Impacts of Narco-Degradation on Protected Areas in Central America: A Critical Ecological Economics Approach[1,2]

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Abstract:

This article uses a Critical Ecological Economics perspective to assess the environmental impacts of drug trafficking (DT) through Central America. It focuses on the impacts of DT routes on the mosaic of protected areas (PAs) in the region, which includes the phenomenon known as narco-deforestation. DT's environmental impacts are diverse and manifest in land dispossession, lost usufruct rights and land grabs. DT also exacerbates neo-extractivist

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activities and includes the development of transport infrastructure and the use of PAs as transportation routes.

We document the monetary value of environmental degradation in five PA drug trafficking hot spots. Between 2001 and 2010, we estimate net losses reaching approximately $88 million per year, equivalent to almost twice the national budgets that Central American nations dedicate to their PAs.

We also document the social costs of DT in terms of "ecological distribution conflicts" (EDC). We identify sixteen EDCs occurring in the areas studied that may be related to the trade. The majority of EDCs show high intensity, implying violence against social and environmental systems. DT aggravates the environmental injustices already present in the region, linked to neo-extractivist activities.

Our findings suggest that strengthening participatory environmental governance may help prevent these impacts of drug trafficking.

Keywords: Narco-degradation; Narco-deforestation; Ecosystem Service Valuation; Ecological Distributive Conflicts; Central America; Protected Area.

I- INTRODUCTION: NARCO-DEGRADATION FROM A CRITICAL ECOLOGICAL ECONOMICS APPROACH

A neo-extractive development model, characterized by a disproportionate and unjust appropriation of the environmental space by some social actors and an acceleration of social metabolisms necessary to maintain the speed of economic growth, dominates Latin America today. As an analytical concept, environmental space introduces approaches for measuring equity beyond the distribution of income and economic benefits. Equity through an environmental space framework recognizes the right of every human being to access the benefits of natural assets and the environmental services provided by the functions of

ecosystems. These functions and the ecosystems that generate them constitute a common heritage (Hille, 1997). The notion of social metabolism allows for the study of the relationships between society and nature, and transformations of these relationships over time. Conceptually, the metabolic structure of society integrates two relational aspects of society and nature: one of material processes (energy and material flows) and another of intangible dimensions (cognitive, symbolic, institutional, legal, etc.) (Toledo, 2013). Social metabolism is especially interested in the understanding of energy and material flows and the social appropriation of their costs and benefits (Toledo, 2013)

These concepts --environmental space and social metabolism—allow us to examine configurations of power that lead to environmental injustice or inequity. Argentine sociologist Maristella Svampa uses the term "Consensus of Commodities" to refer to the political consensus that favors neo-extractivist landscapes tending to deprive the socially marginalized (i.e. women, indigenous, and farmers) of their fundamental rights and harm their quality of life, and thus engenders environmental distributional conflicts (EDC) (Svampa, 2013).

In Central America, neo-extractive EDCs have increased during the last decades, with emphasis on the sectors of mining, land and biomass appropriation (mostly by agricultural plantations-also known as land grabs), and management of water resources (Gudynas, 2009; Burchardt & Dietz, 2014; Aguilar-González, et al., 2018b). The resources of the region (soil, climate, water, biodiversity, geographical position, etc.) are strategic to maintain the speed of economic activities that benefit the neo-extractivist model through energy production; carbon sinks to offset industrial greenhouse emissions and the transport of goods to the manufacturing and consumption centers of the world. The support of governments in the region to economic groups promoting neo-extractivism is contrary to the interests of groups negatively affected by these activities. Marginalized groups, sometimes in association with civil society organizations, develop movements of resistance against anti-ecological and neo-extractivist rationality which favors a narrow view of monetary profit and its chrematistic

language of valuation[12] above the value of these groups' human rights, culture, and the implementation of strong and fair models of sustainability (Martínez-Alier, et al., 2010). Documented characteristics of these conflicts include high levels of violence, particularly against leaders of community groups and NGOs resisting neo-extractive activities (Aguilar-González, et al., 2018; Aguilar-González, et al., 2018b).

Faced with these divergences in valuation language –monetary profit versus nature based or rights based— ecological economists of several Latin American societies have privileged an approach of "environmentalism of the poor", applying methodological approaches typical of what Barkin, Fuente, and Tagle (2012) call a Critical Ecological Economics. This approach uses a multidimensional perspective of value[13] intertwined with concepts such as ecological distribution conflicts and environmental justice coming from political ecology (Barkin, et al., 2012).

A multdimensional perspective of value allows the identification of ecological distribution conflicts (EDC), where part of the inequities in the appropriation of environmental space is a bias in favor of the language of valuation benefiting the interests of extractivist companies. This process happened in Central America to the detriment of rural, indigenous communities, and other actors, damaging the possibility of enjoying human rights related to the land and the environment and, therefore, harming their means and quality of life (Martínez-Alier, et al.,

[12] This research recognizes the ecological economic literature that differentiates valuation languages in at least three venues: monetary or chrematistic, biophysical and qualitative. The term chrematistic is used as Martínez-Alier in *The Environmentalism of the Poor*has suggested, to acknowledge the distinction made by Aristotle between economics and chrematistics. According to Martínez-Alier, Aristotle and Plato condemned chrematistic behavior leading to the accumulation of wealth based on usury and speculation, commonly known as the ¨love of money¨. This distinction appears in later literature to distinguish between use values and exchange value as Karl Marx did (Martínez-Alier, 2003).

[13] The multidimensional perspective of value uses qualitative, biophysical and, if necessary, monetary measures, especially in forensic and reporting environments. The denomination of a multidimensional theory of value refers to recognizing the plurality of valuation languages, the need for equity in their use and social validation, and respect for incommensurability with a single criterion.

2010; Svampa, 2013; Aguilar-González, et al., 2018b).

This paper extends this multidimensional perspective on value to a new driver of socio-ecological conflicts: narco-trafficking. Evidence shows that the increase in forest loss and environmental degradation in several Central American biodiverse regions accelerated around 2006-2007 in connection with the increase of cocaine drug trafficking activity in these regions (Sesnie, et al., 2017). Drug traffickers use these zones as trade routes or to make investments in order to launder the funds generated by their illegal activity (McSweeney, et al., 2014). We denominate the multiple negative environmental impacts of drug trafficking "narco-degradation".

The rerouting of drug trafficking routes through Central America in the early 2000s made the region a crucial segment of the cocaine trafficking corridor. Recent studies argue that this is the result of drug control policies that have made trafficking through Mexico and the Caribbean comparatively more expensive (UNODC, 2012). These policies, overly focused on control, surveillance, and interdiction, have caused this "balloon effect" through Central America (Gendle & Mónico, 2017).

