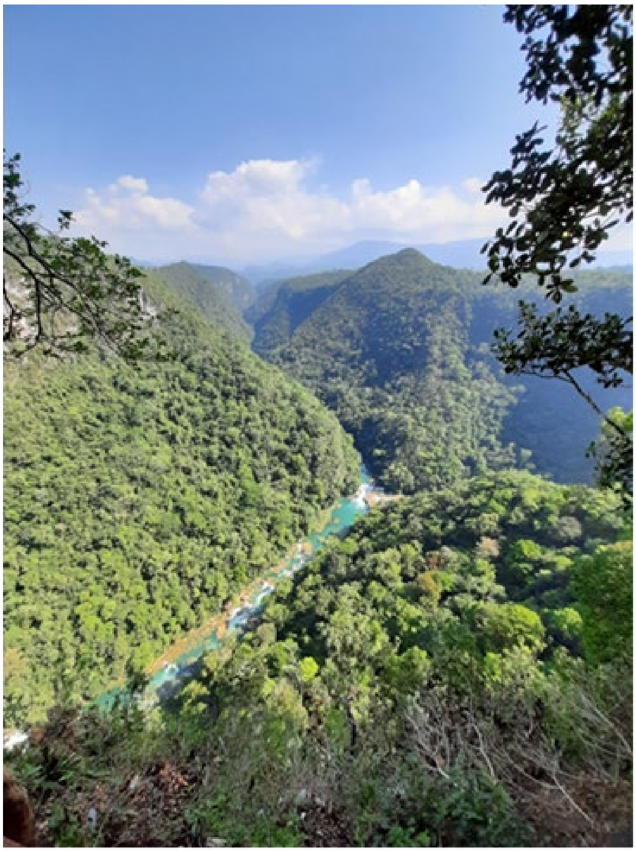
Response of the Baird´s tapir (*Tapirella bairdii*) and white-lipped peccary (*Tayassu pecari*) to climate change and habitat fragmentation in the Mayan Forest

Final Report

Rufford Foundation



Fredy Alberto Falconi Briones

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Fredy.falconi@estudianteposgrado.ecosur.mx

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Abstract

In this study, we examine two threatened ungulate species of scarce distribution, *Baird´s tapirella bairdii* and *Tayassu pecari* whose presence and distribution has been strongly disturbed by human use in the tropical forests of Mesoamerica. Where observations of dispersal of individuals or possible metapopulation movements are not available, habitat connectivity simulations can provide a valuable alternative source of information for assessing threats and conservation options. We analysed the effect of the presence of resistance factors limiting the long-distance movement of the Central American Baird´s tapir (Baird´s tapirella bairdii) and the white-lipped peccary (Tayassu pecari). We characterised ecological connectivity for both ungulates in the Selva Maya. We use a least-cost path analysis (circuit theory) and a graph theory approach. In addition, for the Selva Lacandona, Chiapas, Mexico, we updated information on some population parameters through estimators such as abundance and occupancy. Finally, in the communities visited in the Lacandon region of Mexico, we provided forums and workshops to improve environmental awareness and attitudes for the endangered species under study and their habitat

Introduction

Tropical forests, despite facing high rates of deforestation over the last five decades (Pennington and Sarukhan 2005; Asner et al. 2009; Armenteras et al. 2017), are still among the terrestrial ecosystems with the highest rates of biodiversity on the planet (Whitmore 1997; Dirzo and Raven 2003; Huston 2012; Andresen et al. 2018; Armenteras et al. 2019). This ecosystem type provides more than twice the economic capital, as a product of the ecosystem goods and services it provides, compared to other terrestrial biomes on the planet (Alamgir et al. 2018). The loss and fragmentation of forests and woodlands, in addition to overhunting, represent the main causes compromising the persistence of viable populations of numerous vertebrate groups on the planet, particularly large mammals (Hanski and Gilpin 1997; Primack 2001; Ripple et al. 2015; Fletcher et al. 2018; Kirk et al. 2018; Liu et al. 2019; Mc Williams et al. 2019).

Habitat connectivity is a fundamental attribute determining species distributions and has a long tradition in biological conservation (Moilanen and Nieminen 2002; Bennett et al. 2006). Connectivity is understood as the degree to which the landscape facilitates or impedes movement between patches of suitable resources (Taylor et al. 1993; Belisle 2005). Connectivity is often assessed by considering its structural (incorporating habitat contiguity into its interpretation) and functional (movement or flow of organisms, matter or energy; Fletcher and Fortin 2018) effectiveness. Although there are diverse meanings of the concept of connectivity, with their respective theoretical underpinnings and levels of appreciation (i.e., scales; Fletcher and Fortin 2018); it is fundamentally determined by the same process, the movement of organisms in a spatially structured landscape (Tischendorf and Fahrig 2000; Moilanen and Hanski 2001). Consequently, in this study, presence and abundances were assessed, occupancy models were generated, considering both community forest fragments (CFFs) and intact areas in the Montes Azules Biosphere Reserve (MABR) In addition, the current threats faced by both ungulates in La Selva Lacandona were assessed, based on habitat conditions and characteristics (e.g., landscape fragmentation) and anthropogenic events (e.g., hunting). Together, this information is expected to provide critically important data on habitat requirements and conservation needs for these ungulates in one of the last remnants of Selva maya habitat in southern Mexico.

