Soil monitoring, indicators, data reporting & publication
Synergies for soil data exchange

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Technical synergies for soil data exchange and reporting

EU-member states and non-EU following with
national monitoring, similar national soil legislation

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Legislation overview

INSPIRE Directive
Open Date Directive

➢ Exchange of environmental data is regulated
➢ Follows existing standards

Supporting projects and agencies

➢ EJP Soil, SoilWise
➢ European Soil Observatory (JRC)
➢ EEA reportnet
➢ National projects

Data on soil – opportunity for synergies?

NEC Directive

➢ Current reporting of soil monitoring (forest)
➢ Will need to be adapted to these standards (prepared, not yet implemented)

Soil Monitoring Law/ existing monitoring

➢ Existing/future national and EU soil monitoring data

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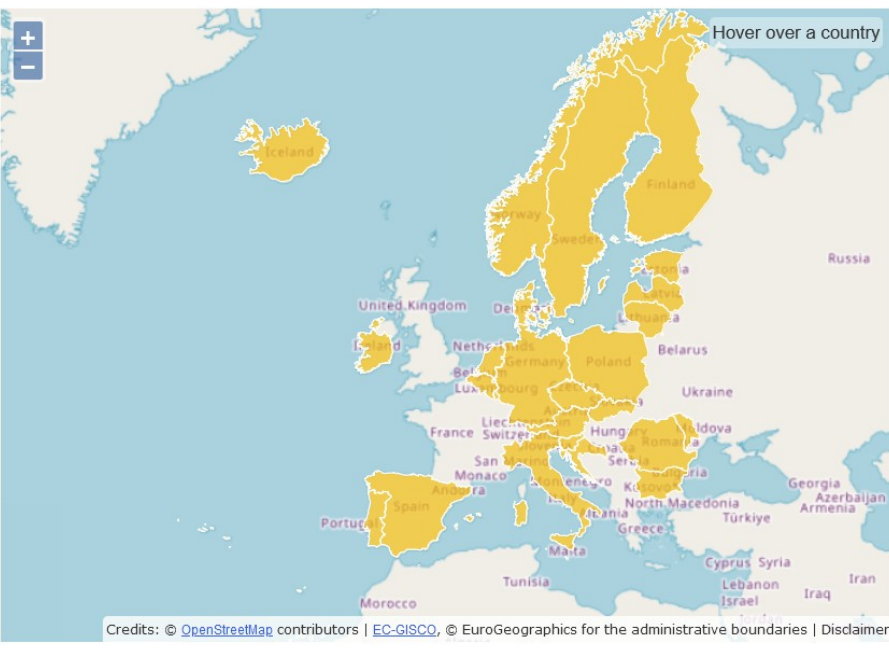
Soil data in INSPIRE GeoPortal

https://inspire-geoportal.ec.europa.eu

INSPIRE Datasets - EU & EFTA Country overview
Datasets by Theme: ⚖ Soil

Hover over a country

Credits: © OpenStreetMap contributors | EC-GISCO, © EuroGeographics for the administrative boundaries | Disclaimer

Geoportal Dataset Statistics

📄 693 Metadata records

⬇ 225 Downloadable Datasets

👁 308 Viewable Datasets

Spatial scope coverage:

☐ ▐ National

☐ ▐ Regional

Country	Metadata	Download	View
🇦🇹 Austria	9 📄	9 ⬇	9 👁
🇧🇪 Belgium	19 📄	16 ⬇	19 👁
🇧🇬 Bulgaria	1 📄	0 ⬇	0 👁
🇭🇷 Croatia	1 📄	1 ⬇	1 👁
🇨🇾 Cyprus	0 📄	0 ⬇	0 👁
🇨🇿 Czech Republic	1 📄	0 ⬇	0 👁
🇩🇰 Denmark	1 📄	0 ⬇	0 👁
🇪🇪 Estonia	2 📄	1 ⬇	1 👁
🇫🇮 Finland	2 📄	0 ⬇	0 👁
🇫🇷 France	0 📄	0 ⬇	0 👁
🇩🇪 Germany	273 📄	143 ⬇	211 👁
🇬🇷 Greece	0 📄	0 ⬇	0 👁
🇭🇺 Hungary	0 📄	0 ⬇	0 👁
🇮🇸 Iceland	2 📄	0 ⬇	0 👁
🇮🇪 Ireland	0 📄	0 ⬇	0 👁
🇮🇹 Italy	317 📄	15 ⬇	19 👁
🇱🇻 Latvia	3 📄	2 ⬇	2 👁
🇱🇮 Liechtenstein	2 📄	0 ⬇	2 👁
🇱🇹 Lithuania	1 📄	1 ⬇	1 👁
🇱🇺 Luxembourg	4 📄	4 ⬇	4 👁
🇲🇹 Malta	1 📄	1 ⬇	1 👁
🇳🇱 Netherlands	8 📄	6 ⬇	6 👁
🇳🇴 Norway	1 📄	0 ⬇	0 👁
🇵🇱 Poland	2 📄	2 ⬇	1 👁
🇵🇹 Portugal	7 📄	2 ⬇	0 👁
🇷🇴 Romania	4 📄	0 ⬇	0 👁
🇸🇰 Slovakia	1 📄	0 ⬇	1 👁
🇸🇮 Slovenia	1 📄	0 ⬇	0 👁
🇪🇸 Spain	6 📄	0 ⬇	6 👁
🇸🇪 Sweden	0 📄	0 ⬇	0 👁

Open Data Directive and HVD Regulation

