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Central Committee for
Drug Abuse control



Lao National Commission for
Drug Control and Supervision



South-East Asia Opium survey 2012

Lao PDR, Myanmar

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PART 1. REGIONAL OVERVIEW

FACT SHEET – SOUTH-EAST ASIA OPIUM SURVEYS 2012

	2011	2012	Change
Opium poppy cultivation			
Lao PDR ¹	4,100 ha	6,800 ha	+66%
Myanmar ¹	43,600 ha	51,000 ha	+17%
Thailand* ²	217 ha	209 ha	-4%
Weighted average dry opium yield			
Lao PDR	6.0 kg/ha	6.0 kg/ha	-
Myanmar	14.0 kg/ha	13.5 kg/ha	-4%
Thailand * ³	15.6 kg/ha	15.6 kg/ha	-
Potential opium production			
Lao PDR	25 tons	41 tons	+64%
Myanmar	610 tons	690 tons	13%
Thailand*	3 tons	3 tons	0%
Opium poppy eradication			
Lao PDR	7,928 ha	24,634 ha	+211%
Myanmar	662 ha	707 ha	+7%
Thailand*	7,058 ha	23,718 ha	+236%
Thailand*	208 ha	205 ha	-1%
Average price of opium ⁴			
Lao PDR	1,640 US/kg	1,800 US\$/kg	+10%
Myanmar	450 US\$/kg	520 US\$/kg	+16%
Thailand*	1,420 US\$/kg	N/A	N/A
Potential value of opium production			
Lao PDR	US\$ 40 million	US\$ 72 million	+80 %
Myanmar	US\$ 275 million	US\$ 359 million	+31 %
Thailand	US\$ 4 million	N/A	N/A

* The Office of the Narcotics Control Board, Government of Thailand, is acknowledged for providing the figures on Thailand.

¹ May include areas eradicated after the date of the area survey.

² The cultivation figures in Thailand are based on satellite images and aerial reconnaissance flights.

³ The 2004 yield per hectare is used due to the absence of a more recent yield survey.

⁴ Prices are not directly comparable between countries as they refer to farm-gate prices in Myanmar and to prices at an unspecified trading level in Lao People's Democratic Republic.

REGIONAL OVERVIEW

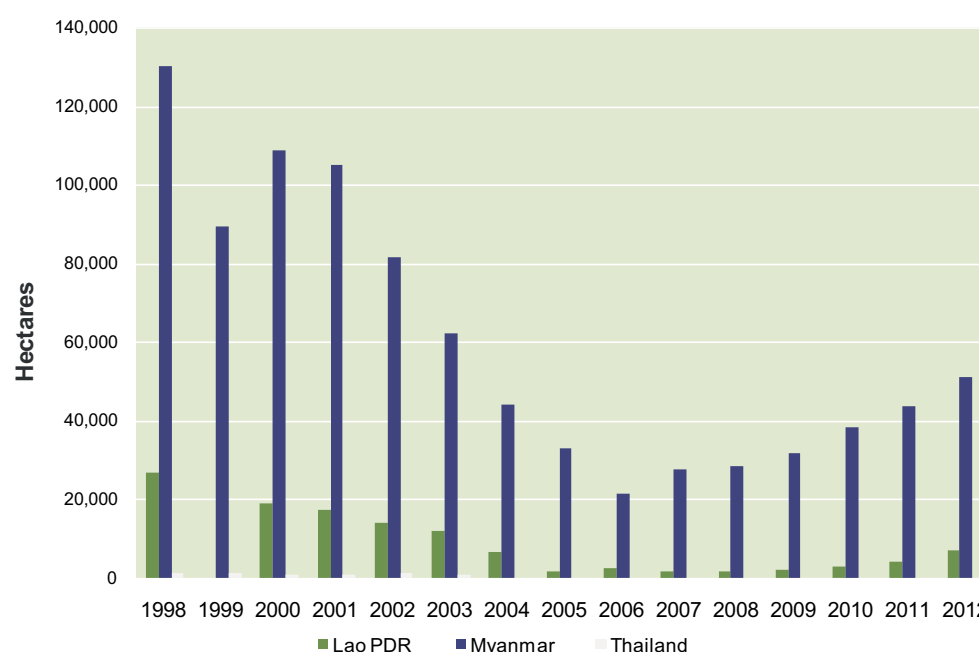
With a total area of over 58,000 hectares in 2012, most opium poppy cultivation in South-East Asia takes place in Lao People's Democratic Republic, Myanmar and Thailand. In order to assess the scope of opium poppy cultivation and opium production in the region, UNODC has been conducting opium surveys in cooperation with the Governments of Lao People's Democratic Republic (since 1992) and Myanmar (since 2002), while Thailand has established its own monitoring system. This report contains the results of the UNODC-supported opium poppy cultivation surveys in Lao People's Democratic Republic and Myanmar. In addition, the results from the opium poppy surveys implemented by the Government of Thailand are presented in this regional overview.

Opium poppy cultivation in South-East Asia

Despite a consistent downward trend in opium poppy cultivation from 1998-2006, when Myanmar experienced an 83% reduction and Lao People's Democratic Republic saw the largest relative decline among the three countries, opium poppy cultivation in the region has since increased, though at a relatively slow pace.

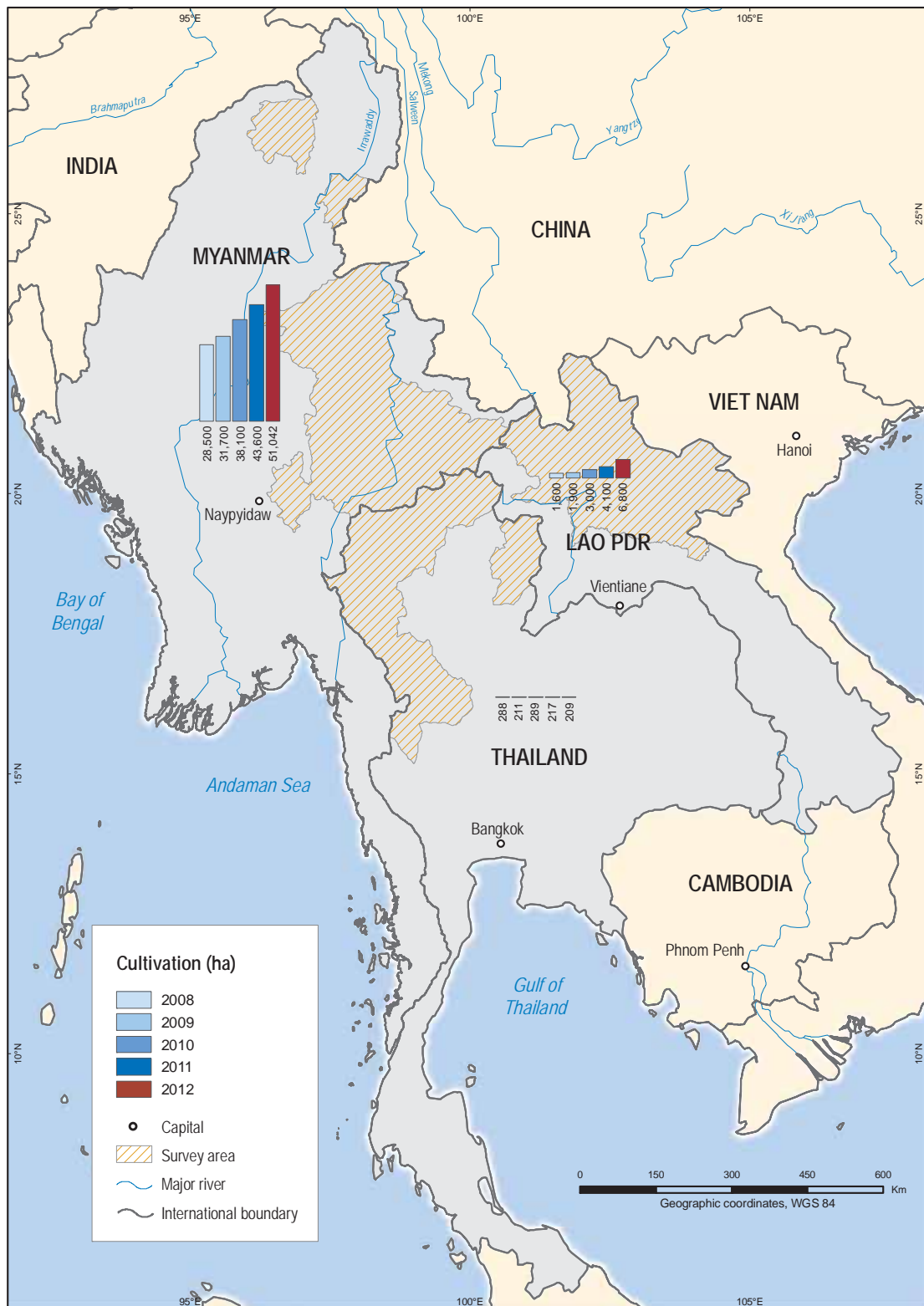
According to Government reports, opium poppy cultivation in Thailand has remained stable at a very low level. However, opium poppy cultivation in Myanmar increased from 21,600 hectares in 2006 to 51,000 hectares in 2012, while in Lao People's Democratic Republic it increased from 1,500 hectares in 2007 to 6,800 hectares in 2012 (almost its 2004 level). Overall, opium poppy cultivation in the region has thus doubled since 2006, this despite official reports from the Governments of the three countries indicating that a total of 24,634 hectares of opium poppy were eradicated in 2012, which represents an increase of 236% on 2011 when 7,928 hectares were eradicated.

Figure 1: Opium poppy cultivation in South-East Asia, 1998-2012 (Hectares)

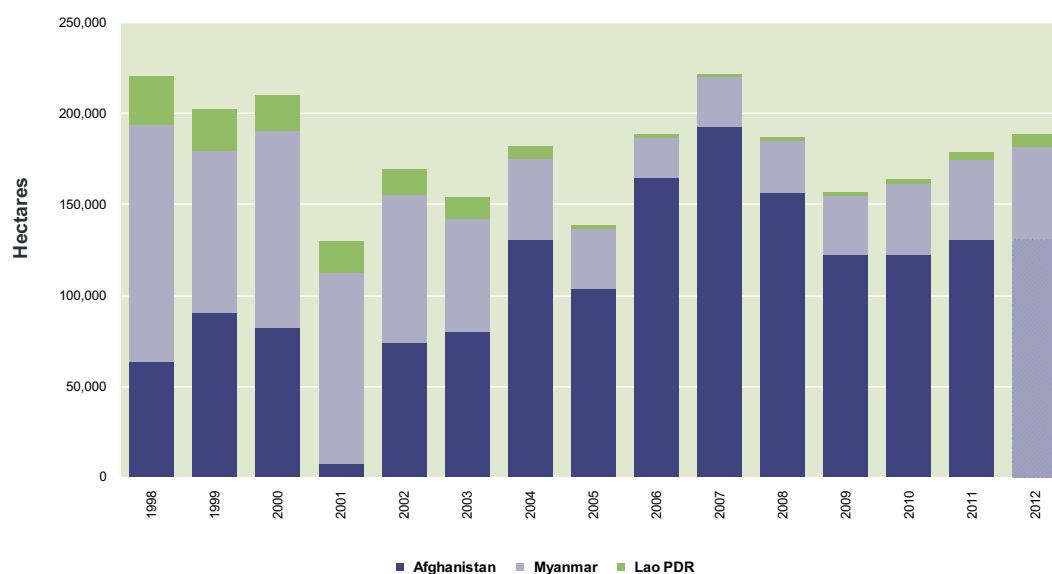


Source: Lao People's Democratic Republic/Myanmar: National monitoring systems supported by UNODC; Thailand: Thai Office of the Narcotics Control Board.

Map 1: Opium poppy cultivation in South-East Asia, 2008-2012 (Hectares)



Source: Government of Lao PDR, Myanmar and Thailand, national monitoring systems supported by UNODC in Lao PDR and Myanmar. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 2: Opium poppy cultivation in major cultivating countries, 1998-2012 (Hectares)

Note: 2012 results for Afghanistan were not available at the time of printing of this report. Source: Afghanistan/Lao People's Democratic Republic/Myanmar: National monitoring systems supported by UNODC.

Notwithstanding the dramatic decreases in opium poppy cultivation between 1998 and 2006, Myanmar remains the second largest opium poppy grower in the world after Afghanistan,⁵ accounting for 25% of global opium poppy cultivation, with Lao People's Democratic Republic accounting for 3%.

Opium yield and production

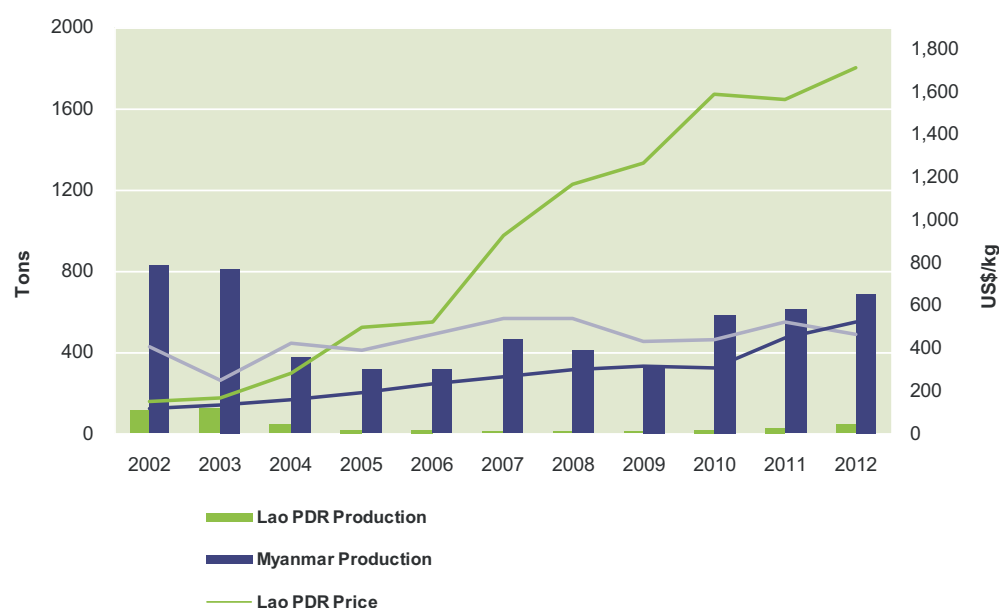
In South-East Asia, opium poppy is mostly cultivated on steep hills with poor soil and no irrigation, and opium yields are much lower than in Afghanistan, where opium poppy is often cultivated on good soils and flat, irrigated land. In 2012, opium yields were estimated at 6 kilograms per hectare⁶ in Lao People's Democratic Republic, 13.5 kilograms per hectare in Myanmar and 15.6 kilograms per hectare⁷ in Thailand. Total potential opium production in South-East Asia decreased from an estimated 1,435 tons in 1998 to only 734 tons in 2012, yet this figure represents a 15% increase on 2011 and overall increase of 55% on 2005 when production reached its lowest point in recent years.

⁵ When compared with Afghan opium poppy cultivation in 2011 (206,703 hectares) as the 2012 Afghan figure was not yet known.

⁶ In the absence of more recent yield surveys, the result of the 2007 yield survey was used.

⁷ The 2004 yield per hectare is used due to the absence of a more recent yield survey.

Figure 3: Opium production and price in cultivating areas in Lao PDR, Myanmar, and Thailand, 2002 - 2012



Source: Lao People's Democratic Republic/Myanmar: National monitoring systems supported by UNODC; Thailand: Thai Office of the Narcotics Control Board.

In 2006, Lao People's Democratic Republic and Myanmar together produced 335 tons of opium, or 5% of that year's global opium production of 6,610 tons. In 2012, the two countries produced 731 tons, or 10% of the 2011 global opium production of 6995 tons (2012 production not yet known). Thus while the countries' contribution to global opium production was still relatively small, it actually doubled in Lao People's Democratic Republic over the six-year period 2006-2012. In light of the steady drop in opium production from 2000 to 2006, what are the driving factors behind the resurgence in opium production in South-East Asia since then?

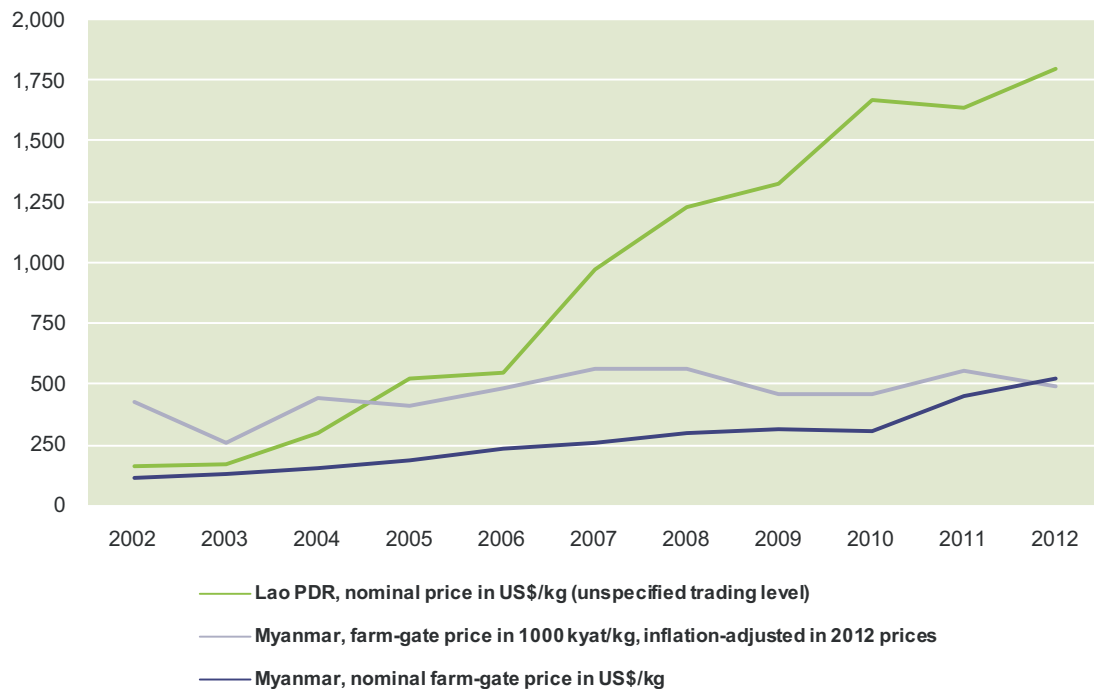
The link between opium cultivation and price

Although there are pronounced price differences between countries, as well as between regions within countries, opium prices in South-East Asia have generally risen in recent years.

In 2012, the average price of opium in Thailand was not available, while in Lao People's Democratic Republic the opium price rose by 10%, from US\$ 1,640/kg in 2011 to US\$ 1,800. This was due to the scarcity of opium — caused by the complete elimination of its cultivation in some regions of the country — while demand for the drug remained relatively high.

Despite the considerable increase in opium production, opium farm-gate prices in Myanmar, though less sharply, also increased considerably: at US\$ 520/kg in 2012, they rose by 16% on the 2011 figure of US\$ 450/kg. However, considering farm-gate prices in Myanmar's currency and taking into account inflation, the per-kilo price of opium in 2012 did not vary a great deal in comparison to the preceding few years and the purchasing power of a kilogram of opium remained quite stable.

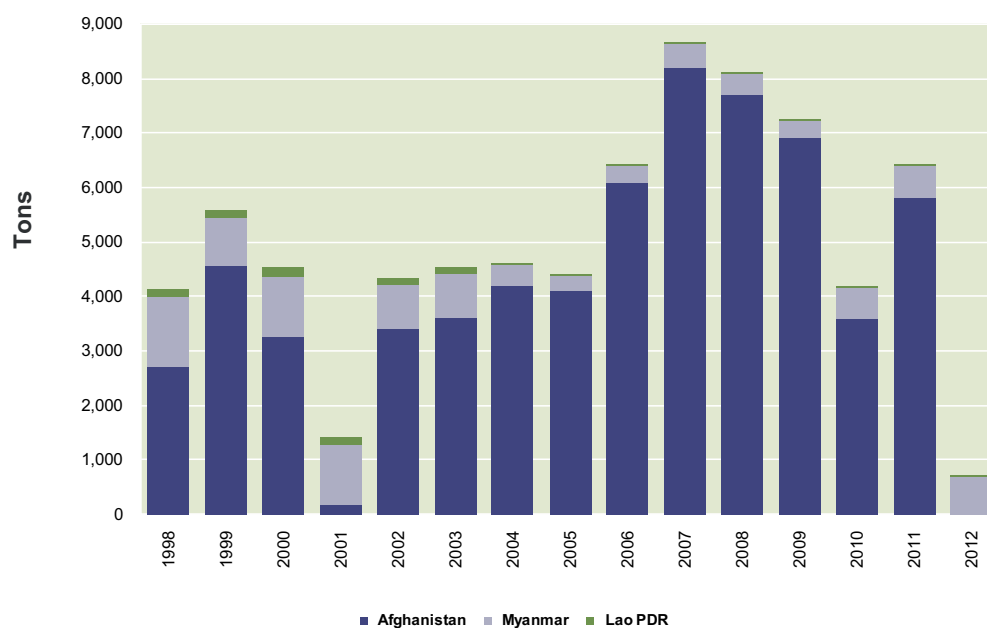
Figure 4: Opium prices in cultivating areas in Lao People's Democratic Republic and Myanmar, 2002-2012



Source: Lao People's Democratic Republic: LCDC; Myanmar: National monitoring system supported by UNODC.

Despite its much higher price in both kyats and United States dollar terms, the real value that opium farmers obtained from a kilogram of opium in 2012 was no greater than in the preceding years. Thus the increasing price of opium is merely a reflection of the cost of living in Myanmar and while the high price of opium is undoubtedly a factor in a farmer's decision to cultivate and produce opium, it is obviously not the only one.

Figure 5: Opium production in major producing countries, 1998-2012 (Tons)



Note: 2012 results for Afghanistan were not available at the time of printing of this report. Source: Afghanistan/Lao People's Democratic Republic/Myanmar: National monitoring systems supported by UNODC.

Opium supply and demand

One probable factor behind the resurgence in opium production in South-East Asia is the demand for opiates, both locally and in the region in general.

While local demand plays a role and opium use in poppy-growing areas of Myanmar is relatively high, it has not changed a great deal in recent years. However, the demand for opiates (especially heroin) in East and South-East Asia and the Pacific may have increased,⁸ with the number of opiate users in East Asia and the Pacific accounting for about a quarter of the world's total number of opiate users, whereas they accounted for a fifth in the first half decade of the century.

The total number of registered heroin users in China rose from 0.9 million in 2002 to 1.1 million in 2010,⁹ and the country accounts for more than 70% of all heroin users in East Asia and the Pacific. In absolute amounts, China consumes most of the heroin in the region, though heroin consumed in China also comes from Afghanistan.

Opium cultivation and land use

Although external drivers probably contribute to the increase in opium cultivation in Myanmar, of all the elements examined in the survey, land availability is possibly the most important factor behind the continuing existence of opium poppy cultivation in the country. While poppy-growing and non-poppy-growing villages in the region showed many similarities in the 2012 survey, their respective land availability for food crops was probably the most important difference between them. In non-poppy-growing villages in Myanmar, for example, households cultivated more and better irrigated land than poppy-growing villages and were thus able to dedicate more land to food production.

Opium poppy is cultivated as a cash crop. Almost half of respondents in the 2012 Myanmar survey said that they grow it for cash, while the drug's easy marketability was another important reason. As households in poppy-growing villages have to make up for the limitations in land availability for generating cash in order to buy food to feed their families, they inevitably have to look for alternatives. Although more than half of households in poppy-growing villages do not plant poppy on their land, growing poppy is a strategy that 40% of households do actually choose. Considering that the market value of the average per-hectare yield of dry opium is some 19 times that of upland rice, this is hardly surprising.¹⁰ Furthermore, a new and worrying finding of this report is that a considerable number of households that do not cultivate poppy on their own land still benefit from opium poppy by working as wage labourers on poppy fields owned by others.

