

## INTRODUCTION

Natural resources are sometimes exploited beyond a sustainable level, spoiling natural habitats, affecting people's livelihoods and even fuelling armed conflicts.

The lack of precise geographic information is a critical limit in the design of appropriate provisions for prevention and response to ongoing crises related to natural resources exploitation. Vast territories have to be observed within a narrow time frame as exploitation activities can easily shift from one area to another. The areas are difficult to access because they are widely dispersed, too remote or too insecure. Conflict situations often prevent research teams

from travelling freely and thus remote sensing provides the potential for complementing more traditional means of monitoring. In this context the use of remote sensing data even proves beneficial for the detection of widespread mining sites in the Democratic Republic of the Congo (DRC), where detailed field assessments are extremely dangerous due to ongoing armed conflicts and the militarisation of the mining sector. The Illegal Mining Service may provide users with relevant information to contribute to focused reactions during conflicts and to support rapid identification of affected areas.

## CORE PRODUCTS: GEOGRAPHIC REFERENCE MAP, POTENTIAL MINING MAP AND INFORMATION DOSSIER

The product consists of three components:

- > A geographic reference map providing basic geo-information of the study area
- > A map indicating those areas where informal mining activities may potentially take place
- > An information dossier describing briefly how to interpret the map and summarizing the analysis steps and major results

The final products focus on the indication of mining areas but also include additional features that are important within the overall context

such as road network, settlements and rivers. Together with the background information provided with the information dossier the maps summarize a comprehensive overview about the situation in eastern DRC to be integrated into policy recommendations.

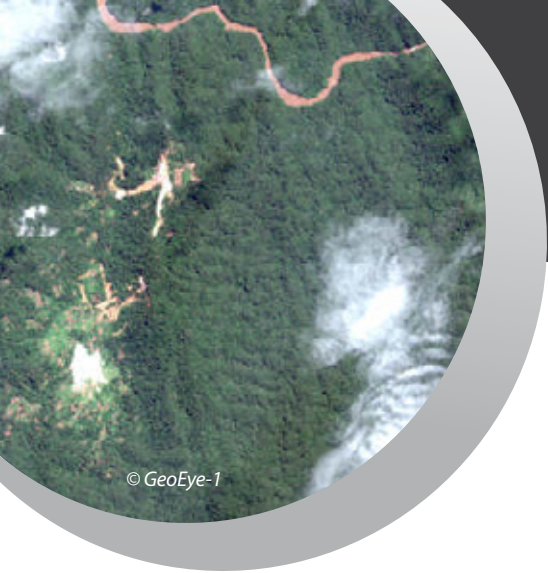
The latter are the main objectives of reports generated by the end user community mainly based on socio-economic analyses. Thus, the major issues that will be addressed are:

- > Supporting political decision making
- > Bridging the gap between Peace and Conflict Research and GIS/Remote Sensing Community