In this study we use the concept of potential connectivity as a sub-type of functional connectivity that measures how individuals of ungulate species might move through the tropical landscape of the Selva Maya, including emergent landscape variables that might limit movement (resistances). Hereafter we refer to this connectivity subtype as ecological connectivity for both ungulates in the Selva Maya. To assess connectivity patterns between Central American Baird´s tapir and white-lipped peccary localities, we modeled the functional connectivity of the species using circuit theory. This model the movement patterns of species in a complex landscape.

Lacandon Forest and Study Area

The Selva Lacandona region, Chiapas, Mexico has been classified into five sub- regions based on historical, political and biocultural criteria; into 1) Northern Zone (ZN); 2) Lacandon Community (CL); 3) Canadas de Ocosingo and Margaritas (CA); 4) Marqués de Comillas (MC), and 5) MABR; Vasquez-Sanchez 1992; De Vos 2010).

The study was carried out physically at sites within the last three sub-regions mentioned above, in the landscape formed by the MABR (continuous forest massif of 3,312 km2), and community forest fragments (n= 4; CFF) of tropical forest, covering the largest possible extension within the study area, with representative sampling units (i.e. 500-1,000 ha) in the vicinity of CA and MC, in the municipalities of Marques de Comillas and Maravilla Tenejapa (Figure 1), are forest patches of 500-1,000 ha) in the vicinity of CA and MC, in the municipalities of Marques de Comillas and Maravilla Tenejapa (Figure 1). The altitude of the study area ranges between 140 and 1,450 masl (De La Maza 2009; Naranjo et al. 2014; INEGI 2018). and covers an area of ~800 km2, with approximately 50% of the existing natural cover (Tropical evergreen forest; Pennington and Sarukhan 2005; Tejeda-Cruz 2009; Garmendia et al. 2013; Muench and Martinez- Ramos 2016).

The predominant climate of the Selva Lacandona region is warm-humid with abundant rainfall in summer (Am (i') gw"; Garcia 2004). Average annual rainfall fluctuates between 2,500 and 3,500 mm, with 80% of precipitation occurring between June and November (García-Alaniz et al. 2010; Arce-Pena et al. 2019).

Currently, the region, except for MABR, is dominated by heterogeneous landscapes composed of tropical rainforest fragments of varying sizes immersed in a livestock and agricultural matrix (i.e., mainly maize and oil palm), with the presence of scattered human populations, which together form a heterogeneous landscape (Carrara et al. 2015; Muench and Martfnez-Ramos 2016; Falconi 2017; De La Torre and Rivero 2019). The relief of the study area is heterogeneous, structured mainly by flood zones, low hills, and steep ravines that divide the mountainous areas that run in a northwest-southeast direction in the region (Orellana 1978). The Lacantun River is the main body of water in the region and separates MABR from the adjacent communities towards the southern part of the region (Medellin 1996).

The natural vegetation of the area corresponds to tropical evergreen forest (Rzedowski 2006) in various successional stages. Some species of flora, common in the forest of the region are: *Attalea butyracea*, *Bactris major, Brosimum alicastrum, Ceiba pentandra,* *Dialium guianense, Ficus insipida, Licania platypus, Pouteria sapota, Scheelea liebmannii, Spondias mombin, Swietenia macrophylla*, and *Terminalia amazonia* (Naranjo 2002). Faunal diversity in the region is composed of species endemic to Mesoamerican tropical forests, endemic to Mexico and Chiapas (Medellin 1994; Lorenzo et al 2017; Naranjo et al. 2018), ranging from Nearctic to tropical affinities. Currently, 151 species of mammals (Naranjo et al. 2018), 345 species of birds (Rangel-Salazar et al. 2005), 67 species of fish, 77 species of amphibians and reptiles, 3,400 species of vascular plants, 44 aquatic species and 1,135 species of arthropods of the Class Insecta (Tejeda et al. 2009).

have been recorded. Threatened fauna, according to NOM-059- ECOL (2010) in the region, include the Baird´s tapir, jaguar, ocelot (*Leopardus pardalis*), puma, spider monkey

(Ateles geoffroyi), harpy eagle (*Harpia harpyja*), hocofaisan (*Crax rubra*), king vulture (*Sarcoramphus papa*), margay (*L. wiedii*) and the white-lipped peccary (Towns et al. 2016; Falconi 2017).

