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Office on Drugs and Crime



Government of Bolivia

BOLIVIA

Coca Cultivation Survey



June 2005

Abbreviations

CONALTID	Bolivian National Council for Fighting against Drugs
DIRECO	Bolivian National Direction of Agricultural Re-conversion
GIS	Geographical Information Systems
GPS	Global Positioning System
GCP	Ground Control Point
ICMP	UNODC Illicit Crop Monitoring Programme
UNODC	United Nations Office on Drugs and Crime
DIGECO	Bolivian National Direction of Coca Leaf Control
FELCN	Special Force against Drug Trafficking

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This report and other ICMP survey reports can be downloaded from:

www.unodc.org/unodc/en/crop_monitoring.html

PREFACE

Although coca cultivation levels in Bolivia continue to be far from the historical peaks reached in the 90's, the increasing trend of the last few years is worrying. Between 2003 and 2004 coca cultivation increased by 17%, raising the extent of cultivation to 27,700ha -- the highest since 1998. Today, 17% of land under coca cultivation worldwide is found in Bolivia.

Effective action is needed to stop the progressive return of the coca-cocaine industry in Bolivia. This necessity becomes even more urgent as the value of the illegal market increases. In 2004 it grew to US\$240 million, representing 3% of GDP and, significantly, more than 17% of the value of the agricultural sector. Taken in the context of the current social, economic and political challenges faced by Bolivia – this is a disturbing trend.

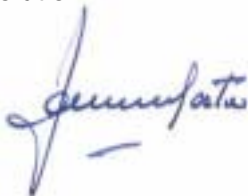
Since prices of the raw material (coca leaves) and derivatives (coca base and cocaine hydrochloride) remain much higher in Bolivia than in neighbouring Peru, there has been an incentive for smuggling of Peruvian coca leaves into Bolivia. Bolivian authorities seized 27 metric tons of Peruvian coca leaves, out of a total of 155 tons (26%).

Another cause for concern is the expansion of coca cultivation into the primary forest, causing irreversible damage within national parks. Between 2003 and 2004, coca cultivation increased by 71% in the National Parks of Chapare, as opposed to increasing only 22% outside National Park boundaries. In fact, coca cultivation within two parks represented 40% of the Chapare's total coca cultivation.

The commitment of the Bolivian Government to the reduction of illicit coca cultivation needs to be strengthened and to be supported internationally. As in other Andean coca producing countries, the issue of illicit coca cultivation in Bolivia is inseparable from domestic political issues. In 2004, as the Government continued its eradication activities, opposition increased and the lobbies established in the context of the Cocalero movement became the basis for wider social and political platforms.

What has been true for Bolivia throughout the past years will be particularly pertinent in the immediate future: namely, drug control policies must be accompanied by credible sustainable legal economic options for ex-coca growers, as well as for impoverished indigenous peasants and miners. Bolivia can point to numerous alternative livelihoods schemes that have reduced the dependence of rural economies on coca cultivation. The most successful programmes combine income generation with the development of social services and infrastructure – including education, health care, and sanitation. Access to these schemes needs to be widened -- sustainable livelihoods programmes in Bolivia still do not reach enough coca growers and far too many people remain dependent on coca.

The United Nations Office on Drugs and Crime calls on donors and international financial institutions to help Bolivia deliver sustainable development opportunities in illicit crop areas. There is ample experience and evidence that these programmes can be developed in Bolivia – and that they are successful. While international support is important to scale up these activities, the engagement of local communities in the development of legal economies and secure societies will be the key to achieving a sustainable solution.



Antonio Maria Costa
Executive Director
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FACT SHEET – BOLIVIA COCA SURVEY FOR 2004

	2003	Variation on 2003	2004
Coca cultivation	23,600 ha	+ 17 %	27,700 ha
<i>Of which in the Yungas of La Paz</i>	16,200 ha	+ 7 %	17,300 ha
<i>in Chapare</i>	7,300 ha	+ 38 %	10,100 ha
<i>in Apolo</i>	50 ha	n.a. ¹	300 ha
<i>Of which permitted by Bolivian law 1008</i>	12,000 ha		12,000 ha
<i>non-permitted by Bolivian law 1008</i>	11,600 ha	+ 35 %	15,700 ha
<i>Of which in national parks</i>	2,400 ha	+ 71%	4,100 ha
Average annual sun-dried coca leaf yield			
in Chapare	2,764 kg/ha		2,764 kg/ha
in the Yungas outside traditional coca growing areas	1,798 kg/ha		1,798 kg/ha
In the Yungas and Apolo, traditional coca growing areas	936 kg/ha		936 kg/ha
Production of coca leaf	39,000 mt*		49,000 mt
Maximum potential production of cocaine	79 mt*	+ 35%	107 mt
in percent of global cocaine production	12 %		16%
National weighted average farm-gate price of coca leaf (outside state market)	n.a.		5.0 US\$/kg
Chapare average farm-gate price of coca leaf	5.4 US\$/kg	- 4%	5.2 US\$/kg
Total farm-gate value of coca leaf production	US\$ 210 millions*	+12 %	US\$ 240 millions
GDP	US\$ 7.8 billions	+ 3.8%	US\$ 8.1 ² billions
Farm-gate value of coca leaf production in percent of GDP	2.7 %		3.0 %
Value of agricultural sector	US\$ 1.4 billions	n.a.	n.a.
Farm-gate value of coca leaf production in percent of value of 2003 agricultural sector	15%		17 %
Reported seizure of cocaine paste	6,934 kg	+ 18%	8,189 kg
Reported seizure of cocaine hydrochloride	5,969 kg	- 91%	531 kg

¹ Survey areas not comparable

² GDP of 2004 estimated from the 2003 GDP, and with a projected growth of 3.8% (source: INE)

* based on the same coca leaf yield and cocaine conversion rate as in 2004

Executive Summary

Under the rubric of its Illicit Crop Monitoring Programme, UNODC assists the Bolivian Government in the implementation of a national coca monitoring system. This joint Bolivian Government-UNODC report, the second since 2003, provides an estimate of coca cultivation at the national level for the year 2004. It also presents information on coca yield, prices and other issues related to coca cultivation in Bolivia.

This year's Survey revealed that **27,700 ha** were under of coca bush cultivation in Bolivia in 2004, **an increase of 17%** compared to last year's estimate of 23,600 ha. It continued the five-year trend of increasing in coca cultivation. Coca cultivation in Bolivia accounted for 17% of global coca cultivation in 2004, far below the levels estimated in the early- to mid-nineties when Bolivia accounted for about a quarter of the global total. In 2004, coca cultivation in Bolivia remained below cultivation in Colombia and Peru.

The increase in coca cultivation in Bolivia between 2003 and 2004 was due mainly to a 38% increase in cultivation in the Chapare region (from 7,300 ha to 10,100 ha). In the Yungas of La Paz, coca cultivation increased by 7% between 2003 and 2004, reaching 17,300 ha. The Yungas of La Paz accounted for 62% of the total cultivation in 2004.

The total estimate of 27,700 ha also includes the 2,000 ha, permitted by the Bolivian Law No 1008 ("Law on the Regime Applicable to Coca and Controlled Substances", 1988) for traditional uses such as leaf chewing, medicinal preparations and coca tea. The total also included an additional 3,200 ha of coca cultivation temporarily authorized in October 2004 by the Bolivian Government in the Chapare region.

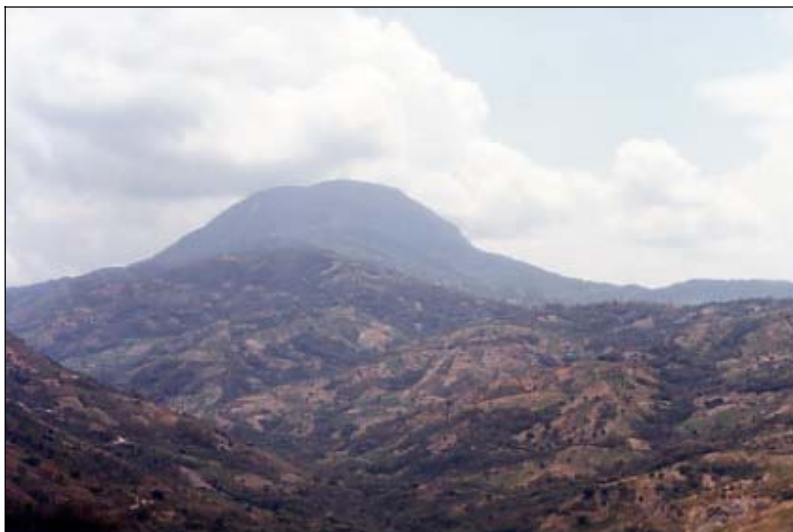
In Chapare, a total of 4,100 ha of coca cultivation was found in two National Parks, this represents 40% of the coca cultivation of Chapare region. Between 2003 and 2004, **coca cultivation in the areas of the National Parks increased by 71%**, from 2,400 ha to 4,100 ha.

The overall area under coca cultivation produced an estimated 49,000 metric tons of leaf, of which 38,000 metric tons were estimated to be available for cocaine production. Applying conversion ratio for Chapare of 370 kg of coca leaf for one kg of cocaine and for Yungas of 315 kg of coca leaf for one kg of cocaine, the potential **cocaine** production in Bolivia amounted to **107 metric tons** in 2004. This corresponded to **an increase of 38%** compared to the 2003 estimate of 79 metric tons³. The significant increase in cocaine production reflected the large increase in coca cultivation in the Chapare region (+38%) where coca leaf yield was more than twice higher than elsewhere in the country (2,700 kg/ha compared to 1,200 kg/ha).

Farm-gate prices of dry coca leaf remained largely stable throughout 2004, at about US\$ 5.0/kg. Prices of coca leaf and its derivatives, coca base and cocaine hydrochloride, remained much higher than in neighbouring Peru (US\$ 2.8/kg for coca leaves), creating an incentive for smuggling of Peruvian coca leaves into Bolivia. Bolivian authorities seized 27 metric tons of Peruvian coca leaves, out of a total of 155 metric tons. The total **seizures of coca leaves in 2004 increased by 132%** compared to 2003.

Farm-gate value of coca leaf production in Bolivia reached **US\$240 million** in 2004. This estimation took into account the total value of the market controlled by DIGECO, as well as the farm-gate value of coca leaf outside this market. Total value was equivalent to 3.0% of the country's GDP for 2004 (US\$ 8.1 billion) or 17% of the value of the agricultural sector in 2003 (US\$ 1.4 billion.)

³ Based on the same coca leaf yield and conversion rate as for 2004



*Landscape with coca cultivation near Uchumachi Mountain,
the Yungas of La Paz.*



Villa Tunari, the main population centre in Chapare



*The town of Arapata, surrounded by coca fields in North Yungas,
Municipality of Coripata*

1 INTRODUCTION

The objectives of UNODC's Illicit Crop Monitoring Programme (ICMP) are to establish methodologies for the collection and analysis of data on illicit crops and to improve Governments' capacity to monitor illicit crops in the context of the strategy adopted by Member States at the General Assembly Special Session on Drugs in June 1998. ICMP is currently active in seven countries: Colombia, Peru, Bolivia, Afghanistan, Myanmar, Laos and Morocco.

The Bolivian Government and UNODC launched the project "Land use management and monitoring system in the Yungas of La Paz" in October 2001. Initially, the project focused only on the Yungas of La Paz, but since 2003 it has extended its scope to include the provision of estimates on coca cultivation at the national level. This report presents the project's findings and methodology for 2004.

The project was implemented in cooperation with the National Direction of Agricultural Re-conversion (DIRECO), Vice-Ministry of Alternative Development (VDA), and the Ministry of Agriculture. DIRECO provided logistical support during the implementation of ground activities, including the collection of a large number of ground control points, mainly in the Chapare area.

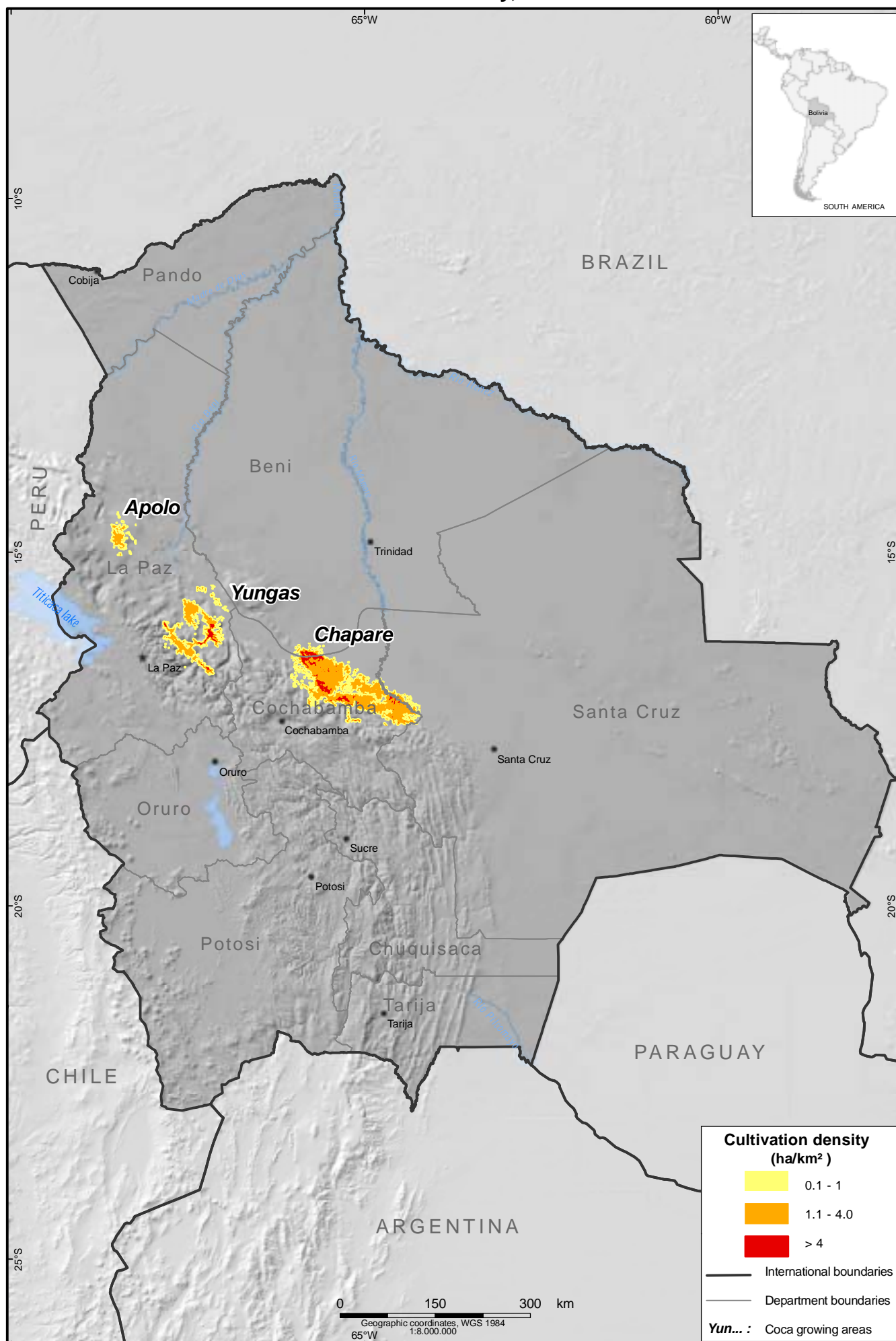
DIRECO is the primary end-user of the results generated by the project. The Bolivian National Government, through the National Council of Fight against Illicit Trafficking of Drugs (CONALTID) is also relying on the information provided by this project for planning and implementing the Comprehensive Bolivian Strategy for the Fight against Illicit Drug Trafficking 2004 – 2008.

Coca cultivation decreased significantly in Bolivia at the end of the 1990s, following a reduction of coca cultivation in the Chapare region. Bolivia is now the third largest coca producer worldwide, far behind Colombia and Peru. Coca cultivation is concentrated in the departments of La Paz (in the areas of the Yungas of La Paz and Apolo) and in the Chapare area (department of Cochabamba).

Bolivian Law 1008 ("Law on the Regime Applicable to Coca and Controlled Substances", 1988) permits up to 12,000 ha of traditional coca cultivation for traditional consumption and other legal uses. Most of this area is located in the Yungas of La Paz. In October 2004, the Bolivia Government also temporarily authorized the cultivation of 3,200 ha of coca in the Chapare region. Law No 1008 does not provide a precise definition of the geographic limits of the traditional coca growing areas, but the Bolivian Government is preparing a study which is intended to lead to legal delineations of the areas where coca for traditional use will be cultivated.

The National Government is also planning to develop a study to determine the licit national demand for coca leaf.

Coca cultivation density, Bolivia 2004



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

2 FINDINGS

2.1 COCA CULTIVATION

In 2004, the total area under coca cultivation in Bolivia was estimated to be 27,700 ha, an increase of 17 over to last year's estimate of 23,600 ha.

Figure 1. Coca cultivation in Bolivia, 1991 – 2004 (ha)

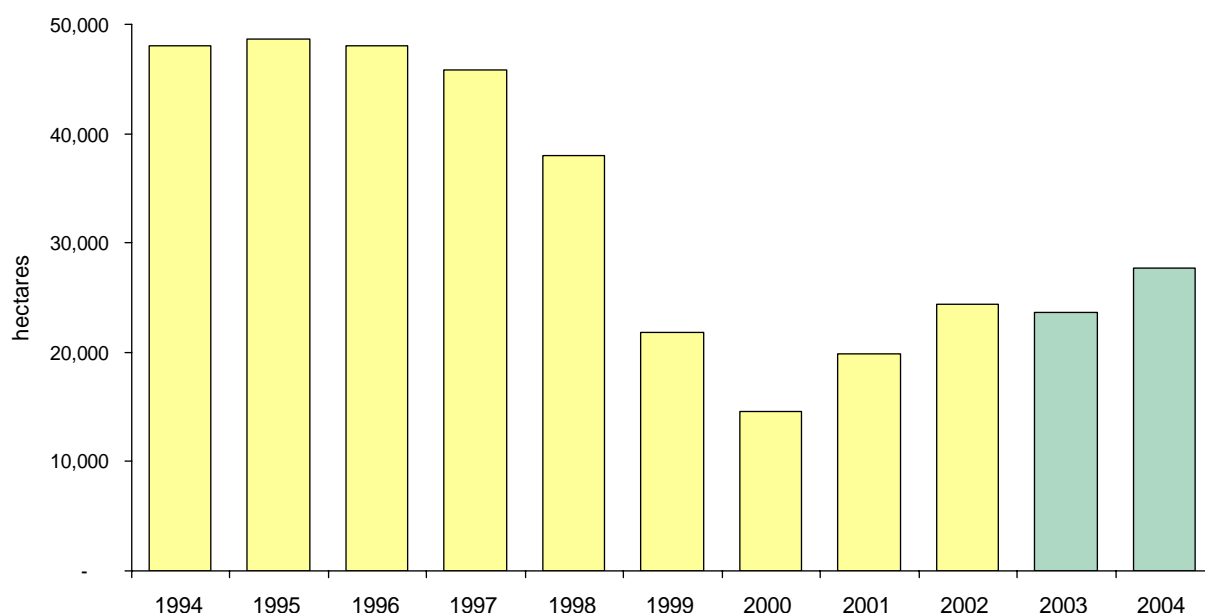


Table 1. Coca cultivation in Bolivia, 1999 – 2004 (ha)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Rounded total	48,100	48,600	48,100	45,800	38,000	21,800	14,600	19,900	24,400	23,600	27,700

Sources United States Department of State

 National Monitoring System Supported by UNODC

Since 2000, coca leaf prices have remained high, at about US\$ 5/kg compared to US\$1-US\$2/kg in the nineties. These high prices were one of the planting incentives offsetting government efforts to decrease coca cultivation through eradication and alternative development initiatives.

Coca cultivation in Bolivia represented 17% of the global coca cultivation in 2004, compared to 15% in 2003. Bolivia remained the third coca cultivator, behind Colombia and Peru.

