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DEFORESTATION IN TINIGUA NATIONAL NATURAL PARK: SOCIO-ENVIRONMENTAL CONSEQUENCES OF THE PEACE AGREEMENT IN COLOMBIA

Carolina Tobón Ramírez, David Zamora Ávila, Mauricio Ángel Macias and Eva Youkhana

Abstract

Deforestation in Colombia has been one of the socio-environmental consequences related with the current implementation process of the peace agreement between the Colombian government and the guerrilla group *Fuerzas Armadas Revolucionarias de Colombia– Ejército Popular* (*FARC-EP*). The signing of this agreement has had positive impacts, especially regarding the demobilisation of thousands of combatants and the arms abandonment, but also has exacerbated the illegal extraction of natural resources in and around national natural parks in Colombia. One example is Tinigua National Natural Park, which increased deforestation rates two years after the signing of the agreement, i.e., in 2016 it was 0.7 % (1539 ha) and for 2018, 5.6 % (12000 ha) of the total area of the park. After 2016, new actors have come to this protected area and its surroundings to control the territory (e.g., landlords, external investors, dissident groups of FARC-EP and some structures of paramilitaries). In this context, we carried out an interdisciplinary analysis of the complex situation that relates Tinigua Park to the peace agreement. This analysis was focused on exploring and describing deforestation as a socio-environmental consequence of the peace agreement, as a result of synergies of new actors inside the park and socio-economic dynamics in the timespan from 2003 to 2018, considering key events before, during and after the signing of the peace agreement in 2016. Our findings underline the close relationship between the expansion of livestock farming, land grabbing and illegal extraction of timber as the main drivers of deforestation in the park. Coca plantations do not seem to have a great role in deforestation in this area, but it has been meaningful for the socioeconomic dynamics of some families within the park and the reason for the current military presence. Finally, it can be concluded that the poor implementation of the peace agreement caused an increase in deforestation in this natural park and promoted the influx of new settlers and new dynamics within the park boundaries, due to the absence of FARC-EP and the precarious presence of the central government.

Keywords: National Parks, Deforestation, Colombian Peace Agreement, Tinigua, Socio-environmental change

INTRODUCTION

Biodiversity conservation and deforestation count among the most challenging environmental issues related to conflict and peace in Colombia (Bustos & Jaramillo, 2016). According to the Colombian Institute of Hidrology, Meteorology and Environmental Studies (IDEAM from its Spanish acronym) in 2017, the first year after the peace agreement, the national deforestation rate increased 44% respect to the previous year (Escobar, 2018; IDEAM, 2017), one of the highest numbers in recent years corresponding to 2199 km^2 of deforested area (IDEAM, 2018c). From 1990 to 2013, 58% of the country's deforestation occurred in areas affected by the inner-armed conflict, with losses of three million hectares (Bustos & Jaramillo, 2016; Gaviria, 2016). Although the conflict contributed to deforestation and ecosystem destruction, it also led to the limitation of activities that have negative consequences on ecosystems, like mining, logging and agribusiness, especially in hard-to-access rural areas (Bustos & Jaramillo, 2016).

Deforestation is analysed in this paper as one of the most complex challenges faced by the current Colombian government in the implementation of the "Final agreement for the termination of the armed conflict and the construction of a stable and lasting peace" (henceforth referred to as "the peace agreement") signed in 2016 between the Colombian government and the FARC-EP. The signing of this agreement is, without doubt, a landmark event in Colombian history, given that the FARC-EP had, until that point, been the longest-active guerrilla in all Latin America, responsible for an armed conflict of over 50 years that caused 220.000 deaths from 1958 until 2012 (GMH, 2013).

Two of the five central and interdependent points of the peace agreement are particularly relevant for this study: (i) comprehensive rural reform and (ii) the solution to the drug problem (Gobierno de Colombia & FARC-EP, 2016). These are the two topics that have stood out as the furthest behind schedule in their implementation, as per reports by the Peace and Reconciliation Organisation (*Fundación Paz y Reconciliación, or FPR*), The Initiative: Union for Peace (*La Iniciativa: Unión por la Paz, or IUP*) and the University of Notre Dame's Kroc Institute for International Peace Studies. In its first report of 2019, the Kroc Institute, appointed to supervise, verify, and technically evaluate the implementation of the peace agreement, classified progress into zero, minimal, intermediate, and complete implementation (KROC Institute for international Peace Studies, 2019).

The comprehensive rural reform contains the central aspect of land access and use, which is composed of three plans, namely Development Plans with a Territorial Focus, Action Plans for Regional Transformation, and National Plans for Comprehensive Rural Reform. By the year 2019, 51% of these commitments have been minimally implemented, 8% have reached intermediate implementation and 3% have been completely implemented (KROC Institute for international Peace Studies, 2019). Despite the peace agreement included the participation of different actors, at least in theory, the current government have not had into account the role or interests of these actors, such as farmers, indigenous communities or even the presence of other armed groups to real implement these plans. This situation is the same when regarding legislation about natural resources management and protected areas. It is supposed to be participatory but in practice it is not in that way.

On the other hand, according to the peace agreement, the solution of the drug problem is composed of Illicit Crop Substitution Programme and the Programme for Consumption Prevention and Public Health. In this case, in 2019, 50% of these commitments have been minimally implemented, 18%

have reached intermediate implementation and 2% have been completely implemented (KROC Institute for international Peace Studies, 2019). The low implementation levels in the rural reform and in the solution of the drug problem has been mainly derived of the lack of political will of the current Colombian government. This government are not agreed with this peace agreement and are not interested in a rural reform or in a substitution programme for illicit crops.

A report released in 2018 by FPR & IUP emphasises that the process of implementing the comprehensive rural reform and the solution to the drug problem have been impeded by the occupation of territories by other armed groups, such as the National Liberation Army (ELN, from its Spanish acronym), structures inherited from paramilitaries and activities of dissident groups of the FARC-EP. It is highlighted that delays in the implementation are associated with power vacuums in these territories, leading to influx of settlers moving to these areas via violent means (as forced displacement from other regions of the country) because of the lack of government presence (FPR & IUP, 2018). In addition, the presence of illegal economies, such as illegal logging, drug trafficking, and coca production has resulted in an increase in deforestation at national level, especially in the zones which were previously occupied by the FARC-EP (FPR & IUP, 2018). Besides the violence aspects, the failures in the implementation process have also been related with the bad quality in the provision of services in rural areas and the low availability of resources needed for implementation, currently a complete defunding of the peace agreement.

When it comes to conservation areas like national natural parks, natural vegetation has deteriorated in many cases due to various causes, livestock, coca plantations, illegal logging, among others. Those activities are completely forbidden in conservation areas as national parks due to the regulations that restrict these uses within those areas. The main regulations regarding conservation areas in Colombia are: the Law 2 of 1959 that regulated the forestry economy and natural resources conservation in the country and which declared Zones of Forestry Reserve, the Decree/Law 2811 – 1974, a National Natural Resources Code and protection to the environment, the Decree 622 of 1977 that regulated the chapter of conservation areas of the former law (2811 of 1974), the Law 99 of 1993 (principles of environmental policy) that includes regulations regarding the Environmental Ministry as the main environmental authority and the National Environmental System of which conservation areas such as National Natural Parks (NNP) are part of and finally the Decree 1076 of 2015 that defined the management categories in Colombia.

In the latter regulation, a NNP is defined as an area that allows ecological self-regulation and whose ecosystems have not been substantially affected by extractive uses and human occupation. The National Unique Register of Protected Areas (RUNAP for its Spanish name) records 59 protected areas and 43 of these areas have the category of NNP. According to PNN (2017) 62,7% of these areas have been sceneries of armed confrontations and have been transit zones for different armed groups which have led to lack of presence of the central government and have allowed the consolidation of illegal activities in those areas leading to deforestation. In 2017, in 11 NNP there was illegal logging of natural forests for commercialisation, illicit crops establishment and increase of pastures and in 12 NNP there was consolidation of extensive livestock (PNN, 2017), all those activities increasing deforestation and have relation to armed groups .

In NNP, the vegetal species, animals, geomorphologic complexes, historical and cultural manifestations have scientific, educative, aesthetic, and recreational values and for its maintenance

in time, those areas are subject of a restricted management regime[1]. All those regulations forbid any human activity within the natural parks but at the same time ignore the fact that before the establishment of those protected areas there were people living there. The approach of all the regulations regarding national parks towards conservation has been preservation without people, which is in contrast with the reality of those areas. This situation has unleashed a long conflict between local people and authorities. For the authorities, all people inside the park are illegal settlers but local people historically have claimed land rights as holders of the territory since they have occupied those places for many years.

