



**UNODC**

United Nations Office on Drugs and Crime



Central Committee for  
Drug Abuse control



Lao National Commission for  
Drug Control and Supervision

# Southeast Asia Opium Survey 2013

## Lao PDR, Myanmar



UNODC's Illicit Crop Monitoring Programming (ICMP) promotes the development and maintenance of a global network of illicit crop monitoring systems. ICMP provides overall coordination as well as quality control, technical support and supervision to UNODC supported illicit crop surveys at the country level. In Southeast Asia, UNODC supports Member States to develop and implement evidence based rule of law, drug control and criminal justice responses through the Regional Programme 2014-2017.

The implementation of UNODC's Illicit Crop Monitoring Programme in Southeast Asia was made possible thanks to financial contributions from the Governments of Japan and the United States of America.

UNODC Illicit Crop Monitoring Programme – Survey Reports and other ICMP publications can be downloaded from:

<http://www.unodc.org/unodc/en/crop-monitoring/index.html>

# CONTENTS

## PART 1

<b>FACT SHEET – SOUTH-EAST ASIA OPIUM SURVEYS 2013 .....</b>	<b>3</b>
<b>REGIONAL OVERVIEW .....</b>	<b>5</b>
OPIUM POPPY CULTIVATION IN SOUTH-EAST ASIA.....	5
OPIUM YIELD AND PRODUCTION.....	8
THE LINK BETWEEN OPIUM CULTIVATION AND PRICE.....	9
OPIUM CULTIVATION AND POVERTY .....	11
THE REGIONAL OPIATE MARKET.....	11

## PART 2

<b>LAO PEOPLE’S DEMOCRATIC REPUBLIC OPIUM SURVEY 2013.....</b>	<b>13</b>
INTRODUCTION.....	19
FINDINGS .....	21
METHODOLOGY .....	31

## PART 3

<b>MYANMAR OPIUM SURVEY 2013.....</b>	<b>39</b>
INTRODUCTION.....	45
FINDINGS .....	47
METHODOLOGY .....	78



## Foreword

This year's Southeast Asia Opium Survey shows that despite eradication efforts, opium poppy cultivation in the region continues to increase.

Poppy cultivation in Myanmar rose 13% from the previous year to 57,800 hectares, more than doubling since 2006. In Lao cultivation levelled off but remains a concern.

The combination of an increase in both cultivation and yield of opium poppy in Myanmar in 2013 resulted in a rise in opium production of some 26% in comparison to 2012. The best estimate for 2013 opium production in Myanmar alone is some 870 tonnes, the highest since assessments by UNODC and the Government began. Heroin seizures in East and Southeast Asia in 2012 were just over nine tonnes, compared to 6.5 tonnes in 2010, while there were 2.7 tonnes of opium seized in 2012 compared to two tonnes in 2010.

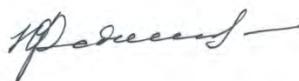
The figures make clear that efforts to address the root causes of cultivation and promote alternative development need to be stepped up. It is important to do so quickly, considering that the area known as the "Golden Triangle" is at the geographic centre of the Greater Mekong sub-region, and plans are already well underway to expand transport and infrastructure systems across the region, while also lowering trade barriers and border controls. Criminal networks that benefit from the drug trade in Southeast Asia are also positioned to take advantage of this well-intentioned integration process.

Surveys of farmers in poppy-growing villages, indicate that the money made from poppy cultivation remains an essential part of family income. Villagers threatened with food insecurity and poverty need sustainable alternatives, or they will continue out of desperation to turn to growing this cash crop.

Another troubling trend that must be addressed is the rise in demand in nearby markets, which may be fuelling the resurgence in cultivation and production.

In Myanmar and Lao PDR, the use of opium, heroin and synthetic drugs – another growing threat in the region –, remains high. Moreover, the number of registered heroin and synthetic drug users in China has been going up since 2007.

This increase in drug production and use represents a clear threat to human security and health. Balanced plans aimed at slowing and stopping production and trafficking, while preventing drug use and providing evidence-based treatment and care for drug-dependent users, in full compliance with human rights standards, must be made a priority by states and international partners.



Yury Fedotov  
Executive Director  
United Nations Office on Drugs and Crime



## **PART 1. REGIONAL OVERVIEW**



## FACT SHEET – SOUTH-EAST ASIA OPIUM SURVEYS 2013

	2012	2013	Change
Opium poppy cultivation (hectares)			
Lao PDR <sup>1</sup>	6,800 ha	3,900 ha	N/A <sup>3</sup>
Myanmar <sup>1</sup>	51,000 ha	57,800 ha	+13%
Thailand* <sup>2</sup>	209 ha	265 ha	+27%
Weighted average dry opium yield			
Lao PDR <sup>4</sup>	6.0 kg/ha	6.0 kg/ha	-
Myanmar	13.5 kg/ha	15.0 kg/ha	+11%
Thailand * <sup>5</sup>	15.6 <sup>6</sup> kg/ha	15.6 <sup>7</sup> kg/ha	-
Potential opium production			
Lao PDR	41 tons	23 tons	N/A <sup>3</sup>
Myanmar	690 tons	870 tons	+26%
Thailand*	3 tons	4 tons	+33%
Opium poppy eradication			
Lao PDR	24,634 ha	12,949 ha	-53%
Myanmar	707ha	397ha	-56%
Thailand*	23,718 ha	12,288 ha	-52%
Thailand*	205 ha	264 ha	+29%
Average price of opium <sup>8</sup>			
Lao PDR	1,800 US\$ /kg	1,840 US\$ /kg	+2%
Myanmar	520 US\$/kg	498 US\$/kg	-4%
Thailand*	N/A	2,734 US\$/kg	
Potential value of opium production			
Lao PDR	US\$ 72 million	US\$ 42 million	N/A <sup>3</sup>
Myanmar	US\$ 359 million	US\$ 433 million	+21%
Thailand	N/A	US\$ 11 million	

N/A – not applicable.

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

<sup>1</sup> May include areas eradicated after the date of the area survey.

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

<sup>3</sup> For technical reasons the estimates of the two years are not comparable. For more details see the Lao PDR chapter of this report.

<sup>4</sup> In the absence of more recent yield surveys, the yield per hectare for 2007 was used.

<sup>5</sup> The 2004 yield per hectare is used due to the absence of a more recent yield survey.

<sup>6</sup> The yield per hectare for 2004 was used due to the absence of yield survey in 2012.

<sup>7</sup> The yield per hectare for 2004 was used due to the absence of yield survey in 2012.

<sup>8</sup> 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 PDR.



## REGIONAL OVERVIEW

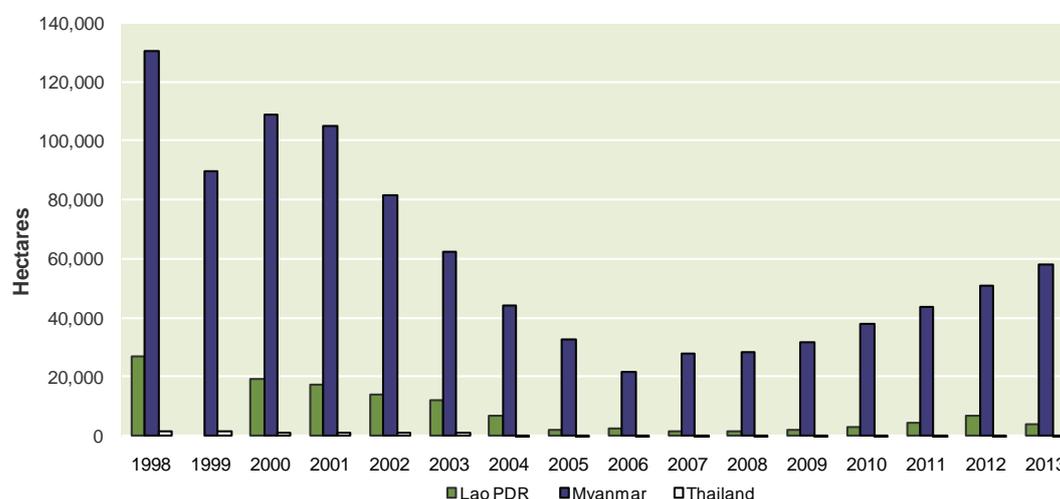
A total area of over 62,000 hectare of opium poppy cultivation took place in Lao People's Democratic Republic (Lao PDR), Myanmar and Thailand in 2013. In order to assess the scope of opium poppy cultivation and opium production in the region, UNODC has been conducting opium surveys in cooperation with the Government of Lao PDR since 1992 and the Government of the Republic of the Union of Myanmar (GOUM) since 2002, while Thailand established its own monitoring system. This report contains the results of the 2013 UNODC-supported opium poppy cultivation surveys in Lao PDR 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 PDR saw the largest relative decline among the three countries, opium poppy cultivation in the region has since increased, though at a relatively slow pace.

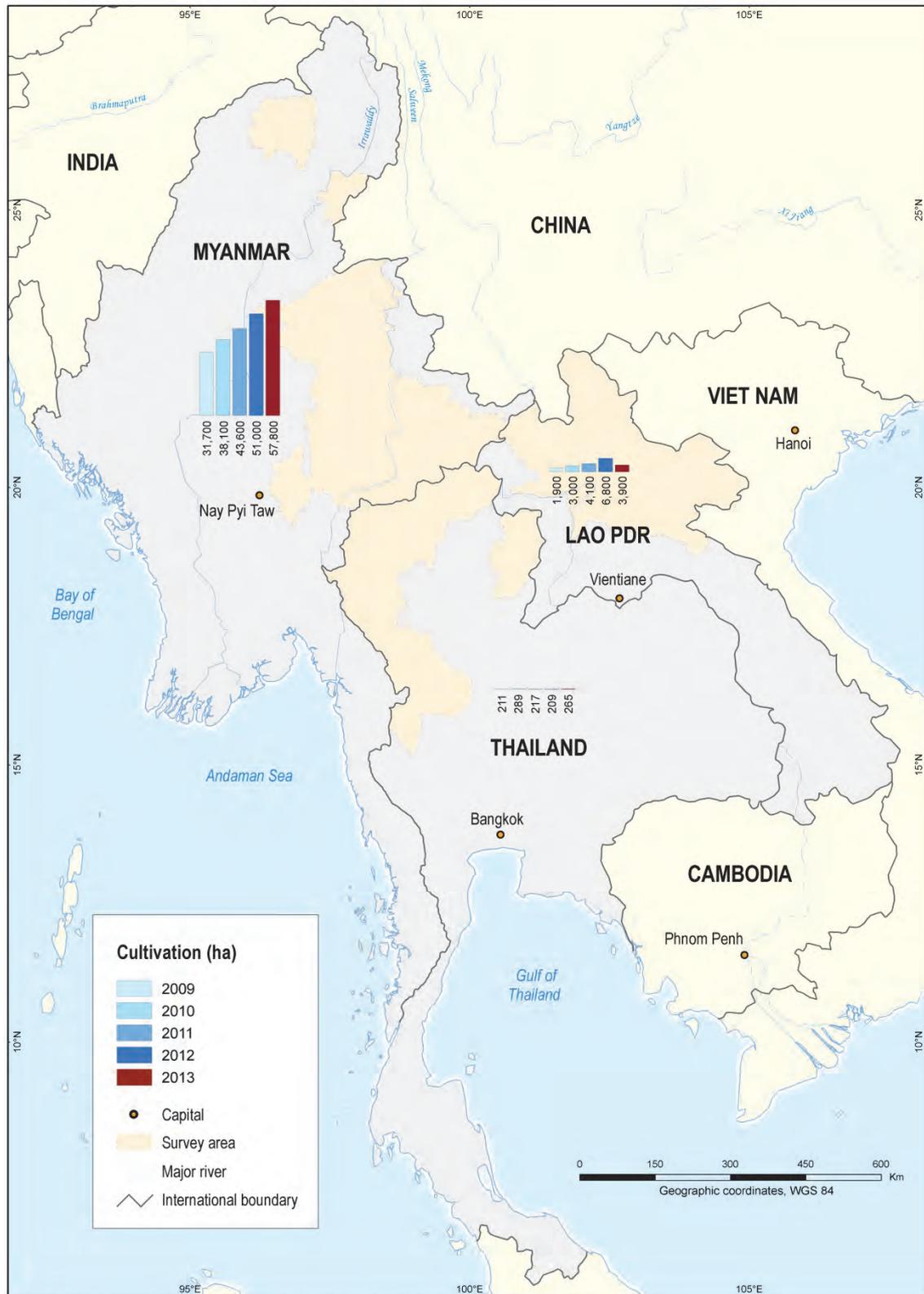
According to government reports, opium poppy cultivation in Thailand has remained stable at a very low level. However, opium poppy cultivation in Myanmar increased from 21,600 hectares in 2006, the year with the lowest level of cultivation, to 57,800 hectares in 2013. In Lao PDR, it increased from 1,500 hectares in 2007 to 6,800 hectares in 2012. In 2013, 3,900 hectares were estimated, but due to differences in methodology compared to 2012, a trend could not be established. Thus, overall, opium poppy cultivation in the region has more than doubled since 2006, this despite official reports from the Governments of the three countries indicating that a total of 12,949 hectares of opium poppy were eradicated in 2013.

**Figure 1: Opium poppy cultivation in South-East Asia, 1998-2013 (Hectares)**



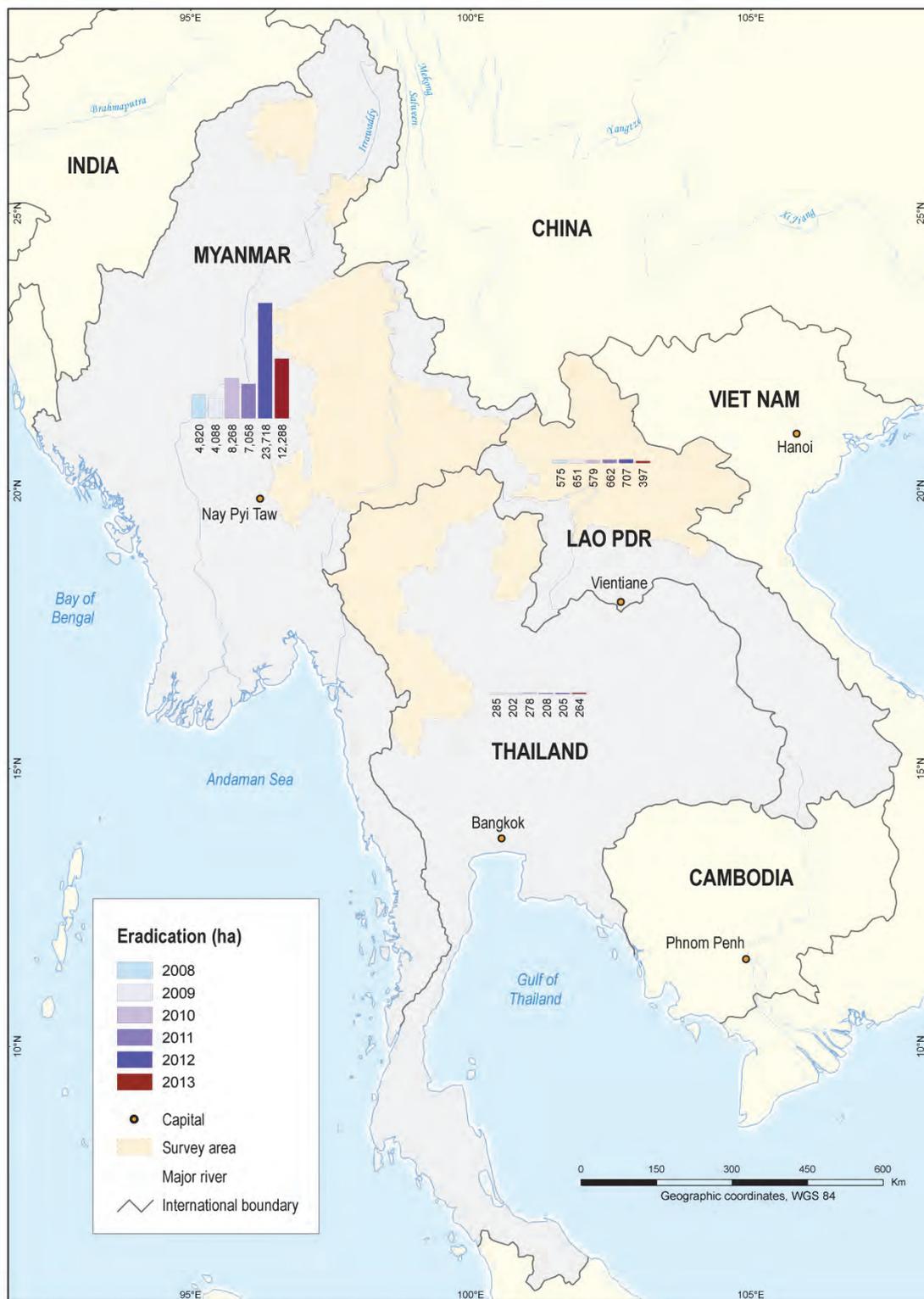
Source: Lao PDR/Myanmar: National monitoring systems supported by UNODC; Thailand: Thai Office of the Narcotics Control Board.

**Map 1: Opium poppy cultivation in South-East Asia, 2009-2013 (Hectares)**



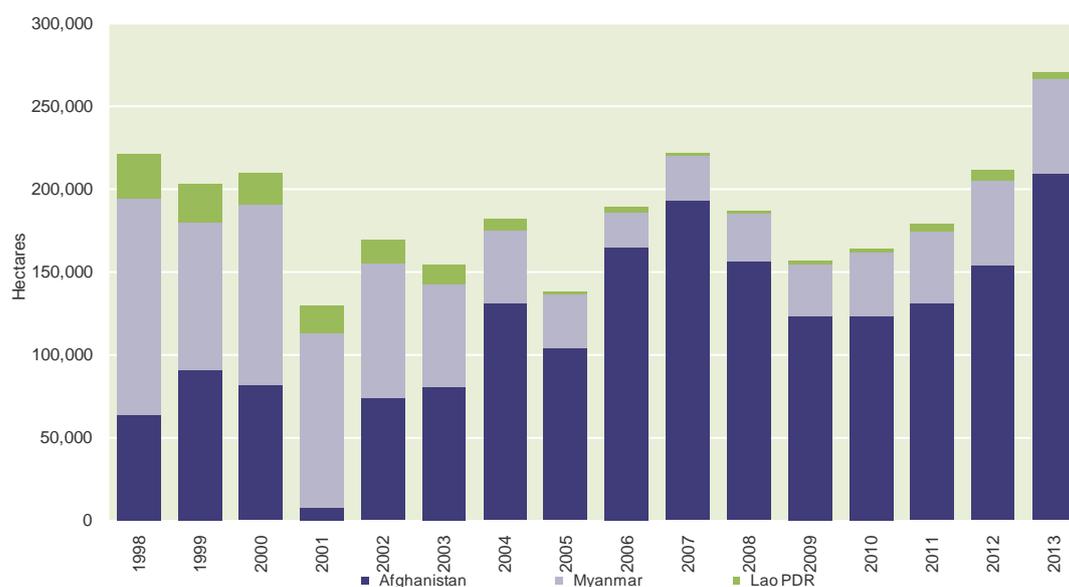
Source: Government of Lao PDR, Myanmar and Thailand, national monitoring systems supported by UNODC in Lao PDR and Myanmar. The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Map 2: Opium poppy eradication in South-East Asia, 2008-2013 (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 Afghanistan, Myanmar and Lao PDR, 1998-2013 (Hectares)**



Source: Afghanistan/Lao PDR/Myanmar: National monitoring systems supported by UNODC.

Myanmar remained the second largest opium poppy grower in the world after Afghanistan in 2013, with Lao PDR accounting for only a very small proportion of the global total.

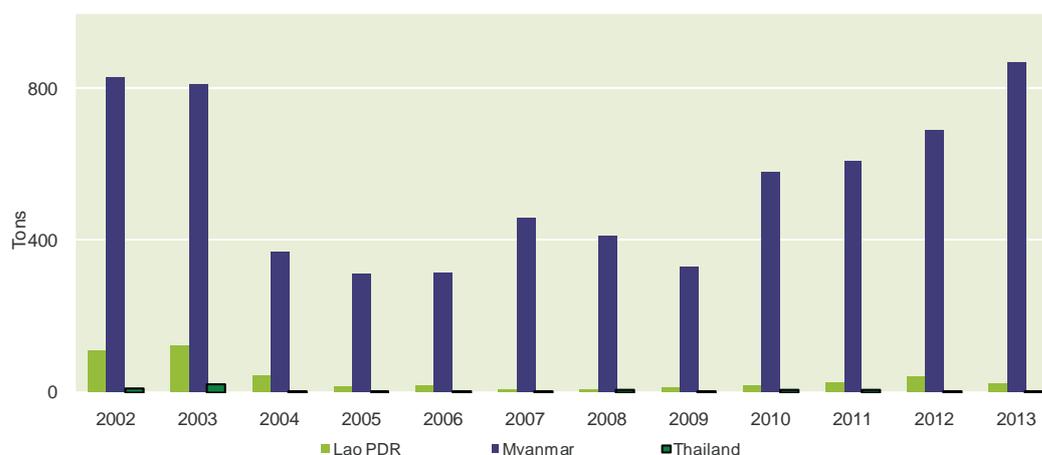
## Opium yield and production

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 2013, opium yields were estimated at 6.0 kilograms per hectare<sup>9</sup> in Lao PDR, 15.0 kilograms per hectare in Myanmar and 15.6 kilograms per hectare<sup>10</sup> in Thailand. In 2005, Lao PDR and Myanmar together produced 326 tons of opium, or 7% of that year's global opium production of 4,620 tons. In 2013, the two countries produced 893 tons, or 18% of the total opium production in 2012.

<sup>9</sup> In the absence of more recent yield surveys, the result of the 2007 yield survey was used.

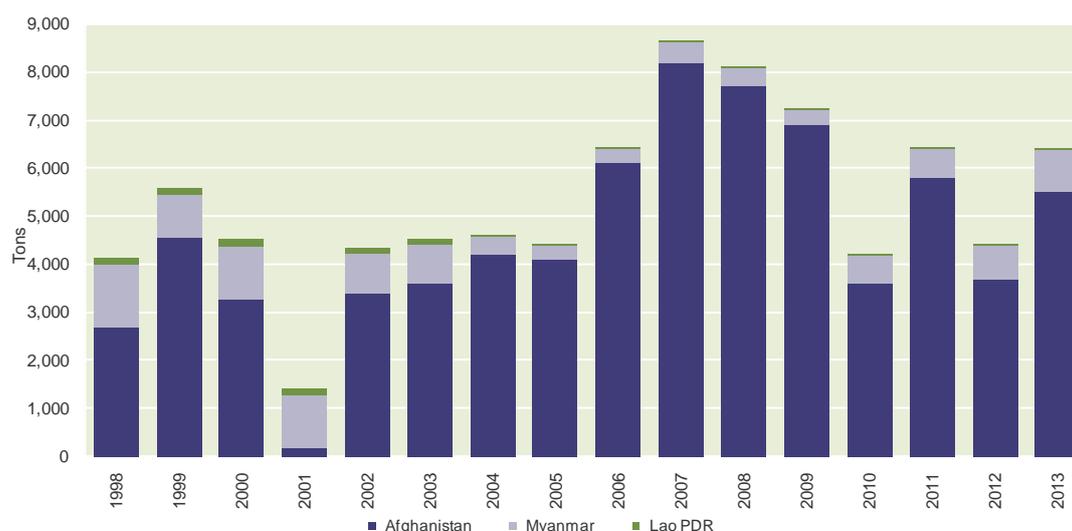
<sup>10</sup> The 2004 yield per hectare was used due to the absence of a more recent yield survey.

**Figure 3: Opium production in cultivating areas in Lao PDR, Myanmar and Thailand, 2002-2013**



Source: Lao PDR/Myanmar: National monitoring systems supported by UNODC; Thailand: Thai Office of the Narcotics Control Board.

**Figure 4: Opium production in major producing countries, 1998-2013 (Tons)**



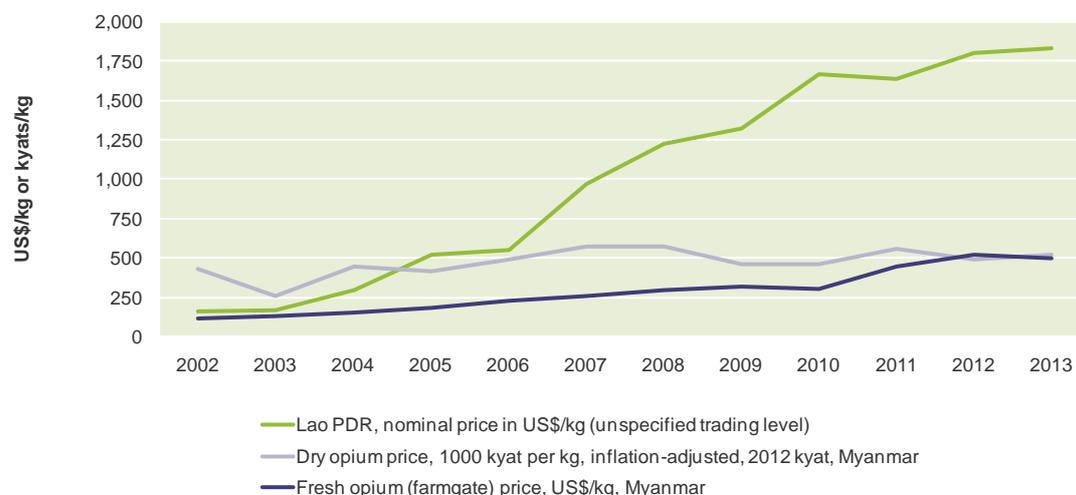
Source: Afghanistan/Lao PDR/Myanmar: National monitoring systems supported by UNODC.

## The link between opium cultivation and price

Opium prices in South-East Asia seemed to have reached a plateau after strong increases in recent years while pronounced differences in price levels continue to exist between Lao PDR, Myanmar and Thailand. This could be an effect of increased opium production and consequently greater availability of opiates in the region.

Opium prices were relatively stable in 2013 in all three countries. Opium prices in Thailand were at about the level in Lao PDR in 2013. Due to the very low opium production in the country, opium prices reported from Thailand reflect predominantly a drug demand situation, unlike prices in Myanmar, which reflect the price level in opium producing areas before trafficking and are thus much lower. It is not clear what caused the strong price dip in Thailand in 2011.

