



# UNODC

United Nations Office on Drugs and Crime

## The use of geospatial data for monitoring areas with illicit crop cultivation



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UNWGIC, Deqing, November 2018






## Illicit crop monitoring programme

- Annual surveys in main coca and opium growing countries, some cannabis
- Since early 2000s
- Monitoring variables:
  - Area (hectares)
  - Yield (kg/ha)
  - Production (tons/year)
  - Prices
  - Socio-economic data of farmers

# Where does UNODC monitor crops?

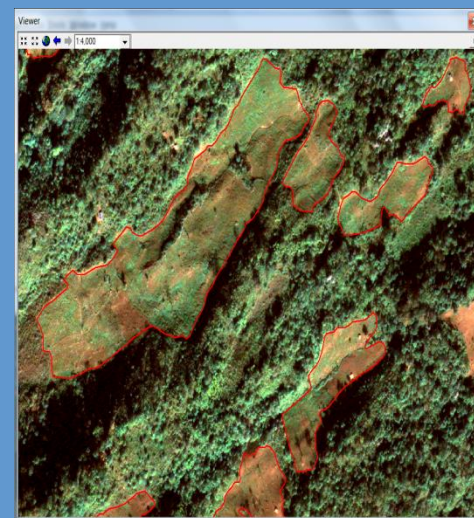
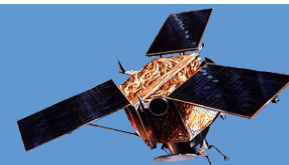
Vienna – Research and Trend Analysis Branch  
Expert advise, project support, quality control,  
remote sensing, statistics, survey design

Survey teams in Afghanistan, Bolivia, Colombia,  
Mexico, Myanmar, Peru, with each 3 – 30 persons.

-  Opium poppy
-  Cannabis
-  Coca
-  Active projects
-  Monitored in the past

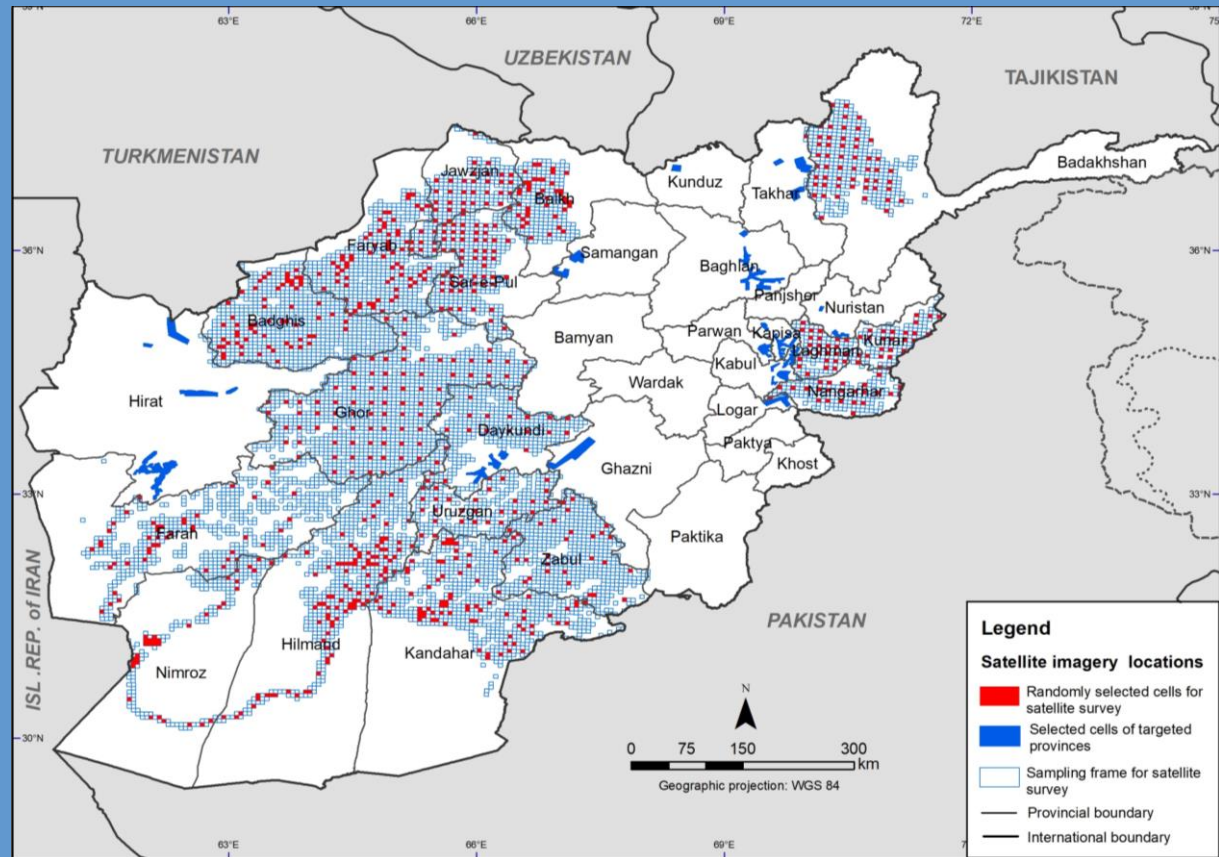
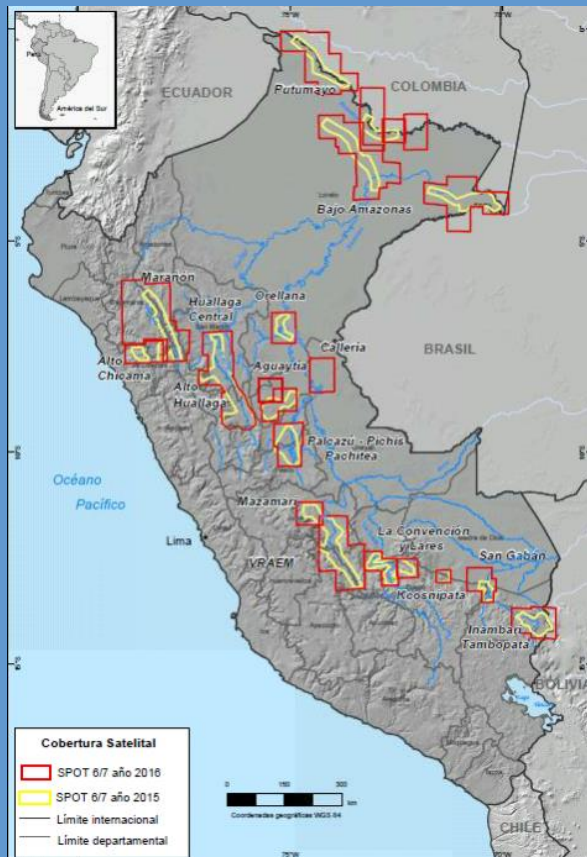
# Challenges for illicit crop monitoring using remote sensing

