



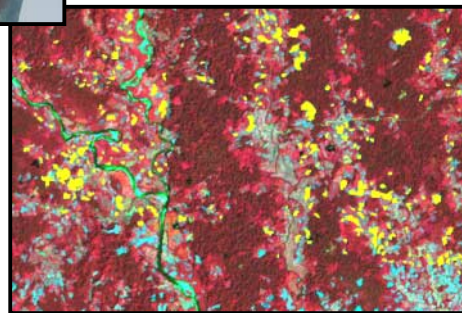
UNDCP

**Illicit Crop
Monitoring
System
Colombia**



COLOMBIA

**Annual
Coca Cultivation
Survey
2001**



March 2002

Country Office
Colombia

SUMMARY

The UNDCP project “Illicit Crop Monitoring System in Colombia – SIMCI”, is implemented with the support of the Illicit Crop Monitoring Programme (ICMP) in Vienna and has produced this year its third annual census of coca cultivation in Colombia. For its execution the project counts with the logistic support of the Colombian Anti-Narcotics Police (DIRAN), and the coordination of the National Narcotics Office in Colombia (DNE). The census-with figures up to November 2001- covers for the first time 100% of the national territory.

For the 2001 census, the project analyzed 56 Landsat images and 17 SPOT images, taken during the period March – November 2001, and flew over coca growing areas. As a result, the reliability of the results reaches approximately 90%.

By 1 November 2001, the project detected 144,807 hectares of coca cultivation distributed in 22 out of the 31 Colombian departments, which represents approximately 0.1% of the national territory. The total area affected by coca cultivation is 7,235,000 hectares (5% of the national territory). Consequently, the average density of coca cultivation is 2 hectares of coca per 100 hectares of land.

Compared to figures from previous years, data for 2001 show an overall decrease of 18,482 hectares, or 11.3%, of the area under coca cultivation, but with very irregular trends at department level. The main concentration of the coca cultivation remains in the traditional coca growing areas of the Amazon basin, in the areas of Putumayo-Caquetá, with 45% of the total coca area (approx. 65,000 ha), and Meta-Guaviare-Vaupés in the Orinoqio basin, with 34% of the coca area (approx. 49,000 ha).

The opium poppy growing areas are concentrated in Cauca, Nariño, Huila and Cesar. The project has not yet established a reliable methodology for an opium poppy survey, based on remote sensing technologies. According to DIRAN’s visual reconaissances, there were approximately 6,200 hectares of poppy cultivation in 2001.

There are no complete studies on productivity, number of harvests per year, percentages of re-cultivation and new cultivation for coca and opium poppy in Colombia. The estimates are made by the Government, the UNDCP alternative development projects and some individual ad-hoc studies.

There are several coca varieties and densities in Colombia, such as the traditional “caucana”, or the Peruvian type “Tingo Maria”, or the Bolivian type “la dulce”, each with different levels of productivity. According to several sources of information, the “caucana” variety produces approximately 3 harvests per year, while the Peruvian and Bolivian varieties produce an average of 6 harvests per year. The Colombian Government as well as the US estimate a coca productivity of 800 kg/ha. If the national average is of 4 harvest per year, this is equivalent to 463,382 mt of coca leaf per year, or about 926,770 kg of cocaine per year (based on a conversion ratio of 500 kg of coca leaf for 1 kg of coca base, equivalent to 1 kg of cocaine in an industrial production setting).

In Nariño, where most poppy crops are found, there are approximately 87,400 plants per hectare. Based on an estimate for opium poppy of 8kg/ha, 2 harvests per year, there would be an average annual opium poppy production of 49,600 kg.

In 2001, the DIRAN carried out an intensive interdiction campaign through aerial spraying of illicit crops with the herbicide glyphosate. According to DIRAN data, 94,500 hectares of coca were fumigated in 2001, mostly in Putumayo, Caquetá, Guaviare, Nariño and Norte de Santander, as well as 2,267 hectares of poppy.

The database for each census allows the production of maps at a scale of 1:100,000, showing different coverage such as forest, waters, pastures and other cultivations, populated centres, roads, etc. These maps are very useful for state and private institutions that carry out activities related to the use of the land, and in particular in the area of alternative development.

BACKGROUND

During the last two decades, illicit coca cultivation has been expanding steadily in Colombia, in particular in remote areas of the Amazon basin. As a result, Colombia is today the largest coca-growing country in the world. Opium poppy cultivation seems also on the rise, but exact figures are not available. The precise extent of illicit crop cultivation has always been the subject of discussion. The Government of Colombia therefore initiated a pilot project of remote sensing for the identification of illicit crops in parts of Guaviare, Vaupés and Vichada in December 1997. The present project continues and expands this work with the objective to establish an Integrated Monitoring System for Illicit Crops that enables the identification and the quantification of existing coca and opium poppy cultivation, and the monitoring of trends. The information supports the decision making process of the institutions in charge of the drug control policy in Colombia, and are used by UNDCP to report to the international community in the framework of the international monitoring system established at the request of Member States (resolutions of the Special Session of the UN General Assembly on drugs in June 1998, and CND Resolution 42/3 on “Monitoring and Verification of Illicit Cultivation”).

