

Crops for illicit use and ecocide

Are illicit crops really the main cause of damage to the ecosystem in Colombia?

By Germán Andrés Quimbayo Ruiz

A comparative reflection on the impact of illicit crops, drug control policy and other sectors of the economy on ecosystems and the environment in Colombia

Foreword

According to the Colombian government, cocaine consumers are unaware of the ecological disaster caused by production of the alkaloid. If they knew that cocaine is perpetrating ecocide in the country that leads on world production of the drug – Colombia – they would stop consuming it. Based on this premise, the government has organised an information campaign called *Shared Responsibility*, which uses pictures and statistics to tell people about the destruction caused by coca and cocaine production in the country. The campaign, which has the support of the United Nations Office on Drugs and Crime (UNODC), amongst others, has mainly taken the form of a travelling exhibition that has visited different countries in Europe.

As a heading on its website, the campaign states that “The first source of air pollution in the Colombian jungle is smoke from the burning of trees to grow coca.” This indicates – right from the start and without any supporting analysis whatsoever – who the campaign believes is mainly to blame for the catastrophe: the small farmer who grows coca.

For decades, Colombia has been implementing supply-side strategies that aim to solve the problem of coca and cocaine production. These strategies have been ineffective and counter-productive. They have failed to reduce production, caused humanitarian

Recommendations

- Current drug control policy shares much of the blame for “ecocide” because it has encouraged the movement of crops from place to place. A new drug policy that managed at least to stabilise the areas where these crops are grown would in itself represent a success in the fight against crops for illicit use as far as their ecological repercussions are concerned.
- The fumigation with herbicides that has been practiced for decades in Colombia is another significant factor in environmental destruction. A drug policy that sought to act responsibly towards the environment would cease aerial spraying immediately.
- The government should reach agreements with rural communities to put socio-economic, environmental and ethical conditions in place, not just to demarcate the areas to be used to grow plants for narcotics, but also to avoid total dependence on the illegal economy.
- The small farmer who is dependent on an economy considered illicit lives in a zone of marginality, and this must be reversed. The decriminalisation of small and medium producers would facilitate dialogue with state institutions.
- With a view to environmental harm reduction, the rural communities involved in the production of illicit crops and the manufacture of narcotics should be provided with the information and training they need on the correct use of the herbicides and chemicals that are required in the process of producing the drug, in order to protect their health and the environment. The problem does not lie in coca itself or the growing of the crop. If there were alternative ways to produce coca safely and cleanly, these would be put in practice, thus reducing the impact of coca production on the environment.

crises and worsened the armed conflict that has afflicted the country for so long.¹ In response to the failure of policies to reduce the supply, the government has started to insist that consumer countries need to strengthen policies to curb the demand. This is where the Shared Responsibility campaign seeks to play a role. Again without any analysis whatsoever, it focuses on the other scapegoat in this affair: the consumer.

And so the small farmer and the consumer are portrayed as sharing responsibility for ecocide. This ignores the complexity of a problem that is global in scope and involves numerous different players on both the legal and the illegal sides.

Equally striking is the touch of naïveté that seems to have inspired a campaign like this, as it tries to dissuade consumers from a product in such high demand as cocaine with a moralistic argument. Since when have people stopped consuming something because they discover that it comes from a “bad” source? Western society consumes vast quantities of all sorts of legal products even though, in many cases, it is well known that they are produced in conditions that are damaging to the environment, or are harmful to nature, or include toxic chemicals.

Unfortunately, knowing this does not necessarily lead to a reduction in consumption of these products. It is true, however, that consumers hope that things will be produced cleanly. Meanwhile they continue to consume them in whatever state they reach the market. Drug users, whether occasional or habitual, will not be deterred by pictures of the ecocide caused by coca, however bad. They would, on the other hand, be comforted to know that the cocaine they are snorting, smoking or injecting was produced safely, without damaging either the place where it was produced or the people who produced it.

Although coca crops are responsible for a percentage of the deforestation that is happening in Colombia, coca is not the main cause of deforestation in the country, as this paper by the Colombian ecologist Germán Andrés Quimbayo Ruiz makes clear. A 2005 FAO report² points to the growth of cattle

“When civilisation’s response to a subject as delicate, complex and rich in lessons as drugs is simply to repress it, everything is reduced to a sordid matter of policing. They even end up making us believe that the plants themselves are to blame, and that the solution to this vast problem is to fumigate crops, poisoning the immense variety of creatures which live in an ecosystem, including human beings, in the process.”

William Ospina³

farming as one of the main causes of the destruction of tropical forests in Latin America (including Colombia), damaging the region’s ecosystems irreversibly. The export-oriented extractive industries are also extremely harmful to Colombia’s megadiversity. In this context, coca, opium poppy and marihuana crops are just one of many hundreds of unsustainable products and irrational use of natural resources.

Furthermore, deforestation and other serious environmental consequences caused by coca growing and cocaine production are the result of drug control policies applied by the Colombian government with the support of the United States, which have encouraged an expansion in these crops and pushed them further and further into the forest.

An appropriate policy to address the problem of illicit crops – along with drug production, trafficking and consumption – could help to prevent the tremendous impact that the production of coca and opium poppy is currently having on the environment. A genuine debate with a view to reformulating current drug policy would be much more useful than the strategy of pointing the finger and apportioning blame.

INTRODUCTION

Colombia is one of the countries with the highest biodiversity per square kilometre in the world, to such an extent that it is considered worldwide as a “megadiverse” country. But the country is also afflicted by a social and armed conflict that is one of the most complex in the western hemisphere. As part of this conflict, drug trafficking has made a

major contribution to the serious humanitarian and ecological disasters of the last few decades.

Coca and cocaine production has led to the destruction of the ecosystem in vast areas of forest, including in protected areas (national parks and nature reserves) that are often home to indigenous peoples, African-descent communities and traditional rural communities who hold collective titles to their territory. The war associated with drug trafficking has had a significant impact on these communities and their biodiverse environments.

Added to this are the actions resulting from the government's drug control policy, such as the forced eradication of crops destined for illicit use. This has failed to achieve its objective and only worsened the conflict, because it is limited to the exercise of police and military control that forces crops to move elsewhere but does not really eradicate them. Furthermore, the presence of armed groups – coupled with the historic absence of the Colombian state in the conflict zones – has led to the harmful involvement of the weakest and most vulnerable rural communities in the first stages of the drug trafficking chain, as they have no real alternatives for integrated development or fully guaranteed ownership of their territory.

In response to a campaign by the current Colombian government, known internationally as Shared Responsibility,⁴ which demonises coca leaf and lays the blame on the small farmer who grows it, the aim of this paper is firstly to raise public awareness about the damage caused to the ecosystem by the growing of coca leaf for illicit use in Colombia (under the illegal conditions in which it takes place), in the context of a drug control policy that has proved to be ineffective and has included controversial strategies to eradicate and control crops destined for illicit use. Secondly, the paper compares this with the impact of other types of agriculture and livestock farming in the country, in terms of changes to ecosystems and effects on biodiversity in Colombia.

