

Evaluation of Factors that Cause Land-Use, Drivers and Agents of Deforestation and Forest Degradation in Guatemala

The construction of REDD+ National Strategy is coordinated by the Interinstitutional Coordination Group (GCI – *for its acronym in Spanish*), which is led by MARN and is made up of: i) Ministry of Environment and Natural Resources (MARN – *for its acronym in Spanish*); ii) Ministry of Agriculture, Livestock and Food (MAGA – *for its acronym in Spanish*); and iii) National Forestry Institute (INAB – *for its acronym in Spanish*) and iv) National Council of Protected Areas (CONAP – *for its acronym in Spanish*).

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INTRODUCTION

In Guatemala, studies have been carried out linked to historical trends in land use, such as the Map of Forest Coverage by Type and Subtype of Forest 2012, Map of Forest Coverage of Density by Forest Type, and Map of Potential Areas for Forest Landscape Restoration of the Republic of Guatemala), and other studies carried out, such as the analysis of livelihoods, and the drivers and agents of deforestation.

As a whole, the analyzes present the historical trends of land use, observing changes in forest areas to other land uses, especially for agricultural and urban growth purposes, forest fires, pests and diseases, illegal timber extraction and firewood deficit.

These analyzes make it possible to define that the main underlying causes of deforestation and forest degradation are based on the model of economic growth, population growth, poverty, the education system, forest culture and land tenure, and distribution systems, which generate driving forces that promote economic options, not necessarily sustainable, from the social, economic and ecological point of view.

According to the analysis carried out in the determination of the Emission Reference Levels (GIMBUT, 2017 (Interinstitutional Forest and Land Use Monitoring Group – GIMBUT – *for its acronym in Spanish*)), in the period 2001-2010, in Guatemala, 1 039 602 ha of forest were deforested (106 845 ha per year), mainly due to livestock (35 %) and production of basic grains, such as corn, beans and rice (31%); To a lesser extent, other crops that contributed to deforestation are: African Palm (4%), Cardamom (3%), Rubber (3%) and several other crops (4%). Added to this is the change in use due to the growth of urban areas, equivalent to 2% of deforestation.

The information that has been generated and systematized provides important inputs, which have been discussed in the five dialogue workshops that have been conducted, providing inputs that have helped to identify the dynamics of land use, drivers and agents of deforestation and degradation of forests in the territories, a process that will continue in the second phase of preparation of the REDD+ National Strategy, presenting the approaches of the process.

1. DEFORESTATION AND DEGRADATION OF FORESTS IN GUATEMALA

Several studies have been conducted to understand the magnitude of forest deforestation in Guatemala. In 1950 it was estimated that in Guatemala the forest cover was 6 973 924 hectares (URL (Rafael Landívar University – URL – for its acronym in Spanish); IARNA (Institute of Agriculture, Natural Resources and Environment – IARNA – for its acronym in Spanish), 2009), which has been reduced to 3 722 595 for year 2010, which gives a rate of deforestation of 1.04% in indicated period. To observe in better detail the behavior of the forest cover and the gross rate of deforestation, in Figure x shows their behavior.

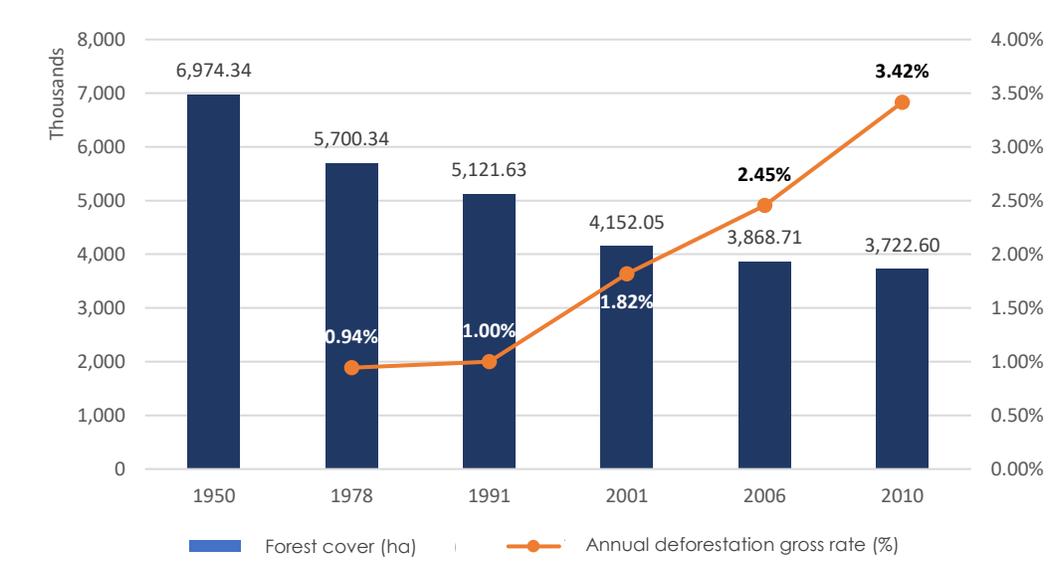


Figure 1. Dynamics of Forest Cover and Deforestation Rate in Guatemala (1950 – 2010)

The per capita availability of forests has been reduced over time, due to the magnitude of deforestation observed and the increase in population, which has influenced this indicator to be drastically reduced, since by 1950 the availability it was 2.50 hectares per inhabitant, by 1978 it had been reduced to 1.0 hectares per inhabitant and stood at 0.26 hectares for the year 2010.

According to the analysis carried out in the determination of the Reference Levels of Emissions (GIMBUT, 2017), in the period 2001-2010, in Guatemala, 1 039 602 hectares of forest (106 845 hectares per year) were deforested, mainly due to livestock (35 %) and production of basic grains, such as corn, beans and rice (31%). To a lesser extent, other crops that contributed to deforestation are: African palm (4%), cardamom (3%), rubber (3%) and other miscellaneous crops (4%). Added to this is the change of use due to the growth of urban areas, equivalent to 2% of deforestation.

1.1. Deforestation Inside and Outside the Protected Areas

Guatemalan System of Protected Areas (SIGAP (Sistema Guatemalteco de Áreas Protegidas – SIGAP – *for its acronym in Spanish*) is the largest effort in the country for the conservation of biodiversity and the resources associated with it by 2017, 3 468 588.11 hectares, are within the conservation and management schemes of SIGAP's protected areas, which is equivalent to 31.88% of the nation.

Within the protected areas is the largest amount of forests, as of December 2010 within the protected areas was 51.9% of the country's forests, against 48.1% that were outside of these, so it is reasonable to say that it is very likely that, without protected areas, the country could have much less forest than it currently (INAB (National Forestry Institute – INAB – *for its acronym in Spanish*) CONAP (National Council of Protected Areas – CONAP – *for its acronym in Spanish*), UVG (University Del Valle of Guatemala – UVG – *for its acronym In Spanish*), URL (Rafael Landívar University – URL – *for its acronym in Spanish*), 2012.

However, the threats for forests inside protected areas are greater, which is evidenced by the reduction of forest cover in these areas. In 2006, 2 044 465 hectares of forests were inside the protected areas, an area that was reduced to 1 930 397 hectares in 2010, which represents a reduction of 33 322 hectares per year, with an annual deforestation net rate of 1.5%. On the other hand, outside the protected areas in the same period (2006-2010) forest cover varied from 1 824 242 to 1 792 199 hectares, which means a net annual loss of 8 127 ha and an annual deforestation rate of 0.4%).

In the evaluation of the forest dynamics 2006-2010 – where the remaining forests were analyzed – also shows that possibly the forests within the protected areas are and have also been more susceptible to deforestation, depending on the average slope values where they are located. It was determined that the average slope value in forests inside protected areas to 2010 is 16.1%, while forests outside protected areas are found in sites with average slopes of 37.1%. This means that many of the forests outside of protected areas are really marginal areas, undesirable for the shift towards agricultural uses and/or agroindustrial crops and probably much more stable or less susceptible to deforestation in the short term.

1.2. Policy Gaps and Incompatibilities to Attend the Drivers of Deforestation and Degradation

Guatemala has a wide political frame related with the actions that seek to reduce the drivers of deforestation and degradation of forests. Gómez-Chavarri (2017) from the analysis of 55 policy documents and its instruments related to the National Strategy REDD+ and the ER-PIN concludes that Guatemala has developed a wide range of international instruments, including contracts, treaties, declarations, agreements, pacts,

letters and memorandum of national insight and character; policies, laws, regulations, standards, strategies, programs, agendas, plans, ministerial agreements and protocols, to comply with UNFCCC Safeguards (7 safeguards) and the FCPF Common Approach Safeguards (IDB and WB Safeguards).

Gómez-Chavarri analyzed that 22 policies and their instruments does not present gaps with the options of the REDD+ National Strategy and with the policies of other programs of the forestry sector and of other sectors related (agriculture, energy, highways, etc.), since these mention actions directly related to the modalities and options of National Strategy REDD+.

However, four of these policies and their analyzed instruments present incompatibilities related to National Strategy REDD+, which are: a) Agricultural Policy 2011 -2015, b) Irrigation Promotion Policies 2013 -2023, c) Agrarian Policy and d) Framework Law for the Regulation of the Reduction of Vulnerability and Obligatory Adaptation to the impacts of Climate Change and the Mitigation of Greenhouse Gases, Decree 07-2013, of the Congress of the Republic of Guatemala (See Table 1).

Table 1 Main incompatibilities identified in the policies and their instruments, related to the options of REDD+ Strategy in Guatemala.

Identified Policy Instruments	Incompatibility
Agricultural Policy 2011-2015	<p>Food and Nutrition Security Axis: To strengthen the land leasing program for the economy of the infra subsistence and subsistence.</p> <p>Agricultural Sanitation Axis: To stablish programs for the promotion of agriculture and artisan fishing, taking special care to benefit the subsistence and infra and subsistence populations.</p> <p>Both axes require for their execution, the existence or availability of lands used for other purposes or the incorporation of new lands, however, it does not make clear or presents mitigation measures in order to not contribute with the deforestation process of the country.</p>
Irrigation Promotion Policy 2013 - 2023	<p>The Promotion Policy will propitiate a larger area under risk, even in lands with agroforestry capacity (Class VI) and will ease these systems with financing and studies. However, it does not explain with more details how it will prevent that this may stimulate the deforestation or degradation of Class VI lands, in order that it can later have an access to these incentives.</p>
Agrarian Policy	<p>Promotes the support to rural producers, located as infra and subsistence, which normally have access to marginal, degraded lands, in high gradient and fragmented, not explaining which mitigation measures will be used in order that this may not promote or motivate the deforestation.</p>
CC Framework Law	<p>The REDD+ National Strategy has the main purpose to implement the actions for mitigation, and since Article 25 proposes that 80% of the financial resources of the National Fund for Climate Change be used for adaptation, it presents incompatibility.</p>

Source: Systematization of the Frame of Policies and Forest Governance for the Execution of REDD+ in Guatemala, Gómez-Chavarri (2016)

Another fundamental aspect regarding the success that can be obtained with the application of the REDD+ Strategy is related to land tenure and the resources associated with it. Ownership, possession and occupation of land and forests determine which actors are involved, how they can negotiate and what benefits they may be entitled to, together with the responsibilities they will have to assume (Kuper, 214).

There are four types of holders of land rights in Guatemala: state, municipal, private, individual and community (including indigenous lands). The tenure rights (as well as the ability to participate in the various incentive schemes) of each of these groups depend on whether they are owners (with registered title), possessors (with documented title, but not registered) or land occupants of lands which belong to third parties, which includes leasing, unregulated peaceful occupation and illegal occupation. The figure of "possessor" is the category with the least legal clarity, but also the one that predominates among the small owners and those who live within the protected areas. Therefore, this is a category of great importance for REDD+.

From the point of view of the revision of land policies and the classification of tenure, the recommendations made include investments to achieve the following: to establish a clearer definition/regulation of the category of "possessors"; continue working with indigenous peoples towards security of tenure; allow communities to carry out internal consultations to register community properties; prioritize land use planning and soil studies in the areas of early REDD+ initiatives; and review land distribution policies (Kuper, 2014).

At present, PINPEP (Forestry Incentives Program for Small Holders on Land Suitable for Forestry and Agroforestry – PINPEP – for its acronym in Spanish) Law expands the range of attention and support to community groups and individual owners to have access to forestry incentives which, by the grounds of land extension and tenure regime, could not be beneficiaries with the previous program PINFOR (Forestry Incentive Program – PINFOR – for its acronym in Spanish) which expired at the end of 2016 and encouraged owners of forest lands. Given the success of these programs, PROBOSQUE Law (Law to Promote Establishment, Regeneration, Restoration, Management, Production and Protection of Forests in Guatemala – PROBOSQUE – for its acronym in Spanish) is created in order to give continuity to PINFOR and also to broaden the typology of beneficiaries, ensuring the granting of forest incentives for another 30 years and thereby contribute to the management and conservation of forest resources with the participation of municipalities, indigenous communities, associations and the private sector, among others. On the frame of ENDDGB (National Strategy for the Approach of Deforestation and Degradation of Forests in Guatemala – ENDDGB – for its acronym in Spanish) the expansion of the forestry incentives programs will be a priority, especially to serve this segment of the population.