To establish an Integrated Monitoring System for Illicit Crops (SIMCI) which provides information on illicit crops on a regular basis – location, dynamics and trends - as well as on progress in eradication and alternative development, the monitoring system is using satellite images and aerial photography. In addition, a Geographical Information System is designed for the storage and analysis of the information. With these tools, the project is establishing a transparent and reliable methodology for the interpretation of illicit crops, the provision of annual official figures on the area covered with illicit crops, the undertaking of multi-temporal analysis of the data, and the establishment of an early-warning monitoring system that will allow the identification of trends and facilitate the decision making of competent institutions in the area of drug control.

METHODOLOGY

The methodology is based on the digital processing of satellite images –SPOT, LANDSAT, IKONOS, and ERS-, in order to identify coca cultivation through an annual national census. The methodology enables also the identification of other important vegetation coverage, such as forest, water sheds, pasture, other cultivations, as well as roads, villages etc. Each stage of the process is subjected to a quality control in order to ensure the production of reliable and credible data (level of confidence up to 90%), obtained through a transparent and technical procedure.

The different steps of this methodology can be summarized as follows:

- Identification and acquisition of medium resolution images, such as LANDSAT and SPOT images, with as little cloud coverage as possible, covering the entire area of interest. For the year 2001 census, the project covered for the first time 100% of the national territory, equivalent to 1,142,000 km².
- Geo-referencing of the images and assignment of coordinates in order to convert them into maps.
- Visual evaluation and enhancement of the images in order to better identify and highlight the elements of interest, in this case the coca crops.
- Identification of the optimum combination of colors that produces the best contrast and allows the interpretation of different vegetations and other elements of interest for the monitoring system.
- Classified supervision of the interpretation process based on the individual expertise of the interpreters and on additional external information such as aerial photographs over illicit crops areas and aerial reconnaissance. On this basis, a preliminary coca crops map is elaborated, used for ground truthing activities to verify the correctness of the interpretation work. This preliminary map is then further edited and improved according to the findings of the field work.
- All coca fields in the image are then precisely identified, located and measured. This procedure applies also to all other coverage included in the interpretation work, if needed (pasture, primary and secondary forest etc.).
- The findings are then incorporated in a database called ILLISYS, specifically designed for this project.
- The interpreted data is then superimposed over an administrative map of Colombia, to produce statistics by departments and municipalities. These thematic maps, the statistical information derived from them and other related information are incorporated into a Geographical Information System (GIS). This wealth of data constitutes a valuable tool for various purposes.

The methodology used by the SIMCI project enables the elaboration of a multitemporal and periodical analysis of census results for a systematic and accurate monitoring of the evolution and behavior of the areas used for illicit crops.

The Geographical Information System –GIS allows the analysis of the information according to specific needs. For instance, the project has provided technical information to the National

Alternative Development Plan, to the Ministry of Environment, and to the Ministry of Agriculture. This system permits the elaboration of detailed maps with information on forests, illicit crops in natural reservoirs, and selection of areas to settle alternative development programmes –among others.

FINDINGS

The project has already conducted three annual censuses for coca crops in Colombia, from 1999 to 2001, covering different areas of the national territory. The last census covers, for the first time, the entire country, approximately 1,142,000 km².

Reference date of the census	Hectares of illicit crops	Number of Departments with illicit cultivation	Coverage of national territory by the survey in %
31 March, 1999	160,119	12	12 %
31 August, 2000	163,289	21	41 %
1 November, 2001	144,807	22	100 %

For the year 2002 census, the project analyzed a total of 56 Landsat images and 17 SPOT images, taken between March and November 2001, and flew over the entire coca growing areas of the country, to verify the results and undertake quality control. The level of confidence of the results is approximately 90%.

By 1 November 2001, the project detected 144,807 hectares of coca cultivation distributed in 22 out of the 31 Colombian departments, which represents approximately 0.1% of the national territory. The total area affected by coca cultivation is 7,235,000 hectares (5% of the national territory).

Compared to the previous figures, the year 2001 indicates a trend in decrease of 11.3% of the coca cultivation – which is 18,482 hectares – over the past year, but with very irregular trends at department level:

The departments that showed the most significant decrease in illicit crops are Putumayo (18,902 ha less than in 2000), and Caquetá (12,087 ha less than in 2000), where traditionally more than 50% of the entire coca was grown, and where most of the Police's interdiction campaigns took place. The departments with the most significant increase in coca cultivation include Guaviare (7,934 ha more than in 2000), Vichada (4,231 additional hectares) and Norte de Santander (2,865 additional hectares). The remaining departments do not show significant changes.

However, the main concentration of the coca cultivation remains in the traditional coca growing areas of the Amazon basin, in the areas of Putumayo-Caquetá, with 45% of the total coca area (approx. 65,000 ha), and Meta-Guaviare-Vaupés, with 34% of the coca area (approx. 49,000 ha).