Based on an ecological analysis and using information from official documents,

academic research and reports by non-governmental organisations, the paper makes some general contributions to the debate about drug control policy. Its aim is to help to arrive at integrated solutions that take into account the arguments for harm reduction in the process of growing crops for illicit use and enable the foundations to be laid for integrated human development in a democratic policy framework.

Armed conflict, narcotics and drug policy in Colombia

Social inequalities, the concentration of wealth and land ownership in the hands of a few, the forced displacement of the rural population, and drug trafficking – these are some of the factors that have come together to debase a society riven by conflict, where the main victims are the most vulnerable people in the country: rural, indigenous and African-descent communities.

In the words of the Colombian researcher César Ortiz, “...the reforms and the increasing complexity of the agrarian problem are internal factors that have created the ideal setting for the appearance and sustainability of illicit crops in Colombia, as well as giving rise to the various changes and alterations that have taken place in the agrarian structure and the economic and social situation of both the rural and the urban population... The illicit crops in turn are reinforcing and accelerating these changes, and thus a complex web of causes and effects is taking shape.”⁵

These causes and effects are the social and political conflicts faced by these rural communities as a result of a phenomenon – drug trafficking – that is global in scope. But drug trafficking has not only helped to unleash a series of violent social and political conflicts; it has also created a number of long-term negative impacts, including on the ecological and environmental wealth that the country provides, not just to its own society but to the world as a whole.

The drug control policies adopted by Colombia have followed the guidelines laid down by the United States government, particularly since the launch of Plan Colombia in the year

2000.⁶ Starting in the early 1970s, a series of strategies to eradicate crops for illicit use have involved the deployment of herbicides as a weapon in the fight against drugs. Around 1978, Colombia began the spraying of Paraquat on the Sierra Nevada de Santa Marta⁷ – a region whose ecosystems are of immense value to humanity – to destroy marihuana crops. Roundup (glyphosate + POEA) started to be used on opium poppy crops in Tolima and Huila in 1984. Its use was later extended to coca as well.⁸

These strategies have proven to be ineffective in eliminating and eradicating crops for illicit use, as the statistics on these crops demonstrate. The government has also persisted with strictly military controls and crop eradication at all costs, ignoring the social impact these measures might have on the conservation of biodiversity in ecological terms.

Colombia – a “megadiverse” country: the state of ecosystems and biodiversity in the country

Colombia is considered by different international conservation bodies as one of the 19 megadiverse countries, meaning those that have the highest levels of biodiversity on the planet.⁹ Although it covers a relatively small area of land, it is home to 10 per cent of the biodiversity of plants and animals in the whole world.

The country’s geographical position and the geomorphology of its territory have shaped a diverse and complex natural world, with the presence of different types of ecosystems and a considerable number of endemic species.¹⁰ Because of these factors, Colombia’s biodiversity tends to be very vulnerable to pressures caused by human activity.

In Colombia the Andes mountain range divides into three vast chains, forming a whole array of mountain landscapes, inter-peak valleys, high plains and a variety of other landscapes and environments where biodiversity is at its highest. The country also has extensive flood plains and tropical forests, whose respective rivers feed into the Orinoco and the Amazon basins, and two long coastlines bordering the Pacific Ocean and the Carib-

bean Sea, with their own particular ecosystems. The complexity of Colombia’s landscape, with its unique wealth of ecosystems, has shaped a diversity of cultural expressions in the social construction of the territory of hundreds of communities.

The country is divided into six natural regions: the Andean, Pacific, Caribbean, Orinoco, Amazon and island regions. Between them, they contain perhaps the highest diversity of ecological environments in a single area in the whole world. According to the Alexander von Humboldt Biological Resources Research Institute (hereinafter IAvH),¹¹ although there are no detailed or complete biological inventories for Colombia, it is known that in terms of species it is considered the country with the fourth highest level of biodiversity in the world. In terms of taxonomic groups, it is the country with the second richest biodiversity in plants, the richest in amphibians and birds, the third richest in reptiles and the fifth richest in mammals¹² (see Table 1).

The country also has a National System of Protected Areas (SINAP), comprising all the protected areas (public, private and community-owned, and managed at the national, regional and local levels), social groups, along with the management strategies and instruments that connect them. The system brings them together to contribute jointly to the fulfilment of the conservation objectives that the country seeks to achieve.¹³ The most valued element of the SINAP¹⁴ is the National System of National Parks (SPNN),¹⁵ which is managed by the Special Administrative Office for National Parks (UAESPNN). It is expected that at least six new areas will be declared part of the SPNN in 2008.¹⁶

THE NEGATIVE IMPACT OF CROPS FOR ILLICIT USE IN COLOMBIA

Before describing the context and analysing this issue in detail, it is useful to look briefly at the level of ecological change that has occurred in the country. This process is closely linked to the model of land ownership in Colombia in social, economic and political terms. It is not limited to the problem of drug trafficking, but relates to processes that are even included in national public policies.

PLANTS	AMPHIBIANS	REPTILES	BIRDS	MAMMALS
Brazil	Colombia	Australia	Colombia	Brazil
53,000	698-733	755	1865	523
Colombia	Brazil	Mexico	Peru	Indonesia
41,000	517	717	1703	515
Indonesia	Ecuador	Colombia	Brazil	Mexico
35,000	407	524	1622	502
China	Mexico	Indonesia	Ecuador	China
28,000	284	511	1559	499
Mexico	China	Brazil	Indonesia	Colombia
26,000	274	468	1531	471

Table 1. Record of biodiversity in Colombia by the most representative taxonomic groups, compared with other megadiverse countries. Adapted from Romero et al. (2008)

The impact of human activities on ecosystems and their associated biodiversity

At present, four main processes that alter land use and ecosystems are under way in countries like Colombia: 1) agricultural land expansion; 2) the intensification of agriculture in highly productive and easily accessible areas; 3) urbanisation. The fourth process, (4) abandonment of marginal land, is a phenomenon that is barely beginning.¹⁷ In an astute study, the Colombian researcher Germán Márquez states that in the space of 50 years, the destruction and alteration of ecosystems due to human settlement in Colombia has systematically affected almost all the ecosystems in the country and their associated biodiversity.¹⁸ As we will see below, this trend seems to be getting worse.

Another study states that natural ecosystems have been altered on 48.6% of the land in Colombia, and that 350,000 hectares are destroyed every year. According to the report, this figure is on the increase.¹⁹ Of the 337 types of ecosystem that have been identified in Colombia, 10 ecosystems have already disappeared and 49 have been at least 90% altered.