Tinigua Park is one of the Colombian NNP, located in Meta department. This park covers an area of 214,362 hectares (ha), was officially established in 1989, plays an important role in linking the Andes Mountains with the Amazon and Orinoco regions, and is essential in maintaining gene flow and biodiversity exchange (Clerici et al., 2019; GIZ, 2015). It belongs to a special management area called La Macarena Special Management Area (AMEM, from the Spanish acronym), a figure of management created for the protection of La Macarena region, declared natural national reserve in 1948[2] and then, Biological Reserve of Humanity.

Furthermore, the park is in a region with a great diversity of social actors, armed groups, and political interests (GIZ, 2015) and was also a hotspot of violence. This park and the surrounding area have been scenery of different moments in the history of violence in Colombia, during the period of two-party violence known as *La Violencia* and the massacre of the Tinigua indigenous group in the middle of twentieth century. The second half of this century was also the scene of the settling of two of the march columns[3] that had arrived from the south of Tolima to Duda and Guayabero rivers during the fifties and sixties (González, 1992). Subsequently, the FARC-EP emerged, which turned the area into a warfare scene until the demobilisation process after the signing of the peace agreement.

In this context, this paper takes an interdisciplinary look at the process of deforestation in Tinigua Park as a socio-environmental consequence (i.e., a product of the interactions between socio-economic, cultural, ecological, political, and institutional dynamics in a territory) of the Colombian peace agreement. Firstly, we present the methodology used in this study, showing perspectives from various disciplines, and including a description of the study area. Next, a socio-environmental characterisation of the Tinigua Park is given, including history, ecology, and the main social and economic dynamics. After that, we present a spatial-temporal analysis of the park's deforestation percentages before, during and after the signing of the peace agreement. Finally, an analysis is given of the public health risks due to deforestation before we end with conclusions and recommendations.

[1] Decree 1076 of 2015

[2] Law 52 24th November of 1948.

[3] March columns were formed by members of the resistance movements in Colombia in the middle of the twentieth century that were persecuted by the dictatorship of Laureano Gómez. Peasants, agrarian and communist movement members conformed these groups of people displacing for different regions of the country escaping from the violence of the government and also strengthening the resistance (González, 1992).

METHODOLOGY

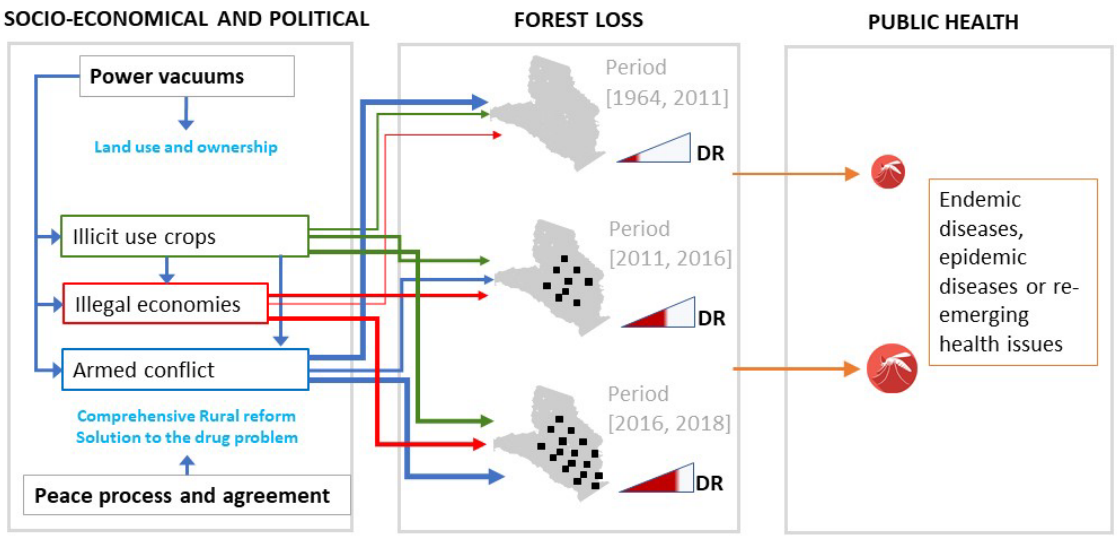
This paper was written within the framework of the Doctoral Studies Support Program (DSSP): Environmental peacebuilding and development in Colombia. As part of this program, an interdisciplinary approach (encompassing medicine, geography, anthropology, and engineering) was used to address the effects of deforestation and the life quality of the inhabitants of Tinigua Park and surroundings before, during and after the signing of the peace agreement in 2016.

This study combined several research techniques. These are documental analysis (written press, audio-visual work, official documents about the park, the AMEM and the peace agreement), analysis of cartographical information (general and thematic) and spatial-temporal analysis of forest loss (deforestation rates). One open-interview with an academic expert in rural development and with knowledge on the area was carried out to complement the analysis and interpretation of secondary data. Teamwork and a constant debate in an interdisciplinary team were necessary to articulate different perspectives and to finally achieve a common focus that interrelated the different views of the problem addressed.

The mixed methodology approaches deforestation in the park as a socio-environmental consequence of the peace agreement, by combining three factors of analysis, socio-political, forest loss and public health, as shown in Figure 1. We analyse those factors under three perspectives, a geographical perspective that allows for an understanding not only of the natural dynamics in the park, but also of their relationship with the socio-economic and political dynamics in the region. Secondly, a technical perspective that assesses forest loss in terms of deforestation rates and that helps to explain the processes that are causing changes in the park. Finally, a public health perspective sheds light on the effects that deforestation can have on health of visitors and people living in the park and surroundings.

In Figure 1, the socio-economic and political aspects are presented in the box on the left, which displays the power vacuums which generated over 50 years of conflict, as well as showing comprehensive rural reform and the drug problem solution, as the topics of analysis of the peace agreement. The central box gives a schematic representation of the loss of forest cover, quantified by satellite images provided by Global Forest Change 2000-2018 (Hansen et al., 2013). Finally, the box on the right displays, in different sizes, the increase in endemic disease vectors, as well as epidemic or re-emerging diseases and their connection to deforestation. The available official information about public health after the peace agreement is not enough to relate with forest loss, nevertheless we try to give an overview of how deforestation can lead to risks in public health. The width of the lines connecting the boxes represents the magnitude of the relevance of each aspect in different periods.

Figure 1: Methodological diagram of deforestation in Tinigua Park



DR: Deforestation rates
Source: Prepared by the authors

STUDY AREA: TINIGUA NATIONAL NATURAL PARK

Tinigua Park located in Meta Department is a protected area belonging to Colombia's National System of National Natural Parks. It is a key element of biodiversity conservation and for the maintenance of ecosystem services between the eastern Andes Mountains, the Orinoco, and the Amazon regions. The park's area is 214,362 hectares (ha), corresponding to 5.3% of the total of the special management area. In line with the common aim of all parks in this area, Tinigua's specific objective is to "conserve tropical rainforest and its associated biological diversity in order to ensure the continuity between the Andean, Orinoco and Amazon ecosystems in the north-western sector of the Amazon" (Clavijo, Olaya, Sierra, et al., 2018, p. 168).

The park is in the municipalities of La Macarena, La Uribe, and Mesetas in Meta Department (see Figure 2), and occupies 89%, 10% and 1% of their respective areas. Table 1 provides basic information on the municipalities of La Macarena, La Uribe and Mesetas. These municipalities form part of the protected area's buffer zone. The park is boarded by the Losada-Guayabero Peasant Farmer Reserve Zone (these reserves are known as ZRCs, from the Spanish acronym), a collective territorial management figure[4] (see Figure 2).

[4] Peasant Farmer Reserve Zones (ZRC) were created in Colombia under the Law 160 of 1994 as a juridic figure with the aim of promoting and stabilizing peasant economy, to overcome the causes of the social conflicts and in general to create conditions to achieve peace and social justice in the selected areas.