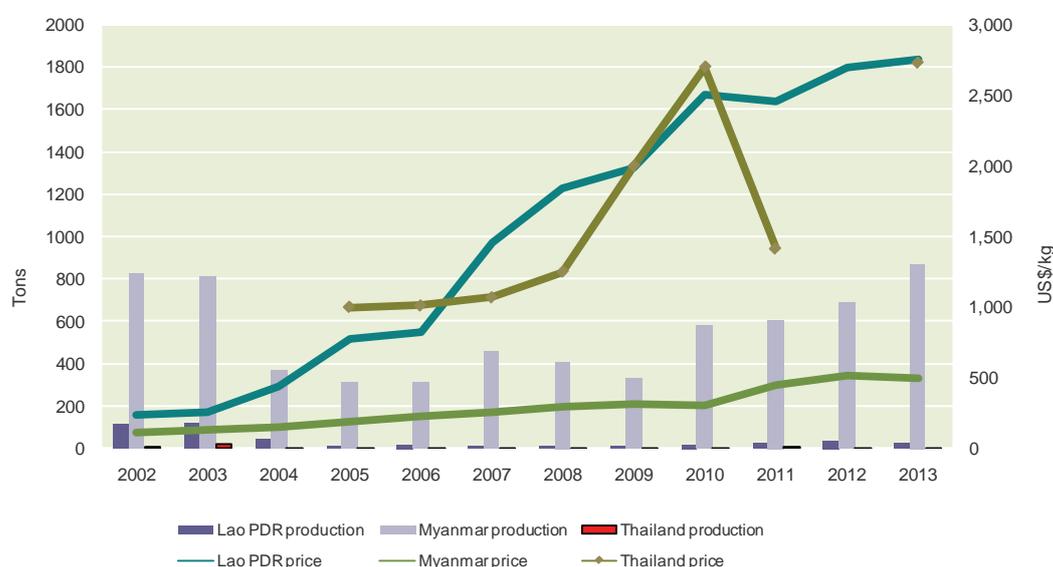
**Figure 5: Opium prices in cultivating areas in Lao PDR and Myanmar, 2002-2013**



Source: Lao PDR: LCDC; Myanmar: National monitoring system supported by UNODC.

Despite recent increases in opium prices suggesting that poppy farmers in Myanmar obtained greater value per kilogramme of opium produced in 2013 than in previous years (particularly when looking at prices in US dollar terms), more in-depth analysis reveals that this was not actually the case. After adjusting for inflation, opium prices in the local currency (kyat) have remained at about the same level since 2006. Poppy farmers have therefore not been able to benefit from rising opium prices.

**Figure 6: Opium production and prices in Lao PDR, Myanmar and Thailand, 2002-2013**



Note: Price data for Thailand was not available in 2012.

## Opium cultivation and poverty

While the area under poppy cultivation in Myanmar increased by 13% in 2013, the number of households growing poppy remained roughly the same, as farmers on average dedicated a larger portion of their land to poppy cultivation than in 2012. The average area of poppy per opium growing household more than doubled from 0.17 hectares in 2002/2003 to 0.43 hectares in 2013. This implies a larger dependency of those households on opium.

Furthermore, the Myanmar survey found that many households not only earn income from the cultivation of opium poppy on their own land, but also by labouring in the poppy fields of other farmers. Alternative development projects thus need to address both of these groups, as a reduction in poppy cultivation for many households means the loss of an opportunity to generate income from poppy-related wage labour.

There is a strong link between poverty and poppy cultivation. In poppy-growing villages in Myanmar, significantly higher proportions of households are in debt and are exposed to food insecurity than in non-poppy-growing villages. Furthermore, households in poppy-growing villages on average suffer longer from food insecurity than households in non-growing villages. Thus, in poppy-growing villages, opium cultivation seems to be a means to earn cash income in order to purchase food in months when households' food resources have been depleted. In other words, poppy farmers try to compensate for a lack of alternatives in their opportunities for earning income in order to subsist.

Income patterns in poppy-growing and non-poppy growing villages in Myanmar are complex and differ in much more than just poppy cultivation. Despite indicators of greater vulnerability (as seen in higher levels of debt, food insecurity and drug use), households in poppy-growing villages in all regions, with the exception of East Shan, had a higher average income than those in non-poppy-growing villages. On the other hand, households in non-poppy-growing villages had better access to salaried jobs and petty trade.

In Lao PDR, no socio-economic survey of poppy-growing villages was conducted in recent years. The data from the helicopter flights and satellite image analysis indicated that poppy cultivation continued to be a phenomenon linked to villages in peripheral, difficult to access locations, far from population and market centres.

Risks and opportunities associated with different income patterns in poppy-growing and non-poppy growing villages need to be investigated in more detail in Myanmar but also in Lao PDR to understand how livelihood risks can be reduced and the resilience of households can be improved in the context of efforts to contain and reduce households' dependence on poppy cultivation.

## The regional opiate market

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.

In the Myanmar opium survey, 2013, drug use was higher in 2013 than in 2012 for all three types of drugs investigated, opium, heroin and amphetamine-type stimulants (ATS, locally called *yaba*). Drug use was much higher in poppy-growing villages than in non-growing villages for all three drugs. According to reports from the Government, the number of opium users increased significantly in Lao PDR in 2013 as well.

The number of registered heroin users in China has been increasing since 2007 and it appears that opium production in Lao PDR and Myanmar is unable to meet demand which is now partly met by opiates originating from Afghanistan. Still, seizure trends in China generally followed opium production trends in South-East Asia, as witnessed by the fact that heroin seizures in China reached their lowest levels in 2007 and 2008, which tied in with the low levels of opium production seen in Lao PDR and Myanmar in 2005-2006 (factoring in the one-year time lag

between the production and seizure of the drug). Subsequently, heroin seizures in China rose again, following increases in opium production in South-East Asia.<sup>11</sup>

---

<sup>11</sup> Source: UNODC, World Drug Report 2013, p. 35.

## **PART 2. LAO PDR**



# CONTENTS

## FACT SHEET — LAO PEOPLE’S DEMOCRATIC REPUBLIC OPIUM SURVEY 2013.17

<b>1 INTRODUCTION.....</b>	<b>19</b>
<b>2 FINDINGS .....</b>	<b>21</b>
2.1 AREA UNDER OPIUM POPPY CULTIVATION .....	21
2.2 CULTIVATION PRACTICES AND CROP CALENDAR.....	24
2.3 YIELD AND PRODUCTION .....	25
2.4 OPIUM PRICES .....	27
2.5 OPIUM POPPY ERADICATION .....	28
2.6 OPIUM USERS .....	29
<b>METHODOLOGY.....</b>	<b>31</b>
3.1 INTRODUCTION.....	31
3.2 SAMPLING FRAME.....	31
3.3 SAMPLE SIZE AND SAMPLE SELECTION.....	33
3.4 AREA ESTIMATION PROCEDURE.....	34
3.5 COMPARABILITY WITH PREVIOUS SURVEYS.....	36

# 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

# ACKNOWLEDGEMENTS

## Government of Lao People's Democratic Republic

### **LCDC**

Kou Chansina	Acting Chairperson of LCDC
Sithat Sisongkham	Head of Civic Awareness Division, LCDC
Sayfonh Onekeovixay	Technical staff, LCDC
Phontha Vilaykham	Head of Provincial Committee for Drug Control Office (PCDC), Houaphanh Province
Khamhoo Phetsachanh	Deputy head of PCDC Office, Xiengkhouang province
Vongsavanh Xayavong	Deputy head of PCDC Office and K26 project
Major Kongkham	Ministry of Defence

### UNODC

Angela Me	Chief, Research and Analysis Branch (RAB)
Leik Boonwaat	Representative to Lao People's Democratic Republic
Coen Bussink	Remote Sensing and GIS Expert, SASS
Juan Ardila	Remote Sensing and GIS Expert, SASS
Philip Davis	Statistician, SASS
Jonathan Gibbons	Consultant (editing)
Antoine Vella	Statistician, SASS
Yuliya Lyamzina	Consultant, SASS
Suzanne Kunnen	Public Information Assistant, RAB
Martin Raitelhuber	Programme Officer, SASS
Oudone Sisongkham	Senior Communication Officer in Lao PDR
Thomas Bauer	University of Natural Resources and Life Sciences, Vienna (remote sensing support)
Matteo Mattiuzzi	University of Natural Resources and Life Sciences, Vienna (remote sensing support)
Tim Wai Ng	University of Natural Resources and Life Sciences, Vienna (remote sensing support)

## FACT SHEET — LAO PEOPLE'S DEMOCRATIC REPUBLIC OPIUM SURVEY 2013

	2012	2013	Change from 2012
Opium poppy cultivation <sup>1</sup> (hectares)	6,800 ha (3,100 to 11,500)	3,900 ha (1,900 to 5,800)	Not comparable <sup>2</sup>
Average dry opium yield <sup>3</sup>	6 kg/ha	6 kg/ha	-
Potential production of dry opium	41 tons (18 to 69)	23 tons (11 to 35)	Not comparable
Average retail/wholesale price of opium <sup>4</sup>	US\$ 1,800 (720 to 2,900)	US\$ 1,840 (720 to 3,010)	2%
Eradication <sup>5</sup>	707 ha	397 ha	-56%
Opium prevalence rate (based on 10 northern provinces) <sup>6</sup>	0.42	N/A	N/A

<sup>1</sup> Range refers to the 95% confidence interval of the estimate.

<sup>2</sup> Two main factors limit the comparability of the two years: In 2013, most poppy fields were digitized on high or very high resolution satellite imagery whereas in 2012 this was the case for some areas only. The 2013 survey took place much later than in 2012 and may have missed some poppy fields that were already harvested.

<sup>3</sup> In the absence of a yield survey in 2012 and 2013, the yield per hectare for 2007 was used.

<sup>4</sup> 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.

<sup>5</sup> Source: LCDC. Eradication campaigns were conducted during and after the survey.

<sup>6</sup> Source: LCDC.



# 1 INTRODUCTION

This report presents the results of the thirteenth Lao People's Democratic Republic opium survey, which has been conducted annually since 1999 by the Lao National Commission for Drug Control and Supervision (LCDC) and UNODC.<sup>7</sup>

In 1999, the Government of Lao People's Democratic Republic and UNODC developed the programme strategy "Balanced approach to opium elimination in Lao People's Democratic Republic." 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 People's Democratic Republic 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.

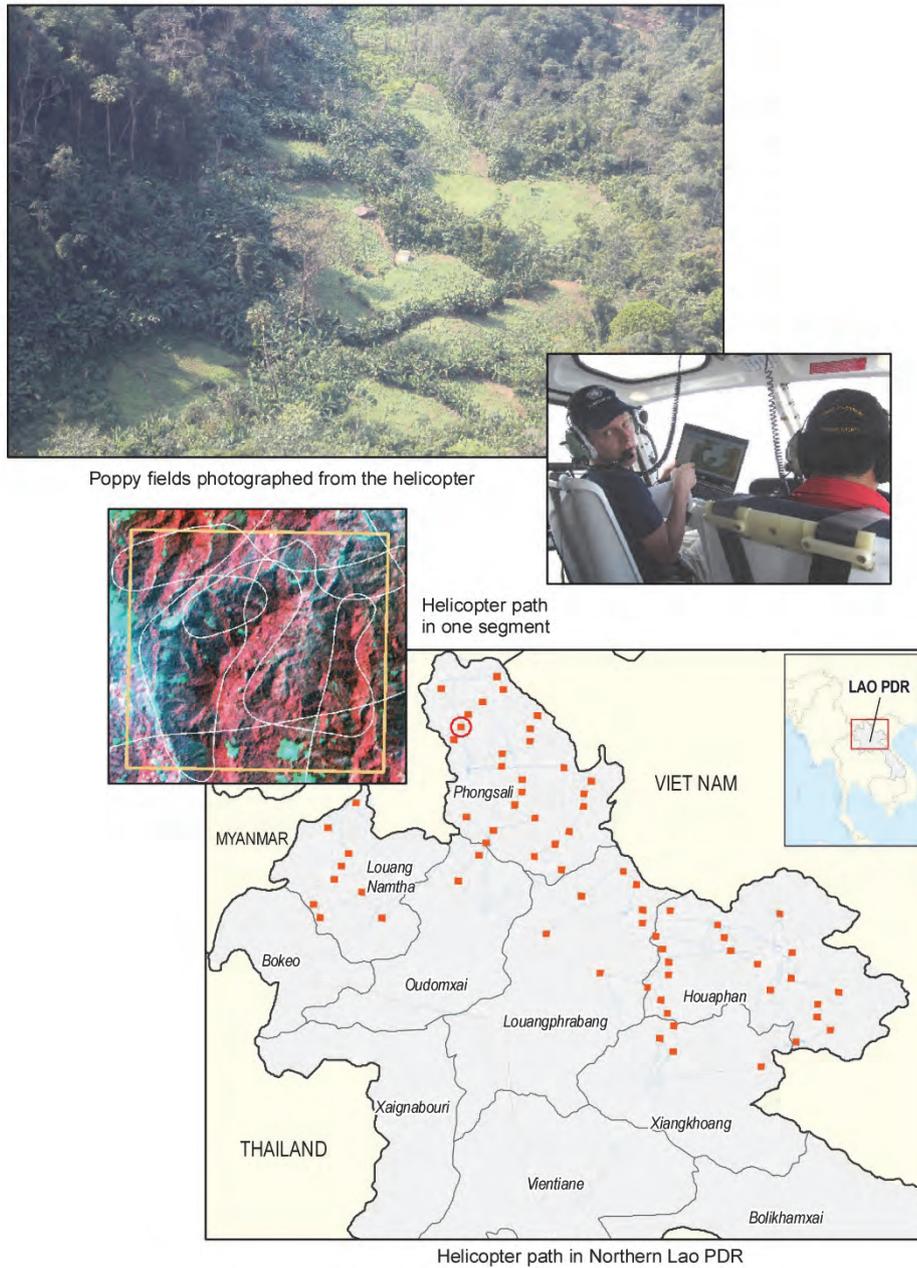
From 2005 to 2009, the survey covered six provinces in northern Lao People's Democratic Republic where opium poppy cultivation had taken place. From 2010, observations were only focused on Phongsali, Houaphan, Louang Namtha and Xiangkhoang provinces, where most opium poppy was cultivated, but in 2012 and 2013 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, Louang Namtha and Houaphan).

If the country's economic dependence on opium is to be reduced effectively, it is necessary to continue to 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.

---

<sup>7</sup> UNODC began to survey the cultivation of opium in Lao PDR 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



## 2 FINDINGS

The 2013 opium poppy survey was implemented by UNODC in coordination with the Lao National Commission for Drug Control and Supervision. 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 and 2013 surveys.

In 2013, 70 randomly selected segments measuring 5 km by 5 km, spread over the six opium poppy-producing provinces, were visited in order to estimate the cultivated area. However, due to strong winds at altitude, two segments were only partly flown over but were completed with the help of satellite images, which were used to verify 15 locations in total. Additional GPS data and photos were collected as ground truth data for posterior satellite image interpretations.

Due to the late arrival of funding, the survey started some three weeks later than usual. This meant that a lot of fields were already harvested, which might have prevented some fields from being identified as poppy fields, although most poppy plants were still green. In addition, observations were made along the helicopter flight path between the sample segments in order to provide information on risk areas for future surveys. Data on the 2013 opium yield could not be collected during the helicopter survey.

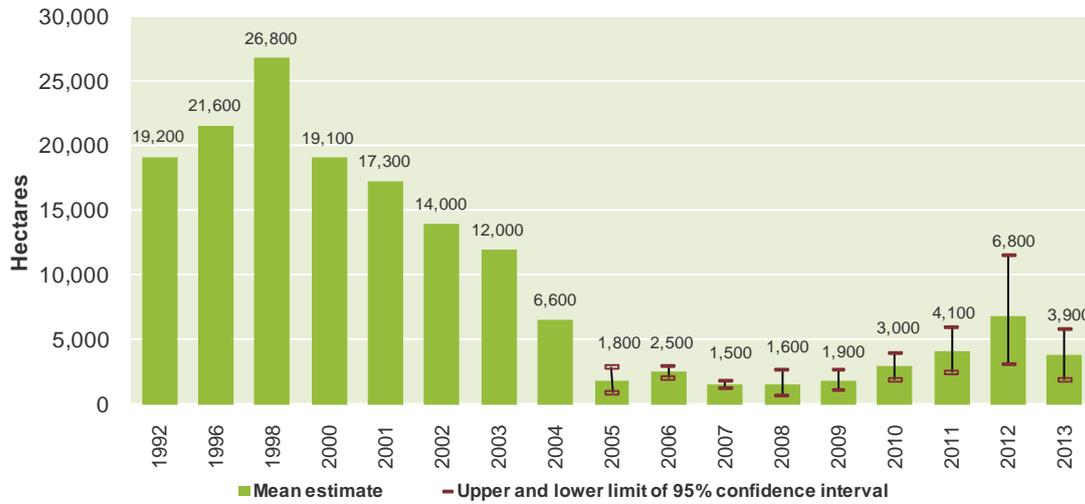
### 2.1 Area under opium poppy cultivation

The 2013 survey confirmed the existence of opium poppy cultivation in three out of six provinces in northern Lao People's Democratic Republic – Phongsali, Xiangkhoang and Houaphan.

The total area under opium cultivation in 2013 was estimated to be 3,900 hectares (between 1,900 hectares and 5,800 hectares, with a 95% confidence interval). This estimate is not comparable with the much higher figures estimated in 2012. The main concern on comparability stems from the fact that in 2013, the helicopter survey took place in late February 2013, about two weeks later than in 2012. It is likely that some poppy fields were no longer identifiable as such because they were already harvested. Indeed, several plots with bare soil were observed from the helicopter which could have been harvested poppy fields. Another difference was that in 2013, most poppy fields observed from the helicopter were later digitized on screen using high to very high resolution satellite imagery, whereas in 2012, this was true only for some poppy areas and the resolution of the imagery used was lower than in 2013. Research on illicit crop surveys in other countries demonstrated that using higher resolution imagery leads to more accurate but often lower area estimates. Both effects together could have led to the low 2013 poppy estimate.

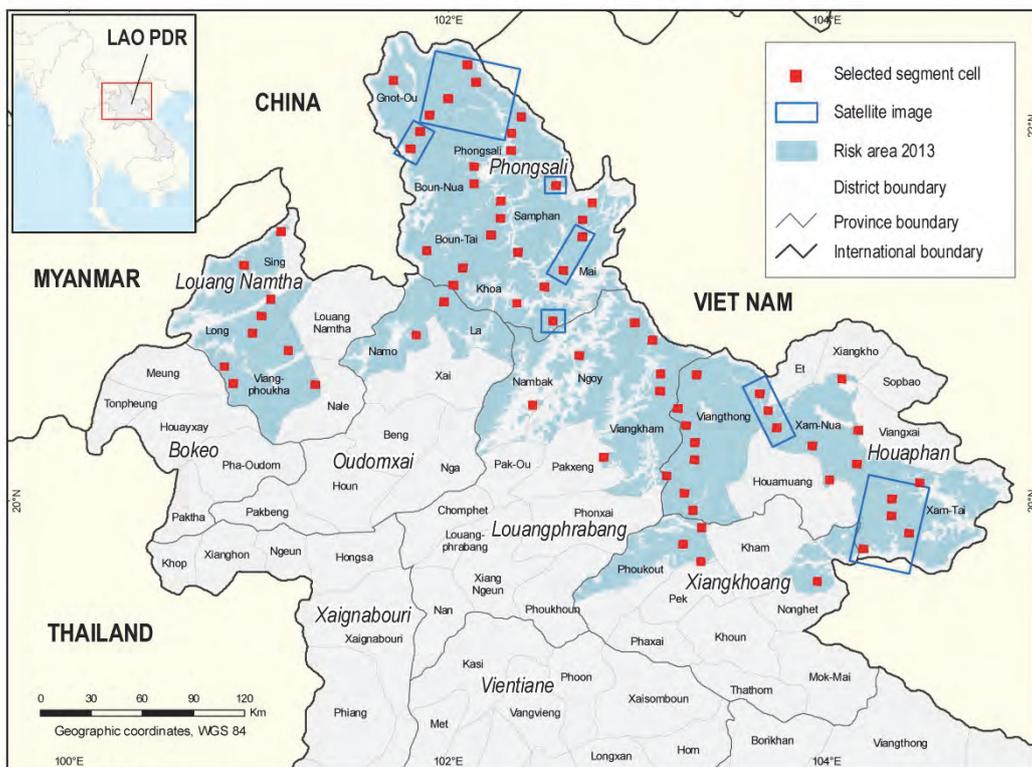
On the other hand, unlike in 2012 when two segments out of 70 could not be surveyed due to adverse weather conditions, all 70 surveys were included in the analysis in 2013 and the eradication of 397 hectares by the Government during or after the survey may have further reduced the area.

**Figure 2: Estimated area under opium poppy cultivation in Lao PDR (Hectares), 1992- 2013**



The estimated area under opium poppy cultivation was calculated based on a risk area that included potential areas for opium poppy cultivation in Phongsali, Louang Namtha, Houaphan, Xiangkhoang, Oudomxai and Louangphrabang. The risk area for the 2013 survey was established in late 2012 taking into account the results of previous surveys as well as information from the Government and UNODC projects on the distribution of poppy cultivation. The results presented here refer only to this risk area and do not include potential poppy cultivation outside its limits.

**Map 1: Sample segments and satellite images, northern Lao PDR, 2013**



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.

In 2013, all selected segments could be visited but due to strong winds at altitude, two segments were not fully flown over. However, these two segments were fully covered with satellite images. Opium poppy fields were found in 25 of the 70 segments, which represents a lower concentration of opium poppy cultivation than in the previous year. In many cases it was impossible to identify the villages to which opium poppy fields belonged, making it difficult to target villages in eradication campaigns. Temporary settlements, which were probably used by labourers during the opium poppy growing season, were observed near poppy-growing fields.

In Oudomxai, Louang Namtha and Louangphrabang provinces, no poppy was found in the segments surveyed. Most poppy was observed in Phongsali, where it was found in over half of the segments. The province with the second highest poppy cultivation density was Houaphan, where cultivation was found in 8 out of 21 segments surveyed.

**Table 1: Segments covered by 2103 survey and number of segments where opium poppy was found, Lao PDR**

Province	Poppy Found		Grand total
	No	Yes	
PHONGSALI	11	16	27
HOUAPHAN	13	8	21
LOUANG NAMTHA	9	0	9
LOUANGPHRABANG	7	0	7
OUDOMXAI	2	0	2
XIANGKHOANG	3	1	4
<b>Grand Total</b>	<b>45</b>	<b>25</b>	<b>70</b>



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



Close-up showing a temporary shelter in a poppy field

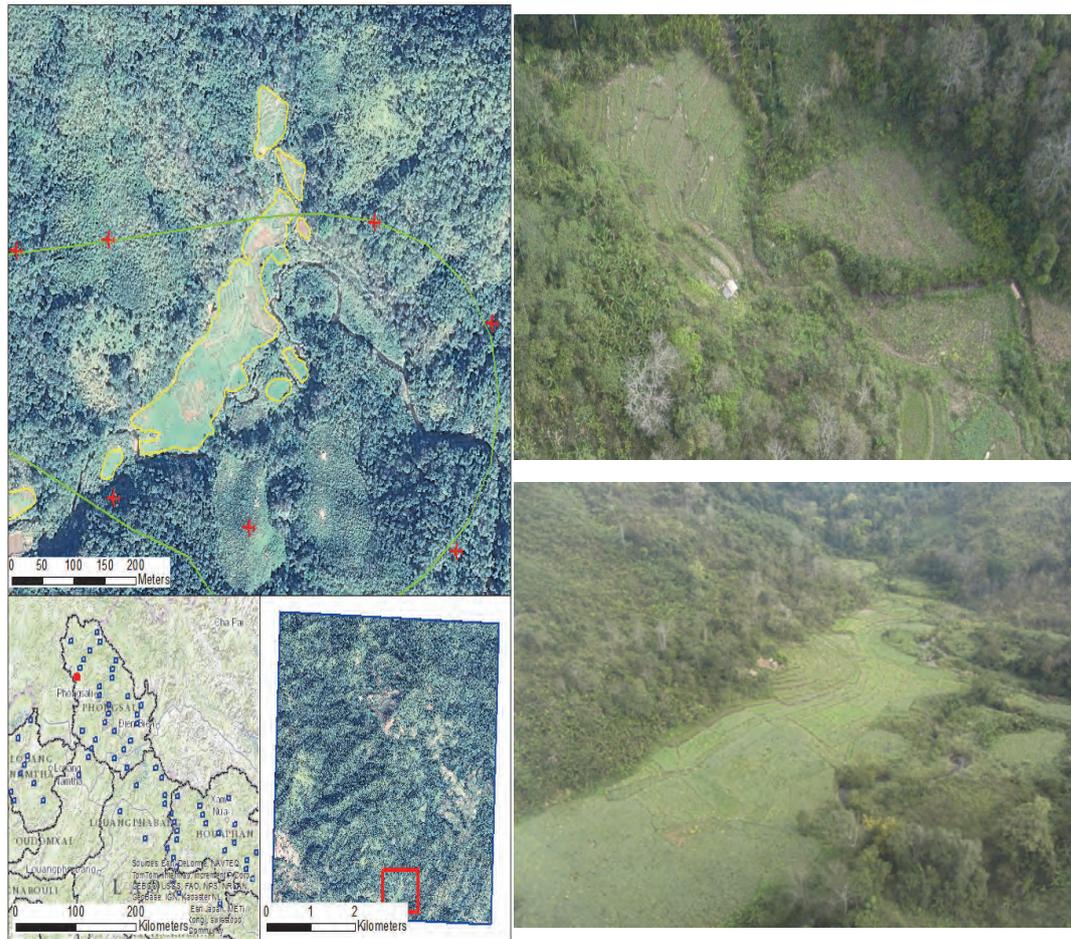
## 2.2 Cultivation practices and crop calendar

As in previous years, multi-staged cropping (planting the same crop at different time intervals in the same field) was also observed in 2013. This method is usually employed to avoid eradication of the entire harvest and also to stagger 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. Some fields reports suggest that opium poppy harvest could begin as early as December, while the typical harvest season is from end-January to mid-March.

