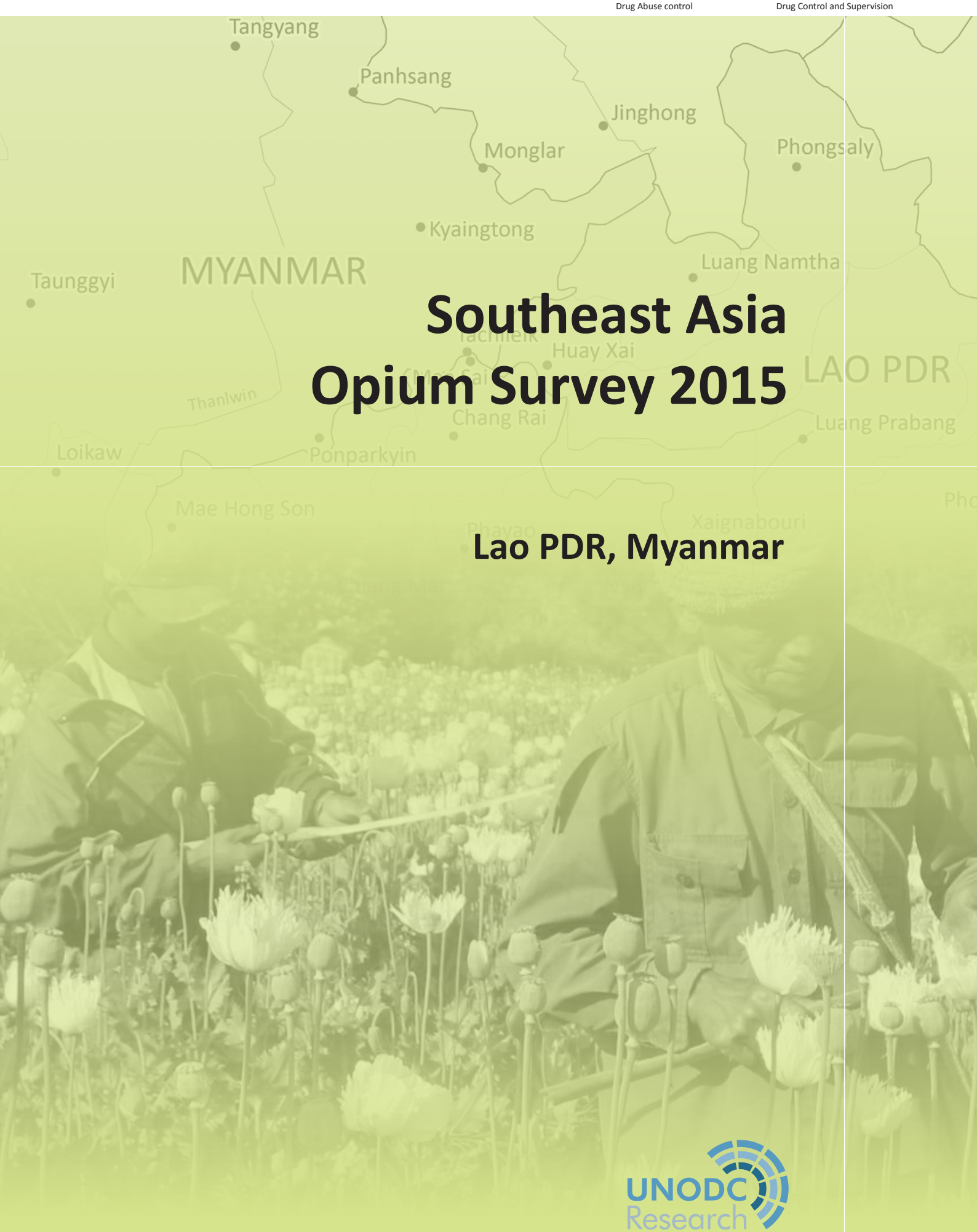
UNODC
United Nations Office on Drugs and Crime

Central Committee for Drug Abuse control

Lao National Commission for Drug Control and Supervision

Southeast Asia Opium Survey 2015

Lao PDR, Myanmar



UNODC Research

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. UNODC's Illicit Crop Monitoring Programming (ICMP) promotes the development and maintenance of a global network of illicit crop monitoring systems.

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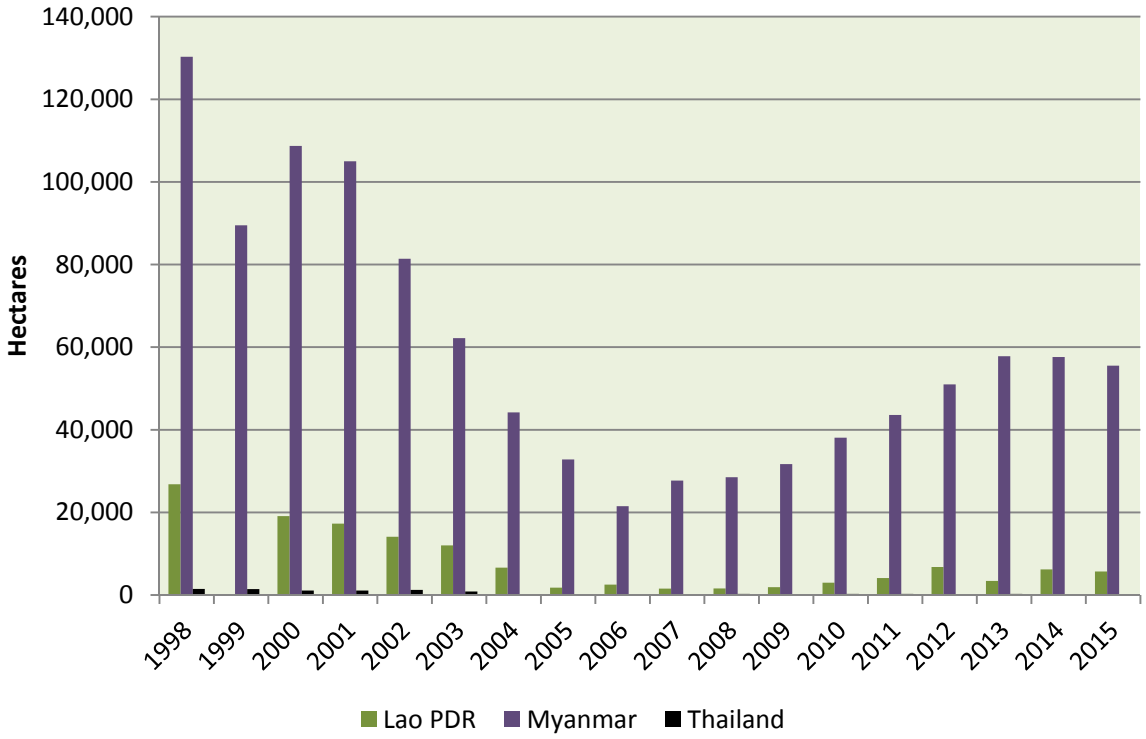
PART 1. EXECUTIVE SUMMARY AND THE WAY FORWARD

1. Executive summary

In order to assess the scope of opium poppy cultivation and opium production in Southeast Asia, UNODC has been conducting opium surveys in cooperation with the Government of Lao People's Democratic Republic (Lao PDR) since 1992, and the Government of the Republic of the Union of Myanmar (GOUM) since 2002. Although Thailand has established its own monitoring system, no data on cultivation and production in Thailand were available for 2015. Consequently, this report contains the results of the 2015 UNODC-supported opium poppy cultivation surveys in Lao PDR and Myanmar. Given the great disparity in the extent of cultivation and production of illicit opium between those two countries, however, Myanmar figures more prominently than Lao PDR in this report.

Stable with respect to 2014, the total area under opium poppy cultivation in Myanmar in 2015 was 55,500 hectares. This figure represents the third year of stabilization in the area under opium poppy cultivation after consecutive year-on-year increases since the low of 21,600 hectares in 2006. The total area under opium cultivation in Lao PDR, which was mainly located in Phongsali province, was also estimated to be stable in 2015. Although significant, at 5,700 hectares it was only roughly a tenth of the size of the area under opium cultivation in Myanmar,

Opium poppy cultivation in Southeast Asia, 1998-2015 (Hectares)



Source: Lao PDR/Myanmar: National monitoring system supported by UNODC; Thailand: Thai Office of the Narcotics Control Board.
Note: Data for Thailand were not available for 2014 and 2015.

Just as cultivation of opium has remained stable in Myanmar so have yields per hectare and opium production (647 tons). Yet despite the stability of opium production, the price of fresh farm-gate opium in Myanmar dropped by an average of more than a third (34%) in 2015, while the average retail/wholesale price of raw opium in Lao PDR increased by 7 % from its 2014 price. In Lao PDR, opium yields were higher in 2014 and 2015 than in the previous years, resulting in an

estimated total opium production of 84-176 tons, which is not comparable to the 2014 total because of the large range in the estimate.

Reasons for the drop in the price of fresh opium in Myanmar are unclear. Prices may differ depending on the ease of transportation and size of supply, reflecting local supply and demand, and while the decrease in poppy prices and subsequent income reductions have been observed in all states of Myanmar, some have been more affected than others. However, as the size of the total area under poppy cultivation remained stable at the national level, this suggests that farmers made decisions about opium cultivation in 2015 based on the previous year's crop prices and, even though 2014 prices also dropped, opium poppy was still perceived to be a viable source of income, at least for some farmers.

In contrast to fresh opium prices, inflation-adjusted dry opium prices have actually remained relatively stable in Myanmar. Dry opium can be stored by farmers to be sold when prices recover, but it is also traded by other protagonists in the value chain with greater bargaining power than farmers. Indeed, the drop in the fresh opium price may be related to a local restructuring of the poppy trade in Myanmar, which could lead to individual farmers losing their bargaining power if the market were to become more dominated by large traders. UNODC does not currently collect data related to local trade relationships for analysing this kind of conjecture, but a restructuring of the opium market has been informally observed by UNODC field staff in Myanmar.

The cultivation of opium poppy is associated with difficult living conditions, number of infants who died last month, households in debt and poor accessibility to market. Poppy-growing villages also have fewer alternative sources of income and receive less external agricultural assistance than non-poppy-growing villages. This is underlined by the fact that many poppy-growing farmers seem to be primarily covering subsistence needs with poppy income. Almost all village headmen (94%) interviewed in poppy-growing villages during the 2015 Myanmar village survey stated that villagers use income from opium for purchasing food more than for any other reason. Rice deficit also decreased to a greater extent in poppy-growing villages than in non-poppy-growing villages, which reinforces this implication (21% decrease in poppy-growing villages, versus 14% in non-poppy-growing villages).

Opium poppy is not only cultivated by farmers in Myanmar because it provides a means of subsistence in the face of poverty, but also because it can do so relatively quickly. The most cited advantage of growing opium poppy in 2015 was that opium provides "income in a short period of time", which means that prospective alternative sources of income would need to be able to compete with opium both in terms of its capacity and speed to provide competitive levels of income. It is unlikely that a single crop would be able compete with opium poppy on both of those fronts, but a combination of agricultural and non-agricultural alternative development opportunities may be able to do so. Indeed, such are the economic benefits of opium cultivation to farmers that their reasons for decreasing or ceasing the cultivation of opium poppy in Myanmar are mostly related to situations in which the potential income from opium poppy is under threat, such as poor yields due to unstable climatic conditions, as well as opium pests and diseases.

Yet opium-growing farmers also seem to be sensitive to external pressure. Roughly one in five village headmen (18%) reported that farmers reduced poppy growing in 2015 because local authorities had forbidden it, while the main reason for actually ceasing opium poppy cultivation was prohibition by local authorities (an average of 56% across all states). In some areas, such as North Shan, prohibition by insurgent groups also led to one in five opium-growing farmers (19%) ceasing the cultivation of opium. The vulnerability of opium-growing farmers to external pressure of this nature underlines the need for alternative sources of income to be in place as a contingency to help avoid food insecurity situations and potential future social conflicts.

As the income of the small group of farmers who ceased cultivating poppy in 2015 subsequently decreased, it seems that to compensate some of those farmers (44%) increased the area of land under the cultivation of other crops. While this further highlights how the economic benefits of cultivating opium poppy, it may also lead to adverse environmental consequences, depending on the type of land use employed for alternative types of cultivation, although further analysis is required to confirm this and other related issues.

Despite the clear link between the cultivation of opium poppy and poverty, it is not only the poorest (subsistence) farmers that cultivate poppy. The ratio of livestock per household and the number of households with land property rights in Myanmar in 2015 increased from the previous year to a greater extent in poppy-growing villages than in non-poppy-growing villages. Income from the cultivation of opium poppy may therefore be used for capital accumulation by some households in poppy-growing villages, although current data do not allow differentiation between different groups.

Moreover, the fact that a high rice deficit in village households decreases the probability of growing poppy may imply that, in some cases, farmers in the very poorest villages are less likely to start poppy cultivation, possibly because of a lack of economic resources necessary for the initial investment in this activity. As such, opium poppy plays a dual role as a source of income for subsistence (although economic resources are needed as an initial source of investment) and also as capital accumulation for the relatively better off.

Whatever the case, as the evidence suggests that an improvement in the living conditions of farmers reduces the probability of the occurrence of poppy cultivation, it is clear that alternative development strategies need to be focused primarily in that direction. Reductions in inequality, the empowerment of farmers and the capacity to address the indirect environmental impacts of poppy growing will hopefully follow.

2. The way forward

Although opium cultivation in both Lao PDR and Myanmar has stabilized, there is still much work to be done to address the underlying causes of illicit cultivation. Sustainable results in reducing illicit cultivation can only be achieved when the socio-economic conditions of communities and the livelihoods of rural households have been improved. Policies undertaken to obtain a sustainable reduction in illicit cultivation should therefore be assessed in terms of the eradication of extreme poverty, in terms of human development, gender equality and women's empowerment, and in terms of environmental sustainability.

The analysis presented in this report shows that the cultivation of opium poppy is associated with a complex combination of factors related to the difficult living conditions of farmers, such as lack of food, number of infants who died last month, households in debt, lack of property rights, and the presence of insurgent activity. A multidimensional approach is required to address these factors, which focuses on improving land governance, strengthening the justice and security sector, promoting human development and protecting the environment.[1] The Sustainable Development Goals, as recently adopted in the 2030 Agenda for Sustainable Development, can provide the framework for developing such initiatives in Lao PDR and Myanmar.

Alternative development initiatives in Myanmar and Lao PDR need to increase and diversify farmers' income, to provide better access to market by improving the infrastructure, and to enhance educational facilities and other basic needs such as access to potable water and

[1] These are described in the United Nations Guiding Principles on Alternative Development.

sanitation. Improving farmers' living conditions and market participation are strategies that would pay off, not only by reducing poppy cultivation but also in terms of increased social and economic inclusion in impoverished areas.

One major coping strategy reported by farmers in Myanmar after ceasing poppy cultivation is to increase the area under the cultivation of other crops, although this may lead to increased land pressure and accelerated soil degradation. This underlines the importance of continuing to develop new alternative development approaches to environmental conservation and protection and the need to embed alternative development programmes into broader sustainable development and environmental policies.

Given that large numbers of households continue to be involved in the cultivation of opium poppy in Southeast Asia, efforts need to be strengthened to institute land tenure and land titling programmes so that households can begin broadening their livelihood and socio-economic opportunities and move beyond the need for food security. Moreover, opium poppy eradication activities need to be aligned with development programmes in order to become more effective and to avoid any negative impact on food security and support provided by local communities.

More in-depth research by means of the socio-economic village survey used in this study has resulted in better insights into the circumstances faced by farmers in the opium poppy-growing areas of Myanmar. Yet the analysis also shows that there are still plenty of unknown issues. Initiatives to provide sustainable livelihood alternatives require in-depth and integrated analysis of local situations to help understand the challenges from an environmental and socio-economic point of view, including the link between drug production and local conflicts. UNODC has a rich database of village surveys that can be further exploited for systematically researching some of the topics explored in this report.

PART 2. LAO PDR

Abbreviations

LCDC	Lao National Commission for Drug Control and Supervision
ICMP	Illicit Crop Monitoring Programme
SASS	Statistics and Surveys Section

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The Lao PDR Opium Survey 2015 was prepared with the Research and Trend Analysis Branch (RAB), Division for Policy Analysis and Public Affairs (DPA), United Nations Office on Drugs and Crime, under the supervision of Jean-Luc Lemahieu, Director of DPA, and Angela Me, Chief of RAB. Field supervision was undertaken by Jeremy Douglas, Regional Representative, Southeast Asia and the Pacific.

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FACT SHEET – LAO PDR OPIUM SURVEY 2015

	2014	2015	Change 2014 - 2015
Opium poppy cultivation[2] (hectares)	6,200 ha (3,500 to 9,000)	5,700 ha (3,900 to 7,600)	-8% (stable)[3]
Average dry opium yield (kilograms per hectare)	14.7 kg/ha	14.7 to 30.6 kg/ha	Not comparable[4]
Potential production of dry opium	92 tons (51 to 133)	84 to 176 tons	Not comparable
Average retail/wholesale price of raw opium[5] (United States dollars per kilogram)	$1,855/kg	$1,980/kg	+7%
Eradication[6] (hectares)	Not reported	809	N/A

[2] Range refers to the 95% confidence interval of the estimate.

[3] The difference of 500 hectares or 8% between the 2014 and 2015 estimates is well within the range of statistical uncertainty. Therefore the situation in 2015 is described as stable.

[4] In 2014 and 2015, yield data were collected in a limited number of fields that were selected by "opportunistic" selection. Since the surveys were not statistically representative, yield and production were estimated based on both years' results. Data collected in future years will be used to update the yield figures accordingly.

[5] 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.

[6] Source: LCDC. Eradication campaigns were conducted during and after the survey. For 2014, no eradication data were reported.

1. Introduction

This report presents the results of the Lao People's Democratic Republic (Lao PDR) opium survey 2015. The survey has been conducted annually by the Lao National Commission for Drug Control and Supervision (LCDC) and UNODC since 1999.[7]

In 1999, the Government of Lao PDR 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 opium poppy cultivation and the number of opium users in the country (by 94% and 81%, respectively) in February 2006.

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

Since 2005, the UNODC Illicit Crop Monitoring Programme (ICMP) has based its opium poppy estimates for the country on observations made via a helicopter survey. Due to the increasing number and size of opium poppy fields, satellite images were added to the survey in 2012 and very high-resolution images have been acquired for all locations since 2014.

From 2005 to 2009, the survey covered six provinces of northern Lao PDR where opium poppy cultivation had taken place. From 2010 to 2012, observations were only focused on Phongsali, Houaphan, Louang Namtha and Xiangkhoang provinces, where most opium was cultivated, but in 2013 the survey was extended again to six provinces, covering Phongsali, Houaphan, Louang Namtha, Louangphrabang, Xiangkhoang and Oudomxai. In 2014, following reports of opium poppy cultivation, the provinces of Bokeo and Xaignabouri were added, but no poppy was found in Xaignabouri. This province was therefore excluded from the 2015 survey and a total of seven provinces were surveyed.

The 2015 opium poppy survey was implemented by UNODC in coordination with Lao National Commission for Drug Control and Supervision (LCDC). The area under cultivation was estimated with data collected through helicopter flights and from satellite images, which both covered the same sites. The sites were randomly selected utilizing a probabilistic sample design. The risk area used for selecting the images was updated with a spatial modelling approach. All observations, helicopter photos, GPS data and satellite images were analysed in UNODC offices. Furthermore, a yield survey was conducted.

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 and substantially increase support to alternative development programmes in Lao PDR. 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 poppy.

[7] 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 then annually from 2000 to 2004. In 2005, the methodology was changed to a helicopter-based survey.

2. Findings

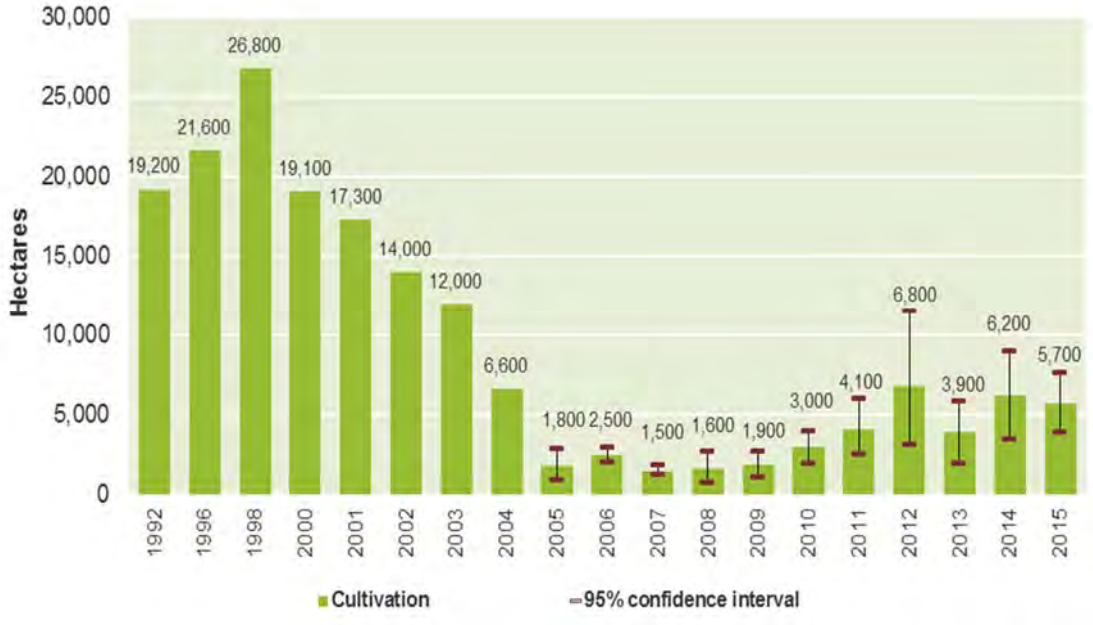
2.1. Estimated area under opium poppy cultivation

The total area under opium poppy cultivation in Lao PDR in 2015 was estimated to be 5,700 hectares, with a 95% confidence interval of 3,900 to 7,600 hectares.

Opium poppy cultivation was confirmed in seven provinces located in northern Lao PDR: Phongsali, Houaphan, Louang Namtha, Louangphrabang, Oudomxai, Bokeo and Xiangkhoang. In 2014, the province of Xaignabouri was included in the survey but omitted in 2015.

In 2014, the area under opium cultivation was estimated to be 6,200 hectares. As the difference of 500 hectares, or 8%, between the 2014 and 2015 estimates is well within the range of statistical uncertainty, the situation in 2015 can be described as stable.

Figure 1: Estimated area under opium poppy cultivation in Lao PDR (Hectares), 1992-2015



Sources: 1990-1991, 1993-1995: US Department of State; 1992, 1996-1999: UNODC; since 2000: National Illicit Crop Monitoring System supported by UNODC.

Risk area and survey approach

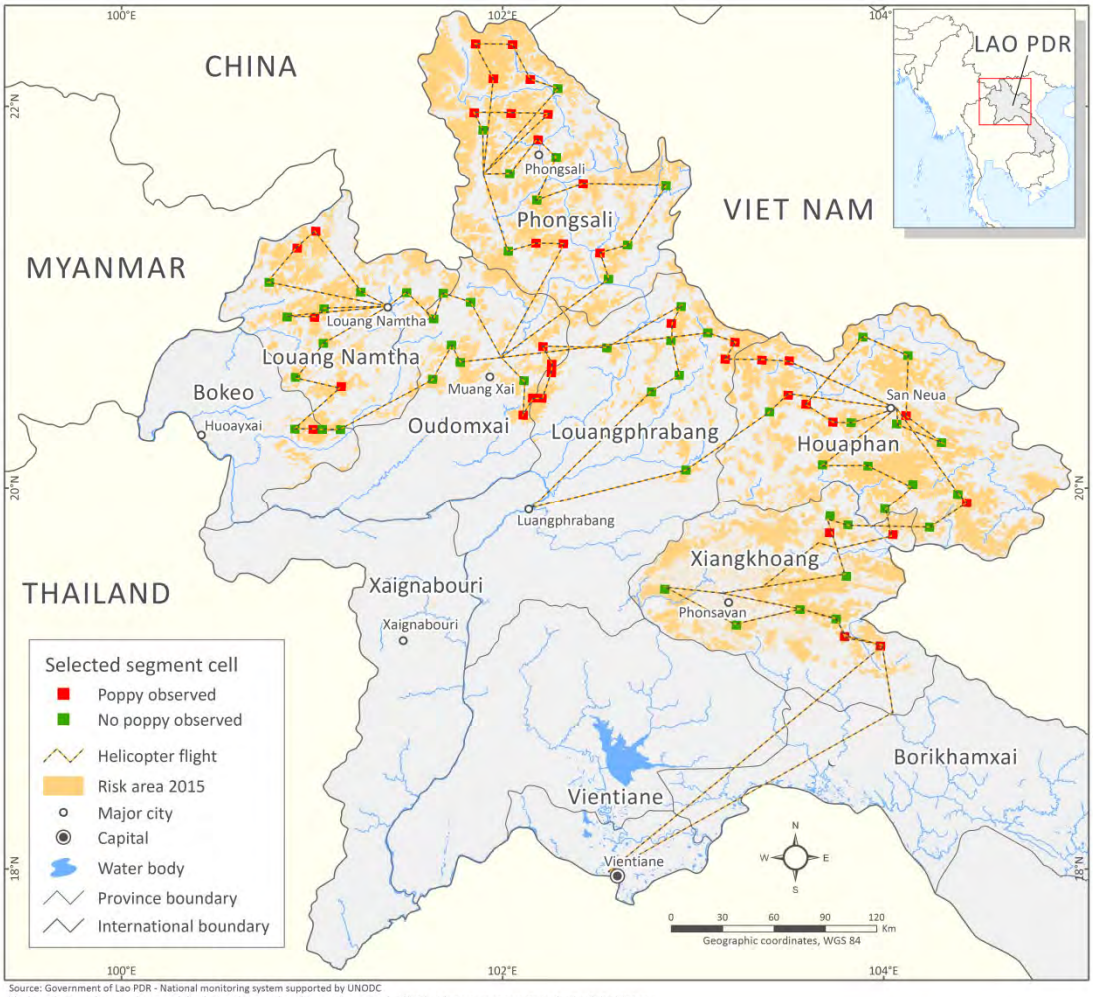
The risk area describes the geographical area considered in the area survey. It is defined based upon reports from the field on poppy cultivation, as well as results from previous surveys. The sampling frame is the set of all 5 km x 5 km segments that can be chosen randomly for obtaining satellite imagery. For this purpose a 5 km x 5 km regular grid is superimposed on the risk area.

In 2015, the estimated area under opium poppy cultivation in Lao PDR was calculated based on a sampling frame that included potential areas for opium poppy cultivation in seven provinces: Bokeo, Houaphan, Louang Namtha, Louangphrabang, Oudomxai, Phongsali and Xiangkhoang. Taking into account the results of previous surveys as well as information from the Government and UNODC projects, it can be assumed that opium poppy cultivation outside this risk area was negligible. The results presented here only refer to this risk area and do not include potential opium poppy cultivation outside its limits.

The area under cultivation was estimated by using a sampling approach in which 89 segments each measuring 5 km x 5 km, spread around the risk areas in the seven provinces, were selected. The 89 sampled areas in all the opium poppy-growing provinces were visited by helicopter and

analysed with very detailed satellite images. Additional GPS data and photographs were taken as ground truth data for the posterior satellite image interpretations. The precision of the estimates improved thanks to some changes in the methodology, which is reflected in the narrowed confidence intervals. Opium poppy fields were found in 51 of the 89 randomly targeted segments.

Map 1: Selected segments with satellite images and helicopter visits, northern Lao PDR, 2015



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.

Provincial estimates

The segment sampling method used in 2015 allowed the area under cultivation at the provincial level to be estimated. Even though the number of samples per province was low, it provides valuable indication of the situation at the provincial level, which enables the Government of Lao PDR to prioritize its policy; for example, on alternative development and law enforcement.

The vast majority (72%) of opium poppy cultivation in 2015 was concentrated in the provinces of Phongsali and Houaphan. At 3,250 hectares and accounting for 57% of national opium poppy cultivation, the largest share was estimated in Phongsali, while 830 hectares of opium poppy cultivation (15% of national opium cultivation) was estimated in Houaphan.

Table 1: Opium poppy cultivation, by province, Lao PDR, 2015 (Hectares)

Province	Area	Percentage of national opium poppy cultivation (rounded)
Phongsali	3,250 ha (1,840 to 4,630)	57%
Houaphan	830 ha (460 to 1,370)	15%
Louangphrabang	490 ha (270 to 750)	8%
Xiangkhoang	470 ha (180 to 890)	8%
Oudomxai	420 ha (110 to 840)	7%
Louang Namtha	180 ha (120 to 340)	3%
Bokeo	110 ha (40 to 220)	2%
National estimate (rounded)	**5,700 ha (3,900 to 7,600)**	**100%**

2.2. Opium poppy yield and production

In 2015, opium poppy production in Lao PDR was estimated to be between 84 and 176 tons. These results are not directly comparable with the 92 tons estimated in 2014 but the estimated confidence interval (51 tons to 133 tons) largely overlaps with the estimated interval for 2015.

It was not possible to implement a yield study in Lao PDR for several years (2008 to 2013), during which the 2006 yield figure was used to calculate the potential production of opium gum. Thanks to additional funds it was possible to start measuring yields again in 2014 and 2015, when yield data were collected in a limited number of fields that were selected by "opportunistic" selection. The poppy fields were selected after visual inspection by helicopter had guaranteed that the opium cultivated in them was ready for harvesting, after which the helicopter landed to allow the team to take measurements.

In 2014, yield data were collected from 25 fields (indicating an average yield of 14.7 kilograms per hectare)[8] while yield data were collected from 17 fields in 2015, indicating an average yield of 30.6 kilograms per hectare. Fields in four provinces were visited both in 2014 (Houaphan, Louang Namtha, Phongsali and Xiangkhoang) and in 2015 (Houaphan, Louang Namtha, Phongsali and Bokeo). All fields were visited by helicopter, but as the terrain and security situation did not

[8] Average yields of provinces included in the yield survey, weighted by estimated cultivation in those provinces.

allow the selection of a random, representative sample of fields for taking measurements, fields were selected where there was land flat enough to enable the helicopter to land. The yield survey was conducted following UNODC Guidelines for yield assessments of opium gum and coca leaf from brief field visits.[9]

Reports from the field indicated that in Phongsali, where most opium cultivation in Lao PDR takes place, opium poppy fields had been affected by low temperatures in early 2014. This affected poppy production as several fields did not reach maturity and seemed to contain stunted plants that would be unable to produce opium latex. To account for this damage, the average productive area per field in Phongsali was estimated and yields adjusted accordingly (25% reduction). Overall, the 2015 yield survey found good, homogenous fields, particularly in Phongsali. As no reports of adverse weather conditions were recorded, higher yields were expected in 2015.

The number of fields visited and the way they are selected limits the validity of the 2014 and 2015 yield surveys for all opium cultivation in Lao PDR: because of security and time constraints, only fields that are relatively easy to spot and to access are selected for calculating yields. This may lead to a bias, as fields on relatively flat terrain may have higher yields than fields in more remote and steeper areas. Secondly, in both years only a small number of fields was visited, which may not accurately reflect the variability in the quality of fields in Lao PDR. However, other factors that could have impacted the results were kept constant; for example, both surveys were conducted by closely following the same yield protocol[10] and by deploying the same team.

