



UNITED NATIONS
Office on Drugs and Crime



Government of Colombia

COLOMBIA

Coca Cultivation Survey



June 2004

Abbreviations

UNODC United Nations Office on Drugs and Crime.
ICMP Illicit Crop Monitoring Programme
SIMCI II Sistema Integrado de Monitoreo de Cultivos Ilícitos II
DIRAN Colombian Anti-Narcotics Police
DNE National Narcotics Office
DANE National Department of Statistics
DEA Drugs Enforcement Agency
CICAD Inter-American Drug Abuse Control Commission
IDP Internally Displaced People
COP Colombian Pesos
USD United States Dollars
PDA Alternative Development Program
RSS – Social Solidarity Net

Acknowledgements

The following organizations and individuals contributed to the implementation of the 2003 coca cultivation survey in Colombia, and to the preparation of the present report:

Government of Colombia:

Ministry of Interior and Justice
National Narcotics Office -DNE
Colombian Anti-Narcotics Police -DIRAN

UNODC:

Rodolfo Llinás, SIMCI Coordinator (Project)
Orlando Gonzalez, Digital Processing Expert (Project)
Sandra Rodriguez, Digital Processing Expert (Project)
Zully Sosa, Digital Processing Expert (Project)
Maria Isabel Velandia, Digital Processing Expert (Project)
Martha Paredes, Research and Analysis Expert (Project)
Leonardo Correa, Field Engineer (Project)
Juan Carlos Parra, Editing Engineer (Project)
Nestor Dueñas, Systems Engineer (Project)
Martha Luz Gutierrez, Administrative Assistant (Project)

Sandro Calvani, Representative for Colombia (Bogotá Office)
Simonetta Grassi, Assistant Representative (Bogotá Office)
Guillermo Garcia, National Project Officer (Bogotá Office)
Veronica Fornaguera, Project Assistant (Bogotá Office)
Maria Claudia Acosta, Research Assistant (Bogotá Office)

Thomas Pietschmann, Research Officer (UNODC-Vienna)
Denis Destrebecq, ICMP Programme Management Officer, (UNODC – Vienna)
Ayako Kagawa, Associate Statistician and Spatial Analyst (UNODC – Vienna)

The implementation of UNODC's Illicit Crop Monitoring Programme in the Andean countries and the Colombia survey in 2003 was made possible thanks to financial contributions from the Governments of the France, Italy, the United Kingdom and United States of America.

PREFACE

For the fifth time the Colombian Government and the *United Nations Office on Drugs and Crime*, produced a joint annual survey on coca cultivation in Colombia, using remote sensing technology and ensuring a high level of reliability and transparency.

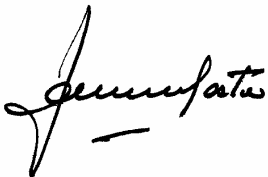
The most encouraging results of this year's survey have been the reduction of coca cultivation in Colombia from 102,000 ha in 2002 to 86,000 ha in 2003, corresponding to a 16% decline that was not matched by a smaller decrease in the other Andean countries. It is the third consecutive annual decrease since 2000, resulting in a total reduction of the area under coca cultivation by an impressive 47%.

At the regional level, the most remarkable results were recorded in the department of Putumayo, once the most important coca producing area in Colombia, with a reduction of 6,000 ha in 2003 (- 45%), after a previous reduction of 34,000 ha (-71%) in 2002. Such records are the results of investment in sustainable livelihood initiatives, in which people participation and understanding of the national policy was achieved, in association with fumigation and law enforcement campaign. The above results could have been even more satisfactory if they had not been overshadowed by the increase of coca cultivation in the departments of Nariño and Meta (by a total of 5,000 ha).

The illegal armed groups, in particular the paramilitary AUC and the FARC, are still the most important protagonists of drug related criminal activities, by promoting and controlling the illicit cultivation. They are by far the largest profit makers of the Colombian drug industry. The international community has been increasingly concerned by the nexus between the armed conflict, internal displacement and illicit crops cultivation. As a result, the internal displacement of people is the third largest in the world.

While Colombia remains the top coca producing country in the world, international and national resources allocated for sustainable livelihoods in the affected areas represent one of the lowest in the world, if measured per hectare as well as per affected family. The appeal by 24 countries in their London Declaration in July 2003 to re-orient foreign aid to Colombia towards sustainable livelihood should not remain unanswered. The strong commitment of the Government, as evidenced by its success in reducing an illicit activity must be matched by (i) international help to reduce the economic hardship of the rural poor; (ii) a decline of cocaine in consuming markets.

The observation of the events in Colombia in the past five years make it clear that the roots of the drug problem are the result of social and economic disruption, the armed conflict and weak social capital, among other causes. Thus, people participation and empowerment represent the most promising hope for long lasting changes.



Antonio Maria Costa
Executive Director

Table of Contents

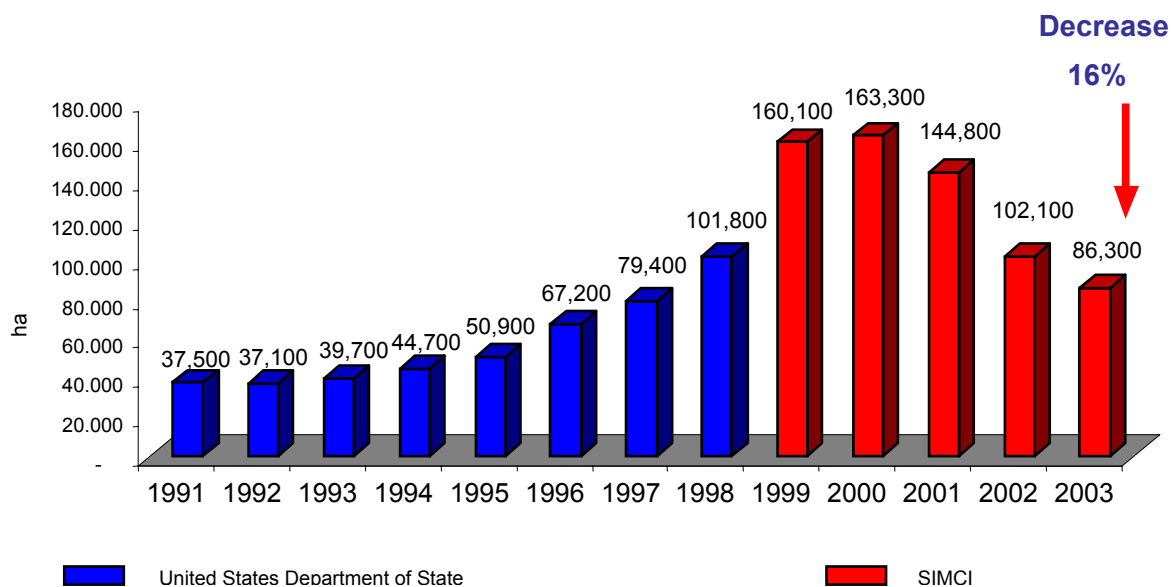
PREFACE	3
1. EXECUTIVE SUMMARY	7
2. INTRODUCTION	10
3. FINDINGS	11
3.1 COCA CULTIVATION	11
3.1.1 <i>Coca density</i>	17
3.1.2 <i>Dynamics and trends of illicit crops</i>	19
3.1.3 <i>Coca cultivation for 2003 by regions</i>	24
3.1.4 <i>Possible new coca areas</i>	31
3.1.5 <i>Coca cultivation in protected areas</i>	32
3.1.6 <i>Coca cultivation and some socio-economic indicators</i>	33
3.2 COCA YIELD AND PRODUCTION	44
3.3 COCA PRICES	45
3.4 OPIUM POPPY CULTIVATION	47
3.5 OPIUM AND HEROIN PRODUCTION	48
3.6 OPIUM AND HEROIN PRICES	48
3.7 AERIAL SPRAYING	50
3.8 DRUG SEIZURES	55
3.9 OTHER APPLICATIONS OF SIMCI DATA	60
3.9.1 <i>Forest Warden Families Programmes</i>	60
4. METHODOLOGY	63
4.1 COCA CULTIVATION	63
4.2 OPIUM POPPY CULTIVATION	73
4.3 COCA AND OPIUM YIELD	74
4.4 COCA AND OPIUM PRICES	74
5. ANNEXES	75
Annex 1: Satellite image coverage (LANDSAT, ASTER and SPOT)	75
Annex 2: Satellite image coverage of possible new coca areas	76
Annex 3: Verification flights	77
Annex 4: Results of quality control	78
Annex 5: Corrections	79
Annex 6: Coca cultivation in National Parks	80
Annex 7: Coca cultivation in Indian Territories	81
Annex 8: Colombia Coca Cultivation in 1999 – 2000 – 2001 – 2002	84
Maps	
Map: Colombia coca cultivation in 2003	14
Map: Colombia coca cultivation density in 2003	18
Map: Dynamic of coca cultivation in 2003	20
Map: Coca cultivation by municipality in 2003	21
Map: Coca cultivation change 2002 – 2003	22
Map: Poverty indicator by department in 2003	35
Map: Forced displacement by department in 2003	38
Maps: Presence of illegal armed groups in illicit crops areas	41
Map: Sprayed coca areas in 2003	54
Map: Destroyed illegal laboratories and trafficking routes in 2003	57
Map: Forest Warden Families Projects	62

1. EXECUTIVE SUMMARY

Under 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 1999 and the present report provides the findings of the coca survey for 2003.

The results of the survey showed that, at the end of December 2003, about 86,000 hectares of coca were cultivated in 23 out of the 32 Colombian departments. This represented a decrease of about 16,000 ha (or - 16%) since December 2002, when coca cultivation was estimated at about 102,000 ha. It is the third consecutive annual decreases and since 2000, coca cultivation in Colombia decreased by an impressive 47% (-11% in 2001, - 30% in 2002 and - 16% in 2003).

Coca cultivation in Colombia 1991 – 2003



Note: Estimates for 1999 and subsequent years come from SIMCI. Due to the change of methodology, figures for 1999 and after cannot be directly compared with data from previous years (based on US government surveys).

The decrease in coca cultivation recorded in Colombia for 2003 corresponded to an intensification of the aerial spraying campaign that peaked at about 133,000 ha¹ in 2003, or an increase of 2% compared to 2002 (130,000 ha).

The national trend masked however important variations at department level, as well as within departments. The most significant reductions in coca cultivation between 2002 and 2003 were found in the departments of Putumayo (-6,166 ha or 45% decrease), Guaviare (-11,218 ha or 41% decrease) and Norte de Santander (-4,471 ha or 44% decrease), while coca cultivation increased in two departments: Nariño (17,628 ha or 17% compared to 2002) and Meta (12,695 ha or 38% compared to 2002).

An interesting change in coca cultivation pattern is the decrease on the average size of the coca parcels. 93% of all coca fields were smaller than 3 ha, accounting for approximately 69% of the total cultivation, while the previously large plantations have largely disappeared over the past three years.

¹ Accumulated sprayed area provided by DIRAN

The vicious nexus between drug trafficking, illegal armed groups and armed conflict remains persistent. Large parts of the illicit crops growing areas are dominated by one or more illegal armed groups, who fight for territorial control and access to strategic trafficking corridors. The drug trade is evidently fuelling the armed conflict. Thousands of internally displaced people are forced out of their homes and regions every year, mainly due to the armed conflict.

UNODC has not yet conducted a scientific and comprehensive study on coca leaf and cocaine productivity in Colombia, but information gathered from other sources, enabled to estimate the potential cocaine production in Colombia at about 440 metric tons – 140 metric tons less than in the previous year.

Contrary to Bolivia and Peru, there is no market for coca leaf in Colombia. Most peasant sell coca base that they themselves produce on the farm. Using the average price for coca base of US\$ 793/kg in 2003, and assuming a one to one conversion rate between cocaine and coca base, the total farm gate value of the 440 metric tons of coca base produced in Colombia in 2003 would amount to about US\$ 350 millions, compared to the US\$ 491 millions of 2002.

As of November 2003, the DIRAN's estimates based on reconnaissance flights and spray operations, identified approximately 4,000 hectares of opium poppy under cultivation, compared to the approximately 4,300 hectares in 2002. The total potential heroin production in Colombia would amount to about 5 metric tons of heroin in 2003.

The price of opium latex for 2003 averaged US\$ 156/kg. With an estimated potential latex production of 121 metric tons, the potential value of the 2003 farm gate production of opium latex would amount to about US\$ 19 millions - US\$ 6 millions less than in the previous year.

The average price for one kg of heroin, as collected by the National Alternative Development Programme, was estimated in US\$ 5,660/kg.

Colombia Coca Survey for 2003

Colombia Coca Cultivation in 2003



Source: Government of Colombia - UNODC Coca cultivation Survey 2003

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

2. 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 General Assembly Special Session on Drugs in June 1998.

ICMP presently covers seven countries: Colombia, Bolivia and Peru for coca; Afghanistan, Laos and Myanmar for opium and Morocco for cannabis.

With illicit coca cultivation expanding steadily during the 1980's and 1990's, Colombia became the country with the largest illicit coca growing area and cocaine production in the world. During the 80s and 90s, illicit coca cultivation expanded steadily in Colombia, in particular in remote areas of the Amazon basin. Although, coca cultivation started to decrease in 2001, Colombia still remains the largest coca-growing country in the world.

UNODC is supporting the monitoring of illicit crops since 1999, and has produced five annual surveys and an inter-mediate estimation. In October 2003, UNODC signed a new agreement with the Colombian government to continue and expand the monitoring and analysis work, to ensure the sustainability of the project. In this context, the SIMCI II project has been requested to carry out additional tasks in the framework of an integrated approach to the analysis of the drug problem in Colombia, and to support the monitoring of particular areas, such as fragile ecosystems, natural parks, indigenous territories, the expansion of the agricultural frontier, deforestation processes, and to provide concrete support to the government's alternative development projects and its Family Warden Programme.

The new project foresees the creation of an Inter-Institutional Committee permanently assigned to the project and in charge of ensuring the transfer of know how to the national beneficiary institutions and their empowerment of SIMCI's methodology and technology. SIMCI II is a joint project between UNODC and the Colombian government, represented by Ministry of Interior and Justice and the International Cooperation Agency. The national counterpart and director of the project is the head of the Ministry of Interior and Justice.

The project is managed by a technical coordinator and composed of engineers and technicians: four digital image processing specialists, one field engineer, a cartographic technician, a research and analysis specialist, a system administrator and an administrative secretary. The team is integrated by the Inter-Institutional Committee assigned on a permanent basis to participate in the activities of SIMCI, and composed of technicians and specialists of the following government and state entities: Ministry of Interior and Justice, its National Narcotics Bureau – DNE, Ministry of Environment and their specialized units IDEAM and Natural Parks, Ministry of Agriculture, Ministry of Social Protection (Welfare), UIAF (Ministry of Finance), Anti-Narcotics Police - DIRAN and the Geographical Institute - IGAC.

The 2003 survey methodology was based on the analysis of different satellite images acquired between September 2003 and February 2004, and complemented with verification flights over coca growing areas. As for the previous two censuses, the project covered and interpreted 100% of the national territory, including areas previously not known as being coca growing regions, thus implementing an early warning system to detect and prevent the spread of coca into new areas.

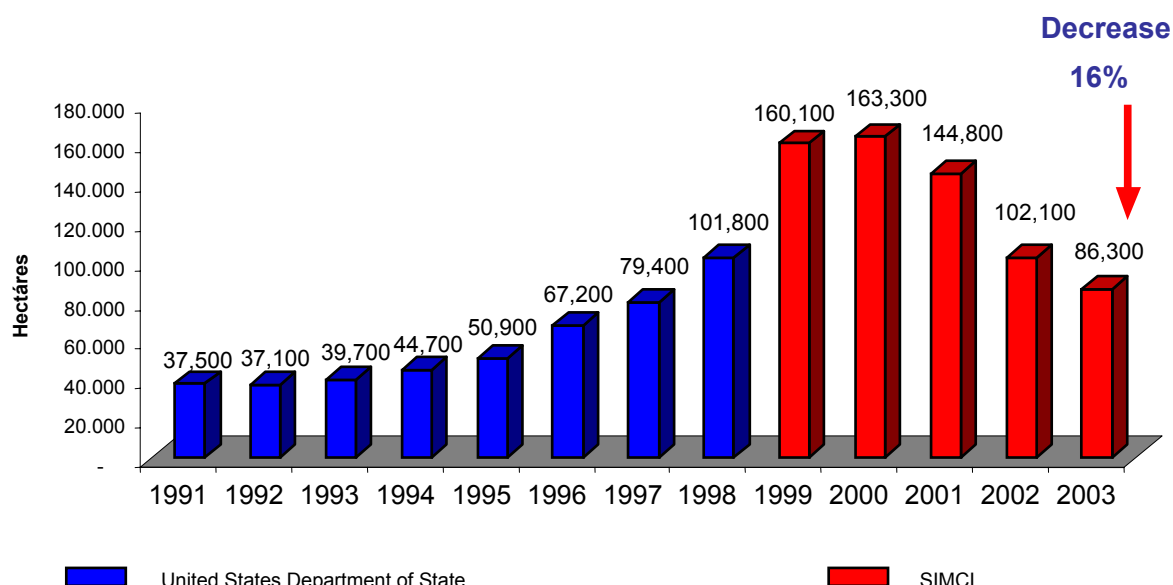
3. FINDINGS

3.1 Coca cultivation

The 2003 census detected a total of 86,340 hectares of illicit coca bush as of 31 December 2003, distributed in 23 out of the 32 departments of the country. This represented 0.075% of the national territory.

The results of the 2003 survey (as of 31 December) indicated a decrease in the area cultivated with coca bush of 15,700 ha (approximately - 16 %) compared to the previous year's estimate. This was the third consecutive decrease after coca cultivation reached a peak at 163,000 ha in 2000

Figure 1: Cultivation of coca bush in hectares, Colombia, 1991 – 2003



Note: Estimate for 1999 and subsequent years come from the national monitoring system supported by UNODC

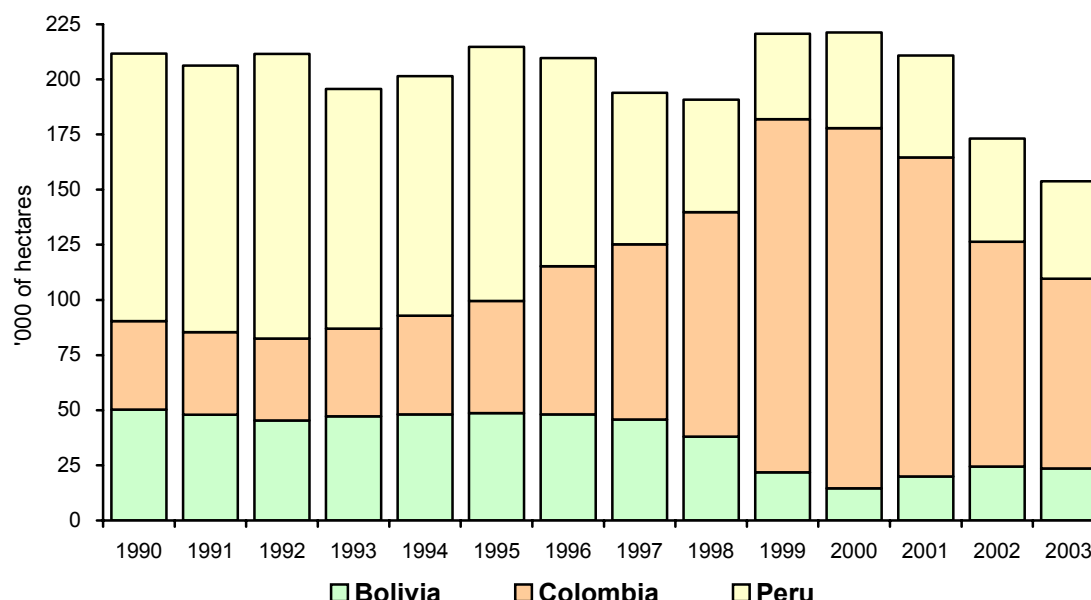
However, the 2003 survey also indicated an increase in the expansion of coca into new areas, with a presence of coca in 23 departments in 2003, compared to the 21 departments in 2002.

Table 1: Summary results of the five census

Reference date of the census	Coca Cultivation (ha, rounded)	Departments with illicit cultivation	Coverage of national territory
31 March, 1999	160,000	12	12 %
31 August, 2000	163,000	21	41 %
1 November, 2001	145,000	22	100 %
31 December, 2002	102,000	21	100 %
31 December, 2003	86,000	23	100 %

At the regional level, the 38% reduction in coca cultivation recorded between 2001 and 2002 in Colombia contributed to a reduction of 22% of the global coca cultivation level. The 16% reduction in coca cultivation recorded between 2002 and 2003 contributed to a reduction of about 11% of the global coca cultivation level, due to the fact that the decrease in coca cultivation in Colombia was not matched by a corresponding decrease in Peru and Bolivia.

Figure 2: Coca cultivation in the Andean region 1994 – 2003



Estimates for Colombia since 1999, for Peru since 2000 and for Bolivia since 2003 come from the national monitoring systems established by the respective governments with the support of UNODC. Because of methodological differences, these figures are not directly comparable with previous estimates based on US Department of State data.

Table 2: Coca cultivation in the Andean region, 1994-2003

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	% change 2002-2003
Bolivia	48,100	48,600	48,100	45,800	38,000	21,800	14,600	19,900	24,400	23,600	n.a. ²
Peru	108,600	115,300	94,400	68,800	51,000	38,700	43,400	46,200	46,700	44,200	-5%
Colombia	44,700	50,900	67,200	79,400	101,800	160,100	163,300	144,800	102,000	86,000	-16%
Total	201,400	214,800	209,700	194,000	190,800	220,600	221,300	210,900	173,200	154,100	-11%

Sources:

US department of State

National monitoring systems supported by UNODC

The decrease in coca cultivation recorded in Colombia for 2003 corresponded to an intensification of the aerial spraying campaign that peaked at about 133,000 ha³ in 2003, or an increase of 2% compared to 2002 (130,000 ha).

Between 2001 and 2002 coca cultivation decreased the most in the departments where sprayings were concentrated, mainly in Meta, Caquetá and Putumayo. Reductions were also registered in Vichada, Bolivar and Cauca. At the same time, cultivation increased significantly in south-western Nariño and in east-central Guaviare.

Between 2002 and 2003, the most significant reductions in coca cultivation were found in the departments of Guaviare (-11,218 ha or - 41%), Putumayo (-6,166 ha or - 45%) and Norte de Santander (-4,471 ha or - 44%). Since the start of SIMCI in 1999 and until 2001, Putumayo was the department with the largest area under coca cultivation. In 2000, coca cultivation reached 66,000 ha, or 40% of the national estimate in this department alone. In 2003, only 7,600 ha of coca cultivation were recorded in Putumayo (or 9% of the national estimate), which ranked this department behind the departments of Nariño, Guaviare and Meta.

² not applicable: 2002 results from US department of State and 2003 results from the Bolivian monitoring system supported by UNODC relied on different methodologies and thus are not directly comparable.

³ Accumulated sprayed area provided by DIRAN

Other departments that recorded reductions in coca cultivation between 2002 and 2003 were: Arauca (-1,675 ha or -76%), Caquetá (-1,182 ha or -14%) and Vichada (-1,092 ha or -22%).

The decrease in coca cultivation in Arauca, Guaviare, Putumayo and Norte de Santander was attributed to a large extent to the aerial spraying campaigns that have intensified considerably since 2002 in these four departments. Putumayo alone accounted for 76 % of the national eradication records in 2002. For the year 2003, sprayings were mainly concentrated in the departments of Guaviare (37,500 ha), Nariño (37,000 ha), Norte de Santander (13,800 ha) and Arauca (11,700 ha), which together accounted for more than 75% of the spraying areas in 2003.

Colombia Coca Survey for 2003

Colombia Coca Cultivation in 2003



Source: Government of Colombia - UNODC Coca cultivation Survey 2003

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

Colombia Coca Survey for 2003

Coca cultivation increased significantly in two departments: In Nariño, coca cultivation increased of about 102 % (7,700 ha) between 2001 and 2002 and again of 17 % (about 2,500 ha) between 2002 and 2003. In Meta the increase was of about 39% (or 3,600 ha) compared to 2002.

Although in 1999 Nariño, located in the South of the country along the Pacific coast, has accounted for less than 6% of the national total, in 2003, this department alone represented 20% of the national total. The increase in coca cultivation in this department took place despite intensifying spraying efforts in this department that was reported to have increased from 8,200 ha in 2001 and 18,000 ha in 2002 to 36,900 ha or 28% of the national total in 2003. The spraying activities were counterbalanced by continuous replanting of the coca fields and extension of coca cultivation in new areas of the department.

Guaviare remained an important department in terms of coca cultivation and represented 19% of the national total in 2003.

In 2003, the major coca growing departments were therefore, in decreasing order of importance, Nariño, Guaviare and Meta. Together they accounted for 54% of the total coca cultivation. The same three departments accounted for 61% of the aerial eradication efforts.