**Table 3: Crop calendar for opium poppy cultivation in Lao PDR, 2012-2013**

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

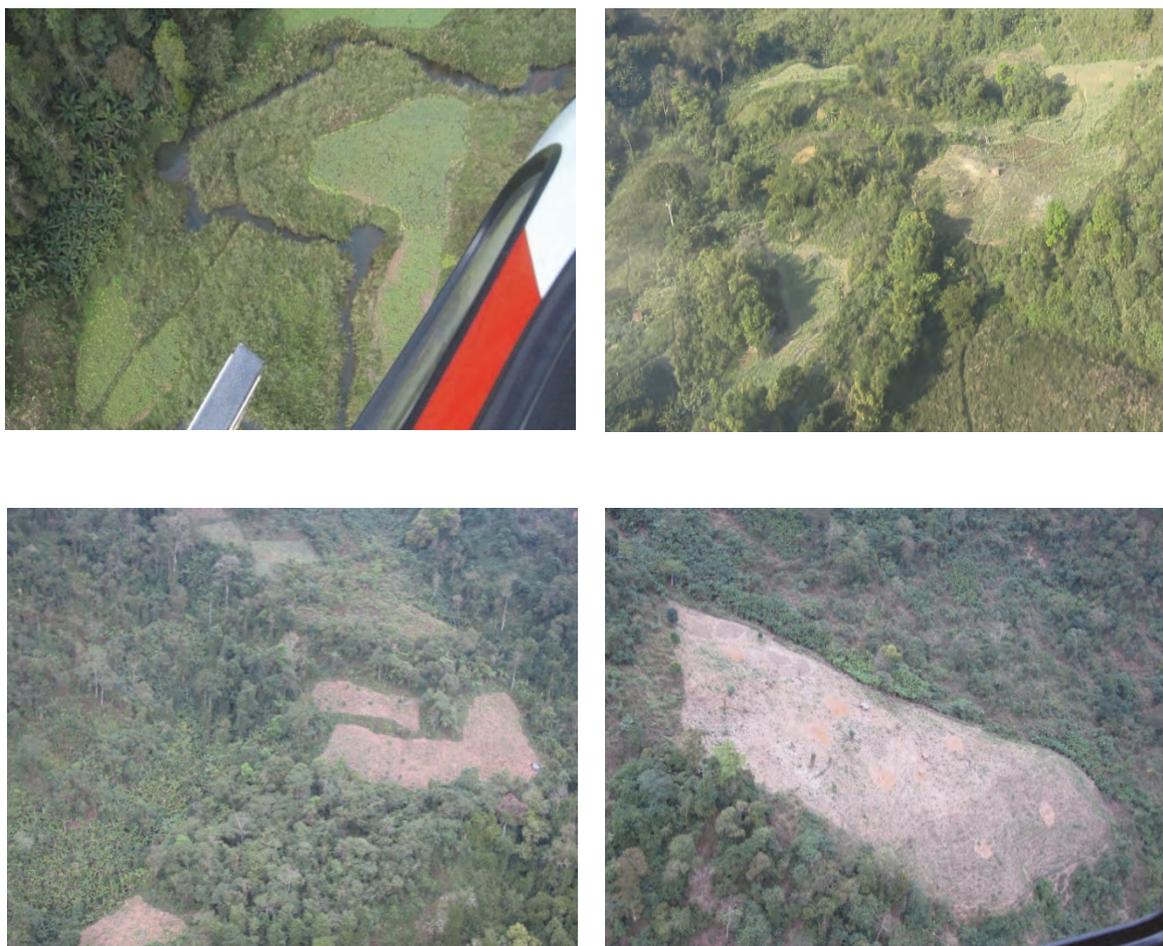
**Figure 3: Examples of opium poppy fields identified during the helicopter survey, Lao PDR, 2013**



## 2.3 Yield and production

As in previous years, no yield survey was conducted in Lao PDR in 2013. 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.

**Figure 4: Examples of poppy fields identified from the helicopter**

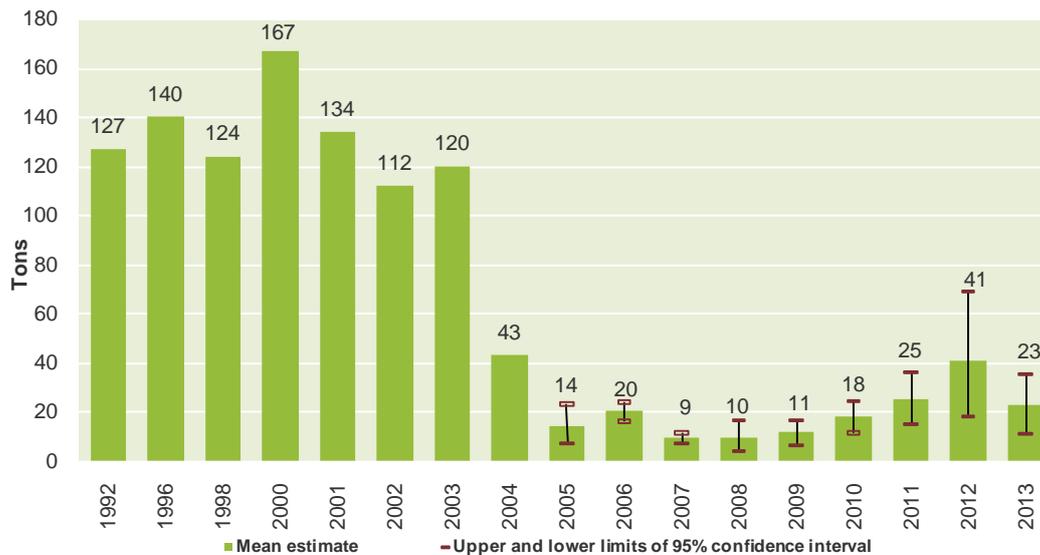


Based on the estimated area under cultivation, the potential production of dry opium for 2013 was 23 tons. The caveats around the cultivation estimate for 2013 explained earlier in this report also hold true for the calculation of potential opium production.

**Table 2: Opium yield, Lao PDR, 1992-2013 (Kilograms per hectare)**

	1992	1996	1998	2000	2001	2002	2003	2004	2005	2006	2007-2013
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 5: Potential opium production, Lao PDR, 1992-2013 (Tons)**

## 2.4 Opium prices

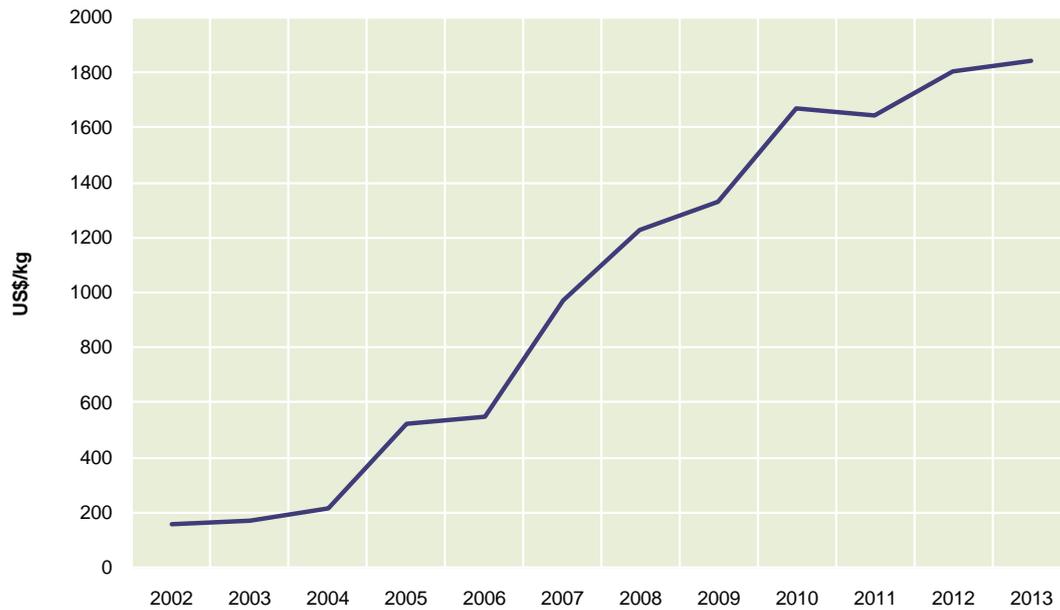
It was not possible to collect opium farm-gate prices due to the difficulty of access to areas where opium is grown. However, local authorities continued to collect opium prices at the provincial level, usually during the harvest or soon after it. As in previous years, in 2013 it was not possible to make a clear distinction between wholesale and retail prices because opium is usually consumed by local opium users who purchase it locally. In 2013, the average opium price reached US\$ 1,840/kg (15,000,000 kip), representing an increase of only 2% on 2012, practically a stable situation.

At US\$ 720 (5,757,000 kip), the lowest price at the regional level in 2013 was, as in previous years, in Bolikhamxai province while, also as in previous years, the highest price was in Xiengkhouang province, at US\$ 3,014 (24,100,000 kip). According to field reports, it is likely that these differences reflect variations in the local availability of opium.<sup>8</sup>

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

<sup>8</sup> Source for all prices reported: LCDC.

**Figure 6: Opium prices, Lao PDR, 2002 to 2013 (United States dollars per kilogram)**

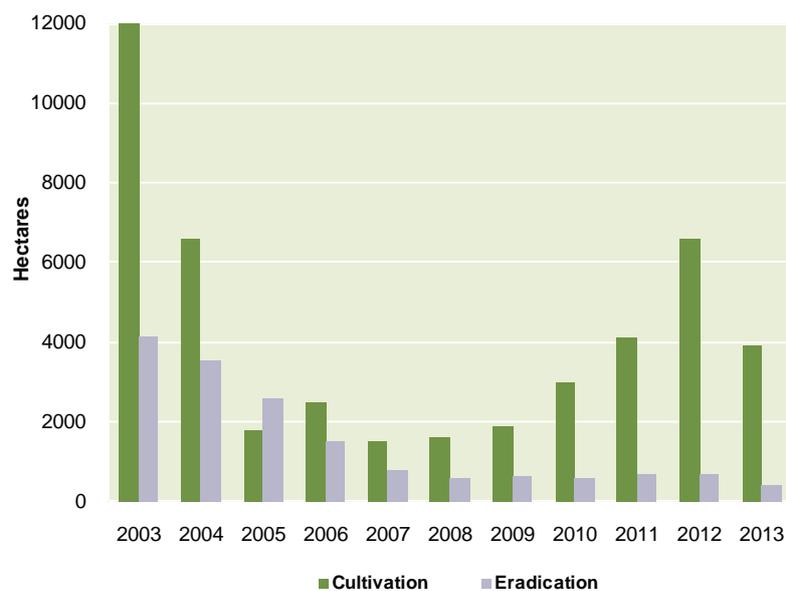


Source: LCDC

## 2.5 Opium poppy eradication

This annual poppy survey is not designed to monitor or validate the results of the eradication campaign carried out by the Government of Lao PDR. According to government reports, the eradication of 397 hectares took place 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 Houaphan (202 hectares) and Phongsali (108 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 7: Opium poppy cultivation and eradication, Lao PDR, 2003 to 2012 (Hectares)**



Source: LCDC

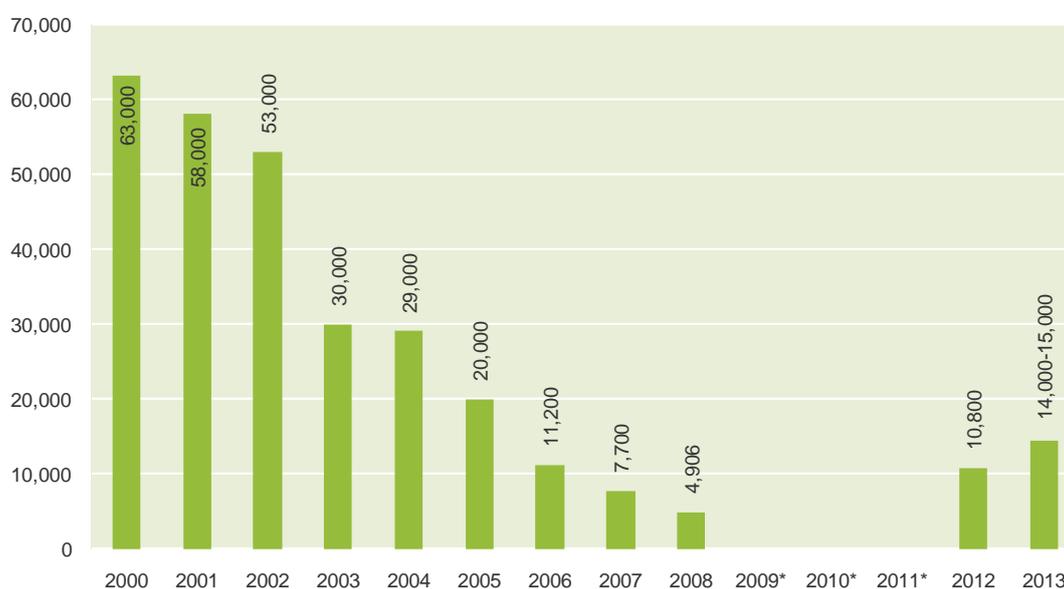
**Table 5: Reported eradication by province, 2013 (Hectares)**

N/O	Province	Eradicated area (hectares)	Percentage
1	Phongsali	108	15%
2	Houaphanh	202	29%
3	Luang Namtha	24	3.4%
4	Luangprabang	32	4.5%
5	Bokeo	4	0.6%
6	Xiengkhouang	10	1.5%
7	Bolikhamxai	14	2.0%
8	Oudomxai	3	0.4%
9	Vientiane	0	0.0%
10	Xayabuli	0.2	0.0%
<b>Total</b>		<b>397</b>	<b>100%</b>

Source: LCDC

## 2.6 Opium users

In 2013, Lao National Commission for Drug Control and Supervision (LCDC) reported the number of regular opium users to be 14,000-15,000 in 10 northern provinces.

**Figure 8: Opium users, Lao PDR, 2000-2013**

Based on 11 provinces in 2002-2004, 8 provinces in 2005, 6 in 2006, 10 in 2007, 2008 and 2012.

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

**Figure 9: Examples of remote opium poppy fields planted in dense forest**



## 3 METHODOLOGY

### 3.1 Introduction

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 PDR, 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 survey team visited selected sites (square segments) by helicopter and checked them for the existence of opium poppy fields. Detected fields were photographed and the coordinates of the viewpoints were recorded by means of a GPS. Archived satellite images over areas with cultivation were later acquired to measure with high precision the acreage of the fields that were identified as poppy fields during the flight.

### 3.2 Sampling frame

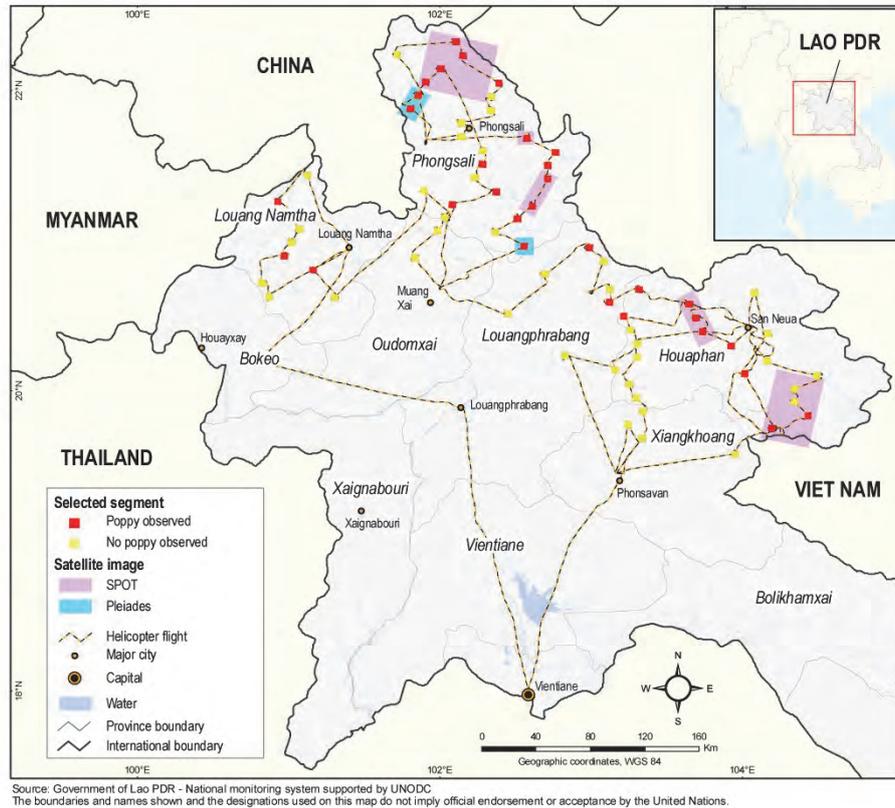
The quality of the data collected from the aerial survey depends to a large extent on the quality of the sampling frame from which the sample is selected. The process to define the sampling frame begins with a selection of provinces and districts where poppy cultivation is thought to occur. This assumption is based on information from local experts and on previous surveys. In 2013, the sampling frame for the area estimation covered six provinces in Northern Lao PDR (Phongsali, Louang Namtha, Oudomxai, Louangphrabang, Houaphan, and Xiengkhoang), as it did in 2012. The frame was established by defining the potential land available for opium poppy cultivation in these provinces and within this area a number of sample plots were selected. The estimate for opium poppy cultivation in the survey is only for the area within the sampling frame, even though there might be some poppy cultivation in other provinces.

In northern Lao PDR, 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 located at altitudes above 700 metres and on slopes with inclines of over 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 size) 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 km<sup>2</sup>. This area was divided into 1,471 grids measuring 5 km by 5 km (25 km<sup>2</sup>).

**Figure 10. Poppy fields photographed by helicopter from 500 feet (160 m) above ground level**



**Map 2: Sample segments surveyed by helicopter in northern Lao PDR, 2013**

### 3.3 Sample size and sample selection

Although a larger sample size means a more accurate estimate, the financial resources available 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 characteristics of the helicopter.

The helicopter used for the survey was a Squirrel, a type of helicopter used mostly for rescue, aero-medical, survey and military roles. The Squirrel has a maximum cruise speed of 220 kph and, powered by a single jet engine, it 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 km<sup>2</sup> of risk area from the sampling frame of 29,596 km<sup>2</sup>, which represents 5.9%, covering a reasonable amount of the sampling frame. The sample of 25km<sup>2</sup> grids was selected using systematic random sampling across the whole frame over northern Lao PDR.

### 3.4 Area estimation procedure

The estimation of the area under opium poppy cultivation was based on the information collected during the helicopter survey. Archived high-resolution satellite images (SPOT5 – pansharpened, 2.5m spatial resolution, SPOT 6 – pansharpened, 1.5m spatial resolution, Pléiades – pansharpened, 1m spatial resolution) were acquired for the segments described above. The acquisition dates selected were close to the dates of the helicopter survey. Opium poppy fields were then identified on the satellite images with the help of the aerial photographs taken from helicopter. The recorded coordinates of the viewpoints and the flight path were used to locate the fields. Each field detected during the helicopter survey was delineated on the satellite imagery with high precision and the acreage measured.<sup>9</sup>

**Table 3: Satellite images used for the 2013 survey**

Segment ID	Province	Sensor	Acquisition date
3	Houaphan	SPOT 5	16/12/2012
3	Houaphan	SPOT 6	20/01/2013
4	Phongsali	SPOT 6	08/02/2013
6	Phongsali	SPOT 6	08/02/2013
7	Phongsali	SPOT 6	06/02/2013
8	Phongsali	SPOT 5	20/02/2013
8	Phongsali	SPOT 6	06/02/2013
10	Phongsali	Pléiades	06/02/2013
10	Phongsali	SPOT 5	20/02/2013
10	Phongsali	SPOT 6	06/02/2013
12	Phongsali	Pléiades	06/02/2013
12	Phongsali	SPOT 5	20/02/2013
12	Phongsali	SPOT 6	06/02/2013
14	Phongsali	SPOT 5	20/02/2013
23	Phongsali	SPOT 6	08/02/2013
28	Phongsai	SPOT 6	08/02/2013
35	Phongsali	Pléiades	28/02/2013
51	Houaphan	SPOT 6	27/02/2013
53	Houaphan	SPOT 6	27/02/2013
65	Houaphan	SPOT 6	20/01/2013
68	Houaphan	SPOT 5	16/12/2012

<sup>9</sup> This process was conducted by remote sensing experts of the Institute of Surveying, Remote Sensing and Land Information, Department of Landscape, Spatial and Infrastructure Sciences, University of Natural Resources and Life Sciences, Vienna.

Figure 11. Delineation of opium poppy fields on a satellite image (Pléiades) with the help of aerial photographs

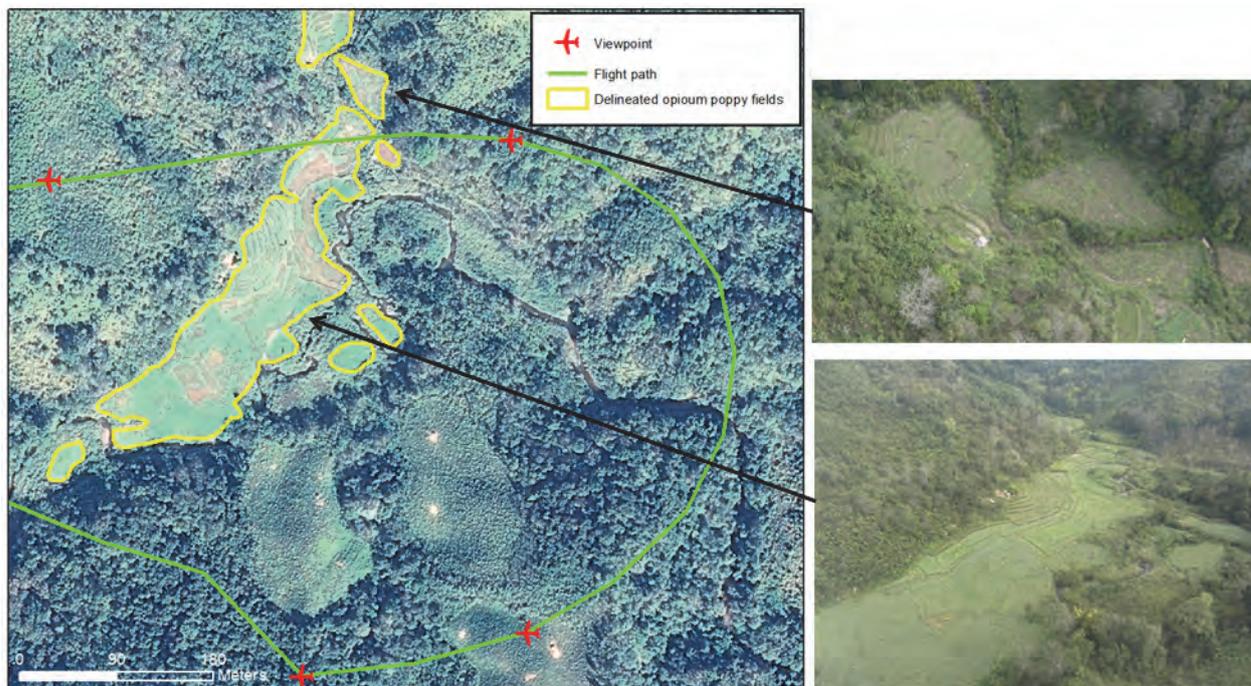
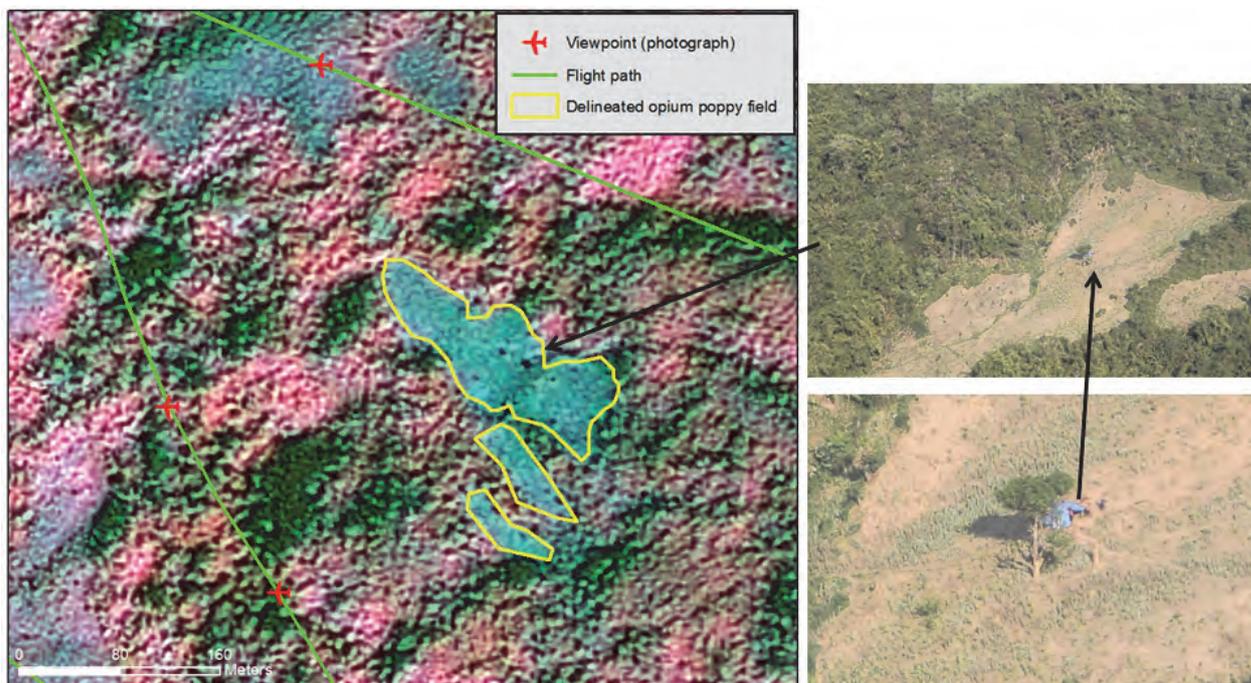


Figure 12. Delineation of opium poppy fields on a false colour satellite image (SPOT 6) with the help of aerial photographs



Ratio estimation formulae were used to estimate the extent of opium poppy cultivation using the equations described below. Two of the 70 segments were only partially surveyed due to poor weather conditions, but were covered by satellite imagery.

Average proportion of opium poppy cultivation over the risk area:

$$\bar{y} = \frac{1}{n} \sum_{i=1}^{70} P_i / R_i$$

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  $i$ .

- a. Estimate of area of opium cultivation in Lao PDR.

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

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.

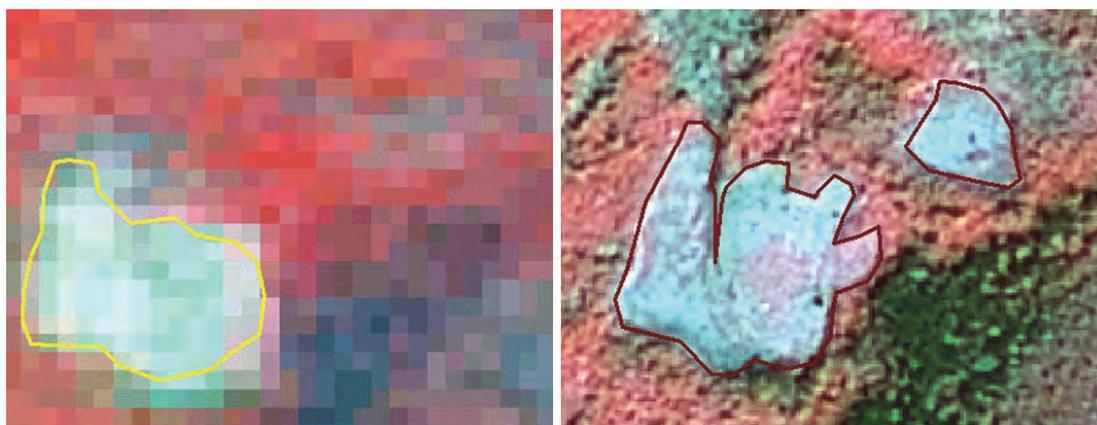
### 3.5 Comparability with previous surveys

The general approach used for the 2013 survey was similar to that used in previous years. In particular the poppy surveys in 2012 and 2013 followed the same method and identical sampling segments were selected. It is not possible, however, to determine if significant change has occurred. This stems from the differences in the resolution of satellite images, timing of the helicopter survey and availability of field information, which seemed to have a great influence on the final result. This makes a year on year comparison unreliable, even though the result of each year taken separately represents a valid picture of the situation in that year.

One important difference was the availability of very high resolution imagery in 2013 as compared to the lower resolution available in 2012. In 2013, the identification of the spatial and spectral characteristics of the fields in the high resolution satellite images permitted to delineate with greater precision the boundaries of poppy fields identified initially during the aerial survey. This improvement in spatial resolution helped to reduce the so-called geometric error. In previous years, the poppy area in the surveyed segments was primarily based on estimates from the helicopter and the use of oblique aerial photographs in combination with ground measurements.

