UNITED NATIONS
Office on Drugs and Crime

Government of Colombia

COLOMBIA

Coca Survey for December 2002 & Semi-Annual Estimate for July 2003

Abbreviations

UNODC	United Nations Office on Drugs and Crime.
ICMP	Illicit Crop Monitoring Programme
SIMCI	Sistema integrado de monitoreo de cultivos ilícitos
DIRAN	Colombian Anti-Narcotic Police
DNE	National Narcotics Office
CICAD	Inter-American Drug Abuse Control Commission
IDP	Internally Displaced People
COP	Colombian Pesos

Acknowledgements

The following organizations and individuals contributed to the implementation of the 2002 coca survey in Colombia, and to the preparation of the present report:

Government of Colombia:
National Narcotics Office -DNE
Colombian Anti-Narcotics Police -DIRAN

UNODC:
Rodolfo Llinas, SIMCI Coordinator (Project)
Orlando Gonzalez, Digital Processing Expert (Project)
Sandra Rodriguez, Digital Processing Expert (Project)
Zully Sosa, Digital Processing Expert (Project)
María Isabel Velandia, Digital Processing Expert (Project)
Leonardo Correa, Field Engineer (Project)
Juan Carlos Parra, Editing Engineer (Project)
Nestor Dueñas, Systems Engineer (Project)
Martha Luz Gutiérrez, Administrative Assistant (Project)

Klaus Nyholm, Representative for Colombia & Ecuador (Bogotá Office)
Simonetta Grassi, Assistant Representative (Bogotá Office)
Steffen Schillinger, Regional Illicit Crop Monitoring Expert (ICMP Bogotá)
Guillermo Garcia, National Project Officer (Bogotá Office)
Juan Pablo Castro, Intern (Bogotá Office)
Martha Eugenia Murcia, Program Assistant (Bogotá Office)

Thibault Le Pichon, Management of Illicit Crop Monitoring Programme (Research Section)
Denis Destrebecq, Technical Supervision of Illicit Crop Monitoring Programme (Research Section)

The implementation of UNODC's Illicit Crop Monitoring Programme in the Andean countries and the Colombia survey in 2002 was made possible thanks to financial contributions from the Governments of the United Kingdom, France and Italy.

COLOMBIA COCA SURVEY FOR 2002

Executive Summary

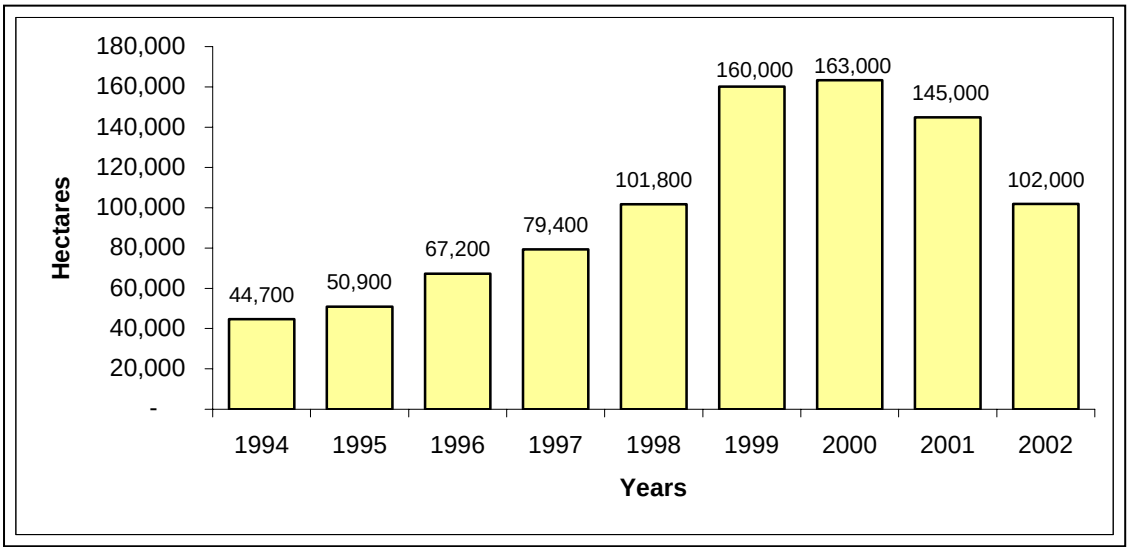
The Illicit Crop Monitoring Programme (ICMP) of the *United Nations Office on Drugs and Crime* (UNODC) presently covers the six countries where most of the illicit cultivation of coca bush and opium poppy takes place (Colombia, Bolivia and Peru for coca; Afghanistan, Laos and Myanmar for opium).

UNODC has been supporting the implementation of an Illicit Crop Monitoring System (SIMCI) in Colombia since 1999, with the logistical support of the Colombian Anti-Narcotics Police (DIRAN), and in coordination with the National Narcotics Office in Colombia (DNE).

The 2002 survey methodology was based on the analysis of satellite images acquired between August 2002 and January 2003, and complemented with verification flights over coca growing areas.

The results of the survey showed that, at the end of December 2002, about 102,000 hectares of coca were cultivated in 21 out of the 32 Colombian departments. This represented a decrease of about 43,000 ha (- 30%) since November 2001, when coca cultivation was estimated at about 145,000 ha. The decline recorded in 2001 (about 18,000 ha, or - 11 % compared to 2000) thus continued and accelerated in 2002.

Coca cultivation in Colombia 1994 – 2002



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 national trend masked however important variations at department level, as well as within departments. The most significant reductions in coca cultivation between 2001 and 2002 were found in the departments of Putumayo (-33,395 ha or 71% decrease) and Caquetá (-6,104 ha or 42% decrease), while coca cultivation increased in two departments: Nariño (7,700 ha or 102% compared to 2001) and Guaviare (1,800 ha or 7% compared to 2001).

While the potential one-year cocaine production of the 102,000 ha recorded in December 2002 in Colombia would amount to 480 metric tons, this number does not represent actual production throughout 2002. 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 more realistic estimate for Colombia, UNODC

calculated an average of the two cultivation figures recorded in November 2001 and in December 2002. This average (123,400 ha) was then multiplied by the estimated yield per hectare and per harvests per year (4). The result amounted to 580 metric tons of potential cocaine production in Colombia for 2002. While the 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 an extensive eradication campaign.

The average coca base price for 2002 amounted to US$ 847/kg. With a total coca base production of 580 metric tons, the total potential value of the 2002 farmgate production of coca base would be US$ 491 million.

During the latter half of 2002, coca base prices fell slowly, but steadily. In December 2002, the price for one kg of coca base was 770 US$[1].

For opium poppy cultivation, the project has not yet established a reliable remote-sensing methodology. Based on visual reconnaissance, the DIRAN estimated that approximately 4,200 ha were under opium poppy cultivation in November 2002, a reduction of about 1,900 ha compared to 2001. Based on an estimated average yield of 15 kg/ha and two harvests per year, the potential opium production would have reached about 128 metric tons, equivalent to approximately 5 metric tons of heroin.

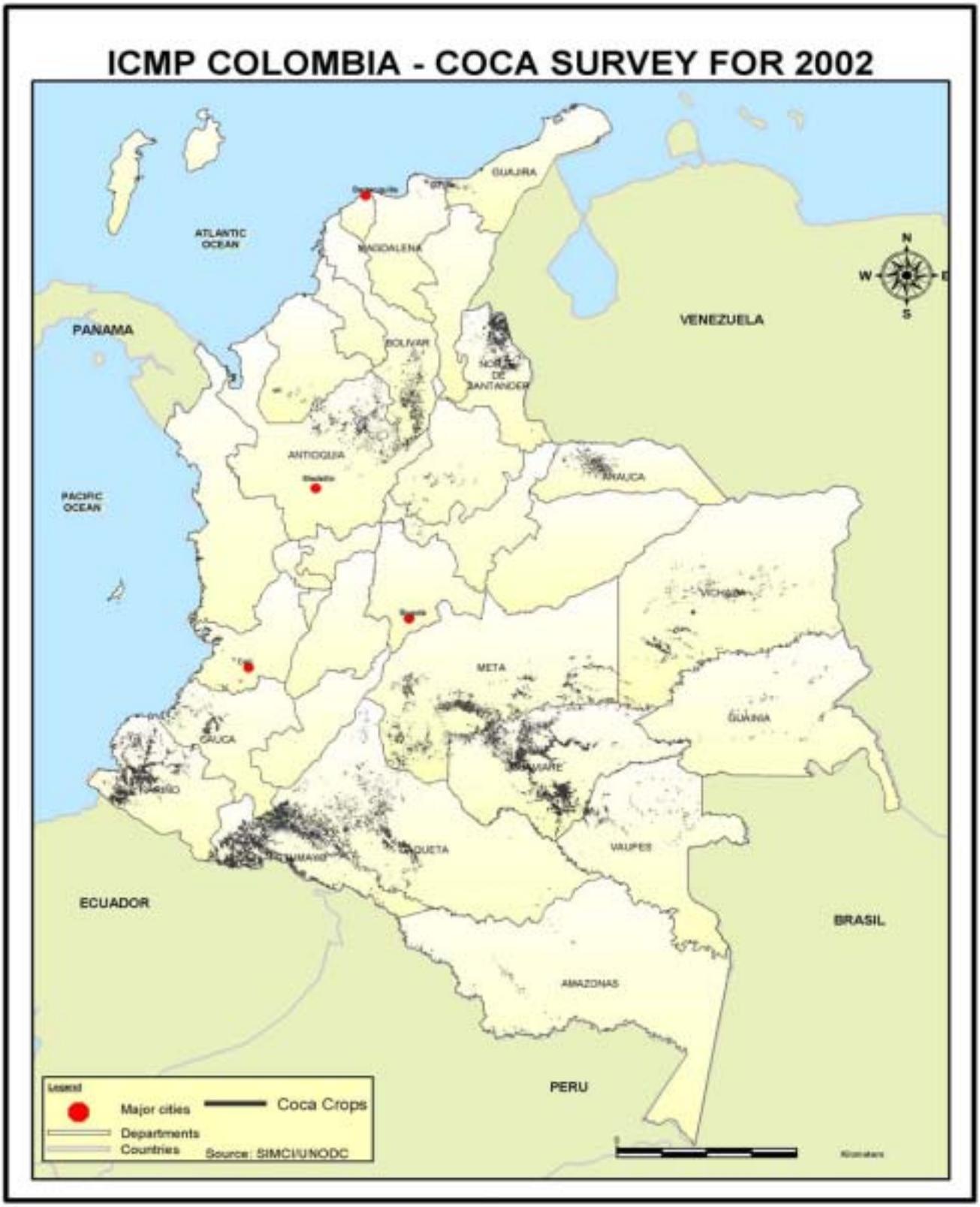
The average price of opium latex for 2002 amounted to US$194/kg of opium latex. With an estimated potential latex production of 128 metric tons, the potential value of the 2002 farmgate production of opium latex would amount to about US$ 25 millions.

In December 2002, the price paid for one kg of opium latex was at about 160 US$. This represented a decrease of 30% compared to last year.

In 2002, the DIRAN carried out a large-scale eradication campaign. The DIRAN reported a total spraying of 130,000 hectares of coca bush and 3,400 ha of opium poppy during the year. Compared with 2001, this represented increases of 38% and 48%, respectively.

[1] At the exchange rate of 2,680 COP/USD of December 2002.

Colombia coca growing area for 2002



Colombia coca density map for 2002

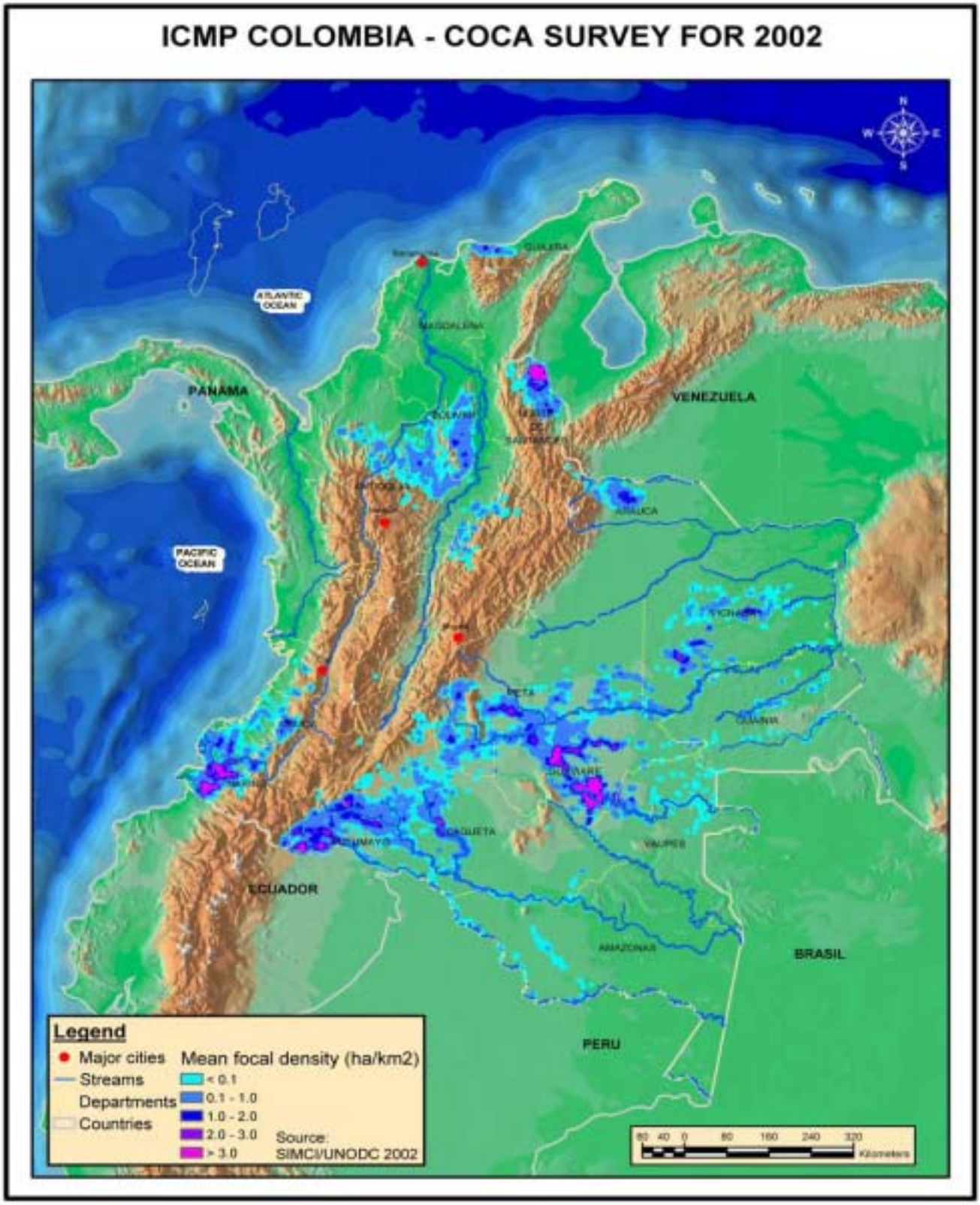


TABLE OF CONTENTS

PART ONE : COCA SURVEY FOR DECEMBER 2002

Maps

PART TWO : SEMI-ANNUAL ESTIMATE FOR JULY 2003

Maps

1. Introduction

The objectives of UNODC's Illicit Crop Monitoring Programme (ICMP) are to establish methodologies for data collection and analysis, to increase the governments' capacity to monitor illicit crops on their territories and to assist the international community in monitoring the extent and evolution of illicit crops in the context of the elimination strategy adopted by the Member States at the General Assembly Special Session on Drugs in June 1998.

ICMP presently covers the six countries where most illicit cultivation of the coca bush and opium poppy takes place (Colombia, Bolivia and Peru for coca; Afghanistan, Laos and Myanmar for opium).

With illicit coca cultivation expanding steadily during the 1980's and 1990's, Colombia has become 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 has been supporting the implementation of an Illicit Crop Monitoring System (SIMCI) in Colombia since 1999, with the logistical support of the Colombian Anti-Narcotics Police (DIRAN), and in coordination with the National Narcotics Office in Colombia (DNE).

SIMCI is a joint project between the United Nations Office on Drugs and Crime (UNODC) and the Colombian government, represented by the National Narcotics Bureau (DNE), the Antinarcotics Police Department (DIRAN) and the International Cooperation Agency. The national counterpart and director of the project is the head of the DNE.

The project is managed by a technical director and composed of engineers and technicians. The personnel consists of four digital image processing specialists, one field engineer, a cartographic technician, a system administrator and an administrative secretary. In addition to the engineers, the project is complemented by technicians and specialists from DIRAN.

2. Findings

2.1. Coca cultivation

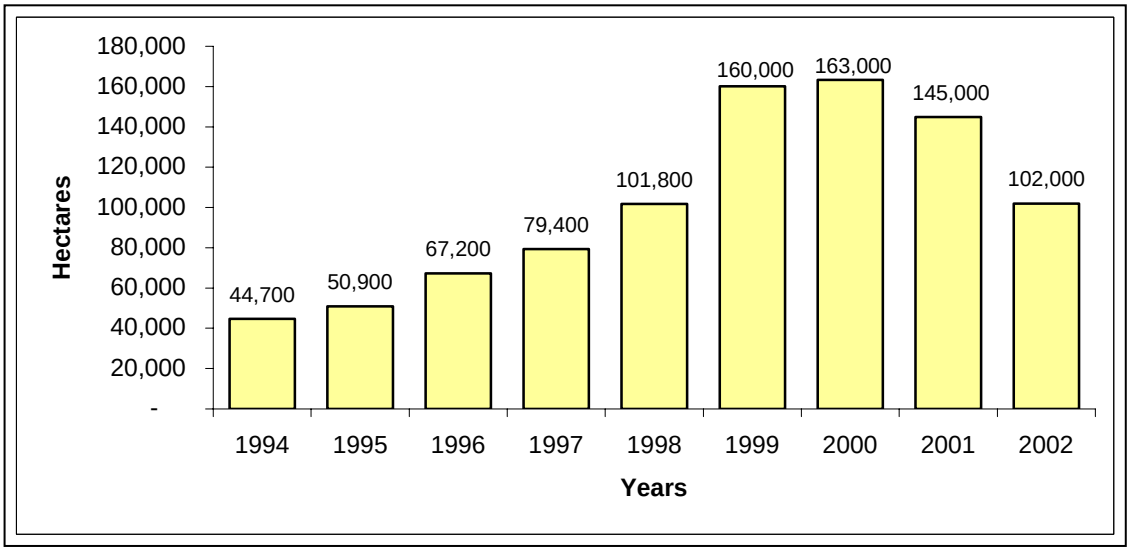
The 2002 census detected a total of 102,000 hectares of illicit coca bush as of 31 December 2002, distributed in 21 out of the 32 departments of the country. This represented 0.09% of the national territory.

The results of the 2002 survey indicated a decrease in the area cultivated with coca bush of 43,000 ha (- 30 %) compared to the previous year's estimate (as of 1 November 2001). This was the largest and second consecutive decrease after coca cultivation reached a peak at 163,000 ha in 2000.

Table 1: Summary results of the four 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 %

Figure 1: Cultivation of coca bush in hectares, Colombia, 1994 – 2002



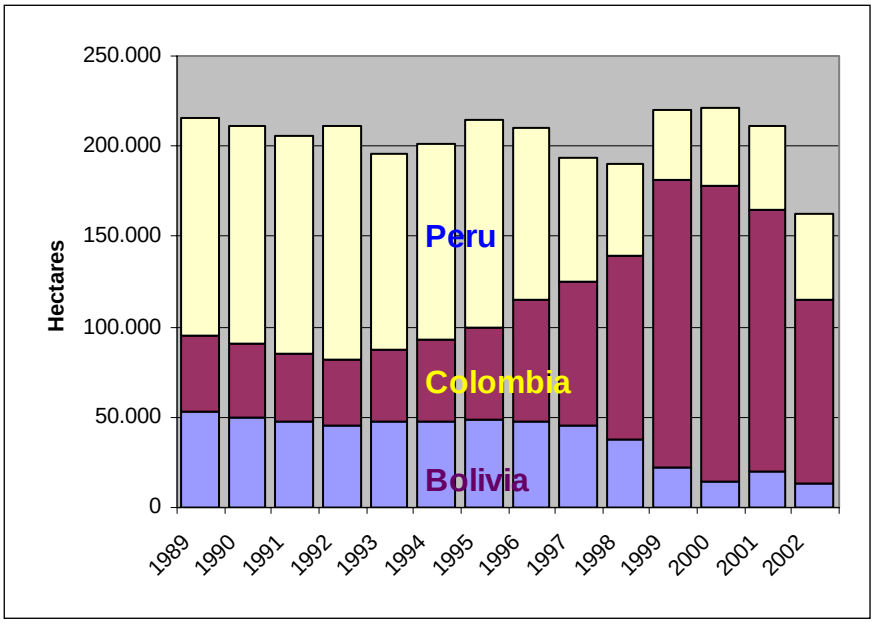
Note: Estimates for 1999 and subsequent years come from the national monitoring system

In the Andean region, Colombia represented 59% of the 2002 coca cultivation, ahead of Peru (27%) and Bolivia (14%). Compared to 2001, the total coca cultivation in these three countries went down by 18% due to the decrease in coca cultivation in Colombia. It is worth noting that the decrease in coca cultivation Colombia was not matched by a corresponding increase in Peru and Bolivia.

Table 2: Coca cultivation in the Andean region, 1994-2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Bolivia	48,100	48,600	48,100	45,800	38,000	21,800	14,600	19,900	24,400
Colombia	44,700	50,900	67,200	79,400	101,800	160,100	163,300	144,800	102,000
Peru	108,600	115,300	94,400	68,800	51,000	38,700	43,400	46,200	46,700
Total	201,400	214,800	209,700	194,000	190,800	220,600	221,300	210,900	173,100

Figure 2: Coca cultivation in the Andean region 1989 – 2002



Source: UNODC, Global Trends 2003

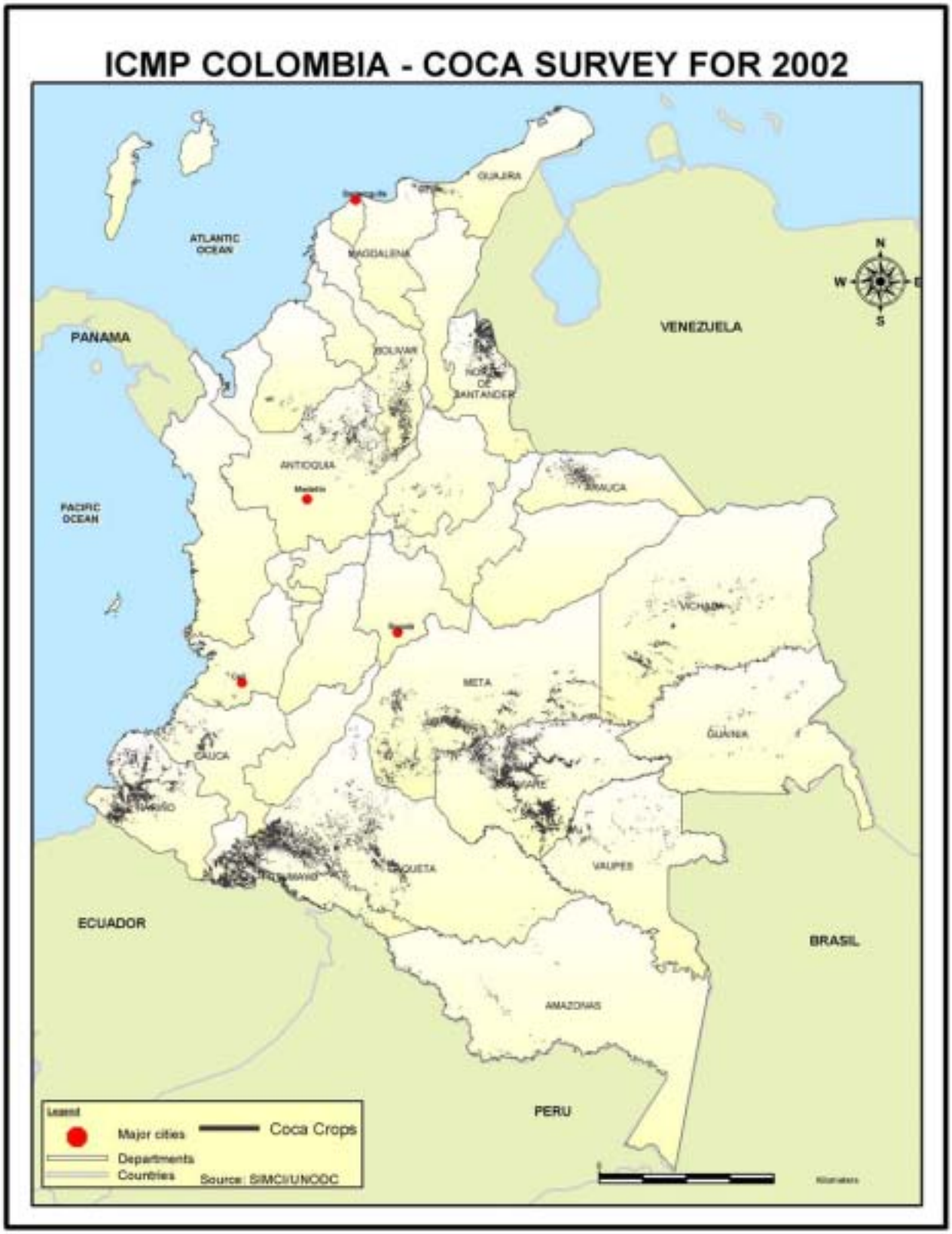
The decrease in coca cultivation recorded in Colombia for 2002 corresponded to an intensification of the aerial spraying campaign that peaked at about 130,000 ha[2] in 2002, or an increase of 38% compared to 2001 (94,000 ha).

