



UNITED NATIONS
Office on Drugs and Crime

PERU

Coca Survey for 2002

March 2003



Abbreviations

ENACO	National Coca Firm
GIS	Geographical Information Systems
GPS	Global Positioning System
ICMP	UNODC Illicit Crop Monitoring Programme
UNODC	United Nations <i>Office on Drugs and Crime</i>
CONTRADROGAS	Committee for the Fight Against Drug Consumption
DEVIDA	Development and Life without Drugs
CORAH	Control and Reduction of Coca Leaf in Upper Huallaga

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1. Summary

Under its global Illicit Crop Monitoring Programme, UNODC has been assisting the Peruvian Government in the development of a national coca monitoring system since 1998. Annual surveys have been implemented since 2000. The report presents the findings of the coca survey for 2002.

In Peru, coca cultivation is concentrated in six main areas (Apurimac, the upper Huallaga, La Convention-Lares, Sandia, Aguaytia and Central Selva). The estimation of coca cultivation is based on the interpretation of satellite images covering the entire coca growing areas, complemented by field verifications and the use of a previously established detailed cartography of the coca cultivation areas.

The total area under coca cultivation in Peru was estimated at about 46,700 ha in 2002. This represented an increase of 1% compared to the 2001 estimates of 46,200 ha. Despite the small increase, the level of coca cultivation remained well below the cultivation levels recorded in the mid-1990s. Concerns regarding a possible displacement of coca cultivation from Colombia to Peru, as a consequence of the increased eradication campaign and reduction in the coca area in Colombia during the last two years, did not materialize in 2002.

Coca cultivation in Peru, 1992-2002 (ha)

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
129,100	108,800	108,600	115,300	94,400	68,800	51,000	38,700	43,400	46,200	46,700

The overall stability masked variations at regional level. Decreases in coca cultivation were observed in the areas of La Convention-Lares (-13%) and in Sandia (-4%), while increases were recorded in other areas, such as Apurimac (+12%), the upper Huallaga (+6%) and Aguaytia (+1%). Coca cultivation remained stable in other areas such as Central Selva.

The total production of dry coca leaf for 2002 was estimated at 52,500 metric tons, with a country average yield of about 1,100 kg of dry leaf harvested per hectare. There are however regional variations: annual yields varied from 400 kg/ha (La Convention-Lares) to 2,200 kg/ha (Apurimac).

After the steep decline in coca prices in 1995-96, a progressive recovery has now brought prices back to the relatively high level of 1994. The average price for dry coca leaf on the illicit market reached 2.5 US\$/kg in 2002, with a maximum of 2.9 US\$/kg in August and a minimum of 2.1 US\$/kg in April. In some areas, increasing coca prices have created an incentive for farmers to reactive abandoned coca fields.

In 2002, the government reported the eradication of 7,200 ha of coca fields. This represents the third largest report of eradication since 1983. In Peru, eradication is conducted manually as chemical eradication is prohibited.

Although, probably still at relatively low levels, there are indications that opium poppy cultivation has spread in recent years in Peru. Given this trend, the monitoring system will develop a methodology to detect opium poppy fields in future years.

PERU - COCA SURVEY FOR 2002 – March 2003

2. Introduction

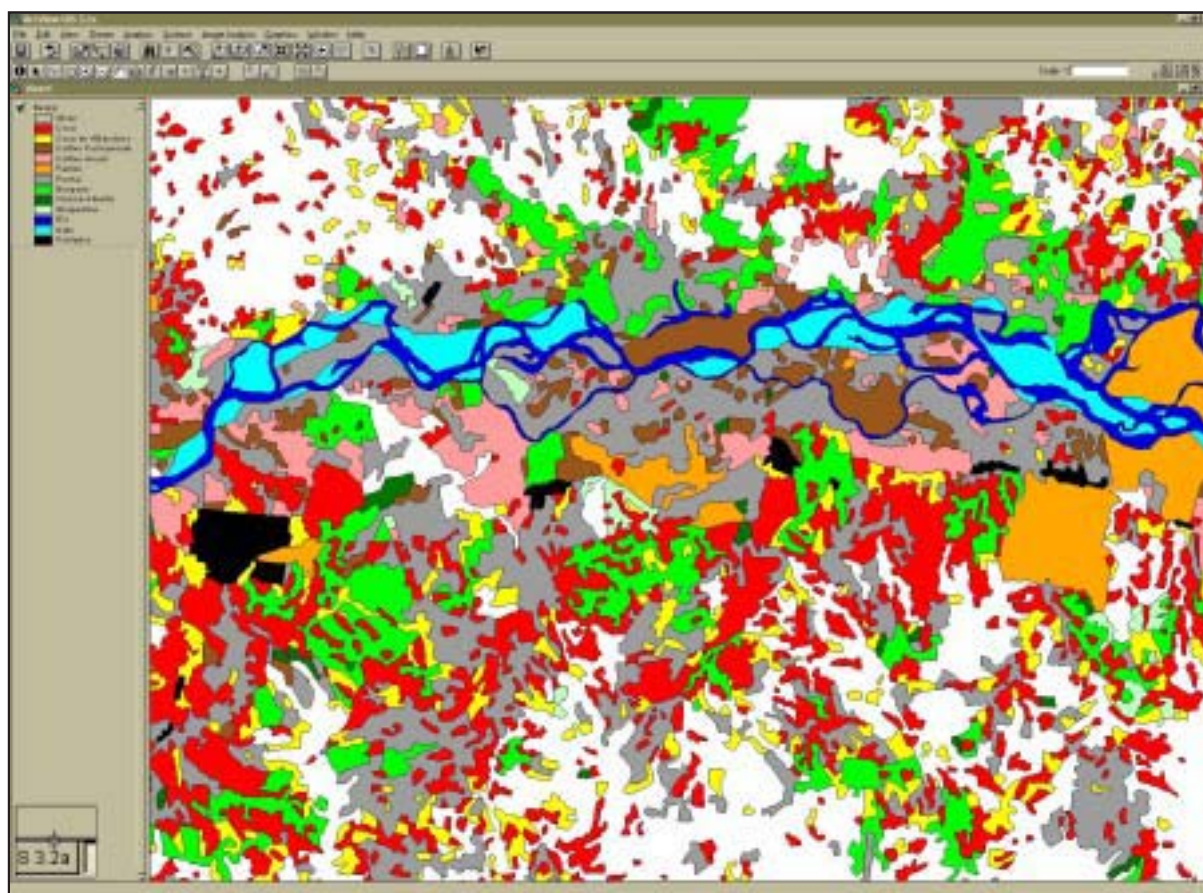
2.1 Monitoring of coca cultivation in Peru

In 1994, Peru adopted a “National Drug Prevention and Control Plan”. The Plan, which describes the country's drug control policy, acknowledged that the lack of reliable and updated data on coca cultivation areas prevented a proper analysis of the national drug problem.

The plan therefore included in its priorities the establishment of an information system to provide reliable data on the location, extent, productivity and dynamics of coca cultivation. The information system would enable the government to assess the social and environmental implications, as well as the effectiveness, of interventions in the areas where coca is cultivated.

In response to decisions of the 1998 UN Special Session of the General Assembly on drug, UNODC developed a global Illicit Crop Monitoring Programme (ICMP). ICMP assists Member States in establishing systems to monitor the illicit cultivation of opium poppy and coca bush. It is currently active in six countries: Colombia, Peru, Bolivia, Afghanistan, Myanmar and Laos.

In Peru, UNODC worked with CONTRADROGAS to develop such a coca monitoring system in 1998. Using aerial photography, the project produced a detailed mapping (at 1/20,000 scale) of all the coca cultivation areas in 2000. Subsequently, in 2001 and 2002, satellite images were used to update the estimates. This report presents the 2002 findings.



Integrated Data Base corresponding to the Monzón River (zero year)

Topic:

Current use of the land including coca crops in production (red) and abandoned (yellow).

2.2. Legal status of coca cultivation in Peru

The General Law on Drugs enacted in 1978 prohibits the cultivation of coca and seedlings in new areas of the national territory, including grafting and renovation of existing coca bushes. In 1978, another law established the National Coca Firm (ENACO) with a monopoly on the commercialization and industrialization of the coca leaves. Therefore, selling coca leaves to another party than ENACO is illicit.

The Government also established a Committee for the Fight Against Drug Consumption (CONTRADROGAS), renamed Development and Life without Drugs (DEVIDA) in 2001. Its objectives are to design, coordinate and implement actions geared towards the prevention of drug consumption.

2.3. Evolution of coca leaf cultivation in Peru

Until the mid-1990's, Peru was the main coca cultivating country in the world. Since then, Peru has become a distant second, behind Colombia.

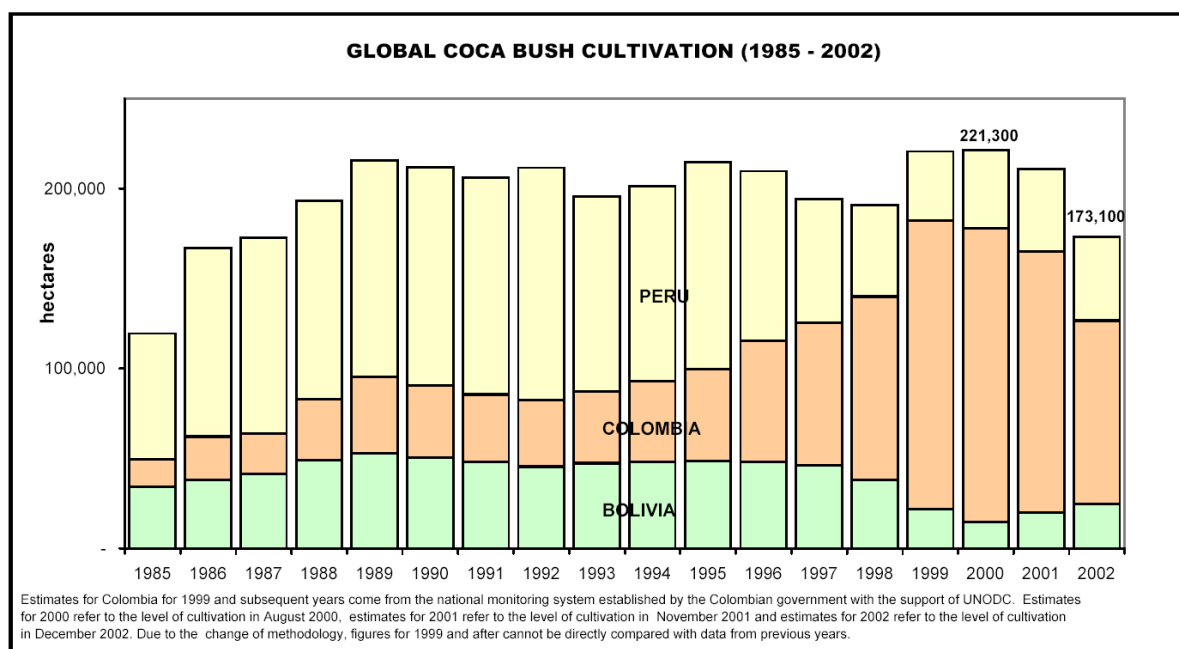


Figure 1: Trends in global coca bush cultivation (1985-2002)

Source: UNODC *Global Illicit Drug Trends*

The reduction in the levels of coca cultivation in Peru in the mid-1990's was linked to the sharp decline in the coca leaf price and demand for Peruvian coca leaves. In 1995, the trade of coca leaves stopped on the local market and, from 1996 to 1998, the price of coca leaf remained lower than its production costs. Farmers abandoned their coca fields and coca cultivation dropped from 115,300 ha to 38,700 ha, or 66%, between 1995 and 1999.

