



UNODC

United Nations Office on Drugs and Crime



Government of Colombia

Colombia

Coca Cultivation Survey



data collection

data transfer

data transfer

June 2009

ABBREVIATIONS

COP	Colombian Pesos
DANE	National Department of Statistics
DEA	US Drugs Enforcement Administration
DIRAN	Colombian Anti-Narcotics Police
DNE	National Narcotics Office
DNP	National Planning Department
GME	Mobile Eradication Group
IGAC	Instituto Geografico Agustin Codazzi
ICMP	Illicit Crop Monitoring Programme
INCB	International Narcotics Control Board
IDB	Inter-American Development Bank
NNPS	National Natural Parks System
OAS	Organization of American States
PDA	Alternative Development Programme
PCI	Presidential management against Illicit Crops
RSS	Social Solidarity Net
SIMCI	Integrated Illicit Crops Monitoring System
UNODC	United Nations Office on Drugs and Crime.
USAID	United States Agency for International Development
US\$	United States Dollars
mt	Metric tons

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PREFACE

In 2008, there was a major decline in the amount of coca cultivation and cocaine production in Colombia. Cultivation dropped by 18% to 81,000 hectares, while production was down 28%, from 600 metric tons in 2007 to 430 mt in 2008.

The dramatic year-on-year reductions represent a return to the levels of coca cultivation reported during the 2004 to 2006 period. In terms of potential production, the 2008 results are the lowest in a decade.

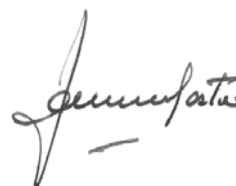
Much of the decline is due to a remarkable 96,115 hectares of coca which was eradicated manually (an increase of 44%), in addition to 133,496 hectares of coca that was sprayed.

The coca economy in Colombia is under threat. The greater reduction in tons compared to hectares shows that eradication successfully targeted regions of high yield. Furthermore, as a result of government pressure, coca fields are becoming more dispersed and smaller and, therefore, harder to tend, resulting in lower yields. The farm-gate value of coca leaf in Colombia is falling, making it less attractive for farmers. Indeed, 20,000 less households grew coca in 2008 compared with 2007 (a decrease of 26%).

Trafficking is also being disrupted: in Colombia, 200 tons of cocaine was seized in 2008, a 57% increase over 2007. More than 3,200 labs were destroyed – an increase of 36%.

Consumers are starting to feel the effects. The significant decreases in cocaine seizures worldwide in combination with rising cocaine prices and falling cocaine purity in the main consumer markets are an indication of market contraction.

Colombia is making tremendous efforts to contain its cocaine problem at the source. It would be helped if the biggest cocaine markets would pay as much attention to reducing demand.



Antonio Maria Costa
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SUMMARY FACT SHEET – COLOMBIA COCA SURVEY FOR 2008

	2007	Variation	2008
Net coca cultivation (rounded total)	99,000 hectares	-18%	81,000 hectares
Of which			
Pacific region	25,960 hectares	+15%	29,920 hectares
Putumayo-Caqueta region	21,130 hectares	-34%	13,960 hectares
Central region	20,950 hectares	-11%	18,730 hectares
Meta-Guaviare region	19,690 hectares	-38%	12,150 hectares
Elsewhere	11,270 hectares	-45%	6,240 hectares
Reported cumulative aerial spraying of coca bush	153,134 hectares	-13%	133,496 hectares
Reported manual eradication of coca bush	66,805 hectares	+44%	96,115 hectares
Average farm-gate price of coca paste	US\$ 943/kg	+2%	US\$ 963/kg
	COP\$ 1,959,000/kg	-4%	COP 1,878/kg
Total farm-gate value of the production of coca leaf and its derivatives	US\$ 934 million	-33%	US\$ 623 million
in % of GDP ¹	0.5%		0.3%
in % of GDP of agricultural sector	5%		3%
No. of households involved in coca cultivation	80,000 households	-26%	59,328 households
Annual household gross income from the production of coca leaf and its derivatives	US\$ 11,675	-10%	US\$ 10,508
Production of cocaine	600 mt	-28%	430 mt
in % of world cocaine production	60%	-15%	51%
Average wholesale cocaine price	US\$ 2,198/kg	7%	US\$ 2,348/kg
	COL\$ 4,567,000/kg	0%	COP 4,580,000 /kg
Reported opium poppy cultivation	714 hectares	-45%	394 hectares
Potential opium latex production	18 mt	-43%	10.3mt
Potential heroin production	2.3 mt	-43%	1.3mt
Average farm-gate price of opium latex	US\$ 286/kg	+11%	US\$ 318 /kg
Average heroin price	US\$ 10,780/kg	-8%	US\$ 9,950/kg
Reported seizure of cocaine	126,641 kg	+57%	198,366 kg
Reported seizure of heroin	537 kg	+20%	646kg
Reported destruction of clandestine laboratories ²	2,367	+36%	3,209

¹ GDP of the respective year as reported by the Government.

² Includes laboratories processing coca paste/cocaine base, cocaine hydrochloride, heroin, morphine, potassium permanganate, and non-specified.

EXECUTIVE SUMMARY

Through its global Illicit Crop Monitoring Programme, UNODC has been assisting the Colombian Government in the implementation and refinement of a national coca monitoring system since 1999. Annual surveys have been produced since then and the present report provides the findings of the coca survey for 2008.

The methodology design by the Project is based in the identification of the coca fields on medium resolution satellite images and field verification. With this verification, the office identification is edited and the estimation of the coca cultivation in areas without information (cloud covered, etc.) is added.

The results of the survey showed that, at the end of December 2008, 81,000 hectares of coca were cultivated in 24 out of the 32 Colombian departments. This represents a decrease of 18,000 hectares or 18% compared to 2007 and a return to the levels of coca cultivation in the 2003-2006 period.

The most important decrease in 2008 took place in all the major coca cultivation regions: Meta-Guaviare (-38%), Putumayo-Caqueta (-34%), Orinoco (-61%) and Central (-11%). In fact, 78% of the 2008 cultivation took place in just eight departments, the same eight departments that also accounted for 89 % of 2007 total cultivation: Nariño, Putumayo, Meta, Antioquia, Guaviare, Vichada, Cauca and Caqueta.

The assessment of the accuracy of the interpretation results is part of a quality control. In September 2004, the Institute of Surveying, Remote Sensing and Land Information of the University of Natural Resources and Applied Life Sciences, Vienna (BOKU, Austria), started an assessment of the accuracy of the interpretation still in process

It was also noted that the average field size decreased from 0.82 hectares in 2007 to 0.66 hectares in 2008 (-22%). Between 2007 and 2008, the government reported the manual eradication of 96,115 hectares, a new record compared to previous levels of 43,051 hectares in 2006 and 66,805 hectares in 2007. In addition, aerial spraying continued to be intense and was above 130,000 hectares for the seventh consecutive year. In 2008, a total of 133,496 hectares were sprayed. The total of both types of activities (spraying and manual eradication) amounted to 230,000 hectares in 2008.

UNODC/SIMCI has been conducting comprehensive research assessing the annual yield of the fresh coca leaf and identifying the agricultural practices associated with coca cultivation since 2005. The analysis of this years' collected data revealed that with respect to the yields estimated in 2005, there was a significant decline of the yields in the studied regions in 2008, a decline of 59% in the fresh coca leaf production was found in Meta-Guaviare and a decline of 33% in Putumayo-Caqueta, as estimated from the data collected from the interviews with farmers. A combination of lower yields and a decline of the area under coca cultivation produced a reduction of 28% in the cocaine production in 2008 as compared to 2007.

In 2008, the production of cocaine HCL in Colombia amounted to 430 metric tons, a dramatic decrease by 28 per cent or 170 metric tons compared to 2007. As a consequence of this decrease and simultaneous production increases in Bolivia and Peru by 21 metric tons, Colombia's share of the world cocaine production continues with its down trend from 60 per cent in 2007 to 51per cent of the total world production in 2008.

At the farm-gate level, the gross value of coca leaf and its derivatives amounted to US\$ 517 million, equivalent to 0.3% of the Colombian 2008 GDP or 3% of the GDP of the agricultural sector. It should be noted, however, that this value does not take into account production costs like herbicides, pesticides, fertilizers and wages. The coca leaf yield survey also enabled to estimate the total number of households involved in coca farming at about 59,300 households (floating population is not included). The farm gate value thus represents an annual gross income per household of US\$ 10,039, equivalent to an annual per capita gross income of US\$ 2,000. By comparison, the GDP per capita in Colombia in 2008 was estimated by approximated US\$ 5,000.

1 INTRODUCTION

The objectives of UNODC's Illicit Crop Monitoring Programme (ICMP) are to establish methodologies for data collection and analysis, to increase the governments' capacity to monitor illicit crops on their territories and to assist the international community in monitoring the extent and evolution of illicit crops in the context of the elimination strategy adopted by the Member States at the U.N. General Assembly Special Session on Drugs in June 1998. ICMP presently covers seven countries: Colombia, Bolivia and Peru for coca; Afghanistan, Lao PDR and Myanmar for opium and Morocco for cannabis.

During the 1980's and 1990's, Colombia became the country with the largest illicit coca growing area and cocaine production in the world. Illicit coca cultivation in the country expanded steadily throughout this period, in particular in remote areas of the Amazon basin. Although coca cultivation started to decrease in 2001, Colombia remains the largest coca-growing country in the world.

UNODC has supported the monitoring of illicit crops since 1999, and has produced ten annual surveys through a special satellite based analysis programme called SIMCI (from the Spanish initials). The initial surveys (1999 and 2000) did not cover the entire country but since the 2001 survey, SIMCI started to cover the entire territory to assure the monitoring of the possible expansion of illicit crops

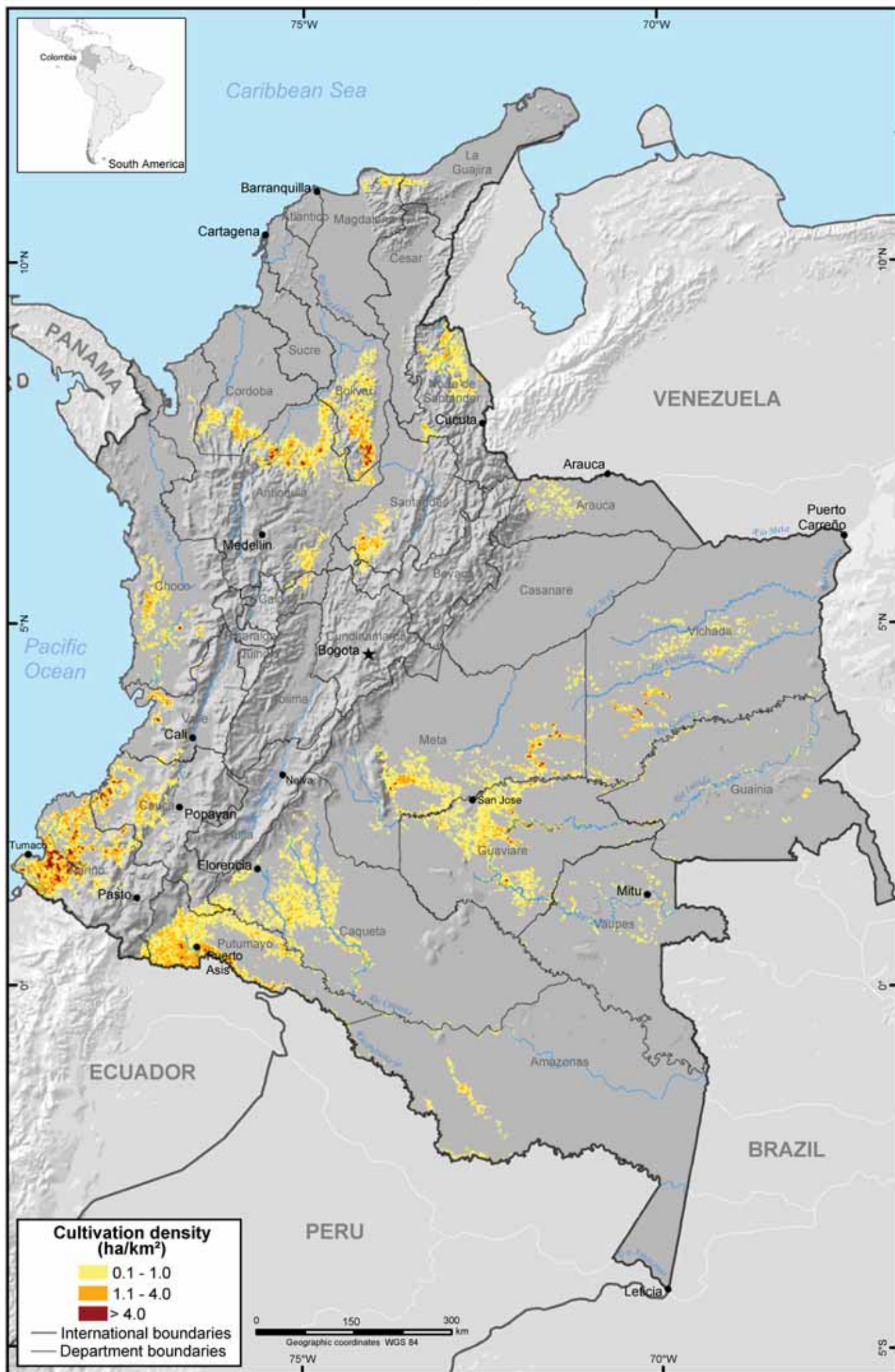
In October 2006, UNODC signed a new agreement with the Colombian government to continue and expand monitoring and analysis work. In this context, the SIMCI II project facilitates the implementation of additional tasks in the framework of an integrated approach to analyse the drug problem in Colombia. The project also supports the monitoring of related problems such as fragile ecosystems, natural parks, indigenous territories, the expansion of the agricultural frontier and deforestation. It provides Geographic Information System support to the government's alternative development projects and its Forest Warden Families Programme.

The new project foresees the creation of an Inter-Institutional Committee permanently assigned to the project in order to ensure the transfer of know-how to the national beneficiary institutions. SIMCI II is a joint project between UNODC and the Colombian government, represented by the Ministry of Interior and Justice and the International Cooperation Agency. The national counterpart is the Ministry of Interior and Justice, President of the National Board of Narcotics.

The project is managed by a technical coordinator and composed of engineers and technicians: four digital image processing specialists, one field engineer, a cartographic engineer, a research and analysis specialist, two assistant engineers and a technician in logistic support and data base. In 2009, two experts in digital image processing and a statistician joined the team to carry out two estimations per year between the cut dates of the census and to establish trends in the coca cultivation at national level. The team cooperates with technicians from the Police Antinarcotics Division (DIRAN) and National Parks Administration. It supports several studies and investigations for government and private institutions, related to land use, environment, licit crops, etc. SIMCI provides to the above-mentioned institutions experts, access to its Spatial Information Data Bank, transfer of technology and guidance to achieve their goals. Organizations that benefited from SIMCI support include the National Directorate for Statistics (DANE), local governments, the National Federation of Coffee Growers, NGOs as well as other UN agencies and projects

The project has developed technical agreements with several national and foreign Universities, to interchange and share knowledge, for training activities and joint projects. Among them are BOKU University in Austria, Zaragoza University in Spain, Universities of Harvard, Michigan and Maryland in USA, Los Andes, Antonio Nariño and other Universities in Colombia.

Coca cultivation density in Colombia, 2008



Source: Government of Colombia - National monitoring system supported by UNODC
 The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

2 FINDINGS

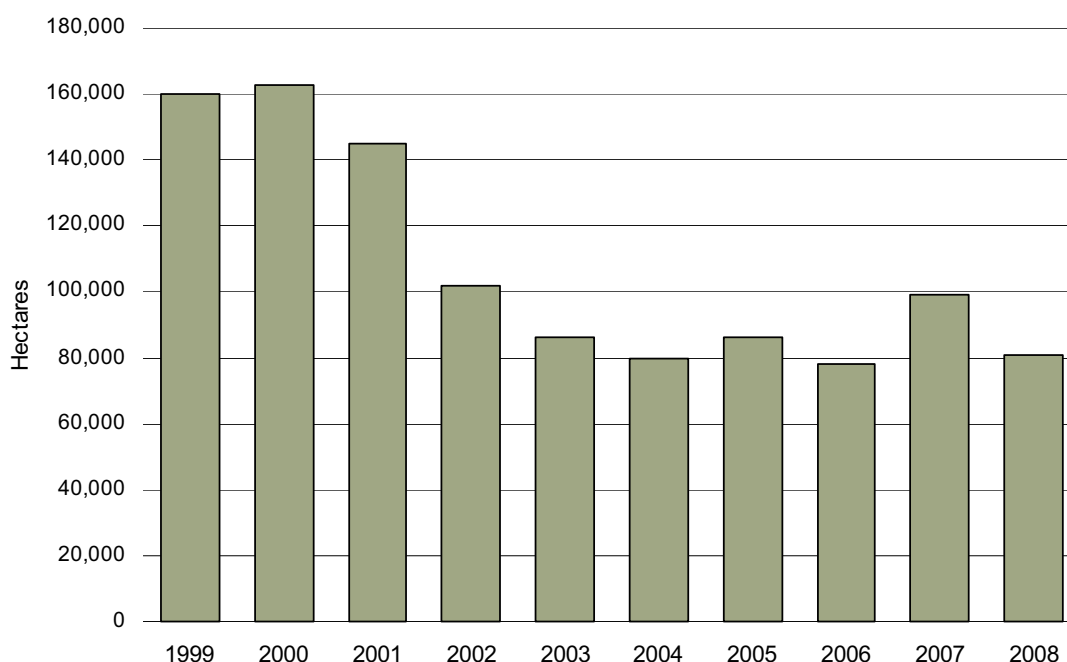
2.1 Coca cultivation

National cultivation

In 2008, the total area under coca cultivation in Colombia was estimated at 81,000 hectares. This estimate represented a 18% decrease in area under the illicit crop as compared to 2007 estimate of 99,000 hectares. This estimation drove the coca cultivation back to the levels presented in the years 2003-2006.

Similarly to the previous nine surveys, the 2008 survey represents the situation as of the end of the year, in this case as of 31 December 2008. As was the case last year, the survey covered the whole territory and detected coca cultivation in 24 out of 32 departments, one more than in 2007. In 2008, the area under coca cultivation represents 1.6% of the total agricultural land in Colombia.

Figure 1: Coca cultivation in Colombia, 1999 – 2008



The decrease in coca cultivation between 2007 and 2008 correspond to the level of manual eradication which accounted up to 96,115 hectares and aerial spraying, which reached 133,496 hectares of coca cultivation. This level of manual eradication is 29,310 hectares higher than the previous year's record of 66,805 hectares. The aerial spraying of coca cultivation has remained above 130,000 hectares since 2002.

Analysis of coca cultivation changes

Coca cultivation is very dynamic in Colombia. A range of variables can be associated with increases and decreases of the cultivation area over time. Factors such as favourable prices, pressure exerted by illicit armed groups on farmers, the legal economy, and temporary crisis situations can all lead to an increase in the cultivated area. On the other hand, factors such as forced eradication, aerial spraying, improved security conditions, and plant diseases can contribute to reducing the cultivated area. This cultivation survey does not endeavour to assess how or in what extent these factors bring about change in the area under coca cultivation. Rather, it shows the situation on a given date of the year (31st of December).

The multitemporal analysis of coca cultivation is done on imagery of 2007 and 2008 and therefore, concepts such as “abandoned” or “new” fields refer exclusively to this period. At the end of the

2007-2008 period, 25% of the area planted with coca was the same as identified at the beginning 2008, and can be considered as “stable” where as 15% of the area planted with coca replaced primary forest vegetation and therefore was newly planted during this period. The remaining 60% of the coca crops replaced other types of vegetation such as pastures or bare soil, of which 44% have been planted and then abandoned in previous years and 16% do not show coca crops since 2001.

Table 1. Stable and new fields of coca bush in 2008

	Stable area 2007-2008	New area in 2008			Total
		Primary forest in 2007	Other vegetation in 2008		
			Not detected with coca before 2008	Cultivated with coca before 2007	
Area (hectares)	20,138	12,356	35,178	13,281	80,953
Percentage	25%	15%	44%	16%	100%

The multitemporal analysis of the last seven years showed that 41% of the coca fields identified in 2008 were cultivated with coca in one or more years during the reference period.

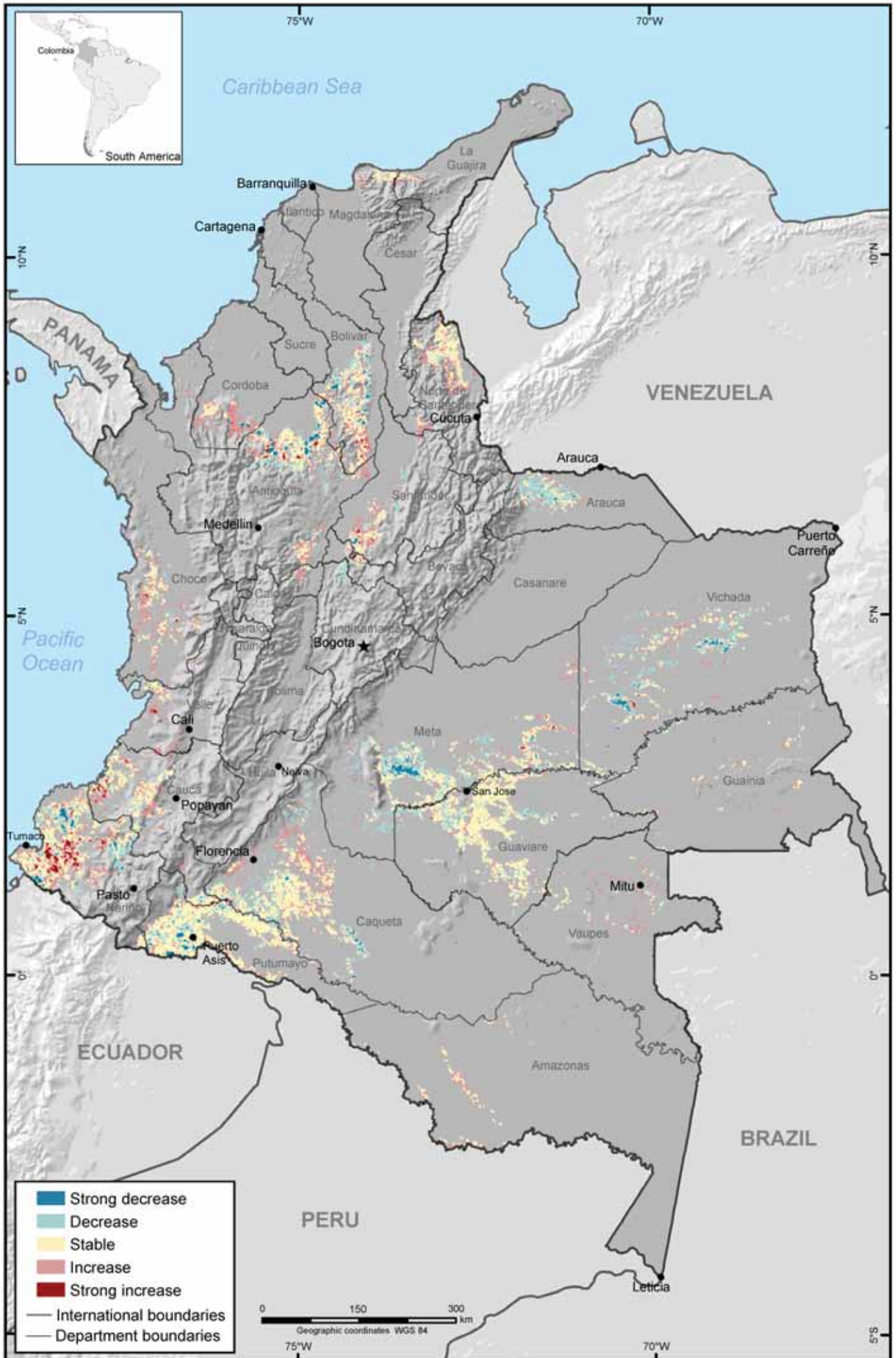
The analysis of the data also showed that the average coca field size continued to decrease since 2001 where the average size was of 2.05 hectares, to 1.13 hectares in 2005 and to 0.66 hectares in 2008. A possible explanation could be that farmers reduced the size of their coca fields to avoid detection and manual eradication or aerial spraying.

The ten municipalities listed below were ranked as the highest municipalities in terms of coca cultivation in Colombia, representing 35% of the national total coca cultivation and 35% of national potential cocaine production. The municipality of Tumaco in Pacific region has the largest coca cultivation area in Colombia (7.2% of the national total) and Cumaribo in the Orinoco region has the largest production of cocaine (11.2% of the national total).

Table 2. The ten municipalities with the highest coca cultivation area and cocaine potential production in 2008

Municipality	Department	Coca cultivated area (hectares)	% of coca cultivation area in Colombia	Pure cocaine production (tm)
Tumaco	Nariño	5,865	20.8%	16
Cumaribo	Vichada	3,128	11.1%	48
Barbacoas	Nariño	3,080	10.9%	7
Puerto Asis	Putumayo	2,627	9.3%	18
El Retorno	Guaviare	2,415	8.6%	15
Roberto Payan	Nariño	2,336	8.3%	7
Magui	Nariño	2,240	7.9%	7
El Charco	Nariño	2,202	7.8%	5
Mapiripan	Meta	2,180	7.7%	12
San Jose del Guaviare	Guaviare	2,143	7.6%	15
Total		28,216	35%	150

Coca cultivation density change in Colombia, 2007 - 2008



Source: Government of Colombia - National monitoring system supported by UNODC

The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

In absolute numbers, the most important decreases of coca cultivation between 2007 and 2008 were in the departments of Putumayo (-5,155 hectares) in the Southwest of the country, Meta (-4,861 hectares) and Antioquia (-3,830 hectares) in the Central region. The decrease in Putumayo which accounted for 35% of the area under coca cultivation in 2007 went from 14,800 hectares to 9,700 hectares. Coca cultivation in Putumayo was significant since 1999 varying between 58,300 and 47,000 hectares until 2001. In 2002 a significant reduction to 15,100 hectares was registered and the coca cultivation took a constant downtrend reaching a record of 4,400 hectares in 2004. Since then, the coca area was increasing constantly until 2007 to decrease again in 2008.

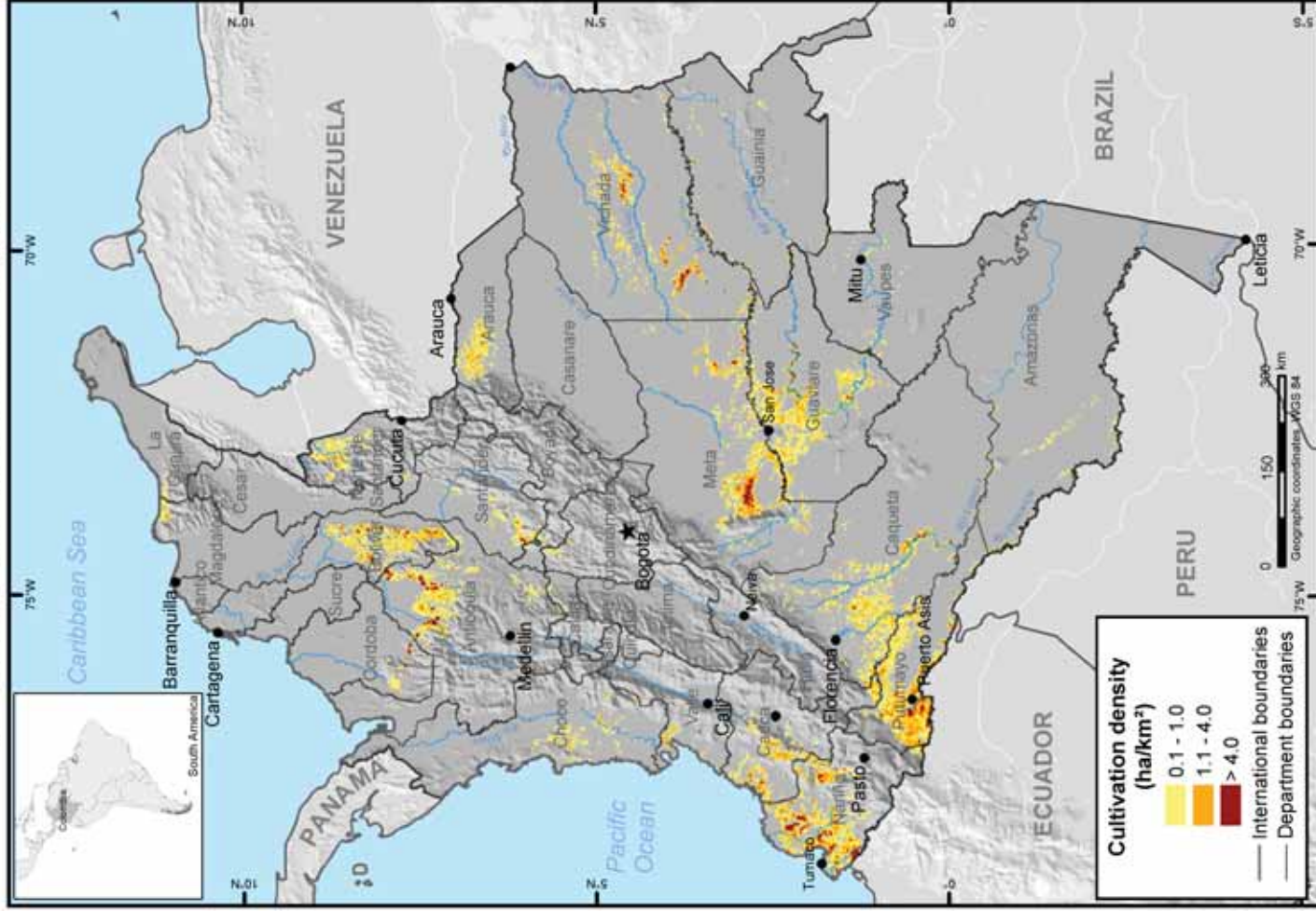
Only small but locally significant increases of coca crops took place in the departments of Choco (+1,714 hectares), Valle del Cauca (+1,636 hectares) and Cauca (+1,254 hectares). The department of Choco, at the Pacific Ocean coast, which had a small coca cultivation area in 2003 with less than 500 hectares, increased its coca area almost six times (2,794 hectares) in 2008.

Nariño and Putumayo, despite a combined decrease of 5,800 hectares – remain as the first two top departments in terms of coca cultivation, together accounting for 36% of the total area under coca cultivation in the country. In fact 44% of the 2008 cultivation took place in just three departments Nariño, Putumayo and Guaviare, the same three departments that accounted for 45% of total cultivation in 2007.

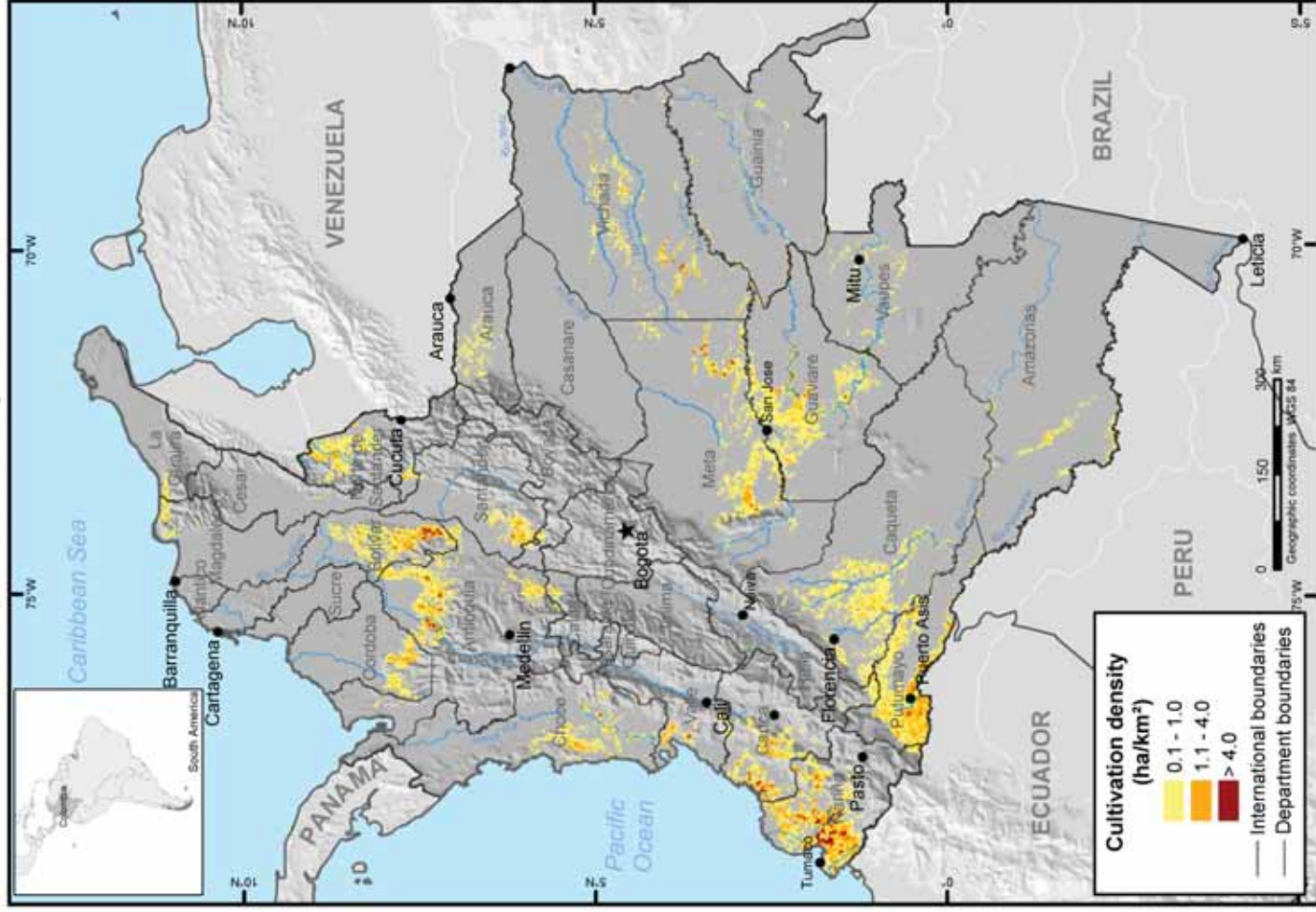
Table 3. Coca cultivation by department, 2003 – 2008 (hectares)

Department	Dec-2003	Dec-2004	Dec-2005	Dec-2006	Dec-2007	Dec-2008	% change 2007-2008	% of total 2008
Nariño	17,628	14,154	13,875	15,606	20,259	19,612	-3%	24%
Putumayo	7,559	4,386	8,963	12,254	14,813	9,658	-35%	12%
Guaviare	16,163	9,769	8,658	9,477	9,299	6,629	-29%	8%
Antioquia	4,273	5,168	6,414	6,157	9,926	6,096	-38%	8%
Bolivar	4,470	3,402	3,670	2,382	5,632	5,847	4%	7%
Meta	12,814	18,740	17,305	11,063	10,386	5,525	-47%	7%
Cauca	1,443	1,266	2,705	2,104	4,168	5,422	+30%	7%
Caqueta	7,230	6,500	4,988	4,967	6,318	4,303	-32%	5%
Vichada	3,818	4,692	7,826	5,523	7,218	3,174	-56%	4%
N, de Santander	4,471	3,055	844	488	1,946	2,886	48%	4%
Choco	453	323	1,025	816	1,080	2,794	+159%	3%
Valle del Cauca	37	45	28	281	453	2,089	+361%	3%
Santander	632	1,124	981	866	1,325	1,791	+35%	2%
Cordoba	838	1,536	3,136	1,216	1,858	1,710	-8%	2%
Amazonas	625	783	897	692	541	836	+55%	1%
Guainia	726	721	752	753	623	625	0%	0.8%
Vaupés	1,157	1,084	671	460	307	557	+81%	0.7%
Arauca	539	1,552	1,883	1,306	2,116	447	-79%	0.6%
Magdalena	484	706	213	271	278	391	+41%	0.5%
Boyaca	594	359	342	441	79	197	+149%	0.2%
Caldas	54	358	189	461	56	187	+234%	0.2%
La Guajira	275	556	329	166	87	160	+84%	0.2%
Cundinamarca	57	71	56	120	131	12	-91%	0%
Cesar	0	0	0	0	0	5	n.a	0%
TOTAL	86,340	80,350	85,750	77,870	98,899	80,953	-18%	100%
Rounded Total	86,000	80,000	86,000	78,000	99,000	81,000	-18%	
Departments affected	23	23	23	23	23	24		

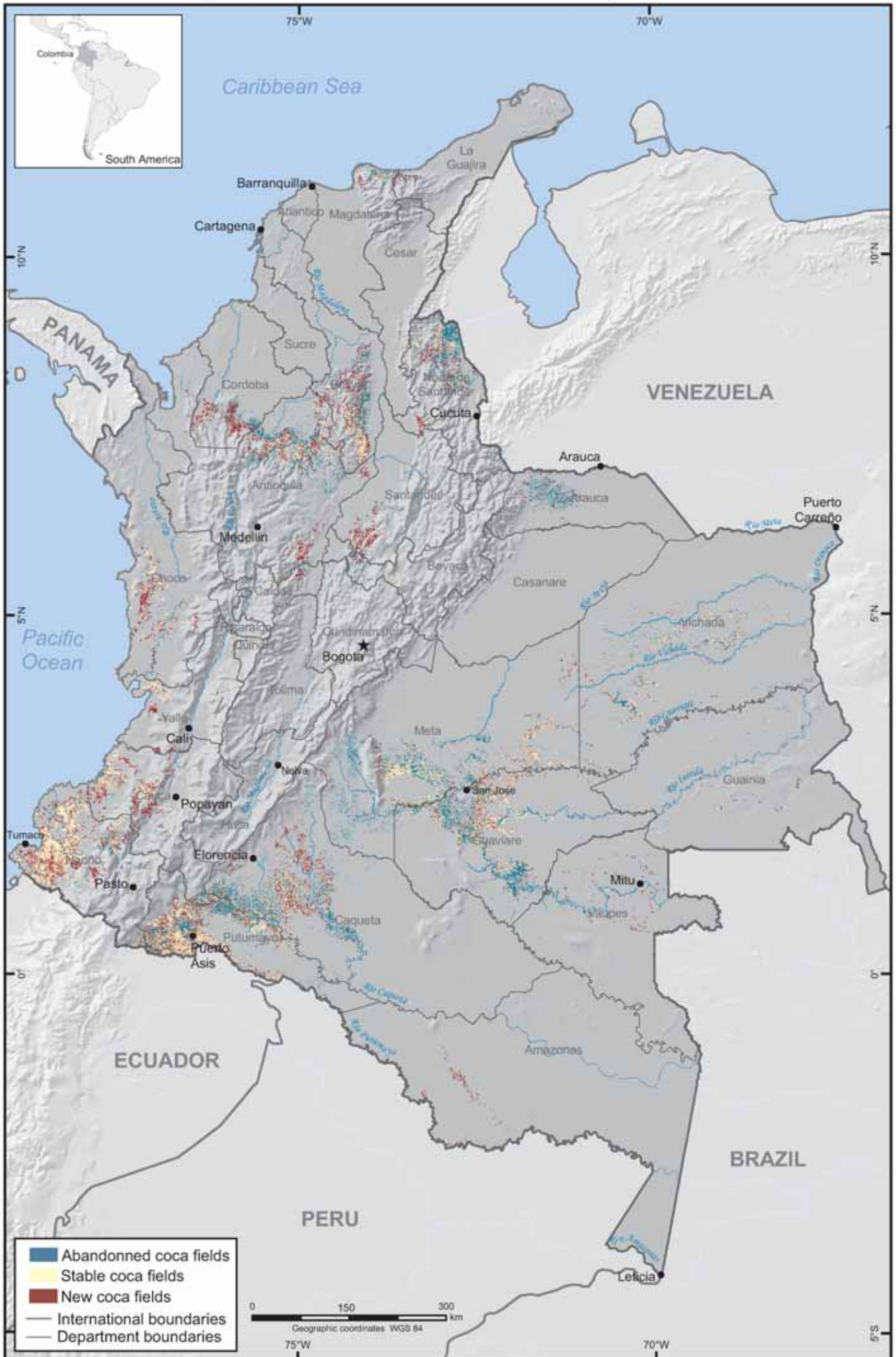
Coca cultivation density in Colombia, 2007



Coca cultivation density in Colombia, 2008



Changes in coca cultivation in Colombia, 2001 - 2008



Source: Government of Colombia - National monitoring system supported by UNODC
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Coca cultivation density in the Andean Region, 2008



Sources: National monitoring systems supported by UNODC - Governments of Bolivia, Colombia and Peru
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In 2008, coca cultivation in Colombia represented 48% of the world coca cultivation, while Peru and Bolivia represented respectively 33% and 18%.

