

# Requirements for Georeferencing and Digitalization of Spatial Data in the New EU Legislation on Climate, Environment, and Biodiversity

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doi: 10.5281/zenodo.11585127

**Abstract:** Since 2019 a significant number of EU legislative acts related to climate and energy policies, as well as policies on environmental protection and biodiversity restoration, have been adopted, amended, or are still in the process of being revised and enacted. These legal initiatives require georeferencing and digitalization of spatial data collected through remote environmental monitoring. The aim of these legislative efforts is to leverage technical and technological capabilities to obtain more precise monitoring data on policy performance in these sectors and to ensure the credibility of law enforcement through certification of fulfilled obligations and achieved goals. Additionally, the more accurate data collected over time will contribute to the development of new models and the improvement of EU policies aimed at achieving UN Millennium Goals and the EU climate neutrality targets by 2050, as well as long-term goals for biodiversity restoration and the protection of the environment. For monitoring and implementing these policies, Member States need to advance their capabilities for tracking emissions and collection environmental data according to the new legislation requirements. Therefore, Republic of Croatia is conducting a demonstration project to develop a multi-scale and multi-purpose system – CROatian Land Information System (CROLIS). The LIFE CROLIS project is co-financed by the EU LIFE Programme. This paper provides an overview of the new EU legislation and the requirements for georeferencing spatial data within the National Emission Inventory System and requirements for monitoring climate, environmental and biodiversity components that could be integrated into a such unified monitoring system.

**Keywords:** LULUCF; georeferencing; climate; biodiversity; environment.

## 1 Introduction

Development and establishment of the Croatian Land Information System through the LIFE CROLIS project is a response to the package of European Union laws that require more precise reporting on greenhouse gas (GHG) emissions and carbon sinks in Member States, with the aim of achieving GHG emission reduction goals. The new EU legislation aligns with two out of the six priorities set by the European Commission (Leyen 2019) for the period from 2019 to 2024: The European Green Deal, A Europe fit for the digital age based on strategic documents (COM(2019) 640,

COM(2020) 380, COM(2020) 66, C(2022) 4388) and within legislative initiatives (Decision (EU) 2022/2481, COM(2021) 550). This set up further strengthen the goals of preserving and restoring the natural environment and reducing greenhouse gas emissions by at least 55% by 2030, with the aim of achieving climate neutrality by 2050. To this end, a significant number of legal acts have been prepared, some of which have already been adopted and enforced, while others are still in the process of negotiations between EU institutions and Member States. All these acts significantly impact or will impact the lives of EU citizens in the coming years.

This paper encompasses an overview of the EU laws falling under the jurisdiction of the Directorate for Climate Policy and the Institute for Environment and Nature of the Ministry of Environmental Protection and Green Transition. In this paper, we provide an overview of the obligations and requirements of the new EU legislation related to climate, environment, and nature protection in terms of digitization, data management, remote monitoring, and georeferencing various data for reporting purposes, verification of EU law enforcement, and assessment of visible effects of these laws implementation that could be aggregated and tracked through a comprehensive, multi-level, and multipurpose land monitoring system. For each new regulation we specify arising obligations, as well as geospatial data that need to be collected, digitized, and reported.

## 2 Requirements for georeferencing and digitalization of spatial data in the new EU legislation

At EU level, the general rules for establishing infrastructure for spatial information required for reporting and data exchange have been defined by the INSPIRE Directive since 2007 (Directive 2007/2/EC). New regulation (Regulation (EU) 2019/1010) amended a group of European laws to enhance environment information management, simplify reporting, and reduce administrative burden. This regulation lays the groundwork for improving databases for future assessments and increases transparency of data of public interest. Additionally, changes to the legislative package determine the format and method of digital data sharing.

## 2.1 Climate and Energy

The new EU legislative package “Fit for 55” has introduced amendments to laws governing climate and energy with the aim of achieving at least a 55% reduction in greenhouse gas emissions by 2030 and creating conditions for climate neutrality by 2050.

