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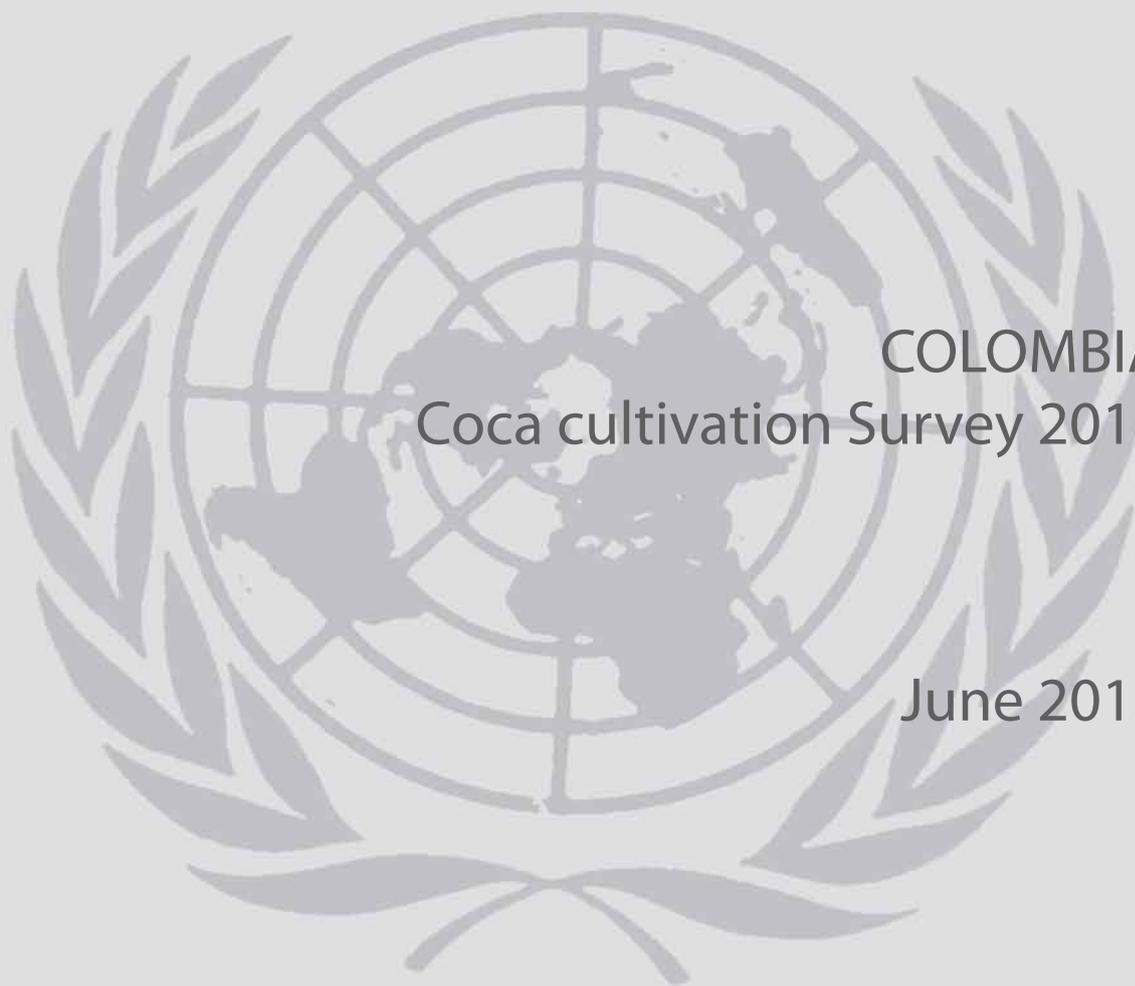
Government of Colombia



Colombia

Coca cultivation survey 2011

June 2012



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Abbreviations

ADAM	Areas of alternative development Municipal
COP\$	Colombian pesos
DANE	National Administrative Department of Statistics
DEA	US Drugs Enforcement Agency
DIRAN	Colombian Anti-narcotics Police
DNP	National Planning Department
FWFP	Forest Warden Families Programme
GDP	Gross Domestic Product
GME	Mobile Eradication Groups
IGAC	Instituto Geografico Agustin Codazzi – National Cartographic Agency
ICMP	Illicit Crop Monitoring Programme
INCODER	Rural Development Agency
INCB	International Narcotics Control Board
MIDAS	More Investment for Sustainable Alternative Development
m.t.	Metric tons
OAS	Organization of American States
PCI	Presidential Management against Illicit Crops
NPTC	National Plan for Territorial Consolidation
PONAL	Policía Nacional
SIMCI	Integrated Illicit Crops Monitoring System II
UNODC	United Nations Office on Drugs and Crime
USAID	United States Agency for International Development
US\$	United States Dollar
UAESPNN	Unidad Administrativa Especial del Sistema de Parques Nacionales Naturales – National Parks Agency

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SUMMARY FACT SHEET –COLOMBIA COCA CULTIVATION SURVEY, 2011

	2010	Variation ¹	2011
Net area under coca cultivation (rounded in thousands)	62,000 hectares	3 %	64,000 hectares
Pacific region	25,682 hectares	4 %	26,789 hectares
Central region	15,308 hectares	-31 %	10,641 hectares
Meta-Guaviare region	8,709 hectares	13 %	9,879 hectares
Putumayo-Caquetá region	7,363 hectares	80 %	13,278 hectares
Amazon region	1,505 hectares	-52 %	717 hectares
Orinoco region	2,990 hectares	-20 %	2,396 hectares
Sierra Nevada Region	255 hectares	-76 %	62 hectares
Potential production of cocaine	350 mt	-1 %	345 mt
Average price of coca leaf production site	US\$ 1.3 \$ 2,500/kg	-4 %	US\$ 1.3 \$ 2,400/kg
Average price of coca paste production site	US\$ 1,015/kg \$ 1,923,000/kg	-1 % -4 %	US\$ 1,002/kg \$ 1,852,000/kg
Average price of cocaine in main cities	US\$ 2,439/kg \$ 4,623,000/kg	1 % -1 %	US\$ 2,468/kg \$ 4,556,000/kg
Cumulative aerial spraying	101,940 hectares	1 %	103,302 hectares
Reported manual eradication	43,690 hectares	-22 %	34,170 hectares
Seizures of cocaine	164,808 kg	-5 %	155,832 kg ²
Seizures of heroin	337 kg	-11 %	299 kg
Illegal laboratories destroyed ³	2,651	-9 %	2,401
Total value of production of coca leaf and its derivatives in farm ⁴	US\$ 443 million	-5 %	US\$ 420 Million ⁵
In GDP percentage ⁶	0.2	-	0.23%
In agricultural sector GDP percentage	3%	-	3%
Number of households involved in coca cultivation	63,660	-2 %	62,400
Average gross annual income per person of leaf production and pasta / base ⁷	US\$ 1,427	-2 %	US\$ 1,400
Area cultivated with opium poppy	341 hectares	-1 %	338 hectares
Potential production of opium latex	8.4 mt	-1 %	8.3 mt ⁸
Potential production of heroin	1 mt	-	1 mt
Average price of opium latex production site	US\$ 503/kg	-7 %	US\$ 466/kg
Average price of heroin	US\$ 9,993/kg	4 %	US\$ 10,348/kg

¹ Figures rounded to the nearest whole

² Of the total seized 140,275 kg are seizures nationwide and 15,557 kg creates raids internationally with information from the National Police.

³ Includes cocaine laboratories and infrastructure pulp and cocaine base.

⁴ Corresponds to gross undiscounted cost of production.

⁵ Net farm income minus production costs are estimated at U.S. \$ 220 million. Source: "Economic Structure of Agricultural Production Units in the coca zones of influence"

⁶ GDP of the year as the government of Colombia (DANE).

⁷ This income does not take into account production costs.

⁸ It is for kiln-dried opium

EXECUTIVE SUMMARY

The Global Programme of Illicit Crops Monitoring of UNODC has been supporting the Colombian Government in the implementation and improvement of the Coca Cultivation Monitoring System since 1999. As from 2001, annual censuses have been carried out, covering the entire Colombian territory; this report expounds the results of the coca census for 2011.

The methodology used by the Project is based on the interpretation of satellite images of medium resolution and field verification. This verification is used for the editing of the interpretation in the office and for the calculation of the extension of coca cultivation. For the areas without information in the images due to cloudiness or other factors, the corrections are estimated based on trend criteria. The historical series was adjusted considering that coca crops in Colombia are smaller and smaller over time; the data in 2011 and 2010 include the adjustment of small fields that give continuity to the historical series.

The results of the census show that on 31 December 2011 Colombia had 64,000 hectares cultivated with coca, distributed in 23 of the 32 departments of the country. This represents a stability relation (+3%) with respect to the 62,000 hectares detected in 2010. 14 out of the 23 departments affected show a tendency to reduction; however, the increase in 4 departments compensate for that trend.

The Putumayo – Caqueta nucleus had the greatest increase in the area under cultivation. The most important reduction took place in the central region, particularly in the departments of Antioquia and Cordoba. On the other hand, the Pacific region, which was the most affected by coca crops, remained stable.

More than half of the area under coca cultivation (63%) is concentrated in 4 departments: Nariño, Putumayo, Guaviare and Cauca. Coca fields are more disperse in the territory and the concentration of coca crops is less frequent; nonetheless, 23% of the fields reported in 2011 are associated to the municipalities in the South border of the country.

In 2011, the Colombian Government reported the manual eradication of 34,170 hectares of coca and the spraying of 103,302; the total eradicated (manual and aerial spraying) adds up to 137,472 hectares, 6% less than the previous year. Likewise, in 2011 COP \$25.496 million were invested in the Forest Warden Family Programme, which benefited 14,918 families; moreover, between 2010 and 2011, the investments of the National Territorial Consolidation Plan added up to COP \$ 444,990 million (\$125,094 million in 2011), mainly devoted to economic and social development with the object of improving the gap in these territories.

UNODC/SIMCI and the Colombian Government carry out coca leaf production and yield studies since 2005. The results so far show a reduction of the capacity of the coca fields to produce coca leaf, although the study of 2011 in the Northern area of the country showed more efficiency in the process of extraction of the alkaloid in the coca leaf to produce coca paste and cocaine base. In this same year, the total production of cocaine remained stable (-1.4%) reaching an estimate of 345 tons of cocaine 100% pure.

In the production site, the market of coca leaf and its derivatives has a gross value of US\$ 420 million (US\$ 220 million subtracting production costs at the farm) that are equivalent to 0.2% of the national GDP and to 3% of the GDP of the agrarian sector in 2011.

According to the results of the surveys applied to the primary producer, the agro-cultural practices and the production costs were importantly reduced compared to the data from the study done in 2005. The average net income per hectare of coca for a grower that only sells leaf are calculated in around COP \$6.500.000 per year, or COP \$541.000 per month; this is equivalent to US\$294 per month.

1. INTRODUCTION

The objectives of the Illicit Crops Monitoring Programme (PMCI) include establishing methodologies for data collection and analysis with the object of increasing the capacity of the governments to monitor illicit crops in their territories and assist the international community in the monitoring of the extension and evolution of these within the context of the strategy of elimination adopted by the member states in the action plan of the Session 53 of the drugs commission of United Nations in March 2009. The PMCI currently covers seven countries: Colombia, Bolivia and Peru for coca, Afghanistan, Laos and Myanmar for opium poppy and Morocco for marihuana; recently, UNODC has started the monitoring of coca cultivation in Ecuador.

UNODC supports the monitoring of illicit crops in Colombia since 1999 and has produced thirteen annual censuses based on the analysis of satellite images. In the two first censuses (1999 and 2000), the country was assessed partially, but as from 2001 the coverage was extended to the entire national territory to assure the monitoring of a possible expansion of illicit crops.

In August 2010, UNODC signed an agreement with the Colombian Government to continue and expand the monitoring and analyses and to assure the sustainability of the project until 2014. On these grounds, the request to the SIMCI project was sustained to carry out additional tasks in the framework of and integrated approach to the analysis of the drug problem in Colombia, with a regional emphasis; in the framework of monitoring, it includes special areas such as fragile ecosystems, National Natural Parks, Indigenous Territories, expansion of the agrarian border, deforestation processes, in addition to providing direct support to the alternative development programmes, National Territorial Consolidation Plan -PNCT and Forest Warden Family Programme, executed by the government of Colombia.

The project is supported by an inter-institutional team in charge of ensuring the transference and adoption of technologies in the beneficiary national institutions. SIMCI is a joint project among UNODC and the Colombian Government; the national counterpart is the Ministry of Law and Justice, President of the National Drugs Board.

The project is led by one technical coordinator and comprised by the following engineers and technicians: Five experts in digital processing, a field engineer, a cartographic editor, a specialist in analysis and research, a statistician, a chemist, a technician in logistics and databases and three engineers in digital processing to support the intermediate estimations and develop regional baseline studies. The team is permanently assisted by technicians from the DIRAN and National Natural Parks. SIMCI supports studies and investigations of the Government of Colombia, and of different national and international academic institutions, in addition to facilitating the access to its Spatial Data Bank -BIE, and providing technical training and transference of technology to achieve their objectives. Some of these entities are: DANE, Department Governments, several NGO, as well as other agencies and projects from the United Nations in Colombia and abroad.

SIMCI has established mutual cooperation agreements with several national and international universities to exchange and share knowledge, training and joint projects. The following are some of these Universities: BOKU in Vienna-Austria; Harvard, Michigan and Princeton in the United States; Los Andes, National, Distrital and other Colombian Universities.

2. RESULTS

2.1 COCA CROPS

The area under coca cultivation in Colombia with cut-off date 31 December 2011 is 64,000 hectares⁹, which is considered stable with respect to the measurement of 31 December 2010. In 14 out of the 23 departments affected, there was a reduction of the area cultivated with coca; it increased in 6, while 3 remained stable. The department of Nariño continues to be the most affected by the presence of coca cultivation. The most important reduction occurred in Cordoba, Antioquia and Bolivar. Five departments have less than 100 hectares cultivated with coca.

Table 1. Coca fields per department in Colombia, 2005-2011 (hectares)

Department	Dec.- 2005	Dec.- 2006	Dec.- 2007	Dec.- 2008	Dec.- 2009	Dec.- 2010	Dec.- 2011	change % 2010-2011	% of the 2011 total
Nariño*	13,875	15,606	20,259	19,612	17,639	15,951	17,231	+ 8%	27%
Putumayo*	8,963	12,254	14,813	9,658	5,633	4,785	9,951	+ 108%	16%
Guaviare*	8,658	9,477	9,299	6,629	8,660	5,701	6,839	+ 20%	11%
Cauca	2,705	2,104	4,168	5,422	6,597	5,908	6,066	=3%	10%
Norte de Santander	844	488	1,946	2,886	3,037	1,889	3,490	+85%	5%
Caqueta	4,988	4,967	6,318	4,303	3,985	2,578	3,327	+29%	5%
Antioquia*	6,414	6,157	9,926	6,096	5,096	5,350	3,104	-42%	5%
Meta	17,305	11,063	10,386	5,525	4,469	3,008	3,040	= 1%	5%
Choco	1,025	816	1,080	2,794	1,789	3,158	2,511	- 21%	4%
Vichada*	7,826	5,523	7,218	3,174	3,228	2,743	2,264	-17%	4%
Bolivar	3,670	2,382	5,632	5,847	5,346	3,324	2,207	-34%	3%
Cordoba	3,136	1,216	1,858	1,710	3,113	3,889	1,088	-72%	2%
Valle del Cauca	28	281	453	2,089	997	665	981	+48%	2%
Santander	981	866	1,325	1,791	1,066	673	595	- 12%	1%
Guainia	752	753	623	625	606	446	318	- 29%	0,5%
Vaupes	671	460	307	557	395	721	277	- 62%	0,4%
Arauca	1,883	1,306	2,116	447	430	247	132	- 46%	0,2%
Amazonas	897	692	541	836	312	338	122	- 64%	0,2%
Boyaca	342	441	79	197	204	105	93	- 11%	0,1%
Caldas	189	461	56	187	186	46	46	= 0%	0,1%
Magdalena*	213	271	278	391	169	121	46	- 62%	0,1%
Cundinamarca	56	120	131	12	0	32	18	- 43%	0,03%
La Guajira*	329	166	87	160	182	134	16	- 88%	0,03%
TOTAL	85,750	77,870	98,899	80,953	73,139	61,812	63,762	3%	100%
Rounded total	86,000	78,000	99,000	81,000	73,000	62,000	64,000	3%	
Number of affected departments	23	23	23	24	22	23	23		

* In the last quarter of 2011, 4,267 hectares were eradicated by GME. Given that this figure does not have standardized geographical records, it was not included as an adjustment parameter of the census.

Between 2007 - 2011, there was a second period of sustained reduction of the area under coca cultivation in Colombia, despite the stability reported between 2010 and 2011 (+3%); it is not possible to determine whether this stability corresponds to a change in the reduction trend or not. It is important to underscore that the coca fields detected in the 2011 census occupied 1.6 % of the total cultivable area in Colombia.

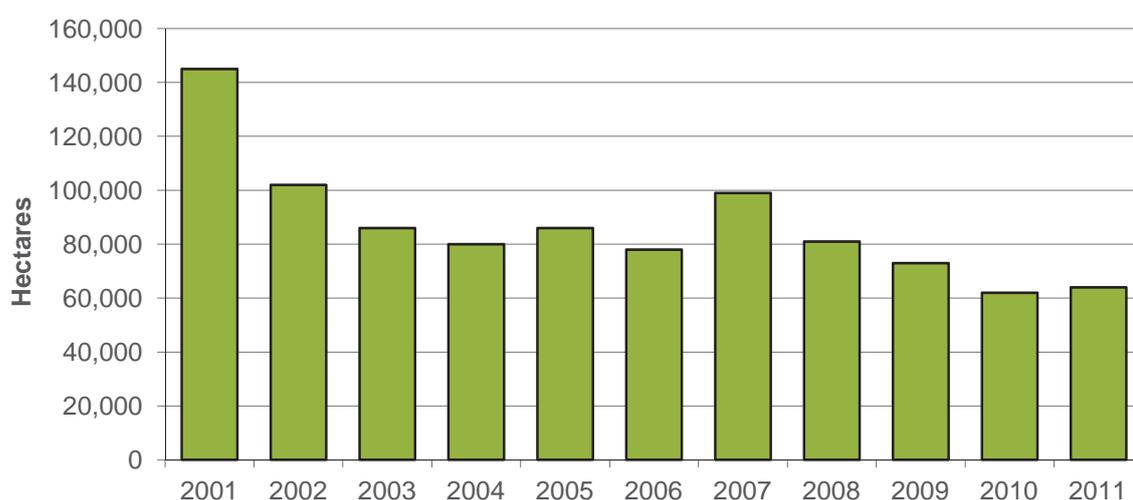
⁹ The thematic accuracy is considerably reduced when there are very small plots (less than 3 pixels); until 2008, the relative weight of this type of plots is considered insignificant; however, as of 2009, an adjustment associated to the presence of small plots is included.

Like in the censuses done since 2001, this one represents the situation of coca crops on 31 December 2011. The census covers the entire country and detected coca fields in 23 out of the 32 departments; given the long winter period in Colombia, the satellite images used in the 2011 census were taken between August 2011 and March 2012. The extension of the period of image collection enabled coverage of 85% of the area under monitoring.

The most important reduction in the area under coca cultivation between 2010 and 2011 took place in the departments of Cordoba (-2,801 ha) and Antioquia (-2,246 ha) in the Central region. The reduction in the area planted with coca in Antioquia began in 2007, although it was interrupted between 2009 and 2010. In 2011, the departments of Bolivar and Vichada reached the lowest point of coca cultivation in the entire historical series and all the departments are below the highest peaks. It is worth highlighting the continuous reduction of coca cultivation in the department of Meta, which started in 2004 with 18,740 hectares and remained in 3,039 in 2011.

Six departments reported an increase in the area cultivated with coca, with Putumayo (+5,166 ha), Norte de Santander (+1,601 ha) and Nariño (+1,280 ha) being the most affected.

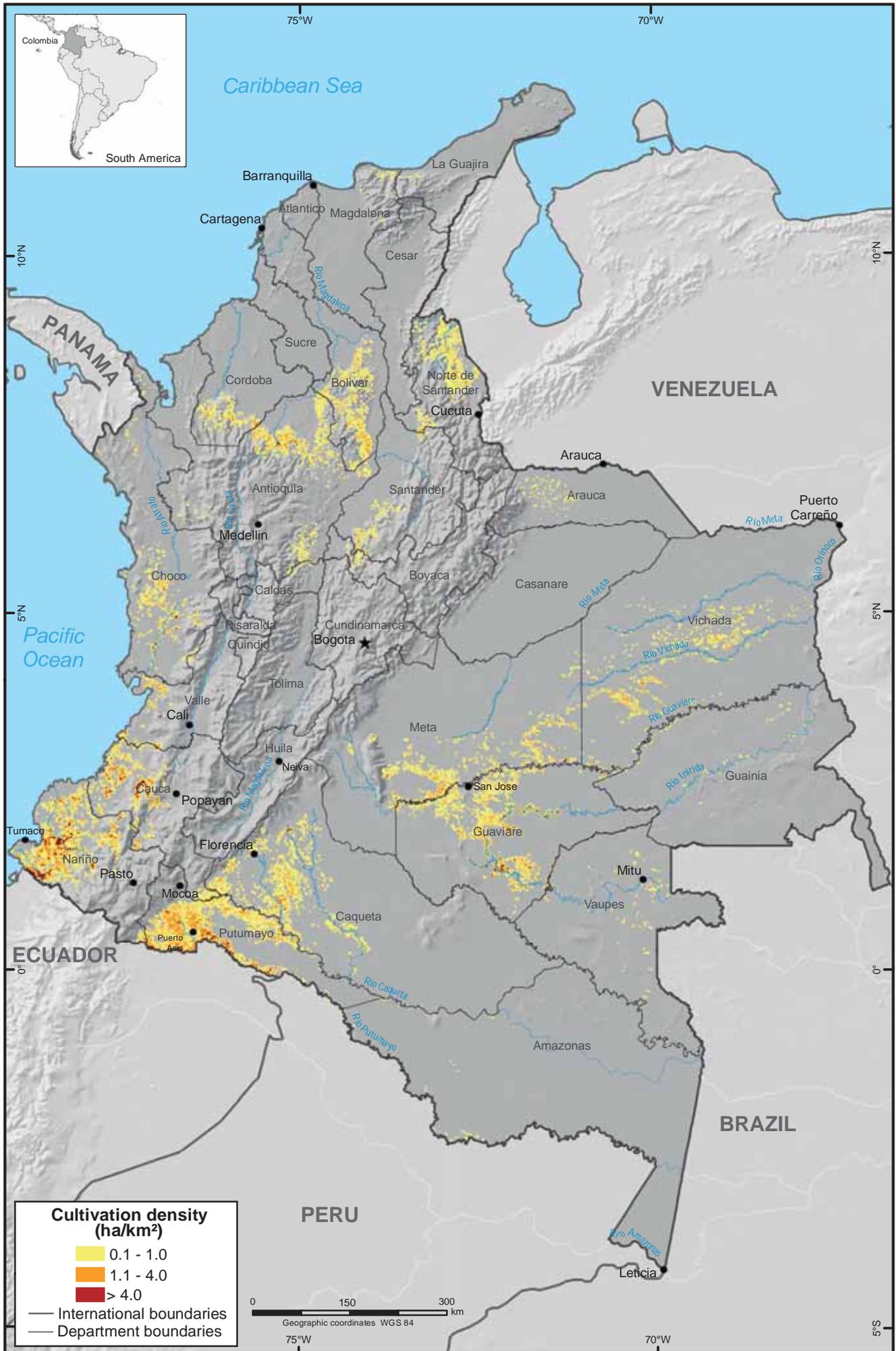
Figure 1. Coca Fields in Colombia, 2001 – 2011



Among the actions taken in Colombia to reduce coca cultivation, during 2011, 34,170 hectares were manually eradicated; this level of eradication is 61,561 hectares lower than the record reached in 2008 (95,731 ha). Aerial spraying of coca fields remained in similar proportion than that in 2010, going from 101,940 hectares to 103,302 hectares in 2011.

Between 2010 and 2011, important investments were made within the framework of the Territorial Consolidation Policy that aims at the coordinated effort of the national and local governments with the private sector and international cooperation to attack the factors that lead to the vulnerability of territories, coca plantation and other forms of crime. The investments in those two years reached the sum of COP \$444,990 million (COP \$125,094 million in 2011), in strategic management areas focused on economic development, social development, justice, governability and property management. The greatest investments in the two years were done in the departments of Meta, Tolima, Cordoba and Antioquia (64%). By type of support, there were important investments in infrastructure; productive projects focused in Cordoba, Antioquia, Meta, Valle and Bolivar; quotas and coverage of social programmes, with the greatest investments in Nariño and Valle del Cauca.

Map 1. Coca cultivation density in Colombia, 2011



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

The municipality of Tumaco continues to be the most cultivated with coca in the country, with 5,771 hectares. The municipalities of Tierralta, El Retorno and Timbiquí were eliminated of the list of the 10 most cultivated and were replaced by the municipalities of Magui, Puerto Leguizamo and El Tambo.

Table 2. The tin municipalities with the greatest cultivated area 2011

Municipality	Department	Coca cultivation (hectares)	% census
Tumaco	Nariño	5,771	9%
Barbacoas	Nariño	2,857	4%
Puerto Asis	Putumayo	2,786	4%
Miraflores	Guaviare	2,560	4%
Roberto Payan	Nariño	2,297	4%
Cumaribo	Vichada	2,249	4%
San Jose del Guaviare	Guaviare	1,877	3%
Magui	Nariño	1,720	3%
Puerto Leguizamo	Putumayo	1,717	3%
El Tambo	Cauca	1,645	3%
Total		25,479	39%

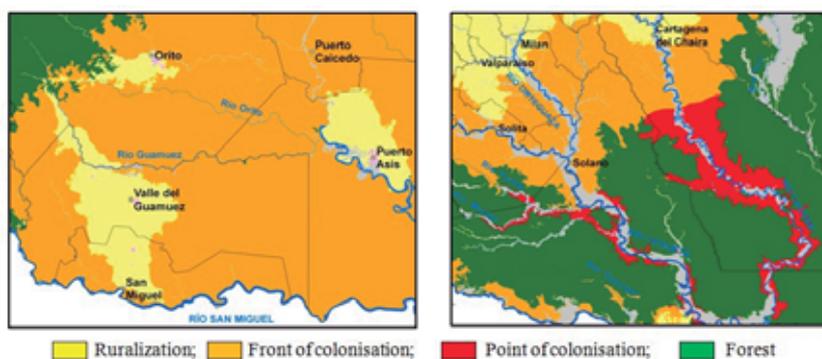
Analysis of the dynamics of coca cultivation

In Colombia, the geography of coca leaf cultivation keeps a tight relation with substantial aspects of the territory and the phenomenon; among these, the following are outstanding: the biophysical, cultural and regional diversity of the territory and the sustainability strategies of the cocaine production and marketing chain. In that sense, the following aspects are put forward for the analysis of the dynamics of illicit crops: The dynamic of the establishment; the permanence spatial analysis; the phenomenon of regionalization of the tendencies in 2011, and, finally, a synthesis of the dynamics that is expressed as Municipal Threat Index due to the presence of illicit crops.

Dynamic of the establishment of illicit crops

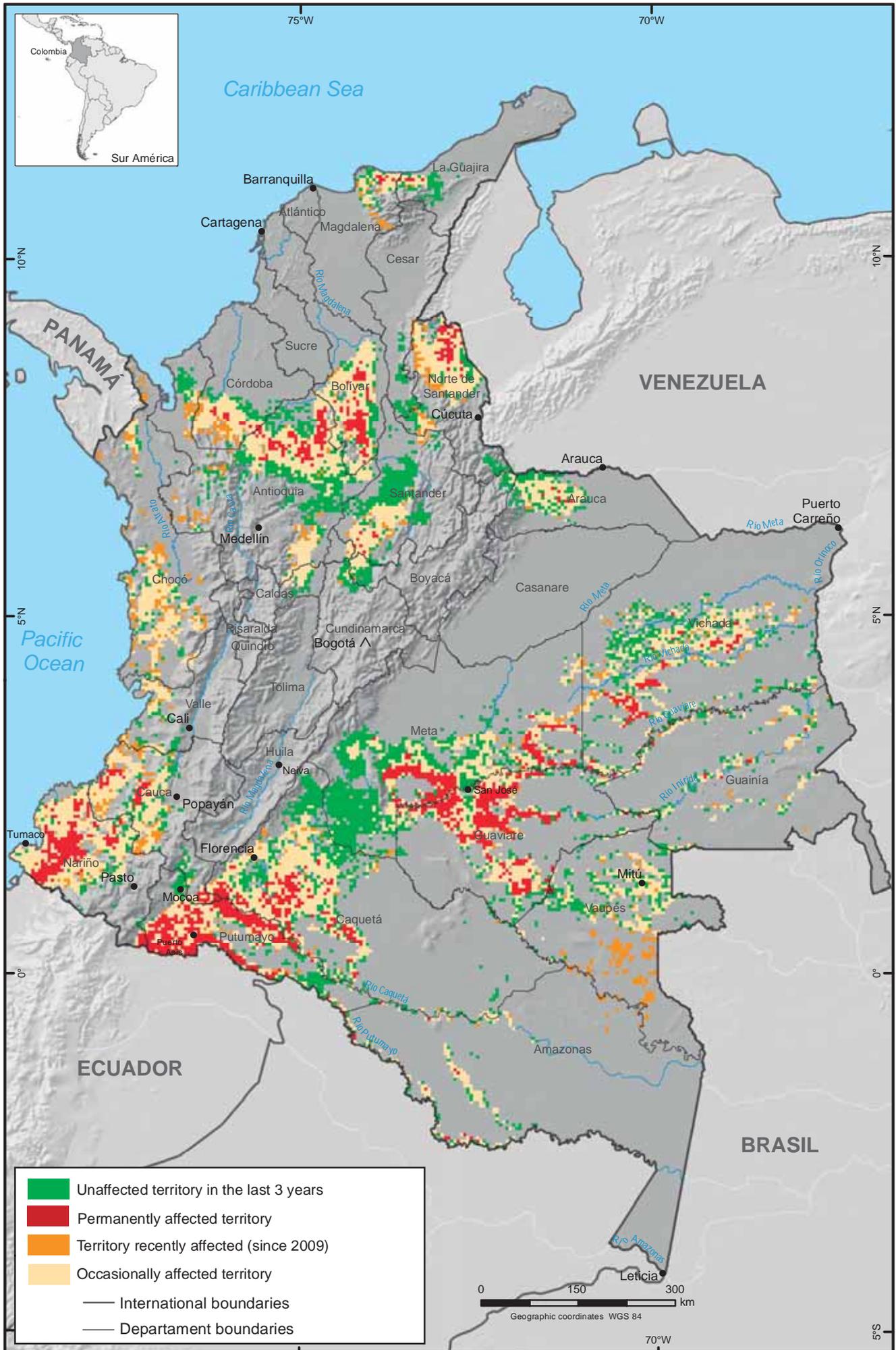
After twelve years of monitoring, the predominant spatial model of establishment and abandonment of coca cultivation persists. Such model is associated with recurrent processes of land occupation in the peripheral surrounding of the Andean zone of Colombia, which are summarized as follows: i) Ruralisation as an advanced process of anthropic transformations of natural environments, which promotes abandonment of coca fields and the incorporation of lands to the production process; ii) The front of colonization, where deforestation, grass growing and subsistence cultivations are combined with illicit cultivations; iii) The points of colonization, which are the progress of illicit crops through the vulnerable hydrography, and iv) The rainforest or firm land forests, which constitute the source of new areas for the establishment of illicit crops. (See Figure No.2)

Figure 2. Ways of occupation of Valle del Guamuez, Cartagena del Chaira and Solano - 2010



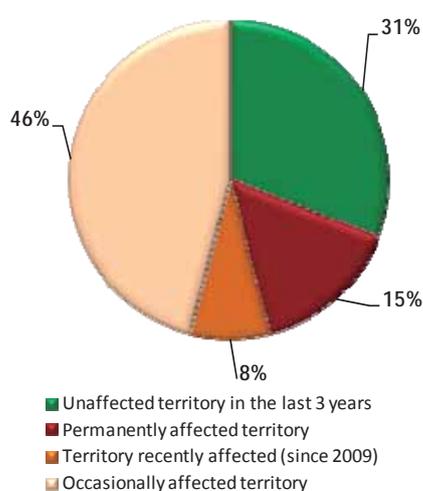
Permanence spatial analysis Based on the SIMCI master framework of grids of one by one and five by five kilometres, the analysis of permanence and affectation due to coca cultivation in the series 2001-2011 has the following characteristics (See map 2 and figure 3).

Map 2. Regional stability of coca cultivation in Colombia, 2001- 2011



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

Figure 3. Regional distribution of permanence



15% of the territory is permanently affected by coca cultivation in the entire series 2001-2011; it remained stable in relation to 2010; in this zone (grids), there is the greatest density of current coca fields; it is distributed in all the regions, with more presence in Nariño, Putumayo, Guaviare, Bajo Cauca, Sur de Bolivar and Catatumbo.

8% of the territory was affected in the three last years of the series (2009 to 2011); it is worth highlighting a reduction of two points in relation to 2010. This area corresponds to the expansion zones and new cultivation areas; it is distributed mainly in the Pacific region and in Catatumbo, at the north of the country. 46% has intermittent affectation; in other words, these area areas where coca fields appear and disappear in any year of the series 2001-2011; it remained stable compared to 2010.

Finally, the increase of between 29 al 31% with respect to 2010 is underscored in the territories that in a year previous to 2009 had coca cultivation but which did not have them again since 2009. This tendency is observed in south Meta, north Caqueta, Antioquean Uraba and zones in Magdalena Medio.

Table 3. Regional distribution of the permanence of coca cultivation (2001-2011)

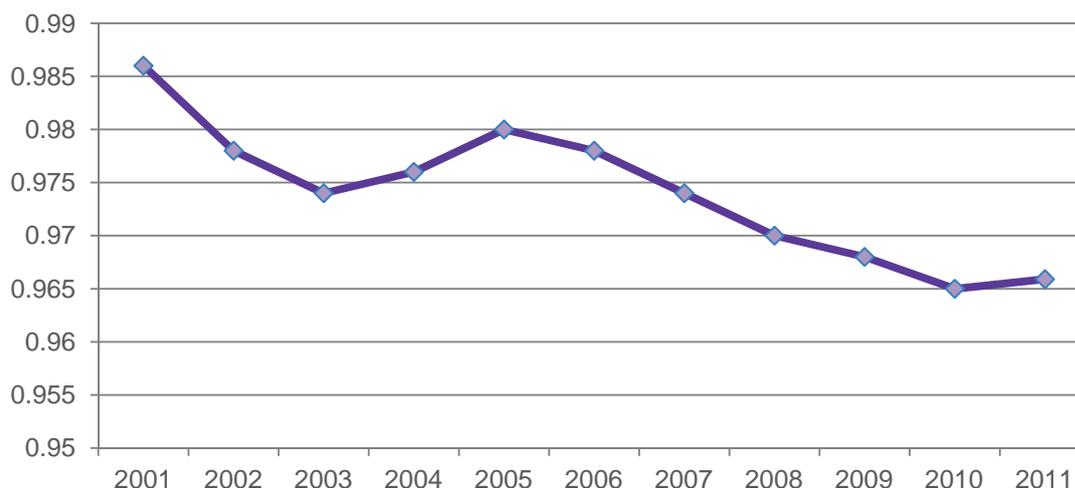
Region	Total		Unaffected area from 2009 to 2011		Area permanently affected from 2001 to 2011		Area affected in an intermittent manner from 2001 to 2011		Area affected as from 2009	
	km ²	%	km ²	%	km ²	%	km ²	%	km ²	%
Amazon	26,774	10%	8,943	3%	657	0%	12,212	4%	4,962	2%
Central	66,734	24%	23,872	9%	6,210	2%	30,712	11%	5,940	2%
Meta-Guaviare	52,148	19%	20,493	7%	12,320	4%	18,135	7%	1,200	0%
Orinoco	30,114	11%	10,821	4%	2,326	1%	15,051	5%	1,916	1%
Pacific	46,759	17%	7,082	3%	6,420	2%	26,148	10%	7,109	3%
Putumayo-Caqueta	46,812	17%	12,590	5%	11,894	4%	20,820	8%	1,508	1%
Sierra Nevada	4,692	2%	1,959	1%	342	0%	1,769	1%	622	0%
Total	274,034	100%	85,760	31%	40,169	15%	124,847	46%	23,257	8%

Analysis of concentration of crops

In addition to the permanence study, the historical series and the master framework enable the calculation of the national indicator of concentration/dispersion of coca leaf cultivations from the Gini Index. (See Figure 4)

The Gini index over 0.96 confirms the tendency to persistence of nucleuses of coca cultivation in the same zones throughout the entire census series (2001-2011); it is worth noting that in 2011 there was a slight increase in this trend, possibly due to the raise in the concentration of fields in the south zone of the country. The distribution pattern can be observed in the map of dynamics of cultivation.

Figure 4. Gini index for the concentration of coca cultivation, series 2001-2011



Regionalization of trends 2011

The spatial results of this monitoring show a regional trend in the different dynamics of the phenomenon. The increase occurred mainly in the south of the country, in the departments of Putumayo, Caqueta, Nariño, Valle and Guaviare; in the north, there was only increase in the Catatumbo region; in the rest of the north zone, there was a strong tendency to reduction, in particular in the Sierra Nevada with -75.7% and in the central zone with -30.5% as regards to 2010. There is a slight trend to reduction in the east of the country, especially in the department of Arauca; in the department of Guaviare there was a moderate increase and in the departments of Amazonas, Guainia and Vaupes, a notable reduction. It is worth underscoring that compared to 2010 there is stability in the departments of Cauca, Meta and Caldas

Hazard index municipal presence of coca, 2011

This monitoring proposes the construction of this index for the municipalities of Colombia, based on the series 2006-2011 and the SIMCI master framework; as from now, it would be a point of reference to track the territorial impact of the phenomenon at the local and regional levels. It is an index built from the statistical pondering of the factors that, according to the studies of SIMCI, have more weight in the comprehensive understanding of the dynamic of coca leaf cultivation in Colombia. These factors are:

Affected area: Net current surface cultivated with coca in the geographical zone under study. It includes hectares cultivated with coca, and eradication and aerial spraying areas.

Persistence: Number of years with presence of coca crops in the 1 km² grid.

Expansion: Rate of new grids with coca cultivation.

Concentration: It is calculated with the Gini index to express the concentration or dispersion of coca cultivation in a given municipality.

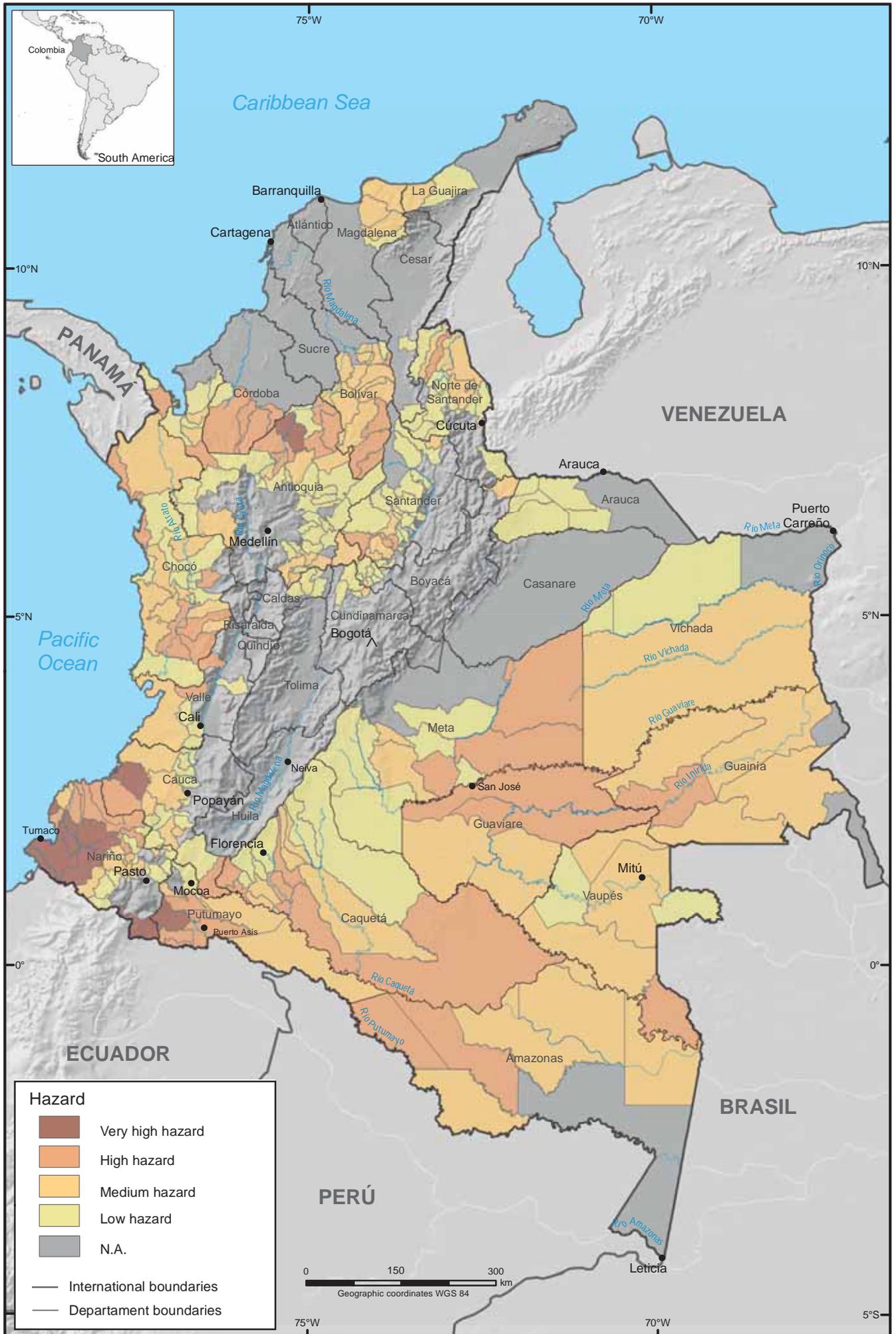
Re-sowing: Rate of re-sowing per municipality in relation to the number of eradicated plots.