The higher precision of the satellite imagery used in 2013 led in some cases to poppy fields having a smaller area than in 2012 even if the field in reality did not change, simply because non-poppy vegetation elements could be excluded more precisely. On the other hand, the higher resolution in 2013 allowed to include also very small fields, which the coarser 2012 imagery would not capture.

**Figure 13. Differences in delineation of opium poppy fields on a false colour satellite image (SPOT 5) in 2012 and on high resolution image (SPOT 6) in 2013.**



Another difference was that, for technical reasons beyond the control of the survey team, the helicopter survey took place in late February 2013, about two weeks later than in 2012. It cannot be excluded that, due to the late timing of the survey, some fields were no longer identifiable as poppy fields as they may have already been harvested. On the other hand, unlike in 2012 when two segments out of 70 could not be surveyed due to adverse weather conditions, all 70 surveys were included in the analysis in 2013. With the help of satellite imagery it was even possible to interpret two segments that could only be partially flown over by the helicopter.



## **PART 3. MYANMAR**



# CONTENTS

<b>FACT SHEET — MYANMAR OPIUM SURVEY 2013.....</b>	<b>43</b>
<b>1 INTRODUCTION.....</b>	<b>45</b>
<b>2 FINDINGS .....</b>	<b>47</b>
2.1 OPIUM POPPY CULTIVATION.....	47
2.2 YIELD AND POTENTIAL OPIUM PRODUCTION .....	57
2.3 OPIUM PRICES .....	61
2.4 AFFLUENCE INDICATORS IN OPIUM-GROWING RISK AREAS .....	65
2.5 HOUSEHOLD CASH INCOME IN OPIUM-GROWING RISK AREAS.....	69
2.6 FOOD SECURITY AND RICE DEFICIT .....	72
2.7 OPIUM AND OTHER DRUG USE IN OPIUM-GROWING RISK AREAS.....	75
2.8 REPORTED ERADICATION.....	76
<b>3 METHODOLOGY.....</b>	<b>78</b>
3.1 INTRODUCTION.....	78
3.2 SAMPLING PROCEDURE FOR VILLAGE SURVEY AND SURVEY AREA.....	78
3.3 SURVEY ORGANIZATION .....	79
3.4 FIELD OPERATIONS.....	80
3.5 AREA ESTIMATION PROCEDURES.....	81
OPIUM YIELD AND PRODUCTION.....	90
ESTIMATING THE NUMBER OF HOUSEHOLDS INVOLVED IN POPPY CULTIVATION OR GROWING POPPY .....	91

## ABBREVIATIONS

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

## ACKNOWLEDGEMENTS

The following organizations and individuals contributed to the implementation of the 2013 Opium Survey in Myanmar and the preparation of the present report:

### CCDAC

Pol. Col. Myint Thein	Joint Secretary and Head of Department, Office of CCDAC
Pol. Col. Myint Aung	Director, International Relations, Office of CCDAC
Pol. Lt. Col. Tin Aung	Deputy Director (Law and Research), Office of CCDAC

### Forest Department

Dr. Nyi Nyi Gyaw	Director General, Forest Department
U Aung Aung Myint	Assistant Director, Remote Sensing and GIS Section, Forest Department

The implementation of the survey would not have been possible without the support from the local administrations and the dedicated work of 138 surveyors.

### UNODC Myanmar

Jason Eligh	Country Manager
San Lwin Htwe	GIS Specialist and Survey Coordinator
Sai Aung Kyaw Win	Assistant Survey Coordinator
Zaw Win	Assistant GIS Analyst

### UNODC Headquarters

Angela Me	Chief, Research and Analysis Branch (RAB)
Coen Bussink	Programme Officer (Remote Sensing and GIS), SASS
Antoine Vella	Statistician, SASS
Yuliya Lyamzina	Consultant, SASS
Philip Davis	Statistician, SASS
Irmgard Zeiler	Research Expert, SASS
Martin Raithelhuber	Programme Officer, SASS
Suzanne Kunnen	Public Information Assistant, RAB
Jonathan Gibbons	Consultant (editing)
Umidjon Rahmonberdiev	Statistical Assistant (database development), SASS

The implementation of the Myanmar opium survey was made possible thanks to the financial support of the Governments of Japan, the United States of America and the United Nations World Food Programme.

## FACT SHEET — MYANMAR OPIUM SURVEY 2013<sup>1</sup>

	Year 2012	Year 2013	Change from 2012
Total opium poppy cultivation (hectares)	51,000 (38,200 to 64,400)	57,800 (45,700 to 69,900)	13%
Opium poppy cultivation in Shan State (hectares)	46,000 (34,800 to 58,700)	53,300 (41,200 to 65,300)	16%
Average opium yield (kg/ha)	13.5	15	11%
Total potential production of dry opium (tons)	690 (520 to 870)	870 (520 to 870)	26%
Total opium poppy eradication (hectares) <sup>2</sup>	23,718	12,288	-48%
Average farm-gate price of fresh opium <sup>3</sup>	US\$ 520/kg	US\$ 498/kg	-4%
Total potential wholesale value of opium production <sup>4</sup>	US\$ 420 million (320 to 530)	US\$ 540 million (390 to 680)	29%
Estimated number of households involved in poppy cultivation <sup>5</sup>	196 thousand (147 to 248)	192 thousand (152 to 192)	No major change
Estimated number of households growing poppy <sup>6</sup>	N/A	130 thousand	N/A
Average reported household income in the preceding year in Shan State:			
Household income in non-poppy-growing villages	US\$ 1,610	US\$ 2,250	N/A <sup>7</sup>
Household income in poppy-growing villages	US\$ 1,830	US\$ 2,340	N/A
Household income from opium sales	US\$ 840	US\$ 920	N/A
Reported drug use in the survey area (last month prevalence of population aged 15 and over):			
Opium	0.68%	0.90%	
Heroin	0.17%	0.27%	
Amphetamine-type stimulants (yaba)	0.31%	0.61%	

<sup>1</sup> Numbers in brackets indicate upper and lower bounds of the best estimate.

<sup>2</sup> Source: CCDAC.

<sup>3</sup> At harvest time. Weighted by area under cultivation. Based on data in Shan State only.

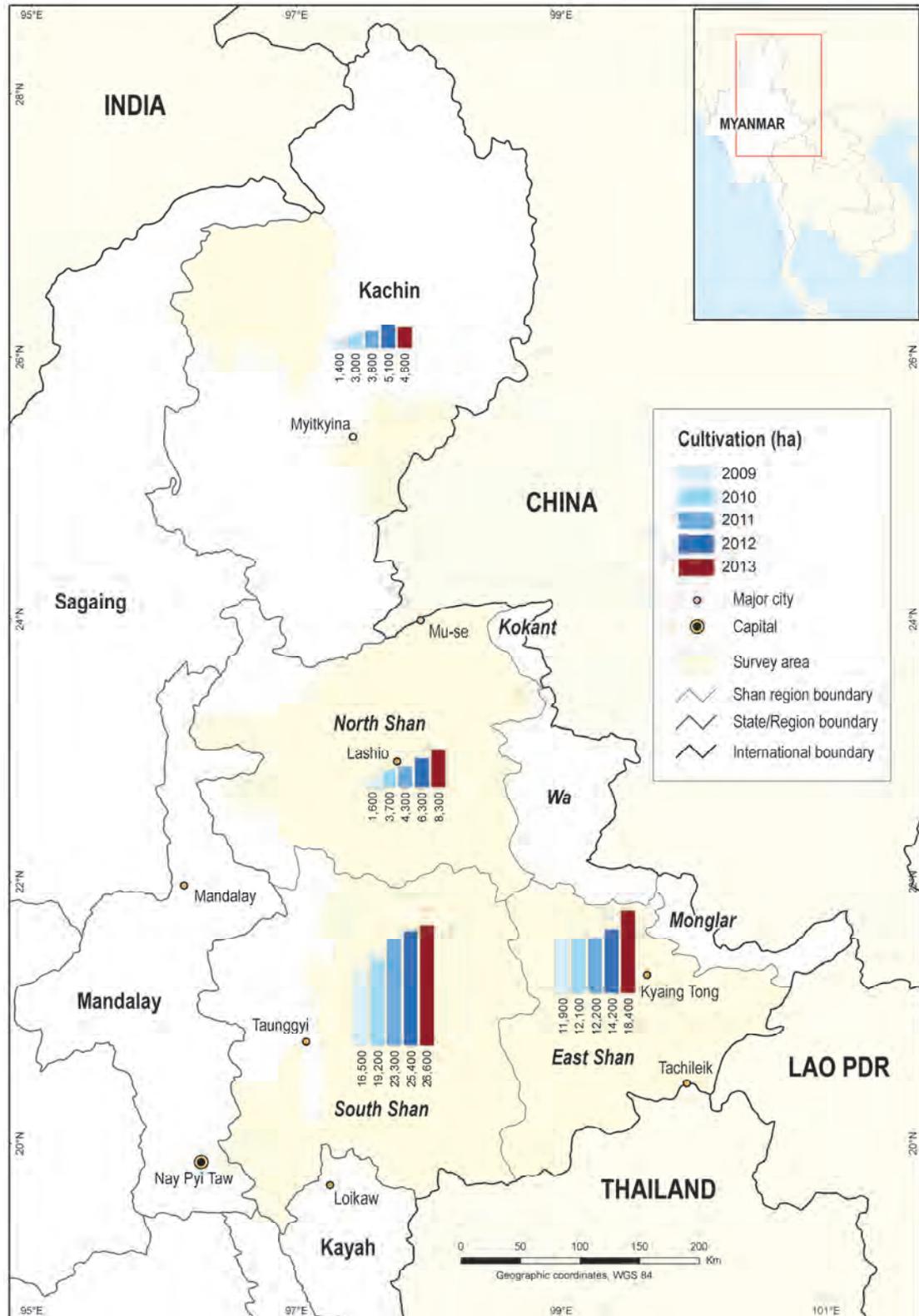
<sup>4</sup> The product of dry opium production and dry opium prices collected during the harvest season.

<sup>5</sup> The estimate for 2013 takes into account the fact that a very small proportion of cultivation was not run by individual households (communal poppy fields) while the data for 2012 did not allow for the corresponding adjustment to be made. This limits the comparability between these two years. In view of this and despite the small numerical difference, no major change was observed. For more details on definitions and estimations, see the Methodology chapter of this report.

<sup>6</sup> This figures was estimated for the first time in 2013. It includes all households which run their own poppy fields but excludes households which obtain income from poppy-related wage labour on other people's fields without having their own poppy fields. For more details on definitions and estimations, see the Methodology chapter of this report.

<sup>7</sup> Due to an improved methodology used to derive the income estimates, the income estimates in the table are not comparable year-on-year.

Map 1: Opium poppy cultivation status in Myanmar, 2013



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 eleventh 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 53<sup>rd</sup> 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 poppy-growing areas of 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 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. 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.

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.



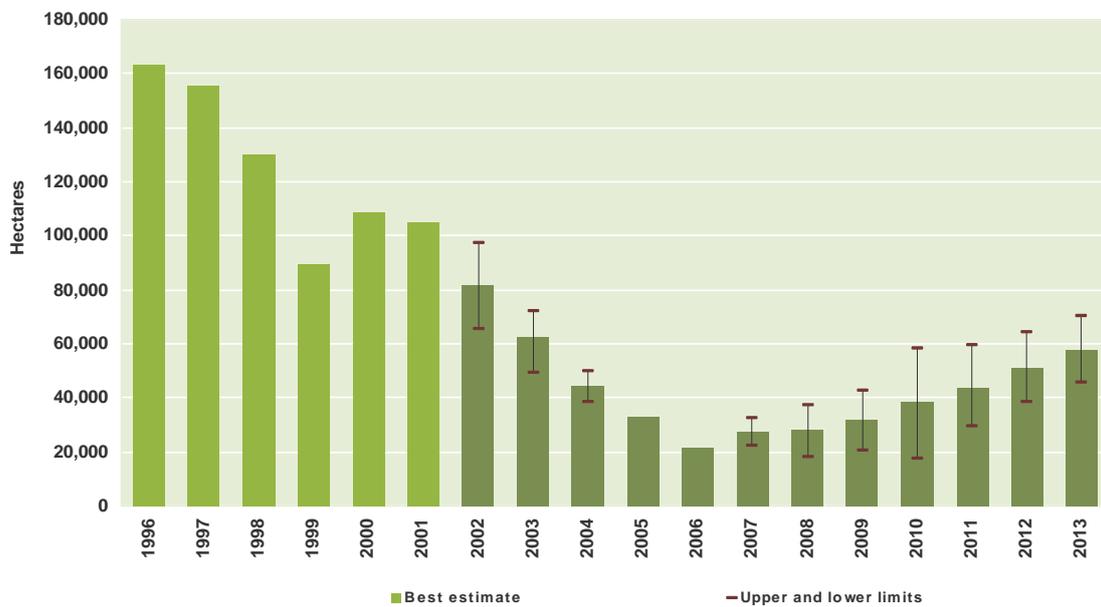
## 2 FINDINGS

### 2.1 Opium poppy cultivation

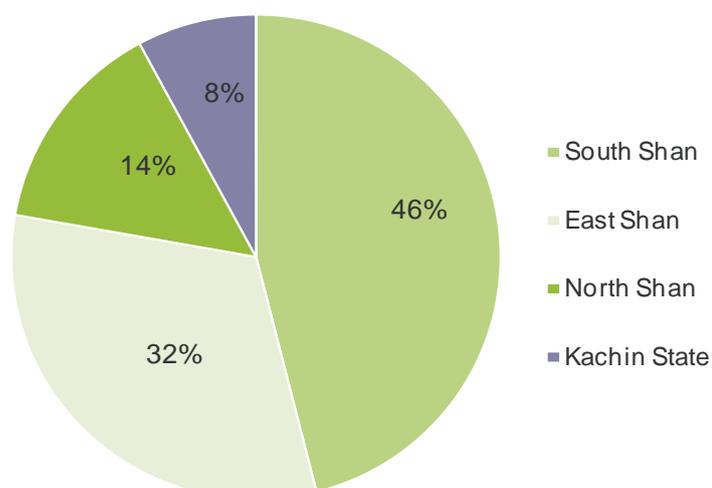
In 2013, satellite imagery was obtained for East, North, South Shan and Kachin. Village interviews were conducted in East, North, South Shan, Kayah and Chin States, though no poppy-growing villages were found by the village survey in the latter.

In Kayah, the village survey covered an area close to the border with South Shan. Some poppy-growing villages were found but Kayah did not contribute to the Myanmar 2013 cultivation estimate as no satellite imagery was acquired for that area. With a total area of 57,800 hectares, the Myanmar 2013 cultivation estimate represented an increase of 13% on the 2012 cultivation level and continued the increasing trend which began after 2006. The 2013 cultivation level was 2.7 times that of 2006, the lowest amount since the start of the monitoring system.

**Figure 1: Opium poppy cultivation in Myanmar, 1996-2013 (Hectares)**



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

**Figure 2: Area distribution of opium poppy cultivation in Myanmar, 2013**

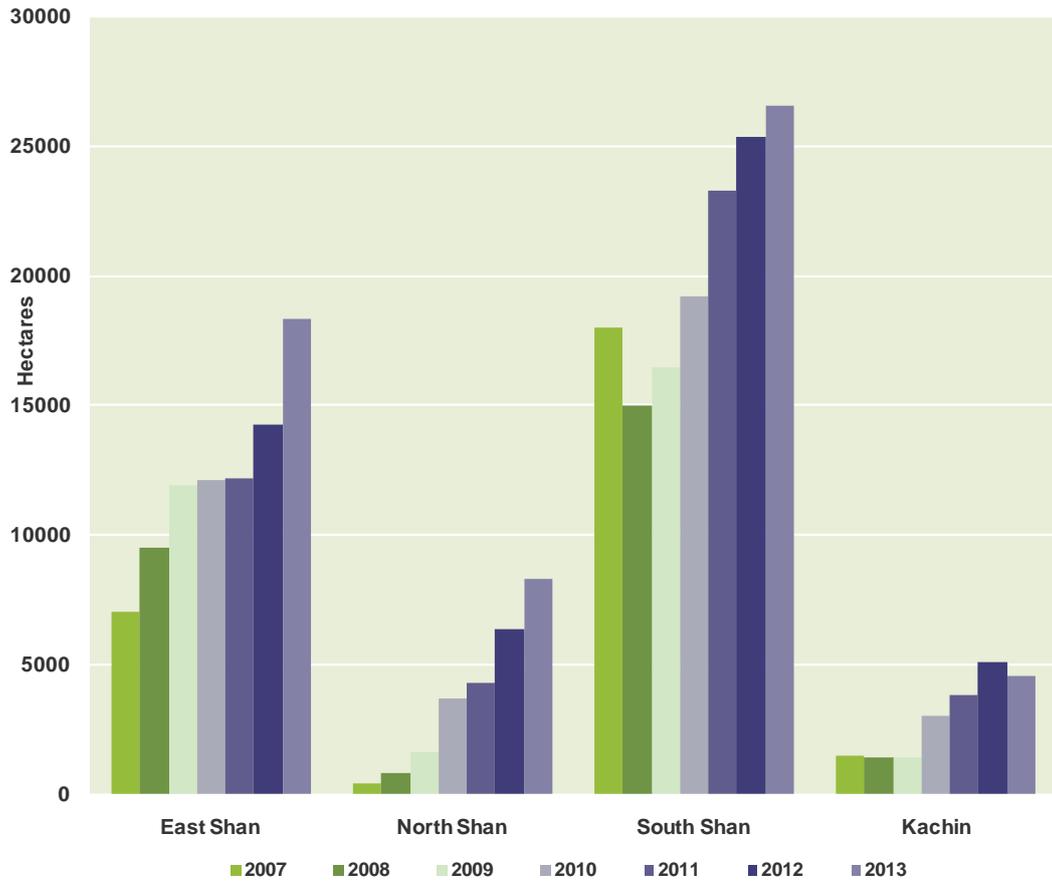
This increase in opium poppy cultivation in 2013 was mainly due to an increase throughout Shan State, most notably (in absolute terms) in East Shan, which registered an increase of approximately 4,200 hectares, and (in relative terms) in North Shan, where cultivation rose by almost a third. Accounting for 46% of the country's total opium poppy cultivation, South Shan remained the region with the largest area under cultivation and while the 2013 estimate for South Shan was only slightly higher than its 2012 estimate.

**Table 1: Opium poppy cultivation areas, by region, Myanmar, 2012-2013<sup>8</sup>**

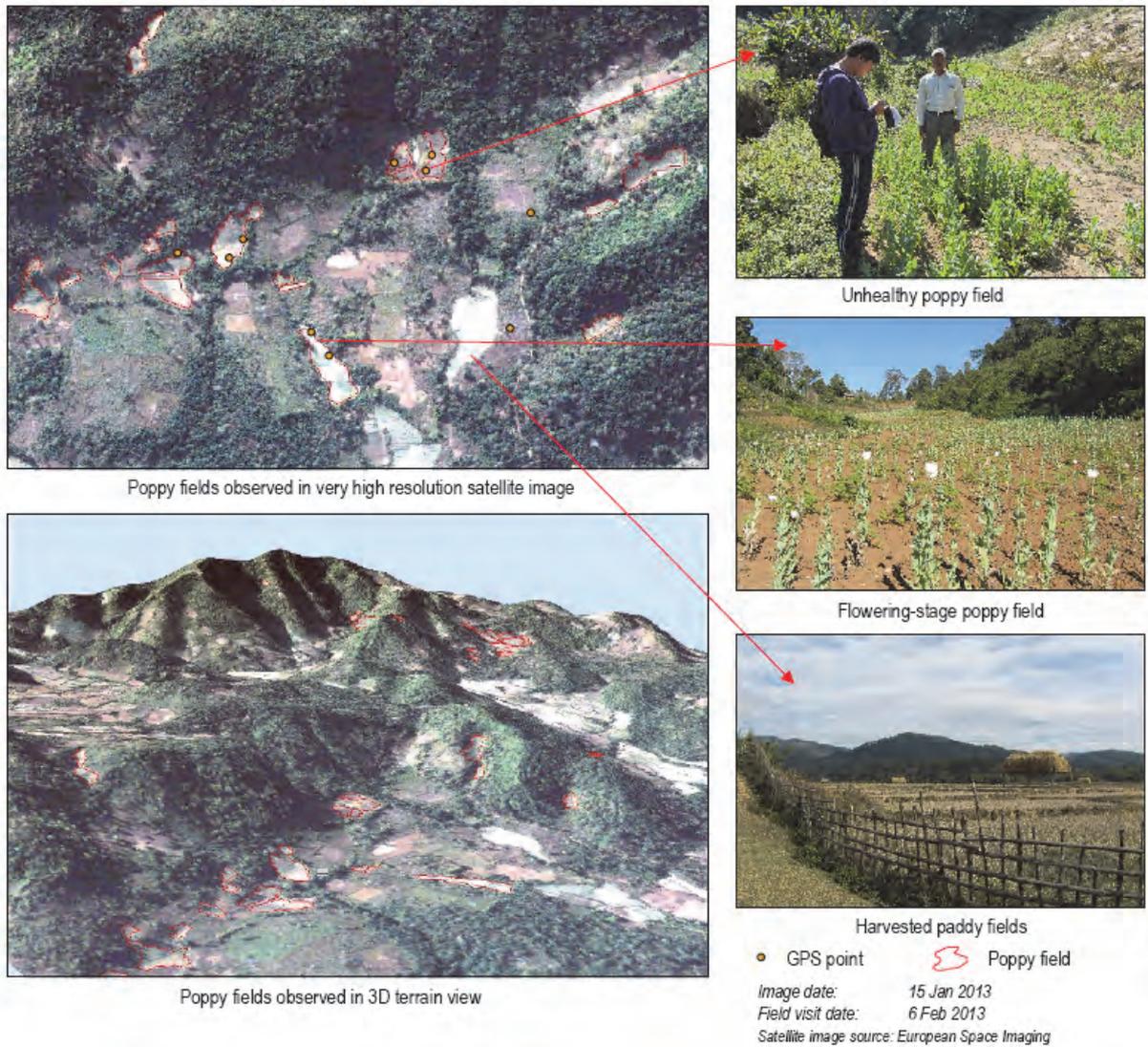
	2012	2013	Change 2012-2013	Percentage of total opium poppy cultivation area
East Shan	14,200 (8,400 to 20,600)	18,400 (9,700 to 27,000)	29%	32%
North Shan	6,300 (3,300 to 9,400)	8,300 (4,600 to 12,000)	31%	14%
South Shan	25,400 (15,700 to 35,900)	26,600 (19,100 to 34,100)	5%	46%
<b>Shan State total</b>	<b>46,000</b> (34,800 to 58,700)	<b>53,300</b> (41,200 to 65,300)	16%	92%
Kachin	5,100 (1,900 to 10,000)	4,600 (3,000 to 6,100)	-10%	7.9%
<b>National total (rounded)</b>	<b>51,000</b> (38,200 to 64,400)	<b>57,800</b> (45,700 to 69,900)	13%	100%

<sup>8</sup> Numbers in brackets indicate upper and lower limits of the best estimate.

Figure 3: Opium poppy cultivation by region, Myanmar, 2007-2013 (Hectares)



**Figure 4: Poppy identification in a very high-resolution satellite image and corresponding photographs from indicated fields, Myanmar, 2013**



## Villages and farmers involved in opium poppy cultivation

Apart from monitoring opium poppy cultivation and production via satellite imagery and field measurements, the opium poppy survey also gathers data from the sampled villages, via interviews with farmers, on the extent of poppy cultivation in individual villages, as well as the number of households involved in poppy cultivation. Previous surveys never attempted to investigate exactly how those households are involved in the cultivation process, but the relevant questions were refined slightly in the 2013 survey in order to obtain a more detailed picture of the organization of opium poppy cultivation and participation by households.

In principal, household can get involved in poppy cultivation by:

- Growing poppy on their own fields
- Earning income from labour in poppy fields run by others (wage labour).

Households could choose to do either one or the other activity or combine both types of involvement. The 2013 survey results show that most households (53%) run their own poppy fields and do not earn income by labouring in poppy fields run by others. However, 16% of households that run their own fields also labour for other poppy growers. Furthermore, a significant proportion of households (31%) only provide labour in poppy fields run by other households, without cultivating their own poppy. This suggests that it may be worthwhile tailoring alternative development initiatives to cater specifically for this segment.

**Figure 5: Breakdown of households involved in poppy cultivation in Myanmar, 2013**

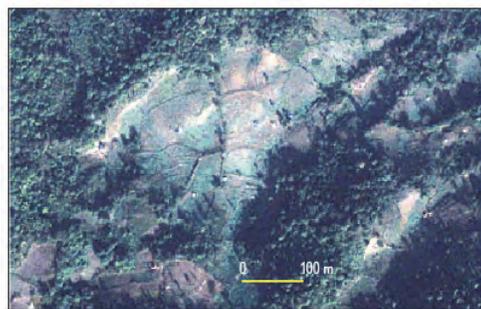


**Table 2: Breakdown of households involved in poppy cultivation, by role, East, North and South Shan States and Kayah, Myanmar, 2013**

Percentage in the region	East Shan	North Shan	South Shan	Shan State average, weighted by cultivation	Kayah	Overall
Households growing their own poppy, but not earning income from labour in poppy fields run by others	72%	42%	54%	58%	53%	53%
Households earning income from labour in poppy fields run by others, but not growing their own poppy	11%	41%	31%	26%	46%	31%
Households growing their own poppy and earning income from labour in poppy fields run by others	17%	17%	15%	16%	1%	16%
Total: All households involved	100%	100%	100%	100%	100%	100%

In addition to cultivation by individual households, in some villages the cultivation of communal poppy fields may also be organized at the village level so as to cover common costs such as those related to the village infrastructure. The 2013 opium survey findings suggest that this phenomenon was quite limited but it appeared to be most common in East Shan, where available responses suggest that only 4% of total opium poppy cultivation in 2013 was not undertaken by individual households but collectively at the village level. The corresponding percentage in the other regions was 1% or lower. However, since this was the first time the question was asked in the opium survey, these results should be interpreted with caution.

