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OPIUM SURVEY IN LAOS

- Background
- Survey method
- The field mission
- Satellite image interpretation
- Result

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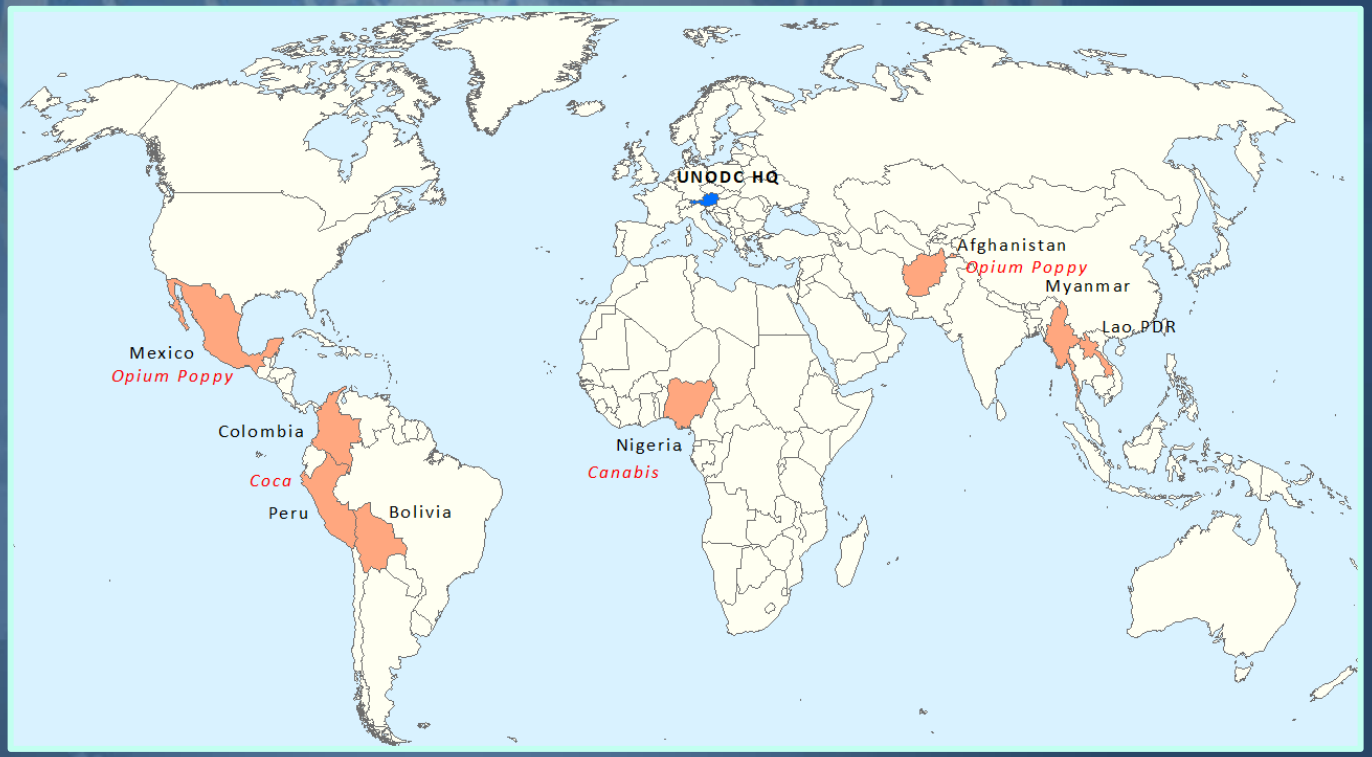
UNODC's Illicit Crop Monitoring Program (ICMP)

- Established in 1999 by the CND (UN Commission on Narcotic Drugs) resolution 42/3.
- Countries engaging in ICMP activities at the time being.



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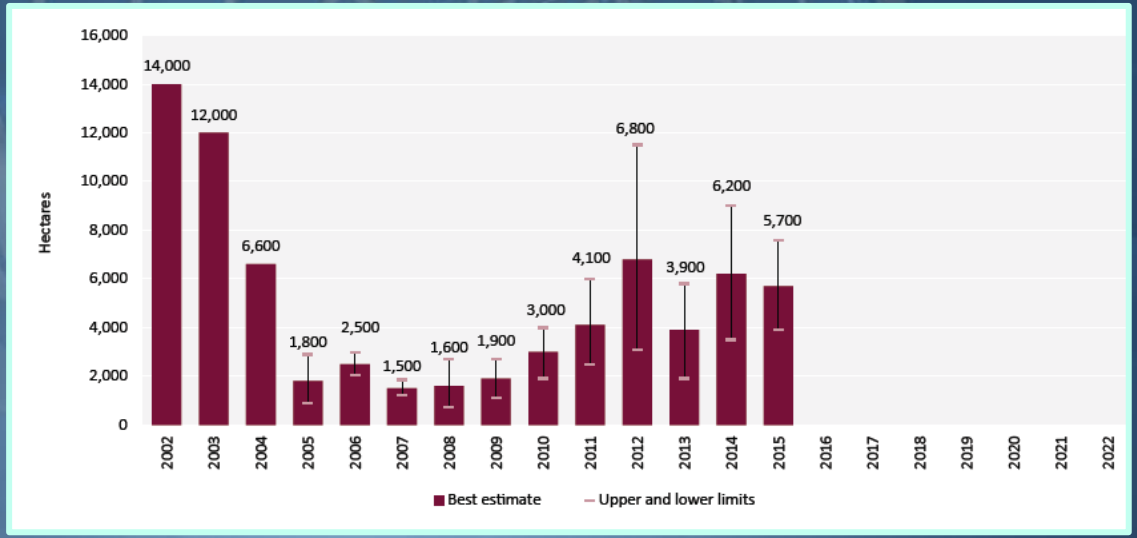
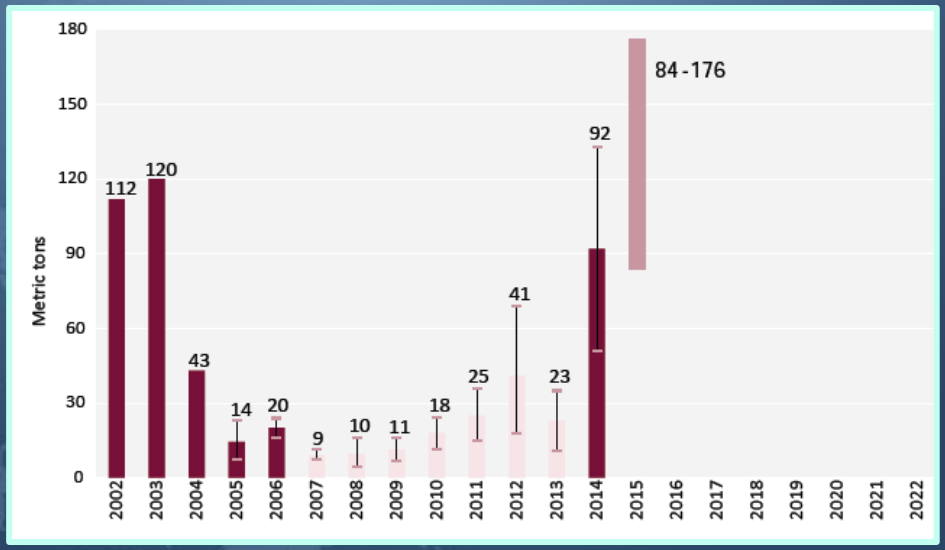
Opium trends in Lao PDR