2. ANALYSIS OF DEFORESTATION00

According to the analysis performed on the determination of the Reference Emission Levels (GIMBUT, 2017), during the period of 2001-2010, in Guatemala, 1 039 602 ha of forest were deforested (106 845 ha per year), mainly due to livestock (35%) and production of basic grains, such as corn, beans and rice (31%). In a lower scale, other crops that contributed to deforestation were: African palm (4%), cardamom (3%), rubber (3%) and other diverse crops (4%). To this, there must be added the change of use due to the growth in the urban areas, equivalent to 2% of the deforestation (See Figure 2).

However, coffee, cardamom, and rubber are associated with arboreal species causing a lower impact on the loss of the forestry resource, representing also an important economic source for the income of foreign currency to the country. For example, Guatemala is the main cardamom producer worldwide, where more than 300 000 small producers export around US\$200 million every year, in the case of rubber, the country is the biggest producer of rubber in Latin America and every year, around US\$ 239 million is exported. In the case of coffee, 18% is the result of the methodologic improvements performed for the period of 2006-2010, which allowed the identification and spatial separation of this category which in the past have been considered as a forest.

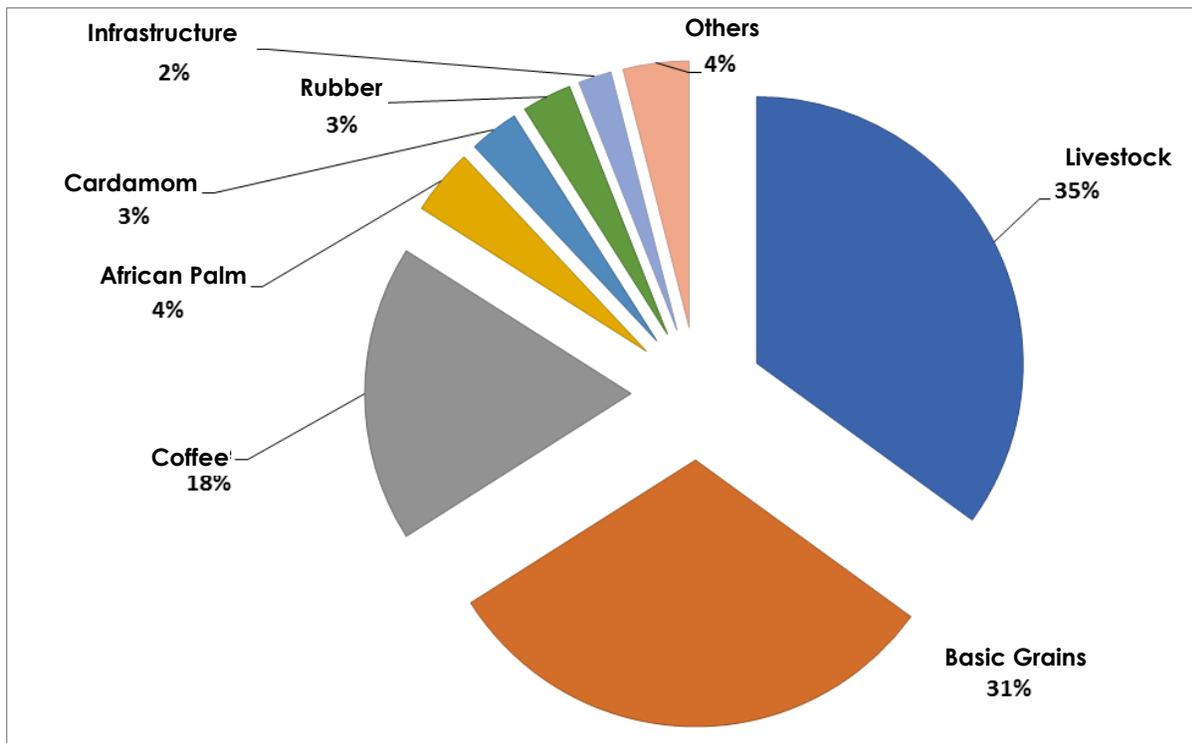


Figure 2. Distribution of deforestation by category

Source: Made with information from GIMBUT (Interinstitutional Forest and Land Use Monitoring Group – GIMBUT – for its acronym in Spanish)/MAGA (Ministry of Agriculture, Livestock and Food – MAGA – for its acronym in Spanish)

With the spatial database and the results of the analysis of the drivers for deforestation, a preliminary analysis that enables to make the correlation between deforestation and its drivers was performed, based on the spatial data, the results of the workshops analyzing the causes and agents of deforestation.

For each of the aforementioned drivers of deforestation, the forest dynamics was analyzed in regard to: a associated coverings and economic variables. Results as presented as follows.

2.1. Livestock

Figure 3 compares the reduction of forest coverage with the increment of the pastureland coverage associated with livestock activity (yearly rate of 2.5% in the period from 2001-2010) same behavior as the number of heads of cattle (yearly growth of 2.4% in the period from 2001-2010). According to the national forest dynamics, during the reference period, 35% of deforestation is caused by the expansion of pastureland associated to livestock, with more occurrence in the National Park Laguna del Tigre and in the Buffer Zone of the MBR (Maya Biosphere Reserve) in Petén, and the Wildlife Refuge Punta de Manabique in Izabal (Figure 4).

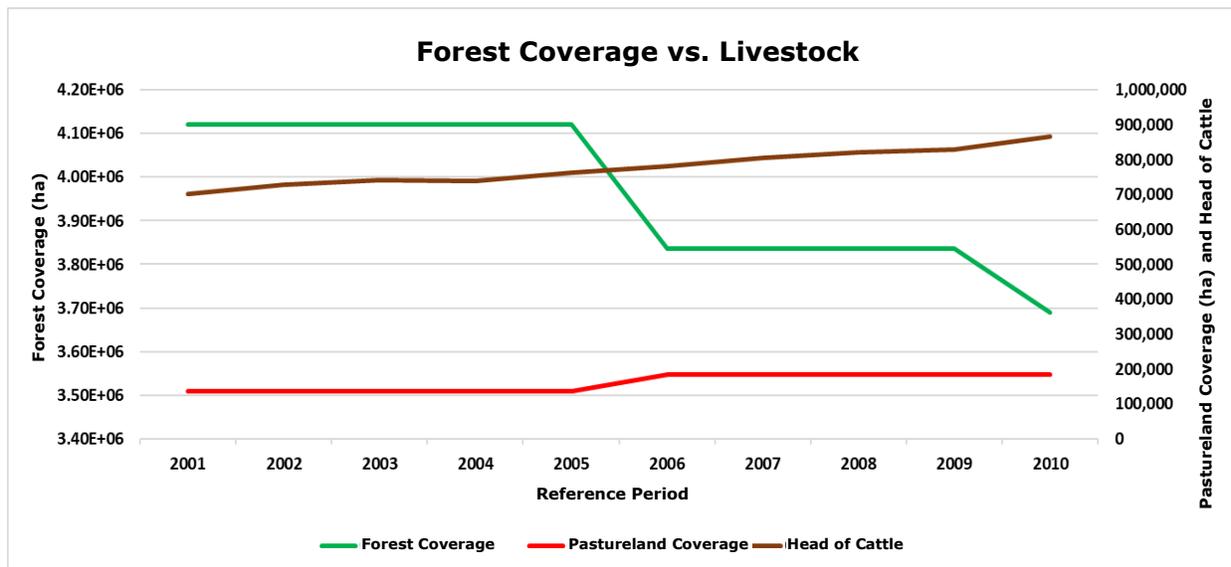
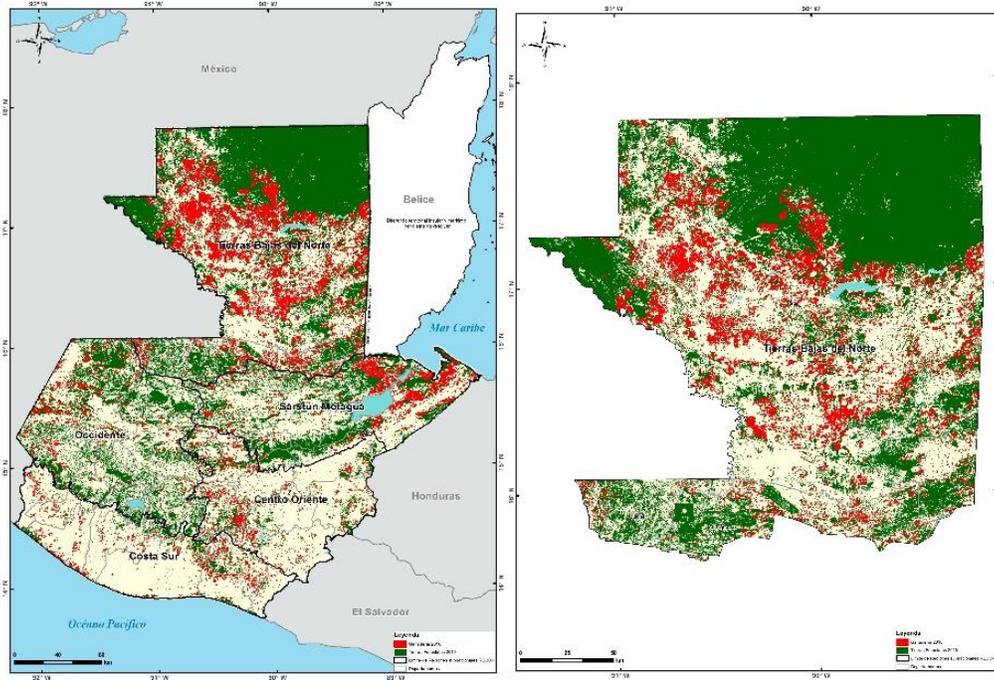


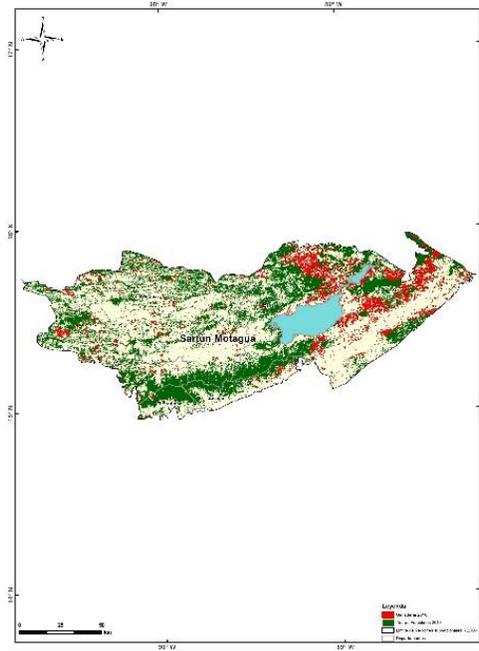
Figure 3. Graphic of Forest versus Livestock Coverage

Source: Elaborated with data from GIMBUT/MAGA and BANGUAT (Bank of Guatemala – BANGUAT – for its acronym in Spanish)



i) National Level

ii) Tierras Bajas del Norte
(Northern Lowlands)



iii) Sarstún-Motagua

Figure 4. Pasture Coverage Associated to Livestock, Mainly on the REDD+ region of Tierras Bajas del Norte (Northern Lowlands) and Sarstún-Motagua

2.2. Basic Grains

Figure 5 compares the reduction of the forest coverage with the increase of the basic grains harvested area (corn, beans and rice). However, the basic grains coverage does not have had a growing behavior during the reference period, since, according to the national forest dynamics, 31% of the deforestation is caused by the incorporation of the new areas of these crops. The reduction of the crops surface is explained by the expansion of monoculture plantations (mainly livestock, African palm and others) on these areas, as well as by the change to other more profitable crops (e. g. vegetables). It is worth adding that this behavior contravenes the efforts aimed at national food security.