The above limitations mean that the yield surveys may not be representative for the area surveyed in Lao PDR, but it is safe to say that yields of up to 30.6 kilograms per hectare were achieved in 2015, although this is a maximum because the selection of fields may have led to an upward bias (see Methodology). The 2014 yield was taken as the minimum potential yield for 2015 because weather conditions were worse in 2014 than in 2015, when yields were supposedly higher than this threshold. Thus, yield and production in 2015 were estimated based on both years' results by using the 2014 estimate as the lower bound and the 2015 yield estimate as the upper bound. This should mitigate the effects of any possible bias introduced by selecting fields that were easy and safe to access. Data collected in the years to come will be used to update the yield figures accordingly.

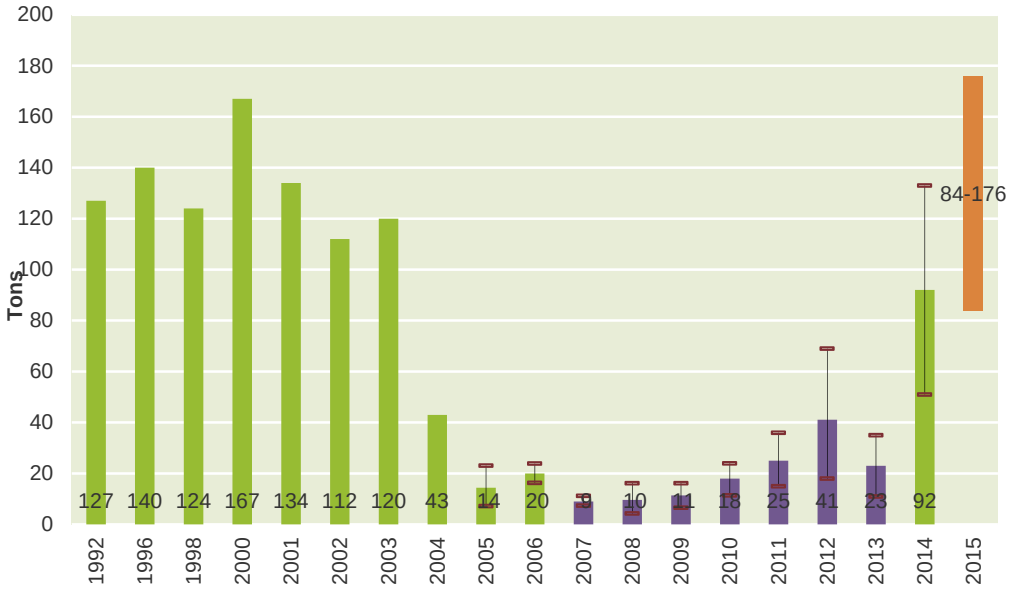
Table 2: Opium yield, Lao PDR, 1992-2015 (Kilograms per hectare)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Potential opium yield (kg/ha)	8	6*	6*	6*	6*	6*	6*	6*	14.7**	14.7-30.6

**Due to the absence of yield surveys, 2007 estimates have been used for the years 2008-2013 (in purple).*
*** Confidence intervals of (12.0 – 17.4) were calculated as if simple random sampling had been applied.*

[9] UNODC Guidelines for yield assessment of opium gum and coca leaf from brief field visits, UN New York, 2001, ST/NAR/33. See also UNODC (2003): Limited opium yield assessment surveys. Technical report: Observations and findings. "Guidance for future activities". In: Scientific and Technical Notes, SCITEC/19, December 2003.
[10] Ibid.

Figure 2: Potential opium production, Lao PDR, 1992-2015 (Tons)



Confidence intervals reflect uncertainty of area estimates only. Due to the absence of yield surveys, 2007 estimates have been used for the years 2008-2013 (in purple). The 2015 estimate has been updated with a new yield survey (in orange).

Figure 3: Large and healthy poppy fields, Houaphan province, 2015.

Figure 4: Poppy fields surrounded by bush, forest and fallow land, Louangphrabang, 2015

Figure 5: Healthy poppy field, Louang Namtha, 2015.

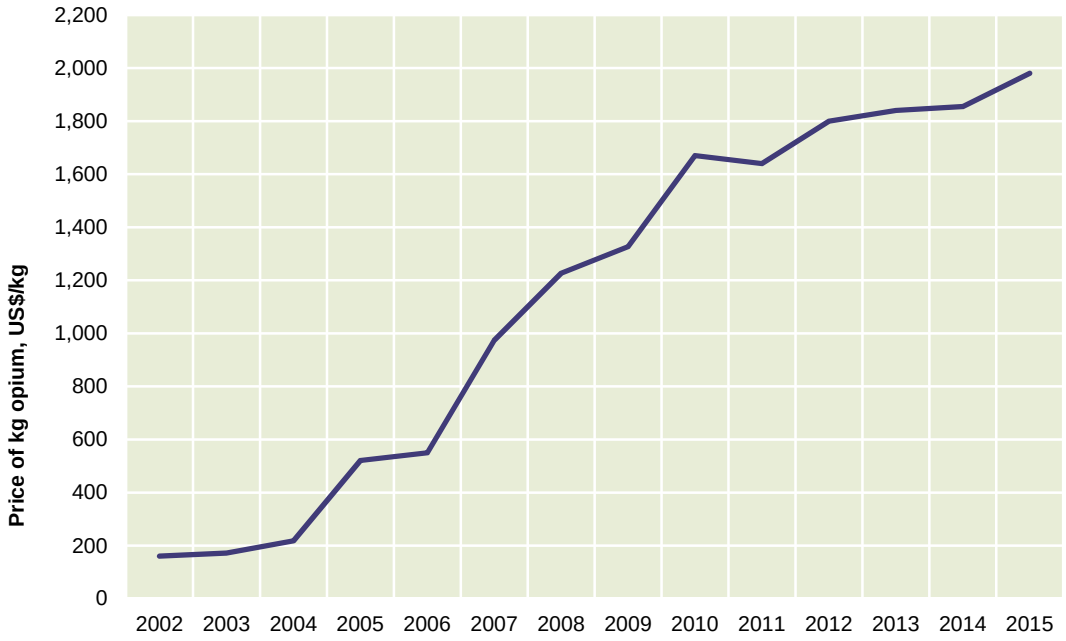
2.3. Opium prices

In 2015, the retail/wholesale price[11] of raw opium in Lao PDR reached $1,980 per kilogram in real terms,[12] which represents an increase of 7% from its 2014 price.

Due to the difficulty of accessing areas where opium is grown, it was not possible to collect opium farm-gate prices. However, local authorities continued to collect opium prices at the provincial level, usually during the harvest or soon after it. As in previous years, it was not possible to make a clear distinction between wholesale and retail prices in 2015, because opium is usually consumed by local opium users who purchase it locally.

The high price of opium, and therefore its high-income potential, makes opium 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 is thus fundamental.

Figure 6: Opium prices, Lao PDR, 2002 to 2015 (United States dollars per kilogram)



Source: LCDC.

2.4. Opium poppy users

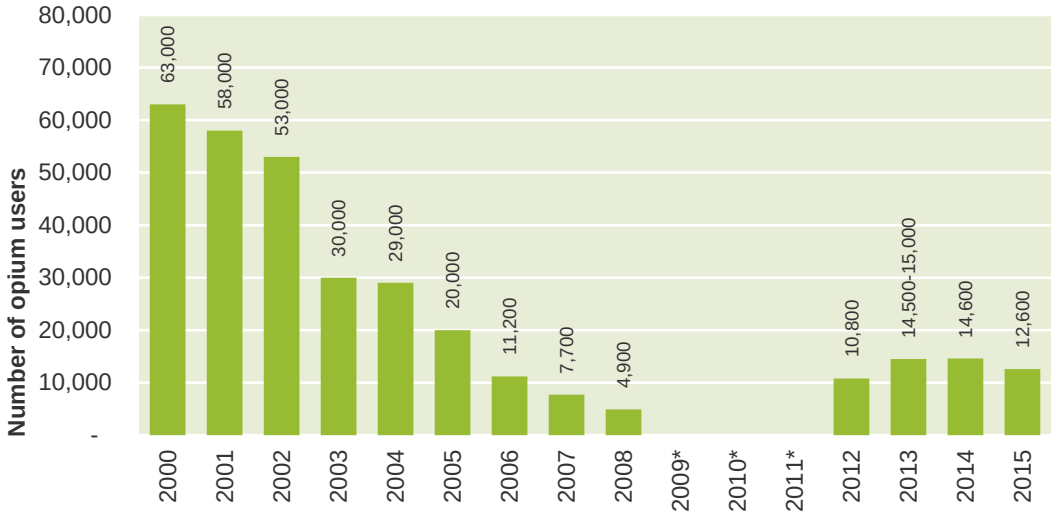
In 2015, Lao National Commission for Drug Control and Supervision reported the number of regular opium users ("opium addicts") to be 12,600 in 10 provinces.[13]

[11] A clear distinction between farm-gate, wholesale and retail prices could not be established.

[12] Simple average of all provincial prices, not adjusted for inflation. Corresponds to Kip 14,840,000; currency conversion rate as provided by LCDC.

[13] Borlikhamxay, Bokeo, Houaphanh, Louang Namtha, Luangphrabang, Oudomxai, Phongsali, Vientiane, Xayabuly, Xaysomboun, Xiengkhouang.

Figure 7: Opium users,[14] Lao PDR, 2015



Based on 11 provinces in 2002-2004 and 2014, 8 provinces in 2005,6 in 2006, 10 in 2007, 2008, 2012 and 2015.
Source: LCDC.
**No data available for 2009-2011.*

[14] Reported as "addicts"' by LCDC.

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 PDR 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 relatively small, not easily accessible and widely distributed. In such circumstances an aerial survey by helicopter is an efficient method to estimate the extent of opium poppy cultivation. In combination with satellite imagery it enables the exact areas of the fields to be determined and gives a very reliable estimate of opium poppy cultivation.

The survey team visited selected sites (square segments) by helicopter and checked those sites for the existence of opium poppy fields. Detected fields were photographed and the coordinates of the viewpoints were recorded by means of a GPS. In addition, high-precision satellite images taken over the opium poppy cultivation areas helped to measure the size of fields identified as poppy fields during the helicopter flight.

3.2. Risk area and sampling frame

The quality of the data collected from the aerial survey depends to a large extent on the definition of the area where the samples are selected, which is called the sampling frame. The design of the sampling frame starts with mapping the areas where opium poppy is expected to be grown, which are called risk areas. This is done by selecting the provinces and districts where opium poppy is grown based on experiences from former surveys. Within these areas a geographic analysis with biophysical indicators was conducted to refine the risk area.

In 2015, a revision of the poppy risk area was conducted using 10 indicators that included bio-physical parameters, such as altitude, slope and the shape of the hills, with spatial parameters, such as accessibility and the distance to existing agricultural areas. The method used was a random forests-based approach that uses various input variables in a complex feature space. The advantage of this approach is the efficient use of various input variables and in the machine learning capability for newly delineated fields. A further advantage of random forests is the capability of ranking input variables according to their prediction performance and therefore also the possibility to remove variables from the model if they do not improve the risk area definition. The result of the new risk area definition is displayed in map 1. The revision resulted in a decrease in the risk area from 58,266 km^2 in 2014 to 26,217 km^2 in 2015, which meant that the sample site location became much more efficient.

The sampling frame is a 5 km x 5 km regular grid, which is superimposed on the risk area. Each 5x5 km segment contains a variable amount of risk areas. To increase the efficiency to capture as much risk area as possible, segments with less than 15% of risk area are excluded from the sampling frame, but not excluded from the area calculation. The 15% rule was determined by the poppy risk analysis that showed that 90% of the predicted risk area is represented when segments contain more than 85% of risk area.

In 2015, the sampling frame for the area estimation was decreased from eight to seven provinces in northern Lao PDR (Bokeo, Houaphan, Louang Namtha, Louangphrabang, Oudomxai, Phongsali and Xiangkhoang). Xaignabouri was not part of the survey in 2015 because no opium poppy was found in the 2014 samples. This allowed for an increase in the number of samples in the provinces where opium poppy was observed in 2014.

To increase the precision of the estimates, the sampling frame was stratified by province, and within each province, by the occurrence of opium poppy in previous years. This led to a total of 13 strata; two for each province, with the exception of Bokeo (because of its small size, this province was not further stratified). The new definition of the risk area improved the selection of the sample locations, as it was more likely to "hit" opium poppy fields, which is reflected in the smaller confidence intervals.

The estimate for opium poppy cultivation in the 2015 survey pertains only to the risk area, even though there may have been some pockets of cultivation in other provinces.

3.3. Sample size and sample selection

In 2015, 89 sites were selected randomly in a manner that ensured good geographical coverage of the risk area. The total sample size was calculated as a function of the costs associated with the helicopter flying time and the precision of the estimate.[15] This was a compromise as a larger sample size leads to greater accuracy in the estimate. However, financial resources limited the size of the sample.

The number of samples for each province and stratum was determined by allocating the number of samples proportional to the square root of the number of cells in the province and proportional to the number of cells in the strata. For selecting the samples, a non-aligned systematic sampling approach was applied in each stratum by using the statistical software *R.*[16]

Table 3: Number of sampled segments surveyed by helicopter in northern Lao PDR, 2015

Province	Number of segments
BOKEO	4
HOUAPHAN	19
LOUANG NAMTHA	12
LOUANGPHRABANG	12
OUDOMXAI	10
PHONGSALI	21
XIANGKHOANG	11
Grand total	**89**

3.4. Interpretation of satellite imagery

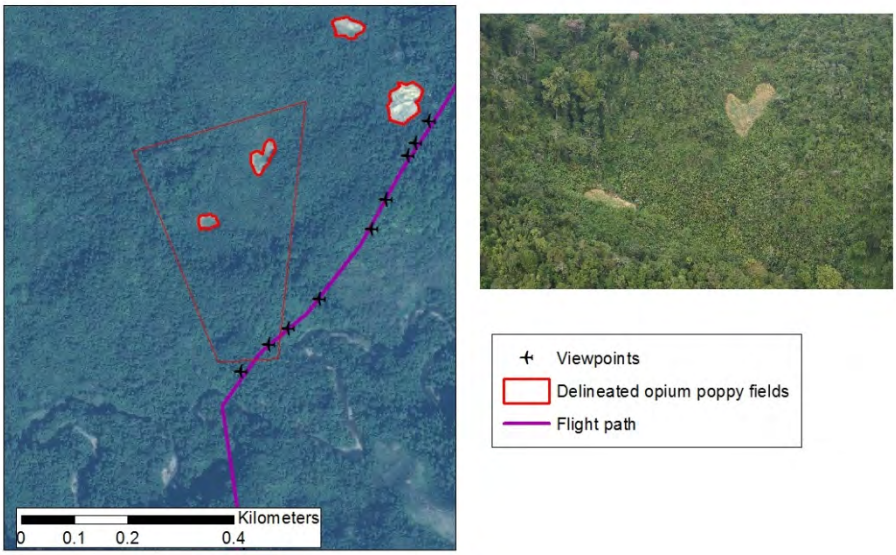
Satellite images were acquired for all selected sample areas and combined with geographic data collected during the helicopter flights. The satellite images used were of a very high resolution

[15] See the Methodology section of the *Southeast Asia Opium Survey 2013*, available at http://www.unodc.org/unodc/en/crop-monitoring/index.html.

[16] http://www.r-project.org/ and package "*spsample*".

(VHR), taken by the Pleiades satellite. The images were ordered as a bundle product and subsequently pan-sharpened to increase a spatial resolution of 0.5 metres. The satellite was programmed to take images when the crops would be easiest to identify (between mid-January and mid-February), close to the date of the helicopter survey. Opium poppy fields were then identified by visual interpretation of the satellite images and with oblique aerial photos and GPS data collected during the helicopter survey. The recorded coordinates of the viewpoints and flight path were used to locate the fields. Each field was delineated on the satellite imagery with high precision.

Map 2: Delineation of opium poppy fields on a satellite image (Pléiades) with the help of aerial photographs



3.5. Area estimation

The sample area estimation of the extent of opium poppy cultivation at the national level is a combined ratio estimate using risk area as an auxiliary variable. The estimation was done separately for the strata containing segments where opium poppy was identified in the past and for the strata that were free of opium poppy (but containing risk area because of their biophysical features). The total is a sum of these two separate estimates. At the provincial level, a simple combined ratio estimate was calculated. The ratios were then extrapolated to risk area outside the frame. The sample mean was calculated as

$$\bar{y}_{st} = \sum_{h=1}^{k} \frac{N_h}{N} \bar{y}_h \, ; \bar{x}_{st} = \sum_{h=1}^{k} \frac{N_h}{N} \bar{x}_h .$$

where k is the number of strata, $\bar{y}_h$ is the sample mean of opium poppy in stratum h; $\bar{x}_h$ is the sample mean of the risk area in stratum h; N_h is the number of sampling units in stratum h, and N is the population size.

The combined ratio estimate of the area under opium poppy cultivation then is given by

$$\bar{Y}_{RC} = \frac{\bar{y}_{st}}{\bar{x}_{st}} \bar{X}$$

where $\bar{X}$ is the total risk area in the sampling frame.

The confidence intervals for the national estimate were calculated by using standard statistical methods for combined ratio estimators.

Bootstrapping[17] was performed to estimate the confidence intervals of the provincial estimates. This was necessary as the heavily skewed distribution of opium poppy in the samples led to unrealistic confidence intervals when applying the standard methods. Although bootstrapping is considered to be an appropriate choice in such situations, UNODC is undertaking further research to assess if this is the case in all situations.

3.6. Changes in methodology from 2014 to 2015

The general approach used for the 2015 survey was similar to that used in previous years. However, two major changes were introduced:

- in 2015, a revision of the risk area was conducted using 10 indicators that included bio-physical parameters, such as altitude, slope and the shape of the hills, and spatial parameters, such as accessibility and the distance to existing agricultural areas. The revision resulted in a decrease in the risk area from 58,266 km^2 to 26,217 km^2.

3.7. Opium yield and production

Data collection

In the yield survey, data on the number of yield capsules per plot and capsule volume are collected. The survey followed the procedure established in the UNODC Guidelines for yield assessment.[18]

In 2015, 17 fields in 4 provinces (Bokeo, Houaphan, Louang Namtha and Phongsali) were visited by helicopter. The fields were selected when the opportunity to do so arose, as the terrain and security in the field did not allow the selection of a random, representative sample of fields for taking measurements. This was also the case in previous UNODC yield surveys undertaken in Lao PDR.

It should be noted that "opportunistic" selection can lead to a bias in yield measurements: healthier, more productive fields may have a greater likelihood of being chosen because they are more visible from the air and are often located in flat areas where a helicopter can land. To a certain extent this is reflected in a comparison of the vegetation activity measured in the satellite imagery. To that end, a so-called Normalized Differential Vegetation Index (NDVI)[19] was calculated and an average value was calculated for each poppy field identified in the 89 satellite images. By comparing the average values of the poppy fields where the yields were measured with the average NDVI-values of the rest of the poppy fields, it shows that the fields measured did indeed have more vegetation activity than poppy fields in general, which confirms that better fields were measured.

Data set	Number of objects (n)	Mean NDVI
Poppy fields total	1,465	0.316
Yield measurement locations	8	0.355

[17] http://cran.r-project.org/web/packages/boot/index.html.

[18] UNODC Guidelines for yield assessment of opium gum and coca leaf from brief field visits, UN New York, 2001, ST/NAR/33. See also, UNODC (2003): Limited opium yield assessment surveys. Technical report: Observations and findings. "Guidance for future activities". In: *Scientific and Technical Notes*, SCITEC/19, December 2003.

[19] Calculated from the near-infrared band and the red band of the satellite images.

The yield survey was conducted following the UNODC Guidelines for yield assessments of opium gum and coca leaf from brief field visits:[20] an imaginary transect was drawn on each surveyed field, along which three one-metre square plots were selected. In each plot, the number of flower buds, flowers, immature capsules and mature capsules that were expected to yield opium were counted, and the diameter and height of 10 to 15 opium-yielding capsules were measured with a calliper. 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 is the field yield. The simple average of all fields in a province is the provincial yield.

The relationship between poppy capsule volume per square metre and dry opium yield is used to estimate opium production. For Lao PDR, it is of linear form:[21]

$$Y = 1.89 + 0.0412\ VC$$

where

Y = Dry opium gum yield (kg/ha), and

VC = Mature capsule volume (cm^3/m^2).

This formula has been developed based on data collected in Thailand and emphasizes the lower end of observed capsule volume. It is based on data varying between 0 and 900 cm^3/m^2. However, high volumes exceeding 900 cm^3/m^2 were observed in few exceptional plots. The formula was not validated for these ranges, and would supposedly overestimate yields. To avoid overestimation, an alternative formula was used for fields where at least one plot exceeded said volume. This formula was calibrated with combined data from Pakistan and Thailand, and reads as

$$Y = [(V + 1{,}495) - ((V + 1{,}495)^2 - 395.259\,V)^{0.5}] / 1.795.$$

Average opium yield was calculated by taking the weighted average provincial opium yield weighted by the estimated provincial area under opium cultivation.

Table 4: Examples of photographs documenting the yield survey, 2015.

Sampling area 1x1 m	Example of measurements (Houaphan province): the capsule height is measured from the bottom to below the stigma surface.

[20] UNODC Guidelines for yield assessment of opium gum and coca leaf from brief field visits, UN New York, 2001, ST/NAR/33. See also UNODC (2003): Limited opium yield assessment surveys. Technical report: Observations and findings. "Guidance for future activities". In: *Scientific and Technical Notes*, SCITEC/19, December 2003.

[21] In three exceptionally productive plots, the capsule volumes exceeded the upper end of the range. To avoid over-estimating yields, the non-rectangular hyperbola formula was applied (see UNDOC guidelines).

Table 5: Number of fields visited and number of capsules measured during 2015 yield survey

Province	Number of fields visited	Number of capsules measured
HOUAPHAN	2	50
LOUANG NAMTHA	1	30
PHONGSALI	3	90
XIANGKHOANG	11	320
Grand total	**1**	**490**

Estimating opium production

Opium production is calculated by multiplying the national average yield by the estimated national area under cultivation. Since sample sizes are very small for some provinces, no provincial estimates of production are provided.

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.

Production was estimated based on results from 2014 and 2015. The 2014 yield estimate was used as the lower bound and the 2015 yield estimate as the upper bound.

PART 3. MYANMAR

Abbreviations

CCDAC	Central Committee for Drug Abuse Control
GOUM	Government of the Republic of the Union of Myanmar
ICMP	Illicit Crop Monitoring Programme
SASS	Statistics and Surveys Section
SR	Special Region

Acknowledgements

The Myanmar Opium Survey 2015 was prepared with the Research and Trend Analysis Branch (RAB), Division for Policy Analysis and Public Affairs (DPA), United Nations Office on Drugs and Crime, under the supervision of Jean-Luc Lemahieu, Director of DPA, and Angela Me, Chief of RAB. Field supervision was undertaken by Jeremy Douglas, Regional Representative, Southeast Asia and the Pacific.

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Pol. Brig. Gen. Kyaw Win	Commander Drug Enforcement Division, Joint Secretary, CCDAC
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The implementation of the survey would not have been possible without the support of local administrations and the dedicated work of 156 surveyors.

UNODC Myanmar

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Irmgard Zeiler	Statistician, SASS

FACT SHEET – MYANMAR OPIUM SURVEY[22]

	2014	2015	Change 2014-2015
Total opium poppy cultivation (hectares)[23]	57,600 ha (41,300 to 87,400)	55,500 ha (42,800 to 69,600)	-4%
Opium poppy cultivation in Shan state	51,400 ha (36,100 to 70,600)	50,300 ha (31,500 to 73,500)	-2%
Average opium yield (kilograms per hectare)	11.7 kg/ha	11.7 kg/ha[24]	0%
Total potential production of dry opium	670 tons (480 to 920)	647 tons (500 to 820)	-3%
Total opium poppy eradication (hectares)[25]	15,188 ha	13,450 ha	-11%
Average farm-gate price of fresh opium in Shan state (United States dollars per kilogram)[26]	$414/kg	$273/kg	-34%[27]
Total potential wholesale value of opium production[28]	$340 million (240 to 470 million)	$236 million (183 to 300 million)	-31%
Estimated number of households involved in poppy cultivation[29]	182,000 (130,000 to 276,000)	173,000 (135,000 to 221,000)	-5%
Estimated number of households growing poppy[30]	135,000 (97,000 to 204,000)	133,000 (104,000 to 170,000)	-2%

[22] Numbers in brackets indicate the upper and lower bounds of the best estimate. Year-to-year comparisons of less than a 5% change from the previous year are considered statistically stable.

[23] May include areas eradicated after the date of the area survey.

[24] Differences in yields were observed at the regional level.

[25] Source: CCDAC.

[26] At harvest time, weighted by area under cultivation. Based on data in Shan state only.

[27] The price of opium at the farm gate in kyat decreased by 28.6% from its 2014 level (weighted by area under cultivation). However, due to changes in the exchange rate, the difference appears larger in United States dollars. Note that before 2014 the exchange rate was used, whereas from 2014 the methodology was updated to use a simple average of the exchange rates from January to June so as to reflect more accurately the rate of exchange between the kyat and the United States dollar during the poppy harvesting season.

[28] The product of dry opium production and dry opium prices collected during the harvest season.

[29] The number of households involved in opium poppy cultivation was calculated using the estimated number of households growing poppy and the proportions by type of poppy household provided by village headmen. Rounded values.

[30] Estimated by the total area under cultivation, divided by the average number of hectares per household of all persons who run their own poppy field. The number of households in which the inhabitants exclusively labour in other farmers' poppy fields was excluded.

FACT SHEET – MYANMAR OPIUM SURVEY[31]

	2014	2015[32]	Change 2014-2015
Average yearly household income in preceding year, Shan state:			
Non-opium-producing households	$1,730	$1,990	-
Opium-producing households	$2,040	$1,540	-
(Income per household from opium sales)	($1,050)	($520)	-

[31] Numbers in brackets indicate the upper and lower bounds of the best estimate. Year-to-year comparisons of less than a 5% change from the previous year are considered statistically stable.

[32] Weighted averages to represent the actual number of villages per state (North Shan, South Shan and East Shan). Not comparable with 2014 values (unweighted averages).

1. Introduction

This report presents the results of the thirteenth 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, which has been collecting statistical information on illicit crop cultivation in Myanmar, within the framework of its Illicit Crop Monitoring Programme, (ICMP) since 2001. ICMP works with national Governments to increase their capacity to monitor illicit crops and supports the international community in monitoring the extent and evolution of illicit crops in the context of the plan of action adopted by the United Nations (the 53rd session of the Commission on Narcotic Drugs in March 2009).

In the 1980s, Myanmar was the world's largest producer of illicit opium. Between 1981 and 1987 the country 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 opium poppy 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. In 2015, opium poppy cultivation remained stable for the third consecutive year.

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. They are also useful tools for gauging the effectiveness of opium bans and their implications, as well as aiding the understanding of cultivation techniques, farmers' well-being and potential alternative livelihood options.

The methodology used in this report combines satellite imagery, a field survey and a socio-economic survey to evaluate the extent of opium poppy cultivation and production, as well as the socio-economic situation of farmers and their potential motivations for growing poppy in Myanmar. Such information is essential for developing effective strategies for sustaining the transition from an illicit economy to a licit economy.

Map 3: States and townships included in the 2015 surveys, Myanmar

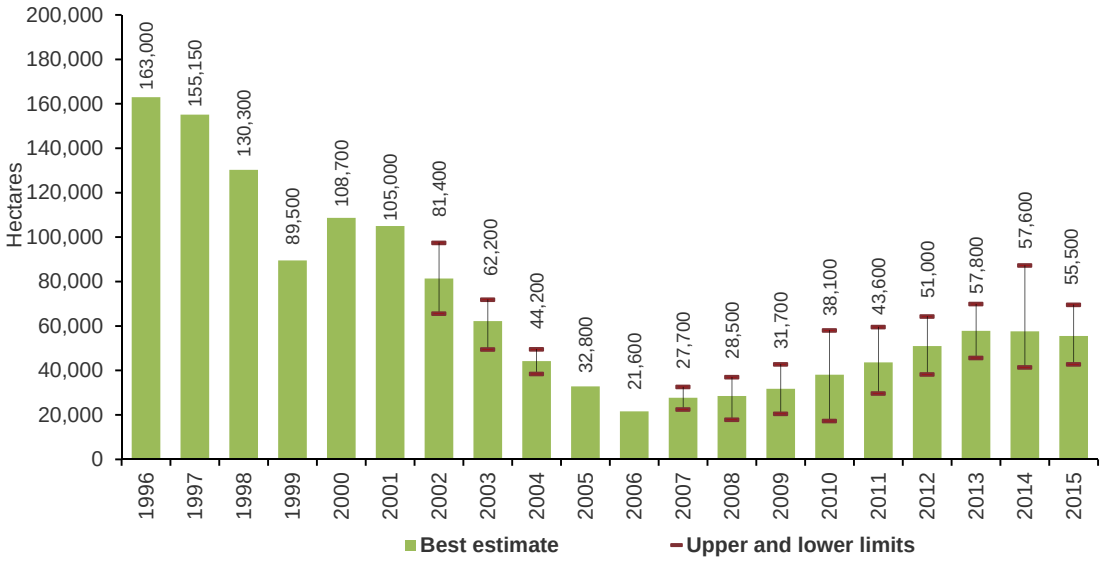
Source: Government of Myanmar - National Monitoring System supported by UNODC
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

2. Findings

2.1. Estimated area under opium poppy cultivation

Representing the third year of stabilization following consecutive year-on-year increases since the low of 21,600 hectares in 2006, the total area under opium poppy cultivation in Myanmar in 2015 was estimated at 55,500 hectares; a decrease of 4% with respect to 2014.

Figure 8: Opium poppy cultivation in Myanmar, 1996-2015 (Hectares)*



* Source: from 1996 to 2001: United States Government; since 2002: GOUM/UNODC.

Irrigated poppy fields in South Shan (Myanmar, 2015)

Poppy fields in a South Shan village (Myanmar, 2015)

Accounting for 91% of all cultivation nationwide, the vast majority of opium poppy cultivation in 2015 took place, as in previous years, in Shan state,[33] with South Shan accounting for 42% of

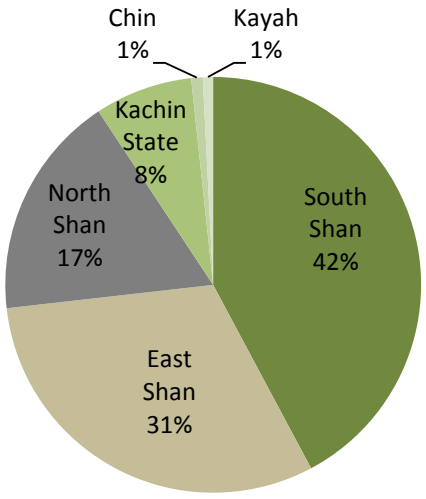
[33] Shan state is divided into three sub-states, North Shan, South Shan and East Shan. For the sake of simplicity, however, they are mostly referred to as "states" in this report.

national cultivation and East Shan almost a third (31%). Decreases in opium poppy cultivation were observed in Kachin (-17%), Kayah (-8%) and Chin (-18%). The whole area under opium poppy cultivation in Myanmar was estimated to be 2,100 hectares smaller in 2015 than in 2014. High-density poppy areas were located in a belt extending from the southern to the north-eastern part of South Shan.