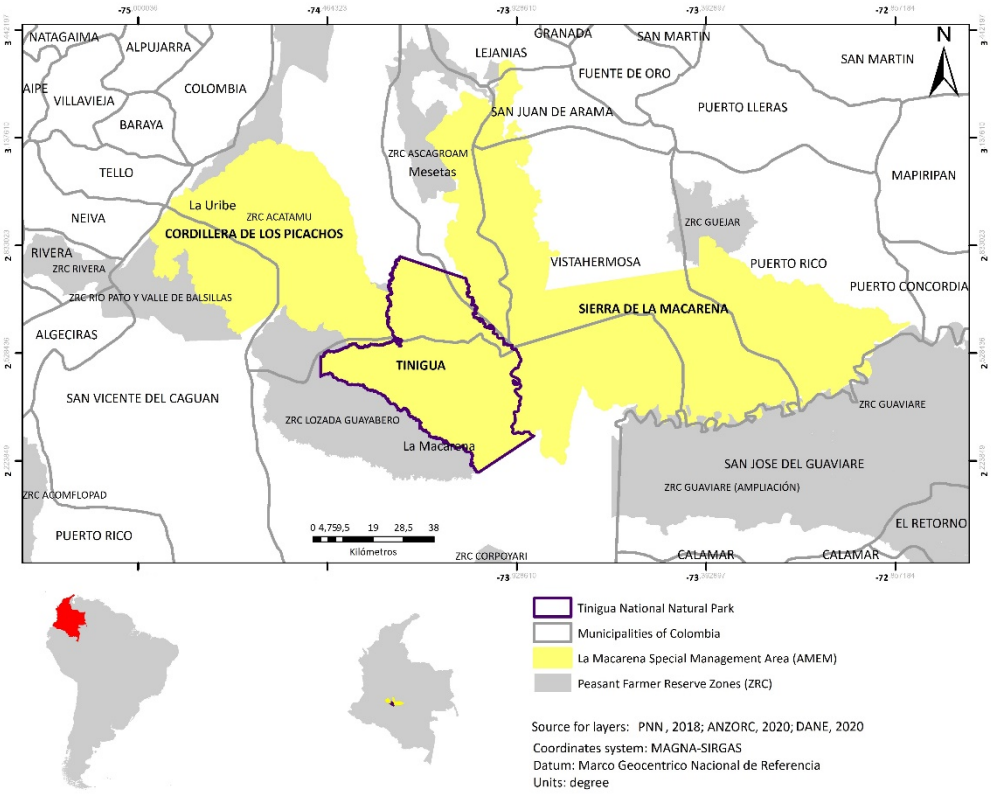
Table 1: Basic information on the municipalities in which Tinigua Park is located.

Municipality	Area (km^2)	Number of inhabitants	Urban population	Rural population	Population living within the park
La Uribe	6,307	16,539	24%	76%	10%
Mesetas	1,980	11,354	32.1%	67.9%	1%
La Macarena	11,230	33,812	14%	86%	10%

Source: Prepared by the authors, based on information from Clavijo et al. (2018)

In addition to its importance in terms of conservation of ecosystems and biodiversity, AMEM in general and Tinigua Park in particular, have historically been part of one of the key regions in Colombia's armed conflict as mentioned above. The population, both in the park as well as in buffer zones, has severely been affected by the conflict in many ways, people coming from other parts of the country because of forced displacement, among many others causes. All the complexity of Tinigua regarding ecological, social, and political aspects makes it necessary to include in the revision of the area the local context in which the park is embedded, its surroundings, urban and rural areas, the AMEM and the situation of the region, especially in socioeconomic dynamics and health issues.

Figure 2: Location of Tinigua Park in AMEM



Source: Prepared by the authors, based on information from PNN, 2018; ANZORC, 2020; DANE, 2020

SOCIO-ENVIRONMENTAL CHARACTERISATION

A socio-environmental characterisation of Tinigua Park addresses the relationship between the nature found in the park and the people living in and around it. The socio-environmental concept is a hybrid angle that seeks to go beyond the historical dichotomy between nature and society via a holistic understanding of the relationship between them. This means analysing not only the components of each system but also their interrelationships and patterns of organisation. This section presents a characterisation of Tinigua Park in terms of its history, nature, society, and economy, leading to an understanding of the transformation processes that have triggered the present socio-environmental crisis.

★ History

The park owes its name to the ethnic group that used to inhabit the forested mountain range of La Macarena between the Yarí, Guayabero and Caguán rivers. Tinigua means "Language of the Ancients" (Urquijo, n.d.). The Tinigua people inhabited the banks of the afore-mentioned rivers until 1949, when they were massacred and exterminated by a group of bandits led by Hernando Palma, who arrived in the region during the era of *La Violencia* (Rehm, 2014), and who was characterised among the population by his evil and cruelty (Leal, 1995). Today, only one last Tinigua survivor inhabits the region; upon his death will expire not only an indigenous language, but also an entire ancestral culture and the Tinigua people will be another extinct indigenous group of the country (Miranda, 2019). The history of modern-day Tinigua is one of colonisation, largely caused by the forced displacement that was a result of *La Violencia* (1948-1958). Some of the first settlers came from the Tolima Department (González, 1992; Leal, 1995), occupying what today constitutes the municipality of La Macarena, and started hunting, fishing, and farming (mainly yucca and plantain crops). From this moment, the relationship between the settlers and the tropical forest became one of extraction.

In the last few decades, deforestation has been increasing, mainly due to livestock raising, expansion of coca plantations, and illegal logging. Those activities reflected relationships of domination, control, and extraction. In contrast, there are also land use practices that reflect a different relationship with nature, more sustainable practices that try to change the rationality of domination and control for a more environmental one related with integration, solidarity and respect (Carreño, 2020). Those practices have been implemented by social and environmental organisations such as Losada-Guayabero Rural Environmental Association (ASCAL-G, from its Spanish acronym), and the Losada-Guayabero Peasant Farmer Reserve Zone. These organisations have developed more sustainable practices regarding local regulations for the natural resources use (limitation to deforested areas and allowed periods of hunting and fishing), species conservation and ecological restoration in alliance with national institutions, and territorial ordering with environmental criteria (ASCAL-G, 2015; Borda, 2017; GIZ, 2015).

In this area, FARC-EP established a kind of parallel state at the end 1960s until the demobilisation process as result of the peace agreement in 2016. González (1992) called these parallel states as Independent Republics, as product of exclusion spaces in Colombia. Those areas were nearly untouchable forming an impenetrable territory where FARC-EP gradually consolidated its military power and exercised social, political, and economic control (Castaño and Trujillo 1989; Redacción el Tiempo, 1990). This included the regulation of hunting, fishing, and illegal logging. Leal and Mejia