Most of the current inhabitants of the region have been legally settled since the 1970s, by right of the agrarian distribution (De Vos 2002; Contreras-Cortes 2018). However, it is only in the last decade that some settlers of foreign (Central American) and national origin, coming from other states of the Mexican Republic, have joined the population (pers. obs.). Some of these generations witnessed the federal decrees of the seven protected natural areas that exist in the region during the 1970s and 1990s, as well as the accelerated and government-induced deforestation and colonisation of the region (De Vos 2010; Muench and Martfnez-Ramos 2016; Contreras-Cortes 2018). In comparison to the La Selva Lacandona sub-regions ZN and CL, where most of the population is of Tzeltal, Chol and Lacandon origin, the CA and MC sub-regions are mainly inhabited by immigrants from Veracruz, Oaxaca, Campeche, Tabasco, Guerrero, other regions of Chiapas and central and northern Mexico (e.g. Michoacan and Chihuahua; De Vos 2002; Marquez-Rosano 2002; Contreras-Cortes 2018). The main productive practices in the three study subregions

are livestock (mainly free-grazing, although there are also intensive and semi- intensive management units; pers. obs.), and rainfed agriculture in plots of no more than 2 ha; maize, beans, squash, coffee and new crops that are expanding rapidly, such as oil palm, banana, jalapeno peppers and pineapple (pers. obs.); generally for self-consumption or small-scale sale (De La Torre 2016; Figueroa et al. 2016).

Complementarily, subsistence hunting, fishing, selective logging and ecotourism are also practiced (Muench and Martfnez-Ramos 2016; Naranjo 2018b). In addition, backyard poultry, pigs and sheep are moderately widespread in the region (García-Alaniz et al. 2010; Amador-Alcala et al. 2013; Montes de Oca et al. 2016).