Currently, there are high levels of alteration of ecosystems in more than a third of the country's land.²⁰ Some 70% of the Andean region (the region where most of the coun-

try's population lives) and over 30% of all forests at altitudes of less than 500 metres have been altered. About 35% of the Pacific region – considered one of the most biodiverse areas in the world – has been affected by human activity, as has 12% of the Colombian Amazon region, although 65% of this region is still intact.²¹

Other sources state that 42% of the logging that takes place in the country is illegal, 50% of the soil is eroded to some extent, and 45% of the land is used for purposes other than what it is suitable for, whether this be agriculture, livestock farming or conservation.²² This has to do with the historic failure to apply clear land management and environmental policies in the country, to ensure territories and ecosystems are used for what they are best suited.

Activities such as agriculture, mining and cattle farming, amongst others, together cause a negative impact on the structure and composition of natural ecosystems and thus on their biodiversity.²³ Pressure is exerted as a result of both the use of ecological services by production activities per se and the tendency to move into areas with natural vegetation when different economic activities are undergoing a process of expansion.²⁴

Jesús Orlando Rangel, an eminent Colombian biologist and environmentalist who works for

Department	Amount of coca in 2007 (hectares)	Increase/Reduction (2006-2007) (%)	Total area eradicated in 2007 (hectares)	Total amount of crops detected 1999-2007 (hectares)	Total fumigated 1999-2007 (hectares)	Total eradicated manually 2005-2007 (hectares)	Protected areas with suspected presence of crops for illicit use
Nariño	20259	+30%	51087	117449	254607	27529	Sanquianga National Park
Putumayo	14183	+21%	51228	233139	213771	31123	La Paya National Park
Meta	10386	-6%	19292	113462	75144	9679	Serranía de la Macarena and Tinigua National Parks
Antioquia	9926	+61%	33185	44330	92376	10950	Paramillo National Park
Guaviare	9299	-2%	11992	152354	146215	4033	Nukak Nature Reserve
Vichada	7218	+31%	7783	48088	17035	708	El Tuparro National Park
Caquetá	6318	+27%	5861	103252	93093	2,152	None
Bolívar	5632	+136%	7564	38972	38941	2,654	None
Cauca	4168	+98%	5368	27812	17908	7,368	Munchique National Park
Arauca	2116	+62%	3355	13337	23749	1248	None
Norte de Santander	1946	+299%	4121	49309	53855	5,295	Catatumbo-Bari National Park

Table 2: Status of coca leaf crops for illicit use in 2007, by department. Source: Figures from UNODC (2008); Adam Isacson (2008)²⁵. Table compiled by the author.

the National University's Science Institute, recently sounded the alarm by stating that the area of forest chopped down in a single day – either in order to sell the wood or to clear land for extensive agriculture and to plant crops for illicit use – is the size of 2,340 football pitches. Rangel also states that 598,000 hectares of forest (equivalent to 854,000 football pitches) are lost every year in Colombia, at an average rate of 1,638 hectares per day.²⁶ In this scenario of destruction, it is also said that 500 species of plants are already under some level of threat in Colombia. Many of these have not even been identified, and the number of plants lost is higher than the number that seed themselves. Organisations like IAvH go further and state that 2,500 species of plants are endangered, including several endemic species such as various types and species of espeletia, zamias and palms.

These economic and land appropriation activities by humans take on new meanings in a scenario of social and armed conflict like that which affects Colombia. As the processes that alter ecosystems continue and ecological and environmental deterioration worsens, the scarcity of natural resources and the need to replace them with artificial substitutes will increase.²⁷

The impact of crops for illicit use on the health of the ecosystem

In the last few years it has been clearly identified that the planting of crops for illicit use in Colombia has been one of the major agents of change that has had the most impact on ecosystems and their associated biodiversity, changes in land use and the drying up (or deterioration) of water sources.²⁸ These crops

have directly affected vast areas of forest and jungle, as many of them are planted on land far away from conventional productive activities and camouflaged in forested areas.²⁹

The report on coca crops for illicit use published in June 2008 by the United Nations Office on Drugs and Crime (UNODC) states that the amount of these crops grown in Colombia rose by 27% in 2007 - from 78,000 hectares in 2006 to 99,000 in 2007. This is the first significant increase in the last four years. Nariño was the department with the largest increase in the country, with a rise of 30% (more than 20,000 hectares) (see Table 2).

The phenomenon in which these crops increase usually follows a process that starts with people moving to forested or protected areas. This leads to the mass destruction of natural ecosystems through the cutting down and burning of primary vegetation, and then the planting of the crop.

Some of the areas most affected by the spread of crops for illicit use in Colombia are the tropical rainforest ecosystem in the River Magdalena valley, the piedmont forests on the Pacific coast (Department of Nariño), and the Amazon rainforest (departments of Nariño and Putumayo).³⁰ All these regions are well known to be areas with a high level of biodiversity and several endemic species.

Several studies have also been carried out on the negative impact that the spread of crops for illicit use is having on a taxonomic group that is key to Colombia's biodiversity: birds.³¹ The areas of highest priority for the conservation of birds affected by illicit crops are the southern Colombian Andes, the northern section of the western mountain range, the lowlands near the Darién, the Sierra Nevada de Santa Marta, the Serranía del Perijá, and the Serranía de San Lucas (central mountain range). The largest areas of forest threatened by illicit crops are in the Amazon region and the Amazon piedmont of the eastern mountain range. All these areas have considerable numbers of endemic species and may contain several of the world's most diverse and unique ecosystems, as they combine elements of various natural regions.

The presence of crops for illicit use in both

National Parks	2004	2005	2006	2007
Nukak	1.043	930	779	1.370
Sierra Macarena	2.707	3.354	1.689	1.258
Paramillo	461	686	236	420
La Paya	230	728	527	358
Sierra Nevada	241	95	119	94
Tinigua	387	155	122	63
Munchique	8	13	6	55
Sanquianga	-	-	-	41
Catatumbo-Bari	107	55	22	38
Puinawai	139	60	41	26
El Tuparro	-	-	-	14
Yariquies	-	2	4	12
Utría	-	-	-	12
Alto Fragua	14	25	1	5
Los Picachos	15	7	6	3
El Cocuy	-	-	2	1
S. de Florencia	-	-	2	-
Farallones	-	-	-	-
Tayrona	1	-	-	-
Total	5.400	6.100	3.600	3.800

Table 3. *Coca cultivation in National Parks (ha) 2004-2007. UNODC*

national parks and indigenous territories has been monitored by the ICMP³² since 2001 (see Table 3). In 2007 coca crops were found in 16 of Colombia's 53 national parks. The area planted with coca crops (3,770 hectares in 2007) is equivalent to 0.02% of the total area covered by the national parks and 4% of the total area planted with coca crops that year.