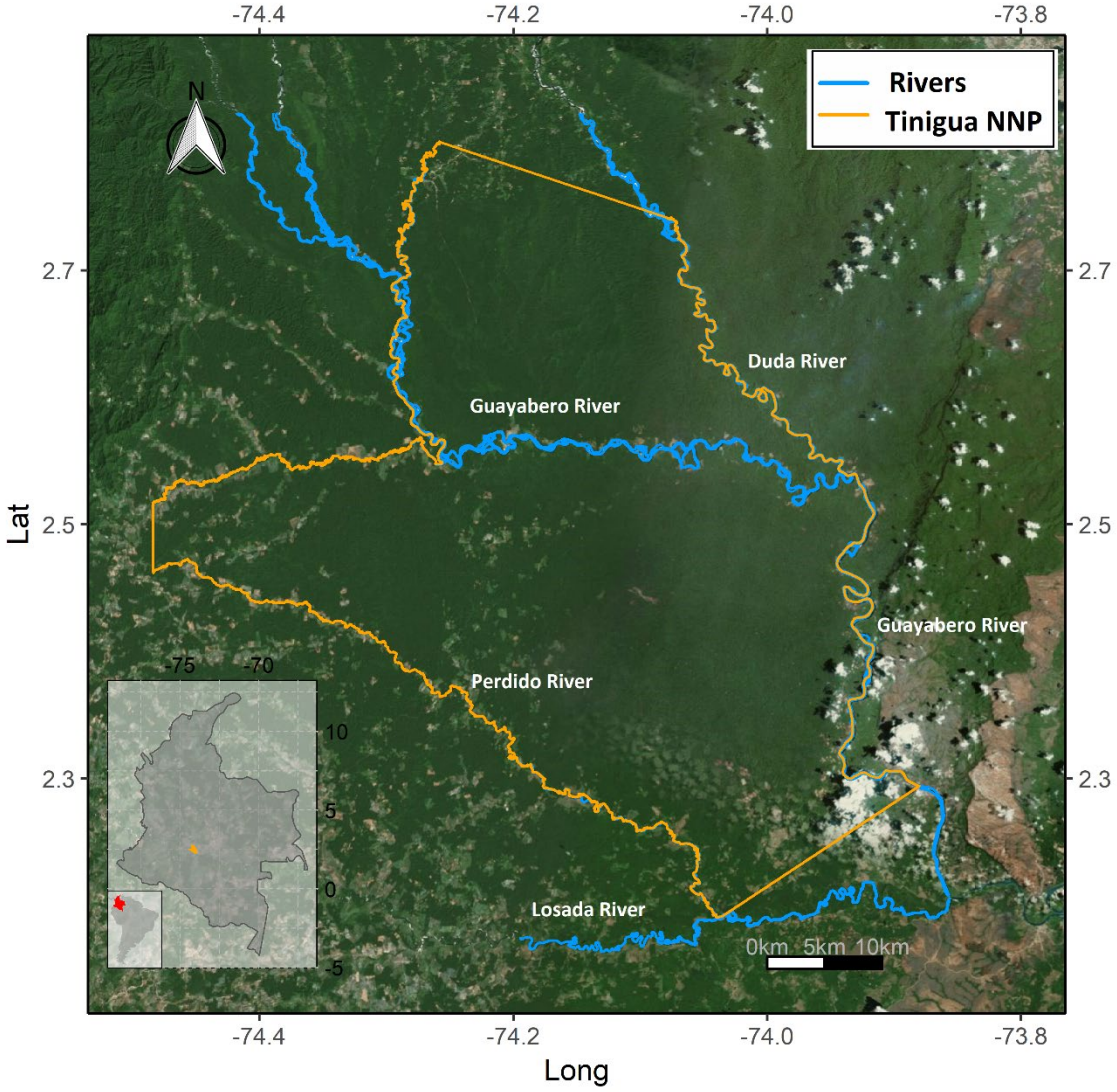
(2017) show testimonial evidence about the environmental control done by FARC-EP in this territory instead of official institutions such as National Natural Parks Unit (UPNN by its Spanish acronym). The guerrilla group regulated, through economic sanctions, fishing and hunting periods, species and quantities of animals being hunted or fished. It was forbidden to fish with mask, with guns or to hunt species as tapir, paujil and deer. It was also forbidden to contaminate the environment through the disposal of wastes to rivers and other water streams (Leal & Mejía, 2017). Castaño and Trujillo (Castaño & Trujillo, 1989) also show evidence of the political situation at the end of the eighties in this region where there were no presence of the government or a precarious one (González, 1992).

The FARC-EP's disarmament in 2016 changed the setting: on the one hand, the group's control over the area including the large forest tracts was lost; on the other hand, the central government was not able to establish a real control over the territory in political, social, and economic terms. Until now, there is no real presence and support to overcome social and economic vulnerabilities of the municipalities surrounding the park and there is no control and regulation over the territory. Different new actors are fighting this control, a dissident group of the FARC-EP, big landlords, external investors, regional politicians, and settlers, the formers but also new colonists from different parts of the country.

★ Nature

86% of Tinigua Park is covered by tropical rainforest. The remaining 14% are covered by seasonally flooded forests located at the banks of the Perdido, Duda, Guayabero and La Lagartija rivers (see Figure 3) (Clavijo, Olaya, Sierra, et al., 2018) . In the flat rivers' banks, the soils were formed in the Holocene via sediment accumulation processes. For this reason, the soils are younger and richer in nutrients than that of the surrounding rainforest (Stevenson et al., 2004). The location of the park between the eastern side of the Andes mountain range and the western part of Serranía de la Macarena gives rise to a high cloud presence for much of the year. Valley-slope wind circulation dynamics generates condensation fronts (Clavijo, Olaya, Sierra, et al., 2018). Clavijo et al. (2018, p. 177) report an altitudinal gradient of 200 to 300 m.a.s.l. in the park, a temperature between 25°C and 26°C and average annual precipitation of 2500 mm, with dry periods from December to March and August to September, and rainy seasons from April to June and October to November (Clavijo, Olaya, Sierra, et al., 2018).

Figure 3: Tinigua Park hydrography



Source: Prepared by the authors

In 1988, La Macarena Ecological Research Centre (CIEM, from its Spanish acronym), was established in the park and started to conduct systematic research on its ecosystems. In 2002, however, the research centre was abandoned due to rising violence and the kidnapping of a Japanese researcher by FARC-EP. According to CIEM, the park is home to plants from four different ecoregions: Amazon forest, the Andean region, savannahs of the Orinoco River, and *tepuis* – steep rocky plateaus that form part of the Guyana Shield. The most common type of vegetation are trees, but there are also lianas, grasses, epiphytes, and bushes (Stevenson et al., 2004). CIEM classified four types of forest, namely: mature forest, degraded open forest, flooded forest, and transitional forest, of which the first three take up the largest share of the park's area (Stevenson et al., 2008).

Tinigua Park, a crucial biodiversity conservation area in Colombia that connects the Orinoquía, the Andes and the Amazon and serves as a natural corridor, is home to many species of mammals, birds,

reptiles, and fish. Clavijo et al. (2018) highlight the presence of mammals such as otter, jaguar, mountain lion and sloth; birds like curassow, falcon, and red, green, and yellow varieties of macaw; reptiles including Orinoco crocodile, tortoise, spectacled caiman, and anaconda; and many species of fish, such as dorado, catfish, snailfish and sturgeon catfish. Over decades, deforestation has caused severe fragmentation of these species' habitats, which has increased the local rate of extinction.

★ Society

Tinigua Park is characterized by high levels of societal, as well as ecological, diversity. The park's buffer zones are inhabited by diverse groups of people, such as peasants, indigenous people, and settlers from other parts of the country. As shown above, the almost extinct Tinigua indigenous group occupied the area now corresponding to the park until 1949. In the following years, until its official classification as a national natural park in 1989, settlers came from La Macarena municipality, and later from the regions of Yarí, Guayas and Caguán in Caquetá Department, due to the war and the anti-coca activities, such as glyphosate fumigation, of the Colombian state in these areas (Borda, 2017).

The arrival of new settlers increased in the 1980s, with many of them congregating in the Losada-Guayabero interfluve where they adopted slash and burn agriculture. This led to the first patches of grassland in the region (ASCAL-G, 2015). The population that has colonized these spaces arrived mainly because of displacement and have been seen by the national authorities as illegal settlers because of the declaration of the area as national park. People living in the park do not feel like illegal because they arrived to the territory before this declaration and the central government and the unit in charge of the natural parks did not take into account that there were people living in the park. Part of this population have conformed social organisations such as Losado-Guayabero Rural Environmental Association (ASCAL-G, from its Spanish acronym) created in 1996 as result of different collective agreements to protect the environment looking for sustainable development and the improvement of life quality of the inhabitants of this area.

Another important social organization in this region is the Losada-Guayabero Peasant Farmer Reserve Zone (ZRC) mentioned above that limits and overlaps with the park in the south. This ZRC is defined as "the fruit of decades of struggle and dreams of a land of peace, good living and a fair economy that recognises typical country folk as the main actors in the region" (Agencia Prensa Rural, 2016, p. 1). This kind of organisation aims to prevent land concentration and forced displacement, among others, as well as to promote rural organization and a more sustainable territorial development (ASCAL-G, 2015). These social organisations are key to collective ordering of the territory and could be useful, for example, in deforestation control and ecological restoration.

Currently, the most densely populated area of the park and its surroundings lies between the Guayabero and Perdido rivers and is the area of influence of the ASCAL-G (Clavijo, Olaya, Sierra, et al., 2018). ASCAL-G is part of AMEM's Corporation for Environmental Defence and Sustainable Development (CorpoAMEM), created between 2013 and 2015, in which peasant associations, indigenous reservations, environmental authorities, local state authorities, social organisations and national organisations participate. CorpoAMEM was established with the objective of influencing decisions concerning the zone's environmental land-use planning and is considered a valid representative when dealing with national institutions (GIZ, 2015). Social Organizations such as ASCAL-G, the Losada-Guayabero ZRC and CorpoAMEM have developed strategies to do micro-

zoning with environmental criteria for territorial ordering and productive systems planned according to the conditions of the territory. They have tried to avoid the arrival of new colonists, to control deforestation and to use old roads built by FARC-EP as ecological paths (Tobón, personal communication, 8 February 2021).