In addition, the 2001 census detected approx. 1,750 hectares of coca plantation in remote, non-traditional areas such as Guainía, Vaupés and Amazonas, near the border with Brasil and Venezuela, as well as in new zones of the Atlantic coast such as Córdoba and Cesar. However, figures for those areas are still to be verified through ground truthing, and therefore, have a lower level of confidence than for the rest of the census.

The opium poppy growing areas are concentrated in Cauca, Nariño, Huila and Cesar. So far, the project has not been able to carry out a census for this cultivation due to the difficult meteorological conditions and constant clouds in the zone that prevent the satellites to take good images. In addition the fields are small -less than 1 hectare-, and hence difficult to detect via medium resolution images, and highly dispersed in the territory. This implies high costs in the purchase of images per poppy hectare. According to DIRAN's estimates, there were 6,200 hectares of poppy cultivation in 2001, compared to 6,500 hectares in 2000.

**COCA CULTIVATION IN COLOMBIA
FIGURES PER DEPARTMENT**

**Figures for the three census
31 March 1999 – 31 August 2000 – 1 November 2001**

Department	1999 (hectares)	2000 (hectares)	2001 (hectares)
Antioquia	3,644	2,547	3,171
Amazonas			532
Arauca	-	978	2,749
Bolívar	5,897	5,960	4,824
Boyacá	-	322	245
Caquetá	23,718	26,603	14,516
Cauca	6,291	4,576	3,139
Cesar	-	779	-
Chocó	-	250	354
Córdoba	1,920	117	652
Cundinamarca	-	66	22
Guainía	-	853	1,318
Guajira	-	321	385
Guaviare	28,435	17,619	25,553
Magdalena	521	200	480
Meta	11,384	11,123	11,425
Nariño	3,959	9,343	7,494
Norte de Santander	15,039	6,280	9,145
Putumayo	58,297	66,022	47,120
Santander	-	2,826	415
Valle del Cauca	-	76	184
Vaupés	1,014	1,493	1,918
Vichada	-	4,935	9,166
TOTAL	160,119	163,289	144,807

NOTES:

1. Reliability of the 1999 figure: 80%
2. Reliability of the 2000 figure: 90%
3. Estimated reliability of the 2001 figure: 90%

SOURCE: Interpretation and digital processing of LANDSAT 7 and SPOT satellite images for the years 1997, 1998, 1999, 2000 and 2001.

PERCENT OF CHANGE 1999 – 2000 - 2001

Department	percent change 1999 –2000	percent change 2000 - 2001
Antioquia	-30.1%	+24.5 %
Amazonas	-	-
Arauca	-	+181.1%
Bolívar	+1%	-19.1%
Boyacá	-	-23.9%
Caquetá	+12.2%	-45.4%
Cauca	-27.3%	-31.4%
Cesar	-	-
Chocó	-	+41.6%
Córdoba	-93.9%	+457.3%
Cundinamarca	-	-66.7%
Guainía	-	+54.5%
Guajira	-	+19.9%
Guaviare	-38%	+45.0%
Magdalena	-61.6%	+140.0%
Meta	-2.3%	+2.7%
Nariño	+136%	-19.8%
Norte de Santander	-58.2%	+45.6%
Putumayo	+13.25%	-28.6%
Santander	-	-85.3%
Valle del Cauca	-	+59.8%
Vaupés	+47.2%	+28.5%
Vichada	-	+89.2%
TOTAL	+1.98%	-11.3%

NOTES:

1. Reliability of the 1999 figure: 80%
2. Reliability of the 2000 figure: 90%
3. Estimated reliability of the 2001 figure: 90%

SOURCE: Interpretation and digital processing of LANDSAT 7 and SPOT satellite images for the years 1997, 1998, 1999, 2000 y 2001.

**COCA CULTIVATION IN COLOMBIA
PRELIMINARY RESULTS
NON TRADITIONAL AREAS**

IMAGE	ZONE	DATE	Coca area Ha
3-58	Guainía	Aug 30 2001	137
3-59	Guainía	Apr 28 2001	157
4-56	Vichada	Oct 08 2001	0
4-59	Guainía	Oct 08 2001	172
4-60	Vaupés	Oct 08 2001	67
4-61	Amazonas	Oct 08 2001	37
4-62	Amazonas	Oct 08 2001	27
4-63	Amazonas	Oct 08 2001	86
5-56	Vichada	Apr 22 2001	27
5-60	Vaupés	Jan 03 2001	84
5-61	Amazonas	Jan 24 001	0
5-62	Amazonas	May 24 001	52
6-56	Casanare	Nov 07 2001	36
6-57	Meta	Jun 16 2001	162
7-52	Guajira	May 062001	0
7-56	Boyacá-Casanare	Oct 29 2001	0
7-57	Casanare-Meta	Jul 25 2001	20
8-53	Cesar	Aug 01 2001	7
8-57	Tolima-Cundinamarca	Jul 16 2001	0
9-53	Atlántico-Magdalena	Sep 25 2001	0
9-54	Sucre-Córdoba	Jul 07 2001	438
9-56	Antioquia-Caldas	Jul 07 2001	64
9-57	Quindío-Valle del Cauca	Apr 18 2001	0
10-54	Urabá	Oct 18 2001	175
10-56	Chocó	Oct 18 2001	55
			1803

Vector correction 1.750

* These figures have not yet been verified through ground truthing and do not have therefore the same level of confidence as the rest of the census.