Studies estimate that these activities generate a value added in the region equivalent to a range of 3% to 15% of the GDP of the Central American nations (McSweeney, et al., 2014; McSweeney, 2015; Nielsen, 2016). A significant amount of these funds circulate in rural transit routes where they finance the regular and irregular acquisitions of land (land grabs), constituting "border" real estate markets (Ballvé, 2012). Corruption, bribes, and impunity achieved through violence allow these activities to foment and thrive (Nielsen & McSweeney, 2015; McSweeney, et al., 2017; McSweeney, et al., 2018).

Thus, in Central America today, we detect a need to unify the analysis of drug trafficking, environmental degradation, environmental justice and biodiversity conservation policies. Recognizing the socio-ecological costs of drug trafficking introduces a necessary dimension to the evaluation of the regional neo-extractivist development model. Doing so opens doors so that the connections between neo-extractivism, the inequity it generates, and illicit activities

can be clarified.

How do we account for the impacts of drug trafficking in Central America's protected areas? Socio-ecological costs can be measured from the perspective of the monetary valuation of environmental degradation. Many Anglophone scholars have criticized the quantification of ecosystem services (ESS) losses as another practice of commodifying nature (McAfee, 1999; Schröter, et al., 2014). Yet, the Critical Ecological Economics approach used here quantifies ESS losses to aid denouncing, restitution and policy formation. It can be a useful tool for resistance or incidence to achieve better socio-environmental policies. This approach proposes a reformulation of the question if we should value monetarily into "when and how to value with money?" and "under what conditions?" Kallis and others (2013) recommend four criteria for a sound choice: environmental improvement; distributive justice and equality; maintenance of plural value-articulating institutions; and, confronting commodification under neo-liberalism (Kallis, et al., 2013).

In summary, the first purpose of this paper is to present the results of a monetary estimate of the current and potential costs of the environmental degradation in protected areas attributable to drug trade since the early 2000s. This was the time when traffic patterns in Central America changed using Guatemala´s Petén region, the northern coast and Olancho regions of Honduras as the main funnel of land pathways combined with air and marine routes also using these biodiversity rich areas (UNODC, 2012; Wrathall, et al., in review). The socio-ecological costs of these activities also include the effects and consequences of the EDCs that are generated (Aguilar-González, et al., 2016). Therefore, the second goal of this research is to document and analyze the EDCs related to drug trafficking, according to available evidence and the pressure they create on protected areas, associated ecosystems and the social groups that live within them and depend immediately on them. For this combined analysis, we adopt the Critical Ecological Economics approach suggested above. We highlight these impacts in terms of increased narco-degradation. This process includes changes in land use, "narco-deforestation", and other environmentally degrading activities in and around the region's protected ecosystems and communities.

The formulation of these goals resulted from a collaborative research effort that brings together scientists from various universities, institutions, and social organizations who have proposed to analyze and disseminate the socio-ecological effects of narco-degradation in Central America[14]. In consequence, we conclude with suggestions of possible implications for relevant public policies addressing the larger issues at stake.

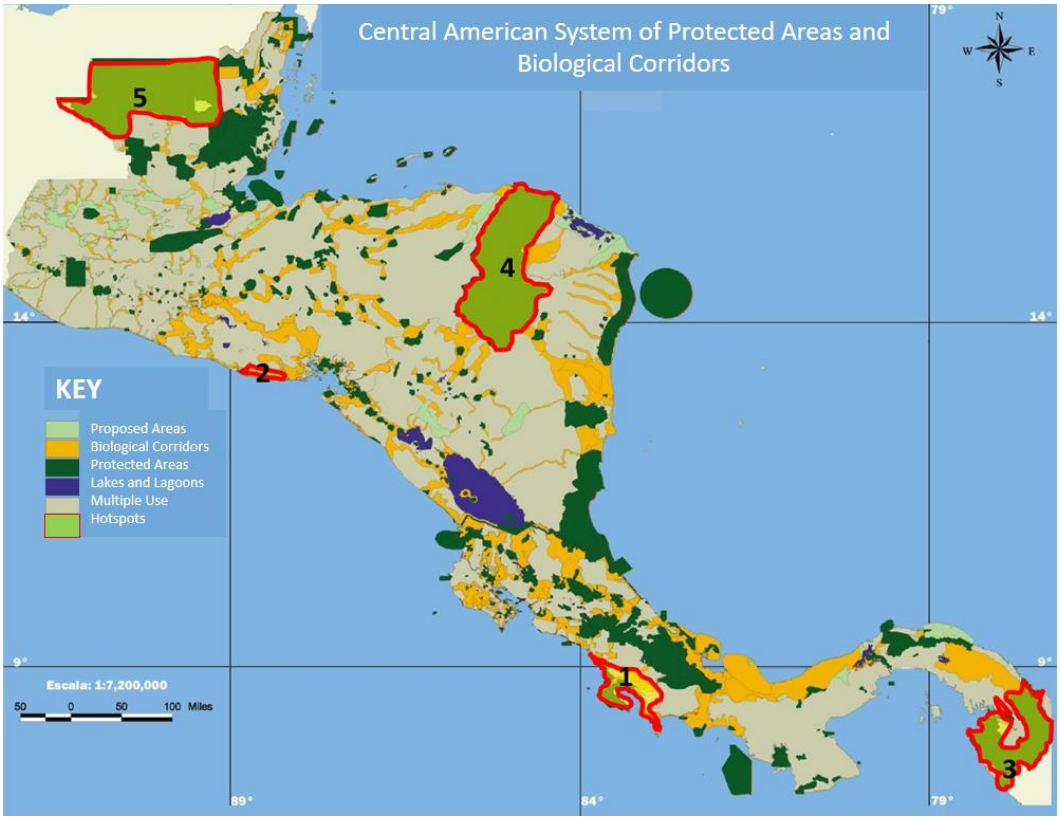
II- METHODOLOGY OF ANALYSIS

The study focused on five protected areas that are both drug trafficking and biodiversity hot spots. Technical reports show overlapping air, land and sea trafficking routes through these protected areas (UNODC, 2012), as such, they are appropriate sites to evaluate the socio/ecological effects of this activity. Figure 1 shows the hotspots numbered from the least to the most affected according to expert reports (Aguilar-González, et al., 2016):

1. Osa Conservation Area in Costa Rica;
2. Xiriualtique-Jiquilisco Biosphere Reserve in El Salvador;
3. Darién Biosphere Reserve - Comarca Emberá-Wounaan, in Panamá;
4. Heart of the Mesoamerican Biological Corridor (MBC): Bosawás Biosphere Reserve in Nicaragua y Tawahka-Asangni Biosphere Reserve / Patuca National Park / Río Plátano Biosphere Reserve in Honduras;
5. Maya Biosphere Reserve in Guatemala.

[14] Ohio State University, Northern Arizona University, Texas State University, Oregon State University, Arizona State University, the Fish and Wildlife Services of the US Government and NGOs as Earth Economics of the USA, Fundación Neotrópica of Costa Rica, among others.

