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Final Paper

Ecotourism, Community-Based Conservation, Inkaterra

The tropics are well known for their abundant biodiversity and rich resources. Many, many people depend on them for their livelihood, for medicines, for food, and for much more. Unfortunately, it has been clear now for a while that human management and use of tropical ecosystems has not been sustainable. Many trends show that as more demand is placed on these environments, unsustainable practices are only increasing. This is truly a globalized, and therefore extremely complex issue that must be addressed from many different disciplines - the sciences, economics, philosophy, cultural studies, and spirituality. In order to address this rapid loss and degradation of tropical ecosystems, there will need to be comprehensive change from the local to the global. One difficult reality in this story is that the tropical areas that tend to be most exploited are areas where there is inadequate human development, whereby people must find ways to make a living in any way possible. Economic interests, from the local to the global, often drive this destruction of the environment. We do not live in a world any longer where all pristine tropical areas are able to be completely put aside and protected from humans. We must learn to sustainably benefit from each other, both human and non-human life. One interesting method of finding this balance of mutual respect, and mutual benefit, is found in the concept of ecotourism. In order to have successful ecotourism, it is important to include community-based conservation in order to determine processes and outcomes. In this paper I will explain the

concepts of ecotourism and community-based conservation, and apply insights of these practices to the real life example of the Peruvian Amazonian ecotourism and research organization, Inkaterra.

Ecotourism is an exciting new endeavor that has the potential to assist in the conservation of important natural ecosystems while at the same time providing employment and ideally sustainable development for the local communities surrounding the ecological destination. A relatively "new" type of tourism, it really took off in the 1970s which is around the same time the environmental movement was coming into full swing at least in the United States. There has been a lot of change in ecotourism since its inception, but it is generally defined by the following definition given by the International Ecotourism Society (TIES):

> Ecotourism is now defined as "responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education" (TIES, 2015)

As the public consciousness has been awakened to some of the existential threats our planet faces there has been an increasing demand for more sustainable everything - including tourism. In fact, ecotourism has seen the highest growth rate compared to other forms of tourism since the beginning of this century (TIES 2006). This growth rate is good when ecotourism is handled correctly. If so, it benefits local communities through increasing income, jobs, improved infrastructure and better services in general like water, education, and electricity. Ideally both the local communities as well as the local natural environments can be protected. Instead of

clear cutting a forest for a quick but unsustainable profit, the forest can be preserved for camping, bird-watching, or sight seeing which creates jobs and income for the local community while preserving the forest. It has been found that there have been new and substantial nature area designations as a direct result of ecotourism, which is a hopeful sign (Honey 2008). Also, the income generated from ecotourism has great potential to fund conservation efforts. According to Kirby et. al, just 1% of ecotourism revenue would be more funding for conservation than the official conservation funding the developing world is receiving from outside sources (2011). However many benefits ecotourism can provide, there is also an increasing list of concerns about ecotourism.

The most stringent critics say that any type of development, even if it is "ecotourism" is playing right into the hands of our destructive capitalistic system. The resources used to create, maintain, and even travel to these ecotourism destinations require the further exploitation of the Earth's resources. Another common problem is the potential for neo colonialist practices when dealing with the local communities surrounding the protected areas (Barnard 2013). There are many stories of local people being taken advantage of and who have ultimately been unhappy about the ecotourism growth on their lands (Honey 2016). There are examples of the land being privatized with no legal contracts that require the companies to give back to the local communities or to the government beyond a few initial payments. One of the clearest examples can be found in Kenya's privatized big game parks (HONEY 2016).

There is also growing concern that the term "ecotourism" is losing its credibility. Increasingly, companies are utilizing "green-washing" techniques where they highlight a small sustainable practice they are committed to in order to label the entire endeavor "green" or

"ecotourism." Because there are no official designations of what constitutes true ecotourism, it is very much up to the individual organization to determine how closely they are following ecotourism's necessary components as explained earlier. Martha Honey (2016) explains how a developer in Mozambique is constructing a huge zoo-like park with incredibly unsustainable practices, but because there will be animals in the zoos, they are calling it an "ecotourism paradise" (HONEY 2016). Finally, another concern is that there may be simply too many tourists visiting a location, making it unsustainable. Machu Picchu in Peru is a good example of this, and there have been recent talks of severely limiting tourists in order to preserve the sight. In order to prevent some of the problems that may come with ecotourism, one solution has been to increase dialogue and participation with the local communities surrounding the ecotourism locations. When the goal is to conserve land and biodiversity by enlisting the help of the local communities, this is community-based conservation.

Though there is no clear, comprehensive definition or model for community based conservation, it can be explained by what it is not. Let's take the conservation of the Peruvian Amazon in the Madre De Dios region. Community-based conservation does not comprise solely of foreign NGOs developing strategies on how to protect the rainforest. It is not only scientific research that provides recommendations on how to proceed. It is not local governments creating laws and regulations on the sustainable use of the land, and it is not local communities deciding on their own how they would like to interact and utilize their traditional lands. Rather, it is a complex combination of all of these strategies, including more than I have mentioned. The great benefit of community-based conservation is that it is a more ethical and morally acceptable way of preserving and sustaining the environment. There are plenty of tragic stories where

indigenous people have been removed from their land in order to make way for a nature preserve. Though there may have to be compromises in certain circumstances when talking about land-rights and land-access, the most common occurrence has been removal or harmful restrictions placed on local communities, often with the communities affected not being allowed to participate in the decision. However, it must also be noted that community-based conservation, because it is so complex, has had mixed results. According to Fikret Birkes, "the results of community-based conservation experiments have been mixed at best, and the performance of many has been well below expectations" (622).