Abandonment: It shows the tendency of a geographical category towards the abandonment of coca fields.

The valuation of the index has a normalized scale from 0 to 1, in which values close to zero show less threat and values close to 1 indicate more threat. For qualitative effects, the index is grouped in three kinds of threat: High, medium, and low.

The results of the first approximation of the index for 2011 show that 280 municipalities (25% of Colombia) have some Hazard; out of these, 3% have a very high hazard, 19% high, 29% medium and 49% low. The geographical distribution of the index shows a regional tendency to the grouping of municipalities according to the intensity of the hazard (See Map 3).

Map 3. Hazard index municipal presence of coca, 2011



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

Deforestation due to coca cultivation.

Although the area planted with coca remains stable, 21.5 % of the existing coca fields in 2011 were originated in the felling of primary forests that existed in 2010; this percentage of participation is 3 points higher than the one reported in 2010. In the period 2001-2011, 583,926 hectares have been cultivated with coca at some point, and 245,382 of these hectares were formerly covered by forests.

In the period 2000-2001, 55,000 hectares of forest were felled to plant coca, while in the period 2010-2011 deforestation reached 23,000 hectares, from which 60 % corresponded to primary forests of high complexity, biodiversity and richness.

In 2001, the percentage of coca plots that have their origin in deforestation was 48% and it progressively decreased to 27% in 2006. A trend to the increase in deforestation for coca cultivation started as of this year and in 2011 36 % of the area under coca cultivation is originated in deforestation of primary or secondary forests; in 2010, this amount reached 35%.

Figure 5. Rate of deforestation due to coca cultivation, 2001-2011

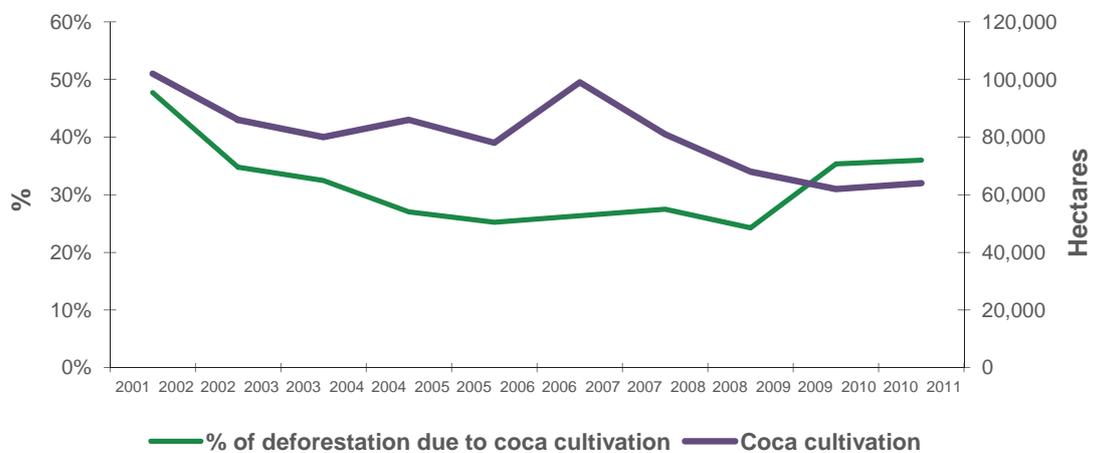
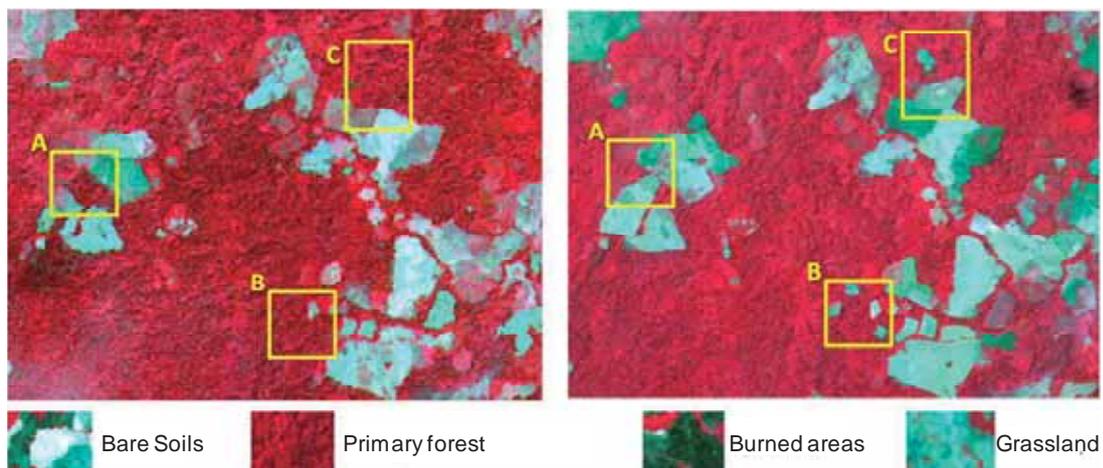
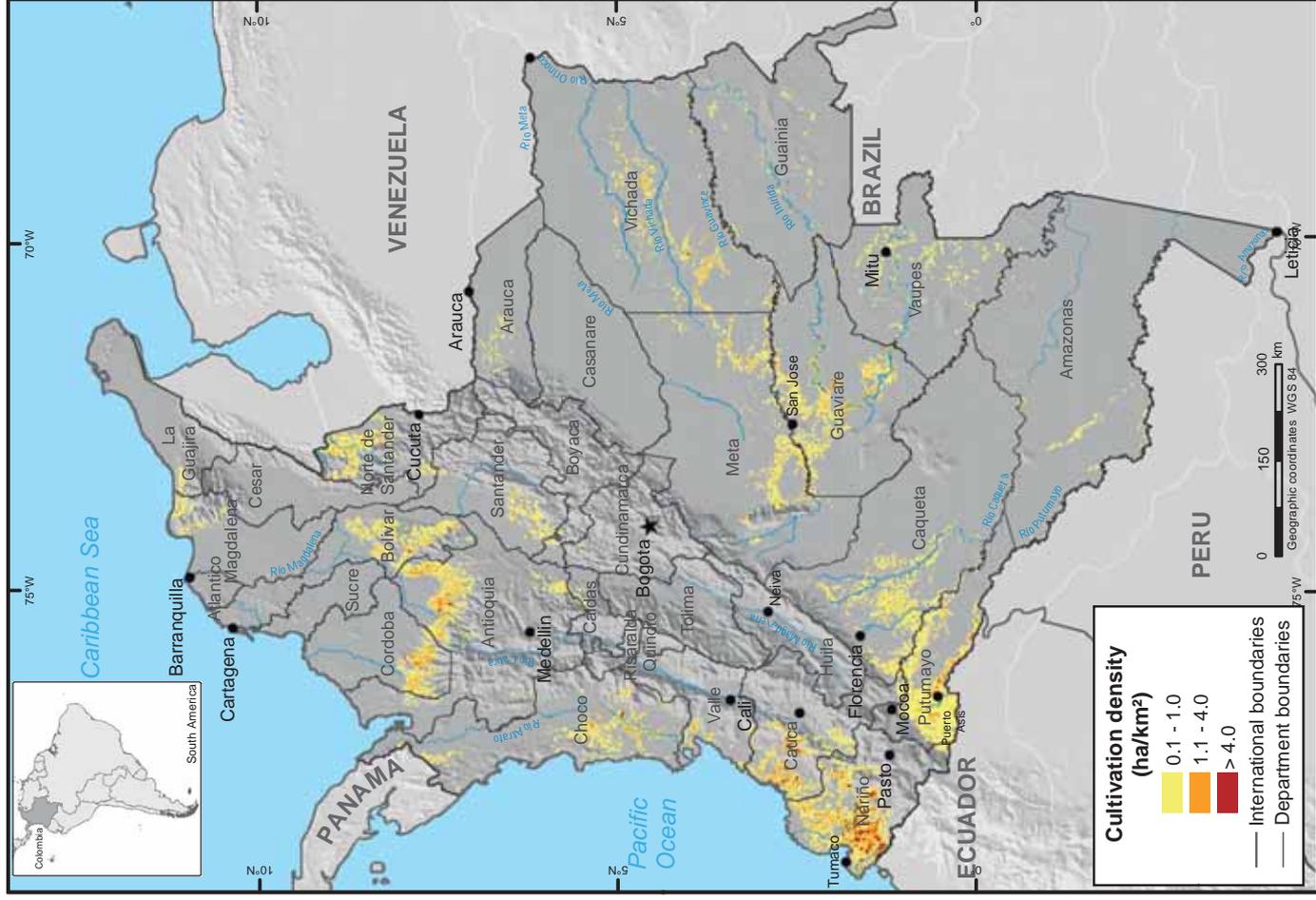


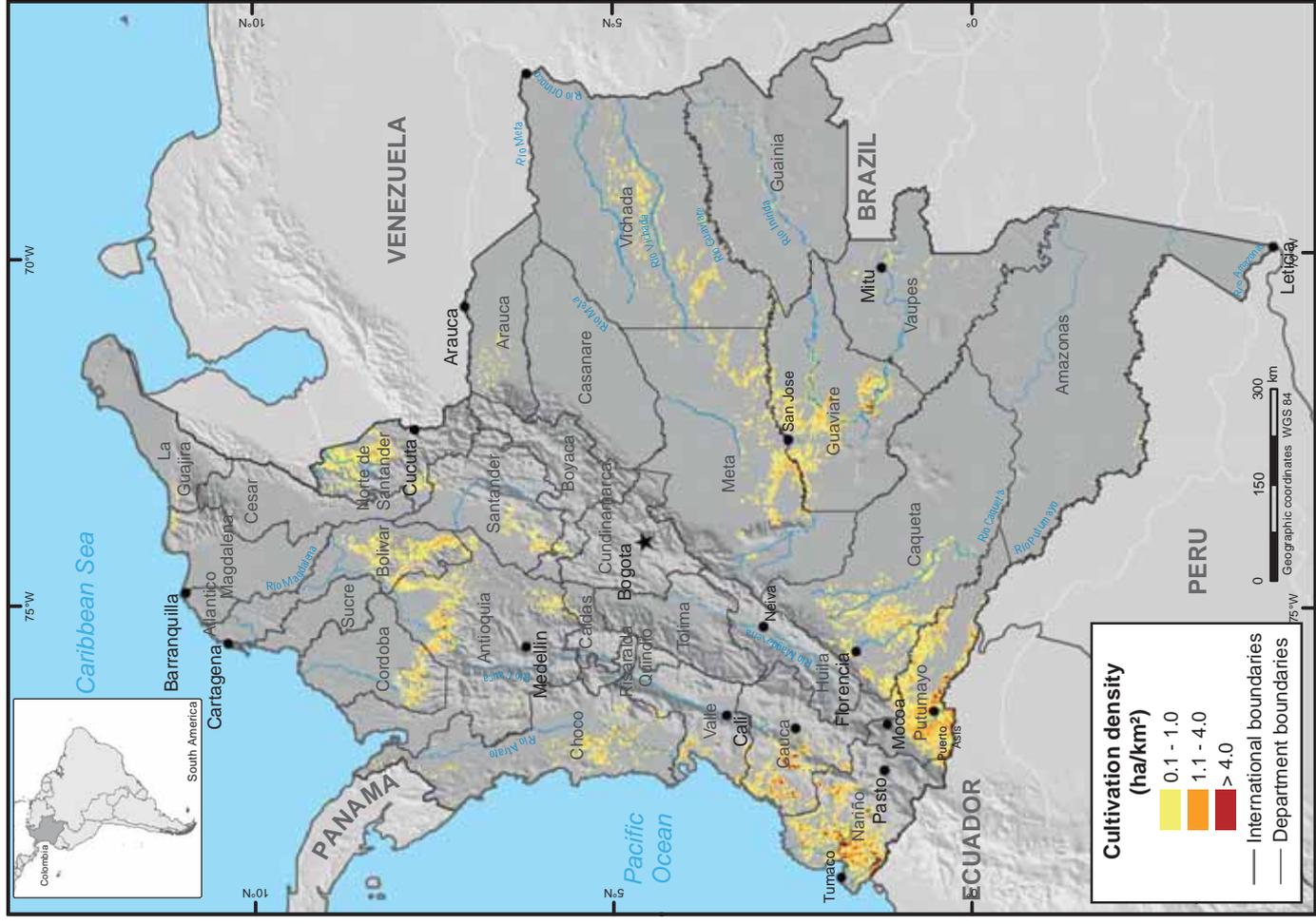
Figure 6. Temporary comparison of satellite images of the municipality of Vistahermosa, Meta department. False colour composition. Left: SPOT Image, 2008. Right: ALOS Image, 2010.



Map 4. Coca cultivation density in Colombia, 2010



Map 5. Coca cultivation density in Colombia, 2011



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

Map 6. Coca cultivation by region in Colombia, 2007 - 2011



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

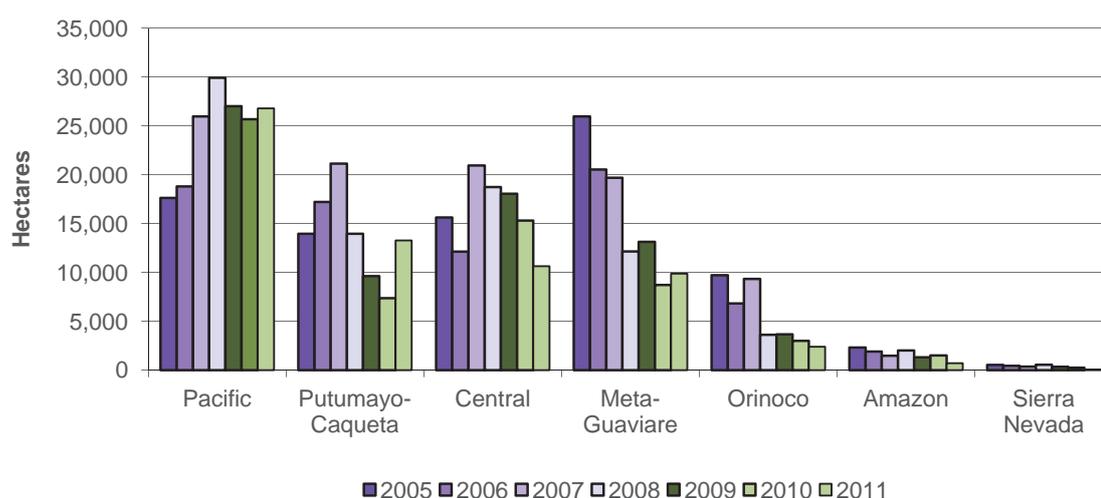
Analysys of the regional historical series

The tendency to reduction of the cultivated area remained in 4 regions of Colombia; the Pacific region remained stable and there was a slight increase in Meta - Guaviare and an important increase in Putumayo - Caqueta. According to the 2011 census, 63% of the coca fields are in the Pacific and Putumayo – Caqueta regions. The greatest reduction took place in the Central region (-4,667 ha).

Table 4. Coca fields in Colombia by region 2005 - 2011 (in hectares)¹⁰

Region	2005	2006	2007	2008	2009	2010	2011	% of the total	Change 2010 - 2011
Amazon	2,320	1,905	1,471	2,018	1,313	1,505	717	1.1	-788
Central	15,632	12,131	20,953	18,731	18,048	15,308	10,641	16.7	-4,667
Meta-Guaviare	25,963	20,540	19,685	12,154	13,129	8,709	9,879	15.5	1,170
Orinoco	9,709	6,829	9,334	3,621	3,658	2,990	2,396	3.8	-594
Pacific	17,633	18,807	25,960	29,917	27,022	25,682	26,789	42.0	1,107
Putumayo-Caqueta	13,951	17,221	21,131	13,961	9,618	7,363	13,278	20.8	5,915
Sierra Nevada	542	437	365	551	351	255	62	0.1	-193
Rounded total	86,000	78,000	99,000	81,000	73,000	62,000	64,000	100	2,000

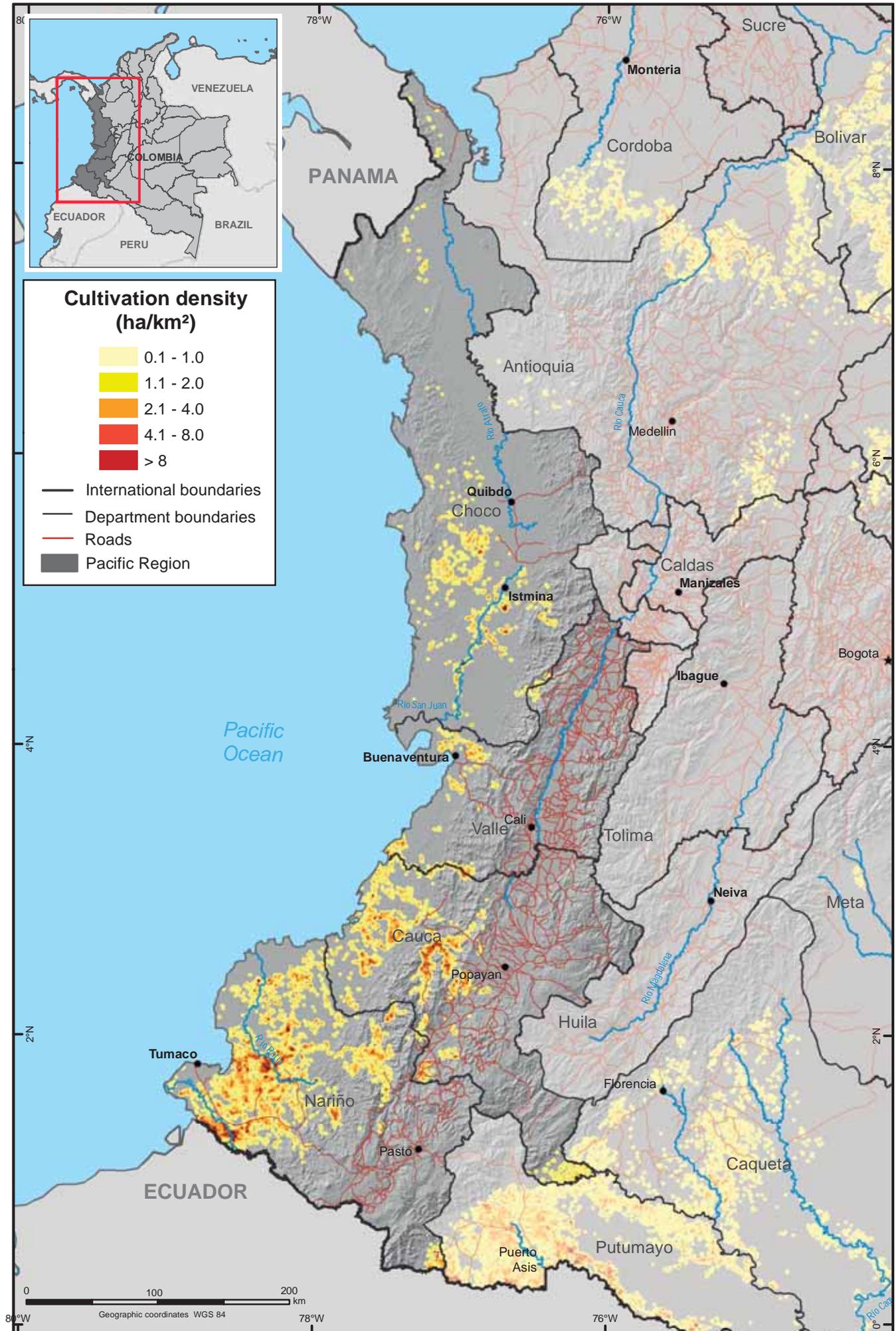
Figure 7. Coca fields by region 2005–2011



Coca fields in Chocó

¹⁰ The historical series was adjusted due to small plots.

Map 7. Coca cultivation density in the Pacific region, 2011



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

This region is located at the west of the country, from the border with Ecuador, following the Pacific littoral up to the border with Panama. Its relief goes from the highest lands of Colombia up to the coast on the Pacific Ocean. The constant presence of clouds in this zone makes it difficult to measure the land cover, including coca crops; the 2011 census was particularly affected by this factor, mainly in the department of Nariño

Table 5. Coca fields in the Pacific region, 2005-2011 (in hectares)

Department	2005	2006	2007	2008	2009	2010	2011
Nariño	13,875	15,606	20,259	19,612	17,639	15,951	17,231
Cauca	2,705	2,104	4,168	5,422	6,597	5,908	6,066
Choco	1,025	816	1,080	2,794	1,789	3,158	2,511
Valle del Cauca	28	281	453	2,089	997	665	981
Total	17,633	18,807	25,960	29,917	27,022	25,682	26,789
Annual trend	+12%	+7%	+38%	+15%	-10%	-5%	+4%

Coca cultivation in Nariño gained importance in 2002, when 40,000 hectares were reduced in the departments of Putumayo and Caqueta and there was an increase of 7,600 in Nariño. As from 2003, Nariño has continued to be in the group of the three departments with greater area under coca cultivation, occupying the first place in 2010 with 26% of the total in the country. In 2011, for sixth consecutive year, Nariño is the department with the greatest area cultivated with coca in the country (27%). Aerial spraying was carried out over 34,988 hectares, 35% more than the area sprayed in 2010. 14,231 hectares were manually eradicated; this is 45% less than the area reported in 2010. Due to a lack of geographical records, 561 hectares that were eradicated in the last quarter were not used as adjustment parameter. In the last years, Nariño started receiving important contributions for alternative development.

The department of Cauca shares many characteristics with its neighbour Nariño, such as a long maritime coast, high mountain ranges and rural economy. Coca cultivation had kept relatively low levels until 2006; as from that year, the area under coca cultivation grew three times, reaching a total of 6,144 hectares in 2009, which put Cauca in the group of the three departments with the greatest area cultivated with coca in the country. In 2011, the area cultivated with coca remained stable (+2.7%). During 2011, 197 hectares were manually eradicated in Cauca and 11,834 hectares were sprayed.

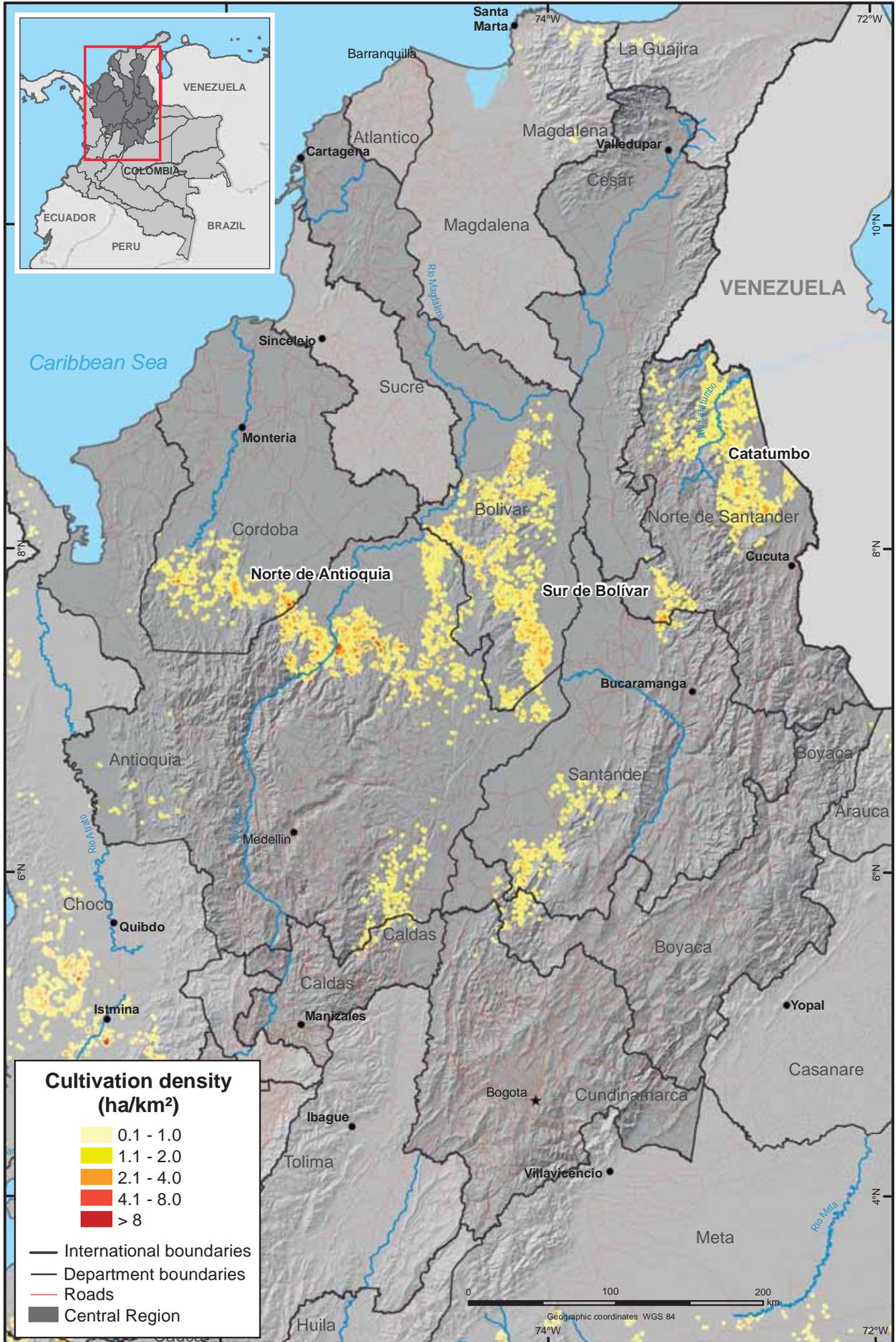
The department of Valle del Cauca had always reported an area smaller than 300 hectares cultivated with coca but it had a dramatic increase in 2008 (2,089 ha); for 2011 the area under coca cultivation increased in 47% (+316 ha) with respect to the 665 hectares detected in 2010.

The department of Choco has a tendency to increase since 2004; in 2010, it reached its peak of cultivated area since UNODC is doing the measurements. In 2011, it dropped from 3,158 hectares in 2010 to 2,511 due to an important reduction in the north of the department which was not compensated for by an equivalent increase in the south nucleuses. In 2011, 4,287 hectares were sprayed and 337 manually eradicated 337.



Coca fields in Nariño

Map 8. Coca cultivation density in the Central region, 2011



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

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Central Region

Table 6. Coca fields in the Central region, 2005-2011 (in hectares)

Department	2005	2006	2007	2008	2009	2010	2011
Antioquia	6,414	6,157	9,926	6,096	5,096	5,350	3,104
Cordoba	3,136	1,216	1,858	1,710	3,113	3,889	1,088
Bolivar	3,670	2,382	5,632	5,847	5,346	3,324	2,207
Norte de Santander	844	488	1,946	2,886	3,037	1,889	3,490
Santander	981	866	1,325	1,791	1,066	673	595
Boyaca	342	441	79	197	204	105	93
Caldas	189	461	56	187	186	46	46
Cundinamarca	56	120	131	12	0	32	18
Total	15,632	12,131	20,953	18,731	18,048	15,308	10,641
Annual trend	+4%	-22%	+73%	-11%	-4%	-15%	-30%

Since 2002, coca cultivation in the Central region of Colombia had stabilized in an average of 16,000 hectares. In 2007, it increased significantly (20,953 ha) and since that moment, a trend to reduction began and remained in 2011 (-4,667 ha), reaching 10,641 hectares which is the lowest point in the entire historical series.

The Central region is comprised by nine departments; 83% of the coca fields are concentrated in three of them: Norte de Santander (33%), Antioquia (29%) and Bolivar (21%). In 2011, only the department of Norte de Santander reported an increase in the area cultivated with coca. The Central region is one of the most affected by the presence of clouds in 2011; the departments of Caldas, Cordoba and Cundinamarca have relatively low coverage.

The departments of Cundinamarca, Caldas and Boyacá have less than 100 hectares planted with coca. In the department of Cesar, no coca cultivation was detected in 2011.

The reduction of the area under coca cultivation in Colombia was concentrated in the department of Cordoba (-2,801 ha) after having reached the peak of cultivation since UNODC does the monitoring in 2010. This reduction also took place in the area of the National Park Nudo de Paramillo. The intervention with manual eradication was reduced by half and the aerial spraying increased six times.

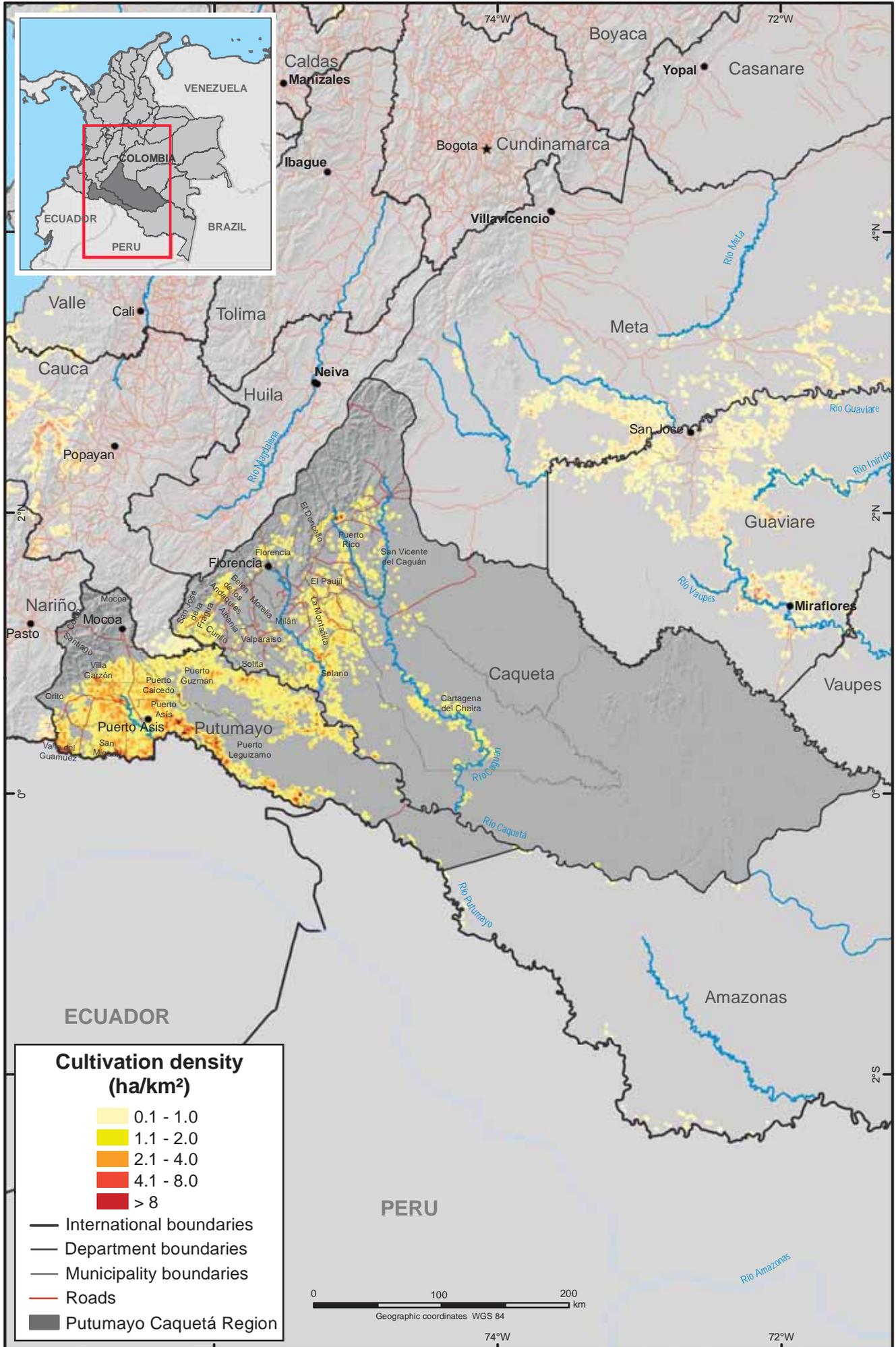
In Antioquia, the area cultivated with coca increased until 2007, year in which it reached its maximum level of 9,926 hectares; since then, there has been stable trend to reduction, which was particularly notable in 2011 (-42%). Aerial spraying was multiplied by three times with respect to 2010 and manual eradication diminished in 40%. In the last two years, 11% of the investment of the Territorial Consolidation Policy is focused in Antioquia.

In the department of Bolivar, coca cultivation is concentrated in the area known as Sur de Bolivar; they represented between 3% and 8% of the country total in the period 2001-2006. In 2008, the cultivation of coca reached a maximum level of 5,847 hectares; in 2011, there was a reduction of -62% with respect to 2008, which was the lowest point in the historical series. In 2011, 3,564 hectares were sprayed and 694 manually eradicated 694.

After reaching the lowest level in 2006, coca cultivation in the department of Norte de Santander increased four times in 2007 and was duplicated in 2008. After a reduction period between 2008 and 2010, this cultivation increased again (+1,601 ha). In 2011, the eradication was reduced in a fourth part and no aerial spraying was done.

Coca cultivation in Santander had its peak in 2008, when they reached 1,791 hectares. In 2011 they dropped to 595. Manual eradication in 2011 was half the one in 2010, while aerial spraying was reduced in 40%.

Map 9. Coca cultivation density in the Putumayo-Caqueta region, 2011



Source: Government of Colombia - National monitoring system supported by UNODC
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Putumayo – Caqueta Region

Table 7. Coca cultivation in the Putumayo-Caqueta region, 2005-2011 (in hectares)

Department	2005	2006	2007	2008	2009	2010	2011
Putumayo	8,963	12,254	14,813	9,658	5,633	4,785	9,951
Caqueta	4,988	4,967	6,318	4,303	3,985	2,578	3,327
Total	13,951	17,221	21,131	13,961	9,618	7,363	13,278
Annual trend	+28%	+23%	+23%	-34%	-30%	-23%	+80%

The increase in the coca cultivation in the country is concentrated in the Putumayo – Caqueta region and the trend to reduction that began in 2007 was reverted.

In the department of Putumayo, limiting with Ecuador and Peru, coca cultivation reached a maximum of 66,000 hectares (40% of the national total) in 2000. After four years of important and consecutive reductions, it dropped to 4,386 hectares (5% of the national total) in 2004 but this trend changed between 2005 and 2007 with consecutive increases of 105% in 2005, 37% in 2006 and 21% in 2007; as of that year, a strong tendency to reduction began and thin it stopped in 2011 when the area under coca cultivation was duplicated with respect to the one reported in 2010. Due to lack of geographical records, 966 hectares eradicated in the last quarter were not used as an adjustment parameter.

In the department of Caqueta, coca cultivation reached its lower historical level in 2010, with 2,578 hectares (4.5% of the national total), after a slight but constant reduction that started in 2001, after reaching 14,516 hectares (10% of the national total). However, in 2011 this trend changed, and coca cultivation increased to 3,327 hectares.

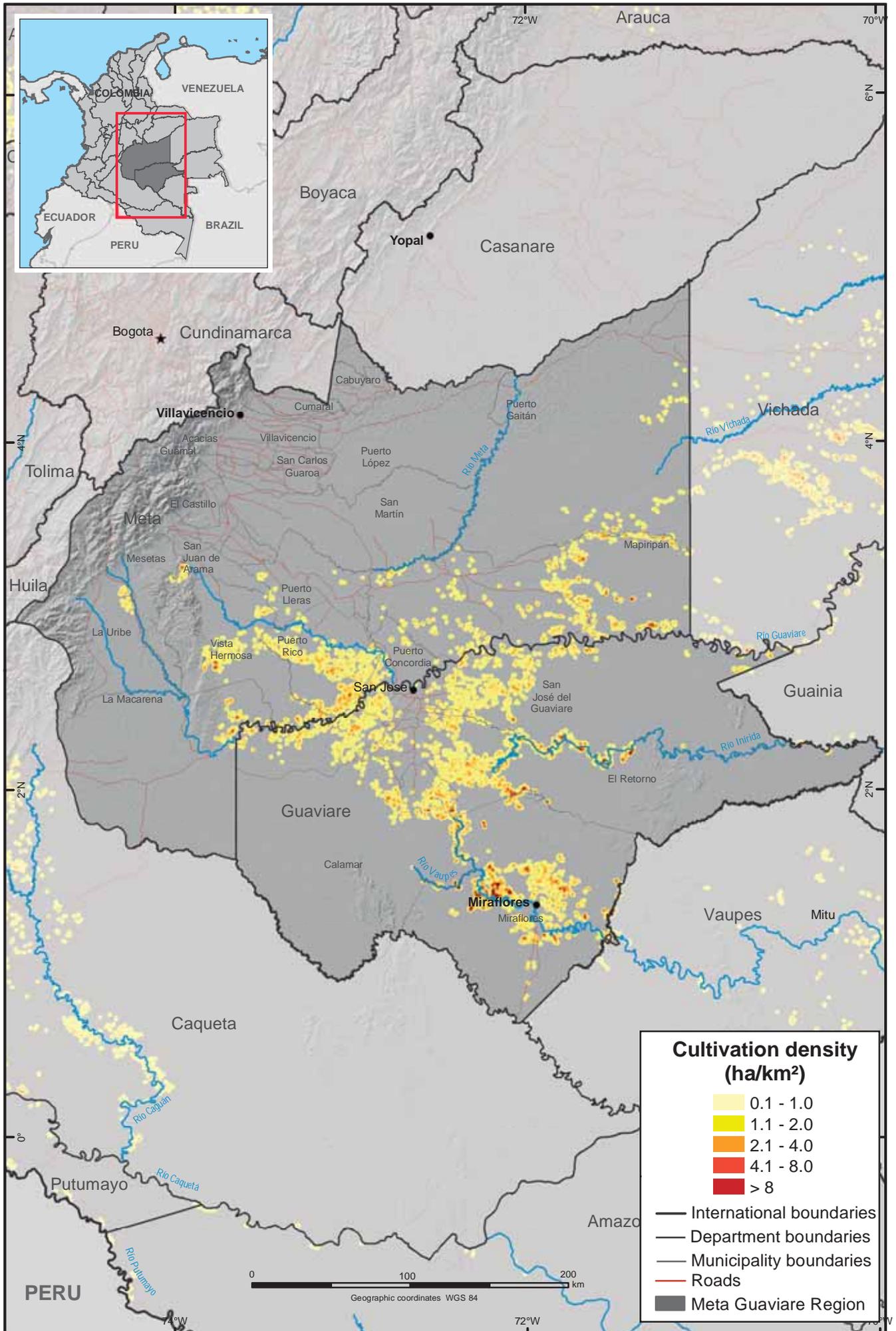
Coca cultivation in Putumayo and Caqueta is characterized by a high dispersion, which makes it difficult to find consolidated nucleuses; nonetheless, in 2011 there important nucleuses were consolidated, mainly on the south of the department, associated to the rivers Putumayo and San Miguel.

Aerial spraying activity in Putumayo went from 11,434 hectares in 2010 to 9,480 in 2011 and in the department of Caqueta from 16,947 hectares in 2010 to 12,888 in 2011. Manual eradication increased in Putumayo, from 1,972 hectares in 2010 to 3,855 in 2011 and in Caqueta from 1,556 hectares in 2010 to 1,254 in 2011. Nevertheless, it is important to note that both aerial spraying operations and manual eradication were concentrated in the first semester of the year, due to which re-sowing had an important incidence in the increase of the area under cultivation.



