EuroGeoSurveys
European Geoscience for Society
The Geological Surveys of Europe

EuroGeoSurveys

Strategic Research and Innovation Agenda

Building a Geological Service for Europe

The EuroGeoSurveys Strategic Research and Innovation Agenda (2025–2034) sets out a forward-looking framework for the sustainable use and management of Europe's geological resources.

Funded by the European Union

GSEU

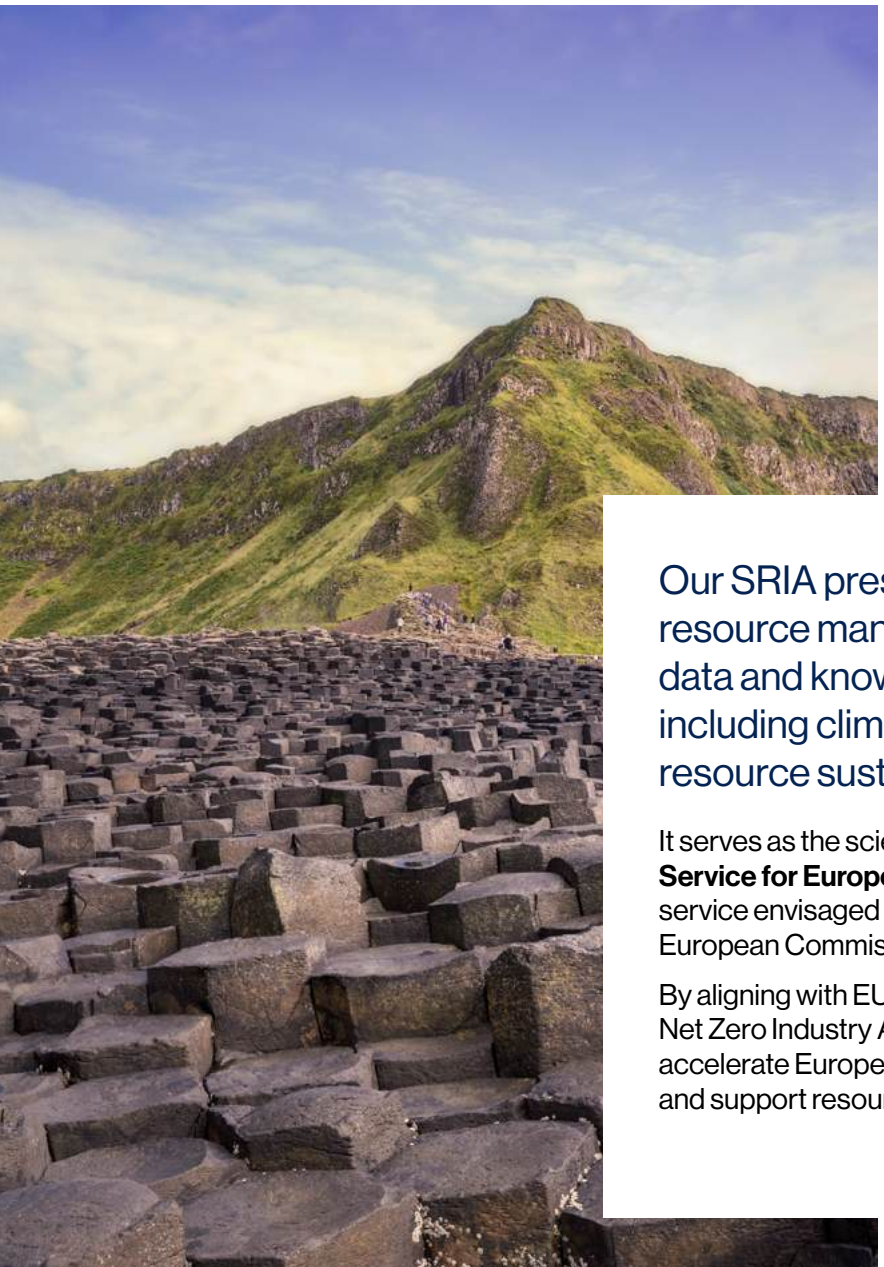
EuroGeoSurveys is the association of European Geological Survey Organisations.