A better understanding of why some households resort to poppy cultivation while others do not yet may still benefit from poppy in other ways could help develop more targeted alternative livelihood strategies.

⁸ World Drug Report 2012, p. 9.

⁹ World Drug Report 2012, p. 21.

¹⁰ US\$ 0.275 per kilogram and a yield of 1.5 tons per hectare gives a market value of US\$370.5 per hectare of upland rice, while \$520 per kilogram of dry opium at a yield of 13.5 kilograms per hectare gives US\$7,020. Thus for a standard 0.17 ha of opium poppy, a farmer could buy over 4 tons of rice at market price, which could pay for a family's entire 12-month supply of upland rice and more.

PART 2. LAO PDR

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ABBREVIATIONS

ICMP	Illicit Crop Monitoring Programme
LCDC	Lao National Commission for Drug Control and Supervision
PFU	Program Facilitation Unit
SASS	Statistics and Surveys Section (UNODC)
UNODC	United Nations Office on Drugs and Crime

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FACT SHEET — LAO PEOPLE'S DEMOCRATIC REPUBLIC OPIUM SURVEY 2012

	2011	2012	Change from 2011
Opium poppy cultivation ¹	4,100 ha (2,500 to 6,000)	6,800 ha (3,100 to 11,500)	+66%
Average dry opium yield ²	6 kg/ha	6 kg/ha	-
Potential production of dry opium	25 tons (15 to 36)	41 tons (18 to 69)	+64%
Number of households cultivating opium poppy	8,300 to 20,000	10,200 to 38,400	
Average retail/wholesale price of opium ³	US\$ 1,640 (810 to 2,600)	US\$ 1,800 (720 to 2,900)	+10%
Total potential value of opium production	US\$ 41 million	US\$ 72 million	+76%
Eradication ⁴	662 ha	707 ha	+7%
Opium prevalence rate (based on 10 northern provinces) ⁵	N/A	0.42	N/A

¹ Range refers to the 95% confidence interval of the estimate. May include areas eradicated after the date of the area survey.

² In the absence of more recent yield surveys, the yield per hectare for 2007 was used.

³ Source LCDC, Provincial authorities survey. Due to the limited market for opium, a clear distinction between farm-gate, wholesale and retail prices could not be established. The range refers to the lowest and highest provincial price observed, respectively.

⁴ Source: LCDC. Eradication campaigns were conducted during and after the survey.

⁵ Source: LCDC.

1 INTRODUCTION

This report presents the results of the twelfth Lao People's Democratic Republic (Lao PDR) opium survey, which has been conducted annually since 1999 by the Lao National Commission for Drug Control and Supervision (LCDC) and UNODC.⁶

In 1999, the Government of Lao People's Democratic Republic and UNODC developed the programme strategy "Balanced approach to opium elimination in Lao PDR." In November 2000, Prime Minister Order Fourteen stipulated concrete Government measures against opium poppy cultivation and opium abuse. In 2001, within the context of poverty reduction, the seventh National Party Congress called for opium production and use to be eliminated by 2005. The National Campaign against Drugs was launched in October 2001 to encourage communities to give up opium production. The Government increased the momentum of the campaign in 2004 and 2005, declaring its success in significantly reducing poppy cultivation and the number of opium users in the country (by 94% and 81%, respectively) in February 2006.

However, subsequent survey results have demonstrated that the total elimination of opium poppy cultivation has not been achieved. Cultivation figures have begun to increase and the continuing presence of opium cultivation in Lao PDR indicates that local opium production is still supplying local users and continues to be a source of livelihood for some communities. Indeed, in the absence of other development initiatives opium could easily become a livelihood strategy for more communities.

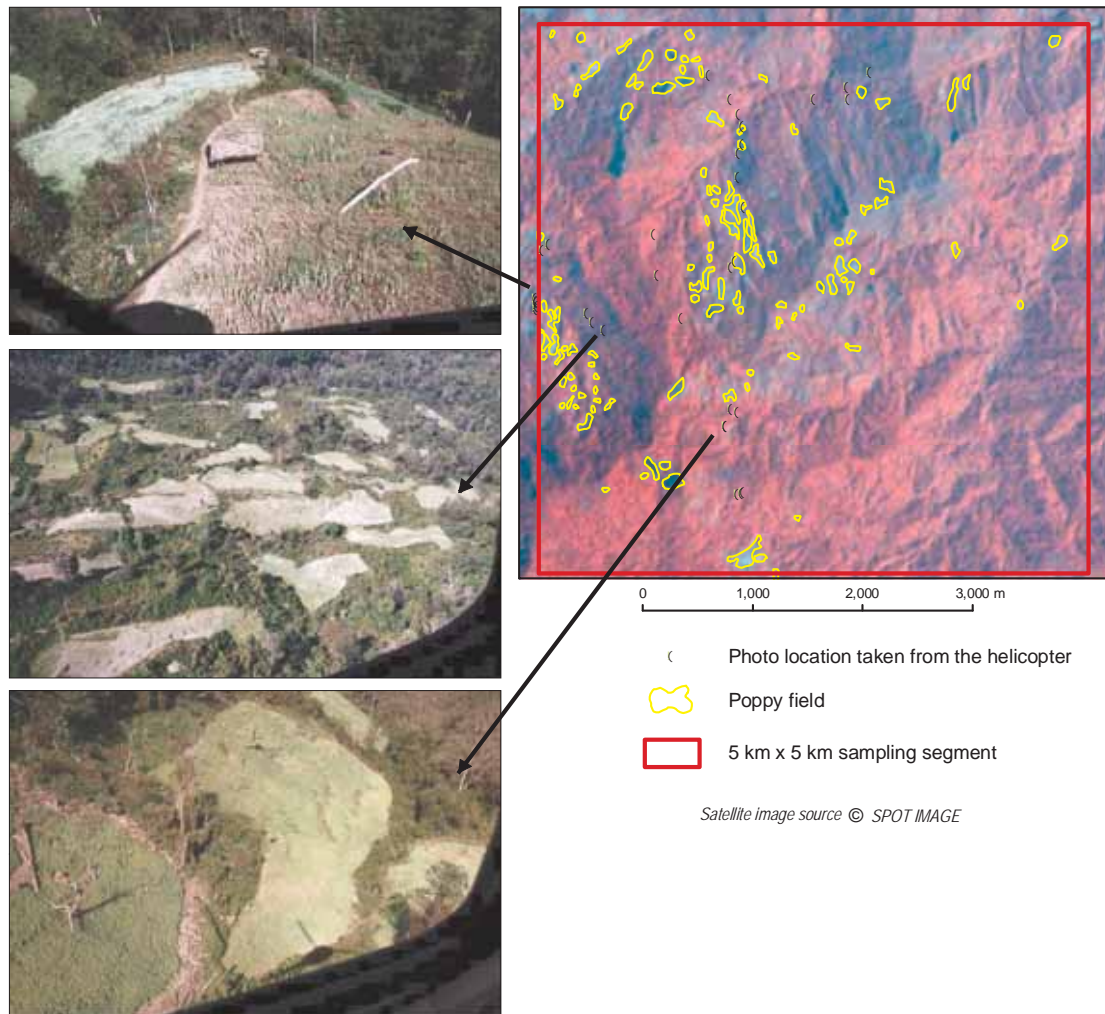
From 2005 to 2009, the survey covered six provinces in northern Lao PDR where opium poppy cultivation had taken place. From 2010, observations were only focused on Phongsali, Houaphan, Louang Namtha and Xiangkhoang provinces, where most opium poppy was cultivated, but in 2012 the survey was again extended to six provinces, covering Phongsali, Houaphan, Louang Namtha, Xiangkhoang, Louangphrabang and Oudomxai. The area was estimated through a helicopter survey in combination with satellite images of major growing areas (in Phongsali) taken when the opium poppy was in flower. All observations, helicopter photographs, GPS data and satellite images were analysed in UNODC offices.

If the country's economic dependence on opium is to be reduced effectively, it is necessary to continue support the National Drug Control Master Plan 2009-2013 and substantially increase support to alternative development efforts in the country. Moreover, in order to evaluate the impact of alternative development programmes, and to allow for effective policy and programme development, it is necessary to continue monitoring the cultivation of opium.

⁶ UNODC began to survey the cultivation of opium in Lao People's Democratic Republic in 1992 based on an inventory of all known opium-producing villages. Similar surveys were conducted in 1996, 1998 and annually from 2000 to 2004 when the methodology was changed to a helicopter-based survey.

Figure 1: Poppy identification in SPOT satellite image and corresponding photographs taken during the helicopter survey, Lao PDR

Poppy identification in SPOT satellite image and corresponding photos taken during the helicopter survey



2 FINDINGS

The 2012 opium poppy survey was implemented by UNODC in coordination with the Ministry of Defence of Lao People's Democratic Republic. Since 2005, the UNODC Illicit Crop Monitoring Programme (ICMP) has based its opium poppy estimates for the country on observations made through a helicopter survey. This method provides accurate results but has become more challenging due to the increasing number and size of opium poppy fields, therefore satellite images were added to the 2012 survey.

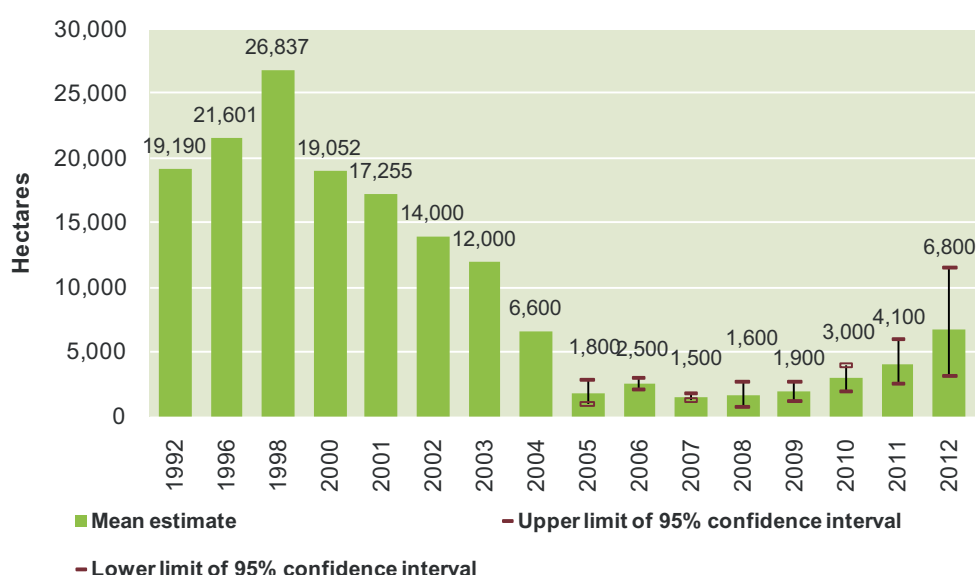
In 2012, the helicopter survey included 70 sample segments measuring 5km by 5km spread over the six opium poppy-producing provinces. The total area covered by the helicopter was 1,688 km², corresponding to 5.7% of the total risk area in the surveyed provinces. In addition, observations were made along the flight path between the sample segments in order to provide information on risk areas for future surveys. However, opium yield data for 2012 could not be collected during the helicopter survey.

2.1 Area under opium poppy cultivation

The 2012 survey confirmed the existence of opium poppy cultivation in four out of six provinces in northern Lao People's Democratic Republic, namely Phongsali, Louang Namtha, Houaphan and Louangphrabang.

The total area under opium cultivation in 2012 was estimated to be 6,800 hectares (with a 95% confidence interval between 3,100 hectares and 11,500 hectares), which represents an increase of 66% in comparison to 2011, follows the increasing trend that began in 2006 and means that opium cultivation in 2012 was back to its 2004 level. This estimate did not take into account the impact of the Government's subsequent eradication efforts (covering 707 hectares), i.e. it may include areas eradicated after the date of the survey.

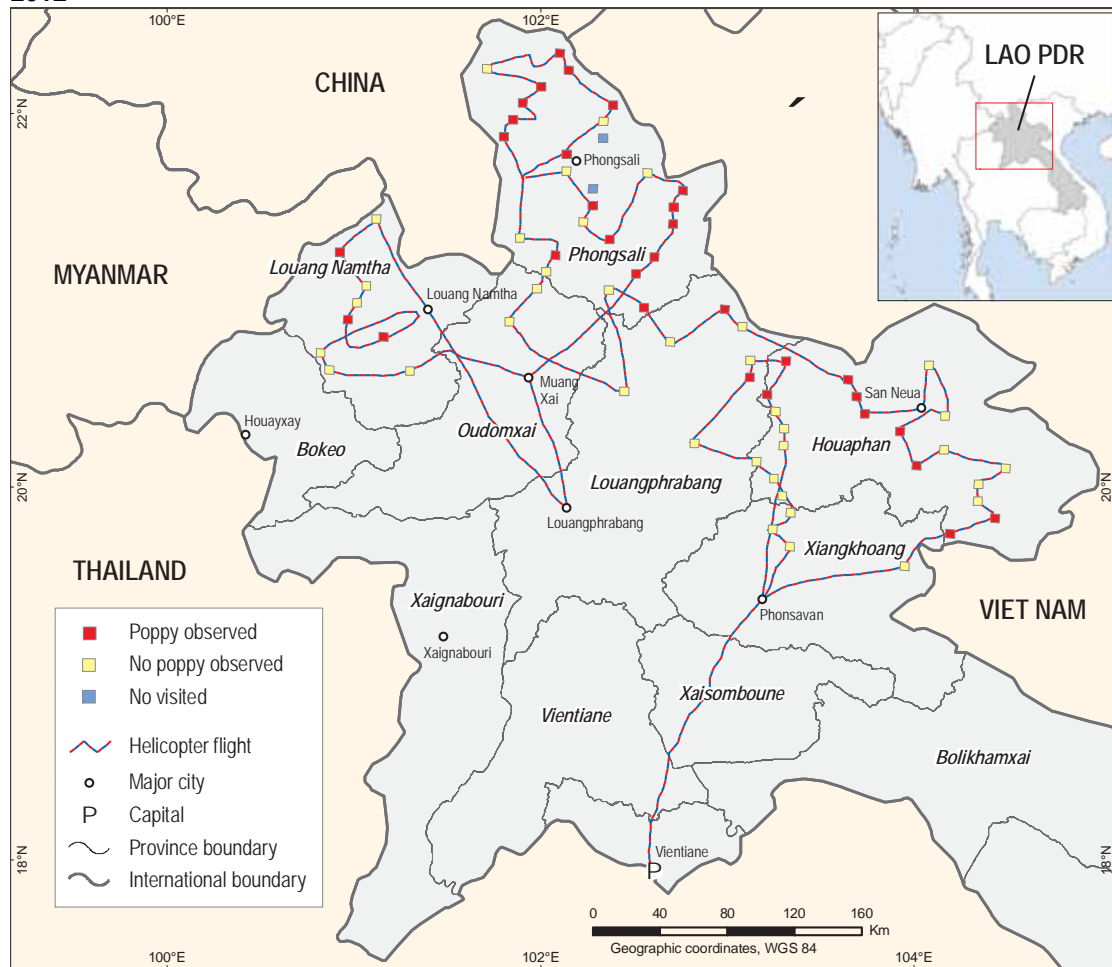
Figure 2: Estimated area under opium poppy cultivation in Lao PDR (Hectares), 1992-2012



The estimated area under opium poppy cultivation was calculated based on a sampling frame that included potential areas for opium poppy cultivation in Phongsali, Louang Namtha, Houaphan, Xiangkhoang, Oudomxai and Louangphrabang. Taking into account the results of previous surveys as well as information from the Government and UNODC projects, it is assumed that opium poppy cultivation outside the sampling frame was negligible.

Out of 70 planned segments, two segments could not be visited in Phongsali province due to heavy fog. Another segment was only partially visited due to technical problems. No poppy was found in Oudomxai and Xiangkhoang provinces. Most poppy was observed in Phongsali where it was found in two thirds of sampled segments and in the whole province, whereas in preceding years poppy cultivation was concentrated in the north of Phongsali. The second province with a high cultivation density was Houaphan where poppy was found in almost half of the sampled segments.

Map 1: Sample segments and helicopter survey route, northern Lao PDR, 2012

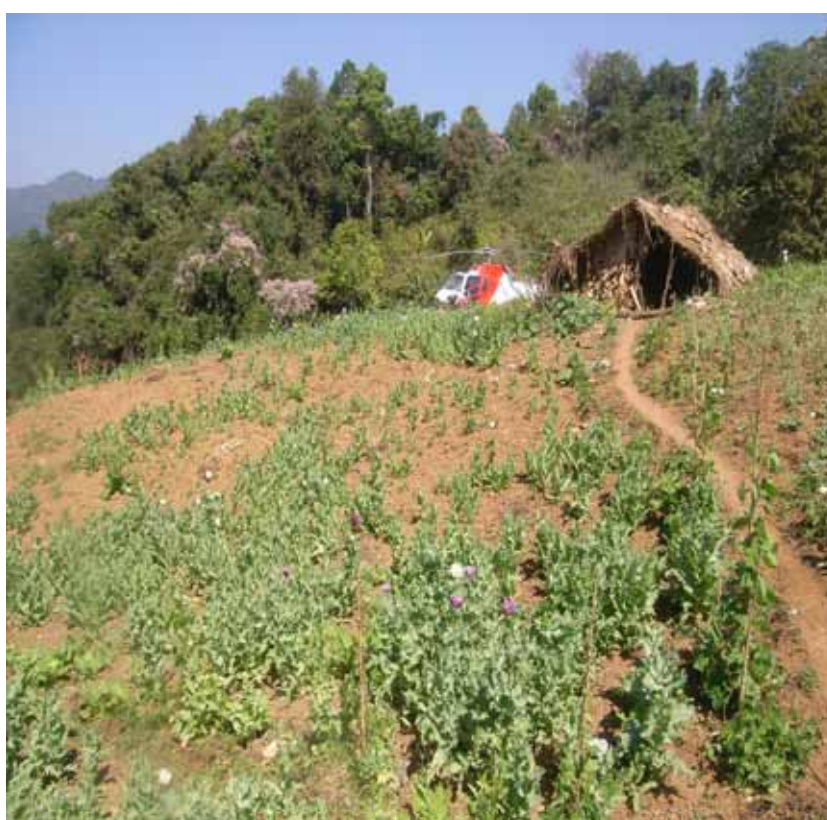


Source: Government of Lao PDR - National monitoring system supported by UNODC
 The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Opium poppy fields were found in 31 of the 70 randomly selected segments. The concentration of opium poppy cultivation was higher in 2012 than in 2011. In many cases it was impossible to identify the villages to which observed opium poppy fields belonged, making it difficult to target villages for eradication campaigns. Temporary settlements, which are probably used by labourers during the opium poppy growing season, were observed near poppy fields.

Table 1: Segments covered by 2012 survey and percentage of opium poppy found, Lao PDR

Province	Not visited	Poppy found		Grand Total	Percentage of segments with poppy
		NO	YES		
PHONGSALI	2	7	18	25	72%
HOUAPHAN		12	9	21	43%
LOUANG NAMTHA		6	3	9	33%
LOUANGPHRABANG		5	2	7	29%
OUDOMXAI		2		2	0%
XIANGKHOANG		4		4	0%
Grand Total	2	36	32	68	46%

**Survey helicopter landing in a poppy field in Lao PDR, 2012**

In 2012, the approximate number of households associated with the cultivation of opium poppy in Lao People's Democratic Republic was estimated to be between 10,200 and 38,400, which represents a significant increase from 2011 (8,300 to 20,000).

Table 2: Estimated number of opium poppy-growing villages and households, Lao PDR, 2003-2012⁷

Year	Number of opium poppy-growing villages	Number of opium poppy-growing households
2003	1,537	40,000
2004	846	22,800
2005	270	6,200
2006	n/a	5,800
2007	n/a	n/a
2008	n/a	n/a
2009	n/a	n/a
2010	n/a	6,300 to 13,300
2011	n/a	8,300 to 20,000
2012	n/a	10,200 to 38,400

2.2 Cultivation practices and crop calendar

As noticed in previous years, multi-staged cropping (planting the same crop at different time intervals in the same field) was observed in 2012. This method is usually employed to avoid eradication of the entire harvest and also to stagger the maintenance of poppy field labour requirements, which is of particular importance during harvesting when opium poppy farmers live alone in the poppy fields for at least three months at a time and cannot count on assistance.

Table 3: Crop calendar for opium poppy cultivation in Lao PDR, 2011-2012

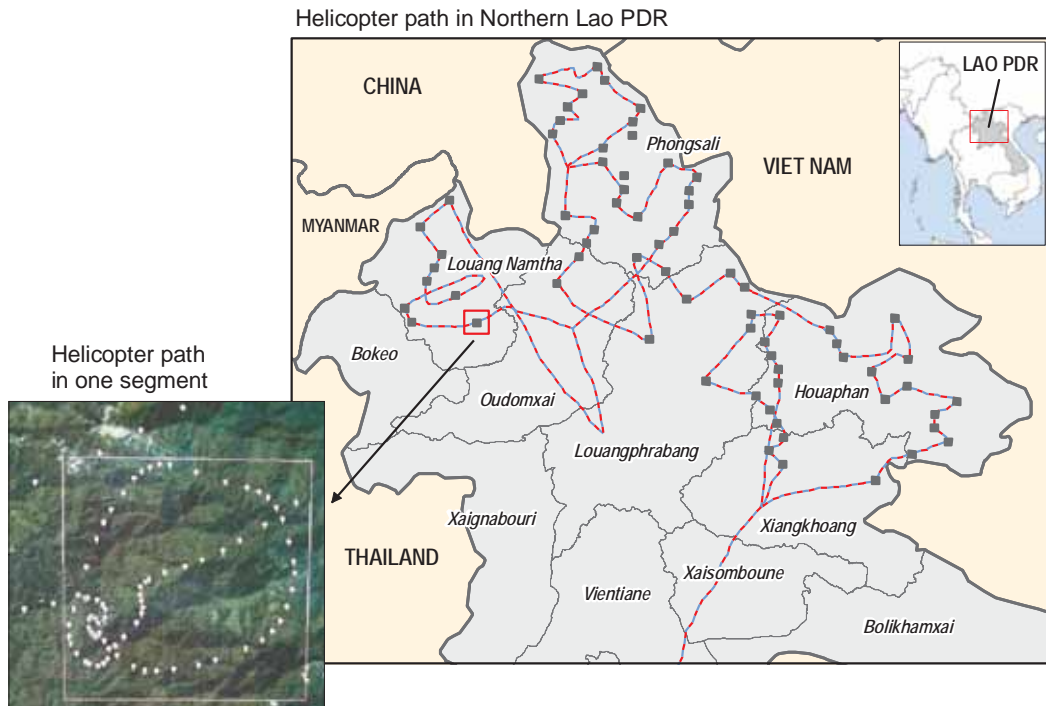
Field preparation	Sowing	Harvest
Mid September – end October	Early October – mid November	End January – mid March

⁷ The number of households associated with opium poppy cultivation was not estimated between 2007 and 2009.



Farmers spend several months of the year away from their villages among the poppy fields.

Map 2: Example of opium poppy fields identified in the helicopter survey, Lao PDR, 2012



2.3 Yield and production

As in previous years, no yield survey was conducted in Lao People's Democratic Republic in 2012. Observations made from the helicopter showed that opium poppy plants were healthier in 2012 than in previous years, but in the absence of a proper yield survey the yield of 6 kilograms per hectare (estimated in 2007) was used to calculate total opium production. Opium farmers were also observed to be using pesticides in poppy fields and some had constructed basic irrigation systems.



An opium poppy farmer's shack.



