

Space for Demining

Integrated Applications Promotion

European Space Agency

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Integrated Application Promotion (IAP) aims to:

- **Incubate sustainable services that benefit society**
 - addressing global/novel challenges
 - listening to **needs of users**
 - partnering with stakeholders
- **Increase societal demand for satellite services**
 - integration of **multiple space assets** yields new opportunities
 - assessment of added value

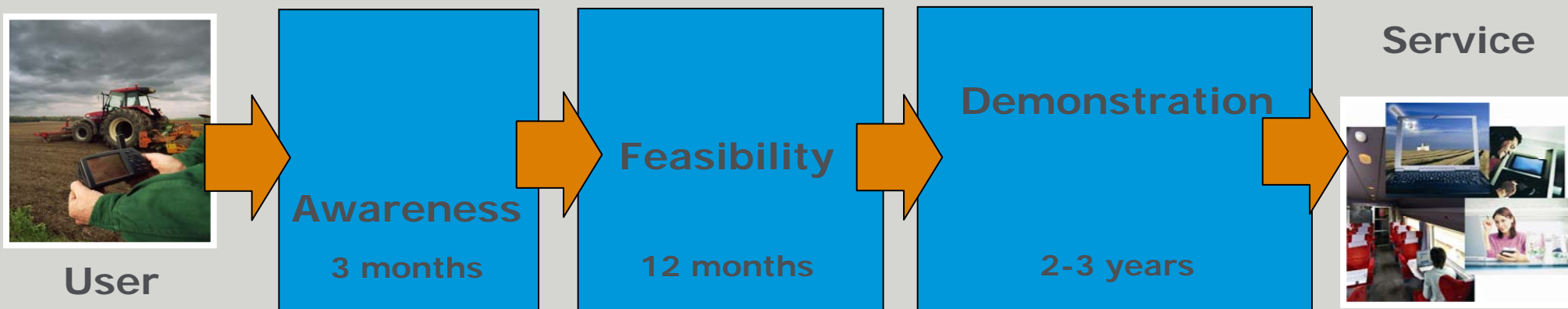
Some IAP Themes

- Health
- Energy
- Transport
- **Safety**
- Agriculture
- Environment
- Education, Development
- Entertainment



IAP Program Structure

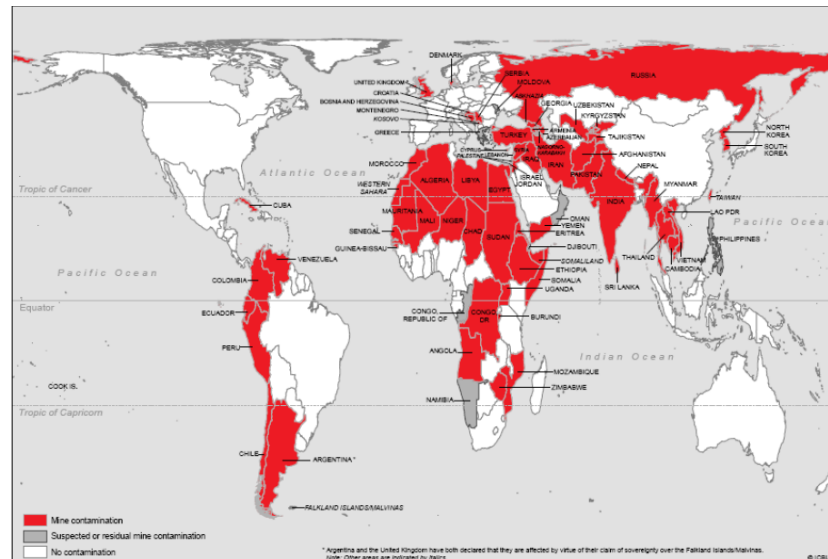
- **Awareness Activities**
 - Understand, foster and organize user demand for service solutions
- **Feasibility Studies**
 - Assess technical and economical viability of these services
- **Demonstration Projects**
 - Implement pre-operational services
 - 50% co-funding by stakeholders



The Mine Action challenge

Background

- Mines and explosive remnants of war claim thousands of civilian victims even after conflicts are over
- Resources (arable land, infrastructure, water, etc) located within areas suspected of mine contamination cannot be exploited - even if there are no mines
- 1997 Mine Ban Treaty : clearance within 10 years after ratification
- 2/3rd remains, ~3000 km² remains mined (2009), 100 million mines
- >100 of million ERW also remain
- today about 4000 victims per year



Courtesy GICHD

Stakeholders in Mine Action

UNMAS & GICHD coordinate standards, information management, technologies

National Mine Action Authority / UNMAS sets up

National Mine Action Center (**NMAC**)

Alternatively **UNMAS, UNDP, UNOPS**

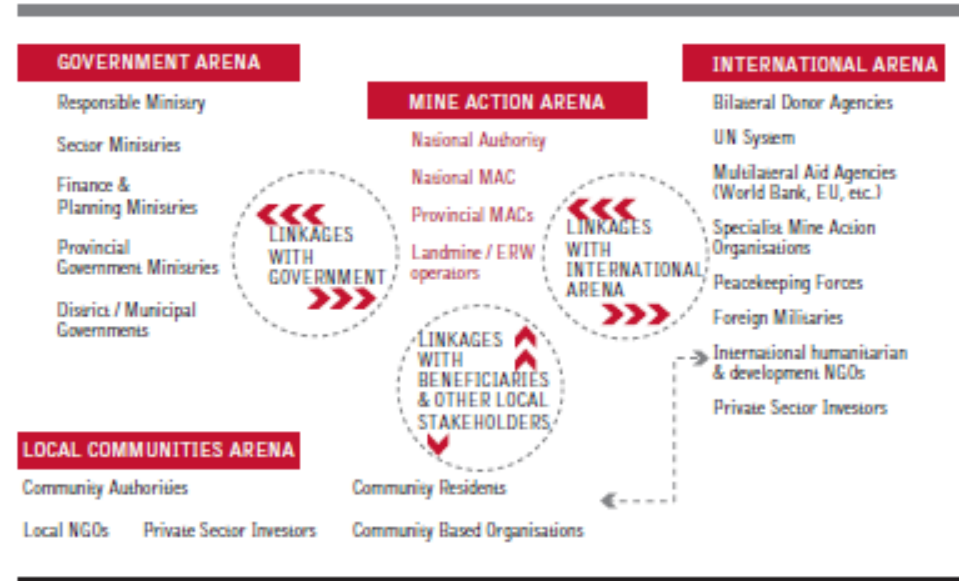
Regional MAC

Operations and advise by

- NGO's
- Commercial operators
- UN bodies
- Military

Paid for by **donors**:

- Red Cross
- ITF for Demining & Victim Assistance
- DoD



Courtesy GICHD

Post-war situation

Few infrastructure

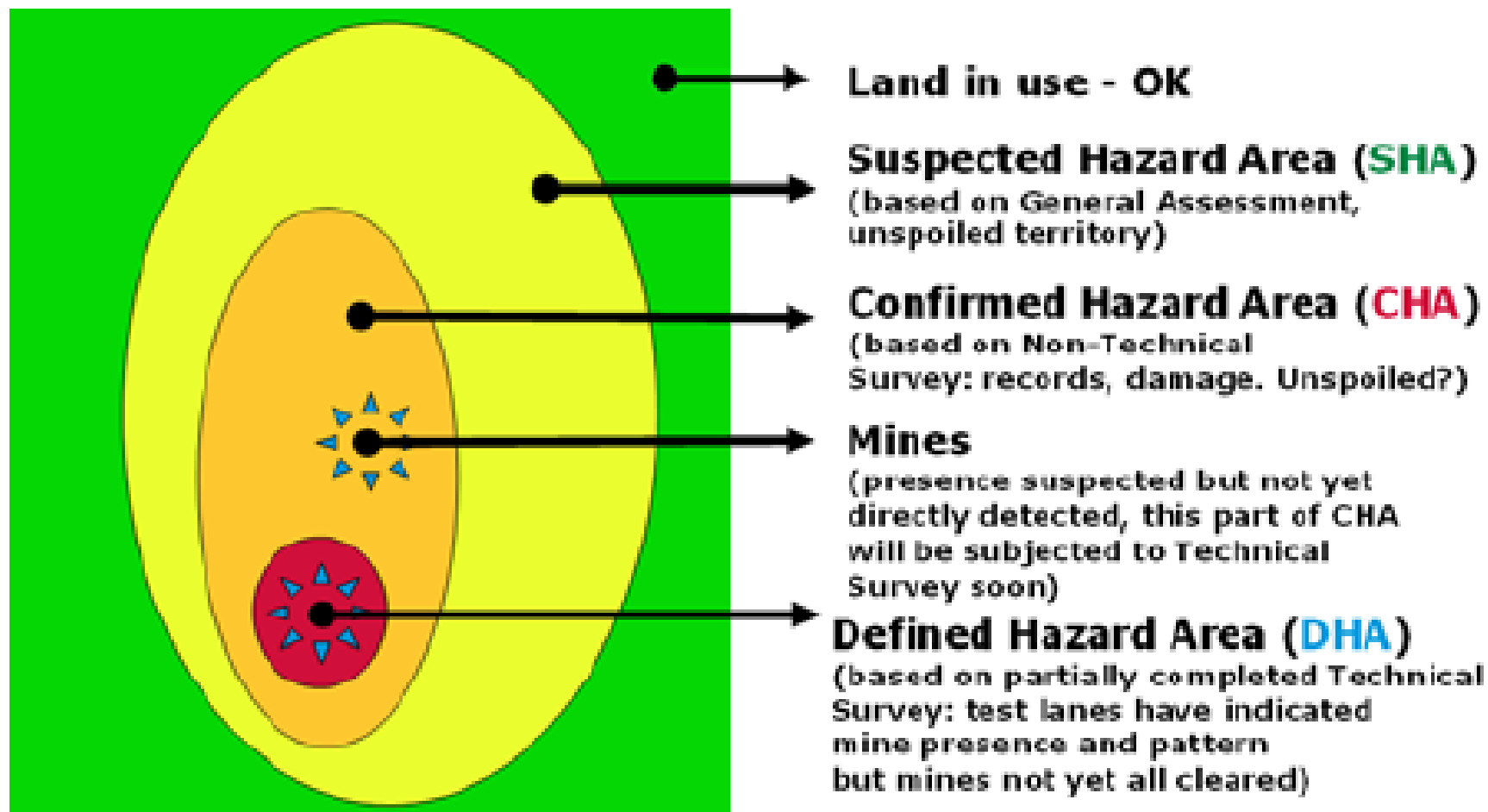
Local staff & language

Extreme weather

Wide range of environments

Easily accessible mines mostly removed

- Budgets leveling off**
- Donor constraints**
- Trend towards integration with development**
- Commercial demining**



Demining current practise (detection & clearance)

Survey & Demarcation

- GPS
- Laser ranging
- Relative positioning
- Staff maps
- Google Earth
- GMS, VHF, HF, Satellite Phone

Detection

- Remove vegetation
- Prodders
- Metal detectors (& GPR)
- Tillers
- Mine action dog teams

Clearance is not an issue

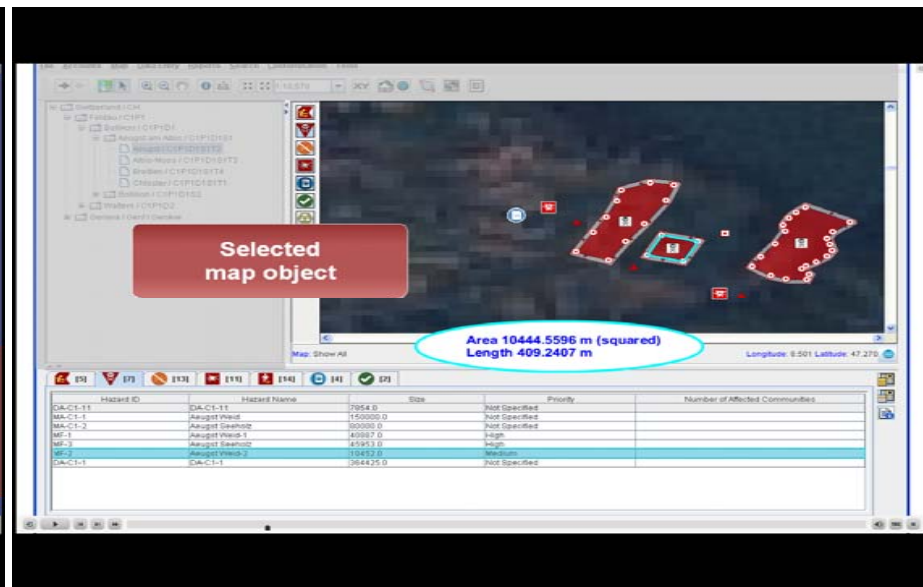
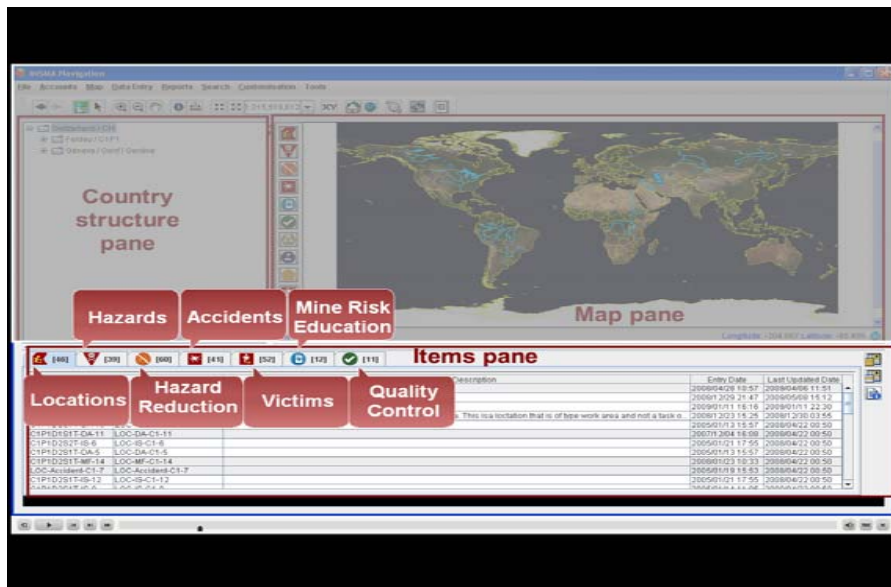
No silver bullet technology



