IUSS WGS SIS
Distributed services, information systems, digital products, the European GS Soil Project, communicating infrastructures

Rainer Baritz, Hannes I. Reuter, Peter Wilson, Einar Eberhardt on behalf of the IUSS WG SIS and the GS Soil Project
Networking among data providers
2 examples will be now provided

**International Soil Science Society (IUSS)**
**WG Soil Information Standards (SIS)**
under the Commissions of Pedometrics and Soil Geography,
Chair: Peter Wilson (CSIRO)

- Technical support to data holders, maximise data availability, utilize modern IT
- Increase network worldwide

**EU ICT project GS Soil**
with 18 EU member states, mostly European Soil Bureau Network (ESBN)

- Test ISO SoilML, test INSPIRE, apply Web-GIS, harmonise legacy data, build portal
- Implementation all over **Europe**
- Framework for integrating legacy data towards new products
Mission
To develop, promote and maintain internationally recognized and adopted standards for the exchange and collation of consistent harmonized soils data and information worldwide

Goals
- provide leadership and focus for collaboration and coordination of soil information standards efforts
- increase accessibility and use of soil data and information for cross-sectoral issues
IUSS WG SIS
inaugural meeting Berlin 16-17 June 2011

• Representation from key international soil information initiatives including GlobalSoilMap.net, ISO, INSPIRE, OGC
• Agreed Terms of Reference
• Chair - Peter Wilson, Vice Chair - Rainer Baritz
• Identified 4 key areas for activity
• Developed work plan with specific short term and longer term activities
IUSS WG SIS

4 Pillars

1. Network building
   - web site (ISRIC)
   - Support GSP
   - Support GEOSS-
     Global Soil Data

2. Soil data exchange format
   - ISO SoilML, other standards (product-/country-specific)
   - Data exchange of raster data
   - Best practice guidance

3. Data availability
   - Generate access to data (metadata, view-/download services)
   - Address harmonization issues

4. Web processing
The role of the IUSS in governing an international model for sharing global soil data (SoilML)

Networks

Infrastructures, standardization

Building linkages to

Development/Implementation
To develop, promote and maintain internationally recognized and adopted standards for the exchange and collation of consistent harmonized soils data and information worldwide.

**Establishment**

The IUSS Working Group on Soil Information Standards (hereafter the Working Group or WG-SIS) was established at the IUSS Executive Committee meeting held in Brisbane, Australia August 2010. The Working Group operates in Division 1 Soils in Space and Time, under the auspices of the Commissions on Soil Geography (C1.2) and Pedometrics (C1.5).

**Membership**

The Working Group is open to any IUSS member with an interest in developing and progressing international soil information standards.

**Mission**

To develop, promote and maintain internationally recognised and adopted standards for the collection, capture and exchange of consistent, harmonized soils data and information.

**Goals**

The Working Group on Soil Information Standards provides leadership and focus in the area of information standards for storage, transfer and collation of soils data and information. This will increase the accessibility and use of soil data and information for cross-sectoral issues such as sustainable food production, climate change, water management, energy production and biodiversity conservation.

WG-SIS will support the community of soil data holders to make a continuously increasing amount of soil data and information accessible using web services, or platforms and tools.

The Working Group will support development of a global soil information model, a soil vocabulary service, and a registry of available soil data and information services which will facilitate national, regional and local interoperability and integration of soils data and information.
Distributed System (data communication/exchange)

Provider A
- Product A: WMS, metadata
- Product B: WMS, metadata

Provider B
- Product A: WFS, WMS, metadata
- Product B: WMS, metadata

Provider C
- Product A: metadata
- Product B: onlineshop, WPS

Portal World Soil Data Centre
- Harvesting, guidance, metadata editing, domain-specific services (best practices, technical + semantic support), Viewer, WPS, methodologies, implementation where resources are limited

Nodes
- "Relais" stations

Other international Data Centres

Other Portals to harvest

Climate data, other data
Next steps regarding **networking**

→ WG SIS Roadmap

- Improve web site
- Active communication with networks: invite further information system holders to become members (ESBN, GlobalSoilMap, etc.)
- Boost activity: GSP governance could help
IUSS WG SIS

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4. Web processing
2. Pillar: soil data exchange format

Where the data stored, and how are they currently exchanged?