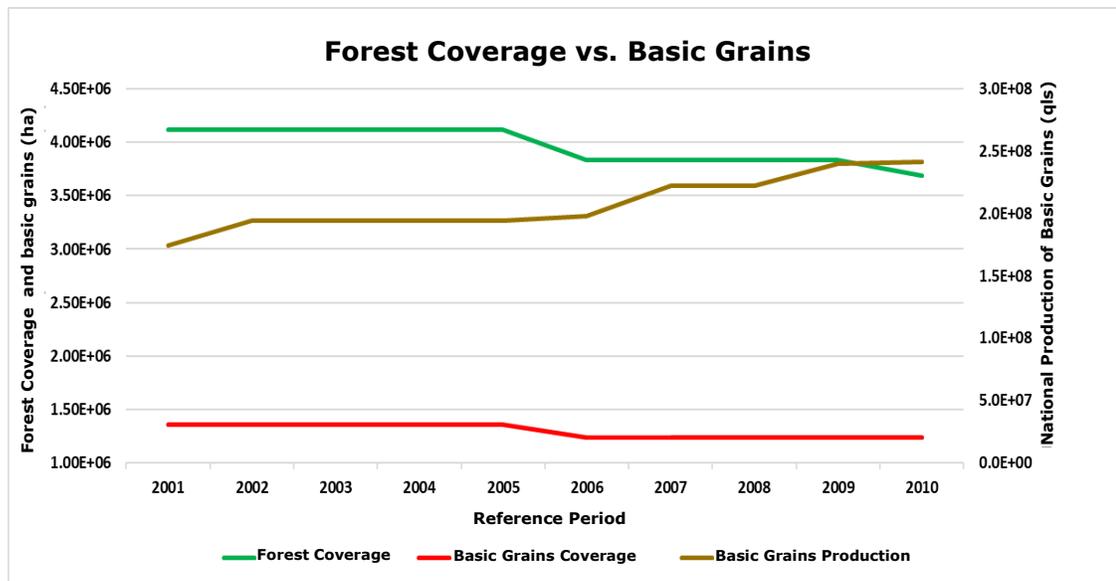
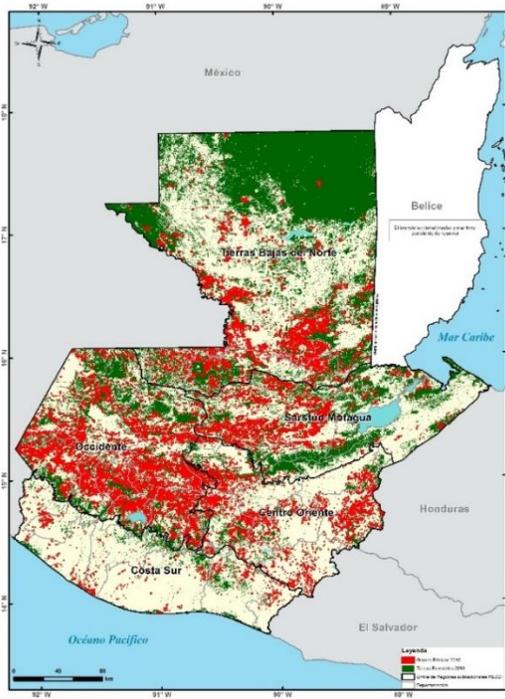
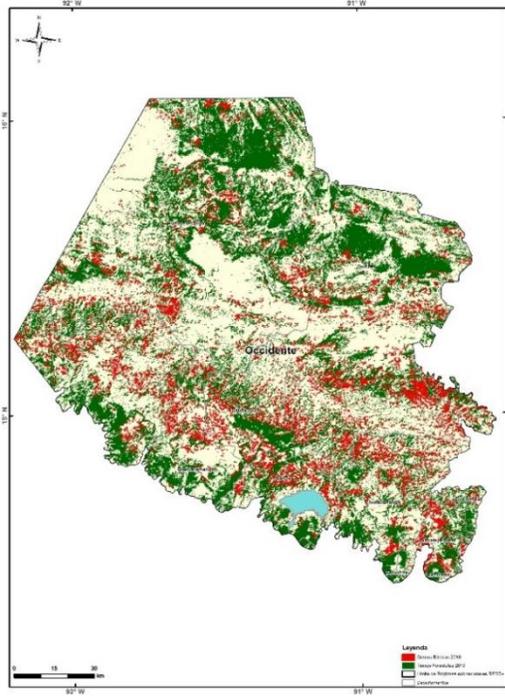


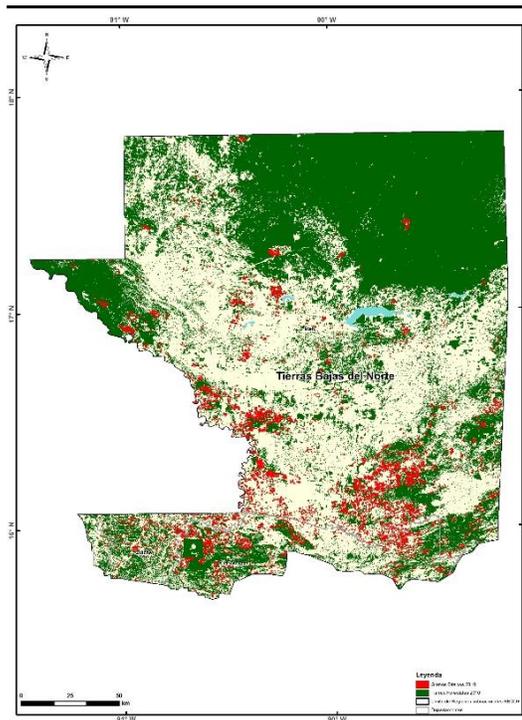
Figure 5. Graphic of Forest versus Basic Grains Coverage
Source: Elaborated with data from GIMBUT/MAGA and BANGUAT



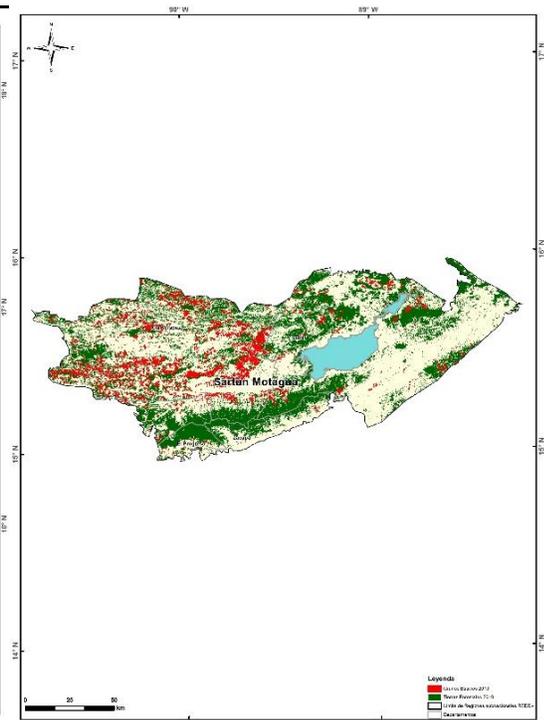
i) National Level



ii) West



iii) Tierras Bajas del Norte
(Northern Lowlands)



iv) Sarstún-Motagua

Figure 6. Basic grains coverage mainly on REDD+ West regions, Tierras Bajas del Norte (Northern Lowlands) and Sarstún-Motagua

2.3. Agriculture

According to the National Forest Dynamics, during the reference period, 16% of deforestation is caused by the incorporation of new agricultural areas, mainly: African Palm (4%), Cardamom (3%); Rubber (3%). For each of these usages, the forest coverage reduction was compared to the increment corresponding to such crops:

2.3.1. African Palm:

Figure 6 compares the reduction in forest cover with the increase in coverage and harvested area of African Palm. According to the national forest dynamics, during the reference period, 4% of deforestation is caused by the expansion of this crop. According to a study conducted by the IARNA (2010¹), approximately 40% was established in forest areas and 25% of the total planted area is located within protected areas, mainly in southern Petén, Alta Verapaz, Retalhuleu, San Marcos and Izabal (Figure 7).

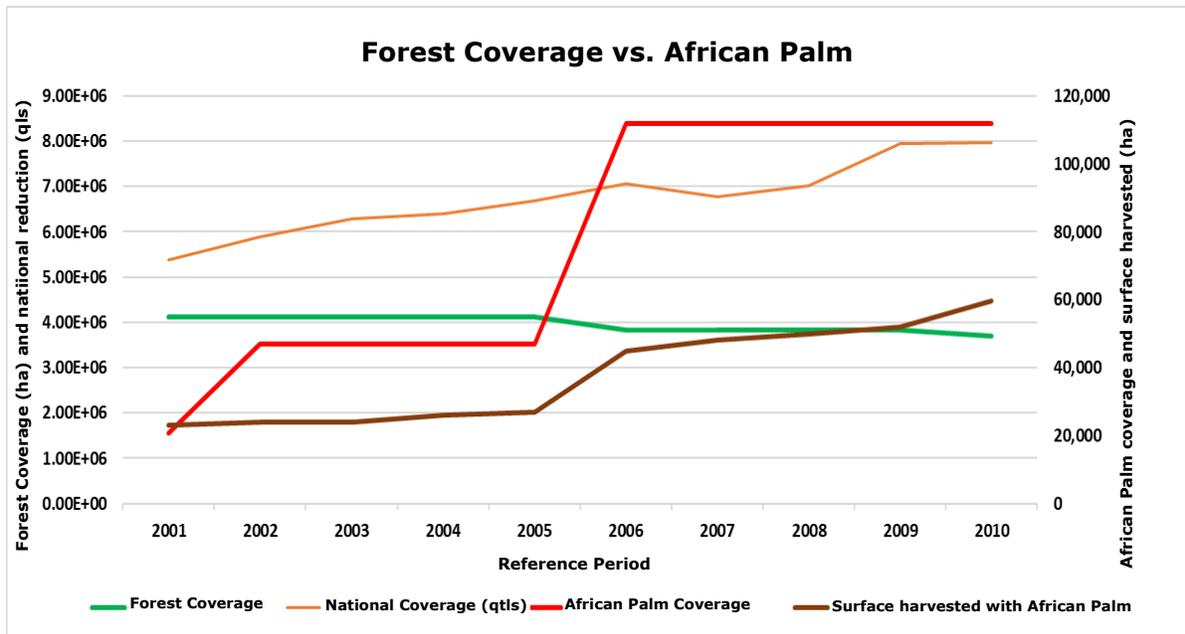


Figure 6. Graphic of Forest versus African Palm Coverage

Source: Elaborated with data from GIMBUT/MAGA and BANGUAT

African Palm

¹ URL, IARNA (Rafael Landívar University. Institute of Agriculture, Natural Resources and Environment). (2010). Analysis of the Dynamics of the Expansion of African Palm Cultivation in Guatemala. Guatemala. <https://www.url.edu.gt/publicacionesurl/FileCS.ashx?Id=40163>

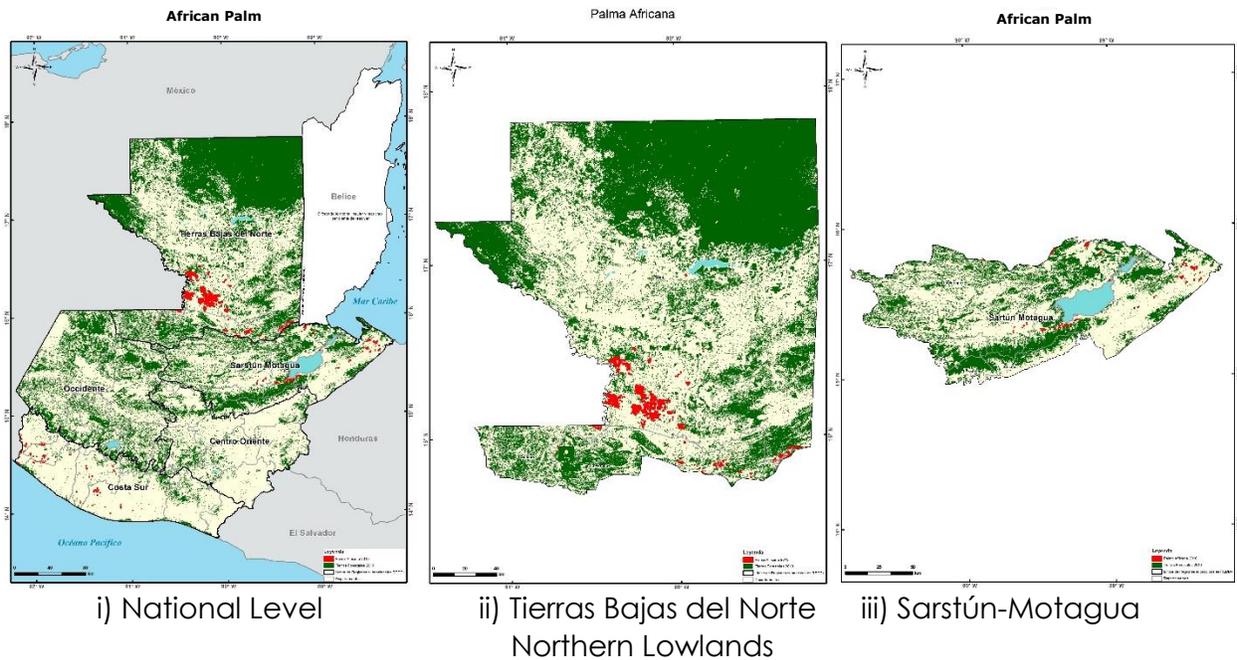


Figure 7. African Palm coverage mainly in the REDD+ areas of Tierras Bajas del Norte (Northern Lowlands) y Sarstún-Motagua

2.4. Urban Infrastructure:

According to the national forest dynamics, during the reference period, 4% of deforestation is caused by expansion of urban infrastructure surface, mainly in the departments of Guatemala, Escuintla and Petén (Figure 9).