Table 6: Area under opium poppy cultivation, by state, Myanmar, 2014-2015[34] (Hectares)

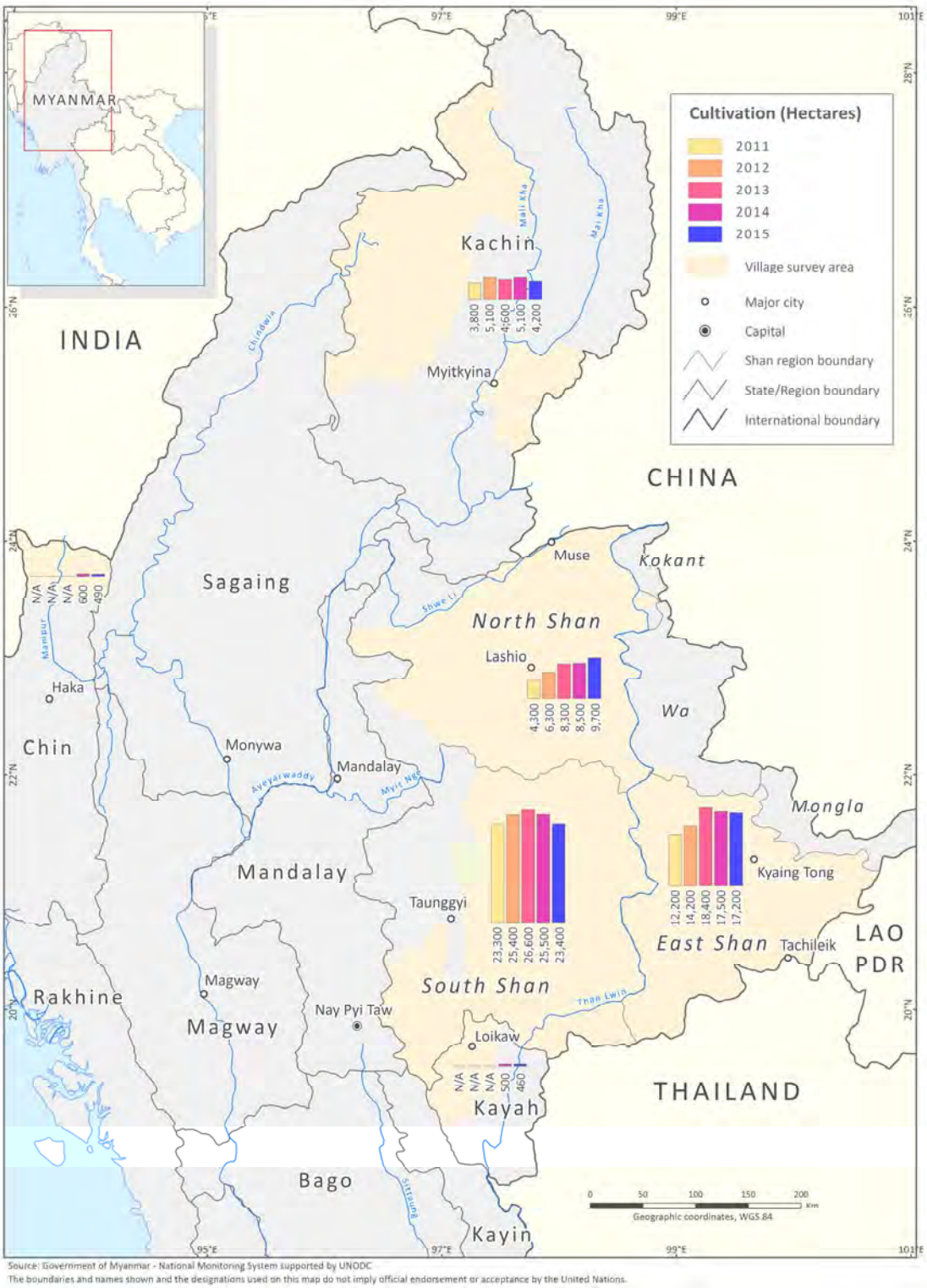
	2014	2015	Change 2014-2015	Percentage of total area under opium poppy cultivation
East Shan	17,500 (10,300 to 26,500)	17,200 (10,200 to 24,000)	-2%	31.0%
North Shan	8,500 (4,800 to 13,300)	9,700 (6,500 to 13,500)	14%	17.4%
South Shan	25,500 (12,500 to 41,700)	23,400 (14,800 to 35,600)	-8%	42.2%
Shan state total	**51,400** (36,100 to 70,600)	**50,300** (38,700 to 64,900)	**-2%**	**90.7%**
Kachin	5,100 (2,200 to 9,300)	4,200 (2,300 to 7,600)	-17%	7.6%
Kayah	500	460 (410-510)	-8%	0.8%
Chin	600	490 (440-530)	-18%	0.9%
National total (rounded)	**57,600** (41,400 to 87,300)	**55,500** (42,800 to 69,600)	**-4%**	**100%**

Figure 9: Distribution of opium poppy cultivation in Myanmar, 2015



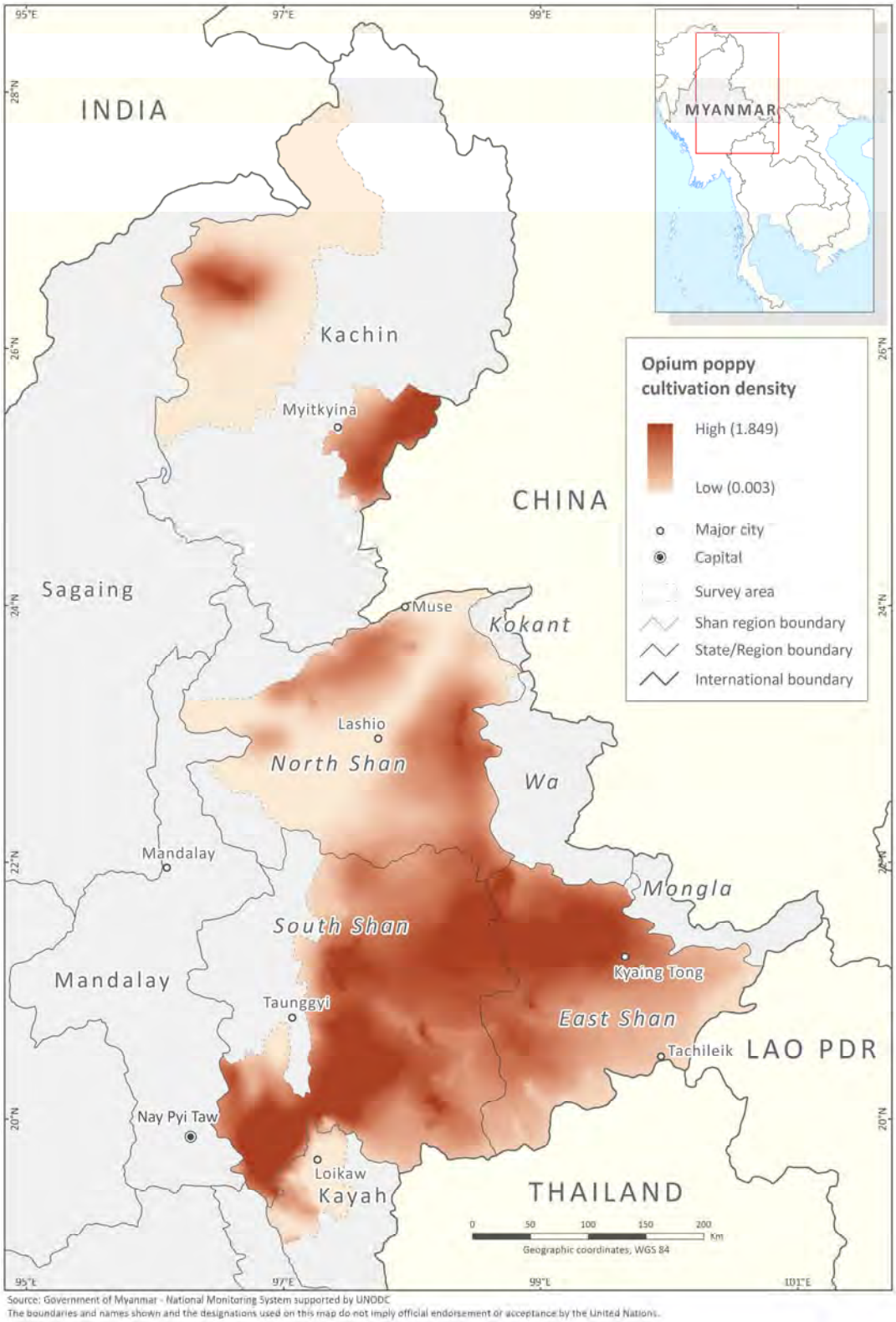
[34] Numbers in brackets indicate upper and lower limits of the best estimate.

Map 4: Areas under opium poppy cultivation in Myanmar, 2015



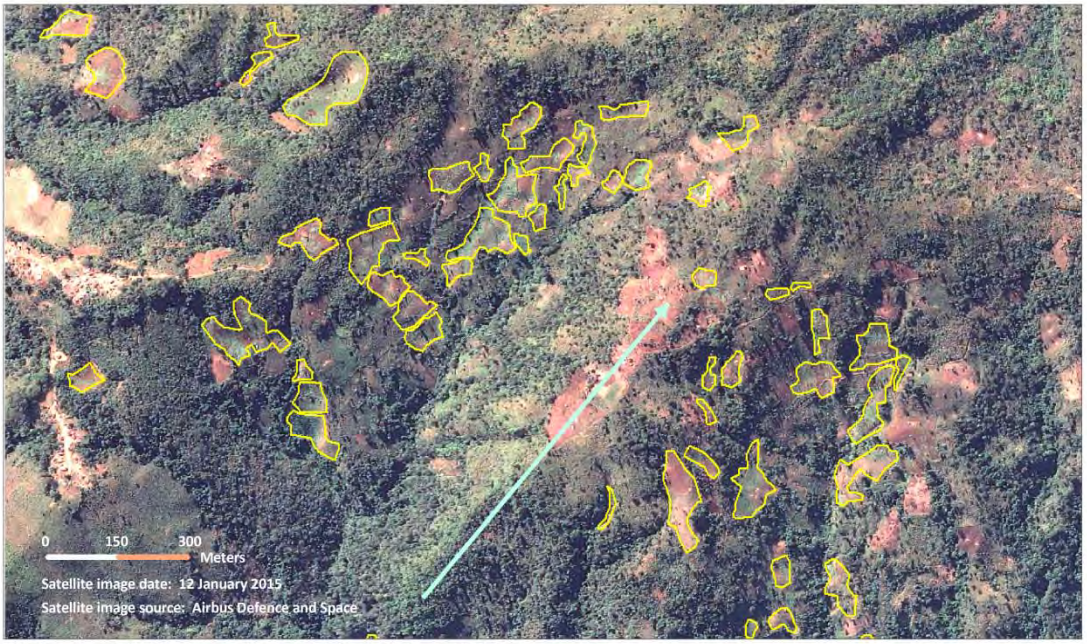
Source: Government of Myanmar - National Monitoring System supported by UNODC
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Map 5: Density of opium poppy cultivation* in Myanmar, 2015

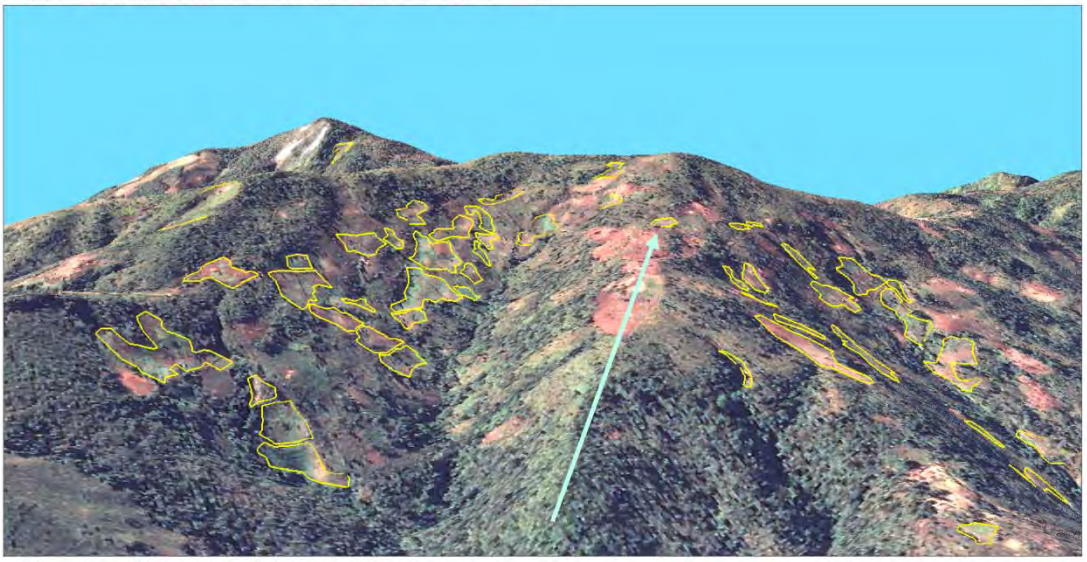


*Chin is not shown because of a lack of sufficient data.

Figure 10: Example of surveyed opium poppy fields, Myanmar, 2015



Opium poppy fields observed in very high-resolution satellite image

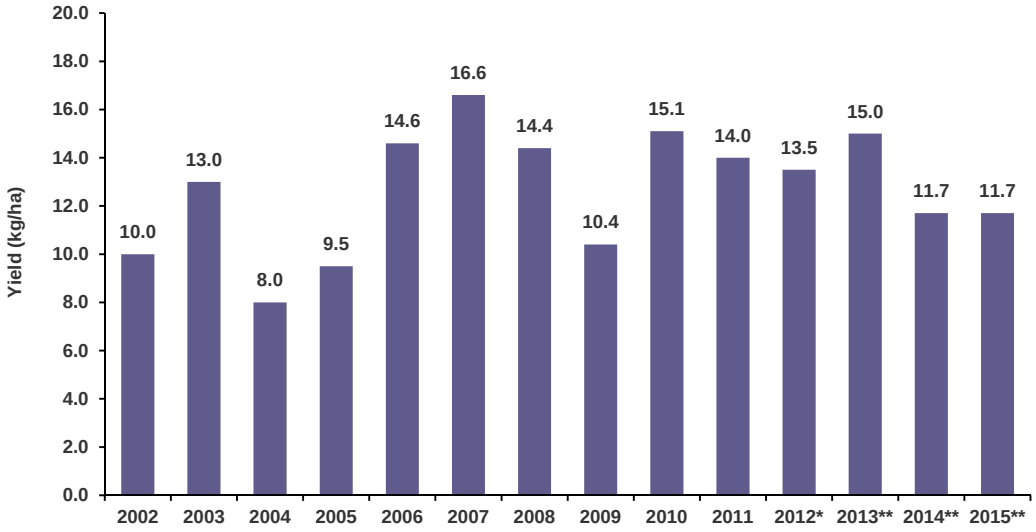


Opium poppy fields observed in 3D terrain view

2.2. Opium yield and production estimates

Field measurements taken from a sample of fields produced an average yield for each state. The national average yield in 2015, weighted by area under cultivation, was estimated to be 11.7 kilograms per hectare; the same level as in 2014. However, opium yield fluctuates from year to year because estimated yield calculations are dependent on the number and size of opium poppy capsules per hectare, which themselves depend on climatological conditions, the presence of poppy diseases and the level of land management applied (land preparation, irrigation and soil rotation, among other factors).

Figure 11: National opium yield, as calculated in 2002-2015 surveys, weighted average of all states unless otherwise specified (Kilograms per hectare), Myanmar



**For Kachin state, data on poppy yield are from 2011 as the yield survey could not be implemented in that state in 2012.*
*** Weighted average by area under poppy cultivation in all states.*

Table 7: Potential opium yield, by state, 2014-2015 (Kilograms per hectare)[35]

State*	2014 Average yield (kg/ha)	2015 Average yield (kg/ha)	Change 2014-2015
East Shan	10.8 (8.7-12.9)	13.0 (11.8-14.2)	20%
North Shan	8.0 (5.1-10.9)	13.3 (9.9-16.6)	66%
South Shan	10.6 (8.6-12.6)	9.9 (8.5-11.2)	-7%
Kachin	27.1 (23.0-31.3)	12.5 (9.7-15.3)	-54%
Kayah	7.5 (5.8-9.1)	9.9 (8.5-11.2)	32%
Average yield**	**11.7**	**11.7**	**-**

** No data from Chin was included in the opium yield results due to the absence of opium poppy capsules in surveyed villages, which is related to the relatively small sample of villages visited in that particular state (20, see methodology section for details).*
***Ratio of total production to total cultivation.*

[35] Average for all areas, including Shan state, Kachin and Kayah, weighted by area under poppy cultivation.

Fresh opium gum on poppy capsules, South Shan (Myanmar, 2015)

The influence of climatological and agronomic factors on opium poppy yields can be unpredictable. For example, North Shan experienced the highest increase in poppy yield in the 2015 season compared with the previous season, with village headmen reporting that a third of villages in that part of the state had been affected by drought and very few had been affected by heavy rain, frost and poppy diseases, whereas Kachin experienced the greatest year-on-year decrease in opium poppy yield even though it was not affected by drought and was hardly affected by heavy rain, frost or poppy pests. This may mean that Kachin's high 2014 yield was an anomaly resulting from relatively favourable climatological conditions and other unknown circumstances.

Table 8: Presence of adverse weather conditions during the poppy-growing season, by state, Myanmar, 2015

Percentage of villages affected by	East Shan	North Shan	South Shan	Kachin	Kayah	All*
Drought	14	34	24	0	40	25
Heavy rain or frost	31	2	52	12	80	27

* Weighted average to represent the actual number of villages per sate.

Table 9: Presence of poppy diseases during poppy-growing season, by state, Myanmar, 2015

	East Shan	North Shan	South Shan	Kachin	Kayah	All*
Percentage of villages affected by poppy diseases	27	5	77	6	80	35
Percentage of poppy cultivation area damaged in villages affected by poppy diseases	43	20	27	10	52	27

* Weighted average to represent the actual number of villages per state.

Opium poppy affected by disease in Kachin, Myanmar, 2015

Although the average yield was the same as in 2014, variations in yield in different states led to a total potential amount of 647 tons of opium in the market in 2015. This was slightly less than in 2014 (673 tons) and also smaller than at any point between 1996 and 2001 when, overall, large amounts of opium were produced in Myanmar.

Figure 12: Potential opium production, Myanmar, 1996-2015 (Tons)*

**Source: from 1996 to 2001: US Government; since 2002: GOUM/UNODC.*

2.3. Socio-economic village survey results

Data on farmers' demographic characteristics and motivations for involvement in opium poppy cultivation in Myanmar are collected annually from group interviews with village headmen and

other villagers during the socio-economic survey. The 2015 survey took place from December 2014 to April 2015 and included a total of 864 villages.[36]

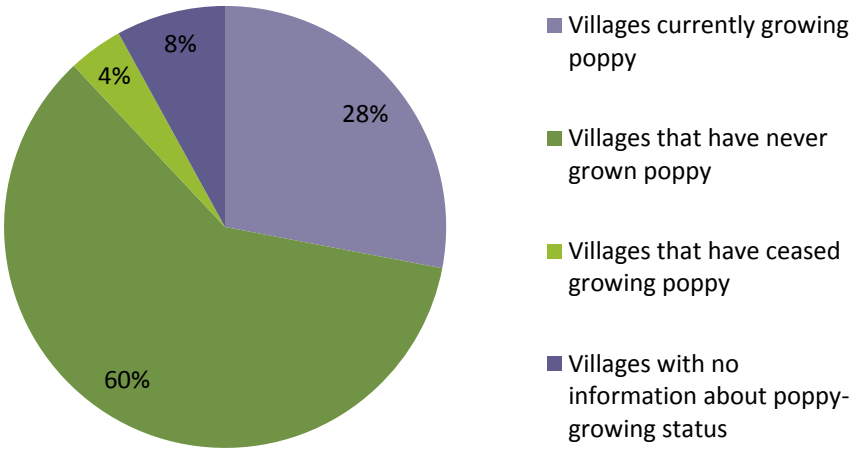
Table 10: Number of villages surveyed, by state, Myanmar, 2015

State	Total number of villages in surveyed area	Number of villages surveyed	Percentage of villages surveyed out of total villages
Chin	95	20	21%
East Shan	2,157	216	10%
Kachin	397	79	20%
Kayah	122	40	33%
North Shan	3,933	277	7%
South Shan	3,411	232	7%
Total	**10,115**	**864**	**8.5%**

The villages surveyed were classified in four categories (based on data provided by village headmen) with the aim of systematically analysing their differences. This may lead to an improvement in the understanding and identification of potential aggregated factors that influence poppy growing:

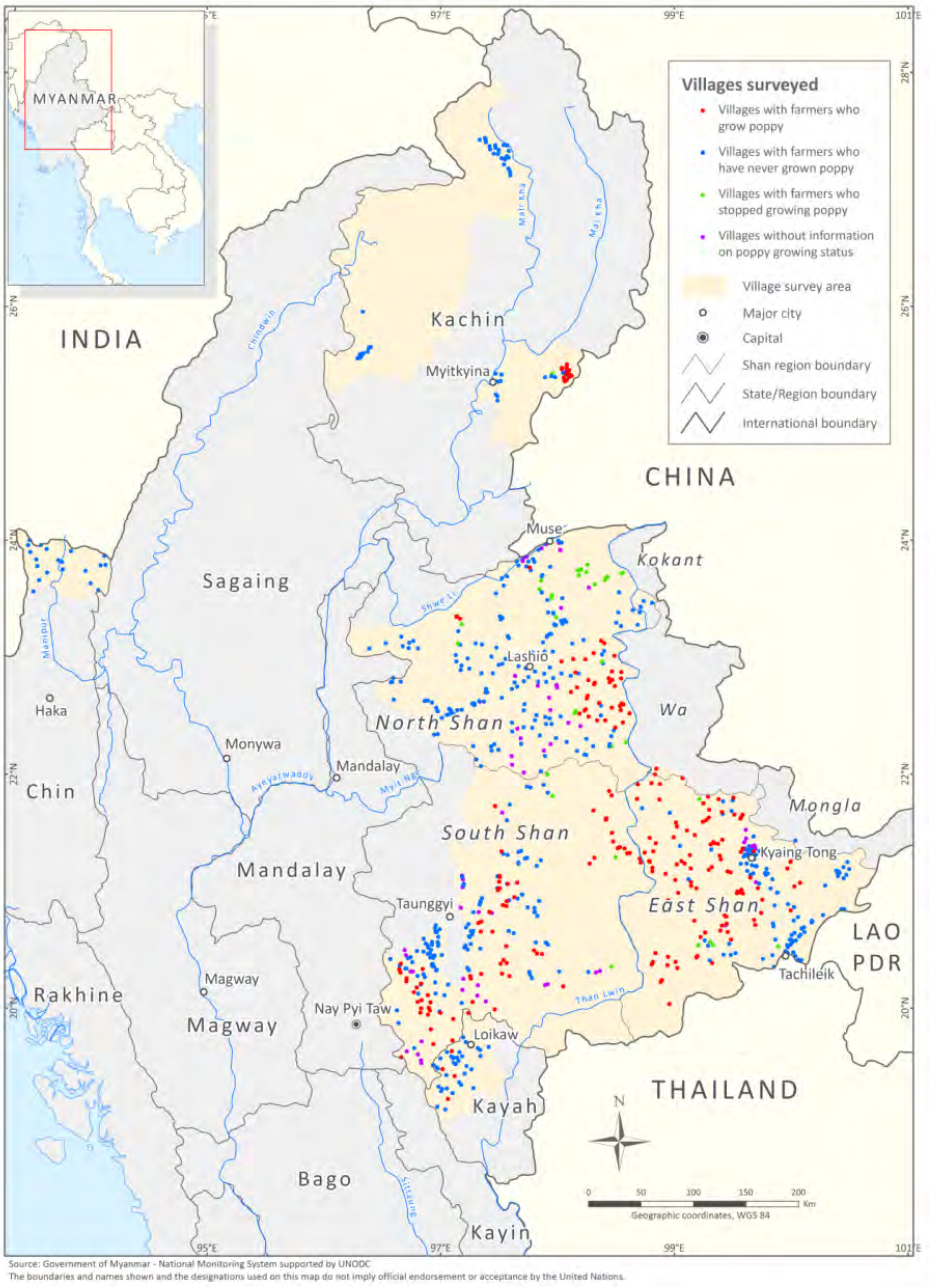
a) villages with farmers currently growing poppy (28%);
b) villages with farmers who have never grown poppy (60%);
c) villages with farmers who have ceased growing poppy (4%); and
d) villages with no information about farmers' poppy-cultivation status (8%).

Figure 13: Villages surveyed, by poppy-cultivation status, Myanmar, 2015



[36] The selection of the villages in each state followed a sampling procedure. The dates when the survey was conducted, the specific number of villages per state and township are included in the Methodology section.

Map 6: Location of villages surveyed, by poppy-cultivation status, Myanmar, 2015



Data were collected using a standardized questionnaire,[37] which included questions for all villages, as well as specific questions for villages with farmers currently growing poppy.

The questions that applied for all villages covered aspects such as:

a) income, prices of non-poppy crops, access to markets and agricultural assistance;
b) livestock assets, land ownership, food (rice) deficit, coping strategies and debt;
c) conflict and governability; and
d) drug use and migration.

[37] The full version of the questionnaire used for the village survey is included in Annex 3 of this report.

The questions that specifically applied to villages with farmers currently growing poppy included topics such as:[38]

a) opium farm-gate prices;
b) daily wages for poppy-related and non-poppy-related labour;
c) poppy-related income and uses of poppy-related income; and
d) reasons for issues such as poppy cultivation and changes in poppy-cultivation levels, and coping strategies after farmers cease growing poppy.

The socio-economic survey included a large number of villages, had extensive geographic coverage and included a comprehensive list of questions, but certain aspects of the village survey methodology mean that some findings should be interpreted with caution. In particular, the socio-economic survey was conducted in each village by interviewing a group consisting of village headman and other villagers, but as it is unclear exactly how these groups were formed, it cannot be guaranteed that the information obtained would be the same were individual households to be chosen randomly.[39] As information about illicit crop areas tends to be limited due to their difficult access, the data collected can, however, help provide guidance and assistance in decision-making.

2.3.1. Analysis of poppy-growing villages[40]

In total, 242 of the village headmen surveyed (28%) in 2015 indicated that farmers in their villages were currently growing poppy. This sub-section only analyses data gleaned from questions that specifically apply to those villages.[41] [42]

a) Households involved in poppy cultivation and average area cultivated per household

Although, according to village headmen, the majority of households in poppy-growing villages (79%) were not directly involved in poppy cultivation in 2015, the one in five households (21%) that were involved in poppy cultivation did so by:

- exclusively growing poppy in their own fields;
- exclusively earning income by labouring in poppy fields operated by others; and
- both growing their own poppy and earning income by labouring in poppy fields operated by others.

On average, of the households involved in poppy cultivation in 2015, 73% exclusively grew poppy in their own fields, 23% exclusively earned income by labouring in poppy fields operated by others and 4% carried out both activities. There were, however, variations in the extent of involvement in poppy cultivation across states. For example, farmers in East Shan seemed to be almost exclusively involved in growing poppy in their own fields (93%), while slightly more than half of farmers in Kachin grew poppy in their own fields and about a quarter earned income by labouring in poppy fields operated by others; the other quarter were involved in both activities.

[38] The questionnaire included additional non-socio-economic questions on poppy-cultivation patterns, problems related to climate and poppy disease during the poppy-growing season, and eradication activities in the state.

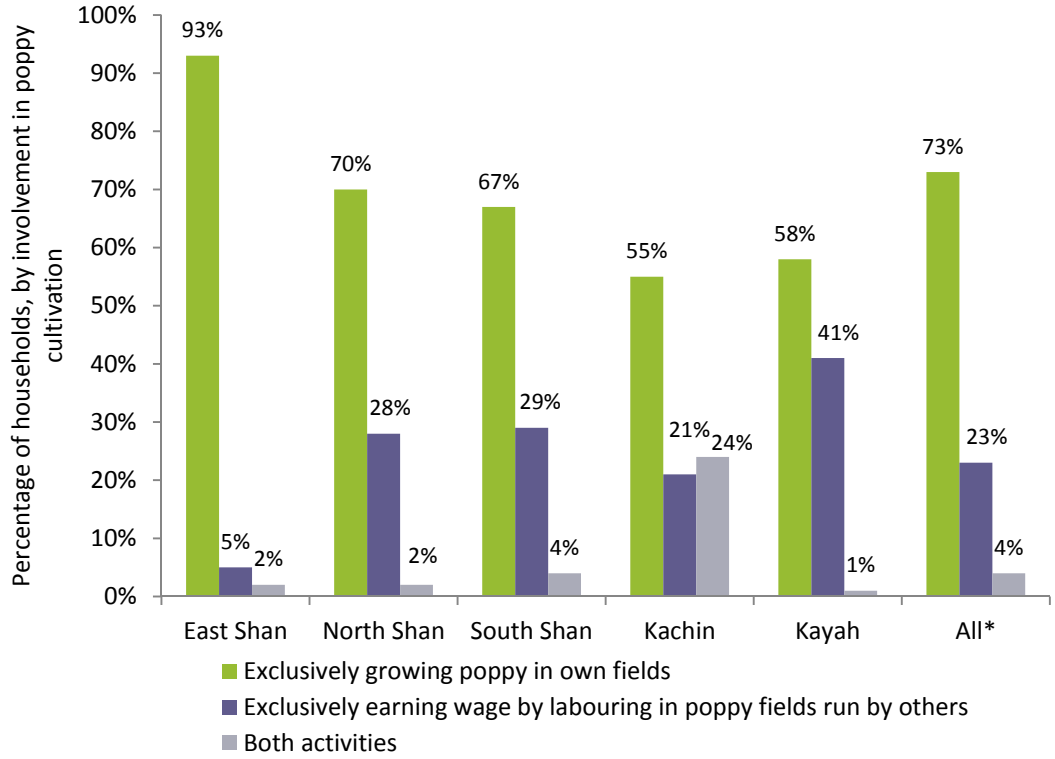
[39] Other limitations are listed in the Methodology section of this report.

[40] Annex 5 includes an overview of key findings in poppy-growing villages by state.

[41] Note that the following states were included in the socio-economic survey: Chin, Kayah, Kachin and Shan (East Shan, North Shan, and South Shan). However, during the socio-economic survey none of the headmen of the villages located in Chin indicated that farmers in their villages cultivated opium poppy. Therefore, Chin was excluded due to a lack of data for this sub-section.

[42] A comparative analysis between the different types of villages according to their poppy-cultivation status is included in the next section using the data from the questions that apply to all villages.

Figure 14: Type of household involvement in poppy cultivation, by state, Myanmar, 2015



* Weighted average to represent the actual number of villages per state.

The high percentage of households exclusively growing poppy in their own fields in East Shan was the result of the combination of favourable opium yields and prices compared with those in other states: opium yields and opium farm-gate prices in East Shan were above the national average (13.0 versus 11.7 kilograms per hectare in the case of yield, and $346 versus $240 per kilogram in the case of the opium farm-gate price).

Consequently, gross poppy income per hectare was higher in East Shan ($4,498 per hectare) than in any of the other poppy-growing states of Myanmar (national average: $2,808 per hectare). This situation created economic incentives for farmers to cultivate their own poppy rather than labouring in poppy fields operated by others. It seems likely that the relatively low incidence of adverse climatological and agronomic conditions in East Shan, as mentioned previously, led to a favourable opium yield and relatively good quality poppy that fetched a high price in the market.