Figure 2. Coca cultivation in the Andean region, 1994 – 2004 (ha)

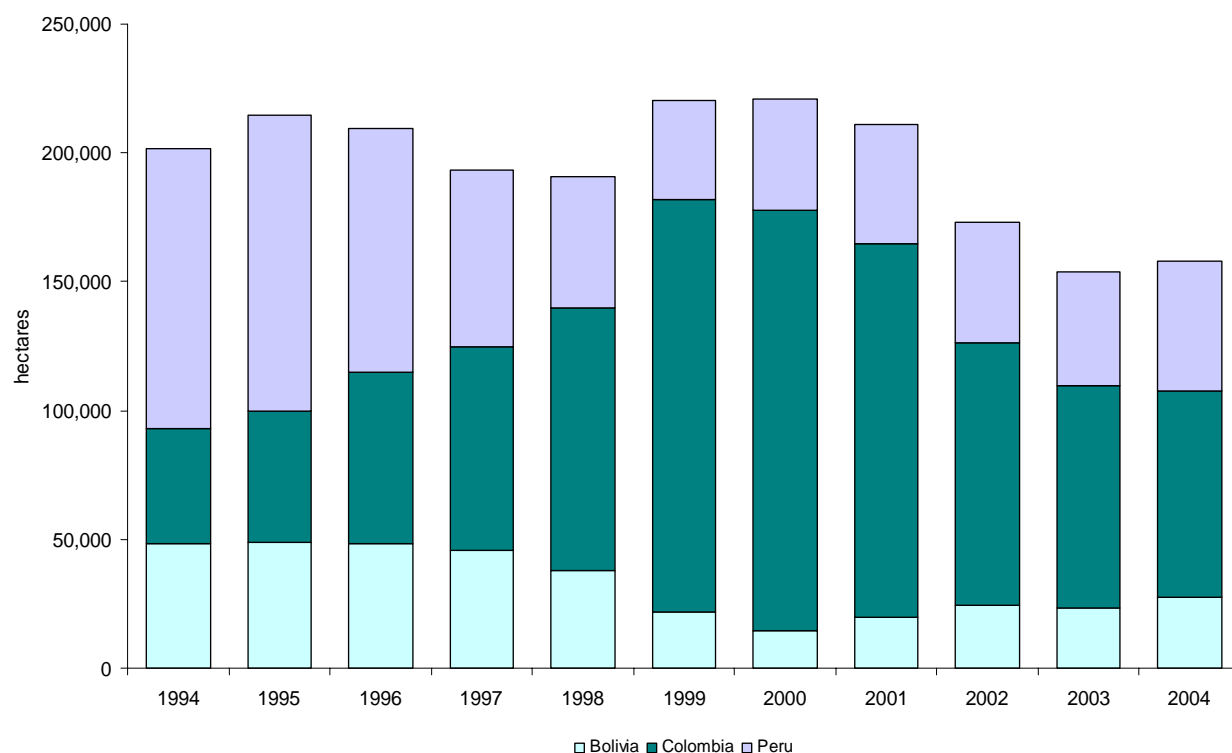


Table 2. Coca cultivation in the Andean region, 1994- 2004 (ha)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	% change 2003-2004
Bolivia	48,100	48,600	48,100	45,800	38,000	21,800	14,600	19,900	24,400	23,600	27,700	17%
Peru	108,600	115,300	94,400	68,800	51,000	38,700	43,400	46,200	46,700	44,200	50,300	14%
Colombia	45,000	51,000	67,000	79,000	102,000	160,000	163,000	145,000	102,000	86,000	80,000	-7%
Total	201,700	214,900	209,500	193,600	191,000	220,500	221,000	211,100	173,100	153,800	158,000	3%

Sources

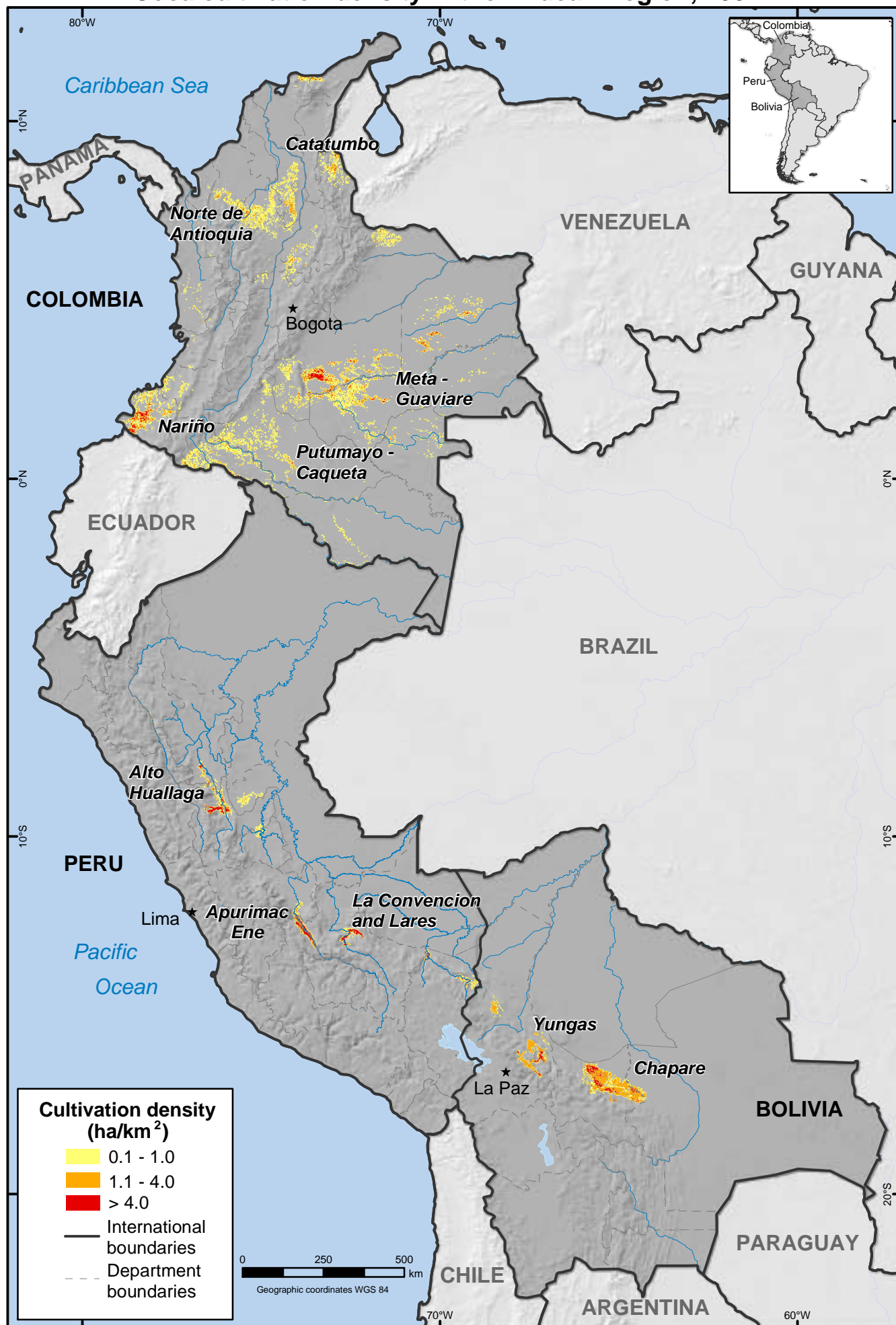


United States Department of States



National Monitoring Systems Supported by UNODC

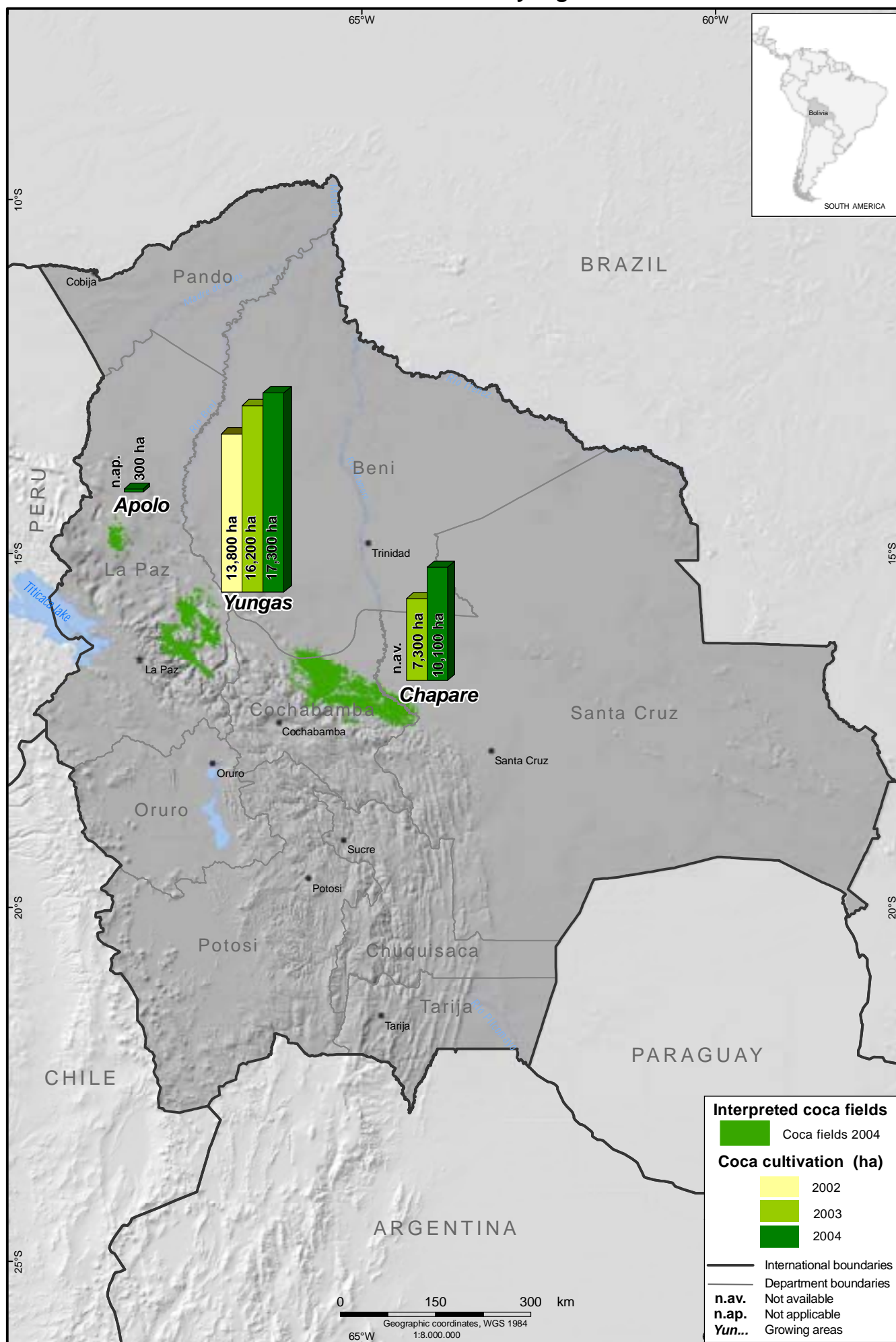
Coca cultivation density in the Andean Region, 2004



Sources: Governments of Bolivia, Colombia y Peru, National monitoring systems supported by UNODC

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

Coca cultivation 2002 - 2004 by region in Bolivia



Source: Government of Bolivia - National monitoring system supported by UNODC
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2.1.1 REGIONAL ANALYSIS

The increase in coca cultivation at the national level was mostly due to an increase in coca cultivation in the Chapare region from 7,300 ha to 10,100 ha, or 38%, between 2003 and 2004. The increase of 2,800 ha in Chapare represented 67% of the total increase of 4,150 ha. Coca cultivation in the Yungas increased by 7% between 2003 and 2004 to reach 17,300 ha, remaining the most important region for coca cultivation in Bolivia, accounting for 62% of the total cultivation in 2004.

Table 3. *Coca cultivation estimates by region, 1999 – 2004 (ha)*

Region	2002	2003	2004	% change 2003-2004	% of 2004 total
Yungas of La Paz	13,800	16,200	17,300	7%	62%
Chapare	n.a.	7,300	10,100	38%	36%
Apolo	n.a.	50	300	n.a.	1%
Country total		23,550	27,700	18%	

In Apolo, the survey areas of 2003 and 2004 were not similar and therefore the results for coca cultivation in 2003 and 2004 were not comparable and no trend can be calculated for this region.

Figure 3. *Coca cultivation estimates by region, 1999 – 2004 (ha)*

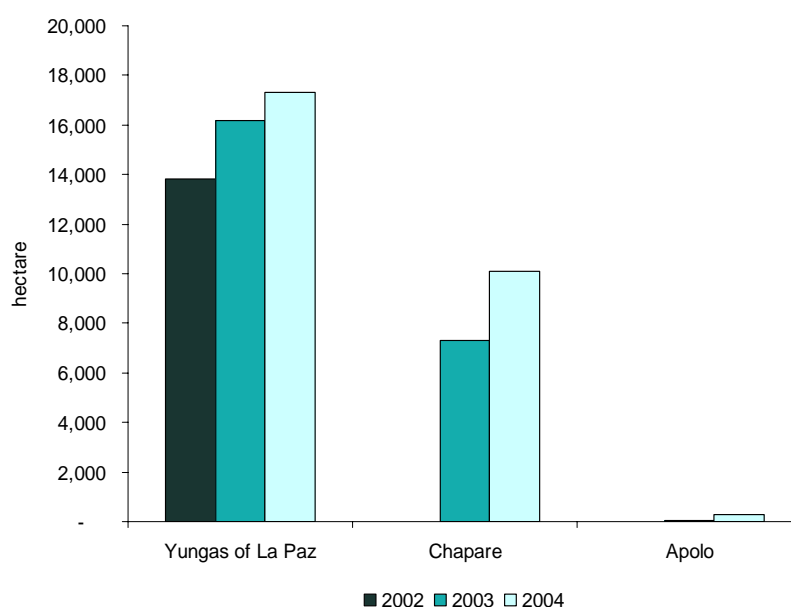
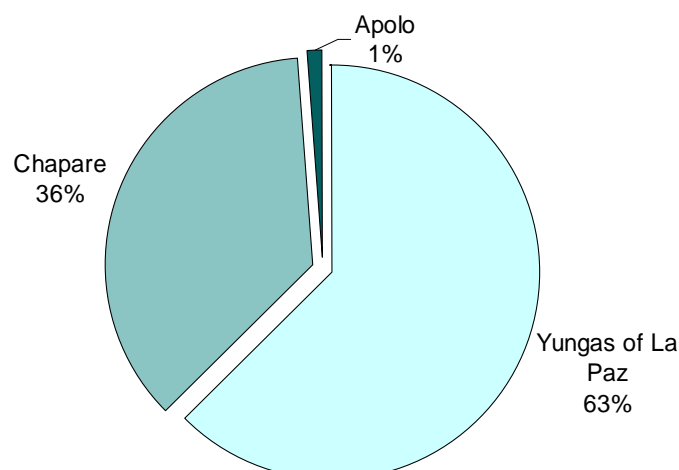
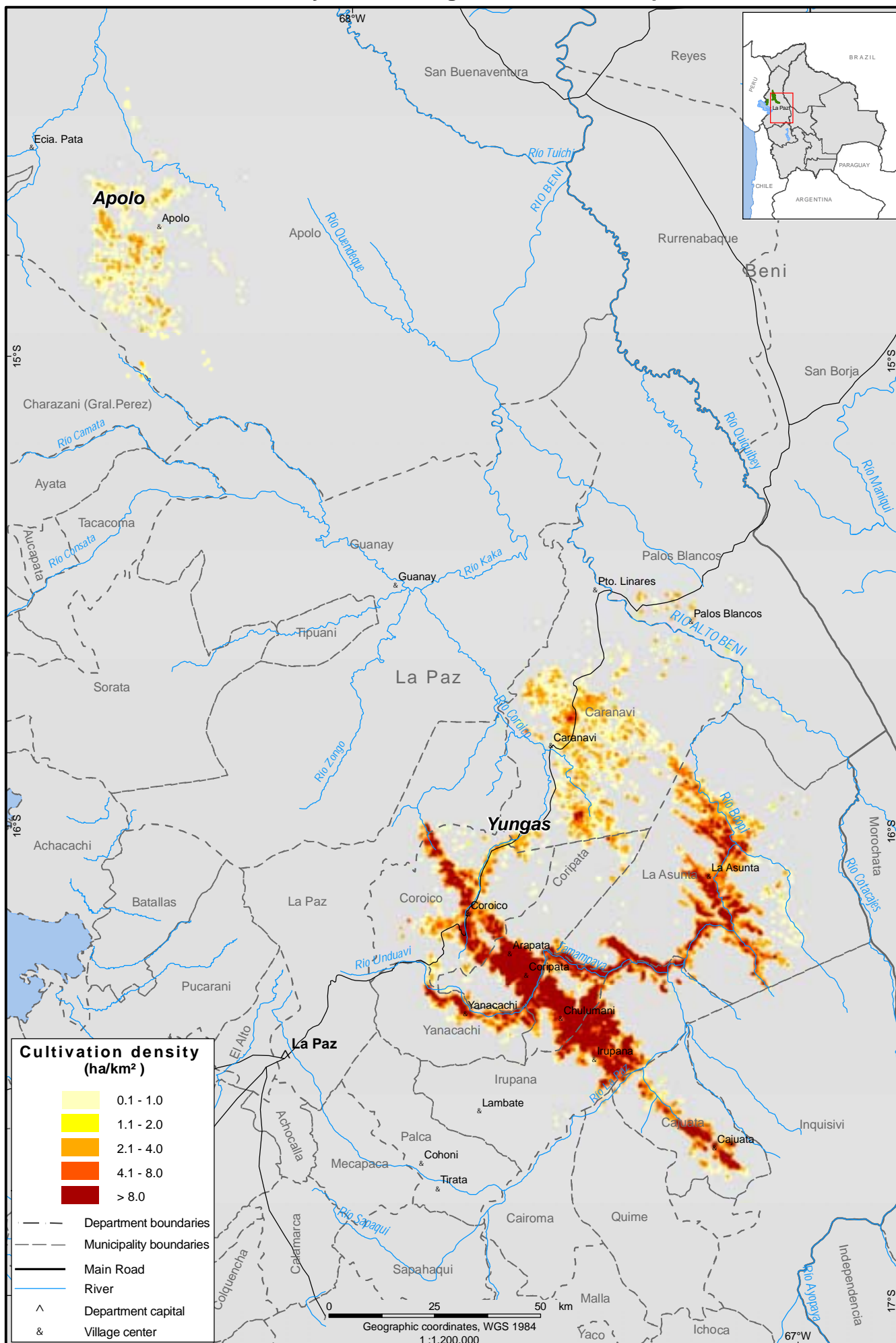


Figure 4. *Distribution of coca cultivation in Bolivia by region, 2004*



Coca cultivation density for the Yungas of La Paz and Apolo, Bolivia 2004



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

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2.1.2 Coca cultivation in the Yungas of La Paz

The Yungas of La Paz, situated at about 150 km from the city of La Paz, is a region of uneven relief with steep slopes, turbulent rivers and elevations ranging from 300 to 4,000 meters above sea level. Significant climatic variations are observed even over short distances. Coca bush is predominantly cultivated on narrow terraces built on high gradient hills.

Coca cultivation in the surroundings of La Asunta

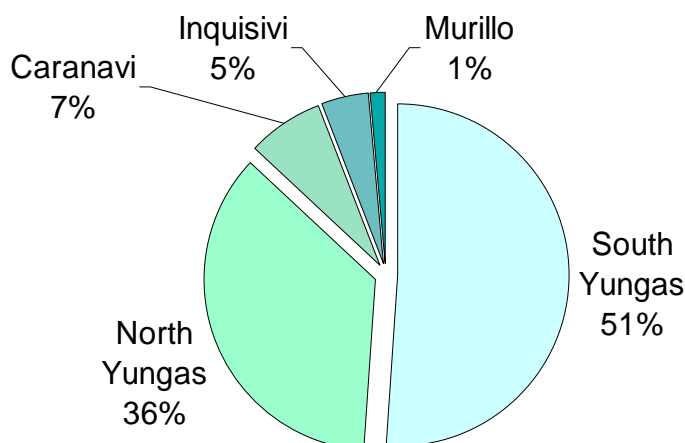


The survey revealed 17,300 ha of coca cultivation in the Yungas of La Paz in 2004, representing an increase of 7% compared with the 16,200 ha found in 2003. Most of the cultivation continued to take place in the provinces of South Yungas and North Yungas, accounting respectively for 51% and 36% of the regional total. The largest annual increase (40%) was observed in Caranavi province, but this province only accounted for 7% of the regional total in 2004.

Table 4. Distribution of coca cultivation in the Yungas of La Paz, 2002-2004 (ha)

Province	2002	2003	2004	% change 2003-2004	% of 2004 total
South Yungas	7,182	8,356	8,867	6%	51%
North Yungas	5,187	5,914	6,166	4%	36%
Caranavi	491	889	1,248	40%	7%
Inquisivi	741	801	805	0%	5%
Murillo	151	210	217	3%	1%
Rounded total	13,800	16,200	17,300	7%	100%

Figure 5. Distribution of coca cultivation in the Yungas of La Paz, 2002-2004 (ha)

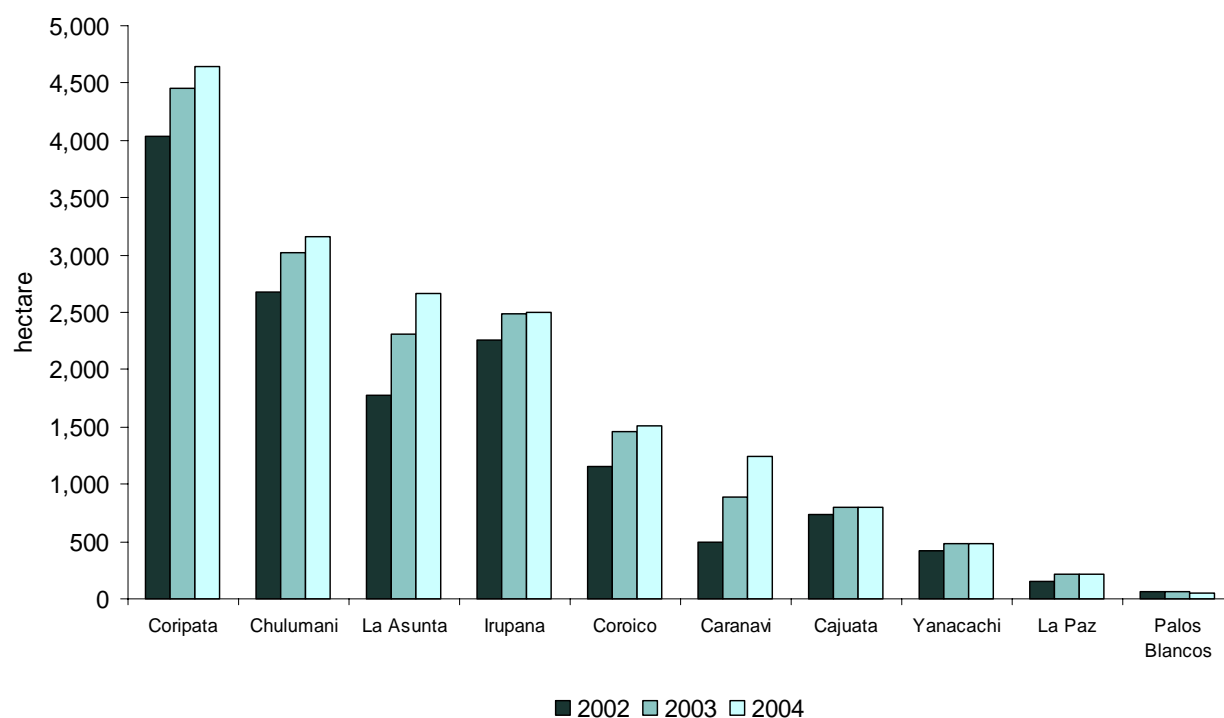


For the second year in a row, the municipality of Caranavi - the only municipality of the province of Caranavi - and the municipality of La Asunta in South Yungas province registered the largest annual rate of increase in coca cultivation with respectively 40% and 15%. However, the municipality of Coripata in North Yungas province remained the most important centre of coca cultivation in the region of the Yungas of La Paz, with 4,650 ha in 2004 (or 27% of the regional total). Compared with 2003, coca cultivation increased in all municipalities, except in Palos Blancos, where a small decrease was observed.

