

Soil Applications and Vocabularies

G. L'Abate

"Improving Semantics in Agriculture" Workshop

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Research centre for agrobiological and pedological



2-3 July 2015, FAO HQ, Rome, Italy

In this talk

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"Improving Semantics in Agriculture" Workshop

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2. Soil Applications and Data
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 2. About Soil Data
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 4. AGRIS Implementation (Germoplasm data)
 5. Example of SQL code to access Soil Data
3. Soil Vocabularies
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 5. agINFRA Soil Terms Vocabulary uses VocBench 2.1
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The Italian National Centre for Soil Mapping

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The Italian National Centre for Soil Mapping (CNCP) has for many years developed and published soil survey, mapping, and informatization methodologies.

Several thousands of soil observations have been stored on a Ms Access database. Climatic variables relevant for soil evaluation and management were also collected and stored.

This Information System was the starting point to develop:

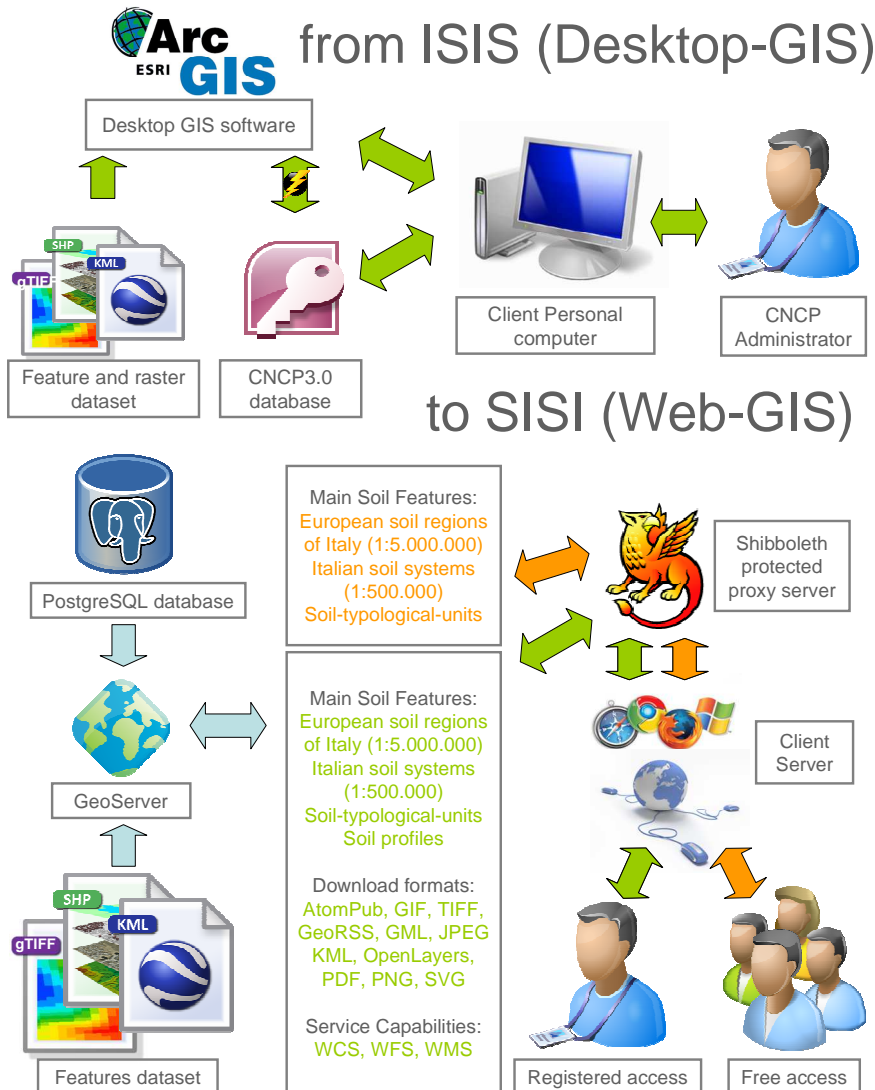
- 1) a web-GIS application for online Italian soil data consultation
- 2) the agINFRA Soil Vocabulary