Demining current practise (Information Management)

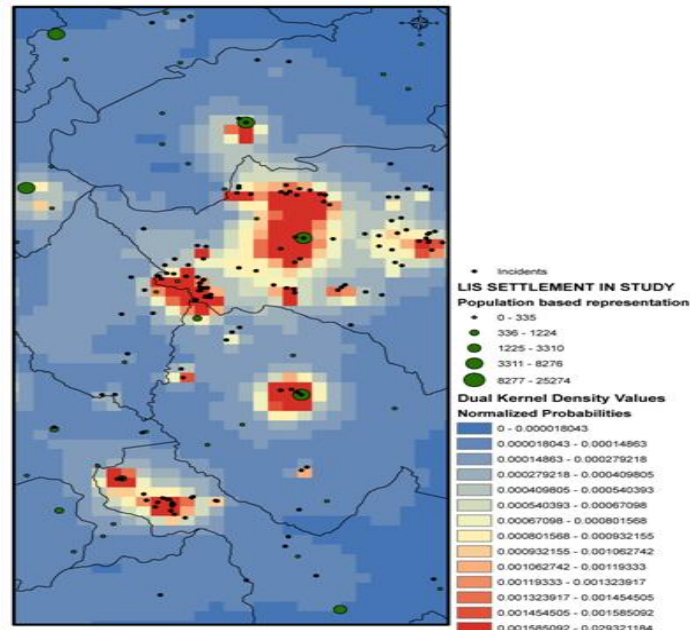
IMSMA : Information Management System for Mine Action, by GICHD

- Data entry & validation
- Data search & reporting



97.5% of suspected land proves in hindsight to be uncontaminated

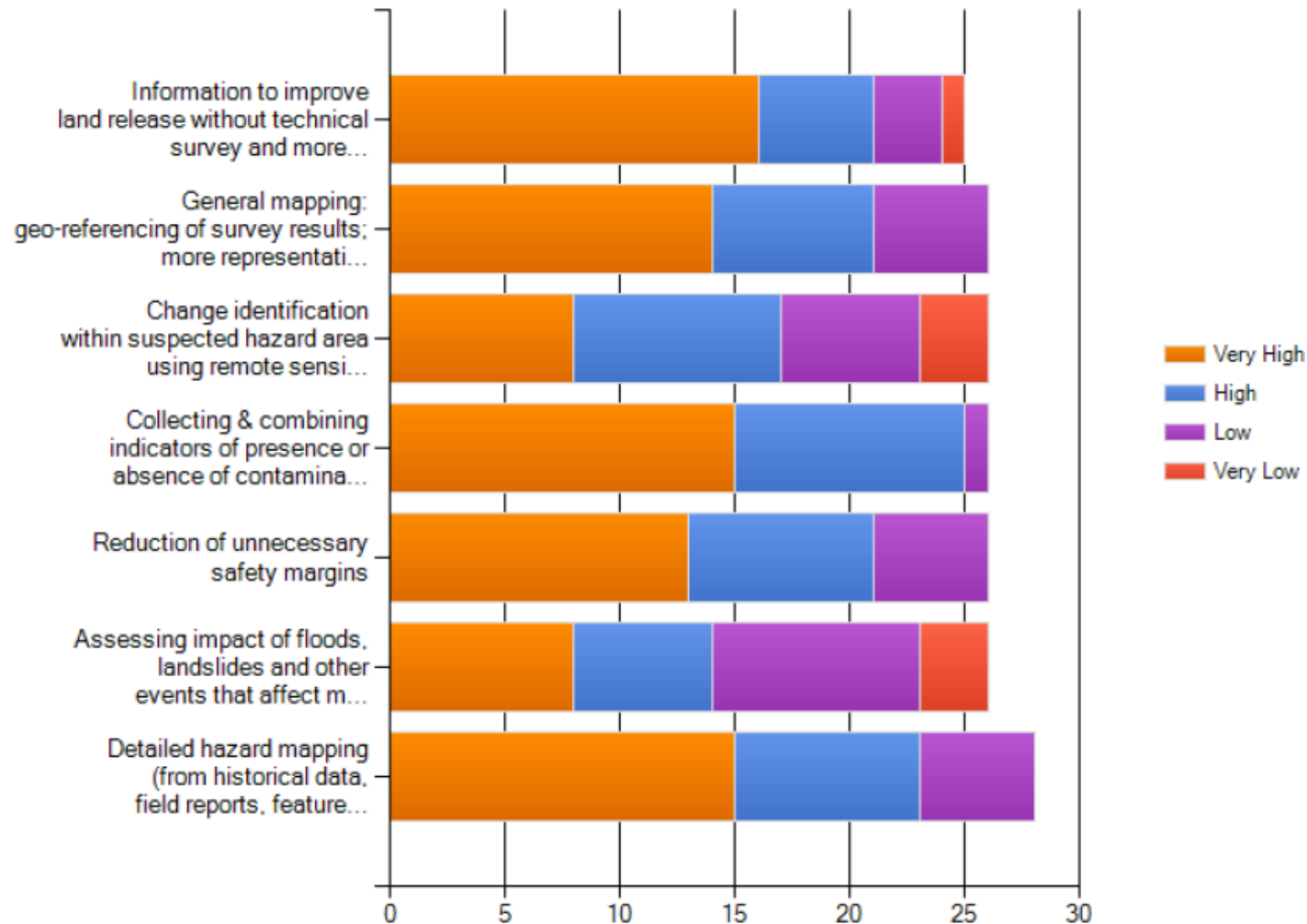
1. Target with priority those minefields that are most threatening and costly to society.
2. Avoid the unnecessary deployment of clearance activities in non-contaminated areas.
3. Reduce the cost of detection and clearance per unit of land area.