We are a 10,000+ workforce collaborating through scientific expert groups, task forces, and EU-funded projects.

We provide essential subsurface knowledge to support Europe's critical needs in energy, environment, and natural resources.

Our mission is to enable sustainable and responsible use of the Earth's subsurface environment and resources. Through our flagship GSEU project, we deliver harmonised datasets and atlases that are critical to achieving this goal.

And this is just the beginning - we are committed to driving innovation, expanding research, and deepening collaboration to meet Europe's evolving subsurface challenges.



Our SRIA presents a framework for sustainable resource management, focusing on geoscientific data and knowledge to address challenges including climate change, energy security, and resource sustainability.

It serves as the scientific foundation for our vision of a **Geological Service for Europe** - a permanent, sustainable, and data-driven service envisaged as the geoscientific reference partner of the European Commission.

By aligning with EU policies (e.g., the Critical Raw Materials Act and Net Zero Industry Act), this SRIA provides key focus areas to accelerate Europe's economic, environmental, and social resilience and support resource autonomy and security.

The EuroGeoSurveys SRIA forms the research and innovation basis to support the future Geological Service for Europe, prioritising:

Geoscientific And Digital Foundational Framework

- Understanding the Subsurface – Geological Data
- A Sustainable European Geological Data Infrastructure

Strategic Geoscientific Focus

- Energy Transition & Decarbonisation
- Responsible Raw Materials
- Sustainable Management of Groundwater in a Climate Change Context
- Managing Geohazards and Environmental Risks

Integrating Subsurface Management And Stakeholder Engagement

- Urban Geology, Geoheritage and Land Planning
- Societal and Economic Impact: Knowledge Sharing, Policy Support, and Public Engagement

Understanding the Subsurface – Geological Data

Reinvest in updating of geological information of Europe

- Create standardised **scientific vocabularies**.
- Establish an **open-source, collaborative GIS platform** for efficient data exchange and analysis.
- Develop harmonised **transboundary datasets**.
- Support and improve existing **national geological mapping programs**.

Towards a European-scale 3D geological model

- **Standardise 3D models** to facilitate integration of national geomodels.
- Set up a **platform** to host and query 3D geomodels linked to existing EGDI.
- Develop a **pan-European 3D geological model**.
- Build **high-resolution 3D digital geological models**.

New technologies for subsurface investigation and geomodelling

- Implement **innovative geophysical methods** for geological surveying and exploration.
- Create **new methods and tools** using geomodelling and AI.
- Develop **common methodologies** for 3D geomodelling.

Subsurface Digital Transition

Standardisation framework for FAIR Data and Metadata

- Develop and maintain a **standardised framework** for European geoscientific data.

EGDI

Transparent and Accessible Sustainable Value Chains

- **Enhance data discoverability, traceability, and interoperability** through enriched metadata, semantic linkages, and advanced search capabilities.
- Develop a **user-friendly interface**, enabling intuitive exploration, analysis, and visualisation of geological data for informed decision-making.

Ensuring Up-to-date and Trusted Data

- **Automate data management** for geological systems to improve efficiency, accuracy, and security while ensuring controlled access.

EGDI: Evolution into a Pan-European Geoscience Knowledge Hub

- **Connect EGDI** with other European data spaces for comprehensive and efficient data sharing.
- Ensure **open and accessible data and tools** for development, research, and education.
- **Enhance EGDI** with Linked Data technology, leveraging semantic technologies, ontologies, and knowledge graphs.

Energy Transition & Decarbonisation

Pan-European Geothermal Deployment Platform

- Develop **tailored information services** to accelerate geothermal energy development.

Pan-European CO_2 Storage Knowledge Hub

- Contribute to **closing knowledge gaps**, with special focus on challenges identified by storage projects.

Unlocking Underground Hydrogen Storage

- Develop **fit-for-purpose information services** to accelerate the development of underground hydrogen storage solutions.

