United Nations
Office on Drugs and Crime

Myanmar Opium Survey 2024

Cultivation, Production, and Implications

December 2024

UNODC Research

In Southeast Asia, UNODC supports Member States to develop and implement evidence-based rule of law, drug control and related criminal justice responses through the Regional Programme and aligned country programmes. This study is undertaken under the framework of the Mekong MOU on Drug Control which UNODC actively supports through the Regional Programme, including the commitment to develop data and evidence as the basis for countries of the Mekong region to respond to challenges of drug production, trafficking and use.

To assess the scope of opium poppy cultivation and opium production in Myanmar, UNODC has been conducting opium surveys regularly in the Republic of the Union of Myanmar since 2002. The opium surveys have been implemented within the technical framework of the UNODC Illicit Crop Monitoring Programme (ICMP), established in 1999 upon request of the Commission on Narcotic Drugs in its resolution 42/3, Monitoring and verification of illicit cultivation. The objective of ICMP is to assist the international community in monitoring the extent and evolution of illicit crops and to compile reliable and internationally comparable data. Currently, UNODC carries out and supports monitoring activities in the following countries affected by illicit crop cultivation: coca surveys in Bolivia, Colombia, and Peru; and opium poppy surveys in Afghanistan, Mexico and Myanmar. ICMP is part of UNODC's Research and Trend Analysis Branch.

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Introduction

This report presents the results of the twenty-second Myanmar opium survey, covering the 2023/2024 opium growing and harvesting season. The last three surveys in Myanmar covering the 2020/2021, 2021/2022, and the 2022/2023 seasons showed an increase at the national level in both areas under opium poppy cultivation and opium production. The 2023 survey reported an 18% increase in the area under cultivation to an estimated 47,100 hectares. For the first time in three years the 2024 survey shows a modest decline in the area under cultivation by 4% to 45,200 hectares, indicating a possible stabilization at recent high levels.

Three consecutive years of expanding cultivation followed by a year of limited decline could indicate some degree of saturation in regional heroin markets supplied by Myanmar. Declining prices of fresh opium in Myanmar and declining purity-adjusted prices of heroin in regional markets could have dissuaded a further increase of production in Myanmar in 2024.

However, information from the field suggests that the stagnation in productivity could also be related to the ongoing internal conflict. While instability and conflict, and their impact on the rule of law have traditionally been seen as a driver of illicit crop cultivation, the expansion of the conflict and shifts in the territorial control of armed actors, especially in the growing areas of Shan and Kachin, have limited the mobility of rural population, and likely prevented farmers from accessing cultivation areas further away from their villages. The dynamics of internal conflict might also explain the uneven development across Myanmar's states in regions, with some areas showing declines in cultivation and others continued growth. In October 2024, the UN Office for the Coordination of Humanitarian Affairs (OCHA) estimated that there were some 3 million people internally displaced across the country,[1] with Shan and Kachin in particular seeing escalating tensions and clashes in late 2023 and early 2024.[2]

The 2024 survey shows decreases in illicit opium cultivation in half of the geographic areas observed, including South Shan which traditionally experienced the most extensive opium cultivation. Eastern Shan, Chin, and Kayah had modest increases between survey years. Overall, cultivation in Shan State, which continues to be the centre of opium production in Myanmar at 88% of total cultivation area, decreased by 4% to 39,700 ha, with decreases in South and North Shan (-9% and -4% respectively) while East Shan increased by 10%. Cultivation in Kachin saw a moderate decrease of 10%, a change from past trends when above-average increases were observed. Estimates for Chin and Kayah, where the overall area remained small in comparison to other areas, showed an 18% and 8% increase, respectively.

Overall potential opium production decreased at greater rates than cultivation due to a decline in opium yield. In 2024, average yield declined by 4% from 22.9 kg per hectare to 22kg per hectare, resulting in an estimated opium production of 995 (700-1,580) metric tons, or 8% less than in 2023. Nevertheless, both yield and production remain at high levels across the last decade.

The decrease in cultivation and production coincided with a decrease in farmgate prices of both fresh and dry opium in USD terms, by 4% and 8%, respectively. In 2024, fresh opium traded at just over US$300 per kilogram, down from US$317 the year before, although it remained high compared to the last low point in 2021 when it stood at US$131 per kilogram. In combination with lower production, nationally farmers earned slightly less income than the previous year, between US$230 – US$518 million in 2024 (US$271 - US$613 million in 2023). The farmgate value only represents a small share of the overall opiate economy, with heroin manufacture and export making up a larger share. Wholesale prices of heroin in the region declined even more, contributing to a much larger decrease in the value of the total national opiate economy of about 40%, now ranging between US$589 million and US$1.57 billion, representing between 0.9 – 2.4% of Myanmar's 2023 GDP.

An analysis of survey data collected over several years from households and villages in Shan and Kachin points to a variety of drivers behind illicit crop cultivation, and confirms the close

1 OCHA, "Myanmar Humanitarian Update No. 41," October 10, 2024, https://www.unocha.org/publications/report/myanmar/myanmar-humanitarian-update-no-41-10-october-2024.

2 OCHA, "Myanmar Humanitarian Update No. 37," April 5, 2024, https://www.unocha.org/publications/report/myanmar/myanmar-humanitarian-update-no-37-5-april-2024.

interdependency of opium cultivation and wider socio-economic development. Opium poppy cultivation is closely linked to multi-dimensional poverty, lack of government services, challenging economic environments, instability, and insecurity. Most importantly, limited access to formalized land use rights and high rates of debt within rural villages and households are significantly associated with poppy cultivation. As all of these factors are negatively affected by conflict and broader instability, the continued crisis and socio-economic disruptions following the 2021 military takeover will remain a decisive factor in farmers' decisions whether or not to grow opium in the future.

Globally, external events may also be relevant to the future of poppy cultivation and opium production in Myanmar. The drug ban issued in Afghanistan in 2022 resulted in a 95% decline in opium production in 2023,[3] with Myanmar becoming the world's main source of opium for the first time since 2001, the last time a ban was instituted in Afghanistan. The ban has continued to hold into a second year, a historic first for Afghanistan, which has long been the dominant supplier of illicitly consumed opiates globally. Although opium poppy cultivation in Afghanistan increased by 19% in 2024, reaching 12,800 hectares, this is significantly lower than in 2022, when an estimated 232,000 hectares were cultivated.[4] A global shortage of opiates, including heroin, could result in upward pressure on the price of opium in Myanmar once global supply chains and distribution networks adjust. This would in turn encourage more cultivation and production, especially if global demand offsets the effects of saturation in regional markets. The resulting dynamic may not only impact cultivation in Myanmar, but also neighbouring countries and other parts of the world where opium cultivation exists.

With the presence of both internal and external pressure factors on opium cultivation in Myanmar, continued monitoring of the situation will remain critical to understanding whether the stabilization recorded in 2024 will remain into 2025. Against the background of continued disruptions to social, political, and economic stability, Myanmar's economic trajectory and future outlook remains highly uncertain. At the same time, the impact of the situation in Afghanistan on global opium supply and distribution patterns presents a risk of an escalating demand for opium produced in Myanmar and Lao PDR. These developments, together with the continued surge in synthetic drug production and trafficking[5], suggest that the Golden Triangle will remain an important centre for illegal drug production.

3 UNODC, "Afghanistan Opium Survey 2023," August 2023.
4 UNODC, "Afghanistan Opium Survey 2024". November 2024.
5 UNODC, "Synthetic Drugs in East and Southeast Asia: latest developments and challenges 2024". May 2024

Key takeaways

Three years after the military takeover in Myanmar, poppy cultivation has stabilized at recent high levels, suggesting that the internal conflict remains a critical factor in illicit cultivation in Myanmar

The 2024 survey points to a slowing down of cultivation, with a slight decrease of 4% to 45,200 ha from 47,100 ha in 2023. Although area under cultivation has not returned to peaks reached in 2013 at nearly 58,000 ha, poppy cultivation remains robust.

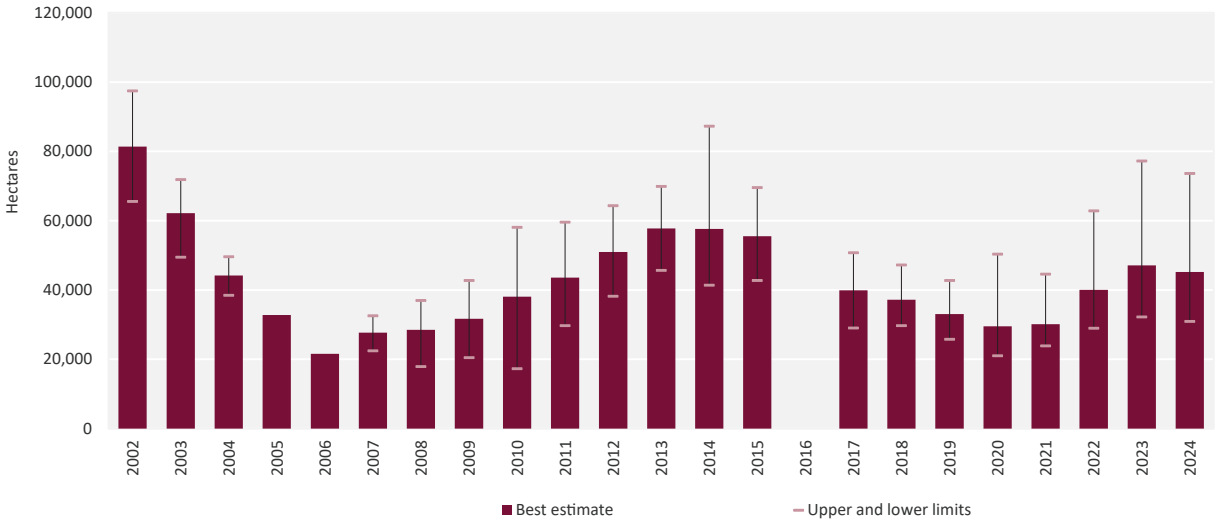
Poppy cultivation has modestly declined in most regions, including in Shan State, which dominates national cultivation

Shan State saw a decline of 4% from 41,300 ha in 2023 to 39,700 in 2024. Shan State remains the most important poppy-producing state in Myanmar at nearly 88% of the country's total. However, the recent decline in cultivation was uneven with East Shan showed a 10% increase while North and South Shan showing declines of 4 and 9%, respectively. These regional variations coincide with recent intensification in the country's internal conflict particularly in South Shan where armed groups not aligned with the government have clashed repeatedly over the last year, resulting in displacement and loss of life.[6] Ongoing conflicts elsewhere in Kachin may have also disrupted poppy cultivation and opium production.

Opium production in Myanmar remains high but has slightly reduced in 2024 as indicated by lower yields

Historically, illicit poppy cultivation in Myanmar, and Southeast Asia in general, was typically of small, poorly organized, and sparse plots. Field and ethnographic research[7] point to longstanding traditions of small-scale poppy cultivation, sometimes as a cash or insurance crop, but also for household use. However, in recent years, cultivation in Myanmar shifted toward more sophisticated practices that increased yields. National yield estimates from 2022's survey indicated an average of 19.8kg of opium per hectare of poppy, which was a substantial increase from 14kg per hectare in 2021. In 2023, the national yield estimate rose again to 22.9kg per hectare—the highest ever recorded by UNODC. By 2024, yields declined slightly by 4% to 22kg/hectare. At the local level, some declines were more pronounced with North Shan declining by 11%. A few field reports found instances of poppy plots that appeared to be poorly cared for or suggested partial abandonment.

Area under opium poppy cultivation in Myanmar

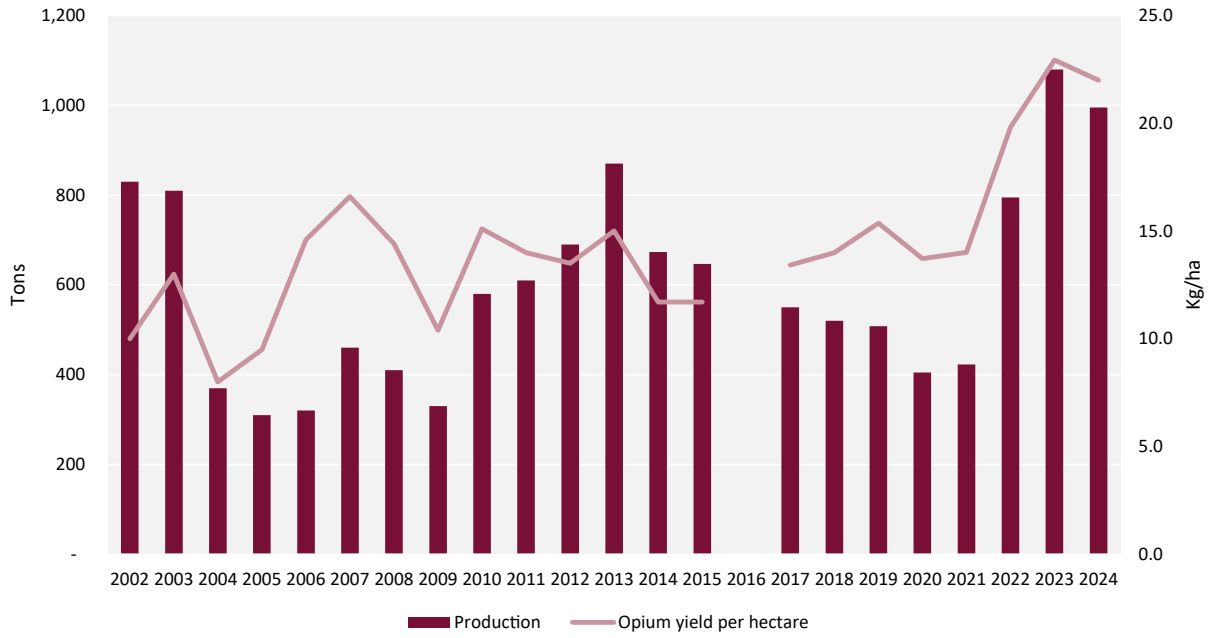


No survey was conducted in 2016. The error bars are the upper and lower limits of the confidence intervals of the sampling uncertainty.

6 OCHA, "Myanmar Humanitarian Update No. 37.".

7 Patrick Meehan, "'Ploughing the Land Five Times': Opium and Agrarian Change in the Ceasefire Landscapes of South-Western Shan State, Myanmar," *Journal of Agrarian Change* 22, no. 2 (2022): 254–77.

Opium production and yields in Myanmar



No survey was conducted in 2016.

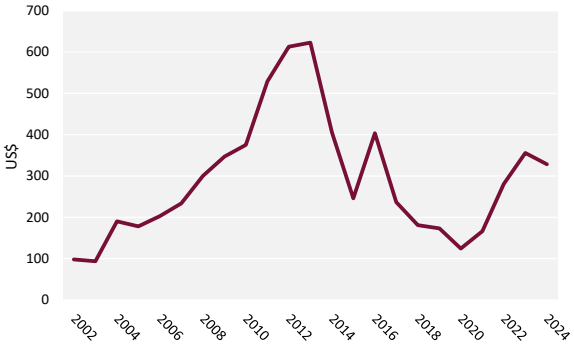
Overall, opium production has slowed in Myanmar, but the country remains a leading source of illegally produced opium

Opium production in Myanmar declined in 2024 by about 8% from 1,080 tons in 2023 to 995 tons in 2024. This is notable given that opium production in Myanmar jumped 38% from 790 tons to 1,080 tons between the 2022 and 2023 surveys. Myanmar has been an important source of global opium production, after Afghanistan, which until 2022 provided over 80% of global production. However, since the 2022 ban on poppy cultivation in Afghanistan, production in that country has fallen dramatically. In 2024, Myanmar's opium production totals are now more than twice that of Afghanistan, making it the world's leading producer of illicitly sourced opium.

The farmgate price of opium in Myanmar decreased slightly

The national average farmgate prices at harvest time of fresh and dry opium in 2024 were assessed at around US$300 (640,000 Kyat) and US$330 (670,000 Kyat) per kilogram, respectively.[8] This marks a 4% decline in fresh opium prices and an 8% decline in dried opium prices compared to 2023. This reversed the previous upward trend in price increases that started in 2021. However, the 2024 price per kilogram of opium continues to be at comparatively high levels, especially when assessing variations in local currency (Kyat).

Farm-gate prices of dry opium in villages with poppy cultivation, Myanmar, 2002-2024 (US$ per kilogram)



Without inflation adjustment.

As Myanmar's licit economy remains fragile, the income from opiates continues to be an important source of revenue but declined slightly from last year

Between 2023 and 2024, the farmgate price decreased slightly by 4% with dry opium prices declining by 8%. In combination with declining

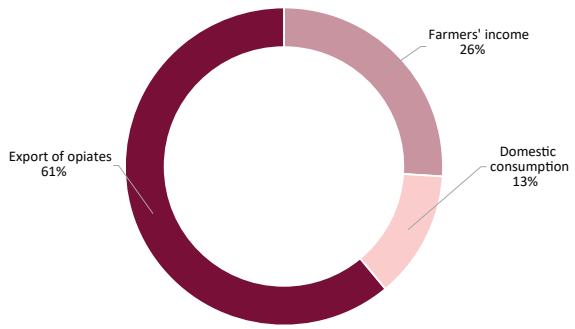
8 Applied MMK/USD exchange rate is the 2024 DEC alternative conversion factor provided by the World Bank (https://data.worldbank.org/indicator/PA.NUS.ATLS).

opium production, this together amounted to a total of US$229 to US$518 million worth of opium sold at the farmgate, representing 0.4% to 0.8% of the GDP in 2023, or between 1.7% and 3.9% of the agricultural, forestry and fishing sectors of the 2023 GDP.[9] Overall, the opium economy generated less revenue for farmers and comprised a smaller portion of the national economy in 2024 relative to the year before.

The most profitable activity in the opiate economy is heroin production and trafficking. In 2024, it was estimated that 5.9 tons of heroin were consumed in Myanmar, with a value ranging between US$63 and US$256 million. Between 52 and 140 tons of heroin were potentially exported, with an estimated value between US$468 million and US$1.26 billion.

The gross value of the entire opiate economy – comprising both the value of domestic consumption and exports of opium and heroin – in Myanmar in 2024 was estimated to be between US$589 million and US$1.57 billion, accounting for about 0.9-2.4% of the national GDP in 2023.

Shares of the Myanmar opiate economy, by component (approximation)



Data collected from villages and households in rural Myanmar show linkages between socio-economic factors and household involvement in the opium economy

Opium poppy cultivation in Myanmar is concentrated in areas characterised by a combination of specific topographical conditions and challenging socio-economic, developmental, and governance environments. Socioeconomic surveys with community leaders and households across several states in Myanmar in different years have consistently identified the absence of formalized land use arrangements, high debt rates, suitable infrastructure, access to markets, and basic services as being linked to illicit crop cultivation.

In turn, households and villages in Myanmar that engage in poppy cultivation and the broader opium economy are often located in more remote areas and have less access to markets. Lower access to public services and infrastructure, such as schools and roads, and less annual income from licit sources are often related to a household's decision to cultivate poppy.

Food security is the most important reason reported for growing opium poppy

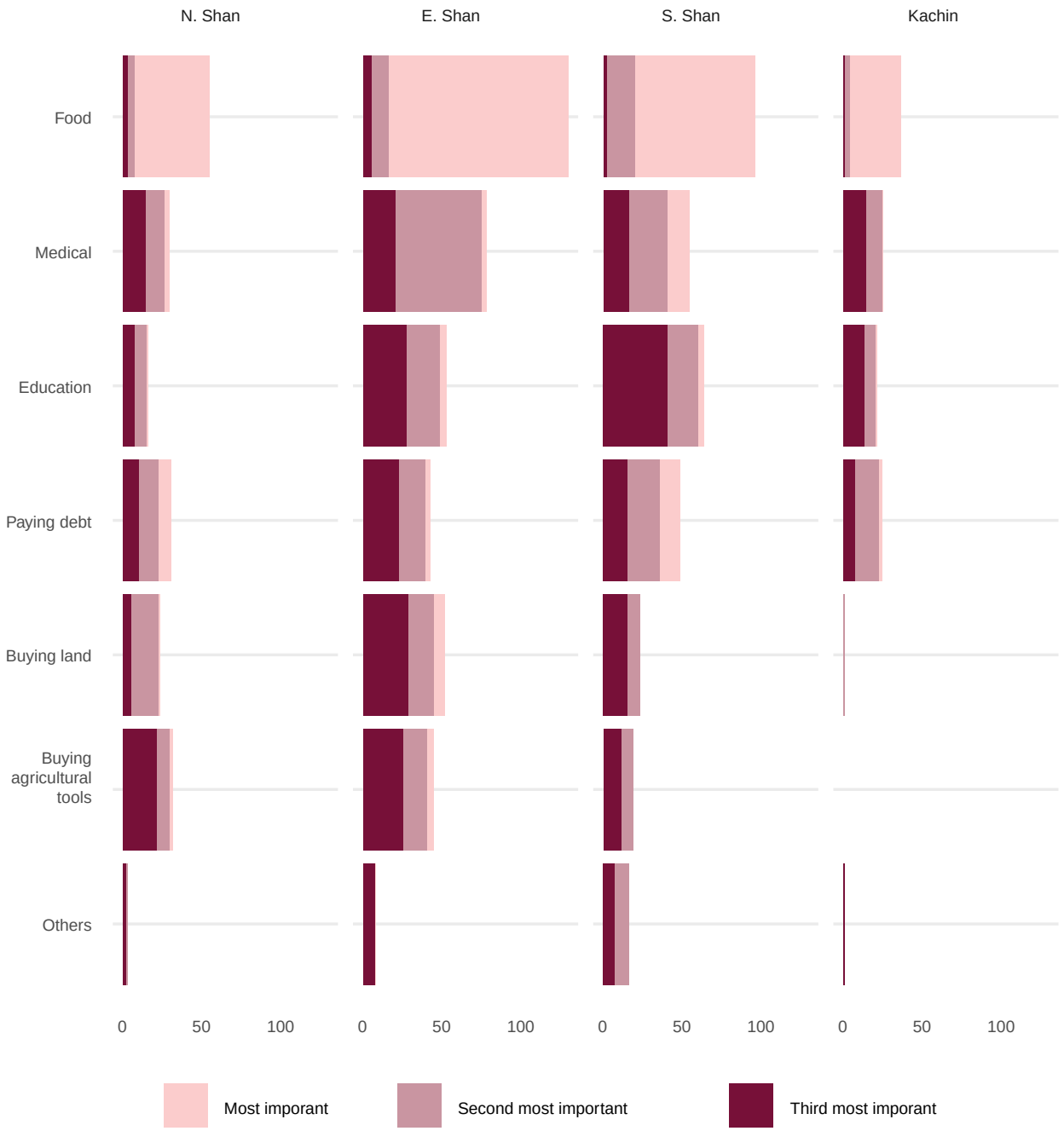
When asked about the reasons why households cultivate poppy, the most common response in terms of quantity and importance, by far, was to obtain income to buy food. This reason was the primary one for all regions and across all years. The need to use poppy income to pay for food was most evident in Shan, but it was also clearly the dominant reason for respondents in Kachin as well. Paying for medical interventions or education were the second and third most common responses depending on the region or year. Nevertheless, food insecurity is a clear motivating factor for why households engage in poppy cultivation.

Farmers lacking formal land tenure rights and those reporting higher levels of debt are more likely to engage in illicit opium cultivation

There are significant differences regarding formalized land use, such as whether households rented or owned their land versus using the land without a formalized certificate of tenure or as a sharecropper. Eighty percent of poppy-involved households surveyed reported no formalized certificate, compared with 59% of non-poppy households. After controlling for a variety of measures and other factors, a household reporting formalized land status was 71% less likely to engage in poppy cultivation, making it an important protective factor.

9 Source: The World Bank, https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=MM

Village leader responses for reasons behind a household's decision to cultivate poppy

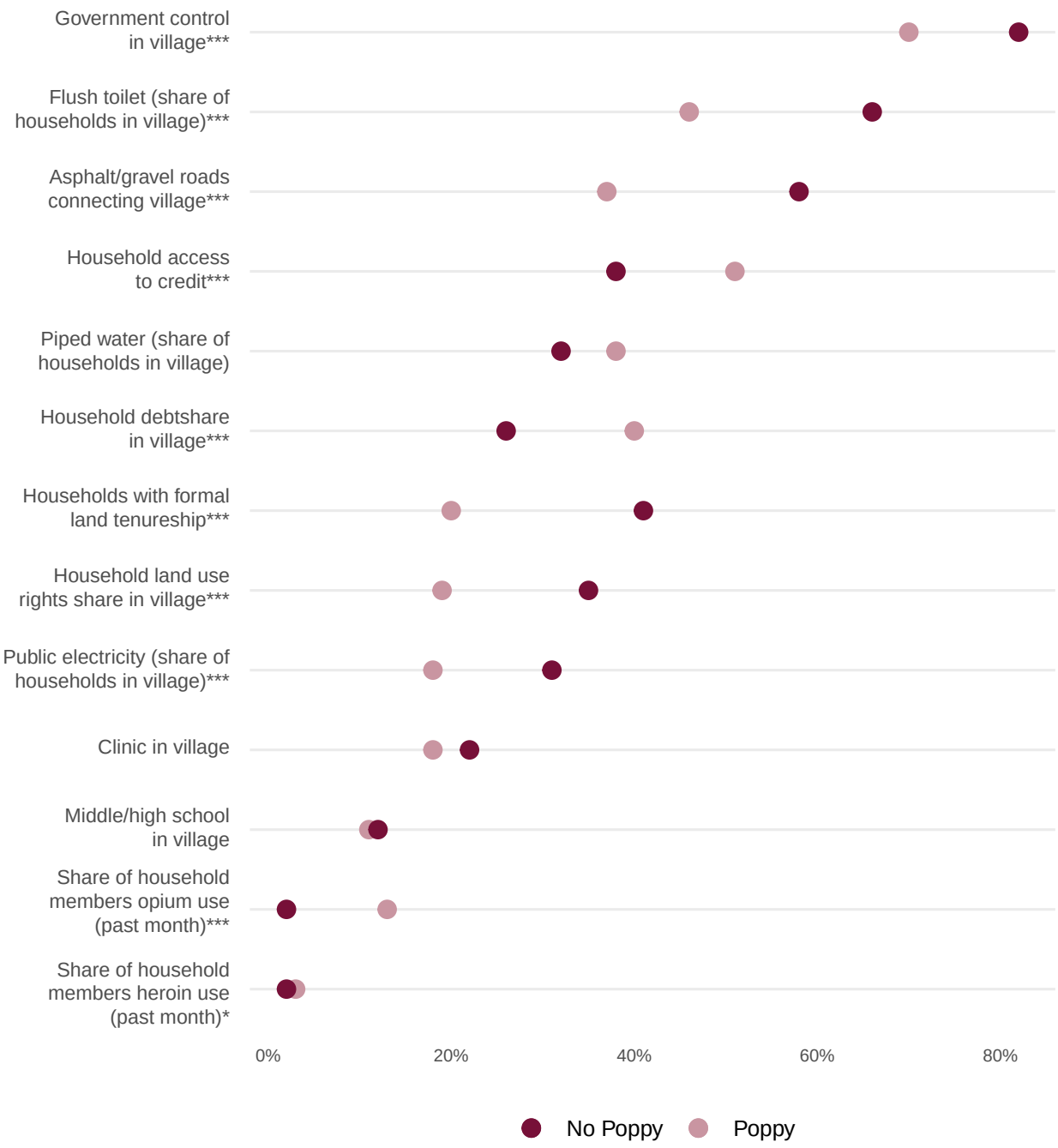


Communities where poppy cultivation is more common are more remote and face transportation challenges (37% are accessible by paved roads versus 58% for non-poppy villages). This correlates with a lack of access to markets to buy and sell alternative legal crops as poppy-related villages were less likely to sell to buyers offering the most competitive price (43% versus 55% for non-poppy villages), relying instead on the same buyer or the closest buyer in 55% of cases.

While poppy cultivating households report significantly greater access to credit (51% versus 38%), surveys did not indicate what types of financial establishments guaranteed or offered such credit. Research has indicated that informal moneylenders play an important role in providing cash loans to households for the explicit purpose of poppy cultivation.[10] Responses from households on their priorities indicate that debt repayment is the fourth most common reason considered in the decision to cultivate poppy while two-thirds of village headmen cited it as the first or second most important reason (only surpassed in its importance by needs like food or medicine). Further, about 40% of households of poppy-involved villages report holding debt versus 26% of households in villages not engaged in poppy. After controlling for a variety

10 Meehan, "'Ploughing the Land Five Times.'".

Poppy-involved villages and households generally report worse socioeconomic measures



*Indicates signifcant difference at p<0.05
***Indicates significant difference at p<0.001 (Wilcoxon Test)

Note: *Indicates significant difference at p<0.05; ***Indicates significant difference at p<0.01 (Wilcoxon Test).

of measures and other factors, a 10% increase in the share of households reporting debt in poppy-involved villages is associated with a 137% increase in the numbers of households engaged in poppy cultivation in that village. This suggests that efforts to reduce household debt could also reduce household engagement in poppy cultivation.

