**Species richness resilience to habitat fragmentation and restoration in tropical rainforests**

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David Luther

CO-PIs

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OBJECTIVE

Increase collaboration between GMU, JMU, and UVA researchers to: increase competitiveness for external grant funding, better understand effects of fragmentation on tropical biodiversity, mentor graduate and undergraduate researchers, and create new instructional labs for undergraduate students.

PROJECT SUMMARY

Habitat destruction is currently the greatest threat to biodiversity, especially in tropical ecosystems. The Biological Dynamics of Forest Fragments Project (BDFFP) is the longest-running study of the effects of tropical forest fragmentation on biodiversity, and has generated a wealth of information relevant to understanding and conserving Amazonian biodiversity. While the original intent of the BDFFP was to assess the impact of fragment size on biodiversity, second growth habitat has now connected the mature fragmented forest with the nearby continuous forests. In addition, second growth forest is becoming an increasingly important part of tropical landscapes. The future of tropical biodiversity may hinge on the capacity of mature forest species to maintain populations in second growth habitats. We propose to conduct terrestrial and arboreal camera trapping as well as acoustic recordings to investigate the effects of forest fragmentation, and forest regeneration on birds, mammals, and frogs at this site for a fuller understanding of the ecological and conservation ramifications of deforestation, and regeneration in tropical forests. Recent technological advances for field cameras and automated recorders will allow greater sampling and will be placed at the BDFFP 1ha, 10ha, and 100ha fragments, second growth forest, and adjacent contiguous forest. We predict that terrestrial mammals and birds will be more likely to move through the second growth forest and repopulate the fragments than arboreal species. We also predict that frogs will be less likely to be detected in the second growth and the fragments will also have fewer frog species than the contiguous forest. Results from this study will inform ecologists and conservationists about both the effects of habitat fragmentation on tropical species but also which species are most likely to colonize restored habitat. We will also help train the next generation of ecologists and conservationists.

PROJECT START DATE

19-May

PROJECT END DATE

20-Dec

PAID FACULTY

0

VOLUNTEER FACULTY

0

PAID UNDERGRADUATE STUDENTS

8

VOLUNTEER UNDERGRADUATE STUDENTS

8

PAID GRADUATE STUDENTS

1

VOLUNTEER GRADUATE STUDENTS

1

PARTICIPANTS

David Luther, PI faculty volunteer Biology Department GMU

Tom Lovejoy, Co-PI faculty volunteer Environmental Science and Policy Department GMU

Lara Kazo, MS student thesis on acoustics paid ESP graduate student GMU

Justin Cooper, research technician volunteer Biology Department GMU

Jessica Deichman, tropical bioacoustics expert volunteer Smithsonian Institution

Marieke K Jones, Claude Moore Health Sciences Library UVA

Dana Moseley, Co-PI Biology Department volunteer JMU

OTHER UNIVERSITIES/ORGANIZATIONS INVOLVED

James Madison University

University of Virginia

Smithsonian Institution

PROJECT LIFECYCLE

The project will have 5 stages; planning for field work (March -June 2019), field work to deploy the cameras and recorders (June - Aug 2019), identification of species from the cameras and recorders (September 2019 to March 2020), analysis of results (March to June 2020), and research papers and presentations (June to December 2020). The expected outcomes of the research are 4 peer-reviewed research papers, 1 Master’s Thesis, 4 undergraduate research projects, 2 research presentations at international conferences, and new laboratory activities based on this data for bio 103 and bio 473 all by winter 2020. With the data collected from this project we will also apply for an NSF LTREB grant in the winter of 2020.

4-VA ALIGNMENT

The proposed research will meet several of the 4-VA initiatives. The research is collaborative between researchers at GMU, JMU, and UVA and the data from this project will result in more external resources to GMU and UVA from federal granting agencies. In addition material from this study will be used to create new laboratory activities in Introductory Biology (103) and Animal Behavior (473) classes that will effect hundreds of students every semester, and result in improved student success as they will learn new technologies and skills they can apply to future jobs and graduate school applications. GMU faculty, graduate students, and undergraduates will plan and carry out the project, UVA faculty will participate in project planning and statistical analysis, JMU faculty will participate in planning, undergraduate mentoring, and analyses of bioacoustics results. Drs. Luther and Moseley will lead a bioacoustics workshop for the undergraduates and graduate students in their labs. We will convene for an all-day workshop in Front Royal at the GMU SMSC campus to better learn how to process and analyze big data associated with multiple sound recordings using sound analysis software and statistical packages in R. Outcomes from the workshop will inform undergraduate labs and activities in both GMU and JMU courses such as a newly designed Ornithology course using the C.U.R.E. method at JMU and the Animal Behavior course at GMU. Dr. Moseley will ask for complementary funds from JMU as a part of our collaboration on this project.

MEASURES OF SUCCESS:

1. Successful recordings and camera images from the Amazon

2. Training/mentoring 4 undergraduate researchers per semester to identify and analyze images and sound files

3. 1 Master’s thesis completed and defended

4. 4 peer reviewed publications

5. 2 presentations at conferences

6. New laboratory activities written and implemented in Biology lab courses 103 and 473.

PUBLICATIONS/PRESENTATIONS

4 peer reviewed publication by fall 2020

2 presentations at conferences during the summer of 2020

NSF LTREB grant submitted fall 2019

FURTHER FUNDING

The 4-VA grant would be seed money for preliminary data used to apply for an NSF LTREB grant worth roughly $500,000 in 2020.

In 2021 we anticipate applying for a NASA grant to overlay spatial imagery to the sites we sampled with cameras and bioacoustics.

EXPENSES/BUDGET

No request for faculty stipends

GRADUATE STUDENT STIPENDS

Lara Kazo MS student $1500 for summer, June - August, 2019

UNDERGRADUATE STUDENT STIPENDS

4 undergraduate students (to be selected if we are funded) September 2019 to May 2020, $500 per person per semester = $4000

MATERIALS

* reconyx cameras to take pictures of terrestrial animals $399.00 per unit, 10units, total $3,990 spring/summer 2019
* audio moth recorders to record animal vocalizations $79.00 per unit, 10units, total $790 spring/summer 2019
* python locks to lock cameras to trees in the forest $20.00 per unit, 10 units, total $200 spring/summer 2019
* Foreign: $3100 for two round trips Washington DC (Justin and Lara) - Manaus (@$1300/trip for airfare and ground travel plus $300 for consular and notary fees and $200 for Brazilian Federal Police registration).
* 20 round trips to the field or transport between camps @ $30/trip = $600 [local travel]
* 180 person/days of lodging and food @ $20/day = $3600 [supplies]
* Travel to Front Royal for all-day acoustic data workshop with JMU and GMU students (gas and lunch provided for participants) = $250

OTHER

* 40 days of assistance by a BDFFP field assistant @ $35/day = $1400 [salaries]
* Camp and road maintenance (5% of travel, food, and field assistant) = $250 [other]

TOTAL BUDGET

$19,680.00