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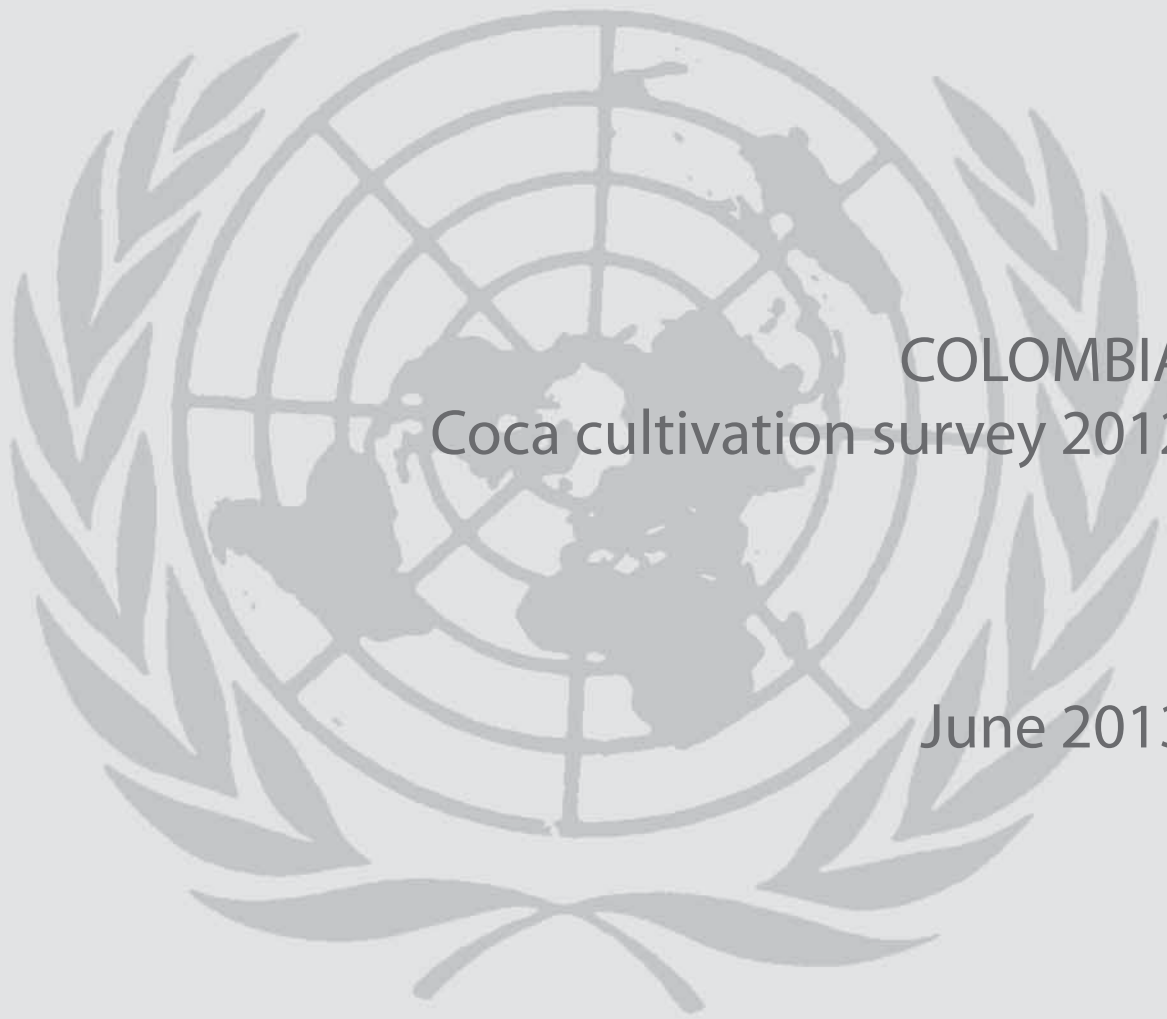
Government of Colombia



# Colombia

## Coca cultivation survey 2012

**June 2013**



COLOMBIA  
Coca cultivation survey 2012

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## Abbreviations

ADAM	Areas of alternative development Municipal
COP\$	Colombian pesos
CLIC	Index of consolidation of zones free from illegal cultivations
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
PRADICAN	Program anti-illicit drugs in the Andean Community
PRELAC	Preventing the diversion of drug precursors in the countries of Latin America and the Caribbean
NPTC	National Plan for Territorial Consolidation
PONAL	National Police
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

## TABLE OF CONTENT

FACT SHEET – COLOMBIA COCA CULTIVATION SURVEY, 2012	7
EXECUTIVE SUMMARY	8
1. INTRODUCTION	10
2. RESULTS	11
COCA CROPS	11
Analysis of the dynamics of coca cultivation	14
Dynamic of the establishment of illicit crops	14
Regionalization of trends 2012	16
Hazard index municipal presence of coca, 2012	17
Deforestation due to coca cultivation	19
Analysys of the regional historical series	22
PRODUCTION OF COCA LEAF, COCA PASTE AND COCAINE BASE	41
Update of the productivity study Putumayo-Caquetá region	41
Potential production of leaf, base and cocaine hydrochloride	47
CHARACTERISATION OF THE AGRICULTURAL GROWERS WITH COCA AND OF THEIR PRODUCTIVE UNITS	51
PRICES	53
Prices of coca leaf	54
Prices of basic paste	55
Prices of cocaine base	56
Prices of cocaine hydrochloride	57
Annual income per hectare under coca cultivation in 2012	58
OPYUM POPY CULTIVATION	60
Production of latex and heroin	61
Prices of latex and heroin	62
RELATED RESEARCH AND STUDIES	63
The market for coca in Colombia: analysis of its imperfections and its determinants	63
Methodology of indicators for the consolidation of the zones free from illegal crops	65
Dynamic phenomena of illegality in the territory	68
TERRITORIAL CONSOLIDATION POLICY 2012	70
Dynamic of illicit cultivation in the focalised territories	70
Progress of the Alternative Development Programmes of the Colombian Government	73
Graduation Strategy	73
SUPPLY REDUCTION	79
Forced manual eradication	79
Aerial spraying	82
Infrastructure of drug production	83
3. METHODOLOGY	90
COCA CULTIVATION CENSUS	90
AJUSTMENTS AND ESTIMATES	98
QUALITY CONTROL	102
EVALUATION OF THE PRECISION	102
METHODOLOGY FOR PRODUCTION AND YIELD ESTIMATION	105

## INDEX MAPS

Map 1. Coca cultivation density in Colombia, 20112.....	13
Map 2. Regional stability of coca cultivation in Colombia, 2003- 2012 .....	15
Map 3. Hazard index municipal presence of coca, 2012.....	18
Map 4. Coca cultivation density in Colombia, 2011.....	20
Map 5. Coca cultivation density in Colombia, 2012.....	20
Map 6. Coca cultivation by region in Colombia, 2012 .....	21
Map 7. Coca cultivation density in the Pacific region, 2012 .....	23
Map 8. Coca cultivation density in the central region, 2012.....	25
Map 9. Coca cultivation density in the Putumayo – Caqueta region, 2012.....	27
Map 10. Coca cultivation density in the Meta – Guaviare region, 2012 .....	29
Map 11. Coca cultivation density in the Orinoco region, 2012 .....	31
Map 12. Coca cultivation density in the Amazon region, 2012.....	33
Map 13. Coca cultivation density in the Sierra Nevada region, 2012.....	35
Map 14. Coca cultivation in National Parks, 2012.....	38
Map 15. Yield of coca cultivation by region in Colombia, 2012 .....	40
Map 16. Annual coca leaf production in Colombia, 2012.....	50
Map 17. Zones of territorial consolidation and integrated monitoring.....	71
Map 18. . Dynamic of the coca leaf cultivation in zones of integrated monitoring 2011-2012.....	72
Map 19. Agricultural land and forest warden families programme in Colombia, 2012 .....	75
Map 20. Forced manual eradication and coca cultivation in Colombia , 2012 .....	78
Map 21. Aerial spraying and coca cultivation in Colombia, 2012 .....	81
Map 22. Destruction of clandestine laboratories and coca cultivation in Colombia, 2012.....	86
Map 23. Drug seizures by departament and by drug type, Colombia 2012 .....	87
Map 24. Satellite images used for the coca cultivation survey, Colombia. 2012.....	91
Map 25. Study area distributed by regions and coca cultivation in Colombia, 2012 .....	97
Map 26. General map of coverage 2012.....	99

## FACT SHEET – COLOMBIA COCA CULTIVATION SURVEY, 2012

	2011	Variation <sup>1</sup>	2012
Net area under coca cultivation (rounded in thousands)	64,000 hectares	-25 %	48,000 hectares
Pacific region	26,789 hectares	-29 %	18,969 hectares
Central region	10,641 hectares	--2 %	10,405 hectares
Meta-Guaviare region	9,879 hectares	-34 %	6,550 hectares
Putumayo-Caquetá region	13,278 hectares	-26 %	9,843 hectares
Amazon region	717 hectares	-9 %	653 hectares
Orinoco region	2,396 hectares	-45 %	1,323 hectares
Sierra Nevada Region	62 hectares	-24 %	47 hectares
Potential production of cocaine <sup>2</sup>	345 mt	-10 %	309 mt
Average price of coca leaf production site	US\$ 1.3 \$ 2,357/kg	9.9 %	US\$ 1.4 \$ 2,589/kg
Average price of coca paste production site	US\$ 1,002/kg \$ 1,852,000/kg	-0.4 %	US\$ 1,025/kg \$ 1,844,250/kg
Average price of cocaine in main cities	US\$ 2,468/kg \$ 4,556,000/kg	-2.4 %	US\$ 2,473/kg \$ 4,447,000/kg
Cumulative aerial spraying	103,302 hectares	-3 %	100,549 hectares
Reported manual eradication	34,170 hectares	-11 %	30,486 hectares
Seizures of cocaine <sup>3</sup>	155,832 kg	21 %	188,021 kg
Seizures of heroin	299 kg	55 %	464 kg
Illegal laboratories destroyed <sup>4</sup>	2,401	3 %	2,480
Total value of production of coca leaf and its derivatives in farm <sup>5</sup>	US\$ 422 million	-12 %	US\$ 370 Million <sup>6</sup>
In GDP percentage <sup>7</sup>	0.3	-	0.2%
In agricultural sector GDP percentage	3%	-	3%
Number of households involved in coca cultivation	62,400	-3 %	60,600
Average gross annual income per person of leaf production and pasta / base <sup>8</sup>	US\$ 1,407	-13 %	US\$ 1,220
Area cultivated with opium poppy	338 hectares	-7 %	313 hectares
Potential production of opium latex	8.3 mt	-1 %	7.9 mt <sup>9</sup>
Potential production of heroin	1 mt	-	1 mt
Average price of opium latex production site	US\$ 466/kg	36 %	US\$ 634/kg
Average price of heroin	US\$ 10,348/kg	13 %	US\$ 11,661/kg

<sup>1</sup> Figures rounded to the nearest whole

<sup>2</sup> The production of pure cocaine hydrochloride estimated from the variance in hectares cultivated in the last two census, oscillate between 240 mt - 377 mt.

<sup>3</sup> Of the total seized 140,275 kg are seizures nationwide and 15,557 kg creates raids internationally with information from the National Police.

<sup>4</sup> Includes cocaine laboratories and infrastructure pulp and cocaine base.

<sup>5</sup> Corresponds to gross undiscounted cost of production.

<sup>6</sup> 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"

<sup>7</sup> GDP of the year as the government of Colombia (DANE).

<sup>8</sup> This income does not take into account production costs.

<sup>9</sup> It is for kiln-dried opium



## **EXECUTIVE SUMMARY**

The Global Programme for the Monitoring of Illicit Cultivations of UNODC has been supporting the Colombian government in the implementation and improvement of a Coca Cultivation Monitoring System since 1999. As from 2001, annual censuses have been conducted covering the entire Colombian territory; this report presents the results of the coca census with cut-off date December 31 2012.

The methodology used by the project is based on the interpretation of satellite images of medium resolution and field verification; with this, the office interpretation is edited and the extension of coca cultivation is calculated. For the areas without information in the images due to cloudiness or other factors, corrections are estimated based on trend criteria. The historical series is adjusted since 2009, considering the coca cultivations in Colombia are smaller and smaller every time. Based on the data of area under coca cultivation, an area frame is built to conduct complementary research to characterise the phenomenon comprehensively. The data on area under coca cultivation are complemented by means of surveys to coca growers and crop tests directly on field.

The results of the census show that in 31 December 2012, Colombia had 48,000 hectares under coca cultivation, distributed in 23 out of the 32 departments of the country. This represents a strong reduction of the area under cultivation (-25%) with respect to the 64,000 hectares detected in 2011. Only 3 departments: Norte de Santander, Caquetá and Chocó, showed an increase in the area under coca cultivation and 3 remained stable; the other departments show a trend to reduction.

The department of Nariño is still the most affected due to the presence of coca cultivation, despite an important reduction in the last year. The most important reductions took place in Nariño, Putumayo, Guaviare and Cauca. Seven departments have less than 100 hectares under coca cultivation. No coca cultivation was detected in Cundinamarca, while the department of Cesar joined the list of affected departments. Around half of all coca fields in the country are in 3 departments and 80% are in 8 departments. The Coca cultivations in Indigenous Reservations and Community Councils were reduced while increase in national parks, however, about 40% of coca in the country is cultivated in any of those authorities.

Assuring the sustainability of reduction is one of the main challenges for the Colombian government. The reduction of the area under coca cultivation reported in 2012 in the departments of Nariño, Guaviare and Putumayo is strongly related to operations of aerial spraying and manual eradication in the last months of the year, due to which the control of re-sowing is fundamental. Likewise, the reductions in Cauca, Antioquia, and Bolivar seem to be related to the appearance of informal mining activities. Sustainability will depend on local communities finding viable legal alternatives.

In 2012, the Colombian Government manually eradicated 34,486 hectares; this level of eradication is 65,245 hectares lower than the record reached in 2008 (95,731 ha). Aerial spraying of coca fields remained in similar levels to those of 2011 and went from 103,302 hectares to 100,549 in 2012. The geographical addition of the data available on presence of coca cultivation shows that 135,000 ha were affected by coca at some point during 2012; at the end of the year, 48,000 ha were remaining. Although the census with cut-off date 31 December 2012 provides a figure that is historically low, the size of the phenomenon in Colombia is still great and requires efforts not only around reduction of the area cultivated with coca but also around improving social, economic and environmental conditions in the affected territories.

In 2012 important investments were made in the framework of the Policy of Territorial Consolidation that aims at a coordinated effort from the national and local governments, the private sector and international cooperation to attack the factors that lead to the vulnerability of territories, coca cultivation and other forms of crime. Investments reached the amount of \$444,990 million pesos in strategic management areas focused on economic development, social development, justice, governability and property planning and use. The greatest investments were made in the departments of Antioquia, Putumayo, Huila and Cauca.

UNODC/SIMCI and the Colombian Government conduct studies of production and yield of coca leaf since 2005. In 2012, this study was updated in the Putumayo – Caquetá region. Data confirm the trend towards

reduction in the annual yields and a recovery of the market of coca leaf; in 2012, there is an increase in the price of fresh coca leaf (+9.9%) in contrast with the stability of the prices of basic paste (-0.4%), cocaine base (+3.9 %) and cocaine hydrochloride (-2.4%). The price of cocaine hydrochloride in Colombia in main cities is USD \$ 2,473 or COP \$4,447,462.

Similarly to the last years, the income resulting from the commercialisation of coca leaf or its sub-products does not represent a source of wealth for the growers. The annual income per capita is estimated in USD \$ 1,220. It is worth mentioning that the last studies on economy of the regions affected by coca cultivation show less dependence on this cultivation. In 2005, 82% of coca growers reported that the main source of income of their productive unit was coca; this figure decreased to 60% in the last measurement.

As time passes, less coca growers are transforming the coca leaf; while in 2005 60% of the growers transformed leaf into paste and base themselves, in 2012 only 30% are still doing it. For 2012, the total production of cocaine was reduced in a lower proportion than the area under cultivation (-10%), with 309 tons of cocaine estimated at 100% of purity.

## **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 illegal crops in their territories and assist the international community in the monitoring of the extension and evolution of these within the context of the eradication strategy adopted by the member states in the action plan of the 53<sup>rd</sup> Session of the United Nations drug commission in March 2009. The ICMP currently covers nine countries: Colombia, Bolivia, Ecuador and Peru for coca; Mexico, Afghanistan, Laos and Myanmar for opium poppy and Morocco for marihuana. The ICMP is coordinated from the office of UNODC in Vienna which also provides support for design methodologies and quality control of the data.

UNODC supports the monitoring of coca cultivation in Colombia since 1999 and has produced fourteen annual censuses based in the analysis of satellite images. The two first censuses (1999 and 2000) did not assess the entire country but as from 2001 the coverage was extended to the entire national territory, so as to assure the monitoring of the possible expansion of illicit crops.

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

The project is supported by an inter-institutional group in charge of guaranteeing the transfer and adoption of the technologies in the beneficiary national institutions. SIMCI is a joint project between UNODC and the Colombian Government, the national counterpart is the Ministry of Justice and Law, which is also the president of the National Council of Narcotics.

The project is lead by a technical coordinator and comprised by the following engineers and technicians: four experts in digital processing, a field engineer, a cartographic editor, two specialists in analysis and research, a SIG analyst engineer, four support SIG engineers, a statistician, a chemist, and a technician in logistics and databases. The team is permanently assisted by technicians from the DIRAN and the National Natural Parks Units. SIMCI supports studies and research 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, Nacional, Distrital and other Colombian Universities.

## 2. RESULTS

### COCA CROPS

The area under coca cultivation in Colombia with cut-off date 31 December 2012 is 48,000 hectares<sup>10</sup>, which is a considerable reduction with respect to the measurement of 31 December 2011. In this way, the lowest point in area cultivated with coca was reached since UNODC is measuring. Only 2 of the 23 departments affected, Norte de Santander, Caqueta and Choco, had an increase in the area under coca cultivation and 3 remained stable; the other departments show a trend to reduction. The department of Nariño is still the most affected by the presence of coca cultivation, despite an important reduction in the last year. The greatest reduction took place in Nariño, Putumayo, Guaviare and Cauca. Seven departments have less than 100 hectares cultivated with coca. No coca cultivation was detected in Cundinamarca, while Cesar joined the list of affected departments. Around half of all the coca cultivation in the country is in 3 departments and 80% is in 8 departments.

Table 1. Coca fields per department in Colombia, 2006-2012 (hectares)

Department	Dec.-2006	Dec.-2007	Dec.-2008	Dec.-2009	Dec.-2010	Dec.-2011	Dec.-2012	% Change 2011-2012	% of the 2012 total
Nariño	15,606	20,259	19,612	17,639	15,951	17,231	10,733	-38%	22%
Putumayo	12,254	14,813	9,658	5,633	4,785	9,951	6,148	-38%	13%
Norte de Santander	488	1,946	2,886	3,037	1,889	3,490	4,516	29%	9%
Cauca	2,104	4,168	5,422	6,597	5,908	6,066	4,325	-29%	9%
Guaviare	9,477	9,299	6,629	8,660	5,701	6,839	3,851	-44%	8%
Caquetá	4,967	6,318	4,303	3,985	2,578	3,327	3,695	11%	8%
Choco	816	1,080	2,794	1,789	3,158	2,511	3,429	37%	7%
Antioquia	6,157	9,926	6,096	5,096	5,350	3,104	2,725	-12%	6%
Meta	11,063	10,386	5,525	4,469	3,008	3,040	2,699	-11%	6%
Bolívar	2,382	5,632	5,847	5,346	3,324	2,207	1,968	-11%	4%
Vichada	5,523	7,218	3,174	3,228	2,743	2,264	1,242	-45%	3%
Córdoba	1,216	1,858	1,710	3,113	3,889	1,088	1,046	-4%	2%
Valle del Cauca	281	453	2,089	997	665	981	482	-51%	1%
Guainía	753	623	625	606	446	318	301	-5%	0.6%
Vaupés	460	307	557	395	721	277	254	-8%	0.5%
Santander	866	1,325	1,791	1,066	673	595	111	-81%	0.2%
Amazonas	692	541	836	312	338	122	98	-20%	0.2%
Arauca	1,306	2,116	447	430	247	132	81	-38%	0.2%
Magdalena	271	278	391	169	121	46	37	-19%	0.1%
Caldas	461	56	187	186	46	46	16	-66%	0.03%
Cesar							13	100%	0.03%
Boyacá	441	79	197	204	105	93	10	-90%	0.02%
La Guajira	166	87	160	182	134	16	10	-40%	0.02%
Cundinamarca	120	131	12	0	32	18	0	-100%	n.a
<b>TOTAL</b>	<b>77,870</b>	<b>98,899</b>	<b>80,953</b>	<b>73,139</b>	<b>61,812</b>	<b>63,762</b>	<b>47,790</b>	<b>-25</b>	<b>100</b>
<b>Rounded total</b>	<b>78,000</b>	<b>99,000</b>	<b>81,000</b>	<b>73,000</b>	<b>62,000</b>	<b>64,000</b>	<b>48,000</b>	<b>-25</b>	
Number of affected departments	23	23	24	22	23	23	23		

The trend to reduction of the area cultivated with coca in Colombia, which started in 2007, remained in 2012. It is important to point out that the coca cultivation detected in the 2012 census occupied 0.04 % of the total cultivable land in Colombia.

Similarly to the censuses conducted as from 2001, this represents the situation of coca cultivation with cut-off date 31 December 2012. The census covers the entire country and it detected coca cultivation in 23 of the 32 departments; the department of Cundinamarca is not in the list any more but it was replaced by Cesar, which

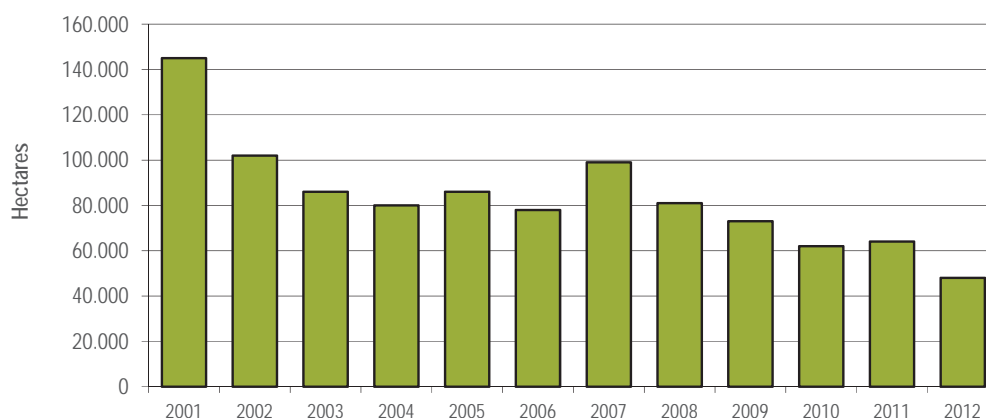
<sup>10</sup> The thematic accuracy is visibly reduced when there are very small plots (smaller than 3 pixels). Until 2008, the relative weight of this type of plots is considered insignificant; however, as of 2009, an adjustment associated to the presence of small plots is included.

joined with 10 hectares detected. Due to the strong winter period over all the Colombian territory, the satellite images used in the 2012 census are from August 2012 to March 2013. The extension of the period of image collection enabled coverage of 85% of the target area of monitoring.

The reduction in the most important areas under coca cultivation between 2011 and 2012 were found in the department of Nariño (-6,498 ha), Putumayo (-3,804 ha) and Guaviare (-2,988 ha), where 83 % of the reduction in the entire country was concentrated. The reduction in these departments is strongly related to actions of aerial spraying and manual eradication. 55% of the aerial spraying took place in these departments, reaching 15,066 has in the last four months of the year. 15,628 ha were intervened with manual eradication, from which 40% was conducted by the end of 2012. Despite of the strong reduction, Nariño and Putumayo are still the departments most affected by coca planting; one third of all the coca in the country is in these two departments.

Many departments reached the lowest point of cultivation of all the historical series in 2012 and all the departments are below the highest peaks. It is worth highlighting the continuous reduction of coca cultivation in the departments of Antioquia, Meta and Guaviare. Three departments reported an increase of the area under coca cultivation: Norte de Santander (+1,026 ha), Choco (+ 918 ha) and Caqueta (+368 ha).

Figure 1. Coca Fields in Colombia, 2001 – 2012



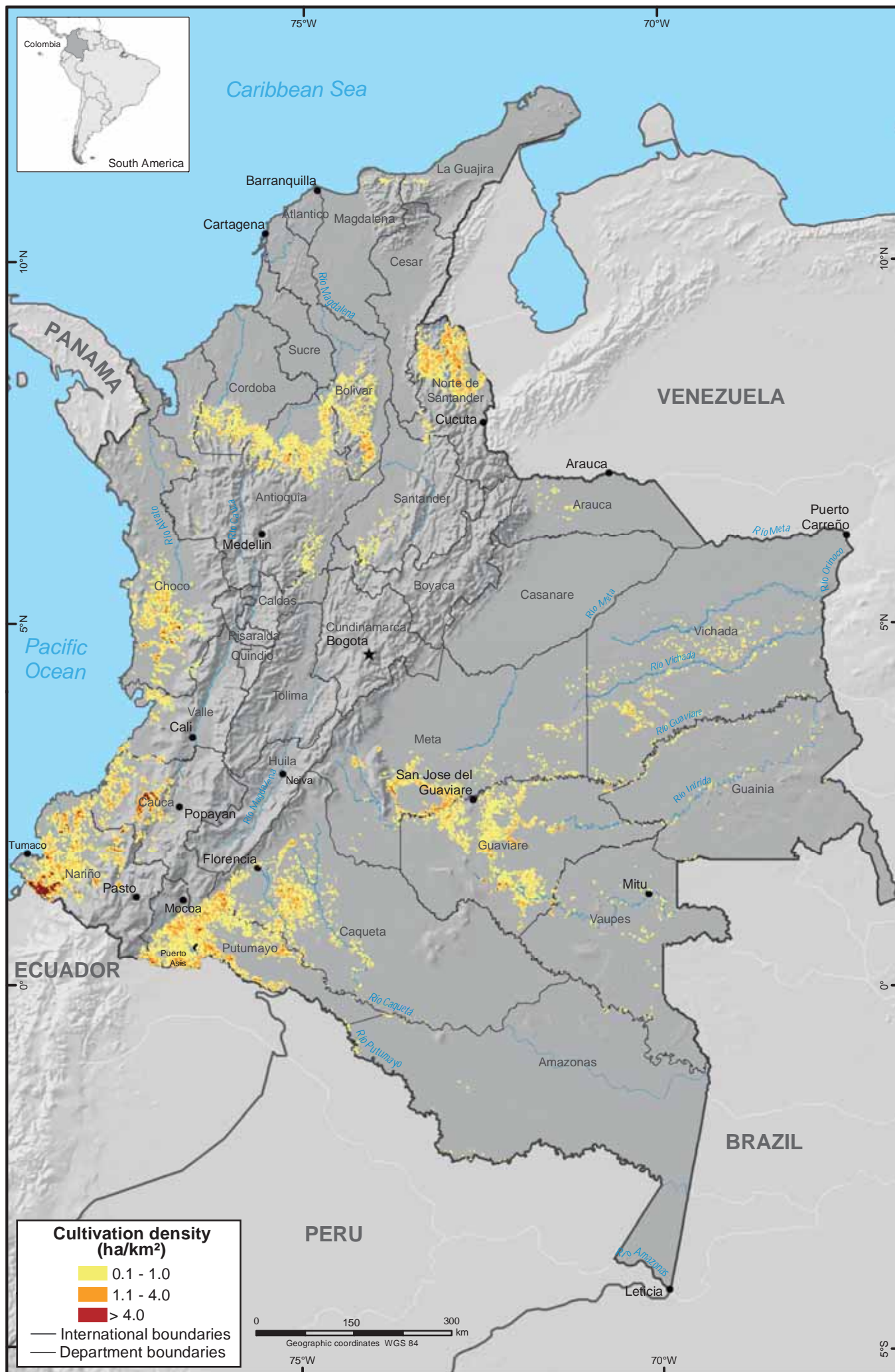
The total aggregation of coca cultivation areas indicates that 135,000 hectares were affected by coca crops at some point during 2012; however the impact of aerial spraying, alternative development and the consolidation program resulted in total of 48.000 ha planted with coca crops at the end of 2012. Although this represents a historical low number the size of the problem in Colombia is still large and requires the combined efforts in reducing coca cultivation and improving social, economic and environmental conditions in the affected areas.

Among the actions conducted in Colombia to reduce coca cultivation, during 2012, 30,486 hectares were manually eradicated. This level of eradication is lower in 65,245 hectares than the record reached in 2008 (95,731 ha). Aerial spraying of coca cultivations remained in similar levels to those of 2011 and went from 103.302 hectares to 100.549 in 2012.

In 2012 important investments were done in the framework of the Policy of Territorial Consolidation that aims at joining efforts from the national and local governments, the private sector and international cooperation to attack the factors that cause the vulnerability of territories to the cultivation of coca and other forms of crime. Investments reached the sum of \$ 444,990 million, in strategic areas of management focused on economic development, social development, justice, governance and management of the property. The largest investments were made in the departments of Antioquia, Putumayo, Huila and Cauca.

Moreover, the actions of struggle to disband armed groups and gangs involved in drug trafficking were intensive in 2012. The catch, submissions and drug cautions actors who directly or indirectly served as sponsors in the production and trafficking of drugs directly affect participation in the initial link in the chain of drug trafficking (planting and production). It is worth noting the blows to drug gangs in the east and south.

**Map 1. Coca cultivation density in Colombia, 2012**



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 (Nariño) is still the most cultivated with coca in the country, with 5,065 hectares. The municipalities of Roberto Payan and Magui (Nariño) and San Jose (Guaviare), abandoned the list of the 10 most cultivated and were replaced by the municipalities of Tibu (Norte de Santander), Puerto Rico (Meta) and El Retorno (Guaviare). 37% of the area under coca cultivation is in these municipalities.

**Table 2. The tin municipalities with the greatest cultivated area 2012**

Municipality	Department	Coca cultivation (hectares)	% census
Tumaco	Nariño	5,065	10.6%
El Tambo	Cauca	1,876	3.9%
Barbacoas	Nariño	1,815	3.8%
Tibú	Norte de Santander	1,658	3.5%
Puerto Asís	Putumayo	1,463	3.1%
Miraflores	Guaviare	1,391	2.9%
Cumaribo	Vichada	1,234	2.6%
Puerto Leguizamo	Putumayo	1,218	2.5%
Puerto Rico	Meta	1,064	2.2%
El Retorno	Guaviare	1,028	2.2%
<b>Total</b>		<b>17,812</b>	<b>37%</b>

### *Analysis of the dynamics of coca cultivation*

In Colombia, the geography of coca leaf cultivations has a close relation with substantial aspects of the territory and the phenomenon; among these, the most outstanding are: bio-physic, cultural and regional diversity of the territory and the sustainability strategies of the production chain and marketing of cocaine. In this sense, the following key aspects for the analysis of the dynamic of illegal cultivations: the dynamic of establishment; the spatial analysis of permanence; the phenomenon of regionalization of tendencies in 2012 and finally, a synthesis of the dynamics that is expressed as the Index of Municipal Threat due to the presence of illegal cultivations.

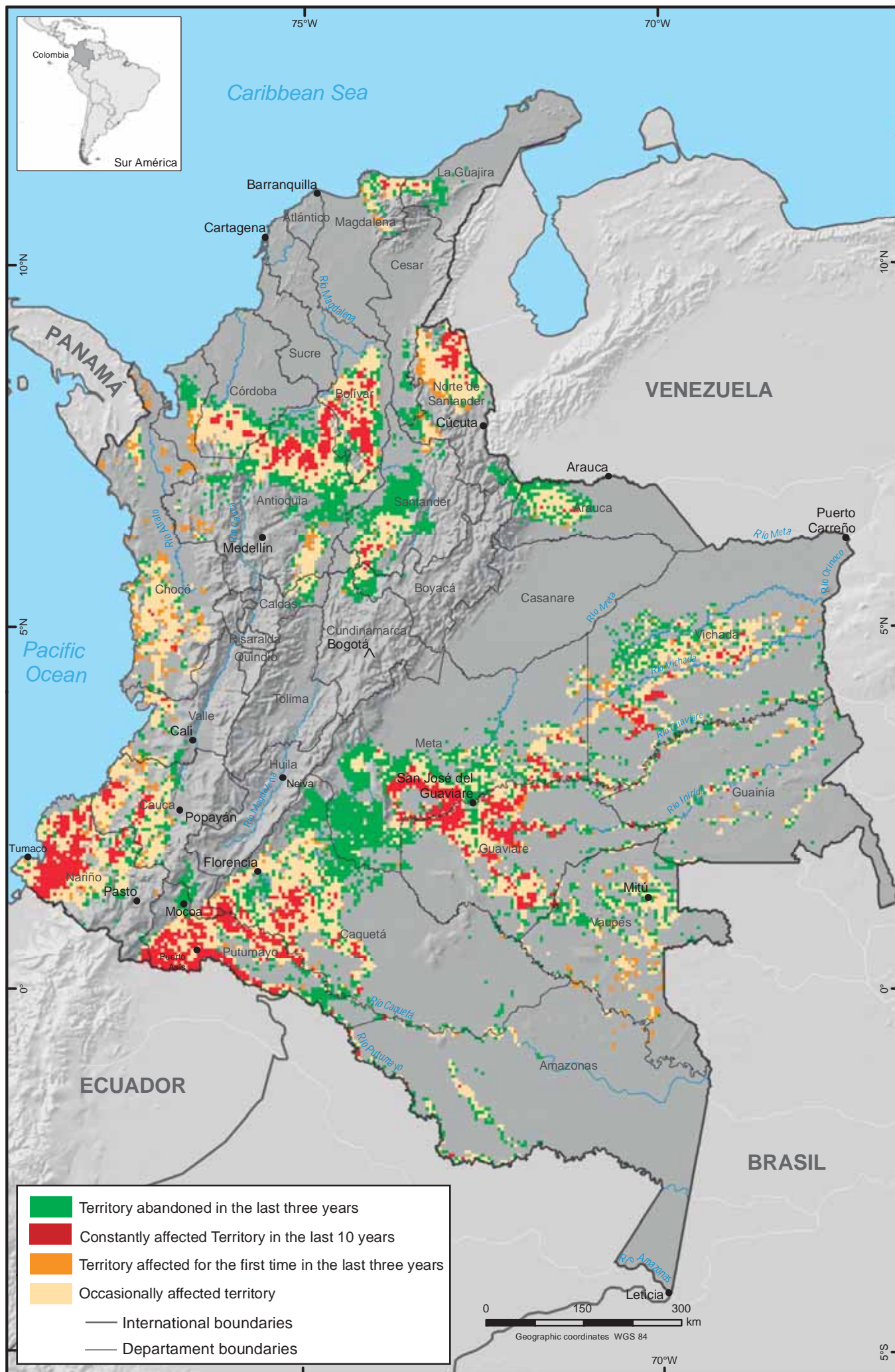
### *Dynamic of the establishment of illicit crops*

After thirteen years of monitoring, the predominant spatial model of establishment and abandonment of coca cultivations persists. Such model is associated to recurring processes of land occupation in the periphery of the Andean Zone in Colombia, which may be summarized in the following: i) Ruralisation as an advanced process of anthropic transformations of natural spaces, which promotes the abandonment of coca cultivations and the incorporation of lands to production processes; ii) the colonization front, in which 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.

Based on the SIMCI master framework of grids of one per one and five per five kilometres, the analysis of permanence and affectation by coca cultivation shows the following characteristics<sup>11</sup> (See map 2 and Figure 2)

<sup>11</sup> *Dynamic analysis draws on the territory affected by coca cultivation since 2001. its measured magnitude is with respect to the area affected by the presence of these crops.*

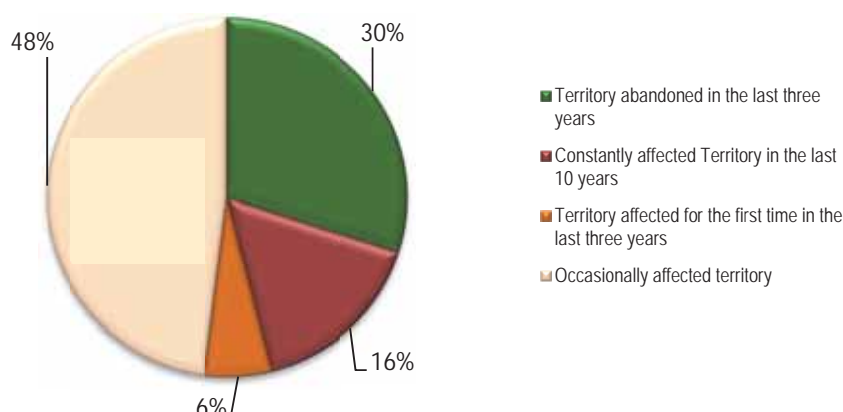
**Map 2. Regional stability of coca cultivation in Colombia, 2003- 2012**



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 2. Regional distribution of permanence



In the series 2003-2012, 16% of the territory shows permanent affectation by coca cultivation, increasing 1% with respect to 2011. The majority of coca fields are located in these zones; the spatial distribution of this category is in all the regions delimited by SIMCI, with more presence in Nariño, Putumayo, Meta, Guaviare, Low Cauca, South Bolívar and Norte de Santander.

6% of the territory shows recent affectation in the last three years of the series (2010-2012). This category decreased two points with respect to 2011. These areas correspond to the zones of expansion and new areas with coca cultivation; it is mainly distributed in the Pacific, Sierra Nevada and Amazon regions. 48% shows intermittent affectation; in other words, areas where coca fields appear and disappear in some year during the series 2003 – 2012, increasing two points with respect to 2011.

Finally, the area that was not affected between 2010 and 2012 reached 30% of the total of the territory, losing one point with respect to the previous year. It is distributed in South Meta, Antioquean Urabá and Santander.

Table 3. Regional distribution of the permanence of coca cultivation (2001-2012)

Region	Total		Territory abandoned		Constantly affected territory		Territory affected for first time in the last three years		Recently affected Territory between 2010 and 2012	
	Km <sup>2</sup>	%	Km <sup>2</sup>	%	Km <sup>2</sup>	%	Km <sup>2</sup>	%	Km <sup>2</sup>	%
Amazon	25,050	10%	8,725	35%	450	2%	13,025	52%	2,850	11%
Central	58,900	22%	17,725	30%	8,325	14%	29,475	50%	3,375	6%
Sierra	4,100	2%	1,100	27%	325	8%	2,250	55%	425	10%
Meta-Guaviare	50,650	19%	20,400	40%	10,375	20%	18,775	37%	1,100	2%
Orinoco	29,500	11%	11,000	37%	2,050	7%	14,675	50%	1,775	6%
Pacific	48,650	18%	7,375	15%	9,425	19%	26,400	54%	5,450	11%
Putumayo-Caqueta	46,350	18%	13,250	29%	10,925	24%	21,125	46%	1,050	2%
<b>Total</b>	<b>263,200</b>	<b>100%</b>	<b>79,575</b>	<b>30%</b>	<b>41,875</b>	<b>16%</b>	<b>125,725</b>	<b>48%</b>	<b>16,025</b>	<b>6%</b>

(a) Dynamic analyzes are performed with 2001 base year for this report

(b) The affected area is considered permanent when presented coca continuously from 2003-2012

### Regionalization of trends 2012

The spatial analysis of the data of the censuses enables the identification of trends at the local level that are worth highlighting. The national trend towards reduction of the area cultivated with coca contrasts with the trends to increase observed in the south end of the department of Nariño, especially towards the border with

Ecuador and in the northeast of the department of Norte de Santander, close to the border with Venezuela. Likewise, the trend to increase of the area under cultivation in the mountainous area of Cauca, south Choco and the zone of La Macarena in the department of Meta must be emphasised. These increases do not exceed the general trend towards reduction in the rest of the country.

### *Hazard index municipal presence of coca, 2012*

The present monitoring proposes the evaluation of changes in the index of threat due to the presence of coca cultivation as an approximation to measure the risk of persistence of the phenomenon in the territory. In 2011 the construction of this index for the municipalities of Colombia was suggested for the first time, based on the series and the SIMCI master framework. This is an index built from the statistical pondering of the factors that, according to the studies of SIMCI, have more weight in the integral comprehension of the dynamic of coca leaf cultivation in Colombia. Such 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 km<sup>2</sup> 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<sup>12</sup>.

*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).