According to Clavijo et al. (2018) in 2018 and previous years, 1,076 people from 333 families had been living in 23 settlements in the park. This figure includes 95 families about which no information was obtained: 21 did not respond to the question about their presence in the park and it was not possible to conduct interviews with the other 74 (Clavijo et al., 2018). None of the families has land property titles because they are within the park despite the fact that some of them arrived before the official recognition as natural park. According to the official data of the environmental management plan, 73 families settled before the park's official recognition in 1989. Another 165 families settled in the park after 1989.

In contrast to these figures, Calle (2018) states that 857 families lived in Tinigua Park in 2018, but those arriving after the signing of the peace agreement in 2016 were not included. Some local leaders have said in an interview with Mongabay Latam that between 2017 and 2018 an estimated 660 families arrived in the park itself (Mongabay Latam, 2018). Despite the different figures presented by official authorities or by social organisations, there are not systematic research behind the percentage of people living before and after the official declaration as national park.

The history of colonization of this area has also been influenced by policies of the central government. Before the declaration of natural parks in the country, the government institutions related with agricultural development such as the Agrarian Bank (Caja Agraria in Spanish name) promoted livestock activity in the region and in some cases funded colonists to establish themselves in some areas that after some decades became protected areas (Tobón, personal communication, 8 February 2021). Besides the local settlers, mainly colonists from different regions with few resources, there were also big landlords with large-scale livestock that in the period of warfare were forced to pay a sum of money to the guerrilla group. Currently, there is also a group of dissidents of the FARC-EP in process of reconfiguring its operation in order to gain strength. This dissident group and the paramilitary structures in this area make hard the work of the authorities in charge of the park in terms of security. Many of them have received death threats from dissident groups in which they have been declared military objective (Luque, n.d.).

Moreno (2017), citing Manlio Vargas, coordinator of the Cormacarena Biotic Group, refers to this situation in the following way: "The de-escalation of the conflict brought with it more settlers who saw the opportunity to occupy new territory, especially some who sought to expand livestock farming and others who looked to take advantage of the illegal timber trade" (Moreno, 2017). The author notes that these territorial battles for potential opportunities in the market – to carry out activities such as livestock farming, agriculture and making wooden products – have generated conflicts that end in violence and death (Moreno, 2017).

Regarding social issues as poverty, violence and health in the park, there are no official data available to talk about social indicators inside the park. For this reason, it is also important to analyse the local context that surrounds the park, the municipalities that have percentages of this areas within the park, La Uribe, Mesetas and La Macarena (see Tab 1 and Figure 2). These three municipalities have been traditionally characterized by poverty and marginalization by the central Colombian government. Mesetas is the smallest municipality, connected to AMEM and Tinigua Park at its

southern border. With a rural population of nearly 70%, it has a Global Multidimensional Poverty Index (MPI) of 68.5%; this figure breaks down as 61.6% of urban and 82.2% of rural households being defined as poor and situates it as the second-poorest municipality in the park's area, after La Uribe, which has a MPI of 93.8%, with 82.6% of urban and 98.4% of rural households classified as poor (Alcaldía Mesetas, 2017). La Macarena has the best state of the three, being the biggest and with the strongest economy, due to the tourism that provides an alternative source of income. This municipality has a significantly better MPI of 45.9%, with a comparatively low 45.8% of urban and 56.1% of rural families defined as poor (Unidad de análisis y Estadística, 2017).

There is a severe lack of job security in these municipalities, with limited opportunities for formal work and a huge problem with informal jobs and unemployment (Alcaldía La Macarena, 2017; Alcaldía La Uribe, 2017; Alcaldía Mesetas, 2017). According to the information generated by the official sources in the municipalities there is no way to disaggregate this kind of information for the population that is living in the park and the others living outside. Nevertheless, the figures give an idea of the conditions of the rural and urban population in the area that are part of the surroundings and buffer zones of the park.

The continued violence is also an issue shared by three municipalities and can be mainly associated to three levels. First, disputes over land between FARC-EP dissident groups and the central government trying to establish territorial control. Dissident groups mainly have two objectives; to promote the coca plantations and to extract natural resources with the aim of obtaining economic resources for its functioning. On the second level, there are also land disputes between peasant communities (local settlers or colonists) and the central government because of the restrictions regarding protected areas mentioned above, especially the Law 2 of 1959 and the declaration of natural parks. Finally, on the third level there is also presence of paramilitary structures trying to grab land of some settlers around urban areas.

The statistic that most stands out are the high rates of death by homicide, which are between 23 and 109 per 100,000 inhabitants, giving a mean rate far higher than the national average of 26 (Unidad de análisis y Estadística, 2017, p. 29). These values are broken down by municipality in Table 2. The La Uribe municipality has the highest rates of mortality by homicide. The municipality has a serious problem with armed violence, which together with the conditions of poverty, aggravate its inhabitants' precarious living conditions. After the signing of the peace agreement, insecurity is still a serious problem in and around the park.

Table 2: Mortality by homicide in the three municipalities that make up Tinigua Park

Municipality	Mortality by homicide per 100,000 inhabitants
Mesetas	70
La Uribe	109
La Macarena	23

Source: Unidad de análisis y estadística (2017). Fact sheet from Villavicencio, Meta Department.

When it comes to health cover, 93.74% of the people rely on the subsidised regime to provide healthcare, with only 6% of the inhabitants – those working for the municipal administration – affiliated to the contributory regime[5]. Healthcare in these municipalities is mainly organised by local agencies that usually are weak, have few resources and just offer services of low complexity which generates a risk of access to medical attention. The closest hospital with more services such as hospitalization, internal medicine and general surgery are more than fifty kilometres to the northeast.

★ Economy

As stated above, none of the inhabitants of the park possess property titles because of protected areas and forestry reserve zones regulations. Despite the above, the most important economic activity in the park is livestock farming, both in the seasonally flooded forests and the tropical rainforest. In the former, it has been determined that 6,710 ha of the flooded forest cover (22%) has been taken over by livestock farming; in the latter, the transformed area of the tropical rainforest is 23,427 ha (12%) (Clavijo, Olaya, et al., 2018)

In fact, all families that live in the park are somewhat engaged in livestock farming. Before the peace process, in this region there were four kinds of livestock activities (G.Tobón, personal communication, 8 February 2021). First, small-scale livestock usually developed by peasants, local settlers, or colonists who were owners of the animals and occupy small and medium areas of land. The second kind of livestock farming is called in the area "A la Medianía o Al Partir" and in this strategy the peasants take care of the animals but are not the owners. There are external investors who own the animals, and the utilities of the activity are divided in two parts; one for the owner of the cattle and the other for the peasant who takes care of them. The third kind of livestock were related with the areas occupied by extinct FARC-EP who also developed livestock for its supply in order to have incomes for its operations. The fourth kind of livestock before the peace agreement was related with external investors that have big areas and have appropriated others. Usually, these landlords have administrators of its land and used to pay some amount of money to the guerrilla group to develop their activities.

After the peace agreement and the demobilisation process of FARC-EP, this livestock scenery changed because the landlords did not need to pay the guerrilla anymore and there has not been any control over the deforestation areas or vegetal and animal species. The external investors, in association with big landlords and in occasions with regional politicians have developed strategies that combine deforestation and land grabbing (Tobón, personal communication, 8 February 2021). In this way, the land appropriation is increasing and there is no real control over deforestation rates. After the demobilisation of FARC-EP, the central government has not been able to control the territory, not only with military presence but also to overcome the socioeconomic vulnerabilities of the people living inside or outside of the park. Clavijo and others (2018) mentioned that nowadays