The most significant reductions in coca cultivation between 2001 and 2002 were found in the departments of Putumayo (-33,395 ha or 71% decrease) and Caquetá (-6,104 ha or 42% decrease). 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 2002, only 13,700 ha of coca cultivation were recorded (or 13% of the national estimate), which ranked Putumayo behind Guaviare and Nariño.

The decrease in coca cultivation in Putumayo and Caquetá could be attributed to a large extent to the aerial eradication campaigns that have intensified considerably since 2000 in these two departments. Putamayo alone accounted for 55% of the national eradication records and Caqueta 15%.

[2] *Accumulated sprayed area provided by DIRAN*

Map 1: Colombia coca growing area for 2002



However, spraying campaigns alone probably did not account for all of the decrease in coca cultivation. According to the Governor of Putumayo, at least 15,000 has were manually eradicated by local communities. This information coincided with the multitemporal analysis that 19.983 has. out of the 29.790 has eradicated or abandoned in 2002 were not fumigated during the 2002 campaign.

Other departments with significant reductions in coca cultivation were: Bolívar (-2,089 ha or - 43% compared to 2001), Cauca (-1,019 ha or -33% compared to 2001) and Vichada (-4,256 ha or -46% compared to 2001). In these departments, there was no aerial spraying in 2002 and the decreases were attributed to abandonment or voluntary eradication.

Coca cultivation increased in two departments: Nariño (7,700 ha or 102% compared to 2001) and Guaviare (1,800 ha or 7% compared to 2001). Guaviare remained an important department in terms of coca cultivation and represented 27% of the national total in 2001.

Although since 1999 Nariño has accounted for less than 6% of the national total, in 2002 this department alone represented 15% of the national total. The 2002 increase in coca cultivation in this department would indicate a new migrating trend of coca cultivation. It is also worth noting that over the years eradication also increased in this department, from 6,500 in 2000 and 8,200 ha in 2001 to 18,000 ha or 14% of the national total in 2002. This intensity of eradication does not follow the trend, mainly because the vicinity of high mountains and the climatic conditions difficults the navigation and aerial spraying operation

In 2002, the major coca growing departments were therefore, in decreasing order of importance, Guaviare, Nariño, Putumayo, Caquetá and Norte de Santander. They accounted for 71% of the total coca cultivation. The same five departments accounted for 95% of the aerial eradication efforts.

Table 3: Coca cultivation estimates 1999-2002, by department (in ha)

Department	Mar-1999	Aug-2000	*1999-2000 change in %*	Nov-2001	*2000-2001 change in %*	Dec-2002	*2001-2002 change in %*
Antioquia	3,644	2,547	*- 30 %*	3,171	*25 %*	3,030	*- 4 %*
Amazonas				532		784	*47 %*
Arauca	-	978		2,749	*181 %*	2,214	*- 19 %*
Bolívar	5,897	5,960	*1 %*	4,824	*- 19 %*	2,735	*- 43 %*
Boyacá	-	322		245	*- 24 %*	118	*- 52 %*
Caquetá	23,718	26,603	*12 %*	14,516	*- 45 %*	8,412	*- 42 %*
Cauca	6,291	4,576	*- 27 %*	3,139	*- 31 %*	2,120	*- 33 %*
Chocó	-	250		354	*42 %*	-	-
Córdoba	1,920	117	*- 94%*	652	*457 %*	385	*- 41 %*
Cundinamarca	-	66		22	*- 67 %*	57	*159 %*
Guainía	-	853		1,318	*55 %*	749	*- 43 %*
Guajira	-	321		385	*20 %*	354	*- 8 %*
Guaviare	28,435	17,619	*- 38 %*	25,553	*45 %*	27,381	*7 %*
Magdalena	521	200	*- 62 %*	480	*140 %*	644	*34 %*
Meta	11,384	11,123	*- 2 %*	11,425	*3 %*	9,222	*- 19 %*
Nariño	3,959	9,343	*136 %*	7,494	*- 20 %*	15,131	*102 %*
Norte de Santander	15,039	6,280	*- 58 %*	9,145	*46 %*	8,041	*- 12 %*
Putumayo	58,297	66,022	*13 %*	47,120	*- 29 %*	13,725	*- 71 %*
Santander	-	2,826		415	*- 85 %*	463	*12 %*
Valle del Cauca	-	76		184	*60 %*	111	*- 40 %*
Vaupes	1,014	1,493	*47 %*	1,918	*29 %*	1,485	*- 23 %*
Vichada	-	4,935		9,166	*89 %*	4,910	*- 46 %*
TOTAL	160,119	163,289	*2 %*	144,807	*- 11 %*	102,071	*- 30 %*
Rounded Total	160,000	163,000		145,000		102,000	
Accuracy	80%	90%		90%		92%*	

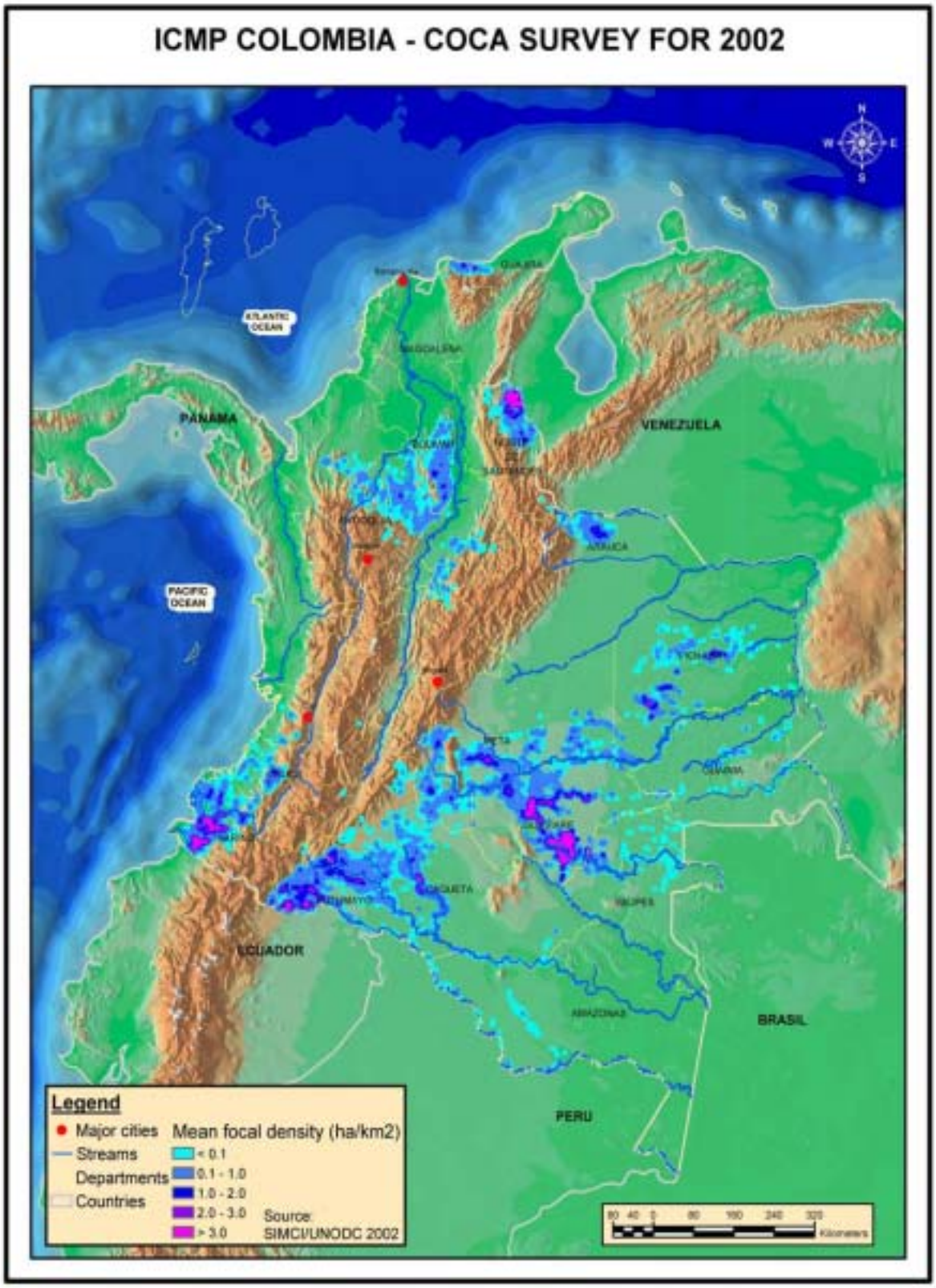
2.1.1. Coca density

To establish the density of coca cultivation, the project established buffers of approximately 300 meters from the center 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 that are therefore of high risk to become new coca fields. In 2003, the “areas of influence” covered 5,391,100 ha. The mean density of coca bush in these areas was 1.89 ha/km2.

Table 4: Coca density per region

Region	Total area of influence (km2)	2002 Coca Cultivation (ha)	Density (coca ha/km2)
Putumayo-Caqueta	15,802	23,164	1.47
Guaviare-Meta-Vaupes	19,674	44,772	2.27
Bolivar-Antioquia-Cordoba	8,071	6,404	0.79
Cauca-Nariño	5,586	16,094	2.88
Norte de Santander	2,418	8,041	3.33
Arauca	1,469	2,218	1.51
Magdalena-Guajira	626	998	1.59
Boyacá	265	380	1.43
Total	53,911	102,071	1.89
Country total	1,141,748		

Map 2: Colombia coca density for 2002



2.1.2. Dynamics and trends of illicit crops

Comparison of the results of the 2001 and 2002 surveys showed the high degree of mobility of coca cultivation, both within and across department boundaries. Only 15,240 ha of coca cultivation were on the same parcels in 2001 and 2002.

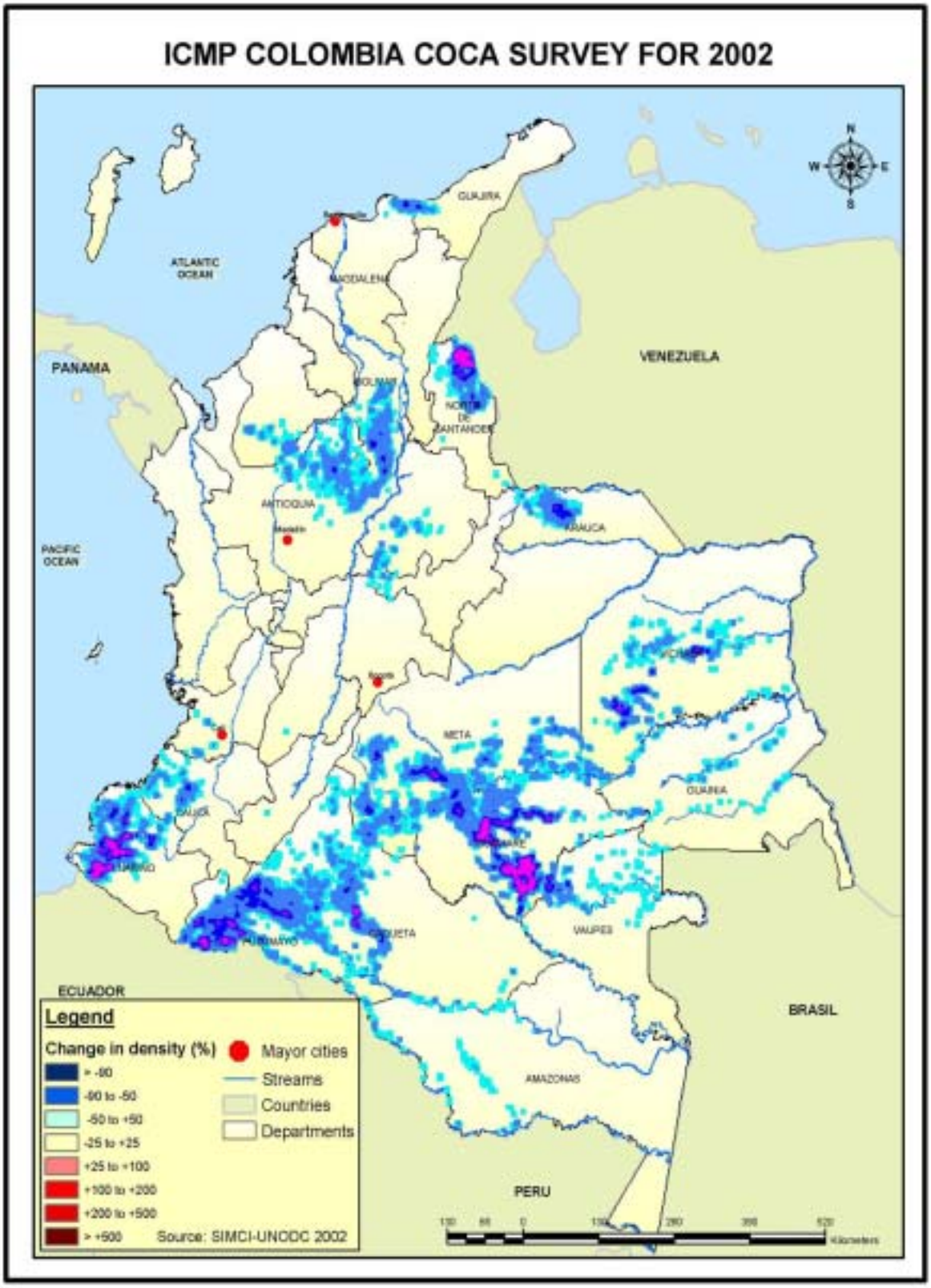
The analysis of the location of the coca fields over the past three years revealed that only about 5,000 ha remained permanently cultivated with coca, while 7% were cultivated in 2000, abandoned in 2001 and re-cultivated in 2002. The remaining 10% represents the area cultivated with coca in 2001 and 2002.

Table 5: Stability of Coca Cultivation 2000-2001-2002

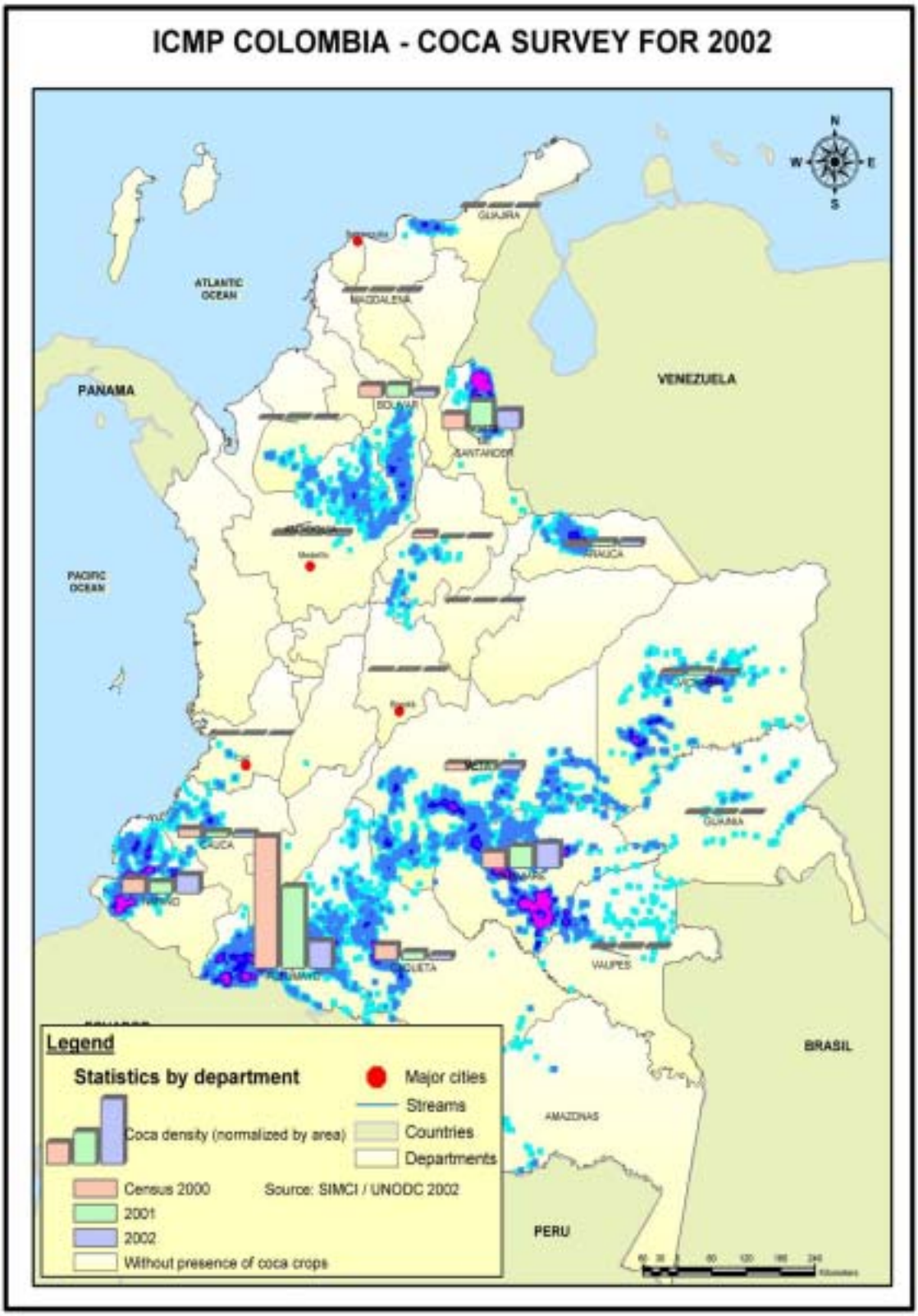
Years of comparison	Stable area (Ha)	Percentage of stability
2000 2001 2002	4,938	5%
2000 2002	7,092	7%
2001 2002	10.302	10%
TOTAL	22.332	22%

Forced eradication was beyond doubt the key reason for the decline in coca cultivation in 2002. 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 was fuelled by narcotics production, deteriorated the security situation in the country to a point that it prevented in some parts of the country the farmers from even cultivating coca. Moreover, a recovery of the prices of some key farm products, such as cocoa and sugar cane in 2002, seemed to have reduced the incentives for farmers to switch to coca cultivation.

Map 3: Spatial variation of coca crops for the period 2001 – 2002



Map 4: Variation in coca extension for the period 2000 – 2002



The following analyses have been carried out on the results of the 2000 , 2001 and 2002 census. For methodological reasons, the comparison between two census 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, 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 5 does not coincide with the final figure of the census.

The analysis of the decrease in coca cultivation between 2000 and 2001 revealed that 90% 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 in 2002.

Table 6: Dynamics of coca cultivation

	2000	2001	Change	In %	2002	Change	In %
Cultivated area (ha)	163,289	144,807	-18,482	-11	102.071	-42.736	-30
Stable area (ha)	na	33,419	0	0	15.240	-18.179	-54
Abandoned area (ha)		117.681	na	na	121.099	3.418	3
New coca plantings (ha)	na	102,650	na	na	79.239	-23.411	-23
Fields larger than 3 ha (in ha)	84,919	67,724	-17,195	-20	35.687	-32.037	-47
Fields smaller than 3 ha (in ha)	65,989	68,615	2,625	4.0	58.785	- 9.830	-14
Fields larger than 3 ha (number of)	11,956	10,413	-1,543	-13	6.292	-4.121	-4
Fields smaller than 3 ha (number of)	61,109	63,233	2,124	4	56.664	-6.569	-10

The analysis also revealed that 40% of the coca cultivation in 2001 took place over land previously covered by primary or secondary forests.

Table 7: Change in land use to coca cultivation between 2001 and 2002

Land use change	Ha	%
Stable coca crops	15,229	16
Primary forest to coca	34,768	37
Secondary forest to coca	14,008	15
Other vegetation (grasslands or crops)	22,105	23
Uncertain changes and corrections	8,369	9
Total	94,479	100

On the contrary, abandonment of coca fields did not result in an important restoration of the forest area: only 30% of the abandoned coca fields were left in process to become as secondary forest, but 41% were left as grassland and savannas. The time period is, however, too short to draw conclusions on the reforestation process of areas of abandoned coca.

Table 8: Land use changes after abandonment 2001 – 2002

Land use change	Hectares	Percent (%)
Coca to secondary forest	54,275	42
Coca to other vegetation or crops	61,824	49
Uncertain changes and corrections	11,132	9

Over the "studied area", the following land use changes since 2000 have been recorded. The studied area is limited to the area covered by satellite images in each census year. Consequently, the results in the land use for each year are not total numbers. For instance, important variations in roads, urban areas and others are caused by the different geographical covertures of the satellite images in each year.

Table 9: Land use in hectares interpreted for the period 2000 – 2002

Land use	2000*	2001	2002
Coca crops	163,289	144,807	102,071
Primary forest	26,434,346	38,577,671	35,580,741
Secondary forest and scrubs	4,944,069	5,209,572	8,484,131
Grassland and shrubs	8,355,809	11,726,387	13,031,471
Water bodies	4,487,476	1,806,504	3,973,963
Sand banks	60,265	52,920	79,718
Other crops	261,267	855,851	659,534
Clouds and shadows	7,638,027	12,398,909	13,903,450
Roads	96,878	199,512	156,843
Urban areas	23,947	73,057	95,997
Inundated areas	410,968	642,867	339,903
Rock outcrops	350,244	306,387	248,574
Other	269,971	1,103,206	770,256
Bare soil	165,266	304,377	315,033
TOTAL	53,661,822	73,404,028	77,734,119

2.1.3. Coca cultivation for 2002 by regions

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 introduced by the interpreters. These regions do not follow political boundaries

Putumayo – Caqueta (23,200 ha)

The satellite images were acquired between September and October 2002, while the spraying activities of the police took place between July and December 2002. Therefore, corrections had to be made for both image antiquity and for spraying and re-planting from October to December. There was no important cloud coverage over most of the areas, except for the southeast region.

Table 10: Correction for 2002 in Putumayo, Caqueta (in ha)

Department	Cloud cover	Eradication (spraying)	Image Antiquity	Total	Interpreted	Adjusted
CAQUETA	1,221	-1,455	-71	-305	8,717	8,412
PUTUMAYO	2,262	-2,041		221	13,504	13,725

In Putumayo, the decrease in coca cultivation corresponded to an increased aerial spraying activity. The sprayed area (72,000 ha) is 2.2 times larger than the area reduced in coca plantations (- 33,400 ha). In the months of September and December, about 80% of the spraying have been realized on areas that were identified with other coverage than coca (mostly secondary forest and pastures). This could indicate that the spraying took place over recently seeded coca fields – not yet visible in a satellite image - and only 20% on productive coca as identified in the images acquired in September and October.

Table 11: Coca cultivation in Putumayo and Caqueta (in ha)

	1999	2000	2001	2002
Coca cultivation	82,015	92,625	61,636	22,137
Annual trend		13%	-33%	-64%

The latest verification flights in Putumayo of March 2003 indicated a high degree of planting on previously sprayed fields, mostly in the upper and middle Putumayo. The coca fields located in lower Putumayo were not sprayed due to their small density, small size and long distance from the fumigation bases.

Guaviare – Meta – Vaupes-Vichada-Guania (44,800 ha)

Most of the satellite images were acquired in December, except for small areas covered by images of September. Since no spraying activities took place during the second semester in this region, and the images were not affected by any significant cloud coverage, only minor corrections were applied.

Table 12: Correction for 2002 over Guaviare- Meta- Vaupes – Vichada - Guania (in ha)

Department	Cloud Cover	Eradication (spraying)	Image Antiquity	Total	Interpreted	Adjusted
GUAVIARE	1,038		26	1,064	26,317	27,381
META	1,911		-419	1,492	7,730	9,222
VAUPES	24		-104	-80	1,565	1,485
VICHADA	119		-9	110	4,800	4,910
GUANIA	24		27	51	698	749

Although coca cultivation remained fairly stable in this area since 1999, the region accounted for 44% of the total coca cultivation in 2002, and therefore became one of the most important coca growing area in Colombia.

Table 13: Coca cultivation in Guaviare – Meta – Vaupes –Vichada-Guania (in ha)

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

A high degree of mobility of coca cultivation was noted within the region of Guaviare as is evidenced in Figure 9 map. 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. The return of important coca fields in this department is an important early alert.

Bolivar – Antioquia – Cordoba (6,400 ha)

Most of the images were taken in August, making corrections for antiquity necessary. As for the previous census, some areas were covered by clouds, even during the aerial verification.

Table 14: Correction for 2002 over Sur de Bolivar – Antioqua – Cordoba (in ha)

Department	Cloud Cover	Eradication (spraying)	Image Antiquity	Total	Interpreted	Adjusted
ANTIOQUIA	343		-265	78	2,952	3,030
CORDOBA	27		-11	16	369	385
BOLIVAR	176		-399	-223	2,958	2,735

The decrease rate of coca cultivation in the region is similar to the national rate although no aerial spraying took place in 2002. It can therefore be deducted that the decrease was a result of voluntary eradication of coca and its substitution with alternative crops or simply abandonment. The increase in armed conflicts could also have been a cause.

Table 15: Coca Cultivation in Bolivar – Antioquia- Cordoba (in ha)

	1999	2000	2001	2002
Coca cultivation	11,461	8,624	8,647	6,150
Annual trend		-25%	0%	-29%

Nariño – Cauca (16,100 ha)

The region is almost always covered by clouds. The only suitable images were of April 2002, and still presented an important cloud coverage of 20% to 40%. Through a mosaic of images of 2001 and 2002, and field verification flights in December 2002, it was possible to get reliable information on the coca cultivation under the clouds.

Table 16: Correction for 2002 in Narino – Cauca (in ha)

Department	Cloud Cover	Eradication (spraying)	Image Antiquity	Total	Interpreted	Adjusted
CAUCA	42	-144	40	-62	2,182	2,120
NARIÑO	4,522		72	4,594	10,537	15,131

This region showed the highest rate of increase (62%) in coca cultivation between 2001 and 2002 mostly concentrated in Nariño. Although eradication took place in this region in July and August 2002, the census results and subsequent field verification showed that by December 2002, most sprayed areas had already been replanted.

