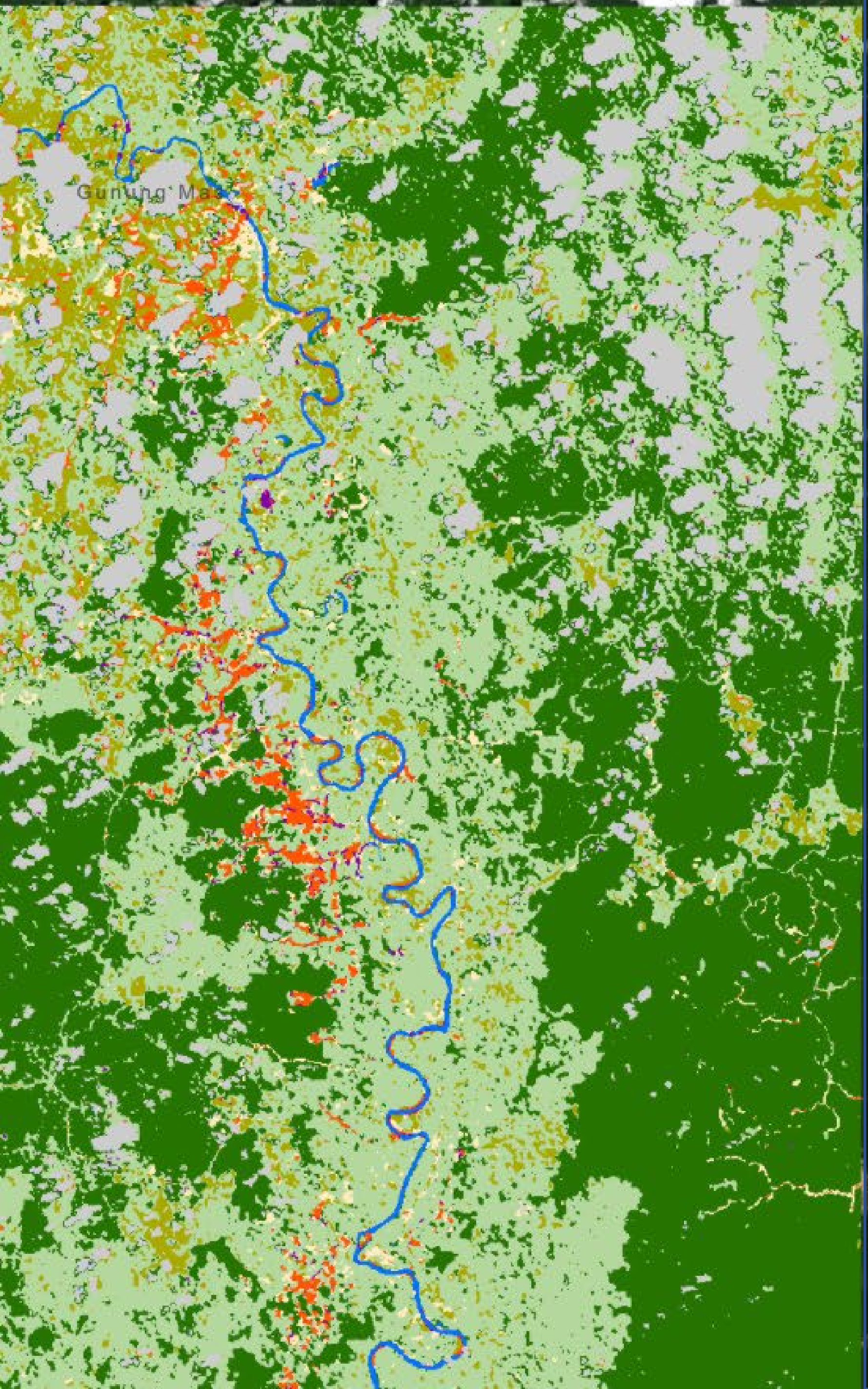

Remote Sensing in support of ASGM policy development, implementation and evaluation

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Session 3: Impact of illegal economies on the environment: monitoring of illegal mineral mining