Illicit crops variety, yield productivity

There are no comprehensive studies on productivity, number of harvests per year, percentages of re-cultivation and new cultivation for coca and opium poppy in Colombia. The estimates are made by the Government, the UNDCP alternative development projects and some individual ad-hoc studies.

There are several coca varieties and densities in Colombia, such as the traditional “*caucana*”, or the Peruvian type “*Tingo Maria*”, or the Bolivian type “*la dulce*”, each with different levels of productivity. According to several sources of information, the “*caucana*” variety produces approx 3 harvests per year, while the Peruvian and Bolivian varieties produce an average of 6 harvests per year. The Colombian Government as well as the US estimate a coca productivity of 800 kg/ha. If the national average is of 4 harvest per year, this is equivalent to 463.382 coca kg per year, or approx. 926,770 kg of cocaine per year.

According to estimations of the UNDCP alternative development projects, in Nariño, where most opium poppy cultivation takes place, there are approximately 87,400 plants per hectare. Based on an estimate for poppy of 8kg/ha, 2 harvests per year, there would be an average annual poppy production of 49,600 kg.

Prices

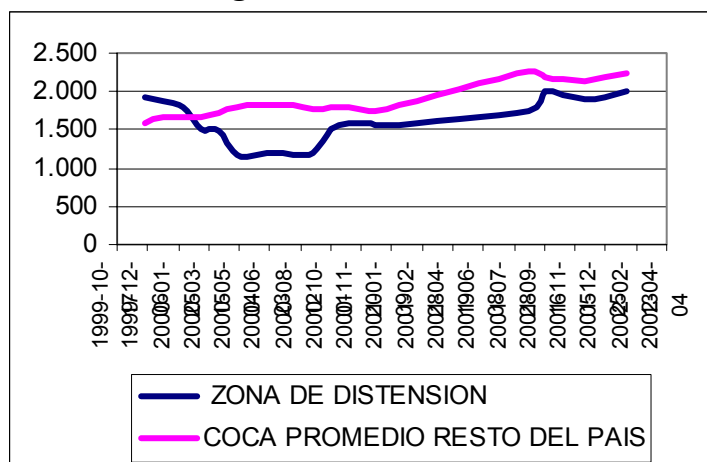
The UNDCP alternative development projects have been collecting information and data about the evolution of prices of illicit crops. Colombia does not have a coca leaf market, but only a coca base market. The farmer must therefore process himself the coca leaf into base, in a so-called “kitchens”.

Since 2000 coca base prices have increased nationwide by about 21%. The regions with the highest increase are the now former “Distension Zone” in the departments of Meta-Caquetá (28% increase) and in the Putumayo region (27% increase).

In January 2002, 1 kg of coca base sold for approximately COL\$ 2,230,000 (1,000 USD), with higher prices in Putumayo and Sur de Bolivar. Despite the above mentioned increase, the prices in the Distension Zone were the lowest, with approximately COL\$ 2,000,000 (870 USD).

The average price for 1 kg opium poppy latex was about COL\$ 600,000.

**Colombia: Evolution of coca base price per kg.
National average vs. Distention Zone. 2000 - 2001**



Incomes and costs

With reference to costs and incomes, two studies were carried out by the Colombian Alternative Development Agency - PLANTE in Caquetá and by an expert, Mr. Sergio Uribe in 1999¹ and 2000², with similar results. Both referred to the low levels of profits obtained by the illicit crops growers of the country – lower than the average income in the rural area of the country. According to Uribe, the average income per year is USD 1,792, which is just slightly more than the average USD 1,419 established as minimum annual salary by Colombian law.

The PLANTE study in Caquetá indicates that the fifth and sixth harvest produce the highest income per ha of coca in the region of Caquetá (around COL\$ 5,000,000, or about 2,174 USD). However, up to the second harvest the income is not higher than COL\$ 2,300,000 (or about 1,000 USD), which represents a total annual income of COL\$22,410,000 (about 9,750 USD) for six harvests per year.

The average annual costs for the set up and maintenance of 1 ha coca per year (including installation, set up of the “kitchen”, seeds, chemical precursors etc.) is about COL\$19,967,000 (approx. USD 8,680).

This means that the net annual profit of a campesino per ha of coca is about COL\$2,443,000, (about 1,060 USD), equivalent to a monthly income of about COL\$203,000 (US\$92) per ha.

¹ URIBE. “Encuesta para la caracterización socioeconómica de la población, producción agrícola y cocalera en las zonas de cultivos ilícitos”.1999.

² URIBE, S. Costos de producción de pequeños y medianos cultivadores de coca en Putumayo, Caquetá y Guaviare. En: “Los cultivos ilícitos en Colombia”. Universidad de los Andes. 2000.