Figure 2: Coca cultivation in the Andean Region 1998-2008 (in hectares)

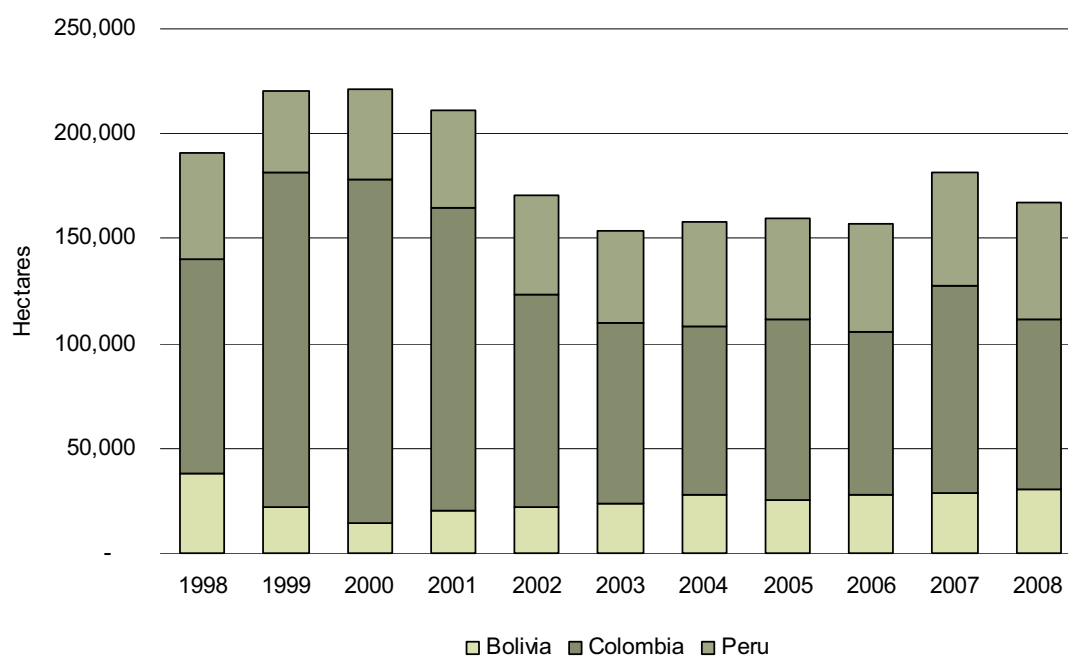
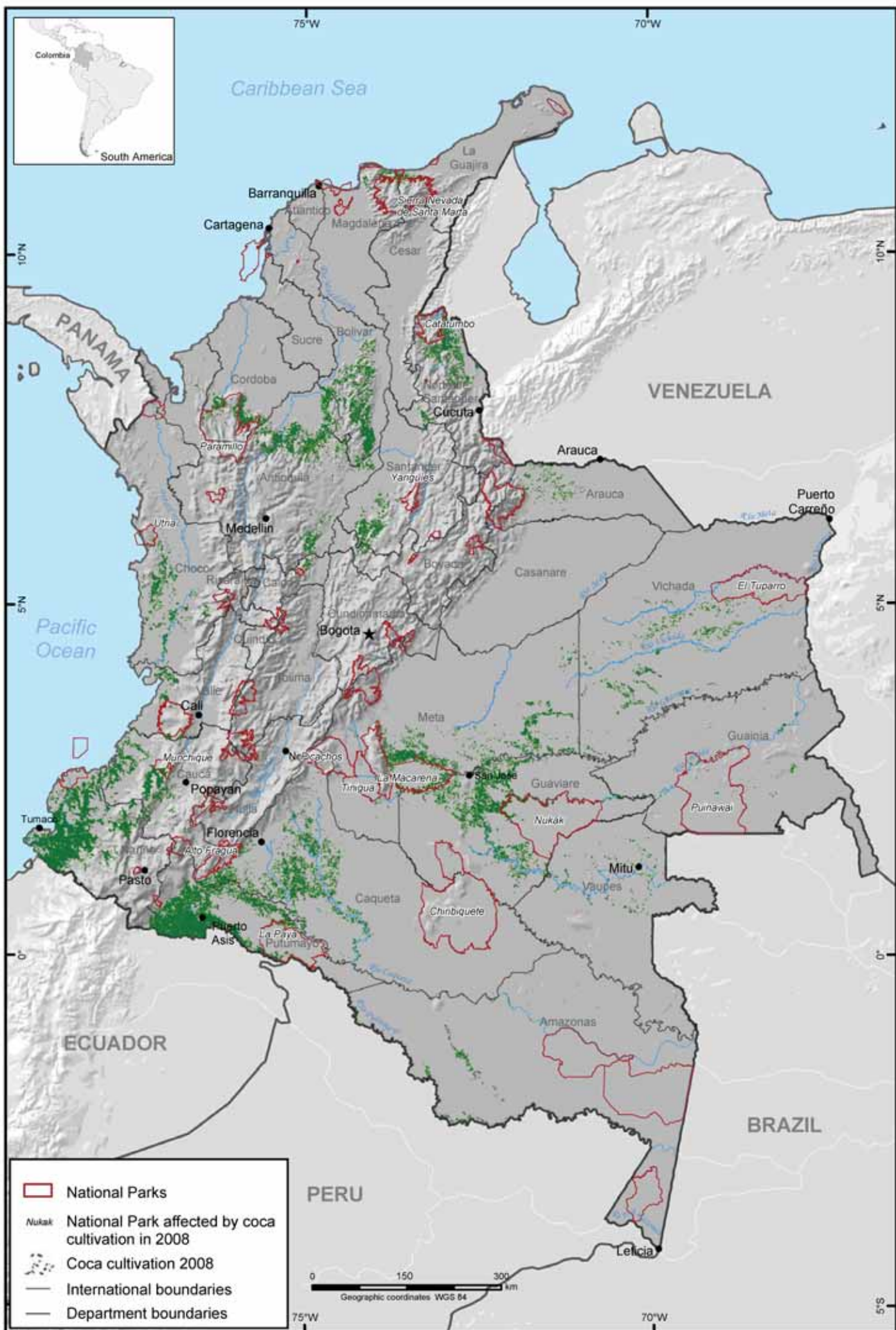


Table 4. Coca cultivation in the Andean region 1998 - 2008 (in hectares)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	% Change 2007-2008
Bolivia	38,000	21,800	14,600	19,900	21,600	23,600	27,700	25,400	27,500	28,900	30,500	+6%
Peru	51,000	38,700	43,400	46,200	46,700	44,200	50,300	48,200	51,400	53,700	56,100	+4%
Colombia	102,000	160,000	163,000	145,000	102,000	86,000	80,000	86,000	78,000	99,000	81,000	-18%
Total	191,000	220,500	221,000	211,100	170,300	153,800	158,000	159,600	156,900	181,600	167,600	-8%

Sources  United States Department of State  National Monitoring System Supported by UNODC

National Parks and coca cultivation in Colombia, 2008



Sources: Government of Colombia; for coca cultivation National monitoring system supported by UNODC; for national parks UAESPNN
The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

Coca cultivation in national parks

The presence of illicit crops in both Natural Parks and Indigenous Territories has been monitored by SIMCI since the 2001 coca cultivation survey, and the data have been delivered to the competent authorities to enable them to identify actions and projects to be applied for the preservation of its social and environmental characteristics with minimum of harm.

The boundaries of National Parks and Indigenous territories have been provided by the official institutions in charge of their management. In 2005 the limits of National Parks were edited by the monitoring project in cooperation with technicians from the National Parks Administrative Unit. The editing improved the match between SIMCI cartographic material and the official boundaries of the Parks. National Parks boundaries are not always precise and therefore coca cultivation estimated in each of them depends on the accuracy of their delimitation.

Coca cultivation in 2008 was found in 14 of the 54 National Parks in Colombia. With 3,445 hectares in 2008, coca cultivation represented 0.02% of the total area covered by National Parks, and coca cultivation in National Parks represented 4% of the total level of coca cultivation in 2008.

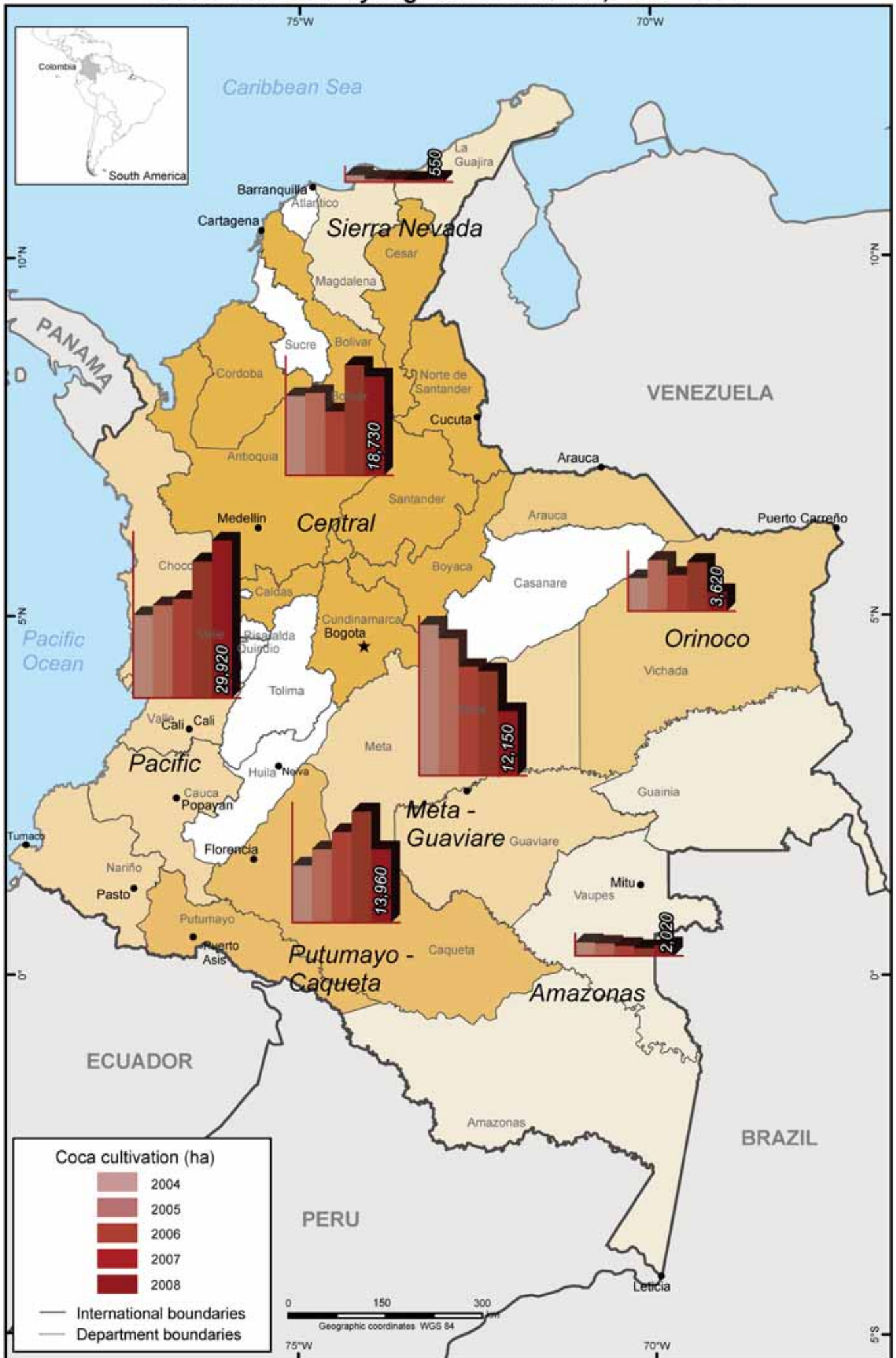
Coca cultivation in National Parks showed a slight decrease of 9% in the period 2007 and 2008. The significant reduction of the area under coca cultivation in the National Parks of Sierra La Macarena (-677 hectares) and Nukak (-337 hectares) contrasts with the increase in the National Park of Catatumbo-Bari (+432 hectares).

The detailed results by indigenous territories are presented in Annex 3.

Table 5. Coca cultivation in National Parks, 2005 – 2008

National Parks	2005	2006	2007	2008	% Change 2007-2008
Nukak	930	779	1,370	1,033	-24%
Sierra La Macarena	3,354	1,689	1,258	581	-54%
Catatumbo-Bari	55	22	38	477	+1,155%
Paramillo	686	236	420	464	+10%
La Paya	728	527	358	377	+5 %
Sierra Nevada	95	119	94	170	+81%
Munchique	13	6	55	96	+75%
Puinawai	60	41	26	67	+58%
Utria	-	-	12	44	+267%
Tinigua	155	122	63	37	-41%
Sanquianga	-	-	41	33	-20%
El Tuparro	-	-	14	18	+29%
Yariguies	2	4	12	-	-
Alto Fragua	25	1	5	4	-20%
Los Picachos	7	6	3	-	-
El Cocuy	-	2	1	3	+200%
Selva de Florencia	-	2	-	-	-
Farallones	-	-	-	44	-
TOTAL	6,110	3,556	3,770	3,445	-9%
Rounded Total	6,100	3,600	3,800	3,400	

Coca cultivation by region in Colombia, 2004 - 2008



Source: Government of Colombia - National monitoring system supported by UNODC
 The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

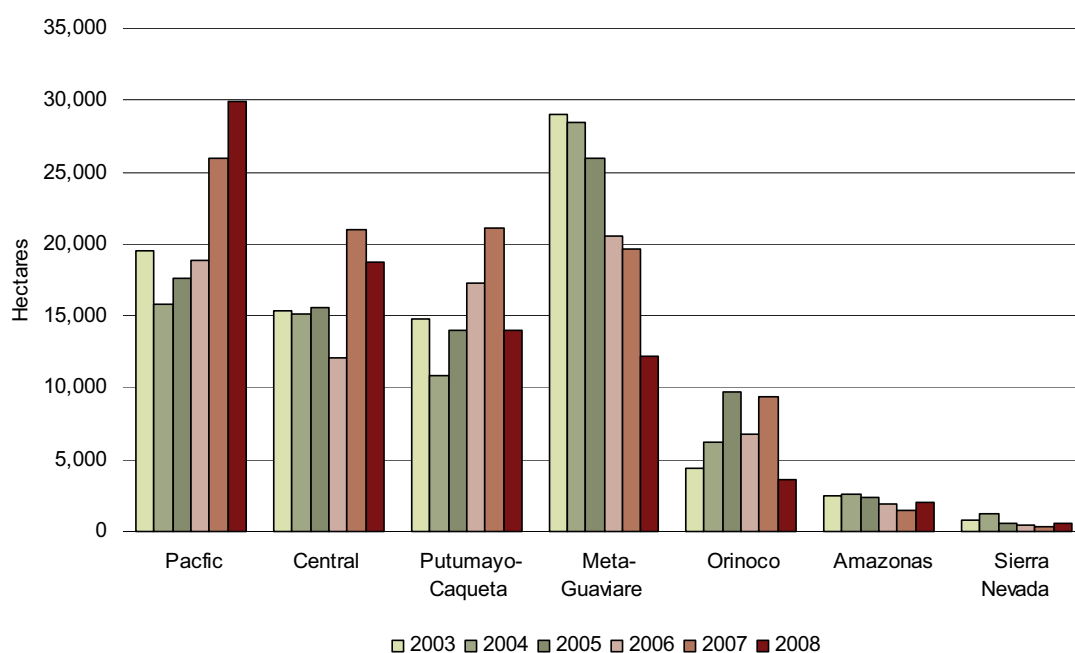
Regional Analysis

In 2008, 77% of coca cultivation in Colombia took place in the coca-growing regions of Pacific, Central and Putumayo-Caqueta. The largest reductions took place in the Meta-Guaviare region (-7,531 hectares), in Putumayo-Caqueta (-7,170 hectares), and in Orinoco (-5,713 hectares) in the eastern part of the country bordering Venezuela. The major increase took place in the corridor between the Western range of mountains and the Pacific Ocean coastal (+ 3,957 hectares, +15%).

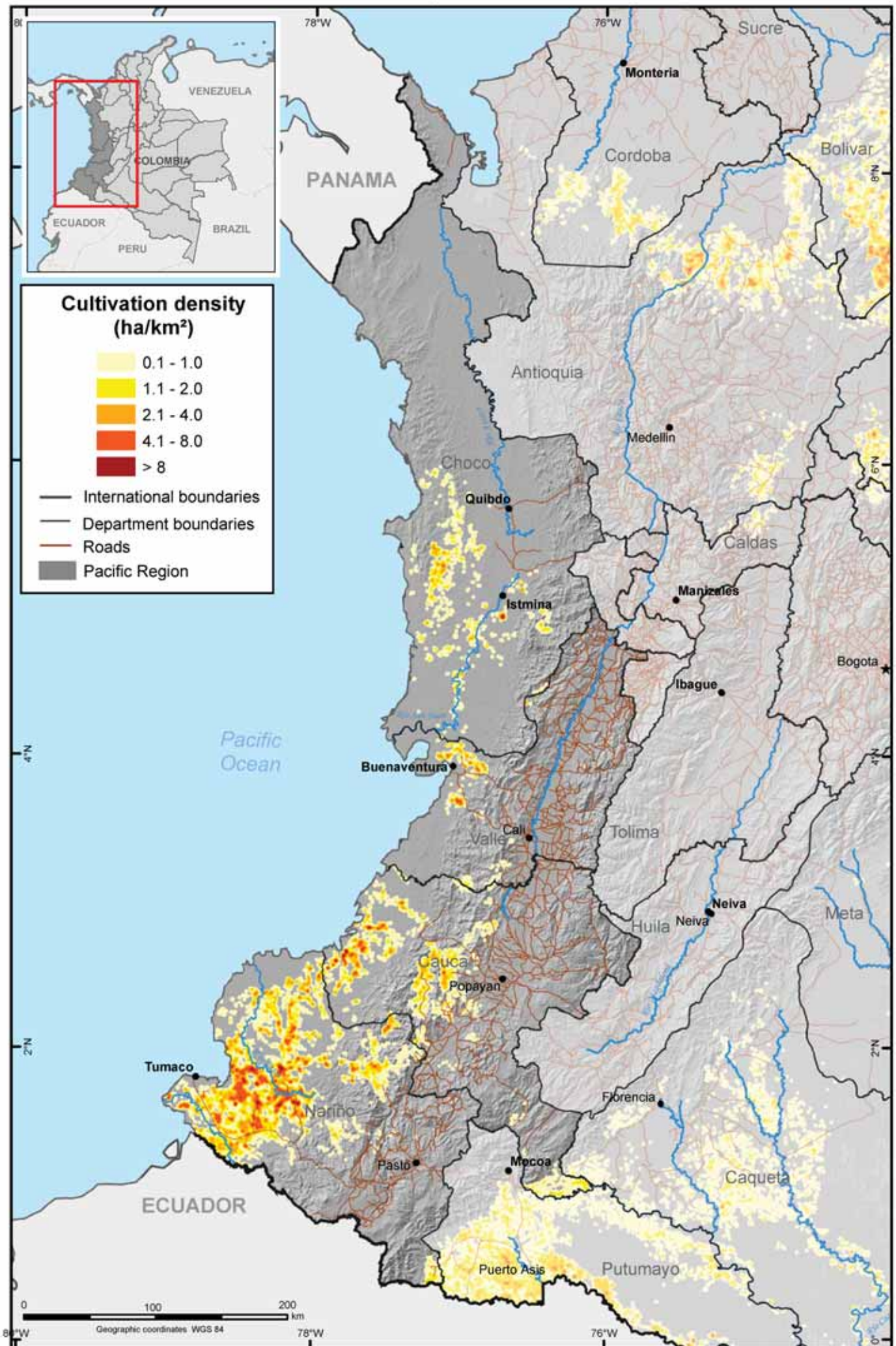
Table 6. Coca cultivation by region 2003 - 2008 (hectares)

Region	2003	2004	2005	2006	2007	2008	% of Change 2007 - 2008	% of Total 2008
Pacific	19,561	15,789	17,633	18,807	25,960	29,917	15%	37%
Central	15,389	15,081	15,632	12,131	20,953	18,731	-11%	23%
Putumayo Caqueta	14,789	10,888	13,951	17,221	21,131	13,961	-34%	17%
Meta-Guaviare	28,977	28,507	25,963	20,540	19,685	12,154	-38%	15%
Orinoco	4,357	6,250	9,709	6,829	9,334	3,621	-61%	4%
Amazonas	2,508	2,588	2,320	1,905	1,471	2,018	37%	3%
Sierra Nevada	759	1,262	542	437	365	551	51%	1%
Rounded Total	86,000	80,000	86,000	78,000	99,000	81,000	-18%	100%

Figure 3: Coca crops by region, 2003-2008



Coca cultivation density in the Pacific region, 2008



Source: Government of Colombia - National monitoring system supported by UNODC

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Pacific region

Nariño is located in the South-western part of the country, at the border with Ecuador. The geographic features of the region include high altitudes, as well as coastline.

Table 7. Coca cultivation in the Pacific Region, 2004 - 2008 (hectares)

Department	2004	2005	2006	2007	2008	% Change 2007-2008
Nariño	14,154	13,875	15,606	20,259	19,612	-3%
Cauca	1,266	2,705	2,104	4,168	5,422	+30%
Choco	323	1,025	816	1,080	2,794	+159%
Valle del Cauca	45	28	281	453	2,089	+361%
Total	15,788	17,633	18,807	25,960	29,917	+15%
Annual trend	-19%	+12%	+7%	+38%	+15%	

Coca cultivation in Nariño became significant in 2002, when coca cultivation decreased in the neighbouring departments of Putumayo and Caqueta. Between 2001 and 2002, coca cultivation decreased by 40,000 hectares in Caqueta and Putumayo, while increasing by 7,600 hectares in Nariño. Aerial spraying in Nariño department reached 54,000 hectares. In addition, 7,985 hectares of manual eradication were reported in 2008. In the period 2007-2008, coca cultivation decreased 647 hectares.

In 2008, coca cultivation was found in 25 municipalities out of 64. With a total of 19,612 hectares of coca cultivation, Nariño has the highest amount of land under illicit cultivation with 24% of the total coca cultivation in the country. Nariño accounted for 34% of all the fields of less than ¼ hectare found in the country in 2008, indicating the small scale of the coca cultivation.

Like neighbouring Nariño department, Cauca has a long coastline, high mountain ranges and a mainly rural economy. Following a period of continuous decrease between 1999 and 2006 interrupted in 2005, the increase in the period 2007-2008 to double of the area, took place when the manual eradication increased from 1,884 hectares in 2007 to 1,919 hectares in 2008.

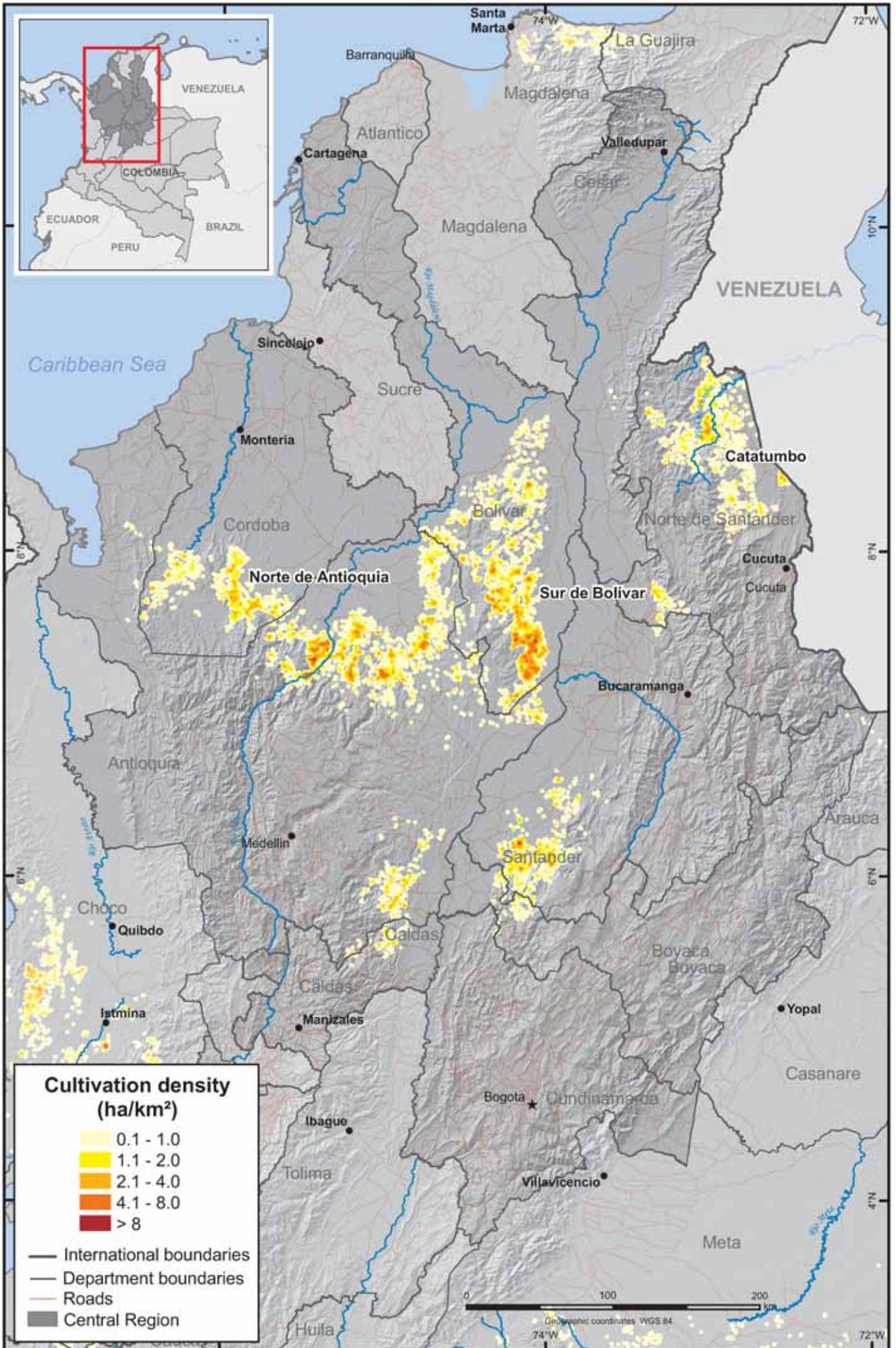
Although its capital, Cali, was an important centre for narco-trafficking in the nineties, the department of Valle del Cauca always recorded less than 300 hectares under coca cultivation, but it showed an increase in the period 2005-2008 (750%) from 28 hectares in 2005 to 2,089 hectares in 2008.



Coca fields in Nariño department

The Choco department also shows an increase in the period 2007-2008 from 1,080 hectares to 2,794 hectares. Although, because of the almost constant cloud coverage it might be due fields newly detected this year. This increase also may be due to the facts that the Choco department is an important gate for cocaine exportation and also to the weather and topographic difficulties for aerial aspersion and manual eradication. In fact no aerial aspersion took place in 2008 and only 677 hectares were eradicated in 2008

Coca cultivation density in the Central region, 2008



Source: Government of Colombia - National monitoring system supported by UNODC
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Central region

Table 8. Coca cultivation in the Central Region, 2004-2008 (hectares)

Department	2004	2005	2006	2007	2008	% change 2007-2008
Antioquia	5,168	6,414	6,157	9,926	6,096	-38%
Bolivar	3,402	3,670	2,382	5,632	5,847	+4%
Norte de Santander	3,055	844	488	1,946	2,886	+48%
Santander	1,124	981	866	1,325	1,791	+35%
Córdoba	1,536	3,136	1,216	1,858	1,710	-8%
Caldas	358	189	461	56	187	+234%
Boyaca	359	342	441	79	149	+149%
Cundinamarca	71	56	120	131	12	-91%
Cesar	0	0	0	0	5	n.a
Total	15,073	15,632	12,131	20,953	18,731	-11%
Annual trend	-2%	+4%	-22%	+73%	-11%	

Since 2002, coca cultivation remained stable at around 15,000 hectares in the Central region of Colombia. In 2007 the region showed a significant increase of 8,822 hectares (+73%) with respect to 2006 but a decrease to 18,731 hectares (-11%) in 2008. At the end of the nineties, Norte de Santander department was one of the most important centres of coca cultivation in the country, accounting for 10% of the country total in 1999. Between 1999 and 2006, the Government has been able to drastically reduce coca cultivation in this department and in 2006 dropped it to less than 500 hectares. In 2008, coca cultivation showed a very important increase of 2,378 hectares (six times more than the amount accounted in 2006 of 488 hectares).

In the department of Bolivar, coca cultivation is concentrated in the South, in an area known as South of Bolivar. Coca cultivation in the department remained relatively stable, accounting for 3% to 8% of the country total in the period 1999 - 2006. In 2008 coca cultivation increased by 245% in the amount of 3,465 hectares with respect to 2006, the highest in the last eight years. The manual eradication increased considerably from 514 hectares in 2007 to 3,773 (+740%) hectares in 2008 whereas the aerial spraying in this department decreased in the considerable amount of 4,836 hectares (-69%).

In Antioquia, coca cultivation averaged 3,000 hectares between 1999 and 2002. Coca cultivation has been increasing since 2002, from 3,030 hectares to 9,926 hectares in 2007 but it showed a significant decrease of 3,830 hectares in 2008. This decrease in the last year responds to a significant increase in manual eradication from 6,166 hectares in 2007 to 18,300 hectares in 2008 along with a reduction of aerial spraying, from 27,000 hectares to 10,000 hectares.

In the department of Caldas, the most important coffee growing area in Colombia, coca cultivation was detected for the first time in 2003 (54 ha). Coca cultivation reached a peak in 2006 with 461 hectares and went back to the 2003 level but increased again to 187 hectares in 2008. The manual eradication decreased from 424 hectares to 285 hectares while no aerial spraying took place in 2008.

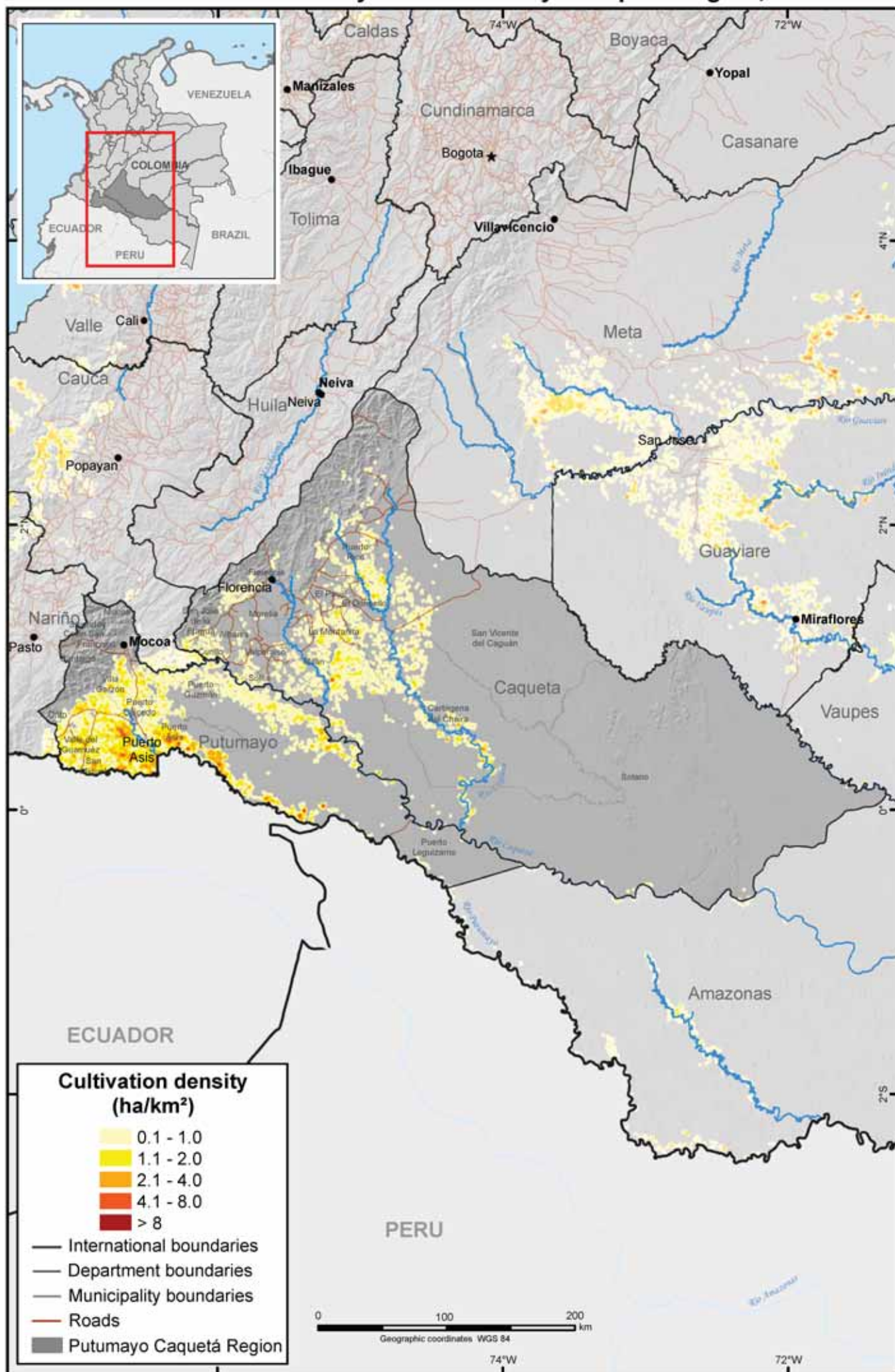
The department of Cordoba showed a minor decrease of 148 hectares in 2008 (-8%). The manual eradication reported in 2008 amounts to 7,310 hectares with respect to 2007 (+43%) and the aerial spraying presented a significant decrease from 6,300 hectares in 2007 to 3,561 hectares in 2008 (-44%).

The departments of Norte de Santander, Antioquia and Santander received the largest support in alternative development in Colombia (65% in 2006 and 58% in 2007) of the national total investment.

Coca field in Catatumbo Region



Coca cultivation density in the Putumayo-Caqueta region, 2008



Source: Government of Colombia - National monitoring system supported by UNODC
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*Putumayo-Caqueta region***Table 9. Coca cultivation in the Putumayo-Caqueta Region, 2004-2008 (hectares)**

Department	2004	2005	2006	2007	2008	% Change 2007-2008
Putumayo	4,386	8,963	12,254	14,813	9,658	-35%
Caqueta	6,500	4,988	4,967	6,318	4,303	-32%
Total	10,886	13,951	17,221	21,131	13,961	-34%
Annual trend	-26%	+28%	+23%	+23%	-34%	

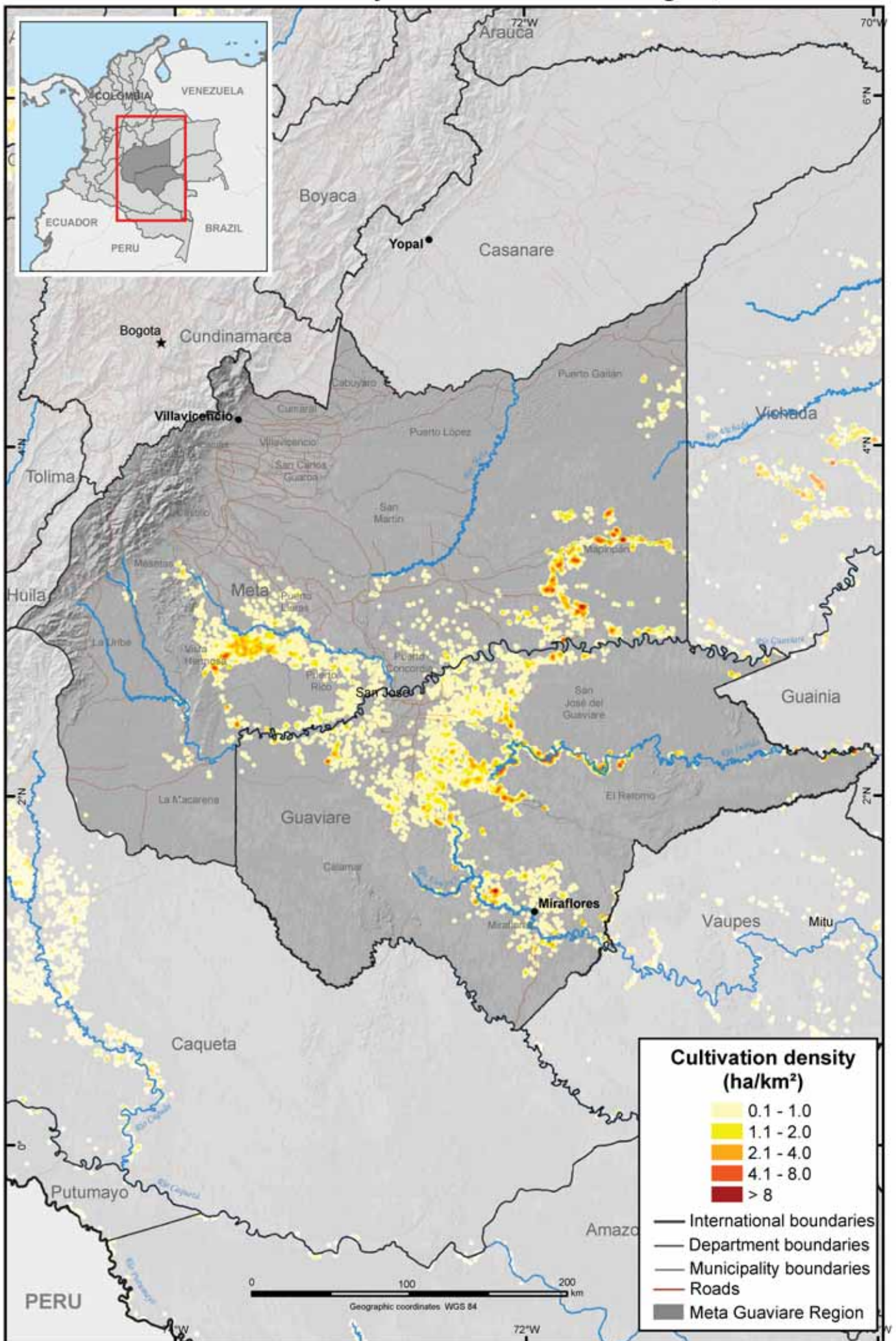
In 2000, coca cultivation peaked in Putumayo department at 66,000 hectares, representing 40% of the national total. Following four years of consecutive decreases, coca cultivation in Putumayo was estimated at only 4,400 hectares or 5% of the national total in 2004, but this trend was later reversed. Between 2005 and 2007, coca cultivation soared by 105% in 2005 and by 37% in 2006 and by 21% in 2007 and went back in 2008 to 2005 levels, although maintaining this department on the second place of coca cultivation in the country. At the same time, 29,284 hectares were manually eradicated which represents an increase of almost five times more over 2006, while the aerial spraying decreased to 11,900 hectares.

The Government's Plan Colombia to fight against illicit drugs was implemented in 2002 in this department, combining actions of interdiction, aerial spraying, manual eradication and important alternative development projects with good results in the period 2002 to 2004. 8% of the 2008 budget of ongoing alternative development projects went to Putumayo, whereas this used to be 35% in the 2003-2006 period. Many of the new coca fields were re-established on the fields cultivated at the beginning of this decade. The spraying activities in 2008 decreased in 28% in this region, but the manual eradication compensated this with an increase of 26%.

In Caqueta department, coca cultivation peaked at 26,000 hectares in 2000 or 16% of the country total. Following intense aerial spraying that started in 1996; coca cultivation decreased to levels around 6,000 hectares in the period 2002-2007. In 2008, coca cultivation shows its lowest level at 4,303 hectares, while the aerial spraying which remained around 5,000 hectares since 2005, but shows an increase to 11,000 hectares in 2008.

*Cocal fields in Putumayo-Caqueta region*

Coca cultivation density in the Meta-Guaviare region, 2008



Source: Government of Colombia - National monitoring system supported by UNODC

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*Meta-Guaviare region***Table 10. Coca cultivation in Meta-Guaviare, 2004 – 2008 (hectares)**

Department	2004	2005	2006	2007	2008	% Change 2007 - 2008
Guaviare	9,769	8,658	9,477	9,299	6,629	-29%
Meta	18,740	17,305	11,063	10,386	5,525	-47%
Total	28,509	25,970	20,540	19,685	12,154	-38%
Annual trend	-2%	-9%	-21%	-4%	-38%	

The Meta-Guaviare region was traditionally the largest coca-producing region; however, the notorious increase of coca cultivation in the Pacific, Putumayo-Caqueta and Central regions and the decreasing trend since 2005, dropped this region to the fourth place in 2007 and 2008. At the same time, the region has received very little support with alternative development programmes.