UN environment
United Nations Environment Programme

UN environment programme GRID Geneva

MINAMATA CONVENTION ON MERCURY

ARTISANAL AND SMALL-SCALE GOLD MINING

Produces up to **20% of world's gold**

Employs **15 million people** typically in remote **rural areas**

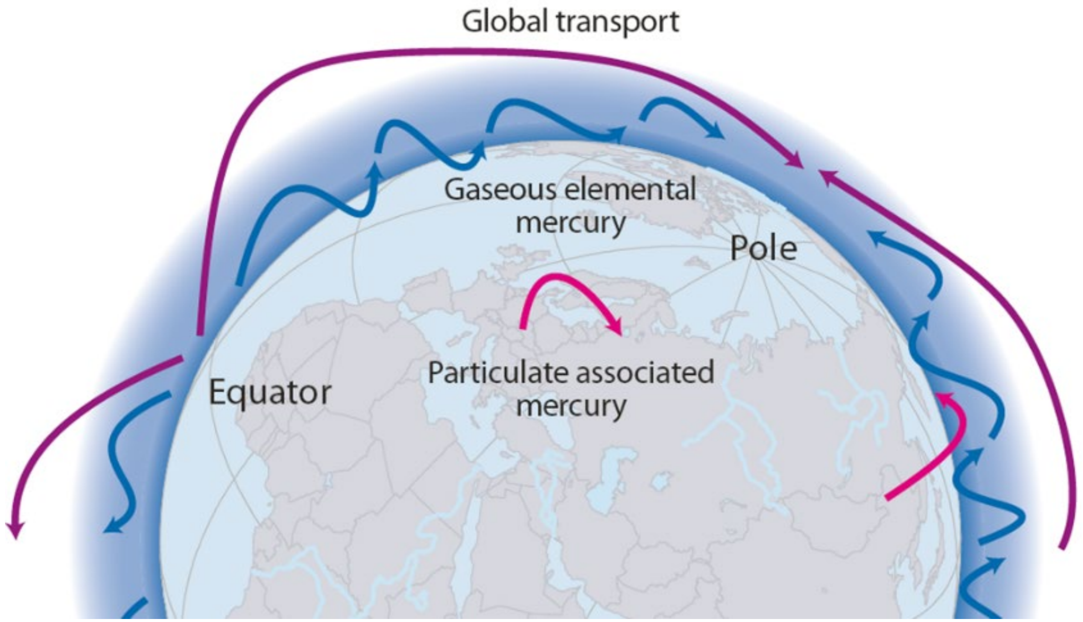
Involves **4 to 5 million women and children**

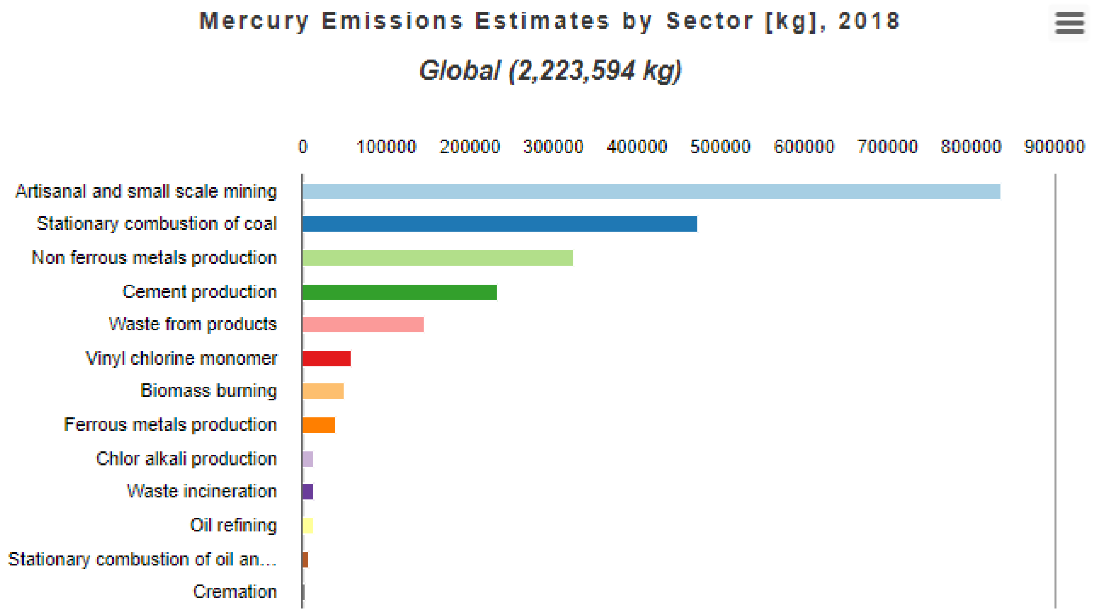
Takes place in **70 countries** and often in areas where there is **limited economic opportunity**