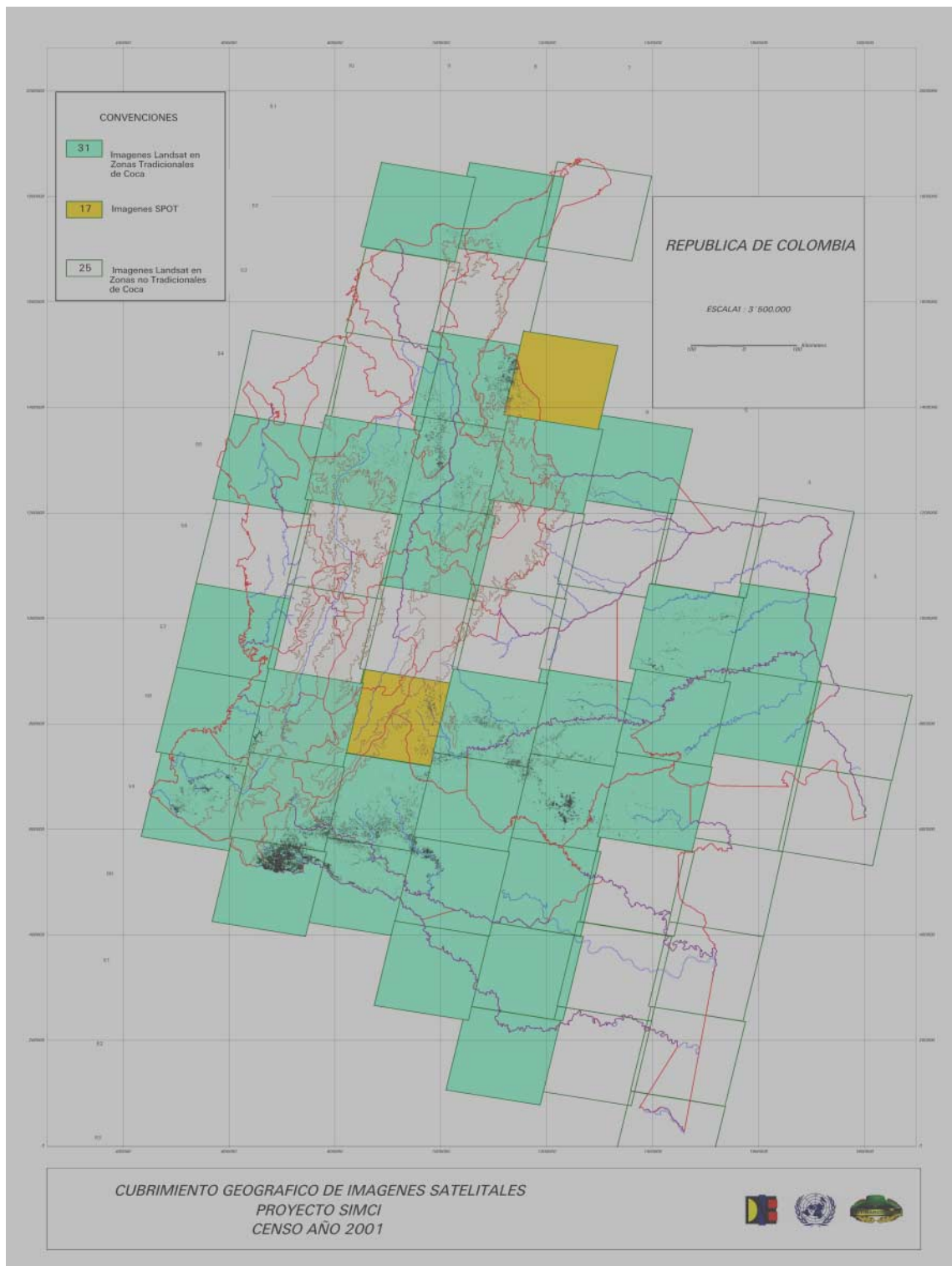
Aerial spraying activities

However, these estimations of productivity are very much affected by the forced eradication activities carried out by the police. During the year 2001, the DIRAN has performed an intensive eradication campaign through aerial spraying of illicit crops with the herbicide glyphosate. According to DIRAN data, in 2001, about 94,500 hectares of coca were fumigated, mostly in Putumayo, Caquetá, Guaviare, Nariño and Norte de Santander, and 2,267 hectares of opium poppy.

Once coca or opium poppy fields are fumigated, it takes approximately 6-8 months to recover the productivity with new cultivations over the same area.