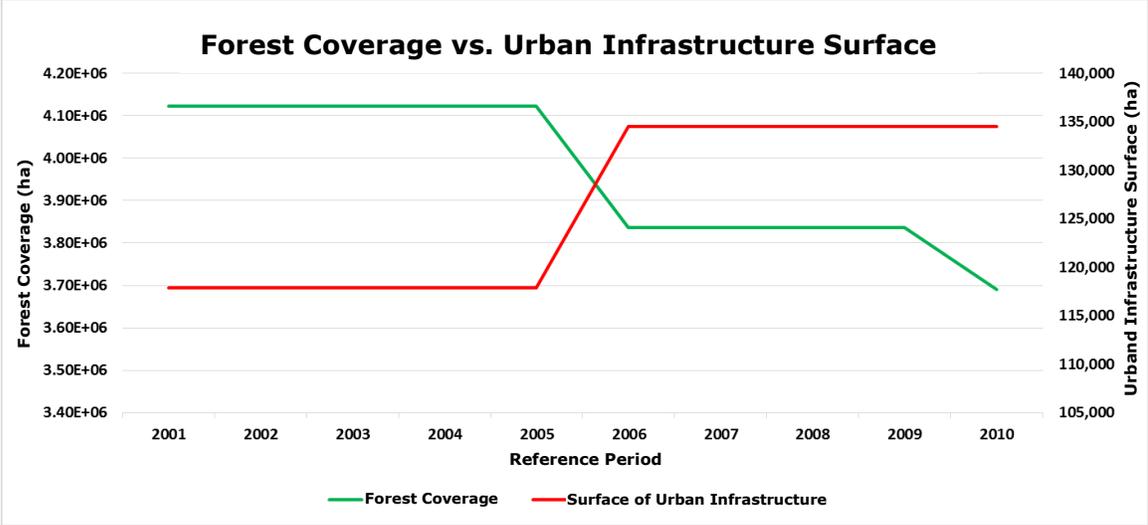
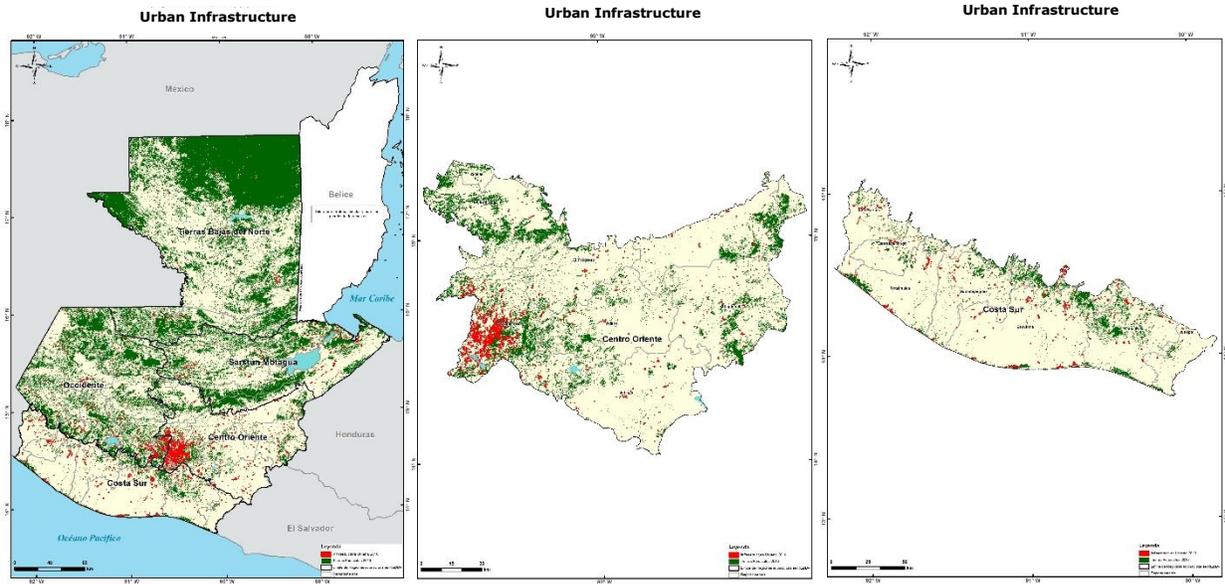


Figure 8. Graphic of forest coverage versus urban infrastructure

Source: Elaborated with data from GIMBUT/MAGA, FAOSTAT and BANGUAT



i) National Level

ii) Central East

iii) Southern Coast

Figura 9. Cobertura Infraestructura Urbana principalmente en las regiones REDD+ Costa Sur y Sarstún-Motagua

3. DRIVERS AND AGENTS OF FOREST DEFORESTATION AND DEGRADATION OF FORESTS IN GUATEMALA

Drivers or causes of deforestation and/or degradation of forests are considered to be direct activities (such as the expansion of a cultivation or grazing area) that are carried out by an agent (persons or groups of people), and that result in deforestation or degradation of forests. An analysis of drivers and agents of deforestation and forest degradation allows countries and projects to identify the main productive and/or social activities that promote the loss of forests, understand the dynamics of agents and their degree of contribution, so that the plans and strategies that are promoted may focus on the most important drivers or motors (Winrock, 2015).

In Guatemala, several analyses of the drivers and agents of deforestation have been performed. At a local or regional level, evaluations have been performed, such as the ones of REDD+ projects: GuateCarbon (Samayoa, 2011), Lacandón Bosques para la Vida (Lacandón, Forests for Life; Portillo y Rojas, 2011), Proyecto Caribe Guatemalteco (Guatemalan Caribbean Project; CEAB-UVG (Environmental and Biodiversity Study Center – CEAB – for its acronym in Spanish / Del Valle University of Guatemala – UVG – for its acronym in Spanish) and FUNDAECO (Foundation for Eco-development and Conservation – FUNDAECO – for its acronym in Spanish), 2015), Ecoregión Lachuá (Lachuá's Ecoregion, Winter, 2010); while at a national level (Leiva 2017-2018) the identification and quantification of forest deforestation and degradation drivers and agents is in process. This last effort is being reinforced by an econometric analysis performed by MARN (Ministry of Environment and Natural Resources – MARN – for its acronym in Spanish, 2018) with information of the Forest Reference Emission Levels/Forest Reference Levels of Guatemala-FREL/FRL- (GIMBUT, 2017). This last effort is being reinforced with an econometric analysis performed by MARN (2018), with information of the Reference Levels of Forest Emissions / Reference Levels of Forestry in Guatemala – NREF/NRF – (GIMBUT, 2017). These efforts made for the analysis of the drivers and agents have been confronted with analysis of the dynamics of land use, both specific analyzes and those of the NREF-NRFs.

3.1. Dialogue Workshops on Land Use, Causes and Agents Related to Deforestation

During the “Second Territorial Gathering to Dialogue About the REDD+ National Strategy”, Leiva (2017) presented and validated the main elements to identify the main drivers and agents of forest deforestation and degradation. The national dialogue process constituted a fundamental platform for the construction of the REDD+ National Strategy.

As part of the strategy construction process, in the second phase of preparation, inputs will continue to be generated that complement the analyzes and conclusions on the use of the land, causes and agents of deforestation and forest degradation in the territories.

In this second gathering it was carried out through the realization of five workshops in the following regions:

1. West,
2. Las Verapaces,
3. Ixcán and Izabal,
4. Tierras Bajas del Norte (Northern Lowlands) and
5. East.

Community-based groups, farmers' organizations, the academic sector, the private sector and the public sector participated. An important aspect was the participation of the women's sector, who expressed their point of view regarding the main causes and agents of deforestation and forest degradation and the role they play within this context of forest conservation.

According to the dialogue process carried out, at the national level, the following are the main drivers of deforestation and forest degradation:

- Drivers of Deforestation:
 - ✓ Demand for food by the rural population
 - ✓ Expansion of commercial agriculture
 - ✓ Livestock expansion
 - ✓ Population growth
 - ✓ Establishment of mining and hydroelectric
- Drivers of Degradation:
 - ✓ Forest fires
 - ✓ Non-sustainable extraction of firewood
 - ✓ Illegal extraction of wood and other forest products
- Main drivers of deforestation and degradation:
 - ✓ Infra and subsistence farmers
 - ✓ Large farmers or entrepreneurs
 - ✓ Livestock
 - ✓ Population in general

In the **Region of Tierras Bajas del Norte** (Northern Lowlands), deforestation and forest degradation is associated with productive activities in landless groups for the production of staple foods. In the same manner, the production of extensive crops such as African palm, pineapple, rubber, among others, is expanding in forest areas. This region is also very affected by the expansion of livestock, in many cases, this activity is

associated with illicit activities with the purpose of land usurpation, where groups of farmers are also involved. Internal migrations often converge in this region, increasing with it the pressure on forests and lands for production.

Several protected areas are located, among them, Laguna del Tigre, the Maya Biosphere Reserve, Sierra Lacandón, which are currently invaded by groups of farmers who have settled in communities within these areas. In addition, livestock zones have been established within the same protected areas.

In the ***Ixcán and Izabal (Sarstún-Motagua) Regions***, the forests have been affected by the extension of the agricultural frontier, both for subsistence and for exporting and livestock. The representative groups of this region indicated that the cultivation of African palm is expanding even in forest areas. In the same way, livestock is associated with illicit activities occupying large tracts of land. In this region there are also several protected areas invaded by communities, one of them is the Río Dulce National Park.

In the ***Region of Las Verapaces***, although it has experienced some gains in forest cover due to plantation processes and the management of protective forests, deforestation and degradation of forests is advancing. The cultivation of coffee and cardamom expands, in the same way the African palm. Forest fires and forest pests in the region have been recurrent and most affected since 2001.

In ***the Western Region***, deforestation and forest degradation are associated with problems of food insecurity. Most of the population, especially indigenous, practices a traditional agriculture based on the production of corn, wheat, potatoes, vegetables, on small tracts of land, since in that region, smallholding predominates. Land of forest vocation change of use to be utilized for agricultural production for subsistence, likewise, population growth in the region is high, which causes greater pressure on forests and greater demand for environmental services.

The degradation of forests is more marked, especially by forest fires, the practice of "ocoteo" (*a local technique to dry trees*) and resination, the use of firewood for cooking food. Pests are recurrent in coniferous forests, especially by weevil attacks (*Dentroctonus spp*) in pine forests. In this region, although the gain in forest cover has been significant, much effort still needs to be made to compensate the local deforestation rate and increase the mechanisms of land management and environmental governance, especially that which is in charge of the municipal authorities in the region.

In ***the Eastern Region***, characterized by problems of land degradation and recurrent effects of drought, deforestation and forest degradation are especially associated with the expansion of the agricultural frontier. Poverty and extreme poverty significantly affect most of the rural population of the region, so they are forced to deforest to cultivate the land with annual crops such as corn, beans, cassava, sweet potatoes, peanuts, among others. Forest degradation occurs due to frequent forest fires, the practice of "ocoteo" (*a local technique to dry trees*) and resining and the extraction of

firewood for cooking food. Although livestock in this region is small, it tends to expand into productive areas.

During the process of organization and consultation, it was also determined that women have a very important role in the management and conservation of forests. The role of women is associated more with forest conservation and greater coexistence with them. Their intervention practices are low impact; generally, they harvest firewood from fallen branches, fallen or dead trees, harvest fruits and help to conserve forests and water sources. For the woman, the forest is a source of life, which must be respected because it is the inheritance of the grandparents. In this segment of the population there is much concern because, for them, deforestation and degradation of forests advances every day.

As well as for men, women express the need for institutional presence in many areas and territories in order to exercise surveillance and vacate invaded lands, especially in protected areas.

On the other hand, the role of local governments (mayors) is very weak; they do not control their territory or apply the Municipal Code as it should. This has allowed deforestation and degradation of the forests at the level of the advance territories. Interinstitutional coordination between State entities and municipalities is very weak, and it affects territorial governance for the protection of forests and natural resources in general.

3.2. Drivers and Agents Related to Forest Degradation

Leiva (2017) concludes that four main drivers that promote deforestation in Guatemala have been identified, being these (See Figure 10). These inputs were generated from the initial implementation of the dialogue and participation process, where diverse interested parties indicated, according to their experience and knowledge, which are the main drivers and agents of deforestation. Below, each one of them is described:

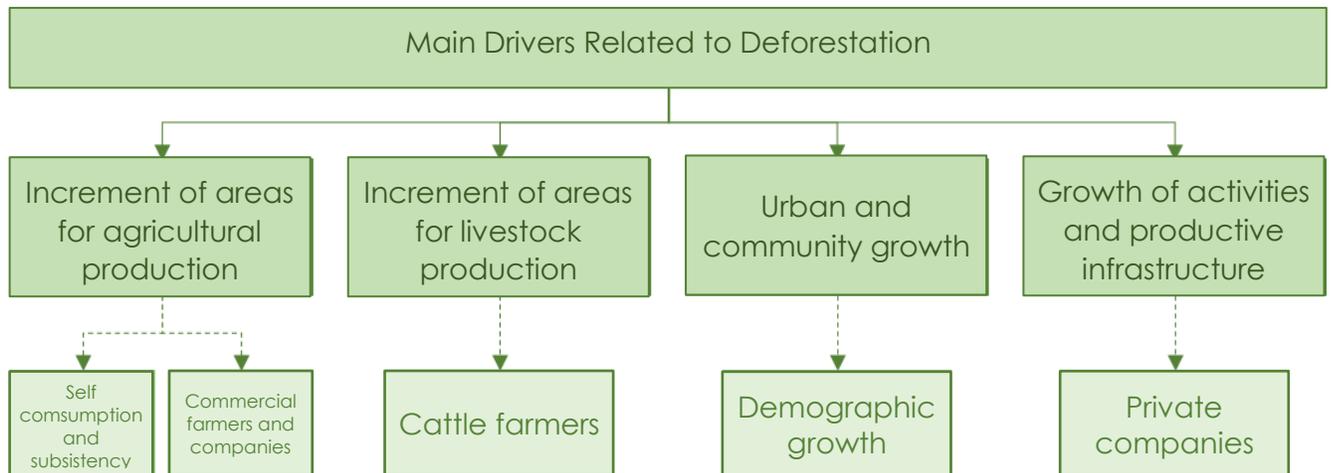


Figure 10. Main Drivers Related to Deforestation in Guatemala

Source: Workshops of the 2nd Territorial Gathering for the Dialogue and Participation for the Construction of the ENDDBG

3.2.1. Increment of Livestock Production Areas

The number of head of cattle, by structure of the herd are distributed as follows: Petén (19%), Escuintla (14%), Izabal (10%), Jutiapa (7%), Santa Rosa (6%), Retalhuleu (6%) and the other departments of the Republic account for the remaining (37%) (Ministry of Agriculture, Livestock and Food, 2013).

