Provisional European Soil Data Infrastructure –
the GS Soil approach

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Presented by Rainer Baritz (WP 4 leader)
Federal Institute for Geosciences and Natural Resources (BGR)

on behalf of the GS Soil Project consortium

GS Soil

"Assessment and strategic development of <u>INSPIRE compliant</u> **G**eodata-**S**ervices for European **Soil** Data"

http://gssoil-portal.eu/

- EU-Programme: *e*Content*plus*

- <u>**Duration:**</u> 06/2009 – 05/2012 (3 years)

- <u>**Coordinator:**</u>

  Coordination Center PortalU

  (German Environmental Portal)

- <u>**Consortium:**</u> 34 Partner
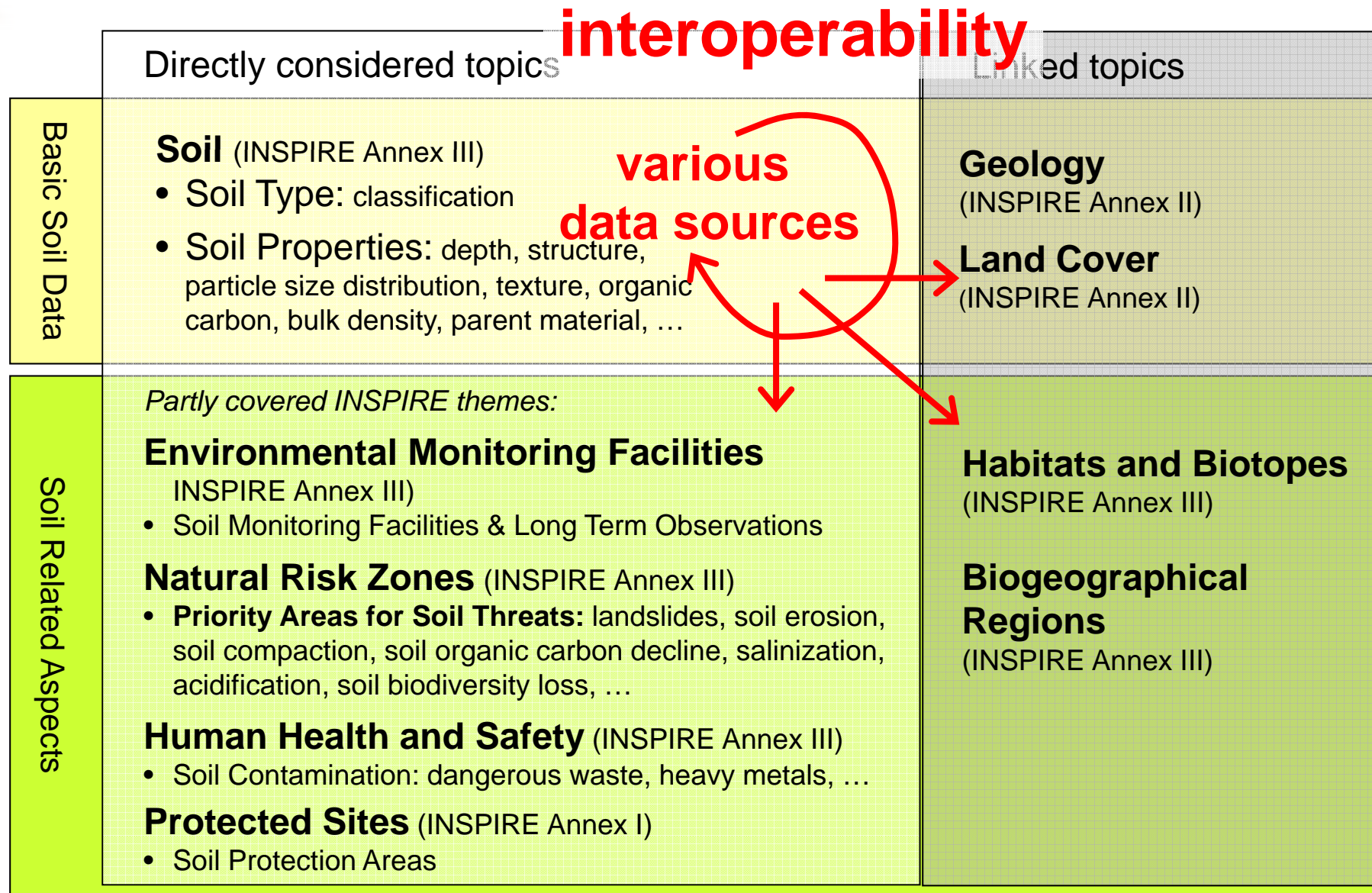
  18 EU member states

  24 soil data providers

Objectives of INSPIRE data exchange

(frame conditions for GS Soil)

- ➢ Data remain with the data owner, are provided acccording to ISO-standards of web-based data exchange (distributed system)

- ➢ The „fit" of data is ensured by data specifications (interoperability of data sets)

- ➢ *Optional: content defintions and rules for harmonization*

INSPIRE: Infrastructure for Spatial Information in Europe

Soil in Infrastructures: e.g. INSPIRE

GS Soil

interoperability

Directly considered topics

Linked topics

Basic Soil Data

Soil (INSPIRE Annex III)
- **Soil Type:** classification
- **Soil Properties:** depth, structure, particle size distribution, texture, organic carbon, bulk density, parent material, …

various data sources

Geology (INSPIRE Annex II)

Land Cover (INSPIRE Annex II)

Soil Related Aspects

Partly covered INSPIRE themes:

Environmental Monitoring Facilities INSPIRE Annex III)
- Soil Monitoring Facilities & Long Term Observations

Natural Risk Zones (INSPIRE Annex III)
- **Priority Areas for Soil Threats:** landslides, soil erosion, soil compaction, soil organic carbon decline, salinization, acidification, soil biodiversity loss, …

Human Health and Safety (INSPIRE Annex III)
- Soil Contamination: dangerous waste, heavy metals, …

Protected Sites (INSPIRE Annex I)
- Soil Protection Areas

Habitats and Biotopes (INSPIRE Annex III)

Biogeographical Regions (INSPIRE Annex III)
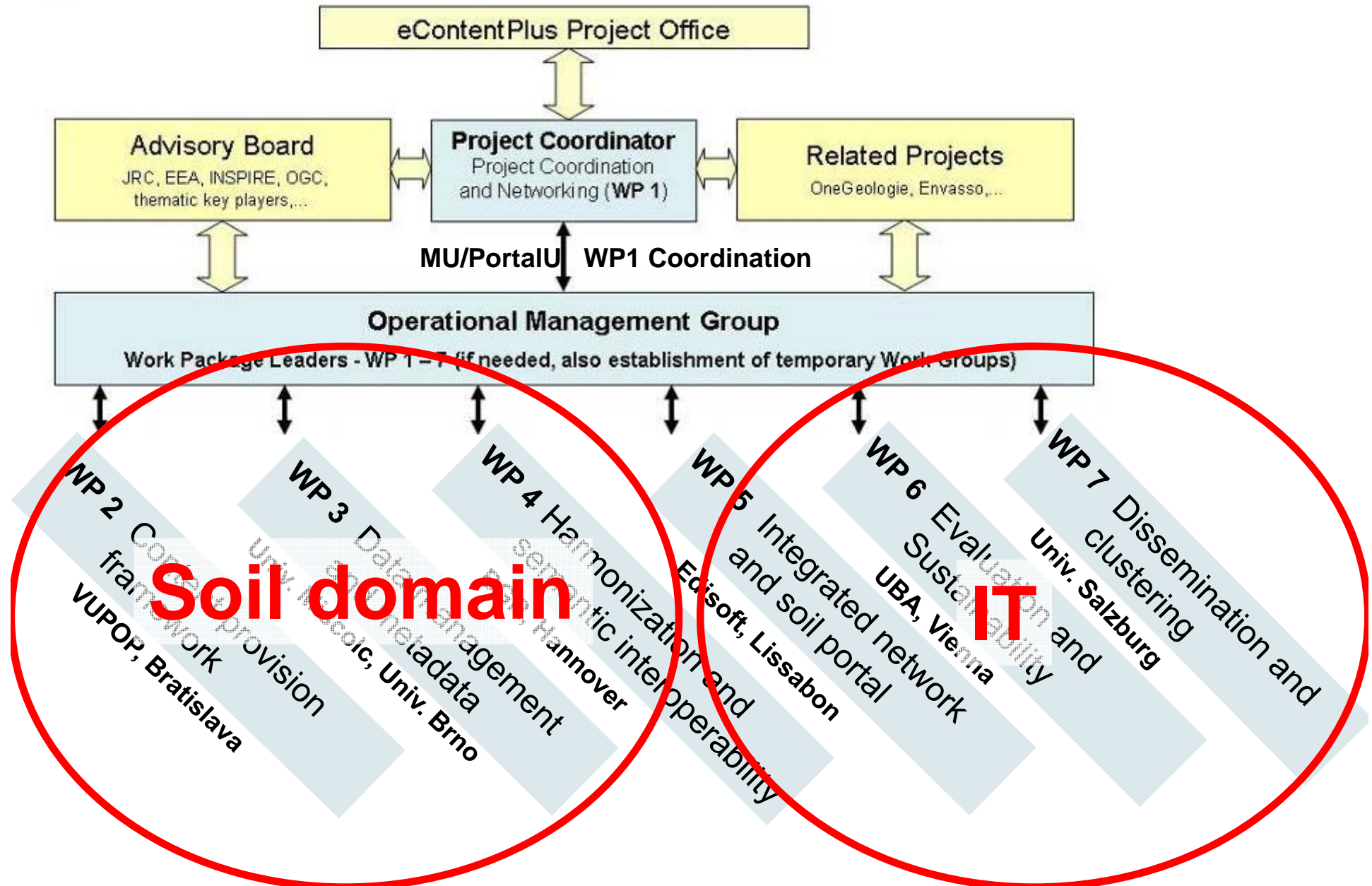
Objectives of the GS Soil Project