Table 17: Coca cultivation for Nariño – Cauca (in ha)

	1999	2000	2001	2002
Coca cultivation	10,250	13,919	10,633	17,251
Annual trend		36%	-24%	62%

The mountainous department of Nariño has traditionally been an opium poppy growing area, with only limited coca cultivation in the lowlands areas bordering the Pacific Ocean. The increase in

coca cultivation recorded in this department in 2002, might have been related to the intensive fumigation campaign held in the neighbouring department of Putumayo that would have driven landless labourers to work in this region according to the respective harvest calendars of opium poppy and coca.

Both the geographic conditions and the almost constant cloud coverage in Nariño have made it particularly difficult for the police to carry out effective fumigation campaigns. Despite the very intensive eradication efforts realized throughout 2002, the results in this department show an increasing trend of illicit crops. The proximity of the sea and the international illicit trafficking routes could also explain the increase in coca cultivation in this department.

Norte de Santander (8,000 ha)

The first satellite image was from July 2002, just before the spraying activities of July – August. A new image was acquired without clouds from December 2002. The interpretation and the subsequent field verification indicated a high degree of replanting of coca on fumigated fields.

Table 18: Correction for 2002 in Norte de Santander

Department	Cloud cover	Eradication (spraying)	Image Antiquity	Total	Interpreted	Adjusted
NORTE DE SANTANDER	1	-60	297	238	7,803	8,041

Arauca (2,200a)

The satellite images were taken in September cloud coverage. There was no significant change between the 2001 and the 2002 totals, but a high degree of mobility within the area. A peculiarity of this region was that coca crops were interspersed with licit crops. Therefore, satellite detection was difficult. Thanks to detailed verification flights, the interpreters were able to recognize the mixed cultivations and correct their initial interpretation.

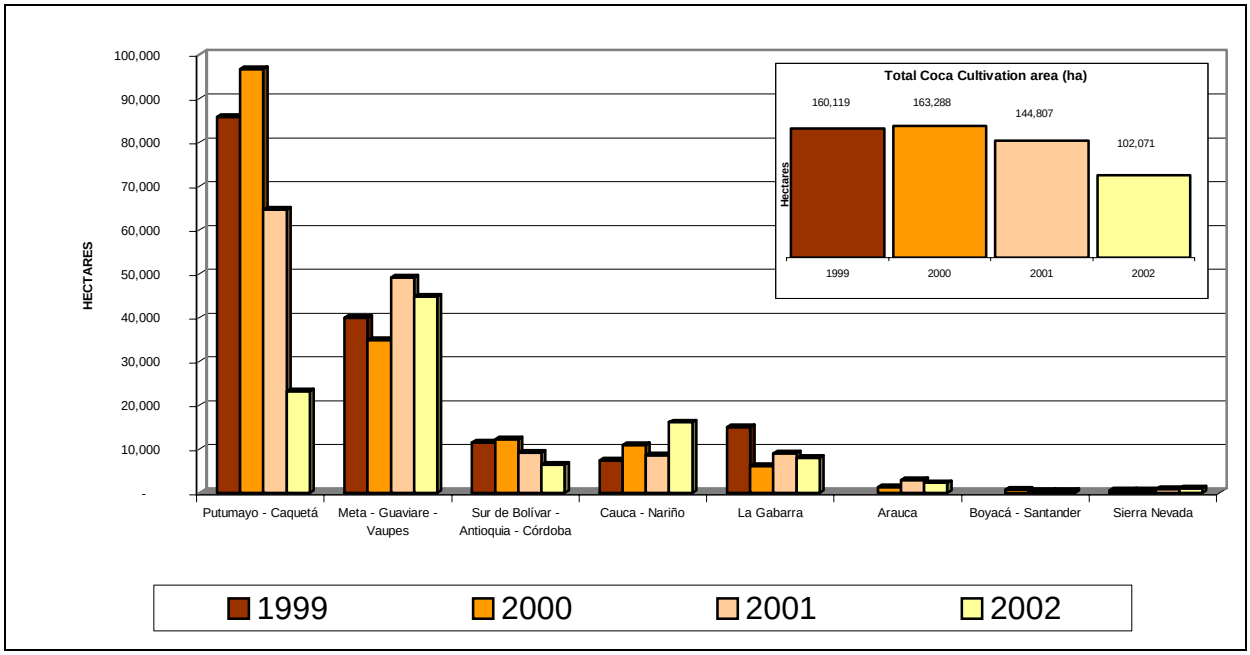
Table 19: Correction for 2002 in Arauca

Department	Cloud cover	Eradication (spraying)	Image Antiquity	Total	Interpreted	Adjusted
ARAUCA	9		-35	-26	2,240	2,214

Magdalena-Guajira (998 ha)

The images were taken in July and October 2002. As most of the area is a national reserve, no fumigation took place. The region has been rather stable compared to the previous year, with only minor changes in land use related to illicit crops.

Figure 3: History of coca cultivation for selected departments



2.2. Non-traditional areas

Potential small coca fields have been detected in remote areas outside the traditional agricultural areas of the departments of the Orinoco and Amazon river basins, as well as in traditional agricultural areas on the Atlantic coast, the coffee growing zone and other Andean areas. Because thorough field verification has not yet been conducted in these areas, estimates on the coca cultivation areas in those non-traditional areas were not included in the 2002 census. As can be seen in the following table, potential coca cultivation in non-traditional areas was reduced by almost 50% in 2002.

Table 20: Coca cultivation in non-traditional areas

Region	2001		2002	
	Image date	Coca cultivation (ha)	Image date	Coca cultivation (ha)
Guainía	30-Aug-01	137	21-Nov-02	59
Guainía	28-Apr-01	157	21-Nov-02	6
Vichada	08-Oct-01	-	28-Nov-02	--
Guainía	08-Oct-01	172	28-Nov-02	57
Vaupés	08-Oct-01	67	9-Sep-02	6
Amazonas	08-Oct-01	37	8-Aug-02	--
Amazonas	08-Oct-01	27	8-Aug-02	--
Amazonas	08-Oct-01	86	8-Aug-02	--
Vichada	22-Apr-01	27	21-Dec-02	--
Vaupés	03-Jan-01	84	22-Jan-03	149
Amazonas	24-May-01	-	22-Jan-03	46
Amazonas	24-May-01	52	16-Sep-02	23
Casanare	07-Nov-01	36	13-Jan-03	--
Meta	16-Jun-01	162	13-Jan-03	88
Guajira	06-May-01	-	13-Aug-02	--
Boyacá-Casanare	29-Oct-01	-	04-Jan-03	28
Casanare-Meta	25-Jul-01	20	30-Sep-02	30
Cesar	01-Aug-01	7	24-Nov-02	26
Tolima-Cundinamarca	16-Jul-01	-	07-Oct-02	--
Atlántico-Magdalena	25-Sep-01	-	02-Jan-03	--
Antioquia-Caldas	07-Jul-01	438	26-Jul-02	157
Quindío-Valle del Cauca	07-Jul-01	64	14-Oct-02	--
Chocó	18-Apr-01	-	06-Nov-02	89
Urabá	18-Oct-01	175	12-Apr-02	213
Chocó	18-Oct-01	55	12-Apr-02	--
Total		1,803		896

This information on potential coca cultivation in the non-traditional areas should be seen as an early warning of the dynamics at play. SIMCI will undertake an investigation of coca cultivation in the coffee zone where coca fields have been reported to be interspersed with and partly covered by coffee bushes.

2.3. Spatial analysis of coca cultivation in relation to other socio-economic dimensions

To better understand the spatial and temporal dynamics of coca crops, as well as their relationship to the socio-economic and environmental characteristics of the regions, GIS tools have been used to analyze coca bush densities in relationship to poverty, violence and environment.

2.3.1. Coca cultivation and poverty

Since the late 1990s, the country economic growth has been modest or even negative and poverty increased dramatically. According to the National Planning Department, the percentage of "poor" persons rose from 56% in 1999 to 60% of the total population in 2000. Out of these, 20% were living in "extreme poverty" in 1999, against 23% in 2000.[3] These trends have continued. According to a study by the World Bank, one out of four Colombians is living in extreme misery and 27 million Colombians find themselves in a situation of poverty – more than half of the population.[4]

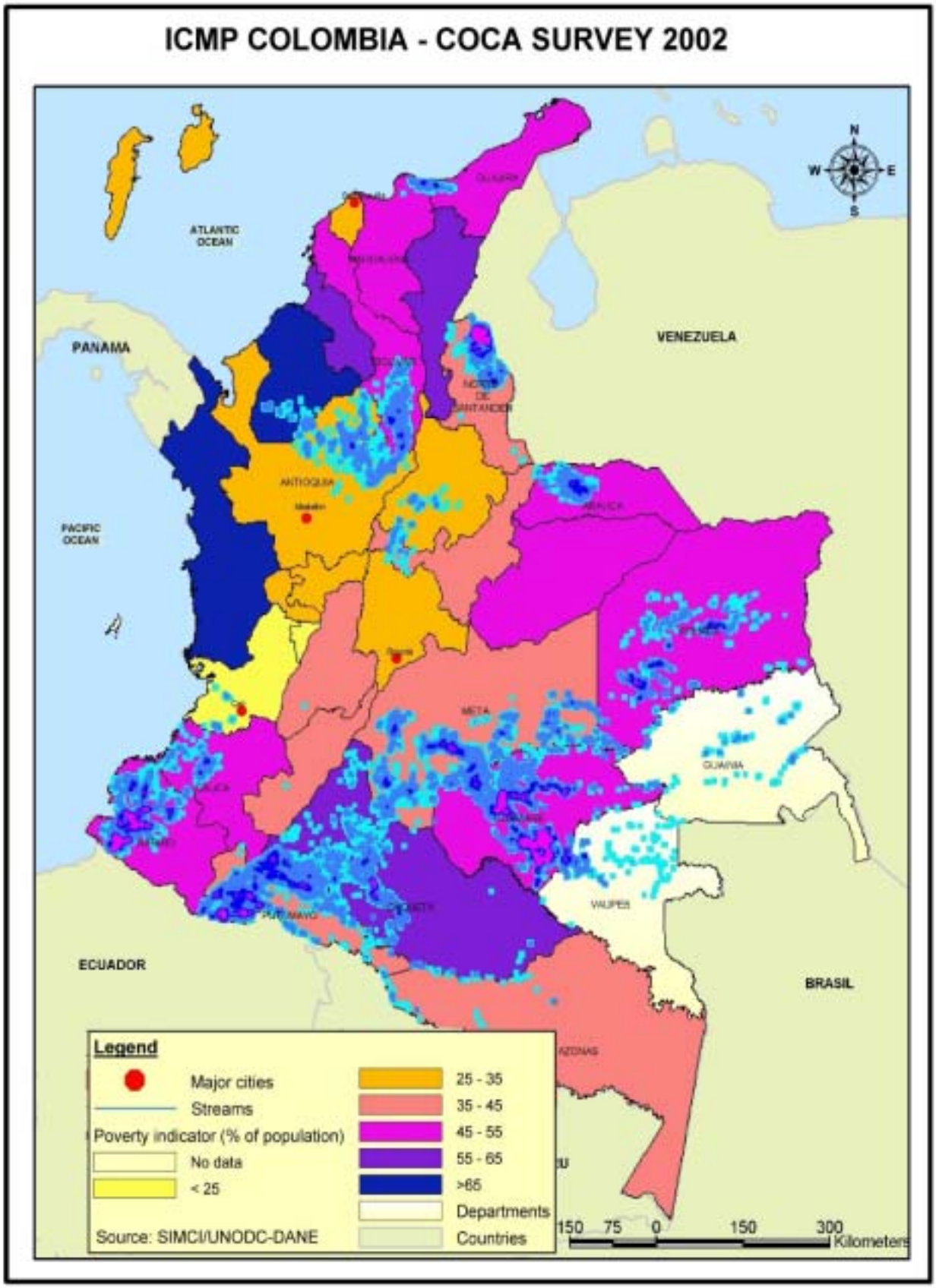
One of the most common and recognised way for measuring the degree of poverty of region is the *indicator on basic unsatisfied needs*. It accounts for the percentage of inhabitants of an administrative unit (in our case department) that have no access to drinking water, electricity, sanitary installations and educational services. An indicator of 65 stands for 65% of the department's population living in poverty.

The information provided by the National Statistical Department (DANE) shows that the highest concentrations of coca crops can be found in departments with a poverty indicator of 45% and above. Areas with low poverty levels, characterised by traditional agricultural or industrial products, like for example the Valle del Cauca department and the coffee growing areas, show no presence of coca cultivations. Nevertheless, it should be noted that the data does not account for variations within the departments.

[3] Informe del Grupo Temático de Desplazamiento, Año 2001, UNHCR, OCHA, March 2002.

[4] Colombia Tiene los Mismos índices de Pobreza de 1988, Según el Banco Mundial, el Tiempo – May 3, 2002

Map 5: Poverty indicator by department and coca densities



2.3.2 Displacement of people

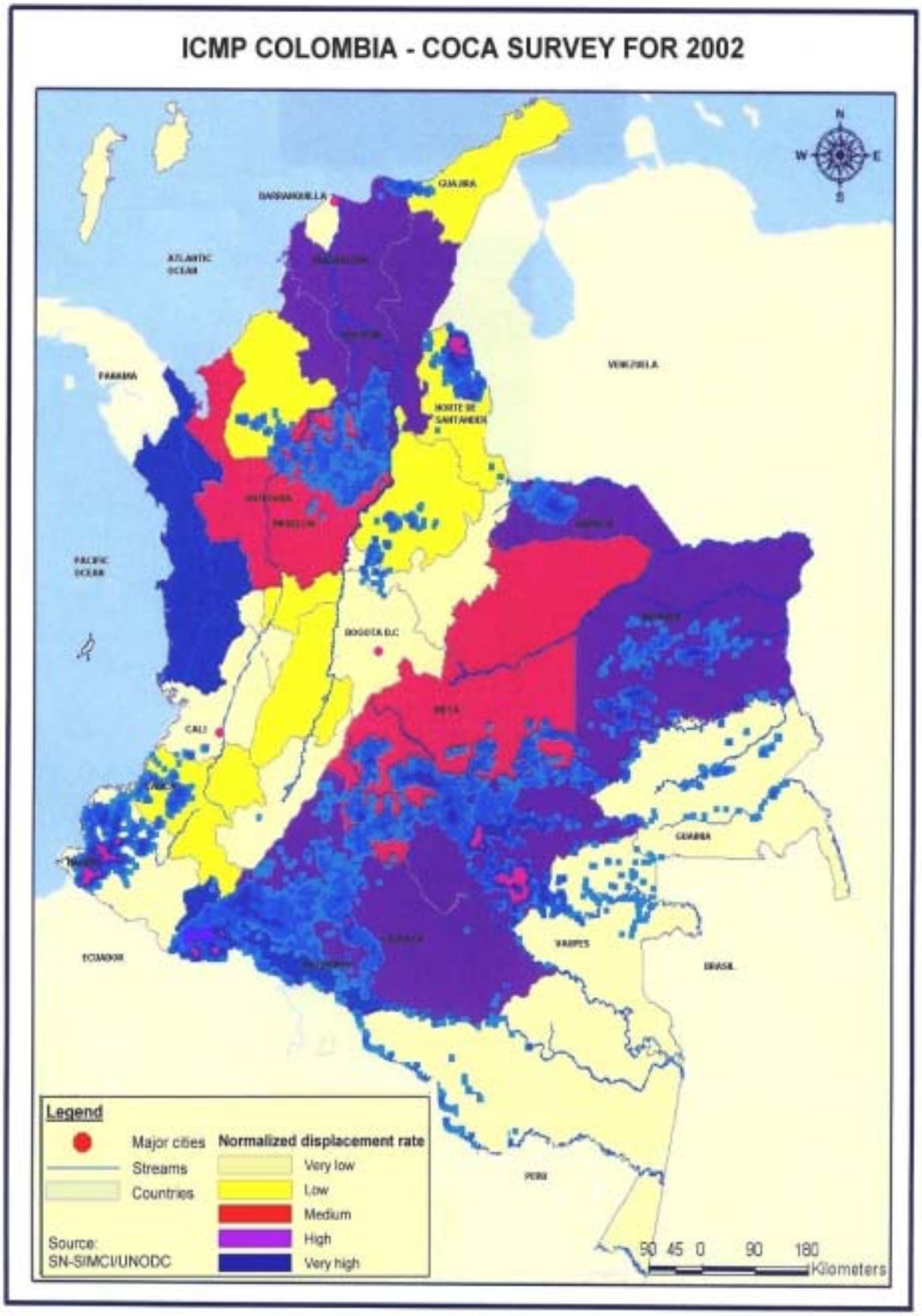
The rural population and increasingly now also the population in marginal urban areas, have become a military target of the armed groups in their fight for the control of the territory, including the control over licit and illicit activities – such as drug trafficking –and as a source for forced recruitment. Over the past five years, some 2.5 million Colombians are thought to have fled to escape rural violence. The number of Internally Displaced People (IDP) is growing steadily. In the first semester of 2002, a total of about 172,320 persons are estimated to have been displaced from their homes, 102% more than in the previous year. Most of today's IDPs have gone to the sprawling barrios around the big cities[5.] Others have joined the previous generation of refugees, from the violent incidents of the 1940s and 1950s, and settled in the southern and eastern lowland forests. Many of today's IDPs end up engaged in illicit cultivation activities or working as auxiliaries in harvesting, processing and transporting coca paste and cocaine[6.].

All coca growing areas, except the Nariño department, show very high levels of forced displacement of population. The data provided by the National Human Rights Observatory indicate a coincidence of the departments of origin of the IDPs and departments with presence of illicit crops. The only exception being the Chocó department, where geographical conditions impede the growing of illicit crops.

[5] Report of the UN Thematic Group on Internally Displaced People, 2001, UNHCR, OCHA, March 2002.

[6] Op Cit.

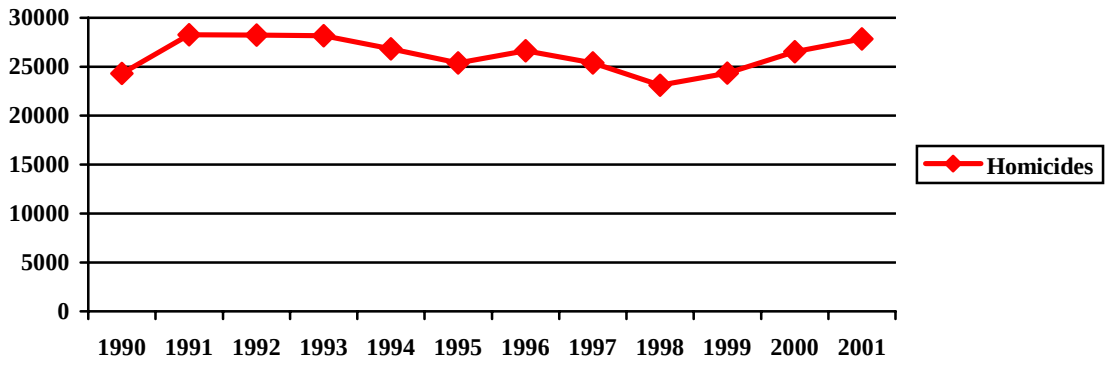
Map 6: Forced displacement by department and coca densities



2.3.3. Coca cultivation and homicide rate

Though the homicide rate in Colombia has been reduced, it is still very high compared to international standards. Homicide rates can be seen varying in relation with drug trafficking. The homicide rates were at their peak during the period when the export market for cocaine was flourishing and the drug cartels were battling for control. Cali and Medellin, the headquarters for two of the biggest Colombian drug cartels, had the highest incidence of homicides. The dismantling of the drug cartels coincided with a drop in homicide rates; in 1991 the homicide rate per 100,000 inhabitants was 79 whereas in 2001 it reached 61[7]. In 2002 the figures are continuing to rise, making it the fourth year in a row with this upward trend in rates per 100,000 inhabitants. Statistics up to October 2002 show that Medellin has the highest homicide rate. However, the Department of Norte de Santander and in particular its capital city, Cúcuta have shown a marked increase in 2002. This is as a result of the strong presence of the armed groups and the difficult problem of displacement.

Table 21: Homicides in Colombia (1990-2001)[8]

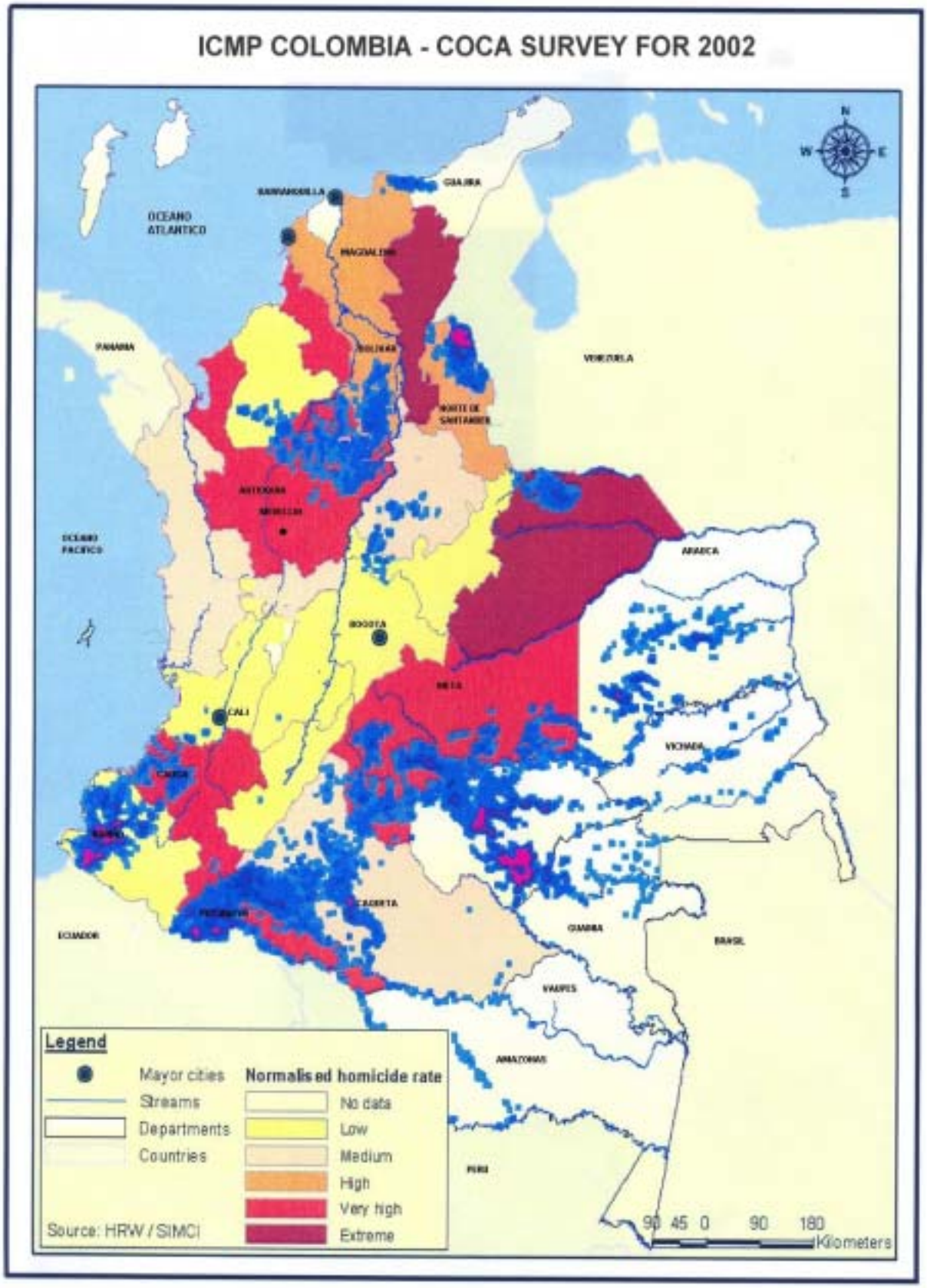


Data for 2002 are not yet completed. For January to 31 July, the number of homicides amounted to about 17,500.

[7] Source: www.derechoshumanos.gov.co/politica/2001/homicidio_01.htm *"Análisis de Algunos Indicadores – Homicidios y Masacres"*

[8] Policía Nacional – Centro de Investigaciones Criminológicas

Map 7: Homicide rates by department and coca densities



*

2.3.4. Biophysical potential indicator for coca cultivation

The analysis of coca crops and socio-economic factors has shown that the presence of coca crops cannot be explained only by the above mentioned parameters. There are also important considerations related to geographical and geophysical conditions that have a strong incidence on the presence or absence of illicit crops in the regions. The Choco department for example is one of the poorest regions in Colombia constantly suffering from attacks by armed groups resulting in murders and displacement of its inhabitants.

