

Forests in the Time of Violence: Conservation Implications of the Colombian War

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SUMMARY. Forest remnants in the Colombian Amazon, Andes, and Chocó are the last repositories of a highly diverse and endemic biota. Historical changes in the Colombian landscape have been dramatic, but the magnitude and rate of change has increased over the last half century, while conflict has consumed the capacity of Colombian society to respond to environmental threats. Academic experts in the study of the Colombian conflict have explored the social, political, and economic implications of the war. However, the environmental consequences of conflict are documented only when groups in conflict target salient economic resources. This paper presents the first analysis of the geographic distribution of forest remnants in relation to armed conflict in Colombia. Results show that guerrillas and/or paramilitaries range throughout areas of human encroachment into remnant forests. The policies promoted by Colombia's irregular armed

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The author dedicates this paper to her grandparents—C. Álvarez and T. Sánchez—campesinos displaced by that other “Violencia” in the 1940s.

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forces range from “gunpoint conservation” rarely applied by guerrillas, to the rapid conversion of forests and crops to cattle ranches and coca (*Erythroxylum* sp.) plantations, following paramilitary occupation. Because the rates and extent of fragmentation are linked to such land use practices, armed groups may play a crucial role in determining the fate of Colombia’s forests and their endemic biota. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <getinfo@haworthpressinc.com> Website: <<http://www.HaworthPress.com>> 2003 by The Haworth Press, Inc. All rights reserved.]

KEYWORDS. Colombia, biodiversity, forest conservation, forest fragmentation, deforestation, forest policy, armed conflict, war, violence, economic incentives, illicit crops, coca, *Erythroxylum*, guerrillas, paramilitaries, drug trafficking

INTRODUCTION

With forests covering the largest portion of its territory—an estimated 50%—and a dizzying array of ecosystems, Colombia ranks among the select few “megadiversity” countries of the world (McNeely et al. 1990; Myers et al. 2000). Analyses that use endemism and biodiversity as criteria for setting world or continent-wide conservation priorities invariably highlight Colombian forests in their results (e.g., Olson and Dinerstein 1998). Most of these studies also include some measure of forest fragmentation threats from demographic pressure, economic development patterns, or both (e.g., Myers et al. 2000).

Forest fragmentation processes are neither recent nor uniform. In some regions, deforestation dates back to pre-Columbian times (Cavelier et al. 1998; Etter and van Wyngarden 2000). Not surprisingly, areas comprising already fragmented landscapes, principally the Andes, inter-Andean valleys, and the Caribbean region, were quickly settled by European colonizers (Etter and van Wyngarden 2000). The ensuing population distribution persists to this date, with 70% of Colombians concentrated in the three Andean cordilleras (World Wide Fund for Nature [WWF] 2000). As a result, Colombia has lost 73% of its continuous montane forests (Cavelier and Etter 1995). Large-scale expansion into the lowlands is relatively recent, and therefore the rainforests of the Chocó and Colombian Amazonia are not yet considered as threatened as the Andean forests (Bryant et al. 1997).

Nevertheless, all Colombian forests face fragmentation to some degree, as noted in the country programs of major environmental non-governmental organizations (Conservation International [CI] 2000; World Resources Institute [WRI] 2000; WWF 2000). Indeed, country wide deforestation rates in Colombia have been estimated somewhere between 0.6% (WRI 1995) and 2.8% per year (Myers 1989), with local measurements as high as 4.4% (Viña and Cavelier 1999). The critical importance of Colombian forests in the maintenance of biodiversity cannot be overstated. Estimates of species richness for well-known taxa rank Colombia as the country with the greatest number of birds, in addition to over 45,000 species of angiosperms (Stattersfield et al. 1998; McNeely et al. 1990). Many of these organisms are completely forest-dependent and endemic to specific regions of the Andes, Chocó, or western Amazonia. In effect, Colombia harbors significant parts of the Chocó and the tropical Andes, which contain 0.8% and 5.7% of the world's endemic vertebrates, and 0.8% and 6.7% of endemic angiosperms respectively (Myers et al. 2000).

International conservation programs aimed at preserving this spectacular diversity in forest remnants note that in addition to the suite of common socioeconomic challenges to conservation in developing countries, Colombia's chronic violence further jeopardizes local and international efforts to curb environmental decline (CI 2000; WWF 2000; WRI 2000). This fact is sometimes dismissed as an anomaly to be resolved by national institutions (for example, see the "Threats/Opportunities" section of WWF 2000). The Colombian war, however, dates back to the middle of the twentieth century, shows no signs of abatement, and has increased in scope and scale over the last decade.

In Colombia, the conflict has become so pervasive that the study of armed conflict within the social sciences has a name of its own, *violentología*. Because most *violentólogos* focus on socioeconomic and political issues, environmental damages have not been central in the discussion about the Colombian conflict. The socioeconomic implications of the predominant patterns of exploitation of natural resources are a perennial explanation of the origins and development of the conflict (Kalmanovitz 1994; Pizarro-Leongómez 1996). But whether the conflict per se has any environmental effect is not known. Perhaps the only recurrent element of environmental concern in the study of violence is the damage that explosives detonated along petroleum pipelines cause in local watersheds (e.g., Peñate 1991). The environmental consequences of armed conflict have received little scientific study, and except for petroleum spill damage, are unknown.

There are two main players whose actions defy the administrative and military role of the state: guerrillas and paramilitaries. The two most powerful left-wing guerrilla groups are the Fuerzas Armadas Revolucionarias de Colombia (FARC) and the Ejército de Liberación Nacional (ELN). Both groups claim to fight for communist revolutionary ideals and trace their history back to 1948 and the mid-1960s, respectively (Echandía 1999). As guerrilla activities increased in the early 1980s, wealthy landowners responded by sponsoring right-wing paramilitaries (Cubides 1999). Whether or not the paramilitaries were or are linked to the Colombian military (and thus to the government) is the subject of political and academic debate (Cubides 1999; Chernick 1998; Human Rights Watch 2000).