- **Establishment** of an European network to improve the access to INSPIRE related spatial soil data
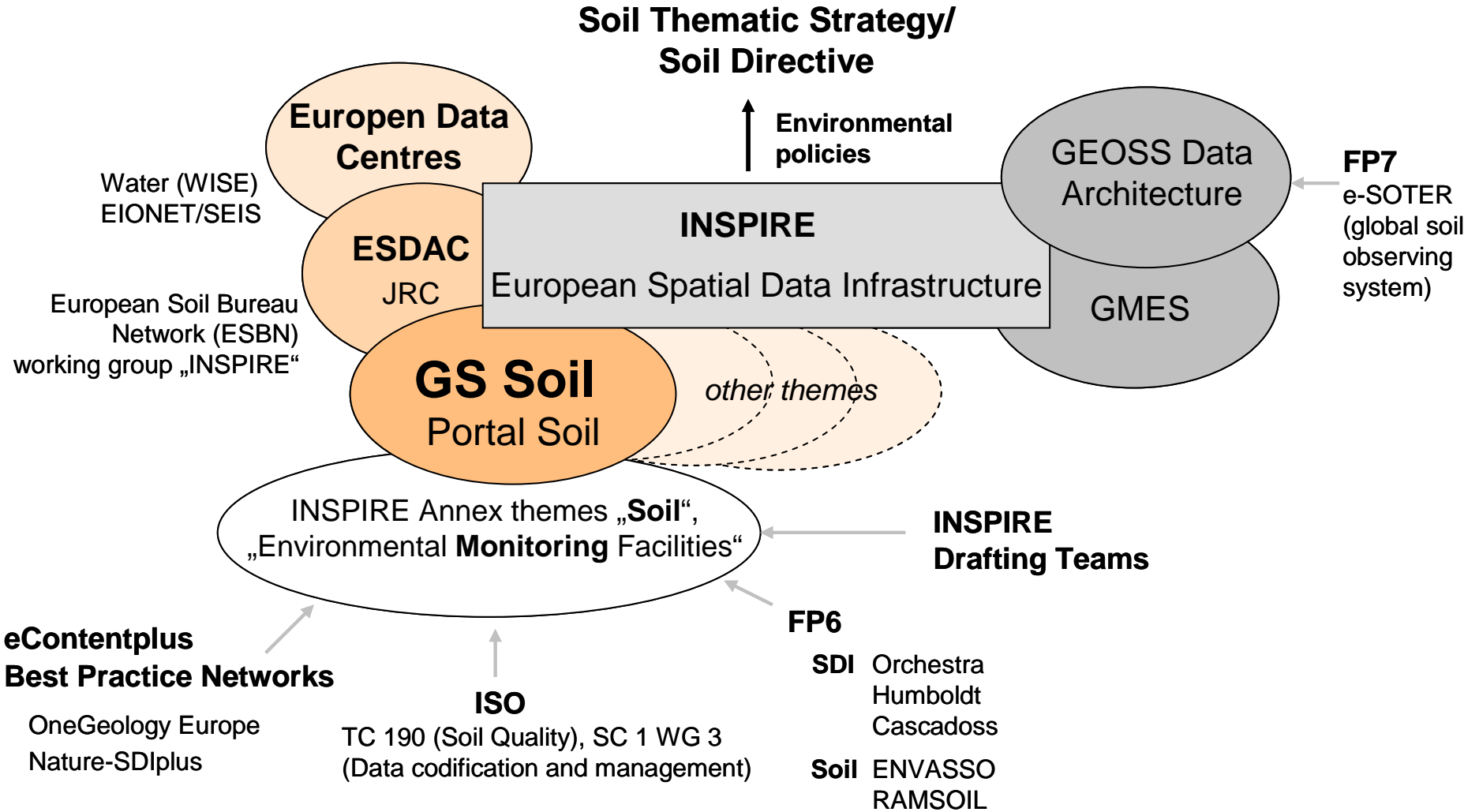
Best Practice Network to …

- improve the accessibility of digital soil data for better (re)usage and exploitation

- lower the barriers to use data from different sources

- develop methods to produce interoperable spatial soil data,

- develop metadata and content framework for harmonized soil information

- establish and operate a network of services for spatial datasets and metadata

Changes and benefits – clustering

GS Soil

**Soil Thematic Strategy/
Soil Directive**

Environmental
policies

**Europen Data
Centres**

Water (WISE)
EIONET/SEIS

ESDAC

JRC

European Soil Bureau
Network (ESBN)
working group „INSPIRE"

INSPIRE

European Spatial Data Infrastructure

GS Soil

Portal Soil

other themes

**GEOSS Data
Architecture**

FP7
e-SOTER
(global soil
observing
system)

GMES

INSPIRE Annex themes „**Soil**",
„Environmental **Monitoring** Facilities"

**INSPIRE
Drafting Teams**

**eContentplus
Best Practice Networks**

OneGeology Europe
Nature-SDIplus

ISO
TC 190 (Soil Quality), SC 1 WG 3
(Data codification and management)

FP6

SDI Orchestra
Humboldt
Cascadoss

Soil ENVASSO
RAMSOIL

New: support to data providers by IUSS

International Soil Science Society (IUSS)
WG Soil Information Standards (SIS)

under the Commissions of Pedometrics and Soil Geography, Chair: Peter Wilson (CSIRO)

↓ *aim*

Technical support to data holders, maximise data availablility, utilize modern IT

↓ *pillars*
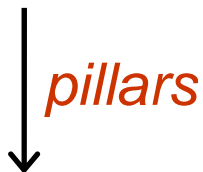
Networking, soil data exchange format , data availability, web processing

iuss-wg-sis@googlegroups.com

Quick outlook for data providers
(e.g. in research projects, agencies, etc.)

- Improved data access via Internet (cheaper data, klick-licencing, cost-free products with large area coverage)

- Data plattforms become increasingly available offering easy data handling/upload of own data sets, also in the field (e.g. OpenProfiles by ISRIC)

- Web processing services offering applications (e.g. water seepage rate, field capacity per horizon and profile)

- Transformation services for owners of large data bases

- Improved guidance material (easy to read and apply cookbooks)