Single European market for data (ensure Europe's global competitiveness and data sovereignty)

- European Data Strategy
- Cross-sectoral legislative framework: Data Act, Data Governance Act, Open Data Directive, Implementing Act on High-value datasets
- Common European data spaces

Open Data Directive 2019/1024 ⟷ **High-value datasets Regulation 2023/138**

Re-use of public-sector information and publicly funded research data

- Available free of charge
- Publication and re-use: open standard licenses
- Mapping between INSPIRE and HVD
- Reporting deadline: 09 February 2025 and every 2 years afterwards
- Reporting guidelines

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Open Data Directive 2019/1024

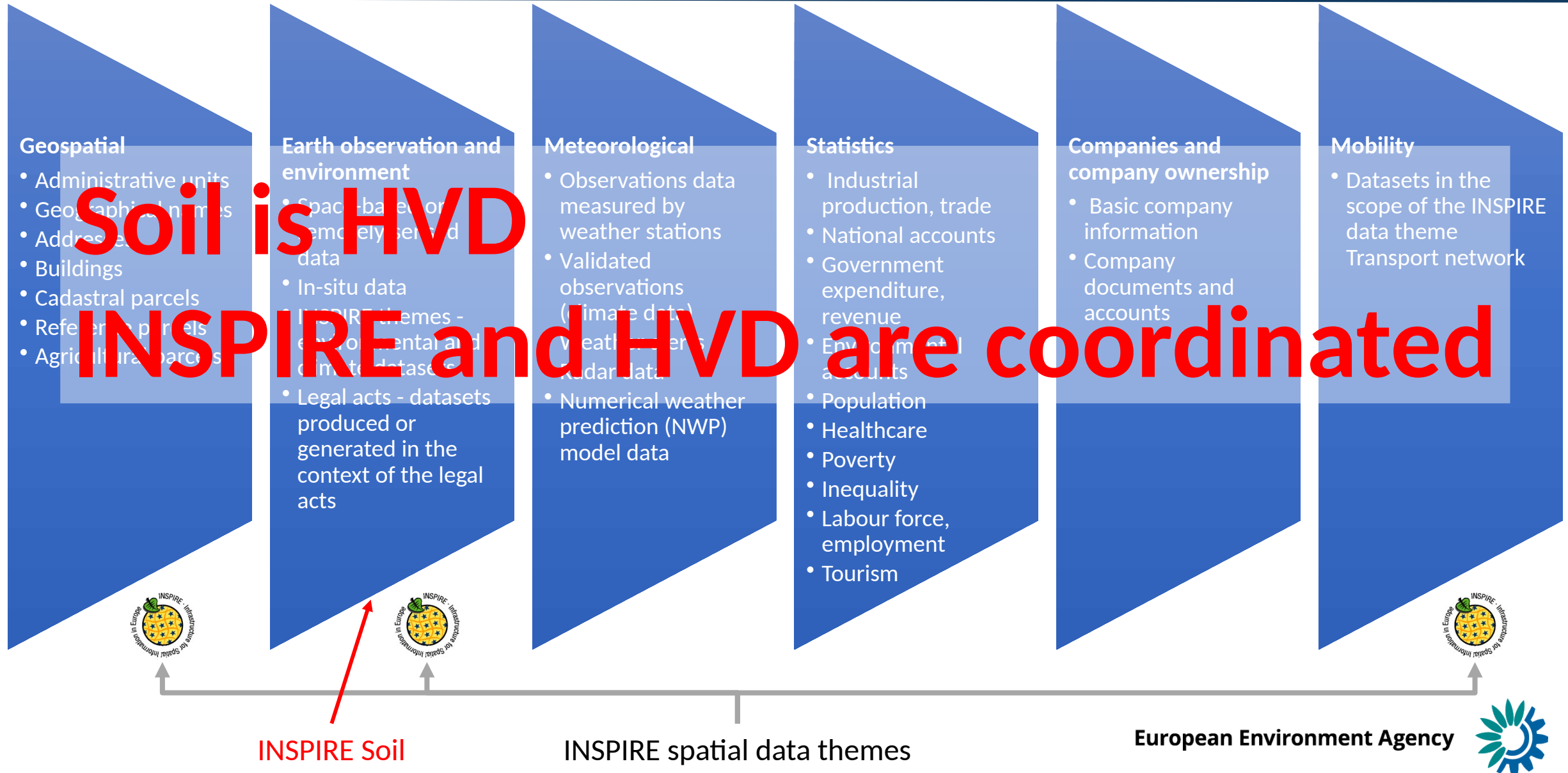Re-use of public-sector information and publicly funded research data