This paper presents results from the first analysis of the geographic distribution of forest remnants in relation to armed conflict. Two objectives are thus accomplished. The first is to estimate the proportion of forests in municipalities where guerrilla and paramilitary activities may impact resource use by individuals. It is implied that these forested areas are, to some extent, beyond the complete access and control of the state. That the Colombian government perhaps never had control over its vast forested territories (L. G. Baptiste, pers. comm.) is neither denied nor discussed because it is irrelevant to this estimation.

The second objective is to propose hypotheses about the effects of armed conflict on deforestation and forest conservation within these municipalities. Because the parties in conflict undertake policies that are directly related to natural resource use, including the preservation or exploitation of forests, some effect of armed conflict on forests can be reasonably expected. In some of the areas affected by armed conflict, governmental and non-governmental actors continue to formulate forestry policies and undertake forestry projects (Rodríguez and Ponce 1999; A. Villa, pers. comm.). This paper does not claim otherwise, rather, it assumes that armed conflict affects resource use by individuals and, based on field observations, suggests tests to detect its effects.

METHODS

Forest cover and forest types are summarized from Etter (1998), with his nomenclature in parentheses. "Andean" forests comprise sub-Andean humid (14), Andean humid (16), high-Andean humid and 'cloud' (18a), high-Andean dry (18b), Andean oak (18c), and dry and humid páramos (19-20). Tropical forests of the middle Magdalena (1m, 3m)

and Caribbean forests (23) were lumped in the Andean category, and they amount to less than 1% of the total. “Chocó” forests comprise tall dense Pacific forests (2c, 3c, 7), flooded Atrato and Pacific forests (46-48a), and hyper-humid mangroves (50). “Amazon” forests comprise tall dense Amazon and Orinoco basin forests (1a, 2a, 3a, 2b, 2d, 3b, 4, 5a, 5b, 6), sub-montane, montane, and “cloud” forests of La Macarena (24-26), tall and dense Amazonian forests (42, 43), middle dense Amazonian (44), and gallery forests of the Orinoco basin (45).

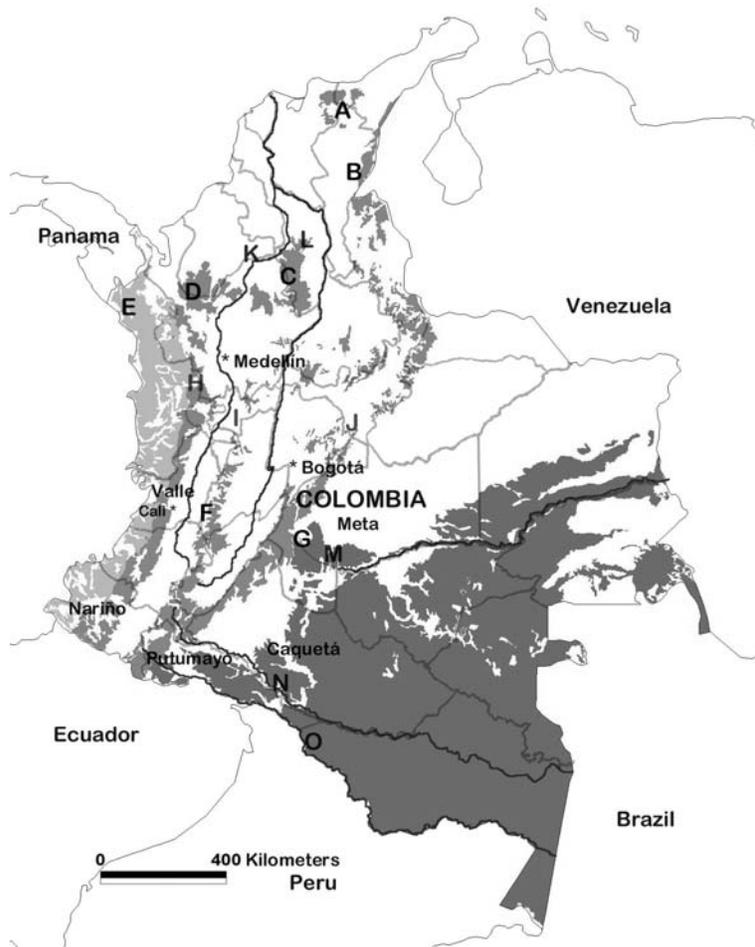
Ranges of guerrillas, paramilitaries, drug crops, and land purchases by traffickers are taken from Reyes (1999). Ranges of paramilitaries reflect their presence or absence from 1985-97. Guerrilla intervention was plotted from the medium (four to ten attacks) and high activity (more than ten attacks) from 1985-97, as documented in Reyes (1999). The entire municipality is marked as affected if guerrilla actions, paramilitary activity, land purchases by traffickers, or illicit crops are detected, regardless of the actual extent of intervention. Because municipalities in the Chocó and the Amazon are very large, forests highlighted there are not proportional to the extent of armed actions, land purchases, or illicit crops in those regions (see Figure 1 for forest “types”). Since political divisions are much smaller in the Andes, the extent of these same phenomena in affected Andean municipalities will be overestimated to a lesser degree. Presence of armed groups, illicit crops, and land purchases by traffickers was overlain and measured on the forest cover map using ArcView 3.2.

Information on the management policies of guerrilla groups was obtained through conversations with local civilians and members of these armed groups in the Macarena mountains (1995), Munchique National Park and Tambito Nature Reserve (1995, 1997-99), the San Lucas mountain range (1998), and the Churumbelos mountains (1998). Additional information on environmental policies of armed actors was drawn from ELN (2001), FARC (2001), Chernick (1998), Cubides (1999), Echandía (1999), and Vargas-Meza (1998).