Poppy cultivation area (Hectares) 2002-2022



Opium production (Metric tons) 2002-2022



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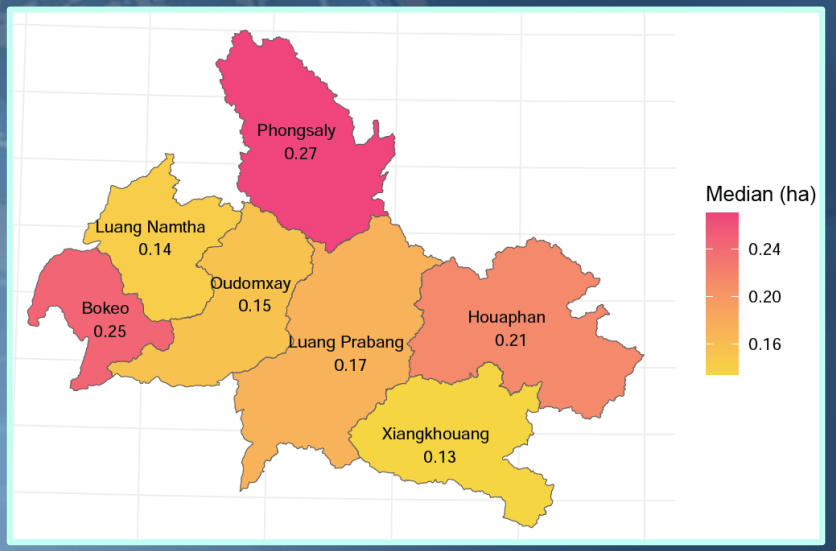
Where & When

- Northern part of Lao PDR.
- Seven opium poppy cultivation provinces.



- Field mission (Helicopter Survey) - Feb 2023

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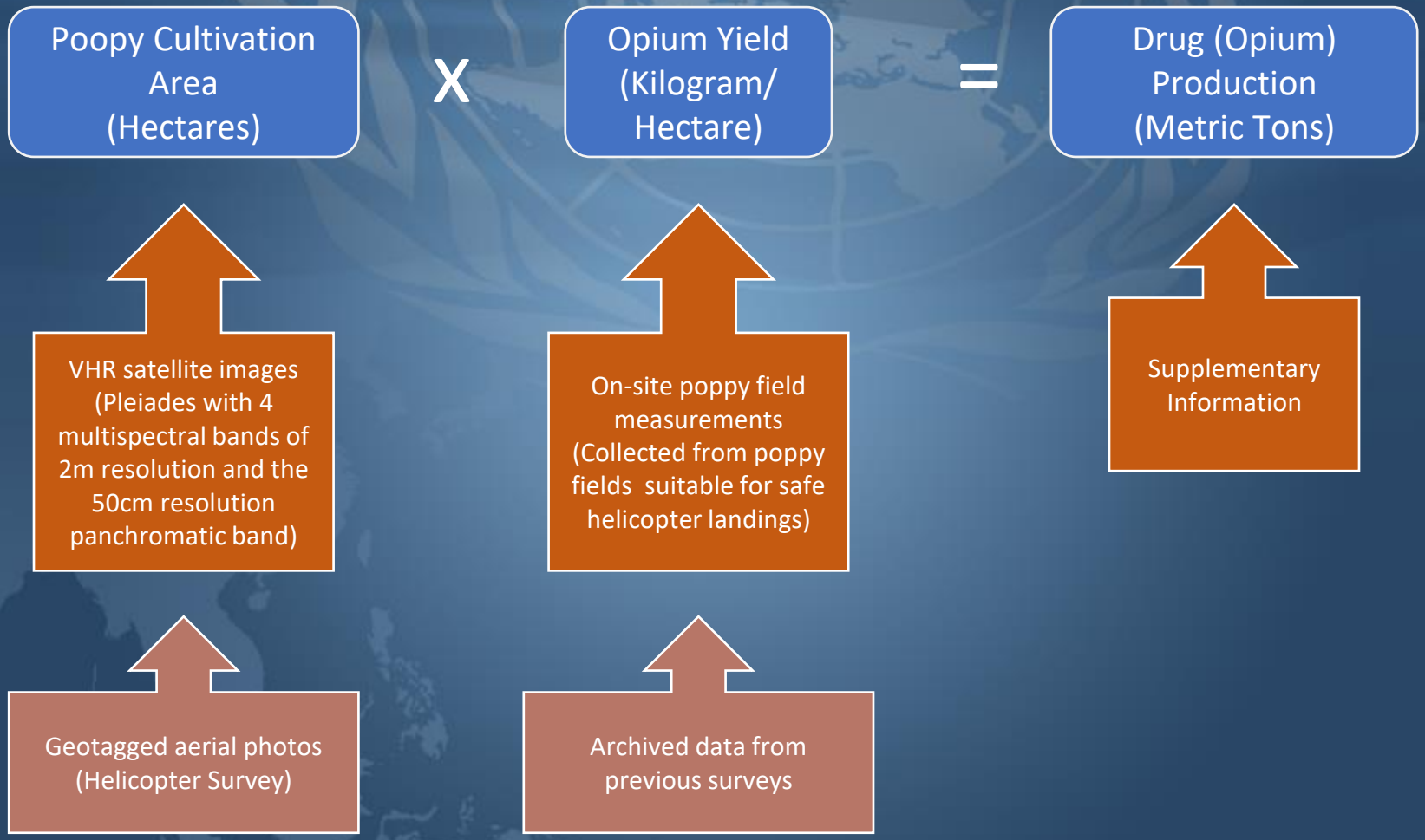
Survey method