Soil Applications and Data

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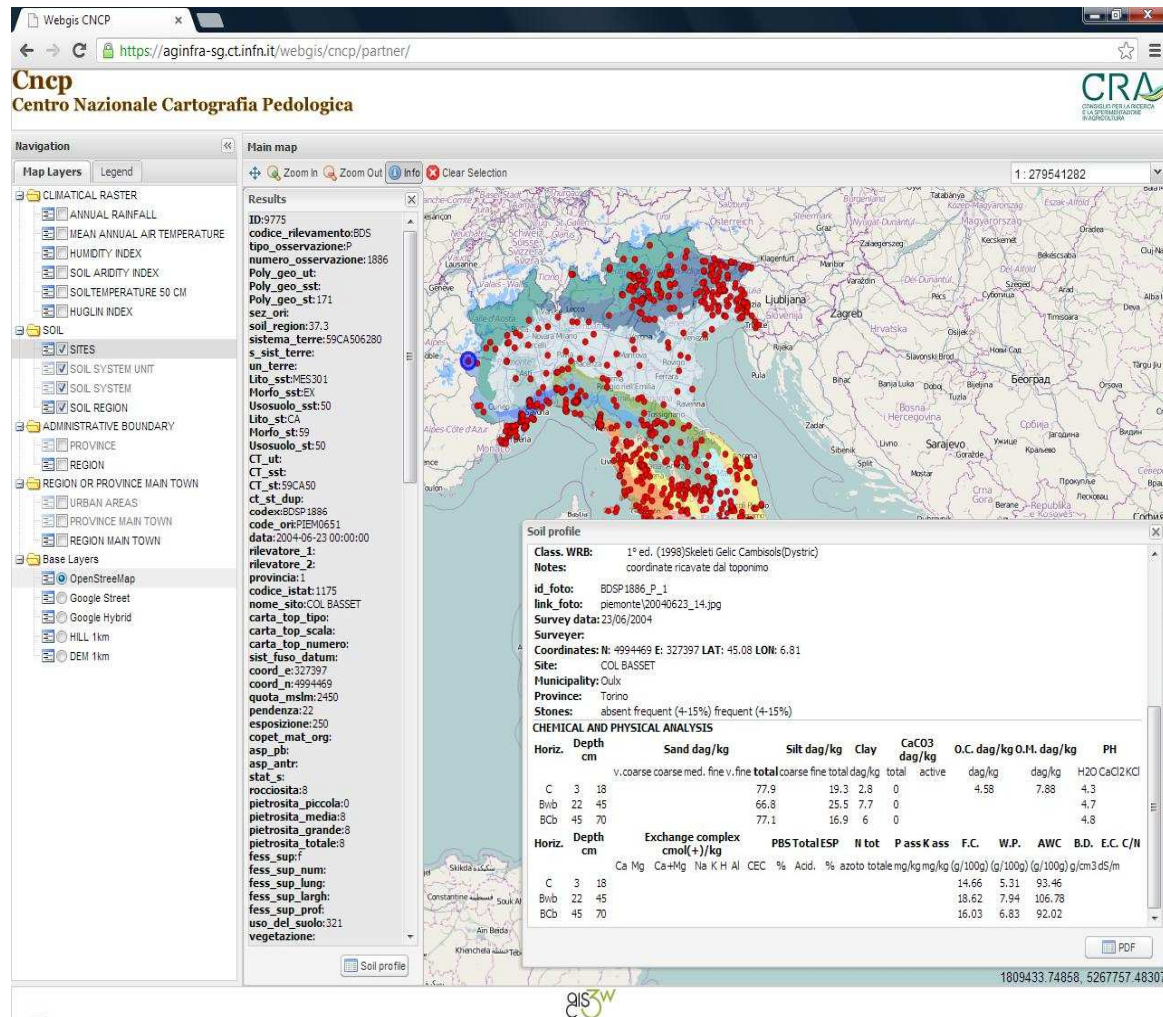
agINFRA EU project - Data Infrastructure for Agriculture - contributed in publishing online Soil Data.

To allow online data consultation, the National database was converted from Ms Access to PostgreSQL.