- Often small fields distributed over large mountainous areas
- Difficult access and limited ground truth information
- Visual interpretation using mixture of information from spectral characteristics, two-date imagery, context information, overflights, former surveys, eradication data
- Difficult to automate



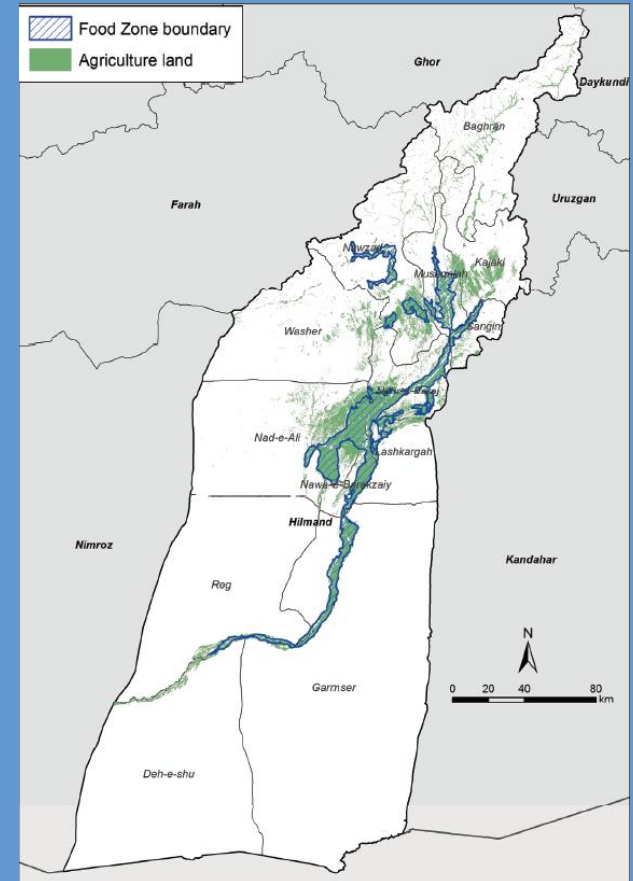
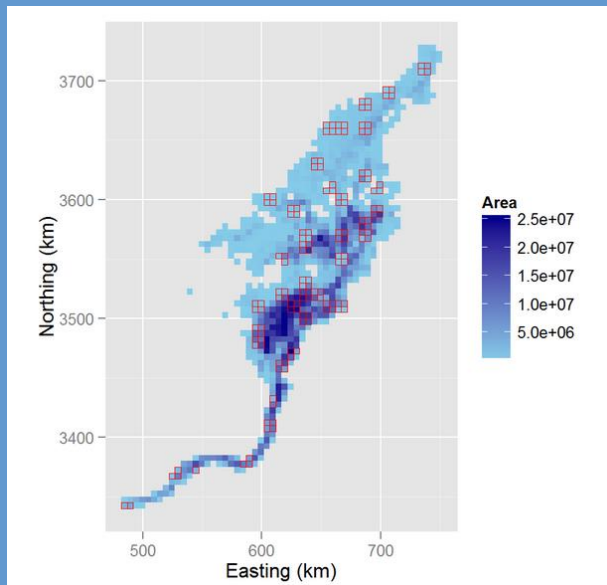
# Full coverage mapping and sampling approaches