Incidents density versus population

Demining Needs

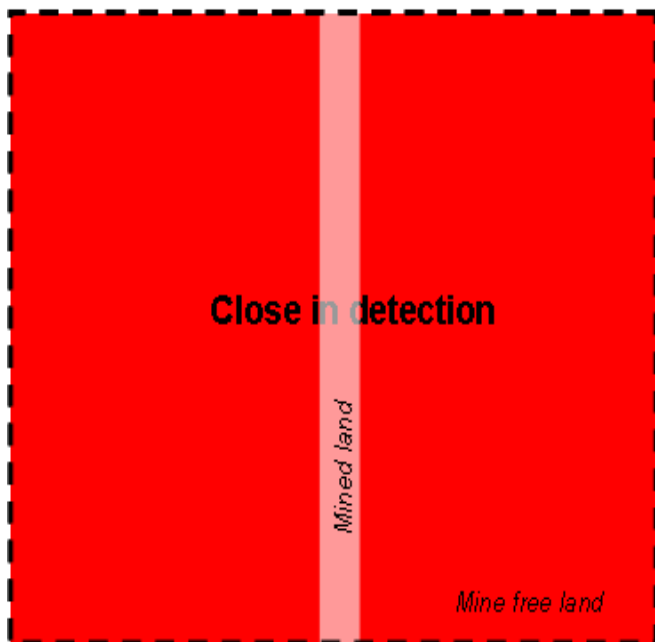
Please rate the "Relevance" of the following Non-Technical Survey activities/services to your organisation and region/country (*)