The move toward traditional conservation to community-based conservation has been the result of a shifting in the understanding of how environmental systems function. They are much more complex and intricate than previously thought and because of this there have been changes in the thinking and study of ecology. Three main shifts are highlighted and explained: "a shift from reductionism to a systems view of the world, a shift to include humans in the ecosystem, and a shift from an expert-based approach to participatory conservation and management" (Birkes 622). These first two show that future conservation will necessarily include humans in the study of how best to save and preserve ecosystems, especially as the population and footprint of humans continues to increase. The third shift is what we are seeing today with the increased involvement in community-based conservation, where a variety of players are included in the discussion and perhaps most importantly the local communities that are affected by the decisions.

One very important key for CBC (Community-based conservation) to be successful is to have adequate and effective implementation. Birkes says that often the model and the idea of the

conservation project are very much set up to succeed, but often don't because of the break-down in communication and authority which are necessary to make the project successful (622). However, there is also a second reason why CBC may not work in certain circumstances, and this is because of a conflict of interest. The goal to have parallel conservation AND development is a very difficult balance. To take an example, the new paved road near Puerto Maldonado, the Interoceanic Highway, has allowed for more development of the ecotourism industry around Puerto, but it has also allowed the exploitation of the forest and particularly of the gold deposits more efficiently - which is leading to increased destruction. This is an example of how development and conservation are often at odds - though this is not always the case.

Inkaterra is a very well respected and effective ecotourism flagship that has been in the business since nearly the inception of the ecotourism movement. Founded in 1975, it operates in Peru and has a number of different locations throughout the country and in different ecosystems. For this paper I will focus on the work Inkaterra is doing in the Madre De Dios region of the Peruvian Amazon. Perhaps the largest contributions Inkaterra has had to the conservation of the area is their successful acquisition of a few government concessions of large tracts of forest. These are agreements between Inkaterra and the government that do not give ownership to Inkaterra, but do provide Inkaterra the rights to use the land. There are stipulations on how Inkaterra manages the land, but overall the effect is that the land is sustainably managed and even protected from outside interests looking to exploit the forest.

Kirby et al. (2011) conducted a large study on the effects of ecotourism on conservation in the Madre de Dios region of Peru. One of their study subjects was in fact Inkaterra! Overall, the study found that Inkaterra and other ecotourism operations were indeed positively

contributing to overall conservation of the area. Inkaterra has been shown (Kirby 2011) to have serious contributions to the wider conservation of the surrounding ecosystems. Inkaterra has provided funds and food to families of local hunters in order to reduce the hunting activity in the concessions given to Inkaterra by the government. Though this is a tricky balance, it seems to be working at least up until the publication of the research paper by Kirby in 2011. Inkaterra was influential by putting pressure on the government to stop a bill introducing industrial gold mining into the Tambopata region which would have endangered the ecosystem and in turn the livelihood of the ecotourism lodges. Inkaterra worked closely with other ecotourism lodges, the Peruvian government, and even brought in international resources to combat this new bill (Kirby 2011). The study determined that direct conservation funding goes to ecotourism lodges, as organizations and people are able to trust the owners and trust that the funds will go to conservation (Kirby 2011). This is money that otherwise would have not ended up going to the conservation of these ecosystems if the lodges were not functioning. Finally, ecotourism lodge owners have used legal action and patrolling to remove illegal activities in their concessions such as poachers, illegal loggers, and illegal gold mining (Kirby 2011).

Inkaterra funds its own research and conservation called Inkaterra Association (ITA) which employs scientists and provides lab space and accommodations for visiting students and scientists who come to study and conserve the forest. For example, currently there is a Colombian woman working on a native vanilla orchid that may be promising in producing a high-quality and in-demand product - vanilla. She is working on the mutualistic interaction between the orchid and fungus, and she represents only one stage of a multi-stage research project aimed at understanding the orchid. They will eventually be working with local

communities, perhaps instructing and advising them in growing this vanilla in order to supplement their income. This would result in much needed income for the local communities while at the same time using an endemic species that will be able to be sustainably grown in the surrounding forest without causing much damage. Also, this may help the communities steer away from engaging in more harmful money-making endeavours such as gold mining, clear cutting, and destructive agricultural practices.

One difficulty highlighted by one of the top scientists of ITA had to do with communication and cooperation with local tribes in the area. This is a testament to what the research Birkes had to say about the difficulties with community-based conservation (622). The conservation project is much less complicated and maybe more efficient if there is one plan that goes forward without a lot of compromise. However, this is not how reality works, and the ITA scientist said that probably the most difficult part of his work is the breakdown and disagreement in communication with local communities on what exactly needs to happen with conservation projects. He mentioned that the local leaders often have other interests and enjoy the power they hold - leading them to at times accept money from large organizations or at least prevent conservation movements from going forward. The gold mining in this area of Peru is extremely intertwined with criminal cartel activity. This makes it difficult for local communities to feel free to oppose the devastation caused by gold mining either because they feel threatened (there have been a number of murders and "disappearances" of people who oppose the gangs) or because their economic livelihood relies on the money generated from gold mining.