Figure 1- Five Hotspots Selected for the study. Source: Modified from



https://geekcom.files.wordpress.com/2009/10/corredorbiologicomesoamericano.jpg.

All of them are important protected areas part of the MBC mosaic. They provide high rates of

biodiversity (Harvey, et al., 2008). The environmental services generated from their ecosystems are fundamental for the quality of life of the adjacent communities and the communities that are within them, as well as for the countries and the region in general. UNESCO's Man and Biosphere Programme recognizes their importance, which is why several are Biosphere Reserves. These areas are also spaces of cultural diversity of indigenous or native peoples with relatively lower rates of social development compared to urban areas (Sobrevila, 2008; Aguilar González, et al., 2018b; Velásquez-Nimatuj & Ford, 2018) . They have also been subjected to many pressures suffered by protected areas in "developing" countries: unsustainable changes in land use (both authorized and illegal), insufficient control and surveillance, illegal hunting, flora, fauna and antiquities trafficking, and more (Aguilar-González, et al., 2016).

In relation to these hot spots, two evaluation procedures were carried out. First, we calculated changes in ecosystem service monetized values by detecting changes in land cover, with a focus on deforestation caused by activities related to drug trafficking between 2001 and 2010. This period was selected because it allows a contrast to be made between the time before and after the patterns in the traffic routes changed (UNODC, 2012). Secondly, in order to have a clearer vision of the social and ecological effects of narco-degradation, the EDCs that took or are taking place in/near the hot spots since the early 90s to the present and that can be related to the drug trafficking activity were inventoried and characterized.

To conduct the monetary damage valuation, the ecosystem services management framework of the millennium ecosystem assessment was used (de Groot, et al., 2002; Working Group MEA-UNEP, 2003; Beaumont, et al., 2007; Naber, et al., 2008). The estimation used the environmental damage valuation framework synthesized by the Institute for Sustainability Policies of Costa Rica comparing the pre-damage to the post-damage state of the ecosystem examined (Barrantes & Di Mare, 2001). The specific estimates of changes in monetary value through time were calculated using the value transfer methodology, transferring ecosystem service values from past studies that estimated them for similar tropical sites, found in the

Ecosystem Valuation Toolkit-Earth Economics´ database[15] (Kocian, et al., 2011). We identified thirty-four studies with transferable values, 24 of which were specific to the Mesoamerican and Caribbean region. Forty four percent of the studies have publication dates after 2005. We adjusted the estimates for inflation and purchasing power parity. Additional measures to avoid biases included verifying the methodologies of the reference studies. (Costanza, et al., 1997; Liu, et al., 2010; Pascual, et al., 2010; Aguilar, et al., 2012; Aguilar González & Segura Bonilla, 2016).

For the five hot spot case studies, land cover change was determined for each biome for the years 2001, 2005, and 2010[16] based on research that shows changes in land uses for all municipalities in the Americas based on the MODIS 250-m[17] (Clark, et al., 2012). The number of hectares and the percentage of each type of land cover in subgroups were summarized into subgroups based on each biome recognized by WWF[18] (Aguilar-González, et al., 2016). We calculated land cover changes per biome during the study period for each protected area.

A list of references detailing monetary values was developed per ecosystem biome, land cover, and ecosystem service. The categories of land cover of the studies were grouped to fit the classifications of the land cover data per biome[19] (Aguilar-González, et al., 2016). Based

[15] Earth Economics is a specialized NGO in ecosystem service and damage valuation. In the site www.earthconomics.org, the conditions to have access to the database are explained.

[16] The range of available years represents the best available information of this type with coverage of all selected sites.

[17] Refers to satellite images taken by the Moderate Resolution Imaging Spectroradiometer, which is found on NASA's Terra and Agua satellites. The term 250 m refers to the spatial resolution of the images (at 250 meters). They can be found at 500 m and at 100 m, the 250 m being the most detailed in these series to be able to identify the texture of the land cover.

[18] World Wildlife Fund

[19] The category of agriculture represents annual crops. The plantations include data on perennial crops such as coffee grown without shade, fruit trees, the African Palm, and forest plantations. The herbaceous vegetation includes rice, grass, and sugar cane. Vegetation mixed with timber includes shade-grown coffee, silvopastoral systems, and other agroforestry/mixed systems with less than 80% forest cover. In the biome of mangroves and

on these data, we calculated the monetary value of ecosystem services related to land use changes for each reported year.

To inventory EDCs related to drug trafficking, we used the framework developed by the Autonomous University of Barcelona for the global Environmental Justice Atlas (EJAtlas)[20]. The Atlas adopts a bottom-up construction model (Healey, et al., 2013; Martínez-Alier, et al., 2014). Fundación Neotrópica and the Mesoamerican and Caribbean Society for Ecological Economics have contributed to this effort in partnership with the Universidad del Valle of Colombia to enrich the database and comparatively analyze the trends of Central America and the Andean region[21].

We adopted several of the EJAtlas methodological instruments (metabolic category classification, basic characterization of the conflict, etc.). The introduction of modifications included the EJAtlas data template, which we modified to include six sections: 1) Basic Data; 2) Sources of the Conflict; 3) Details of the Conflicts and Actors; 4) Conflict and Mobilization; 5) Connection of the Conflict with Drug Trafficking; and 6) Sources and Comments.

To identify the conflicts, a series of identification codes designate the kind of relationship that the conflict appears to have with narco-trafficking activity. An ND (Narco Degradation) designation identifies conflicts in/around areas where evidence indicates a relationship to drug trafficking. We found conflicts that, despite being outside the hot spots, are located in the MBC and showed a level of public notoriety that seemed pertinent to document as part of the database of this study. These were designated with the abbreviation NDO (for Narco Degradation Outside hot spots). Likewise, situations of conflict worthy of consideration were found in the areas where the connection with drug trafficking is suspected yet the evidence

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other coastal wetlands with trees/palms, the group of plantations includes perennials such as lowland fruit trees and African Palm and woodland vegetation includes mangroves and other tree species from coastal wetlands

[20] https://ejatlas.org/

[21] The comparative analysis was led by Dr. Mario Pérez, director of CINARA at UNIVALLE, and had the strong participation of Fundación Neotrópica´s representative at the time, Grettel Navas.

does not seem conclusive. These were designated as NDS (Narco Degradation Suspected). In other cases, the conflict is latent, but all the pieces seem to be there for it to become an ND conflict. In this case, the NDP (Narco Degradation Potential conflict) designates this situation.

In instances in which the areas are in public ownership the "general public" of the country was included as an additional category of affected group. This category does not currently appear in the EJAtlas methodology. We believe this inclusion is appropriate due to our specific focus on protected areas under the logic that it is a misappropriation of public environmental space. Illicit drugs were included as one of the categories of consumer products involved in the characterization of conflicts, apart from those considered in the Atlas.