Coca fields in Putumayo - Caqueta region

Map 10. Coca cultivation density in the Meta-Guaviare region, 2011



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

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Meta - Guaviare Region

Table 8. Coca fields in Meta - Guaviare, 2005 – 2011 (in hectares)

Department	2005	2006	2007	2008	2009	2010	2011
Guaviare	8,658	9,477	9,299	6,629	8,660	5,701	6,839
Meta	17,305	11,063	10,386	5,525	4,469	3,008	3,040
Total	25,970	20,540	19,685	12,154	13,129	8,709	9,879
Annual trend	-9%	-21%	-4%	-38%	+8%	-34%	+13%

The Meta-Guaviare region had traditionally been the one with the greatest area under coca cultivation in the country; however, since 2005 there was an important and continuous trend to reduction, dropping from 28,509 hectares in 2004 to 9,878 in 2011. The increase of 13% that is recorded between 2010 and 2011 is importantly concentrated in the department of Guaviare.

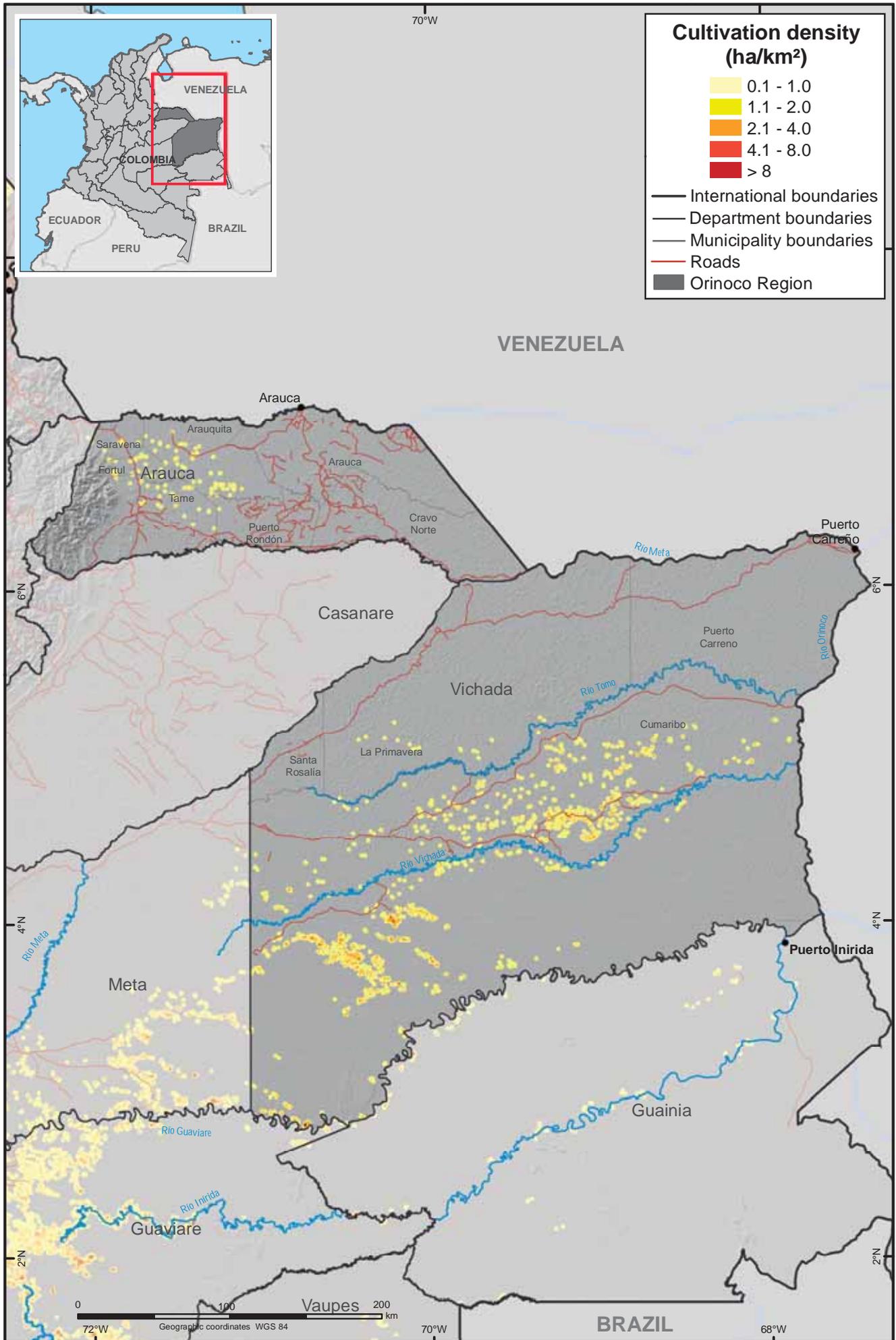
Between 2004 and 2005, the department of Meta had the highest level of coca cultivation in Colombia; in 2008, it went down to the sixth place and in 2011 it is in the eighth place with 5% of the total area cultivated with coca in the country in this year. Aerial spraying decreased from 5,825 hectares in 2010 to 2,545 in 2011, while manual eradication was of 1,096 hectares, slightly below 2010. The PCIM continued to be executed in that department, with the aim of strengthening the presence of the State, recovering the security of the population and promoting the investment of the private and international sectors in licit agriculture; in the area intervened by the PCIM, a trend to stability was observed.

In Guaviare, a general tendency to stability remains, with alternating periods of increase and reduction since 2007. In 2011, there was an increase of 20% in coca cultivation, in contrast with the reduction of -34% recorded in the previous period. The first record of coca cultivation in Colombia took place in this department at the end of the 70's and since then, this cultivation has been of great importance there. In 2010, the area cultivated with coca (5,701 ha) in Guaviare achieved its minimum point, after an increase of 26% (8,323 ha) in 2009 that gave this department the second place in area under coca cultivation. In 2011, 2,799 hectares were manually eradicated and 8,917 hectares were sprayed in Guaviare. Due to a lack of geographical records, 2,056 hectares that were eradicated in the last quarter were not used as an adjustment parameter.

Two of the three National Parks most affected by coca crops are located in the Meta – Guaviare region: the Nukak National Park in Guaviare reached 740 hectares cultivated with coca (-15%) and the Sierra de la Macarena that reached 825 hectares (+14%).

*Coca fields in the Meta – Guaviare region*

Map 11. Coca cultivation density in the Orinoco region, 2011



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

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Orinoco Region

Table 9. Coca cultivation in the Orinoco region, 2005 - 2011 (in hectares)

Department	2005	2006	2007	2008	2009	2010	2011
Vichada	7,826	5,523	7,218	3,174	3,228	2,743	2,264
Arauca	1,883	1,306	2,116	447	430	247	132
Total	9,709	6,829	9,334	3,621	3,658	2,990	2,396
Annual trend	+56%	-30%	+37%	-61%	+1%	-18%	-20%

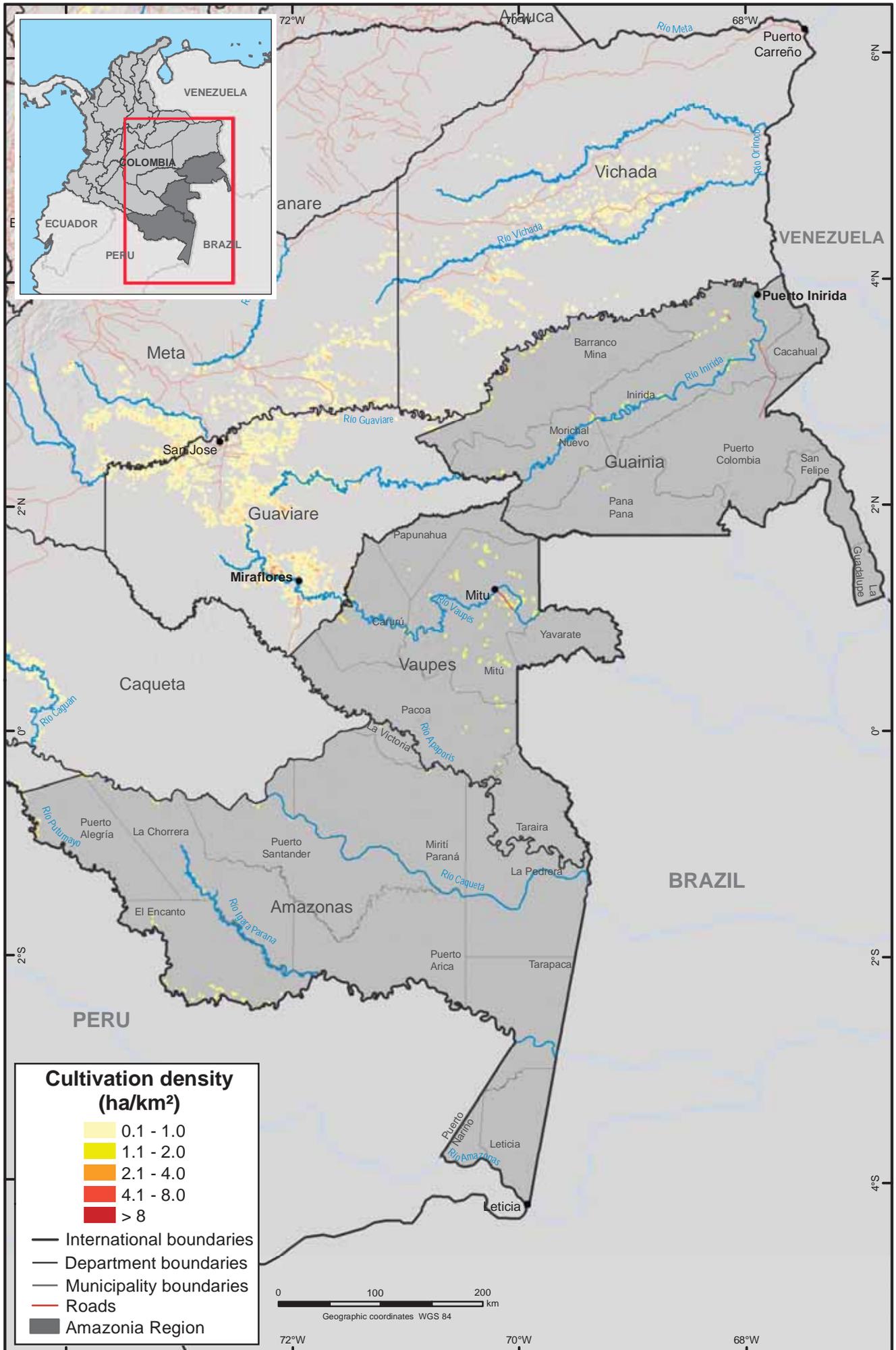
The region has a tendency to reduction in the area under coca cultivation since 2007, dropping from 9,334 hectares in 2007 to 2,396 in 2011. The fields are overall disperse and associated to the gallery forests.

In the department of Vichada, bordering with Venezuela, the coca cultivation reached a peak of 9,200 hectares in 2001 and decreased to 5,523 in 2006; it increased again in 2007 to 7,218 and in 2008 it went down again to the level of 2003, with 3,174; in 2011, the area decreased again (-478 ha), to 2,264 hectares, which is the lowest value in the historical series. Manual eradication went from 1,214 hectares in 2010 to 2,005 in 2011; due to a lack of geographical records, 594 hectares eradicated in the last quarter were not used as adjustment parameter. Aerial spraying went from 1,425 hectares in 2010 to 1,014 in 2011.

In the department of Arauca, coca cultivation was detected for the first time in 2000, with around 1,000 hectares planted with coca; the highest point of the historical series occurred in 2001 (2,749 ha) and the lowest in 2011 (132 ha), 115 less than in 2010. In 2003, a record of aerial spraying was achieved with 12,000 hectares; no aerial spraying actions were taken in the last three years. On the other hand, 46 hectares were manually eradicated in 2010 and 9 in 2011.

*Coca fields in the Orinoco region*

Map 12. Coca cultivation density in the Amazonas region, 2011



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

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Amazon Region

Table 10. Coca cultivation in the Amazon region, 2005 - 2011 (in hectares)

Department	2005	2006	2007	2008	2009	2010	2011
Guainia	752	753	623	625	606	446	318
Vaupes	671	460	307	557	395	721	277
Amazonas	897	692	541	836	312	338	122
Total	2,320	1,905	1,471	2,018	1,313	1,505	717
Annual trend	-10%	-18%	-23%	+37%	-35%	+15%	-52%

The departments of Vaupes, Amazonas and Guainia, like the Putumayo – Caqueta region, belong to the Amazon basin. Although they share several geographical characteristics with Putumayo and Caqueta, the former three have not been important centres in coca cultivation and they show similar tendencies to reduction.

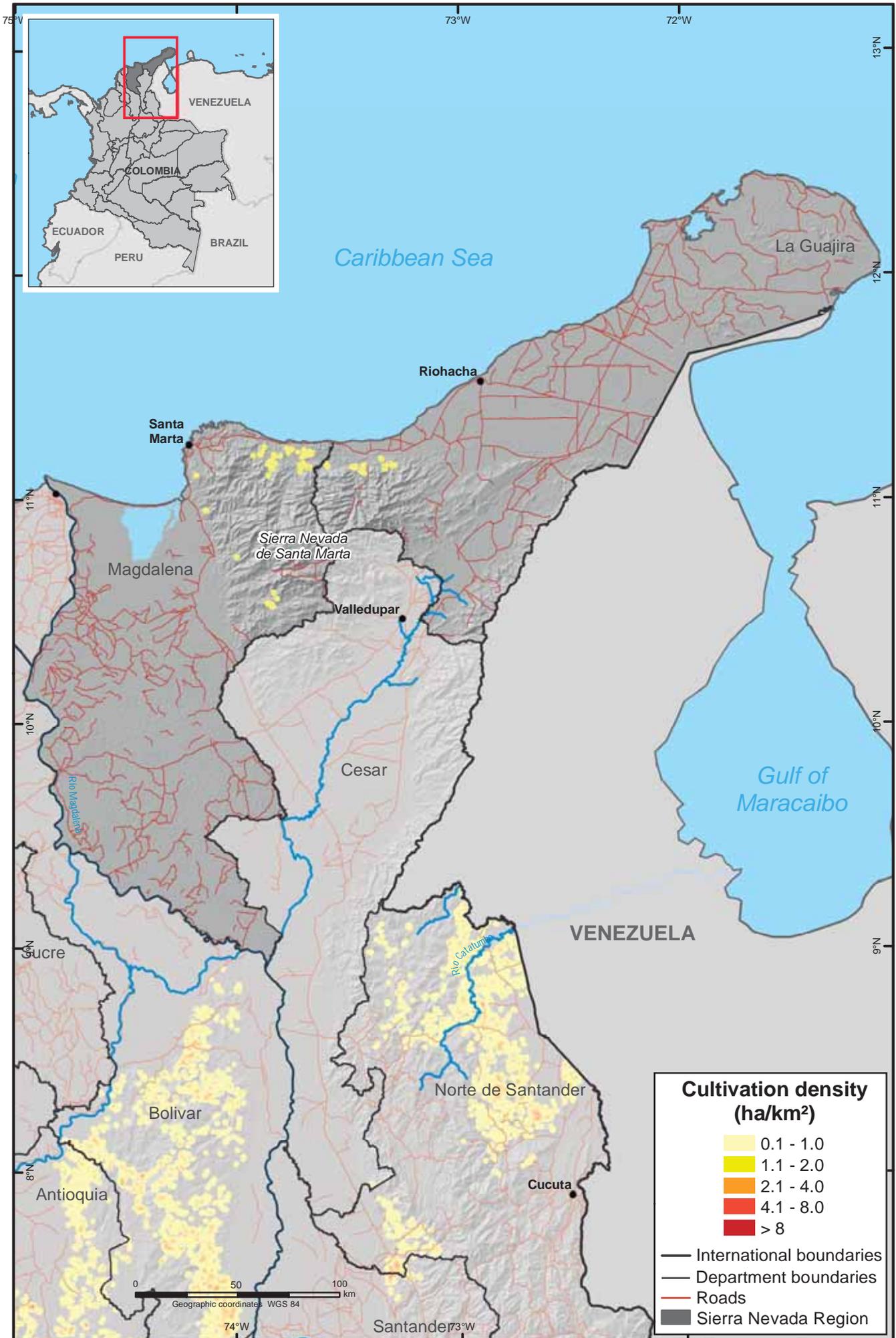
Coca cultivation was reduced by half between 2010 (1,505 ha) and 2011 (717 ha). The most important reduction took place in the department of Vaupes (-444 ha).

Manual eradication actions were taken in Vaupes (20 ha) and Guainia (35 ha), but there was no aerial spraying in any of the departments of the nucleus.



Abandoned coca fields in process of natural regeneration in the department of Amazonas

Map 13. Coca cultivation density in the Sierra Nevada region, 2011



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

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Sierra Nevada Region

Table 11. Coca cultivation in the Sierra Nevada region, 2005-2011 (in hectares)

Department	2005	2006	2007	2008	2009	2010	2011
La Guajira	329	166	87	160	182	134	16
Magdalena	213	271	278	391	169	121	46
Total	542	437	365	551	351	255	62
Annual trend	-57%	-19%	-16%	+51%	-36%	-27%	-76%

The Sierra Nevada region has low density of cultivation in relation to the rest of the country. Coca crops remained between 500 and 1,300 hectares until 2004, when a trend to reduction began until they reached 365 hectares under cultivation in 2007. After a slight increase in 2008, the nucleus achieved the lowest level of coca cultivation in 2011 (62 ha).

This cultivation has basically occurred in the margins of lower lands, between the high mountains of the Sierra Nevada and the Caribbean coast. No aerial spraying operations have been performed in this region since 2005, although in 2011 the manual eradication of 286 hectares was reported in Magdalena and 64 in La Guajira.

During the last years, the region has benefitted from important contributions for alternative development, preservation and recovery of environmentally strategic ecosystems and support for the strengthening of indigenous cultural traditions.

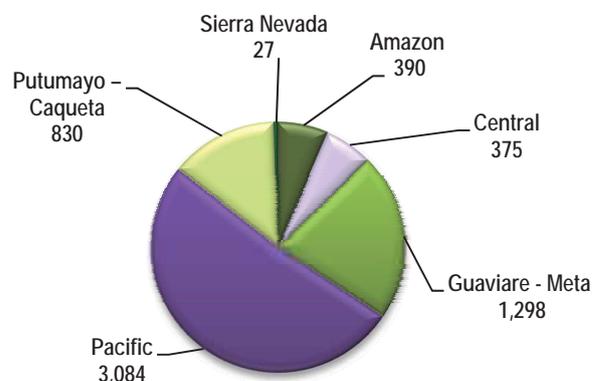
The region is an important tourist centre, with the presence of the complex of National Natural Parks of Tayrona - Sierra Nevada, which is one of the most important ecological reservations in Latin America, known by its biodiversity and the presence of several indigenous groups of ancestral cultures. Coca cultivation in these parks was reduced in 78% in 2011, and 9 hectares under cultivation were reported in the Sierra Nevada Park.

*Coca fields in the Sierra Nevada region*

Coca cultivation in Indigenous Reservations

The information about indigenous territories in Colombia is reported by the IGAC. The analysis of presence of coca cultivation is based in the 2009 delimitation; when crossing these maps with the coca polygons, there is presence of 6,004 hectares that correspond to 9% of the national total in indigenous territories, 3.5% more than in 2010. The Appendix 3 shows the area cultivated with coca in 2010 and 2011 per reservation.

Figure 8. Number of hectares in indigenous reservations by region, 2011

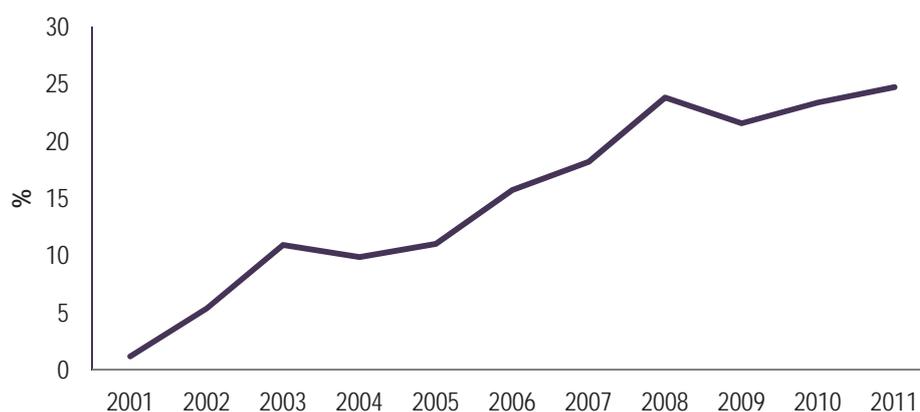


Coca cultivation in Communal Councils of Afro-descendant communities

The information about councils in Colombia is reported by the IGAC. Opposite to the tendency at the national level, coca cultivation in communal councils has increased since 2001. The participation of coca fields in councils with respect to the national total went from 1% in 2001 to 25% in 2011, as shown in the figure 9.

Thus, the communal councils become the special territorial units most affected by the presence of coca cultivation.

Figure 9. Percentile participation of coca cultivation in Communal Councils with respect to the national total



The historical series of coca in Councils has 2 periods: the first one is characterized by a constant growth in the area under cultivation between 2001 and 2008, when the area increased 10 times, going from 1,721 hectares in 2001 to 19,293 in 2008. Since 2008, the trend changed and coca cultivation diminished down to 14,504 hectares in 2010, the same level it had in 2006. In 2011, there was an increase (+9%), reaching 15,883 hectares planted with coca.

Coca cultivation in National Natural Parks

The presence of coca cultivation in the National Natural Parks has been monitored by SIMCI since the 2001 census. The data is handed out to the competent authorities to support the identification of actions and projects to preserve the social and environmental features of the territory.

The borders of the National Natural Parks are defined by the entities officially in charge of their preservation and maintenance. In 2005, these were amended based on satellite images provided by SIMCI. For 2010, they were adjusted again by UAESPNN and IGAC. The data in the table 12 is based in the most recent delimitation.

In 2011, coca crops were found in 18 out of the 56 National Natural Parks in Colombia, one less than in 2010. The area under coca cultivation in National Natural Parks (3,048 ha) represents 0.026% of the total area covered by National Natural Parks, and 4.8% of the total area of coca cultivation in that same year.

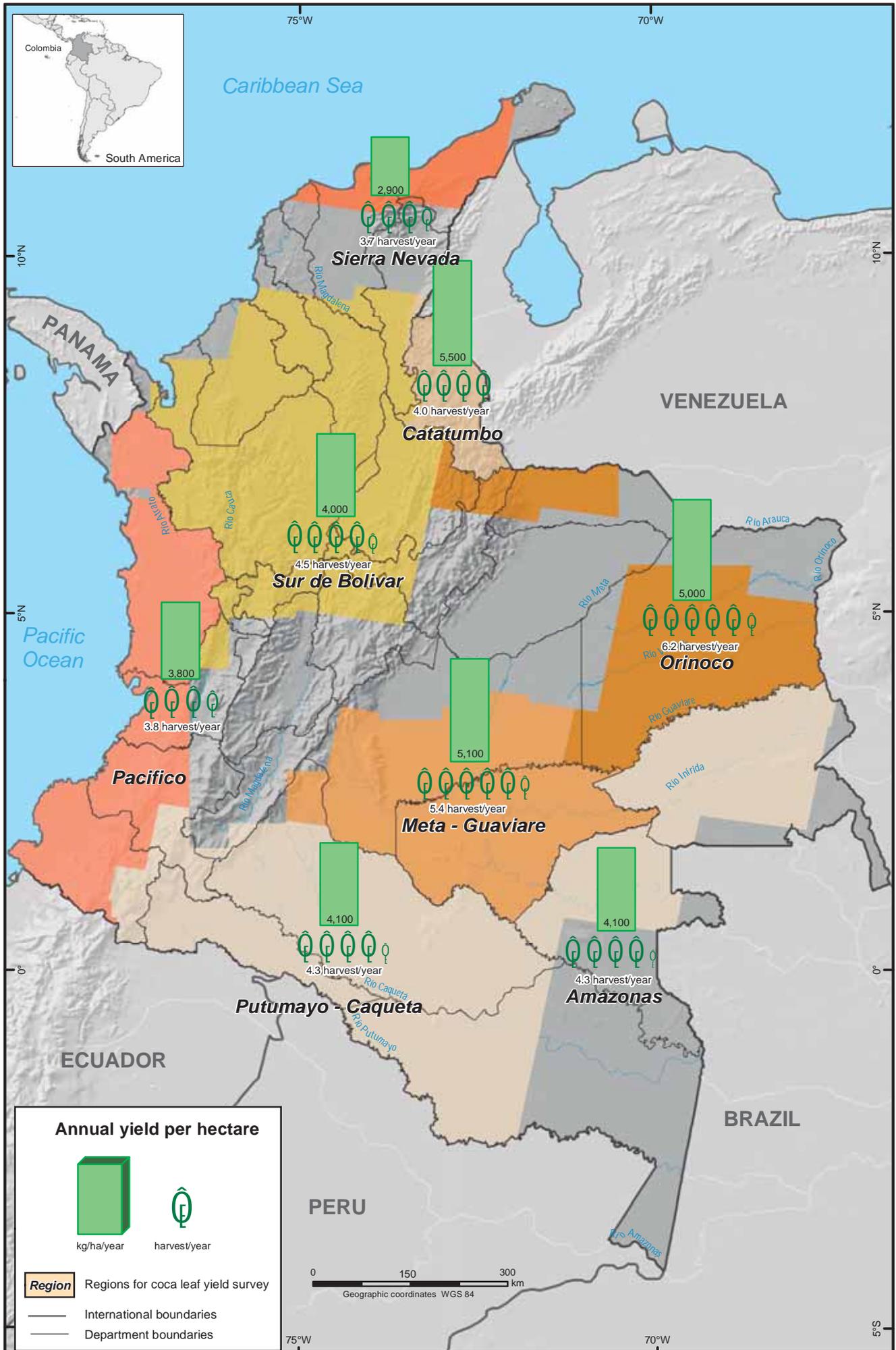
Coca cultivation in the Parks decreased in 17%. This reduction is strongly concentrated in the parks Catatumbo – Bari, Munchique, Nukak, Paramillo, Puinaway and Sierra Nevada de Santa Marta. The La Paya Park had an important increase (+61%). The parks Los Katios and Churumbelos were affected for the first time in 2009 and continued to have coca fields in 2011. The Tinigua Park, where coca cultivation had been reported in previous years does not have cultivation since 2010.

Table 12. Coca cultivation in hectares in National Natural Parks¹¹ 2009 – 2011

Region	Park	2009	2010	2011
Amazon	Puinawai	86	86	3
	Yaigoje Apaporis	15	29	0
Central	Paramillo	1,210	1,092	582
	Catatumbo - Bari	365	167	68
	Serranía de los Yariguies	13	8	10
	El Cocuy	3	1	0
Meta-Guaviare	Nukak	1,146	868	740
	Sierra de la Macarena	668	723	825
	Tinigua	6	0	0
Orinoco	El Tuparro	4	12	16
Pacific	Munchique	156	232	137
	Los Farallones de Cali	41	59	88
	Sanquianga	15	5	5
	Utria	2	5	1
	Los Katios	8	2	4
Putumayo-Caqueta	La Paya	312	332	536
	Alto fragua - Indiwasi	1	8	19
	Plantas Medicinales Orito Ingi Ande	4	3	4
	Serrania de los Churumbelos	1	1	1
Sierra Nevada	Sierra Nevada de Santa Marta	89	41	9
Total		4,143	3,675	3,048

¹¹ The boundaries of the National Parks were revised by the UAESPNN in 2010, and SIMCI updated the historical series of coca cultivation in the period 2008-2011

Map 15. Coca yield by region in Colombia, 2011



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

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

2.2 PRODUCTION OF COCA LEAF, COCA PASTE AND COCAINE BASE

The productivity studies enable the characterization of the productive systems in terms of agro-cultural practices of growers, varieties, sowing densities, and the determination of the scope and impact in terms of capacity to produce coca leaf and efficiency in the extraction processes in the primary production phase. The main difficulty to obtain these data is the high complexity of coca cultivation in Colombia, the problems to access the zones and a high dynamic and variability in coca plots.

The studies to determine the yield of the coca leaf in Colombia are done jointly by UNODC/SIMCI and The Ministry of Justice and Law. In 2005, the first phase in the entire national territory was carried out; since then, one or two regions are updated every year, given the high costs and the security conditions of the zones affected by coca cultivation. The Government of Colombia and UNODC have agreed to keep the studies of productivity up-to-date, establishing a period of validity of three years

Table 13. Year of execution of the productivity studies used as reference in the 2011 report.

Region	Amazon	Catatumbo	Meta Guaviare	Orinoco	Putumayo Caqueta	Sierra Nevada	Sur de Bolivar
Year of study	2008	2011	2008	2010	2009	2011	2011

In 2011, the study of production and yield was carried out in the northern regions of the country: Catatumbo, Sur de Bolivar and Sierra Nevada; studies were also done in these same regions in 2005 and 2007.

The methodology applied is a multistage sampling, based on area frameworks¹² and is done by means of two components: crop tests and application of direct surveys to coca growers. The sampling framework is built from the coca censuses.

The size of the sample for 2011 was 360 direct surveys to agrarian producers, 120 primary sampling units (1 km² grids), from which 109 coca fields were selected. 100 crop tests were conducted in Sur de Bolivar and Catatumbo; no data from the Sierra Nevada was reported due to the decrease in the size of the universe (0.67 ha in the 2011 census), which may be attributed to the policies of prevention and control that have been applied in this zone of the country¹³.

Table 14. Study Areas 2011

Region	Coverage includes the departments	Area of incidence of coca Hectares	Area planted with coca (2011) Hectares
Sur de Bolivar	Antioquia, Bolivar, Cordoba, Boyaca, Cundinamarca	3,060,000	7,613
Catatumbo	Norte de Santander	694,492	2,309

According to the data collected in the crop tests, the yield of the coca leaf in Sur de Bolivar keeps the trend to decrease; it went from 6,600 kg/ha/year in 2005 to 5,700 kg/ha/year in 2007 and to 4,000 kg/ha/year in 2011; nevertheless, the crops increased from 3.3 in 2005 to 4.5 in 2011. In the Catatumbo zone, there was a decrease between 2005 and 2007 in the yield, going from 4,600 kg/ha/year to 4,200 kg/ha/year, but it grew in 2011 to 5,500 kg/ha/year. The crops decreased from 4.5 in 2005 to 4.0 in 2011.

¹² Multistage sampling: it refers to sample designs associated to various selection stages. This sampling allows focusing on the units, minimizing costs and improving field operatives. The sample framework enables the identification and location of the elements of a universe. It is used as a tool for random selection of elements that comprise the sample in particular; the framework of areas refers to units or elements associated to a geographical component.

¹³ The dynamic of coca cultivation in the nucleus of Sierra Nevada is a marked reduction and no coca fields were found to carry out the crop tests in the selected sample. Any estimation of coca leaf yield or production in this nucleus is associated to a bias in the expansion of the results; hence it is advised to use previous studies for production estimates and to use the data of the 2011 study only for descriptive purposes.

Table 15. Changes in the yield of coca leaf in the regions of Sur de Bolivar, Catatumbo, 2005-2007-2011

Region	Area (hectares)			Number of crops			Annual yield of the coca leaf (tm/ha/year)		
	2005	2007	2011	2005	2007	2011	2005	2007	2011
	ha	ha	ha	#	#	#	Kg/ha/year	Kg/ha/year	Kg/ha/year
Sur de Bolivar	13,618	19,007	7,613	3.3	4.8	4.5	6,600	5,700	4,000
Catatumbo	846	1,946	2,309	4.5	6.2	4.0	4,600	4,200	5,500

Among the main factors that have incidence on the yield, there are: the varieties planted, the age of the cultivation, agro-cultural practices such as use of agrochemicals, and the affectation of crops due to diverse factors (aerial spraying, manual eradication, climate, plagues, and diseases).

In relation to the varieties planted, in Sur de Bolivar and Catatumbo the most used is the so called "*Cuarentana*" with 85% and 89% of the plots, and an average yield of 5.5 mt of leaf/ha/year and 5.4 mt of leaf/ha/year respectively; growers manifested that their preference for this selection is due to its productivity and availability in the zones. In the previous studies, it was found that the most frequent varieties in Sur de Bolivar were "*Tingomaria*" (2005), "*Cuarentana*" and "*Pajarito*" (2007); on the other hand, in Catatumbo the predominant type was "*Peruana*". According to the taxonomic analysis of the coca leaves of these regions, "*Cuarentana*" corresponds to *Erythroxylum coca* var. *Coca*¹⁴ with 77% of the samples.

As for the density of cultivation, there was reduction in both regions under study. In Sur de Bolivar it went from 11,000 plants per hectare 2005 to 9,500 in 2011; in Catatumbo, from 14,000 plants per hectare it went to 9,900 in the same periods.

When the coca growers (PAC) were asked about the age of the crops, the period of 5 years was predominant, especially for the Sur de Bolivar region, and between 3 and 4 years for the Catatumbo region.

Table 16. Age of coca fields in the Sur de Bolivar and Catatumbo regions, 2005-2007-2011

Age	Sur de Bolivar				Catatumbo			
	2005	2007	2011		2005	2007	2011	
	% Fields	% Fields	% Fields	Yield Tm/ha/year	% Fields	% Fields	% Fields	Yield Tm/ha/year
Less than one year old	7.3	2.7	12	0.6			9.3	0.8
1 a 2 years old	20.0	6.5	5	2.5	24.4	12.4	9.3	4.9
2 a 3 years old	21.8	16.5	13	4.5	24.4	6.1	18.5	5.6
3 a 4 years old	36.4	13.3	21	4.2	17.8	12.0	46.8	5.7
4 a 5 years old	9.1	9.7	19	5.6	11.1	11.3	12.0	4.9
5 years old or more	5.5	51.3	30	4.7	22.2	58.1	4.0	5.3

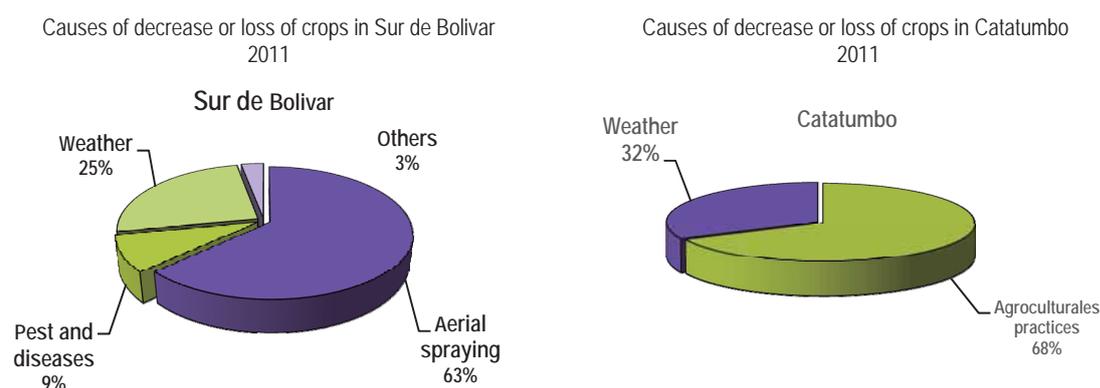
The PAC were asked if their plots had suffered any loss or reduction of their crops. In 2011, in the Sur de Bolivar region, 54% of coca growers reported loss or reduction and the most important causes were associated to aerial spraying (63%), weather (25.4%), plagues and diseases (8.4%). In 2005, only 11% of their plots reported loss or reduction and in 2007, 68%. In 2011, in the Catatumbo region, the results showed that 65% of the PAC did not report losses; this coincides with the aerial spraying and eradication actions that were relatively low in year (149 ha were sprayed and 316 ha were manually eradicated).

¹⁴ The Herbarium of the District University Francisco Jose de Caldas conducted the Taxonomic Analysis of 149 samples of coca leaf collected in field as part of the 2011 production and yield study.

Table 17. Plots with loss and/or reduction of crops due to different causes, according to interviews with growers in Sur de Bolivar and Catatumbo, 2005 – 2007- 2011

Region	2005		2007		2011	
	Fields with loss or decrease	Fields without loss	Fields with loss or decrease	Fields without loss	Fields with loss or decrease	Fields without loss
	%	%	%	%	%	%
Sur de Bolivar	11	89	68	32	54	46
Catatumbo	39	61	0	100	35	65

Figure 10. Causes of reduction or loss of crops in 2011



Coca plantations may produce several crops a year. The frequency of these crops may depend on several factors, which may be climatic, agrológica, and agronomical (quality of the soil, use change/amount of herbicides, pesticides and fertilizers), aerial spraying, manual eradication and varieties planted, among others. Sometimes the frequency of crops is also determined by the market of coca instead of the maturity of the cultivation.

In Catatumbo, the average of days between each crop in 2005 was 81 days (4.5 crops per year); in 2011, there were crops every 91 days (4 crops per year). During 2005 in Sur de Bolivar, the average of days between crops was every 110 days (3.3), and in 2011, every 81 days (4.5 crops per year).

Table 18. Regional average of number of crops per year, 2005-2011

Region	Based measurement (2005)	Actual measurement *
Amazon	3,9	4,3
Catatumbo	4,5	4,0
Meta-Guaviare	6,6	5,4
Orinoco	5,4	6,2
Pacific	2,5	3,8
Putumayo-Caqueta	3,9	4,3
Sierra Nevada	3,4	3,7
Sur de Bolivar	3,3	4,5
National average	4,2	4,5

* See Table 13 for the reference years of studies

Table 19. Average annual yield of coca leaf per region in Colombia.

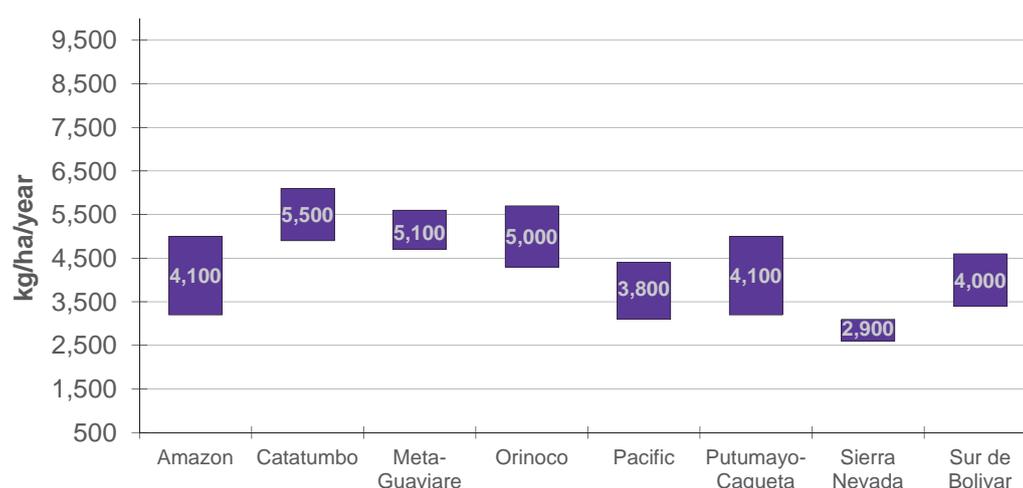
Region	Annual yield of fresh coca leaf	Lower boundary of the 95% reliability interval (kg/ha/year)	Upper boundary of the 95% reliability interval (kg/ha/year)
	kg/ha/year		
Amazon ¹	4,100	3,200	5,000
Catatumbo ²	5,500	4,900	6,100
Meta-Guaviare ²	5,100	4,700	5,600
Orinoco ²	5,000	4,300	5,700
Pacific ²	3,800	3,100	4,400
Putumayo-Caqueta ¹	4,100	3,200	5,000
Sierra Nevada ²	2,900	2,600	3,100
Sur de Bolivar ²	4,000	3,400	4,600
Average yield of coca leaf	4,200	3,800	4,600

¹ See table 13 for the years of reference of the studies

1. The yield of the coca leaf corresponds to the average resulting from the direct survey.

2. The yield of the coca leaf corresponds to the average resulting from the crop test.

Figure 11. Regional annual average of coca leaf yield (reliability intervals).



In previous years, the process of extraction of coca leaf to basic coca paste or cocaine base is carried on by the growers themselves; in the last years, there was an increase in the sale of coca leaf to intermediaries that process it in some place within the region. The transformation of cocaine base into cocaine hydrochloride is not carried out by growers but done in clandestine laboratories in which other actors are involved.

The production process has different phases that include the extraction of basic paste, the oxidation and re-oxidation of cocaine base and the production of cocaine hydrochloride. The basic paste is the first product of the extraction process of the alkaloid and it contains organic residues. The cocaine base results from dissolving basic paste in an acidic medium, adding an oxidizing agent as permanganate to eliminate impurities. The re-oxidation of the base is a process used to homogenize the cocaine base and it consists in oxidizing the paste or base that gets to the laboratory to attain a standard oxidation state.