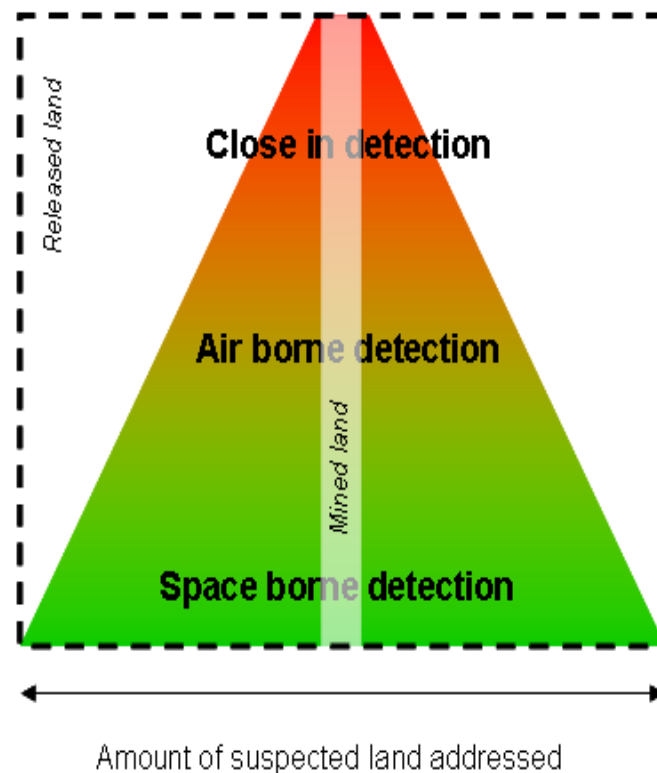
Potential of space assets: land release



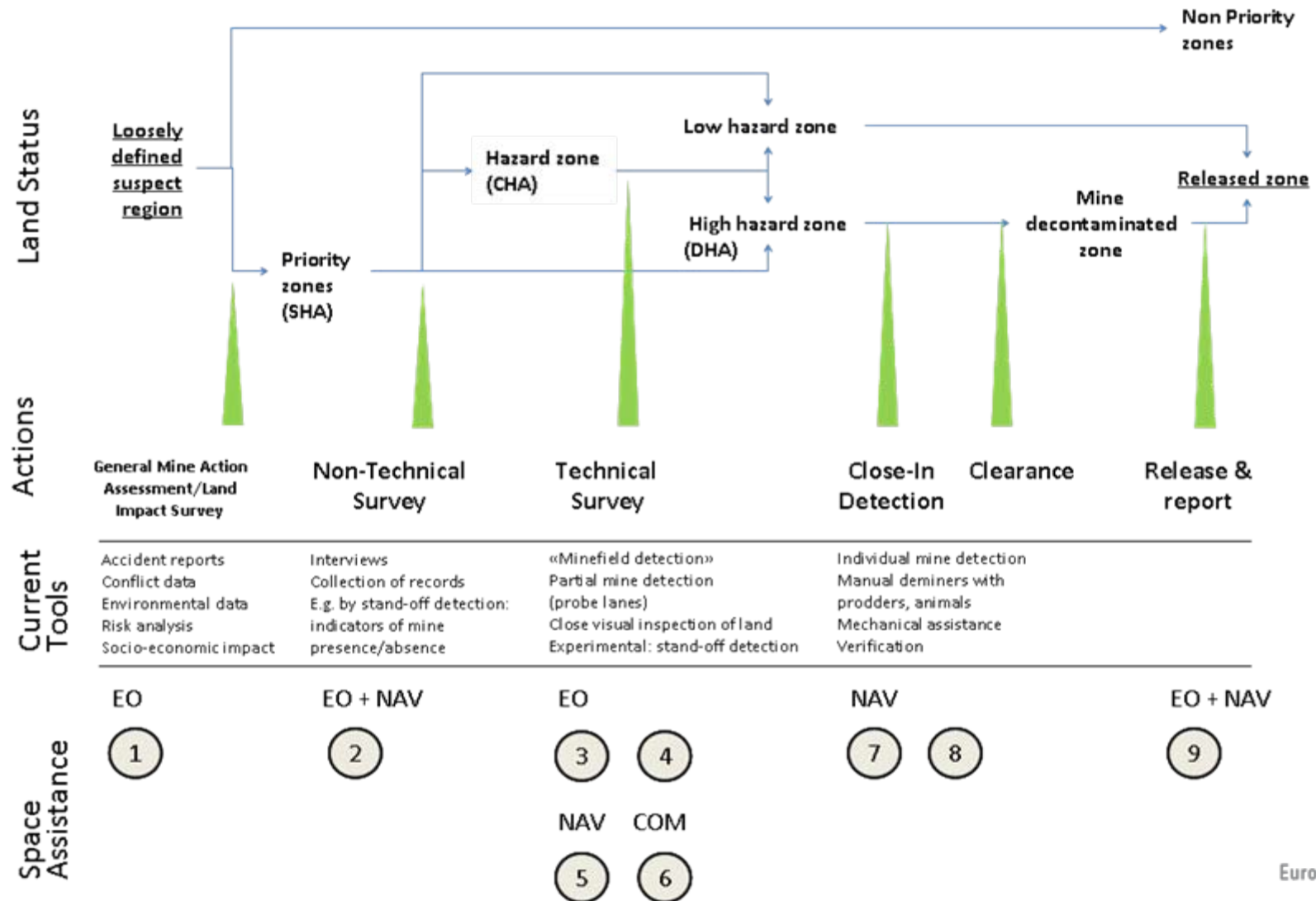
Actual situation



Desired situation



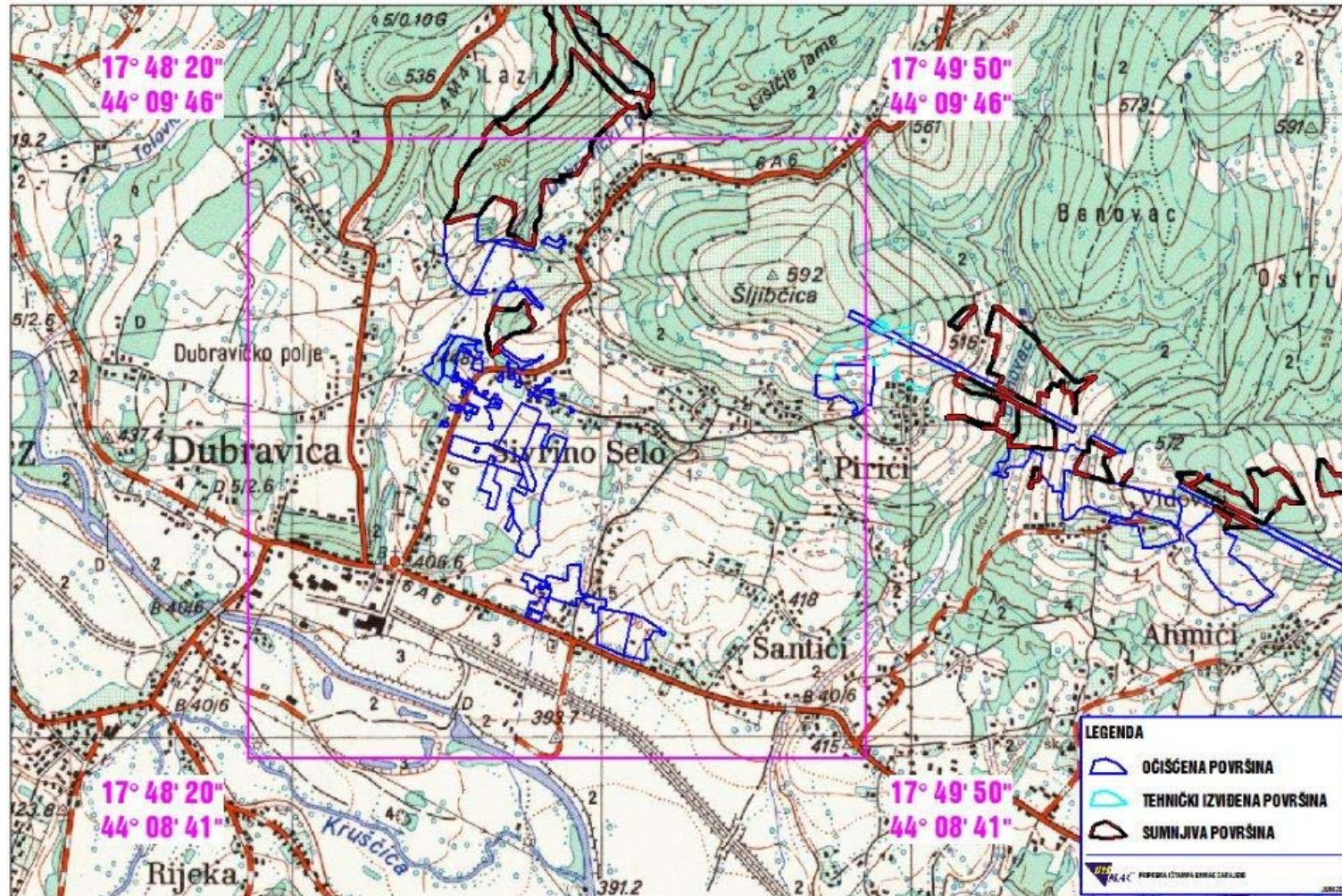
Space Assets for Demining Assistance



Potential of space assets : indirect indicators



OPĆINA - VITEZ

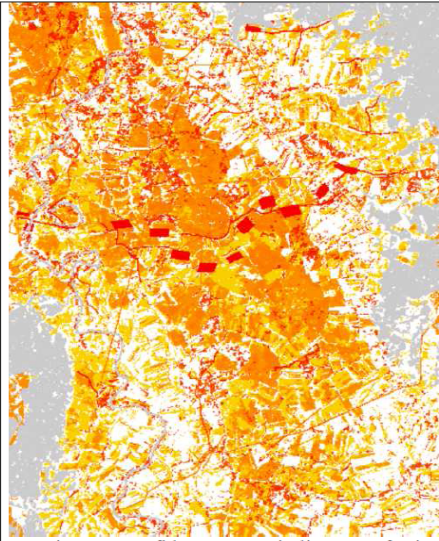
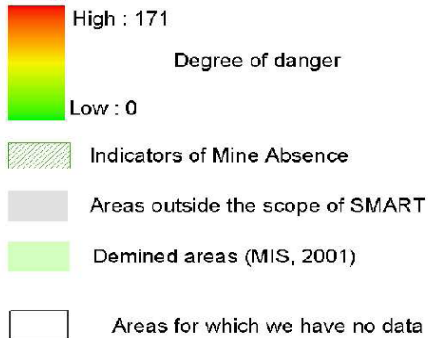


Potential of space assets : SMART



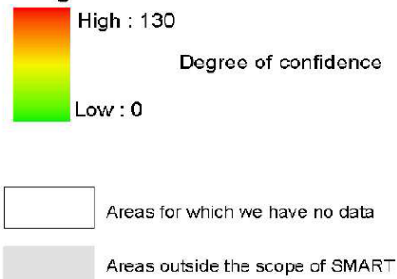
Continuous location map (Glinska poljana)

Legend

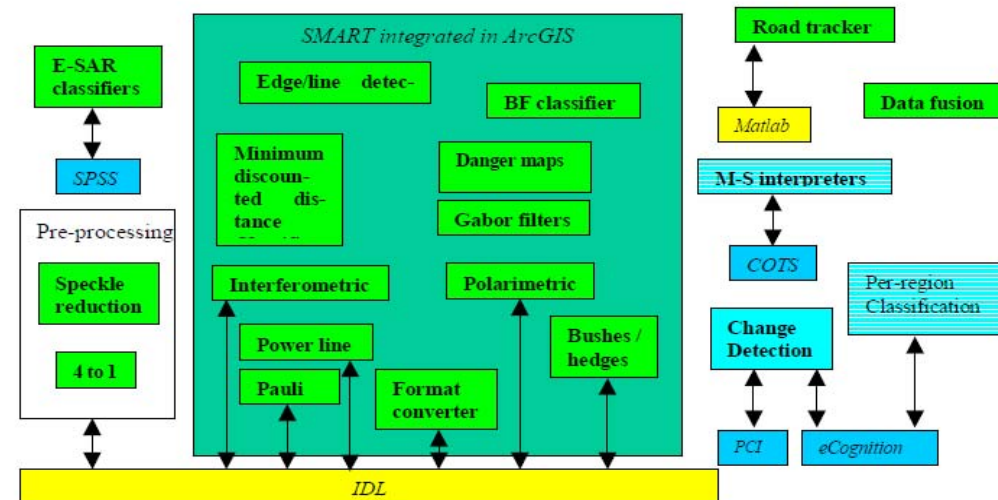


Continuous confidence map, indicators of mine presence (Glinska poljana)

