Deforestation (agricultural encroachments) In the Chiquibul National Park

Technical Report 2011

Prepared by: Boris Arevalo

FCD Biologist

Friends for Conservation and Development

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INTRODUCTION

The Chiquibul Forest (CF), located within the Cayo District, covers an area of 176,999 ha (437,376 acres) and is comprised of three protected areas being the Chiquibul National Park (CNP) (106,838 ha), Chiquibul Forest Reserve (CFR) (59,822 ha) and the Caracol Archeological Reserve (CAR) (10,339 ha), with central UTM coordinates 1,878,200 – 1,871,800 North and 265,600 – 322,600 East. Meerman and Sabido (2001) identified 17 different ecosystems within the area, all being variants of Tropical Broadleaf Forests, except for a pine forest category. The region has a subtropical climate with a marked dry season between February to June and a rainy season coinciding with the hurricane season which starts from July to November (Salas & Meerman 2008). Cretaceous limestone forms the parent rocks found in the western half of the Chiquibul while Permian meta-sediments are dominant on the east (Cornec 2003). On the extreme south of the Main Divide there are volcanic deposits. The soils are generally derived from limestone and are regarded fertile in comparison to other tropical areas but on the steeper limestone slopes Wright *et al.*(1959) classifies the soils as skeletal where the bedrock tends to protrude out as a consequence of the soil layer being a few centimeters thick.

Within the Chiquibul Forest there are no human settlements but an estimated 65 Guatemalan communities are found along a 45 km stretch along the Belize-Guatemala border of which 11 are buffering the CF and are highly dependent on the natural resources found in this forest. Guatemalans from these communities are the major agents causing threats to the native biodiversity and altering ecosystem functions having a myriad of direct and indirect impacts to the area's ecological integrity.

Along the western border the major threat to the ecological integrity of the CF is deforestation as a cause of converting forested lands to "milpa" farms (through the process of slash and burn agriculture) and livestock pastures. This phenomenon not only has local impacts but also at a regional and international scale where it has been associated with climate changes at the global scale (Fearnside 1996). While developed countries have contributed to much of the planet's recent warming trend by burning fossil fuels and via the introduction of industrial compounds, Adger & Brown (1994) estimate that tropical deforestation is responsible for between 25% and 30% of the alleged climate warming in the world; and forests are responsible for about 90% of the carbon stored in global vegetation.

Slash and burn agriculture is a form of shifting cultivation system that supports millions of mostly poor people throughout the world, especially in the tropics (Loza 2004) and accounts to about 30% of all cultivated lands (Attiwill 1994). Conklin (1961) defines slash and burn agriculture as any continuing agricultural system in which temporary clearings are cropped for shorter periods in years that follows. It consists of clearing plots of land from forest and allowing vegetation to dry, then burning, and finally planting crops in the ashes. This practice is also a major precursor of permanent agriculture and pasture establishment (Ewel *et al*. 1981) and considered a major cause of tropical lands used and land cover changes, especially deforestation (Metzger *et al*. 2002).

Potential explanations for why farmers in developing nations employ slash and burn agriculture range from increased population pressure (Jones & O'Neill, 1992), land tenure (Larson & Bromley, 1990), government policies (Deacon 1995), and price risk (economical factors) (Barrett 1999).

METHODOLOGY

The methodological process employed in this assessment included three phases being: i) a literature review; ii) aerial surveys and iii) satellite imagery interpretation. No ground base surveys were conducted during the course of the assessment (2011) due to high security reasons but reports from previous ground truthings were utilized. The literature review was conducted in order to obtain historical deforestation data within the CF and to understand the ecological impacts of deforestation at the local, regional and global scales. Satellite imagery interpretation was employed in order to calculate deforested areas and produce maps showing the spatial arrangement and distribution of deforestation along the western border. Aerial surveys were conducted (three aerial surveys: 26/08/2011; 25/11/2011; 24/12/2011) in order to verify what was observed in satellite imagery and to record new encroachments.

RESULTS AND DISCUSSION

The ecological integrity of the Chiquibul Forest is severely being altered by agricultural encroachments along the western border between Belize and Guatemala; being caused by Guatemalans. These individuals mostly live on extreme cases of poverty and depend greatly on the available natural resources found within the Chiquibul Forest. The major cause of deforestation along the western border of the Chiquibul Forest is slash and burn agriculture, which is a mechanism primarily practiced by natives and presently by the most poor of any society who take advantage of the nutrient rich ashes left after burning felled vegetation.