Releases **35% of all mercury** pollution to the environment

Is often considered as **informal sector**

Mercury: A Global Pollutant



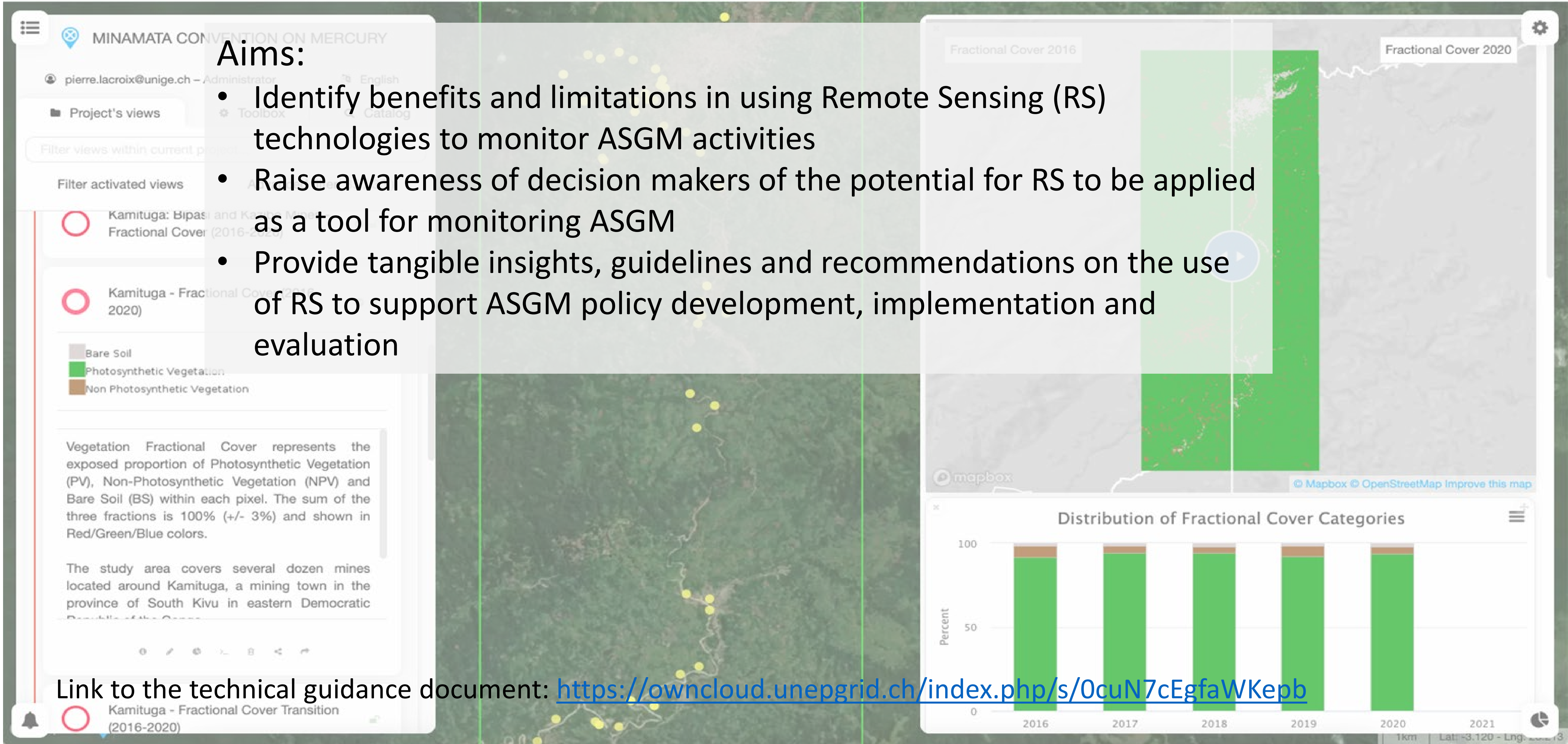


Development of a technical guidance document

Aims:

- Identify benefits and limitations in using Remote Sensing (RS) technologies to monitor ASGM activities
- Raise awareness of decision makers of the potential for RS to be applied as a tool for monitoring ASGM
- Provide tangible insights, guidelines and recommendations on the use of RS to support ASGM policy development, implementation and evaluation

Link to the technical guidance document: https://owncloud.unepgrid.ch/index.php/s/0cuN7cEgfaWKepb



Outputs: 1. identification of benefits of using RS for ASGM monitoring

- In terms of analysing large areas
- Analysing back in time
- Analysing inaccessible/remote areas
- Scalability
- Combining multispectral information (optical and radar)
- Integrating RS results with other geographical or in-situ data in GIS software to understand correlations between different factors
- In terms of the increasing availability of processing platforms, pre-processed data and available tools
- Land use/land cover methods applied to ASGM will likely increase their accuracy and ease of use through time
- Same for RS data spatial and temporal resolution

Outputs: 2. limitations (non-technical) of using RS for ASGM monitoring

- Technical competences are present in scientific communities but not always in policy agencies and governmental agencies

- Technical competences are not always present in local mining associations and local communities, decreasing their involvement in the monitoring process and the policy development. This can sometimes undermine local trust and inflame tensions

- RS technology used for environmental surveillance purposes can lead to “crime mapping” and enhance socio environmental disputes

Outputs: 3. technical limitations of using RS for ASGM monitoring

- ASGM activities are not always detectable by night light emissions
- Optical imagery can be hampered by clouds
- Seasonality limits the use of optical RS data on ASGM monitoring
- Large forest canopy cover can affect the visibility of optical satellite sensors
- RS data cannot easily distinguish mining areas from bare soil; similar spectral signatures
- The medium-resolution sensors do not fully capture activities in smaller areas
- Medium-resolution satellite images have limited frequency and do not easily allow tracking the rapid evolution of ASGM activities in a given area
- The limited size of single scenes of high-resolution satellite images could result in expensive prices for projects that require several scenes to cover a large area

Outputs: 4. recommendations for governments/policymakers

- Include GIS and RS tools in programmes related to ASGM policy development
- Integrate with local knowledge
- Solicit the know-how from local universities
- Build capacity among local universities lacking technical knowledge
- Encourage multi-disciplinarity, e.g. combine RS outputs with other information (social, health, conflicts, demography)
- Involve local communities and mining associations in the elaboration of ASGM policies and programmes
- Disseminate RS outputs on cartographic media to make them understandable by a non technical audience
- Pay attention to crime mapping

Outputs: 5. recommendations for International Organizations and funders

- Build on RS tools in programmes related to ASGM policy development
- Foster collaborations with RS scientists
- Engage discussions on the consequences of RS, especially in terms of surveillance and crime mapping
- Take into account the fact that RS can highlight environmental issues but should not prevent from looking at other dimensions like social, economic
- Involve various stakeholders in programmes and projects: researchers, government officials, local communities’ representatives, artisanal miners etc.