Table 5. *Distribution of coca cultivation by municipality in the Yungas of La Paz, 2002-2004 (ha)*

Province	Municipality	2002	2003	2004	% change 2003-2004	% of 2004 total
North Yungas	Coripata	4,032	4,456	4,651	4%	27%
South Yungas	Chulumani	2,678	3,020	3,157	5%	18%
South Yungas	La Asunta	1,771	2,314	2,666	15%	15%
South Yungas	Irupana	2,253	2,481	2,502	1%	14%
North Yungas	Coroico	1,155	1,458	1,515	4%	9%
Caranavi	Caranavi	491	889	1,248	40%	7%
Inquisivi	Cajuata	741	801	805	0%	5%
South Yungas	Yanacachi	421	483	488	1%	3%
Murillo	La Paz	151	210	217	3%	1%
South Yungas	Palos Blancos	59	58	53	-9%	0%
TOTAL		13,800	16,200	17,300	7%	100%

Figure 6. *Distribution of coca cultivation by municipality in the Yungas of La Paz, 2002-2004 (ha)*



Bolivian Law 1008 ("Law on the Regime Applicable to Coca and Controlled Substances", 1988) permits up to 12,000 ha of traditional coca cultivation for traditional consumption and other legal uses. Most of this area is located in the Yungas of La Paz, although the law does not provide for a geographic delimitation of the traditional coca cultivation area. Most of the coca cultivation in the Yungas of La Paz is traded through the coca market, controlled by DIGECO, of Villa Fatima in La Paz-city.

Although there was no forced eradication in the Yungas of La Paz, in 2004 and in previous year, there were a few road blockades in the Yungas of La Paz brought about by the threat of eradication of coca cultivation. Only 4 ha have been voluntary reduced through manual uprooting of the coca bush, after agreement between the farmers and the government authorities.

Although no updated data on coca leaf yield existed, for a couple of years now, the project noted during its field missions that farmers were using more sophisticated agricultural techniques in their coca fields, employing more fertilizers, pesticide and mechanical irrigation of their coca fields.

Figure 7. 3-D view near the town of Trinidad Pampa on, the Yungas of La Paz, 2004



Coca cultivation (red rectangle), near the town of Trinidad Pampa on (bottom left of the image)



Picture corresponding to the area within the red rectangle in the image above, showing coca fields in various stages of development (2004).

Figure 8. Coca cultivation in the locality of Siguani, Municipality of La Asunta, 2002-2004

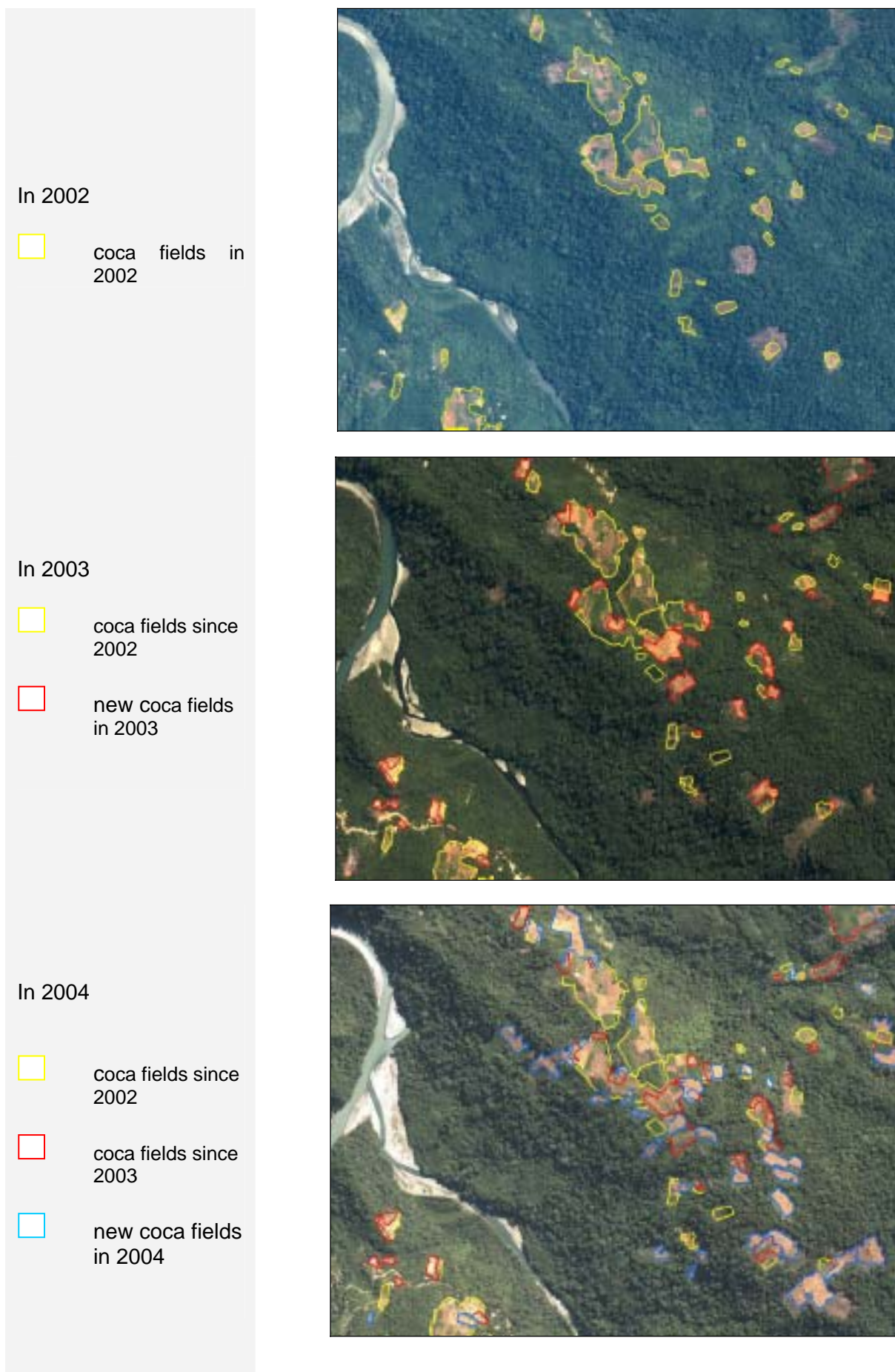
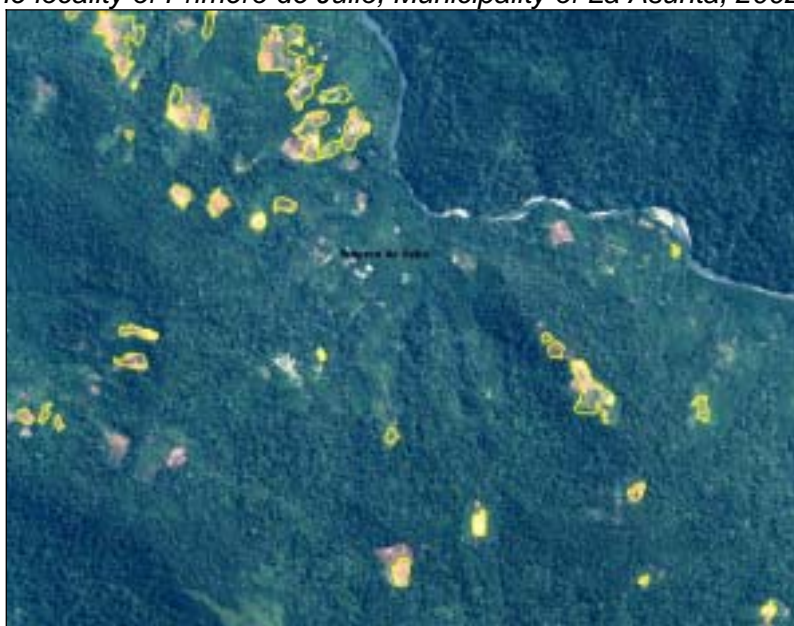


Figure 9. Coca cultivation in the locality of Primero de Julio, Municipality of La Asunta, 2002-2004

In 2002

coca fields in
2002

In 2003

coca fields
since 2002new coca fields
in 2003

In 2004

coca fields
since 2002coca fields since
2003new coca fields
in 2004

Coca cultivation techniques in the Yungas of La Paz

1. Burning of land and soil preparation: The burning of land often takes place during the dry season (May to August), but it can also happen until the month of December if the weather conditions are suitable.



2. Terraces construction: Most of the coca fields are established on terraces to avoid erosion and soil nutrients loss. This practice prolongs the life of the crop. The width of the terraces varies from forty-five centimetres to one meter, depending on the slope. The lines of furrows for coca cultivation are established transversally to the slope direction. This practice is widely used in traditional areas, while in the rest of the Yungas, terraces are not built.



The width and shape of the terraces varies according to the slope and structure of the terrain.

3. Seedling and transplant: The coca seeds are obtained from plants of 5 years old or older. The seeds are settled in a seedling nursery of rich soil and abundant irrigation protected from the sun for about 4-6 weeks before their transplantation to the field.



Young coca plants ready to be planted in field



4. Young crop and first harvest: The small plants are carefully planted in the field, at a distance of 20 cm between each other. During the first few days, they are continuously irrigated. A new crop produces its first harvest usually 12 months after the transplantation, but there have been reports of fields harvested as soon as 8 months after transplantation thanks to the use of fertilizer.



In the Yungas of La Paz, harvest of coca fields is mainly done by women and children.

5. Maintenance: In the Yungas of La Paz fertilizers, pesticides and irrigation are used. Typically, the pesticides are applied right after the harvest, in order to protect the crop from a variety of plagues, including larvae, fungus and ants. At 4-5 years old, the plant is totally pruned, leaving only the base of the trunk. This practice greatly increases the yield of the crop starting from the next harvest, which is produced after 6-8 months. The life of a coca field is about 30 years old; however, there are reports of fields of up to 50 years, with adequate maintenance.



The intensive use of chemical pesticides, and foliar fertilizers produce coca leaves which are not suitable for traditional consumption like mastication and tea preparation.

The bottom picture show organic fertilizer being applied to coca plants 3 months after pruning.



Mechanical irrigation is widespread in coca fields.



Example of pruning, after 3 weeks the first leaves start to re-appear.



6. Drying and transport of the leaves: Drying is done carefully to protect the leaves and maintain their quality. After the harvest, the fresh coca leaves are stored for at least one night in the dark and after that spread for sun drying. In the traditional area, the leaves are spread over a special floor built of dark stones called “cachi”. The “cachi” accelerates considerably the time of drying. In other areas, the leaves are spread over agricultural nets. If the coca leaves are spread right after the harvest, they become damaged and their value reduces drastically. If rain comes over the drying coca leaves, or the farmer picks them up before complete drying, the leaves are also damaged.



Dried coca leaves packed and loaded for transportation.

2.1.3 Coca cultivation in Apolo

Apolo is located at the northern part of the department of La Paz, on the eastern edge of the Andean mountain range. With relatively dry weather conditions and poor soils, coca fields in Apolo often have a low yield and are cultivated for only for about three to five years.

In 2004, DIRECO conducted a cadastral survey of coca cultivation in the Apolo region, measuring in situ all the coca fields located in the region. It revealed that coca cultivation reached 289 ha in 2004. A large proportion of coca cultivation was found in the southern part of the Apolo municipality and in a small part of the neighbouring municipality of Juan José Perez (also known as Charazani municipality) in the province of Bautista Saavedra. These areas were not surveyed by the monitoring project in 2003, and only 50 ha of coca cultivation was found. In 2004, the satellite coverage was expanded to include these areas and the 2004 survey revealed 273 ha of coca cultivation. It should be noted that the survey areas of 2003 and 2004 being different, it was not possible to establish a trend in coca cultivation between 2003 and 2004. The results for Apolo in 2004 were rounded at 300 ha.

Table 6. *Coca cultivation in Apolo region, 2003 and 2004 (ha)*

Province	Municipality	2003	2004	% change 2003 - 2004
Franz Tamayo	Apolo	50	300	n.a.

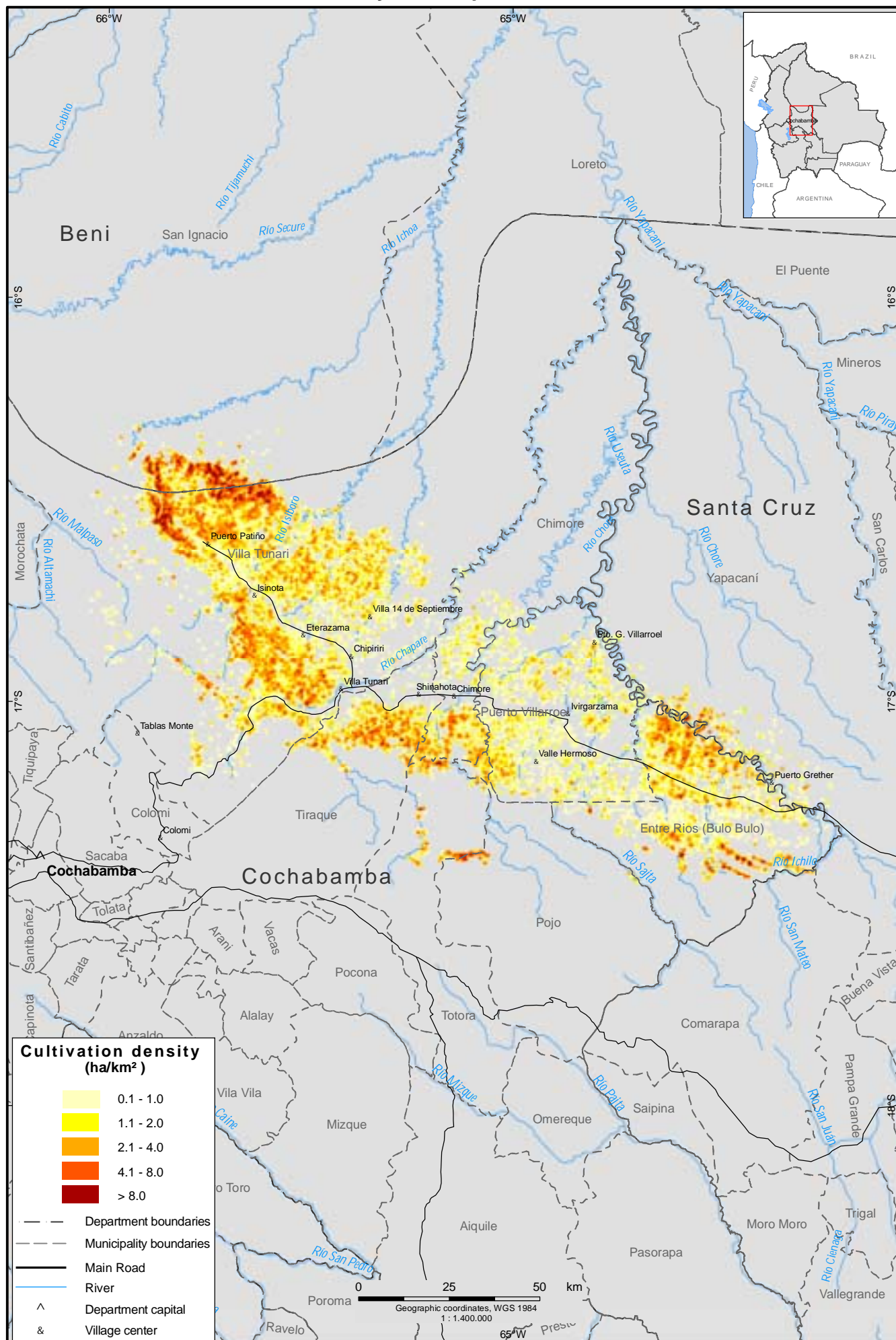
Coca cultivation in Apolo region is traditionally associated with cassava to take advantage of the same furrow for two different crops. The coca fields in Apolo are scattered and relatively small (about 200 m²) compared to coca fields found elsewhere in the country. Terraces are not used. The coca cultivation techniques and coca leaf sun drying are similar to techniques used in the Yungas area of La Paz.

The northern part of Apolo is part of the Madidi National Park, the largest biosphere reserve in Bolivia. Only a few dispersed and small coca fields were found on the western side of the Madidi Park. In Apolo, coca cultivation is considered traditional according to law 1008. No eradication is undertaken in this area.



A coca field in Apolo, 2004.

Coca density for Chapare, Bolivia 2004



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

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

2.1.4 Coca cultivation in Chapare

The Chapare region is situated in Cochabamba department, and the region is also referred to as the Cochabamba tropics, extending over the provinces of Chapare, Carrasco and Tiraque. In contrast to the Yungas of La Paz, Chapare region has moderate slopes and large rivers. Elevations vary from 300 to 2500 meters, with coca cultivated between 300 and 1000 meters. The highest mountains are located in the south and the country's large tropical savannas begin in the northern part of Chapare. Temperatures are tropical and the area records the highest precipitation levels in Bolivia.

In the nineties, the Chapare region held the largest amount of coca cultivation, but following sustained eradication efforts and alternative development programmes, cultivation decreased dramatically.

The 2004 survey estimated coca cultivation at 10,100 ha in Chapare, representing an increase of 38% compared to the 7,300 ha found in 2003. Although the increase was significant, coca cultivation in Chapare remained below the levels seen in the 1990s.

Table 7. Distribution by province of coca cultivation in Chapare region, 2003-2004 (ha)

Province	2003	2004	% change 2003-2004	% of 2004 total
Chapare	4,250	5,844	38%	58%
Carrasco	2,864	3,520	23%	35%
Tiraque	214	723	238%	7%
Rounded Total	7,300	10,100	38%	100%

Between 2003 and 2004, coca cultivation increased in all three provinces of Chapare, Carrasco and Tiraque of the Chapare region. The increase in Chapare province alone, from 4,250 ha to 5,844 ha, accounted for 58% of the regional increase.

Like in 2003, social tensions continued in the coca growing areas of Chapare region in 2004. Road blockades and demonstrations were frequent. In October 2004, the government signed an agreement with the leaders of the coca growing federations, authorizing the temporary cultivation of 3,200 ha of coca in Chapare. This agreement will be revised once the study quantifying the national demand for coca leaf will be concluded. These 3,200 ha of authorized coca cultivation are additional to about 200 ha of coca cultivation in the Yungas de Vandiola considered traditional under the provision of Law 1008.

Table 8. Distribution by municipality of coca cultivation in Chapare region, 2003-2004 (ha)

Province	Municipality	2003	2004	% change 2003-2004	% of 2004 total
Chapare	Villa Tunari	4,250	5,841	37%	58%
Carrasco	Pojo	1,106	1,921	74%	19%
Carrasco	Puerto Villarroel	1,394	821	-41%	8%
Tiraque	Tiraque	214	724	238%	7%
Carrasco	Chimore	250	525	110%	5%
Carrasco	Totora	114	253	122%	3%
Rounded Total		7,300	10,100	38%	100%

The municipality of Villa Tunari continued to be the most important area of coca cultivation in the region, and represented 58% of the coca cultivation in Chapare in 2004. Between 2003 and 2004, coca cultivation increased by 37% in this municipality. The municipality includes part of the Isiboro Secure National Park, where most of the new coca cultivation was found. In 2004, new coca cultivation was also found in another part of the municipality called the Yungas of Chapare.

Coca cultivation only decreased in the municipality of Puerto Villarroel (-41%), due to a combination of alternative development projects and eradication campaigns. However, the pressure of eradication in this municipality may also have pushed farmers to plant coca fields in more remote areas. This local 'balloon effect' could partly explain the large increase recorded between 2003 and 2004 in the remote municipalities of Tiraque, Chimore and Totorá, and contributed as well to the increase in Villa Tunari.

It should be noted that political boundaries are not properly defined between the departments of Cochabamba and Beni. For this reason, although some coca cultivation might actually be located in Beni Department, all the coca fields identified during the survey along the departmental border were counted as part of the municipality of Villa Tunari, in the Department of Cochabamba.

At the end of 2004, the municipality of Pojo was split between the new municipality of Entre Ríos and Pojo municipality. According to this new administration delimitation, the municipality of Entre Ríos contained 1,843 ha of coca cultivation, and only 78 ha remained located under the territory of Pojo municipality.