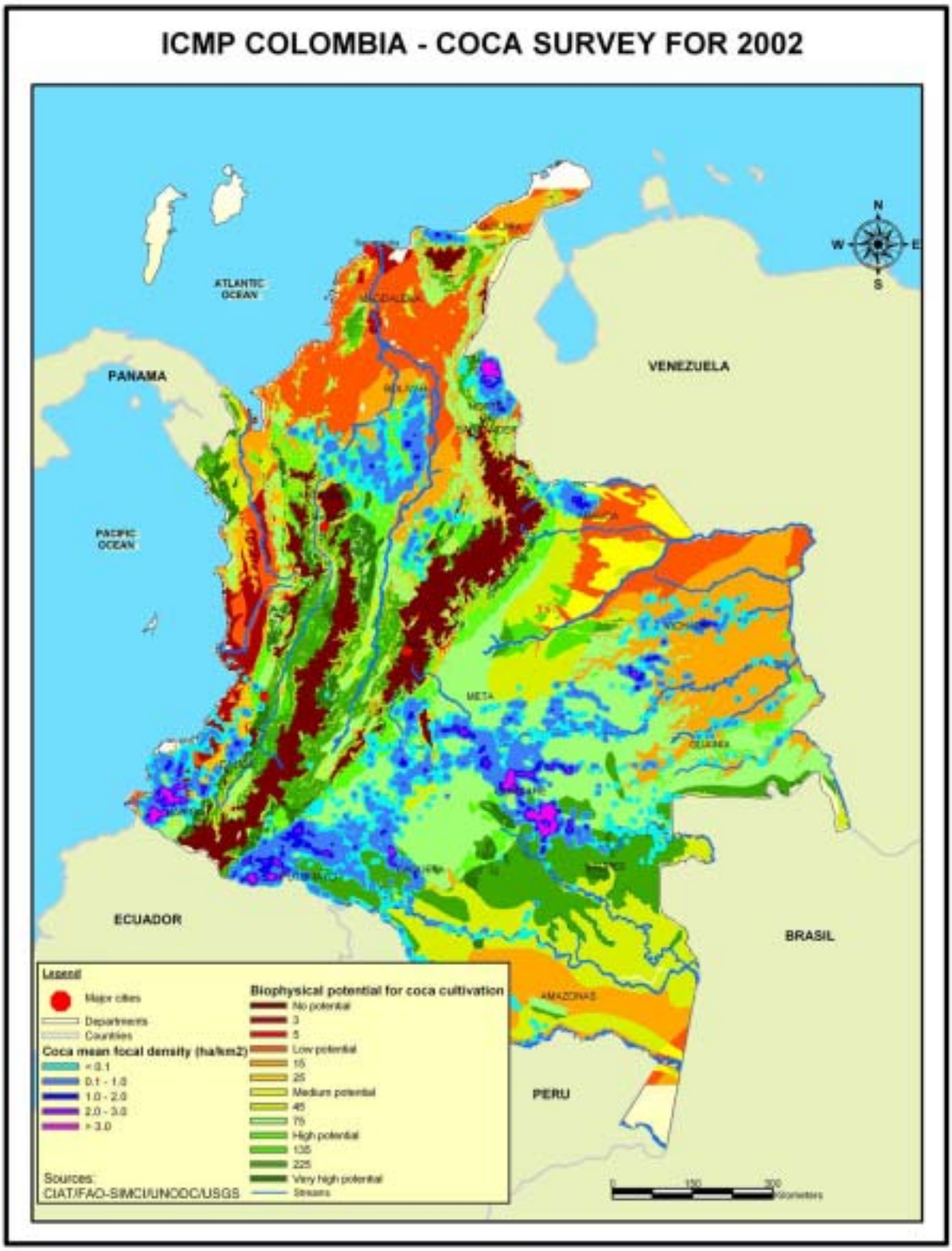
While Choco has established itself as a trafficking route for drugs and arms, the survey detected very few coca fields. In order to understand the reasons for the low cultivation patterns in this region, we have carried out a spatial analysis of bio-physical parameters that shall help to explain why productive coca cultivation does not have good conditions in the Choco department[9].

Coca is usually cultivated on slight slopes with well drained soils in an elevation that ranges from 250m to 1600m. It competes with lowland coffee, cacao, plantain, and some other land use patterns.

In order to estimate the potential, or risk, for areas being apt for coca cultivation, the project has combined the following biophysical information: elevation model (DEM), slopes (derived from DEM), soil texture and annual mean precipitation. Previous to spatially combining the four maps, they have been categorized and weighted, resulting in an indicator map for the potential aptitude for cultivating coca crops. In this map, yellow and green colours represent areas that have a medium to high potential for growing coca crops, whereas red tones indicate a low potential. Dark reddish-brown coloured areas have no potential due to elevations higher than 2000m.

[9] Sources of information: CIAT rainfall data, FAO soil map, USGS GTOPO30 elevation model and SIMCI 2002 illicit crop survey.

Map 8: Indicator of the biophysical potential for growing coca crops



2.4. 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 so far has been done by the US government under “Operation Breakthrough”. The findings of this operation, provided by the National Narcotics Bureau**,** indicated that the average cocaine yield per hectare of coca plants amounts to 4.7 kg/ha in Colombia in 2002.

Based on that ratio, the total coca cultivation of 102,000 ha recorded by SIMCI in December 2002 would have a potential cocaine production of about 480 metric tons.

While the potential one-year cocaine production of the 102,000 ha recorded in December 2002 in Colombia would amount to 480 metric tons, this number does not represent actual production throughout 2002. 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 more realistic estimate for Colombia, UNODC calculated an average of the two cultivation figures recorded in November 2001 and in December 2002 by the UNODC supported national monitoring system. This average (123,400 ha) was then multiplied by the estimated yield per hectare and per harvests per year (4). The result amounted to 580 metric tons of potential cocaine production in Colombia for 2002. While the 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.

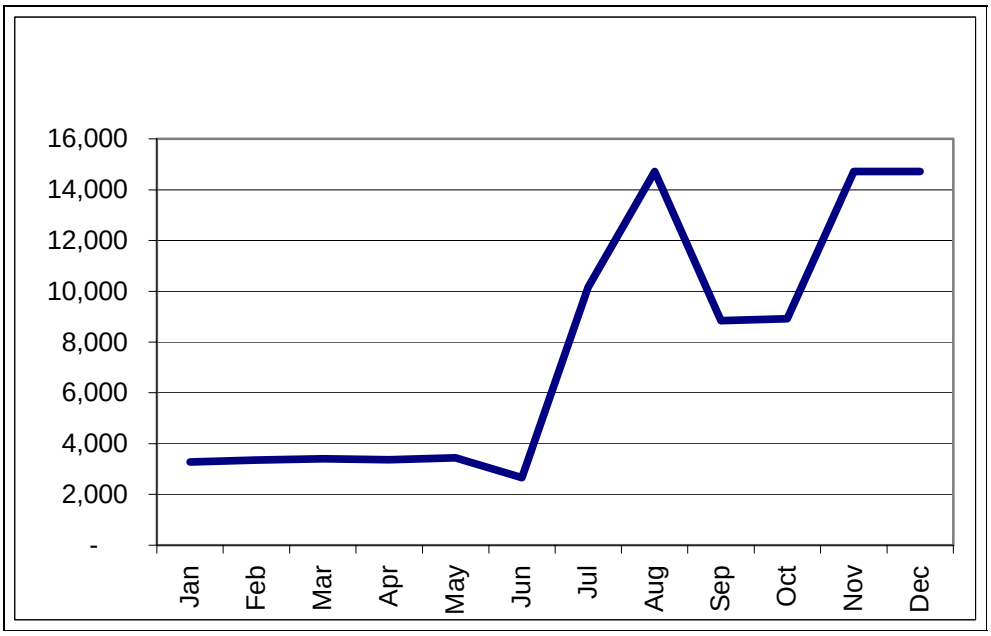
It should be noted that, although less than in the past, some of the coca base produced in Peru is still processed into cocaine in Colombian clandestine laboratories.

2.5. Coca prices

Contrary to Bolivia and Peru, there is no market for coca leaf in Colombia. 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 commercialization of cocaine. As a result of this procedure, the coca leaf producers could almost triple their income: 1 kg of coca base can be sold for about 790 US$[10], whereas the amount of dry leaf required for the production of 1 kg of coca base costs only 285 US$

The following chart shows the evolution of the coca leaf prices in 2002.

Figure 4: Coca leaf prices for 2002 (COP/arroba)



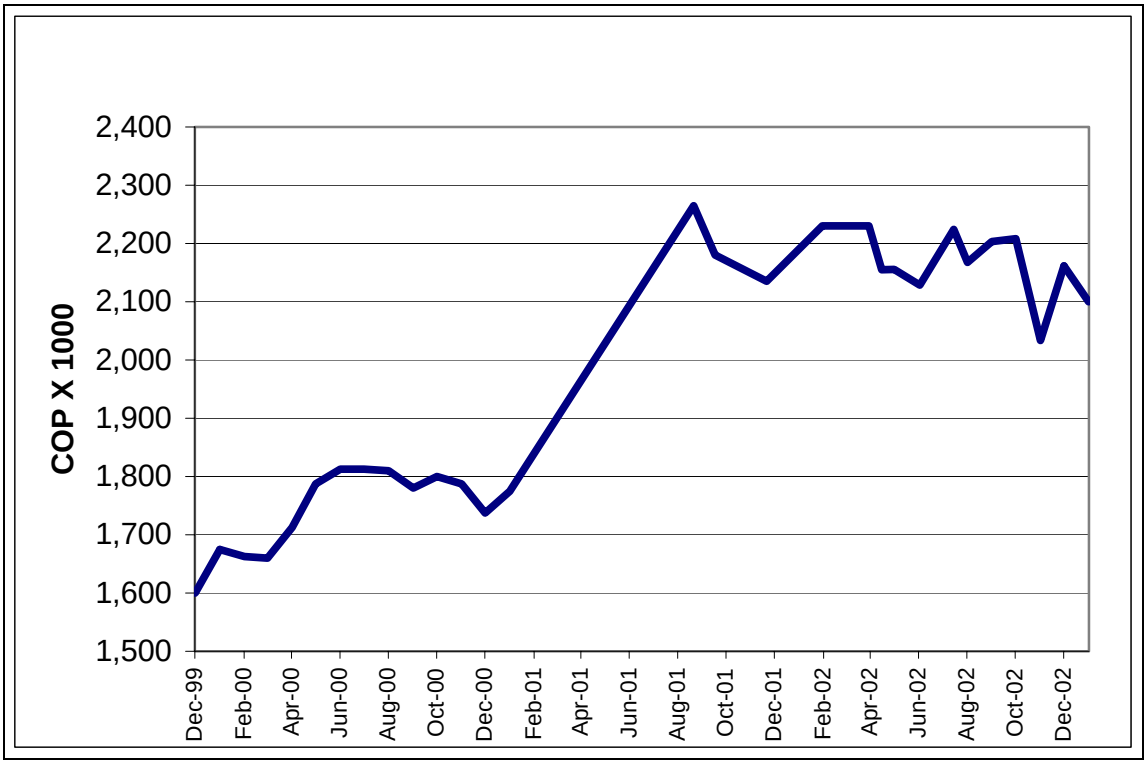
Source: PLANTE (2002)

The graph shows that prices for coca leaf increased almost 350% after June 2002, stabilizing at about US$ 0.42/kg (5 US$ per "arroba", equivalent to about 12 kg) in December 2002.

[10] At the exchange rate of 2.680 COP/USD of December 2002

In contrast to the evolution of coca leaf prices, the following graph indicates a slight decrease in prices paid for coca base since August 2001.

Figure 5: Average coca base prices 2000-2002 (thousands of COP/arroba)

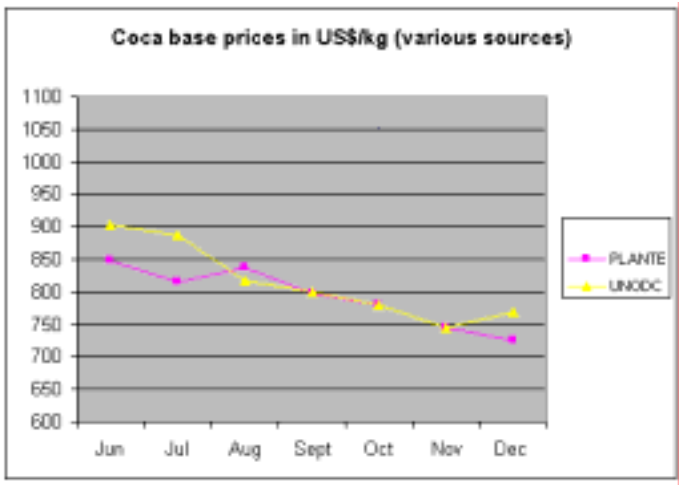


*Source: UNODC

Between August 2001 and December 2002, the prices for one kg of coca base fluctuated but remained in the range of 2,000,000 and 2,300,000 COP, recording only a decrease between the two dates of 1.7%.

However, during the latter half of 2002, coca base prices fell slowly, but steadily. As of December 2002, the price for one kg of coca base was 770 US$[11].

Table 22: Coca bases prices in US$/kg (various sources)



[11] at the exchange rate of 2.680 COP/USD of December 2002

The average coca base price for 2002 as a whole amounted to US$847/kg. Combined with the total coca base production of 580 metric tons, the total potential value of the 2002 farmgate production of coca base would be US$ 491 million.

2.6. Opium Poppy Cultivation

Opium poppy cultivation was introduced in Colombia in the 1980's, in a few marginal agricultural zones, when coffee prices fell. Opium poppy is now mainly being cultivated on mountain sides in south-western Colombia, especially in the departments of Huila, Tolima, and Nariño.

According to 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 2002, the DIRAN's estimates based on reconnaissance flights and spray operations, identified 4,253 hectares of opium poppy under cultivation, compared to 6,200 hectares in 2001.

2.7. Opium Production

Previous estimates assumed 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 the growing regions but one (Nariño department).

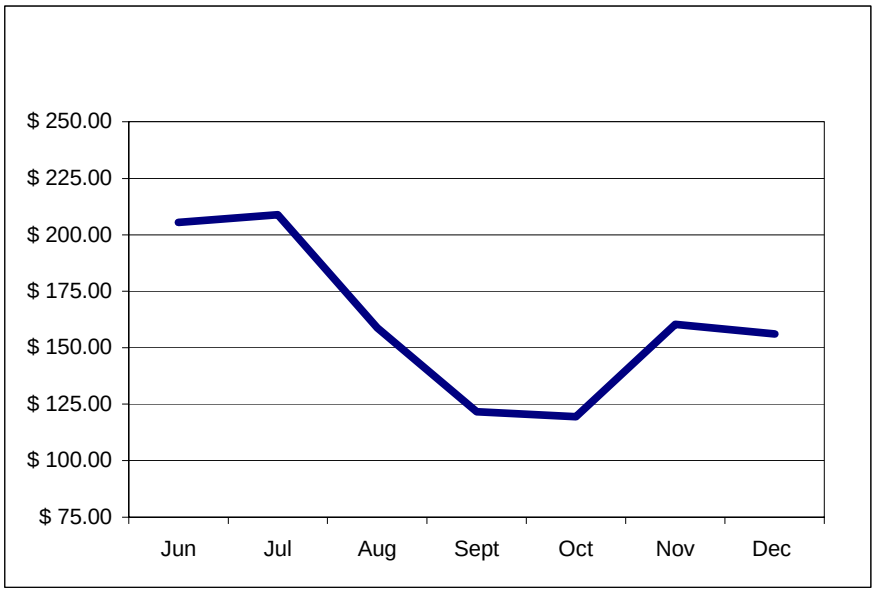
According to these studies, opium poppy fields yield between 13 and 17 kilograms of latex per hectare and per harvest, depending on the growing region. Assuming an average yield of 15 kilograms per hectare, and 2 harvests per year, the total potential opium latex production would be around 128 metric 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 in 2002.

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.

2.8. Opium Price

According to UNODC**,** in December 2002, the price paid for one kg of opium latex was about 160 US$. This represented a decrease of 30% compared to the previous year.

Figure 6: Opium latex prices for 2002 (US$/kg)



The average price for 2002 amounted to US$194/kg of opium latex. Combined with an estimated potential latex production of 128 metric tons, the potential value of the 2002 farmgate production of opium latex would amount to about US$ 25 millions.

2.9. Eradication

The Colombian anti-drugs strategy includes an important forced eradication 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. The exact content of this mixture that has changed over time and its present concentration are not known by UNODC.

UNODC did not participate in or supervise the spraying activities. All data were received directly from DIRAN. The 2002 data indicated that the government's eradication programme had a record year in 2002. The DIRAN sprayed a total of 130,364 hectares of coca and 3,371 hectares of opium poppy. This corresponded to an increase of 45 percent for coca and 67 percent for opium poppy, as compared to 2001.[12]

Table 23: 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	30,154
Meta	729	2,471	2,524	6,725	5,920	2,296	1,345	3,251	1,496	2,852
Caqueta	-	-	537	4,370	18,433	15,656	9,172	17,252	18,567	1,060
Putumayo	-	-	-	574	3,949	4,980	13,508	32,506	71,891	8,343
Vichada	-	50	85	-	297	91	-	2,820	-	-
Antioquia	-	-	684	-	-	-	6,259	-	3,321	5,540
Cordoba	-	-	264	-	-	-	-	-	734	-
Vaupes	-	-	-	-	349	-	-	-	-	-
Cauca	-	-	-	-	-	2,713	2,950	741	-	-
Norte Santander	-	-	-	-	-	-	9,584	10,308	9,186	6,734
Nariño	-	-	-	-	-	-	6,442	8,216	17,962	30,646
Santander	-	-	-	-	-	-	470	-	-	5
Boyaca	-	-	-	-	-	-	102		-	-
Bolivar	-	-	-	-	-	-	-	11,581	-	3,209
Total	3,871	23,915	18,519	41,861	66,029	43,111	58,073	94,153	130,364	88,543

* until 31 July 2003.

Table 24: 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
Antioquia	0.00	0.00	120.00	0.00	0.00	0.00	0.00	0.00	0.00
Caldas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Caquetá	0.00	0.00	0.00	382.60	0.00	0.00	0.00	0.00	400.70
Cauca	102.00	53.50	122.50	50.00	0.00	828.60	1.600.70	387.00	236.00
Cesar	128.00	305.00	713.00	91.00	650.00	125.00	423.30	426.00	547.60
Guajira	81.00	177.00	371.50	0.00	50.00	0.00	0.00	0.00	0.00
Huila	20.57.00	13.82.50	715.10	2.175.10	748.66	1.426.25	2.420.95	429.10	544.70
Meta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nariño	0.00	0.00	0.00	0.00	0.00	312.80	1.089.50	630.00	788.00
Tolima	1.169.00	1.548.50	4843.00	4.289.50	1.452.08	5.556.50	3.719.96	194.60	854.30
Total país por año	3.537.00	3.466.50	6.885.10	6.988.20	2.896.74	8.249.15	9.254.41	2.066.70	3.371.30

[12] Source: International Narcotics Control Strategy Report - INCSR

Regarding the estimates on spraying area, it is important to differentiate between the *accumulated sprayed area* reported here – which is the sum of areas fumigated 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. For example, in Putumayo, the *accumulated sprayed area* between January and December 2002 was 71,891 ha, while the project calculated that the spraying areas without overlapping amounted to 67,808 ha and once subtracting the areas covered several times within a short period, the effective sprayed area was estimated at about 65,000 ha.

Nevertheless, as can be seen from the graph below, the reduction in coca cultivation noted since 2001, corresponded to an increased and sustained eradication effort.

Figure 7: Comparison of net coca cultivation and accumulated sprayed areas (in ha)

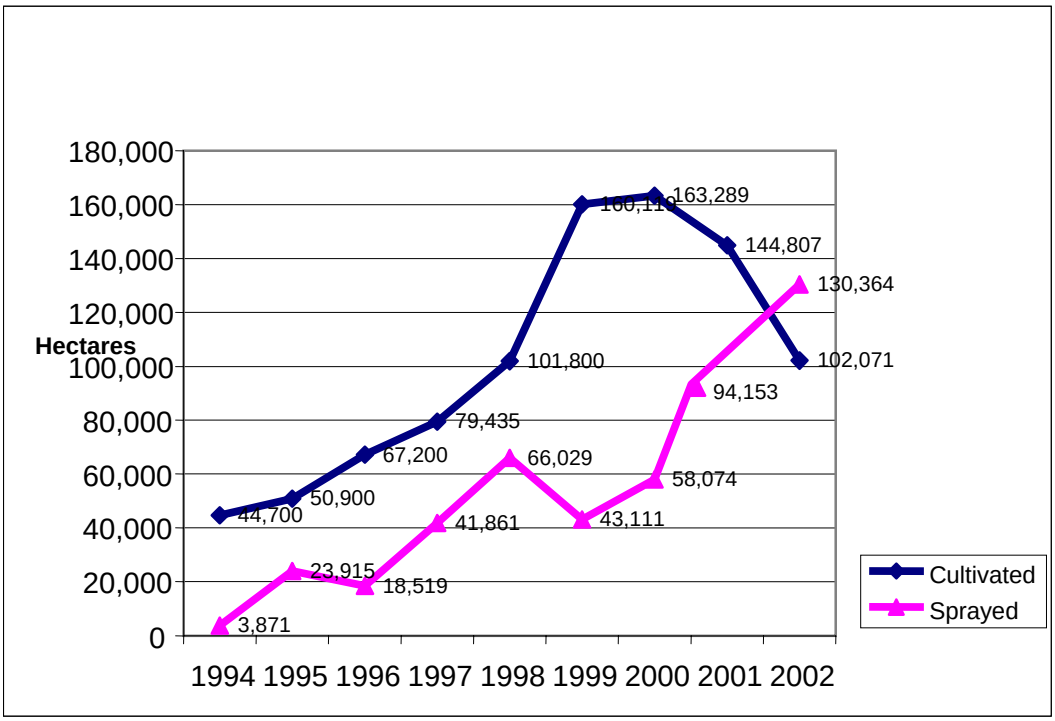
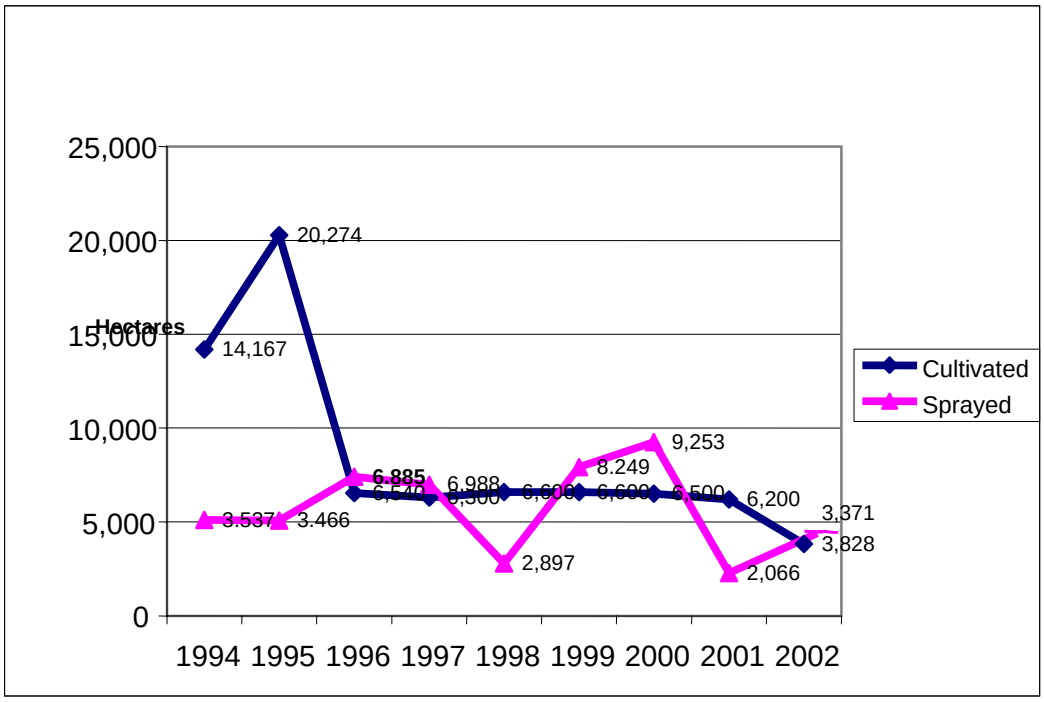


Figure 8: Comparison of net poppy cultivation and accumulated sprayed areas



The dynamics of reproduction of illicit crops after a fumigation campaign vary significantly from region to region. Once coca or opium poppy fields are fumigated, 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 cultivations into new and more remote areas of the country (balloon 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 Putumayo and Nariño.

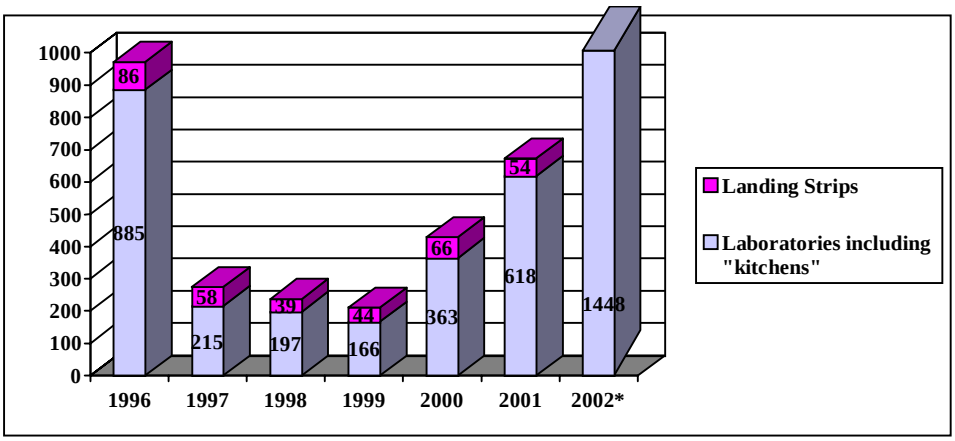
2.10. Other applications of SIMCI data

The geographical information generated by SIMCI on land use (forest, water, pastures, licit crops, infrastructure, urban areas etc.) also contributed to physical planning activities in general and to the Colombian alternative development programme in particular. The SIMCI project has actively supported the government's alternative development programme - PLANTE - in various ways, e.g. by contributing to geo-referencing process of the areas of alternative development, and by providing relevant data and information on land use and other secondary information, that enabled for better decision making while defining alternative development strategies.

2.11. Seizures

Although the UNODC was not involved in their collection, the data on seizures reported for 2002 by the government are reproduced below for information.