Table 3: Coca cultivation estimates 1999-2003, by department (in ha)

Department	March 1999	August 2000	November - 2001	December 2002	December 2003	% change 2002-2003
Nariño	3,959	9,343	7,494	15,131	17,628	17%
Guaviare	28,435	17,619	25,553	27,381	16,163	-41%
Meta	11,384	11,123	11,425	9,222	12,814	39%
Putumayo	58,297	66,022	47,120	13,725	7,559	-45%
Caquetá	23,718	26,603	14,516	8,412	7,230	-14%
Norte de Santander	15,039	6,280	9,145	8,041	4,471	-44%
Bolívar	5,897	5,960	4,824	2,735	4,470	63%
Antioquia	3,644	2,547	3,171	3,030	4,273	41%
Vichada	-	4,935	9,166	4,910	3,818	-22%
Cauca	6,291	4,576	3,139	2,120	1,443	-32%
Vaupés	1,014	1,493	1,918	1,485	1,157	-22%
Córdoba	1,920	117	652	385	838	118%
Guainía	-	853	1,318	749	726	-3%
Santander	-	2,826	415	463	632	37%
Amazonas	-	-	532	784	625	-20%
Boyacá	-	322	245	118	594	403%
Arauca	-	978	2,749	2,214	539	-76%
Magdalena	521	200	480	644	484	-25%
Chocó	-	250	354	-	453	-
Guajira	-	321	385	354	275	-22%
Cundinamarca	-	66	22	57	57	0
Caldas	-	-	-	-	54	-
Valle del Cauca	-	76	184	111	37	-67%
TOTAL	160,119	163,289	144,807	102,071	86,340	-15 %
Rounded Total	160,000	163,000	145,000	102,000	86,000	-16 %
Accuracy	80%	90%	90%	92%	89%	

Figure 3: Coca cultivation trends for the main coca growing departments, 1999-2003

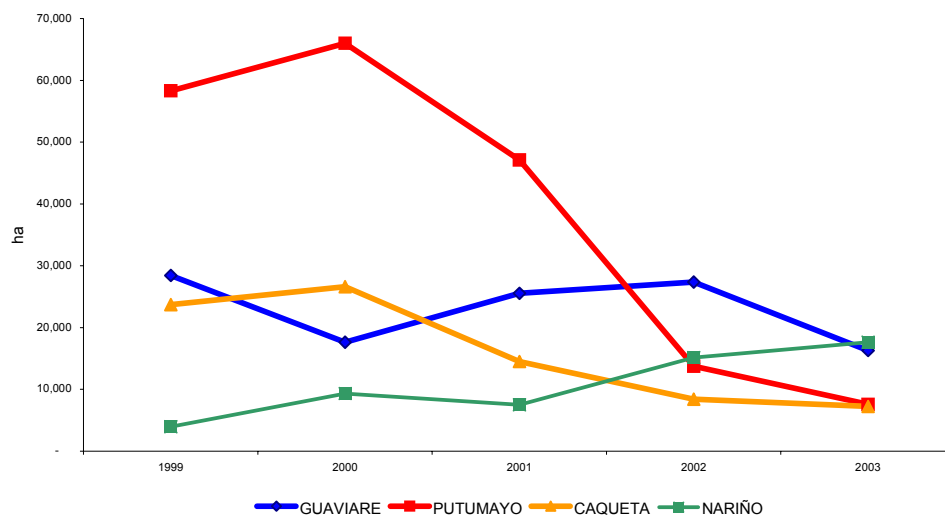
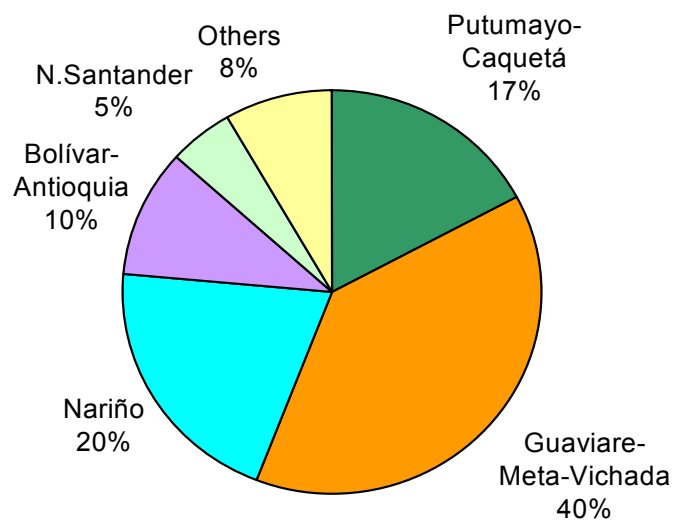


Figure 4: Coca cultivation by regions in 2003



3.1.1 Coca density

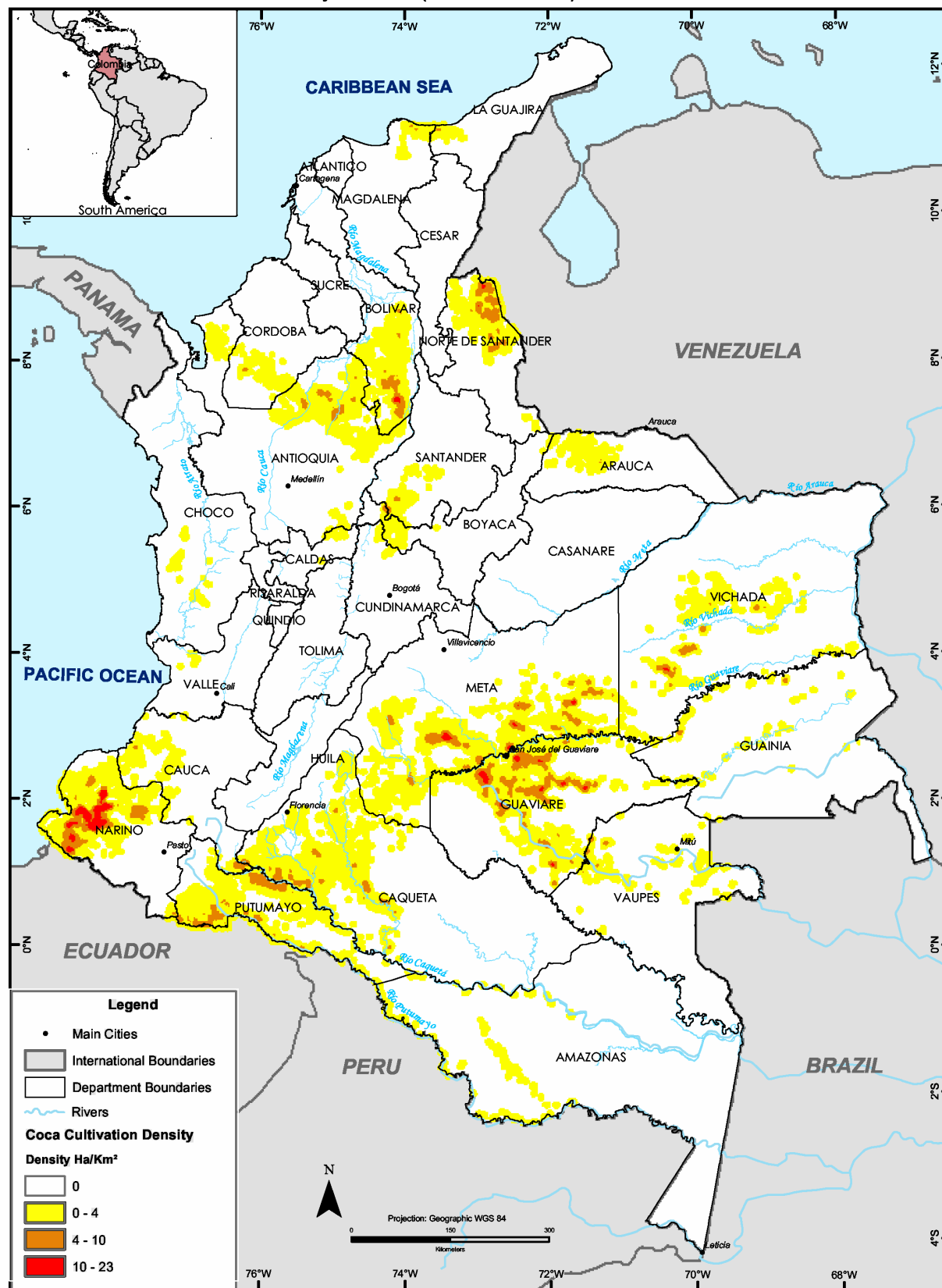
To measure the density of coca cultivation, the project established buffers of approximately 300 meters from the middle around sets of conglomerated coca plots, referred to as “areas of influence” which are considered areas in the immediate surroundings of a coca plot and therefore of high risk to become new coca fields. In 2003, the “areas of influence” covered 1,185,000 ha. The mean density of coca bush in these areas was 7.26 ha/km².

Table 4: Coca density per region

Region	Total area of influence (km ²)	2003 Coca Cultivation (ha)	Density (coca ha/km ²)
Amazonas-Putumayo-Caquetá	2,608	15,414	5,91
Guaviare - Guainia-Meta-Vaupes -Vichada	3,982	34,678	8,71
Bolívar-Antioquia-Córdoba - Chocó	1,688	10,034	5,94
Cauca-Nariño	2,044	19,108	9,35
Norte de Santander	1,030	4,471	4,34
Arauca	82	539	6,57
Magdalena-Guajira	211	759	3,61
Boyacá – Caldas - Santander	208	1,337	6,42
Total	11,853	86,340	7,28
Country total	1,141,748		

Colombia Coca Survey for 2003

Colombia Coca Cultivation density in 2003 (ha of coca/Km²)



Source: Government of Colombia - UNODC Coca cultivation Survey 2003

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

3.1.2 Dynamics and trends of illicit crops

The analysis of the location of the coca fields over the past four years revealed that only about 2,100 ha remained permanently cultivated with coca, while 5,271 ha (6.7%) were cultivated in 2001, abandoned in 2002 and re-cultivated in 2003. The remaining 9,482 (12.1%) represents the area cultivated with coca in 2002 and 2003.

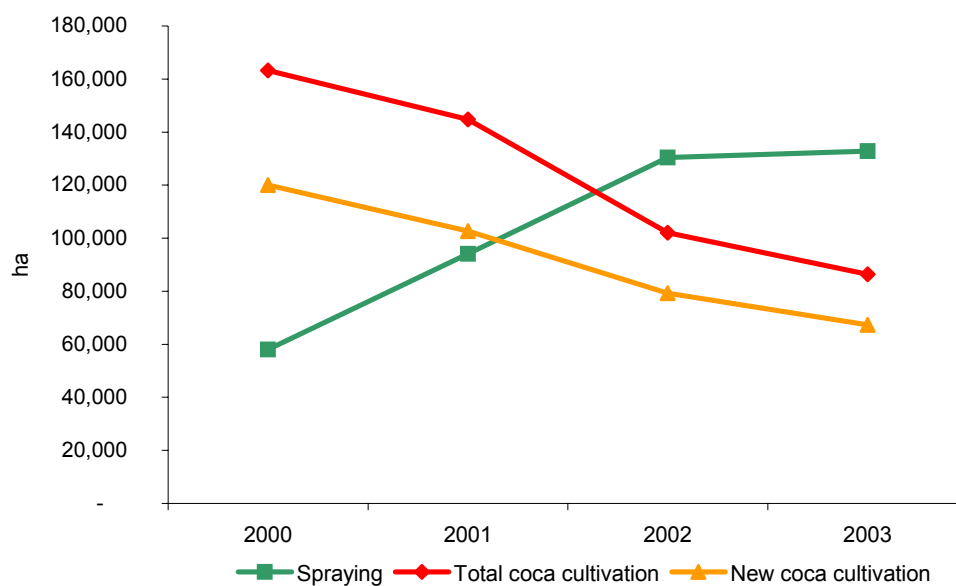
Table 5: Dynamics of Coca Cultivation since 2001

Years of comparison	Stable area (Ha)	Percentage of stable cultivation over total cultivation
Stable from 2001 to 2003	2,085	2.6%
Cultivated in 2001, abandoned in 2002 and re-cultivated in 2003	5,271	6.7%
Stable between 2002 and 2003	9,482	12.1%

Forced eradication was beyond doubt the key reason for the decline in coca cultivation in 2002 and 2003. Nonetheless, other factors such as the practice of abandonment of fields and voluntary eradication seemed to have played a role as well. The armed conflict, which is being fuelled by narcotics production, deteriorated the security situation in the country.

Another interesting finding is the decline in the establishment of new coca fields since 2000 when intensified spraying activities started. Although new coca fields are still making more than 70% of the total coca cultivation in 2003, it is encouraging to note that they follow a parallel decline with the total annual coca cultivation. It is also worth noting that in 2003 the economy of the agricultural sector recovered, and prices of some key farm products increased which seemed to have contributed to the reduced incentives for farmers to switch to coca cultivation.

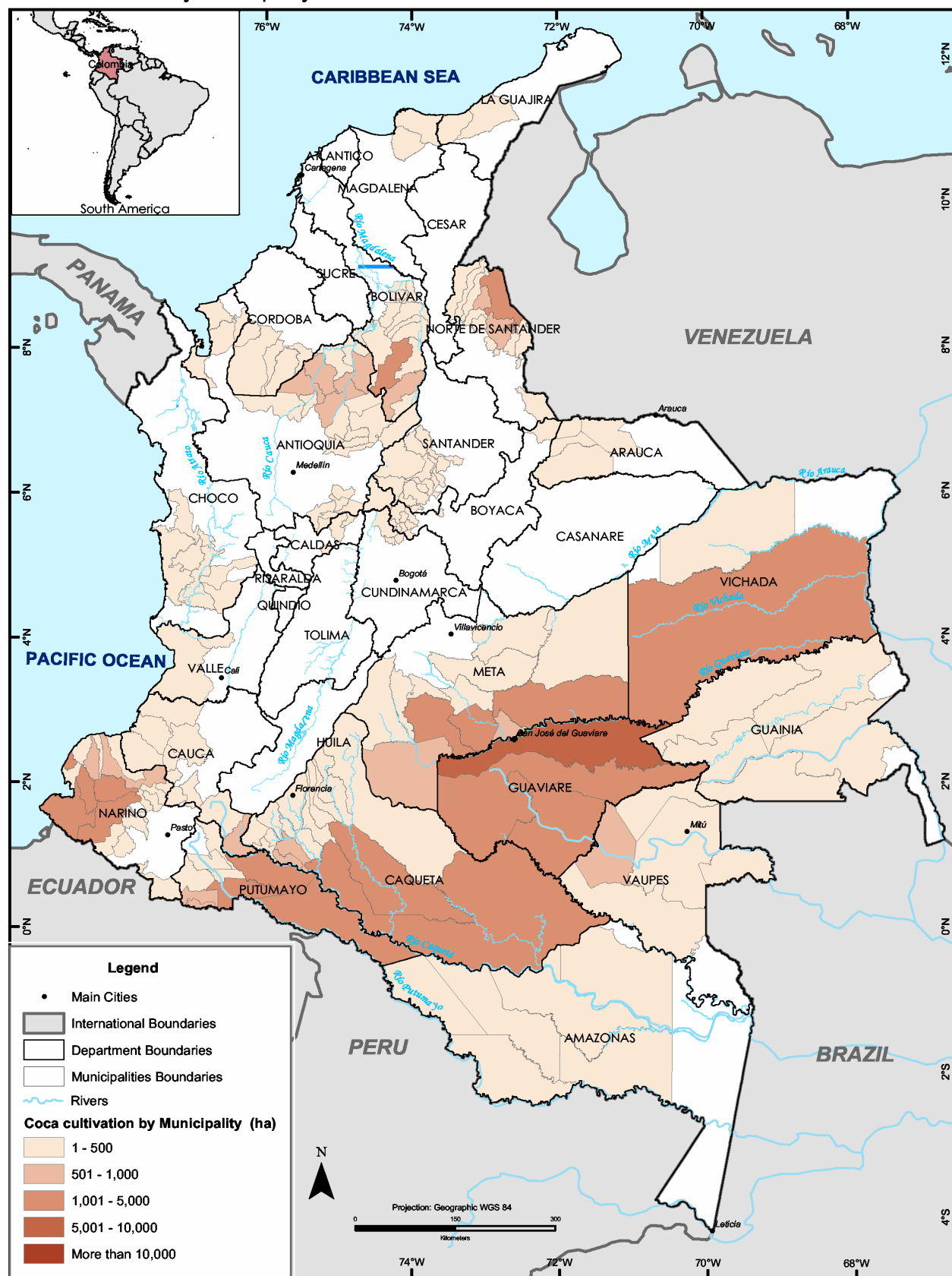
Figure 5: Trends in spraying, total coca cultivation and new coca cultivation since 2000



Source: Government of Colombia - UNODC Coca cultivation Survey 2003
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

Colombia Coca Survey for 2003

Coca Cultivation by Municipality in 2003

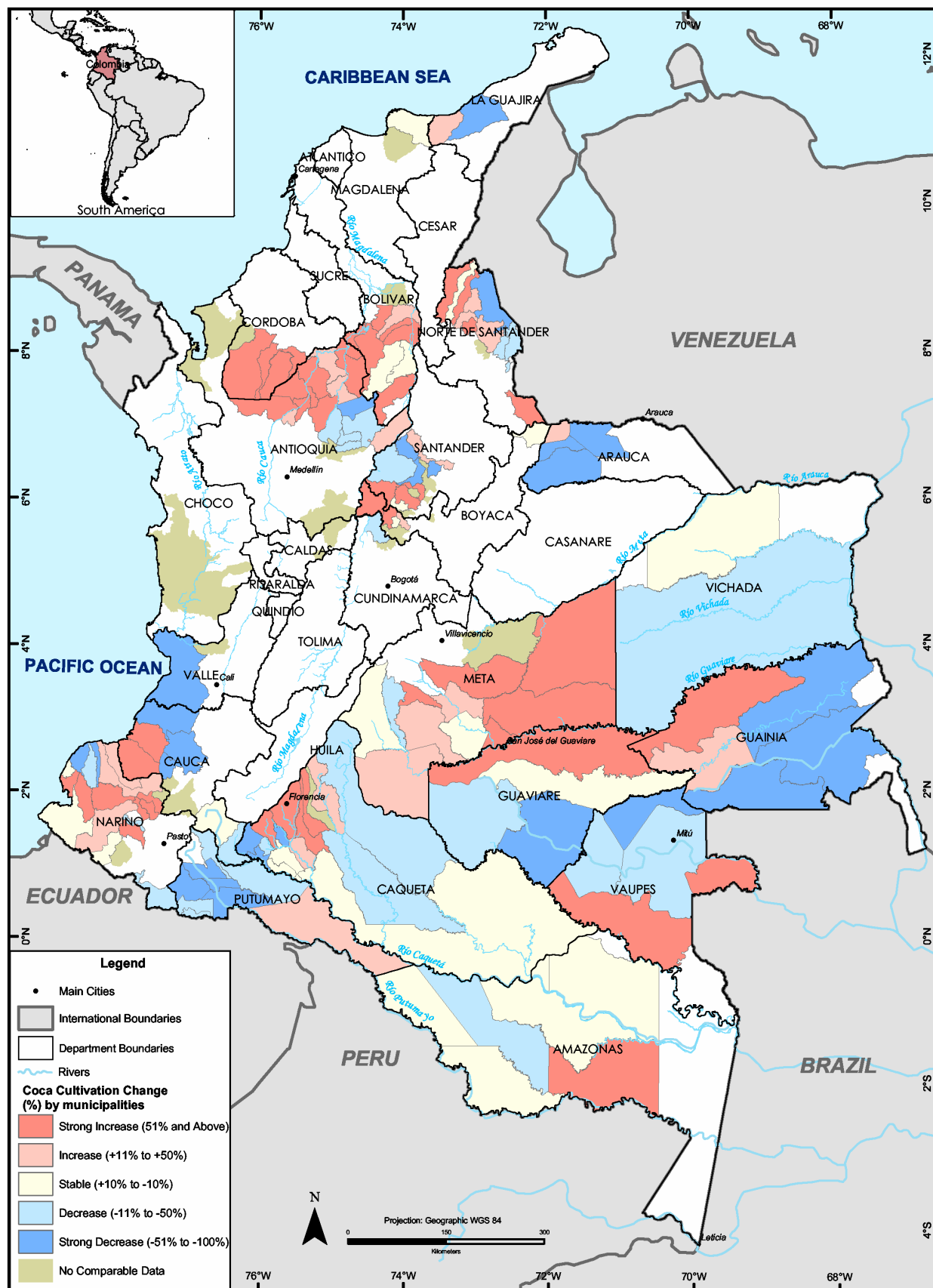


Source: Government of Colombia - UNODC Coca cultivation Survey 2003

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

Colombia Coca Survey for 2003

Coca Cultivation Change 2002 - 2003 (%)



Source: Government of Colombia - UNODC Coca cultivation Survey 2003

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

The following analysis has been carried out on the results of the 2001, 2002 and 2003 census. For methodological reasons, the comparison between two censuses could only be made on coca areas actually interpreted on the satellite images of the two census periods, while the information on coca obtained through statistical corrections for cloud cover, gaps in the Landsat7 images, spraying or due to the different dates of the images (see methodology) could not be used for the multi-temporal analysis. Therefore, the summation of the areas in Table 4 does not coincide with the final figure of the census.

The analysis of the decrease in coca cultivation between 2002 and 2003 revealed that 71% of this decrease concerned fields larger than 3 ha. Large fields (more than 3 ha) were the target of the eradication campaign up to 2001, aimed primarily at the more industrious type of coca cultivation, while smaller coca fields were left intact. This distinction between large and small coca fields during the eradication campaign has been abolished since 2002.

Table 6: Dynamics of coca cultivation

	2001	2002	Change 2001- 2002	% change 2001- 2002	2003	Change 2002- 2003	% change 2002- 2003
Total cultivated area (ha)	144, 807	102,071	-42,736	-30%	86,340	-15,731	-16%
Stable area (ha)	33,419	15,240	-18,179	-54%	11,567	-3,673	-24%
Abandoned area (ha)	117,681	121,099	-3,418	3%	79,152	-41,947	-35%
New coca plantings (ha)	102,650	79,239	-23,411	-23%	67,325	-11,914	-15%
Area for fields larger than 3 ha (ha)	67,724	35,687	-32,037	-47%	24,487	-11,200	-31%
Area for fields smaller than 3 ha (ha)	68,615	58,785	-9,830	-14%	53,806	-4,979	-8%
Number of fields larger than 3 ha	10,413	6,292	-4,125	-4%	4,464	-1,828	-29%
Number of fields smaller than 3 ha	63,233	56,664	-6,569	-10%	58,746	2,082	4%

Another significant change in coca cultivation practice is the decrease of the average size of coca fields since 2001. In 2001, 86% of the coca fields were smaller than three hectares. In 2003, this figure has grown up to 93% of the coca fields. While in 2001, the total area for the fields under three hectares was 69,000 ha or 50% of the national estimate, in 2003, these small fields amounted to 78,300 ha or 69% of the national estimate. Between 2002 and 2003, this trend seemed to have increased, as there are more fields of less than three hectares (+4%), while the established large plantations tended to disappear.

If we considered that one family cultivate only one coca field, these data would also indicate that, although the total coca cultivation area decreases, there are more families involved in coca cultivation in 2003 than in 2002.

3.1.3 Coca cultivation for 2003 by regions

About 86% of the coca cultivation in Colombia is located in the south and east part of the country, in ecosystems that are classified as tropical rain forests. In 2003, the main concentrations of coca were found in the departments of Nariño, Guaviare and Meta, accounting for 54% of the total coca cultivation, followed by Putumayo, Caquetá, Norte de Santander, Bolivar, Antioquia, accounting for approximately 32% of the total coca cultivation in Colombia.

The situation of illicit crops and its dynamics differ significantly at the regional level. The following regional analysis gives relevant background information on the interpretation process and on external factors that have influenced the changes in coca cultivation in the seven most representative geographical areas, as well as the corrections that were applied to the original interpreted findings.

► Putumayo – Caquetá – Amazonas (15,400 ha)

The department of Putumayo was for a long time the major coca producer in the country. In general, the department is characterized for the limited Government presence and of basic infrastructure. It has also been the scenes of violent confrontations between FARC guerrillas and paramilitary groups, campesino movements, important displacement and migration trends and a high level of violence and crimes. In addition, Putumayo was also the region where Plan Colombia started and where most spraying efforts were concentrated over the past years. Between 2001 and 2003, an accumulated total of 112,700 ha were sprayed over this department.

However, Putumayo has also become the recipient of important investments in alternative development and basic infrastructure by the international community. The reduction of coca cultivation in this department in the past few years contributed to a large extent to the reduction of coca cultivation at the country level.

The situation is somewhat comparable in Caquetá department. Coca cultivation first appeared in the seventies and for long time it played an important role in the economic activity of the department. The region is characterized by the low productivity of the soil, due to its high level of acidity and its poor composition, which makes established agriculture difficult⁴.

Amazonas recorded for the first time coca plantations in 2002 (784 ha), and 625 ha in 2003.

Table 7: Coca cultivation in Putumayo, Caquetá and Amazonas (in ha)

	1999	2000	2001	2002	2003
Coca cultivation	82,015	92,625	62,168	22,921	15,414
Annual trend		13%	-33%	-63%	-33%

The decrease in coca cultivation in Putumayo and Caquetá corresponded both to the aerial spraying activity and voluntary eradication, but unlike in other parts of the country, the decrease has not been counterbalanced by the establishment of new coca fields or reseeded over sprayed areas. In Putumayo and Caquetá, the total accumulated area sprayed in 2003 amounted to 9,400 ha, and the reduction in coca cultivation was 7,500 ha.

