Repercussions in the Landscape of Colombian Amazonas (Caquetá and Putumayo Region) Caused by Deforestation and Illicit Crops During the Internal Armed Conflict; a Review

Fernando Arturo Mendez Garzón[1], István Valánszki[1]

[1]Szent István University, Faculty of Landscape Architecture and Urbanism, Department of Landscape Planning and Regional Development

Abstract

Colombia has lived in the last sixty years trapped between the claws of an internal conflict with special characteristics, which have led to serious consequences on its development and very high-cost of human lives. However, these consequences are not limited to economic and social fields only; it has also resulted in several effects on the environment as well as notorious changes in the landscape, especially in the country boundaries and more neglected zones as the Amazonas region.

The Amazon rainforest, the largest in the world in terms of size and diversity, is recognized as a source of ecological services for both local and worldwide communities. Ten percent of its territory belongs to Colombia, covering approximately 35% of the country's total area. In spite of global efforts, it continues to be vulnerable to deforestation pressures changing the land use and consequently, the landscape. In the Amazonian departments of Caquetá and Putumayo, human activities such as logging and illicit crops are the main causes of deforestation, which is increasing the department's vulnerability to climate change and natural hazards, especially in the foothills between the Amazonas and Andes region, that works as a greenway (transition zone) linking these two important ecosystems, one of the most biodiverse regions in the world.

This paper seeks to collect data from several sources in order to give an integral and general approach based on mixed methods. It also involves an analysis of drivers including the internal armed conflict in the forest cover and the landscape in the last 16 years.

The methodology used in the review paper comprised comparing and crossing data of the conflict, deforestation and illicit crops, private and public sources as United Nations Office on Drugs and Crime (UNODC), The Monitoring Project of the Andean Amazon (MAAP), The "Peace and Reconciliation Foundation", "Dejusticia Study Centre" and The Alexander von Humboldt Institute. In addition, using remote sensing and GFW data generating indicators of degradation and affectation in the Land Use and Land Cover.

Nowadays after the agreement with the "FARC" guerrilla in 2016, the discussion focus with the threat that post-conflict could have on the development of potentialities of affected areas. The government is now focusing on decreasing the number of Illicit Crops and increasing the reforestation and therefore recovering the original landscape. Thus, the end of the armed conflict results in opportunities to repair the environmental damage and the possibility of a rethink about the development of the country.

Introduction

Colombia is one of the countries that still has large internal frontiers of occupation open. This fact, however, represents a contradictory situation (Andrade, 2004). Although from the environmental point of view, the persistence at the beginning of the 21st century of large wild areas or in which natural ecosystems predominate represents an asset of global value, these same areas are the scenario of unresolved social conflicts, and on which the political future of the country depends.

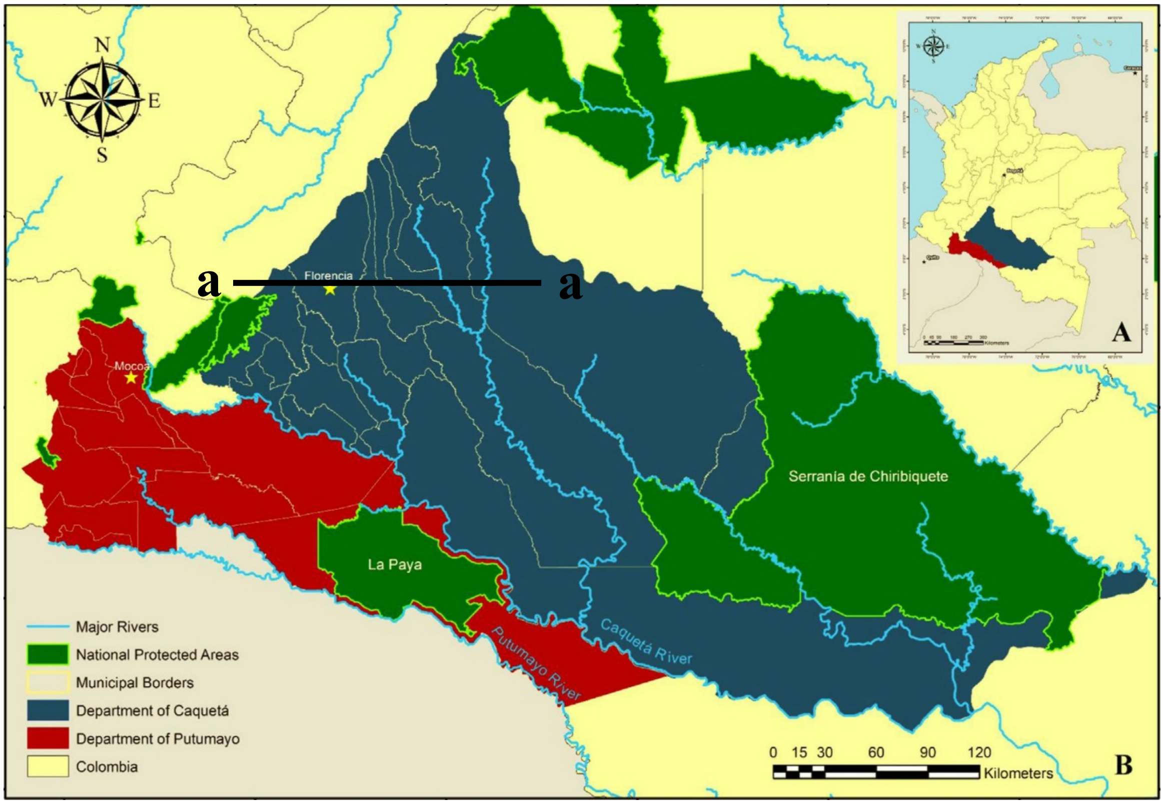

Figure 1. Caquetá and Putumayo Departments and regions of Colombia. (Murad & Pearse. 2018)