Outputs: 6. recommendations for researchers

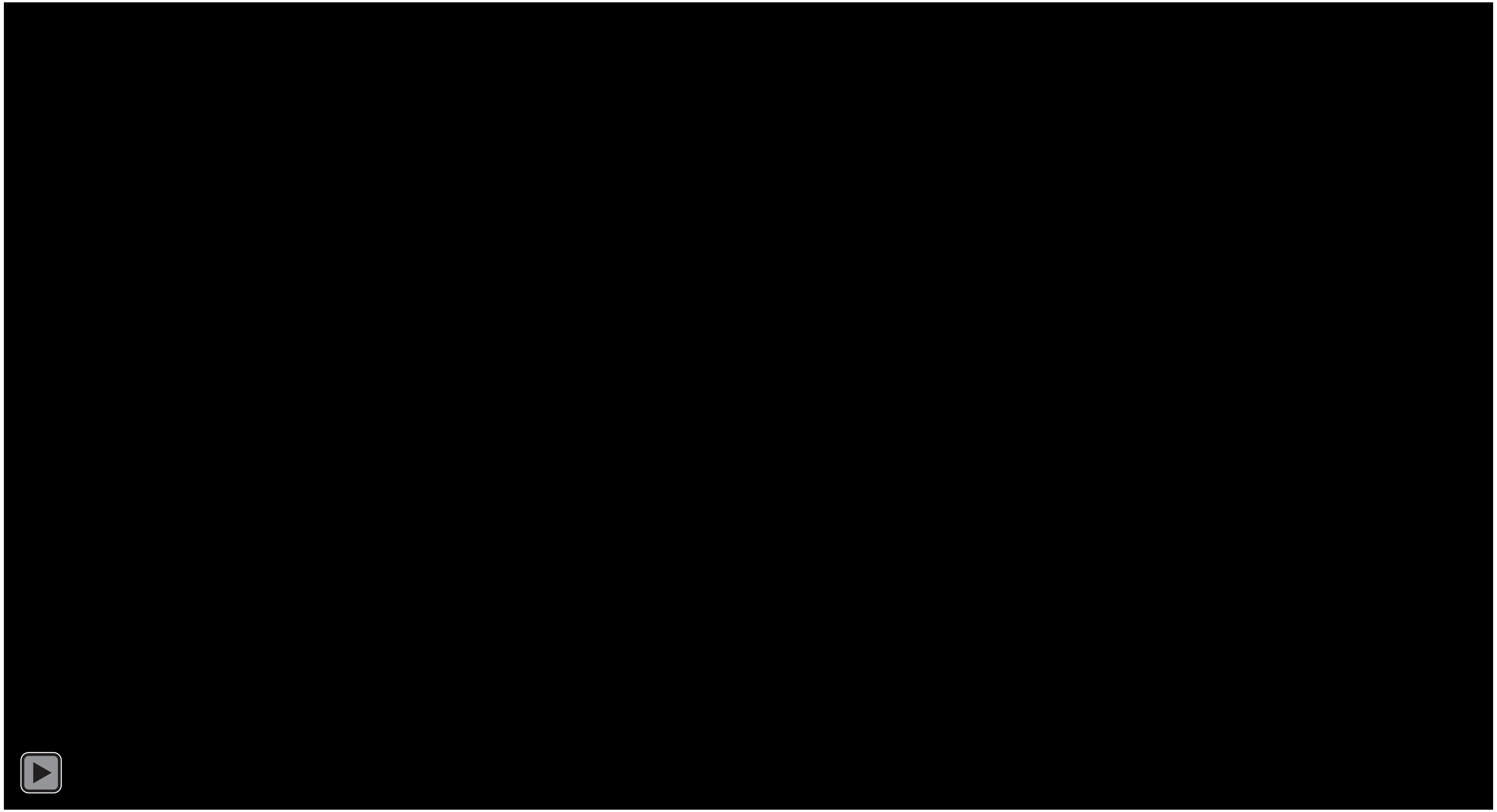
- Improve LULC methodologies applied to ASGM. In particular, the use of Machine Learning/Deep Learning techniques together with data fusion techniques (e.g., optical, radar, UAV, lidar, in-situ, crowd-sourced), time-series analysis and stack of Analysis Ready Data organized in Data Cubes are relevant means to reliable and consistent LULC information

- Integrate RS data with in-situ measurements to provide better estimates of pollutant contents and to train/validate outputs of ML/DL algorithms