The National Beef Cattle Policy established by the Government in the period 2012-2016 reports within the current situation of this productive activity that, in the last decade, due to changes in land use and the advance of intensive crops in sugar cane, African palm and rubber on the south coast, territory traditionally occupied for livestock development, livestock migrated to areas of greater environmental fragility such as the central highlands, the Atlantic plain and the department of Petén, which has soil of karstic origin, shallow and of limited fertility, in which, without adapting to the new conditions of the soils, the livestock continued to use extensive production models, causing a negative impact on the surfaces of the farms themselves; additionally, the complications that global climate change represents (Ministry of Agriculture, Livestock and Food, 2014).

Within these activities, we have also been able to identify groups of people that promote the occupation and market of state-owned land, mainly in the Maya Biosphere Reserve.

3.2.2. Increment of Areas Destined to Agricultural Production

The vast majority of CO₂ emissions are derived from the conversion of forest to agricultural land, in fact, from the estimated total of 42 778 076 tCO₂ year, 98% , in other words 41 802 601 tCO₂ year, correspond to this forest conversion to land for agriculture (Sidman G., 2017).

This conversion, depending on the region of the country in which it occurs, is included within two production modalities representative of the national agricultural sector, either within commercial and business agriculture which is focused on the search for profitability through the production of crops generally in high demand in the international market, such as rubber, coffee and African palm; while on the other hand self-consumption and subsistence agriculture is identified, which is characteristic of the poorest producers and for whom profitability is not the goal, but rather the subsistence of their family nuclei through the production of traditional crops in the culture and diet of the country, usually corn, beans and some vegetables.

In Guatemala, self-consumption and subsistence agriculture encompasses an important segment of the population, in this logic of production, corn being the basis of the diet of the majority of the Guatemalan population, it is the crop that farmers who are immersed in this mode of production, usually plant.

The 2014 National Agricultural and Livestock Survey reports that corn cultivation showed a surface area of 819 227 ha nationwide for the reference period from May to October 2014 (National Institute of Statistics, 2015).

The deforested area attributable to agriculture is 108 863 ha per year, occurring at the level of the 5 REDD+ regions but being more significant in the Northern Lowlands, West and Sarstún Motagua regions (Sidman G., 2017). In which two types of actors participate, one group that cultivates the land for obtaining their own food, and the other group cultivates the land for commercial purposes.

Related to this activity there have been found specific people or groups that promote the occupation and usurpation of lands, mainly those that are property of the State, and the ultimate goal is the appropriation and / or sale of the lands.

3.2.3. Growth of Urban Areas and Rural Communities

The population growth in addition to influencing the pressure on natural resources before the demand of greater area to satisfy the increase in the demand for food, also affects the change in the use of the land, as it is necessary to build new houses and of social and productive infrastructure.

Guatemalan population at the national level shows a significant increase, to the point that since the last census in 2002 to date the population has increased from 12.1 million to 16.9 million in 2017.

This conversion in the use of forest land to urbanized or inhabited areas is a product of this increase in the amount of population which is more evident in the peri-urban areas of the cities, especially the capital city and departmental capitals, although it also occurs in rural areas where the demand for housing areas generates forest loss.

3.2.4. Growth of Productive Infrastructure

Although maps and analyzes of deforestation do not show the impact of these activities at the national level, one of the conclusions of the process of dialogue and participation is that some of these activities have an impact at the local level.

3.3. Drivers and Agents Related to Forest Degradation

Three causes related to the degradation of forests in Guatemala were identified (See Figure 11):

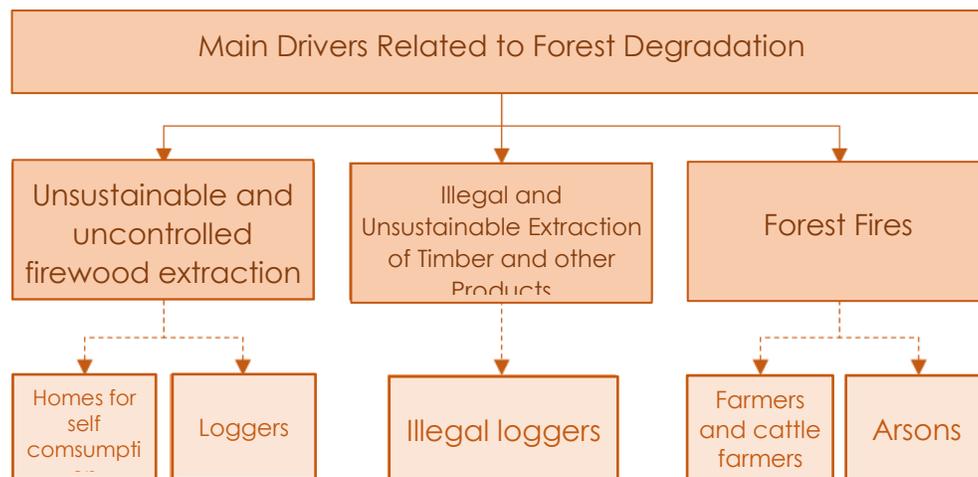


Figure 11. Main causes related to the degradation of forests in Guatemala
Source: Workshops of the 2nd Territorial Gathering for the Dialogue and Participation for the Construction of the ENDDBG

3.3.1. Non-sustainable and Uncontrolled Firewood Extraction

A 64% of the population depends on firewood as an energy source, 67% of it is in the rural area and 33% in the urban area (BANGUAT- URL, IARNA. 2009). The consumption of firewood as fuel is carried out in several areas: residential, commercial and industrial.

Residential consumption essentially consists of the consumption of firewood for cooking, for heating and domestic hot water for homes. A total of 1 992 430 households (69.6%) use firewood to cover family needs over a total of 2 858 423 households nationwide. From the point of view of consumption according to the type of population, the consumption of firewood assumes its greatest magnitude in rural households, concentrating approximately 86.5% of total residential consumption amounting to 13 333 907.98 t in dry basis (INAB-IARNA- FAO, 2012).

On a commercial level, the use is in restaurants, hotels, tortillerías (places for the fabrication of tortillas a type of thin, unleavened flatbread, made from finely ground maize) , etc. Although it is difficult to quantify the magnitude of the same, analyzes conducted infer that it is not negligible and can reach considerable magnitudes.

In the industrial scale, its use is mainly focused on the production of bread in bakeries of different sizes, of which 82% use firewood as fuel in their ovens and which is estimated to consume 4 193 m³ per day. Also, the production of bricks, mainly in the traditional way, consumes 4 928 634 kilograms of firewood per year; activities such as cardamom drying are also important when consuming 43 200 tons of firewood per year. The total consumption in 2010 in the industrial sector amounts to 352 953.4 t in dry basis (INAB-IARNA-FAO, 2012).

In summary, the current consumption of biomass for energy purposes was estimated at 15 771 187 t in dry basis, of which 15 418 233.6 t comes from the residential sector and 352 953.4 t are due to the industrial sector (INAB-IARNA-FAO, 2012).

3.3.2. Illegal and Non-sustainable Extraction of Timber and Other Forest Products

Illegal logging, in addition to being linked in most cases to the severe deterioration of the forest in environmental terms, entails disrespect for the laws and authorities in force, as well as constituting unfair competition, where those who violate the law have advantages in the market of the wood in front of those who manage and take advantage of the forests according to the law.

In Guatemala, the uncontrolled use of wood and wood for consumption is one of the main reasons for reducing forest volume. Complementary national estimates with case studies in selected locations indicate that 95% of the flow of forest products in the country occurs outside of control; of which 76% corresponds to firewood and 24% to wood, in the case of wood it is estimated that two thirds of the wood processed in the country are of uncontrolled origin (National Forestry Institute, 2010).

The prevalence of this model of illegal extraction of wood, as well as other products of the forest, is strengthened by the lack of institutional capacities for its control, the lack of controls in the transport of forest products, the lack of an effective system of emission of wood allows, harvesting and trafficking of wood covered by the distortion of family use permits and the lack of an effective system for controlling the volumes of wood processed in forest industries.

3.3.3. Forest Fires

Forest fires are an important cause of the degradation of forests at the national level, whether they are the result of burning by farmers and ranchers as part of their activities of clearing or clearing or intentional fires.

Forest fires caused emissions of more than 3.5 million tons of CO₂e per year in forest areas, with the Tierras Bajas del Norte (Northern Lowlands) Region accounting for 87% of emissions due to this cause, which is equivalent to a burnt area of 48 910 ha per year, followed by the Western Region with 6% of the total and the Sarstún Motagua Region with 4% of the total of 56,891 ha that are burned annually (Sidman G., 2017).

They are mainly caused by carelessness at the time of the cleaning of the agricultural plots or in the activities of pasture renewal and in the control of ticks, mainly in the region of the north and north-east of Guatemala. In addition to these causes, agents related to hunting, and people who cause arson, are also identified as intended to affect the forest and thus be able to use the land once it is devoid of trees.

4. PRIORIZATION OF DEFORESTATION AND DEGRADATION AGENTS BY REDD+ REGION

4.1. Tierras Bajas del Norte (Northern Lowlands) Region

4.1.1. Subsistence Farmers and Small-scale Cattle Farmers

The department of Petén is the largest producer of corn nationwide, representing 24% of total production (Ministry of Agriculture, Livestock and Food, 2013). Small-scale producers (poor rural families) generally practice subsistence agriculture, selling their surplus. Some also engage in small-scale livestock activity. More than 12 000 plots were reported in the region according to the last agricultural census of 2003, but only a little more than 2 000 of them involved livestock activity (17%). (Zander & Durr, 2011).

The production system includes the tomb and burn, to enable new cultivation areas, negatively impacting the forest cover, aggravated by edaphic karstic factors of the place, natural fertility is limited and after a few years the tomb cycle and burning must be repeated. The expansion of the agricultural frontier has promoted the invasion of the protected areas of the region, while the deteriorated lands are abandoned and are often converted to pastures for livestock, sometimes as a front for illicit activities.

Sometimes, the owner does not even have the title on the land, but through this system he/she subsequently succeeds in titling it, demonstrating possession and improvement. Thus, some livestock families were able to convert large areas of forest to pasture with minimal cost. (Kaimowitz, 1996; Carbon Decisions International, 2011).

There is not much knowledge about the social environment or the family economy of small Petén ranchers as a group, they are described as mixed with small farmers, about 28% of whom have a Mayan Queqchí mestizo origin (Zander & Durr, 2011)

The amount of accumulated deforestation attributable to small farmers who plant corn and small farmers in the Tierras Bajas del Norte is 2 128 km², which makes this group of agents the second in order of magnitude that has most deforested, according to the Baseline elaborated by the Guatecarbon Project (Carbon Decisions International, 2011) while the own determination, made through the analysis of maps of forest use and coverage in the period from 2001 to 2010, indicates an area of 1 309.09 km² of forest area with change to agriculture, however when combined with the area determined as guamil (agricultural land at rest for more than one crop), the total area amounts to 3 021.64 km², which, according to our estimate, is considered the main agent of deforestation in the Tierras Bajas del Norte.

4.1.2. Medium and Large-scale Cattle Farmers

Geographically, these medium-sized ranchers are scattered, but they are well known in the region of Laguna del Tigre and Valle de las Estrellas. It is considered that small and medium-sized cattle ranchers with less than 92 head of cattle are those that have deforested most of the farms, although as a whole they have a lower percentage of the national herd (Carbon Decisions International, 2011).

Those with good financial resources will probably be more involved in calf fattening cattle (Grandia, 2012) cited by (Carbon Decisions International, 2011).