Figure 10. Distribution by municipality of coca cultivation in Chapare region, 2003 – 2004 (ha)

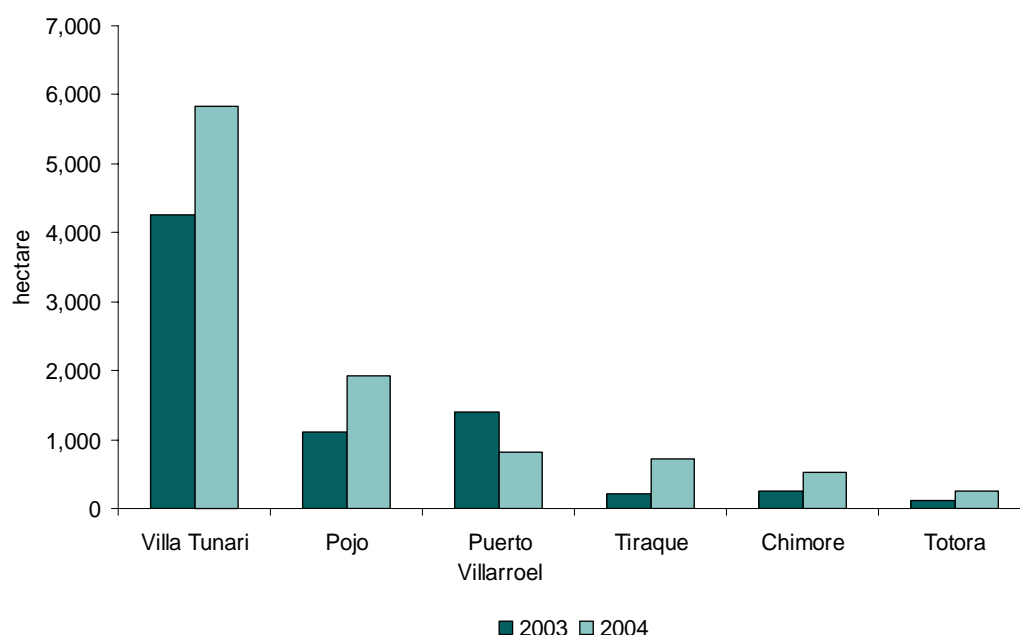
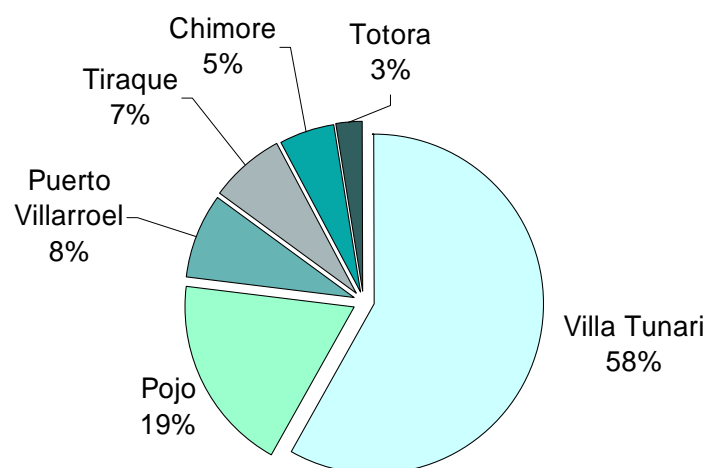


Figure 11. Distribution by municipality of coca cultivation in Chapare region, 2004 (ha)



The following sequences of satellite snap shots (IKONOS and SPOT5) taken in the western part of the Chapare in 2003 and 2004, illustrates that coca fields appearing in 2004 were established at the expense of the primary forest.

Figure 12. Coca cultivation encroaching primary forest

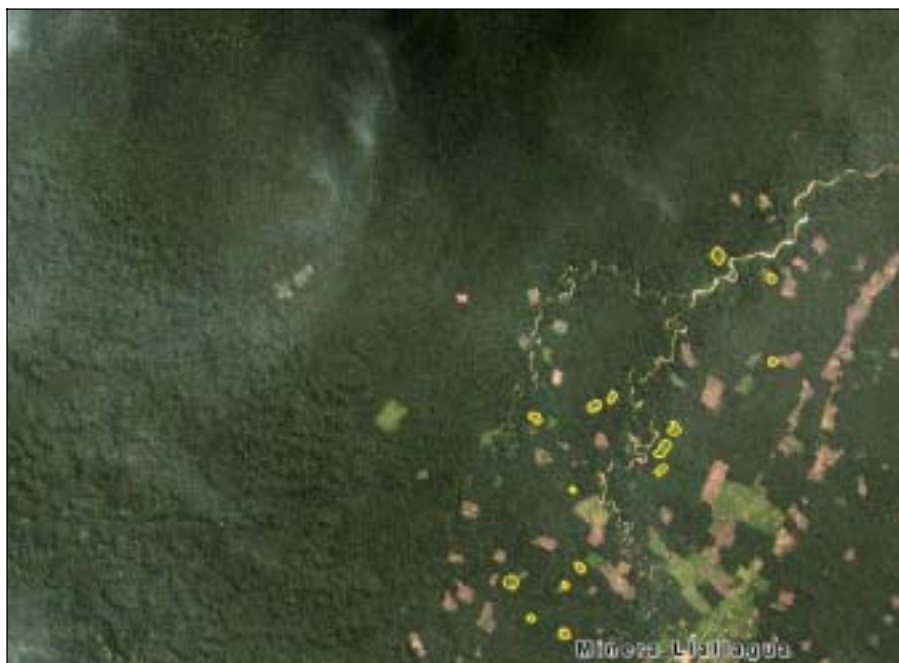


Satellite image taken in 2003 (IKONOS, true color): no coca cultivation is observed in this area. Primary forest is shown in green.

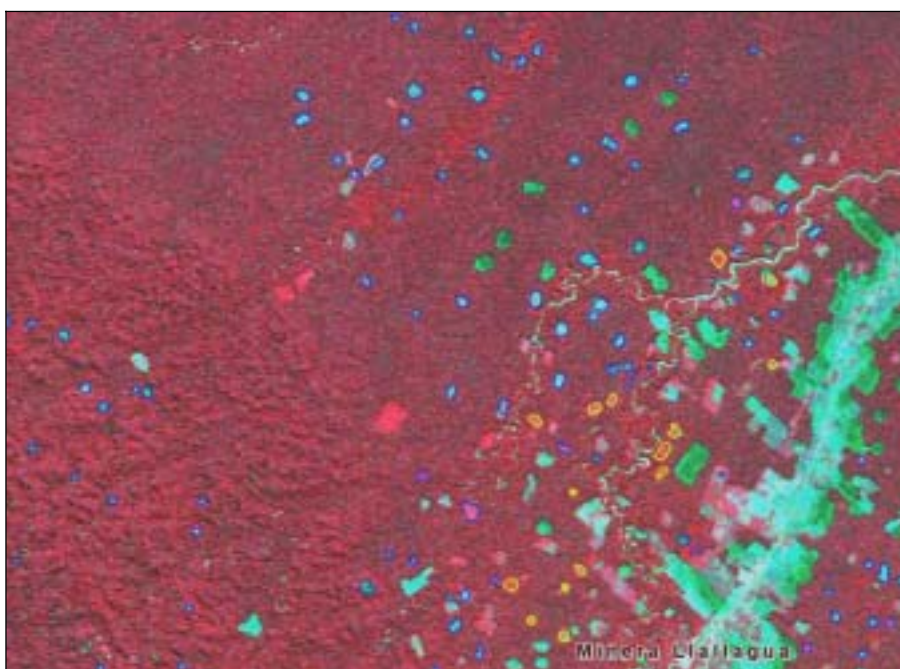


The same area as above, from a satellite image taken in 2004 (SPOT 5 , false colour): coca cultivation delineated with white lines and primary forest appearing in dark red on the false color image.

Figure 13. Coca cultivation spreading in Isiboro Secure National Parks, 2003 - 2004



IKONOS image taken in 2003: scattered coca fields shown in yellow located at the boundaries of the Isiboro Secure National Park



SPOT 5 taken in 2004: coca fields appearing in 2004, delineated with blue lines, were established at the detriment of the primary forest of the Isiboro Secure national Park.

Contrary to the situation of the Yungas of La Paz where there was little eradication, eradication of coca cultivation was intense in the Chapare region. For this reason, farmers often interspersed or associated coca bushes with other crops, or hid their coca fields under tree canopy to avoid detection and eradication. However, under these growing conditions, coca leaf yields are often lower than for coca monoculture.

Broadly speaking, one can distinguish four classes of coca fields in Chapare:

1. Coca bush associated with other crops

When establishing new coca fields, farmers burn the land and start planting banana, rice, corn or yucca. Then they plant coca seeds and use the associated crop as protection for the young coca plants against the sun, instead of establishing coca seedling nurseries. The associated crop, which most of the time is an annual crop, is harvested before the coca plants are ready for harvest. Often the coca plants are kept hidden under residuals of associated crops, like rice and corn straw.



Coca bush under banana trees, , Chapare, 2004.

2. Coca bush and weeds

Farmers leave the weeds grow together with the coca plants. It reduces the coca leaf yield, but this association is very difficult to detect, even from the ground.



Coca bush and weeds, , Chapare, 2004.

3. Coca cultivation under tree canopy

Farmers clear the lower vegetation of forested areas and plant coca seeds or transplant coca seedlings under taller trees. The density of coca plants is not high, but the plants receive enough sunlight to grow.



Coca cultivation under tree canopy, Chapare, 2004.

4. Open coca monoculture

The majority (65%) of the coca fields in Chapare remained mono-cropped and visible fields, especially in the densest areas of coca cultivation, or in places where no eradication is undertaken, like the small area of Yungas de Vandiola, considered traditional for coca production.



Clearly visible coca field, Chapare, 2004.

Fertilizers and pesticides are also widely used in the Chapare, and even sophisticated techniques like the use of phytohormones to recover destroyed roots have been reported.

The life of a coca field in Chapare, under normal conditions is on average 30 years. Isolated, scattered old plants of big dimensions have been observed, still yielding substantial quantity of coca leaves.

The coca leaves are also sun dried on bare floor before commercialization, but not with the same care as in the Yungas. According to FELCN, part of the production is marketed outside the region, but it is believed that most of the coca leaves are used locally for cocaine manufacturing.



Sun-drying of coca leaves, Chapare, 2004.



Sun-drying of coca leaves, Chapare, 2004.

2.2 COCA YIELD AND PRODUCTION

In July 2004, UNODC started its first study of coca leaf yield in Bolivia. Thirteen fields of the Yungas of La Paz were selected and the weight of fresh and sun-dried coca leaves weighted from one sampled plot within each of these fields. However, farmers were often reluctant to cooperate with the study and the tense situation prevailing in the coca growing areas of Bolivia in 2004 did not permit to complete all the activities. Only the July and September harvests could be weighted, which did not enable to derive an annual estimate. UNODC plans to carry on data collection on coca leaf yield in 2005.

For the 2004 annual estimate of coca leaf and cocaine production, UNODC relied on information available from other sources. The latest data available came from the Bolivian Government and the US Government Operation Breakthrough was the following:

Table 9. *Coca leaf yield in Bolivia*

Region	Annual coca leaf yield (kg/ha/year)
Chapare	2,764
Yungas outside traditional coca growing areas	1,798
Apolo and Yungas in traditional coca growing areas	936

Sources: Bolivian Government and US Government Operation Breakthrough

Table 10. *Conversion rate coca leaf to cocaine*

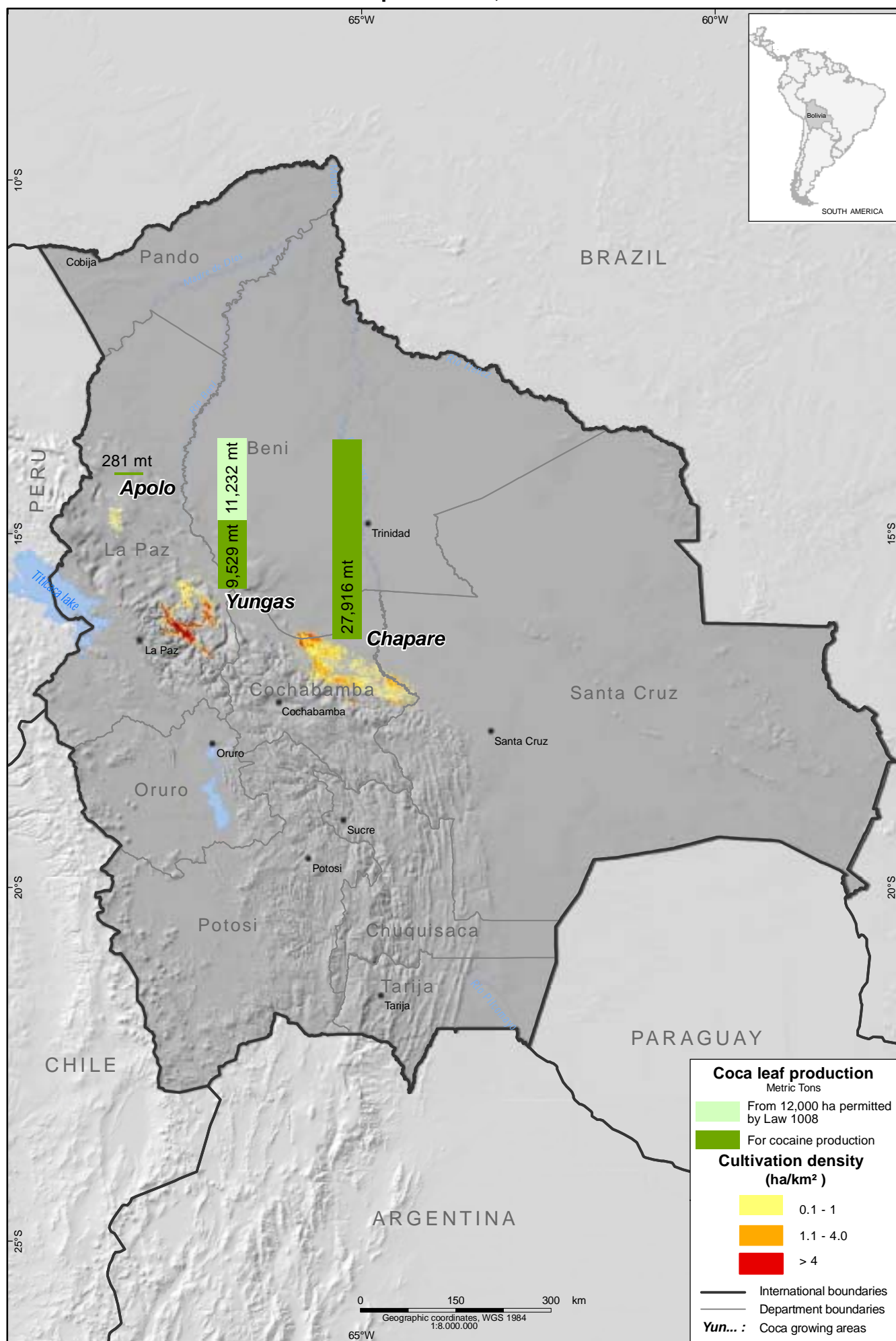
Region	Coca leaf for 1 kg of cocaine
Chapare	370
Yungas	315

Based on these data, the total coca leaf production amounted to 49,000 metric tons, of which 38,000 metric tons were estimated to be available for cocaine production. Based on these calculations, the weighted coca leaf yield in the Chapare was about 2,700 kg/ha, compared to 1,200 kg/ha elsewhere in the country.

Table 11. *Calculation of coca leaf production in Bolivia, 2004*

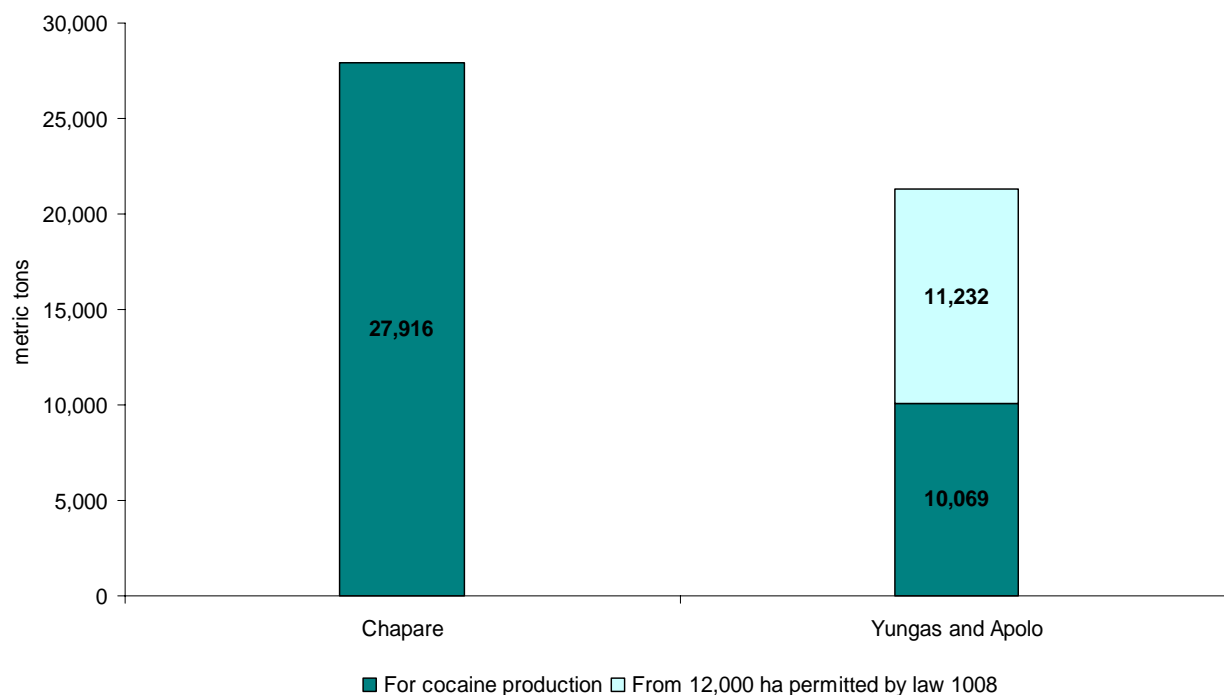
Area	Coca Cultivation	Yield	Production
	(ha)	(kg/ha/year)	(metric tons)
Chapare	10,100	2,764	27,916
Yungas minus 12.000 ha permitted by law 1008	5,300	1,798	9,529
Rounded sub-total: dry coca leaf for cocaine production			38,000
Yungas and Apolo 12.000 ha permitted by law 1008	12,000	936	11,232
Rounded total dry coca leaf production			49,000

Coca leaf production, Bolivia 2004



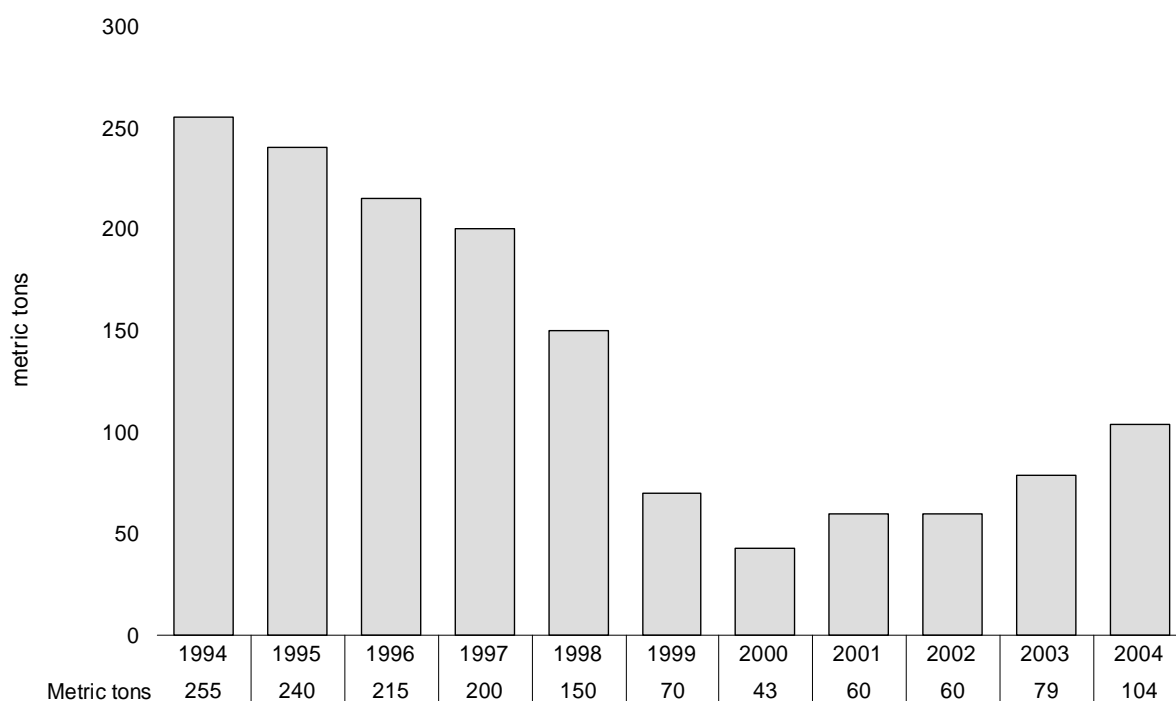
Source: Government of Bolivia - National monitoring system supported by UNODC
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Figure 14. Distribution by region of dry coca leaf production in Bolivia, 2004 (metric tons)



Applying a conversion rate for Chapare of 370 kg of coca leaf for one kg of cocaine and for the Yungas of 315 kg of coca leaf for one kg of cocaine, the potential cocaine production in Bolivia was estimated at 107 metric tons in 2004. This corresponded to an increase of 32% compared to last year potential cocaine production of 79 metric tons⁴. The large increase in cocaine production reflected the larger increase in coca cultivation in the Chapare region (+38%) where coca leaf yield was twice higher than elsewhere in the country (2,700 kg/ha compared to 1,200 kg/ha).