After 1999, coca prices increased slowly while the price of licit crops (coffee and cacao) decreased. Farmers then started to re-activate their abandoned coca fields and coca cultivation rose again in Peru. To some extent, the increase has been contained by the introduction of eradication measures, both forced eradication conducted by CORAH (Ministry of Interior) and voluntary eradication conducted by DEVIDA.



Abandoned Coca Fields (Tocache)



Close-up view of an abandoned coca field. The proliferation and predominance of bush-size weeds is notable.



Re-activated Coca Field



Eradication conducted by CORAH (Peruvian Ministry of Interior)

2.4. Poppy cultivation

Ten years ago, low levels of poppy cultivation were observed in the northern area of Cajamarca department bordering Ecuador. In the past three years, eradication of opium poppy fields and seizures of opium latex have increased and been reported in five departments (Cajamarca, Piura, Amazonza, San Martin and Huanuco). The information provides an indirect indication of the spread and increase of opium poppy cultivation in Peru.

The UNODC supported monitoring system has not yet established a reliable methodology for the detection of opium poppy in Peru and no data was available for 2002.

3. Methodology

3.1 Organisation and staff

The survey team is composed of eight professionals: one co-ordinator, one agricultural engineer and three forestry engineers specialised in photo-interpretation, digital classification, cartography and GIS analysis, one system engineer specialised in multi-spectral analysis, one geographic engineer specialised in surveying, cartography and GIS, and one cartographic technician.

Staff from DEVIDA were trained in digital classification and remote sensing techniques and participated in the initial stages of the monitoring activities.

The project also relied on staff from UNODC alternative development project for the collection of data on prices and yield of coca leaf.

3.2 General pattern of coca cultivation in Peru

The coca bush is a resistant crop that prospers below 2,000 meters in many different regions of the eastern part of the Andes. It belongs to the *Erythroxylon* gender that groups around 250 species. Only two species contains cocaine: *Erythroxylon coca* which is cultivated throughout the higher and lower tropical rainforest areas of Peru, and *Erythroxylon novogranatense*, which is mainly cultivated in Colombia.

Coca bushes in Peru are cultivated in very small parcels of less than one hectare. About 80% of the coca fields are located on slopes of more than 20 degrees. Except in the Apurimac-Ene valley, the coca bush foliage does not fully cover the soil (from 40% to 60%).



Coca plant of the Erythroxylon coca variety

Coca bushes are not generally cultivated with other crops. However, during the past five years, a tendency to cultivate coca bushes under other plants canopy has been observed, suggesting an attempt to avoid aerial detection.



Pure coca field



Mixed coca field under canopy

in Peru, coca crops can be harvested from 3 to 5 times a year. The number of harvests per year depends on the field slope, the age of the plantation and the agricultural techniques applied.

In areas of traditional coca cultivation such as in the valley of La Convencion y Lares, in Cuzco department, the use of fertilizers is minimal and there are only 3 to 4 harvests per year. In areas oriented towards the illicit market, like in Apurimac-Ene, there are 4 to 5 harvests and even, in some cases, up to 6 harvests per year, due to the intensive use of agro-chemical and the higher plant density.

The harvest periods are closely related to the climatic conditions of the areas. In general, the first harvest is carried out between February and March. This is the period of highest precipitation and, consequently, the volume of coca leaf is higher than for any other harvests. The second harvest takes place 3 to 4 months later, i.e. between May and June. The third harvest, between August and September, and the fourth harvest, between November and December, are less productive because they coincide with the dry season.

The harvest periods determine the foliage density of the coca bushes and affect the spectral pattern of the coca fields on satellite images.



Coca harvesting labours - Apurimac-Ene



Drying and weighting of coca leaves

3.3 Coca cultivation

The coca census survey for 2002 was based on the acquisition of 14 satellite scenes covering a total area of 152,100 km² over the coca growing areas in Peru.

Ninety percent of the survey area was covered by 10 multi-spectral SPOT5 images acquired in September 2002. The pixel resolution of the SPOT5 multi-spectral sensor is 10 meters. This level of resolution is sufficient to differentiate coca crops from other crops, even in environments where coca fields are mixed with other crops.

Four LANDSAT7 were acquired when SPOT5 images were not available with less than 10% of cloud cover. LANDSAT7 have a resolution of 30 meters. These images were used in the southern sector of the Upper Huallaga area, the northern sector of Apurimac-Ene and Inambari-Tambopat and the valleys of Pichis and Palcuзу rivers.

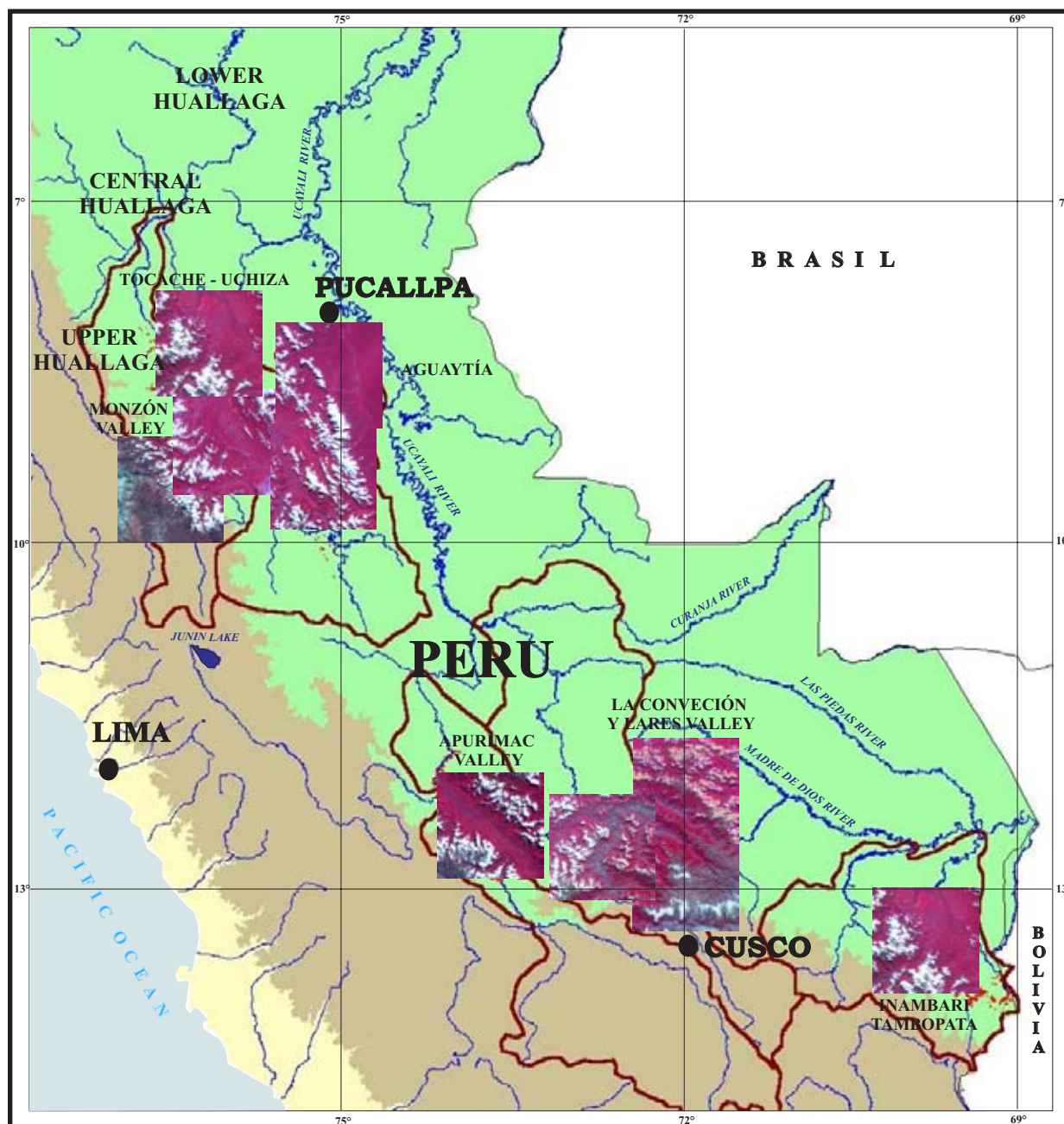
Table 1: Spot Images

ZONE	COVERAGE (Km ²)	REFERENCE	REGISTRATION DATE
LA CONVENCION Y LARES	3600	659 / 376	12/08/02
LA CONVENCION Y LARES	900	659 / 375	12/08/02
LA CONVENCION Y LARES	3600	657 / 375	12/08/02
APURIMAC	3600	655 / 375	11/08/02
UPPER HUALLAGA	3600	649 / 367	26/08/02
AGUAYTIA	1800	650 / 367	11/08/02
TINGO MARIA	900	650 / 369	11/08/02
UCHIZA	1800	648 / 367	11/08/02
UPPER MONZON	900	648 / 368	11/08/02
INAMBARI	1800	666 / 377	27/07/02

