



Herptofaunal Abundance and Diversity in Terre-Firme Forest and Edge Habitat

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Abstract

Madre de Dios is in the southwest border of the Amazon basin and borders Brazil and Bolivia. This area is a hotspot for biodiversity in herptofauna but the landscape is changing due to humans. Human interaction with the environment is harming many animals and insects, and especially for herptofauna. Herptofauna are extremely susceptible to being affected by changing environments, so it is important to record and document these amphibians and reptiles. Using drift fence pitfall traps and visual encounter surveys this study collected and recorded amphibians and reptiles within Finca las Piedras in the Madre de Dios region of Peru.

Introduction

The Amazon Basin is the largest tropical rainforest and is home of the most diverse habitats for wildlife in the world but, there are still many species waiting to be discovered. Within the Madre de Dios department in southeastern Peru there is a high biodiversity of species as well as many threats to these species. Some major issues within this area include human settlement of the area, gold mining, and other anthropogenic impacts (e.g., illegal logging, slash-and-burn agriculture). Increased human settlement and agriculture have an enormous impact on amphibians because they are highly susceptible to chemical changes. Because many reptiles and amphibians inhabit the soil or leaf litter they are difficult to observe (Conant and Collins, 1998; Todd et al., 2007), so they will be the main focus of the study. Most of the changes in habitat and environment show negative effects on biodiversity and abundance of species. Conservation is an extremely hard topic here because habitat destruction is

happening so fast and environmental law enforcement is difficult to regulate in such a large area. Because of this, species richness and biodiversity should be monitored and kept track of for the protection and conservation of the species.

Monitoring species richness and biodiversity is a good way to keep track of certain species and how they are maintaining life within the changing habitat. Monitoring species can help in long-term, by showing declines or increases in species richness in certain areas of concern, such as the Amazon Basin and more importantly the area of Finca Las Piedras. Finca Las Piedras is a 54-ha site in the Madre de Dios department, that has a few habitats such as terra firme forest, grassland, and palm swamp. The terre firme forest has been selectively logged for the last 30-40 years and the grassland is abandoned agriculture fields.

Due to the difficulties of monitoring amphibians and reptiles because of multiple variables such as terrestrial and nocturnal habits, small in size, and cryptic behaviors,

drift-fence pitfall traps are one of the most used ways to catch herpetofauna (Bury and Corn, 1987; Enge, 1997). Visual encounter surveys (VES) are also used a lot when conducting herpetology research. VES can aid in monitoring larger species that can escape the pitfall traps as well as other species that have arboreal habits such as tree snakes and tree frogs.

The aim of this project is to expand the current species list at Finca Las Piedras (currently 22 amphibians and 33 reptiles), compare data from mid dry season in 2017 to the beginning of the wet season in 2019, compile the difference in abundance of species from the forest vs. forest edge, and to show a species accumulation curve. Comparing data from years past and current, and also from dry season to wet season allows a better conception on what species are more likely to be here during what season. Last is the species accumulation curve which will allow a visual representation of days of collection vs. the amount of new species discovered.

Methodology

Study Site

This study took place at Finca Las Piedras, the field site for the Alliance for a Sustainable Amazon (ASA) near Puerto Maldonado, Madre de Dios, Peru. The 54-ha site includes a few different habitats, terra firme forest, palm swamp (aguajal), and grassland. The terra firme forests are unflooded forests (Condit et al, 2002) and this particular forest, it was selectively logged the last 30-40 years, removing all mature big-leaf mahogany (*Swietenia macrophylla*) and Spanish cedar (*Cedrela*

odorata) and most of the ironwood (*Dipteryx micrantha*) (Suess, 2017). Within palm swamps, palms are primarily the major components of the forest canopy (Kahn, 1991). The sites for this study because of time constraints and previous knowledge include terra firme forest and on the forest edge, two drift fence and pitfall traps per site. The location of each site is in the GPS labeled INTERNS 1 which are 11E01, 11E02, 11F02, and 11F03. The code for each site is as followed, [11] indicates Finca las Piedras, [E] edge, [F] forest, and [01,02,03] show which trap site . This field site was only studied 2 years ago from 7/22/2017 to 9/06/2017 by a previous intern for ASA, Tobias Suess, so this is furthering his research. While his research was in the dry season (Suess, 2017) more in particular the end of the dry season, this research will be done from 09/27/2019 to 11/04/2019 right as the wet season begins. His research included three habitats, terra forest, terra forest edge, and grassland. The grassland field site had a small diversity of species and caught mostly rats and field mice. So for this study, the grassland field site was not used.