In pursuit of EU climate goals, the sector of Land Use, Land-Use Change, and Forestry (LULUCF) plays a crucial role. To achieve climate neutrality (where emissions equal removals), it is essential to balance remaining emissions—after appropriate reduction measures have been taken in both EU ETS (EU Emissions Trading System) and non-EU ETS sectors — by permanently storing carbon in natural sinks (such as vegetation, soil, deadwood, and wood products) or by technological storage methods (such as carbon capture and storage or carbon capture and utilization).

The potential and accounting of carbon storage in natural reservoirs in the calculation of emission balance presents a unique problem for each country. The methodology for accounting for these emissions is prescribed by the IPCC guidelines for national greenhouse gas inventories (IPCC 2006).

When reporting in all sectors including the LULUCF sector, we distinguish three levels of methodological complexity: Tier 1 (basic method that uses international emission factors and has a high degree of calculation uncertainty), Tier 2 (medium complexity, with lower calculation uncertainty and use national emission factors) and Tier 3 (most demanding in terms of complexity and data requirements, with low calculation uncertainty and use emission factors specific to individual categories/facilities/processes).

The Regulation (EU) 2023/839, defines an obligation of Member States to use at least Tier 2 methodology in the LULUCF sector from 2028 while from 2030, Member States shall use Tier 3 methodology. The Tier 3 methodology requires a significant effort from Member States to properly identify, monitor, and precisely determine/georeference land cover, land use, and land use changes to ensure that calculations are credible.

According to the specified obligations Croatia, along with other Member States, should establish a system for monitoring land use changes with geographically explicit data on land conversion by 2030. This monitoring should be done on regular basis across the entire surface of Croatia, using specific carbon sink factors based on climate-vegetation zones and types of land cover/crops/products. Additionally, it should consider background emission levels caused by natural disasters (such as fires, floods, landslides, desertification...) in accordance with the IPCC guidelines.

## 2.2 Nature Restoration

Despite the European Union’s longstanding active environmental and habitat protection policies, a Final evaluation report (Trinomics B.V. 2022) conducted as part of the evaluation of the EU Biodiversity Strategy up to 2020 (COM(2011) 244) reveals that the EU has not halted

biodiversity loss between 2011 and 2020, nor has achieved the voluntary goal of restoring at least 15% of degraded ecosystems by 2020 (SWD(2022) 284).

Due to these negative indicators, as well as numerous other negative signs of pressures on natural habitats and biodiversity, the European Commission introduced the Proposal for a Regulation on Nature Restoration (COM(2022) 304) in 2022, in line with the new EU Biodiversity Strategy for 2030, titled “Bringing Nature Back into Our Lives” (COM(2020) 380).

Among the proposed measures to improve the state of nature, there are plans to develop national restoration plans for the period up to 2050. These plans will need to establish georeferenced maps of areas included in nature restoration efforts, along with prescribed actions.

The proposed regulation requires periodic delivery of data on the location and extent of areas covered by measures for the restoration of terrestrial, coastal, and freshwater ecosystems, as well as marine ecosystems, including georeferenced maps of these areas. Monitoring results will need to be submitted annually through Monitoring Reports, while data on the location and extent of areas covered by restoration measures will need to be provided every three years, including georeferenced maps of those areas.

## 2.3 Resilience of forests

Due to increasing stress caused by climate change, unsustainable direct or indirect human use and activities, as well as related land use changes, a proposal for a new Regulation (COM(2023) 728) was introduced in 2023. The proposed regulation envisions the establishment of a forest monitoring system. The forest monitoring system should consist of:

- a geographically explicit identification system for mapping and locating forest units,
- a framework for collecting forest data on annual basis,
- a framework for exchanging forest data.

The forest monitoring system should include electronic databases and geographic information systems, allowing for data exchange and integration with other electronic databases and geographic information systems, including those developed for monitoring emissions and sinks in the LULUCF sector as previously mentioned. The collected data should be standardized, and the framework for data collection and responsibilities for collecting specific data will be distributed between Member States and the European Commission.

## 2.4 Deforestation

Under EU law (Regulation (EU) 2023/1115) certification is required for certain goods and certain products associated with deforestation and forest degradation when made available on the Union market and for export from the Union. The aim of the regulation is to prevent deforestation, and products such as soy, beef products, and timber products will need to have a certificate of origin that must not be associated with deforestation. To this end, an information system is being established that, among

other things, should georeference land parcels larger than four hectares that are used to produce relevant goods.

