



Geospatial Intelligence for Environment Protection against illegal activities

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Activity and objectives

Activities are performed by **taking into account** the EU context and actions to improve environmental compliance and governance and aim at **designing appropriate workflows** allowing to collect and process EO space and in-situ data, as needed to produce actionable intelligence to be used in Environmental Compliance Assurance (ECA)

The partners planned a number of activities aiming to perform the needed data processing and analysis in order to answer the **where, when, what, why, who** questions and allowing them to **formulate recommendations supporting the uptake** of the services by the relevant users

In *Combating environmental crimes and related infringements : environmental compliance assurance : guidance document** the **geo-spatial intelligence is mentioned in combination with Earth observation and tracking capabilities contributing to the general surveillance**, with 6 roles: Early alerts based on land use changes; Risk assessment; Real-time information in combination with site visits; Forensic evidence of past misconduct - based on archive data; Visual evidence at criminal trials; Deterrence when the method is publicly known.

GEOINT4ENV is a top-down activity supported by DG ENV as part of the FPCUP WP 2021

General approach

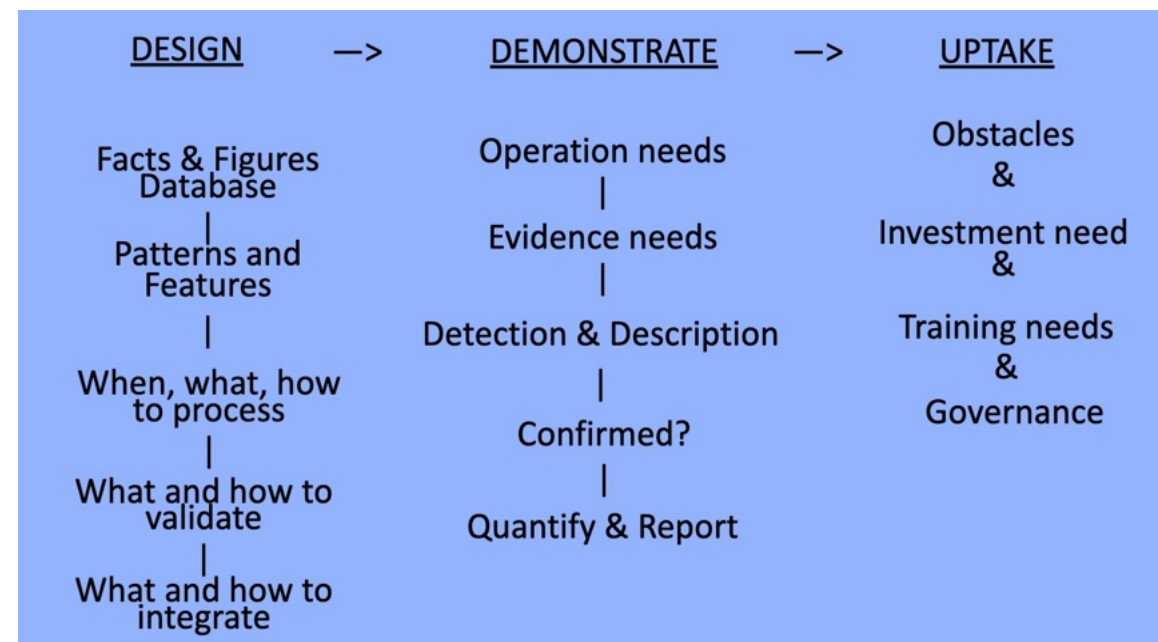
Need analysis (types of non compliant events, current knowledge on patterns and features, types of intelligence required)

Investigate **methods and resources** (needed to detect / raise warning, validate, measure / quantify, evaluate / assess in order to produce evidence / actionable intelligence)

Prepare and run **demonstrations** (identify relevant sites / cases, collect data, apply methods using web platforms, other means)

Validate findings (based on dialog with user organisations and relevant parties and relevant OSINT)

Disseminate and report (design and implement the **Knowledge-Sharing Platform** based on selected cases addressed in demonstration activities gathering information on requirements, methods and data, intelligence produced)



Interaction with possible users

Workshops and seminars organized by the partners allowed identification of operational requirements as well as sharing information on current findings and way forward; events included national user dialogs and workshops, european events e.g. water and land and 4 networks conferences organized by IMPEL