- **differently constructed local data bases**, managed with different software, and different export formats
- Additional information (not transported) is needed to understand the relationships between content features (to combine the tables, site description with horizon parameters)
Analysis of data bases to find generic exchange principles to be introduced to data exchange recommendations
Data exchange - principles

Where do we go with data exchange – Web-GIS

- Allows the **harvesting, reproduction and processing of data from various sources** building on data exchange standards
- **Integration of data between different themes** and topics is easier (see also data infrastructures, e.g. GEOSS architecture, SEIS, national systems, etc.)
- Data exchange: structured XML files
- Data will not anymore provided to an individual user, each time, again, but only once based on standardized data exchange
- For the handling of domain-specific XML/GML, there will be increasingly available and user-friendly capacities (GIS software) which utilize complex features like soil profiles combined with polygons

XML: eXtensible Mark up Language

Standard for generating documents readable to machines/humans using a document tree defined by the World Wide Web Consortium (W3C). XML defines the **rules for the structure** of such documents
ISO 28258 SoilML now draft standard

Soil Quality - recording and exchange of soil-related data

Resolution 152 Implementation of ISO 28258 as EN-ISO

Concept of soil data
Map units, sites, soil profiles, soil horizons/depth classes, samples, analysis

Term Dictionary
Definitions of terms and codes used by soil quality experts

Soil quality information model
- Compatible with ISO 19156 Observations and measurements
- UML: soil quality packages (submodels with definition tables and normative attributes): project, spatial relation, soil mapping, soil observation, soil sampling, profile description
Currently, grid/raster features (GSSML) are not included

Empty structure files (XSD) provided
User (data holder) receives 2 structure files (XSD: data content and parameter descriptions such as codes)

Guidance (handbook) and schema mapping (transport)
- GS Soil project together with WG SIS will develop this handbook
- Tool for extracting data from formatted GIS or data bases into XML/GML (HALE, Fraunhofer, GS Soil partner)
ISO 28258 SoilML

Usability
Allows all sorts of data, coded and classified, and measured in different ways, to be exchanged
...in the near future: as Web Feature Services

ISO is draft standard, but different local systems

projects (SOTER), disciplines (GeoSciML and BoreholeML in OneGeology), countries (Germany: KA5ML, Australia: OzSoilML; The Netherlands: SIKB-protocol 0101, etc.)

Web Feature Services

Data transported applying these standards should „communicate“ (receive, understand, process in a single system, e.g. a global portal)
Next steps regarding **standards**

→ WG SIS Roadmap

- Check differences between existing standards: check validity of SoilML as common denominator, provide recommendations

- Develop test bed for demonstrating the operational data exchange (build on the European GS Soil exercise → Cookbook for data exchange)

- Develop and offer a simplified data exchange platform for core soil profile data

- Incentive to adapt services (e.g. soil profile up-/download)
IUSS WG SIS

4 Pillars

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   - Generate access to data (metadata, view-/download services)
   - Address harmonization issues

4. Web processing
3. Pillar: data availability

→ Elaborate, distributed system, data upload, tools and services

- Support to data owners lacking infrastructure:
  → Information: search system
  → Metadata upload and cataloguing
  → Data management: transformation services (e.g. FAO soil profile description, classification transformation tools), soil profile up-/download (export XML, linke WISE, etc.)
  → For data holders lacking a data base: free download load of a simple (empty) data base (e.g. SoDa)
  → Domain-specific vocabulary development and service
Global MetaData Harvesting (ISRIC)
Soil Vocabulary Service – SoilVOC
(ISRIC)

The ISRIC World Soil Information Vocabulary Service provides ontologies of interest in the Soil Science domain as service of the IUSS. This service is based on the SEEGrid Vocabulary Service implementation. Vocabularies are developed in a collaborative effort from scientist around the world.