Figure 9: Air strips and laboratories destroyed[13]



For 1 January – 25 November 2002. Number of landing strips destroyed in 2002 not available.

According to other Government sources, the Public Forces destroyed a total of 1448 laboratories in 2002. Out of these, 1,273 corresponded to cocaine base labs, 138 to cocaine labs, 23 to cocaine paste labs, nine to potassium permanganate labs, three to heroine labs, one to a synthetic lab and one to an ammonia lab. Most cocaine labs were discovered in the Putumayo department (43%), Norte de Santander (14,4%) and Magdalena (11,1%), less in Nariño (8,2%), Antioquia (5,9%), Meta (3,5%), Arauca (3,2%), Caqueta (2,2%) and Guaviare (2,2%).[14]

Table 25: Drugs seized[15]

DRUG TYPE	1999	2000	2001	2002*
Cocaine (kg)	47,003	89,856	57,140	95,278
Coca base (kg)	16,035	9,771	16,572	22,614
Basuco (kg)	543	802	1,225	1,706
Coca leaf (kg)	307,783	897,911	583,165	368.000
Coca Paste (kg)	365	118	53	974
Latex (kg)	29	17	4	110
Morphine (kg)	154	91	47	20
Heroin (kilos)	515	564	788	775
Marihuana (kg)	70,124	75,465	86,610	76.998
Solid hashish (kg)	338	na	0.20	3,5
Poppy seeds (grams)	49,945	17,000	43,000	123,900
Coca seeds (kg)	754,032	1,678	98,916	27,752
Marihuana seeds (g)	25,214	121,350	11,310	na
Synthetic drugs (kg)	1,022	na	22,750	na

Results of actions over the main distribution channels (maritime, air and land) January - October 2002. Ministry of Defence

[14] Figures compiled by the General Command and National Police – DIJN, 2001

[15] Sistema de Información de Drogas de Colombia – SIDCO. In: Colombia's War Against Drugs. Actions and Results 2002.

[16] Sistema de Información de Drogas de Colombia – SIDCO. Consolidated from the National Police Anti-Narcotics Division, the National Navy, the Colombian Air Force, the National Army, the DAS and CTI – Consolidated by the National Anti-Narcotics Agency. In: Colombia's War Against Drugs. Actions and Results 2002.

Table 26: Drug seizures by drug type (kg)[16]

Drug Type	1997	1998	1999	2000	2001	2002*
Cocaine and Coca Base & Salts	42,044	107,480	63,945	110,428	31,335	50,421
Coca Leaf	117,817	340,564	307,783	897,911	583,165	368,000
Marihuana	178,132	70,025	70,124	75,465	86,610	76,988

Source: UNDCP, Global Illicit Drug Trends 2002. Sistema de Información de Drogas de Colombia - SIDCO

Table 27: Seizures of personal goods[17]

TYPE/YEAR	1997	1998	1999	2000	2001	2002*
Firearms	732	415	584	463	414	364
Vehicles	777	619	616	770	889	524
Boats	162	331	213	497	239	286
Aircraft	59	105	79	98	42	22

For 1 January – 25 November, 2002

According to the National Anti-Narcotics Bureau, a total of 40,406 goods were seized between 1989 and 2002.[18] Out of these, 8,329 are urban real estate, 5,405 land vehicles, 1,923 rural real estate, 406 motorboats, 227 aircrafts, in addition to 4,254 substances, money (3,756) and other goods (15,631).

[16] Resultados Operaciones 1996-2001, Policía Nacional Dirección-Antinarcóticos

[17] General Command and National Police – DIJN, January, 2001

[18] National Antinarcotics bureau – DNE. Assets Subdivision. In: Colombia's War Against Drugs. Actions and Results 2002.

Figure 10: Arrests for drug trafficking 1996-2001 (Law 30/86 "Estatuto Nacional de Estupefacientes")[19] 1 January –25 November, 2002.

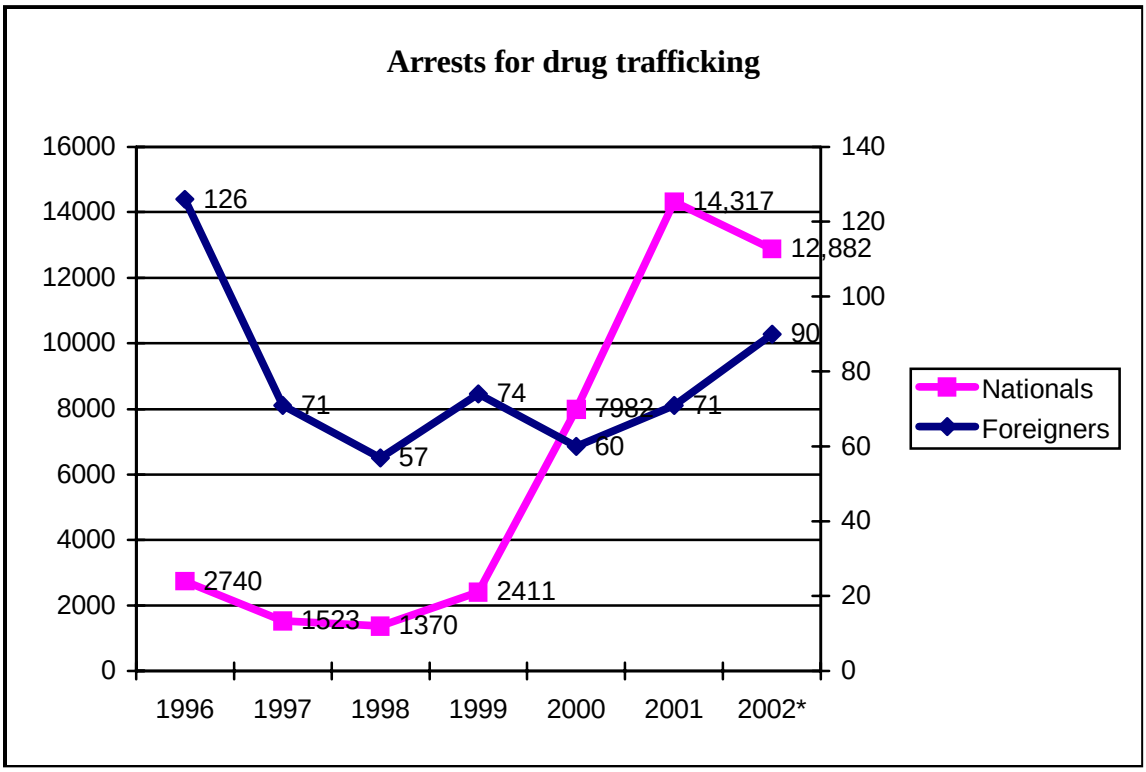


Table 28: Seizure of chemical substances[20]

INPUTS/YEAR	1997	1998	1999	2000	2001	2002*
Solid (kg)	2,236,711	1,129,883	1,007,197	797,103	1,359,926	2,627,169
Liquid (gallon)	1,684,236	1,956,462	1,154,028	898,986	1,459,986	2,229,374

[19] Ibid

[20] For 1997 – 1998 Policía Nacional Dirección Antinarcóticos, Actividades Antinarcóticos Periodo 1995-2001, Bogotá DC., November 2001. As of 1999: Sistema de Información de Drogas de Colombia – SIDCO. In: Colombia's War Against Drugs. Actions and Results 2002.

3. Methodology

3.1. Coca Cultivation

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).

Because fields of the two different coca varieties can be found next to each other in various proportion in different regions, it is difficult to establish a unique crop calendar or growing cycle valid for the whole country. 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.

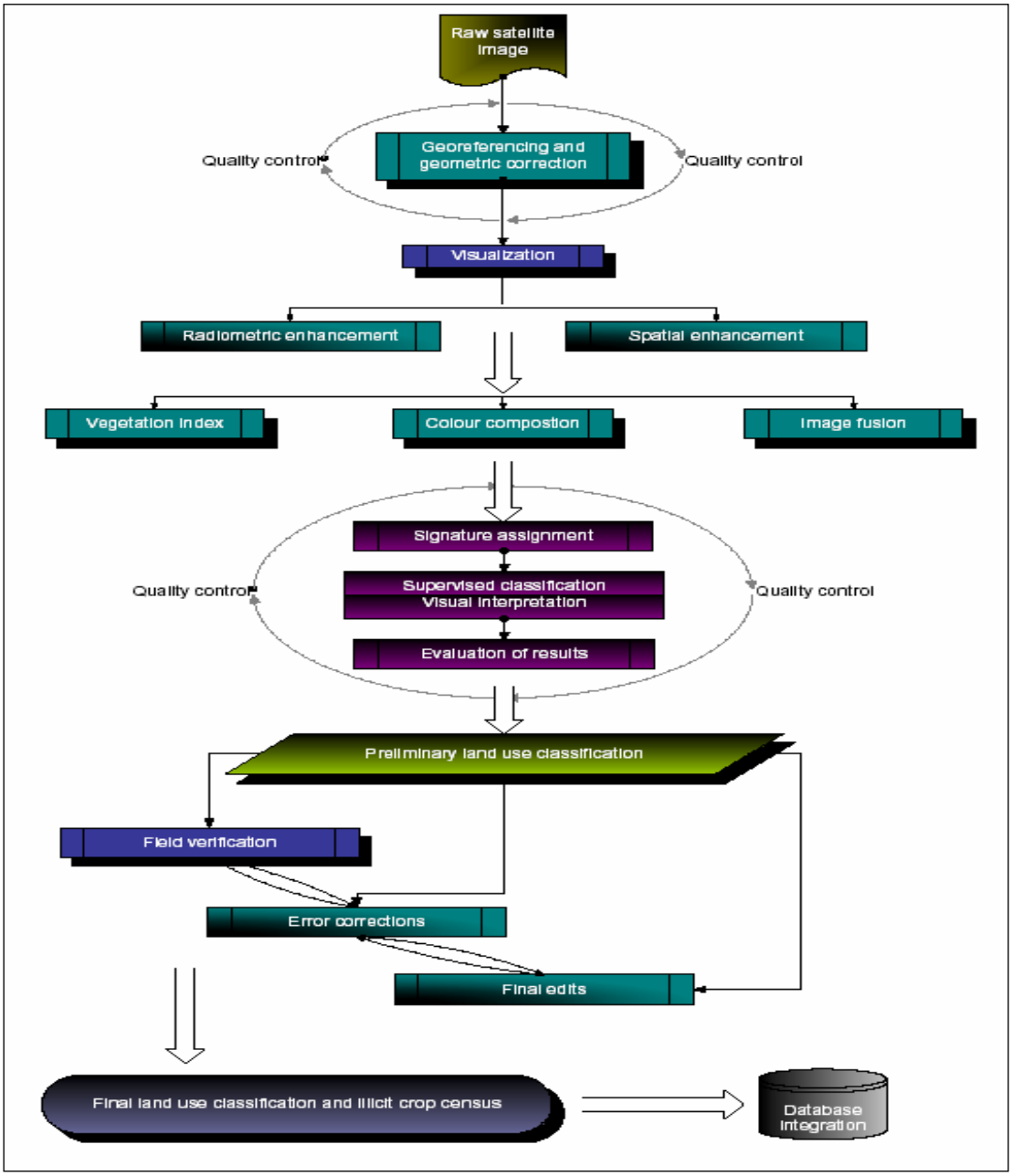
Coca cultivation in Colombia is located in remote regions, including national parks, indigenous reservations and other areas that lack infrastructure, although coca lately has turned up in more developed areas, such as the coffee growing zone. More than 60% of the coca is grown on small plots, while 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 crop interpretation

The monitoring of illicit coca bush cultivation is based on the interpretation and digital processing of Landsat and SPOT satellite images. For the 2002 census, the project analyzed a total of 61 Landsat images and 2 SPOT images, taken between August 2002 and January 2003. Compared to the 2001 survey, the acquisition window in 2002 was reduced from 9 to 6 months. This year’s shorter acquisition window enabled to produce a more precise estimate as of December 2002.

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

Figure 11: 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.

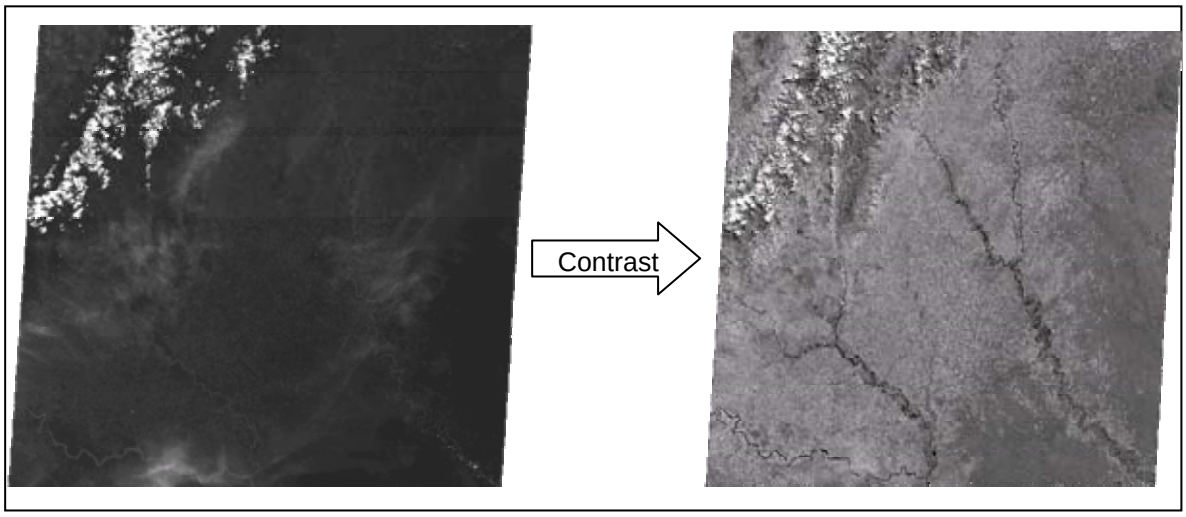
Re-sampling is the process of extrapolating data values for the pixels on the new grid from the values of the source pixels.

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 12: Example of the effects of radiometric enhancement

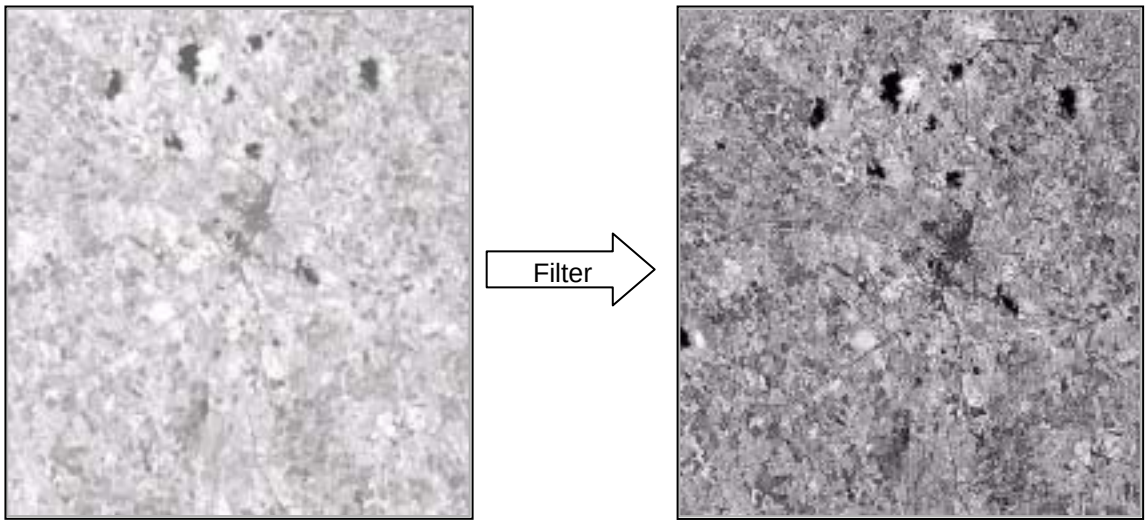


Spatial enhancement:

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 13: 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 color. The data file values in each layer are input to the assigned “color gun”. The most useful color 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 14: Display colour 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 criteria. 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:

1. Supervised classification of the land use and vegetation cover except coca, as defined in the classification scheme.

2. 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.

Only productive coca plants can be identified by means of multi-spectral image analysis. Unproductive coca, i.e. seedlings, harvested stems or fumigated plants show the same spectral characteristics as barren 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.

<u>Corrections:</u>

Three 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 2002 were included in the corrections for spraying. Two scenarios were considered:

- image acquired before the spraying activities.

In this case, 83% of the area identified as coca and coinciding with the spraying buffers were subtracted from the census results. The 83% accounted for the spraying effectiveness as provided by DIRAN / NAS.

- 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 fumigations 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 Caqueta, Cauca, Norte de Santander and Putumayo. A total of 3,700 ha (or 4%) was subtracted from the initial interpretation of 94,512 h of coca cultivation. The breakdown of the correction applied by department is presented in annex.

Figure 15: Example of buffers (in yellow) calculated around the SATLOC paths (in black)

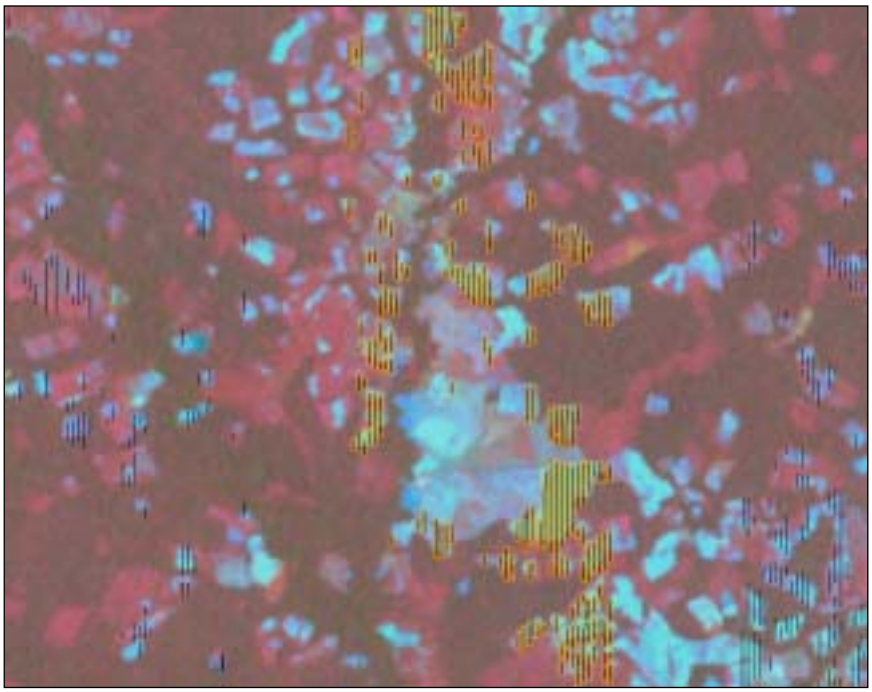
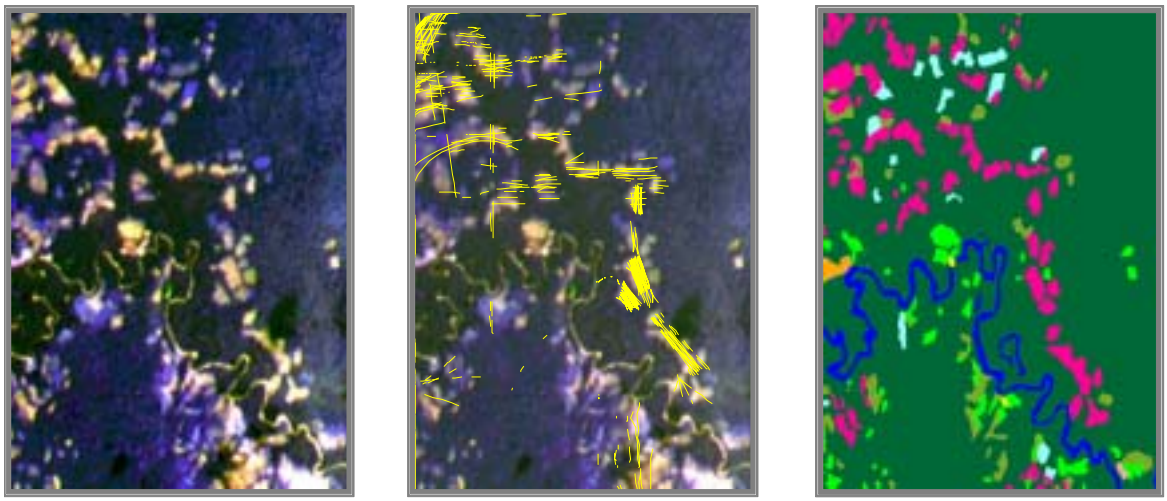


Figure 16: Example of correction process for spraying.



2) Correction of 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.

The following two scenarios were considered:

- Areas covered with clouds in the 2003 census that were cloud free in previous census

As a first step, in both scenarios, buffers of the cloud covered areas were generated. The results of the most recent survey (2001, 2000 or 1999) coinciding with the buffered areas were used as the best approximation of the coca cultivation under the clouds in 2003.

- Areas covered with clouds in all existent census

In this case, buffers of cloud free areas in previous census images lying within the 2003 cloud-buffers were generated and subtracted to obtain clouded and cloud free areas of all census results. After this, the identified cloud free areas were added to the initial interpretation results.

Finally, for the area completely overcast by clouds in all images acquired, a buffer of about 1 km width around the clouded areas was created and the average coca density in this buffer calculated and multiplied by the size of the cloud-buffers. The result was then added to the initial interpreted results.

Corrections for cloud cover were applied in all departments (see breakdown in annex). For the whole country, a total of 12,070 ha (or 13 %) were added to the initial interpreted coca cultivation of 94,512 ha

3) 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 30 December 2002.

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 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 to the initial interpreted results.

Because growing cycles and crop dynamics were disrupted in fumigated areas, the corrections for clouds were not applicable in areas subject to aerial spraying.

Correction for antiquity totaled 811 ha (or 1% of the initial results) for the whole country and were subtracted from the initial interpreted results of 94,502 ha.

The detailed breakdown of correction by department was presented in annex. All together, the three corrections amounted to 7,559 ha (or 8%) that were added to the initial interpretation results.

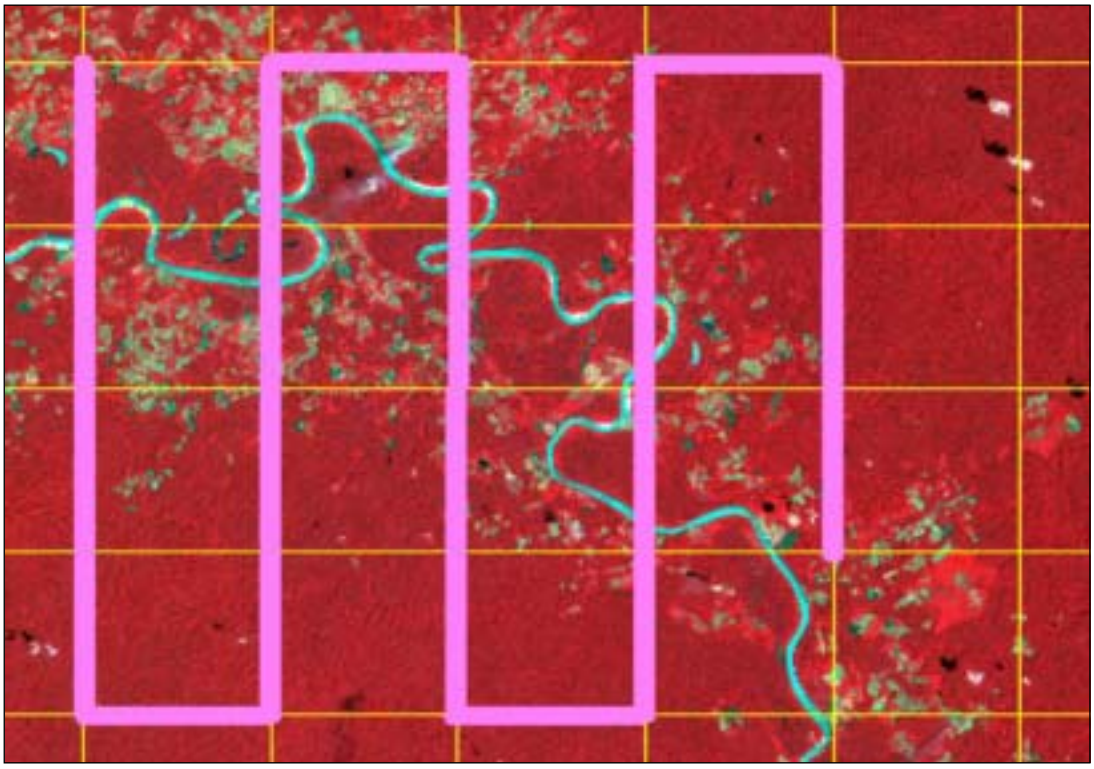
Field verification:

To correct and improve the results of the preliminary interpretation, 135 hours of flight verification were carried out before the final process of quality control. The verification process was conducted over ten 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 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 17: 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

A total of 144 polygons, representing 205 ha were randomly selected for the quality control exercise. Their interpretation was verified through over-flight or the use of MDIS or SATLOC data.

During the 29 hours over flight, a sample of 93 interpreted polygons (representing 131 ha), was verified through over-flight. However, the over-flight security restrictions made impossible to finish the field work on 13 polygons representing 42.66 ha in the Guaviare area.

Table 29: Quality Control

	MDIS images	SATLOC	Over-flight	Total
Sample:				
Area (ha)	1.71	48.2	130.56	180.47
Nbre polygons	5	33	93	131
Error				
Area (ha)	0	0	14.53	14.53
Nbre polygons	0	0	11	11

Contrary to the verification work, this process did not change the initial interpretation results but was used as an accuracy assessment only.