ANNEX

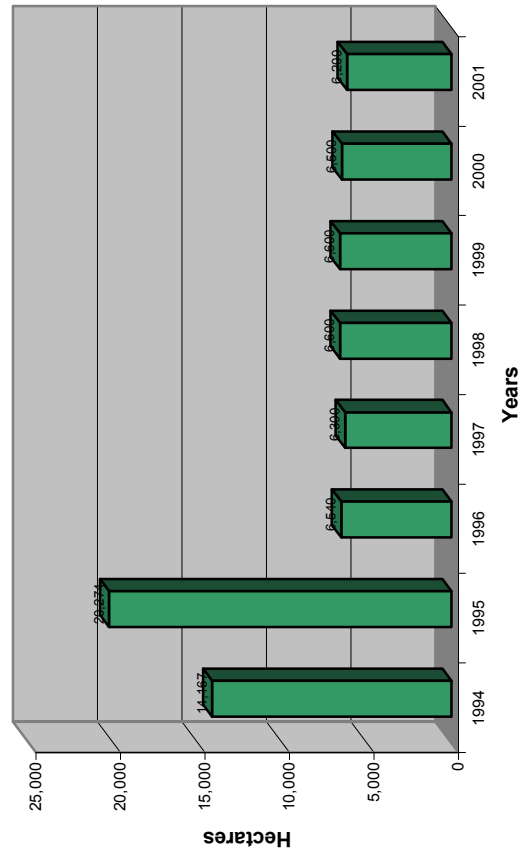
SATELLITE IMAGES COVERAGE
2001 CENSUS



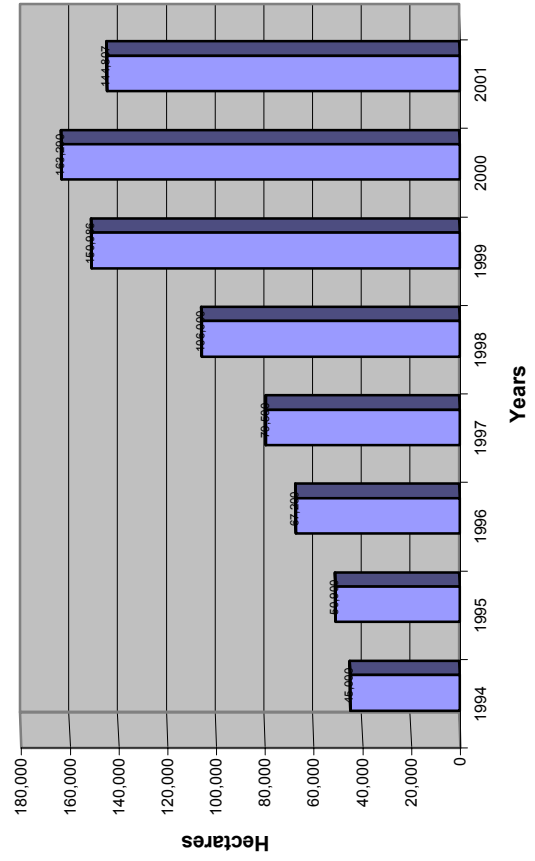
HISTORICAL NATIONAL RECORDS ILLICIT CROPS CULTIVATION

YEAR	COCA		OPIUM POPPY	
	HECTARES	INCREASES DECREASES (%)	HECTARES	INCREASES DECREASES (%)
1994	45,000	BASE DATA	14,167	BASE DATA
1995	50,900	13.1	20,274	43.1
1996	67,200	32.0	6,540	-67.7
1997	79,500	18.3	6,300	-3.8
1998	106,000	33.3	6,600	4.8
1999	* 150986	42.4	6,600	0.0
2000	* 163290	8.1	6,500	-1.5
2001	* 144807	-11.3	6,200	4.6

OPIUM POPPY



COCA

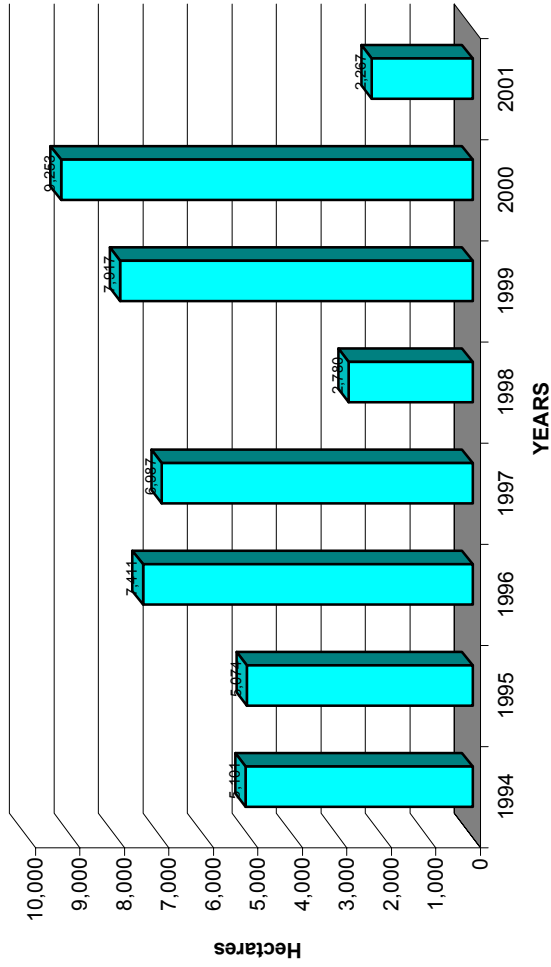


Source: National Police Eradication Programme -
ARECI visual reconnaissance
* SIMCI Figures for coca 1999 - 2001