The API has been implemented over a ReST Interface adapted from GEMET API

Using the SISSVoc API as a rest service:

- Step 1 - Get the URL where the API is available - http://vocab.isric.org/
- Step 2 - Encode the parameters as a GET operation - getConceptByLabel?ISRICDB/Cambisol
- Step 3 - http://vocab.isric.org/getConceptByLabel?ISRICDB/Cambisol

SISSVoc API
For detailed documentation of SISSVoc_API click here:
Work stopped because exchange standard is needed, then new data input mask is easy (implemented for KA5ML).

Prepare for interactive profile descriptions and calculations (WPS).

XML-based output
Transformation service: schema mapping
HUMBOLDT Alignment Editor
GS Soil

“Assessment and strategic development of INSPIRE compliant Geodata-Services for European Soil Data”

http://gssoil-portal.eu/

- EU-Programme: eContentplus
- Duration: 06/2009 – 05/2012 (3 years)
- Coordinator: Coordination Center PortalU (German Environmental Portal)
- Consortium: 34 Partner
  18 EU member states
  24 soil data providers
Aim:

- **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
### Soil in Infrastructures: e.g. INSPIRE

<table>
<thead>
<tr>
<th>Directly considered topics</th>
<th>Linked topics</th>
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</thead>
<tbody>
<tr>
<td><strong>Basic Soil Data</strong></td>
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</tr>
<tr>
<td><strong>Soil</strong> (INSPIRE Annex III)</td>
<td><strong>Geology</strong> (INSPIRE Annex II)</td>
</tr>
<tr>
<td>• Soil Type: classification</td>
<td></td>
</tr>
<tr>
<td>• Soil Properties: depth, structure, particle size distribution, texture, organic carbon, bulk density, parent material, …</td>
<td><strong>Land Cover</strong> (INSPIRE Annex II)</td>
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<tr>
<td><strong>Soil Related Aspects</strong></td>
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<tr>
<td><strong>Partly covered INSPIRE themes:</strong></td>
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<tr>
<td><strong>Environmental Monitoring Facilities</strong> (INSPIRE Annex III)</td>
<td><strong>Habitats and Biotopes</strong> (INSPIRE Annex III)</td>
</tr>
<tr>
<td>• Soil Monitoring Facilities &amp; Long Term Observations</td>
<td><strong>Biogeographical Regions</strong> (INSPIRE Annex III)</td>
</tr>
<tr>
<td><strong>Natural Risk Zones</strong> (INSPIRE Annex III)</td>
<td></td>
</tr>
<tr>
<td>• Priority Areas for Soil Threats: landslides, soil erosion, soil compaction, soil organic carbon decline, salinization, acidification, soil biodiversity loss, …</td>
<td></td>
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<tr>
<td><strong>Human Health and Safety</strong> (INSPIRE Annex III)</td>
<td></td>
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<tr>
<td>• Soil Contamination: dangerous waste, heavy metals, …</td>
<td></td>
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<tr>
<td><strong>Protected Sites</strong> (INSPIRE Annex I)</td>
<td></td>
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<tr>
<td>• Soil Protection Areas</td>
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</table>

**Linked topics:**

- Geology (INSPIRE Annex II)
- Land Cover (INSPIRE Annex II)
- Habitats and Biotopes (INSPIRE Annex III)
- Biogeographical Regions (INSPIRE Annex III)
Project Structure

Advisory Board
JRC, EEA, INSPIRE, OGC, thematic key players,...