One concern in ecotourism in general is the influence of outside personnel and resources on the operations. It is more sustainable, and more economically advantageous for the local

peoples if most of the resources required for operating the ecotourism company are local. I saw numerous examples of this happening at Inkaterra. One example is that some of the employees were from local villages, cities, and a few of them were specifically sent to school in order to study ecotourism in order to be more effective in the guiding and management of the organization. Inkaterra runs an agroecological operation, where they grow a variety of local food-producing plants (exotics as well) in order to provide the lodges with fresh produce that has a low carbon footprint. Additionally, they are employing and educating local people in agricultural systems that strive to be organic and sustainable. The system is not a monoculture, but rather a rich and diverse polyculture of different plants which also provides good habitat for endemic fauna. Inkaterra has built most of their lodges with sustainably sourced materials from the surrounding areas, most notably building their lodges in the fashion of the local people who use palm branches as thatch roofing.

One of the conservation projects happening is called the Palmetum. This is a preserve growing the endemic palm species with a particular focus on the species that have historically provided important resources for the indigenous people of the area. These are being studied in order to provide more information on how to conserve these species as well as promote sustainable harvesting. This may provide extra income for the local tribes, and as I've previously mentioned, provide them with an alternative to other income generating activities that may have more harmful effects on the environment. One particularly interesting study being carried out by the principal Palmetum researcher involves a plant species that produces some of the most high-quality oil found in the world. Its fruit has an extremely high percentage of favorable lipids - Omega 3 and 6, which are in high demand throughout the world for their

cardiovascular health benefits. This again may represent an opportunity for a native species to be utilized, bringing sustainable development to the area. With all of these projects, the implementation of producing and harvesting these resources will necessarily incorporate the local communities, which ITA holds in great importance. Involving the local community in these conservation practices is the only way a sustainable, and socially just future will be created.

Another example of community-based conservation is the work ITA is doing with local tribes in the cultivation of an endemic giant snail which provides significant amounts of protein in order to supplement the indigenous communities' diets. The hope is that this increased protein will both improve the health of the local people as well as relieve some of the hunting pressure on local fauna. There is also a large Brazil Nut operation, which is involving the local community in its conservation and production. The concerns I have for these products has to do with the potential economic gain from these products. The newly built Interoceanic Highway which connects this area of Madre de Dios has the potential for bringing fast and substantial development. If these products are found to be highly profitable, there needs to be measures taken to prevent the overexploitation of them by the government or private interests.

Inkaterra, and its research wing ITA are exemplary models of how ecotourism can work closely with community-based conservation. The money generated by tourism enhances the local economy, providing sustainable jobs to people, which may be preventing people from engaging in more environmentally damaging modes of employment. The conservation of the areas surrounding Inkaterra and beyond are extremely important, and important research is being conducted in these areas. The agricultural research may provide indigenous communities with a new source of income, allowing them to maintain their traditional ways and strengthen them

against the encroachment of illegal activities like gold mining, logging, and poaching. Through the education at ITAs Field Station and from the guides, understanding and knowledge of the importance of this area of the Amazon is increasing and spreading as each new group of tourists and students return home.

References

Ballantyne, Roy, and Jan Packer. *International Handbook on Ecotourism*. Cheltenham: Edward Elgar, 2015.

Barnard, Mason. *Ecotourism's Hidden Cost: "Green" tourism's colonial toll.* Harvard International Review, Vol. 35, No. 2 (FALL 2013), pp. 8-9

Cardozo, M. 2011. Economic Displacement and Local Attitude Towards Protected Area Establishment in the Peruvian Amazon. Geoforum 42(5):603–614.

Chan, K., Pringle, R. M., Ranganathan, J. A. I., et al. (2007). When agendas collide: Human welfare and biological conservation. Conservation biology 21: 59-68

Dasgupta, S. (2016). 5 reasons why many conservation efforts fail. Mongabay

Honey, M. and Gilpin, R. *Tourism in the Developing World Promoting Peace and Reducing Poverty*. US Institute of Peace (2009)

Honey, Martha. Treading Lightly? Ecotourism's Impact on the Environment Chapter Author(s): *The Environment in Anthropology: A Reader in Ecology, Culture, and Sustainable Living*. Second Edition. Book Editor(s): Nora Haenn, Richard R. Wilk, Allison Harnish Published by: NYU Press. (2016)

Helfman, Gene S. *Fish Conservation: a Guide to Understanding and Restoring Global Aquatic Biodiversity and Fishery Resources*. Washington: Island Press, 2007.

Kirkby, C., Giudice, R., Day, B., Turner, K., Soares-Filho, B., Oliveira-Rodrigues, H., and Yu, D.
(2011). Closing the ecotourism-conservation loop in the Peruvian Amazon. Environmental Conservation, 38: 6- 17.

Louv, Richard. *Last Child in the Woods*. North Carolina, USA: Algonquin Books of Chapel Hill, 2006.

Osborne, Patrick L. *Tropical Ecosystems and Ecological Concepts*. Cambridge: Cambridge University Press, 2012.