Spraying activities took place between May and July 2003 in Putumayo, while the satellites images were acquired between September and December 2003. Caquetá was only sprayed in January 2003. Thus the productive coca fields were visible on the satellite images and there was no need to apply a correction factor to account for spraying activities. The latest verification flights in Putumayo of March 2004 indicated a high degree of abandoned coca fields on previously sprayed areas, mostly in the upper and middle Putumayo. The coca fields located in lower Putumayo and Amazonas were not sprayed due to their small density, small size and long distance from the spraying bases.

⁴ Caquetá, Building an Amazonian Territory in XX Century. SINCHI Institute.

Table 8: Correction for 2003 in Putumayo, Caquetá, Amazonas (in ha)

Department	Cloud cover	Eradication (spraying)	Gaps	Image Antiquity	Total	Interpreted	Adjusted
CAQUETA	73	-4	349	141	559	6,671	7,230
PUTUMAYO	484	0	202	-517	169	7,390	7,559
AMAZONAS	36	0	39	0	75	550	625

► **Guaviare – Meta – Vaupés-Vichada-Guanía (34,700 ha)**

The region is placed in a fragile ecosystem, characterized by its humid rain forest. The region is a strategically important area not only for coca cultivation, but also as crossing point for both drug trafficking and arms smuggling, as well as for storage of coca base production before export outside the country, due to its vicinity to Venezuela and Brazil. It is important to note that in the 90's, Guaviare was the largest coca growing area of Colombia, until most of the coca migrated to Putumayo at the end of the decade and then to Nariño department.

However, despite the 20% decrease in the level of coca cultivation between 2002 and 2003, this area remains one of the most important coca growing regions in Colombia. The illicit drug economy did not benefit to the economical development of the region, but on the contrary they were factors encouraging population displacement, presence of illegal armed groups and increased levels of violence. A high degree of mobility of coca cultivation was noted within the region of Guaviare as is evidence on map 4.

Table 9: Coca cultivation in Guaviare – Meta – Vaupes –Vichada - Guania (in ha)

	1999	2000	2001	2002	2003
Coca cultivation	40,833	36,023	49,380	43,747	34,678
Annual trend		- 12%	37%	11%	-20%

The Meta department has been relatively stable in its coca cultivation throughout the past five years, with approximately 11,000 – 12,000 ha of coca in every census, making about 14,5% of the total cultivation. The region is characterized by the presence of natural parks and forests, at risk of being damaged by coca cultivation.

Table 10: Correction for 2003 over Guaviare- Meta- Vaupes – Vichada - Guania (in ha)

Department	Cloud Cover	Eradication (spraying)	Gaps	Image Antiquity	Total	Interpreted	Adjusted
GUAVIARE	188	-827	1392	718	1,471	14,692	16,163
META	193	-806	1144	1187	1,718	11,096	12,814
VAUPES	190	-19	69	-34	206	951	1,157
VICHADA	66	-5	167	-91	137	3,681	3,818
GUANIA	5		77	19	101	625	726

Most satellite images were acquired between October 2003 and February 2004. Sprayings were mainly concentrated in the Guaviare and Meta departments, and spraying activities were spread throughout the year. Vichada, Vaupés and Guanía were not sprayed and the reduction recorded in these areas may be attributed to voluntary abandonment. Since most of the spraying activities took place during the first semester in this region, and the images were not affected by any significant cloud coverage, little corrections were made for spraying and cloud cover. The corrections applied to the original interpreted coca fields, corresponded to the Landsat7 gap and the antiquity of the images that were acquired between September and February 2004.

► **Bolívar – Antioquia – Córdoba – Chocó (10,000 ha)**

These departments are important regions due to its closeness to the Pacific and Atlantic oceans, and therefore strategic crossroads between the coca production areas and the coca trafficking routes.

In addition to the increase in coca cultivation especially in Antioquia, it should be noted that this department is also the second in importance in terms of quantity of laboratories and airstrips detected and destroyed in 2003⁵

The Chocó department counts among the poorest in the country. Their adverse biophysical and geographical conditions might explain the low presence of illicit crops in the region.

Table 11: Coca Cultivation in Bolivar – Antioquia- Cordoba - Choco (in ha)

	1999	2000	2001	2002	2003
Coca cultivation	11,461	8,774	9,001	6,150	10,034
Annual trend		-23%	1%	-32%	63%

Aerial sprayings was carried out mainly in between May and August in both Antioquia and Bolivar for a total of approximately 15,000 ha. Nevertheless, coca cultivation increased of 41 % and 63% respectively. The total area of cultivation in the region amounted to 10,000 ha in 2003, and further increase might be expected. The increase in coca cultivation despite intense spraying would indicate a high percentage of reseeding and the establishment of coca fields in new areas towards the higher regions and the jungle areas in Chocó department.

Table 12: Correction for 2003 over Bolívar – Antioquia – Córdoba - Choco (in ha)

Department	Cloud Cover	Eradication (spraying)	Gaps	Image Antiquity	Total	Interpreted	Adjusted
ANTIOQUIA	55	-2	60	-55	58	4,215	4,273
CORDOBA	2		44	2	48	790	838
BOLIVAR	121	-1	542	-73	589	3,881	4,470
CHOCO	318	0	0	0	318	135	453

As most of images were taken in January – February 2004 and the cloud coverage was not significant, the main correction applied to the initially interpreted coca fields in this area was due to the gaps in the Landsat7 imagery.

► Nariño – Cauca (19,100 ha)

The mountainous department of Nariño has been for a long time an opium poppy growing area. The fast increase in coca cultivation in this department may be due to a number of reasons described below, but certainly, its geographic location has been an important factor contributing to the establishment and increase of the illegal drug business. Its access to the Pacific coast has facilitated all sorts of trafficking, including of drugs. The vicinity of the long Ecuadorian border offers a variety of routes for all sorts of smuggling and trafficking, such as arms, precursors and drugs. Violence and insecurity brought about by the presence of armed groups, have also been reported on the increase in this department.

Table 13: Coca cultivation for Nariño – Cauca (in ha)

	1999	2000	2001	2002	2003
Coca cultivation	10,250	13,995	10,817	17,362	19,108
Annual trend		37%	-23%	61%	10%

Coca cultivation increased by 11% between 2002 and 2003, and with an increase of about 88.6% from 2000 to 2003. Although spraying activities nearly doubled between 2002 and 2003⁶ (amounting to 38,200 ha or 29% of the 2003 total), the census results and subsequent field verification showed that by December 2003, most sprayed areas had already been replanted and many new fields established.

⁵ DNE Consolidado de Fuerzas Militares y Policía Nacional

⁶ 83% of the spraying activities in 2003 took place between January and May 2003.

The increase in coca cultivation recorded in Nariño in 2002 and 2003, might have been a consequence of the significant reduction in coca cultivation in neighbouring Putumayo, following the intense spraying campaign carried out in this department in 2002. The decrease in coca cultivation in Putumayo would have driven landless labourers to move to Nariño in 2002.

In contrast, coca cultivation continued to decrease in Cauca department from 6,300 ha in 1999 to 1,440 ha in 2003.

Table 14: Correction for 2003 in Nariño – Cauca (in ha)

Department	Cloud Cover	Eradication (spraying)	Gaps	Image Antiquity	Total	Interpreted	Adjusted
CAUCA	113	0	225	-80	258	1,185	1,443
NARIÑO	2,672	-578	28	-110	2,012	15,616	17,628
VALLE DEL CAUCA	24	0	0	0	24	13	37

As in previous years, cloud cover remained a problem for the survey in this area, as reflected in the correction for cloud cover (15%). However, compared to previous census, most of the satellite images in 2003 were acquired close to the reporting date of December 2003 (November 2003 – February 2004), which reduced the correction that had to be applied for image antiquity.

► Norte de Santander (4,500 ha)

Norte de Santander is a department with a complex situation that contributed to the development of the drug industry: presence of the three illegal armed groups (AUC, ELN, and FARC), its vicinity to Venezuela opening trafficking corridors for arms, precursors and drugs and the difficult socio-economic situation that facilitated the enrollment of the population in the illegal drug business.

Table 15: Coca cultivation for Norte de Santander (in ha)

	1999	2000	2001	2002	2003
Coca cultivation	15,039	6,280	9,145	8,041	4,471
Annual trend		-58%	46%	-12%	-44%

For the second year in a row, coca cultivation decrease significantly in this area. Between December 2002 and December 2003, coca cultivation decreased by 3,570 ha, representing a 44% decrease, while the reported spraying amounted to 13,821 ha during 2003, compared to 9,186 ha in 2002 (i.e. an increase of 50%). The decrease is in large part related to the intensive sprayings that between 2001 and 2003 reached a total of 33,317 ha. In 2003, the department was sprayed in January – March and September – October. During the over flights conducted in the area as part of the field verification, little replanting on sprayed coca fields was observed.

Table 16: Correction for 2003 in Norte de Santander (in ha)

Department	Cloud cover	Eradication (spraying)	Gaps	Image Antiquity	Total	Interpreted	Adjusted
NORTE DE SANTANDER	18	-402	34	1	-349	4,820	4,471

► Arauca: (500 ha).

Arauca shares its large boundaries with Venezuela and is known for its natural resources, in particular petrol, which is the most important source of income for the local population. It is, however, the department with the highest homicide, massacres and terrorist attacks, compared with the number of population. More than a established coca growing region, Arauca hosts the largest number of laboratories detected by the authorities in 2003 (350 out of 1,489 labs detected at national level),⁷.

⁷ DNE. Consolidated figures for 2003 from the Military Forces, the National Police and DAS.

Table 17: Coca cultivation for Arauca (in ha)

	1999	2000	2001	2002	2003
Coca cultivation		978	2,749	2,214	539
Annual trend			181%	-8%	-76%

A strong decrease in coca cultivation was nevertheless noted in Arauca, and in 2003, only about 500 ha were left.

This reduction followed an intense eradication campaign that was reported at almost 12,000 ha in the second semester of 2003.

It should be noted that in this area, coca cultivation is interspersed with licit crops, which makes its detection with satellite images difficult. However, following verification flights, the interpreters were able to recognize the mixed cultivation pattern and account for most of the coca fields.

Table 18: Correction for 2003 in Arauca (in ha)

Department	Cloud cover	Eradication (spraying)	Gaps	Image Antiquity	Total	Interpreted	Adjusted
ARAUCA	0	0	0	1	1	538	539

The satellite images were taken in January – February 2004 after the end of the spraying campaign in September – November 2003, and therefore it was not necessary to apply any correction for this.

► Magdalena – Guajira (800 ha).

The Magdalena department is facing since the Marihuana boom in the seventies and increasingly in the past six years an intensification of the armed confrontations between guerrillas, paramilitary groups and drug traffickers. The direct involvement of illegal armed groups in the production and trafficking of cocaine through the Atlantic coast has been reported in this region, notably in the strategic Sierra Nevada region⁸.

The Guajira department has always been a region for all sorts of illegal activities, such as contraband, trafficking of drugs, arms, illegal trade of gasoline.

Nevertheless, between 2002 and 2003, coca cultivation decreased by 24% in this area.

Table 19: Coca cultivation for Magdalena – Guajira (in ha)

	1999	2000	2001	2002	2003
Coca cultivation	521	521	865	998	759
Annual trend		0	66%	15%	-24%

Table 20: Correction for 2003 in Magdalena – Guajira (in ha)

Department	Cloud Cover	Eradication (spraying)	Gaps	Image Antiquity	Total	Interpreted	Adjusted
MAGDALENA	1	0	0	-55	-54	538	484
GUAJIRA	2	0	13	-15	0	275	275

The images were taken in September and December 2003. As most of the area is a national reserve, no spraying took place.

⁸ "Human Rights in Magdalena Department". Presidential Programme for Human Rights and International Humanitarian Rights, Vice-Presidency: www.derechoshumanos.gov.co

► Boyacá – Caldas – Santander - Cundinamarca (1300 ha)

Coca cultivation remained low in these departments but places of processing of drugs were reported. In these departments, the licit economy is often able to compete successfully with the illegal one, and in general, the levels of living conditions and socio-economic indicators are higher when compared to the rest of the country. Caldas is part of the coffee growing area and is characterized by these predominant licit products. Boyacá is an agricultural department, and is a major emerald producer. Cundinamarca has a remarkable production of export flowers. The main economic activity in Santander is agriculture, but it also the main poultry breeding centre of the country. This is one of the main reasons for the low level of illicit cultivation in the region. However, clandestine drug laboratories have been reported in the region, notably in Boyacá and Santander.

Table 21: Coca cultivation for Boyacá – Caldas – Santander - Cundinamarca (in ha)

	1999	2000	2001	2002	2003
Coca cultivation		3,214	682	638	1,337
Annual trend			-79 %	-12 %	209 %

Between 2002 and 2003, coca cultivation increased but remained a marginal crop compared to the other licit crops in this important agricultural area. In this area, coca cultivation is easily interspersed with licit crops, which makes its detection difficult.

Only 5 ha of coca fields were reported sprayed in Santander in 2003. Spraying campaigns are difficult to implement due to the presence of licit crop interspersed with coca or surrounding coca fields.

Table 22: Correction for 2003 in Boyacá – Caldas – Santander - Cundinamarca(in ha)

Department	Cloud cover	Eradication (spraying)	Gaps	Image Antiquity	Total	Interpreted	Adjusted
BOYACA	15	0	6	27	48	546	594
CALDAS	1	0	0	2	3	51	54
SANTANDER	16	0	6	29	51	581	632
CUNDINAMARCA	1	0	1	3	5	52	57

Only few corrections were applied to the initial interpretation in this area. The images acquired at the end of November 2003 offered low cloud coverage.

Figure 6: Dynamics of Coca Cultivation in Selected Departments

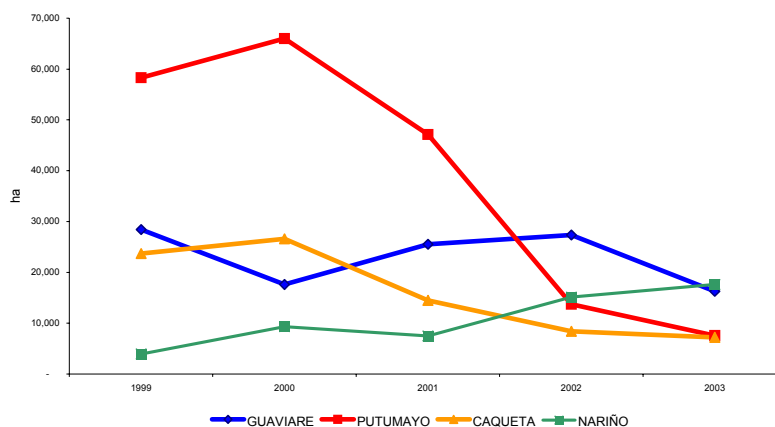
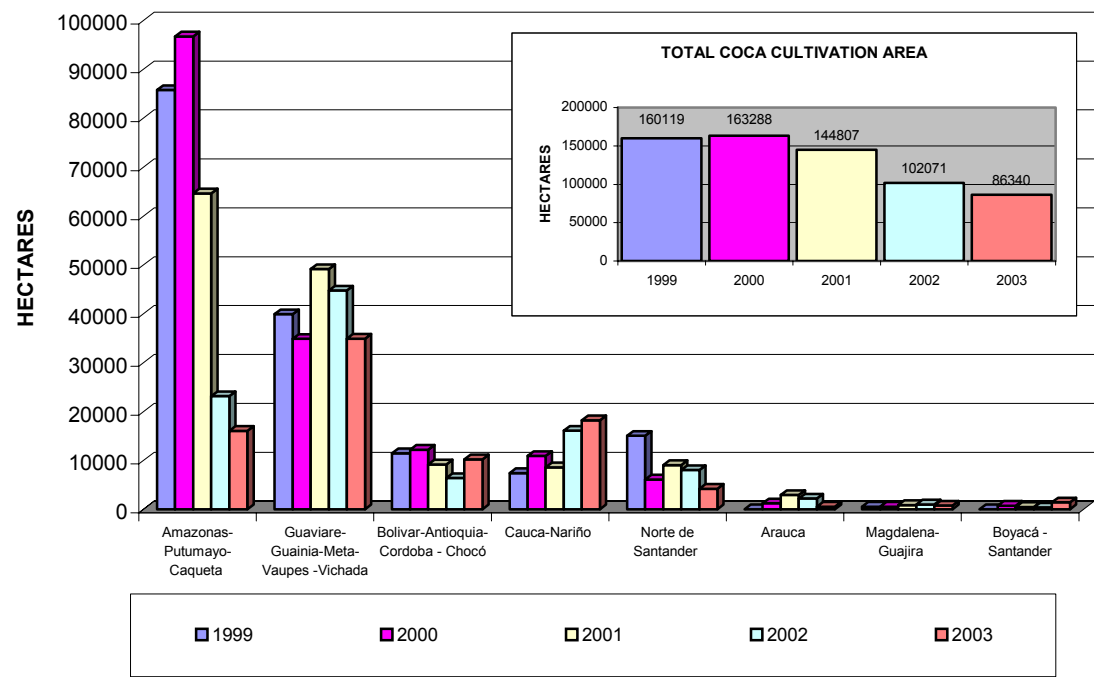


Figure 7: History of coca cultivation for selected department



3.1.4 Possible new coca areas

As for the previous three censuses, the project covered and interpreted 100% of the national territory, including areas previously not known as being coca growing regions, thus implementing an early warning system to detect and prevent the spread of coca into new areas.

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, as well as in established agricultural areas on the Atlantic coast, the coffee growing zone and other Andean areas.

Field verification has not been carried out in these areas because it was considered too time consuming and too costly to verify small and isolated patches of coca cultivation. Because of the absence of field verification, the estimate for coca cultivation in these areas are presented as indicative and not included in the final estimate.

This information on potential coca cultivation in the possible new coca areas should be seen as an early warning of the dynamics at play. However, in some cases, the areas that were previously classified as non established areas and that show a significant level of coca cultivation, have been progressively incorporated in the census and their respective satellite images have been fully processed. Therefore, for each census the area fully processed is larger than for the previous census. For 2003, three areas found with the larger amount of coca within possible new coca areas (North of Antioquia, Choco and Valle) become part of the regular processing. Consequently, the estimate of coca cultivation in non established area has constantly decreased.

Up to now, none of the “established” coca growing areas have received the opposite treatment, or has managed to classify as a “former” coca growing area. This might be an indication of expansion of coca cultivation, although of small importance. Such is the case of departments like Valle, Choco North of Antioquia, Amazonas, Cundinamarca, Guainia and Santander. These lines of expansion of illicit crops tend to go in two directions: one downstream from Guaviare and Meta to Guanía, Vaupés and Amazonas towards the Brazilian border and the tripartite border with Brazil and Peru; the second in central western Chocó, on the border to Panamá and with access to both the Pacific and the Caribbean, from Cauca, passing through Valle del Cauca, Tolima, and Quindio, as well as from Antioquia, Caldas and Risaralda.

As result of this analysis, for the 2001 census 18 Landsat images covering about 300,000 km² were classified as possible new coca area and 1,803 ha of possible coca cultivation found, in the 2002 census, 14 images covering 200,000 km² were classified as possible new coca area and 896 ha of possible coca cultivation found, and in the 2003 census, only seven images covering 100,000 km² were classified as possible new coca area and only 547 ha of possible coca cultivation found.

Table 23: Coca cultivation in possible new coca areas

Region	2003	
	Image date	Coca cultivation (ha)
Guainía	10-Dec- 03	43
Vaupés y Amazonas	25-Jan-04	244
Amazonas	25-Jan-04	29
Amazonas	02-Aug-03	14
Meta	01-Feb-04	137
Caldas, Risaralda, Chocó, Antioquia	06-Feb-04	11
Valle del Cauca, Quindío, Tolima	06-Feb-04	69
Total		547

The project team and DIRAN checked through aerial reconnaissance for possible coca cultivation in the coffee zone of Caldas, Risaralda, Chocó, Antioquia, but found only very small and scattered coca fields camouflaged with licit crops.

3.1.5 Coca cultivation in protected areas

Although the government accepted not to spray over these protected areas, there is public concern following reports of spraying activities carried out on the borders of these areas, for the risk on these areas to be harmed by spraying.

The presence of illicit crops both Natural Parks and Indigenous Territories has been monitored by SIMCI since the 2001 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 limits of National Parks and Indian territories have been provided by the official entities in charge of their management and are being edited. Therefore the accuracy of the amount of coca cultivation identified in each of them depends on the accuracy of their delimitation. However, it is worth stressing that the annual comparison of the level of coca cultivation was made using the *same* geographical boundaries throughout the three years of survey, which allows identifying trends over the same areas.

A major result of the comparison has been the continuous decrease of illicit crops both in national parks and indigenous territories since year 2001. It is however important to state that aerial spraying was not authorized over protected areas, even though some aerial spraying has been carried out over these years, especially at the borders of these territories.

The detailed results by national parks and indigenous territories are presented in annexes

3.1.6 Coca cultivation and some socio-economic indicators

The drug problem in Colombia is the result of a number of factors, that have existed side by side in Colombia - none of them decisive in themselves – but which have created a fertile ground for coca cultivation to proliferate.

The GIS tools facilitate the analysis of many of these factors, thus allowing a better understanding of the spatial and temporal dynamics of coca crops, as well as their relationship to the socio-economic and environmental characteristics of the regions. The GIS tools have been used to analyze coca bush densities in relationship to poverty indicators, violence, internal displacements and environment, amongst others.

Coca cultivation and poverty

The emergence of illicit crops has allowed an increase in the peasants' income, although they are far from being the main beneficiary from the huge profits generated by this business. The data analysis on illicit drugs production and economic growth rates in the main drug producing countries on INCB report (2002) shows a negative effect in such relation. The farmers from developing countries who grow illicit crops earn only 1% of world drug trafficking income while the remaining 99% goes to drug trafficking groups at different points of the chain.

The rural area has suffered major transformations during the last 20 years due to violence, drug trafficking and population movement. When analyzing indigence or extreme poverty indexes, big gaps are found between the situations of rural and urban areas, and this has been associated to the strong crises suffered by the rural sector, reflected in the decrease of real income in the homes.

According to what National Planning Department (NPD) reports, the percentage of poor people increased from 50, 4% in 1997 to 58, 8% in 2001. Between 1999 and 2000, the indexes reflect that the number of poor people increased in two million persons (22, 647,877 in 1999 and 24,610,844 in 2000). As for extreme poverty (percentage of persons below the Indigence Line) it went from 18% in 1997 to 22.5% in 2001⁹. On the other hand, according to a World Bank Study, one out of four Colombians lives in extreme poverty conditions and 27 million Colombians live in poverty – more than half of the total population.

The areas with illicit crops report higher poverty levels than the national level. Between 1997 and 2000 the poverty incidence in Nariño was 67, 1% and it went up to 74, 7%, the extreme poverty incidence was 38, 2% and went up to 40, 6%. In Meta, the poverty level was of 38, 6% and it increased to 55, 5%, the level of extreme poverty was of 10,1% and went to 17,5%. In Caquetá the percentage of poor people in the same period went from 57, 5% to 69, 2% and below the poverty line from 15, 3% to 28, 7%.

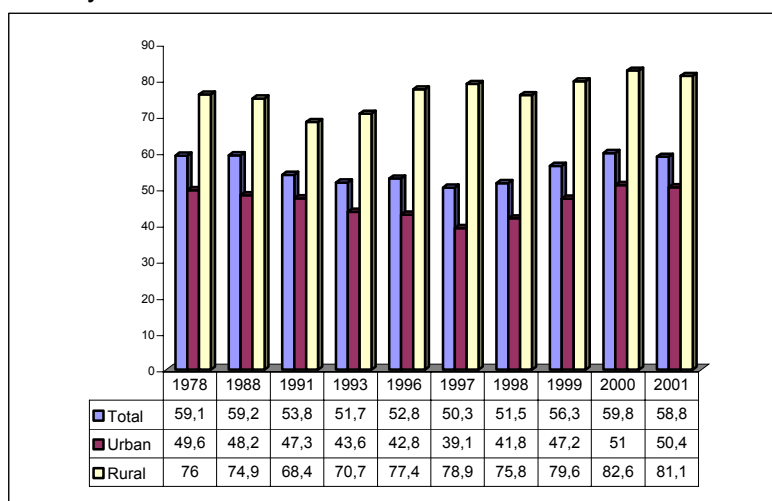
Another way of measuring the poverty degree of a region is through the indicator of Unsatisfied Basic Needs (UBN) which the DANE reported to be of 20, 9% in 2003. At the urban level it was of 12, 7% and at the rural level of 43, 5%. The report shows that some larger concentrations of coca cultivation happen to be in departments with a UBN index of 43% or higher. The Pacific Coast, which includes Chocó, Nariño and Cauca, has the worst

⁹ National Planning Department. Social Impact of the Crisis, 2001

poverty indexes, followed by the Atlantic Coast and the Coffee Productive Region. The regions that 15 years ago had the better life conditions, are currently suffering food restrictions specially attributed to the progressive decrease in the family income.