Deforestation as a cause of agricultural encroachments is an activity occurring since before 1987 as in this year aerial photography analysis indicated that an area of 113 hectares were deforested. Satellite imagery analysis clearly indicate that over the last 24 years there has been a clear increase in area being deforested within the Chiquibul Forest, accounting up to May of 2011 for an area of 4,931 ha. (Figure 1).

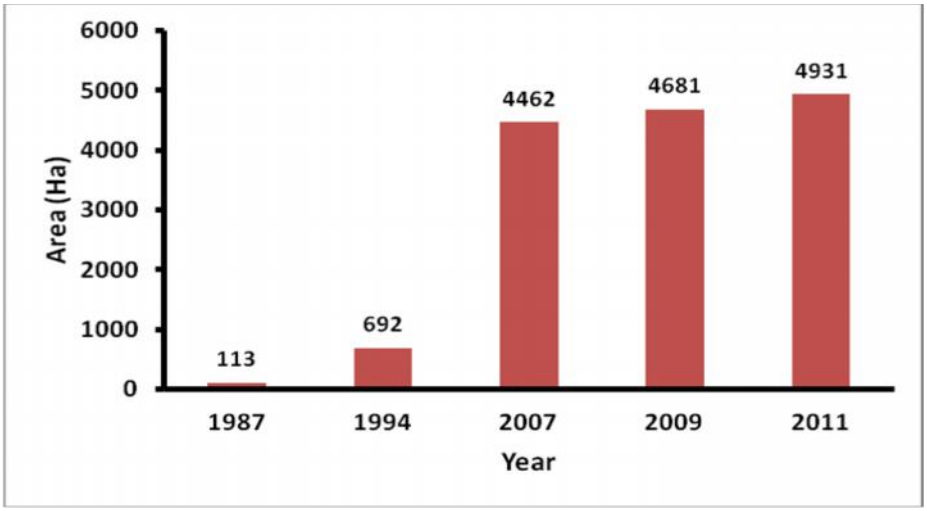

Figure 1*: Deforested areas within the Chiquibul Forest as a consequence of agricultural encroachments*.

Based on the available historical deforestation data (1987 to 2011) the annual rate of deforestation along this 24 year time period was calculated at 200 ha. per year. It must be clearly stated that this figure does not mean that annually there is an increase in land under agricultural production but this also includes areas deforested due to fires as a consequence of those escaping when farmers burn their fields.

If no aggressive interventions are set in place to cease the present rate of deforestation it will inevitably continue to increase in a linear manner. Based on a business as usual projection model it is estimated that by 2015, an estimated area of 5734 ha. will be deforested and by 2035, the total deforested area will be 9,749 ha. (Figure 2). The results of this model need to be interpreted with caution as it is a very conservative one, where it does not take into account population growth rates, political and economical changes within communities.

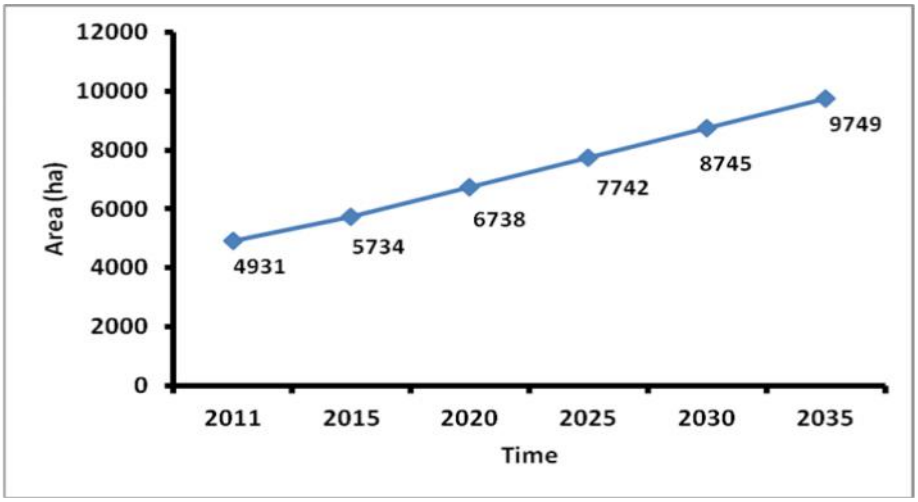

***Figure 2**: Projected deforested area from 2011 to 2035, within the Chiquibul Forest based on a business as usual projection model.*

Based on the historical satellite imagrey available, the general areas most impacted by deforestaion are the CAR, Southern CNP (Rio Blanco area) and the area just south of the CAR but within the CNP limits. By mid 2011, there was an evident increase in deforestation on the northern part of the CNP and CAR, as well as an evident increase in deforestation along the west central zone of the CNP (Figure 3).