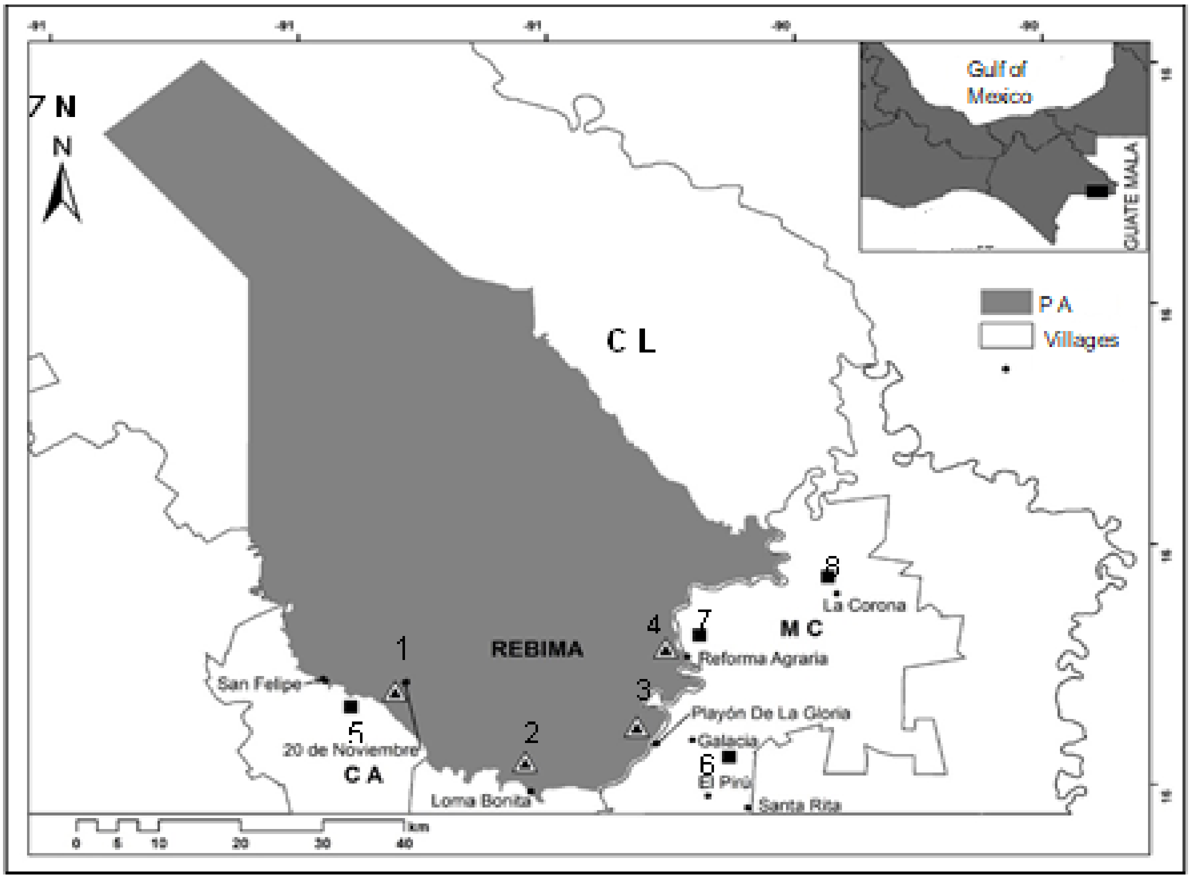


Figure 1. Study area. The five sub-regions are shown; Northern Zone (ZN); Lacandon Community (CL); Cañadas de Ocosingo and Margaritas (CA); Marqués de Comillas (MC), and Montes Azules Biosphere Reserve (MABR). Triangles, sampling sites within the Reserve. 1) site located adjacent to ejidos in the municipality of Maravilla Tenejapa; 2) site in front of ejido Loma Bonita; site in front of ejido Playón De La Gloria and 4) site in front of ejido Reforma Agraria. Squares, sampling sites outside the Reserve. 5) site within the boundaries of rural ejidos of Maravilla Tenejapa; 6) site within the community forest fragment of the ejido Playón De La Gloria; 7) site within the boundaries of the community forest fragments of the ejidos Santa Rita, El Pirú and Galacia; and 8) site in front of the ejido Reforma Agraria.

Methodology

Camera -traps

To achieve detections of Baird´s tapirs and white-lipped peccaries in the study area, traps were used to: 1) fit occupancy models, 2) obtain abundance-related values (i.e. capture rates), 3) density and 4) population parameters that can be alternatively calculated for the complementarity of this study (e.g. activity patterns, habitat use, selection or preferences, ecological niche models). Four sites were sampled within MABR and four more in the FFCs: Figure 1). For each FFC, a systematic and targeted sampling design was used, stratified by vegetation and land use types (i.e., induced crops, grassland, pasture, paddock, high forest, medium forest, acahualesand riparian vegetation); which are mainly found in the FFCs, to ensure that these are represented in the sampling. The sampling in MABR, being technically a continuous massif of high and medium rainforest with less variation in vegetation and land use, a systematic sampling was applied, considering the heterogeneity in its spatial and structural components, such as hills, valleys, ravines and riparian areas. Total trapping period: 2019-05-01 al

2021-09-08, with 71 camera-traps (16,850 camera-days). 65 independent records were made for Baird's tapir and 32 for white-lipped peccary at 15 and 10 photo-trapping stations: respectively out of 71.

Estimation of relative abundance

Rates of relative abundance were estimated from two complementary sampling techniques: 1) the use of camera-traps, 2) counts of tracks and individuals in line transects. To avoid auto-correlation in the number of photographic records, selection criteria were established (Silveira et al. 2013; Foster et al. 2013).

To estimate abundances, indices were calculated for each ungulate in the following ways:

1) Index of relative abundance (IAR) based on photographic records (IAR-f) suggested by Sanderson (2004). The equation was used: IAR-tf= ∑Indf/UEM *1000; where: ∑Indf = sum of individuals observed in independent records, per particular or general site throughout the study or over a given time span; USE= Unit of Sampling Effort, weighted in camera-days; 1000= unit of standardisation.

2) Based on the frequencies of observed individuals and traces.
We also proceeded to calculate indices of relative abundance per kilometre travelled, multiplied by 100 (Carrillo et al. 2000; Naranjo 2000; Sanderson 2004):
I = (number of records/USE)* 100.

The months from February to May were considered as dry months and from May to October as rainy months.

The program Distance 6.0 (Thomas et al., 2010) was used to calculate the population density, following the method of Buckland et al.

D= nA * f(0) / 2L (number of individuals / km2; Buckland et al., 1993).

Where: D = density

n = number of individuals observed

A = sampling area (km^2)

L = length of transect (km)

f(0) = probability of detection calculated from perpendicular observation distances.