Shepard Jr, G., Rummenhoeller, K., Ohl-Schacherer, J., and Yu, D. (2010). Trouble in paradise:

Indigenous populations, anthropological policies, and biodiversity conservation in Manu National Park, Peru. Journal

Sodhi, N., Barry Brook, & Corey J.A. Tropical Conservation Biology. 2008. Bradshaw Wiley-Blackwell Scientific Publishing

Stevens, Fisher & Ahnemann, Olivia. *Racing Extinction.* Directed by Louie Psihoyos. (2015; Santa Monica: Lionsgate.) DVD

Woolf, D., Amonette, J., Street-Perrott, F., Lehmann, J., and Joseph, S. (2010). Sustainable biochar to mitigate global climate change. Nature communications 1: 1-7.

Mariposas de Peru

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Abstract

Butterfly and moth (Order Lepidoptera) diversity is used as a bioindicator of ecosystem health. Peru is home to the highest recorded number of butterfly species in the world, currently numbering 3,500 with 7,500 Neotropical species. The high species richness of Lepidoptera in the rainforest surrounding Inkaterra Field Guide Station indicates high biological diversity. Using Inkaterra field guides and iNaturalist, a citizen science tool used to identify fauna and flora, images of butterflies and moths taken in the Amazon region of Madre de Dios, specifically near Inkaterra, were identified and compiled into a list of species.

Figure C: Periander Metalmark -- *Rhetus periander*

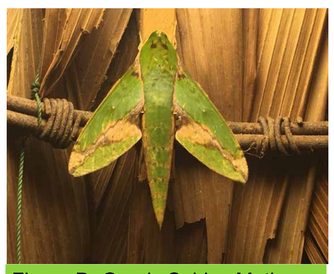

Figure D: Gaudy Sphinx Moth *Eumorpha labruscae*

Figure E: Demea Silverstreak *Theclopsis demea*

Figure F: Green-banded Urania *Urania leilus*

Citizien Science and Inkaterra

Citizen science is defined as the collection and analysis of data relating to the natural world by members of the general public, typically as part of a collaborative project with professional scientists. This is a great opportunity for the general population to be educated about their surrounding environment while participating in a larger project. Inkaterra Association (ITA) is a non-profit organization dedicated to biodiversity conservation and education in the Amazon. ITA uses the revenue they earn through ecotourism programs for conservation projects and purchasing land for conservation purposes. Citizen science is particularly important in the Amazon because of the high volume of ecological interactions between organisms.

Figure A: *Helioconius erato*

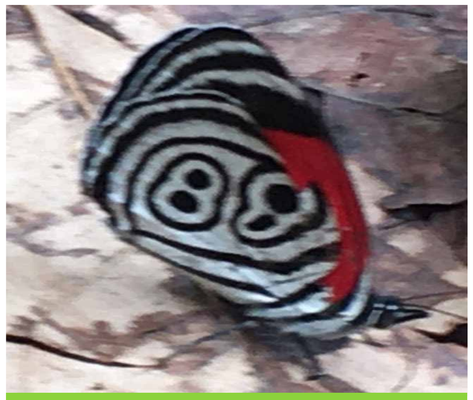

Figure B: Cramer's Eighty-Eight - *Diathria clymena*

Results/Data – Identified Field Images

Example of Species List:

- *Eumorpha labruscae* – Gaudy Sphinx Moth
- *Rhetus periander* - Periander Metalmark
- *Theclopsis demea* – Demea Silverstreak
- *Helioconius erato*
- *Pachylia ficus* – Fig Sphinx
- *Eresia Eunice*
- *Siproeta stelenes* - Malachite
- *Parides neophilus* – Cattleheard
- *Caligo eurilochus* – Forest Giant Owl
- *Hamadryas Feronia* – Variable Cracker
- *Diathria clymena* – Cramer's Eighty-Eight
- *Heliconius Melpomene* – Postman Butterfly
- *Urania leilus* - Green-banded Urania
- *Morpho helenor theodorus*
- *Anartia amathea*
- *Haetera piera* – The Amber Phantom
- *Ascia monuste* – Great Southern White
- *Catonephele acontius* – Acontius firewing
- *Hypocrita plagifera*
- *Dryas iulia* - Julia Heliconian
- *Perrhybris pamela*
- *Junonia genoveva* – Southern Mangrove Buckeye
- *Junonia everate*
- *Junonia atlites*