Figure 15. Cocaine production in Bolivia 1994 - 2004 (in metric ton)



Source: UNODC World Drug Report

⁴ using the same coca leaf yield and conversion rate to cocaine as in 2004

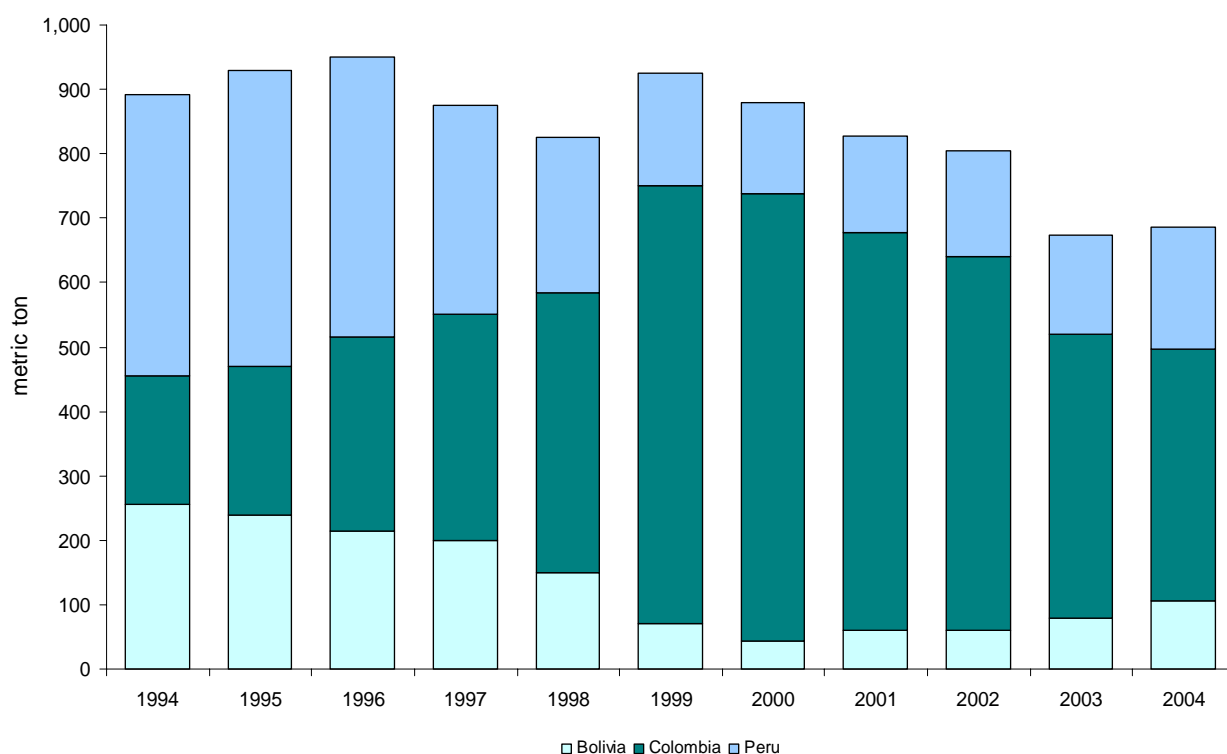
In 2004, potential cocaine production in Bolivia accounted to 16% of the global potential cocaine production of 687 metric tons. This was a much lower percentage than in 1994 when potential cocaine production in Bolivia represented about 30% of the global potential cocaine production.

Table 12. *Potential cocaine production in the Andean region 1994 - 2004 (in mt)*

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	% change 2003-2004	% of 2004 total
Bolivia	255	240	215	200	150	70	43	60	60	79	107	35%	16%
Peru	435	460	435	325	240	175	141	150	165	155	190	23%	28%
Colombia	201	230	300	350	435	680	695	617	580	440	390	-11%	57%
Total	891	930	950	875	825	925	879	827	805	674	687	2%	

Source: UNODC World Drug Report

Figure 16. *Potential cocaine production in the Andean region 1994 - 2004 (in mt)*



2.3 COCA PRICES AND TRADING

In Bolivia, sun-dried coca leaf trade is regulated by DIGECO that controls the quantity and prices of coca leaf traded in two markets: The market of Vila Fatima in La Paz-city and the market of Sacaba in Cochabamba department, close to Cochabamba city.

Of the 11,908 metric tons of coca leaves that fell under the control of DIGECO in 2004, the largest amount, 11,560 metric tons or 97%, was traded in Villa Fatima, and the remaining 348 metric tons in Sacaba. Prices of coca leaves in Vila Fatima market were also higher than in Sacaba market, with respective annual averages of 35 Boliviano/kg (US\$ 4.4/kg) and 31 Boliviano/kg (US\$ 3.9/kg). The annual average weighted price for coca leaves on these two markets was 35 Boliviano/kg (US\$ 4.4/kg) in 2004.

Table 13. Reported monthly price of coca leaf marketed through DIGECO in 2004

Month	Chapare: Sacaba market		La Paz: Villa Fatima market		Weighted average	
	BOL/kg	Quantity sold metric tons	BOL/kg	Quantity sold metric tons	BOL/kg	US\$/kg
January	31	46	37	879	36	4.6
February	27	24	34	889	33	4.2
March	28	28	33	997	32	4.1
April	29	26	32	1,026	32	4.1
May	28	20	30	1,015	30	3.8
June	30	13	30	1,022	30	3.7
July	35	13	35	950	35	4.4
August	35	45	42	891	41	5.2
September	36	40	41	882	41	5.1
October	38	36	40	955	40	5.0
November	33	34	40	975	40	5.0
December	27	22	28	1,079	28	3.5
	31	348	35	11,560	35	4.4

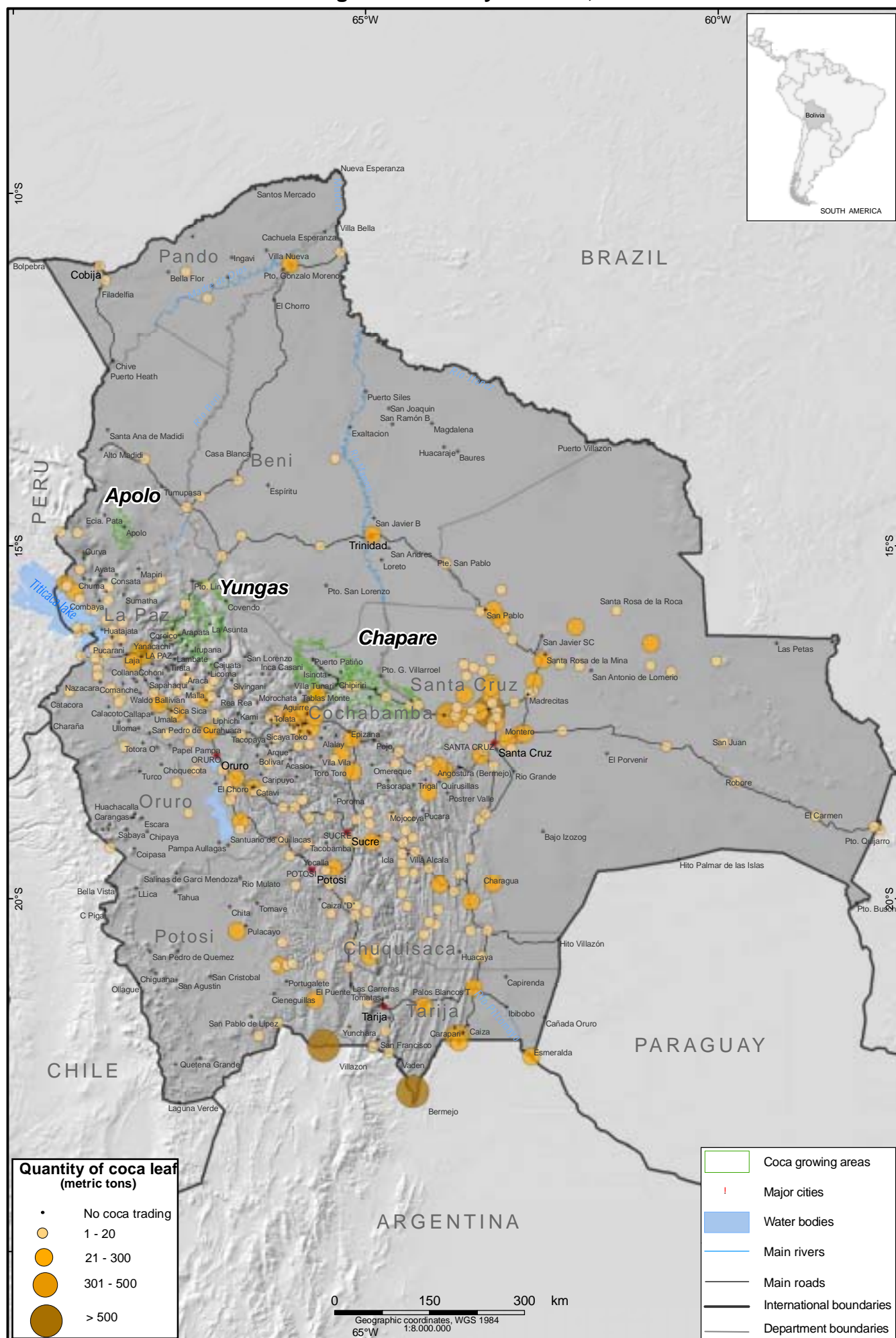
Source: DIGECO

Each trader is authorized by DIGECO to trade up to 500 pounds (227 kg) of dry coca leaf per month. DIGECO's authorization specifies where the coca leave are bought (Villa Fatima or Sacaba) and the point of final destination for its retailing. Coca is retailed in packages of maximum 15 pounds (6.8 kg).

The following map shows the distribution of traded coca leaves throughout the country according to the DIGECO registry. In 2004, most of the coca leaves ended up in Santa Cruz department, followed by the departments of Tarija, La Paz and Potosi. In Santa Cruz, coca leaves are supplied mostly for the workers of large scale industrial farms of soy beans and sugar canes who use to chew it. Coca chewing is also widespread among miners of the departments of La Paz, Potosi and Oruro. Although not documented, it is likely that a certain quantity of coca leaves traded in the southern of the country is smuggled to neighbouring Argentina.

The total value of the coca leaves traded through the control of DIGECO amounted to 415 millions Bolivianos or US\$ 52 millions in 2004.

Coca leaf trading authorized by DIGECO, Bolivia 2004



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

Farm-gate prices of dry coca leaf have been collected in Chapare on a monthly basis by DIRECO since 1990 and by the UNODC monitoring project in the Yungas of La Paz since 2004. Average annual prices for coca leaf were higher in Chapare with 41 Boliviano/kg (US\$5.2/kg) than in the Yungas of La Paz with 37 Boliviano/kg (US\$ 4.7/kg). Prices remained largely stable throughout 2004, but increased slightly in the Yungas of La Paz to the level of prices of Chapare for the last quarter of the year.

Table 14. *Monthly coca leaf price in the Yungas of La Paz, 2004*

	Municipality of Coripata	Municipality of Chulumani	Municipality of La Asunta	Municipality of Caranavi	Average	
	BOL/kg	BOL/kg	BOL/kg	BOL/kg	BOL/kg	US\$/kg
January	33	31	35	38	34	4.4
February	33	35	38	35	35	4.5
March	31	33	38	38	35	4.4
April	33	35	35	38	35	4.5
May	35	35	38	35	36	4.5
June	38	38	35	35	36	4.6
July	35	40	40	40	39	4.9
August	38	38	38	40	38	4.8
September	38	40	40	42	40	5.0
October	40	40	42	40	40	5.0
November	40	40	42	38	40	4.9
December	40	42	42	40	41	5.1
Annual average	36	37	38	38	37	4.7

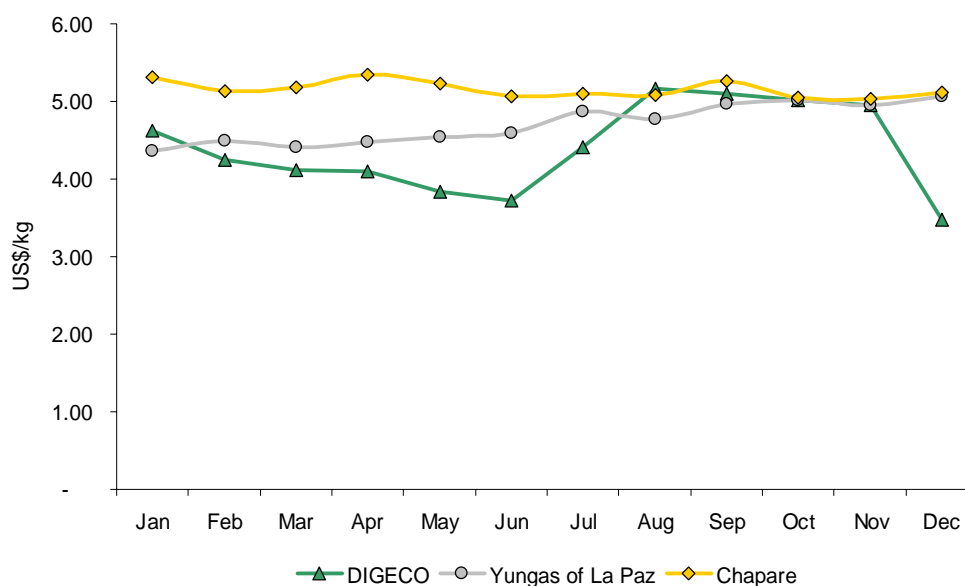
Source: UNODC monitoring project

Table 15. *Reported monthly coca leaf price in the Chapare, 2004*

	Chapare	
	BOL/kg	US\$/kg
January	42	5.3
February	40	5.1
March	41	5.2
April	42	5.3
May	41	5.2
June	40	5.1
July	41	5.1
August	41	5.1
September	42	5.3
October	40	5.0
November	40	5.0
December	41	5.1
	41	5.2

Source: DIRECO

Figure 17. Monthly coca leaf price in the Yungas of La Paz and Chapare Bolivia 2004



Sources: DIGECO/DIRECO/UNODC monitoring project

Weighted by production, the annual average price for coca leaf outside the market controlled by DIGECO was US\$ 5.0/kg. This was a higher price than the price US\$ 4.4/kg on the market controlled by DIGECO. However, during the dry season when less coca leaves were available, prices from the markets controlled by DIGECO were similar to prices on other markets.

The sudden drop in prices recorded between November and December 2004 from DIGECO, was due to the arrival on the market of Vila Fatima of coca leaves from Caranavi municipality. Coca farmers from Caranavi obtained in November 2004 their licenses to sell coca leaves through DIGECO. The higher supply of coca leaves in Vila Fatima in December pushed the prices down.

Prices of coca leaves have not been systematically recorded for Apolo. Anecdotal information reported much lower prices in Apolo than elsewhere in the country, ranging from US\$2.5 to US\$2.8/kg in 2004. The reason for lower prices in Apolo could be attributed to the remoteness of the region, outside the main trading centres. The low coca leaf production in Apolo (281 mt) was rather negligible compared to the national total, and therefore was not taken into account in the establishment of the national annual price estimate.

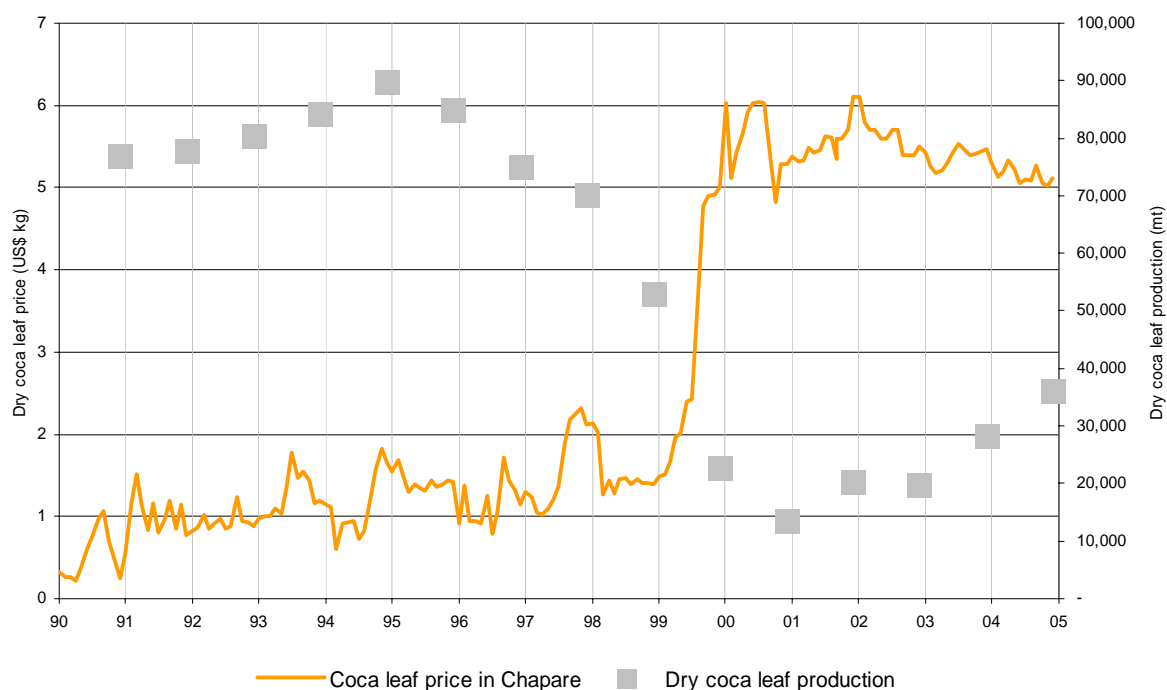
The long term trend of prices can be appreciated with prices of coca leaves from Chapare collected by DIRECO since 1990. Following a strong price rise in 1999 – in line with a strong increase in eradication – dry coca leaf prices reached a peak of US\$5.7 /kg in 2000. Since then, prices fell slightly to US\$ 5.2/kg. However, coca leaf prices in Bolivia continued to be substantially higher than in neighbouring Peru (US\$ 2.8/kg).

Table 16. *Reported monthly prices of coca leaf in Chapare (US\$/kg)*

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
January	0.8	1.0		0.9	1.4	0.9	1.1	1.3	2.0	5.9	5.4	5.7	6.1	5.4	5.3
February	1.2	0.8	1.4	0.9	1.3	1.3	1.2	1.5	2.4	6.0	5.5	5.6	5.8	5.3	5.1
March	0.8	0.9	1.8	0.7	1.3	0.8	1.4	1.5	2.4	6.0	5.6	5.6	5.7	5.2	5.2
April	1.0	1.2	1.5	0.8	1.4	1.1	1.9	1.4	3.7	6.0	5.6	5.7	5.7	5.2	5.3
May	1.2	0.9	1.5	1.2	1.4	1.7	2.2	1.5	4.8	5.3	5.3	5.7	5.6	5.3	5.2
June	0.9	0.9	1.4	1.6	1.4	1.4	2.2	1.4	4.9	4.8	5.6	5.4	5.6	5.4	5.1
July	1.1	0.9	1.2	1.8	1.4	1.3	2.3	1.4	4.9	5.3	5.6	5.4	5.7	5.5	5.1
August	0.8	1.0	1.2	1.7	1.4	1.2	2.1	1.4	5.0	5.3	5.7	5.4	5.7	5.5	5.1
September	0.9	1.0	1.1	1.5	0.9	1.3	2.1	1.5	6.0	5.4	6.1	5.5	5.4	5.4	5.3
October	1.0	1.0	1.1	1.7	1.4	1.2	2.0	1.5	5.1	5.3	6.1	5.4	5.4	5.4	5.0
November	0.8	1.1	0.6	1.5	0.9	1.1	1.3	1.7	5.4	5.3	5.8	5.3	5.4	5.4	5.0
December	0.9	1.0	0.9	1.3	0.9	1.0	1.4	2.0	5.7	5.5	5.7	5.2	5.5	5.5	5.1
Annual Average US\$/kg	0.9	1.0	1.2	1.3	1.3	1.2	1.8	1.5	4.4	5.5	5.7	5.5	5.6	5.4	5.2

Source: DIRECO

Figure 18. *Reported monthly prices of coca leaf in Chapare and total dry coca leaf production (US\$/kg)*



The estimation of the total farm-gate value of coca leaf production in Bolivia included the total value of the market controlled by DIGECO, and the farm-gate value of coca leaves outside this market. In 2004, it amounted to US\$240 millions.

Table 17. Estimation of the total farm-gate value of coca leaf production in Bolivia, 2004

Region	Production (mt)	Price (US\$/kg)	Value (US\$)
Chapare	27,916	5.2	143,978,146
Yungas, outside the 12,000 ha permitted by law 1008	10,069	4.7	47,442,632
Yungas from 12,000 ha permitted by law 1008	10,951	4.4	48,158,783
Apolo	281	2.7	744,650
Rounded total	49,000		240,000,000

The total farm-gate value of coca leaf production in 2004 was thus equivalent to 3.0% of the projected Bolivian GDP of US\$ 8.1 billions for 2004, or 17% compared with the 2003 value of the licit agricultural sector of US\$ 1.4 billions⁵.

These figures suggested that, for the country as a whole, coca production still had an impact on the Bolivian economy, and continued to play an important role within the coca producing region. About 300,000 people live in the (rural) coca producing areas of the country, equivalent to 3.8% of the country's total population (8.8 millions in 2003).

The FELCN also reported street prices of cocaine paste and cocaine of unknown purity from the major cities and coca growing regions in Bolivia. Reported prices of coca paste and cocaine did not vary from prices reported in 2003.