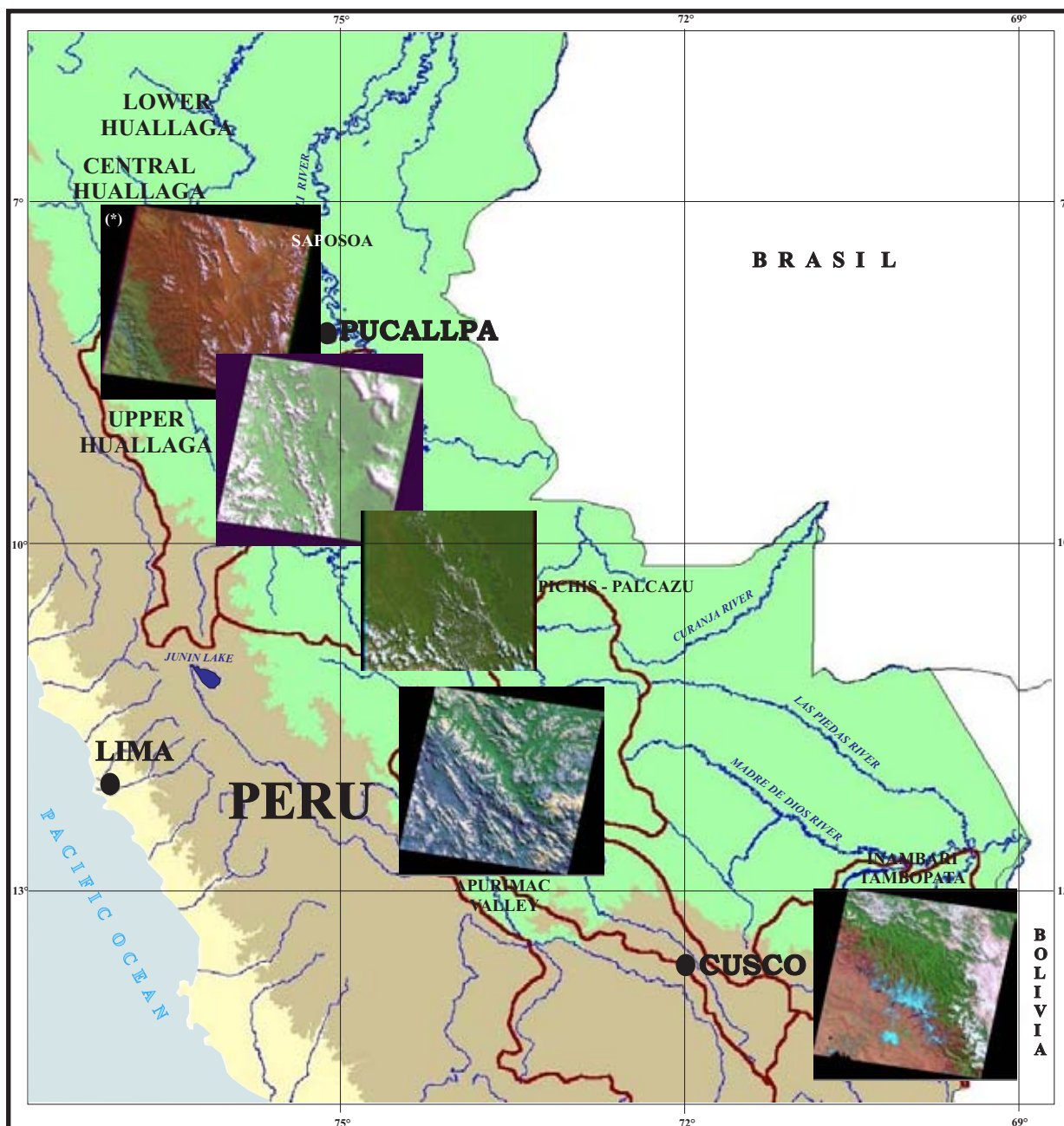
Table 2: Landsat Images

ZONA	COVERAGE (Km ²)	PATH / ROW	REGISTRATION DATE
APURIMAC	32400	005_069	14/07/02
INAMBARI	32400	002_070	12/08/02
UPPER HUALLAGA	32400	007_066	13/08/02
PICHIS	32400	006_067	07/09/02

Map 1: Satellite Coverage Map - Spot 5 2002



Map 2: Satellite Coverage Map - Landsat 7 2002



Categories of coca fields identified

As in 2001, only productive coca fields were taken into account in the implementation of the 2002 census survey. Productive coca fields can be grouped into the following five categories:

A) *Young coca fields*

This category corresponds to coca fields from 6 to 12 months old. The coca foliage coverage accounts for 20% to 40% of the spectral characteristics of these fields, while the remaining spectral characteristics come from the soil. As the soil spectral characteristics plays an important part in the identification of these coca fields, ground information and previous year's mapping information are crucial.



Coca fields in growing stage. Apurimac river valley

b) *Mature coca fields*

This category corresponds to coca fields from 12 to 24 months old and older coca fields during a period of 3 to 4 months after each harvest. Coca fields have a high coca foliage density at this stage and therefore show a high level of contrast on the satellite images.

Generally speaking, the higher the coca plants density, the higher the contrast on the satellite image. It is therefore easier to identify coca fields in areas where the coca plant density is high, like in Apurimac, than in areas where the coca plant density is lower, like in Monzon and La Convencion y Lares.



Crops under development Apurimac



Foliage maturity Apurimac



Crops under development Apurimac



Foliage maturity Apurimac

c) *Harvested coca fields*

This category corresponds to coca fields on which the leaves have been harvested and only nude plants and stems remain. Most of the spectral characteristics of these fields come from the colour of the soil. The identification and mapping of these fields therefore requires the use of additional information, such as the results of the 2001 census, as well as field data on the surrounding environment.



Harvested coca crops

d) *Rehabilitated coca crops*

This category corresponds to abandoned coca fields recently rehabilitated. The rehabilitation process includes weeding and planting of new coca plants in addition to old coca plants. These coca fields can be productive in a very short time and the first harvest can already take place 3 to 4 months after the rehabilitation.

The spectral characteristics of these fields are the same as for mature coca, but the use of the 2001 coca mapping

enables to identify these rehabilitated coca fields.



Rehabilitated coca Apurimac

e) *Mixed crops*

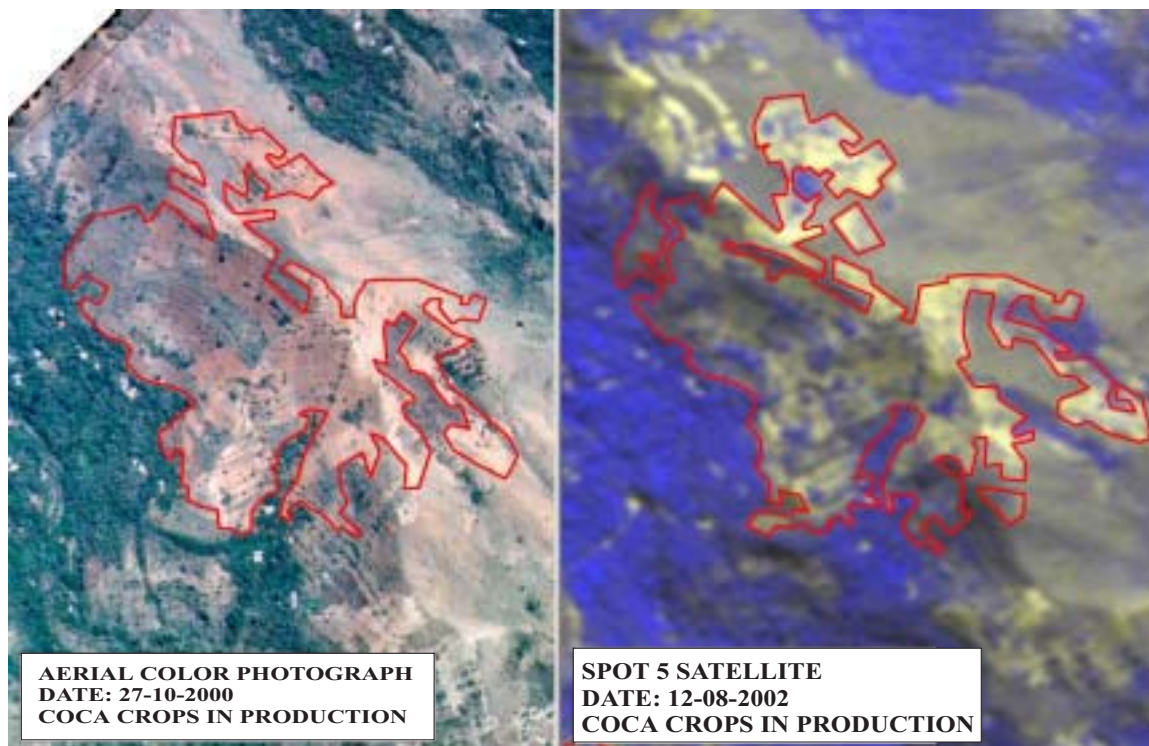
This category includes parcels where the coca crop, while maintaining its structure in the field (furrows and/or alternating lines), share the ground with licit crops. Associated crops are generally annual agricultural products, such as maize and cassava.

The spectral characteristics of these fields are given by the combination of the spectral characteristics of the coca foliage, the associated crop and of the soil.

Classification of coca fields on training areas

The satellite images were first geo-corrected using ground control points, national base maps (scale 1/50,000) and 2001 ortho-rectified images.

The appearance of the coca fields on the satellite images depends on the field slope, the sun exposure (shaded or sunny areas of the satellite images), and the stage of vegetation development. Based on their extensive field experiences and the 2000 mapping of all coca fields from aerial photography ("year zero"), the technicians defined the various interpretation patterns of the different coca fields categories on training areas.



Once these patterns were defined, coca fields were then visually interpreted and their borders digitized on the screen. The best combination of the SPOT5 spectral bands on the screen colour channels were:

a) for medium to high levels of foliage coverage

Screen colour channel	SPOT5 spectral band
Red	Band 4
Green	Band 3
Blue	Band 2

b) for low level of foliage coverage and mixed crops

Screen colour channel	SPOT5 spectral band
Red	Band 2 and 1
Green	Band 2
Blue	Band 4

The classification results of the training areas were then printed on a map at a scale of 1:50,000 for field verification.

Verification and correction of interpretation patterns

The field verification of the training areas concluded that the crops and land uses that were more likely to be confused with coca fields were: “purmas” (areas predominantly covered with shrub), annual crops with short vegetation period, small areas covered with pastures and recently cleared areas.

These conclusion enabled to correct the preliminarily identification patterns, and to better characterize the confusing crops.

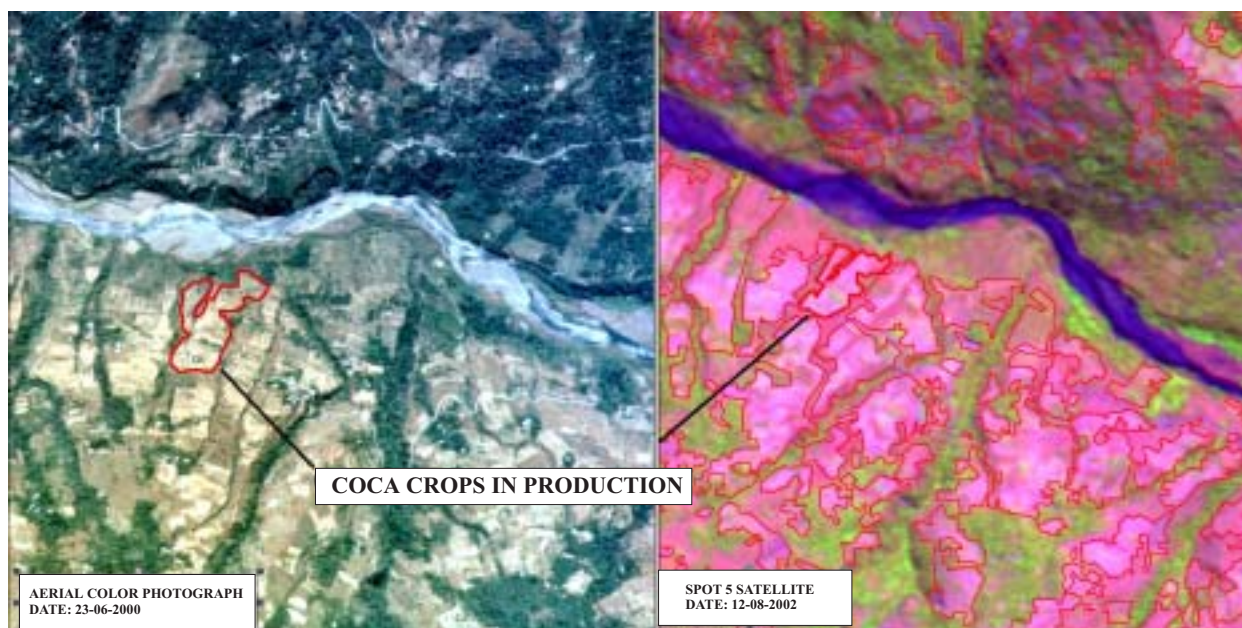
Final Classification

After the interpretation patterns were corrected and adjusted, coca fields were classified in the entire survey area.