GS Soil

What kind of data are concerned?
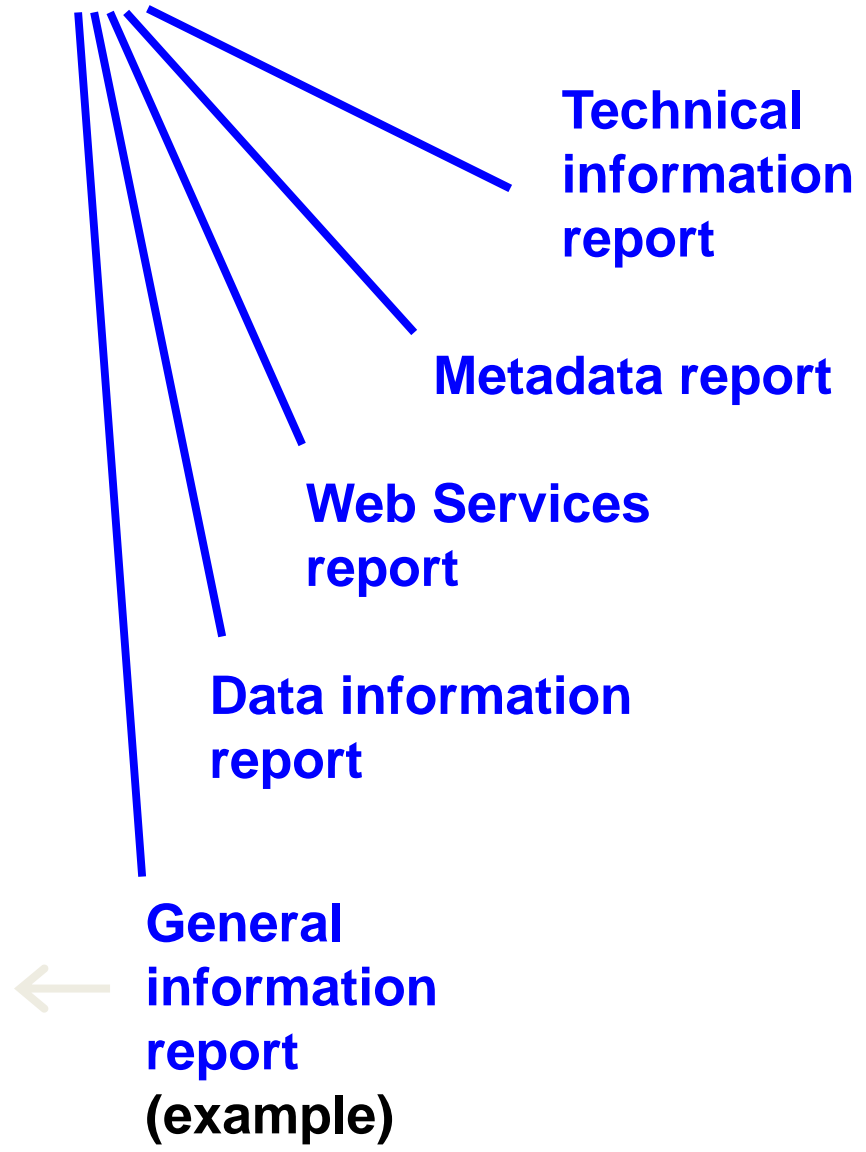
Do these data sets „fit" together?

Are there access restrictions?

WP 2

Content provision framework

➢ Inventory and themes catalogue
➢ IPR assessment
➢ Content framework standards

WP 2: soils inventory and theme catalogue

GS Soil

Product ID:	313
Country:	Slovakia
Product name:	Land Evaluation Unit database
Owner:	Soil Science and Conservation Research Institute, Gagarinova 10, 827 13 Bratislava, Slovakia
Author:	Soil Science and Conservation Research Institute, Gagarinova 10, 827 13 Bratislava, Slovakia
Version:	final Date: 1993
Updates:	yes ; annually
Availability for GS SOIL:	no
	no additional info
Description and purpose:	Land-evaluation unit (LEU) map being delineated according to: soils (Soil Typological Unit, depth, stoniness and texture), climate and topography, agricultural land; implemented in national legislation
	evaluation of agricultural soils
Free keywords:	land-evaluation unit, soils, agricultural land
Use constraints:	free to view, certificate is charged
Citation:	no information
Contact information:	
Organization:	Soil Science and Conservation Research Institute, Gagarinova 10, 827 13 Bratislava, Slovakia
Person:	Pavol Bielek no information
E-mail:	p.bielek@vupop.sk no information
Telephone:	+421-2-434 20 866
Fax:	+421-2-432 95 487
Web:	www.vupop.sk

Technical information report

Metadata report

Web Services report

Data information report

General information report (example)

> 300 products

WP 2: IPR assessment

Intellectual property rights assessment

- **Evaluation of IPR**

103 records have been evaluated:

Map scales	Portion of catalogue products
Very large (1 : 5 000 to 1 : 10 000)	19%
Large (1 : 10 000 to 1 : 50 000)	29%
Medium (1 : 100 000 to 1 : 250 000)	23%
Small (1 : 400 000 to 1 : 750 000)	13%
Very small (1 : 900 000 to 1 : 2 300 000)	15%

Fee category	Portion of soil products (%)
Free public data (use not limited)	11
Free for non-commercial use	15
Free for scientific / educational use only	22
Fee under special agreement	43
Fee applies for all uses	9

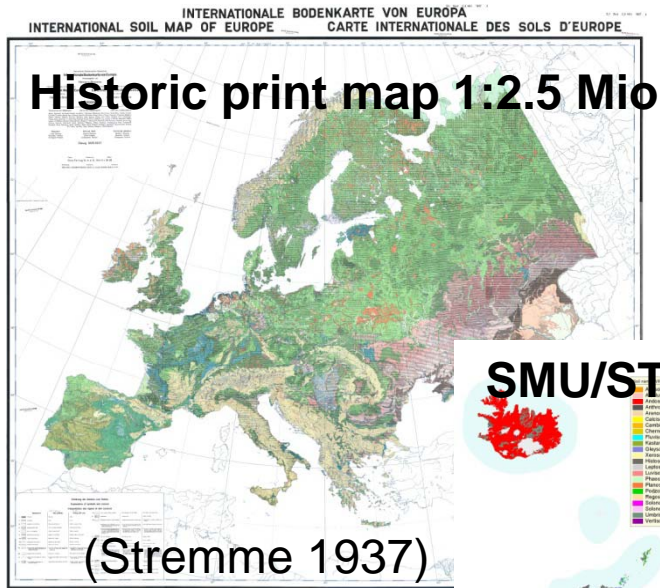→ **WP5: licensing/rights management**

Which reference materials exist defining the content of soil map data?
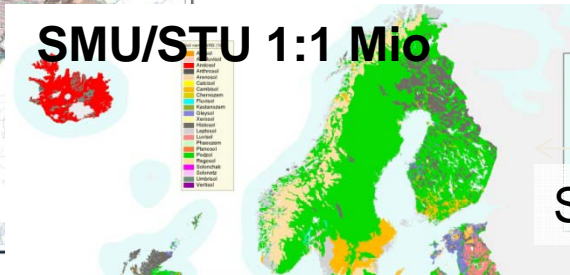**Which recommendations can be derived from it?**

WP 2 and 4
Content framework best practice

Historic print map 1:2.5 Mio

(Stremme 1937)

History and frame conditions for harmonization in Europe

Pedotransfer Rules
Database (PTR)

HYPRES (PTF for
hydraulic characteristics)

SMU/STU 1:1 Mio

STU

Soil Profile Analytical Data-
base for Europe (SPADE)

SPADE-2

FAO (1965)
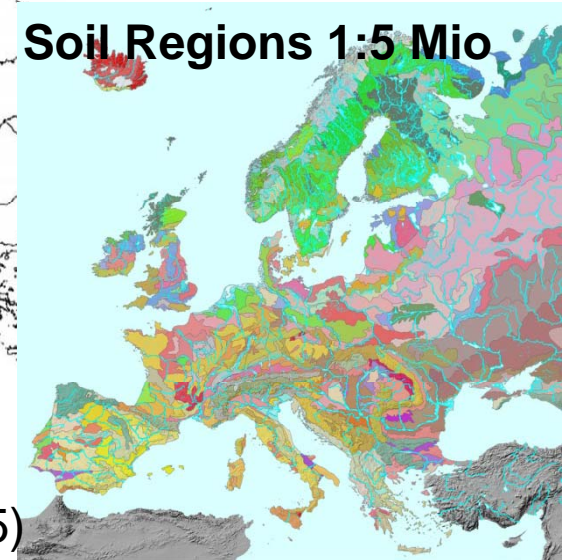Soil map of
Europe 1:2,5 Mio
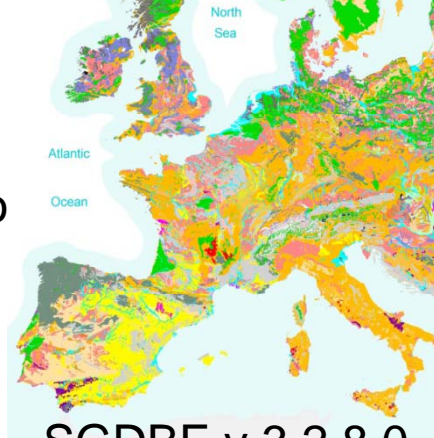
1:250k

div. ESBN
research reports

SGDBE v 3.2.8.0
(v.1.0 CEC 1985)

Soil Regions 1:5 Mio

Soil Resources of Europe
(Jones et al. 2005)