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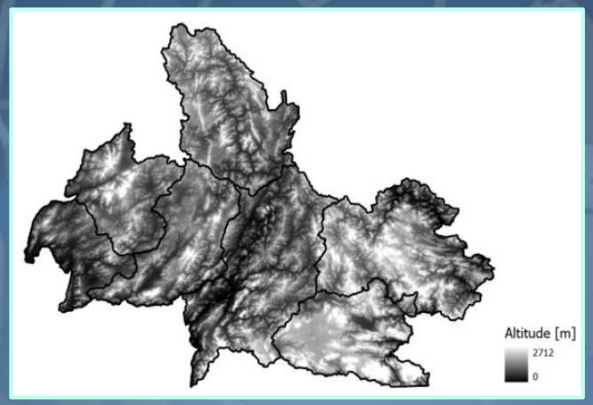
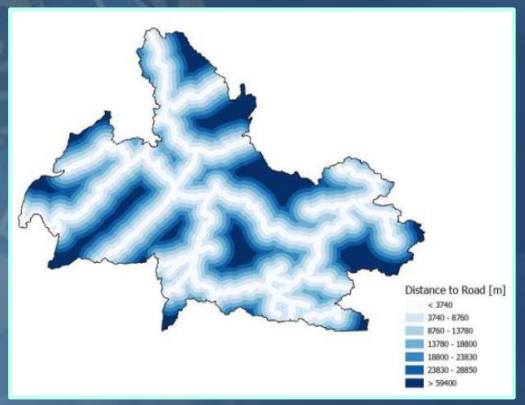
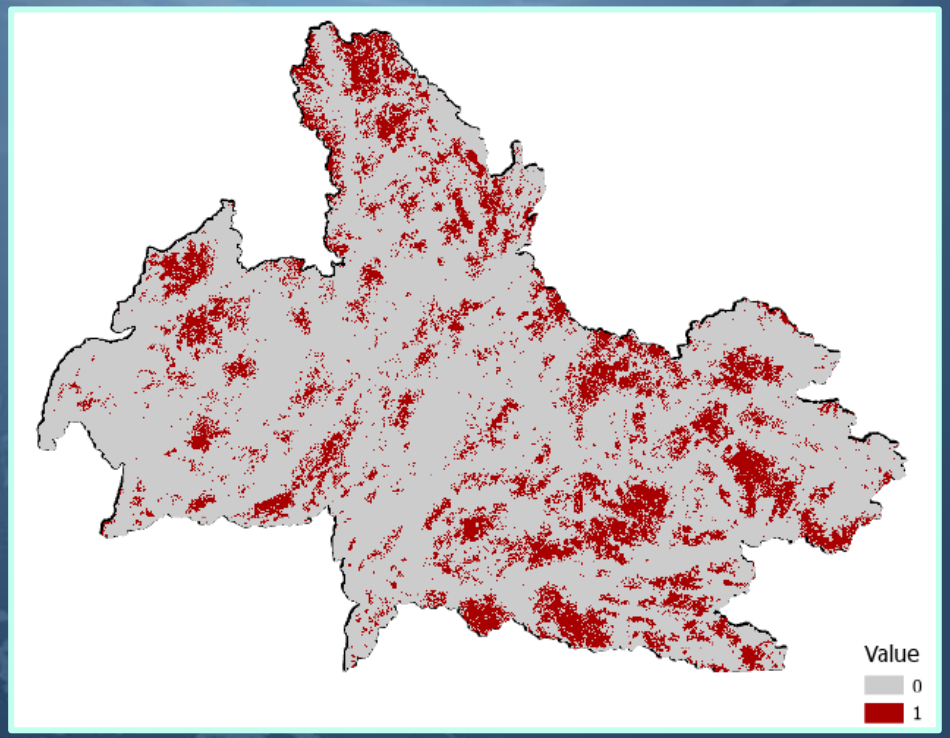
Risk Map

- Applied sampling approach. It is necessary to define an area of interest.
- The risk map was developed with the Dept. of Geoinformatics (Z_GIS), Salzburg University.
- A binary random forest (RF) model was trained using poppy occurrence data of LCDC, the data from past surveys, the distance to major roads (OSM), and DEM.







RF prediction of potential poppy occurrences (binary raster of 10x10m per pixel)