Methods

Upon opening the pitfall buckets a GPS system was used to find the previously used drift fence and pitfall traps. Once the traps were located, some maintenance was done to help reconstruct and clear any fallen trees on the fences or buckets. This was done by using a machete, saw, and string to hold up the fence by attaching it to a nearby tree. The traps were constructed by Suess at least 100 m from each other, at least 50 m from a 4 m wide unpaved road and at least 5

m from a 1 m wide trail (Suess, 2017). The trap locations were randomly chosen with the software, Basecamp (GARMIN) (Suess, 2017). Each pitfall trap is constructed of four 18 liter buckets buried up to the rim, black mesh fence, and wooden stakes. The traps are arranged in a Y-shape with 5 meter long mesh fence arms, a bucket at the end of each fence and a bucket in the center. Each bucket has a corresponding code starting from the northern most bucket labeled [1], then following clockwise [2-3] and the center bucket is [4]. When going to check the traps, Rite in the Rain notebook and pen, GPS INTERNS 1, phone camera, and containers are brought to the sites.

Traps are checked every day in the morning ranging from 7:00AM to 12:00PM and on the off chance on Sunday evenings. When checking the traps, the date, time,

weather, rain status, trap ID, bucket ID, capture ID and notes are taken. Walking along the drift fence some species may be present; they are captured and recorded as well as specimens in the pitfall traps. Extra precaution is taken care when dealing with the specimen, making sure DEET is not applied to skin when handling them to ensure no specimen gets injured. Once specimens are caught the known species are recorded and released and then the new or unidentified species are placed in a plastic container, mesh cage or fabric bag and are brought back to the lab for identification. Once the specimens are identified, pictures are taken and the information of the specimen is put into the sightings log and ASA herpetology excel file as well as the FLP amphibian guide. Then the specimen are brought back to the area of capture and