A bamboo piping irrigation system, which usually gives the farmer the benefit of both drinking and irrigation water.



Inside an opium farmer's shack, where farmers live in extreme poverty.



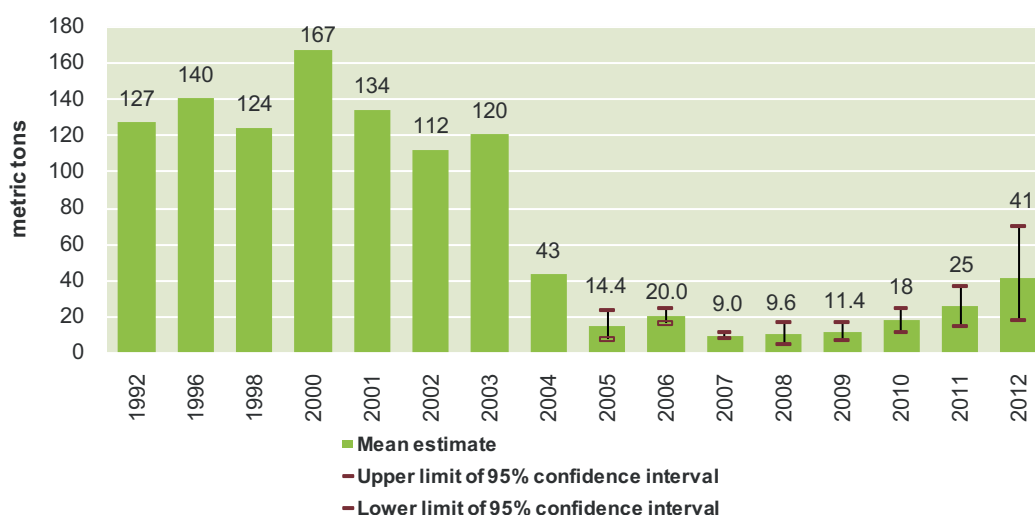
The basic production tools of an opium poppy farmer, including opium pipe.

Based on the estimated area under cultivation, the potential production of dry opium for 2012 was 41 tons, which represents a 64% increase on the previous year. Nevertheless, the actual amount of opium harvested in 2011 may have been lower than the estimated potential production due to the impact of the Government's eradication efforts after the survey.

Table 4: Opium yield, Lao PDR, 1992-2012 (Kilograms per hectare)

	1992	1996	1998	2000	2001	2002	2003	2004	2005	2006	2007-2012
Potential opium yield (kg/ha)	6.6	6.4	4.6	8.7	7.2	8	10	6.5	8	8	6*

* Due to the absence of a proper yield survey, since 2007 a yield of 6kg/ha has been used.

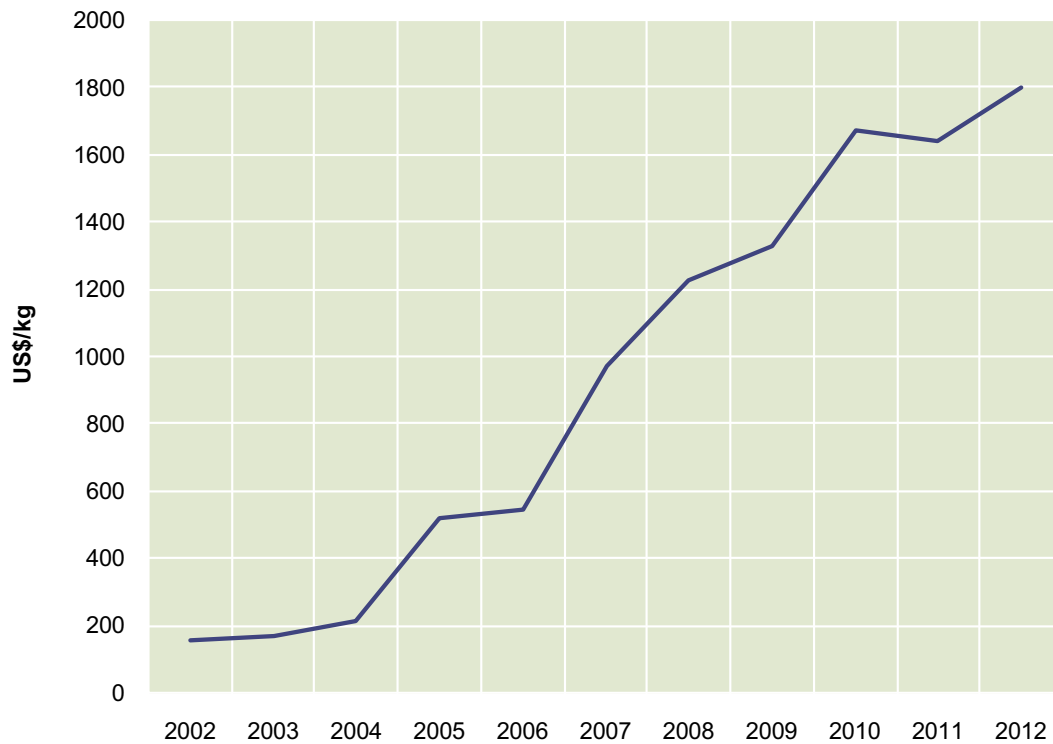
Figure 3: Potential opium production, Lao PDR, 1992-2012 (Tons)

2.4 Opium prices

It was not possible to collect opium farm-gate prices due to the difficulty of access to areas where opium is grown. However, local authorities collect opium prices at the provincial level, usually during the harvest or soon after it. As in previous years, in 2012 it was not possible to make a clear distinction between wholesale and retail prices because opium is usually consumed by local opium users who purchase it locally. In 2012, opium prices reached US\$ 1,800/ kg, representing an increase of 76% on 2011.

The lowest price at the regional level in 2012 was US\$ 721 in Bolikhamxai province and the highest was US\$ 2,931 in Xiangkhoang. According to field reports, it is likely that these differences reflect differences in the local availability of opium.

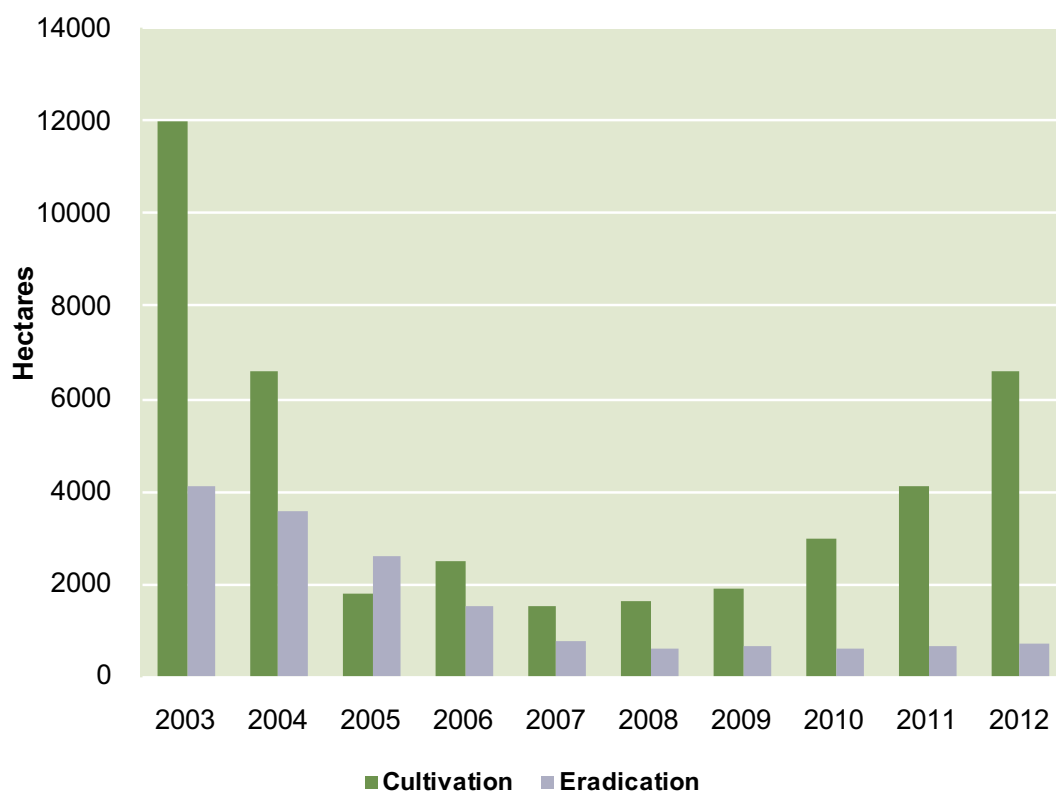
The high price of opium makes its cultivation very attractive to farmers, especially if they have no other options or alternative source of income. The continued provision of relief and development assistance to the most affected part of the region's population is thus fundamental.

Figure 4: Opium prices, Lao PDR, 2002 to 2012 (United States dollars per kilogram)

Source: LCDC..

2.5 Opium poppy eradication

The annual opium poppy survey is not designed to monitor or validate the results of the eradication campaign carried out by the Government of Lao People's Democratic Republic. According to Government reports, eradication took place on 707 hectares during or after the helicopter survey, in most cases at a time when opium harvesting was already underway. Most eradication took place in two provinces, the largest areas eradicated being in Phongsali (245 hectares) and Houaphan (225 hectares). Most opium cultivation in the country is concentrated in remote areas, which makes it difficult for eradication teams to reach and destroy the opium crop.

Figure 5: Opium poppy cultivation and eradication, Lao PDR, 2003 to 2012 (Hectares)**Table 5: Reported eradication by province, Lao PDR, 2012 (Hectares)**

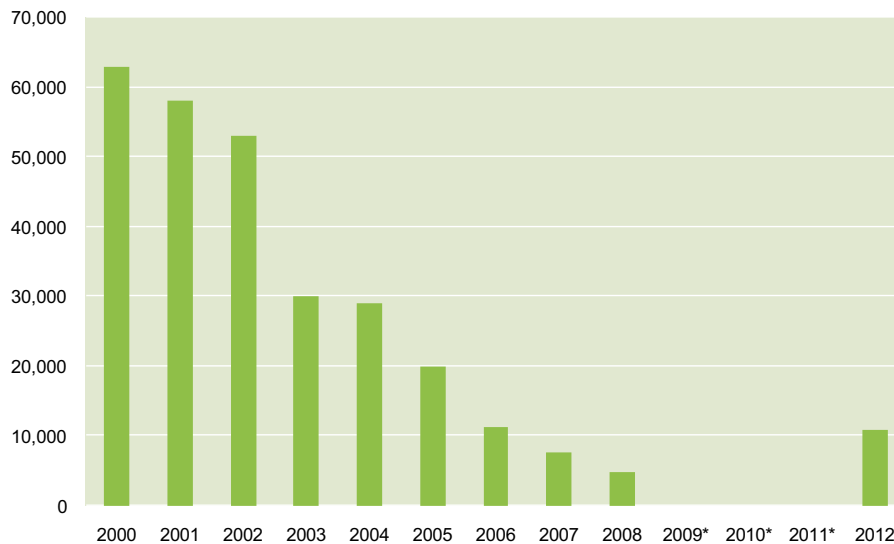
NO	Province	Eradication area in hectares	%
1	Phongsali	245.05	35%
2	Houaphan	225.88	32%
3	Louang Namtha	95.69	14%
4	Louangphrabang	69.44	10%
5	Bokeo	21.88	3%
6	Xiangkhoang	20.71	3%
7	Bolikhamxai	11.50	2%
8	Oudomxai	11.25	2%
9	Vientiane	5.36	1%
10	Xaignabouri	0	0%
	Total	706.76	100%

Source: LCDC

2.6. Opium users

In 2012, Lao National Commission for Drug Control and Supervision (LCDC) reported the number of regular opium users to be 10,776 in 10 northern provinces, which translates into a prevalence rate of 0.42% among the population aged 15-64 in those provinces.⁸ The provinces with the highest opium prevalence rates were the two main opium-producing provinces, Phongsali and Houaphan. Of reported users, 17% were female.

Figure 6: Opium users,⁹ Lao PDR, 2000-2012



* No data available for 2009-2011. Source: LCDC.

⁸ Calculated with population figures from the national population census 2005.

⁹ Source: LCDC. Based on 11 northern provinces in 2002-2004, 8 provinces in 2005, 6 in 2006, 10 in 2007, 2008 and 2012.

Table 6: Reported opium use by province, Lao PDR, 2012

NO	Provinces	Regular users (male and female)	Female users	Total population ¹⁰	Prevalence of regular use(%)
1	Phongsali	2,413	247	167,181	1.44
2	Houaphan	2,977	583	280,780	1.06
3	Louang Namtha	1,516	315	145,231	1.04
4	Xiangkhoang	1320	273	228,882	0.58
5	Bokeo	512	89	145,919	0.35
6	Louangphrabang	793	72	405,949	0.2
7	Oudomxai	505	86	264,830	0.19
8	Vientiane	516	133	386,558	0.13
9	Bolikhamxai	150	34	225,167	0.07
10	Xaignabouri	64	12	338,044	0.02
Total		10,766	1,844	2,588,541	0.42

Source: LCDC.

Remote opium poppy fields planted in dense forest.

These poppy fields are difficult for the eradication squad to find. Farmers who cultivate remote fields live on site for months on end in small shacks and feed themselves with locally caught game and fish, as well as with rice brought from their villages.



¹⁰ Source: National population census 2005, Lao PDR Government.



Easy-access poppy fields. Large areas are also found relatively close to villages, especially in northern Phongsali. These are sometimes close to mountain roads.



3 METHODOLOGY

3.1 Helicopter survey

Under its global illicit crop-monitoring programme, UNODC has established methodologies for data collection and analysis with a view to increasing the capacity of the Government of Lao People's Democratic Republic to monitor illicit crops and assist the international community in monitoring the extent, growth and contraction of illicit crop cultivation.

In Lao People's Democratic Republic, the area under opium poppy cultivation is small, not easily accessible and widely distributed. In such circumstances an aerial survey by helicopter is an efficient method for estimating the extent of cultivation. As in former surveys, the team visited randomly selected sites (square segments) by helicopter and made an estimation of the area covered by poppy for each field within the selected site. Due to the increasing number of poppy fields found, however, two satellite images were acquired that were used to count and accurately measure the fields identified as poppy fields during the flight.

3.2 Sampling frame

The quality of the data collected from the aerial survey depends to a large extent on the quality of the sampling frame from which the sample is selected. The process for defining the sampling frame begins with a selection of provinces and districts where poppy cultivation is thought to occur. This assumption is based on information from local experts and on previous surveys. In 2012, the sampling frame for the area estimation was extended from four to six provinces in northern Lao People's Democratic Republic (Phongsali, Louang Namtha, Oudomxai, Louangphrabang, Houaphan, and Xiangkhoang) since there were indications in the former survey and from the ground that poppy growing had increased in those areas. The frame was established by defining the potential land available for opium poppy cultivation in those provinces and a number of sample plots were selected within the area. The estimate for opium poppy cultivation in the 2012 survey is only for the area within the sampling frame, even though there might be some remnants of cultivation in other provinces.

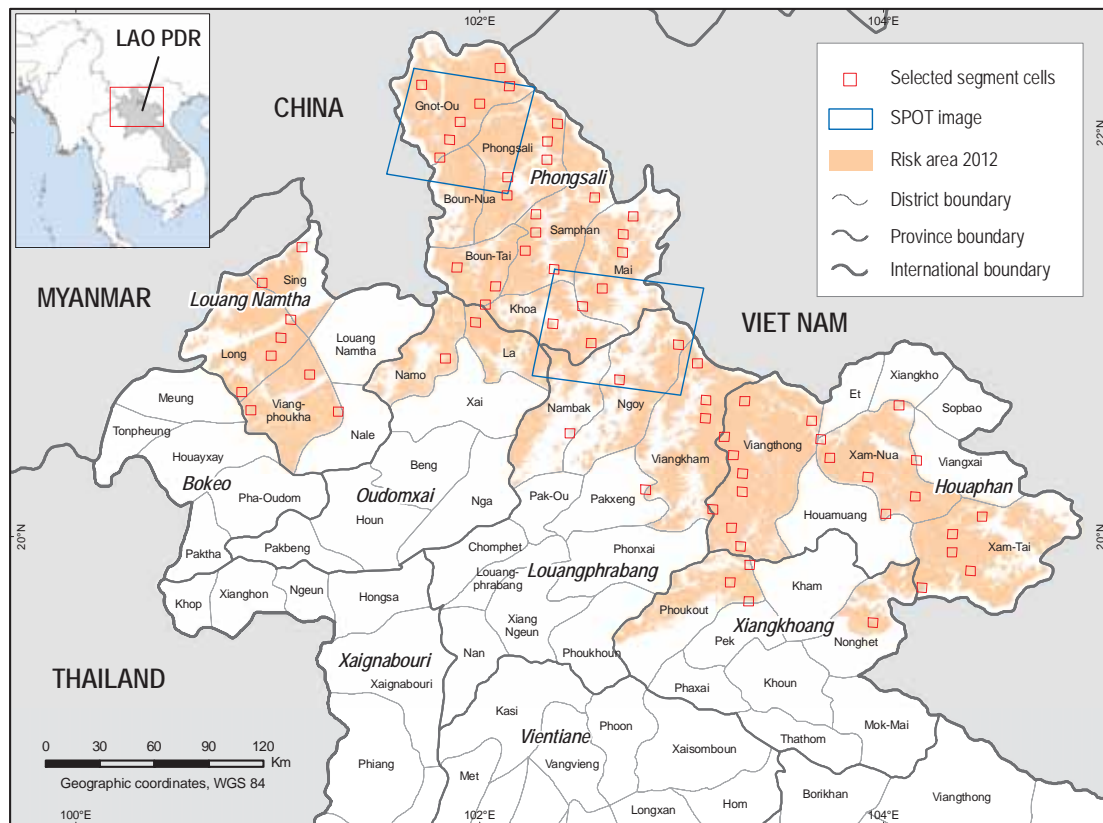
In the north of the country, small opium plots are mainly found dispersed in mountainous areas. Farmers avoid large, sparsely forested plains and densely inhabited/settled areas, located at lower altitudes. Past surveys have indicated that more than 80% of opium poppy-growing villages are at an altitude of above 700 metres and on slopes with inclines of more than 10%. Because such topographic conditions correspond so closely to both actual cultivation patterns and probable cultivation patterns they were used to define the frames themselves. The calculations were performed with the help of a Geographic Information System (GIS). A digital elevation model (90 metre pixel) and its derived slope map were used to delineate areas above 700 metres in altitude and slopes of more than a 10% incline. In addition, the sampling frame was further defined by a 3-kilometre buffer area along the country's international borders, which was completely excluded from all survey activities for security reasons.

The final sampling frame consisted of 29,596 km², which was divided into 1,471 grids measuring 5 km by 5 km (25 km²).



Poppy fields photographed from above and at ground level.



Map 3: Sampling frame and selected segment cells in northern Lao PDR, 2011

Source: Government of Lao PDR - National monitoring system 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.

3.3 Sample size and sample selection

Although a larger sample size means a more accurate estimate, the financial resources available unfortunately limited the size of the sample. As a compromise, the sample size was calculated as a function of the costs associated with the helicopter flying time and the precision of the estimate.

The budget available limited the flying time to a maximum of 26 hours. Therefore, in order to estimate the number of potential selected segments, it was necessary to evaluate the helicopter's characteristics.

The helicopter used for the survey was a Squirrel, a type of helicopter used mostly for rescue, aero-medical, survey and military roles. Powered by a single jet engine, the Squirrel has a maximum cruise speed of 220 kph, can accommodate up to four passengers and carry loads of up to 750 kg.

On the basis of available financial resources, the total number of segments can be estimated from the following formulae:

$$T = nt_s + n(d/v)$$

$$n = \frac{T}{t_s + (d/v)} \approx 70$$

where T is total helicopter time available for sampling (= 26 hours minus 3 hours for transit time between regions and refueling), determined by an estimate of total time spent sampling in all segments plus an estimate of total time travelling between segments;

n is the number of segments;

t_s is the average time required to complete sampling within a segment (= 10 minutes);

v is the average helicopter speed between segments (200 kph);

d is the average distance between segments (= 35 km, based on total flight path from previous surveys).

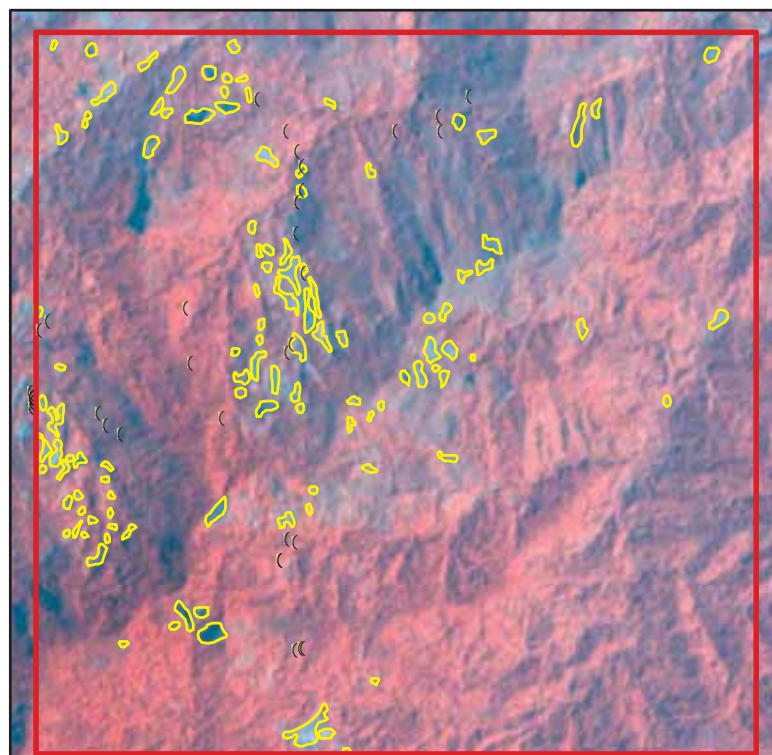
The 70 selected grids contain 1,688 km² of risk area from the sampling frame of 29,596 km², which represents 5.9%, covering a reasonable amount of the sampling frame.

The sample of 25km² grids was selected using systematic random sampling across the whole frame over northern Lao People’s Democratic Republic.

3.4 Area estimation procedure

The estimation of the area under opium poppy cultivation was based on the information collected during the helicopter survey in combination with two satellite images of major growing areas (in Phongsali) taken when the opium poppy was in flower. All observations, helicopter photographs and GPS data were analysed along with the satellite images in UNODC’s offices. The satellite images were SPOT images with 10-metre resolution taken at the beginning of March, some three weeks after the helicopter flight. For the segments containing a lot of poppy, the satellite images were used to delineate the fields and calculate the total area covered with poppy. This resulted in opium cultivation area estimations per segment.

Example of area calculation in a segment with helicopter observations and a satellite image



0 1,000 2,000 3,000 m

- (Photo location taken from the helicopter
- Poppy field
- 5 km x 5 km sampling segment

Satellite image source © SPOT IMAGE

Ratio estimation formulae were used to estimate the extent of opium poppy cultivation using the equations described below. Two of the 70 segments were not surveyed due to poor weather conditions and only 50% of another segment could be observed. These three segments were excluded from the analysis.

- a. Average proportion of opium poppy cultivation over the risk area:

$$\bar{y} = \frac{1}{n} \sum_{i=1}^{67} P_i / R_i$$

where n is the number of surveyed segments, P_i is the area of poppy in segment i and R_i is the risk area in segment i .

- b. Estimate of area of opium cultivation in Lao People's Democratic Republic.

$$A = R_s \bar{y}$$

where R_s is the total risk area in the sampling frame.

To obtain confidence intervals for the area estimate bootstrapping was performed.

To calculate opium production the area of opium cultivation, A , is multiplied by the yield.