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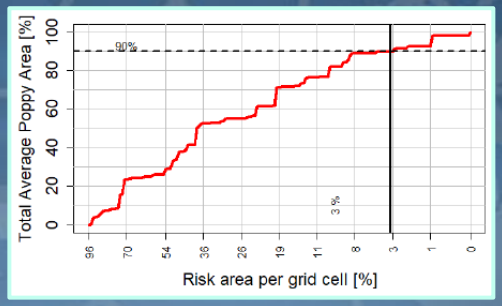
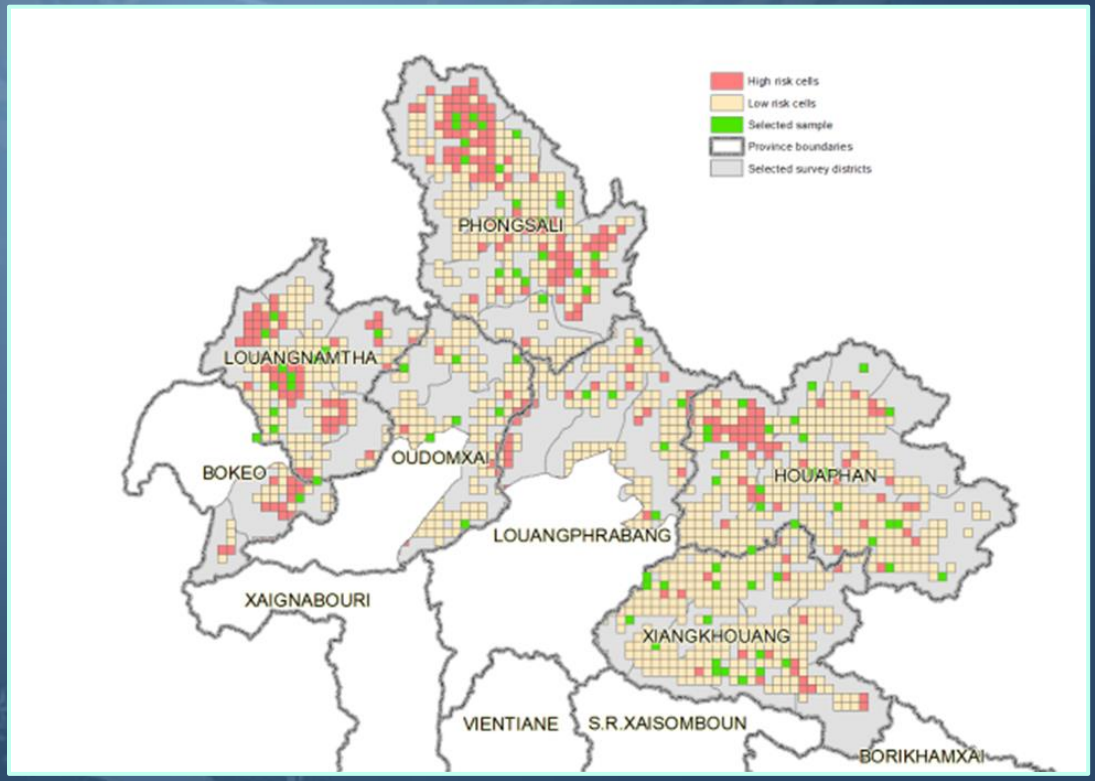
Sampling Frame & Sampling

- The risk raster were aggregated into 5 x 5 km grid.
- A 3% risk threshold was set based on the past survey data.
- The resulting 1,555 cells of the frame were eventually classified into high-risk and low-risk based on poppy occurrence between 2014 and 2019.
- The sample was selected randomly in each stratum, with 30 segments in the high-risk and 59 segments in the low-risk, a total sample size of 89 cells.





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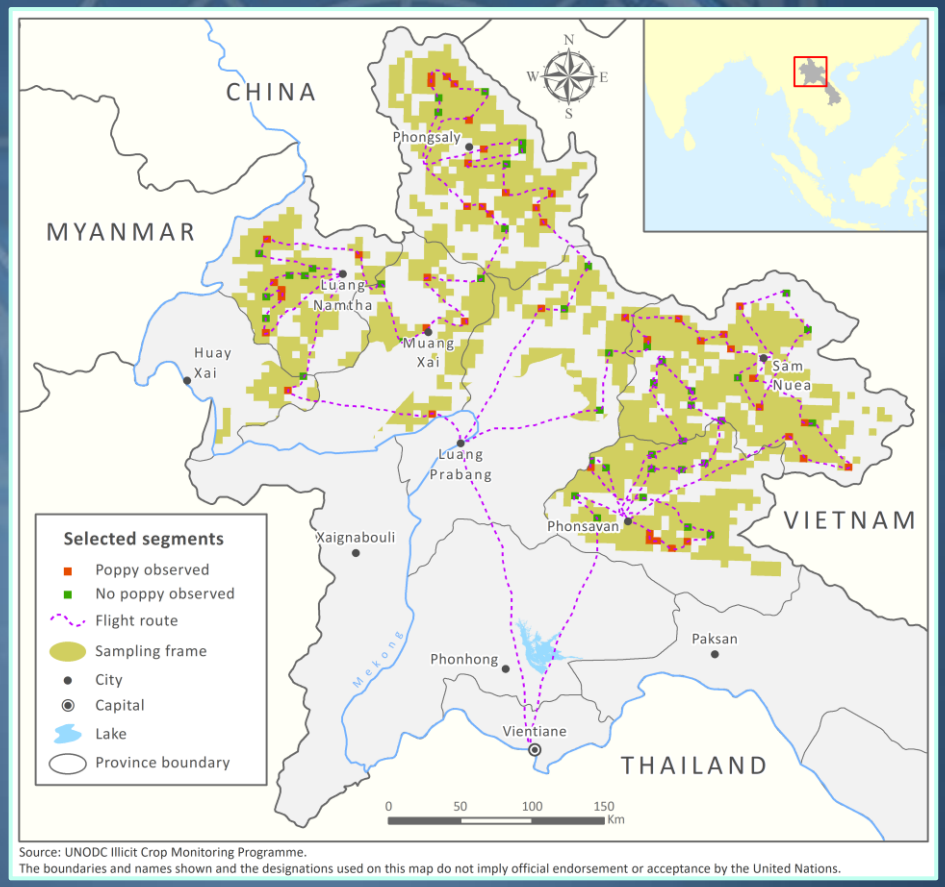
The field mission (helicopter survey)

- Each sample was thoroughly overflown and collected Gigabytes of information.
- Geotagged pictures of the poppy fields and their surrounding were taken with two GPS Reflex cameras, and the flight track was recorded with GPS devices.
- When needed (for yield data collection), the small helicopter could even land on isolated fields.



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.