Cyprus: agencies (9) and Municipalities (3): Department of Environment, Department of Fisheries and Marine Research, Water Development Department, Department of Land and Surveys, Public Works Department, Cyprus Quarries Association, Nicosia Municipality, Limassol Municipality

Germany: Federal Ministry for the Environment (BMUV – 16), Environmental Agency Germany (UBA - 16), Federal Criminal Police Office (BKA – 16 local offices), public order offices and prosecutors, Environmental NGOs, foundations & activists

Italy: National Park, Administrative Region, Environmental Protection Agency (forestry & illegal logging), Environment protection agencies and regional administrative authorities in Veneto, Latium, Lombardia, Emilia Romagna, Basilicata, Valle D'Aosta, Umbria, Campania (manure spreading), local administrations and authorities involved in land planning and monitoring (illegal construction)

Poland: Ministry of Climate and Environment (Ministerstwo Klimatu i Środowiska) - Department of Waste Management, Department of Nature Conservation, Department of Environmental Instruments, Department of Forestry and Hunting, Main Inspector of Environmental Protection (Główny Inspektor Ochrony Środowiska), General Directorate for Environmental Protection (Główna Dyrekcja Ochrony Środowiska), State Forest, National Parks (23), National Water Management (11 regional boards), Construction Supervision Inspectorates (1 central, 16 regional, 314 province)

Romania: Ministry of Environment, Water and Forest - MMAP (Ministerul Mediului, Apelor si Pădurilor) as central authority, National Environmental Protection Agency - ANPM (Agenția Națională pentru Protecția Mediului) as executive agency, with 42 subordinated county agencies; the National Environmental Guard - GNM (Garda Națională de Mediu), in charge of enforcement, with 42 subordinated county commissariats, and 2 additional commissariats for Bucharest and the Danube Delta; and the National Agency for Natural Protected Areas - ANANP (Agenția Națională pentru Arii Naturale Protejate) with 5 territorial areas. Construction State Inspectorate (One central Office, 42 regional offices at county level)



Activities & Deliverables

Calendar

Activities / Time	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Requirements analysis	--	--	--	--	--	W1	--	R1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methods selection	--	--	--	--	--	--	--	--	W2	--	R2	--	--	--	--	--	--	--	--	--	--	--	--	--
Case studies	--	--	--	--	--	--	--	--	--	--	R3	--	--	--	--	--	R3	--	R4	--	--	--	--	--
Uptake planning	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	W3	--	R5	R6	--	--

Coordination

Overall coordination: ROSA

Coordination per topic:

Air (METEO)

Forestry (CBK PAN)

Waste (GFZ)

Water (CUT)

Illegal Building (ISPRA)

Illegal Manure Spreading (ISPRA)

Dialogue with users: coordination ISPRA,
implementation all partners.

Demonstration products: GFZ

Outcomes

W1: Workshop on user need analysis in M06

R1: report on users profiles, needs and regulatory obstacles (M08)

W2: Workshop on GEOINT methods and tools in M10. Deliverables:

R2: report on recommended IT infrastructure, needed data and analysis tools (M12)

R4: portfolio of demonstration products (INTREPs) in pilot test sites (M20)

R3: knowledge sharing platform (KSP) - software and user manual (M18)

W3: Workshop on workflows and technical and legal barriers in M20

R5: report on possible workflows, technical obstacles and needed investment (M22)

R6: summary of recommendations on workflows, training needs and uptake (M23)

*Due to delays in accessing needed data, a project extension of 6 months was approved; activities ended 30 May 2024

Requirements: Manure spreading

Needs and technical requirements:

- Key requirement: Database platform to collect and homogeneously manage the information on manure spreading activities
- Monitoring activities during the **no-spreading period**
- **Minimum mapping unit:** between 10 m² and 1 ha
- Monitoring **frequency:** weekly or at least monthly threshold
- **Delivery time** of monitoring results: a few days after the reported event and remote sensing data acquisition

Obstacles

- difficulty in tracing the spreading information (timing and location of the event)
- difficulty in linking the event to measures on the ground and the company responsible for the spreading
- difficulty in monitoring because the spreading is not always reported to the competent authorities
- difficulty in accessing manure spreading authorisation
- lack of up-to-date spatial layers