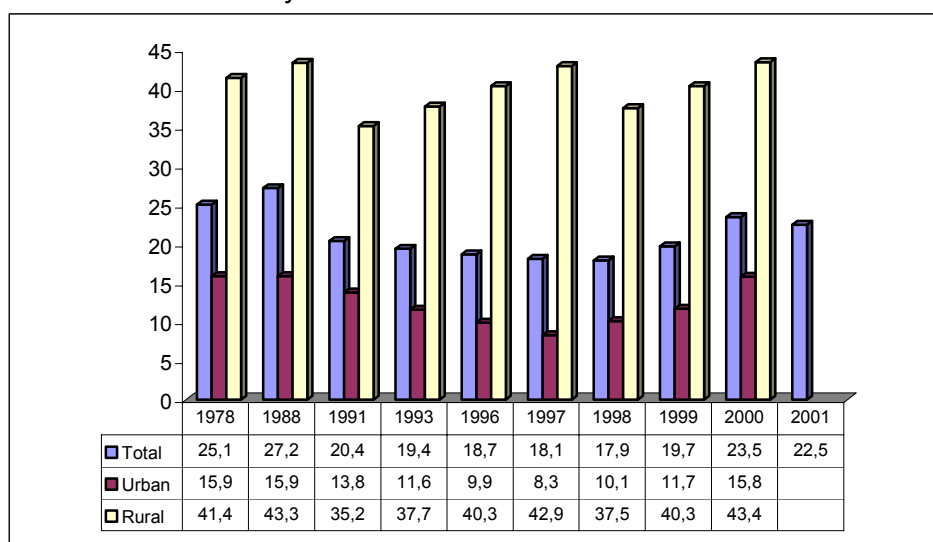
The National Survey on Life Quality in 2003, carried out by the DANE, reports that although the illiteracy of people 15 years old and beyond in the rural sector decreased from 22,2 to 18,0 between 1997 and 2003, it is still higher than the national index. The population affiliated to the Health Social Security System in the rural sector, has the following characteristics: 48.3% non affiliates, 13, 3% contributors and 38.4% have a subsidy.

Figure 8: Poverty indicators



Source: DNP-UDS based in DANE

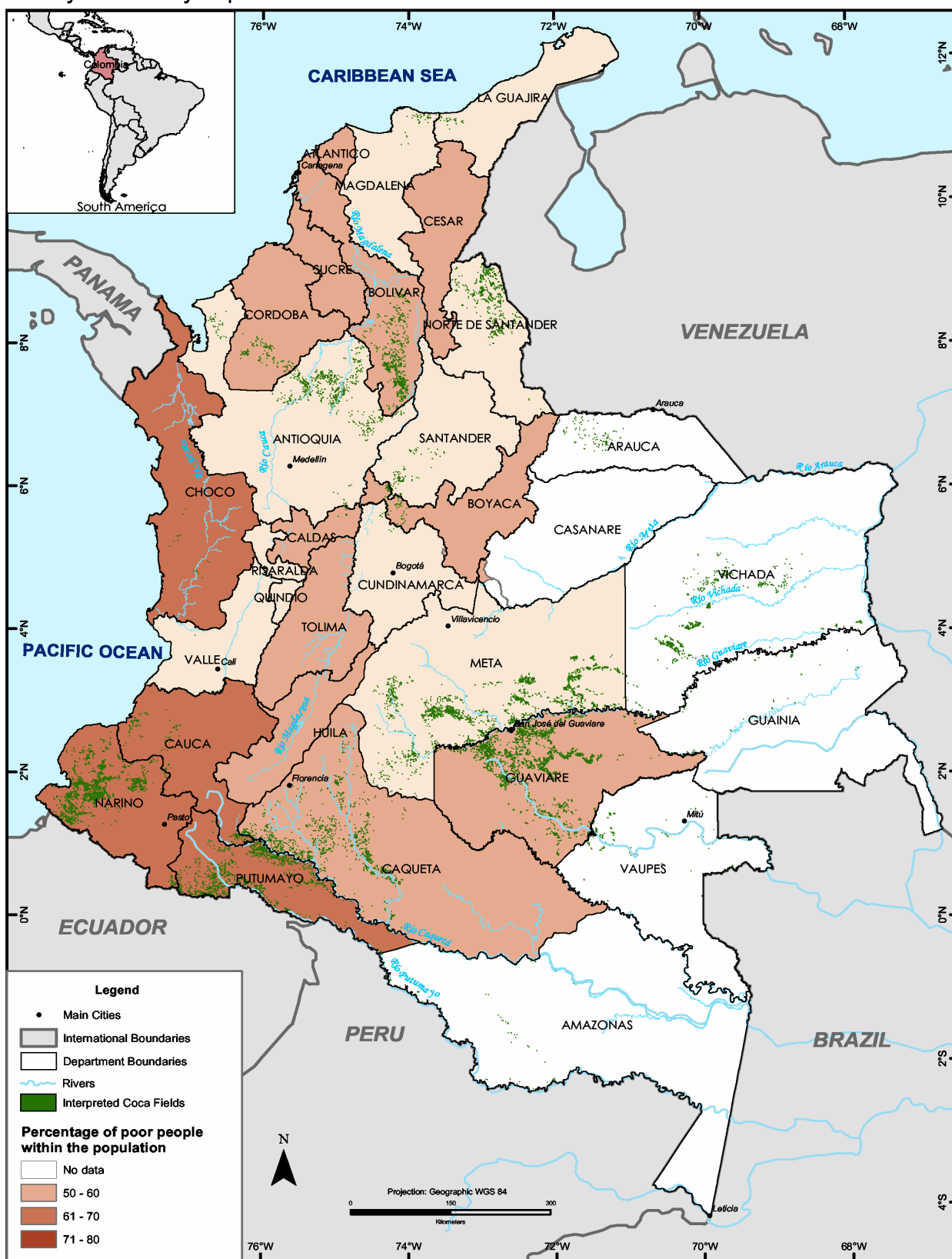
Figure 9: Extreme Poverty



Source: DNP-UDS based in DANE

Colombia Coca Survey for 2003

Poverty Indicator by Department in 2003



Source: Government of Colombia - UNODC Coca cultivation Survey 2003 and DANE for poverty
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

Internally Displacement of People

The past two decades have been characterized by important displacements of people, generated by violence, the armed conflict, drug trafficking and in general the search for better living conditions. Although there is discrepancy between different sources of information regarding the total number of internally displaced people (IDP), there is no doubt that the gravity of the phenomenon has reached the dimensions of a real humanitarian crisis for the country.

According to official figures of the government, over the past five years, some 1.5 million Colombians are thought to have fled to escape rural violence.

The Social Solidarity Network (RSS) reports that between 1996 and 2003, an average of 33,455 families has left every year their homes to escape from violence¹⁰. Many of these people come from areas where there are large numbers of illicit crops and where confrontations occur between armed groups for territorial control or controlling illicit crops or transportation corridors. Many refugees have sought shelter in shanty towns in the big cities, while others end up in areas where illicit crops are grown and they grow these themselves¹¹.

The departments with the greatest incidence of population displacement were: Antioquia (15%), Cesar (8%), Putumayo (6%), Bolívar (6%), Cundinamarca, Tolima, Valle y Caquetá (5% each one). 74% of the abandoned land corresponded to rural buildings, out of which, 69% were represented by small farms with a house and a parcel, while abandoned lands represented only 5%; this would indicate, that the majority of the abandoned places belonged to families with low socio-economic conditions.

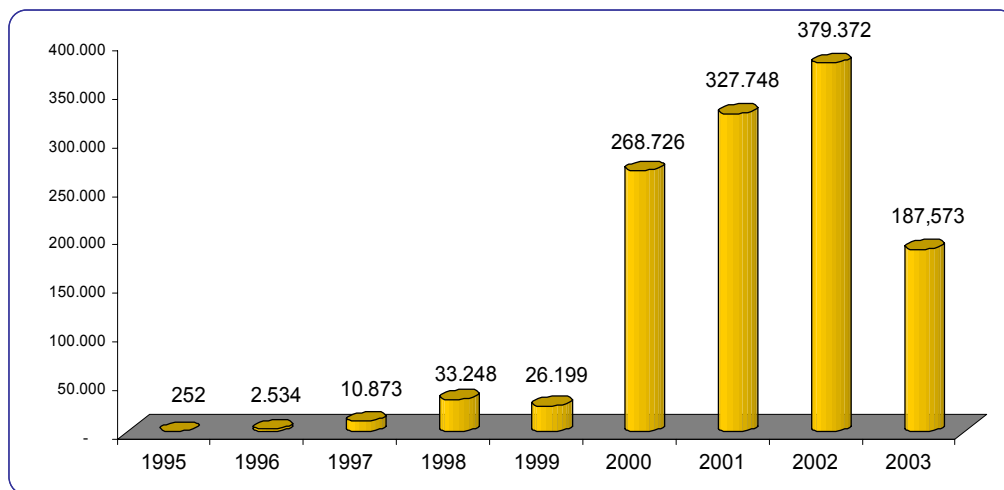
Considering the average rate of IDP by each 100,000 habitants in the period between 1996 and 2002, the departments with greater impact of displacements were Putumayo, Chocó, Caquetá, Guaviare, Sucre, Bolivar, Cesar, Magdalena, Meta, Antioquia, Casanare and Arauca¹². The departments coincided with the areas of armed confrontations for the control and use of land, strong presence of illegal armed groups, and often the presence of illicit crops.

¹⁰ According to RSS, the armed conflict is caused by the Colombian Guerrilla, the paramilitary groups and simply by common delinquency

¹¹ United Nations Thematic Group on Displacement Report, 2001, UNHCR, March 2002.

¹² DNP. Rates of violence 1992-2002.

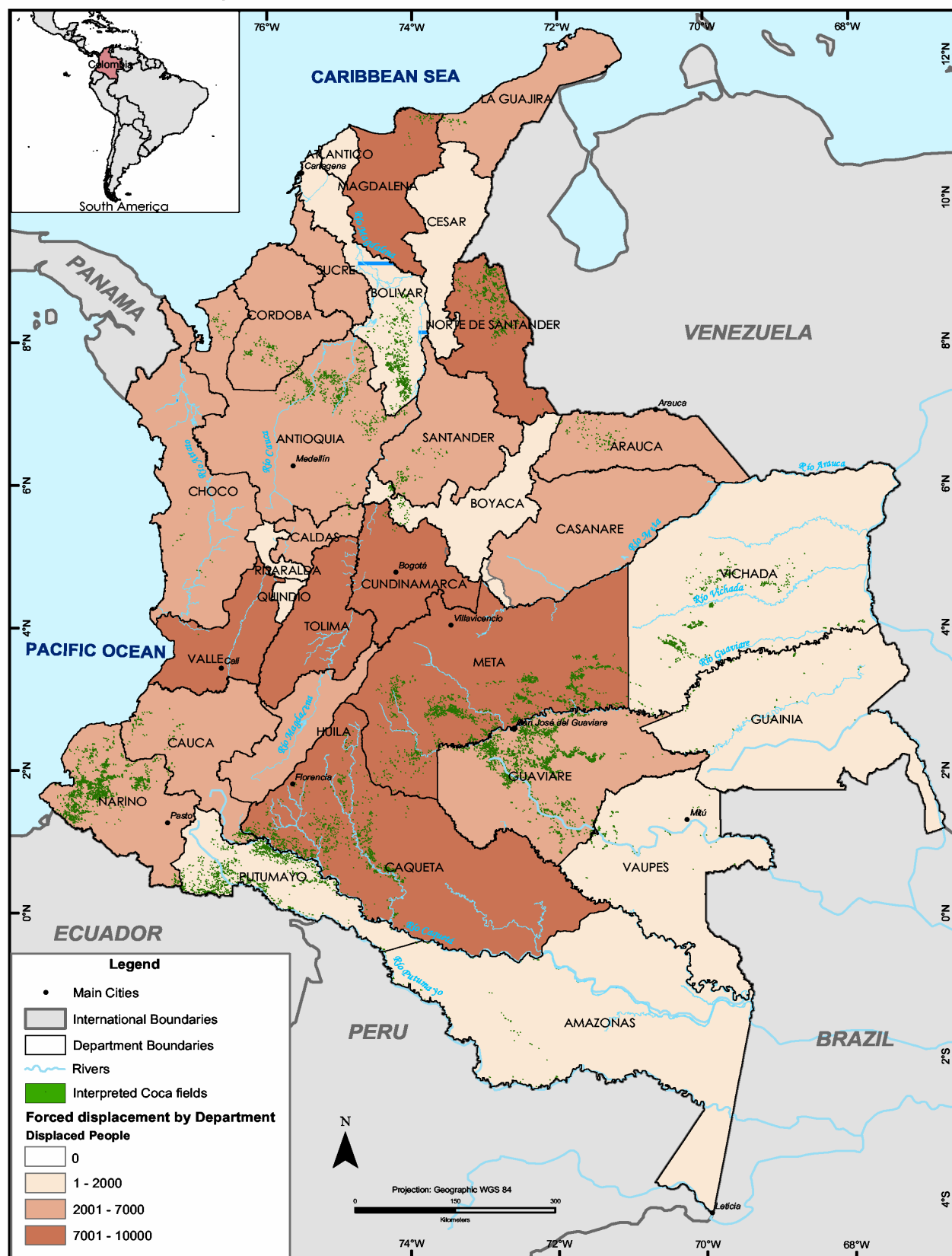
Figure 10: IDPs in Colombia, 1995 – 2003 (persons)



Source: Social Solidarity Net

Colombia Coca Survey for 2003

Forced Displacement by Department in 2003



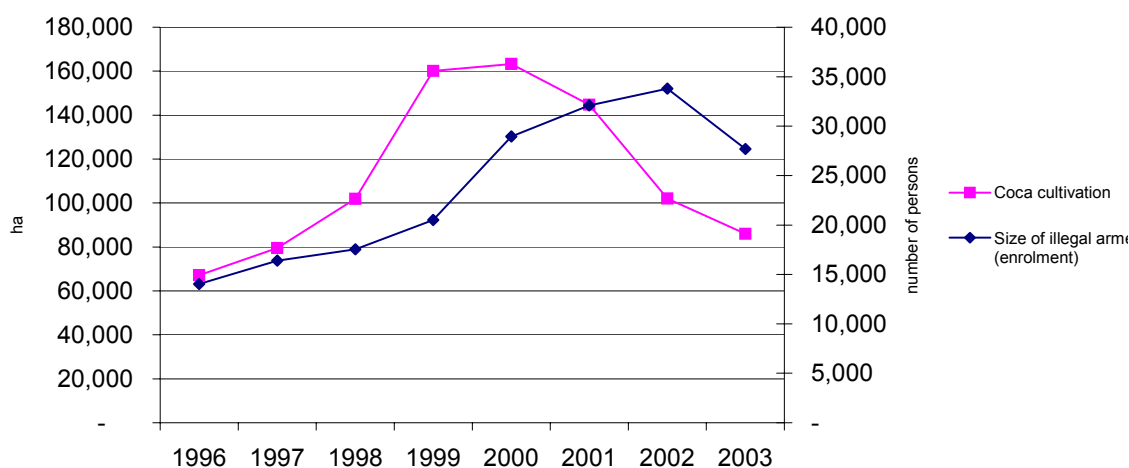
Source: Government of Colombia - UNODC Coca cultivation Survey 2003 and RSS for forced displacement
 The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

Coca cultivation and armed conflict

Colombia is plagued by the nexus between illicit cultivation and armed conflict. As regards to the production and processing, the illegal armed groups guarantee a territorial control for the illicit drugs production. Depending on the territory, these groups assume direct control or a regulating function among the producing peasants and the intermediaries. Yet in addition to what is called “gramaje”¹³, the regulation of prices and quantities produced, sales tax, and their direct involvement in laboratory processing and in part of the actual trafficking, armed groups get their funds from other sources as well, such as kidnapping, extortion, and the “protection” that they offer.

Out of 189 municipalities where coca cultivation have been detected, guerilla groups may be found in 162 and paramilitary groups in 86. In 43 Colombian municipalities where the three illegal armed groups of the country may be found, there are coca cultivation as well. The three illegal armed groups are also present in the areas with higher density of cultivation (Nariño) and higher persistence (La Gabarra)¹⁴.

Figure 11: Illicit Crops and illegal armed groups (1996 –2003).



Sources: National Police for armed groups and UNODC for coca cultivation

Illicit cultivation aggravates the conflict due to territorial control and income from the drug business. In fact, the majority of areas where illicit cultivation is also the scene of violent confrontations between armed groups. The Armed Revolutionary Forces of Colombia – FARC– is located in eight areas: Central, Medium Magdalena, Northwestern, North or Caribbean, Eastern, Southern and Western. In 162 municipalities of Colombia where there is activity of the FARC, there is also coca cultivation.

The southern area of the FARC operating in Putumayo and Caquetá, the eastern area with activities in Meta, Vichada and Guaviare and the western area that operates in Nariño and Cauca, match up with the highest concentration of coca cultivation. This illegal force has varied its condition of rural guerrilla with exclusive influence on peripheral areas and extended their presence to urban centers belonging to the national production core. The following map shows the presence of the FARC in a vast area of the national territory related to their expansion towards areas that represent strategic advantages for their confrontation.

¹³ Payments made to armed groups to allow illicit business, in exchange for protection.

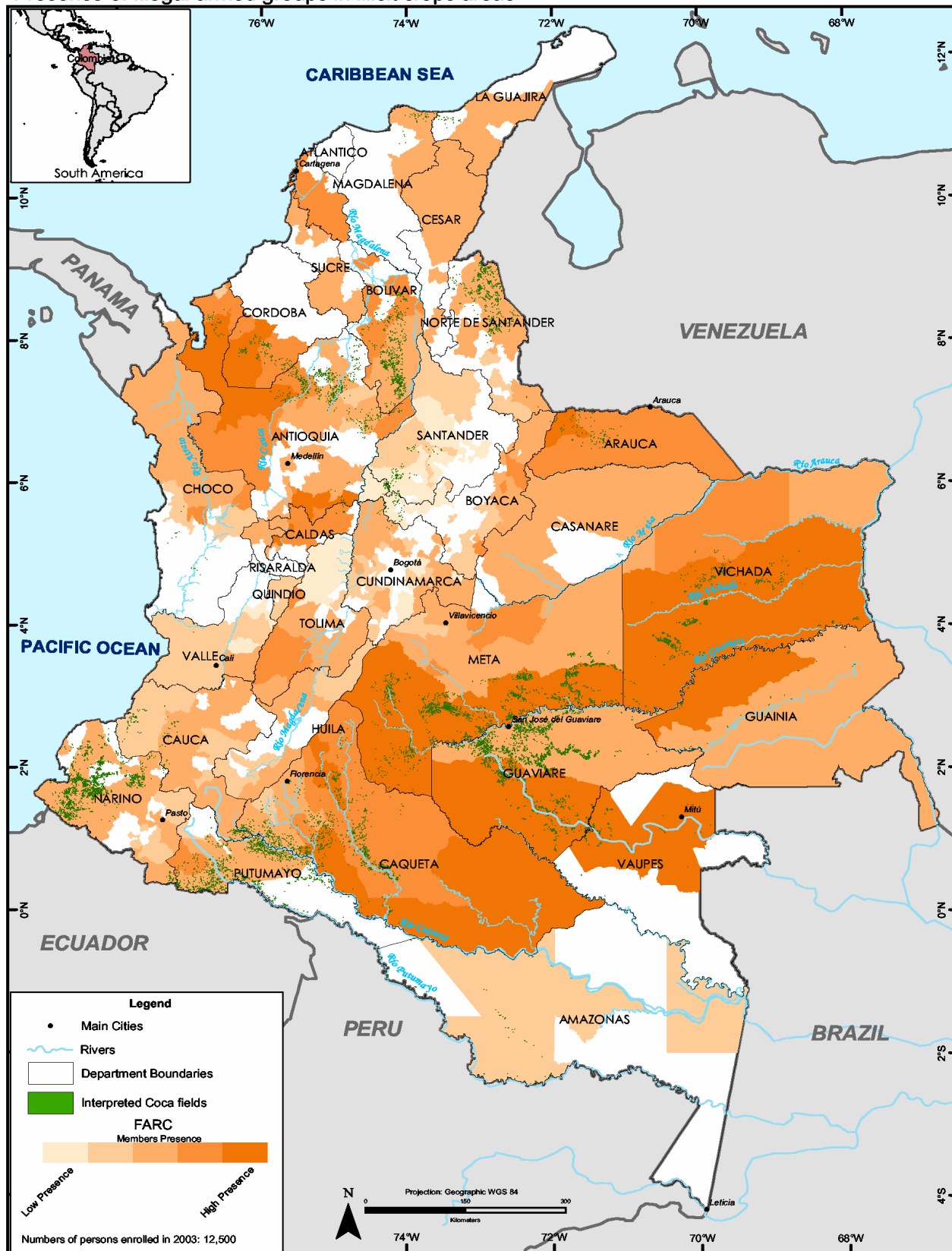
¹⁴ This information does not include the Mobile Groups that belong to the illegal armed groups.

On the other hand, the National Liberation Army (ELN) started its territorial expansion mainly in the north of the country. It counts with 5 areas (northeastern, northwestern, northern, southwestern and central). The northeastern area has the major armed activity of the organization in Santander, followed by the ones operating in Southern Bolívar (Serranía de San Lucas), Antioquia, Cesar, Cauca, Southern Huila and Nariño. The territorial expansion of this group has aimed to zones with natural resources for mining such as oil, coal, gold and emeralds. As to coca cultivation, the presence of the group coincides with these crops in Southern Bolívar.

Regarding paramilitary groups, they have been constantly growing since the mid-1990s. The number of members increased from 850 in 1992 to approximately 12,000 in 2003, which has helped in consolidating their influence, especially in the northwest region of the country, in Antioquia, Córdoba, Sucre, Bolívar and North of Santander. These departments are strategically located for drug trafficking. These forces get funds from the coca cultivation and drug trafficking as well as from extortion of farmers.

Colombia Coca Survey for 2003

Presence of Illegal armed groups in illicit crops areas



Source: Government of Colombia - UNODC Coca Cultivation Survey 2003 and Ministry of Defence for number of persons enrolled in armed groups. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Colombia Coca Survey for 2003

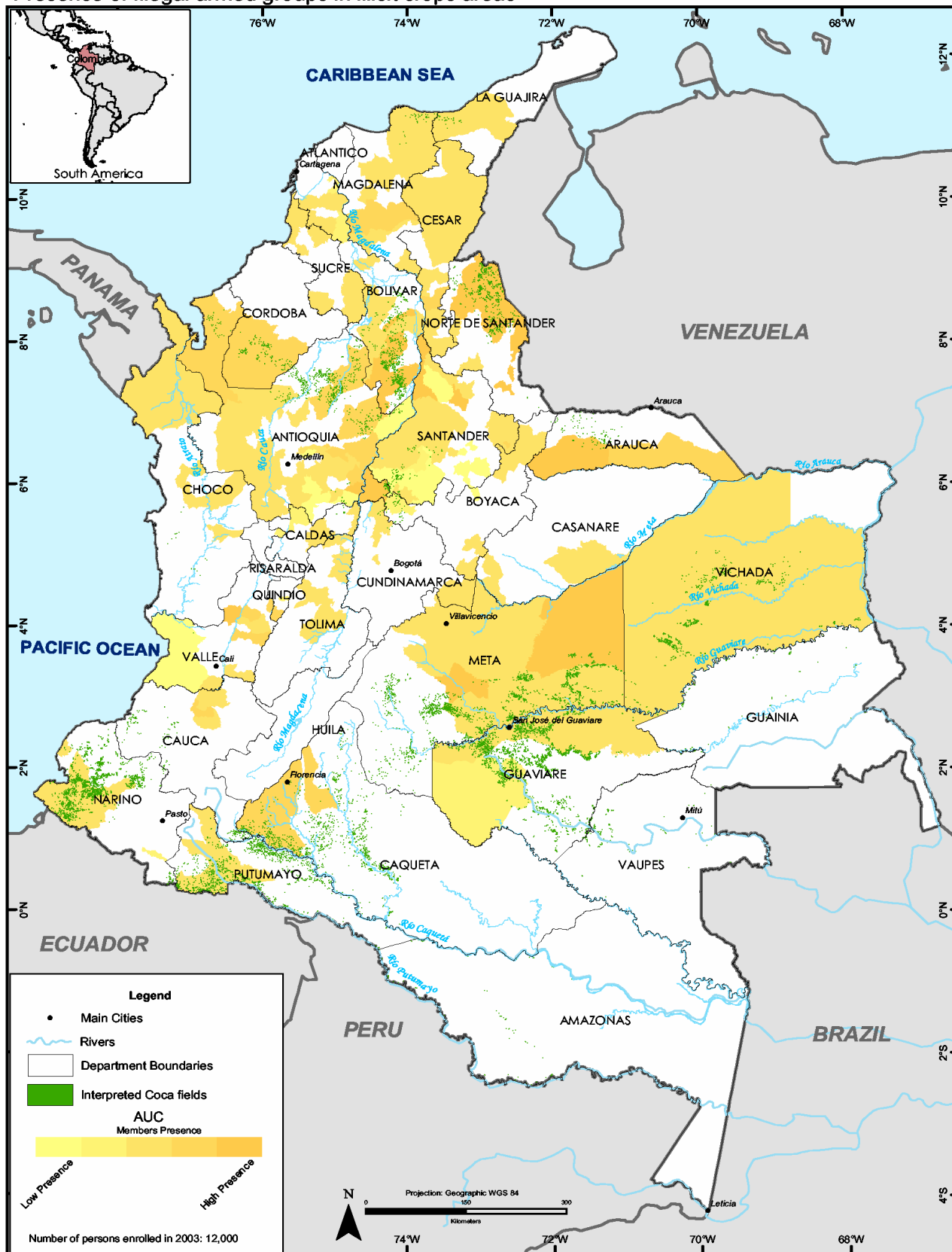
Presence of Illegal armed groups in illicit crops areas



Source: Government of Colombia - UNODC Coca Cultivation Survey 2003 and Ministry of Defence for number of persons enrolled in armed groups
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

Colombia Coca Survey for 2003

Presence of Illegal armed groups in illicit crops areas



Source: Government of Colombia - UNODC Coca Cultivation Survey 2003 and Ministry of Defence for number of persons enrolled in armed groups
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

3.2 Coca yield and production.

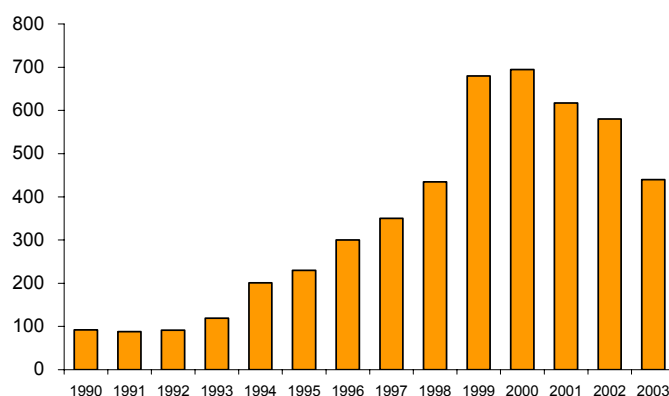
Field work carried out by UNODC project staff indicated that high-yield varieties were being introduced by coca farmers, but UNODC has not yet conducted a scientific and comprehensive study on coca leaf and cocaine productivity in Colombia.