We modified the intensity scale of the EjAtlas. According to their website, high intensity conflicts show widespread mass mobilization, violence, arrests, deaths, etc. Medium intensity is characterized by street protests and visible mobilization but at lower scales and less violence. Low intensity conflicts only show some local organizing. Latent conflicts are those that have no visible organizing, but where opposing interests are clearly manifested and on the verge of collision. We extended the conflict intensity scale to include the spatial scale that corresponds with the conflict, the scale of public actions, the organization and complexity of groups of opposing actors, and the level of social tension/violence generated (Aguilar-González, et al., 2016). This scale is consistent with the logic of other scales of conflict (Heidelberg Institute for International Conflict Research, 2015)

The section documenting the connection between the conflict and drug trafficking is new to the template. In addition to the factual description, it includes elements that help to document the connection between the EDC and ND. These elements include the mode of connection (governance, coexistence, political connections and narco-capitalization), the drug trafficking organization, and the type of routes involved. Based on these elements and the empirical description of the EDC, the links between environmental conflict and drug trafficking are evaluated as confirmed, suspected, or potential (Aguilar-González, et al., 2016). The criteria used to select conflicts, in addition to the ND connection, include the level of

visibility, media coverage, direct actions, and the seriousness/urgency of the environmental justice complaints, as established for the EJAtlas (Temper, et al., 2015; Temper, et al., 2015b). Up to the time of this research, over 80 conflicts had been documented in the atlas for Central America. Of those, 15 deemed relevant were evaluated. An additional number of conflicts that have not been mapped in the EJAtlas were also evaluated.

Our work characterized regional trends through the mapping and analysis of descriptive statistics. It gives special emphasis to the relationship between the levels of intensity and recently documented violence against environmentalists in the region (Global Witness, 2016) . It compares ND conflict trends with patterns of land use pressures that seem correlated with cocaine trafficking in selected areas (Sesnie, et al., 2017).

III- RESULTS AND DISCUSSION

A- Narco Degradation Driven Loss in Monetary Value of Ecosystem Services from 2001-2010

Figure 2 summarizes the trends found in the five hotspots. For comparison purposes, given the size differences for each area, it summarizes them in US dollars per hectare. The arrow indicates the median average trend.

here is a general decreasing trend in the monetary value of ecosystem services in all hot zones, with the exception of ACOSA in Costa Rica, where there is a net increase of up to $262/ha. The areas with the highest losses are the Darién BR-Comarca Emberá hotspot, the Maya Biosphere Reserve and Heart of the MBC (Bosawás, etc.) with respective losses of $267, $233 and $217 per hectare.

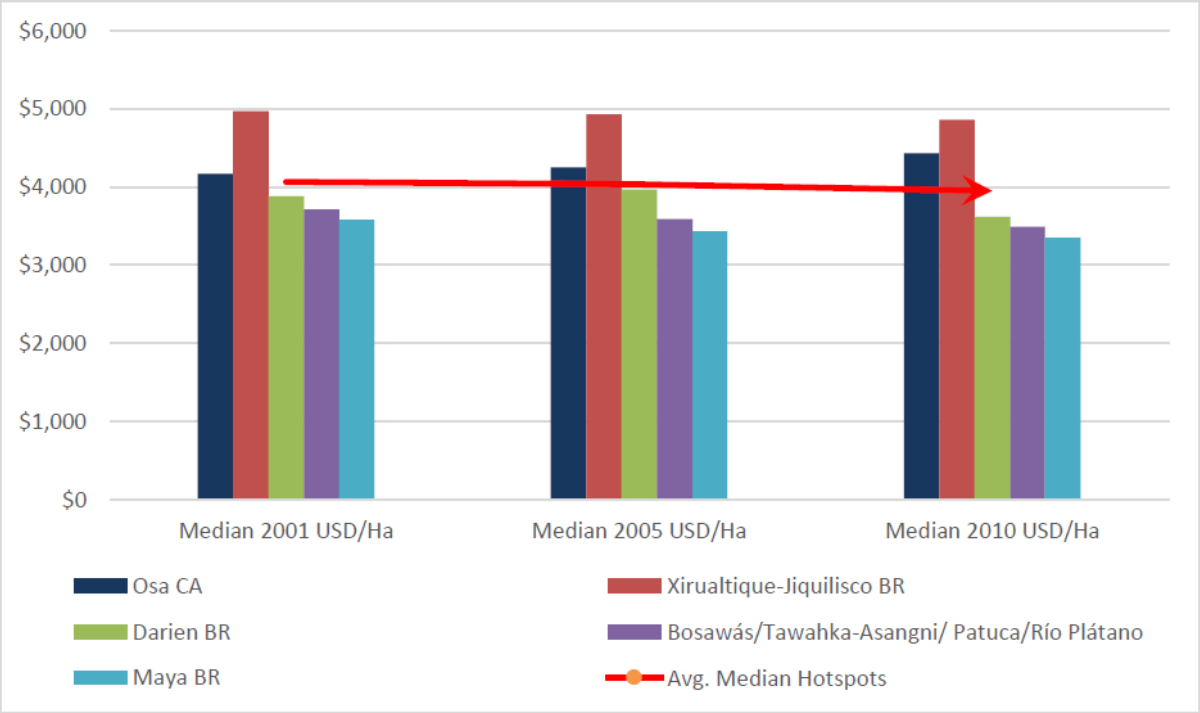

Figure 2 - Changes in Ecosystem Services Monetary Values in 2015 USD/Hectare 2001-2010. Source: Authors applying the Ecosystem Valuation Toolkit.

Figure 3 shows the combined effect of the reductions recorded. The changes in the Heart of the MBC contribute in greater percentage due to its size. The combined total loss in the hot zones from 2001 – 2010 is $1,321 million. This amounts to an annual average loss of $146.7 million across the region. The land uses that have increased the most and caused this reduction are agriculture and herbaceous vegetation (which may include pasturelands and sugar cane). In the 2005-2010 sub-period, plantations (such as African palm oil) also appear as an important change in land use (an increase of 75,774 ha.) that substitute forests.