**Figure 6: Example of communal poppy fields observed in satellite images, North and South Shan States, Myanmar, 2013**

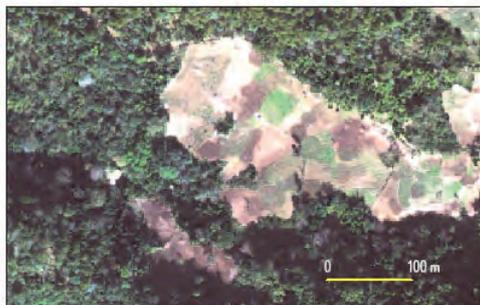


First image - 25 Jan 2013

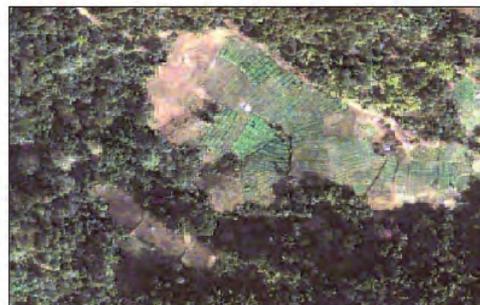


Second image - 9 Mar 2013

Communal poppy field observed in satellite image, North Shan



First image - 10 Jan 2013



First image - 9 Feb 2013

Communal poppy field observed in satellite image, South Shan

Satellite image source: European Space Imaging

Based on data from the 2012 opium poppy survey, an average area of 0.26 hectares per household involved in opium poppy cultivation was estimated, whereas the data collected in the 2013 survey estimated an average area of 0.30 hectares. It is important to note that this includes households that cultivate their own poppy as well as households that only earn income by labouring in the poppy fields of others.<sup>9</sup> Another way of expressing the same estimate is that, on average, it takes the participation of 3.3 households to cultivate one hectare of opium poppy and, with total poppy cultivation in Myanmar estimated at 57,800 hectares in 2013, this translates into approximately 190,000 households involved in poppy cultivation, either by growing poppy themselves or working as labourers in other households' poppy fields. The corresponding calculation for households that actually grow their own poppy yields an estimate of 130,000 households with 0.43 hectares of poppy cultivated per household.<sup>10</sup>

Previous surveys in 2002 and 2003 indicated that a poppy-growing household in Myanmar cultivated an average area of 0.17 hectares of opium poppy.<sup>11</sup> This estimate was reached by an

<sup>9</sup> The calculation assumes that, both in the case of households growing their own poppy and households earning from labour in poppy fields run by others, cultivation was occurring within the given village.

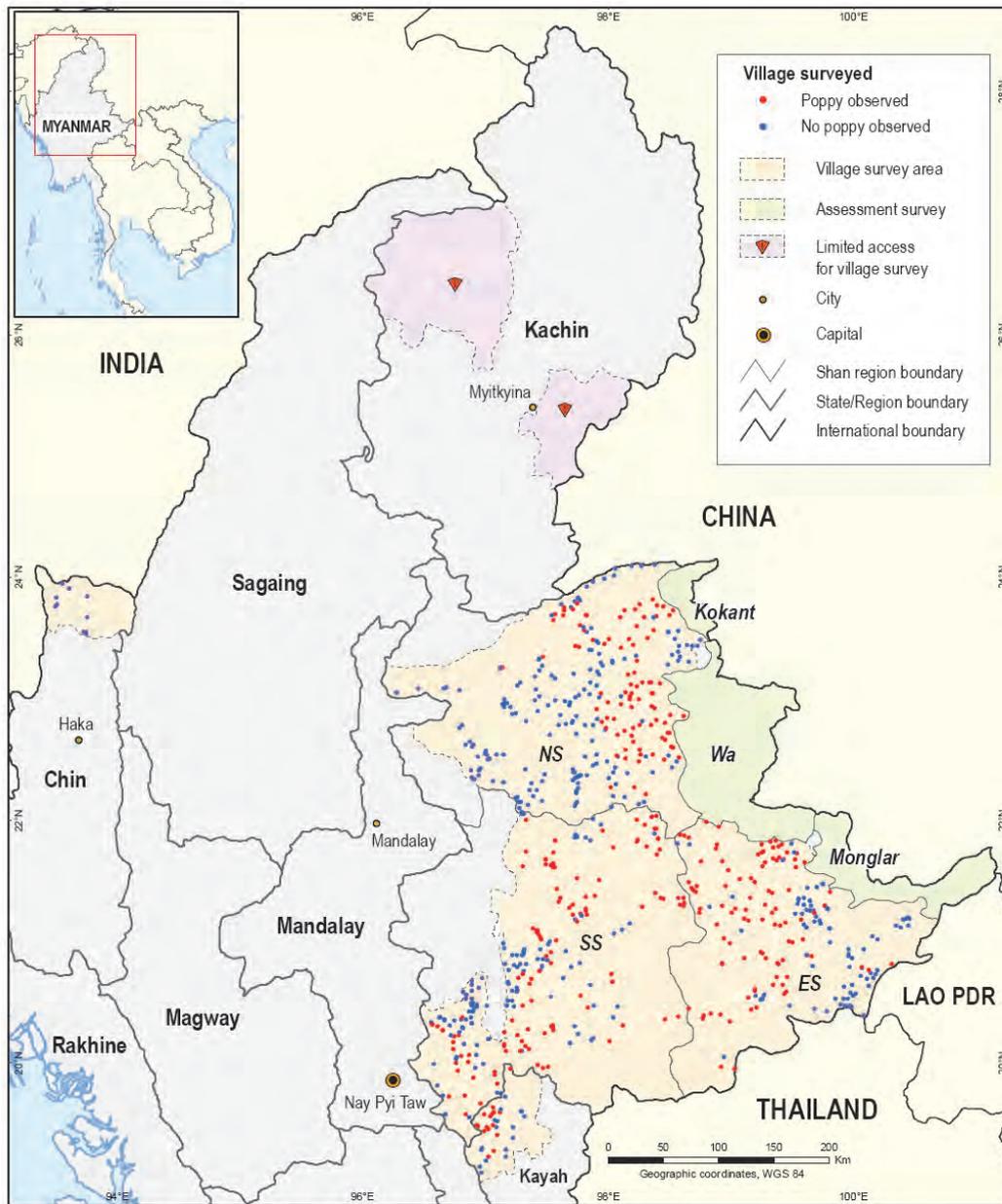
<sup>10</sup> For more details on definitions of household involvement see the Methodology chapter of this report.

<sup>11</sup> 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.

entirely different method and thus may not be directly compatible with the much higher 2012 and 2013 estimates. Nevertheless, it is not implausible that the average area cultivated per household has increased in recent years, especially given the recent sustained increasing trend in the total area under cultivation.

The village survey obtained responses to the questionnaires from 758 villages, among which 342 replied “yes” when asked if poppy was grown in the village and 308 answered “no”. For the remaining 108 villages, no information was available about the reply to this question.

**Map 2: Surveyed villages and their opium poppy cultivating status, Myanmar, 2013**





**Sugarcane fields in Kongyan township, Kokant region**



**Dry-stage monsoon poppy field, Pekon township, South Shan**



**Unhealthy rain-fed poppy field suffering from lack of water, Theinne township, North Shan**



**Healthy poppy field**

Figure 7: Opium poppy cultivation calendar in Shan State, Myanmar, 2012-2013

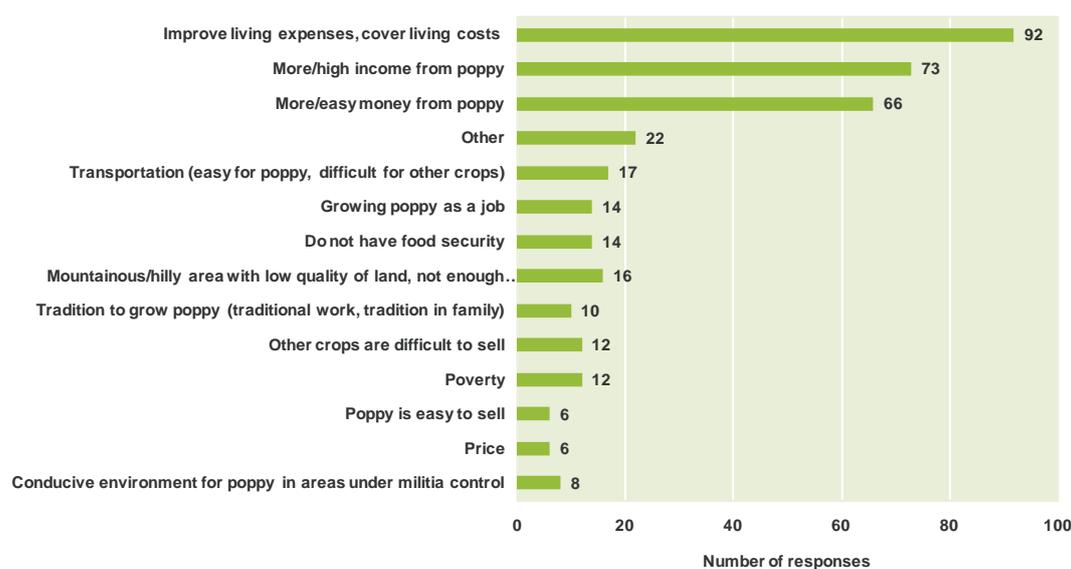
		Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	
<b>East Shan</b>	<b>All Townships</b>													
	Round 1													Early crop
	Round 1													Normal cultivation
	Round 2													
Round 3														
<b>North Shan</b>	<b>Lashio, Mong yai, and Tangyang Townships</b>													
	Round 1													Normal cultivation
	Round 2													
	Round 3													
	Round 1													Late crop
	Round 2													
	<b>Theinne, Nam kham, Kutkai, and Manton Townships</b>													
	Round 1													Normal cultivation
	Round 2													
Round 3														
<b>South Shan</b>	<b>Pinlaung, Pekon, Nyaungshwe, Mawkmai, and Hsi hseng Townships</b>													
	Round 1													Early crop on hillside
	Round 2													
	Round 3													
	Round 1													Normal cultivation
	Round 2													
	Round 3													
	Round 1													Late crop
	Round 2													
	Round 3													
	<b>Hopong, Loilem, Nam sang, and Monae Townships</b>													
	Round 1													Early crop
	Round 1													Normal cultivation
	Round 2													
	Round 3													
Round 1													Late crop	
Round 2														
<b>Lai hka, Mong kung, Kye thi, Mong shu, Kun heing, and Mong pan Townships</b>														
Round 1													Normal cultivation	
Round 2														
Round 3														
<b>Eradication Level</b>														
<b>Survey (field operation) period</b>														

### Reasons for cultivating opium poppy

With 63% of poppy-growing villages in Myanmar reporting that they cultivated opium in order to make more (or easy) money (18%), to improve their income (20%) and to solve the difficulty of their household’s living expenses, it is clear that opium was still very much a cash crop in 2013.

However, when looking at the reasons for cultivating opium poppy in the country’s different regions the situation is a little more nuanced. For example in North Shan, where there was an armed conflict between the Government and the KIA, the reasons for cultivating opium poppy reported reflected poverty, food security, the difficulty of selling other crops and the need for easy money. Moreover, 2% of villages in North Shan reported a conducive environment for growing poppy in areas under militia control.

**Figure 8: Reasons for cultivating opium poppy as reported by farmers in poppy-growing villages, Myanmar, 2013**



Based on 368 multiple answers from 301 in poppy-growing villages

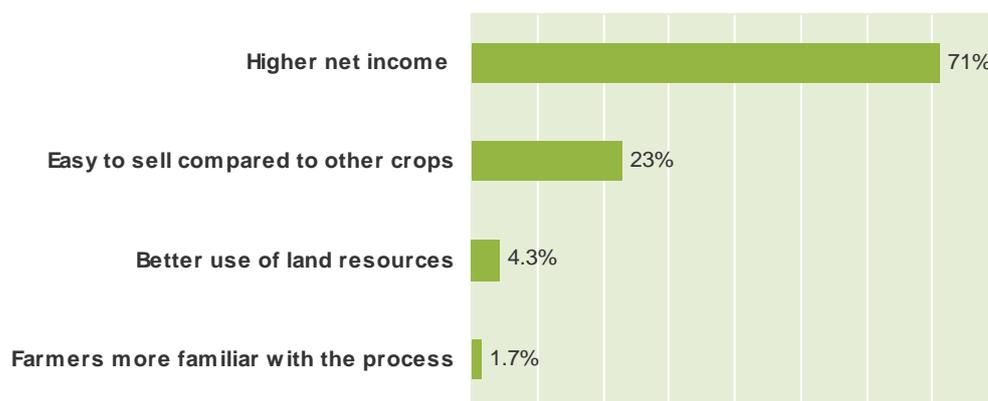
\* The category "Other" includes: "high profit with low investment"; "grow poppy because other villagers do"; "poppy growing is best fit for their needs"; "climate is favourable for poppy cultivation"; "poppy is easy to cultivate"; "poppy is suitable for local situations"; "want to start poppy growing"; "want to be rich".

Data collected in South Shan State in 2013 indicated that this region was affected by difficult accessibility and transportation, which lead to difficulties in growing and selling other crops. It was not surprising therefore that the next most popular reasons for cultivating opium poppy there was "opium is easy to sell" and "to make more money" or "earn a large amount of money by growing poppy". The influence of others was also seen in South Shan, as witnessed by answers such as "grow poppy because other villagers do".

In Kayah, villages reported "household income" and "improve living expenses" as the main reasons for cultivating poppy, whereas in East Shan State they opted for "earn a large amount of money", "increase annual income" and "poppy growing is the easiest way to make money". However, East Shan State was the one region where respondents acknowledged that poppy growing is a traditional occupation passed down from generation to generation.

Overall, the 2013 data imply that poppy growing in Myanmar is an essential part of family income which covers food insecurity, living expenses costs and poverty.

**Figure 9: Farmers' opinions regarding the advantages of opium poppy cultivation in poppy-growing villages, Myanmar, 2013**



## 2.2 Yield and potential opium production

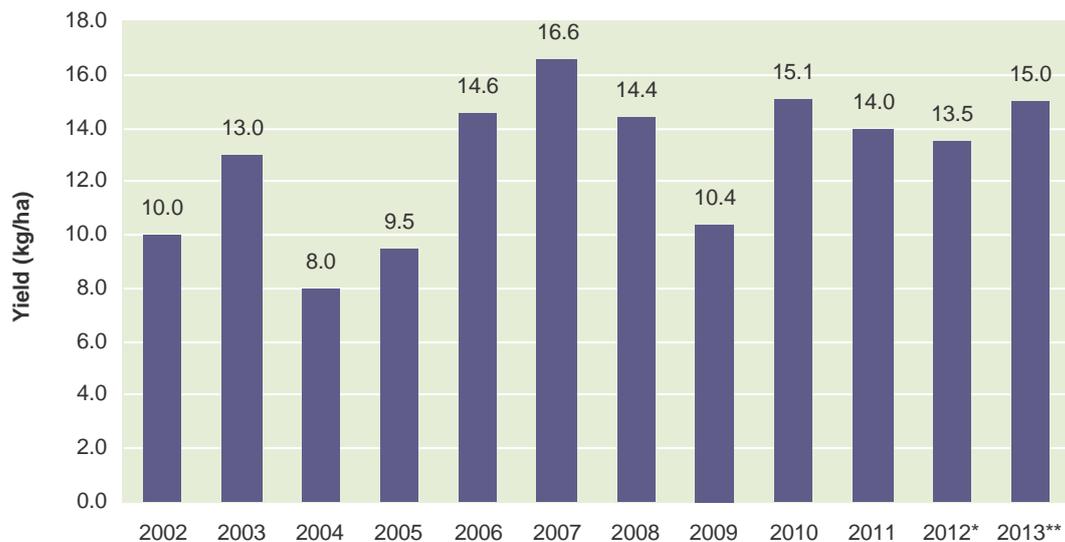
Field measurements in East, North and South Shan resulted in an average yield estimate, weighted by area under cultivation, for Shan State of 15.0 kilograms per hectare. As no yield data were available for Kachin State, the Shan average was also applied to Kachin, so that the average yield of 15.0 kilograms per hectare was also the estimate at the national level. Higher than in 2012 and 2011, the 2013 average opium yield is comparable to 2010 and was the result of an increase in yield observed in North, South and East Shan, though it was most pronounced in the latter.

**Table 3: Potential opium yield, by region, Shan State, 2012-2013 (Kilograms per hectare)**

Region	2012 Average yield (kg/ha)	2013 Average yield (kg/ha)	Change 2012-2013
East Shan	14.1	18.4	30%
North Shan	11.8	12.5	6%
South Shan	11.4	13.4	17%
<b>Average yield*</b>	<b>13.5</b>	<b>15.0</b>	<b>11%</b>

\* Weighted by area under poppy cultivation.

**Figure 10: National opium yield calculated in 2002 to 2013 surveys, Myanmar (Kilograms per hectare)**

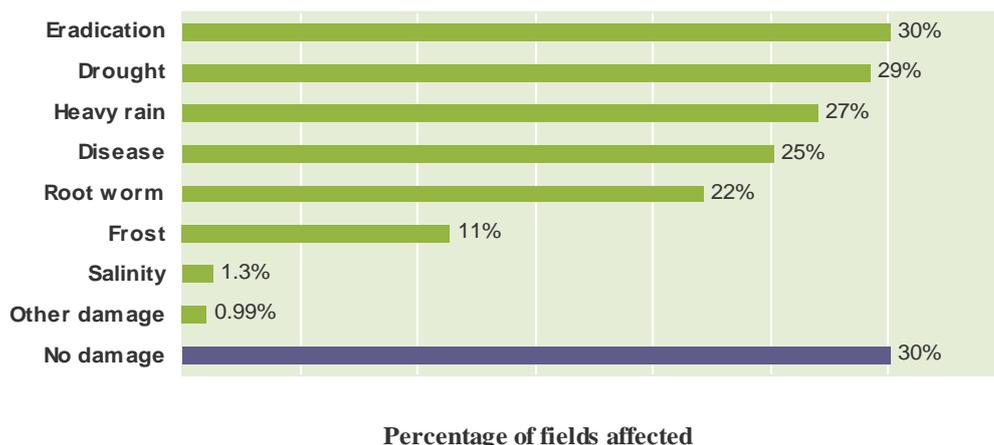


\*For Kachin State, data from 2011 were used as the yield survey could not be implemented in that region.

\*\* Based on data from Shan State only.

It appears that conditions for cultivating poppy were more favourable over the course of 2013 than 2012, which is consistent with the noticeable increase in yield. According to farmers interviewed in the village survey, some 30% of fields were not affected by any problems, whereas this figure was 16% in the previous year. The proportions of fields affected by disease, heavy rain, root worm and frost all decreased in 2013. In terms of natural conditions, the exception to this pattern was drought, which, along with eradication, was foremost among the problems mentioned by farmers. In both cases, however, the proportion of affected fields declined in 2013.

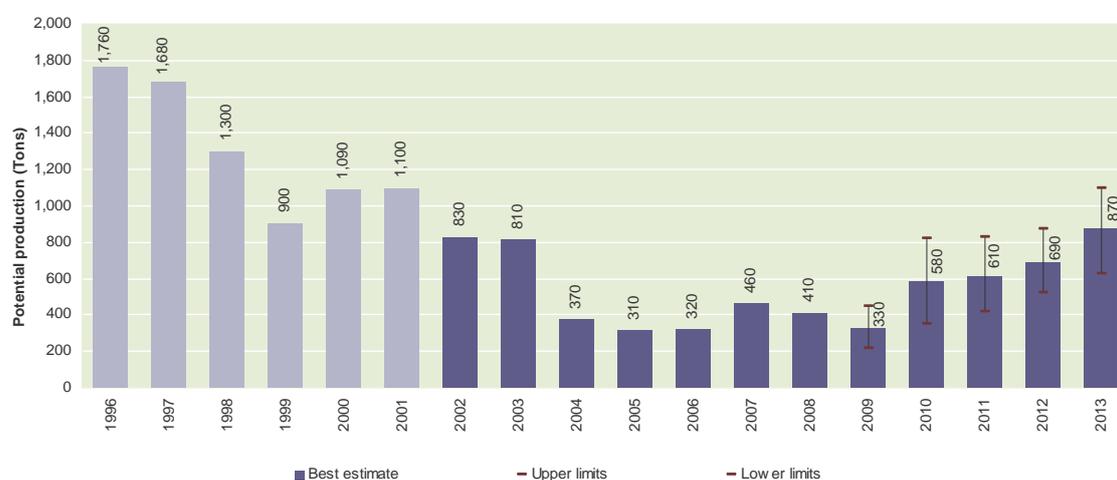
**Figure 11: Problems affecting poppy fields, according to farmers interviewed during 2013 yield study, Myanmar**



\* Based on 705 fields in 287 villages covered by the yield study. A single village may have reported multiple problems affecting the same poppy field. With exception of fields under “No damage”, a single field may be counted under multiple categories in the graph. Hence, the sum may be larger than 100%.

The combination of an increase in yield and in cultivation of opium poppy in 2013 resulted in an increase in production of approximately a quarter in comparison to 2012. The best estimate for total 2013 opium production in Myanmar is some 870 tons, which was the highest since UNODC/GOUM estimates began.

**Figure 12: Potential opium production, Myanmar, 1996-2013 (Tons)**



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

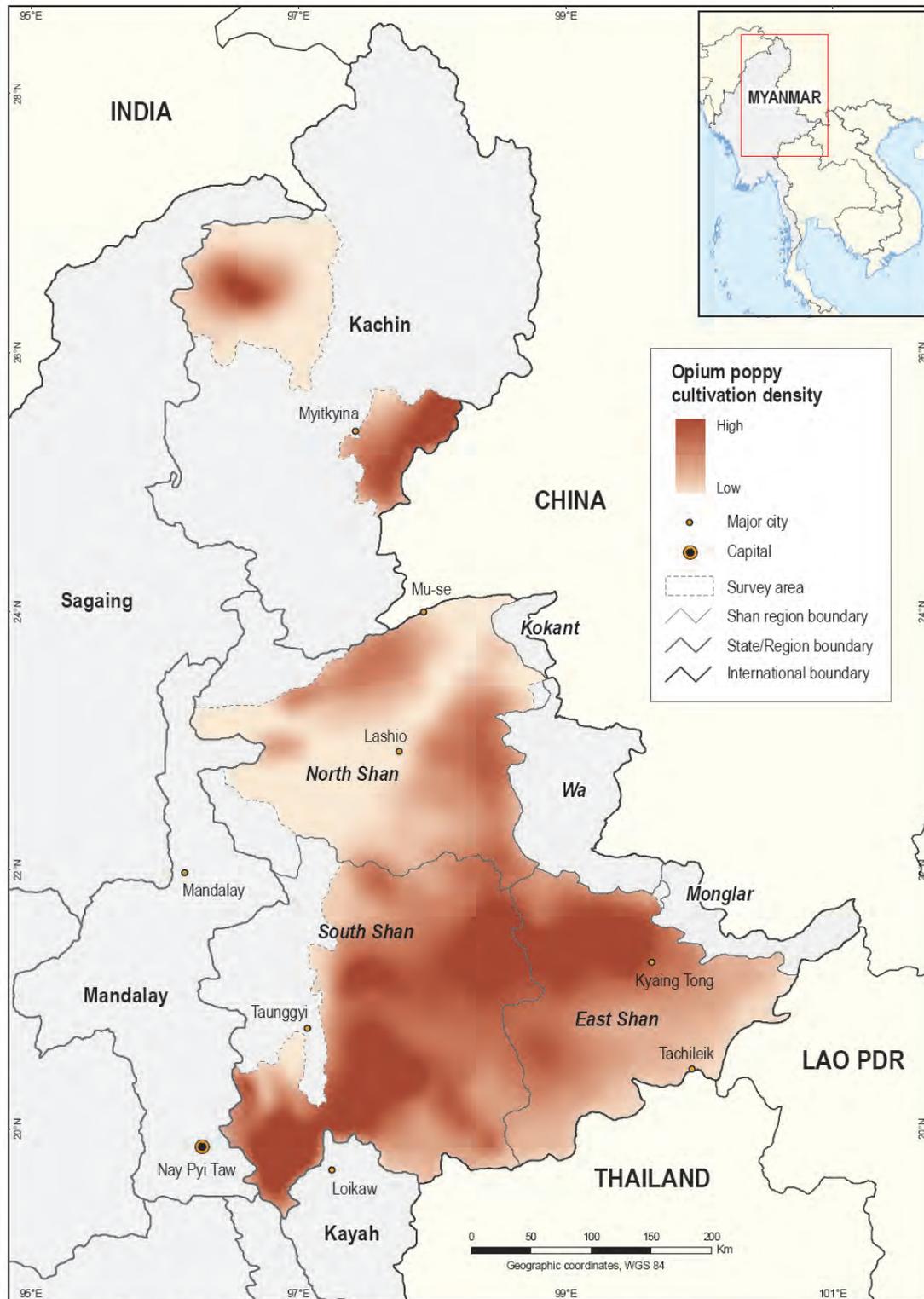
Opium production in East Shan rose from 201 tons in 2012 to 338 tons in 2013. An increase of approximately two thirds, placing East Shan at almost the same level as South Shan in terms of opium production, this means that together the two regions accounted for approximately four fifths of Myanmar's total opium production in 2013.

**Table 4: Potential opium production, by region, Myanmar, 2011-2013 (Tons)**

Region	Potential production (tons) 2012	Potential production (tons) 2013	Change 2012-2013	Share of production by State (percentage)
Kachin*	125	68	55%	8%
East Shan	201	338	68%	39%
North Shan	75	104	39%	12%
South Shan	289	356	24%	41%
<b>Total (rounded)</b>	<b>690</b>	<b>870</b>	<b>26%</b>	<b>100%</b>

\* No field measurements from Kachin were available for the 2012 and 2013 opium surveys. For the purposes of the 2013 production estimates, the average yield estimate for Shan State (weighted by cultivation) was used.

**Map 3: Cultivation density map, Kachin and Shan States, Myanmar, 2013**



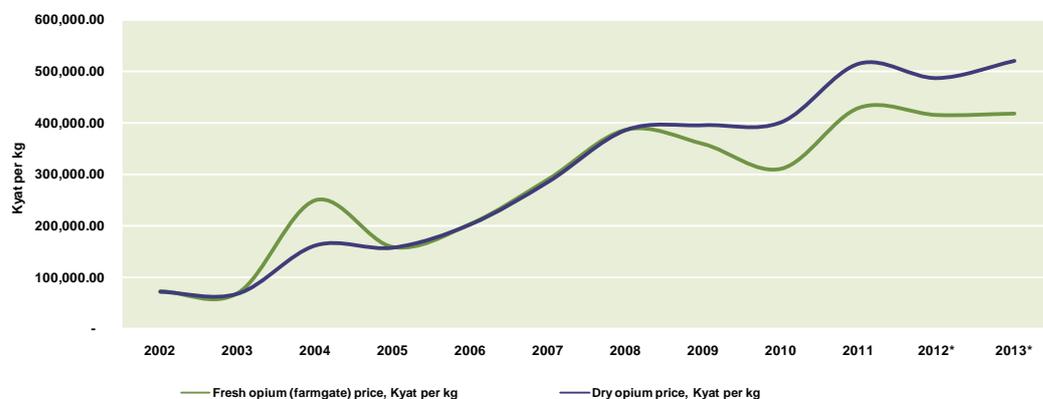
Source: Government of Myanmar - National Monitoring System supported by UNODC  
 The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

## 2.3 Opium prices

Opium prices were relatively stable in 2013. When expressed in local currency (kyat), the average farm-gate price of fresh opium (weighted by cultivation) showed a very slight increase in comparison to 2012 (1%), while the average price of dry opium (weighted by cultivation) showed a more significant increase (+7%). Possibly influenced by the availability of data, this trend should not be over-interpreted.

Dry opium prices refer to the latest transaction and may therefore reflect prices in the months prior to the poppy-growing season (in contrast to farm-gate prices), which could contribute to the moderate divergence in the trend between farm-gate and dry opium prices. Another factor that may drive up the average price of dry opium is price reporting that reflects dry opium traded at stages and locations away from the source cultivating village, further down the value chain.