Basic paste

Cocaine base

Base reoxidized

In Catatumbo, 82% of the producers sell the coca leaf and in Sur de Bolivar, 59%; according to the reports from the workshops conducted by UNODC/SIMCI in the different regions of the country, coca leaf is being processed by an intermediary (drug traffickers or illegal armed group) to get cocaine base or re-oxidized base, and achieve a more homogeneous product of better quality. The national averages are the following: 56% sell the coca leaf directly with no process, 27% of the growers process the coca leaves to obtain basic paste and the remaining 17% process the coca leaves to produce cocaine base.

Table 20. Work division in the sale and transformation process of coca leaf.

Region	% coca growers that sell coca leaf	% coca growers that process basic paste	% coca growers that process cocaine base
Sierra Nevada	91%	4%	0%
Catatumbo	82%	18%	0%
Pacific	78%	21%	1%
Putumayo-Caqueta	33%	1%	66%
Sur de Bolivar	59%	8%	33%
Orinoco	0%	100%	0%
Meta-Guaviare	22%	78%	-
Amazon	33%	1%	66%
All regions	56%	27%	17%

* See table 13 for the years of reference of the studies

The distinction between paste and base is not easy to establish, since the terms are used indistinctly by the producers. For the purpose of distinguishing the two products, it was decided to refer to cocaine base when the growers report the use of potassium permanganate in the process.

Table 21. Regional average in kilograms of coca paste and cocaine base resulting from a metric ton of coca leaf, 2011

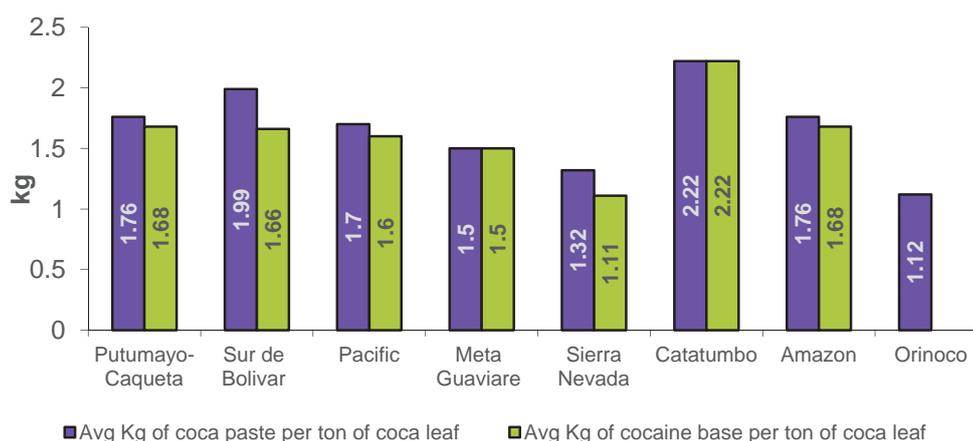
Region	Coca paste/Cocaine base					
	2005		2007		2011	
	Kg coca paste/m.t of coca leaf	Kg Cocaine base/m.t of coca leaf	Kg coca paste /m.t of coca leaf	Kg Cocaine base /m.t of coca leaf	Kg coca paste /m.t of coca leaf	Kg Cocaine base /m.t of coca leaf
Sur de Bolivar	1.41	1.41	1.59	1.14	1.99	1.66
Catatumbo	1.39	1.38	1.31	1.01	2.22	2.22

The amount of coca paste/cocaine base obtained is high if compared to the results from previous periods and with other regions of the country. The current report of the primary growers in Sur de Bolivar is an average of

24.9 grams of coca paste per *arroba*¹⁵ of coca leaf and 20.8 grams of cocaine base per *arroba* of coca leaf. In Catatumbo, they reported an average of 27.7 grams of coca paste per *arroba* of coca leaf.

According to the growers' report, the process of transformation of coca leaf is relatively similar in all the regions and they do not perceive any limitations as regards to the availability of chemical precursors; they inform that in the event of restrictions, there are substitutes for the process. They report gasoline as the most used product in the process of coca paste and/or cocaine base. Based on the data from surveys and workshops, it is estimated that the amount of fuel required for one kilogram of cocaine hydrochloride is 74 to 86 gallons, taking into account the recycling process.

Figure 12. Regional average of coca paste and cocaine base obtained from one metric ton of coca leaf.



* See table 13 for the years of reference of the studies

Potential production of coca leaf, base and cocaine

The productivity studies provide information not only on the yield of fresh coca leaf, but also on the transformation process of coca leaf into coca paste or cocaine base. The production potential of fresh coca leaf in Colombia in 2011 was calculated by multiplying the average area cultivated in each region, by the most up-to-date annual yield of fresh coca leaf available in each region. The yield of fresh coca leaf in the Orinoco Region was calculated in 2010, in Meta-Guaviare and Putumayo-Caqueta in 2008, and in Sur de Bolivar and Catatumbo in 2011.

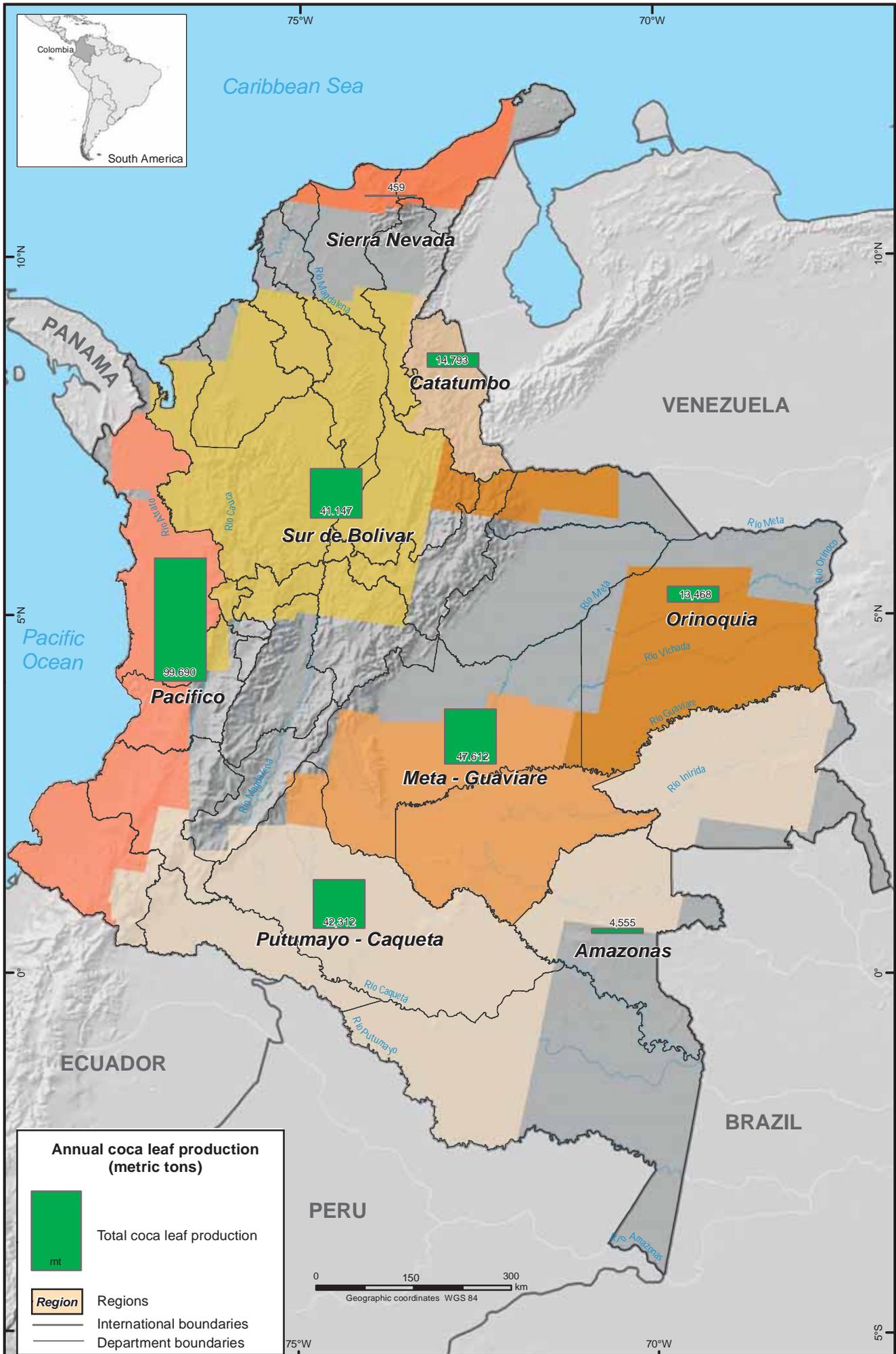
Table 22. Yield and production of coca leaf per region, 2011

Region	Annual yield of coca leaf in Kg./ha/year*	Coca leaf production in m.t
Meta-Guaviare	5,100	47,401
Putumayo-Caqueta	4,100	42,312
Sur de Bolivar	4,000	41,147
Pacific	3,800	99,690
Orinoco	5,000	13,468
Amazon	4,100	4,555
Catatumbo	5,500	14,793
Sierra Nevada	2,900	459
National yield	4,200	263,825

* See table 13 for the years of reference of the studies

¹⁵ The word *arroba* is from Arabic origin and means a fourth part (one quintal). *Arroba* is used widely in Colombia, Peru and other countries as a weight unit. *Arroba* is a weight, mass or volume unit. In weight it is equivalent to around 25 pounds or 12.5 kilograms in Colombia.

Map 16. Annual coca leaf production in Colombia, 2011



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

From the total production of 263,825 mt of coca leaf, around 77,975 mt are transformed into 120 mt of basic paste. If the type of conversion of coca paste into cocaine base is used, 116 mt of cocaine base are obtained. The rest of the leaves (185,836 mt) are directly processed into cocaine base and they produce 309 mt. In consequence, the production of cocaine base from coca paste and directly from coca leaves in 2011 add up to 426 mt.

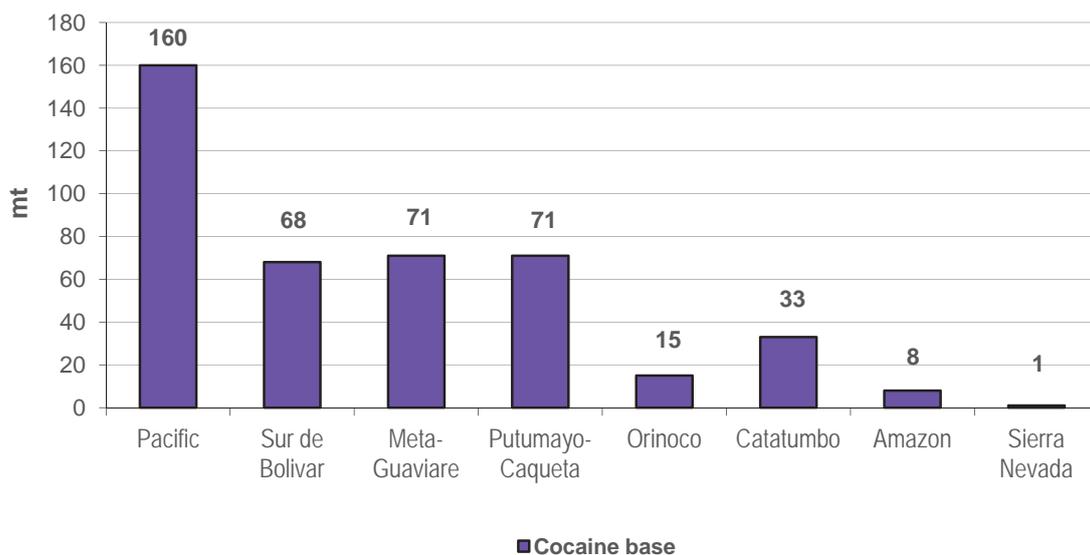
UNODC, together with the Colombian Government are developing research studies for the estimation of the efficiency of clandestine laboratories and the amount of cocaine hydrochloride that is produced from coca paste or cocaine base. Nonetheless, in 2011 the conversion rates of cocaine base into cocaine hydrochloride are based on data obtained by the Government of the United States about the efficiency of secondary transformation (cocaine base into cocaine hydrochloride) and purity of cocaine base.



Transformation of coca leaves to paste, base and cocaine hydrochloride

Considering the conversion rates used (average purity of cocaine base=81% and the conversion rate of cocaine base into cocaine hydrochloride 1:1), the production of cocaine base in 2011 is 345 mt of pure cocaine.

Figure 13. Production of cocaine base, 2011



2.3 ECONOMIC STRUCTURE OF THE UNITS DEVOTED TO THE LEGAL AGRARIAN PRODUCTION (UPA) IN ZONES OF INFLUENCE OF COCA CULTIVATION ¹⁶



The study conducted by UNODC/SIMCI and the Government of Colombia was done in response to the need of a deeper knowledge of the regions affected by coca cultivation and, in particular, how the economic structure of the producing units with coca and without it works; this is especially, in relation to the processes of production, employment and markets, for a better understanding of the rationality behind the decisions made by growers.

The research was conducted by means of analysis units; the first one was determined by the legal agrarian production units (UPA) and the second one by the production units with coca cultivation (UPAC). The methodology applied was probabilistic and it was carried out by implementing a multistage sample design. The collection method was field surveys applied to agrarian producers, associated to agrarian production units, with and without coca cultivation, in one single region. The period of reference was between the second semester of 2010 and the first semester 2011,

and it was done in the regions of Meta-Guaviare, Putumayo-Caqueta, Pacific and Orinoco. The main findings are the following:

Coca leaf is a main element of economic analysis in the coca producing regions because it plays an important role in regional production and it has modelled the production means or factors. However, despite it has become an alternative to generate income and it is a mean of subsistence, it does not represent capital accumulation. In relation to the legal agrarian production, the most relevant source of economic income of the population is related to coca and commonly in traditional agricultural products such as plantain, yuca and corn; nonetheless, the economic characteristic of these legal products implies limitations and potentials that agrarian producers manifest consistently. It is worth underscoring that in the regions affected by coca cultivation there are no important production nucleuses that guarantee the placement of productive poles, due to poor infrastructure and limited access to regional markets mainly caused by transport costs and distances, which keeps the offer in a relatively small and limited spectrum.

With the analysis of the gross income of the regions under study, it is highlighted that Putumayo - Caqueta is the only region where the gross income of the UPA is higher than the one in the UPAC (see following table). In the regions of Arauca - Vichada and Meta - Guaviare, the gross income produced by the UPAC is more than two times the one produced by the UPA, while in the Pacific region it is just 21% more. At the interregional level, the average gross income produced by the UPAC is 72% over the one produced by the UPA.

Table 23. Annual gross income in COP by region and by type of productive unit (UPA and UPAC)

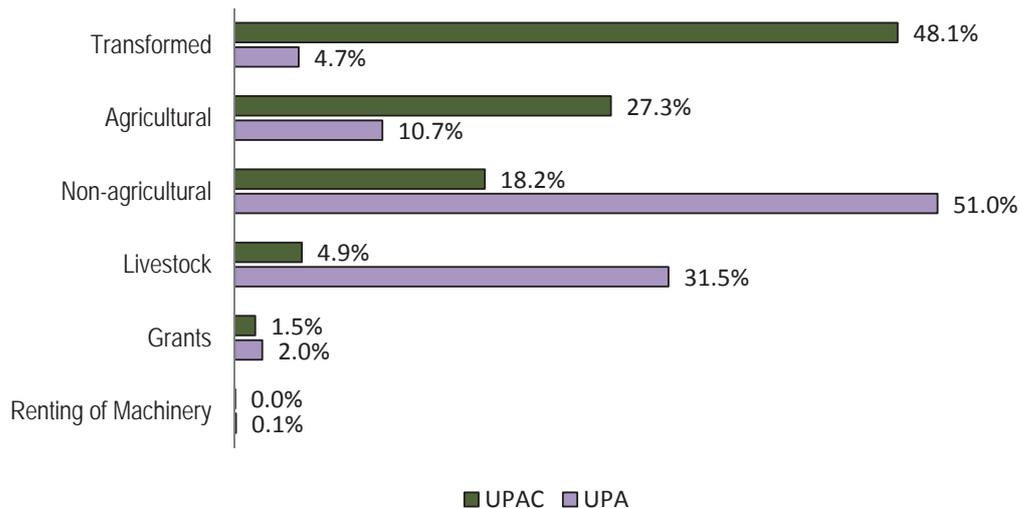
Region	UPA	UPAC	Average UPA - UPAC
Pacific	9,631,345	11,630,742	10,631,044
Putumayo - Caqueta	10,622,370	9,671,109	10,146,740
Arauca - Vichada	7,054,524	19,610,506	13,332,515
Meta - Guaviare	12,607,370	27,913,538	20,260,454
Average	9,978,902	17,206,474	13,592,688

¹⁶ The study considered the following activities: i) Geo-spatial analysis; ii) field work for the collection of data by means of direct surveys, from a sampling design, to characterize the population, production factors and economic processes; iii) workshops with representatives from institutions and communities; iv) collection of secondary data on some social indicators

The composition of the income varies considerably between the UPA and the UPAC. In the case of the UPA, a bit more than half of the income comes from day-labouring (Non-agrarian row), which is associated to activities of coca leaf cropping; it is followed in importance by the livestock production (31%), and in a lower proportion the production of legal crops.

In the case of the UPAC, 48% of the income comes from the transformation of products (coca paste or cocaine base, mainly), followed by the production of crops (mainly coca leaf where the transformation does not take place in situ), and in a lower proportion by day-labouring. According to the testimonials of the producers, there is a subsidy contribution close to 2% of the income, slightly higher in the case of the UPA, but also present in the UPAC.

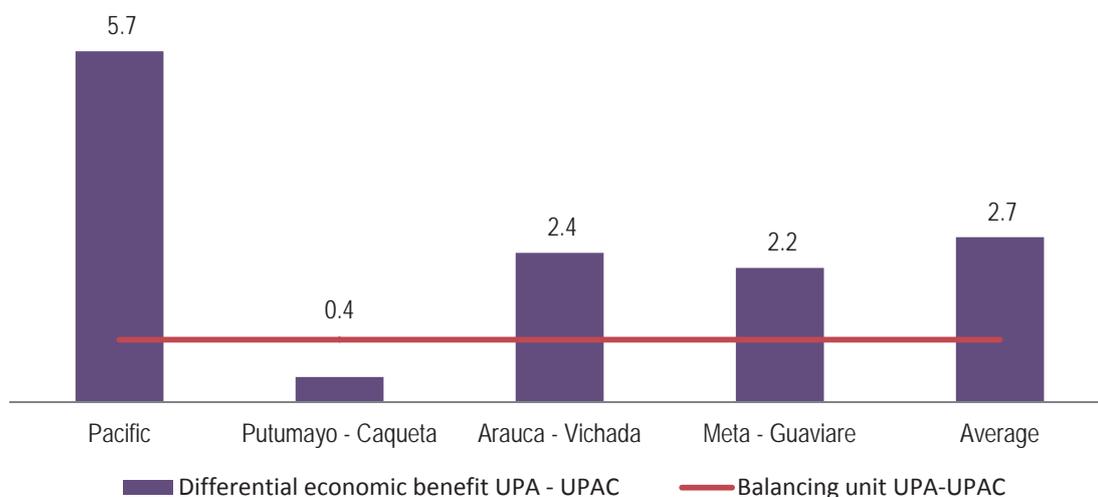
Figure 14. Composition of the average annual gross income in UPA and UPAC



The agrarian income includes coca leaf; the income due to transformed products includes coca paste and cocaine base

In the UPAC, the row that generates income depends on the volume of transformation done in the region, which is linked to the process of coca paste and cocaine base. In Arauca - Vichada and in Meta - Guaviare the transformation generates more than 60% of the annual gross income; it is also important in Putumayo - Caqueta, but not in the Pacific region, where 76% of the income comes from the sale of coca leaf.

Figure 15. Difference of economic benefit (UPAC Benefit / UPA Benefit) per region.



Note: the economic benefit is the difference between the income received and the expenses incurred in due to the development of an activity.

In the case of the Pacific region, the profitability of the UPAC is 5.7 times higher than that of the UPA, which shows that the illegal production has a significant utility driver. On the other hand, in Arauca-Vichada and Meta - Guaviare, the legal production is slightly more profitable than the illegal one, but it must be taken into consideration that in the case of Arauca - Vichada, one very significant part of the income in the UPA comes from day-labouring (51%), which leads to the assumption that the illegal production is generating a significant portion of work in the zones affected by coca. In Meta - Guaviare, the livestock production is the one generating the highest profits in the UPA, competing against the production and transformation of coca leaf into coca paste and cocaine base. In the Putumayo - Caqueta region, the legal production is more profitable than the illegal production in 63%; the dependence on work outside the productive units is 41%, but the livestock production and the transformation of dairy makes up for 49% of the income, so the level of dependence of the day-labouring required by illicit production could be lower. Nevertheless, the average monthly gross income of the agricultural producing units (with and without coca) is estimated in COP \$145,000, which is below the poverty line.

It is pertinent to note that when assessing the profit in the productive units of the four regions, it is observed that the transformation of coca leaf into coca paste or cocaine base is producing the highest level of profitability in the UPAC; in these units, agricultural production occupies a secondary place.

According to this, the following paragraphs present the income from the production of coca leaf and its derivatives in farm for 2011, calculated from the results of the income and costs study¹⁷ and, because they are farmers' economies, have more information available from field works. This is complemented with the results from the studies of yield, cultivated area and prices. .

Gross and net income from the production of coca leaf and its derivatives in farm in the regions under study

The drug production is an added value chain that starts with coca cultivation, continues with basic transformations to get coca paste and cocaine base and then with a process of refining and obtaining the final product which is cocaine hydrochloride. Depending on the different phases of the economic circuit, the dominant actors change: in the sowing, growing and primary production (coca paste and cocaine base), farmers play the lead role; in the industrial production that requires more knowledge, chemical precursors and infrastructure, other actors linked to drug trafficking are the main characters.

The area under coca cultivation in 2011 was 64,000 hectares. In average, one household cultivates between 0.5 and 1 hectare and the average number of people by household is four. An approximate of 62,398 families is estimated to be involved directly with coca cultivation and 300,000 people (this figure does not include floating population¹⁸).

According to the results of the surveys, the coca agrarian producers reduced importantly the agricultural practices and the costs of production compared to the data of the de study; this compensates in some manner for the affection of crops by control programmes (aerial spraying and manual eradication) and the economic requirements of illegal armed groups.

The average gross income by hectare of coca for a grower that only sells coca leaf are calculated in around COP \$ 6,500,000 per year or COP \$541,000 per month; this is equivalent to US\$ 294, which shows that coca does not generate extraordinary profit for the small agrarian producers in the producing regions, considering that this income is in the poverty limit.

In the Meta - Guaviare, Putumayo - Caqueta and Orinoco regions, the calculated average monthly gross income per hectare was COP \$418,000; with the average number of people per household, the daily income

¹⁷ Economic Structure of Agrarian Productive Units in zones of influence of coca cultivation.

¹⁸ Floating population: Is defined as the demographic contingent comprised by those people that live temporarily or permanently in a geographical area although they are not officially part of the population census, and make use of or contribute to the provision and trading of services developed on that particular territory.

per person is around COP \$ 3,486 or US\$ 1.9. The Sur de Bolivar, Pacific and Catatumbo regions have a higher average income (COP \$663,000) and with the average of five people per household, the net daily income per person was calculated in around \$4,400 or US\$ 2.4.

Table 24. Net income when coca leaf is planted and sold, 2010 - 2011

Region	Net income	Net income	Net income per person per day	Net income per person per day
	\$/ha year	\$/ha month	COP	USD
Meta-Guaviare	4,781,947	398,496	3,321	1.8
Putumayo-Caqueta	5,286,720	440,560	3,671	2.0
Orinoco	4,992,000	416,000	3,467	1.9
Pacific	7,890,830	657,569	4,384	2.4
Sur de Bolivar	8,208,000	684,000	4,560	2.5
Catatumbo	7,785,400	648,783	4,325	2.3
Average	6,490,816	540,901	3,955	2.2

In the cost structure, labour is higher (70%) due to the use of day-labourers for the maintenance of the cultivation and to crop the coca leaf ("*raspachines*"); in some zones, they use family labour or associate work from communities in crop season as ways to compensate for the production costs; the costs of agricultural supplies (27%) are becoming less every time due to the reduction in the use of agro-chemical products in relation to previous years. Transport has a very low weight (3%), which is attributed to the fact that the coca leaves are generally traded in the same UPAC.

It is worth noting that the production costs may vary for the producer, because they depend on the sale prices and the prices of the agricultural supplies, added to the economic requirements of illegal armed groups and the affectation of cultivations by control programmes.

Figure 16. Cost structure of the coca leaf production



Income is higher if the transformation processes of coca leaf into cocaine base are included, but they are relatively low in the transformation process of coca leaf into coca paste. As a consequence, and different from previous years, every time less farmers process the coca paste, because the production costs do not compensate for the net income received from it (the prices of chemical substances have an important weight in the production costs). On the other hand, the process of cocaine base is being assumed by intermediaries, with the aim of homogenizing the production process. It is important to highlight that in the regions around the borders the structure of costs change because supplies such as gasoline have a lower price or are smuggled.

Estimate of income in the primary transformation chain of the regions

To calculate the farm-gate value of the production of coca leaf and its derivatives or what is called primary production in the different regions of the country, the data of price, coca leaf yield and planted are used; however, this data varies in the different regions under study.

Table 25. Annual potential income per hectare under coca cultivation for the derivatives of coca leaf in 2011

Product	Annual yield per hectare	Annual price average		Annual income per hectare	
	kg/hectares	'000 \$/kg	US\$/kg	'000 \$/kg	US\$/hectares
Coca leaf	4,200	2.4	1.3	10,090	5,460
Coca paste	6.6	1,852	1,002	12,221	6,613
Cocaine base	5.9	2,596	1,407	15,340	8,301

According to the data in the productivity studies, 56% of the farmers sell the coca leaf, 27% process the coca paste directly and 17% process cocaine base directly. In other words, from the 263,825 mt of coca leaf produced in 2011, a percentage is used to produce coca paste and another to process cocaine base directly by the primary producer (or farmer); the remaining coca leaf is sold to an intermediary (different from the farmer) that collects it to produce in greater scale and transform it into cocaine base, which guarantees a more homogeneous product.

The calculation of the total farm-gate value of the production is done using the total coca leaf production and the estimates of coca paste and cocaine base production done directly by the primary producer (farmer) and the available sale farm-gate prices of coca leaf, coca paste and cocaine base. Thus, the estimated gross income of primary production (farm-gate) was US\$ 420 million (US\$ 220 million without production costs). As a GDP percentage, the farm-gate value of the production of coca leaf and its derivatives is 0.2%. The estimate GDP in Colombia in 2011 was 333 thousand million USD –at current 2011 prices and using the official exchange rate 2011, 3% corresponds to the agricultural sector.

Table 26. Farm-gate production value and regional total, 2011

Product	Production 2011	Prices	Gross income		Net income	
	kg	US\$/kg	US\$	COP \$	US\$	COP \$
Coca leaf	144,972,816	1,3	188,464,661	348,282,693,727	125,418,566	231,773,510,703
Coca paste	122,039	1,002	122,282,989	225,978,964,429	52,775,006	97,528,210,248
Cocaine base*	77,655	1,407	109,260,733	201,913,834,254	42,426,035	78,403,311,999
Farm production value			420,008,383	776,175,492,409	220,619,607	407,705,032,950
Cocaine base**	239,312	1,407	336,711,452	622,242,763,279	223,070,822	412,234,878,611
Total production value			756,719,835	1,398,418,255,688	443,690,428	819,939,911,561

* Direct production by coca growers

** Production by Region intermediary.

2.4 PRICES

As from 2005, UNODC has an information system of the prices of drugs and its derivatives. The system feeds from the collection and systematization of the prices of finished products in the main cities of the country and in different trading phases; this task is carried on jointly by SIMCI/UNODC, DIRAN and UACT. It is complemented with the information of international prices reported by the World Drug Report.

The nominal prices of coca leaf and primary production have had a stable behaviour during the last years because the intermediaries (both illegal armed groups and drug traffickers) set the prices of the product in their area of influence; the majority of farmers do not have influence on the market or the prices.

As regards to the prices of cocaine hydrochloride, although they have been relatively stable, as the traffic chain goes further into other drug trafficking points, they increase. The current report includes the prices of cocaine hydrochloride in the main cities of the country.

In 2011, the average price of coca leaf was \$2,357 per kilogram (US\$ 1.3/kg), with a decrease of 4% in relation to the previous year. The average price of coca paste was \$1,852,000 per kilogram (US\$ 1,002/kg), and it decreased 3.7% in relation to the previous year. The average price of cocaine hydrochloride in Colombia was \$4,556.000 per kilogram, equivalent to US\$2,468, with a reduction of 1.4%. There is no information about the purity of the cocaine hydrochloride that exits the country; this is an indicator that together with the price indicator would enable the analysis of the behaviour in the drug market; the analysis of the purity of the cocaine hydrochloride seized in bulk in US and reported by this country shows a decreasing tendency (72.5% in 2011).

The price of cocaine increases considerably when it leaves Colombia and enters the consumption markets: US\$27,000/kg in the retail market in United States and US\$53,000/kg in the retail market of Europe¹⁹ (retail prices are not adjusted by purity); the detail prices, adjusted according to the purity, these are: US\$169/gr in the United States and US\$ 253/gr in Europe.

Table 27. Average prices of coca leaf and its derivatives, 2007-2011

Product	2007		2008		2009		2010		2011		% Change 2010/2011	
	US\$/kg	'000 \$/kg	US\$/kg	'000 \$/kg	US\$/kg	'000\$/kg	US\$/kg	'000 \$/kg	US\$/kg	'000 \$/kg	US\$/kg	'000 \$/kg
Cocaine ¹	2,198	4,567	2,348	4,580	2,147	4,587	2,439	4,623	2,468	4,556	1.2	-1.4
Cocaine base	1,326	2,752	1,450	2,825	1,249	2,674	1,475	2,795	1,407	2,596	-4.6	-7.1
Coca paste ²	943	1,959	963	1,878	956	2,048	1,015	1,923	1,002	1,852	-1.3	-3.7
Coca leaf ²	1.2	2.4	1.1	2.2	1.3	2.8	1.3	2.5	1.3	2.4	-	-4.0

Source: UNODC-SIMCI, DIRAN and UACT

¹ In main cities

² In the production site

¹⁹ Source: World Drug Report 2012. The price provided by the US is an estimation of the retail sale price and is based in transactions of 50 grams or more; hence, they may not be directly comparable to the sale price of Europe, which is based on the prices reported per 1 kg.

Coca leaf prices

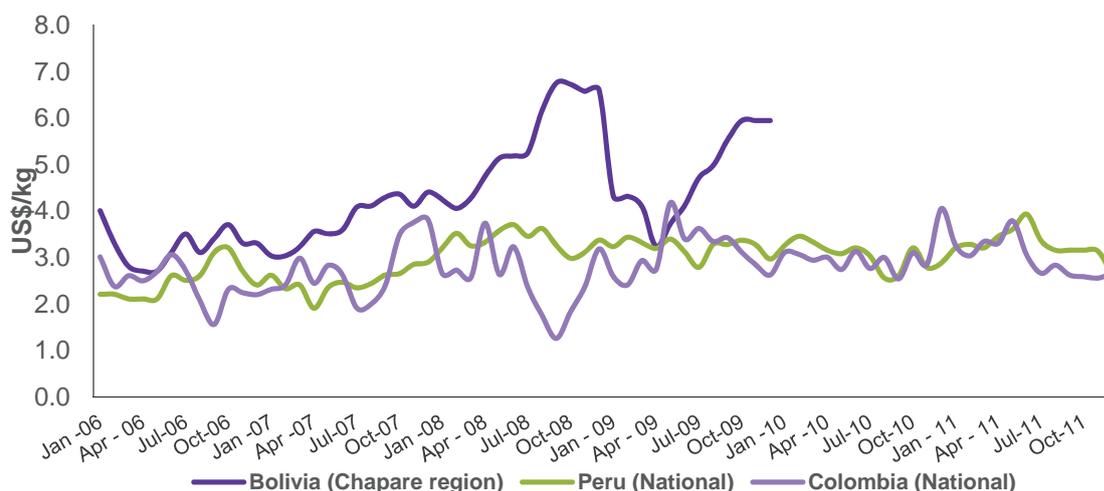
In 2011, there was a reduction in the prices of coca leaf. The average national price was COP \$2,387/kg, equivalent to US\$1.3/kg. There was a 4% decrease in relation to the previous year. At the regional level, the highest prices were in the Pacific and Amazon region.

The prices of coca leaf change according to the varieties planted and in some zones; public order has influenced in the difficulties for trading and the scarce circulation of money. In the Pacific, particularly in the department of Nariño, there is a difference in the prices of the variety planted; "Tingomaría" (the most planted and with more contents of alkaloid if compared to other varieties) is between \$2,500 and \$3,000 per kilogram, different from the "Caucana", which is between \$ 2,200 and \$2,400 per kilogram.



In Colombia, the coca leaf is commercialized fresh, while in Peru and Bolivia it is air-dried before trading. The equivalent price of dry coca leaf in Colombia and in Peru was similar in 2010 (US\$ 3.0/kg); in 2011, it was US\$3.2/kg in Peru and US\$3.0/kg in Colombia²⁰.

Figure 17. Comparison of dried coca leaf prices in the Andean countries 2006-2011.



Source: SIMCI Colombia, Peru and Bolivia.

Note: There is no information on prices in Bolivia in 2010 and 2011

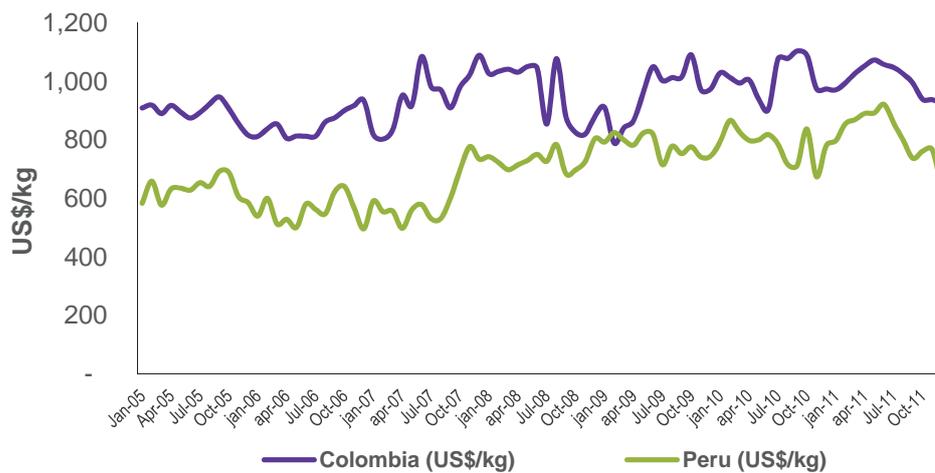
Prices of coca paste

The coca paste is a product usually processed by farmers in the same places where they plant the coca bushes, but recently it is being passed on to intermediaries that collect the coca leaf from several growers.

In Colombia and Peru, the prices of coca paste have remained relatively stable during the last years. Nonetheless, in Colombia they have always been higher than in Peru, although the difference is less every time. In 2011, the average price per kilogram in Colombia was US\$ 1,002 (COP\$ 1,852,000), 18% higher than in Peru (US\$815/kg average); in the last quarter, there was a decreasing tendency in the two countries.

²⁰ By converting the fresh leaf into its equivalent in dry leaf (assuming 57% of loss of humidity).

Figure 18. Average price of the coca paste in Colombia and Peru, 2006-2011



Source: SIMCI Colombia and Peru

The lowest prices were found in Amazon, Putumayo - Caqueta and Pacific region (particularly in the department of Nariño), departments that report the greatest market of coca leaf. The highest prices were found in the Central region and in Meta - Guaviare

The small farmers attribute the decrease in prices to the presence of Law Enforcement and their control in the zones, which generates trading problems, affects the market and causes problems in the circulation of money; this reduction is compensated by the reduction in the production costs. The greatest decrease in prices took place in the last quarter of the year.

The field studies show that the farmers increase their profitability when they transform coca leaf into coca paste, but given the current tendency to increasingly smaller plots, the production of coca leaf is not enough for this extraction process. One of the strategies is the sale of coca leaf to an intermediary that does the process of transformation and provides more homogeneous products and more efficiency in the extraction of alkaloids.



Figure 19. Monthly average prices of coca paste in Colombia, March 2000 – December 2011 ('000 \$)

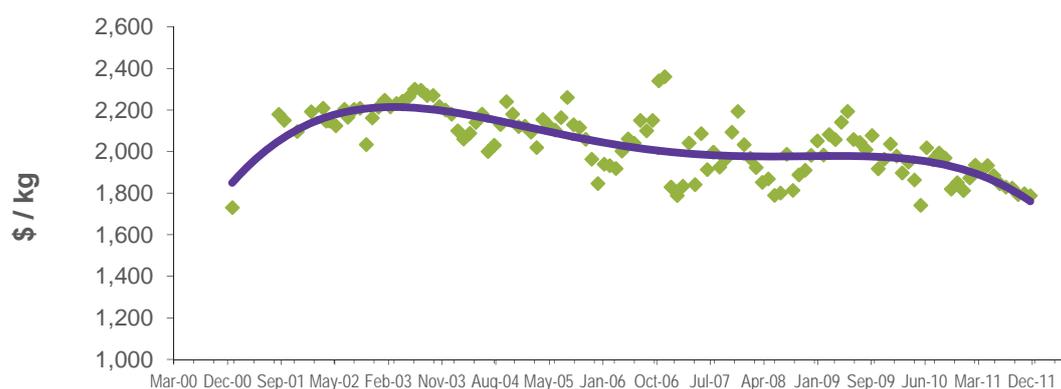


Table 28. Monthly prices of coca paste in Colombia 2011 (in \$/kg)

	Average total	Central	Pacific	Putumayo-Caqueta	Meta-Guaviare	Sierra Nevada	Amazon
January	1,812,037	2,033,333	1,788,889	1,700,000	2,000,000	2,000,000	1,350,000
February	1,872,593	2,080,000	1,722,222	1,750,000	2,033,333	2,000,000	1,650,000
March	1,934,815	2,070,000	1,838,889	2,000,000	2,050,000	2,000,000	1,650,000
April	1,908,403	2,040,000	1,843,750	1,866,667	2,050,000	2,000,000	1,650,000
May	1,932,857	2,040,000	1,807,143	2,000,000	2,100,000	2,000,000	1,650,000
June	1,884,354	2,040,000	1,821,429	1,736,364	2,033,333	2,000,000	1,675,000
July	1,845,139	2,000,000	1,862,500	1,600,000	1,933,333	2,000,000	1,675,000
August	1,828,561	1,900,000	1,800,000	1,636,364	1,960,000	2,000,000	1,675,000
September	1,823,970	1,950,000	1,800,000	1,518,818	2,000,000	2,000,000	1,675,000
October	1,792,500	2,000,000	1,666,667	1,362,500	1,933,333	2,000,000	
November	1,797,500	2,000,000	1,650,000	1,337,500	2,000,000	2,000,000	
December	1,787,500	2,000,000	1,600,000	1,337,500	2,000,000	2,000,000	
Annual average in COP\$	1,851,686	2,012,778	1,766,791	1,653,809	2,007,778	2,000,000	1,627,778
Annual average in US\$	1,002	1,089	956	895	1,086	1,082	881

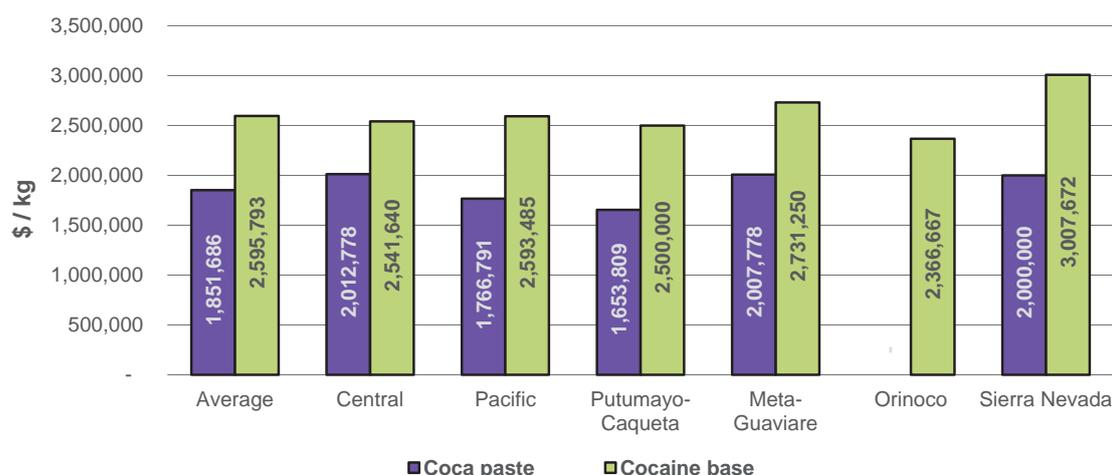
Source: UNODC/SIMCI, Social Action -PCI and DIRAN

Cocaine base prices

The process to obtain cocaine base is more complex and uses more chemical substances than the extraction process of coca paste. The prices of cocaine base are 45% higher than those of coca paste, which may be attributed to the fact that the producer uses more chemical supplies, mainly potassium permanganate to eliminate impurities, sulphuric acid and ammonia.