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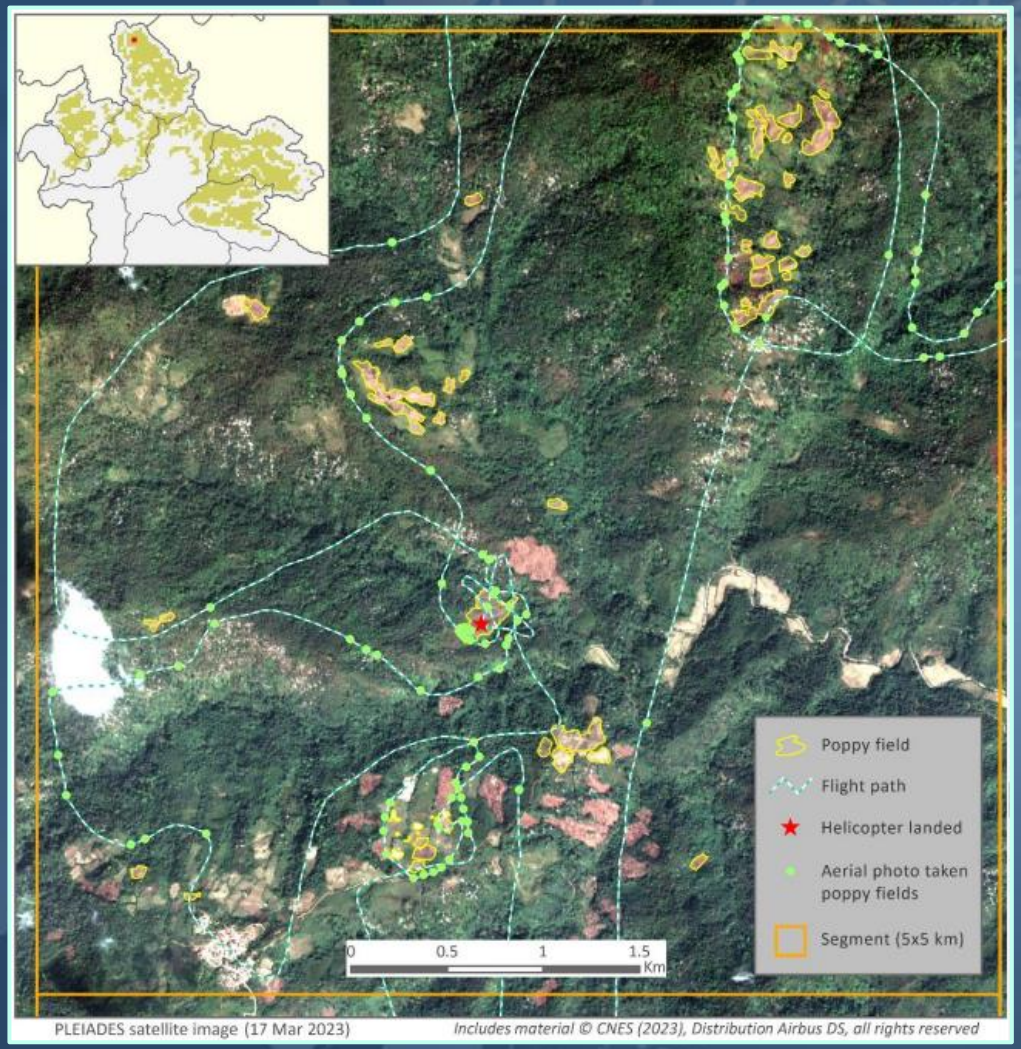
Flight route in a single segment



Pleiades satellite image (17 Mar 2023)

Aerial photo of a poppy field

The poppy field where the helicopter landed (1 Feb 2023)

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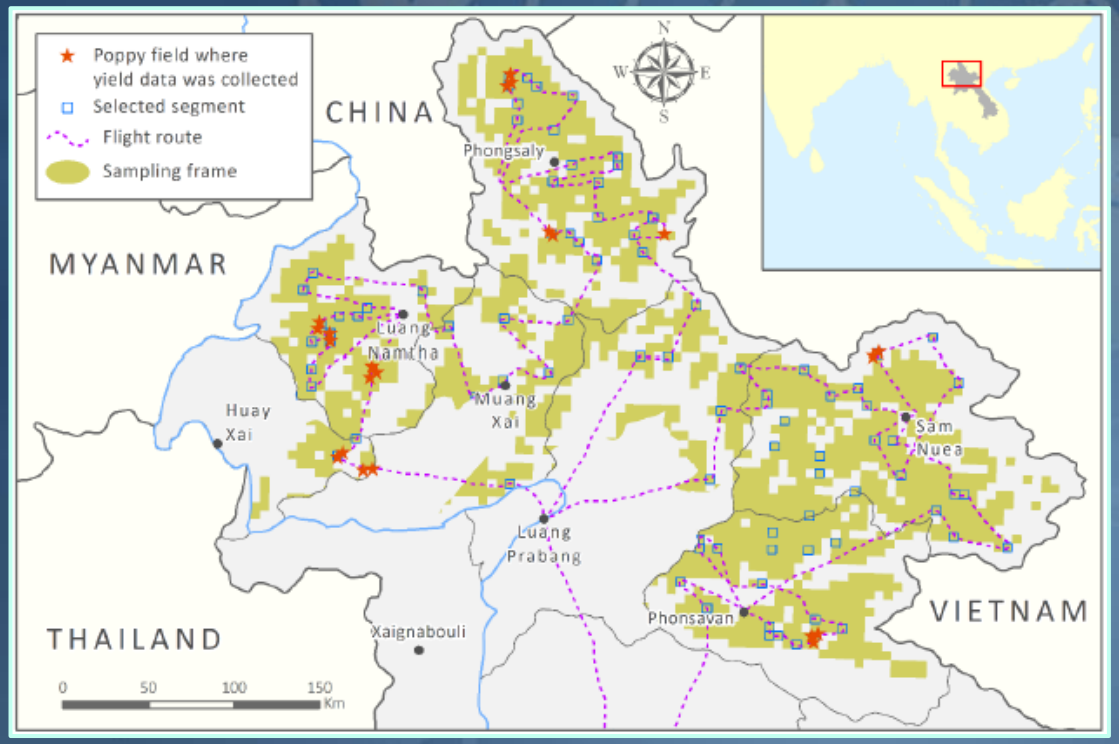
Data collection for Yield estimation



A total of 21 poppy fields were visited and collected data.

On-site data collection in poppy field

Poppy capsule measurements

Different plant stages of the poppy fields where the helicopter landed.