Connectivity modelling

Models were constructed with the locations of occurrence of individuals and a resistance surface layer, which was derived from species environmental suitability models obtained with Maxent 3.4.1 (Phillips et al., 2021). For suitability modelling, we used the bioclimatic layers available in Worldclim Project 2 (Fick & Hijmans, 2017) and the ENVIREM climate layers (Title & Bemmels, 2018). To avoid the model having an effect caused by over-parameterisation and collinearity between layers, we discarded some bioclimatic layers based on the variance inflation factor (VIF), which quantifies multicollinearity between layers by indicating the degree to which a variable increases the standard error of a regression, the VIF was calculated with the usdm 1.1.18 package, (Naimi et al., 2014). The final set of variables for the T. bairdii model were: temperature seasonality (Bio4), annual temperature range (Bio7), mean temperature of the driest quarter (Bio9), precipitation of the wettest quarter (Bio14), precipitation seasonality (Bio15), precipitation of the warmest quarter (Bio18), potential evapotranspiration (PET) of the driest quarter, PET of the coldest quarter and PET of the wettest quarter. Additionally, we integrated the topographic moisture index layers, which indicate topographic and hydrological processes, and a forest landscape integrity index layer for the study area (Grantham, 2020). The latter indicates the state of landscape integrity by considering the degree to which a system is free of anthropogenic modifications to its structure, composition and function (Parrish et al. 2003). The layer has continuous values from 0-10, where the highest value indicates a landscape with high integrity. The resulting model for both species was used to obtain the resistance surface by resampling the raster layer obtained in ArcGIS. We assigned low resilience values to pixels representing high percentages of suitability and included a layer of roads, infrastructure and cities obtained from OpenStreetMap (http://www.openstreetmap.org/). Likewise, we assigned lower values of resistance to species movement to rural roads, footpaths and dirt roads, while the highest resistance value was considered for population centres, urban roads and road infrastructure. Finally, the layer was rasterised and rescaled using the Mosaic to raster tool in ArcMap 10.8. and the landscape resistance values were 5-100.

Connectivity patterns were obtained with the CIRCUITSCAPE 4.0.5 program, which calculates the effective resistance to movement and all possible paths between pairs of locations or focal nodes, where one node is arbitrarily connected to a 1-ampere current source, while the other node is connected to ground (McRae, 2006). The process is performed by iterations between pairs of focal nodes and expressed in current values on a map. Additionally, least cost paths (LCPs) were determined with the Linkage Mapper 3.0.0 program (McRae and Kavanagh, 2006). (McRae and Kavanagh, 2011), which calculates all possible routes and their cost in the landscape, showing the least cost routes based on the Arcinfo® Cost Distance algorithm, i.e., a calculation of the minimum cumulative cost distance between two nodes. The result is a raster layer with cell values representing the cumulative cost from a nearby source cell. From this raster, LCPs are calculated in a vector layer of lines that establishes the optimal routes for corridor establishment (Adriaensen et al. 2003). Finally, we calculate the bottlenecks or constriction zones for species movement (pinch points) in the study area, these are used to identify important areas for connectivity due to a high flow of individuals, where high values indicate that corridors are vulnerable to unfavourable conditions (McRae et al. 2008).

Level of achievement of the project's original objectives

Objective	Not achieved	Partially achieved	Fully achieved	Comments
To estimate the abundance and density of Baird's tapir and white-lipped peccary populations within and adjacent to the Montes Azules Biosphere Reserve; within the Lacandon forest.			X	The Baird's tapir showed a considerable abundance in this study, compared to others carried out in its range (See Appendix 5), which could indicate that it is a species that is little hunted (Naranjo 2009); and to the possible effects of governmental conservation programmes implemented in the area for more than 15 years (i.e., payment for environmental services (Valdez 2015). According to relative abundance rate (RAI) estimates by species, the white-lipped peccary presented the highest total abundances of the three species with 66.3 ind/1000 camera-days: 15.9 ± 3.24 D.E. ind/100 km), and 4.60 [0.16] traces/ 100 km. In contrast, for Baird's tapir abundances were estimated at 8.72 ind/1000 camera-days; 0.76 ± [0.1] ind/100 km; 7.3 [0.02] tracks/100 km)
Estimating the home ranges of Baird's tapir and white-lipped peccary.	X			It was not possible to acquire the satellite service due to lack of financial resources. The prices of the equipment (radio-collars) rose too high in a short period of time.
To estimate and model the probability of habitat occupancy of the ungulates under study in the study area.		X		This objective is still in progress. The methodological framework of MacKenzie et al. (2002) and (2006) is used to fit models to estimate site occupancy (Ψ) coupled with