The webGIS application

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<https://aginfra-sg.ct.infn.it/sisi>

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About Soil Data

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Four principal entities organized in several concepts according the INSPIRE model:

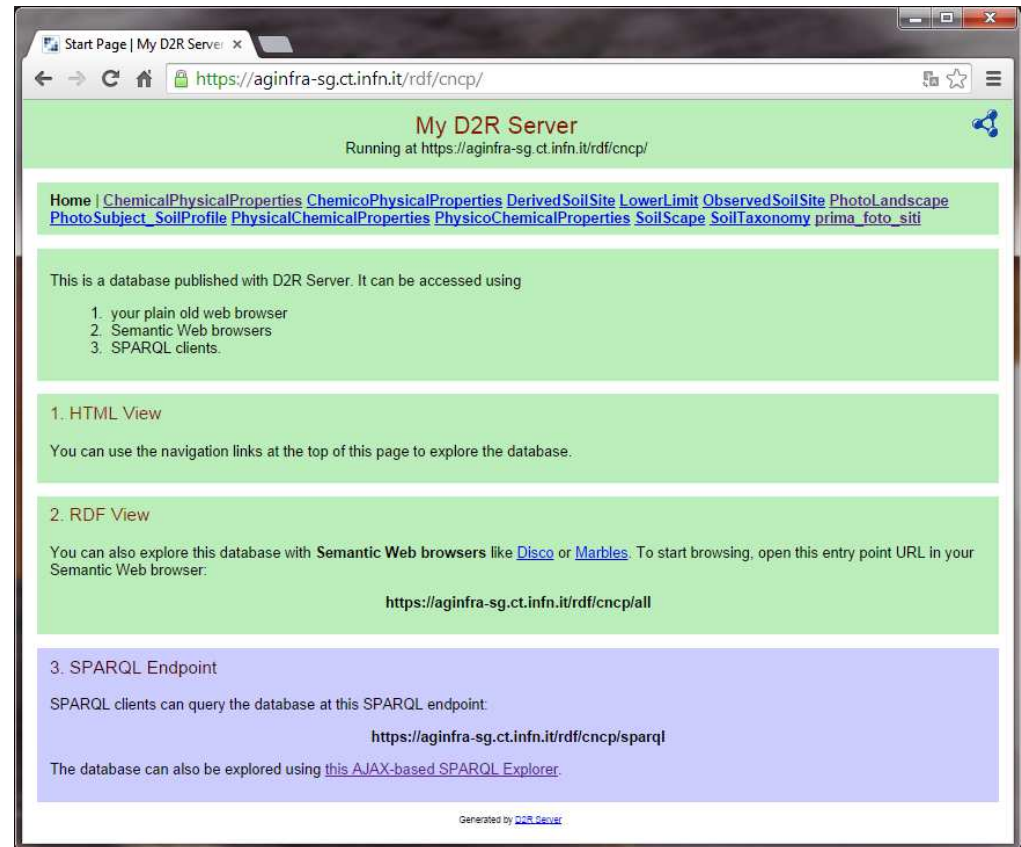
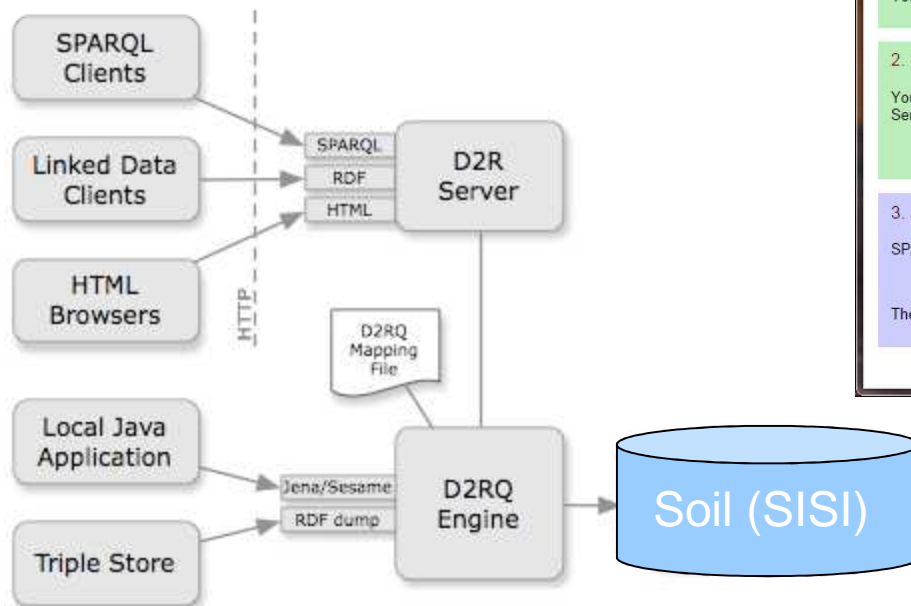
- 1) Soil region (*Soil Body* 1:5,000,000): **34** regions described by **20** attributes
- 2) Soil systems (*Soil Body* 1:500,000): **3358** polygons described by **40** attributes and related to Soil typological units by **9727** relations
- 3) Soil typological unit:
 - 1412** *Derived soil profile*;
 - 4263** *Derived Profile Element*;
 - 16** *Soil parameters* statistic (mean value, standard deviation, frequency) for **82791** measured or modeled data;
- 4) Benchmark profile:
 - 1412** *Observed Soil profiles*;
 - 4284** analyzed *Soil Profile Elements* according **46** *soil parameters* for **81366** measured or modeled data;
 - 1747** photos about **834** *Observed soil profile*