In 2004 and 2005, the department of Meta was the department with the highest level of coca cultivation, but dropped to the sixth place in 2008, because of a continuous decrease of 36% in 2005-2006, 6% in 2006-2007 and a dramatic 47% in 2008.

The department of Meta included 7% of the national coca cultivation area. The sprayed area of coca cultivation decreased from 15,527 in 2007 to 9,057 hectares in 2008 and 7,972 hectares were eradicated manually against 3,768 hectares in 2007.

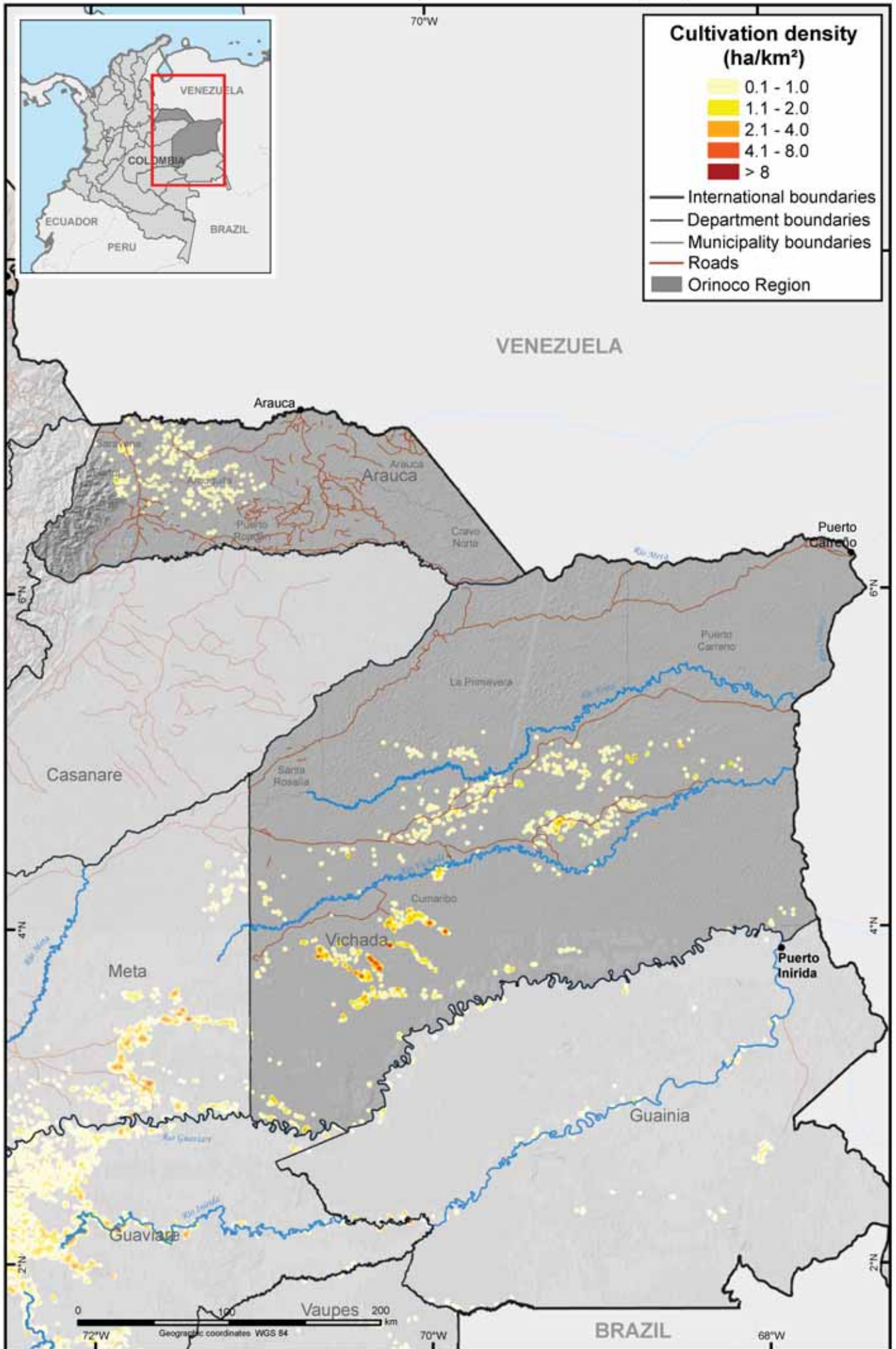
Guaviare was the department where coca cultivation first appeared in Colombia at the end of the seventies. Since then, coca cultivation remained important in the department. Though a significant decrease was noted in the past few years, this trend was reversed in 2007 when 9,299 hectares were detected and went back in 2008 with a notorious reduction of 2,670 hectares (-29%) reaching its lowest level ever measured (6,629 hectares). At the same time, aerial spraying increased from 11,000 hectares in 2007 to 13,000 hectares (+18%) while no manual eradication took place in 2008. Guaviare accounted for 8% of the national total.

The simultaneous lack of the eradication activities along with the important reduction of coca cultivated area, might be explained by the implementation in the Meta-Guaviare region of the government's Consolidation Plan in 2007 lead to strengthen the presence of the state, to recover the population safety and to promote the investments of the private and international sector in licit agricultural production.

Among the fifteen national parks surveyed, the National Park of Nukak, located within Guaviare department, had the largest level of coca cultivation within a protected area in 2008 (1,033 hectares). This represented a decrease of 337 hectares (-24%) compared with 2007. This Park replaced the National Park Sierra La Macarena as the protected area with the largest area cultivated with coca.

*Coca fields in Meta Guaviare region.*

Coca cultivation density in the Orinoco region, 2008



Source: Government of Colombia - National monitoring system supported by UNODC
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*Orinoco region***Table 11. Coca cultivation in the Orinoco region, 2004 – 2008 (hectares)**

Department	2004	2005	2006	2007	2008	% Change 2007 - 2008
Vichada	4,692	7,826	5,523	7,218	3,174	-56%
Arauca	1,552	1,883	1,306	2,116	447	-79%
Total	6,244	9,709	6,829	9,334	3,621	-61%
Annual trend	+43%	+56%	-30%	+37%	-61%	

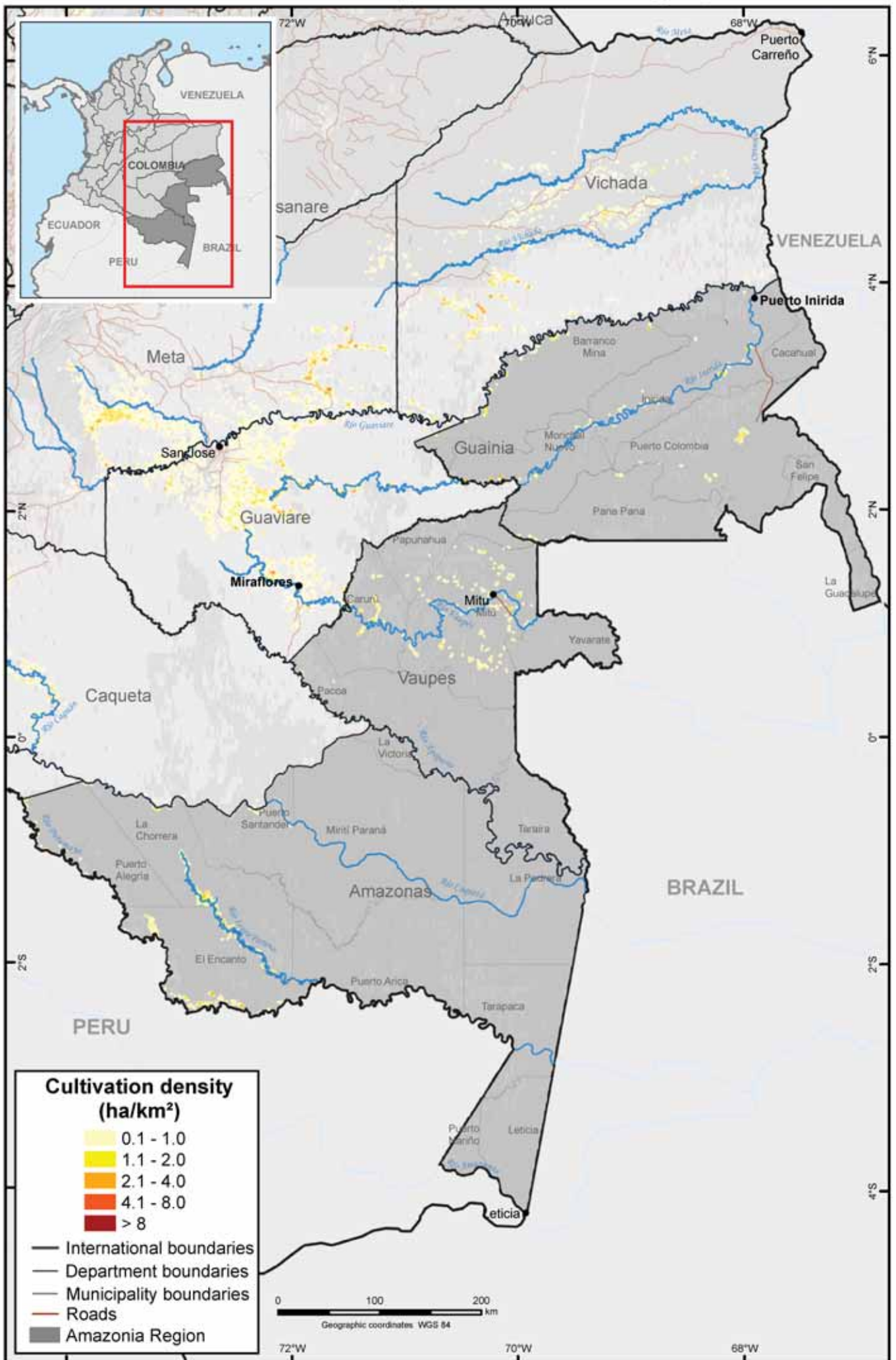
In Vichada department, near the Venezuelan border, coca cultivation peaked at 9,200 hectares in 2001 decreasing to 5,523 hectares in 2006, increasing again to 7,218 hectares in 2007 and decreasing again to the level in 2003 with 3,174 hectares in 2008.

In Vichada, the most important concentration of coca cultivation was found between the Tuparro and Vichada rivers in the centre of the department. The dispersion of coca cultivation in remote parts of the department increases the time flight and cost of aerial spraying. However, after a record of 7,193 hectares of aerial spraying in 2007 it decreased to 5,900 hectares in 2008 but a considerable amount of 7,242 hectares were manually eradicated in 2008 against only 590 hectares reported in 2007.

Coca cultivation in Arauca was detected for the first time in 2000 with about 1,000 hectares. It went over 2,000 hectares in 2001 and after a decrease in 2003-2006, it went back over 2,000 hectares in 2007 and showed its lowest record of 447 hectares in 2008. In 2003, aerial spraying amounted to 12,000 hectares and coca cultivation dropped to 500 hectares in December of that year. However, the coca cultivation increased in the period 2004-2007 to 2,116 hectares and decreased again to 447 hectares in 2008 against a decrease of manual eradication from 660 hectares to 106 hectares and aerial spraying from 2,695 hectares to 2,296 hectares.

*Coca fields in the Orinoco region.*

Coca cultivation density in the Amazonas region, 2008



Source: Government of Colombia - National monitoring system supported by UNODC
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*Amazonas region***Table 12. Coca cultivation in the Amazonas Region, 2004-2008 (hectares)**

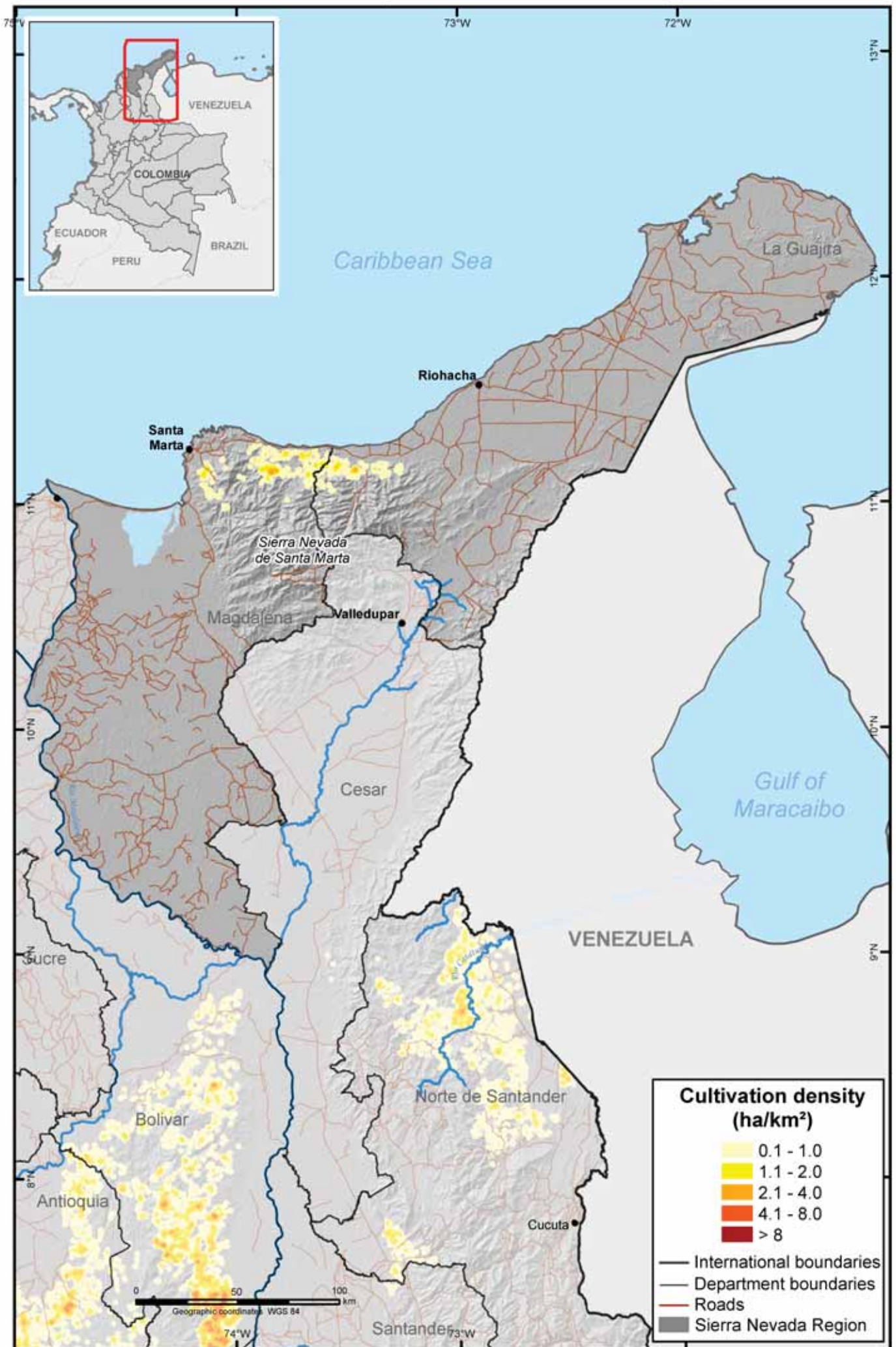
Department	2004	2005	2006	2007	2008	% Change 2007 - 2008
Guainia	721	752	753	623	625	0%
Amazonas	783	897	692	541	836	+55%
Vaupes	1,084	671	460	307	557	+81%
Total	2,588	2,320	1,905	1,471	2,018	+37%
Annual trend	+3%	-10%	-18%	-23%	+37%	

Like the Putumayo-Caqueta region, the departments of Vaupes, Amazonas and Guainia belong to the Amazon basin. Although sharing important similarity with Putumayo and Caqueta, these three departments, referred to as Amazon region, have never been important centres of coca cultivation. This is due to the remoteness of the area, as well as to the lack of airport and road infrastructure linking this region to the rest of the country. Consequently, no aerial spraying of coca cultivation was carried out in 2008 but for the first time, 310 hectares of coca were manually eradicated by the Army and the National Police in the department of Amazonas.

Coca cultivation continues the trend of slow decrease since coca cultivation was first observed in 2000.

*Coca field in Amazonas Department*

Coca cultivation density in the Sierra Nevada region, 2008



Source: Government of Colombia - National monitoring system supported by UNODC

The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

*Sierra Nevada region***Table 13. Coca cultivation in the Sierra Nevada region, 2004-2008 (hectares)**

Department	2004	2005	2006	2007	2008	% Change 2007 - 2008
Magdalena	706	213	271	278	391	+41%
Guajira	556	329	166	87	160	+84%
Total	1,262	542	437	365	551	+51%
Annual trend	+66%	-57%	-19%	-16%	+51%	

The Sierra Nevada region, with the departments of Magdalena and Guajira, has never been an important centre of coca cultivation in Colombia. Coca cultivation remained between 500 and 1,300 hectares over the last eight years and started a decreasing trend to reach the lowest level with only 365 hectares in 2007 and increasing to 551 hectares in 2008. Coca cultivation remained located mainly in the fringe of lowlands between the high mountains of the Sierra Nevada and the seashore. No aerial spraying activities took place in the region and at the same time manual eradication reached 1,026 hectares in 2008 for an increase of 249 hectares with respect to 2007.

However, the region is an important area for narco-trafficking activities, in particular for the shipping of drugs to the Caribbean Islands and the United States.

For a few years already, the Sierra Nevada region benefited from important aid for alternative development, mainly due to the Sierra Nevada National Park.

The region is also an important tourism centre and hosts the Sierra Nevada National Park. The National Park is one of the most important ecological reserves in Latin America, known for its biodiversity and presence of several ancient indigenous cultures. In 2008, coca cultivation amounted to 170 hectares in the Sierra Nevada National Park, an important increase of 81% compared to 2007.

*Coca field in Sierra Nevada region*

Possible areas of new cultivation

The survey covered and interpreted 100% of the national territory, including areas previously not known as being coca-growing regions. In doing so it serves as an early warning system to detect and prevent the spread of coca into new areas.

In 2008, potential small coca fields have been detected in remote areas outside the established agricultural areas of the departments of the Orinoco and Amazon River basins. Field verification has not been carried out in these areas because the verification of small and isolated patches of coca cultivation was considered too time consuming and too costly. Therefore, the estimate for coca cultivation in these areas is presented as indicative and was not included in the final estimate.

The 2008 survey analyzed 14 Landsat images for vegetation having characteristics similar to coca fields. A total of 564 hectares were assessed as possible coca cultivation in new areas.

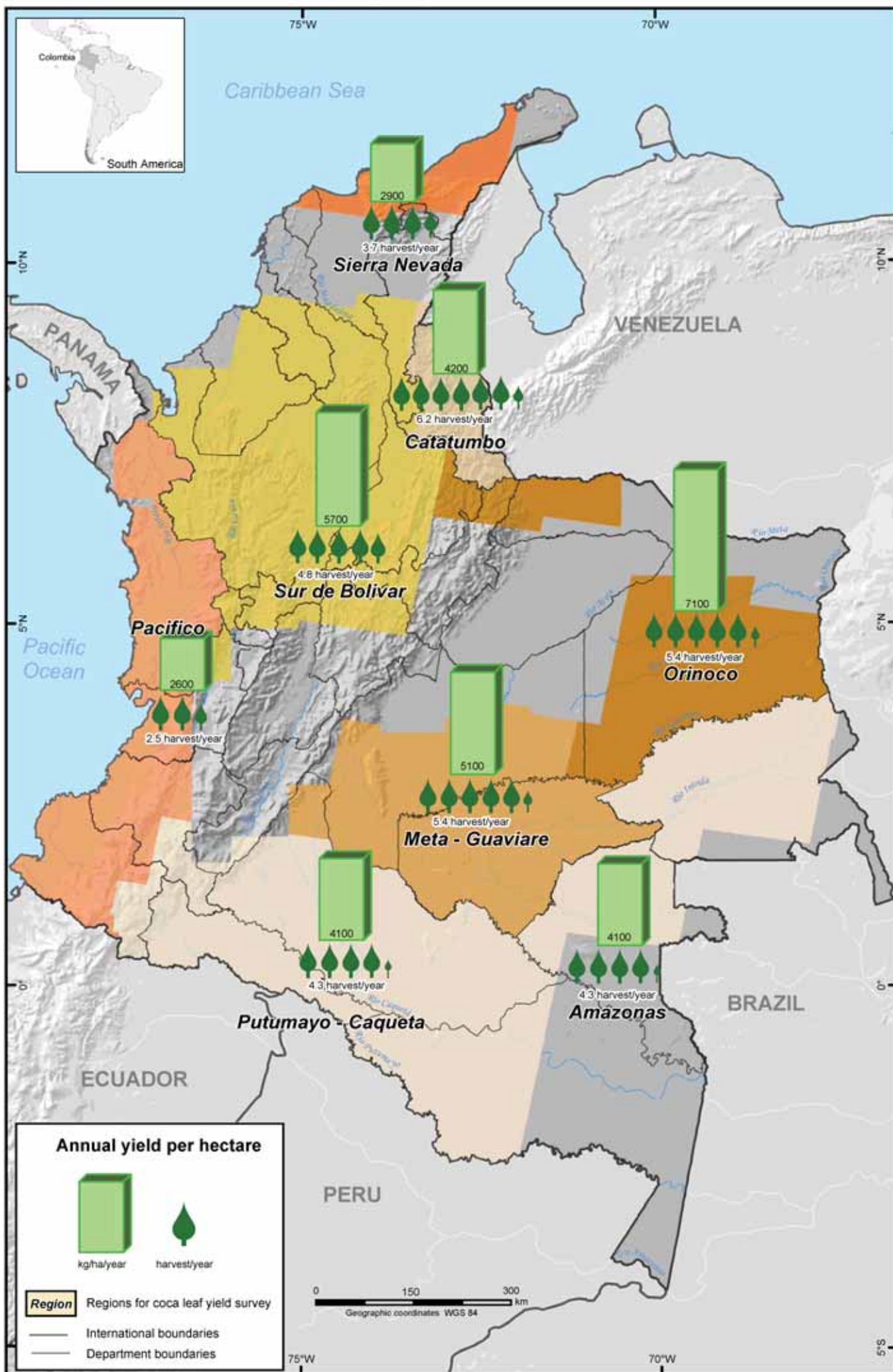
Table 14. Possible coca cultivation in new area, 2008

Department	Area (ha)
Vaupes	246
Amazonas	172
Boyaca	14
Magdalena	58
Guainia	48
Cesar	23
Vichada	2
Caqueta	1
Total	564



New coca fields in Vaupes department.

Coca yield by region in Colombia, 2008



Source: Government of Colombia - National monitoring system supported by UNODC
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2.2 Coca leaf, coca paste and cocaine base production

In December 2008 and April 2009, SIMCI with the support of the UNODC and the Colombian Directorate of Narcotics (DNE) conducted a new comprehensive piece of research toward assessing the current annual yield of the fresh coca leaf, identifying the latest agricultural practices associated with coca cultivation, such as extent of the use of pesticides, fertilizers and herbicides as well as estimating conversion rates from fresh coca leaf into cocaine base.

Unfortunately, high survey costs and security conditions prevailing in the areas around coca fields (including the presence of illegal armed groups) prevented SIMCI from monitoring the yield every year in all the coca cultivation regions in Colombia. This round of coca leaf survey was carried out in Putumayo-Caqueta³ and Meta-Guaviare⁴.

The surveys were composed of two components; the first component involving the harvesting of fresh coca leaf, where fresh coca leaves were harvesting by stripping them from the branches of all plants in each of the random selected plots and their fresh weights on each plot were recorded. The second component was composed of interviews by questionnaire with coca farmers. The survey relied on 210 face to face interviews and 70 actual harvest tests in Putumayo-Caqueta, and 300 face to face interviews and 100 actual harvest tests in Meta-Guaviare.

The figures presented herein derive from the field work carried out during the survey, and correspond to the averages found in the questionnaire data collected from the coca farmers and extrapolated to the whole sampling frame under a statistical sampling design⁵.

The analysis of the collected data in the field by these surveys revealed that with respect to the yields estimated in 2005⁶, there was a significant decline of the amount of coca that could be harvested from the fields in 2008. UNODC/SIMCI was able to confirm that with respect to 2005, there was a decrease of 59% in the fresh coca leaf production in Meta-Guaviare and 33% in Putumayo-Caqueta as estimated from the data collected from the interviews with farmers.

The estimated annual coca leaf yield in Meta-Guaviare went down from 8,200 kilograms per cultivated hectare/year to 5,100 kilogram per annual cultivated hectare in 2008. The estimated annual coca leaf yield in Putumayo-Caqueta changed from 4,600 kilograms per cultivated hectare/year in 2005 to 4,100 kg/ha/year in 2008.

Table 15. Changes in coca leaf yield Meta-Guaviare and Putumayo-Caqueta, 2008

Region	Area (Ha)	Number of harvest		Coca leaf yield (Tm/ha/year)	
		2005	2008	2005	2008
Meta-Guaviare	12,154	6.6	5.4	8.2	5.1
Putumayo-Caqueta	13,961	3.9	4.3	4.6	4.1

In 2005 and 2008, biomass data from harvesting fresh coca leaf and from interviews was collected. The comparison of interviews data in the region showed a decrease of 8,200 kg/ha/year in 2005 to 5,100 kg/ha/year in 2008. The comparison of harvesting data showed a decrease of 9,900 kg/ha/year

³ The survey field work was subcontracted by DNE to Empresa Gestion Rural Consultants, an agricultural research consultant based in Bogota, Colombia.

⁴ The survey field work was subcontracted by SIMCI to Agricultural Assessments International Company (AAIC), an agricultural research consultant with extensive experience in agricultural surveys in Latin America and South Asia which has been working with UNODC/SIMCI since the beginning of the coca leaf yield surveys in 2005.

⁵ The survey to assess the coca leaf yield in Colombia was conducted using a stratified multistage area frame sampling design. The sampling frame was constructed based on those coca fields identified using satellite images covering the entire country in 2007 and 2008.

to 5,700 kg/ha/year. The interviews data was used for the calculation of the coca leaf production in 2008.

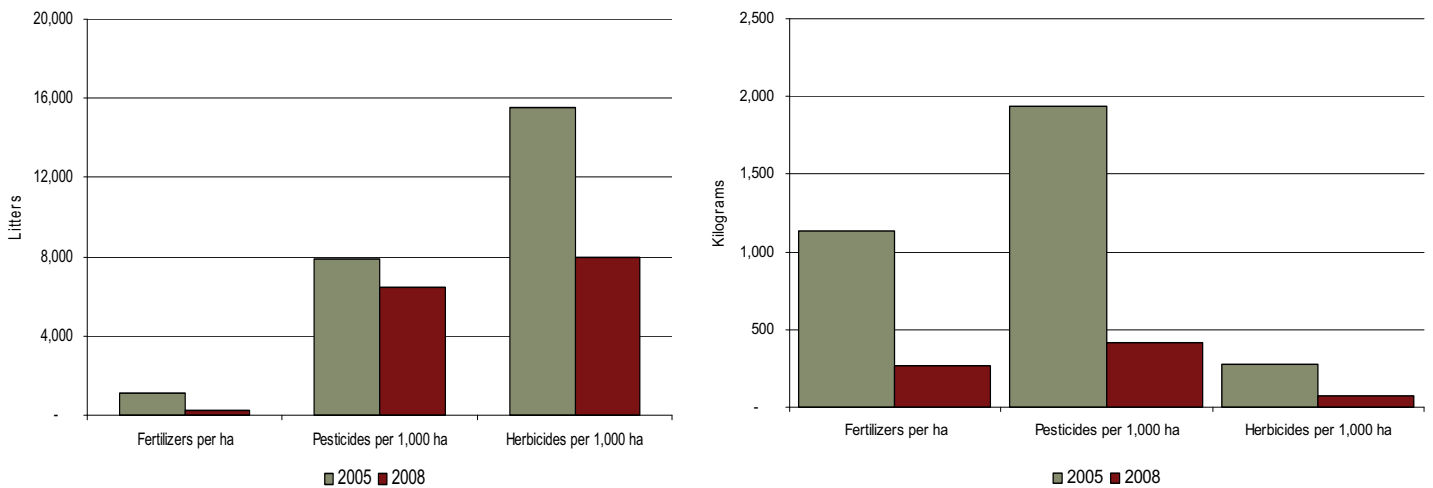
Coca cultivation like any other agricultural activity is not exempt of the effects of the environment. However, not only the climate, pest, and diseases could have affected coca leaf yields this year but also the coca bush in Meta-Guaviare faced the challenge of aerial spraying and manual eradication. In Meta-Guaviare, 22,118 hectares cultivated with coca were sprayed in 2008 and 7,982 hectares were eradicated manually against 4,810 hectares in 2007.

Farmers declared the use of several herbicides, fertilizers and pesticides in order to keep their crops free of a wide variety of competitive plants (including grass and perennial weeds) and pest, as well as to increase the productivity of their crops. Survey data provide evidence that with respect to the 2005 survey in the region under study, there was a significant reduction in the amount of agricultural inputs used by coca farmers to manage the coca fields in 2008. From the collected data, it was estimated that in Meta-Guaviare, coca farmers decrease in average as much as 73% the amount of solid fertilizers, pesticides and herbicides and as much as 40% the amount of liquid agricultural inputs. In the northern regions, the use of these agricultural inputs has also been reduced in an average of 60% in its solid form and of 5% in its liquid form.



Weeding coca field

Figure 4: Use of fertilizers, pesticides and herbicides in liquid and solid form in Meta-Guaviare, 2005-2008



In relation with the age of the plant, it was observed that in 2005, 44% of the coca fields were planted with plants with age between two and four year old, which according to coca farmers, it is the time when plants give its maximum yields. In 2008, 59% of the coca fields were planted with coca bushes older than five years old, which according to coca farmer is the time when there is a steady decline of the leaf production.

Table 16. Plant age in Meta-Guaviare, 2005-2008

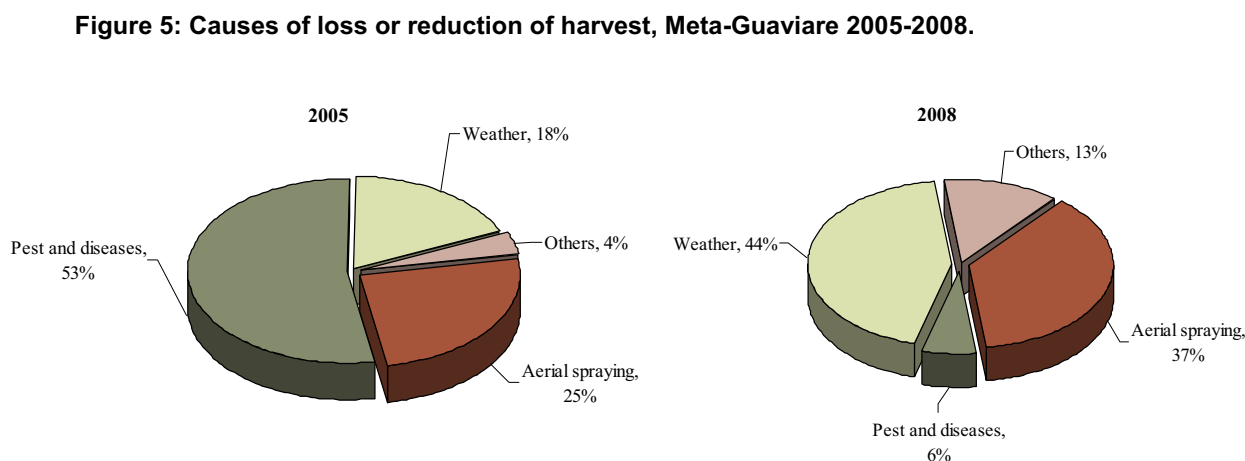
Age	2005		2008	
	%fields	Yield 05 Tm/ha/year	% fields	Yield 08 Tm/ha/year
Less than 1 year	13	5.7		
From 1 to < 2 years	14	9.6	1	5.4
From 2 to < 3 years	19	8.8	8	5.5
From 3 to < 4 years	25	8.7	15	6.1
From 4 to < 5 years	12	8.3	17	5.8
Five years and more	17	6.3	59	4.7

In terms of coca variety, the survey did not find any significant change in the coca variety used in Meta-Guaviare by the farmers. Most of the farmers used one type (Dulce that could be *Erytroxilum coca* Lam Var *Ipadu*) and it is planted alone without some association with licit cultivation or other varieties.

During the time of the survey farmers in Meta-Guaviare were asked whether or not they have experienced any loss of a full harvest or of part of it. In 2005, 56% of the coca farmers did not have any loss. The most significant causes of loss of harvest among the affected farmers, was pest and diseases. In the same context, in 2008 it was found that 68% of the coca farmers experienced a loss of a full harvest or of part of it.

Table 17. Fields with of loss or reduction of harvest for different reasons in Meta-Guaviare (from interviews), 2005-2008.

Aspects	2005		2008	
	# fields	Percentage	#fields	Percentage
Fields with losses or reduction of harvests	9,978	44%	7,451	68%
Fields without losses	12,535	56%	3,487	32%



Coca fields can be harvested several times during the year. The number of times a coca field is harvested may depend on several factors such as weather, agricultural management (change in use/amount of herbicides, pesticides and fertilizers), aerial spraying, manual eradication, and coca variety grown. Furthermore, in some cases, the frequency of harvests is also determined by the coca trade market rather than crop maturity.

At the time of the field work, coca farmers in Meta-Guaviare were asked how often they harvest their fields. Based on the interview data, it was estimated that in average the number of days between each harvest was increased from 55 days in 2005 to 67 days in 2008. This represents a decrease in the annual number of harvest from 6.6 harvests in 2005 to 5.4 harvest in 2008. For the Putumayo-Caqueta region the number of harvests went from 3.9 in 2005 to 4.3 in 2008.

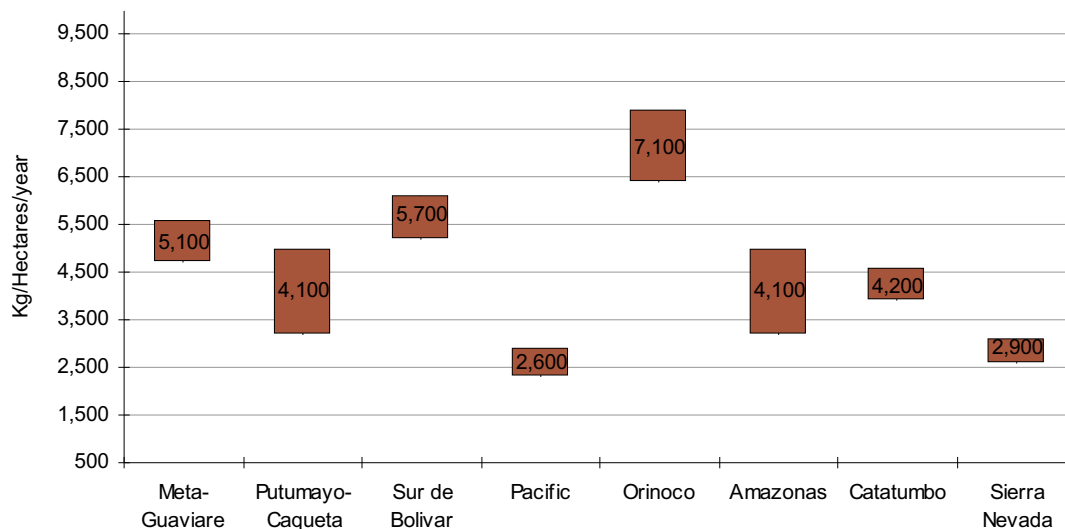
Table 18. Number of harvest by region, 2005-2008.

Region	2005	2007/2008
Meta-Guaviare	6.6	5.4
Sur de Bolivar	3.3	4.8
Putumayo-Caqueta	3.9	4.3
Orinoco	5.4	5.4
Pacific	2.5	2.5
Catatumbo	4.5	6.2
Amazonas	3.9	4.3
Sierra Nevada	3.4	3.7

Table 19. Regional coca leaf yields in Colombia, 2008.

Region	Annual coca leaf yield kg/ha/year	Lower limit 95% confidence interval (kg/ha/year)	Upper limit 95% confidence intervals (kg/ha/year)
Meta-Guaviare ¹	5,100	4,700	5,600
Putumayo-Caqueta ¹	4,100	3,200	5,000
Sur de Bolivar ²	5,700	5,200	6,100
Pacific ³	2,600	2,300	2,900
Orinoco ³	7,100	6,400	7,900
Amazonas ¹	4,100	3,200	5,000
Catatumbo ²	4,200	3,900	4,600
Sierra Nevada ²	2,900	2,600	3,100
National average yield	4,200	3,300	5,100

1. The coca leaf yield corresponds to the average found in the questionnaire data collected from the coca farmers in 2008-2009.
2. The coca leaf yield corresponds to the average found in the questionnaire data collected from the coca farmers in 2007.
3. The coca leaf yield corresponds to the average found in the questionnaire data collected from the biomass in 2005.

Figure 6: Regional average annual number of harvest, framed within their confidence intervals in 2008

Traditional use of the coca leaf is marginal in Colombia and virtually all coca leaf production is destined for cocaine production. There are various ways to produce cocaine: The typical process is that leaves are processed into coca paste, then into cocaine base, then into cocaine hydrochloride. The farmers can either sell the coca leaves, or process these leaves into coca paste or base. In Catatumbo and Sierra Nevada, for instance, most of the coca farmers sell the coca. The last step, the processing of the cocaine base into cocaine hydrochloride is not carried out by farmers but in clandestine laboratories.

Coca paste is the first product obtained in the process of alkaloid extraction from coca leaves using sulphuric acid and combustibles. Therefore, it becomes a cocaine sulphate with a high content of organic remnants, pigments, tannin, and other chemical substances. Cocaine base is obtained by dissolving the cocaine sulphate in an acid and adding an oxidant agent, potassium permanganate being the oxidant most often used and then adding a base. The resulting substance is precipitated and filtered.

The coca leaf yield survey in Catatumbo and Sierra Nevada regions revealed that most of the farmers sell directly the coca leaves (86% and 91% respectively), while in Meta-Guaviare, almost 8 out of 10 farmers process the leaf into coca paste without getting involved in any further process with the leaf. This could be explained because of the high prices of the coca leaf in the regions. On the other hand, two thirds of the farmers in South of Bolivar region process by themselves the coca leaf.



At the national level the division of labour among coca farmers is as follows: 39% of the farmers sell directly the coca leaves without any process most of the times at the farm; 24% of the farmers process the coca leaf into coca paste; whereas the rest of farmers, 37%, process their leaves into cocaine base. As it can be seen in the table below, about 61% of the farmers in Colombia opt to get involved in the transformation process in order to improve their profits.

Manual labour in coca field

Table 20. Division of labour among coca producers, 2008

Region	% of farmers directly selling fresh coca leaves	% of farmers processing coca leaves into coca paste	% of farmers processing coca leaves into cocaine base
Sierra Nevada	91%	4%	5%
Catatumbo	86%	13%	1%
Pacific	68%	31%	1%
Putumayo-Caqueta	32%	1%	66%
Sur de Bolivar	31%	5%	64%
Orinoco	15%	-	85%
Meta Guaviare	22%	78%	-
All regions	39%	24%	37%
Production of leaf TM	131,600	79,264	124,043

During the survey, the farmers who processed their coca leaves were asked about the amount of coca leaves and ingredients used, and the amount of final product obtained. The distinction between paste and base is not easy to draw because the terms are often misused by the farmers themselves. In order to distinguish between these two products, it was decided to refer to cocaine base when the farmers reported the use of permanganate potassium for processing their leaves, and coca paste when the farmers did not report the use of these products.

Figure 7: Proportion of farmers processing and not processing coca leaves in 2008

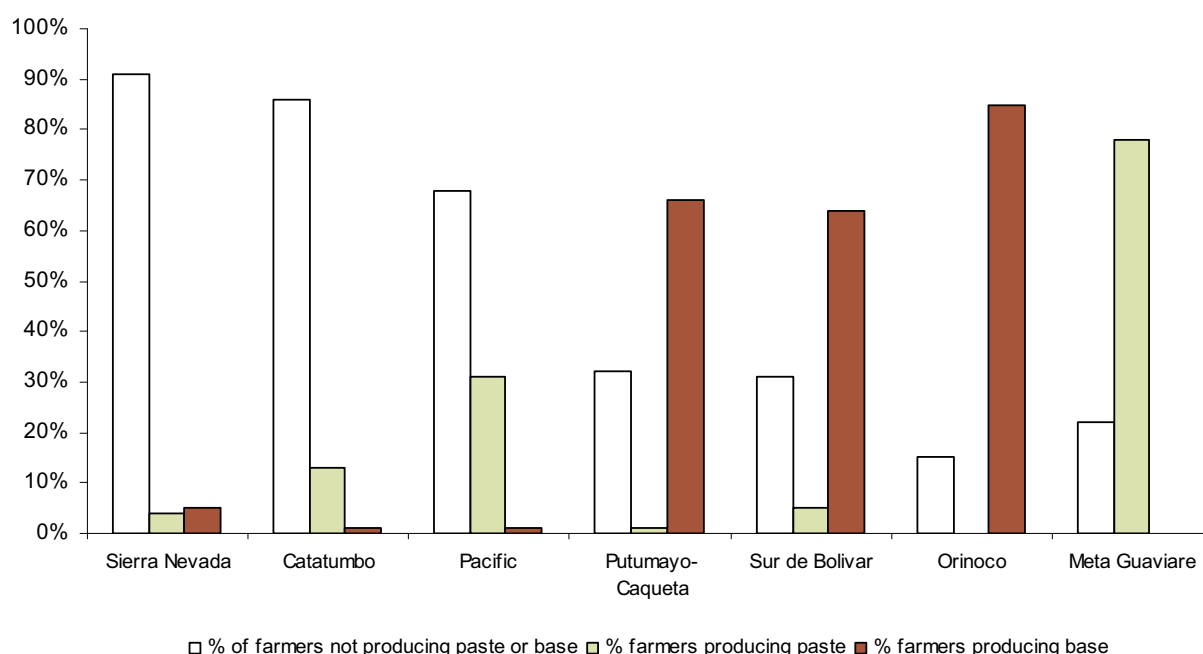


Table 21. Average kg of coca paste or base obtained from one metric ton of coca leaf, 2008.