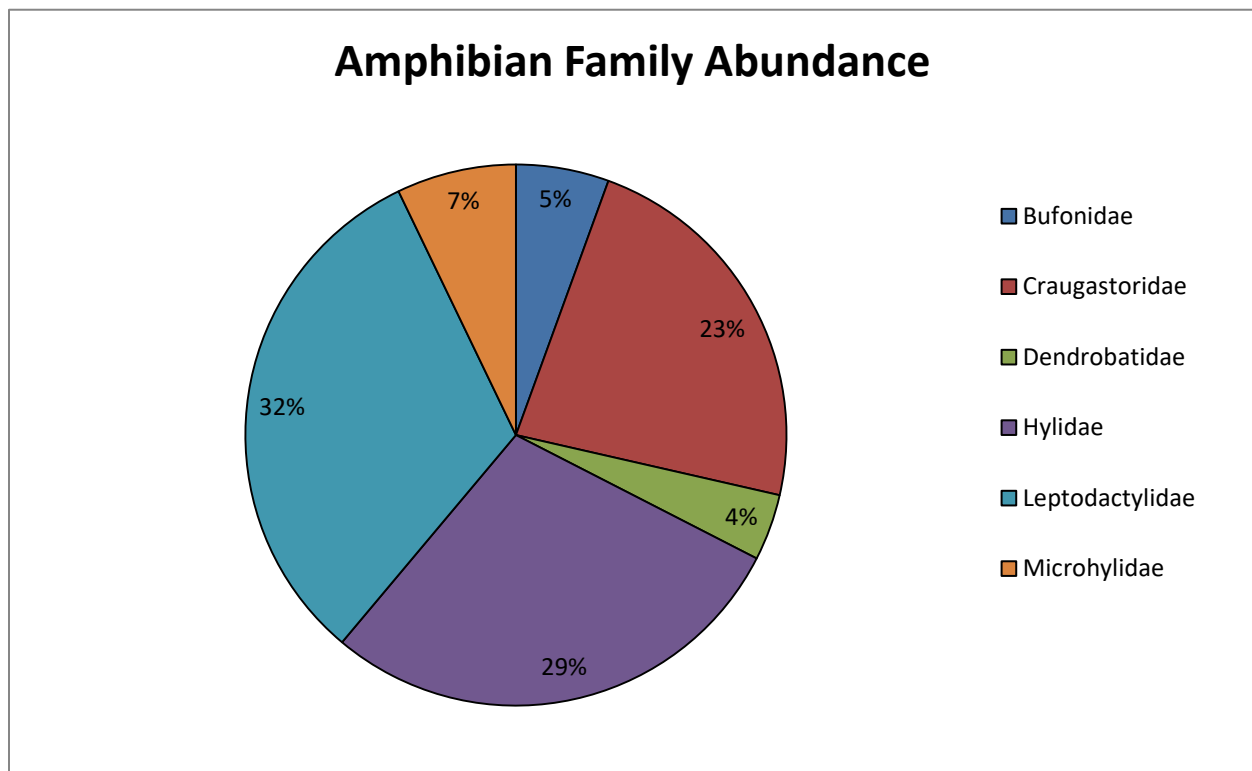


Figure 1: Amphibian family abundance in drift fence/pitfall traps and VES.

released.

Visual encounter surveys (VES) were also implemented into the data collection. These surveys consisted of walks (ranging from 1-4 hours) on the trails and off-trail to try and observe and identify species. VES allows researchers to see and spot the targeted specimens in their nature habitat, to see what type of plants/trees they perch on, and to see how they behave in the wild. The date, weather, time, location, whether or not the specimen was spotted vs. caught, and the identification of the species are all taken note of. There are roughly one VES per day and some days multiple surveys are conducted. Due to the heat and rainy season the focus on night hikes and night VES was higher. Most amphibians tend to come out at night and have a better

chance of survival compared to mid-day so there was more opportunity to collect and record species.

Results

This study lasted 39 days and 38 nights with a total of 15 families, 42 species, and 162 individuals recorded and identified using drift fence/pitfall traps and visual encounter surveys (VES) within the 54-ha site. The drift fence/pitfall traps caught 58 individuals with the most abundant being twenty-six *Leptodactylidae adenomera* roughly 45% of all caught in traps. Because of the difficulty to determine certain *Leptodactylidae adenomera* species, *adenomera* was used to label this specimen. The high majority of the species caught in