Publishing Soil Data as Linked Data

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D2R is the tool to represent soil data in RDF format




<http://rdf.entecra.it/soilmaps/>

AGRIS Implementation (Germoplasm data)

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**Food and Agriculture Organization
of the United Nations**

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AGRIS

[About](#)
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In vitro propagation of Echinacea angustifolia [feb2006]

[RDF](#)
[lodlive](#)

Venturi, E.
 Lucchesini, M.
 Mensuali-Sodi, A.
 Serra, G.

Abstract:
 The genus Echinacea includes three species; E. angustifolia DC. var. angustifolia (syn. Rudbeckia angustifolia L.), E. pallida (Nutt.) Nutt. ed E. purpurea (L.) Moench., used for phytotherapy. This genus, due to its immunological activity, is one of the main officinal plant genus commercially utilized. In particular, Echinacea angustifolia DC. is used for the extraction of caffeic acid derivatives from roots. As regards the Echinacea genus, few reports are published on cultivation; it is very difficult to find propagation material of E. angustifolia. The development of a rapid and efficient in vitro culture protocol could allow the achievement of a standardized production of plant material to satisfy the market demand. The aim of the present work was to study the adaptability to in vitro culture of plant tissue excised from adult E. angustifolia. In this paper, in vitro plant regeneration of E. angustifolia obtained from flower stalks and leaves of mature plants is described for the first time. The explants were cultivated on LS medium added with PPM (3 ml/l), to face contamination, and 0.6 mg/l BA or NAA 0.01 mg/l + BA 1 mg/l, to induce the differentiation process. BA 0.25 mg/l was added to LS medium to promote shoot proliferation. De novo formation of shoots was observed on leaf veins of in vitro cultivated plantlets. This behaviour confirms a high regeneration potential of E.

[Read More](#)

▼ **Agrovoc Keywords**

- tissue culture
- in vitro culture
- micropropagation
- drug plants
- plant propagation
- culture media
- in vitro regeneration
- cropping systems
- Echinacea
- cropping patterns
- vegetative propagation

▼ **Culture protette (Journal)**

FREQUENCY: Monthly

START DATE: 1972

▼ **Agris articles from the same journal:**

- Evolutione delle caratteristiche chimiche dei terreni delle serre.
- Effetti della concimazione azotata sulla produzione e sulle asportazioni di elementi nutritivi in cultivar di Lilium.

▼ **Other information:**

Volume: 35

Issue: 2

Language: ita

Type: Bibliography

All titles:

"Moltiplicazione in vitro di Echinacea angustifolia"

"In vitro propagation of Echinacea angustifolia"

▼ **Source:**

Istituto di Servizi per il Mercato Agricolo Alimentare
 (click here for contact information)

L'ISMEA (Istituto di Servizi per il Mercato Agricolo Alimentare) è un ente pubblico economico istituito con l'accorpamento dell'Istituto per Studi, Ricerche e Informazioni sul Mercato Agricolo (già ISMEA) e del [...]

HOMEPAGE: <http://www.ismea.it>

Related information in other data sources

Powered by Google™

Read the article and/or related articles:

- ▼ [PDF] Mass Propagation of Echinacea angustifolia: A Protocol Refinement ...
- Tissue culture of **Echinacea angustifolia** allows for selection and rapid **multiplication** of ... Previous reports on **micropropagation** of E. angustifolia have had low ...
- Go to the page
- ▼ [PDF] Establishment of in vitro tissue cultures from Echinacea angustifolia ...
- ▼ [PDF] Micropropagation of Echinacea angustifolia, E. pallida and E. ...
- ▼ In vitro regeneration of Echinacea pallida from leaf explants - Springer

Activities from the Web
 (BETA) Powered by [Scopus](#)