(Hollis et al. 2006)

(Hartwich et al. 2005)

Diversity of soil data in Europe: scale ca. 1:250,000

History of soil data base development in Europe

➢ Medium-resolution soil mapping +/-1:250,000

not harmonized

Small scale soil maps (%)
- not done
- 40 - 60
- 60 - 80
- deviating scales
- > 80

1:100,000

1:200,000 – 1:400,000
1:300,000
1:400,000

Despite the existence reference material:

Manual of Procedures"
(1:250,000; Finke et al. 2001)
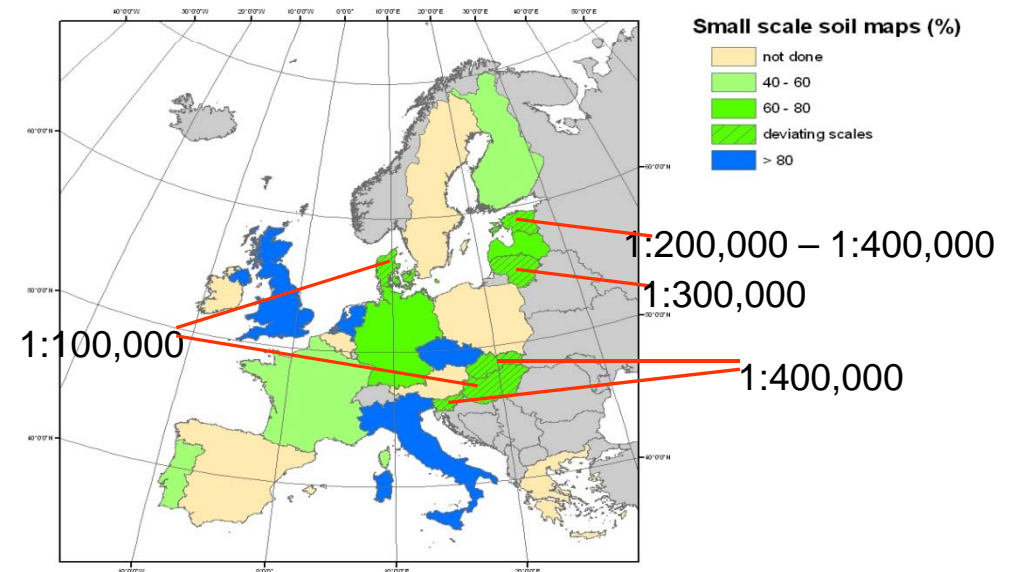
⇒ Fazit: improvement required: more detail, best practice examples

$\Rightarrow$ **Content framework**

> *Pre-requisite: definition of terms (mulitlingual) (WP4)*
> $\Rightarrow$ *soil thesaurus (WP3)*

Example 1:Definition of mapping units SMU/STU :

- It is <u>good practice </u>to document the delineation criteria for soil mapping units, its definitions, input data used, and the elements and parameters used to describe the SMUs/STUs.
- Use <u>WP4 checklists </u>(to supplement metadata)

Example 1: Definition of mapping units SMU/STU :
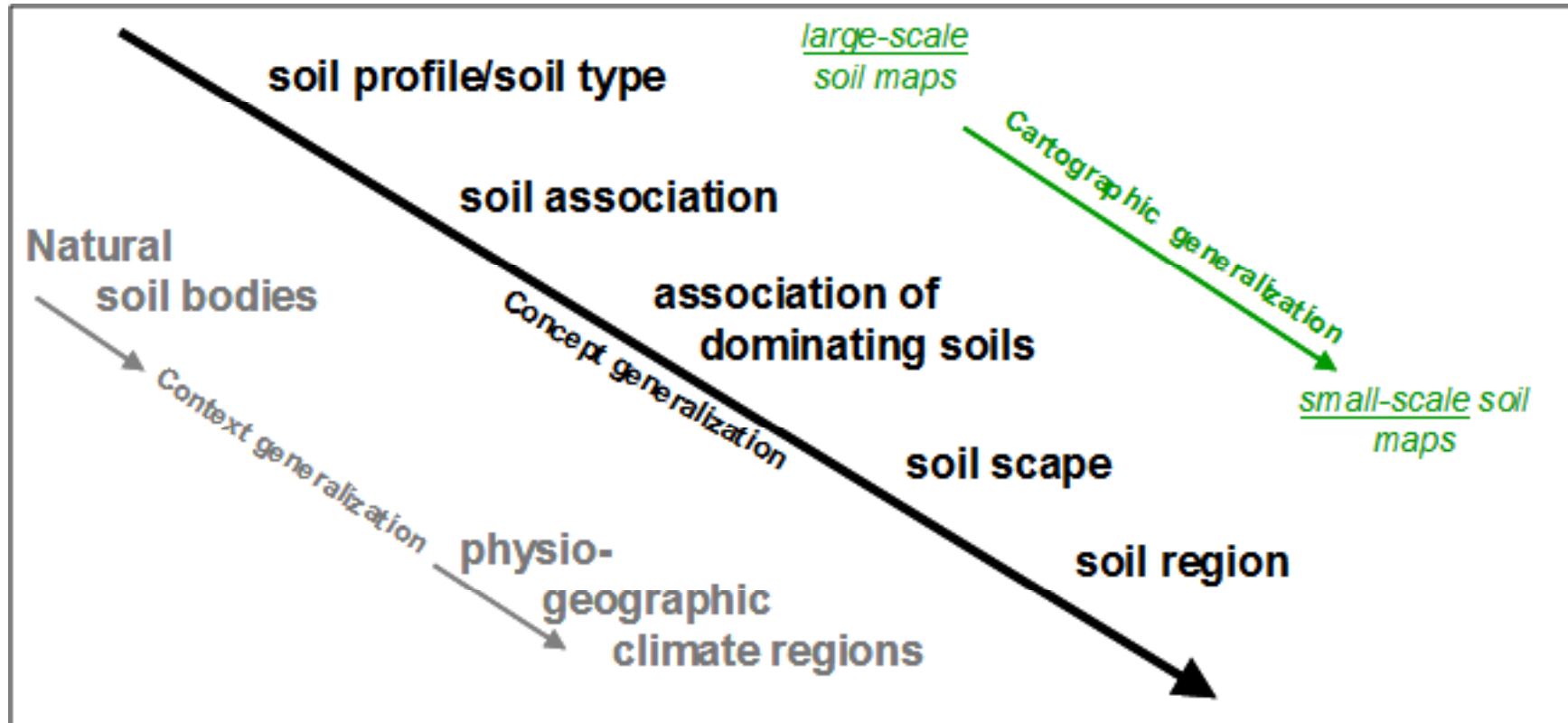
Example 1: Definition of mapping units SMU/STU :

Soil typological unit
not delineated

Soil mapping unit
delineated

scale- /content-
independent

Soil association

Reconnaissance
soil maps

parent
material

soil-
horizons

Soil body

soil type b

Parent
material

soil-
horizons

scale-
dependent

aggregation

Pedon

soil type a

Detailed
soil maps

soil type c
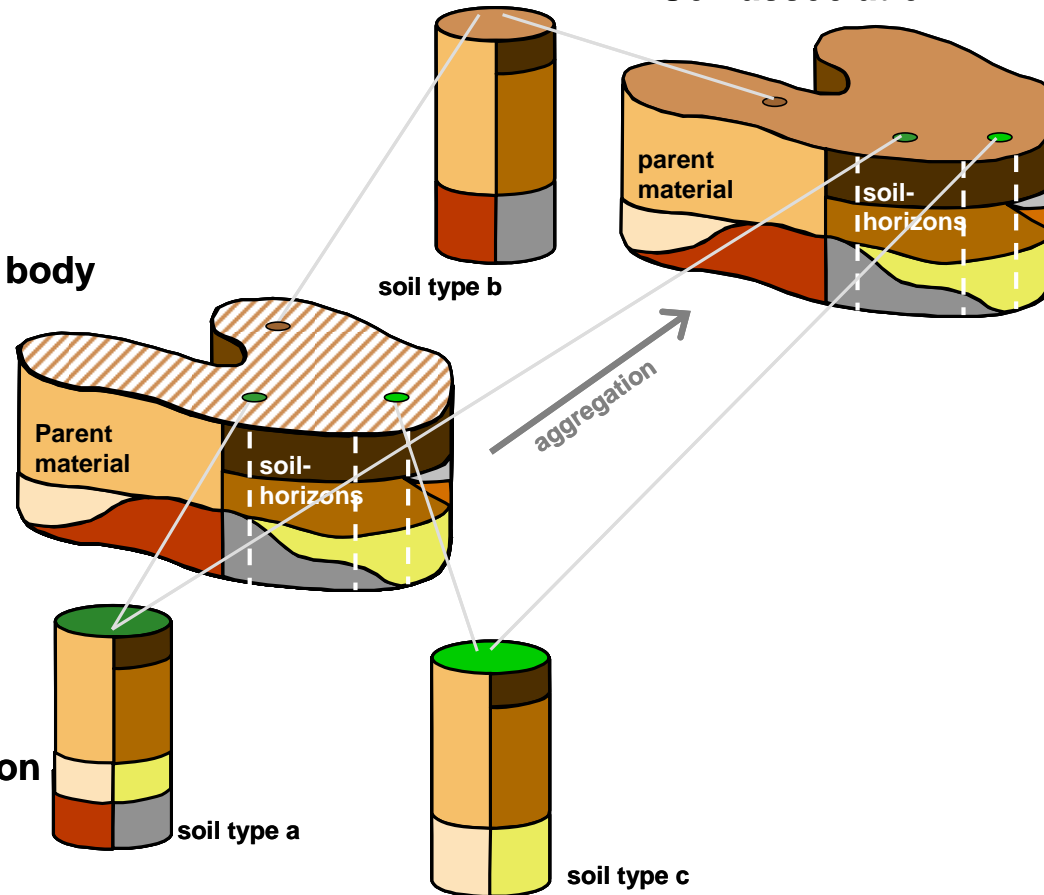
WP 2: Content framework standards