Nevertheless, the significant percentage of households exclusively labouring in poppy fields operated by others in most poppy-growing states suggests that it would be worthwhile extending alternative development initiatives beyond those who actually cultivate their own poppy, to include those who work solely as labourers in poppy fields.

In addition to individual households growing poppy in their own fields, an average of 3% of village headmen in the areas surveyed reported poppy-growing areas owned by community groups, whereby a group of households operates a poppy field to earn income for a common purpose. The majority of poppy growing by community groups was reported in Kachin, although Kayah and North Shan did not report this kind of activity. The average area under opium poppy cultivation by community groups was 2.5 hectares, with the largest average area per village reported in Kachin (11 hectares) and the smallest in East Shan (0.4 hectares).

Table 11: Villages with poppy grown by community groups, by state, Myanmar, 2015

	East Shan	North Shan	South Shan	Kachin	Kayah	All*
Percentage of villages with poppy grown by community groups	3	0	6	6	0	3
Average area cultivated by community groups per village with such groups (hectares)	0.4	-	3	11	-	2.5

* Weighted average to represent the actual number of villages per state.

The average area under poppy cultivation per household in the areas surveyed was 0.42 hectares and was calculated by dividing the poppy-cultivation area reported by village headmen (excluding poppy-growing areas owned by community groups) by the reported number of households that grow poppy in their own fields (households that exclusively grow poppy in their own fields plus households that grow their own poppy and also labour in other farmers' fields).[43] The highest estimate was reported in South Shan (0.52 hectares per household), the lowest in North Shan (0.27 hectares per household).

Figure 15: Estimated average area under poppy cultivation per poppy-growing household, by state, Myanmar, 2015 (Hectares)

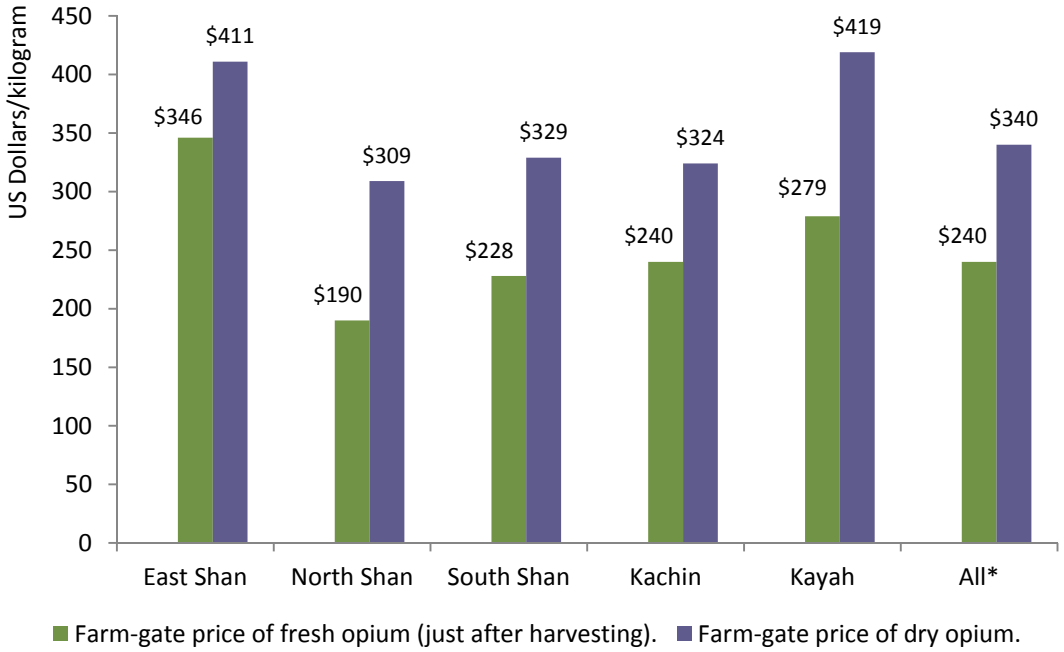
[43] Village headmen may have incentives for providing biased estimates of the area under poppy cultivation and number of households involved in poppy cultivation. However, both estimates seem to be biased in a similar way, at least to some extent, as the calculated average poppy area per household was partially corroborated by visual inspections conducted by field staff, suggesting that most of them are about one acre (0.4 hectares) in size and less than one acre in low-density areas.

b) Poppy farm-gate prices[44]

In the case of farmers who cultivate their own poppy fields, poppy prices directly influence their household income. In 2015, the average price per kilogram of fresh opium in all the poppy-growing states of Myanmar was $240 and the average price per kilogram of dry opium was $340; both lower than in 2014 when they were $397 and $502, respectively. Some variation could be observed when comparing average 2015 opium prices across the individual poppy-growing states of Myanmar. For example, a kilogram of fresh opium at the farm gate fetched $190 in North Shan, but fetched $346 in East Shan. Nevertheless, the price of fresh opium decreased in all states in 2015 with respect to 2014.

The reasons for this drop in the fresh opium price are unclear. Prices may differ according to ease of transportation and size of supply, reflecting local supply and demand. The price drop in 2015 may be related to a local restructuring of the opium trade, which could lead to individual farmers losing their bargaining power if the market were to become more dominated by large traders. A restructuring of the opium market has been informally observed by UNODC field staff in Myanmar, but UNODC does not currently collect data related to local trade relationships in the questionnaire for analysing this kind of conjecture.

Figure 16: Average farm-gate price per kilogram of fresh and dry opium (United States Dollars), by state, Myanmar, 2015

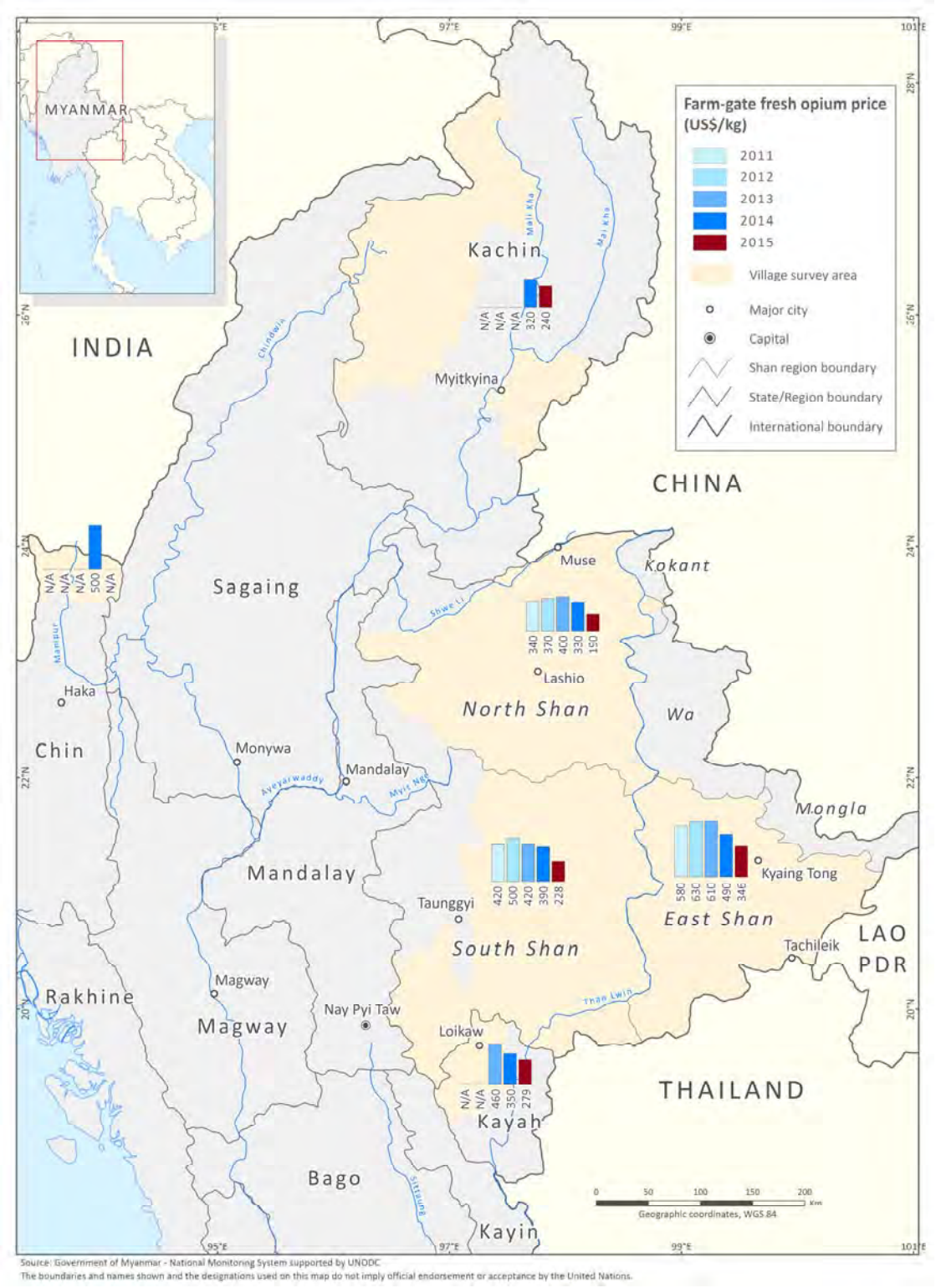


* Weighted average to represent the actual number of villages per state.

[44] Note that farm-gate prices refer to prices of opium purchased directly from farmers in poppy-growing villages, not prices at other points of sale.

Dried opium poppy capsules, Myanmar, 2014-2015

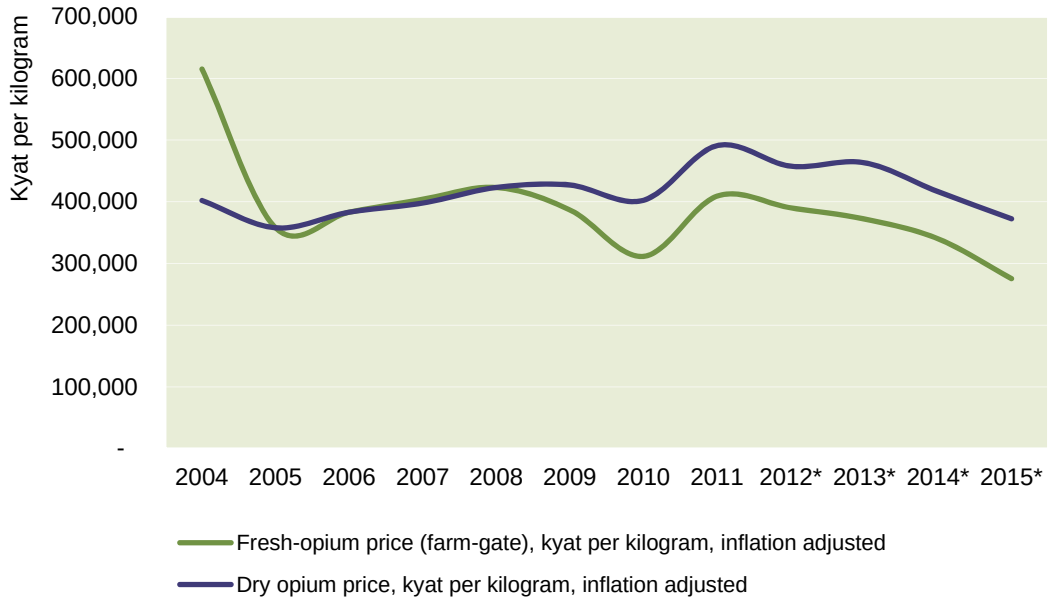
Map 7: Trends in the farm-gate price of fresh opium, Myanmar, 2015 (United States dollars per kilogram)



Calculated by removing the effects of inflation, inflation-adjusted prices allow a more accurate comparison of price changes over time. Although the trend in the inflation-adjusted price of dry opium remained relatively stable during the 2004 to 2015 period (prices ranged from 358,000 kyat per kilogram in 2005 to 491,000 kyat per kilogram in 2011), the inflation-adjusted price of

fresh opium actually reached a minimum low of 275,000 kyat per kilogram in 2015. Dry opium can be stored (for example, until prices improve) and is therefore less susceptible to strong price fluctuations than fresh opium. The following figure shows the inflation-adjusted price trend in fresh and dry opium in Shan state, the main poppy-growing state in Myanmar.

Figure 17: Inflation-adjusted farm-gate price (weighted average) of fresh opium in poppy-growing villages, and the inflation-adjusted price of dry opium (weighted average) in Shan state, Myanmar, 2002-2015, (Kyat per kilogram)*



**For 2012-2015, price reflects data from East, North and South Shan only, weighted by cultivation. In 2015, the consumer price index used was based on a projection of the historical consumer price index (2010=100) (World Bank, http://data.worldbank.org/country/myanmar).*

c) Daily wages for poppy-related and non-poppy-related labour

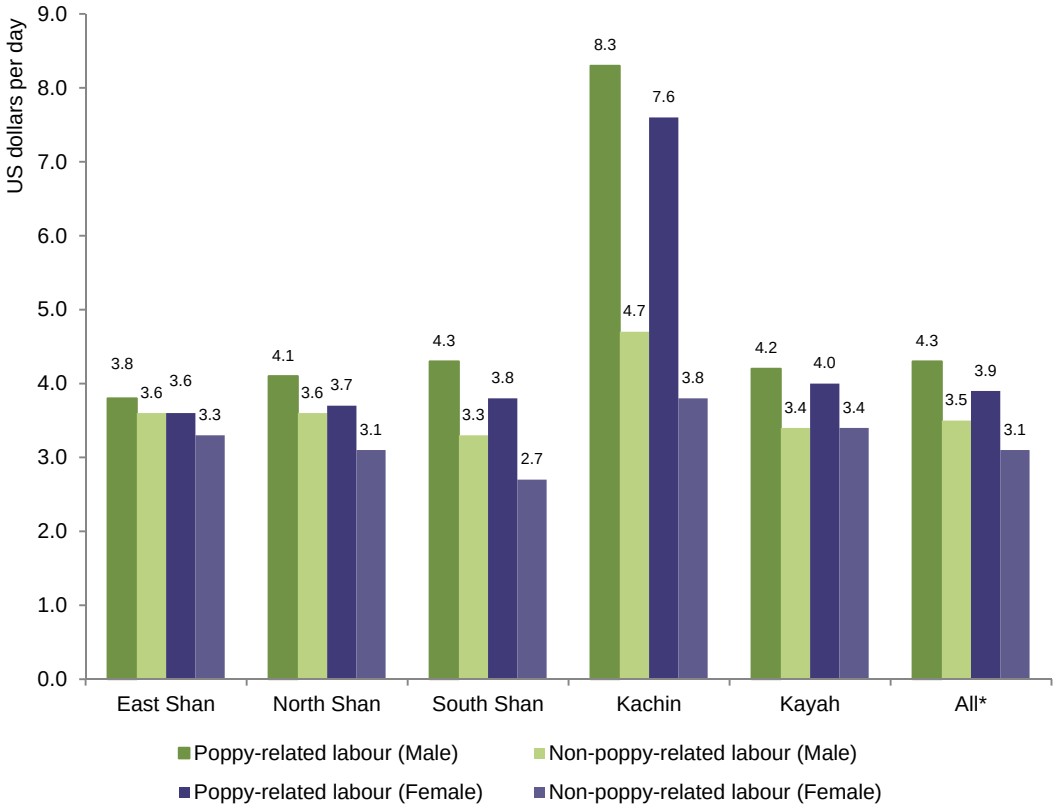
The income of households that work in the cultivation of opium poppy is determined by the daily wage that they earn by doing so. Households may be more likely to become involved in poppy growing if it pays them a higher wage than work related to other agricultural activities.

Due to the presence of gender wage gaps, the daily wage rates of male and female labourers were analysed separately, but both have a clear economic incentive to work in poppy growing. Both male and female labourers earned approximately $0.80 more per day for poppy labour than for “other” types of labour in 2015, which roughly corresponds to a 19% increase in the male daily wage rate and a 21% increase in the female daily wage rate. Potential explanations for this include greater skill being required for poppy-related labour than for “other” types of labour, the seasonal nature of poppy-related work, and being paid a premium for the risk of working in an illicit market.

Collecting/harvesting opium gum (Myanmar, 2015)

Lancing tools (Myanmar, 2015)

Figure 18: Daily wage earned for poppy-related and non-poppy-related labour in poppy-growing villages, by sex and by state, Myanmar, 2015



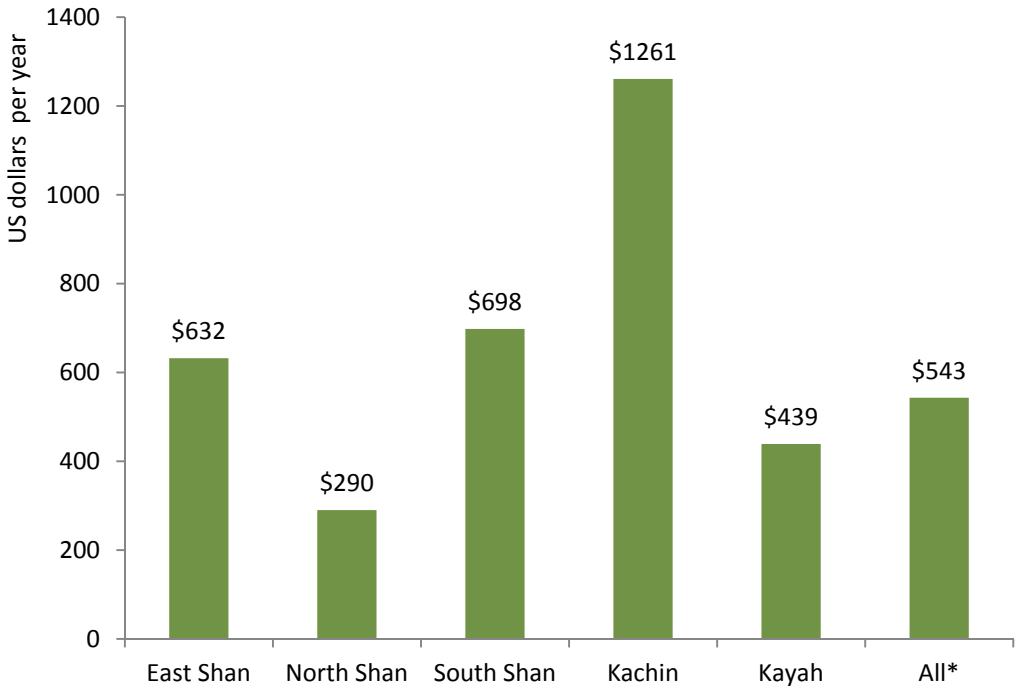
* Weighted average to represent the actual number of villages per state.

A comparison by state of the average daily wage for male and female poppy-related labour shows a greater disparity in Kachin than elsewhere. As poppy harvesting is less staged in Kachin than in other states, opium poppy farmers need skilled labour to harvest large poppy areas in a particularly short period of time (generally 7-10 days), which seems to increase the local daily wage for poppy-related labour quite substantially.

d) Poppy income and its uses

Village headmen were asked to estimate average poppy income per household, as well as the main uses of this particular income. Reported poppy-related income per household in Kachin was higher than in the other poppy-growing states of Myanmar, which is partially explained by the high yield per hectare, and the large average poppy area per household in Kachin (although poppy prices in Kachin were similar to those in other states, while poppy wages were higher).[45] Poppy income per household in South Shan and East Shan was similar in 2015. Farmers in South Shan cultivated a larger poppy area per household (0.52 hectares) than farmers in East Shan (0.30 hectares) but fresh poppy prices in South Shan ($228) were lower than in East Shan ($346), which partially explains why poppy income in both sub-states was similar.

Figure 19: Average reported annual poppy income per household, by state, Myanmar, 2015

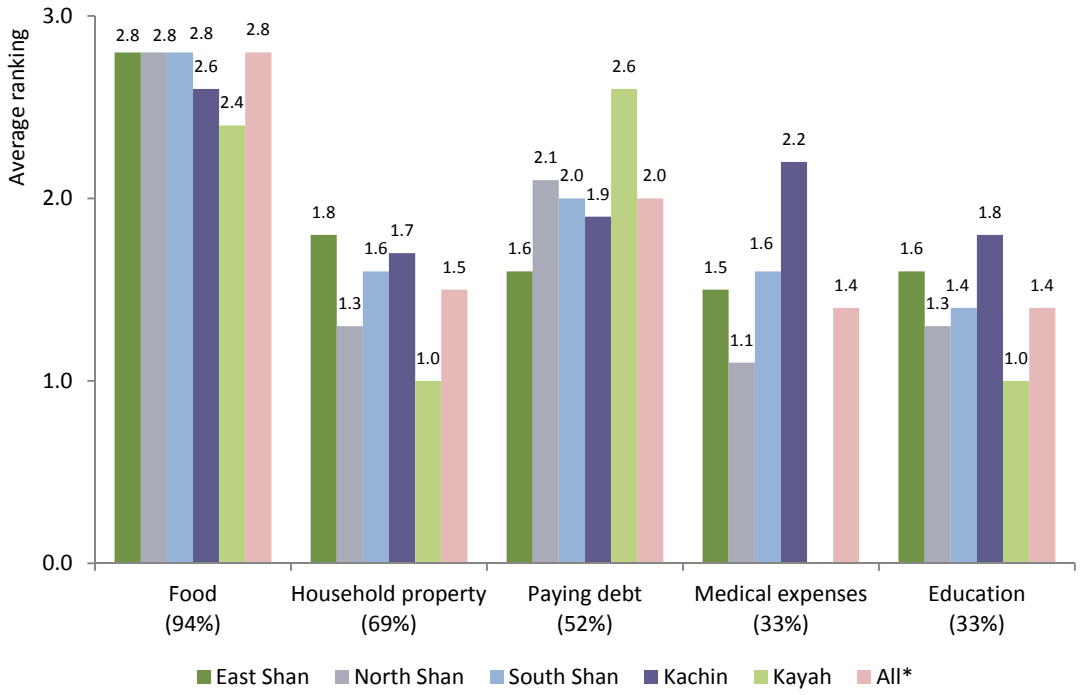


* Weighted average to represent the actual number of villages per state.

During the survey, village headmen were asked about the three most important household uses of poppy income. They indicated that, on average, buying food was the most important use of poppy income in their villages, followed by paying debt and paying household property expenses. An exception was observed in the state of Kayah where the most important use of poppy income was paying debt. Other uses of income of relatively less importance were paying for medical expenses and education. South Shan reported a more diverse use of poppy income compared with the other poppy-growing states, such as paying for village infrastructure and religious buildings. The importance of poppy income for buying food in all states suggests that poppy farmers in Myanmar are mostly subsistence farmers.

[45] It could also be that farmers in Kachin sold mostly dry poppy, which fetches a higher price than fresh poppy. Nevertheless, no information on this issue was collected during the survey interviews.

Figure 20: Uses of poppy income, by importance and by state, Myanmar, 2015[a,b]



Numbers in parentheses are the percentage of respondents who stated the option. Options not mutually exclusive.

* Weighted averages were taken to represent the actual number of villages per state.

[a] Average ranking per village from 3 = the most important use of poppy income to 1 = the third most important use of poppy income.

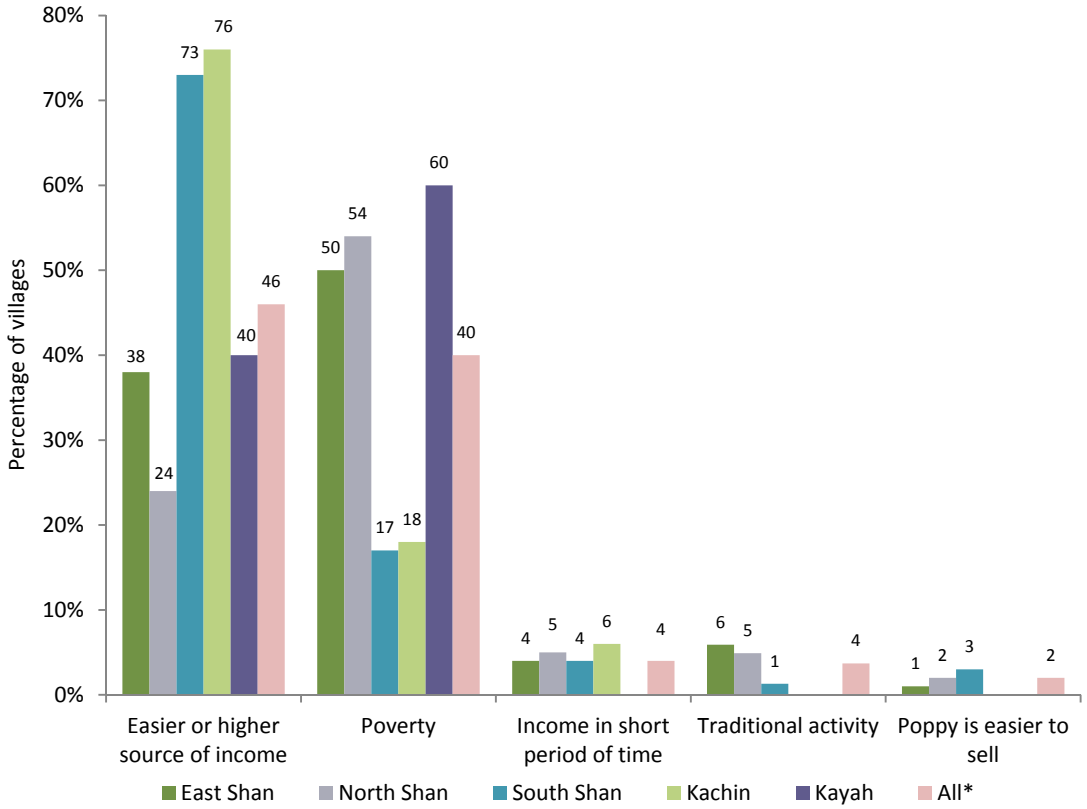
[b] Village infrastructure was reported by 9% of respondents (South Shan:1.6; East Shan: 1.0; and North Shan: 1.0). Religious building was reported by 6% of respondents (South Shan: 1.1). Not shown in the graph.

e) Reasons for cultivating opium poppy and its associated advantages

Village headmen also indicated the reasons why farmers get involved in poppy cultivation and their perceptions of its associated advantages. Poppy is clearly cultivated for economic reasons, with an average of 46% of the headmen of poppy-growing villages reporting that farmers cultivate opium in order to make more (or easy) income, while 40% specified that farmers do not cultivate opium to make more money *per se*, but rather to be able to cover family expenses as a result of poverty or lack of "livelihood assistance". Few respondents cited non-income-related reasons for cultivating opium poppy, such as poppy growing being a "traditional activity" (4%), or other income-related reasons such as earning "money in short period of time" (4%) or poppy being "easier to sell than other crops" (2%).

Reasons for cultivating poppy varied across the poppy-growing states of Myanmar. For example, all the responses in Kachin and Kayah exclusively focused on economic reasons (easy income, family expenses, or income in short period of time), while responses in the other states were more diverse.

Figure 21: Reasons for cultivating opium poppy, by state, Myanmar, 2015[a]



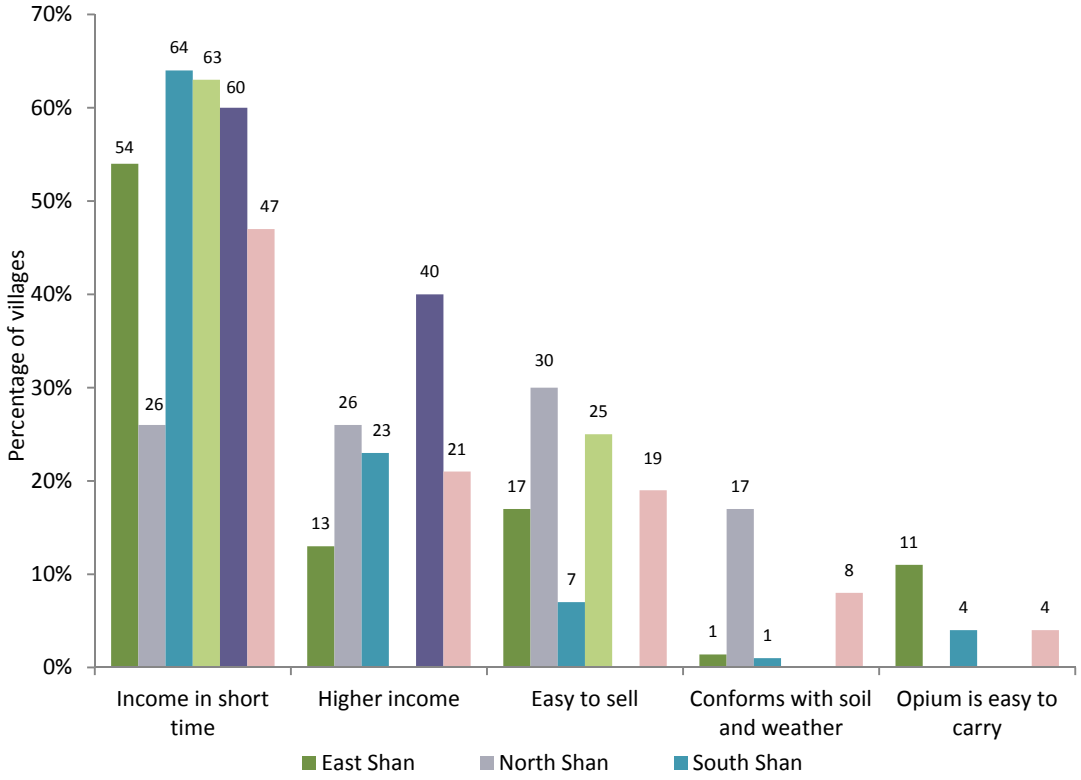
* Weighted average to represent the actual number of villages per state.

[a] Other minor reasons include: "appropriate soil or weather" (East Shan: 1%, North Shan: 5%), "village nearby grows poppy" (South Shan: 5%) and "felt that there was no prohibition by authorities" (South Shan: 1%). Not shown in the figure.

Regarding perceptions of the advantages of growing poppy, interestingly, the most cited advantage was that poppy provides "income in a short period of time" (47%), whereas providing "more income than other crops" was cited as the major reason for cultivating poppy, but only accounted for 21% of responses as a major advantage of cultivating poppy. Other major advantages were "poppy is easier to sell than other crops" (19%) and "raw opium is easy to carry" (4%). However, ecological and agrological reasons did not appear to be major advantages of cultivating poppy, with only 8% of respondents indicating that "poppy growing conforms to soil and weather" was a poppy-growing advantage. Villages in North Shan were an exception, with some 17% of survey respondents in that part of the state indicating that particular issue as an advantage of cultivating poppy compared with other crops.

There were other differences across the poppy-growing states regarding perceptions of the advantages of growing poppy. For example, cited advantages in Kayah once again focused on economic advantages (income in short period of time: 60%; more income than other crops: 40%) while responses in other states were more diverse.

Figure 22: Advantages of cultivating opium poppy, by state, Myanmar, 2015[a]



* Weighted average to represent the actual number of villages per state.