To establish an estimate for the purpose of the present report, UNODC therefore relied on information available from other sources. The most comprehensive work on this topic has been done by the US government. The findings of this work indicated that the average cocaine yield per hectare of coca plants amounts to 4.7 kg/ha in Colombia.

Some recent estimates from US sources in Colombia, suggested that the average amount of pure cocaine obtained from one hectare under cultivation of coca bush was 4.0 kg in 2003. In contrast, the DIRAN estimated an average output of cocaine per hectare of coca cultivation, of 5.8 kg/ha/year. The yield/conversion rate of 4.7 kg of cocaine per hectare under cultivation of coca used by UNODC in this report falls within these ranges of estimates.

Estimating the actual production of cocaine in Colombia in 2002 is not easy, because coca fields are harvested more than once in a given year and eradication activities are spread over several months. In order to arrive at a realistic estimate for Colombia, UNODC like last year, calculated an average of the two cultivation figures recorded in December 2002 and in December 2003 by the UNODC supported national monitoring system. This average (94,000 ha) was then multiplied by the estimated yield per hectare and per harvests per year. The result amounted to 440 metric tons of potential cocaine production in Colombia for 2003. While this calculated estimate is not very accurate, it is probably closer to the actual amount produced during the calendar year than a figure derived solely from the extent of cultivation recorded at the end of the year, after extensive eradication campaign.

Figure 12: Potential production of cocaine.



It should be also noted that total manufacture of cocaine in Colombia is higher as some of the coca base produced in Peru is still processed into cocaine in Colombian clandestine laboratories.

3.3 Coca prices

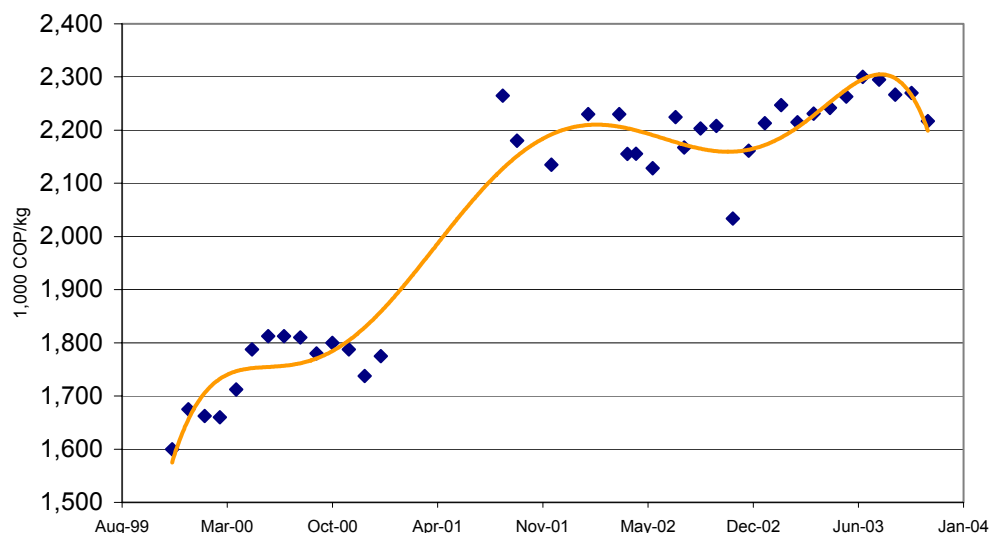
Contrary to Bolivia and Peru, there is no market for coca leaf in Colombia because to its low price and the peasants gradual mastering of the coca process to convert it to coca base. Most peasants sell coca base that they themselves produce in small “kitchen” located on the farm. The necessary technical know-how was brought to the farmers during the 90’s by drug-traffickers with the objective to facilitate and increase the commercialisation of cocaine

In 2003, the average price for one kg of coca base amounted 2,251,000 Colombian Pesos. Coca base prices in local currency remained largely stabled compared to 2002, but fell in terms of US\$ by 6%, from US\$ 847/kg to US\$ 793.¹⁵

Table 24: Monthly coca base prices 2003 (in Colombian Pesos/kg)

Months	Colombian Pesos
January	2,212,500
February	2,246,666
March	2,214,706
April	2,231,250
May	2,242,105
June	2,262,500
July	2,300,000
August	2,295,455
September	2,266,750
October	2,270,000
November	2,216,667
December	not available
Average in Colombian Pesos	2,250,964
Average in US\$	US\$ 793

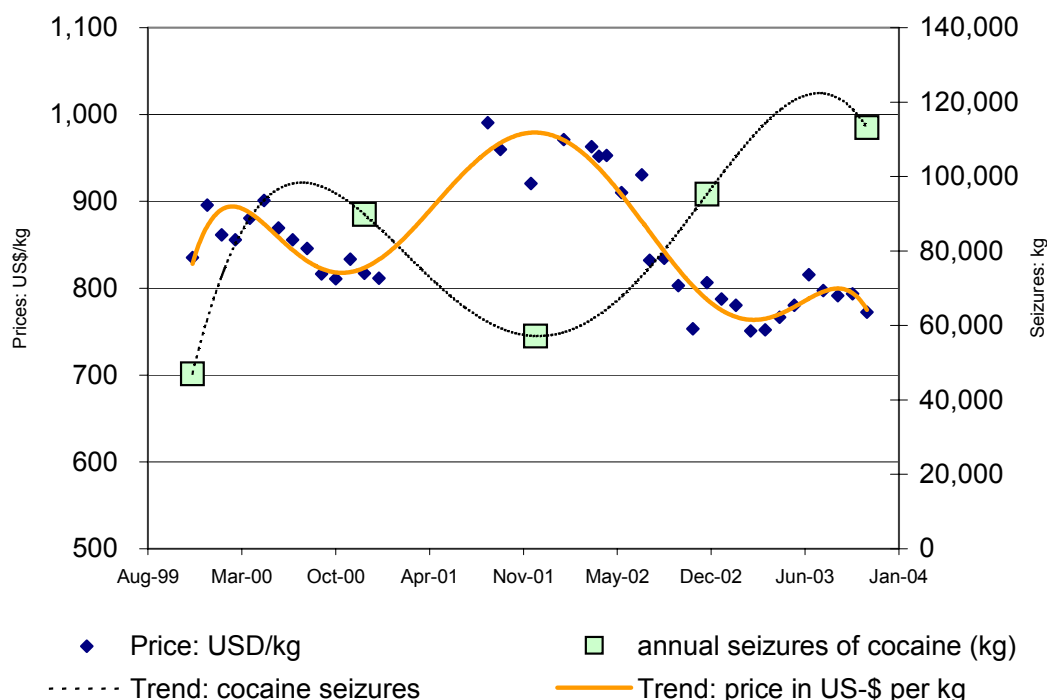
Figure 13: Monthly coca base price December 1999-November 2003 (in COP)



¹⁵ At the exchange rate of \$ 2.838 COP/USD

The decline of coca base prices – despite falling levels of production – appears to have been largely due to intensified law enforcement efforts by the Colombian authorities which rendered cocaine exportation more difficult. Seizures of cocaine increased in Colombia in 2003 – despite falling levels of production – by almost 20% compared to 2002 or by almost 100% compared to 2001. The number of cocaine laboratories detected and dismantled was more than twice as high in 2003 than in 2000.

Figure 14: Monthly coca base price December 1999-November 2003 (in US\$) and annual seizures of cocaine (in kg)

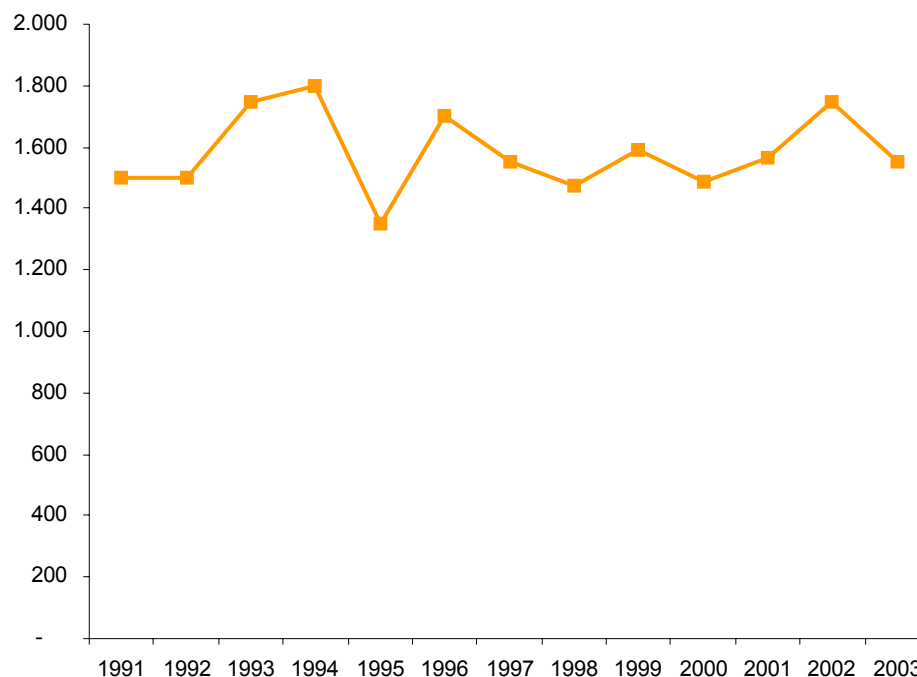


Using the average price for coca base of US\$ 793/kg in 2003, and assuming a one to one conversion rate between cocaine and coca base, the total farm-gate value of the 440 metric tons of coca base produced in Colombia in 2003 would amount to about US\$ 350 millions.

According to DIRAN, the cocaine price showed an increase from 3,100,000 Colombian Pesos/kg in 2000 to 4,400,000 Colombian Pesos/kg in 2002 (or +42%). In 2003 the average cocaine price slightly increased again and was approximately at 4,500,000 Colombian Pesos/kg in the main cities of the country.

In US\$ terms, cocaine prices in Colombia remained relatively stable over the last few years, though they decreased by 11% from US\$ 1,750/kg in 2002 to US\$ 1,551/kg in 2003, partly reflecting the decline in coca base prices (-6%).

Figure 15: Cocaine prices for 2003 (US\$/kg)



Source: DIRAN.

3.4 Opium Poppy Cultivation

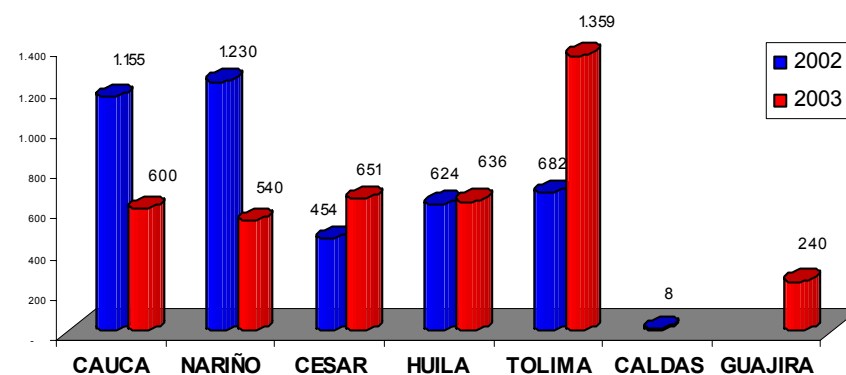
Opium poppy cultivation was introduced in Colombia in the 1980's, in a few marginal agricultural zones, when coffee prices fell down. The farmers cultivated the plant in a range of 1,700 to 3,000 ms altitude, intersperse with licit crops.

Opium poppy is now mainly being cultivated on mountain sides in south-western Colombia, especially in the departments of Huila, Tolima, Cauca and Nariño, and in minor quantities in Cesar and Guajira.

UNODC – so-far – has not monitored the extent of opium poppy cultivation in Colombia. According to Colombian Government figures, the total area under opium poppy cultivation has not varied much during the 1990's in spite of extensive spraying efforts. Apart from a short-lived boom in 1994, opium poppy has remained between 4,000 – 7,000 hectares. As of November 2003, the DIRAN's estimates based on reconnaissance flights and spray operations, identified 4,026 hectares of opium poppy under cultivation, compared to 4,253 hectares in 2002.

The reports showed regional differences, with increases reported from the departments of Tolima (located between Cali and Bogota) and of Guajira (on the Caribbean coast next to the border with Venezuela), while strong declines were reported from the Nariño and Cauca (departments located along the Pacific coast in the southern part of the country).

Figure 16: Opium poppy cultivation by departments



Source: DIRAN

3.5 Opium and heroin production

DIRAN's previous estimates assumed that Colombian farmers harvested three opium poppy crops per year. Recent US government studies on heroin production showed however that, in Colombia, opium poppy farmers cultivate two crops per year in all growing regions but one (Nariño department).

According to these studies, opium poppy fields yield between 13 and 17 kilograms of latex per hectare and per harvest, depending on the growing region. Assuming an average yield of 15 kilograms per hectare, and 2 harvests per year, the total potential opium latex production would be around 121 metric tons. Based on a conversion rate of 24 kg of opium latex for one kilo of pure heroin (US-DEA study, 'Operation Breakthrough' conducted in 2001), the total potential heroin production in Colombia would amount to about 5 metric tons of heroin in 2003.

To compare with other opium production estimates in Asia where a conversion rate of 10 kg of opium gum for 1 kg of heroin is usually used, the potential opium gum production in Colombia would be around 50 metric tons. Some recent work carried out by the US Government seems to show even higher opium yields; however, the study has not yet been made available.

3.6 Opium and heroin prices

Opium prices in 2003 were rather similar to the opium prices reported in 2002. According to UNODC Alternative Development projects, the price paid for one kg of opium latex was about US\$ 160 in December 2002. The price in 2003 for one kg of opium latex was around US\$ 156 according to DIRAN and the Alternative Development National Programme (PDA) based on a monthly monitoring of drugs price.

Table 25: Latex and morphine monthly prices in 2003 (Colombian Pesos/kg)

Months	Opium latex (Colombian Pesos/kg)	Morphine (Colombian Pesos/kg)
January	288,182	10,500,000
February	440,000	11,500,000
March	392,727	9,833,333
April	424,444	10,000,000
May	518,500	11,625,000
June	476,429	12,250,000
July	480,000	12,300,000
August	531,111	12,375,000
September	534,000	12,250,000
October	468,750	12,100,000
November	388,751	9,600,000
December	not available	not available
Average in Colombian Pesos	449,360	11,303,030
Average in US\$	US\$ 156	US\$ 3,931

Source: Alternative Development National Programme and DIRAN

With an estimated opium latex production of 121 metric tons, the potential value of the 2003 farm gate production of opium latex would amount to about US\$19 millions.

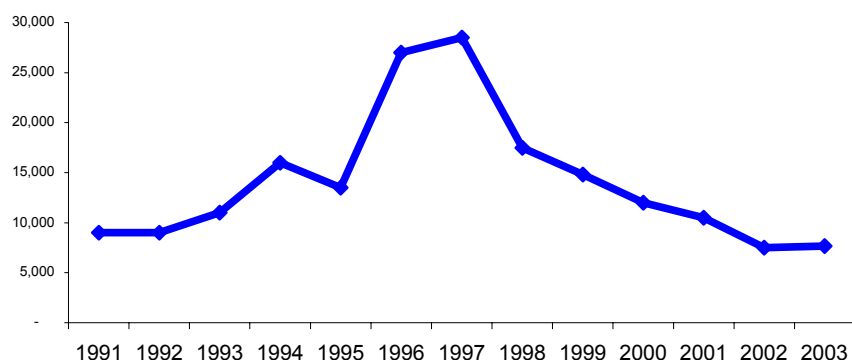
Trends in heroin prices per kg showed a decrease over the last few years though stabilizing in 2003. From US\$11,977 in 2000 and US\$10,650 in 2001, it dropped to US\$7,500 in 2002. In 2003 DIRAN reported the price of heroin to amount to US\$7,650 (range between US\$ 4,800 – US\$10,000 per kg). PNDA reported an average price of US\$ 5,660/kg for 2003.

Table 26: Heroin monthly prices in 2003 (Colombian Pesos/kg) (source: PNDA)

Months	Colombian Pesos
January	14,500,000
February	14,333,333
March	15,250,000
April	15,000,000
May	17,500,000
June	17,500,000
July	17,650,000
August	15,000,000
September	18,000,000
October	18,000,000
Average in Colombian Pesos	16,273,333
Average in US\$	US\$ 5,660

Source: Alternative Development National Programme and DIRAN

Figure 17: Heroin prices for 2003 (US\$/kg)



Source: DIRAN

3.7 Aerial Spraying

The Colombian anti-drugs strategy includes a number of measures ranging from aerial spraying, to forced or voluntary manual eradication, including alternative development and crops substitution programmes.

By far the most important is the spraying programme carried out by the Antinarcotics Police – DIRAN. This is realized through aerial spraying with a mixture of products called Round up – composed of a herbicide called glyphosate - and a surfactant called Cosmoflux and other additives. In late 2002, the National Narcotics Council approved a herbicide concentration of 2.5 liters per hectare for opium poppy and 10.4 liters per hectare for coca, with a view to increasing the spraying effectiveness percentage, which was estimated as being 91%.

However, it should be kept in mind that 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. To eliminate the production of a given field, the authorities have to spray at least twice a year, to discourage the farmers to abandon the field.

UNODC did not participate in or supervise the spraying activities. All data were received directly from DIRAN.

The Illicit Crop Eradication Programme foresees an Environmental Management Plan and environmental auditing, as well as periodic verifications on the ground of the effectiveness of spraying activities and their environmental impact. Whereas the protocols for this verification have been implemented since 1999, the Environmental Management Plan recently approved has not been fully applied.

Reports from DIRAN showed that spraying activities reached a record level in 2003. The DIRAN sprayed a total of 132,817 hectares and the Army manually eradicated 4,011 ha of coca. In addition, DIRAN sprayed 2,994 hectares and the Army manually eradicated 257 ha of opium poppy. Compared to 2002, the spraying activities over coca cultivation increased by 2%, while it decreased by 11% over opium poppy cultivation.

Colombia Coca Survey for 2003

Table 27: Aerial spraying by department and year, for coca (in ha)

Sources:	Environmental Audit of the National Narcotics Bureau						Antinarcotics Police Department			
Department	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Guaviare	3,142	21,394	14,425	30,192	37,081	17,376	8,241	7,477	7,207	37,493
Meta	729	2,471	2,524	6,725	5,920	2,296	1,345	3,251	1,496	6,973
Caquetá	-	-	537	4,370	18,433	15,656	9,172	17,252	18,567	1,059
Putumayo	-	-	-	574	3,949	4,980	13,508	32,506	71,891	8,342
Vichada	-	50	85	-	297	91	-	2,820	-	-
Antioquia	-	-	684	-	-	-	6,259	-	3,321	9,835
Córdoba	-	-	264	-	-	-	-	-	734	550
Vaupés	-	-	-	-	349	-	-	-	-	-
Cauca	-	-	-	-	-	2,713	2,950	741	-	1,308
Norte Santander	-	-	-	-	-	-	9,584	10,308	9,186	13,822
Nariño	-	-	-	-	-	-	6,442	8,216	17,962	36,910
Santander	-	-	-	-	-	-	470	-	-	5
Boyacá	-	-	-	-	-	-	102	-	-	-
Bolívar	-	-	-	-	-	-	-	11,581	-	4,783
Arauca	-	-	-	-	-	-	-	-	-	11,734
Sub-Total	3,871	23,915	18,519	41,861	66,029	43,111	58,073	94,153	130,364	132,817
Manual Eradication								1,745	2,752	4,011
Total	3,871	23,915	18,519	41,861	66,029	43,111	58,073	95,898	133,116	136,828

Table 28: Aerial spraying by department and year for opium poppy (in ha)

Sources:	Environmental Audit of the National Narcotics Bureau						Antinarcotics Police Department			
Department	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Antioquia	-	-	120	-	-	-	-	-	-	-
Caldas	-	-	-	-	-	-	-	-	-	-
Caquetá	-	-	-	382	-	-	-	-	400	-
Cauca	102	53	122	50	-	828	1.600	387.00	236.00	550
Cesar	128	305	713	91	650	125	423	426.00	547	1.004
Guajira	81	177	371	-	50	-	-	-	-	75
Huila	2.057	1.382	715	2.175	748	2.251	2.420	429.10	544	391
Meta	-	-	-	-	-	-	-	-	-	-
Nariño	-	-	-	-	-	312	1.089	63-	788	725
Tolima	1.169	1.548	4.843	4.289	1.452	5.556	3.719	194.60	854	250
Sub-Total	3.537	3.466	6.885	6.988	2.896	8.249	9.254	2.066	3,371	2,995
Manual Eradication								2,586	205	257
Total	3,537	3,466	6,885	6,988	2,896	8,249	9,254	4,642	3,577	3,252

Regarding the estimates on spraying area, it is important to differentiate between the accumulated sprayed area reported here – which is the sum of areas during a given time period (calculated by multiplying the length of flight lines by their width), and the effective sprayed area, which disregards the overlap between adjacent sprayed bands and areas sprayed several times in the same calendar year.

The dynamics of reproduction of illicit crops after a spraying campaign varies significantly from region to region. Once coca or opium poppy fields are sprayed, it takes approximately six to eight months to recover productive crops. 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

Colombia Coca Survey for 2003

effect). The verification flights realized in some departments between January and March 2003 showed by visual estimation, an important replanting rate in some departments, especially Norte de Santander and Nariño.

The records of the monthly spraying activities carried on by DIRAN in 2003 indicate that the major amount of spraying was performed in the first semester. The dynamics of replanting of coca bushes in these areas immediately after the sprayings were therefore fully visible in this year's census, and reflected in the census statistics.

Table 29: Monthly aerial spraying in 2003, for coca and opium poppy (in ha)

MONTH /DEPARTM.	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
GUAVIARE	4.995,84	5.340,35	3.740,04	3.955,54	2.825,12	4.684,11	4.288,89	4.453,96	273,51		306,89	2.629,27	37.493,52
META	841,30	0,00	1.563,11	269,55		178,15		133,29	100,92		2.869,82	1.017,51	6.973,65
CAQUETA	1.059,56												1.059,56
PUTUMAYO					1.368,72	2.362,67	4.611,47						8.342,86
SANTANDER					5,00								5,00
BOLIVAR					996,01	1.508,93	705,05	1.573,05					4.783,04
ANTIOQUIA					405,27		5.459,24	3.970,78					9.835,29
NORTE DE SANTANDER	2.106,00	4.245,00	383,00						3.900,58	3.187,34			13.821,92
NARIÑO	1.442,85	6.220,19	11.290,15	8.493,15	3.199,32				859,93	744,12		4.660,71	36.910,42
CAUCA								1.203,22	104,72				1.307,94
CORDOBA								549,90					549,90
ARAUCA									2.477,47	6.204,10	3.052,34		11.733,91
TOTAL COCA	10.445,55	15.805,54	16.976,30	12.718,24	8.799,44	8.733,86	15.064,65	11.884,20	7.717,13	10.135,56	6.229,05	8.307,49	132.817,01
MONTH /DEPARTM.	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
TOLIMA			107,00				106,76					35,99	249,75
HUILA							154,35	63,30				173,07	390,72
CESAR	382,00			193,00				260,84				168,00	1.003,84
GUAJIRA	75,00												75,00
NARIÑO			342,75	276,00				4,59	101,63				724,97
CAUCA			282,25						180,20			87,46	549,91
ANTIOQUIA								0,00					0,00
TOTAL POPPY	457,00	0,00	732,00	469,00	0,00	0,00	261,11	328,73	281,83	0,00	0,00	464,52	2.994,19

Colombia Coca Survey for 2003

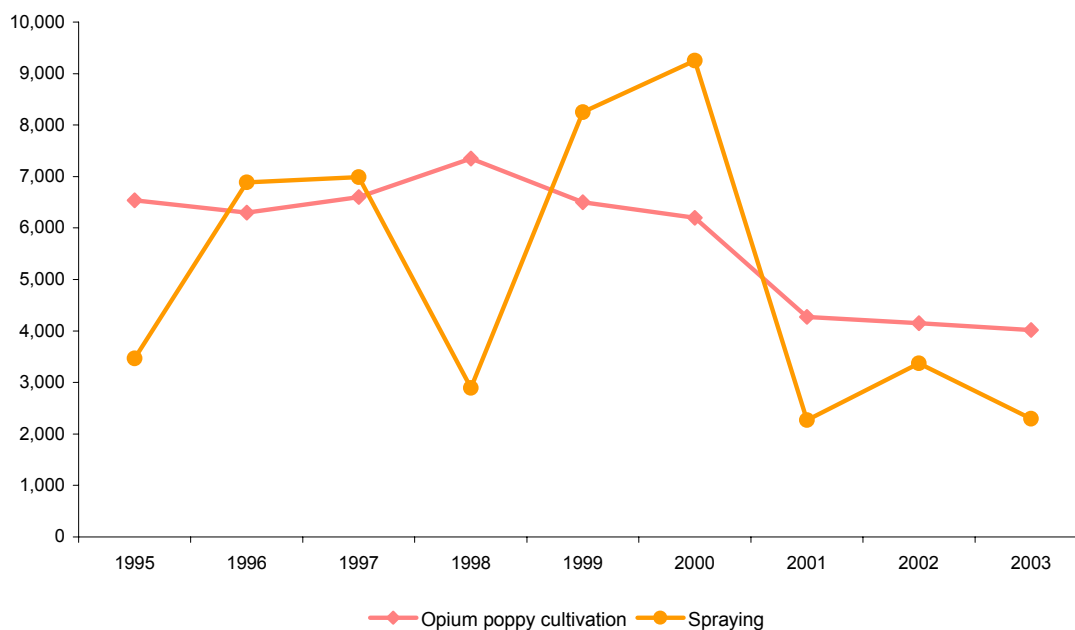
As can be seen from the graph below, the reduction in coca cultivation noted since 2002, corresponded mainly to an increased and sustained spraying effort.