The average price of cocaine base in 2011 was COP \$2,596,000/kg (US\$ 1,407/kg). At the regional level, the highest prices were found in Sierra Nevada and Meta - Guaviare.

Figure 20. Comparison of the prices of coca paste and cocaine base (\$/kg) per region, 2011



Re-oxidization of cocaine base

According to the workshops conducted with Law Enforcement in different regions of the country, the process of *re-oxidization of cocaine base* continues. This process has the object of homogenizing the production of coca paste and cocaine base from different producers and taking them to a standard oxidization state as a previous step to their conversion into cocaine hydrochloride. They also report that cocaine base re-oxidization laboratories are not always in the same place than those that produce cocaine hydrochloride.



Re-oxidation base

The information sources of Meta - Guaviare and Norte de Santander reported an average price per kilogram of re-oxidized base between COP \$3,300,000 and \$3,600,000, which shows that there are regions where this product is being commercialized.

Cocaine hydrochloride prices

The prices of cocaine are more difficult to collect than the ones of coca paste and cocaine base because they have other type of actors involved. These are collected by the DIRAN and in general correspond to prices in the main cities of the country, which may be affected by factors such as drug supply or offer, control policies and changes in the levels of purity²¹.

The prices (nominal) of cocaine hydrochloride in the last five years continue to be an average of COP \$4,582,000 per kilogram. In 2011, it was \$4,556,000 with a reduction of 1.5% as compared to the previous year. It is important to underscore that the prices correspond to the main cities of the country; as the traffic chain goes further towards other nucleuses of drug trafficking, prices increase²². At the regional level, the highest prices were found in Sierra Nevada, Orinoco and Meta - Guaviare; the lowest were in the Pacific because this region has the entire production chain, from the cultivation of coca leaf, through the production of cocaine hydrochloride, to drug trafficking.

²¹ The study "*Análisis Forense de Muestras de Cocaína producidas in Colombia: Perfil Cromatográfico de muestras de hidrocloreuro de cocaína*", conducted in the Chemistry Laboratory of the Nation's General Attorney Office in 2009, with 65 samples of seized cocaine hydrochloride, found that 84% of the samples had a purity within the range of 71% to 90% and only 11% of these were more than 90% pure.

²² Cocaine hydrochloride in some Ports of Colombia is reported by intelligence information for between COP \$7 and 10 million

Throughout the distribution chain in the consumption markets, cocaine has several degrees of dilution or "adulteration". In relation to the levels of purity of cocaine produced in Colombia, the information available reports a purity of 72.5% of Colombian cocaine²³.

Colombian cocaine is added "cutting" substances; the most common are caffeine, lactose, creatinine and Manitol²⁴. The study conducted by UNODC and the national Government (Ministry of Justice and Law, FGN and DIRAN) shows that some processors use substances generically called *rindex*; the most used are Levamisole and Diltiazem, which are intended to increase the amount of cocaine hydrochloride produced, to recover the loss it suffers in the process.

The following table contains the annual averages of the prices of cocaine in nominal terms since 1991.

Table 29. Nominal prices of cocaine hydrochloride in Colombia 1991-2011

Year	'000 \$/kg	US\$/kg	Cocaine potential production mt*	Cocaine seizures mt**
1991	950	1,500	88	70
1992	1,020	1,500	91	31
1993	1,377	1,750	119	22
1994	1,488	1,800	201	28
1995	1,232	1,350	230	28
1996	1,762	1,700	300	27
1997	1,769	1,550	350	46
1998	2,101	1,472	435	78
1999	2,800	1,592	680	44
2000	3,100	1,485	695	87
2001	3,599	1,571	617	57
2002	4,389	1,532	580	95
2003	4,500	1,565	550	113
2004	4,600	1,713	640	149
2005	4,315	1,860	640	173
2006	4,155	1,762	610	127
2007	4,567	2,201	600	127
2008	4,580	2,348	430	198
2009	4,587	2,147	410	203
2010	4,623	2,439	350	165
2011	4,556	2,465	345	156

Source: DIRAN for prices, SIMCI for production and ODC for seizures

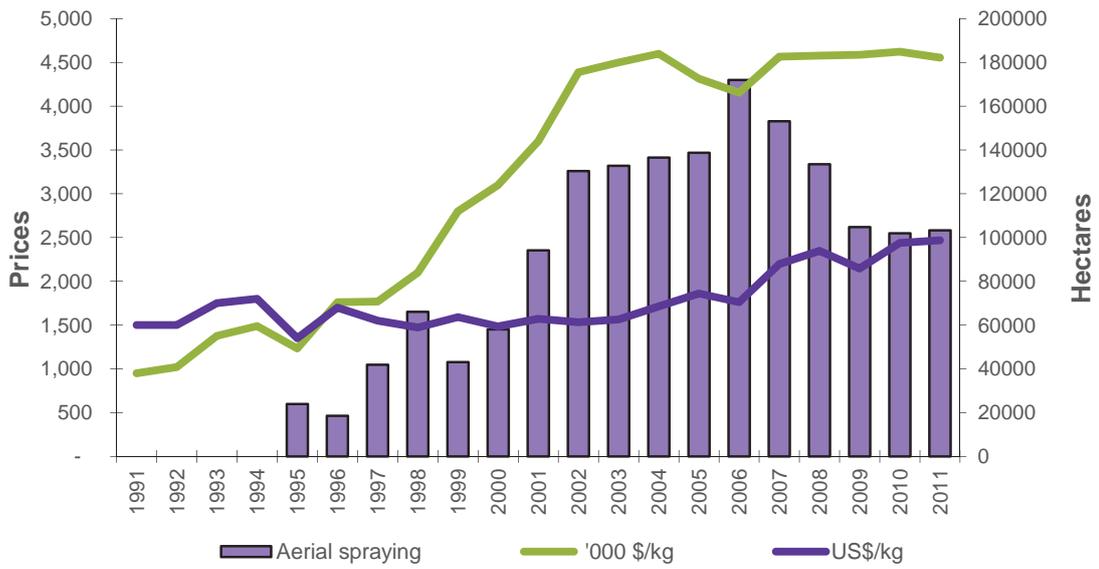
* Estimate potential production at 100% of purity

** Cocaine hydrochloride seizures in Colombia with unknown purity

²³ Information of the United States based on seizures conducted in that country.

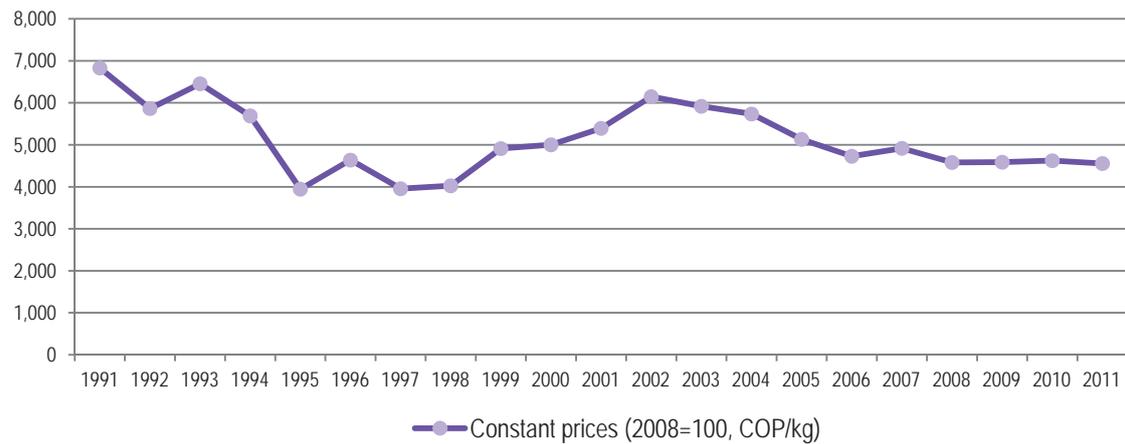
²⁴ Information provided by the Nation's General Attorney's Office and the DEA.

Figure 21. Annual averages of cocaine prices and levels of aerial spraying 1991-2011



Source: SIMCI and DIRAN

Figure 22. Cocaine prices in Colombia, 1991-2011



2.5 OPYUM POPPY CULTIVATION

The cultivation of opium poppy²⁵ in Colombia remains with no important variation; in 2011 the Anti-narcotics Police reported 338 hectares, as compared to 341 of the previous year. In general, opium poppy is cultivated in small plots (smallholders) located in mountainous areas, with altitudes between 1,700 and 3,000 masl. Most opium poppy fields are in Nariño (68%) and Cauca (30%), departments that due to their strategic importance also have coca cultivation and illicit drug trafficking.

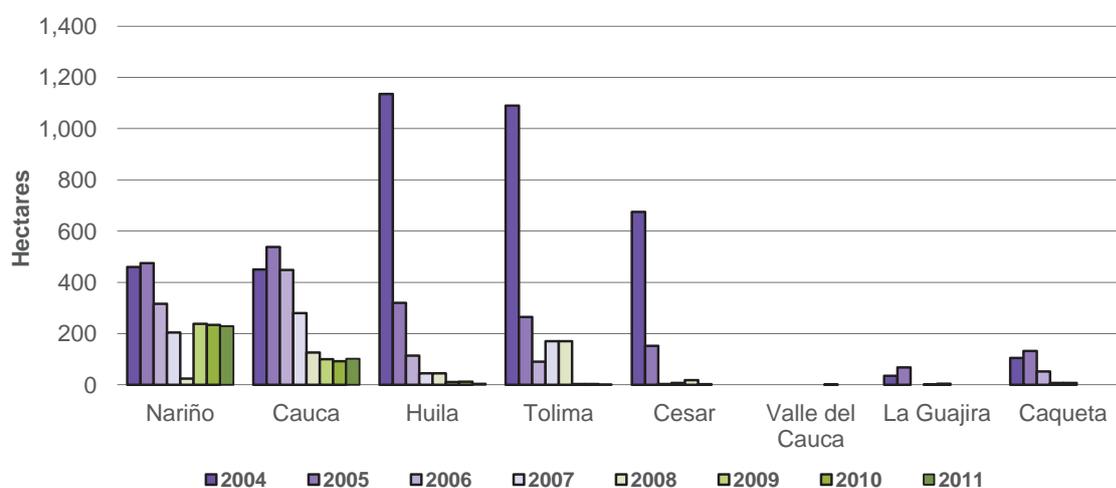
According to the data from the Drugs Observatory of Colombia, the seizures of latex in 2011 were 193 kilograms and 299 kilograms of heroin. One laboratory of heroin was detected and destroyed.

Table 30. Opium poppy cultivation in Colombia by department, 2003 – 2011 (in hectares)

Department	2003	2004	2005	2006	2007	2008	2009	2010	2011
Nariño	540	460	475	316	204	24	238	234	229
Cauca	600	450	538	448	280	126	100	92	102
Huila	636	1,135	320	114	45	45	11	12	5
Tolima	1,359	1,090	265	90	170	170	3	3	2
Cesar	651	675	152	3	7	18	2,5	-	-
Valle del Cauca	-	-	-	-	-	-	1,5	-	-
La Guajira	240	35	68	-	2	4	-	-	-
Caqueta	-	105	132	52	7	7	-	-	-
Total	4,026	3,950	1,950	1,023	715	394	356	341	338

Source: DIRAN (by means of aerial recognition)

Figure 23. Opium poppy cultivation by department, 2004 – 2011



²⁵ The DIRAN carries out recognition of the area under coca cultivation. For the 2011 figure, the recognition was done between March and April 2012. UNODC does not monitor opium poppy cultivation.

Table 31. Global cultivation of opium poppy, 2000 – 2011 (hectares)

GLOBAL CULTIVATION OF OPIUM POPPY 2000-2011												
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
SOUTHWEST ASIA												
Afghanistan	82,171	7,606	74,100	80,000	131,000	104,000	165,000	193,000	157,000	123,000	123,000	131,000
Pakistan	260	213	622	2,500	1,500	2,438	1,545	1,701	1,909	1,779	1,721	362
Subtotal	82,431	7,819	74,722	82,500	132,500	106,438	166,545	194,701	158,909	124,779	124,721	131,362
SOUTHEAST ASIA												
Lao PDR ^(a)	19,052	17,255	14,000	12,000	6,600	1,800	2,500	1,500	1,600	1,900	3,000	4,100
Myanmar ^(a)	108,700	105,000	81,400	62,200	44,200	32,800	21,500	27,700	28,500	31,700	38,100	43,600
Thailand ^(b)	890	820	750									
Vietnam ^(b)												
Subtotal	128,642	123,075	96,150	74,200	50,800	34,600	24,000	29,200	30,100	33,600	41,100	47,700
LATIN AMERICA												
Colombia	6,500	4,300	4,153	4,026	3,950	1,950	1,023	715	394	356	341	338
Mexico ^(c)	1,900	4,400	2,700	4,800	3,500	3,300	5,000	6,900	15,000	19,500	14,000	
Subtotal	8,400	8,700	6,853	8,826	7,450	5,250	6,023	7,615	15,394	19,856	14,341	<i>14,338</i>
OTHERS												
Others countries ^(d)	2,479	2,500	2,500	3,074	5,190	5,212	4,432	4,184	8,600	7,700	10,500	<i>13,300</i>
TOTAL	221,952	142,094	180,225	168,600	195,940	151,500	201,000	235,700	213,003	185,935	190,662	206,700

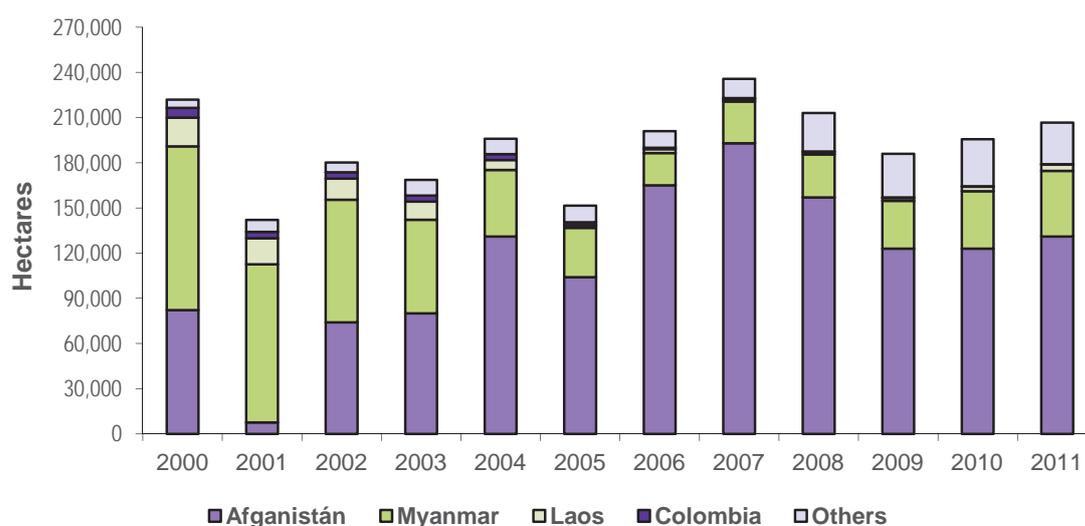
Source: UNDOC, World Drug Report, 2012

* The figures in italics are preliminary and may be revised when there is up-to-date information. The information on methodologies of estimation and the definitions may be found in the methodology chapter of the World Report on Illegal Crops Monitoring.

Sources of information: Afghanistan, before 2003: UNODD; since 2003: National System of Illegal Crops Monitoring, with the support of UNODC. Pakistan: ARQ, Government of Pakistan, US State Department. Laos Popular Democratic Republic: before 1999: UNODC; since 2000: National System of Illegal Crops Monitoring, with the support of UNODC. Myanmar: before 2001: State Department of the US; since 2001: National System of Illegal Crops Monitoring with the support of UNODC. Colombia: before 2000: several sources; since 2000: Colombian Government; for 2008 and 2009, the production was calculated over the regional yield figures and US State Department/ DEA conversion factors. Mexico: The estimations result from surveys conducted by the Government of the United States; 2010: estimation of production of UNODC.

- a) May include areas that were eradicated after the survey data was collected in the zone.
b) Due to the continuous decrease in cultivation, the figures of Vietnam (in 2000) and Thailand (as from 2003) were included in the category "other countries".
c) The Government of Mexico does not validate the estimations provided by the United States, since these are not part of the official figures and they do not have information on the methodology used for their calculation. The Government of Mexico is in the process of implementing a monitoring system in cooperation with UNODC to estimate illegal crops and production.
d) Eradication of plants and seizure reports from various sources suggest that illegal cultivation of poppy also exists in the following regions: North America, North Africa, Central Asia and Transcaucasia, Near East and Middle East / South West Asia, Middle, East and South East Asia - Asia, East Europe, South East Europe, Central America and South America. As from 2008, a new methodology was introduced to calculate the cultivation of poppy and opium poppy/ heroin in the production of these countries. These estimations are higher than the previous figures but have a similar magnitude order. A detailed description of the estimation methodology is available in the online version of the World Drug Report.

Figure 24. Global cultivation of opium poppy, 2000-2011 (hectares)



Source: World Drug Report, 2012.

The world extension of opium poppy cultivation in 2011 increased in 8% compared to the previous year. Afghanistan is the country with the greatest area under opium poppy cultivation (63%), followed by Myanmar (21%); together, they represent 84% of the total area under cultivation and 92% of the potential world opium production. It is worth highlighting that the cultivation of opium poppy in Colombia (338 ha) represents 0.2% of the world cultivation and 0.1% of the total opium production.

Production of latex and heroin

Opium poppy in Colombia is cropped in the form of latex, different from Asia, where it is cropped as gum. In Colombia, the cultivation of opium poppy is limited to the mountainous areas, since it needs low temperatures in some stages of the growth cycle; thus, it is not associated to coca cultivation.

According to productivity studies from the United States Government, 24 kilograms of opium latex (equivalent to 8 kilograms of oven-dried opium) are required to produce 1 kg of pure heroin. In Colombia, opium is cropped twice a year, except for Nariño, where it is cropped just once. The following are the yields per hectare of the main opium poppy nucleuses:

Table 32. Yield per hectare of oven-dried opium

Poppy area	Yield (kg/ha/harvest)
Nariño	16.8
Serrania de Perija	18.4
Cauca Oriental	20.8
Huila Occidental	15.3
Tolima	13.1

Source: US Government. Nariño (2010), Cauca (2009), Huila, Serrania Perija and Tolima (2004)

The production potential in Colombia for 2011 was calculated in 8.3 mt of oven-dried opium, which produce one ton of heroin; this represents around 0.1% of the world heroin production.

Prices of Latex and Heroin

Table 33. Monthly prices of latex, morphine, and heroin, 2011 (in '000 \$/kg and US\$/kg)

Period	LATEX		MORPHINE		HEROIN	
	'COP/kg	US\$/kg	'000 COP/kg	US\$/kg	'000 COP/kg	US\$/kg
January	800,000	428	11,400,000	6,106	19,272,727	10,323
February	1,000,000	531	11,800,000	6,267	17,550,000	9,320
March	1,000,000	531	11,750,000	6,237	18,750,000	9,952
April	1,000,000	552	11,750,000	6,481	20,000,000	11,031
May	1,000,000	555	11,500,000	6,382	19,857,143	11,020
June	737,500	414	11,750,000	6,590	18,388,889	10,313
July	913,333	518	12,000,000	6,810	19,800,000	11,237
August	790,000	443	9,000,000	5,042	19,000,000	10,644
September	752,000	410	9,000,000	4,902	19,000,000	10,349
October	833,333	436	9,000,000	4,712	19,200,000	10,052
November	750,000	391	9,750,000	5,083	19,200,000	10,010
December	750,000	388	9,750,000	5,041	19,200,000	9,928
Annual average	860,514	466	10,704,167	5,804	19,101,563	10,348

Source: prepared with the prices reported by the DIRAN.

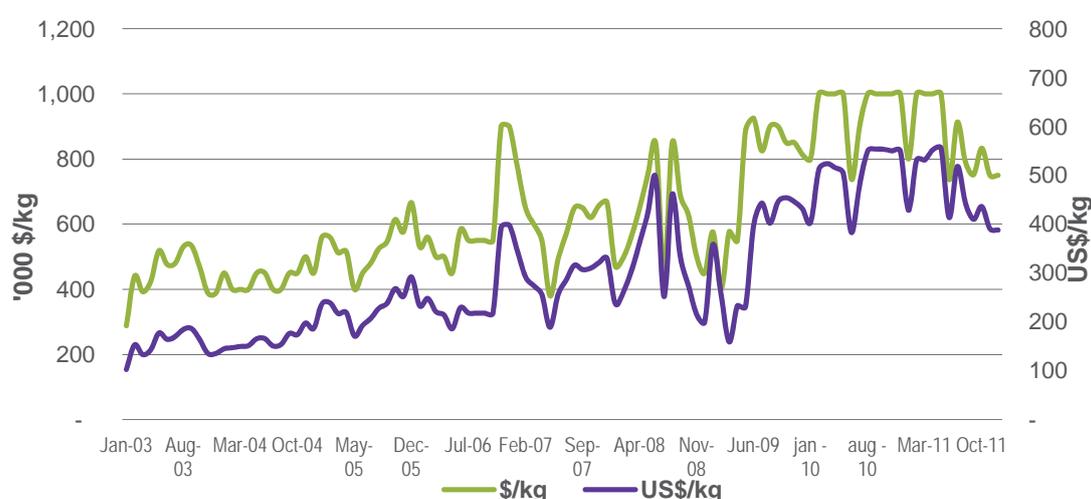
The prices of opium latex, morphine and heroin decreased in relation to the previous year. The latex prices are in an average of COP \$ 860,514 per kilogram. On the other hand, the prices of heroin dropped, although in a smaller proportion, going from COP \$20 million to COP \$19 million per kilogram; the highest prices were recorded in the Sierra Nevada and Pacific regions.

Table 34. Average prices of latex, morphine and heroin, 2007-2011

Product	2007		2008		2009		2010		2011		% Change 2010/2011	
	US\$/kg	'000 \$/kg	US\$/kg	'000 \$/kg								
Latex	286	591	318	612	358	754	503	953	466	860	-7	-10
Morphine	8,022	16,630	7,369	14,400	7,114	15,162	7,842	14,892	5,804	10,704	-26	-28
Heroin	10,780	22,294	9,950	19,550	9,993	21,421	10,786	20,421	10,348	19,101	-4	-6

Source: DIRAN, SIMCI and PCI for latex

Figure 25. Prices of latex in Colombia, 2003 – 2011 ('000 \$/Kg, and US\$/Kg.)



2.6 RELATED RESEARCH AND STUDIES

Methodology of indicators for the consolidation of the zones free from illegal crops

With the purpose of finding comprehensive solutions to the problem of illegal cultivations and to the strengthening of a culture of lawfulness, UNODC/SIMCI has been working with the cooperation of the Government of Colombia in practical methodologies with risk approach. By means of the combination of the institutional, social, economic and bio-physical vulnerability factors of the territory with the spatial-temporary characteristics of illegal cultivations, these methodologies propose a group of indicators at regional and local levels that facilitate the management of a comprehensive process of *progressive and sustainable consolidation of zones, regions and territories free from illegal cultivations*. In other words, a *zone free from illicit cultivations* is considered when it meets the following conditions simultaneously: i) all evidence of illegal crops has disappeared; ii) there is improvement of the capacity to start a sustained process of social and institutional consolidation of the territory.

It is worth noting that the study of the mentioned conditions requires the integral understanding of the regional processes of spatial comprehension, both of the zones traditionally affected, and the zones where the phenomenon could eventually expand. The following processes associated to the dynamic of establishment of illegal cultivations are outstanding: i) Ruralisation that shows a strong tendency of incorporation of lands to the illegal productive process; ii) colonization front in which deforestation and grass growing are combined with illegal crops; iii) colonization points that constitute the progress of illegal crops along vulnerable hydrography and iv) rainforest or firm land forests that constitute the source of new areas for the establishment of illegal cultivations (see figure 2, page 14).

The technical proposal²⁶ is supported on the experiences of United Nations, particularly FAO, CEPAL²⁷, UNDP, in the construction of indicators for the regional and local monitoring of development processes. In fact, the building of indicators for the consolidation of zones free of illegal crops applies the following instruments: i) The model *Pressure-Affectation-Response*²⁸ that helps inquiring the vulnerability factors in the perspective of the conditions that favour the presence or abandonment of illegal cultivations and the collective and State actions aimed at the social and institutional recovery of the territory; ii) the inter-institutional selection of the group of indicators that characterize the vulnerability to and the threat of illegal crops; iii) the building of a geo-referenced database with the statistics of the indicators at a municipal level; iv) the building and running of three synthetic indexes: *Index of threat due to illegal cultivations*; *Index of vulnerability due to illegal activities*; the synthesis of these two in the *Index of consolidation of zones, regions or municipalities free from illegal cultivations*.

As regards to the compound indexes; the Index of Threat (I_A) due to the establishment of illegal cultivations results from the pondered and normalized addition of six variables directly related to cultivation:

$$I_A = (\lambda_1 \cdot \text{Abandonmen} + \lambda_2 \cdot \text{Expansion} + \lambda_3 \cdot \text{Permanencia} + \lambda_4 \cdot \text{Affected area} + \lambda_5 \cdot \text{Re-planting} + \lambda_6 \cdot \text{Concentration})$$

The vulnerability Index (I_V) that results of the pondering of two opposed factors. On one side, the factors that put pressure on (P) the establishment and persistence of cultivation and, on the other side, the institutional response (R), which favours the permanent disappearance of cultivation; this is to say a high response reduces vulnerability:

$$I_V = P * (1-R)$$

²⁶ The complete proposal is in the document: UNODC/SIMCI. 2011. Indicators for the monitoring of the consolidation of zones free from illegal cultivations – Methodological guideline. Prepared with the cooperation of the Ministry of Justice and Law of Colombia.

²⁷ CEPAL, United Nations, 2009. Methodological guideline to develop environmental and sustainable development indicators in Latin American and Caribbean countries. Manual Series No.61. Prepared by Rayén Quiroga M, Regional Advisor on Environmental Statistics. Santiago de Chile. United Nations Publications ISSN printed version 1680-886. Available in: <http://www.eclac.cl/publicaciones/xml/1/37231/LCL3021e.pdf>

²⁸ Adaptation from: FAO. 2001. Indicators of the Quality of Land and its use for sustainable agriculture and rural development. Lands and Waters Bulletin No.5. (PER Structure by Dumansky and Pieri). In: <http://www.fao.org/DOCREP/004/W4745S/W4745S00.HTM> The concept of land follows the FAO definition (1976) that integrates all the landscape attributes: Relief, soil, climate, population, occupation forms, uses and land cover.

The Index of consolidation of zone free from illegal cultivations (I_C) is the comprehensive grading of the absence of illegal cultivations (I_A) and of the vulnerability factors (I_V). It is expressed as the normalization of the product of the indexes in the following relation:

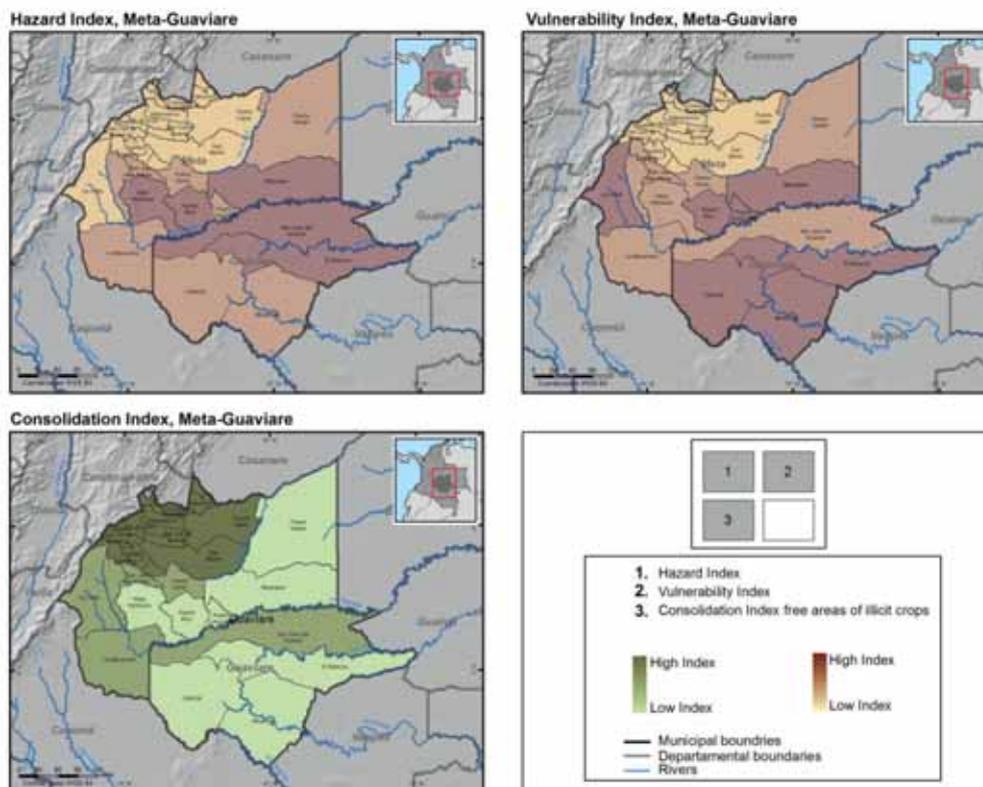
$$I_C = 1 - (I_A * I_V)$$

Application Meta-Guaviare: As a test, an application of the proposal of indicators was conducted in the sub-region of the south Meta-Guaviare, affected by illicit crops; in this zone, the Colombian State developed the Macarena Integral Consolidation (In previous chapter of the census document there is more information on illegal cultivation in this sub-region). The results of this application are summarized in the following Figure.

The correlation between the regional dynamic of coca cultivation and the institutional response can be deduced by observing the geographical distribution of the Indexes. Such is the case of the municipalities in South Meta, where there was a dynamic of reduction and relocation of coca cultivations as a result of the integral consolidation plan; or the case of Guaviare, where the conditions of threat and vulnerability are reflected by the dynamics of ruralisation (San Jose, El Retorno, Calamar) and the establishment and expansion of coca fields along the vulnerable rivers Inirida and Vaupes. The Consolidation Index shows a geographical distribution consequent with the regional situation of illegal cultivations in 2010; one zone at the north of Meta whose municipalities are integrated in the development of the country and a zone historically affected by illicit crops, where the consolidation shows different kinds of progress in the permanent solution of the conditions that favour the presence of illegal crops and the strengthening of a lawfulness culture.

Towards an immediate future, the practice of the methodology of indicators needs to advance in the validation of the indicators by means of statistical and econometric techniques that simplify the complex relations among the factors that generate vulnerability to and threat the territory with illegal cultivation

Figure 26. Maps of synthetic Indexes for the monitoring of consolidation of zones free from illegal cultivations. South Meta-Guaviare Region.



Coca plants in Colombia: botanic-forensic analysis²⁹

During the study of coca leaf yields conducted in 2011 in the northern regions of the country different samples of coca leaves were collected and were subject of a botanic-forensic analysis by the Forest Herbarium of the District University Francisco José de Caldas. A total of 149 samples were analyzed, collected in the departments of Antioquia, Bolívar, Córdoba, La Guajira and Norte de Santander. Each sample was treated individually since the moment of its collection, including the common name given by the farmers. The results showed that the predominant species in these departments is the *Erythroxylum coca* var. *Coca*, followed in importance by *Erythroxylum novogranatense* Var. *Novogranatense*.

Coca growers identify coca leaves with several names and the reasons for using such a wide range of typical names are the difficulties to identify botanical varieties that are different from each other only in very small details, and also the differences between the coca bushes of the same variety. The common names of the coca plants reported by the farmers in the northern zone of the country are: "Cuarentana" (77%), "Peruana" (9%) and "Pajarito" (11%), although they also mentioned "Silvestre".

It was found that the *Erythroxylum coca* var. *Coca* was the most cultivated in the north of the country, with 77% of the samples. It is the species with the greatest number of morphological variations (six), evident in the shape, colour and size of the leaves due to the conditions of the soil and the climate. It was associated to the common names "Cuarentana" and "Peruana", used for different morphological types that are not stable. It is a bush with leaves with the shape of an ellipse, lanceolate elliptical, oblanceolate and ovoid-elliptical; sharp tips, sharp-rounded, sharp bases, slightly decurrent or cuneate.



The majority of the collections called "Peruana" were related to a variation of *Erythroxylum coca* var. *Coca*; however, the samples showed ambiguous characteristics that could be associated to hybrids among the species traditionally planted.

On the other hand, the *Erythroxylum novogranatense* Var. *Novogranatense* corresponded to 19% of the samples; the most stable common name for this taxonomical classification was "Pajarito", although also "Cuarentana" and "Peruana" were mentioned due to the different morphological types that were also found in this species. It is a bush with leaves in the shape of oblanceolate, elliptical-obovate, elliptical-lanceolate; sharp tips, sharp-rounded or rounded; decurrent bases, cuneate or sharp.



Table 35. Samples used per variety of coca

Scientific name	Total samples	%
<i>Erythroxylum coca</i> var. <i>coca</i>	115	77%
<i>Erythroxylum novogranatense</i> var. <i>novogranatense</i>	28	19%
Others	6	4%
Total samples analyzed	149	

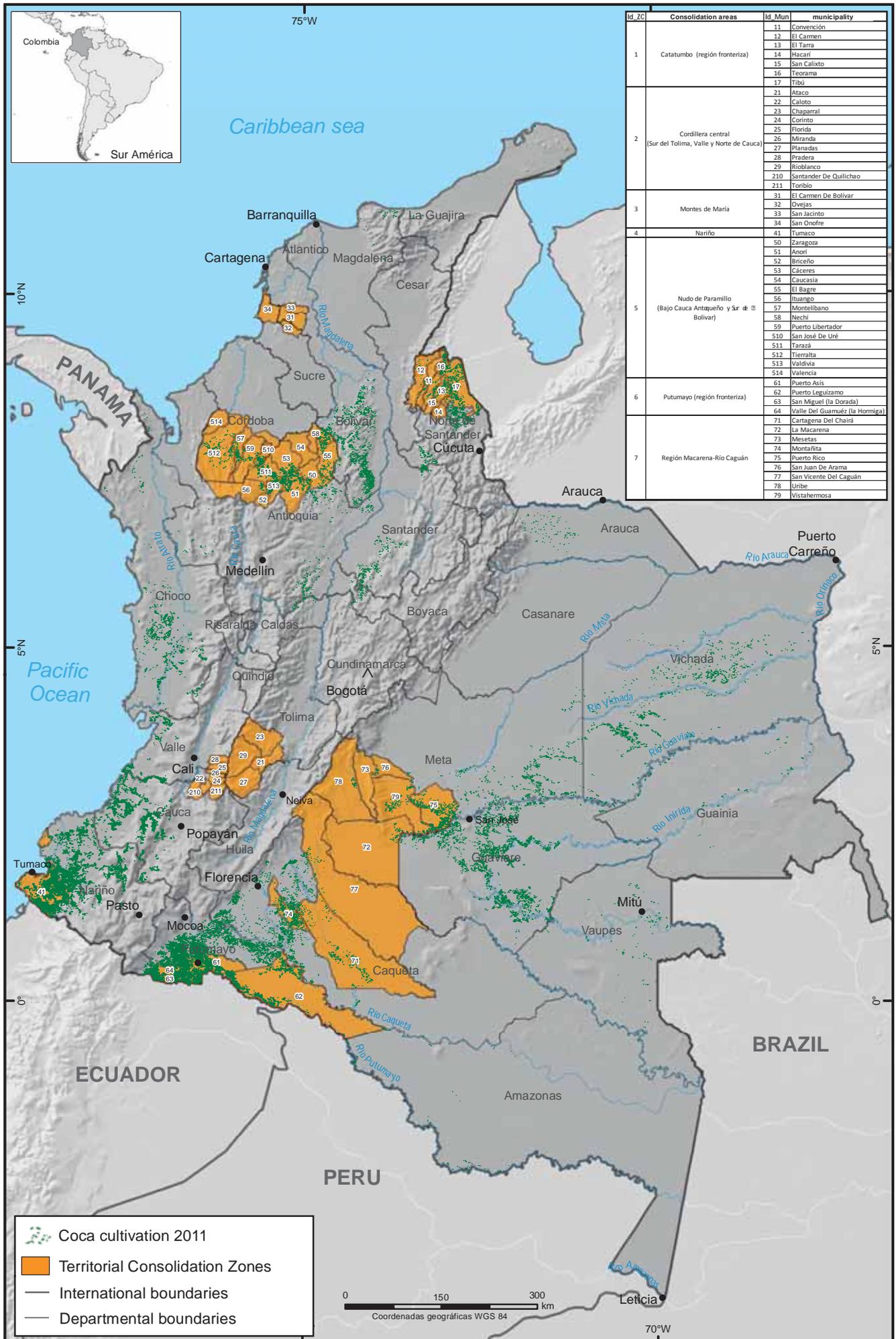
²⁹ Summary of the Report prepared by the Herbarium of the District University Francisco Jose de Caldas, 2012.

Main morphological characteristics in cultivated species of coca.

A. Shapes and sizes of leaf in *Erythroxylum coca* var. *coca*. B. Rough texture in branches with elongated lenticels that break the epidermis in *Erythroxylum coca* var. *coca*. C. and D. Abaxial lines in leaves of *Erythroxylum*, slight change in the colour of the tissue and change in the veins pattern (D). E. Sharp tip in *Erythroxylum coca* var. *coca*. F. Shape and texture of branches, striated with scattered lenticels. G. Cataphylls that wrap-around in knots, notorious in branches of short internodes. H. Position of inflorescences in foliated and defoliated knots.



Map 17. National territorial consolidation and reconstruction policy



Id. ZC	Consolidation areas	Id. Mun	municipality		
1	Cataumbo (región fronteriza)	11	Convención		
		12	El Carmen		
		13	El Tarra		
		14	Hacarí		
		15	San Calixto		
		16	Tierrama		
		17	Tibú		
2	Cordillera central (Sur del Tolima, Valle y Norte de Cauca)	21	Ataco		
		22	Caloto		
		23	Chaparral		
		24	Corinto		
		25	Florida		
		26	Miranda		
		27	Pianetas		
		28	Pradera		
		29	Ricoblanco		
		210	Santander De Quilichao		
		211	Toribío		
		31	El Carmen De Bolívar		
		32	Ovejas		
		33	San Jacinto		
3	Montes de María	34	San Onofre		
		41	Tumaco		
4	Nariño	50	Zaragoza		
5	Nudo de Paramillo (Bajo Cauca Antioqueño y Sur de Bolívar)	51	Anorí		
		52	Briceño		
		53	Cáceres		
		54	Caucasia		
		55	El Bague		
		56	Huango		
		57	Montebello		
		58	Nechí		
		59	Puerto Libertador		
		510	San José De Uré		
		511	Tarazá		
		512	Tierralta		
		513	Valdivia		
		514	Valencia		
		61	Puerto Asís		
		6	Putumayo (región fronteriza)	62	Puerto Leguizamón
				63	San Miguel (La Dorada)
		7	Región Macarena-Río Caguan	64	Valle Del Guamuez (La Hormiga)
				71	Cartagena Del Chairá
				72	La Macarena
				73	Mesetas
74	Montaña				
75	Puerto Rico				
76	San Juan De Arama				
77	San Vicente Del Caguan				
78	Uribe				
79	Vistahermosa				

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

2.7 TERRITORIAL CONSOLIDATION POLICY

National Plan of Territorial Consolidation

The Territorial Consolidation Policy³⁰ is a proposal of the Colombian State aimed at a joint and sustained effort of the local and national entities, as well as the private sector and international cooperation to attack the factors that have led to the vulnerability of territories, among others, the planting of illicit crops. The initiatives are intended to promote the economic and social development, recognizing that one single entity, project or programme does not have the ability to solve all the factors that have driven the expansion of illegal cultivations; hence, a whole range of interventions is required to generate the consolidation of zones free from illicit crops.