**Figure 13: Farm-gate price (weighted average) of fresh opium in poppy-growing villages and dry opium price (weighted average), Myanmar, 2002-2013,\* (kyat/kg)**

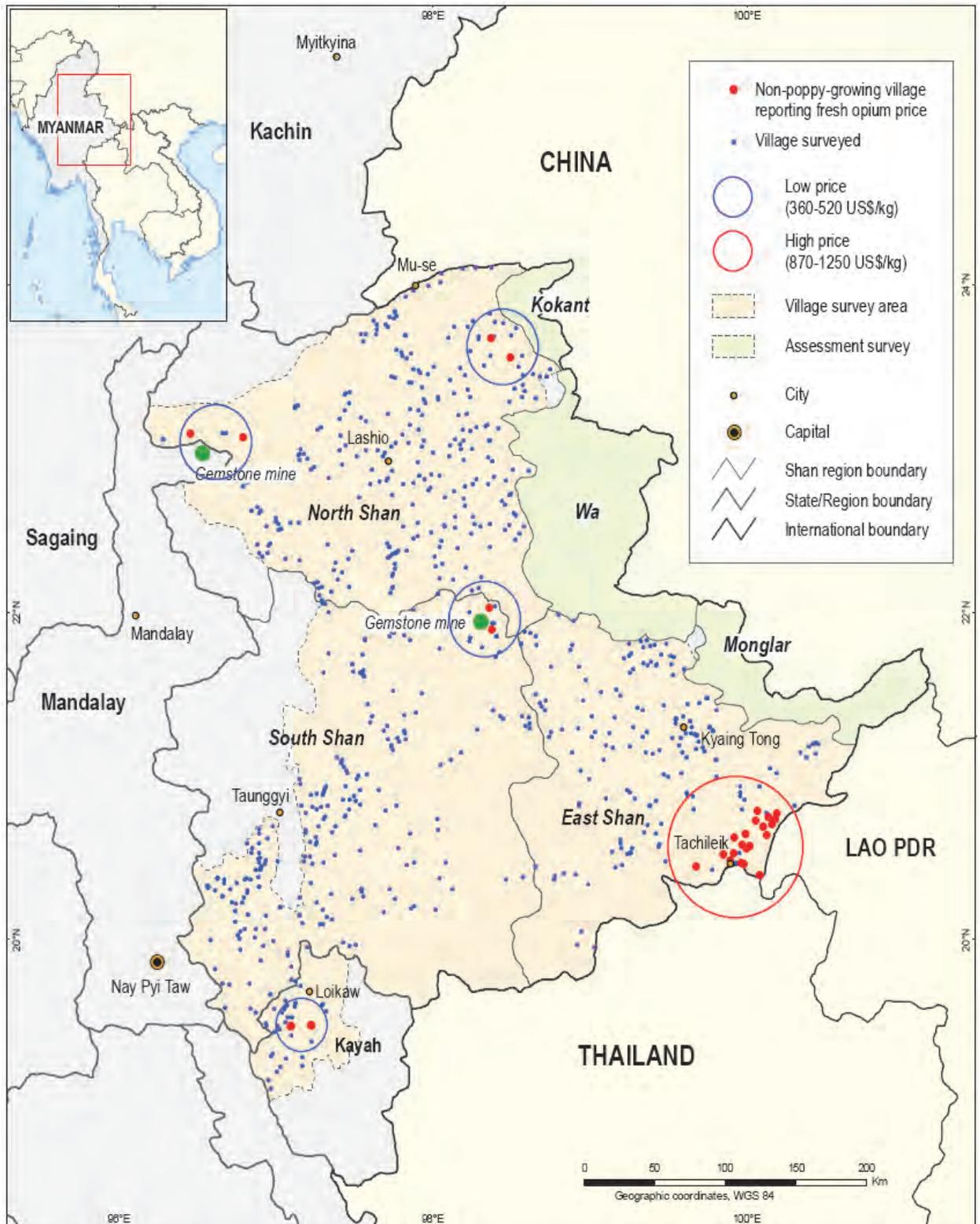


\* For 2012 and 2013, price reflects data from East, North and South Shan only, weighted by cultivation.

Some non-poppy-growing villages reported both fresh and dry opium prices. While dry opium prices in non-poppy-growing villages could relate to opium cultivated in a given village in the previous year, fresh opium prices most likely denote opium traded away from cultivating villages. The regions with sporadic reporting of fresh opium prices in non-poppy-growing villages included East Shan, North Shan and Kayah, and possibly reflected fresh opium intended for local consumption. However, the majority of fresh opium prices were reported from a cluster of villages in East Shan, close to the borders with Lao PDR and Thailand. Moreover, the prices in this cluster tended to be significantly higher than the East Shan average, which was already relatively high. This suggests a significant demand for opium in that area, possibly for further processing. Incidentally, seizures of heroin were also made near there in 2013.

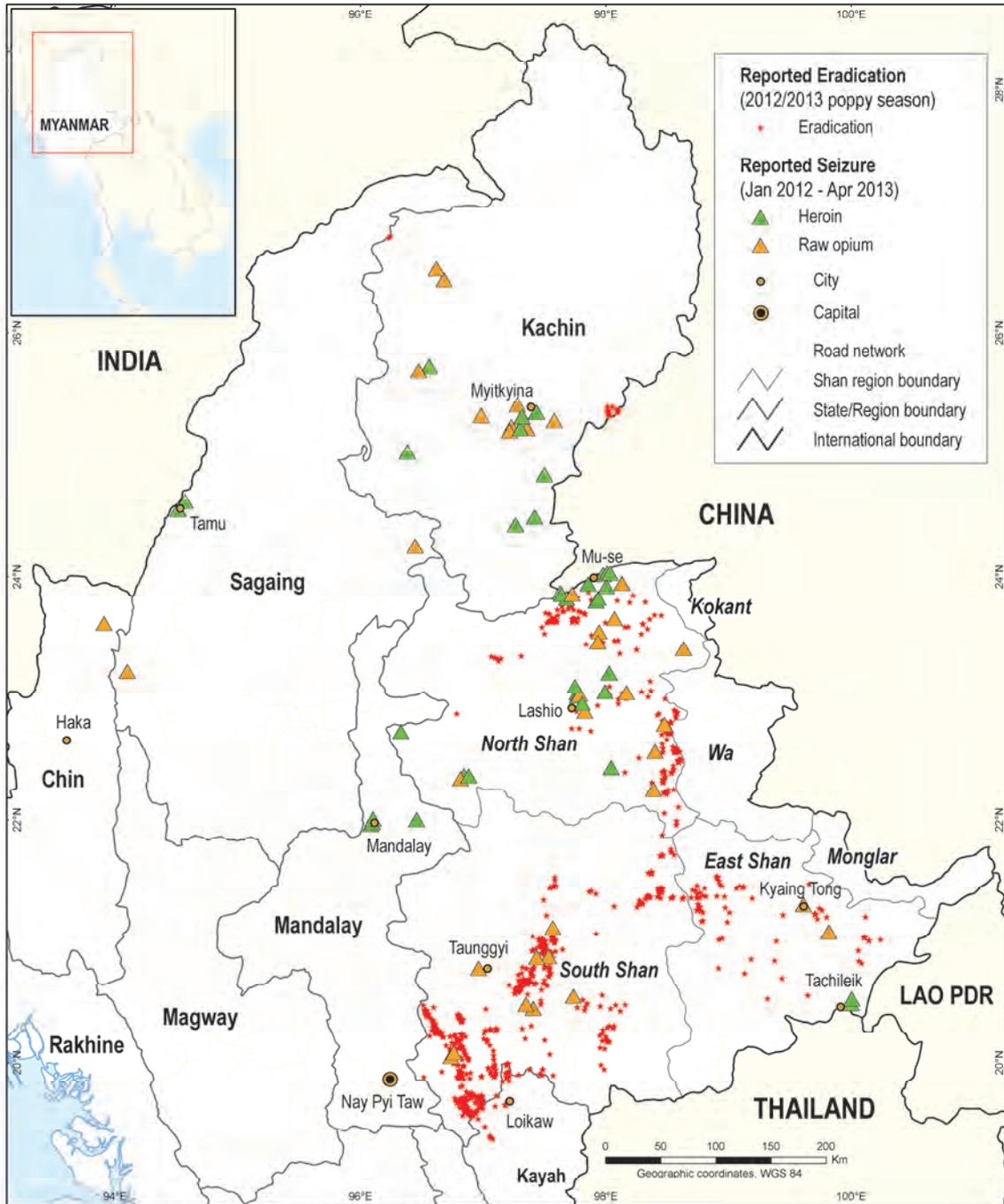
In general (apart from fresh opium prices in non-poppy-growing villages), both dry opium prices and farm-gate prices of fresh opium in poppy-growing villages were highest in East Shan in 2013.

**Map 4: Non-poppy-growing villages reporting fresh opium prices, Myanmar, 2013**

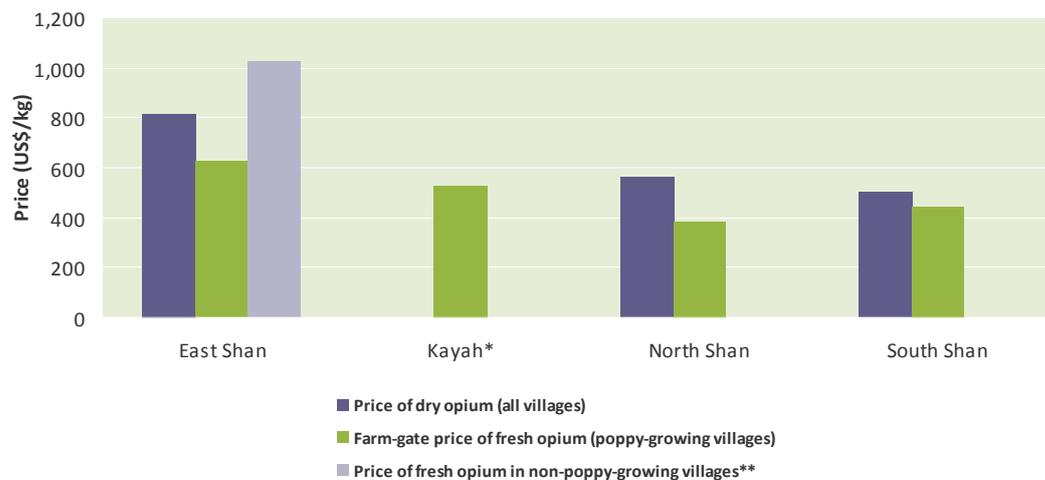


Source: Government of Myanmar - National Monitoring System supported by UNODC  
 The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

**Map 5: Eradication of opium poppy in 2012/2013 season and reported seizures of heroin and raw opium, Myanmar, January 2012-April 2013**



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.

**Figure 14 : Fresh and dry opium prices, by State, Myanmar, 2013 (US\$/kg)**

\* In Kayah, the number of data points for the price of dry opium was too small to yield a statistically significant mean.

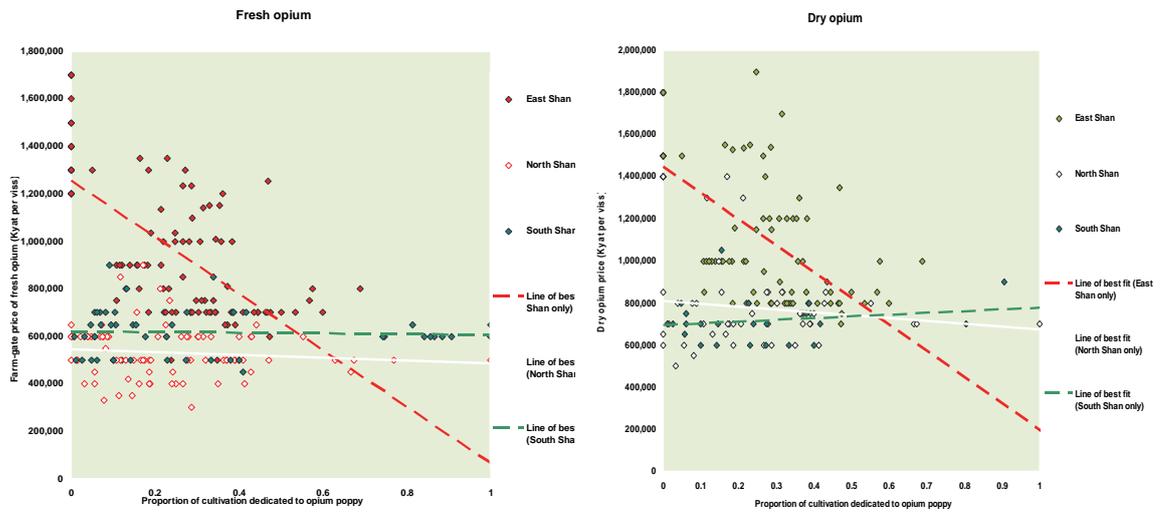
\*\* A small number of villages with no opium poppy cultivation provided prices of fresh opium, which likely reflects opium traded (but not produced) in the village. In East Shan State, these prices came from villages in two townships; outside East Shan, the number of data points was too small to yield statistically significant means.

Source: GOUM/UNODC opium survey 2013.

In addition to opium poppy, the 2013 opium survey collected data on the cultivation of licit crops. Based on this, it was possible to estimate the proportion of cultivation dedicated to opium poppy and to use it to attempt to measure the inclination of farmers to grow poppy, as well as to try to investigate the factors driving that inclination.

No single indicator appears to explain these driving factors clearly. In the case of East Shan, however, a relationship of a different kind, albeit obfuscated by other factors, could be discerned between the price of opium and the proportion of cultivation dedicated to opium poppy: the higher the availability of opium, as reflected in the proportion of poppy cultivation, the lower the price. Although this relationship is hardly surprising, it was much less clear in the case of South Shan and North Shan. This was true of farm-gate prices of fresh opium as well as dry opium. It appears that the market for opium in East Shan behaves differently from South and North Shan, possibly due to greater demand in the region.

**Figure 15: Opium prices versus proportion of cultivation dedicated to opium poppy, Shan State, Myanmar, 2013 (Per village)**



## 2.4 Affluence indicators in opium-growing risk areas

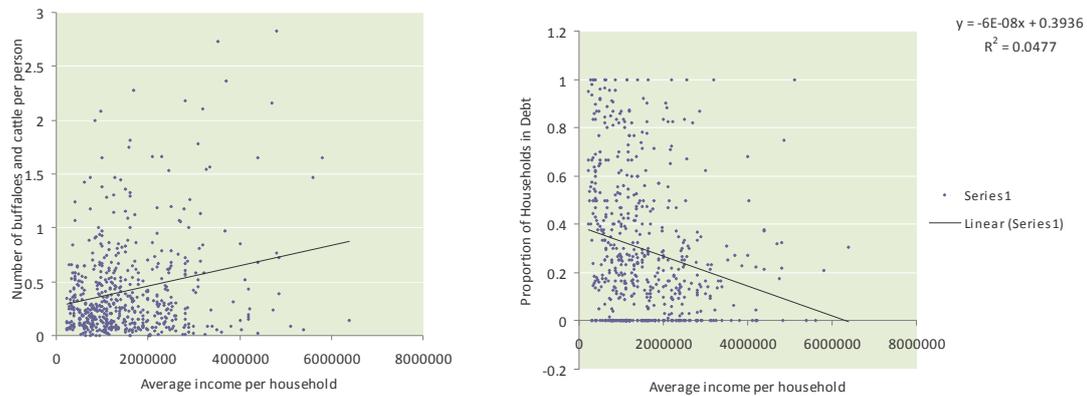
The relationship between poverty and opium poppy cultivation is not always a straightforward one. Indeed, the picture emerging from the data available in the years preceding the 2013 survey could be described as “blurred” at best. For this reason, in addition to household cash income, the 2013 survey provided data relating to other, less direct indicators of affluence, which can be compared to the inclination of farmers to grow poppy.

At the village level, the following indicators were considered:

- percentage of debt-free households;
- percentage of households not experiencing a rice deficit;
- average number of months of rice deficit experienced by a household;
- number of buffalo and cattle per person.
-

These indicators were not directly asked about during interviews, but were derived instead from breakdowns and totals collected in questionnaires at the village level, which is why the results of this analysis should be treated with care. These indicators are used to measure different aspects of affluence and appear to be related. For example, household income and number of cattle or buffalo are positively related, meaning the higher the income, the larger the number of cattle/buffalo per person; or the lower the income, the more a household is in debt.

**Figure 16: Number of buffalo and cattle per inhabitant and proportion of households in debt, versus average income per household in villages surveyed, Myanmar, 2013**



The overall weighted averages for the above affluence indicators show that:

- about a quarter of the households in surveyed villages were in debt;
- roughly a third of households in surveyed villages experienced a rice deficit;
- on average, households in surveyed villages experienced a rice deficit for a period of nearly two months;
- on average, there were approximately four inhabitants for every buffalo or cow in the surveyed villages.

The relationship between affluence and poppy cultivation is complicated. Previous surveys looked at cash income and compared households in poppy-growing villages with those in non-poppy-growing villages, but there is a problem with this simplistic approach because opium prices are customarily high, so that households which decide to grow opium automatically generate high cash income but that does not mean that they are well off. It is plausible that non-monetary affluence indicators are a better proxy of affluence than monetary income, in that they may be less directly and immediately influenced by the decision to grow poppy and any consequent extra income from opium sales.

One approach taken was to compare these indicators between poppy-growing and non-poppy-growing villages. In each case there was a significant difference in the values indicated between poppy-growing and non-poppy-growing villages.

**Table 5: Affluence indicators in villages surveyed in 2013, comparisons between poppy-growing and non-poppy-growing villages, and percentage of cultivation dedicated to opium poppy, Myanmar, 2013**

Indicator	Significance test for difference in means (two-tailed Welch's t-test)				Weighted averages			
	Non-poppy-growing villages, simple average (per village)	Poppy-growing villages, simple average (per village)	P-value	Significant/non-significant	Weighting factor	Non-poppy-growing villages	Poppy-growing villages	All villages*
Percentage of households not in debt	78%	68%	< 0.01	Significant	Households	81%	78%	78%
Percentage of households not experiencing rice deficit	68%	52%	< 0.000 000	Significant	Households	76%	61%	66%
Average duration of rice deficit per household	160%	272%	< 0.000 000	Significant	Households	125%	223%	1.918
Average number of buffalo and cattle per inhabitant	28%	59%	< 0.000 000	Significant	Inhabitants	19%	36%	0.2593
Overall income per household (Kyat)	1 502 328	1 734 775	< 0.01	Significant	Households	1 794 057	1 900 666	1,839,737
Income from non-opium sources per household (Kyat)	1 502 328	1 045 933	< 0.000 000	Significant	Households	1 794 057	1 143 249	1 515 198
Income from opium sales per household (Kyat)		N/A			Households	0	757 417	324 539
Poppy cultivation as percentage of overall cultivation		N/A			Cultivation	0%	21%	8%

*With the exception of the income indicators, "All villages" includes villages for which poppy-growing status was unknown. Due to the specific nature of the questions on income in the questionnaire, in the case of the income indicators (overall income, income from non-opium sources, and income from opium sales), villages which did not reply to the question on whether poppy was grown were excluded, in order to avoid bias due to apparent under-reporting.*

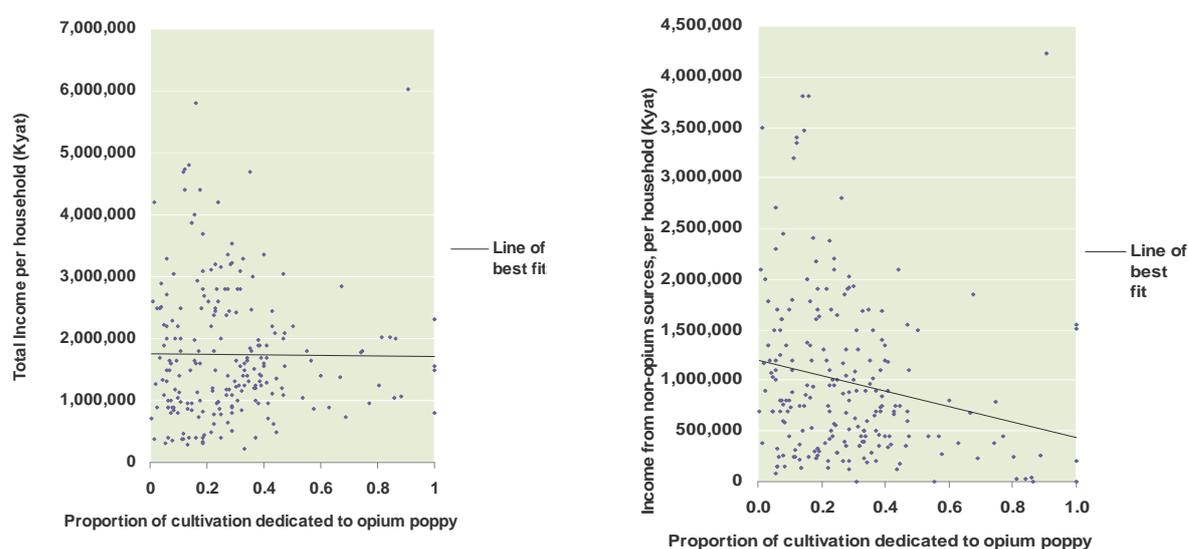
Comparisons based on shorter-term non-monetary affluence indicators suggest that (overall) poppy-growing is more associated with villages at the poorer end of the scale than those at the wealthier end, which implies that growing poppy is a means of compensating for poverty. This was the case for the proportion of households with debts (on average, more households were in debt in poppy-growing villages), as well as for both indicators associated with rice deficit (more households experienced a rice deficit and the average period of that deficit was longer in poppy-growing villages than in non-poppy-growing villages). The exception to this pattern was the number of buffalo and cattle per person, which was higher among poppy-growing villages. It is worth noting that the number of buffalo or cattle per person is more of a longer-term indicator, as it reflects decisions based on the level of affluence during the lifetime of the livestock, whereas indicators related to household debt and rice are derived from answers that relate to the period of the survey or the previous 12 months.

A second approach to the investigation of the relationship between the affluence of farmers and their inclination to grow poppy was taken by measuring poppy cultivation in terms of the percentage of poppy cultivated of total land cultivated. This indicator in itself reveals that about a fifth of cultivation in poppy-growing villages is dedicated to opium poppy. In terms of establishing links between poppy growing and affluence, overall the results of this second approach were inconclusive, in the sense that, among poppy-growing villages, none of the non-monetary affluence indicators bore a strong correlation to the percentage of cultivation dedicated to opium poppy.

**Table 6: Correlation of affluence indicators to percentage of cultivation dedicated to opium poppy among poppy-growing villages, Myanmar, 2013**

Affluence indicator	Relationship found	Coefficient of determination ( $R^2$ )
Percentage of households not in debt	None	0.0006
Percentage of households not experiencing rice deficit	None	0.0166
Average duration of rice deficit per household	None	0.0015
Average number of buffalo and cattle per inhabitant	None	0.0036
Overall income per household (kyat)	None	0.0001
Income from non-opium sources per household (kyat)	Negative	0.0423

Even household income (in monetary terms) did not appear to respond to the proportion of poppy grown, in the sense that a change in the proportion did not appear to bring about a corresponding change in the level of household income. In contrast, as to be expected, the income (in monetary terms) from non-opium sources (that is, all sources excluding opium sales) did exhibit a weak negative correlation: presumably income from opium sales replaces income from other activities. The rather surprising absence of any correlation to total income (among poppy-growing villages) again suggests that farmers resort to poppy cultivation to compensate for deficiencies in income and to maintain a minimum level of subsistence, rather than in pursuit of progressively higher income levels.

**Figure 17: Average yearly income per household in surveyed villages, including and excluding income from opium sales, versus proportion of cultivation dedicated to opium poppy, Myanmar, 2013**

The lack of a clear link between most of the above affluence indicators and the extent of poppy cultivation (relative to other crops) underlines the fact that the cultivation of opium poppy is a complex phenomenon and that decisions about how much poppy to cultivate, if any, are subject to various factors, which possibly exert an influence in opposite directions. A clearer picture may emerge from the analysis of information about poppy-growing villages collected in previous years, when the villages in question may have been poppy-free. However, this kind of analysis is difficult to perform on the basis of the available data because the surveyed villages differ year on

year as the sample is random and most of the information collected only relates to one season or one calendar year.

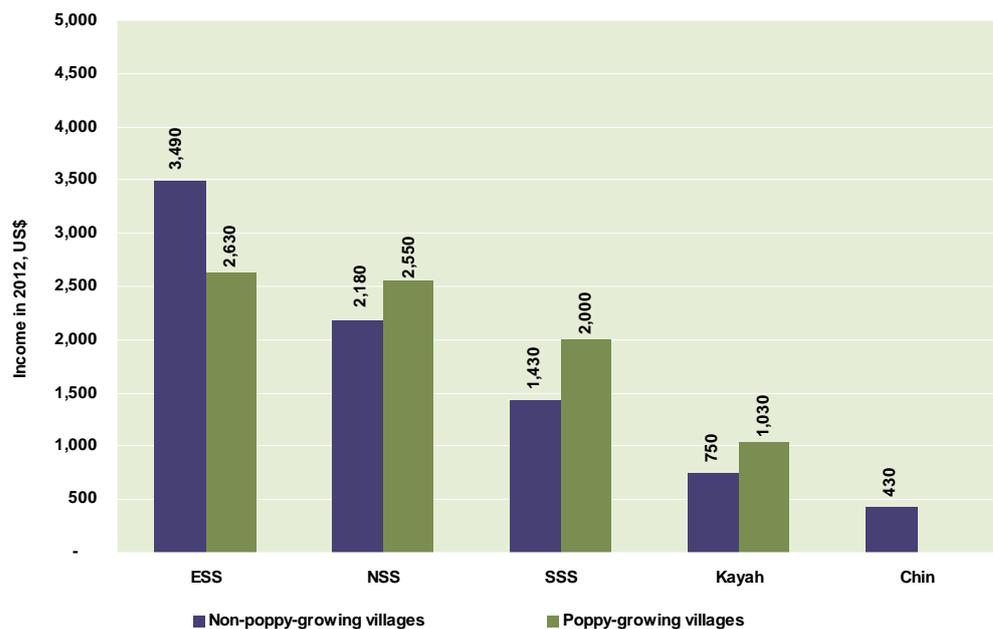
## 2.5 Household cash income in opium-growing risk areas

Information about income per household is collected at the village level, together with the number of households in the village in question. The averages presented in this section were weighted by the number of households, thereby avoiding an over-representation of small villages. For this reason, the averages in the 2013 survey are not directly comparable to those of previous surveys.

As discussed in the previous section, some affluence indicators suggest that poppy-growing villages tend to be less affluent than villages that do not grow poppy. Nevertheless, choosing to grow poppy instead of, or in addition to, other crops does appear to improve the affluence level of households, as reflected in the total income earned in 2013, which was slightly higher in poppy-growing villages than in non-poppy-growing villages.