Example 2: Definition of stratification:

- It is <u>good practice</u> to apply and document the use of the **soil regions** <u>map of Europe</u>
  (*key issue: macro-climate-geology regions*)

- It is good practice to apply the <u>revised FAO</u> **parent material** <u>list</u> (<u>www.esoter.org</u>)

- It is good practice to stratify soil typological units according to <u>dominant</u> **land use**

GS Soil

**Without metadata (and metadata catalogues), data
cannot be found in the web!**

WP 3

Data management and metadata

➢ **Soil-specific metadata profile**
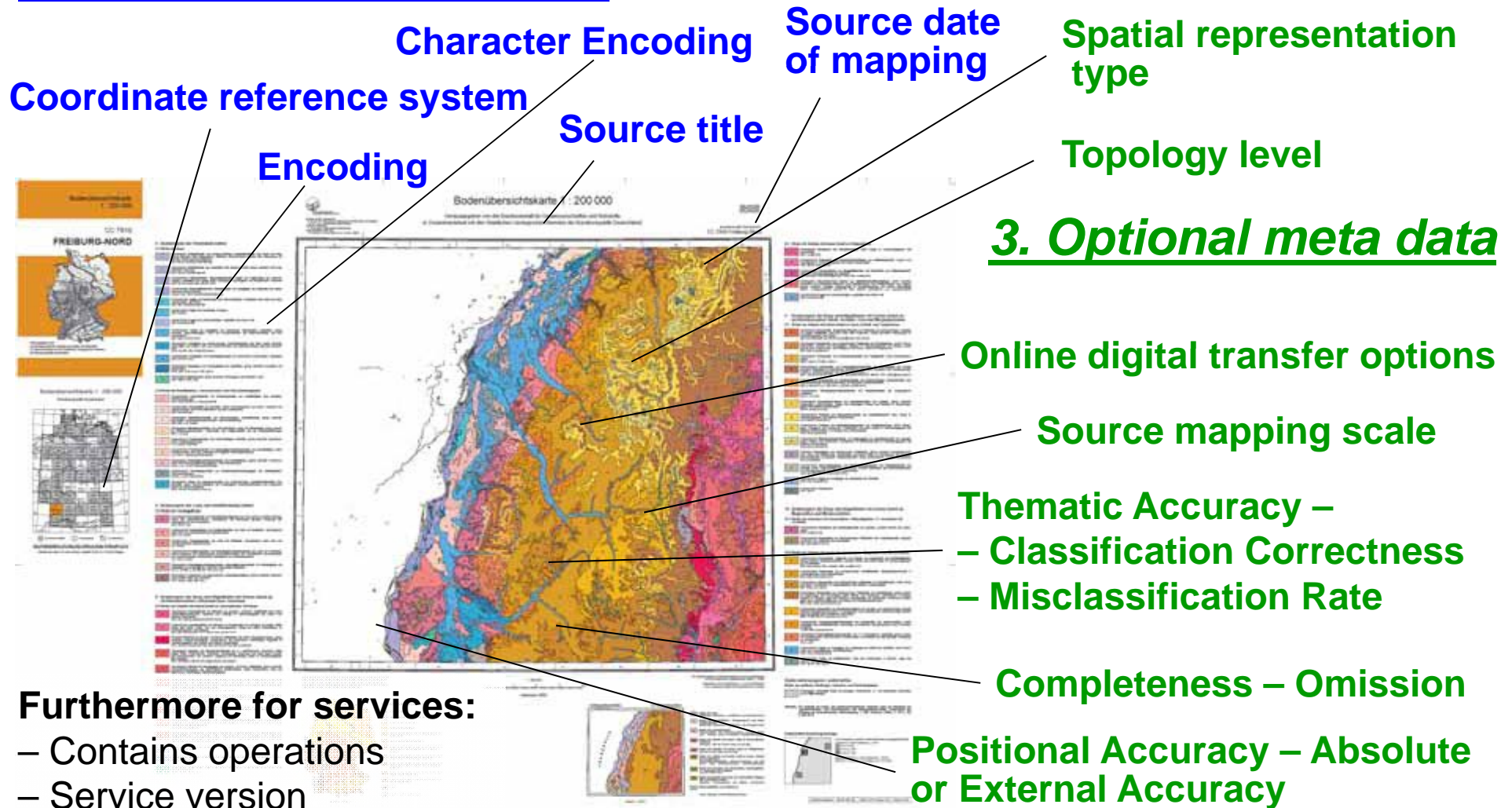➢ **Soil thesaurus**

WP 3: Soil metadata profile

used as INSPIRE reference material for data specification development

GS SOIL PROFILE

INSPIRE

ISO CORE

Mandatory

ISO 19115

ISO 19119

ISO 19139

WP 3: introduced soil-specific metadata elements

GS Soil

2. *Mandatory/conditional*

1. *INSPIRE meta data (1205/2008/EC)*

Character Encoding

Source date of mapping

Spatial representation type

Coordinate reference system

Source title

Topology level

Encoding

3. *Optional meta data*

Online digital transfer options

Source mapping scale

Thematic Accuracy –
– Classification Correctness
– Misclassification Rate

Completeness – Omission

Furthermore for services:
– Contains operations
– Service version

Positional Accuracy – Absolute or External Accuracy

Example of the printed map Sheet Freiburg-North
(map representation acc. to the German topographic map 1:200.000)

WP 4

GS Soil

Harmonization (part II) and semantic interoperability (part I)

Part I

➤ **INSPIRE testing, support to ISO 28258 (SoilML)**
   - cookbook

➤ **Link WP5 (IT-implementation) on schema mapping**
   (transformation service)

Part II

➤ **set-up of test cases throughout Europe to test feasibility of harmonization requirements:**
   - reference terminology (link WP2, and WP3 thesaurus)
   - FAO soil profile properties
   - WRB
   - cartography: soil maps

⇒ **Data Harmonization Best Practice Guidelines**

I. Data exchange standard

Analysis of data bases to find generic exchange principles to be introduced to data exchange recommendations

- ➢ **Development of the SoilML application schema for ISO 28358 (partner MU Brno)**

- ➢ **Testing of the schema (AGES, CAO, UBA, VUPOP, BGR)**

- ➢ **Close cooperation with WP5 on the development of a schema transformation tool (partner Fraunhofer)**

II. Best practice harmonization

Overview: test cases to study harmonisation

	Objectives of TEST CASES (see also D4.1)	FI 250	BG 200	Celtic 250	DE-FR 200/250	AT 10	BE 20[1]	SI 25	HU 50	SK 20	RO[2] 200	GR 100
Reference terminology	– comparability of terminology – support GS Soil Thesaurus		X	X	X	X	X		X	X		X
Harmonizing soil profile data (Ch. 1.4.1)	– compare parameter definitions with FAO soil profile description – support WRB correlation		X	X	X	X		X		X		X
Harmonizing soil classification (Ch. 1.4.2)	Align the equivalent of each mapping guideline to one another and compare and evaluate discrepancies	X	X	X	X	X	X	X	X	X		X
Harmonizing soil maps (Ch. 1.4.3)	– check list for maps – analysis of geometry	X X	X X		 X	X	X		X	X		