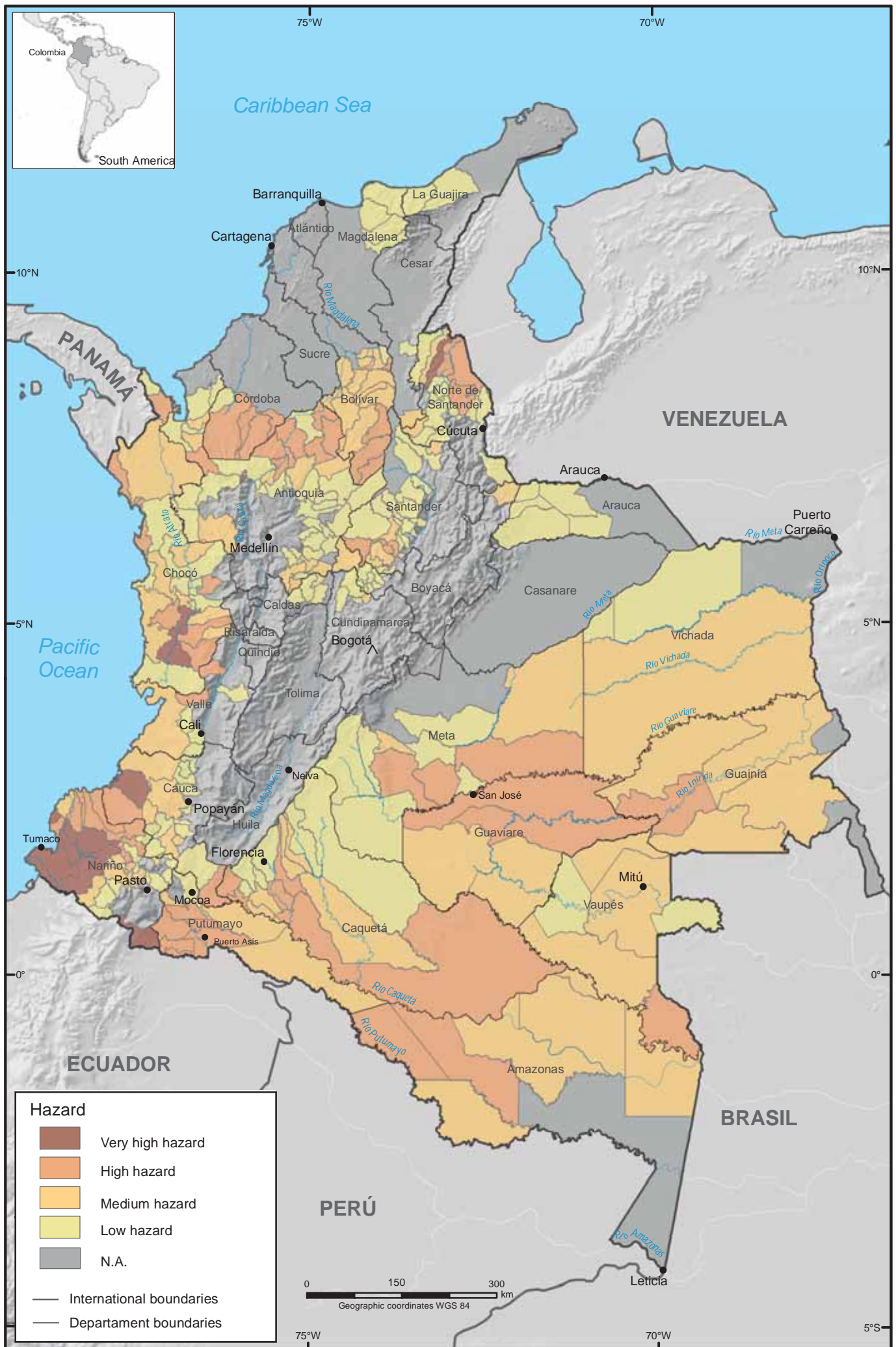
The valuation of the index has a normalized scale from 0 to 1, in which values close to zero show less hazard and values close to 1 indicate more hazard. For qualitative effects, the index is grouped into four classes of hazard: very high, high, medium and low.

The hazard index for 2012 show that 280 municipalities (25% of Colombia) presented a hazard, of these, 3% have a very high hazard, 21% high, 27% medium and 49% low. It comes in absolute terms a decrease of two percentage points in municipalities with high threat by passing medium. It is the reduction in the core of the Sierra Nevada where all municipalities have low hazard, unlike Norte de Santander where 4 of the 17 municipalities affected by the presence of coca increased their hazard rate from medium to high (3 municipalities) and high to very high (one municipality) The geographical distribution of the regional trend index shows the grouping of municipalities according to the intensity of the hazard. (See Map 3).

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<sup>12</sup> The Gini coefficient is a measure of inequality. It is used as an indicator of the concentration of coca cultivation. Values close to one indicate maximum concentration and values close to zero indicate greater dispersion. Within the hazard index the Gini coefficient the closer to zero is considered greater the threat, since a larger proportion of the municipality is affected by coca cultivation.

Map 3. Hazard index municipal presence of coca, 2012



Source: Government of Colombia - National monitoring system supported by UNODC  
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**Deforestation due to coca cultivation**

Although the area cultivated with coca decreased considerably, 15,307 hectares of the forests that existed in 2011 have been felled to plant coca directly; out of these, 61% were primary forests of high complexity, biodiversity and richness.

In the period 2001-2012, 259,086 hectares have been deforested for direct coca sowing. During this period, it is observed that in 2002 the percentage of coca crops that gave origin to deforestation processes was 46% and it progressively decreased, dropping to 26% in 2009; as of that year, a trend towards increase of deforestation for coca planting started.

Figure 3. Rate of deforestation due to coca cultivation, 2001-2012

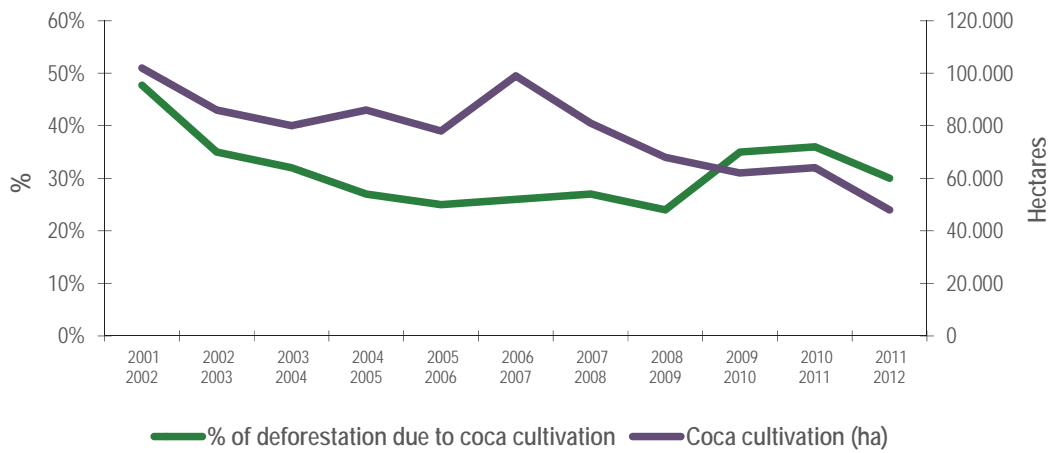
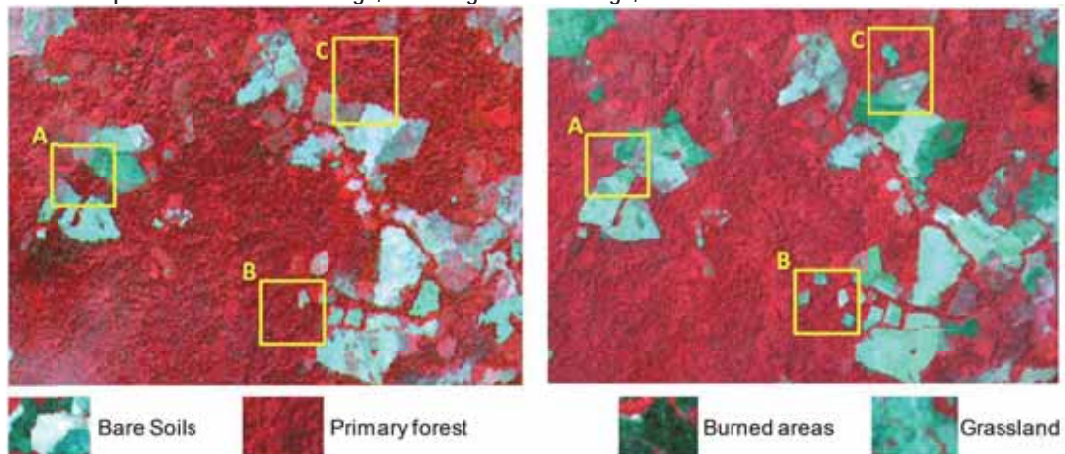
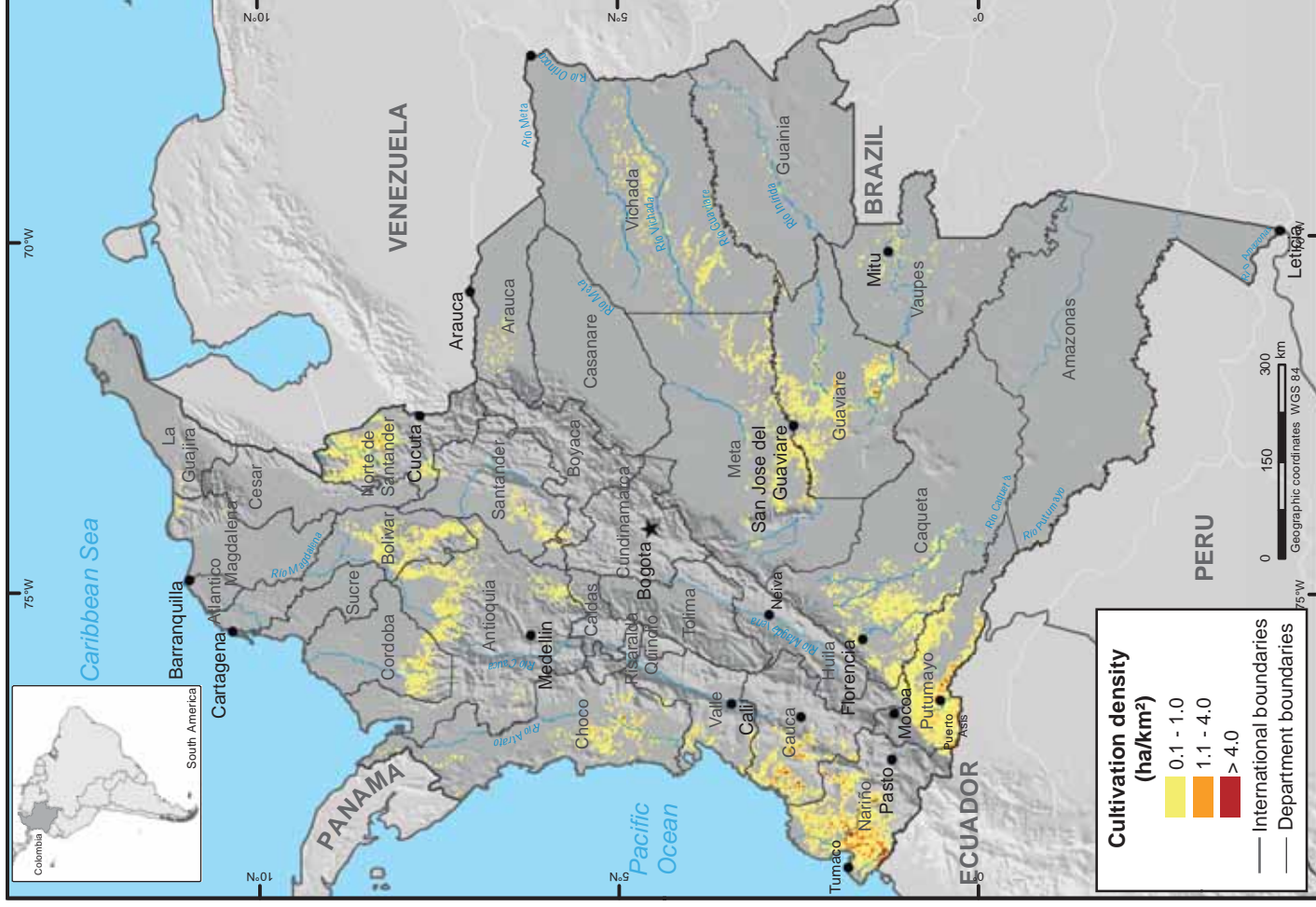


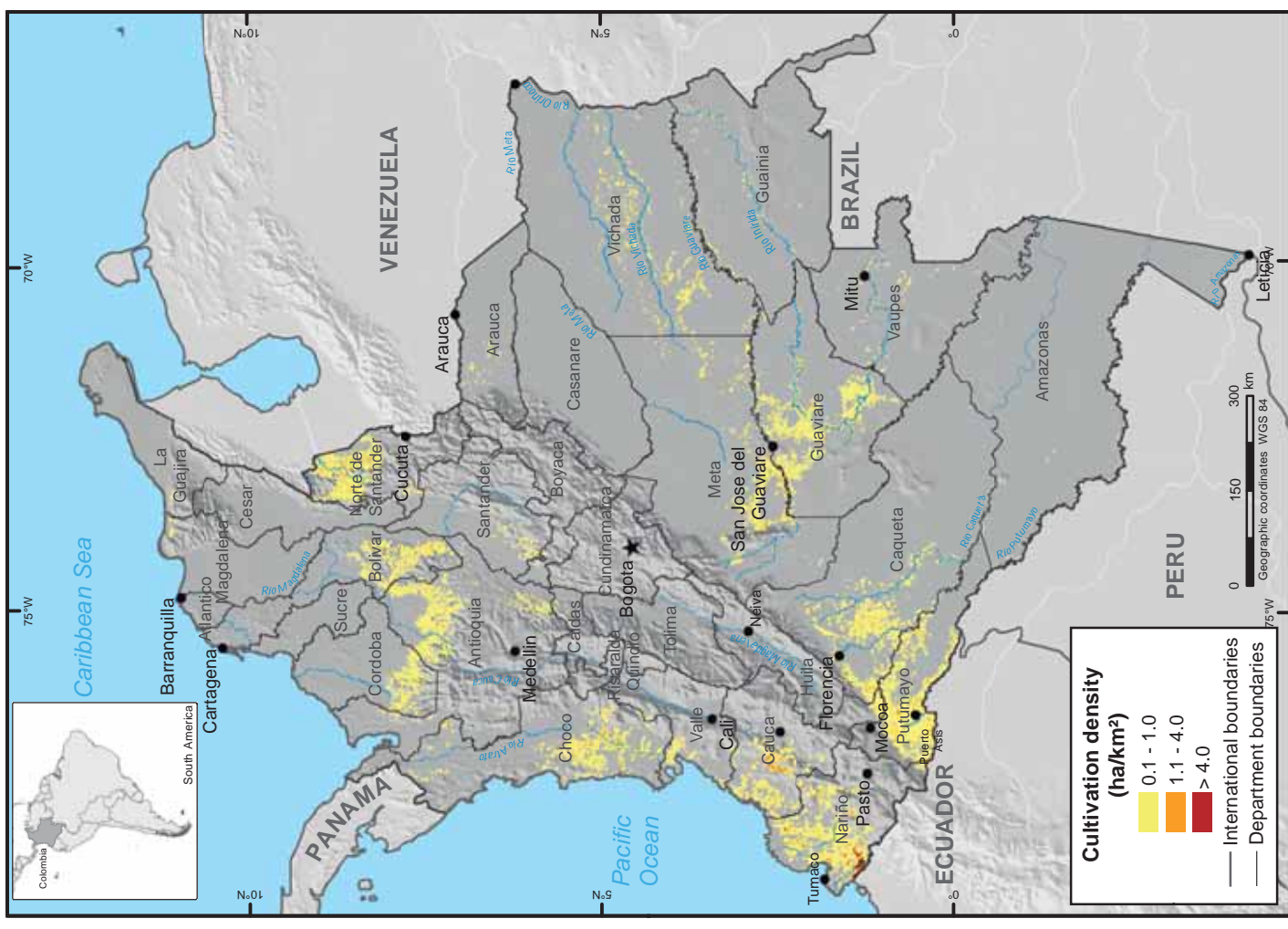
Figure 4. Temporary comparison of satellite images of the municipality of Vistahermosa, Meta department. False colour composition. Left: SPOT Image, 2008. Right: ALOS Image, 2010.



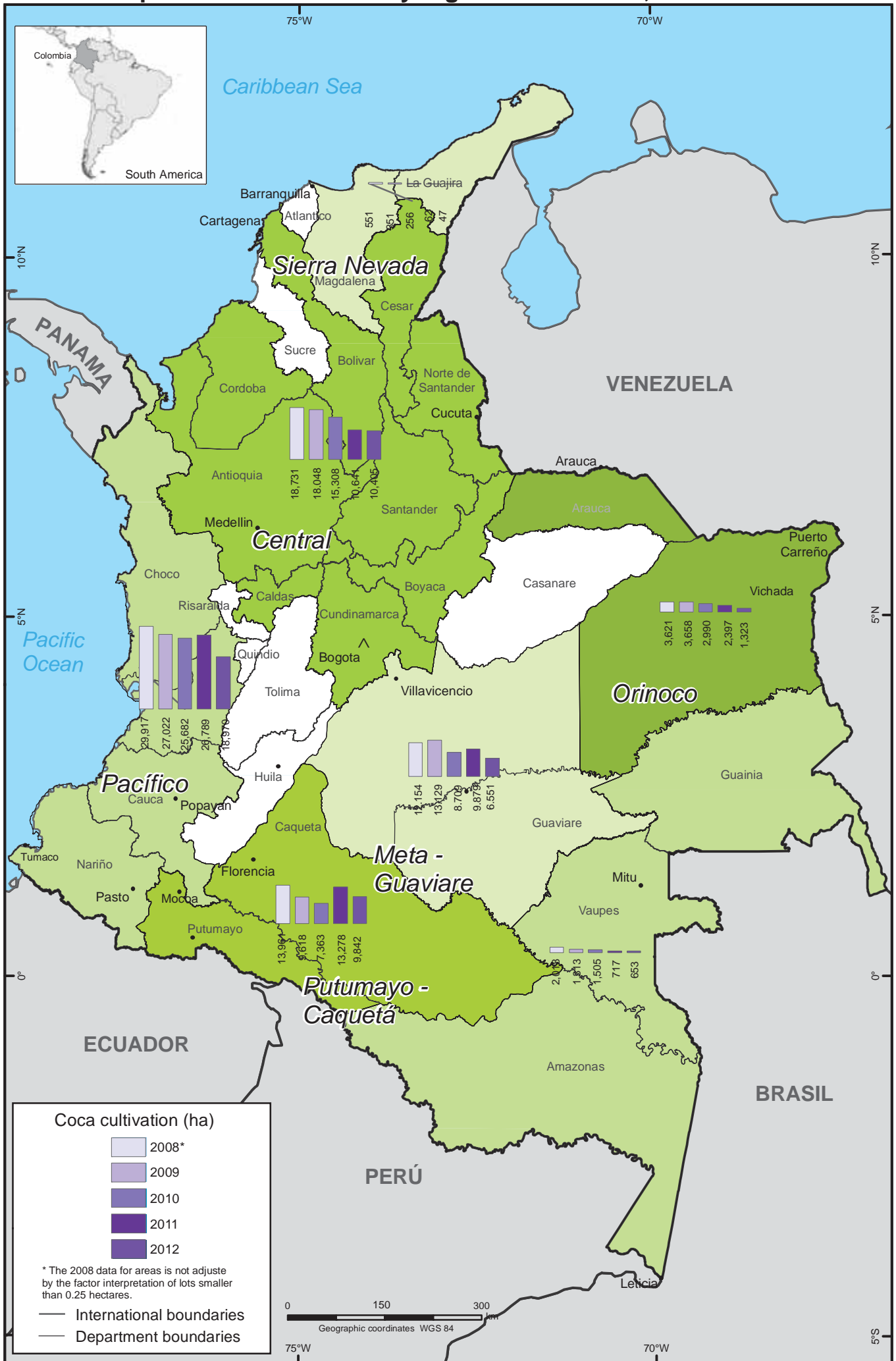
Map 4. Coca cultivation density in Colombia, 2011



Map 5. Coca cultivation density in Colombia, 2012



# Map 6. Coca cultivation by region in Colombia, 2008 - 2012



Source: Government of Colombia - National monitoring system supported by UNODC  
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*Analysis of the regional historical series*

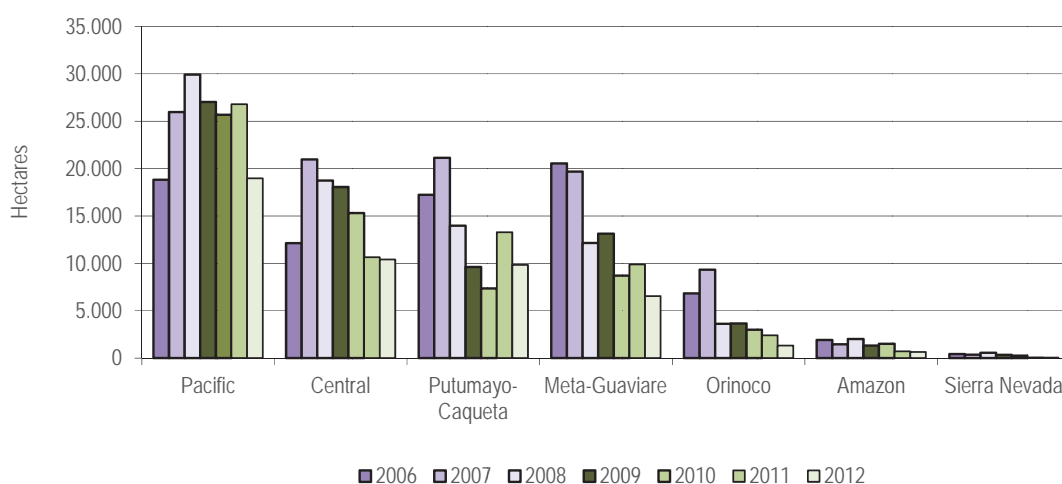
The trend to reduction of the area under coca cultivation was predominant in the country. Only two regions (Amazon and Central) remained stable and the rest showed a strong reduction.

According to the 2012 census, 62% of coca crops are in the Pacific and Central regions. The greatest reduction took place in the Pacific region (-7,819 ha).

**Table 4. Coca fields in Colombia by region 2006 - 2012 (in hectares)**

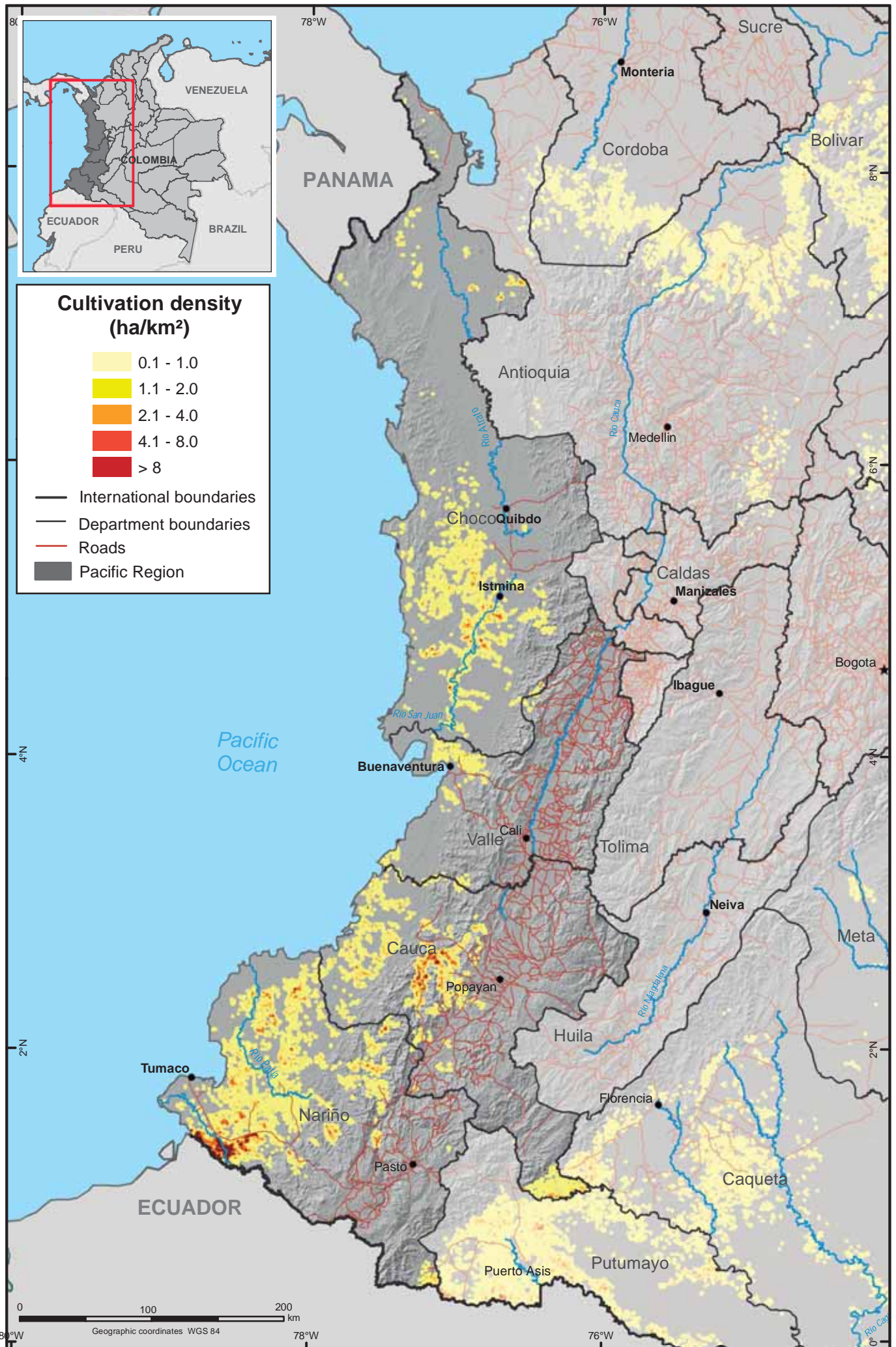
Region	2006	2007	2008	2009	2010	2011	2012	% of the total	Change 2011 - 2012
Amazon	1,905	1,471	2,018	1,313	1,505	717	653	1.4	-64
Central	12,131	20,953	18,731	18,048	15,308	10,641	10,405	21.8	-236
Meta-Guaviare	20,540	19,685	12,154	13,129	8,709	9,879	6,551	13.7	-3,327
Orinoco	6,829	9,334	3,621	3,658	2,990	2,396	1,323	2.8	-1,075
Pacific	18,807	25,960	29,917	27,022	25,682	26,789	18,969	39.7	-7,819
Putumayo-Caqueta	17,221	21,131	13,961	9,618	7,363	13,278	9,842	20.6	-3,436
Sierra Nevada	437	365	551	351	255	62	47	0.1	-16
Rounded total	78,000	99,000	81,000	73,000	62,000	64,000	48,000	100	-16,000

**Figure 5. Coca fields by region 2006–2012**



*Coca fields in Pacific region*

**Map 7. Coca cultivation density in the Pacific region, 2012**



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



**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 topography goes from the highest lands in Colombia to the coasts on the Pacific Ocean. The constant presence of clouds makes it difficult to measure the land coverage, including coca cultivation; the 2012 census was particularly affected by this factor, mainly in the departments of Choco and Valle del Cauca.

**Table 5. Coca fields in the Pacific region, 2006-2012 (in hectares)**

Department	2006	2007	2008	2009	2010	2011	2012
Nariño	15,606	20,259	19,612	17,639	15,951	17,231	10,733
Cauca	2,104	4,168	5,422	6,597	5,908	6,066	4,325
Choco	816	1,080	2,794	1,789	3,158	2,511	3,429
Valle del Cauca	281	453	2,089	997	665	981	482
Total	18,807	25,960	29,917	27,022	25,682	26,789	18,969
Annual trend	7%	38%	15%	-10%	-5%	4%	-29%

Coca cultivation in Nariño became important in 2002, when it decreased 40,000 hectares in the departments of Putumayo and Caqueta and increased in 7,600 ha in this department. Since 2003, Nariño has remained in the group of the three departments with greatest area under coca cultivation, occupying the first place in 2006. The highest level of the historical series occurred in 2007, and as from then it kept a trend of stability that was broken in 2012 with a strong reduction. Nonetheless, in 2012, for the seventh consecutive year, Nariño is the department with the greatest area cultivated with coca in the country (22%). For the third consecutive year, the aerial spraying operations grew, reaching 37,891 ha; manual eradication was performed in 14,231 ha, 45% less of the area reported in 2011; In recent years Nariño began receiving significant contributions to alternative development.

The department of Cauca shares many characteristics with their neighbour Nariño, such a vast maritime coast, high mountains and rural economy. Coca cultivation had remained in relatively low levels until 2006; since then, the area cultivated with coca was tripled, reaching a total of 6,597 hectares in 2009, which put it in the group of the three departments with the greatest area under coca cultivation in the country. In 2012, after 2 years of stability, the area under coca cultivation dropped (-1,740 ha). The reduction in coastal zones, associated to a strong aerial spraying (10,697 has) exceeded the trend to increase observed in the mountainous zones.

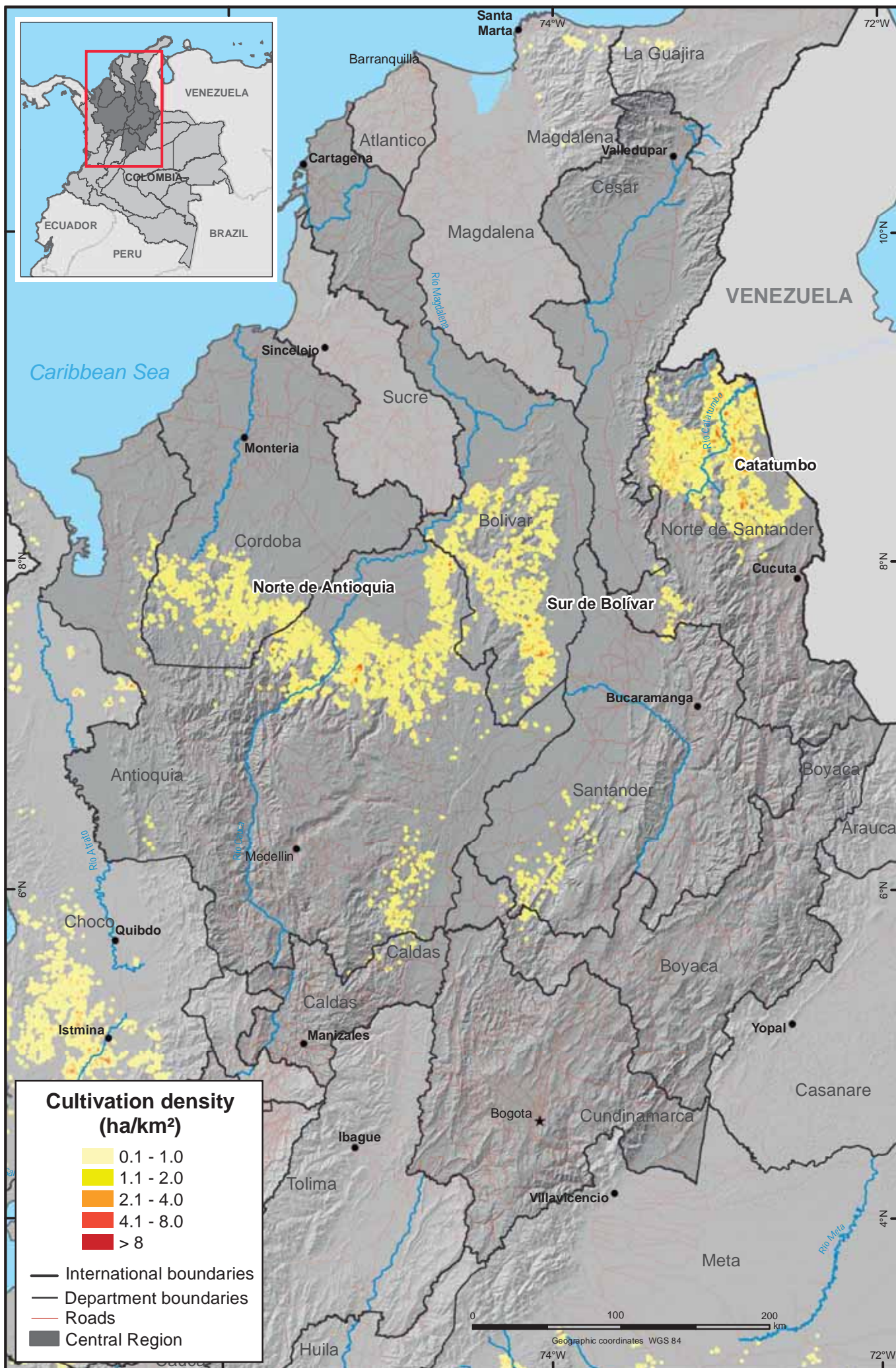
The department of Valle del Cauca had always reported an area smaller than 300 ha of coca crops, but it had a dramatic increase in 2008 (2,089 ha). For 2012, the area cultivated with coca was reduced to 482 has, half of what existed in 2011; nevertheless, the aerial spraying effort increased 50%.

The department of Choco showed a trend to increase since 2004, and in 2012 it reached the highest level of cultivation since UNODC has measured (3,429 ha). In 2012, aerial spraying was done in 13,259 ha; this is 3 times more of what was sprayed in 2011. 668 ha were manually eradicated.



*Coca fields in pacific region*

Map 8. Coca cultivation density in the Central region, 2012



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

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**Central Region**

Table 6. Coca fields in the Central region, 2006-2012 (in hectares)

Department	2006	2007	2008	2009	2010	2011	2012
Norte de Santander	488	1,946	2,886	3,037	1,889	3,490	4,516
Antioquia	6,157	9,926	6,096	5,096	5,350	3,104	2,725
Bolivar	2,382	5,632	5,847	5,346	3,324	2,207	1,968
Cordoba	1,216	1,858	1,710	3,113	3,889	1,088	1,046
Santander	866	1,325	1,791	1,066	673	595	111
Caldas	461	56	187	186	46	46	16
Cesar	-	-	-	-	-	-	13
Boyaca	441	79	197	204	105	93	10
Cundinamarca	120	131	12	0	32	18	0
Total	12,131	20,953	18,731	18,048	15,308	10,641	10,405
Annual trend	-22%	73%	-11%	-4%	-15%	-30%	-2%

Since 2002, the cultivation of coca in the Central region of Colombia had been stable in an average of 16,000 hectares. In 2007, it increased significantly (20,953 ha) and since that moment there has been a trend to reduction that was interrupted in 2012 with 10,405 ha, which is 2.2% less than in 2011. 22% of coca cultivation in the country is in the Central Region. The presence of clouds implies that the data for Boyaca, Caldas and Cordoba must be used with precaution.

The Central region is comprised by nine departments; 98% of the crops are concentrated in four of them: Norte de Santander, Antioquia, Cordoba and Bolivar. For second consecutive year, only the department of Norte de Santander reported an increase of the area under coca cultivation. In Santander, 111 ha of coca were detected; the departments of Cesar, Caldas and Boyaca have less than 20 hectares cultivated with coca and no coca was detected in the department of Cundinamarca in 2012.

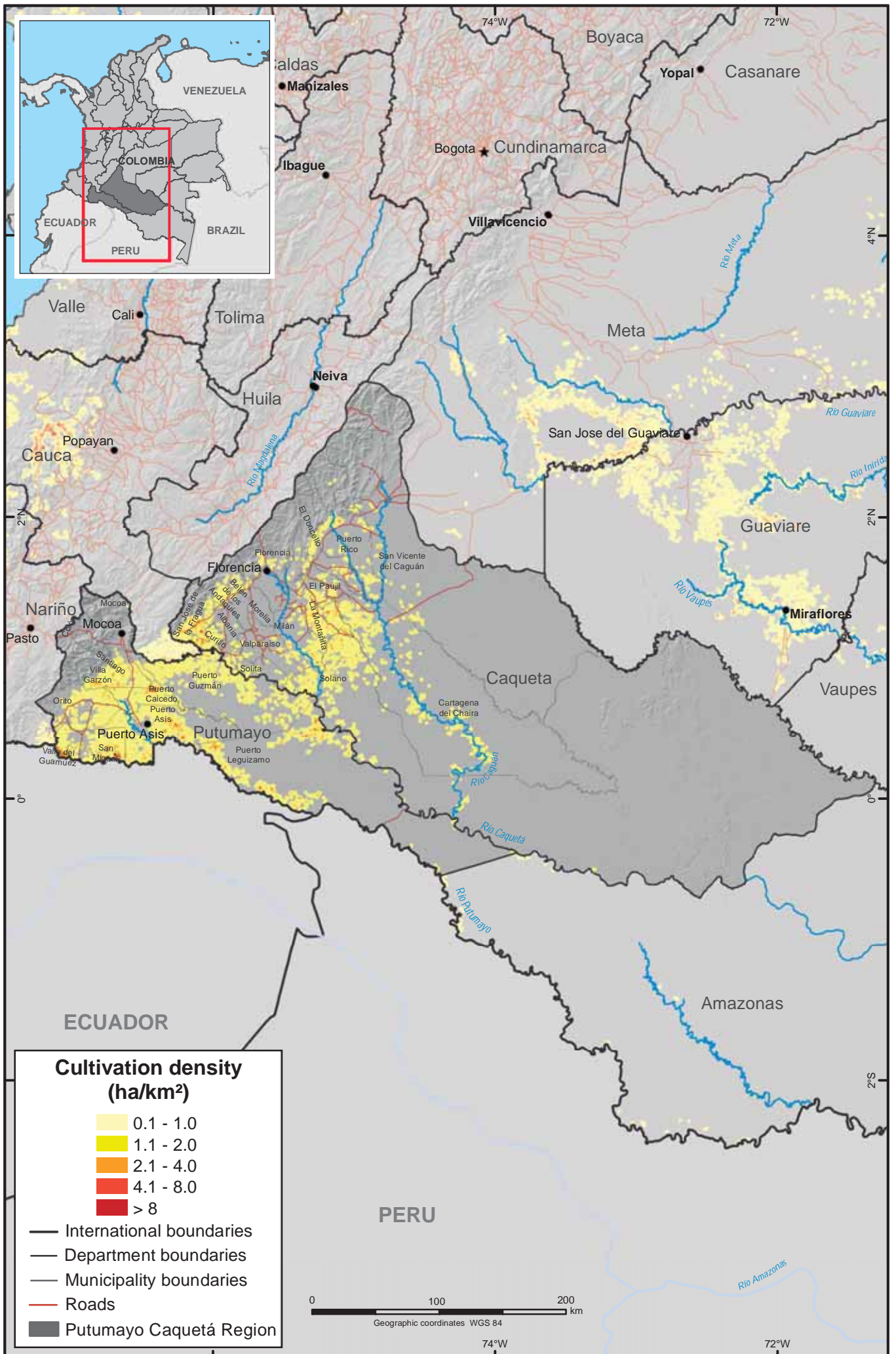
The area under coca cultivation remained stable in the department of Cordoba, despite of a reduction of half of the effort of aerial spraying and augmented 58% in the manual eradication effort.

In Antioquia, the area cultivated with coca increased until 2007 when it reached its maximum peak of 9,926 hectares; since then, there has been a permanent trend to reduction that still remains in 2012 (-12%). Aerial spraying was reduced in a third part with respect to 2011 and manual eradication was reduced by half. In the last two years, 11% of the investment of the Territorial Consolidation Policy is concentrated in Antioquia.

In the department of Bolivar, coca crops are concentrated in the area known as Sur de Bolivar; they represented between 3% and 8% of the total of the country in the period 2001-2006. In 2008, the cultivation of coca reached its maximum peak of 5,847 hectares and since that year, there has been a trend to reduction that remained in 2012 with 1,968 ha under coca cultivation, which is the lowest point since UNODC has been measuring. For 2012, the effort of aerial spraying and manual eradication also decreased.

After reaching the lowest level in 2006, coca cultivation in the department of Norte de Santander started an increasing trend that remained in 2012, with 4,516 ha, which is nine times the area cultivated in 2006.

**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, 2006-2012 (in hectares)

Department	2006	2007	2008	2009	2010	2011	2012
Putumayo	12,254	14,813	9,658	5,633	4,785	9,951	6,148
Caqueta	4,967	6,318	4,303	3,985	2,578	3,327	3,695
Total	17,221	21,131	13,961	9,618	7,363	13,278	9,843
Annual trend	23%	23%	-34%	-30%	-23%	80%	-26%

Coca cultivation in the Putumayo – Caqueta region has fluctuated between 5,000 ha and 20,000 ha since 2002, without a specific trend; this is mainly due to the dynamic of cultivation in Putumayo. In 2012, 20% of the coca cultivation in the country was found in this region, with an important reduction of -26%.

In the department of Putumayo, bordering with Ecuador and Peru, the coca cultivation reached an area of 66,000 hectares (40% of the national total) in 2000. After four years of important and consecutive reduction, it dropped to 4,386 hectares (5% of the national total) in 2004, but this trend changed between 2005 and 2007 with consecutive increase of 105% in 2005, 37% in 2006 and 21% in 2007; as of that year, there has been alternative increase and reduction with no particular trend. In 2012, 6,147 ha were found, almost 4,000 less than in 2011.

Coca crops in the department of Caqueta reached their lower historical level in 2010 with an area of 2,578 hectares (4.5% of the national total), after a minor but constant reduction that began in 2001 when they reached 14,516 hectares (10% of the national total). Nevertheless, as from this year, a trend towards increase started and remained stable in 2012 with an increase of 11% compared to 2011. Caqueta is one of the three departments with an increasing trend in 2012.