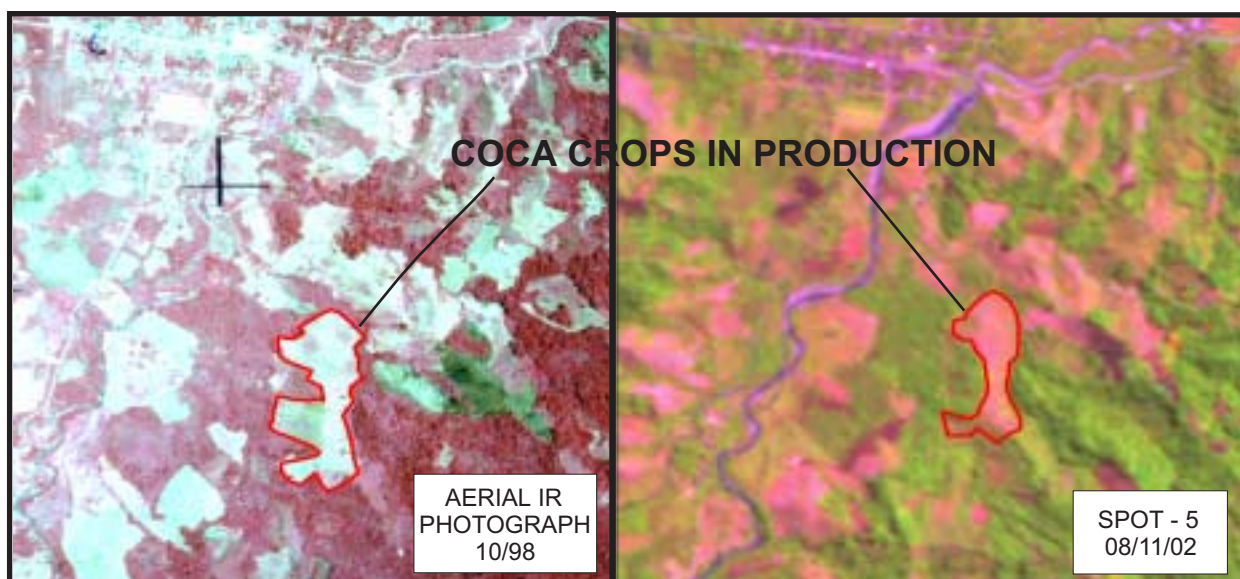
A total of 36,966 polygons areas (polygons) classified as coca cultivation were digitised; 10,928 in Apurimac-Ene; 8, 260 in Upper Huallaga; 5,300 in La Convencion y Lares; 5,200 in the Monzon river basin and 7,178 in the remaining basins.

During the classification process, the “year zero” mapping from aerial photography (scale of 1:20,000) was used as follows:

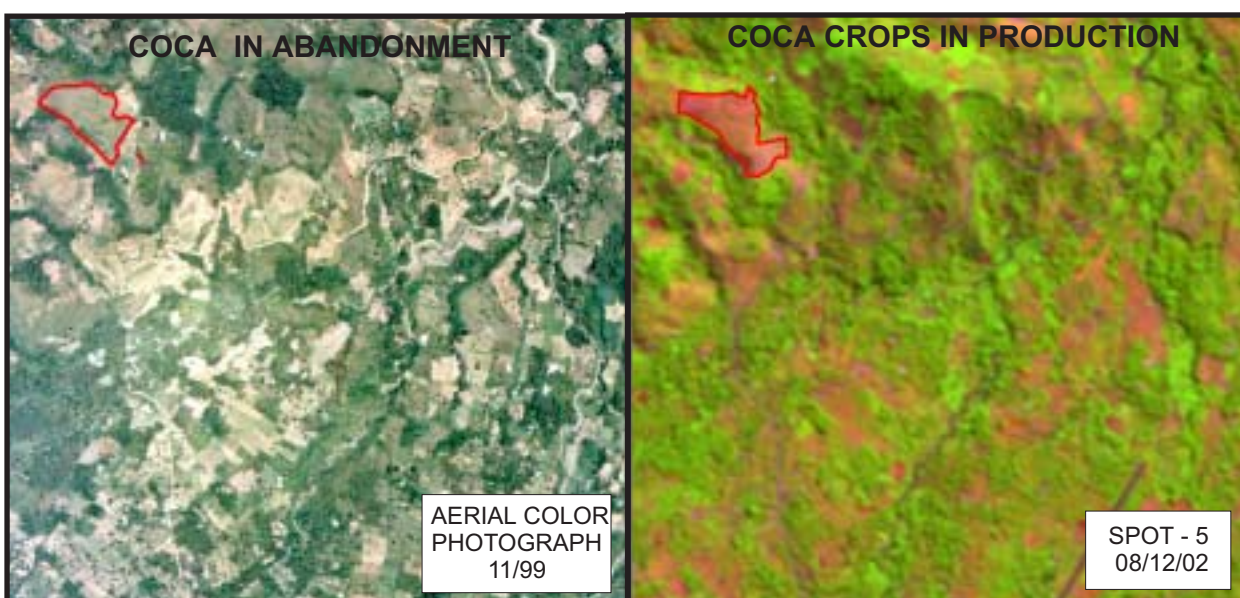
a) Comparison between the 2000 and 2002 land uses to ascertain the interpretation of coca fields on the 2002 satellite images.



b) Definition of the limits of the 2002 survey area



c) Identification of land use changes



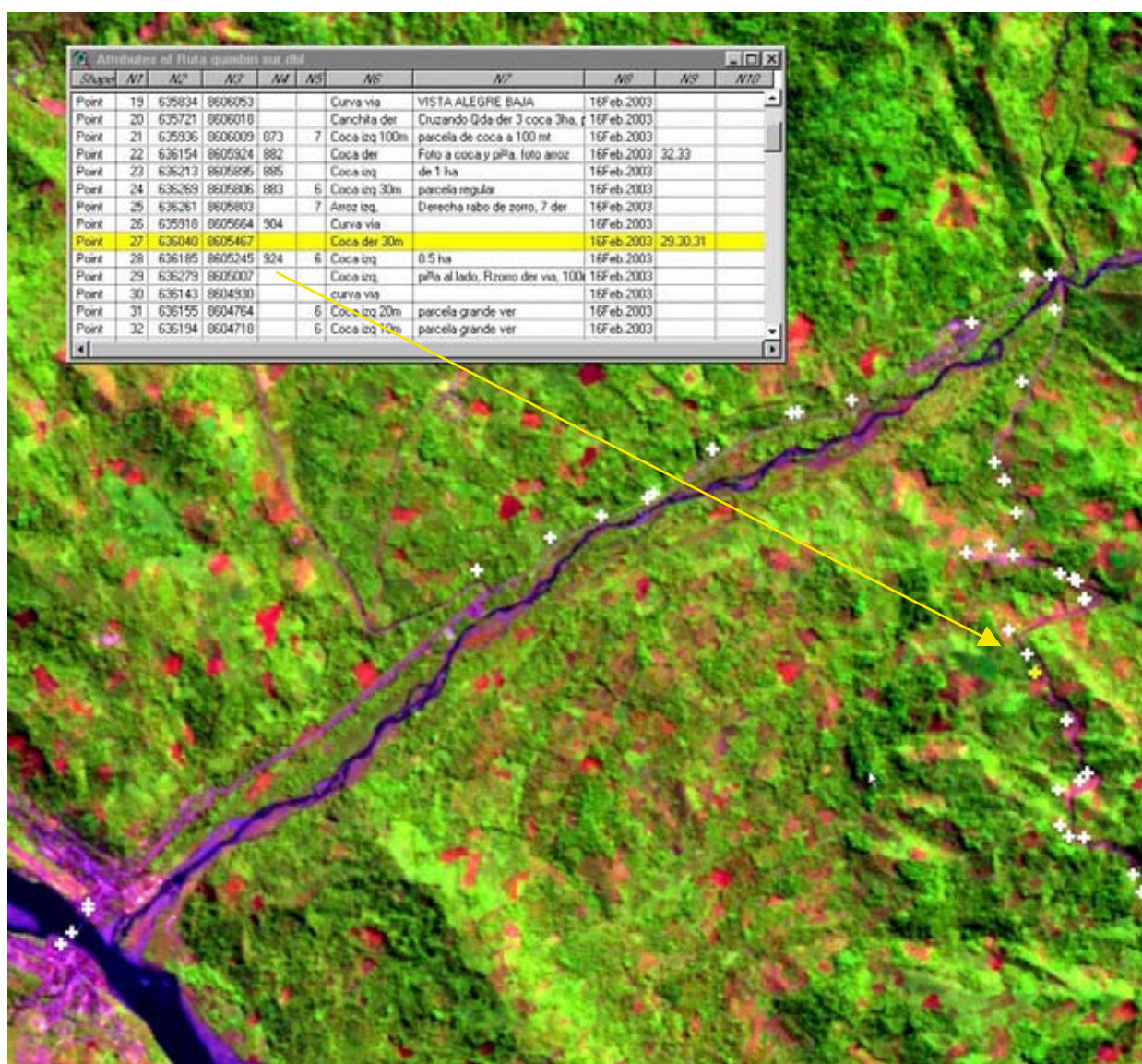
Previous year's ground control points and mapping of coca fields were also used as reference information, in particular to identify the presence of new cultivation areas.

Verification of results

The verification of the classification results was based on the “year zero” aerial photographs at a scale of 1:20,000 and the GPS points taken in the field. A total of 1,800 geo-referenced points were used over coca fields in various stages, and 1,300 points for other crops and land uses. The following figure shows an example of the registration format and of the corresponding geo-referenced location of the registered points.

The overall accuracy for the classification of coca cultivation was calculated at 88%.

Figure 2: Route of field data gathering using GPS and the corresponding registration format



Slope correction

A Digital Elevation Model based on 1:50,000 contour interval was used to account for the field slope. The digitized coca fields areas (polygons) were superimposed on the slope map and their areas corrected based on the inclination of the underlying slope.