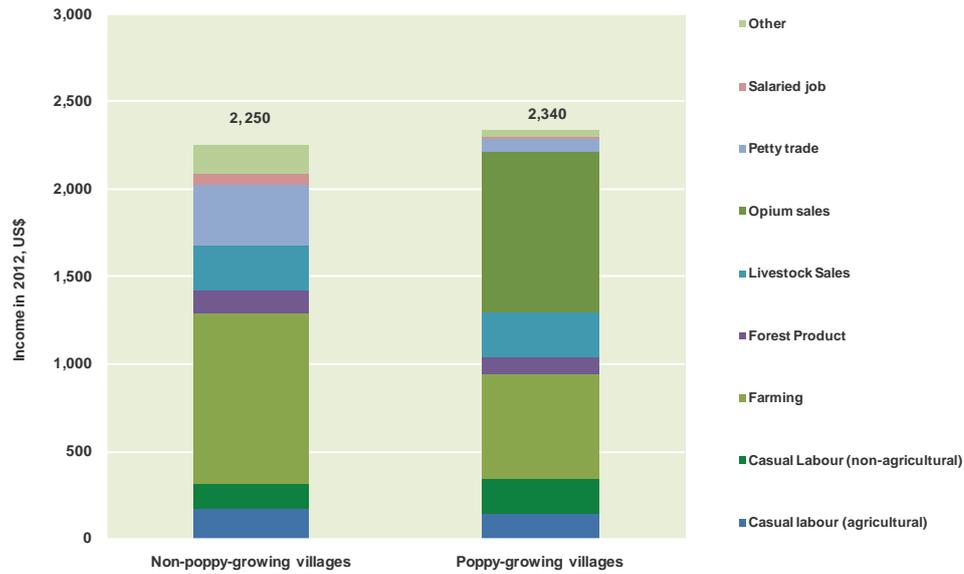
Among the regions where village interviews were carried out in 2013, household cash income was generally highest in East Shan, followed by North Shan, South Shan, Kayah and Chin. In North Shan, South Shan and Kayah, household cash income in 2013 was generally higher among poppy-growing villages than among non-poppy-growing villages, with, in relative terms, the disparity being most notable in South Shan. The exception to this pattern was East Shan, where household cash income was significantly higher among non-poppy-growing villages.

**Figure 18: Income per household (weighted average) in 2012 (reported in 2013) per household, by region and poppy-growing status, Myanmar (United States dollars per year)**



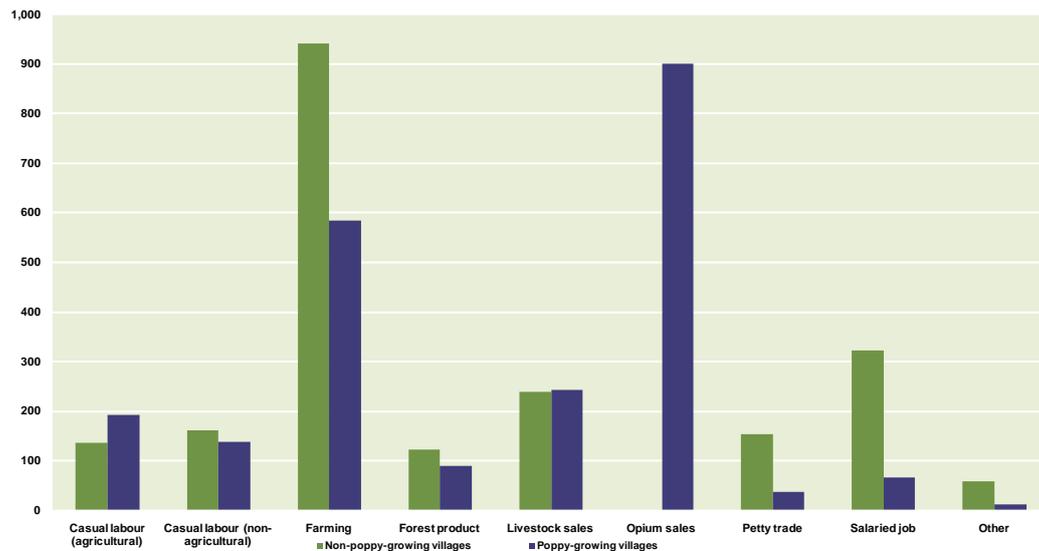
Among non-poppy-growing villages, licit farming was the most important source of income in 2013, while opium sales played a bigger role than any other source of income in poppy-growing villages, including the farming of licit crops.

**Figure 19: Income per household (weighted average) in 2012 (reported in 2013) in Shan State, Myanmar (United States dollars per year)**



Apart from licit farming, the most notable differences between poppy-growing and non-poppy-growing villages in 2013 were seen in salaried jobs and in petty trade, both of which were significantly lower in poppy-growing villages than non-poppy-growing villages, suggesting a trade-off between opium sales and those income sources, or the absence of such job opportunities. Income from casual agricultural labour, which may have included labouring in poppy fields, was higher in poppy-growing villages than in non-poppy-growing villages.

**Figure 20: Income per household (weighted average) in 2012 (reported in 2013) in surveyed villages (including Chin and Kayah), by source and poppy cultivation status, Myanmar (United States dollars per year)**



**Table 7: Annual income per household (weighted average) in 2012 (reported in 2013) by source and poppy cultivation status, Myanmar (United States dollars)**

	Non-poppy-growing villages	Poppy-growing villages	All villages
Casual labour (non-agriculture)	161	137	151
Casual labour (agriculture)	135	192	160
Farming	942	585	789
Forest product	123	90	109
Livestock sales	240	242	241
Petty trade	153	36	103
Salaried job	322	66	212
Other	59	12	39
<b>Sub-total</b>	<b>2,135</b>	<b>1,361</b>	<b>1,803</b>
Opium sales	0	901	386
<b>Grand total*</b>	<b>2,135</b>	<b>2,262</b>	<b>2,190</b>

\* Due to the specific nature of the questions on income in the questionnaire, in the case of the income indicators, villages which did not reply to the question on whether poppy was grown were excluded, in order to avoid bias due to apparent under-reporting.



**Out-of-season cultivation**



**Maize threshing, East Shan**



**Preparing firewood to store for rainy season, Demawso township, Kayah State**



**Animal parts to be sold in Laukkai market, Kokant**



Collecting firewood to store for rainy season, northern Chin State



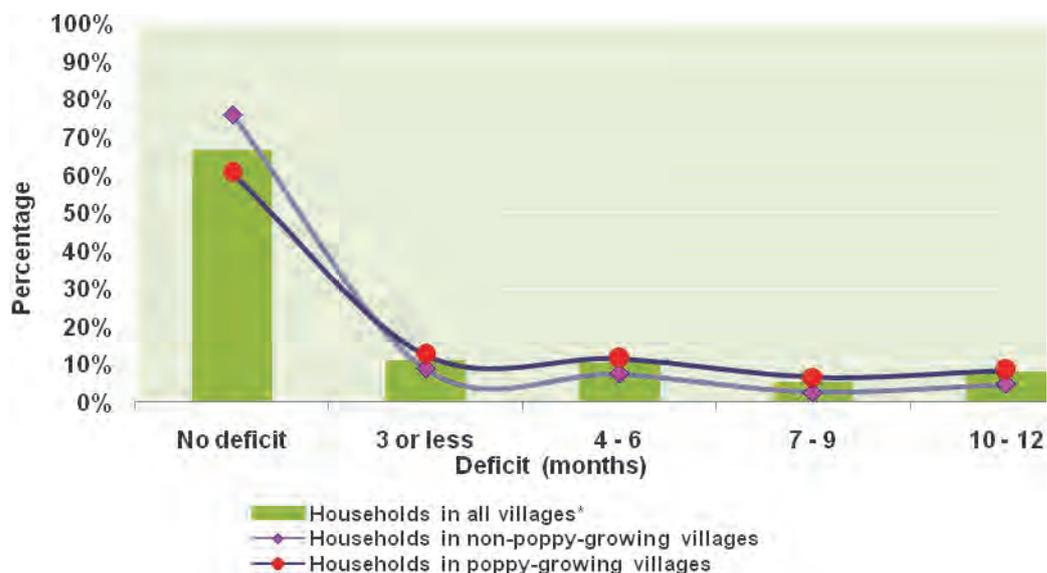
Dry mustard stored for consumption in rainy season, North Shan

## 2.6 Food security and rice deficit

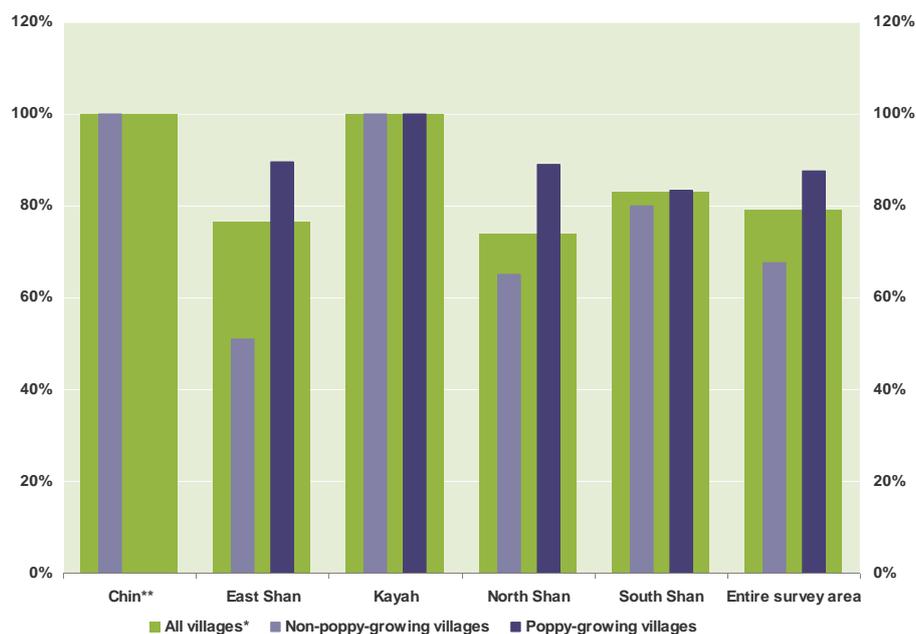
For the purposes of this report, a household is considered to have had a rice deficit if it did not produce enough rice for its own consumption in the 12 months preceding the survey and, by the same token, a household is considered food secure if it did not experience a rice deficit during that period.

Of the households in the villages surveyed in 2013, reportedly some two-thirds did not experience a rice deficit in the 12 months preceding the survey and were thus food secure, while the remaining households experienced rice deficits of varying durations. Roughly a tenth of those that experienced rice deficit did so for periods of three months or less, another tenth for periods of four to six months, and a significant proportion of households experienced even longer periods of rice deficit.

Figure 21: Breakdown of households, by duration of rice deficit and by poppy-growing status, Myanmar 2013



\* Including villages whose poppy-growing status was unknown.

**Figure 22: Proportion of villages experiencing rice deficit, by region and by poppy-growing status**

\* Including villages whose poppy-growing status was unknown.

\*\* No poppy-growing villages were registered in Chin.

Note: A village is counted as experiencing a rice deficit if even one household (or more) in that village experienced a rice deficit. Hence the proportion of villages experiencing a rice deficit is much higher than the proportion of households experiencing a rice deficit.

The proportion of households with no rice deficit was slightly lower in poppy-growing villages than in non-poppy-growing villages in 2013, meaning that poppy-growing villages were less food secure than non-poppy-growing villages. This difference was borne out by each of the four different durations of rice deficit experienced by households (3 or less months; 4-6 months; 7-9 months; and 10-12 months). In other words, at all levels of severity of rice deficit, poppy-growing villages were consistently worse off than non-poppy-growing villages.

Although some two-thirds of households (overall) did not experience a rice deficit in 2013, the problem of rice deficit was very widespread, with almost 80% of the villages surveyed experiencing a period, however short, of rice deficit (affecting at least one household). Moreover, the fact that the proportion of villages in which rice deficit was reported tended to be higher among poppy-growing villages than non-poppy-growing villages could also be observed.

**Table 8: Proportion of food-secure households\* in non-poppy-growing villages, 2012 and 2013, Myanmar (Percentage)**

Region	In 2012	In 2013
East Shan	87%	96%
North Shan	72%	74%
South Shan	80%	86%
Kayah	10%	32%
Chin	28%	5%
<b>Total</b>	<b>69%</b>	<b>76%</b>

\* Households that did not experience a rice deficit in preceding 12 months.

According to the 2013 survey, the food security situation appears to have improved overall in non-poppy-growing villages, as the percentage of households with food security increased in all regions with the exception of Chin, where the number of surveyed villages was very small. While this could be an indication that farming conditions may have been better in 2013 than in previous years, the pattern was much more mixed among poppy-growing villages, with decreases in East Shan and South Shan and an increase in North Shan.

**Table 9: Proportion of food-secure households\* in poppy-growing villages, 2012 and 2013, Myanmar (Percentage)**

Region	In 2012	In 2013
East Shan	72%	66%
North Shan	50%	71%
South Shan	75%	52%
Chin	1%	N/A
Kayah	N/A	50%
<b>Total</b>	<b>67%</b>	<b>61%</b>

\* Households that did not experience a rice deficit in preceding 12 months.

Although 2013 data relating to food security in Chin and Kayah is limited, it suggests that communities there were significantly worse off than those in Shan State.

**Table 10: Coping strategies reported\* in households with insufficient food, Myanmar, 2013**

Strategy	Poppy-growing villages	Non-poppy-growing villages	All surveyed villages
Purchase food on credit	38%	35%	37%
Borrow food or rely on friends or relatives	26%	26%	25%
Rely on less desirable or cheaper food	10%	16%	13%
Gather wild food or hunt	5%	7%	6%
Other strategy	22%	14%	19%

\* Multiple mentions by a single village are counted separately.

Purchasing food on credit emerged (more clearly than in the previous survey) as the most reported strategy for coping with a lack of food in 2013, while borrowing food or relying on friends and relatives remained the second most reported strategy. Households in non-poppy-growing villages were more likely to rely on less desirable or cheaper food than households in poppy-growing villages.

**Table 11: Average cultivated land in villages, per household, Myanmar, 2013 (Hectares)**

	Rice	Wheat and corn	Mustard and sunflower	Vegetables	Other	Poppy	Total
Non-poppy-growing villages	0.60	0.19	0.05	0.03	0.12	0.00	0.98
Poppy-growing villages	0.47	0.24	0.04	0.04	0.08	0.22**	1.08
All villages *	0.55	0.21	0.04	0.03	0.10	0.08	1.01

\* Due to the specific nature of the question on cultivation in the questionnaire, villages which did not reply to the question on whether poppy was grown were excluded, in order to avoid bias due to apparent under-reporting.

\*\* This represents an average out of all households in poppy-growing villages, rather than an average out of all poppy-growing households.

Taking all crops into account, households in poppy-growing villages cultivated slightly more land than those in non-poppy-growing villages in 2013. This was in contrast to the previous year, during which households in non-poppy-growing villages registered, on average, a higher total area cultivated per household. In 2013, the total excluding poppy among poppy-growing villages was less than total cultivation in non-poppy-growing villages. In other words, poppy cultivation partly substituted the cultivation of licit crops, and was partly an addition to it.

## 2.7 Opium and other drug use in opium-growing risk areas

The 2013 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. In this case, “use” means having taken the drug at least once in the month prior to the day of the interview, though the drug 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.

Across all villages in the survey area, opium continued to be the most widely used of the three drugs (opium, ATS and heroin), with an estimated 0.9% of the population in the surveyed villages having used opium at least once in the preceding month. However, this was mainly due to opium use in poppy-growing villages, which appeared to be significantly higher than ATS and heroin use in those villages, and also approximately six times higher than opium use in non-opium-growing villages.

In non-poppy-growing villages, the extent of opium use was comparable to ATS use. Interestingly, heroin use and even ATS use were also significantly higher in poppy-growing villages than in non-poppy-growing villages. The reason for this is not clear, but there could be both supply-driven and demand-driven explanations: the former being that the presence of opium creates an illicit market in which ATS and heroin may become more easily available; the latter that opium use can serve as a stepping stone to other drugs, especially for drug users who progress from opium to heroin.

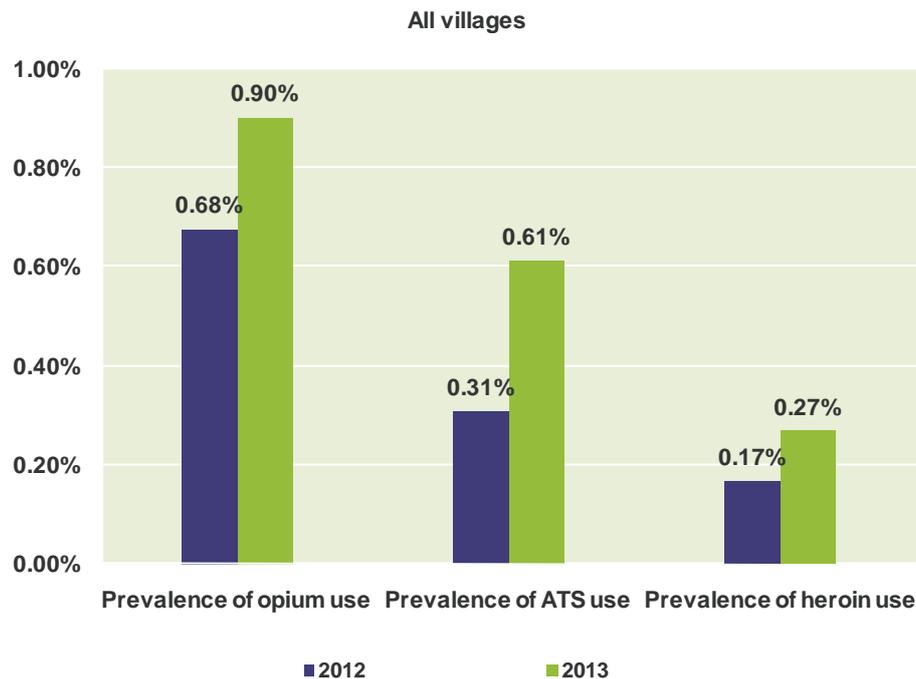
**Table 12: Monthly prevalence of opium, heroin and ATS use, as reported by headmen in Shan State and Kachin, Myanmar, 2013 (Population aged 15 and above)**

Description	Non-poppy growing villages	Poppy-growing villages	Total*
Prevalence of opium use (Number of users reported)	0.32% (277)	1.91% (1,241)	0.90% (1,554)
Prevalence of ATS use (Number of users reported)	0.35% (303)	1.13% (730)	0.61% (1,053)
Prevalence of heroin use (Number of users reported)	0.15% (133)	0.50% (325)	0.27% (463)
<b>Total population in surveyed villages (reported)</b>	<b>87,492</b>	<b>64,833</b>	<b>172,055</b>

\* Total including villages whose poppy status was unknown.

The prevalence of all three drugs, opium, heroin and ATS, was higher in 2013 than in 2012, with the greatest difference observed in ATS prevalence. While this could indicate a worrying development, some caution needs to be exercised when interpreting these results. In 2013, for the second time, headmen, not users themselves, were interviewed about the prevalence of drug use during the previous month. It is not known to what extent headmen can accurately report the number of drug users in their communities and how sensitive the survey instrument is to year-on-year variations in reporting. Still, it is not implausible that after years of increase in poppy cultivation and potentially an increase in the availability of opiates in the region, user levels have also gone up. As for ATS, increases in use have also been reported in other countries.

**Figure 23: Last month prevalence of opium, heroin and ATS use, as reported by headmen in Shan State and Kachin, Myanmar, 2012-2013 (Population aged 15 and above)**



## 2.8 Reported eradication

The 2013 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 11,939 hectares was eradicated in the 2012-2013 opium poppy season, which was less than the area reported as eradicated in the previous season but still higher than the annual levels registered throughout the period 2007-2011. As in the previous season, almost 90% of eradication took place in South Shan.

It is likely that the eradication figures provided 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 13: Eradication from 2007 to 2013, by region, Myanmar (Hectares)**

Region	2007	2008	2009	2010	2011	2012	2013
East Shan	1,101	1,249	702	868	1,230	1,257	537
North Shan	916	932	546	1,309	1,315	977	532
South Shan	1,316	1,748	1,466	3,138	3,579	21,157	10,869
<b>Shan State total</b>	<b>3,333</b>	<b>3,929</b>	<b>2,714</b>	<b>5,315</b>	<b>6,124</b>	<b>23,391</b>	<b>11,939</b>
Kachin	189	790	1,350	2,936	847	83	250
Kayah	12	12	14	13	38	84	59
Magway	45	-	1	1	-	4	7
Chin	10	86	5	2	10	110	32
Mandalay	-	3	2	-	39	45	-
Sagaing	9	-	1	-	-	-	2
Other States	64	-	-	-	-	-	-
<b>National total</b>	<b>3,662</b>	<b>4,820</b>	<b>4,087</b>	<b>8,267</b>	<b>7,058</b>	<b>23,718</b>	<b>12,288</b>

Source: GOUM/ CCDC

## 3 METHODOLOGY

### 3.1 Introduction

In 2013, 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 eleventh time.

The 2013 opium poppy survey was composed of three parallel components:

1. A cultivation estimation survey throughout 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 820 villages in Shan State and parts of Kayah and Chin States. Villages in Shan and Kayah States were selected randomly. In order to provide extra ground truth information, 10 villages were selected in Chin (opportunistic sample) in areas covered by the satellite images. The surveyors conducted interviews with village headmen and other key informants.

### 3.2 Sampling procedure for village survey and survey area

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 2013 survey, the poppy-growing area of Kachin State was excluded from the sampling frame because of the ongoing armed conflict. The northern part of Kayah State was included into the sampling frame and field reports indicated the presence of poppy in those areas.

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.

**Table 14: Composition of 2013 village survey sample**

Particulars	North Shan	South Shan	East Shan	Kayah	Chin	Total
Projected number of villages to be surveyed	310	280	195	35	10	830
Actual number of villages that were surveyed	278	245	190	35	10	758
Type of sample	Representative sample				Opportuni- stic sample	

### 3.3 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.



Field measurements by a survey team, North Shan



Ground data collection by ground truth team for satellite image analysis, Tangyang township, North Shan

In 2013, 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 regional 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 2013.

A survey without a statistical sampling frame was conducted in northern Chin State in collaboration with the CCDAC and Chin local authorities. The survey covered two townships, Tongzan and Teddim, in northern Chin. The village survey in Chin State was the second there since UNODC began annual surveys in Myanmar.

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 2013 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 2013. 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.

### 3.4 Field operations

In total, 138 surveyors carried out the village survey 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.



Socio-economic interview at Tunzang township, northern Chin



Eradication cooperated by villagers

**Table 15: Training village surveyors**

Region	From	To	Trainees	Venue
South Shan and Kayah	19-Dec-2012	22-Dec-2012	57	Taunggyi
North Shan	27-Dec-2012	30-Dec-2012	51	Lashio
East Shan	27-Dec-2012	30-Dec-2012	30	Kyaing Tong
<b>Total</b>			<b>138</b>	

The surveyors who completed the training were organized into teams. 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).

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. More details about the organization of the survey can be found in the table below.

**Table 16: Key information on the implementation of the 2013 socio-economic survey**

	North Shan	South Shan	East Shan	Kayah	Chin	Total
Start date	1-Jan-2013	24-Dec-2012	1-Jan-2013	24-Dec-2012	25-Feb-2013	24-Dec-2012
End date	15-Mar-2013	15-Mar-2013	15-Mar-2013	15-Mar-2013	15-Mar-2013	15-Mar-2013
<b>Survey teams</b>	17	16	10	3	1	47
Targeted villages	310	280	195	35	10	830
Surveyed villages	278	245	190	35	10	758
% of Villages	90%	88%	97%	100%	100%	91%
Households covered	18,296	17,031	10,401	2,144	407	48,279
Rural Population covered	98,051	82,935	54,156	11,357	2,679	249,178

### 3.5 Area estimation procedures

The poppy cultivation area estimate was based on the interpretation of satellite images. The area estimate by remote sensing methodology was carried out in South, North and East Shan State and Waingmaw township of Kachin State. In 2010, Waingmaw township of Kachin State was added to the area where the poppy cultivation estimate is performed with satellite images. Very high-resolution satellite images were purchased after a systematic random selection throughout the study area.

A total of 74 sample locations (North Shan 14, East Shan 25, South Shan 27, and Kachin 8) were selected. The number of locations was defined by the available budget and the total area to be surveyed. For Shan and Kachin State, the number of sample locations was higher than in former surveys. Since 2012, the sample location size has been 5km x 5 km. Half of the 2012 sample locations were retained for the 2013 sample, the rest was resampled using stratified random sampling (stratification with geo-strata).

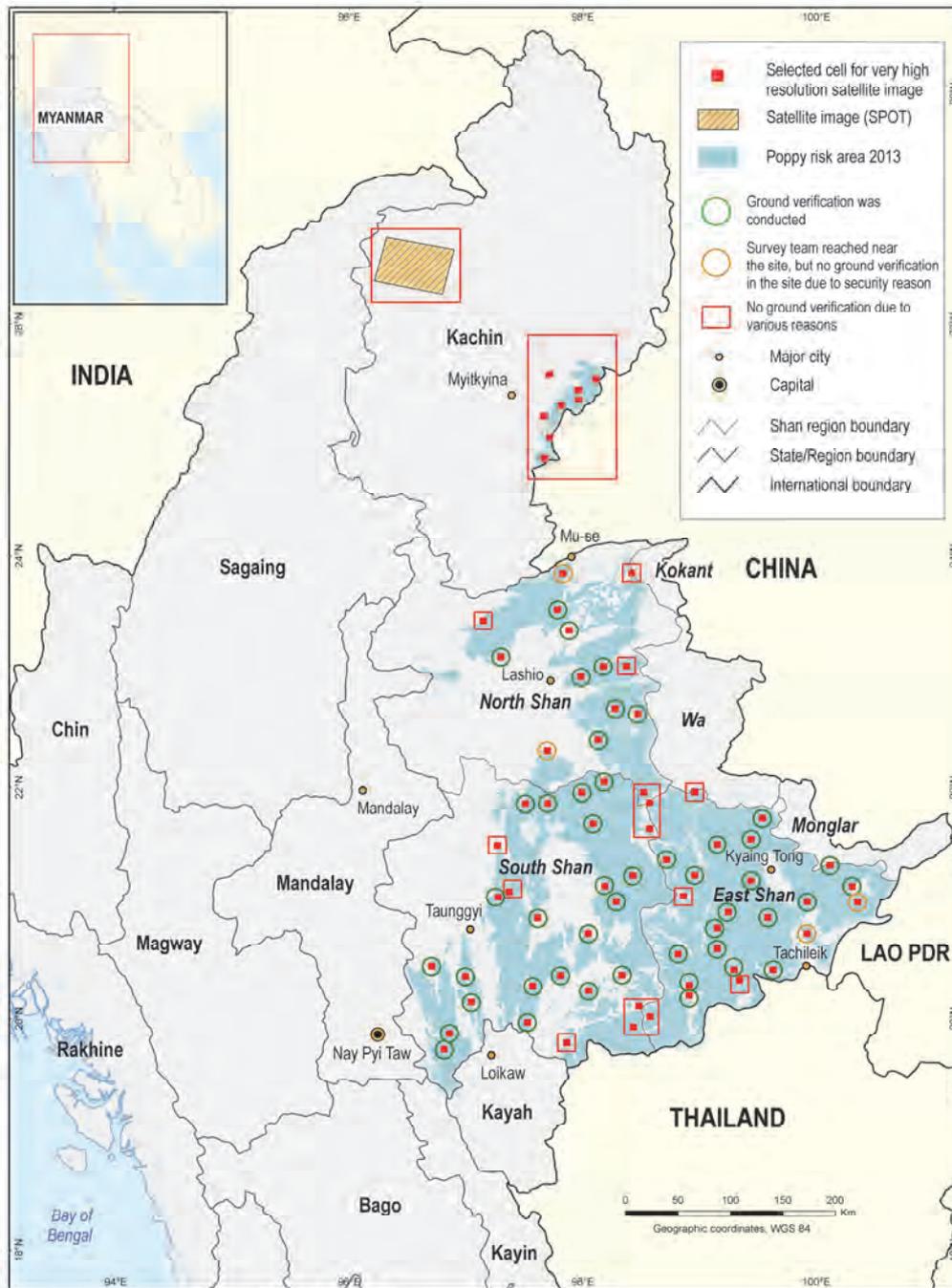
At selected locations, very high-resolution images (Geoeye with 2m resolution multi-spectral 4 bands plus one 50cm panchromatic band and WorldView-2 images with 2m resolution multi-spectral 4 bands plus one 50cm panchromatic band) were acquired. For every location, images of two different dates with a five-week interval (December/January and February/March) were purchased. Such two-date images facilitate the identification of opium poppy. The image acquisition dates take into account the regional differences of the crop calendars.