Households engaged in poppy cultivation have higher use rates of opiates

Proximity to opiates production is associated with higher rates of opium or heroin use by members of a household. Poppy-involved households reported higher shares of household members using opium

in the past month versus households that did not earn income from the poppy economy (13.5% versus 2.3%). Poppy-involved households also reported significantly higher shares of past-month heroin use in the household than households that did not engage in poppy cultivation (2.7% versus 2.1%).

In areas where poppy cultivation is more common, villagers reported higher levels of insecurity and fear; the military takeover has likely made it worse

Government control was found to be a protective factor against involvement with poppy at the village level. While 82% of non-poppy-involved villages report government control, only 70% of poppy-involved villages are under such control. The remaining villages mentioned most often insurgents or militia groups as being in control. Poppy engaged households were more likely to agree with statements that indicated they feared for their life or physical property. Notably, the percentage of households reporting fear for their life or property also increased over time as the internal conflict in Myanmar has continued. The share of poppy-involved villages among the surveyed sample went from just over 19% in 2019 to 34% in 2023. Similarly, the share of households engaged in poppy increased from 11% to 20% over the same period. In addition to more households and villages engaging with poppy, there has also been a tripling in average plot size growing from 0.034 hectares in 2019 to 0.112 in 2023.

Poppy cultivation generates greater gross income than other agricultural commodities, but is more costly to produce and make households more vulnerable to economic uncertainty

On average, poppy households are reported to earn US$2,500 a year versus a little over US$2,200 for non-poppy households. However, poppy-involved households only earn more due to revenue from poppy. Absent the sale of opium or related wages from opium those annual household earnings drop to US$1,800.

However, these opium-related earnings may not translate to profitability. As reported by village headmen, the average cost of cultivating poppy is higher than that of paddy rice - about twice as much. The costs of production are similar for seeds and ploughing, yet rice requires almost no irrigation costs and less expenditures for fertilizer, weeding, and harvesting. In contrast, poppy cultivation is more labour intensive when it comes to weeding and harvesting. Harvesting is significantly more expensive for poppy (US$35.8/hectare) than rice (US$13.5/hectare; $p<0.01$). Furthermore, non-poppy households are economically engaged in a wider range of activities, including nonagricultural income, such as trades, and are thus more diversified and possibly resilient to economic uncertainty and risk.

Fact Sheet

	Year 2023 (rounded)	Year 2024 (rounded)	Change 2023-2024
Total opium poppy cultivation (ha)[11]	47,100 (32,200 to 77,200)	45,200 (30,900 to 73,700)	-4%
Opium poppy cultivation in Shan State	41,300 (26,500 to 55,900)	39,700 (25,600 to 53,300)	-4%
Opium poppy cultivation in Kachin State	4,600 (2,700 to 11,200)	4,140 (2,390 to 10,300)	-10
Opium poppy cultivation in Chin State	700 (590 to 820)	832 (806 to 858)	18%
Opium poppy cultivation in Kayah State	480 (420 to 540)	521 (453 to 590)	8%
Total potential production of dry opium (metric tons)[12]	1,080 (760 to 1720)	995 (698 to 1,580)	-8%
Potential dry opium production in Shan State	900 (590 to 1510)	836 (544 to 1,390)	-7%
Potential dry opium production in Kachin State	153 (90 to 371)	129 (74 to 320)	-16
Potential dry opium production in Chin State	16.2 (13.4 to 19.0)	18 (17.1 to 19.5)	13%
Potential dry opium production in Kayah State	11.0 (9.44 to 12.6)	11.5 (9.8 to 13.1)	4%
Average opium yield (kg/ha)[13]	22.9 (21.6 to 24.4)	22.0 (20.8 to 23.2)	-4%
Farmgate price of fresh opium[14]	317 US$/kg (590,000 Kyat/kg)	304 US$/kg (640,000 Kyat/kg)	-4%
Farmgate price of dry opium	355 US$/kg (662,000 Kyat/kg)	330 US$/kg (690,000 Kyat/kg)	-8%
Farmgate value of opium in million US$	271 - 613	229 – 518	-15%
Value of the opiate economy (gross) in million US$	998 - 2,460	589 – 1,570	-36 to -40%
Value of the opiate economy (after the farmgate) in million US$	727 – 1,850	360 – 1,060	-43 to -49%
Total opium poppy eradication reported by the CCDAC (ha)	2,358	2,502	6%

Numbers in the table are rounded, percentage changes are calculated with exact estimates. CCDAC is the Central Committee on Drug Abuse Control.

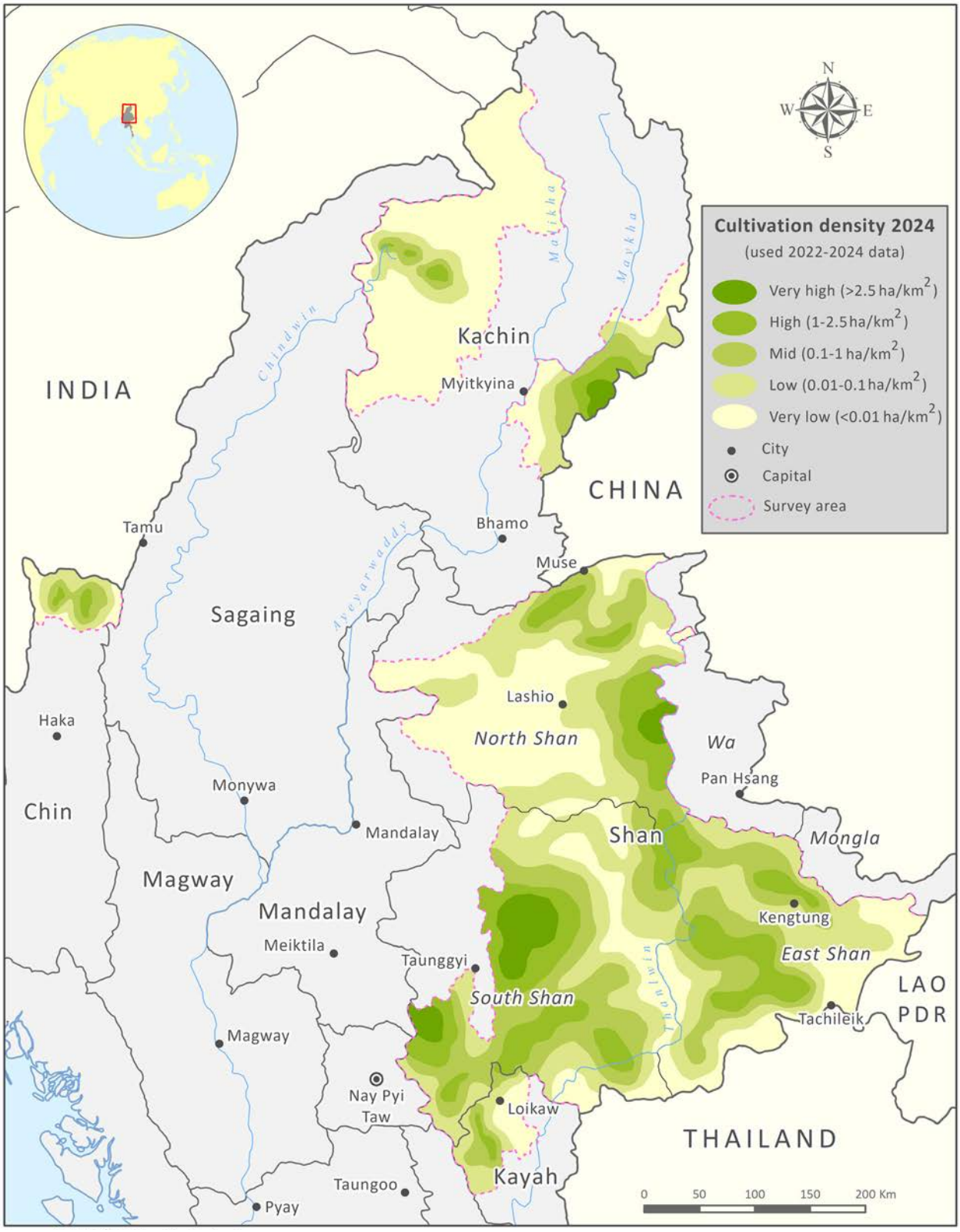
11 The estimates may include areas eradicated after the acquisition date of the satellite images.

12 In 2022, for Shan and Kachin States a multi-year average was applied, using data from 2020 to 2023. For Chin and Kayah States the national average yield was applied (see methodology report for further details).

13 Opium yields weighted by cultivation. In Kayah and Chin, the national average has been applied since no yield measurements were available.

14 National average weighted by regional production estimates. For 2023 and 2024, the applied exchange rates MMK/US$ are the 2022 and 2023 DCE alternative conversion factors provided by the World Bank (https://data.worldbank.org/indicator/PA.NUS.ATLS?locations=MM).

Map 1: Opium poppy cultivation density in Myanmar in 2024[15]



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

15 To have a more comprehensive visualisation of cultivation density UNODC uses data from 2022, 2023 and 2024.

FINDINGS

Findings

Estimated area under opium poppy cultivation

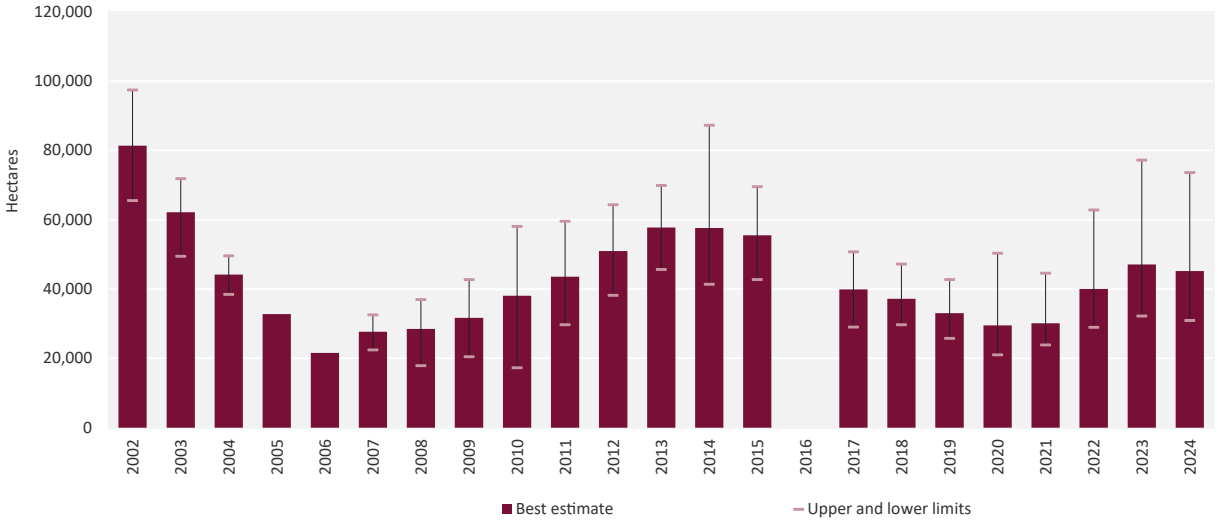
In 2024, the area under opium poppy cultivation in Myanmar was estimated at 45,200 (30,900 to 73,700) hectares. That is a 4% decrease from the 47,100 hectares estimated to be under cultivation in 2023. This represents the first decline after three years of expanding cultivation. The national trend of reductions in poppy cultivation starting in 2014, when area under cultivation was estimated at 57,600 ha, levelled off in 2020 and rose for three consecutive years until 2024.

The reasons behind this recent modest decline in the area cultivated are varied and may relate to broader dynamics of the regional opiate economy as well as the ongoing internal conflict, which has resulted in the internal displacements of populations in regions that have long engaged in poppy cultivation. It is yet to be seen if this is the start of a new chapter in illicit cultivation or attributed to disruptive factors brought on by the country's internal conflict which saw rapid changes in events in 2024 in poppy-growing areas.

Poppy cultivation decreased unevenly, with most states seeing declines from 2023. Some states, notably Chin and Kayah, saw increases compared to last year. Compared to 2023, Shan State showed the largest decrease in absolute terms of cultivated hectares (a decrease of some 1,500 hectares, or 4% from the previous year). Decreases were observed in North and South Shan (4% and 9%, respectively), but East Shan showed a 10% increase from 2023. In Kachin State, a 10% decrease was estimated. Chin and Kayah showed increases of 18% and 8%, respectively, making these regions some of the few that found overall increases from last year.

Shan continued to be the major cultivating state in Myanmar, accounting for about 88% (39,700 ha) of the overall opium poppy area. Within Shan State, the sub-regions of South, North, and East Shan accounted for 45%, 22% and 20% of total cultivation in 2024, respectively. Kachin State accounted for 6% (2,800 ha), and Chin and Kayah States together for 3% (1,350 ha).

Figure 1: Opium poppy cultivation in Myanmar, 1996-2024 (ha)



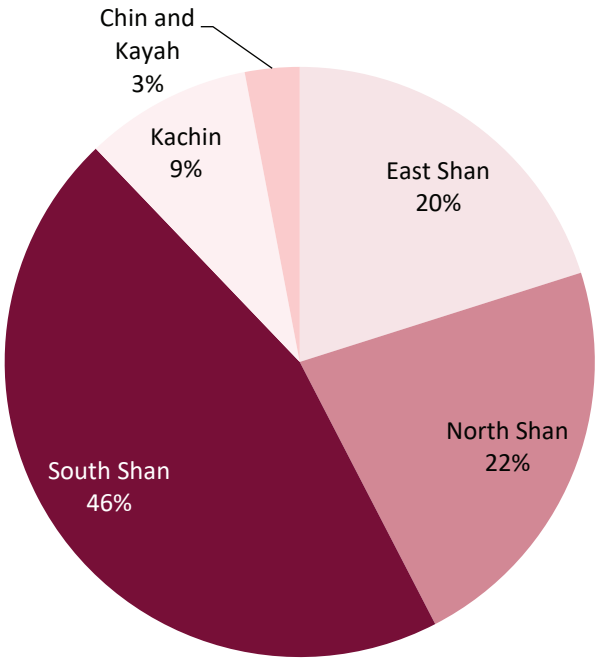
Sources: from 2002 to 2020 CCDAC-UNODC, from 2021 to 2024 UNODC. In 2016 no area survey was conducted.

Table 1: Areas under opium poppy cultivation in Myanmar (ha), in 2023 and 2024

Region	Year 2023 (rounded)	Year 2024 (rounded)	Change 2023-2024
South Shan	22,600 (10,200 to 47,300)	20,600 (9,100 to 43,200)	-9%
East Shan	8,200 (3,400 to 16,000)	9,090 (3,550 to 17,800)	10%
North Shan	10,500 (4,100 to 24,300)	10,100 (3,870 to 23,500)	-4%
Shan State total	**41,300 (26,500 to 55,900)**	**39,700 (25,600 to 53,300)**	**-4%**
Kachin	4,600 (2,700 to 11,200)	4,140 (2,390 to 10,300)	-10%
Chin	700 (590 to 820)	832 (806 to 858)	18%
Kayah	480 (420 to 540)	521 (453 to 590)	8%
National total	**47,100 (32,200 to 77,200)**	**45,200 (30,900 to 73,700)**	**-4%**

Values in parenthesis indicate the 95% confidence interval. Numbers in the table are rounded, percentage changes are calculated with exact estimates.

Figure 2: Regional share of opium poppy cultivation areas in Myanmar, 2024

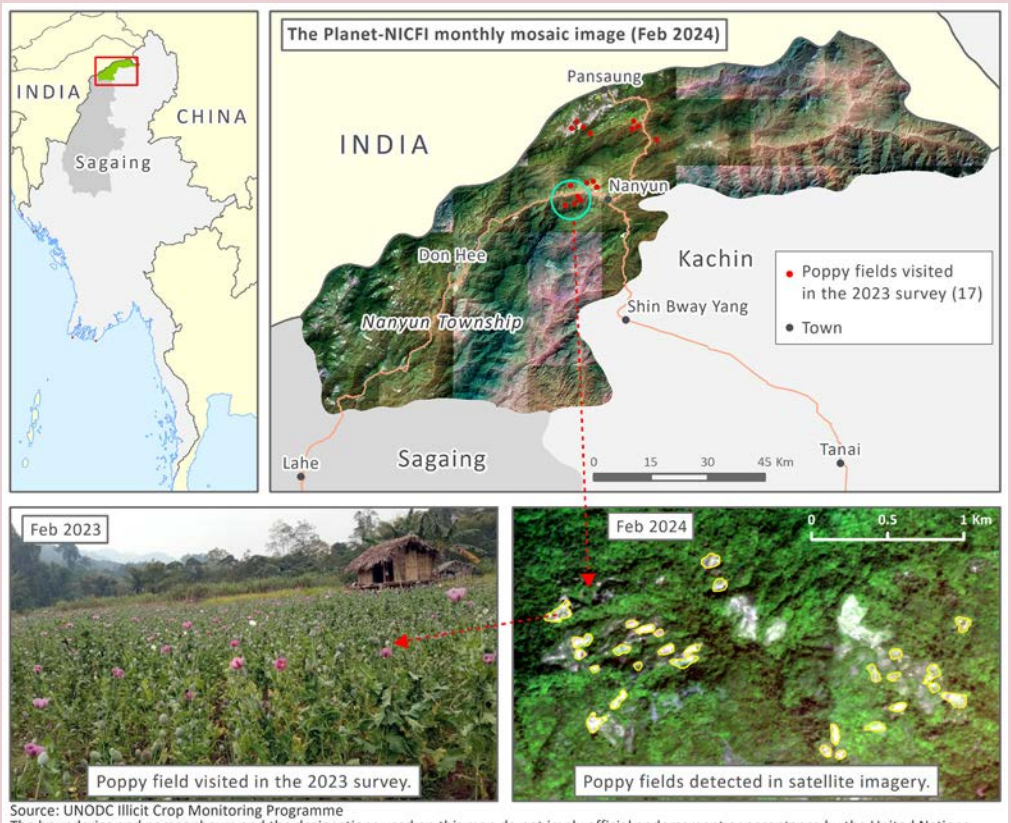


Information on opium poppy cultivation in northern Sagaing Region

In the 2010s, UNODC conducted field missions to assess opium poppy cultivation in the northern Sagaing Region, also known as Naga Land, following reports of increased cultivation by local communities. The assessments indicated no significant opium poppy cultivation, estimating a total area of around 50 hectares in 2015. UNODC resumed these assessments in 2023, organizing a mission to the region. During this mission, a dedicated surveyor interviewed 17 poppy farmers across nine poppy-growing villages in Nanyun township and collected geo-tagged photos from 17 harvesting stage opium poppy fields. Based on these interviews and field information, the poppy cultivation area in Nanyun township in 2023 was estimated between 250 and 300 hectares.

To verify the 2023 assessment, the satellite imagery interpretation was conducted as part of the 2024 survey. High-resolution Planet-NICFI mosaic images, covering 6,597 square kilometers across Nanyun township, were acquired in February 2024 to align with the crop harvesting period. Using geo-tagged pictures of poppy fields from the previous year, satellite image analysis was conducted to estimate the extent of opium poppy cultivation. The satellite interpretation estimated to be approximately 200 hectares of poppy cultivation, which was lower than the previous year's field-based estimate. However, several areas with suspected poppy cultivation were identified during the analysis; these areas require additional information to distinguish between poppy and other crops. Consequently, the actual cultivated area could potentially exceed 200 hectares. This estimate has not been incorporated into the national figures due to limited ground truthing. UNODC plans to continue the assessments in the next survey (2025) using a methodological approach with high-resolution and very high-resolution satellite imagery.

Assessing poppy cultivation in Sagaing, 2024



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

A healthy opium poppy field in harvesting stage in Kachin, 2024

Factors driving opium production

The recent declines in production in Myanmar follows three years of increase. It is hard to say exactly why production has possibly levelled off or if this was just a bad year due to extenuating circumstances. There are three possible (non-exclusive) reasons for which UNODC has some evidence. Declining yields may be related to reductions in productivity in hotspot clusters. Visual evidence of plots in some clusters showed that some crops were in poorer condition compared to last year. The second could be related to Myanmar's ongoing internal conflict, which could have disrupted labour supply and the opium trade. The last may be related to the broader opiate markets in the region, which might be saturated after recent production increases in the last few years.

Opium poppy cultivation remains concentrated in certain areas

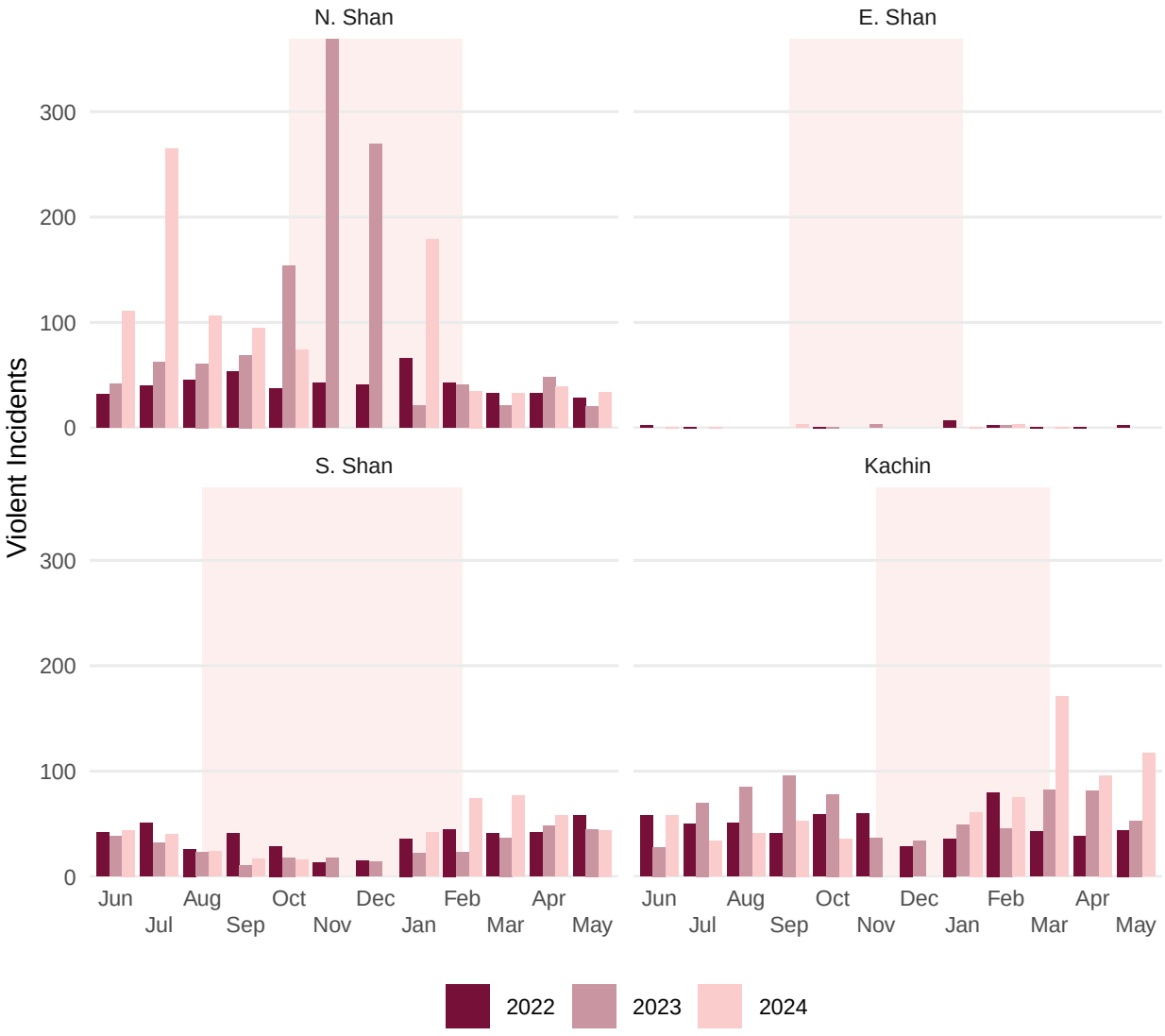
Opium poppy cultivation is concentrated in areas characterised by a combination of specific topographical conditions, challenging socio-economic circumstances and a precarious security situation. Additionally, poppy cultivation can be found in high density near some international borders. Map 1 above provides an overview of the average density of opium poppy cultivation during the 2023 and 2024 growing seasons.

South Shan showed high density opium poppy cultivation in the southwestern mountains and the mountain ranges in the eastern part of Taunggyi city. Medium cultivation levels were observed in the southern part of South Shan region. The areas near the boundaries of South, East, and North Shan regions, on both sides of the Than Lwin River, presented several extensive areas of poppy cultivation, while cultivation was dispersed in the areas along the southern boundaries of South Shan and East Shan.

High-density cultivation areas were detected in the southeastern mountains bordering the Wa region. Very high cultivation levels were observed in pockets in the northwestern part of Kachin State and the areas east of Myitkyina city, next to the international boundary with China. Chin State showed high poppy cultivation density in the mountains north of Tonzang town, near to the international border with India. In Kayah State, poppy cultivation was mainly dispersed.

A visual examination of year-over-year changes for several poppy plots shows similar density from 2023. Analysis of poppy cultivation plots shows

Figure 3: Monthly number of violent incidents, 2022 to 2024



Shaded area indicates the start and end of typical poppy harvest
Source: ACLED, 2024 data are not complete

clustering and continued organized planting of poppy. That said, several plots were found to be in poorer condition compared to last year and the average poppy bulb size significantly declined from last year.

Myanmar's internal conflict could be affecting poppy production through violence and lack of response to natural disasters

The UN noted that the country's ongoing internal conflict has experienced an escalation in parts of Kachin and South Shan in the first half of 2024.[16] Some 3 million people are estimated to have been displaced, with the Northwest and Southeast parts of the country experiencing deteriorating situations.[17] In South Shan, the monsoon season coincided with severe flooding. The lack of response to natural disasters in the region have affected perhaps a million people in the region.[18]

Several regions experiencing increased intensity in armed clashes and flooding are also areas where cultivation of poppy is most prevalent, especially in Kachin, North Shan, and South Shan. Clashes in northern Shan have also continued with internal

16 OCHA, "Myanmar Humanitarian Update No. 37."

17 OCHA, "Myanmar Humanitarian Update No. 36," March 3, 2024, https://myanmar.un.org/en/262193-myanmar-humanitarian-update-no-36, https://myanmar.un.org/en/262193-myanmar-humanitarian-update-no-36; OCHA, "Myanmar Humanitarian Update No. 41."

18 OCHA, "Myanmar Humanitarian Update No. 41."

displacements of civilians reported across northern Shan.[19] In Kachin, over 100,000 internally displaced persons (IDPs) remain in shelters with about 80% of those having been recently displaced in March of 2024 alone, which coincided with the tail end of the poppy harvest period.[20] It is possible that increased violence and disruption of normal daily life in parts of Myanmar could have displaced rural populations that have cultivated or harvested poppy in these areas. Kachin and South Shan both saw reductions in cultivation and production, while East Shan, which has been less affected by the internal conflict, showed no declines in poppy productivity.

Figure 3 uses open-source incident reporting data to show the monthly trends across the four regions of analysis. There are clear monthly spikes of reported violence in North Shan starting in late 2023 which continued into 2024 during the harvest period and again peaking in July of that year. Kachin also saw sharp increases in violence in the spring of 2024. It is possible that these violent events from the conflict could have displaced some populations that were engaged in poppy cultivation and opium harvesting.

Regional heroin markets are possibly experiencing oversupply, which could reduce demand for opiate exports

Myanmar is an important source of opiates (both opium and heroin) for regional markets across Southeast Asia, East Asia, South Asia, and Oceania. There are limited timely data for understanding drug market trends, but measures of prices and purities from the Annual Report Questionnaire (ARQ) indicate that heroin has become cheaper in recent years. Purity-adjusted prices are presented below because the amount of heroin may fluctuate due to changes in supply. Figures below indicate the amount in US$ for a pure kilogram amount of the drug. As shown, purity-adjusted prices were highest with distance from Myanmar and declines over time were more pronounced with greater proximity to Myanmar. In this case, purity-adjusted prices of a kilogram of heroin fell by 11% between 2020 and 2022 in China, while prices fell by more than a quarter between 2020 and 2023 in Hong Kong, China and they fell by almost three-quarters between 2022 and 2023 in Thailand. Although ARQ data for 2024 are not yet available, these trends are in line with recent production increases in Myanmar. It is possible that the fall in prices over the last few years, especially a substantial drop in immediate export prices in neighbouring Thailand, could have sent signals to suppliers in Myanmar to not further increase production.