CORRECTION PROCEDURES



Spot Image - Apurimac-Ene Area



Contour interval



Elevation map



Elevation Map showing coca crops



Elevation map and field slopes



Elevation map and field slopes with coca crops

3.4. Coca Production

To estimate dry coca leaf yield in 2001, thirteen coca parcels were surveyed with the collaboration of UNODC's alternative development projects. The parcels were distributed between the areas of Apurimac-Ene (3), Tocache-Uchiza (5), Aguaytia (3) and Monzon (2).

The size of the coca parcels ranged between 11,500 m² in the Aguaytia to 925 m² in the Apurimac-Ene. The parcels were selected to be as representative as possible of the coca fields in these areas, taking into account the slope (80% of the coca fields are on slope with an inclination of more than 20 degrees), the plant density, the age of the crop and the use of agro-chemical fertilizers.

The staff collecting the yield data participated in each of the four harvests and recorded the weight for fresh and dry leaf.

In 2002, the collection of yield data could only be carried out in Tocache-Uchiza. In all other coca producing areas, the deteriorating security situation prevented the implementation of this activity. Therefore, the results for dry coca yield estimates obtained in 2001 were used again in 2002.

3.5. Coca Prices

Prices of dry coca leaf and other commodities are collected through a network of 13 collection points located in the following areas: Aguaytia (1), Apurimac (3), Inambari (3), Monzon (2), Tocache (1) and Uchiza (3).

Since August 1999, the survey has recorded the prices of 31 products grouped into four categories: (a) coca and its by-products, (b) agricultural and industrial raw materials with potential illicit use, (c) witness products and (d) licit agricultural products.

Prices are collected once a month by project specialists through semi-structured interviews of key informants selected among farmers, storekeepers and people who participate in the production and distribution of illicit drugs.

Map 3: Record of Prices Points 2002



4. FINDINGS

4.1. Coca cultivation

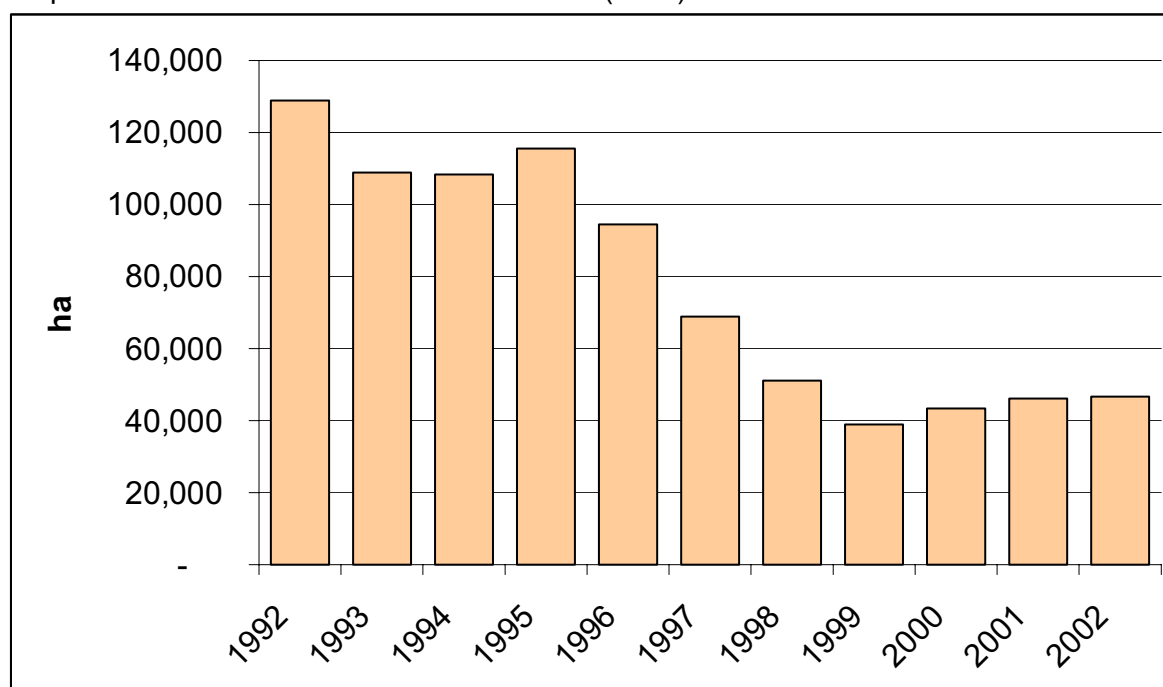
In 2002, the total area under coca cultivation in Peru was estimated at about 46,700 ha. This represented an increase of 1% compared to the 2001 estimates of 46,200 ha.

The 2002 level of coca cultivation remains well below the cultivation levels recorded in the mid-1990s. Concerns regarding a possible displacement of coca cultivation from Colombia to Peru, as a consequence of the increased eradication campaign and reduction in the coca area in Colombia during the last two years, did not materialize in 2002.

Table 3. Annual coca cultivation since 1992 (in ha)

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
129,100	108,800	108,600	115,300	94,400	68,800	51,000	38,700	43,400	46,200	46,700

Graph 1. Annual coca cultivation since 1992 (in ha)



The increase was mainly due to the rehabilitation of abandoned coca fields in important coca growing areas, like Apurimac.

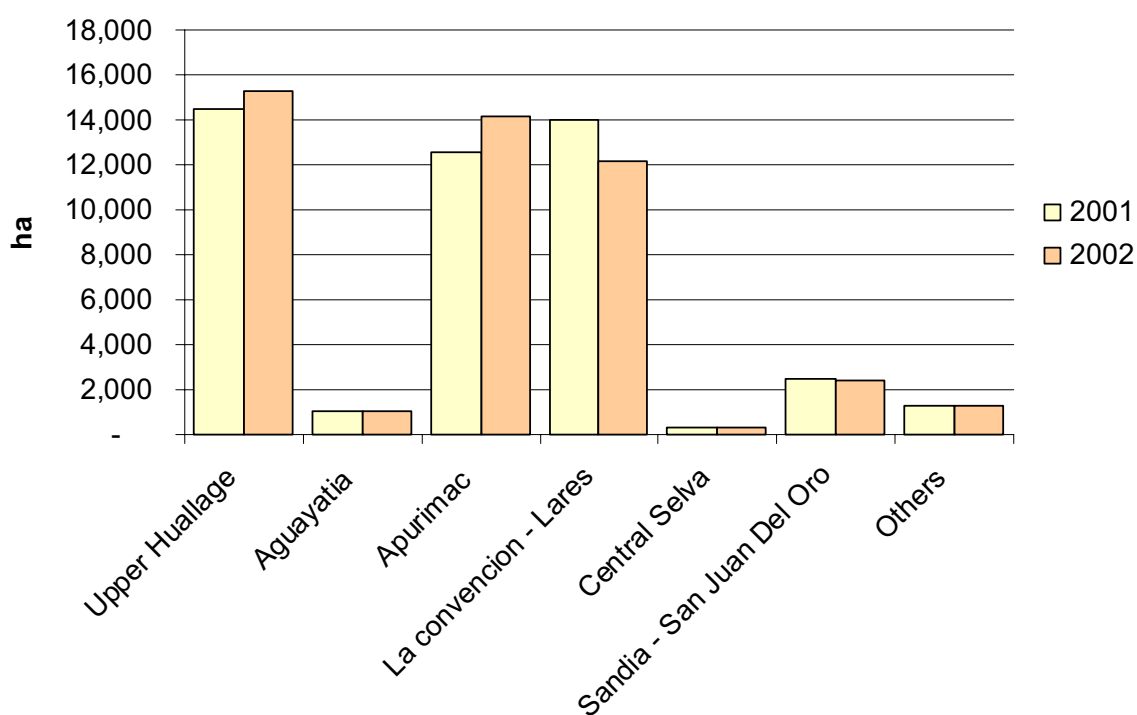
The following map shows the areas of coca cultivation in Peru. There were important regional variations as discussed below.

Table 4: Coca cultivation by areas for 2001 and 2002 (in ha)

AREAS	2001	2002	2001-2002 variations
I. UPPER HUALLAGA			
Monzón	8,847	10,935	
Tulumayo	2,192	1,438	
Pendencia-Aucayacu	791	1,147	
Aspuzana	471	488	
Cuchara/Magdalena/S.Marta/Camote/Frijol	1,173	587	
Tocache – Chontayacu	624	691	
Ongón	383	-	
TOTAL UPPER HUALLAGA	14,481	15,286	6%
II AGUAYTIA	1,051	1,065	1%
III. APURIMAC	12,600	14,170	12%
IV. LA CONVENCION – LARES	13,980	12,170	-13%
V. CENTRAL SELVA	350	350	0%
VI. SANDIA – SAN JUAN DEL ORO	2,520	2,430	-4%
VII. OTHERS (*)	1,250	1,250	0%
TOTAL	46,232	46,721	
ROUNDED TOTAL	46,200	46,700	1%

* Includes Central Huallaga Basin (Saposo, Sisa, Sauce, Ponaza), Lower Huallaga Basin (Shanusi, Caynarachi) Upper and Lower Mayo Basins (Lamas, Pamashto, San Antonio de Cumbaza), Marañón Basin