The expansion of the activity of medium-scale farmers is limited only by their ability to buy new land or to enjoy the rights of improved plots, as well as access to water (Gould, Carter, & Shrestha, 2006). Since the last decade, many medium-scale farmers have moved away from the income system in favor of wage labor, since it allows them to go directly from forest to pasture, without having to go through the stage of corn cultivation (Kaimowitz, 1996) cited by (Carbon Decisions International, 2011).

The large landowners in the south east of Petén are almost exclusively involved in raising livestock with some complementary forestry-type activities and in early stages of African palm cultivation (Zander & Durr, 2011). From the 1960s to the 1980s, through land colonization programs, Guatemala's large cattle ranches were created by preferences in the delivery of lands to powerful livestock families, receiving these from 225 to 1000 ha, while the poor colonizers received from 22 to 45 ha (Grandia, 2012).

It is estimated that in Guatemala there were 300 large cattle ranchers in 1979 and that they had 30% of the national herd (Kaimowitz, 1996) cited by (Carbon Decisions International, 2011). Today, 8 farmers from the southeast of Petén alone have more than 1,000 hectares each, and 5 of these belong to families associated with drug trafficking (Zander & Durr, 2011).

It has been suggested that the development of large ranches in the north of the country is a disguise to support money laundering and smuggling operations. According to RBM (Mayan Biosphere Reserve – RBM – for its acronym in Spanish) officials, the western part of the reserve has been the most affected, with Salvadoran, Mexican, and Chinese bands operating in the area. The eastern part has been left relatively intact. The destruction has been caused by a series of illicit activities. Presumably, the Mexican and Salvadoran gangs have cleared large tracts of land to launder money through ranches; with the first selling livestock on the Mexican side of the border to make a profit. The practice has led Guatemalans to coin the term "narcoganadería," says the report (Allen, 2012).

The directors of these "industries" are so well connected that they are untouchable, which raises fears that an expansion of large-scale livestock activity at the expense of forests in the Petén will not be easy to stop.

The amount of accumulated deforestation attributable to medium-scale livestock in the Northern Lowlands is 2194 km², which makes this group of agents the main responsible for deforestation in the region (Carbon Decisions International, 2011). similar to the analysis carried out as part of this determination of agents and causes of deforestation in the country in which we estimate a value of 2088.73 km² of forest area converted into livestock exploitation areas in the analysis period from 2000 to 2010 being the second agent in magnitude according to our estimate.

4.1.3. Agroindustry

Commercial agriculture has become a cause of deforestation in the region. The main agent is the agro-export companies dedicated to the cultivation of African palm and sugarcane. The INE (National Institute of Statistics INE – for its acronym in Spanish) reports that the cultivated area of African palm increased by 33% in relation to the 2013 National Agricultural Survey from 115 to 152.7 thousand hectares while sugarcane increased by 7% from 260.8 to 278.9 thousand hectares (Figure 12).

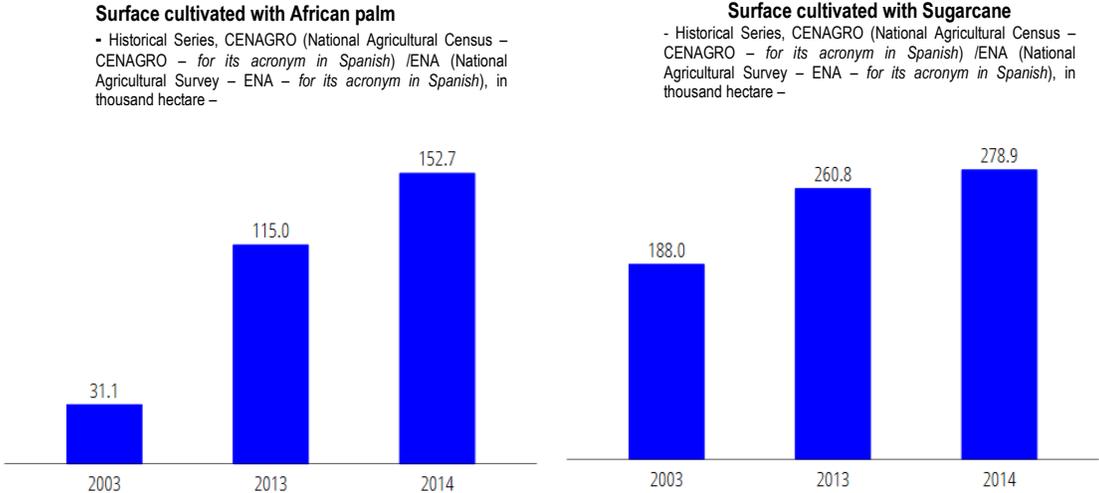


Figure 11. Area cultivated with African palm and sugarcane in Guatemala
Source: INE, 2015

In the last ten years the expansion of corporations dedicated to the cultivation of sugarcane and African palm in the northern region of Guatemala has invaded the lands historically inhabited by the Queqchies indigenous populations, displacing hundreds of families and even entire communities, generating increase in poverty, hunger, unemployment and lack of land for their sustenance (Alonso-Fradejas, 2013).

The baseline of the Northern Lowlands reports a study presented in 2011, which showed that in the region's villages land rights had been transferred from farmers to corporate interests for small amounts of money and even threats and coercion (Carbon Decisions International, 2011).

The study by Alonso-Fradejas quoted by Carbon Decisions International (2011) adds that these areas are inhabited mainly by Mayan indigenous Queqchi people, include 60% of the harvested African palm lands and most of the new lands planted with palm since 2005.

The farmers reported that most of the time they sold their land to the agro-palm businesses either because of a desire for liquidity or as a response to coercion by third parties. By 2009, African palm cultivation companies had amassed 100 000 ha and 230 000 ha more for sugarcane. Operations with sugarcane to generate ethanol, mainly for export, are in the hands of 5 family companies and processed a total of 790 000 liters in 2007, 20% of which is consumed locally while the remaining 80% is exported.

The amount of accumulated deforestation attributable to commercial agriculture in this Region is 867 km², which places third group of deforestation agents in this group (Carbon Decisions International, 2011). However, our own determination in this study results in only 285.89 km² of forest converted to African palm cultivation, 0.02 km² to sugarcane and 7.07 km² to other permanent crops, and it can be inferred that in addition to this area, a fraction of the forest area deforested and converted into fallows, has subsequently been incorporated as a palm crop.

4.1.4. Loggers

The institutional plan for the prevention and reduction of illegal logging in Guatemala (Instituto Nacional de Bosques, 2010) indicates that the sites prioritized as the main sites of occurrence of illicit forest activities in the region are in the municipalities of Poptún and Sayaxché, both at the south of the department of Petén in which mainly illicit logging and illegal transport occur.

This agent is often related to illegal logging practices of precious species in the area. Normally, the wood from affected areas is extracted illegally. Unfortunately, the weakness of forest governance is evident in the region; Surveillance systems are very scarce or do not exist, all of which affects the forest systems of the region.

Although the northern lowlands comprise a significant area of the Maya Biosphere Reserve (RBM), usually every year this area is affected by forest fires, its exact origin is unknown, although some occasions have been indicated to occur intentionally by people looking for places to extract archaeological objects buried in some places in the area. Forest fires also bring other collateral effects such as the displacement of native fauna, the destruction of native flora and favor conditions for any illicit activity with wood from affected areas.

The type of analysis carried out does not allow estimating an amount of area attributable to illegal logging for the illegal commercialization of wood, however, it is possible to affirm that of the 5454.40 km² of forest area eliminated in the region (according to our analysis), a good amount of wood was extracted and marketed illegally.

4.1.5. Oil Companies

Since 2001, the Perenco Group has been extracting oil from the Petén Xan oil field, located in the northwest part of the Region, at the Laguna del Tigre National Park. Perenco's operations in Xan are supported by park rules since the oil field exists before the park itself. The oil is also extracted from the small Rubelsanto oil field in the southern part of Tierras Bajas del Norte. The company also operates 475 km of oil pipelines, an oil terminal and a small refinery (Carbon Decisions International, 2011).

Other oil companies have exploration interests. Of 45 such companies that showed initial interest in exploring the last 4 blocks put out to bid in April 2011, only Perenco and City Petén tendered exploration contracts in Yalcanix (Carbon Decisions International, 2011)

After the 2016 Perenco Guatemala Limited concession expired, the tender for the operation of the pipeline connecting the Xan field in Petén with the Piedras Negras oil terminal was announced and in June 2017 the Ministry of Energy and Mines announced that it was looking for disclosing such bidding contest as soon as possible and that the contract would be extended for another 18 months as from February 2017 to Perenco Guatemala Limited while the public bidding process is carried out (Central America Data, 2017).

It is assumed that oil activity is a generator of deforestation because the road infrastructure that it generates facilitates access to areas with forest, and, in addition, the activity itself generates certain deforestation in the exploration and extraction sites (Carbon Decisions International, 2011).

4.2. The Sarstún Motagua Region

4.2.1. Subsistence Farmers

The National Surveys on Living Conditions (ENCOVI – for its acronym in Spanish) conducted by the National Institute of Statistics in 2006 and 2014, show that in this Region poverty levels were high in 2006, mainly in Alta Verapaz and Baja Verapaz. For the year 2014 there was an increase in extreme poverty in all the Sarstún Motagua departments with the exception of Baja Verapaz. The increase was more drastic in the department of Alta Verapaz where extreme poverty increased from 35.3% to 53.6% in the interval of 2006 to 2014.

This group is characterized by having little or no access to education, which limits their possibilities to seek other trades and diversify the economic income not linked to agriculture. There is also little family planning, each family nucleus has at least 5 members; Men are employed as laborers to work the land. Being subject to subsistence conditions, its main purpose is to cultivate basic grains, especially corn and beans, to do this, decommission areas with secondary forest or regenerated fallows, clean the land, burn and sow for a short time.

With regard to deforestation caused by the change of use to non-forest lands for the period 2006-2014, it was reported a loss of 132 371.

4.2.2. Medium and Large-scale Cattle Farmers

The livestock systems are concentrated mainly in the departments of Izabal and Alta Verapaz and a smaller part in Zacapa. These systems correspond to the production of cattle for meat and in some cases for dual purposes (meat and milk). According to the analyzed information, there seems to be an alliance between the ranchers and loggers for the change of land use. The owners of these lands have large areas with a double purpose, on one hand, raising cattle and renting it to third parties with high prices.

This agent is strongly associated with the change in land use, mainly because the forest areas are converted to pastures; its establishment occurs in hillside and flat areas. It is an unsustainable livestock, which for its development needs strong inputs of energy, mainly fertilizers.

The department of Izabal is the second department with the largest area for livestock after Petén, reporting 5439 farms dedicated to the production of cattle, with a total of 588 784 hectares, representing 12.19% of the total area of the country. Alta Verapaz reports 312 792 ha for grazing that represents 6.48% of the country's total (National Institute of Statistics, 2008).

4.2.3. Agroindustry

The cardamom shown growth within the departments of the region. From 2008 to 2013 there was an increase in the area of the same, reporting a total of 51 960 hectares that represents a 36% more area compared to the year 2005. 57% of the surface area of the country destined for the production of cardamom is found in the department of Alta Verapaz, according to studies performed by ENA, carried out during the 2005-2009 period. As regards of coffee, the Sarstún Motagua region only uses 11% of the area of this crop's production. Alta Verapaz is the department of the region with most surface area.

The crop grown by association with cardamom is coffee, this crop shows a downward trend with respect to 2005, 2006 and 2007, since in 2008 the area under cultivation of coffee fell by 70%, reporting as much as only 30 774 hectares compared to the 70 857 hectares reported for year 2005.

On the other hand, the data published in the agricultural census of 2003 for the departments of the region indicated that for that year, the area occupied by coffee was 56 791 hectares, which represents 44% less than in 2005. These fluctuations in the surface may be due to volatile prices in the international market and/or pests that affect the crop. For the 2006-2010 period, the area of coffee that changed to non-forest land was 10 348 hectares.

On the other hand, the expansion of African palm increased in the region, especially by the American company Palmas de Ixcán, which encouraged the growth of crops to the west of the country, while the plantations in Alta Verapaz were consolidated. Another company that continued with the expansion was Grasas y Aceites that accumulated large tracts of land in the municipalities of Fray Bartolomé de las Casas, Raxuhá and Chahal in the department of Alta Verapaz and Izabal in the municipalities of Livingston and El Estor.

African palm is a crop that attracts investors for its profitability. Likewise, the physiographic conditions of the region make the areas for its cultivation attractive, as well it is for rubber. It is a source of significant employment generation and for 2014 the Association of Palm Growers of Guatemala reported that this industry generates close to 100 000 direct and indirect jobs.

The study case "Analysis of the Expansion Dynamics of African Palm Cultivation in Guatemala: A Cartographic Approach" (IARNA-URL, 2012); reports among its main conclusions that there was a very marked trend of expansion of African palm cultivation during the period 2006-2010 in the departments of Alta Verapaz, with an increase of 649.2%; in Petén with 192.4%, and Izabal with 23.6%.

The study also states that the area covered by African palm in 2005 was occupied in the following way: land uses associated with livestock and agricultural activities (shrublands and pastures) with 34% (32 096.52 ha); followed by forests with around 10% (9 550.61 ha); this weighting includes all forest types, in their different stages of maturity and levels of intervention.