In Tanai township, Kachin State, the area estimate was based on a targeted high-resolution image. In Tanai, opium poppy cultivation was concentrated in one area that could be measured with one SPOT satellite image. A SPOT5 10m colour image was acquired to estimate that poppy area.

The northern parts of Kayah State, which were surveyed in the village survey, were not covered by satellite imagery and thus did not contribute to the 2013 area estimate.

In 2012 and 2013, attempts were made to estimate the opium poppy area in northern Chin State (Tunzang and Teddim townships) using a high-resolution image (SPOT5 5m colour). However, because of a lack of ground control information, it was not possible to estimate an area figure with sufficient certainty despite the fact that information from the field pointed to the existence of poppy fields in that area.

**Map 6: Field verification status for the survey with satellite images, 2013**



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

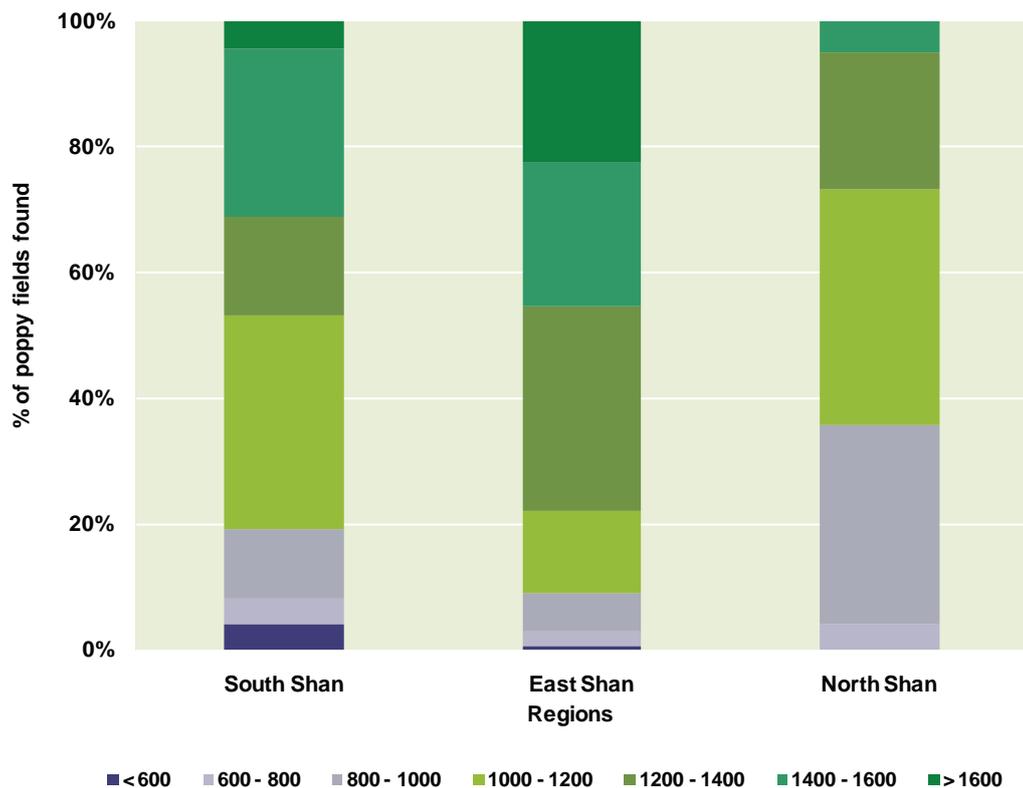
Basically, the sampling frame was developed by the combination of the following factors:

- Land cover 2011
- Altitude
- Opium poppy-free areas according to ground information.

Land cover was the first important factor in defining the sampling frame. From the 2012 survey onwards, a land cover map, which was developed by classifying 5 DMC images with 22 metre resolution, acquired in February 2011, was used. From this map, large agricultural areas were extracted and considered to be poppy-free, since the cultivation of opium poppy is practised in small agricultural areas, often surrounded by natural vegetation. Wetlands and settlements were also excluded. Some large, flat areas were excluded, since the accessibility of these areas is very difficult and there is only a small chance of finding poppy cultivation there. Other classes of land use were considered to have the potential for opium poppy cultivation.

Former surveys had revealed that 95% of opium poppy is cultivated at altitudes of 800-1800 metres. However, recent surveys indicated the existence of poppy fields at 600m altitude and above, without a specific higher limit. Consequently, the sampling frame for the selection of the sample locations was updated in 2013 using this finding.

**Figure 24: Altitude ranges of opium poppy fields found in satellite images 2012/2013 (Metres)**



Several opium poppy-free areas were identified based on information on the ground: Wa Region (S.R.2), Monglar Region (S.R.4), and Kokant Region (S.R.1) were excluded from the sampling frame. The townships Mabein, Kyaukme, Nawng cho, and Kunlon in North Shan and Kalaw, Pindaya, Yauksauk, Ywa ngan in South Shan were excluded from the sampling frame for the same reason. A 10-km buffer zone along the border with Thailand, which had been assumed to be

opium poppy-free in former surveys, was included in the 2013 sampling frame because ground information from the 2012 survey indicated a certain poppy risk.

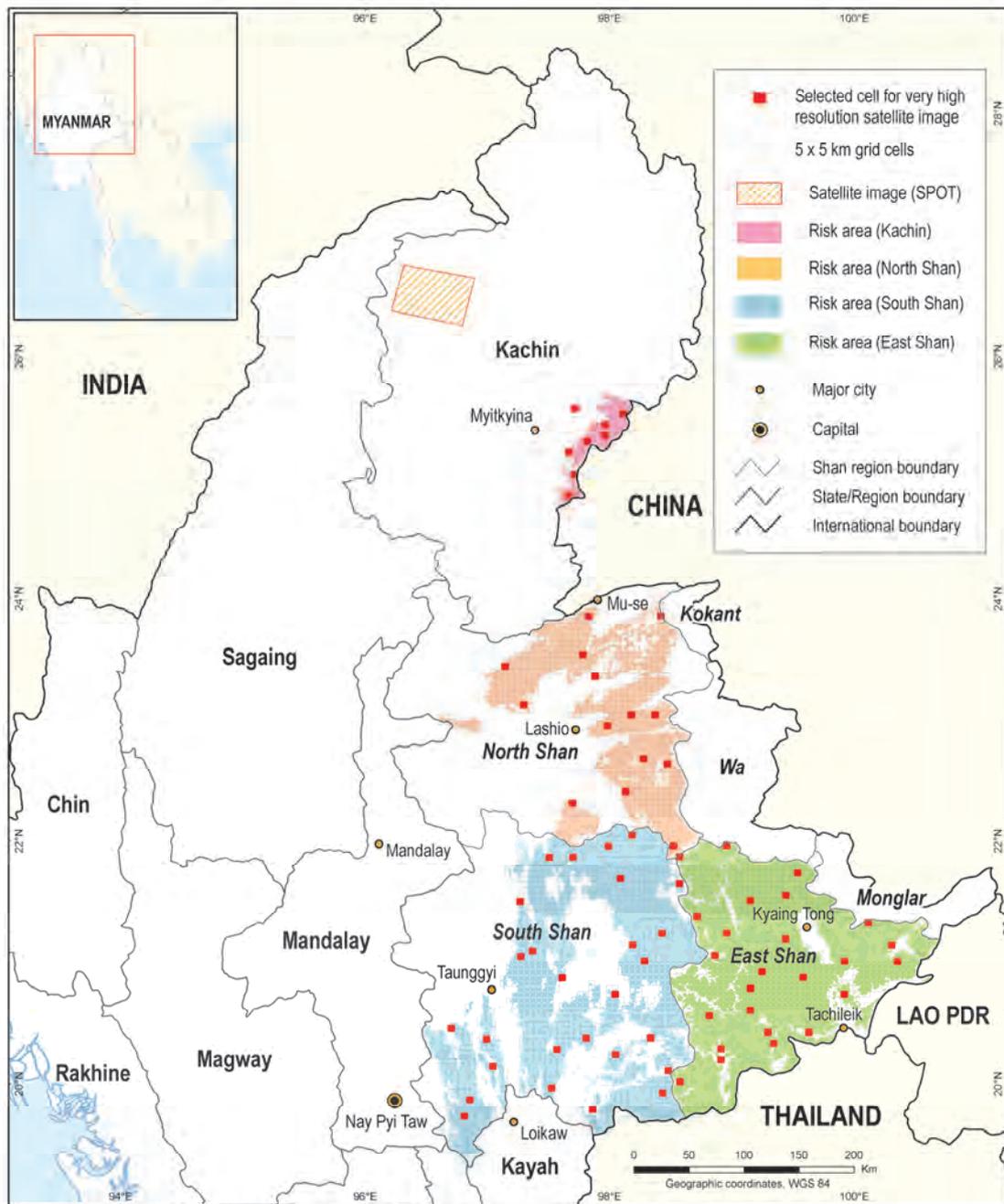
The above-mentioned factors were combined in a Geographic Information System to calculate the sampling frame. The sampling frame for Waingmaw area in Kachin State was the same as in the 2012 survey, which was developed with an altitude factor of above 800 metres.

### ***Selection of satellite image locations***

A grid with 5km by 5 km cells was placed on top of this sampling frame in order 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, i.e. the larger the risk area, the greater the number of images. Half of the locations that were sampled last year were selected again, if they matched the selection criteria. The remaining images were selected in a systematic random way within the sampling area, i.e. a random selection was made within determined clusters.

In total, 74 locations were selected out of a total 3,375 cells (27 locations in South Shan, 14 locations in North Shan, 25 locations in East Shan, and 8 locations in Waingmaw area in Kachin). Those locations represent 2.2% of the total risk area in the sampling frame. From the selected locations, 71 images were successfully acquired for both dates, and the rest were acquired for only one date.

**Map 7: Sampling frame area and satellite image locations in Myanmar, 2013**

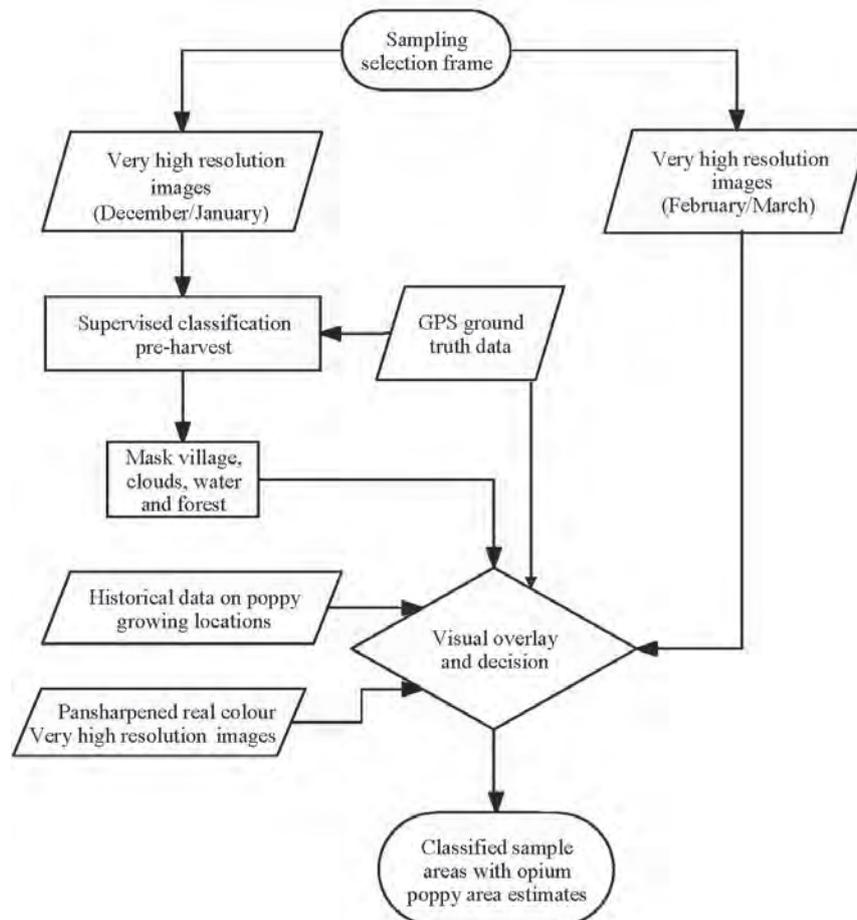


Source: Government of Myanmar - National Monitoring System supported by UNODC  
 The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

### Satellite image processing

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

**Figure 25: Flow chart of satellite image processing steps in Shan state and Kachin (Waingwaw township)**



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, scrubs, 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, accuracy and precision of the result vary with the experience and the skills of those doing the interpretation. 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 about 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, 3D terrain visualization and real colour pansharpened (very high-resolution images) visualization were used to facilitate the 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, East Shan, South Shan, 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 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 2013 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.

**Table 17: Area estimates with 95% confidence interval, 2013 (Hectares)**

Region	Area estimate	Lowest estimate	Upper estimate
East Shan State	18,400	9,700	27,000
North Shan State	8,300	4,600	12,000
South Shan State	26,600	19,100	34,100
Kachin	4,600	3,000	6,100
<b>Total</b>	<b>57,800</b>	<b>45,700</b>	<b>69,900</b>

### **Opium poppy cultivation status by township**

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

Table 18: Poppy-growing status in 2013, by township and source

Region	Township	In Satellite image location	During the socio-economic survey	Eradication campaign
East Shan	Kyaing tong	√	√	√
	Mong hkat	√	√	-
	Mong hpyat	√	√	√
	Mong pyin	√	√	√
	Mong sat	√	√	√
	Mong tong	√	√	-
	Mong yawng	√	-	-
	Metmang	√	√	-
	Tachileik	√	√	√
		<b>Sub-total</b>	<b>9</b>	<b>8</b>
North Shan	Kunlon	-	-	-
	Kutkai	√	√	√
	Kyaukme	-	-	√
	Lashio	√	√	√
	Mong yai	√	√	√
	Manton	√	√	√
	Momeik	-	-	-
	Muse	-	-	√
	Nam hkam	√	√	√
	Nam hsan	-	-	-
	Namtu	-	-	-
	Tang yang	√	√	√
	Theinne	-	-	√
	Thibaw	√	-	-
		<b>Sub-total</b>	<b>7</b>	<b>6</b>
South Shan	Kalaw	-	-	√
	Hopong	√	√	√
	Hsi hseng	-	√	√
	Kye thi	√	√	√
	Kun heing	√	√	√
	Lai hka	-	√	√
	Loilem	√	√	√
	Lin khay	√	√	√
	Mong kung	√	√	√
	Mong pan	√	√	√
Mong shu	√	√	√	

	Mawkmai	√	√	√
	Monae	√	√	√
	Nam sang	√	-	√
	Nyaungshwe	√	-	√
	Pekon	√	√	√
	Pinlaung	√	√	√
	Taunggyi	√	-	√
	<b>Sub-total</b>	<b>15</b>	<b>14</b>	<b>18</b>
Kachin	Waingmaw	√	-	√
	Tanai	√	-	√
	<b>Sub-total</b>	<b>2</b>	<b>-</b>	<b>2</b>
Kayah	Demawso	-	√	√
	Hpruso	-	√	√
	Loikaw	-	√	√
	<b>Sub-total</b>	<b>-</b>	<b>3</b>	<b>3</b>
Chin	Tunzang	-	-	√
	<b>Sub-total</b>	<b>-</b>	<b>-</b>	<b>1</b>
	<b>Total</b>	<b>33</b>	<b>31</b>	<b>38</b>

### ***Information on opium poppy cultivation in Kokang Region (S.R.1), Wa Region (S.R.2) and Monglar Region (S.R.4)***

Two dedicated teams both led by UNODC national staff members conducted a rapid assessment survey in Kokang, Wa, and Monglar Regions.

#### ***Kokant Region***

Kokant Region has been opium poppy free since 2003. An assessment survey was conducted by a dedicated team, led by UNODC staff in collaboration with local anti-narcotic task force members, to certify the poppy-free status of the region. The survey was carried out from 7 to 9 January 2013. The team visited Kyasishu, Tar Shwe Htan, Shauk Kaing, Chin Saik Htan and Shauk Pin Kaing villages in Laukkai, and Kon Gyan townships. The survey indicated no evidence of poppy cultivation in this region.

#### ***Wa Region***

Wa Region has been opium poppy free since 2005. A dedicated team led by UNODC national staff worked in coordination with local authorities to conduct a rapid assessment survey in this region. The survey was conducted from 4 to 12 March 2013. The team visited Mong Pawk, Pang Kham, Nam Kham Woo, Ai Chan, Mong Maw, Yin Phang, Ka Laung Pha, Long Tang, Kun Ma, Nam Tip, Nar Wee, Man Tun, Man Man Sein, Weing Kao, Hotao and Mong Phan townships in the region. The survey indicated no evidence of opium poppy cultivation in this region.

#### ***Monglar Region***

A rapid assessment survey was also conducted in Monglar Region (S.R.4) to certify its opium poppy-free status. The survey was carried out from 27 February to 3 March 2013. The survey team visited Nam Pang, Sam Touk and Si Lu areas. The survey indicated no evidence of poppy cultivation in this region, which has been opium free since 1997.

## Opium yield and production

### *Estimating potential opium yield*

For estimating potential opium yield, a relationship between poppy capsule volume per square metre and dry opium yield is used. The relationship is based on extensive field research and is described as

$$Y = 1.89 + 0.0412VC,$$

where  $Y$  is dry opium weight (kg/ha) and  $VC$  is the mature capsule volume ( $\text{cm}^3/\text{m}^2$ ).

The yield data collection follows the *UNODC Guidelines for Yield Assessment*.<sup>12</sup> In Myanmar, Surveyors select mature fields close to villages selected for the village survey and are instructed to visit a good, an average and a bad field. Field selection is also subject to security.

Once a field is selected, a transect is drawn through the field, along which three one-metre square plots are selected. In each plot, the numbers of flower buds, flowers, immature capsules and mature capsules that are expected to yield opium are counted, and the diameter and height of 10 to 15 opium-yielding capsules are measured with a calliper. All data is entered in data sheets for later analysis.

For the Myanmar survey in 2013, the capsule volume per square metre was calculated with these data and entered into the formula for the yield calculation. Each plot thus provided one yield observation. The simple average of the three plots in a field was the field yield. The regional yield was calculated as the simple average of all fields in a region. A range was calculated to express the uncertainty of the yield estimate due to sampling with the 95% confidence interval. It has to be noted that, due to circumstances in the field, a certain proportion of fields was chosen in a non-random, opportunistic way.

**Table 19 Regional potential opium yield values with 95% confidence intervals, 2013 (Kilograms per hectare)**

Region	Best estimate	Lower limit	Upper limit
East Shan	18.4	17.2	19.7
North Shan	12.5	9.6	15.4
South Shan	13.4	10.9	15.9

### *Data quality*

In 2013, UNODC undertook extensive data quality checks on the Myanmar yield data, based on experience gained in the Afghanistan opium surveys<sup>13</sup> and the application of a similar set of statistical data quality checks.

The data quality assessment started with basic tests for consistency. In addition to that, three more tests for identifying data of poor quality were used. The first test aimed at identifying surveyors that did not follow the yield protocol correctly. This protocol requires surveyors to start by measuring all the mature capsules of a “typical” poppy plant in a plot. If such a plant has less than 10 capsules, all the mature capsules of a second plant are also measured. This process is continued until at least 10 mature capsules have been measured, a procedure that ensures capturing the variability in capsule volumes.

The measurements of several surveyors in 2013 showed little variation in capsule volumes, which indicated that it was unlikely that those surveyors had followed the yield protocol with the required level of detail. Such data was excluded from the sample.

The second test aimed at identifying data recording and data entry problems. Poppy capsules are usually larger than 10 mm in both height (h) and width (w), and are measured with digital callipers

<sup>12</sup> UNODC Guidelines for yield assessment of opium gum and coca leaf from brief field visits, UN New York, 2001, ST/NAR/33.

<sup>13</sup> See MCN/UNODC *Afghanistan Opium Survey 2012*, May 2013, page 82.

showing two digits after the decimal point. Comprising of a total of eight digits (hh.hh and ww.ww), it is unlikely that the height and width measurements of two capsule measurements result in identical values, so an unusually large proportion of duplicate values in a dataset indicates data quality problems. Consequently, if the proportion of duplicated capsule measurements per village exceeded a certain threshold, all the data from that particular village were excluded.

The third test aimed at measuring the thoroughness of surveyors. Doubts had arisen about how rigorous surveyors were when recording measured values, so this test identified villages in which surveyors did not work with the necessary rigour. Data from villages that failed this test were excluded.

Only consistent data that passed all three tests were considered reliable and used for the yield calculations. Based on the tests, only data from 267 villages (42% of total villages visited) was used for the calculations (see table below).

**Table 20 Number of villages and fields visited and percentage of accepted data in parenthesis, 2013**

	East Shan	Kayah	North Shan	South Shan	Total
# Villages	91 (73%)	2 (0%)	73 (33%)	101 (21%)	267 (42%)
# Fields	236 (65%)	6 (0%)	166 (25%)	269 (33%)	677 (33%)

### ***Estimating opium production***

Opium production was calculated by the estimated regional area under opium cultivation being multiplied by the corresponding regional opium yield. As no fields from Kayah State passed the quality tests, the average yield for Shan State was used to estimate opium production in Kayah. All opium estimates in this report are expressed in oven-dry opium equivalent, i.e. the opium is assumed to contain 0% moisture. The same figure expressed in air-dry opium, i.e. opium under “normal” conditions as traded, would be higher as such air-dry opium contains some moisture.

The uncertainties of the opium production estimate due to sampling for the area under poppy cultivation and yield are calculated by using standard formulae for error propagation.

### **Estimating the number of households involved in poppy cultivation or growing poppy**

#### ***Defining household involvement in poppy cultivation***

In the 2012 survey, two kinds of poppy cultivation of household involvement were asked for: "households growing poppy" and "households earning from poppy growing". These categories were meant to capture the difference between households managing poppy fields and wage labour on poppy fields. However, some households could have chosen to grow poppy on their own land and in addition to that work on poppy fields of other farmers as wage labourers. From the data available, it was not possible to determine what proportion of households fell into this third category which may have led to some double counting.

The 2013 survey avoided double counting by introducing three mutually exclusive categories of household involvement in poppy cultivation into the questionnaire:

1. Households growing their own poppy but not earning income from labour in poppy fields run by others
2. Households earning income from labour in poppy fields run by others but not growing their own poppy
3. Households growing their own poppy and earning income from labour in poppy fields run by others

In addition, reports from the field indicated the existence of a fourth type of involvement, so-called communal poppy farming whereby the village community operates a poppy field to achieve income for a community purpose. In that case, households would work on a poppy field without receiving a payment. However, as communal poppy farming would not generate income at the

household level, it was not included in the household-involvement typology. The 2013 survey results indicated that only a very small proportion of poppy fields fell into the category of communal poppy cultivation.

### **Average poppy area per household**

The estimated number of households involved in the cultivation of opium poppy is derived as a ratio of the estimated area under cultivation divided by the average area cultivated per household. The average area cultivated per household is calculated by dividing the area under poppy cultivation reported by headmen during the village survey interview by the number of “households involved in poppy cultivation”. As seen above, in 2012 this number included all households whether they ran their own poppy fields or worked on other people’s fields, with the potential risk of having double counted some. Because of this potential double counting, the estimate of 0.26 ha poppy per household involved in poppy cultivation could be an underestimate and the resulting national estimate of households involved in poppy cultivation an over estimate.

The 2013 avoided double counting households involved in poppy cultivation. In addition, it was possible to estimate the number of households growing poppy, which is an indicator also used in other illicit crops surveys in other countries. The number of households growing poppy includes all households running their own poppy fields, whether or not they chose to do wage labour in other people’s field, additionally (categories 1 and 2 in above typology). As the number of households growing poppy is smaller than the number of households involved in poppy cultivation (including wage labour on poppy fields), the average poppy area per households is larger. The household estimate for 2013 takes into account the fact that a very small proportion of cultivation was not run by individual households. However, the data for 2012 does not allow for the corresponding adjustment to be made for the 2012 estimate.

In the context of understanding the distribution of land by crop, the average poppy area per household in poppy-growing villages is calculated by dividing the poppy area reported by headmen by the reported number of all households in the village.

**Table 21: Poppy households by type of involvement and average poppy area cultivated, 2013**

	<b>Number of households (rounded)</b>	<b>Poppy area per household (ha)</b>
Category 1 and 2: Households growing poppy (including those doing additional wage poppy-related labour)	130,000	0.43
Categories 1, 2 and 3: Households involved in poppy cultivation	190,000	0.30
All households in poppy-growing villages		0.22

In previous surveys, an area estimate of 0.17 ha of poppy per households was used to calculate the number of households involved in poppy cultivation. This figure was based on actual measurements of poppy fields indicating average fields sizes of 0.14 ha in 2002 and 0.10 ha in 2003, with adjustments made to account for the fact that, on average, households reported the cultivation of more than one poppy field.<sup>14</sup> It is not clear why the poppy area per household estimates derived from the 2012 and 2013 surveys differ so much from 2002/2003 figures. It should be noted that the methodology for the 2002/2003 estimate was fundamentally different. It is not known how accurate the headmen estimates of poppy and households involved in poppy cultivation used for the 2012 and 2013 estimates are. Area estimates “by eye” without proper surveying instruments are bound to have large margins of error.

<sup>14</sup> GOUN/UNODC Myanmar Opium Survey Report 2002 and 2003.





**UNODC**

United Nations Office on Drugs and Crime

**Regional Office for Southeast Asia and the Pacific**

United Nations Building, 3<sup>rd</sup> floor B Block, Secretariat Building, Raj Damnern Nok Avenue, Bangkok 10200, Thailand

Tel. (66-2) 288-2091 Fax. (66-2) 281-2129 E-mail: [fo.thailand@unodc.org](mailto:fo.thailand@unodc.org)

Website: <http://www.unodc.org/southeastasiaandpacific>