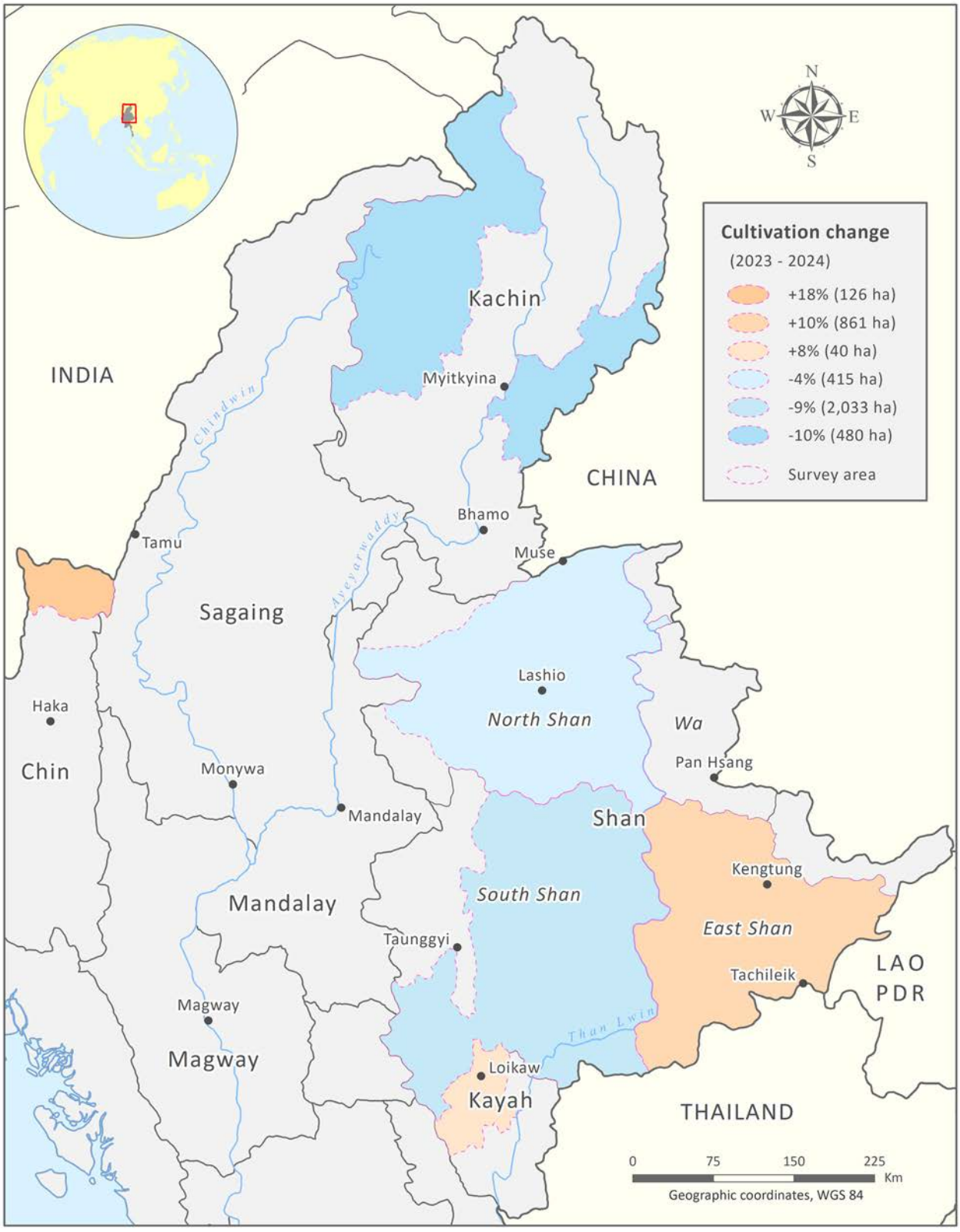
Table 2: Purity-adjusted wholesale prices of heroin (US$/kg)

Country	2020	2021	2022	2023
China	171,660	217,133	152,675	
Hong Kong, China	85,487	88,432	62,917	60,479
Thailand			18,883	5,127

Source: Data on prices and purities come from Annual Report Questionnaire for years stated.

19 Ibid.
20 Ibid.

Map 2: Cultivation changes between 2023 and 2024



Source: UNODC Illicit Crop Monitoring Programme.
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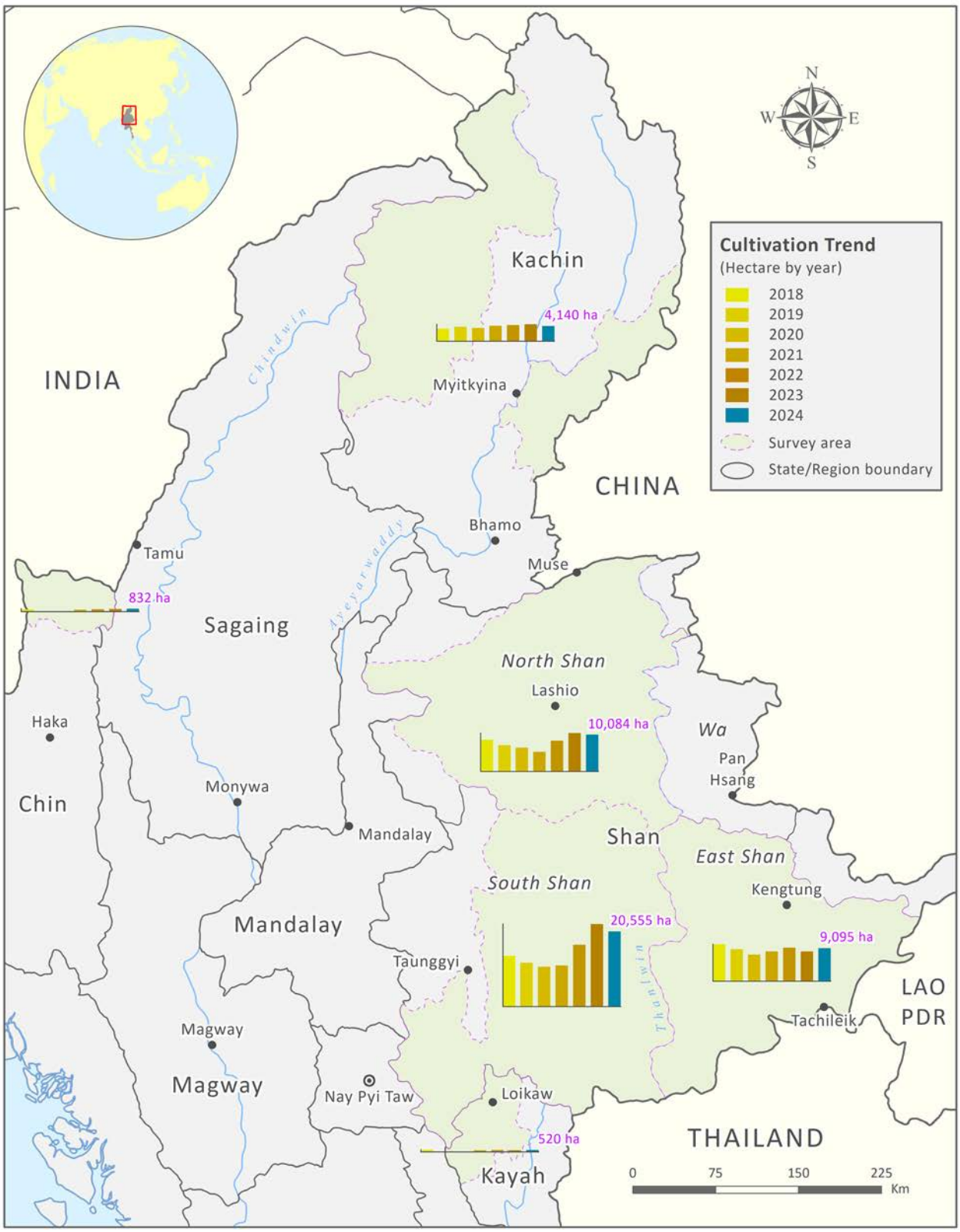
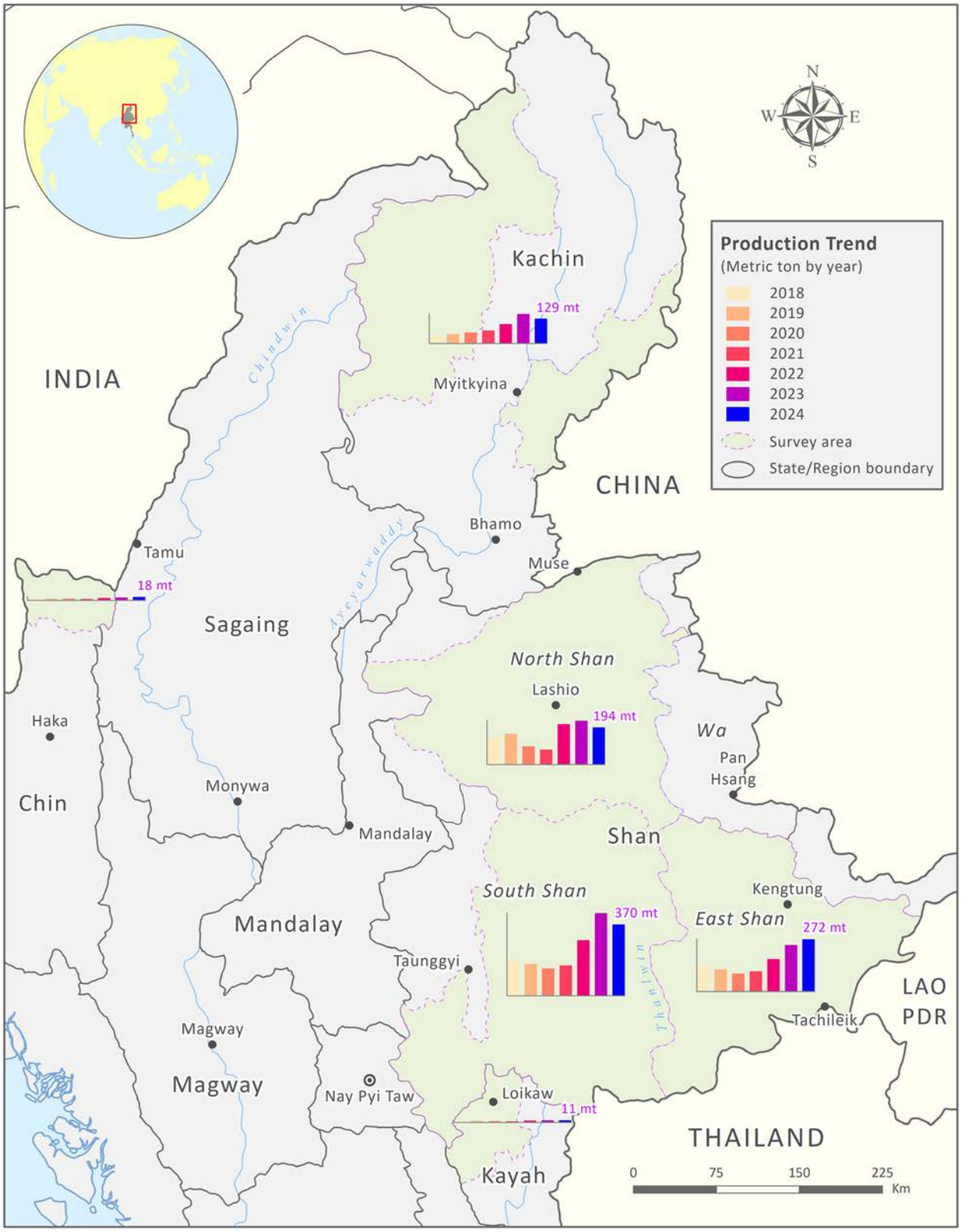
Map 3: Opium poppy cultivation trends in Myanmar, 2018-2024



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

Map 4: Opium gum production trends in Myanmar, 2018-2024



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

Abundant poppy field lacking proper care, South Shan, 2024

Opium poppy cultivation near residential area, Kachin, 2024

A flowering-stage opium poppy field with irrigation tubes, East Shan, 2024

Opium poppy fields with young stage plants, South Shan, 2024

Well-maintained opium poppy field in full bloom, South Shan, 2024

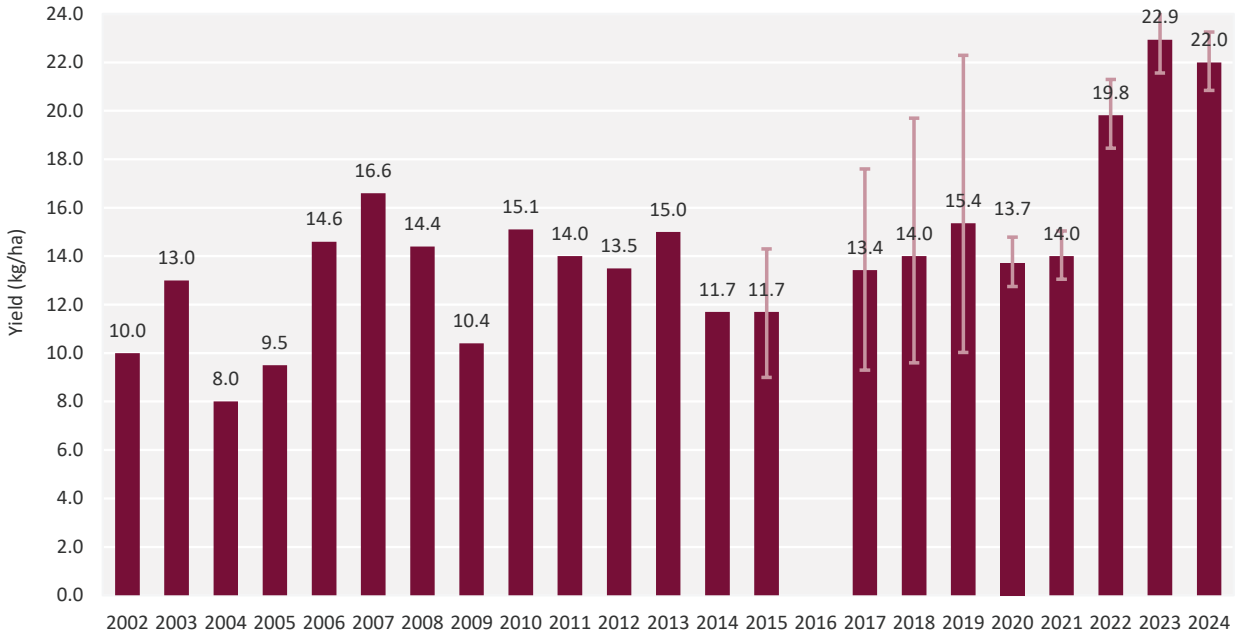
Opium yield and production estimates

In 2024, the yield survey was carried out in Shan and Kachin States. To avoid the possibility of the opportunistic nature of the sample biasing the final estimates, a three-year average was calculated using measures from 2022, 2023, and 2024. For Chin and Kayah States, the national average yield was applied (see separate methodology report for further details).

Compared to 2023, which also averaged yields over three years using measures from 2021, 2022, and 2023, decreases in yield were observed in three surveyed regions: 11% in North Shan (19.2 kg/ha in 2024), 6% in South Shan (18 kg/ha in 2024), 6% Kachin (31.1 kg/ha in 2024). Only in East Shan, which saw more cultivation this year, there was a slight increase in yield at 2% (29.9 kg/ha).

The national average yield in 2024 was estimated at 22 kg/ha (95% confidence interval: 20.8 to 23.2), 4% lower than the previous year. The yield estimate in 2023 was a record high, with 2024 yield estimates slightly down from this.

Figure 4: Average opium yield in Myanmar, 2002 – 2024



Average weighted by regional area estimates. In 2016 no survey was conducted. In 2021 to 2024, a multi-year average was used to estimate yields in Shan State regions, which reduced the uncertainty ranges around the average yield, as a much larger sample size was available (see the separate methodology report for further details).

Lancing an opium poppy capsule with the scratching tool, Kachin, 2024

Table 3: Potential opium yield by region (kg/ha), in 2023 and 2024

Region	2023	2024	Change
Kachin	33.1 (31.2 to 35.0)	31.1 (29.5 to 32.8)	-6%
South Shan	19.0 (18.1 to 20.0)	18 (17.2 to 18.9)	-6%
East Shan	29.4 (27.4 to 31.4)	29.9 (28.5 to 31.5)	2%
North Shan	21.7 (20.1 to 23.6)	19.3 (17.9 to 20.8)	-11%
Average yield	**22.9 (21.6 to 24.4)**	**22.0 (20.8 to 23.2)**	**-4%**

Average weighted by cultivation. Values in parentheses indicate the 95% confidence interval. Numbers in the table are rounded, percentage changes are calculated with exact estimates but rounded. In Kayah and Chin, the national average has been applied since no yield measurements were available.

The resulting estimate of potential dry opium production in Myanmar in 2024 was 995 (698-1,580) metric tons, or 8% less from last year. Total production estimates appear relatively stable given this modest decline, but various factors, such as disruptions to the internal labour market brought on by the ongoing civil conflict, could have contributed to overall reductions in productivity. Declines in opium production were estimated in most states, with Kachin seeing a 16% decline overall. Declining yields and declining area under cultivation combined to result in overall decreases in opium production across Myanmar.

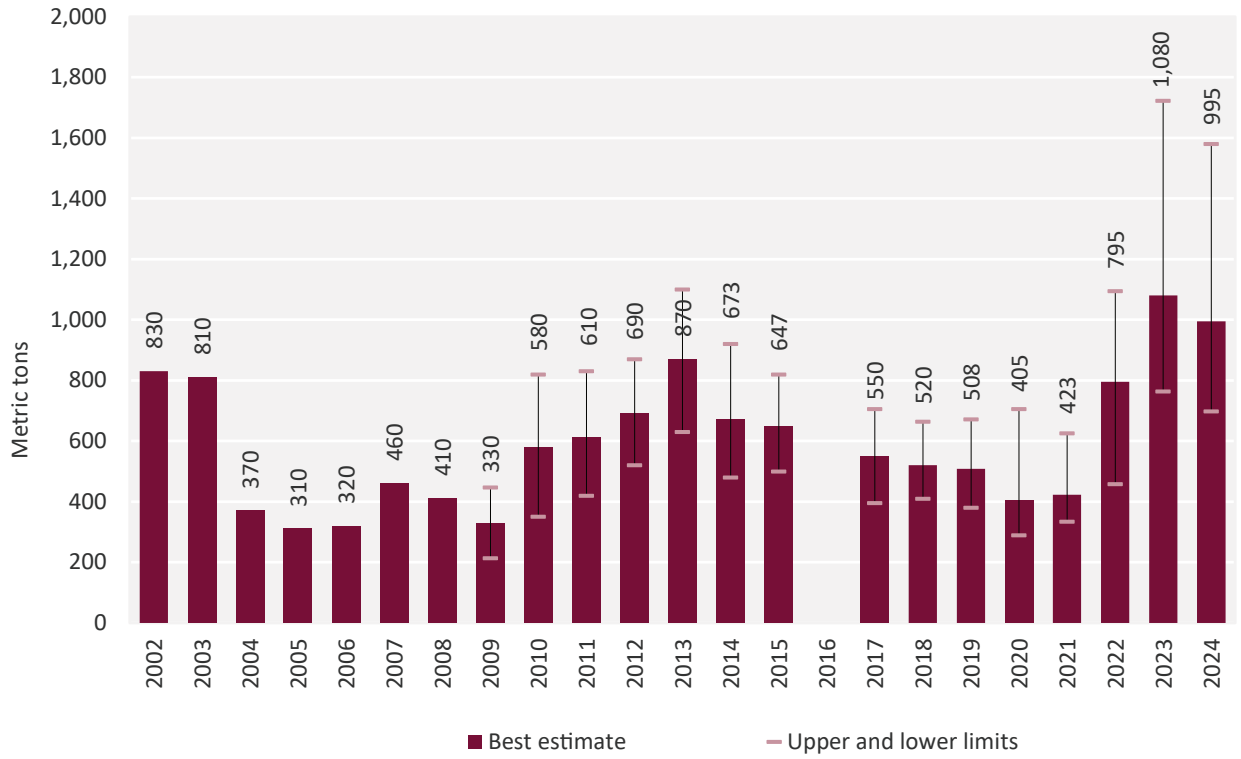
However, at the national level, Shan State continues to be by far the dominant opium producing State, accounting for more than the 84% of the national total of opium, of that 45% comes from the South Shan region.

Table 4: Potential opium production by region and State (metric tons) in 2023/2024

Region	Potential production 2023	Potential production 2024	Change 2023-2024	2024 proportion by State
South Shan	430 (193 to 902)	370 (163 to 778)	-14%	37%
East Shan	242 (100 to 470)	272 (106 to 532)	12%	27%
North Shan	228 (87 to 529)	194 (74 to 454)	-15%	20%
Shan State total	**900 (590 to 1,510)**	**836 (544 to 1390)**	**-7%**	**84%**
Kachin State	153 (90 to 371)	129 (74 to 320)	-16%	13%
Chin State	16 (13 to 19)	18 (17.1 to 19.5)	13%	2%
Kayah State	11 (9 to 13)	11.5 (9.8 to 13.1)	4%	1%
Total	**1,080 (760 to 1,720)**	**995 (700 to 1,580)**	**-8%**	**100%**

Values in parentheses indicate the 95% confidence interval. Numbers in the table are rounded, percentage changes are calculated with exact estimates.

Figure 5: Potential opium production in Myanmar, 2002-2024 (metric tons)



Source: From 2002 to 2020 CCDAC-UNODC, from 2021 to 2024 UNODC only. In 2016 no survey was conducted.

Collecting fresh opium gum using a tin container, North Shan, 2024

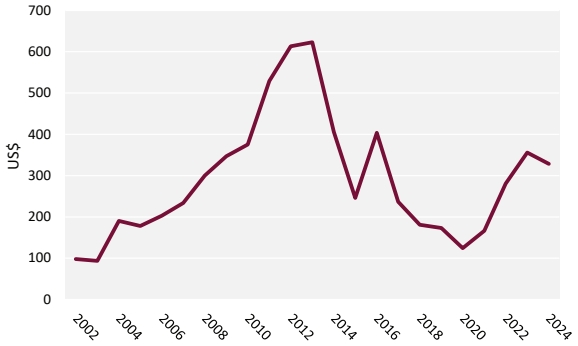
Collecting opium gum in an opium poppy field, North Shan, 2024

Farmgate price of opium

Opium price data were collected during the yield survey implemented between January and March 2024 in the three regions of Shan State and in Kachin State. The average[21] farmgate prices at harvest time of fresh and dry opium in 2024 were assessed at around US$300 (640,000 Kyat) and US$330 (670,000 Kyat) per kilogram, respectively.[22] This represents a 4% and 8% decline in fresh and dry opium prices, respectively, from the previous year when prices were around $317 and $355 per kilogram.

In 2024, the farmgate price halted its upward trend that started in 2021. However, because of the small number of price data samples collected in 2021, it is difficult to pinpoint the exact reasons for rising prices given growing production. It might also be that opium production and prices are linked to political and economic insecurity in Myanmar or that the opiate markets across the region face little shortages, pushing prices downward.

Figure 6: Nominal farm-gate prices of dry opium in poppy-growing villages, Myanmar, 2002-2024 (US$ per kilogram)



Note: Prices not adjusted for inflation.

Opium economy in Myanmar

In 2024, the role of opiates in the Myanmar economy remains important although its share of the national GDP declined slightly due to the decreases in production and prices. The farmgate value of opium is an important measure of the gross income of farmers generated by opium poppy cultivation. In 2024, it was estimated to range between US$229 and US$518 million, representing between 0.4 and 0.8% of the 2023 national GDP, and between 1.7 and 3.9% of the agricultural, forestry and fishing sector of the 2023 GDP, which was estimated at US$13 billion.[23]

The harvested opium is either consumed raw or further processed into heroin. Both raw opium and heroin reach the end-consumer markets in Myanmar and are exported outside Myanmar – or are seized by law enforcement.

After deducting the seizures of opiates in Myanmar reported by relevant law enforcement agencies,[24] it was estimated that 99 tons of raw opium and between 52 to 140 tons of heroin reached the illicit markets in the country and outside.[25] Out of these 99 tons of opium, 22 tons were destined for domestic consumption, with a value of US$13 million; the remaining 77 tons of opium were exported with a value of US$46 million.

The most valuable component of the opium economy is heroin trafficking. In 2024, it was estimated that perhaps some 5.9 tons of heroin were consumed in Myanmar, with a monetary value ranging between US$63 and US$256 million. Between 52 to 140 tons of heroin were potentially exported, with a value between US$468 million and US$1.26 billion.

The gross value of the entire opiate economy – comprising both the value of domestic consumption and exports of opium and heroin – in Myanmar in 2024 was estimated to be between US$589 million and US$1.57 billion, accounting for about 0.9-2.4% of the national GDP in 2023.

The value of manufacturing and trafficking after farmgate up to the border of Myanmar ranged between US$0.36 and US$1.06 billion. This value represents the income generated by traffickers after deducting the cost of buying raw opium from the farmers.

21 Weighted by opium production in the respective regions.

22 Applied MMK/USD exchange rate is the 2023 DEC alternative conversion factor provided by the World Bank (https://data.worldbank.org/indicator/PA.NUS.ATLS).

23 Source: World Bank, https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=MM

24 CCDAC reported between 1 of January and 31 October 2024 seizures of 1,658 kg of opium and 1,231 kg of heroin. The quantities of opiates seized in the whole year 2024 were extrapolated based on these figures to 1,989 and 1,477 kilograms, respectively.

25 See more in separate Methodology report.

Table 5: Estimated values of the opiates economy, 2024

	Gross value Millions of US$	Value in relation to GDP* (%)
Value of the opiates economy (gross)	589 – 1,570	0.9% – 2.4%
Value of opiates potentially available for export	514 – 1,310	0.8% – 2%
Raw opium	46	
Heroin	468 – 1,260	
Value of the opiates market for domestic consumption	76 – 269	0.1% – 0.4%
Raw opium	13	
Heroin	63 – 256	
Farm-gate value of opium	229 – 518	0.4% – 0.8%
Value of the opiate economy after farm-gate to the border	360 – 1,060	0.6% – 1.6%

*GDP 2023. Source: World Bank.
The gross value of opiates is the sum of the value of the domestic market and the value of opiates believed to be exported. Numbers in the table are rounded, percentages are calculated with exact estimates. Ranges are calculated based on lower and upper bounds of opium production and on assumptions about the different purities of exported and domestic heroin. See more details in the Methodology report.

Limitations of estimating the value of the opiate economy

The estimates presented here have some limitations. There is great uncertainty around the conversion ratio of opium to heroin, which depends on three main factors: The morphine content of opium, the efficiency of traffickers to extract morphine from opium and convert morphine to heroin, and the purity of the heroin estimated.[26] None of these factors are well researched in the context of Myanmar, but can have a strong impact on the estimated values of the opiate economy. Estimates on demand in the region are based on 2010 data and may have changed since then. Moreover, the estimates presented are gross estimates before deducting any cost, e.g., costs for precursor substances, such as acetic anhydride, which can substantially reduce the profits of manufacturers and traffickers of heroin. To assess the profits made, other cost components such as transportation, labour costs and costs of bribery also need to be considered.

The estimates presented here need to be understood as an indication of the order of magnitude rather than as precise measurements. UNODC is working on improving the accuracy of the estimates.

Collecting harvested opium poppy capsules to extract seeds for the next cultivation season, East Shan, 2024

26 For a detailed description of the calculation of conversion ratios see "*UNODC/MCN Afghanistan opium survey 2014*" and "*UNODC/MCN Afghanistan opium survey 2017 – Challenges to sustainable development, peace and security*".

ERADICATION AND SEIZURES

Eradication and seizures

Eradication

During the 2023 – 2024 poppy growing season, CCDAC, reported the eradication of 2,502 ha of opium poppy, 6% more than in the previous season, with almost 99% of the eradication achieved in South Shan.

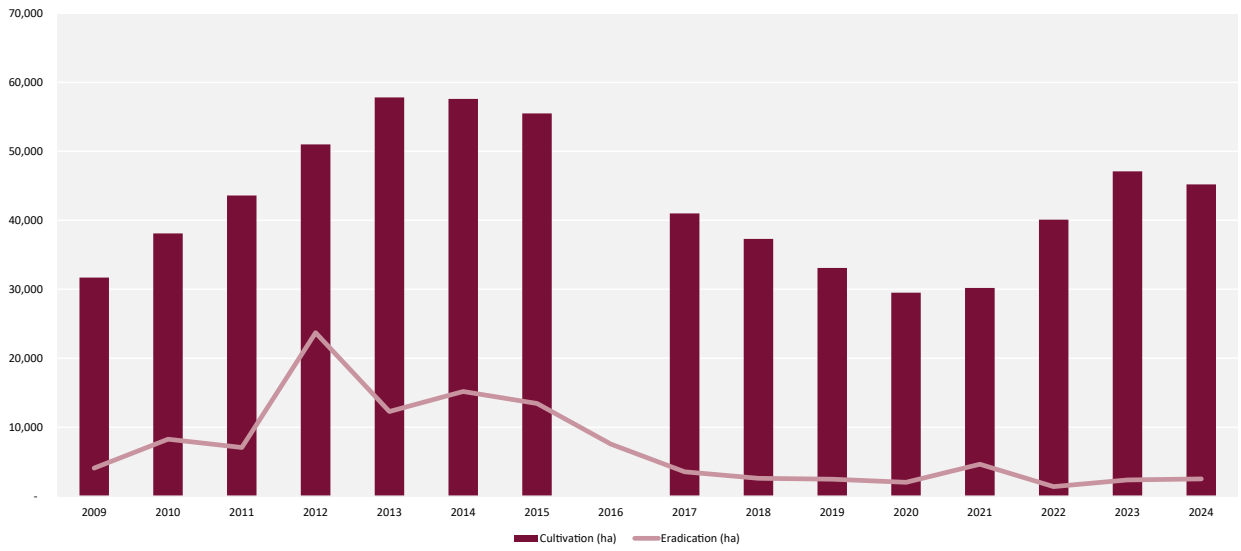
The opium poppy cultivation estimates presented in this report refer to the fields that were identified at the time that the satellite images were taken. Therefore, if any effective eradication was carried out after the satellite image acquisition dates, it is not reflected in the estimated cultivation figures. Data provided by CCDAC may include eradication implemented during the monsoon poppy season, prior to the main growing season when the remote sensing survey was implemented. The eradication figures reported by CCDAC were not verified by UNODC.