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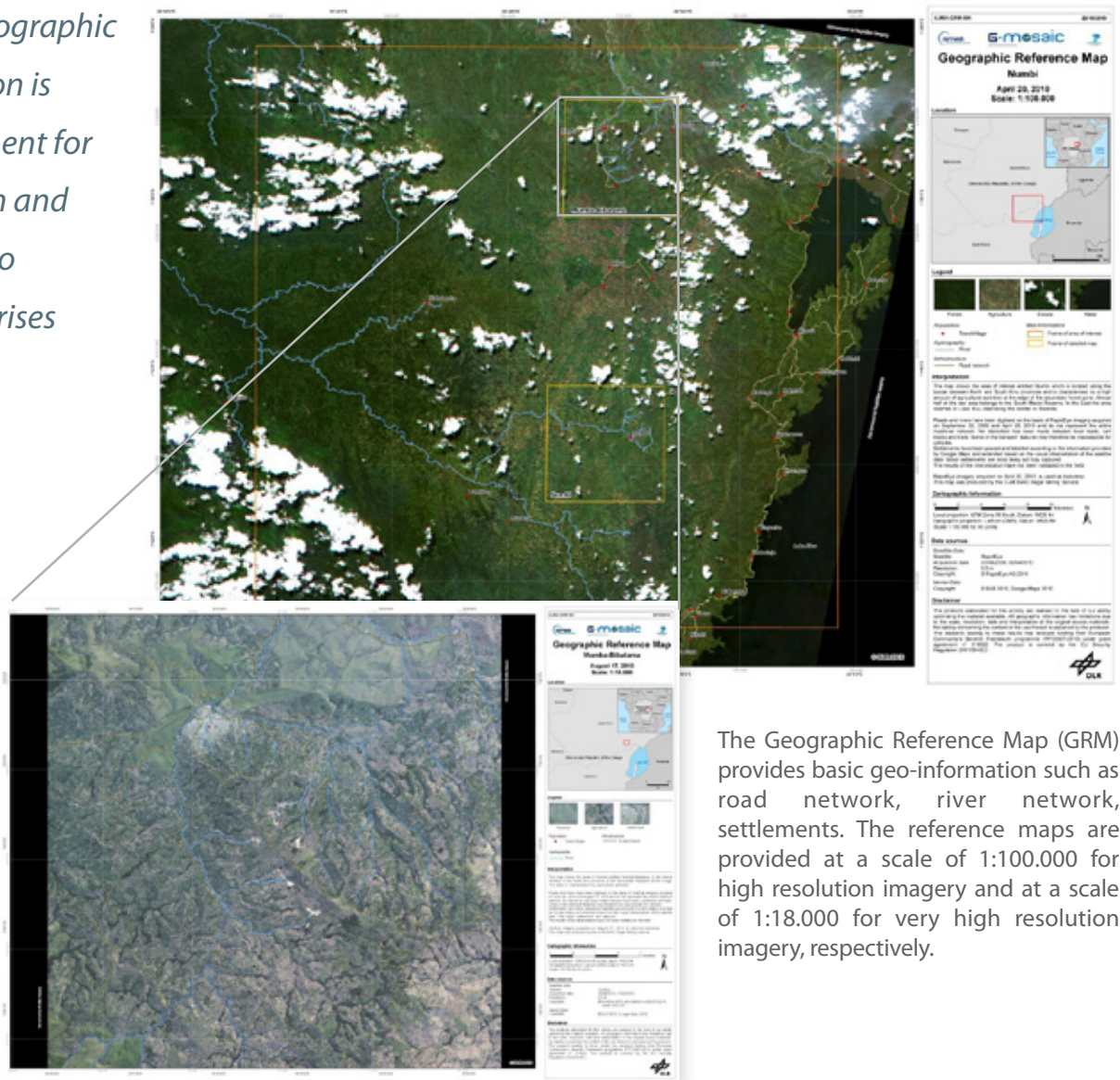
# ILLEGAL MINING SERVICE CHAIN

## GEOGRAPHIC REFERENCE MAP

For regions such as the DRC vector data are hardly available and often not reliable. Due to the lack of geo-data most of the vector data has been derived from visual interpretation and manual digitization of the satellite imagery in order to support the satellite based image analyses. The

extraction of the features profits from the multitemporal data acquisition plan. Thus, the impact of seasonal or even daily variations due to factors such as rainfall or biological growth can be overcome and the range of detectable features extended.

*Precise geographic information is a key element for prevention and response to ongoing crises*



Geographic Reference Map of Numbi (RapidEye, HR), scale 1:100.000 (top) and of Mumba-Bibatama (GeoEye, VHR), scale 1:18.000 (bottom)