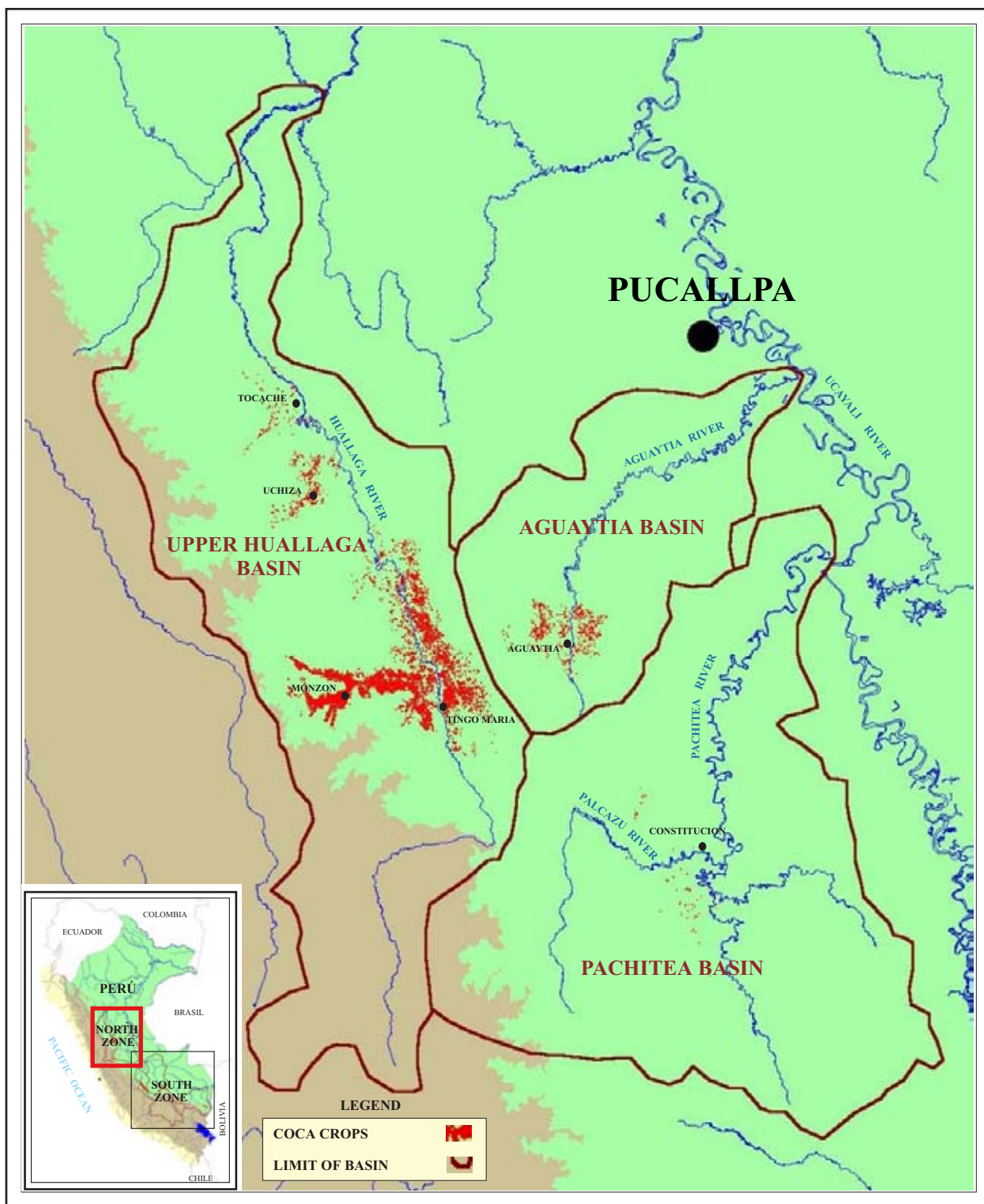
Graph 2. Coca cultivation by areas for 2001 and 2002 (in ha)



Map 4: Peru coca growing areas for 2002



Map 5: Peru coca growing areas for 2002 - North Zone



Upper Huallaga

With 15,300 ha of coca cultivation in 2002, this large area contributed 33% of the total coca cultivation in Peru. It represented an increase of 5% compared to the 2001 estimate of 14,500 ha.

Most of the coca cultivation in Upper Huallaga is concentrated in the Monzon sector (8,800 ha) that, alone, accounted for 57% of all coca cultivation in Upper Huallaga, or 19% of the national total.

Compared to last year, an increase in coca cultivation of 2,100 ha, or 23%, was noted in Monzon sector. The increase was due to the rehabilitation of abandoned coca fields on the most elevated parts of Monzon (e.g. Rio Tazo, Shipaquillo, Maravillas, Caunarapa).

The rehabilitation of abandoned coca fields has several advantages compared to the establishment of new coca fields: It is cheaper (it costs between US\$300 and US\$400 per ha compared to between US\$ 1,500 and US\$ 2,000 for the establishment of a new plantation); the first coca harvest can already be carried out 3 or 4 months after the rehabilitation; and the number of new coca seedlings needed is lower than for new coca fields. Therefore, farmers tend to first rehabilitate the abandoned coca fields before establishing new ones.

In Monzon sector, most abandoned coca fields seem to have been rehabilitated in the past few years and the land seems to offer little potential for new coca fields.

In the Tocache and Chontayacu sectors, 700 ha of coca cultivation were identified. This represents an increase of 11% compared to 2001. Abandoned coca fields have also been rehabilitated in this area. But unlike in Monzon sector, many more coca fields could still be rehabilitated as, prior to 1994, coca cultivation was estimated at 16,000 ha in Tocache and Chontayacu.

In the seven remaining sectors of Upper Huallaga, a total of 3,700 ha of coca cultivation was identified in 2002. This represented a decrease of 17% compared to 2001. The decrease was mainly attributed to the eradication operations launched by CORAH (Department of Interior) in May and June 2002.

In Ongon sector, located in the higher part of the Mishollo river valley, CORAH reported the eradication of practically all the coca fields (1,000 ha) in the first semester of 2002. This area was therefore not included in the 2002 census. About 400 ha were identified in 2001.

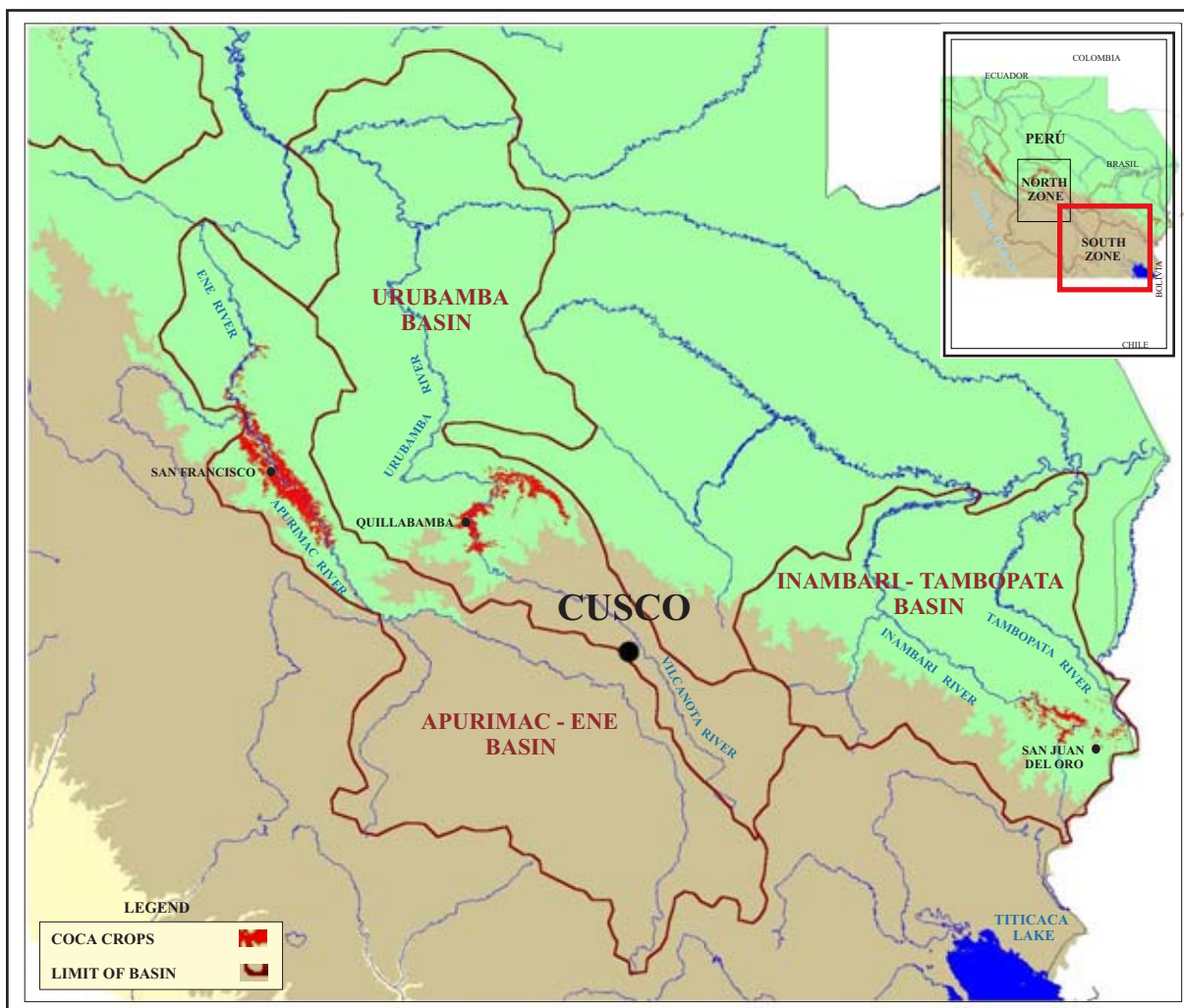
Aguaytia

In Aguaytia sector, 1,100 Ha of coca bushes were detected. This is comparable to the 2001 estimate.

The stability can be attributed to the voluntary eradication programme launched in September 2002 by DEVIDA. The programme is based on voluntary and manual eradication of coca bushes by the farmers themselves, in return for financial compensation and alternative development assistance.

In the mid-1990's, coca cultivation in the area ranged between 18,000 ha and 20,000 ha, making it the third coca cultivating area of Peru, behind the Alto Huallaga and Apurimac-Ene. The reduction in coca cultivation in Aguayatia was closely linked to the intensive eradication efforts conducted by CORAH during the latter half of the 1990s.

Map 6: Peru coca growing areas for 2002 - South Zone



Apurimac

In 2002, coca cultivation amounted to 14,000 ha in Apurimac. This represented 30% of the national total and made the Apurimac the second largest coca cultivating area in Peru, after Upper Huallaga.

The increase of 1,600 ha, or 12%, compared to 2001, was mainly attributed to the important decrease of the coffee price which is the main alternative crop in the area.

Like in previous years, the increase in coca cultivated land was principally due to the rehabilitation of abandoned coca fields. In 1997, UNODC interpreted from aerial images a total of 14,320 ha in this area, split into 8,834 ha of productive coca and 5,486 ha of abandoned fields. This would

indicate that all coca fields abandoned in the past decade have now been rehabilitated.

Until now, no eradication measures have been carried out in Apurimac, mainly because of the continuous social unrest and demonstrations by coca growing organisations.

Important agricultural intervention efforts were conducted in the municipalities of Monterrico, San Antonio, Acon, Llohegua, Mayapo, Catarata, Otari, Alto Pichari.

La Convención y Lares

Coca cultivation was estimated at 12,200 ha in the area of La Convención y Lares, making it the third-ranking coca cultivating area of Peru, with 26% of the national total.

Compared to 2001, this represents of decrease of 13% (1,800 ha).

This reduction was not related to eradication measures, but could rather be attributed to the traditional practices of crop rotation and soil rehabilitation with the objective of stabilizing the soil nutrient levels and increasing the agricultural productivity (including coca plantations').

This basin is considered to be the source of coca leaves for traditional uses. It is also where ENACO headquarters are located. ENACO owns 10,670 ha of coca bushes and has the monopoly for the commercialization of all coca leaves produced in this traditional coca-growing area. Between 2,500 and 3,500 mt of coca leaves are processed annually through ENACO in the area. It is estimated that between 2,000 mt to 2,500 mt of coca leaves produced in that area go to the illicit market.

Selva Central

In 2002, about 350 ha of coca bushes were identified in the Selva Central area.

In the 1990's, about 12,000 ha of coca were cultivated there. The sharp reduction was mainly due to the fall in coca leaf price during the 1990's. Rehabilitation of coca crops has been limited and little variations in the level of coca cultivation have been observed recently.