PART 3. MYANMAR

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ABBREVIATIONS

CCDAC	Central Committee for Drug Abuse Control
GOUM	Government of the Republic of the Union of Myanmar
ICMP	UNODC Illicit Crop Monitoring Programme
SASS	Statistics and Surveys Section (UNODC)
SR	Special Region
UNODC	United Nations Office on Drugs and Crime

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FACT SHEET — MYANMAR OPIUM SURVEY 2012¹

	Year 2011	Year 2012	Change from 2011
Total opium poppy cultivation (hectares) ²	43,600 (29,700 to 59,600)	51,000 (38,200 to 64,400)	17%
Opium poppy cultivation in Shan State (hectares)	39,800 (25,900 to 59,600)	46,000 (34,800 to 58,700)	16%
Average opium yield (kg/ha)	14	13.5	-4%
Total potential production of dry opium (tons)	610 (420 to 830)	690 (520 to 870 tons)	13%
Total opium poppy eradication (hectares) ³	7,058	23,718	236%
Average farm-gate price of fresh opium ⁴	US\$ 450/kg	US\$ 520/kg	16%
Total potential wholesale value of opium production ⁵	US\$ 330 million (230 to 450)	US\$ 420 million (320 to 530)	28%
Estimated number of households involved in opium poppy cultivation ⁶	256, 000 (175 to 351,000)	300, 000 (220 to 380,000)	17%
Household average yearly income in the preceding year in Shan State:			
Non-opium-producing households	US\$ 1,180	US\$ 1,610	N/A ⁷
Opium-producing households (income from opium sales)	US\$ 1,030 (US\$ 560)	US\$ 1,830 (US\$ 840)	N/A

¹ Numbers in brackets indicate upper and lower bounds of the best estimate.

² May include areas eradicated after the date of the area survey.

³ Source: CCDAC.

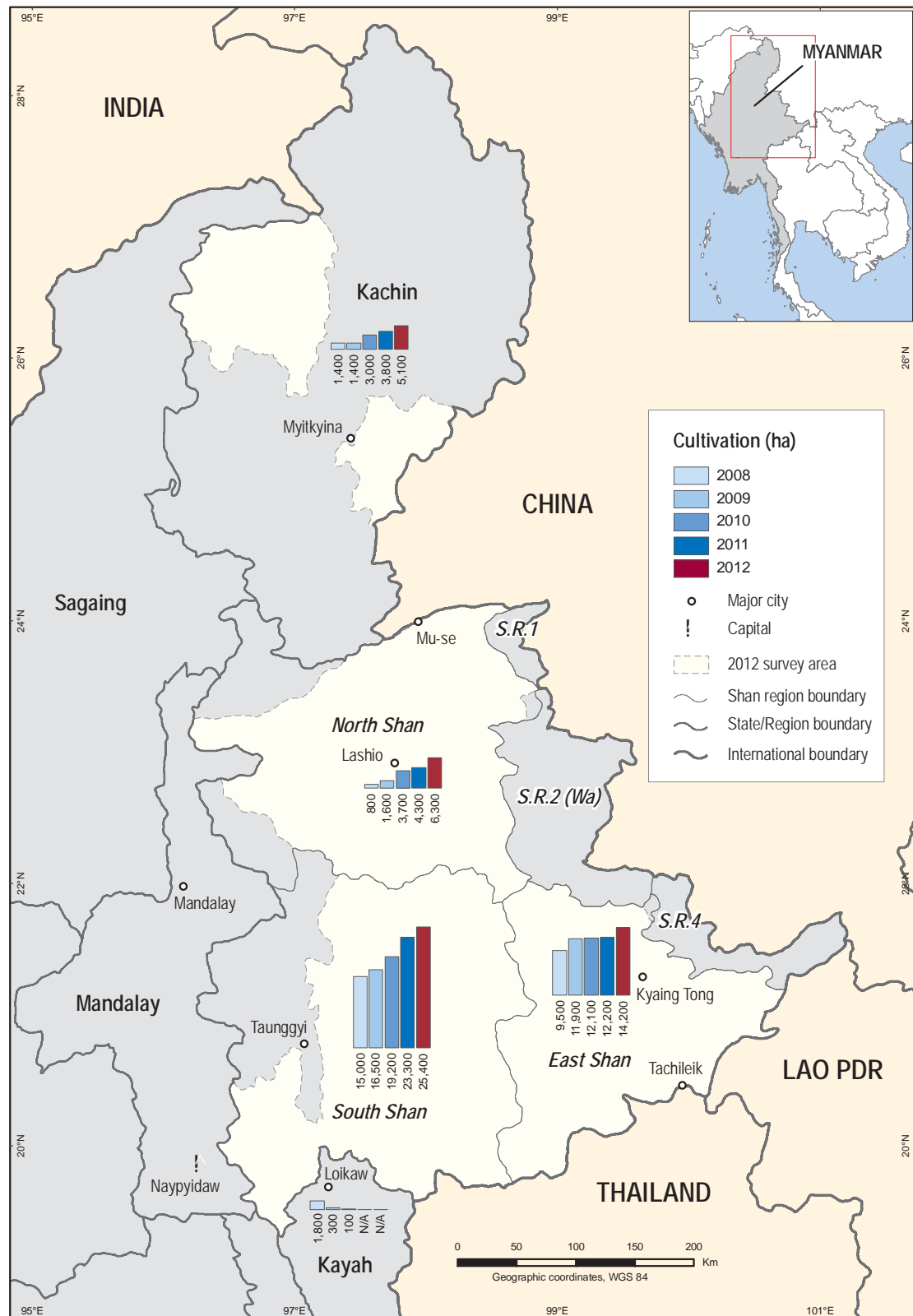
⁴ At harvest time, weighted by area under cultivation. Based on data in Shan State only.

⁵ This is a result of dry opium production and farm-gate price which can be a mixture of semi-dry and fresh opium prices. Due to the different times of storage the difference between fresh and dry opium is not clearly differentiated by the farmers.

⁶ The estimated number of households involved in the cultivation of poppy is derived as the ration of the estimated area cultivated by region divided by the average area of opium poppy cultivated per household. This calculation presupposes that the average area per household remains unchanged at 0.17 hectares.

⁷ The methodology used to collect income data for 2011 in the Opium Survey 2012 was different to that used in the previous year; hence the income estimates in this table are not comparable year-on-year.

Map 1: Opium poppy cultivation status in Myanmar, 2012



Source: Government of Myanmar - National Monitoring System 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.

1 INTRODUCTION

This report presents the results of the tenth annual opium survey in Myanmar. It was conducted by the Central Committee for Drug Abuse Control (CCDAC) of Myanmar, with the support and participation of UNODC. Since 2001, UNODC has been collecting statistical information on illicit crop cultivation in Myanmar, within the framework of its Illicit Crop Monitoring Programme (ICMP). ICMP works with national governments to increase their capacity to monitor illicit crops and supports the international community in monitoring the extent and evolution of illicit crops in the context of the plan of action adopted by the United Nations (the 53rd session of the Commission on Narcotic Drugs in March 2009). The survey methodology combines satellite imagery with field and village surveys. In combination, these three survey methods provide the information used to determine the extent of opium poppy cultivation and production, as well as the socio-economic situation of farmers in Myanmar.

In the 1980s, Myanmar was the world's largest producer of illicit opium. Between 1981 and 1987 it had an average annual opium production of about 700 tons, which continued to increase until 1996 when it reached annual production levels of some 1,600 tons. In 1991, Afghanistan replaced Myanmar as the world's largest producer of opium, primarily due to its higher opium yield per hectare. However, the area under cultivation remained larger in Myanmar than in Afghanistan up until 2002.

In 1999, the Government of the Republic of the Union of Myanmar (GOUM) and local authorities in areas affected by opium poppy cultivation developed a 15-year plan to eliminate illicit crop production by the year 2014. Up until 2006 there was a considerable decrease in the total area under opium poppy cultivation in Myanmar but illicit opium poppy cultivation has since increased, although it is still well below the levels reached in the 1990s.

This development indicates that achievements in reducing the cultivation and production of opium can only be sustained if alternative livelihoods are available to local communities. Farmers are very vulnerable to losses in income derived from opium, especially those who depend on such an income source for food security. Furthermore, opium cultivation is generally linked to the absence of peace and security, which indicates the need for both political and economic solutions.

Wa Region was reported as being opium poppy-free in 2006. However, as it was unclear to what extent remnants of poppy cultivation were left there, or if there had been any resurgence in poppy cultivation, the area monitored with satellite images was extended to Wa Special Region 2 for the 2012 survey. In addition, an area in Chin State was surveyed with satellite images where previously only rapid assessments had been performed.

Annual opium surveys remain essential for assessing the extent of opium poppy cultivation in Myanmar, as well as changes in cultivation patterns in the country. They are also useful tools for gauging the effectiveness of opium bans and their implications, as well as aiding with the understanding of cultivation techniques and alternative livelihoods. Such information is essential for developing effective strategies for sustaining the transition from an illicit economy to a licit economy.

2 FINDINGS

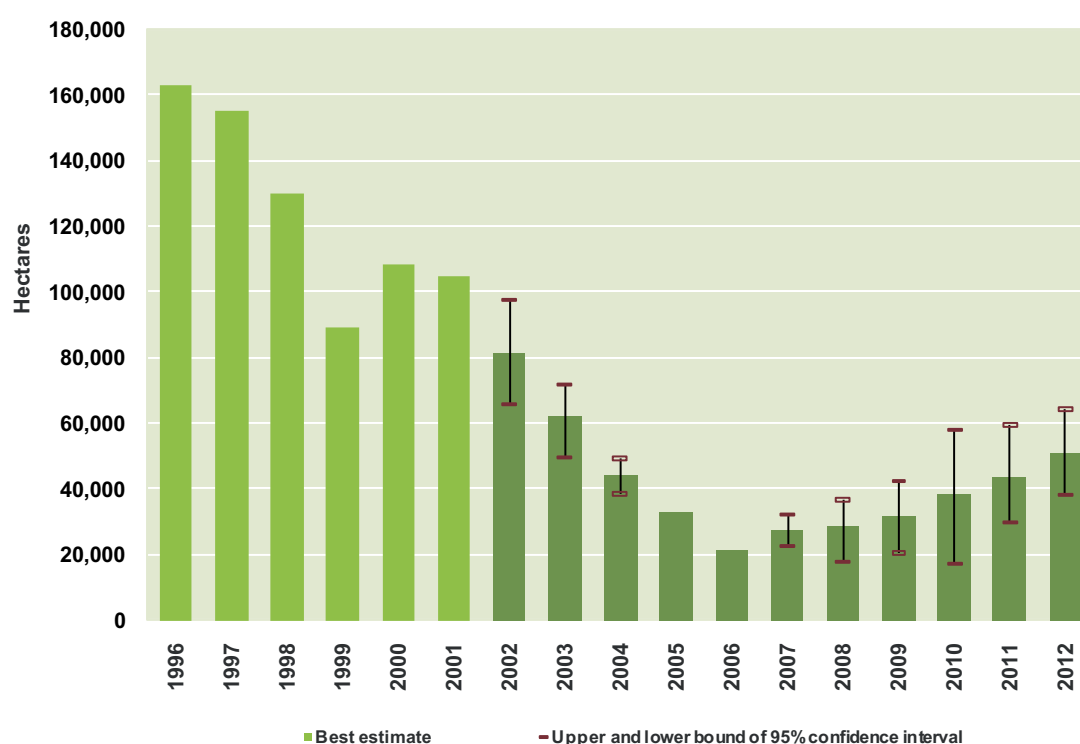
2.1 Opium poppy cultivation

In 2012, the annual opium survey in Myanmar covered Shan State (North, East, and South Shan), and Kachin State, which constitute the country's principal opium poppy-cultivating regions. The UNODC rapid assessment survey found no evidence of opium poppy cultivation in the Special Regions in Shan (Wa Special Region 2, Kokang Special Region 1 and Special Region 4).

However, limited satellite imagery and findings from ground surveillance did find evidence of limited opium poppy cultivation in Chin, though the region was not fully covered in the survey.

The total area under cultivation in 2012 was estimated at 51,000 hectares, representing an increase of one sixth on the 2011 level of 39,800 hectares and the sixth consecutive year-on-year increase since the low 2006 level of 21,600 hectares.

Figure 1: Opium poppy cultivation in Myanmar, 1996-2012 (Hectares)

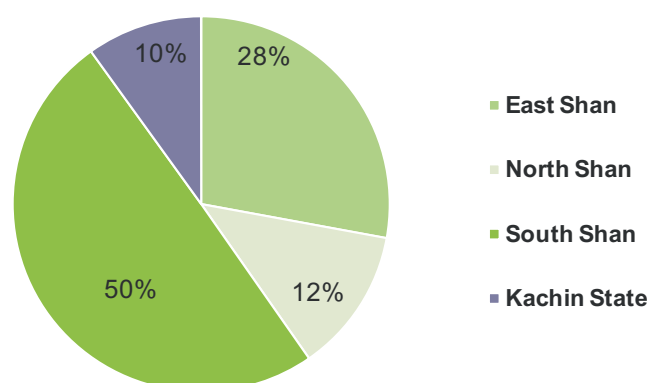


Source: 2001 and before: United States Government; since 2002: GOU/UNODC.

Table 1: Opium poppy cultivation in Myanmar, 2002-2012 (Hectares)

Estimate	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Upper	97,500	71,900	49,600	*	*	32,600	37,000	42,800	58,100	59,600	64,400
Lower	65,600	49,500	38,500	*	*	22,500	17,900	20,500	17,300	29,700	38,200
Best	81,400	62,200	44,200	32,800	21,600	27,700	28,500	31,700	38,100	43,600	51,000

Source: GOU/UNODC. * In 2005 and 2006 upper and lower estimates could not be calculated.

Figure 2: Area distribution of opium poppy cultivation in Myanmar, 2012

This increase in opium poppy cultivation was not confined to a specific region, but was actually observed in East, North and South Shan, as well as in Kachin. The area under cultivation continued to be dominated by areas in South and East Shan, which continued to account for more than three quarters of the estimated total, but the increase was most pronounced (in relative terms) in North Shan, where the area rose by nearly half (from 4,300 hectares in 2011 to 6,300 hectares in 2012), and in Kachin, which registered an increase of more than a third (from 3,800 hectares to 5,100 hectares). This explains why the share of the total attributable to Kachin and North Shan (collectively) edged up from 19% in 2011 to 22% in 2012. In absolute terms, East Shan, North Shan and South Shan all registered an increase of approximately 2,000 hectares. The increase in East Shan followed a relatively stable trend over the preceding two years, while the increases in each of the other regions represented a continuation of the recent trend. These figures do not include cultivation in Chin, which, based on limited data, was assessed to be in the order of several hundred hectares in 2012.

From a long-term perspective, 2006 represented a turning point in terms of the total area under cultivation, which declined markedly in the decade leading up to 2006 but has gradually increased since then: the 2012 level (51,000 hectares) corresponds to more than twice the low 2006 level (21,600 hectares).

Table 2: Opium poppy cultivation areas, by region, Myanmar, 2011-2012⁸

	2011	2012	Change 2011-2012	Percentage of total opium poppy cultivation area
East Shan	12,200 (6,700 to 18,300)	14,200 (8,400 to 20,600)	17%	28%
North Shan	4,300 (1,700 to 7,200)	6,300 (3,300 to 9,400)	47%	12%
South Shan	23,300 (11,500 to 37,400)	25,400 (15,700 to 35,900)	9%	50%
Shan State total	39,800 (25,900 to 55,800)	46,000 (34,800 to 58,700)	16%	90%
Kachin	3,800 ⁹ -	5100 (1,900 to 10,000)	33%	10%
National total (rounded)	43,600 (29,700 to 59,600)	51,000 (38,200 to 64,400)	17%	100%

⁸ Numbers in brackets indicate upper and lower bounds of the best estimate.

⁹ There is no range calculated since the Kachin estimate was based on changes in the satellite images from 2012 to 2011, which does not allow for a range calculation.

Figure 3: Opium poppy cultivation by region, Myanmar, 2007-2012 (Hectares)

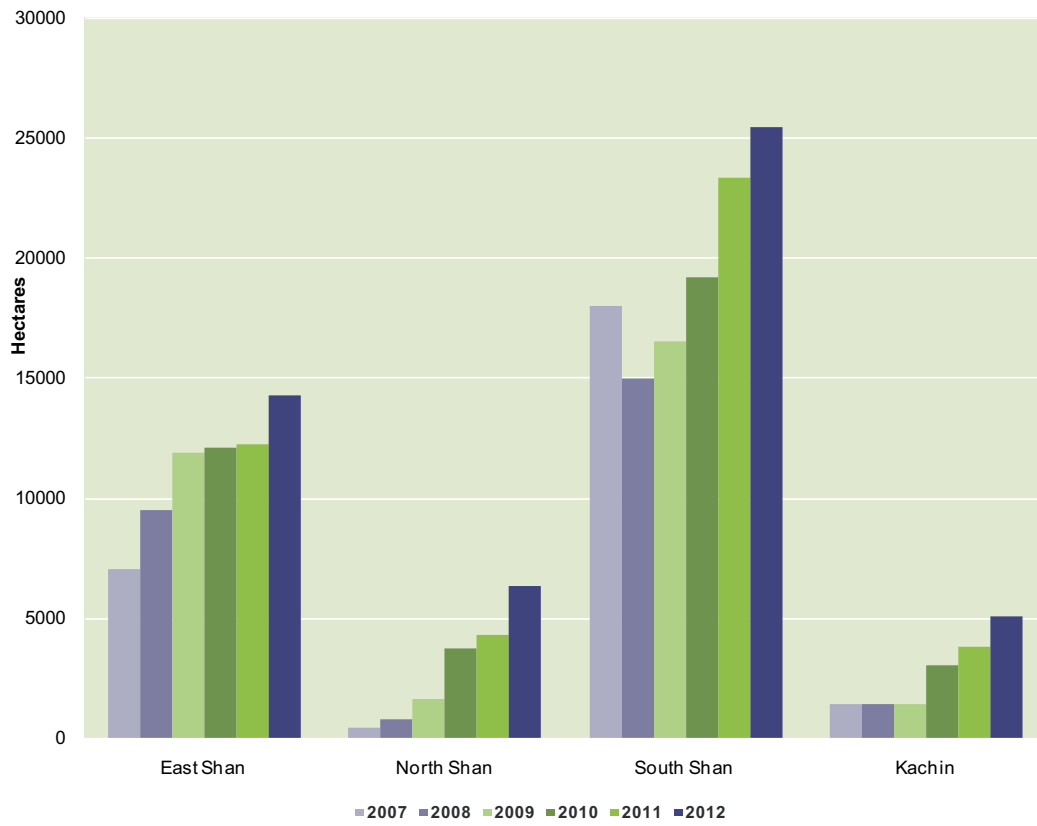
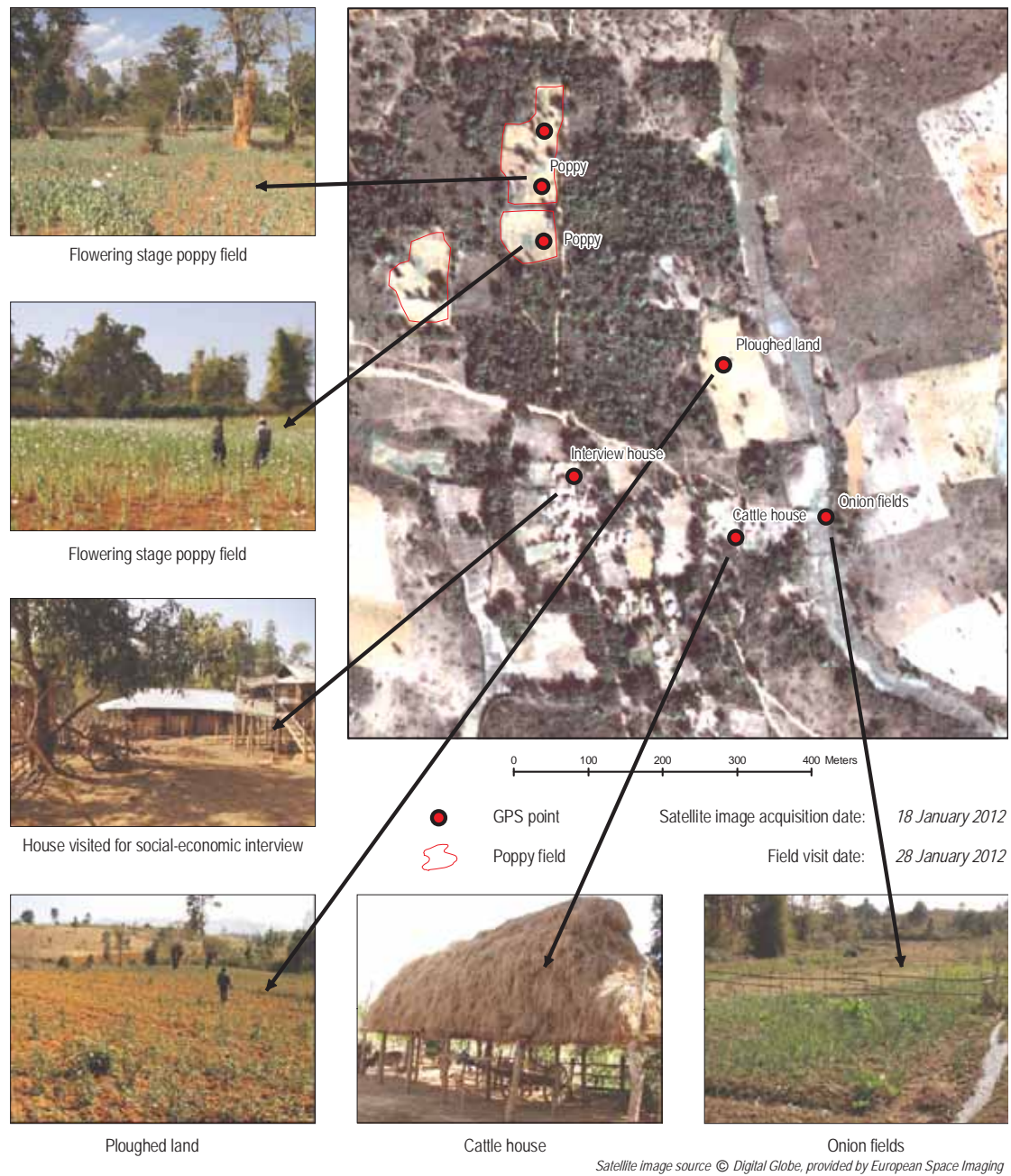


Figure 4: Poppy identification in a very high-resolution satellite image and corresponding photographs from indicated fields, Myanmar, 2012



Villages and farmers involved in opium poppy cultivation

Previous surveys indicated that a poppy-growing household in Myanmar cultivated an average area of 0.17 hectares of opium poppy.¹⁰ Based on this assumption, the estimates for cultivation in Myanmar in 2012 translate into 300,000 poppy-growing households (from 220,000 to 380,000).

Indirect calculations based on data collected for the 2012 opium poppy survey suggest a much higher area per household (0.26 hectares), which would translate into the significantly lower number of less than 200,000 households.¹¹ It is uncertain if the difference between the 2012 estimate of 0.26 hectares and previous much lower estimates is the consequence of applying a different methodology, a real increase in the amount of land dedicated to poppy cultivation by households, or if it points to a change in the organisation of poppy cultivation at the village level. Indeed, according to anecdotal information received during field visits, in recent years it seems to have become more common to cultivate poppy on large swathes of land, which involves activities carried out as a communal activity such as clearing and preparing the land before broadcasting seeds. If this is indeed the case, variations in the amount of poppy cultivated per household should be treated with caution and more in-depth studies on the role of communal activities in poppy cultivation should be undertaken to shed light on this phenomenon.

