| Name of Project: Geospatial Intelligence for Environmental Damage Assessment (GIEDA) | |
|---|---|
| ToR Reference No.: 2023-VIII/10 | Author(s): Federico Filipponi (ISPRA) |
| Version: ☐Draft ☐Final ☒Adopted | Date: 16-May-23 |
| **TERMS OF REFERENCE FOR WORK UNDER THE AUSPICES OF IMPEL** | |

Please read the IMPEL Internal Rules, IMPEL Tender Policy and IMPEL Travel Policy before filling in the Terms of Reference Template.

## 1. Work type and title

| **1.1 Identify which Expert Team this needs to go to for initial consideration** | |
|---|---|
| Industry and air | ☐ |
| Waste and TFS | ☐ |
| Water and land | ☐ |
| Nature protection | ☐ |
| Cross-cutting tools and approaches | ☒ |

| **1.2 Type of work you need funding for** | |
|---|---|
| Exchange visits | ☐ |
| Peer reviews (e.g. IRI) | ☐ |
| Conference | ☐ |
| Development of tools/guidance | ☒ |
| Comparison studies | ☐ |
| Assessing legislation (checklist) | ☐ |
| Other, (please describe): | ☐ |

**1.3 Full name of work**

*Geospatial Intelligence for Environmental Damage Assessment to support guidelines definitions and the implementation of new regulations*

**1.4 Abbreviated name of work or project**

*Geospatial Intelligence for Environmental Damage Assessment (GIEDA)*

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## 2. Outline business case (why this piece of work?)

| 2.1 Name the legislative driver(s) where they exist |
|---|
| *Legislative drivers:*<br><br>1. Environmental Liability Directive 2004/35/EC<br><br>2. Environmental Crime Directive 2008/99/EC |

| 2.2 Link to IMPEL MASP priority work areas | |
|---|---|
| 1. Assist members to implement new legislation. | ☐ |
| 2. Build capacity in member organisations through the IMPEL Review Initiatives. | ☐ |
| 3. Work on 'problem areas' of implementation identified by IMPEL and the European Commission. | ☐ |
| 4. Other, (please specify):<br>Build capacity in member organizations for the topics identified in IMPEL implementation challenge report 2021 | ☒ |

| 2.3 Why is this work needed? |
|---|
| Rapid growing of geospatial techniques, like spatial statistics and satellite earth observation remote sensing technology, as well as recent advances in artificial intelligence, increased the ability in monitoring environmental processes. In the last decades, there has been a growing awareness that geospatial technology has the ability to monitor, inspect and assess the environment, producing the information needed by regulatory practitioners, supporting the investigation of eco-criminal acts and environmental laws infringement. However, competent authorities across EU need to find out what methodological approach best meet the requirements for the investigation of specific eco-criminal acts in the most efficient way.<br><br>Previous IMPEL projects already focused on cutting edge developments in the use of technology (e.g. artificial intelligence, earth observation, Unmanned Aerial Vehicles), by organizing mini-conferences to share knowledge with IMPEL practitioners. Principles of water, land and atmosphere monitoring using earth observation data from satellite acquisitions, including those collected within the Copernicus EU Programme, is a topic that has been introduced by previous IMPEL projects. The GIEDA project explicitly focuses on how geospatial intelligence can effectively exploit from earth observation data with the aim of contributing to the solution of specific problems related to environmental damage. In particular, the availability of earth observation time series acquired by satellites with high revisit period, allows to monitor and track anomalies and changes in natural ecosystems. Complementary information, acquired by very-high spatial resolution sensors aboard satellites or through Unmanned Aerial Vehicles (UAV - Drone), allows for more detailed information. Environmental applications of Unmanned Aerial Vehicles in environmental inspections have been presented by previous 'Use of technology in regulation' IMPEL project. Considering recent advances in drones technology, integrated with satellite-derived data, and artificial intelligence (e.g. deep learning), there is the need to present examples of good practice using such updated technologies. |

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The project aims to build on the experience of the Copernicus FPCUP project GEOINT4ENV - 'Geospatial Intelligence for Environment Protection Against Illegal Activities' (ending 30/11/2023), addressing user needs and requirements in the topic of geospatial intelligence, however, GIEDA project is more focused on the forensic aspect, and will likely further develop and extend the results obtained within the GEOINT4ENV project.

## 2.4 Desired outcome of the work

The expected outcomes in the period July 2023 – December 2024 are:

• sharing knowledge by reporting on demonstration real cases, showing geospatial intelligence ability to produce evidences and support the assessment of environmental damage, with the aim of increase agencies and regulators capacity.

If the project will be extended, the expected outcomes will be:

• bring together IMPEL practitioners with a variety of roles by organizing a mini-conference in hybrid mode, to raise the support of latest cutting edge developments in geospatial intelligence technology, fostering the institutional use and the legal application for environmental analysis and making regulations more efficient.