Figure 18: Comparison of net coca cultivation and accumulated sprayed areas (in ha)



Sources: Coca cultivation UNODC; Accumulated spraying DIRAN

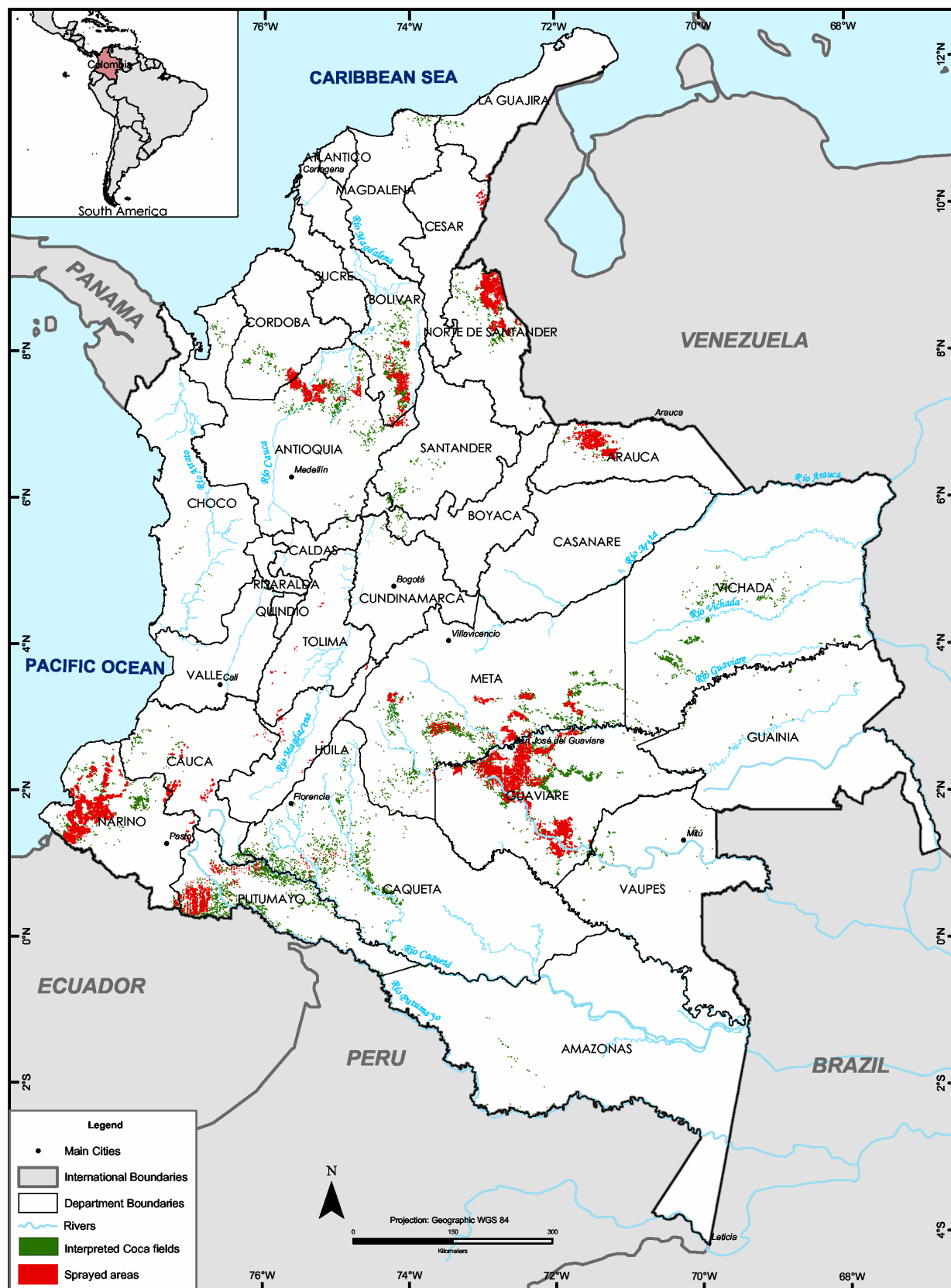
Figure 19: Comparison of net poppy cultivation and accumulated sprayed areas



Source: DIRAN

Colombia Coca Survey for 2003

Sprayed Coca areas in 2003



Source: Government of Colombia - UNODC Coca cultivation Survey 2003 and DIRAN for sprayed areas
 The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations

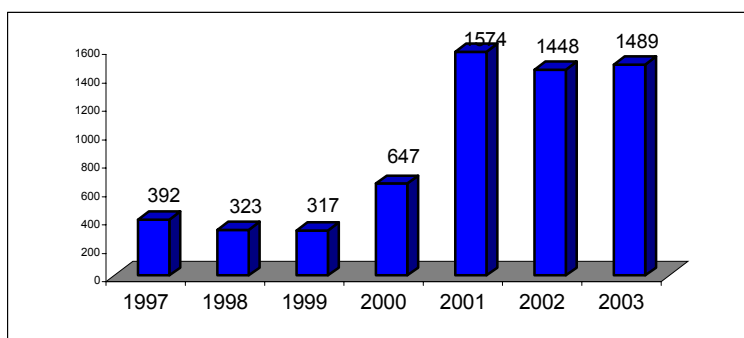
3.8 Drug Seizures

The cross analysis of information on location of illicit cultivation, seizures of drugs and precursors and destruction of laboratories provide interesting indications as to the existence of possible trafficking corridors, and allow for a better understanding of the dynamics that surround the overall drug business.

Although the UNODC was not involved in their collection, the data on seizures reported for 2003 by the government are reproduced below for information.

According to other Government sources, the Public Forces destroyed a total of 1,489 laboratories in 2003. Out of these, 827 corresponded to cocaine base laboratories, 632 to cocaine laboratories, 12 to cocaine paste laboratories, 11 to potassium permanganate laboratories, 4 ammonia and 3 heroin laboratories.

Figure 20: Illegal laboratories destroyed



Source: DNE consolidated from DIRAN, Armed Forces and DAS.

Between 2001 and 2002, about 45% of the detected and destroyed laboratories were located in Putumayo— at that time the department with the highest concentration of illicit cultivation in the country – followed by Norte de Santander (12%). The analysis of the data on seizures of 2003 revealed that 53% of the destroyed laboratories were located in the departments of Arauca, Antioquia and Magdalena, which are not major centres of coca cultivation, but more and more becoming centres for the storage and transformation of coca base in cocaine. Consequently, the data would indicate that laboratories are not located in the major coca cultivation areas, but rather in strategic areas that facilitate the trafficking of their production to the main markets.

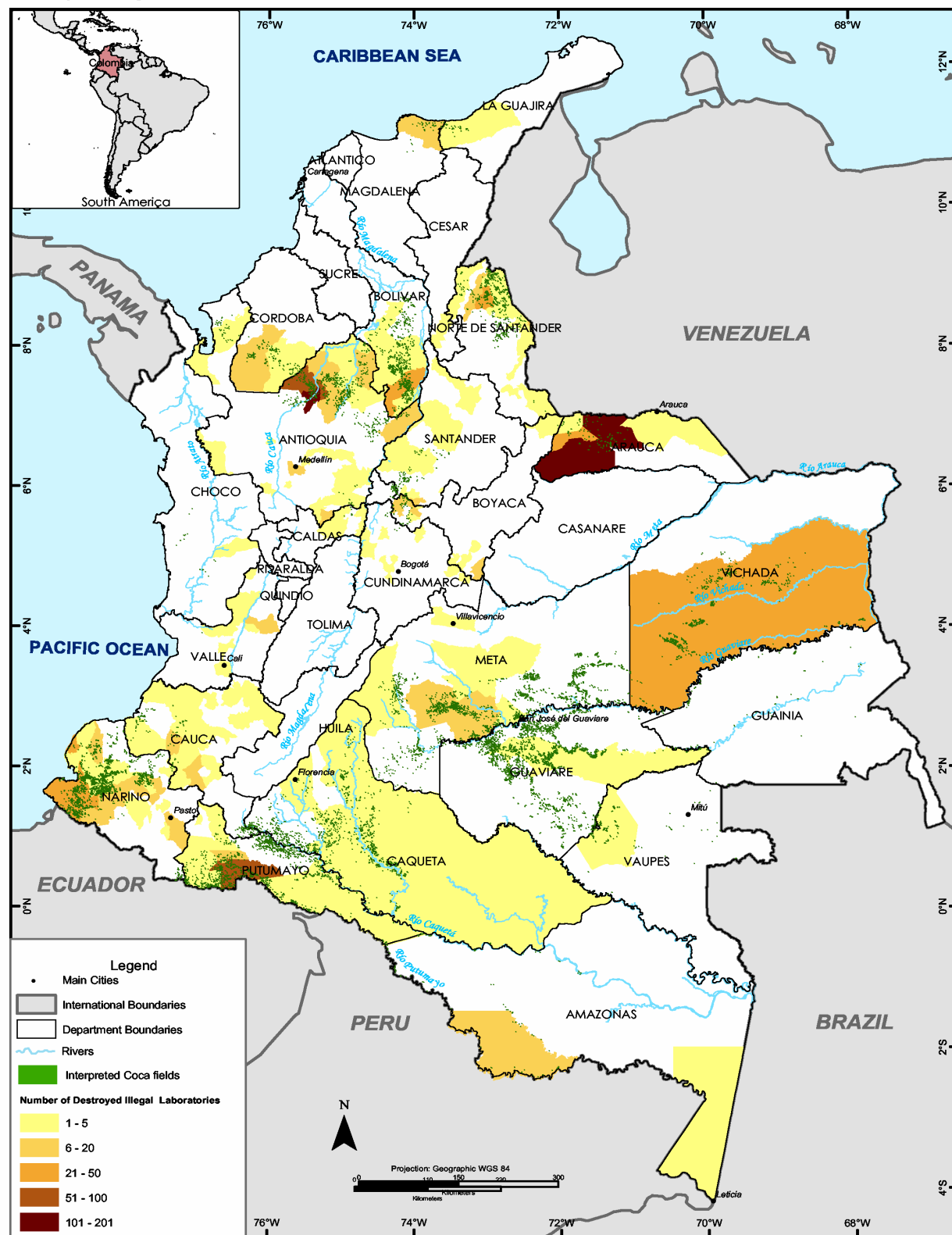
Table 30: Destroyed illegal laboratories per department

DEPARTMENT	2001	2002	2003
Arauca	25	46	350
Antioquia	63	85	277
Magdalena	93	159	162
Nariño	78	118	122
N. Santander	141	207	114
Putumayo	779	616	102
Cauca	16	10	51
Boyacá	27	7	49
Bolívar	25	12	37
Santander	17	6	38
Vichada	52	0	32
Valle	20	5	31
Meta	27	50	30
Amazonas	60	8	18
Caquetá	59	32	16
Guaviare	71	31	1
Guainía	3	11	
Otros	18	45	59
Total	1,574	1,448	1,489

Source: DNE. Consolidated from DIRAN and Armed Forces

Colombia Coca Survey for 2003

Destroyed Illegal Laboratories in 2003



Source: Government of Colombia - UNODC Colombian cultivation survey 2003

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

Colombia Coca Survey for 2003

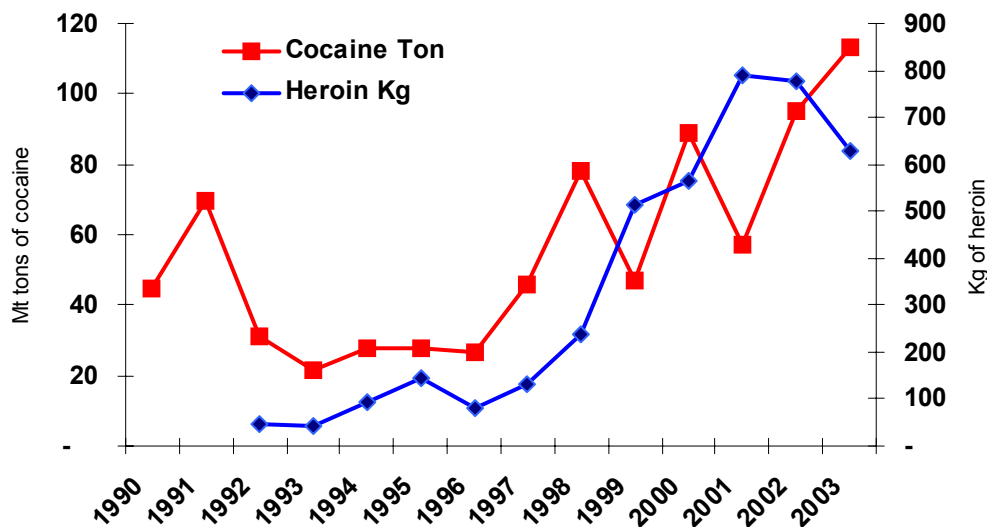
Table 31: Drugs seized¹⁶

Drugs Seized	1999	2000	2001	2002	2003
Cocaine (kg)	47,003	89,856	57,140	95,278	113,142
Coca Base (kg)	16,035	9,771	16,572	22,615	27,103
Basuco (kg)	543	802	1,225	1,706	2,988
Coca leaf (kg)	307,783	897,911	583,165	638,000	688,691
Coca Paste (kg)	365	118	53	974	2,368
Latex (kg)	29	17	4	110	27
Morphine (kg)	154	91	47	21	78
Heroin (kg)	515	564	788	775	629
Marihuana (kg)	70,124	75,465	86,610	76,998	108,942
Hashish (kg)	338	na	0.20	3,5	
Opium poppy seeds (grams)	49,945	17,000	43,000	123,900	86,500
Coca seeds (kg)	754,032	1,678	98,916	27,752	173,141
Marihuana seeds (kg)	25,214	121,350	11,310	510	24
Synthetic Drugs (kg)	1,022	na	22,750	175,382	5,042

Source: DNE. Consolidated from DIRAN, Armed Forces and DAS.

In the period 2001 – 2003, a total of 266 metric tons of cocaine and 2,191 kg of Heroin were seized. These products have in U.S.A. market, an estimated value of US\$ 5,200 millions and US\$ 234 millions respectively.

Figure 21: Cocaine and heroin seized



Source: DNE. Consolidated from DIRAN, Armed Forces and DAS

Most of large shipments of cocaine seizures took place on sea routes (55%) and the Pacific corridor continued to be the most important route for trafficking. As regards heroine seizures, 328 kg (52%) corresponded to seizures at airports, mostly trafficked with Human couriers or in luggage.

¹⁶ "Colombia's War Against Drugs. Actions and Results 2002."

Colombia Coca Survey for 2003

Table 32: Drug seizure by the place in 2003

Type of Drug	Sea		Airport		Rivers		Interior		Labs		Sea port		Land port		TOTAL	
	kg	cases	kg	cases	kg	cases	kg	cases	Kg	cases	kg	cases	Kg	cases	Kg	Cases
Cocaine	61.790	43	966	624	4	1	26.345	211	18.719	40	5.318	17	1.5	1	113.142	937
Heroine	51	3	328	259			235	42	2.4	1	7	3	4.6	1	629	309
Marihuana	3.908	5	136	9			130.224	409	464	8	180	2	28	1	134.939	434
Coca leaf					500	1	93.551	116	594.640	296					688.961	413
Éxtasis (u)			2.050	1			2.992	3							5.042	4
Coca base	41	4			17.2	4	15.470	666	11.283	73			292	2	27.103	749

Source: DNE. Consolidated from DIRAN, Armed Forces and DAS

According to the National Anti-Narcotics Bureau, a total of 44,305 goods were seized between 1989 and 2003. Out of these, 8,606 are urban real estate, 2,146 rural real state, 6,195 land vehicles, 1,923 rural real estate, 500 motorboats, 279 aircrafts, in addition to 666 business companies.

The next table shows the amount of personal goods seized by Armed Forces and National Police from 1997 to 2003

Table 33: Seizures of personal goods.

Type / year	1997	1998	1999	2000	2001	2002	2003
Fire arms	732	415	584	463	414	364	568
Vehicles	777	619	616	770	889	524	1,924
Boats	162	331	213	497	239	286	130
Aircraft	59	105	79	98	42	22	12

Table 34: Seizure of chemical substances

Seizures of solids, liquids controlled and non - controlled					
Substance	2000	2001	2002	2003	TOTAL
Controlled solids Kg.	545.574,71	838.957,94	1.621.737,86	1.162.443,50	4.168.714,01
Non – controlled Solids Kg.	251.528,91	520.968,45	1.005.431,51	1.348.527,33	3.126.456,20
Total solids	799103,62	1.361.927,39	2.629.171,37	2.512.973,83	7.295.170,21
Non – controlled Liquids Gal.	49.923,99	83.113,24	328.417,20	79.523,61	540.978,04
Controlled Liquids Gal.	849.062,30	1.376.873,14	1.900.957,76	1.663.468,21	5.790.361,41
Total liquids	898.986,29	1.459.986,38	2.229.374,96	1.742.991,82	6.331.339,45

Source: DNE. Consolidated from Armed Forces, National Police and DAS

3.9 Other applications of SIMCI data.

The geographical information generated by SIMCI on land use (forest, water, pastures, licit crops, infrastructure, urban areas etc.) also contributed to the planning of activities of various institutions such as UNODC and USAID, as well as to the Colombian Alternative Development programme.

The SIMCI II project was implemented with the participation of 12 experts from different government institutions, some of them not directly involved in the drug problem, but with experience in environment, health, licit agriculture, mapping, etc. In the future, it is expected that SIMCI will produce additional analysis and results with the inputs of these institutions, and in parallel allow these institutions to exploit on line the data produced by SIMCI II for their particular purposes.

3.9.1 Forest Warden Families Programmes

An important project presently been carried out by UNODC for Plan Colombia, is the Monitoring of the Government's "Forest Warden Families Programme", whose main objective is the incorporation of farmer families into a process of voluntary eradication of illicit crops and the recovering of forest in ecological and social vulnerable areas, through a contract with payments of a monthly salary (US\$ 125) per family per parcel in three years. The map shows the geographic location of the ten ongoing projects.

The Forest Warden Families Programme has three main components: environmental, social and economic, represented respectively by the preservation of the environment, an increase in social protection and a temporary financial aid to the beneficiary families. The selection criteria for the areas of each project is based in the identification of a number of districts within one or two municipalities that constitutes a geographic unit along with the commitment of the inhabitants to keep all farms of his own district free of illicit crops. This minds that a break of this commitment from just one family in a given district implies the retirement of all families of that district from the project. However, in practice, this environmental criteria has been replaced by the consideration of lists of families willing to enter in the agreement.

The Colombian government requested to UNODC to monitor as a third impartial and independent party, the achievements of the project in these three components and the verification of the fulfillment of obligations from both sides. To this end, a group of field experts have carried out the ground truth work, with the technical and substantive support of SIMCI II.

The role of SIMCI II to provide support to UNODC in this commitment has consisted mainly in the design of the monitoring methodology, the establishment of base lines at the initiation of each Forest Warden Families Programme and periodic verification of the absence of illicit crops as well as forest recovery using remote sensing tools.

The following table shows the ten ongoing projects with the number of benefited families, the illicit crop eradicated and the location of each of them. SIMCI II has provided base lines only for the projects where coca cultivation was eradicated in consideration that no opium poppy monitoring is been carried out.

Table 35: Forest Warden Families Projects

Project Name	Department	Benefited families	Illicit crop eradicated
Orito	Putumayo	2,800	coca
Sur de Bolivar	Bolivar	3,230	coca
Tolima	Tolima	3,249	Opium poppy
Alban	Nariño	2071	Opium poppy
Buesaco	Nariño	2,394	Opium poppy
Aponte	Nariño	650	Opium poppy
San Jose de Guaviare	Guaviare	170	coca
El Bagre	Antioquia	211	coca
Uraba	Antioquia	3,216	coca
Santa Marta	Magdalena	945	coca

It is not yet possible to establish clearly the number of illicit crops has eradicated in each area, due to inconsistencies in the geographic delimitation of the areas of work, and the frequent changes of families involved in the programme from one cycle to another. An in depth analysis of the achievements of the Forest Warden Families Programme as regards the eradication of illicit crops will be carried out at a later stage of the programme.

As a general activity, SIMCI II has supported various UNODC and GOC alternative development projects in geo-reference of the project area, monitoring methodologies and base line data using remote sensing tools and satellite imagery.

Legend

- Main Cities
- International Boundaries
- Department Boundaries
- Rivers
- Interpreted Coca fields
- Forest Warden Families Programme

Map Details:

- Geographic Labels:** CARIBBEAN SEA, ATLANTICO, MAGDALENA, CESAR, SUCRE, BOLIVAR, NORTE DE SANTANDER, CORDOBA, ANTIOQUIA, SANTANDER, BOYACA, CASANARE, VICHADA, GUAINIA, VAUPES, AMAZONAS, PERU, BRAZIL, ECUADOR, PANAMA, SOUTH AMERICA, Colombia.
- Major Cities:** Bogotá, Medellín, Villavicencio, Florencia, Iquitos, Leticia.
- Rivers:** Río Magdalena, Río Cauca, Río Atrato, Río Guaviare, Río Putumayo, Río Caquetá.
- Geographic Features:** Interpreted Coca fields (green dots), Forest Warden Families Programme (orange dots).
- Projection:** Geographic WGS 84
- Scale:** 0 to 300 Kilometers
- Coordinates:** 76°W, 74°W, 72°W, 70°W, 68°W; 12°N, 10°N, 8°N, 6°N, 4°N, 2°N, 0°N, 2°S, 4°S

4. METHODOLOGY

4.1 Coca Cultivation

Cocaine is the principal alkaloid extracted from the different species and varieties of the *Erythroxylum*, cultivated in the foothills of the Andes, from Ecuador to Bolivia and other south-American regions such as Colombia, the Caribbean and the middle of Brazil. In favourable conditions, the coca bush is 1.5 meters high and can produce four or five crops per year.

There are more than 250 species of coca, from which about 200 are native from the American tropics. The coca bush is sensitive to cold weather and it can grow in wild conditions up to 1000 meters altitude. In cultivation conditions it can grow up to 2000 meters altitude.

Scientifically, two productive coca varieties can be found in Colombia: *Erythroxylum coca* (known as “Tingo Maria”) and *Erythroxylum novogranatense* (known as “Caucana”). The Tingo Maria variety was introduced from Peru in the 90’s because of its higher productivity (up to six harvests per year) than the traditional Caucana variety (usually three harvests per year).

The time from sowing to harvesting is estimated to be between six and nine months, depending on the variety and the growing practices.

In general, the farmers purchase the seeds and sow them in rudimentary seedbeds until they are three months old. The seedlings are then transplanted to the field, at a rate of approximately 12,500 plants per hectare.