Table 18. Reported prices of cocaine base and cocaine HCL, Bolivia, 2004

City	Cocaine base	Cocaine HCL
La Paz	1,150	2,000
Cochabamba	1,150	1,800
Santa Cruz	1,200	1,700
Average	1,200	1,800
Region		
Yungas of La Paz	800	na
Chapare	1,000	na

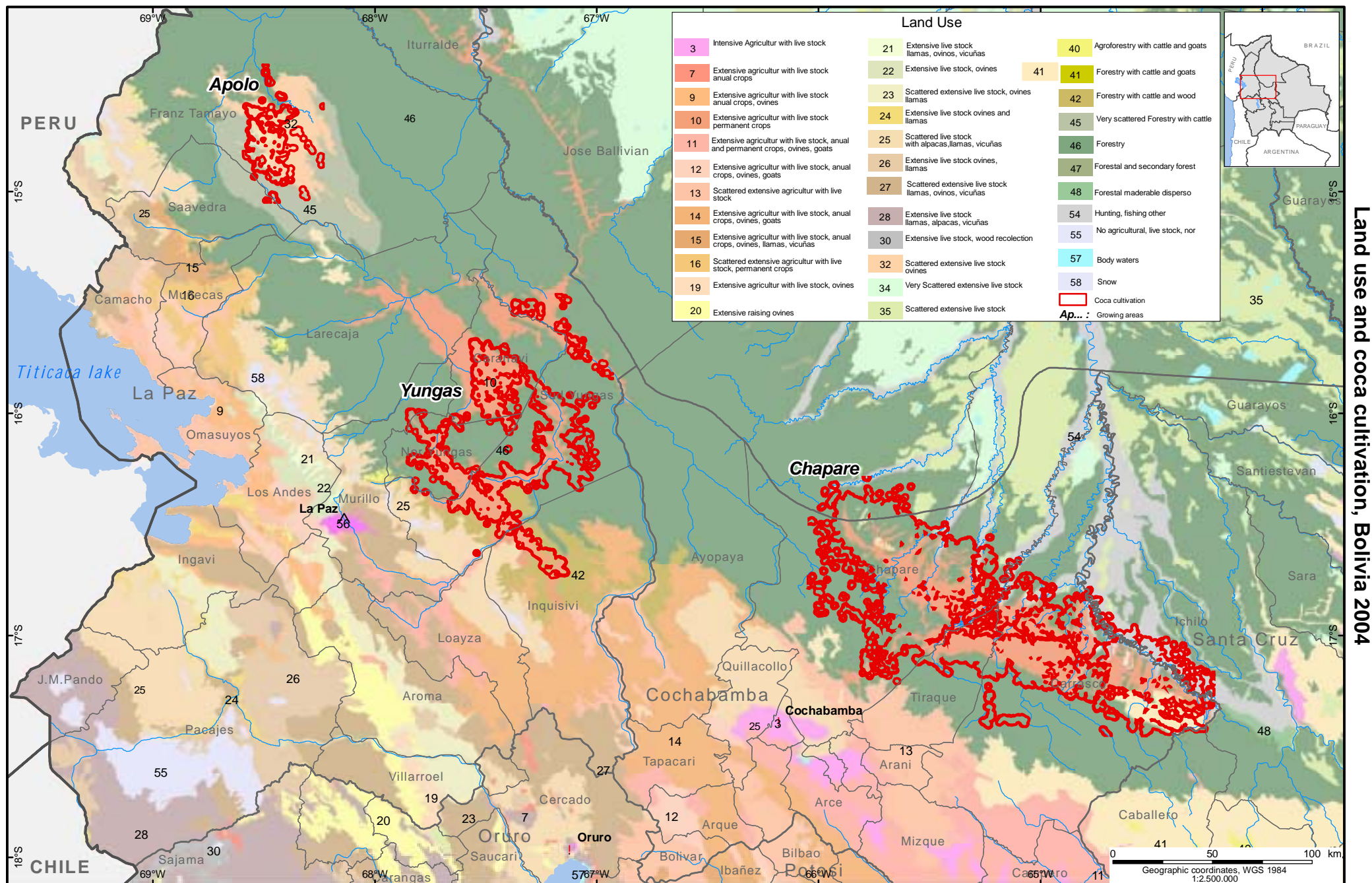
Source: FELCN

It is interesting to note that prices for coca leaf and its derivatives were consistently higher in Bolivia than in neighbouring Peru. This price difference explained the smuggling of coca leaves but also coca base from Peru to Bolivia.

Table 19. Prices for coca leaf and its derivatives in Peru and Bolivia, 2004 (US\$/kg)

Products	Peru	Bolivia	Difference between Peru and Bolivia prices
Coca leaf	2.8	5.0	79%
Coca base	640	1,200	88%
Cocaine HCL	900	1,800	100%

⁵ GDP for 2004 estimated from the GDP 2003 of US\$ 7.8 billions and a projected growth of 3.8%. GDP for agricultural sector only available for 2003. Source INE.



Land use and coca cultivation, Bolivia 2004

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

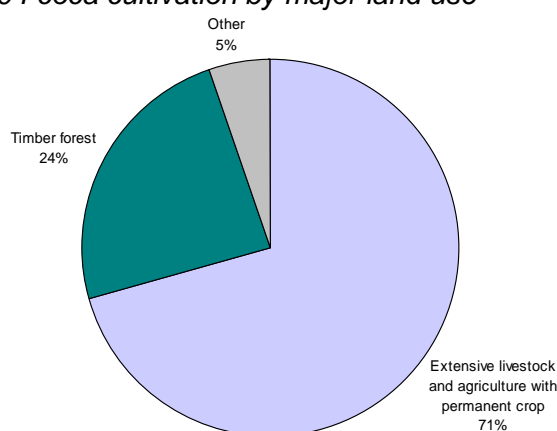
2.4 COCA CULTIVATION AND RELATED ISSUES

2.4.1 COCA CULTIVATION AND LAND USE

The Bolivian National Authorities of Land Management ('Ordenamiento Territorial') released in 2002 a country wide map of major land use, based on the classification of Landsat images. This map was superimposed on the map of coca cultivation for 2003 and 2004. This analysis revealed that coca cultivation is found over four main types of land use: Extensive livestock and agriculture with permanent crop; timber forest; timber forest and cattle; non-timber forest and cattle; hunting, fishing and non-timber forest products.

In 2003, 70% of coca cultivation took place on land dedicated to extensive livestock and agriculture with permanent crop, and 25% over land where the major land use is classified as timber forest. This last category corresponded mainly to the border of the Isiboro Secure National Park that is now protected, meaning that activities like extensive agricultural or logging are no longer permitted.

Figure 19. Distribution of 2004 coca cultivation by major land use

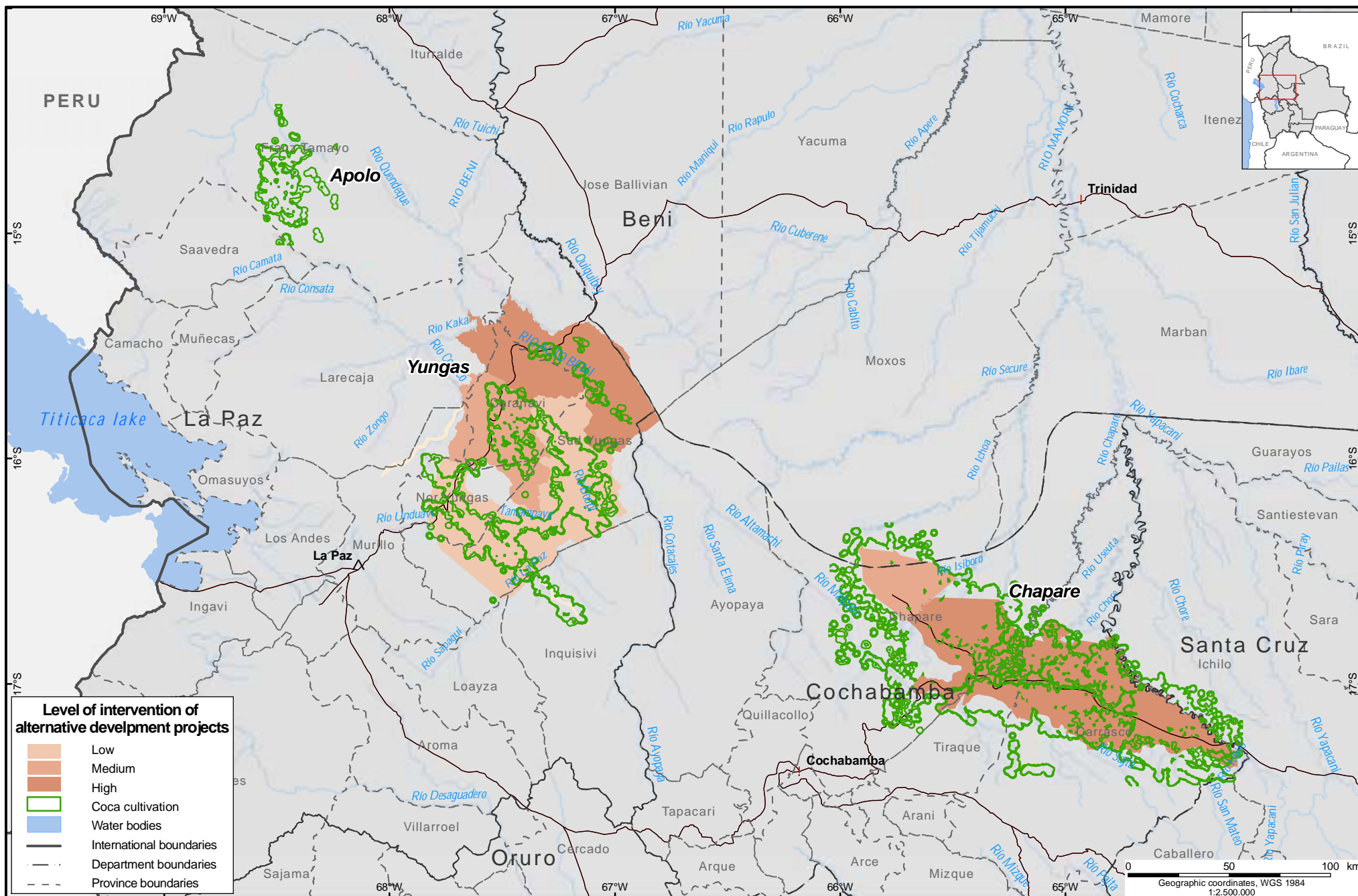


More than 50% of the increase of 4,300 ha in coca cultivation between 2003 and 2004 took place at the expenses of forest area. Between 2003 and 2004 a total of 2,200 ha of forest land were turned into coca fields.

Table 20. Distribution of 2004 coca cultivation by major land use and by region (ha)

Region	Major land use	2003	2004	% change 2003 - 2004	% of 2004 total
Yungas	Extensive livestock and agriculture with permanent crop	14,908	15,878	7%	57%
	timber forest	1,069	1,270	19%	5%
	timber forest and cattle	186	189	2%	1%
Chapare	Extensive livestock and agriculture with permanent crop	3,265	3,659	12%	13%
	timber forest	3,442	5,433	58%	20%
	non-timber forest and cattle	369	495	34%	2%
	hunting, fishing and non-timber forest products	194	507	161%	2%
Apolo	Extensive livestock, sheep	50	178		1%
	Timber forest		11		0.0%
	Very scattered forest with cattle		51		0.2%
	non-timber forest and cattle		61		0.2%
Rounded total		23,600	27,700	17%	100%

Coca cultivation and alternative development projects, Bolivia 2004



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

2.4.2 COCA CULTIVATION AND ALTERNATIVE DEVELOPMENT PROJECTS

The Bolivian government usually refers to six geographical zones for the implementation of Alternative Development projects: four in the Yungas of La Paz (Caranavi North and Alto Beni, Caranavi Centre South, region of La Asunta, Inquisivi, south-western region), and two in Chapare (Bosque de uso multiple, or BUM, and the colonization area of the Isiboro Secure National Park). The number of projects and their level of interventions within each of these zones was not quantified in 2004, but varied broadly from no intervention at all to high level of intervention.

Table 21. *Coca cultivation and alternative development in Bolivia*

Region	Zone	level of interventions	Coca cultivation in 2003	Coca cultivation in 2004	% of change 2003 - 2004	% of 2004 coca cultivation total
Yungas of La Paz	Caranavi North Alto Beni	High	96	99	3%	0,4%
	Caranavi Centro South	Medium	478	650	26%	2%
	South-western Yungas and La Asunta	Low	14,825	15,802	6%	57%
	Inquisivi	None	801	807	1%	3%
Chapare	Bosque Uso Multiple (BUM) or Multiple Use Forest	High	4,370	4,317	-1%	16%
	Colonization area of the Isiboro Secure National Park	Low	1,640	2,587	37%	9%
	Other	None	1,273	3,185	60%	11%
Apolo	Apolo	None	50	300	n.a	1%
	Rounded total		23,500	27,700	18%	100%

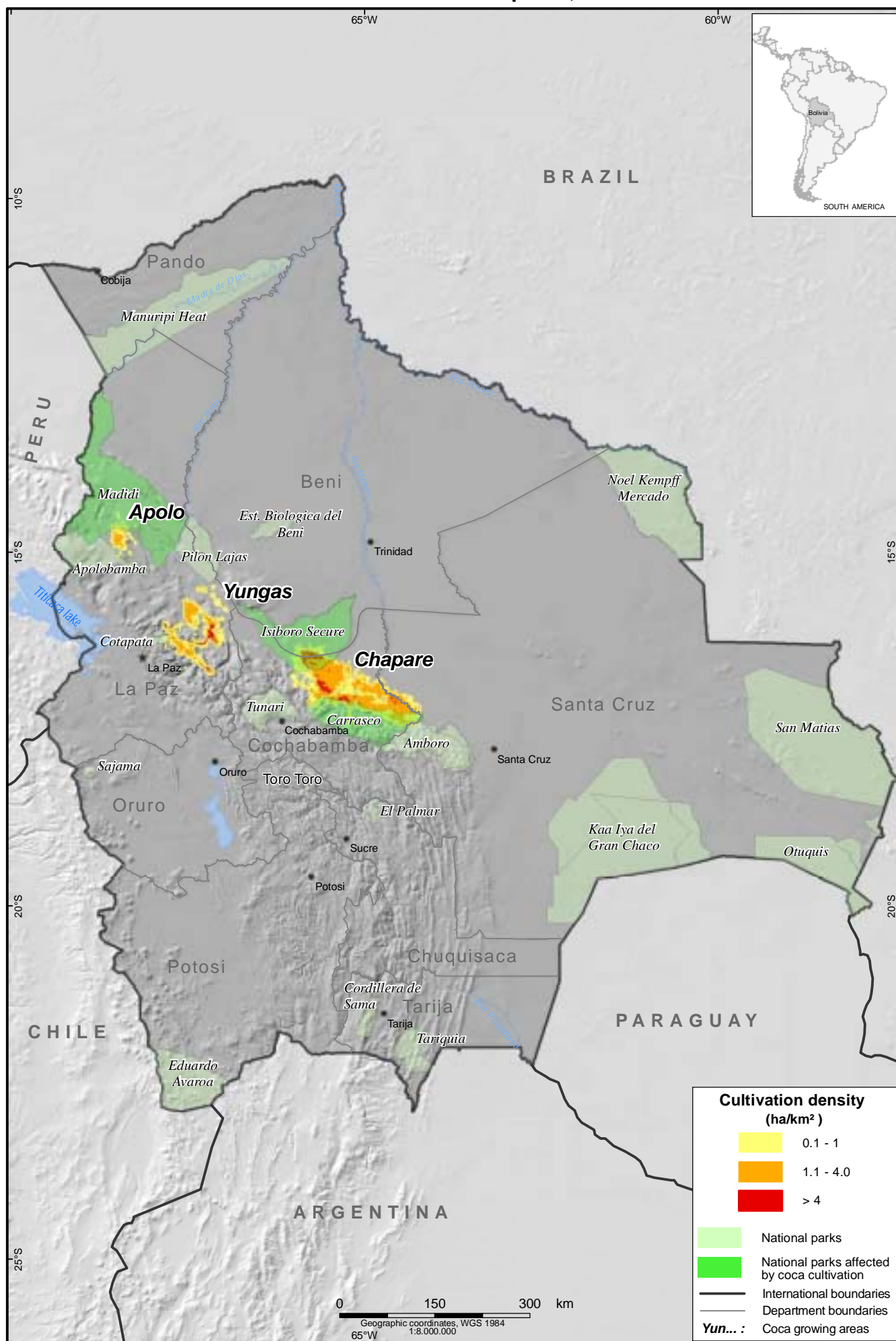
In the Yungas of La Paz, the area of major intervention of alternative development was the Northern part of the municipality of Caranavi and the Alto Beni, representing 0.4% of the national total in 2004. However, the region of South-western Yungas and La Asunta representing the largest proportion of coca cultivation in 2004 (57%), received fewer support from alternative development project.

In Chapare, the main area of intervention of alternative development was the region defined by the Ministry as 'multiple use forest'. Between 2003 and 2004, coca cultivation remained stable in this region. On the contrary, the areas with little or no intervention of alternative development showed an increased in coca cultivation between 2003 and 2004.



Controlled timber extraction, part of the UNODC Alternative Development project BOL/C23 in Chapare

Coca cultivation and national parks, Bolivia 2004



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

2.4.3 COCA CULTIVATION IN NATIONAL PARKS

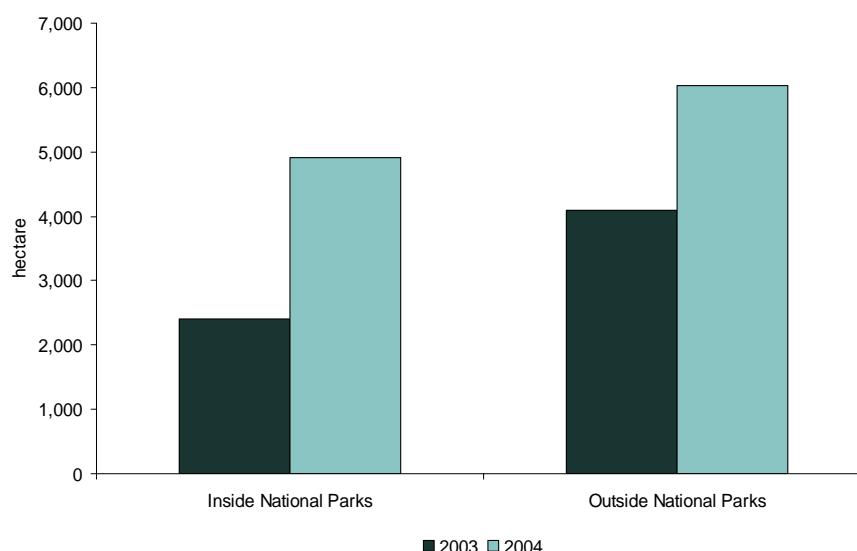
There are 21 protected areas and national parks in Bolivia, totalling an area of 165,000 sq km, representing 15% of the national territory. In 2004 coca cultivation was found in three national parks: In the national park of Madidi, in the Apolo region, only about 10 ha of coca cultivation were found. A much larger amount of 4,100 ha of coca cultivation was found in the two national parks Isiboro Secure and Carrasco, in Chapare region. Coca cultivation within these two National Parks represented 40% of the coca cultivation of Chapare region.

Between 2003 and 2004, coca cultivation increased by 71% in the areas of the National Parks, from 2,400 ha to 4,100 ha. A possible explanation for this increase could be that the pressures to reduce coca cultivation in the existing centres of production pushed the farmers to plant new fields in isolated and remote areas. Between 2003 and 2004, the increase of 1,700 ha in the National Parks, represented 60% of the total increase in Chapare of 2,800 ha. While coca cultivation increased by 71% within the limits of the National Parks, it increased only by 22% outside their boundaries. Ecosystems of the National Parks are particularly fragile and the deforestation for the establishment of coca cultivation makes irreversible damages to their environment.

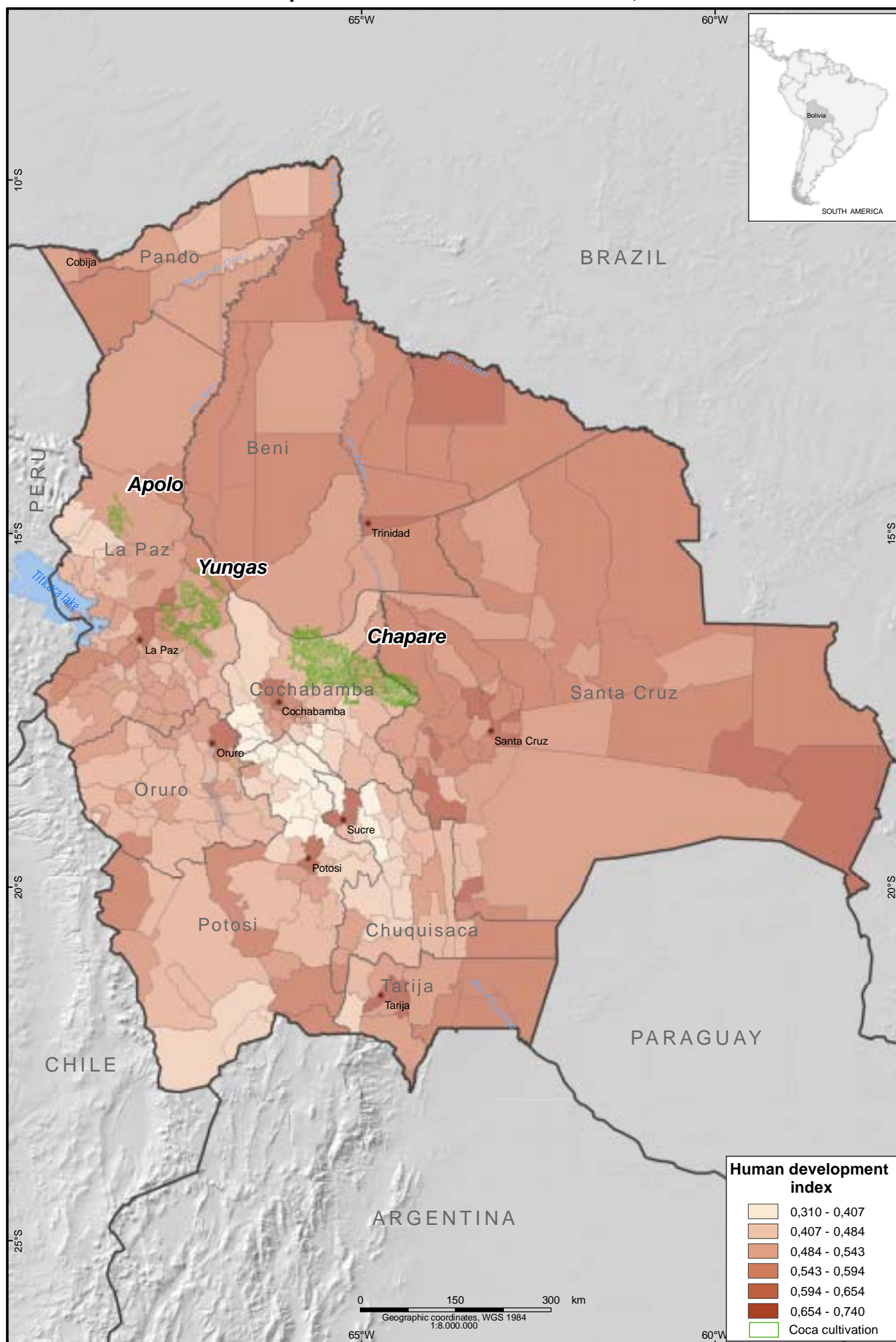
Table 22. *Coca cultivation estimates by national parks in Chapare 2003 – 2004 (ha)*

Area	2003	2004	% change 2003 - 2004	% of 2004 total
Isiboro Secure National Park	1,605	2,807	75%	28%
Carrasco National Park	778	1,257	62%	12%
Madidi National Park	n.a.	10	n.a.	0.1%
Total within National Parks	2,400	4,100	71%	41%
Outside National Parks	4,900	6,000	22%	59%
Rounded Total	7,300	10,100	38%	100%

Figure 20. *Distribution of coca cultivation in Chapare region inside and outside national parks, 2003 – 2004 (ha)*



Human development index and coca cultivation, Bolivia 2004



Source: Government of Bolivia - Bolivian Human Development Report - National monitoring system supported by UNODC
 The boundaries and names shown and the designation used on this map do not imply official endorsement or acceptance by the United Nations

2.4.4 COCA CULTIVATION AND POVERTY

The human development index (HDI) focuses on three measurable dimensions of human development: living a long and healthy life, being educated and having a decent standard of living. Thus it combines measures of life expectancy, school enrolment, literacy and income to allow a broader view of a country's development than does income alone. Bolivia is ranked 114th in the 2004 Human Development Report, with an HDI value of 0.681. For comparison, Barbados ranked first in the region, with a value of 0.888.