The total amount of coca grown in national parks increased by 6% between 2006 and 2007. This rise is mainly due to the increase in these crops in the following parks: Nukak (+591 hectares or +75%), Paramillo (+184 hectares or +78%) and Munchique (+49 or 81%). In most of the other parks, the amount of coca grown has diminished. However, the El Tuparro, Sanquianga and Utría parks have been affected for the first time.³³ (See Table 3)

Commercial name	Active ingredient	Toxicological classification
Herbicides		
Anikilamine	2,4 D	I LD Oral: 699 mg/kg
Gramoxone	Paraquat	I LD Oral 150 mg/kg
Round up	Glyphosate	IV LD Oral: 4500 mg/kg
Insecticides		
Lorsband	Chlorpyrifos and Cypermetrine	II Organophosphate
Karate EC	Lambda cialotrine	III Pyrethroid
Endosulfan	Endosulfan	I Benzodioxathiepin
Fungicides		
Benlate	Benomil	III Benzimidazole
Dithane	Mancozeb	III Dithiocarbamate
Manzate	Mancozeb	III Dithiocarbamate
Toxicological categories (according to the Colombian Ministry of Health, 2001):		
I: Extremely toxic	IV: Slightly toxic	
II: Highly toxic	LD = Oral lethal dose	
III: Moderately toxic		

Table 4. Chemicals used to grow coca crops for illicit use. Source: Uribe, 2001 in Ramos & Ramos, 2002

Due to their zones of impact, in which large quantities of coca crops have been planted because of their proximity to rivers, the region between the La Macarena National Park and the Nukak Nature Reserve is where the fragmentation of local ecosystems and changes are taking place most rapidly.³⁴ At a rate that may be slower, but constant, the Serranía del Chiribiquete National Park could be witnessing a process of change due to human activity that has probably already altered local biodiversity, especially near the northern edge of this protected area due to the influence of the nearby municipality of Miraflores, Guaviare.

In the Amazon region of Colombia as a whole, several studies report that crops for illegal use (mainly coca leaf) are having a high impact on the process of change in the region

and altering its spatial configuration. They are also the main driver of human settlement in the area.³⁵

The planting of crops of this sort in the strategic ecosystems of regions like the Amazon, Orinoco or Andes does not differ greatly from the introduction of other legal crops such as potatoes, yuca, rice, sugar cane, maize and certain vegetables. The growing of this type of crops has caused serious negative impacts, usually due to the use of environmentally unsustainable farming techniques and practices that start with the chopping down of forests and end with cattle farming or monocrop agriculture. This is highly dependent on the use of pesticides (insecticides, herbicides, fungicides) and chemical fertilizers.³⁶ These are absorbed by the soil and alter not only its physical and

Coca leaf + alkaline (lime / sodium /bicarbonate / cement) + kerosene + sulphuric acid = **Cocaine base paste**

Cocaine base paste + potassium permanganate + sulphuric / hydrochloric acid + ammonia = **Cocaine base**

Cocaine base + acetone / ether + hydrochloric acid + potassium permanganate = **Cocaine Hydrochloride**

chemical composition but also the micro-organisms present in the soil. Water quality is also damaged when residues of these chemicals reach bodies of water, especially rivers (see Table 4).

The processing of coca leaf begins by adding precursor chemicals to extract the active ingredients in the plant. These chemicals are also disposed of in water courses.³⁷ This processing of coca leaf is carried out with the aim of obtaining coca paste, cocaine base, basuco and cocaine chlorhydrate (or cocaine).³⁸ These products are obtained through processes to extract and purify the alkaloids present in coca leaf, which are no more than 2% of the total vegetable matter in the leaf.³⁹ Right from the start, then, the process involves the unjustifiable use of chemicals that are extremely toxic both to human health and to the ecosystem.

Colombia has seized about 16.2 million gallons of liquid precursor chemicals (acetone, hydrochloric acid, etc) and 17.6 million kilograms of solid precursor chemicals (such as potassium permanganate, sodium carbonate and others).⁴⁰ These seizures, however, have given rise to another problem for the country which has not been sufficiently addressed: the pollution of the environment due to the destruction of these chemicals in the open air by the Anti-Narcotics Police.⁴¹

Aside from the effects of planting and processing coca leaf, the greatest environmental impact of growing coca is caused by the fact that it moves from place to place in response to eradication policies.⁴² This is something that has rarely been questioned officially or scientifically in Colombia.

Forced eradication and its impact on ecosystems and society

The fumigation of crops intended for illicit use, as an “eradication” strategy, has given rise to a phenomenon that aggravates the pollution of the ecosystem caused by the monocropping and processing of coca leaf. Processes such as the destruction of ecological niches and the genetic stock in local biodiversity, erosion, the pollution and

drying up of water sources, forest clearance and the disappearance of endemic species are caused by the destruction of the forest as a result of crops shifting from place to place.⁴³

Over the last few years, the fumigation of “illicit” crops has meant that they have moved to new, more isolated areas of forest and forced people to penetrate more inaccessible regions rich in biodiversity, such as protected areas.⁴⁴ The effect of the aerial spraying of crops for illicit use has been amply documented.⁴⁵ Fumigation not only affects the areas where crops for illicit use are grown, but adjacent areas as well, as wind and rain spread the chemicals. This affects people, their farm land, the soil, bodies of water and consequently large groups of wildlife, mainly mammals, insects, amphibians and fish.

Spraying uses a broad-spectrum herbicide compound⁴⁶. A critical analysis of spraying should focus on the negative impact of glyphosate surfactants⁴⁷ and avoid falling into the trap of a cause-and-effect-type protest against fumigation, because the negative effects of fumigation unleash a series of multiple causalities that go beyond the post-fumigation sickness which affects people.

For the last few years the Colombian government has maintained a firm position in defence of fumigation “as and when necessary,” despite opposition not just from environmentalists and social organisations but also from institutions such as the UNODC itself. The government’s position might be the result of the influence that Plan Colombia has had on the “fight against drugs” and the country’s drug control policy in general. This strategy has mechanisms such as the Programme to Eradicate Illicit Crops with Glyphosate (PECIG), which involves fumigation using this herbicide and its surfactants.

The PECIG should comply with an Environmental Management Plan in conformance with Colombian law and the United Nations Convention against the Illicit Traffic in Narcotic Drugs and Psychotropic Substances. Both require that eradication measures protect ecosystems and the environment. In 2003, however, Colombia’s Ministry of the Environment, Housing and Territorial

Development altered the terms of the PECIG Environmental Management Plan and lifted the ban on spraying in areas that are part of the National System of National Parks, as well as increasing the altitude of fumigation flights. This caused a national-level controversy that even reached the courts.⁴⁸

Seeking “scientific” backing, the Colombian government also commissioned a study of glyphosate from the Inter-American Drug Abuse Control Commission at the Organisation of American States (CICAD-OAS).⁴⁹ The CICAD report has been harshly criticised, not just for its lack of independent opinion but also for its biased design and research approach. This was pointed out at the time by the Institute of Environmental Studies (IDEA) at the National University of Colombia.⁵⁰