• extend scopes to infringements under the environmental Compliance Assurance Process, in relation to early warning of possible law infringements of environmental matrices.

The GIEDA project aims to contribute on information needs related to illegal activities affecting the environmental matrices by reporting effective methodological approaches that use geospatial intelligence, based on the use of earth observation and geostatistical analysis. Presented good practices contribute to share knowledge, and build technical and procedural capacity in producing a posteriori evidences of environmental damage caused by environmental incidents, violations, eco-criminal acts.

The reported real cases are related to environmental incidents (e.g. responsible for water pollution), violations (e.g. unauthorized ploughing in protected sites) and eco-criminal acts (e.g. illegal forest logging, illegal dumping), affecting various environmental matrices, like water and biodiversity.

The illustrated methodological approaches allow to detect, characterize and evaluate environmental damages. Dealing with environmental compliance infringement, satellite earth observation represents a valuable tool for the assessment of pre-existing environmental conditions, allowing to produce a posteriori evidences. Synergic use of earth observation data and geostatistics allows indeed to qualitatively and quantitatively assess environmental conditions, prior and after an investigated eco-criminal act. Infringement investigation can be done by producing the information needed by regulatory practitioners, in order to specifically characterise it in terms of nature and gravity, assess spatial extent of the affected area, identify temporal occurrence, and quantitatively estimate variations of specific biophysical parameters.

Description of the developed methodological approaches applied to each specific case aims at sharing knowledge with practitioners, improve the ability to produce evidences, and support the assessment of environmental damage under Environmental Liability Directive and Environmental Crime Directive. Currently applied geospatial intelligence technologies make regulatory needs on environmental

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processes and protection more efficient and could support environmental law enforcement, providing highly updated and valuable spatially explicit information. The project finally formulates recommendations, contributing to support guidelines definitions and the implementation of new regulations, therefore improving Environmental Compliance Assurance and Governance.

**2.5 Does this project link to any previous or current IMPEL projects?**

- Use of technology in regulation
- Water Over-abstraction and Illegal Abstraction Detection and Assessment (WODA)
- Project. No. 6 of the Climate Emergency Umbrella Programme about "Technology"
- Tackling Illegal Groundwater Drilling and Abstraction (TIGDA)
- Inspection planning tool of nature protected sites
- Criteria for the Assessment of the Environmental Damage (CAED)
- 4 Networks Conference

## 3. Structure of the proposed activity

**3.1 Describe the activities of the proposal**

The project will gather IMPEL members which are experienced in the use of geospatial intelligence technology to increase procedural capacity in producing a posteriori evidences of environmental damage caused by environmental incidents.

The main activities of the project are:

- Project meetings: 3 virtual and 2 face-to-face, in order to share and discuss within the project team best practices, cases collection and methodological approaches in relation to the use of geospatial intelligence technology. Questionnaire will be used for the collection of cases to be reported.

- Reporting the requirements, methodological approaches, technical issues and juridical aspects for a collection of successful cases that take advantage of geospatial intelligence technology to produce evidences, and support the assessment of environmental damage under Environmental Directives

Project milestones (M) are:

- M1: November 2023 - Setup a questionnaire to boost cases collection.
- M2: December 2023 - Contact EUFJE and ENPE Networks Milestone.
- M3: June 2024 - Identify collected cases to be reported.
- M4: July 2024 - Setup report structure.
- M5: November 2024 - Identify juridical aspects and requirements and technical aspect required for the use of geospatial intelligence.

**3.2 Describe the products of the proposal**

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Report on demonstration real cases, with description of the methodological approaches used to produce evidences and support the assessment of environmental damage, available as an e-document.

Contents of the report include:

• description of methodological approaches to detect, characterize and evaluate environmental damages through synergic use of earth observation data and geostatistics. Methodological approaches, selected to deal with specific real cases, consisting of up-to-date scientifically validated algorithms, allow to qualitatively and quantitatively assess environmental conditions and their variability in space and time domains.

• specific focus on technical aspects of the methodologies, like: algorithm sensitivity; temporal domain, enabling the evaluation of conditions prior and after an investigated eco-criminal act; spatial resolution, allowing the identification of phenomena at required scale; strength and weaknesses of the approaches; and uncertainty estimates, to assess reliability of the produced information.

• description of organizational technical aspects and issues to be implemented (e.g. equipment, human resources, costs) in order to extend the use of geospatial intelligence technology to IMPEL members.

• juridical aspects and requirements in order to use evidences and information produced provided by geospatial intelligence in courts, seeking necessary input from EUFJE and ENPE, IMPEL Networks.

• recommendations to support guidelines definitions and the implementation of new regulations, therefore improving Environmental Compliance Assurance and Governance

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