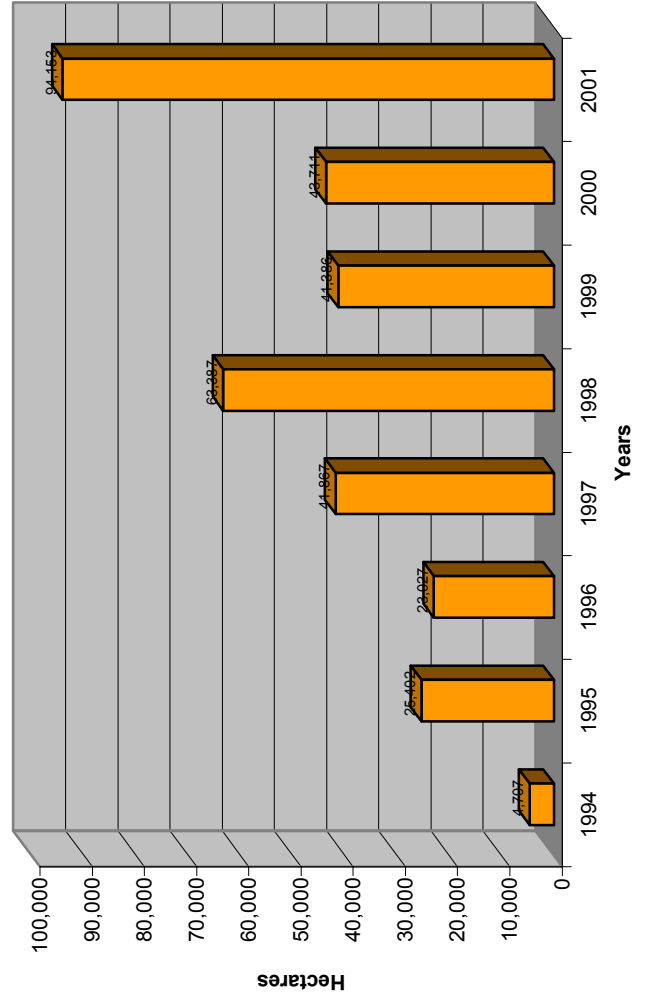
HISTORICAL NATIONAL RECORDS SPRAYINGS

YEAR	COCA		OPIUM POPPY	
	HECTARES	HECTARES	HECTARES	HECTARES
1994	4,707		5,101	
1995	25,402		5,074	
1996	23,027		7,411	
1997	41,867		6,987	
1998	63,387		2,780	
1999	41,386		7,917	
2000	43,711		9,253	
2001	94,153		2,267	