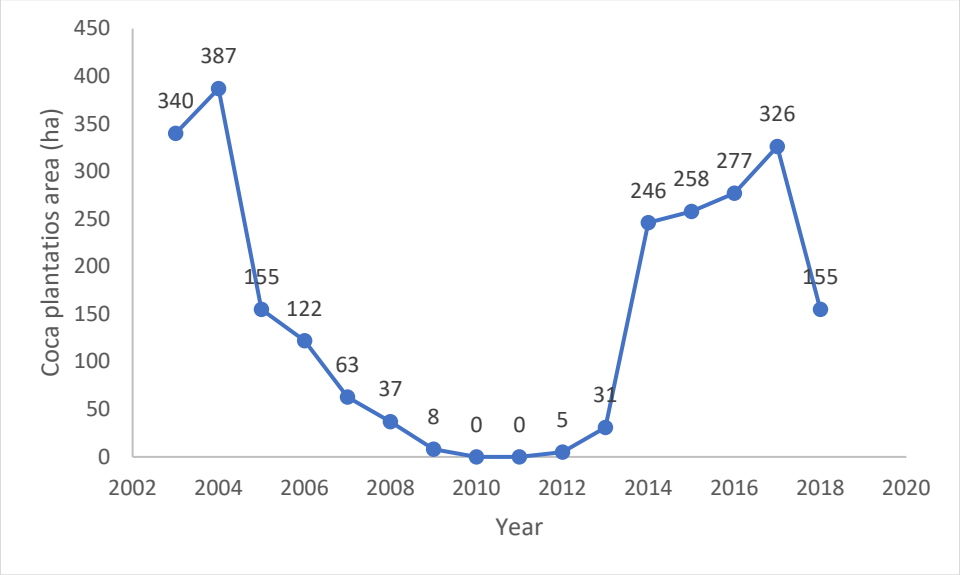
[5] According to the Health and Social Protection Ministry of Colombia, the subsidised regime is the mechanism through the poor and most vulnerable population that do not have payment capacity have access to health services through a statal subsidy. The contributory regime is a set of rules for the labour relationships of people to the General System of Social Security in Health, it means that this regime is for people that have a labour contract or work in an independent way.

the least common form of livestock is the direct ownership of animals, from which it can be inferred that there is a high incidence of external investors (Clavijo, Olaya, et al., 2018).

Although livestock is the main economic activity carried out inside the park, the extractive and infrastructure-related activities constitute a threat to the conservation of this strategic area and the sustainability of its communities. In this regard, Clavijo and others (2018) note that the current and projected road infrastructure will worsen the ecological deterioration of AMEM and Tinigua Park, particularly the northern zone, which is currently in the best state of conservation. Some of the roads inside the park were built by FARC-EP at the end of the twentieth century while developing activities from this area, others have been opened in recent years for illegal logging and timber extraction. Social organisations as ASCAL-G and Losada-Guayabero ZRC have converted some of the roads built by FARC-EP into ecological paths to develop activities of eco-tourism and biological conservation. Besides, they are trying to implement a scheme of payment for environmental services because of the conservation process that they have begun.

In terms of illegal economies, the main important activity is the coca production that have had a dynamic behaviour in the last sixteen years according to the Integrated Illicit Crop Monitoring System (SIMCI, from the Spanish acronym). SIMCI has been tracking changes in Colombia due to coca plantations since 2000 and has reported data of cultivated areas in Tinigua Park from 2003 until 2019. Figure 4 presents the area of coca plantations in this period in Tinigua Park according to the data reported by SIMCI.

Figure 4: Dynamic of coca plantation area in Tinigua Park



Source: UNODC, 2020

The graph shows a maximum figure in 2004 of 387 ha and present a big decrease until achieving 0 hectares in 2010. From 2003 until 2010 the strategy of the central government of Alvaro Uribe was the eradication of coca crops via aerial fumigation with all the negative effects associated to people, ecosystems, and other kinds of crops. During the first years of Juan Manuel Santos administration there was a change in the eradication form beginning with manual eradication and substitution of crops. In the period between 2012 and 2017 there was an increase of areas cultivated with coca,

probably due to misunderstandings about the incentives created by the peace process with the Illicit Crop Substitution Programme. Some families came to the park to cultivate coca with the hope of being included in this program. Nevertheless, the families that could submit to this program needed to be in the region with this kind of crops before 2015. After 2017 there has been a decrease of the coca plantations area related with the substitution program mentioned above. Some families in the park subscribed to this program.

Unfortunately, nowadays the strategy of the government of Ivan Duque regarding the eradication of the coca crops doesn't continue to be manual. Instead, the strategy returns to glyphosate aspersion and military intervention in the zones with coca plantations in the park where there are people that are part of the substitution program. Those military operations are contrary to what was agree in the peace process, are affecting people's life quality and security in the region and the militaries not only are destroying crops but also seized cattle. Local people that submitted to the substitution program feel that the central government is not fulfilling the commitment that came with the peace agreement in which they will have other economic alternatives to the coca production.

DEFORESTATION IN TINIGUA PARK

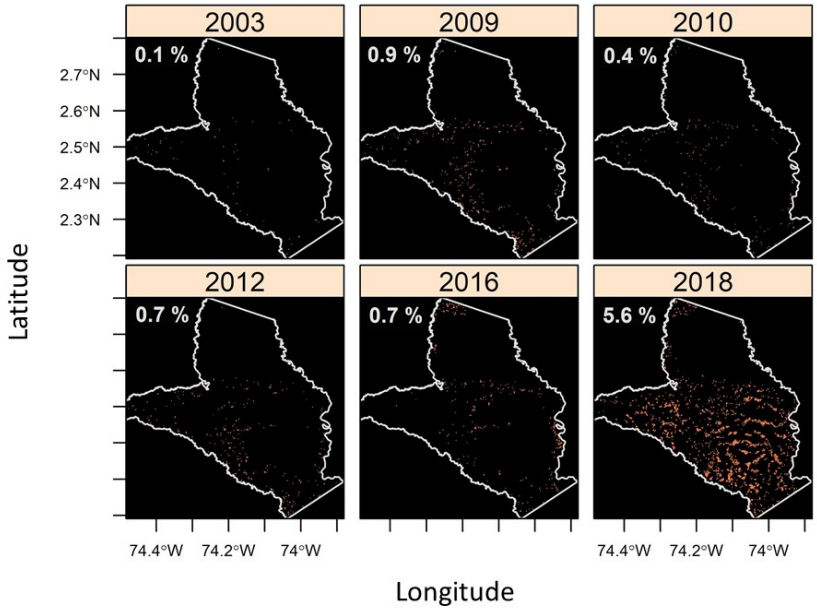
Tropical rainforest, the most common type of vegetation found in Tinigua Park, has been the setting for a variety of processes whose principal consequence has been deforestation. Some of these can be classified as direct processes such as the settling and expansion of the agricultural frontier (e.g., for pastures and large-scale livestock farming), coca plantations, illegal timber extraction and forest fires and indirect such as the execution of inadequate policies regarding the occupation and utilisation of territory (IDEAM, 2018a; IDEAM et al., 2007) and the power vacuum of the central government not only in the area of the park but also in the entire region. Data on loss of forest cover in Tinigua Park between 2003 and 2018 were obtained from Version 1.6 of the Global Forest Change 2000-2018 archive (see Figure 4). These images, in raster format, are the result of image analysis from Landsat 7 (2000-2012) and Landsat 8 (2013-2018) satellites (Hansen et al., 2013).

Using this data, six years before and after the signing of the peace agreement have been selected to show deforestation in Tinigua Park and to link it with historic events. These are: 2003 when ex-president Álvaro Uribe's was elected, 2009 before the end of Uribe's second term, 2010 when ex-president Juan Manuel Santos's started his first term, 2012 when the peace talks between the Colombian government and the FARC-EP started, 2016 when the peace agreement was signed, and 2018 when ex-president Santos's presidency ended.

The first three selected years (see upper part of Figure 4) show that between 2003 and 2010 the percentage of deforested area had risen from 0,1% to 0,4% of the total percentage of the park area. Between the end of Álvaro Uribe's presidency and the start of the peace talks in 2012, the percentage of deforested area expanded to 0,7% (1571 ha). This area remained constant during the four years of peace talks (2012-2016), but two years after the signing of the peace agreement, it had increased dramatically to 5,6% (12,000 ha) with respect to the total area of the Tinigua park. Clerici and others (2020) also reported an increase in deforestation in the post-conflict years in Tinigua Park and in the buffer area. In the park, the change in deforestation before and after the peace agreement was 122 km^2 (12200 ha) which corresponds to a percentage change of 325,7% and

in the buffer area of the park the change in deforestation was 72,3 km^2 (7230 ha) with a percentage of change of 235.1% with respect to the years before the peace agreement[6] (Clerici et al., 2020).