Region	Avg kg of coca paste per metric tons of coca leaf	Avg kg of cocaine base per metric tons of coca leaf
Putumayo-Caqueta	1.76	1.68
Sur de Bolivar	1.59	1.14
Pacific	1.55	1.46
Meta -Guaviare	1.50	1.50
Sierra Nevada	1.32	1.11
Catatumbo	1.31	1.01
Orinoco ⁷	-	1.73

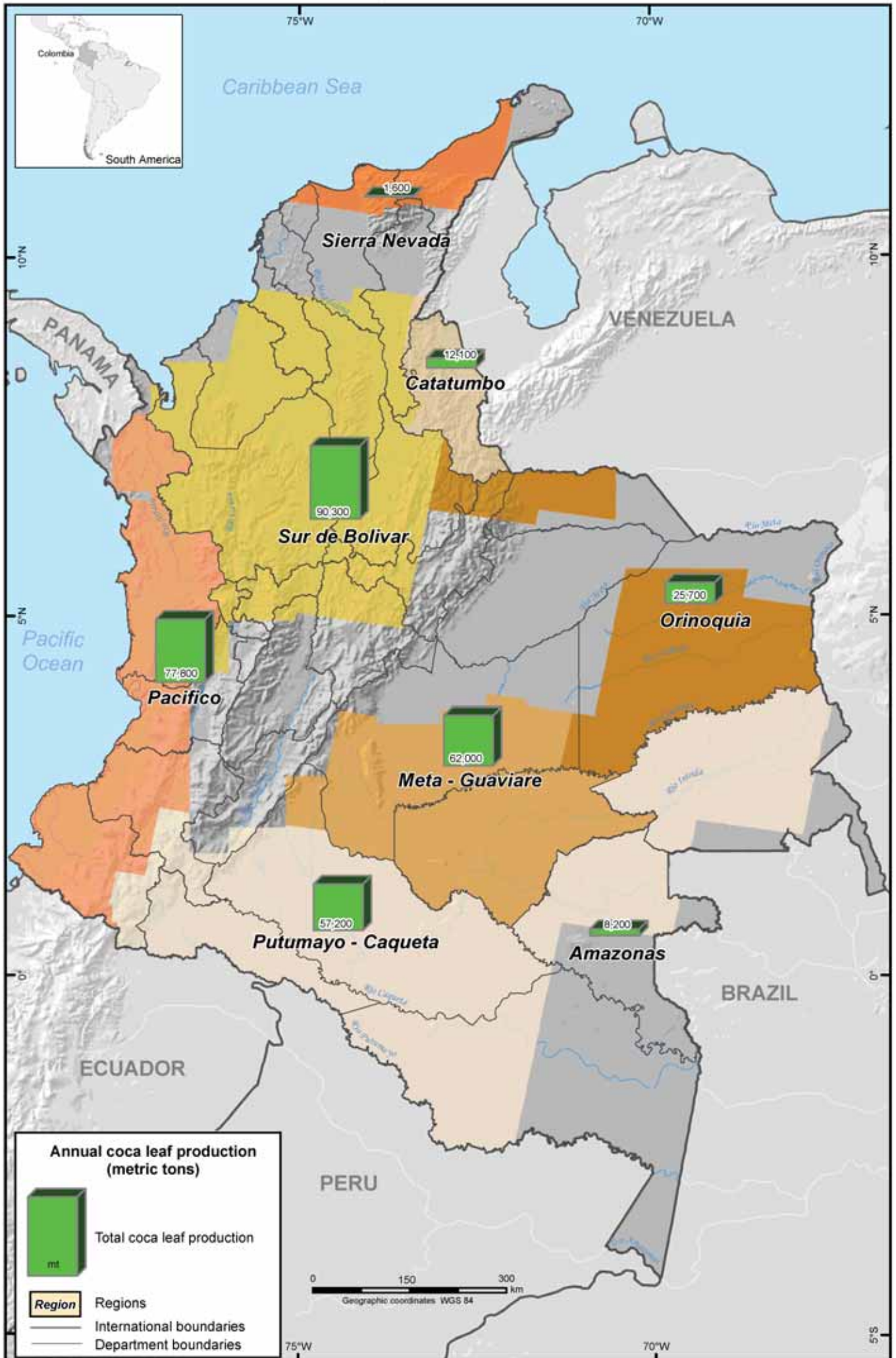
According to the questionnaire interviews, the cocaine extraction process is relatively similar in all regions. Producers prefer to use chemical substances which are accessible in public markets, albeit with some variations depending on the region. Gasoline is reported as the chemical product most used in the production process of coca paste or cocaine base. Based on the data captured during the surveys, it is estimated that the amount of fuel used to process the cocaine base in 2008 amounted to approx. 71 million of gallons taking into account the recycling.



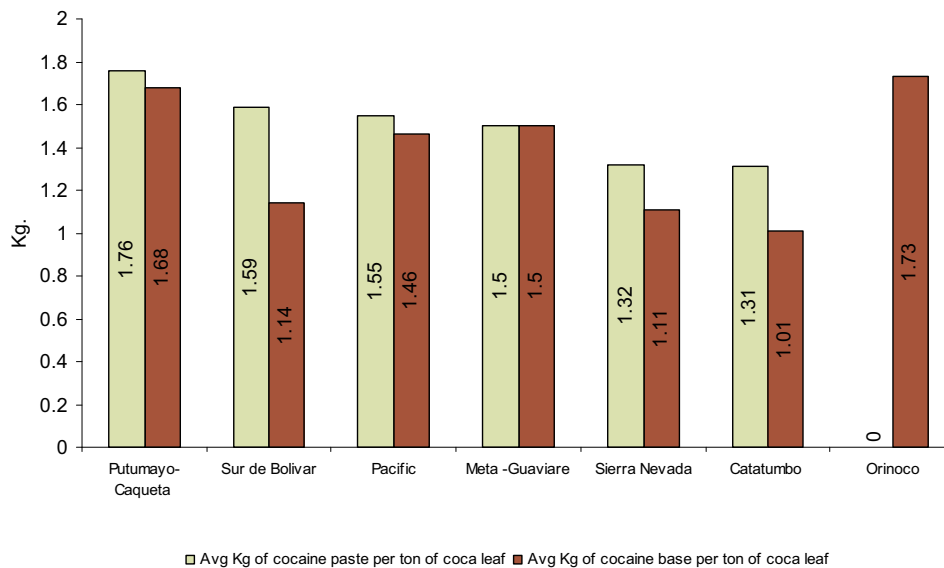
Processing of coca leaves to coca paste

⁷ The Orinoco farmers process only cocaine base.

Annual coca leaf production in Colombia, 2008



Source: Government of Colombia - National monitoring system supported by UNODC.
 The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

Figure 8: Regional average of coca paste and cocaine base obtained from one metric ton of fresh coca leaf, 2008

Combining all the responses from the questionnaires, it is estimated that one *arroba*⁸ of fresh coca leaf could produce up to 18 to 20 grams of cocaine base. Thus, one metric ton of fresh coca leaf is equivalent in average to 1.5 kg of coca paste and 1.4 kg of cocaine base. Putumayo-Caqueta continues being the region with the highest efficiency in the extraction process, whereas Sierra Nevada and Catatumbo show the lowest performance in the extraction process.

Potential base and cocaine production

The latest coca leaf yield surveys carried between 2005 and 2008 have focused on obtaining data not only on the yield of the fresh coca leaf but also on the transformation process from fresh coca leaf to coca paste or cocaine base. The data on annual coca leaf yield and the conversion rates of coca leaves into coca paste and cocaine base were combined with the average area 2007-2008 area under coca cultivation estimates to determine the total productions of coca leaf, coca paste and cocaine base. The production of coca leaf in Putumayo-Caqueta and Meta-Guaviare was calculated by applying the 2008 findings; the production of fresh coca leaf in Sur de Bolivar, Catatumbo and Sierra Nevada was calculated by using the 2007 survey findings, while the production of fresh coca leaf in Pacific and Orinoco⁹ was calculated by the 2005 survey findings.

The potential production of fresh coca leaf was estimated at 389,571 metric tons. Assuming 57% moisture content, this was equivalent to a total production of 167,516 metric tons of sun-dried coca leaf.

⁸ The word *arroba* has its origin in Arabic, which means the fourth part (of a quintal). *Arroba* is widely used in Colombia, Peru and other countries as weight unit. *Arroba* was a Spanish and Portuguese unit of weight, mass or volume. In weight it is equal to about 25 pounds, or 12.5 kilograms in Colombia.

⁹ A new survey is foreseen to be carried out this fall to update coca leaf yields in Pacific and Orinoco regions.

Table 22. Regional coca leaf yields and production in Colombia, 2008

Region	Annual coca leaf yield kg/ha/year	Coca leaf production metric tons
Meta-Guaviare	5,100	81,200
Putumayo-Caqueta	4,100	71,900
Sur de Bolivar	5,700	99,300
Pacific	2,600	72,600
Orinoco	7,100	46,000
Amazonas	4,100	7,200
Catatumbo	4,200	10,100
Sierra Nevada	2,900	1,300
Total coca leaf production	4,200	389,571

Out of the total production of 389,571 mt of coca leaf in 2008, about 93,052 metric tons were processed into coca paste. Using the conversion rate of coca paste for each region, the total coca paste production from farmers was estimated at 125 mt. The rest of the farmers either processed directly into cocaine base, or sell their production as leaf, corresponding to a total of 296,519 mt. Assuming that the production of coca leaf sell directly by the farmers was processed outside the farm into cocaine base at the same rate as within the farm, the total amount of cocaine base was estimated at 429 mt. Overall, either produced from coca paste or directly from coca leaves, the total production of cocaine base in Colombia in 2008 was estimated at 554 metric tons.

To determine conversion rates from cocaine base to cocaine hydrochloride, UNODC relied on external sources. So far, UNODC did not collect any data to estimate the efficiency of these clandestine laboratories nor on the quantity of cocaine hydrochloride that can be produced from coca paste or cocaine base. In addition to the technical difficulties to obtain these data, this kind of survey is also complicated by the existence of several techniques to produce cocaine hydrochloride, and various purity level of the end-product.

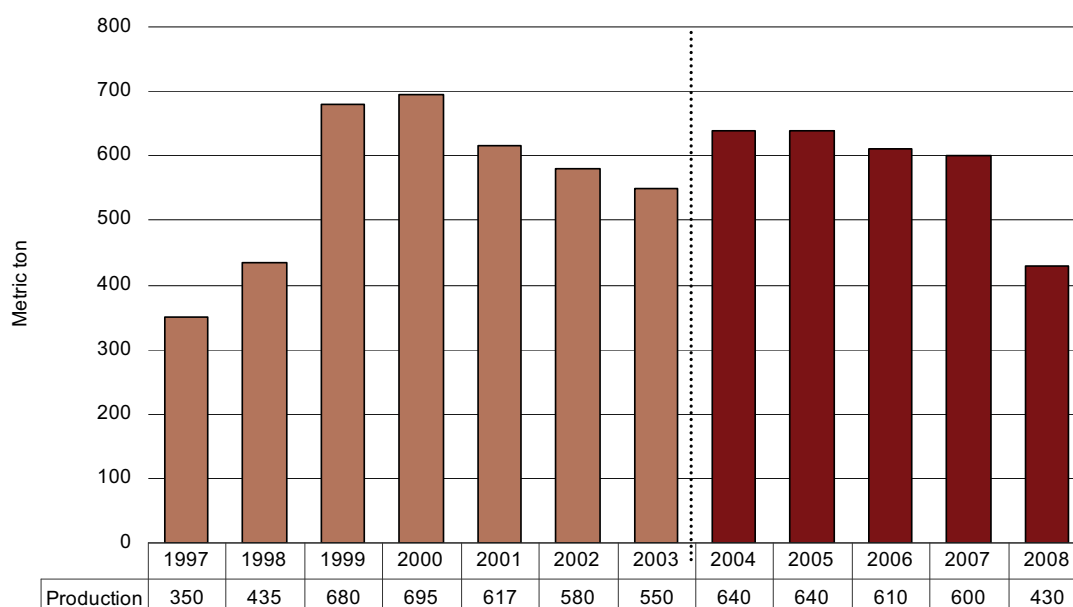
Therefore, the UNODC calculation for cocaine production in 2008 relied on its own estimates of cocaine base and on data obtained by the United States “*Operation Breakthrough*” regarding the conversion rates from cocaine base to cocaine hydrochloride and the resulting purity level of cocaine hydrochloride for conversion into equivalent of pure cocaine production.

US Operation Breakthrough mentioned a 1:1 conversion rate from cocaine base to cocaine hydrochloride. However, this was obtained from laboratories especially set up for this kind of survey, and thus this conversion rate is likely to correspond to ideal circumstances not always obtained in reality. The same source also communicated to UNODC that cocaine base contained about 75% of pure cocaine alkaloid and the cocaine hydrochloride contained about 85% of pure cocaine alkaloid. From this data, UNODC derived a 1:0.91 ratio to convert cocaine base to cocaine hydrochloride. This ratio was deemed to apply better to the cocaine base production which corresponded to cocaine base obtained from farmers not working in ideal conditions.

Based on this data, the 554 metric tons of cocaine base were equivalent to 506 metric tons of cocaine hydrochloride and 430 of pure cocaine.

Table 23. Regional cocaine base, cocaine hydrochloride and pure cocaine production in Colombia, 2008.

Region	Cocaine base (mt)	Cocaine hydrochloride (mt)	Pure Cocaine (mt)*
Meta-Guaviare	111	101	86
Putumayo-Caqueta	121	110	94
Sur de Bolivar	115	105	89
Orinoco	80	73	62
Pacific	104	95	81
Amazonas	12	11	9
Catatumbo	11	10	8
Sierra Nevada	1	1	1
Total	554	506	430

Figure 9: Cocaine production in Colombia, 1998 - 2008 (metric tons)

Note: Cocaine production estimates for 2004 and later is not directly comparable with previous years.

In 2008, at the global level, the cocaine production in Colombia represented 51% of the potential cocaine production estimated in 845 metric tons.

Figure 10: Global cocaine production 1998 – 2008 (in metric tons)

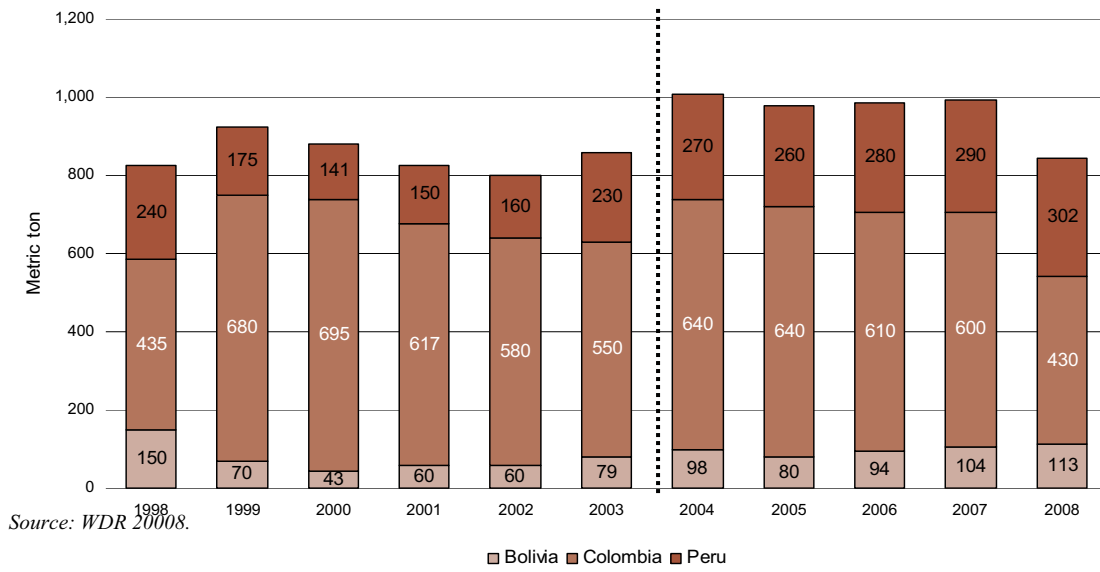


Table 24. Global potential cocaine production, 1998 – 2008 in metric tons.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	% Change 2007-2008	% of 2007
Bolivia	150	70	43	60	60	79	98	80	94	104	113	9%	13%
Peru	240	175	141	150	160	230	270	260	280	290	302	4%	36%
Colombia	435	680	695	617	580	550	640	640	610	600	430	-28%	51%
Total	825	925	879	827	800	859	1,008	980	984	994	845	-15%	100%

Source: World Drug Report 2008

2.3 COCA PRICES

Coca leaf, cocaine base and cocaine prices

Over the past four years coca leaf prices and coca paste prices remained without significant changes in Colombia. In 2008, in local currency (Colombian peso, COP), coca leaf prices remained at an average of COP 2,270/kg whereas coca paste prices remained at an average of COP 1,878,000/kg. In US dollar equivalent, coca leaf price remained at US\$/kg 1.10 and coca paste price remained at \$963 US/kg. Cocaine prices¹⁰ in US dollars have increased by 7% from an average of US\$2,198/kg to US\$2,348/kg in 2008; in local currency, cocaine prices remained unchanged at COP 4.6 million pesos.

The changes in prices and purity of drugs are important indicators for the availability of drugs in the market. In 2005, UNODC/SIMCI started the periodic and systematic collection of price data in the first production stages (coca leaf, coca paste and cocaine base). This information is completed with data from the Presidential management against Illicit Crops (PCI). The prices of cocaine, cocaine base, morphine and heroin were provided by DIRAN and were collected by intelligence services in different cities across the country.

Most of peasants sell coca paste, which they have produced in small “kitchen” located in the farm. The processing does not require vast know-how and high level of technology, therefore, in 85% of the cases the peasant does the processing by himself, and only the remaining proportion of farmers hire a “cook” or “chemist” to do the processing. The technical know-how was brought to the farmers during the 90’s by drug-traffickers to facilitate and to increase the commercialization of cocaine.

The prices of coca in different processing stages (coca leaves and coca paste) are influenced by the aerial spraying and manual eradication, interdiction and the intervention of illegal armed groups, who often impose their prices and conditions on the farmers. In general, it was observed that repressive interventions of the national army have a significant decreasing impact on the prices due to the poor availability of sellers and buyers affect production. On the other hand, extensive aerial spraying or problems due to adverse climate, pests and diseases could have an increasing impact on the prices.

Table 25. Average prices of coca leaf and its derivatives, 2005 – 2008

Product	2005		2006		2007		2008	
	US\$/kg*	'000 COL\$/kg	US\$/kg*	'000 COL\$/kg	US\$/kg*	'000 COL\$/kg	US\$/kg*	'000 COL\$/kg
Cocaine	1,860	4,315	1,762	4,155	2,198	4,567	2,348	4,580
Cocaine base	1,090	2,532	1,038	2,447	1,326	2,752	1,450	2,825
Coca paste	910	2,109	879	2,070	943	1,959	963	1,878
Coca leaf	1.1	2.4	1.0	2.4	1.2	2.4	1.1	2.2

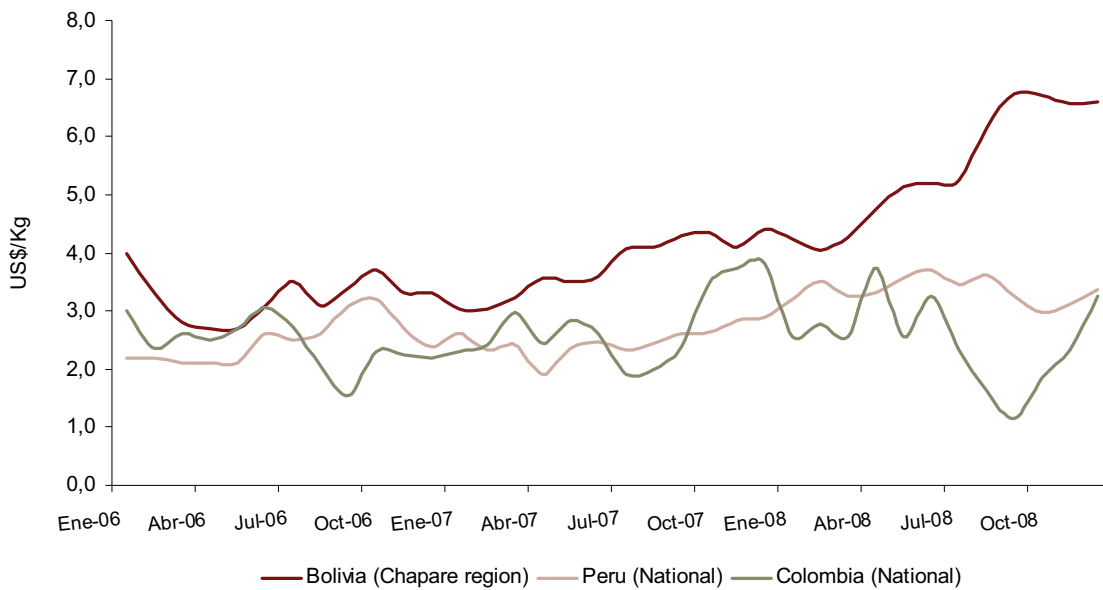
Source: SIMCI, PCI, DIRAN

* It must be noticed that the Colombian peso increased its value against the US dollar in the period 2003-2007.

Coca leaf prices

In Colombia, coca leaf is traded as fresh, whereas in Peru and Bolivia, coca leaf is traded as sun-dried. Converted in equivalent sun-dried coca leaf (assuming a moisture loss of 57% from fresh coca leaf to sun-dried coca leaf, as established from the 2004 UNODC survey on coca leaf yield in Peru), coca leaf price in Colombia in 2008 was estimated at \$2,50 US/kg, which is about the price of sun-dried coca leaf in Peru (\$ 3,40 US/kg) and lower than the prices registered this year in Bolivia (\$ 5,50 US/kg).

¹⁰ Cocaine prices are collected by DIRAN at the wholesale brokers in the country's major cities (U.S. \$ 2,348). In comparison, the latest available data on the price of cocaine on the streets of Europe had an average of \$ 96,000/kg and United States of \$ 120,000/kg in 2007.

Figure 11: Prices of sun-dried coca leaf in Andean region

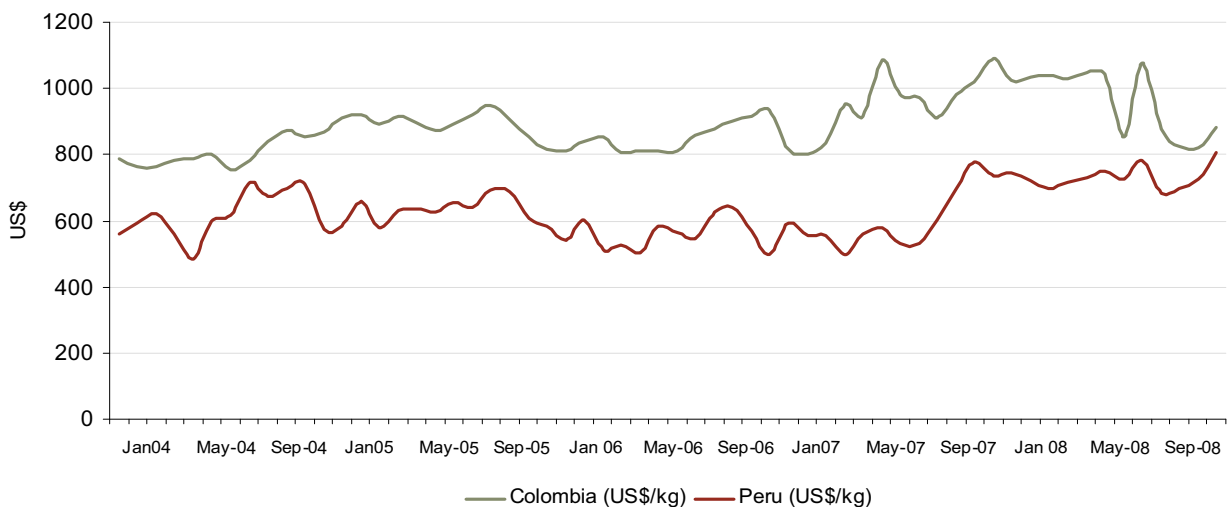
Source: SIMCI/UNODC Peru, Bolivia and Colombia

Fresh coca leaf prices between 2005 and 2008 remained relatively stable at an average of \$1,10 US/kg dollars or COP 2,350/kg. At regional level, prices are higher in Pacific (Nariño) and Putumayo, Caqueta, with averages of COP 2,690/kg (\$ 1,40 US/kg) and COP 2,344/kg (\$ 1,20 US/kg) respectively. The high price in these regions where the coca leaf is trade may be due to the effect of the manual eradication and the impact of the “pyramid” money scam.

Coca leaf and coca paste is traded on the same farmer premises, although in some regions the police presence of the police force farmers to transport the merchandise to the nearest trading town.

Coca paste prices

In Colombia and Peru, the coca paste prices have been relatively stable in recent years. However, between 2004 and 2008, the coca paste price in Colombia has been consistently higher than in Peru. In 2008 the average price in Colombia was \$963 US/kg and in Colombia of \$ 732US/kg.

Figure 12: Coca paste price in Colombia and Peru, 2004 2008

Source: SIMCI Colombia-Peru

The coca paste is produced by the farmers in Colombia. Therefore it is a good indicator to measure the fluctuations in the market. However, prices are set by illegal armed groups as well as payment conditions. Coca paste prices have been varying between 2005 and 2008 at an average of \$ 2 million Colombian pesos (equivalent to US\$ 924 /kg).

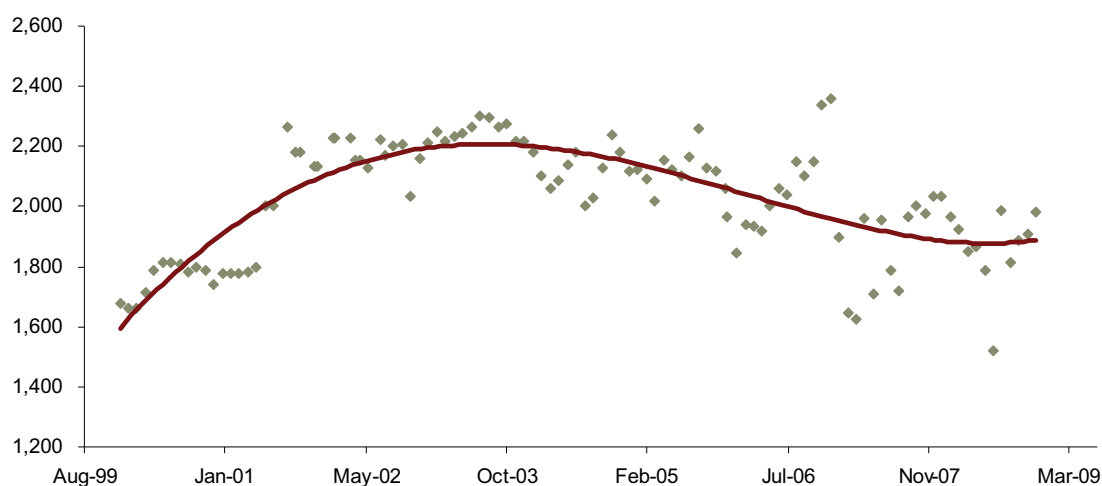
In 2008, prices fell by 4% over the previous year, from COP 1,960,000/kg in 2007 to COP 1,878,000/kg in 2008, In US dollars, the price increased by 2%, from US\$ 943 /kg in 2007 to US\$ 963 /kg in 2008. At regional level, the trend was steady during the calendar year as shown in the table below, with a broken point in July attributed to the presence of security forces which affects the markets.

Table 26. Average monthly coca paste price in Colombia (en '000 COL\$/kg) per region,2008

Month	Weighted national average	Central	Pacific	Putumayo-Caqueta	Meta-Guaviare
January	2,033	2,050	2,300	1,781	2,000
February	1,968	2,080	2,000	1,740	2,050
March	1,923	2,060	1,775	1,808	2,050
April	1,852	2,127	1,400	1,831	2,050
May	1,868	2,120	1,400	1,850	2,100
June	1,789	-	1,425	1,830	2,113
July	1,522	-	1,200	1,667	1,700
August	1,987	2,200	1,800	-	1,960
September	1,813	1,765	1,625	1,900	1,960
October	1,888	2,050	1,750	1,886	1,867
November	1,910	-	1,800	1,931	2,000
December	1,982	-	2,100	1,929	1,900
Average COP	1,878	2,057	1,715	1,832	1,979
Average US\$	963	1,070	873	935	1,020

Source: UNODC/SIMCI y PCI

Figure 13: Average monthly coca paste prices in Colombia, August 1999 –March 2009 ('000COL\$)

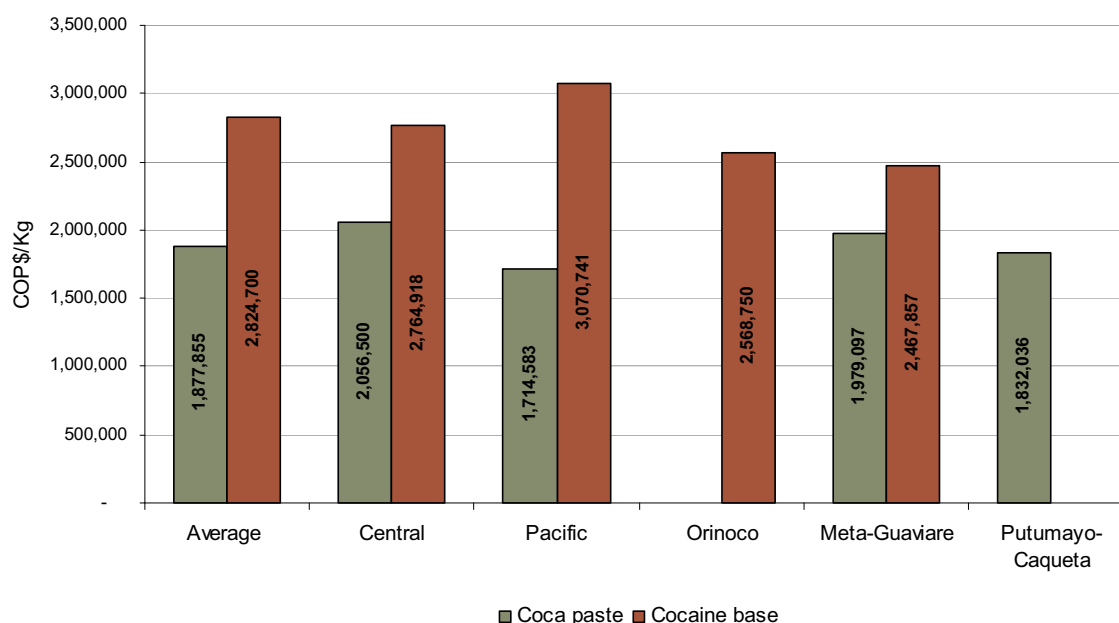


Cocaine base prices

The collection of prices data and their analysis is complicated by the absence of standard in naming the products, and in the absence of indications on the quality of the products. This is the case for cocaine base and coca paste, which can easily be confused. However, the data on cocaine base, albeit less frequently reported than the data on coca paste, confirmed that cocaine base is a more refined product than coca paste, and that both products can be traded.

There is a difference in price between coca paste and cocaine base due to the complexity and the chemicals added in the production of the latter. The average price of cocaine base in 2008 was \$2,825,000/kg (US\$ 1,438/kg an increase of 9% with respect to last year). The highest prices were recorded in the Central region and Pacific.

Figure 14: Comparison of coca paste prices and cocaine base by region (COP/Kg), 2008



**Orinoco does not have information on coca paste because the coca is immediately processed into cocaine base. In 2007, cocaine base prices for Putumayo-Caqueta were not available.*

Cocaine prices

Because of the criminal nature of the trade, cocaine prices are less easily collected than prices of coca paste or coca leaf. In Colombia, prices of cocaine hydrochloride are collected by DIRAN (the Anti-Narcotics Police), and refer to wholesale prices in the main cities.

Prices may be affected by factors such as supply, anti-drug control measures and purity levels. In connection with the supply, cocaine production has decreased by 28% this year as compared to 2007. The estimated potential cocaine production in 2008 is 430 metric tons after five years of relatively stable production. Although a significant impact on prices is not yet visible; in terms of seizures, after the all-time high recorded in 2004 and 2005 with 149 and 173 tons respectively, seizures in the 2008 increase to 198 metric tons. The purity level was not investigated yet in this report; the information comes from the seizures of the US Government who estimates the purity of the Colombian cocaine in 85% (2007).

The table below presents the annual averages of cocaine prices since 1991. The prices are presented both in Colombian Pesos (COP) and US\$ dollars.

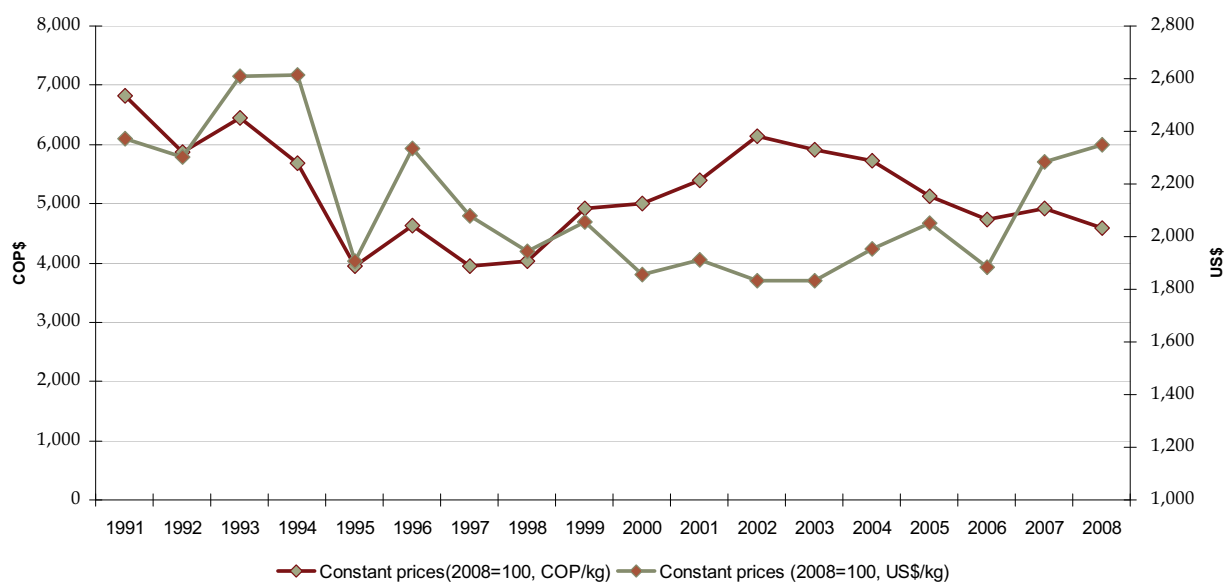
Table 27. Cocaine HCl price in Colombia 1991 - 2008

Year	'000 COP/kg	US\$/kg	Potential production of cocaine mt	Seizures of cocaine mt
1991	950	1,500	88	70
1992	1,020	1,500	91	31
1993	1,377	1,750	119	22
1994	1,488	1,800	201	28
1995	1,232	1,350	230	28
1996	1,762	1,700	300	27
1997	1,769	1,550	350	46
1998	2,101	1,472	435	78
1999	2,800	1,592	680	44
2000	3,100	1,485	695	87
2001	3,599	1,571	617	57
2002	4,389	1,532	580	95
2003	4,500	1,565	550	113
2004	4,600	1,713	640	149
2005	4,315	1,860	640	173
2006	4,155	1,762	610	127
2007	4,567	2,201	600	127
2008	4,580	2,348	430	198

Source: DIRAN for all prices, SIMCI cocaine production and DNE for seizures of cocaine,

The graphic below presents the annual averages of cocaine prices since 1991 as constant price to correct for the inflation.

Figure 15: Constant prices of cocaine in Colombia (2008=100), 1991-2008



Income per hectare

The data from the monthly survey on prices in Colombia combined with the data from the coca leaf yield survey and cost of production survey, enabled UNODC/SIMCI to calculate a theoretical income from the sale of coca leaf, coca paste and cocaine base. The differences between these incomes give an indication of the value-added if farmers produce coca paste and cocaine base. The table below shows a definite increase in the value added at each step of the processing. The value-added of cocaine base (95%), as final product that can be produced by the farmers explains why 37% of the coca leaf production was transformed into cocaine base by the farmers. However, the 2007 survey revealed that in some regions such as Catatumbo, Sierra Nevada and Pacific) some farmers sell directly coca leaf without any further process.

Table 28. Potential annual gross income per hectare of coca cultivation for different derivatives of coca leaf in 2008

Derivatives	Annual yield	Average annual price	Annual income in	Value-added from coca leaf
	kg/ha	US\$/kg	US\$/hectare	%
Coca leaf	4,200	1,1	4,620	-
Coca paste	6.6	963	6,360	38%
Cocaine base	6.2	1,450	8,990	95%

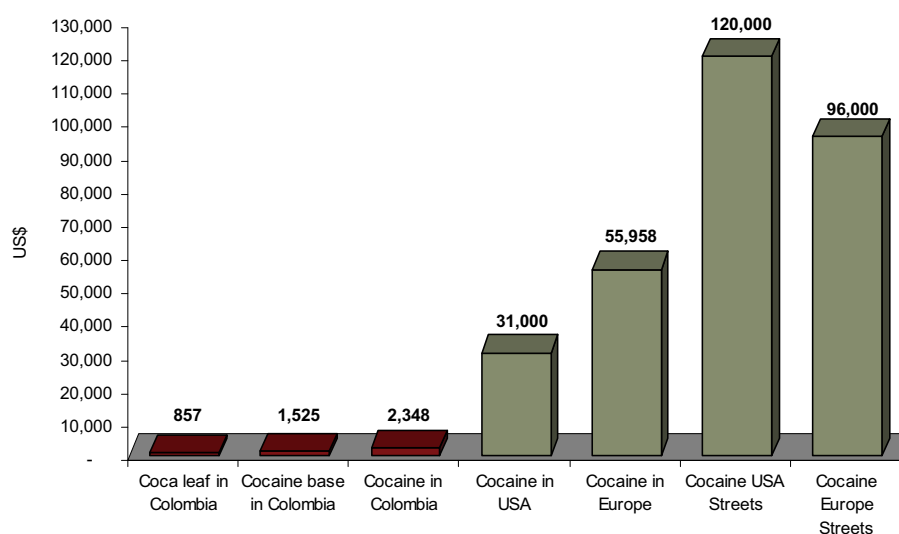
Based on the total production of each item sold by the farmers and the respective prices in 2008, the total farm-gate income value resulting from coca cultivation was estimated at about US\$ 623 million. This value does not take into account the farmers production costs, such as cost of herbicides, pesticides, fertilizers and labour wages.

Table 29. Value of the production of coca leaf and its derivatives at farm-gate level, 2008

Product	Kg	US\$/kg	US\$ value
Coca leaf	140,589,000	1.1	154,648,000
Coca paste	142,000	963	136,746,000
Cocaine base	229,000	1,450	332,050,000
Rounded total farm-gate value			623,444,000

The total farm-gate value of production of coca leaf and its derivatives corresponded to 0.3% of the 2008 GDP in Colombia of US\$ 242 billion according to DANE (provisional data). In 2008, the total farm-gate value of coca cultivation also represented 3% of the agricultural GDP in Colombia.

The coca leaf yield survey also enabled UNODC to collect data on the average area of coca cultivated per family. It was found that on average, a household cultivates about 1.2 hectares of coca bush for a total area under coca cultivation of 80,953 hectares in 2008. The number of family involved in coca cultivation was estimated at 59,300 or 236,000 persons without floating population.