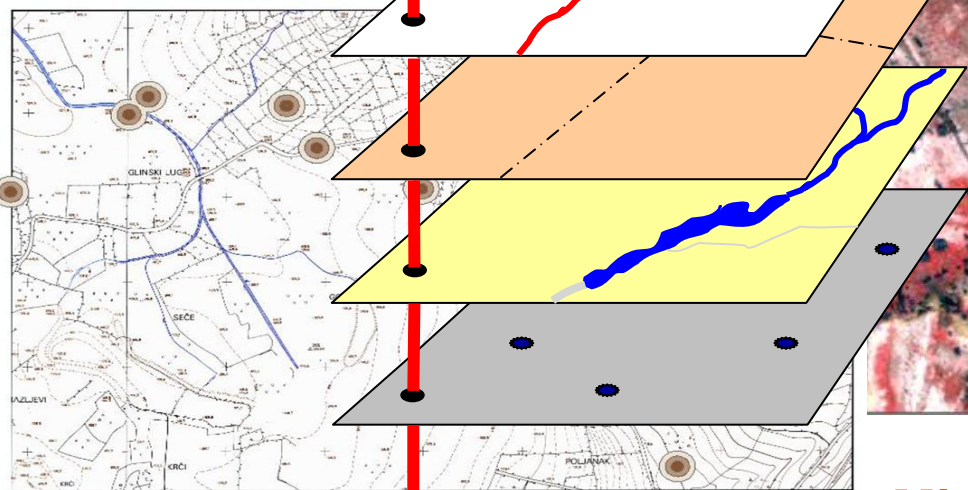
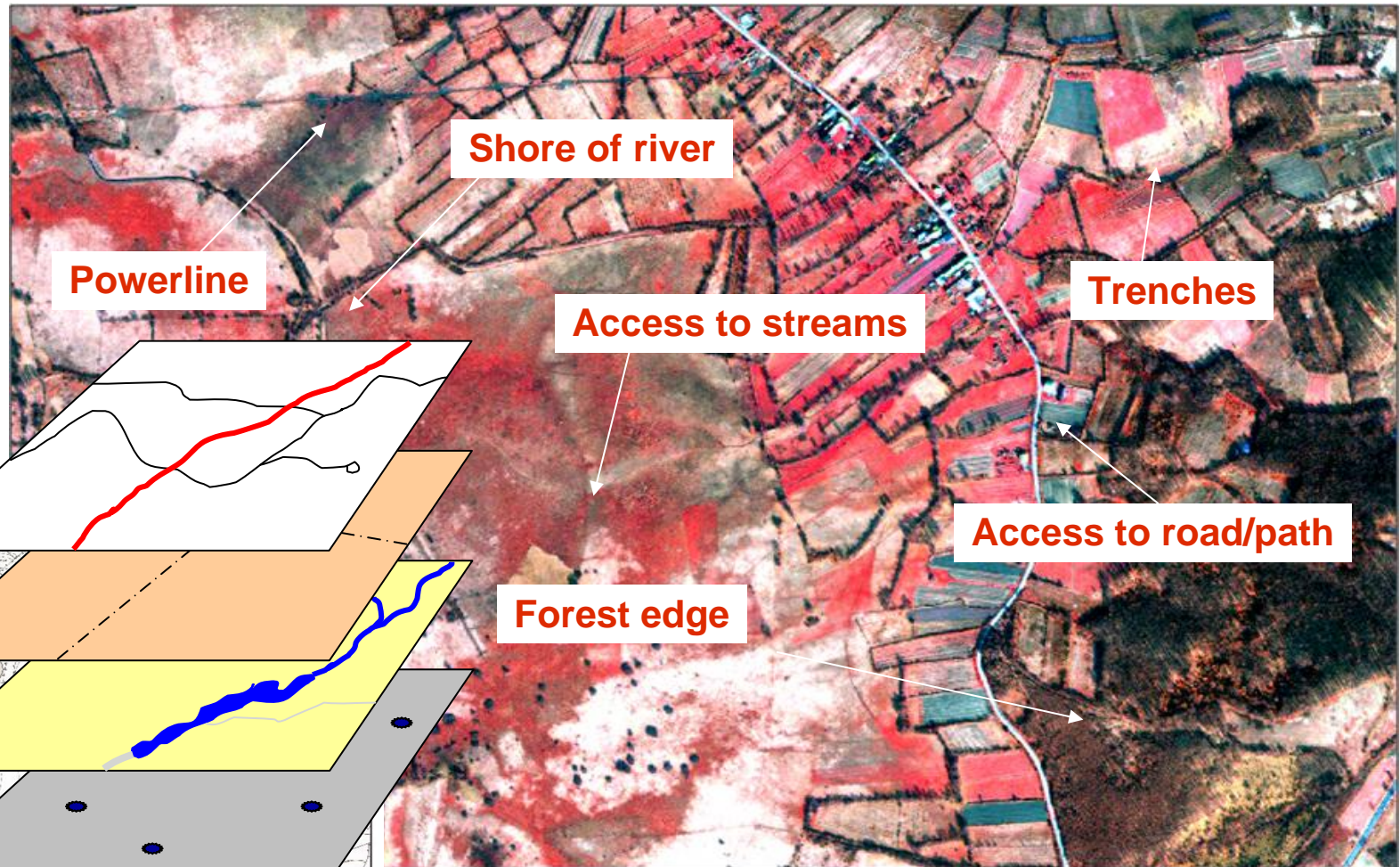
Legend



