The Anthropogenic Impact on Cañón del Usumacinta Protected Area: Implications for Monkey Populations in Tabasco, Mexico

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Awarded a PSGB Conservation Grant in 2017

In southern México, deforestation related to changes in land-use and constant anthropogenic activities have caused environmental disturbances in tropical forests and modified the habitat of *Alouatta pigra* and *Ateles geoffroyi*, both Endangered species.

The purpose of my research is to identify how anthropogenic activities relate to the current distribution and demographics of monkeys. Through ethnographic techniques and methodologies of ecological data collection, I intend to generate information that works to create better conservation strategies suited to the cohabitation of monkeys and people.

The goals of my field study were to:

1. Estimate the population density of *Alouatta pigra* using line transects in disturbed and continuous forest.
2. Compare the structure and composition of *Alouatta pigra* groups in disturbed and continuous forest.
3. Compare presence/absence of *Ateles geoffroyi* in disturbed and continuous forest.
4. Identify and categorize human activities related to the use of natural resources through participant observation, participatory mapping and the application of a semi-structured questionnaire.
5. Identify overlaps in activity areas of villagers and non-human primates that inhabit the study site.

My research was conducted within the Flora and Fauna Protection Area Cañón del Usumacinta (17°27′ N, 91°31′ W; 46,) in three rural villages located in a mountainous region known as Sierra de Tenosique in the southern state of Tabasco, México: Niños Héroes de Chapultepec (17° 16' N, 91° 24' W), Corregidora Ortiz (17° 15' N, 91° 2' W) and Cortijo Nuevo 2da Sección (17 ° 17 'N, 91 ° 20' W).

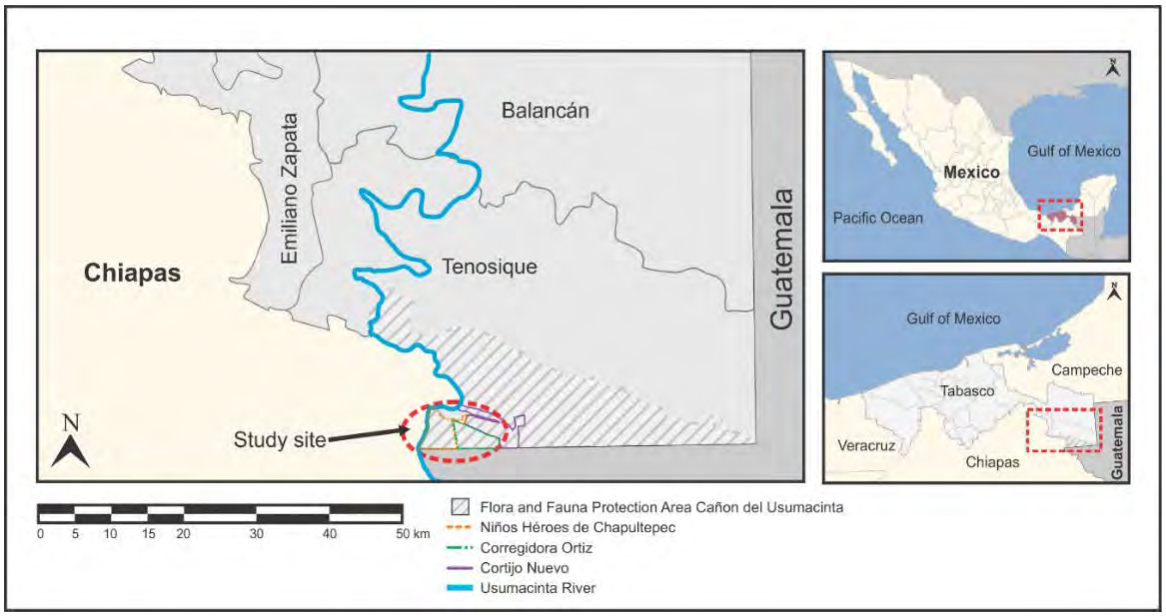

Figure 1. Study site located in the Flora and Fauna Protection Area Cañón del Usumacinta
Source: Own elaboration (CorelDraw 2017) based on Google Earth and APFFCU official map.

Non-human Primate Surveys

Surveys took place between June and July 2017. Data were collected every third day on diurnal line transects alternating in areas of continuous and disturbed forest.

We walked 36.5 kilometres on 11 transects, with an average of 3.91 hours/transect, for a total sampling effort of 58.63 hours over 15 days. An encounter rate of 1.43 individuals/kilometre (0.26 groups/kilometre) was estimated in continuous forest*. A total of 77 individuals were recorded corresponding to 15 groups, with an average of 5.1 and 5.5 individuals per group in continuous and disturbed forest, respectively.

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* To estimate the encounter rates of *A. pigra*, I considered only 38 of the 77 independent sightings for seven groups out of a total of 15 groups that we spotted, using only the sightings recorded during the morning transects (0600 to 1200 hours).

** The data for disturbed forest were insufficient since only a group of seven individuals were observed during the mornings transects.