FAO Properties: texture class
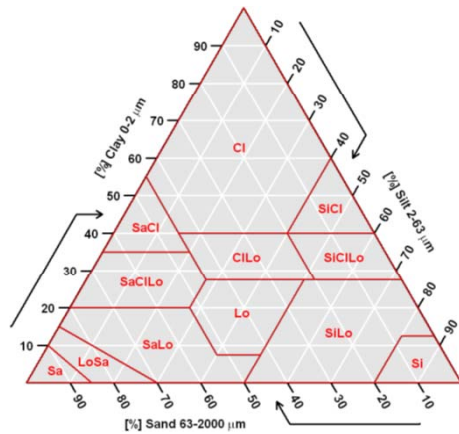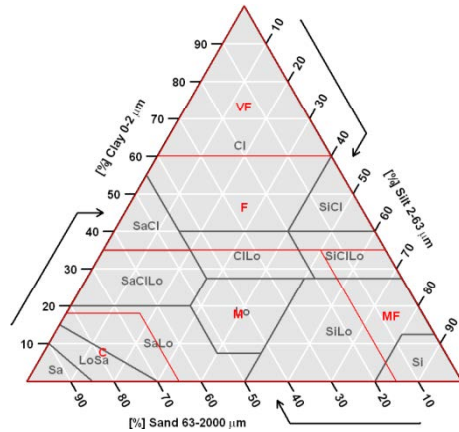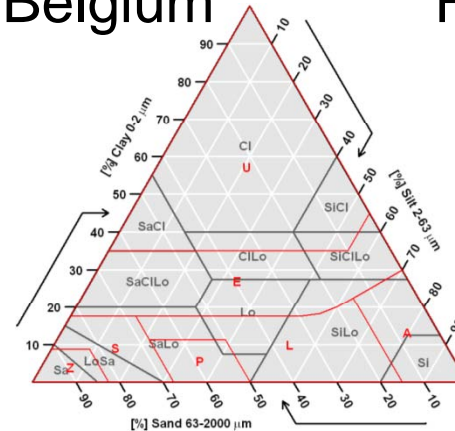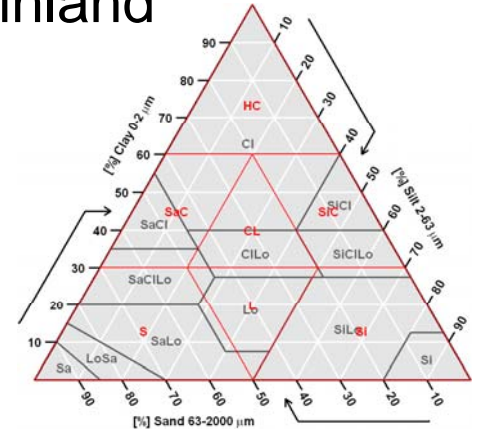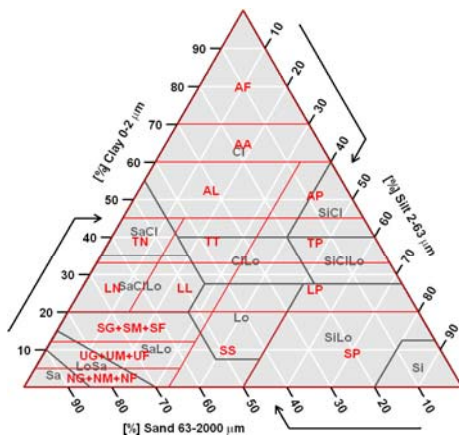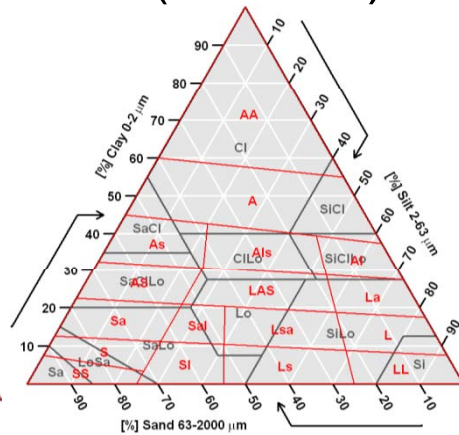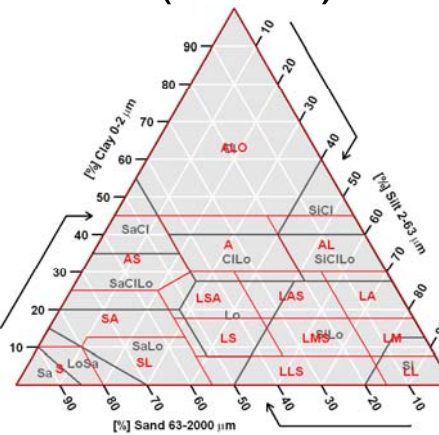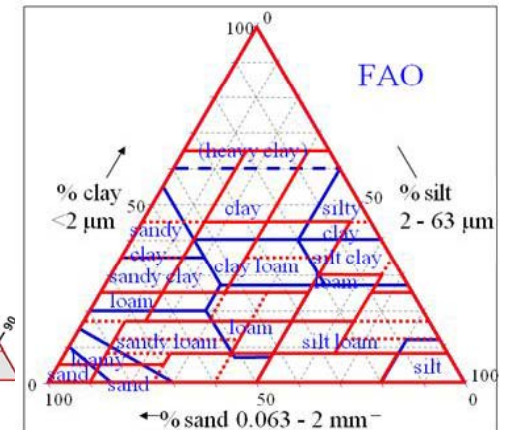
Prepared by A. Paetzold, using R-Package ‚soiltexture' (Moeys, .J. 2011)

Harmonized soil classification

Aim: Understanding national taxonomic terms; needed for the search for a common taxonomic level with WRB

Austria

Nationl term	Taxonomic category
Ordnung	Order
Bodentypengruppe	Soil type group
Bodentyp	Soil type
Zusatz	Addition

Belgium

National term	Taxonomic category
Bodemserie	Soil series
Variante	Variants
Fase	Phases

... 13 countries

Harmonized soil classification

Conclusions (1)

- Common taxonomic level in most cases can**no**t be defined/identified for most cases investigated; no direct match to RSG + *n* Qualifiers (complex mixture of diagnostics at both the RSG and qualifier levels)

- Additional contraint: soil map data bases (legends, soil forms, SMU attributes, sometimes derived soil profiles) often only contain very limited set of properties: application of WRB is then strongly simplified;

Conclusions (2)

➢ WRB: a more or less elaborate method of translation was actually found in most test cases (mostly RSG) - usually with unquantifiable "uncertainties"

➢ High-quality approaches require the use of (better) analysed soil profiles as a <u>framework</u> for the translation process

➢ A hierarchy of WRB-qualifiers is needed

Content of soil maps

Terminology - delineation – aggregation (for Europe)

➢ Varying complexity of legends and delineations; lack of documentation

➢ After applying WRB: clear aggregation of national SMU/STU depending on available attribute data

➢ Review (and application) of statistical tools/indexes to geometrically analyse (the pedodiversity/aggregation level of) existing soil maps

➢ Concept for aggregation (at the continental level) now proposed incl. content-based nested system

Where can I search for existing data sets?
Where can I view them?
Where can I receive guidance for own action?

WP 5
Integrated network
and soil portal

GS Soil

Geodata-Services for European Soil Data

Co-funded by the community programme eContentplus

Search | Publication | Maps | About GS Soil | **Best Practice** | Data Harmonisation

Best Practice

Navigation

Short description of each WP and publication of the final deliverables

WP 2 - Content Provision Framework

WP 3 - Data Management and Metadata

WP 4 - Harmonisation and semantic Interoperability

WP 5 - GS Soil Portal and its integrated network

WP 6 - Evaluation and Sustainability

WP 7 - Dissemination and Awareness

Introduction to Best Practice

Introduction

The project GS Soil is a so-called Best Practice Network under the eContent*plus* Programme. The aim is to establish a European network and infrastructure to improve the access to spatial soil data for public sector bodies, private companies and citizens. The project considered aspects of data organisation, ata harmonisation as well as semantic and technical interoperability in order to produce seamless geospatial soil information and to improve the data access for a wider community of different user groups. Using regional data sets from GS Soil test cases, but also national data sets, a Spatial Data Infrastructure (SDI) was set-up and operated as a distributed system in the true INSPIRE philosophy. Technical and syntactic interoperability were ensured by the use of open standards such as those published by the Open Geospatial Consortium (OGC) and the INSPIRE Specifications on Network Services. As a result, soil data providers were given prescriptions to offer their data via OGC compliant Web Map Services (WMS), ensuring that the GS Soil Portal and other client systems are capable of accessing and displaying the distributed data. A generic application schema for soil data serves as a backbone for data interoperability.