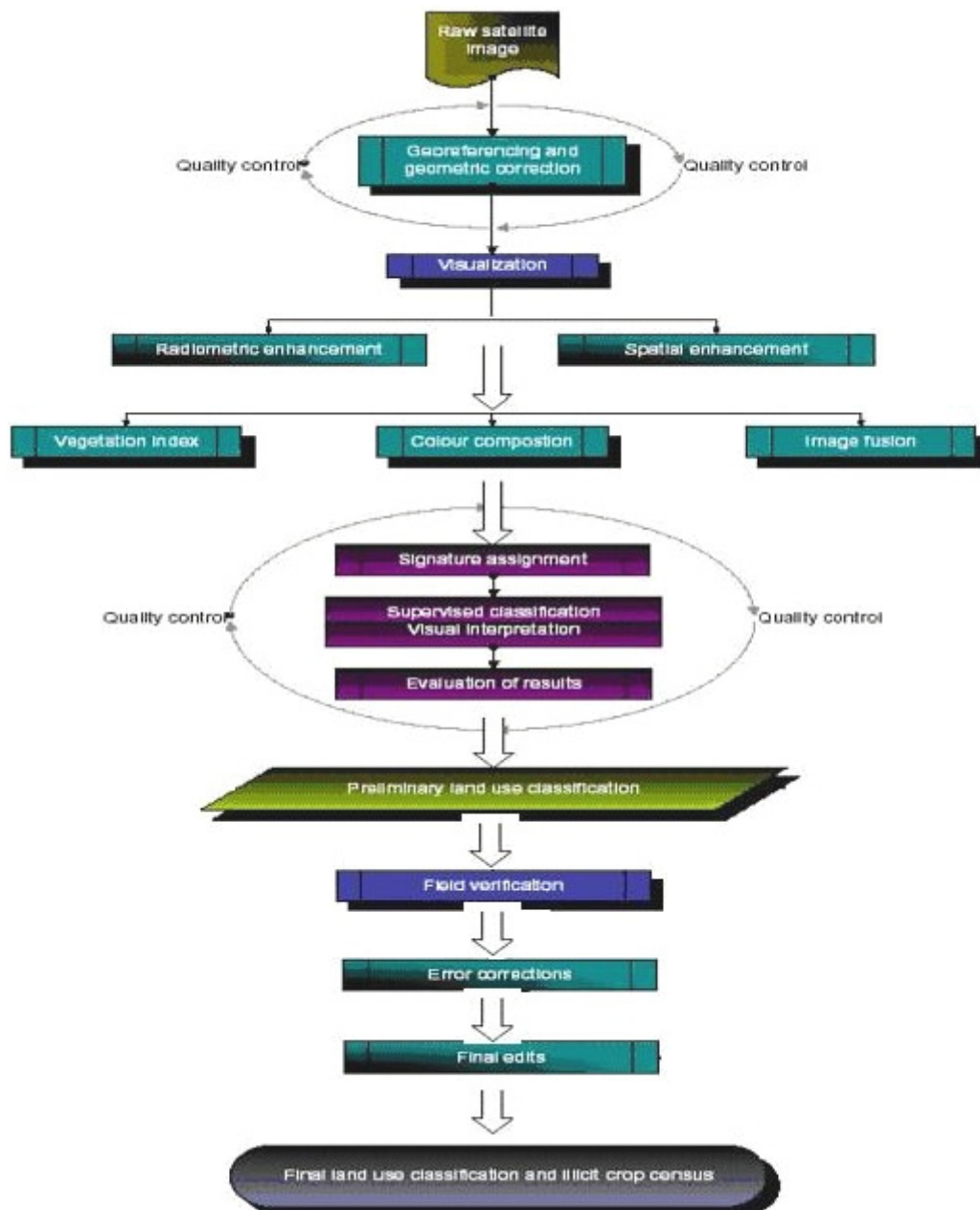
Coca cultivation in Colombia is located in remote regions, including national parks, indigenous reservations and other areas that lack infrastructure, although coca lately has turned up in more developed areas, such as the coffee growing zone. More than 69% of the coca is grown on small plots, while the remainder is found on plantations bigger than 3 hectares, much of it controlled by outsiders with links to drug cartels. This does not necessarily mean that more than half of the area under coca is cultivated by peasants – many of the large scale producers fragment and disperse their fields in order to avoid aerial reconnaissance.

Coca crops interpretation

The monitoring of illicit coca bush cultivation is based on the interpretation and digital processing of LANDSAT, ASTER and SPOT satellite images. For 2003 census, the project analyzed a total of 39 LANDSAT images, 45 ASTER and 4 SPOT images, taken between September 2003 and February 2004.

The following chart shows the work flow of the interpretation process:

Figure 22: Image interpretation process :



The survey steps can be summarized as follows:

- Identification and acquisition of LANDSAT and SPOT images, with as little cloud cover as possible. The images cover the whole national territory less the islands of San Andres and Old Providence, equivalent to 1,142,000 km².
- Geometric correction of the images and geo-referencing to the national grid. Radiometric and spatial enhancement of the images for a better identification of coca cultivation.

- Identification of training samples of the different land use and vegetation types to be classified.
- Supervised classification of land use and vegetation according to the established legend. Manual, visual identification and delineation of all coca fields using the previously classified land use as base information. Corrections for spraying effects, cloud cover and temporal changes from date of image acquisition to the census date. Ground verification and quality control of the results.
- Incorporation of results in a spatial database system and superimposition of coca fields over the administrative map of Colombia.

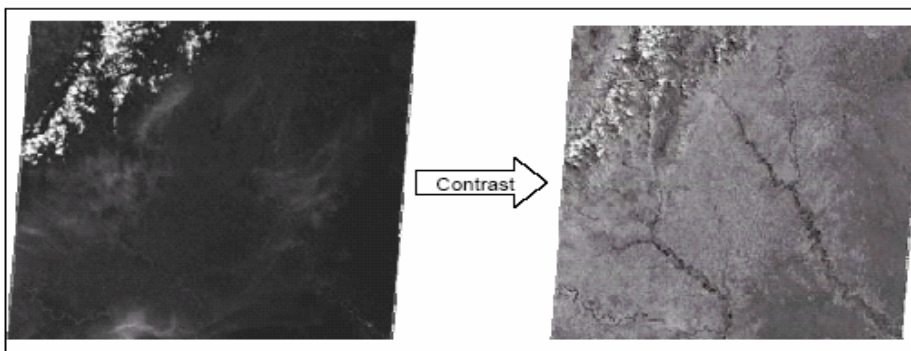
Geometric image corrections:

- Raw, remotely sensed image data gathered by a satellite or aircraft are representations of the irregular surface of the Earth. Even images of seemingly flat areas are distorted by both the curvature of the Earth and the sensor being used. Before the project can use the images, they have to be geometrically corrected so that they can be represented on a planar surface, conform to other images, and have the integrity of a map.
- Rectification is the process of transforming the data from one grid system into another grid system using a geometric transformation. Since the pixels of the new grid may not align with the pixels of the original grid, the pixels must be re-sampled.
- Re-sampling is the process of extrapolating data values for the pixels on the new grid from the values of the source pixels.
- Geo-referencing refers to the process of assigning map coordinates to image data. The image data may already be projected onto the desired plane, but not yet referenced to the proper coordinate system. Rectification, by definition, involves geo-referencing, since all map projection systems are associated with map coordinates.

Radiometric enhancements:

In order to improve the visual interpretation process, radiometric enhancements are performed on the display device to increase the contrast of the analyzed image in certain spectral ranges of the input data (i.e. certain crop types). This process is called contrast stretching.

Figure 23: Example of the effects of radiometric enhancement

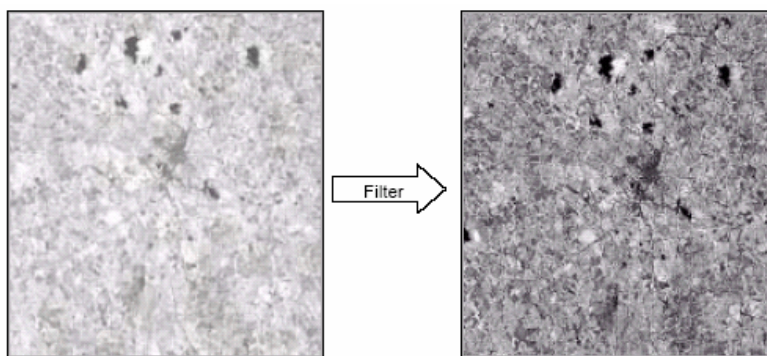


Spatial enhancement:

While radiometric enhancements operate on each pixel individually, spatial enhancement modifies pixel values based on the values of surrounding pixels. To enhance the spatial characteristics of an image (i.e. softening or sharpening), filters are applied to the raw image data.

Filtering is a broad term, which refers to the altering of spatial or spectral features for image enhancement (Jensen 1996). Convolution filtering, for example, is one method of spatial filtering.

Figure 24: Example of the effects of spatial enhancement



Band combinations:

When displaying a satellite image, it is possible to assign which layers (bands) are to be displayed with which colour. The data file values in each layer are input to the assigned “colour gun”. The most useful colour assignments are those that allow for an easy interpretation of the displayed image. For example:

A natural-colour image approximates the colours that would appear to a human observer of the scene. A colour-infrared image shows the scene as it would appear on colour-infrared film, which is familiar to many analysts.

Band assignments are often expressed in R,G,B, order. For example, the assignment 4,2,1 means that band 4 is assigned to red, band 2 to green, and band 1 to blue.

The following examples show the different colour compositions used to support the identification of illicit crops, pastures, water bodies, forest and other vegetation types.

Figure 25: Display coloured composition

Landsat 7 Bands	True colour	Colour infrared (vegetation enhanced)	False Colour (thematic)
BLUE	Blue		
Green	Green	BLUE	Blue
Red	Red		
Near infrared		Red	Green
Mid infrared 1			Red
Mid infrared 2		Green	

Image interpretation:

Multi-spectral classification is the process of sorting pixels into a finite number of individual classes, or categories of data, based on their data file values. If a pixel satisfies a certain set of criteria, the pixel is assigned to the class that corresponds to that criterion. In order to enable the computer system classify a multi-spectral image, it must be trained to recognize patterns in the data. Training is the process of defining the criteria by which these patterns are recognized (Hord, 1982). Training can be performed with either a supervised or an unsupervised method.

Supervised training, as being implemented in the project census work is closely controlled by the analyst. In this process, pixels that represent the land cover features defined in SIMCI's classification scheme are selected by the engineer. The result of training is a set of signatures that defines a training sample or cluster. Each signature corresponds to a class, and is used with a decision rule to automatically assign the pixels in the image file to a class. The 14 classes used by the project are:

- Coca crops
- Primary forest and rainforest
- Secondary forest and shrubs
- Grassland and scrubs
- Water bodies
- Sand banks
- Other crops
- Clouds and shadows
- Roads
- Urban and populated areas
- Inundated areas
- Rock outcrops
- Other
- Bare soil

In addition to the experience of SIMCI engineers, secondary information is used to support the identification of land use classes and coca plantations. An important source of information is the record of the flight of the spraying airplanes. Another source is aerial-photos taken by the Antinarcotics police (DIRAN) to plan and monitor forced eradication, as well as results from their aerial surveillance and aerial survey work.

The interpretation process itself is composed of two separate methods:

- Supervised classification of the land use and vegetation cover except coca, as defined in the classification scheme.
- Manual, visual identification and delineation of every coca field present in the analysed image.

The manual process of identifying every single coca field is assisted by techniques provided by the image analysis software, such as on screen polygon digitizing and pixel seeding. The latter technique allows the analyst to identify a single pixel (seed pixel) that is representative of the training sample. This seed pixel is used as a model pixel, against which the pixels that are contiguous to it are compared based on parameters specified by the interpreter. When one or more of the contiguous pixels is accepted, the mean of the sample is calculated from the accepted pixels. Then, the pixels contiguous to the sample are compared in the same way. This process repeats until no pixels that are contiguous to the sample satisfy the spectral parameters. In effect, the sample grows outward from the model pixel with each iteration. These homogenous pixels are converted from individual raster pixels to a polygon representing one coca field. This method is known as “seed pixel”.

Another method for identification of vegetation is carried out in the project, using new software based in identification of “objects” instead of single pixels. These objects are clusters of similar pixels, generated in the image through a segmentation process in which pixels are merged taking in account a homogeneity criterion. The resulting objects representative of a particular vegetation, are assigned by the interpreter to that class, using either a set of intrinsic, semantic and topologic features or a manual method classification, having so the particular vegetation pixels just by identifying the object that is representative of this particular cultivation.

Only productive coca plants can be identified by means of multi-spectral image analysis. Unproductive coca, i.e. seedlings, harvested stems or sprayed plants show the same spectral characteristics as bare soil or river banks, and are therefore classified accordingly. Since six to nine months are required for these coca classes to become productive again they are not included in the census (see also chapter on corrections).

After identifying all coca fields in an image, they are combined with the previously classified land use to represent the complete land use map. Finally, the preliminary results are evaluated, refined and corrected by a second team of engineers in order to obtain a product of higher quality and accuracy.

Corrections:

Four types of corrections have been applied to the initial results of an image interpretation:

1) Correction for spraying

In most of the cases, the date of image acquisition did not coincide with the spraying date. Since coca bushes require six to nine months to grow from a seedling to a productive crop, only spraying actions carried out during the last six months of 2003 were included in the corrections for spraying. Two scenarios were considered:

- Image acquired before the spraying activities.

In this case, 91.5% of the area identified as coca and coinciding with the spraying buffers was subtracted from the census results the 91.5% accounted for the spraying effectiveness as provided by DIRAN/NAS for 2003. This percentage was higher than in 2002 (83% of spraying efficiency) because of the higher concentration of glyphosate in 2003.

- Image acquired after the spraying activities

In this case, the area identified as coca and coinciding with the spraying buffers was maintained. As the effects are only noticeable about 15 days after the spraying, images acquired within 15 days after sprayings were treated according to the first scenario.

Spraying information was automatically recorded in a system called SATLOC installed in the spraying airplane and recording the location, length and width of the spraying paths. The data were provided to the project by the Antinarcotics Police. The coordinates of the spraying lines were imported to a GIS database and adjusted to the same geographic projection and coordinate system as for the processing of the satellite images. A buffer is applied around the spraying lines according to the width of the spraying path (the width depends on the airplane type) and provides the effective area sprayed used for correction.

Corrections for eradication were applied in the department of Nariño, Guaviare and Norte de Santander. A total of 2,644 ha (or 3%) was subtracted from the initial interpretation of 78,892 ha of coca cultivation. The breakdown of the correction applied by department is presented in annex.

Figure 26: Example of buffers (in yellow) calculated around the SATLOC paths (in black).

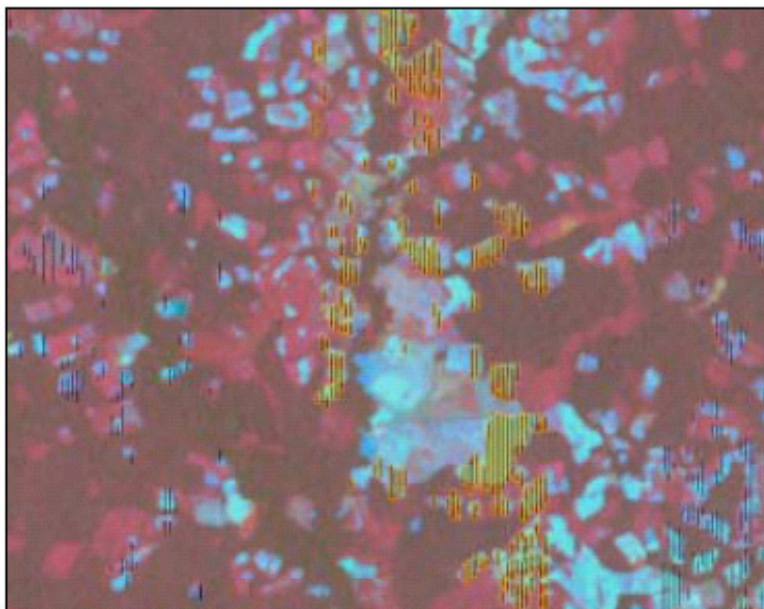
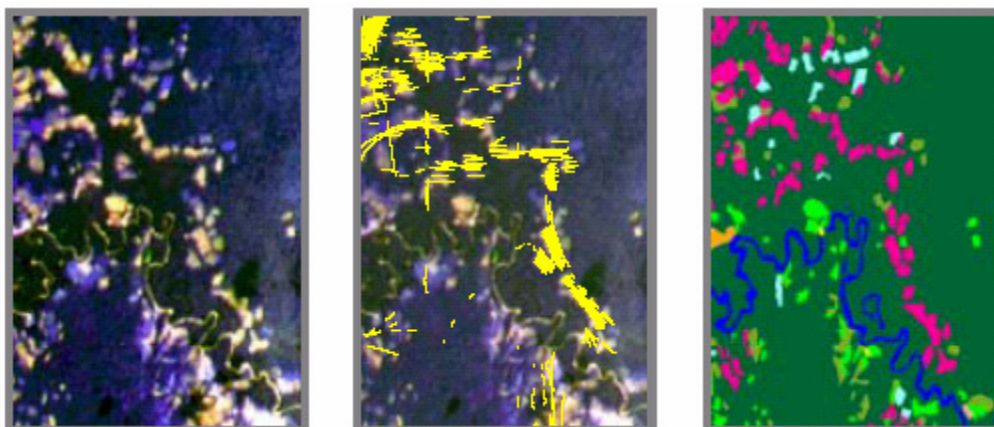


Figure 27: Example of correction process for spraying.



2) Correction for cloud cover

Due to the weather conditions prevailing in the tropical areas, the satellite images acquired often contained some clouds preventing the interpretation of coca fields underneath. As a first step, buffers of one kilometre width around the cloud covered areas in 2003 were generated and coca cultivation within this buffer was measured. The results of the most recent available survey (2002, 2001 or 2000) coinciding with the buffered areas were compared with the coca measured in 2003 within the buffer. The calculated trends in coca cultivation within the buffer between 2003 and previous years, was applied to the coca cultivation found in previous years under the area covered by clouds in 2003.

Corrections for cloud cover were applied in all departments (see breakdown in annex 7). For the whole country, a total of 4,594 ha (or 6 %) were added to the initial interpreted coca cultivation of 78,892 ha.

3) Correction for gaps in Landsat images (SLC-off anomaly)

The gap areas, without information caused for the scan line corrector failure in Landsat images that occurred in May 2003, were corrected in identical way as the cloud correction, considering both cases like areas without information for different causes. The only difference is the width of the buffer that in this case is only 300 meters because of the distance between to consecutive gaps. The area of coca interpreted in ASTER, SPOT and LANDSAT images on areas not affected by this anomaly sum 37,400 ha or 47% of the total area.

4) Correction for various acquisition date of images (antiquity)

As the satellite images used in the census had different acquisition dates, the initial interpretation results were updated to the cut-off date of 31 December 2003.

The difference in coca cultivation between the previous and current images acquired over the same area was divided by the number of months separating the two images to provide the mean monthly coca growing rate. This rate was multiplied by the number of months separating the current image and the cut-off date and the product added or subtracted to the initial interpreted results.

Because growing cycles and crop dynamics were disrupted in sprayed areas, the corrections for antiquity were not applicable in these areas, except if in spite of spraying activities, the interpretation

of the satellite images showed an increased in coca cultivation. In this special case, the correction for antiquity applied.

Correction for antiquity calculated was 1100 ha (or 1% of the initial results) for the whole country and were added from the initial interpreted results of 78,892 ha.

The detailed breakdown of correction by department is presented in annex. All together, the three corrections amounted to 7447 ha (or 9%) that were added to the initial interpretation results. The area interpreted on images within one month from de cut-off date reaches 48,000 ha or 61%.

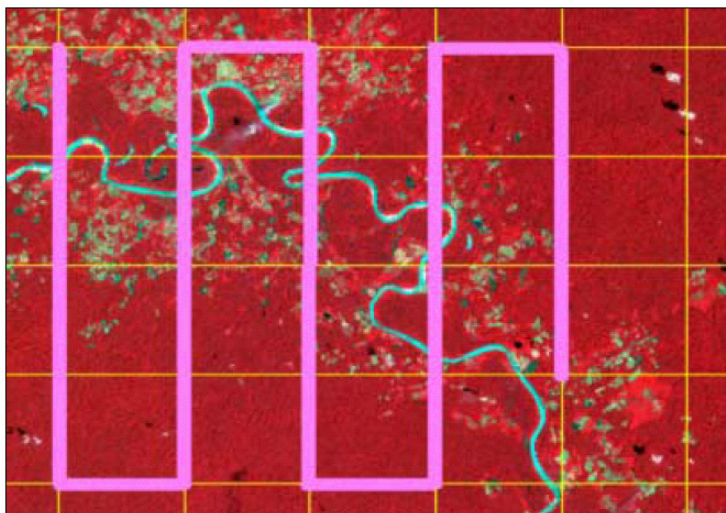
Field verification:

To correct and improve the results of the preliminary interpretation, 104 hours of flight verification were carried out before the final process of quality control. The verification process was conducted over 13 departments. The number of flight hours by department is presented in annex.

The field verification aimed at finding errors in land use class assignment, changes in land use since the acquisition date, as well as geometric discrepancies between digitized polygons and their counterparts in the real world.

After setting the flight lines on a pre-established grid, the analyst on board the plane starts the initial interpretation of some specific areas. Special attention was given to problematic area or areas for which there were conflictive interpretation results between different interpreters.

Figure 28: Example of verification flight set-up



The results of the field verification were documented with photos or videos and registered in a verification table.

Finally, the preliminary interpretation results were edited and corrected manually based on the field verification findings.

Quality control

Contrary to the verification work, the quality control component of the survey does not change the initial interpretation of the satellite images, but is performed to assess the accuracy of this interpretation work. To this aim, a sample of fields interpreted on the satellite images as coca fields are randomly selected and their interpretation verified against another source of information considered as the reference for what is actually grown on these fields.

Reference information is normally obtained by visiting and checking the correctness of the interpretation of the images on the spot, but logistics difficulties related to the availability of aircrafts did not allow the implementation of the designed quality control methodology. Instead, other sources providing accurate information on the vegetation coverage had to be used: High-resolution multi-spectral aerial images provided by NAS (MDIS images), geo-referenced records of flying paths taken during the spraying actions (DELNORTE), and photographs taken from a portable digital camera on board a small aircraft shortly after the census cut off date of December 2003 and geo-referenced with GPS. Therefore, the accuracy was calculated as the percentage of correctly interpreted polygons over the total number of polygons checked and not over areas of the polygons, which normally result into a higher percentage of accuracy.

The data from a total of 144 reference areas randomly selected (polygons on the satellite images), were cross-checked with the satellite interpretation results. It revealed an accuracy of the satellite interpretation of 89 % (87 % in 2002) for the thematic identification of coca fields (number of correctly interpreted polygons over total number of polygons checked).

Figure 29: Quality Control

	MDIS images	DELNORTE	Aerial photographs	Total
Sample:				
Number of polygons	35	38	71	144
Correct				
Number of polygons	33	38	71	128

Established and possible new coca zone

Although the satellite images were acquired over the whole country, the project distinguished between the established coca area over which over-flight and accuracy assessment were performed and the possible new coca area over which the project only identified potential coca fields but without thorough field verification. The national estimates were limited to the coca cultivation interpreted in the established coca area. The findings over the possible new coca areas are presented separately.

Area of influence

The project established buffers of approximately 300 meters from the center around sets of conglomerated coca plots, referred to as "areas of influence".

Table 36: Satellite survey meta-data

Total land size of the country	1,141,748 km ²
Percentage of total land size studied	100 %
Percentage of total land cultivated in coca	0.075 %
Area of influence	1,184,857 ha
Mean Coca cultivation density	6.5 coca ha/km ²
Satellite images processed in established area	39 Landsat (5 duplicates) 4 SPOT and 41 ASTER
Satellite images processed in non established area	18 Landsat
Area covered by one Landsat image	3,240,000 ha
Area covered by one SPOT image	360,000 ha
Area covered by one ASTER	360,000 ha

Spatial Analysis

The Geographic Information System (GIS) database set up by the project made it possible to monitor the dynamics of coca cultivation and assisted in the planning of institutions involved in drug control activities such as the National Police, Plan Colombia, and the ministries of Environment, Agriculture, Justice and Interior.

The GIS database enabled, inter alia, to elaborate detailed maps with information on changes in land use related to forests, illicit crops in natural reservoirs, and the selection of areas suitable for alternative development programmes.

One of the most direct applications of the geographical analysis was the quantification of licit crops and natural vegetation replaced with coca cultivation, and the land use evolution following the abandonment or eradication of coca fields. Through the study of the coca cultivation within agricultural and protected areas, the project could also provide valuable information to environmental studies and rural development projects.

The project also analysed the relationship between coca cultivation and other socio-economic factors.

4.2 Opium Poppy Cultivation

The project has not yet been able to identify a reliable methodology for the identification of opium poppy due to the conditions prevailing in the mountainous poppy growing areas (almost constant cloud cover, small size of fields often interspersed with other crops). The medium-resolution Landsat and SPOT images cannot be used, and even the high-resolution IKONOS images and aerial photography are not always sufficient. There is a need to intensify the research in this field; also using the experience from the UNODC supported illicit crop monitoring projects in Asia.

Up to now, the opium poppy estimates were performed by the DIRAN through aerial reconnaissance of the opium poppy growing areas. These flights were carried out two or three times during the year on a small airplane. The observer on-board recorded the GPS coordinates of observable poppy fields and estimated the field area.

4.3 Coca and Opium Yield

Several known coca varieties are found in Colombia, such as the traditional “Caucana”, the Peruvian “Tingo Maria” and the Bolivian “La dulce”. Average yields vary from department to department, depending on, among other factors, the coca variety predominantly cultivated.

Field work indicated that high-yield varieties were being introduced by coca farmers, but UNODC has not yet conducted a scientific and comprehensive study on coca leaf and cocaine productivity in Colombia.

To establish an estimate for the purpose of the present report, UNODC therefore relied on information available from other sources for coca as well for opium poppy. The most comprehensive work on this topic so far has been done by the US government (Operation Breakthrough) though also DIRAN has their own methodology based on the mentioned “Operation” and field work in some regions.

4.4 Coca and Opium Prices

Prices of coca base and opium latex were collected by field technicians through interviews of farmers in the various coca and opium poppy growing departments. PNDA, the government’s alternative development authority, collected prices in Caquetá, Vichada, Norte de Santander, Nariño, Meta, Guaviare, Cauca, Putumayo and Bolivar. UNODC also collected prices in Caqueta, Putumayo, Guaviare, South Bolivar and Meta.