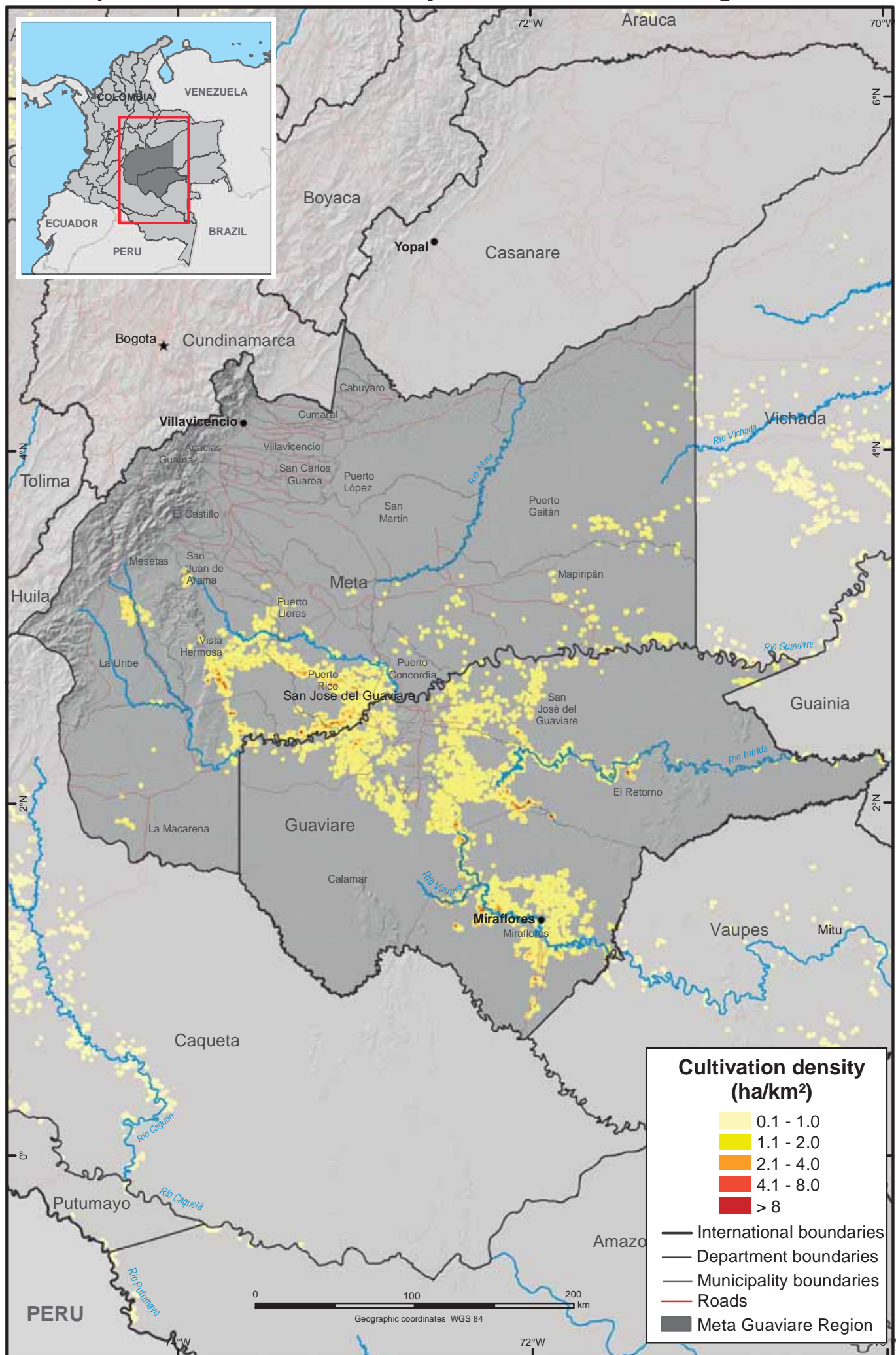
The cultivation of coca in Putumayo and Caqueta is characterised by a high dispersion; however, in 2012 a trend to increase could be observed mainly in the foothill at the south of the department of Caqueta and the watershed area Caguan – Orteguzaza. The zones of greatest reduction are at south Putumayo in the border with Ecuador and are associated to actions of manual eradication and alternative development.

Aerial spraying operations in Putumayo went from 9,480 hectares in 2011 to 6,504 in 2012 and in Caqueta from 12,888 hectares in 2011 to 5,638 hectares in 2012. Manual eradication operations remained in the same levels than in 2011 in Putumayo, while decreased in Caqueta to 258 hectares; nonetheless, an important part of the actions were conducted at the end of the year, so it had an important incidence in the reduction of the area under cultivation.



*Coca fields in Putumayo - Caqueta region*

**Map 10. Coca cultivation density in the Meta-Guaviare region, 2012**



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

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**Meta - Guaviare Region**

Table 8. Coca fields in Meta - Guaviare, 2006 – 2012 (in hectares)

Department	2006	2007	2008	2009	2010	2011	2012
Guaviare	9,477	9,299	6,629	8,660	5,701	6,839	3,851
Meta	11,063	10,386	5,525	4,469	3,008	3,040	2,699
Total	20,540	19,685	12,154	13,129	8,709	9,879	6,550
Annual trend	-21%	-4%	-38%	8%	-34%	13%	-34%

The Meta-Guaviare region had been traditionally the one with the greatest area under coca cultivation in the country. However, as from 2005, a strong and continuous trend to reduction started, going from 28,509 hectares in 2004 to 6,551 hectares in 2012. The strong reduction (-34%) took place in the department of Guaviare.

Between 2004 and 2005, the department of Meta had the greatest area under coca cultivation in Colombia; in 2012, it is in the seventh place with 2,700 hectares. Aerial spraying had a slight increase, going from 2,545 hectares in 2011 to 3,152 hectares in 2012, while manual eradication decreased by half (319 ha). In this department, especially in the zone of La Macarena, the National Consolidation Plan was implemented in 2006, aimed at strengthening the presence of the State, recovering the security of the population and promoting investment from private and international sectors in legal agriculture; nonetheless, coca cultivation increased in La Macarena region.

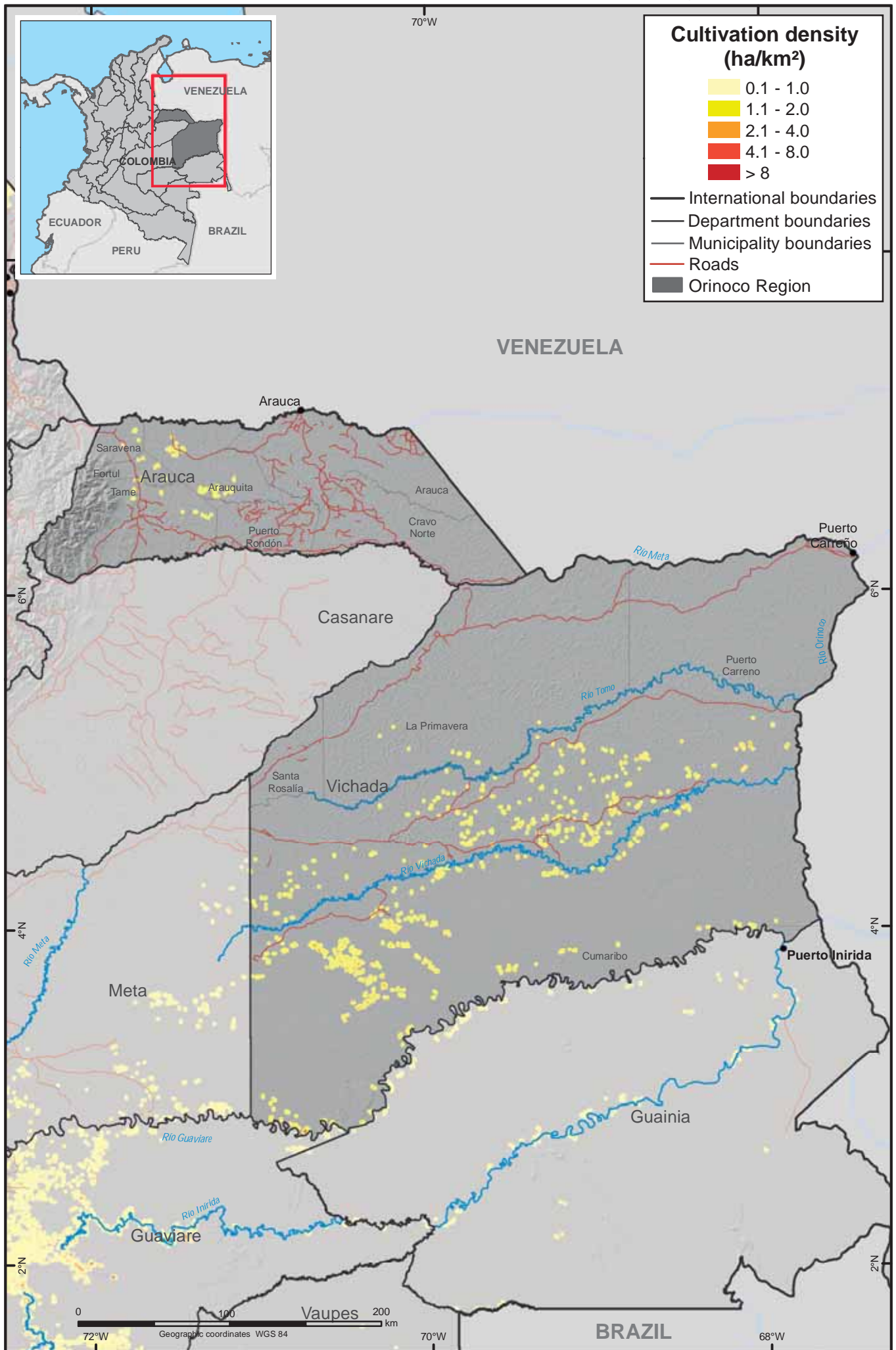
An alternation of increase and decrease periods remains stable in Guaviare since 2007. In 2012, there was an important reduction (-43%) in coca cultivation, that is contrasting with the increase of 20% recorded in the previous period. The first appearance of coca cultivation in Colombia took place in this department by the end of the 70's and since then this crop has been very important. In 2012, the area cultivated with coca dropped to its minimum in the historical series (3,851 ha), which is the seventh part of the area found in 2002. In Guaviare, 325 hectares were manually eradicated, this is 11% of the eradication in 2011; aerial spraying was performed in 11,393 hectares, 28% more than in 2011.

Two of the three National Natural Parks most affected by coca cultivation are located in the Meta – Guaviare region: The Nukak National Park in the department of Guaviare, where coca cultivation was reduced by 18% and the Sierra de la Macarena National Park, where coca cultivation increased by 50% compared to 2011.



*Coca fields in the Meta – Guaviare region*

**Map 11. Coca cultivation density in the Orinoco region, 2012**



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

Table 9. Coca cultivation in the Orinoco region, 2006 - 2012 (in hectares)

Department	2006	2007	2008	2009	2010	2011	2012
Vichada	5,523	7,218	3,174	3,228	2,743	2,264	1,242
Arauca	1,306	2,116	447	430	247	132	81
Total	6,829	9,334	3,621	3,658	2,990	2,396	1,323
Annual trend	-30%	37%	-61%	1%	-18%	-20%	-45%

The region shows a trend to reduction of the area under coca cultivation since 2007, going from 9,334 hectares in 2007 to 1,323 hectares in 2012. Crops are generally disperse and associated to gallery forests, and importantly concentrated in Vichada.

In the department of Vichada, bordering with Venezuela, coca cultivation reached its maximum peak of 9,200 hectares in 2001, decreased to 5,523 in 2006, increased again in 2007 up to 7,218 and since then it has had a trend to reduction that remained in 2012, with its lowest point in the complete historical series: 1,242 hectares. Manual eradication went from 2,005 hectares in 2011 to 689 in 2012, and aerial spraying was conducted in 222 hectares.

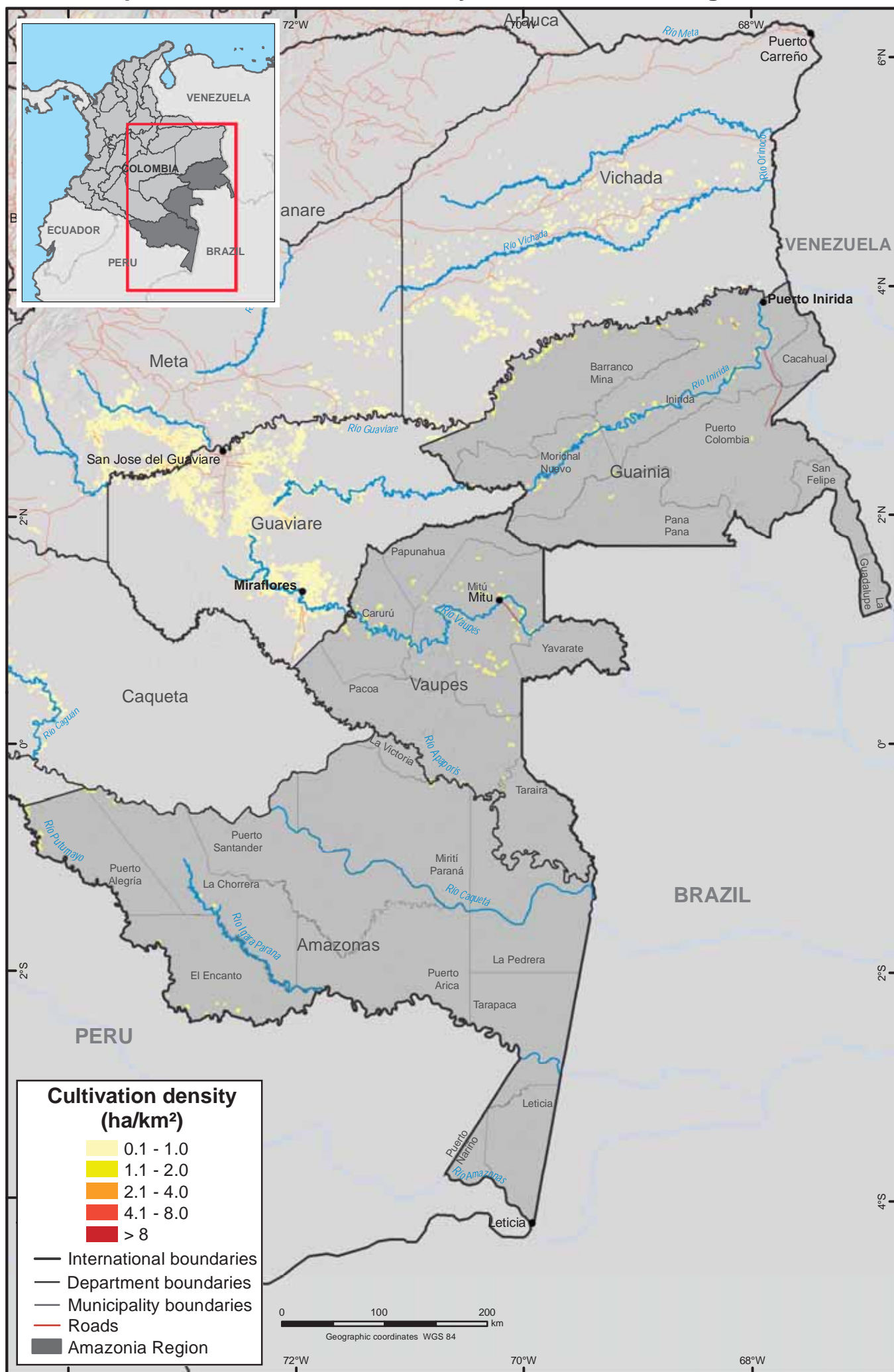
In the department of Arauca, around 1,000 hectares under coca cultivation were first detected in 2000; the highest peak in the historical series was found in 2001 (2,749 ha) and the lowest in 2012 (81 ha). Similarly to their neighbour Vichada, in 2007 a decreasing trend started, which in 2012 put it in the list of departments with less than 100 hectares cultivated with coca. In 2003, the record of aerial spraying was achieved with 12,000 hectares. No aerial spraying has been conducted in the last years and no manual eradication was done in 2012.

The National Natural Park of El Tuparro is located in this region, which is still affected by the presence of coca crops (11 ha).



*Coca fields in the Orinoco region*

Map 12. Coca cultivation density in the Amazonas region, 2012



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

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**Amazon Region**

Table 10. Coca cultivation in the Amazon region, 2006 - 2012 (in hectares)

Department	2006	2007	2008	2009	2010	2011	2012
Guainia	753	623	625	606	446	318	301
Vaupes	460	307	557	395	721	277	254
Amazonas	692	541	836	312	338	122	98
Total	1,905	1,471	2,018	1,313	1,505	717	653
Annual trend	-18%	-23%	37%	-35%	15%	-52%	-9%

The departments of Vaupes, Amazonas and Guainia, like the Putumayo-Caqueta region, belong to the basin of the Amazonas River. Although they share several geographical characteristics with Putumayo and Caqueta, these three departments have not been important centres for coca cultivation and show similar trends to reduction.

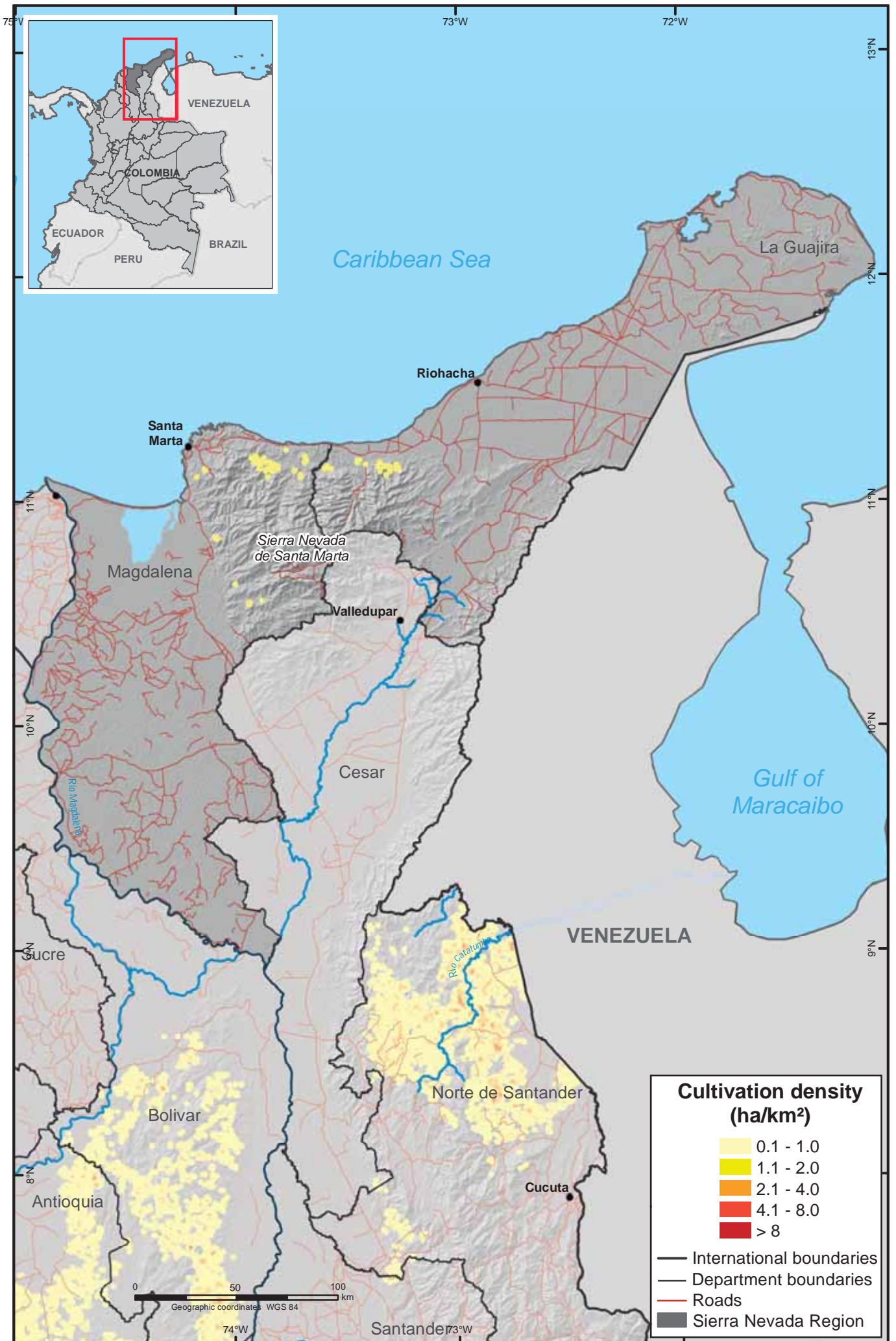
The highest point in the historical series of coca cultivation took place in 2001, with 3,768 ha; for 2012, the area planted with coca is a sixth part of what existed in 2001. The most important reduction occurred in Amazonas, while in Vaupes and Guainia the situation is stable.

No aerial spraying or manual eradication activities were carried out in this region.



*Coca fields in the Amazon region*

**Map 13. Coca cultivation density in the Sierra Nevada region, 2012**



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

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

*Sierra Nevada Region*

Table 11. Coca cultivation in the Sierra Nevada region, 2006-2012 (in hectares)

Department	2006	2007	2008	2009	2010	2011	2012
La Guajira	166	87	160	182	134	16	10
Magdalena	271	278	391	169	121	46	37
Total	437	365	551	351	255	62	47
Annual trend	-19%	-16%	51%	-36%	-27%	-76%	-24%

The Sierra Nevada region has low cultivation density in relation to the rest of the country. Coca cultivation remained between 500 and 1,300 hectares until 2004 and as of that year, a trend to reduction began until it dropped to 365 hectares under cultivation in 2007. After a slight increase in 2008, the nucleus reached the smallest area under coca cultivation in 2012 (47 ha).

Coca cultivation has basically remained in the margins of lower lands, between the high mountains of Sierra Nevada and the Caribbean coast. No aerial spraying activities were conducted since 2005 in this region; in 2012, 10 hectares were manually eradicated in Magdalena and 15 in La Guajira.

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

The region is an important tourist centre, with the presence of the National Natural Parks complex of Tayrona - Sierra Nevada, which is one of the most important ecological reservations in Latin America, known by its biodiversity and the presence of various indigenous groups of ancestral cultures. Coca cultivation in these parks maintains a decreasing trend in 2012, with 5 hectares cultivated with coca reported in the Sierra Nevada Park.

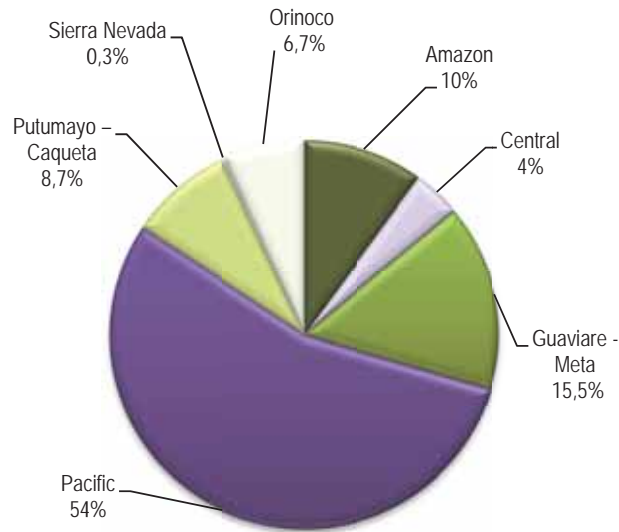


*Coca fields in the Sierra Nevada region*

**Coca cultivation in Indigenous Reservations**

The information on the geographical limits of indigenous territories in Colombia is reported by IGAC. The analysis of the presence of coca crops is based on the 2009 delimitation; crossing these maps with the coca polygons, a reduction of -8 % with respect to the previous year can be seen. Despite the reduction, the area under coca cultivation in the reservation has remained relatively stable since 2003, with a total figure between 6,000 ha and 8,000 ha. The Appendix 3 shows the area cultivated with coca in 2011 and 2012 per reservation.

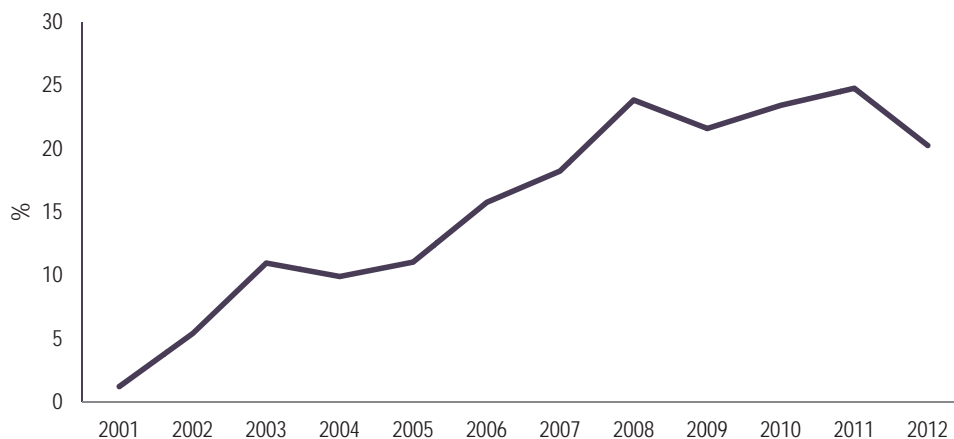
**Figure 6. Percentile participation of coca cultivation in indigenous reservations by region, 2012**



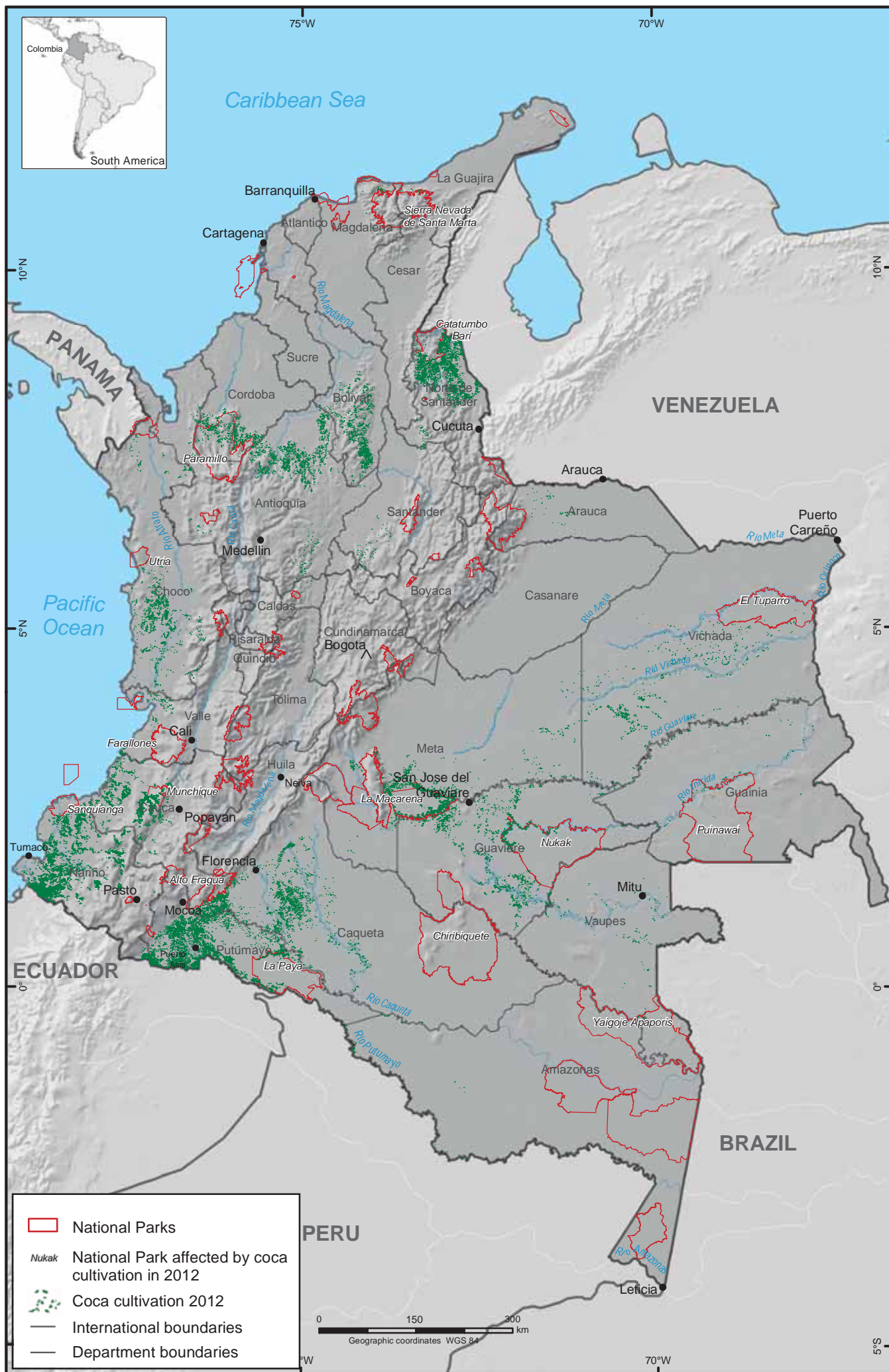
**Coca cultivation in Communal Councils of Afro-descendant communities**

The information about the geographical limits of the Communal Councils of Afro-descendant communities in Colombia is reported by IGAC. Opposed to the trend at the national level, coca cultivation in the Communal councils has increased since 2001; in 2012, this trend was broken with a strong reduction of -39%. This reduction is strongly concentrated in Nariño, in association with aerial spraying operations conducted by the end of 2012. Nonetheless, the participation of these crops in Communal councils with respect to the national total is still high: 20% of coca cultivation in the country is in Communal councils; thus, Communal Councils are still the special territorial units most affected by the presence of coca cultivation.

**Figure 7. Percentile participation of coca cultivation in Communal Councils with respect to the national total, 2012**



Map 14. National Parks and coca cultivation in Colombia, 2012



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

### Coca cultivation in National Natural Parks

The presence of coca cultivation in National Natural Parks has been monitored by SIMCI since the census of 2001. The data is delivered to the competent authorities as a support of the identification of actions and projects for the preservation of the social and environmental preservation of the territory.

The limits of the National Natural Parks are defined by the entities officially in charge of their preservation and maintenance. In 2005 they were revised based on the satellite images provided by SIMCI; for 2010, they were adjusted again by UAESPNN and IGAC. The data of the table are based in the most recent delimitation.

From the 57 National Natural Parks in Colombia, 19 were found to have coca cultivation in 2012, which is one more than in 2011. The area under coca cultivation in National Natural Parks (3,379 ha) represents 0.028% of the total area covered by National Natural Parks and 7% of the total area of coca cultivation this year.

Coca cultivation increased by 5% in Natural Parks. This increase is concentrated in the parks of Sierra de la Macarena, Munchique and Alto la Fragua. 84% of coca cultivation in parks is located in four of them: Sierra de la Macarena, Nukak, Paramillo and La Paya

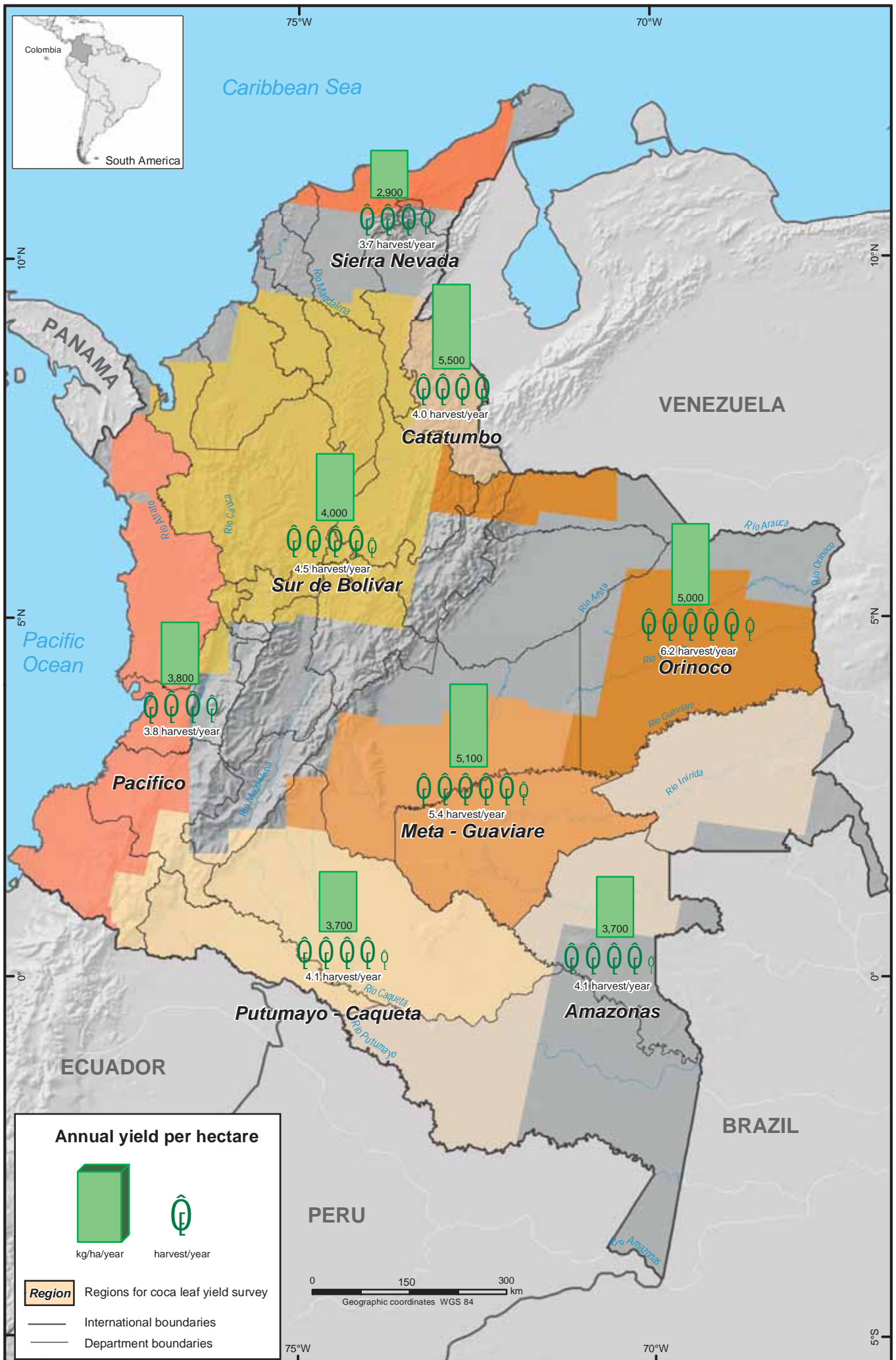
Table 12. Coca cultivation in hectares in National Natural Parks 2011 – 2012<sup>13</sup>

Region	Park	2011	2012
Amazon	Puinawai	42	45
	Yaigoje Apaporis	6	9
Central	Catatumbo - Barí	191	155
	Paramillo	446	408
	Serranía de los Yariguíes	10	3
Meta - Guaviare	Nukak	786	634
	Sierra de la Macarena	971	1466
	Tinigua	0	5
Orinoco	El Tuparro	18	11
Pacific	Los Farallones de Cali	79	38
	Los káticos	4	3
	Munchique	128	204
	Sanquianga	5	7
	Utría	1	2
Putumayo - Caqueta	Alto fragua - Indiwasi	6	14
	La Paya	500	362
	Plantas Medicinales Orito Ingi Ande	2	5
	Serranía de los Churumbelos	1	3
Sierra Nevada	Sierra Nevada de Santa Marta	11	4
Total		3,208	3,379

<sup>13</sup> The data has a setting as the boundary area of the park



Map 15. Coca yield by region in Colombia, 2012



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

## PRODUCTION OF COCA LEAF, COCA PASTE AND COCAINE BASE

Productivity studies enable the characterization of the productive systems in terms of growers' agro-cultural practices, varieties and sowing densities, with the aim of determining the capacity to produce coca leaf and the efficiency in the extraction processes in the primary production phase. Given the high complexity of the dynamics around illegal crops in Colombia, the main difficulties to collect this information are the problems to access the zones and a high mobility of resources and the variability of coca plots. Productivity studies are jointly conducted by UNODC and the Government of Colombia and refer to the producer's level in the regional sphere established by UNODC.

### *Update of the productivity study Putumayo-Caquetá region*

Productivity studies started in 2005, when the baseline of information collection was established in the entire national territory; since then, due to the high costs and security conditions of the zones affected by coca cultivation, one or two regions are updated every year. Considering the commitments between UNODC and the Colombian Government of maintaining productivity studies updated, every round is of approximately 4 years. To date, the information at the national level has been consolidated in two phases and the third phase has started in the Central, Catatumbo and Putumayo-Caquetá regions.

**Table 13. Year of execution of the productivity studies used as reference in the 2012 report**

Region <sup>1</sup>	Meta-Guaviare	Pacific	Orinoco	Sierra Nevada	Central	Catatumbo	Amazon	Putumayo-Caquetá
Year of study	2008	2009	2010	2011	2011	2011	2012(1)	2012 (1)

*Nota:*

<sup>1</sup> Productivity studies do not collect information in the Amazon region, due to which the production estimations are done taking into account the results of the Putumayo-Caquetá region.

In 2012, the production and yield study was conducted in the Putumayo-Caquetá region; in this region, field operatives were carried out in 2005 and 2008<sup>14</sup>.

The methodology multistage sampling<sup>15</sup> was applied, based on area frameworks with development of two components: crop tests and application of direct surveys to coca growers. The methodology used in productivity studies is probabilistic and it allows for the extrapolation of the information of the sample to the entire population. It is worth mentioning that, since the universe of coca leaf producers is unknown, the reference taken is the geographical component from the location of the coca cultivation in an area that is determined in advance. This location comes from the annual censuses conducted by SIMCI, which becomes the population universe called Framework of Areas<sup>16</sup>.

The size of the sample for 2012 was 240 direct interviews with agricultural producers, 80 primary sample units (grids of 1 km<sup>2</sup>), i.e., 3 surveys in each primary unit. 160 coca fields were selected and 80 crop tests were conducted in Putumayo-Caquetá.

**Table 14. Study areas 2012**

Region	Area of incidence of coca Hectares	Area planted with coca (2012) Hectares
Putumayo - Caquetá	1,111,874	9,843

According to the data that resulted from the crop tests, the yield of coca leaf in Putumayo-Caquetá maintains the decreasing trend; it went from 5,600 kg/ha/year in 2005 to 4,100 kg/ha/year in 2008 and to 3,700

<sup>14</sup> Study of production and yield in Putumayo – Caquetá 2008; was conducted by the National Narcotics Office.

<sup>15</sup> It refers to designs of samples associated to several stages of selection of the units of interest. This type of sampling enables the focalisation of the units of interest, minimising costs and improving field operatives.

<sup>16</sup> The framework allows for the identification and location of the elements of the universe; it is used as a tool for the random selection of the elements that comprise the sample by means of the geographical reference to units associated to the area under the connotation of being unique, unrepeatable and identifiable. To make detailed reference to the methodology applied, the document "Agro-cultural characteristics of coca cultivation in Colombia" 2005 in <http://www.biesimci.org/Documentos/Documentos.html>.

kg/ha/year in 2012. However, the number of crops per year increased from 3.9 in 2005 to 4.3 in 2008, and then it dropped to 4.1 in 2012. This region of the country has a decrease in the area under cultivation; from 13,951 hectares cultivated in 2005, it went to 9,843 hectares in 2012. In the region, there is a total reduction of 38% in the potential production of fresh coca leaf, going from 69,544 mt in 2005 to 42,773 mt in 2012.

Table 15. . Changes in the yield of coca leaf in the Putumayo-Caquetá region. 2005, 2008, 2012

Variable	Unit of Measure	Years		
		2005	2008	2012
Area	Hectares	13,951	13,961	9,843
Crops	Number of crops per year	3.9	4.3	4.1
Annual yield of the coca leaf	(kg/ha/year)	5,600	4,100	3,700

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).

As regards to the varieties planted in Putumayo-Caquetá, it was found that the varieties most used are the so called "*Tingo María*" with 28%, "*Peruana*" with 26% and "*Boliviana Negra*" with 25%, which showed changes in the predominant varieties as compared to those found in 2005 (*Tingo María* and *Boliviana*) and in 2008 (*Tingo María* and *Peruana*). The variety "*Tingo María*" has the highest yield (4.8 mt/ha/year), while the variety "*Peruana*" has a yield of 3.7 mt/ha/year. According to the taxonomic analyses of the coca plants of this region, the varieties found are: *Erythroxylum coca var. Coca* (66%) and *Erythroxylum coca var ipadú* (32%)<sup>17</sup>. In addition, in the taxonomic analyses, evidence was found of the existence of morphologic variations or morphotypes within the varieties of *E. coca*, which suggests that the crops have suffered significant changes in their morphology and distribution in the south of the country.

According to the information reported by Agricultural Producers with coca (PAC) in Putumayo-Caquetá, 55.3% of the fields are in a productive age between 2 and 4 years, 23.5% of the fields are between 4 years and more, while 1.4% is plots of less than one year. It is worth highlighting that, in relation to 2005, the yields have decreased, with a more pronounced trend between the ages of 2 to 4 years.

Table 16. Age of coca fields in the Putumayo – Caquetá, 2012

Age	2005		2012	
	% Fields	Yield Tm/ha/year	% Fields	Yield Tm/ha/year
Less than one year old	14.5	1.3	1.4	1.5
1 a 2 years old	11.6	4.7	19.8	3.5
2 a 3 years old	16.7	5.5	26.7	4.4
3 a 4 years old	14.7	5.5	28.6	4.5
4 a 5 years old	18.6	4.8	11.9	4.5
5 years old or more	24.0	4.8	11.6	4.4

Note: age categories correspond to those reported in interviews with growers

The regional update of the Phase II of the productivity studies showed a decreasing trend in the use of agrochemical products due to the increase of their prices, which resulted in changes in amounts used and in substitution of supplies. This trend was confirmed by the surveys to coca growers in the Putumayo-Caquetá region.