In continuous forest, the most frequent social structure* was Multimale-Unifemale (45.5%), followed by Multimale-Multifemale (36.6%), Unimale-Multifemale (9.1%) and Unifemale (9.1%). In disturbed forest, the most frequent groups were Multimale-Multifemale and Multimale-Unifemale (at 50% each).

Finally, I recorded 18 different sites with *Ateles geoffroyi* presence* obtaining a higher percentage of sightings in continuous forest (72.3%) compared to disturbed forest (27.7%).

Ethnographic Work (Social Science Methods)

Over five weeks, through participant observation, I spoke to 142 villagers 16 and older, using a semi-structured questionnaire about the villages' history, daily land use activities and ecological information about local non-human primates. Through participatory mappings, I made two maps in each village with the support of local people, where they drew their demography, location of human activity areas, houses, roads, streets and reference sites.

I identified that 49.3% of people surveyed said they performed at least one activity that directly affected forests. These activities were: ""Agriculture", "Livestock rearing", "Extraction of timber resources" and "Support in any agricultural activities" (Figure 2).

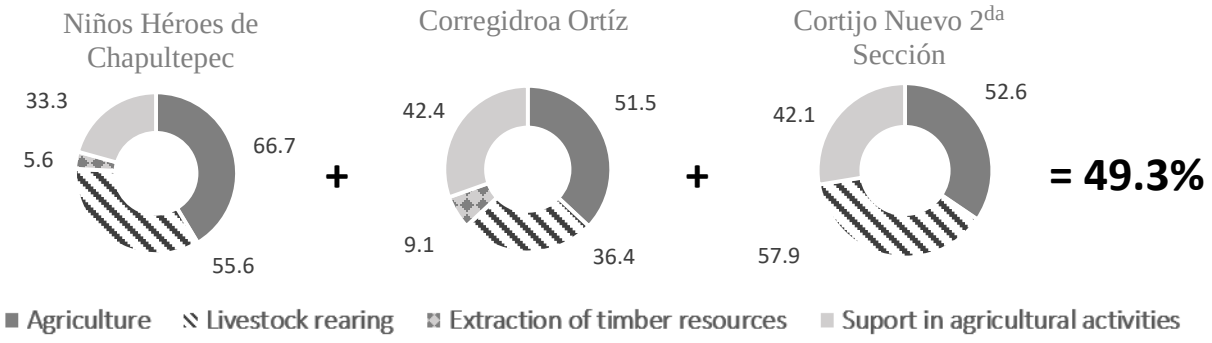

Figure 2. Comparison of current activities that directly affects habitat of non-human primates in each village.

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* For the structure and composition of *A. pigra* and the presence/absence records of *A. geoffroyi*, I had an average of 8.09 hours/day from a total sampling effort of 121.4 hours over 18 days.

Use of Forest Resources**

I listed the tree species most commonly used by villagers, as some kind of forest resource*. Five of them are: *Manilkara Chicle* (Chicle) (78.0% to 94.3%), *Cedrella odorata* (Red cedar) (13.6% to 54.3%), *Swietenia macrophylla* (Mahogany) (15.2% to 54.3%), *Terminalia Amazonia* (Canchán) (37.1% to 41.5%) and *Calophyllum brasilense* (Barí) (24.2% to 40.0%). The fourth resource on the list, is an unidentified species, commonly called Bayo (39.0% to 42.9%). *Manilkara Chicle* and *Calophyllum brasilense* have been previously reported in other studies as species that provide fruits and leaves that the monkeys feed on.

General Perception of Monkey Populations by Villagers

Most men in "Niños Héroes of Chapultepec" and "Corregidora Ortiz" considered that monkey populations were stable and were not threatened (45% and 59.4%). Most women in "Niños Héroes de Chapultepec" simply did not answer or did not know. In "Corregidora Ortíz" most women (45.5%) answered the same as men in their village. Lastly, in Cortijo Nuevo 2da Sección, most men and women considered that monkey populations have decreased over the years (53.8% and 45.5%).

Overlaps Between Human Activity Areas and Monkey Presence Sites

I recorded 30 sites where there was a presence of monkeys, of which 56.6% were located in areas of Primary Forest areas and 43.4% in Secondary Forest and "acahuales" areas. Those areas were nearest the villages and land plots used for livestock and agriculture (Figure 3).

Conclusions:

- The low detectability of *A. pigra*, associated with exogenous factors during our field season, generated insufficient data to estimate population densities; however, I identified differences between social structures in both types of forests. Also, I recorded fewer *A. geoffroyi* in disturbed forest than in continuous forest, probably because the human activities that are performed close to this type of forest have altered the activity areas and home ranges of these species.

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* I selected the species that were most mentioned ($\geq$ 40%) in all villages.

** "Use of forest resource" data is based on what was stated by the people with whom I spoke

- A large percentage of families subsist through agricultural activities and the use of some tree species, including those that feed the monkeys. Some of these tree species are protected in Mexico and Guatemala, which increase their surplus value and causing their daily exploitation, as they are an immediate and easily accessible resource.