The paper is focused on the analysis and synthesis of research about the deforestation and the land use changes in the Putumayo and Caquetá departments. It intends to give a general overview of the situation in the last two decades from the landscape and land cover point of view. The Amazonas foothill region was chosen for the review paper because it is one of the most affected zones by the armed conflict and has particular importance insomuch as this region works as a natural greenway, a transition zone that connects two relevant South American ecosystems; High Mountains and jungle. (Fig. 2) The deforestation in this

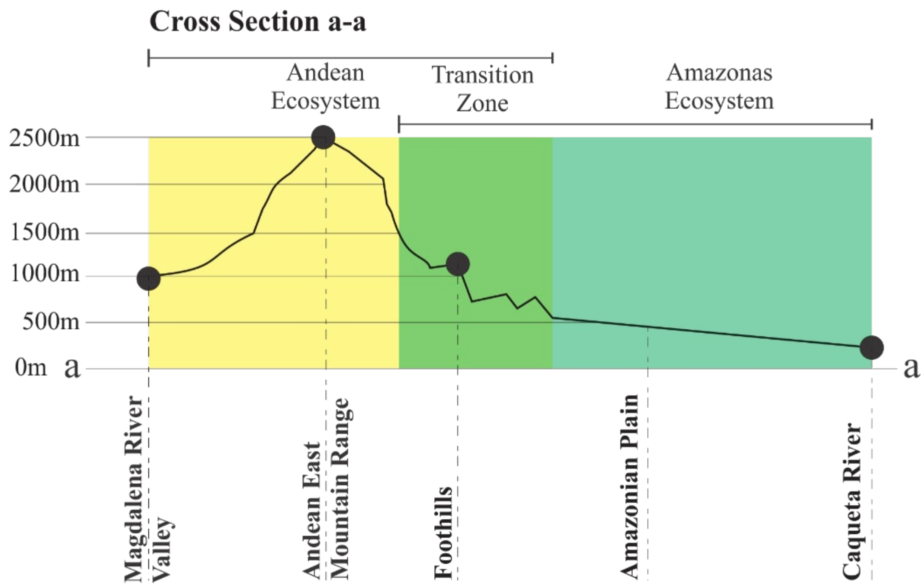

Figure 2. Cross Section. Altimetry; Andean and Amazonas Ecosystems

area cuts the natural flow of fauna and flora, a phenomenon that especially has been occurred meanwhile the armed conflict has increased its intensity.

The study area is a large subset of the Colombian Amazon corresponding to the departments of Caquetá and Putumayo (Fig. 1), both of which are strongly affected by human activity including the armed conflict and illicit crops. They share geographical features and both act as a connection zones between rainforest and mountainous ecosystems. (Murad & Pearse. 2018)

The department of Putumayo is located in the south of Colombia, bordered to the south by Ecuador and Peru and to the north by the department of Caquetá. Putumayo has two morphological units: the west flank of the Andean Eastern mountain range that extends to the Amazonian foothills; and the Amazonian plain. The department of Caquetá is located immediately to the north of Putumayo, and consists of three well-defined morphological units: the eastern flank of the Andean Eastern mountain range, the foothills, and the Amazon plain. (Fig. 1 and 2)

Background

In the case of Colombia, there is no doubt that the conflict has left its mark on Colombian landscapes and ecosystems. The armed conflict has been accompanied by bombings against oil pipelines, fumigations of illegal crops with glyphosate, chemical contamination due to illegal mining, the presence of armed groups and antipersonnel mines in protected areas, and the expansion of the agricultural frontier as a result of forced displacement, among other problems (Rodríguez, Durán, & Rodríguez, 2017; Sánchez-Cuervo et al., 2013; Hoffmann et al., 2018) (Fig.3).

In the last 20 years, the armed conflict has been the cause of the loss of 6,210,000 hectares of forest, most of them in the studied area. If the situation does not change, the next ten years the country could lose at least another two million hectares (El País, 2012).

The copious bibliography about the topic makes clear that there are obvious and multiple links between armed conflicts, on one hand, and disputes over natural resources and the environment on the other hand (Rodríguez Becerra, 2004; Hanson et al., 2009; McNeely, 2003; UNEP, 2009). 81% of the armed conflicts that occurred around the world between 1950 and 2000 had as a scenario of high biodiversity and especially vulnerable zones (Hanson et al., 2009). Although there are several articles and bibliography about the relation between the internal armed conflict and the environment from ecologic, politic, social, economic point of view, there are just few studies about the repercussions in the landscape and land uses changes.