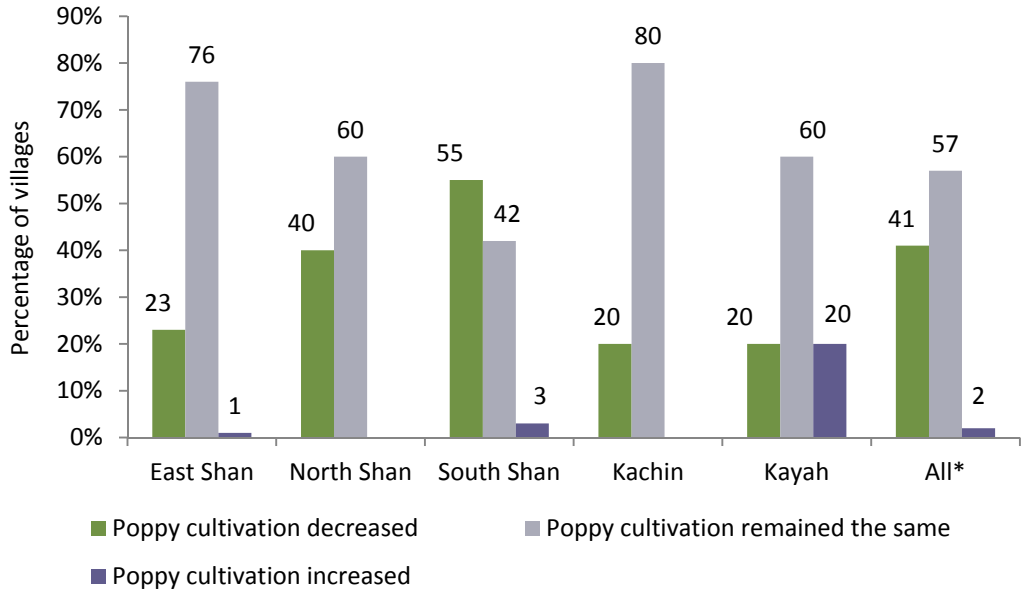
[a] Other minor advantages were opium is easy to grow (East Shan: 2%; Kachin: 6%) and poppy growing is a traditional activity (East Shan: 1%; Kachin: 6%). Not shown in the figure.

These findings suggest that, for the purposes of alternative development efforts, alternatives to opium cultivation not only need to be competitive in terms of income generated and the speed with which they provide it, but also need to have a well-established market. Although it seems unlikely that one single crop in isolation would be able to cover all these requirements, a range of crops and non-farming activities may be able to replace poppy to a certain extent.

f) Changes in poppy cultivation levels and reasons for changing the intensity of poppy cultivation

In 2015, most village headmen reported that areas under poppy cultivation either remained the same size as in the previous year (57%) or decreased in size (41%), while few village headmen reported increases in the size of areas under poppy cultivation with respect to the previous year (2%). This result is in line with the slight overall decrease in poppy cultivation captured by satellite images (-4%). However, the perception of change in North Shan and Kachin did not correspond to the figures estimated in the satellite survey.

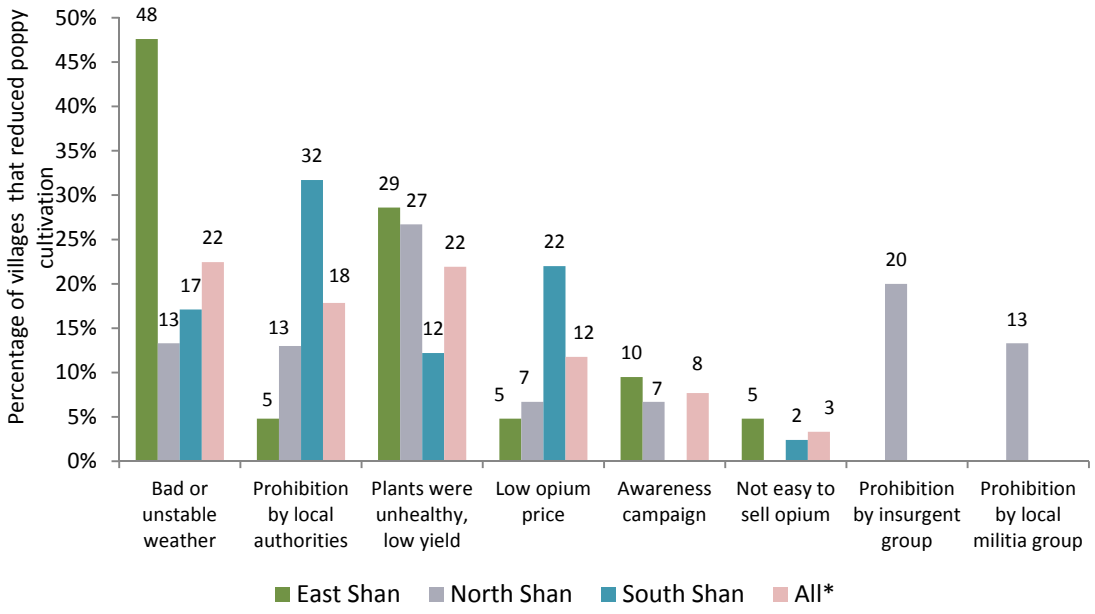
Figure 23: Changes in poppy cultivation with respect to previous year, by state, Myanmar, 2015



* Weighted average to represent the actual number of villages per state.

The headmen of villages where changes in poppy cultivation actually occurred were also requested to report their perceptions of why that was the case. On average, the reasons given for decreases in poppy cultivation were mostly associated with climatological and biological factors, such as bad or unstable weather (22%) and poppy diseases (22%). Moreover, about 18% of village headmen reported that farmers reduced poppy growing because it was forbidden by local authorities. Prohibitions by insurgent groups and local militia were also cited, though only in North Shan (20% and 13%, respectively), while low opium prices and awareness campaigns were cited as additional reasons (12% and 8%, respectively). These results suggest that the willingness of farmers to obey regulations directly established by the Government, and to pay attention to awareness campaigns, are factors that influence their decision to reduce poppy cultivation. The survey did not indicate a decline in opium prices as an important motivation for reducing poppy cultivation, other than in South Shan.

Figure 24: Reasons for a reduction in poppy cultivation with respect to previous year, by state, Myanmar, 2015[a]



* Weighted average to represent the actual number of villages per state.

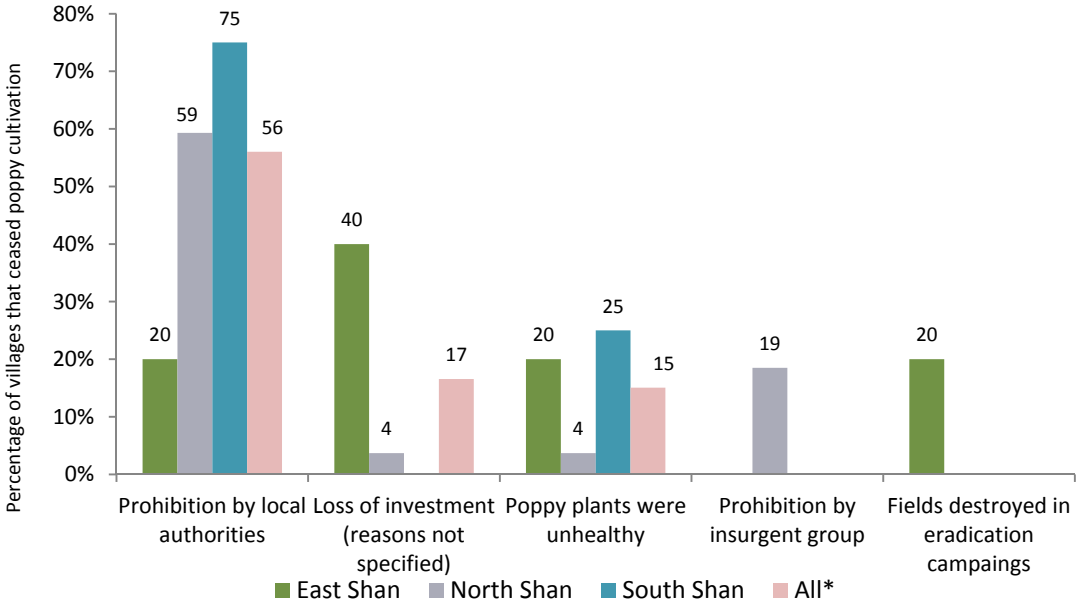
[a] Other reasons not shown in the figure: no access to credit (South Shan: 5%) and eradication or fear of eradication (South Shan=10%). Kachin and Kayah are not included in the figure due to low number of responses (n=2 and n=1, respectively).

As mentioned above, very few survey respondents reported increases in the size of areas under poppy cultivation in 2015 with respect to the previous year. Of the 2% who did, only five respondents stated reasons for increases in poppy cultivation, which included earning more income (60%), decreases in corn prices (20%) and the perception that there were non-eradication campaigns in their villages (20%).

g) Reasons for ceasing the cultivation of opium poppy, subsequent changes in income and coping strategies

Besides reducing poppy cultivation, farmers also have the option to cease poppy cultivation completely. As mentioned previously, 4% of village headmen reported that farmers in their villages stopped growing opium poppy in 2015. The main motivation for doing so was the prohibition of opium poppy cultivation by local authorities (56% on average), and by insurgent groups in the case of North Shan (19%); the latter result was similar to the one mentioned above regarding reasons for reducing poppy cultivation. Other main reasons for ceasing poppy cultivation were loss of investment (for example, due to climatic conditions) and unhealthy plants, which accounted for 17% and 15% of responses, respectively; and eradication in the case of East Shan (20%).

Figure 25: Reasons for ceasing opium poppy cultivation, by state, Myanmar, 2015[a]

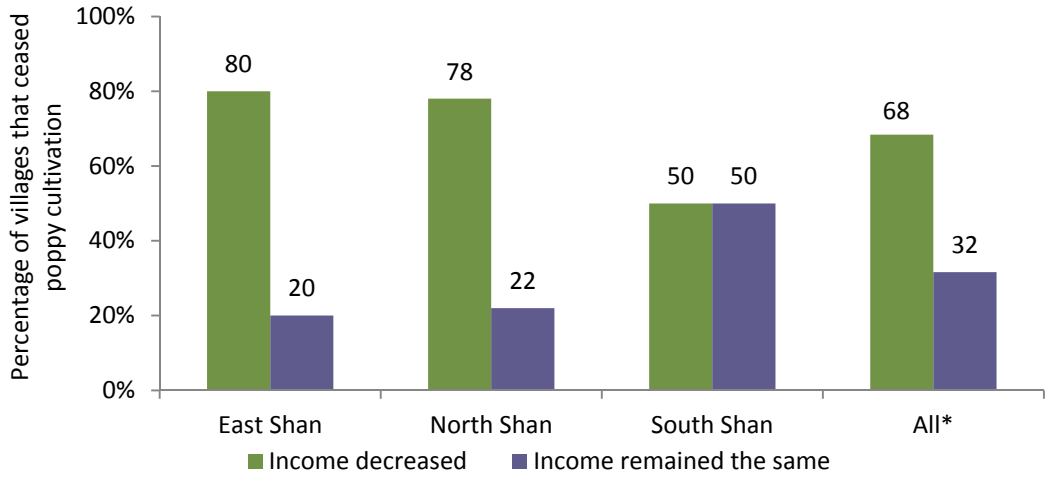


* Weighted averages were taken to represent the actual number of villages per state.

[a] Other reasons not included in the figure: violence (North Shan: 7%), NGOs encourage cultivation of alternative crops (North Shan: 4%), villages nearby ceased growing poppy (North Shan=4%). Kachin and Kayah are not included in the figure because of a low number (or no) responses (n=1 and n=0, respectively).

It is important to note that most village headmen reported subsequent decreases in income among farmers who ceased the cultivation of opium poppy (68%). The remaining respondents indicated that farmers' income stayed the same while none stated that farmers' income increased after ceasing poppy cultivation. As most opium poppy farmers are subsistence farmers, alternative sources of income need to be in place to prevent a decline in living conditions and potential social conflict if and when prohibition and eradication are imposed to reduce poppy cultivation.

Figure 26: Changes in income after farmers ceased opium poppy cultivation, by state, Myanmar, 2015[a]

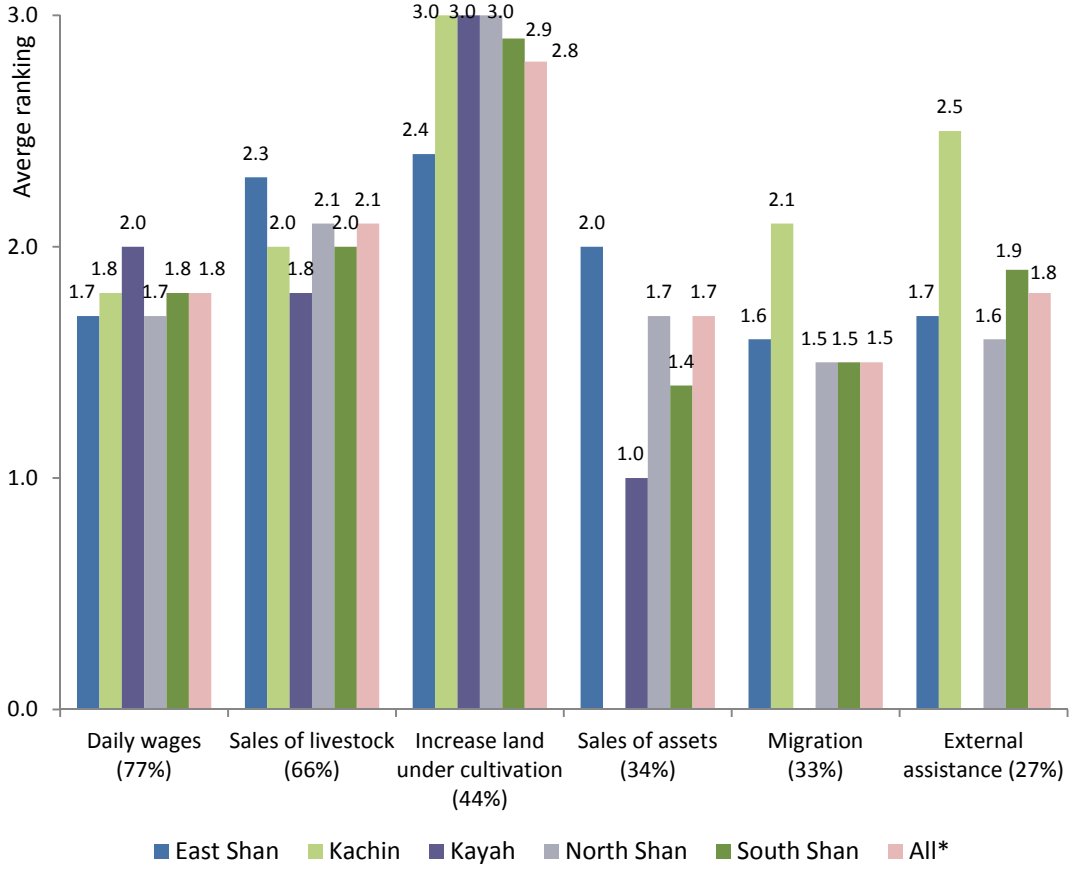


[a] Kachin and Kayah are not included in the figure because of a low number (or no) of responses (n = 1 and n = 0, respectively).

* Weighted averages were taken to represent the actual number of villages per state.

In addition, village headmen indicated the three most important coping strategies adopted by farmers after ceasing poppy cultivation. Important strategies in terms of the percentage of responses focused on daily wages and sales of livestock. However, a highly important coping strategy adopted by about half of households in all states was the expansion of the crop cultivation area, presumably to compensate for economic losses incurred after ceasing poppy growing. This could have environmental consequences, depending on the type of land used for that purpose.

Figure 27: Coping strategies after farmers ceased opium poppy cultivation, by importance and by state, Myanmar, 2015 [a]



Numbers in parentheses are the percentage of respondents from all villages who stated the option. Options not mutually exclusive.

[a] Average ranking per village from 3 = most important coping strategy to 1 = third most important coping strategy. Only the main coping strategies are shown in the figure. Other coping strategies include: remittance from abroad (7%); shifting cultivation (3%); and forest products (1%).

* Weighted averages were taken to represent the actual number of villages per state.

2.3.2 Comparative analysis of poppy-growing and non-poppy-growing villages[46]

This sub-section focuses on the comparison of poppy-growing and non-poppy-growing villages in order to explore differences between them and potentially identify (aggregated) factors associated with the cultivation of opium poppy. As very few of the villages surveyed indicated

[46] Annex 4 includes an analysis of the changes in socio-economic indicators from 2014 to 2015 and an explorative analysis of potential factors influencing poppy cultivation in villages.

that they had ceased growing poppy (4%) and some did not even report their poppy-growing status (3%), the results of these two categories need to be treated with caution and, for the sake of simplification, are not discussed further in this report. As such, the comparative analysis in this section mainly focuses on villages with farmers who grow opium poppy (poppy-growing villages) and villages with farmers who have never grown opium poppy (non-poppy-growing villages).

a) Demographic characteristics of villages

Poppy-growing villages seem to face more difficult living conditions than non-poppy-growing villages located in the same state. On average, poppy-growing villages had fewer total inhabitants than non-poppy-growing villages in 2015, and the percentage of children who died (under 1 year of age and between 1 and 14 years of age) was higher in poppy-growing villages than in non-poppy-growing villages, which is not explained by the slightly higher birth rate in poppy-growing villages.

Table 12: Demographic characteristics of villages surveyed, by poppy-cultivation status, Myanmar, 2015*

	Poppy-growing villages	Non-poppy-growing villages	All villages**
Number of inhabitants***	291	410	386
Birth rate (number of births in past 12 months per 1000 inhabitants)***	17	16	17
Percentage of children who died (under 1 year of age) in the past 12 months per number of inhabitants***	0.14	0.06	0.09
Percentage of children who died (between 1 and 14 years of age) in the past 12 months per number of inhabitants	0.16	0.11	0.12
Number of ethnic groups in village***	1.17	1.30	1.26

* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

**"All villages" includes villages with farmers who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the table).

***The differences between the weighted averages of poppy-growing and non- poppy-growing villages are statistically significant at 5% significance level (weighted Welch's t-test).

b) Prices of crops, sources of income and reported annual income (total and per activity)

On average, prices of rice and corn were slightly higher in poppy-growing villages than in non-poppy-growing villages in 2015, which may reflect the relative local scarcity of those products. Prices of paddy (rice with husk), which requires the removal of the husk prior to consumption and can be stored for a relatively long period of time, were higher in non-poppy-growing villages than in poppy-growing villages. Interestingly, prices of dry poppy were lower in non-poppy-growing villages than in poppy-growing villages, which may have been related to the availability of low-quality product for local consumption in those villages.

Table 13: Prices of cereals (United States dollars) in villages, by poppy-cultivation status, Myanmar, 2015*

Average in United States dollars per kilogram	Poppy-growing villages	Non-poppy-growing villages	All villages**
Paddy (rice with husk)***	0.28	0.29	0.27
Rice (without husk)***	0.48	0.44	0.45
Corn***	0.18	0.13	0.14
Wheat	0.32	0.28	0.32
Poppy (dry)	340	329	358[a]

* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

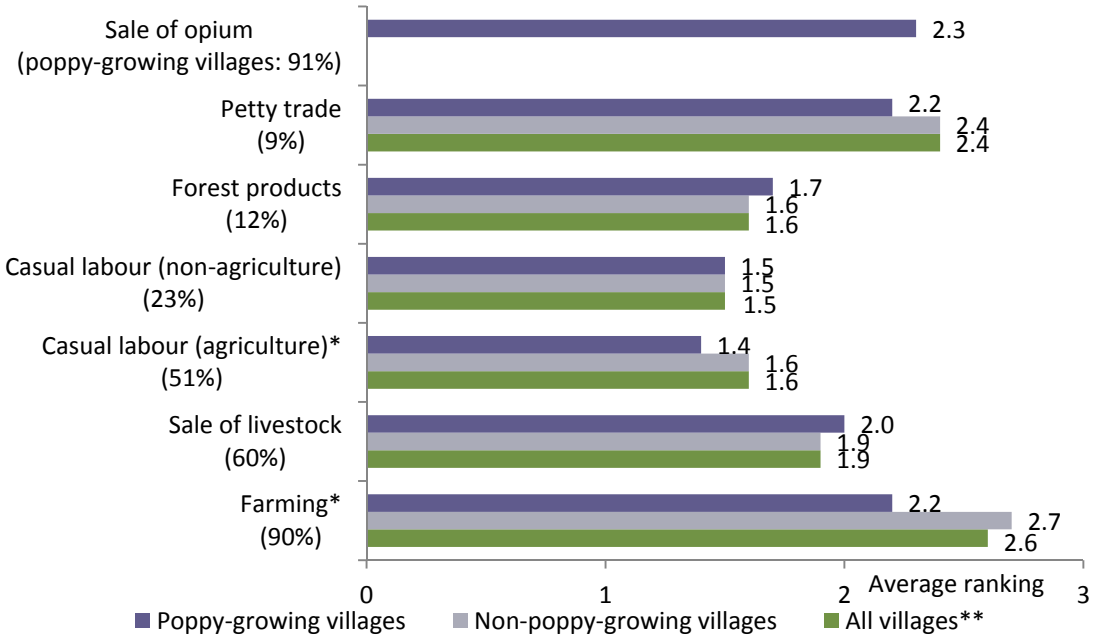
** "All villages" includes villages with farmers who ceased poppy cultivation and villages where poppy-cultivation status was not specified (not shown in the table).

*** The differences between the weighted averages of poppy-growing and non-poppy-growing villages are statistically significant at 5% significance level (weighted Welch's t-test).

a The average for all villages was higher than in poppy-growing and non-poppy-growing villages because of the inclusion of villages with farmers who had ceased growing poppy and non-specified villages, as indicated above.

Village headmen were interviewed about the three most important sources of income for households in their village. The primary source of income in terms of importance in non-poppy-growing villages was farming, while in poppy-growing villages it was the sale of opium. Other important sources of income were the sale of livestock, casual labour (agriculture related and non-agriculture related), the sale of forest products and petty trade. Sources of income of households in poppy-growing villages were less diverse than in non-poppy-growing villages, where handicrafts, fishing and hunting, rubber products, salaried jobs and "others" were also indicated as important sources of income. Income diversification is important to prevent households relying on high-value crops such as opium poppy as practically their only source of cash. Shorter distance to market (see next sub-section), and therefore to rural towns, seems to offer more opportunities for income diversification in non-poppy-growing villages than in poppy-growing villages.

Figure 28: Main sources of income, by importance and by village poppy-cultivation status, Myanmar, 2015[a,b]



Numbers in parentheses are the percentage of respondents who stated the option. Options not mutually exclusive. No data collected on importance of opium sales in non-poppy-growing villages.

Other sources of income in non-poppy-growing villages included handicrafts (1%: 2.3), fishing and hunting (1%: 1.3), rubber products (0.4%: 2.0), salaried job (0.2%: 2.0), and others (0.4%: 2.0). Not shown in the figure.

[a] Average ranking from 3 = most important source of income to 1= third most important source of income.
[b] All figures are weighted averages that were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

* The differences between the weighted averages of poppy-growing and non-poppy-growing villages are statistically significant at 5% significance level (weighted Welch's t-test).

** "All villages" includes villages with households who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the figure).

In 2015, poppy-growing villages reported lower total income than non-poppy-growing villages because of the sharp decrease in the price of fresh opium, the sale of which is the former's most important source of income. Households in non-poppy-growing villages earned higher income than poppy-growing villages in each of the non-poppy-related economic activities indicated below.

Table 14: Average annual income per activity in United States dollars per household, by village poppy-cultivation status, Myanmar, 2015*

Average	Poppy-growing villages	Non-poppy-growing villages	All villages**
Casual labour*** (agriculture)	185	341	319
Casual labour*** (non-agriculture)	182	326	277
Farming***	468	949	783
Fishing/hunting	-	861	861

Forest products***	199	197	224
Handicrafts	-	662	456
Sale of livestock	487	550	532
Sale of opium***	543	270	547
Petty trade***	189	565	471
Rubber products	-	444	444
Total income[a], * **	**1548**	**1952**	**1843**

* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

** "All villages" includes villages with farmers who ceased growing poppy and villages where poppy-cultivation status were not specified (not shown in the table).

*** The differences between the weighted averages of poppy-growing and non-poppy-growing villages are statistically significant at 5% significance level (weighted Welch's t-test).

[a] Total income does not correspond to the sum of the income from all activities, as not all farmers perform all the activities included in the table.

On average, opium sales accounted for up to a third of average household income in poppy-growing villages in 2015. In non-poppy-growing villages, large proportions of income were derived from other types of farming, but for some households in those villages, which probably have access to nearby markets, fishing and hunting, handicraft sales and petty trade made up a relatively high proportion of total income.

Small forest market in South Shan, Myanmar, 2015

Fish products in Kachin, Myanmar, 2015

c) Access and distance to markets

As distance to markets has an effect on farmers' transaction costs it may affect their crop-cultivation decisions, including about whether or not to grow opium poppy. For example, when faced with a long distance to markets, the willingness of some opium traders to collect opium directly from villages may prove attractive as it considerably reduces the travel burden required to transport other crops to market.

Most households did not count on markets taking place in their village (92%) and only 7% of villages had weekly markets. Moreover, a smaller proportion of poppy-growing villages (0.4%) than non-poppy-growing villages (2%) had daily markets.

The time taken to get to market on foot was an average of 1 hour 32 minutes in the case of non-poppy-growing villages and 2 hours 25 minutes in the case of poppy-growing villages. Clearly, non-poppy-growing villages tend to be closer to market than poppy-growing villages, which seems to have implications for farmers' crop-cultivation decisions and income diversification opportunities, as indicated above.

Table 15: Presence of markets, by village poppy-cultivation status, 2015*

Percentage of villages	Poppy-growing villages	Non-poppy-growing villages	All villages**
No market in village***	92.4	92.0	91.8
Daily market in village	0.4	1.7	1.1
Weekly market in village	7.2	6.3	7.1

* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

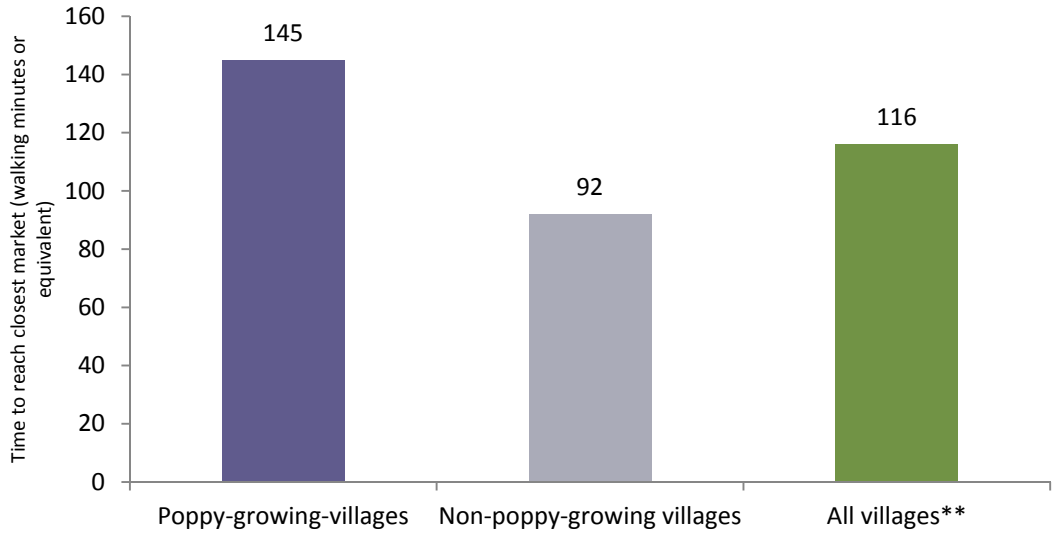
** "All villages" includes villages with farmers who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the table).

*** The differences between the weighted averages of poppy-growing and non-poppy-growing villages are statistically significant at 5% significance level (weighted Welch's t-test).

Local bridge in East Shan, Myanmar, 2015

Transportation by boat, Myanmar, 2015

Figure 29: Time (walking minutes) to reach market, by village poppy-cultivation status, 2015*



* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

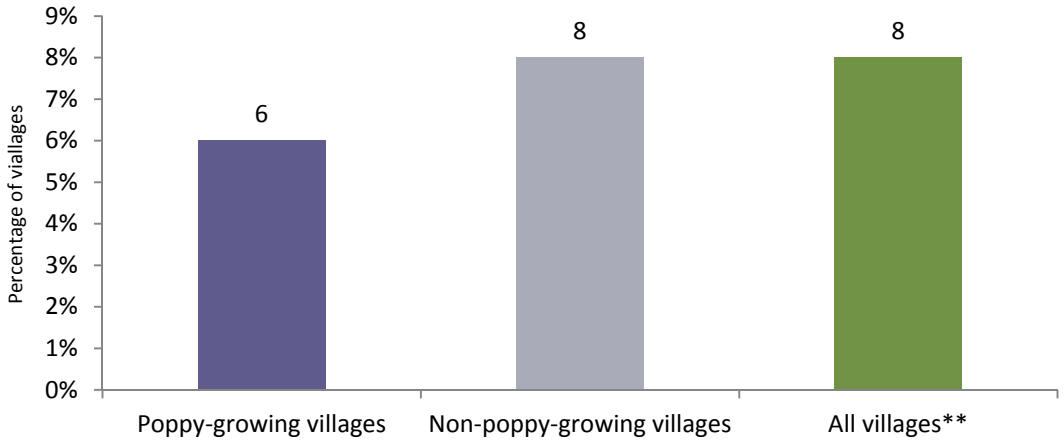
** "All villages" includes villages with farmers who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the figure).

The differences between the weighted averages of poppy-growing and non-poppy-growing villages are statistically significant at 5% significance level (weighted Welch's t-test).

d) Agricultural assistance

Although an average of 8% of the villages surveyed indicated that they had received agricultural assistance in the past 12 months, the percentage of poppy-growing villages that received agricultural assistance (6%) was slightly lower than the percentage of non-poppy-growing villages (8%).

Figure 30: Percentage of villages that received agricultural assistance in the past 12 months, by poppy-cultivation status, 2015*



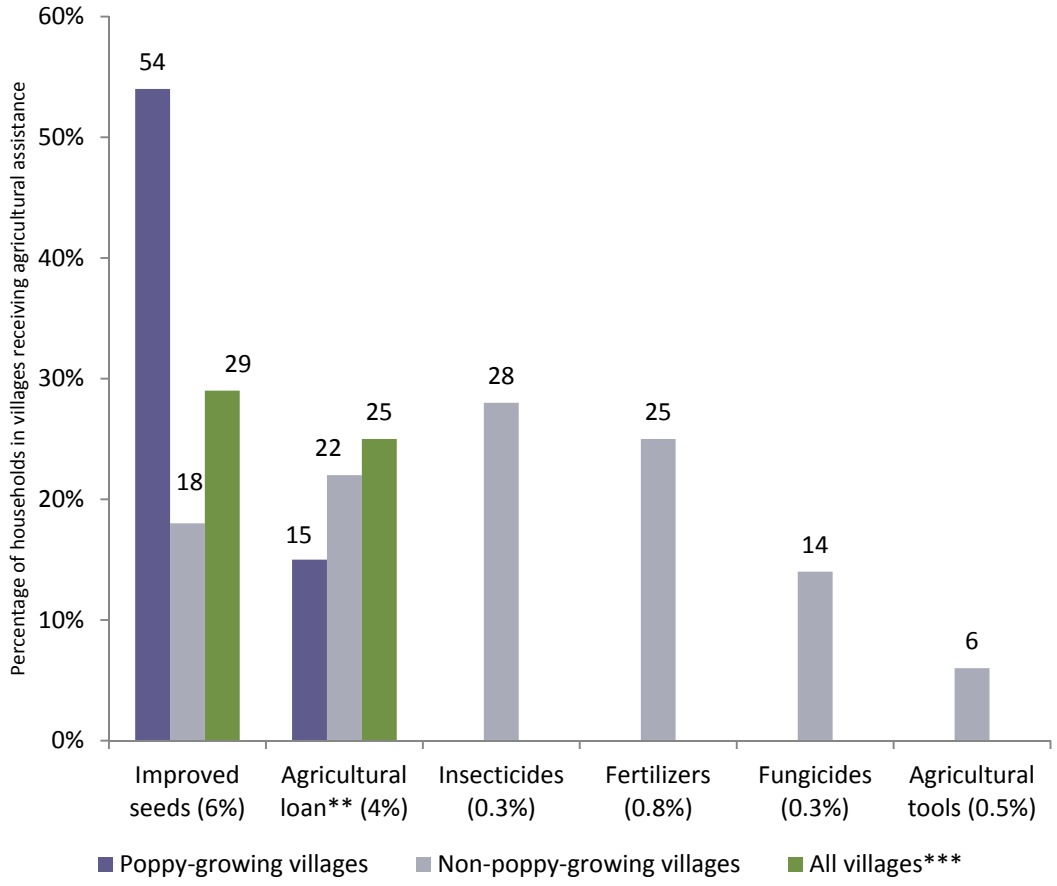
* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

** "All villages" includes villages with farmers who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the figure).

Agricultural assistance in poppy-growing villages was mainly focused on seed quality and agricultural loans, with 54% of households in villages that actually received agricultural assistance receiving improved seeds and 15% receiving agricultural loans.