- In Niños Heroes de Chapultepec and Corregidora Ortíz most people considered that the monkeys are not threatened and the populations remain stable, it is probably due to the fact that these towns have the largest extension of primary forest and large areas of difficult access near the border with Guatemala. Meanwhile, in the Cortijo Nuevo 2da Sección, most people concluded that monkey populations have moved away and declined considerably over the years, probably because they have the largest extensions of livestock and agricultural areas.

- The considerable reduction in government programs of economic support for the protection of local biodiversity and the reduction of harvested products has influenced to illegal traffic of wood in protected areas that affect the habitat of the monkeys.

Finally, it is necessary to understand that these data are preliminary and require ~~a~~ greater effort and sampling time; however, I propose three short-term steps:

- The restructuring and reintegration of economic support programs for the enhancement of protected areas.
- The creation of local educational campaigns to generate an identity with non-human primates in each village.
- Afforestation campaigns for timber species that would significantly reduce illegal logging.

Data presented here are part of my thesis project and I am currently developing new analyses, using satellite mapping, integrating information collected in the field, to show, strengthen my theories and promote educated proposals to authorities and villagers.

Figure 3. Pair of Black-handed spider monkeys *(Ateles geoffroyi)*, left; Group of *Black* howler monkeys (*Alouatta pigra)* foraging near a house in Niños Héroes de Chapultepec village, centre; recently logged area designated to agricultural activities, right.

Figure 4. Participatory mapping in Niños Héroes de Chapultepec and Cortijo Nuevo 2da Sección, left and centre; principal investigator developing housing maps with the support of women group in Corregidora Ortíz, right.

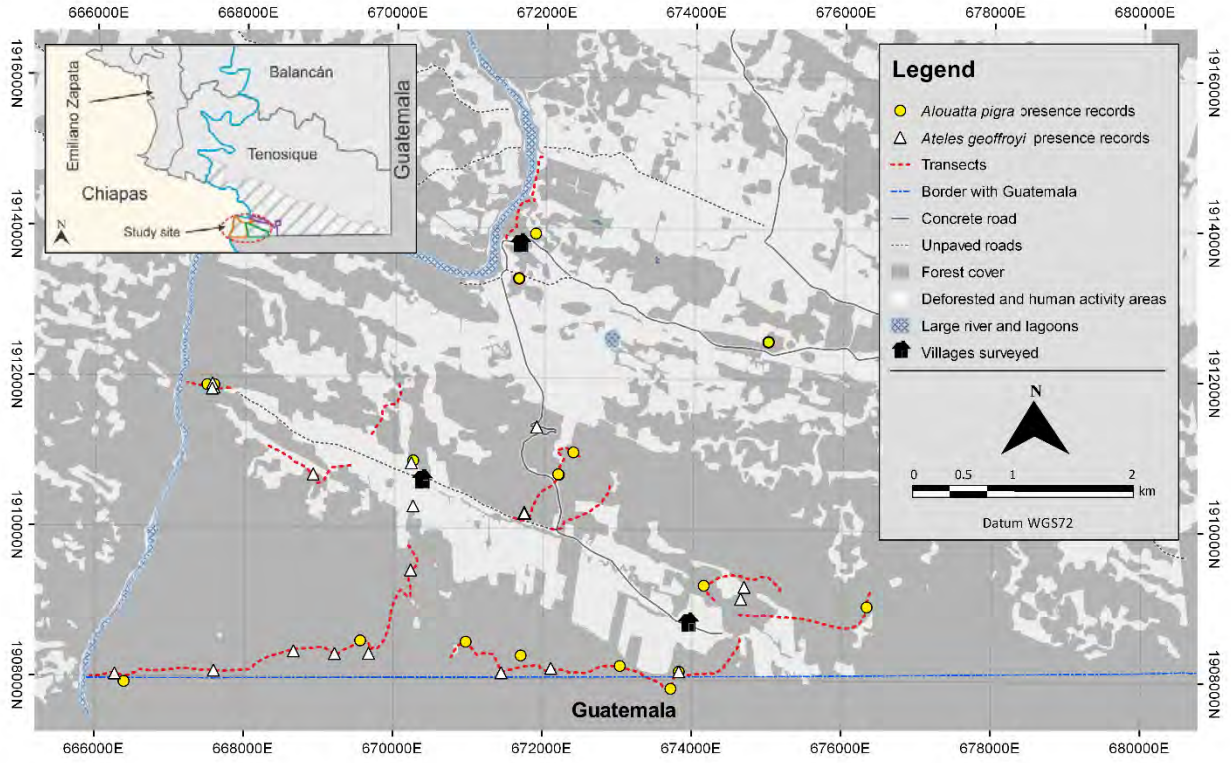

Figure 5. Human activity areas and monkey presence sites during field season.
Source: My own elaboration based on data collected in the field and software QGIS 2.18 (Datum WGS72)