Table 6: Reported eradication in Myanmar (ha), 2012-2024

Region	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024
East Shan	1,101	1,249	702	868	1,230	1,257	537	356	378	482	264	224	100	106	85	55	74	75
North Shan	916	932	546	1,309	1,315	977	532	337	532	69	97	29	44	179	127	34	53	0
South Shan	1,316	1,748	1,466	3,138	3,579	21,157	10,869	13,696	10,715	4,947	3,019	2,209	2,000	1,575	4,226	1,282	2,186	2,394
Shan State total	**3,333**	**3,929**	**2,714**	**5,315**	**6,124**	**23,391**	**11,939**	**14,389**	**11,625**	**5,498**	**3,381**	**2,462**	**2,144**	**1,861**	**4,438**	**1,370**	**2,312**	**2,469**
Kachin	189	790	1,350	2,936	847	83	250	395	1,495	1,504	28	65	126	75	90	19	33	18
Kayah	12	12	14	13	38	84	59	67	54	16	47	12	3	0	0	0	0	0
Magway	45	0	1	1	0	4	7	60	8	9	47	44	19	25	18	15	9	15
Chin	10	86	5	2	10	110	32	277	267	534	28	22	50	35	81	0	0	0
Mandalay	0	3	2	0	39	45	0	0	0	0	1	0	0	0	0	0	0	0
Sagaing	9	0	1	0	0	0	2	1	0	0	0	0	118	31	5	0	4	0
Other States	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
National total	**3,662**	**4,820**	**4,087**	**8,267**	**7,058**	**23,718**	**12,288**	**15,188**	**13,450**	**7,561**	**3,533**	**2,605**	**2,460**	**2,027**	**4,633**	**1,403**	**2,358**	**2,502**

Source: CCDAC.

Figure 7: Eradication versus opium poppy cultivation in Myanmar (ha), 2009-2024



Sources: CCDAC(eradication); UNODC (cultivation).

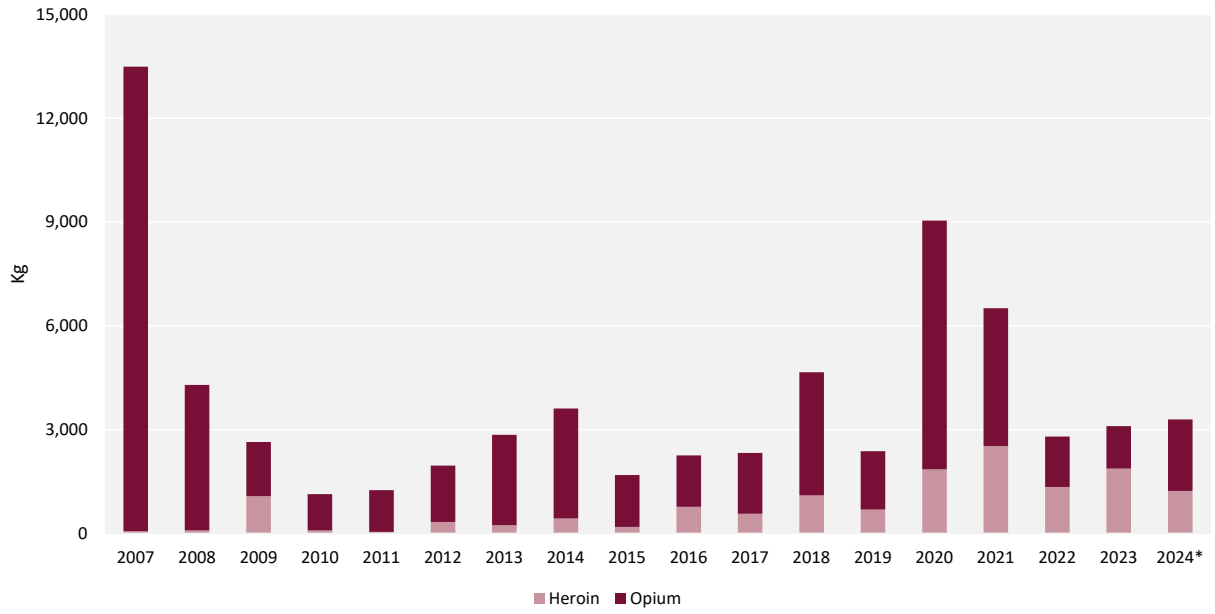
Seizures

Table 7: Reported opiates seizures in Myanmar (kg), 1998-2024

Year	Raw Opium	Heroin	Brown Opium	Liquid Opium	Low-grade Opium
1998	5,394	404	96	206	312
1999	1,473	245	24	333	314
2000	1,528	159	23	16	245
2001	1,629	97	7	19	142
2002	1,863	334	314	18	126
2003	1,482	568	156	52	204
2004	607	974	59	39	396
2005	773	812	44	21	128
2006	2,321	192	1,371	29	6,154
2007	1,274	68	1,121	56	10,972
2008	1,463	88	206	80	2453
2009	752	1,076	326	27	465
2010	765	89	98	35	147
2011	828	42	37	60	282
2012	1,470	336	46	29	81
2013	2,357	239	72	115	66
2014	1,828	435	1,109	102	134
2015	889	186	539	38	35
2016	944	769	472	47	22
2017	1,256	754	348	146	6
2018	2,829	1,099	554	146	30
2019	1,553	690	6	65	66
2020	3,883	1,853	523	2,694	22
2021	2,110	2,003	0	1,334	21
2022	1,078	1,249	1	2	13
2023	581	1,873	573	75	0.4
2024*	1,658	1,231	401	1.2	3.4

* Figures for 2024 correspond to the period 1 January – 31 October. Source: CCDAC.

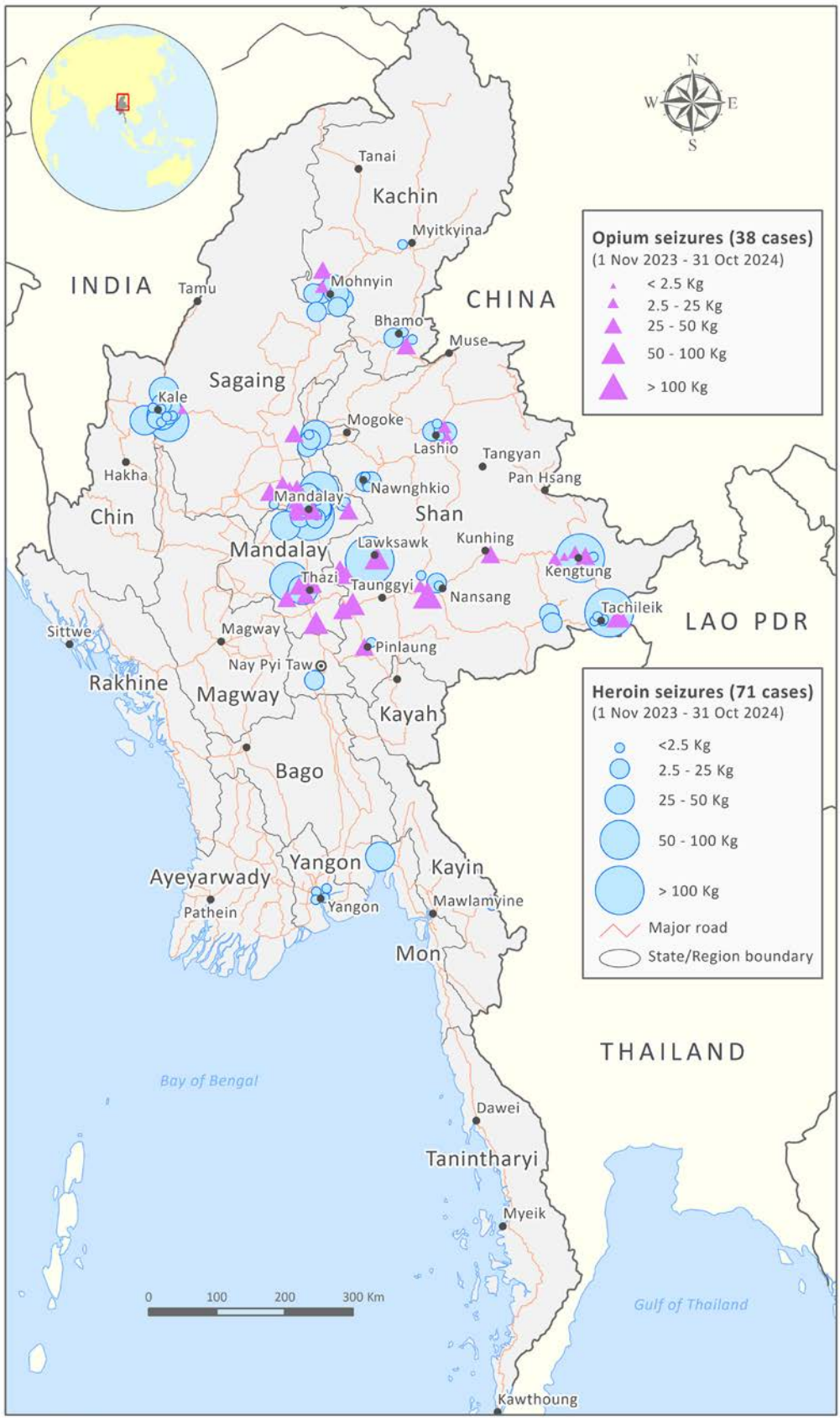
Figure 8: Opiates seized in Myanmar (kg), by type, 2007-2024



Source: CCDAC. Figures for 2024 correspond to 1 January – 31 October.

Heroin packages hidden in a lorry trailer transporting corn

Map 5: Seizures of opium and heroin in Myanmar, 1 November 2023 to 31 October 2024



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.

SOCIOECONOMIC ANALYSIS

Socioeconomic analysis

UNODC carried out socio-economic surveys in opium-affected states to improve the understanding of the cultivation setting as well as aid in evidence-based policymaking. One purpose is to identify aspects that make villages and households vulnerable to poppy cultivation, as well as the role of the opium economy in those communities. Another goal is to identify trends since the 2021 military takeover and end of the civilian government in Myanmar.

Due to the close linkages that exist between development and poppy cultivation, several sustainable development goals (SDGs) have been used as a framework for the analysis and conclusion based on the results. Results from the survey have been separated into sections involving SDGs, particularly those related to socioeconomic wellbeing (specifically SDGs 1, 2, 3 and 4 on poverty, health and wellbeing, education) and security (specifically SDG 16 on peace and justice). To identify the challenges that contribute to vulnerability of poppy cultivation, the results compare poppy and non-poppy areas across several key areas measured by surveying households and village authorities in Kachin and Shan States between 2019 and 2023, often focusing on statistically significant differences in measures. Use of standardized statistical tests, such as t-tests and Wilcoxon tests were used to determine significance. At the end, several regressions were conducted to identify significant predictors of poppy engagement while holding others constant. To understand the role of opium poppy in household economies, various aspects of poppy's economic role are investigated as well.

After several years of fielding similar surveys across parts of Shan and Kachin States, UNODC is able to leverage the time-series nature of asking the same questions to households and village leaders between 2019 and 2023, specifically to examine how poppy cultivation has changed since the 2021 military takeover. UNODC did not execute a survey in 2020 due to the COVID-19 pandemic. Data from 2024 were not finalized for this report and the analysis here only considers the relationship that socioeconomic measures have on poppy cultivation up until 2023.

In 2019, UNODC carried out surveys of households and villages in Shan State, within three subregional parts, North Shan, South Shan, and East Shan. That year's survey included 600 village headmen and 1,800 heads of households; the largest size for years analysed in this report. In late-2021 UNODC conducted similar surveys, asking many of the same questions, across Kachin State. First, a village survey comprised 150 village headmen from randomly sampled villages from the opium poppy cultivation risk zone across four townships and two sub-townships in Kachin State. This was augmented by another survey eliciting responses from 447 households sampled from within the villages across the same townships and sub-townships in Kachin State. In 2022 and again in 2023, UNODC returned to Shan State for field surveys for each year asking many of the same questions to 250 village headmen and 447 heads of households for each year. In total, the surveys covering years 2019, 2021, 2022, and 2023 included 1,250 villages and 3,747 households across Shan and Kachin States. The questionnaires were designed to cover a range of development aspects to provide a clearer picture of the vulnerabilities faced. See Appendices 1 through 3 for more information on survey methods and the questionnaires.

Many of the results from this analysis are consistent with those published previously in the socio-economic report of Shan from 2018, which had a focus on the developmental progress made since 2016. This report goes further and explores certain drug and security related issues in a more detailed analysis, covering more years and comparing measures over time and space.

Opium poppy cultivation in Myanmar is concentrated in areas characterised by a combination of specific topographical conditions and challenging socio-economic environments. One notable finding is that higher elevation villages are more likely to engage in poppy cultivation. On average, poppy-involved villages had an average elevation of 1,200 meters compared to 890 meters for non-poppy villages. Higher elevation may correlate with a degree of remoteness or simply relate to the specific nature of poppy, which makes it an ideal crop for higher elevation areas. In places where poppy is extensively cultivated, such as

Defining poppy and non-poppy involvement

Administratively, households in Myanmar reside in villages, which then comprise townships. There are notable differences in the prevalence of poppy-involved villages between each township in Kachin and Shan. Villages defined as 'poppy villages' where those where any households cultivated and/or worked on poppy fields. In contrast, villages were defined as 'non-poppy villages' if no households in the village derived income from poppy. Using this definition, in the village survey, 892 villages (71%) are non-poppy villages, while 358 villages (29%) are poppy villages.

In this report, 'poppy households' are defined as households that cultivate poppy and/or earn income from one or more members working in a neighboring poppy field. In contrast, 'non-poppy households' are those that do not derive income from poppy (i.e., the household does not cultivate poppy nor earn wages working on another household's poppy field). Using these definitions, there are 2,787 (74%) non-poppy households and 960 (26%) poppy households.

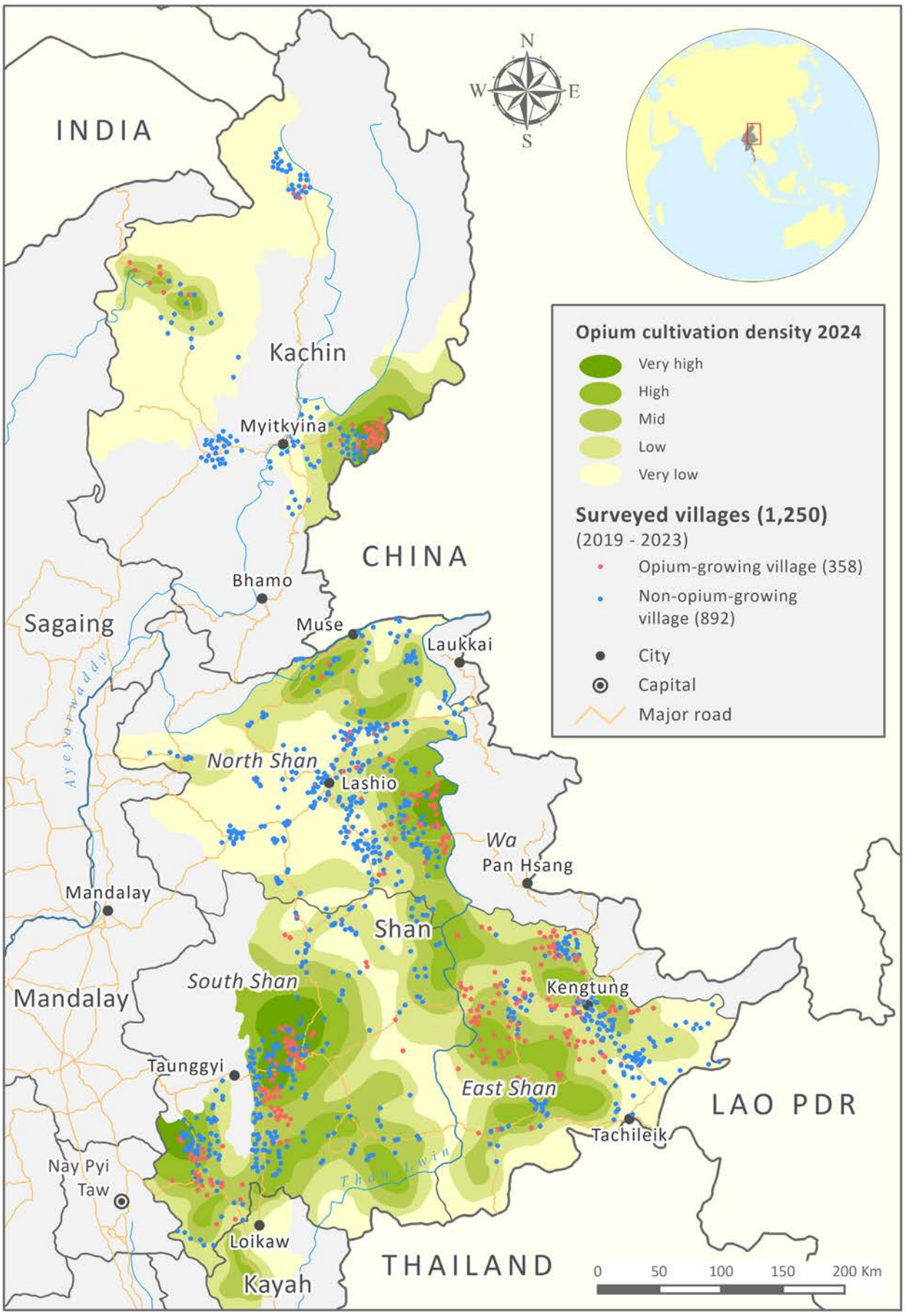
Afghanistan[27] or Myanmar[28], socioeconomic surveys with community leaders and households have consistently identified the absence of formalized property arrangements, suitable infrastructure and basic services as important determinants of illicit crop cultivation. In many cases, these measures were also similar after looking at the larger set of responses after combining the four years of survey data across Kachin and Shan States.

Map 6 indicates where poppy and non-poppy villages are across Kachin and Shan States. There are some notable clusters of villages engaged with poppy cultivation, especially in Kachin State. In Shan, there is wider interspersing of villages both engaged and not engaged with poppy cultivation.

27 UNODC and NSIA, "Afghanistan Opium Survey 2018 Challenges to Sustainable Development, Peace and Security," July 2019, https://www.unodc.org/documents/crop-monitoring/Afghanistan/Afghanistan_opium_survey_2018_socioeconomic_report.pdf.

28 UNODC, "Opium Poppy Cultivation and Sustainable Development in Shan State, Myanmar," 2019, https://www.unodc.org/documents/crop-monitoring/Myanmar/Myanmar_Socio-economic_Survey_2019_web.pdf.

Map 6: Location of surveyed villages by poppy cultivation involvement



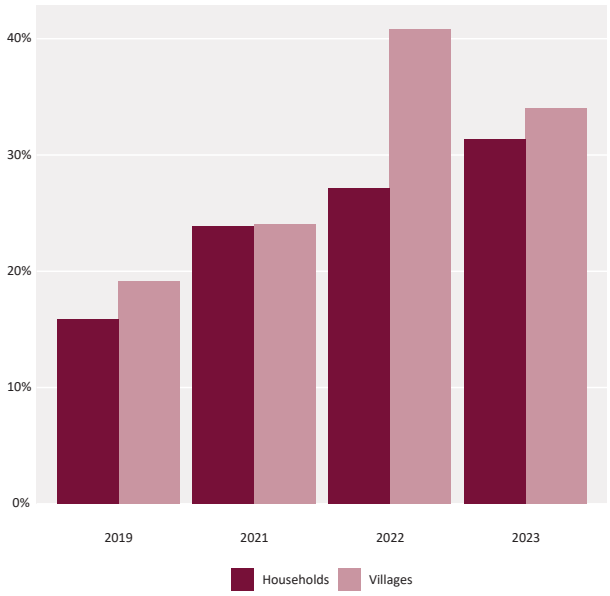
Source: UNODC Illicit Crop Monitoring Programme.
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Poppy engagement across Shan and Kachin States and over time

Increase in poppy engagement at the village level since 2019

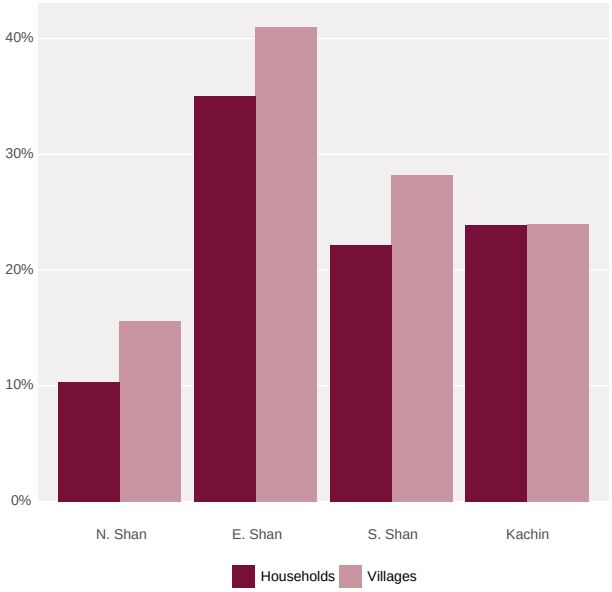
Since 2019 there has been a noticeable increase in the share of villages that indicate involvement with poppy cultivation, although shares slightly declined from 2022 to 2023. In 2019 the share of villages that were involved with poppy was at 19%. By 2022 that share had reached a peak of 41%, falling slightly to 34% in the following year. In terms of numbers of households, there is a year-over-year increase in the share of households that engage in poppy cultivation. In 2019, about 16% of households were engaged in poppy cultivation, rising to 31% in 2023–a near doubling.

Figure 9: Share of households and villages that are involved with poppy over time



A look at the share of poppy-involved villages across the four regions of North Shan, South Shan, East Shan, and Kachin shows some variation in the proportion of villages engaged with poppy. In East Shan, the highest share of poppy-involved villages at 41% was found. This share was the most consistent over the time periods examined, fluctuating between 39% and 44%. The lowest average share over the time period examined was North Shan at 16%.

Figure 10: Share of villages and households involved with poppy across regions



Similarly, the shares of households that engage with poppy across regions was highest in East Shan at 35% of households. The lowest share was reported in the North Shan at 10%. When examining the share of households only within poppy-involved villages (that is, after excluding non-poppy villages), there is also an increase over time in most regions. It could be that the increasing share of households engaged in poppy cultivation in a village is indicative of the village's reliance on poppy due to its lack of connectivity with the wider economy. Some village leaders reported that all households were poppy involved, while the smallest share of households was 2.3%. Overall, the average share of households in villages engaged with poppy cultivation over this period was 57% - in those villages where poppy cultivation was present.

The largest increase over time in the average share of poppy-involved households within villages was in North Shan which reported the share of poppy-involved households increasing from 46% to 62% between 2019 and 2023. Only in East Shan did the share of households engaged in poppy cultivation within villages decline from 68% to 64% over the same time. Overall, responses from Kachin suggested that it had the highest share of households within villages that engaged with poppy cultivation with an average of 73%.

Figure 11: Share of village households involved in poppy

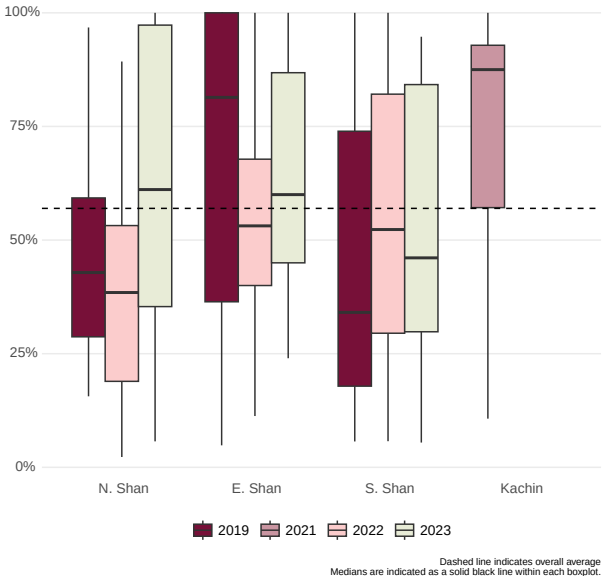
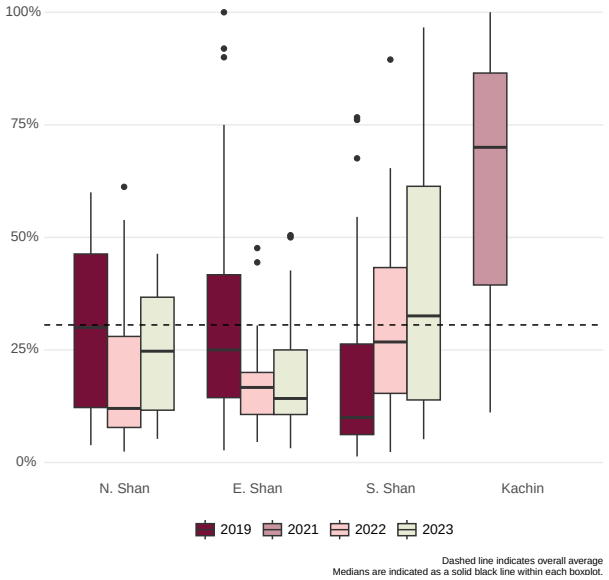


Figure 12: Share of village arable land dedicated to poppy

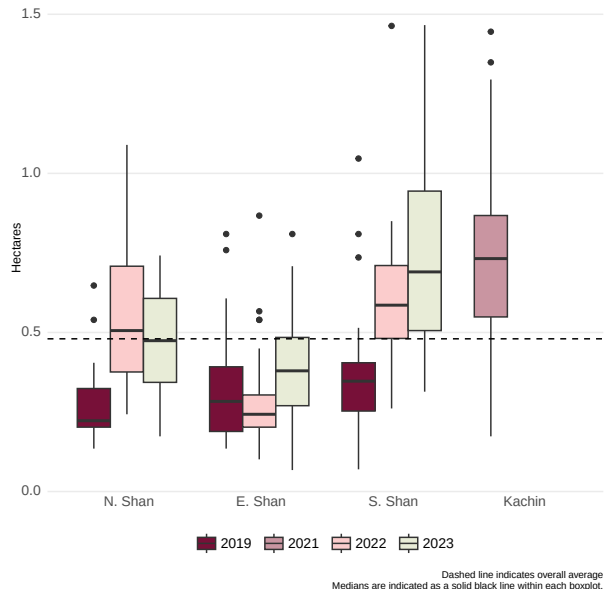


More intensive poppy cultivation within most villages since 2019

The share of households in villages engaged with poppy cultivation correlates, over time and across region, with measures of total agricultural area dedicated to poppy within villages. Figure 12 below shows the distribution of the share of agricultural area dedicated to poppy cultivation within each village as reported by village leaders. In three cases, villages were entirely dedicated to growing poppy. These may be extreme outliers. Nevertheless, two of those were reported in Kachin, where reports by village leaders indicated the highest average share of village land dedicated to poppy cultivation at 65%. Overall, the mean share of land for a poppy-involved village dedicated to poppy was 31%. That is, on average, roughly one-third of a poppy-involved village's land is dedicated to poppy at some point over this period. This share has grown most pronounced in South Shan when it rose from 20% in 2019 to 39% in 2023. North Shan reported a modest decline between those years while East Shan reported a slightly larger decline.

This shows that some villages in some regions are more extensively involved with poppy cultivation than others. This is most readily the case for Kachin in 2021. Additionally, a similar breakdown occurs when looking at the average plot size as calculated from measures of self-reported poppy plot sizes within villages. The figure below shows the distribution of poppy plot sizes, in hectares, for the four regions and four years. Overall, there was a clear shift to greater cultivation within villages as well as farmers engaged in cultivation on larger plots in later years after the military takeover. Kachin reports, on average, the largest plot size at 0.78 hectares. Average plots in South Shan were not that much smaller in later years, coming in at 0.6 and 0.75 hectares for 2022 and 2023, respectively. The overall average plot size throughout the series was 0.48 hectares.