Very high / High / Medium resolution remote sensing imagery



# Sampling frames: mapping potential growing areas

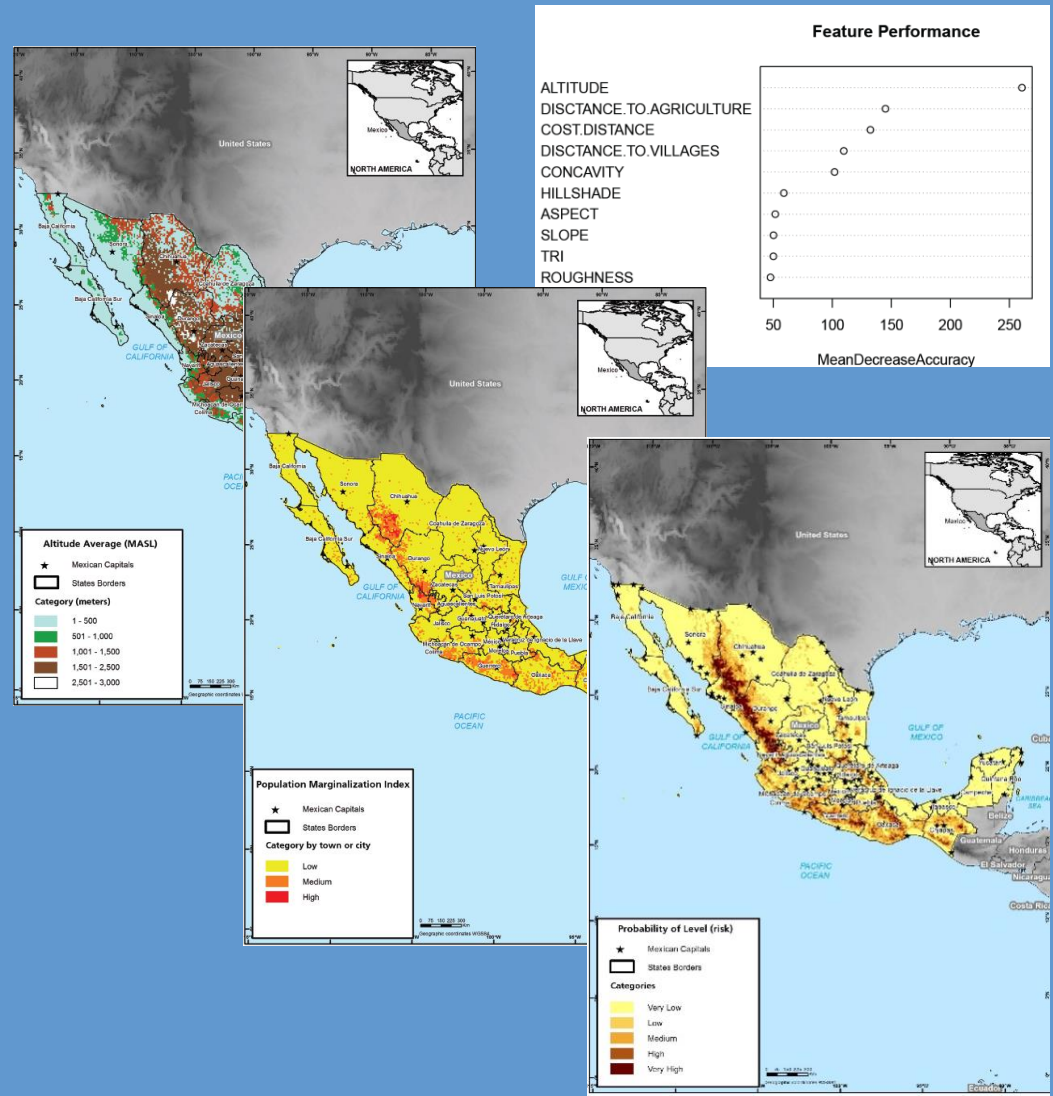
- Agricultural areas in Afghanistan using medium resolution satellite images
- Spatial simulations of potential crop areas to test sampling methods