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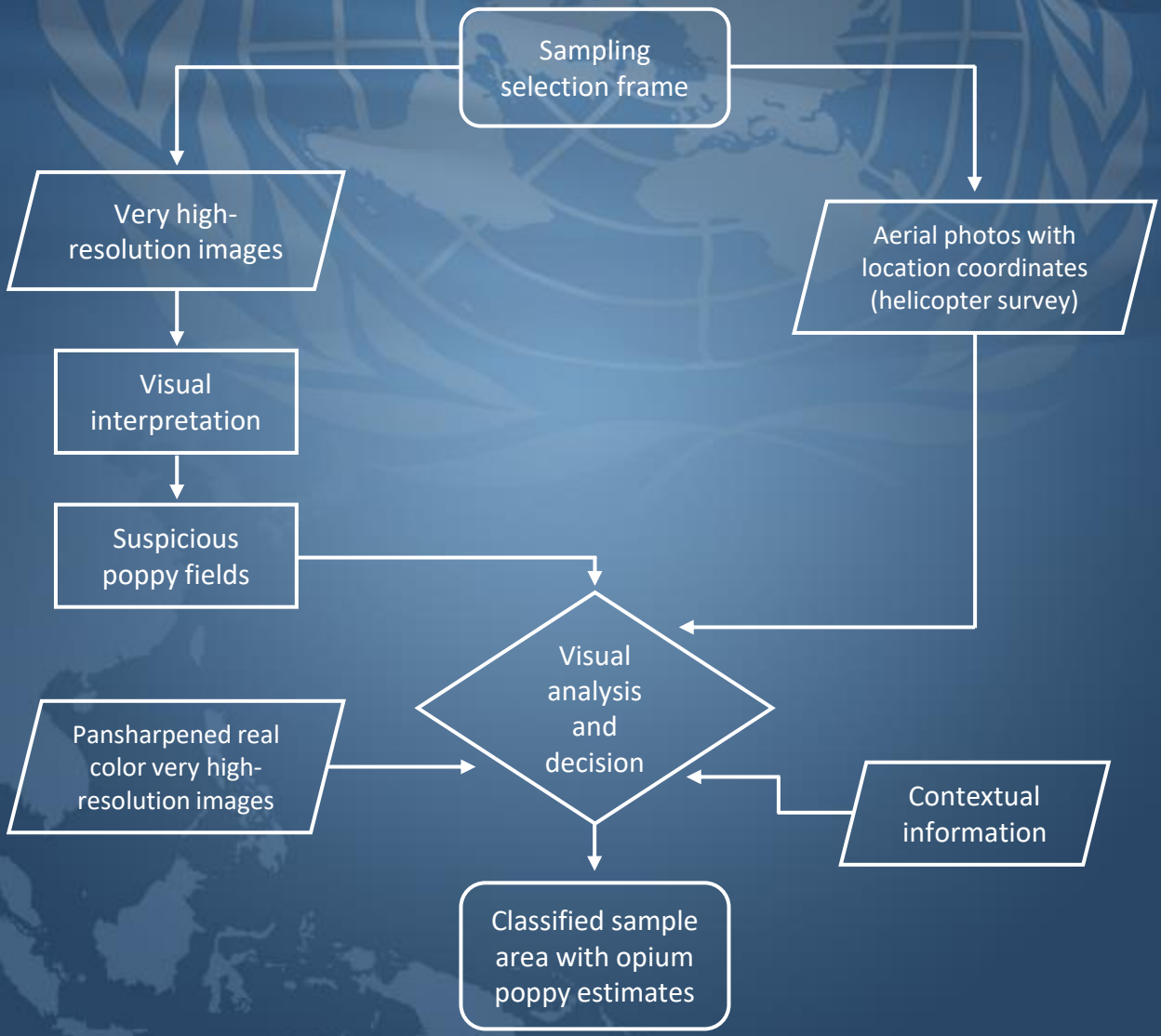
Satellite image interpretation flowchart



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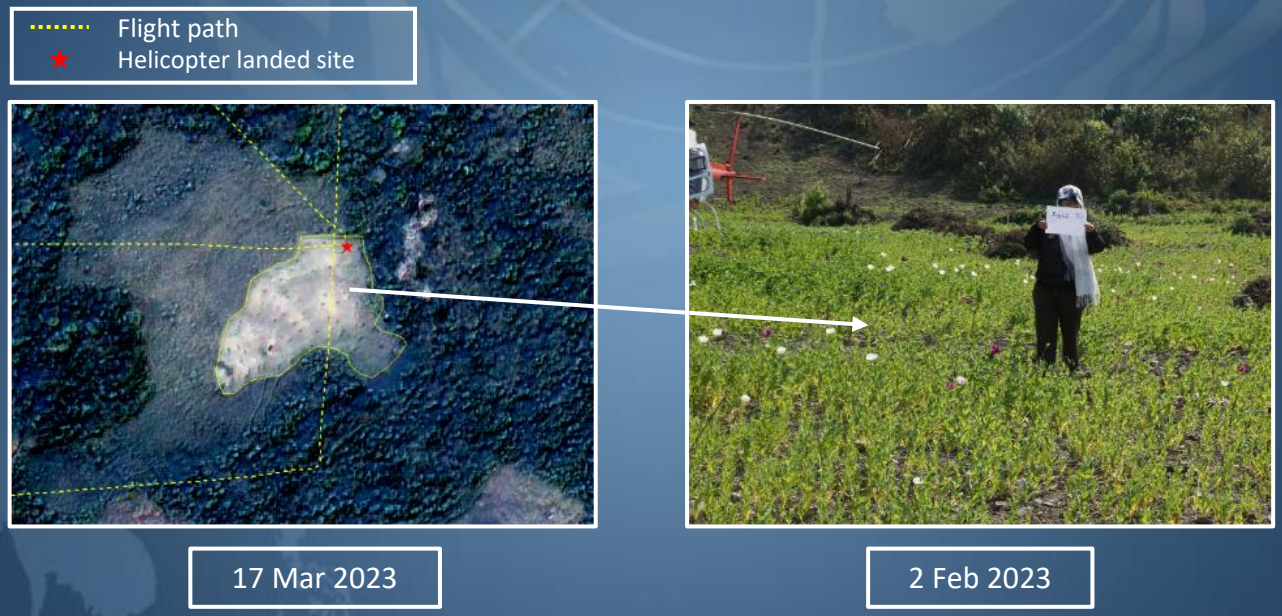
Challenges

- Satellite image acquisition was set from mid-Jan to mid-Feb, but only 38% were acquired in that period due to weather conditions. The remaining images were acquired just in Mar and Apr.

- Most poppy fields observed were not well organized and planted naturally.



There appears no-good vegetation in the VHRs that was acquired one month after field time.