Requirements: Illegal logging

- Over 30% of Italian user indicate illegal logging occurring **outside concession boundaries** of a forest management plan
- Also consider Illegal logging occurring on: protected areas, along river banks, municipalities areas
- Ancillary information are required to identify illegal logging using satellite Earth Observation, to **exclude authorized logging sites or areas of forest loss related to natural factors** (i.e. wildfires, insect outbreaks, wind disturbance)
- Required **minimum mapping unit**: 1 to 5 hectares
- Optimal **update frequency**: from weekly to monthly
- Required information: Satellite/ airborne **imagery before and after**, **time** of occurrence, affected **area/ biomass** volume

Requirements: Waste crime

Main needs of users from Germany, Poland and Romania

- **Detection** of illegal waste sites
- Monitoring of legal & illegal waste sites regarding **type and quantity** of materials, **time** of occurrence and temporal evolution
- Methane **emissions** from landfills
- Detection of **fires** related to waste sites

Challenges

- **heterogeneity** of waste sites regarding size, materials, spatial layout/structure
- small **size and structure** of waste sites

Specific requirements

- Method used in the detection and monitoring of waste dump sites should be **scalable and affordable**

Requirements: Illegal construction

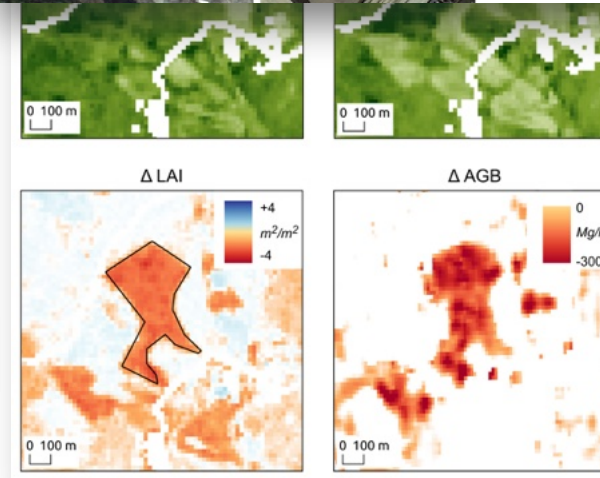
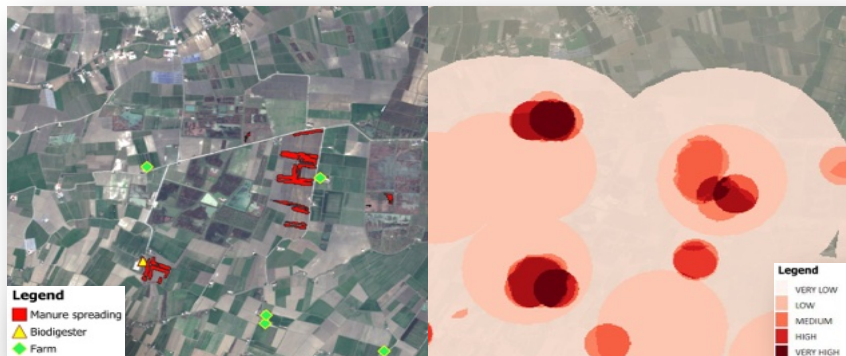
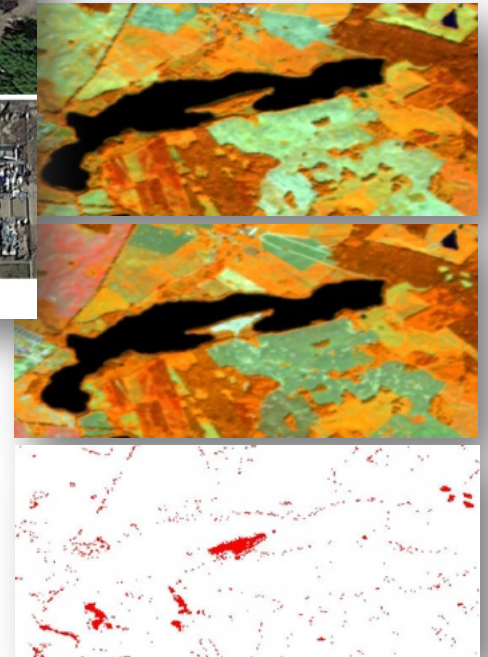
- The main output should be **GIS maps** identifying **land cover changes** related to new **construction sites or buildings**
- A sufficient level of detail to **distinguish illegal activities in the frame of local planning and protected areas**; local authorities and municipalities can therefore use the produced change detection maps to verify if the detected changes are illegal constructions
- The minimum **spatial resolution** for monitoring illegal buildings is between 10m and 100m ($100 \text{ m}^2 < \text{MMU} < 10,000 \text{ m}^2$)
- The **temporal period** of the monitoring should be between 1 and 12 months
- The **delivery time** of the monitoring results should be between a few days and a month after the monitoring activity