The Special Management Unit for Territorial Consolidation³¹ has the Direction of Programmes against Illegal Cultivations (DPCI), which executes the following programmes as intervention strategies to achieve territories free from illicit crops: i) Voluntary eradication of illegal cultivations with the participation of local governments and communities (activity considered as a priority for being an expression of the community); ii) post-eradication actions as strategies that include food security and productive initiatives; iii) forced manual eradication with Mobile Eradication Groups (GME) with the support of Law Enforcement. These actions are developed in coordination with the illicit cultivations aerial spraying programme, under the direction of the National Police.

The strategies are based in the knowledge of the affected zones by the specific features of each region of the country³², and the zones of intervention are selected according to the focalization criteria established (development, security, institutionalism and affectation by illegal cultivation). The strategy is based on making alliances with the local governments, State entities and international cooperation to determine the intervention actions and the monitoring to measure the progress and potential impact of social, institutional and security indicators in the areas of intervention. In particular, the consolidation strategy of the DPCI includes:

- a) *Micro-focalization*: Consists on regional and local analyses inside and outside the zones of consolidation for previous selection of the zones of intervention, territorial agreements, intervention modalities and commitments of the communities and regional actors.
- b) *Macro-focalization*: The results of the National Analysis and the micro-focalization will be assessed at the national level to establish the priorities of intervention, taking into account the affectation by illegal cultivations, the political willingness of the national governments, the security assessment and the available sources of resources. This process is linked to the operations of aerial spraying and manual eradication conducted by law enforcement.

In summary, the macro-focalization results in the design of a network of strategic alliances with different state and international cooperation entities, which with different programmes and plans that include own resources and resources from other funding sources, aim at assisting communities with productive and sustainable initiatives and projects. The Direction of Programmes against Illegal Cultivations supports this strategy in the initial stage of post-eradication.

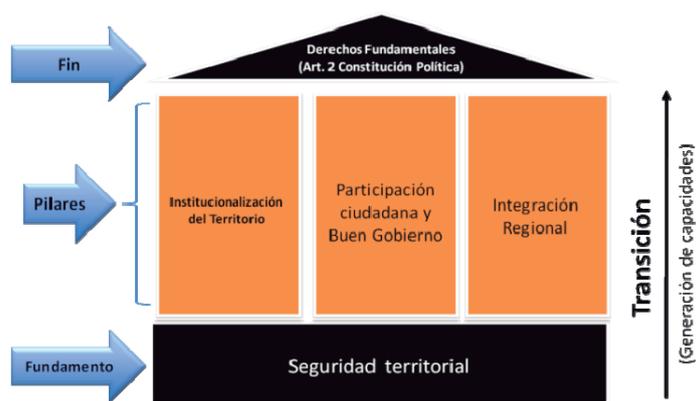
The process of consolidation comprises five stages to be completed: getting ready, recovery, transition, stabilization and consolidation of the territory. The sequence must guarantee that once the minimum conditions are met, the zones will be prepared to go through another phase of the territorial consolidation and reconstruction processes.

³⁰ The 2010-2014 National Development Plan has the strategic guideline of the National Policy of Territorial Consolidation and establishes the support transversal to the democratic prosperity and regional development that intends to close the gap of the indicators of regional development and integration in zones that have been traditionally affected by the illegal conditions of those non-affected

³¹ The Special Management Unit on Territorial Consolidation was created by means of the Decree 4161 of November 2011.

³² Previous analysis of the local situation by means of threat and vulnerability indicators that will enable to determine the risk factor of illegal activities. The 2011-2014 National Development Plan acknowledges the diversity and complexity of the country, and suggests that the local reality requires "a regional approach that starts from recognizing the local differences as reference framework to formulate public policies and programmes according to the characteristics and economic, social and cultural capacities of each region."

Figure 27. National Policy of Territorial Consolidation and Reconstruction



Source: Unidad Administrativa de Consolidación Territorial

Behavior of coca cultivation in the PNCT focalized regions

Presently, the PNCT focuses the intervention zones on 7 regions and 51 municipalities of the country³³: Catatumbo Zone (bordering region); Central Mountain Chain (Southern Tolima, Valle and Northern Cauca); Montes de María; Tumaco; Nudo de Paramillo (Low Antioquean Cauca and Sur de Bolívar); Putumayo (bordering region), and Macarena – Caguan River region. With the historical information of the censuses and field studies, UNODC/SIMCI support in the macro-focalization of the intervention zones in relation to the component of illegal cultivations³⁴. Progress has been made in the Macarena Region, considering that this zone was chosen for the pilot in 2007; the other regions are in process of implementation of the policy.

Coca cultivation in the zones focalized by the National Policy of Territorial Consolidation have remained relatively stable in the last two years. In 2011, the area cultivated with coca in the focalized municipalities was 20,086 hectares, which corresponded to 31% of the national total; in 2010, the area under coca cultivation was 21,081 hectares. From these zones, the municipalities of Tumaco in Nariño; Puerto Asis, Puerto Leguizamo and Valle del Guamuez (la Hormiga) in Putumayo and Tibu in Norte de Santander, have the greatest area planted with coca, with a participation of 61% of the total focalized zones and 19% of the national total.

In the Macarena region, the strategy of consolidation started as a pilot project in 2007 (former PCIM), with the municipalities of Vista Hermosa, La Uribe, Mesetas, Puerto Rico, San Juan de Arama and la Macarena; currently the municipalities of Cartagena del Chaira, Montañita and San Vicente del Caguan in Caqueta were included. Coca cultivation in the department of Meta showed an increasing tendency since 2001, until this department became the one with the greatest area under cultivation in the country between 2004 and 2005. Nevertheless, in 2008 there was an important change when it occupied the sixth place in area cultivated with coca after being in the third in 2007. In the territory of the six municipalities of the PCIM, between 2007 and 2010 cultivation decreased in 77%, and remained relatively stable in the last year (+ 2%).

³³ The National Government, with the 2011 – 2014 National Development Plan, established that the intervention zones will be located and revised constantly and periodically, so as to formulate and execute strategies to promote the economic and social transition of these territories and monitor the process of consolidation and reconstruction in the regions affected by the presence of illegal armed groups and illicit crops.

³⁴ The measurement uses the *affection approach* that consists on considering the damage and transformations suffered by the territory due to the presence of illegal cultivations; the *threat approach* due to the settlement of illegal cultivations with the descriptors of affected area, expansion, density, concentration, permanence; the *resistance approach*, measured by the effort applied and the permanence in time. The *vulnerability approach*, understood as the conditions of the territory that define the level of exposure to threat and the ability to resist and recover, is transversal to all the components of consolidation and they are beyond the component of illegal cultivations.

Investment of the PNCRT



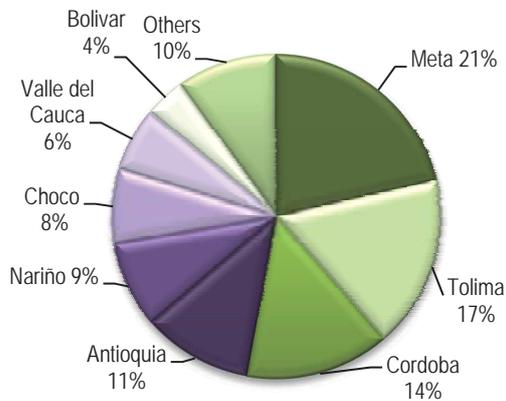
Source: UACT, Projects in consolidation zones.

The PNCRT focuses local, national and international resources on different regions, so that the zones subject of intervention of the policy meet the minimum conditions to control the territory institutionally, improve the citizens' participation and promote their integration into the national life and economy. The strategic management areas for these objectives are: economic development, social development, justice, governability and property management.

Between 2010 and 2011, the investments added up to COP \$ 444,990 million (COP \$125,094 million in 2011), mainly allotted to economic and social development, with the object of closing the gap in these territories. The greatest investments in the two years were done in the departments of Meta, Tolima, Cordoba and Antioquia (64%).

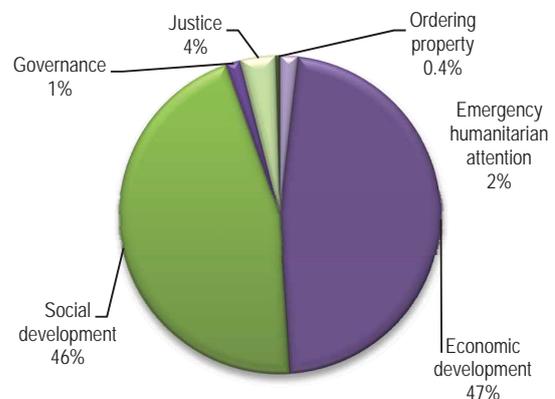
By type of support in 2010 and 2011, there were important investments in: i) Infrastructure related to improvement of roads, construction or maintenance of educational centres, sewage or electric networks; the greatest investments were done in the departments of Tolima, Meta and Chocó; ii) productive projects, which are focused mainly in the departments of Cordoba, Antioquia, Meta, Valle del Cauca and Bolivar; iii) quotas and coverage of social programmes aimed at the implementation of Peace and Cohabitation Schools, assistance to school students, juvenile clubs, incentives for graduate education, among others, and the greatest investments were done in the departments of Nariño and Valle del Cauca.

Figure 28. Investment in the Territorial Consolidation Policy



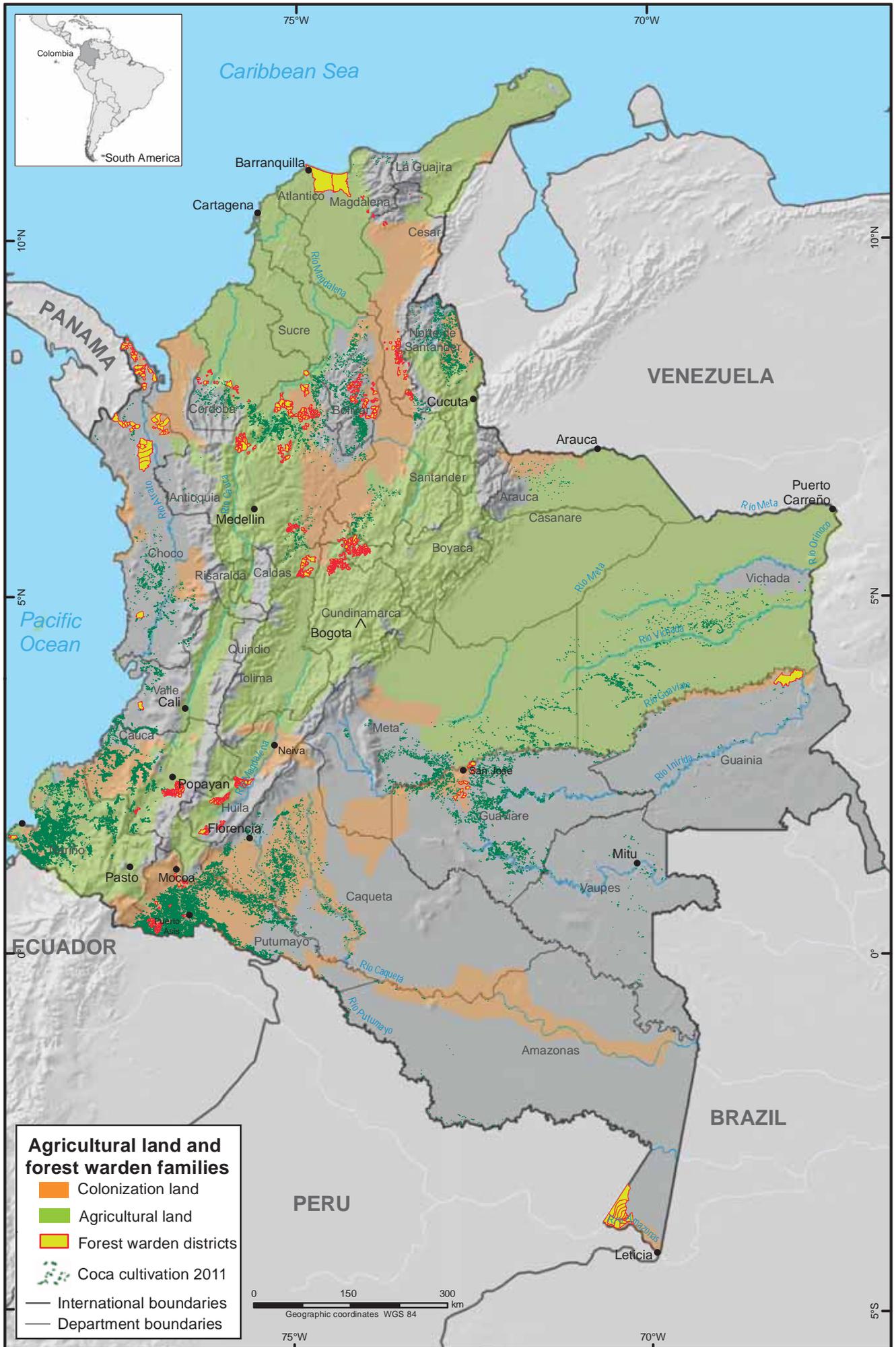
Fuente: UACT

Figure 29. Investment by strategic lines



To assist this group of actions, resources from different institutions and public national and regional programmes as well as from international cooperation, the beneficiaries and private sector are put together. The main sources in 2010 and 2011 were the Central Government (49%), regional and local levels represented by resources of Mayoralties, Departmental Governments and institutions (28%); beneficiaries and private sector (12%) and international cooperation (11%). Resources from international cooperation come from: the United States Agency for International Development (USAID), the Embassies of United Kingdom, Netherlands, New Zealand, United States, Germany China; Spanish Agency for Cooperation; OIM and European Union among others.

Map 18. Agricultural land and forest warden families programme in Colombia, 2011



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

Forest Warden Family Programme

The Forest Warden Family Programme (PFGB) benefits farmer, indigenous, and Afro-Colombian communities located in ecosystems that are environmentally strategic and affected or in risk of being affected by the presence of illegal cultivations. The Government and the families sign an agreement that formalizes the communal commitments of eradicating existing illicit crops manually and voluntarily, not sowing or re-sowing, not executing tasks related to these crops and attending the monitoring activities foreseen by the Programme. Likewise, the responsibilities of the Government with those families that meet these commitments are clarified: transferring every four months a conditioned incentive of COP \$408,000 per family (50% is transferred directly and 50% to a collective account for investment in productive projects) during a period of one year and a half; provide integral support for the promotion of productive activities, and follow-up, monitor and evaluate the programme (nowadays responsibility of UNODC – Colombia).

In 2011, the National Government invested COP \$ 25,496 million in the PFGB, assisting 14,918 families located in 11 departments of the country and 30 municipalities.

SIMCI supports the Programme of UNODC with thematic maps, updated satellite images and detection of coca fields by means of the coca census and other land cover such as forest, high stubble, grasses and low stubble, other kinds of cultivation, etc. Based on the Multi-temporal analysis of land cover carried out by UNODC for the PFGB, which was conducted over all the areas focalized by the programme, and with satellite images of the period 2003 - 2010, it was found that the recovered area, adding forest and high stubble, reached 532,422 hectares, and 1,028 hectares cultivated with coca changed their cover.

In a study conducted by Social Action, nowadays Department for Social Prosperity, and UNODC to determine the contribution of the PFGB and productive projects to the mitigation of climatic change with the capture and collection of carbon, it was estimated that in the natural forest the carbon captured was 123 thousand tons. The study was applied on a sample of 23 municipalities with presence of the PFGB between 2003 and 2010.

Table 36. Compilation of the Forest Warden Family Programme, 2011

Forest warden family programme, 2011				
Department	Municipality	Districts served	Families served	Conciliated amount (\$)
Huila	Pitalito	19	1,544	\$ 3,759,720,000,00
Cauca	Sotara	34	1,352	\$ 3,271,344,000,00
Cauca	Rosas	31	1,341	\$ 3,207,696,000,00
Huila	La argentina	23	1,195	\$ 2,903,736,000,00
Huila	Paicol	23	719	\$ 1,754,808,000,00
Antioquia	Caceres	12	881	\$ 1,036,320,000,00
Antioquia	Ituango	24	720	\$ 851,904,000,00
Antioquia	Zaragoza	23	680	\$ 767,652,000,00
Caldas	Victoria	21	620	\$ 743,172,000,00
Magdalena	Sitionuevo	2	483	\$ 585,480,000,00
Antioquia	Nechi	6	490	\$ 541,416,000,00
Antioquia	El Bagre	11	465	\$ 536,520,000,00
Magdalena	Puebloviejo	2	439	\$ 534,888,000,00
Guainia	Inirida	5	431	\$ 526,320,000,00
Putumayo	San Miguel	11	414	\$ 505,920,000,00
Archipelago de San Andres	San Andres	4	416	\$ 484,092,000,00
Cordoba	Tierralta	7	296	\$ 478,992,000,00
Cauca	Balboa	5	343	\$ 420,444,000,00
Antioquia	San Francisco	13	317	\$ 384,540,000,00
Archipelago de San Andres	Providencia	2	331	\$ 380,664,000,00
Cordoba	Valencia	8	231	\$ 376,584,000,00
Antioquia	San Luis	17	284	\$ 326,196,000,00
Antioquia	Anori	11	261	\$ 296,412,000,00
Cordoba	Montelíbano	5	156	\$ 252,960,000,00
Guaviare	San Jose del Guaviare	5	143	\$ 170,952,000,00
Guaviare	El Retorno	8	111	\$ 124,440,000,00
Cordoba	Puerto Libertador	4	77	\$ 93,840,000,00
Antioquia	Briceño	4	92	\$ 86,904,000,00
Putumayo	Puerto Asis	1	59	\$ 69,768,000,00
Vichada	Cumaribo	1	27	\$ 22,440,000,00
TOTAL		342	14,918	25,496,124,000

Source: Management unit of territorial consolidation.

Map 19. Forced manual eradication and coca cultivation in Colombia, 2011



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

2.8 SUPPLY REDUCTION

Forced manual eradication

In 2011, 34,170 hectares of coca bushes were eradicated; the area eradicated decreased with respect to the previous year (-22%). These activities were conducted in 29 departments, focusing mainly on Nariño (14,459 ha) and Putumayo (3,872 ha). 299 hectares of opium poppy were eradicated in six departments; 96% in Nariño, Cauca and Tolima.

The strategy of manual eradication is under the responsibility of the DPCI of the Management Unit for Territorial Consolidation, and is carried out by means of the Mobile Eradication Groups – GME, with assistance of Law Enforcement and certified by UNODC since 2007. As a complement, the National Police and the Military Forces carry out forced manual eradication activities throughout country.

Table 37. Manual eradication of coca fields by department, 2011

Department	Coca cultivation		Opium poppy	
	Eradicated area (ha)	% of the total	Eradicated area (ha)	% of the total
Nariño	14,459	42.3	239.2	80.1
Putumayo	3,872	11.3	-	-
Antioquia	2,862	8.4	-	-
Guaviare	2,799	8.2	-	-
Vichada	2,005	5.9	-	-
Cordoba	1,583	4.6	-	-
Caqueta	1,254	3.7	-	-
Meta	1,084	3.2	-	-
Bolivar	694	2.0	-	-
Valle del Cauca	530	1.6	3	1.0
Santander	466	1.4	-	-
Norte de Santander	442	1.3	-	-
Magdalena	380	1.1	-	-
Choco	337	1.0	-	-
Cundinamarca	239	0.7	-	-
Cauca	222	0.6	22.4	7.5
Amazonas	206	0.6	-	-
Caldas	202	0.6	-	-
Boyaca	191	0.6	-	-
Tolima	141	0.4	23.5	7.9
La Guajira	76	0.2	-	-
Cesar	44	0.1	9.5	3.2
Guainia	35	0.1	-	-
Vaupes	20	0.1	-	-
Meta	15	0.0	-	-
Arauca	9	0.0	-	-
Atlántico	3	0.0	-	-
Huila	1	0.0	1	0.3
Risaralda	1	0.0	-	-
Total Nacional	34,170	100.0	299	100

Sources: DPCI, PONAL, Army and National Military Forces, UNODC.

Manual eradication has a greatest impact on the coca leaf production, since the plants are completely uprooted. Re-sowing means costs for the growers, since they need approximately eight months between the sowing and the first crop, with a low productivity in the first stage.

UNODC evaluated the behaviour of the re-sowing activities in the areas that were forcedly eradicated, by means of the superposition of the coordinates reported by the GME, considering the date of the image and the date of the eradication. The following table shows the area of fields that were manually eradicated throughout 2011, and that were re-sowed with coca at the moment of the census. The analysis includes only the data of forced manual eradication certified by UNODC.

Table 38. Re-planting analysis in areas of forced manual eradication of coca fields by GME, 2011

Region	Eradication		Re - planted with coca		No re - planting		No data available	
	Hectares	Study area	Hectares	%	Hectares	%	Hectares	%
Amazon	-	-	-	-	-	-	-	-
Central	5,474	4,122	548	13	3,574	87	1,352	25
Meta - Guaviare	1,483	1,361	252	18	1,109	82	122	8
Orinoco	1,229	1,080	269	25	811	75	149	12
Pacific	13,599	9,829	4,679	48	5,150	52	3,770	28
Putumayo - Caqueta	3,050	3,000	844	28	2,156	72	50	2
Sierra Nevada	305	259	8	3	250	97	47	15
Total	25,140	19,651	6,600	34	13,050	66	5,490	22

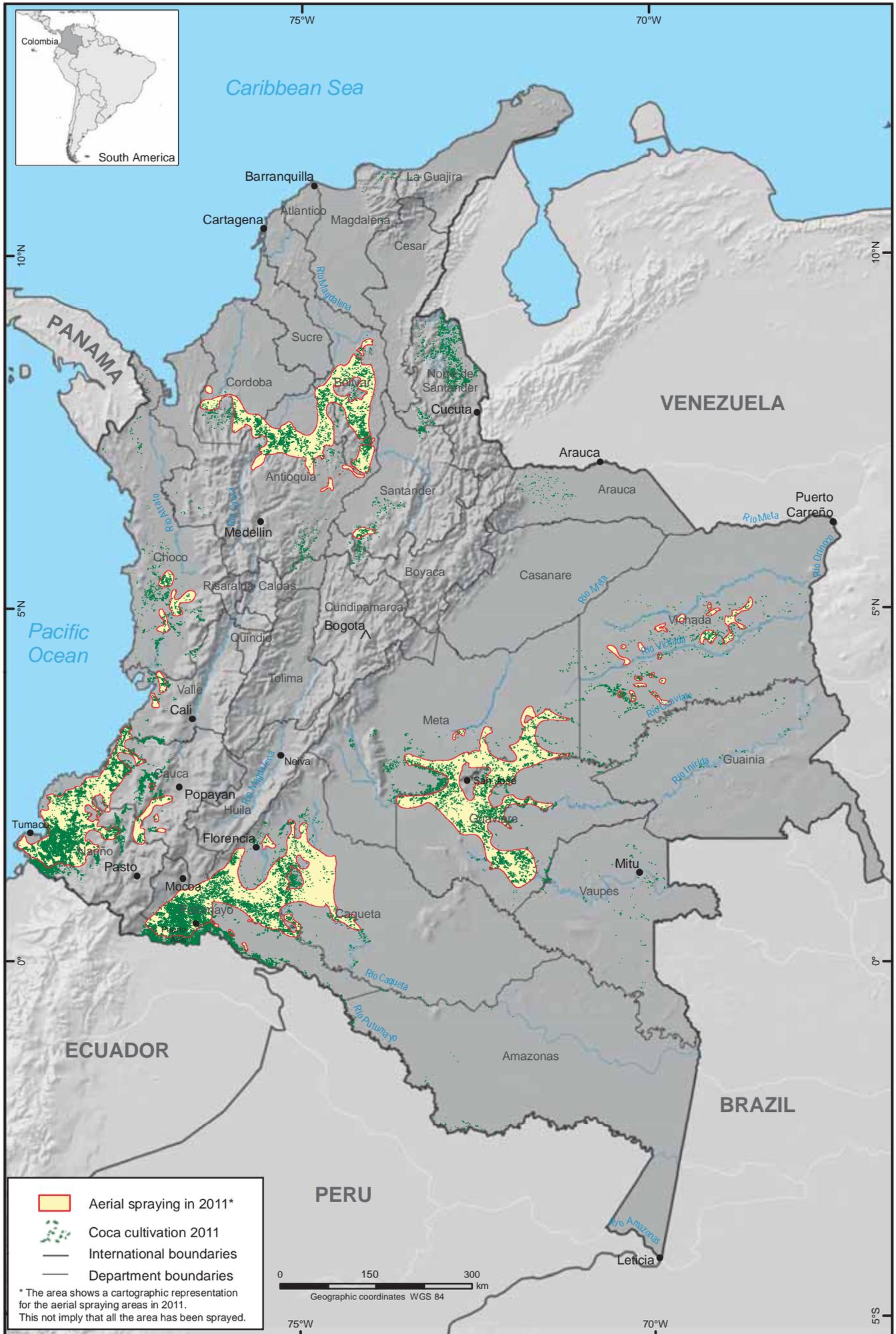
Source: DPCI and UNODC.

This comparison showed that 78% of the total eradicated area has enough information to evaluate re-planting and 22% is covered by clouds or gaps. From the areas with information, 34% has evidence of re-planting; this is 35% less than the previous year. In the national consolidated report, the regions that report the greatest re-planting of coca are the Pacific and Putumayo - Caqueta.



Source: GME. Forced manual eradication of a coca field

Map 20. Aerial spraying and coca cultivation in Colombia, 2011



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

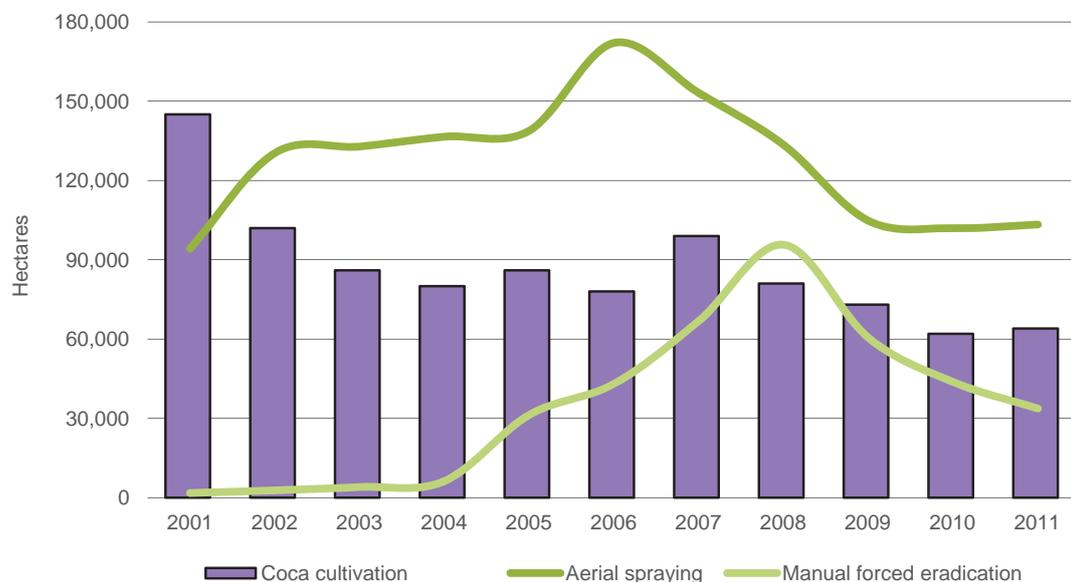
Aerial spraying

The Colombian strategy for the reduction of the supply of drugs includes aerial spraying, manual eradication – either forced or voluntary, alternative development programmes and the National Plan for Territorial Consolidation. UNODC neither participates nor supervises aerial spraying activities. All the information included here is sent directly by the National Police -DIRAN.

By request of the National Narcotics Council, the aerial spraying programme is conducted by the National Police – Antinarcotics Directorate; it is done with a mixture of herbicide with active ingredient glyphosate, a coadjuvant and water. The chemical mixture has a systemic effect and is absorbed by the leaves and transported to the root. In 2011, the Commission of National Verification of Spraying Operations estimated a percentage of 98% of effective death of plants per field.

The DIRAN sprayed a total of 103,302 hectares in 2011, which represents a 1.3% increase with respect to the one done the previous year. In 2011, 34% of the activities were carried out in the department of Nariño, and 42% in the departments of Guaviare, Caqueta, Cauca and Antioquia.

Figure 30. Comparison of coca cultivation vs. the accumulated areas sprayed and manually eradicated, 2001-2011



Source: PCI and UACT for eradication DIRAN for aerial spraying and SIMCI for coca cultivation.

The accumulated sprayed area corresponds to the total intervention during one calendar year, calculated by the multiplication of the length of the flight lines times its passing width, without including the superposition of adjacent bands and the number of applications done over a same field during the same year; hence, it is different from the sprayed area.

Table 39. Aerial spraying of coca fields per department and year (in hectares) 2001-2011

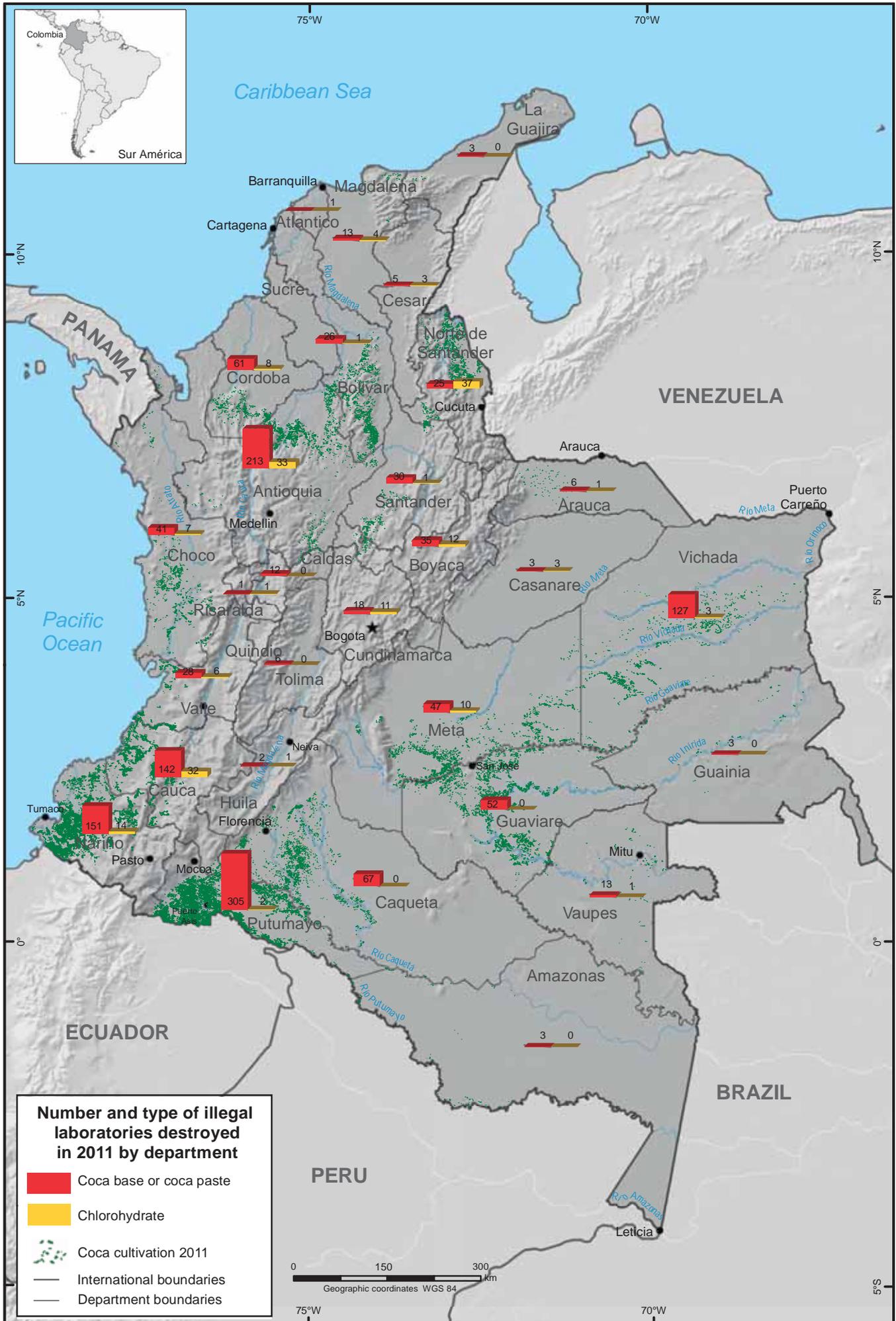
Department	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Nariño	8,216	17,962	36,911	31,307	57,630	59,865	36,275	54,050	39,992	25,940	34,988
Caqueta	17,252	18,567	1,060	16,276	5,452	4,575	5,084	11,085	6,652	16,947	12,888
Cauca	741	-	1,308	1,811	3,292	1,536	3,557	6,891	11,136	14,450	11,834
Antioquia	-	3,321	9,835	11,048	16,799	18,022	27,058	10,028	9,281	3,026	9,847
Putumayo	32,506	71,891	8,343	17,524	11,763	26,491	26,766	11,898	3,777	11,434	9,480
Guaviare	7,477	7,207	37,493	30,892	11,865	14,714	10,950	13,061	12,584	17,633	8,917
Choco	-	-	-	-	425	-	-	-	-	-	4,287
Bolivar	11,581	-	4,783	6,456	6,443	2,662	7,050	2,214	8,715	4,412	3,564
Cordoba	-	734	550	-	1,767	5,588	6,259	3,561	742	546	3,128
Meta	3,252	1,496	6,974	3,888	14,453	25,915	15,527	9,057	6,756	5,825	2,545
Vichada	2,820	-	-	1,446	-	5,485	7,193	5,901	1,699	1,425	1,014
Valle del Cauca	-	-	-	-	5	-	-	-	-	-	719
Santander	-	-	5	1,855	2,042	2,146	1,754	422	1,269	153	92
Norte de Santander	10,308	9,186	13,822	5,686	899	1,687	2,683	2,864	1,883	149	-
Caldas	-	-	-	190	1,090	1,068	284	-	169	-	-
Boyaca	-	-	-	-	925	831	-	166	117	-	-
Arauca	-	-	11,734	5,336	2,584	1,400	2,695	2,296	-	-	-
Cundinamarca	-	-	-	-	43	41	-	-	-	-	-
La Guajira	-	-	-	449	572	-	-	-	-	-	-
Magdalena	-	-	-	1,632	383	-	-	-	-	-	-
Vaupes	-	-	-	756	340	-	-	-	-	-	-
Total spraying	94,153	130,364	132,817	136,551	138,775	172,025	153,134	133,496	104,772	101,940	103,302
Cultivated area (hectares)	145,000	102,000	86,000	80,000	86,000	78,000	99,000	81,000	68,000	62,000	64,000

Source: National Police –Anti-narcotics Directorate

Coca growers develop strategic behaviours to reduce the effect of aerial spraying on coca cultivations; examples of these strategies are: doing interspersed or mixed sowing; applying substances to isolate the surface of the leaves from the effects of glyphosate; washing the leaves; increasing the amount of fields so that some of them will not be affected; rotating the plots in one productive unit and reducing the size of the fields, among others. Depending on the degree of impact, aerial spraying may cause the loss of one or more crops, reduction of the production or total loss. These impacts vary significantly from one region to the other, and it is clear that aerial spraying is not the only cause for the reduction or loss of crops.

The former reasons, added to the reductions or losses due to the weather, plagues or illnesses, contribute to the understanding that the area under coca cultivation in Colombia is not constant during the year due to actions or factors that induce the rise (re-sowing and protection against spraying) or the fall (aerial spraying, manual eradication, market problems or factors such as violence).

Map 21. Destruction of clandestine laboratories and coca cultivation in Colombia, 2011



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

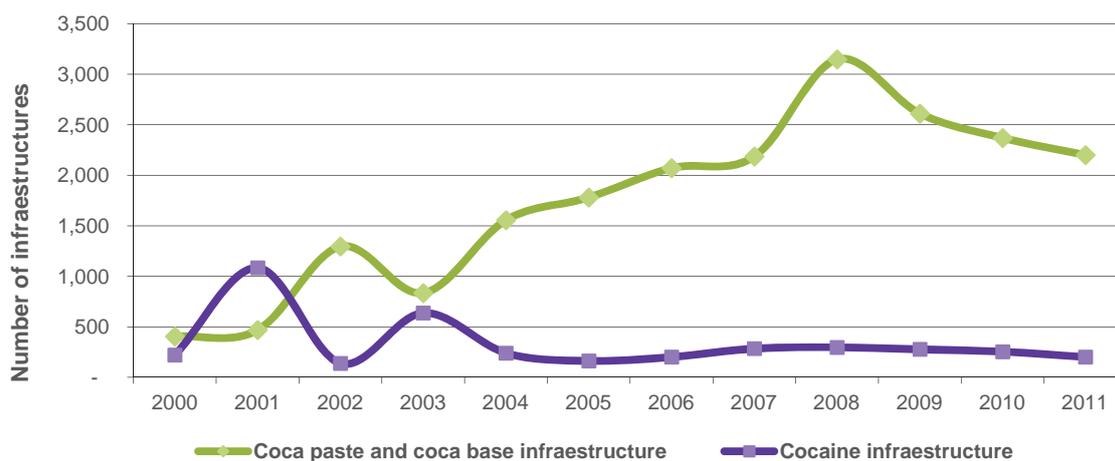
Infrastructure of drug production

UNODC do not participate in the collection of data on detection and destruction of production infrastructure; however, this information is considered because it provides interesting clues on the production zones and enables a better comprehension of the dynamic around the drug business.

According to data from the Colombian Drug Observatory –ODC, a total of 2,447 facilities of illegal extraction and production were destroyed in 2011, from which 2,200 corresponded to infrastructure for the extraction of coca paste and cocaine base, 200 laboratories for the processing of cocaine hydrochloride, 1 laboratory for the production of heroin, 39 for marihuana, 7 for potassium permanganate and 81 artisan gasoline refineries. There was an 8% decrease in the dismantling of cocaine hydrochloride laboratories and infrastructure in relation to the previous year.

According to the studies conducted by UNODC/SIMCI with the Colombian Government, the following characteristics are still being detected as regards to the drug production infrastructure and its processes: i) The laboratories for the processing of cocaine hydrochloride (so called "*crystalizadores*") are progressively smaller, which facilitates assembling and disassembling and mobility; ii) there are changes in the processes for the optimization of times and yields; iii) use of new substances that improve times and optimize crystallization processes; iv) recycling or reusing of fuels and solvents; v) clandestine manufacturing of chemical substances as potassium permanganate, ammonia hydroxide, sulphuric acid and petrol derivatives such as natural gasoline; vi) fabrication by means of "*maquila*" or "*encargo*" and, vii) use of "cutting" or "*rindex*" substances such as Levamisole, Diltiazem, Hydroxyzine and Aminopyrine or adulterating substances³⁵.

Figure 31. Production facilities and laboratories destroyed in Colombia, 2000 -2011



78% of the cocaine laboratories were detected and destroyed by Law Enforcement in the departments of Norte de Santander, Antioquia, Cauca, Nariño, Boyacá, Cundinamarca and Meta. In general, the cocaine hydrochloride laboratories are not always in the same zones with presence of coca cultivation but they are supplied by the close zones where they plant and process coca paste and cocaine base. 84% of the places where the coca paste/ cocaine base are processed (commonly called "*cocinas*" or "*chongos*") were detected and destroyed in the departments of Putumayo, Antioquia, Nariño, Cauca, Vichada, Caqueta, Guaviare, Cordoba and Bolivar; then again, these were found in most of the departments of the country (see table 40).

³⁵ Forensic analysis of cocaine samples produced in Colombia: Chromatographic profile of cocaine hydrochloride samples. William F. GARZÓN M. Fabián PARADA A. and Néstor M. FLORIÁN R., 2009.