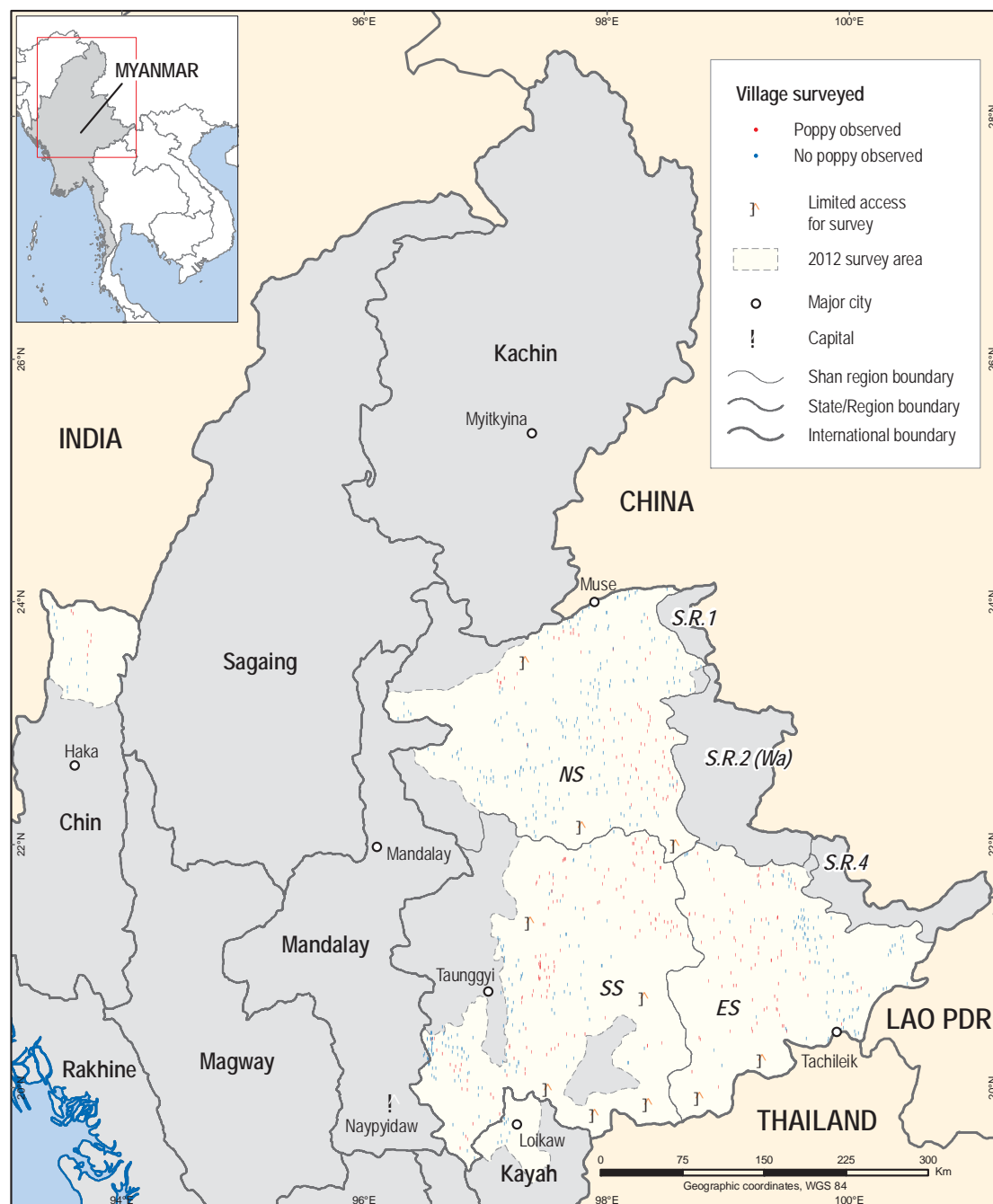
The 2012 survey also collected information on the number of households that generated income by working in poppy fields without actually cultivating poppy themselves. The findings indicate that a considerable number of households did indeed make an income from agricultural wage labour in poppy fields and that almost all of them were in poppy-growing villages. However, it is not clear if they worked in poppy fields in their own village or in other locations, and whether this wage labour formed part of the above-mentioned communally organized poppy cultivation.

Overall, opium cultivation took place in slightly more than a third (37 per cent) of the surveyed villages in 2012, with relatively high concentrations in South Shan (48 per cent) and East Shan (43 per cent).

¹⁰ Based on actual measurements of poppy fields indicating average fields sizes of 0.14 hectares in 2002 and 0.10 hectares in 2003, with adjustments made to account for the fact that, on average, households reported the cultivation of more than one poppy field. GOUM/UNODC Myanmar Opium Survey Report 2002 and 2003.

¹¹ The area of 0.26 hectares is still much smaller than in the estimate for Afghanistan, where the average area under poppy cultivation was 0.5 hectares per household in 2011.

Map 2: Surveyed villages and their opium poppy cultivating status, 2012



Source: Government of Myanmar - National Monitoring System 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.

Opium poppy growing seasons

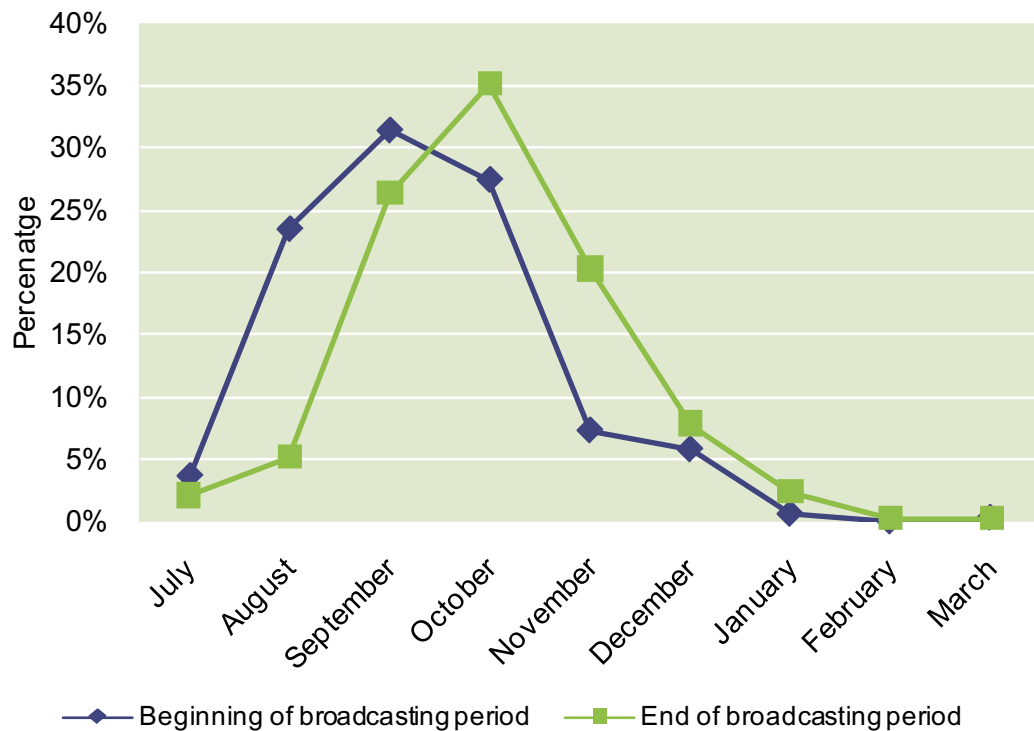
Observations made during the implementation of the 2012 socio-economic survey showed that farmers in Myanmar, as in previous years, staggered the planting of their opium crop to help distribute the workload and to avoid the risk of crop loss due to unfavourable weather during germination or harvest. Staggered planting means that poppy seed is not broadcast in all fields operated by a household at the same time but over a period of one or two weeks. This practice can also be applied to individual fields and, depending on the number of fields and their subdivisions, the planting period for poppy can extend over a month or more.

The main opium poppy growing season in Myanmar is from September to March (the dry season) with seed broadcasting being carried out mostly in September/October. Opium poppy cultivation

in the monsoon season occurs only in southern parts of Shan State, but earlier surveys have shown that the area is very limited (about 500 hectares in 2009) and gives very low yields.

A practice called multi-stage cropping is also increasingly common. During multi-stage cropping, opium poppy seeds are sown twice in the same field with a gap of a few weeks between them, thus plants of two different sizes grow in the same field at the same time. The difference between multi-stage and staggered cropping is that, in the case of the latter, poppy at different stages of development are cultivated in separate plots or field subdivisions, whereas no such divisions are made in a multi-stage field and plants of different development stages grow alongside each other.

Figure 5: Beginning and end of the opium poppy broadcasting period, frequency distributions by month, as reported in the 2012 village survey, Myanmar







	
<p>Poppy field in Maing Tong township, East Shan</p>	<p>Farmers use tin for poppy gum collection from the capsules, Tangyang township, North Shan</p>
	
<p>Dry poppy capsules after seed extraction, Pekon township, South Shan</p>	<p>Bag of poppy seed for next season's cultivation, Pekon township, South Shan</p>

Figure 6: Opium poppy cultivation calendar in Shan State, Myanmar, 2011-2012

		Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
East Shan	All Townships												
	Round 1												Normal cultivation
	Round 2												
	Round 3												
North Shan	Lashio, Maingyai, and Tantyang Townships												
	Round 1												Normal cultivation
	Round 2												
	Round 3												
	Round 1												Late crop
	Round 2												
	Theinne, Namkham, Kutkai, and Manton Townships												
	Round 1												Normal cultivation
	Round 2												
	Round 3												
South Shan State	Pinlaung, Pekhon, and Hsihseng Townships												
	Round 1												Early crop on hillside
	Round 2												
	Round 3												
	Round 4												
	Round 1												Normal cultivation
	Round 2												
	Round 3												
	Round 1												Late crop
	Round 2												
	Hopong, Loilem, Namsang, and Monea Townships												
	Round 1												Early crop
	Round 2												
	Round 1												Normal cultivation
	Round 2												
	Round 1												Late crop
Round 2													
Lecha, Maingkaing, Kehsi, Maingshu, Kunhein, Nyaungshwe, Maukmai, and Maingpan Townships													
Round 1												Normal cultivation	
Round 2													
Round 3													
Kachin State	Tanaing Township												
	Round 1												Normal cultivation
	Round 2												
	Round 3												
	Hpakant, Waingmaw, Sadon, and Putao Townships												
Round 1												Normal cultivation	
Round 2													
Chin State	Tunzan Township												
	Round 1												Normal cultivation
	Round 2												
Eradication Level													

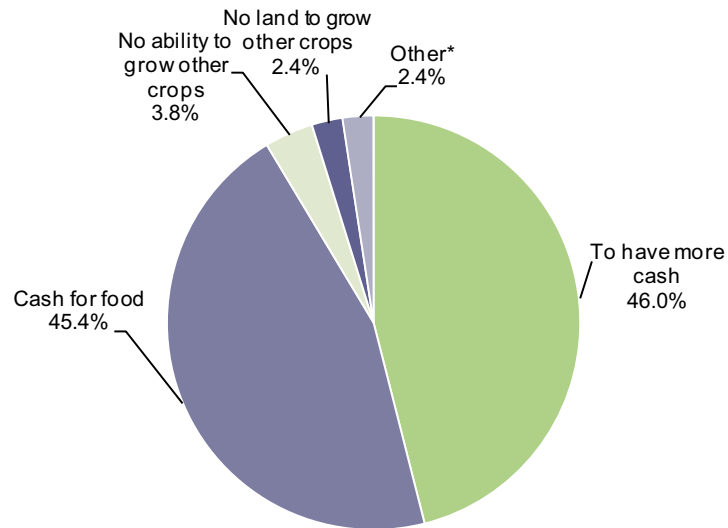
Reasons for cultivating opium poppy

Opium poppy is cultivated as a cash crop and almost half (46%) of poppy-growing villages reported that they cultivated opium poppy in 2012 to gain access to cash, while 45% did so due to the need to buy food. By comparison, the need to buy food was by far the most common reason given (60%) in 2011.

When asked to assess the advantages of poppy over other crops, more than three quarters of respondents (79%) mentioned the high net income that opium provides. The possibility of using

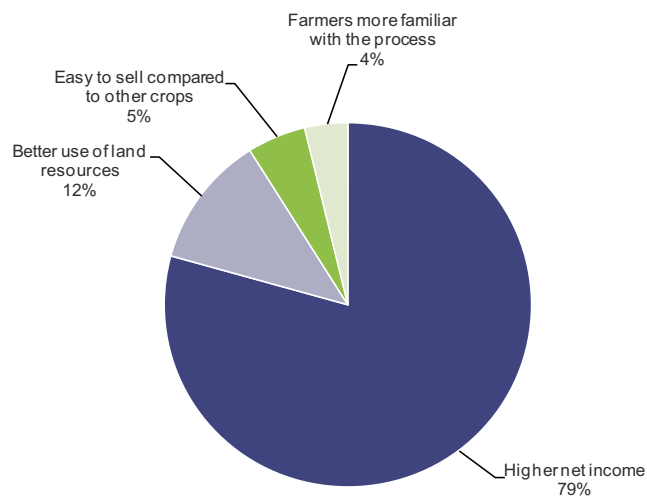
available land resources efficiently and the easy marketability of opium were also among the reasons reported.

Figure 7: Reasons for cultivating opium poppy, as reported by farmers, Myanmar, 2012



* The category "Other" includes "No market for other crops", "To be used as medicine" and "Own consumption".

Figure 8: Farmers' opinions regarding the advantages of opium poppy cultivation, Myanmar, 2012



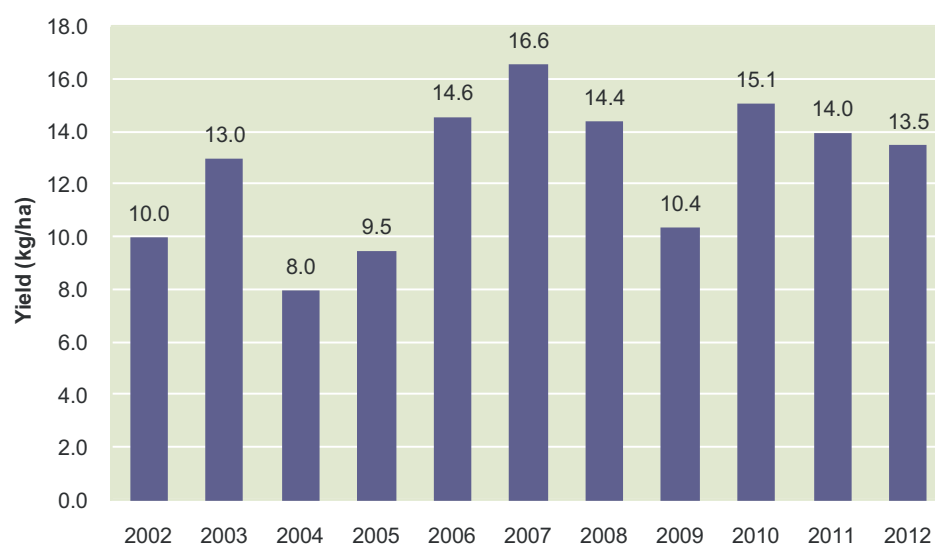
2.2 Yield and potential opium production

Field measurements and associated calculations in the 2012 opium survey resulted in an average national yield, weighted by area under cultivation, of 13.5 kilograms per hectare. Yield data were successfully collected in North, South and East Shan but not in Kachin State, due to lack of access resulting from an on-going armed conflict. For Kachin, the 2011 yield estimate was used instead (24.7 kilograms per hectare). In Shan State alone, an opium yield of 12.3 kilograms per hectare was estimated for 2012.

Table 3: Potential opium yield by region, Myanmar, 2011-2012 (Kilograms per hectare)

Region	2011 average yield (kg/ha)	2012 average yield (kg/ha)	Change 2011-2012
East Shan	11.9	14.1	+18%
North Shan	11.8	11.8	0%
South Shan	13.6	11.4	-16%
Kachin	24.7	N/A ¹²	N/A
Average¹³ yield	14.0	13.5	-4%

Figure 9: National opium yield calculated in 2002 to 2012 surveys,¹⁴ Myanmar (Kilograms per hectare)



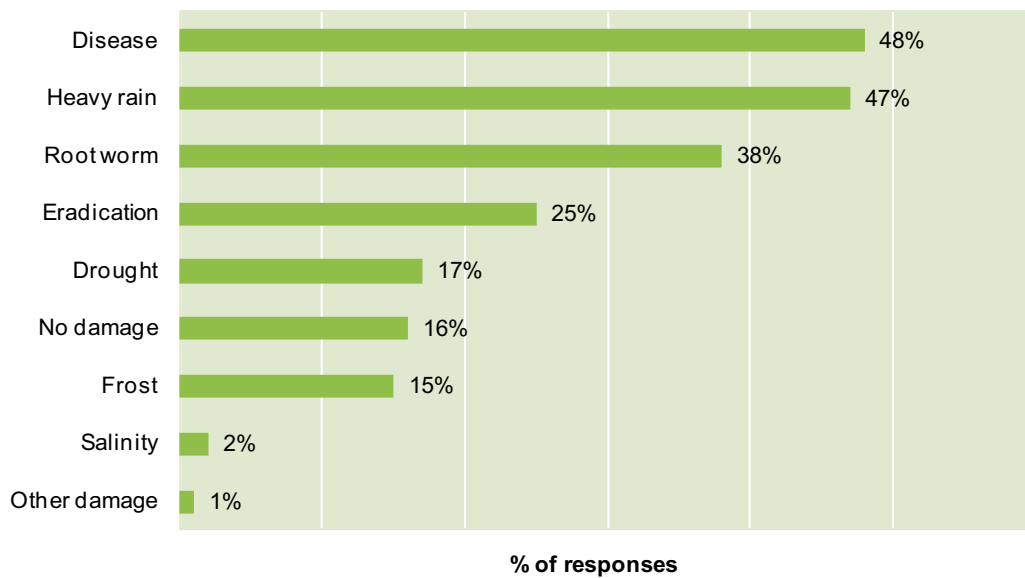
While lower than in the preceding two years, the average yield of 13.5 kilograms per hectare estimated for 2012 was still higher than the 2002-2012 yield average of 12.6 kilograms per hectare, although the regional yields in North and South Shan State were below that average. Unfavourable weather conditions in November 2011, reflected in farmers' responses as "heavy rain", as well as plant disease were reported from the field in Shan State, which may have negatively affected the 2012 opium harvest. The survey is not designed to verify the cause or type of damage reported by farmers.

¹² Due to lack of access resulting from an on-going armed conflict during the 2012 Opium Survey, the opium yield could not be estimated for Kachin. For the purposes of the 2012 production estimates the 2011 Kachin yield estimate of 24.7 kg/ha was used instead.

¹³ Ratio of total production to total cultivation.

¹⁴ Yield data for Kachin was included as of 2006. Data for Kachin was imputed for 2010 and 2012.

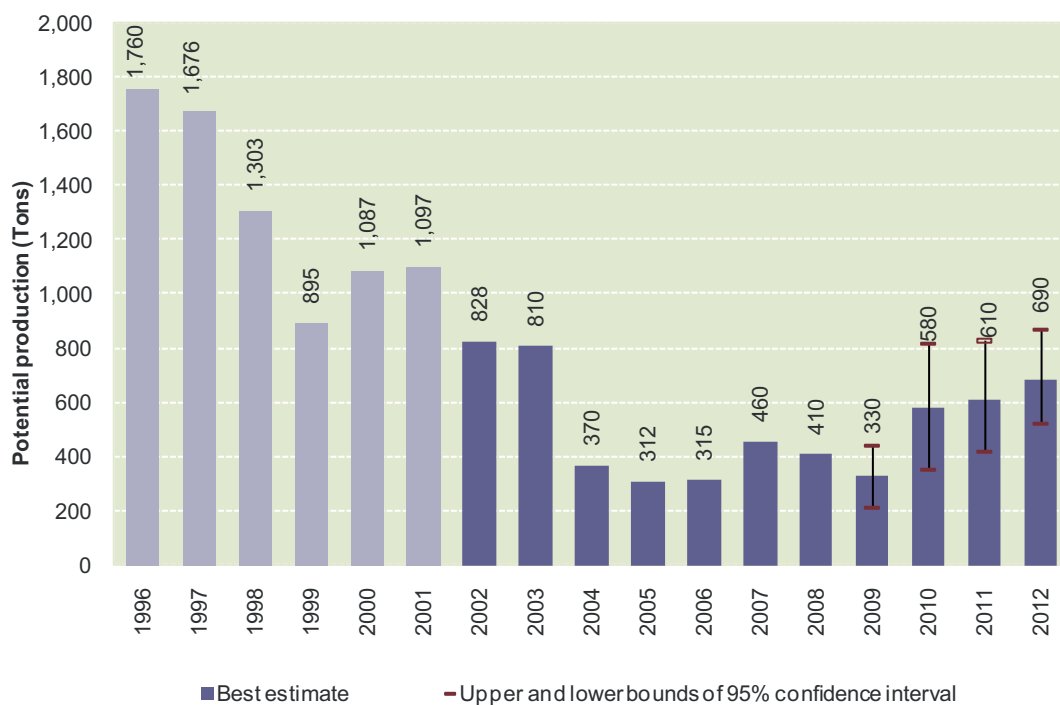
Figure 10: Problems affecting poppy fields, according to farmers interviewed during 2012 yield study, Myanmar



Based on 680 farmers interviewed for the yield survey in 264 poppy-growing villages. The sum may be larger than 100% due to multiple problems mentioned per field.

Total potential opium production in Myanmar in 2012 was 690 tons, representing a 13% increase on 2011. The increase in production was lower than the increase in cultivation as the opium yield in 2012 was lower than the year before. However, opium production in 2012 was the highest in Myanmar since 2003 and was equivalent to about 10% of global opium production in 2011.¹⁵

Figure 11: Potential opium production, Myanmar, 1996-2012 (Tons)



Source: 2001 and before: United States Government; since 2002: GOU/UNODC.

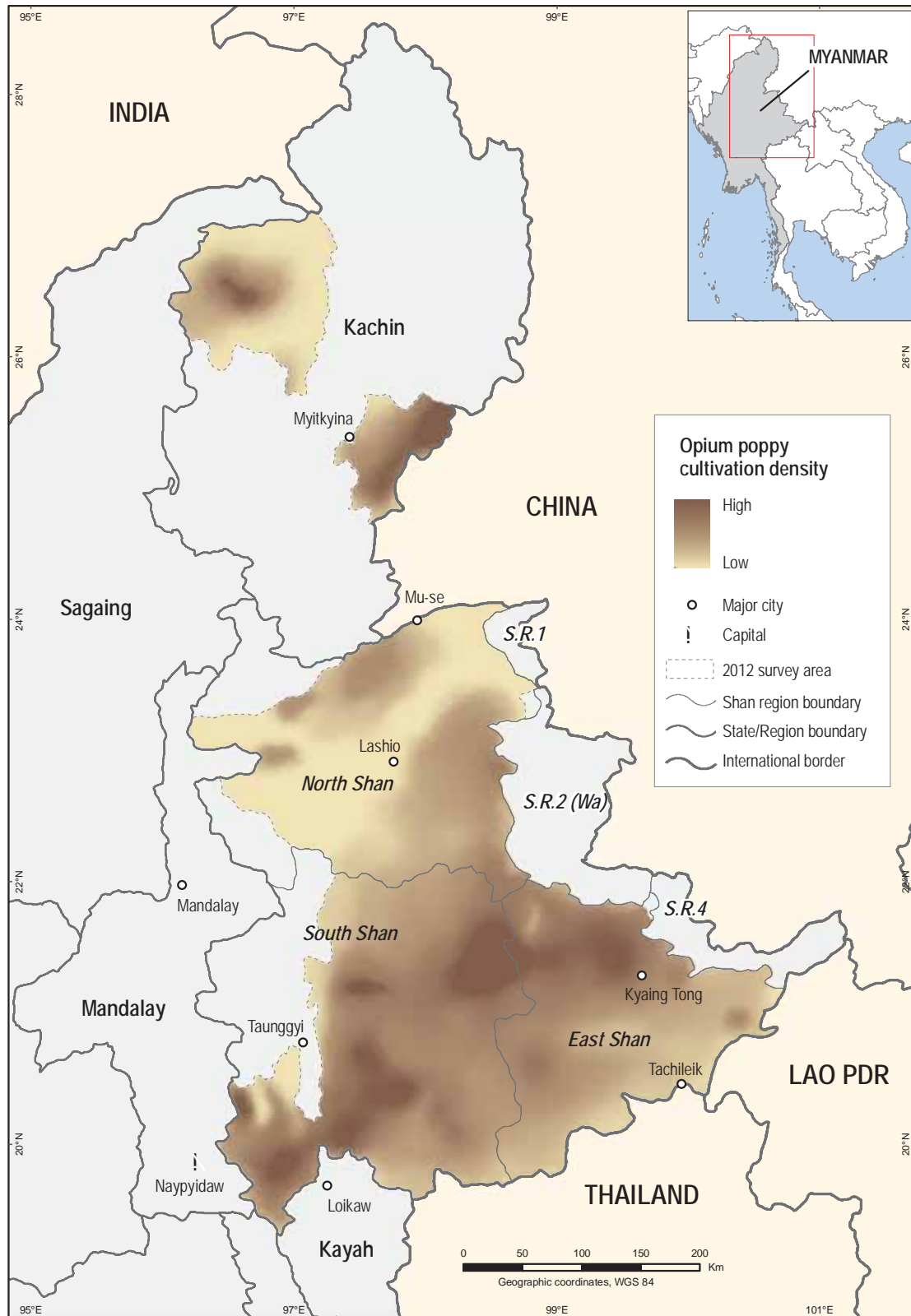
¹⁵ Global opium production estimates for 2012 were unavailable when this report was published.