RESULTS: ARMED CONFLICT, ILLICIT CROPS, AND FORESTS IN COLOMBIA

Large portions of all types of forest lie in municipalities affected by armed groups, with the highest values calculated for Andean forests (Table 1, Figures 2, 3). Andean forests are also disproportionately located in municipalities experiencing conflict as inferred from the presence of guerrillas and paramilitaries (Table 1). Forests in municipalities experiencing

FIGURE 1. Outlines of the Colombian *departamentos*, place-names mentioned in the text, and main geographic features of Colombia. Lowland forests of Chocó in light green, montane and submontane forests of the Andes in darker green, and lowland forests of the Amazon and Orinoco basin in the darkest green (see “Methods” for specific forest types). Main forested areas discussed in the text: A, Sierra Nevada de Santa Marta; B, Serranía del Perijá; C, Serranía de San Lucas (Central Andes); D, Nudo del Paramillo (West Andes); E, Serranía de Los Saltos (north), Serranía del Baudó (south); F, Páramo de Las Hermosas; and G, Serranía de La Macarena. Cordilleras of the Andes (dark green font): H, West Andes; I, Central Andes; and J, East Andes. Main rivers (blue font): K, Cauca; L, Magdalena; M, Meta; N, Caquetá; and O, Putumayo.



conflict totaled 20% of the total remaining forest of Colombia (Table 1 and Figure 4). The most significant Andean forests in municipalities experiencing conflict include the Sierra Nevada de Santa Marta, the Serranía del Perijá, the Serranía de San Lucas, the Nudo del Paramillo, and the Páramo de Las Hermosas (Figures 1 and 4). The northeastern tip of the East Andes and the eastern slope of the East Andes in the departments of Meta and Putumayo also lie in municipalities experiencing conflict (Figure 4).

Chocoan forests in municipalities experiencing conflict include the western half of the Serranía de los Saltos and the lowlands of the department of Valle del Cauca. In the Colombian Amazon, the forests of the upper and middle Guaviare, Caquetá, and upper Putumayo river basins are in municipalities with ongoing conflict. The Serranía de la Macarena and the foothills of the East Andes—where some Amazon forest is found—are also experiencing conflict (Figure 4). In addition to their investments in municipalities experiencing conflict or having armed groups, traffickers have also made significant land purchases in non-conflict areas of the Chocó, the Serranía del Baudó, and lowlands of Nariño (Figure 2).

TABLE 1. Forest Types and Sociopolitical Factors

Number of hectares and percentage of total remnant forests of each forest type located in municipalities affected by armed groups, conflict, and all factors considered: guerrillas, paramilitaries, illicit crops and land purchases by traffickers. The total extent of the categories Andes, Chocó, and Amazon is 9.5, 4.3, and 35 million ha, respectively. See "Methods" for details. Percentages of total remaining forests are fractions of the estimated 48.8 million ha of forests of all types (including secondary growth) remaining in Colombia (Etter, 1998).

Forests in municipalities with	Andes		Chocó		Amazon		% of total remaining forests
	10 ⁶ ha	%	10 ⁶ ha	%	10 ⁶ ha	%	
Presence of armed groups	6.63	70	1.9	44	7.48	21	33
Armed conflict (inferred)	3.42	36	1.00	23	4.74	13	18
All factors present	1.39	15	0.04	1	0.88	2	5

FIGURE 2. Forests in municipalities affected by, clockwise from top left, illicit crops (gray), land purchase by drug business (yellow), guerrillas (red), and paramilitaries (pink). See "Methods" for details. Forest color codes as in Figure 1.

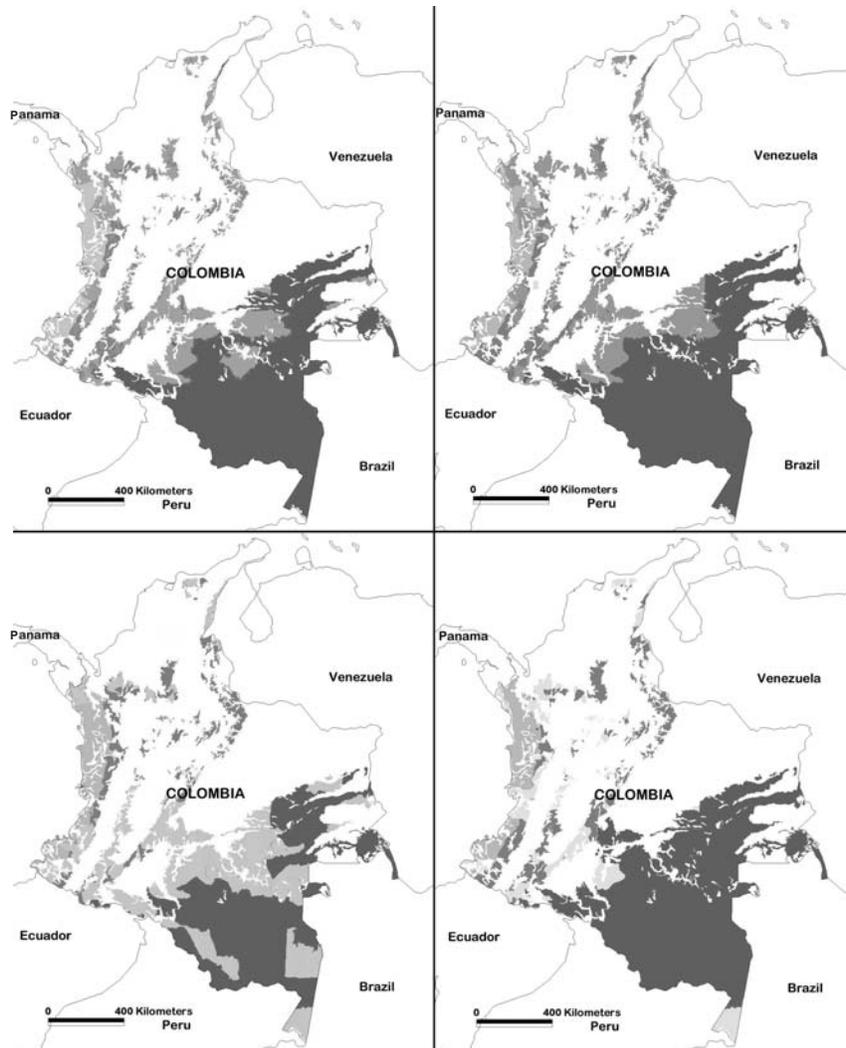


FIGURE 3. Forests in municipalities affected by non-governmental armed groups (gray). Point sites of documented “gunpoint conservation” are marked with dots, see “Methods” for sources, details. Forest color codes as in Figure 1.