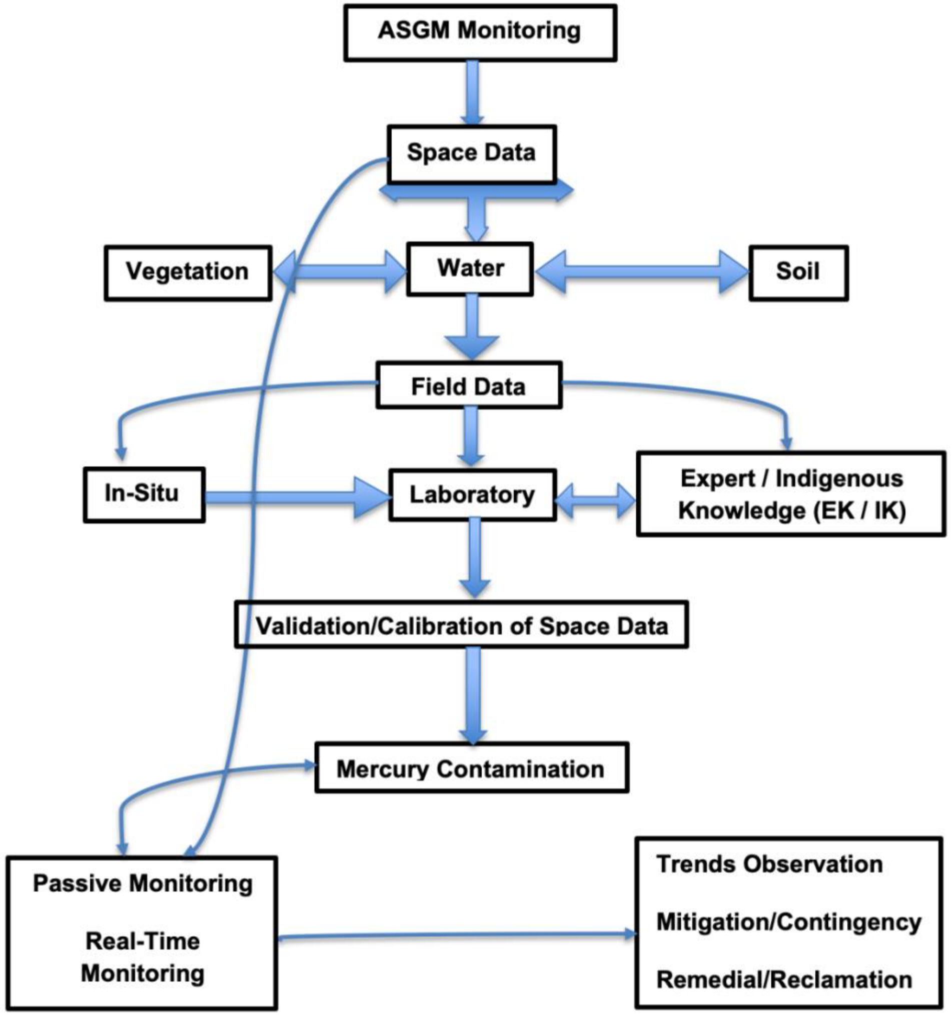
Outputs: 7. recommendations for data/software providers

- Continue improving and automating data workflow (e.g., producing Analysis Ready Data)
- Continue offering high-resolution images
- Offer free satellite images
- Increase processing capacity
- Platforms and software allowing image-classification processing should keep up with the advancement in research on machine-learning algorithms and facilitate, where possible, the parameterization of those algorithms to users

Outputs: 8. ability to evaluate land cover changes due to ASGM



Outputs: 9. guidelines for practitioners



- Involve local practitioners of ASGM and host communities in the policymaking process
- Introduce them to the RS protocol
- Identify source of pollution
- Embark fieldwork; get sampling data, in-situ data and historical data for training labeled classification, calibration and validation
- Perform tests in laboratory
- Assess the age of the mining activities
- Select RS sources
- Apply RS algorithms
- Perform post-classification processing where necessary (e.g., to distinguish ASGM sites and bare soil; integrate seasonality issues; solve dry environment-related issues)
- Disseminate the results of the analysis and discuss them with local stakeholders
- Develop, implement, evaluate policy

Thank you for your attention

Photos: the negative impacts of informal ASGM on river networks in Ghana.
Left: pollution of the Pra River. Right: pollution of the Ankobra River