The quality control carried out revealed an accuracy of 87% (i.e. 13% error rate) in the thematic identification of the coca fields (number of correctly interpreted polygons over total number of polygons) and an overall accuracy of 92% (i.e. 8% error rate) for the area estimate and for the number of polygons identified (number of hectares/polygons correctly interpreted over total number of hectares/polygons).

Traditional and non-traditional zone

Although the satellite images were acquired over the whole country, the project distinguished between the traditional coca area over which over-flight and accuracy assessment were performed and the non-traditional coca area over which the project only identified potential coca fields but without thorough field verification. The national estimates was limited to the coca cultivation interpreted in the traditional coca area. The findings over the non-traditional 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 30: 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	0.09 %
Area of influence	5,391,100 ha
Mean Coca cultivation density	1.89 coca ha/km^2
Satellite images processed in traditional area	36 Landsat (3 duplicates) and 2 SPOT
Satellite images processed in non traditional area	25 Landsat
Area covered by one Landsat image	3,240,000 ha
Area covered by one SPOT image	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 socio-economic factors like poverty, homicide rates, population displacement.

3.2. Opium Poppy

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 Antinarcotics Police - 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.

3.3. 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. The most comprehensive work on this topic so far has been done by the US government. The US estimate for the average cocaine yield per hectare of coca plants amounts to 4.7 kg/ha in Colombia in 2002.

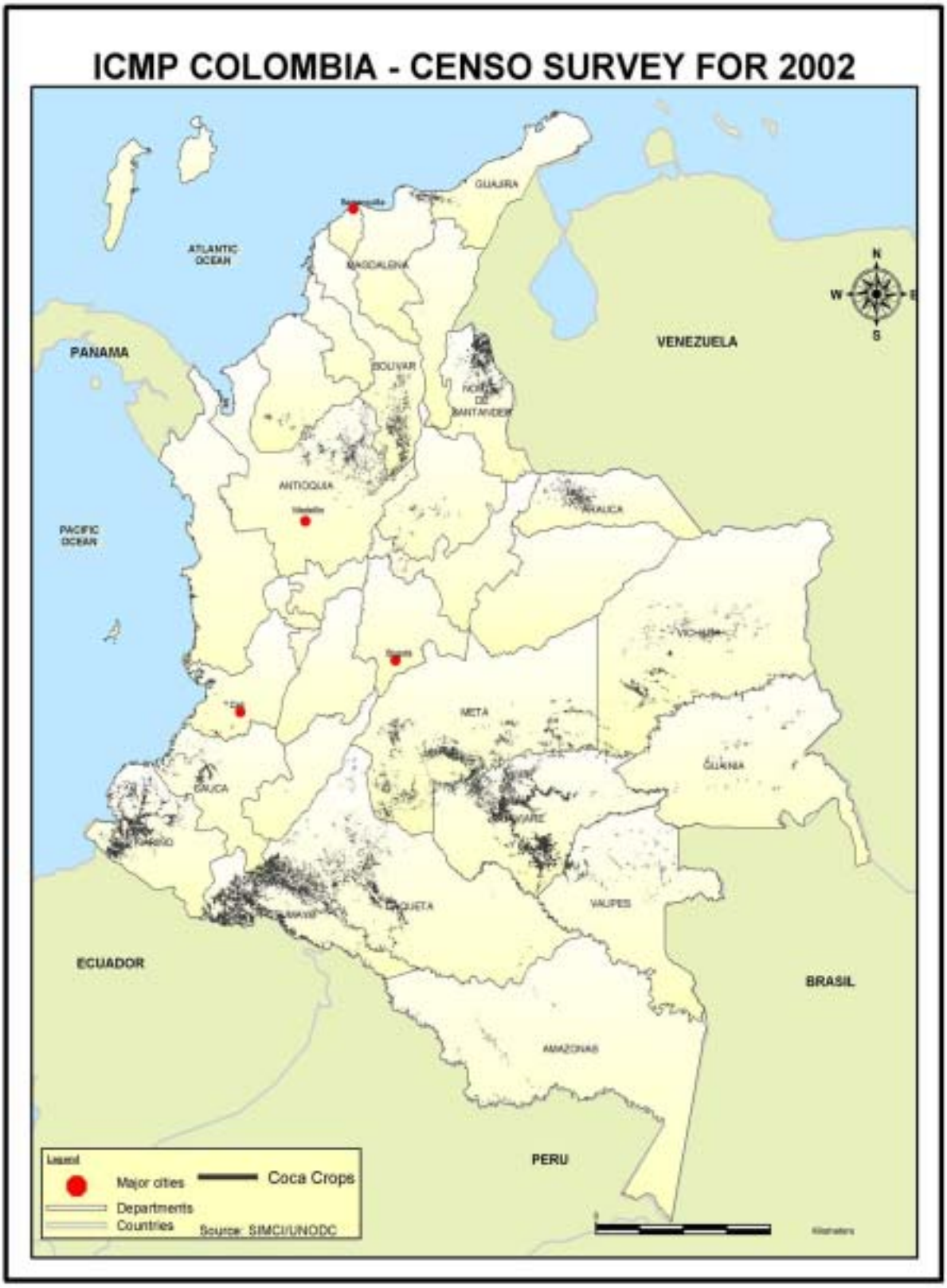
Similarly, UNODC has not conducted studies on opium yield and relied on the available US findings for opium yield.

3.4. Coca and Opium Prices

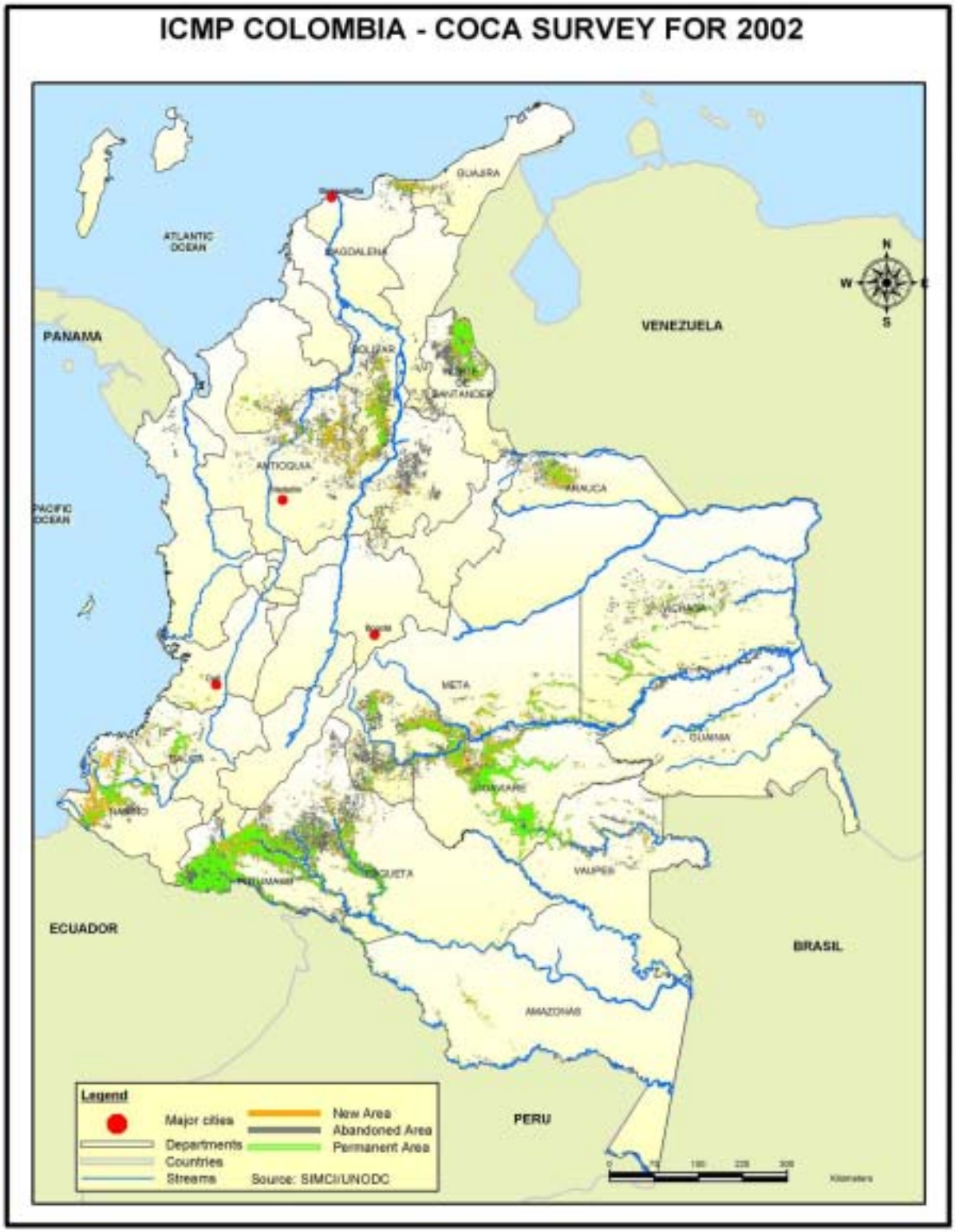
Prices of coca base and opium latex were collected by field technicians through interviews of farmers in the various coca growing departments. PLANTE, the government’s alternative development authority, collected prices in Caquetá, Vichada, Norte de Santander, Nariño, Meta, Guaviare, Cauca, Putumayo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

4. Annexes

Annex 1: Map of coca growing areas



Annex 2: Map of areas of persistence and abandonment



Annex 3: Satellite image coverage (Landsat and SPOT)

Image No.	Area	Date	% Cloud
4-57	Guaviare	Nov 12	15
4-58	Guaviare	Nov 28	0
5-57	Guaviare	Jan 6 03	0
5-58	Guaviare	Jan 22 03	0
5-59	Guaviare	Mar 8 03	2
6-55	Arauca	Sep 7	35
6-58	Guaviare	Dec 28	5
6-59	Guaviare	Sep 23	25
6-59	Guaviare	Dec 28	10
6-60	Guaviare	Aug 6	25
6-61	Amazonas	Sep 7	15
6-62	Amazonas	Jul 21	7
7-54	Gabarra	Jun 10	44
7-55	Arauca	Sep 14	25
7-58	Guaviare	Sep 30	15
7-59	Guaviare	Sep 30	15
7-60	Putumayo	Sep 14	5
7-61	Amazonas	Jan 4	0
8-52	S. Nevada	Jul 3	38
8-54	Sur Bolívar	Dec 26	35
8-54	Sur Bolívar	Aug 4	12
8-55	Sur Bolívar	Aug 4	15
8-56	Boyacá	Aug 4	36
8-58	Guaviare	Sep 21	30
8-59	Putumayo	Oct 7	15
647/346*	Putumayo	Sep 5	0
647/348*	Putumayo	Sep 12	0
8-60	Putumayo	Oct 7	35
9-52	S.Nevada	Oct 14	15
9-54	Sur Bolívar	Jul 26	42
9-55	Sur Bolívar	Oct 14	26
9-58	Cauca	Jan 2 03	55
9-59	Putumayo	Sep 12	25
9-60	Putumayo	Sep 12	5
9-60	Putumayo	Oct 14	0
10-55	Chocó	Nov 6	45
10-58	Nariño	Abr 12	20
10-59	Nariño	Abr 12	39

* SPOT images

Annex 4: Satellite image coverage of non traditional areas

Region	Image No.	Date
Guainía	3-58	Nov 21
Guainía	3-59	Nov 21
Vichada	4-56	Nov 28
Guainía	4-59	Nov 28
Vaupés	4-60	Sep 9
Amazonas	4-61	Aug 8
Amazonas	4-62	Aug 8
Amazonas	4-63	Aug 8
Vichada	5-56	Dec 21
Vaupés	5-60	Jan 22 03
Amazonas	5-61	Jan 22 03
Amazonas	5-62	Sep 16
Casanare	6-56	Jan 13 03
Meta	6-57	Jan 13 03
Guajira	7-52	Aug 13
Boyacá-Casanare	7-56	Jan 4 03
Casanare-Meta	7-57	Sep 30
Cesar	8-53	Nov 24
Tolima-Cundinamarca	8-57	Oct 7
Atlántico-Magdalena	9-53	Jan 2 03
Antioquia-Caldas	9-56	Jul 26
Quindío – Valle del Cauca	9-57	Oct 14
Urabá	10-54	Nov 6
Chocó	10-56	Apr 12
Chocó	10-57	Apr 12

Annex 5: Verification and quality control flights

	Destination	Dates	Days	Hours of flight	Tasks	Type of vehicle
2002	PUTUMAYO	7-11-02	1	5	Quality control	Caravan airplane
	PUTUMAYO	7-17-02	1	9	Quality control	Caravan airplane
	GUAVIARE*	9-24, 9-25-02	2	15	Quality control	Caravan airplane
	ARAUCA	12-2-02	1	7	Field verification	Caravan airplane
	CAUCA - NARIÑO	12-3, 12-4-02	2	10	Field verification	Caravan airplane
	GABARRA	12-27-02	1	7.5	Field verification	Caravan airplane
	SIERRA NEVADA – SUR DE BOLIVAR	1-5, 1-6,1-7-03	3	25	Field verification	Caravan airplane
	PUTUMAYO - CAUCA NARIÑO	2-6, 2-7, 2-8, 2-9, 2-10-03	5	30	Field verification	Caravan airplane
	ARAUCA	2-17-03	1	7	Field verification	Caravan airplane
	ANTIOQUIA	2-18, 2- 19-03	2	15	Field verification	Caravan airplane
	GUAVIARE	2-25, 2-26, 2-27, 2-28, 1-3-03	5	33	Field verification	Caravan airplane
	Total		24	164	Hours helicopter	0
					Hours airplane	164

Annex 6: 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 fumigation through GPS data and visual inspection by over-flights, to evaluate the sample selected by statistics procedures.

Areas evaluated with different verification methods

EVALUATION		**VERIFICATION METHOD**			
		MDIS images	Spraying corridors	Field verification 2002	**TOTAL**
TOTAL EVALUATED	Area (ha)	1.71	48.2	130.56	**180.47**
	No. Parcels	5	33	93	**131**
NOT EVALUATED	Area (ha)	NA	NA	42.66	**42.66**
	No. Parcels	NA	NA	13	**13**
TOTAL SAMPLE	Area (ha)	1.71	48.2	173.22	**223.13**
	No. Parcels	5	33	93	**144**

Quality control results

EVALUATION RESULTS		VERIFICATION METHOD			
		MDIS images	Spraying corridors	Field verification 2002	TOTAL
HITS	Area (ha)	1.71	48.2	116.03	165.94
	No. parcels	5	33	82	120
ERRORS	Area (ha)	0	0	14.53	14.53
	No. parcels	0	0	11	11
NOT EVALUATED	Area (ha)	NA	NA	42.66	42.66
	No. parcels	NA	NA	13	13

Annex 7: Correction for cloud cover, eradication, antiquity for 2002 by department (in ha)

Department	Cloud cover	Eradication (spraying)	Image Antiquity	Total	Interpreted	Adjusted
ANTIOQUIA	343		-265	78	2,952	3,030
AMAZONAS	113		63	176	608	784
ARAUCA	9		-35	-26	2,240	2,214
BOLIVAR	176		-399	-223	2,958	2,735
BOYACA	13		-18	-5	123	118
CAQUETA	1,221	-1,455	-71	-305	8,717	8,412
CAUCA	42	-144	40	-62	2,182	2,120
CORDOBA	27		-11	16	369	385
CUNDINAMARCA	6		-7	-1	58	57
GUAINIA	24		27	51	698	749
GUAJIRA	74		47	121	233	354
GUAVIARE	1,038		26	1,064	26,317	27,381
MAGDALENA	87		30	117	527	644
META	1,911		-419	1,492	7,730	9,222
NARIÑO	4,522		72	4,594	10,537	15,131
NORTE DE SANTANDER	1	-60	297	238	7,803	8,041
PUTUMAYO	2,262	-2,041		221	13,504	13,725
SANTANDER	45		-76	-31	494	463
VALLE DEL CAUCA	13		1	14	97	111
VAUPES	24		-104	-80	1,565	1,485
VICHADA	119		-9	110	4,800	4,910
TOTAL	12,070	-3,700	-811	7,559	94,512	102,071

Annex 8: Pilot project for the determination of recommended land use in an alternative development programme

The SIMCI project developed together with the government's Geographical Institute a concrete pilot project for the determination of recommended land use in a limited area of Putumayo, in order to evaluate and assess the utility of such information system for alternative development in general.

Objectives

- Prepare a map of the recommended land use within the study area.
- Identify agricultural products and vegetation species that are suitable to the biophysical characteristics of the study area and economically and socially competitive with the illicit crops to be substituted.

Study area

Limited to areas with presence of illicit crops and availability of adequate base information, the area of interest identified for the pilot projects is located between the Guamez and San Miguel rivers and the meridians 77°03` W and 76°46` W.

Modalities

The Project has been carried out in close cooperation with the National Geographic Institute (IGAC) which provided with the information about soils, recommended land use and environmental risks.

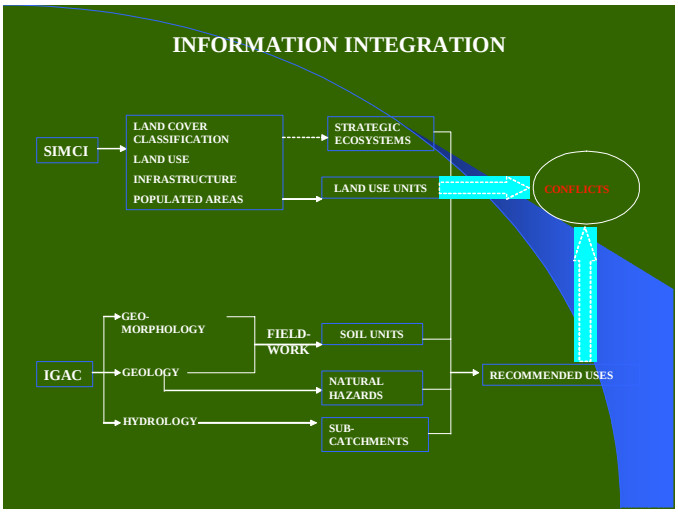
SIMCI prepared the cartographic information on recent land use, infrastructure and populated areas.

The IGAC and SIMCI data were combined in a local GIS to provide information on recommended land use as well as to identify bio-physical and economical conflicts derived from actual land use.

The resulting recommendations and base information shall help with the technical and scientific tasks to be carried out in the decision making process for establishing alternative development policies for that region.

The following graphs illustrate the methodology of the project.

Figure 18: Work flow of information integration



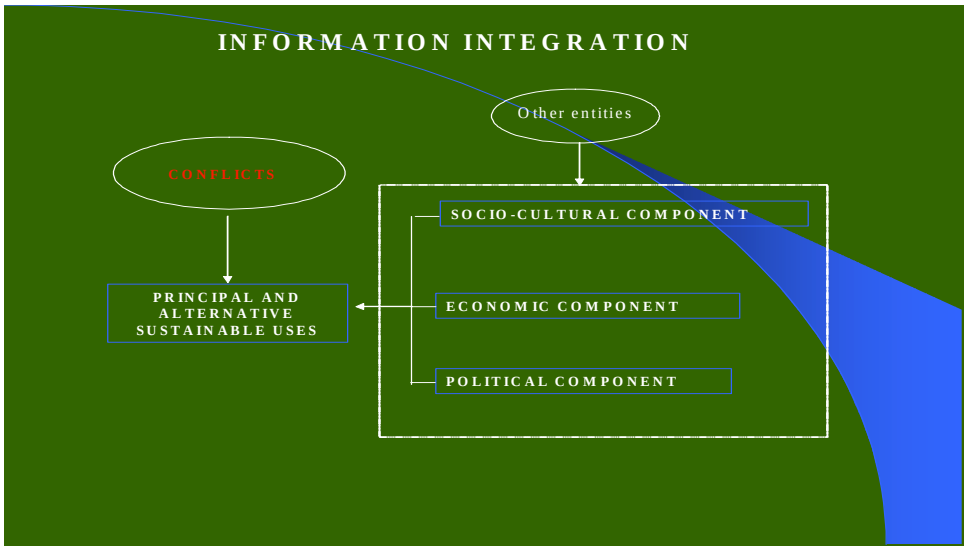
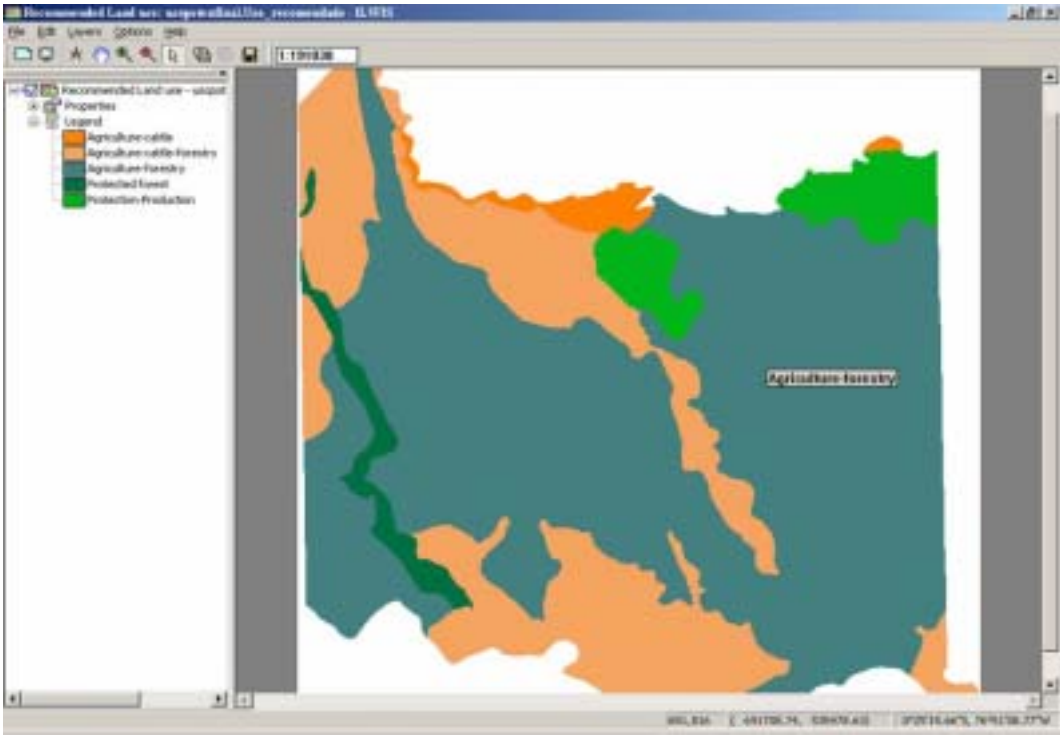
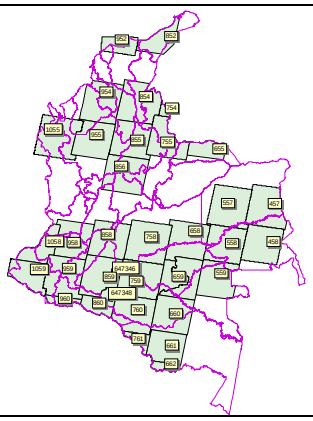


Figure 19: Sample of GIS query



Annex 9 : Multitemporal Analysis for 2001-2002



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION NATIONAL

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	144.807	94.447	-47.981	-33
Stable area	15.240	15.240	NA	NA
Abandoned area	127231	NA	NA	NA
New coca plantings	NA	79.239	NA	NA
Coca in fields larger than 3 has	67.724	35.595	-35.095	-51
Coca in fields smaller than 3 has	71.771	58.785	-12.986	-19
Number of coca in fields larger than 3 has	10.450	6.292	-4.158	-40
Number of coca in fields smaller than 3 has	63.396	56.664	-6.732	-11

<u>The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected</u>

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
NATIONAL

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	15.229
Primary forest to coca	34.768
Secondary forest to coca	14.008
Other to coca	22.105
Uncertain changes and corrections	8.369

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to secondary forest	54.275
Coca to other	61.824
Uncertain changes and corrections	11.132

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
NATIONAL

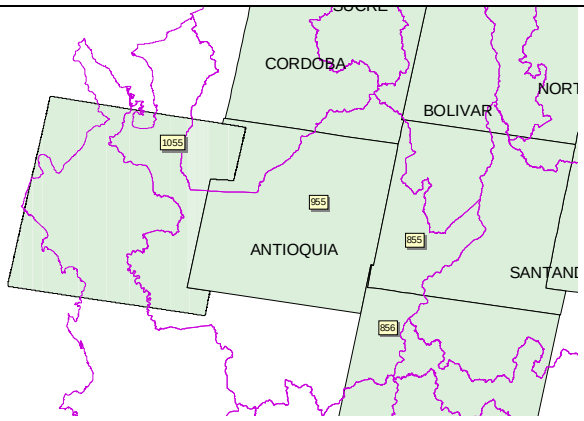
4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	15.229	15.229	NA	NA
Primary forest / coca	34.768	NA	NA	NA
Secondary forest / coca	14.008	54.275	40.267	287
Other/coca	22.105	61.824	39.719	180
Uncertain changes and corrections	8.369	11.132	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: There is a high mobility of new plantings caused by spraying activities and other factors, and an important reduction of large fields. The decrease of coca cultivation is lower in small fields. The most important changes affect primary forest. The results of felling activities and forest regeneration is even, but 77% of the felled forest was done in primary forest which contains a degree of complexity, ecological richness and biodiversity far superior in comparison to the regenerated forest.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION DEPARTAMENT OF ANTIOQUIA

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	3.574	2.952	-622	-17
Stable area	34	34	NA	NA
Abandoned area	3.540	NA	NA	NA
New coca plantings	NA	2918	NA	NA
Coca in fields larger than 3 has	1.262	825	-436	-35
Coca in fields smaller than 3 has	2.312	2127	-185	-8
Number of coca in fields larger than 3 has	246	170	-76	-31
Number of coca in fields smaller than 3 has	1.745	1847	102	6