DISCUSSION

Critical portions of Colombia’s Andean, Chocoan, and Amazonian forests are located in municipalities where armed groups contest political authority (Figure 3). This is perhaps most evident in the case of the Andes, where the largest continuous forest remnants (Serranía de San Lucas, Nudo del Paramillo, Páramo de Las Herosas, and East Andes) lie in mu-

FIGURE 4. Forests in municipalities affected by conflict between non-governmental armed groups (black). Armed conflict is inferred from the simultaneous presence of medium and high guerrilla activity and the presence of paramilitaries from Reyes (1999). See "Methods" for sources and details, forest color codes as in Figure 1.



municipalities where both guerrillas and paramilitaries are present (Figure 4). The management policies and practices of these armed groups are not homogeneous in space or in time. Neither can it be assumed that their policies and practices are applied throughout their respective ranges or "territories." The following sections propose hypotheses about the scope and trends of environment-related actions by armed groups in order to characterize the effects of armed conflict on Colombia's forests.

This study examines three processes whereby armed conflict may affect forest use and conservation. The first, “gunpoint conservation” involves the exclusion of most productive activities from certain areas, but seems to be a rare phenomenon. It is enforced with land mines and civilian curfews. The second involves forest fragmentation pressures from illicit crop growers and cattle ranchers in areas that are beyond the rule of law and/or contested by armed groups. The third is a consequence of development under the “violence syndrome,” which is defined as the collapse of the institutional framework for civilian law and order.

Gunpoint Conservation

In a number of guerrilla-controlled areas, including parts of the Serranía de San Lucas, conservation is carried out by means of armed coercion. The ELN protects some forests in the Serranía de San Lucas purportedly because of their role in the local hydrology. Their methods include placing landmines or posting signs that warn of landmines in patches of montane forests. In addition, these forests—*el monte*—have served as refuge from air surveillance by government forces (Dávalos 2001). The control exerted by the ELN over these resources is also a demonstration of authority and a manifestation of a broader ideological program. This approach to forest preservation can be labeled “gunpoint conservation” because it is strictly enforced and maintained with the threat of violence (Figure 3). There is no evidence that the local communities would respect the ELN’s conservation policies in the absence of coercion (Dávalos 2001).

The guerrilla groups have appropriated the current discourse of biodiversity and conservation, incorporating it into their revolutionary rhetoric with nationalistic undertones. On their Internet web pages, both FARC and ELN tout their environmental concerns, emphasizing sovereignty over biodiversity (FARC 2001; ELN 2001). Sometimes these interests and management initiatives coincide with the government’s conservation objectives. For example, during the 1997 El Niño, campesinos seeking to expand their lots burned the lowlands of the Munchique National Park. The FARC, advised by the park’s low-ranking officials, threatened those responsible for the fires. Consequently, and despite the continuing drought, the fires stopped in late August.

However, there may be other considerations motivating the application of these policies. For example, as of 1995, the FARC excluded almost all agriculture and hunting from the southern half of the Serranía de la Macarena. They claimed to preserve the wealth and beauty of the forests

for the benefit of future generations, but these forests also housed their national headquarters at the time. The guerrillas construe the forest as shelter from air raids (strategic cover), an invaluable source of water (reservoir), or a necessary condition for the protection wildlife and other biodiversity values (natural habitat).

In the latter interpretation, some charismatic animals have an intrinsic value that the guerrillas are willing to protect. Interestingly, these values are more attached to the animals than to the forest itself. In the Serranía de San Lucas, FARC agents expressed their preoccupation regarding the plight of a spectacled bear (*Tremarctos ornatus*) whose partner in captivity had died. They wanted either to build a zoo for the local villagers or send the lonely male to an urban facility that could care for him. This may partly explain the zeal with which the guerrillas preserve some forest fragments, but their practical and strategic considerations provide a more parsimonious explanation for their conservation initiatives.

These policies, however, are not static or evenly applied. In August 2000, the Colombian newspaper *El Tiempo* reported the construction of more than 200 km of roads linking the demilitarized zone (DMZ)—also known as the Military Exclusionary Zone—in southeast Colombia to the southern outskirts of Bogotá through the Macarena, Tinigua, Picachos, and Sumapaz National Parks. The following month, television footage confirmed the road construction. According to journalistic versions, the purpose of the road would be to facilitate the entry of hostages and reagents for drug processing into the DMZ. The construction of the road seems to have paralleled an unprecedented growth in illicit agriculture in the DMZ, where coca (*Erythroxylum* sp.) plantations increased 32% over the 1999-2000 period (Maserié 2001). However, it is not clear whether the new illicit crops within the DMZ replaced agricultural crops or natural habitats. The construction of this road suggests that economic interests override the environmental agenda that the FARC had claimed to promote by, for example, including the sustainable development of natural resources as an item in the agenda for peace negotiations with the government (Ricardo et al. 2000).

