data in occupancy models. It has been particularly helpful in navigating false-positive and false-negative detections and how to account for that in my model. Additionally, they give a lot of insight to presence/absence datasets and have been a great reference for data formatting.

1. You are not locked into this title; we want you to identify the main point or topic of your thesis. [↑](#endnote-ref-1)
2. You might discuss selection of case studies, sampling methods, experimental design, and/or specific hypotheses you will test. You should also address any specialized knowledge or skills that are necessary to complete the research. [↑](#endnote-ref-2)
3. If you are planning to use existing data, explain the specific source, contact information, arrangement with collaborating agencies, and expectations about use of data and final products of your research. If you are planning to gather new data, describe specific methods, time, place, and equipment that will be required. [↑](#endnote-ref-3)
4. If you’re not sure where to start, consult a ‘Code of Ethics’ or other similar document from an academic society in an applicable field of study. [↑](#endnote-ref-4)
5. If you are collecting ANY samples or data, even observational data, on public lands (city, county, state and/or federal) it is your responsibility to find out the permit requirements BEFORE you collect data. Conducting research with tribal members/on tribal lands will have different and additional requirements. [↑](#endnote-ref-5)
6. Your *positionality as a researcher* refers to the fact that one’s “…beliefs, values systems, and moral stances are as fundamentally present and inseparable from the research process as [one]’s physical, virtual, or metaphorical presence when facilitating, participating and/or leading the research project…” (The Weingarten Blog 2017). [↑](#endnote-ref-6)