Table 40. Laboratories and infrastructure for the production of drugs detected and destroyed in 2011

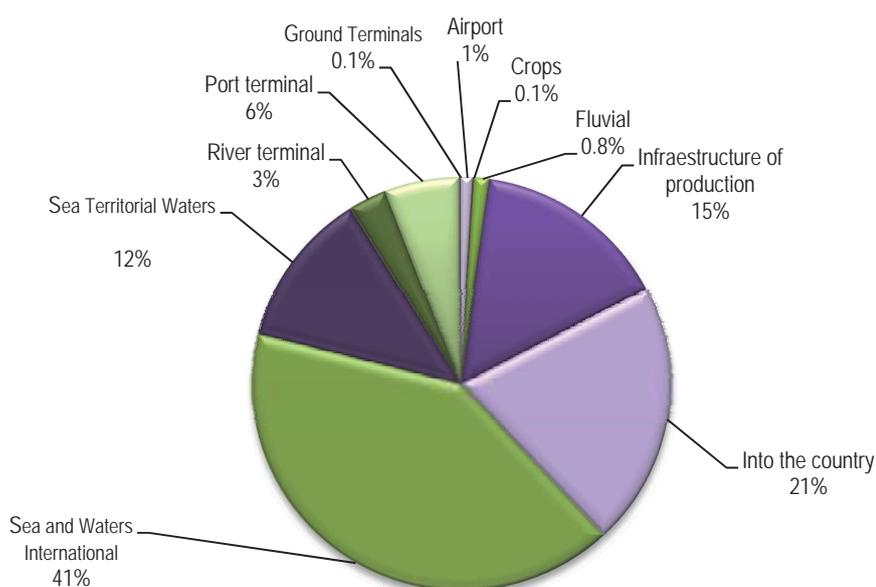
Department	Coca paste/cocaine base	Cocaine hydrochloride	Heroine	Pressed marihuana	Potassium permanganate
Norte de Santander	46	39			1
Antioquia	295	34	1		4
Cauca	217	34		38	
Nariño	267	15			
Boyaca	38	12			
Cundinamarca	18	12			1
Meta	69	11			
Cordoba	107	8			
Choco	48	7			
Valle del Cauca	31	6		1	
Magdalena	13	4			
Vichada	190	3			
Cesar	5	3			
Casanare	3	3			
Putumayo	323	2			
Bolivar	103	1			1
Santander	32	1			
Vaupes	13	1			
Arauca	6	1			
Huila	2	1			
Risaralda	2	1			
Atlántico	0	1			
Caqueta	171				
Guaviare	171				
Caldas	13				
Tolima	6				
Amazonas	4				
Guainia	4				
La Guajira	3				
Total	2,200	200	1	39	7

Source: Drugs Observatory of Colombia. Ministry of Justice and Law

Drug seizures

The volume of cocaine hydrochloride seizures remained relatively constant in the two last years; in 2010, it was 165 tons and in 2011, 156 tons (-6% as compared to the previous year); 71% of the seizures of cocaine hydrochloride took place in the departments of Valle del Cauca, Antioquia, Choco, Archipelago de San Andres and Providence, La Guajira and Bolivar. There is no information on the degree of purity of the seizures conducted in Colombia and the majority were done in the sea (both territorial and international waters), followed by the interior of the country and in production facilities (laboratories).

Figure 32. Cocaine facilities by type of place



Around one thousand tons of coca leaf were seized in 2011, most of them in the department of Antioquia, followed by the departments of Cauca, Putumayo, Nariño, Vichada and Guaviare. 54.2 tons of coca paste and cocaine base were seized; 74% of these seizures were done in the departments of Nariño, Cauca, Caqueta, Guaviare, Antioquia and Putumayo. By type of place, the greatest seizures took place in the production facilities (*cocinas* or *chongos*), inland and on rivers.

As regards to the seizures of heroin, these continued to decrease, which coincides with the reducing trend of the production area. In 2011, 299 kg were seized, as compared to 337 kg of the previous year; the greatest seizures were carried out in the departments of Nariño, Valle del Cauca, Antioquia, Choco and Cundinamarca.

The seizures of de marihuana show an increasing trend; in 2011, 348 mt were seized, compared to 255 mt in 2010 and 207 mt in 2009. These seizures were done throughout the national territory but the greatest volumes were seized in the departments of Antioquia, Cauca, Magdalena and Valle del Cauca.

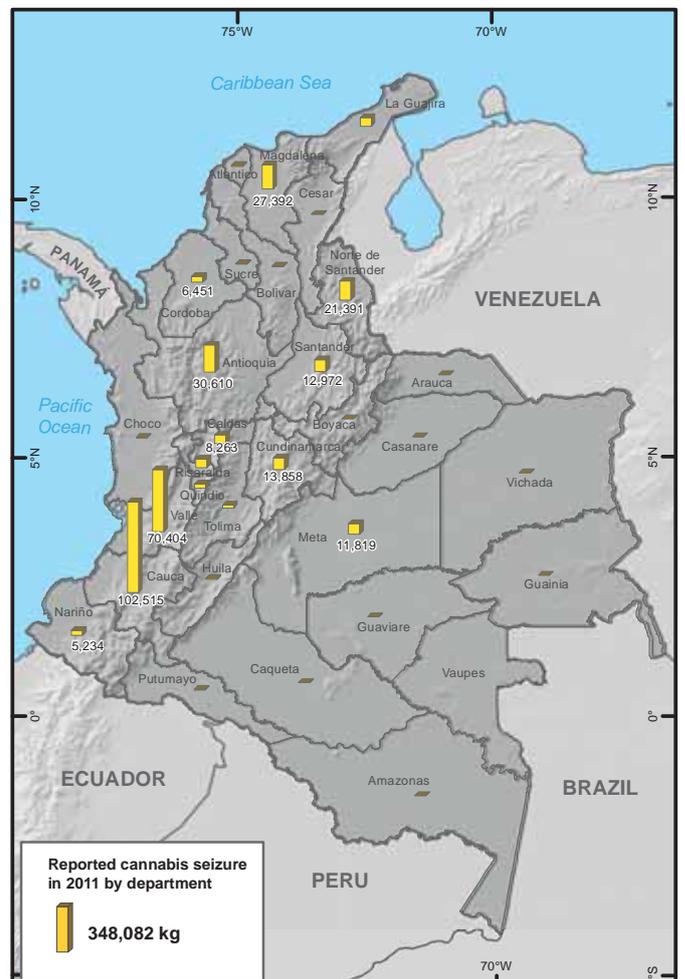
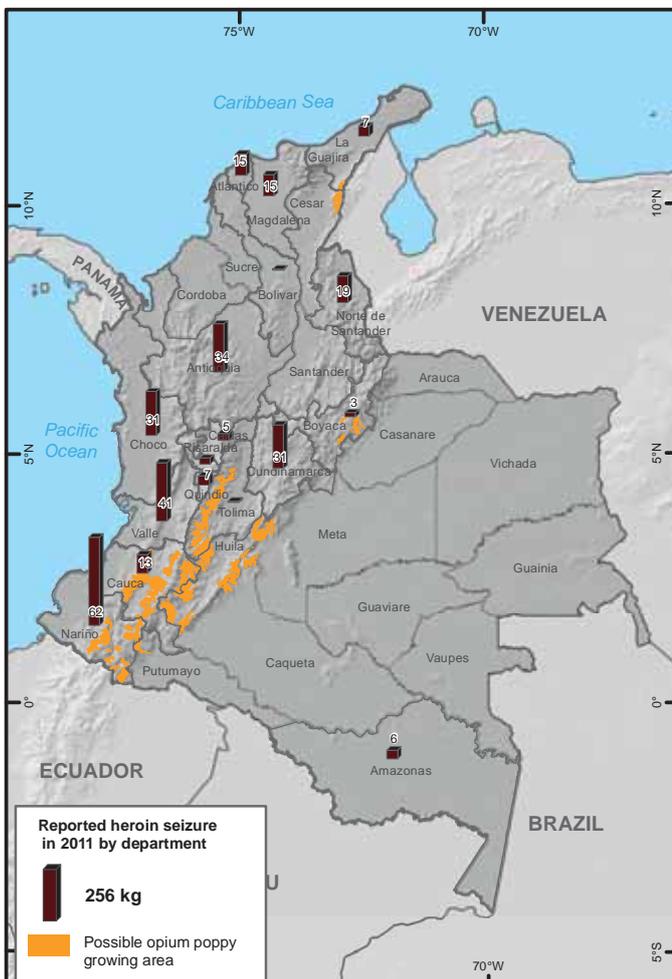
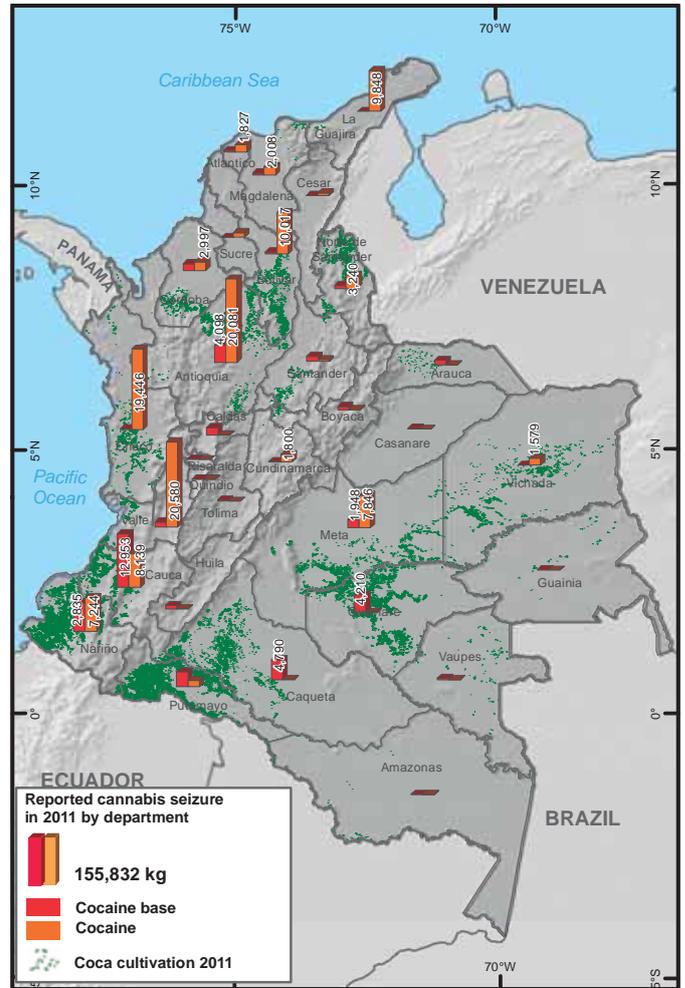
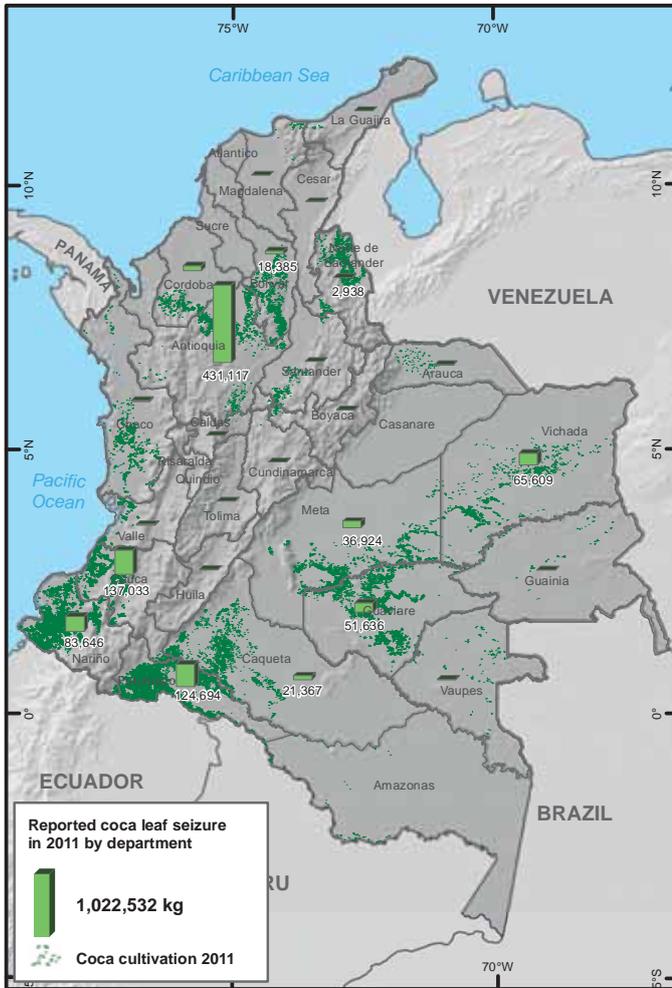
In 2011, there were seizures of substances of the amphetamine type such as *ecstasy* (22,809 units); 3,303 units of amphetamines, and 16,412 and 4,035 units of pills of Roche and Rohypnol respectively.

Table 41. Seizures of cocaine hydrochloride, coca paste and cocaine base, 2011

Department	Cocaine hydrochloride	Coca paste/cocaine base
	Kilograms	Kilograms
Amazonas	118	158
Antioquia	20,081	4,098
Arauca	1	1,075
Archipiélago de San Andrés	19,177	-
Atlántico	1,827	457
Bogotá	154	-
Bolívar	10,017	556
Boyacá	89	832
Caldas	103	1,873
Caquetá	22	4,790
Casanare	2	206
Cauca	8,139	12,953
Cesar	668	67
Chocó	19,446	195
Córdoba	2,113	1,702
Cundinamarca	1,800	166
Guainía	0	72
Guaviare	0	4,210
Huila	36	814
La Guajira	9,848	1
Magdalena	2,008	482
Meta	7,846	1,948
Nariño	8,247	6,842
Norte de Santander	3,240	755
Putumayo	1,496	3,546
Quindío	54	83
Risaralda	56	204
Santander	427	1,274
Sucre	1,075	9
Tolima	26	309
Valle del Cauca	20,580	1,257
Vaupés	0	367
Vichada	1,579	2,993
Subtotal	140,275	54,294
Report by the international operating PONAL	15,557	
Total General	155,832	54,294

Source: Drug Observatory of Colombia, Ministry of Justice and Law.

Map 22. Drug seizures by department and by drug type, Colombia 2011



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

Table 42. Seizures of illegal drugs, 2002-2011

Drug	U	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Coca leaf	kg	638,000	688,691	567,638	682,010	818,544	1,064,503	644,353	826,793	871,249	1,022,532
Coca paste	kg	974	2,368	1,218	2,651	5,451	922	5,001	11,400	3,685	3,892
Cocaine base	kg	22,615	27,103	37,046	106,491	42,708	33,882	49,663	41,634	46,405	50,401
Cocaine*	kg	95,278	113,142	149,297	173,265	127,326	126,641	198,366	203,166	164,808	155,832
Opium latex	kg	110	27	57	1,632	118	125	172	49	2	193
Heroin	kg	775	629	763	745	442	537	646	728	337	299
Marihuana	kg	76,998	108,942	151,163	150,795	93,745	142,684	254,685	206,811	254,991	348,082
Synthetic drugs	tablets	175,382	5,042	19,494	148,724	7,888	1'968,857	5,597	132,987	26,299	22,809

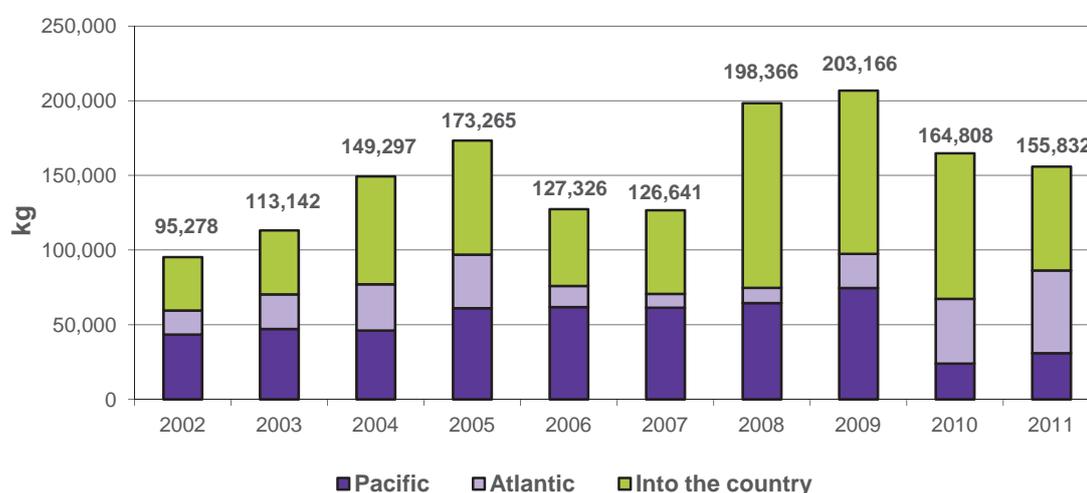
Source: Drug Observatory, Ministry of Justice and Law. * The figure on cocaine hydrochloride includes 15.5 tons reported by the National Police related to international operatives.

Out of 155.8 metric tons of cocaine seized in 2011, 55% took place in territorial and international waters. The majority of seizures in the last two years were done in the Atlantic Ocean, different from previous years in which they took place mainly in the Pacific Ocean. The seizures of cocaine were done in joint operatives of the National Army with the United States, with other countries and other law enforcement institutions, and seizures done according to reports from the National Police.

Table 43. Cocaine seizures in the Pacific and Atlantic routes (Kg), 2002-2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	% seized
Pacific	43,435	47,137	46,128	61,042	61,758	61,423	64,487	74,617	24,016	30,931	36%
Atlantic	16,065	23,157	30,928	35,856	14,150	9,235	10,157	22,783	43,306	55,349	64%
Total seizures at sea	59,500	70,294	77,056	96,898	75,908	70,658	74,644	97,400	67,322	86,280	100%
Total seizures (in land and at sea)	95,278	113,142	149,297	173,265	127,326	126,641	198,366	203,166	164,808	155,832	n.a,
% seizures at sea	62%	62%	52%	56%	60%	56%	38%	48%	41%	55%	n.a,

Figure 33. Cocaine seizures in maritime ports, at sea and inland, 2002 – 2011



Source: Armada Nacional

Table 44. Seizures of illicit drugs in 2011

Department	Coca leaf	Coca paste	Cocaine base	Cocaine hydrochloride	Heroin	Latex	Pressed marihuana	Ecstasy	LSD	Amphetamines	Roche	Rohypnol
	Kg	Kg	Kg	Kg	Kg	Kg	Kg	U	U	U	U	U
Amazonas		115	43	118	6		47					
Antioquia	431,117	238	3,859	20,081	34	0	30,610	67			13,584	2,163
Arauca	1,755	1,070	5	1	0		82			10		
San Andres				19,177	4		30	71				
Atlántico			457	1,827	15		1,450	1,224	10			
Bogota D.C				154			6					
Bolivar	18,385		556	10,017	1		683	110			103	69
Boyaca	351	2	830	89	3		522	59		75		
Caldas	678		1,873	103	5		9,601	1,211		742	509	
Caqueta	21,367	103	4,687	22			598					
Casanare			206	2			120				1	
Cauca	137,033	2	12,951	8,139	13		102,515	12,000				515
Cesar	200		67	668	0		654	16		30		
Choco	4,254	110	85	19,446	31		1,012					
Cordoba	27,584		1,702	2,113			6,451					
Cundinamarca	317	40	126	1,800	31		13,858	5,139	10	67		
Guainia	222		72	0			3					
Guaviare	51,636		4,210	0			179					
Huila	1,175	2	812	36			1,269			1,843		
La Guajira	450		1	9,848	7		10,208					
Magdalena	1,170		482	2,008	15		27,392	13		1		
Meta	36,924	9	1,940	7,846			11,819			447		
Nariño	83,646	676	6,166	8,247	62	193	5,234	15				
Norte de Santander	2,938	50	705	3,240	19		21,391			8		21
Putumayo	124,694	296	3,250	1,496			390					
Quindío			83	54	7		4,592	152				
Risaralda			204	56	4		9,916	1,898			250	
Santander	2,408	1,111	163	427	0		12,972	22	592		3	270
Sucre			9	1,075			278					
Tolima	180		309	26	1		3,781	8				
Valle del Cauca	5,951	3	1,254	20,580	41		70,404	804	7	80	1,962	997
Vaupés	2,490	15	351	0			0					
Vichada	65,609	50	2,943	1,579			15					
Subtotal	1,022,532	3,892	50,401	140,275	299	193	348,082	22,809	619	3,303	16,412	4,035
Others*				15,557	256							
Total general	1,022,532	3,892	50,401	155,832	555	193	348,082	22,809	619	3,303	16,412	4,035

Source: Drug Observatory of Colombia, Ministry of Justice and Law.

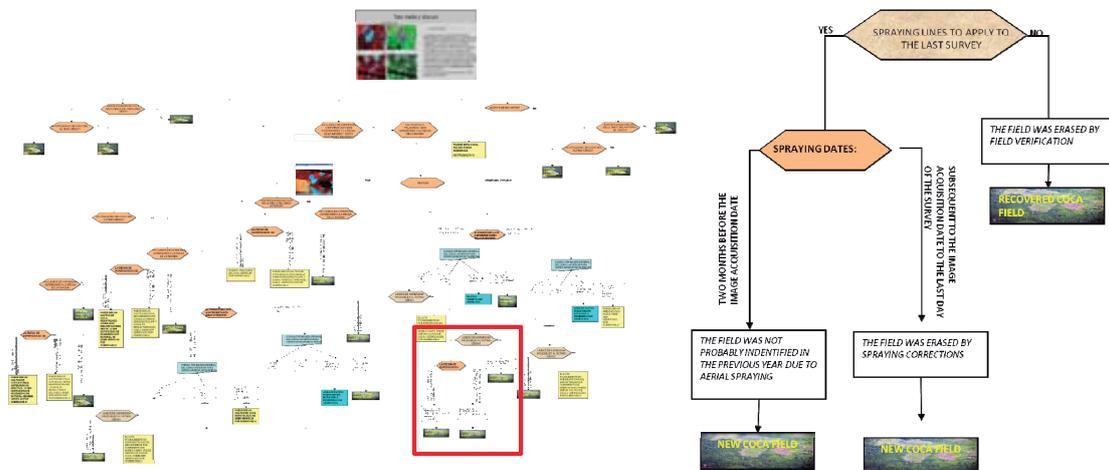
3. METHODOLOGY

3.1 COCA CULTIVATION CENSUS

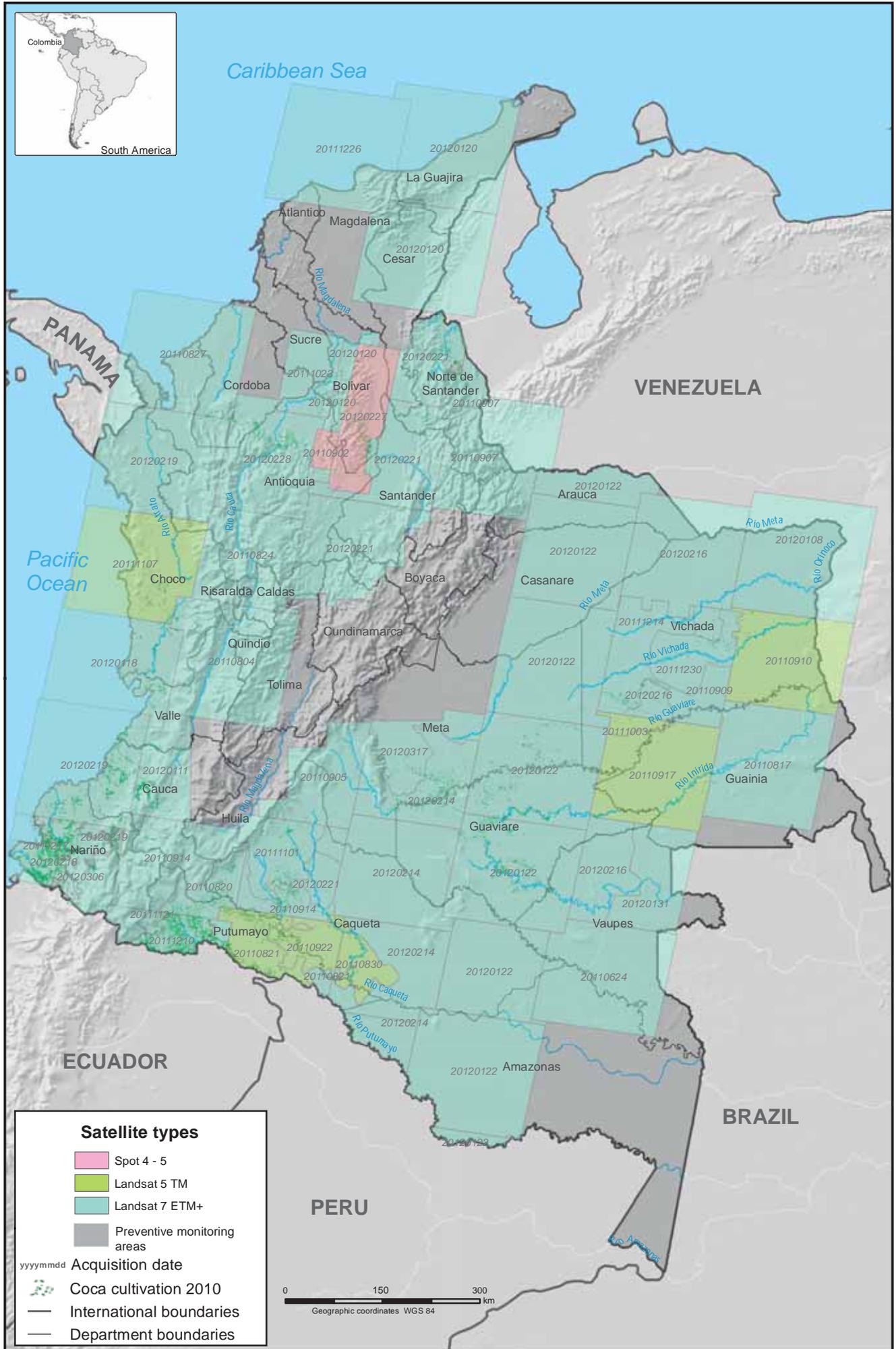
The monitoring of coca cultivation in Colombia is based on the interpretation of several types of satellite images. For the 2011 census, the project analyzed a total of 87 LANDSAT 7 ETM+ images, 5 LANDSAT 5 TM images and 5 SPOT 4 images. 96% of the area under study was covered by satellite images collected between September 2011 and March 2012; the conditions of cloudiness predominant in Colombia at the end of 2011 forced the use of images collected in June and August 2011. The images cover the entire national territory (1,142,000 km²), except for the islands of San Andres and Providence.

The Project developed decision trees for the interpretation of coca cultivation in satellite images with the support of the BOKU University in three regions: Meta-Guaviare, Putumayo-Caqueta and Cauca-Nariño. The objective is the documentation of the process done to qualify a plot as coca cultivation with all the possible variations within the dynamic present in each one of the regions. (See figure 34)

Figure 34. Detail of a decision tree designed for the interpretation key for coca cultivation.



Map 23. Satellite images used for the coca cultivation survey in Colombia, 2011



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

The estimate of the total area under coca cultivation in Colombia in 2011 is the result of the following processes:

Identification and collection of satellite images: One of the main difficulties in acquiring satellite images is the frequent cloudiness over the Colombian territory. For this reason, a permanent monitoring of the passing of satellites is kept in the search for images that provide information on the areas with excessive cloudiness.

The LANDSAT 7 ETM+ data is collected in 6 spectral bands with a spatial resolution of 30 meters, one thermal with spatial resolution of 60 meters and one additional panchromatic band with a spatial resolution of 15 meters. The satellite has a repetition cycle of 16 days, which increases the chances of getting images free from clouds. Their band width of 185 Km is appropriate for regional studies.

The LANDSAT 5 TM images have the same characteristics than the LANDSAT 7 ETM+ images, with the additional advantage that they do not have damages in the scanning corrector, due to which the images do not have gaps.

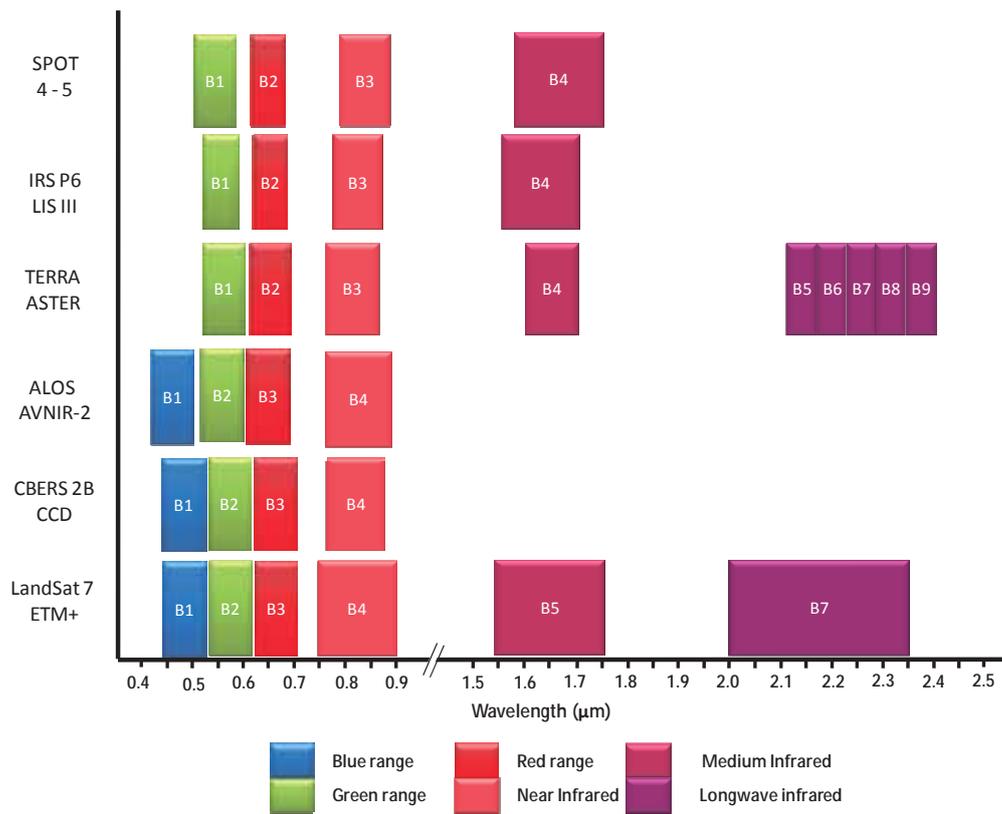
The ASTER images captured 14 spectral bands with a spatial resolution that varies between 15 and 90 meters. Since 2008, the bands 4 to 9 are not available due to failure in the sensor; currently, only the green and red bands with 15 meters of resolution and the one of close infrared with 30 meters of resolution are of use; this implies that the range of capture of spectral information is smaller than the one in the original images. The image has a band width of 60Km with a repetition cycle of 16 days. This type of images was not used in 2010.

The SPOT 4 images have a spectral resolution of 4 bands: 2 bands of the visible, 1 band of close infrared and 1 in the medium infrared, with a spatial resolution of 20 meters and sweep width of 60Km.

Table 45. Satellite images used in the censuses from 2003 to 2011 in Colombia, percentile participation.

Sensors	% 2003	% 2004	% 2005	% 2006	% 2007	% 2008	% 2009	% 2010	% 2011
LandSat 7 ETM+	82	94	92	89	89	95	69	67	88
LandSat 5 TM	-	-	-	-	-	-	13	11	7
SPOT 4 and 5	2	1	5	3	3	4	-	-	5
ALOS	-	-	-	-	3	1	11	22	
ASTER	16	5	3	5	5	-	7		
IRS6 – LISS III	-	-	-	3	-	-	-	-	
Total	100								

Figure 35. . Spectral comparison between bands of SPOT, ASTER, IRS, LISS III, LANDSAT, ALOS and CBERS images



Pre-processing of the images

Geo-referencing

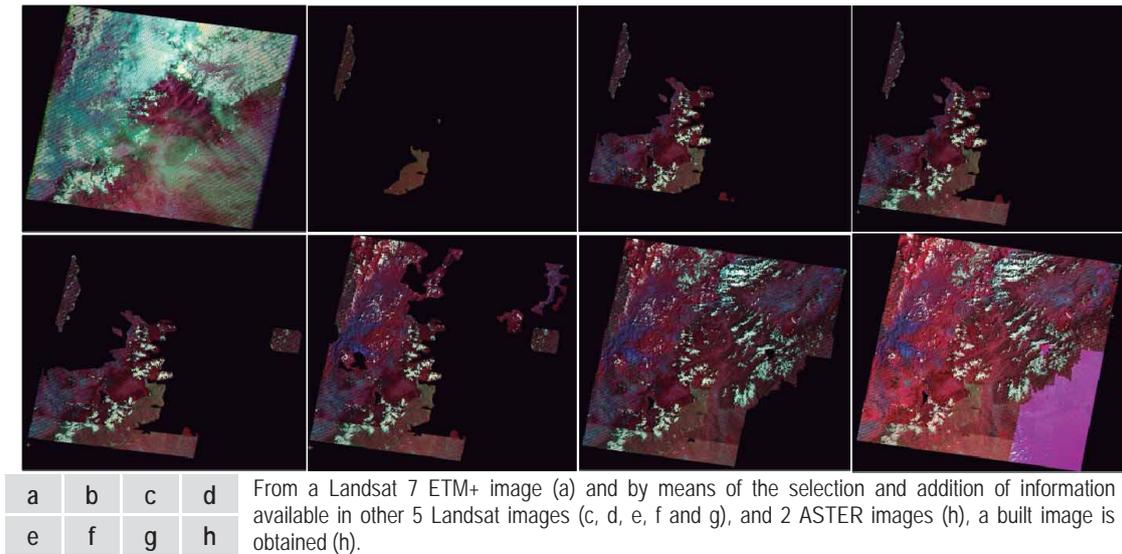
To be able to use spectral and spatial information together with other spatial data available (i.e. models of digital elevation, secondary information) the image data needs to be in the same coordinate system than maps. The satellite images were geo-referenced based on mosaics built with the adjusted and spliced images with the least cloudiness used in previous censuses.

Minimization of areas with no information

The constant presence of clouds over the Colombian Territory makes it difficult to collect images free from clouds; on the other hand, since May 2003 there is failure in the LANDSAT 7 ETM+ Scanning Lineal Corrector (SLC). This failure produces loss of information in the image calculated in 16 %, which is gradually reduced towards the centre of the scene. To minimize this loss of information, a permanent monitoring of the images captured by the different satellites is done, so as to replace the cloudy areas with areas free from clouds from other images; every segment of image used is analyzed as an individual image and this enables a greater coverage in the zones of interest.

The minimization of areas without information corresponding to the gaps in the Landsat 7 ETM+ SLC-off images is adjusted in a way similar to that of the images with clouds; in this case, images free from gaps or Landsat images of different dates with gaps superposed one over the other are used.

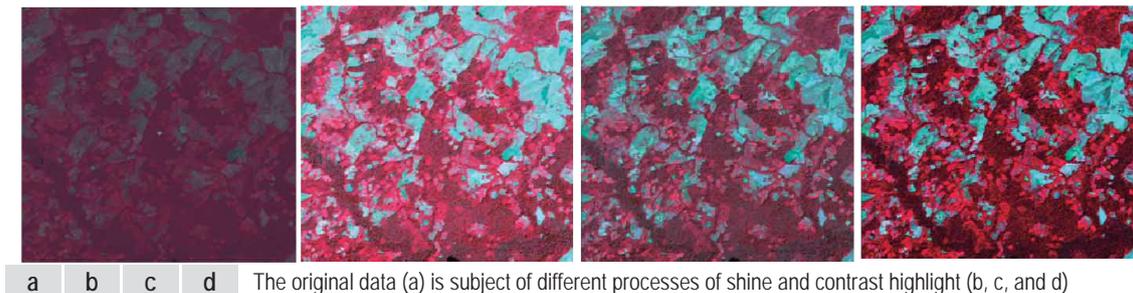
Figure 36. Example of minimization of areas with no information.



Radiometric and spatial enhancements

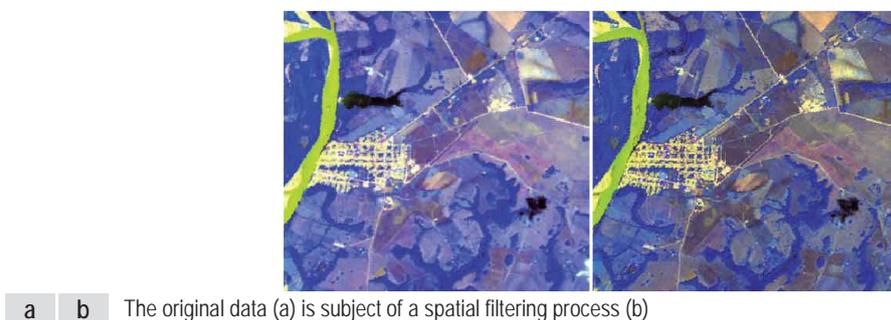
The radiometric enhancement is aimed at improving the spectral contrast of the data to facilitate and optimize the visual interpretation.

Figure 37. Example of radiometric enhancement.



To improve the spatial characteristics of an image, several filters are used to modify the value of the pixels, using the values of the neighbour pixels; this is to highlight lineal elements such as hydrographical and road networks present in the image.

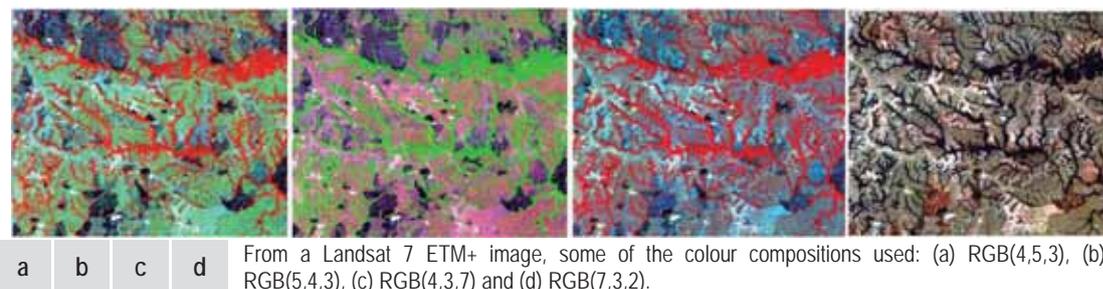
Figure 38. Example of spatial enhancement.



Colour compositions

The multi-spectral images capture information in several ranges of the electromagnetic spectrum; in this way, it is easy to use them either in gray scale or by using colour combinations by means of assigning bands. The composition of the spectral bands depends on the objective of the interpretation; different compositions highlight certain characteristics or image data.

Figure 39. Example of different colour compositions.



Visual interpretation of coca fields

The characteristics of the Colombian territory make it impossible to establish a fixed crop calendar; this, together with the spectral characteristics of coca cultivation that in its different phenological states superpose with other vegetable land covers, does not allow the use of a supervised classification to obtain of coca fields. The identification of coca fields is based on the visual interpretation of the satellite images according to: spectral characteristics, interpretation elements (shade, shape, texture, pattern), geographical environment and the specific characteristics of the zone. The type of coca in all its vegetative states may be considered as a composition of areas where zones of high and medium foliar density are mixed with those of low foliar density, characterized by a high reflectivity of the lands; this causes the spectral response of a coca field to be in a wide range.

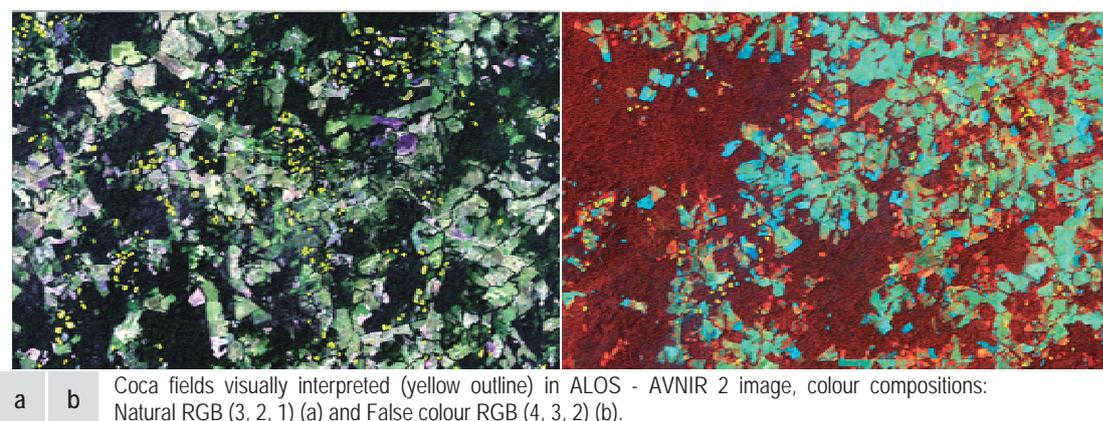
The interpretation of coca fields considers the three stages:

- 1- Preliminary interpretation of coca fields
- 2- Verification overflights
- 3- Edition.

Preliminary interpretation of coca cultivation

The process of preliminary visual interpretation is based on: the elements mentioned before, the analysis of the historical series of coca and of the secondary information as aerial pictures, information provided by different agencies of the Government and the United Nations, information on aerial spraying and manual eradication.

Figure 40. Visual interpretation



Verification overflights

Verification overflights are necessary to validate and adjust the interpretation. This verification is based on direct visual inspection of the terrain from an aircraft. Graphic outputs of satellite images (scale 1:70,000) are used for orientation and as record of the verification, where coca plots and cultivation nucleuses are identified, as well as other land covers.