Peace negotiations with the ELN are moving towards establishing a second DMZ in the Serranía de San Lucas. For updates on this process, the reader is referred to the Internet web pages of the Presidencia de la República and Proceso de Paz (<http://www.presidencia.gov.co/webpresi/> and <http://www.procesodepaz.com/>). Programs for the protection of river basins, top soil, flora, and fauna have been included as one of many items in their charter, the *Reglamento para la Zona de Encuentro* (Presidencia de la República 2001). Whether or not these proposals result in environ-

mental protection remains to be seen, particularly in the face of the government's plan to develop gold mining in the region beyond its current artisanal scale (Londoño 2001; Villaruel et al. 2000).

GUNPOINT FRAGMENTATION AND ECONOMIC INCENTIVES

The second and perhaps more pervasive type of impacts on the forest stems from the pattern of economic development that prevails in many guerrilla and paramilitary-dominated areas. This is necessarily linked to the other half of the violence equation: illicit trafficking and displacement. Because of the FARC's geographic range during the coca boom of the 1980s (Echandía 1999), this was the first politically oriented armed group to profit from illicit crops. In effect, the FARC regulate trade between growers and buyers by collecting taxes and requiring campesinos to grow three hectares of food for every hectare of coca (A. Reyes, unpublished). Paramilitaries battle for control of the land and transport routes throughout guerrilla territories. This is most efficiently accomplished by undermining their own income base: the campesinos (Echandía 1999; Cubides 1999; Chernick 2000). This policy would explain why the distribution of guerrillas and paramilitaries overlaps significantly, as shown by a comparison between their full ranges (Figure 2) and areas of overlap (Figure 4).

Because the paramilitaries are mercenaries for cattle ranchers and traffickers, landholdings usurped from 'guerrilla territories' are quickly consolidated following the displacement of the local campesinos. These so-called territories are often small holdings where political power is partially or totally administered by guerrillas, sometimes by sheer force. This would explain why the percentage of farms in Colombia over 500 ha has grown from 33% in 1984 to 50% in 1997 (Rincón 1997). The conversion of the last forest remnants to cattle ranches often follows territorial gains made by the paramilitaries. The paramilitaries have been able to evict guerrillas completely from only some parts of the Guaviare river basin and the lowlands of the department of Nariño (compare Figures 2 and 4). Their territorial conquests, however, are expected to increase as conflict escalates and the government strategically focuses its military-backed campaign to eradicate illicit crops on the southern part of the country (Chernick 1998; Vargas-Meza 1998; Cubides 1999; Tate 2000).

The environmental effects of these contests for land are not limited to the areas seized by cattle ranchers. Illicit agriculture per se has already been identified as a notorious factor in forest degradation (Cavelier and

Etter 1995; Henkel 1995; Young 1996). In 1998, it accounted for up to half the annual deforestation (Álvarez, in press). Illicit crop eradication programs undertaken by the Colombian government over the last decade may have led to greater conversion pressure on the surrounding forests as growers seek new lands to make up for their lost revenue (Henkel 1995; Young 1996; Kaimowitz 1997; Reyes 1999; but see Cavelier and Etter 1995).

If the United Nations Office for Drug Control and Crime Prevention (UN-ODCP) is correct, an average hectare of coca in Colombia yields 1,630 kg of coca leaf (no time period given, presumably per year) (UN-ODCP 1999, 44). If the price of coca leaf at the farm is comparable to that found in Bolivia and Peru, US\$1.44 (no prices given for Colombia, UN-ODCP 1999, 80), then an average campesino would receive US\$2,347 per hectare planted with coca. This amount of coca leaf results in 3.5 kg of cocaine (see Table 11, UN-ODCP 1999, 44). It would fetch an average wholesale price of US\$79,590 in the US, the main importer of Colombian cocaine (UN-ODCP 1999, 164). Thus, the campesino receives 2.9% of the wholesale price paid for the cocaine produced from his/her crop, while assuming much of the risk associated with armed conflict and law enforcement against illicit crops. Ironically, the paramilitary expansion that threatens the lives and property of coca growers is partly funded by landed traffickers.

These facts indicate that forested areas near illicit crops face at least three kinds of fragmentation pressure. First, the economic incentives for growing illicit crops are high, with expected revenue from a single hectare of coca (see above) exceeding the average per capita income of Colombia (at US\$2,168) (WRI 2000). Therefore, campesinos may choose to expand their crop areas for simple economic reasons. Second, government eradication of illicit crops may lead growers to move deeper into the forests to avoid detection (Henkel 1995; Young 1996; Kaimowitz 1997; Reyes 1999). Finally, paramilitaries may attack, facilitating the expansion of cattle ranches and/or the consolidation of lands held by traffickers (Cubides 1999; Reyes 1999). If these pressures exist in rural Colombia, fragmentation threats are greater than 'background' levels found in forested areas adjacent to coca and opium poppy (*Papaver somniferum*) production (Figure 2). Here the term 'background' applies to those areas without armed conflict and illicit crops. Pressure on areas with armed conflict (Figure 4) is also expected to be higher than in background areas because the conflict diminishes local incentives for long-term management, as explained below.

These processes that transform land use and tenure may explain why forest clearing continues despite rural flight in the Chocóan lowlands of the department of Valle del Cauca (Figure 1) (Reyes 1999). By itself, the persistence of deforestation is surprising because the Colombian countryside is more sparsely populated and less economically productive today than it was ten years ago. This defies the conventional connection between population growth, economic growth, and deforestation. Between 1990 and 1995, the rural population of Colombia decreased 0.3% each year, while the total national population grew at an annual rate of 1.7% (WRI 1997). A significant part of this trend can be attributed to forced migration: 300,000 people were displaced by the conflict in 1998 alone (Reyes, 1999), for a total of 1,800,000 campesinos displaced as of 1999 (Chernick 2000).

Arguably, forest fragmentation driven by illicit trade would occur regardless of the contested status of these forested areas. Although this may be true, there is no actual way of testing the effects of illicit crops and armed groups independently since the association between them dates back to the 1980s, and state repression guarantees a lack of transparency. The paradoxical conclusion is that due to the conflict, rural population growth, and/or economic output are not directly proportional to deforestation. This provides a rebuttal to the usual malthusian description of deforestation pressures in tropical countries.