Non-poppy-growing villages reported receiving more varied agricultural assistance than poppy-growing villages, including improved seeds (18% of households in villages that actually received agricultural assistance), agricultural loans (22%), insecticides (28%), fungicides (14%) and agricultural tools such as Tolaji (6%). This finding may be related to the less diverse sources of income available in poppy-growing villages than in non-poppy-growing villages. However, it may be necessary to evaluate whether poppy-growing villages are in need of access to other types of agricultural assistance in addition to the two options indicated above.

Figure 31: Type of assistance in villages that received assistance in the past 12 months, by poppy-cultivation status, Myanmar, 2015*



Numbers in parentheses are the percentage of villages that received agricultural assistance in the past 12 months.

* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

** The differences between the weighted averages of poppy-growing and non-poppy-growing villages are statistically significant at 5% significance level (weighted Welch's t-test).

*** "All villages" includes villages with farmers who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the figure).

e) Livestock assets, land ownership and debt

Farmers in isolated areas tend to accumulate capital by raising livestock (an absence of banks in the vicinity may be a factor). This seems to be the case in poppy-growing villages, in particular, where farmers had more buffalo per household (0.7) and cattle per household (1.3) than farmers in non-poppy-growing villages (0.5 and 0.8, respectively). The ratio of the number of households that owned livestock was similar in both types of village (an average of 0.37), which suggests that the accumulation of livestock takes place among relatively better-off farmers in poppy-growing villages, who end up owning the most livestock in those villages. This may mean that they are no longer subsistence farmers, yet they continue to cultivate poppy and use the income from it to accumulate capital by purchasing livestock.

Table 16: Livestock assets in villages, by poppy-cultivation status, 2015*

Average	Poppy-growing villages	Non-poppy-growing villages	All villages**
Ratio of number of households that own buffalo or cattle per total number of households in village	0.33	0.36	0.37
Ratio of number of buffalo per total number of households in village***	0.71	0.50	0.60
Ratio of number of cattle per total number of households in village***	1.32	0.77	0.93

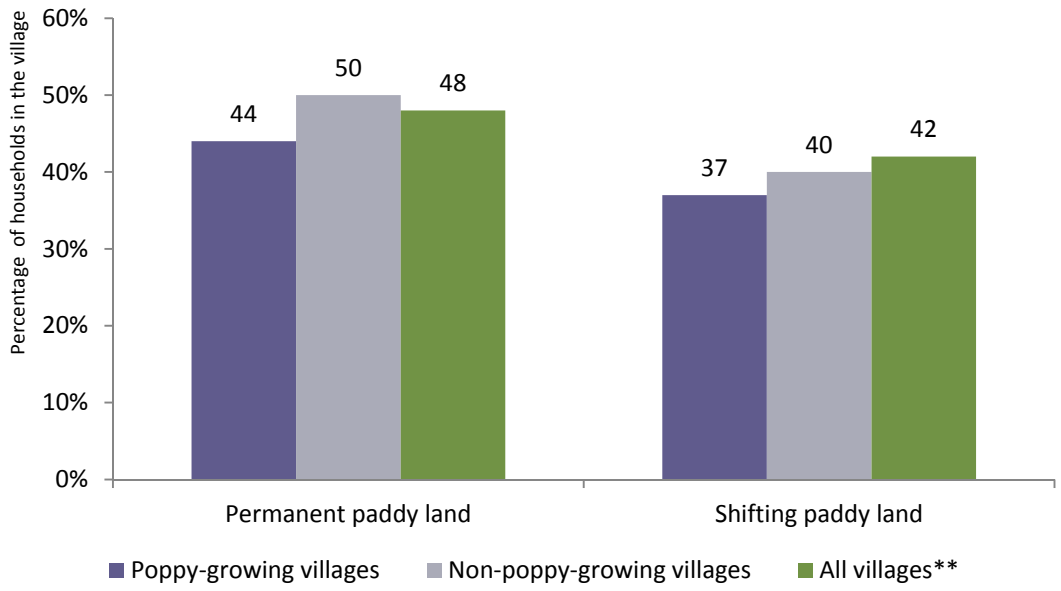
* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

** "All villages" includes villages with farmers who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the figure).

*** The differences between the weighted averages of poppy-growing and non-poppy-growing villages are statistically significant at 5% significance level (weighted Welch's t-test).

Farmers' investment decisions are probably influenced by their land-ownership status and level of debt, meaning that farmers who own their own land tend to consider investments with a longer rate of return than farmers who do not own their own land. The percentage of land ownership was slightly lower in poppy-growing villages than in non-poppy-growing villages in 2015, while a higher percentage of households in poppy-growing villages were in debt than in non-poppy-growing villages.

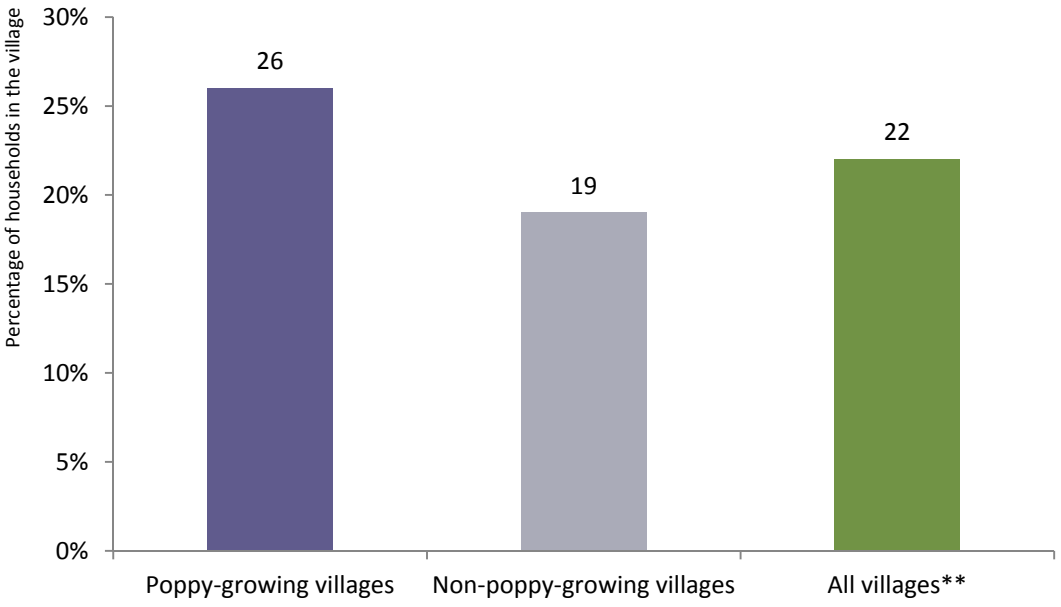
Figure 32: Percentage of land owners, by village poppy-cultivation status, 2015*



* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

** "All villages" includes villages with farmers who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the figure).

Figure 33: Percentage of households in debt, by village poppy-cultivation status, 2015*



* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing all villages per state.

** "All villages" include villages with farmers who ceased growing poppy and villages for which poppy-cultivation status was not specified (not shown in the figure).

f) Food (rice) deficit and coping strategies

Village headmen were requested to indicate the number of households that experienced rice deficit in their villages. An average of 77% of households did not experience rice deficit in the 12 months preceding the survey, which means that slightly less than a quarter of households in both types of village experienced rice deficits of varying durations in that period.

Table 17: Households that suffered rice deficit in the past 12 months, by village poppy-cultivation status and by duration of deficit, 2015*

Percentage of households that suffered rice deficit	Poppy-growing villages	Non-poppy-growing villages	All villages**
No deficit	74%	78%	77%
10-12 month deficit***	2%	2%	2%
7-9 month deficit	4%	2%	3%
4-6 month deficit***	7%	3%	4%
3 month deficit or less	13%	11%	12%

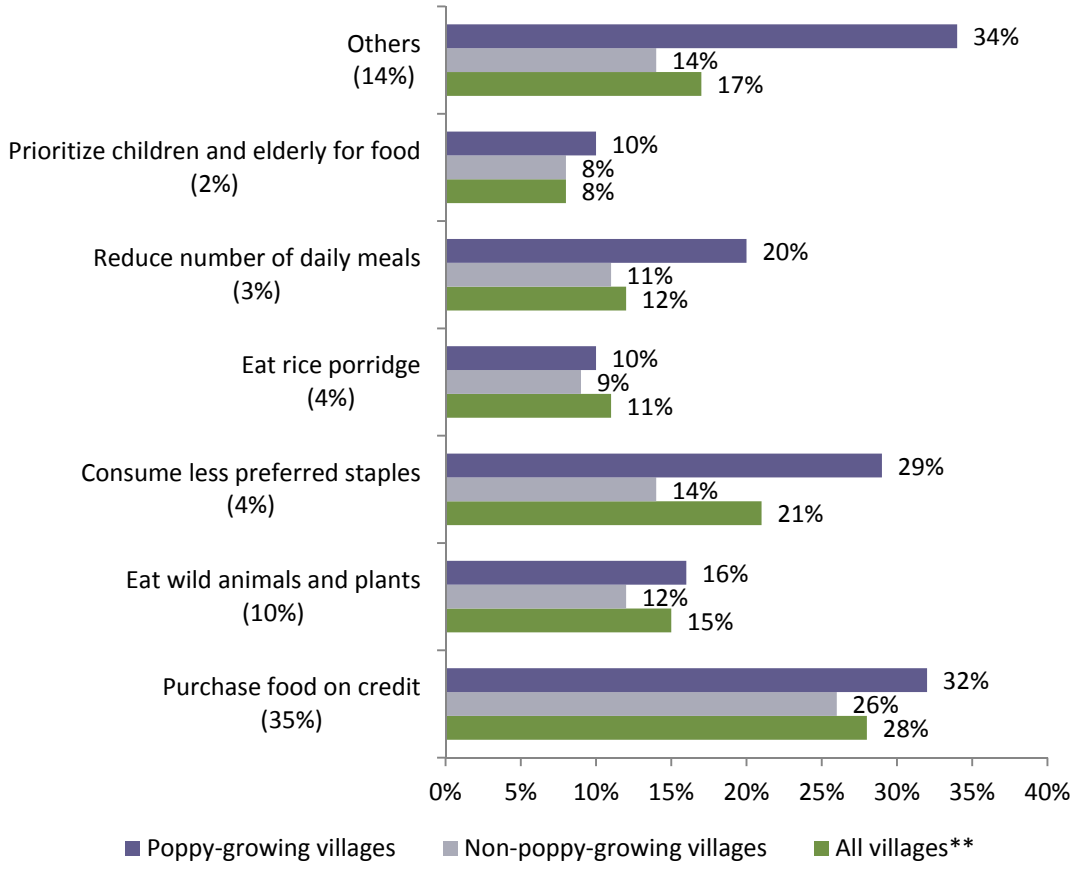
* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

** "All villages" includes villages with farmers who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the table).

*** The differences between the weighted averages of poppy-growing and non- poppy-growing villages are statistically significant at 5% significance level (weighted Welch's t-test).

Village headmen were also requested to indicate the coping strategies used to address food deficit and the number of households using them. The coping strategies used by most villages were purchasing food on credit (35% of villages) and eating wild animals and plants (10%). Two other coping strategies, though mostly used by households in poppy-growing villages, were reducing the number of daily meals (3%) and consuming less preferred staples (4%).

Figure 34: Percentage of households using the following coping strategies to address food deficit in the past 12 months, by village poppy-cultivation status, 2015*



Numbers in parentheses are the percentage of headmen who stated that the coping strategy was used in their village. Options not mutually exclusive.

* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

** "All villages" includes villages with farmers who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the figure).

g) Drug use

The prevalence of drug use, as reported by village headmen, decreased in the villages surveyed from 2014 to 2015. However, the values reported in 2014 seem to correspond to an abnormal year (outlier), as 2015 values were closer to those reported in 2012 and 2013.[47] The use of opium, heroin and amphetamine-type stimulants (ATS or yaba) was more common in poppy-growing villages than in non-poppy-growing villages.

[47] A specific survey focusing on drug use, to take place in 2016, will provide more information and evidence about the prevalence of drug use in Myanmar.

Table 18: Drug use in adults, by village poppy-cultivation status, 2015*

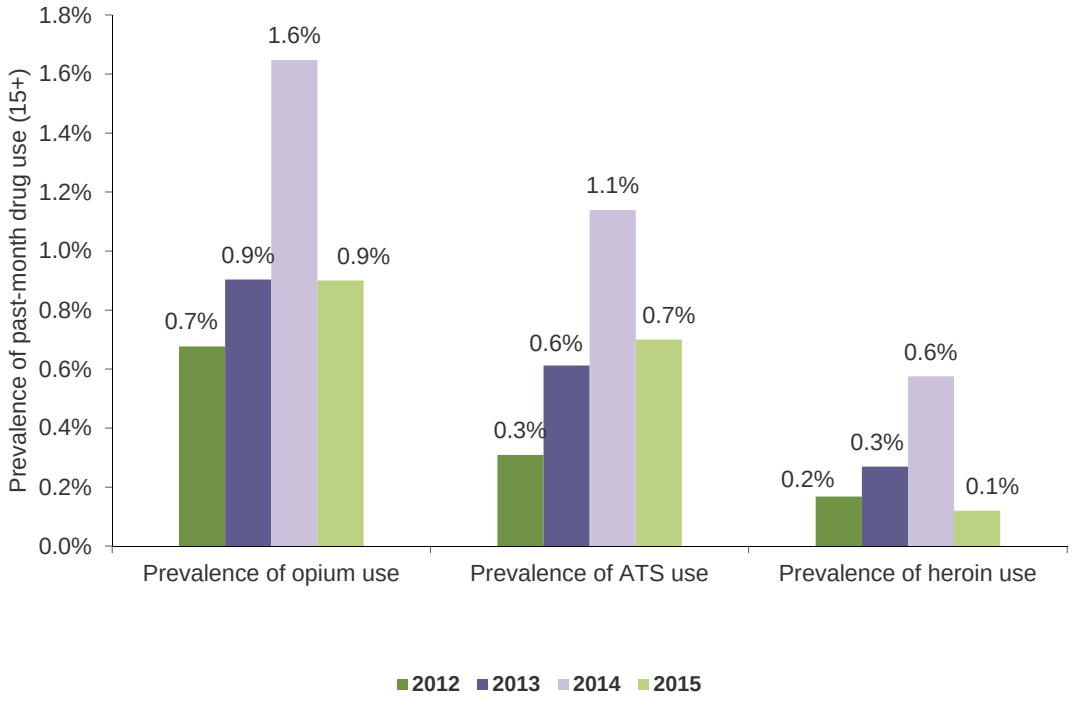
	Poppy-growing villages	Non-poppy-growing villages	All villages**
Percentage of adults who used opium in the past 4 weeks (15 years of age and above)***	2.00%	0.25%	0.86%
Percentage of adults who used ATS (Yaba) in the past 4 weeks (15 years of age and above)	0.73%	0.66%	0.72%
Percentage of adults who used heroin in the past 4 weeks (15 years of age and above)	0.14%	0.09%	0.12%

* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

** "All villages" includes villages with farmers who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the table).

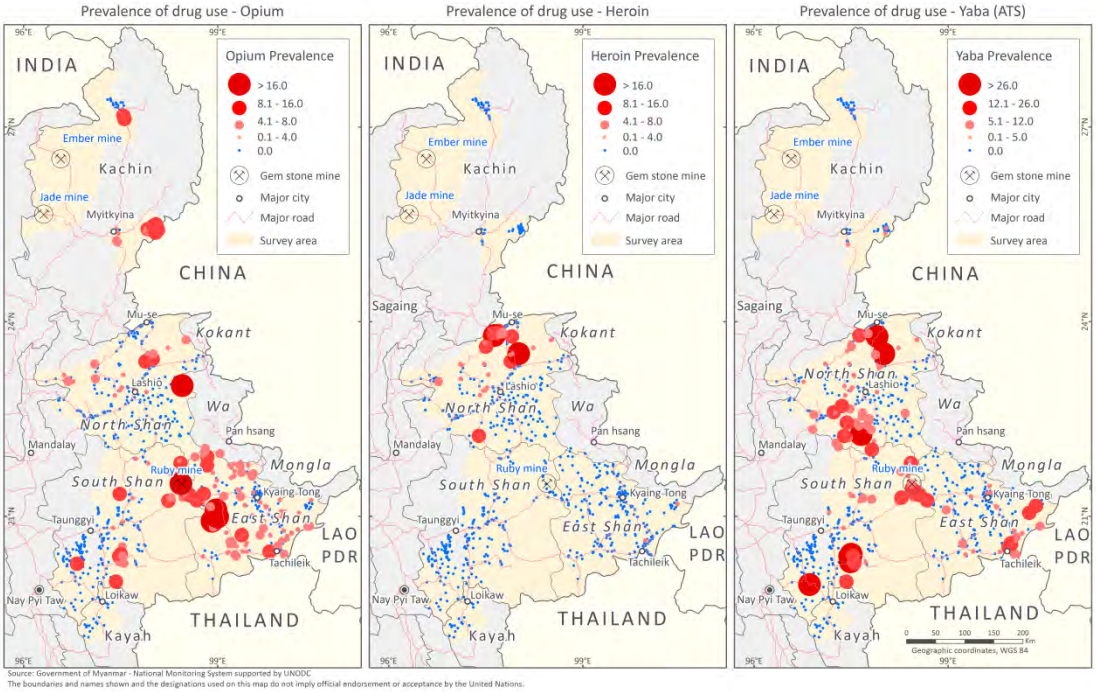
*** The differences between the weighted averages of poppy-growing and non-poppy-growing villages are statistically significant at 5% significance level (weighted Welch's t-test).

Figure 35: Percentage of drug use in adults in villages surveyed, Myanmar, 2012-2015



As in 2014, geographic patterns of ATS (Yaba) use in 2015 were focused around the far north of Shan state and the south-eastern border of East Shan. Villages detected in the survey with a high-prevalence of heroin were clustered in North Shan, while a cluster of opium use was detected in close proximity to a ruby mine in South Shan.

Map 8: Prevalence of drug use at the village level, by drug type, Myanmar, 2015



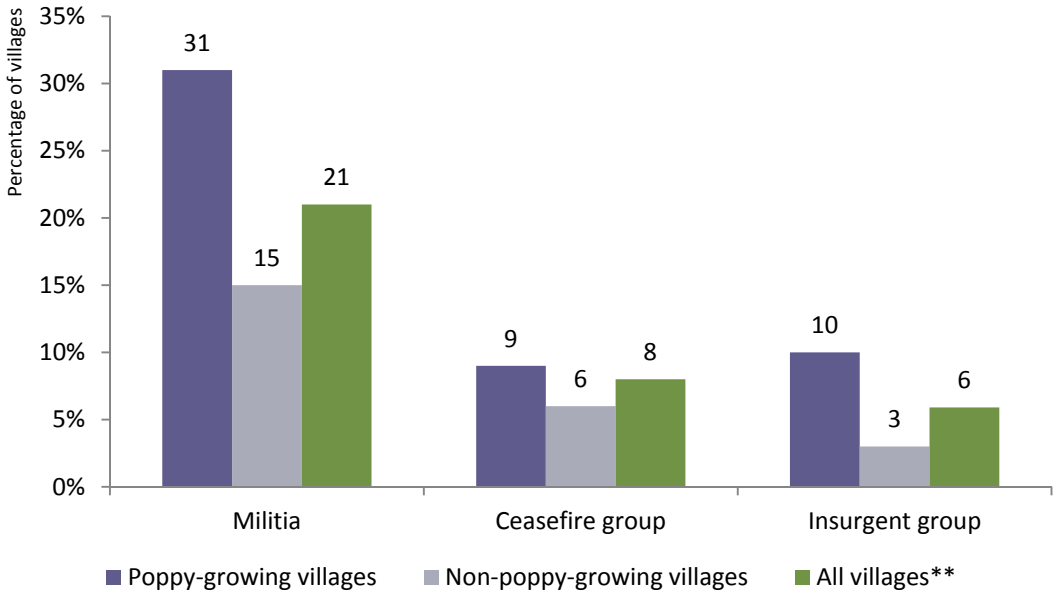
Liquid opium (Myanmar, 2015)

Liquid opium mixed with leaves for smoking (Myanmar, 2015)

h) Conflict and governability

A higher percentage of non-poppy-growing villages than poppy-growing villages indicated the presence of militia activity (31% and 15%, respectively), ceasefire groups (9% and 6%, respectively) and insurgent groups (10% and 3%, respectively) in 2015, which denotes that the cultivation of opium poppy is associated with social conflict and governability.

Figure 36: Presence of conflict groups, by village poppy-cultivation status, 2015*



* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

** "All villages" includes villages with farmers who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the figure).
The differences between the weighted averages of poppy-growing and non-poppy-growing villages are statistically significant at 5% significance level (weighted Welch's t-test) for all variables.

Concentrated in North Shan and southern Kachin, conflicts between various groups were ongoing in 2014-2015. Many instances were between the Myanmar Armed Forces (Tatmadow) and either the Kachin Independence army or the Ta'ang National Liberation Army.

Map 9: Reported conflicts, Myanmar, 2014-2015

Source: UNODC Country Office, Myanmar. Based on newspaper reports.

i) Migration

Migration rates may be indicative of the socio-economic and security situation in particular areas of Myanmar. According to village headmen, the adult emigration rate was four times higher than the immigration rate in both poppy-growing and non-poppy-growing villages, the latter rate being similar for males and females.

Table 19: Migration to and from villages, by poppy-cultivation status, 2015*

Average	Poppy-growing villages	Non-poppy-growing villages	All villages**
Number of men who left village in past three months (15 years of age and above) per 1000 adults in village.	2.4	2.8	2.8
Number of women who left village in past three months (15 years of age and above) per 1000 adults in village.	2.3	2.5	2.5
Number of men who moved to village in past three months 15 years of age and above) per 1000 adults in village.	0.52	0.83	0.67
Number of women who moved to village in past three months (15 years and above) per 1000 adults in village.	0.51	0.70	0.62

* Weighted averages were taken to represent the actual number of poppy-growing, non-poppy-growing and all villages per state.

** "All villages" includes poppy-growing and non-poppy-growing villages, as well as villages with farmers who ceased growing poppy and villages where poppy-cultivation status was not specified (not shown in the table).

Only a few village headmen indicated the three most important reasons for emigrating and immigrating (16 and 5, respectively). The most important reason for emigrating was to look for casual labour, followed by schooling and marriage, while the most important reasons for immigrating were casual labour, marriage and to work in poppy-growing areas (in the case of poppy-growing villages).

3. Eradication and seizures

The Government of the Republic of the Union of Myanmar (GOUM) provided data on the eradication of opium poppy and seizures of opium, according to which a total area of 13,450 hectares was eradicated in the 2015 opium poppy season, representing a decrease of 11% from the 2014 figure. As in previous years, most eradication took place in South Shan (78%). It should be noted, however, that UNODC did not monitor or validate the results of the eradication campaign or seizures carried out by GOUM.

Table 20: Eradication of opium poppy from 2007 to 2015, by state, Myanmar (Hectares)

State	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
East Shan	1,101	1,249	702	868	1,230	1,257	537	356	378
North Shan	916	932	546	1,309	1,315	977	532	337	532
South Shan	1,316	1,748	1,466	3,138	3,579	21,157	10,869	13,696	10,715
Shan state Total	**3,333**	**3,929**	**2,714**	**5,315**	**6,124**	**23,391**	**11,939**	**14,389**	**11,625**
Kachin	189	790	1,350	2,936	847	83	250	395	1,495
Kayah	12	12	14	13	38	84	59	67	54
Magway	45		1	1		4	7	60	8
Chin	10	86	5	2	10	110	32	277	267
Mandalay		3	2		39	45			
Sagaing	9		1				2	1	
Other states	64								
National total	**3,662**	**4,820**	**4,087**	**8,267**	**7,058**	**23,718**	**12,288**	**15,188**	**13,450**

Source: GOUM/CCDAC.

It is likely that the eradication figures provided by GOUM also included the monsoon poppy crop (prior to 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. The cultivation estimate may therefore include poppy-cultivation areas eradicated after the image date. Seizures of drugs by GOUM are reported in the table below.

Table 21: Seizures of drugs (opiates) from 1988 to 2015 (Kilograms)

Year	Raw Opium	Heroin	Brown opium	Liquid opium	Low-grade opium
1988-1997	22,992.26	3,721.51	185.73	117.57	305.79
1998	5,393.63	403.80	95.87	206.07	312.25
1999	1,473.03	245.35	24.10	332.50	314.35
2000	1,528.39	158.92	22.70	16.09	245.26
2001	1,629.07	96.74	6.52	18.68	141.70
2002	1,863.28	333.89	314.40	18.25	125.95
2003	1,481.70	568.08	156.25	51.74	203.87
2004	606.89	973.52	58.90	39.12	395.75

2005	772.72	811.69	43.77	20.55	127.74
2006	2,320.90	92.33	1,370.84	28.96	6,153.56
2007	1,273.97	68.38	1,120.97	56.36	10,972.20
2008	1,463.39	88.13	206.08	80.14	2,452.79
2009	752.04	1,076.13	325.70	27.48	465.43
2010	764.78	88.54	98.20	35.47	147.07
2011	828.27	42.44	36.88	60.04	281.65
2012	1,470.35	335.79	45.76	29.32	80.79
2013	2,356.98	238.93	71.55	115.25	65.98
2014	1,828.41	435.46	1,108.76	102.11	134.10
2015 (until april)	253.62	106.91	36.29	22.79	12.65

Source: GOUM/CCDAC.

Eradication in South Shan, Myanmar, 2015

Seized heroin lab, Myanmar, 2015

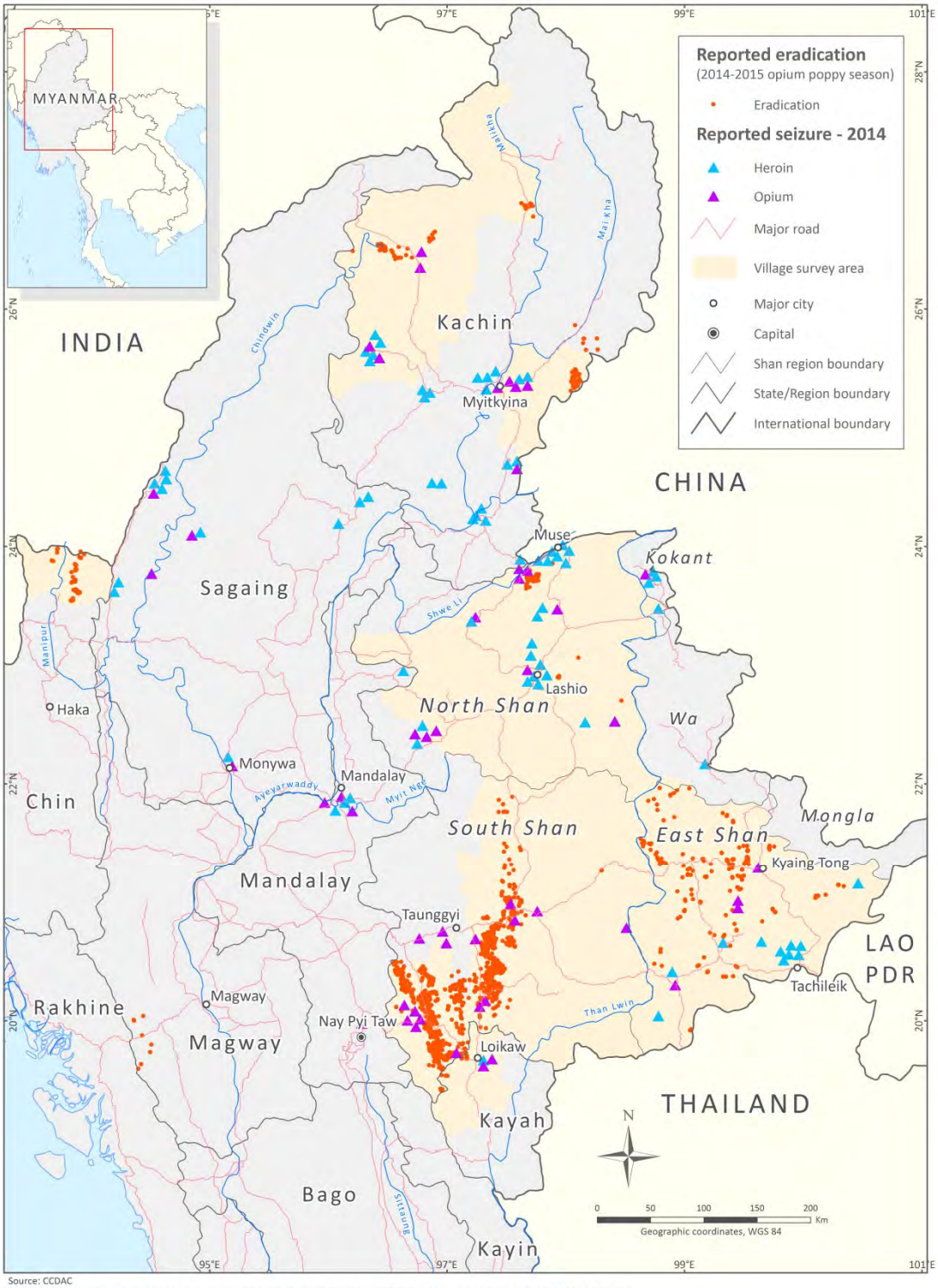
During the socio-economic survey (December 2014 to April 2015), 32% of village headmen in all 242 poppy-growing villages reported that their villages were affected by eradication, which affected a total of 20% of the poppy-growing areas in their villages. According to village headmen, South Shan was the state most targeted by eradication activities, with 56% of villages reporting eradication activities and 22% of the area under poppy cultivation eradicated in those villages.

Table 22: Poppy eradication, by state, Myanmar, 2015

	East Shan	Kachin	Kayah	North Shan	South Shan	All*
Percentage of villages affected by poppy eradication	13.9	52.9	40.0	19.5	55.7	32.2
Average percentage of poppy-growing area eradicated per village affected by poppy eradication	20.7	17.8	17.5	18.8	21.8	20.2

* Weighted averages were taken to represent the actual number of villages per state.