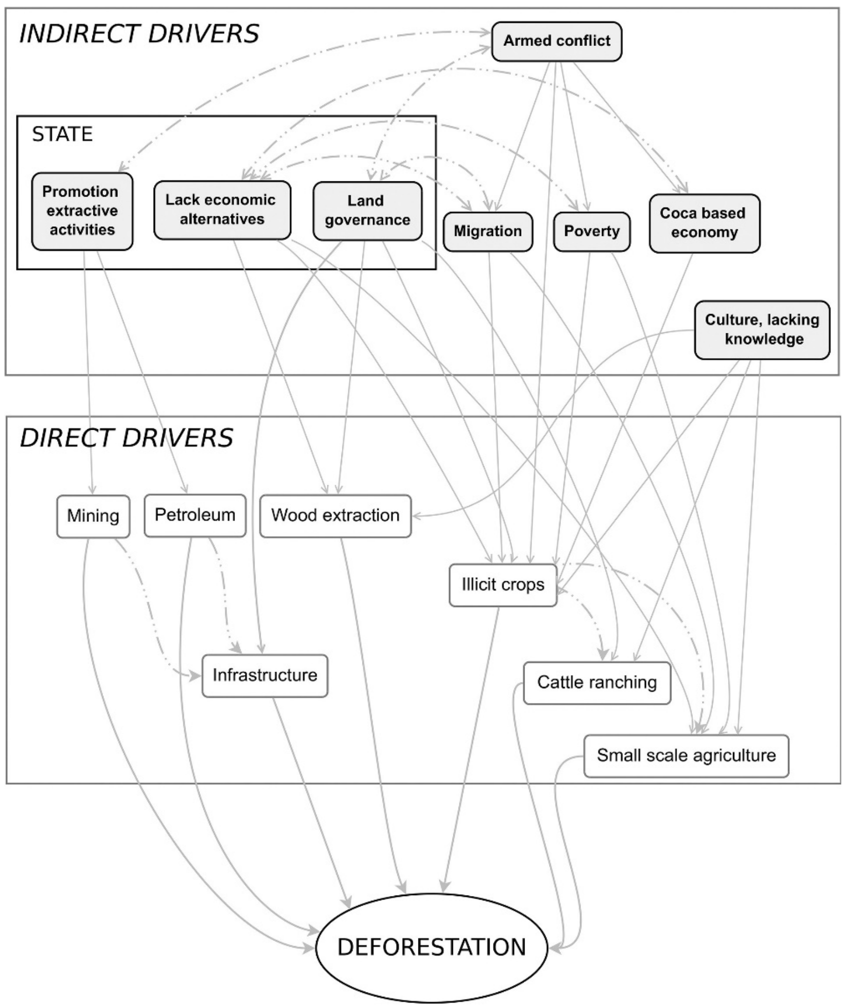

Figure. 3. Relationships between direct and indirect deforestation drivers. (Hoffmann et al., 2018)

.

Goals and Objectives

The objective of this paper is to collect bibliography, summarize it and give a general overview of the effects of the armed conflict in the landscape and land use in the last years; based mainly on the repercussions caused by the deforestation. It also seeks to give an integral and general approach based on mixed methods, such as remote sensing (Landsat Images) and how they affect the deforestation rates during the internal armed conflict in the forest cover as well as the landscape in the departments of Caquetá and Putumayo.

Methods

For the paper, we collected, merged and added to the existing literature, data that was critically assessed from the point of view of landscape and deforestation. In particular, we provide new and more up-to-date information that has been generated and analyzed in a spatial context, using fine-scale data and geographic information system applications to produce detailed maps.

We collected and analyzed articles that relate the environment to the Colombian armed conflict using key words like "Deforestation; Illicit Crops; Landscape Degradation; Colombian Armed Conflict; Andean Foothills; Colombian Amazonas Rainforest". The results showed a huge quantity of literature, so we applied filters like; "Caquetá and Putumayo zone; Articles of the last 20 years; Greenway Connections; Landscape and Land Use Affectations". We took in sources from both, public and private, Colombian and international based. Sources like United Nations Development Program (UNDP), United Nations Office on Drugs and Crime (UNODC), The "Peace and Reconciliation Foundation" and "Dejusticia Study Centre", Alexander von Humboldt Institute. For the Landsat study of deforestation using remote sensing, we took as base a study by the Geosciences Department of Universidad de Los Andes in Bogotá and for the Quantification of deforestation with GFW data; we analyzed a study from the Geography Department, Humboldt-Universität zu Berlin, and data from Monitoring Project of the Andean Amazon (MAAP), web portal of Amazon Conservation and the Association for the Conservation of the Amazon Basin (ACCA).

The data presented in this article has been derived from the UNODC and MAAP and satellite images from: Digital Globe, UMD/GLAD, Hansen/UMD/Google/USGS/NASA, PNN, SIAC, RAISG. Data on changes in land use, notably loss of vegetation cover due to the planting of coca (affectation) and its eradication or abandonment (substitution to legal crops or cover change), accord with information contained in the multi-temporal analyses which have been published annually by the Integrated Illicit Crops Monitoring System in Colombia (SIMCI) since 2001 (Rincon-Ruiz, et al., 2016).