- ▶ [altweb.jhsph.edu](#)
- ▶ [www.cabi.org](#)
- ▶ [eprints.nwsl.ars.usda.gov](#)
- ▶ [www.currentprotocols.com](#)
- ▶ [www.jkuat.ac.ke](#)

Data from Germplasm accessions from the Planta-res database

▼

Scientific Name: Echinacea angustifolia

ACCENAME:

Vernacular Name: Echinacea/Coneflower; narrow-leaved purple

Species: angustifolia

Genus: Echinacea

Institution Code: ITA389

Country of origin: Canada

[Get More Info...](#)

Data from [www.nature.com](#):

- ▶ Evaluation of thrombolysis by using ultrasonic imaging: an in vitro study
- ▶ The NASH drug dash
- ▶ FDA approves two IBS drugs
- ▶ A β -lactamase inhibitor revival provides new hope for old antibiotics

Data from [TECA](#):

- ▶ Grafting Techniques of Allanblackia spp
- ▶ The Li Seeder
- ▶ Participatory approaches: Soaking seeds (seed priming) to improve crop yields
- ▶ Grafting Techniques of Allanblackia spp

Data from [DBPedia](#):

- ▶ Tissue culture
- ▶ Micropropagation
- ▶ Plant propagation
- ▶ Echinacea

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Example of SQL code to access Soil Data

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```
SELECT [NOME UNITA] & ", " & [NOME] AS Title, "http://aginfra-sg.ct.infn.it/webgis/cncp/public/static/photos/" & [link_foto] AS Thumbnail,  
      "http://aginfra-sg.ct.infn.it/webgis/cncp/public/schedastu/cncp:soil_system/" & [UNITA] & "/" & [sottounita].[S_UNITA] & "?type=pdf" AS URI  
FROM ((unita INNER JOIN sottounita ON unita.CODICE_UNITA = sottounita.CODICE_UNITA) INNER JOIN sito_su ON (sottounita.S_UNITA = sito_su.s_unita) AND  
      (sottounita.CODICE_UNITA = sito_su.unita)) INNER JOIN Q_FOTO_prima ON (sito_su.numero_osservazione = Q_FOTO_prima.numero_osservazione) AND  
      (sito_su.tipo_osservazione = Q_FOTO_prima.tipo_osservazione) AND (sito_su.codice_rilevamento = Q_FOTO_prima.codice_rilevamento)  
WHERE (((sottounita.class_wrb) Like "* calcic*")) OR (((sottounita.class_usda) Like "*Calcic*"));
```

AgrisDerivedSoilProfile

Title	Thumbnail	URI
-------	-----------	-----

Calcic Luvisols of 61.3, fine	http://aginfra-sg.ct.infn.it/webgis/cncp/public/static/photos/Abruzzo\A01P11P1.jpg	http://aginfra-sg.ct.infn.it/webgis/cncp/public/schedastu/cncp:soil_system/61.3LVcc1/1?type=pdf
-------------------------------	---	---

Calcic Chernozems of 61.3, fine	http://aginfra-sg.ct.infn.it/webgis/cncp/public/static/photos/Abruzzo\SANP31P1.jpg	http://aginfra-sg.ct.infn.it/webgis/cncp/public/schedastu/cncp:soil_system/61.3CHcc1/1?type=pdf
---------------------------------	---	---

Calcic Kastanozems of 72.2, fine-loamy	http://aginfra-sg.ct.infn.it/webgis/cncp/public/static/photos/Abruzzo\Kastanozems.jpg	http://aginfra-sg.ct.infn.it/webgis/cncp/public/schedastu/cncp:soil_system/72.2Kastanozems/1?type=pdf
--	---	---

Snorql: Exploring <http://rdf.entecra.it/soilmaps/sparql>

SPARQL:

```
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>  
PREFIX foaf: <http://xmlns.com/foaf/0.1/>  
PREFIX gs_soil: <https://secure.umweltbundesamt.at/soil/>  
PREFIX d2r: <http://sites.wiwiiss.fu-berlin.de/suhl/bizer/d2r-server/config.rdf#>  
PREFIX owl: <http://www.w3.org/2002/07/owl#>  
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>  
PREFIX map: <http://rdf.entecra.it/soilmaps/resource/#>  
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>  
PREFIX vocab: <http://rdf.entecra.it/soilmaps/resource/vocab/>  
PREFIX meta: <http://www4.wiwiiss.fu-berlin.de/bizer/d2r-server/metadata#>  
PREFIX soil: <http://vocabularies.aginfra.eu/soil#>
```