A generic application schema for soil data serves as a backbone for data interoperability. Using a number of international OGC and other standards the partners established and operated a network of services for spatial datasets and metadata. This network includes distributed services for data transformation, discovery, view and best practice for download.

The central result of the project is the GS Soil Portal. European soil data from heterogeneous sources are bundled here and best practice expertise is exposed. In order to ensure transnational usability of the portal and related services, aspects of multilingualism and data interpretation were considered thoroughly. In this respect, the harmonisation of metadata and the definition of terms and conditions have been addressed with supporting tools and descriptive documents.

GS Soil

Geodata-Services for European Soil Data

Co-funded by the

Search   Publication   Maps   About GS Soil   Best Practice   **Data Harmonisation**

Data Harmonisation

Introduction and illustration of the data harmonisation process

Navigation

Background and overview

Link to INSPIRE and ISO 28258

Theme specific test suite for developing data specifications for spatial soil information (D 4.1)

Generic application schemes for soil information - design, testing and validation against user requirements (D 4.2)

Data harmonisation Best Practice Guidelines (D 4.3)

The standards-based exchange of data requires interoperability. Metadata and data specifications provide the methodical framework for interoperability. Under INSPIRE, interoperability components were identified, which are the basis for developing data specifications. Despite the strong weight of technical requirements, domain knowledge is needed since data are extracted from local data bases and transformed by the data providers. WP 4 represents the link between data sets and data specifications: it has analysed the interoperability components under INSPIRE, and developed data specifications based on the conceptual ideas developed under ISO 28258 (Exchange of soil-related data). Because data specifications are technical thus do not guarantee the comparability of data, WP 4 has also addressed the issue of harmonisation using a test case approach. This test case approach has reflected back into different work packages, WP 3 (metadata developed for test case data sets), and WP 5 (developing sample WMS and WFS; testing of a transformation service).

Three deliverables were developed:

- D 4.1: Theme specific test cases for developing data specifications for spatial soil information

- D 4.2: Data exchange with the GS Soil Generic application schema for soil information - a soil data cookbook using ISO DIS 28258

- D 4.3: Data Harmonization Best Practice Guidelines

Presentation of all deliverables from WP 4

List of test case reports:

- D 4.3: Data Harmonization Best Practice Guidelines - Test Case Report: 1:10k Agricultural Soil Map of Austria (Part I); BORIS Soil information system (Part II)

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Basic Search | Thesaurus Browser

Search Results

soil europe map   Search

» Advanced Search   » History   » Options   » Tips

SEARCH TOOLS

...function,... ...informati... databases. Just enter one or more search terms, or use the GS Soil search... (Advanced Search) to de...

Search Query

Search results

Link to description of metadata

⊞ **Similar Terms: Search for ...**

124 ranked hits
(page **1**) | 1 | **2** | **3** | **4** | **5** | **»**

3 additional data sources
(page **1**) | 1

⚙ **Climatic Areas of Europe 1:15,000,000 Mio (EUCA15000) (WMS)**

The Climatic Areas of Europe (EUCA15000) were delineated in order to stratify the legend of the European Soil Regions Map (EUSR5000). Because soil properties largely depend on climate, relief and geology, soil regions must be defined according to fairly homogenous macro-scale physiogeographic conditions. Because climate (and parent material) is the initial top level stratifier for the soil...
Data Provider: Federal Institute for Geosciences and Natural Resources [GS Soil]
Source : Geodak - Metadata from BGR - Version 3.2.0

» Show Map

GEODAK - METADATA FROM BGR - VERSION 3.2.0 (2 HITS)
Geodak - Metadata from BGR
Data Provider: BGR - Federal Institute for Geosciences and Natural Resources

⚙ **Climatic Areas of...** 1:15,000,000 Mio... (WMS)

» Show all results... from BGR - Version 3.2.0

📖 **The Soil Map of Romania at the scale 1:200,000**

The fifty sheets constituting "The Soil Map of Romania at the scale 1:200,000" were published between 1963 and 1993, while the Legend was released in 1994. The Soil Map generation begun at the Romanian Geologic Institute at the initiative and under the supervision of Prof. Nicolae Cernescu (until 1967). The major part of the work was afterwards carried out at the National Research and Development...
Data Provider: National Research and Development Institute for Soil Science, Agricultural Chemistry and Environment [GS Soil]
Source : InGridCatalog for ICPA

METADATA CATALOGUE FROM INSTITUTE OF SOIL SCIENCE, AGRO-TECHNOLOGY AND PLANT PROTECTION "NIKOLA POUSHKAROV"
ISSAPPNP CSW
Data Provider: Institute of Soil Science Nikola Poushkarov [GS Soil]

🌐 **Maps of soil vulnerability to degradation 1:2500000**

🌐 **Maps of soil vulnerability to degradation 1:2500000**

GS Soil

Geodata-Services for European Soil Data

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Publication ❓

Country

| Hungary |
| Ireland |
| Poland |
| Portugal |
| **Romania** |

Grouping

- ⦿ No
- ○ Country
- ○ Data Provider

Show

1 - **2** of **2** entries in **Publication**(page **1** of **1**) | 1

➪ **Assimilation of remotely-sensed data of high repetitivity in process models**

Data Provider: National Research and Development Institute for Soil Science, Agricultural Chemistry and Environment [GS Soil]
Category: Publications

http://www.icpa.ro/proiecte/AgriTel_2000.pdf

➪ **USING HYPERION SATELLITE DATA FOR VEGETATION PROPERTIES ESTIMATION**

Data Provider: National Research and Development Institute for Soil Science, Agricultural Chemistry and Environment [GS Soil]
Category: Publications

http://www.icpa.ro/proiecte/AgriTel_Hyperion.pdf

1 - **2** of **2** entries in **Publication**(page **1** of **1**) | 1

Country	WMS	WFS
Austria	3	(2)
Belgium	8	1
Bulgaria	1	(1)
Czech Republic	4	(2)
Denmark	3	
Finland	1	
Germany	9	
Greece	2	
Hungary	4	
Poland	1	
Portugal	1	1
Slovakia	1	
Slovenia	1	
United Kingdom	3	

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Maps

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| Partner |
| Metadatasearch |
| Search WFS |

1 : 2906333 ▾   WGS84 ▾

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   ⊟ PT - Portuguese Soil Data
      🔍 ⓘ ☐ PT - Soil Acidity and Alkalinity
      🔍 ⓘ ☑ PT - Soil Type
      🔍 ⓘ ☐ PT - Soil Lithology
      🔍 ⓘ ☐ PT - Soil Usage Capacity

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Mapbender

Top left (LAT,LON)=(N39º36',W9º50').
Bottom right (LAT,LON)=(N38º16',W8º31').