Review of Remote Sensing
Difficulty of access to an area during war combined with no clear spatial or temporal definition for the extent of conflict makes an accurate and timely assessment of the impacts extremely challenging. Because of these limitations, information derived from satellite remote sensing data can provide insight into how conflict directly affects the physical landscape during wartime, and indirectly leads to changes in human populations and land use activity that drive the observed land cover modifications. The impacts of armed conflict on ecosystems are complex and difficult to assess due to restricted access to affected areas during wartime making satellite remote sensing a useful tool for studying direct and indirect effects of conflict on the landscape. (Murad & Pearse. 2018; Hoffmann et al., 2018))

Review of LULC change detection
Multi-temporal satellite imagery is routinely used to detect and monitor changes in ecosystems, and maps of land cover evolution are produced by comparing a pair of classified images from two different periods (Coppin et al., 2004). The researchers used the Post-Classification Comparison (PCC) change extraction

algorithm to compare the classified pairs of images from 2000 and 2016. Change maps are subject to the same errors as the input classifications, so it was necessary to use a pixel-by-pixel comparison of the LULC maps to produce a change matrix showing quantitative "from-to" changes. These changes can be also displayed visually as a change detection map, which facilitates the interpretation (Rawat and Kumar, 2015; Hoffmann et al., 2018). (Fig. 4) Image classification Supervised image classifications were applied to the 2000 and 2016 subset images using the Maximum Likelihood Classification algorithm (MLC). The MLC approach was applied because it has been successfully used for previous Landsat classifications in the region (Messina and Delamater, 2006; Reyes, 2017). For the supervised classification, nine Level I classes were defined for both periods according to spectral variations of the same LULC category. The classification scheme was based on the land cover and land use classification system developed by Anderson (1976) and defined according to the land features present in the region (Table 1).

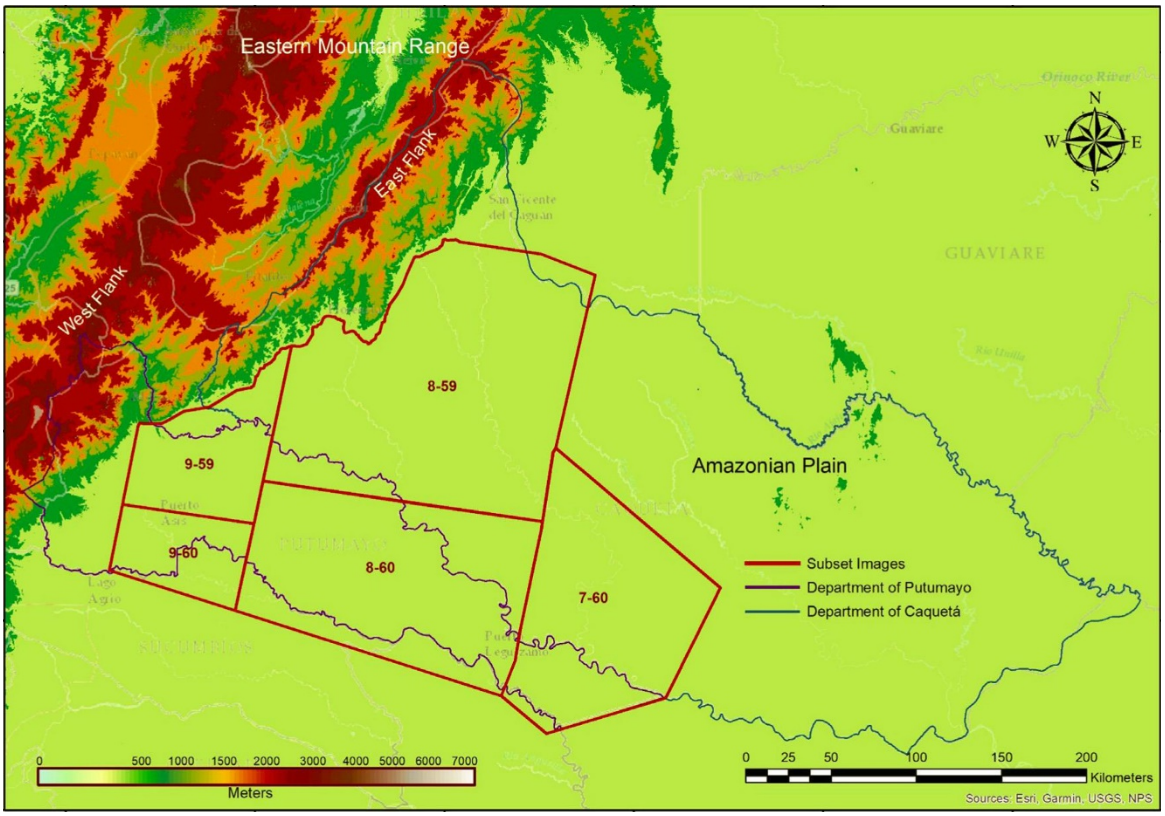

Figure 4. Map showing the delineation of the subset images with a Shuttle Topography Radar Mission. (Murad & Pearse. 2018)

LULC class	Description
Tropical Rainforest	Land covered by dense Amazon rainforest
Rangeland	Natural vegetation, predominantly grasses, grass-like plants, forbs, or shrubs
Agriculture	Crop fields, bare fields and pasture
Water	Streams, river, lakes, ponds and reservoirs
Soil	Land areas of exposed soil
Barren Land	Sand, rock and barren area influenced by human activity
Built-Up	Residential, commercial, industrial, and mixed urban areas
Clouds	Areas covered by clouds
Shadows	Areas shaded by clouds

Table 1. Land use and land cover classification scheme. (Murad & Pearse. 2018)

Results

After selecting and analyzing all the data, we synthesized it and chose the most relevant information to highlight the repercussions in the landscape and land uses in the studied area. As is possible to find in the tables and comparing with the maps, it is clear that the forest cover has been changing drastically, especially in the foothills zone and the riverbanks, affecting directly the greenway connection and fauna flows between the rainforest and High Mountains. The research also could prove that not just the illicit and licit crops, but also the consequent infrastructure has resulted in this change as roads, buildings, public services. For LULC maps (Fig. 5) and statistics were produced for both periods, and the total (and percent) areas covered by each LULC category are summarized in Table 2.