```
SELECT DISTINCT * WHERE {  
  ?s ?p ?o  
}  
LIMIT 10
```



Results:

Browse:

- [Classes](#)
- [Properties](#)

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aginfra
A data infrastructure for agriculture



Argicultural

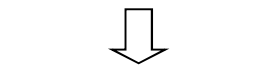
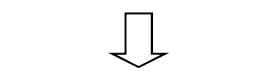
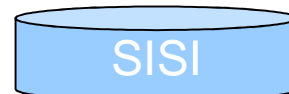
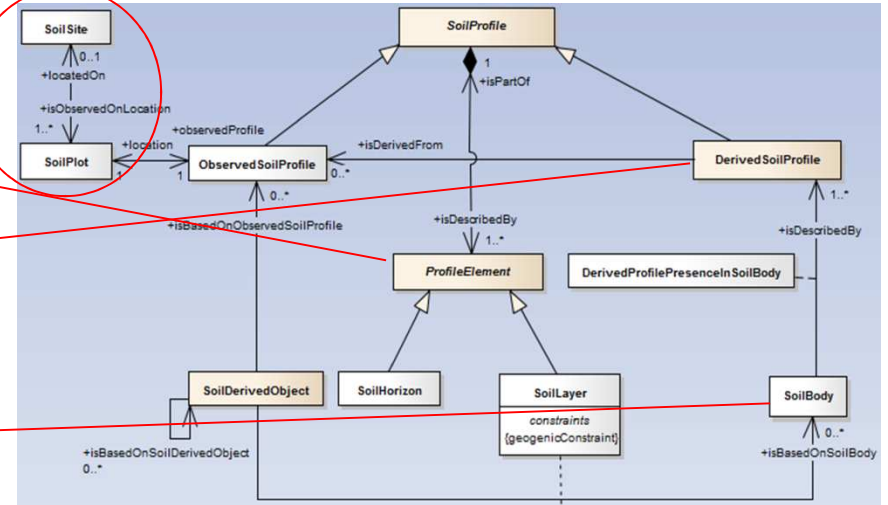
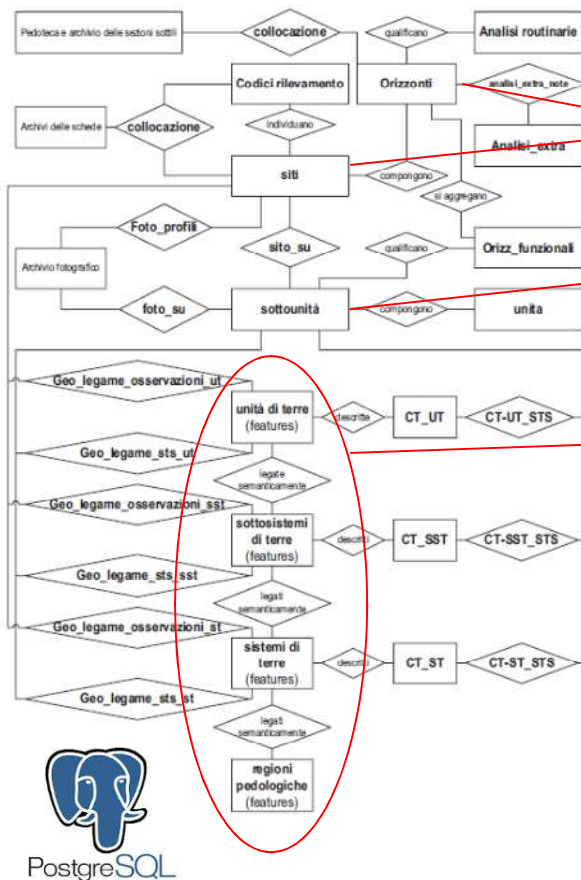
OPEN DATA

- The INSPIRE directive aims to create a European Union (EU) spatial data infrastructure. This will enable the sharing of environmental spatial information among public sector organisations and better facilitate public access to spatial information across Europe
- agINFRA project adopted EU INSPIRE concept scheme to develop a metadata vocabulary for soil data.
- INSPIRE is a good starting point for both:
 - An RDF metadata vocabulary, as it defines entities and attributes / relationships;
 - The identification of KOSs that need to be published, as it defines “registers” of values.

Models Integration

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from local Soil Vocabulary to the agINFRA Soil Vocabulary

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Publishing the agINFRA Soil vocabulary

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VocBench :: Version 2.1 [x] agINFRA vocabularies

vocabularies.aginfra.eu/soil.html

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RDF vocabularies and KOSs used in agINFRA
for improved interoperability of agricultural data

HOME METADATA VOCABULARIES VALUE VOCABULARIES / KOSs **UNDER DEVELOPMENT**

Authors:
Giovanni L'Abate (CRA)
Valeria Pesce (Global Forum on Agricultural Research (GFAR)) (Email)

Last update:
22 April 2014

Namespace URI:
<http://vocabularies.aginfra.eu/soil/>

Abstract
Under construction. Based on INSPIRE. Developed by the Italian Consiglio per la Ricerca e la sperimentazione in Agricoltura (CRA) in collaboration with the Global Forum on Agricultural Research (GFAR) and the Food and Agriculture Organization of the United Nations (FAO).

All terms at a glance

Classes: DerivedProfilePresenceInSoilBody | DerivedSoilProfile | ObservedSoilProfile | ObservedSoilProfile | ProfileElement | SoilBody | SoilDerivedObject | SoilHorizon | SoilLayer | SoilPlot | SoilProfile | SoilSite | SoilThemeCoverage | SoilThemeDescriptiveCoverage | coverage | coverageByDomainAndRange | rectifiedGridCoverage