Remarkably, in 2006 the Colombian government radicalised its stance to allow fumigation in the country’s national parks where crops for illicit use were being grown. This was achieved after a tragic incident during the manual eradication operations that the Colombian government was carrying out in the Sanquianga and La Macarena national parks. A group of manual eradicators supported by the police fell victim to an ambush attributed by the government to FARC guerrillas in the La Macarena national park. Although manual eradication was proving to be a very effective method and had been producing some results, the government decided to fumigate. TNI expert Ricardo Vargas pointed out at the time that the decision to fumigate was part of a warlike response instead of proposing an integrated policy to control crops for illicit use.⁵¹

In this regard, it is worth highlighting and reviewing a study carried out as a result of the fumigations on the border between Colombia and Ecuador, which led to a diplomatic row following the complaints made by both the Ecuadorian government and environmental and social organisations about the serious impact of these “eradication” operations in border areas near Ecuador.⁵² This is the Report of the Ecuadorian Scientific Commission (2007), which adopted “an integrated model of interpretation to avoid the scientific

error of the reductionist notion that glyphosate causes sickness, and which reveal the scientific and ethical errors made by those who advocate aerial spraying, documenting international scientific evidence of the dangers of this spraying and presenting evidence of its impact, gathered from Ecuadorian organisations in the border communities that have been attacked in this way.” Nevertheless, and despite the humanistic and social scientific value of the study, it would have been useful (at least from the comparative point of view) to have information about the effects of chemicals and herbicides used in the production and processing of coca leaf as well.

In any case, the impact on the health of the ecosystem is incalculable. There is often uncertainty about the real extent of the effects these measures might have on ecosystem conservation, not to mention the impact they might have on human health (understood in all its dimensions, both physical and psychological), domestic animals, small-scale farming systems and the environment in general, and the fact that they have a considerable impact on the weakest and most vulnerable people in society: small farmers and indigenous communities.

Despite all the evidence, actions and legislation against fumigation, the Colombian government is currently continuing with a policy that combines manual eradication with fumigation in protected areas and even indigenous reserves, where several rural communities have reported constant spraying and damage to the environment,⁵³ especially in Nariño, Putumayo, Meta, Guaviare and the Sierra Nevada de Santa Marta.⁵⁴

Incidents have recently been reported on the border in the Pacific coast area (Tumaco – Northern Ecuador), regarding the damage to small farmers’ crops caused by fumigation.⁵⁵

Finally, it is important to mention that countries like Peru and Bolivia do not apply a fumigation strategy to eradicate their illicit crops. Thanks to this, these countries do not suffer from the large-scale moving around of crops that happens in Colombia, which has had such serious consequences for the ecosystems in the Amazon and Orinoco regions. In

contrast to other parts of the country, these regions in particular do not have clear borders or administrative demarcations. They are characterised by the comprehensive absence of the state and the presence of para-state entities (controlled by illegal groups such as guerrillas and paramilitaries associated with drug trafficking), which has led to a situation of ungovernability. These are also vast regions with a high level of connectivity between areas of forest.

All these factors, together with the drug control policies adopted by Colombia (which include fumigation), have led to the current situation in which forest ecosystems are the main “victims” of the shifting around of crops for illicit use and the methods used to eradicate them.⁵⁶

THE NEGATIVE IMPACT OF OTHER TYPES OF AGRICULTURE AND LIVESTOCK FARMING IN COLOMBIA

Is coca really the main cause of damage to the ecosystem in Colombia?

The scale of movement of crops for illicit use from place to place as a result of drug control policies and the multiplication of their effects in terms of deforestation has been a cause of great concern for many different organisations.⁵⁷ The actions associated with this phenomenon in Colombia are mainly unplanned. Their aim is not only to plant crops of this type but also to clear grazing land for livestock farming. In other words, deforestation in Colombia has taken place depending on the potential use of the land or its strategic value.

Potential land use and its associated damage

A study of the zoning of land and its potential different uses in Colombia⁵⁸ defined the following categories and their distribution in the country:

Land suitable for agriculture (including silvoagricultural⁵⁹ uses): an area of 21,493,538 hectares in total, equivalent to 18.9% of the country’s land.

Land suitable for agroforestry (agrosilvo-pastoral use): an area of 6,908,398 hectares in total, equivalent to 6.1% of the country’s land.

Land suitable for livestock farming (including silvopastoral uses): an area of 14,223,774 hectares in total, equivalent to 12.5% of the country’s land.

Land suitable for forestry (production or protection): an area of 21,591,025 hectares in total, equivalent to 19% of the country’s land.

Land for conservation (the vast majority of which are areas suitable for forest protection and areas for the conservation and restoration of water and hydrobiological resources): an area of 49,652,300 in total, equivalent to 43.6% of the country’s land.

More than 60% of the land that has been used for farming and extractive industries is the subject of conflicts of differing levels of intensity. These concern both the over-use and the under-use of the land, although they tend to be more over the former than the latter. The amount of land being used appropriately is equivalent to 37.7% of the total area of land put to use in the country (approximately 22,669,660 hectares) and 19.9% of Colombia’s total land. 48% of the country’s total land is unaffected by conflicts, because it is land that has been used very little or not at all.⁶⁰

Clearly, the country still has a large amount of land that has not been greatly affected by the human population. This means that Colombia continues to hold invaluable ecological wealth that must be defended at all costs. Public policies need to apply precautionary principles in terms of the conservation of these areas. The current tendency to transform land to bring it into use in the country, however, could place this under threat.

Leading on from this, it is worth asking questions about the impact that the actions of Colombian society as a whole have had on ecosystems. As mentioned earlier, this is part of a comprehensive model of appropriating land and its associated ecological wealth. To a great extent, this model seems to derive from the historic exercise of social and political

control, not just by illegal groups but by the Colombian establishment itself.

The development of new national policies aimed at promoting permanent crops could obviously lead to an increase in deforestation. We will now go on to summarise some of the ecological and environmental impacts caused by certain of the country's productive sectors such as agriculture and livestock farming, in contrast to illegal activities that form part of the drug trafficking process. In order to do this, we will look at three specific cases that illustrate this phenomenon: extensive cattle farming, African palm crops and conflicts related to water in Colombia.

The impact of extensive cattle farming in Colombia

One activity that has led to the large-scale sacrifice of natural ecosystems and vast areas of forest is livestock farming, especially in its extensive form. It is therefore a significant cause of deforestation in the country.

Likewise, it has affected a considerable number of ecosystems, from the high mountains to the savannah. Livestock grazing systems in Colombia are heavily dominated by bovine species,⁶¹ and the analysis will therefore focus on this type of cattle farming.

In comparative terms, the land used to grow crops in Colombia is less than a fifth of the country's territory, while more than four fifths of the land currently being used is for livestock farming. There has historically been a close relationship between a low density rural population and a high level of transformation of ecosystems to create grazing land for livestock in the country. This pattern is even more marked in the lowlands at altitudes of less than one thousand metres, while the Colombian Andes have seen shocking changes in 60 years (during the 20th century), with transformation rates of more than 90%.⁶²

In much of Colombia, extensive cattle farming on large estates is the main activity. This situation has worsened in some regions due to the forced displacement of the rural population caused by the actions of illegal armed groups and drug trafficking.⁶³ Cattle

farming in settlement areas in the tropical rainforest, for example, is principally a way to occupy land rather than a form of production.⁶⁴ This pattern continues today in areas where crops for illicit use have usually been present.