In southern CNP, agricultural encroachments are up to 3 km (bird flight) within Belizean territory while in the CAR and vecinity these have been expanding up to 4 km. Figure 3 clearly shows a correlation between conglomerate of communities close to the western boarder and deforestation, directly indicating that as population grows within these communities, so will the pressure for deforesatation.

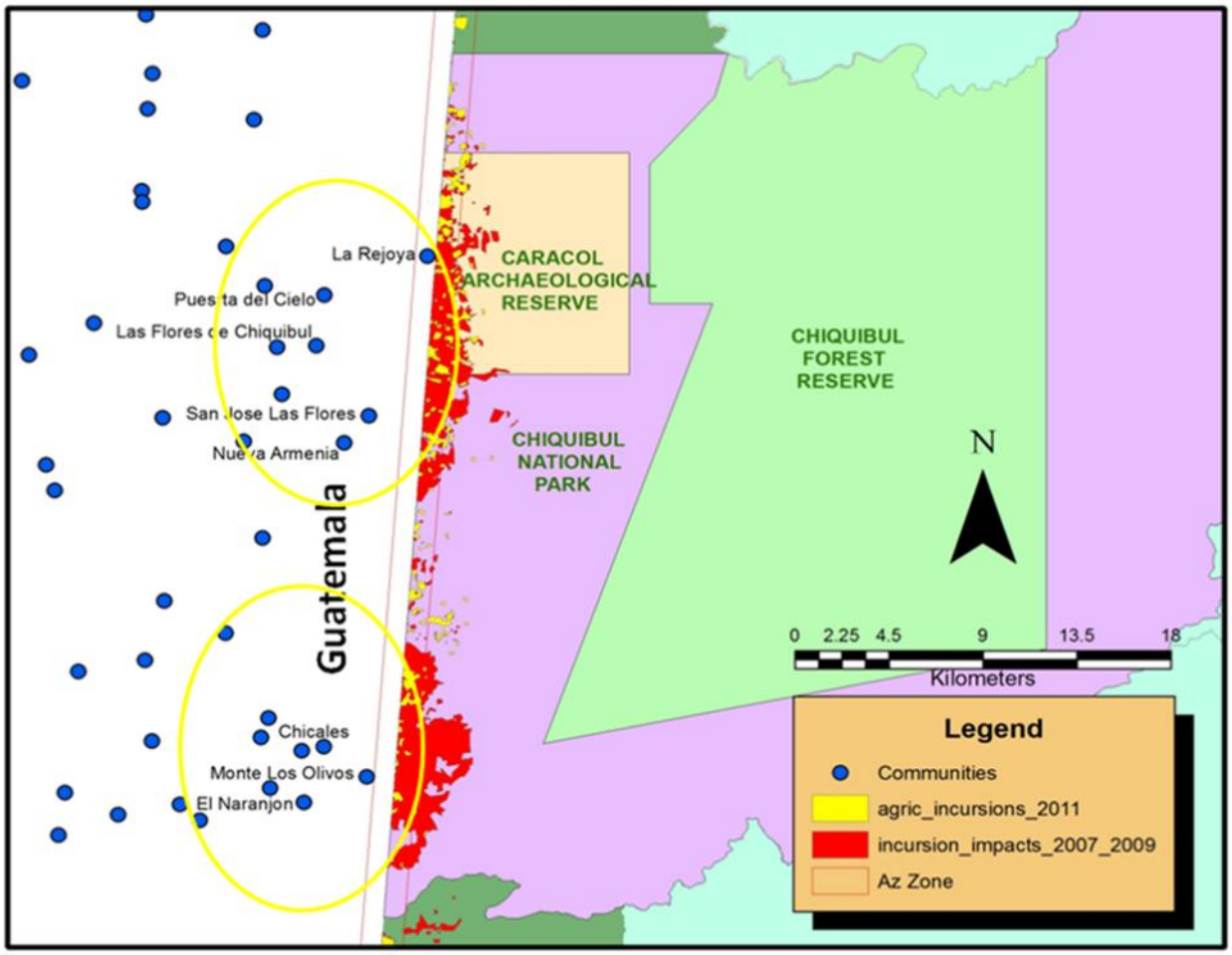

***Figure 3**: Spatial distribution and arrangement of deforestation and Guatemalan communities along the western border of the Chiquibul Forest caused by agricultural encroachments.*

Based on aerial and ground truthing surveys Guatemalans have mainly been deforesting for planting basic grain crops such as corn and beans (Figure 4). There have been confirmed reports as is the case with that of Rigoberto Gutierrez, that land is being cleared to give way for cattle ranching (Figure 5) and for the building of human dwellings.