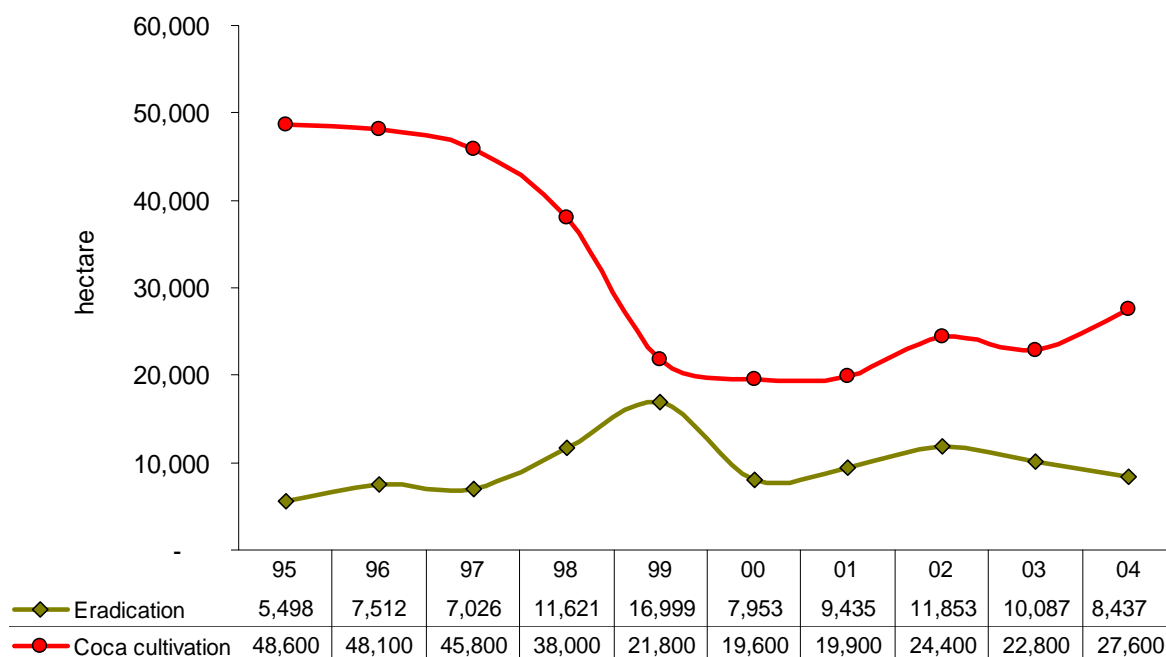
In Bolivia, HDI values for 2001 were also available at the municipality level. Coca cultivation was found in 17 out of the 326 municipalities in Bolivia. The average HDI for these 17 municipalities with coca cultivation was 0.54, while the mean value for municipalities without coca cultivation was 0.57. However, the difference was not statistically significant to declare that there is a difference between both groups.

UNODC monitoring project intend to develop a socio-economic survey that will bring more data and information on the conditions of the coca farmers in Bolivia. The study should also enable to estimate the number of persons involved in coca cultivation in Bolivia.

2.5 REPORTED ERADICATION

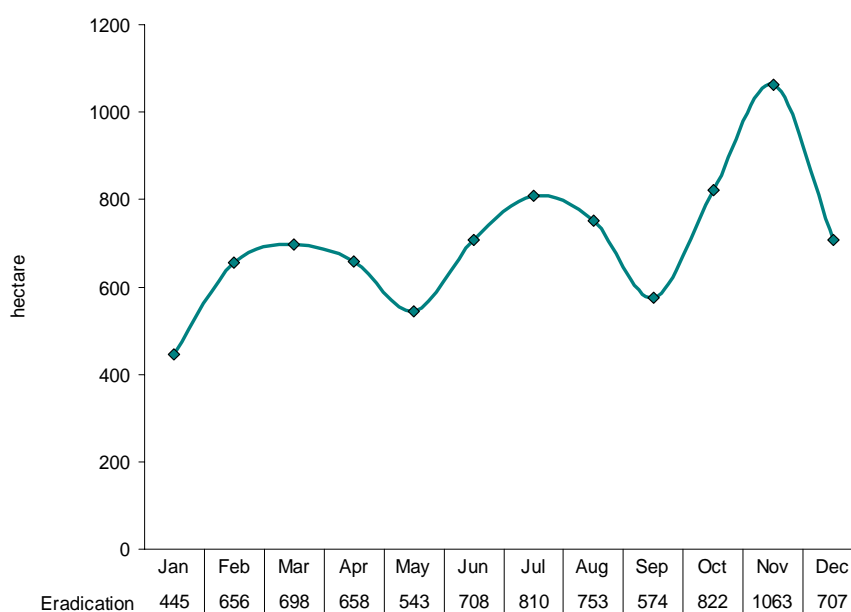
In 2004, the Bolivian Government reported the eradication of 8,437 ha of coca fields. Only 4 ha were reported eradicated in the Yungas of La Paz and the remaining 8,433 ha in the Chapare region. A similar pattern was also shown in previous years. In 2004, the level of reported eradication decreased by 16% compared to the level of eradication in 2003. In Bolivia, the eradication of coca cultivation is exclusively manual, and no chemical or spraying agents are used.

Figure 21. Reported eradication and coca cultivation in Bolivia, 1995 – 2004 (ha)



Eradication in the Chapare was often opposed by the farmers. However, the agreement authorizing temporarily coca farmers to grow up to 3,200 ha of coca in the Chapare somehow relieved the tensions between farmers and eradication forces. It resulted in a peak in eradication in November 2004.

Figure 22. Reported monthly eradication in Chapare in 2004 (ha)



The Bolivian government also reported the eradication of coca seedlings in the Chapare region.

Table 23. *Reported monthly eradication of coca seedlings, 2003 -2004*

	2003	2004
January	1,460	1795
February	1,415	2830
March	4,520	3296
April	4,013	2936
May	2,352	2989
June	2,972	5411
July	5,962	6963
August	10,140	4344
September	6,438	3156
October	9,978	4470
November	7,280	5869
December	3,294	5488
Total	59,823	49,547

Source: DIRECO



Eradication of a recently harvested coca field in the Chapare

2.6 REPORTED SEIZURE

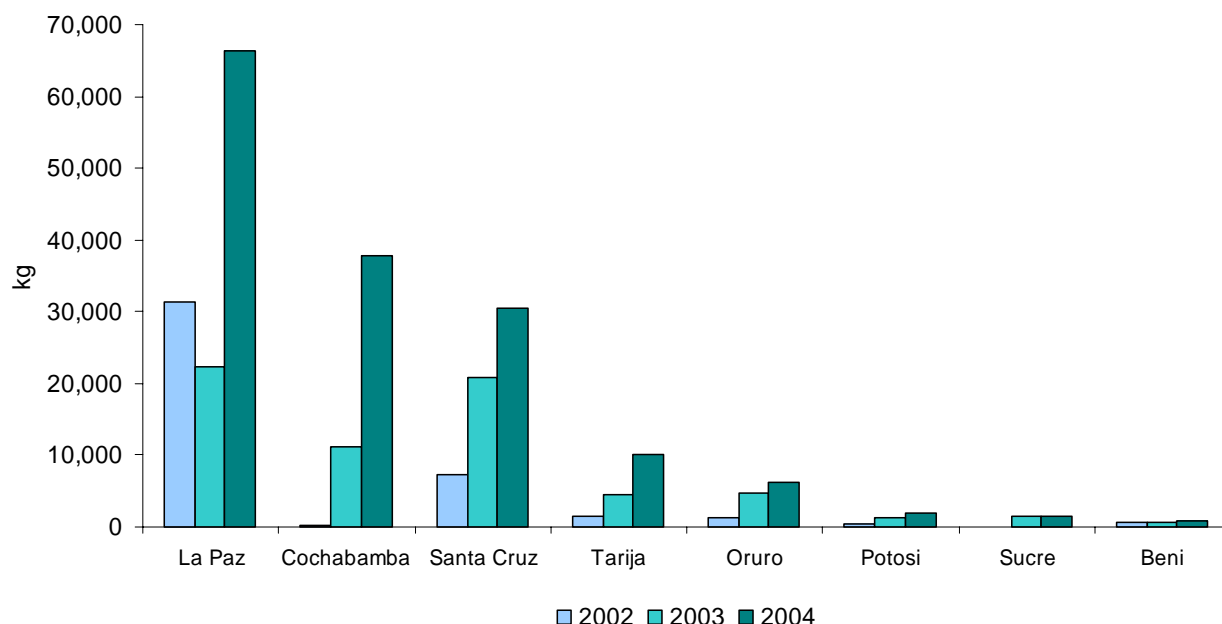
DIGECCO controls the trade of coca leaves within the country, which also includes control over the transport of coca leaves. Coca leaves are seized if transported without license or outside the authorized route specified in the license. In 2004, DIGECCO reported the seizure of 155 metric tons of coca leaves, representing an increase of 132% compared to the 2003 reported seizure of 67 metric tons. The increase can be attributed to the strengthening of DIGECCO's special force the control of coca leaves transportation (Grupo Especial de Control de la hoja de Coca, GECC) as well as the increase in production of coca leaves and the trafficking.

In addition, it should be noted that 27 metric tons of coca leaves from Peru were seized mostly in La Paz department, representing 26% of the total seizure in Bolivia. There were no reports in previous years on seizures of Peruvian coca leaves. The much higher prices for coca leaves in Bolivia (US\$ 5.0/kg) than in Peru (US\$ 2.8/kg) probably triggered the smuggling of coca leaves from Peru to Bolivia through the border post of Desaguadero, next to the Lake Titicaca.

Table 24. *Reported seizure of coca leaves, 2002 – 2004 (kg)*

Department	2002	2003	2004
La Paz	31,291	22,375	66,396
Cochabamba	214	11,105	37,748
Santa Cruz	7,343	20,828	30,441
Tarija	1,407	4,451	10,183
Oruro	1,205	4,682	6,120
Potosi	357	1,321	1,942
Sucre	0	1,450	1,448
Beni	728	600	904
Pando	0	0	-
Total:	42,544	66,811	155,182

Reported seizure of coca leaves, 2002 – 2004 (kg)

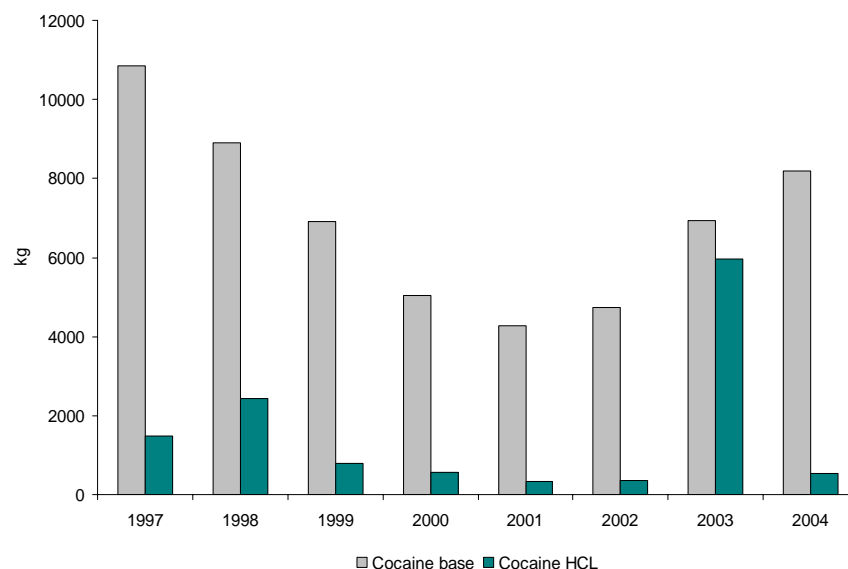


The Special Force for the Fight against Drugs (FELCN) reports annually on drugs seizures. There was a significant increase of 18% in seizure of cocaine base between 2003 and 2004. Seizures of cannabis also rose sharply to reach a record high of 28,200 kg.

Table 25. *Reported seizure of drugs, Bolivia, 1997 – 2004 (kg)*

	1997	1998	1999	2000	2001	2002	2003	2004
Cocaine base	10,848	8,906	6,905	5,044	4,280	4,741	6,934	8,189
Cocaine HCL	1,477	2,440	802	555	334	362	5,969	531
Heroin	2.9	0.8	0	0	0	0	0	0
Cannabis	3,617	320	2,160	3,745	7,055	8,754	8,510	28,200

Source: FELCN

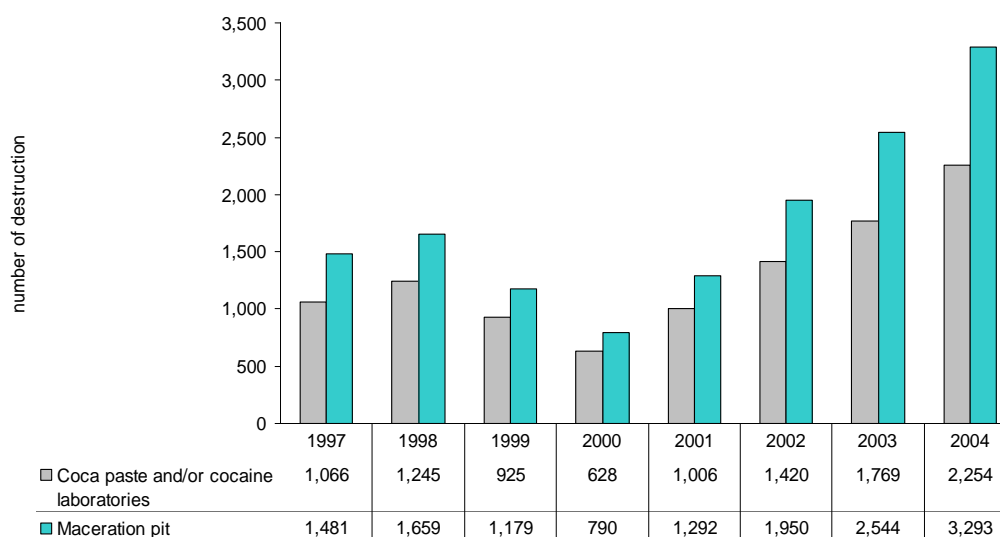
Figure 23. *Reported seizure of cocaine base and cocaine HCL, Bolivia, 1997 – 2004 (kg)*

The peak in seizure of cocaine HCL in 2003 was due to an exceptional operation conducted by FELCN. The graph also showed that seizure of coca paste increased steadily since 2001, in line with the increase in coca cultivation. The same trend can be seen in the report of destruction of maceration pit and clandestine coca paste or cocaine laboratories.

Table 26. *Reported destruction of clandestine laboratories and macerations pits*

Type	1997	1998	1999	2000	2001	2002	2003	2004
Precursors laboratories	19	15	8	3	2	6	0	3
Cocaine laboratories only	10	4	3	17	3	1	0	4

Source: FELCN

Figure 24. *Reported destruction of clandestine laboratories and macerations pits*

3 METHODOLOGY

3.1 COCA CULTIVATION

The monitoring of coca cultivation in Bolivia is based on the interpretation of satellite images. For the 2004 census, a total of 10 SPOT5 images and 14 IKONOS images taken between June and November 2004 were analyzed. The images covered a total of 41,901 square km over the known coca growing areas of Bolivia, or 4% of the entire territory.

1) Identification and acquisition of the image

The Bolivian 2004 coca survey was based on the use of SPOT5 images over the Chapare and Apolo regions and on IKONOS images over the Yungas of La Paz.

Table 27. Satellite images used for the 2004 survey in Bolivia

Region	Sensor	Resolution	Bands	Total area in square km
Yungas	IKONOS multispectral	4 meter	Red, Green, Blue, near infrared	5,901
Chapare	SPOT5	5 meter	X1, X2, X3, near infrared, mid infrared*	28,800
Apolo	SPOT5	5 meter	X1, X2, X3, near infrared, mid infrared*	7,200
Total				41,901

* 10 meter resolution

In 2003, the Chapare region was surveyed with IKONOS images, covering 20,000 square km. In 2004, SPOT5 image were used, and because of their fixed sizes (60 km x 60 km), the area covered with satellite images reached 28,800 sq km. The cloud cover in all scenes was less than 15%.

In Apolo, with the acquisition of SPOT5 images, the project updated the coca cultivation cadastre performed on the ground by DIRECO in the course of 2004.

SPOT5 possesses very good characteristics for crop monitoring. With a spectral sensitivity from the visible to the medium infrared and a spatial resolution of 5 meter for the visible to near-infrared and 10 meter for the medium infrared, SPOT fulfils the requirements for vegetation monitoring.

In 2004, in the Yungas of La Paz, the project focused exclusively on the areas where coca cultivation was identified in 2003, thereby the IKONOS coverage was reduced to 5,901 sq km in 2004, over 12,000 sq km in 2003. IKONOS multispectral images provided data at a four-meter spatial resolution in four spectral channels: the visible red, green and blue bands, plus one near infrared band.

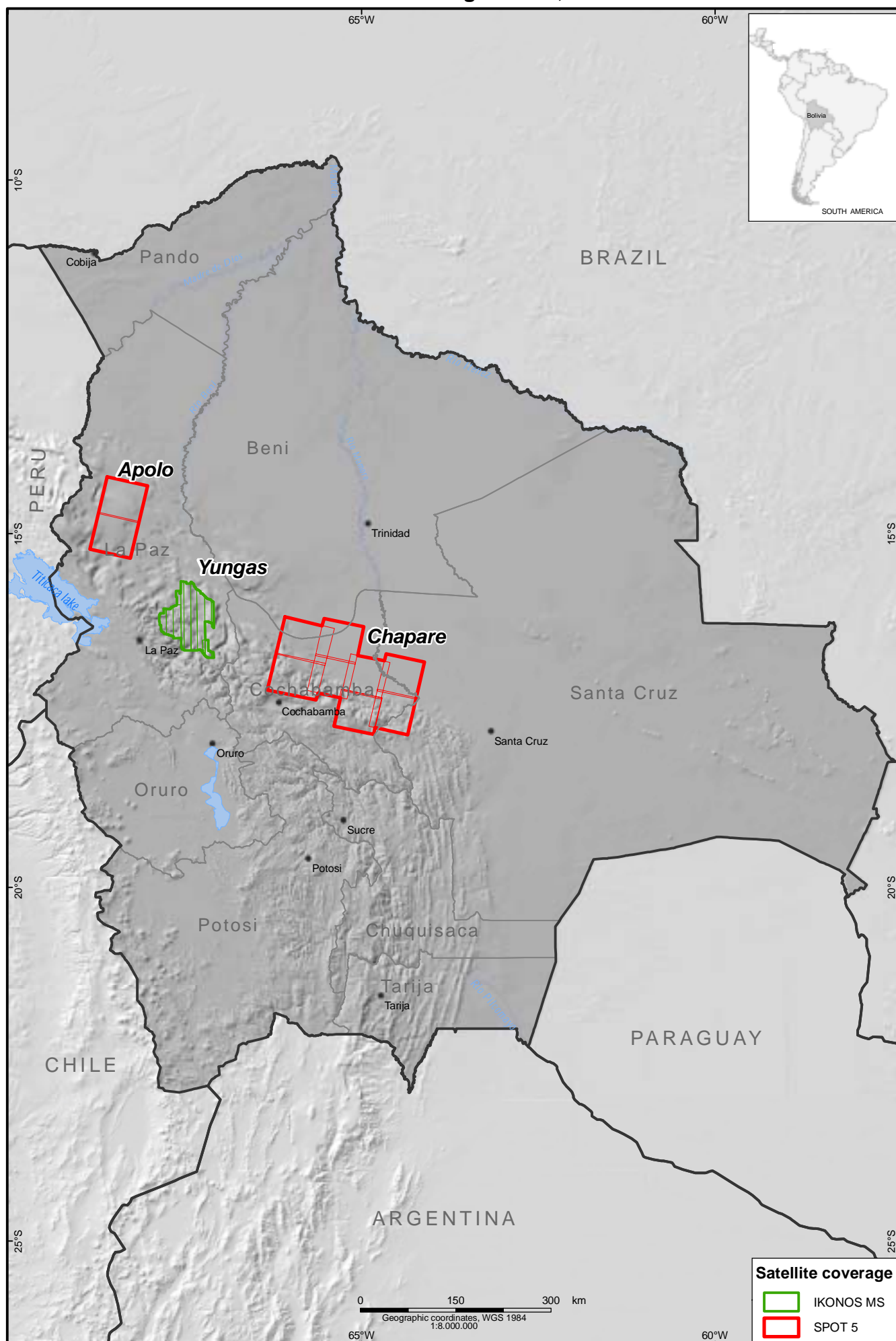
2) Image pre-processing

The IKONOS images were acquired in the ortho kit mode. They were first ortho-rectified using a DEM with a 20 meter vertical resolution and ground control points.