⟷

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HVD categories and list of datasets

Geospatial
- Administrative units
- Geographic names
- Addresses
- Buildings
- Cadastral parcels
- Reference parcels
- Agricultural parcels

Earth observation and environment
- Space-based or remotely sensed data
- In-situ data
- INSPIRE themes - environmental and climate datasets
- Legal acts - datasets produced or generated in the context of the legal acts

Meteorological
- Observations data measured by weather stations
- Validated observations (climate data)
- Weather alerts
- Radar data
- Numerical weather prediction (NWP) model data

Statistics
- Industrial production, trade
- National accounts
- Government expenditure, revenue
- Environmental accounts
- Population
- Healthcare
- Poverty
- Inequality
- Labour force, employment
- Tourism

Companies and company ownership
- Basic company information
- Company documents and accounts

Mobility
- Datasets in the scope of the INSPIRE data theme Transport network

Soil is HVD
INSPIRE and HVD are coordinated

INSPIRE Soil

INSPIRE spatial data themes

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INSPIRE Directive 2007/2/EC

- Establishes Infrastructure for Spatial Information in the European Community

INSPIRE component	Implementation requirements
Metadata	ISO 19115, ISO 19139
Data Specifications	data models with mandatory, optional and voidable parameters – to provide interoperable data sets
Network Services	mandatory web services
Data and Service Sharing	regulates the provision/access to spatial data sets from Member States to the EU
Spatial Data Services	other spatial data services for data processing
Monitoring and Reporting	country fact-sheets

GLOSIS/SoilSTAT

Model component	Implementation requirements
Metadata and metadata catalogue	Same SO 19139, DCAT, Dublin Core/open Addition N, GeoNetwork, PyCSW and git
Data specifications	GloSIS and ISO28258 database and data Comparable els and formats with mandatory and optional
Vocabularies	(machine readable) Terminology on soil Needs work/ can be comparable ation. International, national.
Network Services	Same d web services that allow harvesting to GloSIS or other applications
Data Sharing	Less strict y, national legislations
Map viewer	Comparable rvices for viewing
Reporting	Needs work/ can be comparable esampled national maps
Enabling environments	Country-specific design of soil information Addition nitoring, incl. use cases, organizational, legal, funding, capacity aspects