The Violence Syndrome

Are incentives for conservation altered by the war? The third type of effects involves unsustainable development not directly associated with illicit crops. Licit economic activities in violently disputed areas are expected to produce greater environmental damages *because* of the conflict (Figure 4). This can be more easily visualized through a concrete example. Because the ELN impedes the entry of investors to the vast gold deposits of the Serranía de San Lucas, gold extraction there is primitive and inefficient. At the same time, because the area is beyond the full scope of action by governmental and non-governmental environmentalists, pollution from artisanal mining is not regulated. The quick profits provided by artisanal mining attract many immigrants who exert pressure on the area's forest with hunting, settlement, and agricultural activities (Dávalos 2001).

Because these settlers live on the brink of eviction (or violent death), high economic stakes are combined with disincentives for long-term conservation or management of resources. As rational economic actors, individual artisanal gold miners forgo any measure that would limit their

production, including pollution control and investment in 'cleaner' mining technology *because* the war makes their future uncertain, and the opportunity costs of not exploiting the gold are very high.

The agrarian economy as the first victim of violence. At the national scale, the prevalent agrarian development model, imposed partly by armed groups in the 1990s, tends to replace annual food crops with less productive cattle pastures (Vásquez 1997). By failing to support the institutions that assisted small farmers, most of which were downgraded or dismantled in the early 1990s, government policies have further entrenched this pattern (Robledo 1999). As the flight of the rural population to urban centers grows, and food imports replace forgone agricultural production (from 800,000 tons in 1990 to 7,000,000 tons in 1999), the expansion of cattle ranching continues throughout the agricultural frontier (Vásquez 1997). Though most of the expansion is taking place on agricultural land, at least a fraction corresponds to forest conversion.

Other things being equal, the impact of violence, estimated at 33% of agriculture's contribution to the Gross National Product (GNP) in 1995, is a staggering blow to the economy of Colombia (Bejarano et al. 1997). Ultimately, the economic adjustments that the Pastrana administration undertook in 1998, including a significant reduction in the budget for the Ministry of the Environment, can be ascribed to an economic recession that is related in important ways to the war. The decentralization of the National Natural Park System, undertaken even before these budget cuts took place, might increase regional investment in conservation (Rodríguez 1998). However, a significant part of this regional investment hinges on channeling resources from power-generating companies (Rodríguez and Ponce 1999).

As a result, more developed regions where infrastructure is concentrated receive more funds for conservation than the undeveloped areas, such as the Serranía de San Lucas or most of southeast Colombia where the threats of illicit crops and armed conflict are concentrated (Figures 1 and 2). In this framework, the current guerrilla policy of attacking the national power infrastructure represents an additional, unforeseen, armed threat to conservation (see Proceso de Paz [<http://www.procesodepaz.com>]). While resources from international funding agencies are also expected to support the new decentralized system (Rodríguez and Ponce 1999), security considerations will always influence the allocation of scarce funds. It is then no wonder that violence is considered the most important obstacle to the economic, social, and political development of Colombia (World Bank 1999).

This last set of effects is the most difficult to trace and outline into a valid test. In principle, the environmental consequences of this ‘violence syndrome’ are not different from the challenges that conservation faces in other developing countries. I contend, however, that the erosion of civilian rule and the almost absolute lack of justice adjudication in the Colombian countryside are distinct, if diffuse, threats to conservation. In terms of investment in development, individuals and companies alike cannot be held accountable for their actions if the rule of law is in shambles, as it is in rural Colombia. The flight of millions of campesinos from rural violence has left the areas affected by conflict less economically productive. Displacement also precludes the practice of forest management, restoration, or conservation.

Future studies on the relationship between armed conflict and forests should focus on quantifying localized deforestation in areas highlighted in Figures 2-4, and they should distinguish between fragmentation from illicit agriculture and that caused by the expansion of cattle pasture. When and if these data become available, the links between paramilitaries, guerrillas, cattle ranching, deforestation, and demographic changes will be established and quantified. Studies of the “violence syndrome” should compare areas of similar demographic characteristics that are with and without conflict to identify the impact that this sociopolitical phenomenon may have on forests.

RECOMMENDATIONS: WHENCE CONSERVATION?

There are no obvious ways to mitigate the effects of conflict on the forests of Colombia because the effects outlined here are ambiguous. Only some of the armed groups practice a form of forest conservation, albeit in a highly localized and coercive manner. On the other hand, the government cannot be considered fully enabled in the 33% of Colombia’s forests that are found in municipalities where armed groups operate. Some of its policies conducted amidst the conflict, including illicit crop eradication and road infrastructure development, may have deleterious impacts on the forest. Despite these limitations, there are a number of policy options directly available to counter deforestation.

First, economic incentives for intensive agriculture should be restored in order to enhance rural productivity. This step is necessary to create profitable alternatives to cattle ranching, an activity that is both less productive and labor intensive than traditional agricultural systems (Robledo

1999). Increased agricultural productivity could also help counteract existing incentives for illicit crop cultivation. Most of the technical and financial support for traditional agriculture was dismantled or downgraded during the early 1990s. Even in those areas where illicit crops are not the only profitable economic alternative, agricultural production has plummeted because most campesinos have no access to technology or markets for their products. In the meantime, food imports have skyrocketed and campesinos are cornered in the crossfire between guerrillas, paramilitaries, and the government's campaign against illicit crops. Low agricultural productivity means that more land is cleared for agriculture, further depleting the forest cover, and impoverishing the natural heritage of Colombia and the world.