				detection probability (P) for each ungulate under study. With this method, in addition to distribution, it will also be possible to infer habitat-associated relationships, for example, data on site-specific characteristics (i.e., canopy cover) with the presence of the species. This occupancy modeling will focus on estimating the proportion of a suitable habitat area that is occupied by an individual or group of the species under study, thereby also interpreting the results in terms of the focal ungulates' use of the habitat (MacKenzie and Royle 2005; Kelt et al. 2019). Therefore, occupancy analyses were begun for Baird's tapir and white-lipped peccary populations in the study area.
Generate a habitat suitability model (HSI) for each focal species in the study area.		X		Work on this is still ongoing. The work depends on many experts answering a virtual survey to give their opinion on habitat suitability variables related to the species under study and on the completion of the habitat occupancy modelling. Due to the health contingency, it was not possible for me to approach many villagers/cowboys to measure several variables on their properties, as well as to conduct a larger number of interviews.
Characterise connectivity for Baird's tapir and white-lipped peccary in the Selva Maya, a humid tropical ecosystem that is fragmented by agriculture and livestock, using least-cost path analysis (circuit theory).4			X	The main findings indicate the different degrees of connectivity between various corridors. Potential (Figure 3) Although all possible connectivity routes offer the same resilience costs, NPAs or core areas have very high costs for the movement of Baird's tapirs and white-lipped peccaries, especially for Guatemala and Mexico, while Belize has a kind of reserve circuits (connectivity networks) with good levels of connectivity and

				low costs for the movement of both Baird's tapirs and white-lipped peccaries. High-speed roads, urban centers and large deforested areas that have fragmented habitat for both species represent the main variables that erode connectivity and habitat quality for both ungulates.

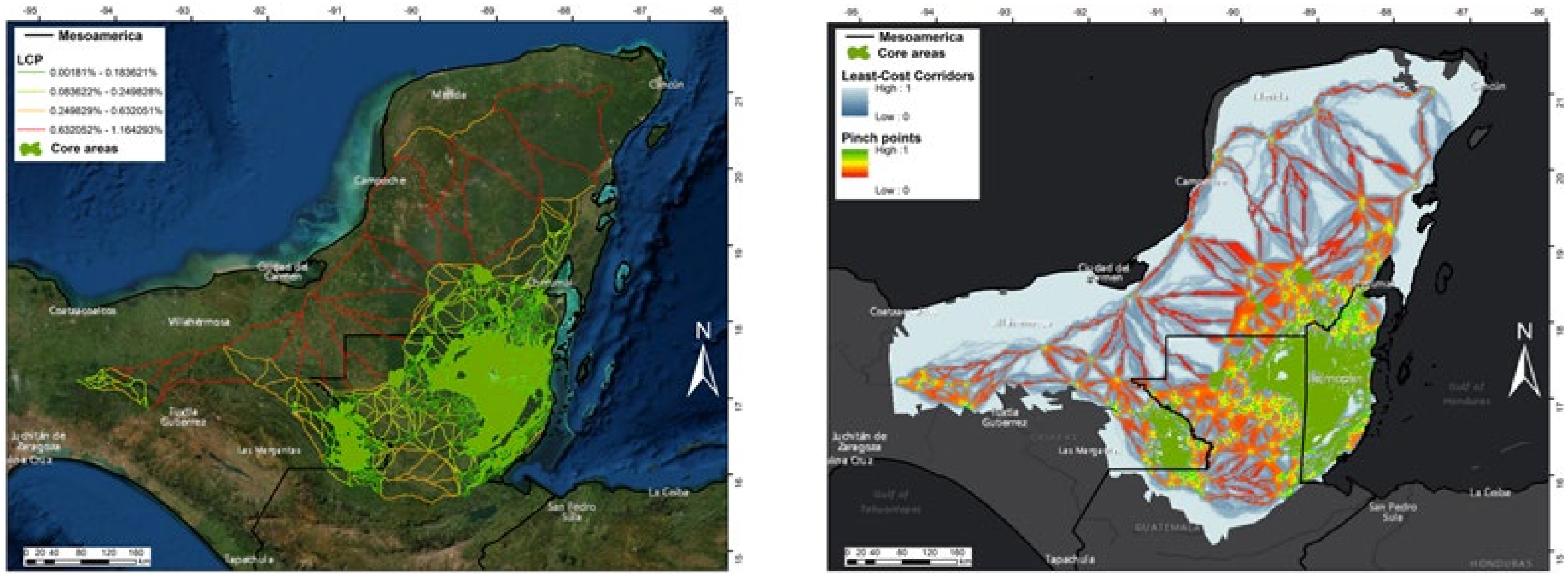
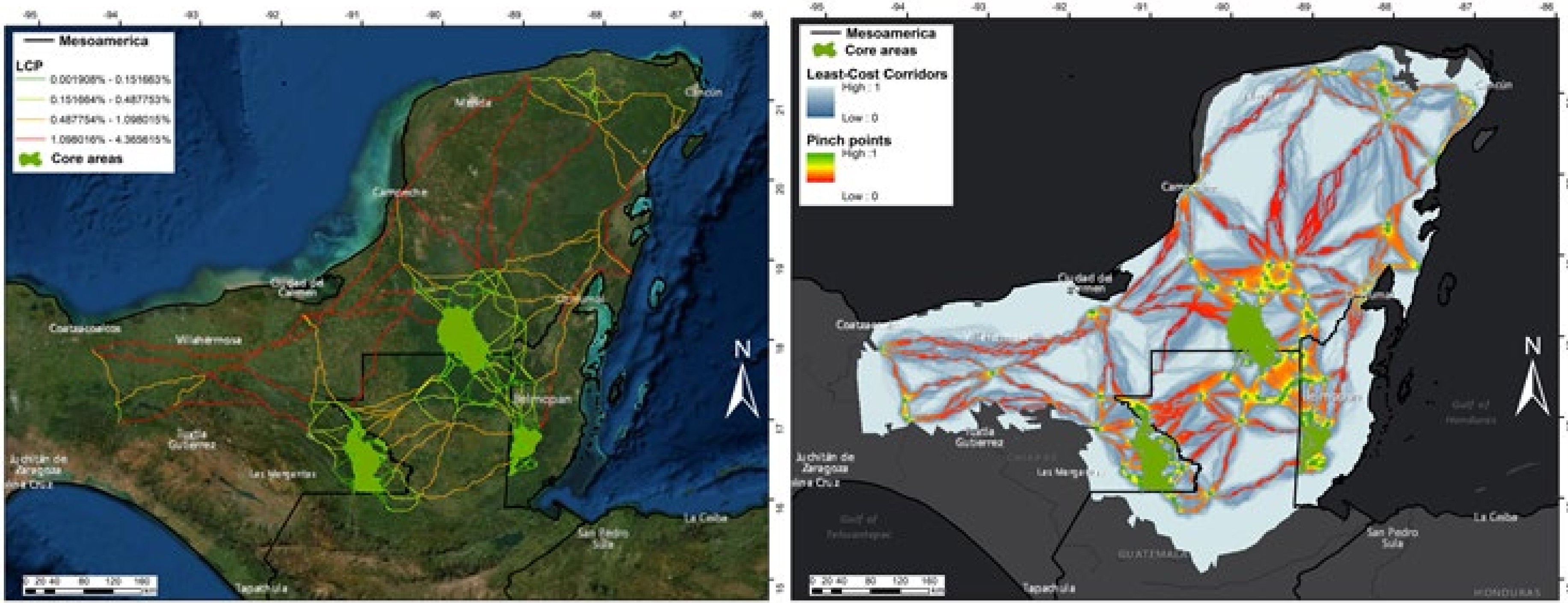