Conclusion: technical synergies for soil data exchange exist

- ➢ EU legislation follows 100% ISO/CEN standards, so does GLOSIS
- ➢ EU and non-EU national data infrastructures also share these standards

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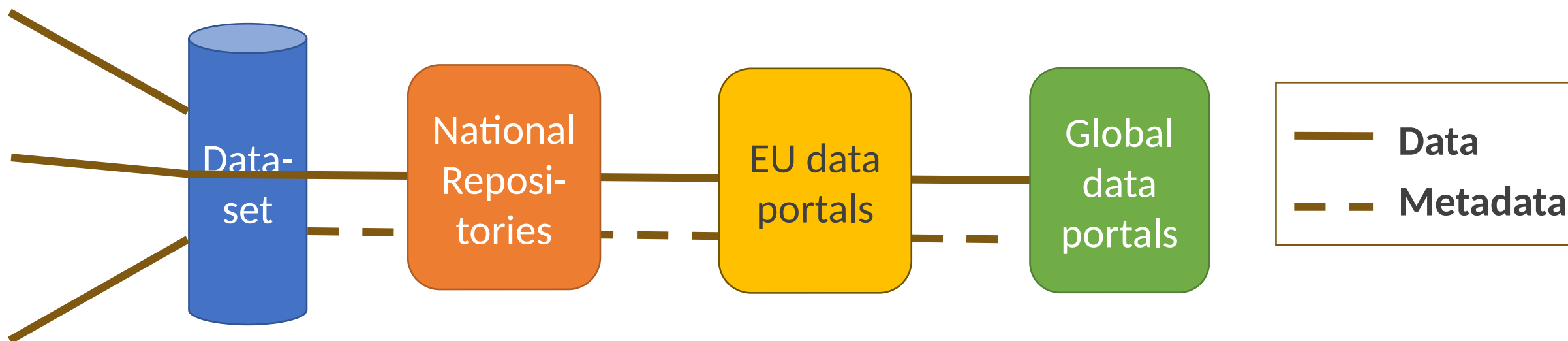
Technical support tools (Reportnet, EJP Soil, SoilWise, JRC)

- Guidance and Capacity building (SoilWise, GSP INSII webinars, ISRIC, EIONET)

- Coordinated standards: INSPIRE, GloSIS, ISO28 258

- Flexible reporting formats: GeoPackage, Excel

- Support to national data provision: transformation services (SoilWise)

- Harmonization: terminology, vocabularies, codelists

- Soil information system tooling, open source, incl. enabling environment

Content synergies for soil data exchange and reporting

EU-member states and non-EU following with
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Overview of requirements from national soil monitoring

Soil data requirements in different legislations

- INSPIRE Directive (spatial data and services)
- Open Data Directive
- NEC Directive Art 9: impact of air pollution on ecosystems
- Soil Monitoring law (proposal)

Other indicator systems

- National soil legislation
- LULUCF
- Nature Restoration Regulation
- UNCCD/LDN
- GSP-Action Framework

Which soil data are concerned?

Mandatory/optional existing spatial data/**use cases** (hardly implemented for soil)

High-value datasets (vague on exact soil content)

Forest soil monitoring data sets

Monitoring of full spectrum of soil descriptors

Varying soil indicators for national and international soil assessments

SOC stock change for different reporting categories

Monitoring of soil health indicators

Use case: National Emission Ceilings Directive (NECD) (link) – Art. 9 (link):
Impact of air pollution on ecosystems – soil profiles, soil chemical parameters

| No.	Title	Obligation	ROD	Reporting guidelines	Reporting frequency	Next report due
I	**Network of impact monitoring sites**	Selection of sampling sites for reporting	[767](#)	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:C:2019:092:TOC	Every 48 months	01/07/2026
J	**Monitoring of air pollutants impacts**	Parameters impacting vegetation and soil, air concentrations of pollutants and ozone, condition of freshwater	[768](#)	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:C:2019:092:TOC	Every 48 months	01/07/2027