Figure 13: Average household poppy plot area



Economics of poppy

Poppy cultivation is an important economic activity in parts of Southeast Asia. In Myanmar, poppy cultivation is often found in villages at higher altitudes as the crop is well suited to higher elevation. UNODC village surveys show an upward trend, across several measures, in cultivation over time within Shan State. Likewise, the farmgate price of opium within Shan State has increased between 2019 and 2023, which might explain why various measures of poppy cultivation are on the rise in these parts of Myanmar.

Opium prices increased from 2019 to 2023, which correlates with larger plot sizes

Village leaders reported opium price estimates during the survey. These estimates may sometimes be inaccurate or reflect more localized prices and may not be directly comparable to prices discussed earlier. In general, they track with national estimates reported by UNODC. The farmgate prices of fresh and dried opium have increased between 2019 and 2023 across all parts of Shan State. Because there is only one survey year from Kachin it is hard to assess any trend. However, prices in that state were higher than the other regions within Shan even during later years. The Shan State median prices for a kilogram, across all sub regions and years, for dried opium was US$330 and US$310 for fresh opium. For Kachin, the median price of dried opium was US$470 and US$340 for fresh opium. Nonetheless, North Shan saw the largest increase in reported farmgate prices for dried opium between 2019 and 2023 by a factor of 2.2 when median farmgate prices rose from US$230 to US$480 per kilogram.

In contrast, prices of rice paddy were much lower and reported much less change over the time period. That said, prices had generally risen over time. In addition to lower price volatility for rice paddy, there was also little difference in median prices of rice paddy between poppy and non-poppy villages as shown in the series of boxplots in Figure 15. This suggests that rice, a common staple foodstuff, remains available across villages that engage with poppy and those that do not.

Figure 14: Distribution of price of poppy

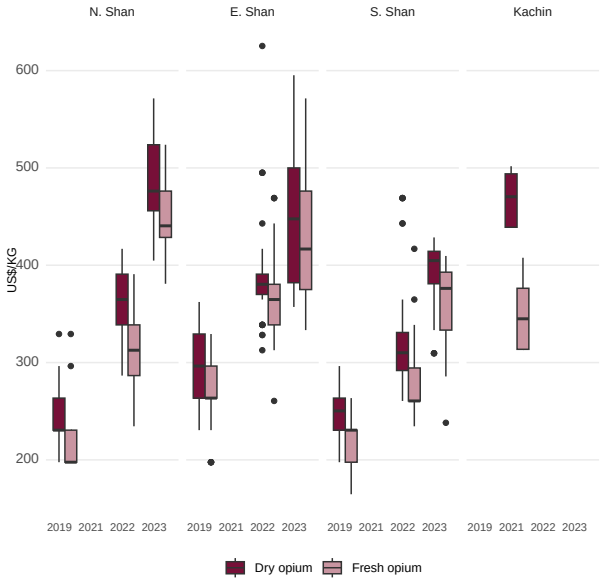
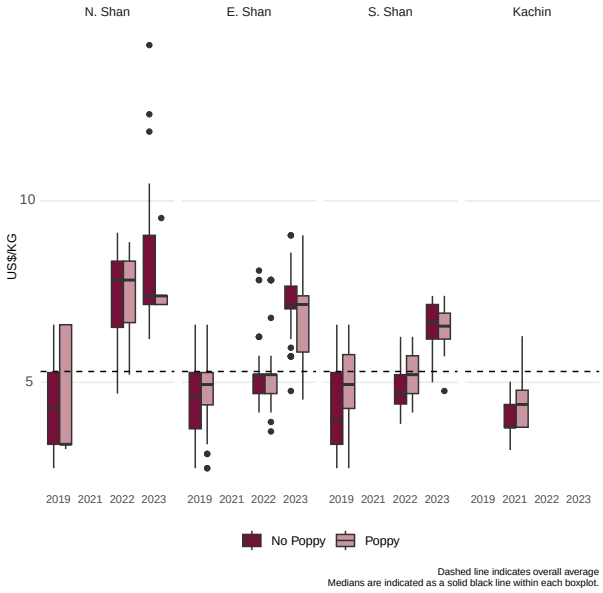
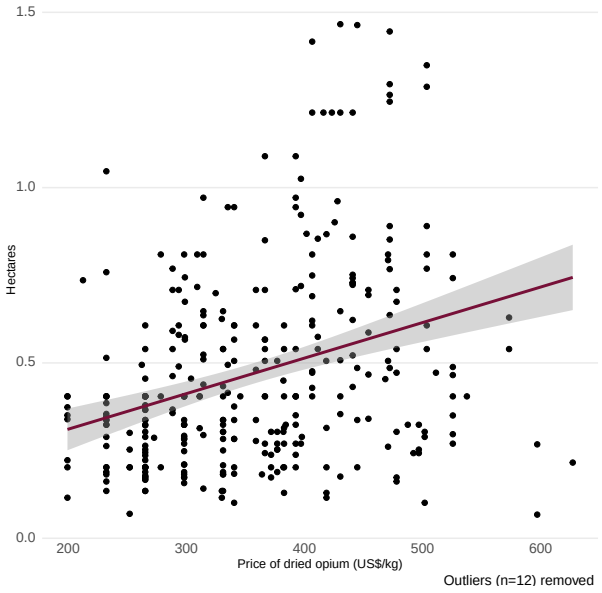


Figure 15: Distribution of price of paddy



Not only is this upward trend in opium price noticeable, it also positively correlates with reported average poppy plot sizes. The scatterplot below shows the reported average poppy plot size in hectares with average farmgate prices for dried opium as reported by village leaders. A linear fit is also plotted showing a statistically significant relationship such that plot sizes increase, on average, by 0.1 hectares, or 1,000 square meters, for every US$100 increase in dry opium prices. This simple analysis shows that quantities and prices are correlated in important ways and that the recent increase in poppy production up through 2023 in Myanmar could be due to increases in farmgate prices in recent years until 2024.

Figure 16: Farmgate price correlates with poppy plot size



In poppy-involved villages, households earn income from the sale of opium to make ends meet

Examining reported average income of households for villages engaged and not engaged in poppy across regions and years shows that, in general, households in poppy-involved villages report similar or slightly lower annual incomes than households in poppy-free villages. If income from opium wages or the sale in opium is removed, then households in poppy-involved villages show markedly lower annual incomes. In essence, households are using opium-related income to make up any differences or shortcomings in annual income. This was most apparent in Kachin and in South Shan in 2023 where opium-related income in poppy-involved households matched or exceeded total licit agricultural income.

Looking at reported household income it is clear that households in villages not involved with poppy earn more, on average, from licit agriculture (e.g., paddy farming, livestock) and licit non-agricultural (e.g., artisanal craft trade, mining, etc.) income when compared to households in poppy-involved villages. For example, the average annual income for licit agriculture and licit non-agricultural income for households in villages not involved with poppy came to US$1,121, and US$1,113, respectively. For households in poppy-involved villages, those amounts were US$825, and US$965, respectively. These differences were significant for licit agricultural and non-agricultural income between poppy and non-poppy villages. In short, poppy income appears to be closing the gaps in total income.

Over time and across regions, licit non-agricultural income was a larger source of income for most regions and years, except for households in 2019 and for households in East Shan. East Shan reported higher shares of agricultural income as well as the lowest annual average household earnings overall. In contrast, South Shan reported the highest annual average incomes, mostly made up from non-agricultural sources.

Figure 17: Average annual income of households by source

Household agricultural activity suggests poppy-involved households have larger areas of fallow land and smaller areas of permanent crops

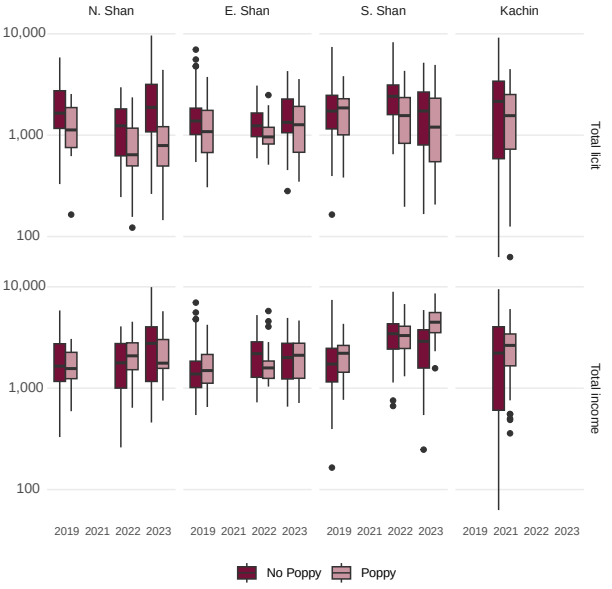
When examining the share of a household's plot dedicated to agricultural activities, poppy-involved households report larger areas of fallow land and smaller areas of permanent crops. Other annual and transitory crops are most commonly reported for both types of households. For fallow land, poppy-involved households report an average area of 0.27ha compared to 0.23ha ($p<0.05$). For permanent crops, which often require more inputs, investment, and energy to maintain, non-poppy households had larger plot sizes on average (0.24ha versus 0.18ha; $p<0.01$). In contrast, poppy-involved households reported sizable area dedicated to poppy: 0.5ha.

Figure 18: Average size of household plot area use

Poppy is an important source of income

When examining income, both total licit (agriculture and non-agriculture) and total income (licit plus illicit income) it is clear that the median income values for total income (which includes opium-related income) is higher for households in villages that engage with poppy. Over time total incomes within Shan do not appear to change much, although East Shan reports, on average, the lowest annual household income. After removing poppy or opium-related income non-poppy villages earn more on average than their counterparts engaged with poppy.

Figure 19: Distribution of total income

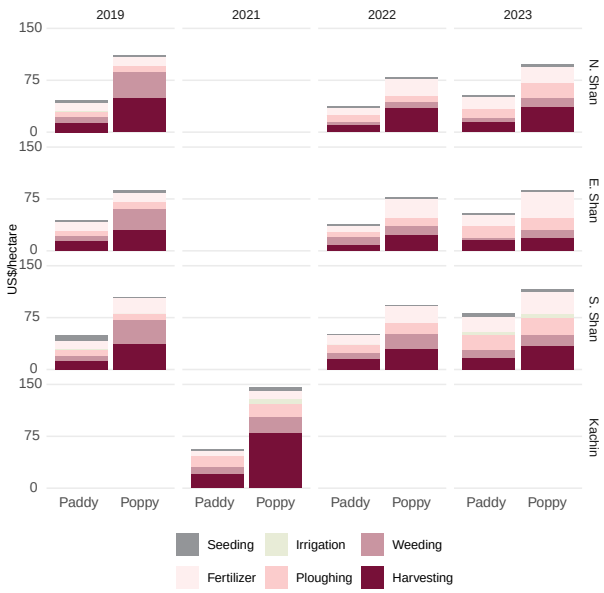


Although poppy generates substantial income it is costly to produce

When compared to rice paddy, an important crop in Myanmar, the costs of poppy production per hectare is often higher by a factor of two. This is mostly due to costs associated with weeding and harvesting given that poppy is a very labour intense crop. As reported by village headmen, the average cost of cultivating poppy is similar for seeds and ploughing, yet rice paddy requires no additional irrigation costs and less expenditures for fertilizer and weeding. In contrast, poppy is substantially costly when it comes to weeding and harvesting. Harvesting is significantly more expensive for poppy on average (US$35.8/hectare) than rice (US$13.5/hectare; p<0.01). Household production of rice ensures against food insecurity, whereas opium harvested from poppy must be traded or sold in order to acquire food. Described later, village leaders note that poppy is grown primarily to pay for the purchase of food.

In terms of the costs of producing poppy, average costs were highest in Kachin in 2021 at near US$150 per hectare. Costs generally declined or remained the same in North and East Shan while costs in South Shan reported about a 20% increase between 2019 and 2023. Those increases in production costs were unlikely related directly to poppy as paddy production costs also increased during this period in most regions examined. Poppy production costs were the lowest in East Shan at just under US$100 per hectare.

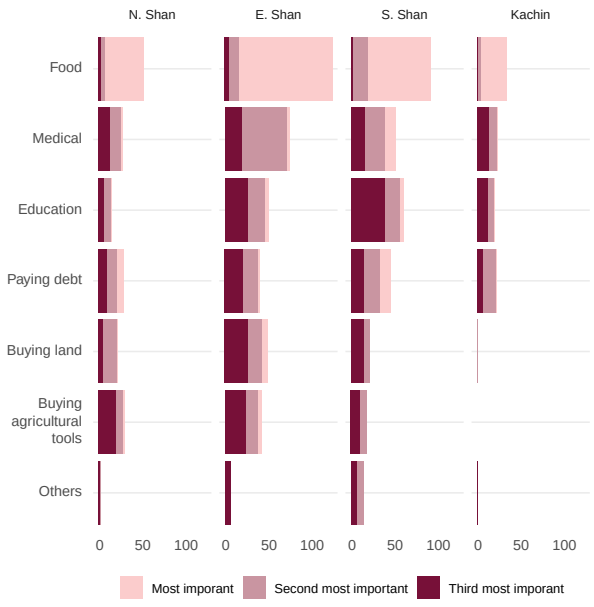
Figure 20: Average annual costs of producing paddy and poppy



Food is the most important reason for growing poppy

When asked about the reasons why households cultivate poppy, the most common response in terms of quantity and importance, by far, was to obtain income to buy food. This reason was the primary reason for all regions and across all years. The need to use poppy income to pay for food was most evident in Shan regions, but it is clearly the dominant reason for respondents in Kachin as well. Paying for medical interventions or education were the second and third most common responses depending on the region or year. Nevertheless, food insecurity is a clear motivating economic factor for why households engage in poppy cultivation. In light of the fact that poppy is often twice as costly to produce as rice paddy, farmers may not be internalizing the opportunity costs associated with their decision to forgo paddy cultivation instead of poppy.

Figure 21: Food is the most often cited reason for growing poppy



Comparing households in poppy and non-poppy villages

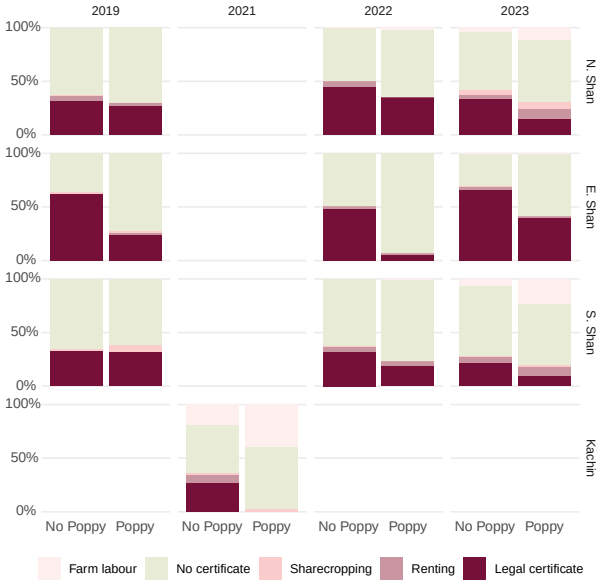
Village leaders were asked questions about shares of households in debt within villages and the number of households that maintain formal property arrangements, such as those that own their land or rent. Within villages, UNODC also asked households directly what type of land use status they maintained (e.g., rental agreement, ownership). Overall, there are clear differences in formal land use rights and debt shares when comparing poppy and non-poppy households or villages.

Poppy-involved households are less likely to maintain formalized land rights than those not involved

Household heads were asked to report on their current land use rights status. No formal certificate was the most common response, but overall households not engaged in poppy cultivation reported significantly higher rates, on average, of a legal certificate across region and over time. For poppy-involved households, 75% had no formal certificate regarding the status of their land use. Only about 21% maintained ownership over their land with the remainder renting, sharecropping, or engaged as farmhands. For households not involved in poppy the share without any legal certificate was 55% followed by 38% that owns their land.

In addition to these differences between households engaged in poppy, the plot below also shows variation across regions and over time. Households reporting engaging only in farm labour, instead of actively engaging in agricultural activity, was highest in Kachin. Over time, households that rent also increase.

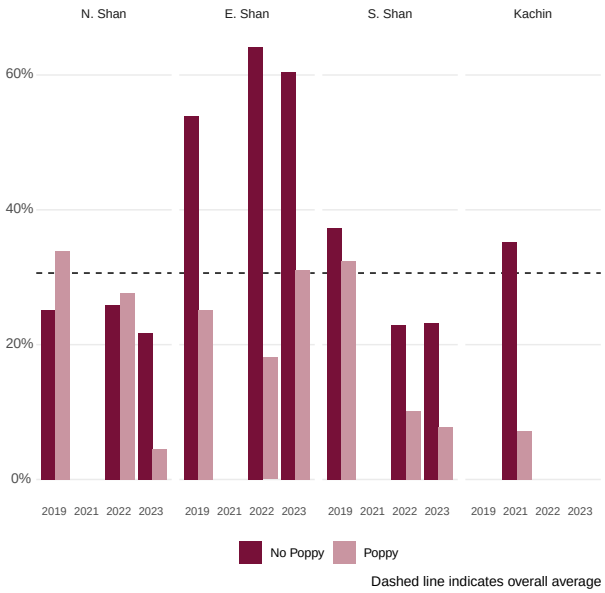
Figure 22: Land use certificate status reported by household head



Note: Farm labour means that the household did not engage in land use activities on their land but worked on others' land as labour.

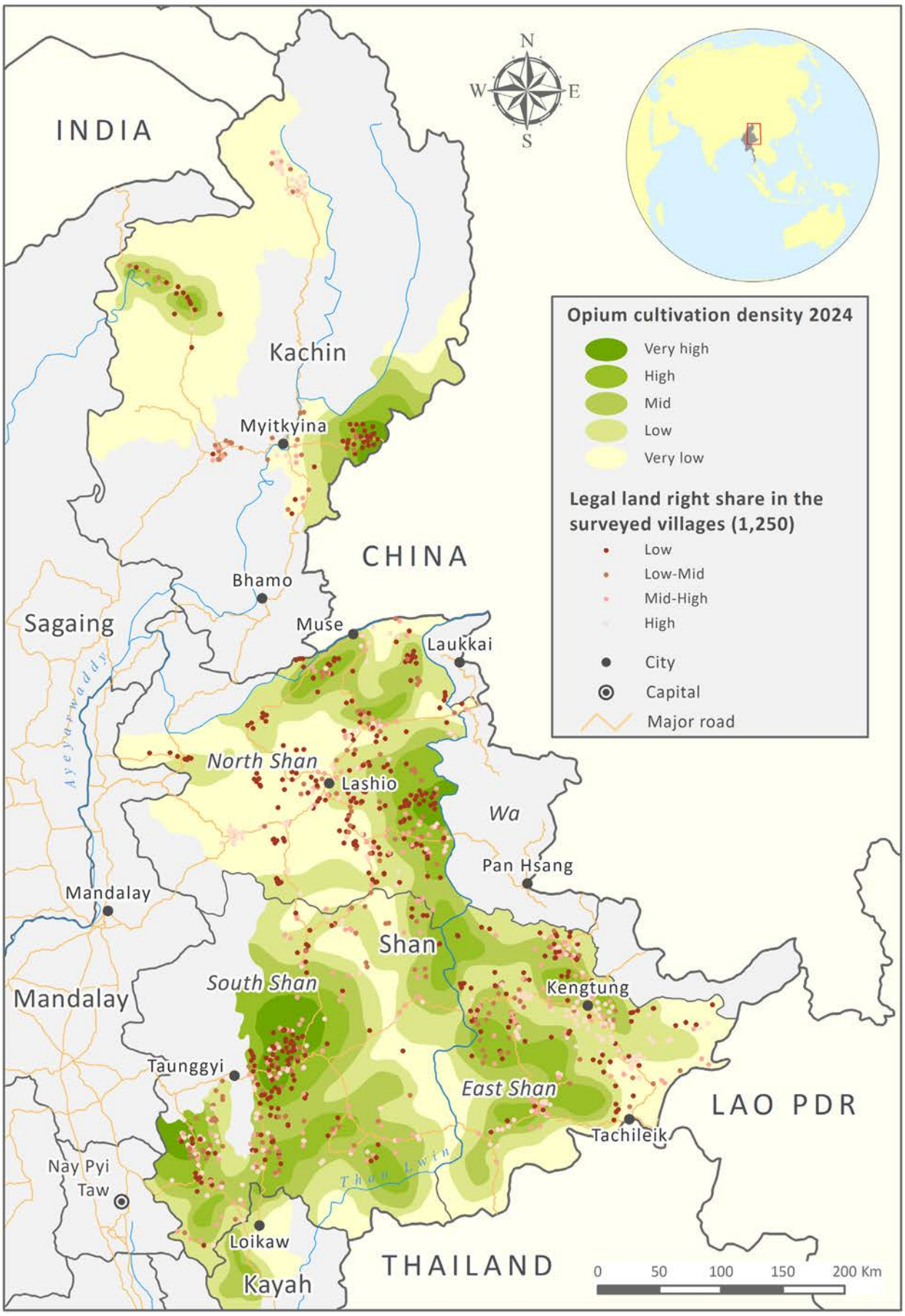
A similar question was posed to village leaders, asking about the number of households in their village that had legal land rights over their agricultural plots. Responses ranged from zero to all households had legal rights (e.g., owned or rented) on their agricultural land. The average proportion for the entire series was 31%. The plot below shows the average share of households between villages engaged or not engaged with poppy over time and across regions. Only in North Shan for 2019 and 2022 were average shares of land use rights higher for poppy-involved villages. However, when looking at median values those differences largely disappear. For all other region-years rates of land use rights are higher for households in villages not engaged with poppy. Interestingly, the averages of land ownership, irrespective of poppy involvement, was highest in East Shan. Overall, there were shifts in both directions across regions in terms of land ownership rates over time with some parts of Shan State seeing increasing or decreasing land ownership shares.

Figure 23: Average share of households with property rights



Plotting the range of shares of households with property rights just for the 358 poppy-involved villages over the density of poppy cultivation shows clear concentrations of villages with low shares of formalized land rights with poppy cultivation. This was most apparent in Kachin State near the border with China and in areas of South and North Shan. Low rates of formalized land ownership in poppy-involved villages indicates a stronger relationship with poppy cultivation.

Map 7: Legal land right share in the surveyed poppy-involved villages

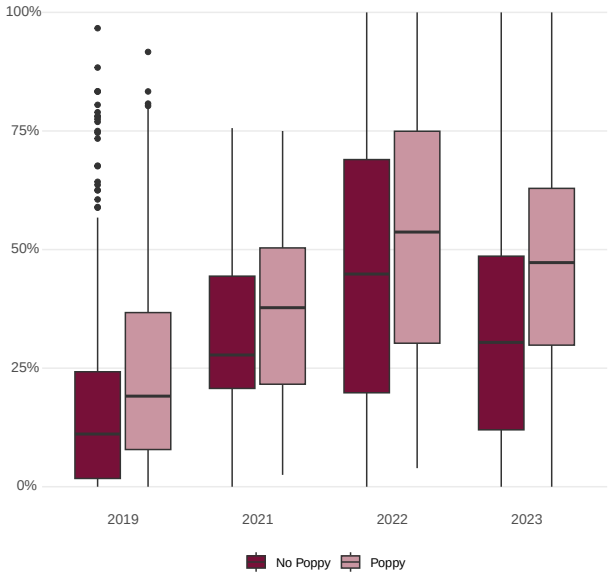


Source: UNODC Illicit Crop Monitoring Programme.
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

More households are in debt in poppy-involved villages and access to credit is higher in households that cultivate poppy

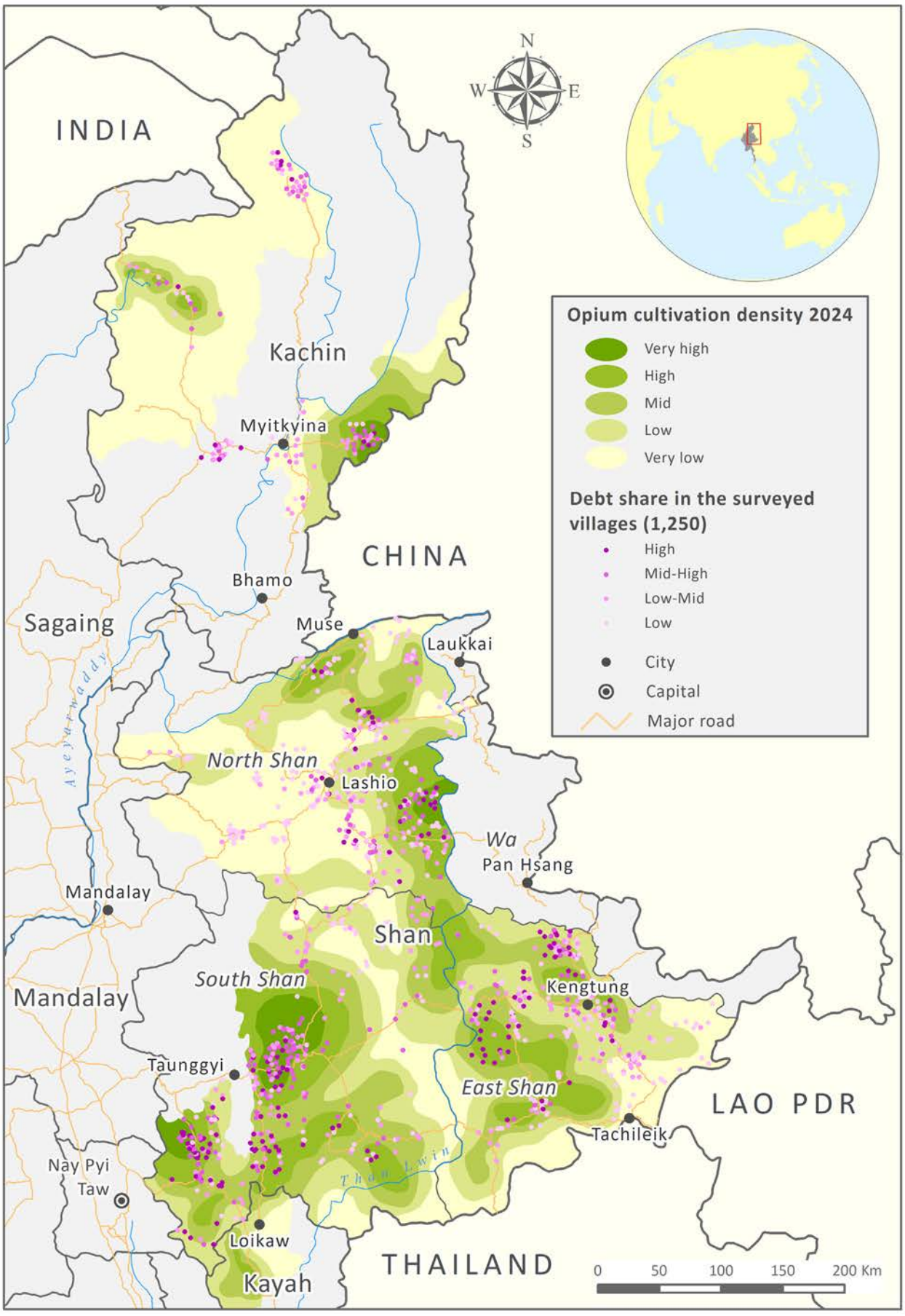
The share of households in debt in villages engaged in poppy is significantly higher than villages not engaged in poppy. On average, the share of households in debt in poppy-involved villages is 40% compared with 26.1% in poppy-free villages ($p<0.01$). As shown above, paying debt is the fourth commonly reported reason why households engage in poppy cultivation. Over time, debt shares increased from 2019 to 2022, falling in 2023. Across regions, East Shan showed some of the highest debt shares, in some cases with all households in some villages reporting being in debt.

Figure 24: Share of households in debt



When plotting the households in debt in poppy-involved villages over poppy cultivation density, it is possible to see the spatial relationship of clusters of high-debt villages with poppy cultivation. Again, clear pockets of villages with high shares of households in debt were found in poppy-dense areas in Kachin, especially along the border with China, and in North and South Shan.

Map 8: Debt share in the surveyed poppy-involved villages



Source: UNODC Illicit Crop Monitoring Programme.
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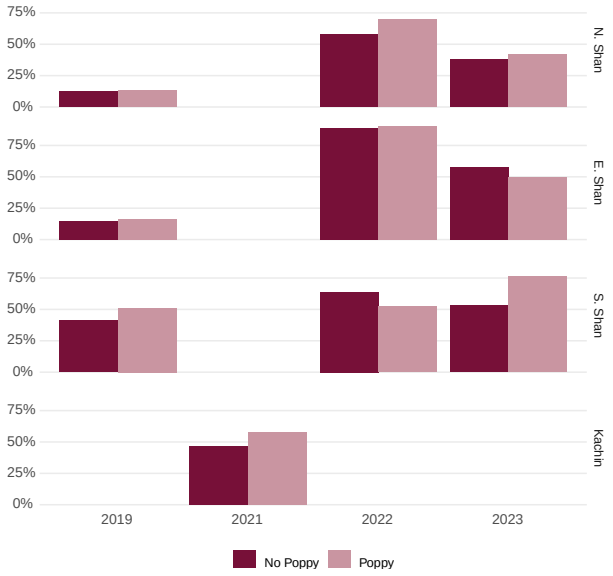
Poppy cultivating households indicate significantly greater access to credit (51% versus 38%; p<0.01). Surveys did not indicate what types of financial establishments guaranteed or offered such credit. Other research has indicated that informal moneylenders play an important role in providing cash loans to households for the explicit purpose of poppy cultivation.[29] In turn, this access to credit may be predatory and trap such households into debt.