Shan State's (including East, North and South Shan) total opium production declined from over 90% in 2011 to 82% in 2012. As opium production increased in Kachin region as well as in North and East Shan, the share of the largest opium-producing region, South Shan, declined to 42% of total production in 2012. Despite this, the largest share of opium was still produced in South Shan in 2012.

Table 4: Potential opium production, by region, Myanmar, 2011-2012 (Tons)

Region	Potential production (tons) 2011	Potential production (tons) 2012	Change 2011-2012	Share of production by State (percentage)
Kachin	93.9	125.1	+33%	18%
East Shan	145.7	200.7	+38%	29%
North Shan	52.7	74.6	+42%	11%
South Shan	316.5	288.6	-9%	42%
Total (rounded)	610	690	+13%	100%

Map 3: Cultivation density map, Kachin and Shan States, Myanmar, 2012



Source: Government of Myanmar - National Monitoring System 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.

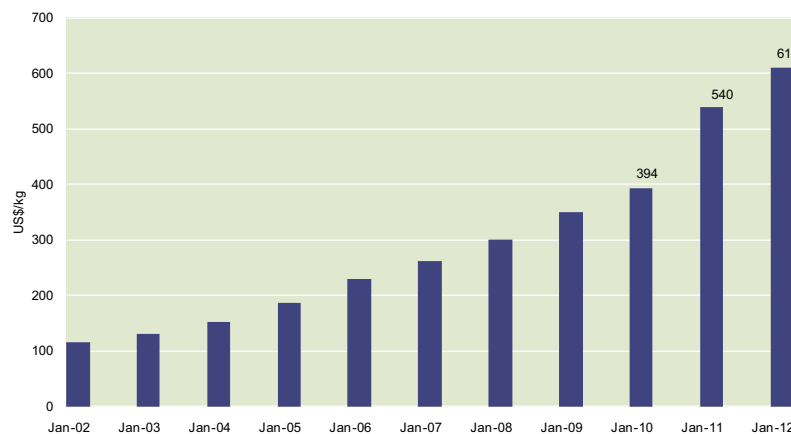
2.3 Opium prices

When expressed in United States dollars, the average farm-gate price of opium (weighted by the estimated area under cultivation) increased from US\$ 450 in 2011 to US\$ 520 in 2012. However, this increase was partly due to the slightly higher value of the kyat during the harvest period than in the corresponding period in the previous season (when expressed in kyat the increase in the farm-gate price was approximately 7%).

Figure 12: Farm-gate price (weighted average) of fresh opium in opium poppy-growing villages, Myanmar, 2002-2012 (US\$ equivalent/kg)



Figure 13: Dry¹⁶ opium price in Myanmar, 2002-2012

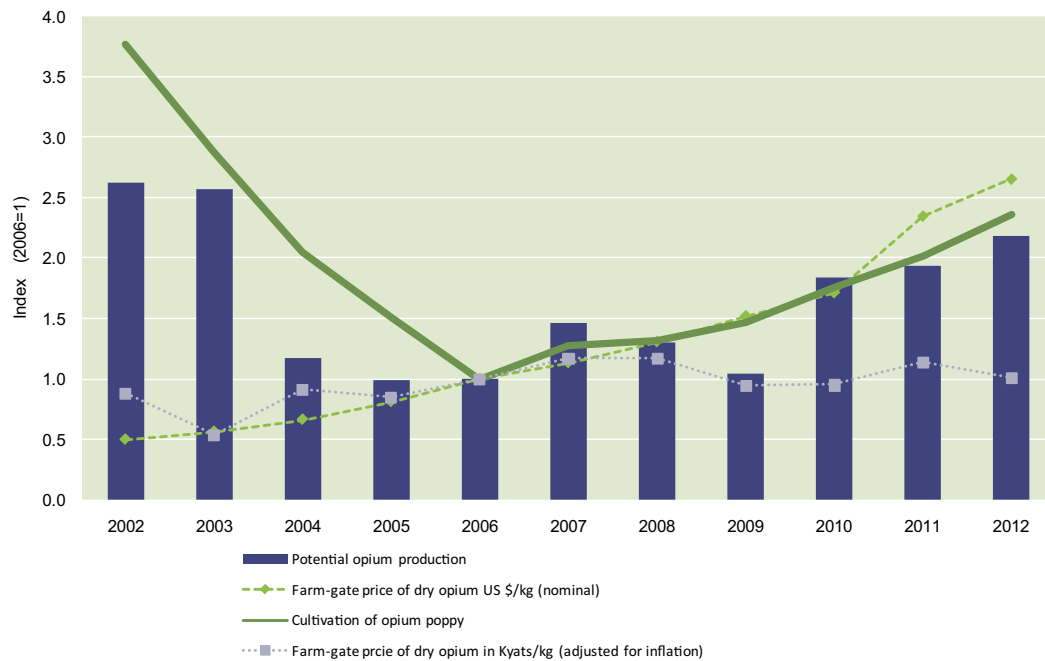


The rationale for choosing 2006 as the base year for figure 14 is that it was a turning point for opium poppy cultivation in Myanmar. The trends in the two time series for nominal prices in United States dollars and inflation-adjusted prices in kyats are quite different, but in both cases appear entirely independent of the supply.

Nominal (i.e. unadjusted) prices for opium in United States dollars have shown a continuous increase since 2002, and a similar trend can be observed when looking at prices in kyats (not shown in this graph). One would expect prices to have increased less following the strong increase in opium production after 2009 as the availability of more opium locally should potentially have brought prices down, but that did not happen.

¹⁶ Dry opium prices are collected during the harvest season, but may reflect transactions in the previous year. For 2012, price reflects data from East, North and South Shan only, weighted by cultivation.

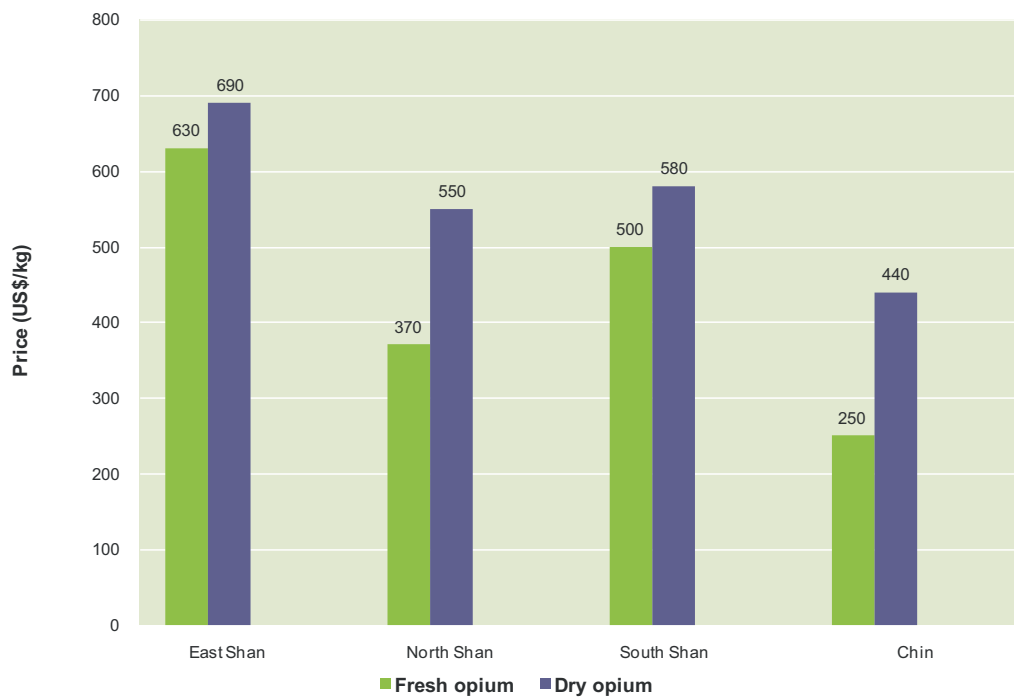
Figure 14: Opium prices in comparison with opium poppy cultivation and potential opium production in Myanmar, 2002-2012 (indexed with baseline 2006)¹⁷



Source: GOUN/UNODC opium surveys 2002-2012.

More telling, however, was the trend in inflation-adjusted prices in the local currency, kyats. The inflation-adjusted price for 2012 was essentially the same as in 2006, which shows that the price increase was simply in line with the rising cost of living. Thus, opium farmers in Myanmar did not make a great deal more money in 2012 as a result of higher prices, as may seem the case when simply looking at nominal, unadjusted prices, since the real value of a kilogram of opium had not changed since 2006. The sharp rise in nominal prices simply reflected a similar increase in prices for basic needs such as cereals. It is therefore unlikely that the rise in nominal prices was linked to stronger demand as that would probably have driven prices to a higher level than one that simply compensated for overall inflation.

¹⁷ Inflation adjustments based on World Bank data.

Figure 15: Fresh and dry opium prices by State, Myanmar, 2012 (US\$/kg)

Source: GOM/UNODC opium survey 2012.

2.4 Household cash income in opium-growing risk areas

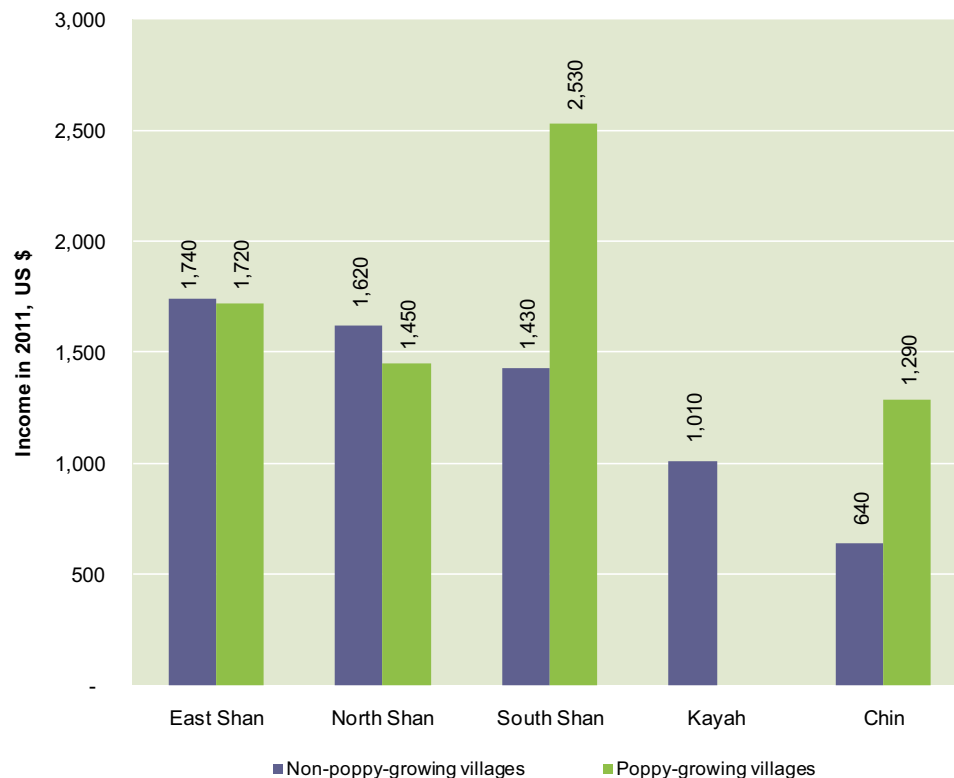
The question about household cash income¹⁸ was more detailed in the 2012 survey than in previous survey rounds and reported household income was considerably higher. But only part of that increase could be attributed to inflation, and the fact that more details were probed in 2012 probably led to more complete reporting, resulting in a higher reported income in both poppy-growing and non-growing villages than in the previous year. Thus, the reported income for 2012 is not comparable to the 2011 survey round.

Yet one new development was observed in 2012: poppy-growing villages reported a considerably higher average household income than non-growing villages, in contrast to the previous four years when the average reported income of households in poppy-growing villages was slightly lower than in non-growing villages. This was mainly due to a comparatively high average income reported in South Shan and, to a lesser extent, in Chin. In East and North Shan, lower average incomes were reported in poppy-growing villages than in non-growing villages. The reason for the much higher income of poppy villages in South Shan is not clear from the survey data.¹⁹

¹⁸ Household cash income, as defined in the Myanmar opium survey, refers to the income a household makes from labour or the sale of products, plus the value of all other farming products at local prices, whether or not they are sold, all expressed in monetary terms. For example, many households are not food self-sufficient, i.e. they produce less food than they need for consumption. Still, the value of crops such as rice is counted as "cash income".

¹⁹ Differences in prices could have played a role but opium prices were higher in South Shan than in North Shan, yet lower than in East Shan. A possible factor could be that, on average, the area cultivated with poppy was much larger in South Shan than North and East Shan. However, when breaking down the poppy area reported in the village survey by household, it does not seem to be the case that households in South Shan cultivate more poppy than in other parts of Shan. The higher opium yield in South Shan in the 2011 growing season could have played a role because income reported was for 2011.

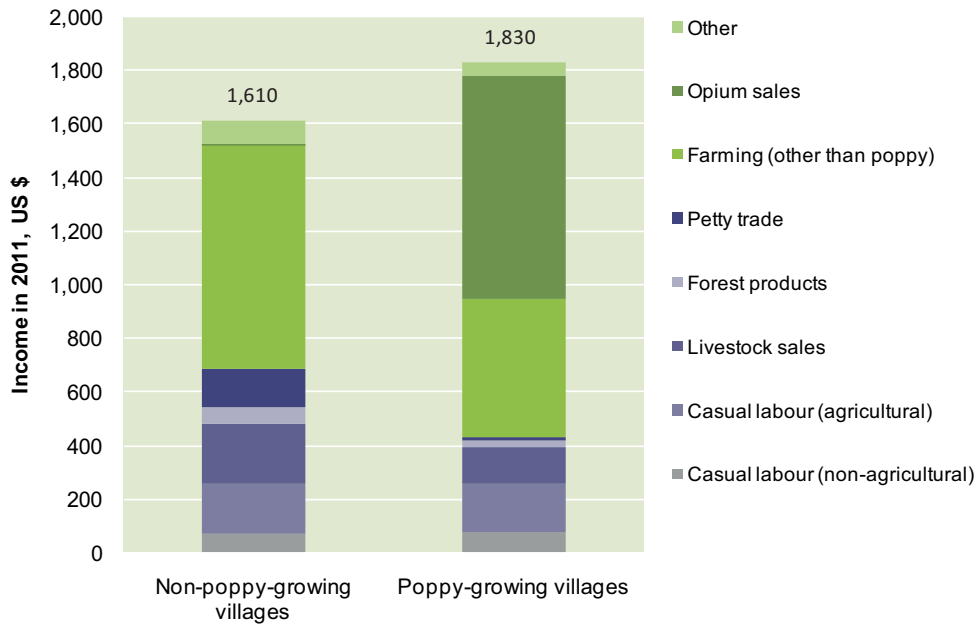
Figure 16: Average 2011 household income (reported in 2012) in non-poppy-growing villages located in opium-growing risk areas, Myanmar (United States dollars per year)



Source: GOM/UNODC opium survey 2012.

A comparison of income composition reveals that there was not much difference between poppy-growing and non-growing villages in terms of casual labour, whether agricultural or not, in 2012. As the survey covered predominantly rural areas, salaried jobs with a regular income did not play a role in either type of villages. Raising livestock for sale, collecting marketable forest products or engaging in petty trade contributed, on average, much more to household incomes in non-growing villages than in poppy-growing villages. In the latter, dedicating a portion of farmland to opium poppy cultivation resulted in a considerably higher overall income from farming (when adding farming income from poppy and other types of farming together).

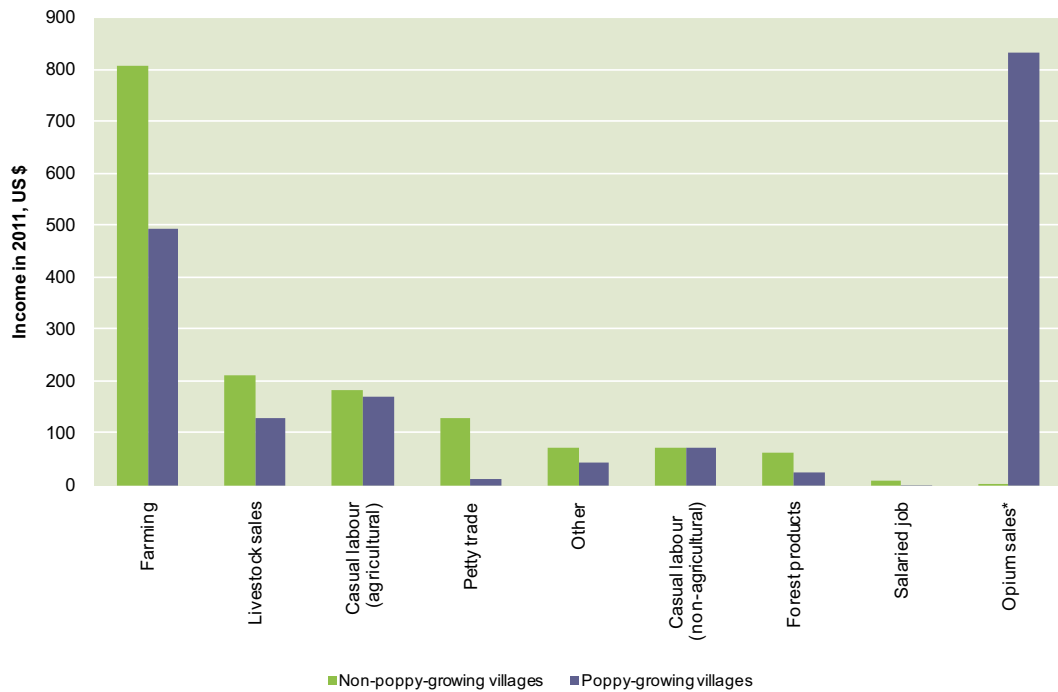
Figure 17: Average household income (reported in 2012) in Shan State, Myanmar, 2011 (United States dollars per year)



Source: GOUN/UNODC opium survey 2012.

Note: a very small proportion of households in non-poppy growing villages were reported to have income from opium stemming from previous years.

Figure 18: 2011 Income (reported in 2012) in villages (including in Chin and Kayah), by source and opium poppy cultivation status, Myanmar



Source: GOUN/UNODC opium survey 2012.

Note: a very small proportion of households in non-poppy growing villages were reported to have income from opium stemming from previous years.



Tobacco drying in the sun, Tongzang township, Chin State.



Villagers use mules and donkeys to carry rice and corn, Chin State.



Production of sugar in Tedim township, Chin State.



Sugar bars, Chin State.



Wild orchids harvested and packaged for export to China, Minepyin Township, Eastern Shan State



Forest products for export to India, Tamu, Chin State.

	
<p>Preparing firewood to store for rainy season, Chin State.</p>	<p>Fired forest for upland rice cultivation, Tongzang township, Chin State.</p>
	
<p>Charcoal production for export to China, Special region 1 (Kokant), Shan State.</p>	<p>Deforestation for banana plantations, Special Region 4, Shan State.</p>
	
<p>Timber (teak) in Minepyin township, Eastern Shan State.</p>	<p>Wood loading in Minepyin township, Eastern Shan State.</p>

2.5 Opium and other drug use in opium-growing risk areas

The 2012 survey data on the illicit use of opium, heroin and amphetamine-type stimulants (ATS) — the latter known locally as “yaba” — was collected through interviews with village headmen who were asked to provide information on the number of illicit drug users aged 15 and above in their village. “Use” was defined as “having taken the drug at least once in the previous month” (monthly prevalence). The users themselves were not interviewed and no data on their level of consumption was collected. The data presented here refers only to the survey area (opium-growing risk area) and does not represent other areas, or Myanmar as a whole. The area covered by the village survey in 2012 was different from 2011, which limits year-on-year comparability.

According to the data reported by headmen, monthly opium use in Shan and Kachin State affected 0.7% of the population aged 15 and above (monthly prevalence). As in previous years, prevalence was considerably higher in opium-growing villages (1.8%) than in non-opium-growing villages (0.2%), underlining the statistically significant association between opium poppy cultivation and opium use.²⁰ Indeed, opium users were 2.5 times more likely to live in opium-growing than in non-opium-growing villages.

The opium prevalence rate in 2012 (0.7%) was similar to 2011 (0.7%) and 2010 (0.8%). However, the comparability of 2012 with 2011 and 2010 is limited as the reference period for the question was changed to monthly prevalence.²¹ The heroin prevalence rate of 0.2% reported in both poppy-growing and non-growing villages was higher than in previous years, but this increase could also be an effect of the change in the reference period for drug use.

As noticed in previous surveys, ATS use in 2012 was at a relatively low level in rural Myanmar and much lower than opium use. Unlike in previous years, when ATS use was found to be similar in poppy-growing and non-growing villages, a much higher use rate was reported in poppy-growing villages (0.6%) than in non-poppy-growing villages (around 0.2%) in 2012. This difference was statistically significant²² and ATS users were almost two times more likely to be found in poppy-growing villages than in non-poppy-growing villages in 2012.

In general, data on drug use must be interpreted with caution, as there may be reluctance on the part of respondents to report opium, heroin or ATS consumption in the context of the Government's efforts to curb such use, while headmen may have only limited knowledge of drug use in their village.

Table 5: Monthly prevalence of opium, heroin and ATS use, as reported by headmen in Shan State and Kachin, Myanmar, 2012 (Population aged 15 and above)²³

Description	Non-poppy-growing villages	Poppy-growing villages	Total
Opium use	0.2% (259)	1.8% (868)	0.7% (1,127)
Heroin use	0.2% (191)	0.2% (81)	0.2% (272)
ATS use	0.2% (218)	0.6% (290)	0.3% (508)
Total population in surveyed villages	112,898	49,343	162,241

Absolute figures in brackets. Source: GOU/UNODC opium survey 2012.