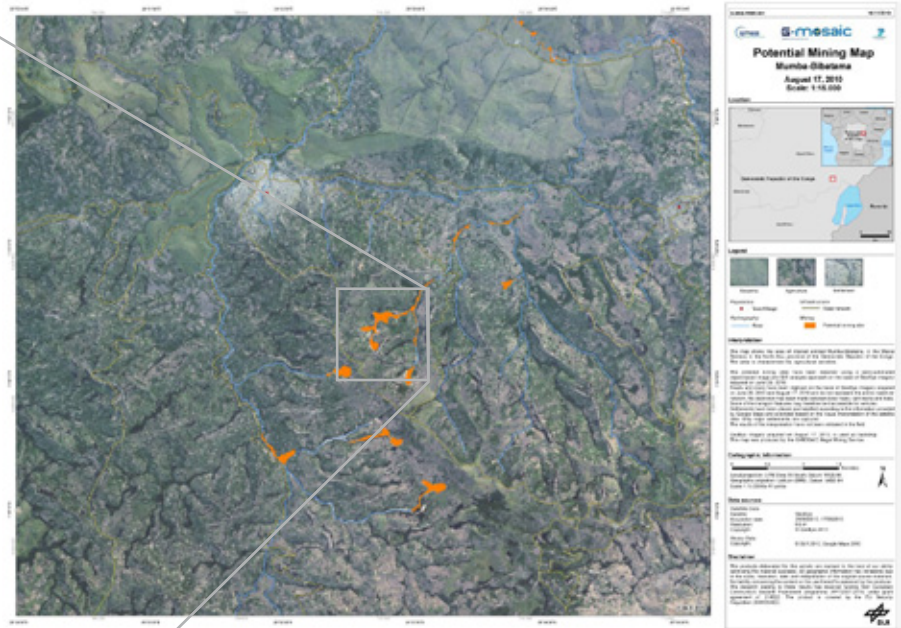
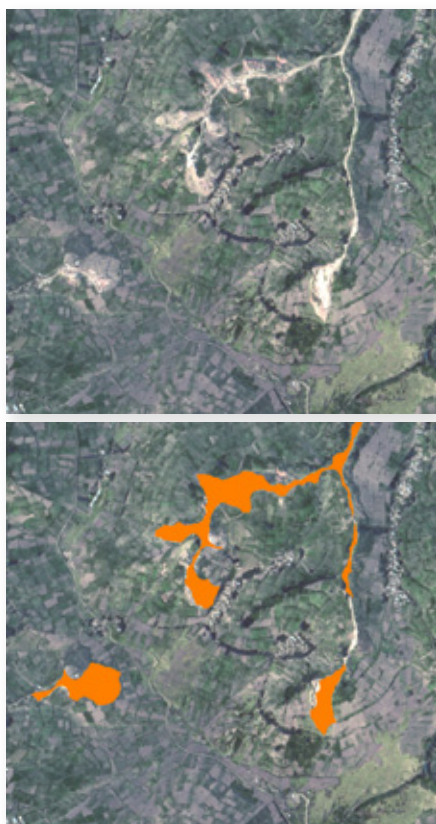
The Geographic Reference Map (GRM) provides basic geo-information such as road network, river network, settlements. The reference maps are provided at a scale of 1:100.000 for high resolution imagery and at a scale of 1:18.000 for very high resolution imagery, respectively.

# POTENTIAL MINING MAP

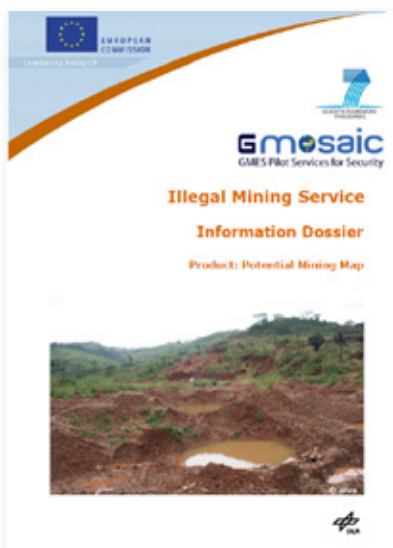
The method used for extracting potential mining sites combines object-based image and geographic information system (GIS) analyses. The designed workflow is concentrating on two levels built on (1) a transferable feature extraction scheme in an object-based image analysis environment for

the extraction of bare soil areas using very high spatial resolution satellite images, and on (2) GIS analyses using relevant ancillary information (e.g. vector data such as roads, rivers and settlements) to further cut down the number of potential mining sites.