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF ANTIOQUIA

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	34
Primary forest to coca	1.591
Secondary forest to coca	545
Other to coca	350
Uncertain changes and corrections	432

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to secondary forest	1.895
Coca to other	779
Uncertain changes and corrections	866

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF ANTIOQUIA

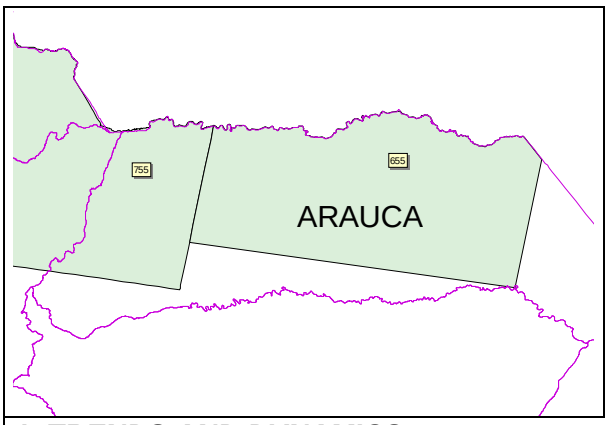
4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	34	34	NA	NA
Primary forest/coca	1.591	NA	NA	NA
Secondary forest/coca	545	1.895	1350	248
Other/coca	350	779	429	123
Uncertain changes and corrections	432	866	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: Fumigation causes high mobility in new plantings. There is a relevant reduction of coca in the large fields and stability in the small ones. 88% of the felled forest for coca cultivation is been regenerated; however, the complexity and ecological richness of the felled forest is highly superior to the secondary forest.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION DEPARTAMENT OF ARAUCA

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	2.726	2.239	-487	-18
Stable area	139	139	NA	NA
Abandoned area	2587	NA	NA	NA
New coca plantings	NA	2.138	NA	NA
Coca in fields larger than 3 has	1.079	976	-103	-10
Coca in fields smaller than 3 has	1.647	1.263	-384	-23
Number of coca in fields larger than 3 has	189	187	-2	-1
Number of coca in fields smaller than 3 has	927	918	-9	-1

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF ARAUCA

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	139
Primary forest to coca	246
Secondary forest to coca	832
Other to coca	982
Uncertain changes and corrections	78

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to secondary forest	598
Coca to other	1.976
Uncertain changes and corrections	13

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF ARAUCA

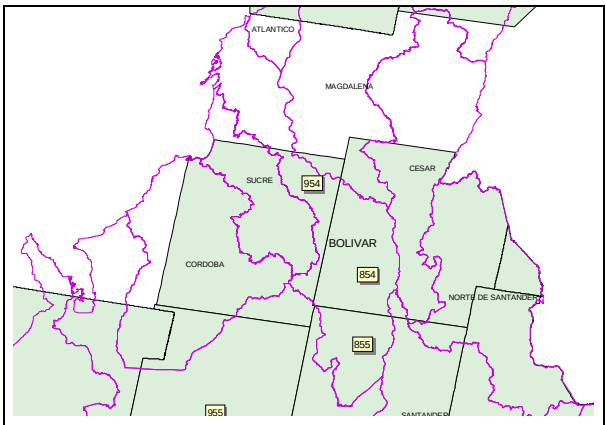
4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	139	139	NA	NA
Primary forest/coca	246	NA	NA	NA
Secondary forest/coca	832	598	-234	-28
Other/coca	982	1.976	994	101
Uncertain changes and corrections	78	13	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: The high mobility of coca cultivation did not expand the area of influence. The coca area shows a small decrease in large and small fields. The secondary forest was the most affected vegetation, while the substitution for pastures and licit crops was the most common.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION DEPARTAMENT OF BOLIVAR

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	6.137	2.957	-3.180	-52
Stable area	297	297	NA	NA
Abandoned area	5.840	NA	NA	NA
New coca plantings	NA	2660	NA	NA
Coca in fields larger than 3 has	3.539	879	-2.659	-75
Coca in fields smaller than 3 has	2.598	2.078	-520	-20
Number of coca in fields larger than 3 has	592	197	-395	-67
Number of coca in fields smaller than 3 has	2.065	1.640	-425	-21

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF BOLIVAR

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	297
Primary forest to coca	1.257
Secondary forest to coca	583
Other to coca	703
Uncertain changes and corrections	117

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to secondary forest	2.654
Coca to other	2.734
Uncertain changes and corrections	452

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF BOLIVAR

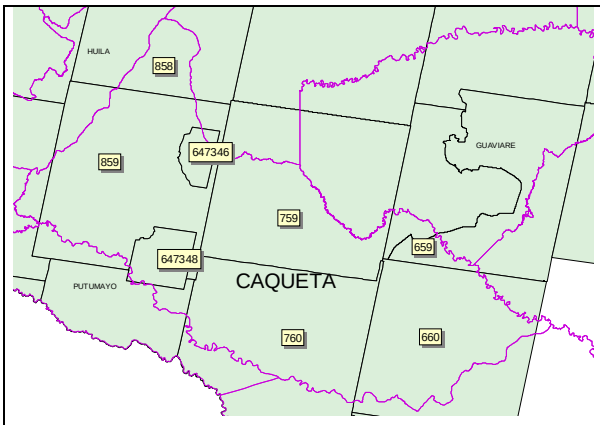
4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	297	297	NA	NA
Primary forest/coca	1.257	NA	NA	NA
Secondary forest/coca	583	2.654	2.071	355
Other/coca	703	2.734	2.031	289
Uncertain changes and corrections	117	452	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: There is a high mobility of new plantings and a reduction in the number and size of large fields. Small fields decreased in the same proportion. Primary and secondary forest was equally affected.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION DEPARTAMENT OF CAQUETA

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	13.785	8.712	-5.073	-37
Stable area	1311	1311	NA	NA
Abandoned area	12.474	NA	NA	NA
New coca plantings	NA	7399	NA	NA
Coca in fields larger than 3 has	5.761	2.768	-2.993	-52
Coca in fields smaller than 3 has	8.024	5.944	-2.080	-26
Number of coca in fields larger than 3 has	1.089	583	-506	-46
Number of coca in fields smaller than 3 has	6.803	4.961	-1.842	-27

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF CAQUETA

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	1.311
Primary forest to coca	1911
Secondary forest to coca	1.579
Other to coca	3.224
Uncertain changes and corrections	685

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to secondary forest	3.145
Coca to other	8.408
Uncertain changes and corrections	920

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF CAQUETA

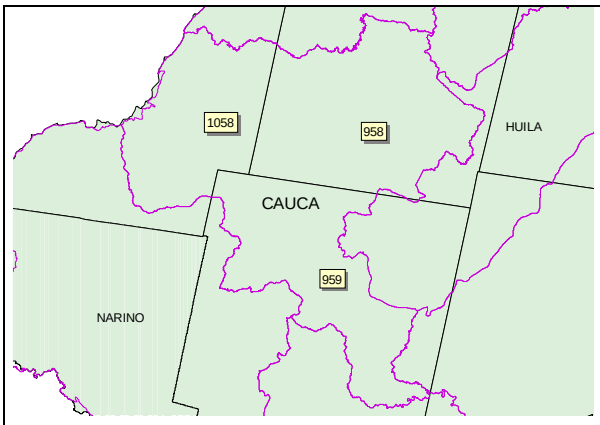
4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	1.311	1.311	NA	NA
Primary forest/coca	1911	NA	NA	NA
Secondary forest /coca	1.579	3.145	1566	99
Other/coca	3.224	8.408	5184	161
Uncertain changes and corrections	685	920	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: There is a high mobility in coca cultivation as result of spraying activities and other factors. Coca cultivation mainly decreased in large fields. Non-forest vegetation was highly affected by coca planting. Most coca cultivation was substituted by grasslands.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION DEPARTAMENT OF CAUCA

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	2.969	2.181	-788	-27
Stable area	117	117	NA	NA
Abandoned area	2.852	NA	NA	NA
New coca plantings	NA	2064	NA	NA
Coca in fields larger than 3 has	996	363	-633	-64
Coca in fields smaller than 3 has	1.973	1.818	-155	-8
Number of coca in fields larger than 3 has	210	87	-123	-59
Number of coca in fields smaller than 3 has	1.565	1.962	397	25

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF CAUCA

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	117
Primary forest to coca	896
Secondary forest to coca	708
Other to coca	360
Uncertain changes and corrections	100

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to secondary forest	1.798
Coca to other	866
Uncertain changes and corrections	188

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF CAUCA

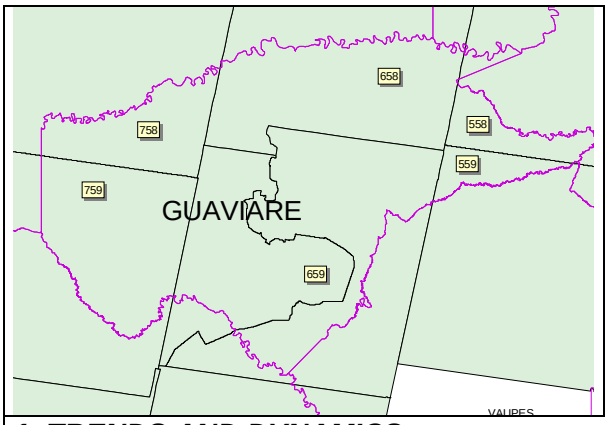
4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	117	117	NA	NA
Primary forest/coca	896	NA	NA	NA
Secondary forest /coca	708	1.798	1.090	154
Other/coca	360	866	506	141
Uncertain changes and corrections	100	188	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: The reduction of coca cultivation in large fields and stability in small ones is predominant. There is a high mobility in new plantings. Substitution for weeds was common.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION DEPARTAMENT OF GUAVIARE

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	24.852	26.316	1.464	6
Stable area	6.179	6.179	NA	NA
Abandoned area	18.673	NA	NA	NA
New coca plantings	NA	20.110	NA	NA
Coca in fields larger than 3 has	12.846	12.524	-321	-3
Coca in fields smaller than 3 has	12.006	13.791	1785	15
Number of coca in fields larger than 3 has	1.870	1.955	85	5
Number of coca in fields smaller than 3 has	10.984	13.173	2.189	20

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF GUAVIARE

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	6.179
Primary forest to coca	2.220
Secondary forest to coca	2.225
Other to coca	5.100
Uncertain changes and corrections	565

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to secondary forest	9.543
Coca to other	8.483
Uncertain changes and corrections	647

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF GUAVIARE

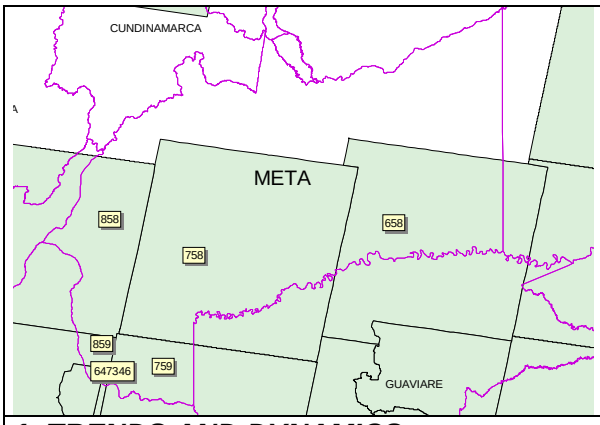
4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	6.179	6.179	NA	NA
Primary forest / coca	12.220	NA	NA	NA
Secondary Forest / coca	2.225	9.543	7.318	329
Other / coca	5.100	8.483	3.383	66
Uncertain changes and corrections	565	647	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: The number and area of large fields was stable, while smaller fields increased. Most of new plantings were established in primary forest areas. Spraying activities and other factors caused an important mobility in new plantings. Coca substitution for grasslands was predominant. Most of new fields were planted in felled forest.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected.



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION DEPARTAMENT OF META

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	11.512	7.730	-3782	-33
Stable area	460	460	NA	NA
Abandoned area	11052	NA	NA	NA
New coca plantings	NA	7.257	NA	NA
Coca in fields larger than 3 has	4.990	1.878	-3.112	-62
Coca in fields smaller than 3 has	6.522	5.852	-670	-10
Number of Coca in fields larger than 3 has	824	425	-399	-48
Number of Coca in fields smaller than 3 has	5.483	4.597	-886	-16

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF META

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	460
Primary forest to coca	4.226
Secondary forest to coca	376
Other to coca	2.300
Uncertain changes and corrections	355

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to Secondary forest	4.841
Coca to other	3.742
Uncertain changes and corrections	2.469

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF META

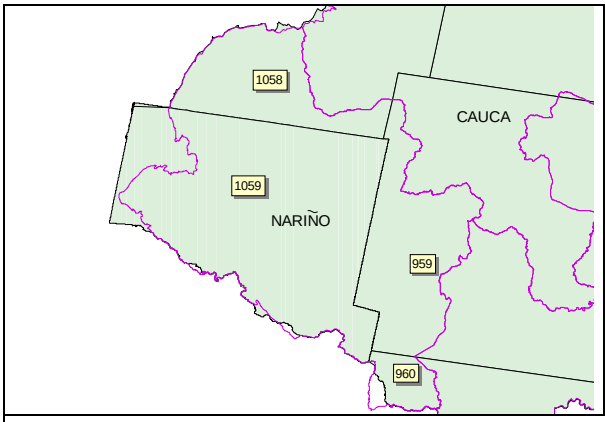
4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	460	460	NA	NA
Primary forest/coca	4.226	NA	NA	NA
Secondary forest/coca	376	4.841	4.465	1.188
Other/coca	2.300	3.742	1.442	63
Uncertain changes and corrections	355	2.469	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: There is a high mobility in new plantings because of spraying activities and other factors. Coca cultivation in large fields was reduced in 50%. The primary forest was the most affected vegetation. Cloud coverage reduced the comparison in common areas.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION DEPARTAMENT OF NARIÑO

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	7.589	10.537	2.948	39
Stable area	726	726	NA	NA
Abandoned area	6.863	NA	NA	NA
New coca plantings	NA	9.813	NA	NA
Coca in fields larger than 3 has	3.840	4.823	984	26
Coca in fields smaller than 3 has	3.749	5.713	1.964	52
Number of coca in fields larger than 3 has	613	766	153	25
Number of coca in fields smaller than 3 has	3.188	5.930	2.742	86

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF NARINO

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	726
Primary forest to coca	3.326
Secondary forest to coca	1.871
Other to coca	987
Uncertain changes and corrections	3.629

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to secondary forest	2.237
Coca to other	1.647
Uncertain changes and corrections	2.979

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected.

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF NARIÑO

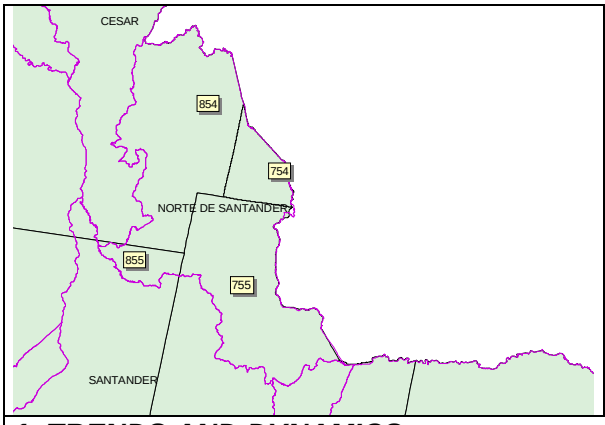
4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	726	726	NA	NA
Primary forest/coca	3.326	NA	NA	NA
Secondary forest/coca	1.871	2.237	366	20
Other/coca	987	1.647	660	67
Uncertain changes and corrections	3.629	2.979	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: There is a high mobility in new plantings because of spraying activities and other factors. The increase of coca cultivation mainly occurred in small fields. The most affected vegetation was primary forest. Cloud cover was very common and reduced the comparison area of analysis to 57% of the total area of influence. The process of regeneration of forest only reaches 43 % of the felled area.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected.



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION DEPARTAMENT OF NORTE DE SANTANDER

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	12.655	7.789	-4.866	-38
Stable area	2.548	2.548	NA	NA
Abandoned area	10.107	NA	NA	NA
New coca plantings	NA	5.241	NA	NA
Coca in fields larger than 3 has	8.907	3.255	-5.652	-63
Coca in fields smaller than 3 has	3.748	4.534	786	21
Number of coca in fields larger than 3 has	664	493	-171	-26
Number of coca in fields smaller than 3 has	3.721	3.988	267	7

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF NORTE DE SANTANDER

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	2.548
Primary forest to coca	1.109
Secondary forest to coca	1.646
Other to coca	2.323
Uncertain changes and corrections	163

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to Secondary forest	6.163
Coca to other	3.910
Uncertain changes and corrections	34

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF NORTE DE SANTANDER

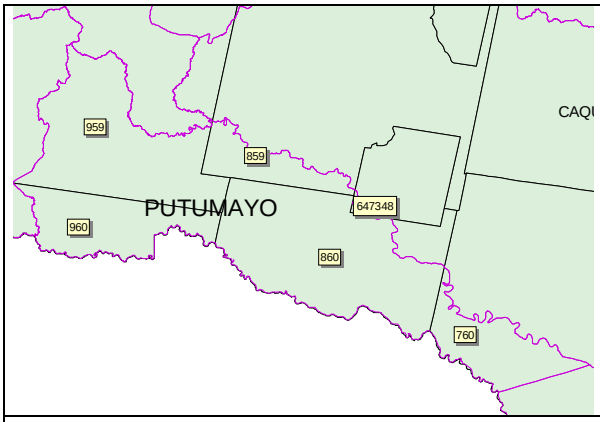
4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	2.548	2.548	NA	NA
Primary forest/coca	1109	NA	NA	NA
Secondary forest/coca	1.646	6.163	4.517	274
Other/coca	2.323	3.910	1.587	68
Uncertain changes and corrections	163	34	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: The mobility in new plantings is lower in comparison to the national average. Coca cultivation decreased, but the area in small fields was stable. Reduction in the number and size of large fields is to be highlighted. Pastures and licit crops were the most affected by coca planting. Coca was mainly substituted with weeds.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION DEPARTAMENT OF PUTUMAYO

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	43.278	13.488	-29.790	-69
Stable area	2.404	2.404	NA	NA
Abandoned area	40.874	NA	NA	NA
New coca plantings	NA	11.087	NA	NA
Coca in fields larger than 3 has	20.039	3.357	-16.682	-83
Coca in fields smaller than 3 has	23.239	10.131	-13.108	-56
Number of coca in fields larger than 3 has	2.982	684	-2.298	-77
Number of coca in fields smaller than 3 has	22.000	12.716	-9.284	-42

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF PUTUMAYO

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	2.404
Primary forest to coca	3.094
Secondary forest to coca	2.195
Other to coca	4.343
Uncertain changes and corrections	1.455

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to Secondary forest	11.483
Coca to other	27.519
Uncertain changes and corrections	1.872

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF PUTUMAYO

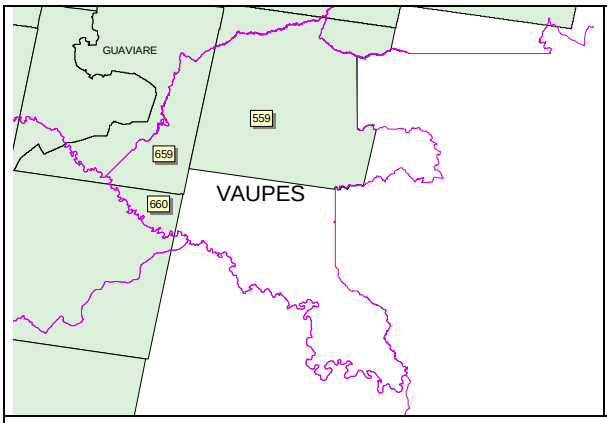
4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	2.404	2.404	NA	NA
Primary forest/coca	3.094	NA	NA	NA
Secondary Forest/coca	2.195	11.483	9.288	423
Other/coca	4.343	27.519	23.176	534
Uncertain changes and corrections	1.455	1.872	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: The mobility of new plantings is lower in comparison to the national average as a result of the intensity of the spraying activities. There is an important reduction of coca cultivation in large and small fields. Substitution activities in grasslands and licit crops overpass in number, planting activities.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION DEPARTAMENT OF VAUPES

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	1.618	1.564	-54	-3
Stable area	242	242	NA	NA
Abandoned area	1.376	NA	NA	NA
New coca plantings	NA	1.322	NA	NA
Coca in fields larger than 3 has	826	665	-161	-19
Coca in fields smaller than 3 has	792	899	107	13
Number of Coca in fields larger than 3 has	147	104	-43	-29
Number of Coca in fields smaller than 3 has	843	1.178	335	40

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF VAUPES

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	242
Primary forest to coca	885
Secondary forest to coca	260
Other to coca	151
Uncertain changes and corrections	26

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to Secondary forest	1.176
Coca to other	188
Uncertain changes and corrections	12

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected.

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF VAUPES

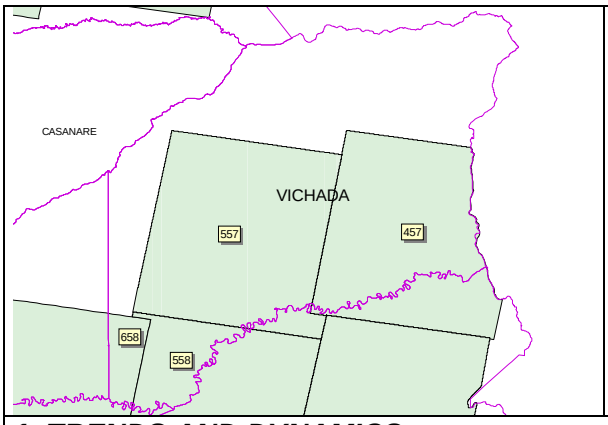
4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	242	242	NA	NA
Primary forest / coca	885	NA	NA	NA
Secondary Forest / coca	260	1.176	916	352
Other / coca	151	188	37	25
Uncertain changes and corrections	26	12	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: There is a high mobility represented in new plantings. There is evident a slight increase of coca in large fields and a high increase in the small ones. Primary forest was highly affected, not only because of the fell but also for the fragmentation. The balance of planting vs. substitution is even; however, 77% of the felled forest was primary forest with a biodiversity and ecological richness far superior than the regenerated forest.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected



MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION DEPARTAMENT OF VICHADA

1. TRENDS AND DYNAMICS

ITEM	YEAR 2001 Has	YEAR 2002 Has	VARIATION Has	%
Cultivated area	8.043	4.800	-3.243	-40
Stable area	681	681	NA	NA
Abandoned area	7362	NA	NA	NA
New coca plantings	NA	4118	NA	NA
Coca in fields larger than 3 has	5.387	2.586	-2.801	-52
Coca in fields smaller than 3 has	2656	2214	-443	-17
Number of Coca in fields larger than 3 has	794	469	-325	-41
Number of Coca in fields smaller than 3 has	2.081	1.564	-517	-25

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF VICHADA

2. CHANGES FOR COCA PLANTING

CHANGES	HAS
Stable coca crops	681
Primary forest to coca	2851
Secondary forest to coca	301
Other to coca	887
Uncertain changes and corrections	79

3. SUBSTITUTION OF COCA CROPS

CHANGES	HAS
Coca to Secondary forest	6.178
Coca to other	1.139
Uncertain changes and corrections	45

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual censushould not be expected

MULTI–TEMPORAL ANALYSIS

NOVEMBER 1/01- DECEMBER 31/02

COCA CULTIVATION
DEPARTAMENT OF VICHADA

4. CHANGES IN VEGETATION

CHANGES	PLANTING HAS	SUBSTITUTION HAS	DIFF	%
Stable coca	681	681	NA	NA
Primary forest / coca	2851	NA	NA	NA
Secondary Forest / coca	301	6.178	5.877	1.952
Other / coca	887	1139	252	28
Uncertain changes and corrections	79	45	NA	NA

Planting*: Replacement of any kind of vegetation by coca.*
Substitution*: Replacement of coca by any other vegetation/crops.*

DIAGNOSIS: There is a high mobility of new plantings caused by spraying activities and other factors; there is also an important reduction in large fields. Coca substitution for secondary forest is predominant. The regeneration process of forest is double than the felling activities, but 90% of the felling was done in primary forest.

The multi-temporal analysis only refers to the common interpreted areas of the two census. Coincidence with figures of individual census should not be expected

PART II

COLOMBIA COCA ESTIMATE FOR JULY 2003

1. INTRODUCTION AND JUSTIFICATION.

The UNODC/SIMCI Project accomplished four coca censuses between 1999 and 2002 through the identification and measurement of all coca fields, by using satellite imagery and supporting on field verification.

The study area in the last two censuses covered the entire national territory with a degree of confidence measured by statistical methods of 90 to 92 %.

As result of each census, the project produced statistics by departments, municipalities and regions as well as multi-temporal analysis on trends and dynamics of the coca cultivation. All the additional data gathered during the process, such as vegetation covertures, land use, forestry analysis, cartographic update, regional statistics, etc. has a great importance for public and private entities interested in agriculture and land use.

Data bases are stored in a GIS, since the methodology allows determining the coordinates and size of the coca fields identified. However, the high dynamics in position and size of these fields, due to spraying operations, alternative development projects, voluntary abandonment or agricultural practices, is reflected in a constant variation in the amount and position of coca crops, with causes the consequent loss of currency. The 2002-2003 multi-temporal analysis shows that only 15 % of the coca fields did not change in position or size.

The almost permanent high cloudiness over most parts of the country makes it very difficult to obtain national satellite imagery in a period shorter than one year, making almost impossible to complete more than one census per year.