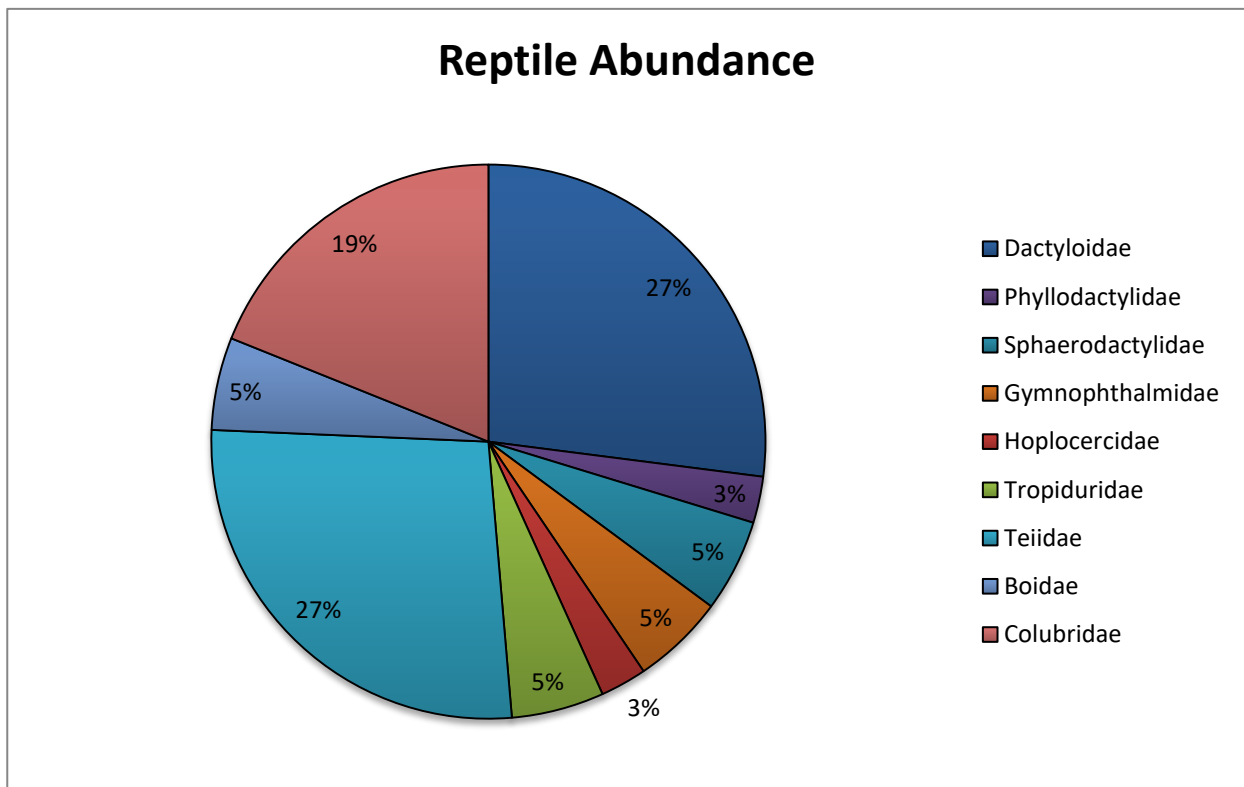


Figure 2: Reptile family abundance in drift fence/pitfall traps and VES

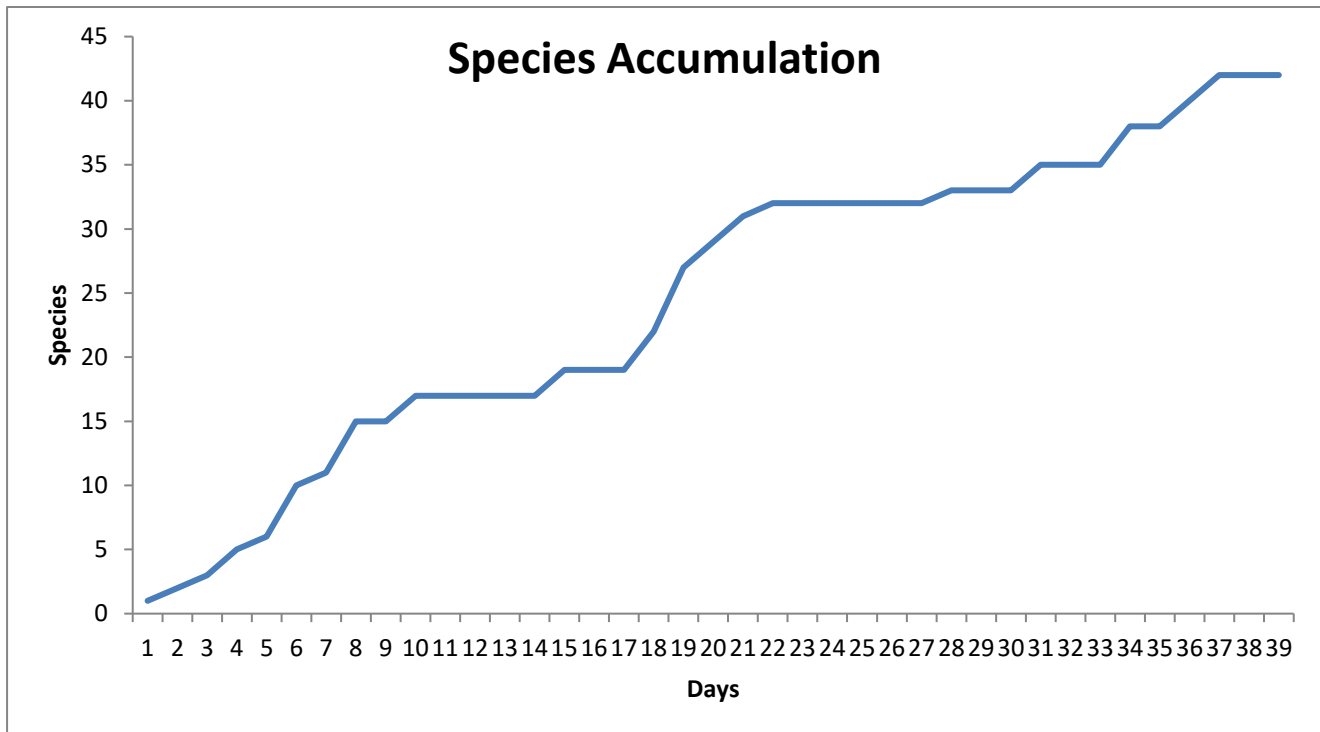


Figure 3: Amphibian and reptile accumulation curve

the drift fence/ pitfall traps were terrestrial species, as they weren't able to climb back up the walls of the buckets. While the VES produced 104 individuals, about double the amount from the traps, only about 11% were those of the *Leptodactylidae adenomera*. The most abundant for the VES were *Osteocephalus castaneicola* (Chestnut's slender-legged treefrog) at 18% of the total. The high majority of the amphibians found during VES were classified as arboreal.