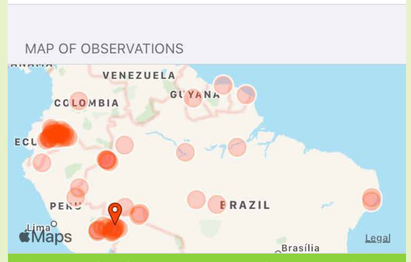

Figure G: Screenshot of iNaturalist

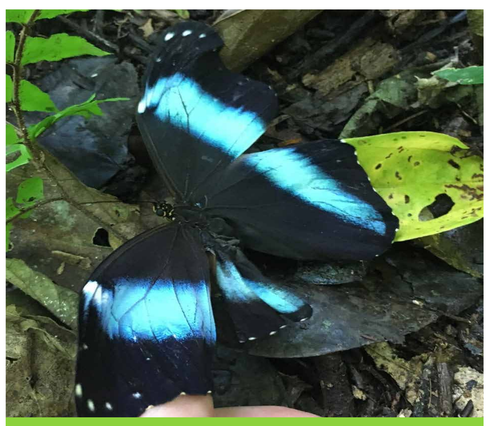

Figure E: Blue Morpho - *Morpho helenor theodorus*

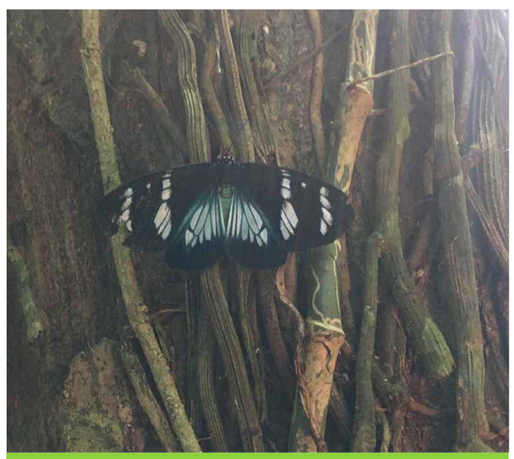

Figure F: *Hypocrita plagifera*

Methods

Butterfly and moth data were collected by photography over the course of of seven days in various locations within Inkaterra land, and Lake Sandoval in the Madre De Dios region of Peru. The images were compared to field guides and online databases from the region and ultimately identified with the assistance of the citizen science platform called iNaturalist. The species were compiled into a list and a few images were selected to present in this poster. Limitations were mainly due to time and resources. Due to the short period of time, we were unable to observe butterflies and moths during seasonal variations and were only able to observe at ground level – excluding species that lived higher up in the canopy. Further research was done on the importance of butterflies and moths in this region of the Amazon rainforest.

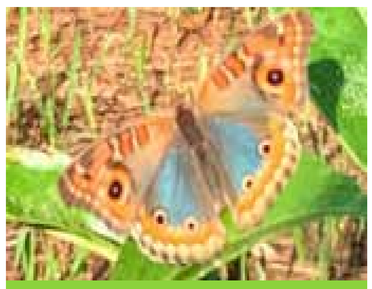

Figure C: *Junonia everate*

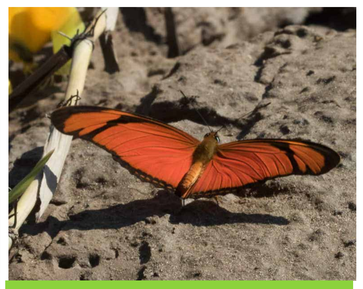

Figure D:*Dryas iulia*

Discussion: Importance of Research

The amount and diversity of butterflies and moths are important indicators for an ecosystem's overall health and viability(1). They are also key members of the food web and provide invaluable pollination services, both contributing to increased biodiversity. The high speciation of Lepidoptera in the Madre De Dios region of the Amazon indicates the high biodiversity in the region, and can be used as important indicators of the effects of habitat change and climate change which is particularly important as more and more extractive industries (i.e.. gold mining) and agriculture (i.e.. cattle grazing) are proliferating and changing habitat in the Madre de Dios region (2). Because butterfly research is so prolific through time and geography, the data is uniquely able to track trends in the changes in climate, giving important insight into how climate change is affecting particular species. Scientists have used butterflies to study community ecology (3), coevolution (4), rainforest fragmentation (5), and species recovery after mass extinction events (6).

References: (1) https://butterfly-conservation.org/butterflies/why-butterflies-matter (2) Lamas, Gerardo. *Comparing the butterfly faunas of Pakitza and Tambopata*, Madre De Dios, Peru (1997)
(3) ELIAS, M., et al. 2008. Mutualistic interactions drive ecological niche convergence in a diverse butterfly community. Biology 6, 2642–2649.
(4) BROWN, K.S. et al. 1991. Aposematic insects on toxic hostplants: coevolution, colonisation and chemical emancipation. Plant–Animal Interactions. John Wiley & Sons, New York, USA, pp. 375–402
(5) UEHARA-PRADO, M. & FREITAS, A.V.L. 2009. The effect of rainforest fragmentation on species diversity and mimicry ring composition of ithomiine butterflies. Insect Conservation and Diversity 2, 23–28.
(6) WAHLBERG, N. et al. 2009. Nymphalid butterflies diversify following near demise at the Cretaceous/Tertiary boundary. Proceedings of the Royal Society of London B 276, 4295–4302.

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The Fungus Among Us

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Preparing people to lead extraordinary lives

Abstract

Species of fungi are some of the least researched organisms in the Amazonian rainforest. During a seven day observational study at the Inkaterra Field Station in the Department of Madre de Dios, Peru, different species of fungi and their substrates were recorded. Because resources for identification of fungi in Madre de Dios are lacking, field guides from Madre de Dios and Cristalino Natural Heritage Private Reserve in the Brazilian Amazon were used to distinguish and classify observed species. Decomposing wood in moist, dark areas was the primary substrate in which fungi were spotted. Over 30 species of fungi were observed. This study provides more photographic evidence of Peruvian fungi and details common locales in which they can be seen.

Introduction

During our seven day trip to the Peruvian Amazon as part of the Conservation and Sustainability of Neotropical Ecosystems course, we conducted a citizen science observational study, in which fungi were recorded and identified. The purpose of this study was to catalogue fungi species, both those previously identified and any that were either unnamed or unidentified, and document the substrates upon which they grew. The kingdom Fungi is one of the least studied in the Amazon, and citizen science is important to advancing research and local data. After returning to Chicago, we reached out to a resource from the Western Montana Mycological Association for assistance with identification and possible additions of new species to the document.