	2000		**2016**		**Δ**
	km2	%	km2	%	%
Tropical Rainforest	42,244.52	72.59	39,223.96	67.4	− 5.19
Rangeland	3813.48	6.55	2920.30	5.02	− 1.53
Agriculture	9658.07	16.60	13,918.16	23.92	7.32
Water	930.53	1.60	794.36	1.37	− 0.23
Soil	734.45	1.26	424.20	0.73	− 0.53
Barren Land	193.34	0.33	273.58	0.47	0.14
Built-Up	10.12	0.02	15.64	0.03	0.01
Clouds	390.52	0.67	496.58	0.85	0.18
Shadows	219.94	0.38	127.72	0.22	− 0.16

Table 2. LULC categories total coverage in terms of area and percentage for both periods, as well as the difference (Δ) between them expressed in percentage gain (+) and loss (-).

The main result is that there was a substantial decrease in the Tropical Rainforest cover together with a reduction in Rangeland and Soil (Bare Ground) that affects directly the landscape and consequently the greenway that links the tropical ecosystems in the foothills region especially the Tropical Rainforest land cover presented the largest decrease in area, losing 3020.56 square kilometers over sixteen years, which corresponds to a 5.2% reduction of its original coverage. An average annual deforestation rate of change of 0.46%, calculated as suggested by Abbas et al. (2016), was obtained for the entire area of study. Rangeland and Soil areas decreased by 893.18 and 310.25 square kilometers respectively. Agriculture showed a large increase of 7.32%, equivalent to 4260.10 square kilometers, whereas Built-Up and Barren Land increased by only 5.50 and 80.23 square kilometers respectively (Table 2). Looking at the LULC vegetation categories separately for the each department (Table 3), it can be seen that the Department of Caquetá experienced higher deforestation than the average overall in both departments, losing 7.95% of the Tropical Rainforest land cover over the sixteen-year study period, an average rate of 0.77% per year. Rangeland also showed a decrease of 1.03%, while Agriculture increased by 10.02%. On the other hand, the Department of Putumayo showed a decrease of 2.5% in Rangeland, while Agriculture increased by total of 6382.68 km2 of tropical rainforest land was converted into other LULC categories, of which 4641.76 km2 were converted into Agriculture. A total of 6636.10 km2 of new land use for Agriculture was established. However, 35,463.57 km2 of Tropical Rainforest remained unchanged. (Table 3) The 2.11%, and Tropical Rainforest increased only by 0.14%. In the departments of Putumayo and Caquetá, most severe LULC changes occurred in the Department of Caquetá mainly along the rivers and the colonization front. (Hoffmann et al., 2018) In the Department of Caquetá, a high population growth rate (according to the statistics of the National Administrative Department of Statistics (DANE)) caused the colonization front to advance in an easterly direction into to the Amazon. In this area, the main cause of deforestation is the conversion of forest to pastures to expand livestock production and commercial agriculture, rather than illegal cultivation. (Murad & Pearse. 2018) (Fig. 6

The environmental conflicts occurring in both Caquetá and Putumayo consist mainly of two factors: incompatibility of the current use of the soil in relation to the forest's capacity to sustain it, and overexploitation of resources through different forms of extraction, without any replenishment or regulation (Montoya, 2000).

	Department of Caquetá		**Department of Putumayo**	
	2000	2016	2000	2016
Tropical Rainforest	26,324.25	23,275.51	15,920.26	15,948.45
Rangeland	2620.55	2224.49	1192.93	695.81
Agriculture	7771.33	11,611.85	1886.73	2306.31

Table 3. Total area coverage of vegetation categories in km2 for each department in both periods.