# Mapping of potential opium poppy cultivation areas

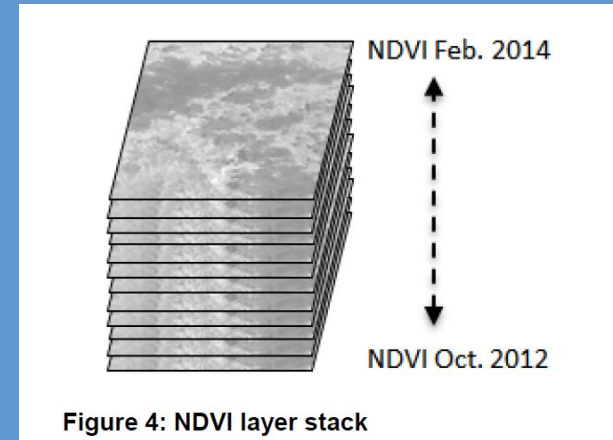
Biophysical and socio-economic indicators from village/farmer surveys and secondary data:

- Altitude
- Slope
- Accessibility
- Population
- Poverty indices
- Presence of armed groups
- Land cover, etc.



# Time series investigation: vegetation index or rainfall

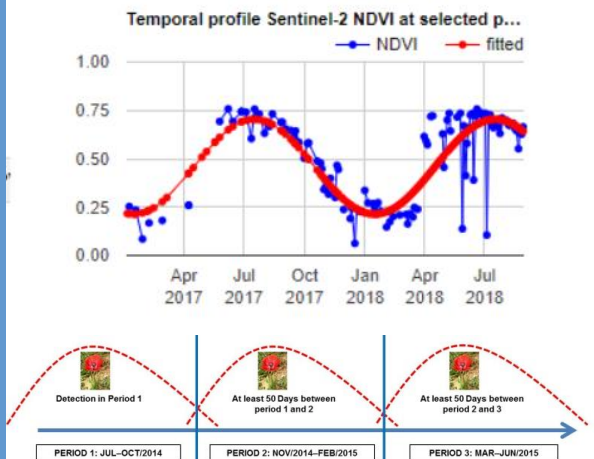
- Vegetation indexes:
  - Optimum timing for VHR acquisition
  - As aid to differentiate from other crops
  - Multi-cropping in a year
- Rainfall data from satellites:
  - Anomalies / drought



## Time series viewer

### 3) Pick pixel of interest

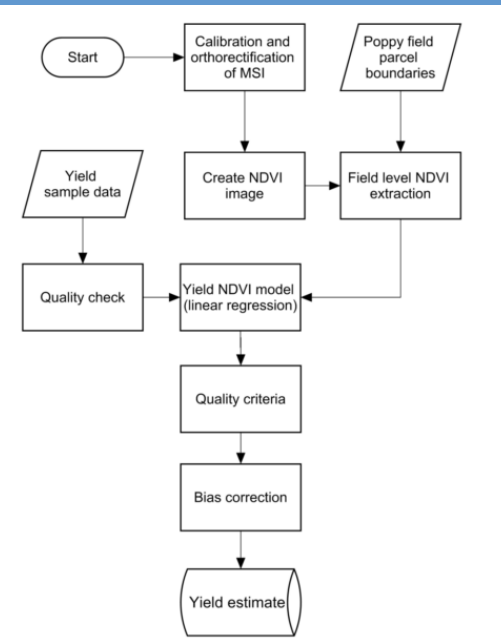
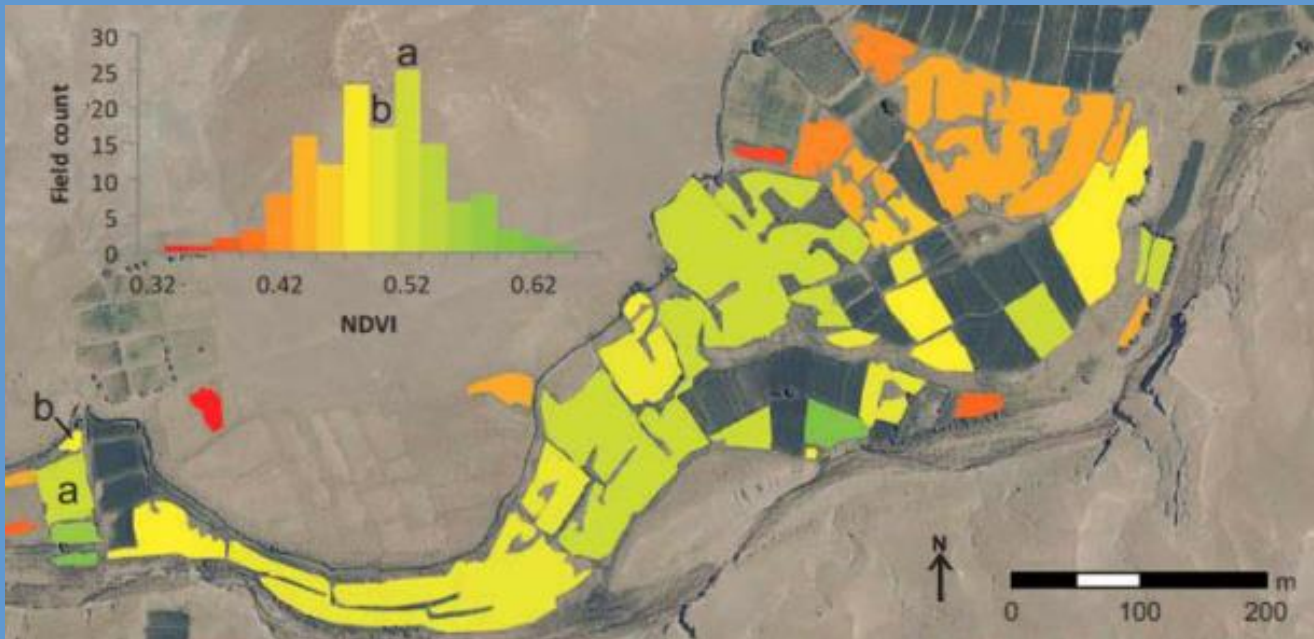
NDVI, S1 Backscatter, Cumulated Precipitation