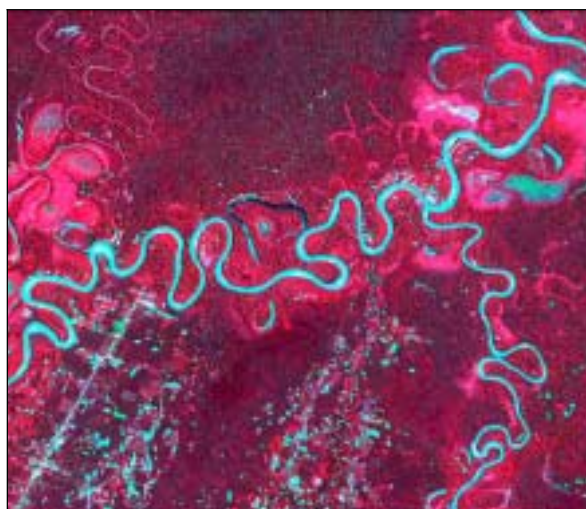
The SPOT5 images were acquired at the level 2A, i.e. with radiometric correction by CCD normalization and standard geometric correction for the UTM projection. Base maps and GPS points acquired by project staff was used to geo-reference the SPOT5 images.

Radiometric and spatial enhancements were performed on the images in preparation of the visual interpretation of coca field. For the SPOT5 images, a natural colour image at 10 meter resolution was generated.

Location of satellite images used, Bolivia 2004



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



SPOT 5, false colour



SPOT 5, natural colour after algorithm application

3) Digital classification of land use and vegetation

Over the IKONOS images, the project performed a supervised pre-classification using the fuzzy logic and Fourier algorithms to determine the main spectral signatures present on the images. The SPOT5 images were pre-classified using the Fourier algorithms. The pre-classifications were checked and analysed during field verification exercises. Based on the finding of the field verification, the images are then re-classified.

The automatic land cover classification is not used to detect coca cultivation, but rather to study broadly the various land classes present on an image. That initial step helped to identify the areas where coca cultivation could be interpreted visually.

4) Visual interpretation of coca fields

The classification of coca fields parcel by parcel, relied on the visual interpretation of satellite images. The detection is based on the spectral characteristics, the shape, the texture, the context and the surroundings of the fields. No distinction is made between the different phenological stages of coca bushes.

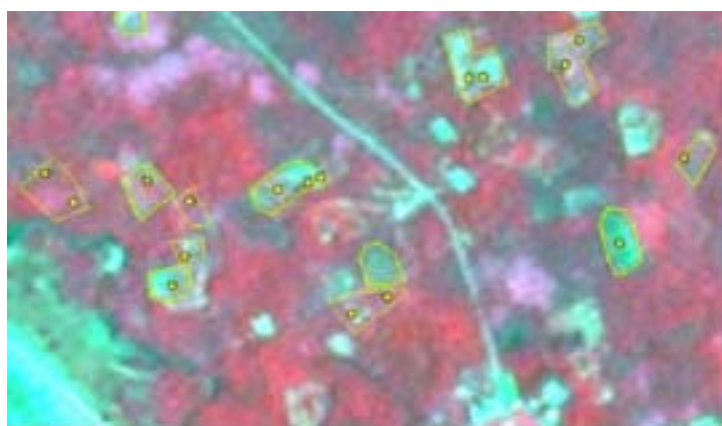


The town of La Asunta, in the Yungas of La Paz, and interpreted coca fields delineated in black over an IKONOS image taken in 2004

In the traditional and densest area of coca cultivation of the Yungas of La Paz, coca is the dominant crop. The large size of parcels and the relative absence of other crops that could create confusion, make the identification of coca fields by visual interpretation less complicated than in areas where other agricultural activities take place.

In Chapare visible coca fields were interpreted the same way as in the Yungas of La Paz. Additional steps were devised to account for interspersed coca cultivation. Field verifications revealed that most of the interspersed coca fields were bordering visible coca fields. In addition, these coca fields gave a particular spectral signature on the SPOT5 images. This spectral information combined with the knowledge obtained from the ground verification enabled to estimate the amount of interspersed coca cultivation. Additionally, the visual interpretation was facilitated by the ground control points of coca fields obtained from DIRECO eradication campaign and from ground verification. Jointly with the project experts, DIRECO personnel also participated actively to the visual interpretation of coca fields on the satellite images.

In Apolo, the visual interpretation of coca cultivation on the SPOT5 images was facilitated by the large quantity of ground reference data collected by DIRECO. In 2004, DIRECO conducted a coca cultivation cadastre in Apolo region, measuring in situ all the coca fields.



DIRECO ground points in yellow, and the coca fields delineated in yellow line over a SPOT 5 image, 2004

5) Field verification

The use of high-resolution satellite images alone is not enough for an accurate measurement of coca cultivation without adequate field verification. The data collected during the field verification enabled to delineate the survey area, determine the spectral signature of coca and other crops and correct the confusion between crops after the initial classification.



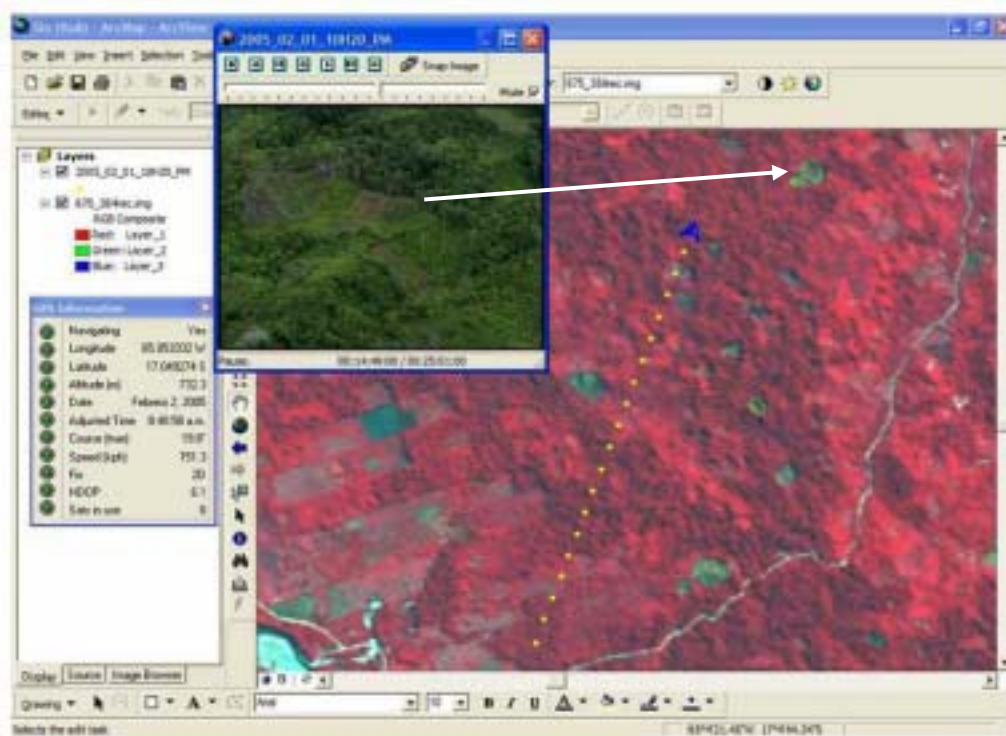
Taking a GCP in a recently established coca field in Caranavi, the Yungas of La Paz, 2004

The project obtained a large number of ground reference data, starting in 2002 in the Yungas of La Paz and, as of 2003, extending to Chapare and Apolo. Since 2002, more than 6,000 ground reference data were collected, of which 2,000 in 2004. The points have been obtained directly from the ground, using regular GPS techniques.

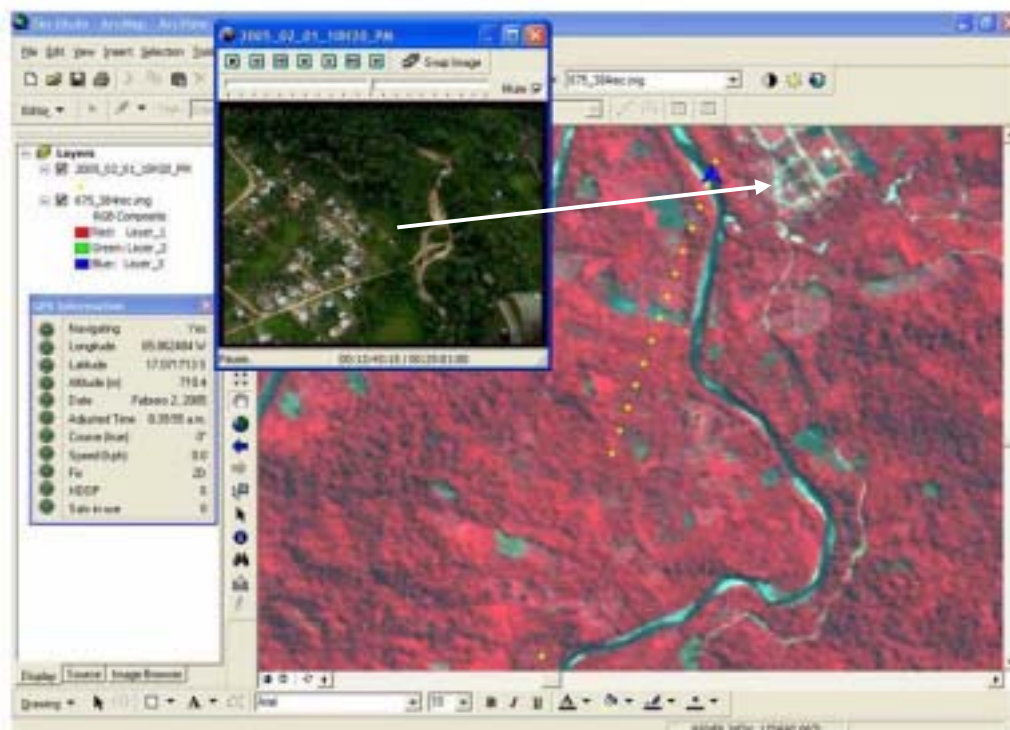
While it is relatively easy to collect ground reference data in the Yungas of La Paz directly from the field, the poor security situation prevailing in Chapare region made the collection of ground reference data difficult and risky. To a large extent, the project obtained the reference data from helicopter flights, and in 2004, 18 hours of flights were organized jointly with DIRECO. The helicopter flew about 450 meters above the ground, either describing circles around pre-defined area of interest, or following straight lanes oriented North-South.

In addition, during the helicopter flights in the Chapare area, the project also acquired geo-referenced videos. Played back on the computers, this geo-referenced video facilitated the interpretation of the satellite images. This cutting-edge technology released in June 2004 greatly helped the project for a more precise interpretation coca fields.

In Apolo, in addition to the coca cultivation cadastre conducted by DIRECO, the project conducted its own field verification mission and interpretation of SPOT5 images. The results of both surveys were very similar, DIRECO reporting 289 ha, while the monitoring project measured 273 ha, rounded to 300 ha.



Examples of the application of georeferenced video: the yellow dashed line is the helicopter track, the blue arrow shows the location of the helicopter at the moment the video was taken (see snapshot frame). The snapshot corresponds to the coca field the arrow is pointing at on the false colour SPOT 5 image. Coordinates and altitude are displayed on the left side of the screen.



Snapshot of video showing the village of Alto San Pablo in Chapare, 2004

6) Accuracy assessment

In addition to the ground data used for verification of the pre-classification and the determination of the spectral signature and characteristics of coca cultivation and main crops, the project also collected ground reference data from the Yungas of La Paz to measure the accuracy of the final interpretation.

The accuracy assessment is established by comparing a sample of reference data obtained from the ground and the image classification. The project followed the recommendation described by Russell and Congalton in "Accuracy assessment for remote sensing". In 2004, 890 ground reference data were obtained in the Yungas region from 11 land classes. They revealed accuracy for the coca class of 89% in 2004, compared to 86% in 2003.

The accuracy assessment methodology required that data are collected directly from the field. This requirement could not be met in the Chapare area throughout 2004 because of the poor security situation prevailing in the coca growing areas of the department of Cochabamba. Therefore, no accuracy assessment is available for this region.

Error matrix for the Yungas of La Paz in 2004

		Field checked classes (crop fields)											correct	sample	% correct
		Coca	Rice	Corn	Citrus	Banana	Coffee	Mixed crops	Other crops	Forest	Mixed weed	Prepared soil			
Interpreted classes (crop fields)	Coca	133	2	2			1	2	3		6	1	133	150	0,89
	Rice	4	69	3				4	6		3	1	69	90	0,77
	Corn	2	7	67			4	2	4		3	1	67	90	0,74
	Citrus				79		4	5		2			79	90	0,88
	Banana					77	3	5		4	1		77	90	0,86
	Coffee			2			48	5	2	8	5		48	70	0,69
	Mixed crops	4	3		5	2		49		3	4		49	70	0,70
	Other crops	5	4	2			3		43		3		43	60	0,72
	Forest				3			5	2	47	3		47	60	0,78
	Mixed weed	2				3			2		53		53	60	0,88
	Prepared soil	1	3	1					3			52	52	60	0,87
TOTAL		151	88	77	87	82	63	77	65	64	81	55	717	890	0,81

Figure 25. Methodological workflow for the Chapare region (Spot5)

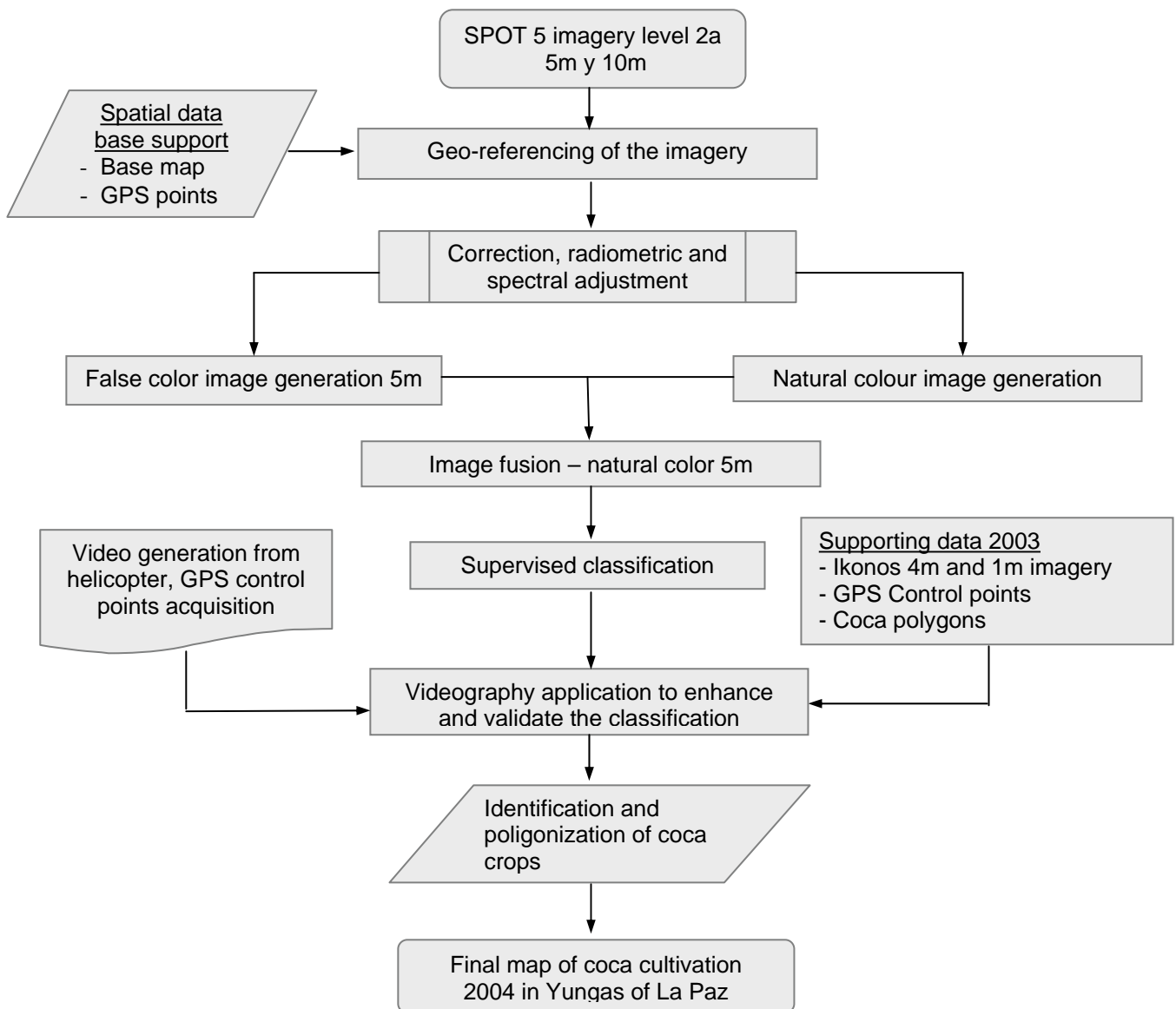
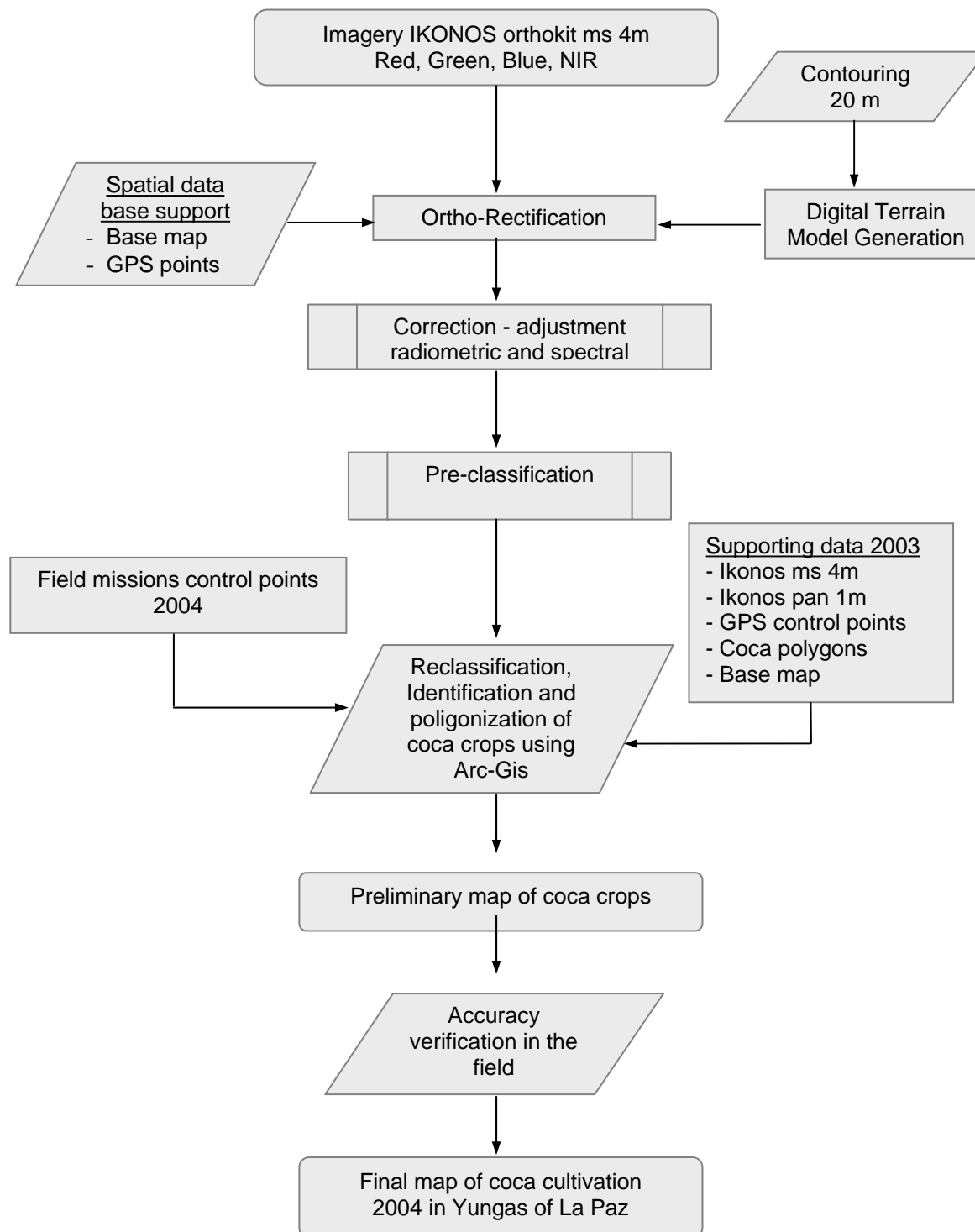


Figure 26. Methodological workflow for the Yungas region (Ikonos)



3.2 YIELD AND PRODUCTION OF COCA LEAF

In July 2004, UNODC started its first study of coca leaf yield in Bolivia. Thirteen fields of the Yungas of La Paz were selected and data collected from a sampled plot within these fields on the coca leaf fresh and sun-dried weight. The main problem was to secure the collaboration of the farmers who are often reluctant to participate to such study. The tense situation prevailing in the coca growing areas of Bolivia in 2004 did not permit to complete all the activities planned for the yield assessment and only the July and September harvests could be studied. Therefore no annual estimate could be derived. UNODC plans to continue collecting data on coca leaf yield in 2005.

For the 2004 annual estimate of coca leaf and cocaine production, UNODC continues to rely on information available from other sources. The most comprehensive work on the subject was done by the US Government during the operation Breakthrough.

3.3 PRICES

The project collected coca leaf prices from farmers in the Yungas of La Paz on an ad hoc basis while performing the field verification missions. In the Chapare region, prices of coca leaf were collected by DIRECO on a monthly basis throughout 2004 in three points of the department of Cochabamba.