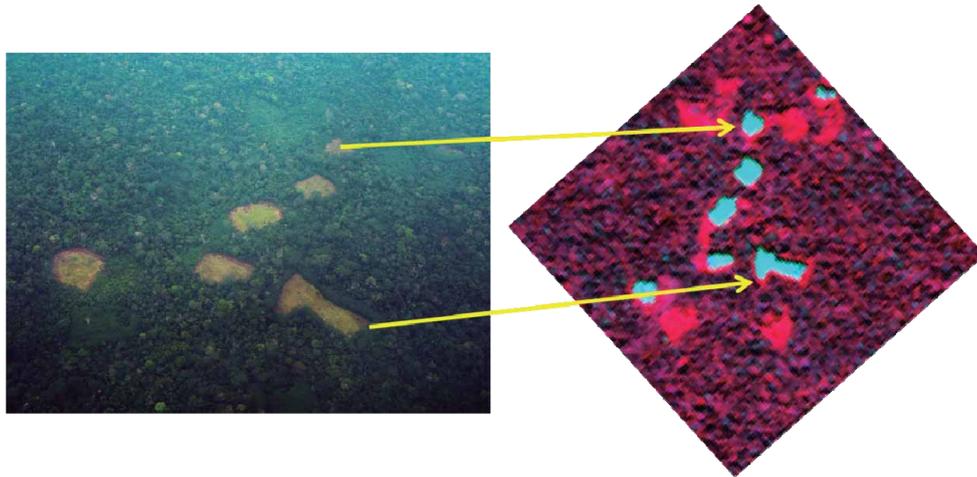
The planning of overflights is guided in four main aspects: general monitoring, verification of changes in the densities of cultivations, monitoring of open areas in the previous census and expansion zones. Verifications are done with 5-mile sweepings and an average of 3,000 feet of height.

Besides from the visual inspection from the aircraft, a digital camera combined with GPS and a video camera are used to provide additional information to confirm the preliminary lots that were detected. Verification overflights are supported by the DIRAN. For the preparation of the coca cultivation census 2011, 14 missions were done, with duration of 172 flight hours.

3.3 Edition

The information collected in the verification overflights is used to adjust the preliminary interpretation, taking into account the moment in which the images were taken; once this adjustment has been carried out, the interpretation file of coca fields is obtained.

Figure 41. Photographic record of verification overflights and its equivalent in satellite image.



Map 24. Study area distributed by region and coca cultivation in Colombia, 2011



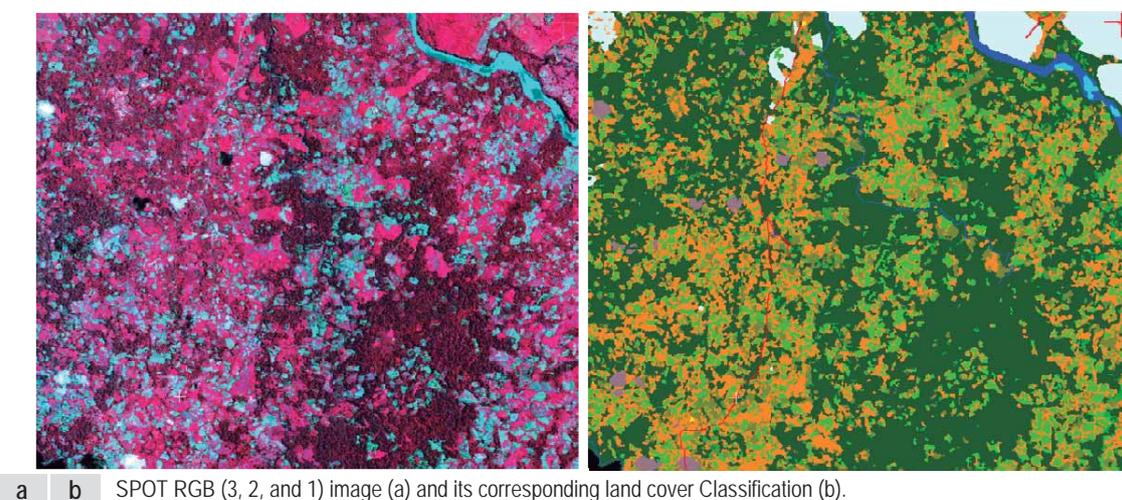
Sources: Government of Colombia, for coca cultivation National monitoring system supported by UNODC; for 1:100.000 grid IGAC. The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

Digital classification of land covers and land use.

In addition to coca cultivation, other land covers are interpreted in the coca regions, according to the legend adapted by the project. These covers are used to conduct the annual multi-temporal analysis, whose objective is to determine the dynamic of coca cultivation in relation to the other covers.

This process is done by means of a supervised classification, in which the cover pixels known are used in training areas to classify all the pixels of the image. The algorithm used is that of the maximum probability that applies a probabilistic model in the formulation of rules of assignment of value to the pixels. 11 of the types of established legend are obtained in this process: Primary forests and rainforest, secondary forests, grasses and low stubble, high stubble, bare lands, other cultivations, rocky outcrops, sandbanks, flooded areas, clouds and gaps; not included: water bodies, roads or urban areas that correspond to lineal covers; coca fields that have a different management.

Figure 42. Digital classification of land covers.



3.2 AJUSTMENTS AND ESTIMATES

The interpretation of satellite images is complemented with the application of a series of corrections that improve the data, reduce the error associated to the lack of information and differences between the date of the image and the cutting date of the census.

Adjustment due to forced manual eradication

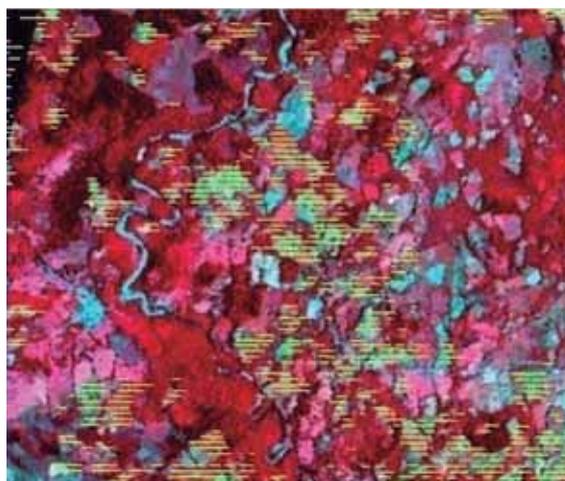
As part of the coca eradication activities, the cultivations are manually uprooted and their coordinates are recorded and informed to UNODC. Then the corresponding corrections are made, depending on the date of the image and the date of the eradication. When the eradication is done before the date of the image and before the cutting date of the census, the eradicated plots are not considered in the interpretation. When the eradication is done after the date of the image, the coca plots that appear in the coordinates reported are suppressed because they will not exist by the cutting date of the census.



Coca plots that were manually eradicated (after the date of the image) in white.

Adjustment due to aerial spraying

Coca fields are sprayed from aircrafts as part of the illegal crops aerial spraying programme. The spraying lines are automatically recorded. After transforming its coordinates into the coordinate system of satellite images, a buffer is outlined around the recorded spraying line according to the type of aircraft. The buffers are superposed on the coca fields interpreted and the corrections are done considering the date of the image and the date of the spraying, as follows: all coca plots interpreted from the images acquired before the spraying are eliminated and the estimate survival percentage of the sprayed cultivation is added to the final statistics. According to the DIRAN, in 2011 the survival was 2.0 %.



Coca cultivation with aerial spraying lines in Yellow.

Adjustment due to differences in the dates of image collection

In the satellite images only fields that are there on the date of the collection can be seen. Hence, a correction factor has to be applied to get the estimate in the cutting date of December 31. This factor is calculated as a monthly increase or decrease rate according to the tendency of coca cultivation in the images of the same area used in consecutive censuses. This rate is applied after the initial interpretation for the number of months between the collection date and the cutting date December 31, and to calculate the area of coca that must be added or subtracted from the final statistics.

Estimation in areas without information

Clouds and shades are reduced as much as possible using several images from the same zone and forming mosaics that reduce the area without information. In 2011, an effective coverage of 85% was achieved. This means that from the entire area affected by the presence of coca cultivation, 15% had restrictions due to lack of information; this percentage is strongly concentrated in the departments of Nariño, Norte de Santander, Choco and Cordoba.

To correct the effect in zones where it is definitely impossible to collect satellite images, these zones are delimited during the process of land cover classification; subsequently, rings are traced around the zones without information present in the images and the coca cultivation around these rings is measured (buffer). As compared to the coca fields in the previous census, the trends of coca cultivation are estimated in the area under the buffer in which there is information in the two years. This trend is applied to the area under coca cultivation detected in the previous census and covered by clouds in the current census to estimate the coca cultivated underneath the clouds in the current census. The coca fields identified in the previous census that are under the clouds or gaps in the current census are kept in position and size, when the tendency indicates an increase in the surrounding area.

Estimation of small fields

The SIMCI project, from the analysis of the historical series of coca cultivation, has established the existence of a trend to reduce the average size of coca fields in Colombia (from 2 hectares in 2000 to 0.67 in 2011), as a change in the typology of cultivation. Although the phenomenon is significant in the proportion of the total number of fields detected (from 2.8% in 2000 to 21.5% in 2009), this does not imply a proportional increase in the total area reported (0.1% to 4.8% in the same period). Nevertheless, the inclusion of this kind of plots in the data of the census is considered a valuable contribution to improve accuracy.

The medium spatial resolution of the images used in the coca cultivation census limits the detection of the areas smaller than 0.25 hectares. The estimate of small plots is aimed at including in the census the proportion and significance of the plots that may not be detected due to the limitations previously mentioned. To facilitate the comparison, the historical series was adjusted, applying the estimation of small fields.

A regular systematic sample framework was used in the zones with historical presence of coca cultivation with 20km² evaluation surfaces separated 20 km from one another. Coca cultivation was interpreted in complementary images of high spatial resolution and was compared with the interpretation done in the 2009 census.

An analysis of conglomerates was done, in which the parameter to model is the proportion of small fields in each one of the conglomerates. The areas interpreted were crossed with the master framework of 1km * 1km grids to determine the number of elements within the conglomerate. Finally, with the aim of controlling the variability, the analysis was stratified by region. The real land cover of each one of the grids in the conglomerate was verified, eliminating those with a percentage lower than 50% of cover in the grid³⁶.

Verifying the variation between conglomerates in each region, homocedasticity was found in every region; this is to say that the behaviour of variation among conglomerates is controlled for each one of the stratum. There are significant differences between regions and thus this stratification factor is significant for the analysis of the information

³⁶ Criterion of inclusion of grids observation units.

Table 46. Tests of differences in means by Duncan grouping

Means with the same letter are not significantly different				
Duncan Grouping	Media	N	Region	
	A	0.37442	117	Central
	B	0.22041	104	Pacific
	B	0.20872	88	Putumayo - Caqueta
C	B	0.14498	76	Guaviare - Meta
C		0.09577	42	Orinoco

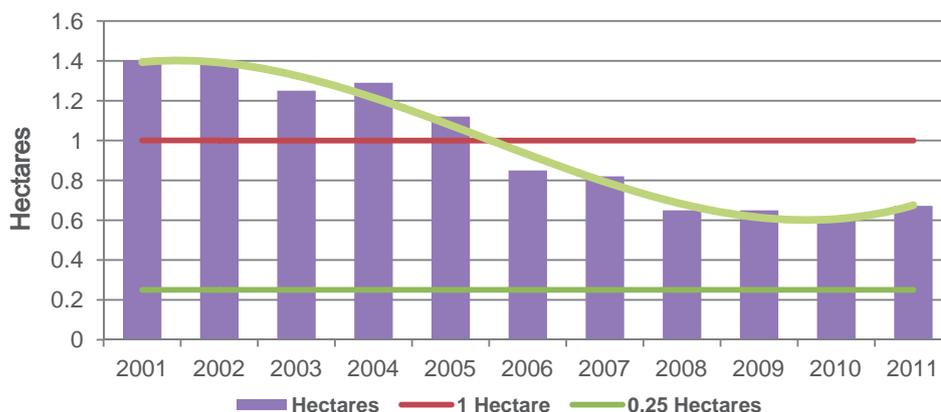
The estimate is determined by the proportional pondering of the area of coca found in the conglomerate with respect to the area of coca found in the region; this pondering affects the parameter of proportion of areas of coca smaller than 0.25 hectares in the conglomerate; it is expressed by:

$$F_i = \sum_{i=0}^n \sum_{j=0}^n \frac{A_j}{A_r}$$

A_j= Area of coca fields smaller than or equal to 0.25 in the region. J=1,2,3,4,5,.....,n.
 A_i= Area of fields identified as having coca in the region. I= 1,2,3,4,5,6.

The previous analyses show that the sizes of the sample are acceptable and guarantee homogeneity of variation per region; this establishes the pondered average behaviour of the conglomerates as the behaviour of the parameter in the region

Figure 43. Distribution of the average plot in the census series



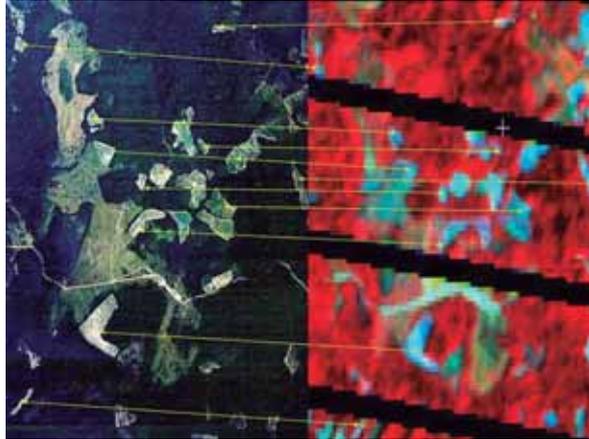
3.3 EVALUATION OF THE PRECISION

The data is submitted to a quality control system that includes the estimation of precision in two aspects: the geometrical precision, which is the precision of the limits interpreted and the thematic precision that measures the reliability in the identification of type of land covers. The difficulty to obtain accurate ground truth data is still the main barrier for the evaluation of the quality of interpretation; the precision studies have been done at the case level. The main conclusions are the following:

The images are geo-referenced based on the geo-referenced mosaic. In the case of LANDSAT 7 ETM+ images, there may be a deviation in maximum position of the order of 1/10 elevation difference in mountainous zones.

The general thematic quality is specified in terms of an error matrix, according to the frequency (probability) of a wrong classification of the different classes. The compilation of the error matrix must be based on a random representative sample. Although the thematic quality is a good indicator of the interpretation quality, this does not provide a range of results and hence it cannot be used to correct the results.

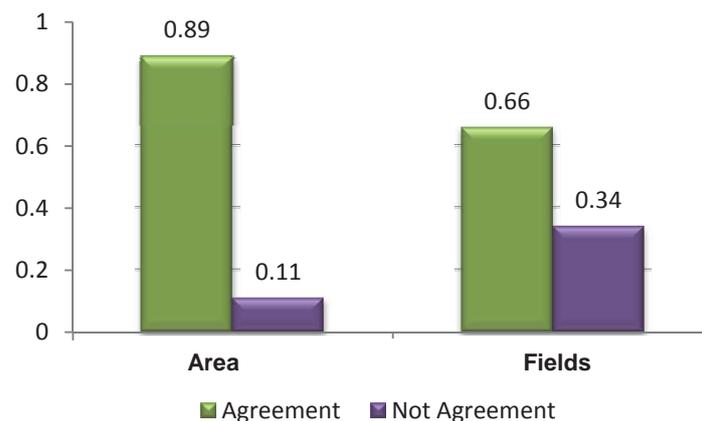
A study conducted during 2008 with medium scale aerial pictures compared to the results of the interpretation in LANDSAT 7 and ALOS satellite images taken in similar dates in the zones of Vista Hermosa (Meta) and Caceres (Antioquia), led to two main conclusions: that field recognitions ostensibly improve interpretation and that the experience of the interpreter in a specific region has a positive effect on the final result. Although area measurements show that the sub estimation and overestimation errors compensate for each other both at the geometrical and thematic levels, the data shows a need to go deeper in the process of adaptation of the interpretation methodology to the new challenges of using images other than Landsat. For this, the project has implemented pilot studies with DEIMOS, RAPIDEYE and ALOS images.



a b Comparison of the interpretation of coca fields (delimited in yellow) in aerial picture (a) and satellite image (b).

During 2011, based on the assumption that the fields eradicated by the GME were coca fields at the moment when the image was taken, the project did an assessment of the thematic precision between the areas reported by the GME with the coca plots detected by SIMCI for the region of Nariño in the first phase of 2011. It is important to note that the records of GME do not have a census character, and that there may be coca fields that are not intervened and hence not recorded; in this sense, the exercise only evaluates the precision of the user. In other words, the omission errors may not be detected.

Figure 44. Concordance between SIMCI interpretation and GME records



Results show that SIMCI detected coca cultivation in 65% of the fields eradicated by GME; 89% of the area is in these fields, which leads to the conclusion that the thematic precision is greater in bigger plots.

The analyses conducted in function of the type of association present in the plot or the state of the cultivation did not show significant differences in the thematic precision; in consequence, from the great variety that may be in coca cultivation, none is systematically excluded in the detection done by the SIMCI project.

Table 47. Thematic coincidence per area

Area		SIMCI	
		Yes	No
GME	Yes	1,628	200
	No	n,a	n,a

A more detailed approach enabled the conclusion that there are no significant differences with respect to the age of the plots, with 87% in the concordance of young fields (less than 6 months) and 89% in the rest. As regards to the sowing density, the differences were not significant: 85% for low sowing densities and 91% for high densities.

Finally, the analysis with respect to the size of fields detected a strong relation between the detection and the area of the fields; the concordance is 90% when the fields are larger than 2,700 m² and 49% when they are smaller. This shows a strong incidence of the type of image used, which may be overcome by the use of images of greater spatial resolution and the application of correction factors.

3.4 METHODOLOGY FOR PRODUCTION AND YIELD ESTIMATION

To calculate the potential of cocaine production in Colombia, three main steps are considered: Conversion of coca leaf into coca paste commonly done by farmers; the conversion of coca paste into cocaine base and the industrial process to get cocaine hydrochloride. The two first steps are covered by productivity studies, while the third one is covered from data published by the government of the United States.

The methodology applied in the productivity studies is multistage sampling based on the master framework of areas³⁷. It is important to underscore that the methodology used, since it is probabilistic, enables the extrapolation of the information of the sample to the total population. Given that the universe of producers is not known, the reference is the location of coca fields that comes from the annual censuses conducted by SIMCI; the census becomes the population universe and it is called Area Framework. The statistical units of observation are the following: i) Primary Sampling Unit (UPM), it is related to the grids found in the statistical framework, ii) Secondary Sampling Unit (USM) corresponds to the coca plots identified in each one of the UPM; iii) Tertiary Sampling Unit (UTM) are the plots selected in the coca field. The observation unit coincides with the USM. The crop test is conditioned only to productive fields.

The sampling framework is built from the coca censuses and a sample design is applied according to the following:

Probabilistic: Each UA (coca field), has a known probability and different from zero, of being included in the sample.

Stratified: The first stratification level is given by the land use cover. The grids (UPMs) are classified in the strata Cultivation (1), Mixed Cultivation (2), Grasses (3), Natural forests and Other uses (4), from the information in the land use cover of SIMCI/UNODC.

Three-stage: In the first stage, the Primary Sampling Units (UPMs) are selected systematically, which are the 1 km * 1 km grids that were selected with Size-Proportional Probabilities (PPT) of the surface under coca cultivation in these units. In the second stage, the Secondary Sampling Units (USMs) are systematically selected, comprised by the coca fields within the UPMs (grids) of the first stage, which were designed with PPT of their area cultivated with coca. In the third stage, the Tertiary Sampling Units (UTMs) are randomly selected (called plots), from the USMs included in the second stage sample. Two plots are selected; they are 5m rectangles, squares or trapeziums, with a surface similar to the one mentioned. In each one of these plots, crop tests are done to measure and weight fresh coca leaves.

³⁷ The Area Master Framework is a construction of 1 km x 1 km areas, with a unique and unrepeatable for the entire national territory.

Until 2011, two phases of these studies were completed throughout the national territory; the third phase started and will be completed in 2014. A total of 3,105 farmers were interviewed, distributed as follows: 1,389 surveys applied in the phase I, which was the baseline for the entire national territory; 1,356 interviews were developed in the phase II, rotating the regions between 2007 and 2011; and 360 surveys were applied to begin phase III in the northern region of the country.

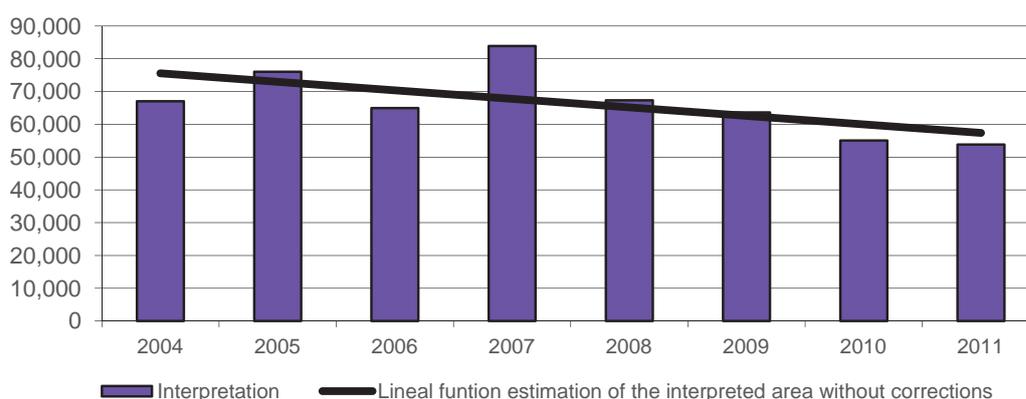
The methodological process includes interviews to coca leaf growers and crop tests based on the guidelines of the United Nations Manual. UNODC/SIMCI and the Government of Colombia began the studies to assess the contents of alkaloid in the coca leaf and the efficiency of laboratories, considering that until now, the data of these two indicators is based on reports from the United States' government.

Appendix 1: Estimate by zones without information, aerial spraying and date when the image was taken in 2011

The census in 2011 is affected by a particularly strong winter that gave origin to high cloudiness throughout the country; as a consequence, the interpretation effort increased in 51% to achieve 85% coverage of the national territory. The departments with the least satellite coverage were Cordoba, Cundinamarca, Caldas, Nariño and Boyacá, reason why the data in these zones must be carefully analyzed. The change relation between 2010 and 2011 in zones with information from the two years is 1.05, which is adjusted to the relation including corrections of 1.04.

The figure 45 shows the area under coca cultivation interpreted in the satellite images and their tendencies, without the estimates applied to calculate the national figure.

Figure 45. Interpretation of coca cultivation without adjustment, 2004 -2011



The weight of the estimates applied in the different censuses throughout the historical series varies between 11% in 2005, to 17% in 2004, 2006 and 2008. In 2011, more than half these corrections are concentrated in the department of Nariño, where the conditions of cloudiness were most adverse. At the national level, the incidence of corrections adds up to 15% in relation to the 64,000 hectares reported and the 9.6% excluding Nariño.

Table 48. Historical series of Adjustments, 2005-2011

Year	2005	2006	2007	2008	2009	2010	2011
Area Estimation without information	6,362	8,418	8,357	9,962	6,177	5,492	8,843
Correction of Age of the image	1,020	1,135	-917	391	371	-119	936
Correction of aerial spaying	2,315	3,349	7,625	3,266	2,843	1,378	159
Total	9,697	12,902	15,065	13,619	9,391	6,752	9,938
Percentage/census	11	17	15	17	14	11	15
Area interpreted in hectares	76,053	64,968	83,888	67,334	63,634	55,061	53,826
Area reported in hectares	86,000	78,000	99,000	81,000	73,000	62,000	64,000

Table 49. Estimation by zones without information, aerial spraying and date when the image was taken in 2011

Department	Interpretation Ha	Corrections			Census 2011 Ha
		Areas without information Ha	Aerial spraying Ha	Temporality Ha	
Amazonas	121	2	0	-1	122
Antioquia	2,827	264	5	8	3,104
Arauca	133	0	0	-1	132
Bolivar	2,000	206	1	0	2,207
Boyaca	64	29	0	0	93
Caldas	40	4	0	2	46
Caqueta	3,190	35	58	44	3,327
Cauca	4,775	1,213	14	64	6,066
Cesar	2	0	0	0	2
Choco	1,986	499	29	-3	2,511
Cundinamarca	5	13	0	0	18
Cordoba	871	212	7	-1	1,088
Guainia	246	19	0	53	318
Guaviare	6,540	289	2	8	6,839
La Guajira	15	1	0	0	16
Magdalena	44	0	0	1	46
Meta	2,953	80	0	7	3,040
Nariño ³⁸	11,779	5,316	0	136	17,231
Norte de Santander	2,863	133	0	494	3,490
Putumayo	9,749	160	43	0	9,951
Santander	428	167	0	0	595
Valle del Cauca	897	82	0	2	981
Vaupés	247	30	0	0	277
Vichada	2,049	90	0	125	2,264
Total	53,826	8,843	159	936	63,764

³⁸ Problems can cause cloudiness in Nariño ranges of variability greater than ed the other departments and therefore the information should be used cautiously

Appendix 2: List of satellite images used in the 2011 coca census

LANDSAT 7 ETM+		
PATH	ROW	Acquisition date (dd/mm/yyyy)
3	58	01/01/2012
3	59	30/11/2011 – 01/01/2012
4	56	08/01/2012 – 24/01/2012
4	57	08/01/2012
4	58	17/08/2011
4	59	17/08/2011
4	60	17/08/2011 – 10/09/2011
4	62	18/09/2011
4	63	18/09/2011
5	56	30/12/2011 - 16/02/2012
5	57	09/09/2011-14/12/2011-30/12/2011-16/02/2012
5	59	31/01/2012 – 16/02/2012
5	60	24/06/2011
5	61	09/09/2011
6	55	02/10/2011 - 22/01/2012
6	56	22/01/2012
6	57	22/01/2012
6	58	22/01/2012
6	59	22/01/2012
6	60	22/01/2012
6	61	22/01/2012
6	62	22/01/2012
7	54	07/09/2011
7	55	07/09/2011 – 25/10/2011
7	56	29/01/2012 – 14/02/2012 – 17/03/2012
7	57	25/10/2011 – 01/03/2012
7	58	14/02/2012 – 17/03/2012
7	59	14/02/2012
7	60	14/02/2012
7	61	14/02/2012
8	52	16/10/2011 - 03/12/2011 - 20/01/2012
8	53	14/09/2011 - 20/01/2012
8	54	14/09/2011 - 20/01/2012- 21/02/2012
8	55	20/01/2012- 21/02/2012
8	56	21/02/2012
8	57	21/02/2012
8	58	05/09/2011
8	59	20/08/2011 - 14/09/2011 – 01/11/2011 – 21/02/2012
8	60	21/08/2011
9	52	26/12/2011
9	53	26/12/2011
9	54	23/10/2011 – 28/2/2012
9	55	04/08/2011 – 21/09/2011 - 28/02/2012- 31/03/2012 – 16/04/2012
9	56	24/08/2011 – 15/03/2012
9	57	04/08/2011
9	58	05/08/2011 - 11/01/2012 – 22/01/2012
9	59	20/08/2011 -14/09/2011
9	60	21/11/2011 – 10/12/2011
10	54	27/08/2011 – 22/03/2012
10	55	27/08/2011 - 19/02/2012
10	56	27/08/2011
10	57	23/04/2011 – 23/05/2011 - 18/01/2012
10	58	19/02/2012
10	59	17/12/2011 – 19/02/2012 – 06/03/2012
TOTAL		94

LANDSAT 5 TM		
PATH	ROW	Acquisition date (dd/mm/yyyy)
4	57	10/09/2011
4	61	10/09/2011
4	62	10/09/2011
4	63	10/09/2011
5	58	17/09/2011 – 03/10/2011
5	61	01/09/2011
5	62	01/09/2011
6	61	07/08/2011
7	60	30/08/2011
7	61	30/08/2011
8	60	21/08/2011 – 22/09/2011
10	56	07/11/2011
TOTAL		14

SPOT 4	
K - J	Acquisition date (dd/mm/yyyy)
644-335	02/09/2011
645-333	27/02/2012
645-334	27/02/2012
645-335	27/02/2012
645-336	27/02/2012
TOTAL	5

Appendix 3: Coca cultivation in Indigenous Territories 2011

REGION	INDIGENOUS TERRITORIES	HECTARES IN 2010	HECTARES IN 2011
Amazon	ADUCHE	14	0
	ALMIDÓN LA CEIBA	3	2
	ARARA, BACATÍ, CARURU Y MIRAFLORES	34	64
	ARRECIFAL	2	0
	BACHACO BUENAVISTA	11	11
	BAJO RIO GUAINIA Y RIO NEGRO	0	0
	CARANACOA YURI-LAGUNA MOROCOTO	13	17
	CARPINTERO PALOMAS	7	4
	CHIGUIRO	2	1
	CUENCA MEDIA Y ALTA DEL RIO INIRIDA	135	69
	CUMARAL-GUAMUCO	18	0
	EL VENADO	2	0
	LAGUNA NIÑAL, COCUY, LOMA BAJA Y LOMA ALTA DEL CYEAR	32	3
	LAGUNA-CURVINA SAPUARA	2	0
	LA PASCUA	0	1
	LOS IGUANITOS	0	3
	MEREY, LA VERAITA	0	1
	MINITAS - MIRALINDO	3	1
	MIRITI-PARANA	1	0
	MONOCHOA	9	0
	MURCIELAGO ALTAVISTA	1	0
	NUNUYA DE VILLAZUL	9	1
	PARTE ALTA DEL RIO GUAINIA	40	3
	PREDIO PUTUMAYO	208	131
	PUEBLO NUEVO-LAGUNA COLORADA	16	17
	PUERTO ZABALO-LOS MONOS	21	5
	REMANSO CHORRO BOCON	14	8
	RIO ATABAPO	2	0
RIOS CUIARI E ISANA	10	2	
TONINA-SEJAL-SAN JOSE-OTROS	35	0	
VAUPES	513	46	
YAIGOJE-RIO APAPORIS	28	0	
Central	ALTO SINU, ESMERALDA CRUZ GRANDE E IWAGADO	266	285
	ANDABU	4	0
	GABARRA-CATALAURA	9	6
	JAI-DUKAMA	4	0
	MAJORE-AMBURA	8	11
	MOTILON - BARI	35	59
	QUEBRADA CAÑAVERAL	0	0
	RIO CHAJERADO	0	2
	SEVER	0	0
	TAGUAL-LA PO	2	0
	UNIDO UWA	0	1
	YABERARADÓ	4	2
YU YIC KWE	0	9	
Guaviare - Meta	BARRANCO CEIBA Y LAGUNA ARAGUATO	56	42
	BARRANCO COLORADO	19	15
	BARRANCON	0	1
	BARRANQUILLITA	34	5
	CYEAR JABON	2	3
	CYEAR NEGRO	0	0
	CYEAR OVEJAS (BETANIA- COROCITO)	2	2
	CHARCO CAIMAN	9	4
	COROCORO	21	6
	EL TIGRE	28	16
	LA ASUNCION	1	3

REGION	INDIGENOUS TERRITORIES	HECTARES IN 2010	HECTARES IN 2011
	LA FUGA	2	4
	LA SAL	0	2
	LA YUQUERA	45	52
	LAGOS DEL DORADO LAGOS DEL PASO Y EL ROMANSO	199	161
	LLANOS DE YARI (YAGUARA II)	0	0
	MACUARE	22	21
	MORICHAL VIEJO, SANTA ROSA, CERRO CUCUY, SANTA CRUZ ...	0	129
Guaviare - Meta	NUKAK MAKU	28	195
	PUERTO NARE	14	14
	PUERTO VIEJO Y PUERTO ESPERANZA	5	3
	SIKUANI DE DOMO PLANAS	6	4
	TUCAN DE CYEAR GIRIZA LA PALMA	10	13
	VUELTA DEL ALIVIO	12	14
	YAVILLA II	0	10
	ALTO UNUMA	312	269
	ANGOSTURAS	5	0
	CALI-BARRANQUILLA	6	10
	CHOCON	2	3
	CIBARIZA	6	15
	CONCORDIA	3	1
	FLORES SOMBRERO	0	2
	GUACAMAYAS MAMIYARE	2	4
	GUACO BAJO Y GUACO ALTO	16	7
	KAWANERUBA	1	0
	LA ESMERALDA	2	0
	LA LLANURA	8	4
	LAGUNA TRANQUILA	1	0
	PUNTA BANDERA	8	0
	RIOS MUCO Y GUARROJO	5	8
	RIOS TOMO Y WEBERI	5	0
	SAN JOSE DE LIPA O CYEAR COLORADO	3	0
	SAN LUIS DEL TOMO	1	3
	SANTA TERESITA DEL TUPARRO	68	79
	SARACURE Y RIO CADA	134	112
SELVA DE MATAVAN	128	59	
SIKUANI DE IWIMI	1	0	
VALDIVIA	2	3	
VALLES DEL SOL	3	0	
Pacific	AGUACLARA Y BELLA LUZ DEL RIO AMPARÁ	14	6
	ALMORZADERO, SAN ISIDRO Y LA UNIÓN	7	7
	ALTO BONITO VIRA VIRA	3	7
	ALTO DEL RIO MUGUINDO	1	3
	BAJO GRANDE	8	0
	BELLAVISTA Y UNION PITALITO RIO SIGUIRI SUA-DOCAMPADO	26	3
	BETE-AUROBETE Y AURO DEL BUEY	1	0
	CALLE SANTA ROSA RIO SAIJA	116	163
	CUASCUABI-PALDUBI	0	2
	CHAGPIEN	3	0
	CHAGUI CHIMBUZA	11	9
	CHIDIMA TOLO	0	2
	CHIGORODO MEMBA	1	0
	CHINGUIRITO MIRA	24	52
	CHONARA HUENA	1	2
	CUAIQUER INTEGRADO LA MILAGROSA	10	10
	CUAMBI - YASLAMBI	9	4
	CUASBIL - LA FALDADA	13	8
	CUAYQUER DEL ALTO ALBI	136	183
	CUCHILLA-PALMAR	3	5
	DEARADE BIAKIRUDE	1	3
	DOMINICO-LONDOÑO-APARTADO	12	2

REGION	INDIGENOUS TERRITORIES	HECTARES IN 2010	HECTARES IN 2011
	EL CEDRO, LAS PEÑAS, LA BRAVA, PILVI	131	83
	EL GRAN SABALO	311	219
	EL SANDE	208	148
	GEGORÁ, QUIPARÁ, MURANDÓ, TIRAVENADO Y JIGUADÓ	4	4
	GRAN ROSARIO	349	350
	GUALCALA	18	14
	GUADUAL, CUMBAS, MAGUI, INVINA Y ARRAYÁN	0	1
	GUAYACAN - SANTA ROSA	0	1
	GUELNAMBI-CARYEAR	9	7
	HONDA RIO GUIZA	24	19
	INDA ZABALETA	212	244
	Pacific	INFI	10
INTEGRADO EL CHARCO		20	57
ISALA DEL MONO		0	8
JURADO		6	21
LA FLORESTA - LA ESPYEARLA		0	3
LA FLORESTA-SANTA ROSA Y SAN FRANCISCO		62	93
LA IGUANA		3	38
LA RAYA		2	0
LA TURBIA		199	303
LA UNIÓN CHOCO - SAN CRISTOBAL		1	1
MAIZ BLANCO		0	0
MANDIYACO		0	0
MORRITO		1	0
MURRI - PANTANOS		0	3
NUNALBÍ ALTO ULBÍ		16	13
NUSSI PURRU		5	6
PAINA		0	0
PATIO BONITO		0	1
PERANCHITO		4	0
PERANCHO		4	0
PIALAPI - PUEBLO VIEJO - SAN MIGUEL - YARE		1	0
PICHICORA, CHICUE, PUERTO ALEGRE		0	2
PIEDRA SELLADA-QUEBRADA TRONQUERIA		1	24
PIGUAMBI-PALANGALA		6	17
PIPALTA PALBI YAGUAPI		17	18
PLANADAS TELEMBI		58	84
PLATA BENDITA		0	11
PLATITA SAN FRANCISCO		0	3
PUADO, MATARE, LA LERMA Y TERDO		24	6
PUERTO ALEGRE Y LA DIVISA		5	24
PUERTO LIBIA TRIPICAY		3	0
PULGANDE CAMPOALEGRE		24	21
QUEBRADA GRANDE		3	1
QUEBRADA QUERA		3	6
RAMOS-MONGON-MANCHURIA		4	0
RIO GARRAPATAS		11	29
RIO GUANGUI		42	80
RIO NAYA		2	7
RIO ORPUSA		1	0
RIO PATO Y JENGADO		1	0
RIO PAVASA Y QUEBRADA JELLA		14	6
RIO PUERRICHA	15	51	
RIO QUIPARADO	5	0	
RIO SATINGA	18	39	
RIO SIARE	5	0	
RIOS CATRU - DUBASA Y ANCOSO	48	120	
RIOS JURUBIDA-CHORI Y ALTO BAUDO	24	18	
RIOS PATO Y JENGADO	0	1	
RIOS TORREIDO Y CHIMANI	13	60	

REGION	INDIGENOUS TERRITORIES	HECTARES IN 2010	HECTARES IN 2011
	RIOS UVA Y POGUE – QUEBRADA TABARAL	0	1
	SABALETERA SAN ONOFRE Y EL TIGRE	3	3
	SALAJUI Y PAVARANDO	8	0
	SAN AGUSTIN-LA FLORESTA	2	1
	SAN RAFAEL	1	3
	SANANDOCITO	20	4
	SANQUIANGA	0	1
	SANQUININI	4	9
	SANTA CECILIA DE LA QUEBRADA ORO CHOCO	1	8
	SANTA MARIA DE PANGALA	4	6
	SANTA ROSA SUCUMBIOS EL DIVISO	6	13
	SAUNDE GUIGUAY	225	149
	TOGOROMA	1	0
	TORTUGAÑA, TELEMBI, PUNDE, PITADERO, BRAVO, TRONQUERIA	78	73
	TRONQUERIA PULGANDE PALICITO	39	29
	YARUMAL Y EL BARRANCO	1	0

REGION	INDIGENOUS TERRITORIES	HECTARES IN 2010	HECTARES IN 2011
Putumayo – Caqueta	ALBANIA	0	4
	AGUA NEGRA	11	7
	AGUANEGRA	27	46
	AGUAS NEGRAS	1	0
	ALTO LORENZO	2	10
	ALTO ORITO	4	5
	ALPAMANGA	0	1
	AWA DE CAÑAVERAL	8	0
	BELLA VISTA	2	13
	BLASIAKU	1	2
	BUENAVISTA	31	46
	CAICEDONIA	4	20
	CALARCA	37	85
	CALENTURAS	6	9
	CAÑAVERAL	0	37
	CAMPO ALEGRE DEL AFILADOR	2	5
	CECILIA COCHA	1	9
	CONSARA-MECAYA	6	10
	COROPOYA	1	6
	CUSUMBE-AGUA BLANCA	2	0
	DAMASCO VIDES	2	19
	EL CEDRITO	0	1
	EL DESCANSO	0	3
	EL ESPINGO	4	23
	EL HACHA	22	32
	EL PORVENIR - LA BARRIALOSA	5	12
	EL PORTAL	0	2
	EL QUINCE	0	4
	EL TABLERO	3	6
	EL TRIUNFO	1	5
	GETUCHÁ	0	1
	HERICHA	9	3
	HONDURAS	0	0
	JÁCOME		2
	JERICÓ -CONSAYA		27
	JERUSALÉN- SAN LUIS ALTO PICUDITO	0	36
JIRIJIRI	3	3	
LA AGUADITA	2	17	
LA CRISTALINA	0	2	
LA ESPERANZA	0	3	
LA FLORIDA	1	0	

LA ITALIA	2	5	
LA PAYA	0	5	
LA SIBERIA	0	3	
LA TEOFILA	0	2	
LOS GUADUALES	2	4	
MATICURU	0	0	
NIÑERAS	1	20	
NUEVO HORIZONTE	0	0	
PLAYA LARGA	0	29	
PUERTO NARANJO-PENAS ROJAS-CUERAZO-EL DIAMANTE	2	8	
SAN ANDRES - LAS VEGAS - VILLA UNION	6	40	
SAN ANTONIO DEL FRAGUA	0	5	
SAN LUIS	6	13	
SAN MIGUEL	0	6	
SAN MIGUEL DE LA CASTELLANA	0	11	
SANTA ROSA DEL GUAMUEZ	4	11	
SANTA ROSA DE JUNAMBÚ, CAMPO ALEGRE,...	0	23	
SELVA VERDE	1	2	
SIMORNA	4	5	
VILLA CATALINA-DE PUERTO ROSARIO	7	78	
WASIPANGA	0	16	
WASIPUNGO	1	0	
YARINAL (SAN MARCELINO)	5	19	
YURAYACO	1	9	
ZIT-SEL DEL QUECAL	0	0	
Sierra Nevada	ARHAUCO DE LA SIERRA NEVADA	28	9
	KOGUI-MALAYO ARHUACO	44	18
Total area		5,806	6,004

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