The multi-temporal analysis 2001-2002 establishes some parameters to estimate the relationship between the effective reduction of the area cultivated with coca and the areas sprayed, abandoned or replaced by other crops. A simple arithmetic operation of cultivated areas minus sprayed areas will not satisfy because it does not take into consideration reseeded and abandoned coca fields. In the analysis of sprayed areas, 83% effectiveness of coca death is also to be considered.

According to the above factors, specially the strong dynamics of the coca cultivation and the huge amount of resources spent in the spraying campaigns in 2002 and 2003 (68.600 net has until July 31), the Colombian government requested UNODC trough its SIMCI Project, an estimate measurement of the coca cultivation in Colombia, updated to July 2003.

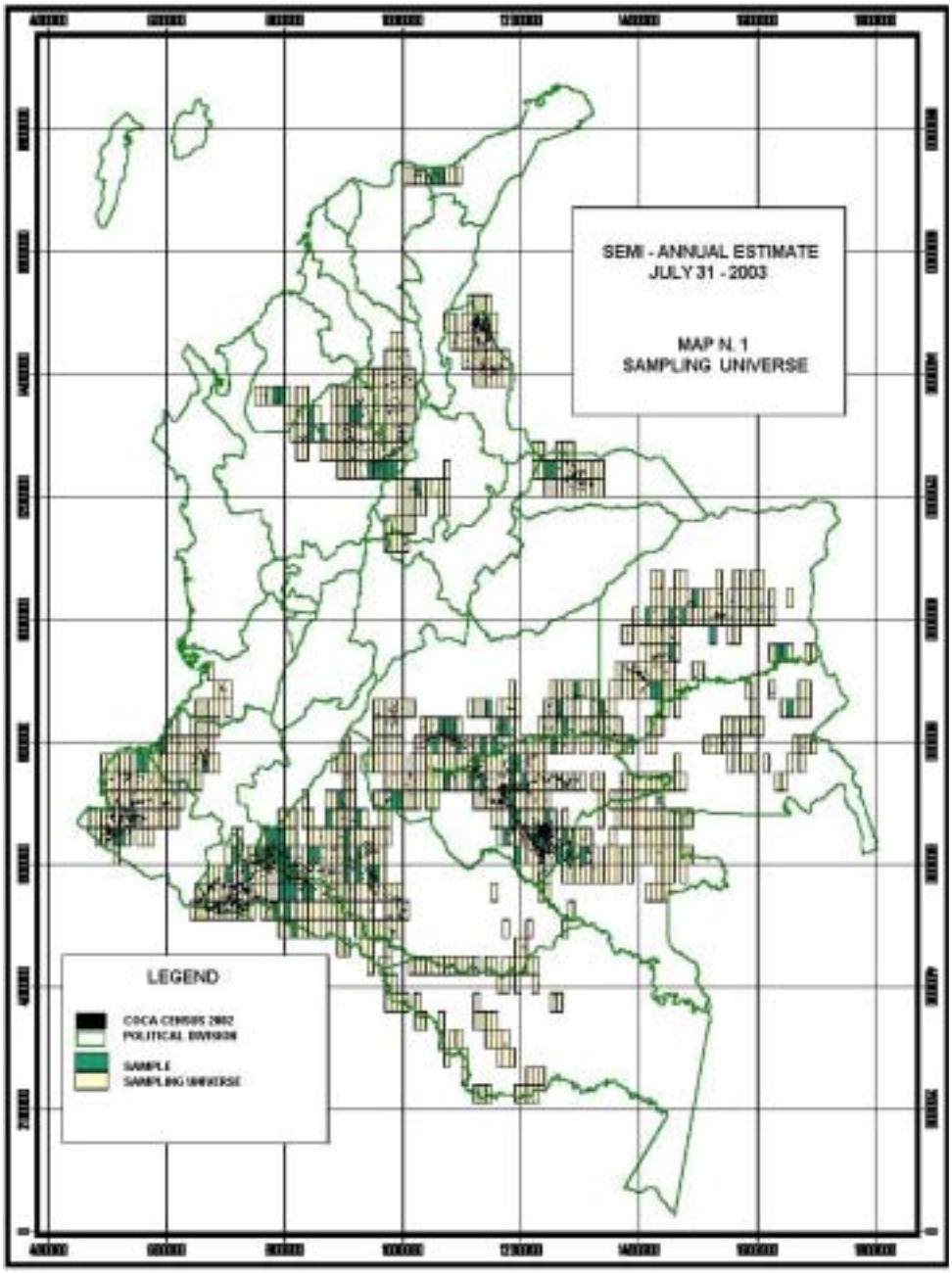
In response to this request, SIMCI designed the following methodology, which combines the data sources available with statistical procedures by over-flight reconnaissance sampling and extrapolating results. For the activities of reconnaissance, SIMCI was supported by DIRAN (the Colombian Anti-Narcotics Police) which is the operational Colombian entity to the project. The availability of satellite images data and the aerial support received, permitted to establish the 31 of July 2003 as the reference date for this purpose.

2. METHODOLOGY

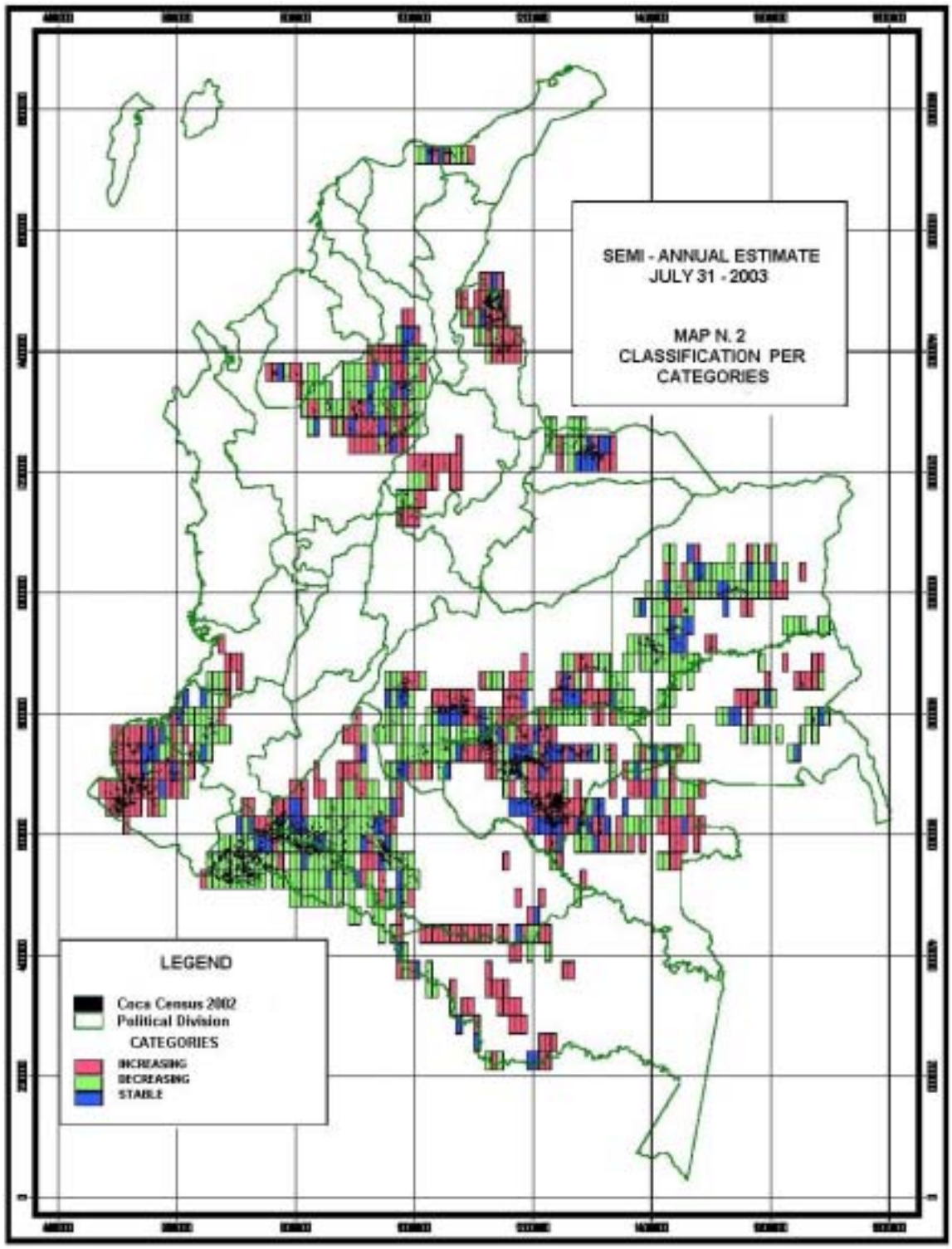
The methodology designed by the project combines the interpretation of satellite images and the statistical sampling over the entire coca areas. 10 % of theoretical or essay error, would result by applying this methodology, but cloudiness and the dynamics of coca cultivation -which are in a permanent harvest status-, only permits 80% degree of confidence. Unavailability of images can also impede a most accurate result.

The procedures to calculate an estimate figure for coca crops in July 2003 are described below:

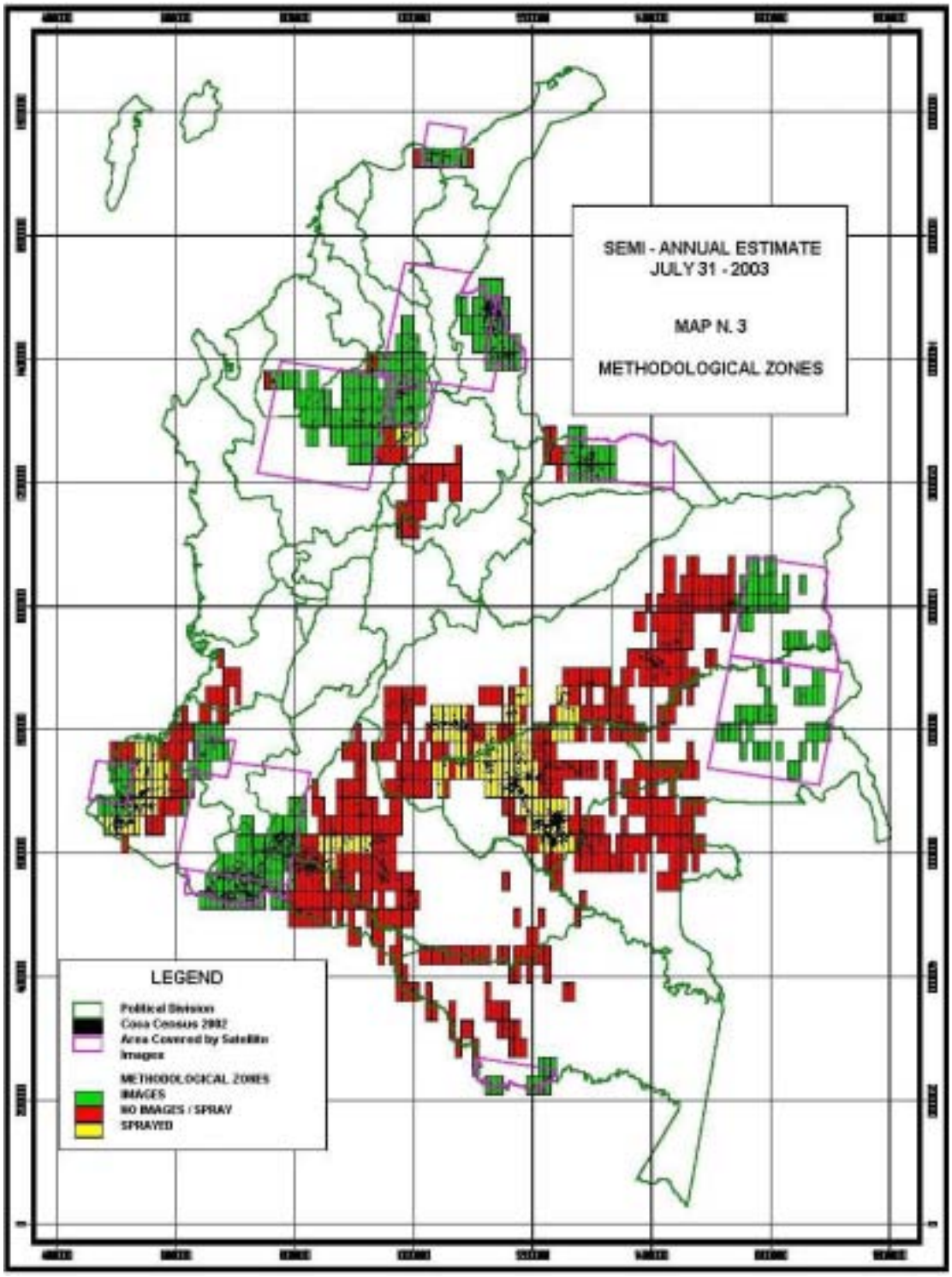
Sampling: A grid of 30x10kms was drawn covering the entire coca areas with 1.013 segments. A sample of this universe was established by statistical methods, with a result of 108 segments. (Map No. 1)



Classification per categories: Based on the multitemporal analysis 2001-2002, the 1.013 segments were classified in three categories: Stable (S) defined by variations lower than 20% within the two censuses. Increasing (I) when it is higher than 20% and Decreasing (D) when it is lower than 20%. (Annex 1). A factor of extrapolation or trend was assigned to the sample for each category obtained by dividing the total area cultivated by coca into each category by the sum of the area of coca into their samples. (Map no.2)



Methodological Zones: Three zones were established as per their capture methods: Zone No. 1: Zones covered by the most suitable images from the various satellites, which present the lower cloudiness possible and less antiquity in relation to the cut date. Zone No. 2 Area sprayed in 2003. Zone No. 3 Areas not sprayed/not covered by satellite imagery in 2003. (Map no. 3)



The methodology to calculate the area cultivated with coca in the zones without satellite imagery consists on i) updating the coca area into each sample by aerial reconnaissance over the sample, 2) extrapolating this value to its category, and 3) adding up the results. (Annex 2). The results for the zone covered by satellite imagery was deleted and replaced by the values obtained by interpretation.

The capture methods for the three methodological zones using the results of the aerial reconnaissance performed in late July 2003 are described above.

Zone No. 1 (Green)
The total area covered by satellite imagery in 2003 was processed with the SIMCI methodology for coca census and mutitemporal analysis, to have the total result for this area.

Zone No. 2 (Yellow)
In 2003 DIRAN continued its intensive spraying campaigns, reaching a total of 91.000 fumigated has, which represent a net area of 66.500 has after corrections for overlapping and death effectiveness. Aerial reconnaissance was performed over the sprayed area into the sample, to evaluate the reseeding. For the non-sprayed area into the sample, new and stable fields were estimated. The sum of the coca area evaluated was used to extrapolate it with the factors calculated for each category into the zone.

Zone No. 3 (Red)

The same aerial reconnaissance procedures were used for this sample, evaluating the stable, abandoned and new coca fields by comparison with the 2002 census maps, to obtain the coca area for the sample. Again, its value was extrapolated using the previously calculated factors for each category.

The difficulty to homogenize the sample extrapolation as consequence of different characteristics in the universe and the impossibility to measure the degree of confidence, the total figure is valid only for a national estimate. However, some regional analysis can be made as described below.

3. FINAL RESULTS

The following final results were obtained for the area cultivated with coca in each zone:

Zone covered with satellite imagery (Green)	17.000 has.
Zone covered by spraying activities (Yellow)	29.000 has.
Zone without spraying/images (Red)	23.000 has.
TOTAL ESTIMATE	**69.000 HAS**.

It is very important to have in mind that these results only represent the different capture methods and can not be applied to departments or natural regions, but to the national universe. Therefore, multitemporal analysis can not be applied by comparison with any census.

4. REGIONAL ANALYSIS

The coca cultivation in Colombia has a geographic distribution pattern that permits to identify regions with similar density and size of the areas of influence delimited in 2002 census. Base on these criteria, the following general description of the behaviour of the coca cultivation was done.

Sierra Nevada de Santa Marta.
This region covers the Magdalena and Guajira departments. The coca cultivation pattern has always been stable with a slight mobility within the area, probably because the area was not fumigated. The ASTER satellite image presents the same situation.

Arauca
The aerial reconnaissance and the LANDSAT image interpretation, show an increase of coca fields with new planting over western foothill area. This area has not been sprayed.

Catatumbo
This region covers the Norte de Santander department. A decrease of the coca area was registered in the interpretation of one LANDSAT image, though a high mobility and new fields toward south and the Venezuelan border was noticed.

Sur de Bolivar
This region covers the departments of Bolivar, Córdoba and Antioquia. The aerial reconnaissance and the interpretation of one SPOT and one LANDSAT images, show a decrease in the coca area. New fields appear in the Serranía de San Lucas enlarging the area of influence towards higher altitude. 85.000 net has were sprayed in scattered areas and reseeding was noticed. Several ongoing alternative development projects are present in the region.

Nariño
Intense spraying activities were performed in 2003 in this region, reaching 23.500 net has. The aerial reconnaissance and the ASTER image interpretation show an important decrease in the coca cultivated area but also an increasing trend to reseeding. The presence of new fields in the eastern foothill, which will enlarge the area of influence towards more difficult areas for the spraying programme, was also noticed.

Cauca
An increase of new planting north of Patia river was observed in the aerial reconnaissance, but the SPOT image which covers the northwest area of the department show a decrease of coca area. No coca spraying activities were performed in 2003.

Putumayo - Caquetá
The last year intense spraying campaign in this region continued in 2003 with 8.500 net has in response to the reseeding activities. The aerial reconnaissance and the two LANDSAT images show a decrease in the coca area, and no reseedings, as a consequence of recent spraying. New plantations were observed in the foothill of Caquetá. Several alternative development projects are present in the region.

Orinoquia
This region covers the departments of Meta and Vichada. The two LANDSAT images cover a low density coca cultivation area; therefore, the results are not representative of the region. In 2003, 2.500 net has of coca were sprayed in Meta. An increase in the area cultivated with coca in Meta, (new plantings at west of the Ari-Ari river and in Vichada)

represent an enlargement of the area of influence. Aerial reconnaissance permitted to obtain the preceding information.

Amazonia

This region covers the departments of Guaviare, Vaupes, Guania and Amazonas. A heavy spraying campaign was performed in Guaviare over 23.500 net has. Low presence of reseeding but new plantings in the vicinity of sprayed areas, were observed at the aerial reconnaissance flights. The LANDSAT image on the Peruvian border shows an increase in the coca area. Stability of coca cultivation was noticed in Vaupés and Guanía.

ANNEXES

ANNEX No. 1

CLASIFICATION PER CATEGORIES

CATEGORY	Data	Universe
INCREASING (I)	COCA IN 2002	42.630
	COCA IN 2001	20.902
	AMOUNT OF SAMPLES	405
DECREASING (D)	COCA IN 2002	35.265
	COCA IN 2001	95.133
	AMOUNT OF SAMPLES	462
STABLE (S)	COCA IN 2002	20.768
	COCA IN 2001	23.647
	AMOUNT OF SAMPLES	146

ANNEX No. 2

CALCULUS FOR THE SAMPLE AREA 2003

CATEGORY	Data	METHODOLOGICAL ZONES			
		No images/spraying	Images	Sprayed Zones	Total
Increasing (a)	Sample	17	6	19	42
	Coca in 2002	1.353	853	9.721	11.928
	Coca in 2003	1.410	840	1.975	4.225
Decreasing (d)	Sample	21	16	9	46
	Coca in 2002	2.287	1.545	1.409	5.240
	Coca in 2003	2.292	965	1.473	4.731
Stable (s)	Sample	7	6	7	20
	Coca in 2002	566	1.545	2.910	5.021
	Coca in 2003	542	1.304	2.823	4.669

he area cultivated with coca in the 2003 sample was determined by the methodological zone to which it belonged in the correspondent 2002 sample. Climatic conditions and flying difficulties for aerial reconnaissance could not guarantee 1OO% coverage. Therefore, an effectiveness factor was estimated for each sample by comparing the interpreted coca fields in 2002 with the observed coca fields in 2003.

ANNEX No 3

RESULTS OF THE IMAGES INTERPRETATION

IMAG	IM 03M.A	IMA 02MA	DIF MES	AREA M02	AREA M03	DIF AREA	FACT MES	AREA TO/02	AREA M/03ACT	FACT. CAMB	ARE AIMA03	FUMIG/03	CORR AREA/03
457	5	9	4	357,93	402,479	44,55	11,137	666,24	458,17	1,28	852,81	0,00	852,81
458	5	8	3	350,98	145,912	-205,07	-68,356	448,54	145,91	0,42	186,47	0,00	186,47
655	3	13	10	947,74	1487,538	539,80	53,980	2124,75	1649,48	1,74	3697,98	0,00	3697,98
662	3	13	10	0,88	3,173	2,29	0,229	161,09	3,86	4,39	706,76	0,00	706,76
754	5	14	9	3413,91	935,070	-2478,84	-275,427	3549,92	935,07	0,27	972,32	1,66	970,66
852	3	12	9	655,32	496,143	-159,18	-17,686	984,88	443,08	0,68	665,91	0,00	665,91
854	4	7	3	1682,21	794,495	-887,72	-295,905	5785,38	794,50	0,47	2732,39	0,00	2732,39
955	3	10	7	2012,96	1787,230	-225,73	-32,247	2779,33	1787,23	0,89	2467,66	511,28	1956,38
959	5	11	6	7434,37	3331,437	-4102,93	-683,822	8017,03	3331,44	0,45	3592,53	258,13	3334,40
960	5	10	5	6435,87	3601,170	-2834,70	-566,94	7836,87	766,47	0,12	933,32	595,94	337,38
1059	4	16	12	495,63	121,029	-374,60	-31,217	2834,88	121,03	0,24	692,26	58,10	634,16
641345	4	7	3	799,89	158,387	-641,50	-213,834	1036,82	158,39	0,20	205,30	0,00	205,30
645335	4	12	8	1236,67	1036,202	-200,47	-25,059	1501,08	935,97	0,76	1136,09	476,42	659,67
								37726,81	11530,59		18841,82	1901,53	16940,29

ANNEX No. 4

COCA AREA PER METHODOLOGICAL ZONES

1 NO IMAGES/SPRAYING ZONE			
CATEGORY	FACTOR	Sample area	Total area
INCREASING	3,574	1.410	5.039
DECREASING	6,730	2.292	15.425
STABLE	4,136	542	2.242
TOTAL		4.244	22.706

2. SATELLITE IMAGES (REPLACED BY ANNEX No.3)			
CATEGORIY	FACTOR	Sample area	Total area
INCREASING	3,574	840	3.002
DECREASING	6,730	965	6.494
STABLE	4,136	1.304	5.393
TOTAL		3.109	14.890

3. SPRAYED ZONE			
CATEGORY	FACTOR	Sample area	Total area
INCREASING	3,574	1.975	7.059
DECREASING	6,730	1.473	9.913
STABLE	4,136	2.823	11.676
TOTAL		6.271	28.648

TOTAL	13.624	66.244

ANNEX No.5

SPRAYING FROM 01 NOV 2001 TO 31 DEC 2002

DEPARTAMENT	Sprayed area in hectares	
	DIRAN Report	Net area (1)
ANTIOQUIA	3.320	1.492
CAQUETA	22.880	17.677
CORDOBA	734	416
GUAVIARE	7.207	5.787
META	1.496	462
NARINO	17.962	16.257
NORTE DE SANTANDER	9.186	5.191
PUTUMAYO	82.019	70.365
TOTAL	144.804	117.647

Net sprayed area	117.647	hectares
Effective coca death (2)	97.647	hectares
Area with coca in November 1 / 2001	145.000	hectares
Area with coca in December 31 / 2002	102.000	hectares
Decrease in the area with coca cultivation	43.000	hectares

(1) The net area corresponds to reported minus overlapping and/or resprayed area

(2) Effective death corresponds to 83% of the net sprayed area

ANNEX No.6

SPRAYING IN 2003

NET AREA

DEPARTMENT	MONTHS							Total
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	
ANTIOQUIA					368	28	5.817	6.212
BOLIVAR					637	1.240	769	2.647
CAQUETA	228							228
GUAVIARE	4.192	4.909	3.334	1.754	2.610	4.302	3.500	24.600
META	961		1.593		17	79		2.651
NARIÑO	1.374	4.897	6.219	7.504	2.890	97	136	23.117
NORTE DE SANTANDER	1.527	2.516						4.042
PUTUMAYO	7				1.298	2.778	4.544	8.626
SANTANDER						1		1
TOTAL GENERAL	8.288	12.321	11.147	9.259	7.819	8.524	11.266	68.624

Area reported byDIRAN	88.543	Hectares
Sprayed net area (1):	68.623	Hectares
Effective dead area (2):	56.957	Hectares
Area with coca in December 31 / 2002:	102.000	Hectares
Area with coca in July 31 / 2002:	69.000	Hectares
Total decreased area in coca cultivation:	33.000	Hectares

(1) The net area corresponds to reported minus overlapping and/or resprayed area
(2) Effective death corresponds to 83% of the sprayed net area

ANNEX 7. Satellite images interpreted.

REGION	**SATELLITE**	**ID. number**	**DATE**
Sierra Nevada	Aster	11.33/-73.62 (8-52)	April 17 / 2003
Sur de Bolívar	Landsat	8-54	April 1 / 2003
Antioquia	Landsat	9-55	May 10 / 2003
Sur de Bolívar	SPOT	641/345	April 2 / 2003
Gabarra	Landsat	7-54	March 9 / 2003
Arauca	Landsat	6-54	May 5 / 2003
Vichada	Landsat	4-57	March 4 / 2003
Vichada	Landsat	4-58	March 4 / 2003
Amazonas	Landsat	6-62	April 19 / 2003
Putumayo	Landsat	9-59	February 19 / 2003
Putumayo	Landsat	9-60	February 19 / 2003
Cauca	SPOT	645/335	April 3 / 2003
Nariño	Aster	2.00/-78.64 (10-59)	April 6 / 2003