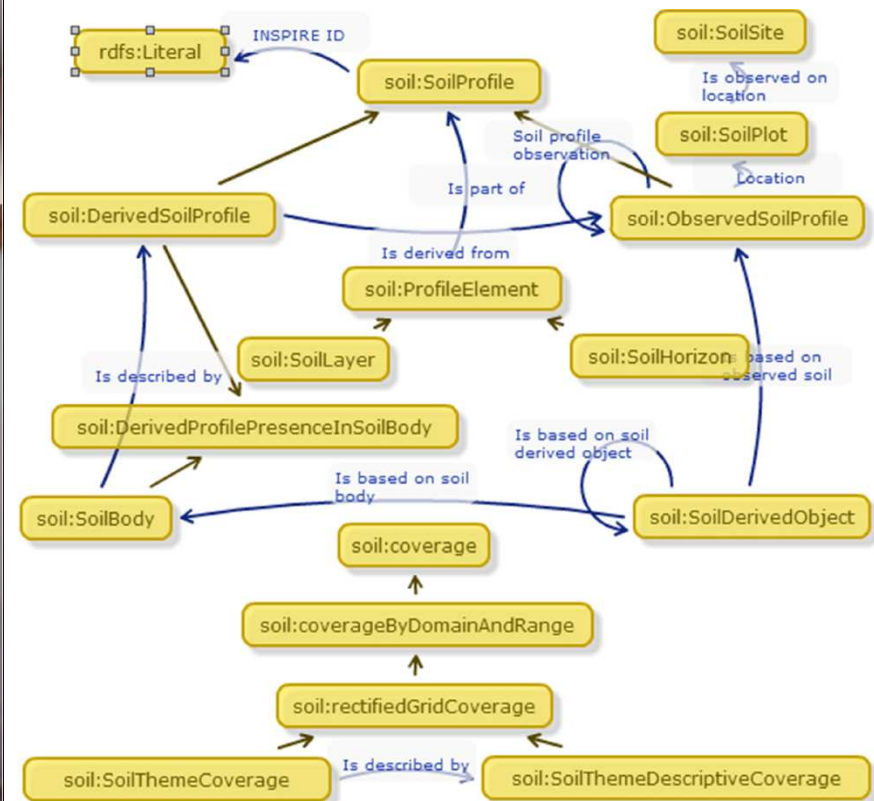
Properties: inspireId | isBasedOnObservedSoilProfile | isBasedOnSoilBody | isBasedOnSoilDerivedObject | isDerivedFrom | isDescribedBy | isDescribedBy | isDescribedBy | isDescribedBy | isObservedOnLocation | isPartOf | isRepresentedBy | location | soilProfileObservation

Browse by thematic area
Agriculture - General/All
Education and Extension
Food safety and Human nutrition
Food Security
Natural Resources and Environment
Plant Production and Protection
_General / Not domain-specific

Browse by resource type
Agents (people, organizations, contacts)
Bibliographic resources
Concepts
Educational resources
Generic datasets
Geographic entities
Germplasm data
Soil data
Statistical data
_General / Not domain-specific

Powered by Neologism | Login

GFAR
Facilitated by GFAR



<http://vocabularies.aginfra.eu/soil.html>

Building the SKOS

getting from the 2D database structure to nD SKOS

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Table (28)	Field (880)	Value	Term (Alternative)	InspireTerm (Preferred)	InspireBroaderTerm
Soil_system	WRB	CH	reference soil group (RSG)	WRB Reference Soil Group (RSG)	Soil Body
sottounita	wrb_unità	RG	reference soil group (RSG)	WRB Reference Soil Group (RSG)	Derived Soil Profile
sottounita	Localita_tipica	Quarto	Representative site name	site name	Derived Soil Profile
sottounita	mpro_utile	135	potential root depth	potential root depth	Soil Derived Object Parameter Name
orizz_funzionali	mph	8.1	mean soil pH (in water)	pH value	Soil Derived Object Parameter Name
orizz_funzionali	mcarb_org	0.75	mean organic carbon content	organic carbon content	Soil Derived Object Parameter Name
analisi_routine	phw	8.0	soil pH (in water)	pH value	Profile Element Parameter Name
analisi_routine	azoto_totale		total nitrogen content	nitrogen content	Profile Element Parameter Name
analisi_routine	carbonio_org	0.60	organic carbon content	organic carbon content	Profile Element Parameter Name

1° approximation:
3 level SKOS

Listing all Classes
and Properties

Naming Classes
and Properties

Adding
Controlled lists

2° approximation
n level SKOS

Cleaning up KOS
Using INSPIRE

expliciting complexity
(logical gerarchies)

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Linking Soil terms