- Includes location of monitoring sites and site information
- Description of soil plots, soil profiles, horizon and /or layers
- Parameters:
  - Soil characteristics (moisture level, colour, textural class, …)
  - Chemical descriptors (soil acidity and eutrophication, nitrate leaching)

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Indicators EU (SML) and GLOSIS/SoilSTAT/ISAF

# Stocktake: review of currently monitored indicators (20 EU-MS)

- **68 indicators** to characterise soil Quality
- **Top 3** : [C], texture, [N], [P] and [Bulk density]
- **Biological indicators** still rarely used
- **Organic Pollutants** not used

![SIREN logo]
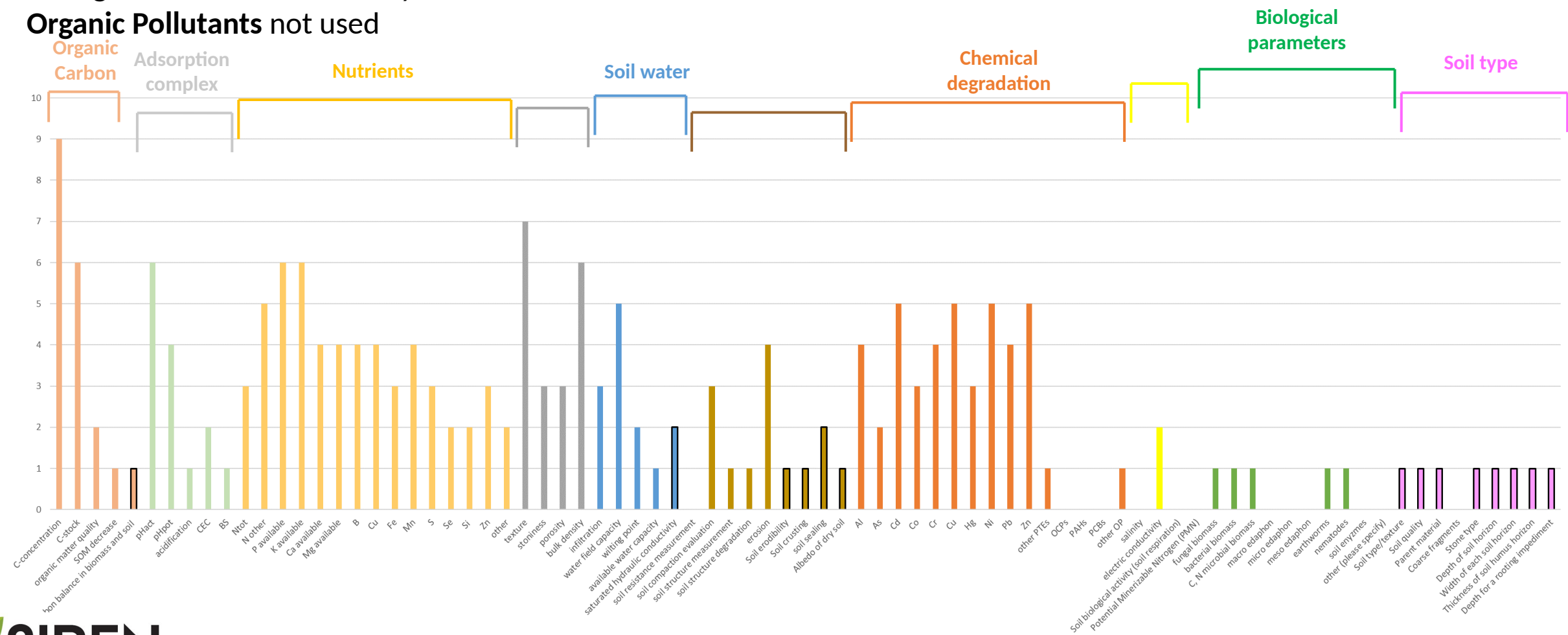
Soil indicators (proposal SML and GSP)