Map 10: Reported eradication and seizures in Myanmar, 2014-2015 season



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

4. Methodology

The 2015 opium poppy survey was composed of three parallel components:

1. A cultivation estimation survey throughout North Shan, East Shan, South Shan and Kachin states. For the second time, an estimate for the northern part of Chin state was also provided. The cultivation survey was based on the use of satellite remote sensing as the primary source of data, which was supplemented by field surveys to provide ground truthing and to support the interpretation of opium poppy fields;

2. A poppy yield survey throughout North Shan, East Shan, South Shan, Kayah, Kachin, and Chin states;[48]

3. A socio-economic survey in the same areas as the poppy yield survey.

4.1. Opium poppy cultivation area estimation

The poppy cultivation area estimate was based on the interpretation of satellite images. The area estimate by remote sensing methodology was carried out in North Shan, East Shan, South Shan and Kachin states as well as the northern part of Kayah and the northern part of Chin states. Very high-resolution satellite images were purchased after a systematic random selection throughout the study area.

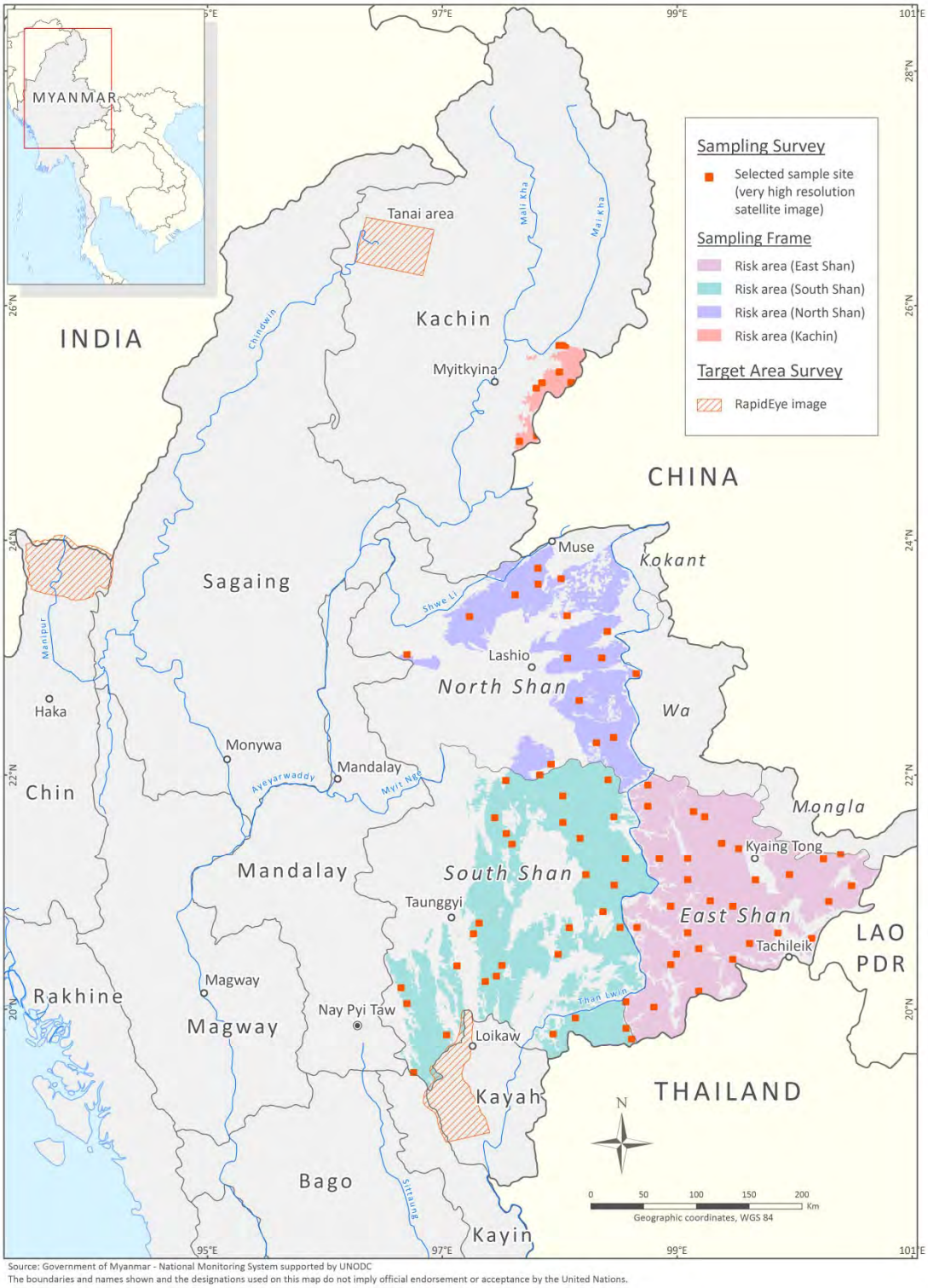
At selected locations, very-high resolution (VHR) images (Pleiades with 2 metre resolution multi-spectral 4 bands plus one 50 centimetre panchromatic band) were acquired. For every location, images from two different dates with a five-week interval (December/January and February/March) were purchased.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

In Tanai area, Kachin state, opium poppy cultivation was concentrated in one area and the area estimate was based on a targeted high-resolution image. A RapidEye (5 metre resolution) image was acquired to estimate the poppy cultivation area.

Poppy cultivation in the northern part of Kayah state was estimated by interpreting high-resolution RapidEye images. For the second time, the poppy cultivation area of northern Chin state was estimated also by using the high-resolution RapidEye images.

[48] This year no poppy capsules were found during the field visits in Chin.

Map 11: Location of different types of satellite images within the sampling frame, 2015



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.

Risk area and sampling frame for the selection of satellite image locations

Risk area describes the entire geographic area considered in the area survey. Basically, the risk area was developed by the combination of the following factors:

- land cover;
- altitude; and
- opium poppy-free[49] 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 was practised in small agricultural areas, often surrounded by natural vegetation. Wetlands and settlements were also excluded. Other classes of land use were considered to have the potential for opium poppy cultivation.

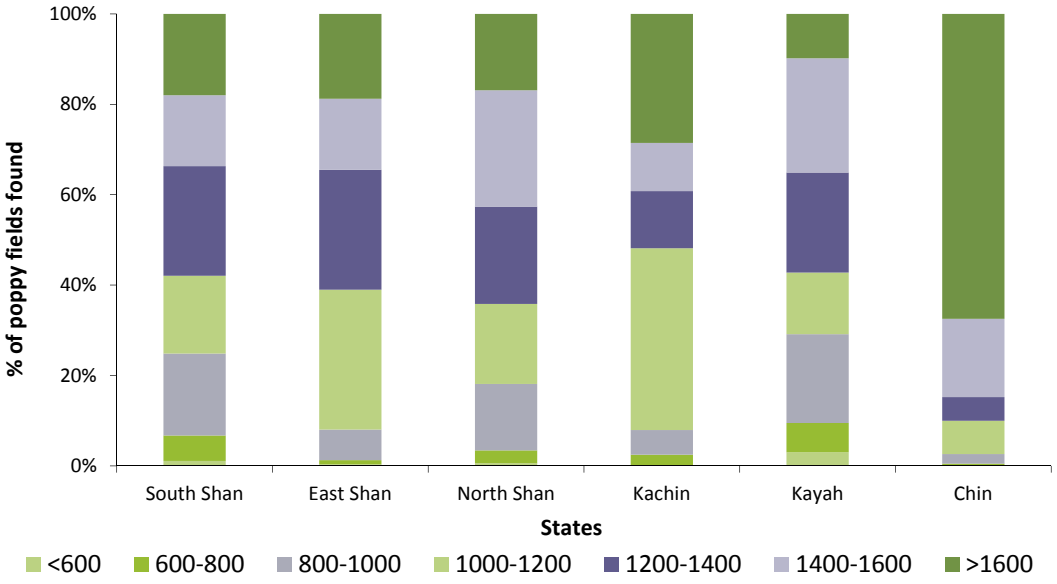
Prior to 2013, only altitudes between 800 and 1,800 metres were to be considered within the risk area. This was based on survey findings which had revealed that 95% of opium poppy was cultivated at such altitudes. However, more recent evidence has shown the existence of poppy fields at 600 metres altitude and above, without a specific higher limit. Consequently, the sampling frame for the selection of the sample locations has been updated since 2013 using this finding. Several opium poppy-free areas were identified based on ground information. The special regions Wa, Mongla, and Kokant were excluded from the sampling frame. The townships Mabein, Kyaukme, Nawng Hkio and Kunlon, in North Shan, and Kalaw, Pindaya, Yak Sauk and Ywa Ngan, in South Shan state, were excluded from the sampling frame for the same reason. A 10-km buffer zone along the border with Thailand, which had been considered to be opium poppy-free in former surveys, has been included in the sampling frame since 2013 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 Township in Kachin state was the same as in the previous survey, which was developed with an altitude factor of above 800 metres.

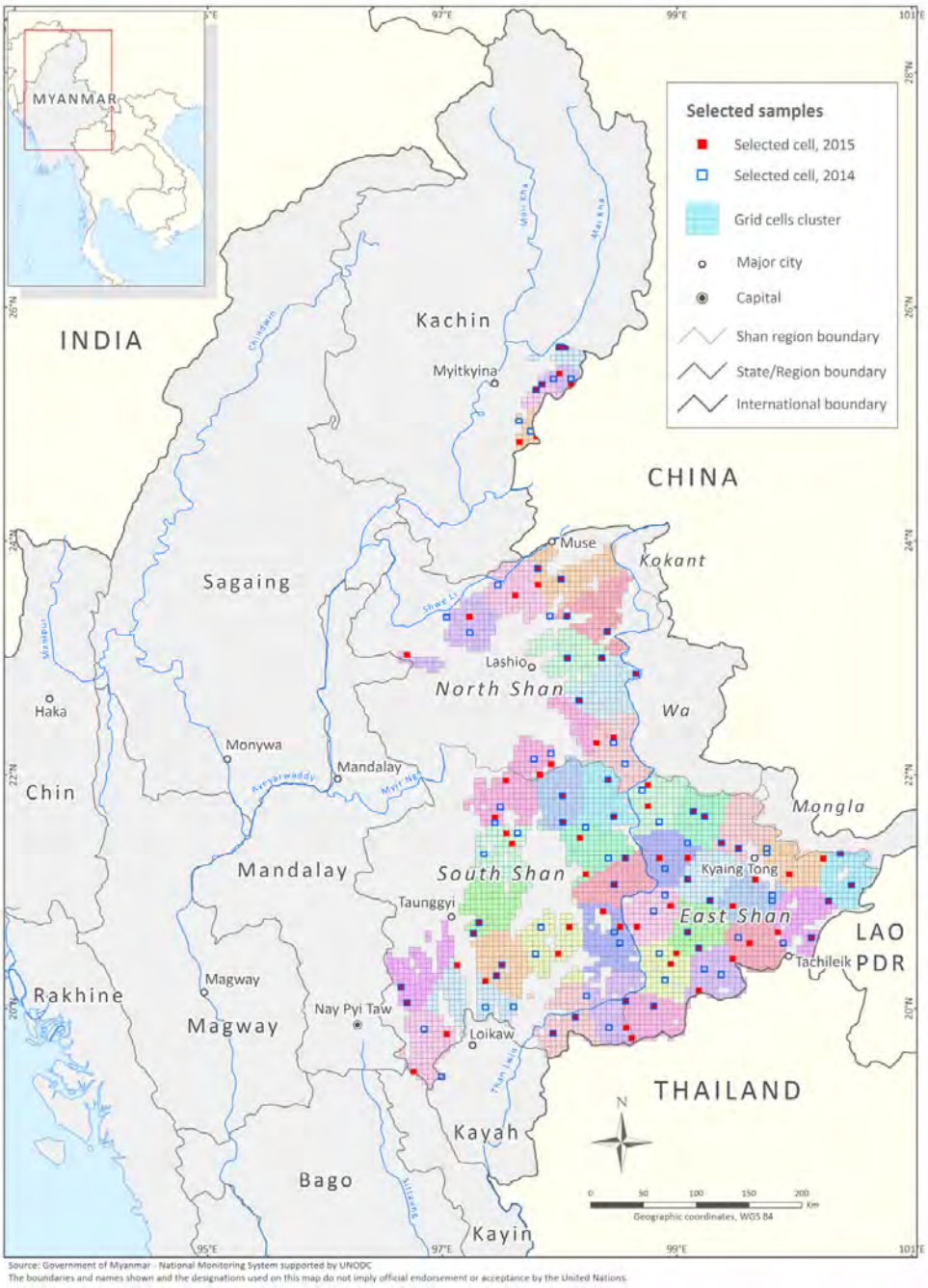
The sampling frame is the set of all 5x5 km segments that can be chosen for obtaining satellite imagery. For that purpose a 5x5 km regular grid was superimposed on the risk area. To increase the efficiency of the sample (thus to reduce the number of pictures purchased that only cover a small part of the risk area), a threshold of a minimum of 20% of risk area is set: if a segment contains less than 20% of risk area (e.g. is a cell at the boundary of the risk area), it is not included in the sampling frame. In the extrapolation, the whole risk area is considered. The limitation of the representativeness of the survey is considered to be small.

[49] Opium poppy-free in the sense of no indication of significant levels of opium poppy cultivation.

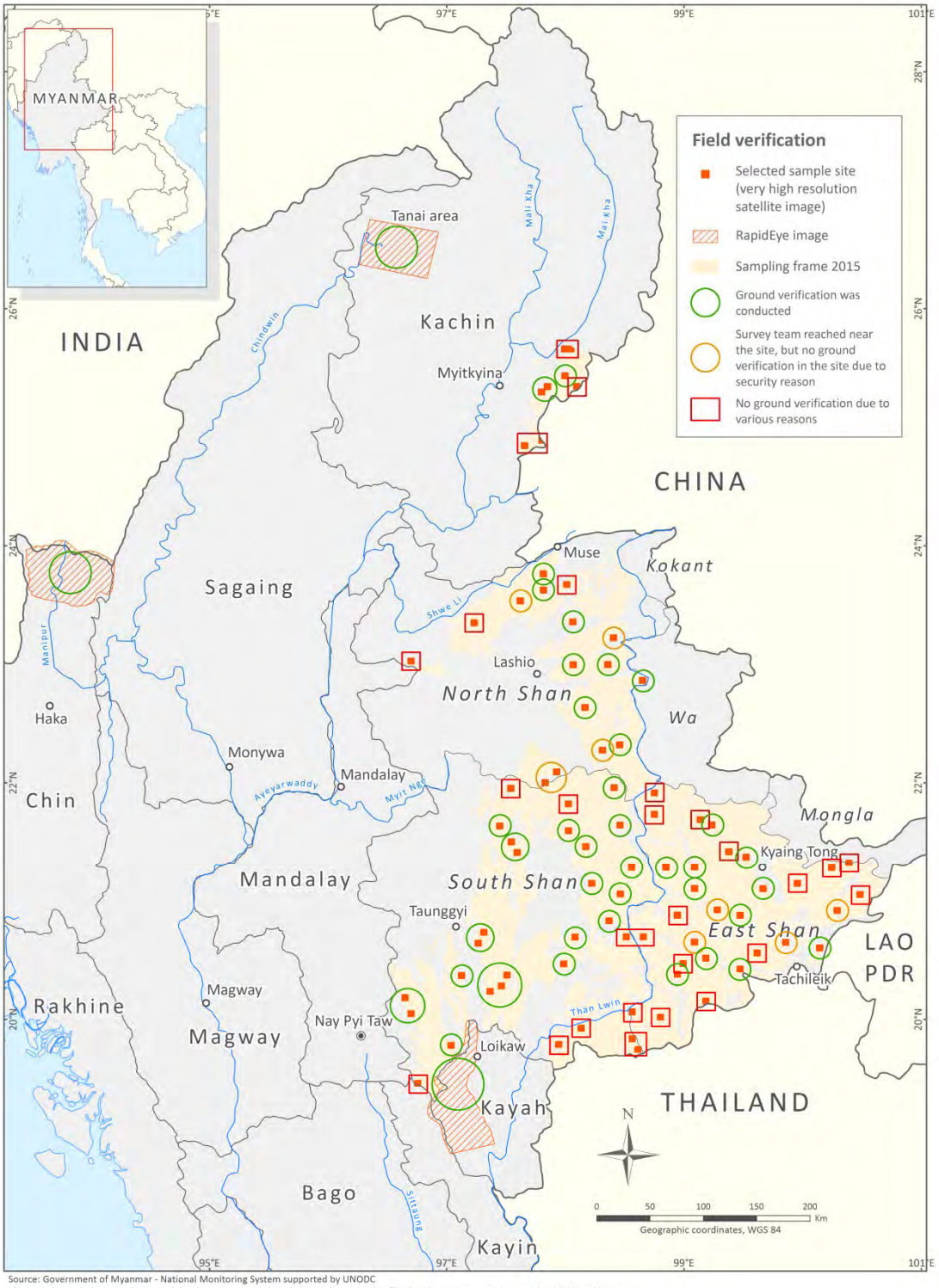
Figure 37: Altitude ranges of opium poppy fields found in satellite images, 2014/2015 (Metres)



Map 12: Selected samples, 2015



Map 13: Field verification status of the survey with satellite images, 2015



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.

Target area selection and interpretation

The estimates for Chin, Kayah and Tanai area in Kachin were based on a so-called targeted approach, in which a larger area was deliberately chosen based on information from the ground. This area was then fully covered by satellite imagery. The target areas were defined based on information on poppy cultivation from previous village survey data, administrative boundaries, elevation and distance from the main road.

In all the target areas in Kayah, Chin and Tanai, high-resolution sensor RapidEye imageries were used. In the previous survey, the wider target areas in Kayah and Chin were covered by RapidEye. Within those areas, very high-resolution samples (GeoEye with 2-metre resolution multispectral bands) were taken, which allowed for an estimation of the omission/commission and geometric error that stems from the use of lower resolution imagery. To that end, the area was first interpreted on the lower resolution imagery and then on the high-resolution image. The variation of the differences between the interpretations was then calculated and used for correcting the area estimation and adding ranges to the estimates. Those variations were applied for correcting the area estimation in 2015.

Sampling approach, sample size and sample selection

A sampling approach was applied due to the widespread poppy cultivation in North Shan, East Shan, South Shan (see Satellite remote sensing survey map) and in the south of Kachin.

In 2015, the total number of satellite images chosen was set to 84, the same number as in the previous year. This number was mainly based on budget and time constraints, as the interpretation and field verification of satellite imagery was time consuming.

A random sample was drawn in Shan and Kachin, as per the following sample size allocation.

Table 23: Sample size allocation, 2014-15

State	Frame size	Sample size 2014	Sample size 2015
East Shan*	1,204	30	30
South Shan	1,350	30	30
North Shan	736	16	16
Kachin	85	8	8*
Total	**3,375**	**84**	**84**

** A minimum of eight cells was chosen for Kachin.*
*** In previous surveys, the sample of East Shan had the highest variance. Therefore, a relatively larger sample size seemed to be in order.*

Since 2010, simple random sampling within geostrata has been applied.

Firstly, the frame is separated by state. Here, each segment has to be assigned exclusively to one state: if the majority of the risk area is within that state, the segment is assigned to that state. Therefore, state boundaries are, to a certain extent, generalized to fit the 5x5 km grid.

Secondly, each sub-frame (state) is divided into compact geographical strata of approximately equal area. In former surveys the definition of the strata was done manually but a clustering algorithm ("k-means") in the statistical software R[50] package spcosa has been applied since the 2014 survey. In each stratum, two sampling locations were selected by simple random sampling.

This sampling method provides a geographically well distributed sample and allows the variance (uncertainty) to be estimated in an unbiased manner.

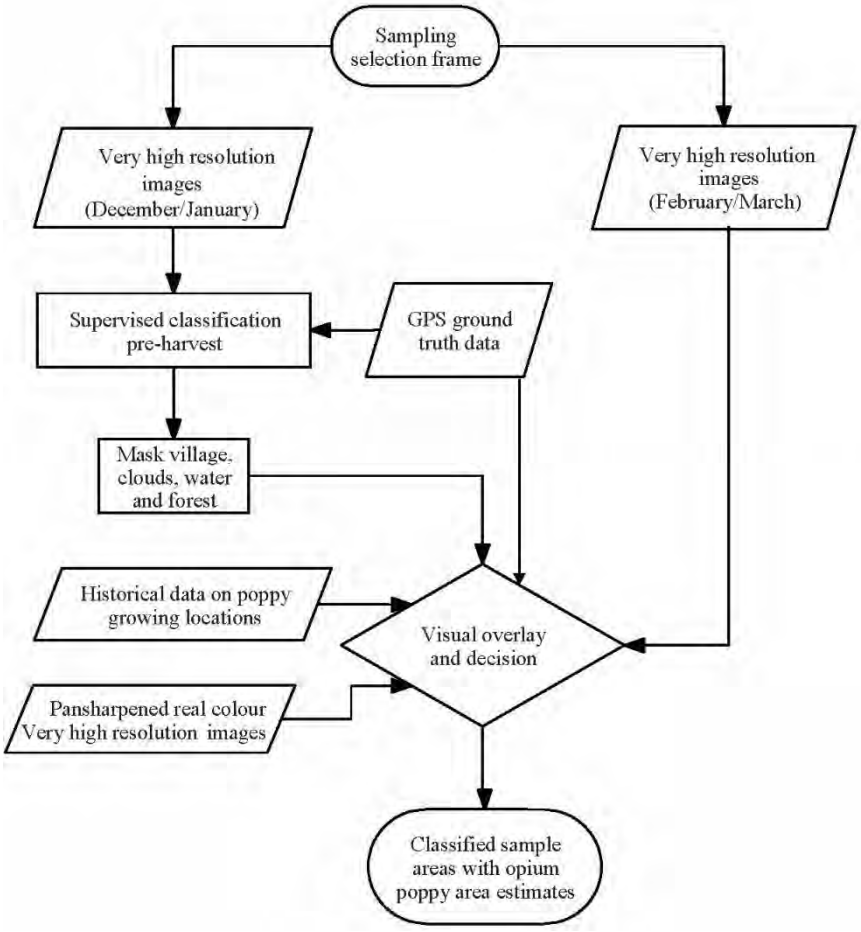
[50] http://www.r-project.org/ and package http://cran.r-project.org/web/packages/spcosa/index.html.

To increase the precision of the change estimate, half of the 2014 samples were kept for the 2015 survey. The other half was re-sampled. To find out the inclusion probabilities of all samples, two new samples were chosen in half of the strata (in contrast to keeping one sample pre-cluster).

Satellite image processing

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

Figure 38: 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 area 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 area sampling survey

The sample area estimation of the extent of opium poppy cultivation is a ratio estimate using risk area as an auxiliary variable.

In each state, the sample mean was calculated as

$$\bar{y}_{st} = \sum_{h=1}^{k} \frac{N_h}{N}\, \bar{y}_h \,;\, \bar{x}_{st} = \sum_{h=1}^{k} \frac{N_h}{N}\, \bar{x}_h .$$

where k is the number of strata (geostratum), $\bar{y}_h$ is the sample mean of poppy in stratum h; $\bar{x}_h$ is the sample mean of the risk area in stratum h; N_h is the number of sampling units in stratum h, and N is the population size.

The combined ratio estimate of the area under poppy cultivation then is given by

$$\bar{Y}_{RC} = \frac{\bar{y}_{st}}{\bar{x}_{st}} \bar{X}$$

where $\bar{X}$ is the total risk area in the sampling frame of the province.

The final national estimate is the sum of poppy estimated in the sampled state and the estimate obtained from the target areas.

Even though an unbiased estimator of the variance is available for this sampling design, bootstrapping[51] was performed for estimating the confidence intervals for both national and sub-national estimates. This was necessary as the heavily skewed distribution of poppy in the sample led to unrealistic confidence intervals when applying the standard methods.

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. The confidence intervals reported are “bca”, bias corrected percentile: In bca the confidence intervals are chosen to make the interval median unbiased and adjusted for skewness.

4.2. Yield and potential opium production estimation

Collection of yield data

Data on the number of yield capsules per plot and capsule volume is collected in the yield survey, which followed the procedure established in the UNODC Guidelines for yield assessment.[52]

[51] http://cran.r-project.org/web/packages/boot/index.html

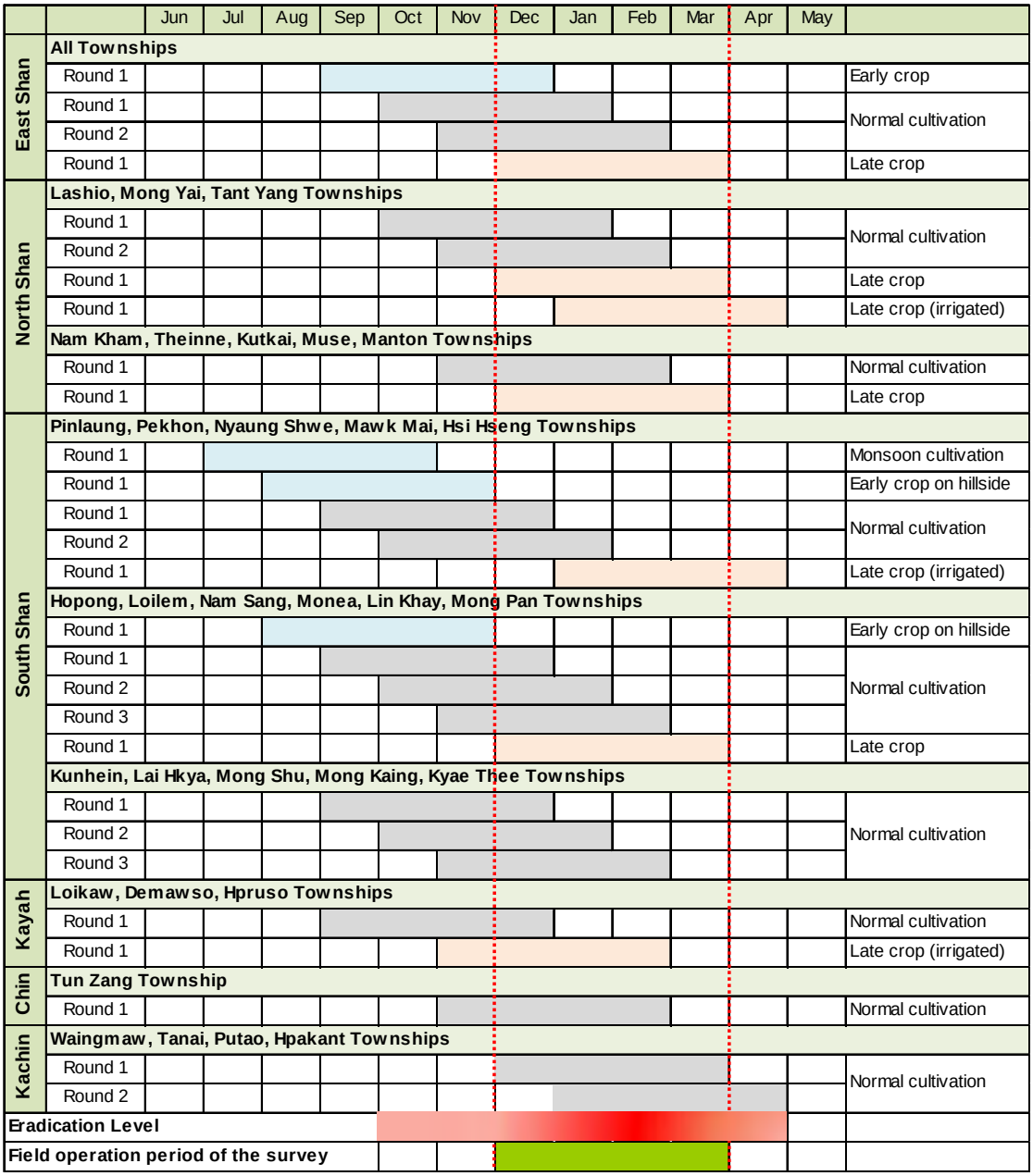
[52] UNODC Guidelines for yield assessment of opium gum and coca leaf from brief field visits, United Nations New York, 2001, ST/NAR/33. See also UNODC (2003): limited opium yield assessment surveys. Technical report: Observations and findings. Guidance for future activities. In: Scientific and Technical Notes, SCITEC/19, December 2003.

The 2015 yield survey was smaller than in previous years. Because of the increasingly difficult security situation, only fields where it was possible to complete the survey without time pressure were visited. Poppy-growing periods vary according to the area. Farmers in Myanmar conduct staggered planting of poppy, which means that poppy seed is broadcast in all fields operated by a household over a period of weeks, rather than all at the same time. This practice can also be applied within individual fields and, depending on the number of fields and their subdivisions, the planting period for poppy can extend over a month or more.

Observations made during the implementation of the 2015 socio-economic survey showed that, as in previous years, farmers in Myanmar staggered the planting of the opium crop to help distribute the workload and to avoid the risk of crop loss due to unfavourable weather during germination, harvest or eradication.

The different opium cultivation periods are highlighted in the calendar below. The survey period mostly overlapped with the poppy-growing periods.

Figure 39: Opium cultivation calendar, by state, Myanmar, 2014-2015



During the field visits, in an effort to increase data quality, digital cameras were introduced and surveyors were instructed to document the yield data collection, which made it possible to check whether the surveyors had adhered to the protocol. A total of 102 villages was visited in 2015, resulting in measurements being taken in 203 fields.

Sample plot for yield measurement, Kachin, Myanmar, 2015

Capsule measurement in East Shan, Myanmar, 2015

Estimating potential opium yield

Yield data collection and calculation follows the UNODC Guidelines for yield assessment.[53] 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. Thus, due to circumstances in the field, a certain proportion of fields was chosen in a non-random, opportunistic manner.

Once a field is selected, a transect is drawn through the field, along which three 1 m^2 plots are selected. In each plot, the numbers of flower buds, flowers, immature capsules and mature capsules 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 subsequent analysis.

For the 2015 survey, 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 yield by state was calculated as the simple average of all fields in a state.

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

$$Y = 1.89 + 0.0412\,V$$

where *Y* is dry opium weight (kg/ha) and *V* is the mature capsule volume (cm^3/m^2).

This formula has been developed based on data collected in Thailand and emphasizes the lower end of observed capsule volume. It is based on data varying between 0 and 900 cm^3/m^2.

However, high volumes exceeding 900 cm^3/m^2 were observed (particularly in Kachin). The formula was not validated for these ranges, and would supposedly overestimate yields. To avoid overestimation, an alternative formula was used for fields where at least one plot exceeded said volume. This formula was calibrated with combined data from Pakistan and Thailand, and reads as

$$Y = [(V + 1{,}495) - ((V + 1{,}495)^2 - 395.259\,V)^{0.5}] / 1.795.$$

A range was calculated to express the uncertainty of the yield estimate due to sampling with the 95% confidence interval.

[53] UNODC Guidelines for yield assessment of opium gum and coca leaf from brief field visits, UN New York, 2001, ST/NAR/33.

Estimating opium production

Opium production was calculated by the estimated area under opium cultivation in a state being multiplied by the corresponding opium yield of each state.

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.

4.3. Socio-economic village survey

Sampling procedure

The sampling frame is composed of an updated village listing provided by the Central Committee for Drug Abuse Control in Myanmar. The village listing includes names of villages, village tracts, townships, states and their codes. The listing also includes 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.

From the updated village listing, villages were excluded from townships in Shan state where they were known as opium poppy-free and insignificant areas. Then the final village listing was defined as the sampling frame. Due to security reasons, Kachin was excluded from the sampling for the village survey in the 2012 and 2013 surveys. The village survey in Kachin has been resumed since the 2014 survey. The sampling size in Kachin was mainly based on logistical considerations.