However, the existence of new coca fields cultivated under the canopy of other crops cannot be ruled out, a cultivation practice that would make the remote detection of coca cultivation difficult.

Sandia San Juan del Oro

In 2002, the survey identified 2,400 ha of coca cultivation in that area, mainly concentrated in the Inambari river valley. This represented about 5% of the national total. Compared to 2001, the level of cultivation decreased by 4%.

Like Convención y Lares, it is considered to be an area of traditional coca leaf production. In the past few years, however, there were indications that about half of the coca leaf production of this area has entered the illicit drug market.

The coca leaf price registered in the municipalities of Masiapo and Yanamayo were higher than the price offered by ENACO.

Other areas

Low levels of coca cultivation were also found in the areas of Alto y Bajo Mayo, (Pamashto, Lamas,

San Antonio de Cumbaza sectors), Huallaga Central (Saposoa, Sisa, Ponaza, Sauce, Chazuta sectors), Bajo Huallaga (Shanusi, Cainarachi sectors), and Marañón (Jaen, San Ignacio, Bagua, Imazita, Santa Maria de Nieva, Sarameriza sector).

In these sectors, a total of 1,250 ha of coca cultivation were found in 2002, which is comparable to last year's estimate.

4.2. Coca Production

The security situation in most coca growing areas of Peru prevented the implementation of the yield assessment activities in 2002. As no other data were available, the results obtained in 2001 were used for 2002.

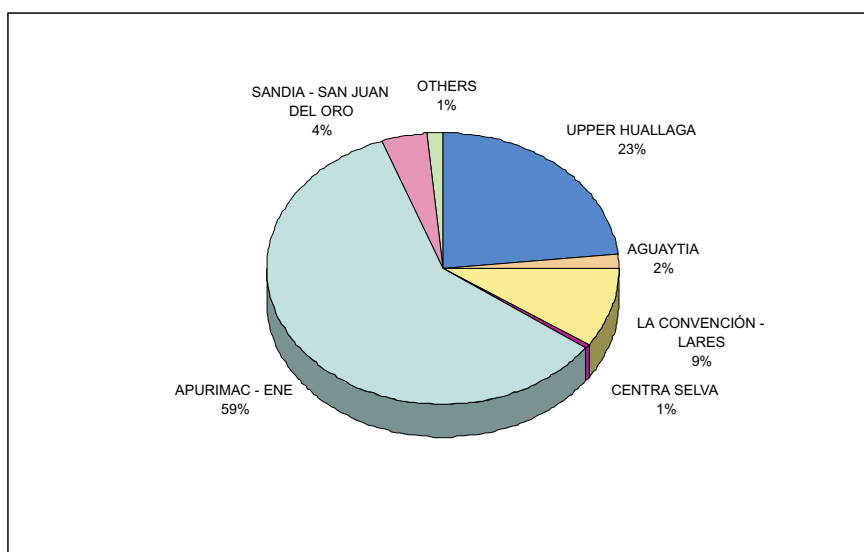
The total production of dry coca leaf for 2002 has been estimated at 52,500 mt, representing an average annual dry leaf yield of about 1,100 kg per ha at the country level.

Assuming a conversion rate of 328 kg of dry coca leaf to produce 1 kg of pure cocaine hydrochloride and that all dry coca leaf production was converted into cocaine hydrochloride and, the potential cocaine production in Peru for 2002 amounted to 160 mt.

As discussed below, important regional variations have been observed in the annual dry coca leaf yield.

Table 5: Annual dry coca leaf yield and production by areas

	Coca cultivation (ha)	Annual Dry coca leaf yield (kg/ha)	Dry coca leaf production (mt)
UPPER HUALLAGA	15,286	798	12,198
AGUAYTIA	1,065	960	1,022
APURIMAC - ENE	14,170	2,200	31,174
LA CONVENCION - LARES	12,170	400	4,868
CENTRAL SELVA	350	1,000	350
SANDIA - SAN JUAN DEL ORO	2,430	900	2,187
OTHERS	1,250	600	750
TOTAL	46,721	1,125	52,549



Apurimac

With an average dry coca leaf yield of 2,200 kg per hectare and a cultivation of 14,200 ha, the total dry coca leaf production in Apurimac was estimated at 31,200 mt in 2002. This represented 59% of the national coca leaf production. Although Apurimac ranked only second in terms of coca cultivation, its high coca leaf yield made it the first coca producing area in Peru.

The high yield for dry coca leaf in Apurimac, the highest observed in Peru, is due to the use of agro-chemicals and the high plant density per hectare. It is not unusual to find densities greater than 300,000 plants per hectare and yields that easily exceed 3,000 kg of dry leaf per hectare in that area.

Upper Huallaga

With an average dry coca leaf yield of 800 kg per ha and a cultivation of 15,300 ha in 2002, the dry coca leaf production in the area was estimated at 12,200 mt, equivalent to 23% of the national total. Upper Huallaga was thus the second coca-producing area of Peru, even though it came first for coca cultivation in 2002.

It is in Monzon sector that the lowest yield was recorded with 450 kg/ha of dry coca leaf. However, since 2001, there have been reports of farmers grafting old plantations, thus improving the coca yield. Anecdotal information received in 2002, suggested that, in some fields, the annual dry coca leaf yield could range between 600 and 800 kg per ha.

The practice of grafting coca seems to be spreading because farmers now have their own seedling nurseries and because most abandoned coca fields have already been rehabilitated. With limited areas left for the establishment of new coca fields, one could expect the cultivation level to remain stable, while coca production could further increase as farmers improved their yields.

The coca leaves in Monzon sector also have a higher alkaloid content than in other areas of the country. While in other areas between 280 and 300 kg of dry coca leaf are required to produce 1 kg of cocaine HCL, only between 160 and 170 kg of dry coca leaf are required in Monzon. The difference is also reflected in the price of coca leaf, which is higher in Monzon than in any other area.

In the other sectors of Upper Huallaga, the average dry coca leaf yield was about 1,000 kg per ha.

La Convencion y Lares

With a coca cultivation estimate of 12,200 ha in 2002 and an annual yield of about 400 kg/ha, the annual dry coca leaf production was estimated at 4,900 mt, representing 9% of the national total.

In this traditional coca growing area, approximately 50 to 60% of the coca production were sold to ENACO. The rest entered the illicit market.

The low coca yield observed in this area can be explained by a combination of several factors. Only herbicides are used in this area, while fertilizers and insecticides are not. The coca fields are old and the plant density typically varies between 20,000 and 25,000 plants per hectare, compared to 300,000 in Apurimac. Finally, most of the fields are on very steep slopes, known to be less productive than fields on flatter land.

Other areas

For all the other areas put together, including Aguaytia, the Central Tropical Forrest and Sandia San

Juna del Oro, the average annual coca dry leaf yield was estimated at 600 kg/ha, resulting in an estimated production of 750 mt of dry coca leave in 2002.

Anecdotal reports suggested that farmers were replacing old coca plants with more productive young plants in 2002.

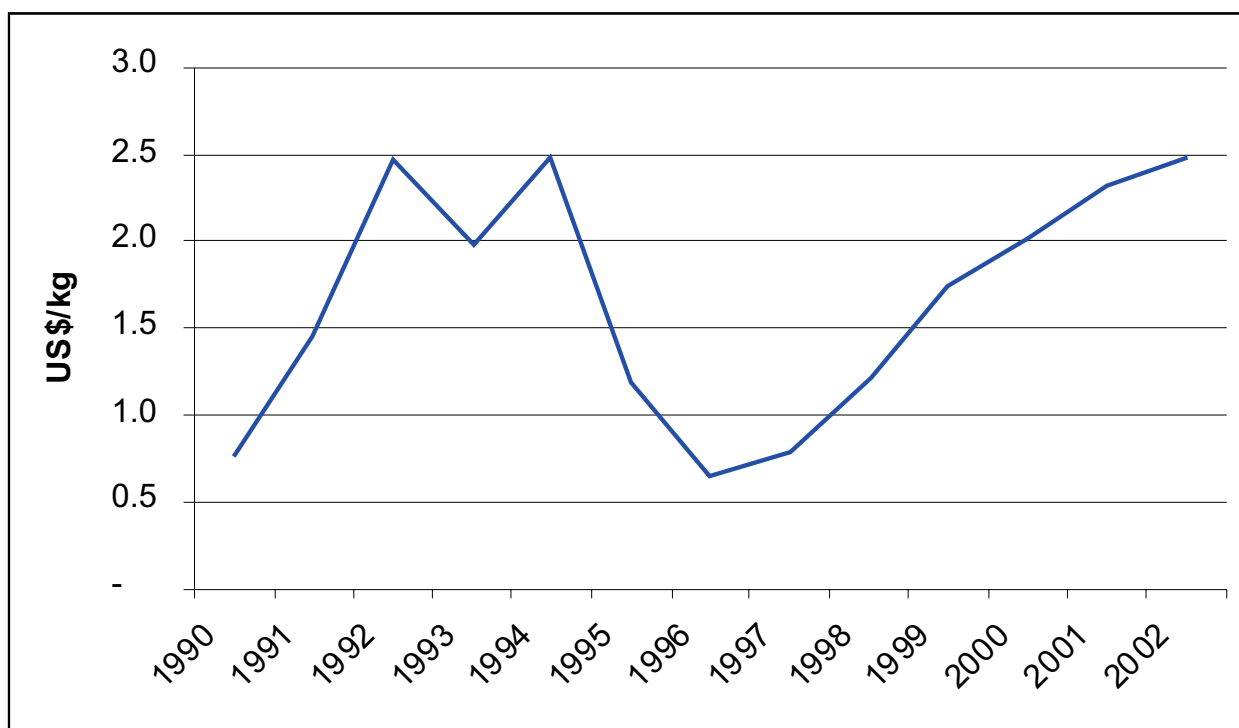
4.3. Coca Prices

Dry coca leaf

At the national level, the average price for dry coca leaf on the illicit market was 2.5 US\$/kg in 2002, with a maximum of 2.9 US\$/kg in August and a minimum of 2.1 US\$/kg in April. The monthly prices of dry coca leaf since 1992 are presented in annex.