Correlating these trends to drug trafficking activity provides evidence and illustrates effects on human wellbeing not considered by the current reach of drug control and conservation policies, as pointed out by McSweeney et. al (2014) and Devine et. al (2018). It shows how this illicit activity has contributed to the economic losses caused by the general trend of deforestation in the Central American region where, in the previous decade, forest loss rates were among the highest in Latin America (FAO, 2011)

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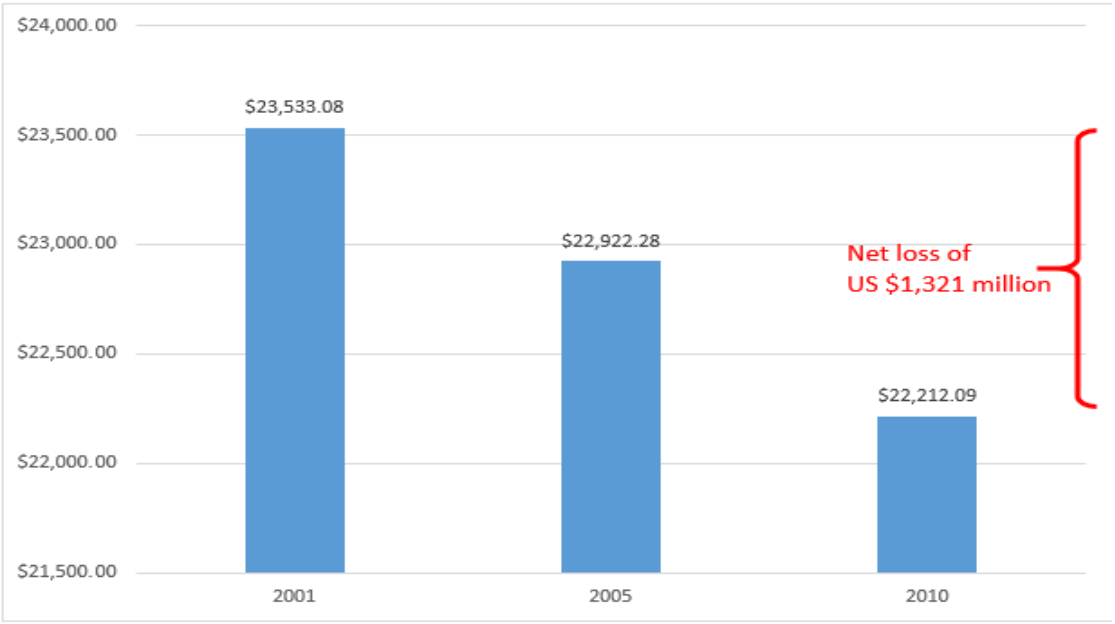

Figure 3 - Net Monetary Value in Millions of US Dollars of Environmental Service Changes due to Land Use Changes in Hot Zones in the Study Period. Source: Authors applying the Ecosystem Valuation Toolkit

Examining the conclusions of recent studies allows inferring this connection between these monetized ecosystem service losses and drug trafficking. Figure 4 illustrates the correlation between the deforestation in the northeastern region of Honduras (including areas comprised within our hotspot at the Heart of the MBC) and the movements of cocaine in the area during the period 2004-2012.

With respect to this and the other hot zones, newer data has informed the correlation between deforestation and drug trafficking as part of the phenomenon known as “anomalous deforestation.” Anomalous forest loss is forest loss with a potential “narco-capitalized” signature showing a statistically significant dissimilarity from other patches in terms of size, timing, and rate of forest loss exceeding deforestation rates typically seen on the agricultural frontier of these areas (Sesnie, et al., 2017).

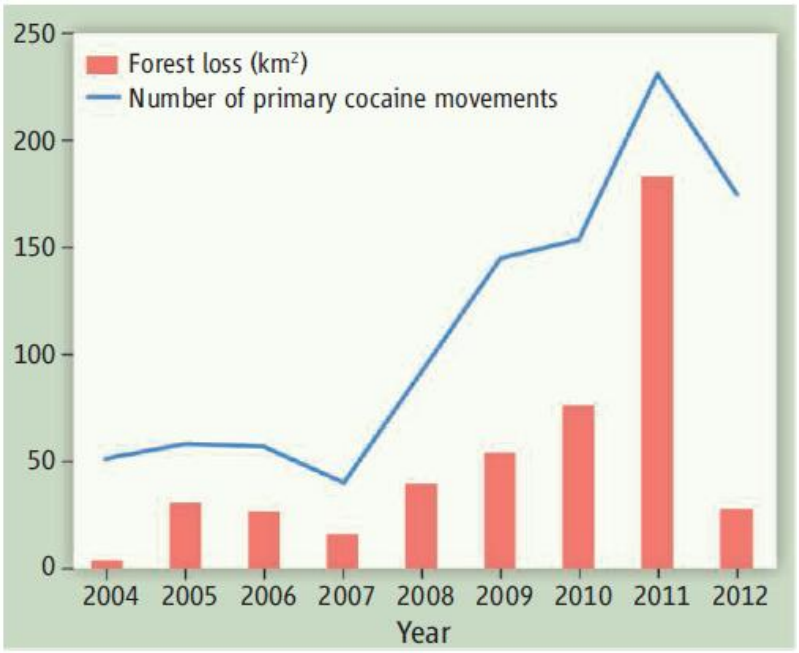

Figure 4 - Deforestation and drug trafficking in eastern Honduras. Source: McSweeney, et al. (2014)

Sesnie, et al. 2017 reported anomalous deforestation between 2000 and 2013. Figure 5 shows how several of the high-level anomalous deforestation zones coincide with the hot spots of this study.

The evidence suggests that between 15-30% of losses for the overall countries and between 30-60% of the forest loss inside nationally and internationally designated protected areas in Honduras, Guatemala and Honduras show anomalous deforestation patterns and are potentially attributable to drug activity (Sesnie, et al., 2017). Pending further verification, if we extrapolate this percentage using the monetary estimations calculated here, the losses due to anomalous deforestation in the protected area hotspots included here cost Central American nations between US$396 million and US$793 million during the study period.

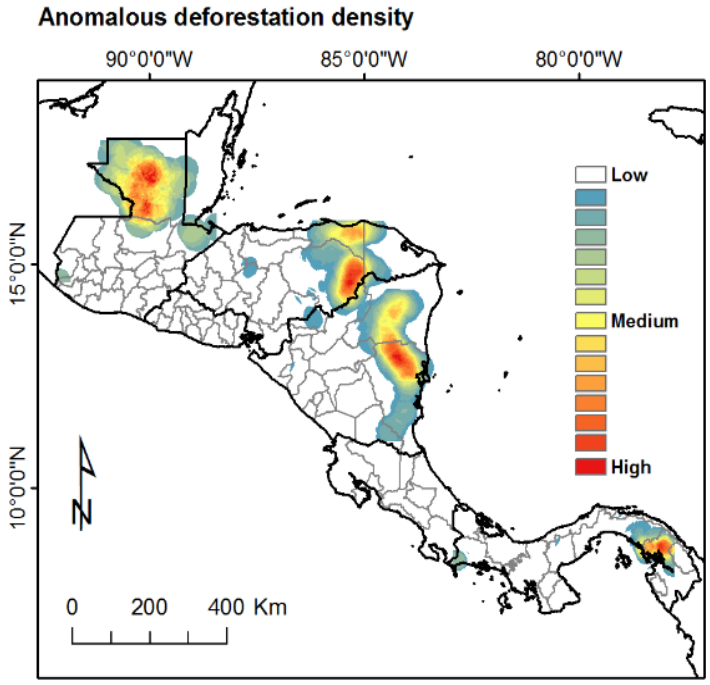

Figure 5 - Anomalous Deforestation in Central America (2001-2013). Source: Sesnie et al. (2017).