Finally, it concludes that only to establish a quarter of the African palm area in Guatemala (24 172 ha) forest has been removed, of which 93.2% (22 533 ha) is registered in the department of Petén. Of the forest replaced in the department of Petén for the establishment of African palm, 75.2% (16 945 ha) occurred in the period 2001-2006 and 24.8% (5588 ha) was between 2006 (IARNA-URL, 2012).

It is important to note that within the departments of Alta Verapaz and Baja Verapaz there is the highest concentration of villages in the sub-region and this accelerated growth of the African palm leads to decrease access to land to communities in order to devote to farming.

In the case of rubber crops, the studies carried out by the MAGA and the GIMBUT show an increase in the rubber surface area for the department of Alta Verapaz, with an increase of 840% of its surface since 2003 had 386 hectares while for 2012, rubber surface was increased to 3627 hectares (Ministry of Agriculture, Livestock and Food, 2005) (GIMBUT, 2014).

In the case of the department of Izabal, it showed a reduction in its rubber surface, since in 2003 there were 5591 hectares and then 3542 hectares, representing a 36% reduction in surface area. This may be because after a few years the rubber tree ceases to be profitable and they change the plantation for a newer one.

In the analyzes carried out in the digital maps of the region for the reference period 2001-2014, the area of forest land that was deforested to grow rubber was 380 ha, while the non-forest lands that became rubber were 1614 ha . The period 2010-2014 shows that 1591 hectares of forest lands were changed to rubber, while the period 2001-2006 is the period in which more non-forest lands were replaced by rubber plantations with a total of 3529 hectares (unpublished preliminary report of the Sarstún Motagua Base Line).

The determination made by this study estimates an area of 0.21 km² of deforested area attributable to the cultivation of sugarcane, 8.33 km² to African palm and 220.14 km² to other permanent crops, which constitutes commercial agriculture in the third agent in estimated magnitude of deforestation in the region.

4.2.4. Loggers

The Sarstún Motagua region is the second region with the highest rate of deforestation in the country. This is an agent that puts more pressure on forests. According to INAB's Institutional Action Plan for illegal logging control, in the urban area of San Cristóbal Verapaz illegal timber trade occurs, while in the municipality of San Juan Chamelco there is illegal logging of forests. In Zacapa and Chiquimula, in the municipalities of Zacapa, La Union, Camotán and Jocotán, illegal logging and illegal timber transport frequently occur (National Forestry Institute, 2010).

The institutional plan for the prevention and reduction of illegal logging in Guatemala (National Forestry Institute, 2010) indicates that the sites prioritized as the main sites of occurrence of illicit forestry activities in the region are in the municipalities of San Cristóbal Verapaz and San Juan Chamelco of the department of Alta Verapaz, mainly illicit logging and illegal commercialization.

Generally, the loggers buy the standing forests from the owners, they take advantage of the forest, extract the wood and commercialize it illegally; the main species used by pine (*Pinus* spp.). Although there is a presence of INAB, forestry institutions and regulations are not respected by this agent.

The type of analysis carried out does not allow estimating an amount of area attributable to illegal logging for the illegal commercialization of wood, however, it is possible to affirm that of the 1500.74 km² of forest area eliminated in the region (according to our analysis), a good amount of wood was extracted and marketed illegally.

4.2.5. Mining Companies

Although mining itself is not considered a significant cause of deforestation and degradation, it does contribute to it because the opening of gaps and the installation of camps for exploration and mining equipment make the areas accessible to other agents such as loggers and subsistence farmers.

The National Human Development Report 2015/2016 describes that in the departments that conform this region there are a total of 28 exploration licenses with an area of 632.17.01 km², as well as 125 exploitation licenses with an area of 776.27 km² for a total of 153 licenses and an area of 1408.88 km² (United Nations Development Program, 2016).

4.3. Western Region

4.3.1. Subsistence Farmers

The zone is characterized by the planting of basic grains for self-consumption. Although several municipalities export vegetables, this activity is not significant in the area (MFEWS USAID, FAO, SESAN (Secretariat of Food and Nutritional Security – SESAN – *for its acronym in Spanish*) 2009). In Quetzaltenango, there are municipalities such as Concepción Chiquirichapa, Palestina de los Altos and San Juan Ostuncalco that produce a large quantity of potatoes for sale, both inside and outside the area. However, the majority of the population, mainly from the strata of extreme poverty and poverty, sells their labor and dedicates themselves to subsistence production.

The mountainous topography of the zone marks differences for farming, since the height and the climate are determining. The lands are for forest vocation, but out of necessity, they are dedicated to the cultivation of basic grains, in spite of their low yield. The plains are the best places to cultivate, but they are urbanized. The main sources of employment are in the agricultural area of the zone, in the production of basic grains and vegetables. Work outside the area is punctual: on the south coast during

sugarcane harvest is for coffee harvest; in the piedmont, in Mexico and El Salvador and in the border areas with Mexico, is for trade. A special feature of the region is that 90% of the population is indigenous.

According to the last agricultural census, almost 95% of farms have an area of less than 0.7 ha, which, coupled with a low agricultural vocation of soils and climatic difficulties, results in the insufficiency of agricultural production to cover family needs, in addition of showing a high rate of population growth.

In the presence of this growing population and the insufficiency of agricultural production to meet food needs, farmers intensify the pressure on natural resources, especially converting forest areas into areas for agricultural cultivation, being this the main pressure that natural resources suffer in this region.

The estimates made for this agent amount to 1299.99 km² of forest area with change of use to agriculture, which, owing to the characteristics of land tenure in the region, correspond to smallholder agriculture and it is the main agent of deforestation in the Western region.

4.3.2. Cattle Farmers

The topography and size of the farms of the region, make the livestock not extensive, then consisting of family farms with little animal load and consistent, not only in raising cattle, but also species such as sheep and goats. The estimate of deforested area attributable to this group of agents amounts to 41.39 km² being the second largest in the region.

4.3.3. Population Growth

The increase of the population along with the insufficient availability of land for agricultural production and the lack of labor opportunities for the inhabitants of the Western side of the country, become factors of population expulsion, being significant the number of migrants coming from this region that move abroad, mainly to the United States which, in addition, by sending remittances, invest in housing construction and increase the demand for services and infrastructure, all of which increases the area occupied by structures and affects the loss of forest areas in the region.

Currently the population growth, as well as the high demand in housing construction, which may be enhanced by the use of remittances sent by migrants from the area, for housing construction. Our estimate in relation to the area deforested for this agent amounts to 10.13 km², being the third cause in order of magnitude.

4.3.4. Loggers

There are reports that 50% of the wood that is sold in the local markets of Quetzaltenango and Huehuetenango is illegal. Another study carried out by the IARNA indicates that between 66% and 77% of the total log entered in the sawmills of the municipalities of Tecpán, Chimaltenango and San Juan Sacatepéquez, Guatemala is of illegal origin (IARNA-URL, 2012).

The institutional plan for the prevention and reduction of illegal logging in Guatemala indicates that the main occurrences of illicit forestry activity in the region are: Tecpán and Chimaltenango in the department of Chimaltenango; Panajachel, San Pedro, Sololá, San Antonio Palopó and Santa Catarina Palopó in the department of Sololá; Chiantla and Cuilco in the department of Huehuetenango and San Pedro Jocopilas, Chichicastenango, Santa Cruz del Quiché and Nebaj in the department of Quiché.

This practice of illegal logging is driven by the owners of sawmills, which take advantage of the evident weakness of forest governance. Surveillance systems are very scarce or do not exist, all of which affects the forest systems of the region.

4.3.5. Wood Sellers

By necessity and tradition, firewood is used and will continue to be used as the main source of energy, mainly in rural areas, because, for the poorest families, 80% of fuel expenditure is used for cooking and home heating. 49% of firewood consumed in homes comes from natural forests; there is also a direct correlation between the consumption of firewood and the concentration of population with high levels of poverty.

4.4. Central Eastern Region

4.4.1. Subsistence and Commercial Farmers of Medium and High-Scale

As in the rest of the country, agricultural activity is important in the region, with several modes of production, "subsistence", generally producing basic grains such as corn, beans and vegetables. The Guatemala Livelihood Profile describes that this Region is characterized by having large areas of melon, watermelon, papaya, lemon and coffee crops. It concentrates wood and mining industries, where the majority of the population sells its labor.

The poorest socioeconomic groups plant basic grains for self-consumption and sale of surpluses, with deficient productive levels as a result of the possession of poor quality land (generally arid); likewise, they rent a considerable percentage to harvest. The most

important market is that of Teculután, which functions as a storage center. Local markets, for agricultural products play the role of suppliers of the majority of the population (MFEWS USAID, FAO, SESAN, 2009).

The National Survey on Living Conditions for years 2006 and 2014 shows high levels of poverty in the departments of the region, mainly in Chiquimula and Jalapa. For year 2014 there was a decrease in extreme poverty in most departments, while in Chiquimula and Jutiapa it increased significantly, being Chiquimula's increase the most drastic, where extreme poverty increased from 27.7% to 40.1% in the interval from 2006 to 2014.

This is one of the few areas of Guatemala where sorghum or *maicillo* is grown, which is more resistant to dry conditions in the region than corn. It is considered a resource or alternative for consumption in times of crisis; people use it when they have exhausted other options (MFEWS USAID, FAO, SESAN, 2009).

In relation to characteristic agriculture, a third of the country's beans are grown in this region, Jutiapa produces 13%, Chiquimula 10%, Jalapa 6% and Guatemala 4%. In the department of Guatemala, 29.9% of the pineapple in the country is produced, in Zacapa 87% of the melon production is concentrated, and in Jutiapa, 4% of this same crop (Ministry of Agriculture, Livestock and Food, 2013).

Red pepper production is also important in the region. The department of Jutiapa produces 22% of the national production while Baja Verapaz produces 12% and the department of Guatemala and Chiquimula 11% each. 77% of the country's tomato is produced in this region, distributed as follows: 20% Jutiapa, 20% Baja Verapaz, 11% Chiquimula, 8% Guatemala, 7% Zacapa, 6% El Progreso and 5% Jalapa (Ministry of Agriculture, Livestock and Food, 2013).

The estimates made in relation to the loss of forested area due to agriculture in the region in the analysis interval between the years 2001 to 2010 result in an area of 910.09 km² being this the main agent in order of magnitude.

4.4.2. Livestock

The raising of cattle is done with a double purpose: fattening and milk production. The fattening cattle, at the time of weaning, are sold to the well-to-do ranchers, who have large tracts of land to finish the fattening and commercialize it to the markets. The dairy cattle, in charge of the average and well-off producers supplies the local market of milk and its derivatives (MFEWS USAID, FAO, SESAN, 2009).

The estimates made in relation to the loss of the forested area due to livestock in the region in the analysis interval between the years 2001 to 2010 result in an area of 47.91 km², being the second agent in order of magnitude.

4.4.3. Population Growth

This region comprises a population estimated from the 11th National Population and the VI Habitational Censuses conducted in 2002 and projected by the National Institute of Statistics at 2017, of 5 474 474 inhabitants, which represents 32.3% of the total population of the country which is estimated at 16 924 190 inhabitants (National Institute of Statistics, 2008).

The estimates made in relation to the loss of forested area due to population or urbanism in the region in the analysis interval between 2001 and 2010 result in an area of 9.81 km² being the third agent in order of magnitude.

4.4.4. Loggers

The timber industry is permanent and processes mainly conifers. The raw material comes, above all, from the Sierra de Las Minas and las Verapaces. The by-products are destined for export.

The institutional plan for the prevention and reduction of illegal logging in Guatemala (National Forestry Institute, 2010) indicates that the sites prioritized as the main sites of occurrence of illicit forestry activities in the region are San Juan Sacatepéquez in the department of Guatemala; Granados, Cubulco and El Chol in Baja Verapaz; Zacapa and La Unión in the department of Zacapa; Camotán and Jocotán in Chiquimula and San Agustín Acasaguastlán in El Progreso.

4.4.5. Mining Companies

A small part of the productive activities is related to mining, since there are deposits of plaster, lime, feldspars, saltpeter, lead, zinc, silver, iron, quartz, copper and chromium. There are some gold-panning sites, but they are not exploited.

In the departments that make up this region there are a total of 225 licenses and a total area of 1293.96 km² (UNDP, 2016).

Table 21. Exploration and mining exploitation rights in departments of the Central Eastern Region

Department	Number of Exploration Licenses	Exploration Area km ²	Number of Exploitation Licenses	Exploitation Area km ²	Total Exploration and Exploitation km ²
Guatemala	5	88.40	73	127.50	215.90
Baja Verapaz	4	34.88	17	45.21	80.09
El Progreso	4	38.43	52	58.96	97.39
Chiquimula	3	193.80	13	17.79	211.59
Zacapa	5	153.21	21	78.29	231.50
Jalapa	5	239.37	8	47.03	286.44
Jutiapa	5	144.27	10	26.78	171.05
Total	31	892.36	194	401.56	1293.96

Source: National Report of Human Development 2015/2016 (PNUD, 2016).