Methods and Research Design

Our seven day excursion at the Inkaterra Field Station in Madre de Dios, Peru, included daily treks throughout the Amazonian rainforest. During these day and night hikes, fungi specimen were spotted and photographed. We tried to get good images of the substrates upon which the fungi grew as well.

We utilized two field guides of neotropical fungi, one of fungi from the Cristalino Natural Heritage Private Reserve in Brazil and the other of fungi from the Cocha Cashu Biological Field Station in Manu National Park, Madre de Dios. We were able to reach out to a co-author of the latter source, Larry Evans, to help us identify species that we were unable to identify. Pictures were also uploaded to iNaturalist, but due to the limited information about neotropical fungi, our posts went unidentified.

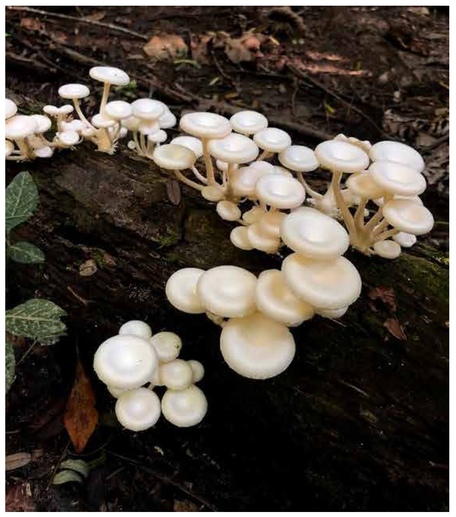


Figure 1. *Lentinus cf. concavus*

Figure 2. *Cookeina speciosa*

Figure 3. *Amauroderma sp.*

Results

- *Amauroderma sp.*
- *Auricularia fuscosuccinea*
- *Auricularia sp.*
- *Auricularia delicata*
- *Cookeina speciosa*
- *Coprinellus acridophila*
- *Coprinellus coprinopsis*
- *Coprinellus disseminatus*
- *Cotylidia*
- *Dictyoploca rhyssophylla*
- *Entoloma sp.*
- *Favolus brasiliensis*
- *Gerronema*
- *Hexagonia variegata*
- *Hydropus cacavus*
- *Lentinus cf. concavus*
- *Lentinus crenitus*
- *Lepiota cf. lilacea*
- *Marasmius sp.*
- *Marasmius sp.*
- *Marasmius guyanesis cf.*
- *Mycenae aff.tesselata*
- *Oudemasiella canarii*
- *Parasola cf. plictilis*
- *Pluteus sp.*
- *Polyporus grammocephalus complex*
- *Polyporus guianensis*
- *Psathyrella sp.*
- *Rigidoporous sp.*
- *Stereum sp.*
- *Trametes sp.*
- *Tremellodenron cf. schweinitizii sp.*
- *Trogia*
- *Tubifera ferruginosa sp.*
- *Xeromphalina tenuipes*
- *Xylaria guianensis*
- *Xylaria multiplex*
- *Xylocoremium flabelliforme*

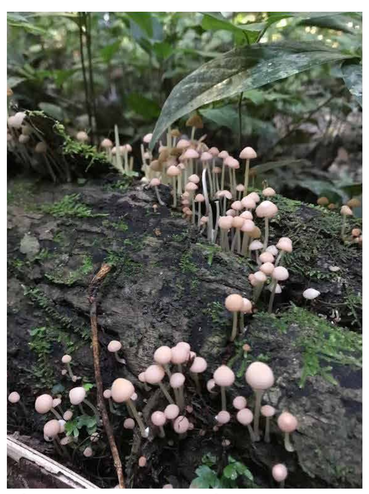


Figure 4. *Marasmius sp.*

Figure 5. *Xeromphalina tenuipes*

Discussion & Conclusion

Over the course of our brief visit to Peru, we witnessed 30+ species of fungi on our excursions, a few of which we were unable to identify. Some of the fungi species could not be identified due to missing information from the photos. In these photos, the fungus' structure, color, or respective substrate could not be determined. The most common substrate was fallen wood. This could be indicative of the composition of detritus on the forest floor and/or the time it takes for fungi to establish. If the rate of leaf litter decomposition is faster than the decomposition rate of wood, perhaps leaf material is decomposed before fungi are able to develop.

The circumstances of our observational study should be noted, as it significantly impacted our results. Being part of a larger class, we often lacked sufficient time to stop and photograph fungi with the quality necessary to successfully identify species later. However, our photos from the slower-paced night walks are considerably higher in quality and these species were more easily identified. Additionally, the latter half of our identification process was completed during quarantine, which made checking for accuracy and consistency in identification difficult.

Although citizen science is important for increasing breadth of information, we were limited in our access to resources. We did not sufficiently familiarize ourselves with Peruvian fungi, and resources for doing so are incredibly limited. Being amateur student scientists, also made the identification of species difficult. Finally, we believe that having someone well versed in local fungi species would have aided in spotting and identifying species in the field.

Future studies of Amazonian fungi should work to increase the photographic evidence of species and descriptions of appearance, location, and substrate.