Figure 4: Loss of forest (% - ha) (orange) per year in Tinigua Park (white border) from 2003 to 2018



Source: Prepared by the authors, based on information from Global Forest Change 2000-2018

As part of AMEM, Tinigua was one of the protected areas with earliest deforestation warnings[7] (ATDs, from the Spanish acronym) during the second half of 2018. Between July and September more than 40% of the ATDs from the National Protected Areas Systems (SINAP by the Spanish acronym) were reported from this park, and from October to December of 2018 the reported figure was 25% (IDEAM, 2018a), the second-highest number of ATDs in protected areas, after Sierra Nevada de Santa Marta. The hotspots of deforestation in Tinigua Park during the second half of 2018 was around the settlements of Jordania, Parque Tinigua, Caño Limón, Atlántida and El Rubí (IDEAM, 2018b). This is the area with the highest concentration of people in the park.

During the first months of 2020, deforestation continued in the park because of forest fires. The Territorial Environmental Information System of the Colombian Amazon (SIAT-AC, from the Spanish acronym) reports 1039 hotspots in La Uribe Municipality and 3231 in La Macarena Municipality. In the first ATD report of IDEAM for 2020 (January to March) the figure of 25% remains constant as the percentage of detections of ATD in the SINAP and for the second period (April to June) the detections of ATD for Tinigua Park decrease to 12% approximately (IDEAM, 2020).

[6] In this study (Clerici et al., 2020) the years before peace agreement were 2013, 2014 and 2015 and the post-conflict years were 2016, 2017 and 2018.

[7] Earliest deforestation warnings (ATDs, from the Spanish acronym) are tools for the decision-making process in Colombia for deforestation reduction created by IDEAM as the result of the digital processing of low-resolution satellite images to identify quickly and conveniently the area of natural forest loss. Those ATD are presented each three months identifying the hotspots (active points) of deforestation at national and regional level.

According to the economic dynamics within Tinigua Park and surroundings, the main drivers of deforestation are livestock, especially the large-scale livestock farming, land grabbing and the illegal timber extraction associated with the appropriation process of land. Rodríguez-Garavito, C. Rodríguez-Franco and Durán-Crane (2017) have pointed out that the responsible for deforestation in the park are groups that are acting outside the law (dissident and paramilitaries), as well as external actors financing activities that destroy the forests for land-use change (external investors). Clerici and others (2020) also have noted that the expansion of agricultural frontier and the transformation of forest into pastures for cattle ranching are some of the major drivers of deforestation.

After the 2016 peace agreement and the consequent demobilisation of the FARC-EP, diverse groups of actors such as big holders of land, external investors, armed groups, local settlers, and other new colonists have tried to appropriate public areas that are not being controlled by any authority because of the vacuum left by the central government in this territory. This vacuum of power is causing a sad war between nature and people in this place. The intervention of the central government in the last months of 2020 in the park and its surroundings has been just military operations (Artemisa and Picachos Operations) that are not being directed to the deforesters of the big areas. They are directing these violent operations to small peasants that used to cultivate coca and that were subscribed in the substitution program for a voluntary and manual eradication of the crops. This commitment has not been upheld by the central government; on the contrary, the answer has been war.

PUBLIC HEALTH RISKS AND DEFORESTATION

Deforestation and other changes in land use in Tinigua Park have direct and indirect risks to human health. These impacts include air contamination by smoke from forest burning, loss of collective memory of medicinal plants, loss of food sovereignty, water pollution from mining activities, livestock farming and agribusiness, as well as more indirect impacts such as diseases following the loss of biodiversity and the emission of greenhouse gases (Pierce et al., 2017).The official health data in Colombia is not clear and there are not available statistics that allow to analyse time series or tendencies at regional or local level and to make direct relations among health and deforestation, even more for a natural park scale. Nevertheless, we try to analyse the social and ecological context within and around the park in order to present potential public health risks than can be generated for deforestation.

In addition to poverty and malnutrition suffered by many inhabitants living in and around the park, the most frequently involved pathogens are vector-borne viral agents and the most common public health problems are endemic diseases, epidemic diseases, and re-emerging health issues. Some of these diseases are dengue fever, zika, and chikungunya that can be transmitted in spaces where the land cover is transformed from natural forests to pastures and where there is no water recirculation and vectors increase because of the watering places for animals. Despite the serious impacts of the afore-mentioned illnesses, however, they are the source of less risk than malaria and yellow fever, diseases of this region that have high mortality indexes (Pierce et al., 2017).

Despite the existence of studies about the effects of economic activities taking place in Tinigua Park on the health and wellbeing of the communities (Niño, 2018; Observatorio Nacional de Salud (ONS), 2017; OPS/OMS, 2016a), availability of historic data pertaining to monthly or annual morbidity or mortality rates in Tinigua Park is limited. With those studies and inferences about the sanitary local

conditions it is possible to relate deforestation with social issues as violence, land conflicts and the impacts on the life quality and health of the local population and settlers.

Our analysis, therefore, depends on limited supply of data obtained from different health organisations from the municipalities. These organisations are the secretaries of health of the municipality that usually are weak, with few resources and low level of complexity as mentioned above. In 2016, Colombia's National Health Institute published figures on morbidity and mortality rates for the Transitional Rural Normalisation Zones (ZVTN, from the Spanish acronym), which were spaces created in the peace talks for the concentration, demobilisation, and reintegration to civil life of the former combatants of FARC-EP. Two of these ZVTN were established between 2008 and 2015 in two of the municipalities that are part of the Tinigua Park, La Macarena and Mesetas. According to this technical report, during the peace talks mortality from infectious diseases was zero, and the morbidity rate was like that in the rest of the country (ONS, 2017).

However, within the framework of notifiable diseases, Colombia's National Focal Point for International Health Regulations notified the PAHO/WHO in June 2016 of the occurrence of a fatal case of jungle yellow fever in La Macarena Municipality in Meta Department (OPS/OMS, 2016b). Yellow fever is the most common of the re-emerging epidemics in the zone of Tinigua Park. This viral disease has been endemic in the region, and its three municipalities have remained on the lists of those in which a vaccination is recommended due to the high risk of infection (Ministerio de Salud, 2017). Tourist activities in the park have brought together the vector, the virus, and infrequent visitors, while the changes to land cover, added to migration and settling in forested regions have caused the virus's dissemination in the park's area to accelerate in the period since the signing of the peace agreement.

The migration of people within the park is not only because of tourists but also related with displacement from other regions of the country (armed conflict or environmental issues). Therefore, there are more people in contact with vectors (tourist and new settlers) and, there are more vectors in the area because of deforestation and increase of livestock. This situation results in high level of transmission and the emergence of other tropical diseases such as zika, Chikunguya, among others.

The municipalities of Mesetas, La Uribe and La Macarena are classified as risk category 1A, defining them as a national priority for vaccination, both for their inhabitants and infrequent visitors, in accordance with 2017 guidance from the Ministry of Health (Ministerio de Salud, 2017). In addition, in the municipality of La Macarena, with more area in the park, there has been an increase in yellow fever on deforestation fronts (Niño, 2018). This study was carried out between 2007 and 2013 and showed the increase in yellow fever especially around the rivers used to transport the timber products of illegal logging out of Tinigua Park's territory. Those areas correspond with deforestation fronts in this municipality.

In the author's words:

> 33.4% of the municipality of La Macarena is vulnerable to yellow fever, especially towards the south east of the municipality and around Tinigua National Natural Park, where 6.4% of the settlements meet this condition across more than 80.0% of their area. High vulnerability spans 31.1% of the municipality, mainly in the colonisation front coming from San Vicente del Caguán

and in some land and river transport corridors. In 7.7% of the settlements, this level of severity is observed in over 70.0% of their territory[8] (Niño, 2018, pp. 24, 25).

There are public health risks related to the drastic change in vegetation cover and the ecological dynamics caused by settling and human mobility in former areas of tropical rainforest. This leads to transformations in ecosystem relationships, which for this case causes a matter of concern for national public health. Deforestation fronts, especially those that transform natural forest cover into pastures are increasing the risk of the emergence of more diseases in areas that usually did not present these diseases before.

CONCLUSIONS

In the post-agreement framework, the Tinigua Park, its forests, and nature can be a victim rather than a beneficiary of the peace process. This park in the past partially benefitted from the control practices of the FARC-EP. Ever since the peace agreement, the Colombian government has not been able to fill the vacuum created by the disarmament of the FARC-EP in this area. The lack of state presence or a precarious one is compounded by the dissident groups, the influx of new settlers into the park, the expansion of livestock, illegal logging, and land grabbing. The findings of Clerici and others (2020) support this conclusion pointing out the systematic weakness of the national government to manage protected areas and its surroundings and the consolidation of dissident groups in Tinigua Park by assigning lands and promoting livestock and coca crops.