Mining activity as such is generally not responsible for high rates of deforestation, however, it creates the possibility of accessing forested areas due to the construction of gaps and access roads. Also at Sierra de Las Minas, the exploitation of marble if it is considered to generate some degree of deforestation.

4.5. Southern Coastal Region

The region is almost entirely dedicated to the production of export monocultures, most of the country's sugarcane is produced in this area, African palm, rubber and coffee are other important crops. The remnants of forests occur in the so-called piedmont and the gallery forest that persists in the route of the numerous rivers that run from this western region to its piedmont in the Pacific Ocean.

An important fact is that, in this region, 81.14% of the mangrove forest existing in the country is concentrated. The presence of forest surface is reduced and consists mainly of permanent crops considered as forest, such as rubber and coffee.

This region has no significant forest cover and its soils are highly fertile and suitable for agriculture, its relevance is that the saturation of the region with highly profitable monocultures such as sugar cane and African palm, has generated the search for new lands in other regions, incorporating to these monocultures areas located in the regions of the Northern Lowlands and Sarstún Motagua.

The protection of the mangrove, which is a protected species **Cites** is important because it is chopped even against the protection that it has in the national legislation for the construction of coastal recreational developments, the implementation of coastal marine activities such as shrimp production and even the use of the mangrove as fuel in the form of firewood and charcoal.

4.5.1. Agroindustry

It is located in the piedmont and plain of the region. Generally, these areas are dedicated to extensive crops such as sugarcane, African palm, rubber and coffee. The cultivation of coffee is established under the shade of secondary forest; in other cases, they are exchanged for selected tree species for shade, firewood and wood purposes. In the coffee area, those who live in poverty and extreme poverty have their main source of income as day laborers, although a small group sells agricultural products.

The cultivation of sugarcane includes an important component that is agroindustry as the most dynamic branch of production in the Central American region; which includes the integration of the sugar mills and the industry as a whole.

4.5.2. Subsistence Farmers

This agent performs salaried agricultural activities. Some carry out informal commercial activities. They carry out fishing and marketing activities.

4.5.3. Cattle Farmers

It is an agent that has been gradually moving to other areas of the country, however, there still are several livestock systems in the area occupying large areas.

4.5.4. Shrimp Industry

This agent is located in the coastal marine zone, where they install complexes for the reproduction and commercialization of shrimp, which has created an impact on the mangrove zones.

The mangrove forest is a food feed factory for millions of people; and vital to face climate change: capture and store carbon, reduce wind gusts and cushion the impact of sea waves.

5. LAND TENURE AND ITS IMPACT ON THE PROCESSES OF FOREST DEFORESTATION AND DEGRADATION

The last Agricultural Census of 2003 registered a total of 830 684 properties that covered an area of 37 144 km², equivalent to 34.1% of the national territory. (INE 2004). 85% of rural farms are individually owned, 11% belong to the so-called law societies, 0.9% to de facto companies, 1.8% to cooperatives, 0.1% to the State, 0.6% to property and 0.6% is included in the "other" category.

With respect to the rural population, 52 percent live on land they own, 19 percent on leased land and 29 percent lacked land. (USAID, 2014).

In Guatemala, the conflict over land refers to one of the oldest structural problems, with characteristics that evoke the exclusion of women from land rights, the contrast between the national legal system and customary law, incompatibilities between visions of individual private property and communal property, claims and struggle for land, not being the only ones, but the most relevant in social terms. (SAA, 2016). (MINUGUA, 2001).

Tenure and use of land are closely related, the trend revealed in the 2003 Census remains today, large portions of land are concentrated in few hands to devote to extensive agriculture, while the vast majority of the population it is displaced to small tracts of land for subsistence crops.

According to the study carried out by USAID in 2014, the characteristics of land and forest use in the five sub-national REDD+ regions are shown in the following table.

Table 3 Predominant Use of Rural Lands.

Region	Predominant Use of Rural Lands	Forest that still exists	Main dynamics of changes in land use
South	Plantations (cane and banana)	Mangroves	Gradual invasion of mangroves by various agricultural companies
Central and East	Subsistence agriculture	Some arid forests	Extensive cattle breeding
West	Subsistence agriculture and cultivation of vegetables and legumes, coffee and cardamom	Communal and Municipal Forests	Subdivision of smallholdings, pressure is exerted on communal and municipal forests as a result of the demand for resources and land
Sarstún-Motagua	Coffee plantations, palm, sugar entering the Polochic Valley	Private lands and protected areas of the State	The workers of the farms claim for land. Consolidation of palm and sugar companies in the lowlands, which seek to buy plots of land owners recently registered in the Registry. Migration of people from the lowlands and new invasions in protected areas.
TBN (Northern Lowlands)	Livestock and subsistence agriculture	Protected areas of the State	The colonized state lands are legalized. Superposition with protected areas. In the south of the department, small plots of land newly registered are consolidated and passed on to palm farmers/producers. Migration of people to the north and new usurpations in protected areas.

Source: Evaluation on sustainable resource and landscape tenure in Guatemala. USAID. 2014. (USAID, 2014)

As observed in the previous table, the conflict over land is a permanent social problem; These problems are exacerbated in regions such as the West, Sarstún-Motagua and Tierras Bajas del Norte. As a result of agrarian history, which brought with it the dispossession of land owned by indigenous communities, since before colonial times, Guatemala is characterized by a high degree of concentration of land, with a GINI coefficient in terms of land distribution of 0.84 in 2003 according to official data. On the other hand, this concentration in land tenure in a few hands is accompanied by the fact that the vast majority of families only have access to land whose productive capacity is limited and which has been over-reutilized.

Population growth, poverty, inequality in land distribution and new processes of concentration of land for export increase pressure on rural lands, forests and protected areas, making it difficult to reduce deforestation. The processes of greater urbanization and the role played by FONTIERRAS (Land Fund – FONTIERRAS – according to its acronym in Spanish) to subsidize the purchase of land, as well as the leasing and regularization of state land holdings, are elements that act to reduce this pressure. At the landscape level, any action that could have an impact on these factors will in turn have an impact on REDD+. (USAID, 2014).

At the same time, the USAID Report presents a set of recommendations that fall into three categories: management of protected areas, forest policies (especially in regard to forest incentives) and land tenure in more general terms.

With regard to land tenure, a set of recommendations are made to the Government of Guatemala, especially aimed to regularizing the "possession" of the land; help indigenous communities to obtain the safest possible possession of the land; allow community authorities to set the consultation method to decide the type of title that best suits them and prioritize the areas with early REDD+ initiatives and the sub-national reference regions for the RIC (Registry of Cadastral Information – RIC – *for its acronym in Spanish*), the soil studies and the planning of the use of the land (USAID, 2014).

In turn, the agrarian conflict in Guatemala is deepened by the slowness in the cadastral process, the insufficiency of the General Registry of Property and the lack of an agrarian jurisdiction, as some aspects that affect the high degrees of conflicts over land and which are expressly contemplated on the Peace Agreements. (MINUGUA (United Nations Mission in Guatemala – MINUGUA – *for its acronym in Spanish*); 2001).

The average size of the farms has varied according to the census conducted between 1950 and 2003. The general average in 1950 was 15.2 blocks; in 1979 it was 11.1 blocks and in 2003, it was 6.4 blocks (INE, 2004). This suggests that land in Guatemala has been subject to strong pressures in accordance with population growth, a factor that has broadened the agricultural frontier, especially for the production of annual crops such as corn, beans, among others, and the establishment of extensive crops, such as sugar cane, livestock, African palm, among others.

The Law of the National Institute of Agrarian Transformation (INTA, National Institute for Agrarian Transformation – INTA- *for its acronym in Spanish*), enacted in 1970, declared in a state of abandonment the lands of the families that took refuge in Mexico, which led to agrarian conflicts in the area, many of which still remain. In this way many villages in the Transversal Strip of the North and Petén mainly, were repopulated with a mixture of new and old settlers. (Carrera, 2000).

The different land tenure regimes have had a significant impact on deforestation and land degradation, due to the use that the land itself has had under those property regimes. Land tenure has been and is currently a structural problem that Guatemala has, which has increased inequality and which has been a constant source of struggle on the part of indigenous groups that claim possession rights over land, from ancestral times.

In the Sarstún-Motagua region, it is indicated that some owners with legal certainty about the land, tend to take better care of the forest and reforest more, so within this factor it can be said that the ownership of lands with forests is a positive element, by promoting reforestation. On the contrary, the ambiguity or lack of security over the possession of the land is the cause of greater deforestation. (CEAB-UVG, 2016).

The ownership of the land is strongly related to its management and conservation. This factor refers to the lack of capacity to implement good land management practices, in the sense that the need to create more capacity to implement better agricultural practices and take care of the forest has been identified. A regime of ownership of the land gives greater certainty in the care of the forests, in fact, there is also a lower level of land degradation. (CEAB-UVG, 2016).

In its 2013 report, the Land Fund indicates that, in order to contribute to the agrarian governability of the rural area of the country, by 2025 it is facilitating access to land for 784 764 farmers families without land or insufficient land, oriented towards sustainable integral development of 92 agrarian communities with an extension of 1 333 300 hectares and 33 440 public deeds of land adjudication. On the other hand, it aims to formalize the total number of land allocations of the State by 2019, to beneficiaries who have been awarded these lands, reaching legal certainty and contributing to its integral and sustainable development. (FONTIERRAS, 2014)).

5.1. Communal and Municipal Lands

The Diagnosis of Conservation and Management of Natural Resources in Communal Lands identified a total of 1307 cases of communal lands with an area of 1 577 124 hectares throughout the country, which corresponds to 12% of the area of the same.

According to this diagnosis, communal lands are present throughout the country, identifying the largest number of cases in San Marcos, Huehuetenango, Alta Verapaz and Chiquimula (with more than one hundred cases each), followed by Quetzaltenango, Totonicapán, Quiché, Baja Verapaz and Sacatepéquez (between 50 and 100 cases each).

In regard to surface in communal lands, it was found in Petén, Izabal, Alta Verapaz and Quiché (with more than 100,000 ha each), followed by Huehuetenango, Baja Verapaz and Jutiapa. The South Coast and piedmont have the least communal land in quantity and surface area, largely due to the historic – and intense – destruction of the communal land system to give rise to export crops. (UNDP, 2015/2016).

There are still extensive wooded areas managed by indigenous communities in the pre-colonial era. In these areas, community management schemes have been highly influenced by the historical forms of organization and the informal regulatory frameworks of the communities. The following table shows the approximate extension of communal lands with forest by department in the Republic of Guatemala.

Table 4. Approximate Extension of Communal Lands With Forest By Department in Guatemala. Year 1995. In thousands of hectares and percentages

Department	Communal Forest	% of the department
Chimaltenango	2285	1.2
Sololá	6320	6.0
Quiché	3135	0.4
Quetzaltenango	16 751	8.5
Totonicapán	7626	7.2
San Marcos	2525	0.7
Huehuetenango	33 763	4.6
Petén (ejidos)	173 525	3.8
Total	219 930	32.4

Source: Elías, S. 1995 and Cabrera, C., 1995 in CCAD (Central American Commission of Environment and Development – CCAD – *for its acronym in Spanish*), CCAB-AP (Central American Council of Forests and Protected Areas – CCAB-AP – *for its acronym in Spanish*), IUCN-ORMA (Regional Office for Middle America – ORMA-*for its acronym in Spanish*); 1997

According to the information presented in the previous table, the departments that have the largest coverage of communal lands and forests are Sololá, Quetzaltenango, Huehuetenango, Totonicapán and Petén.

In Guatemala, municipal *ejidos* (*communal land used for agriculture*) represent an important area of land and forests. Often the character of the tenure is unclear, as it is not known if the ownership of the land is communal or municipal. In many cases, the only property title dates from the colonial era and municipal administrations rarely have a cadastre, so they cannot even provide accurate information on the extent of communal and municipal areas.

Although it was not possible to find precise information on the total extension of the national *ejidos*, it is clear that they still represent important areas under municipal administration. At Petén, *ejidos* cover an area of approximately 138 000 hectares. (López Gallego, 2010).

As for the lands and forests located in the department of Petén, these have been subject to colonization processes and recent invasions, either for the exploitation of non-timber products from the early twentieth century or for the establishment of agricultural and livestock areas.

Forest areas that still exist in Petén are located within the Maya Biosphere Reserve and are legally considered as property of the State. However, most of the forest is managed under community forestry schemes (more than 400 000 hectares managed by 22 forest concessions). (López Gallego, 2010).

In this sense, there is the Petén experience where four forest concessions have been granted to communities for their management and exploitation. From experience it can be said that this has been successful, since there is a practice of sustainable forest management, with practices of forest exploitation with low impact on the soil and fauna of the area. There is exploitation of the forest with a focus on replacing the forest mass through the management of natural regeneration and reforestation. Currently, communities export certified wood with a green seal. In addition, progress is being made so that forests can enter a carbon market through Guatecarbón project, which aims to reduce 37 million metric tons of CO₂ in a forest area of 72 8001.86 hectares. (ACOFOP (Association of Forest Communities of Petén – ACOFOP – *for its acronym in Spanish*)-CONAP, 2014).

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