Detect illegal mining activities

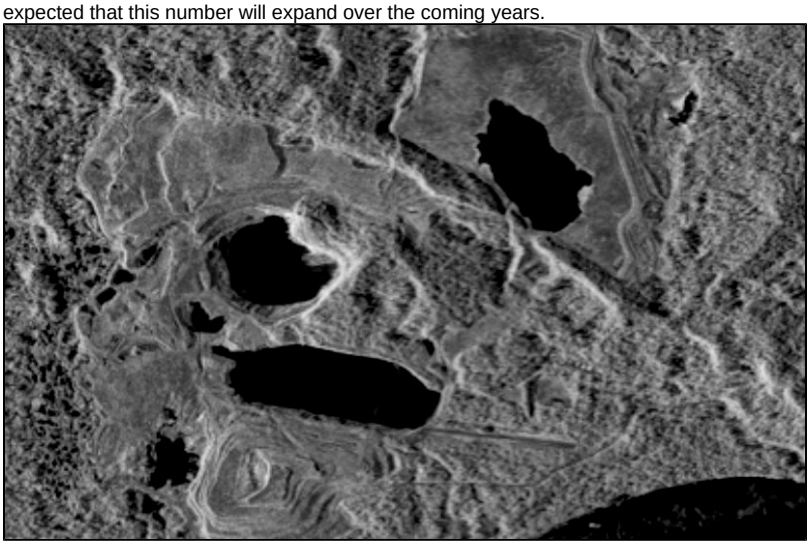
Application Details

Satellite imagery can be interpreted manually to characterize the extent to which illicit or unregulated mining is taking place in a defined area of interest. Information content includes:

• location and extent of features related to illicit or unregulated mining
• characterisation of features close to illicit mining sites that may represent a potential hazard (e.g. chemical tailings)

Features associated with illicit mining are quite small scale (a few metres in diameter) hence reliable detection and characterisation requires very high resolution imagery. In addition, reliable detection of contextual features such as waste products from illicit mining may have colour signatures so multi-spectral imagery at very high resolution (i.e. 1-2.5 m or better) is of interest. In some areas, very high resolution radar imagery can also be used to detect features associated with illicit mining (e.g. for gold mining) – again resolution of at least 1m is necessary.

Update frequency is driven by the orbit dynamics of the satellites. At present there are three different satellites capable of providing very high resolution optical imagery and six different high resolution radar systems and it is expected that this number will expand over the coming years.



Detection of irregular mining using TerraSAR imagery. This shows unlicensed activity close to an existing mining operation. The small ponds in the centre left of the image are caused by
illicit mining activities which can cause leakage from the larger ponds (containing toxic waste products) into the surrounding ground water. Credits: GAF, ASTRIUM

These small digs can also be routinely detected on optical imagery as show in this example from an area adjacent to a gold mine. Tailings (visible as light coloured features) resulting from these irregular mining activities are also visible. The photo below shows a ground based view of these illicit mining activities. Credits: GAF, Digital Globe Inc.

Between the different optical systems it is possible to obtain an image at least once per month over a defined region of interest although cloud cover may limit the number of analyses that can be performed with these data. Images are geocoded so location accuracy is better than 1 pixel. Detection accuracy depends on the mineral being extracted and the scale of the illicit mining operation.

The main utilisation is for central monitoring of remote regions where law enforcement or environmental protection personnel may be exposed to risk from local populations while conducting on-site inspections and surveys. In addition, the satellite derived information can be extended backwards in time to compile longer term assessments of the evolution of the illicit mining activity.

Costs are driven by the commercial price of acquiring new very high resolution optical imagery – typically 5 – 10 K Euro per analysis should be expected.

Availability of national hyper-spectral missions such as the German EnMAP system may also contribute to an improved capability to detect and characterise different types of illicit mining.

References:

ESA 2013, Earth Observation for Green Growth: An overview of European and Canadian Industrial Capability