In environmental terms this type of (extensive) cattle farming is an inefficient way to use the land. The human population density is very low – barely higher than in the forest itself – while the ecological impact is immense.⁶⁵ The environmental outcome of this process in Colombia could not be worse: loss of forests, degradation of ecosystems, and changes in human territoriality.⁶⁶

As most cattle are raised for the Colombian market, their ecological footprint is caused by the domestic consumption of beef products. Although the immediate and medium-term impact of cattle farming on ecosystems is huge, little is yet known about its long term effects on biodiversity and ecological processes.⁶⁷

The environmental impacts of cattle farming not only involve deforestation to clear land for grazing, but are also caused by the livestock grazing itself. The following negative environmental impacts have been identified:⁶⁸ soil erosion and compaction; genetic uniformity as the monocropping of grassland is given priority, including seasonal burning and the removal of vegetation growth by chemical (herbicides) or physical means; the drying up of wetlands; the building of access roads; the growing demand for wood for fences, livestock pens and cattle trucks; water and soil pollution caused by artificial fertilisers and pesticides, and the gas emissions produced by the burning of fuel during the transport of live animals or animal products by land or by river.

The advance of the African palm in Colombia: an exceptional case in farming

The impacts of large-scale projects to grow crops to produce agrofuels⁶⁹ have already been amply documented, not just in Colombia⁷⁰ but also worldwide.⁷¹ These crops include the African palm, which is specifically

used to produce biodiesel. Most of the impacts are related to the farming system employed to implement these projects, involving the use of techniques associated with monocropping which result in a high impact on the ecosystem and society, under the false “ecological” and environmental justice discourse.

With regard to palm crops, the IAvH itself reported in the year 2000⁷² that palm plantations are not forests but uniform ecosystems that replace natural ecosystems and their biodiversity. The impacts this causes include effects on the local water system (water production), changes to soil structure and composition, and disruption of the abundance and composition of wildlife and plant species. The environmental basis of local people’s livelihoods is lost, and in some cases local rural communities (the majority of whom are African-descent and indigenous) are forced to move away.

Having been grown for five decades, oil palm is a crop that is consolidating its presence in the country. In 2006 it occupied an area of 301,000 hectares of land, with sustained growth over the last ten years both in the area planted (an increase of 8.5% per year on average) and in the amount of oil produced (5.9%). Colombia is currently the main producer in the Americas and the fifth largest producer in the world.⁷³

The pressure on strategic ecosystems caused by African palm crops is clearly evident in the departments where the land is most suited for forest cover and conservation, which currently account for a large percentage of the area planted. However, the figures proposed in the plans to expand this type of farming system are even more alarming. These plans follow the model applied in countries such as Indonesia and Malaysia, where the cost of biodiesel has been the almost total destruction of these countries’ rainforests.⁷⁴ (See Table 5)

Damage to water quality in Colombia: a special case

Although the growing and processing of coca leaf has caused serious damage to sources and bodies of water in strategic ecosystems, several of the activities of the country’s most

Departments ⁷⁷	Forest cover	Area planted 2005 (hectares)	%
Bolívar	1	3,560	1.5
Casanare	1	11,983	5.1
Cesar	1	32,669	13.8
Córdoba	1	0	-
Cundinamarca	1	3,189	1.3
La Guajira	1	328	0.1
Magdalena	1	28,683	12.1
Santander	1	45,842	19.3
Antioquia	2	354	0.1
N. de Santander	2	3,743	1.6
Meta	3	74,950	31.6
Caquetá	4	385	0.2
Chocó	4	3,245	1.4
Nariño	4	28,000	11.8
Guaviare	4	0	
Putumayo	4	0	
Vichada	4	0	
		236,931	100

Table 5. Area of land planted with oil palm in Colombia in 2005. Adapted from Pérez-Rincón, 2008. Original source: Minagricultura and Departamento Nacional de Planeación (DNP) (2007).

Forest cover: 1) Forested area less than 25%; 2) Forested area less than 40%; 3) Forested area less than 60%; 4) Forested area more than 80% of the land.

typical productive sectors have had an impact that is perhaps even greater than that caused by these illegal activities related to drug trafficking. Agriculture (farming methods and agroindustry) in Colombia, for example, is one of the largest consumers of water in the country and by far the leading culprit in the deterioration of water resources.⁷⁵

The situations triggering problems related to the quality of the water have already been clearly identified: 1) deterioration due to pollution and sedimentation, caused by farming and agroindustry in particular; 2) shortcomings in the management of water resources and the technical handling of irrigation districts and installations.⁷⁶ With

Ecological and environmental effects caused by water misuse in Colombia (INAT, 2001, in León, 2007)		
Ecological effects	Biophysical effects	Environmental effects
<ul style="list-style-type: none"> * Loss of strategic ecosystems due to the drying up of wetlands and swamps * Reduction in the associated biodiversity * Changes to local water systems 	<ul style="list-style-type: none"> * General physical changes to the soil: erosion at every level, compaction, rise in the water table * General chemical changes to the soil: salinisation, sodification 	<ul style="list-style-type: none"> * Changes to the landscape * Reduction in fish stocks * Environmental degradation in general: pollution of aquifers and surface bodies of water, presence of pathogens, etc.

Table 6 – Summary of some of the effects caused by water misuse in Colombia

regard to this latter problem, irrigation districts have not been implemented as well as they could have been, considering the large investments of capital that have been made in the country.

The main agents that damage water quality and could be connected in a cause or effect relationship with the farming sector are pathogenic micro-organisms, heavy metals and suspended sediment. Added to this is the impact of other human activities (waste from large cities, for example) which pollute the water that is then used for farming. The situation regarding water is clearly not very encouraging, and drug trafficking is just one more factor in the spiralling environmental damage involving the deterioration of water resources (see further details in Table 6).

FINAL REMARKS

Based on the research, official and academic studies and related information on the issue, it is clear that the advance of drug trafficking – as manifested in the growing of illicit crops to manufacture narcotics – has been to the detriment of both the country’s ecological wealth and its rural communities. This process, however, is only part of the major spiral of socio-environmental conflicts in the country, which are firmly rooted in the social and political model that Colombia has applied for most of its life as a republic.

Given the above, we would venture to say that it is nonsense to blame the production of coca and opium poppy as the sole cause of the deterioration of the ecosystem in Colom-

bia. If one looks in depth at the conflict in Colombia – today intimately linked to illicit production – it is related to occupation of land and the exploitation of the land’s ecological and environmental potential at all costs. Land occupation is a sign of power and political control for any of those involved: the state itself, the guerrillas, the paramilitary groups and the local people who live there.⁷⁸

Current environmental and agrarian policies in Colombia seem to be going in the opposite direction to integrated human development options that would lessen environmental conflicts associated with land appropriation.