Acknowledgements and References

Thank you to our field guides, Uriel and Rene, and our classmates for helping us spot fungi during our time in Peru. Special thanks to Larry Evans for helping us identify species we weren't able to identify ourselves, along with all the researchers who collaborated with The Field Museum to develop the Field Guides for Amazonian fungi.

Lodge, D. Jean, and Susanne Sourell. "Fungi of Cristalino Natural Heritage Reserve." *The Field Museum*, vol. 1, no. 1047, Oct. 2016, pp. 1–39.

Loayza, Patricia Alvarez, et al. "Fungi of Cocha Cashu." *The Field Museum*, vol. 1, no. 525, Feb. 2014, pp. 1–7.

Herpetofauna de Madre de Dios

Lily Paukstys, Ola Brzezinska, Veronika Szczepanik
Mentored by Stephen Mitten, S.J.

Abstract

Within the Madre de Dios region of Peru, we observed and classified species of herpetofauna, focusing on habitat and location of the individual. Tropical ecosystems have a higher abundance of herpetofauna, housing lizards, frogs, snakes, turtles, and caiman. Some of the species that we identified include: the Great Amieva, Leptodactylus Bolivianus, Dipsas Catesbyi, and Podocnemis Unifilis. While most of the species observed are relatively abundant, we did find an endangered species - Melanosuchus Niger. Our week-long observational study contributed to the biodiversity profile of the Madre de Dios region by adding to a citizen science database, iNaturalist.

Species	Amount Observed	Habitat
FROGS/LIZARDS:		
Ameiva ameiva	3	Inkaterra Courtyard and Lake Sandoval - exposed area, dry, sunny, grassy areas, hide in bushy areas
Leptodctylus bolivianus	3	Monkey Island - moist conditions, muddy, shade, next to wood (damp, dead log)
Leptodctylus pentadactylus	1	Main Camp off-trail - off-path, slightly damp lots of leafy/woody detritus
Hamptophryne boliviana	1	Night Hike - sitting on bright leaf (uncamoflauged) amongst a rocky/littered area
Rhinella marina	3	Entry Trail - exposed area, rocky/dirty, moist, small amount of shrubs
Leptodactylus didymus	1	Monkey Island - moist conditions, muddy, shade
Anole nitens	1	On the bark of a tree- daytime
Anole anolis	1	On the bark of a tree- daytime
Gonatodes humeralis	2	Lake Sandoval and Inkaterra- on the tree about 6ft up from ground; hiding in between vines on tree
Trachycephamus venulosus	1	Forest floor on fallen leaves
Osteocephalus taurinus	1	Found indoors within a cabana
CAIMAN:		
Melanosuchus niger	3	Lake Sandova - in the river to the lake, underneath a log, tail afloat, in between or near woody brush
Caiman crocodilus	2	Night Boat - underneath river edge bush, next to woody brush
Paleosuchus trigonatus	1	Night Boat - directly next to mud bank, easy exit to vegetation for cover
TURTLES:		
Podochemis unifillis	10	Lake Sandoval - on a log in the lake, near edge, exposed to sun
SNAKES:		
Clelia clelia	1	On the trail to Inkaterra Guides Field Station, middle of rocky trail
Diposas catesbyi	1	In leaves within a tree
Spilotes pullatus	1	Fruit Palm Plantation

Figure 1: A log of all the different herpetofauna that was observed and identified along with their habitats

FIgure 2: *Ameiva ameiva,* Great Ameiva, most often found in sunny exposed areas

Figure 3: *Leptodactylus didymus,* found on Monkey Island in moist and shady conditions

Conclusion

By contributing to specimen data collection, 26 specimens that include frogs, lizards, caiman, snakes, and turtles have been geotagged in the iNaturalist application. The identification of these specimens will further aid in species and neotropical ecosystem research, as well as conservation efforts.

Citizen Science

Throughout our research, our observations contributed to Citizen science by recording our species and contributing to neotropical conservation efforts. Utilizing apps such as iNaturalist, we photographed, uploaded, and geotagged our specimen to contribute to growing data collections. Primarily, this data will aid future population and migration studies. In addition, this practice allowed the researchers to gain experience in capturing, identifying, and cataloging species, progressing our undergraduate skills.

Figure 4: *Hamptophryne boliviana,* Amazon Sheep Frog, sits on a bright colored leaf during a night hike along the Inkaterra walking trail

Discussion

The herpetofauna found in the Madre de Dios region consisted of different species of frogs, lizards, caiman, snakes, and turtles as presented in the table above. All species were found to be in habitats specific to their family. Habitats observed are described as:

- **Frogs:** moist and shady conditions; generally found leafy and woody detritus
- **Lizards:** exposed, dry, sunny, grassy areas; hide in bushy areas
  - **Anoles:** elevated, shady surfaces; typically on bark of trees
- **Caiman:** along river bank resting within vegetation such as woody brush, logs, or grasses
- **Snakes:** shady, canopy floor
- **Turtles:** in the sun on logs exposed near the bank of a river/lake

Furthermore, most species of frogs were identified after sunset suggesting that most frogs are most active at night. The only frog that was observed only at night was the trachycephalus venulosus, as its green color limits its camouflage abilities in the day. Caimans were also identified in the evening, as most are nocturnal. Herpetofauna identified specific to the day time were lizards and turtles. Mostly snakes were present in both day and night time.

Acknowledgements

We would like to thank the Inkaterra eco-tourism company, specifically the Guides Field Station in Puerto Maldonado. Additionally, we would like to thank all of the staff at Inkaterra for their hospitality and guidance though all excursions.