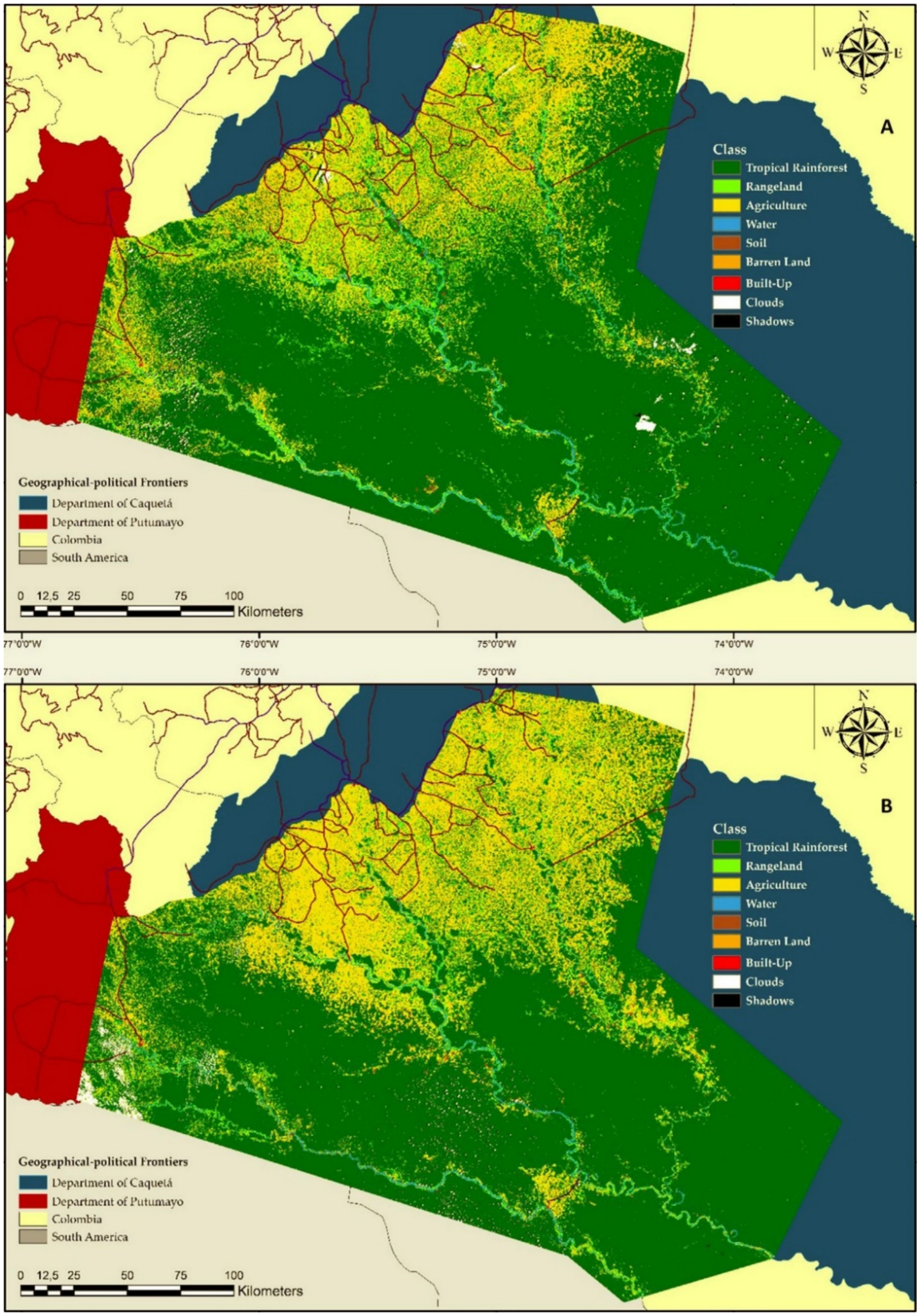

Figure 5. Land use/Land cover maps of the area with the road network - earthen/rural roads (dark red) and paved roads (purple). Up 2000, Down 2016 Supervised classification results: (A) (Murad & Pearse. 2018); LULC map for the year 2000 (B) LULC map for the year 2016.

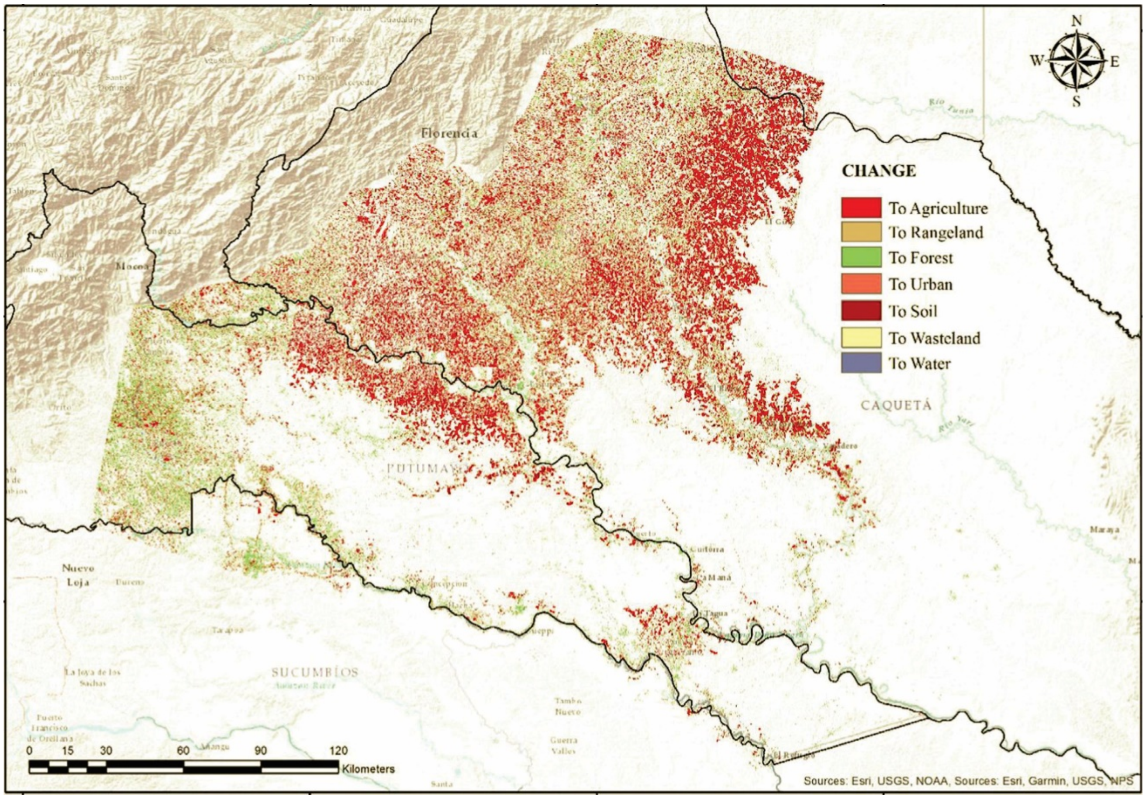

Figure 6. LULC change detection map from 2000 to 2016 with a terrain base map as background. The most extensive change of Tropical Rainforest into other LULC classes can be seen in red, highlighting where major deforestation occurred. (Murad & Pearse. 2018)