Figure 3. Functional connectivity patterns for tapirs (Top left and Top right) and white-lipped peccaries in the Maya Forest (Bottom left and Bottom right).



Mesoamerica
LCP
0.001908% - 0.151663%
0.151664% - 0.487753%
0.487754% - 1.098015%
1.098016% - 4.365615%
Core areas
Mérida
Cancún
Campeche
Ciudad del Carmen
Chetumal
Coatzacoalcos
Villahermosa
Belmopan
Tuxtla Gutiérrez
Juchitán de Zaragoza
Las Margaritas
San Pedro Sula
La Ceiba
Tapachula
N
Mesoamerica
Core areas
Least-Cost Corridors
High : 1
Low : 0
Pinch points
High :1
Low : 0
Gulf of Honduras
Gulf of Tehuantepec
GUATEMALA
HONDURAS

Unforeseen difficulties that arose during the project and how these were tackled (if relevant).
One of the genuine objectives of this project was to capture the ungulates understudy and attach radio-collars to track their movement patterns (gps tracking collars). However, due to unexpected and severe funding complications related to the radio-collars and their implementation, my research advisory committee decided to cancel the plan to capture individuals.

This was after assessing that radio-collars (with standard VHF collars technology) were not reliable to use for accurate range assessment. I needed around 7000 GBP for gps-collar monitoring equipment for at least two individuals and the payment of the satellite service for one year. To balance this deficit in the research project we decided to purchase Audiomoths (ultrasonic recorders) to incorporate information on possible temporal and spatial patterns of poachers (by recording gunshots) in the Lacandon rainforest to inform and guide management interventions in the area. However, due to the international shortage of chips and electronic components, we had an emerging complication of not getting the devices from the suppliers. We have, to date, a delay of approximately one year since their purchase (the administrative department of El Colegio de la Frontera Sur can account for this).

The three most important outcomes of your project.
1) The contribution of this study is part of the monitoring of Baird´s tapirs and white-lipped peccaries undertaken by the author for the last decade. We now have a clearer vision of the population trends and dynamics of the species under study.