Stand-off Detection : SMART

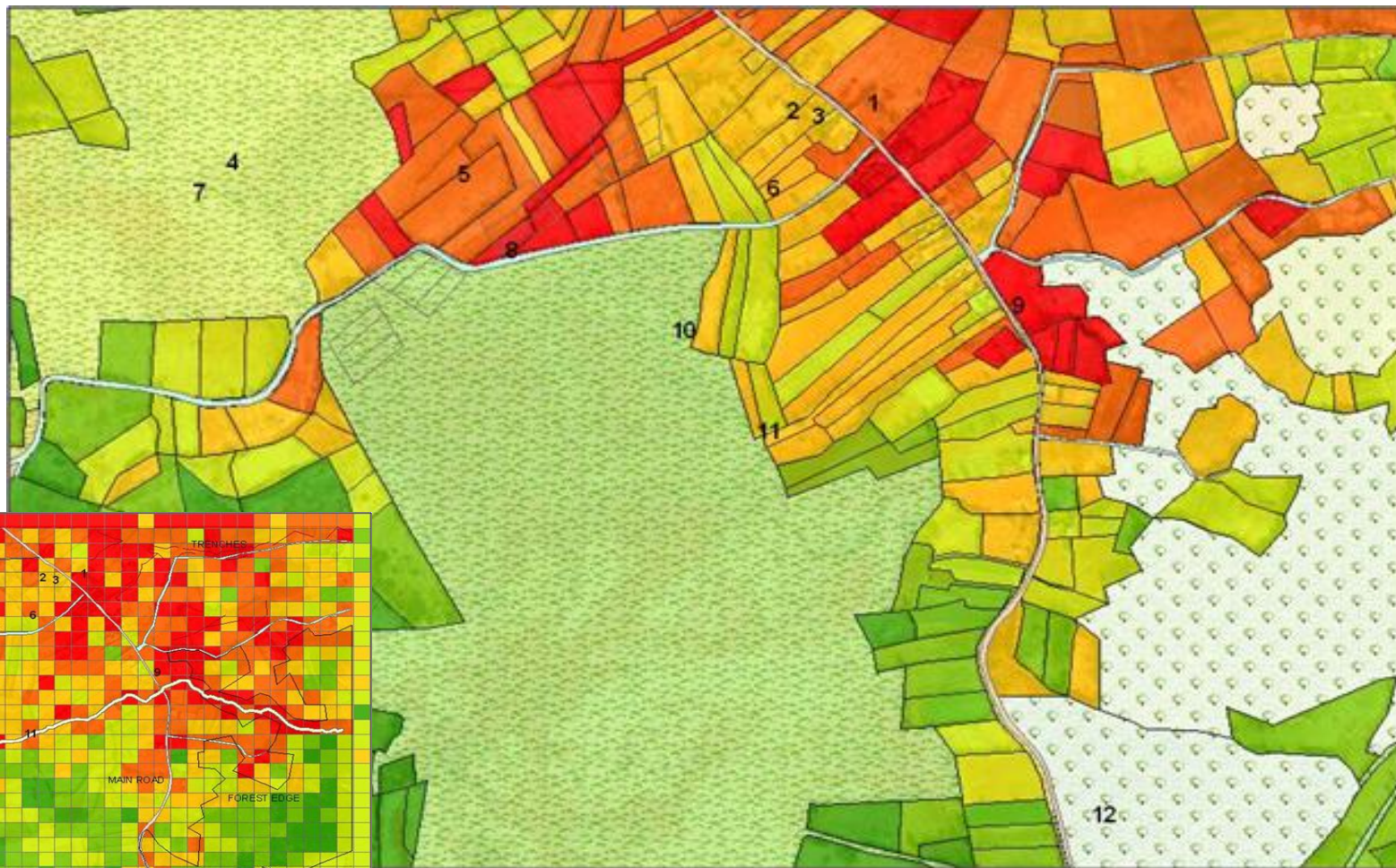


Minefield Indicators

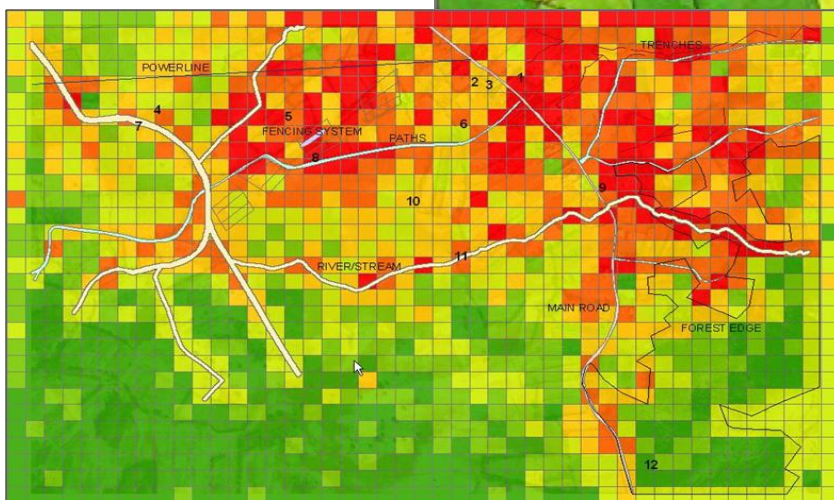


Mine Accidents Records

Parcel-based per-field risk estimation

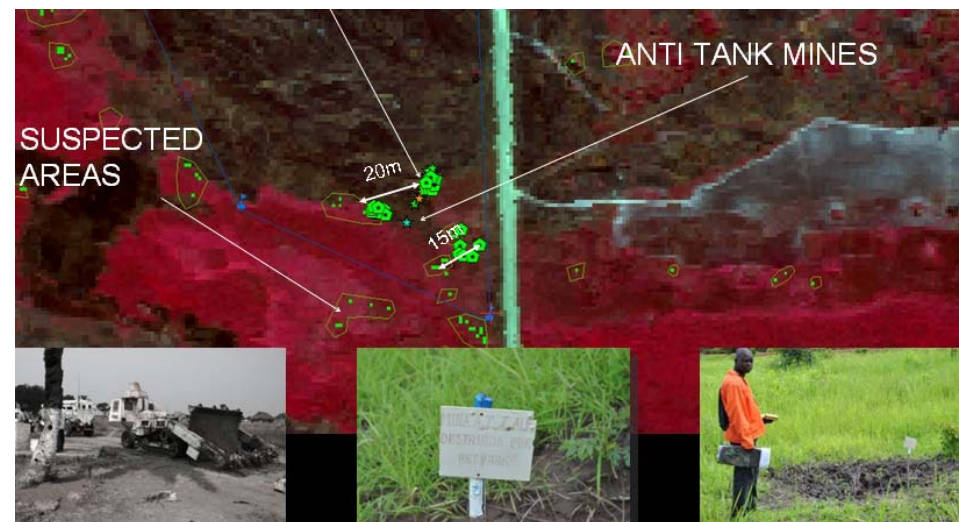
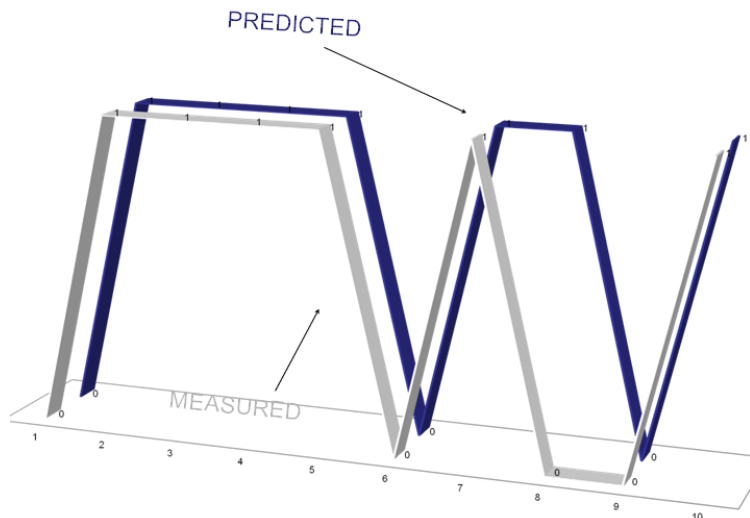
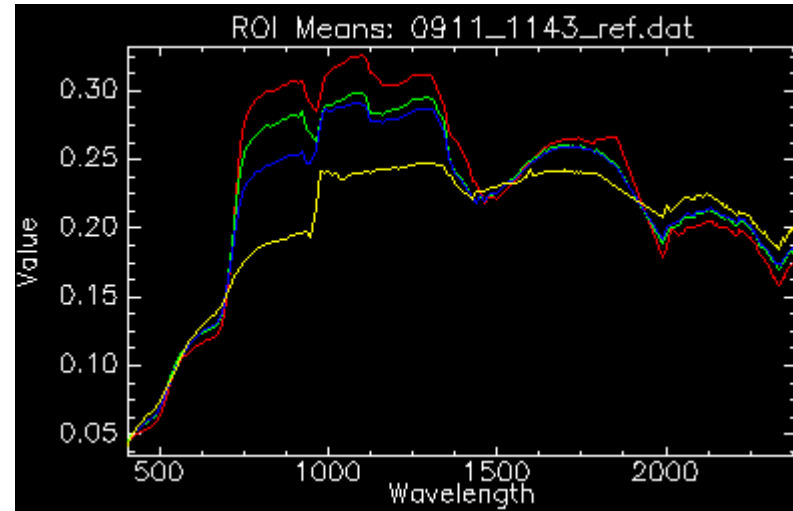
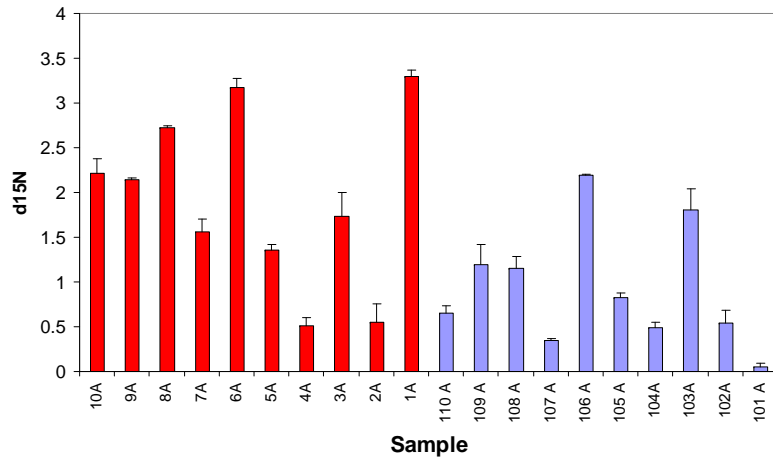