Assuming a constant linear pattern, the yearly loss rate is between US$44 million and US$ 88 million across the region. The amounts from this extrapolation require further modeling and scrutiny in order to control for other factors that may be affecting the rate and patterns of deforestation. Nevertheless, the evidence merits paying attention to their significance.

In order to understand the dimension of the impact of these losses to regional conservation and sustainable development efforts, relating them to the national public budgets for protected areas in the region is useful. Table 1 shows the public budgets for protected areas in the Central American region as reported by a study commissioned by USAID. With the exception of Costa Rica, the amounts shown exclude donations and other support from organizations that co-administer protected areas. For the countries with figures reported, the total public budget adds to close to US$47 million (ECOEDIT, 2016). The losses estimated here that are attributable to anomalous deforestation represent between 94% and 187% of this amount.

Table 1- Public Budgets[22] for Protected Areas in Central America 2016. Source: Adapted from ECOEDIT (2016).

Country	National Budget for Protected Areas 2016 (US$)	% Total National Budget
Belize	130,000	0.03
Costa Rica	33,254,961	0.22
El Salvador	n/a	n/a
Guatemala	422,479	0.005
Honduras	5,678,701	0.06
Nicaragua	4,028,440	0.08
Panama	3,648,400	0.04
Total	47,162,981	

Links develop between these economic-ecological impacts and the formal and informal economy implicit in the drug trafficking activity in Central America. They occur in the establishment of clandestine roads and runways. In addition, significant monetary flows and weapons are injected into zones of weak environmental governance. Cattle ranches, African palm plantations, land speculators and clandestine sellers of wood are narco-capitalized (McSweeney, et al., 2014; Devine, et al., 2018). As said before, the aggregate effect to the economy of the region is significant. Of all the value of the trade that moves through Central America, about 10% of the overall value is added in Central America (between US$1,580 and $2,500 million per year) which amounts to between 3% and 15% of the total GDP per capita of the region (Nielsen, 2016).

The inventory of social costs for Central American societies should also include the erosion of environmental governance by violence and corruption, where environmental groups are intimidated, and government authorities often do not apply legislation. Likewise, narco-capitalized activities typically expand at the expense of small landowners and indigenous people who become defenders of the forest (Wrathall, et al., in review). Hence, we now

[22] The numbers for Costa Rica include donations and other support from organizations that co-administer protected areas.

report the trends regarding ecological-distribution conflicts related to drug trafficking in the protected area hot zones examined.

B- Ecological Distribution Conflicts (EDCs) Trends in Selected Hot Zones.

Several regional trends can be identified from the EJAtlas´ EDC inventory. The countries with the highest numbers of conflicts at the moment this research was made were Guatemala (27.5% of total), Panama (18.8%), and Honduras (17.5%). Twenty-nine percent of all documented conflicts relate to mining activities and 24% to water management (including hydroelectric projects). Conflicts of biomass and land appropriation (land grabs) and conservation of biodiversity account for 25% of the total (Navas, 2016). There is a gradual increase in conflicts that began in the study period, with peaks between the years 2006-2007 and 2011-2013 (Aguilar-González, et al., 2018)

Highlighted among the trends that most attract attention regarding the objectives of this study is that the intensity of conflicts related to biomass and land appropriation as well as mining activities is mostly categorized in the high level of intensity (according to the scale of the EJAtlas). Water management presents an important percentage of this intensity category as well. Conflicts related to biodiversity conservation are also of high intensity[23] (Table 2).

[23] The categories are defined as in the EJAtlas. Some are self-explanatory as they refer to the specific type of economic activity that generates the EDC. In some, it is less evident. Conflicts that refer to biomass and land appropriation refer to biomass or land grabs mostly by agricultural plantations and cattle ranches. Biodiversity conservation includes EDCs related to the conservation of biodiversity in many ways such as land or use access in protected areas, poaching, illicit species trade, biopiracy and others.

Table 2-Intensity of the EDC by Metabolic Sector in Central America. Source: Adapted from Navas (2016) who developed it for the MESCOCA-ANCA[24] Project.

Metabolic Sector	Intensity of Conflicts				Total
	Low	Medium	High	Unknown	
Mining	1	9	13		23
Water Management		10	9		19
Biomass and Land Appropriation	2	6	9		17
Tourism	3	3	1		7
Fossil Energy /Climate Justice	2	2	1	1	6
Biodiversity Conservation			3		3
Infrastructure		3			3
Industry		1			1
Waste Management		1			1
General Total	8	35	36	1	80

Taking into account that all of these categories are related to the control of territory, a relationship becomes evident between these conflicts and the structural conditions that determine the insecurity in land ownership and the lack of recognition of the rights of indigenous people to their territories. The high intensity has repeatedly resulted in the loss of human lives, confirming the trends pointed out by the NGO Global Witness, according to which Central America (with 30 deaths in Nicaragua, Guatemala, and Honduras) is part of the trend that characterized Latin America as the most dangerous area for environmental defenders in 2015 (Global Witness, 2016). Unfortunately, the distribution of those harmed by the EDC is concentrated in the indigenous and small farmers as illustrated in Figure 6.

[24] The MESOCA-ANCA (Social Metabolism and Environmental Conflicts in the Andean Region and Central America) was a collaborative project between the Universidad del Valle from Cali, Colombia, the University of Barcelona´s ICTA institute and Fundación Neotrópica, which was executed between 2015 and 2016.