2) I consider that providing information on the drivers of habitat distribution patterns and assessing habitat connectivity is crucial for conservation in the face of climate change.

3) Worked with people in the communities on issues of awareness, norms and environmentally friendly attitudes. Through interviews and talks, I was able to generate information, not only to learn about the current perception of the ungulates under study but also to strengthen capacities that can be implemented soon in the surveillance committees and community wildlife and habitat monitors in the region.

Involvement of local communities and how they have benefitted from the project (if relevant)
During the monthly camera-trap monitoring, some groups of local monitors were trained. These were people who showed real interest in the project and the data collection techniques (i.e., tracking and use of camera traps). These people will be able to strengthen a community committee for the future surveillance and monitoring of wildlife, as well as be able to participate in different ecotourism programs in the region.

The local monitors were trained in the correct use of GPS, camera-traps, tracking and line transect walks to obtain faunal signs, as well as the recording and basic processing of information in logbooks. Finally, this project contributed to a small economic benefit, as at least 12 local people were hired as guides or boatmen for the fieldwork. In addition to paying for cooks and accommodation services.

Are there any plans to continue this work?
Yes, I intend to continue the evaluation of the hunt with the use of the Audiomoths (ultrasonic recorders). This is unfinished business, which we will seek to complete with external funding that we can get soon. We already have serious news about the arrival of the audiomoths, and as soon as they arrive, we want to install them in areas that we have detected as potential hunting sites. We also intend to finalize the documentation of evidence of in situ deforestation to incorporate this variable along with hunting rates and habitat fragmentation/connectivity indices into our habitat suitability models.

How do you plan to share the results of your work with others?
1) We expect that the results of this project, and the information obtained will be published in scientific international journals that focus on ecology and conservation 2) We hope to share the information directly with the expert specialist groups on Baird´s tapirs and white-lipped peccaries, a group in which we have taken place in the last decade.

Timescale: Over what period was The Rufford Foundation grant used? How does this compare to the anticipated or actual length of the project?
The grand was transferred in September 2020 to El Colegio de la Frontera Sur, the institution that received and administered the funds. I had already started prospective activities in the field, so the same month that I received the Rufford foundation funds, I continued with the activities in the study area. The study was planned with a duration of 24 months, from February 2020 to February 2022. The Rufford Foundation grant was used from the date of its receipt until the beginning of February 2022.

Which are the next important steps?
The next step is 1) to publish as soon as possible the main findings derived from this research in three scientific articles (in prestigious science journals), of which drafts are already available. 2) Provide the information obtained in this study to the federal authorities that administer the protected area (Montes Azules Biosphere Reserve and zones of influence) so that they can make decisions and it can be incorporated into the reserve's management plan.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did The Rufford Foundation receive any publicity during the course of your work?
Yes, I used the Rufford Small Grants Foundation logo in workshops and forums where we presented information related to this project. In addition, I report that we will continue to use the logo at upcoming national conferences, as well as on the day of my thesis defence (Figure 3).

I extend my gratitude to the Rufford Small Grants Foundation for supporting this project; this grant was instrumental in the development of this study.

Figure 3. Use of Logo RSGF

Please provide a full list of all the members of your team and briefly what was their role in the project.


Figure 4. Part of the team working on this project.

Fredy A. Falconi Briones. Project coordinator and responsible for the monitoring of field activities and the analysis of the information obtained.

Eduardo Naranjo Piñera. Directly responsible for the project before the administration of El Colegio de la Frontera Sur, the institution that administered the resources. He will participate in the analysis of the information and publication of results.

Carlos Trillanes Flores, Jorge Rodriguéz, René Bolóm-Huét and Pablo González. They were of great support during some of the field sampling activities. **Edwin Hernández**

García was in charge of the management of the ultrasonic recording devices (Audiomoths).

Rubén Jiménez Álvarez was the lead guide and liaison in the Lacandon Jungle region. His experience as an assistant in wildlife monitoring, as well as his knowledge of the region, helped substantially in the development of this project, for example in identifying key actors and getting people to agree to answer interviews or participate in forums.

Doris Castañeda, as well as **Ronald Domínguez Mayorga,** supported the necessary procedures and management for the use of the financial resources of this project.

Finally, Efrain Orantes was in charge of taking some photographs during the forums and workshops, as well as of the landscape in the study area. To all of them, thank you.

Other comments

It is well known that connectivity can influence populations and communities through a variety of mechanisms, including inbreeding avoidance, colonisation of unoccupied habitats, mass effects and disease spread. We will therefore seek to continue working for the rest of the year to generate information on 1) the connectivity status of tapir and white-lipped peccary populations and 2) population viability in the face of climate change in the Maya Forest region.

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