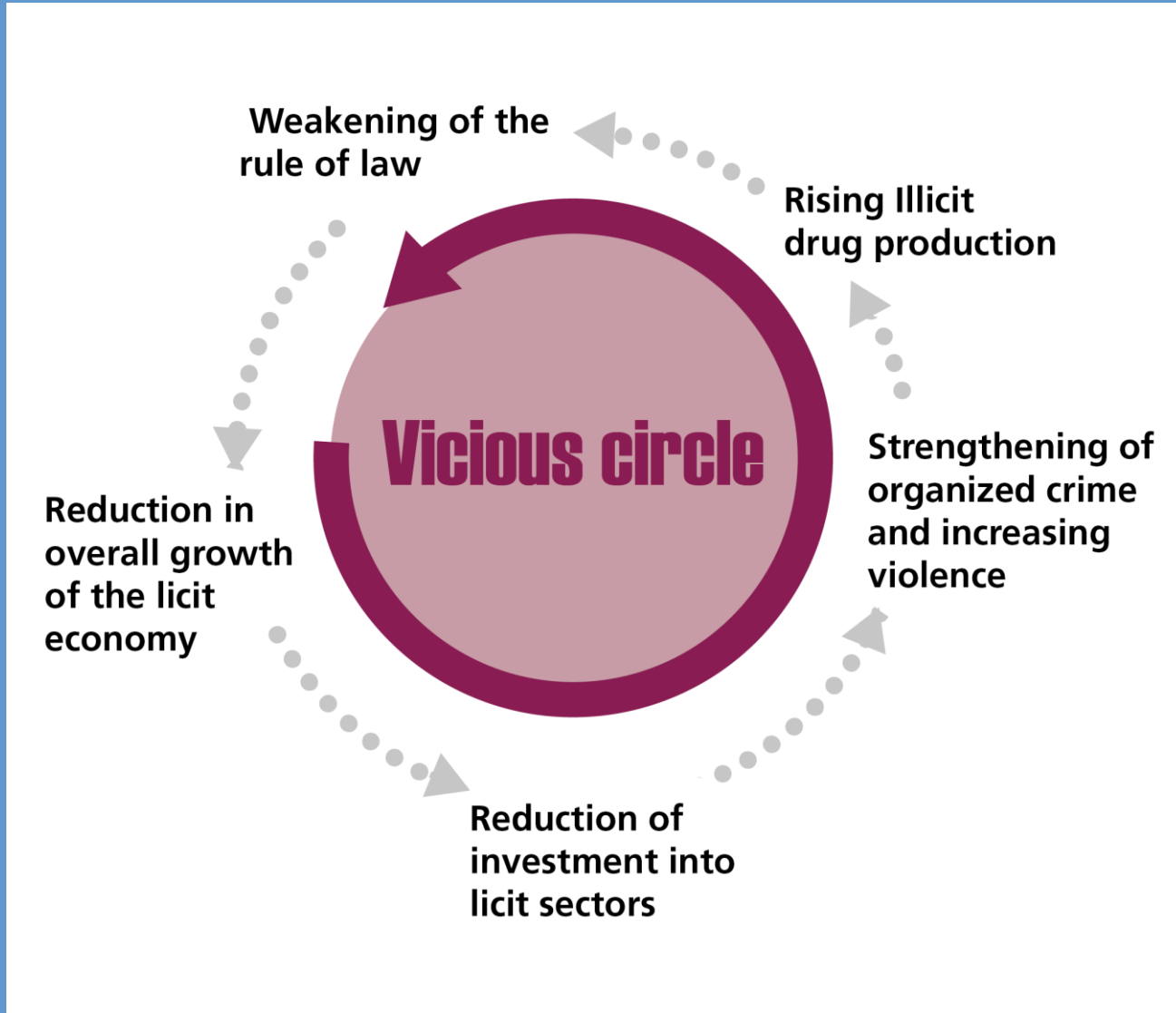


# Bias correction of yield measurements

- Models to correct for selection bias in the fields to measure yields
- Challenge: sufficient ground truth data for calibration