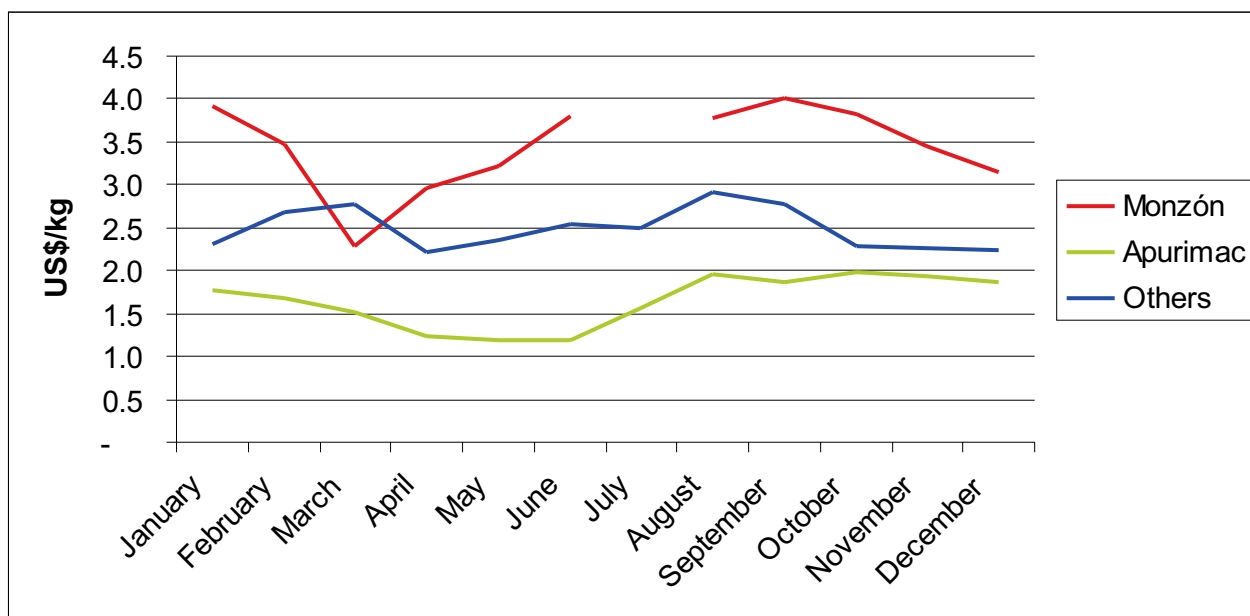
Data shows that prices have returned to levels comparable to the early 1990s.

Graph 4: Dry coca leaf price since 1990s (US\$/kg)



There are important regional variations, which are discussed below.

Graph 5: Monthly coca dry leaf prices (US\$/kg) for Monzon, Apurimac and others areas.



Apurimac

In 2002, an average of 1.6 US\$/kg was paid for dry coca leaf in Apurimac, with a maximum of 1.9 US\$/kg registered in October and a minimum of 1.2 US\$/kg in May (the lowest national level).

As illustrated in the following graph, prices fell during the second quarter at about 1.20 US\$/kg. The reduction could have been caused by the counter-trafficking operations conducted by the Anti-narcotics police, as well as by the demonstrations organized by coca farmers during that period.

Inambari

Inambari is usually considered a traditional coca growing area where coca production is intended for traditional coca consumption, such as coca chewing and coca teas. However, in the past few years, there have been indications that an important part of the coca production has gone to the illegal drug market.

In 2002, ENACO paid an average of 1.8 US\$/kg for dry coca leaf. On the illicit market, an average of 2.6 US\$/kg was paid, with a maximum of 3.0 US\$/kg registered in September and a minimum of 2.2 US\$/kg registered in July.

Aguaytia

An average price of 2.4 US\$/kg for dry coca leaf was registered on the illicit market in this area, with a maximum of 3.0 US\$/kg in August and a minimum of 1.8 US\$/kg in April. The average price paid by ENACO in 2002 was 1.5 US\$ per kg of dry coca leaf, i.e. 35% less than on the illicit market.

Monzon

The average monthly prices for dry coca leaf on the illicit market in Monzon were consistently higher

than in any other areas of the country throughout the year. The average price for 2002 was 3.5 US\$/kg, with a maximum in September at 4.0 US\$/kg, and a minimum in March at 2.7 US\$/kg.

The higher level of prices for coca leaf recorded in Monzon is probably due to the higher alkaloid content of the leaf in that area. While, in other areas, between 280 and 300 kg of dry coca leaf are required to produce 1 kg of cocaine HCL, area between 160 and 170 kg of dry coca leaf are required in Monzon.

On the legal market, the average price was 1.7 US\$ per kg of dry coca leaf, which is 50% lower than the illicit market price.

Tocache

The average price for dry coca leaf on the illicit market was 2.6 US\$ per kg, with a maximum of 3.0 US\$ in August and a minimum of 1.9 US\$ in October. In that area, ENACO has no office and no prices were recorded for the legal market. Those who wish to sell legally would have to do so in the municipality of Uchiza (see below).

Cacao registered an average price of 1.6 US\$ per kg of dried beans, reaching up to 1.9 US\$ in September, thus representing a serious alternative for coca growers. However, the yield for cacao in this area is only about 488 kg/ha compared to 900 kg/ha for coca leaves.

Uchiza

The average price for dry coca leaf on the illicit market was 2.4 US\$ per kg, with a maximum of 3.0 US\$ in August and a minimum of 1.7 US\$ in October. The average price on the legal market was 1.5 US\$ per kg of dry coca leaf, i.e. 35% less than on the illicit market.

Cacao is also one of the alternative crops that receive relatively attractive prices in this area, with an average of 1.5 US\$ per kg of dried beans, but with much lower yield than for coca cultivation.

Cocaine base

The average price for washed cocaine base, was 602 US\$/kg in 2002, with a minimum of 479 US\$/kg and a maximum of 652 US\$/kg.

Cocaine HCL

The average price paid for cocaine HCL in the production centers was 1,012 US\$/kg, with a maximum value of 1,207 US\$/kg and a minimum of 901 US\$/kg. Prices for cocaine HCL were only recorded in the Monzon river, Tocache and Uchiza areas.

In the city of Lima, the price of cocaine ranged between 1,300 US\$/kg and 1,500 US\$/kg and 4 to 5 US\$ per gram.

5. Eradication

CORAH reports administratively to the Executive Office for Drug Control (OFECOD) of the Ministry of Interior and is responsible for the eradication programme in Peru. Eradication is conducted manually as chemical eradication is prohibited.

Since 1983, CORAH has concentrated its actions in the Upper Huallaga, Central Huallaga and Aguaytia areas. In 2002, 7,200 ha were reported as eradicated. This represents the third largest report of coca fields eradication since 1983.

Table 6: Report of eradication since 1983

Year	ha	Year	ha
1983	700	1993	-
1984	3,100	1994	-
1985	4,800	1995	-
1986	2,600	1996	1,300
1987	400	1997	3,500
1988	5,100	1998	7,800
1989	1,300	1999	14,700
1990	-	2000	6,200
1991	-	2001	6,400
1992	-	2002	7,200

In the last five years, in addition to productive coca fields, abandoned coca fields have also been subjected to eradication.

Table 7: CORAH eradication report for 2002

	AREAS				
	Padreabad	Huimbayoc	Ongon	Tarapoto	Total
Productive coca	551	346	1,048	797	2,742
Semi-abandoned coca	210	685	3	1,668	2,586
Abandoned coca	245	-		1,562	1,807
					7,134

6. Annexes

Annex 1	Technical Form
Annex 2	Map of survey areas
Annex 3	Map of survey sectors
Annex 4	Map of type of coca crops
Annex 5	Monthly dry coca leaf prices 1990 (US\$/kg)
Annex 6	Future activities - Ecological Economic Zonification (EEZ)

Annex 1

Technical Form

1 Inputs Used	<ul style="list-style-type: none">* Data of coca cultivation "year zero"* Spectral information 2002* Speciality Software
2 Characteristics of Multiespectral Records	<p>Spot 5 1-A scenes 5</p> <ul style="list-style-type: none">* Not corrected* 3 Visible bands* 1 Infrared band* Resolution 10x10 m <p>Landsat 7 scenes</p> <ul style="list-style-type: none">* Corrected* 7 Visible Bands* 1 panchromatic band* Resolution 25x25 m
3 Processing Method	<ul style="list-style-type: none">* Visual intepretation of satellite image* Use of data base "year zero"* Ground control and GPS points
4 Results 2002	<div>* 46,721 Hectares</div>
5 Levels of Error	<ul style="list-style-type: none">* 10 -12 %
6 Complementary Information	<ul style="list-style-type: none">* Spot records 1999 - 2001* Landsat records 2000 - 2001* Colored and infrared aerial photographs 1:20,000 years: 1996 - 97 - 98 - 99 - 2000

Annex 2

Survey Areas



Peru Coca Survey for 2002

Annex 3

Survey Sectors



Peru Coca Survey for 2002

Annex 4

Type of coca crops



Peru Coca Survey for 2002

Annex 5

Peru Coca Survey for 2002

Monthly dry coca leaf prices since 1990 (US\$/kg)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
January	0.7	0.8	1.1	4.4	1.5	3.0	0.4	0.6	0.6	1.8	1.6	2.0	2.6
February	0.9	1.6	1.7	3.5	1.6	3.0	0.4	0.6	0.7	1.4	1.3	2.1	2.6
March	0.8	1.6	1.7	1.7	1.6	2.6	0.4	0.6	0.7	1.7	1.6	2.1	2.3
April	0.5	1.5	2.6	1.3	1.6	1.7	0.5	0.6	0.6	1.6	1.7	2.3	2.2
May	0.5	1.5	1.9	1.7	1.6	0.9	0.5	0.6	1.0	1.6	1.9	2.4	2.3
June	0.4	1.7	2.2	1.3	1.8	0.7	0.7	0.6	1.0	1.4	2.0	2.5	2.5
July	0.4	1.6	2.2	1.0	2.6	0.4	0.9	0.9	1.1	1.3	2.1	2.5	2.3
August	0.4	1.5	3.0	1.9	3.0	0.4	1.0	1.3	2.1	1.8	2.3	2.7	2.9
September	1.2	1.7	4.4	2.1	3.0	0.4	1.0	1.3	2.0	2.2	2.7	2.7	2.8
October	1.6	1.7	2.6	2.1	3.9	0.4	1.0	0.9	1.5	2.5	2.8	2.5	2.5
November	0.9	1.3	2.6	1.3	4.4	0.4	0.6	0.7	1.4	2.0	2.2	2.0	2.4
December	0.9	1.0	3.5	1.3	3.0	0.4	0.6	0.7	1.7	1.6	1.9	1.9	2.3
Annual Average	0.8	1.5	2.5	2.0	2.5	1.2	0.7	0.8	1.2	1.7	2.0	2.3	2.5

Sources: UNODC Alternative Development Projects

Annex 6

Future activities - Ecological Economic Zonification (EEZ)

Since 2000, the project has generated detailed cartographic information on land use and on the spatial evolution of coca crops on the national territory. The project is now considering to use a Geographic Information System that would allow to combine the data with other types of thematic cartography (natural resources, economic and social dimensions) compatible with the objective of EEZ (such as land use planning and monitoring of deforestation in coca cultivation areas). The process of regionalizing the country (decentralizing political decision), currently under implementation in Peru, requires international assistance for the formulation and establishment of development programmes and environmental protection, particularly in zones where the presence of illicit crops has had a negative impact on the management of natural resources.

The UNODC monitoring system can support this process with its large stock of thematic maps (land use, climate, geology, vegetation, etc...), its good technical infrastructure, the methodology it has developed and its qualified staff. Technical information and cartographic material of the area (aerial photography and satellite images), as well as field information, are available in the system's database.