Proposed by EU Commission (2023)	Changes suggested (EJP SOIL2024)	Proposed by ISAF WG
• SOC/clay	• Delete: SOC/clay • Add: SOC/SOCexp and SOC/SOCmax	• SOC seq pot, SOC stock, SOC conc
Nutrients: Total N, Extractable P	Add : P stocks , C/N ratio (N pot. deliv.)	Av. Nutrient content (NPK), nutrient budget
	CEC and ESP to be added	Exch. Na or Na adsorp. rate
pH in Water		pH
Electr. Conductivity		EC
Available water capacity	Infiltration rate, permeability soil profile and/or the soil porosity and structure stability	Soil drainage classes
Biodiversity (soil respiration)	Biodiversity (functional and structural indicators)	Soil microbial biomass, soil respiration
Structure: Bulk density		Bulk density
Contamination: Trace elements and selected organics		Nr contaminated sites, heavy metals (predicted/measured)
Soil sealing		Sealed area
Soil erosion: loss rate		Water and tillage erosion, water erosion risk, susc to wind erosion

Harmonisation needs: variability of laboratory methods

Cornu et al. 2023. EJSS. https://doi.org/10.1111/ejss.13398
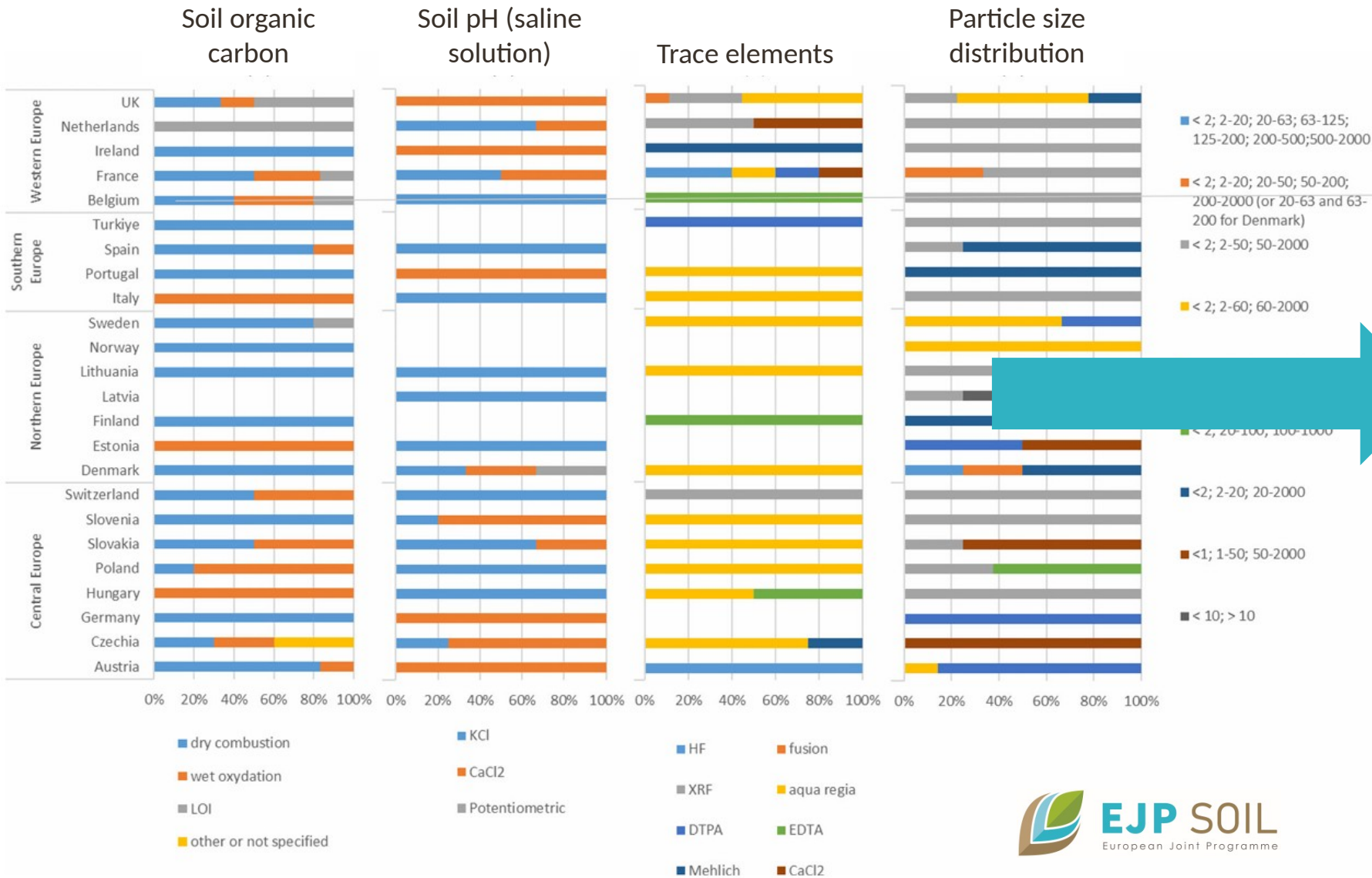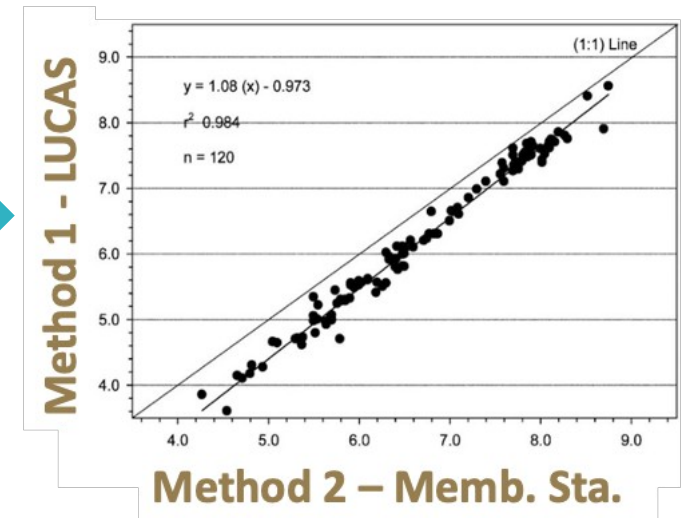
Content support (Harmonization)