Figure 4*: An illegal corn plantation within the boundaries of the Chiquibul National Park.*

Figure 5*: Illegal cattle ranching within the boundaries of the Chiquibul National Park*.

A

B

Figure 6*: Aerial photographs of freshly deforested areas within the Chiquibul National Park (**A**: date taken: 25/11/2011; UTM coordinates: northing: 1842587; easting: 268307; **B**: date taken: 25/11/2011; UTM coordinates: northing: 1835901; easting: 269017).*

Ecological and economical impacts of deforestation

Ecological impact:

It is extremely difficult to quantify the true ecological impact of deforestation on the local biodiversity without having rigorous research that aim to provide insight on specific questions. Being faced with lack of information only general conclusions can be made based on the results of other case studies. An evident impact of deforestation is habitat loss and destruction but its true impact on population dynamics is not known. This alters population structure due to limiting habitat and food availability. The disturbances create habitat and niches for more generalist species that will tend to displace specialized ones. Another evident effect of deforestation is the phenomenon known as "edge effect." This concept tends to explain that not only the deforested patch is affected but that the effect migrates into forested areas as there are changes in light availability, humidity and temperature that affects floral composition and structure up to a kilometer from the edge depending the severity of deforestation ultimately having a direct impact on fauna diversity.

Economical impact:

Based on a study conducted by Cho *et al*. 2011, the Chiquibul Forest has an average of 752 metric tons of CO_2 per hectare. This means that the net CO_2 lost through deforestation along the western boarder of the Chiquibul Forest has been 3.7 million metric tons. REDD+ is a payment for environmental services scheme that tend to reduce deforestation through the marketing of CO_2. In this regard it is calculated that US $526,000 are lost annually due to illegal deforestation, not taking into account the impact being caused through forest degradation such as that caused by illegal logging and the annual increase of 9 metric tons of CO_2 per ha./yr.

The economical impact on the non-timber forest products industry due to deforestation is very difficult to quantify. Based on a study conducted by Bridgewater *et al.* 2006 on *Chamaedorea ernesti-agustii* (Xaté/ Fish-tail), it was found that the Chiquibul forest has an average of 228 individual Fish-tail palms per ha. with an average number of 6 leaves per plant. On this assumption it is estimated that in the area deforested along the western border US$ 51,914.00 has been lost only from Xaté at a selling price of US$ 0.77 per hundred leaves harvested from the wild.

Although FCD lack accurate data on timber species density, based on an pilot illegal logging assessment conducted in Caracol Archaeological Reserve; it is estimated that US$ 1,411,177 have been lost due to due to logging of mahogany and cedar only. This result

may likely be duplicated along the western border taking into account that in a deforested area all the trees are cut down.

Great caution must be taken while interpreting these results as results are based on generalized data available and considering that the area has been deforested the results obtained are static; thus if the forest is to be under a management regime the economical impact will likely be greater as the variable to time will be incorporated into the equation.

CONCLUSION

Deforestation is a major threat to the ecological integrity of the Chiquibul Forest as a cause of slash-and-burn agriculture, practiced by Guatemalans. By May of this year an estimated 4,931 ha. of forest had been cleared and were under some form of agricultural development mainly basic grain crops (corn beans), cattle pasture or fallow. Based on the historical deforestation data, over a period of 24 years, the annual rate of deforestation has been 200 ha per year and will continue to be the case if no aggressive interventions are set in place, reaching a projected 5,734 ha. of deforested land by 2015. The true ecological impact of deforestation within the Chiquibul Forest is difficult to quantify but it is affecting native biota by altering habitat and food availability and creating niches for more generalized species that will eventually displace forest specialists, which are of greater conservation concern. Based on a sustainable forestry management scheme the economical impact as a consequence of deforestation is well over the millions of US dollars. In order to have a clear picture of the true ecological impact of deforestation it is imperative to conduct further research but such initiative is limited due to security reasons but can be alleviated through the analysis and interpretation of satellite imagery.

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