Discussion and Conclusion

In conclusion, we can affirm that although there is abundant literature on deforestation and illicit crops in the study areas where the armed conflict took place, probably, that is some of the most well documented and monitored areas in the Colombian Amazonas. There is a gap in literature of land use changes and almost nonexistent with, referred to the effects on the landscape, therefore it was very difficult to approach the subject with that focus. Also due to the particular conditions of the area, there are no studies based on social cartography nor has the necessary importance been given to the local communities perception. In addition, there, are not enough studies that highlight this area as a greenway that links the Andean and Amazonian ecosystems and its importance, that is why this is a huge challenge in the post-conflict era. Tracking of year-to-year changes using high-resolution data would be especially useful for correlating specific economic and political conditions with landscape, land use, and deforestation rates and distributions.

We can conclude that although anti-drug policy has led to a significant decrease in coca crops between 2001 and 2012, the deforestation caused by illicit crops has increased especially since 2008 and despite the marked reductions in coca cultivation in the same period. One explanation for this paradox is that the cultivation of coca crops has been displaced to other areas, thus generating new deforestation. This phenomenon has generally been referred to in terms of 'the balloon effect' which is an economic description of what happens when, given a fairly elastic supply function but fairly inelastic demand function, temporary supply reductions lead to higher prices subsequently stimulating greater supply production. (Rincón-Ruiz & Kallis, 2013).

Picture 1. Deforestation at Caguan Foothills. (Ministry of Environment and Sustainable Development. March 2018)

In addition, we can affirm that in Colombia the causes of deforestation are diverse and result from a complex network of environmental, social, economic and political factors that differ in each of the region of the country (Lambin et al., 2001), often boosted by contextual factors such as policies of land occupation and agricultural development, armed conflict, poverty and institutional absence among others. (Sánchez-Cuervo et al., 2013; Hoffmann et al., 2018) In order to update information from studies done in previous decades in the Colombian Amazon (Ruiz et al., 2011) and to better understand the drivers of deforestation, systematic analysis of local-scale land use and land cover (LULC) changes must be performed, region by region (Lambin et al., 2003).

The environmental conflicts occurring in both Caquetá and Putumayo consist mainly of two factors: incompatibility of the current use of the soil in relation to the forest's capacity to sustain it, and overexploitation of resources through different forms of extraction, without any replenishment or regulation (Montoya, 2000). Both megaprojects and extraction initiatives have resulted in the cut of the original greenway that represents the zone, contamination of water sources, the exponential increase of deforestation and increased vulnerability to climate change. (Sánchez-Cuervo et al., 2013)

The review paper is of particular relevance in light of the peace agreement between the Colombian Government and the Colombian Revolutionary Armed Forces (FARC) and ongoing negotiations with other armed actors. The international community has applauded the approval of the peace agreement by the Colombian congress, but it has also raised environmental concerns regarding possible negative effects on forest ecosystems (Baptiste et al., 2017; Aguilar et al., 2015; SINUC, 2014). The armed conflict is viewed as having had a somewhat ambiguous effect on natural ecosystems in Colombia (Sanchez-Cuervo and Aide, 2013): on one hand, research and reviews like this one stress how ecosystems have suffered from the expansion of illicit crops and the direct and indirect effects of aerial fumigation to combat coca production (Rincón-Ruiz and Kallis, 2013a, b), the devastation caused by landmines and by attacks on oil pipelines and illegal mining (SINUC, 2014). On the other hand, there is the perspective that the conflict has kept some forested areas with high degrees of biodiversity isolated from the impact of colonization and socio-economic development (Aguilar et al., 2015; SINUC, 2014) and that the guerilla has incidentally protected some forested areas of strategic importance by forced coercion.

Given the recent peace process in Colombia marking the official end to the internal armed conflict in 2016, it would be especially interesting to continue tracking deforestation in Putumayo and Caquetá, both of which have been heavily affected by the armed conflict, to see if the rates and patterns of LULC will change in response.

References

Abbas, S., Nichol, J.E., Fischer, G.A., 2016. A 70-year perspective on tropical forest regeneration. Sci. Total Environ. 544–552.

Aguilar, M., Sierra, J., Ramirez, W., Vargas, O., Calle, Z., Vargas, W., Murcia, C., Aronson, J., Barrera Cataño, J.I., 2015. Toward a post-conflict Colombia: restoring to the future. Restor. Ecol. 23 (1), 4–6. Available at: http://onlinelibrary.wiley.com/doi/10.1111/rec.12172/abstract [Accessed 19 Apr. 2018].

Anderson, J.R., 1976. A Land Use and Land Cover Classification System for Use with Remote Sensor Data. U.S. Government Printing Office.

Andrade, German. 2004. Selvas sin ley. Conflicto, drogas y globalización de la deforestación en Colombia. En Cárdenas, M. y Rodríguez Becerra, M. Guerra, sociedad y medio ambiente, pp. 107-173. Bogotá: Foro Nacional Ambiental.