Project Coordinator
Project Coordination and Networking (WP 1)

Related Projects
OneGeologie, Envasso,...

eContentPlus Project Office

MU/PortalU WP1 Coordination

Operational Management Group
Work Package Leaders - WP 1 – 7 (if needed, also establishment of temporary Work Groups)

WP 2
Content provision
Univ. Miskolc, Univ. Brno

WP 3
Data management and metadata framework
VUPOP, Bratislava

WP 4
Harmonization and semantic interoperability
BGR, Hannover

WP 5
Integrated network and Soil portal Edisoft, Lissabon

WP 6
Evaluation and Sustainability
UBA, Vienna

WP 7
Dissemination and clustering
Univ. Salzburg
Changes and benefits – clustering

Soil Thematic Strategy/Soil Directive

Environmental policies

European Spatial Data Infrastructure

GS Soil Portal Soil


environmental policies

other themes

GS Soil

Europen Data Centres

Water (WISE) EIONET/SEIS

GS Soil

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

ESDAC JRC

INSPIRE Drafting Teams

FP6 SDI Orchestra Humboldt Cascadoss

SOIL ENVASSO RAMSOIL

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

eContentplus

Best Practice Networks

OneGeology Europe Nature-SDIplus

FP7 e-SOTER (global soil observing system)

GMES

GEOSS Data Architecture

TC 190 (Soil Quality), SC 1 WG 3 (Data codification and management)
WP 2
Content provision framework

- Inventory and themes catalogue
- IPR assessment
- Content framework standards
WP 2: soils inventory and theme catalogue

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<th>General information report</th>
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<td><strong>Product ID:</strong> 333</td>
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<td><strong>Product name:</strong> Land Evaluation Unit database</td>
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<td><strong>Owner:</strong> Soil Science and Conservation Research Institute, Gagarinova 16, 827 13 Bratislava, Slovakia</td>
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<tr>
<td><strong>Author:</strong> Soil Science and Conservation Research Institute, Gagarinova 16, 827 13 Bratislava, Slovakia</td>
</tr>
<tr>
<td><strong>Version:</strong> final</td>
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<tr>
<td><strong>Date:</strong> 1993</td>
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<tr>
<td><strong>Updates:</strong> yes</td>
</tr>
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<td><strong>Availability for GS SOIL:</strong> annually</td>
</tr>
<tr>
<td><strong>Description and purpose:</strong> 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</td>
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<td><strong>Free keywords:</strong> evaluation of agricultural soils</td>
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<td><strong>Use constraints:</strong> free to view, certificate is charged</td>
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<tr>
<td><strong>Organization:</strong> Soil Science and Conservation Research Institute, Gagarinova 16, 827 13 Bratislava, Slovakia</td>
</tr>
<tr>
<td><strong>Person:</strong> Pavol Bietek</td>
</tr>
<tr>
<td><strong>E-mail:</strong> <a href="mailto:p.bietek@upop.sk">p.bietek@upop.sk</a></td>
</tr>
<tr>
<td><strong>Telephone:</strong> +421-2-434 20 666</td>
</tr>
<tr>
<td><strong>Fax:</strong> +421-2-432 95 467</td>
</tr>
<tr>
<td><strong>Web:</strong> <a href="http://www.upop.sk">www.upop.sk</a></td>
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WP 2: IPR assessment

Intellectual property rights assessment

• Evaluation of IPR

103 records have been evaluated:

Data access without restriction: 24 records
Data with restriction: 13 records
  Access as raster: 10 records
  Access with costs: 1 record
  Access with the other restrictions: 2 records
Data with not definitely determined access: 12 records
Data with not defined access: 15 records
Data not available for GS Soil portal: 39 records

→ WP5: WSS (Web Security Service)
WP 2: Content framework standards

- Recommendations for **legend definitions** legend elements
- Recommendations for **legend stratification**
- Recommendations for mandatory (SMU/STU-) **attribute data** (definitions)
- Recommendations for **soil profile properties** (minimum set needed for important applications - PTF)
- Recommendations for **parameter definitions** (texture class acc. to FAO)
  - dependent on product type and scale

⇒ **Recommendations include a lot of existing knowledge about harmonization, but it is now combined into a common framework for soil data exchange and harmonization in Europe**