Analysis methods

Selected methods ranging from CAPI to fully automated change detection or quantification methods i.e based on vegetation indices or fusion with in-situ observations e.g. biomass gathered by TLS were applied in 15 demo cases; the IntReps produced are also uploaded in the KSP available at

<http://geoint4env.meteoromania.ro>

in the form of geostories (include interactive maps, web pages and graphics)



Strengths and limitations: Manure spreading

Strengths

- semi-automatic procedure
- Sentinel-2 open data
- Spectrally richer data (e.g. PRISMA) images to deepen manure spectral signature
- analysis of wide areas of agricultural soil
- immediate overview/ focus on critical areas
- periodic update possibility
- annual implementation

Limitations

- Needs of an operator to validate the data
- Difficulties Identifying spreads in vegetated soils
- Need of further field campaign and new soil chemistry analyses

Strengths and limitations: Illegal construction

Strengths

- The method allows for the **automatic detection of possible changes**
- **Training data is not required**
- **Synergic use of Sentinel-1 and Sentinel-2** data, reducing cost of monitoring
- **Method** that can be adapted to different landscapes

Limitations

- The method doesn't allow for detecting **changes in height of existing buildings**
- The possible changes need to be **photointerpreted** to refine the number of actual changes
- **Ancillary data is required** to define **zones of illegal construction**
- **In situ verification is required** to detect constructions that are illegal according to the local legal framework

Strengths and limitations: Waste crimes

Strengths:

- **Detection** of illegal landfills, dump sites, and illegal waste storage facilities
- Monitoring of activities at **closed landfills** and closed storage facilities
- Monitoring of **legal landfills** with regard to the quantity of waste
- Monitoring and **classification of waste types** that are spread on a landfill, dump site or facility
- Detection of **contaminated** sites and deposits
- Monitoring of **interim waste storage** sites

Limitations:

- Lack of VHR satellite imagery with a high repetition rate at affordable costs
- Eventually conflicts with the General Data Protection Regulations
- Some process cannot be automated

Technical summary

Requirements collected after no-so-easy process involving potential user organisations and included in the planned deliverable

Demo sites selected by each partner in agreement with the main user organizations participating in the dialog started by the consortium partners

Data selection / acquisition still difficult; VHR data provision ensured by each partner based on specific agreements concluded with satellite data providers