According to Colombia’s Ministry of Agriculture and Rural Development, it is expected that the area planted with productive crops will increase by 2.5 million hectares between 2006 and 2020.⁷⁹ Recently, the Ministry also presented a preview of the Prospects and Opportunities for the Farming Sector in Colombia,⁸⁰ in which it is clear that the aim is to promote large-scale agroindustrial projects. Although these might have good intentions, they would radically alter areas of rural land in every way, both socially and in terms of ecosystems. One example might be the planting of crops for agrofuels which, as stated above, are experiencing a boom in Colombia.

Apart from the environmental impact of agroindustrial projects, the building of the accompanying infrastructure also contributes to the destruction of the environment. This is what is happening with megaprojects such as the international port in Turbo, the Pan-American highway, the Atrato-Truandó canal and the energy grid, amongst others, in the

Urabá region of the departments of Antioquia and Chocó.⁸¹ It is also important to mention the curious connections between the presence of crops for illicit use and armed conflict, and the regions such as the Amazon piedmont that have been identified for megaprojects, which involve drilling for oil, and the advance of infrastructure projects such as the Pasto-Mocoa road and the Putumayo waterway.⁸²

Nevertheless, we should not underestimate the fact that in terms of the ecosystem one of the areas most under pressure due to the planting of crops for illicit use might be the Amazon piedmont, especially in the departments of Caquetá, Putumayo and Nariño. This area is one of the regions with the most biological wealth in the country, as the flora and fauna of the Andes and the Amazon converge there. To offer just one example, it is believed that 13 species of non-human primates may live in this region. In the case of this taxonomic group, that is an exceptionally high number for just one region.⁸³ The same might be said of the opium poppy crops (used to make heroin) in the upper sections of the Andean foothills, which contain the headwaters of river systems. The planting and fumigation of these crops has an ecological and environmental impact that is just as serious as the planting and fumigation of coca, and possibly even worse. This should be taken into account in analyses of changes to the ecosystem and environmental impacts that affect society.⁸⁴

Alternative options with a view to harm reduction

As we have stated in this report, the moving around of crops as a result of the strategy of forced eradication, whether manual or by aerial spraying, is an important part of the ecological problem. A drug control policy that managed at least to stabilise the areas where these crops are grown would in itself represent a success in the fight against crops for illicit use as far as their ecological repercussions are concerned. But it is only possible to stabilise the location of coca by respecting and recognising the role of local communities. With this in mind, the

government and local communities could reach agreements to put the socio-economic, environmental and ethical conditions in place, not just to demarcate the areas to be used to grow plants for narcotics, but also to avoid total dependence on the illegal economy. In such a scenario, the damage and risks to the environment and human health associated with producing these plants would be significantly reduced.

A measure like this should be implemented as part of the decriminalisation of small and medium producers, thus enabling them to hold dialogue with the state. At the moment, the small farmer who is dependent on an economy currently considered illicit lives in a zone of marginality, and this must be reversed.

To make progress in this direction, the Colombian state should re-evaluate the strategy that has been applied for years to combat the supply, which combines forced eradication with alternative development programmes. It is not just that fumigation with herbicides that is also responsible for ecocide. As a previous TNI report⁸⁵ makes clear, the implementation of one of the current Colombian government's flagship alternative development programmes, Forest Guardian Families, in a region like Urabá reveals a profound contradiction in its objectives: although it is said that the aim is to restore and protect the forest, the programme is being used to clear the tropical forest and small farmers' land to plant thousands of hectares of African palm as a monocrop. One of the obstacles to indiscriminate exploitation in Urabá is precisely the existence of the tropical forests in the Darién. These are protected by UNESCO, a body that considers them a world heritage site because of their unusual wealth of flora and fauna.

In areas dependent on the illicit economy, a solid socio-economic and environmental policy needs to be developed. This should take into account the potential and limits of the producer areas and propose alternatives suited to the bio-physical conditions and the economic and demographic viability of the land currently used to grow crops for illicit use. Likewise, local communities need to participate in consensus-building processes

that would provide technical backing for community aspirations. Along the same lines, the rural communities involved in the production of illicit crops and the manufacture of narcotics at any stage could be provided with the information and training they need on the correct use of the herbicides and chemicals that are required in the process of producing the drug, in order to protect their health and their environment.

Another very valuable contribution would be to respect traditional views of land management as practised by indigenous, African-descent and rural communities, and avoid imposing other models or crops that are alien to the suitable cultural and agricultural uses of the land.

The anti-narcotics authorities need to recognise that the supply reduction model focusing on the destruction of crops has failed, has been counterproductive, and is one of the main perpetrators of ecocide. The problem does not lie in coca itself or the growing of the crop. If there were alternative ways to produce coca safely and cleanly, these would be put in practice, thus reducing the impact of coca production on the environment. Rather than security based on policing, an appropriate drug policy would guarantee the safety of the environment – currently under threat from the indiscriminate increase in the clearing of land to grow crops for illicit use.

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NOTES

1. TNI and Washington Office on Latin America WOLA have produced over the last decade a broad bibliography which supports these conclusions. All documents can be consulted on their web pages. On the impact of coca production on the environment, TNI and Acción Andina published (1999) “*Fumigación y conflicto. Políticas antidrogas y deslegitimación del Estado en Colombia*” Ricardo Vargas, Tercer Mundo Ed., Bogotá.
2. FAO, United Nations Food and Agriculture Organisation,

<http://www.fao.org/newsroom/ES/news/2005/102924/index.html>

3. From the article “Las hojas culpables”, El Espectador, 2 August 2008.
4. For more information, see the campaign website: <http://www.sharedresponsibility.gov.co/>
5. Ortiz, C. 2003: 22.
6. Washington Office on Latin America (WOLA), 2008: 1-2.
7. Vargas, R. 1999: 2001
8. Nivia, E. 2004: 23.
9. The World Conservation Monitoring Centre, the official scientific agency of the United Nations Environment Programme (UNEP), ranks the following countries as “*megadiverse*”: Australia, Brazil, China, Colombia, Democratic Republic of Congo, Ecuador, Guatemala, India, Indonesia, Madagascar, Malaysia, Mexico, Papua New Guinea, Peru, the Philippines, South Africa, the United States and Venezuela.
10. The ecological wealth is not as diverse as in other countries, but much of it is unique in the world. Chaves & Arango, 1998, amongst others.
11. The Institute is part of the Colombian Ministry of the Environment, Housing and Territorial Development. It conducts scientific and applied research on biotic (biological related material) and hydrobiological resources in the continental regions of Colombia. <http://www.humboldt.org.co/>
12. Romero *et al.*, 2008.
13. Definition by the Special Administrative Office for National Parks. Available at: <http://www.parquesnacionales.gov.co>
14. At its regional and local levels, the SINAP is represented by the Regional Protected Areas Systems (SIRAP) and the Civil Society Reserves Network.
15. More information can be found at: <http://www.parquesnacionales.gov.co/PNN/portel/libreria/pdf/Cuadrodeareasdespnn.pdf>
16. More information can be found at: http://www.parquesnacionales.gov.co/PNN/portel/libreria/php/decide.php?patron=01.1103&f_patron=01.11
17. Etter & Sarmiento, 2008.
18. Márquez, 2001.
19. Fandiño-Lozano and van Wyngaarden, 2005.
20. Etter *et al.*, 2006.
21. Etter, *et al.*, *idem*.
22. Rudas *et al.*, 2007.
23. Romero *et al.*, 2008: 134.
24. See IAvH, 2002.
25. Blog entry: *Plan Colombia and Beyond: “Coca data: a chronicle of frustration”*, available at: <http://www.cipcol.org/?p=620>.