Second, the spraying of herbicides on coca and poppy plots in Colombian forests must cease. This technique for combating illicit crop cultivation has been ineffective in Colombia. Since 1986, the total area under illicit crop cultivation has more than quadrupled despite an 80-fold increase in the area fumigated with herbicides (UN-ODCCP 1999). The fumigation of illicit crops is also believed to create additional pressure on primary forests of Latin America by driving illicit growers deeper into the frontiers to avoid law enforcement (Henkel 1995; Young 1996; Kaimowitz 1997). Moreover, there is no indication from data on the price and overall availability of illicit drugs that this policy is achieving anything more than social upheaval and deforestation in the Colombian countryside (UN-ODCCP 1999). Indeed, the policy of persecuting poor growers who earn less than 5% of the revenue generated by illicit drugs could be questioned on humanitarian grounds alone. Because the Colombian government is bound by international agreements to reduce illicit crop production, policies for achieving this goal need to be evaluated in light of the progress made by consumer countries as well. International organizations, such as the United Nations Office for Drug Control and Crime Prevention could play an instrumental role in investigating alternative policies (e.g., market approaches) for eliminating illicit crops.

Third, international and Colombian environmental agencies need to prepare for enforcement of conservation in those areas that are currently under a "gunpoint conservation" regime. While these areas represent a minuscule fraction of the "guerrilla" areas (Figure 2), their protection would cease with the return of guerrillas into civilian life. With peace negotiations in place or underway, the possibility of full-blown, large-scale, unplanned exploitation becomes certain in areas that are now off-limits from security risks. Some areas of exceptional biological importance, like Munchique National Park, the Serranía de la Macarena, and the Serranía

de San Lucas, should receive special protection against such future threats. Not only is the future of 10% of the world's biodiversity at stake (McNeely et al. 1990), but the stability of the watersheds that support many Colombian cities—a more politically salient justification to preserve forests—will be compromised if strong protective measures are not taken soon.

The measures described above are paltry steps when compared to the efforts required by the more fundamental challenge that Colombian society faces: the reconstruction of the nation and the validation of its own legitimacy. This reconstruction will necessarily involve the country's forest and biodiversity resources. Perhaps then the lessons learned from decades of violence will come to fruition in national policy.

REFERENCES

- Álvarez, M.D. in press. Illicit crops and bird conservation priorities in Colombia. *Conservation Biology*.
- Bejarano, J.A., C. Echandía, R. Escobedo and E. León. 1997. Colombia: inseguridad, violencia y desempeño económico en las áreas rurales. Fondo Financiero de proyectos de Desarrollo-Universidad Externado de Colombia, Bogotá.
- Bryant, D., D. Nielsen, and L. Tangle. 1997. The last frontier forests: ecosystems and economies on the edge: what is the status of the world's remaining large, natural forest ecosystems?. World Resources Institute, Forest Frontiers Initiative, Washington, DC.
- Cavelier, J. and A. Etter. 1995. Deforestation of montane forest in Colombia as result of illegal plantations of opium (*Papaver somniferum*). Pp. 541-549 in P. Churchill, H. Baslev, E. Forero, and J.L. Luteyn (eds). Biodiversity and conservation of neotropical montane forests. New York Botanical Garden, Bronx, New York.
- Cavelier, J., T.M. Aide, C. Santos, A.M. Eusse, and J.M. Dupuy. 1998. The savannization of moist forests in the Sierra Nevada de Santa Marta, Colombia. *Journal of Biogeography*, no. 25:901-912.
- Chernick, M.W. 1998. The paramilitarization of the war in Colombia. *NACLA Report on the Americas* 31(5):28-33.
- Chernick, M.W. 2000. Elusive peace: Struggling against the logic of violence. *NACLA Report on the Americas* 34 (2):34-37.
- CI (Conservation International). (2000, July 13). Colombia Program Extended Overview [Overview]. Washington, DC. Conservation International Foundation. Retrieved March 16, 2001 from the World Wide Web: <http://www.conservation.org/web/fieldact/regions/TTAREG/colomb1.htm>
- Cubides, F. 1999. Los paramilitares y su estrategia. pp. 151- 199 in Llorente, M.V. and M. Deas (eds). Reconocer la guerra para construir la paz. Editorial Norma, Bogotá.
- Dávalos, L.M. 2001. The San Lucas mountain range in Colombia: how much conservation is owed to the violence? *Biodiversity and Conservation*, no. 10: 69-78.

- Echandía, C. 1999. Expansión territorial de las guerrillas colombianas: geografía, economía y violencia. pp. 99-149 in Llorente, M.V. and M. Deas (eds). Reconocer la guerra para construir la paz. Editorial Norma, Bogotá.
- ELN (Ejército de Liberación Nacional). 2001. Recursos Naturales [Announcement]. Unknown place: Ejército de Liberación Nacional. Retrieved 16 March, 2001 from the World Wide Web: http://www.eln-voces.com/f_todo_recursos.htm
- Etter, A. and W. van Wyngarden. 2000. Patterns of landscape transformation in Colombia, with emphasis in the Andean region. *Ambio* 27 (7):432-439.
- Etter, A. 1998. Mapa general de ecosistemas de Colombia. In: Informe Nacional sobre el Estado de la Biodiversidad 1997 Colombia. Instituto de Investigación de Recursos Biológicos Alejandro von Humboldt, PNUMA, Ministerio del Medio Ambiente, Bogotá.
- FARC (Fuerzas Armadas Revolucionarias de Colombia). 2001. La Amazonía objetivo del Imperio [Article]. Unknown Place: Fuerzas Armadas Revolucionarias de Colombia. 13 March. Retrieved March 16, 2001 from the World Wide Web: <http://www.farc-ep.org/>
- Henkel, R. 1995. Coca (*Erythroxylum coca*) cultivation, cocaine production, and biodiversity loss in the Chapare region of Bolivia. pp. 551-560 in Churchill, S.P., H. Balslev, E. Forero, and J.L. Luteyn (eds). Biodiversity and conservation of neotropical montane forests. The New York Botanical Garden, Bronx, New York.
- Human Rights Watch. 2000. COLOMBIA: The Ties That Bind: Colombia and Military-Paramilitary Links. Reports 12 (1B). [Report]. Human Rights Watch, New York. Retrieved March 16, 2001 from the World Wide Web: <http://www.hrw.org/reports/2000/colombia/>
- Kaimowitz, D. 1997. Factors determining low deforestation: the Bolivian Amazon. *Ambio* 26 (8):536-540.
- Kalmanovitz, S. 1994. Economía y nación: una breve historia de Colombia. CINEP, Universidad Nacional, Bogotá.
- Londoño, J.G. 2001. Colombia presenta nuevo mapa minero: Yacimientos de oro en zona de guerra. *El Tiempo*. March 12.
- Maserié, S.G. 2001. Colombia será certificada hoy: La coca crece 32% en zona de despeje. *El Tiempo*. March 1.
- McNeely, J.A., K.R. Miller, W.V. Reid, R.A. Mittermeier, and T.B. Werner. 1990. Conserving the world's biological diversity. The World Conservation Union, World Resources Institute, Conservation International, World Wildlife Fund, and The World Bank, Gland, Switzerland.
- Myers, N. 1989. Deforestation rates in tropical forests and their climatic implications. Friends of the Earth, London.
- Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca, and J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403: 853-858.
- Olson, D. and E. Dinerstein. 1998. The Global 200: A Representation Approach to Conserving the Earth's Most Biologically Valuable Ecoregions. *Conservation Biology* 12(3):502-515.
- Peñate, Andres. 1991. Arauca: politics and oil in a Colombian province. M.Sc. Thesis. St. Anthony's College-Oxford University, Oxford (UK). Cited in Echandía, C. 1999. Expansión territorial de las guerrillas colombianas: geografía, economía y violencia.