Figure 25: Average share of households with access to credit



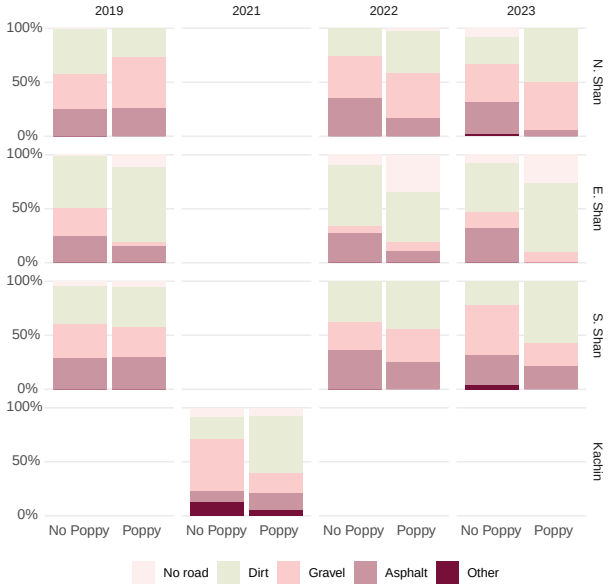
Social services and connection to the rest of the country are greater in villages not engaged with poppy

Surveys asked village leaders about the availability or access to a variety of services or infrastructure. These included asking questions about the types of roads, travel times, access to drinking water, access to electricity, and access to schools and clinics. In general, village not engaged in poppy reported measures that would suggest better access to services and a higher degree of connection to the wider national economy or infrastructure. Several of these measures are significantly different between villages based on their reported engagement with poppy.

Villages engaged with poppy report greater measures of remoteness compared to their non-poppy counterparts

In terms of road types, villages that reportedly engaged with poppy cultivation are significantly less likely to be connected to a road (96% of non-poppy villages are connected to a road versus 87% of poppy-involved villages). Better types of roads that allow for all weather and faster travel, such as asphalt or gravel, were more commonly reported for villages that did not engage in poppy whereas poppy-involved villages most commonly reported dirt roads. That is, for poppy-involved villages 57% were connected by dirt roads compared to 38% for non-poppy villages. Across region and year, there were some slight differences. East Shan reported the highest share of villages not connected to roads.

Figure 26: Average share of road type in villages

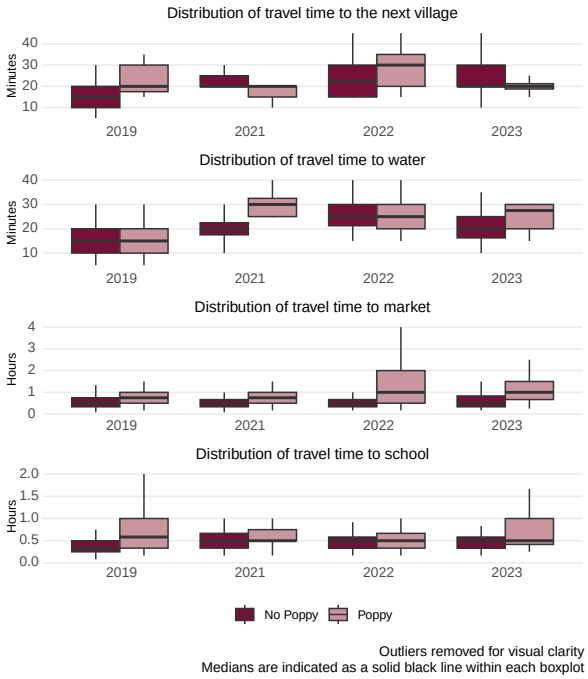


Improved roads can reduce travel time and costs, allowing greater access to services and markets. The survey asked village leaders about the time it takes to travel to schools, neighboring towns, markets, or access to water. The series of plots below show the distribution of travel times. The median is favored as averages are affected by outliers and some villages report long travel times in some cases. Across most of these measures, median estimates in time traveled are higher for poppy-involved villages than non-poppy villages, with the exception of travel time to school which showed virtually no difference in median travel

29 https://onlinelibrary.wiley.com/doi/full/10.1111/joac.12446

times. There was some slight variation across regions, but East Shan, generally reported highest travel times.

Figure 27: Measures of travel time



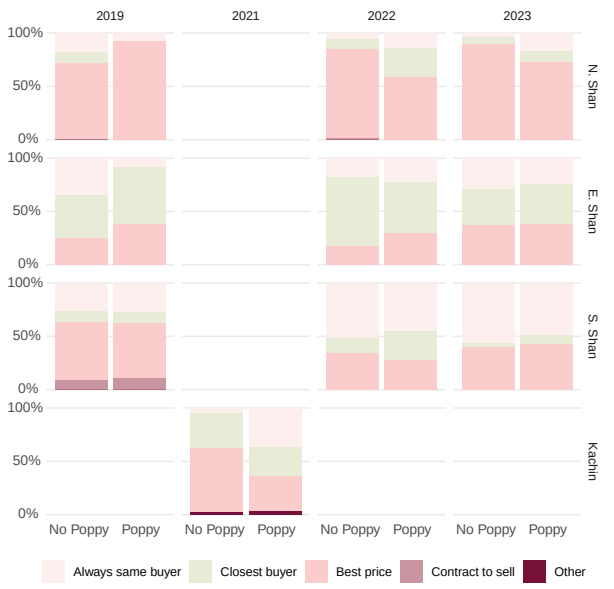
Outliers removed for visual clarity
Medians are indicated as a solid black line within each boxplot

Villages not engaged with poppy are likely to sell their goods in competitive markets

Poppy-involved villages reporting fewer paved roads and generally higher travel times compared with their non-poppy counterparts may help explain why poppy-involved villages tend to sell their agricultural products to the closest buyer instead of those offering the most competitive price. On average, poppy-involved villages sell to buyers offering the most competitive price 43% of the time which is significantly lower ($p<0.01$) than non-poppy villages which report selling to the most competitive buyer 55% of the time. In contrast, poppy-involved villages reported selling to the closest buyer at significantly higher rates compared to their non-poppy counterparts (30% versus 20%; $p<0.01$).

In terms of comparing measures across regions, East Shan was the least likely to report selling to most buyers offering the most competitive price but instead the closet buyers. North Shan reported the highest share of most competitive buyers. These reported measures also correlate with longer travel times to markets for households in poppy-involved villages which report almost having to travel twice as long on average (65 minutes versus 37 minutes; $p<0.01$).

Figure 28: Average share of typical buyer of market goods from farmers in villages



Social and basic services are more accessible in villages not involved with poppy

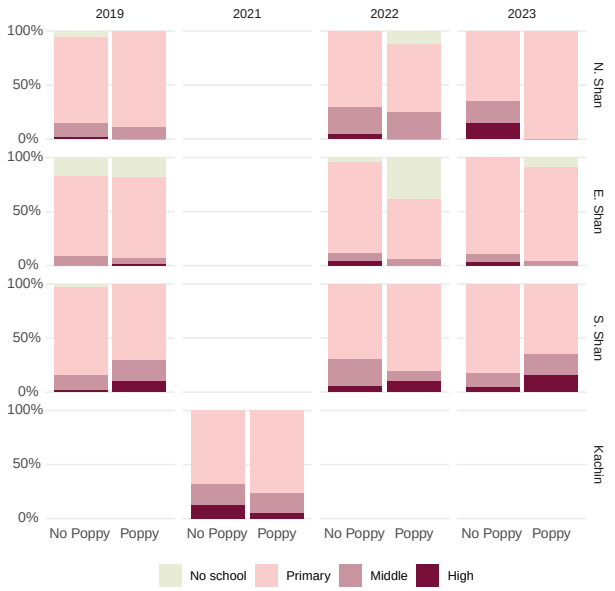
Other measures of access to social and basic services, such as schools, medical clinics, water/ sanitation, and electricity generally indicate better connectivity with respect to villages not engaged in poppy cultivation. More remote and isolated villages are often likely to face greater challenges in this regard. However, not all of these differences are statistically significant.

Schools

In terms of schools and school types, non-poppy villages were more likely to have any school compared to poppy-involved villages. In poppy-free villages, 3% did not have schools compared with 6% that engaged in poppy. Although these shares are small, they were significantly different. Across other types of schools, both poppy and non-poppy villages reported similar shares of middle and high schools. Nonetheless, when examining measures of schools across regions and years, East Shan reported the highest shares of villages without any schools. This was more common in poppy-involved

villages. Overall, most villages had primary schools, followed by middle and then high schools. The shares of middle and high school were much less across all regions and years.

Figure 29: Average share of school type in villages

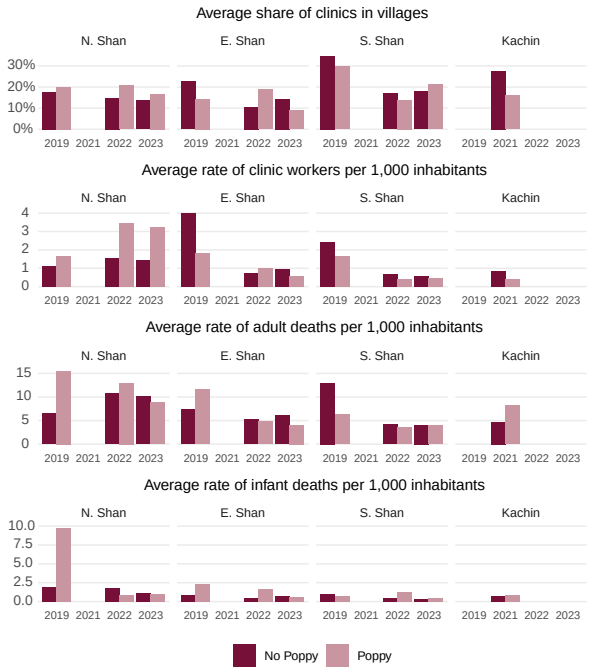


Health and healthcare

An examination of several health and healthcare measures shows slightly better measures for villages that are not involved with poppy, but across all measures they are not significantly different. Clinics were slightly more common, on average, in non-poppy villages compared to poppy villages (21.5% versus 17.6%). In terms of clinic workers, non-poppy villages also reported, on average, slightly higher rates of clinic workers per 1,000 inhabitants in the village (1.6 versus 1.3). Adult mortality rates, on average, were roughly the same between poppy and non-poppy villages but slightly higher for non-poppy villages (7.8 versus 7.7). However, infant deaths, on average, were higher for poppy-involved villages (1.1 versus 1.6).

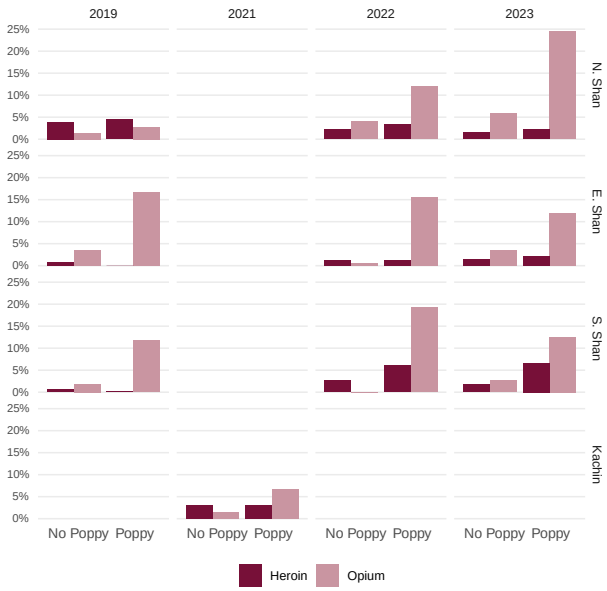
Although these measures were not significant across the entire set of data, there were regional and yearly variations. In particular, adult deaths declined over time across all regions. Deaths for infants also declined, most notably in North Shan.

Figure 30: Health and healthcare measures



Proximity to opiates is associated with higher rates of opium or heroin use by members of a household. Poppy-involved households reported higher shares of household members using opium in the past month versus households that did not earn income from the poppy economy (13.5% versus 2.3%). Poppy-involved households also reported significantly higher shares of past-month heroin use in the household than households that did not engage in poppy cultivation (2.7% versus 2.1%).

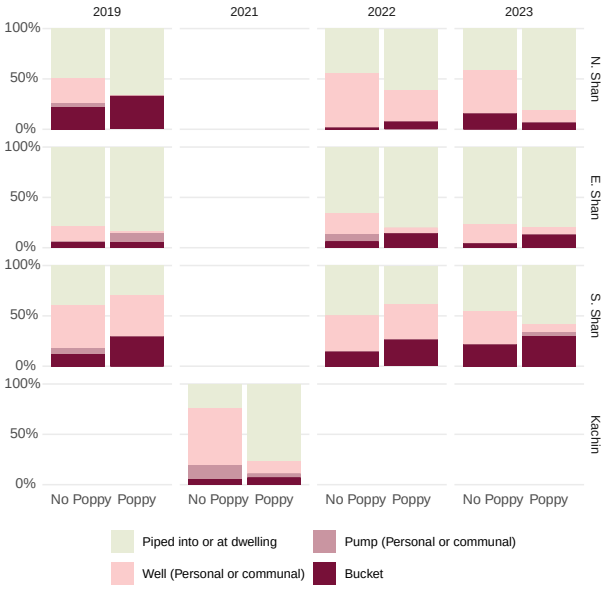
Figure 31: Share of household members using drugs



Water

When comparing types of access to water, overall poppy-involved villages had, on average, higher access to piped drinking water, whether piped indoors or outside near the dwelling. On average, poppy-involved villages had piped water in 60.1% of villages compared to 45.2% for non-poppy households. These differences were significant. Instead, non-poppy households relied more on wells than piped access (30.5% compared to 13.1%). However, piped water does not necessarily mean treated water from a public service and should not be considered a development indicator. In many cases, although piped, these do not represent a systematic water supply. Instead, piped water in this case refers to a traditional, hand-made water channels (such as bamboo troughs) that direct water from a nearby natural water source, like a spring or river. When examining regional and yearly differences, East Shan had some of the highest rates of water connectivity via pipe.

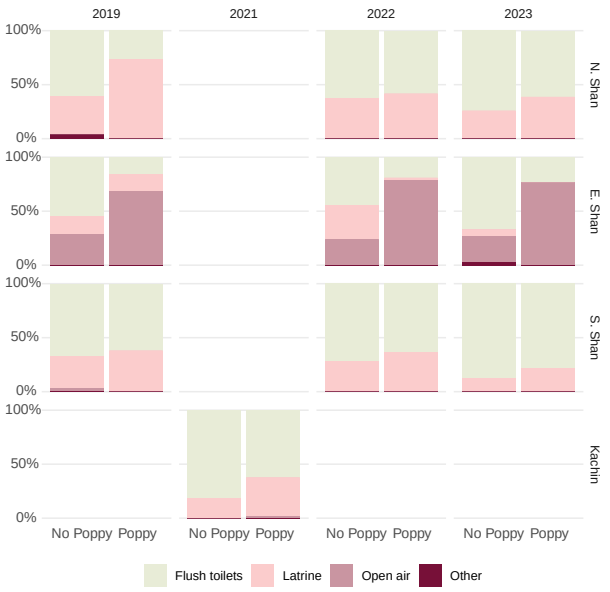
Figure 32: Type of access to drinking water in villages



Sanitation

In terms of sanitation, villages not involved with poppy report significantly higher shares of access to higher quality sanitation, such as flush toilets. The access to flush toilets does not necessarily mean in-house flush toilets. But the use of flush toilets reduces the risk of health hazards. On average, non-poppy villages reported 66.4% with access to flush toilets compared with 45.8% for villages engaged with poppy. Rates of latrines were generally the same, but open-air toilets were reported at much higher rates in poppy-involved villages and almost exclusively in Eastern Shan (27.7% versus 45.8%). It is clear from the plot below that East Shan had the highest share of use of open-air toilets, suggesting the most severe limitations in development as it pertains to sanitation.

Figure 33: Type of access type of sanitation in villages



Lighting

In terms of reported measures of lighting, non-poppy villages were significantly more likely to be connected to public electricity grids used in household lighting. On average 31.2% reported connections to the public grid compared with 17.9% for villages engaged with poppy ($p<0.01$). Shares of solar electrification were about the same between villages, but poppy-involved villages were several times more likely to use candles for in-home lighting (15.6% versus 5.9%; $p<0.01$).

In terms of trends across time and region, candles were most commonly reported in Kachin and East Shan. However, Kachin also reported the highest share of access to public grids 45% and the lowest access to solar 23%. Over time, South Shan reported increases in the share of villages connected to the grid, growing from 27% in 2019 to 43% in 2023.

Figure 34: Type of lighting in villages

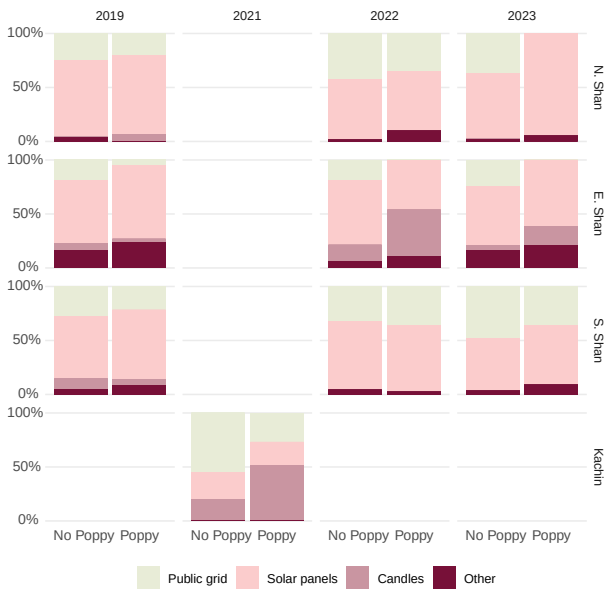
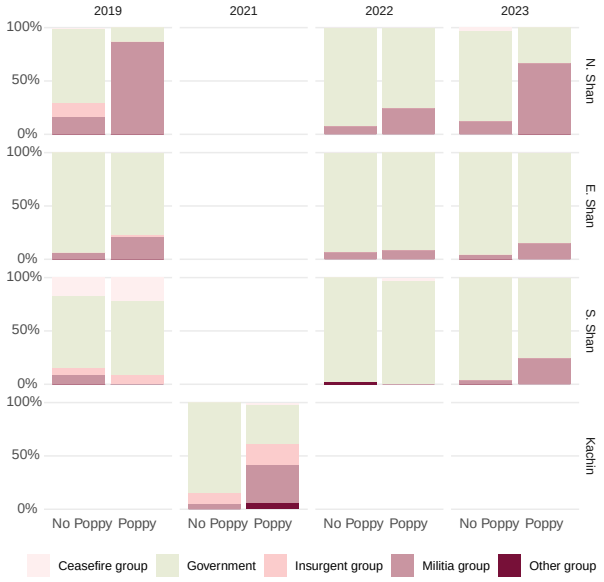


Figure 35: Control of village by entity



Security

Of the UN's Sustainable Development Goals, number 16 focuses on promoting a peaceful and inclusive society, providing access to justice for all, and building effective, accountable, and inclusive institutions. With this lens, there are some differences regarding safety and security between poppy and non-poppy villages. Surveys asked household heads and village leaders about measures of victimization and security.

Control of villages

In terms of control over villages, government control was higher in villages not engaged with poppy (82% versus 70%; p<0.01). In contrast, control by militias was more common in poppy-involved villages (23% versus 9%; p<0.01). North Shan reported the highest share of militia control over villages across all regions.

Over time, government control of villages included in the survey rose from 72% to 92% in 2022, after which it decreased to 84% in 2023. However, the question of control in the survey areas remains fluid and the correlation of government control with lower rates of poppy-involved villages may relate to a range of factors, such as a generally lower likelihood of engaging in illegal activity or possible disruptions in local economic activity due to changing control.

Household measures of fear

In 2021, surveys started asking household heads about levels of self-reported fear and perceptions of safety toward various measures, including threats to life, fear of robbery, and going out at night. In general, poppy-involved households reported agreeing, partially or completely, with statements such as "I fear being robbed" more often than their poppy-free counterparts. In terms of threats to life, non-poppy households were significantly less likely to agreeing with the question "I fear I could suffer threats to my life" (24% versus 30%; p<0.01). Similarly, non-poppy households were significantly less likely to agreeing with the question "I fear I could suffer physical aggression" (23% versus 32%; p<0.01). Lastly, non-poppy households were significantly less likely to agreeing with the question "I fear being robbed" (12% versus 18%; p<0.01).

From the figure below several details are apparent. First, levels of fear from threats to life, physical aggression, or robbery get worse over time. Fear of robbery in particular gets much worse from 2022 to 2023. In contrast, feelings of safety at night improve over time, most notably from 2022 to 2023.

Figure 36: Reported levels of fear

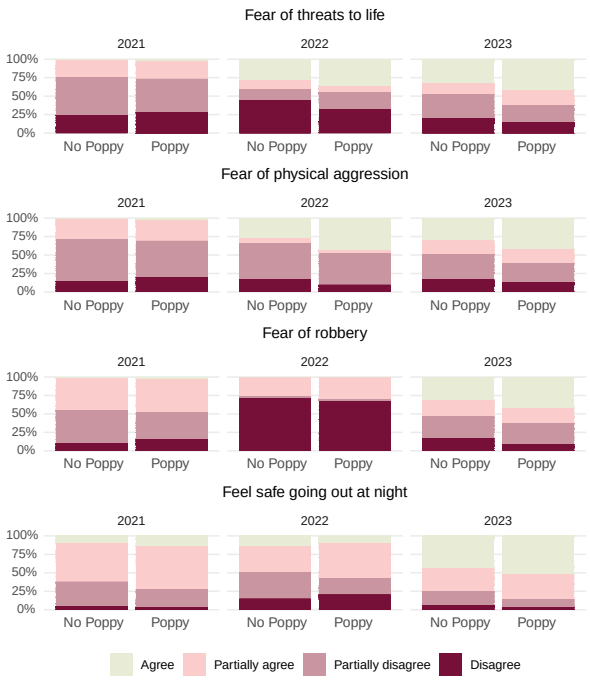
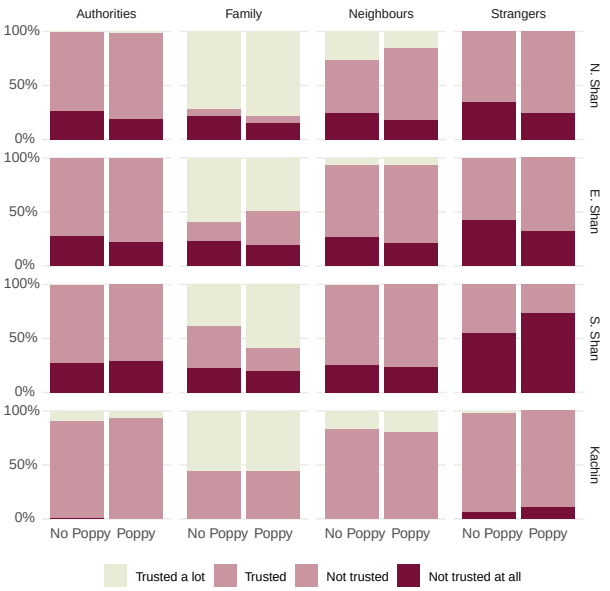


Figure 37: Trust in social institutions



Household measures of trust across social institutions

Recent surveys have also asked heads of households about various levels of trust in authorities, family, neighbours, and strangers. Not surprisingly, levels of trust were highest for family and lowest for strangers. Overall, the differences between households engaged or not in poppy were generally not significant. In terms of levels of trust in authorities, South Shan had the lowest levels of trust while Kachin had the highest. However, the definition of authorities may not always be the same and in some cases may reflect the government or some other armed group that effectively controls the locality. Likewise, Shan had the highest rates of distrust across all regions for neighbours, family, and strangers.

Comparing differences across households and villages

Building off the visual analysis above and to better examine the significant differences in measures between households and villagers that engage or do not engage in poppy cultivation across Shan and Kachin States, several additional analyses were considered. These include a straightforward nonparametric test of various measures between households or villages engaging in poppy as well as several regressions to identify significant predictors, holding other measures constant.

Comparing households

Across several demographic or other measures, poppy-engaging households have more adults and fewer children than their non-poppy counterparts. They also have younger heads of households, greater access to credit, and less formalized land tenureship. The measure of years before or after the military takeover is the number, in years, since 2021. So, measures that occurred in 2019 would equal -2 while those in 2023 would measure 2. The means reported in the table below are also significantly different.

Table 8: Comparing household differences

Mean (standard deviation)			
	No Poppy	Poppy	P value
Count	2787	960	
Years before/after military takeover	-0.56 (1.65)	0.22 (1.59)	<0.001
Household size	5.66 (2.16)	5.57 (2.07)	0.456
Adult males	1.96 (1.06)	1.74 (0.91)	<0.001
Adult females	1.92 (0.93)	1.81 (0.94)	<0.001
Children	1.77 (1.24)	2.02 (1.33)	<0.001
Male head of household	0.91 (0.29)	0.91 (0.28)	0.408
Head of household at least secondary school	0.16 (0.37)	0.15 (0.35)	0.194
Head of household age	49.41 (11.02)	46 (10.56)	<0.001
Household access to credit	0.38 (0.49)	0.51 (0.5)	<0.001
Formal land tenureship	0.41 (0.49)	0.2 (0.4)	<0.001

In order to identify which predictors may be significantly associated with a household's decision to engage in poppy cultivation, a logistic regression was fit, controlling for region (referent is Kachin), time before/after the miliary takeover, household size, number of females in a household, number of children in a household, whether or not the household was headed by a male, whether or not the head of household had attended at least a secondary school, the age of the head of household, whether or not the household had access to credit, and whether or not the household had a formalized land tenureship status (i.e., owned or were on contract to rent the land).

Table 9: Estimating relationship between household factors and poppy-involvement

	Poppy involved
N. Shan	0.3076*** [0.236, 0.401]
E. Shan	1.2543 [0.980, 1.605]
S. Shan	0.6371*** [0.499, 0.814]
Years before/after military takeover	1.3670*** [1.296, 1.442]
Household size	0.8729** [0.798, 0.955]
Adult females	1.1510 [0.999, 1.327]
Children	1.3796*** [1.229, 1.548]
Male head of household	1.1436 [0.869, 1.505]
Head of household at least secondary school	0.8892 [0.706, 1.120]
Head of household age	0.9797*** [0.972, 0.987]
Household access to credit	1.1417 [0.962, 1.355]
Formal land tenureship	0.2948*** [0.240, 0.362]
Num.Obs.	3,747
AIC	3,658
Estimation	Logistic
Coefficients exponentiated	Yes
* p < 0.05, ** p < 0.01, *** p < 0.001 95% confidence intervals reported in brackets Kachin is the referent state	

As shown in the table above, several measures are significantly associated with a household engaging in poppy cultivation. Coefficient estimates are reported as odds ratios, alongside their 95% confidence intervals and p-values. Odds ratios above 1 have a positive association; odds ratios less than 1 have a negative association.

As specified in the regression, years after the military takeover are positively associated with a household's engagement with poppy cultivation. Similarly, households with more children are also positively associated with poppy cultivation. Smaller households are negatively associated with poppy cultivation within households as are households with older heads of households. Formalized land tenureship was estimated to have a large negative association with a household's decision to engage in poppy.

Comparing villages

When comparing the differences across villages that engage or not with poppy, standard nonparametric differences show that non-poppy villages are larger on average in terms of number of households and population. Poppy-involved villages are located at significantly higher elevations, have smaller shares of flush toilets, access to public electrical grids, and lower levels of government control. Several other measures, as described above, are significantly different with poppy-involved villages having higher shares of households in debt, lower shares of households with formalized land use rights, and lower shares of paved roads. The mean differences on years before/after military takeover are also significantly different, suggesting that there is an important time-variant relationship since 2021 after the military takeover.