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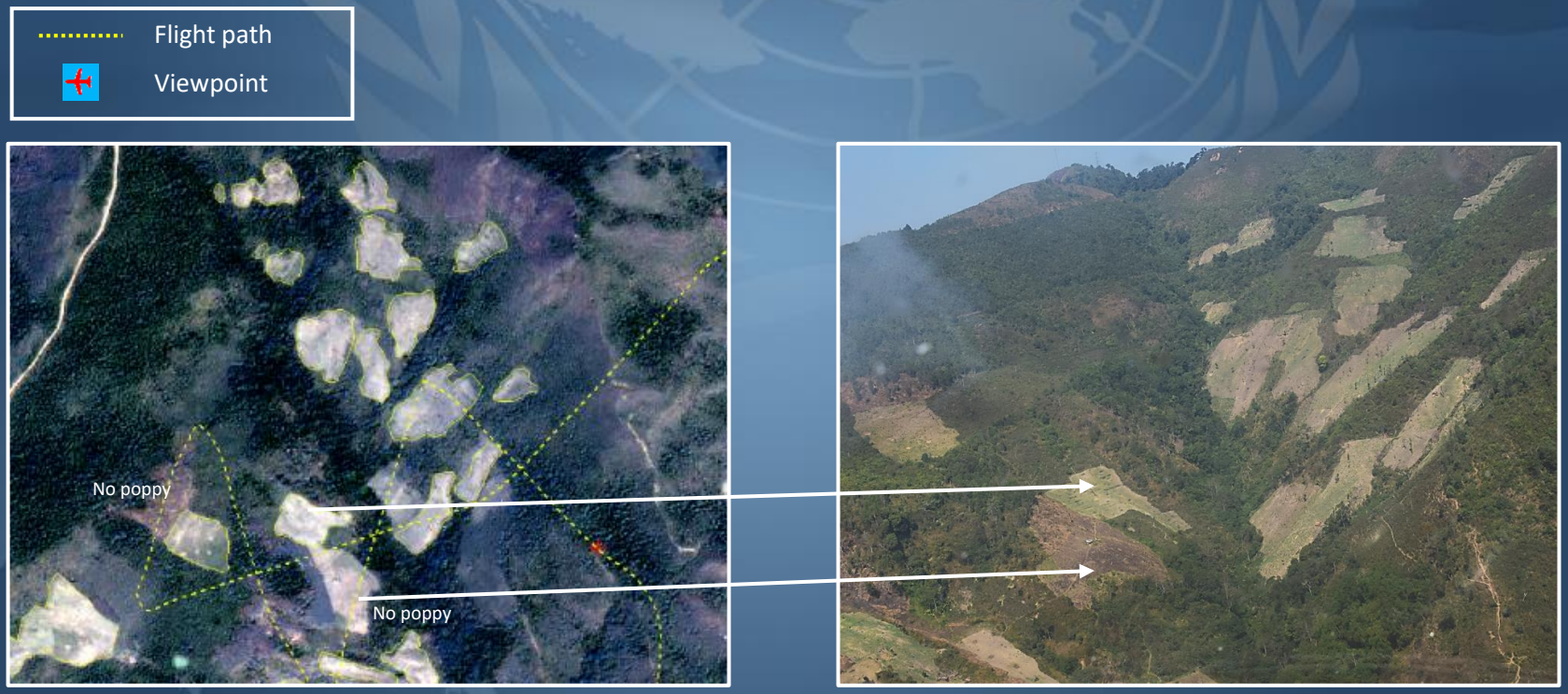
Due to the gap between image and aerial photo timing, most non-poppy plots in aerial photos appeared very similar to poppies in satellite images.



Some plots that looked like poppy fields in the aerial photos were not poppies in the satellite image.

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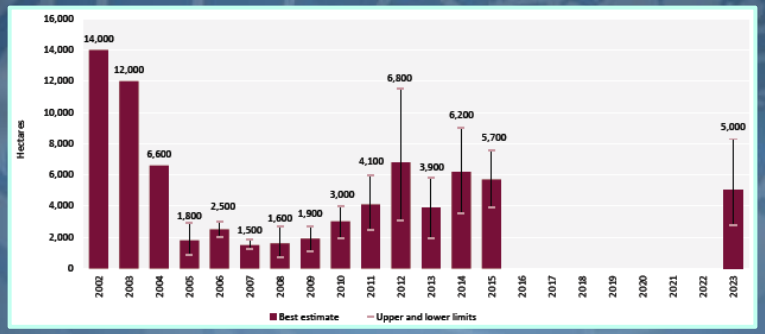
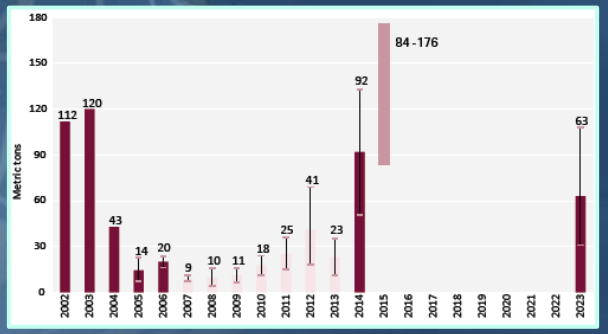
Results

- A ratio estimator was calculated as the quotient between the detected poppy area in the sample and the risk area of the sample for each stratum.
- The point estimate was then calculated multiplying the ratio estimator by the total risk area in the stratum.
- Bootstrapping was applied to estimate the confidence intervals.

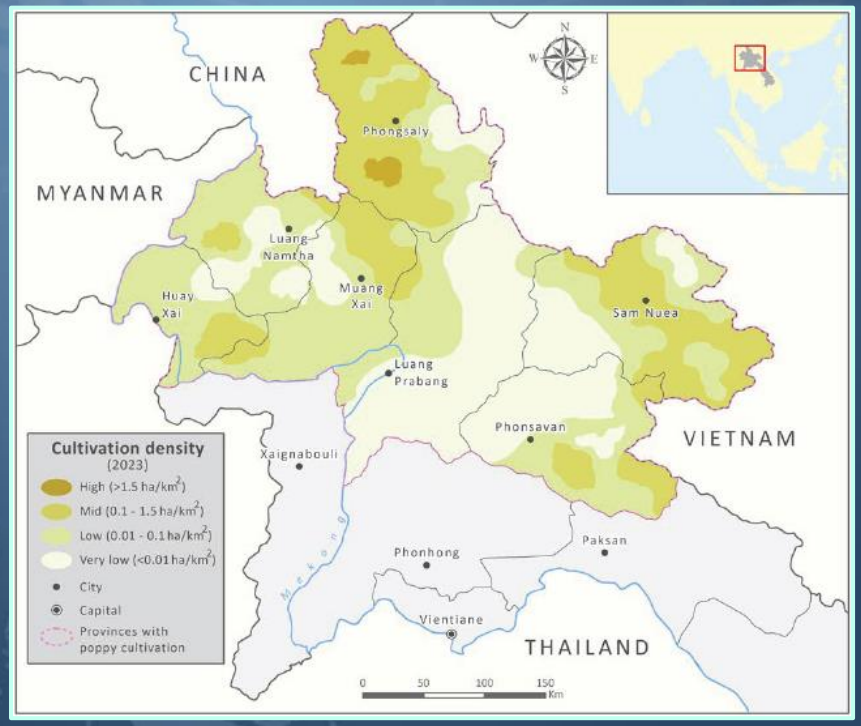
Stratum	Point	Low	High
High Risk	1,016	356	1,872
Low Risk	3,969	1,826	7,172
Total	**4,985**	**2,742**	**8,300**