Many factors contributed to deforestation and affected habitats in Tinigua Park. The main drivers of deforestation are livestock farming, land grabbing and illegal logging mainly developed in large areas of the park by landlords and external investors. New settlers arriving to the territory are also deforesting to develop their activities because they do not have any other economic alternative though they do not have enough resources to deforest large areas such as are being affected. Although coca is not between these main drivers in Tinigua Park, its production also implies the deterioration in the quality of water sources and changes in soil characteristics because of the agrochemicals used for crops and the chemicals utilised to process coca that are dumped or transported by surface runoff. The uses of land that implies those drivers of deforestation have not only exacerbated habitat conversion and fragmentation, and negatively impacted the conservation of neo-tropical biodiversity corridors, but also led to an increase in homicide rates because of disputes over territory and local power.

In the complex process of implementing a peace agreement in protected areas, it is essential to emphasise the various ways of planning from the territories themselves and the inclusion of the local communities in environmental territorial planning, especially the peasant communities that have lived for decades in the park. The regulations related with national parks and conservation areas are obsolete and do not correspond with the changes taking place in the local contexts and

[8] 33,4% del área de La Macarena presenta vulnerabilidad media a la fiebre amarilla, en particular, al sureste del municipio y alrededor del Parque Nacional Natural Tinigua, donde el 6,4% de las veredas presentan una proporción mayor al 80,0% de su territorio bajo esta condición. La alta vulnerabilidad abarca el 31,1% del municipio, principalmente, en el frente de colonización proveniente de San Vicente del Caguán y en algunos corredores de transporte terrestre y fluvial. En el 7,7% de las veredas se observa este nivel de severidad en la vulnerabilidad en un área mayor al 70,0% de su territorio. (Niño, 2018, pp. 24, 25) Translated by Philip Charles Dyer.

the reality of these territories. The approach of preservation of those areas without people needs to be changed to one in which the conservation is done with the support of social actors but also with the support of the state. In Tinigua Park, ASCAL-G, CorpoAMEM and the Losada-Guayabero ZRC are examples of social organisations, appointed as socio-environmental movements that do sustainable territorial planning, but are at the same time stigmatised by the country's political groups and targeted with violence from illegal armed groups. "The system of protected areas of Colombia needs a radical transformation and development, to acquire effective enforcement of existing laws against the illegal use of natural resources and for the recovery of grabbed land" (Clerici et al., 2020, p. 6).

The case of Tinigua Park reflects the three central points that were emphasised with respect to the implementation of the peace agreement: the occupation of territories by other armed groups; the continuous power vacuum of the Colombian government; and the presence of economic activities that exacerbate the processes of deforestation as livestock farming. This is all compounded by the failure to implement a truly comprehensive rural reform that would solve the issue of land access, use and ownership, and would be linked to the problem of the growth of coca. The solution to the drug problem, particularly the Illicit Crop Substitution Programme, is currently under serious threat from the Colombian government's new strategy of restarting aerial crop-spraying despite crops substitutions and manual eradication. Serious socio-environmental impacts will be felt in all the regions where coca eradication is implemented by glyphosate spraying, rather than substituting crops and giving more sustainable economic alternatives to the population.

In that sense, the solution of the drug problem needs to be implemented as an integral part of the comprehensive rural reform (Tobón, 2016). Coca production is directly related to structural problems in land use and agriculture in rural areas of Colombia and these ones are also related with the power vacuums and lack of presence of the state. If the comprehensive rural reform does not sufficiently include a solution of the drug problem, it is most likely that violence in the territories abandoned by the FARC-EP will again increase, that other armed groups will continue taking control of these areas, making the implementation of the peace agreement more difficult or even impossible (Tobón, 2016), and deforestation will continue increasing as it is also happening now.

The mechanisms of the Illicit Crop Substitution Programme, which is being implemented in La Macarena Municipality, has been misinterpreted and occasionally used as a "perverse incentive" to cut down forest and plant illicit use crops in the hope of receiving incentives stipulated in the peace agreement. This is the result of a lack of clarity regarding the economic incentives among the communities that inhabit these territories, which is intended for those with coca crops planted before 2015 (Calle, 2018), and this lack of clarity has caused an increase in the flow of migrants to this municipality, coming with the objective of finding an area of forest in which to cut down trees and plant the crop.

The failure in the implementation process of the peace agreement implies also a failure in the peace agreement itself because there was no real recognition of the possibility of new actors emerging in the territories in conflict. There was also no recognition of the urgent needs of the population of these areas, already abandoned by the state, in terms of social and economic issues. The parties that made the agreement had to take into account that FARC could be replaced by other kind of armed groups in the territories because there was no a real control of the central government over those areas.

The development model of high levels of productivity without limits or control promoted by the Colombian government before, during and after the peace agreement and which was not discussed during the negotiations that took place prior to the signing of the treaty can be considered as a structural cause of deforestation and a main driver of violence, grabbing and concentration of land. The historic abandonment of the central government over territories as Tinigua Park has triggered not only a long conflict between local people and authorities but also a deep conflict between people and nature.

RECOMMENDATIONS

The end of the armed conflict with the FARC-EP brings opportunities to reconsider how the country is run and to restructure environmental governance. Most important is the chance to reduce deforestation through social control and management of ecological restoration and the recovery and conservation of areas with high environmental importance such as national parks. This social control and management could be achieved by connecting the various social actors that are found in and around national parks and by considering also the social and economic needs of this population as we mentioned before. It is also necessary the promotion and creation of community initiatives to protect the environment to reinforce the participation of local actors in the environmental legislation and ordering in Colombia. A successful example of this kind of initiatives leaded by social organisations can be found in the San Lucas Mountains (Serranía de San Lucas in Spanish) in the northern region of Colombia (Carreño, 2020; Quijano Mejía & Alfonso León, 2020).

The socio-environmental changes that have been taking place in Tinigua Park since the peace agreement reflect the need for stronger government presence in the protected area, not only to control of the territory, deforestation, and crime, but also to tackle social issues such as health, education, poverty, and concentration of land ownership, and to provide economic alternatives in this area of special ecological and social diversity. Despite resistance from communities and social organisations against violence and the abandonment of the state, the pressure from armed groups is very strong and the support of the especial administrative unit of NNP or environmental corporations is insufficient as they lack the resources to confront these armed groups.

A complementary strategy to the above is to promote a more sustainable, efficient, and diversified economy (Bustos & Jaramillo, 2016) that can be strengthen on a local level through greater government presence and a higher allocation of resources. These economies can be promoted together with the communities that inhabit these regions, as proposed by actors such as ASCAL-G in its Sustainable Development Plan: "…fair ways of occupying territory where the rural community and surrounding environment can develop in a sustainable way" (ASCAL-G, n.d.). There is a need that the approach of the regulations of protected areas is directed to conservation with the support of local actors and also related with land policies regarding access and formalisation. One attempt in that sense was the policy of social participation in conservation called "Parks with people" promoted by the especial administrative unit of NNP in 2001 (UAESPNN, 2001). This policy was a good initiative but could not be successfully implemented because it was not related with any policy of land and also because only could be applied to people in the buffer areas and not to the people living in the parks. It is also related with the obsolescence of the regulations of protected areas that was mentioned before.

Comprehensive rural reform and the solution to the drug problem laid the foundations to forming effective partnerships between the communities inhabiting protected areas and governmental institutions in order to develop "balanced alternatives between the environment, wellbeing and good living, under the principles of sustainable development and participation by the rural communities found next to, or within, the areas of special environmental interest" (Betancourt et al., 2017). The agreement includes alternatives for the continued presence of people within protected areas like provision of ecosystem services, sustainable food production systems, and ecological restoration. However, there exists a lack of political will to implement these strategies in those areas, initiate effective rural reforms, and tackle the roots of the drug problem.

In the same vein, it is essential to bear in mind proposals like those of De Pourcq and others (2017) regarding the need for interventions on multiple levels to work on conflicts related to the national parks and their inhabitants in Colombia. These authors also point to the need for modifications to environmental regulations to strengthen citizen engagement and the processes of governance at a local level. This point gains relevance in the light of the conclusions of the work of Bonilla-Mejía and Higuera-Mendieta (2019), who find that protected areas in Colombia located in remote regions are more vulnerable to the expansion of coca plantations. In addition, they show that actors involved in collective property tend to protect the forest more, even when the presence of central government and its institutions are weak.

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