Table 10: Comparing village differences

Mean (standard deviation)			
	No Poppy	Poppy	P value
Count	892	358	
Number of Households	68.67 (77.52)	58.65 (72.22)	<0.001
Population	339.47 (444.85)	290.61 (345.33)	0.003
Elevation (m)	889.32 (369.14)	1204.94 (345.98)	<0.001
Flush toilet	0.66 (0.47)	0.46 (0.5)	<0.001
Public electricity	0.31 (0.46)	0.18 (0.38)	<0.001
Piped water	0.32 (0.47)	0.38 (0.49)	0.317
Government control	0.82 (0.39)	0.7 (0.46)	0.001
Years before/after military takeover	-0.55 (1.67)	0.12 (1.59)	<0.001
Household debt	0.26 (0.24)	0.4 (0.25)	<0.001
Household land use rights	0.35 (0.35)	0.19 (0.27)	<0.001
Asphalt/gravel roads	0.58 (0.49)	0.37 (0.48)	<0.001
Middle/high school	0.12 (0.33)	0.11 (0.31)	0.399
Clinic workers/1,000	1.61 (5.8)	1.31 (5.17)	0.167

To analyze the significant predictors associated with poppy engagement, several regressions were undertaken. Given that poppy engagement is measured both dichotomously at the village level as well as a continuous share of households within poppy-involved villages two different models were considered. In the first model, a logistic regression was used. In the second a simple linear fit model was used. Both show generally similar outcomes in key predictors associated with poppy engagement. Elevation was positively associated with poppy engagement at the village or house-share measures, as was years before/after the military takeover for the model where poppy engagement was dichotomous. Likewise, government control was also negatively associated with poppy engagement in the logistic model.

However, the strongest predictors across both models were household debt share and household land use rights. Debt was very strongly associated with poppy engagement in the logistic model as well as in the linear model. In the linear model, a 1% increase in households in debt within poppy-involved villages is associated with a 13% increase in households that engage in poppy within said villages. In contrast, land tenureship is negatively associated with poppy engagement in both models. In the linear model, a 1% increase in formal land use rights within poppy-involved villages is associated with a 13% decrease in households that engage in poppy within said villages. Other socioeconomic measures of development, such as access to flush toilets, piped water, public grid connections, connections to paved roads, schools, or numbers of clinic workers per capita were not significantly associated with poppy engagement in either model.

Table 11: Estimating relationship between village factors and poppy-involvement

	Poppy involved	Share of households that grow poppy
N. Shan	0.3106** [0.152, 0.636]	-0.2213*** [-0.322, -0.121]
E. Shan	2.4051* [1.176, 4.917]	-0.1261* [-0.235, -0.017]
S. Shan	0.4553* [0.234, 0.885]	-0.2507*** [-0.355, -0.146]
Years before/after military takeover	1.1279* [1.025, 1.242]	-0.0118 [-0.034, 0.010]
Population	1.0002 [1.000, 1.001]	-0.0001 [0.000, 0.000]
Elevation	1.0024*** [1.002, 1.003]	0.0002*** [0.000, 0.000]
Flush toilet	0.7949 [0.566, 1.116]	-0.0418 [-0.118, 0.035]
Piped water	0.7964 [0.568, 1.118]	-0.0222 [-0.088, 0.043]
Public electricity	0.7047 [0.449, 1.106]	-0.0202 [-0.111, 0.071]
Household share of debt	4.5260*** [2.283, 8.971]	0.1374* [0.006, 0.269]
Household share of land use rights	0.3051*** [0.176, 0.529]	-0.1363* [-0.267, -0.005]
Government control	0.4500*** [0.307, 0.659]	-0.0366 [-0.118, 0.045]
Asphalt/gravel roads	1.0829 [0.775, 1.513]	-0.0580 [-0.138, 0.023]
Middle/high school	1.1308 [0.646, 1.978]	-0.0102 [-0.124, 0.104]
Clinic workers/1000	1.0119 [0.980, 1.045]	-0.0019 [-0.013, 0.009]
Num.Obs.	1,225	331
R2		0.212
R2 Adj.		0.174
AIC	1,102.2	106.7
Estimation	Logistic	Ordinary Least Squares

Socioeconomic conclusions

Poppy cultivation appears to be increasing over time. Villages and households in Shan and Kachin States show an upward trend, at least for Shan, as it pertains to poppy engagement and increasing plot sizes. This suggests that poppy cultivation is increasing extensively on the margins but also intensively within households and villages that engage in poppy cultivation. In 2019, 19% of villages engaged in poppy; by 2023 that figure reached 34%. A more challenging political and economic situation may be contributing to this rise, especially since the military takeover in 2021. In more robust estimation approaches, time from before or after the military takeover in 2021 was associated with poppy engagement, suggesting that political and economic instability is encouraging households to see poppy cultivation as a form of insurance during times of instability.

Similarly, an analysis of socioeconomic measures within households and villages shows that those engaged in poppy more often are remote and report lower access to services. Additionally, although levels of income are similar between poppy and

non-poppy villages, poppy income is needed to make up the difference in reduced incomes for licit, especially licit agricultural, earnings. The most common reason behind poppy engagement is out of a need to pay for food, followed by medicine and education expenses. When looking at households and villages that engage in poppy cultivation in Kachin and Shan States, they often report lower levels of government control, higher rates of opiate use, reduced levels of trust, and higher levels of fear. Most importantly, household debt share is strongly associated with increased poppy engagement. The share of households with formalized land status (e.g., households that own or hold a rental contract) are negatively associated with poppy engagement.

Across measures considered, households and villages that engage with poppy cultivation are more likely to face considerable socioeconomic challenges, greater insecurity, and overall fewer connections to the regional and national infrastructure and services provided by the state. Findings here support research elsewhere that suggests that poppy cultivation in Myanmar is related to the debt burden faced by rural farmers with limited access to reliable and sustainable financing. Instead, informal money lenders appear to be encouraging poppy cultivation to payback debt acquired earlier.

There are many interrelated factors contributing to poppy cultivation. However, across many dimensions poppy-involved areas are more remote, appear to face challenges of access and formality, have limited engagement with socioeconomic services and the wider market, and experience greater security challenges. Working to improve governance and investments into these communities may help serve as protective factors against illicit cultivation. This will require improving not only the security situation but also formalizing the use of land by many rural poppy communities.

Further, working to improve the means by which such households can generate licit income is likely to persuade many from poppy cultivation. While poppy cultivation generates higher household income, it is also more costly to produce and most of the revenue appears to go to servicing pre-existing household debt due to the tenuous legal and economic situations that many households experience. Instead, ensuring that these households have other means to generate income and the access to markets may reduce their reliance on costly cultivation of illicit poppy crops.

METHODOLOGY

Methodology

The 2024 Myanmar Opium Survey on cultivation and production comprised two key components:

1. **Cultivation Survey**: focuses on estimating the extent of opium poppy cultivation throughout North, East, and South Shan, as well as Kachin, Chin, and Kayah states where opium poppy is commonly cultivated. The estimation primarily used satellite imagery as the main data source, with field surveys conducted to validate and confirm the identification of opium poppy fields;
2. **Yield Survey**: This part of the survey estimates crop yields in the major cultivation areas, which include North, East, and South Shan and Kachin states.

Area estimation

Satellite imagery

To assess the extent of opium poppy cultivation in Myanmar, an area estimation was conducted using satellite remote sensing techniques. This satellite imagery survey encompassed North, East, and South Shan state, the Tanai region and eastern Kachin state, as well as cultivation areas in Chin and Kayah states. The satellite imagery was acquired through two distinct approaches:

1. A sampling method using randomly selected square segments was applied for the three Shan state regions and the eastern part of Kachin state (see the "*Sampling Approach, Sample Size, and Sample Selection*" sections for details); and
2. An inclusive coverage approach using larger, specifically targeted images for the Tanai area in Kachin state, the northern part of Chin state, and the northwestern part of Kayah state (see the "*Target Area Selection and Interpretation*" section).

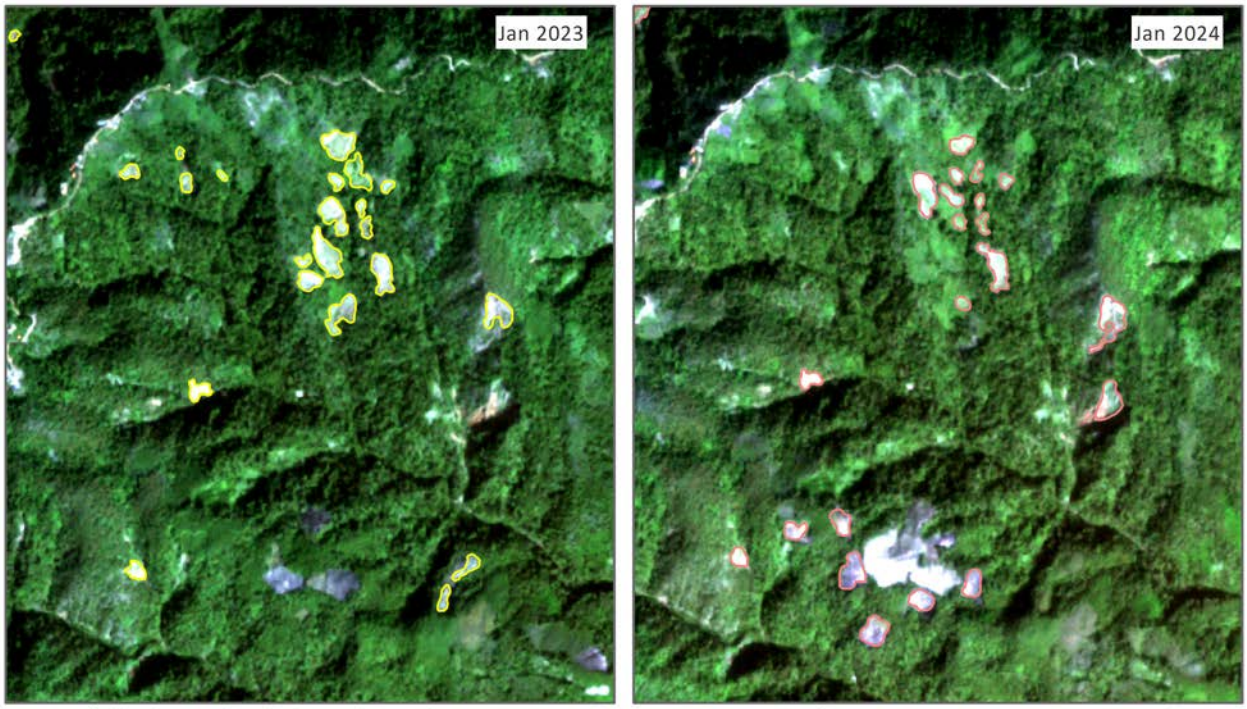
Specifically, very high-resolution (VHR) satellite images were used for the sampled areas, while both VHR and high-resolution (HR) images were employed for the targeted areas.

The VHR images for the sample locations were acquired by Pleiades satellites, which provide 2-meter ground resolution imagery with four spectral bands (blue, green, red, and infrared) and a 50-centimeter panchromatic band. Typically, two images were acquired for each location (sample segment) with approximately a five weeks interval: the first in December/January and the second in February/March. These dates align with the pre- and post-harvest periods for poppy, facilitating in the identification of poppy fields and distinguishing them from similar crops. Regional crop calendar variations were taken into account to optimize the image acquisition dates.

For the targeted areas, Planet-NICFI monthly mosaic images were used to interpret the Tanai area in Kachin state, northern part of Chin state, and northwestern part of Kayah state. These images provided an approximate ground resolution of 4.7 meters in analysis-ready products and included four spectral bands, ranging from blue to near-infrared wavelengths.

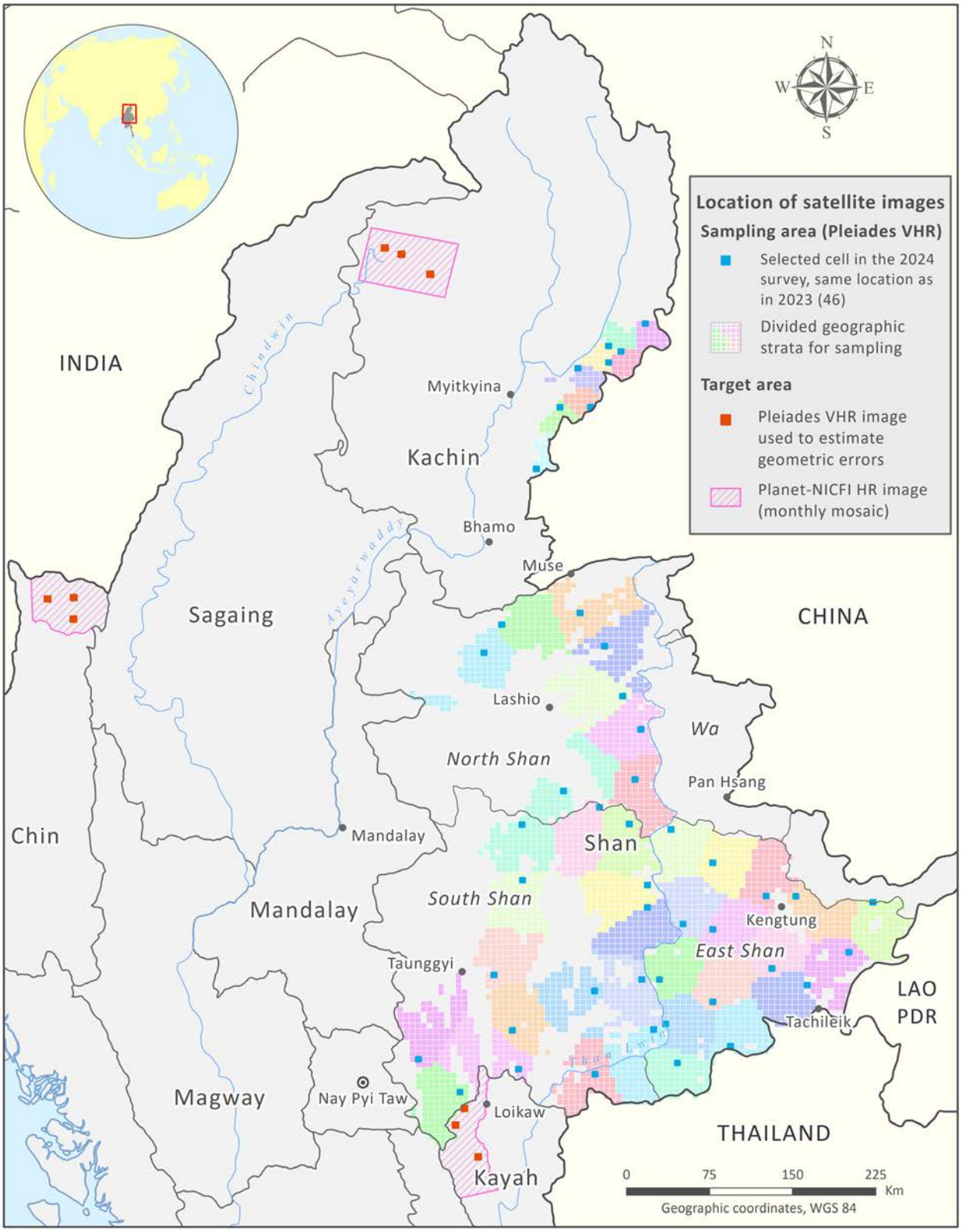
In each target area, three 5x5 km segments with Pleiades VHR images were acquired to assess and validate interpretation results against Planet-NICFI mosaic data. By independently examining both image types, a correction factor was derived to account for differences in area estimates between the Planet mosaic images and the Pleiades VHR images. This factor was then applied to adjust for spatial resolution differences in fields covered solely by the Planet-NICFI images.

Poppy fields delineated in HR satellite images



Poppy fields detected in high-resolution Planet-NICFI monthly mosaic images in Chin target area, comparing 2023 and 2024

Map 9: location of satellite images, Myanmar opium survey 2024



Source: UNODC Illicit Crop Monitoring Programme in Myanmar.
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

The risk area refers to the regions with potential opium poppy cultivation that are included in the estimation survey. For the opium survey in Myanmar, the risk area was identified by integrating the following factors:

1. Land Cover;
2. Altitude;
3. Opium poppy-free[30] areas according to ground information.

In the early 2010s, the risk area was limited to altitudes between 800 and 1,800 meters, based on previous survey data showing that 95% of opium poppy cultivation occurred within this range. However, later evidence revealed poppy fields at altitudes as low as 600 meters and at higher elevations without a defined upper limit. Consequently, starting in 2013, the sampling frame for selecting sample locations was adjusted to reflect these findings.

In Shan state, several areas were designated as poppy-free based on on-site information. The special regions—Wa (formerly S.R.2), Mongla (formerly S.R.4), and Kokant (formerly S.R.1)—were excluded from the sampling frame. Additionally, the townships of Mabein, Kyaukme, Nawnghkio, and Kunlong in North Shan, along with Kalaw, Pindaya, Lawksawk, and Ywa Ngan in South Shan, were also excluded as they were reported to be poppy-free. However, a 10-kilometer buffer zone along the Thailand border, previously considered free of opium poppy cultivation in surveys conducted in the early 2010s, was reintroduced into the sampling frame in the later 2010s. This decision was informed by ground information collected during surveys, which indicated a potential risk of poppy cultivation in this area.

The analysis of the eastern part of Kachin state required a unique approach. In previous surveys, the sampling frame for identifying significant poppy cultivation areas was limited to Waingmaw township. However, field observations from earlier surveys identified several poppy fields in Chipwe township. As a result, the sampling frame in Kachin was updated for the 2022 survey to include this new evidence. The revised frame now covers part of Chipwe township and applies an altitude threshold of over 800 meters, incorporating village tract-level administrative boundaries based on field data.

The factors described above were incorporated into the Geographic Information System (GIS) to refine the sampling frame for Shan state. In contrast, the sampling frame for Kachin state, covering Waingmaw and Chipwe townships, was prepared solely based on altitude criteria and local administrative boundaries.

Figure 38: Altitude ranges (metres) of area of poppy fields detected in satellite images, 2023/2024

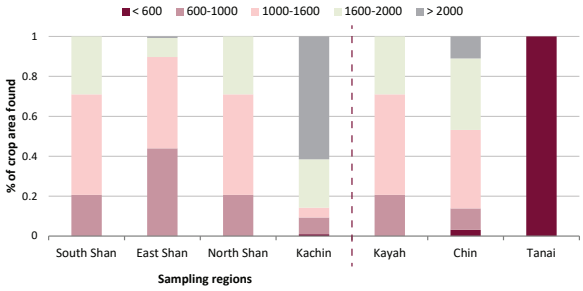
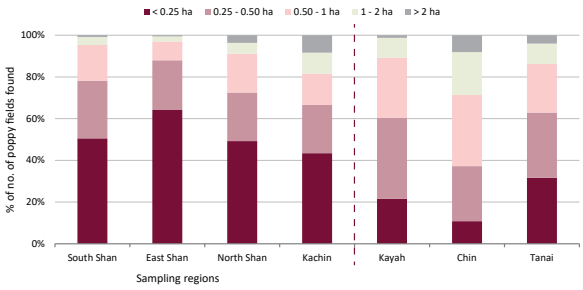


Figure 39: Field size distribution of poppy fields detected in satellite images, 2023/2024



Updated sampling approach, sample size and sample selection

In Shan state and the eastern part of Kachin state, poppy cultivation is typically dispersed throughout the regions. Due to the dispersed nature of poppy cultivation in these areas, employing a sampling approach is the most cost-effective way to achieve the required level of accuracy.

The sampling frame for this survey consisted of 5x5 km segments used to pinpoint locations for satellite imagery acquisition. To enhance sampling

30 Opium poppy free in the sense of no indication for significant levels of opium poppy cultivation.

Table 12: Sample size allocation in 2024

Region	Number of geo-strata	Sample size 2022	Sample size 2023	Sample size 2024
East Shan	15	30	15	15
South Shan	15	30	15	15
North Shan	8	16	8	8
Kachin	8	16	8	8
Total	**46**	**92**	**46**	**46**

efficiency and reduce the acquisition of images covering only small portions of the risk area, a minimum threshold of 30% risk area coverage was set. Segments below this threshold, particularly those on the outer edges of the risk area, were excluded from the sampling frame. However, during extrapolation, the entire risk area was considered, with the assumption that areas outside the frame share, on average, similar characteristics to those within the sampling frame.

A simple random sampling method within geographic strata was employed. Starting with the 2014 survey, a clustering algorithm called "k-means" from the *Spcosa* package in the statistical software R was employed to define the geo-strata. Within each stratum, two sampling locations were typically selected through simple random sampling. This approach provides a well-distributed geographic sample and allows for an unbiased estimation of variance (uncertainty). For more details, refer to the Myanmar Opium Survey 2015[3].

In a full survey with the standard sample size, such as in 2022, a total of 92 satellite image locations were selected: 76 in Shan and 16 in Kachin. However, for the 2023 and 2024 surveys, the number of satellite image locations was reduced to 46, comprising 38 locations in Shan and 8 in Kachin. This reduction represents half of the standard sample size. Within each geographic stratum, one of the two originally selected sampling locations was chosen to acquire satellite images. For the 2024 survey, all image locations were kept the same as in the 2023 survey to ensure comparability. Of the 38 sample locations in Shan, 15 were in South Shan, 15 in East Shan, and 8 in North Shan.

To calculate unbiased trends, an adjustment for the reduced sample size was applied in both 2023 and 2024 surveys by considering cultivation trends of the sample units that were analysed along the three surveys (2022, 2023 and 2024).

Opium poppy cultivation in Myanmar typically occurs in discreet, small plots situated in remote and difficult-to-access terrain, making assessment particularly challenging. To enable temporal comparability, consistent sampling methods are used over time in Myanmar. This approach involves periodic resampling with replacement to monitor changes in plot sizes, planting density, and cultivation areas across the survey area.

Ground verification

In early 2010s surveys, ground verification was a collaborative effort with the Remote Sensing and GIS Section of the Forest Department. Each year, the field teams organized by the Department conducted ground-truthing at selected sample sites. From the late 2010s onward, the ground truth data collection was conducted alongside yield measurements by contracted, trained local surveyors. In the 2024 survey, the surveyors could conduct limited on-site data collection due to security and transportation concerns. Four teams, each one consisting of two trained surveyors (one team per region), carried out ground verification at 10 satellite image locations. Specifically, surveyors visited two sites in South Shan, four in East Shan, two in North Shan, and three in Kachin, collecting geo-tagged field pictures for ground validation. Additionally, surveyors visited several poppy fields in the Tanai target area, collecting geo-tagged photos of these fields. The survey teams conducted these visits, corresponding with Google Earth image footprints during the period of December 2023 to March 2024.

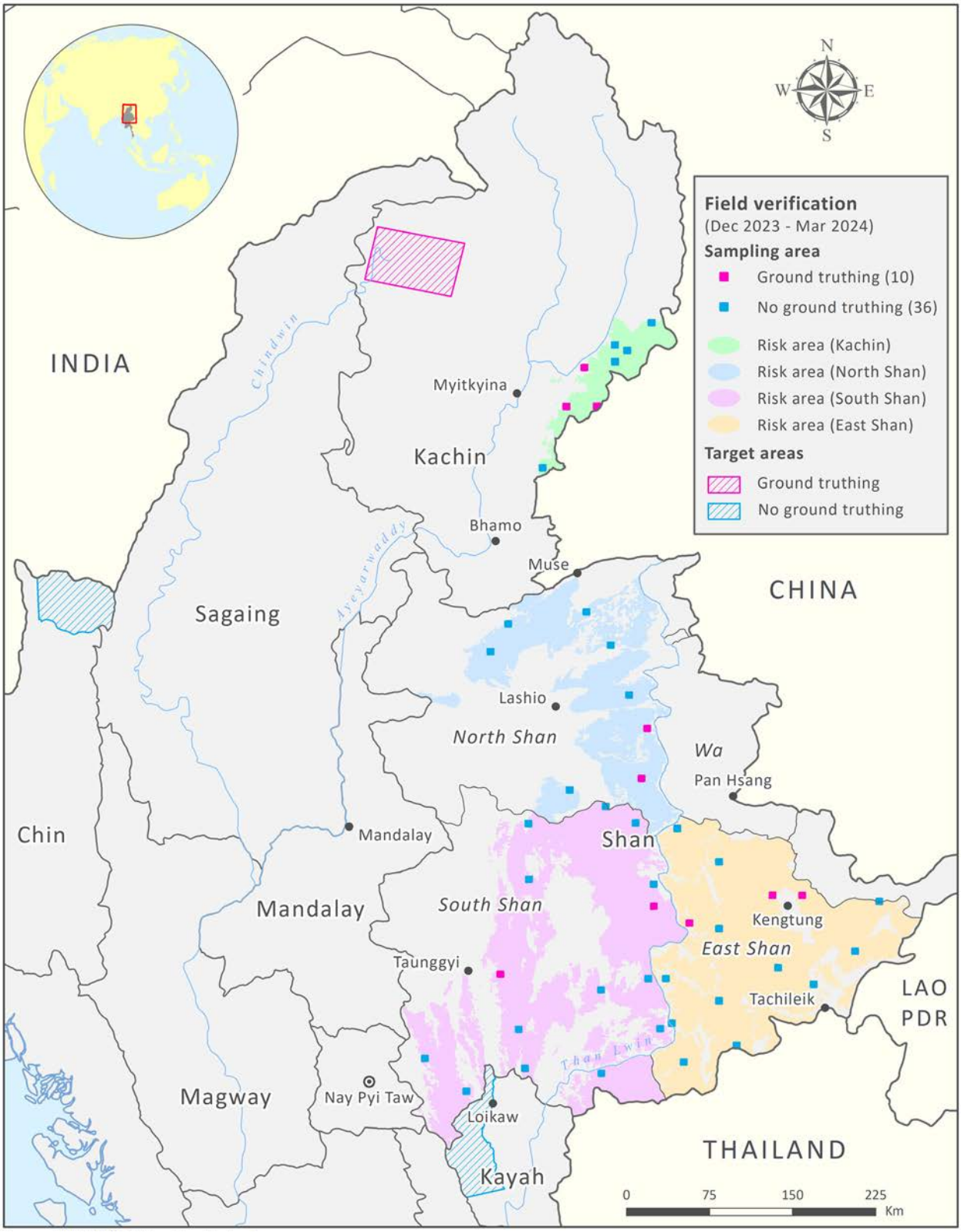
Ground through data collection

The survey teams visited the satellite image locations based on opportunistic considerations. Equipped with printouts of location maps and Google Earth images, they collected GPS coordinates for poppy fields and similar crops, and took field photographs at ten satellite image sites in Shan and four in Kachin state. The collected field data supported the visual interpretation of poppy fields, conducted by a national expert at the UNODC Myanmar Office. Finally, the interpretation results were examined using a rigorous quality control assessment at the UNODC Headquarters in Vienna.

