A local perspective on drivers and measures to slow deforestation in the Andean-Amazonian foothills of Colombia

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ABSTRACT

Colombia's Andean-Amazonian foothills are among the most pressing deforestation hotspots in the country. Yet, the relationships and dependencies of underlying deforestation drivers are not well understood. For an adequate territorial reorganization in the post-conflict era that is sensitive to local context, a targeted analysis of the present situation at the local level is required. This study investigates direct and indirect deforestation drivers, relationships among these and potential measures to lower deforestation post-conflict. The analysis uses spatial data of the Global Forest Watch project as a starting point for semi-structured interviews with 25 locally and regionally engaged stakeholders, triangulated with existing literature on the social, political and economic situation in the region. The results suggest that deforestation is not only caused by uncontrolled land colonization, but also related to the armed conflict, specifically the eradication of illicit crops and waves of migration due to the displacement of communities. Interviewees stressed the ambiguous role of armed groups and the responsibility of the state in incentivizing deforestation through building roads for the oil industry, fostering extractive industries and cattle ranching. The study reveals a high level of uncertainty among stakeholders regarding the possible effects of the peace agreement between the government and the FARC. Interviewees emphasized the crucial role of good governance and state sovereignty when working towards the establishment of alternative profitable industries, the implementation of environmental compensation schemes and an increased investment into environmental education.

1. Introduction

Being located in the transition zone between the two major ecosystems of the Andes and the Amazon, Colombia's southern Andean-Amazonian foothills comprise unique biological, eco-systemic and cultural values. This ecological corridor plays a significant role in hosting a diverse range of plant and animal species that are partly endemic to the region (Rico Baez and CI Colombia, 2015; Etter et al., 2006a). The region is an important element of the hydrological system of the Amazon, as rivers originating in the Colombian foothills feed into the Amazon drainage basin (McClain and Naiman, 2008; Barrera et al., 2007). However, this unique ecosystem is in decline: The Andean-Amazonian foothills in the department Putumayo have been identified as one out of eight major deforestation hotspots in Colombia (IDEAM, 2015c).

In 2014, the two neighboring departments in which the Andean-Amazonian foothills are mainly located accounted for the highest deforestation rates in Colombia: Caquetá and Putumayo ranked 1st and 4th with 20.84% and 7.91% of national deforestation, respectively (IDEAM, 2015a). Still, the area is far from being completely understood

by the scientific community: decades of intense conflict in the region and the presence of different armed groups have made deforestation processes difficult to observe and analyse for researchers. Armenteras et al. (2006) and Viña et al. (2004) have stated that ecosystem diversity and deforestation patterns in the Colombian Amazon are "totally different" from the ones reported for Ecuador or Brazil, and a deeper understanding of the human dimension of the phenomenon is lacking (cf. Viña and Estévez, 2013).

The majority of previous studies has taken different geospatial approaches such as remote sensing and modelling to analyse some or certain combinations of the causes of deforestation, mostly in larger geographical areas in Colombia (Chadid et al., 2015; Dávalos et al., 2014; Sanchez-Cuervo and Aide, 2013; Viña and Estévez, 2013; Armenteras et al., 2006; Etter et al., 2006a). Several of these case studies have identified the conversion of forests to pastures and coca production as mayor deforestation drivers (Chadid et al., 2015; Dávalos et al., 2014) with different dynamics: coca cultivation typically takes place hidden in the forest and has proven highly dynamic and mobile in response to governmental eradication programs (such as the Plan

Colombia). The indirect impact of coca production on deforestation is considered much larger than the actual area used for cultivation, since abandoned plots tend to convert to agricultural frontiers and sites used for small-scale agriculture, cattle ranching and further land clearing in the surrounding area (Dávalos et al., 2014; cf. Rincón-Ruiz and Kallis, 2013a,b). Cattle ranching, in turn, is associated with the conversion of forests to pasture with the objective of claiming titles to the land and the speculation on rising prices for property (Chadid et al., 2015). Dávalos et al. (2014) have shown how the expansion of pastures is not driven by an increased consumer demand for beef and dairy products, but by the speculation on increasing land values and benefits obtained through the exchange and accumulation of property both with and without legal titles.

This study aims to shed new light on and offer suggestions for slowing down deforestation in the Andean-Amazonian foothills through a mixed-methods approach that triangulates information from pre-processed Global Forest Watch (GFW) data with interviews of 25 locally and regionally engaged stakeholders. The conceptual framework of the IPBES is used as the basis for the analysis of direct and indirect drivers of deforestation (Díaz et al., 2015), which is analogous to the concept of proximate and underlying causes of deforestation developed by Geist and Lambin (2001). This paper complements previous studies with specific on-the-ground information obtained in 2016 from stakeholders with a variety of backgrounds, who shared their perspectives on the causes of deforestation in the Andean-Amazonian foothills and suggested measures to slow down the phenomenon.