Baptiste, B., Pinedo-Vasquez, M., Gutierrez-Velez, V.H., Andrade, G.I., Vieira, P., Estupiñán-Suárez, L.M., Londoño, M.C., Laurance, W., Lee, T.M., 2017. Greening peace in Colombia. Nat. Ecol. Evol [online] 1, p.102. Available at: http://www.nature.com/articles/s41559-017-0102 [Accessed 26 Mar. 2018].

El País (2012). Medio ambiente, otra víctima del conflicto armado en Colombia. Retrieved from: http://www.elpais.com.co/judicial/medio-ambiente-otra-victima-del-conflicto-armado-en-colombia.html

Geist, H., McConnell, W., Lambin, E.F., Moran, E., Alves, D., Rudel, T., 2006. Causes and Trajectories of Land-Use/Cover Change. In: Land-Use and Land-Cover Change. Springer, Berlin, Heidelberg, pp. 41–70. https://doi.org/10.1007/3-540-32202-7_3.

Hanson, T., Brooks, T., Da Fonseca, G., Hoffman , M., Lamoreux, J., Machlis, G. et al. (2009). Warfare in Biodiversity Hotspots. Conservation Biology, 23 (3), 578-587.

Hoffmann, Carolin., García Márquez, Jaime Ricardo., Krueger, Tobias. (2018). A local perspective on drivers and measures to slow deforestation in the Andean-Amazonian foothills of Colombia. Land Use Policy 77. 379-391.

Lambin, E.F., Turner, B.L., Geist, H.J., Agbola, S.B., Angelsen, A., Bruce, J.W., Coomes, O.T., Dirzo, R., Fischer, G., Folke, C., George, P.S., Homewood, K., Imbernon, J., Leemans, R., Li, X., Moran, E.F., Mortimore, M., Ramakrishnan, P.S., Richards, J.F., Skånes, H., Steffen, W., Stone, G.D., Svedin, U., Veldkamp, T.A., Vogel, C., Xu, J., 2001. The causes of land-use and land-cover change: moving beyond the myths. Glob. Environ. Change 11, 261–269.

McNeely, Jeffrey. (2003). Conserving forest biodiversity in times of violent conflict. Oryx. 37 (02), 142 -152.

Messina, J. P., & Delamater, P. L. (2006). Defoliation and the war on drugs in Putumayo, Colombia. International Journal of Remote Sensing, 27, p121–128.

Montoya, C., 2000. Municipio de Leguizamo. Plan De Ordenamiento Territorial.

Murad, Cesar., Pearse, Jillian. (2018) Landsat study of deforestation in the Amazon region of Colombia: Departments of Caquetá and Putumayo. Remote Sensing Applications: Society and Environment 11. 161–171.

Pearce, F. (1995). Devestation in the desert. New Scientist (1971), 146, 40–43. Coppin, P., Jonckheere, I., Nackaerts, K., Muys, B., Lambin, E., 2004. Digital change detection methods in ecosystem monitoring: a review. Int. J. Remote Sens. 25, 1565–1596.

Rawat, J.S., Kumar, M., 2015. Monitoring land use/cover change using remote sensing and GIS techniques: a case study of Hawalbagh block, district Almora, Uttarakhand, India. Egypt. J. Remote Sens. Space Sci. 18, 77–84.

Reyes, M.C., 2017. Evaluación de la deforestación en las sabanas del Yarí a partir de un análisis multitemporal de imágenes de satélite Landsat años 2010 y 2017 por medio del procesamiento digital de imágenes (B.S. thesis). Universidad Militar Nueva Granada.

Rincón-Ruiz, A., Kallis, G., 2013. Caught in the middle, Colombia's war on drugs and its effects on forest and people. Geoforum 46, 60–78.

Rincon-Ruiz, Alexander., Correa, Hyarold., Leon, Daniel. & Williams, Stewart. (2016) Coca cultivation and crop eradication in Colombia: The challenges of integrating rural reality into effective anti-drug policy. International Journal of Drug Policy 33 p56–65.

Rodríguez Becerra, Manuel. (2003). Cultivos Ilícitos y Medio Ambiente. Analisis histórico del narcotráfico en Colombia. Bogotá: VIII Cátedra Anual de Historia "Ernesto Restrepo Tirado".

Rodríguez, Cesar., Durán, Helena., & Rodríguez, Diana. 2017. La paz ambiental: retos y propuestas para el posacuerdo. Center for Law, Justice and Society Studies, Dejusticia.

Sánchez-Cuervo, Ana Maria., Aide, Mitchell. (2013). Consequences of the Armed Conflict, Forced Human Displacement, and Land Abandonment on Forest Cover Change in Colombia: A Multi-scaled Analysis. Ecosystems 16, Issue 6, 1052–1070.

SINUC, 2014. Consideraciones ambientales para la construcción de una paz territorial estable, duradera y sostenible en Colombia: insumos para la discusión. Available at:. [Accessed 19 Apr. 2018]. http://www.co.undp.org/content/dam/colombia/docs/MedioAmbiente/undp-co-pazyambientenuevo-2015.pdf.

UNEP (2009). From Conflict to Peace Building: The role of natural resources and the environment. Kenya: UNEP.

UNODC, 2017. Colombia: Survey of territories affected by illicit crops – 2016.