2.6 Socio-economic characteristics of the population living in opium-growing risk areas

Food security

Following the definition in the village survey, a household is food secure if it had enough rice for the 12 months preceding the survey.²⁴ Some households may achieve food security by producing enough rice on their own land. More typically, however, households supplement the amount of rice harvested from their own fields with rice purchases, for which they need cash from wage labour or – licit and/or illicit – cash crops.

²⁰ Chi-square test of independence, significant at 0.01 level.

²¹ In the 2011 survey, the question was: "How many persons aged 15 and above take opium/yaba/heroin more than twice a week?" In the 2012 survey, the question was: "How many persons aged 15 and above took opium/yaba/heroin last month?"

²² Chi-square test of independence, significant at 0.01 level.

²³ Poly-drug use was not investigated in this survey.

²⁴ In the 2012 survey, the question was: "During the past 12 months, how many households experienced a rice deficit for 12/9/6/3/0 months".

On average, household food security in the survey area in 2011 (reported during the 2012 survey) increased in both poppy-growing and non-growing villages in comparison to its 2010 level. Only in North Shan was a decrease in food-secure households found. In Shan State, food security levels were comparatively high. In contrast to Shan State, 2011 food security levels reported in Kayah and Chin were alarmingly low.

Table 6: Proportion of households with food security in non-opium-poppy-growing villages, by region, Myanmar, 2010 (reported in 2011) and 2011 (reported in 2012)

Region	2010	2011
Kachin	56%	Not part of survey area
East Shan	65%	87%
North Shan	76%	72%
South Shan	69%	80%
Kayah	Not part of survey area	10%
Chin	Not part of survey area	28%
Total	66%	69%

Table 7: Proportion of households with food security in opium poppy-growing villages, by region, Myanmar, 2010 (reported in 2011) and 2011 (reported in 2012)

Region	2010	2011
Kachin	88%	Not part of survey area
East Shan	53%	72%
North Shan	73%	50%
South Shan	61%	75%
Kayah	Not part of survey area	No poppy villages found
Chin	Not part of survey area	1%
Total	64%	67%

These results also reveal that about one third of households in the survey area experienced a period of food insecurity in the 12 months prior to the survey despite their efforts to earn cash, which, in poppy-growing villages, may have included opium production. Households with food security for less than 12 months may face severe hardship in those months when they experience a rice deficit. In order to overcome or at least alleviate that lack of food, the most frequent strategies reported in Myanmar in 2012 were taking out a loan or borrowing food. The importance of different coping strategies was relatively similar in poppy-growing and non-growing villages.

Table 8: Coping strategies in households with insufficient food, reported in 2012, Myanmar

Strategy	Poppy-growing villages	Non-poppy-growing poppy villages	All surveyed villages
Purchase food on credit	25%	34%	31%
Borrow food or rely on friends or relatives	34%	28%	30%
Rely on less desirable or cheaper food	18%	19%	19%
Gather wild food or hunt	7%	4%	5%
Other strategy	16%	15%	15%

The comparison of average land cultivated by households in poppy-growing and non-poppy-growing villages in 2012 revealed that households in non-poppy-growing villages cultivated significantly more land (1.20 hectares i.e. 61% more than households in poppy-growing villages; see table 9). In addition, the proportion of cultivated land that is irrigated (which typically has higher yields) was also higher in non-poppy-growing villages (23% vs. 17% in poppy-growing

villages). Consequently, households in non-poppy-growing villages were able to produce more food than households in poppy-growing villages, and they were less dependent on cash income strategies.

Households in poppy-growing villages have to make up for the limitation in land under cultivation, and growing poppy is a strategy many households choose in order to generate cash to buy food. It is important to note, however, that not all households in poppy-growing villages actively farm poppy. In the 2012 survey, about 40% of households in poppy-growing villages reportedly grew poppy on their land in the 2012 season. A further quarter of households in poppy-growing villages generated some income from poppy cultivation, for example by working as agricultural labourers in poppy fields, without cultivating poppy on their own land. Thus, in 2012 the majority of households in poppy-growing villages depended on income from poppy cultivation in one way or another. In view of the relatively small amount of land that households in poppy-growing villages were able to dedicate to cultivating food crops, poppy remained an important source of cash income for achieving food security or, at least, for reducing periods of food shortage.

A better understanding of the decision-making process of households regarding their food security and cash income strategies could help develop more targeted alternative livelihood strategies.

Table 9: Average cultivated land in villages, per household, Myanmar, 2012 (Hectares)

	Rice	Wheat and corn	Mustard and sun-flower	Vegetable	Long term (rubber, fruit tree)	Poppy	Other	Total
Non- poppy-growing	0.52	0.37	0.03	0.03	0.01	N/A	0.23	1.20
Poppy-growing	0.38	0.10	0.03	0.03	0.00	0.14 ²⁵	0.07	0.75
All villages	0.48	0.29	0.03	0.03	0.00	0.04	0.18	1.06

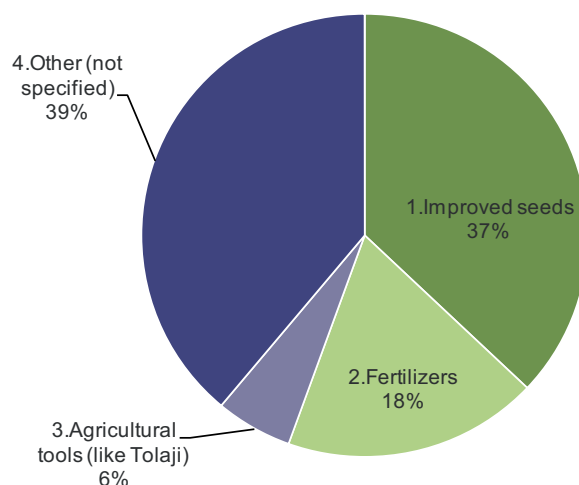
Agricultural Assistance

In Shan State, similarly to the findings of previous years, 95% of villages did not receive any type of agricultural assistance in 2012 (such as in the form of improved seeds, fertilizer or agricultural tools/machines), irrespective of whether or not poppy was grown in the village. The situation in Chin was markedly different as a considerable proportion of villages reported having received some kind of assistance in the previous 12 months. However, with only 15 villages responding to the question the case numbers in Chin were very small.

All in all, only 42 of the 811 villages surveyed in 2012 reported having received any kind of agricultural assistance in the previous 12 months (767 did not receive any assistance, 2 did not know). The findings indicate that there is a lot of scope for improving agriculture in Shan State by improving agricultural inputs and making techniques accessible and available. However, the survey was not designed to assess the actual needs or suitability of certain types of agricultural development.

The most frequent types of assistance reported were improved seeds, fertilizer and agricultural tools. The large proportion of other/not specified types of agricultural assistance indicates the need to collect such information in more detail and perhaps also to check whether agricultural assistance was sought (successfully or not) and, if so, from whom.

²⁵ This refers to the average poppy-growing area taking into account all households in the village, irrespective of whether they actually grew poppy in that season. The amount of poppy cultivated by poppy-growing households is considerably higher.

Figure 19: Type of agricultural assistance reported, Myanmar, 2012

2.7 Reported eradication

The 2012 opium survey did not monitor or validate the results of the eradication campaign carried out by the Government of the Republic of the Union of Myanmar (GOUM). According to GOUM, a total of 23,717 hectares was eradicated in the 2011-2012 opium poppy season, which is a significant increase on the area reported as eradicated in previous years. It is likely that the eradication figures given by GOUM also included the monsoon poppy crop (before the main growing season), which is not captured by the remote sensing survey carried out in the framework of the opium survey. The poppy cultivation estimate provided in this report refers to opium poppy identified on satellite imagery at the time the images were taken and does not take into account eradication carried out after the image date. Therefore, it may include poppy cultivation areas eradicated after the image date.

Table 10: Eradication from 2005 to 2012, by region, Myanmar (Hectares)

Region	2005	2006	2007	2008	2009	2010	2011	2012
East Shan	124	32	1,101	1,249	702	868	1,230	1,257
North Shan	1,211	76	916	932	546	1,309	1,315	977
South Shan	1,203	3,175	1,316	1,748	1,466	3,138	3,579	21,157
Shan State total	2,538	3,283	3,333	3,929	2,714	5,316	6,124	23,391
Kachin	1,341	678	189	790	1,350	2,936	847	83
Kayah	8	0	12	12	14	13	-	84
Kayah(*)	-	-	-	-	-	-	38	
Magwe	0	0	45	0	1	1	0	4
Chin	3	0	10	86	5	2	10	110
Mandalay	0	9	0	3	2	0	39	45
Sagaing	17	0	9	0	1	0	0	0
Other States	20	9	64	0	0	0	0	0
All surveyed villages	3,927	3,979	3,662	4,820	4,087	8,268	7,058	23,717

3 METHODOLOGY

3.1 Introduction

In 2012, the Central Committee for Drug Abuse Control (CCDAC) of the Republic of the Union of Myanmar collaborated with the United Nations Office on Drugs and Crime to implement the annual Myanmar Opium Survey for the tenth time.

The pattern of opium poppy cultivation continued to change in Myanmar in 2012: In South Shan State, the opium poppy crop calendar changed and new patterns such as multi-cropping were observed. The amount of eradication increased considerably and cultivation possibly shifted to areas already considered opium-free or to climatically less favourable regions. All these considerations, combined with reduced accessibility and the expected change in cropping pattern, influenced the survey methodology and the sampling procedure for the estimation of the planted area and other socio-economic indicators.

Considerable efforts were made in the preceding five-year period to improve various methodological details and to adapt to the evolving conditions of cultivation. This survey integrated the ground data collection component and combined the use of satellite remote sensing with field surveys and interviews.

The 2012 opium poppy survey was composed of three parallel components:

1. A cultivation estimation survey throughout the two regions, Shan State (North, South, East) and Kachin State. The survey was based on the use of satellite remote sensing as the primary source of data for Shan State and Kachin State. In those two States, satellite remote sensing was supplemented by field surveys to provide ground truthing and to support the interpretation of opium poppy fields;
2. An opium yield survey in the three regions of Shan State;
3. A socio-economic survey in 800 villages in Shan State. A large number (750) of villages was selected randomly and, in order to provide extra ground truth information, 50 additional villages were selected in those areas covered by the satellite images. In addition, interviews were conducted in Chin and Kayah States, using an opportunity sample. The surveyors conducted interviews with village headmen and other key informants.

3.2 Sampling procedure for village survey

The sampling frame was composed of an updated village listing provided by the Central Committee for Drug Abuse Control in Myanmar. The village listing included names of villages, townships, regions and their codes. The listing also included the opium poppy-growing history and the GPS latitude and longitude of the former surveyed villages. This listing or baseline data is regularly updated with information obtained through previous surveys to reflect changes in village location or name, village mergers and relocations, and to delete double entries. For many village entries, GPS positions facilitate the unique identification of each village.

Villages in townships considered to be free from poppy cultivation, based on field reports or previous surveys, were excluded from the village listing to establish the sampling frame for the opium risk area. In the 2012 survey, the poppy-growing area of Kachin State was excluded from the sampling frame because of the ongoing armed conflict. Kayah State was also excluded from the sampling frame after the 2011 survey due to insignificance of its poppy cultivation area.

The sample size was influenced by a number of requirements and constraints. The main requirement was the level of accuracy considered acceptable for the estimates, whereas the constraints were either economical or logistical.

For the 2012 socio-economic survey, a total of 800 villages were randomly selected throughout Shan State, which is approximately 8.45% of the 9473 villages in the sampling frame. A total of 300 villages in North Shan, 300 villages in South Shan and 200 villages in East Shan State were selected.

A non-representative survey (socio-economic interview only without yield survey and ground survey components) was conducted in the northern part of Chin and the poppy-growing area of Kayah State. Without statistical design, a total 22 villages were selected in Chin State and 10 villages in Kayah State. The village selection was based on opportunity taking into account budgetary and logistical constraints.

Table 11: Composition of 2012 village survey sample

Particulars	North Shan	South Shan	East Shan	Chin	Kayah	Total
Projected number of villages to be surveyed	300	300	200	20	15	835
Actual number of villages that were surveyed	297	285	197	22	10	811
Type of sample	Representative sample			Opportunistic sample		

The ethnic composition of the different regions of Shan State is possibly the most diverse in the whole of the Republic of the Union of Myanmar. The villages surveyed in 2012 reflected the major ethnic groups present in each surveyed region.

3.2 Survey organization

As in previous years, components of the survey were coordinated by the UNODC Country Office in Myanmar and operationally implemented in close collaboration with government institutions.

The village surveys for measuring opium yield and socio-economic indicators were supervised and implemented by CCDAC, while UNODC provided technical support, coordination and supervision with national and international staff throughout the survey.



UNODC/ICMP training for ground verification teams.



Ground verification team equipment necessary for field surveys and interviews.

In 2012, rapid assessment surveys on compliance with the opium ban were conducted in the three Shan Special Regions (S.R), namely in S.R.1 (Kokant), S.R.2 (Wa) and S.R.4 (Maila). The assessment surveys in S.R.2 (Wa) and S.R.4 (Maila) were directly implemented by UNODC as the region authorities gave authorisation for the surveys, which was not the case in previous years. The rapid assessment survey in S.R.1 (Kokant) was carried out in close collaboration with the CCDAC. According to observations and ground information during the survey, there was no evidence of opium poppy cultivation in these regions in 2012.

A survey without a statistical sampling frame was conducted in northern Chin State and Kayah State in collaboration with the CCDAC and Chin local authorities. The survey covered two

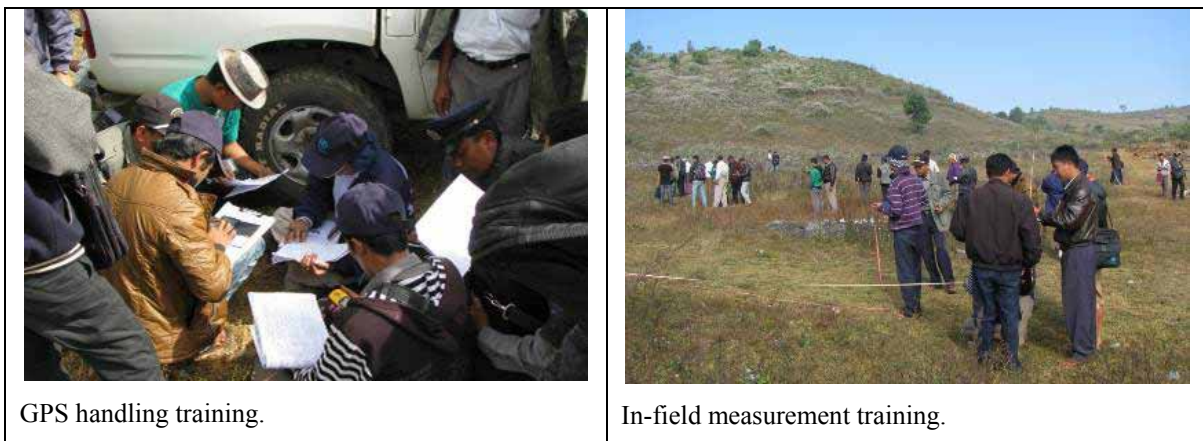
townships, Tongzan and Teddim, in northern Chin and two townships, Loikaw, and Demawso, in Kayah State. The village survey in Chin State was the first there since UNODC began annual surveys in Myanmar. According to interviews with villagers and local authorities, opium poppy cultivation in Kayah was no greater than in recent years. The cultivation of Kayah was estimated at 100 hectares in 2010. The assessment of poppy cultivation in Chin was supported by SPOT5 satellite image. While the analysis indicated the presence of poppy fields, the results did not allow to provide a quantitative estimate of the area under opium poppy cultivation in Chin State .

The area estimation was conducted in collaboration with the Remote Sensing and GIS Section of the Forest Department, Ministry of Environmental Conservation and Forestry. Four teams from the Forest Department conducted ground verification in the different Shan States. No ground verification was carried out in Kachin State in 2012 because of ongoing armed conflicts. All teams, each comprising of two surveyors from the Forest Department and one officer from the local Anti-narcotic Task Force visited selected satellite sample sites between mid-January and the end of March 2012. Three teams from the UNODC country office, each in collaboration with a CCDAC officer, conducted ground verification in Shan State.

The ground verification teams visited selected sites with printouts of the corresponding satellite images. Once they reached the area represented in each single scene, they annotated the print with land use classes, delineated boundaries and collected detailed information along specific transects. They collected GPS coordinates and took field photos. In the office, the data collected were then used to classify the satellite images combining digital and visual interpretations. The image interpretation by the Forest Department was monitored by two GIS analysts from the UNODC country office . The results were quality control checked by a UNODC GIS analyst in UNODC Myanmar country office. The final results were subject to quality control by the international remote sensing expert at UNODC Headquarters, Vienna.

3.3 Field operations

In total, 135 surveyors carried out the village survey in 38 townships in Shan State. The surveyors were selected by the CCDAC in collaboration with local authorities. UNODC trained the surveyors in socio-economic data collection and poppy field measurements for yield estimation. Village survey training for each region was conducted as described in the table.



GPS handling training.

In-field measurement training.



Surveyors being trained to interview villagers and local authorities.

Being trained to interview villagers and local authorities.

Table 12: Training village surveyors

Region	From	To	Trainees	Venue
South Shan	21 Dec 2011	24 Dec 2011	54	Taunggyi
North Shan	29 Dec 2011	1 Jan 2012	51	Lashio
East Shan	29 Dec 2011	1 Jan 2012	30	Kyaing Tong
Total			135	

The surveyors who completed the training were organized into 45 teams (17 teams for North Shan, 18 teams for South Shan, and 10 teams for East Shan). Each team leader was from the Myanmar Police Force and the team members were one person from the General Administrative Department and one from the Settlement and Land Records Department or the Myanmar Agriculture Service from each township.

One survey team was assigned to each township and two teams were assigned to each of those townships with either a particularly heavy workload or difficult accessibility (townships with more than 40 selected villages). Townships assigned two teams were two townships in North Shan (Tangyang and Lashio townships), three townships in South Shan (Pinlaung, Leacha, and Loilem townships), and one township in East Shan (Kyaing tong township).

Field operations for the village survey started on 26 December 2011 and ended on 15 March 2012. A supervisor from CCDAC head-office (Naypyidaw) and three supervisors coordinated the local authorities for field operations in each region and three staff from the UNODC country office in Myanmar monitored the field work in its entirety. Additionally, one international expert from UNODC headquarters (Vienna) conducted field observation during the course of the survey. The survey teams were all involved in interviews with village headmen and heads of households, as well as in field measurements for the collection of yield estimation variables.

The supervision teams met with all the teams during the field survey to assess the progress of the survey and ensure quality control. The duration of the main ground survey was 10 weeks and operations were wrapped up with a debriefing by the end of March 2012.



Table 13: Key information on the implementation of the 2012 socio-economic survey

	North Shan	South Shan	East Shan	Kayah	Chin	Total
Start date	02/01/2012	26/12/2011	02/01/2011	18/01/2012	22/02/2012	26/12/2011
End date	15/03/2012	15/03/2012	15/03/2012	24/01/2012	23/03/2012	23/03/2012
Survey teams	17	18	10	1	2	48
Targeted villages	300	300	200	15	20	835
Surveyed villages	297	285	197	10	22	811
% of Villages	99%	95%	99%	67%	110%	97%
Households covered	18,133	17,670	6,989	727	3,776	47,295
Rural population covered	95,682	87,303	35,743	3,938	25,121	247,787

3.4 Area estimation procedures

The poppy cultivation estimate with remote sensing techniques is performed in the South, North, and East Shan and Waingmaw township of Kachin State. This was the third time that the Waingmaw township of Kachin State was added to the area where the poppy cultivation estimate is performed with satellite images. In that region and in South, North and East Shan, very high-resolution satellite images were purchased after a random selection throughout the study area.

In total, 74 locations were selected. The number of locations was defined by the availability of the budget and the total area surveyed. For 2012, this was the highest number of sample locations in comparison to earlier surveys, mainly due to a reduction of the image size. In 2011, the cells were 6 km x 6 km, in 2012 it was possible to reduce them to 5 km x 5 km, which, since images are paid by the square kilometre, reduced the cost per image. Half of the locations selected for the satellite images were the same as those used in 2011, which avoided sudden changes caused by the selection method, while the other half were new locations. All selections were made on a systematic random base.

Very high-resolution images were acquired of the selected locations. Two types of images were obtained: Geoeye images with 2-metre resolution multi-spectral 4 bands plus one 50-centimeter panchromatic band and WorldView-2 images with 2-metre resolution multi-spectral 4 bands plus one 50-centimeter panchromatic band.

For every location, images were purchased at two different dates with a five-week interval (December/January and February/March). Two date images facilitate the identification of the opium poppy, taking into account the different crop calendars (pre and post-harvest) for every region obtained from the former surveys.

In Tanai township in Kachin, the area estimate was based on a targeted high-resolution image (SPOT5, 20 metre resolution). There, opium poppy cultivation was concentrated in one area that could be completely measured in the SPOT5 satellite image.

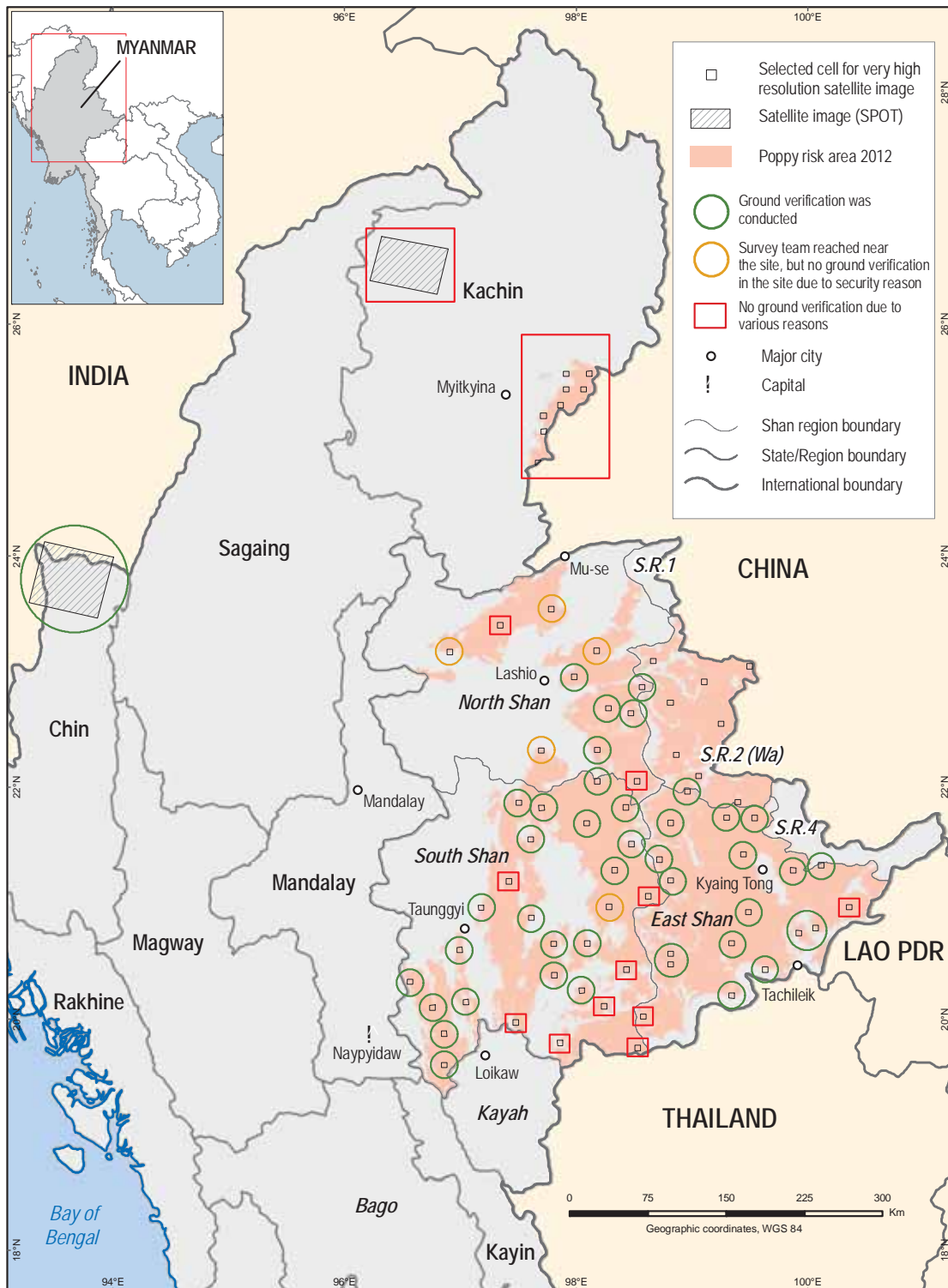
In former surveys the area estimate of Kayah State was performed on the basis of the village survey. However, the level of opium poppy cultivation in Kayah has become very low, thus Kayah was excluded from the area estimate process.