Figure 16: Cost of coca leaf derivatives for one kilogram of cocaine, 2008

Source: SIMCI, DIRAN, World drug report and DEA

Table 30. Number of families involved in coca cultivation in Colombia in 2008

Region	Coca cultivation (hectares)	Persons per family	Hectares per family	Number of families	Number of people
Meta-Guaviare*	12,154	4.2	1.2	10,021	42,088
Sur de Bolivar*	15,845	5.2	1.2	12,937	31,177
Putumayo-Caqueta	13,961	3.8	1.9	7,348	27,555
Orinoco	3,621	4.4	1.4	2,500	11,000
Pacific	29,917	5.1	1.4	21,600	110,160
Amazonas	2,018	3.8	1.0	2,100	7,875
Catatumbo*	2,886	4.8	1.5	1,968	7,472
Sierra Nevada*	551	4.8	0.6	854	1,020
All regions	80,953		1.4	59,328	238,347

* Includes households and people who live out of the farm.

In this way, US\$623 million evenly distributed among 59,328 families represented an annual gross income per family of US\$ 10,508. For a total of 238,347 people in these families, this was equivalent to an annual per capita gross income of US\$ 2,616 while the national per capita gross income is approximately US\$ 5,000. The gross income value does not take into account the production costs, such as cost of herbicides, pesticides, fertilizers and labour wages.

2.4 OPIUM POPPY CULTIVATION

Opium poppy in Colombia is mainly being cultivated on mountain sides in the south-west, especially in the departments of Cauca, Nariño, Huila and Tolima and in minor extensions in Cesar, Caqueta and Guajira. Farmers cultivate opium poppy at an altitude ranging between 1,700 to 3,000 meters, in small fields, interspersed with licit crops. According with the Colombian Anti-Narcotics Police - DIRAN- (UNODC does not monitor opium poppy cultivation in Colombia), the opium poppy cultivation is being reducing its extension, and after a short boom of to 7,500 hectares in 1993, is showing in 2008 its minimum record of 394 hectares.

Table 31. Opium poppy cultivation by department in Colombia, 2003 – 2008 (hectares)

Department	2003	2004	2005	2006	2007	2008	% Change 2007-2008	% 2008 total
Cauca	600	450	538	448	280	126	-55	32
Nariño	540	460	475	316	204	24	-88	6
Tolima	1,359	1,090	265	90	170	170	-	43
Huila	636	1,135	320	114	45	45	-	11
Cesar	651	675	152	3	7	18	157	5
Caqueta	-	105	132	52	7	7	-	2
La Guajira	240	35	68	-	2	4	100	1
Caldas	-	-	-	-	-	-		
Total	4,026	3,950	1,950	1,023	715	394	-45	100%

Source: DIRAN (by aerial reconnaissance)

Figure 17: Opium poppy cultivation by department in Colombia, 2003 – 2008

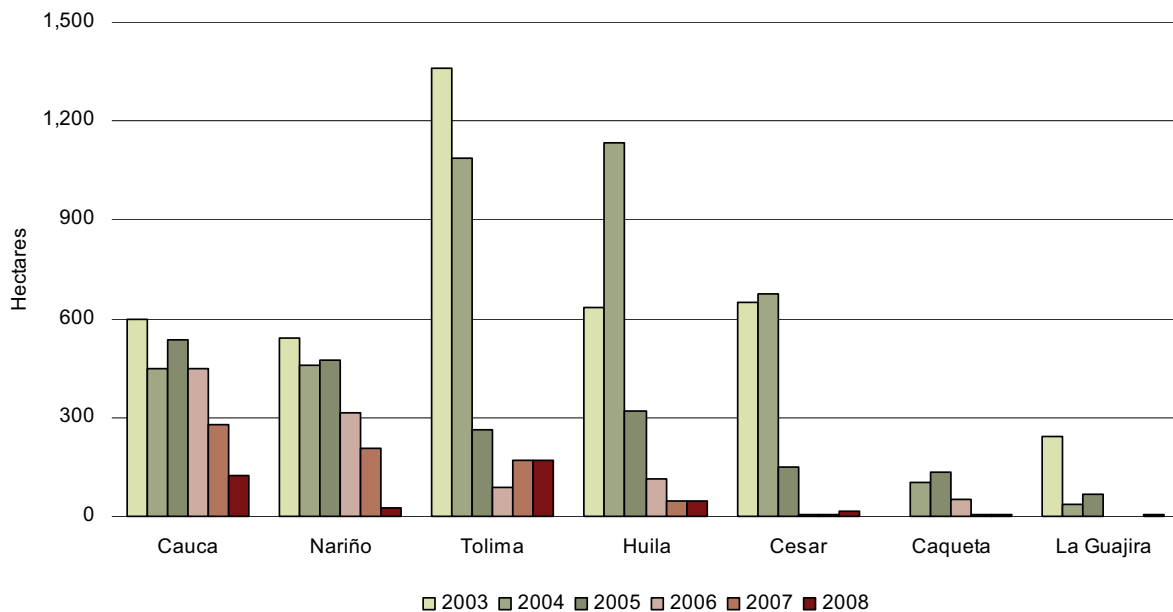
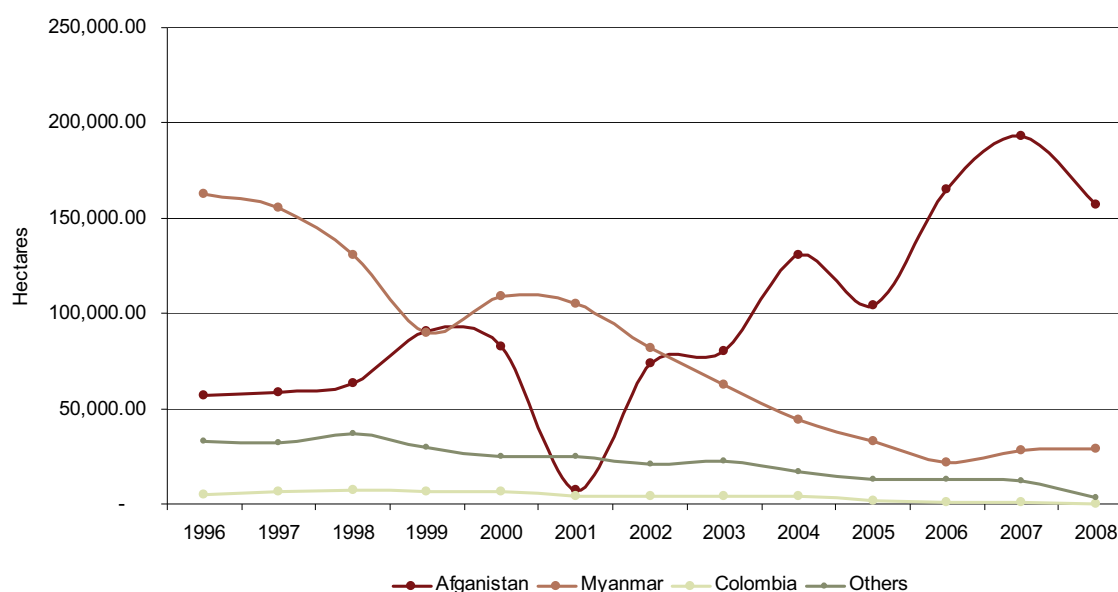


Table 32. Global opium poppy cultivation, 2000– 2008 (hectares)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Afghanistan	82,171	7,606	74,100	80,000	131,000	104,000	165,000	193,000	157,000
Myanmar	108,700	105,000	81,400	62,200	44,200	32,800	21,500	27,700	28,500
Laos	19,052	17,255	14,000	12,000	6,600	1,800	2,500	1,500	1,600
Pakistan	260	213	622	2,500	1,500	2,438	1,545	1,701	1,909
Colombia	6,500	4,300	4,153	4,126	3,950	1,950	1,023	714	394
México	1,900	4,400	2,700	4,800	3,500	3,300	5,000	6,900	n.a.
Others	3369	3320	3250	3074	5190	5212	4432	4185	n.a.
Total	222,000	142,100	180,200	168,600	196,000	151,500	200,000	234,405	189,403

Source: UNDOC, WDR, 2008

Figure 18: Global opium poppy cultivation, 1996-2008 (hectares)

The extent of opium poppy cultivation in 2008 represented a 45% decrease as compared to the opium poppy cultivation in 2007. Opium poppy cultivation in Colombia represents only 0.2% of the world opium poppy cultivation in 2008 and 0.1% of the production of latex. For the sixth consecutive year, most of the opium poppy cultivation takes place in Afghanistan, accounting for 83% of the global area under opium poppy cultivation and accounting for 94% of the world opium production.

Opium Latex and Heroin Production

In Colombia, opium is harvested in the form of latex. In Asia instead opium is harvested as a denser gum. In Colombia, opium poppy cultivation is confined to the mountainous areas because it requires low temperatures at some stages in the growth cycle. Opium poppy is therefore not found in association with coca cultivation, which is located in low lands.

According to the US studies, opium poppy fields yield an average of 24 kilograms of opium latex (equivalent to 8 kilograms of dried opium) are required to produce 1 kg. of pure heroine. Colombia has two harvests per year, with the exception of Nariño with only one harvest per year. The yields of the main opium poppy regions are:

Nariño: 24.6 kg/ha/harvest

Serranía de Perijá: 18.4 kg/ha/ harvest

Cauca Oriental: 12.3 kg/ha/ harvest

Huila Occidental: 13.1 kg/ha/ harvest.

The total potential heroin production in Colombia would amount to about 10.3 mt of dried opium which produces 1.3 metric tons of heroin in 2008 representing 0.1% of the world total production.

Opium Latex and Heroin Prices

Table 33. Monthly opium latex, morphine and heroin prices, 2008 ('000 COP/kg)

Month	Opium latex		Morphine		Heroin	
	'000 COP/kg	US\$/kg	'000 COP/kg	US\$/kg	'000 COP/kg	US\$/kg
January	472	238	15,292	7,719	20,656	10,427
February	497	261	15,125	7,948	19,544	10,270
March	562	304	12,982	7,029	20,370	11,029
April	650	362	9,500	5,290	11,500	6,403
May	750	422	10,500	5,906	13,500	7,593
June	845	494	14,542	8,494	18,307	10,693
July	450	252	19,500	10,937	23,666	13,273
August	850	461	15,000	8,134	19,500	10,575
September	688	333	13,021	6,303	18,900	9,148
October	628	274	17,133	7,485	22,856	9,985
November	500	215	15,208	6,530	22,055	9,470
December	450	200	15,000	6,658	23,750	10,542
Annual Average	612	318	14,400	7,369	19,550	9,950

Source: SIMCI and PCI for latex, DIRAN for morphine and heroine.

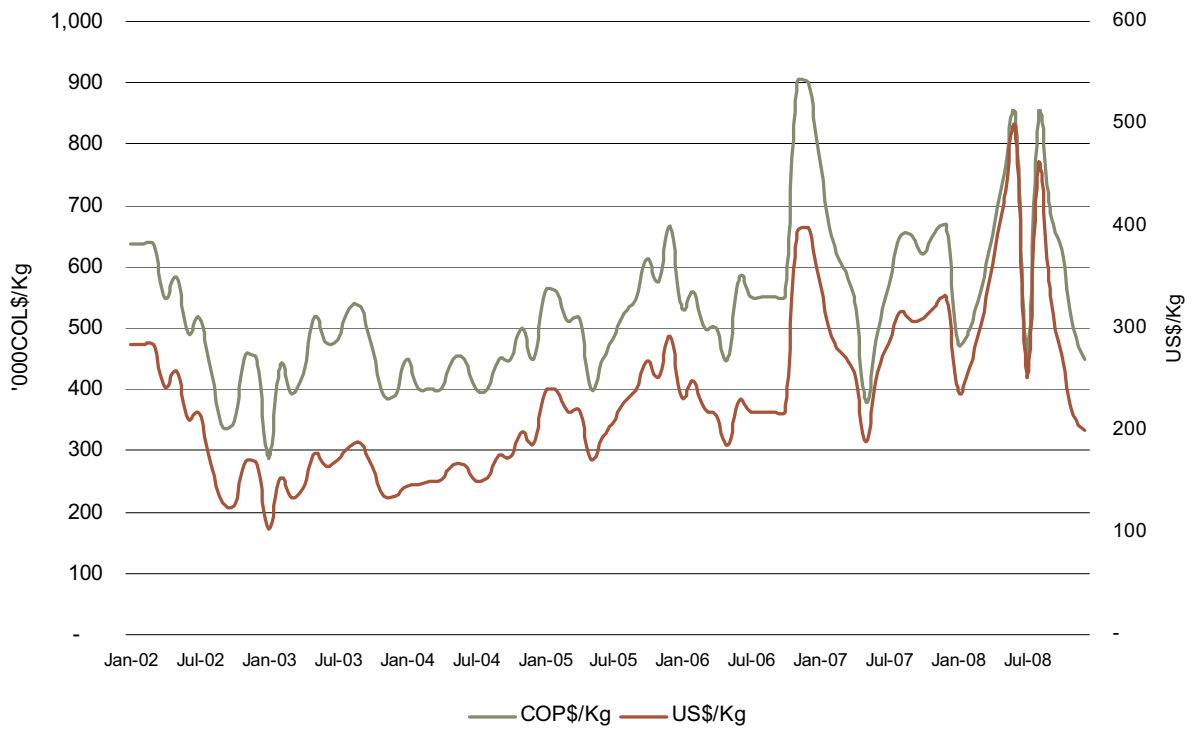
Despite of the decline in opium poppy cultivation in Colombia, prices of opium latex remain relatively stable at around 318 US\$ per kilogram, just +11% as compared to 2007; whereas prices of heroin went down from an average price of 10,780 US\$ per kilogram in 2007 to 9,950 US\$ per kilogram in 2008 (-8%).

Table 34. Annual average prices of opium latex, morphine and heroin 2005-2008

Product	2005		2006		2007		2008		% Change 2007-2008	
	US\$/kg	'000 COP/kg	US\$/kg	'000 COP/kg	US\$/kg	'000 COP/kg	US\$/kg	'000 COP/kg	US\$/kg	'000 COP/kg
Opium latex	230	534	251	593	286	591	318	612	11	3.5
Morphine	6,204	14,401	8,045	18,969	8,022	16,630	7,369	14,400	-8	-13.4
Heroin	9,070	21,051	9,992	23,562	10,780	22,294	9,950	19,550	-8	-12.3

Source: DIRAN, SIMCI and PCI for latex

Figure 19: Opium latex prices in Colombia, 2002-2008 by month ('000 COP/kg and US\$/kg)



2.5 RELATED STUDIES AND RESEARCH

Economical structure of the agricultural production units in coca influence areas.

The study has been conducted by the SIMCI Project in coordination with *PCI-Accion Social-*, to identify the reasons for which peasants cultivate coca bush. The first survey was carried out in 2008, on the northern region. A second survey is expected to cover the rest of the country in 2009.

Even though coca cultivation is very dynamic, the regions where coca is cultivated remain relatively stable. From a group of peasants living under similar social, political, cultural and environmental conditions, there are some that grow coca (UPAC)¹¹ next to other that do not grow it (UPA)¹².

The survey consisted in 440 interviews to coca growers and non-growers, to find out about their living conditions; i.e. land tenancy and land use and distribution, sources of income, costs, expenses and profitability of the production units-UPA and UPAC-.

The main findings of the survey are:



The costs associated to accessibility in the coca region are higher than those in the licit agriculture regions. The environmental offer in the coca region is underused and there are no incentives for licit agriculture. The vegetation in the Production Units shows 67% of grass lands and small shrubs, 19% of forest and only 7% of licit crops. A low percentage of peasants grow coca at an average of 1.3 hectares per production unit.

Coca region landscape

Different studies coincide in that the high income generated by coca cultivation produces stability in the coca region; the current study is emphatic showing that the net income is not significantly higher for coca growers. The Productive Unit that sells coca leaves receives daily net income *per capita* of approx US\$ 1. Other agricultural products may reach relatively similar profits or even higher.

Rather, the net income of those coca growers who process coca leaf into coca paste or cocaine base is higher. Despite the increase of the production costs, the prices of coca leaf per kilogram (US\$ 1) and that of paste (US\$ 900/kg) have remained stable in the last four years.

Table 35. Annual net income for coca leaf selling

Region	Unit	Gross income	Chemical substances costs	Labour costs	Transportation costs	Net income
South of Bolivar	COP\$	8,208,000	1,223,000	1,668,500	60,000	5,256,500
	US\$	4,104	612	834	30	2,628
Northwest	COP\$	8,005,200	2,577,500	2,585,000	202,400	2,640,300
	US\$	4,000	1,289	1,292	101	1,320

¹¹ UPAC: Agricultural Production Unit with coca crops

¹² UPA: Agricultural Production Unit without coca crops though in a coca region

Table 36. Annual net income with coca leaf processing

Region	Unit	Gross income	Chemical substances costs	Net income
South of Bolivar	COP\$	17,236,800	5,047,600	9,237,700
	US\$	8,618	2,524	4,619
Northwest	COP\$	15,403,248	2,251,780	7,786,633
	US\$	7,700	1,126	3,893

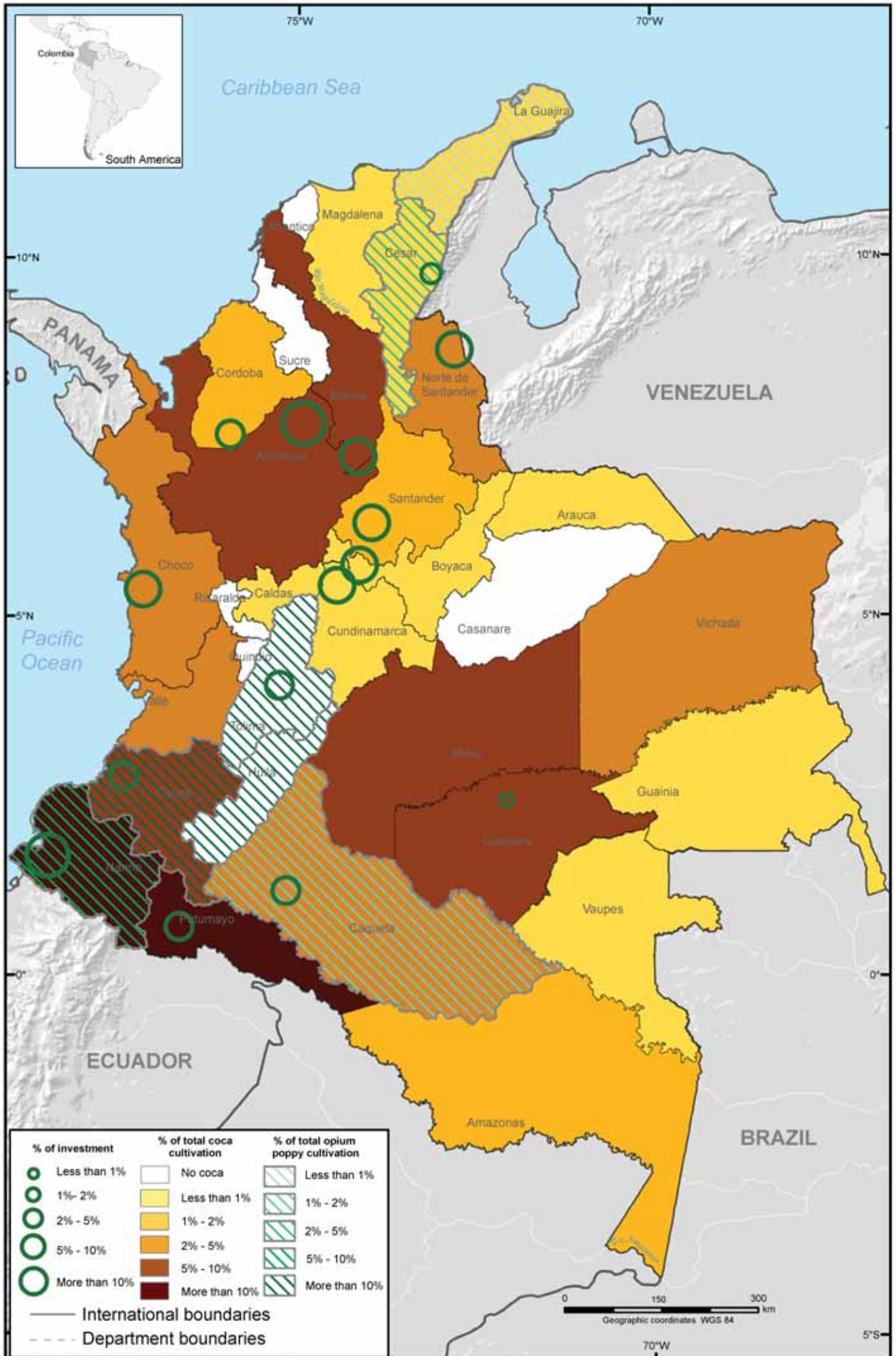
The most common products cultivated by peasants in the area under study are bitter banana and yucca. Peasants mostly live out of day-wages, including that derived from coca cropping.

The reasons behind farmers decide to plant coca is not necessarily profits. Coca cultivation has comparative advantages include better information on market and price and accepted marketing rules including the purchase directly at the Production Units.



Bitter banana Crops

Investment in Alternative Development and illicit crops in Colombia, 2008



Source: Government of Colombia - National monitoring system supported by UNODC. PCI for Alternative Development investment. DIRAN for poppy cultivation. The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

2.6 ILLICIT CROPS AND ALTERNATIVE DEVELOPMENT

Alternative development programmes

In 1985, alternative development projects started in Colombia with the aim to substitute illicit crops and to complement spraying and eradication activities. The first department was Cauca followed by Guaviare, Caqueta and Putumayo in 1990. The Productive Projects Programme is run by Social Action-PCI- and looks forward through the encouragement and support for agricultural and forestry activities that the coca growers abandon illicit activities. Investments come from the Colombian Government and international cooperation resources.

The reported data for 2008 refers only to the investments from Accion Social and PCI. USAID investments were included in 2007 Coca Survey and are presently been carrying out. The investment shown in this table corresponds to 2008.

Table 37. Coca and opium poppy cultivation, aerial spraying and alternative development budget

Department	Coca cultivation 2008 (hectares)	Opium poppy cultivation 2008 (hectares)	Budget ongoing 2008 -COP
Nariño	19,612	24	3,173,614,257
Putumayo	9,658	-	798,497,400
Guaviare	6,629	-	120,000,000
Antioquia	6,096	-	3,037,371,130
Bolivar	5,847	-	1,380,827,490
Boyaca	197	-	940,948,160
Cauca	5,422	126	527,800,000
Caqueta	4,303	7	468,948,000
Vichada	3,174	-	-
Norte de Santander	2,886	-	1,729,337,810
Choco	2,794	-	1,583,797,079
Valle del Cauca	2,089	-	-
Santander	1,791	-	1,029,865,165
Cordoba	1,710	-	682,998,000
Amazonas	836	-	-
Guainia	625	-	-
Vaupes	557	-	-
Arauca	447	-	-
Magdalena	391	-	-
Caldas	187	-	-
La Guajira	160	4	-
Cundinamarca	12	-	974,348,160
Meta	5,525	-	328,429,935
Cesar	5	18	-
Huila	-	45	-
Tolima	-	170	778,789,981
Total	80,953	394	17,555,572,567

Sources: PCI- Social Action, USAID, SIMCI for coca area and DIRAN for opium poppy area.

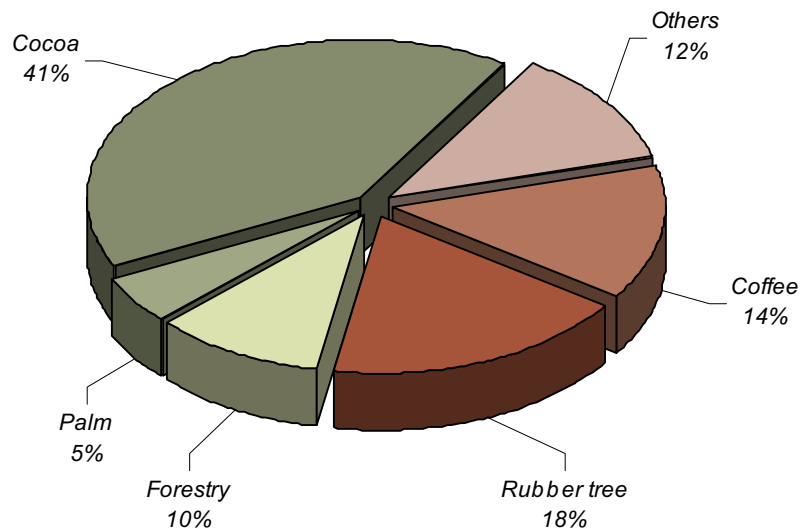
The overall budget of ongoing productive projects in 2008 has reached an amount of COP 17,500 million from national contributions: Accion Social-PCI. The northern region of the country (Norte de Santander, Antioquia, Santander, Bolivar and Cordoba departments) obtained about 45% of the

total budget of ongoing projects, though the coca cultivated area increased in 2008 to 23% of the national total.

In the Pacific Region the investment represented 30% of national budget having 37% of the coca cultivated while 7% was invested in the Putumayo-Caqueta Region who shows 17% of total coca cultivation.

The overall investment is mainly lead to finance cocoa, rubber tree, coffee, palm and forestry projects. These five items represent 88% of total national investment.

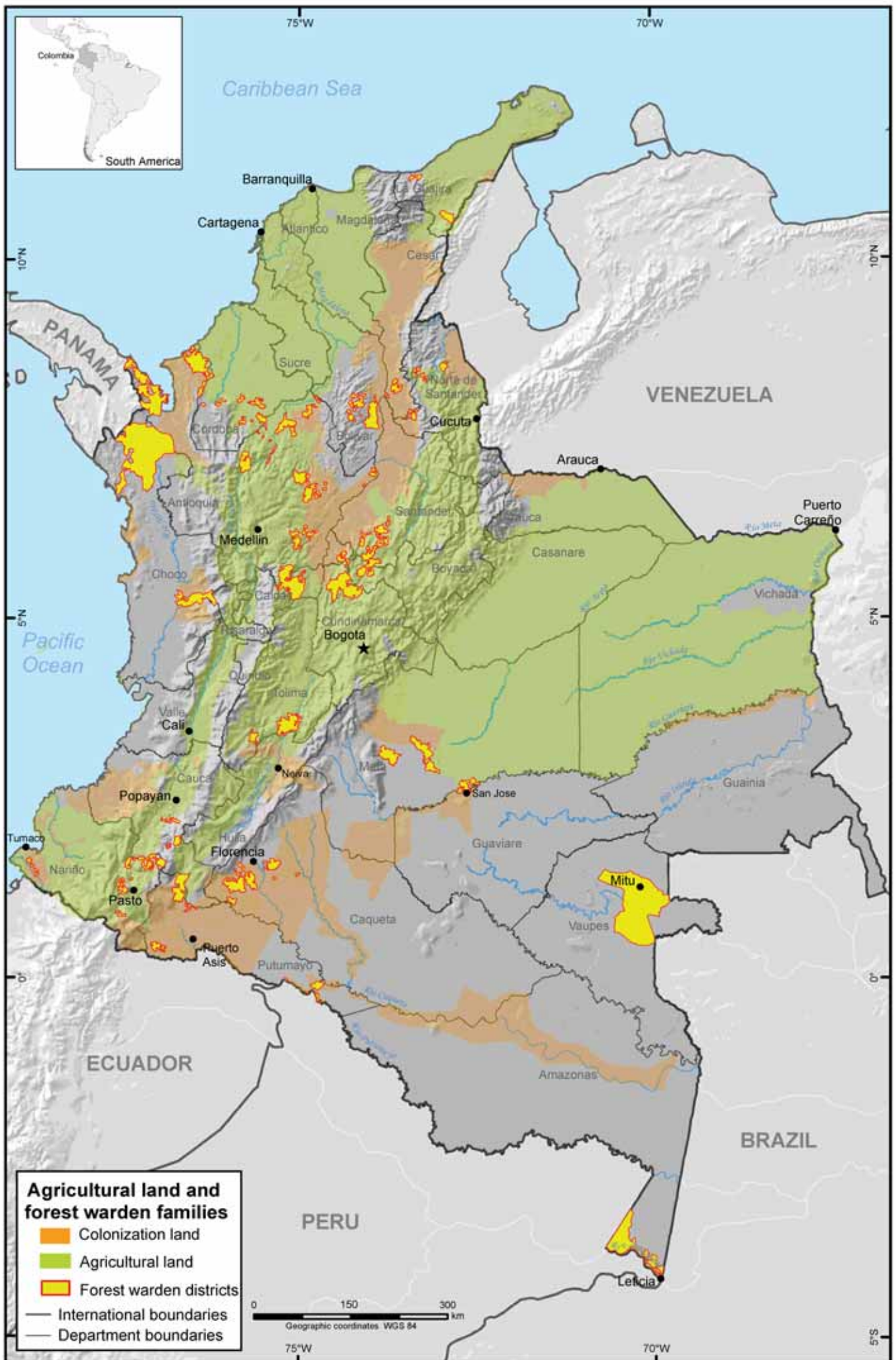
Figure 20: Ongoing projects,2008



*Women working in Iraca
palm handcraft*



Agricultural land and forest warden families programme in Colombia, 2008



Source: Government of Colombia for Agricultural land - Forest warden families programme for districts supported by UNODC.
 The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

Coca cultivation and the Forest Warden Families Programme

Starting in 2003 UNODC monitors the Forest Warden Families Programme (FWFP), a component of Presidential management against illicit crops (PCI) of the Presidency of the Republic of Colombia. UNODC verifies the coca cultivation and other illicit crop free status of selected districts. The main objectives of the programme are: i) to motivate farmers to keep their land free of illicit crops, ii) to establish productive projects socially acceptable, economically feasible and environmentally sustainable, iii) to recover the forest in areas that are environmentally and socially vulnerable, and iv) to produce socio-territorial cohesion and identity through the legal tenancy of their land property.

The FWFP has four main components: The first one is the preservation of the environment with technical support of expert entities in the training of families for the establishment of productive and sustainable projects. The second component deals with the increase of the social capital, by a permanent training of families in community savings, leadership, project managements among others. The economic component consists in a temporary financial aid to the beneficiary families. The institutional component is focused to strengthening the inter-institutional.

The government and the families sign a contract with payments of a bimonthly salary COP 600,000 (approximately US\$ 305) per family for a three years period. The programmes started in 2003 and 88,488 families have participated so far. In December 2008, the Programme was available in 89 municipalities of 19 departments. 66,000 individual contracts were running to whom approximately COP 611,000 million (approximately US\$ 311) were paid.

SIMCI supports the monitoring activities of the programme by providing thematic cartography, satellite images and annual classification of vegetation coverage in the selected areas. The UNODC monitoring project shows that 9,036 hectares of secondary forest and 53,477 hectares of high shrubs have been recovered as well as 2,987,000 hectares in the selected areas are free of illicit crops.

Table 38. Consolidated contracts of the Forest Warden Families Programme by department, 2008

Department	Active individual Contracts	Payments ('000 COP)	% of Payments
Antioquia	11,780	83,469,341,200	14.0
Nariño	9,753	76,730,060,000	12.6
Putumayo	3,184	67,124,360,500	11.0
Tolima	3,595	56,049,704,000	9.2
Huila	0	45,468,580,000	7.4
Choco	5,951	44,926,704,000	7.4
Bolivar	1,709	43,223,406,750	7.1
Cauca	1,240	27,645,792,000	4.5
Santander	4,741	21,607,512,000	3.5
Norte De Santander	1,183	21,404,808,000	3.5
Caqueta	2,447	21,247,560,000	3.5
Magdalena	0	18,854,168,000	3.1
Cordoba	1,702	15,830,064,000	2.6
Boyaca	1,572	12,379,344,000	2.0
Meta	1,996	11,862,144,000	1.9
Caldas	6,587	10,255,896,000	1.7
Guaviare	0	8,638,207,000	1.4
Arauca	0	7,486,200,000	1.2
Amazonas	1,739	5,539,824,000	0.9
Cundinamarca	4,440	5,450,880,000	0.9
Vaupés	1,157	2,202,384,000	0.4
La Guajira	734	1,797,648,000	0.3
Cesar	490	1,588,344,000	0.3
Total COP	66,000	610,782,931,450	100%
Total US\$		310,831,008	

Source: PCI, Accion Social, UNODC

Coca cultivation in coffee plantation areas

In Colombia, coffee cultivation is the most important agricultural product and there is a national concern about the possible penetration of illicit coca crops in territories ecologically suitable for coffee cultivation (*ecotopos*) with the subsequent impact on the agricultural economy of Colombia.

Though the amount of coca cultivation in coffee lands reaches in 2008 only 1.1% of total coca crops (906 hectares), the increase of 33 hectares (3.8%) with respect to 2007 represents an early alert to intensify the implementation of prevention and forced or voluntary eradication projects.

Table 39. Coca cultivation in coffee plantation areas, 2008

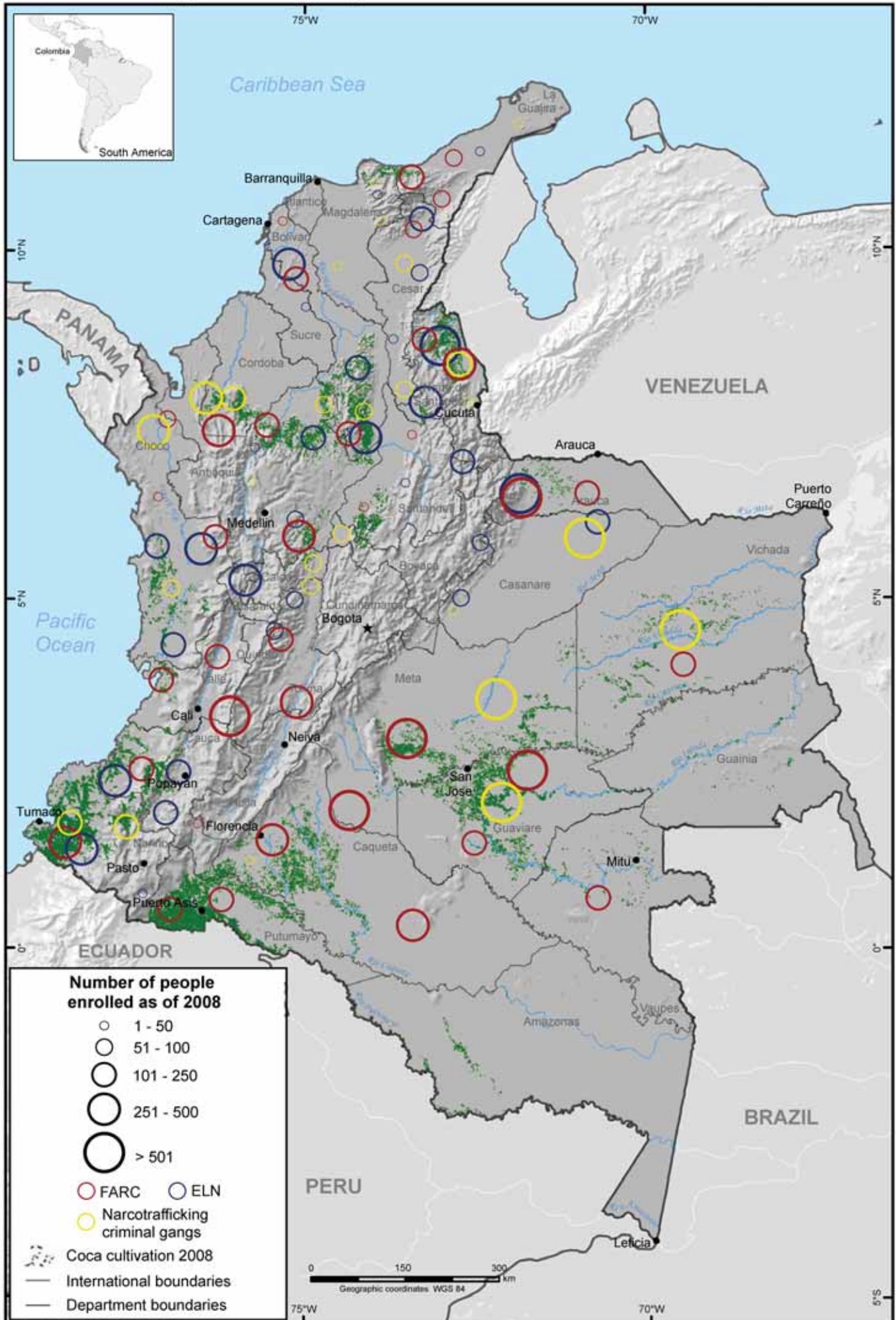
Department	Potential coffee cultivation area (hectares)	2006 Coca cultivation area (hectares)	2007 Coca cultivation area (hectares)	2008 Coca cultivation area (hectares)
Antioquia	1,205,099	165	163	190
Boyaca	324,190	29	4	-
Caldas	257,571	49	4	44
Caqueta	196,509	26	34	83
Cauca	668,825	155	335	308
La Guajira	118,228	38	10	19
Magdalena	157,621	18	13	55
Nariño	154,046	116	257	60
Norte de Santander	475,130	25	36	122
Santander	624,649	38	17	24
Valle del Cauca	594,793	-	-	1
Total	4,776,661	659	873	906

Source: National Federation of Coffee Growers for Ecotopos



Coca cultivation mixed with coffee cultivation

Illegal armed groups and coca cultivation in Colombia, 2008



Sources: for coca cultivation Government of Colombia - National monitoring system supported by UNODC, Ministry of Defence and National Police for number of persons enrolled in armed groups. The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

Armed groups and coca cultivation

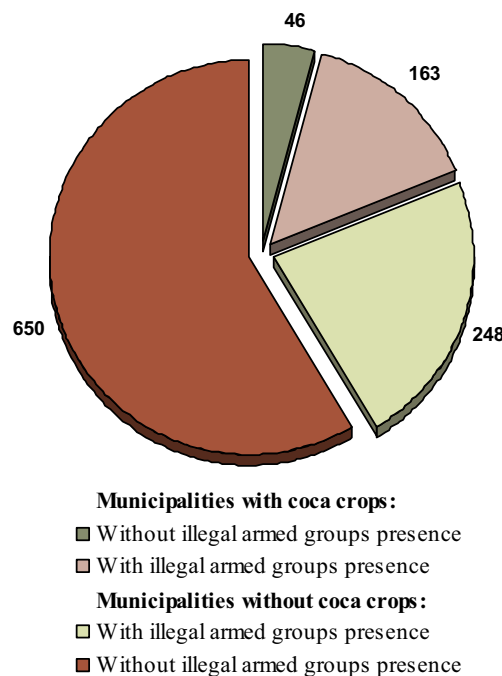
Although not directly involved in coca cultivation per se, illegal armed groups controlled the business and prices of coca leaf and their derivatives offered to the coca farmers. The Ministry of Defense reports the presence of illegal armed groups in 411 municipalities (163 of which with coca crops). In some of them the presence of two or three groups has been reported. It is extremely difficult to know which of the links in the chain of the cocaine business of production and sale are managed by these groups, but it is well known that the illegal armed groups guarantee territorial control.

According to Government sources, in 2007, there were around 13,200 people enrolled in illegal armed groups (Revolutionary Armed Forces of Colombia- FARC- and National Liberation Army-ELN-). The FARC group is present in 195 of these municipalities (93 of them have illicit coca crops) and the ELN is present in 219 municipalities (69 with coca crops).

The United Auto-Defense of Colombia-AUC- started a process of demobilization in 2003 that included 31,689 enlisted people, but the OAS and the security agencies of Colombia reported the emergence of new groups or emerging gangs not demobilized or regrouping of demobilized people in criminal gangs that control some communities and the illicit economy. The National Police estimated about 4,800 illegal armed people in 115 municipalities (52 of them with coca crops) especially in the departments of Antioquia, Cordoba, Nariño, Choco, Meta, Guaviare Casanare and Vichada.