There were 6 amphibian families that were surveyed, Bufonidae, Craugastoridae, Dendrobatidae, Hylidae, Leptodactylidae, and Microhylidae. Of the 6 families the most abundant were Leptodactylidae with 40 of the 124 amphibians caught. As of the most diverse family caught was the Hylidae family with 10 of the 23 species. Hylidae was only caught or encountered during VES,

mostly because they can climb out of the traps and almost all were found at night.

There were 9 families of reptiles caught and found during the survey, Boidae, Colubridae, Dactylidae, Gymnophthalmidae, Hoplocercidae, Phyllodactylidae, Sphaerodactylidae, Teiidae, Tropiduridae. Of these 9 families Gymnophthalmidae and Teiidae were the most abundant. The Colubridae family was the most diverse with 5 different species. The drift fence pitfall traps mostly caught *Ameiva ameiva*, 9 of the 12. No snakes were found in the pitfall traps, only lizards. Most of the reptiles were found within the underbrush or low on the trees.

Species accumulation curve helps show and explain the cumulative number of species that were found in relation to the amount of days surveyed. This species accumulation curve shows the amount new reptiles and amphibians observed and

caught starting from September 27 and goes all the way to November 4. This survey ended with 42 total species but for only 39 days, in regards to a longer duration should show a better curve for future research.

The species list from Finca las Piedras was at 22 amphibians and 33 reptiles before this study, now it is at 42 amphibians and 45 reptiles. This added 20 new amphibians and 12 new reptiles. Of the new species 16 amphibians and 6 reptiles came directly from the surveys the remaining new species were found randomly during the study time period. On the amphibian side most of the new species were of the Hylidae family, due to extensive night hikes.

When comparing data from 2017 to the new data of 2019 it was extremely difficult due to the amount of data from the previous study. But the surveys relatively resemble one another as the main species that was recoded was that of *Adenomera* (the lowland Tropical bullfrog). The previous study had traps open in the grassland where more of the majority of the observations was made, while this study did not. So opening the grassland traps could possibly add more abundant *Ameiva ameiva*.

Comparing the data from the drift fence pitfall traps in the forest vs. forest edge nothing really stands out. All of the *Ameiva ameiva* were found in the edge traps as well as all of the individuals from the amphibian family Bufonidae. Every other species was equally distributed throughout forest and forest edge traps. Maybe if more traps were open in different locations, such as deeper in the forest and a different edge habitat, there could be more individuals captured and possibly new species.

Discussion

The surveying included two different ways of observing herptofauna, drift fence pit fall traps and visual encounter surveys. Both were successful in collecting data and both produced new species for Finca. VES definitely produced more outcomes but it is understandable because more frogs that come out at night are up in trees or have sticky toe pads to help grip and escape the buckets. The drift fence pitfall traps had half the amount of captures, but caught more terrestrial amphibians and reptiles than the VES. This makes sense because the traps are on the ground and the fences force creatures towards the buckets.

All in all this study did end up adding to the Finca las Piedras species list, adding and confirming new species is important here as FLP is a young organization. Only 3 years old, with now 42 species of amphibians and 44 species of reptiles and many more to be discovered. As this area is a biodiversity hotspot new species can be discovered at any time. One possible addition to this study would include longer period of surveying and more within the rainy wet season. This could help add more of the species that breed during wet nights and also fill up the stream in the back to allow more water holes.

While comparing data from the 2017 study and 2019 study, it was difficult to come to a clear conclusion on differences. The previous study was done in a very short time and not many individuals were caught, identified, and recorded. But it is safe to say the majority of both study's seemed similar in the individuals caught in drift fence pitfall traps. Considering the time of year for the

2019 study, it makes sense to be finding more species because the rainy season is a big breeding time for most amphibians.

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