Maturing next-generation geoenergy technologies

- Facilitate the development and deployment of **new technologies and innovations.**

Responsible Raw Materials for Europe

Support raw materials exploration to assess European potential

- Maintain a **reliable and harmonised inventory** of European mineral resources.
- Develop **cutting-edge exploration models**.
- Lead **collaborative exploration efforts** with industry and technology partners.
- Implement a **multi-disciplinary approach** for researching unconventional ore deposits.

Improve responsible supply of raw materials in Europe

- Develop and share **advanced models** for mineral resource lifecycle.
- Maintain **criticality assessments** for raw materials to support public authorities and industry.
- Build **partnerships** in the raw materials sector.
- Develop **tools** for evaluating environmental and societal impacts.

Support the development of responsible mining and a circular economy

- Develop **innovative tools** for mine lifecycle monitoring.
- Promote **innovation in recycling** ancient mining wastes.
- Update **knowledge on raw materials potential** in mining waste.

Sustainable Management of Groundwater

Groundwater resources in a changing climate

- Improve **data availability** through platforms, integration, modelling, sensors, transparency, and ML.
- Create **integrated hydrogeological** models combining climate, surface, and marine interactions.
- Understand **groundwater vulnerability** through tracer databases, residence-time distributions, and tracer-calibrated modelling.

Nature-based solutions for sustainable groundwater management and resilient groundwater resources

- Create assessment tools, enhance monitoring, evaluate mitigation strategies (including emerging pollutants), and improve subsurface characterisation for integrated **quality and quantity groundwater management impacts**.

Protecting Groundwater in relation to drinking water, ecosystems, and public health

- Develop **tools** to trace, forecast, and quantify contamination in relation to **public health**.
- Enhance **tools** for assessing groundwater **impacts on ecosystems**.

Groundwater and the green transition

- Develop integrated **4D geocharacterisation and modeling** tools to balance competing subsurface uses, including drinking water, energy, and storage, while mitigating risks.

Managing Geohazards and Environmental Risks

Predicting Geohazards: Understanding Natural and Human Impacts

- **Innovate geohazard mapping and monitoring** using advanced Earth observation technologies and sensors.
- Develop new stochastic, multi- physics, or mixed models for **improved geohazard forecasting**, including the use of Digital Twin concepts.

Risk assessment and mitigation

- Continuously update **geohazard inventories and databases**.
- Establish **consistent risk mapping approaches** across Europe.
- Improve **susceptibility, hasard, and risk maps**.
- Enhance **early-warning systems** for improved disaster preparedness.

Reduce pollution and improve soil health

- Establish **Natural Background Levels** for soil chemical and physical properties.
- Develop **standard methodologies** for soil mapping and monitoring.
- Monitor **soil erosion and contamination**.

Urban Geology, Land Planning, and Geoheritage

Urban Geology: a Crucial Asset for Sustainable Cities

- Develop **urban subsurface ontologies** and standards compatible with Building Information Modelling standards.
- Analyse the **geological and climate footprint of cities**.
- Utilise **3D models** to manage competing use and support urban subsurface spatial planning.

Land Use Planning

- Develop **strategic land-use planning tools** to optimise resource exploitation while balancing surface and subsurface use with competing land uses, environmental integrity, and socio-economic factors.

Geoheritage

- Emphasise the importance of **identifying and preserving geoheritage sites**.
- Highlight the need to integrate **geoconservation** into broader environmental policies and to engage the public.
- Stress the importance of **research and collaboration** to enhance understanding of geoheritage and its significance.

Knowledge Sharing, Policy Support, and Public Engagement

A Network for Knowledge Sharing and Best Practices

- Foster **collaboration, knowledge sharing, and geoscience innovation** to support Europe's industrial and policy efforts.

Public Awareness, Engagement, Education, and Policy Support

- Revitalise **geoscientific expertise** in Europe.
- Improve **geoscience communication** to diverse stakeholders.
- Build **public engagement** for sustainable development.
- Build **urban resilience** and risk awareness.

Policy Support Advice and Services

- Develop **collaborative geoscientific tools and data platforms** to provide policy-makers with informed, standardised, and real-time support for risk assessment, sustainable management, and efficient implementation of strategic initiatives.

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