Figures:
Asch and Troppenhagen (2004)
WP 3
Data management and metadata

- Soil-specific metadata profile
- Soil thesaurus
WP 3: Soil metadata profile

ISO 19115

ISO 19139

ISO 19119

GS SOIL PROFILE

INSPIRE

ISO CORE

Mandatory
WP 3: introduced soil-specific metadata elements

2. Mandatory/conditional

1. **INSPIRE meta data (1205/2008/EC)**
   - Character Encoding
   - Coordinate reference system
   - Source date of mapping
   - Source title
   - Spatial representation type
   - Topology level

3. **Optional meta data**
   - Online digital transfer options
   - Source mapping scale
   - Thematic Accuracy –
     - Classification Correctness
     - Misclassification Rate
   - Completeness – Omission
   - Positional Accuracy – Absolute or External Accuracy

Furthermore for services:
- Contains operations
- Service version

Example of the printed map Sheet Freiburg-North
(map representation acc. to the German topographic map 1:200.000)
WP 4

Harmonization and semantic interoperability

- set-up of test cases throughout Europe to test feasibility of harmonization requirements:
  - reference terminology (link thesaurus)
  - FAO soil profile properties
  - WRB
  - soil maps
- INSPIRE testing, support to ISO 28258 (SoilML)
  - cookbook
- Link WP5 (IT-implementation) on schema mapping (transformation service)

⇒ Data Harmonization Best Practice Guidelines
## Test cases

<table>
<thead>
<tr>
<th>soil mapping 1:250k and related scales</th>
<th>soil mapping at higher resolutions</th>
<th>thematic mapping</th>
<th>soil profiles</th>
<th>soil monitoring</th>
<th>Nomenclature/classification (WRB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordic (FI)</td>
<td>Belgium (BE)</td>
<td>Belgium (BE)</td>
<td>–</td>
<td>Austria (AT)</td>
<td>– various partners</td>
</tr>
<tr>
<td>Balkan (RO, BU, GR)</td>
<td>Slovenia (SL)</td>
<td>Germany (DE)</td>
<td>Slovakia (SK)</td>
<td>Hungary (HU)</td>
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<td>UK/IRL/N.-IRL</td>
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<td>Slovakia (SK)</td>
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WP 5
Integrated network and soil portal
WP 5: GS Soil Portal

- Concept of the Portal and GS Soil network architecture

- Establishment of semantic services (Thesaurus, Gazeteer)

- Provision of open tools and INSPIRE services for data providers

- Continuous integration of services and information

- Deployment and operational manual including guidelines

Discovery (CSW)
View (WMS)
Download (WFS)
GS Soil services
...
Portal surface supports currently 11 Languages:
- English,
- German
- Portuguese
- Dutch
- Czech
- Hungarian
- Slovak
- Bulgarian
- Greek
- Slovene
- Romanian
WP 5: GS Soil Portal semantic services

Similar Terms from GEMET

...currently further improved for soil specific thesaurus

Gazetteer:

...on the basis of GeoNames, OpenStretMaps, GeoHash
WP 5: GS Soil portal *open tools*

GeoFOSS DP’s Catalogue ‘GeoNetwork’

GeoFOSS Map Server ‘GeoServer’

GsSoil Catalogue ‘InGrid©’

Portal Map Viewer WMS Services
Conclusions

- **IUSS WG SIS** provides a concept for data exchange
- Implemented within the IUSS community (… data knowledge, methods)
- Exchanges and combines the developments in soil information systems (as an open network) with the objective to facilitate max. data availability, globally
- Needs to be embedded into a global governance structure despite the idea of a distributed system
Conclusions

- **GS Soil** goes through a large spectrum of soil (data) networking issues, introduces data providers into data infrastructures and web-GIS
- Provides guidance/best-practice (BP) recommendations
- Implementation of BP is not an automatic procedure!
OneSoil Map Viewer
(under development)

Thank you for your attention!

http://www.isric.org/data/web-map-service