### 2.5 Soil Monitoring

All Member States are faced with problems of soil degradation, erosion, pollution and sealing. Research conducted by the European Commission (Veerman et al. 2020) shows that between 60 to 70% of soils in the European Union are not healthy. Therefore, in 2023, the European Commission presented a Proposal for a Soil Monitoring Act (COM(2023) 416) which establishes measures for monitoring and assessing soil health, sustainable soil management, and contaminated sites.

For this purpose, Member States will need to establish a framework for monitoring soil health, contaminated sites and their remediation, and permanent coverage (so-called sealing), and conduct regular measurements on soil samples taken “in situ.” Member States will need to report results and trends every five years.

The proposal for the new Directive envisages the establishment of a digital portal for soil health data that should be compatible with the EU’s data strategy and EU data spaces and serve as a hub for accessing soil data from various sources.

### 2.6 Protection of carbon-rich soil

EU law (Regulation (EU) 2021/2115) establishes rules for supporting strategic plans developed by Member States within the framework of the Common Agricultural Policy (CAP). It mandates the implementation of GAEC 2 standards (Standard for good agricultural and environmental condition of land) to protect carbon-rich soil through the preservation of wetlands and peatlands. Member States are required to comply with this obligation starting in either 2024 or 2025. The regulation further demands the identification (including geolocation) of such areas, as well as agricultural land (within the LPIS system), where agricultural activities supported by CAP annual payments are assessed (cross-compliance checks) against the GAEC 2 standard.

### 2.7 Certification framework for carbon removals

Carbon certification is an additional mechanism that could contribute to achieving high-quality carbon removals, thereby contributing to the Union’s goal of achieving climate neutrality by 2050. The new legislative proposal (COM(2022) 672) on the certification of carbon removals (in the adoption phase) establishes a voluntary framework for the entire EU, sets criteria for high-quality carbon removals, and a procedure for monitoring, reporting, and verifying the authenticity of these removals. According to the EU framework, there are several ways to remove and store carbon, which can be certified:

- natural solutions such as forest restoration, soil, and innovative agricultural practices,
- technological solutions such as bioenergy with carbon capture and storage or direct air capture and storage of carbon,
- long-lasting products and materials, such as wood-based construction.

Also, a series of certification methodologies tailored to the main types of carbon removal activities will be developed to ensure the correct, harmonized, and cost-effective implementation of the EU’s quality criteria for carbon removals.

Farmers and forest owners will be able to certify carbon storage using a credible system such as the existing LPIS or a similar credible system. Operators who permanently store carbon through technological carbon storage in geological structures must also have georeferenced storage locations. The explicit geolocation of the storage must be stated in the appropriate certificate with which the operator participates within the certification scheme.

## 3 Discussion

The presented package of EU legislation promotes the digitalization of information and data, their georeferencing (i.e., precise spatial positioning), and their sharing. The requirements of the new legislation are focused on:

- determining the actual state of the environment based on remote monitoring and georeferencing of collected data,
- exchange of digital information among Member States and other stakeholders,
- standardization of data collected from different sources and exchange of these data,
- establishing a timeline for collecting data and information to monitor changes and trends in the environment and climate.

This aims to obtain detailed and credible information, which will be important for evaluation of implementation of existing policies and for designs of new policies, as well for certification or participation in certification schemes, which can be or are a source of income for individuals, entrepreneurs, and Member States.

The quality of collected information and spatial data is always a challenge, which is addressed by specifying data requirements for established reporting systems or by data evaluation during audits for developing reporting systems.

## 4 Conclusions

The development of a comprehensive monitoring system for different indicators on climate, nature and environment changes and their impacts to society, as well as information on the effects of policies implementation in these areas against the time is becoming increasingly important. Pairing and interpretation of data based on objective indicators and models is necessary for making informed decisions.

In the area of climate and energy, environment, and nature policies EU not only set high requirements for the collection, standardization, and processing of data but also enable, encourage, promote, and assist Member States in establishing monitoring systems.

*Acknowledgments:* LIFE CROLIS project is co-financed by the LIFE Programme of the EU.

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