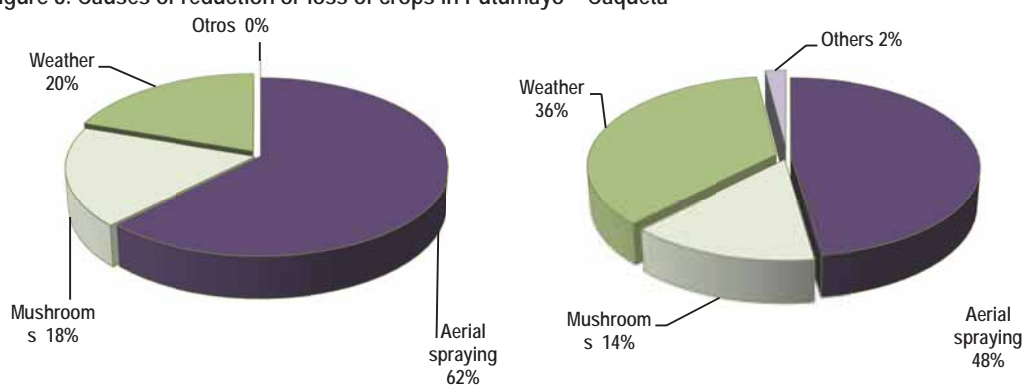
<sup>17</sup> In the taxonomic study conducted by the Herbarium of the District University Francisco Jose de Caldas about 111 botanic samples of coca collected in Caquetá and Putumayo. Considering the common varieties reported in the survey of Putumayo – Caquetá and the results of the taxonomic analysis, the conclusions were the following: i) The common name "*Tingo María*" is taxonomically classified in the species *Erythroxylum coca* in two varieties *E.coca var.coca* and *E.coca var.ipadú*; ii) in the case of "*Boliviana Negra*", it is classified in the three varieties: *E.coca var.coca*, *E coca var.ipadú* and *E.novogranatense var.novogranatense*; iii) in the case of the common name "*Peruana*", in the samples collected in the department of Caquetá, they were classified as *E. coca var.coca* and in Putumayo as *E.coca var ipadú*. In addition to this, a sample of *Erythroxylum sp* was detected, and it corresponds to a wild coca, which could be a sign of the incorporation of this variety to improve the cultivation process and a greatest resistance to aerial spraying.

In 2012, 62% of coca cultivations reported loss and/or decrease in their crops, mainly associated to aerial spraying (48%), climate (36%) and plagues and diseases (14%). Like in 2005, aerial spraying is the greatest cause of loss/reduction of crops; it is worth noting that 12,142 hectares were subject to aerial spraying and 3,856 hectares were manually eradicated in the region.

Table 17. Plots with loss and/or reduction of crops due to different causes, according to interviews with growers in Putumayo – Caqueta

Variable	2005	2012
Fields with loss or decrease	17.2%	62.2%
Fields without loss	82.8%	37.8%

Figure 8. Causes of reduction or loss of crops in Putumayo – Caqueta



Causes of reduction or loss of crops in Putumayo – Caqueta, 2005

Causes of reduction or loss of crops in Putumayo – Caqueta, 2012

Coca cultivations can produce several crops during the year. The frequency of these may depend in several factors, such as climate, agricultural factors and agronomic factors (quality of soil, change of use/amount of herbicides, pesticides and fertilisers), aerial spraying, manual eradication and varieties cultivated, among others. In some occasions, the frequency of crops is also determined by the market of coca instead of by the maturity of the cultivation.

In Putumayo-Caqueta region, the average of days between one crop and the other went from 94 days (3.9 crops per year) in 2005 to 89 days in 2012 (4.1 crops per year). Although there was an increase in the frequency of crops in the year, the average annual yield per crop had a decrease of 10% compared to the record in 2005, with 900 kg of fresh coca leaf per hectare per crop in 2012.

Table 18. Regional Average number of annual crops in interview with growers, 2005-2012

Region <sup>1</sup>	Based measurement (2005)	Actual measurement <sup>1</sup>
Amazon <sup>2</sup>	3.9	4.1
Catatumbo	4.5	4.0
Central	3.3	4.5
Meta-Guaviare	6.6	5.4
Orinoco	5.4	6.2
Pacific	2.5	3.8
Putumayo-Caqueta	3.9	4.1
Sierra Nevada	3.4	3.7
National Average	4.5	4.3

Note:

<sup>1</sup> The reference years in the update of the productivity study are in table 13.

<sup>2</sup> Productivity studies do not collect information in the Amazon region and hence the production estimates are done taking into account the results of the Putumayo-Caqueta region.

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

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

Note:

<sup>1</sup> The reference years in the update of the productivity study are in table 13.

<sup>2</sup> Productivity studies do not collect information in the Amazon region and hence the production estimates are done taking into account the results of the Putumayo-Caqueta region.

Figure 9. Regional annual average of coca leaf yield (reliability intervals)<sup>18</sup>

While in previous years the extraction process of coca leaf into basic paste was conducted mainly by the same grower, in the three last years there was an increase in the sale of fresh coca leaf to intermediaries that process it somewhere in the region. This implies that the process of extraction of the alkaloid tends to occur separately from the Agricultural Productive Unit with Coca -UPAC, due to which the added value generated is mainly concentrated in coca cultivation; the increase in the prices of coca leaf seems to be an incentive that promotes the sale of fresh coca leaf rather than processed products. In addition, the transformation of coca leaf into cocaine base, when not carried out by the growers, implies changes in the productive structures of the extraction and refining processes.

According to the results of workshops conducted by UNODC/SIMCI, the production process has different phases that include extraction of basic paste, oxidization and re-oxidization of cocaine base and refining of cocaine hydrochloride. Basic paste is the first product obtained in the extraction process of the alkaloid and contains organic residues. Cocaine paste results from dissolving basic paste in an acid mean, adding an oxidizing agent as potassium permanganate to eliminate impurities. The re-oxidization of cocaine base is a process used to homogenize the cocaine base and consists of oxidizing the paste or base that arrives to the

<sup>18</sup> The limits were obtained from the range at 95% confidence.

laboratory to take it to a standard oxidization state. This modified productive structure implies that the extraction tends to be centralised in clandestine laboratories in which other actors or intermediaries are involved (drug traffickers or illegal armed groups) in the standardisation of the quality of the product by homogenisation of processes so as to optimise the efficiency of extraction and purity.



The distinction between paste and base is not easy to establish because the terms are used indistinctively by the producers. To distinguish the two products, the decision was to refer to cocaine base when growers inform the use of potassium permanganate in the processing of leaves.

In Putumayo-Caquetá, 64% of the producers sell fresh coca leaf, which confirms the national trend to the strengthening of the market of fresh coca leaf. At the national level, 63% sell coca leaf directly with no process involved (35% did it in 2005), 32% of the growers process coca leaf to obtain basic paste (31% in 2005) and the remaining 5% processes coca leaf to produce cocaine base (34% in 2005). This national trend in the last years of the growers to sell fresh coca leaf has implications not only in the productive structures of the processes, but also in the agents that carry them out.

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

Region <sup>1</sup>	% coca growers that sell coca leaf	% coca growers that process basic paste	% coca growers that process cocaine base
Amazon <sup>2</sup>	64%	36%	0%
Catatumbo	82%	18%	0%
Central	59%	8%	33%
Meta-Guaviare	22%	78%	0%
Orinoco	0%	10%	0%
Pacific	78%	21%	1%
Putumayo-Caqueta	64%	36%	0%
Sierra Nevada	91%	4%	5%
All regions	63%	32%	5%

Note:

<sup>1</sup> The reference years in the update of the productivity study are in table 13.

<sup>2</sup> Productivity studies do not collect information in the Amazon region and hence the production estimates are done taking into account the results of the Putumayo-Caquetá region.

According to the arguments previously expounded, it must be highlighted that this changing dynamic implies a limitation for the representative quality of the yields of the extraction process of basic paste and cocaine base. Given that the informant for the productivity studies is the agricultural producer with coca -PAC who only processes 37% of the leaf, the 63% processed by different agents is outside the scope of the interviews. UNODC, with the support of different institutions of the Colombian Government, have conducted experimental case pilot studies on the *efficiency of transformation of coca leaf* (see text on page 47), with the object of establishing parameters of potential efficiency of the processes of extraction and refining of the alkaloid, based on the knowhow and expertise of the processors. On the grounds of these studies, it will be possible to know in-depth the resources, types of infrastructure and supplies required for the production, as well as reference points of optimisation and homologation of productive processes and standardisation of qualities in clandestine laboratories. Considering that these results currently have regional coverage limitations that affect

the strength of the technical parameters detected, the production estimations of the extraction and refining processes in 2012 are done taking into account the data collected by the Government of the United States on efficiency of secondary transformation (purity of cocaine base 81% and the conversion rate of cocaine base to cocaine hydrochloride 1:1) methodology applied in previous years.

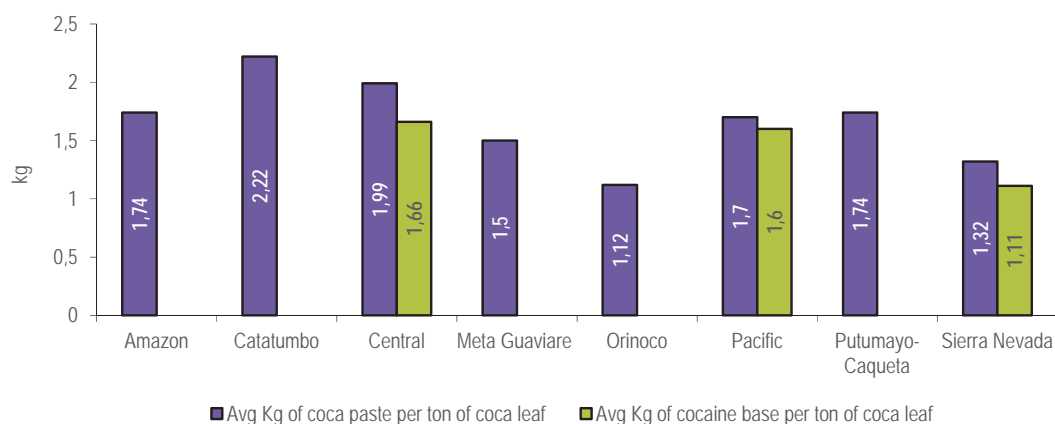
Table 21. Regional average in kilograms of coca paste and cocaine base resulting from a metric ton of coca leaf, 2012

Region	Coca paste/ Cocaine base					
	2005		2008		2012	
	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
Putumayo-Caquetá	1.75	1.74	1.76	1.68	1.74	-

In accordance to the update of the region, the amount of basic paste extracted keeps the trend if compared to the results in previous periods and in absolute terms, it is high in relation to other regions of the country; the current report by primary producers for Putumayo-Caquetá is an average of 21.8 grams of basic paste per arroba<sup>19</sup> of coca leaf.

As suggested by the report of producers, the transformation process of coca leaf is relatively similar in all the regions and they do not perceive limitations as regards to the availability of chemical substances; they inform that in events of restriction there are substitute substances for this process. They reported gasoline as the product most used in the production process of paste and/or cocaine base. On the grounds of the date from surveys and workshops conducted in the region, it was found that the processors of basic paste get gasoline from clandestine refineries and there is evidence of a trend to use sulphuric acid for car batteries in the process of extraction of the alkaloid.

Figure 10. Regional average of coca paste and cocaine base obtained from one metric ton of coca leaf<sup>1</sup>



Note:

<sup>1</sup> The reference years in the update of the productivity study are in table 13. Conversion studies are part of an effort at UNODC to update the regional estimates of potential cocaine produced in the region, using a comparable methodology.

<sup>19</sup> 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, mass or volume unit. In weight it is equivalent to around 25 pounds or 12.5 kilograms in Colombia

### Potential production of leaf, base and cocaine hydrochloride

Productivity studies provide information not only about the yield of fresh coca leaf, but also about the process of transformation of coca leaf into coca paste or cocaine base. The potential production of fresh coca leaf in Colombia in 2012 was calculated in relation to the average area under coca cultivation in each region in the last two censuses and the annual yield of fresh coca leaf based on the updated information available per region.

**Table 22. Yields and production of coca leaf per region, 2012**

Region <sup>1</sup>	Annual yield of coca leaf in Kg./ha/year*	Coca leaf production m.t
Amazon <sup>2</sup>	3,700	2,534
Catatumbo	5,500	22,017
Central	4,000	26,078
Meta-Guaviare	5,100	41,895
Orinoco	5,000	9,298
Pacific	3,800	86,942
Putumayo-Caqueta	3,700	42,773
Sierra Nevada	2,900	158
<b>National yield</b>	<b>4,200</b>	<b>231,695</b>

Note:

<sup>1</sup> The reference years in the update of the productivity study are in table 13.

<sup>2</sup> Productivity studies do not collect information in the Amazon region and hence the production estimates are done taking into account the results of the Putumayo-Caqueta region.

At the national level, taking into account that 32% of the growers process basic paste directly, out of the total estimated production of coca leaf (231,695 mt for 2012<sup>20</sup>), around 82,613 mt are transformed into 132 mt of basic paste<sup>21</sup>, which is equivalent to 129 mt of cocaine base, using the type of conversion from paste into base. It is assumed that the remaining fresh coca leaf (149,082 mt) is processed directly into cocaine base by the grower or other agent<sup>22</sup>, producing 252 mt<sup>23</sup>. In consequence, it is calculated that the potential production of cocaine base in 2012, from coca paste and directly from coca leaf, adds up to 381 mt.

<sup>20</sup> The potential production estimated of coca leaf from the variance in the hectares cultivated the last two census, oscillate between 179,208 mt to 284,181 mt

<sup>21</sup> The potential production of coca paste estimated from the variance in the hectares cultivated in the last two census, oscillate between 99 mt - tm 165 mt

<sup>22</sup> According to the productivity study, it is estimated that 5% of the growers at the national level process fresh coca leaf into cocaine base.

<sup>23</sup> The production of cocaine base process in farm and other agents, estimated from the variance of the hectares cultivated in the last two census, oscillate between 200 mt - tm 304 mt.

### Conversion, purity and extraction efficiency:

The results of the experimental pilot exercise of the studies *efficiency of the transformation of coca leaf* conducted by SIMCI/UNODC, the Antinarcotics National Police and the Government of Colombia, under controlled conditions, provide the knowledge of the following parameters: a) conversion, b) purity and c) efficiency of the extraction processes of products derived from the different productive processes that are currently made in clandestine laboratories of: i) fresh coca leaf into cocaine base, ii) cocaine based into re-oxidized base and iii) from re-oxidized base into cocaine hydrochloride.

Initial Product	end-product	a) Performance processing efficiency			b) purity	c) Extraction efficiency
		Units	Lower limit	Upper	% Alkaloid in the final product	Initial alkaloid / end (percentage s)
Coca leaf fresh (CLF)	Base de cocaine (BC)	Kg de CB /tm CLF	1.44	1.62	78 - 85	( <sup>1</sup> )
Cocaine base (CB)	Base reoxidized (BR)	Kg de (CB)/ kg de (BR)	0.763	0.857	81 - 89	73 - 82
Base reoxidized (BR)	Cocaine hydrochloride (CC)	Kg de (BR)/ kg de (CC)	0.874	0.959	82 - 89	87 - 96

(<sup>1</sup>) UNODC does not have data on content of alkaloid of the coca leaf that was used in the pilot exercises.

It is important to underscore that, due to its condition of experimental pilot exercise, the results have the following restrictions: i) No great scale exercises were done as it may happen in the production sites; ii) the transformed amounts of fresh coca leaf were not homogeneous, which results in differences in the standardisation of the production, and this means possible losses of intermediate and final products with the consequent possible underestimation of the final amount in relation to clandestine laboratories; iii) the analyses of purity and content of alkaloid were conducted with the support of the Chemical Forensic Laboratory of the CTI of the General Attorney's Office of the Nation, which has an international credential for this aim.

In the short and medium terms, these studies may be established as an information alternative given the changing dynamic with the incorporation of new agents and the specialisation of the extraction processes.

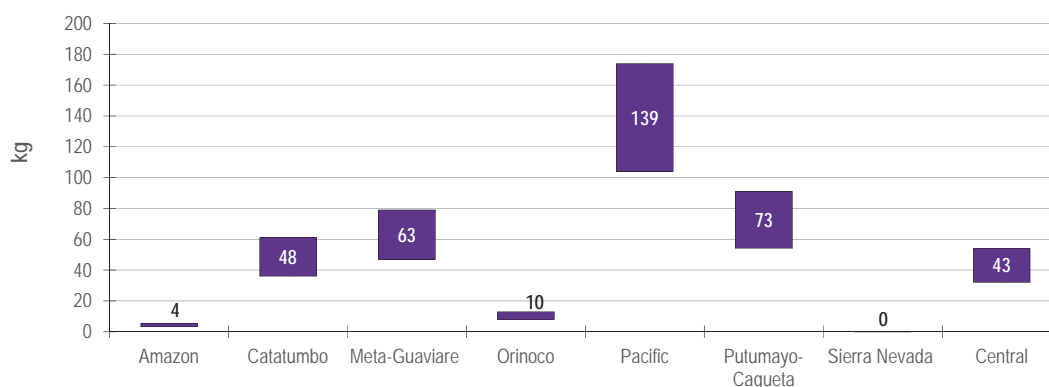


Process of transformation of coca leaf into paste cocaine base and cocaine hydrochloride



Based on the results from the productivity studies, the estimated production of basic paste and cocaine base and the conversion rates used (average purity of cocaine base =81% and the rate of conversion from cocaine base into cocaine hydrochloride 1:1), the production of cocaine base in 2012 is equivalent to 309 mt of pure cocaine<sup>24</sup>. Taking into account the different parameters resulting from the processes of cultivation, extraction and refining of the alkaloid that were previously expounded, the estimated relation of potential production is 6.3 Kg of cocaine base per cropped hectare and 5.1 Kg of cocaine hydrochloride per cropped hectare<sup>25</sup>.

Figure 11. Potential production estimated of cocaine base, 2012



Note:

<sup>1</sup> The estimations are done under the assumption that all the crops from the region is processed into cocaine base in the same territory, using the yields paste/base reported by the growers that process in their UPAC.

<sup>2</sup> Productivity studies do not collect information in the Amazon region and hence the production estimates are done taking into account the results of the Putumayo-Caqueta region.

<sup>3</sup> The estimations of production of cocaine base are done based on the average of the areas under coca cultivation in the last two censuses, the distribution of labour in the process of sale and transformation of coca leaf, and the yield of cultivation and of the extraction process in each one of the regions under study.

<sup>4</sup> Calculate the potential production data assumed purity of 81%.

<sup>5</sup> the estimation of potential production are determined from calculations of the intervals at 95% confidence of annual area of coca crops. From these intervals and maintaining the performance parameters of leaf, coca paste and base and market structure determined by the survey. The potential production was estimated from the upper and lower limits of the confidence intervals. These results in the minimum and maximum estimates of potential output in the various links in the chain associated with the variance of hectares reported in the censuses of coca.

The result of 309 mt refers to pure cocaine hydrochloride, which is a reference to compare the levels of production with other countries although there is no market for pure cocaine hydrochloride. In this regard, it has been identified that cocaine has various degrees of dilution or "adulteration" in the distribution chain in consumption markets. According to the results of studies conducted by SIMCI/UNODC, the Colombian Government and other institutions such as PRADICAN and PRELAC, the following was found: i) in Colombia, cocaine is added with cutting substances, among which the most common are caffeine, lactose, lidocaine, creatinine and Manitol. In addition, some processors use substances called *rindex*, like Diltiazem and Levamisole; ii) currently the drug is being adulterated directly in the production laboratories, with substances that have marked pharmacologic effects, which enhance the effects of the alkaloid and are harmful for human health.

It must be highlighted that, although historically coca cultivation is thought to be in function of the production of cocaine hydrochloride mainly for exportation, currently there is evidence of some trends to deviate intermediate production (basic paste and cocaine base) to the Colombian local market by means of micro-traffic chains. In relation to this, the case study of *Chemical characterisation of cocaine-based drugs seized in*

<sup>24</sup> For the effects of the estimation of cocaine production, the following data was used: data from the studies of production and yield in primary transformation (leaf into cocaine base) and data collected by the Government of the United States about efficiency in secondary transformation (base into cocaine hydrochloride, which is 1:1) and the purity of base (81%). The production of pure cocaine hydrochloride estimated from the variance in hectares cultivated in the last two census, oscillate between 240 mt - 377 mt.

<sup>25</sup> These estimations correspond to the national level, in which all the area cultivated is extracted as cocaine base and refined into cocaine hydrochloride.

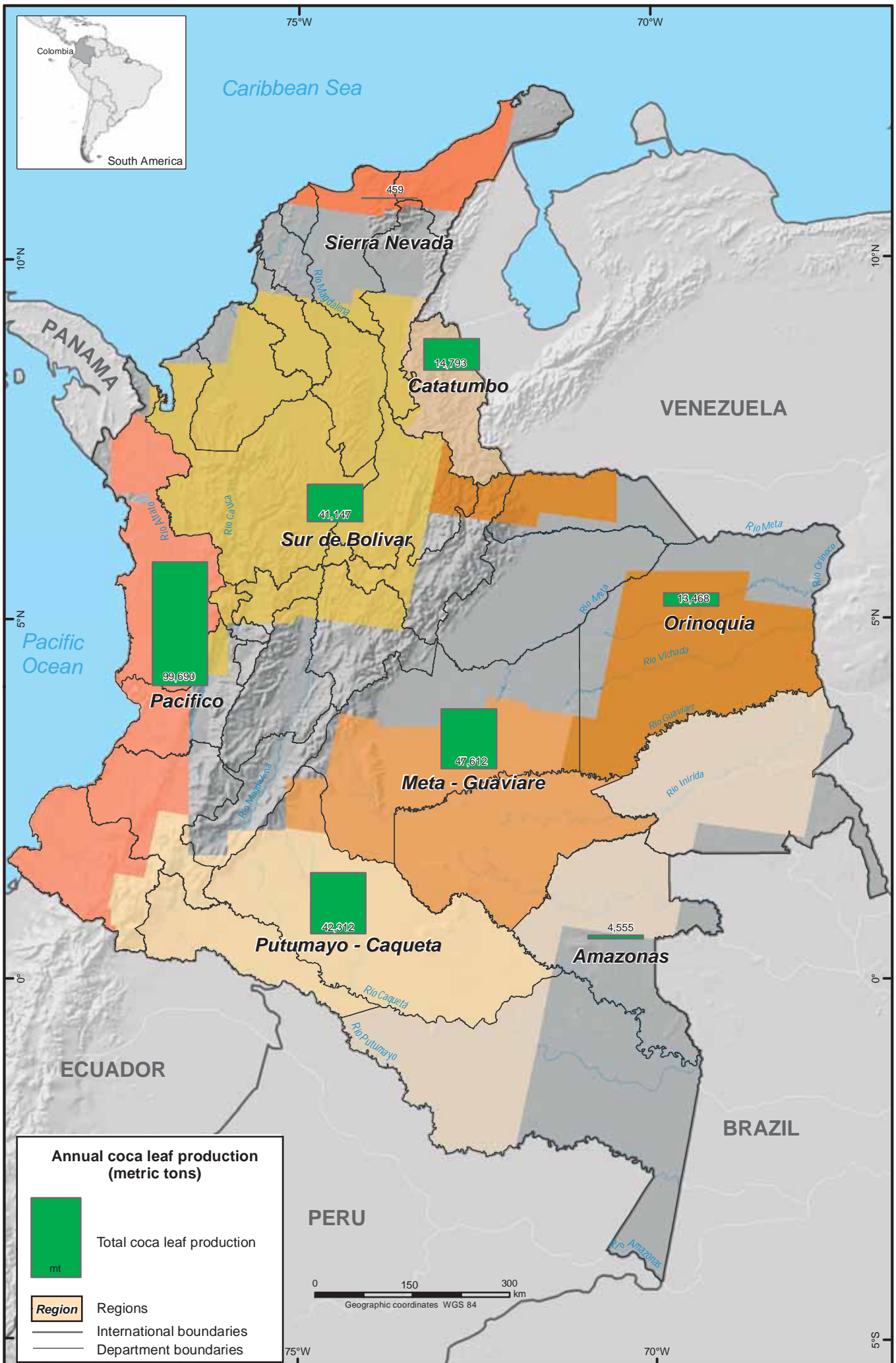
13 cities of Colombia conducted in 2012<sup>26</sup> by the Andean Community PRADICAN detected that: i) 63% of the samples correspond to cocaine base, while the remaining 37% are cocaine hydrochloride; ii) the most common way of consumption of cocaine in almost all the cities under study is smoked, either as crack or cocaine base; iii) in 50% of the samples there was presence of *cis* and *trans cinnamoilcocaine*<sup>27</sup>, which means that these are poorly refined (oxidized); and iv) the samples of cocaine hydrochloride had a purity between 10% and 20%, while the cocaine base was between 70% and 80% pure, which makes them highly addictive and harmful. However, the magnitude of these behaviours and structures has not been yet identified in terms of production and trading volumes.

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<sup>26</sup> Based on the chemical analyses of 373 samples of cocaine seized in 13 cities of Colombia: Bogotá, Pamplona, Manizales, Popayán, Medellín, Cali, Barranquilla, Cúcuta, Santander de Quilichao, Pereira, Armenia, Sincelejo, San Andrés, Ibagué, Cartagena.

<sup>27</sup> According to the study of PRADICAN, these alkaloids are native of coca leaf and are indicators of the oxidization process with potassium permanganate done in the extraction process.

Map 16. Annual coca leaf production in Colombia, 2012



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

## CHARACTERISATION OF THE AGRICULTURAL GROWERS WITH COCA AND OF THEIR PRODUCTIVE UNITS

Drug trafficking has imposed its logic in the territories it occupies. Territories - from farmers, indigenous people or Afro-descendant people- are used by drug traffickers for their lucrative ends, and the socio-economic dynamic of towns and rural settlements has been organised in function of its merchandise. Agricultural producers have been forced in the dynamics of drug trafficking and their domestic farmers' economies, in many cases, are at the service of the drug business.

However, in a progressive way, the agricultural producers have been recovering their productive units and the trend perceived is that day by day they are devoting more space to the production of licit crops in their productive units and less to coca cultivations. While in 2005 82% of agricultural producers manifested that coca cultivation was their main source of income, in 2011 only 60% stated the same. The production of livelihood cultivations, small livestock (pigs and birds) and the presence of some cows in the productive units has become a source of food safety for their family and in the second source of income.

81% of the agricultural producers with coca in their productive units have manifested their wish to leave coca cultivation and substitute it with legal agricultural economies. Nonetheless, for this it is necessary to have a much stronger institutional support and to implement public policies aimed at protecting the national agricultural sector, strengthen the national food market and to implement much more sustainable and comprehensive alternative development programmes. This type of measures may contribute to subtract agricultural producers from the coca market chain.

This chapter will go deeper in the socio-economic characteristics of agricultural producers with coca. To the extent that a more complete view on the agricultural producers that cultivate coca in their productive units is achieved, there will be a secure progress in the design of suitable public policies that will offer them viable alternatives to consolidate a self-sustainable economy and an effective and profitable relation with local and regional markets.

### *Place of birth*

The coca producing regions where these surveys were applied have been historically characterised by having an important movement of population. As may be inferred from the survey, in average 50% of the inhabitants state that they were born in the place where they have their productive unit, 20% were born in other municipalities of the region and 30% outside of it. Regions as Orinoco (67.5%), Meta- Guaviare (46.0%), Sierra Nevada (25.4%) and Central (24.6%) are the regions with higher rates of immigrants<sup>28</sup>.

When the immigrants of the coca producing regions were asked for the reasons they had to leave their places of origin –or their former places of residence- and go to this new place, 57% answered that they were forced by economic reasons (unemployment and poverty) and 21% answered it was because of reasons related to political and social violence (security issues- mainly intensification of the armed conflict, threats and extortion- and evacuation). This, of course, must not be understood as if the economic variables and socio-political variables did not occur at the same time; contrarily, they are deeply interwoven and we mentioned them separately for analytical reasons.

### *Reasons to get involved in coca cultivation*

Agricultural producers state in general terms, the following reasons: "Profitability", "There are no options" and "Easy market", which add up for 77% of the reasons expounded. The arguments are related to economic reasons and they responded, particularly, to survival strategies given the extremely restricted socio-economic conditions that the agricultural producers have to deal with and which have turned their productive units into high vulnerability territories for the establishment of drug trafficking.

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<sup>28</sup> The data refer to the Phase 2 study of productivity for 2010

**Source of income of the household**

The survey of farmers showed the following results: 60% (82% in 2005) of farmers reported that the main source of income comes from coca cultivation, for the 27% comes from farming, for the 9 % come from other areas and 2% did not know or did not respond.

Figure 12. Alternative agricultural production



Farmers in areas affected by coca developing different actions such as grazing and grinding

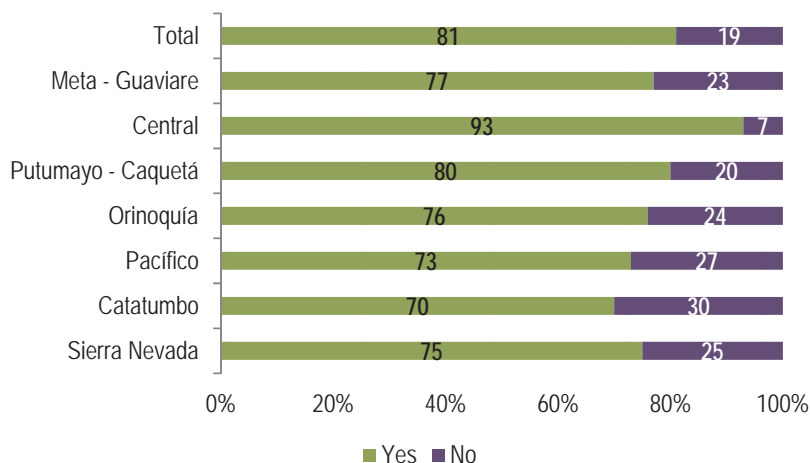
Source: Field monitors, project K53/UNODC

It is important to mention that with time, some agricultural producers have acquired, thanks to their income, housing in the urban area close to their productive units. This has modified in part their habits and their family structure, but their economic life continues to happen in the rural setting. According to the survey, in general terms, 61% of the producers still live in the Agricultural Production Unit with Coca (UPAC) and 39% outside of it.

**Agricultural producers want to leave coca cultivation**

According to the results of the study, 81.2% of the agricultural producers manifested their wish to leave coca cultivation, strengthen their agricultural activities and make them their main source of income.

Figure 13. Percentile distribution of farmers who want to stop growing coca



As shown in the Figure 12, in Sierra Nevada, 100% of the interviewees manifested their wish to leave coca cultivation. In order, the regions that stated in favour of substituting their coca cultivations with legal crops were Central region (92.8%), Putumayo-Guaviare (80%), Meta-Guaviare (76.6%), Orinoco (75.6%), Pacific (73.4%) and Catatumbo (70.1%). Only 18.8% of the agricultural producers manifested to be in favour of continuing with coca cultivation in their productive units.

## PRICES

As from 2005, UNODC/SIMCI have an information system of the prices of drugs and its derivative products by means of the collection and systematization of the records from the different trading phases and main cities of the country. For 2012, data of prices in Colombia have been collected in cultivation zones as well as in places of influence of commercialisation, thanks to the work of people involved in programmes of UNODC and National Anti-drugs Police -DIRAN.

In Colombia, the prices of the products derived from the production and transformation of illicit cultivation show that the market does not always respond to the laws of supply and demand. While the supply tends to decrease in the last years, the nominal prices of coca leaf and primary production have remained stable; this behaviour may be explained by the intervention of intermediaries (either illegal armed groups or drug traffickers), who determine the prices of the product in their area of influence. This implies that the growers – most of them farmers- do not have influence in the market or the prices.

The coca markets and their derivative products in the country seem to be associated to a local monopsony structure, in which one single consumer puts pressure on the exchange of goods, manifested in a scenario of control of the price with lower levels in relation to those that can be found in a competitive market (many buyers and demanders). This situation forces the producers to adapt to the conditions imposed. Given the illegal and clandestine character of coca markets, the configuration of this scenario of monopsony is possible provided that the buyer establishes a series of strategies that transcend the mechanisms typical from the allocation of resources in the economic dimension; this favours its establishment in regions characterised by conditions of vulnerability in the social and institutional dimensions.

In the case of the prices of cocaine hydrochloride, although they have a relatively stable behaviour, the further in the trafficking chain, the higher they are. This report presents the prices of cocaine hydrochloride in the main cities of the country<sup>29</sup>.

In 2012 there was a trend towards the raise of prices of fresh coca leaf and cocaine base, while the price of basic paste and cocaine hydrochloride remained stable as compared to the same period of the previous year. Factors as problems in public order, lower supply of fresh coca leaf, climate, difficulties of access to transportation and possible changes in the productive processes (homogenisation of intermediate products) have had greater or lesser incidence in the decrease/increase of commercialisation flows and hence in the local behaviour of prices in the regions.

The average price of the kilogram of coca leaf was recorded in \$2,589/kg (US\$1.4/kg), presenting an increase of 9.9%; basic paste was \$1,844,250 (US\$1,025/kg) with a decrease of 0.4%; cocaine base was \$2,696,351 (US\$ 1,499/kg) with a raise of 3.9% and cocaine hydrochloride was \$4,447,462 (US\$ 2,473/Kg) with a reduction of 2.4%, all in relation to 2011.

The levels of purity of basic paste, cocaine base and cocaine hydrochloride are unknown in the analysis of the behaviour of prices, although it is a determinant variable for their construction. However, to analyse the behaviour of the drug market, there is secondary information that is complementary in relation to the purity of cocaine hydrochloride, based on the analyses of the seizures done in the United States.<sup>30</sup>

There is differentiation in the price captured in each one of the products, given that it depends on the point where it is collected and it increases with intermediation and traffic. Thus, the prices of coca leaf and intermediate products progressively increase as they move away from the producing zones. In the case of the price of cocaine, it increases considerably when it exits Colombia and enters the consumption markets at

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<sup>29</sup> The prices of cocaine hydrochloride are obtained through the National Anti-drugs Police (DIRAN) in the reports of the Police Commands in the different cities.

<sup>30</sup> The figures of the purity of the seized cocaine hydrochloride conducted by the Government of the United States were updated for: 2007 (83%), 2008 (79.2%), 2009 (75.2%), 2010 (73.4%), and 2011 (75.1%).

US\$27,000/kg in the wholesale market of United States and at US\$ 53,000/kg in the wholesale market of Europe<sup>31</sup>.

Table 23. Average prices of coca leaf and its derivatives, 2008-2012

Product	2008		2009		2010		2011		2012		% change 2012/2011	
	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 <sup>1</sup>	2,348	4,580	2,147	4,587	2,439	4,623	2,468	4,556	2,473	4,447	0.2	-2.4
Cocaine base <sup>2</sup>	1,450	2,825	1,249	2,674	1,475	2,795	1,407	2,596	1,499	2,696	6.5	3.9
Coca paste <sup>2</sup>	963	1,878	956	2,048	1,015	1,923	1,003	1,852	1,025	1,844	2.2	-0.4
Coca leaf <sup>2</sup>	1.1	2.2	1.3	2.8	1.3	2.5	1.3	2.4	1.4	2.6	12.9	9.9

Source: UNODC-SIMCI, DIRAN and UACT.

Note:

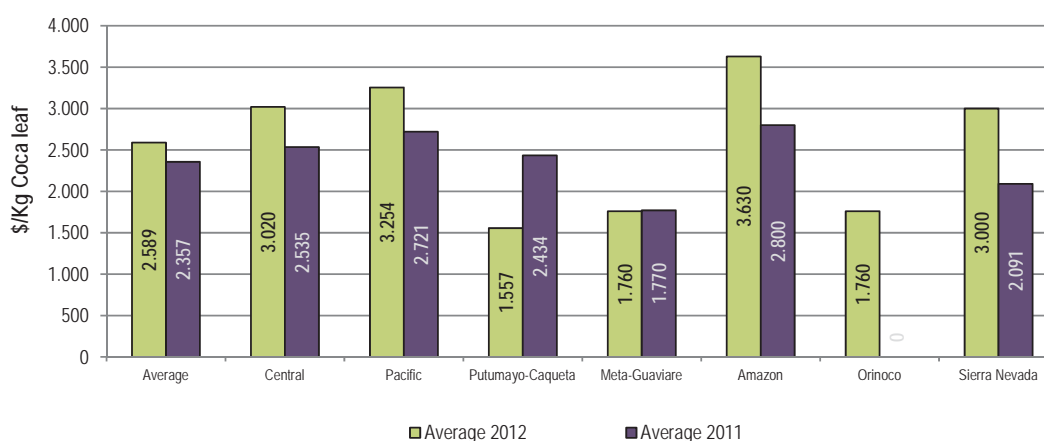
<sup>1</sup> Prices captured in the main cities.

<sup>2</sup> Prices correspond to the records captured in the production sites.

### Prices of coca leaf<sup>32</sup>

In 2012, the average price of fresh coca leaf reported was \$2,589/kg (US\$1.4/kg), with an increase of 9.9% in relation to the same period of the previous year; this behaviour was somehow influenced by the difficulties of commercialisation of coca leaf in the producing regions and by an increasing trend of the growers to sell fresh coca leaf directly. In the regional sphere, and with respect to 2011, the highest prices were recorded in Sierra Nevada (+ 43.4%), Amazon (+ 29.6%) and Pacific (+ 19.6%).

Figure 14. Average prices of coca leaf by region, 2011 – 2012



Source: UNODC-SIMCI, National Police-DIRAN

Calculation: UNODC-SIMCI.

In the regions of Sierra Nevada and Amazon, the low number of hectares under coca cultivation and reduction of commercialisation perceived by the growers could be of incidence in the raise of prices. On the other hand, in the Pacific region there is a differentiated price depending on the variety planted; *Tingomaría* is the most cultivated, with an average purchase price of \$3,100/kg in 2012, while *Caucana* is commercialised at an average price of \$2,600/kg.

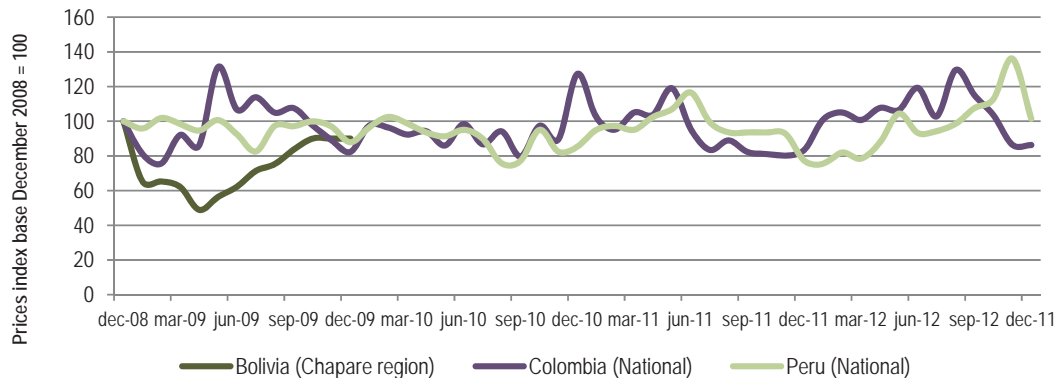
According to the perception of the inhabitants of the Putumayo-Caqueta region, the fall of the price of fresh coca leaf by 36.1% with respect to 2011 might be due to some factors as public order, climate, and difficulties to access transportation which affected the commercialisation flows. This reduction was offset by increases in the price of coca leaf in the other regions of the country.

<sup>31</sup> Source: World Drug Report 2012. The price provided by the U.S. is an estimation of the wholesale price and is based in transactions of 50 grams or more; hence, they might not be directly comparable with the wholesale price in Europe, which is based on the prices provided for 1 kg.

<sup>32</sup> Farm-gate prices

It must be highlighted that in Colombia fresh coca leaf is commercialised, while in Peru and Bolivia they sell air-dried coca leaf. In general, the growth of the prices of coca leaf in January, March, May and in the last two quarters of the year with respect to the previous year shows the same tendency in the three countries of the region. Nevertheless, in the last quarter of the year, there is evidence of an increasing trend but not in the same proportion: while the price of coca leaf in Colombia tends to grow by 12.9% compared to 2011, in the case of Peru the price is increasing by around 0.8% in relation to the previous year, with the greatest differences during August and November.

Figure 15. Fixed base indexes 2005 of the behaviour of the prices of air-dried coca leaf in Peru and fresh coca leaf in Colombia 2008-2012



Source: SIMCI, Colombia, Peru and Bolivia.

Note:

1 To facilitate the comparative analysis of the growth of the variables previously mentioned, December 2008 fixed base indexes were estimated. A fixed base index goes beyond the comparison of two moments in time and aims at analysing the variations in relation to a fixed reference period.

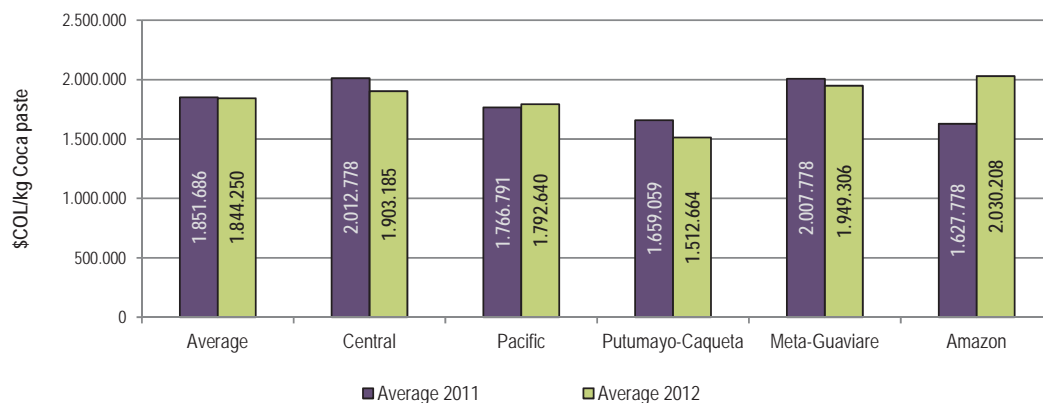
2 The growth of the price of the air-dried coca leaf in Peru and fresh coca leaf in Colombia was estimated based on the values in USD.