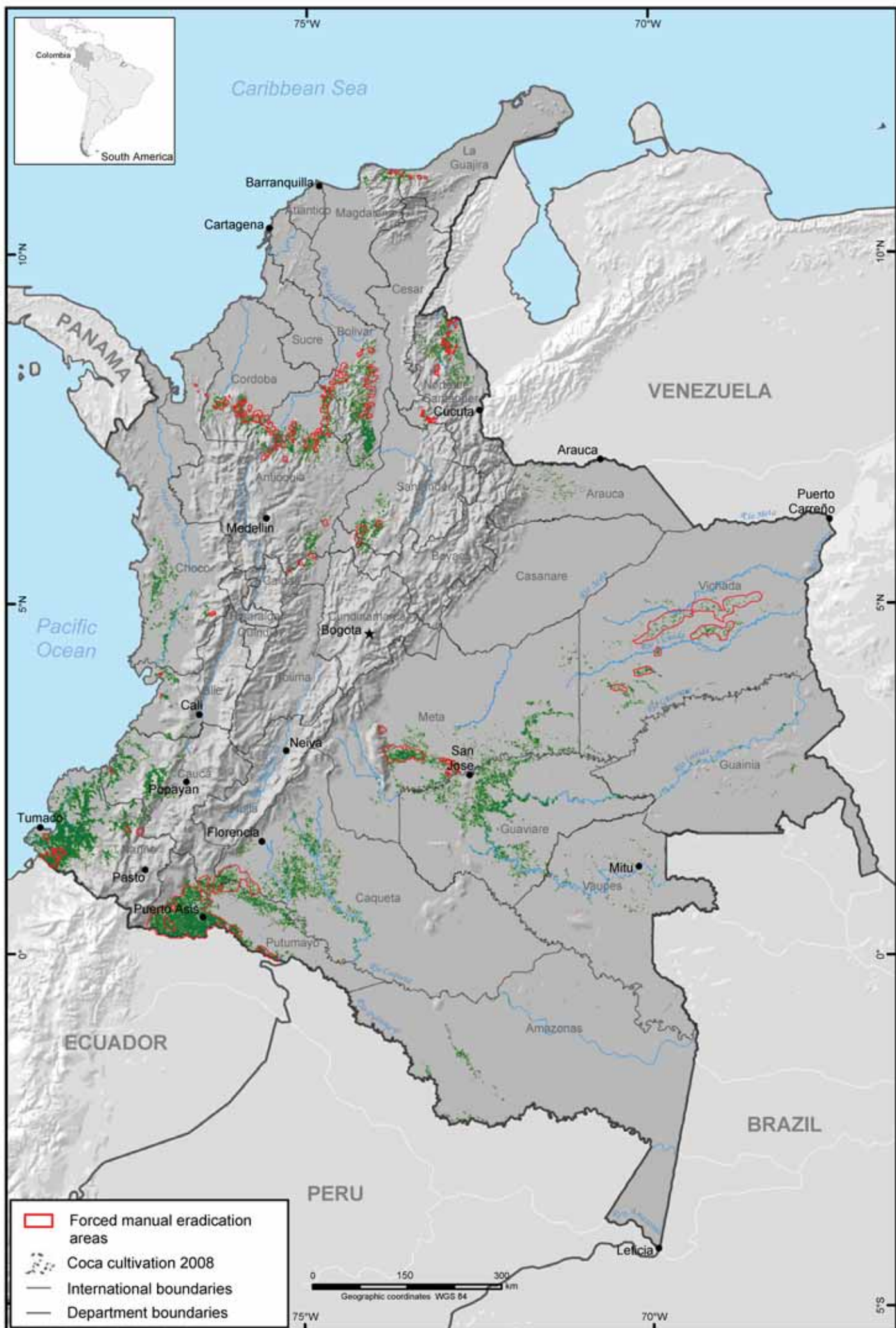
OAS points out the geographic correlation between the illicit crops areas and the strategic corridors for drug trafficking with the presence of illegal armed structures or emergent gangs particularly in the Uraba gulf and South of Bolivar, Pacific and Putumayo-Caqueta regions.

Figure 21: Number of municipalities with presence of illicit armed groups.



Source: Ministry of Defense

Forced manual eradication and coca cultivation in Colombia, 2008



Sources: Government of Colombia, for coca cultivation National monitoring system supported by UNODC; GME monitoring system for manual eradication areas. The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

2.7 SUPPLY REDUCTION

Reported forced manual eradication

For the third consecutive year, forced manual eradication increased again in 2008 and summed up to 95,731 hectares. This was an increase of 43% compared to 2007 (66,805 hectares). The eradication activities have been extended to 27 departments (same as 2007). Half of the total eradicated area is located in two departments: Antioquia (18,285 hectares) and Putumayo (29,284 hectares). The manual forced eradication of opium poppy accounts for 361 hectares in 9 departments with most of the area in Cauca (45%).

Forced manual eradication is the responsibility of the Presidential Agency for Social Action, and is executed by Mobile Eradication Groups-GME- with the help of the Anti Narcotics Police (DIRAN) and the Army. In addition, the national police and the Army carry on manual eradication programmes all over the country.

Since 2007, UNODC has monitored and verified the manually eradicated fields on a 100% base.

Table 40. Reported forced manual eradication of coca areas, by department, 2008

DEPARTAMENT	Coca Cultivation		Opium poppy Cultivation	
	Eradicated Area (has)	% of total	Eradicated Area (has))	% of total
Putumayo	29,284	30.6	-	-
Antioquia	18,285	19.1	7	1.9
Meta	7,972	8.3	-	-
Nariño	7,857	8.2	128	35.4
Cordoba	7,310	7.6	-	-
Vichada	7,242	7.6	-	-
Nte. Santander	4,065	4.2	1	0.1
Bolivar	3,773	3.9	-	-
Caqueta	2,632	2.7	-	-
Cauca	1,755	1.8	164	45.4
Santander	1,612	1.7	-	-
Magdalena	922	1.0	-	-
Choco	677	0.7	-	-
Boyaca	650	0.7	-	-
Cesar	315	0.3	12	3.3
Amazonas	310	0.3	-	-
Caldas	285	0.3	-	-
Valle	202	0.2	15	4.2
Cundinamarca	167	0.2	2	0.6
Arauca	106	0.1	-	-
Guainia	102	0.1	-	-
Guajira	99	0.1	-	-
Risaralda	65	0.1	-	-
Huila	29	0.0	22	5.9
Guaviare	10	0.0	-	-
Tolima	3	0.0	12	3.2
Casanare	3	0.0	-	-
Total	95.731	100	361	100

Sources: UNODC. PCI- Social Action. National Police

Manual eradication has a major impact on coca production since the bushes are completely uprooted. Replanting means significant costs for the farmer since it takes about 8 months between planting and the first harvest, moreover with low productivity in the initial stage. However in some eradicated areas, replanting and new coca plantations have been observed and UNODC recommends in its eradication report¹³ to accompany eradication with alternative production projects.

UNODC assessed the replanting of coca fields in the four phases of the eradication activities during 2008 by verifying the replanting of the eradication of each phase three months after the end of the correspondent activities. The interpretation for the assessment used satellite images obtained in March 2008 through May 2009.

In Phase I (first trimester of 2008) 12,900 hectares were eradicated in seven departments, out of which 26% were replanted. In Phase II (second trimester) 16,600 hectares were eradicated in ten departments, out of which 35% were replanted. In Phase III (third trimester) 27,600 hectares were eradicated in 15 departments, out of which 22% were replanted and in Phase IV (last trimester) 18.5% of the 26,900 hectares eradicated were replanted.

This methodology permits to identify the replanting of the fields in the middle months of the year that can not be detected in the yearly Report. The Table below shows the accumulative total replanting identified including the replanting occurred four months after the end of Phase IV (December 31st of 2008).

Table 41. Analysis of replanting in forced manual eradicated coca areas by GME

Regions	Reported Eradication	Replanted		Without Replanting		Without info.	
		Has	%	Has	%	Has	%
Putumayo - Caqueta	31,374	10,082	32	17,583	56	3,710	12
Central	30,883	8,887	29	15,090	49	6,906	22
Pacific	9,160	2,557	28	3,610	39	2,993	33
Orinoco	6,801	2,502	37	4,084	60	215	3
Meta-Guaviare	5,994	2,124	35	2,525	42	1,344	22
Sierra Nevada	216	43	20	106	49	67	31
Amazonas	0	0	0	0	0	0	0
TOTAL	84,428	26,195	31	42,998	51	15,235	18

Source: PCI, UNODC

The behavior of the replanting activities of coca farmers in forced eradicated areas was measured by the overlay of coca cultivation and GME reported coordinates on eradication, considering the dates of image acquisition and eradication. This comparison showed that 82% of the total eradicated area (69,193 hectares) was useful to perform the assessment of replanting; and 18% (15,235 hectares) were covered by clouds or gaps,

The analysis showed that 26,195 hectares (31 %) were replanted in the same field whereas 42,998 hectares (51%) have no evidence of being replanted, However, 928 hectares (1%) of this last group were eradicated a few months before the date of acquisition of the images, which causes some uncertainty about the replanting,

In absolute numbers the regions with the most replanted areas are Putumayo-Caqueta and Central, representing 61% of the national total replanted.

¹³ Report on monitoring and assessment of the manual eradication conducted in 2007 (GME)

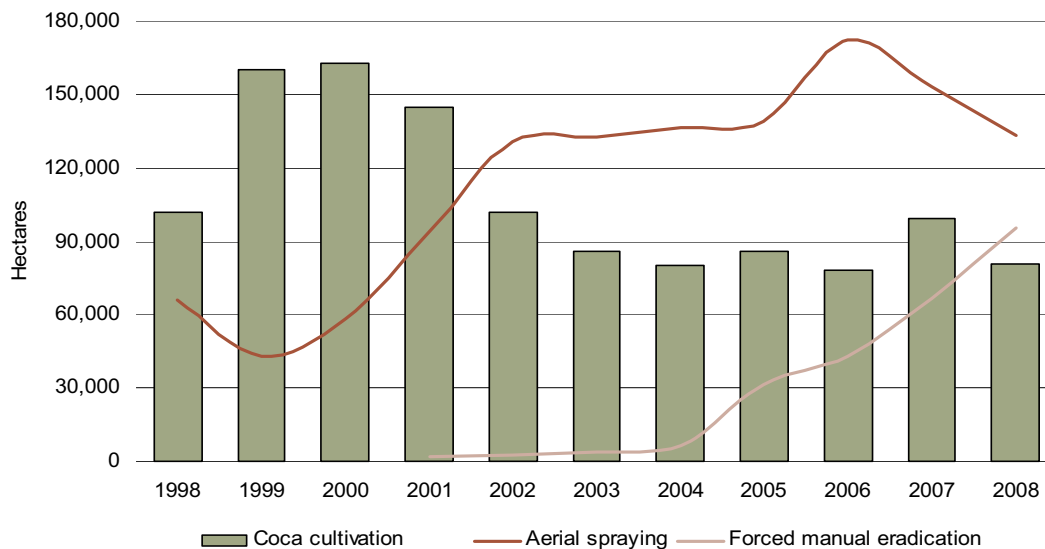
Reported aerial spraying

The Colombian anti-drugs strategy includes several measures of control, ranging from aerial spraying, to force or voluntary manual eradication; this measures often times include alternative development and crops substitution programmes. UNODC does not participate in or supervise the spraying activities; all data were received directly from the Antinarcotics Police (DIRAN).

The spraying programme carried out by DIRAN is done through aerial spraying with a mixture of products of the commercial substances of the herbicide glyphosate, a surfactant named Cosmoflux and water. In late 2002, the National Narcotics Council approved an herbicide concentration of 2.5 litres per hectare for opium poppy and 10.4 litres per hectare for coca, with a view to increasing the spraying effectiveness rate, which was estimated as being 91% in 2004. The chemical mixture has effect over the leaves and not over the roots or the soil, and therefore the bush can be subject of a prune operation at about one feet over the ground to obtain a renewal of the bush in about six months. In 2008, the spraying effectiveness rate was estimated as being 91 %.

As shown in the table below, the largest spraying operations in the period 2000-2008 has been conducted in Nariño, Putumayo and Guaviare departments; these regions are where most of the area under coca cultivation can be found in Colombia. In 2008, DIRAN reported a total of 133,496 hectares of coca fields sprayed, this represented a decrease of 13% compared with 2007. The departments of Nariño, Putumayo, Guaviare and Antioquia presented the highest levels of spraying in this year.

Figure 22: Comparison of coca cultivation and cumulative sprayed and manually eradicated areas (hectares), 1998 - 2008



Source: DIRAN for spraying, PCI for eradication, SIMCI for coca cultivation.

The cumulative sprayed area is the sum of areas during a calendar year (calculated by multiplying the length of flight lines by their width), and it differs from the effective sprayed area, which disregards the overlap between adjacent sprayed bands and areas sprayed several times in the same calendar year.

Table 42. Reported aerial spraying of coca cultivation by department and year 2000 - 2008

Department	2000	2001	2002	2003	2004	2005	2006	2007	2008
Nariño	6,442	8,216	17,962	36,910	31,307	57,630	59,865	36,275	54,050
Antioquia	6,259	-	3,321	9,835	11,048	16,833	18,022	27,058	10,028
Putumayo	13,508	32,506	71,891	8,342	17,524	11,763	26,491	26,766	11,898
Meta	1,345	3,251	1,496	6,973	3,888	14,453	25,915	15,527	9,057
Guaviare	8,241	7,477	7,207	37,493	30,892	11,865	14,714	10,950	13,061
Vichada	-	2,820	-	-	1,446	-	5,485	7,193	5,901
Bolivar	-	11,581	-	4,783	6,456	6,409	2,662	7,050	2,214
Cordoba	-	-	734	550	-	1,767	5,588	6,259	3,561
Caqueta	9,172	17,252	18,567	1,059	16,276	5,452	4,575	5,084	11,085
Cauca	2,950	741	-	1,308	1,811	3,292	1,536	3,557	6,891
Arauca	-	-	-	11,734	5,336	2,584	1,400	2,695	2,296
Norte Santander	9,584	10,308	9,186	13,822	5,686	899	1,687	2,683	2,864
Santander	470	-	-	5	1,855	2,042	2,146	1,754	422
Caldas	-	-	-	-	190	1,090	1,068	284	-
Choco	-	-	-	-	-	425	-	-	-
Valle	-	-	-	-	-	5	-	-	-
La Guajira	-	-	-	-	449	572	-	-	-
Magdalena	-	-	-	-	1,632	383	-	-	-
Vaupés	-	-	-	-	756	340	-	-	-
Boyaca	102	-	-	-	-	925	831	-	166
Cundinamarca	-	-	-	-	-	43	41	-	-
Aerial Spraying	58,073	94,152	130,364	132,814	136,552	138,772	172,026	153,135	133,496
Net Cultivation hectares)	163,000	145,000	102,000	86,000	80,000	86,000	78,000	99,000	81,000

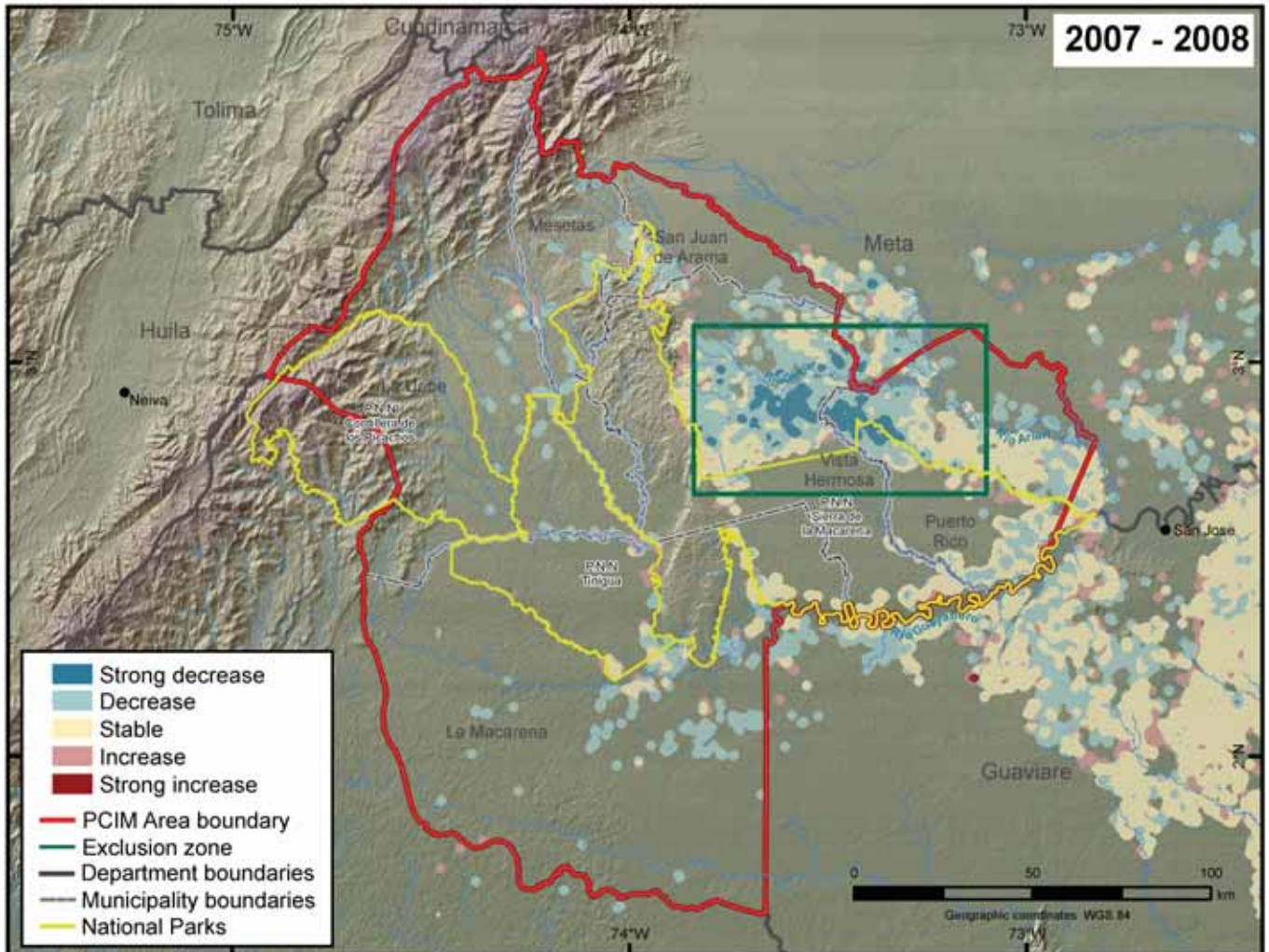
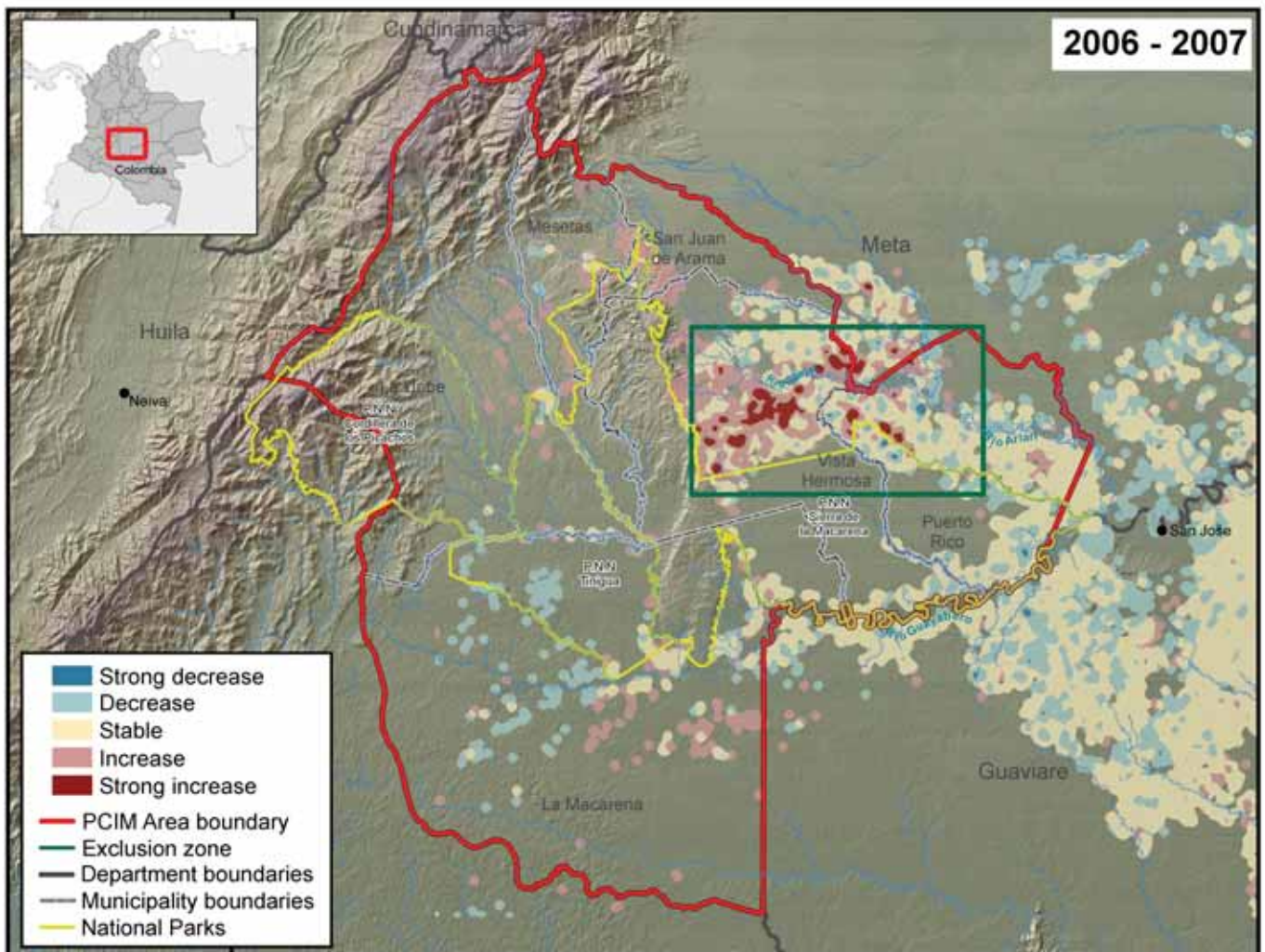
Source: DIRAN

Once coca fields are sprayed, it takes approximately six to eight months to recover productive crops when the bushes are pruned or replanted. However, when heavy rain occurs or bushes are washed by the farmers immediately after the spraying, the loss in coca leaf can be reduced and the crop recovers quickly. The sustainability of the eradication efforts depends to a large extent on the real alternatives open to the farmers and to the displacement of the cultivation into new and more remote areas of the country (balloon effect).

The aerial spraying may cause the loss of one or more harvests, the reduction of productivity or the total loss of crops but it has become clear that the impact varies considerably from one region to another and that it is not the only cause for reduction or loss of coca crops. In order to neutralize or reduce the impact of the aerial spraying, several actions are taken by the farmers such as: to plant coca bushes interspersed with other plants, to apply protective substances on leaves, to wash the leaves, to reduce the size of the fields, to rotate coca crops with other licit crops in the same field, etc.

These factors together with the reductions or losses due to the climate, plagues or diseases help to explain why the coca cultivated area is not stable along the year and suffers constant increases by replanting and decreases by eradication, marketing difficulties, violence, etc.

Coca cultivation density change in PCIM area



Source: Government of Colombia - National monitoring system supported by UNODC, DIRAN for Exclusion zone.
 The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

Plan of Integral Consolidation

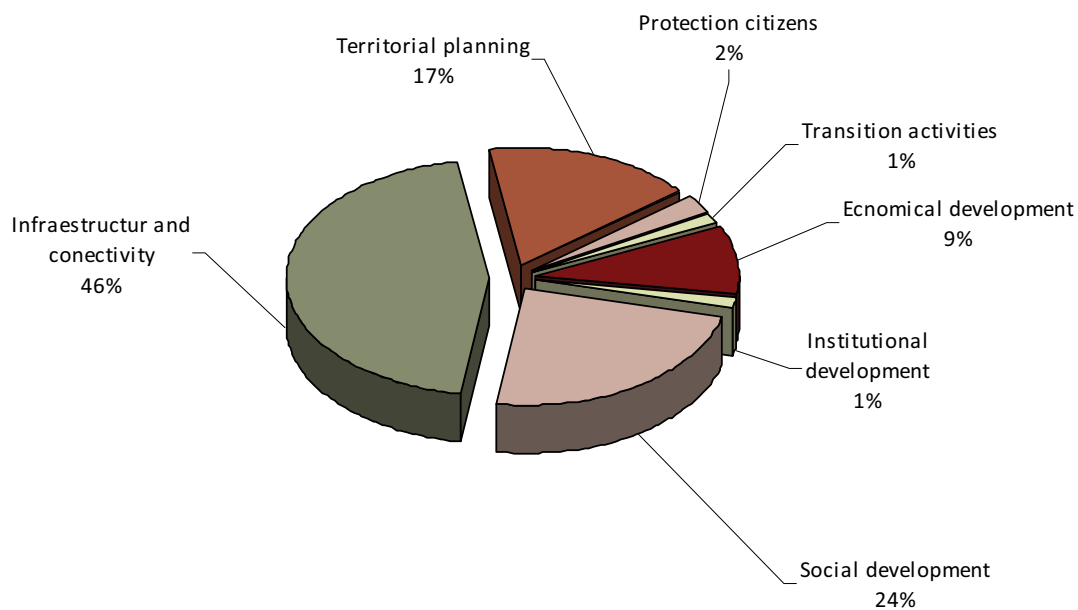
The main objective of this plan –PECIM- carried out by the Government of Colombia, aims to recover the institutional control of the territory and to establish the necessary conditions for the full exercise of the citizen’s rights. This area has an environmental importance considering the existence of three National Parks in their territory: La Macarena, Picachos and Tinigua.

One of the main objectives of the PECIM aims to the final elimination of illicit crops in the region. For this purpose, an eradication strategy focused in the conditions that determine the replanting of the illicit crops and the progressive consolidation as a territory free of coca. The most important fact is the coordination of the Government efforts in territorial security, eradication and assistance for the economical, social and institutional development of the population.

The investments in the area reached COP 132 billion (US \$67 million). Most of the investment has been implemented in the municipalities of Vista Hermosa and Puerto Rico, which formed part in 2007 of the ten municipalities with the most area cultivated with coca in the country.

The mentioned investments are aimed to: Infrastructure and connectivity, Social Development, Territorial planning, Economical development, Protection to citizens and Transition activities (livelihood).

Figure 23: Investments in PCIM



Source: Center of integral coordination. Office of the President.

In the PCIM area 2,233 hectares were sprayed and 5,735 hectares were eradicated in 2008. Into the PCIM area, a polygon of 387,000 hectares was selected and called *Exclusion Zone* where no spraying activities can be realized with the purpose of implement the eradication strategy through the control of the territorial security and assistance for their transition to licit cultivation. In this area, agreements with the farmers to forced and voluntary eradication involved more than 1,500 families. At the end of 2008 into the *Exclusion Zone* where most of the coca of the department was cultivated, some coca fields estimated in 1,524 hectares were still present in the zone

Coca cultivation in Meta department shows an increasing trend since 2001 and reached the record of the most coca cultivated area in the country in 2004 and 2005. Meta shows an important decrease in 2008 dropping to the sixth place in 2008 (5,525 hectares) after the third place occupied in 2007

(10,386 hectares) in 2007. On the other hand, the coca cultivation in the six municipalities of the PECIM decreased 63% in 2008 with respect to 2007 going from 7,248 hectares to 2,697 hectares cultivated in 2008. In the *Exclusion Zone* where the eradication strategy is applied, the reduction reached 75% in 2008.

Table 43. Coca cultivation in Meta department and in PCIM area (hectares), 2001-2008

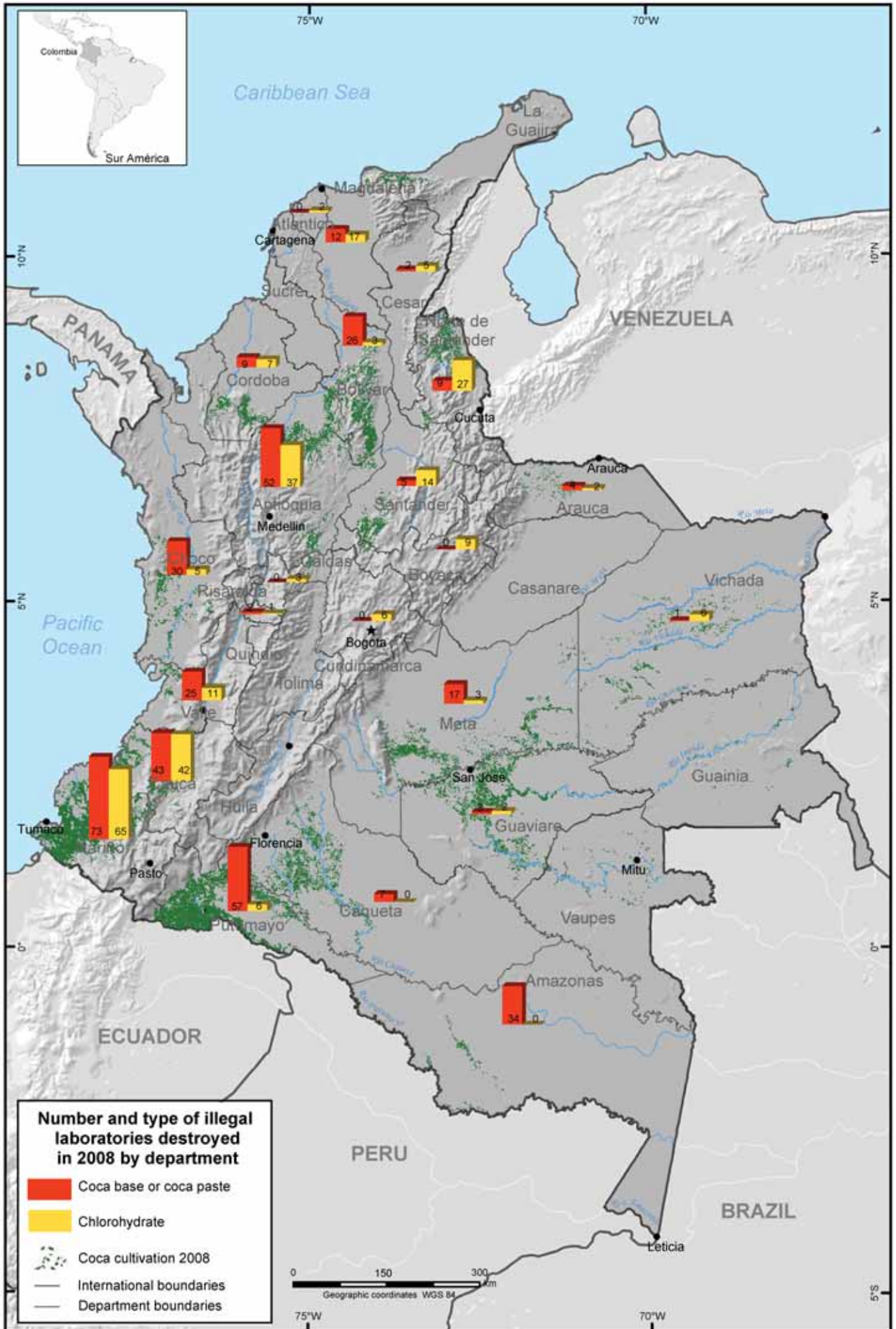
AREA	2001	2002	2003	2004	2005	2006	2007	2008	%Change 2007 -2008
Exclusion Zone	1,777	2,546	2,718	8,705	9,530	3,574	5,333	1,524	-71
PCIM	8,949	6,527	5,858	12,200	12,597	6,498	7,248	2,697	-63
Meta departament	11,425	9,222	12,814	18,740	17,305	11,063	10,386	5,525	-47

Source: UNODC

The productivity of coca cultivation decreased in the PCIM area from 6,6 harvests per year and a coca leaf yield of 8,2 mt/ha/year in 2005, to 5,4 harvests per year and a yield of 5,1 mt/ha/year in 2008.

The potential production of cocaine decreased from 120 mt of pure cocaine (19% of national total) in 2005 to 30 mt (7% of national total) in 2008.

Destruction of clandestine laboratories and coca cultivation in Colombia, 2008



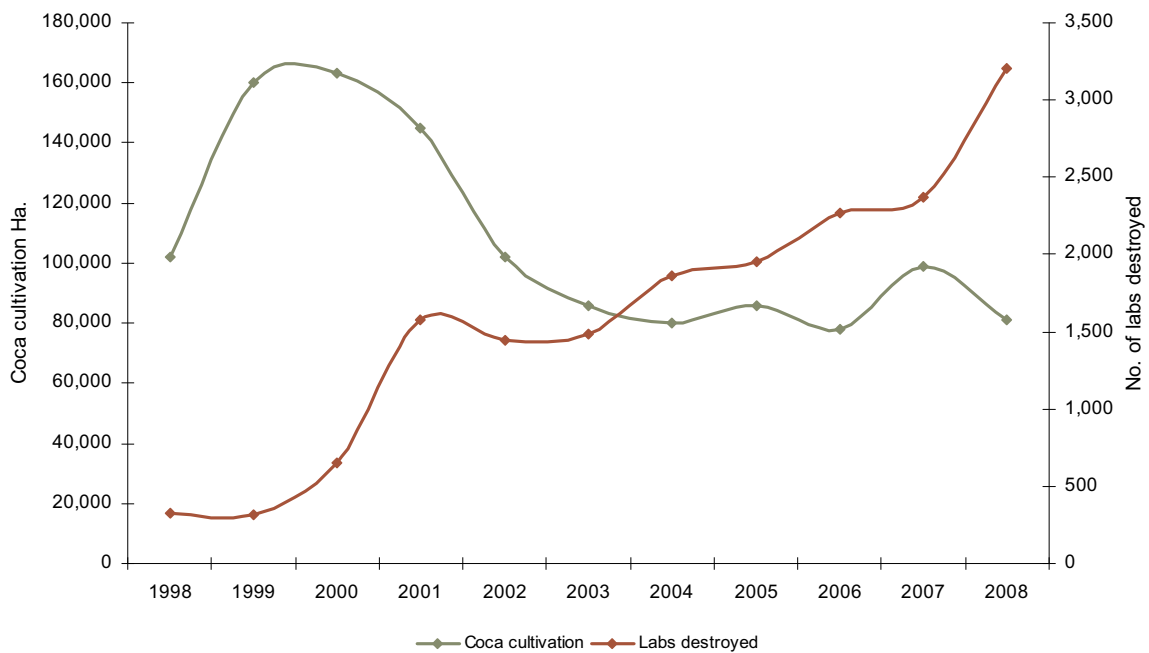
Source: Government of Colombia, for coca cultivation National monitoring system supported by UNODC, DNE for destruction of illegal laboratories. The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

Reported seizures

UNODC is not involved in the collection of data on seizures and destruction of laboratories. However the data provided by the Colombian government are presented here in order to show the existence of possible trafficking corridors and allow for a better understanding of the dynamics that surrounds the drug business.

According to DNE, a total of 3,209 clandestine laboratories were destroyed in 2008. Out of these, a total of 2,942 corresponded to laboratories processing coca paste or cocaine base, 267 corresponded to laboratories processing cocaine hydrochloride. Compared to 2007, it represented an increase 36% in the number of illegal laboratories dismantled.

Figure 24: Number of clandestine laboratories destroyed and coca cultivation, 1998 - 2008



In Antioquia, Nariño, Cauca, Putumayo and Norte de Santander, 64% of the illegal laboratories were detected and destroyed and 61% of the self called “kitchens” to process coca pasta or cocaine base were also detected and destroyed in en Putumayo, Nariño, Cauca, Antioquia and Meta.

Table 44. Table: Illegal laboratories destroyed by department and by drug type, 2008

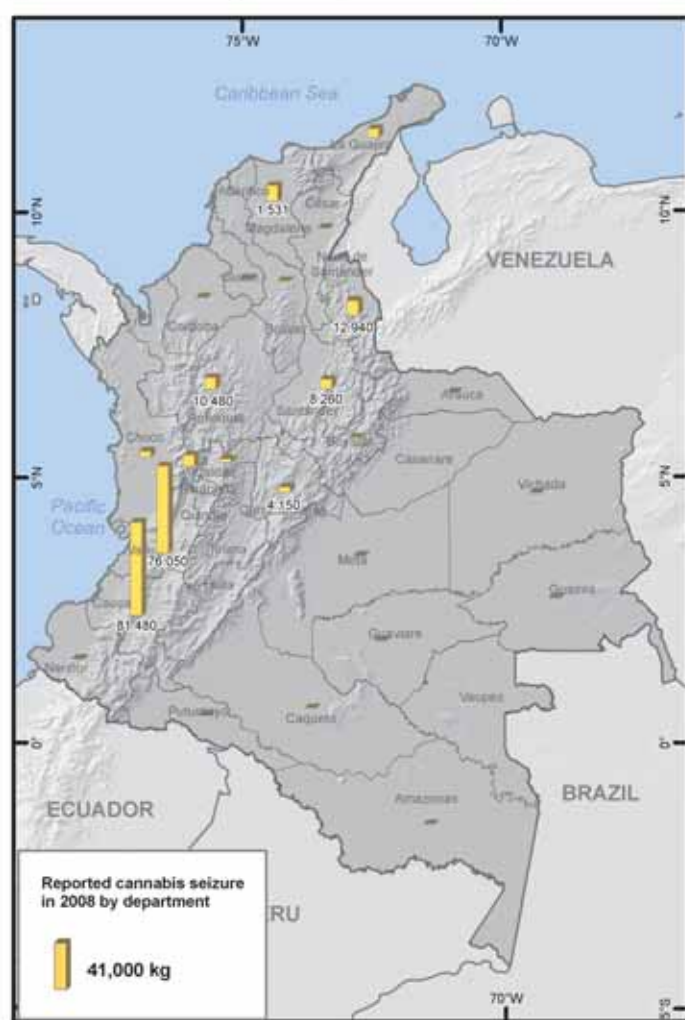
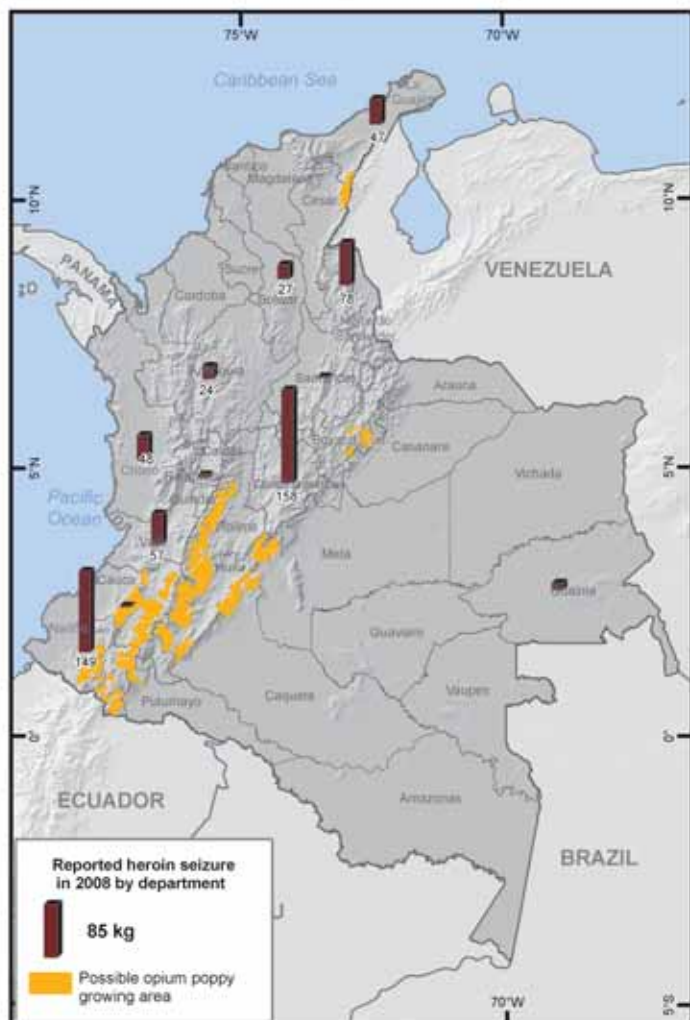
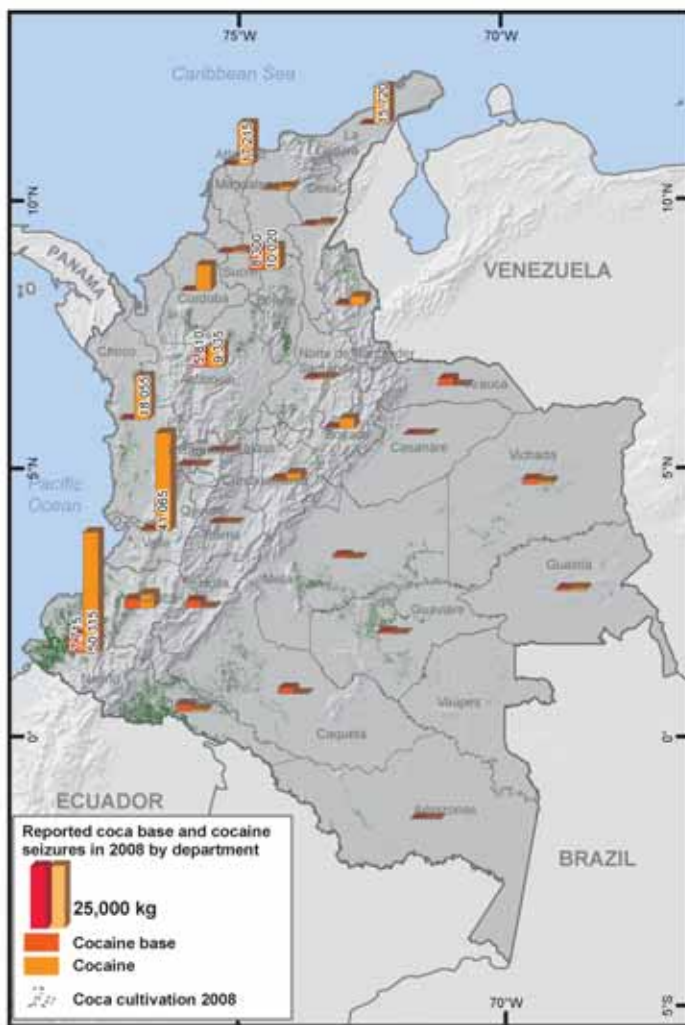
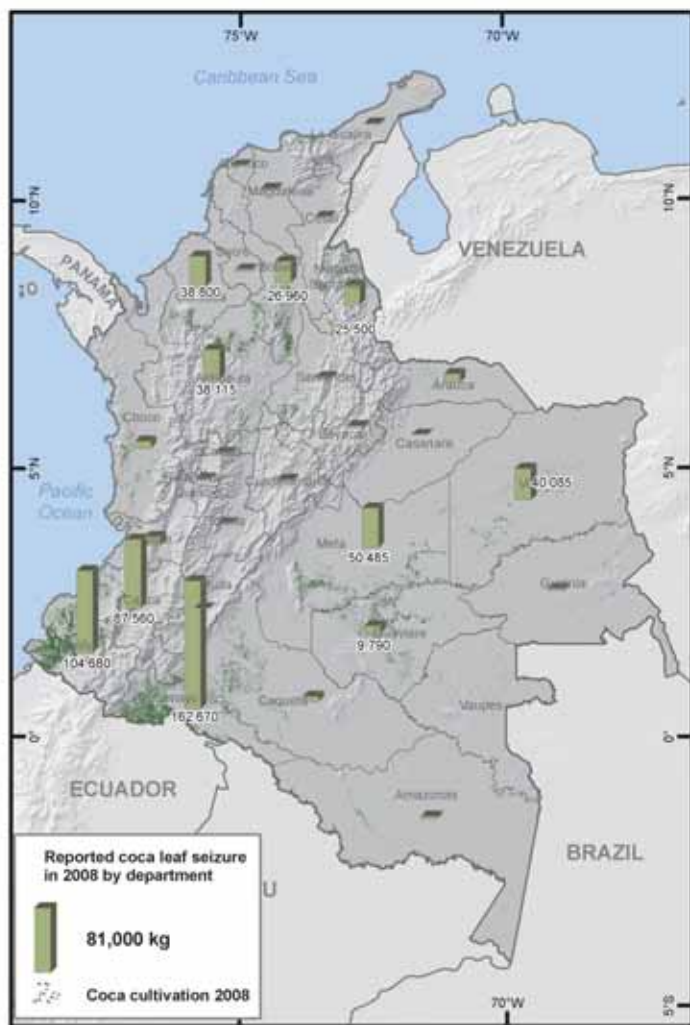
Department	Cocaine laboratories destroyed	Cocaine base laboratories destroyed "kitchens"	Coca paste destroyed "kitchens"	TOTAL
Amazonas	-	6	34	40
Antioquia	37	469	52	558
Arauca	2	101	4	107
Atlantico	2	-	-	2
Bolivar	3	52	26	81
Boyaca	9	24	-	33
Caldas	3	10	-	13
Caqueta	-	37	7	44
Cauca	42	136	43	221
Cesar	5	11	2	18
Choco	5	48	30	83
Cordoba	7	103	9	119
Cundinamarca	6	7	-	13
Guainia	-	6	-	6
Guaviare	2	34	3	39
La Guajira	-	10	-	10
Magdalena	7	9	12	28
Meta	3	157	17	177
Nariño	65	424	73	562
Norte Santander	27	97	9	133
Putumayo	6	492	57	555
Risaralda	1	-	2	3
Santander	14	38	5	57
Sucre	1	3	-	4
Tolima	3	-	-	3
Valle	11	32	25	68
Vichada	6	225	1	232
Total	267	2531	411	3209

Source: DNE

Data provided by the National Narcotics Office (DNE) shows an increase between 2007 and 2008 in terms of cocaine seizures (from 127 mt in 2007 to 198 mt in 2008). 58% of cocaine seizures took place in the Pacific Region (departments of Choco, Valle, Nariño and a 31% in the departments of Atlantico, Guajira, Cordoba, Bolivar and Antioquia.