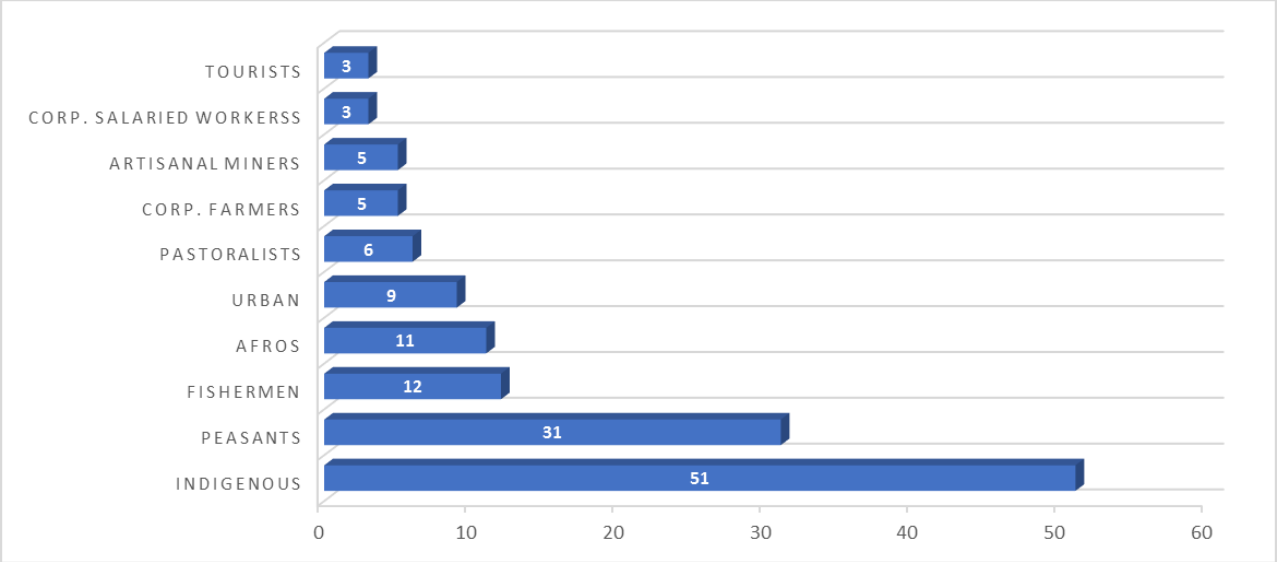

Figure 6- Groups Affected by EDC in Central America. Source: Adapted from Navas (2016) based on the MESOCA-ANCA Project.

We identified nine EDCs (labeled ND) that show clear relationships with narco-trafficking activities. Four conflicts have connections with the illicit activity but are not located strictly in the hot zones while in the MBC (labeled NDO). We identified one with a potential connection (labeled NDP) and one with a suspected connection (labeled NDS). Figure 7 represents these EDCs spatially, although locations are only approximate.

Each of these conflicts has a descriptive sheet to be uploaded as part of a regional web based observatory that is planned to conclude the Pegasus grant project. Summarizing some trends, as Figure 7 shows, the hot zones with the greatest number of conflicts in them and their proximity are the Maya Biosphere Reserve in Guatemala and the Heart of the MBC in Honduras and Nicaragua.

All identified EDCs affect the conservation of biodiversity, a logical consequence of their relationship with the hot zones studied. Seventy-eight percent relate to land grabs or appropriation of biomass and territory. All involve the expansion of monocultures (mostly African palm) and livestock, as ways to establish territorial control, which coexist with drug trafficking or act as a vehicle for laundering/narco-capitalization, supporting the conclusions

of the McSweeney and Nielsen group cited above. These conclusions are also reinforced by the fact that the four NDO conflicts identified in Costa Rica and Honduras are divided between conservation of biodiversity and land grabs or appropriation of biomass and territory. In this case, the agricultural activity is the African palm.

Fifty six percent of documented ND conflicts are classified as high intensity, and 100% include high levels of violence. The countries with the highest levels of deaths and violence are Guatemala and Honduras where conflicts ND4, ND5, and ND6 report high levels of violence in their descriptions. ND4 includes territorial control of African palm plantations and cattle ranchers in the south of Petén along the Northern Transversal Strip in Alta Verapaz. ND5 refers to illegal deforestation, illegal timber extraction and illegal occupation of the Maya

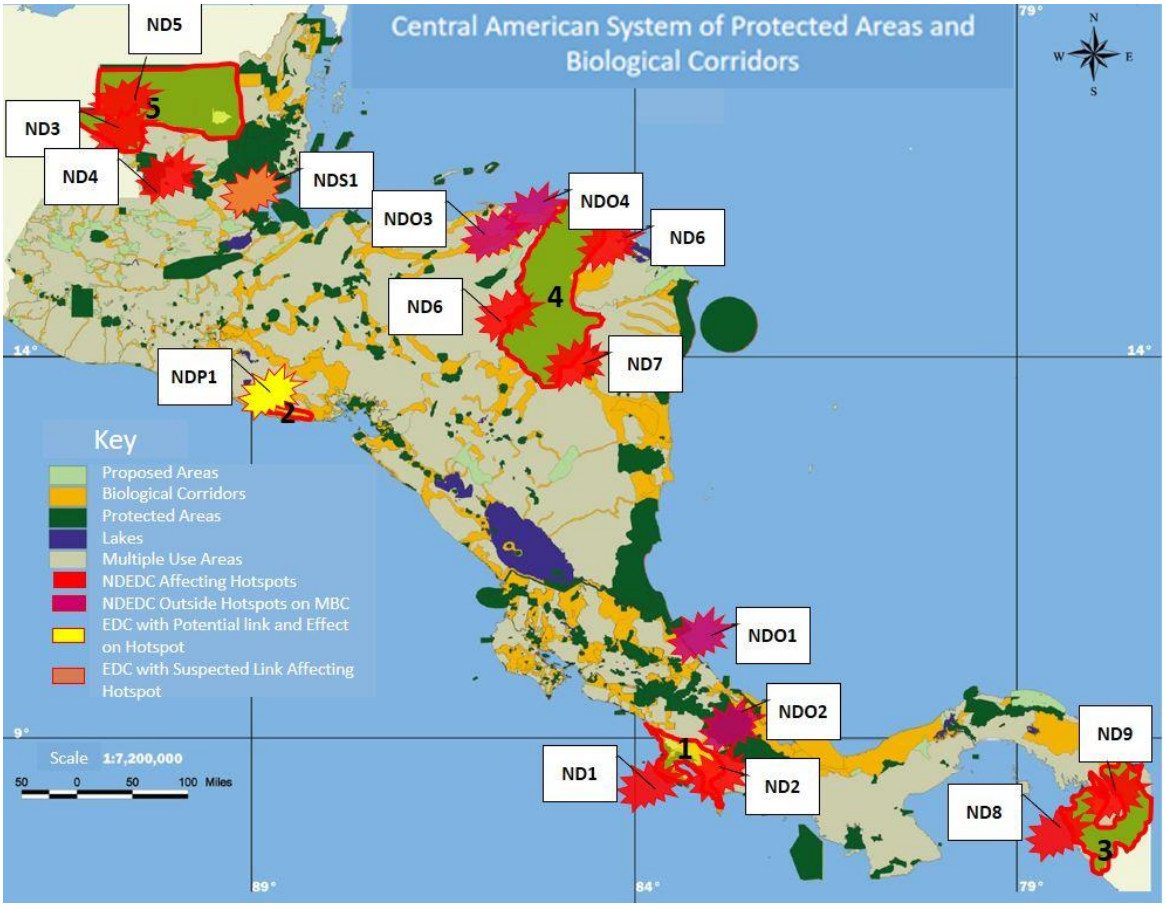

Figure 7- Ecological Distribution Conflicts Related to Narco Activity in the Hot Zones or in the Mesoamerican Biological Corridor. Source: Authors

Biosphere Reserve. ND6 refers to illegal deforestation, timber extraction, agricultural

expansion, and territorial occupation in the Heart of the MBC.