Table 13: Overview of remote sensing and field data

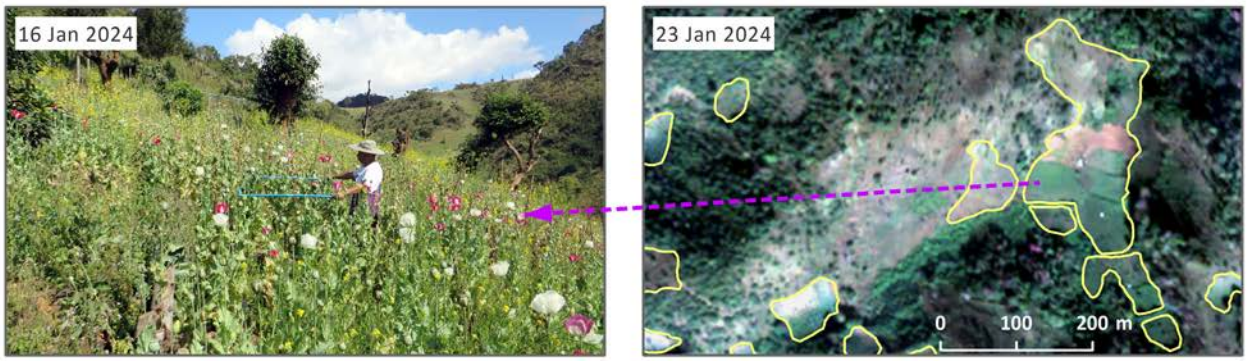
Survey Year	Satellite image VHR	No. of segments in Shan	Segment size (km)	Segments visited in Shan (ground truth)	Ground truth % in Shan	No. of segments in Kachin	Segments visited in Kachin (ground truth)	Ground truth % in Kachin	VHR images area (km²)
2007	Ikonos	22	8x8	17	77%	--	--	--	2,816
2008	Ikonos	28	8x8	19	68%	--	--	--	3,584
2009	Ikonos	40	8x8	34	85%	--	--	--	5,120
2010	GeoEye, WorldView	40	6.5 x 6.5	32	80%	3	--	--	3,634
2011	WorldView, QuickBird	51	6 x 6	40	78%	3	--	--	3,888
2012	GeoEye, WorldView	58	5x5	47	81%	8	--	--	3,300
2013	GeoEye, WorldView	66	5x5	46	70%	8	--	--	3,700
2014	GeoEye, WorldView, QuickBird	76	5x5	49	64%	8	--	--	4,200
2015	Pleiades	76	5x5	47	62%	8	--	--	4,200
2016	No survey	--	--	--	--	--	--	--	--
2017	Pleiades	38	5x5	3	8%	8	--	--	2,300
2018	Pleiades	76	5x5	30	39%	8	--	--	4,200
2019	Pleiades	76	5x5	32	42%	8	--	--	4,200
2020	Pleiades	38	5x5	12	32%	8	3	38%	2,300
2021	Pleiades	76	5x5	8	11%	8	--	--	4,200
2022	Pleiades	76	5x5	8	11%	16	5	31%	4,600
2023	Pleiades	38	5x5	11	29%	8	4	50%	2,300
2024	Pleiades	38	5x5	7	18%	8	3	38%	2,300

Map 10: Field verification coverage in 2024



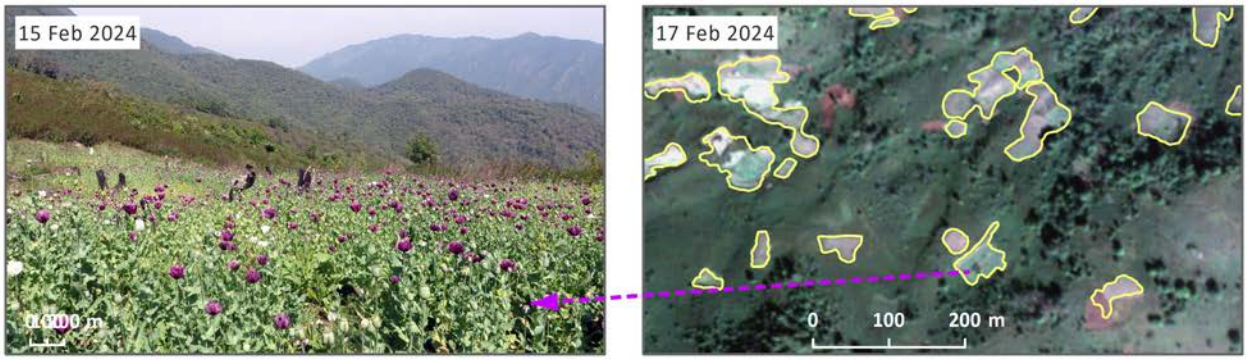
Source: UNODC Illicit Crop Monitoring Programme in Myanmar.
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Geotagged pictures of poppy fields (left) and corresponding area digitized on VHR satellite images



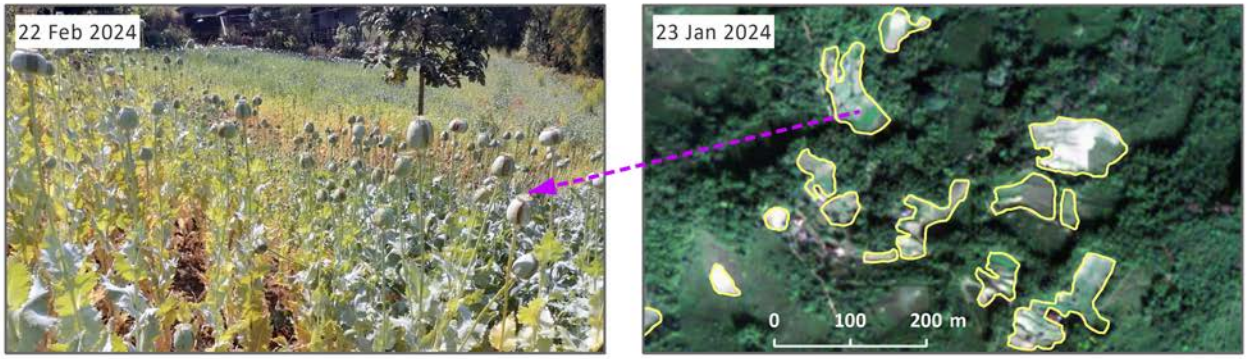
Mature poppy field in the harvesting stage

Poppy field observed in Pleiades satellite image, South Shan



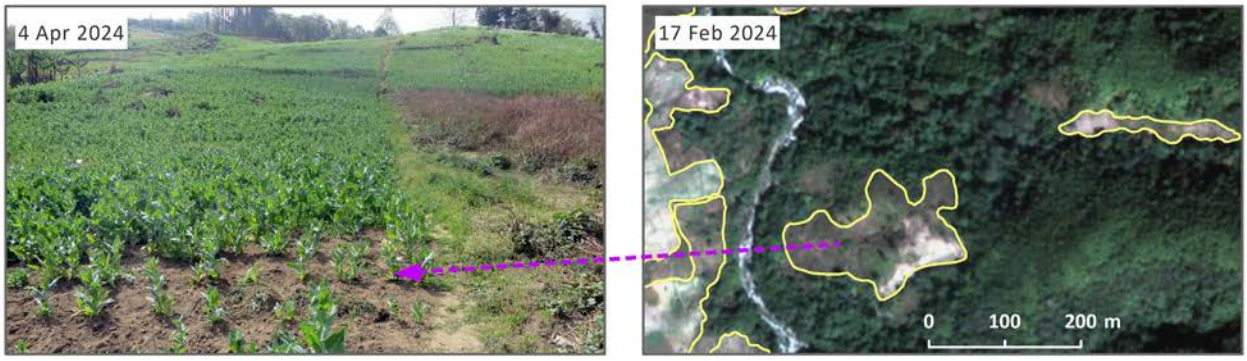
Mature poppy field in the flowering stage

Poppy field observed in Pleiades satellite image, East Shan



Harvesting stage poppy field with fully lanced capsules

Poppy field observed in Pleiades satellite image, North Shan



Large poppy field in its pre-bloom stage

Poppy field observed in Pleiades satellite image, Kachin

Target area interpretation and correction factors

Opium cultivation area estimates for targeted regions—specifically the Tanai area in Kachin, the northern part of Chin, and the northwestern part of Kayah states—were determined using a comprehensive "target approach" or full coverage survey method. Each designated area was thoroughly surveyed with high-resolution (HR) Planet-NICFI mosaic images. Very high-resolution (VHR) images were also acquired for each target region (Map 9).

For each target area in Kachin, Chin, and Kayah, three 5x5 km segments with Pleiades VHR images were acquired. These images were used to assess potential omission and commission errors, as well as geometric discrepancies associated with lower-resolution imagery. In each target area, the same three 5x5 km segments as the previous 2023 survey were selected to ensure comparability. Firstly, opium poppy field areas were visually interpreted using the full-coverage Planet-NICFI mosaic images. Independently, the same areas were interpreted on the Pleiades images at three specific locations within each target area. The variation in opium poppy field area estimates between the two interpretations provided a correction factor, which was then applied to adjust the estimates derived from the Planet-NICFI images[5].

Satellite image processing and interpretation

The geotagged field photos and yield measurement pictures collected during the field campaign, along with field pictures from previous surveys, served as the primary reference for visually identifying, interpreting, and delineating poppy fields. A UNODC national expert based in the Myanmar office, with extensive experience in detecting and interpreting poppy fields based on their characteristics, was assigned this responsibility.

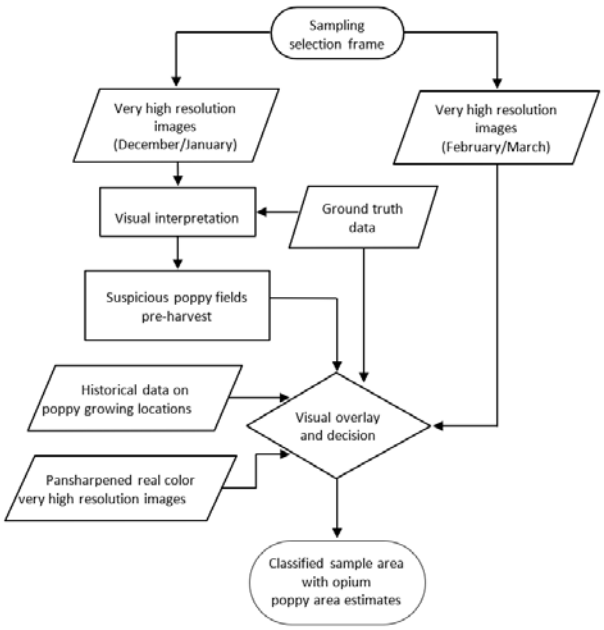
The flowchart below (figure 40) illustrates the classification process of very high-resolution (VHR) images. Before interpretation, the acquired imagery undergoes several pre-processing steps to achieve a consistent and standardized format suitable for visual analysis.

The preliminary processing task involves pan-sharpening, where high-resolution panchromatic imagery from Pleiades is combined with lower-resolution multispectral imagery, to create a pan-sharpened VHR image with a spatial resolution of 50 cm. Pan-sharpening is a critical step for enhancing the differentiation between poppy fields and other land cover types. When needed, visual enhancement techniques are also applied.

The interpretation of satellite images was conducted visually, using the latest ground truth data, historical field data, and yield measurement data as reference throughout the process. Visual interpretation accuracy and precision can vary depending on the expertise and skill of the interpreters. To maintain consistency in knowledge, experience, and subject understanding, interpretation keys (decision rules) were employed. These keys integrate typical elements of the target object —such as tone, color, shape, and texture of poppy fields—alongside contextual insights.

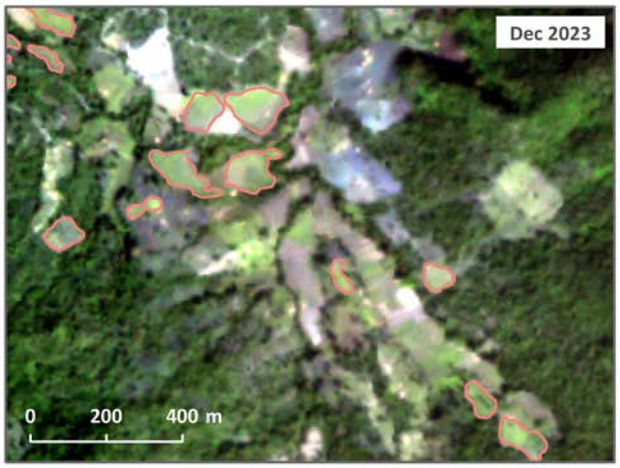
Images acquired in the second date were typically used to monitor potential poppy cultivation areas for any noticeable changes. When a visible change associated with poppy harvesting was detected, it confirmed that the field was indeed used for poppy cultivation.

Figure 40: Satellite image interpretation flowchart

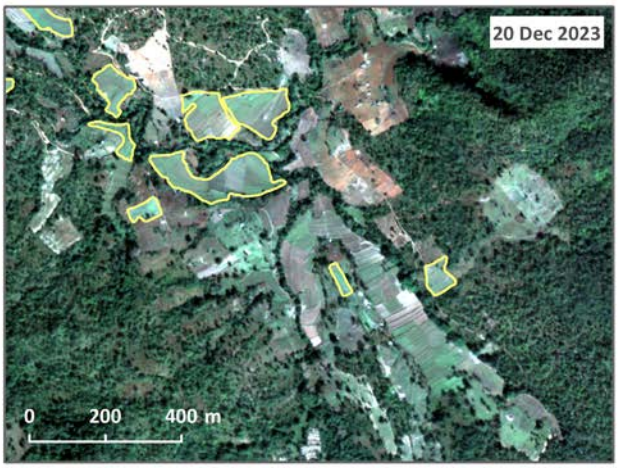


The decision rules were developed by comparing the actual field conditions with the satellite images, allowing for regional and cultivation stage variations. The primary rule used was that if an area identified as a potential poppy in the first image appeared

Poppy field interpretation on HR and VHR images, Kayah



Poppy field interpretation in Planet-NICFI image, Kayah



Poppy field interpretation in Pleiades VHR image, Kayah

as bare soil or showed a noticeable vegetation change in the second image, this indicated opium poppy cultivation. To support this decision-making process, historical poppy interpretation data, three-dimensional (3D) terrain visualizations, true-color pan-sharpened VHR images, and contextual information were used.

Area estimation methods

The area estimation included both the sampling estimates and the target area estimates. The final national estimate is the precise sum of the regional estimates, specifically: poppy estimates from sampled regions in Shan and Kachin states, along with estimates from target areas in Tanai (Kachin), northern Chin, and northwestern Kayah.

The sample area estimation of the extent of opium poppy cultivation at the national level is a combined ratio estimator using risk area as an auxiliary variable.. At the regional level, a simple combined ratio estimator was calculated. The ratios were then extrapolated to risk area outside the frame. In 2024, the sample means for poppy area and risk area were 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 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 estimator 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. When a full survey is implemented (e.g., in 2022), the area under poppy cultivation is then calculated by extrapolating the regional ratios to the total risk area of each region. However, in order to assure comparability and obtain unbiased trends, when a downsized survey is implemented (e.g., in 2023 and 2024), the area estimates are based on cultivation trends of the overlapping sample in two consecutive years at regional level (table 14).

Table 14: Cultivation trends 2023-2024

Region	2023 ratio est.	2024 ratio est.	% Difference
East Shan	0.002930551	0.003237182	10%
North Shan	0.01255889	0.012062186	-4%
South Shan	0.006219467	0.005659624	-9%
Kachin	0.012150787	0.01125404	-7%

Resulting trends are finally multiplied by previous year regional estimates.

Bootstrapping[31] is performed to estimate the confidence intervals of the regional estimates, combining the variance of previous and current year.

31 http://cran.r-project.org/web/packages/boot/index.html.

This is 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. The confidence interval of the national estimate combines the uncertainty of the regional estimates.

Yield and potential opium production estimation

Collection of yield data

In the 2024 survey period, the yield data collection was limited due to the escalation armed conflicts throughout the survey area beginning in late October 2023. As a result, yield data collection followed an opportunistic approach in specific areas of North Shan, South Shan, East Shan, and Kachin (map 11). As in the previous 2023 survey, data collection was conducted by four teams, each consisting of two trained local surveyors, with one team assigned per region. These teams independently conducted field measurements across a total of 68 poppy-growing villages in Shan and Kachin states. Specifically, the data collection covered 17 poppy-growing villages in Hopong and Loilen townships in South Shan; 17 villages in Kengtung and Mongping townships in East Shan; 17 villages in Tangyan township in North Shan; and 17 villages in Waingmaw and Chipwe townships in Kachin. This data collection effort took place from 27 December 2023 to 30 March 2024.

The surveyors selected poppy-growing villages opportunistically, based on factors such as accessibility, security, and the harvesting stage of the poppy plants. In the 2024 survey, field measurements were taken from three poppy fields within each village, totalling 204 poppy fields across the 68 villages in Shan and Kachin states. Notably, all fields visited were at the harvesting stage, allowing for the collection of relevant yield data. The cumulative count of measured poppy capsules reached 6,441.

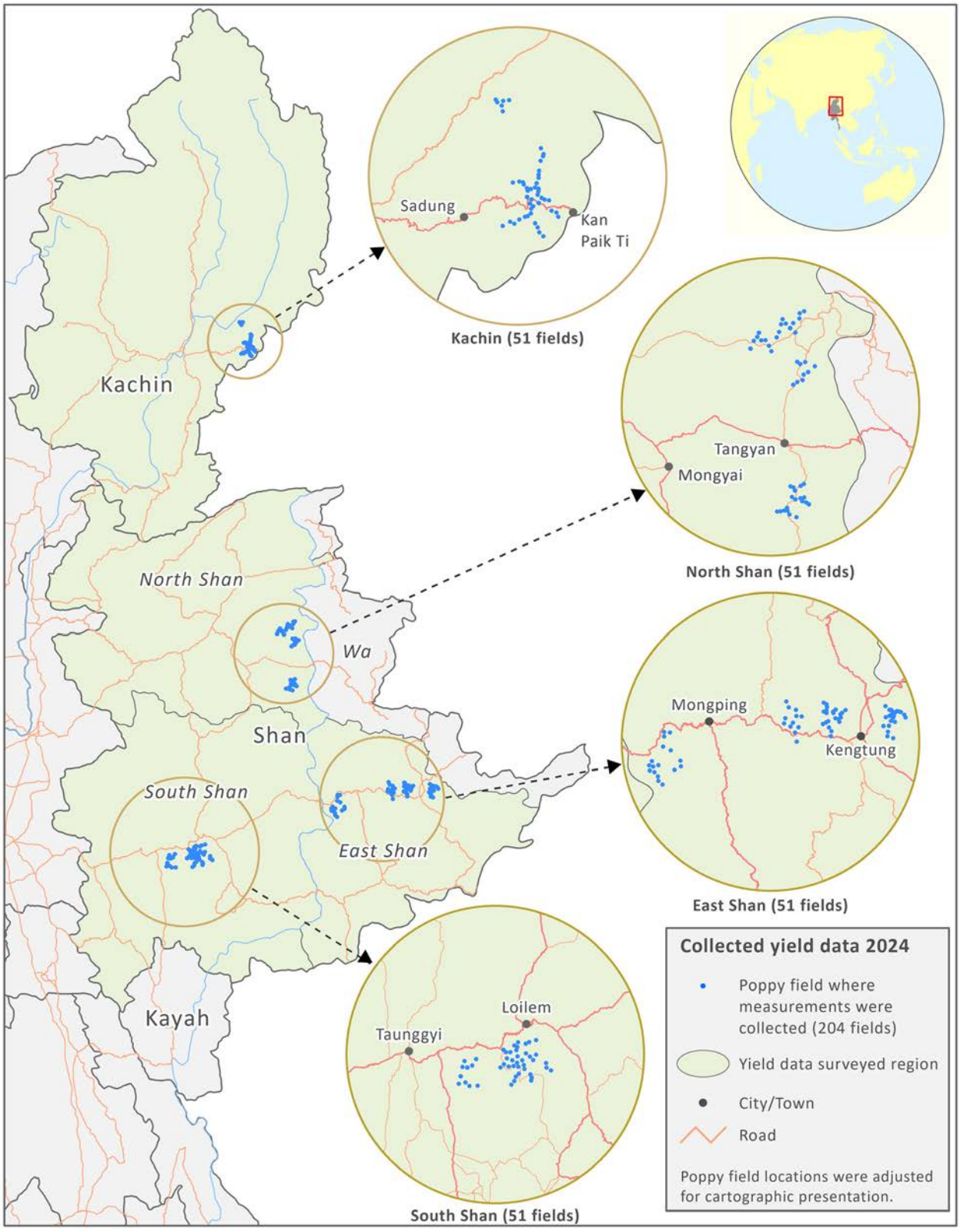
The field teams followed the UNODC Guidelines for yield assessment[7]. The surveyors examined opium poppy fields in the harvesting stage around each visited village, selecting one high-quality, one average, and one lower-quality field. After selecting a field, a transect line was defined, along which three sample plots, each one square meter, were set up. Within each plot, the team counted the number of buds, flowers, immature capsules, and mature capsules likely to yield opium. Additionally, they measured the diameter and height of 10 to 14 lanced capsules using a digital caliper. To ensure data quality, all measurements were meticulously documented with a digital camera. The GPS coordinates of each poppy field were also collected.

Yield data collection


44.29


30.78

Map 11: Locations where yield data were collected



Source: UNODC Illicit Crop Monitoring Programme in Myanmar.
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Table 15: Opium cultivation calendar 2023-2024, Myanmar

Region	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Kayah											
South Shan											
East Shan											
North Shan											
Kachin											
Chin											

	Monsoon cultivation
	Normal cultivation
	Late cultivation

Source: Illicit Crop Monitoring Programme in Myanmar

* Monsoon cultivation observed in Kayah and southern South Shan refers to early planting before end of rainy season and late cultivation refers to staggered planting after normal time to spread the harvest over a longer period.

Opium poppy cultivation in Myanmar typically occurs between October and February, with most seed broadcasting happening in September and October. However, in several areas, farmers stagger their poppy planting. Staggered planting involves sowing poppy seeds over a period of a few weeks to a month rather than all at once. This method helps distribute the workload and minimizes the risk of crop loss due to unfavorable weather during harvest, extending the planting period to over a month in many areas.

Another widespread practice is multi-stage cropping, where farmers sow opium poppy seeds twice in the same field, spaced a few weeks apart. This results in plants of varying stages growing together in a place. In specific higher-altitude areas of Shan and Kachin, where the climate is cooler, the cultivation period can extend into up to April. Additionally, in certain areas of southern Shan and Kayah, there is an early cultivation practice where poppy is grown during the monsoon rainy season. However, previous studies have shown that this practice leads to very low yields.

Estimating potential opium yield

The capsule volume per square metre is derived from field measurements and entered into the formula for the yield calculation. Each plot thus provides one yield observation. The simple average of the three plots in a field is considered the field yield. The yield by State is 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

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

A range was calculated to express the uncertainty of the yield estimate due to sampling with the 95% confidence interval.[32]

In 2024, yield data were collected in 68 villages of Shan and Kachin States. A total of 204 fields were visited. A three-year (2022 – 2024) average was applied to calculate yield figures for North, East, South Shan regions and Kachin State.

It has not been possible to conduct yield surveys in Kayah State since 2014 and not at all in Chin State and hence, yield values were derived from the national average yield (see following section).

Estimating national average yield

In 2024, national average yield was calculated based on the average yield of Shan and Kachin States and then weighed by cultivation estimates of the respective States.

Estimating opium production

Opium production was calculated by region/State as the result between the estimated area under opium cultivation and the corresponding opium yield. The total national potential opium production is a sum of regional estimates, weighted by cultivation.

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 combine those due to sampling for the area under poppy cultivation and those related to the yield estimate. These uncertainties were calculated by using the standard method for error propagation. The point estimates and uncertainties of the area under poppy cultivation and yield can be expressed as ap ±Δa and yp ± Δy respectively, where the uncertainty is determined from the 95% confidence intervals. These uncertainties will impact on the estimate of production (pp ± Δp, or equivalently expressed as the range [pp - Δp, pp+Δp]), where the best estimate is pp = ap yp. Therefore,

$$\frac{\Delta p}{p_p} = \sqrt{\left(\frac{\Delta a}{a_p}\right)^2 + \left(\frac{\Delta y}{y_p}\right)^2}$$

expresses the error in production (Δp), resulting from uncertainty in the estimates for cultivation area and yield.

The ranges around average national yield were calculated by using the uncertainty around yield estimates, that is the national lower/upper bounds are the averages of the regional lower/upper bounds weighted by the point estimates of the area estimates.

Estimating the value of opium economy in Myanmar

Estimating the value of Myanmar opium economy implies evaluating the amounts of raw opium and heroin which are used either for the domestic consumption or for export, along with their prices at every link of the chain. This means estimating and then combining multiple factors, using the best available data.

Due to the scarcity of reliable and/or updated data, especially on purity and conversion factor, the degree of uncertainties is significant and infers the use of range rather than point estimates.

The key components of the opium economy which have been estimated to derive the gross and net values of the opium economy in Myanmar are:

- The farm-gate value;
- The amounts of raw opium and heroin reaching the illicit end-consumer markets;
- The value of opiates market for domestic use;
- The value of opiates potentially available for export.

32 $Y \pm 1.96 \frac{\sigma}{\sqrt{n}}$, where Y is the point estimate, n is the number of samples and σ is the standard deviation.

The farm-gate value

The farm-gate value is derived directly from the potential production of dry opium. The national price per kilogram of dry opium used for the calculation is the weighted average of the farm-gate prices at harvest time of the two main producing regions of Shan State. The lower and upper bounds of the farm-gate value reflect the range of the potential opium production estimate.

The amounts of raw opium and heroin reaching the illicit end-consumer markets

Opium can be consumed either as raw opium or further processed into heroin. Starting from the production figures, the estimate of the share of unprocessed opium entering the illicit markets is based on the direct opium consumption in the Southeast Asia region[33] and the comparison of the opium production levels between Myanmar and Laos,[34] which are supposedly the only opium providing countries in the region.[35] The remaining opium, after discounting opium seizures,[36] is deemed to be processed into heroin. A ratio of 10:1 is used for converting opium to heroin of unknown purity,[37] and, after subtracting the reported heroin seizures,[38] the amount of heroin reaching the end-consumer markets is obtained.

The value of opiates market for domestic use

The value of the domestic opiates market is given by:

(annual estimated domestic opium consumption x *typical retail opium price)*

+

(annual estimated domestic heroin consumption x typical retail heroin price adjusted for purity)

33 Source: *Transnational Organized Crime in Southeast Asia: Evolution, Growth and Impact 2019* (TOCTA-EAP), (UNODC, 2019).

34 Source: *Southeast Asia Opium Survey 2023 – Lao PDR, Myanmar* (UNODC, 2023).

35 The assumption is that the ratio between total opium production and unprocessed opium is the same for the two countries. Sources: *World Drug Report 2020* (UNODC, 2020), *Transnational Organized Crime in East Asia and the Pacific – A Threat Assessment (*UNODC, 2013) and *Transnational Organized Crime in Southeast Asia: Evolution, Growth and Impact 2019*, UNODC.

36 CCDAC by October 2021 reported the seizure of 2,063 kg of opium. The quantities of opium seized in the whole year 2024 was linearly extrapolated based on this figure.

37 For countries other than Afghanistan, a traditional conversion ratio of opium to heroin of 10:1 is used. Source: *World Drug Report 2020, Booklet 3, p.79* (UNODC, 2020).

38 CCDAC by October 2021 reported the seizure of 1,045 kg of heroin. The quantities of heroin seized in the whole year 2024 was linearly extrapolated based on this figure.

The estimates of opium and heroin consumed in Myanmar are based on:

- The prevalence of opiates use[39] in the country
- The respective proportions of opium and heroin users[40]
- The Myanmar population between 15 and 64 years old[41]
- The annual heroin[42] and opium[43] average consumption rates

The retail price of opium and the retail price of heroin were provided by the Central Committee on Drug Abuse control of Myanmar (CCDAC).[44] Heroin's street price has been adjusted for purity, resulting in a range due to the uncertainties related to the purity of the retail market's heroin.[45]

The value of opiates potentially available for export

The amounts of opiates potentially available for export are derived by subtracting the domestic consumption from the opiates reaching the illicit market. The obtained opium and heroin quantities are then multiplied by the respective wholesale prices[46] and summed to each other to find the value of the opiates export.

Gross and net values of opiates economy in Myanmar

The gross value of the opiates economy is the sum of the value of the domestic market and the value

39 Annual prevalence for opiates is 0.8%. Source*:* UNODC, 2010 (https://dataunodc.un.org/data/drugs/Prevalence-general).

40 Heroin users represent the 90.5% of opiates users, opium users the 9.5%. Derived from 2020 treatment data at the 2021 SMART Regional Workshop.

41 Source: World Bank, 2023.

42 The global annual average value of 22g of heroin is used, obtained from data from Australia's wastewater analysis (Source: https://www.unodc.org/documents/southeastasiaandpacific/Publications/2019/SEA_TOCTA_2019_web). The value was used to calculate the heroin market size in the region.

43 A value of 770g of opium for yearly consumption is used. Source: *Drug Use in Afghanistan* (Afghanistan Ministry of Counter-narcotics/ Afghanistan Ministry of Health/ UNODC, 2009).

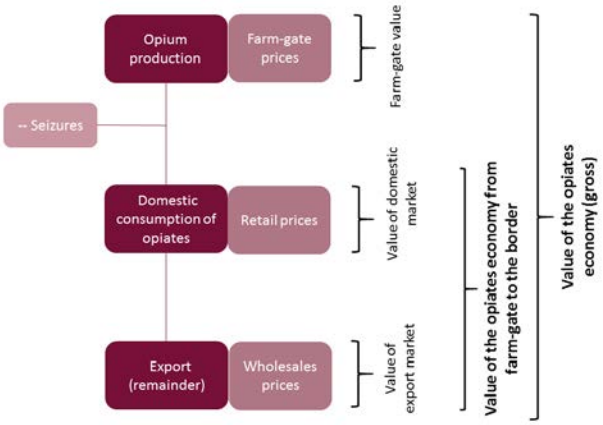
44 CCDAC, opium prices reported at the 2021 SMART Regional Workshop, heroin prices rported at the 2024 SMART Regional Workshop.

45 Due to the lack of data on street heroin's purity in Myanmar, Thailand ARQ 2022 figures, were used, which recorded a retail purity ranging from 21 to 95%.

46 Wholesale opium and heroin prices were reported by CCDAD respectively at the 2021 and 2024 SMART Regional Workshop.

of opiates believed to be exported.[47] The estimate of the value of manufacture and trafficking of opiates to the border excludes the farm-gate value, which is paid by first-level traffickers to the farmers. A detailed analysis of the profits made at each stage needs to consider other costs associated to the illicit drug business, for instance those related to manufacture and distribution, most importantly precursor substances. Due to lack of data, it was not possible to include the above-mentioned components in this analysis.

Figure 41: Workflow diagram of the analysis of the opiates economy



Uncertainties

There is a significant uncertainty around these estimates. While confidence in the opium production estimates is high, uncertainties around the conversion ratio from opium to heroin[48] stem mainly from the wide range of possible purities of the product and from the lack of data on the efficiency of the conversion from opium to heroin (i.e., how much opium is needed to produce 1kg of heroin). Uncertainties around the demand estimate are mainly associated with the assumptions around annual opium consumption per user.

Socioeconomic village and household survey

Please find the socioeconomic village and household survey methodology documentation of the Myanmar opium survey following the link: https://www.unodc.org/roseap/uploads/documents/2024/Combined_house_and_village_survey_methods.pdf

47 The gross value of opiates economy includes several components (e.g., costs associated to precursor substances, transports, processing, etc.), which are not considered in this analysis.

48 The amount of raw opium needed for producing 1kg of heroin depends on two main factors: i) the average morphine content of opium and ii) the efficiency of the heroin labs. To date there are no available studies that focus on opium's morphine content and/or heroin labs efficiency in Myanmar.

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