3 There is no information on prices in Bolivia for 2010 to 2012. Prices of basic paste

### Prices of basic paste<sup>33</sup>

In 2012, the average price of the kilogram of basic paste was \$1,844,250 (US\$1,025/kg), which is stable in relation to the same period of the previous year. At the regional level, in 2012 the Putumayo-Caquetá region records a fall of 9%, while the Amazon region had an increase of 25% in relation to the same period of the previous year.

Figure 16. Average prices of coca paste by region, 2011 – 2012



Source: UNODC-SIMCI, National Police-DIRAN

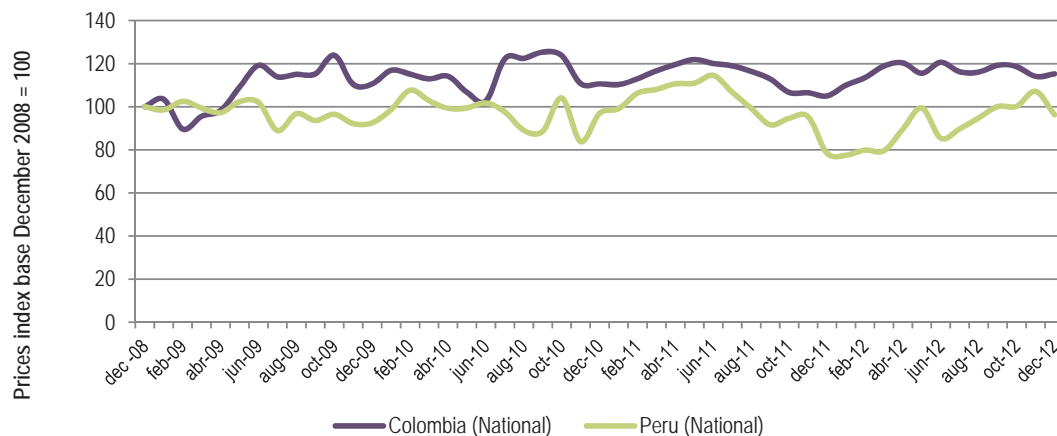
Calculations: UNODC-SIMCI.

<sup>33</sup> Farm-gate prices



The prices of basic paste in Colombia in 2012 with respect to 2011 have shown a similar trend in relation to the prices recorded in Peru; nevertheless, the growth across both countries is not the same. In Peru, the price of basic paste went from US\$815 in 2011 to US\$732 in 2012, with a fall of 9.5%, while in Colombia there was an increase of 2.2%, going from US\$1,003 in 2011 to US\$1,025 in 2012.

Figure 17. Fixed base indexes 2005 of the behaviour of the prices of basic paste in Peru and Colombia 2008-2012



Source: SIMCI, Colombia and Peru.

Note:

1 To facilitate the comparative analysis of the growth of the variables previously mentioned, December 2008 fixed base indexes were estimated. A fixed base index goes beyond the comparison of two moments in time and aims at analysing the variations in relation to a fixed reference period.

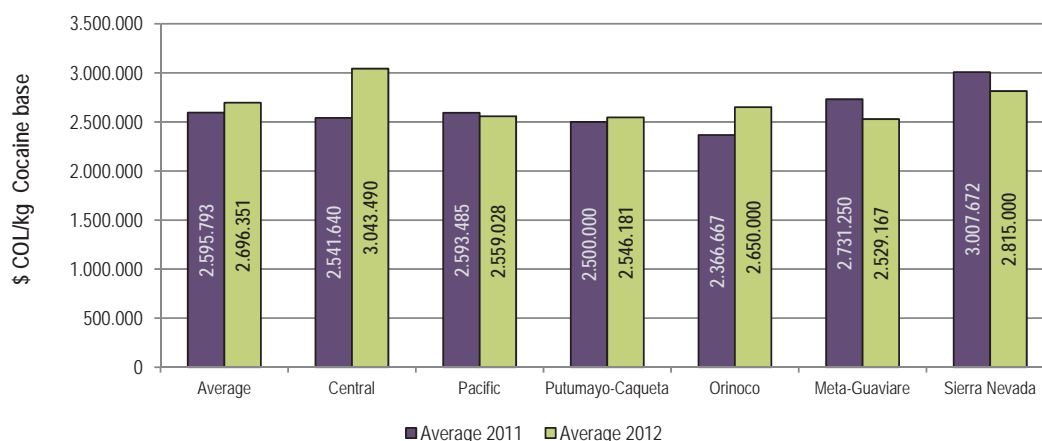
2 The growth of the price of the air-dried coca leaf in Peru and fresh coca leaf in Colombia was estimated based on the values in USD.

3 There is no information on prices in Bolivia for 2010 to 2012.

### Prices of cocaine base

In 2012, the average price of cocaine base was \$2,696,351 (US\$1,499/kg); this means an increase of 3.9% in relation to the same period in the previous year. In the regional sphere, the highest prices in 2012 were found in the Central and Orinoco regions, with an increase of 19.7% and 12% respectively in relation to the previous year.

Figure 18. Average prices of cocaine base by region, 2011 – 2012



Source: UNODC-SIMCI, National Police-DIRAN

Calculations: UNODC-SIMCI.

The prices of cocaine base are higher than the prices of basic paste (46.2% in 2012), possibly explained by the difference in the production costs between these two processes; in the case of cocaine base, the producer

needs to use additional chemical supplies such as potassium permanganate to eliminate impurity, sulphuric acid and ammonia.

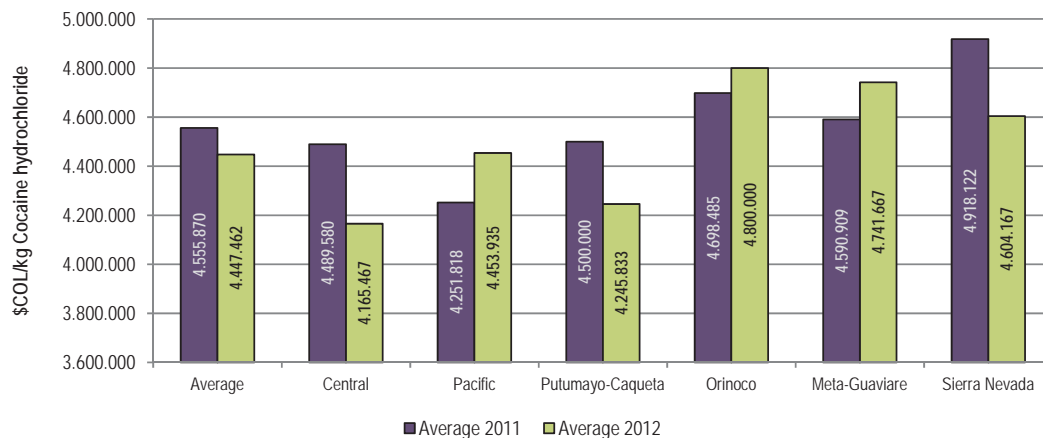
The field studies conducted in this subject show that farmers increase their profitability by doing the extraction process of the coca leaf. However, the changes in the productive structures with fields smaller and smaller every time, the need to homogenise intermediate products (base/paste) to guarantee higher quality and efficiency in the extraction and the increase of the sales of coca leaf by the producer, have made the UPAC less involved in the extraction process. This implied that other agents or intermediaries are collecting and processing the leaf with homologation of processes and qualities, which has direct implications on the levels of purity and efficiency; it is necessary to go deeper in the research to establish such reach.

As a consequence of the previously mentioned, a market of re-oxidized base has been identified; this is a process with greater added value that starts in the collection of the cocaine base and basic paste, and ends in the production of cocaine hydrochloride. In the Meta-Guaviare region, it was found that the commercialisation of the re-oxidized based is between \$3,300,000 and \$3,600,000; there is no certainty of whether this product is sold or directly used in the cristalizaderos.

### Prices of cocaine hydrochloride

In 2012, the average price of cocaine hydrochloride was \$ 4,447,462 (US\$ 2,473/Kg) with a reduction of 2.4% in relation to the same period of the previous year; the Central, Sierra Nevada and Putumayo-Caqueta regions had decreases of 7.2%, 6.4% and 5.6% respectively, while the Pacific, Meta-Guaviare and Orinoco regions showed increases of 4.8%, 3.3% and 2.2% respectively, all of them in relation to 2011.

Figure 19. Average prices of cocaine hydrochloride by region, 2011 – 2012



Source: UNODC-SIMCI, National Police-DIRAN

Calculations: UNODC-SIMCI.

Note: Prices reported in the main cities.

It is important to mention that these prices correspond to the records collected in the main cities of the country and that the farther in the trafficking chain into other nodal points, the higher they are.

Figure 20. Annual averages of cocaine prices and levels of aerial spraying 2000 – 2012



Source: Information of prices, SIMCI and DIRAN. Information of area under aerial spraying, National Police, DIRAN.

### Annual income per hectare under coca cultivation in 2012

The behaviour of potential income varies depending on the product to be traded and the process conducted in the Agricultural Unit with coca -UPAC; this has a direct incidence on the changes in labour division and the trend to the specialisation of the coca cultivation that appeared in the last years. To know the potential income perceived by agricultural producers with coca -PAC, estimations were made based on the information collected on prices, combined with the coca leaf yield studies and with the division of labour in the sales process, economic structure of the agricultural producing units and transformation of fresh coca leaf.

An Agricultural Unit with coca -UPAC may receive income due to the sale of products derived from different processes, as follows: i) cultivation by means of the sale of coca leaf, ii) extraction of the alkaloid by means of the sale of basic paste and iii) extraction of the alkaloid using potassium permanganate to obtain cocaine base for its subsequent sale. It is estimated that in 2012 around 60,600 households receive income from these activities, with an average of 5 people per household; each member of the household could potentially receive around US\$1,220 per year.

Table 24. Potential annual income per hectare of coca growers PAC from the process of cultivation and extraction of alcoloide in 2012

Product	Annual yield per hectare <sup>1</sup>	Annual price average		Annual income per hectare	
	kg/hectare	'000\$/kg	US\$/kg	'000\$/kg	US\$/hectare
Coca leaf	4,200	2.6	1.4	11,632	6,338
Coca paste	6.7	1,844	1,025	12,140	6,750
Cocaine base	5.5	2,696	1,499	16,439	9,140

Note:

<sup>1</sup> Annual yield per hectare (kg/hectare) of basic paste and cocaine base corresponding to the production of the growers in the Agricultural Units with coca -UPAC.

In the first place, given the increasing trend of the proportion of PAC that sell fresh leaf and the stability of the amounts commercialised of fresh coca leaf in relation to 2011, it is estimated that the growth of 7.7% in the income that the growers would potentially receive from the sale of fresh coca leaf per cultivated hectare, is mainly influenced by the raise in the prices of this product.

In the second place, the reduction of 1.4% of the potential income per cultivated hectare derived from the sale of basic paste produced in the UPAC (estimated in 32% of the UPAC) in relation to the previous year is explained by two factors: i) the specialisation of the extraction process in Putumayo-Caquetá as a stable productive nucleus has incidence in the increase of 10% in the amounts to be transformed with respect to the records of 2011; moreover, this has influence on the growth of 4.2% in the potential income and ii) the hectares that contributed to the production of basic paste increased by 6% in the same period.

In the third place, it is estimated that 5% of the PAC that currently process cocaine base have diminished their potential income per hectare by around 7.4%, explained by the decrease in the amounts to be processed.

The differences between incomes and the intermediate costs of the productive process is evidence of the added value generated in the UPAC at the national level. The table 3 shows the estimations of the added value of the processes of coca cultivation and extraction of the alkaloid in basic paste or cocaine base, differentiating between the economic agents that carry it out: either the agricultural producer or an intermediary<sup>34</sup>.

Table 25. Potential annual income per hectare of coca cultivation for the derivatives of the coca leaf in 2012

Product	Production 2012	Prices	Gross income		Net income	
	kg		US\$/kg	US\$	COP \$	US\$
Coca leaf	139,520,831	1.4	210,528,081	386,417,079,510	182,339,208	327,962,089,486
Coca paste	131,803	1,025	132,763,934	238,794,154,776	38,942,585	70,043,583,387
Cocaine base*	15,815	1,499	26,385,089	47,457,204,391	12,715,998	22,871,466,856
<b>Farm production value</b>			<b>369,677,104</b>	<b>672,668,438,677</b>	<b>233,997,791</b>	<b>420,877,139,729</b>

Note: Each process is conducted directly in the agricultural productive unit with coca -UPAC.

The total value of the farm-gate production was calculated using the total production of coca leaf and the estimates of production of coca paste and cocaine base carried out directly by the primary producer (farmer); likewise, the available farm-gate sale prices of coca leaf, basic paste and cocaine base. Based on this, the gross income of primary production (farm-gate) was estimated in US\$ 370 million (US\$ 233 million without production costs).

It is worth mentioning that the research conducted by the Directorate of Synthesis and National Accounts of the DANE Enclave: illegal crops agricultural phases and industrial Base 2005<sup>35</sup> has the objective of identifying the economic flows derived from the production and transformation of illegal cultivation in the Colombian economy. The enclave of illegal cultivation has two phases: one agricultural phase, in which the cultivation of coca is performed until the processing of cocaine base in the UPAC, and an industrial phase that refers to the establishments devoted to processing cocaine hydrochloride and heroin. For 2011, the DANE estimates that the added value of the production and transformation of illegal crops represents 0.3% of the national GDP and of 1.3% of the agricultural sector<sup>36</sup>, disaggregated by each one of the agricultural activities (of 0.1% of the national GDP) and Industrial (of 0.2% of the national GDP). The production processes associated to coca cultivation and its transformation contributes 93% of the total economic flows of the enclave.

<sup>34</sup> It must be underscored that the estimations referred to the added value are conducted taking into account the productivity studies and the studies of productive structure of the agricultural producing units with coca. The costs of the supplies are estimated based on the evolution of the indexes of prices to the producer, associated to the basket of supplies. In the differentiation of the economic agent it is assumed that the production process is conducted using as reference the labour division in the process of sale and transformation of coca leaf.

<sup>35</sup> According to the document Enclave: illegal crops agricultural phases and industrial Base 2005 series 2000-2010pr, the Enclave is a "virtual" space that belongs to the economic territory, artificially created to record, separately from the national economy, the activities related to the production and transformation of illicit cultivations (except for trading). For more detail: [http://www.dane.gov.co/files/investigaciones/pib/especiales/metodologia\\_enclave\\_ilicitos\\_2000\\_2010.pdf](http://www.dane.gov.co/files/investigaciones/pib/especiales/metodologia_enclave_ilicitos_2000_2010.pdf).

<sup>36</sup> The GDP of Colombia at current prices in 2011 was estimated in around US\$336 thousand million, while the GDP of the agricultural sector was estimated in US\$21 thousand million.

## OPYUM POPPY CULTIVATION

In Colombia, opium poppy is cultivated in smallholdings located in mountainous zones with heights between 1,700 masl and 3,000 masl, since they need low temperatures in some stages of their growth cycle. Thus, opium poppy cannot be cultivated in association with coca since the biophysical conditions of the latter have not been adaptable to heights over 2,200 masl<sup>37</sup>.

According to the information collected by overflights carried out by the National Police, in Colombia, in 2012, 313 hectares under opium poppy cultivation were detected, which represents a decrease of 7.4% with respect to the previous year. The hectares of opium poppy were mainly detected in Nariño (66%) and Cauca (33%); due to their strategic importance, these departments are also affected by coca cultivation and illicit drug trafficking. It is worth noting that UNODC Colombia does not generate primary information about the behaviour of opium poppy cultivation.

Table 26. Opium poppy cultivation in Colombia by department, 2005 – 2012 (in hectares)

Department	2005	2006	2007	2008	2009	2010	2011	2012
Nariño	475	316	204	24	238	234	229	205
Cauca	538	448	280	126	100	92	102	102
Huila	320	114	45	45	11	12	5	4
Tolima	265	90	170	170	3	3	2	2
Cesar	152	3	7	18	2.5	-	-	-
Valle del Cauca	-	-	-	-	1.5	-	-	-
La Guajira	68	-	2	4	-	-	-	-
Caqueta	132	52	7	7	-	-	-	-
<b>Total</b>	<b>1,950</b>	<b>1,023</b>	<b>715</b>	<b>394</b>	<b>356</b>	<b>341</b>	<b>338</b>	<b>313</b>

Source: DIRAN (by means of aerial recognition)

According to the data of the Drug Observatory of Colombia, heroin seizures went from 299 kilograms in 2011 to 464 kilograms in 2012, while no seizure of opium latex was reported in 2012. In 2012, one heroin laboratory was detected and destroyed.

Worldwide, the area of opium poppy cultivation in 2012 had an increase of 15% in relation to the previous year. 86% of the area under cultivation is in Afghanistan (65%) and Myanmar (21%). It is worth highlighting that opium poppy cultivation in Colombia (313 ha) represents 0.1% of the total hectares under this cultivation in the world.

Table 27. Global cultivation of opium poppy, 2003 – 2012 (hectares)

GLOBAL CULTIVATION OF OPIUM POPPY 2003-2012										
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>SOUTHWEST ASIA</b>										
Afghanistan	80,000	131,000	104,000	165,000	193,000	157,000	123,000	123,000	131,000	154,000
Pakistan	2,500	1,500	2,438	1,545	1,701	1,909	1,779	1,721	362	382
Subtotal	82,500	132,500	106,438	166,545	194,701	158,909	124,779	124,721	131,362	154,382
<b>SOUTHEAST ASIA</b>										
Laos PDR <sup>(a)</sup>	12,000	6,600	1,800	2,500	1,500	1,600	1,900	3,000	4,100	6,800
Myanmar <sup>(a)</sup>	62,200	44,200	32,800	21,500	27,700	28,500	31,700	38,100	43,600	51,000
Thailand <sup>(b)</sup>										

<sup>37</sup> Information provided in the report: "La coca: Aspectos taxonómicos y corológicos en Colombia" carried out by Ariza Cortes William, curator of the Forest Herbarium of the District University in the framework of the research conducted by UNODC: "Agro-cultural characteristics of Coca Cultivation in Colombia", 2005.

GLOBAL CULTIVATION OF OPIUM POPPY 2003-2012										
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Viet Nam <sup>(b)</sup>										
Subtotal	74,200	50,800	34,600	24,000	29,200	30,100	33,600	41,100	47,700	57,800
LATIN AMERICA										
Colombia	4,026	3,950	1,950	1,023	715	394	356	341	338	313
Mexico <sup>(c)</sup>	4,800	3,500	3,300	5,000	6,900	15,000	19,500	14,000	12,000	
Subtotal	8,826	7,450	5,250	6,023	7,615	15,394	19,856	14,341	12,338	12,338
OTHERS										
Others countries <sup>(d)</sup>	3,074	5,190	5,212	4,432	4,184	8,600	7,700	10,500	16,100	13,500
<b>TOTAL</b>	<b>168,600</b>	<b>195,940</b>	<b>151,500</b>	<b>201,000</b>	<b>235,700</b>	<b>213,003</b>	<b>185,935</b>	<b>190,662</b>	<b>207,500</b>	<b>238,020</b>

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: UNODC; 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.

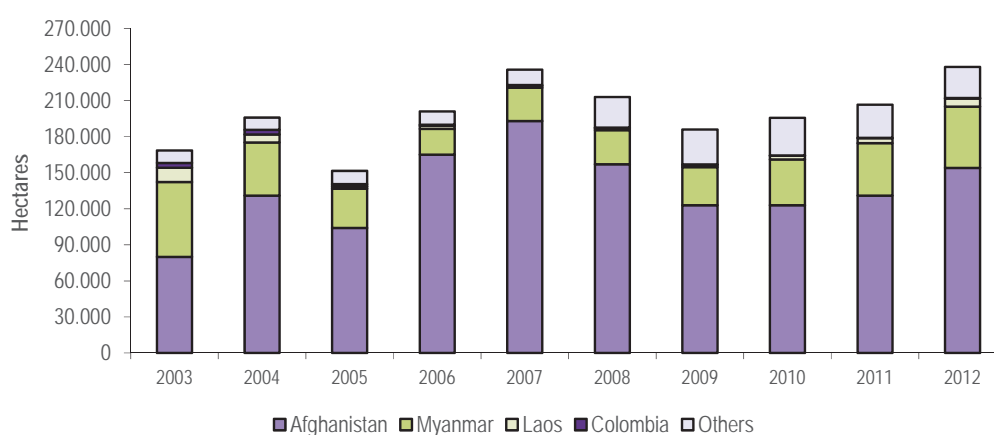
May include areas that were eradicated after the survey data was collected in the zone.

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".

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.

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 21. Global cultivation of opium poppy, 2003-2012 (hectares)



Source: word drugs report 2012

### 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. 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 28. Yield per hectare of oven-dried opium

Poppy area	Yield (kg/ha/harvest)
Nariño	16.8
Serranía 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)

Considering the information of hectares detected by the National Police in 2012 and the yield per hectare of oven-dried opium poppy reported by the U.S. Government, it is estimated that Colombia produces 7.9 metric tons of oven-dried opium, which represent around 1 ton of heroin.

In the global perspective, it is estimated that the potential production of oven-dried opium is around 4,931 metric tons, of which Afghanistan (65%) and Myanmar (21%) are the main producers; it is calculated that Colombia has 0.2% of this production.

### Prices of latex and heroin

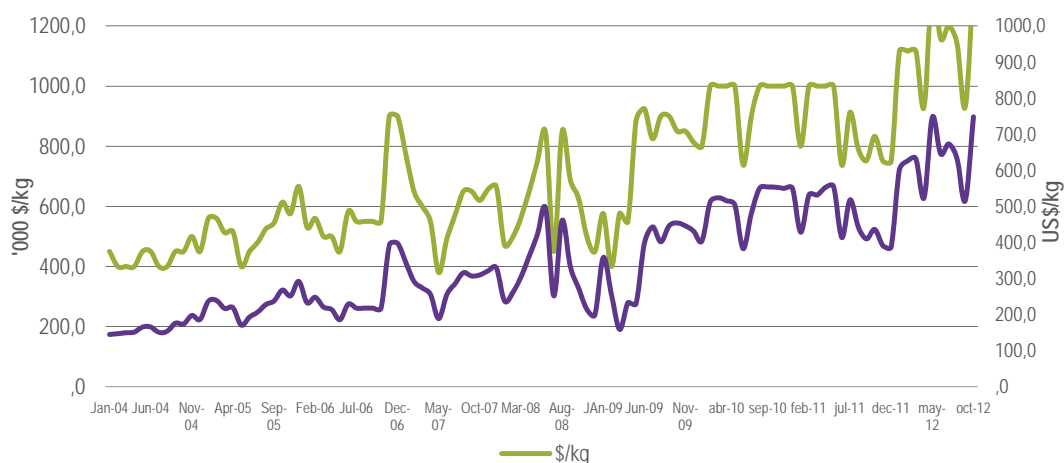
In 2012, the prices of opium latex, morphine and heroin in Colombia increased by 32.5%, 42.3% and 9.8% respectively. The prices of latex are within an average of COP \$1.1 million per kilogram (US\$ 634/kg) and morphine is COP \$15.2 million per kilogram (US\$ 8,473/Kg). Then again, the prices of heroin are within an average of COP \$20.9 million per kilogram (US\$11,661/Kg).

Table 29. Average prices of latex, morphine and heroin, 2008-2012

Product	2008		2009		2010		2011		2012	
	US\$/kg	'000 \$/kg	US\$/kg	'000 \$/kg	US\$/kg	'000 \$/kg	US\$/kg	'000 \$/kg	US\$/kg	'000 \$/kg
Latex	318	612	358	754	503	953	466	860	634	1,140
Morphine	7,369	14,400	7,114	15,162	7,842	14,892	5,804	10,704	8,473	15,241
Heroine	9,950	19,550	9,993	21,421	10,786	20,421	10,348	19,101	11,661	20,974

Source: prepared with the prices reported by the DIRAN.

Figure 22. Prices of latex in Colombia, 2004 – 2012 ('000 \$/Kg, and US\$/Kg.)



## RELATED RESEARCH AND STUDIES

### *The market for coca in Colombia: analysis of its imperfections and its determinants*<sup>38</sup>

The market of coca and its derivatives is not a perfectly competitive market; on the contrary its condition of illegal market has several imperfections: in the first place, it induces an increase of the price for the final consumer, and in the second place, it has poor elasticity in the demand as a consequence of the consumer's addiction.

However, the illegal nature of the production, traffic and consumption, together with the low elasticity of demand are not the only failure in the cocaine market. In the *market of coca cultivation* there are, besides, other important imperfections. In general terms, the market of the *production* of coca cultivations may be characterised in most cases studied as a *monopsony*<sup>39</sup>, in which there are strong barriers for the entrance of other buyers, and in which the producers also have to deal with "exit barriers"; in other words, limitations to have access to other buyers. The most important factor for the analysis of the distortions of the production market is the possibility to use the force by the agents that control the market. The force may be applied to avoid the entrance of other buyers but it can also be used to intimidate the producers of a specific zone so that they do not sell other buyers and thus prevent these producers from having access to other markets with better prices.

The different imperfections of the market of illicit crops that were mentioned cause inefficiency with respect to the perfectly competitive markets. There are cases, however, in which the accumulation of commercializing agents and the closeness to exports points may induce responses more similar to competitive markets; the data show that the regions of Catatumbo and Pacific have this condition.

The agents that participate in drug production and trafficking are illegal criminal groups of different size that have shown a great level of adaptation to the pressure put by the Colombian State during the last decades. This pressure has managed to dismantle some of the most important mafias, but the persistence of extraordinary incentives derived from the imperfections of the market produce a permanent renovation and adaptation of the agents associated to drug trafficking. In recent years, the strategies implemented by law enforcement agencies for the control of criminal groups and their different mechanisms of repatriation of utilities and legalisation of capitals of illegal origin have shown a high level of success. Then again there is record of a dynamic of persisting association among the groups that participate in the drug business, consisting in a tendency to form increasingly bigger criminal groups.

In relation to production, the illegal armed groups that promote illicit crops have established in the producing regions. So far, it has not been possible to dismantle the main nucleuses of historical production of coca cultivation. Only 17% of the area intervened by the State records abandonment for a period longer than 3 years, and the level of concentration of the production is maintained in very few zones.

On the other hand, it was found that there is an important effect of the price in the production dynamic, but this effect is neither homogeneous, nor obeys to the same factors in all the production zones. At the national level, it was evident that the area under cultivation in Colombia has an important and significant correlation with the real price of cocaine hydrochloride and cocaine base, but not with basic coca paste or with the fresh leaf. This indicates that, at least partially, the reduction in the area cultivated with coca in the country is associated to a failure in the adjustment of prices by the drug traffickers. The previous statement might be a signal of decrease in the profitability of the drug trafficking business at the country level due to the set of control policies established by the State during the last years, which would be a very good result for the country;

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<sup>38</sup> The chapter is a brief summary of the main aspects addressed in the book "Characterisation of the Coca Market in Colombia. General Guidelines". This document was prepared by UNODC/SIMCI, May 2013. It is important to note that the statistical information referred corresponds to 2011. This book is under publication.

<sup>39</sup> Monopsonic markets are defined as those in which the demand of a raw material is concentrated in one single buyer and are considered, together with monopolies, as the classic cases of imperfect competition in which there is market power.



nonetheless, it is also an alert since a recovery of the actual price by an application of foreign capital (i.e. Mexican cartels) may induce a recovery of the actual price, with the subsequent cultivation increase.

On the other hand, as regards to the relation between prices and areas under cultivation in the regions, two behaviours with clearly different trends are perceived. On one side, in some of the regions the area under coca cultivation seem to respond consistently to the behaviour of the actual price of the products with higher sales, showing the prevalence of strict monopsony conditions. On the other side, and particularly in the bordering producing regions (Catatumbo and Pacific), the behaviour of the price shows the presence of a greatest level of competition.

As regards to each one of the producing regions, the following can be briefly stated:

**Putumayo – Caqueta Region:** The cultivated area shows a relatively strong association with the actual price of cocaine base. This relation is not strongly significant but yet it is consistent with the high proportion of growers that commercialise cocaine base.

**Central Region:** In this region, the production dynamic does not keep any consistent relation with the behaviour of any of the prices of sub-products, which have shown a regressive trend until 2011.

**Catatumbo Region:** In this region there is a strong and significant *negative* correlation between the area and the price of hydrochloride (-0.87, sig. at 1%), and between the area and the price of cocaine base (-0.83, sig. at 5%). For this reason, although with some discretion, it may be suggested that the decision of planting illegal coca crops in the Catatumbo region is closely and inversely associated to the actual price of hydrochloride and cocaine base. This behaviour is quite particular and may be due to the proximity to the border with Venezuela, one of the most important exit points for drug trafficking.

**Sierra Nevada Region:** The cultivation dynamic is closely associated to the price of hydrochloride, but in this case the association is strongly positive and significant (0.82, sig. at 5%). In this region, the price of fresh coca leaf is not related to the price of the other sub-products which may show that, although Sierra Nevada has very low production of raw material, it is probably being used as a point for drug processing.

**Pacific Region:** In this region, the decreasing trend of prices has been continuous but weaker than in other regions. The relative profitability of the agricultural productive units with coca is 5.7 times higher than that of the units without coca. These factors partially explain that the Pacific region has a trend of production of illegal crops opposite to the national decreasing trend, and that it is currently one of the most important nucleuses of coca production. In this region, there is a strong and significant negative correlation of the cultivated area with respect to the price of coca leaf (-0.80, sig. at 5%), and in lesser proportion of hydrochloride (-0.67, sig. at 10%). The high correlation between the prices of sub-products suggests that there is more vertical integration in the transformation chain in the Pacific region, and that the leaf and the coca paste are being processed by illegal organisations in charge of buying raw material. On the other hand, the close and negative correlation between the area under cultivation and the price could show that the dynamic of the coca market in the Pacific region has a closer behaviour to that of the competitive markets, in which the increase of the supply causes a reduction of price.

**Orinoco Region:** In Orinoco, the area responds strongly to the price of basic cocaine paste. The strongly positive and highly significant response must, nonetheless, consider the existence of voids in the price series.

**Meta-Guaviare Region:** In this region there is a positive, close and significant relation between the area under coca cultivation and the price of basic coca paste (0.96, sig. at 1%) and hydrochloride (0.87, sig. at 1%). Thus, the suggestion is that the increase of the areas cultivated with coca is strongly associated to increases in the actual price of basic coca paste. The coincidence in several elements in the Meta Guaviare and Orinoco regions support the assumption that this dynamic is common to the two regions.

**Amazon Region:** The sowing dynamic does not show correlation with the behaviour of the prices of any of the sub-products and neither there is correlation between the prices of the different sub-products between

each other. This suggests that the transformation is done with raw materials from other regions, to use the routes of the Guainía River towards Venezuela and of the Vaupes River towards Brazil.

As a general conclusion, it may be said that the determinant factors of the supply of coca cultivation in Colombia are related to: (a) the actual price of sub-products; (b) the transformation characteristics and dynamics of the illegal agents associated to trade and trafficking; (c) the conditions of relative profitability of legal production, and (d) social and economic particularities of the regions that participate in the production.

With respect to these two last points, it is worth noting that the level of relative profitability of illegal production with respect to the legal one is also an important factor, since an high differential in favour of illegal production generates a strong incentive for this production, even more when the conditions of poverty and misery in the region are a favourable scenario for any productive alternative that improves the family income. Hence, it is important that the policies for improvement of life conditions for the producers and of reduction of the supply consider a differential treatment in accordance with these factors, so that they may achieve higher impact

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

With the aim of finding comprehensive solutions to the problem of illegal cultivations and the strengthening of a culture of lawfulness, UNODC/SIMCI have worked in cooperation with the Colombian Government in the development of risk-approach methodologies which by means of combining the vulnerability factors (institutional, social, economic and biophysical), and hazard to the territory (spatial-temporary characteristics of illegal cultivations) enable the calculation of a group of indicators at different levels to facilitate the management and monitoring of the comprehensive process of progressive and sustainable consolidation of zones, regions and territories free from illicit cultivations.

The methodology considers that a zone is free from illegal cultivations when the following conditions occur 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. The study of these conditions requires the comprehensive understanding of the regional processes of spatial configuration, both of the zones traditionally affected by illegal crops and the zones where there could be expansion of the phenomenon.

The technical proposal<sup>40</sup> is supported on the experiences of United Nations, particularly FAO, CEPAL<sup>41</sup>, 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*<sup>42</sup> 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 building of a geo-referenced database with statistics of the indicators at a municipal level; and iii) the building of three synthetic indexes: Index of hazard due to illegal cultivations; Index of vulnerability due to illegal activities, and Index of consolidation of zones, regions or municipalities free from illegal cultivations (CLIC).

CLIC is an adaptation of the risk model and establishes a probability that combines the hazard of coca cultivation with the consequences on the vulnerability of the territory; the result of the integration of the threat with vulnerability enables the construction in the quantitative scale and its translation into a synthetic index with a vulnerability approach.

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<sup>40</sup> 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.

<sup>41</sup> 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>

<sup>42</sup> 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 zones free from illegal cultivations CLIC ( $I_C$ ) is the comprehensive qualification of the dynamic of the illegal cultivation ( $I_A$ ) and its relation with the vulnerability factors ( $I_V$ ). It is expressed as the normalisation of the product of the indexes  $I_A$  and  $I_V$ , in the following relation:

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

As for the other two indexes, the Index of hazard ( $I_A$ ) due to the establishment of illegal cultivations results from the pondered and normalized addition of six variables directly related to cultivation:

$$I_A = (\lambda_1 \cdot \text{Abandonment} + \lambda_2 \cdot \text{Expansion} + \lambda_3 \cdot \text{Permanence} + \lambda_4 \cdot \text{Affected area} + \lambda_5 \cdot \text{Re-sowing} + \lambda_6 \cdot \text{Concentration})$$

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 the cultivation; and is expressed in the following relation:

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

### **Applications**

Currently the CLIC has been calculated for the regions of Sur del Meta – Guaviare<sup>43</sup> and for the department of Chocó<sup>44</sup>. Observing the geographical distribution of the Indexes, the correlation between the regional dynamic of coca cultivation and the institutional response may be deduced. The Index of Consolidation shows a geographical distribution consequent with the regional situation of illegal cultivations for both applications.

In the case of Chocó, it is evident that the municipalities of Medio Baudó, El Cantón de San Pablo, Unión Panamericana, Río Iro, Condoto and Nóvita have the greatest risk of presence and establishment of illegal crops; besides, they constitute a nucleus in the department in which the index of consolidation is low. This behaviour is particularly related to the threat data, due to which it is recommendable to implement actions for the reduction of illegal cultivation in the zone.

Such municipalities have little presence of the judicial branch, lack of infrastructure in education, low allocation of financial resources revoked by the state, poor hospital infrastructure. At the socio-economic level, the rates of school absorption and illiteracy are low; the rate of infant mortality shows that the health sector is poor; unsatisfied basic needs point out that the population is in unfavourable conditions in relation to housing, sanitary services, minimum income and basic education. With respect to violence data, it basically shows that the presence of illegal armed groups has forced displacement of the population.

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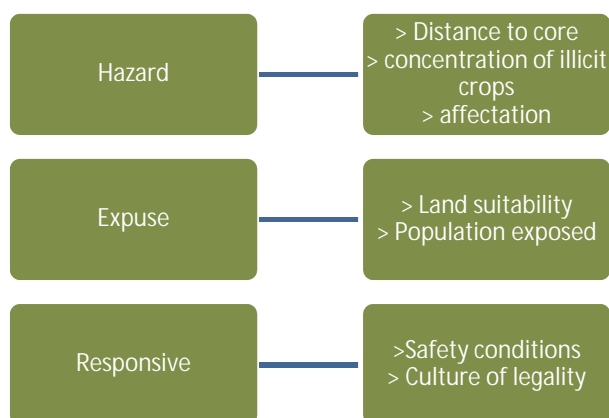
<sup>43</sup>The results of this application may be found in: *Monitoring of Coca Cultivation 2011, UNODC/SIMCI* pg65

<sup>44</sup>The calculation of the synthetic indexes was conducted in the way of a pilot application of the methodology. It must be noted that presently these indexes are not comparable across applications, since the variables have not been normalised and besides they have different periods of analysis.



Based on the pillars of the policy of territorial consolidation (Institutionalization of the territory, citizen participation and good governance, and economic development and regional integration) the index considers three elements: i) the threatening element, which corresponds to illegal cultivation; ii) the exposed system, which corresponds to the territories intervened by DPCI and iii) the response capacity, as the relations between institutional supply of the state and civil society (See figure 22). The interaction between hazard, exposure and vulnerability is quantified by means of indicators that reflect the situation at the moment of the monitoring visit conducted by UNODC to the focalised territories. In this sense, the hazard indicators are defined based on the historical series of SIMCI on illegal cultivation, interpreted in satellite images, and on the observation in the field missions in the focalised territories; exposure derives from the study of the territory in relation to its infrastructure and land coverage, and the indicators of response capacity are estimated based on primary information collected by UNODC professionals in the field visit. Figure 23 shows examples of some indicators.

Figure 25. Example of indicators used for the proposed icli



### *Dynamic phenomena of illegality in the territory*

The boom of gold mining of the last years has had incidence on the dynamics of some zones of the Colombian territory such as Chocó, Córdoba, Antioquia, Guainía and Nariño. These departments - characterised by the presence and permanence of coca cultivation- have progressively diminished their participation in this illegal activity but at the same time have started sharing territory with a new activity: informal gold mining.

The appearance and trend to increase of mining prints in open sky in the regions focalised by the Project and detected, by both verification overflights conducted in different moments during the year and interpretation of the satellite images used for the census, coincide with the constant rise in the international prices of gold since some years ago.

The phenomenon of reduction in the area under coca cultivation is quite noticeable since two years ago in the regions of Córdoba, Antioquia and Bolívar, where the areas that were continuously visited and verified with presence of coca crops have progressively given place to different stages of vegetable succession, added to the fact that mining prints became evident in the margin of the rivers. This is consistent with the reduction of the area reported by SIMCI in these departments, -42 % for Antioquia, -72% for Córdoba and -34% for Bolívar in 2011, and -10%, -4%, -11% in 2012 respectively.



*Outlined in black, abandoned coca fields in different stages of vegetable succession. Red arrows indicate mining prints*

In these regions there has not only been a change in the manifestation of illegality in relation to the vulnerability of the territory to these phenomena, but also an accelerated and drastic transformation of the landscape, characterised by deforestation, erosion and change in the course of rivers.

A similar case is taking place in the Cauca region, where zones such as Timbiquí and Guapi have diminished their percentage of National participation in the area under coca cultivation since 2010. Oppositely, in other zones –as is the case of Nariño, Valle and Chocó- both phenomena still persist: coca cultivation and gold mining. In particular, Valle and Chocó are characterised by an accelerated growth in mining prints. On the other hand, in Putumayo the phenomenon is incipient within the area with coca cultivation.



*Outlined in black, coca fields. Red arrows indicate mining print*

The current dynamic detected in verification overflights makes it necessary to go deeper in the relations between both illegal phenomena in the territory, including not only the geographical aspect but also social and economic aspects.

## TERRITORIAL CONSOLIDATION POLICY 2012

The National Policy for Territorial Consolidation and Territorial Reconstruction of the Colombian State (PNCRT) is aimed at strengthening the institutional capacity for the full exercise of the fundamental rights of the inhabitants of the territories affected by armed conflict and illegal cultivation. The Administrative Unit for Territorial Consolidation - UACT, appointed by the Department for Social Prosperity -DPS, is the entity in charge of channelling and coordinating the intervention of the state institutions to achieve three objectives: Institutionalisation of the territory, citizen participation and good local governance, and the integration of the regions intervened by this policy into the country, based on the recovery of territorial security.

In compliance with their mandate, UNODC support the Colombian Government in the development, implementation, monitoring, follow-up and evaluation of their strategy of reduction of illicit cultivation in the institutional framework of the policy. In fact, UNODC provide support to the payment of economic incentives to the beneficiaries or selected communities, does comprehensive accompaniment in the intervention zones and carries out the integrated monitoring that supports the consolidation of territories free from illegal cultivation.

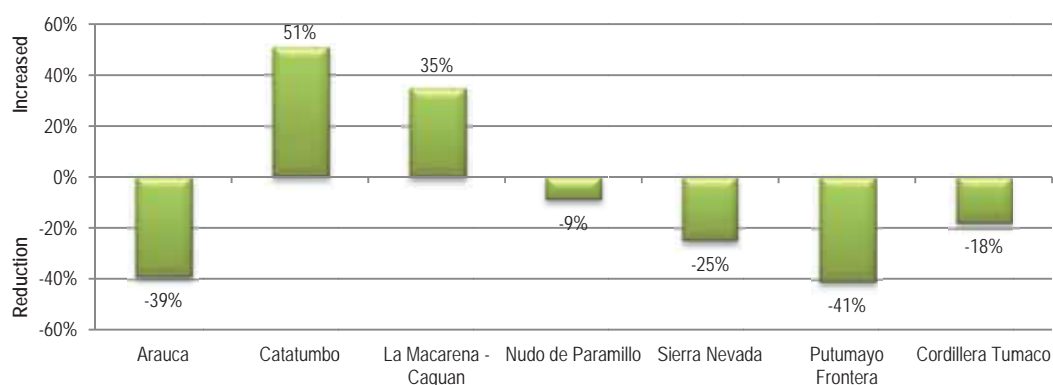
In general, the consolidation policy covers the following zones (See Map No.17): i) Nine Zones of Territorial Consolidation, with 58 municipalities in thirteen departments; ii) Twenty eight municipalities focalised outside the consolidation, and iii) 850 Rural settlements focalised for the institutional intervention of the programme against illicit crops and the integrated monitoring of UNODC. The following section presents the summary of the dynamic of illegal crops and the investments of the Colombian State in the different intervention strategies 2012: Forest Warden Family Programme (14,308 families benefitted), Productive Projects Programme (17,062 families benefitted), Post-eradication Programme (33,204 families enrolled) and Quick Response (134 projects).