Risk index



Potential of space assets : GeoMine

Plants d15N



Potential of space assets : navigation & communication

Georeferencing for GIS integration of:

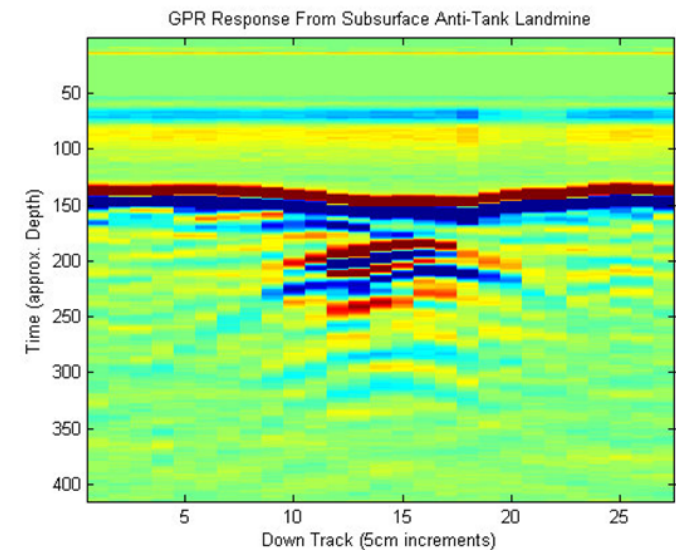
- Interviews
- Field observations
- Stand off detection
- Demarcation
- Clearance



Potential of space assets : direct detection?

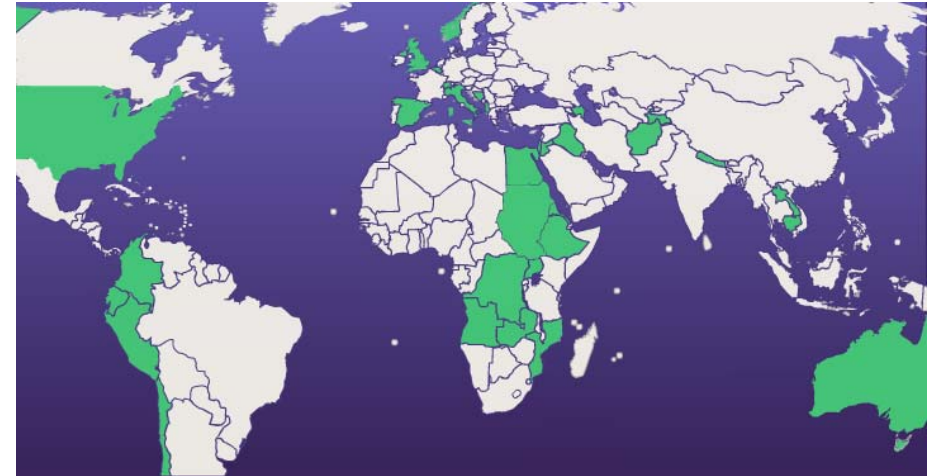


- GPR range ~30 cm, 2 km/hr, dry soil
- May be extended to 10 m, 120 km/hr (TU Delft)
- Miniaturization required
- Potential for UAV + DGPS/RTK
- Reliability likely low (<85%)
- Possible additional data source for pattern detection



Objective of SADA Feasibility Study

- Improve planning & efficiency of existing de-mining procedures
- By integrating space services with:
 - field survey,
 - clearance and reporting activities,
 - aerial remote sensing
- (geospatial) information management system for mine action (IMSMA).



Stakeholders involved

- 3 consortia (led by resp. Infoterra [UK], Radiolabs [IT] and INSA [E])
- GICHD as observer & advisor to ESA
- Over 30 user organizations in 20 countries



Spaceborne Earth Observation data

- Mapping support (input to GIS)
- Planning of mine action resources (land cover, humidity, slope)
- Prioritization (socio-economic impact, agricultural value, infrastructure etc.)
- Risk mapping (indicators of mine presence/absence) and land release support

Satellite Navigation

- supports the navigation of UAV/aircraft in zones of investigation.
- Support survey & clearance teams for georeferencing and geofencing.

Satellite Communication

- Enable the transfer of collected data to a remote processing centre
- Support to global deployment of the service.

Space asset added value:

- **improved socio-economic impact:** planning, prioritization
- **improved land release process:** detection & fusion of indicators, reporting, georeferencing, communication, better maps
- **improved a priori selection of technologies:** complementary, stand-off and/or close-in based on weather, topology, vegetation, season etc.
- **cost reduction:** better procedures, operations

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