Who saw that Hoatzin?!

Ethan Ferguson and Jenna Molaro
Mentored by Stephen Mitten, S.J.
Loyola University Chicago Institute of Environmental Sustainability and the Inkaterra Association

Preparing people to lead extraordinary lives

Abstract

Over the course of 6 days in the Madre de Dios Region in Peru, research was conducted on the various native birds. 111 species were identified using sight and sound. Species included Hoatzins, White-throated Toucans, Scarlet Macaws, Gilded Barbets, Festive Coquettes, Band-tailed Manakins, and many more. This detailed inventory of species was uploaded into The Cornell Laboratory's ebird database. The diversity that was documented in the neotropics contributes to the important field of citizen science which can offer invaluable aid to future research.

Introduction

The primary purpose of this research was to build a detailed inventory of birds by genus and species, thereby contributing to citizen science. Citizen science is the voluntary involvement of the public in scientific research. Citizen scientists can help design experiments, collect data, analyze results, and solve problems (1). Our research focused on data collection. This data was made available to scientists using "ebird," which is a web-based tool for recording bird observations and is a link to hundreds of thousands of citizen-scientist birdwatchers who use it every day (2).

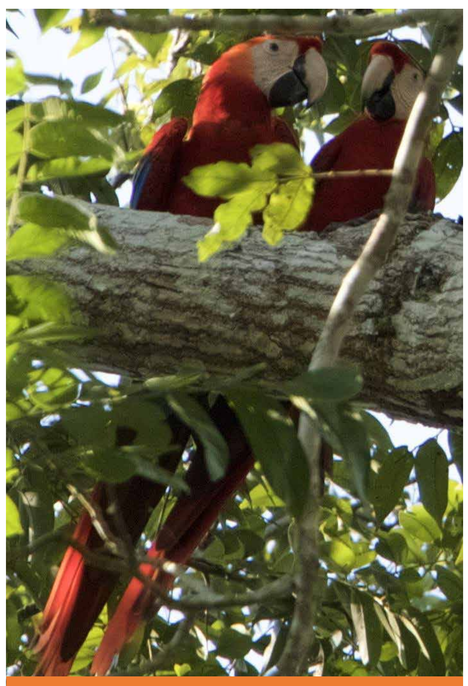
The base of our operations was the Inkaterra Field Station located roughly 17 km down the Madre de Dios from the city of Puerto Maldonado and maintained by the Inkaterra Association. Excursions from the station were conducted daily and included visits to their Palmetum, botanical garden, and canopy walkway among others. Species were recorded at every opportunity.

Hoatzin, *Opisthocomus hoazin,* Lago Sandoval

Black-tailed Trogon, *Trogon melanurus,* Inkaterra Guides Field Station

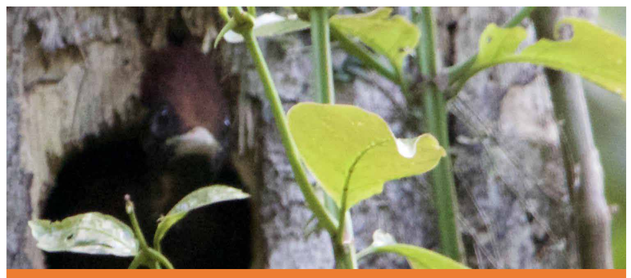
Methods and Research Design

Our inventory of bird species in the region was collected through visual and auditory means. When possible, photographic documentation was gathered and recordings of bird calls were taken. Sightings and calls which we were unable to explicitly link to a genus or species were omitted. The ebird database was also utilized to aid in our identifications. Once identified, bird species were recorded in both ebird checklists and in personal notebooks.



Scarlet Macaw, *Ara macao,* Taricaya Ecoreserve

Band-tailed Manakin, *Pipra fasciicauda,* Inkaterra Guides Field Station



Woodpecker species, *Dryocopus unidentified species,* Inkaterra Guides Field Station

Results

The results of our observations are summarized in complete checklists of every genus and/or species we were able to identify, along with the general location of the observation, the number of observers, and the date and time of observations. The locations include the Inkaterra Guides Field Station along with all excursion sites mentioned in this introduction, the Isla de Monos, Carachamayoc farms, Taricaya Ecoreserve, and Lago Sandoval. These checklists can be found on the ebird database under the usernames jmolaro and eferguson2.

White-throated Toucan, *Ramphastos tucanus,* Taricaya Ecoreserve

Discussion/Conclusion

This investigation plays a small but vital role in citizen bird science. By documenting every species that we came across and were able to identify, we provided neotropical ornithologists with valuable data to conduct their own research in the future. Our work is realized alongside hundreds of thousands of other citizen scientists allowing researchers to analyze the data we collect to determine how birds are being affected by habitat loss, pollution, disease, climate change, and other environmental changes by tracking bird migration, nesting success, and changes in population numbers over time. (3)

Citations:
1. "Citizen Science" National Park Service, September 25 2018, www.nps.gov/subjects/citizenscience/citizen.
2. "What is ebird" The Cornell Lab, 2020, www.birds.cornell.edu/landtrust/what-is-ebird/.
3. "Citizen Science" The Cornell Lab, 2020, https://www.birds.cornell.edu/citizenscience/.