The sampling frame in Kayah was defined separately. Those villages located within a 3 km buffer zone from the main road and located below 800 metres altitude were excluded from the village listing. Those areas were supposed non-poppy-growing areas according to previous surveys. The final village listing of poppy-growing townships in Kayah was defined as the sampling frame.

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

For the 2015 village survey, a total of 800 villages were randomly selected throughout Shan state, which is approximately 8% of the 9,511 villages from the sampling frame. About 300 villages in North Shan, 280 villages in South Shan and 220 villages in East Shan were selected. In Kayah, a total of 40 villages were randomly selected from 122 villages. In Kachin and Chin, respectively, 100 villages out of 397 and 20 villages out of 95 were randomly selected.

Table 24: Sample selection and village survey period, 2015

	South Shan	East Shan	North Shan	Kayah	Chin	Kachin	Total
Start date	7 Dec 2014	15 Dec 2014	23 Dec 2014	12 Dec 2014	25 Feb 2015	2 Mar 2015	7 Dec 2014
End date	15 Feb 2015	20 Feb 2015	28 Feb 2015	15 Feb 2015	15 Apr 2015	30 Apr 2015	30 Apr 2015
Number of survey teams	16	10	17	3	1	5	52
Targeted villages	280	220	300	40	20	100	960
Surveyed villages	232	216	277	40	20	79	864
% of villages achieved	83%	98%	92%	100%	100%	79%	90%
Households covered	19,100	8,296	22,337	2,992	1,064	15,764	69,553
Rural population covered	97,032	42,619	111,397	15,426	6,362	78,416	351,252

The ethnic composition of the sub-states of Shan state is possibly the most diverse in the whole of Myanmar. The villages surveyed reflect the major ethnic groups present in each surveyed state.

Survey organization and ground truthing

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

The interview-based socio-economic survey and crop yield survey were implemented by the CCDAC, while UNODC provided technical support, coordination and supervision with national and international staff throughout the survey.

Rapid assessment on compliance with the opium ban in Shan special regions; Kokant, Wa and Mongla were conducted in 2015. The assessment mission to Wa and Mongla regions were conducted by UNODC national staff since the state authorities allowed authorisation for rapid assessment. A similar assessment mission to that in Kokant region was carried out in collaboration with local drug enforcement officers.

For the second time, a survey with a statistical sampling method was conducted in northern Chin state in collaboration with the CCDAC and local authorities. The survey covered Tunzang township and its sub-township Kyi Hka. Assessment of opium poppy cultivation in northern Chin was supported by RapidEye satellite image.

The opium poppy planted 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 organized by the Department carried out ground data collection in North Shan, East Shan, South Shan and Kachin. All teams, each comprising two surveyors from the Forest Department and one officer from the local drug enforcement police, visited selected satellite sample sites from December 2014 to the end of March 2015. A dedicated team, led by UNODC national staff, in collaboration with a CCDAC officer, conducted monitoring to ground verification activities.

The ground verification teams visited selected sites with printouts (large size) of the satellite images. Once they reached the area represented in each single scene, they annotated the printouts with the land use classes and relative boundaries proceeding with specific transect itineraries. They collected GPS coordinates taking field photos. Back in the office, the collected data were used to classify the satellite images combining digital and visual interpretations. During the image interpretation by the Forest Department, dedicated UNODC national experts monitored the analysis. The results were quality-control checked by two UNODC national experts in the Myanmar office. The final results were subjected to quality-control by international experts at UNODC Headquarters, Vienna.

Organization of village survey interviews and yield data collection

A total of 156 surveyors carried out the village survey in 47 townships in North Shan, East Shan, South Shan, Kayah, Chin and Kachin. The surveyors were selected by CCDAC in collaboration with local authorities. UNODC trained the surveyors in interview-based socio-economic data collection and poppy field measurements for crop yield estimation.

Table 25: Training village surveyors, 2015

State	From	To	Trainees	Venue
South Shan and Kayah	3 Dec 2014	6 Dec 2014	57	Taunggyi
East Shan	10 Dec 2014	13 Dec 2014	30	Kyaing Tong
North Shan	19 Dec 2014	22 Dec 2014	51	Lashio
Chin	10 Feb 2015	13 Feb 2015	3	Tunzang
Kachin	25 Feb 2015	28 Feb 2015	15	Myitkyina
Total			**156**	

The field operation of the village survey started in the second week of December 2014 and continued until the end of February 2015 in Shan and Kayah states. The field operation in Chin and Kachin states was conducted later: from the last week of February to the end of April 2015. About 10% of the targeted villages could not be visited by field surveyors.

Survey training, South Shan, Myanmar, 2015

Socio-economic interview, East Shan, Myanmar, 2015

Limitations of the village survey

Some of the limitations related to data collection and analysis are indicated below:

- The data obtained were aggregated at the village level, so all analyses reflect the likelihood of a village to cultivate opium poppy or the proportion of opium poppy cultivated. These factors cannot lead to conclusions about why individual people grow poppy or work in the poppy trade.
- The interviewers were trained and instructed to establish a basis of trust before conducting the interview. However, since law enforcement was part of the group, it cannot be excluded that this had a certain effect on interviewees' answers ("social desirability" or reluctance to talk freely about illicit activities).

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 (from satellite images) 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 the headmen during the village survey interview, by the number of households involved in poppy cultivation.[54]

Table 26: Estimated number of households growing poppy, Myanmar, 2015

	Number of households (rounded)	Poppy area per household (hectares)
Category 1 and 2: Households growing own poppy, and households growing own poppy and labouring in poppy fields owned by other farmers	133,000	0.42
Category 1, 2 and 3: Households growing own poppy, households growing own poppy and labouring in poppy fields owned by other farmers, and households only earning wage in poppy fields	173,000	-

The total number of households involved in poppy cultivation was calculated using the proportions reported by village headmen. On average, village headmen indicated that of the households involved in poppy cultivation, 73% corresponded to households exclusively growing poppy in their own fields (category 1 above), 4% to households growing poppy and labouring in poppy fields owned by other farmers (category 2). The remaining 23% exclusively earn a wage labouring in poppy fields owned by other farmers (category 3). If 133,000 households correspond to 77% of the total number of households involved in poppy cultivation, the total number of households involved in poppy cultivation is roughly 173,000 households.

[54] For this calculation it was assumed that poppy fields are owned by villagers. Currently, there is no information available about poppy fields operated by households from outside of the village or insurgency groups. Questions related to this issue are not currently included in the questionnaire due to security reasons.

Annex I: Information on opium poppy cultivation in Kokang, Wa and Mongla Regions; and Naga Land (northern Sagaing)

Assessment missions were conducted to the areas where an opium ban was in practice and to the poppy cultivation risk areas that the village survey cannot cover. Assessment of the opium-free regions, Kokant, Wa, and Mongla (special regions in Shan state), were carried out in the 2015 survey. A rsk assessment of "Naga Land", in northern Sagaing Region, was performed in order to find out the poppy cultivation status of that region.

Kokant Region

Kokant Region is considered to have been opium poppy-free[55] since 2003. The region was under government control following conflicts between MNDAA (ethnic armed group) and the Government in 2010. According to ground information, there was poppy cultivation in some villages located along the border with North Shan state. A dedicated UNODC national team in collaboration with local drug enforcement members conducted an assessment mission to the region in December 2014.The team visited Shwe Yin Si, Pan Waing, Phi Kyan Shwe, Man Law, Kyar Si Shu and Tar Shwe Htan villages (former poppy-growing villages) in the region. There was no evidence of poppy cultivation in the areas visited. The team could not visit border villages because of very difficult accessibility.

Wa Region

Wa region has been opium poppy-free since 2005. The assessment mission to Wa region was conducted in February 2015 by a dedicated UNODC national team. The team coordinated local authorities in order to authorize assessment of the areas where poppy growing took place in the past. The team visited Mong Phen, Ho Tao, Mong Pawk, Pang Kham, Weing Kao and Mat Man Sai townships in the region.

The team observed rubber and tea plantations systematically cultivated throughout those areas. The team visited the area where UNODC implemented an alternative livelihood project during the 1991-2008 period. Local authorities maintain infrastructure such as the water supply system and village roads, etc. constructed by the project. The mission indicated no evidence of opium poppy cultivation in this region.

Mongla Region

Mongla region has been opium poppy-free since 1997. After the opium ban in 1997, the capital, Mongla experienced a boom thanks to its proximity to Jing Hong, China. Jing Hong has long been promoted as a major internal tourist destination in China and receives around three million tourists a year. A day trip can be made to Mongla, an exotic destination in the "golden triangle". The present economy of the region is continually improving as a result of trade with China, seasonal fruit cultivation and tourism in the capital.

The UNODC national team coordinated the local authorities to get permission for an assessment to this region, which was conducted in February 2015. The local authority has its own drug control programme, which monitors poppy growing, drug trafficking and drug use in the region. The mission found no evidence of opium poppy cultivation in the region.

[55] There was no indication of significant levels of opium poppy cultivation.

“Naga Land”, Northern Sagaing

Since 2014, UNODC has conducted a risk assessment mission in Naga region in order to establish the opium poppy cultivation status of the region. During the 2015 survey, a dedicated UNODC national team conducted a risk assessment mission to the region in March 2015. The team discussed the poppy-cultivation situation with local authorities, local CSOs and villagers in the region. An eradication campaign was conducted by local authorities in collaboration with local communities. Most poppy-growing areas were a long way from villages. The team observed poppy fields in the Ta Gar area but, in general, the local people traditionally cultivate poppy for medicinal purposes. Two successive years of risk assessment have indicated that there is no significant level of poppy cultivation in the region. The team estimated a total poppy cultivation area in the region of less than 50 hectares.

Map 14: Assessment survey locations, 2015

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.

Annex II. Opium poppy-cultivation status, by township

The table below indicates poppy-growing status in villages based on different sources: remote sensing analysis; socio-economic survey; or eradication campaign.

Table 27: Poppy-growing status in 2015, 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 Hsat	√	√	√
	Mong Ton	√	√	√
	Mong Yawng	-	-	√
	Metman	√	√	√
	Tachileik	√	-	-
Sub Total		**7**	**7**	**8**
North Shan	Kunlon	-	-	-
	Kutkai	√	√	-
	Kyaukme	-	-	-
	Lashio	√	√	√
	Mong Yai	√	-	-
	Manton	√	√	-
	Moemit	√	-	-
	Muse	-	√	-
	Nam Hkam	√	√	√
	Nam Hsang	-	-	-
	Namtu	-	-	-
	Tang Yang	√	√	√
	Theinne	√	-	-
	Thibaw	√	-	-
Sub Total		**9**	**6**	**3**
South Shan	Hopong	√	√	√
	Hsi Hseng	√	√	√
	Kyae Thee	√	√	-
	Kun Heing	√	√	√
	Leicha	√	√	√
	Loilem	-	√	√
	Linhkay	-	-	-
	Mong Kaing	√	√	√
	Mong Pan	√	√	-
	Mong Shu	√	√	-
	Maukmai	√	√	√
	Monae	√	√	-
	Nam Sang	√	√	-
	Nyaung Shwe	-	√	√
	Pekon	√	√	√
	Pinlaung	√	√	√
Sub Total		**13**	**15**	**10**
Kachin	Putao	-	√	√
	Tanai	√	√	√
	Hpa Kant	-	-	-
	Waingmaw	√	√	√
Sub Total		**2**	**3**	**3**
Kayah	Demawso	√	√	√
	Hpruso	√	√	-
	Loikaw	√	√	√
Sub Total		**3**	**3**	**2**
Chin	Tun Zang	√	√	√
Sub Total		**1**	**1**	**1**
Total		**35**	**35**	**27**

Annex III. Socio-economic village survey questionnaire

UNODC
United Nations Office on Drugs and Crime

Myanmar Opium Survey 2015

Part (I)

Central Committee for Drug Abuse Control

Guideline-1: The survey upon arrival to a village will meet with the village headman and/or key informants and explain the purpose of survey.
Guideline-2: After gaining their confidence and/or willingness to collaborate, the survey team will start the interview.
Guideline-3: The surveyor must fill up the forms in the presence of the interviewed.
Guideline-4: The surveyors have to conduct interviews in all sample villages.

A - SITE IDENTIFICATION

Name of Team Leader:			***Survey Team No:***	
	Township	***Village Tract***	***Village***	***Date of Survey***
Name:				*dd/mm/yy*
Code:				
	Latitude (N)	***Longitude (E)***	***Elevation (Meter)***	***Supervisor Sign***
Village GPS position:				
Number of people participating in the survey in the village			***Number of women:***	
			Number of men:	

Identify the village, village-tract, township, by name and code according to the coding system in the given table and make a correct data entry.

B - VILLAGE PROFILE

1	-	Total number of households:	Households
2	-	Total number of men 15 years or above:	
3	-	Total number of women 15 years or above:	
4	-	Total number of children younger than 15 years:	
5	-	Total number of inhabitants:	

Check Q5 = (Q2 + Q3 + Q4).

6	-	How many children have been born in the past 12 months?	
7	-	How many children younger than 1 year passed away in the past 12 months?	
8	-	How many children between 1 to 14 years old passed away in the past 12 months?	
9	-	What ethnic groups are in the village?	

Ethnic group	No of HH
Total	

Total households in Q9 should be equal to Q1. Make crosschecks and verify the data during the interview.

10	-	Was there any activity in the village area by one of the following group during past 12 months?	Government
			Military
			Ceasefire Group
			Insurgent Group

Ask the headman to identify their village is under which group's control.Tick in respective boxes.

11	-	Was the village affected by a drought during this poppy growing season?	Yes	No
12	-	When did the rain stop during this poppy growing season?	week/month	
13	-	Was the village affected by heavy rain or frost during the dry season of the poppy growing?	Yes	No
		If yes, when did this occur for the first time?	week/month	

Make crosschecks and verify the answers during the interview.

14	-	Did the village receive any kind of agricultural assistance in the past 12 months?	Yes	No
15	-	If Yes, which kind of assistance did the village receive?	Check	No. of HH
			Improved seeds	
			Fertilizers	
			Insecticides	
			Fungicides	
			Agricultural tools (like Tolaji, hand tractor)	
			Other (specify) _____	

Check with the villagers what kind of assistance does their village received for the given boxes by number of households.

C - POPPY CULTIVATION INFORMATION

16	-	Is there poppy cultivation in the village this season?	Yes	No	No answer

*Ask the headman and the key informants whether poppy growing village in this season.Tick **one** of **"Yes"** or **"No"** or **"No answer"**.*
*If **"Yes"**, answer the following poppy questions Q18 to Q23. If **"No"**, no need to answer the following poppy questions Q18 to Q23.*

17	-	Has poppy been ever grown in this village?	Yes	No	No answer
		If your village stopped cultivation poppy, why? _____			
18	-	This season, how many households in the village were:			
		→ only growing their own poppy (but not earning from labour on poppy fields run by others)?	Households		
		→ only earning from labour on poppy fields run by others (but not growing their own poppy)?	Households		
		→ growing their own poppy and earning from labour on poppy fields run by others?	Households		

Mention the number of households growing this season by respective boxes.

19	-	Was there any poppy grown by an organized group of people rather than a household?	Yes	No
		If yes, what was the area cultivated in this way?		Area unit

			From		Until	
			Week	Month	Week	Month
20	-	When did the poppy seeds broadcast in this poppy season?				

*Mention the Week and Month by **numbers**.*

21 - Is there any disease with poppy this season? Yes ☐ No ☐

If Yes, what percentage of total area was affected? ☐ %

22 - Are there fields of poppy mixed with other crops? Yes ☐ No ☐

If yes, what was the area cultivated in this way? ☐ _____Area unit

What proportion was poppy?

Less than 1/3 ☐
Between 1/3 - 2/3 ☐
More than 2/3 ☐

Q19 to Q22 are concerned for all poppy fields grown by by the village.

23 - Has there been any poppy eradication in the village this season? Yes ☐ No ☐

If Yes, what percentage of total poppy area was affected? ☐ %

24 - Total area under cultivation:

Unit of area
☐ Mu
☐ Acre
☐ Hectare
☐ Ton

*If Q16 **"Yes"** need answer, If Q16 **"No"** no need answer.*

Tick one box for unit of area.

	Last year cultivation area		This year cultivation area	
	Irrigated	Rain-Fed	Irrigated	Rain-Fed
Paddy				
Wheat/Corn				
Mustard, Sesame, Sunflower				
Vegetable				
Poppy				
Others (please specify)_____				
Others (please specify)_____				

If Q16 "Yes", answer Q25 to Q28. If Q16 "No", no need to answer Q25 to Q28.

25 - Is there any change in poppy cultivation between the last season and this year?

☐ Increase
☐ Stable
☐ Decrease

*If **Increase** or **Decrease**, mention the best fit reason.*

Reasons for decrease _____
Reasons for increase _____

26 - Why do you grow poppy? _____

This is an open question. Describe the best fit answer.

27 - If your village earned money from poppy cultivation in the past 12 months, what was the money used for?

1 Main -	☐ Food	☐ Medical expense	☐ Education	☐ For debt
2 Second -	☐ Household property	☐ Village infrastructure	☐ Religeous building	☐ Other (specify)
3 Third -	☐ No answer			

Rank 3 most important answers. Enter number 1,2,3 in respective boxes.

28 - What is main advantages of poppy instead of other crops? _____

This is an open question. Describe the best fit answer.

D - INCOME AND OPIUM PRICES

29 - If your villages stopped poppy some years ago, how has your income changed? ☐ Increase ☐ Stable ☐ Decrease

30 - Current farm-gate sale price of **one Viss** of opium (just after the harvest) in Kyat ☐ Kyat *Mention by thousand separator.*

31 - When was the last time a farmer sold dry opium? *Mention month by number* ☐ Month

What price did the farmer get for selling the dry opium (Kyats for **one Viss**)? ☐ Kyat *Mention by thousand separator.*

Ask the key informants about the farm gate price and dry opium price. Crosscheck the data with other relevant information.

32 - Current prices in Kyat of cereals (if farmer sells)

Paddy	☐	Kyat	☐	Unit
Wheat	☐	Kyat	☐	Unit
Corn	☐	Kyat	☐	Unit
Other (please specify)_____	☐	Kyat	☐	Unit

33 - What are the daily wages earned by labourers?

If working for poppy growing (Male)	☐ Kyat	Other labour (Male)	☐
If working for poppy growing (Female)	☐ Kyat	Other labour (Female)	☐

34 - What are the primary sources of income of your villagers? (Rank the top 3 sources with the biggest incomes)

Main - _____
Second - _____
Third - _____

Rank the top 3 sources from Q35 with the biggest incomes.

35 - What was the average income per household from each of the following sources over the past 12 months?

*If Q16 **"Yes"** need answer, If Q16 **"No"** no need answer.*

Farming	☐	Kyat
Opium sales	☐	Kyat
Livestock sales	☐	Kyat
Forest product	☐	Kyat
Casual labour (agri)	☐	Kyat
Casual labour (non-agri)	☐	Kyat
Salaried job	☐	Kyat
Petty trade	☐	Kyat
Other_____	☐	Kyat
Total	☐	Kyat

Mention income amount by thousand separator.

E - ADDICTION

36 - How many people of 15 year old and above took opium in last 4 weeks? ☐ People

37 - How many people of 15 year old and above took yaba in last 4 weeks? ☐ People

38 - How many people of 15 year old and above took heroin in last 4 weeks? ☐ People

Inquire the number of drug addicts in the village and insert the number of addicts in the respective box. Crosscheck the data with other relevant information.

F - MIGRATION

39 - How many people have left your village in the past 3 months?

Men (15yr and above) ☐ Persons
Women (15yr and above) ☐ Persons

40 - What are the main reasons for leaving the village?

1 Main -	☐ Schooling	☐ Poverty	☐ Getting Married
2 Second -	☐ To work in poppy growing	☐ Secutrity	☐ Others(specify)
3 Third -			

Rank 3 most important answers. Enter number 1,2,3 in respective boxes.

41 - How many people immigrated to your village in the past 3 months? Men (15yr and above) [ ] Persons; Women (15yr and above) [ ] Persons

42 - Which township do they mainly come from? _____

If they come from the same township, no need to answer.

43 - What are the main reasons why they come to your village?

1	Main -		More food
2	Second -		To work in poppy growing
3	Third -		Poverty
			Secutrity
			Getting married
			Others (specify)

Rank 3 most important answers. Enter number 1,2,3 in respective boxes.

G - FOOD SECURITY and VULNERABILY

44 - During the past 12 months, how many households experienced a rice deficit? (did not produce enough rice for their own consumption)

	No. of HH
10 to 12 months deficit	
7 to 9 months deficit	
4 to 6 months deficit	
3 months or less deficit	
no deficit	
Total	

Check the number of households who have faced rice deficit for the given time duration.Total number of HH should be equal to Q1.

45 - When the households in the village don't have enough food or money to buy food, what do they usually do?

Check the villagers that they used to do the given actions when they have to face food shortage and insert number of households by action.

Coping Strategy	No. of HH
1. Eating rice porridge	
2. Prioritizing children and elderly for food	
3. Reducing the number of daily meals	
4. Consuming less preferred staples	
5. Borrowing food from neighbours / relatives	
6. Eating wild animals or plants	
7. Purchasing food on credit	
8. Others (please specify)	

46 - How many households own paddy land (permanent fields)? [ ] No. of HH [ ] - - - Aera unit

47 - How many households own upland paddy fields (shifting fields)? [ ] No. of HH [ ] - - - Aera unit

Inquire the number of households who own paddy fields and total area of their paddy land. Check the area unit.

48 - How about the staple crop yield of this year if compared to last year?

Tick in repective boxes.

	Increase	Stable	Decrease
Paddy			
Wheat			
Corn			
Others (specify)_____			

49 - How many buffaloes and cattle are in your village? Buffaloes [ ] Cattle [ ]

50 - How many households possess buffaloes or cattle? [ ] No. of HH

51 - How many households are in debt? [ ] No. of HH

Ask the villagers how many households for relevant information.Crosscheck the data by different villagers.

52 - If you have to stop poppy growing for some reason how does your village cope with stress?

1	Main -	Increase cultivation land	
2	Second -	Sale of livestock	
3	Third -	Daily wages	
		External assist	
		Migration	
		Sales of assets	
		Outside remittance	
		Others (specify)_____	

Rank 3 most important answers. Enter number 1,2,3 in respective boxes.

53 - What type of market does the village have?

- [ ] No market
- [ ] Daily market
- [ ] Weekly market

Select and tick one box.

If **No market**, what type of market is the closest to your village?

- [ ] Market in other village
- [ ] Market in Town (same township)
- [ ] Market in Town (other township)

Select and tick one box.

How long does it take to reach the closest market? [ ] minutes by

- [ ] Foot
- [ ] Motor-cycle
- [ ] Tolaji/Car
- [ ] Boat
- [ ] _____Other (specify)

*Select **one box** only for travel mode.*

Annex IV. Changes in socio-economic indicators (2014-2015) and explorative analysis of potential factors influencing poppy-growing in villages

One of the main arguments used to explain poppy cultivation is that farmers experience hardship and instability, and they therefore need to cultivate poppy in order to overcome their difficult living conditions. For example, highly populated villages in rural areas may have better infrastructure and living conditions than villages with few inhabitants, as the Government tends to invest in the former before the latter. It could therefore be expected that farmers in large villages with

- a small number of inhabitants and newborn children

would have a greater incentive to grow opium poppy than farmers in small villages.

Other indicators of difficult living conditions, which could be expected to increase the probability of farmers cultivating opium poppy in a village, are:

- high number of children (younger than 1 year old) who died in the previous 12 months
- (lack of or) low level of agricultural assistance
- high emigration rates
- high number of households in debt
- high prevalence of food (rice) deficit
- lack of land ownership (e.g,, ownership of permanent paddy land)
- difficult government control in the area (e.g., presence of insurgent groups).

Conversely, indicators of wealth, such as:

- high income (from non-poppy-related agricultural activities)
- high number of livestock (cattle) in the village
-

are expected to reduce poppy cultivation.

a) Changes in socio-economic indicators (2014-2015)

A comparative table with the simple averages of the indicators mentioned above from the 2014 and 20015 socio-economic surveys is included below.[56]

Table 28: Comparison of socio-economic indicators in poppy-growing and non-poppy-growing villages (2014-2015), Myanmar

	Poppy-growing villages			Non-poppy-growing villages		
	2014	2015	Difference (2014-2015)	2014	2015	Difference (2014-2015)
Average number of inhabitants per village	360	276	-84	489	458	-31
Birth rate (number of births in past 12 months per 1000 inhabitants)	21	20	-1	25	17	-8
Percentage of infants who died (under 1 year of age) in past 12	0.38	0.12	-0.26	0.59	0.06	-0.53

[56] There are additional factors that could influence the decision to grow poppy. A non-exhaustive list includes: level of education, perception of soil quality, environmental and agronomic shocks, social capital and identify. However, it is not possible to analyse these factors as the survey does not currently cover these aspects.

months per number of inhabitants						
Percentage of villages receiving agricultural assistance	3%	7%	4%	11%	10%	-1%
Number of men who left village in past 3 months (15 years of age and above) per total number of adults in village	0.0112	0.0030	-0.01	0.0219	0.0029	-0.02
Percentage of households in debt in village	30%	23%	-7%	28%	21%	-7%
Percentage of households not suffering rice deficit in village	56%	77%	21%	62%	76%	14%
Percentage of households in village owning permanent paddy land	38%	48%	10%	56%	53%	-3%
Average annual income from farming, non-poppy related (Kyat/year)	629624	507118	-122506	845704	958359	112655
Ratio of number of cattle per household in village	1.25	1.35	0.10	1.30	0.83	-0.47
Percentage of villages with insurgent activity	14%	6%	-8%	7%	4%	-3%

The results suggest that a number of living conditions improved slightly for both poppy-growing and non-poppy-growing villages in the 2014-2015 period (reduction in percentage of households in debt and increase in the percentage of households not suffering rice deficit). The percentage of households not suffering rice deficit was the same for poppy-growing and non-poppy-growing villages in 2015 (77%), but the improvement with respect to the previous year was greater in poppy-growing villages (21%) than in non-poppy-growing villages (14%). During the socio-economic survey, as indicated previously, households in poppy-growing villages tend to invest their poppy income in buying food. This could partially explain the greater improvement in poppy-growing than in non-poppy-growing villages.

There has been a reduction in the birth rate and, correspondingly, also in the percentage of infants who died in both types of village. In addition, there has been a reduction in the number of men leaving villages, which could be related to the observed decrease in insurgent activity in the surveyed villages. However, a slight decrease in rural population (number of inhabitants) in both types of village was still observed.

In terms of sources of income, although there was a reduction in farming income (non-poppy related) in the 2014-2015 period, there was an increase in the number of cattle per household and in the percentage of households owning paddy land in poppy-growing villages. The opposite was observed in non-poppy-growing villages. This result suggests that, in contrast to non-poppy-growing villages, poppy-growing villages invest part of their earnings in livestock and land. Finally, there was an increase in the percentage of poppy-growing villages receiving agricultural assistance in the 2014-2015 period (4%). Nevertheless, the percentage of villages that received agricultural assistance was still lower in poppy-growing villages (7%) than in non-poppy-growing villages (10%) in 2015.

b) Explorative analysis of potential factors influencing poppy growing in villages

Analysis of individual factors in isolation can be misleading as there could be some degree of association among the different factors. For example, the number of households not suffering rice deficit may be associated with the number of households owing permanent paddy land. So when discussing the effect of rice deficit in the probability of growing poppy, it is not possible to know if the observed effect can be fully attributed to this variable (or to other factors correlated

with this variable). Modelling[57] allows the evaluation of the effect of a single factor while maintaining the other (correlated) factors at a fixed level. In this way it is possible to assess its individual effect in, for example, the probability of growing poppy.

A group of factors were modelled together to evaluate their potential individual influence in the probability of a village being classified a poppy-growing or non-poppy growing village. A summary of the results of the analysis are included in the table below (the full results of the model is included in the annex of this report). The data for some variables from last year were used in order to explain poppy-growing decisions made in 2015 (as indicated in the table).[58]

Table 29: Summary of the results of a model[59] to evaluate factors that influence the probability of poppy growing in villages, Myanmar, 2015

	Influence on growing poppy in villages
Number of inhabitants (2015)*	-
Number of infants who died (under 1 year of age) in the last 12 months (2014)	+
Number of men who left the village in past 3 months (15 years and above) (2014)*	-
Number of households in debt (2014)*	+
Number of households not suffering rice deficit (2015)*	+
Number of households owning permanent paddy land (2015) *	-
Number of cattle in village (2014)	+
Villages with insurgent group activity (%) (2014)	+

* Statistically significant at 95% confidence level.
Data analysed included only villages interviewed both in 2014 and 2015 (N=80. Some variables have missing values to allow for a more precise evaluation using the same units of analysis over time.

The exploratory results suggest that the factors that increase the probability of growing poppy at the village level were as expected (difficult living conditions increase the probability of growing poppy). Difficult living conditions were measured as:

- Low number of inhabitants
- High number of infants who died (under 1 year of age) in past year
- High number of households in debt in past year
- Low number of household owing permanent paddy land
- Difficult governmental control in past year (measured as insurgent activity)

Other factors behaved in opposite direction, as expected:

- Low number of men who left the village in past year (which could be an indication of lack of non-farming opportunities in other villages and the need to stay in village)
- High number of cattle in village in past year (which is in line with continuous livestock accumulation as one of the characteristics of poppy-growing households)

[57] Multivariate modelling.

[58] This is to avoid "endogeneity" in the model (or inverse causality). For example, number of cattle in 2015 cannot be considered one of the causes of growing poppy in the same year, as it is probably a consequence (households who grow poppy are likely to invest the earnings in livestock). By using number of cattle last year, the endogeneity effect is minimized.

[59] Probit model. Note it was not possible to include all the variables as indicated above due to the small sample size (only villages that were interviewed both in 2014 and 2015 were considered in the sample).

- High number of households not suffering rice deficit in the last 12 months (which may imply that the poorest in the village are less likely to be involved in poppy cultivation, probably due to a lack of economic resources for investing in this activity).

Annex V. Overview of key findings in poppy-growing villages, by state

	East Shan	North Shan	South Shan	Kachin	Kayah	Chin	All (weighted average)
Number of surveyed villages	216	277	232	79	40	20	864 (Total)
Total poppy area (ha)	17,200	9,700	23,400	4,200	460	490	55,000 (Total)
Poppy yield (kg/ha)	13.0	13.3	9.9	12.5	9.9	NA	11.7
Average poppy area per household (ha)	0.30	0.27	0.52	0.51	0.32	NA	0.42
Fresh poppy prices ($/kg)	346	190	228	240	279	-	240
Dry poppy prices ($/kg)	411	309	329	324	419	-	340
Annual (net) poppy income per household ($)	632	290	698	1261	439	-	543
% of villages facing drought	14 %	34%	24%	0%	40%	NA	25%
% of villages that faced heavy rain or frost	31%	2%	52%	12%	80%	NA	27%
% of villages with poppy diseases	27%	5%	77%	6%	80%	NA	35%
% of households growing own poppy*	93%	70%	67%	55%	58%	NA	73%
% of households labouring in other farmers' poppy fields*	5%	28%	29%	21%	41%	NA	23%
% of households growing on poppy and labouring *	2%	2%	4%	24%	1%	NA	4%
% of land owners in village (permanent paddy field)	51%	38%	44%	13%	76%	NA	44%
% of households in debt in village	27%	39%	12%	8%	29%	NA	26%

NA= not available. * From total number of households involved in poppy cultivation.

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