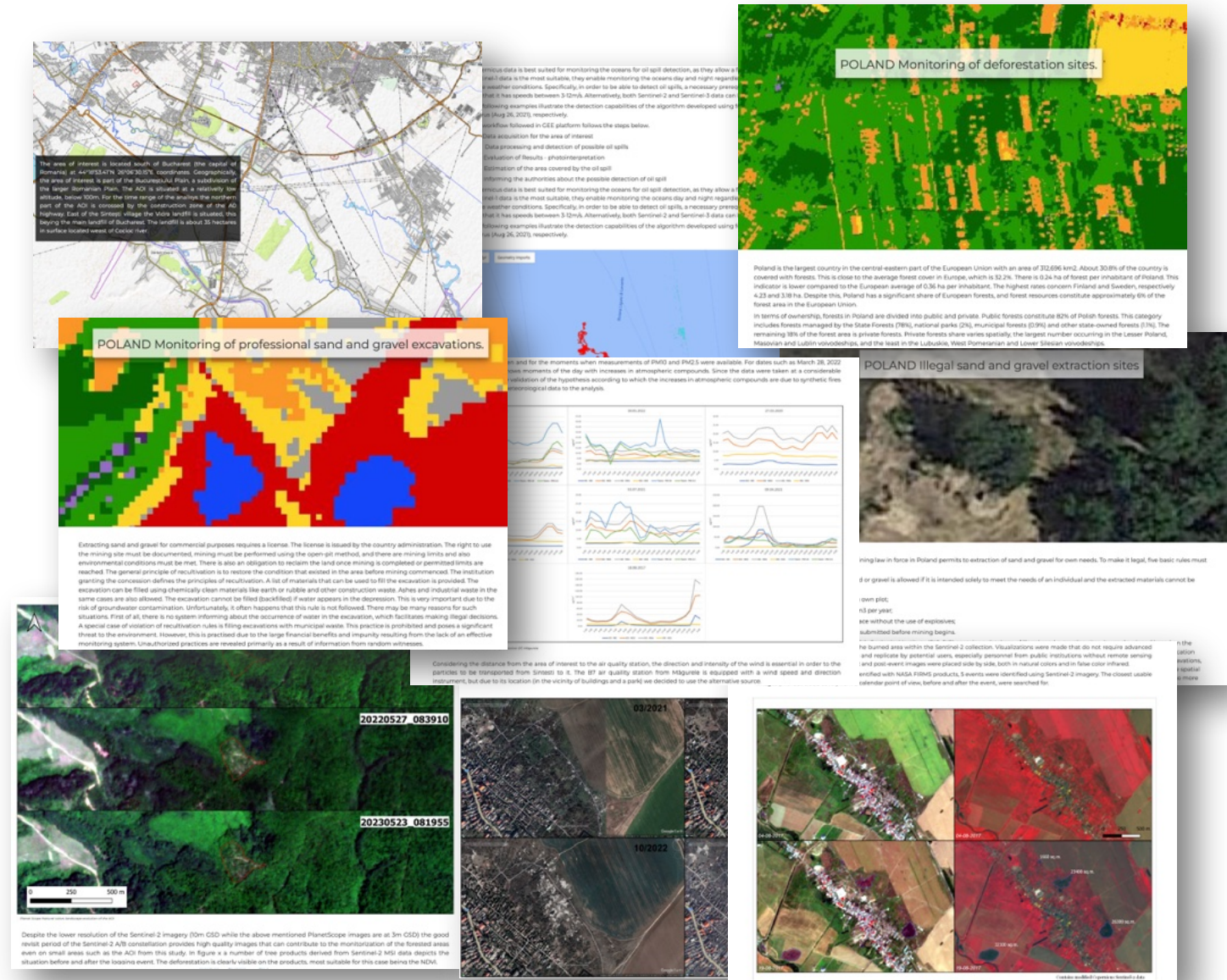
Details on methods and workflows are given in the planned deliverables; results of the demo cases are included in the KSP (Knowledge Sharing Platform) and made available online at:

<http://geoint4env.meteoromania.ro>

Feedback from possible / contacted user organizations evaluated as positive; deliverables to be sent together with the invitation to study the demo cases published in KSP.

Results summary

Main results consisting of reports summarizing the concepts and principles applicable, identified requirements and recommendations for uptake; Intelligence Reports produced for AOIs selected for each of the topics addressed: manure spreading, air quality, illegal building, waste crimes, illegal logging, water pollution



Uptake recommendations

Know the phenomena and its impact in terms of effects e.g water becomes red; Associate the effects with markers derived from remote sensing / other geo-spatial data

Perform feasibility studies on selected methods and workflows allowing the production of needed intelligence i.e. for answering the where, when, what, why, who questions; make difference between the detection and detailed analysis

Make sure the needed data is available considering qualitative and quantitative criteria and the licensing allows operational exploitation

Check the preferred operation method - can be based on own resources or external services; plan and apply organizational adaptation in terms of human and material resources; organize any needed training

Uptake recommendations

Assess the existing legislation and check with the prosecutors the way information / intelligence should be conveyed for ensuring effectiveness and legal use

Choose the best ways to collect needs, prepare for operational new cases and manage processes and information delivery; knowledge platforms could be a solution if appropriate levels of access and visibility can be set depending of the type of information being managed see KSP demo, globalplasticwatch

Work early for preparing the operations phases of newly identified problems; one more use cases identified already in RO in terms of sand and gravel exploitation in river beds; IMPEL working on ground water abstraction case

Contributions

Topics and contributors

Air pollution: CUT, METEO, ROSA

Illegal construction: ISPRA, ROSA, CBK PAN

Illegal forestry: CBK PAN, ROSA, CUT, ISPRA

Illegal manure spreading: ISPRA, ROSA, METEO

Waste crime: GFZ, ROSA, CBK PAN, CUT

Water pollution: CUT, METEO, GFZ

Organisations and scientists

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Website: <https://www.copernicus-user-uptake.eu/>