### *Dynamic of illicit cultivation in the focalised territories*

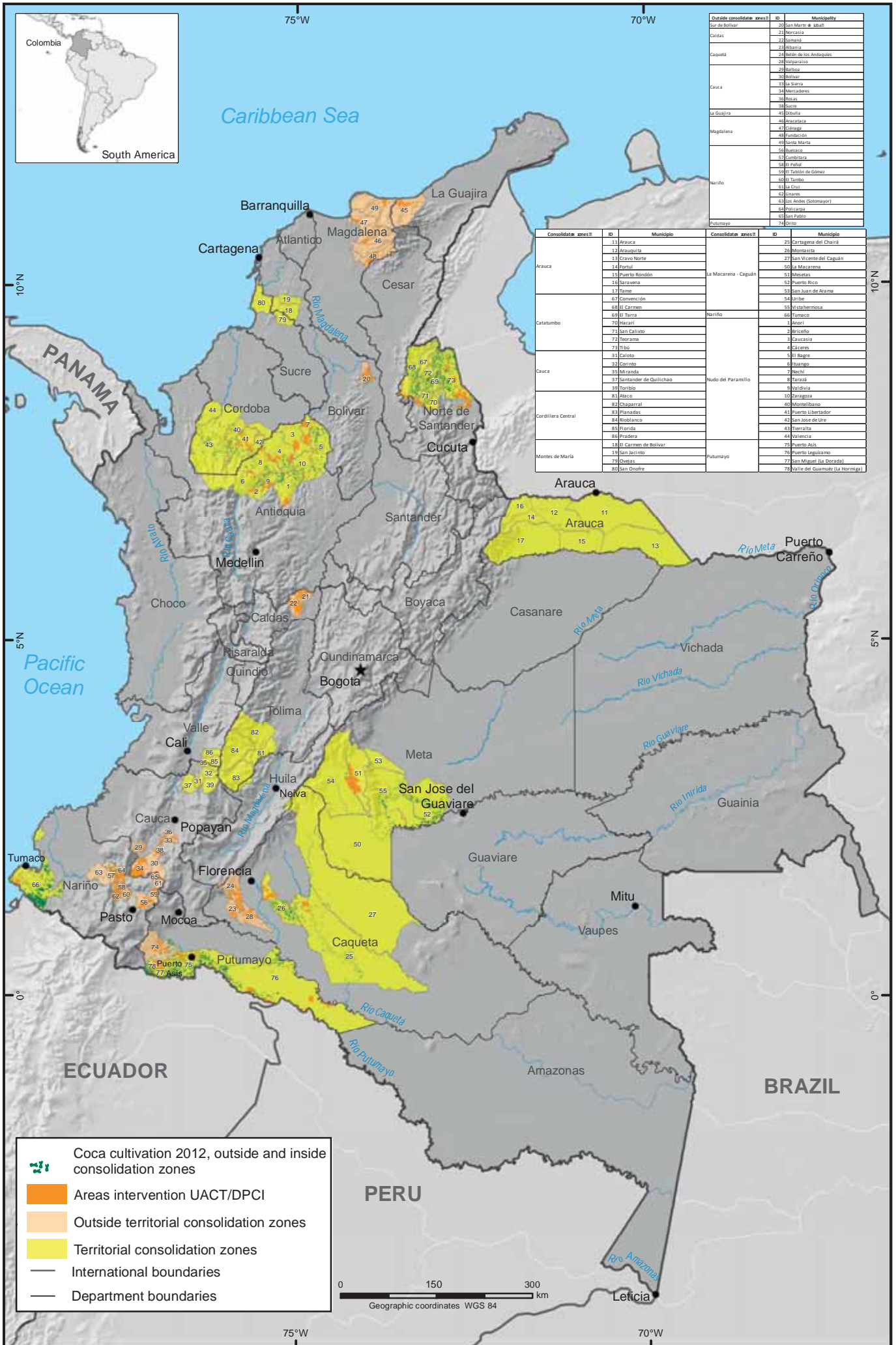
For 2012, in the zones of consolidation and focalised out of consolidation, 44% of the national total area under coca cultivation is concentrated. The municipalities with greatest participation are: Tumaco, Tibú, Puerto Asís, Puerto Leguizamo and La Montaña.

The analysis of the dynamic of illicit cultivations in the consolidation zones and focalised territories between 2011 and 2012 was conducted based on the SIMCI master framework of 1Km<sup>2</sup> grids. This analysis shows that 56% of the territory affected by the presence of coca cultivation remains stable, 19% shows increase, mainly in Norte de Santander and Meta, and 25% shows reduction of the area under coca cultivation, particularly in Putumayo and Caquetá. The general trend shows a reduction of 12% in the area devoted to the cultivation of coca leaf. (See Map No.18. ; Figure No.26)

Figure 26. Trend of coca cultivation in consolidation zones, out of consolidation and focalized territories



# Map 17. Territorial Consolidation Zones and Integrated Monitoring



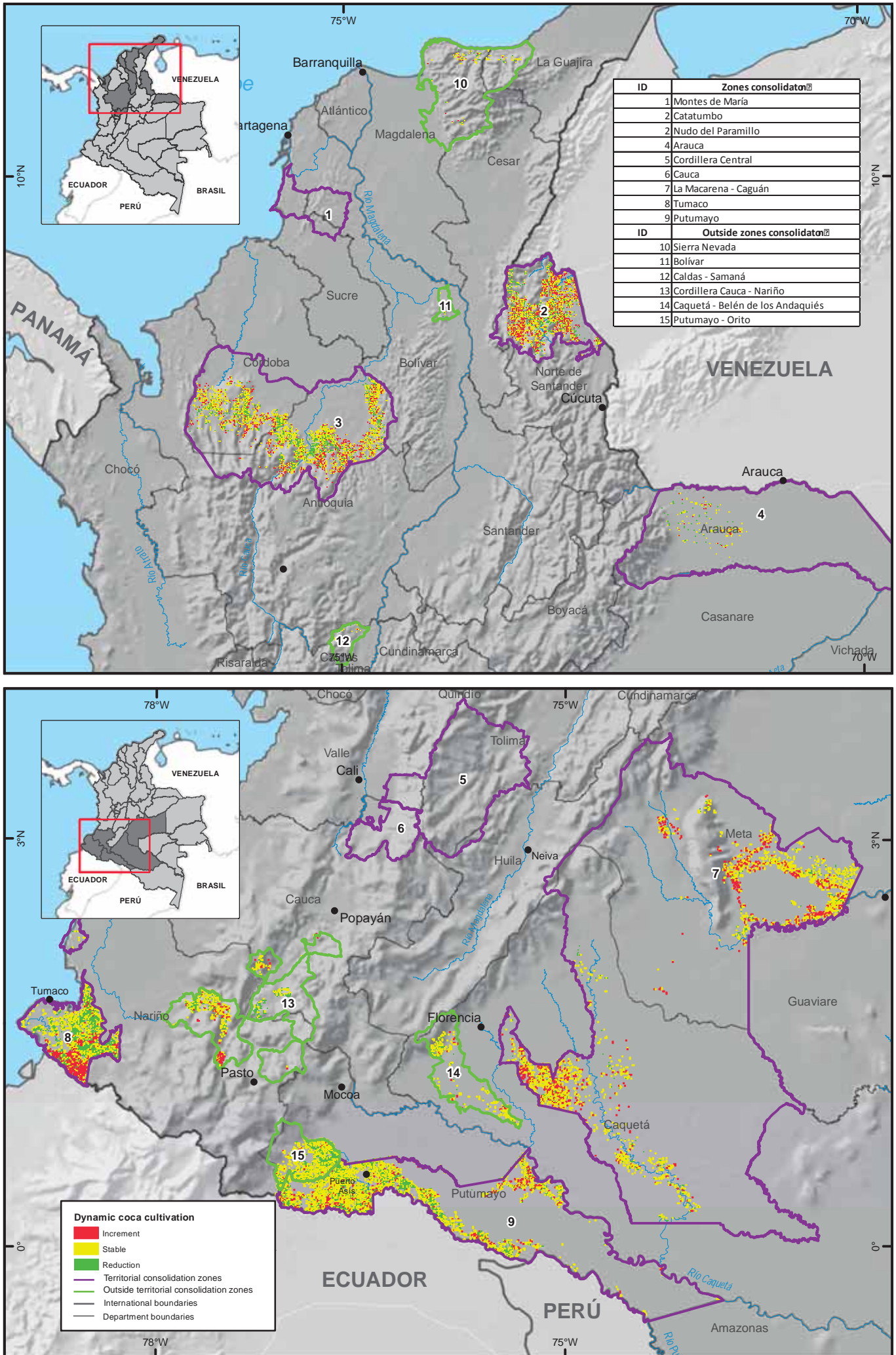
Outside consolidation zones	ID	Municipality
Sur de Bolívar	20	San Martín de Ubalá
Caldas	21	Norcasia
	22	Santana
	23	Valparaiso
Caquetá	24	Valle de los Andes
	25	Valparaiso
	26	Valparaiso
	27	Valparaiso
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	80	Valparaiso

Consolidate zones II	ID	Municipio	Consolidate zones II	ID	Municipio
	11	Arauca		25	Cartagena del Chairá
	12	Arauca		26	Montelía
	13	Arauca		27	San Vicente del Caguán
	14	Arauca		28	La Macarena
	15	Arauca		29	La Macarena - Caquán
	16	Arauca		30	Musitas
	17	Arauca		31	Puerto Rico
	18	Arauca		32	San Juan de Arama
	19	Arauca		33	San Mateo
	20	Arauca		34	San Mateo
	21	Arauca		35	Valparaiso
	22	Arauca		36	Valparaiso
	23	Arauca		37	Valparaiso
	24	Arauca		38	Valparaiso
	25	Arauca		39	Valparaiso
	26	Arauca		40	Valparaiso
	27	Arauca		41	Valparaiso
	28	Arauca		42	Valparaiso
	29	Arauca		43	Valparaiso
	30	Arauca		44	Valparaiso
	31	Arauca		45	Valparaiso
	32	Arauca		46	Valparaiso
	33	Arauca		47	Valparaiso
	34	Arauca		48	Valparaiso
	35	Arauca		49	Valparaiso
	36	Arauca		50	Valparaiso
	37	Arauca		51	Valparaiso
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	40	Arauca		54	Valparaiso
	41	Arauca		55	Valparaiso
	42	Arauca		56	Valparaiso
	43	Arauca		57	Valparaiso
	44	Arauca		58	Valparaiso
	45	Arauca		59	Valparaiso
	46	Arauca		60	Valparaiso
	47	Arauca		61	Valparaiso
	48	Arauca		62	Valparaiso
	49	Arauca		63	Valparaiso
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	51	Arauca		65	Valparaiso
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	54	Arauca		68	Valparaiso
	55	Arauca		69	Valparaiso
	56	Arauca		70	Valparaiso
	57	Arauca		71	Valparaiso
	58	Arauca		72	Valparaiso
	59	Arauca		73	Valparaiso
	60	Arauca		74	Valparaiso
	61	Arauca		75	Valparaiso
	62	Arauca		76	Valparaiso
	63	Arauca		77	Valparaiso
	64	Arauca		78	Valparaiso
	65	Arauca		79	Valparaiso
	66	Arauca		80	Valparaiso

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



# Map 18. Dynamics of coca cultivation in areas Integrated Monitoring, 2011 - 2012



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

### *Progress of the Alternative Development Programmes of the Colombian Government*

Next, there is a summary of the progress of the programmes against illegal cultivation in 2012, led by the Administrative Unit for Territorial Consolidation (UACT), addressed to the progressive consolidation of territories free from illegal cultivation.

#### *Graduation Strategy*

##### *Forest Warden Family Programme – PFGB*

This is a government initiative within the strategy of voluntary manual eradication of illegal cultivations. It is aimed at benefitting farmers', Afro-Colombian and indigenous communities located in different areas of the national territory with presence of environmentally strategic ecosystems and zones that are affected or are vulnerable due to the presence of illegal cultivations.

In 2012, the PFGB progressed in the phases VI and VII, based on previous commitments of the families enrolled to eradicate illegal cultivation and maintain their territories free from them, to avoid any involvement in illegal activities and to take care of natural resources.

The total investment of the Colombian Government in the PFGB in 2012 was COP \$28,101 million to assist 14,308 families located in ten (10) departments and twenty nine (29) municipalities.

**Table 30. Forest Wardes Family Programme investment 2012.**

Department	No. Municipalities	No. Families served	Economic incentive	Support	Technical support environmental and social
Antioquia	9	3,774	\$ 4,274	\$ 2,937	\$ 2,712
	<b>Total Antioquia</b>			<b>\$ 9,924</b>	
Archipelago de San Andres	2	646	\$ 384	\$ 272	\$ 457
	<b>Total San Andres</b>			<b>\$ 1,113</b>	
Caldas	1	590	\$ 596	\$ 479	\$ 345
	<b>Total Caldas</b>			<b>\$ 1,421</b>	
Cauca	3	3,013	\$ 2,546	\$ 275	\$ 1,097
	<b>Total Cauca</b>			<b>\$ 3,918</b>	
Cordoba	4	723	\$ 839	\$ 574	\$ 653
	<b>Total Cordoba</b>			<b>\$ 2,066</b>	
Guainia	1	409	\$ 495	\$ 328	\$ 396
Guaviare	2	243	\$ 275	\$ 195	
	<b>Total Guainia y Guaviare</b>			<b>\$ 1,688</b>	
Huila	3	3,405	\$ 2,795	\$ 0	\$ 1,362
	<b>Total Huila</b>			<b>\$ 4,157</b>	
Magdalena	2	1,043	\$ 1,208	\$ 747	\$ 730
	<b>Total Magdalena</b>			<b>\$ 2,685</b>	
Putumayo	2	462	\$ 446	\$ 349	\$ 335
	<b>Total Putumayo</b>			<b>\$ 1,130</b>	
	<b>Total General</b>	<b>14,308</b>	<b>\$ 13,858</b>	<b>\$ 6,156</b>	<b>\$ 8,087</b>
	<b>Total Investment</b>			<b>\$ 28,101</b>	

\*Rounded to COP \$ million  
Source: UACT

**Productive Projects Programme – PPP**

Its main aim is institutional strengthening and communal development<sup>45</sup>, under the strategies of contention or voluntary manual eradication of illegal cultivation. The PPP works jointly with communal organisations in the strengthening, implementation and/or leverage of the productive lines prioritized in each one of the municipalities, by means of different instruments for income generation.

In 2012, the PPP assisted 17,062 families in 21 departments, which received technical assistance and organisational strengthening for COP \$11,778 million, by means of projects of Productive Alliances of the Ministry of Agriculture, and partnerships with the private sector through an alliance with UNODC. In addition, the agreement between USAID-BIORRED and the UACT, which promotes the socio-economic development and environmental conservation of territories of the Colombian Pacific assists 3,400 families with an economic contribution of COP \$2,445 million.

Table 31. Productive projects investment 2012

Department	No. Municipalities	No. Families served	Budget 2012	Productive line
Amazonas	2	14	\$ 40	Tourism
Antioquia	5	393	\$ 376	Fishing, Cocoa
Archipelago de San Andres	1	107	\$ 80	Fishing
Bolivar	3	5,686	\$ 1,388	Cocoa
Boyaca	5	908	\$ 442	Cocoa
Caldas	3	386	\$ 504	Agroforestry, Cocoa
Cauca	2	170	\$ 383	Coffee
Cesar	2	450	\$ 50	Cocoa
Choco	3	1,588	\$ 681	Tourism, Forestry
Cordoba	5	442	\$ 692	Fishing, Cocoa
Cundinamarca	2	394	\$ 393	Cacao
La Guajira	1	341	\$ 190	Coffee
Guaviare	2	274	\$ 492	Cocoa, Silvopastoral
Huila	1	26	\$ 59	Coffee
Magdalena	3	1,218	\$ 795	Fishing, Cocoa
Meta	2	103	\$ 203	Cocoa
Nariño	6	1,615	\$ 1,102	Cocoa, Handicrafts, Coffee
Norte de Santander	6	1,341	\$ 1,243	Cacao, Apiculture
Putumayo	5	1,426	\$ 2,176	Cane, Cocoa, Silvopastoral
Santander	2	76	\$ 228	Palm, Cocoa
Tolima	1	104	\$ 73	Coffee
National	Cacaoleros red	0	\$ 190	Cocoa
<b>Total</b>	<b>62</b>	<b>17,062</b>	<b>\$ 11,780</b>	

\*Rounded to COP \$ million

Source: UACT

Table 32. Productive projects investment in the Pacific region, 2012

Department	No. Farms houses	No. Families served	Economic contribution
Nariño	84	3,400	\$ 2,445
<b>Total</b>	<b>84</b>	<b>3,400</b>	<b>\$ 2,445</b>

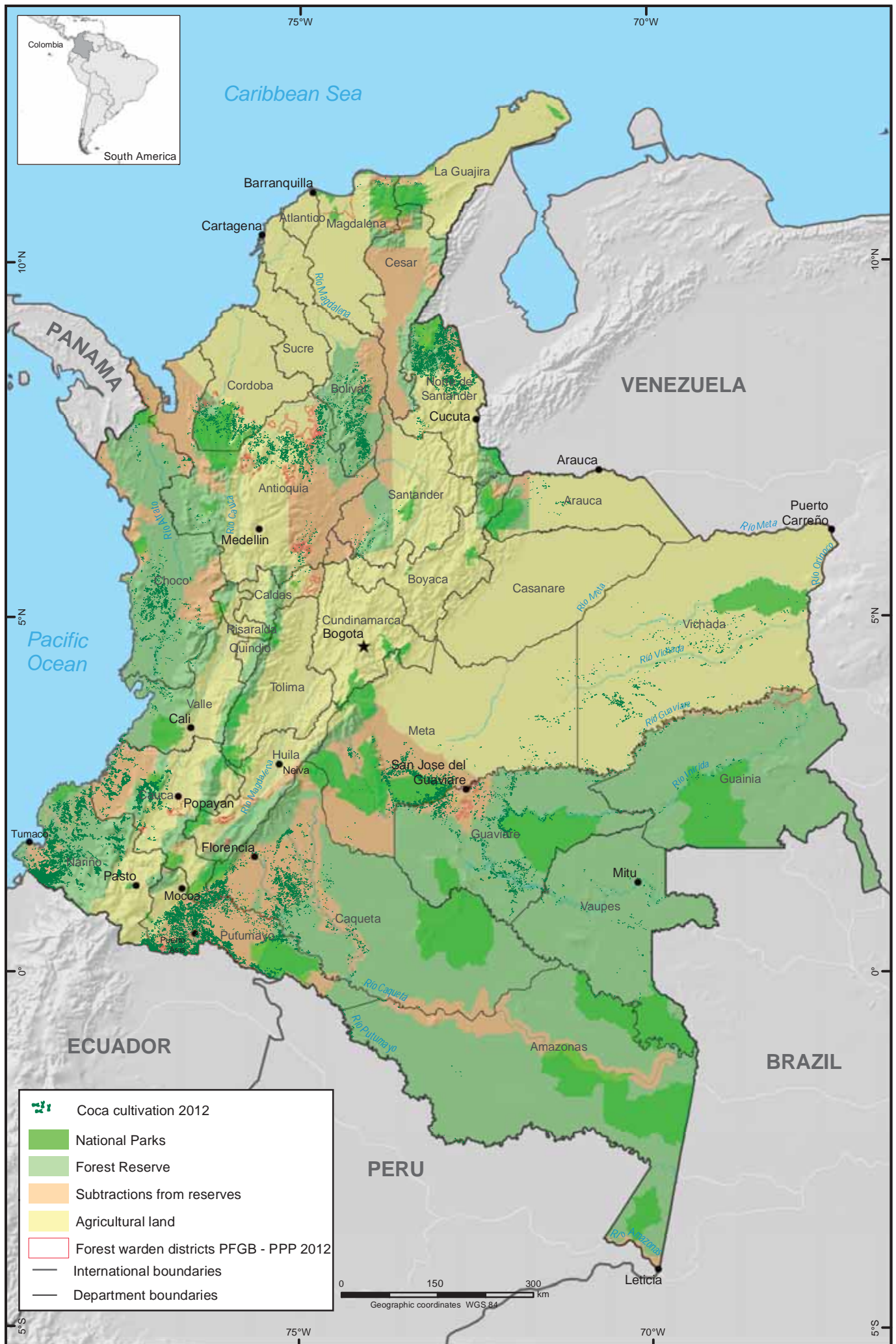
\* These projects correspond to the MOU USAID – BIORRED in alliance with UACT

Rounded to COP \$ million

Source: UACT

<sup>45</sup> Colombia National Planning Department (DNP). National Council of Economic and Social Policy (CONPES). Document 3218: Alternative Development Programme 2003 - 2006. Bogotá: National Planning Department, 2003. p. 6-7.

# Map 19. Special areas and alternative development programs FGB - PP



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

**Post-eradication and Contention Strategy**

In 2012, the National Policy for Territorial Consolidation and Reconstruction, through UACT, continued the post-eradication and contention strategies in zones affected by illegal cultivation. Under this modality, 50,902 families were pre-enrolled, out of which 33,294 are assisted through the different Alternative Development Programmes in the period 2012-2013.

The table 3 shows the total families enrolled by department, which meet processes of voluntary or forced manual eradication or contention of illegal crops.

**Table 33. Families enrolled in the Post-eradication Strategy and Containment, 2012**

Department	No. de farms houses	No. Families enrolled
Antioquia	62	1,938
Bolivar	18	709
Caldas	88	1,842
Caqueta	75	1,324
Cauca	106	4,274
Cordoba	19	721
La Guajira	10	505
Magdalena	19	837
Meta	11	742
Nariño	106	5,139
Nariño (no consolidation)	164	8,646
Santander	82	2,401
Putumayo	89	4,216
<b>National total</b>	<b>849</b>	<b>33,294</b>

Source: UACT

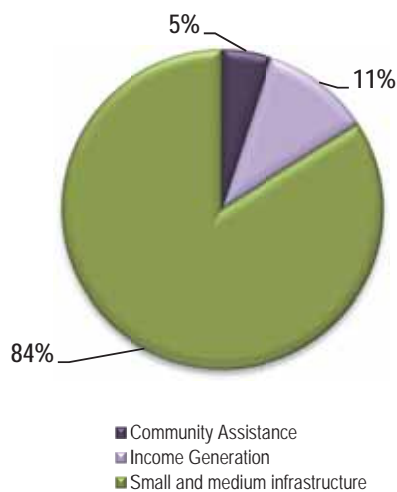
**Quick Response Programme<sup>46</sup>**

It is intended to meet the needs of vulnerable populations due to the phenomenon of illegal cultivation in the territories focalised by the Territorial Consolidation Policy by means of agile mechanisms of coordination and intervention. It is aimed at promoting social participation and creating the conditions for the institutional intervention of the territory.

The Quick Response Programme (PRR) operates under three modalities: i) Communal Assistance, which provides emergency assistance to populations for the transition and construction of reliability; ii) generation of Income, which supports the development of projects that generate productivity and food security for the community in the short, middle and long terms; and iii) infrastructure works that support the construction of social works of collective interest, by means of the identification, agreement, formulation, making viable and execution of collective projects that respond to basic needs of the communities (See Figures 26 and 27 ).

<sup>46</sup> National Policy of Manual Eradication of Illegal Cultivation and Alternative Development for Territorial Consolidation, CONPES 3669 of June 2010.

Figure 27. Modalities of intervention of the Quick Response Programme – 2012



During 2012, the PRR was present in 10 departments and 28 municipalities, with a total of 134 projects and an appropriate investment for the execution of COP \$ 10,396 million.

Table 34. Appropriate investment for the execution of projects, Quick Response Programme – 2012\*

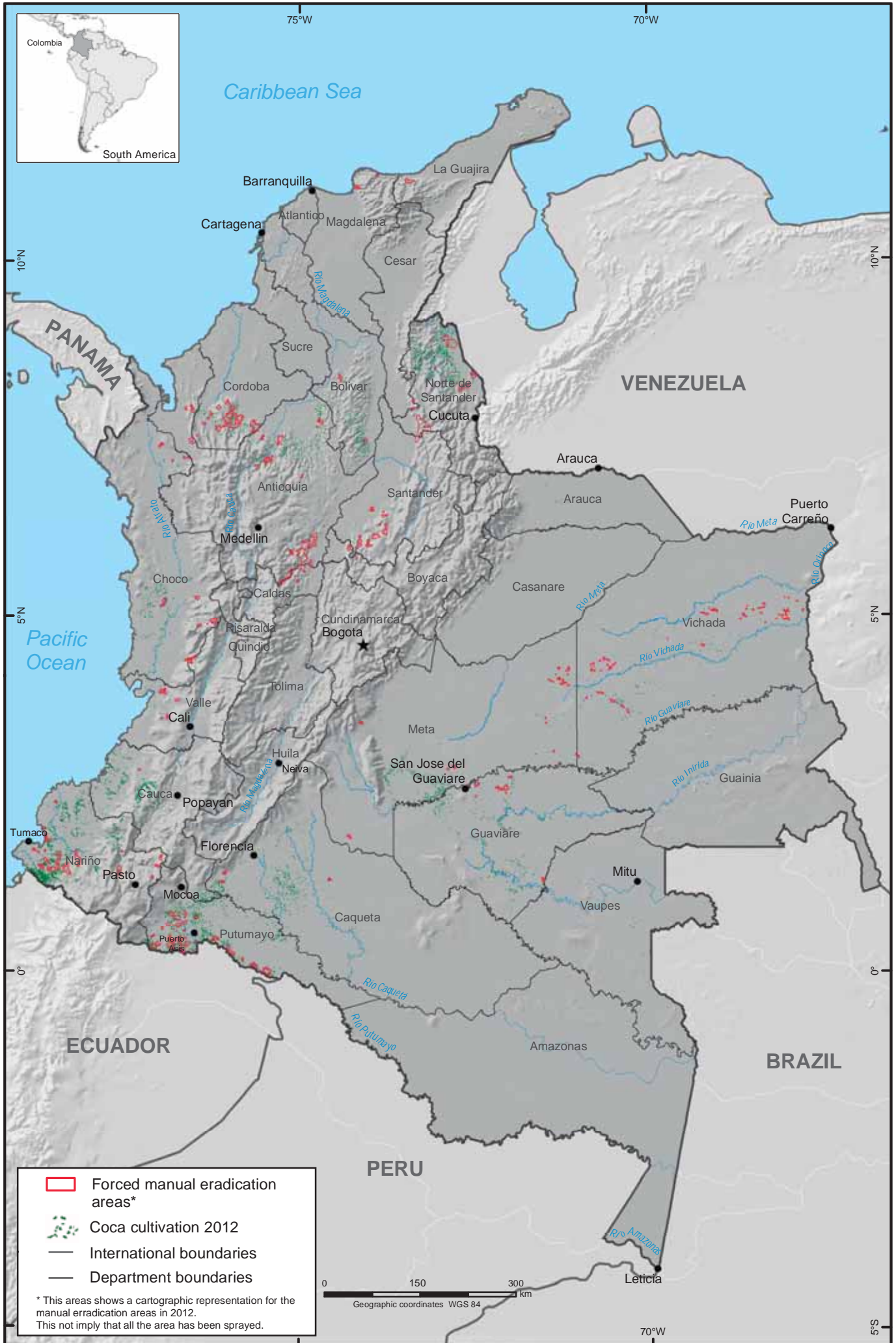
Department	No. Municipalities	No. Projects	Resources
Antioquia	3	11	\$ 373
Bolivar	1	2	\$ 199
Antioquia	3	25	\$ 1,685
Cauca	1	1	\$ 65
Meta	6	33	\$ 2,457
Nariño	1	9	\$ 1,086
Norte de Santander	3	5	\$ 280
Putumayo	4	37	\$ 1,990
Sucre	2	5	\$ 982
Tolima	4	6	\$ 1,279
<b>Total</b>	<b>28</b>	<b>134</b>	<b>\$ 10,396</b>

\*Rounded to COP \$ million  
Source: UACT



Sample of communal works of the Quick Response Programme of the Special Administrative Unit for Territorial Consolidation of the Government of Colombia: communal rooms, sports settings and sanitary batteries (Norte de Santander and Caquetá)

# Map 19. Forced manual eradication and coca cultivation in Colombia, 2012



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

## SUPPLY REDUCTION

### *Forced manual eradication*

In 2012, 30,486 hectares of coca cultivation were manually eradicated, 11% less than the previous year. Manual eradication activities were mainly concentrated in Putumayo (31 %), Nariño (18%) and Cordoba (18%). The strategy of manual eradication is under the responsibility of the DPCI of the Administrative Unit for Territorial Consolidation, and it is conducted by means of the Mobile Groups of Manual Eradication -GME with the support of the Public Force and certified by UNODC since 2007. In 2012, UNODC accompanied the manual eradication of 14,529 ha, 47.6% of all manual eradication reported. As a complement, the National Police and the Military Forces carry out forced manual eradication activities throughout the country; in 2012, 15,957 were reported as manually eradicated in this modality.

Table 35. Manual eradication of coca fields by department, 2012

Department	Coca cultivation		Opium poppy		Marihuana	
	Eradicated areas (ha)	% of the total	Eradicated areas (ha)	% of the total	Eradicated areas (ha)	% of the total
Putumayo	3,603	25.1	-	-	-	-
Nariño	2,488	17.3	113	100	-	-
Cordoba	2,498	17.4	-	-	-	-
Antioquia	1,461	10.2	-	-	1	1.8
Norte de Santander	843	5.9	-	-	-	-
Vichada	689	4.8	-	-	-	-
Choco	668	4.7	-	-	-	-
Valle del Cauca	528	3.7	-	-	-	-
Meta	517	3.6	-	-	2	3.6
Guaviare	325	2.3	-	-	-	-
Caqueta	253	1.8	-	-	-	-
Santander	228	1.6	-	-	-	-
Bolivar	77	0.5	-	-	-	-
Boyaca	74	0.5	-	-	-	-
Caldas	64	0.4	-	-	-	-
Magdalena	10	0.1	-	-	52	92.9
La Guajira	15	0.1	-	-	1	1.8
Cauca	10	0.1	-	-	-	-
Cesar	9	0.1	-	-	-	-
<b>Total National</b>	<b>14,360</b>	<b>100.0</b>	<b>113</b>	<b>100</b>	<b>56</b>	<b>100</b>

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

Manual eradication has greatest impact on the production of coca leaf, given that the plants are uprooted. Re-sowing implies costs for the farmer, since they need approximately eight months after sowing to collect the first crop with a low productivity in the initial stage.

UNODC evaluated the behaviour of re-sowing activities in the areas forcedly eradicated by means of overlapping of the coordinates reported by GME, taking into account the date of the image and the date of eradication. The following table shows the area of fields that were manually eradicated throughout 2012 and which were re-sowed with coca at the moment of the census. The analysis includes only the forced manual eradication data certified by UNODC.



Table 36. Re-planting analysis in areas of forced manual eradication of coca fields by GME, 2012

Region	Eradication			Re - planted with coca		No re - planting	
	Hectares	Study area	% of total area	Hectares	%	Hectares	%
Amazonia							
Central	5.254	3.688	70	485	13	3.203	87
Meta Guaviare	844	704	83	68	10	636	90
Orinoquia	689	617	90	135	22	482	78
Pacifico	3.807	2.807	74	354	13	2.453	87
Putumayo Caquetá	3.856	3.839	100	934	24	2.905	76
Sierra Nevada	79	71	91	1	2	70	98
<b>Total</b>	<b>14.529</b>	<b>11.726</b>	<b>81</b>	<b>1.978</b>	<b>17</b>	<b>9.748</b>	<b>83</b>

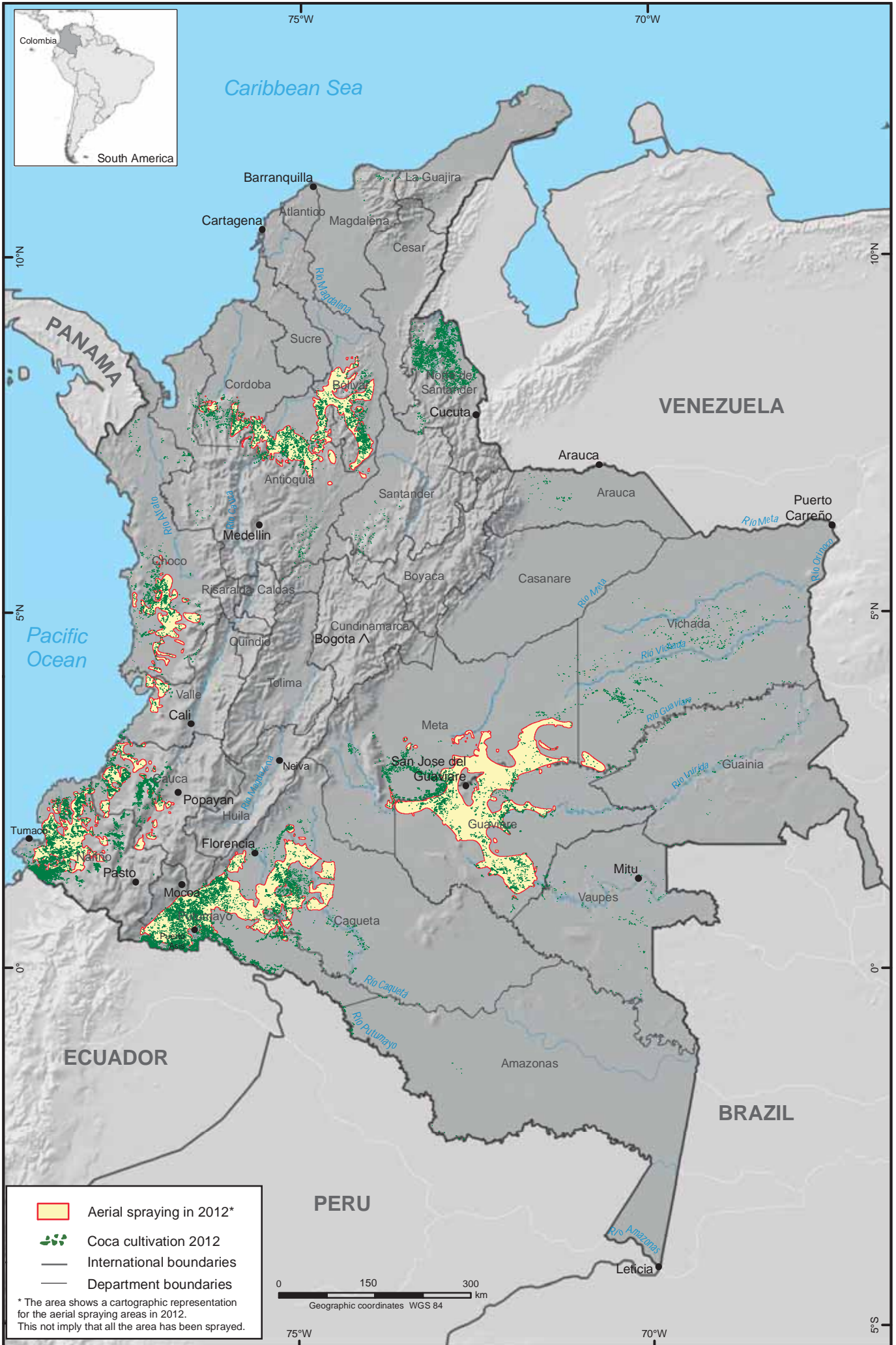
Source: DPCI and UNODC.

This comparison showed that 81% of the total eradicated area has enough information to evaluate re-sowing and 19% is covered by clouds or gaps. In the areas with information, 17% has evidence of re-sowing, which is 70% less in relation to the previous year. In the national consolidate, the regions that report more re-sowing of coca are Putumayo – Caqueta and Orinoco.



Source: GME. Forced manual eradication of a coca field

# Map 20. Aerial spraying and coca cultivation in Colombia, 2012



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

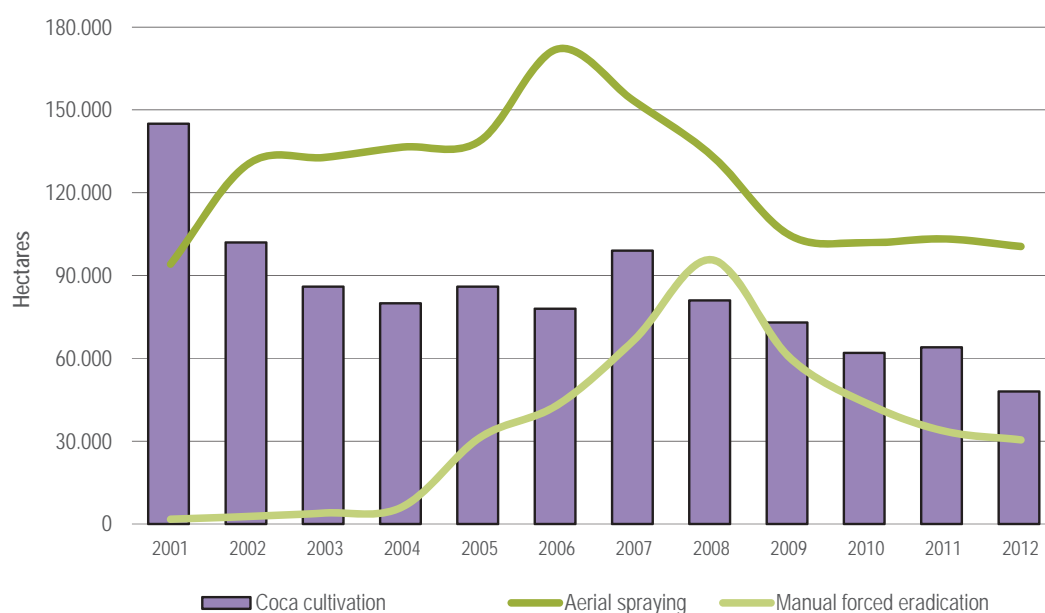
### Aerial spraying

The strategy of Colombia for the reduction of the drug supply includes aerial spraying, forced or voluntary manual eradication, alternative development programmes and the National Plan for Territorial Consolidation. UNODC neither participates nor supervises aerial spraying activities. All the information presented here in this regard is directly reported by the National Police -DIRAN.

The aerial spraying programme, as provided by the National Drugs Council, is conducted by the National Antinarcotics Police. 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 2012, the Commission of National Verification of Spraying Operations estimated a percentage of 94.1% of effective death of plants per field.

In 2012, the DIRAN sprayed a total of 100,549 hectares of coca, 2.6 % less than the previous year. 38% of the activities were conducted in the department of Nariño and an additional 35% in the departments of Guaviare, Cauca and Chocó.

Figure 28. Comparison of coca cultivation vs. the accumulated areas sprayed and manually eradicated, 2001-2012



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 pass width, without including the overlapping between adjacent bands and the number of applications done over one same field during the same year; hence, it is different from the effective area sprayed.

Coca growers develop strategic behaviours to reduce the effect of aerial spraying on coca cultivations, such as 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).

Table 37. Aerial spraying of coca fields per department and year (in hectares) 2002-2012

Department	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Nariño	17,962	36,911	31,307	57,630	59,865	36,275	54,050	39,992	25,940	34,988	37,831
Choco	-	-	-	425	-	-	-	-	-	4,287	13,259
Guaviare	7,207	37,493	30,892	11,865	14,714	10,950	13,061	12,584	17,633	8,917	11,088
Cauca	-	1,308	1,811	3,292	1,536	3,557	6,891	11,136	14,450	11,834	10,697
Antioquia	3,321	9,835	11,048	16,799	18,022	27,058	10,028	9,281	3,026	9,847	6,971
Putumayo	71,891	8,343	17,524	11,763	26,491	26,766	11,898	3,777	11,434	9,480	6,504
Caqueta	18,567	1,060	16,276	5,452	4,575	5,084	11,085	6,652	16,947	12,888	5,638
Meta	1,496	6,974	3,888	14,453	25,915	15,527	9,057	6,756	5,825	2,545	3,152
Bolivar	-	4,783	6,456	6,443	2,662	7,050	2,214	8,715	4,412	3,564	2,740
Cordoba	734	550	-	1,767	5,588	6,259	3,561	742	546	3,128	1,632
Valle del Cauca	-	-	-	5	-	-	-	-	-	719	986
Vichada	-	-	1,446	-	5,485	7,193	5,901	1,699	1,425	1,014	51
Santander	-	5	1,855	2,042	2,146	1,754	422	1,269	153	92	-
Norte de Santander	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	-	-	-	-	-	-	-
Vaupés	-	-	756	340	-	-	-	-	-	-	-
<b>Total spraying</b>	<b>130,364</b>	<b>132,817</b>	<b>136,551</b>	<b>138,775</b>	<b>172,025</b>	<b>153,134</b>	<b>133,496</b>	<b>104,772</b>	<b>101,940</b>	<b>103,302</b>	<b>100,549</b>
Cultivated area (hectares)	102.000	86.000	80.000	86.000	78.000	99.000	81.000	68.000	62.000	64.000	48.000

Source: National Police –Anti-narcotics Directorate

### *Infrastructure of drug production*

In Colombia, the detection and dismantling of infrastructure devoted to drug production, as well as drug seizures, are carried out by the Government of Colombia, by means of strategic actions by law enforcement agencies; for this reason, it is worth noting that UNODC does not participate in these operations and neither collects direct information on the matter. Nevertheless, given the relevance of this subject in the analysis of the dynamic of the drug business, the official information consolidated and reported by the Drug Observatory-Ministry of Justice is included in this report.