OPIUM POPPY



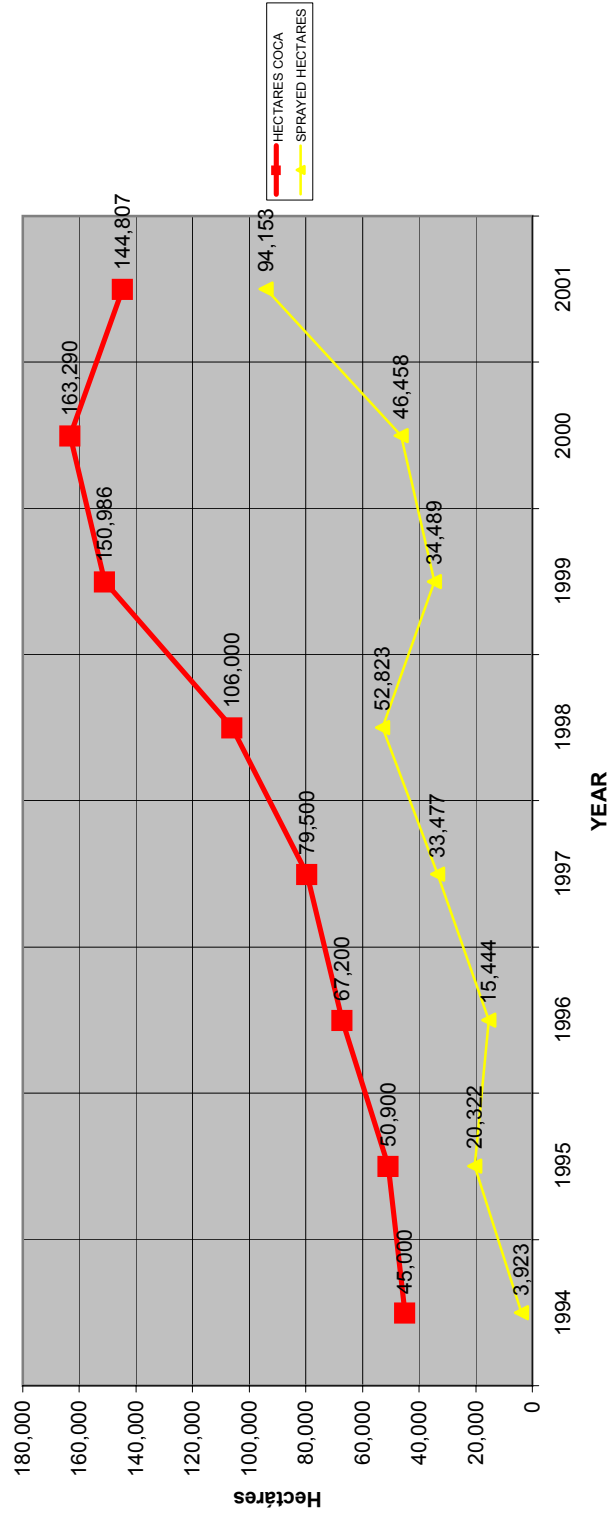
COCA



**COMPARISON COCA CULTIVATION
AREAS VS SPRAYED AREAS**

YEAR	COCA		SPRAYING	
	HECTARES		HECTARES	
1994	45,000	4,707		
1995	50,900	25,402		
1996	67,200	23,027		
1997	79,500	41,867		
1998	106,000	63,387		
1999	150,986	41,386		
2000	163,290	43,711		
2001	144,807	94,153		

COCA CULTIVATED AREA- SPRAYED AREA



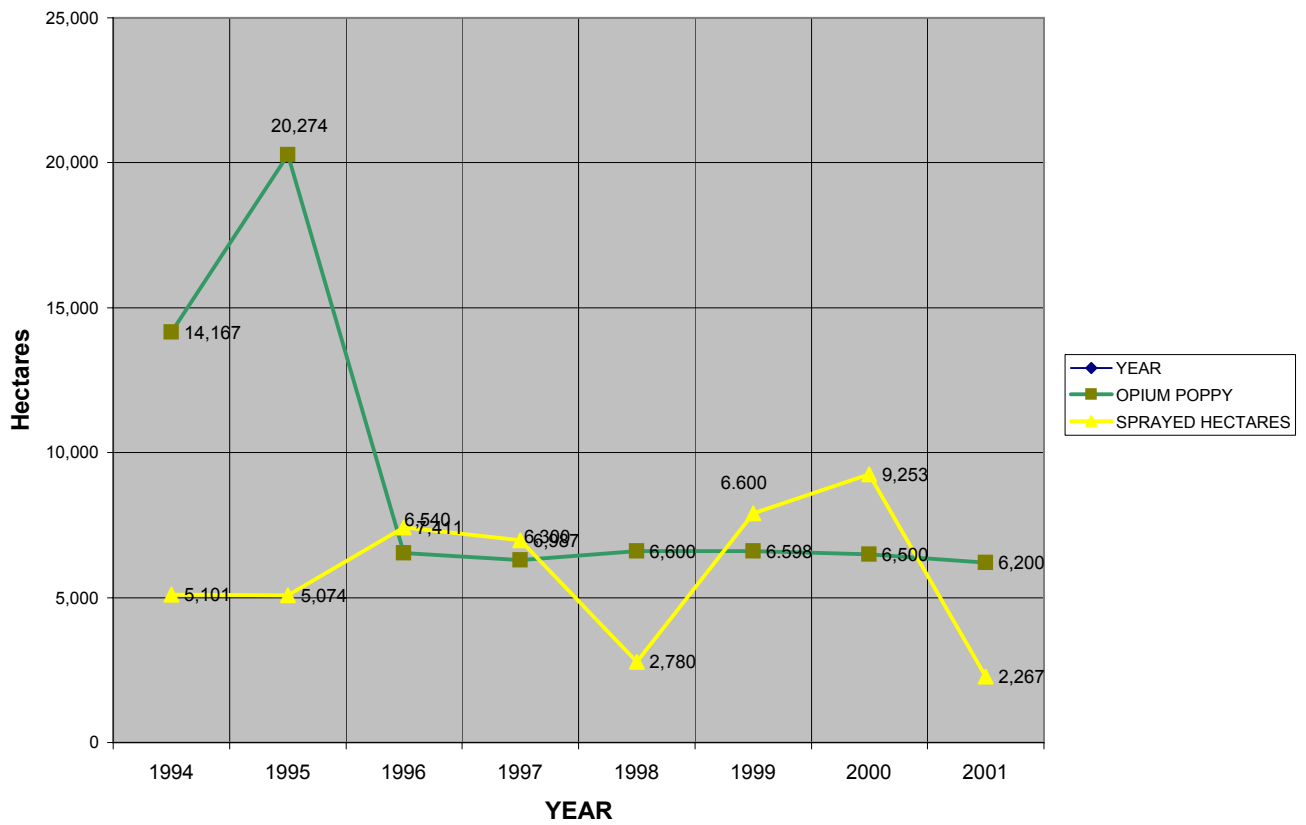
Coca :Source for the years 1994 -1998 : National Police - ARECI

Coca: Source for the years 1999, 2000 end 2001: SIMCI Project

Spraying Source: National Police - ARECI

COMPARISON OPIUM POPPY CULTIVATION AREAS Vs SPRAYED AREAS		
YEAR	OPIUM POPPY	SPRAYING
	HECTARES	HECTARES
1994	14,167	5,101
1995	20,274	5,074
1996	6,540	7,411
1997	6,300	6,987
1998	6,600	2,780
1999	6,600	7,917
2000	6,500	9,253
2001	6,200	2,267

CULTIVATED AREA - SPRAYED AREA



Source: National Police Erradication Programme - ARECI