26. Statements made for the article in El Tiempo newspaper, "La deforestación pone en riesgo a 500 especies de plantas en el país", published in July 2008: http://www.eltiempo.com/vidadehoy/ciencia/home/la-deforestacion-pone-en-riesgo-a-500-especies-de-plantas-en-el-pais_4382859-1
27. Márquez, 2002: 9-10.
28. Ortiz, 2006; Romero *et al.*, 2008; Rudas *et al.*, 2007; UNODC, 2003-2008.
29. Rudas *et al. op. cit.*
30. Romero *et al.*, 2008: 136-140.
31. See the studies by Álvarez, 2002 and Fjeldsa° *et al.*, 2005.
32. Illicit Crop Monitoring Programme (SIMCI, Spanish acronym)
33. UNODC, 2008: 20.
34. Armenteras & Villa, 2006: 60-62.
35. Armenteras *et al.* 2006, Armenteras & Villa, 2006; Etter *et al.*, 2006a & Gutiérrez *et al.* 2004.
36. Nivia, 2004: 19.
37. See Ortiz, 2006 and Calvani, 2004.
38. Ramos & Ramos, 2002: 5
39. Departamento Nacional de Estupefacientes (DNE), 2002, cited in Ramos & Ramos, *op.cit.*
40. Calvani, 2004: 2.
41. Idem
42. Andrade, 2004: 135.
43. Castillo *et al.* 2003: 66.
44. Calvani, 2002 & Ortiz, 2006.
45. Castrillon, 2000; TNI, 2001; Castillo *et al.*, 2003; Andrade, 2004; Vargas, 2004; Comisión Científica Ecuatoriana, 2007; WOLA, 2008; and others.
46. TNI, 2001, "Fumigation and Conflict in Colombia: In the Heat of the Debate," describes the formula sprayed on p.5.
47. A substance or product that reduces the interfacial tension between two surfaces in contact with each other.
48. WOLA, 2008: 9.
49. Solomon *et al.*, 2005.
50. León *et al.*, 2005.
- 51 Vargas, 2006, TNI, "The Sierra de la Macarena. Drugs and armed conflict in Colombia." See also the 11 August 2006 BBC news report, "Colombia: polémica por fumigaciones," available at: http://news.bbc.co.uk/hi/spanish/latin_america/news_id_4785000/4785897.stm
- 52 BBC, "Colombia-Ecuador: cadena de tensiones," 22 December 2006. Available at: http://news.bbc.co.uk/hi/spanish/latin_america/news_id_6204000/6204383.stm. See also TNI, "The politicisation of fumigations: Glyphosate on the Colombian-Ecuadorian border," February 2007. Available at: <http://www.tni.org/docs/200702221900378752.pdf> ; and TNI, "Colombia, Ecuador y la JIFE ante las fumigaciones de coca," available at: http://www.tni.org/detail_page.phtml?&act_id=16458
- 53 WOLA, *op. cit.*
- 54 For more information and a chronology of the fumigation of crops for illicit use in Colombia, see: TNI, *Las fumigaciones en el marco del Plan Colombia*, available at: http://www.tni.org/detail_page.phtml?act_id=16593
- TNI, "Vicious Circle: the chemical and biological 'war on drugs'," Jelsma, M., available at: <http://www.tni.org/archives/jelsma/viciouscircle-e.pdf?>
- Asociación Mamacoca: http://www.mamacoca.org/docs_de_base/impunidad_en_la_guerra_quimica_en_Colombia_ens.htm
- Drug Czar: fumigation opponents support narcoterrorists.* Posting on Adam Isacson's blog: "Plan Colombia and Beyond", <http://www.cipcol.org/?p=140>
- 55 News item on Diario En Línea Hoy: "Preocupación en cacaoteros fronterizos," available at: <http://www.hoy.com.ec/noticias-ecuador/preocupacion-en-cacaoteros-fronterizos-311445.html>
56. This paragraph includes several contributions made by Hugo Cabieses in a personal communication (November 2008).
57. Etter & Sarmiento, 2008.
58. Instituto Geográfico Agustín Codazzi (IGAC) and Corporación Colombiana de Investigación Agropecuaria (CORPOICA), 2002.
59. Combined Forestry and Agriculture
60. Idem.
61. Murgueitio, 2003.
62. Etter & van Wyngaarden, 2000: 435-438.
63. Ortiz, 2003: 21.
64. Murgueitio & Calle, 1999: 29.
65. Etter & Sarmiento, 2008.
66. Yepes, 2001 and Etter & Sarmiento, *op. cit.*
67. Etter & Sarmiento, idem.
68. See especially Murgueitio, 1999.
69. Here we adopt the idea proposed by the international movement *Vía Campesina*, whereby the liquid fuels produced from agricultural matter are given the name "agrofuels" rather than "biofuels." The aim of this is to call into question the apparent ecological "benefits," which are contradicted by the large expanses of monocrops usually used to produce these fuels.

70. Pérez-Rincón, 2008; Mejía, 2008.
71. Crutzen *et al.*, 2007; Gilbertson *et al.*, 2007
72. Instituto Alexander von Humboldt (IavH), August 2000. Biosíntesis Boletín No. 21.
73. Pérez-Rincón, 2008: 92-95 & Mejía, 2008: 139-142
74. Pérez-Rincón, *op. cit.*: 92.
75. León, 2007: 170.
76. León, *op. cit.*
77. In most of the departments there are plans to plant extensive areas with the crop.
78. Cárdenas & Rodríguez-Becerra, 2004: 13-46.
79. Source: Colombian Ministry of Agriculture and Rural Development, 2006.
80. Presentation given by Andrés Felipe Arias Leiva, Minister of Agriculture and Rural Development, in October 2008. Available at: http://www.minagricultura.gov.co/06docypresent/06_presenta.aspx
81. Tenthoff, 2008: 13.
82. Flórez, 2007: 90.
83. Thomas Defler, personal communication. 2005.
84. This paragraph includes comments made by Hugo Cabiess in a personal communication, November 2008.
85. Tenthoff, 2008: 12

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