### *Infrastructure*

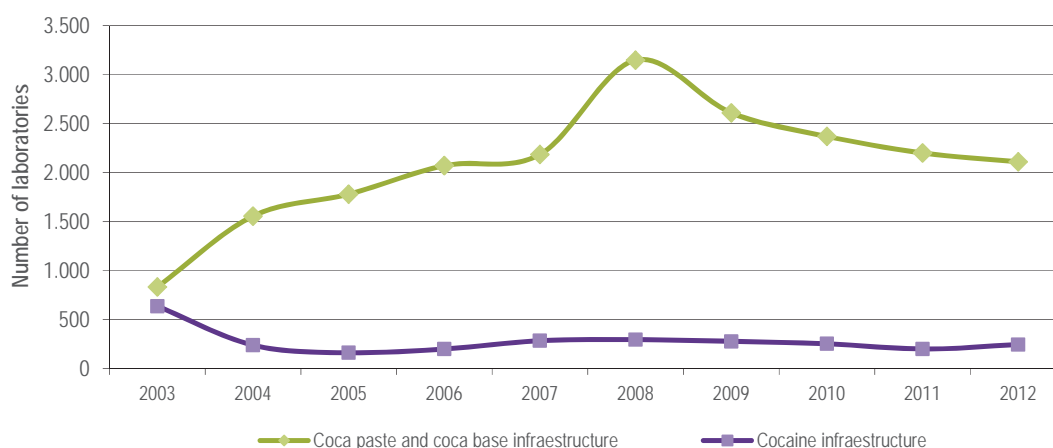
According to the information of the Observatory of Drugs of Colombia –ODC, in 2012 Colombian authorities destroyed a total of 2,480 infrastructures devoted to the illegal extraction and production of drugs and chemical substances, which correspond to the following: 2,110 laboratories for the extraction of basic paste or cocaine base, 246 laboratories of cocaine hydrochloride, one heroin laboratory, 15 marijuana greenhouses and 8 laboratories of potassium permanganate. It is worth mentioning that the number of dismantled infrastructures devoted to the extraction of basic paste and cocaine base is higher to those used in the

crystallisation of cocaine hydrochloride or other type of substances, given that the latter are quite difficult to detect apart from being less.

69% of the laboratories of basic paste and cocaine base that were destroyed in 2012 were found in the departments of Nariño (16%), Putumayo (12%), Antioquia (10%), Guaviare (9%), Caqueta (8%), Cauca (7%) and Norte de Santander (7%).

In the case of laboratories for the production of cocaine hydrochloride, the majority of dismantled "cristalizaderos" were found in the departments of Norte de Santander (26%), Nariño (15%), Antioquia (14%), Valle del Cauca (9%) and Cauca (8%).

Figure 29. Production infrastructures for the extraction and refining of cocaine destroyed by law enforcement agencies in Colombia in 2012



As regards to the infrastructures for drug production, the studies conducted by UNODC/SIMCI, the Colombian Government, PRELAC and other institutions have found the following: i) The crystallisation laboratories for the production of cocaine hydrochloride tend to be smaller every time to facilitate dismounting and mobility; ii) use of new substances and changes in the processes, which contribute to improve yield and optimise both times and crystallisation processes; iii) clandestine fabrication of chemical precursors such as potassium permanganate, ammonia hydroxide, sulphuric acid and petroleum 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 substances.

### Seizures

Drug seizures are an effort by the institutions of the Colombian Government to reduce the supply in the market for both their transformation and consumption. Considering the figures reported by the Observatory of Drugs of Colombia, in 2012, the amounts seized were: 719 mt of coca leaf, 5 mt of basic paste, 50 mt of cocaine base and 188 mt of cocaine hydrochloride

In 2012, the seizures of coca leaf decreased by 29.7% with respect to the previous year; the 719 mt were seized mainly in the departments of Nariño (69%), Putumayo (6%), Chocó (6%) and Vichada (4%).

The amounts of basic paste seized grew by 36.5% in 2012, and the 5 mt were found mainly in the departments of Norte de Santander (32%), Putumayo (17%), Chocó (15%), Santander (15%) and Antioquia (11%).

On the other hand, seizures of cocaine base decreased by 1.4%, mainly in the departments of Nariño (15%), Antioquia (13%), Norte de Santander (9%), Caqueta (8%), Tolima (7%), Guaviare (7%) and Cauca (7%).

Table 38. Seizure of illegal drugs 2005-2011

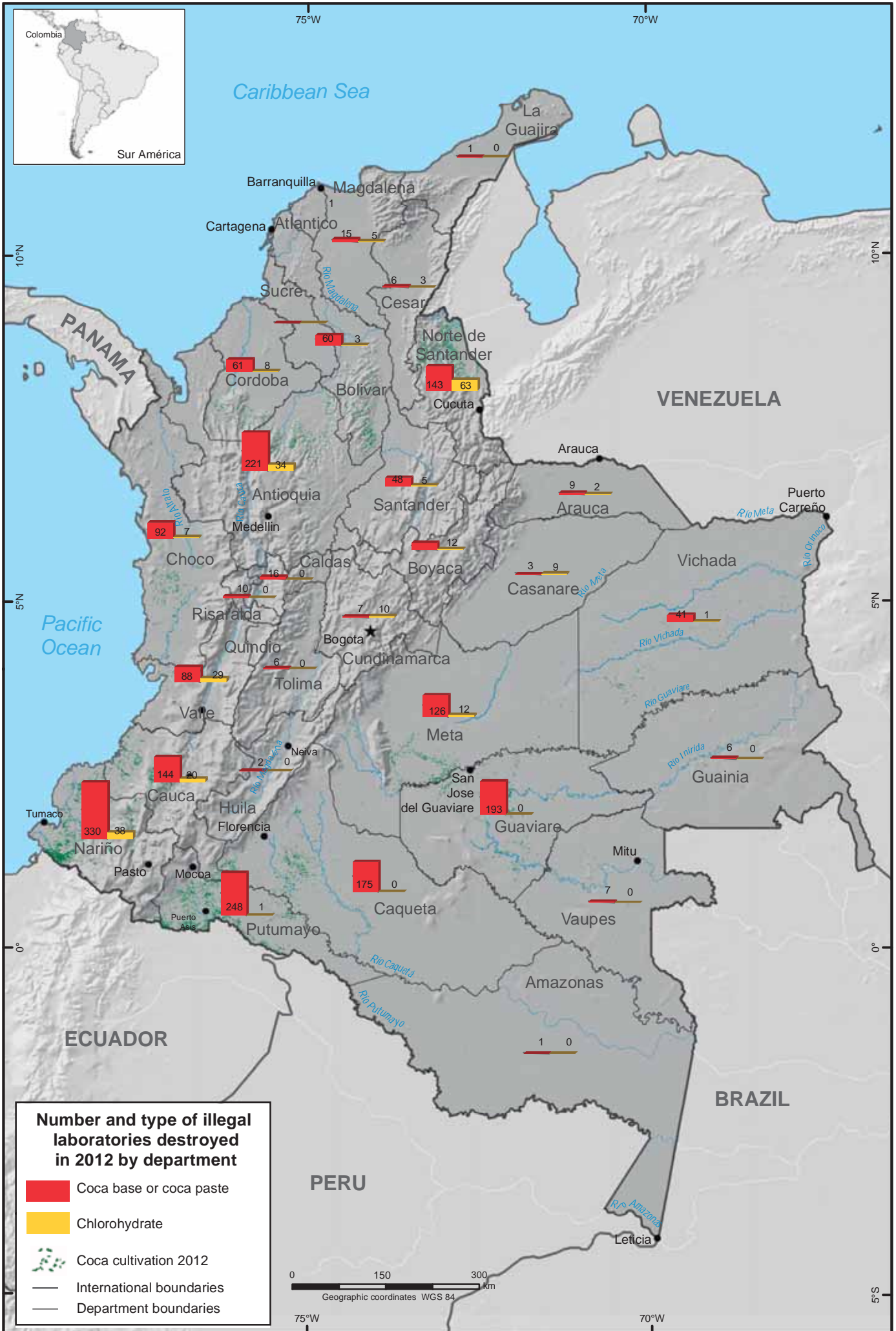
Droga	U	2005	2006	2007	2008	2009	2010	2011	2012
Coca leaves	kg	682,010	818,544	1,064,503	644,353	826,793	871,249	1,022,532	718,992
Coca paste	kg	2,651	5,451	922	5,001	11,400	3,685	3,892	5,312
Coca base	kg	106,491	42,708	33,882	49,663	41,634	46,405	50,401	49,698
Cocaine	kg	173,265	127,326	126,641	198,366	203,166	164,808	155,832	188,021
Opium latex	kg	1,632	118	125	172	49	2	193	0
Heroin	kg	745	442	537	646	728	337	299	464
Marihuana	kg	150,795	93,745	142,684	254,685	206,811	254,991	348,082	348,472
Synthetic drugs		148,724	7,888	1,968,857	5,597	132,987	26,299	22,809	56,961

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

<sup>1</sup> The data of cocaine hydrochloride seizures in 2011 includes 15.5 mt reported by the National Police related to international operatives.

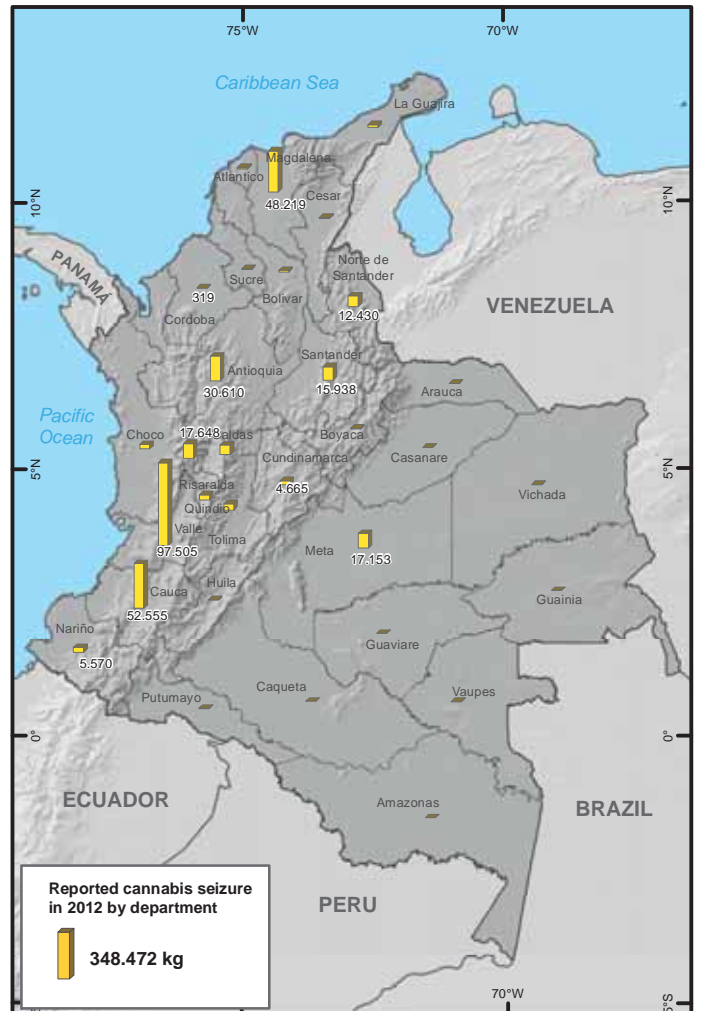
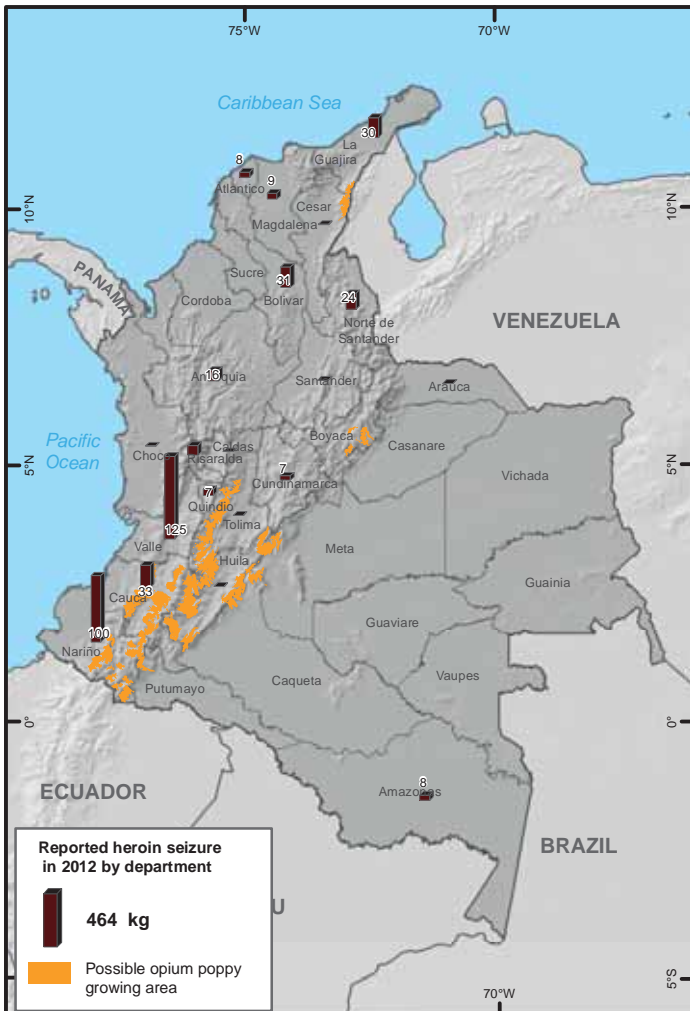
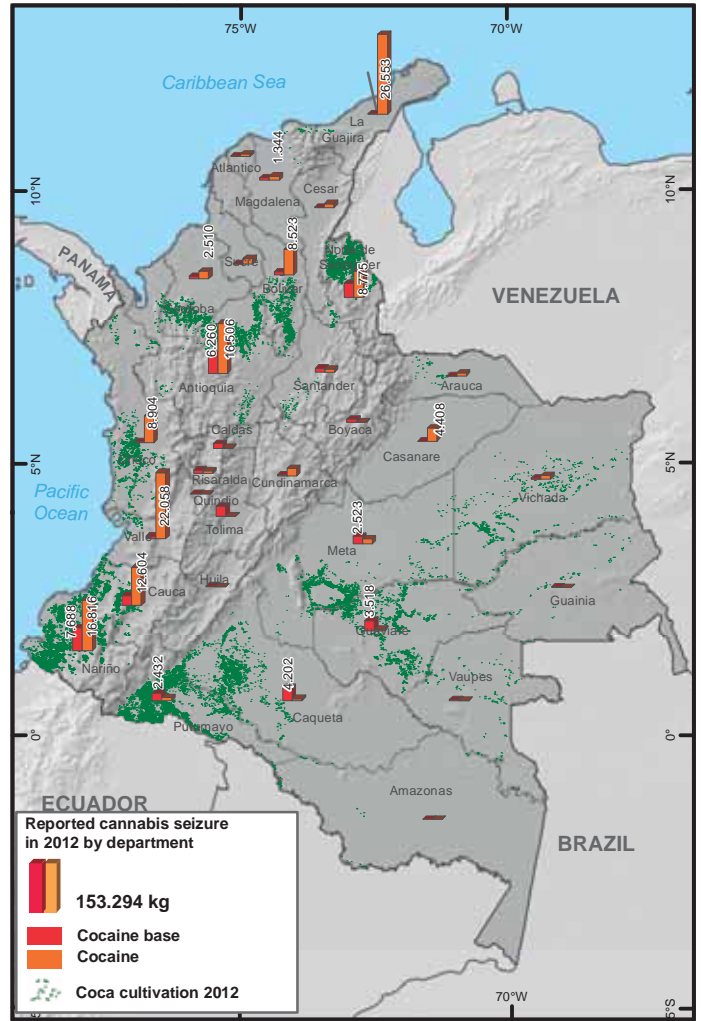
<sup>2</sup> The total of 188 mt on cocaine hydrochloride seized in 2012 includes 34.7 mt related to international operatives in cooperation with Colombian law enforcement institutions.

Map 22. Destruction of clandestine laboratories and coca cultivation in Colombia, 2012



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

# Map 23. Drug seizures by department and by drug type, Colombia 2012



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 39. Seizures of illicit drugs by product and department in 2012

Department	Coca leaf	Coca paste	Coca base	Cocaine hydrochloride
	Kilograms	Kilograms	Kilograms	Kilograms
Amazonas		0	7	19
Antioquia	15,301	563	6,260	16,506
Arauca	770	2	10	982
Archipiélago de San Andrés				7,518
Atlántico	0	0	142	839
Bogotá, D.C.			40	1,379
Bolívar	11,506	7	989	8,523
Boyacá	2,158		1,156	135
Caldas	350	1	1,691	265
Caquetá	19,356	361	4,202	633
Casanare			3	4,408
Cauca	39,649	76	3,289	12,640
Cesar	250	25	121	1,257
Chocó	3,895	807	486	8,904
Córdoba	7,858	1	748	2,510
Cundinamarca	50	2	361	2,497
Guainía	129	1	108	0
Guaviare	20,828	16	3,518	535
Huila	400	2	321	31
La Guajira			292	26,553
Magdalena	445		770	1,344
Meta	10,054	1	2,523	1,741
Nariño	492,586	56	7,687	16,816
Norte de Santander	11,289	1,683	4,566	8,775
Putumayo	45,193	887	2,432	1,051
Quindío			122	58
Risaralda		3	1,252	939
Santander	1,414	792	1,441	1,138
Sucre		0	6	1,809
Tolima	35		3,433	149
Valle del Cauca	5,407	1	1,003	22,058
Vaupés			332	0
Vichada	30,069	25	387	1,282
<b>Total general</b>	<b>718,992</b>	<b>5,312</b>	<b>49,698</b>	<b>153,294</b>
Others <sup>1</sup>				34,727
<b>Total general</b>	<b>718,992</b>	<b>5,312</b>	<b>49,698</b>	<b>188,021</b>

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

It is worth highlighting that great part of the seizures of coca leaf were done in the production infrastructures commonly called *cocinas* or *chongos*, while in the case of basic paste these were made mainly in the central part of the country. As for cocaine base, the amounts seized were reported in both production sites and in the central part of the country.

In relation to the seizures of cocaine hydrochloride, they went from 156 mt in 2011 to 153 tm in 2012, in the central part of the country, which corresponds to a decrease of 1.6%. 79% of the amounts of cocaine hydrochloride seized were concentrated in the departments of La Guajira (17%), Valle del Cauca (14%), Nariño (11%), Antioquia (11%), Cauca (8%), Norte de Santander (6%), Chocó (6%) and Bolívar (6%).

The greatest amounts of the cocaine hydrochloride seized were found in international waters, in the central part of the country and in production infrastructures; the purity of the substances seized in Colombia is unknown.

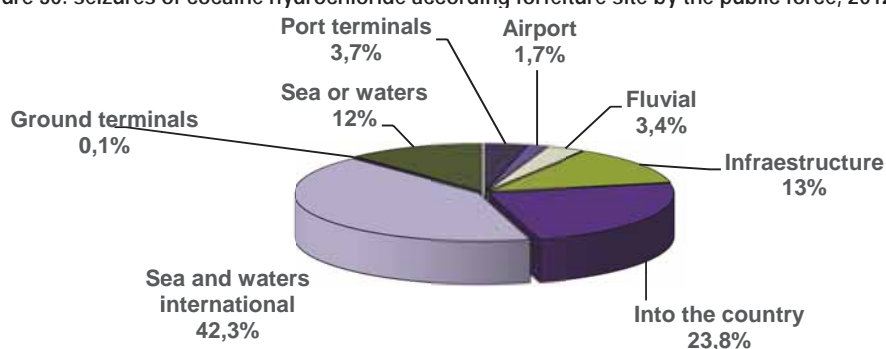
Figure 30. seizures of cocaine hydrochloride according forfeiture site by the public force, 2012<sup>47</sup>

Table 40. Seizures of illicit drugs in 2012

Department	Basuco	Heroine	Pressed marihuana	Amphetamines <sup>1</sup>	Ecstasy <sup>1</sup>	Flunitrazepam <sup>1</sup>	LSD <sup>1</sup>
	Kilograms	Kilograms	Kilograms	U	U	U	U
Amazonas	12	8	178				
Antioquia	400	16	29,082	14,000	20	28,526	
Arauca	1	0	259	11			
Archipiélago de San Andrés	2		1,729			15	
Atlántico	68	8	1,612		1,679		
Bogotá, D.C.	460	46	4,087		5,687		
Bolívar	34	31	1,813		20	110	
Boyacá	12		1,342	40	104	4	
Caldas	70	0	11,036		1,482	471	52
Caquetá	32		261				
Casanare	8		124				
Cauca	674	33	52,555				
Cesar	17	1	1,227		56		
Chocó	20	1	5,217				
Córdoba	42		319	60			
Cundinamarca	117	7	4,665				
Guainía	16		5				
Guaviare	1		99				
Huila	19	0	379				
La Guajira	55	30	3,458				
Magdalena	19	9	48,219		14		
Meta	18		17,153	26			
Nariño	82	100	5,570		18	2	
Norte de Santander	160	24	12,430		1	30	
Putumayo	12		172				
Quindío	50	9	6,150	190	8		
Risaralda	120	15	17,648	85	2,212		
Santander	83	0	15,938		25	356	
Sucre	1		645		130		
Tolima	282	1	7,560	10	9		
Valle del Cauca	342	125	97,505	2,813	28,255	4,447	52
Vaupés	1		1		6		
Vichada	2		34				
<b>Total general</b>	<b>3,232</b>	<b>464</b>	<b>348,472</b>	<b>17,235</b>	<b>39,726</b>	<b>33,961</b>	<b>104</b>
Others			522				
<b>Total general</b>	<b>3,232</b>	<b>464</b>	<b>348,994</b>	<b>17,235</b>	<b>39,726</b>	<b>33,961</b>	<b>104</b>

<sup>1</sup>Data refer to the name by which the substance is marketed, there are no laboratory tests to confirm the nature of the substance

<sup>47</sup> Percentages are calculated from the quantities in kilograms seized in each site.

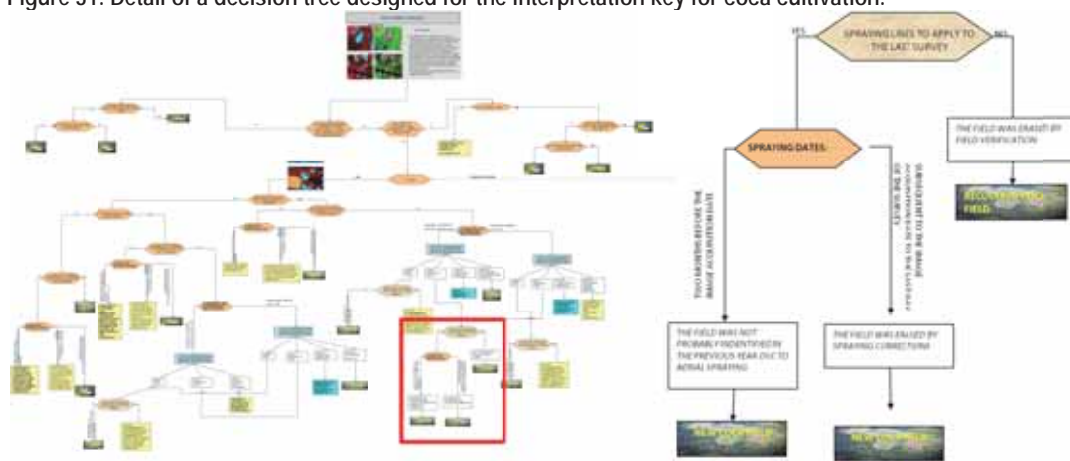
### 3. METHODOLOGY

#### COCA CULTIVATION CENSUS

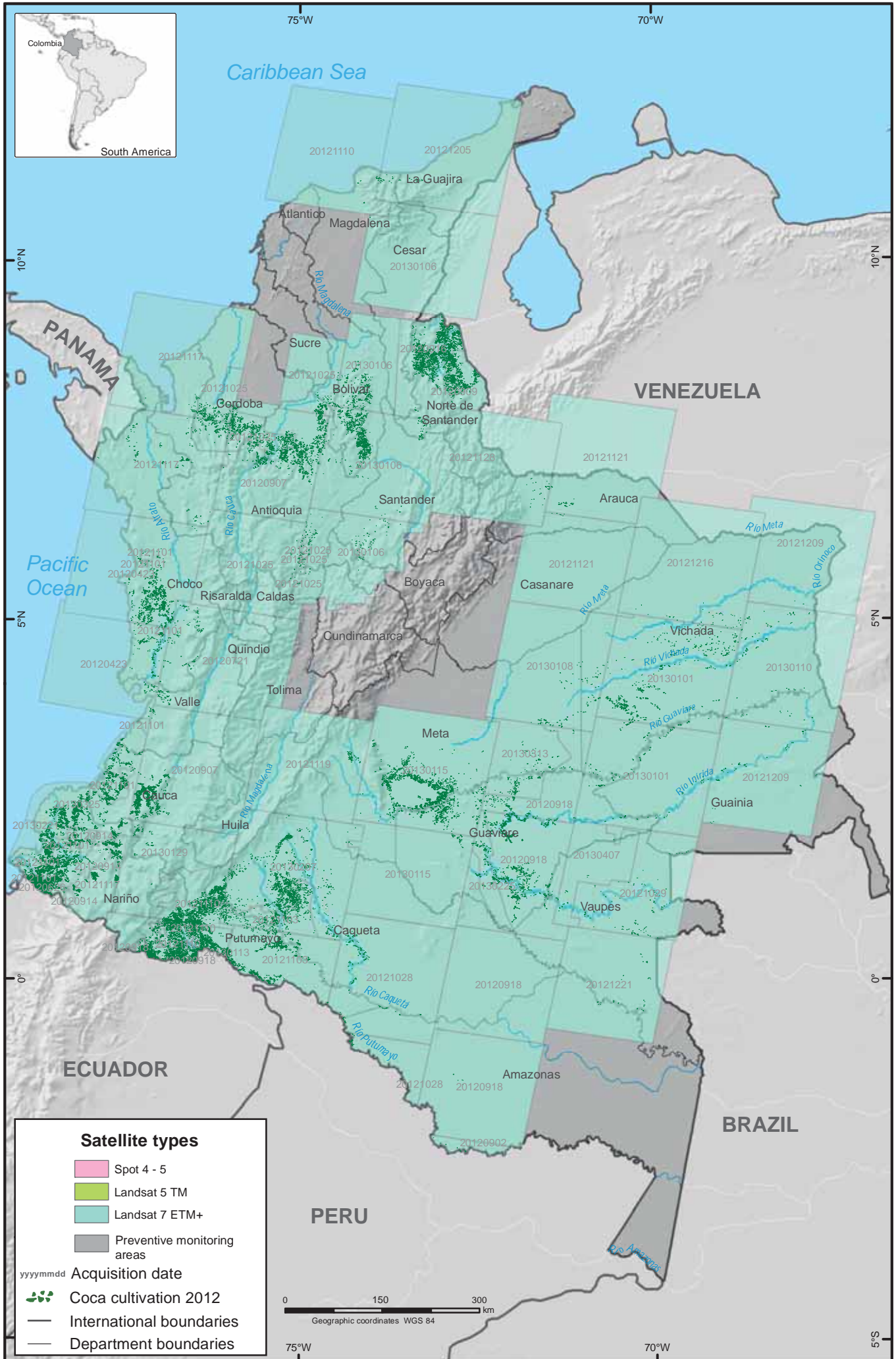
The monitoring of coca cultivation in Colombia is based on the interpretation of several types of satellite images. For the 2012 census, the project analyzed a total of 153 LANDSAT 7 ETM+ images. 92% of the area under study was covered by satellite images collected between September 2011 and March 2012; the conditions of cloudiness predominant in Colombia at the end of 2012 forced the use of images collected in June and August 2012. The images cover the entire national territory (1,142,000 km<sup>2</sup>), 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 31. Detail of a decision tree designed for the interpretation key for coca cultivation.



# Map 24. Satellite images used for the coca cultivation survey in Colombia, 2012



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 2012 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, two 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.

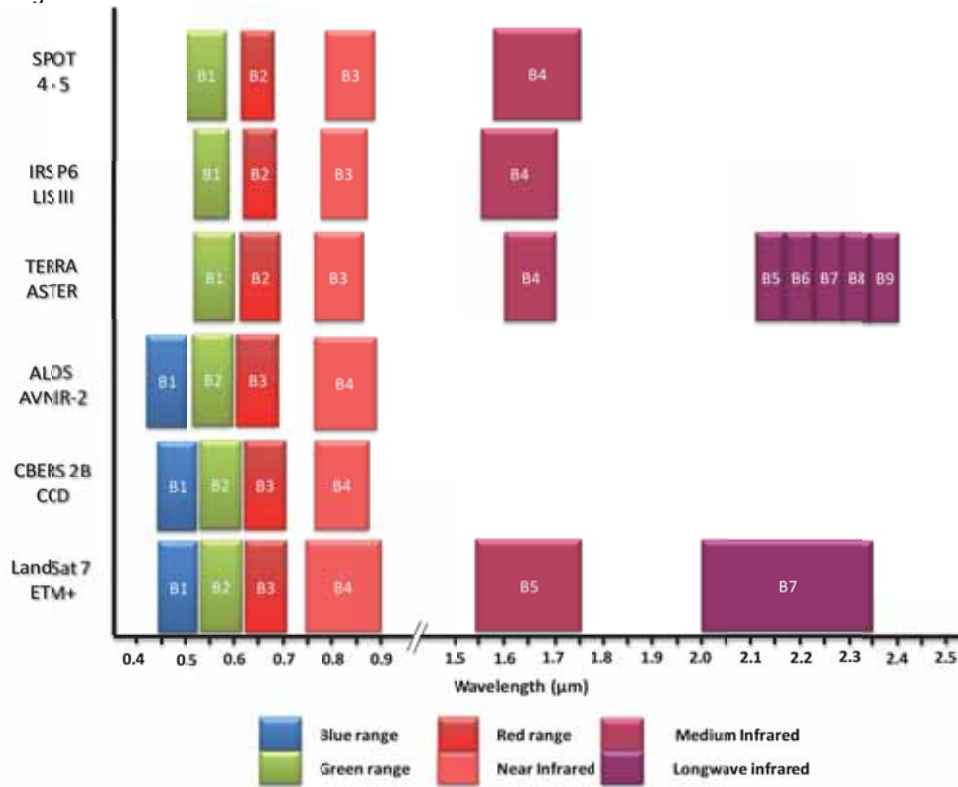
The SPOT 4 images have a spectral resolution of 4 bands: 2 bands of the visible, 1 band of close infrared and 1 in the medium infrared, with a spatial resolution of 20 meters and sweep width of 60Km.

RapidEye satellite images have a spectral resolution of 5 bands: 3 bands visible, one near-infrared and one in the red edge with a spatial resolution of 5 meters and swath width of 77km.

**Table 41. Satellite images used in the censuses from 2005 to 2012 in Colombia, percentile participation**

Sensors	% 2005	% 2006	% 2007	% 2008	% 2009	% 2010	% 2011	% 2012
LandSat 7 ETM+	92	89	89	95	69	67	88	100
LandSat 5 TM	-	-	-	-	13	11	7	-
SPOT 4 and 5	5	3	3	4	-	-	5	-
ALOS	-	-	3	1	11	22	-	-
ASTER	3	5	5	-	7	-	-	-
IRS6 – LISS III	-	3	-	-	-	-	-	-
Total	100	100	100	100	100	100	100	100

Figure 32. Spectral comparison between bands of SPOT, ASTER, IRS, LISS III, LANDSAT, ALOS and CBERS images



*Pre-processing of the images*

*Geo-referencing*

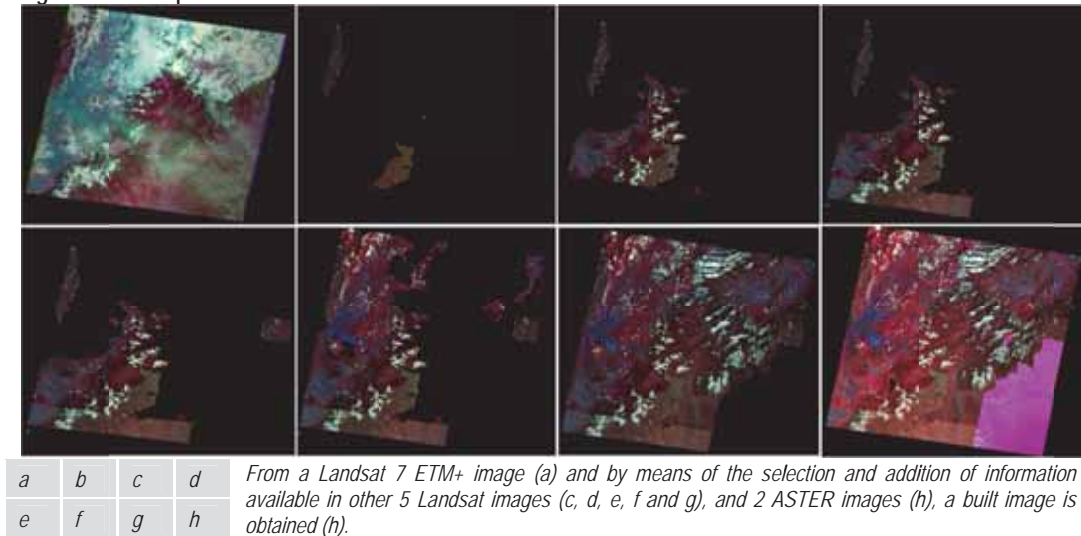
To be able to use spectral and spatial information together with other spatial data available (i.e. models of digital elevation, secondary information) the image data needs to be in the same coordinate system than maps. The satellite images were geo-referenced based on mosaics built with the adjusted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

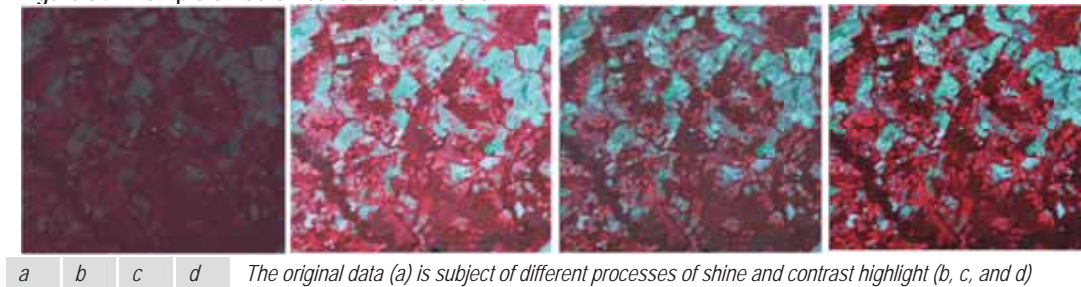
Figure 33. Example of minimization of areas with no information.



### Radiometric and spatial enhancements

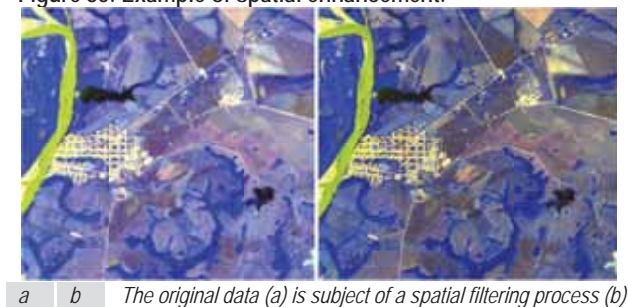
The radiometric enhancement is aimed at improving the spectral contrast of the data to facilitate and optimize the visual interpretation.

Figure 34. 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 35. Example of spatial enhancement.

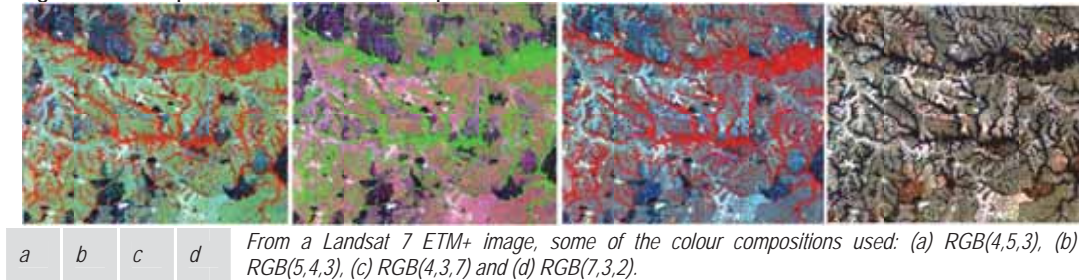


### Colour compositions

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 36. 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 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.

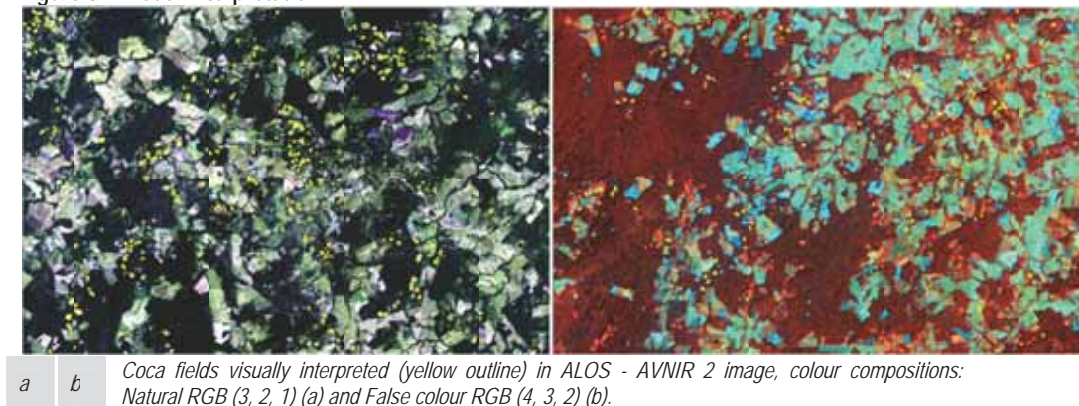
The interpretation of coca fields considers the three stages:

- 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 37. 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.

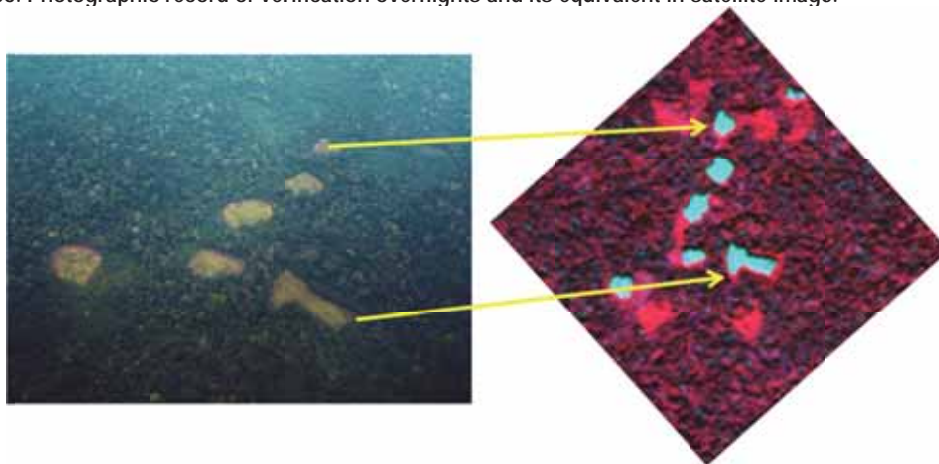
The planning of overflights is guided in four main aspects: general monitoring, verification of changes in the densities of cultivations, monitoring of open areas in the previous census and expansion zones. Verifications are done with 5-mile sweepings and an average of 3,000 feet of height.

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.