DIRAN also performs surveys through intelligence methods for cocaine, coca base and heroin in several cities of the country.

PDA carries on monthly surveys about these same topics in their projects located on high density cultivation areas

5. ANNEXES

Annex 1: Satellite image coverage (LANDSAT, ASTER and SPOT)

Image Landsat No.	Area	Date	Image Aster – Spot Lat / Long K / J		Area	Date
4-57	Guaviare	Feb 3-04	-2.26°	-71.99°	Amazonas	Nov. 29/03
4-58	Guaviare	Feb 3-04	-0.39°	-75.01°	Putumayo	Jan. 23/04
5-57	Guaviare	Oct 21-03	-0.13°	-74.52°	Putumayo	Jan. 30/04
5-58	Guaviare	Dec 8-03	0.04°	-75.68°	Putumayo	Oct. 26/03
5-59	Guaviare	Aug 2-03	0.15°	-74.90°	Putumayo	Jan. 23/04
6-55	Arauca	Dic-15-03 - Feb. 1-04	0.40°	-74.40°	Putumayo	Jan. 30/04
6-58	Guaviare	Sep 26-03	0.42°	-71.42°	Guaviare	Nov. 29/03
6-59	Guaviare				Putumayo	
		Aug. 25-03 - Jan.16-04	0.52°	-76.72°	Caquetá	Sep. 15/03
6-60	Guaviare	Aug 25-03	0.57°	-75.57°	Putumayo	Oct. 26/03
6-61	Amazonas	Aug 25-03	0.66°	-76.17°	Putumayo	Sep. 24/03
					Caquetá	
6-62	Amazonas	Aug 25-03	0.68°	-74.78°	Putumayo	Jan. 23/04
					Caquetá	
7-55	Arauca	Feb 8 -04	0.94°	-74.29°	Guaviare	Jan. 30/04
7-58	Guaviare	Oct 3-03	0.96°	-69.78°	Guaviare	Dec. 08/03
7-59	Guaviare	Oct 3-03	0.96°	-71.31°	Guaviare	Nov. 29/03
7-60	Putumayo	Oct 3-03	1.11°	-75.45°	Putumayo	Oct. 26/03
7-61	Amazonas	Oct 3-03	1.22°	-74.67°	Putumayo	Jan. 23/04
8-52	Magdalena	Dec 13-03	1.48°	-74.17°	Guaviare	Jan. 30/04
8-54	Bolívar	Oct. 10-03 - Jan.30-04	1.62°	-72.10°	Arauca	Jan. 16/04
8-55	Bolívar	Jan 30-04	1.64°	-75.34°	Putumayo	Oct. 26/03
8-56	Boyacá	Nov 27-03	1.67°	-78.61°	Cauca Nariño	Nov. 25/03
8-58	Guaviare	Oct 26-03	1.75°	-74.55°	Putumayo	Jan. 23/04
8-59	Putumayo	Oct 26-03	2.01°	-74.06°	Guaviare	Jan. 30/04
8-60	Putumayo	Oct 26-03	2.01°	-77.15°	Cauca Nariño	Feb. 13/04
9-54	Bolívar	Nov18-03	2.21°	-78.50°	Cauca Nariño	Nov. 25/03
9-55	Bolívar	Oct.17-03 - Feb.6/04	2.24°	-72.55°	Guaviare	Feb. 01/04
9-58	Cauca - Nariño	Feb 6 / 04	2.29°	-74.44°	Guaviare	Jan. 23/04
					Putumayo	
9-59	Putumayo - Caquetá	Oct 17-03	2.55°	-73.95°	Guaviare	Jan. 30/04
9-60	Putumayo - Caquetá	Nov 18-03	2.75°	-73.81°	Guaviare	Sep. 1/03
10-54	Antioquia	Nov 25-03	3.08°	-73.83°	Guaviare	Jan. 30/04
10-55	Choco	Nov 25-03	3.62°	-70.63°	Guaviare	Feb. 17/04
10-56	Choco	Nov 25-03	4.17°	-69.09°	Vichada	Dic. 08/03
10-57	Choco	Jan 28-04	4.29°	-69.92°	Vichada	Feb. 10/04
10-58	Cauca -Nariño	Oct.24-03 - Feb.13-04	4.71°	-68.98°	Vichada	Dec. 08/03
10-59	Cauca	Feb 13-04	4.84°	-69.94°	Vichada	Sep. 03/03
	Nariño					
			6.44°	-71.07°	Arauca	Jan. 16/04
			6.52°	-71.64°	Arauca	Feb. 01/04
			7.06°	-71.53°	Arauca	Feb. 01/04
			7.38°	-74.58°	Bolívar	Dec. 04/03
			7.97°	-74.81°	Antioquia	Aug. 30/03
			8.10°	-72.67°	Bolívar	Sep. 01/03
			8.64°	-72.56°	Bolívar	Sep. 01/03
					Putumayo	
			642	348-8	Caquetá	Sep. 15/03
					Putumayo	
			643	349-1	Caquetá	Sep. 15/03
			644	327-9	Magdalena	Aug. 31/03
			647	332-3	Bolívar	Sep. 01/03

Annex 2: Satellite image coverage of possible new coca areas

IMAGE	REGION	DATE
358	GUANIA	10-Dic-03
359	GUANIA	23-Oct-03
456	VICHADA	01-Dic-03
463	AMAZONAS	27-Ago-03
556	VICHADA	10-Feb-04
560	VAUPES Y AMAZONAS	25-jan-04
561	AMAZONAS	25-jan-04
562	AMAZONAS	02-Ago-03
656	CASANARE	01-Feb-04
657	META, CASANARE, VICHADA	01-Feb-04
752	GUAJIRA	01-Sep-03
756	BOYACA, CASANARE, SANTANDER	08-Feb-04
757	META CASANARE Y CUNDINAMARCA	08-Feb-04
853	CESAR Y GUAJIRA	30-jan-04
857	CUNDINAMARCA, TOLIMA Y META	30-jan-04
953	MAGDALENA ATLANTICO Y BOLIVAR	21-jan-04
956	CALDAS, RISARALDA, CHOCO, ANTIOQUIA	06-Feb-04
957	VALLE DEL CAUCA, QUINDIO, TOLIMA, RISARALDA, CHOCO	06-Feb-04

Colombia Coca Survey for 2003

Annex 3: Verification flights

2003	Destination	Dates	Days	Hours of flight	Tasks	Type of vehicle
	SIERRA NEVADA BOLIVAR GABARRA ARAUCA	21 FEBRERO 2003 FABRERO 24 2004	4	26	Field Verification	Caravan Airplane
	CHOCO – CAUCA NARIÑO PUTUMAYO CAQUETA GUAVIARE	MARCH 16 MARCH 19 2004	4	30	Field Verification	Caravan airplane
	GUAVIARE - META	MARCH 28 MARCH 31 2004	4	17	Field Verification	Caravan airplane
	GUAVIARE – META VICHADA - GUAINIA	APRIL 12 APRIL 13 2004	2	16	Field verification	Caravan airplane
	NATIONAL PARKS	APRIL 27 APRIL 28 2004	2	15	Field verification	Caravan airplane

Colombia Coca Survey for 2003

Annex 4: Results of quality control

In order to achieve suitable results to determine the degree of confidence in the final data of the coca census, different methods of verification were applied depending on the availability of other and more accurate sources of information such as high resolution imagery, field reports on spraying through GPS data and aerial photographs, to evaluate the sample selected by statistics procedures.

EVALUATION		VERIFICATION METHOD			
		MDIS images	Spraying Controls	Aerial Photographs	TOTAL
TOTAL EVALUATED	Área (ha)	N.a	N.a	N.a	N.a
	No. Polygons	35	38	71	144
NOT EVALUATED	Área (ha)	N.a	N.a	N.a	N.a
	No. Polygons	0	0	0	0
TOTAL SAMPLE	Área (ha)	N.a	N.a	N.a	N.a
	No. Polygons	35	38	71	144

Quality Controls Results

EVALUATION RESULTS		VERIFICATION METOD			
		MDIS images	Spraying Controls	Aerial Photographs	TOTAL
HITS	No. Polygons	33	38	71	144
ERRORS	No. Polygons	2	38	57	144
NOT EVALUATED	No. Polygons	0	0	0	0

Colombia Coca Survey for 2003

Annex 5: Correction for cloud cover, eradication, antiquity for 2002 by department (in ha).

Departament	Interpreting ha	Corrections				Total ha
		Clouds	Spraying	Gaps	Antiquity	
ANTIOQUIA	4215	55	-2	60	-55	4273
AMAZONAS	550	36	0	39	0	625
ARAUCA	538	0	0	0	1	539
BOLÍVAR	3881	121	-1	542	-73	4470
BOYACÁ	546	15	0	6	27	594
CALDAS	51	1	0	0	2	54
CAQUETÁ	6671	73	-4	349	141	7230
CAUCA	1185	113	0	225	-80	1443
CHOCO	135	318	0	0	0	453
CÓRDOBA	790	2	0	44	2	838
CUNDINAMARCA	52	1	0	1	3	57
GUAÏNIA	625	5	0	77	19	726
GUAVIARE	14692	188	-827	1392	718	16163
LA GUAJIRA	275	2	0	13	-15	275
MAGDALENA	538	1	0	0	-55	484
META	11096	193	-806	1144	1187	12814
NARIÑO	15616	2672	-578	28	-110	17628
NORTE DE SANTANDER	4820	18	-402	34	1	4471
PUTUMAYO	7390	484	0	202	-517	7559
SANTANDER	581	16	0	6	29	632
VALLE	13	24	0	0	0	37
VAUPES	951	190	-19	69	-34	1157
VICHADA	3681	66	-5	167	-91	3818
TOTAL	78892	4594	-2644	4398	1100	86340

Colombia Coca Survey for 2003

Annex 6: Coca cultivation in National Parks in ha (2001-2003)

PARK	CENSUS 2001	CENSUS 2002	CENSUS2003
ALTO FRAGUA - INDI WASI	0	16	8
CATATUMBO-BARI	72	85	129
CORDILLERA DE LOS PICACHOS	243	34	13
EL TUPARRO	18	0	0
FARALLONES DE CALI	62	55	2
LA PAYA	640	600	310
LOS KATIOS	3	0	0
MUNCHIQUE	21	42	1
NUKAK	1,342	1,464	1,469
PARAMILLO	295	48	110
PUINAWAI	182	108	33
SANQUIANGA	6	49	7
SERRANIA DECHIRIBIQUETE	5	2	0
SIERRA DE LA MACARENA	1,618	1,450	1,152
SIERRA NEVADA DE SANTA MARTA	326	246	212
TAMA	17	0	0
TAYRONA	8	4	4
TINIGUA	1,201	413	340
Total AREA COCA Ha	6,057	4,617	3,790

Colombia Coca Survey for 2003

Annex 7: Coca cultivation in Indian Territories in hectares (2001 – 2003)

INDIGENOUS TERRITORIES	CENSUS 2001	CENSUS 2002	CENSUS 2003
ADUCHE	2	1	0
AFILADOR CAMPO ALEGRE (YARINAL AFILADORES)	853	138	68
AGUA NEGRA	71	0	25
AGUANEGRA	14	2	2
AGUAS NEGRAS	16	8	9
ALMIDON LA CEIBA	9	1	0
ALTO ALBI	8	51	33
ALTO SINU, ESMERALDA CRUZ GRANDE E IWAGADO	47	3	3
AMENANAE Y OTROS	0	1	0
BACHACO BUENAVISTA	3	30	18
BARRANCO CEIBA Y LAGUNA ARAGUATO	65	50	66
BARRANCO COLORADO	18	3	24
BARRANQUILLITA	73	255	75
BEROCAL – ANAPO PUEBLO ESCONDIDO	0	0	4
BUENAVISTA	101	50	47
CALARCA	1	0	0
CALENTURAS	1	0	0
CALI-BARRANQUILLA	74	39	44
CALLE SANTA ROSA RIO SAIJA	8	4	7
CAÑO CAVASI	5	0	0
CAÑO JABON	11	9	49
CAÑO NEGRO	1	1	3
CAÑO OVEJAS (BETANIA – COROCITO)	1	0	12
CAÑO CUNAS TSEPAJIBO - WARRACAÑA	14	0	1
CAÑOS ATANA-PIRARIANI	2	2	0
CARANACOA YURI – LAGUNA MOROCOTO	3	0	5
CARPINTERO PALOMAS	82	7	53
CARRIZAL	2	0	0
CECILIA COCHA	42	3	3
CHIGUIRO	0	0	27
CHOCON	91	57	57
CONCORDIA	50	9	9
CONSARA-MECAYA	73	30	23
COROCORO	51	12	12
COROPOYA	2	1	0
CUASBIL - LA FALDADA	11	37	25
CUENCA MEDIA Y ALTA DEL RIO INIRIDA	368	285	163
CUMARA	28	0	0
CUMARAL-GUAMUCO	77	5	54
EL HACHA	5	2	0
EL TABLERO	0	1	0
EL TIGRE	2	8	33
EL UNUMA	866	326	201
EL VENADO	13	14	9
GABARRA-CATALAURA	16	9	24
GIRO	1	0	0

Colombia Coca Survey for 2003

GRAN ROSARIO	15	195	178
GUACAMAYAS MAMIYARE	9	6	0
GUACO BAJO Y GUACO ALTO	90	20	0
GUALCALA	0	0	3
HERICHA	2	0	4
INFI	3	5	3
JAGUAL RIO CHINTADO	33	0	0
JERICO CONSAYA	5	17	8
JIRIJIRI	2	0	1
KAWANERUBA	1	0	0
KOGUI-MALAYO ARHUACO	336	197	208
LA FLORESTA-SANTA ROSA-RIO SANQUIANGA	2	18	36
LA FUGA	5	12	57
LA LLANURA	31	16	28
LA PASCUA	16	0	0
LA SAL	3	8	56
LA TURBIA	41	106	75
LA YUQUERA	213	128	18
LAGARTO COCHA	1	0	0
LAGOS DEL DORADO LAGOS DEL PASO Y EL ROMANSO	2697	2730	358
LAGUNA ANGUILLA LA MACARENA	14	10	31
LAGUNA NEGRA Y CACAO	11	2	13
LLANOS DE YARI 8 YAGUARA II)	22	0	0
MACUARE	32	34	72
MATAVEN - FRUTA	12	0	0
MEREY – LA VERAITA	6	0	0
MINITAS-MIRALINDO	64	3	0
MONOCHOA	4	6	3
MOROCOTO - BUENAVISTA	4	0	0
MOTILON-BARI	6	21	20
NIÑERAS	64	62	121
NUKAK MAKU	83	55	18
NUNUYA DE VILLAZUL	3	6	2
PARTE ALTA DEL RIO GUAINIA	76	13	7
PERANCHO	4	0	0
PIGUAMBI-PALANGALA	3	30	5
PIPALTA PALBI YAGUAPI	18	25	19
PREDIO PUTUMAYO	798	732	638
PUEBLO NUEVO-LAGUNA COLORADA	46	24	5
PUERTO ALEGRE Y LA DIVISA	0	0	2
PUERTO NARANJO – PEÑAS ROJAS –CUERAZO – EL DIAMANTE	6	0	2
PUERTO ZABALO-LOS MONOS	23	67	14
PULGANDE CAMPOALEGRE	2	84	24
REMANSO CHORRO BOCON	2	26	0
RIO GUANGUI	23	2	6
RIO PUERRICHA	0	0	9
RIO SATINGA	0	1	0
RIO SIARE	39	0	0

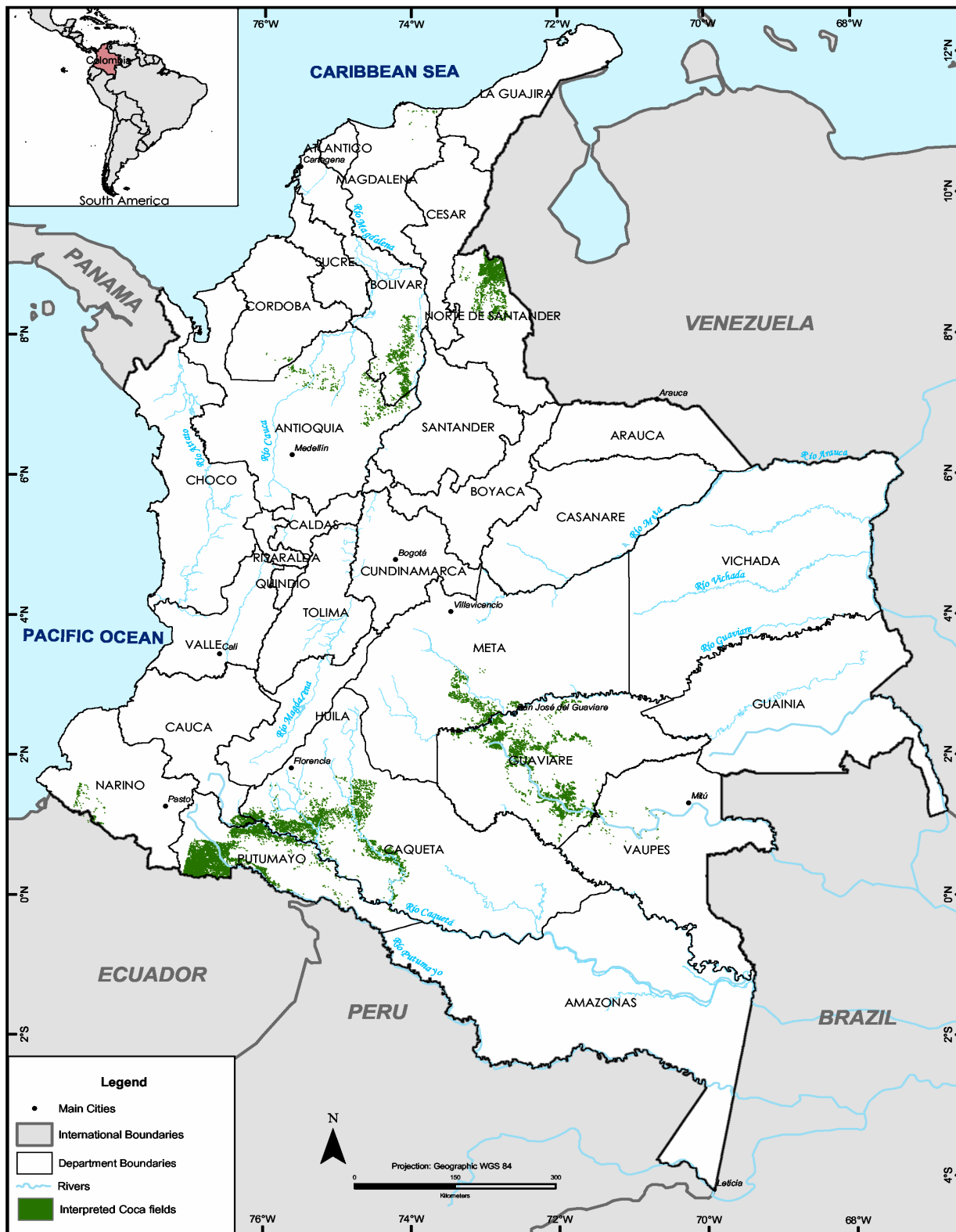
Colombia Coca Survey for 2003

RIOS ATABAPO E INIRIDA	11	0	0
RIOS CATRU Y DUBASA	0	0	24
RIOS MUCO Y GUARROJO	32	14	4
RIOS TOMO Y WEBERI	27	2	16
RIOS TORREIDO Y CHIMANI	0	0	1
SALACUI Y PAVARANDO	8	0	0
SAN JOSE DE LIPA O CAÑO COLORADO	0	33	0
SAN LUIS	1	0	0
SAN LUIS DEL TOMO	33	0	0
SAN MIGUEL	0	0	0
SANTA CRUZ DE PIÑUÑA BLANCO	4	0	1
SANTA ROSA DEL GUAMUEZ	343	53	17
SANTA ROSA SUCUMBOS EL DIVISO	395	46	80
SANTA TERESITA DEL TUPARRO	181	14	25
SARACURE Y RIO CADA	485	387	143
TONINA-SEJAL-SAN JOSE-OTROS	193	108	5
TORTUGAÑA-TELEMBI-PUNDE-PITADERO-BRAVO- TRONQUERIA-ZABAL	19	18	13
TUKUNARE	4	0	0
UNIDO UWA	0	7	7
VAUPES	446	356	272
WITORA O HUITORA	6	14	0
YARINAL (SAN MARCELINO)	1,556	567	159
TARUMAL Y EL BARRANCO	4	0	0
YURI	3	0	0
Total Area coca ha	11,791	7,739	3,994

Colombia Coca Survey for 2003

Annex 8: Colombia Coca Cultivation in 1999 – 2000 – 2001 - 2002

Colombia Coca Cultivation in 1999



Source: Government of Colombia - UNODC Coca cultivation Survey 1999

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

Colombia Coca Survey for 2003

Colombia Coca Cultivation in 2000



Source: Government of Colombia - UNODC Coca cultivation Survey 2000

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

Colombia Coca Survey for 2003

Colombia Coca Cultivation in 2001

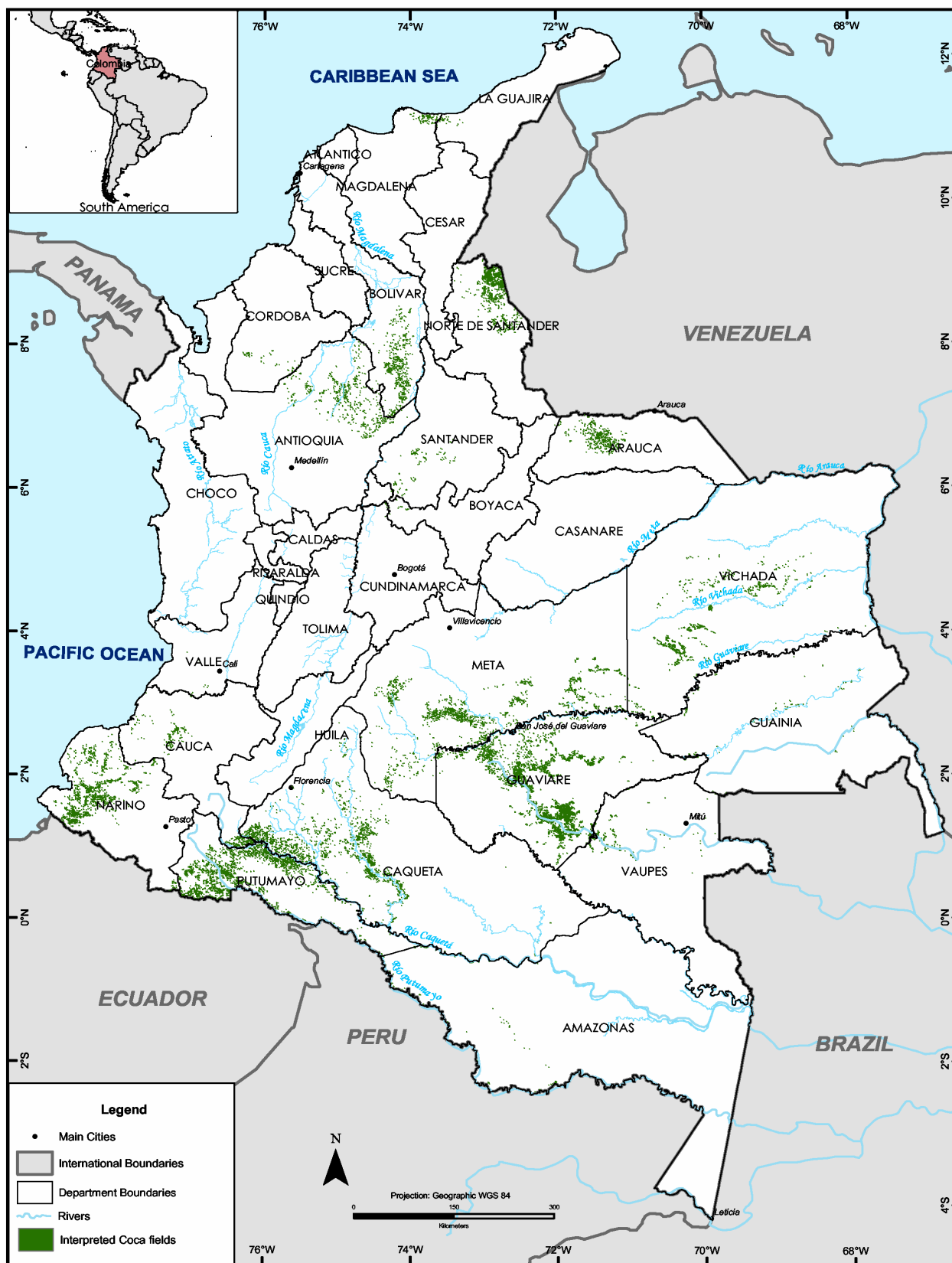


Source: Government of Colombia - UNODC Coca cultivation Survey 2001

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

Colombia Coca Survey for 2003

Colombia Coca Cultivation in 2002



Source: Government of Colombia - UNODC Coca cultivation Survey 2002

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

For more information please contact:

UNODC Colombia
Cra 4 No. 72-35 Piso 7
Bogotá, Colombia
TEL: +57 1 255 9333
Fax: +57 1 314 2945
www.unodc.org
fo.colombia@unodc.org

All rights are reserved. No part of this publication may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems without permission in writing from UNODC. This includes the reproduction of single pictures, or parts of text, graphics, table or maps in magazines, newspapers or in any digital form, or for public events,