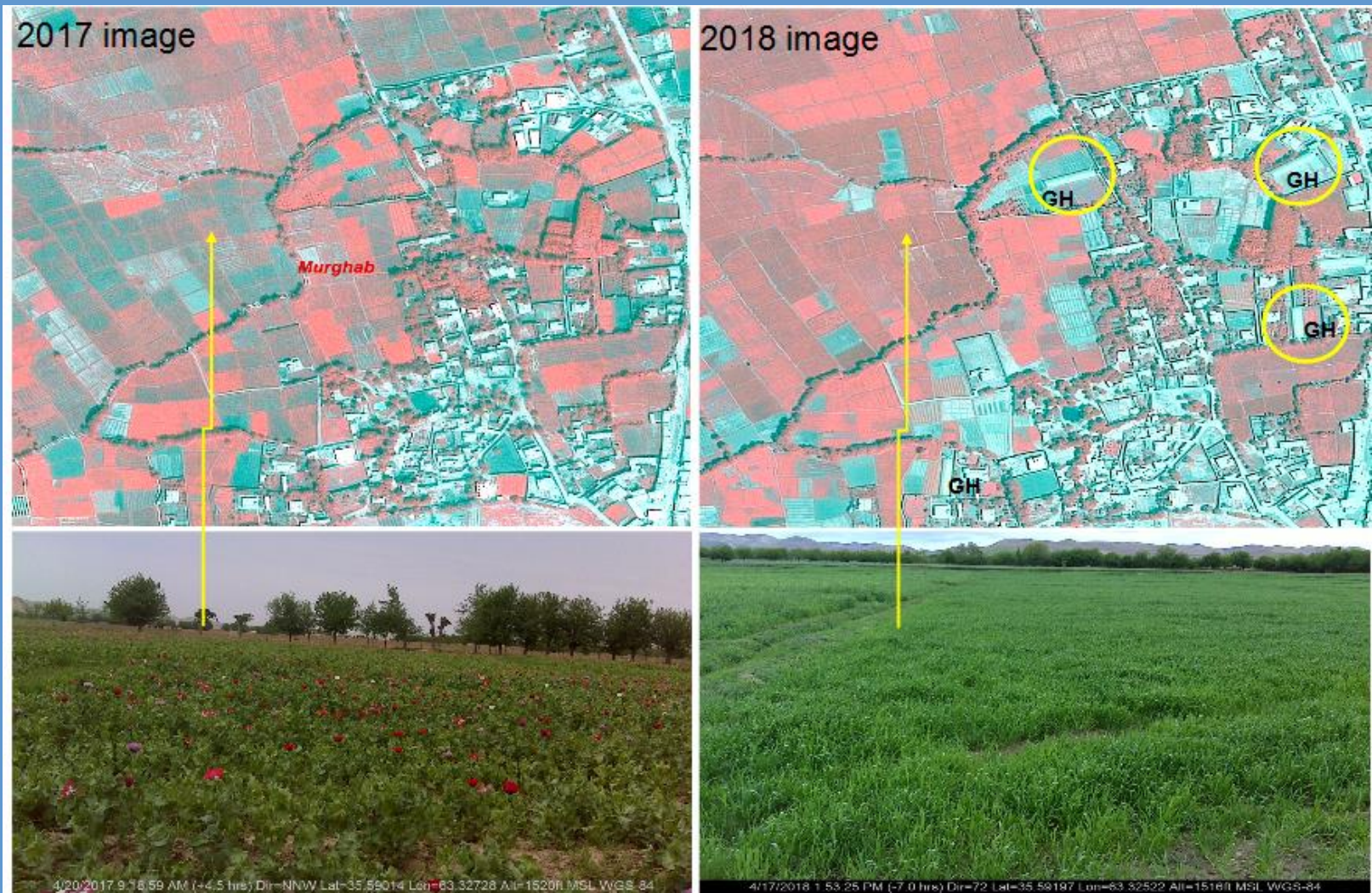


# Vicious circle of illegal drug production





## Impact assessments of development programs

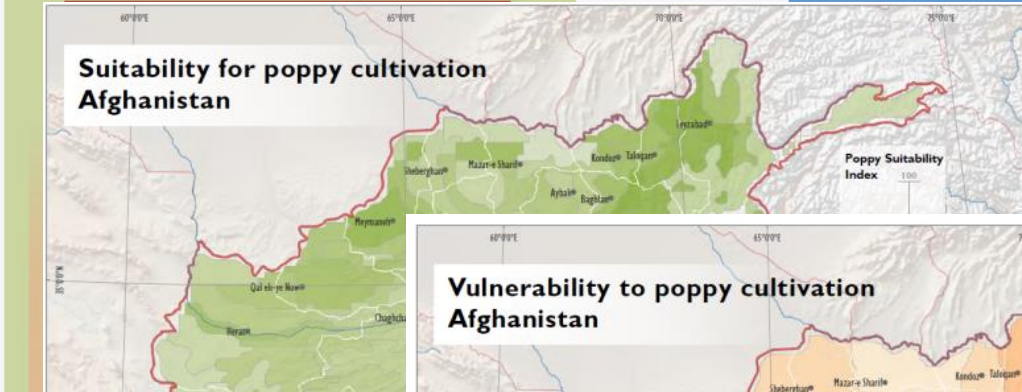


## Socio-economic data about farmers and farming

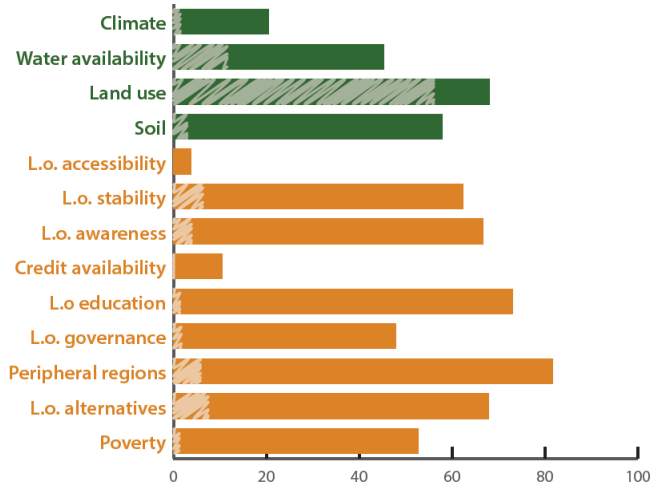
- Extensive data collection in Afghanistan and Myanmar