In connection with heroin seizures, it showed an increase of 20% over the previous year, going from 537 to 646 kilograms (50% of the potential production of heroin), which were seized mostly in the departments of Cundinamarca, Nariño, Norte de Santander, Valle and Choco (79%). It is noticeable the significant increase (+78%) of seizures of cannabis in 2008 with respect to 2007.

Drug seizures by department and by drug type, Colombia 2008



Source: Government of Colombia, for coca cultivation National monitoring system supported by UNODC, for drug seizures: Colombia Drug Observatory DNE. The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

Table 45. Reported seizures of illicit drugs, 2002 - 2008

Drug	Unit	2002	2003	2004	2005	2006	2007	2008
Coca leaves	Kg.	638,000	688,691	567,638	682,010	818,544	1,064,503	644,353
Coca Paste	Kg.	974	2,368	1,218	2,651	5,451	922	5,001
Cocaine base	Kg.	22,615	27,103	37,046	106,491	42,708	33,882	49,663
Cocaine	Kg.	95,278	113,142	149,297	168,465	127,326	126,641	198,366
Opium Latex	Kg.	110	27	57	1,632	118	125	172
Morphine	Kg.	21	78	39	93	27	8	-
Heroine	Kg.	775	629	763	745	442	537	646
Cannabis	Kg.	76,998	108,942	151,163	150,795	93,745	142,684	254,685
Sintetic Drugs	unit	175,382	5,042	19,494	148,724	7,888	1,968,857	5,597

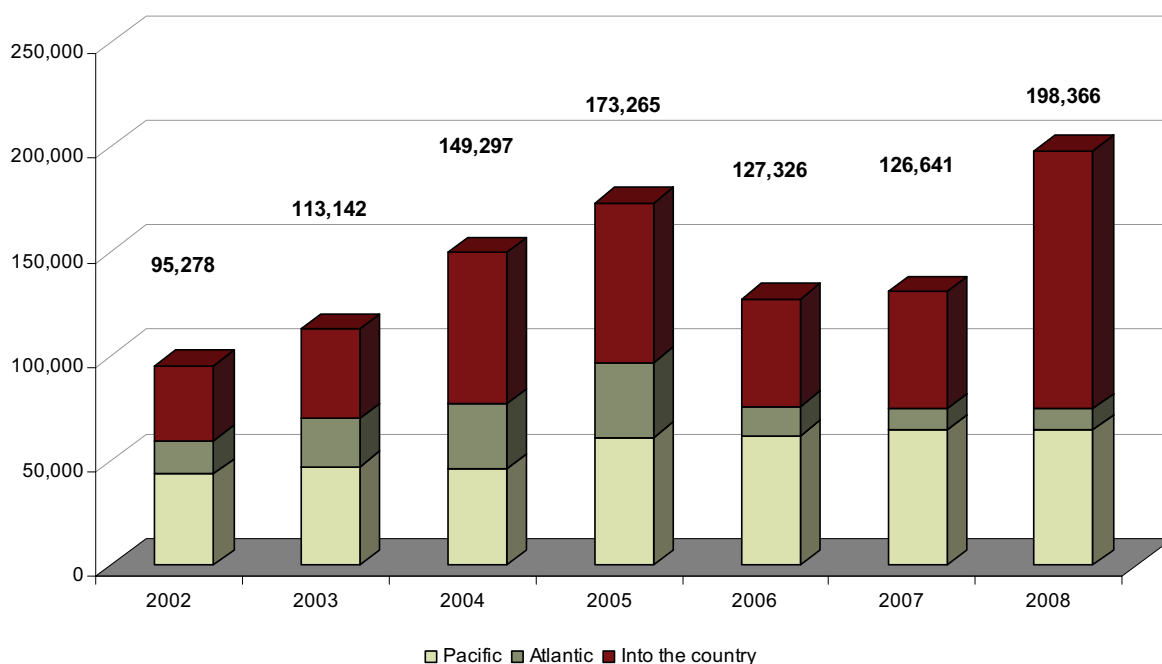
Source: DNE

Table 46. Reported seizures of cocaine on the Pacific and Atlantic routes, 2002 – 2008

	2002	2003	2004	2005	2006	2007	2008	% seizures on sea
Pacific	43,435	47,137	46,128	61,042	61,758	61,423	64,487	86%
Atlantic	16,065	23,157	30,928	35,856	14,150	9,235	10,157	14%
Total seized by sea	59,500	70,294	77,056	96,898	75,908	70,658	74,644	100%
Total seizures (land and sea)	95,278	113,142	149,297	173,265	127,326	126,641	198,366	
% of seizures on sea	62%	62%	62%	52%	56%	60%	38%	

Note: Seizures by the Maritime Agreement reached 24.7 tm Source: Colombian Navy, Intelligence Division

From a total seizure of 198 metric tons of cocaine, 74.6 tons were seized on the high seas (43%) and maritime ports mostly in the Pacific Ocean. It is noticeable the seizure of 29.5 mt on board of semi-submersibles in the Pacific Ocean. Most of the seizures were registered along the Choco-Cordoba-Uraba corridor due to its condition as the most commonly used route for drug transport.

Figure 25: Reported seizures of cocaine in the Pacific and Atlantic routes and into the country 2002 -2008.

Source: Colombian Navy, Intelligence Division

Table 47. Drug seizures by department and by drug type, 2008

Department	Coca leaf	Cocaine paste	Cocaine base	Cocaine	Latex	Heroin	Cannabis	Amphetamines	Extasis	Flunitrazepam
	Kg	Kg	Kg	Kg	Kg	Kg	Kg	Unit	Unit	Unit
Amazonas	3.133	553	273	51	-	-	17	-	-	-
Antioquia	38.114	132	5.808	9.334	-	24	10.480	10	329	6.965
Arauca	11.101	-	2.835	69	-	-	10	-	-	-
Atlantico	-	-	49	17.215	-	-	1.531	-	235	-
Bolivar	26.963	590	8.305	10.021	-	27	152	-	127	153
Boyaca	3.268	1	415	4.180	-	0	85	-	30	-
Caldas	1.957	-	160	197	-	0	3.429	-	108	-
Caqueta	6.830	834	2.312	17	-	-	214	-	-	-
Casanare	-	-	116	93	-	-	22	-	-	-
Cauca	87.563	510	3.835	6.144	-	3	81.480	-	-	12
Cesar	274	-	39	963	35	0	416	-	-	-
Choco	8.804	267	153	18.056	-	48	5.199	-	-	-
Cordoba	38.804	7	2.020	10.724	-	-	327	57	2	-
Cundinamarca	2.590	-	2.489	3.216	-	172	4.903	122	2.559	-
Guainia	1.715	12	103	88	-	-	17	-	-	-
Guaviare	9.793	107	868	88	-	-	95	-	-	-
Huila	-	3	3.072	529	-	-	256	-	-	-
La Guajira	1.087	-	11	15.722	-	47	7.715	-	-	-
Magdalena	1.917	1	516	1403	-	0	13.968	-	3	-
Meta	50.486	3	1.063	60	-	0	530	-	-	-
Nariño	104.677	1.669	7.716	50.314	137	149	498	-	5	-
Norte Santander	25.499	15	593	3.635	-	78	12.940	-	-	-
Putumayo	162.672	104	3.195	1.191	-	-	139	-	-	-
Quindio	-	-	41	22	-	1	9.660	-	-	-
Risaralda	375	-	81	110	-	6	10.038	-	152	-
San Andres	-	-	-	784	-	23	286	-	-	-
Santander	2.623	69	554	726	-	3	8.257	-	7	50
Sucre	2.700	44	117	1.112	-	-	393	-	-	-
Tolima	-	-	70	3	-	8	5.570	-	146	-
Valle Del Cauca	11.326	72	673	41.066	-	57	76.052	1.671	34	2.034
Vaupes	-	-	0	0	-	-	1	-	-	-
Vichada	40.085	10	2.179	1.234	-	-	5	-	-	-
Total	644.353	5.001	49.663	198.366	172	646	254.685	1.860	3.737	9.214

Source: DNE

3 METHODOLOGY

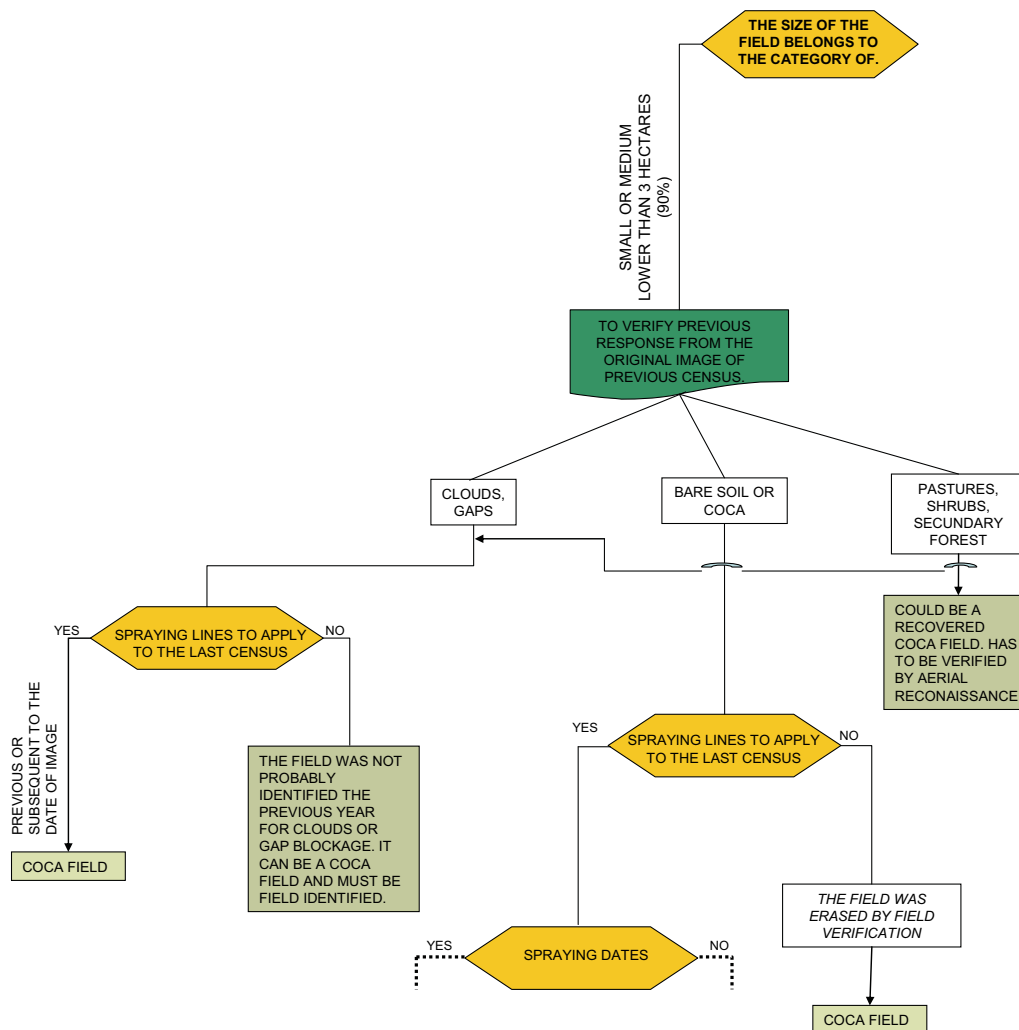
3.1 Coca cultivation

The monitoring of coca cultivation in Colombia is based on the interpretation of various types of satellite images. For the 2008 census, the project analyzed a total of 86 LANDSAT images, 9 SPOT-4 images and 3 ALOS images, acquired between August 2008 and March 2009. The images cover the whole national territory (excluding the islands of San Andres and Providence) equivalent to 1,142,000 square km.

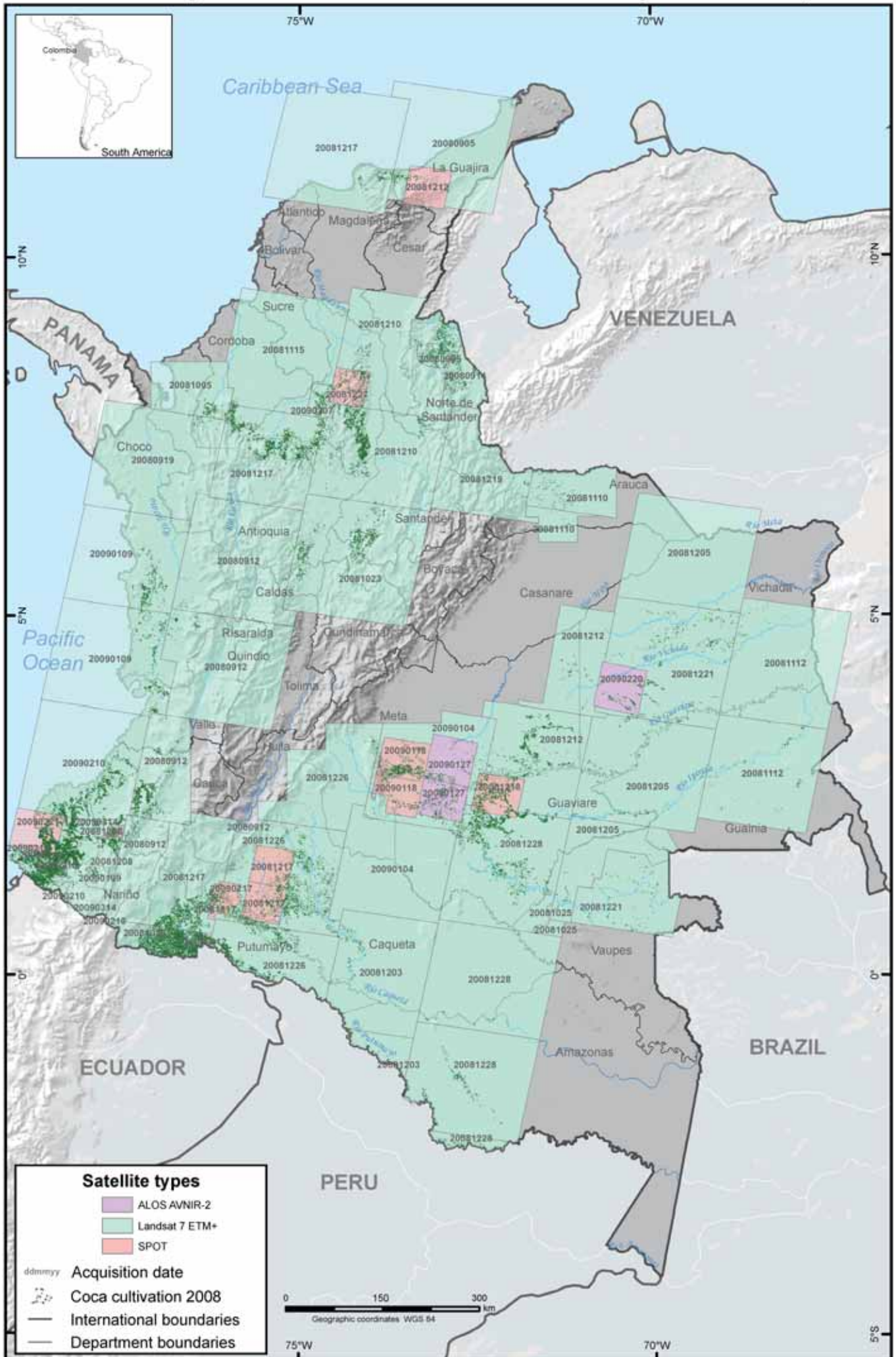
In September 2005, the Institute of Surveying, Remote Sensing and Land Information of the University of Natural Resources and Applied Life Sciences, Vienna (BOKU, Austria), conducted a technical evaluation of the methodology developed for the assessment of coca cultivation. The Institute concluded that the methodology is appropriate and commended the work of the remote sensing team performing the interpretation of the satellite images. The Institute also made some recommendations in particular the use of aerial photography for quality control which was initiated in 2008 in two test areas located in the departments of Meta and Antioquia.

The project staff continues working in the development and updating of a decision tree for the interpretation of coca crops in satellite images with the support of the BOKU University. The identification of the different factors that determine the interpretation of the coca fields in the regions (Meta-Guaviare, Putumayo-Caqueta and Cauca-Nariño) as well as the decision tree with the data obtained is already finished.

Figure 26: Part of the decision tree designed for the interpretation key study



Satellite images used for the coca cultivation survey in Colombia, 2008



Source: Government of Colombia - National monitoring system supported by UNODC
The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

The estimation of the total area under coca cultivation in Colombia in 2008 is the result of the following steps:

1) Identification and acquisition of satellite images

The survey relied mostly on LANDSAT 7 ETM+ images and to a lesser extent on SPOT- 4 and ALOS images.

Table 48. Table: Satellite images used for the 2008 survey in Colombia

Sensores	% 2001	% 2002	% 2003	% 2004	% 2005	% 2006	% 2007	% 2008
LandSat 7 ETM+	92	99	82	94	92	89	89	95
SPOT 4 and 5	8	1	2	1	5	3	3	4
ALOS	-	-	-	-	-	-	3	1
ASTER			16	5	3	5	5	-
IRS6 – LISS III	-	-	-	-	-	3	-	-
Total	100	100	100	100	100	100	100	100

One of the major difficulties in data acquisition is the frequent cloud cover over the Colombian territory. Therefore, satellite with a frequent view and a continuous recording of the area were favoured. The free cost of LANDSAT 7 ETM+ contributed to their larger selection than SPOT or ALOS images.

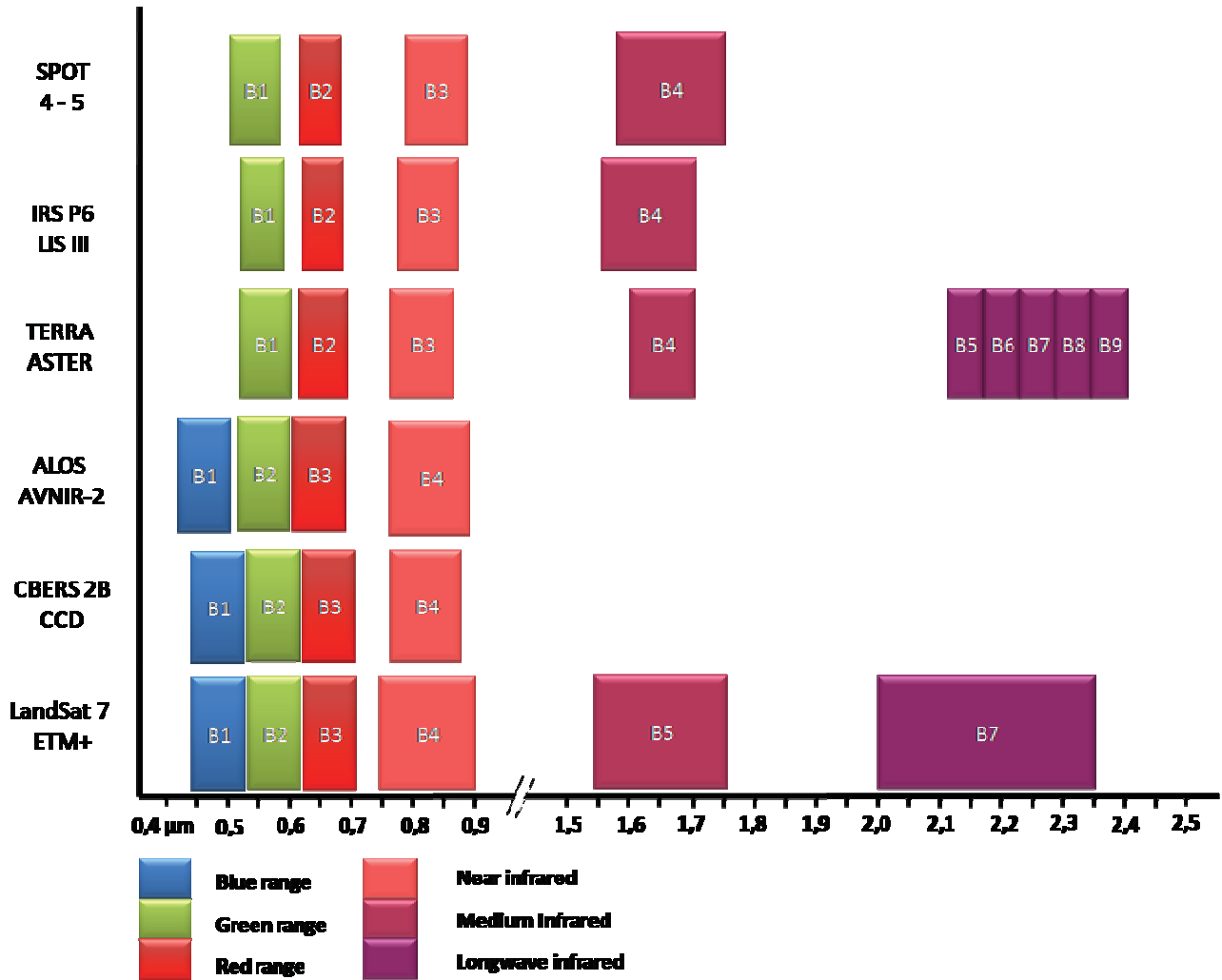
LANDSAT 7 ETM+ data are collected in 6 spectral bands of 30 meter spatial resolution, a thermal band with 60 meters spatial resolution and an additional panchromatic band of 15 meter spatial resolution. The satellite has a 16-day repeat cycle, which enhances the chance for cloud free images. The swath width of 185 km is appropriate for regional studies. The project identified suitable images by consulting frequently the on-line catalogue of available LANDSAT 7 images at the US Geological Survey.

As of May 2003, the Scan Line Corrector (SLC) of the LANDSAT 7 ETM+ instrument failed. This malfunction is leading to gaps in the image, gradually diminishing towards the centre of a scene. The assessment of coca cultivation under these gaps (without information) is described in the below section on correction. To obtain information on gaps areas, Landsat images of different date or others sensors are used.

SPOT 4 has a spatial resolution of 20 meter with a swath width of 60 km. About 500 SPOT images would be necessary to cover the entire country.

The images of the spectral sensor AVNIR-2 on board of the Advanced Land Observing Satellite (ALOS) have four bands and a spatial resolution of 10 meters with a swath width of 70 km. They are comparable in spectral resolution with CBERS and the first four bands of LANDSAT.

Figure 27: Spectral comparison between bands SPOT, ASTER, IRS, LSIII, LANDSAT, ALOS and CBERS



2) Spatial Information Data Base -BIE- (www.biesimci.org)

The BIE is an infrastructure of spatial data that aims to guarantee the knowledge and access of anyone to the spatial information gathered by SIMCI, framed into the recommendations of the United Nations Seventh Regional Cartographic Conference for the Americas, held in New York in September 1999.

The BIE is divided into five sections: Satellite Data, Thematic Cartography, Altimetry Cartography, Illicit Crops Spatial Data and Documents. It may be consulted at the web page of UNODC Colombia shown in the last page of this report.

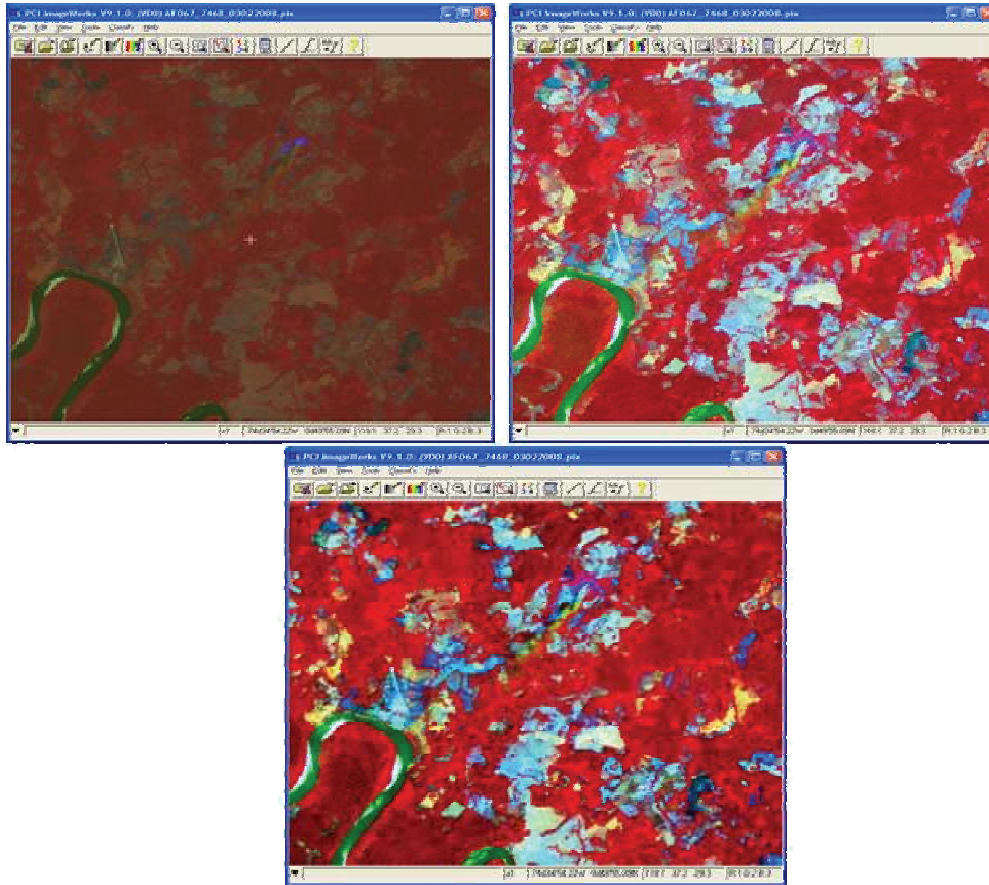
3) Image pre-processing

3.1) Geo-referencing

In order to use image datasets in conjunction with other spatial data available (e.g. digital elevation model), it is necessary to align the image data to the same map coordinate system. The satellite images are geo-referenced on the basis of mosaics built with geo-referenced images with the less cloud coverage used in previous census. The Digital Terrain Model -DTM- from the Space Shuttle Radar Mission was used for spatial enhancements. In order to improve the quality and accuracy of the coca fields coordinates, the Geographical Institute of Colombia orthorectified the mosaics to provide official coordinates to the shp. file.

3.2) Radiometric and spatial enhancements

To improve the visual and supervised interpretation process, various radiometric enhancements (colour or spectral) are applied to enhance the contrast of the image.



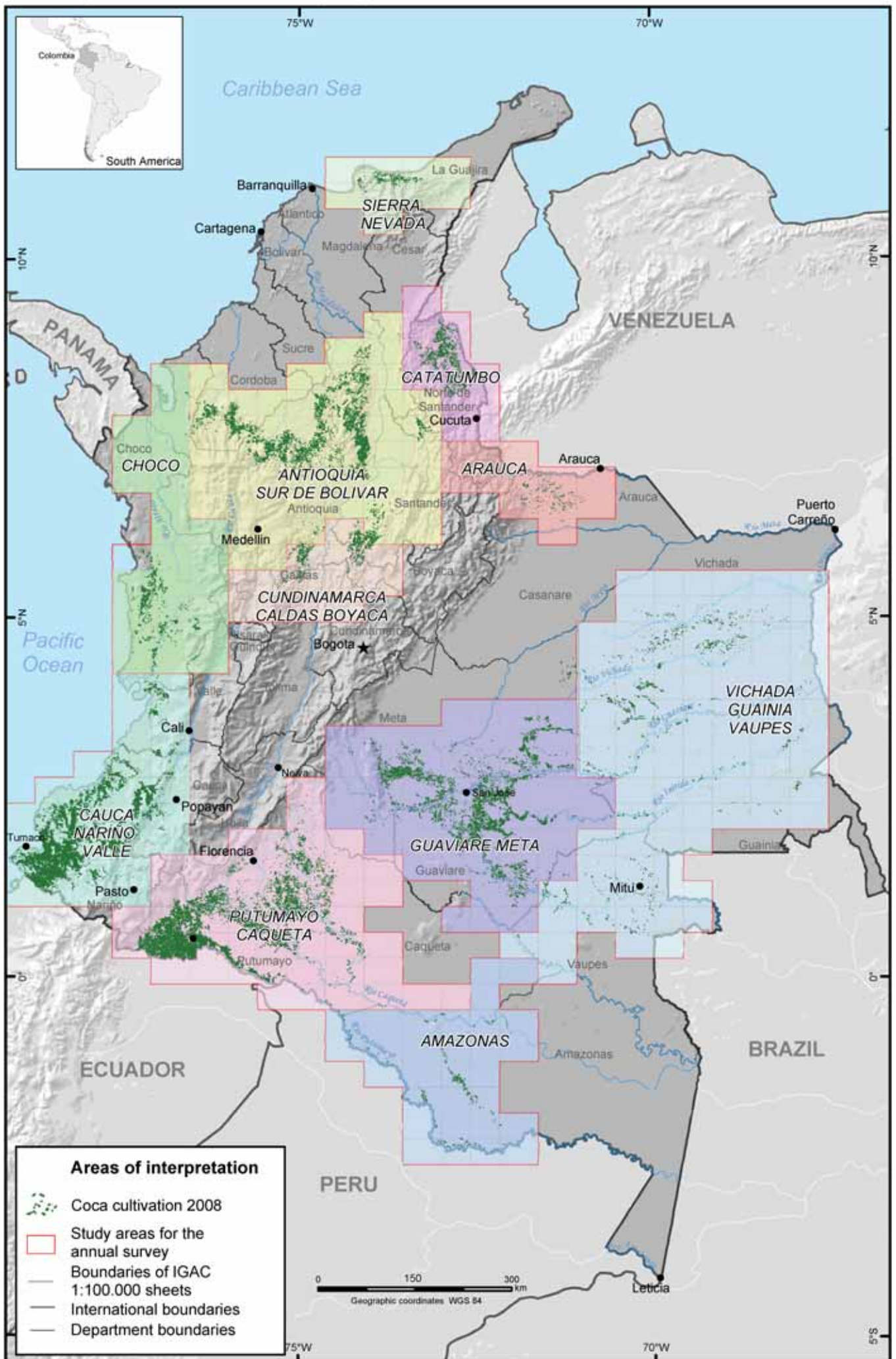
Example of radiometric enhancement

To enhance the spatial characteristics of an image various filters that modified the value of a pixel using the values of surrounding pixels, were used.

3.3) Band combinations

To allow an easy interpretation of the displayed image, it is possible to assign which band is displayed using a different primary color (RGB) for each band

Study area distributed by region and coca cultivation in Colombia, 2008

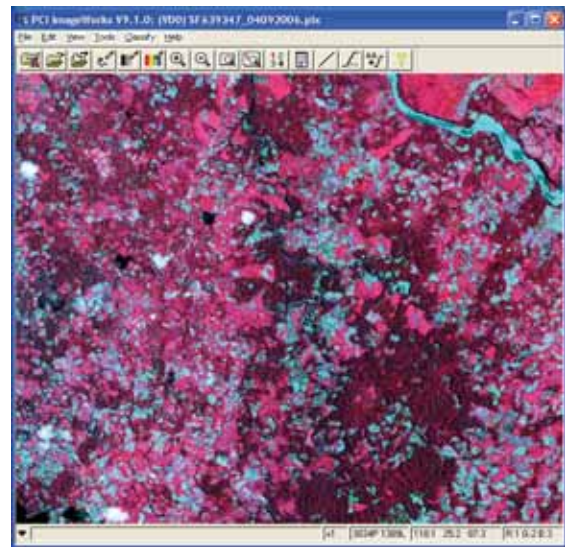
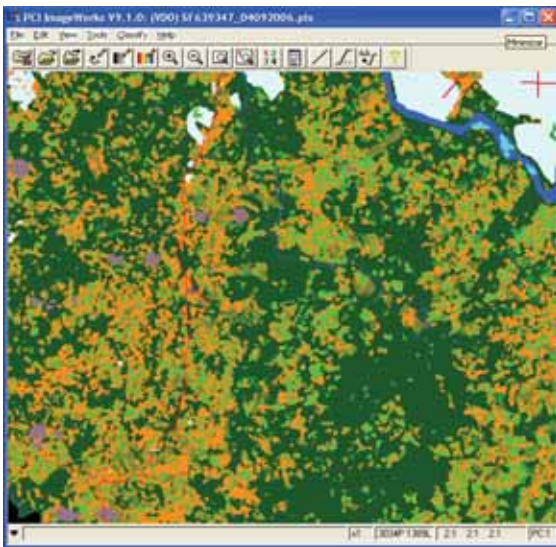


Sources: Government of Colombia, for coca cultivation National monitoring system supported by UNODC; for 1:100.000 grid IGAC. The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

4) Digital land cover classification of land use and vegetation

One of the difficulties for an automatic or supervised classification of vegetation in Colombia is the absence of well defined crop calendar. Most crops, including coca, are cultivated throughout the year. This makes it difficult to separate coca from other crops based on phenological differences. The automatic land cover classification is not used to detect coca cultivation, but rather to study broadly the various land cover present on an image.

The project performed a supervised classification, where training areas represent the features to be mapped in advance and class signatures are calculated. Each pixel is then assigned to a land cover class depending on an algorithm. In this case, based on the maximum likelihood algorithm, 17 land cover classes are classified within each image: primary forest and rainforest, secondary forest, grassland and small shrubs, water bodies, sand banks, clouds and shadows, roads, urban and populated areas, inundated areas, rock outcrops, bare soils, crops, high shrubs, artificial water bodies, runways other.



SPOT Scene with the land use interpretation

5) Visual interpretation of the coca fields

The classification of coca fields relies on the visual interpretation of satellite images. The detection is based on the spectral characteristics, texture, patterns and the surroundings of the fields. The class 'coca' can be considered to be composed of bare soils and small rows of bushes. No distinction is made between the different phenological stages of coca bushes.

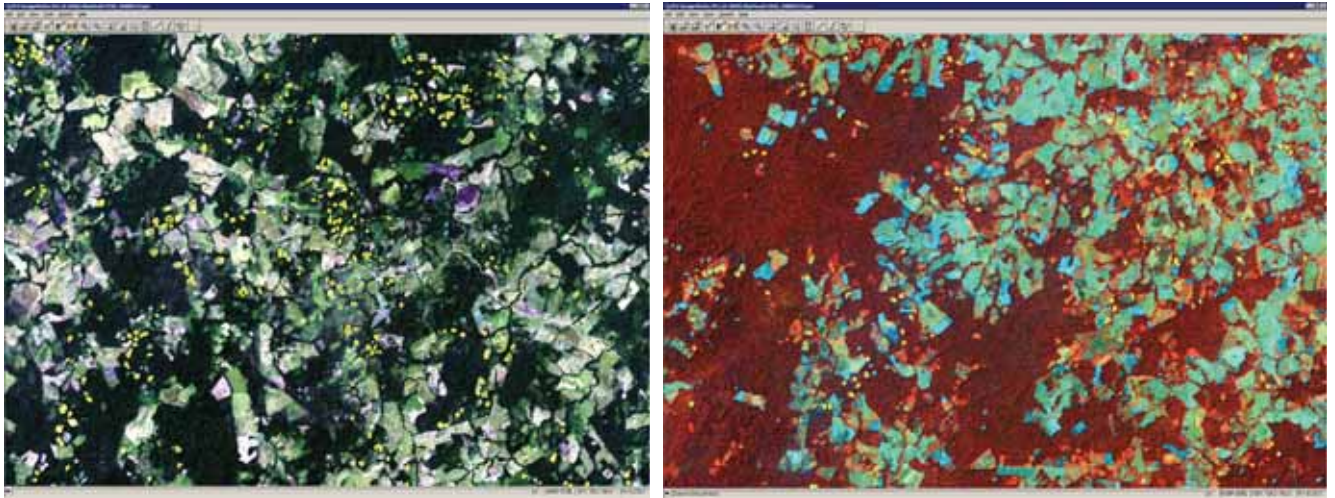
The interpreter verifies the coca crops based on spectral characteristics, texture, shape, size of the fields and contextual information, like information from previous surveys and geographic information on spraying and manual eradication.

Coca fields are digitized on screen in two ways: with the help of semi-automatic software tools (e.g. pixel seeding). This means that pixels are grouped together automatically by the software if their spectral value are similar. The similarity threshold for grouping pixels is determined by the interpreter. The second way consists in the unit selection of pixels to configure the fields.

Small polygons of less than 2 pixels are deleted because the interpretation is not reliable enough due to the coarse spatial resolution of the sensor.

In addition, aerial photos taken by the Antinarcotics Police (DIRAN) and SIMCI, recording of aerial spraying path, manual eradication and Forest Warden Families reports and coca polygons interpreted for the census of previous years are also used to facilitate the interpretation, as well as the information supplied by different government and UN agencies.