The topic is of particular relevance in light of the peace agreement between the Colombian Government and the FARC and ongoing negotiations with other armed actors. The approval of the peace agreement by the Colombian congress has been applauded by the international community, but it has also raised environmental concerns regarding possible negative effects on forest ecosystems (Baptiste et al., 2017; Negret 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 the one hand, researches 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; cf. Álvarez, 2003). 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, including the installation of landmines (Álvarez, 2003).

In the post-conflict era, the exploitation of natural resources, such as timber and minerals, is expected to accelerate through official economic development plans and infrastructure projects, but also through unofficial activities such as illegal mining and coca cultivation (Negret et al., 2017; Morales, 2017). The identification and timely implementation of measures to foster inclusive development, the conservation of biodiversity and the provision of ecosystem services will therefore play a crucial role for the success of the peace building process and the preservation of unique ecosystems such as the Andean-Amazonian foothills.

2. Materials and methods

2.1. Study area

The study area is located in the Amazon region near Colombia's south-western border with Ecuador (Fig. 1). It is mainly situated in the department Putumayo, with northern parts of the area in the departments of Cauca and Nariño, and a total size of about 1.2 million ha. The three main types of landscape comprise: the Cordillera Oriental, which

is the Andean mountain range in the north and west of the study area with an elevation between 900 m and 3500 m above sea level; the foothills representing the transition between the Andes and the Amazon plains at an elevation between 300 m and 900 m; and the Amazon plains below 300 m in the south and east of the region (cf. Martínez, 2007).

Vegetation below an altitude of 1000 m can be generalized as evergreen tropical rain forest with extensive river systems and an abundance of tree species, palms, hygrophytes, epiphytes, orchids and ferns, among others (Martínez, 2007). Wildlife is particularly diverse in the tropical parts of the study area, comprising a multitude of bird species, mammals, reptiles and insects (INCOPLAN S.A., 2008; Barrera et al., 2007). There are several publicly managed protected areas: the forest reserve "Reserva Forestal Protectora de la Cuenca Alta del Río Mocoa" (RFPCARM), large parts of the national park "Parque Nacional Natural Serranía de los Churumbelos" (PNNSC) and a fraction of the neighboring national park "Parque Nacional Natural Alto Fragua Indi Wasi" (PNNAFIW).

The highest population density in the study area is in Mocoa, the capital of the department Putumayo. An estimated 341,034 people, or 48% of the population of the department, live in Mocoa (DNP, 2014). The overall population density in the department is 13.70 persons per km^2 (DNP, 2014). Various ethnic groups include indigenous and afro descendant communities (cf. Martínez, 2007).

Historically, the environmental transformation of the study area is linked to its wealth of natural resources and a sequence of economic booms that have stimulated colonization and immigration in the region. Immigration rose sharply when the exploitation of one of the country's most important oil deposits was initiated in the department Putumayo in Puerto Asís in 1963 (Brücher, 1970). Extensive cattle ranching has accompanied the process of colonization, with continuously increasing numbers of animals despite low efficiency in meat and dairy production (cf. Fajardo et al., 2012; Calderón, 2007). Small-scale mining in the Andean-Amazonian foothills has experienced relative continuity since the beginning of colonization, most of it taking place informally, without official mining licenses (cf. Martínez, 2007; cf. Calderón, 2007). The cultivation of illicit crops, mainly coca and marihuana, has had strong impacts both at the social and the environmental level. Its initiation towards the end of the 1970s followed a temporal decline in the production of petroleum, failed state policies for managing uncontrolled colonization processes and a semi-permanent crisis of the agricultural sector (Ramírez, 2010; Walsh et al., 2008). Domínguez et al., 1999Domínguez et al. (1999, pp.48-49) states that the cultivation of coca represented a "maná salvador", the salvation for thousands of settlers that had lived in misery for several decades and suffered from low returns of their land and low prices for their products. The Colombian Antinarcotics Directorate estimated that for each hectare cultivated with coca, producers have to destroy three hectares of forest (Walsh et al., 2008). In 2001, 42% of the estimated total area of 145,000 ha used for coca plantations in Colombia were located in Putumayo and Caquetá (UNODC, 2015). The Colombian government began with massive aerial fumigations of coca plantations in 1996, a measure that later became part of the US-supported Plan Colombia (Ávila, 2014). However, repressive measures have not succeeded in eliminating coca plantations in the region: the area from the southern Andean-Amazonian foothills to the Ecuadorian border is still one of the major coca-producing regions in the country (UNODC, 2015).

The study area has been highly affected by Colombia's violent armed conflict and militarization on behalf of the FARC, paramilitary groups, illicit armed groups related to drug trafficking and the armed forces of the government. As a result of several waves of violence in the form of military attacks and massacres, massive displacements of the population have taken place (cf. Ávila, 2014). Putumayo and Caquetá have played an important role in the conflict given their strategic importance for the FARC for generating income and as a zone for retreat (FIP, 2014). The guerilla has frequently attacked oil pipelines and