- Hundreds of villages visited each year
- Information about the crops, costs, income, reasons for growing illicit crops, security situation, etc.
- Price data from informants



# Spatial risk analysis to facilitate policy decisions in Afghanistan



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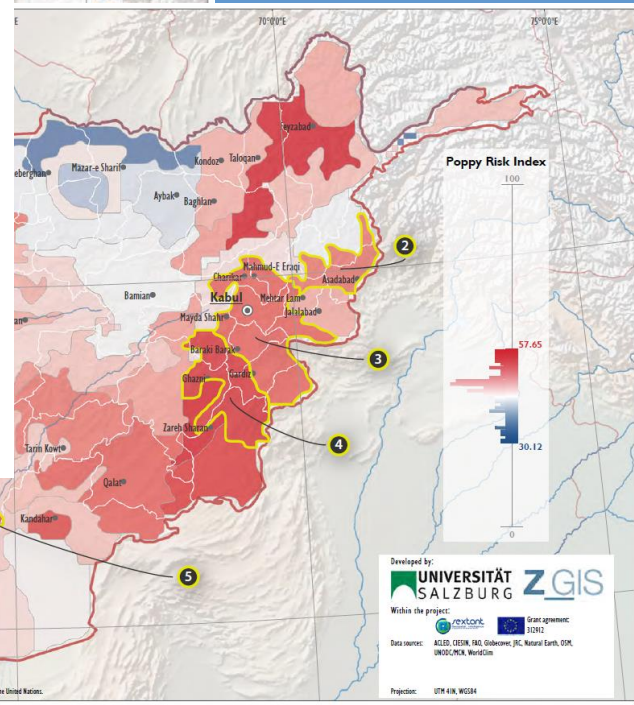