For the first time, a targeted high-resolution image (SPOT5, 5-metre resolution) was acquired for Chin State. In northern Chin, opium poppy cultivation was concentrated in Tonzang and Teddim townships. The satellite image was used to identify possible poppy areas, but without proper ground control there was too much uncertainty to provide a quantitative area estimate.

Also, for the first time, the Wa special region (Special Region 2) was added to the area where the poppy cultivation estimate was performed with remote sensing techniques. In total, eight systematic random locations were selected in the study area. Very high-resolution satellite images (Geoeye) were collected for two dates.

In none of the surveys performed to date were the cultivation figures adjusted for the eradication that had taken place after the acquisition of the satellite images. So if poppy cultivation was observed in the images, but those fields were eradicated afterwards it was not accounted for. However, the timing of the images targets the flowering period, when most of the eradication campaigns have been finalized, which minimizes the potential error.

Map 4: Field verification status for the survey with satellite images, 2012



Source: Government of Myanmar - National Monitoring System 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.

Sampling frame for the selection of satellite image locations

The sampling frame for selection of the sample locations is improved from year to year. The sampling frame for the 2012 survey was adjusted with new information obtained from the previous year's survey.

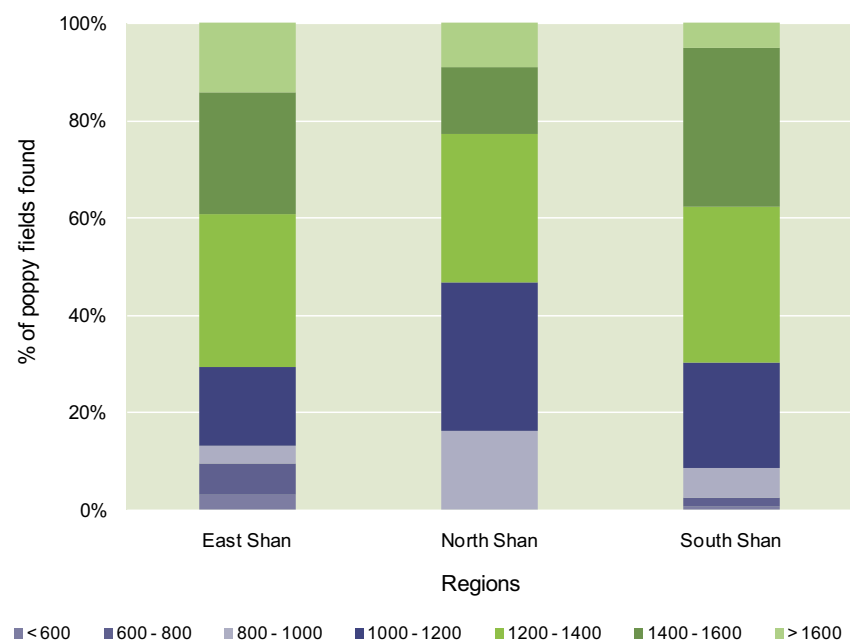
Basically, the sampling frame was developed by the combination of the following factors:

- Land cover map
- Altitude/slope
- Opium poppy-free areas, according to ground information.

Land cover is the first important factor in defining the sampling frame. In the former surveys, the land cover map developed in 2005 was applied. For the 2012 survey, the upgraded land cover map was developed by classifying 5 DMC images with 22-metre resolution acquired in February 2011. From this map, large agricultural areas were extracted and considered poppy-free, since the cultivation of opium poppy is practised in small agricultural areas, which are often surrounded by natural vegetation. Wetlands and settlements were also excluded. Other classes of land use were considered as potential opium poppy growing areas.

Altitude is the second important factor since former surveys had revealed that 95% of opium poppy is cultivated at altitudes between 800-1800 metres. However, as a result of former survey findings, in East Shan the lower altitude was adjusted to 600 metres. Some large, flat areas were also excluded as the accessibility of such areas is very high, and the chance of finding poppy cultivation there very low.

Figure 20: Altitude ranges of opium poppy fields found in satellite images, 2011/2012 (Metres)

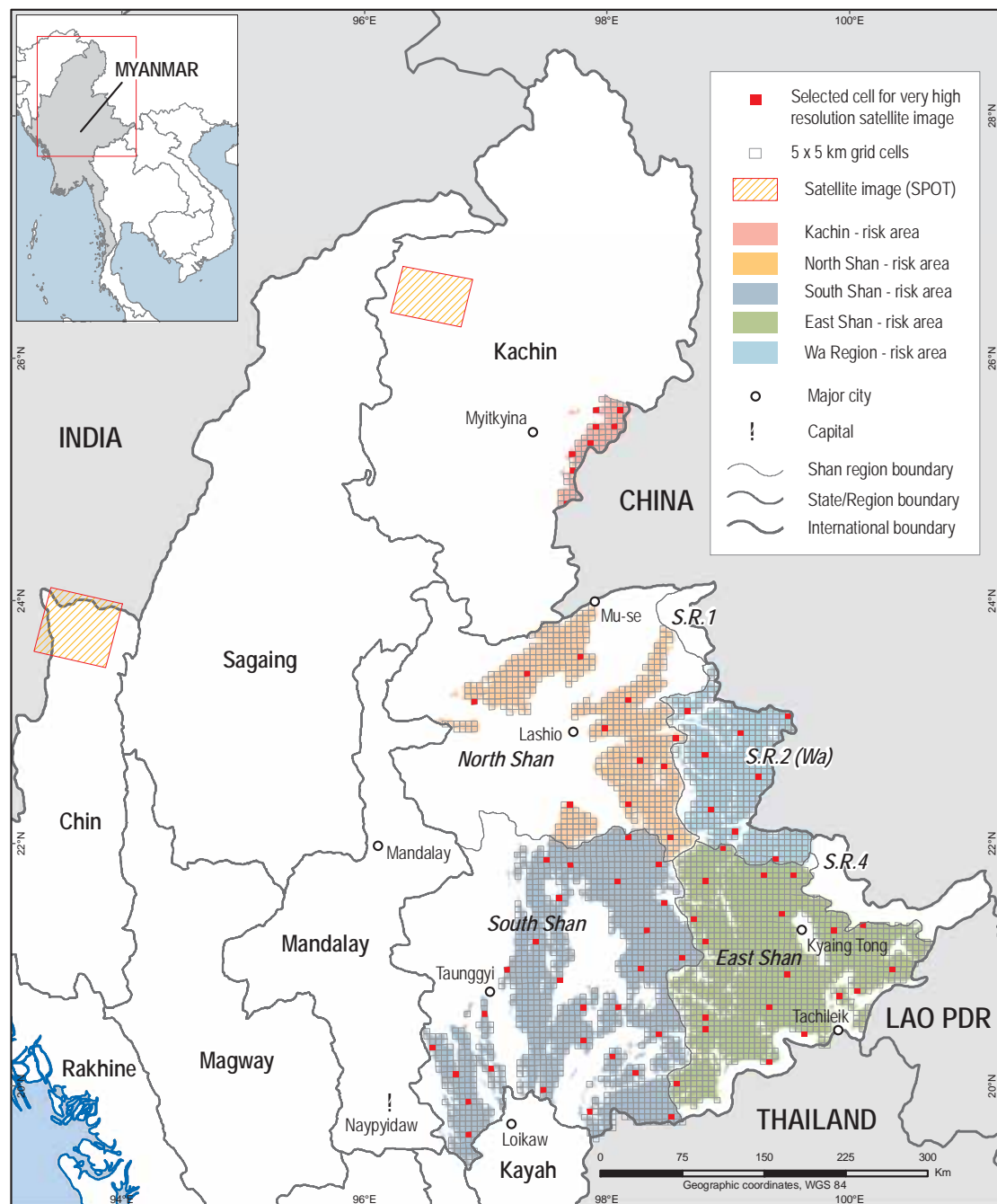


Several opium poppy-free areas were identified from information on the ground: Special Region 4 and the townships Maingyang, Kalaw, Pindaya, Yauksauk, Ywangan, Nawngcho, Mabein, and Hopan, as well as a 10-km buffer zone along the border with Thailand. These areas were excluded from the sampling frame.

The above-mentioned factors were combined in a Geographic Information System in order to calculate the sampling frame. North, East and South Shan, Waingmaw area in Kachin and Wa

special region were analysed separately. A grid with 5 x 5 km cells was placed on top of the sampling frame so as to select the image locations. The number of images in each region was determined according to the size of the risk area in each region. Half of the locations that were sampled in 2011 were selected again, as long as they matched the selection criteria. The images were selected randomly and systematically within the sampling area, i.e. a random selection was made within determined clusters. Out of a total of 3,213 cells, 74 locations were selected (28 locations in South Shan, 11 locations in North Shan, 19 locations in East Shan, 8 in Waingmaw area, and 8 locations in Wa Special Region), representing 2.1% of the total risk area in the sampling frame. From the selected locations, 66 images were successfully acquired for both dates, and the rest were acquired with only one date.

Map 5: Sampling frame area and satellite image locations in Myanmar, 2012

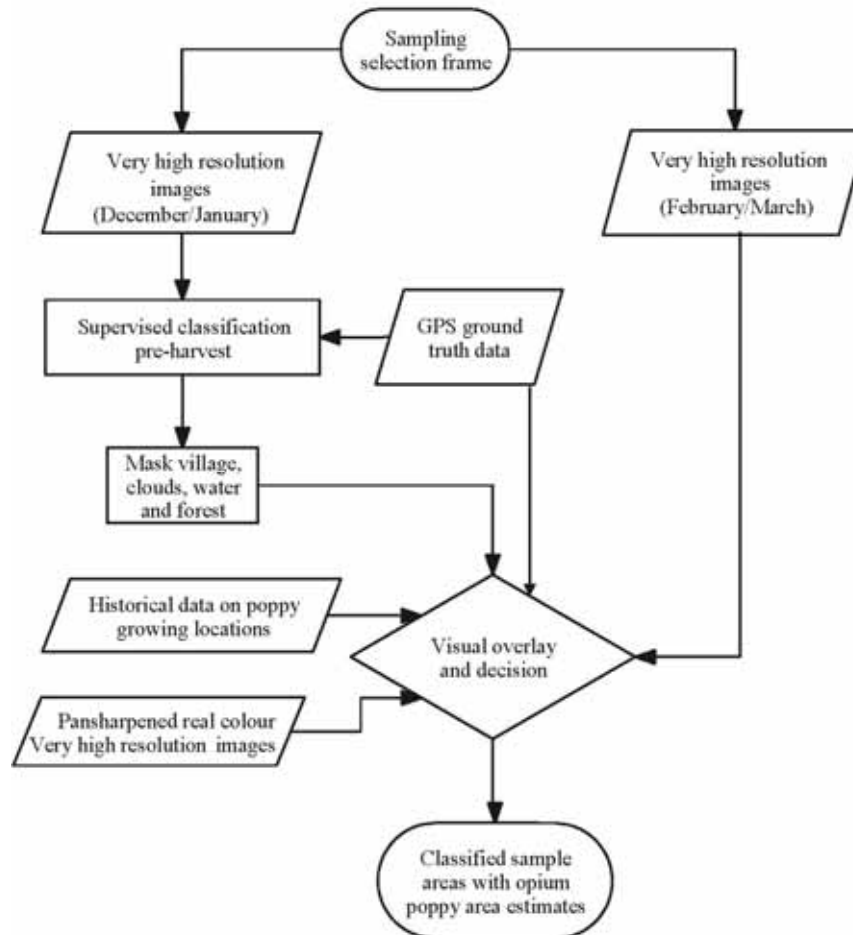


Source: Government of Myanmar - National Monitoring System supported by UNODC
 The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Satellite image processing

The classification procedure of very high-resolution images is illustrated in the following flow chart.

Figure 21: Flow chart of satellite image processing steps in Shan State, Kachin (Waingwaw township) and Wa Special Region



The satellite images were classified with ground truth data collected by the ground control teams. For the first round of images, supervised classifications with maximum likelihood rules were applied to obtain maps that identified different land cover as forest, scrub, grass, agricultural land and possible poppy-growing areas. The images taken in the second round were used to observe changes in possible poppy-growing areas. If there was an apparent change that corresponded to the harvesting of the poppy, it was used to confirm that the field was indeed a poppy field. This was done in a visual manner, since the images were not geometrically corrected and automation was not possible due to the displacement of the fields in question.

In visual interpretation, the accuracy and precision of the result vary according to the experience and skill of those doing the interpreting. Therefore, an interpretation key (decision rule) was developed for bringing the interpreters to a comparable level of knowledge, experience and notion of the topic. The interpretation key uses features of poppy fields (historical training materials collected in the former surveys) such as tone, colour, shape or texture, in addition to context information and knowledge of the area.

The decision rules can vary by region and stage of poppy cultivation, however the most commonly applied rule was that potential poppy in the first classification, when classified as bare soil in the second classification, meant that it was opium poppy. Historical data on poppy cultivation and real colour, pansharpened (very high-resolution images) visualization was used to facilitate decision-making.

Area estimation formulae for satellite imagery

A ratio estimate approach was used in order to provide the most accurate approximation of the extent of opium poppy cultivation in North Shan State, East Shan State, South Shan State and part of Kachin.

The estimation of the area under opium poppy cultivation was based on the information collected from the satellite imagery.

An estimate of the extent of the opium poppy cultivation was made using the equations described below.

- a. Average ratio of opium poppy cultivation within region, k :

$$\bar{y}_k = \frac{1}{n_k} \sum_{i=1}^{n_k} P_i / R_i$$

where n_k is the number of satellite image locations within the region, P_i is the area of poppy in segment i and R_i is the risk area in segment i .

- b. Estimate of area of opium cultivation in each region, k :

$$A_k = \bar{y}_k R_k$$

where R_k is the total risk area in the sampling frame in region k .

The confidence intervals were calculated using the bootstrap method with 100,000 iterations. The 2012 area estimates and confidence intervals for Myanmar are presented in the table below. It should be noted that the upper and lower estimates do not lie symmetrically between the mean estimates because of the different statistical tools used to arrive at the most robust regional estimates.

Bootstrapping consists of sampling with replacement from the original sample with multiple iterations, composed in this case of the total poppy areas of the selected segments. After each iteration, a mean value is estimated and scored. At the end, a distribution of means can be observed, producing a mean estimate and a 95% confidence interval for the mean.

Area estimation in Chin State and Wa special region

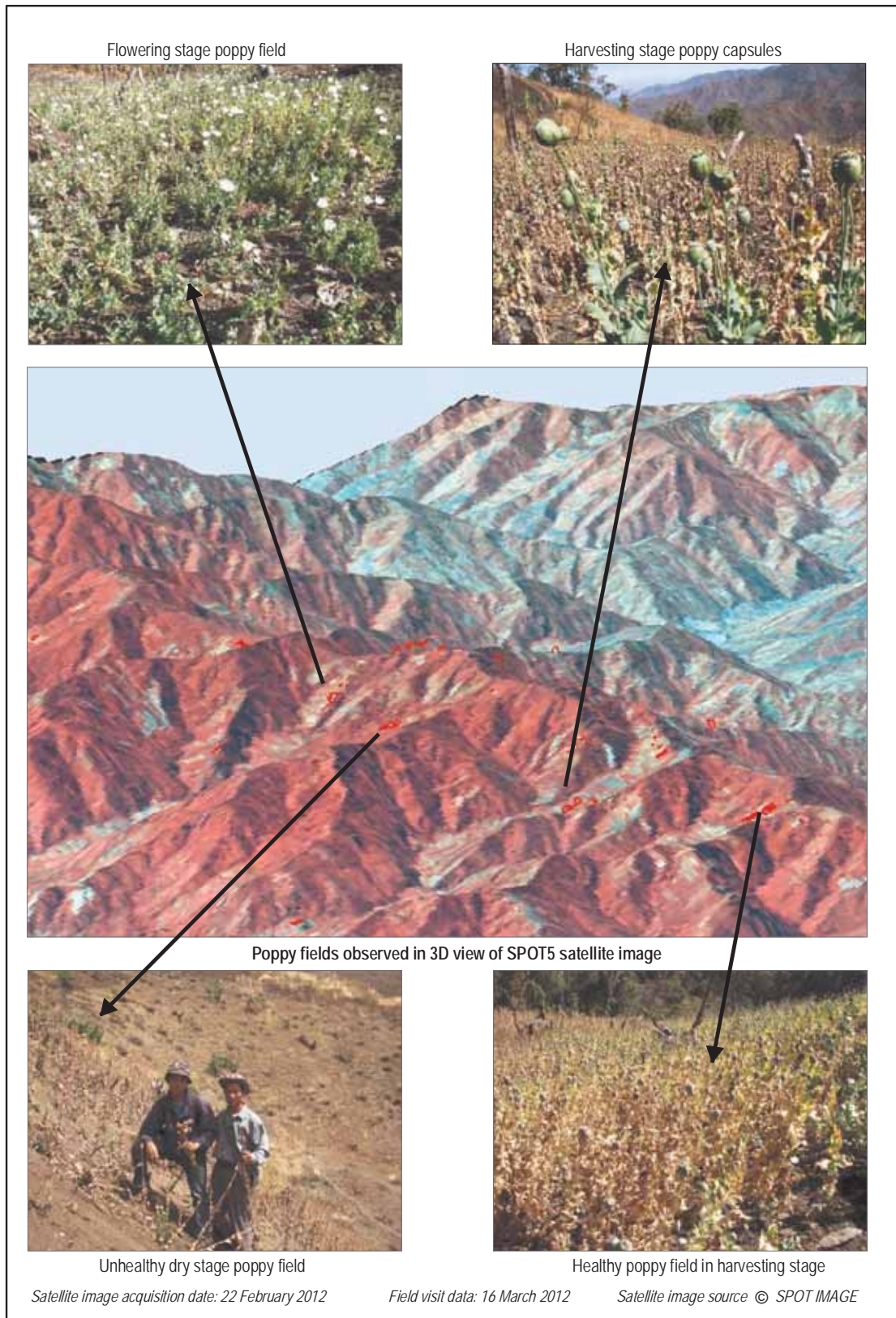
Chin State

For the first time, a high resolution SPOT5 image with 5-metre resolution was acquired for the targeted area of northern Chin State. The targeted area (area of interest) was based on the GPS point data collected during the former rapid assessment surveys and Government eradication reports.

The image rectification was performed based on the 250 K topographic maps. The supervised classification with maximum likelihood rules was applied to classify different land covers, such as forest, scrubs, grass, agricultural land, etc. Possible poppy area was classified using training dataset collected during ground survey and historical GPS data collected in the past assessment surveys.

The poppy field interpretation was performed in both automatic classification and visual manner. The decision-making process considered several factors such as field geometry (size, sharpness of field boundary), field texture, altitude, accessibility, and spatial pattern. Because of lack of ground truth data, the extent of opium poppy cultivation was only classified as probable areas without further quantification.

Figure 22: Poppy field interpreted on SPOT5 satellite image with ground control photos



Wa Special Region 2

For the first time, a probabilistic sample of very high-resolution satellite images was used to know the status of opium poppy cultivation in the Wa Special Region. For every location of eight selected segments, images from two different dates with a five-week interval were acquired.

The satellite images were classified in the way described above. As in Chin State, due to a lack of sufficient ground truth data, the extent of opium poppy cultivation was only classified as probable areas without further quantification.

Table 14: Area estimates with 95% confidence interval, 2012 (Hectares)

Region	Area estimate	Lowest estimate	Upper estimate
East Shan State	14,241	8,400	20,600
North Shan State	6,335	3,300	9,400
South Shan State	25,403	15,700	35,900
Kachin	5,063	1,900	10,000
Total	51,000	38,200	64,400

Table 15: Opium poppy cultivation areas, by region, 2011-2012

	2011	2012	Change 2011-2012	% of total area of opium poppy cultivation
East Shan	12,200 (6,700 to 18,300)	14,200 (8,400 to 20,600)	17%	28%
North Shan	4,300 (1,700 to 7,200)	6,300 (3,300 to 9,400)	47%	12%
South Shan	23,300 (11,500 to 37,400)	25,400 (15,700 to 35,900)	9%	50%
Shan State total	39,800 (25,900 to 55,800)	46,000 (34,800 to 58,700)	16%	90%
Kachin	3,800 -	5100 (1,900 to 10,000)	33%	10%
National total (rounded)	43,600 (29,700 to 59,600)	51,000 (38,200 to 64,400)	17%	100%

Opium poppy cultivation status by township

The table below indicates the poppy-growing status according to different sources, either from the remote sensing analysis, the socio-economic survey or from the eradication campaign.

Table 16: Poppy-growing status in 2012, by township and source

Region	Township	In Satellite image location	During the socio-economic survey	Eradication campaign
East Shan	Kyaingtong	X	X	X
	Maing Khat	X	X	X
	Maingpyat	X	X	X
	Maingpyin	X	X	X
	Maingsat	X	X	X
	Maingtong	X	X	X
	Maingyaung ²⁶	X		X
	Metmang	X	X	X
	Tachileik	X	X	X
Sub-Total		9	8	9
North Shan	Kunlon			
	Kutkai	X	X	X
	Kyaukme			
	Lashio	X	X	X
	Maingyai	X	X	X
	Manton	X	X	X
	Moemeik		X	X
	Muse			
	Namkham		X	X
	Namsan(N)			
	Namtu			
	Tantyang	X	X	X
	Theinne	X		X
	Thibaw	X		
Sub-Total		7	7	8
South Shan	Kalaw			X
	Hopong	X	X	X
	Hsihseng		X	X
	Kehsi	X	X	X
	Kunghein	X	X	X
	Leacha		X	
	Linkhay	X		X
	Loilem	X	X	X
	Maingkaing	X	X	X
	Maingpan	X	X	X
	Maingshu	X	X	X
	Maukmai	X	X	X
	Monea	X	X	X
	Namsan(S)	X		X
	Nyaungshwe	X		X
	Pekhon	X	X	X
	Pinlaung	X	X	X
Taunggyi			X	

²⁶ Data from the village survey for Maingyu, a sub-township of Maingyaung, was not available.

Sub-Total		14	13	17
Chin	Teddim	X	X	X
	Tonzang	X	X	
Sub-Total		2	2	1
Kachin	Waingmaw	X		X
	Tanai	X		
Sub-Total		2	0	1
Kayah	Demawso			X
	Fruso			X
Sub-Total		0	0	2
Total		34	30	38

Information on poppy cultivation in Special Region 1 (Kokang) and Special Region 4 (Monglar)

A dedicated team led by a UNODC official (from Myanmar) worked in conjunction with local anti-narcotic task force members to conduct a rapid assessment survey in Special Region 1 (Kokang) in January 2012. The survey indicated no evidence of poppy cultivation in that region, which has been opium poppy-free since 2003.

In Special Region 4 (Monglar), a rapid assessment survey led by a UNODC official was conducted to certify the poppy-free status of the region. The survey indicated no evidence of poppy cultivation in Special Region 4, which has been opium poppy-free since 1997.



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