The interpretation process relies on the profound knowledge of the area by the interpreter. This knowledge is gained through many years of experience analysing satellite images and frequent over-flights. Interpreters have several years of experience with the project.



Coca fields visually interpreted (outlined in yellow) in ALOS - AVNIR 2 satellite image

6) Verification flights

Verification flights are required for editing and improving the initial interpretation. The verification is based on direct visual inspection of the ground from a plane. Paper maps are used for orientation and as a data base for verification.

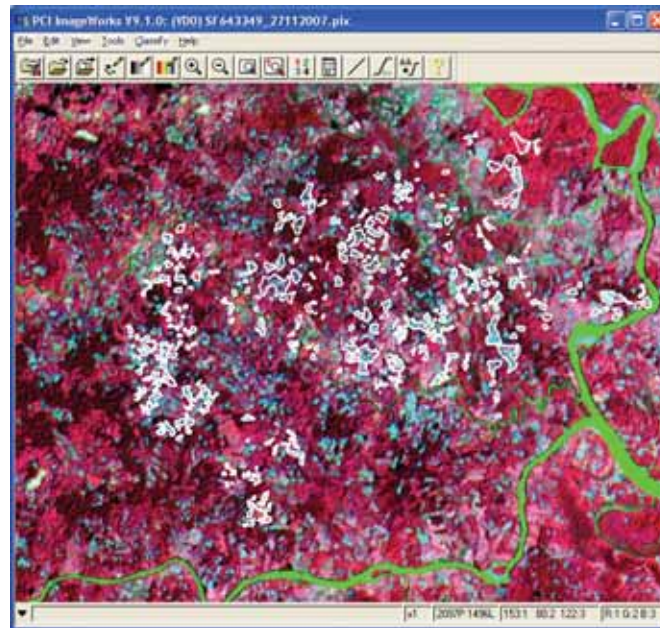
In addition to visual inspection from the aircraft, a video camera and a digital camera combined with GPS and a video camera were used for documentation. The preliminary interpretation results are edited and corrected with the verification findings.

7) Corrections

Following the interpretation process, a number of corrections are applied to account for the effects of spraying activities before or after image acquisition, for missing image information due to clouds or gaps (SLC-off) and for differences in acquisition date of the images with respect to the census cut of date of 31 December. These corrections are necessary to improve the final statistics.

7.1) Correction for manual eradication

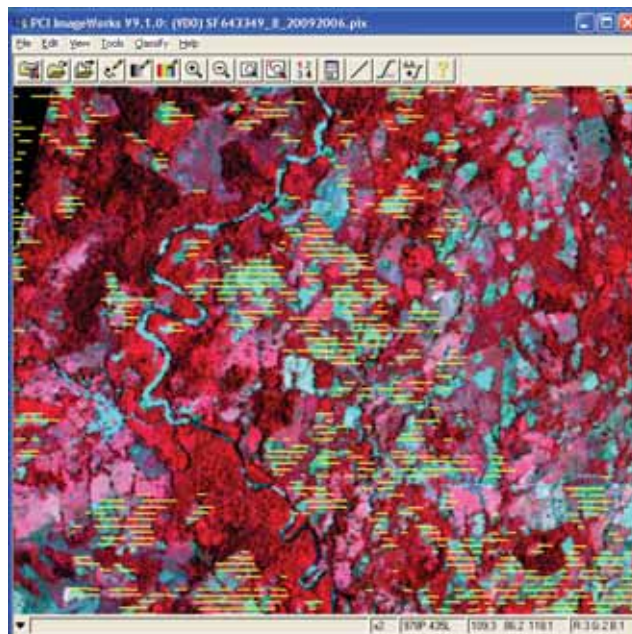
As part of the illicit crop eradication activities, coca fields are pulled out by hand and their coordinates are registered and reported to UNODC. Corrections are then performed depending on the date of image acquisition and on the date of eradication. Reported eradicated coca fields are ignored in images acquired after manual eradication and deleted from the interpretation when the eradication takes place after the date of the image. The manual eradication happened in the first months of the year after the census year, is used to replace corrections by clouds or gaps and to verify the interpretation of those fields that should be present in the census. These eradicated fields are then added to the statistics.



Manual eradication polygons (occurred after the date of the image) in white

7.2) Correction for spraying

Another activity aimed to destroy coca fields consists in spraying them from aircraft. The spraying lines are automatically recorded. After transforming the coordinates into the coordinate system of the satellite images, a buffer is calculated depending on the type of the plane and the recorded spraying line. The buffer is placed over the coca interpretation. Corrections are then performed depending on the date of image acquisition and on the date of spraying. Coca areas that were identified in the satellite images are excluded if the images were acquired before spraying, except for an estimated survival rate of 9% for 2008 certified by DIRAN.



Coca fields with the aerial spraying lines in yellow

7.3) Corrections for cloud cover and gaps in LANDSAT 7 images (SLC-off)

Clouds and shadows are delineated during the land cover classification process. In a first step, buffers of one kilometre width around the clouds are calculated. The coca cultivation area within this buffer is measured. By comparison with the previous survey, trends for coca cultivation are calculated for the buffer area. This trend is used to estimate recent area under the clouds from corresponding area in the previous survey. Old coca fields under clouds or gaps are preserved in position and size, when trends indicate an increase in the surroundings areas.

In the 2008 survey, the corrections for the gaps of the LANDSAT 7 scenes were treated like clouds. The only difference is in a buffer of 300 meter instead of 1000 meter for the clouds. The definition of the buffer is based on experience in both cases.

7.4) Corrections for differences in acquisition dates of images

The satellite image only reflects the cultivation at their acquisition date. A correction factor should be applied to get the estimates at the cut-off date of 31st December. A monthly coca rate of increase or decrease is calculated from the difference in coca cultivation between images acquired over the same area at different dates. This rate is then applied to the initial interpretation for the number of months separating the acquisition date and the cut off date of 31 December.

Table 49. Corrections applied

	Area (hectares)	% of initial result
Initial results	67,334	83.2%
Correction for cloud cover and gaps	9,962	12.3%
Correction for spraying	3,266	4.0%
Correction for difference in dates	391	0.5%
Final results	80,953	100%

Accuracy assessment

The assessment of the accuracy of the interpretation results is part of a quality control. The accuracy assessment has two aspects: a geometric accuracy which is the accuracy of the interpreted boundaries (or size) of land cover units and a thematic accuracy which measures the reliability of the identification of land cover classes.

The images are presently geo-referenced on the basis of the mosaics built by the project. In this case, for LANDSAT 7 ETM+ images a maximum positional deviation of the order of 1/10 of elevation difference can occur. During its revision of the methodology, the Institute of Natural Resources and Applied Life Sciences of Vienna (Austria) recommended to ortho-rectify the images with detailed Digital Elevation Model to increase the geometric accuracy to below 1.5 pixels.

Thematic accuracy is usually specified in terms of error matrix, giving frequency (probability) of misclassification between different classes. The compilation of the error matrix must be based on a representative, unbiased sample of reference data. The collection of reference data is difficult where access to the ground is not possible due to security reasons.

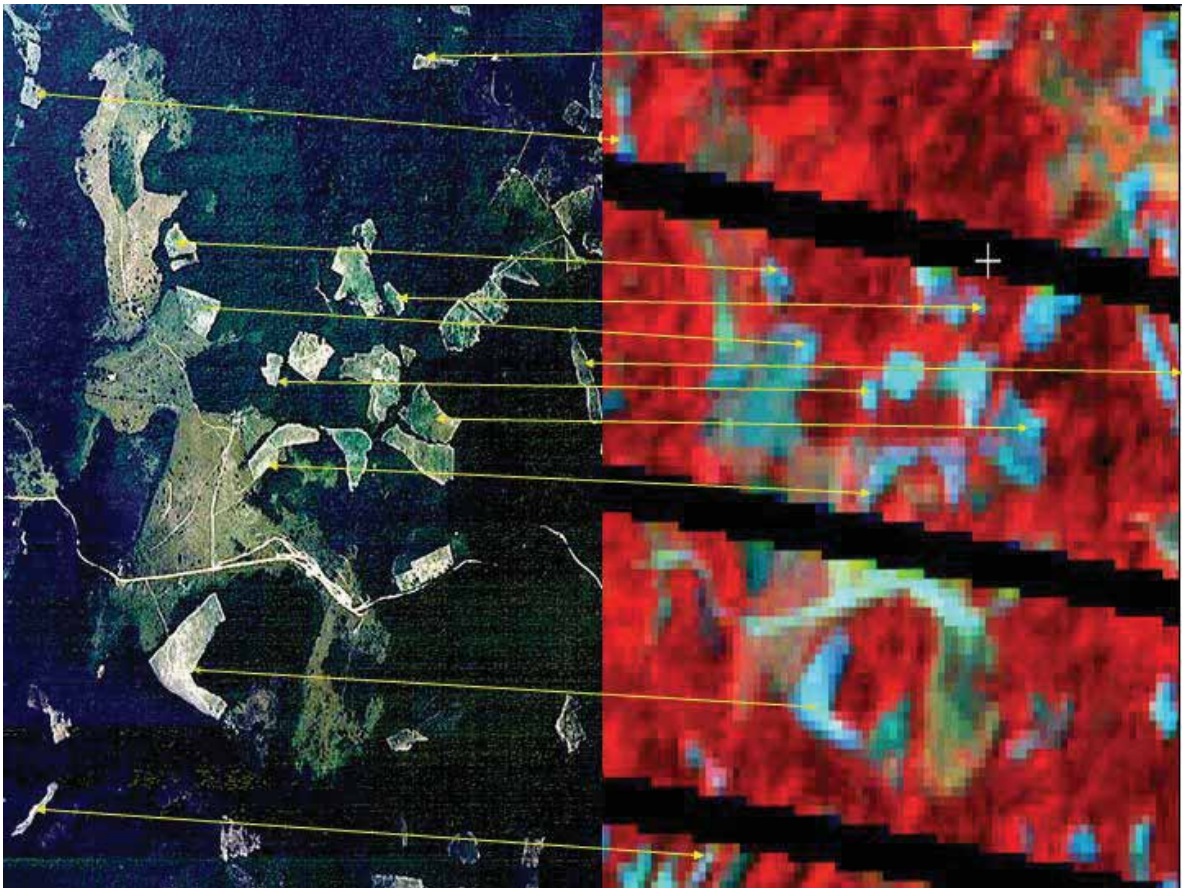
Although the thematic accuracy is a good indicator of the quality of the interpretation, it does not provide for a range of the results, and therefore it cannot be used to correct the results.

Following the recommendations of the Institute of Natural Resources and Applied Life Sciences of Vienna (Austria), the project is currently developing an accuracy assessment method relying on aerial photography as surrogate ground data that might provide for such a bias-correction factor.

The project obtained medium scale true colour aerial photography taken by a private company contracted in January 2008 over the surroundings of the Vista Hermosa-Meta and Caceres-Antioquia municipalities to compare the results of the interpretation of coca fields in the aerial photography with the results of the interpretation in the LANDSAT and ALOS images taken around the same date and used in the 2007 coca survey.

The results of the Meta and Antioquia test areas are been analyzed by Institute of Natural Resources and Applied Life Sciences of Vienna (Austria).

The results of this study are a first approximation to the proposed measurement of the interpretation accuracy of coca cultivation using high-resolution aerial photography interpretation as reference for accuracy assessment of the interpretation of satellite imagery and will be continued with an appropriate statistical design.



Comparison of coca fields in aerial photography with LANDSAT image

Analysis of the dynamics of cultivation**Table 50. Stable and new fields of coca bush in 2008 by region**

Region	Identified in 2007 and 2008				Not detected in 2007				Total 2008	
	Number of fields	% of total fields	Area (hectares)	% of total area	Number of fields	% of total fields	Area (hectares)	% of total area	Total Fields	Total Area (hectares)
Pacific	21,616	40	6,976	23	32,622	60	22,944	77	54,238	29,920
Putumayo-Caqueta	10,765	42	3,426	25	14,750	58	10,537	75	25,515	13,963
Central	5,492	25	2,590	14	16,480	75	16,114	86	21,972	18,734
Meta-Guaviare	9,759	59	5,024	41	6,766	41	7,131	59	16,525	12,155
Orinoco	1,293	45	1,401	39	1,610	55	2,222	61	2,903	3,623
Amazonas	627	32	433	21	1,332	68	1,587	79	1,959	2,020
Sierra Nevada	223	33	107	20	454	67	431	80	677	538
TOTAL	49,775	40	19,957	25	74,014	60	60,996	75	123,789	80,953

The comparison of the position of the coca fields in 2007 and 2008 revealed that about 60% of the fields (75% of the total cultivated area), were in a different position or at least not observed in 2007 for various reasons (aerial spraying, recently harvested, recently planted, etc) and therefore not in production and not accounted for in the 2007 census. Therefore not necessary all of these coca fields can be qualified as new fields planted in 2008 because the identification as “new” is not referred to the age of the cultivation but to the position of the field. The higher percentage of the area over the number of fields indicates that the average area of new fields is higher than the total average.

Table 51. Stable and new fields of coca bush in 2001-2008 by region

Region	Stable 2001-2008				New in 2008				Total 2008	
	Number of fields	% of total fields	Area (hectares)	% of total area	Number of fields	% of total fields	Area (hectares)	% of total area	Total Fields	Total Area (hectares)
Pacific	30,603	57	11,013	37	23,476	43	18,895	63	54,079	29,908
Meta-Guaviare	12,647	77	7,730	64	3,875	23	4,433	36	16,522	12,163
Putumayo-Caqueta	15,250	60	5,430	39	10,369	40	8,528	61	25,619	13,958
Central	9,089	41	4,420	24	12,885	59	14,312	76	21,974	18,732
Orinoco	1,845	64	2,290	63	1,048	36	1,326	37	2,893	3,616
Amazonas	855	44	614	30	1,109	56	1,411	70	1,964	2,025
Sierra Nevada	328	44	166	30	118,410	56	385	70	738	551
TOTAL	70,617	57	31,663	39	53,172	43	49,290	61	123,789	80,953

For a better assessment of the dynamic of coca cultivation in Colombia, a comparison was made between the position of the coca fields identified in 2008 and the position of the fields identified between 2001 and 2007. In total, 43% of the fields that covers 61% of the total cultivated area identified in 2008 had never been detected before. Such observation suggests a high mobility of coca cultivation in Colombia. The higher percentage of the area over the number of fields indicates that the average area of new fields is higher than the total average. The changes in the different years not necessarily obey to new fields or disappeared for abandonment, eradication or spraying but also for lack of secondary information or the meteorological conditions of satellite images.

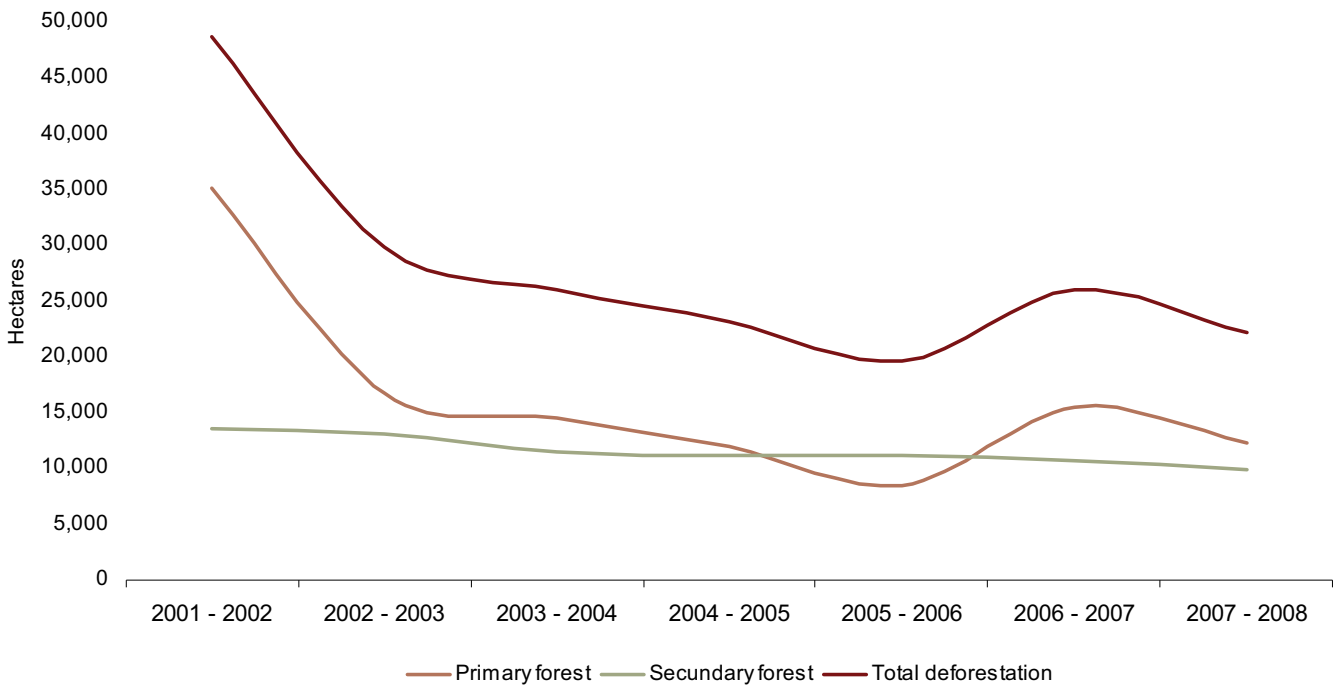
Forest felling rate by coca cultivation

Although the reduction of the coca cultivated area, one fourth of the coca fields present in 2008 came from primary forest felling existing in 2007. In the period 2001-2008 has been destroyed 192,000 hectares of forest for coca cultivation into an area of 500,000 hectares.

In the period 2000-2001, 55,000 hectares of forest were destroyed to cultivate coca while 22,270 were destroyed in the period 2007-2008, of which more than 50% were primary forest with a high complexity, biodiversity and richness. This reduction represents a return to the continuous decreasing trend of the forest felling rate for coca cultivation, interrupted in the period 2006-2007.

In the period 2000-2006, the average distance from the coca fields to urban centers was 25 km while in 2008, that distanced decreased to 22 km, the same as 2007.

Figure 28: Forest felling rate by coca cultivation, 2001-2008.



Annex 1: Correction for cloud cover, gaps, aerial spraying and date of imagery in 2008.

Departament	Interpretation	Corrections				Total 2008	% of Corrections
		for clouds	for gaps in satellite images	for aerial spraying	for date of imagery		
Amazonas	736	45	55	0	0	836	12
Antioquia	5,236	322	280	214	44	6,096	14
Arauca	323	14	58	54	-2	447	28
Bolivar	4,888	615	220	49	75	5,847	16
Boyacá	181	6	1	3	6	197	8
Caldas	148	13	23	0	3	187	21
Caqueta	3,671	577	81	90	-116	4,303	15
Cauca	4,512	364	312	191	43	5,422	17
Cesar	5	0	0	0	0	5	0
Choco	2,060	750	0	0	-16	2,794	26
Cordoba	1,489	0	22	101	98	1,710	13
Cundinamarca	4	0	0	0	8	12	67
Guainia	519	38	59	0	9	625	17
Guajira	137	0	11	0	12	160	14
Guaviare	6,076	129	135	210	79	6,629	8
Magdalena	350	2	26	0	13	391	10
Meta	4,774	82	58	104	507	5,525	14
N. de Santander	2,070	356	206	100	154	2,886	28
Nariño	15,721	2,222	494	1,814	-639	19,612	20
Putumayo	8,959	369	270	238	-178	9,658	7
Santander	1,453	176	11	8	143	1791	19
Valle del Cauca	906	1,194	0	0	-11	2,089	57
Vaupés	509	14	34	0	0	557	9
Vichada	2,607	70	248	90	159	3,174	18
TOTAL	67,334	7,358	2,604	3,266	391	80,953	17

Figure 28 shows the area with coca cultivation interpreted in the satellite images and their trends without the corrections applied to calculate the final amount of coca cultivation. Figure 29 shows the area with coca cultivation interpreted in the satellite images and the corrections for clouds, gaps and date of imagery and their trends applied to calculate the amount of coca cultivation. Figure 30 shows the area with coca cultivation interpreted in the satellite including all the corrections applied.

The trends shown are quite similar, which indicates that the trend is ruled by the amount of coca fields interpreted with a slight influence of the corrections applied.

Figure 29: Interpretation of coca cultivation without corrections, 2002-2008

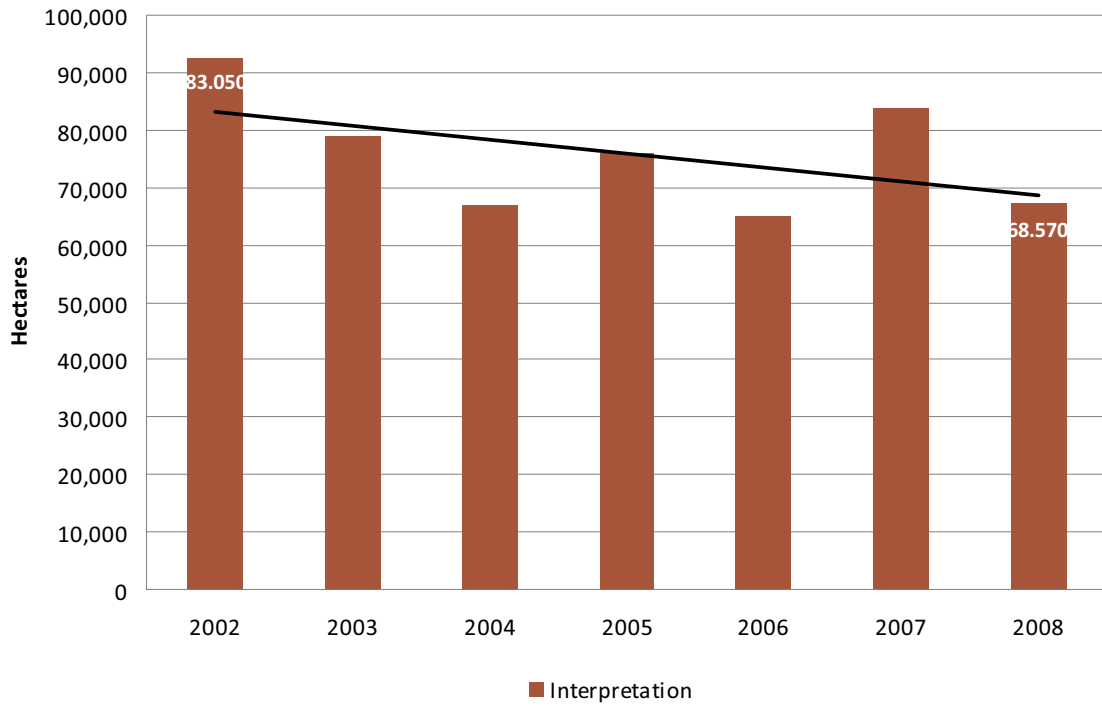


Figure 30: Interpretation of coca cultivation without spraying corrections, 2002-2008

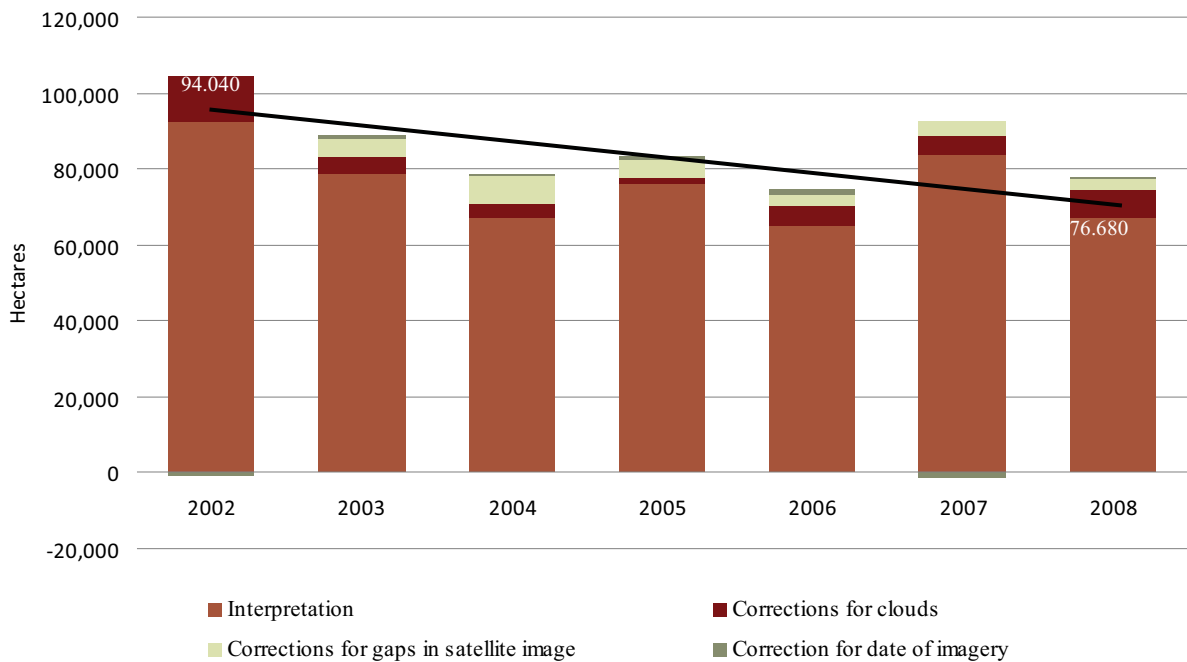
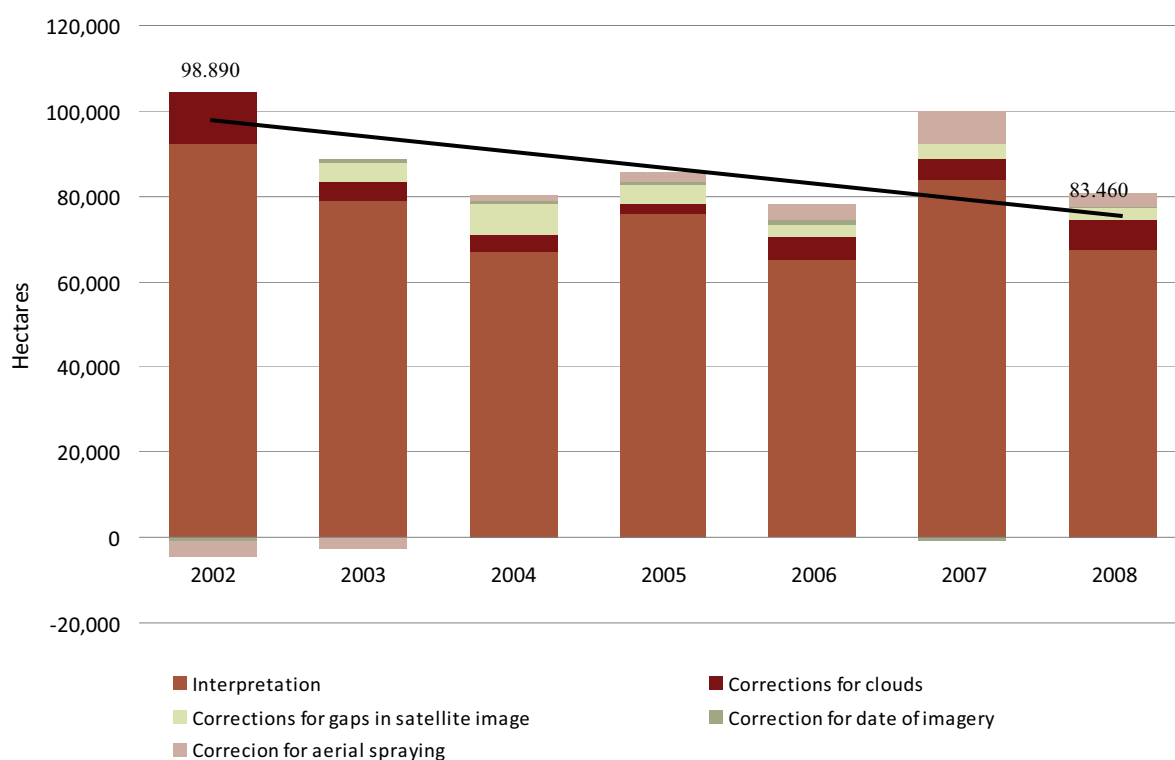


Figure 31: Interpretation of coca cultivation including all the corrections, 2002-2008

The amount of the corrections applied, shows a variation between 11% in 2005 with respect to the 86,000 hectares estimated in the census, to 17% in 2004, 2006 and 2008 with respect to the number of hectares estimated in the respective census. Therefore, there is no correlation between the amount of the corrections with the amount of the interpretation because the position and amount of the clouds and gaps (which are most of the corrections) over the coca fields are totally random and unpredictable.

Table 52. Corrections applied to obtain the final result in the census, 2004 – 2008.

Year	2004	2005	2006	2007	2008
Corrections for clouds cover	3,990	1,942	5,554	4,941	7,358
Corrections for Gaps	7,163	4,420	2,864	3,416	2,604
Corrections for Date of imagery	665	1,020	1,135	-971	391
Corrections for Spraying and	1,483	2,315	3,349	7,625	3,266
Total	13,301	9,697	12,902	15,011	13,619
Percentage	17	11	17	15	17
Number of interpreted hectares	67,049	76,053	64,968	83,888	67,334
Number of interpreted hectares	80,000	86,000	78,000	99,000	81,000

Annex 2: List of satellite images used for the Colombia coca cultivation survey 2008

LANDSAT 7 ETM+		
PATH	ROW	Acquisition date (dd/mm/yyyy)
3	58	17/08/2008
3	59	02/09/2008
4	56	08/08/2008
4	57	12/11/2008
4	58	12/11/2008
4	61	07/07/2008
4	63	08/08/2008
5	56	02/10/2008 - 05/12/2008
5	57	05/12/2008 - 21/12/2008
5	58	05/12/2008
5	59	05/12/2008 - 21/12/2008
5	60	21/12/2008
5	61	02/10/2008
5	62	02/10/2008
6	55	10/11/2008 - 23/09/2008
6	56	10/11/2008-28/12/2008
6	57	10/11/2008 - 12/12/2008
6	58	12/12/2008
6	59	25/10/2008-12/12/2008 - 28/12/2008
6	60	28/12/2008
6	61	28/12/2008
6	62	28/12/2008
7	52	04/01/2009
7	54	14/09/2008
7	55	19/12/2008
7	56	04/01/2009
7	57	21/02/2009
7	58	04/01/2009 - 21/02/2009
7	59	04/01/2009
7	60	03/12/2008
7	61	03/12/2008
8	52	05/09/2008
8	53	11/01/2009
8	54	05/09/2008 - 10/12/2008 - 11/01/2009
8	55	10/12/2008 - 27/01/2009
8	56	23/10/2008
8	57	08/11/2008
8	58	21/09/2008- 08/11/2008 - 26/12/2008
8	59	26/12/2008
8	60	26/12/2008
9	52	15/11/2008 - 17/12/2008
9	53	07/03/2009
9	54	07/03/2009-15/11/2008
9	55	12/09/2008 - 17/12/2008
9	56	12/09/2008
9	57	12/09/2008
9	58	12/09/2008
9	59	12/09/2008 - 17/12/2008
9	60	12/09/2008 - 30/10/2008 - 17/12/2008
10	54	05/10/2008
10	55	19/09/2008
10	56	09/01/2009 - 14/03/2009
10	57	05/10/2008 - 09/01/2009 - 14/03/2009 - 30/05/2009
10	58	10/02/2009 - 26/02/2009
10	59	08/12/2008 - 09/01/2009 - 10/02/2009 - 14/03/2009 - 30/03/2009
TOTAL		84

SPOT 4 y 5		
J	K	Acquisition date (dd/mm/yyyy)
638	346	21/02/2009
644	333	27/12/2008
644	348	17/02/2009
645	328	12/12/2008
645	347	17/12/2008
645	348	17/12/2008
648	344	18/01/2009
648	345	18/01/2009
651	345	18/12/2008
TOTAL		9

ALOS	
PATH-CENTER No.	Acquisition date (dd/mm/yyyy)
446-3520	20/02/2009
450-3540	27/01/2009
450-3550	27/01/2009
TOTAL	3

Annex 3: Coca cultivation in indigenous territories

INDIGENOUS TERRITORIES	HECTARES IN 2007	HECTARES IN 2008
AFILADOR CAMPO ALEGRE (YARINAL AFILADORES)	9	22
AGUA NEGRA	14	16
AGUACLARA Y BELLA LUZ DEL RIO AMPARO	5	10
AGUANEGRA	23	10
AGUAS NEGRAS	3	2
ALMIDON LA CEIBA	4	0
ALPAMANGA	1	1
ALTAMIRA	7	1
ALTO ALBI	42	87
ALTO LORENZO	12	9
ALTO ORITO	9	14
ALTO SINU, ESMERALDA CRUZ GRANDE E IWAGADO	9	43
ANDABU	1	0
ANDOQUE DE ADUCHE	6	9
ANGOSTURAS	9	6
BACATI-ARARA	117	114
BACHACO BUENAVISTA	11	4
BAJO GRANDE	2	0
BARRANCO CEIBA Y LAGUNA ARAGUATO	21	26
BARRANCO COLORADO	41	21
BARRANQUILLITA	47	43
BELLA VISTA	5	10
BELLAVISTA Y UNION PITALITO RIO SIGUIRI SUA-DOCAMPADO	2	12
BUENAVISTA	58	67
CACHIVERA DE NARE	1	0
CAICEDONIA	7	13
CALARCA	33	40
CALENTURAS	74	9
CALI-BARRANQUILLA	19	16
CALLE SANTA ROSA RIO SAIJA	113	135
CAÑAVERAL	10	19
CAÑO JABON	7	6
CAÑO NEGRO	2	1
CAÑO OVEJAS (BETANIA- COROCITO)	6	1
CARPINTERO PALOMAS	5	12
CECILIA COCHA	1	0
CHAGPIEN - TORDO	0	4
CHAGUI CHIMBUZA	11	10
CHARCO CAIMAN	10	7
CHIGUIRO	43	25
CHINGUIRITO MIRA	40	9
CHOCON	67	43
CHONARA BUENA	4	7
CIBARIZA	13	4
CONCORDIA	8	1
CONSARA-MECAYA	3	6
COROCORO	14	26
COROPOYA	18	29
CUAIQUER INTEGRADO LA MILAGROSA	17	0
CUASBIL - LA FALDADA	5	5
CUCHILLA-PALMAR	4	0
CUENCA MEDIA Y ALTA DEL RIO INIRIDA	163	191
CUMARAL-GUAMUCO	49	16
DAMASCO VIDES	9	11
DEARADE BIAKIRUDE	2	4
DOMINICO-DONDOÑO-APARTADO	9	30
DOMO PLANAS (SAN RAFAEL)	0	13
EL CEDRITO	1	0

INDIGENOUS TERRITORIES	HECTARES IN 2007	HECTARES IN 2008
EL CEDRO,LAS PEÑAS,LA BRAVA,PILVI	52	129
EL DESCANSO	0	1
EL GRAN SABALO	54	104
EL HACHA	0	8
EL PROGRESO	4	8
EL QUINCE	0	2
EL SANDE	0	3
EL TABLERO	6	4
EL TIGRE	11	37
EL UNUMA	550	237
EL VENADO	4	8
GABARRA-CATALAURA	12	16
GRAN ROSARIO	204	539
GUACAMAYAS MAMIYARE	4	1
GUACO BAJO Y GUACO ALTO	5	11
GUALCALA	3	4
GUELNAMBI-CARAÑO	2	2
HERICHA	6	1
HONDA RIO GUISA	6	7
INDAZABALETA	73	90
INFI	11	12
INGA DE ALBANIA	8	2
INGA DE BLASIAKU	4	2
INTEGRADO EL CHARCO	12	7
JACOME	1	1
JAIDEZAVE	1	8
JIRIJIRI	1	1
KOGUI-MALAYO ARHUACO	150	181
LA AGUADITA	16	6
LA ASUNCION	2	2
LA ESPERANZA	2	0
LA FLORESTA-SANTA ROSA-RIO SANQUIANGA	105	54
LA FLORIDA	0	4
LA FUGA	8	11
LA IGUANA	0	6
LA ITALIA	8	7
LA LLANURA	17	14
LA PAYA	2	3
LA TEÉFILA	0	1
LA TURBIA	107	209
LA VORAGINE-LA ILUSION	30	0
LA YUQUERA	42	27
LAGARTO COCHA	0	2
LAGOS DEL DORADO LAGOS DEL PASO Y EL ROMANSO	203	133
LAGUNA NINAL,CUCUY,LOMABAJA	4	0
LAGUNA TRANQUILA	3	5
LAS BRISAS	2	0
LLANOS DE YARI (YAGUARA II)	2	0
LOS GUADUALES	4	5
LOS IGUANITOS	18	0
MACUARE	47	24
MANDIYACO	0	5
MONOCHOA	0	3
MOTILON - BARI	0	14
NIÑERAS	8	2
NUKAK MAKU	20	40
NUNALB ALTO ULB	2	2
NUNUYA DE VILLAZUL	10	9
ORDO SIVIRU AGUACLARA	0	1
PAMPON	0	2

INDIGENOUS TERRITORIES	HECTARES IN 2007	HECTARES IN 2008
PARTE ALTA DEL RIO GUAINIA	6	17
PAUJIL	0	6
PIALAPI-PUEBLO VIEJO-SAN MIGUEL-YARE	2	0
PIGUAMBI-PALANGALA	6	5
PIPALTA PALBI YAGUAPI	2	4
PORVENIR LA BARRIALOSA	67	14
PREDIO PUTUMAYO	572	758
PUADO, MATARE, LA LERMA Y TERDO	4	4
PUEBLO NUEVO-LAGUNA COLORADA	18	5
PUERTO ALEGRE Y LA DIVISA	29	12
PUERTO LIBIA TRIPICAY	3	3
PUERTO LIBRE DEL RIO PEPE	0	2
PUERTO NARANJO-PÉÑAS ROJAS-CUERAZO-EL DIAMANTE	13	17
PUERTO NARE	73	56
PUERTO VIEJO Y PUERTO ESPERANZA	7	6
PUERTO ZABALO-LOS MONOS	53	17
PULGANDE CAMPOALEGRE	0	29
QUEBRADA QUERA	0	13
RAMOS-MONGON-MANCHURIA	1	0
REMANSO CHORRO BOCON	23	51
RIO GARRAPATAS	13	8
RIO GUANGUI	36	42
RIO NUQUI	2	0
RIO PANGÚI	4	0
RIO PAVASA Y QUEBRADA JELLA	26	12
RIO PUERRICHA	6	157
RIO SATINGA	5	2
RIO SIARE	32	8
RIO TAPARAL	0	1
RIOS ATABAPO E INIRIDA	11	0
RIOS CATRU Y DUBASA	114	412
RIOS JURUBIDA-CHORI Y ALTO BAUDO	44	93
RIOS MUCO Y GUARROJO	17	3
RIOS PATO Y JENGADO	7	0
RIOS TOMO Y WEBERI	2	3
RIOS TORREIDO Y CHIMANI	22	32
ROQUEROS	1	1
SAN AGUSTIN-LA FLORESTA	5	2
SAN ANDRES - LAS VEGAS - VILLA UNION	10	6
SAN ISIDRO ALMORZADERO LA UNIÉN	5	3
SAN JOSÉ AMIA DE PATO	2	1
SAN LUIS DEL TOMO	3	0
SAN MATIAS O JAI-DUKAMA	4	0
SAN MIGUEL	29	4
SAN PABLO EL PARA	0	1
SANQUIANGUITA	18	21
SANTA CECILI DE LA QUEBRADA ORO CHOCO	5	7
SANTA CRUZ DE PINUÑA BLANCO	2	6
SANTA ROSA DEL GUAMUEZ	10	7
SANTA ROSA SUCUMBIO EL DIVISO	6	4
SANTA TERESITA DEL TUPARRO	17	10
SARACURE Y RIO CADA	479	141
SELVA MATAVAN	124	37
SELVA VERDE	6	2
SIMORNA	13	21
SUANDE GUIGUAY	42	196
TONINA-SEJAL-SAN JOSE-OTROS	32	78
TRONQUERA PULGANDE PALICITO	7	30
TUCAN DE CAÑO GIRIZA LA PALMA	6	4
UNIDO UWA	0	2

INDIGENOUS TERRITORIES	HECTARES IN 2007	HECTARES IN 2008
UNION CHOCO – SAN CRISTOBAL	0	3
VALDIVIA	2	1
VALLES DEL SOL	2	2
VAUPES	116	339
VILLA CATALINA	32	13
VUELTA DEL ALIVIO	5	7
WASIPANGA	2	2
WASIPUNGO	2	1
YARINAL (SAN MARCELINO)	53	35
YAVILLA II	20	23
Z.E.	1	3
Z.E.D.	3	6
ZIT-SEL DEL QUECAL	1	1
Total area	5,357	6,049

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