**Environmental Suitability** (Green)

**Social Vulnerability** (Orange)

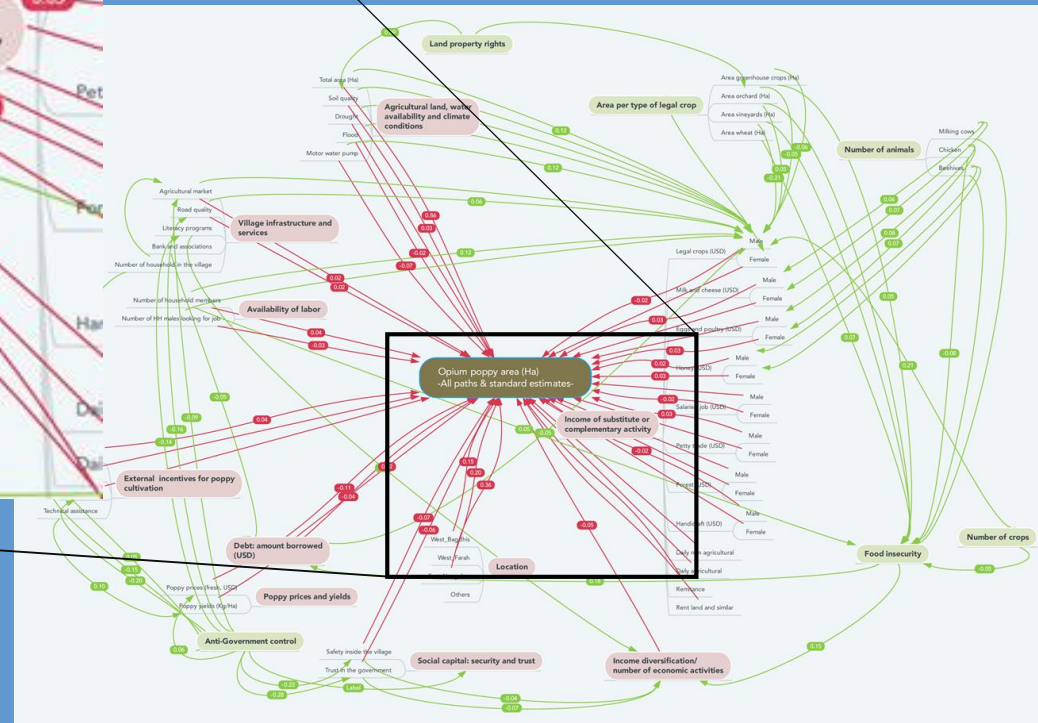
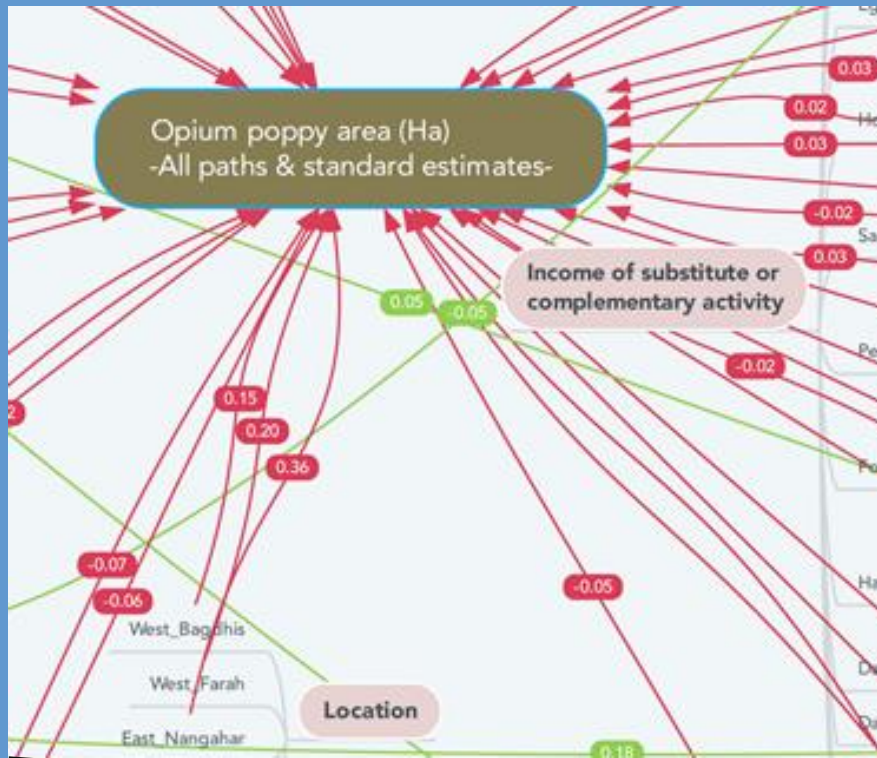
Mean indicator value per region (Normalised between 0-100)

Weighted mean indicator value per region (Sum adds up to 100)



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

# Multiple factor analysis – theory of change







## Conclusions

- Illicit crop monitoring is strongly dependent on remote sensing: satellite images and geographic data collected from the air
- Challenges to get independent ground truth data to validate and calibrate
- Secondary geospatial information is used to build sampling frames
- Detailed information generated for the evaluation of impact of policies and projects, also in a geospatial manner

# Thank you!


 **UNODC**  
United Nations Office on Drugs and Crime


  
Central Commission for Drug Control


**Evidence for enhancing resilience to opium poppy cultivation in Shan State, Myanmar**


Implications for alternative development, peace, and stability

March 2017

  
UNODC Research


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Islamic Republic of Afghanistan  
Ministry of Counter Narcotics





**Afghanistan Opium Survey 2018**  
Cultivation and Production


NOVEMBER 2018

  
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Oficina de las Naciones Unidas  
contra la Droga y el Delito


  
MÉXICO  
GOBIERNO DE LA REPÚBLICA



**México**  
Monitoreo de Cultivos de Amapola  
2014-2015

Sinaloa  
Chihuahua  
Durango

JUNIO 2016

  
UNODC Research

<https://www.unodc.org/unodc/en/crop-monitoring/>