Add new WMS service

GS Soil
Geodata-Services for European Soil Data

Co-funded by the community programme eContentplus

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Maps

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| Legend |
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1 : 2906333 ▾   WGS84 ▾
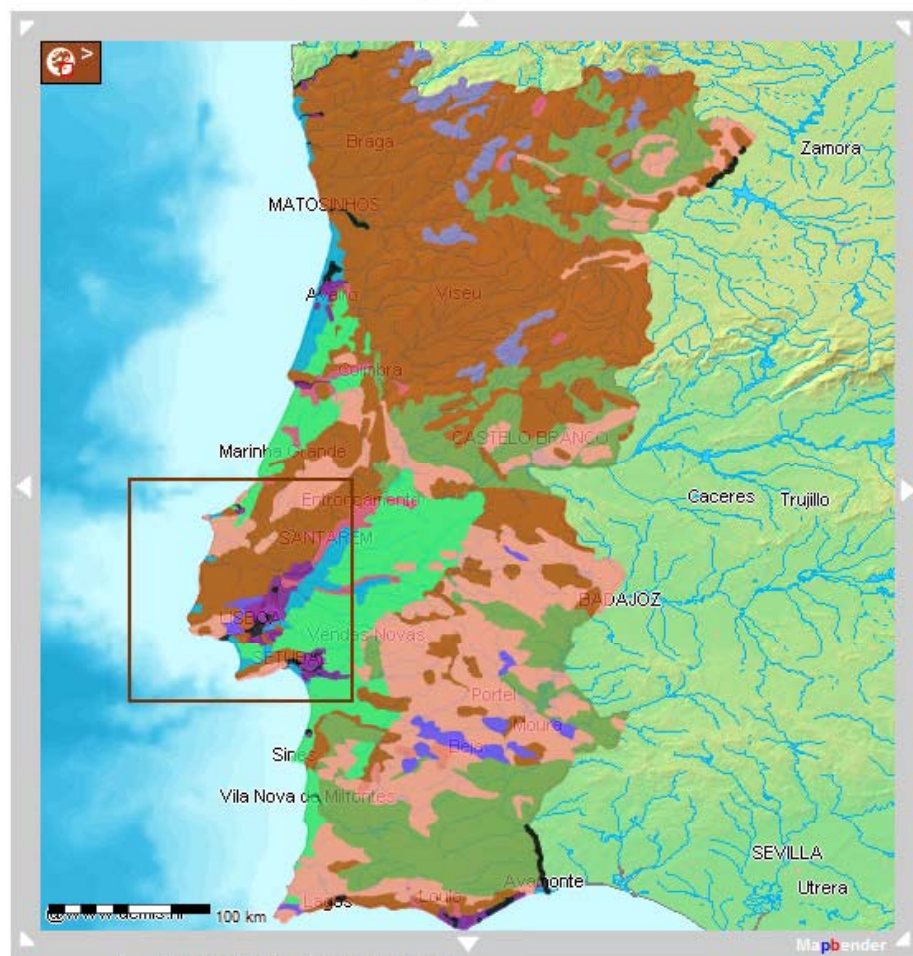
⊞ Austria
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Search resultsPT - Soil Type

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Codsolo:	Name:	Subname:	Especifi:	Perimete:	Area:
undefined	undefined	undefined	undefined	19457.664	7010067.0
undefined	undefined	undefined	undefined	317041.25	1.94101472E8
undefined	undefined	undefined	undefined	210397.906	1.0943356E8
103	FLUVISSOLOS	Fluvissolos calcários	undefined	20656.436	1.8090942E7
201	REGOSSOLOS	Regossolos êutricos	undefined	23776.531	1.4492415E7
201	REGOSSOLOS	Regossolos êutricos	undefined	16968.482	1.3741141E7
201	REGOSSOLOS	Regossolos êutricos	undefined	22935.613	3.5546404E7
201	REGOSSOLOS	Regossolos êutricos	undefined	44321.629	9.0288008E7

BADAJOZ

LISBOA
Vendas Novas
SETUBAL

Porter

Moura
Bela

Sine

Vila Nova de Milfontes

SEVILLA

Utrera

Avamonte

Lagos   Loule

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Ma**pb**ender
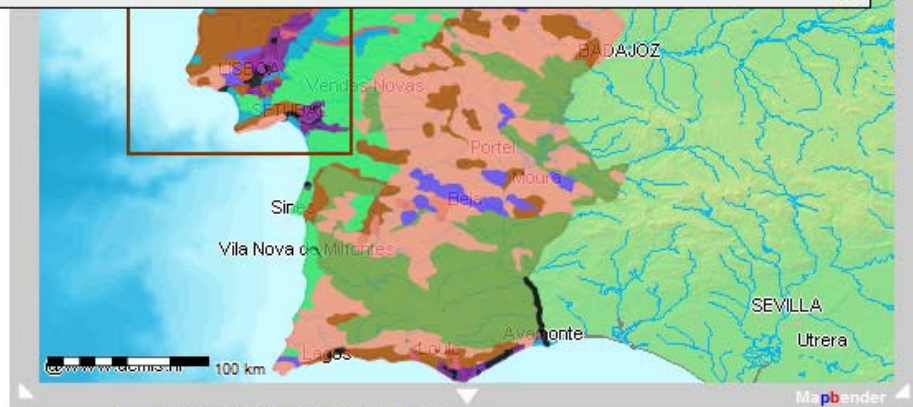
Add new WMS service

Top left (LAT,LON)=(N39º36',W9º50').
Bottom right (LAT,LON)=(N38º16',W8º31').

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                    134070.3125,291802.71875 136495.5,292782.6875 135049.34375,290978.5 132030.09375,288971.3125
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                    125773.8828125,290729.90625</gml:coordinates>
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```

Download result as XML file
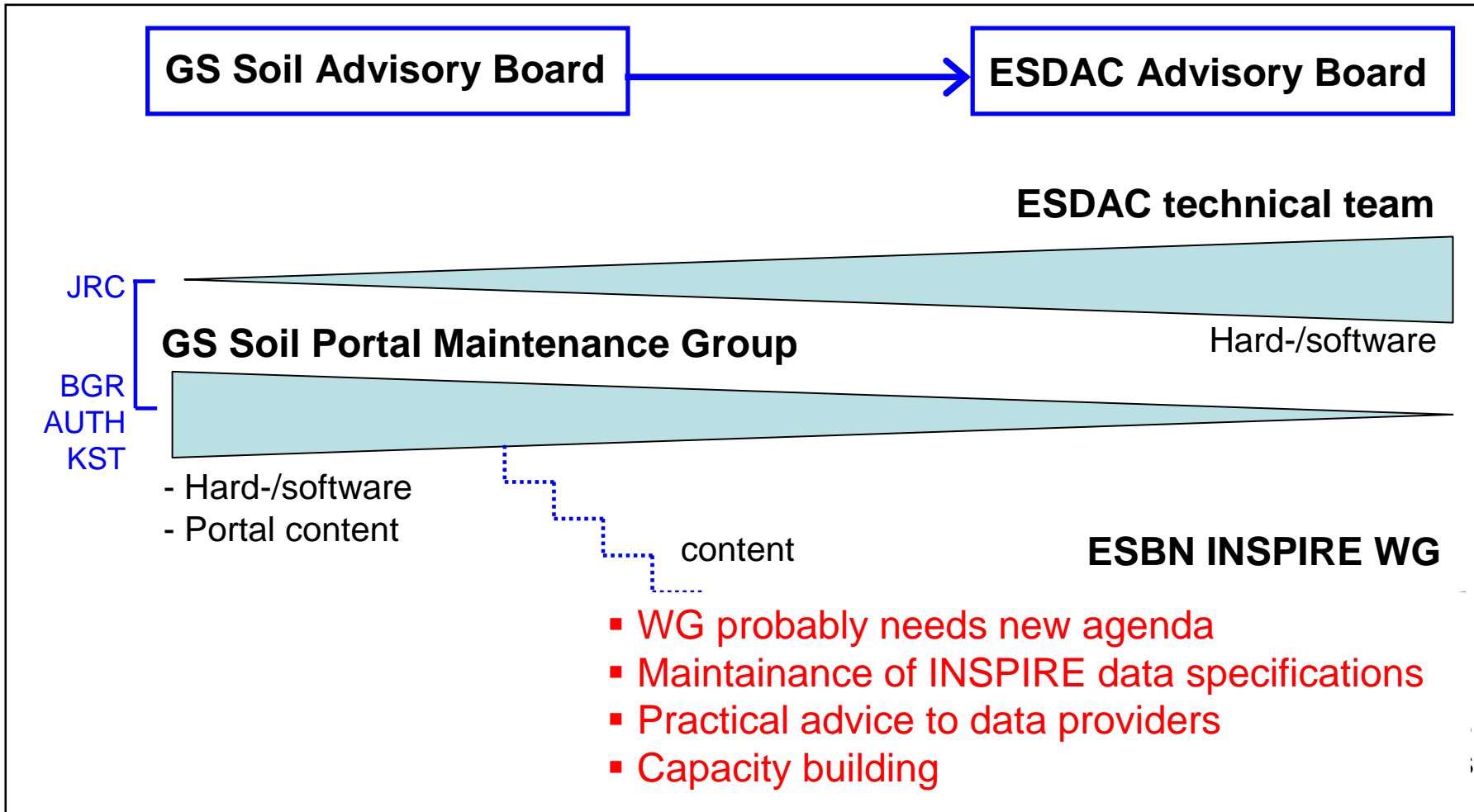
What do users think of the portal functionlities?
Does everything work right?

How is this GS Soil maschine maintained?
What is the relation to the European Soil Data Centre?

WP 6
Evaluation & Sustainability

Long-term operation plan

GS Soil Advisory Board → **ESDAC Advisory Board**

ESDAC technical team

JRC

GS Soil Portal Maintenance Group

Hard-/software

BGR
AUTH
KST

- Hard-/software
- Portal content

content

ESBN INSPIRE WG

- WG probably needs new agenda
- Maintainance of INSPIRE data specifications
- Practical advice to data providers
- Capacity building

Thank you for your attention

and please visit:

Web: http://gssoil-portal.eu/