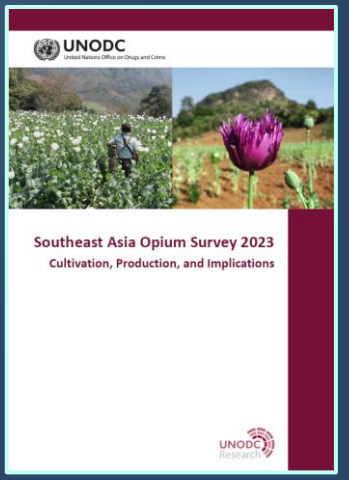
Cultivation area



Production



Cultivation density map



The report

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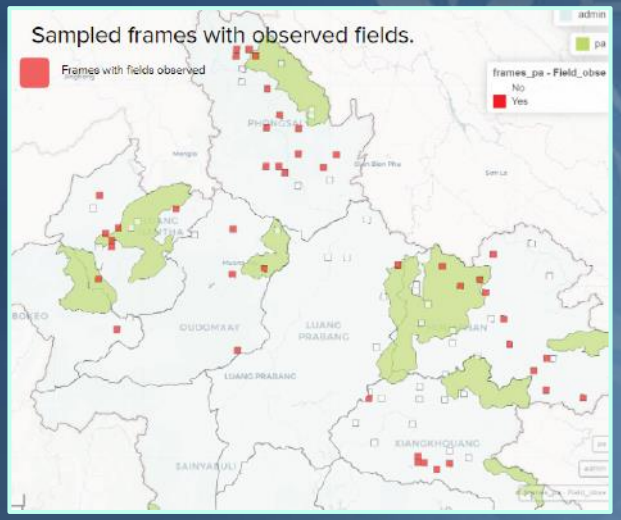
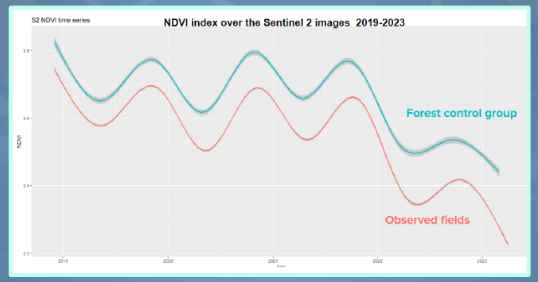
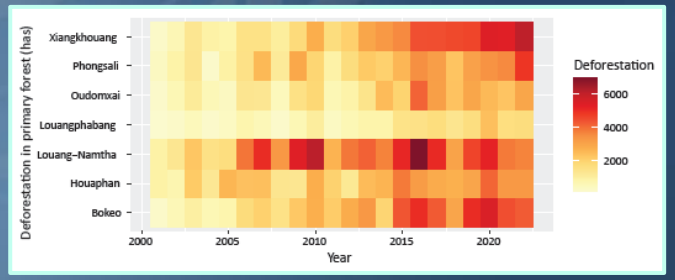
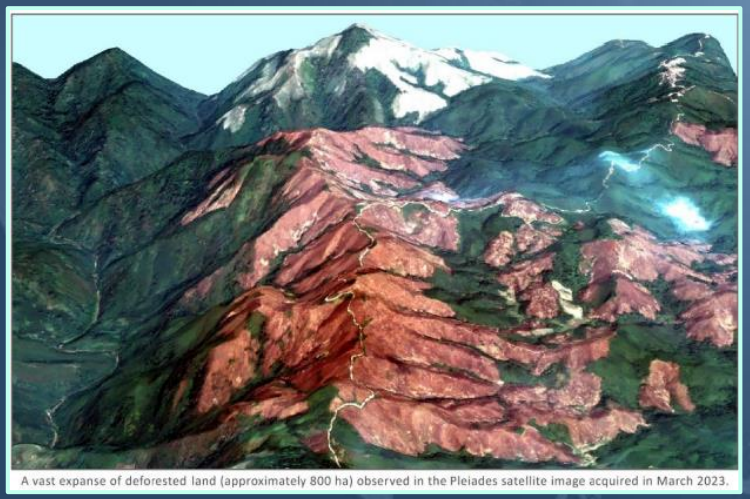
Spatial analysis of poppy cultivation associated to deforestation and protected areas



Relationships between poppy cultivation and deforestation were analyzed based on the observed poppy fields and the WRI data. Deforestation was calculated as tree cover loss in primary forest areas for the entire northern provinces and for the sampled fields. Additionally, an analysis was carried out using the GEE platform on the NDVI calculated on Planet and Sentinel images for a time series of observed fields






A vast expanse of deforested land (approximately 800 ha) observed in the Pleiades satellite image acquired in March 2023.

Pleiades VHR, Mar 2023


The same area observed in the Planet-NICFI monthly mosaic image (September 2022), prior to the forest clearances.
The satellite images were draped on SRTM Digital Elevation Model (DEM) for 3D visualization. Includes materials ©CNES (2023), Distribution Airbus DS, and Planet-NICFI programme, all rights reserved.

Planet-NICFI, Sept 2022

	Deforestation 2022-2022	Forest 2001	Deforestation rate 2002 to 2022
Bokeo	59,314	348,213	17.0%
Houaphan	52,193	575,774	9.0%
Louang-Namtha	83,265	509,407	16.4%
Louangphabang	20,408	290,236	7.0%
Oudomxai	36,984	252,752	14.6%
Phongsaly	46,858	530,641	8.8%
Xiangkhouang	60,743	511,317	11.9%

sanlwin.htwe@un.org