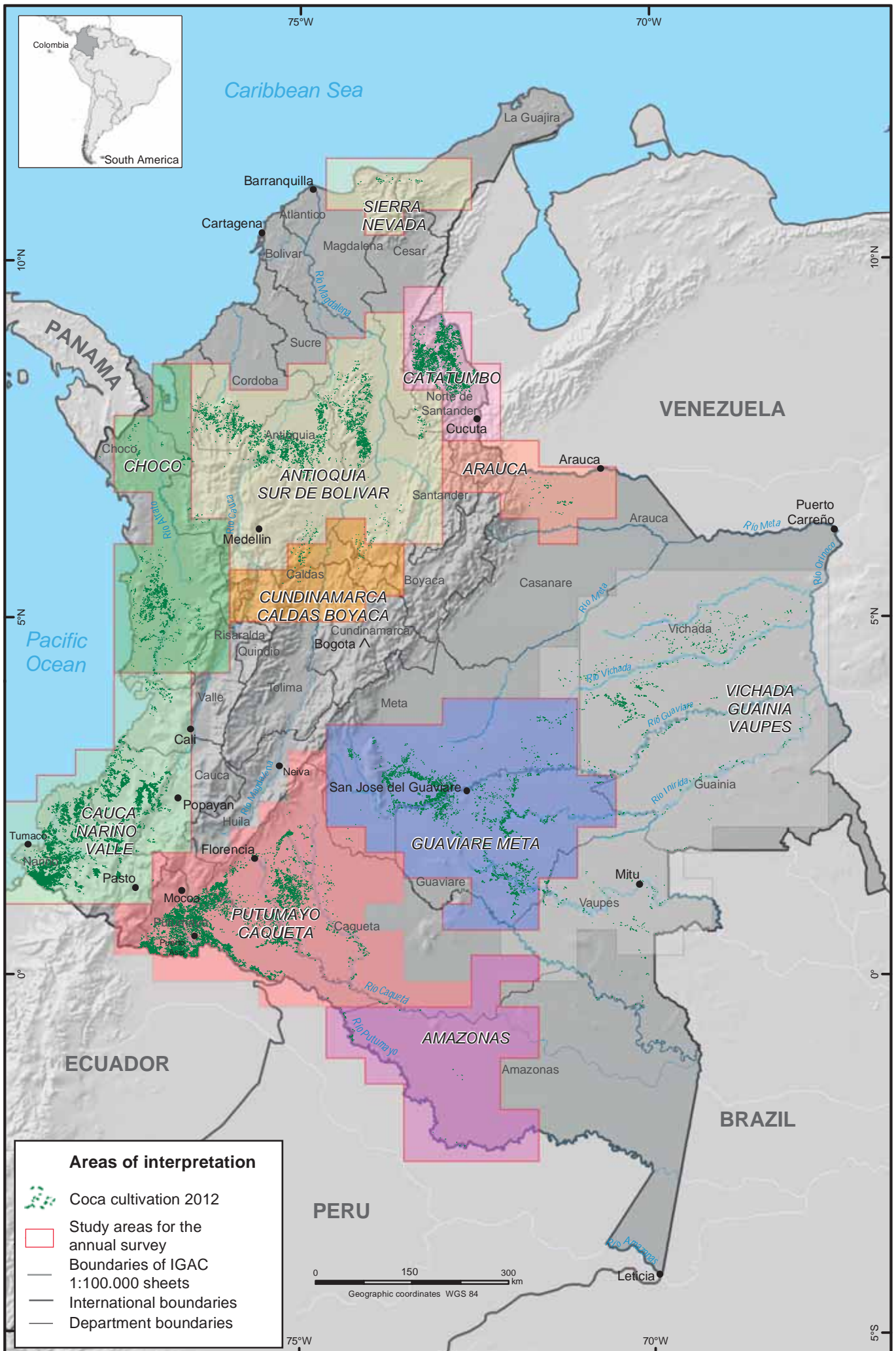
### *Edition*

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



Map 25. Study area distributed by region and coca cultivation in Colombia, 2012



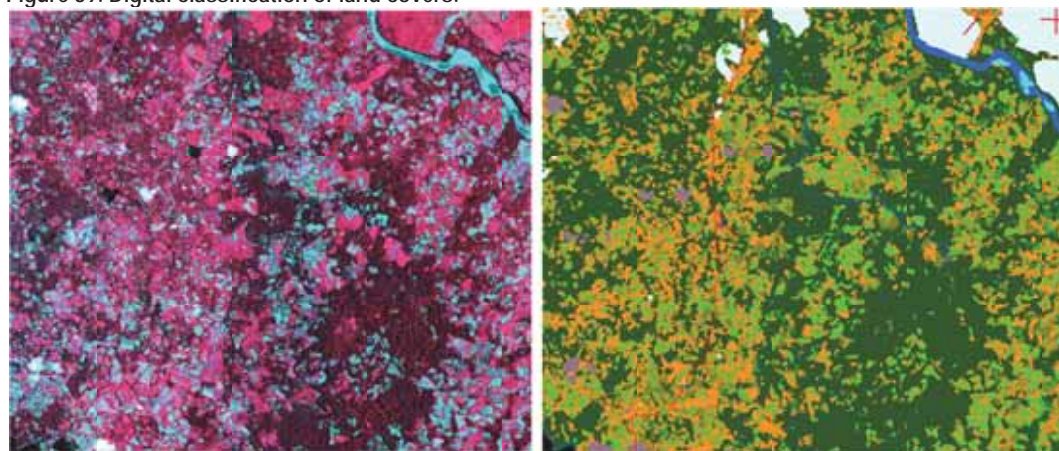
Sources: Government of Colombia, for coca cultivation National monitoring system supported by UNODC; for 1:100.000 grid IGAC. The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations

**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 39. Digital classification of land covers.



**a** **b** SPOT RGB (3, 2, and 1) image (a) and its corresponding land cover Classification (b).

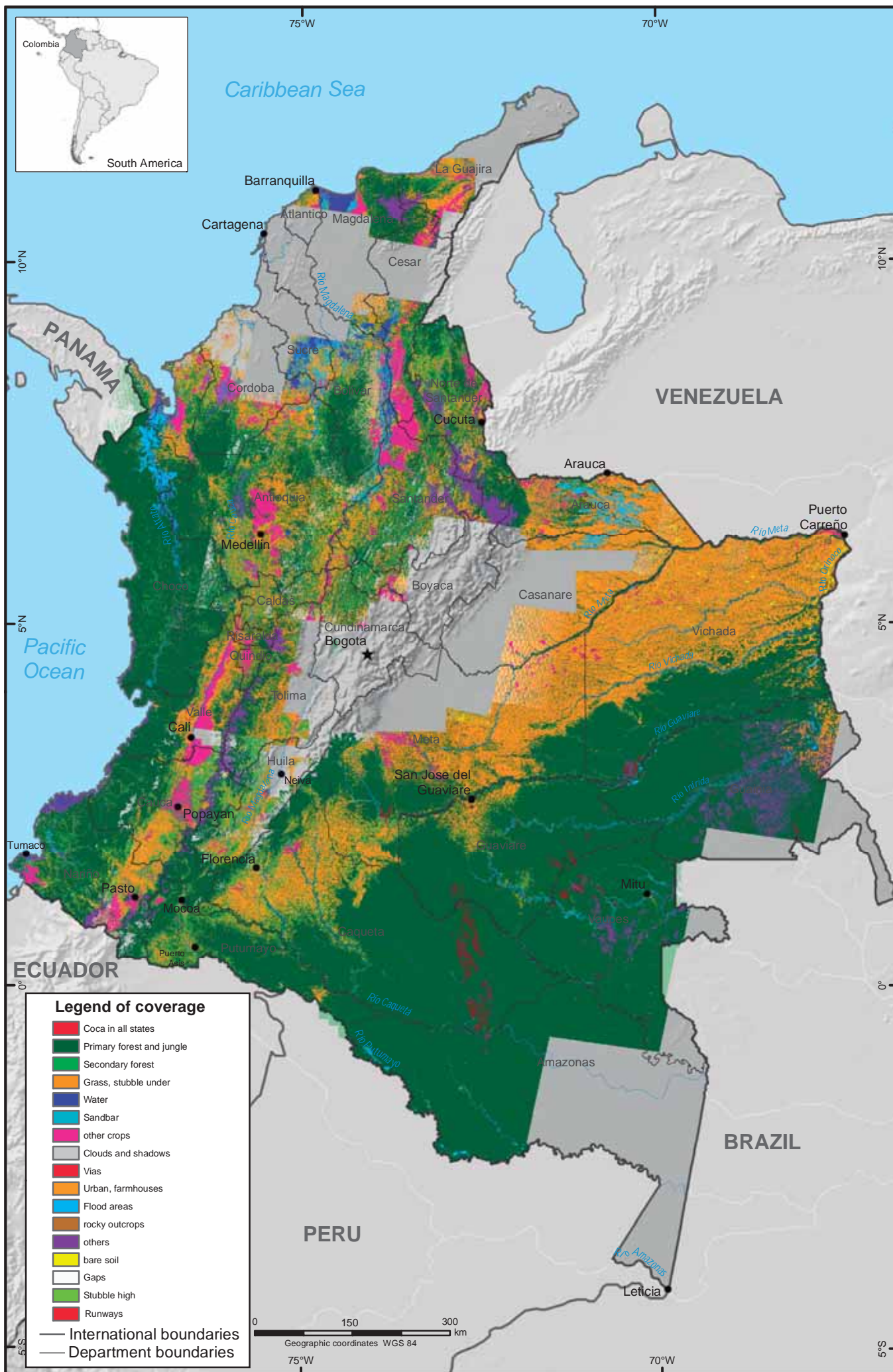
**AJUSTMENTS AND ESTIMATES**

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 activities of eradication of coca crops are started manually and recorded their coordinates, date of eradication and other features. With the above information are made corrections that depend on the date of the image and the date of eradication. When eradication was performed after the date of the image and before the cutoff date of the census, the coca fields are interpreted in the image, however, was eliminated in the process of adjustments because are been eradicated.

# Map 26. General map of coverage 2011



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

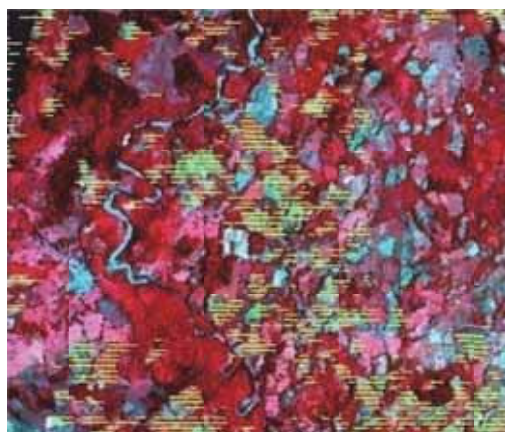
The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations



*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 2012, an effective coverage of 83% was achieved. This means that from the entire area affected by the presence of coca cultivation, 13% had restrictions due to lack

of information; this percentage is strongly concentrated in the departments of Nariño, Norte de Santander, Choco and Cordoba.

To adjust the effect which is definitely not possible to obtain coverage of cloud-free images, delimiting the areas of information in two consecutive years, then by comparison with the previous coca cultivation survey estimated trends. The result of trends in areas with information applies to the areas without information.

### *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 0.66 in 2012), 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 20km<sup>2</sup> 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 grid<sup>48</sup>.

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

Table 42. 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	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:

$$F_i = \sum_{i=0}^{n1} \sum_{j=0}^{n2} \frac{A_j}{A_i}$$

<sup>48</sup> Criterion of inclusion of grids observation units.

A<sub>j</sub>= Area of coca fields smaller than or equal to 0.25 in the region. J=1,2,3,4,5,.....,n.  
 A<sub>i</sub>= 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.

## QUALITY CONTROL

The quality control over the processes is based in the following premise: *"a good quality in these processes improves the reliability of the final data"*, provided that it enables detecting and correcting the possible errors that may occur, and hence improves the final level of reliability.

The measurement of quality of the 2012 census has three basic lines: the first one refers to the adjustments of data that are not associated to interpretation but which reduce the error associated to lack of information (clouds and gaps) and temporality; collecting images with the least amount of clouds possible and close to the cut-off date of the census are an important factor for the total coverage of the territory. For this census, the incidence of adjustment was 16% due to lack of information. The second line is based on the intensity and distribution of field work for the validation and adjustment of the thematic character of data. In 2012, this activity comprised 11 overflights missions that used 119 flight hours with a trajectory of 16.000 kilometres. The third and last line is the quality control of processes based on specific evaluations to the different activities included in this process (geo-reference and interpretation).

A correct geo-reference enables controlling distortions in the satellite images to guarantee a correct geographical position, a good aerial measurement and the comparability with the historical of censuses and other layers of information. To control the geo-referencing, three types of factors were considered: number of points, their distribution in the image and the exactitude in localisation. The evaluation of the geo-reference was done by means of the indicator Mean-Square Error (RMS).

The RMS parameters established in the project comprise RMS <3 pixels for mountainous areas and RMS< 1 pixel for flat areas. The national value for the 2012 census is 0.61 pixels in the X coordinate and 0.55 pixels in the Y coordinate. The parameter of the X coordinate oscillates between 0.4 and 0.78, and for the Y coordinate between 0.4 and 0.74. Both mountainous zones (Central, Pacific and Sierra Nevada) and flat zones meet the geo-reference parameters of the project.

Table 43. Mean-square error by region, 2012

Core	Average Points	M_Rms_X	M_Rms_Y	DesvRms_X	DesvRms_Y
Amazonia	1,33	0,56	0,74	0,22	0,35
Central	1	0,46	0,38	0,22	0,1
Meta-Guaviare	2	0,4	0,41	0,09	0,17
Orinoquía	1,89	0,71	0,74	0,15	0,22
Pacífico	1,69	0,61	0,54	0,06	0,16
Putumayo-Caquetá	2,3	0,78	0,48	0,42	0,11
Sierra-Nevada	2,33	0,72	0,57	0,13	0,07
National Average	1,79	0,61	0,55	0,18	0,17

The control over the interpretation process included three basic screeners:

1. Evaluation and validation of data among interpreters.
2. Validation of information by atypical errors.
3. Confrontation of the dynamic obtained with the historical tendency with the information of the activities that generate the dynamic in the region and with the findings of the field verification.

## EVALUATION OF THE PRECISION

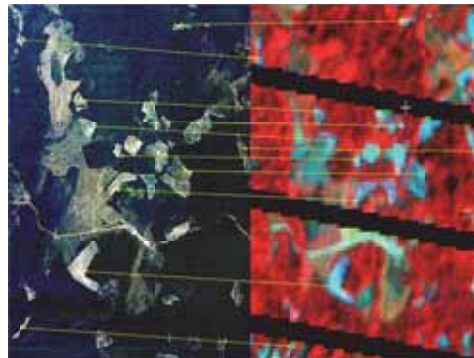
The data is submitted to a quality control system that includes the estimation of precision in two aspects: the geometrical precision, which is the precision of the limits interpreted and the thematic precision that measures the reliability in the identification of type of land covers. The difficulty 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).*

For the 2012 census, a study case in the Department of Caquetá in the area called Union Peneya with an area of 100 km<sup>2</sup>. For this exercise was acquired as basic input for the construction of the truth of field (Ground truth) a Pleiades image with dated January 16, 2013, free of clouds, with 2 meters of spatial resolution and 4 bands of spectral resolution, three bands visible and infrared.



*Fields detected by overflights in high resolution Pleiades image on the left, in yellow. On the right, Landsat Image with fields interpreted for the census in red.*

The process to obtain the thematic reliability lever for this census went through three stages:

1. Field truth: it was achieved using a high resolution spatial image and overflights of the zone to identify the different coverage present in the area under study.



The terrible climatic conditions in the zone during two consecutive months marked a significant time difference of 3 months between the field verification and the high resolution image, and of 2.5 months with respect to the image of the 2012 cultivation census. This, added to the strong dynamic that characterises the region, made it difficult to build the field truth.

The detection overflights covered 35% of the area of interest; this information was used as training area (seeds) for the construction of the field truth. A supervised classification was conducted to differentiate, in a wide range, the zones with coca from the zones with other coverage. This result was classified again, masking the areas with coca and applying the same training areas; in this way, we obtained a more detailed classification. Finally, the result was filtered by size and shape; throughout the process control was kept on the fields detected directly in field and their coincidence with the data collected.

2. Confrontation of the data collected by the interpreters, the expert in the area and the remaining three interpreters, in the area under study, using the worked image for the census (medium resolution) and the usual method of interpretation for coca cultivation survey.

3. Evaluation and analysis.

For the evaluation of reliability we used the interpretation of the image used for the 2012 census (Landsat 7 etm+) in the zone. The dates of the images and overflights were:

- Image 2012 Census February 7, 2013
- Pleiades Image January 26, 2013
- Field detection by overflights April 24, 2013

The results show that:

The field recognition improves considerably the interpretation and the experience of the interpreter of the region and their knowledge of the dynamics has a positive effect on the level of reliability of the interpretation.

The reliability obtained in the exercise in *La Unión Peneya* applies only for the zone under study and it is not applicable to the census due to representation limitations.

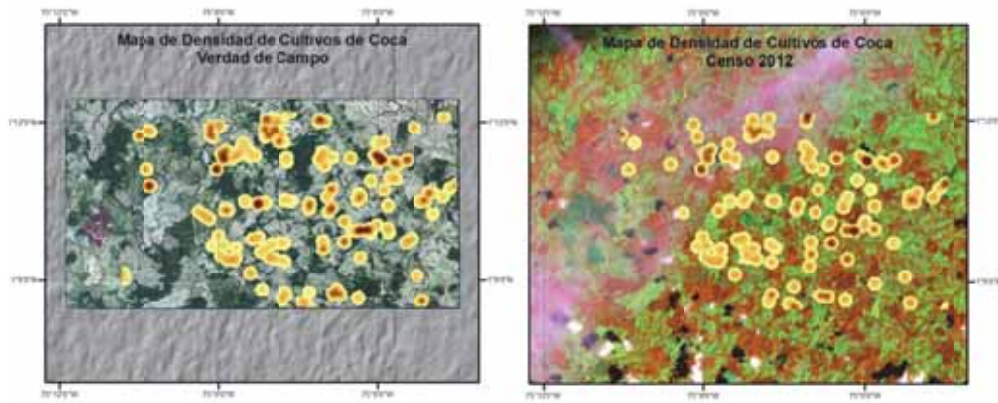
The difficulty in collecting and confronting with the field truth makes it strictly necessary to have temporary consistency of no more than 15 days between the field verification and the images.

The area measurements in the census show, that omission and commission errors tend to offset and the balance sheet is an approximation of 95% the actual area.

According to the field truth, there are 153 ha under coca cultivation in the area under study. The zone interpreter reported 145 ha (95%); the omission error prevails for the four performers, and is associated with problems in defining the boundary of the coca fields.

Between 79% and 89% of the interpretation coincides with the field truth; three out of the four interpreters are close to the upper limit. There is more thematic reliability in great fields, which has the highest weight in the area. The maps of density of the area under coca cultivation show that both the detection by overflights and the interpretation reported for the census are highly consistent in the focuses and distribution of coca fields.

Figure 40. Maps of density of the interpretation in Pléides and Landsat images



The data shows the need of deepening in the identification of possible biases, mainly towards omission and the identification of small fields. It is necessary to focus efforts in the process of adaptation of the interpretation methodology to the new challenges set forth by the dynamic of coca cultivation in Colombian territory. UNODC is still conducting detailed studies of geometric and thematic precision to offer the best information possible, meeting the quality standards, necessary to guarantee a proper analysis of the tendencies of drug production.

## 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 areas<sup>49</sup>. 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

<sup>49</sup> The Area Master Framework is a construction of 1 km x 1 km areas, with a unique and unrepeatable for the entire national territory.

### *Coca Cultivation Survey 2012*

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.

Until 2012, two phases of these studies were completed throughout the national territory; the third phase started and will be completed in 2014. A total of 3,330 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.

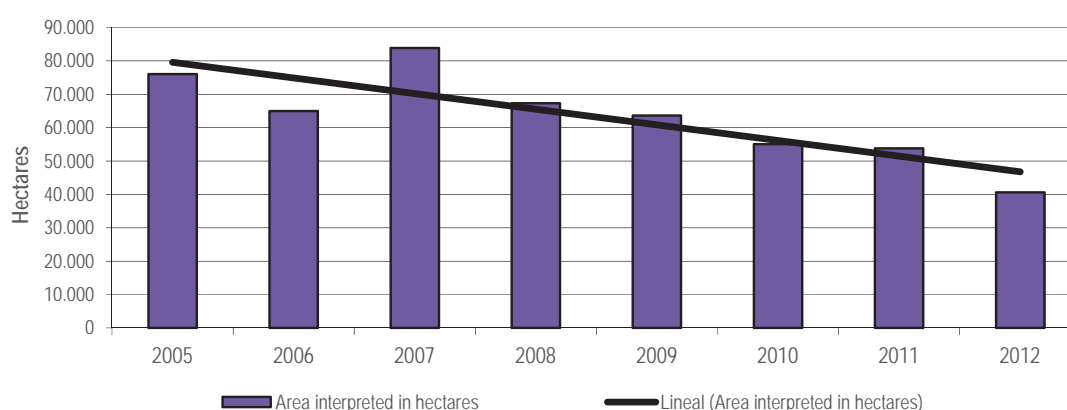
The methodological process includes interviews to coca leaf growers and crop tests based on the guidelines of the United Nations Manual. UNODC/SIMCI and the Government of Colombia began the studies to assess the contents of alkaloid in the coca leaf and the efficiency of laboratories, considering that 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 2012**

The census in 2012 is affected by a particularly strong winter that originated high cloudiness throughout the country; as a consequence, the effort of interpretation was tripled to achieve a national coverage of 85%. The departments with less satellite coverage are Chocó, Caldas and Valle del Cauca, due to which the data in these zones must be analysed with precaution. The relation of change between 2010 and 2011 in zones with information in the two years is 0.65 that adjusts to the relation including corrections of 0.75.

The figure shows the area under coca cultivation interpreted in the satellite images and their trends without the estimations applied to calculate the national figure.

**Figure 41. Interpretation of coca cultivation without adjustments, 2005 -2012**



The weight of the estimations applied in the different censuses throughout the historical series varies between 11% in 2005, to 17% in 2004, 2006 and 2008. In 2012, the weight of the corrections is 15%; 54% of these corrections are concentrated in the departments of Nariño (38%) and Norte de Santander (16%), where the conditions of cloudiness were adverse.

**Table 44. Historical series of Adjustments, 2005-2011**

Year	2005	2006	2007	2008	2009	2010	2011	2012
Area estimation without information	6,362	8,418	8,357	9,962	6,177	5,492	8,843	5,328
Correction of age of the image	1,020	1,135	-917	391	371	-119	936	1,834
Acorrection of aerial spraying	2,315	3,349	7,625	3,266	2,843	1,378	159	30
Total	9,697	12,902	15,065	13,619	9,391	6,752	9,938	7,192
Percentage/Census	11	17	15	17	14	11	15	15
Area interpreted in hectares	76,053	64,968	83,888	67,334	63,634	55,061	53,826	40,597
Area reported in hectares	86,000	78,000	99,000	81,000	73,000	62,000	64,000	48,000

Table 45. Estimation by zones without information, aerial spraying and date when the image was taken in 2012

Department	Interpretation ha	Corrections			Census 2012 ha
		Aerial spraying ha	Areas without information ha	Temporality ha	
Amazonas	93	0	1	4	98
Antioquia	2,487	-1	-64	303	2,725
Arauca	80	0	-5	6	81
Bolivar	1,704	0	273	-9	1,968
Boyaca	8	0	2	0	10
Caldas	21	0	-6	0	16
Caqueta	3,509	0	154	32	3,695
Cauca	3,873	0	320	133	4,325
Cesar	10	0	0	2	13
Choco	3,209	8	-16	229	3,429
Cordoba	862	0	153	31	1,046
Guainía	266	0	34	1	301
Guaviare	3,434	23	319	75	3,851
La Guajira	9	0	0	0	10
Magdalena	35	0	0	2	37
Meta	2,510	0	222	-33	2,699
Nariño	8,701	0	1,151	882	10,733
Norte de Santander	3,634	0	725	157	4,516
Putumayo	6,150	0	40	-42	6,148
Santander	118	0	-7	0	111
Valle del Cauca	353	0	75	54	482
Vaupés	222	0	24	8	254
Vichada	1,181	0	63	-1	1,242
<b>Total</b>	<b>42,468</b>	<b>30</b>	<b>3,458</b>	<b>1,834</b>	<b>47,790</b>

## Appendix 2: List of satellite images used in the 2012 coca census

LANDSAT 7 ETM+		
PATH	ROW	Acquisition date day (dd/mm/yyyy)
3	59	09/04/2013
4	56	23/11/2012 - 09/12/2012 - 10/01/2013
4	57	22/10/2012 -09/12/2012 - 10/01/2013
4	58	20/09/2012 -22/10/2012 -09/12/2012- 15/03/2013
4	59	26/01/2013 - 15/03/2013
4	60	22/10/2012
4	61	20/09/2012 - 22/10/2012 - 26/01/2013
4	62	20/09/2012
5	56	16/12/2013 -01/01/2013 - 17/01/2013
5	57	29/10/2012 -16/12/2013 -01/01/2013 - 17/01/2013
5	58	29/10/2012 -16/12/2013 -01/01/2013- 02/02/2013
5	59	29/10/2012 -16/12/2013 -18/02/2013- 07/04/2013
5	60	29/10/2012 -16/12/2013
5	61	29/10/2012 - 07/04/2013
5	62	29/10/2012 - 30/11/2012
6	55	04/10/2012 -21/11/2012 - 08/01/2013 - 25/02/2013
6	56	04/10/2012 -21/11/2012 -- 25/02/2013
6	57	08/01/2013 - 24/01/2013 - 13/03/2013
6	58	18/09/2012 - 08/01/2013 - 24/01/2013 - 13/03/2013
6	59	18/09/2012 - 25/02/2013
6	60	18/09/2012 - 25/02/2013
6	61	14/06/2012 -18/09/2012
6	62	14/06/2012 -02/09/2012
7	54	09/09/2012 - 16/02/2013
7	55	28/11/2012 - 30/12/2012
7	56	28/11/2012 - 30/12/2012
7	57	27/10/2012 - 30/12/2012 - 15/01/2013
7	58	09/09/2012 -27/10/2012 - 30/12/2012 - 15/01/2013
7	59	09/09/2012 -27/10/2012 - 30/12/2012 - 15/01/2013
7	60	09/09/2012 -27/10/2012
7	61	09/09/2012 -27/10/2012
8	52	16/09/2012 - 05/12/2012
8	53	05/12/2012 - 06/01/2013
8	54	16/09/2012 - 05/12/2012 - 06/01/2013
8	55	06/01/2013
8	56	16/09/2012 - 21/12/2012 - 06/01/2013
8	57	11/03/2013 - 27/03/2013
8	58	19/11/2012 - 07/02/2013 - 11/03/2013
8	59	16/09/2012 - 02/10/2012 - 03/11/2012 - 07/02/2013
8	60	03/11/2012 -06/01/2013 - 07/02/2013
9	52	10/11/2012 -13/01/2013
9	53	28/12/2012 - 13/01/2013 - 29/01/2013 - 14/02/2013
9	54	07/09/2012 - 25/10/2012 - 28/12/2012 - 13/01/2013
9	55	07/09/2012 - 25/10/2012 - 28/12/2012 - 14/02/2013
9	56	25/10/2012
9	57	21/07/2012
9	58	07/09/2012 - 29/01/2013
9	59	07/09/2012 - 10/11/2012 - 13/01/2013 - 29/01/2013
9	60	07/09/2012 - 10/11/2012 - 13/01/2013 - 14/02/2013
10	54	17/11/2012 - 03/12/2012 - 21/02/2013
10	55	23/04/2012 - 12/07/2012 - 01/11/2012 - 17/11/2012
10	56	23/04/2012 - 25/05/2012 - 01/11/2012
10	57	23/04/2012 - 26/06/2012 - 14/09/2012 - 01/11/2012
10	58	01/11/2012 - 25/03/2013 - 10/04/2013
10	59	14/09/2012 - 01/11/2012 - 17/11/2012 -21/02/2013 -25/03/2013
<b>TOTAL</b>		<b>153</b>

## Appendix 3: Coca cultivation in Indigenous Territories 2012

Region	Indigenous territories	Hectares in 2011	Hectares in 2012
Amazon	ALMIDÓN LA CEIBA	6,2	8,2
	ARARA, BACATÍ, CARURU Y MIRAFLORES	39,4	83,1
	ARRECIFAL	0,0	4,8
	BACHACO BUENAVISTA	7,5	7,5
	CARANACOA YURI-LAGUNA MOROCOTO	15,9	3,5
	CARPINTERO PALOMAS	0,3	10,6
	CHIGUIRO	1,8	12,0
	CUENCA MEDIA Y ALTA DEL RÍO INIRIDA	118,5	108,8
	CUMARAL-GUAMUCO	0,0	5,2
	EL VENADO	0,0	0,8
	LAGUNA NIÑAL, COCUY, LOMA BAJA Y LOMA ALTA DEL CAÑO GUARIBEN	23,6	4,6
	LAGUNA-CURVINA SAPUARA	1,6	0,0
	MINITAS-MIRALINDO	1,4	6,1
	MURCIÉLAGO ALTAMIRA	0,4	10,4
	NUNUYA DE VILLAZUL	0,7	0,0
	PARTE ALTA DEL RÍO GUAINÍA	5,2	5,0
	PREDIO PUTUMAYO	113,3	90,2
	PUEBLO NUEVO-LAGUNA COLORADA	23,5	13,8
	PUERTO ZÁBALO Y LOS MONOS	0,4	0,2
	REMANSO - CHORRO BOCON	15,6	19,0
RÍOS CUIARI E ISANA	2,6	18,0	
TONINA, SEJAL, SAN JOSÉ Y OTRAS	0,0	4,8	
VAUPÉS	207,5	148,8	
YAIGUJÉ-RÍO APAPORIS	6,4	9,1	
Central	ALTO SINU, ESMERALDA CRUZ GRANDE E IWAGADO	200,5	142,3
	ANDABÚ	0,0	2,1
	CHONTADURAL CAÑERO	0,0	2,7
	GABARRA-CATALAURA	9,2	13,8
	JAIDEZAVÍ	0,0	6,2
	JAI-DUKAMA	0,0	1,3
	JAIKERAZAVI	0,0	4,4
	MAJORÉ-AMBURÁ	15,3	0,0
	MOTILÓN - BARÍ	59,7	42,7
	MURRI-PANTANOS	3,1	0,0
	PABLO MUERA	0,5	6,8
	POLINES	0,0	1,1
	QUEBRADA CAÑAVERAL	0,0	0,7
	RÍO CHAJERADÓ	3,3	0,0
	TAGUAL-LA PO	0,7	0,0
	UNIDO UWA	0,7	0,0
	YABERARADÓ	2,6	5,7
Meta Guaviare	ALTO UNUMA	41,5	42,1
	ARARA, BACATÍ, CARURU Y MIRAFLORES	7,8	10,0
	BARRANCO CEIBA y LAGUNA ARAGUATO	40,7	16,4
	BARRANCO COLORADO	14,1	9,2
	BARRANCÓN	1,4	3,2
	BARRANQUILLITA	10,0	13,8
	CAÑO JABÓN	3,2	2,5
	CAÑO OVEJAS (BETANIA COROCITO)	3,4	0,0
	CENTRO DE MIRAFLORES	0,0	2,2
	CHARCO CAIMÁN	3,3	4,6
	COROCORO	6,4	6,9
	EL REFUGIO	0,5	0,6
	EL TIGRE	18,0	27,0

Region	Indigenous territories	Hectares in 2011	Hectares in 2012
	LA ASUNCIÓN	2,5	4,1
	LA FUGA	5,0	17,8
	LA SAL	2,4	0,0
	LA YUQUERA	57,6	58,3
	LAGOS DEL DORADO, LAGOS DEL PASO Y EL REMANSO	160,0	179,1
	MACUARE	19,1	7,0
	MORICHAL VIEJO, SANTA ROSA, CERRO CUCUY, SANTA CRUZ, CAÑO DANTA- OTROS	146,0	127,5
	NUKAK - MAKU	216,8	217,3
	PUERTO NARE	14,1	22,7
	PUERTO VIEJO Y PUERTO ESPERANZA	3,2	9,6
	SIKUANI DE DOMO PLANAS	7,1	7,3
	TUCÁN DE CAÑO GIRIZA Y PUERTO LA PALMA	15,9	23,3
	VUELTA DEL ALIVIO	23,5	16,8
YAVILLA II	10,9	64,9	
Orinoco	ALTO UNUMA	229,9	106,1
	CALI-BARRANQUILLA	10,6	4,4
	CARPINTERO PALOMAS	5,1	2,5
	CHOCON	3,9	0,0
	CIBARIZA	5,5	0,0
	CONCORDIA	2,3	0,0
	COROCORO	1,9	0,0
	FLORES SOMBRERO	4,3	3,3
	GUACAMAYAS MAMIYARE	4,3	3,3
	GUACO BAJO Y GUACO ALTO	10,1	17,5
	KAWÁNERUBA	0,0	1,1
	LA LLANURA	3,8	4,6
	LA PASCUA	1,1	1,1
	LAGUNA TRANQUILA	0,6	0,0
	LOS IGUANITOS	2,8	0,0
	MEREY, LA VERAITA	0,8	0,0
	PUNTA BANDERA	0,0	1,5
	RÍO SIARE	1,5	4,5
	RÍOS MUCO Y GUARROJO	8,8	3,8
	RÍOS TOMO Y WEBERI	0,2	6,4
	SAN JOSÉ DE LIPA O CAÑO COLORADO	0,0	1,0
	SAN LUIS DEL TOMO	1,7	0,0
	SANTA TERESITA DEL TUPARRO	89,5	62,4
SARACURE-CADÁ	118,2	68,1	
SELVA DE MATAVÉN	70,8	93,2	
SIKUANI DE IWIVI	0,0	2,2	
VALDIVIA	3,6	0,0	
Pacific	AGUACLARA Y BELLA LUZ DEL RÍO AMPORÁ	9,2	11,5
	ALMORZADERO, SAN ISIDRO Y LA NUEVA UNIÓN	11,8	7,9
	ALTO BONITO VIRA VIRA	4,3	8,2
	ALTO DEL RÍO MUNGUIDÓ	3,3	6,0
	BAJO GRANDE	3,2	10,2
	BELLAVISTA-UNIÓN PITALITO	8,2	19,7
	CALLE SANTA ROSA RÍO SAJA	157,7	84,2
	CAÑÓN DEL RÍO SANQUININI	7,3	2,6
	CHAGPIEN	1,2	6,5
	CHAGUI CHIMBUZA VEGAS Y OTROS	7,6	14,7
	CHIDIMA TOLO	1,2	0,0
	CHINGUIRITO MIRA	60,7	98,1
	CHONARA HUENA	2,0	0,4
	CHONTADURAL CAÑERO	0,0	1,2
	CUAIQUER INTEGRADO LA MILAGROSA	13,2	25,3
CUAMBI-YASLAMI	4,1	0,5	



Coca Cultivation Survey 2012

Region	Indigenous territories	Hectares in 2011	Hectares in 2012
	CUASBIL-LA FALDADA	7,1	5,7
	CUASCUABI-PALDUBI	2,8	1,4
	CUAYQUER DEL ALTO ALBI	224,9	228,3
	CUCHILLA-PALMAR	6,1	7,1
	DEARADE BIAKIRUDE	3,1	2,7
	DOMINICO, LONDOÑO Y APARTADÓ	4,5	13,6
	EL CEDRO, LAS PEÑAS, LA BRAVA, PILVÍ Y LA PINTADA	117,7	64,0
	EL GRAN SABALO	230,9	543,8
	EL SANDE	240,1	98,5
	GEGORÁ, QUIPARÁ, MURANDÓ, TIRAVENADO Y JIGUADÓ	8,0	
	GRAN ROSARIO	376,3	229,1
	GUADUAL, CUMBAS, MAGÜI, INVINA Y ARRAYÁN	0,8	0,0
	GUALCALA	16,3	11,5
	GUAYACAN-SANTA ROSA	0,9	0,0
	GUELNAMBI-CARAÑO	9,8	13,7
	HONDA RÍO GUIZA	18,5	4,2
	INDA ZABALETA	210,5	148,3
	INFI	49,4	13,0
	INTEGRADO EL CHARCO	39,6	50,7
	ISLA DEL MONO	8,0	0,7
	JURADÓ	6,7	6,7
	LA FLORESTA - LA ESPAÑOLA	3,6	5,7
	LA FLORESTA, SANTA ROSA Y SAN FRANCISCO	108,9	156,9
	LA IGUANA	11,2	13,5
	LA TURBIA	273,7	598,9
	LA UNIÓN CHOCO - SAN CRISTOBAL	1,7	13,2
	MAIZ BLANCO	0,8	
	NUNALBÍ ALTO ULBÍ	14,7	7,1
	NUSSI PURRU	2,1	2,1
	PAINA	0,6	0,7
	PATIO BONITO	3,0	2,4
	PERANCHITO	0,0	1,5
	PERANCHO	0,0	1,5
	PIALAPI-PUEBLO VIEJO-SAN MIGUEL-YARE	0,0	0,6
	PICHICORA, CHICUE, PUERTO ALEGRE	1,8	1,7
	PIEDRA SELLADA-QUEBRADA TRONQUERIA	14,3	14,6
	PIGUAMBI PALANGALA	3,7	2,4
	PIPALTA-PALBI-YAGUAPI	20,5	9,1
	PLANADAS TELEMBÍ	96,0	18,5
	PLAYA BENDITA	13,0	2,3
	PLAYITA SAN FRANCISCO	2,8	1,8
	PUADÓ, LA LERMA, MATARÉ, Y TERDO	3,9	19,1
	PUERTO ALEGRE Y LA DIVISA	25,9	14,5
	PUERTO LIBIA TRIPICAY	0,5	6,6
	PULGANDE CAMPOALEGRE	26,5	3,4
	QUEBRADA GRANDE	0,7	2,1
	QUEBRADA QUERA	4,7	18,4
	RAMOS-MONGON-MANCHURIA	4,5	0,0
	RÍO GARRAPATAS	16,2	6,4
	RÍO GUANGÜI	84,1	23,7
	RÍO NAYA	5,4	1,1
	RÍO NUQUÍ	0,0	3,0
	RÍO PAVASA Y QUEBRADA JELLA	6,4	12,1
	RÍO PURRICHÁ	47,3	50,6
	RÍO SATINGA	25,5	20,1
	RÍO TAPARAL	0,3	
	RÍOS CATRU-DUBASA Y ANCOSO	91,7	139,0

Region	Indigenous territories	Hectares in 2011	Hectares in 2012
	RÍOS JURUBIDA-CHORI Y ALTO BAUDÓ	17,2	27,7
	RÍOS PATO Y JENGADÓ	0,9	1,1
	RÍOS TORREIDÓ Y CHIMANI	56,0	37,4
	RÍOS UVA Y POGUE-QUEBRADA TAPARAL	1,6	0,0
	SALAQUI Y PAVARANDÓ	0,5	
	SAN ANTONIO DEL FRAGUA	0,7	1,8
	SAN MIGUEL	1,9	4,8
	SANANDOCITO	9,8	8,8
	SANQUIANGUITA	0,3	3,0
	SANTA CECILIA DE LA QUEBRADA ORO CHOCÓ	4,7	9,8
	SANTA MARÍA DE PANGALA	2,0	25,6
	SANTA ROSA SUCUMBIOS EL DIVISO	12,8	6,4
	SAUNDE GUIGUAY	199,1	55,9
	SIRENA BERRECUY	1,7	3,7
	TOGOROMA	0,0	0,1
	TOKOLLORO	0,0	1,9
	TORTUGAÑA, TELEMBI, PUNDE, PITADERO, BRAVO, TRONQUERIA Y ZABALETA	106,6	38,1
	TRONQUERIA, PULGANDE-PALICITO	38,4	4,0
	URADÁ JIGUAMIANDÓ	0,0	8,3
	WASIPANGA	4,4	2,3
YU YIC KWE	3,6	0,0	
Putumayo Caqueta	AGUA NEGRA	9,8	7,9
	AGUANEGRA	44,5	36,9
	AGUAS NEGRAS	0,6	1,1
	ALBANIA	0,7	0,0
	ALTO LORENZO	10,8	11,1
	ALTO ORITO	3,2	3,5
	BELLA VISTA	12,2	6,9
	BUENAVISTA	45,8	27,9
	CAICEDONIA	18,3	12,7
	CALARCA	63,9	23,8
	CALENTURAS	5,0	3,4
	CAMPO ALEGRE DEL AFILADOR	6,1	8,3
	CAÑAVERAL	38,7	15,3
	CECILIA COCHA	3,5	0,0
	CHALUAYACO	0,6	2,1
	CONSARA-MECAYA	10,4	10,8
	COROPOYA	4,8	3,3
	DAMASCO VIDES	26,4	24,0
	EL CEDRITO	1,5	0,7
	EL DESCANSO	0,8	0,0
	EL ESPINGO	28,1	21,6
	EL GUAYABAL	2,0	2,4
	EL HACHA	26,0	32,2
	EL PORTAL	0,7	0,6
	EL PORVENIR - LA BARRIALOSA	7,0	3,7
	EL QUINCE	3,2	0,0
	EL TABLERO	4,5	0,0
	EL TRIUNFO	2,4	1,0
	GETUCHÁ	0,8	0,0
	HERICHA	9,2	0,9
	HONDURAS	0,2	1,0
	JACOME	0,0	1,1
JERICÓ-CONSAYA	19,3	11,8	
JERUSALÉN-SAN LUIS ALTO PICUDITO	38,7	36,5	
JIRIJIRI	1,9	0,0	
LA AGUADITA	8,3	13,2	

Coca Cultivation Survey 2012

Region	Indigenous territories	Hectares in 2011	Hectares in 2012
	LA CRISTALINA	1,7	0,0
	LA ESPERANZA	2,9	0,0
	LA ITALIA	5,3	6,3
	LA PAYA	2,6	3,7
	LA SIBERIA	3,6	3,3
	LA TEÓFILA	0,0	1,1
	LOS GUADUALES	3,5	1,8
	NINERAS	10,9	9,3
	PLAYA LARGA	13,9	13,3
	PREDIO PUTUMAYO	12,5	15,1
	PUERTO NARANJO, PEÑAS ROJAS, CUERAZO Y EL DIAMANTE	6,3	2,2
	PUERTO ZÁBALO Y LOS MONOS	5,3	8,6
	SAN ANDRES - LAS VEGAS - VILLA UNION	29,8	20,5
	SAN ANTONIO DEL FRAGUA	1,4	2,6
	SAN LUIS	9,9	5,4
	SAN MIGUEL	2,8	2,4
	SAN MIGUEL DE LA CASTELLANA	3,2	2,3
	SANTA CRUZ DE PIÑUÑA BLANCO	1,2	1,0
	SANTA ROSA DE JUANAMBÚ, CAMPO ALEGRE, ALPES ORIENTALES Y LA FLORESTA	15,0	12,2
	SANTA ROSA DEL GUAMUÉZ	9,0	1,0
	SELVA VERDE	3,9	5,0
	SIMORNA	4,9	2,2
	VEGAS DE SANTANA	0,7	0,0
	VILLA CATALINA-DE PUERTO ROSARIO	60,6	49,2
	WASIPANGA	1,9	0,0
	YARINAL (SAN MARCELINO)	17,8	3,9
	YURAYACO	0,9	1,8
<b>Sierra Nevada</b>	ARHUACO DE LA SIERRA NEVADA	7,5	4,1
	KOGUI-MALAYO ARHUACO	21,6	11,5

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