The NDOs located on the north coast of Honduras ratify the trend of high intensity with violence. The deaths of Rigoberto Lima Choc in Petén Guatemala, Carlos Arturo Reyes in Olancho Honduras, among many others, and the kidnapping of Miriam Miranda in La Ceiba Honduras are just some of the expressions of these patterns of violence (Amnesty International, 2015; Global Witness, 2016; Phillips, 2016). The death of Jario Mora in Costa Rica (NDO1) and the intensity in Panama of ND8 (illegal deforestation in the Emberá-Wounaan Community) and ND9 (monoculture in the Matusagaratí Lagoon) indicate that these levels of violence are a reality throughout the region.

The prevalence of higher intensity in Guatemala and Honduras seems correlated to the general trends reported in the literature, which point to higher levels of territorial control by narco-traffickers in the northern countries of Central America. A land transportation corridor runs east to west from the northern and central regions of Honduras (Mosquitia and Olancho) through the Petén region in Guatemala. In the southern countries of the region, the use of the territory is for marine, air, land transportation and temporary storage (UNODC, 2012).

Guatemala and Honduras, where control of territories and land and river routes is most prevalent are also countries where drug trafficking groups that operate locally tend to exhibit a more well-known public identity, based, among other things, on their ability to establish borders through intimidation (Arnson & Olson, 2011; UNODC, 2012). In terms of social groups, these practices of violence affect especially the farmers and indigenous peoples (77% and 62% of all EDCs identified).

All of the inventoried conflicts show weak or insufficient environmental governance that allows for the use of the areas for trafficking purposes. In almost half of the protected areas, there is an obvious coexistence between the presence of degrading economic activities and drug trafficking. The trends detected show that political connections allow for the coexistence of legal and illegal activities. Thirty eight percent of the EDCs show evidence of narco-

capitalization through money laundering investments in these economic activities.

Documentation of these trends in much more detail in Guatemala and Honduras is present in the literature with cases such as those of the Mendoza family in Petén and the Cachiros in northeastern Honduras (Farah, 2010; Insight Crime Foundation, 2011; Waxenecker, 2013; Waxenecker, 2014; Dudley, 2016). Apart from the appropriation of environmental space and the consequences of conflict, the conditions are created so that, in response to the social needs of remote areas, parallel power structures are developed that consolidate control over a region through satisfaction of local needs through a narco-populist model (Insight Crime Foundation, 2011; Aguilar-González, et al., 2016). These results suggest a troublesome combination for the environmental future of the region between the social and environmental consequences of neo-extractivism and illicit activities, which merits further research and critical analysis.

IV- CONCLUSION: IMPLICATIONS FOR THE RELATIONSHIP BETWEEN DRUG CONTROL AND CONSERVATION POLICIES

The application of a Critical Ecological Economics approach reveals several trends regarding the impact of the drug trade on protected areas in Central America with implications for public policies. First, this research revealed that the monetary value of narco-driven environmental degradation captured through land use change in Central America's protected areas is significant. As presented above, the average yearly loss of $88 million per year in protected areas surpasses significantly the amount of public budgets in the region dedicated to the protection of these areas. Not addressing this connection creates a negative leakage effect of drug control policies, which are not integrated with conservation policies.

By complementing the analysis of ESS losses with an analysis of EDCs in the same protected areas, we determine that the socio-ecological costs of this illegal activity magnify or reinforce the tendencies that are already causing conflict driven by the neo-extractive regional development model. Apart from those that originate from environmental damage, ND

conflicts related to illegal activity include a significant percentage of conflicts related to the impacts of agricultural plantations. These EDCs are also characterized by high levels of conflict intensity and violence and are related to processes of territorial control that substitute institutional mechanisms of formal power. Those who are most harmed by these high levels of violence, including the social costs of an increasing number of murder victims, are rural populations, indigenous populations, environmentalists, and other vulnerable groups that defend their environmental space.

If we look at the particularities of the public budgets in the region, we can see further useful implications. Of the countries that registered in the data presented by USAID, Costa Rica has an allocated budget of $33 million for its protected areas (75% of the total presented for Central America). A significant percentage of this budget is allocated to the maintenance of its participatory governance system: The National System of Conservation Areas (SINAC).

It seems that this investment has important results. Not only is it possible to say that this system has contributed to the level of many of Costa Rica's environmental indicators, including reaching 52% forest coverage in the country. It is also conceivable that the reason why the analysis did not detect net losses of forest cover in the hot zone of ACOSA in Costa Rica during the period examined in this study is due to this level of investment and the participatory nature of the system. This fits well with the findings of recent studies from USAID and other technical bodies in the region that argue that the best defense mechanism against drug trafficking for communities in rural areas where there are protected areas nearby, is by strengthening conservation models and, specifically, models of participative environmental governance (PRISMA, 2014; ECOEDIT, 2016; Devine, et al., 2018).

The community forest concessions of Guatemala's Maya Biosphere Reserve also provide evidence of successful participatory governance (Davis & Sauls, 2017). Our findings indicate that narco-degradation is concentrated in national parks in the reserve's western half while forest cover remains in communally managed lands (Devine, et al., 2018; Wrathall, et al., in review).

Putting things in perspective, the financing allocated by Costa Rica for conservation, despite being the highest in the region, represents only 0.22% of its national budget. In the regional range, the lowest place is occupied by Guatemala with 0.005% of its national budget allocated to protected areas. The other countries range from 0.03% to 0.08% (ECOEDIT, 2016). These amounts do not in any way equal the contribution that these ecosystems provide for the welfare of these nations. In the case of Costa Rica, for example, SINAC's contribution to the national economy is related to the country's success in the tourism sector that is heavily concentrated in protected areas and generates 20% of the country's export earnings (Moreno, et al., 2011).

Here it is important to consider what notions of environmental space and social metabolism add to an investigation of the Drug War. How does drug trafficking amplify the risks of neo-extractivism and impose additional costs to the consequences of environmental conflict? Should we also evaluate these costs through a more ample approach to valuation languages that incorporates qualitative notions of quality of life?

We have seen here that conflict accelerated by narco-trafficking develops in areas where governance is weak and does not provide powerful safeguards (such as land concessions) to forest dependent communities. Likewise, conflict occurs where the financial stability of the protected areas systems in the region is weaker and dependent on external aid in its various forms. In recent decades, fundamental players in providing aid have been public and private sources from the US and other countries (Karliner, 1993; Fox, 1996). The regional tendency of US public foreign aid in response to the new phenomenon of drug trafficking has been to increase the amounts allocated to control and interdiction against drug trafficking. The amounts allocated for environmental protection are between five to ten times smaller.

The priorities and funds of counter-narcotic programs should focus on strengthening mechanisms of participatory environmental governance that help prevent conflict and environmental damage. This emphasis should be extended to the governments of the region

in order for them to give budgetary emphasis to meet this task with endogenous funds that allow this approach to be implemented independently and sovereignly. We post these policy implications as possible useful areas of research to face the socio-ecological conjuncture revealed by this research. This focus on environmental conflict, justice and policy can lead us to enrich the applications of the Critical Ecological Economics approach and perhaps even force us to ask ourselves more questions from a Radical Ecological Economics perspective.

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