- pp. 99-149 in Llorente, M.V. and M. Deas (eds). Reconocer la guerra para construir la paz. Editorial Norma, Bogotá.
- Pizarro-Leongómez, E. 1996. Insurgencia sin revolución: la guerrilla colombiana en una perspectiva comparada. Tercer Mundo Editores, Bogotá.
- Presidencia de la Republica. 2001. Texto completo del reglamento para la zona de encuentro ELN [Announcement]. Bogotá: Gobierno Nacional de Colombia and ELN. Retrieved March 16, 2001 from the World Wide Web: <http://www.presidencia.gov.co/eln/index.htm>
- Reyes, A. 1999. Especial: 35 años de conflicto. Lecturas Dominicales. El Tiempo, 17 October.
- Ricardo, V.G., F. Valencia-Cossio, M.E. Mejía, N. Restrepo, R. Espinosa, R. Reyes, J. Gómez, and F. Ramírez. 2000. Agenda común por el cambio hacia una nueva Colombia. [Agenda]. Colombia: Gobierno Nacional de Colombia and FARC, 6 May. Retrieved March 16, 2001 from the World Wide Web: <http://www.dialogos.com.co/>
- Rincón, C. 1997. Estructura de la propiedad rural y mercado de tierras. Postgraduate Thesis. Universidad Nacional de Colombia, Bogotá.
- Robledo-Castillo, J.E. 1999. Neoliberalismo y desastre agropecuario. *Deslinde*, no. 25:32-49.
- Rodríguez, M. 1998. La reforma ambiental en Colombia: anotaciones para la historia de la gestión pública ambiental. Tercer Mundo Editores, Bogotá.
- Rodríguez, M., and E. Ponce. 1999. Financing the green plan ('Plan Verde') in Colombia: challenges and opportunities. Paper presented at the Workshop on Financing of sustainable forest management PROFOR, UNDP Programme on Forests, 11-13 October 1999, London.
- Stattersfield, A.J., M.J. Crosby, A.J. Long, and D.C. Wege. 1998. Endemic Bird Areas of the World: Priorities for Biodiversity Conservation. BirdLife Conservation Series No. 7, BirdLife International, Cambridge, UK.
- Tate, W. 2000. Repeating past mistakes: aiding counterinsurgency in Colombia. *NACLA Report on the Americas* 34 (2):16-19.
- UN-ODCCP (United Nations Office for Drug Control and Crime Prevention). 1999. Global illicit drug trends. UN Publication Series No. E 99 XI 15. United Nations, New York.
- Vargas-Meza, R. 1998. A military-paramilitary alliance besieges Colombia. *NACLA Report on the Americas* 32 (3):25-27.
- Vásquez-Ordoñez, R. La agricultura colombiana en 1996. *Agronomía Colombiana* XIV (2):158-181.
- Villaruel, J., J.H. Ochoa, J.M. Molina, L. Alvarado, J.L. Navarro, L. Bernal, L.E. Jaramillo, R. Salinas, C. Sánchez, H. Castro, and J. Buenaventura. 2000. Minerales estratégicos para el desarrollo de Colombia. UPME, Minercol, Ingeominas, Bogotá.
- Viña, A. and J. Cavelier. 1999. Deforestation rates (1938-1988) of tropical lowland forests on the Andean foothills of Colombia. *Biotrópica* 31(1):31-36.
- World Bank. 1999. Violence in Colombia: building sustainable peace and social capital. Report No. 1865-CO, The World Bank, Washington, DC.
- WRI (World Resources Institute). 1995. World resources 1994-1995: a guide to the global environment. World Resources Institute, Washington, DC.
- WRI. 1997. World resources 1996-1997: a guide to the global environment. World Resources Institute, Washington, DC.

- WRI. 2000. Facts and figures: country environmental data. World Resources Institute, Washington, DC.
- WWF (World Wide Fund for Nature). 2000. WWF's Latin America & Caribbean programme: Colombia [Program]. World Wide Fund for Nature, Washington, DC. Retrieved March 16, 2001 from the World Wide Web: <http://www.farc-ep.org/>
- Young, K.R. 1996. Threats to biological diversity caused by coca/cocaine deforestation. *Environmental Conservation* 23(1):7-15.