*Supporting political decision making*



*Potential Mining Map of the study area of Mumba-Bibatama. The potential mining sites are highlighted in orange.*

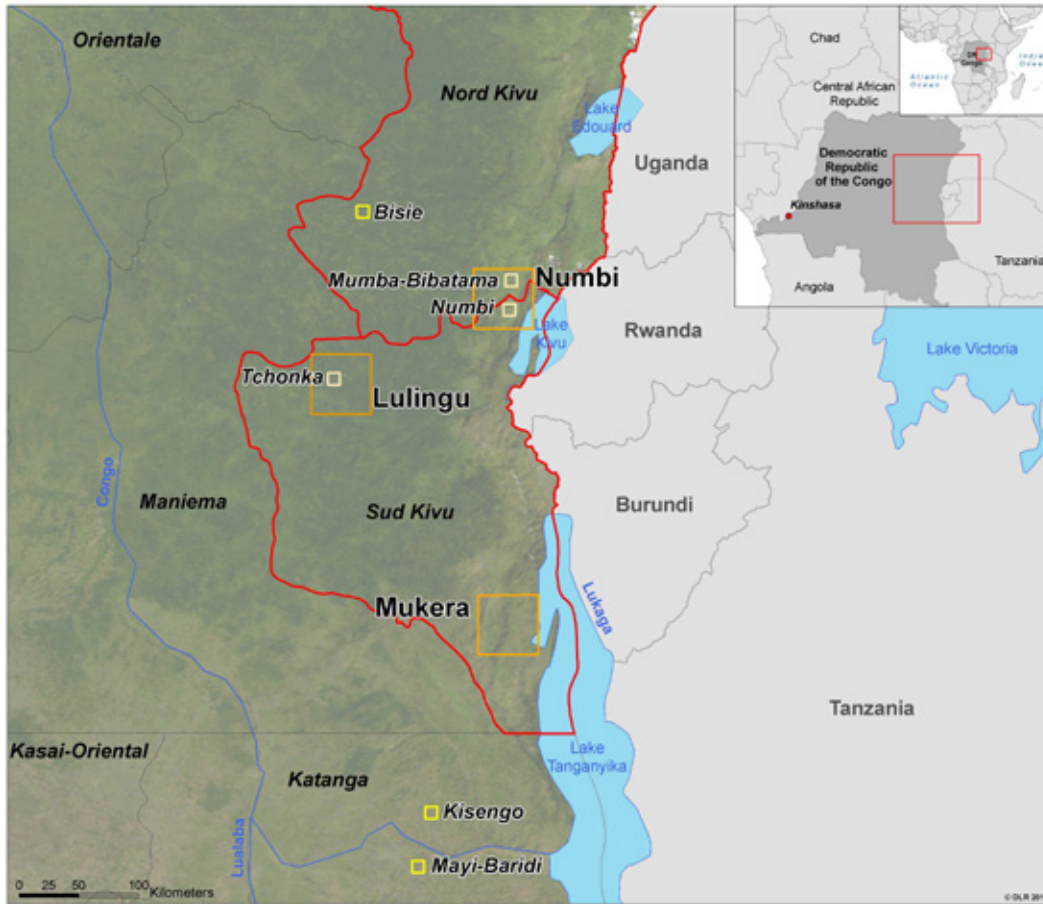


# INFORMATION DOSSIER

The interpretation of satellite data is more complex compared to in-situ observations and requires a careful analysis. This dossier aims to report the processing steps of the analysis approach for the detection of potential mining sites in the DRC and to describe the information extracted based on satellite data.

*Information Dossier of Illegal Mining*

## GERMAN AEROSPACE CENTER (DLR)



### High Resolution

(50km x 50km)  
Numbi  
Lulingu  
Mukera

### Very High Resolution

(10km x 10km)  
Mumba-Bibatama  
Numbi  
Tchonka  
Bisie  
Mayi-Baridi  
Kisengo

MORE INFORMATION AT  
[WWW.GMES-GMOAIC.EU](http://WWW.GMES-GMOAIC.EU)

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*This service "Illegal Mining" is coordinated by the German Aerospace Center (DLR) with the efforts of other partners inside the G-MOSAIC project: e-Geos, GISAT, Astrium Geo-Information Services, JRC and TNO. As a coordinator of the service DLR organizes the production, ensures the quality of the product and the suitability to the user needs.*



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