- <u>Field description tools</u> (Kobo, ODK): digital, flexible, applying standards

- <u>Lab (quality) ring tests</u> (EUROSOLAN, ICP Forests, agricultural laboratories), <u>transfer functions</u> for lab methods

- <u>Communities for collaboration</u> (ESP, INSII, EUROSOLAN, Mission Soil Cluster on Data and Knowledge Management, EIONET, EUSO Stakeholder Forum)
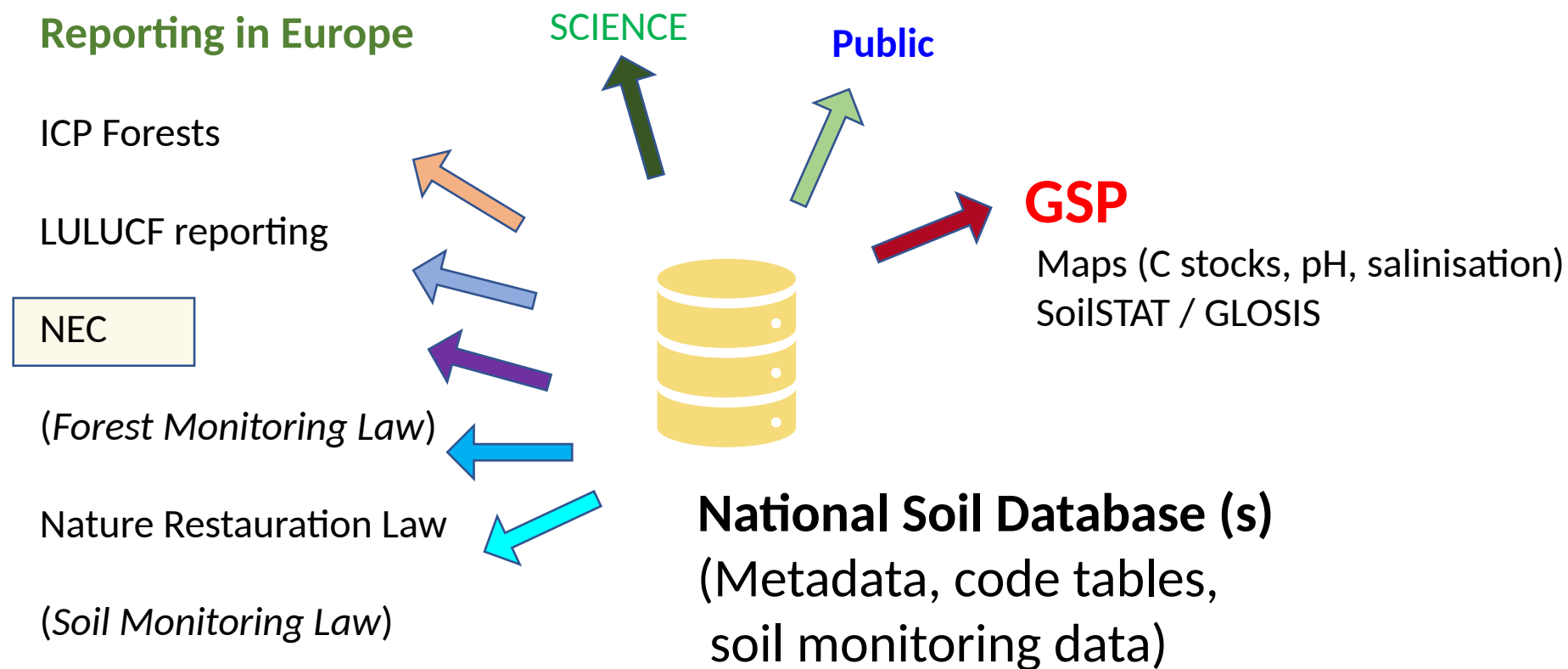
National experience:
exchange of forest soil monitoring data (Germany)

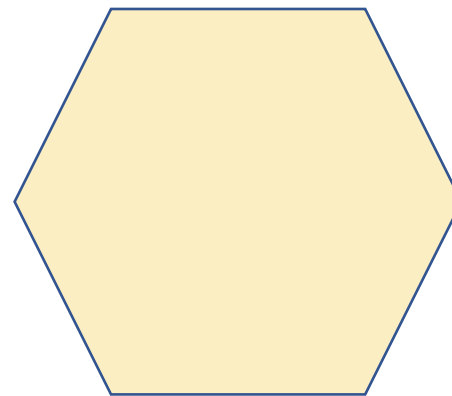**European Environment Agency**

Data submission

Database
(Metadata,
codetables,
 data)

Data transformation (technical:
„export" different data
structure in national data base)

Content transformation
(national methods, national
nomenclature)

Webportal (standards-based)

- Needs to be constructed, or
- National plattforms exist and can be used
- Links need to be created (data registration,
  code lists, etc.)

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Summary from Germany's experience

- OpenData enables to "map", publish and report data from existing monitoring systems
- Available standards and specifications increase awareness of the technical and semantic options and needs, and enable better cooperation

Requirements:
- **Capacity**: staff needed (soil + data competency) for data manageent, data transformations, data updating and maintenance
- Synergies accross different institutions need to be developed and utilized
- Meta „information" templates beyond the mandatory metadata standards for spatial services
- Webportal „ecosystem": connectivity of national/thematic island solutions in relation to larger harvesting portals (including codelist registries)

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Conclusions

Link between national soil data and international soil data exchange (GloSIS, SoilSTAT, EU reporting):

- Technical standards and tools exist and/or are under development; effort for countries to align with their existing systems (connecting to international standards)

- Content: challenging, solutions in development: code lists with national/ international definitions, conversions (methodical comparisons) needed if national methods deviate from an agreed "standard"

Governance/cooperations to solve these challenges exist:

- GloSIS Technical WG and GLOSOLAN
- ISAF WG -> SoilSTAT WG in INSII
- *EIONET work on INSPIRE Soil*
- EJP Soil and SoilWISE technical developments, outreach and capacity building: tests with countries upcoming

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Thank you

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