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3° approximation
n level SKOS

Expliciting URIs

prefLabelEn	prefLabelIt	exactMatch
WRB diagnostic horizon	ORIZZONTE DIAGNOSTICO WRB	https://secure.umweltbundesamt.at/soil/en/concepts/SoilCore_47
WRB edition	EDIZIONE WRB	http://inspire.ec.europa.eu/codelist/OtherSoilNameTypeValue
WRB prefix qualifier	PREFISSO WRB	https://secure.umweltbundesamt.at/soil/en/concepts/SoilCore_54
WRB suffix qualifier	1° SUFFISSO WRB 2006	https://secure.umweltbundesamt.at/soil/en/concepts/SoilCore_
WRB diagnostic material	MATERIALE DIAGNOSTICO WRB	https://secure.umweltbundesamt.at/soil/en/concepts/SoilCore_48
WRB Reference Soil Group (RSG)	UNITA' WRB	http://inspire.ec.europa.eu/codelist/WRBReferenceSoilGroupValue
WRB Qualifier Place	Posizione dei qualificatori WRB	http://inspire.ec.europa.eu/codelist/WRBQualifierPlaceValue
WRB Qualifiers	Qualificatori WRB	http://inspire.ec.europa.eu/codelist/WRBQualifierValue
WRB Specifiers	Specificatori WRB	http://inspire.ec.europa.eu/codelist/WRBSpecifierValue

<http://inspire.ec.europa.eu/registry>

<http://lod.nal.usda.gov/nalt/>

<https://secure.umweltbundesamt.at/soil/en/concepts/>

<http://linkeddata.ge.imati.cnr.it:2020/>



XML



JSON



Atom



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agINFRA Soil Terms Vocabulary uses VocBench 2.1

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<http://artemide.art.uniroma2.it/vocbench2/#Concepts>

The screenshot displays the VocBench 2.1 web application interface. The main window shows the 'Concepts' tab, which is highlighted with a red circle. The interface includes a sidebar on the left with a tree of concepts, a central panel for editing a term (currently 'Soil (en)'), and a right sidebar with a list of concepts. A diagram of soil horizons (O, A, B, C, R) is shown in the center.

Left Sidebar (Concepts):

- INSPIRE Application Schema Soil (en)
- DerivedProfilePresenceInSoilBody (en)
- DerivedSoilProfile (en)
- geology (en); geologia (it)
- Land Use (en); USO DEL SUOLO (it)
- reference soil group (RSG) (en); UNITA' DEL WORD REFERENCE BASE (it)
- Soil Site (en); stazione intorno al profilo (it)
- U.S. Soil Taxonomy (en)
- World Reference Base for Soil Resources (WRB) (en)
- FAO Horizon Notation Type (en)
- Observed Soil Profile (en)
- Other Horizon Notation Type (en)
- Other Soil Name Type (en)
- Particle Size Fraction Type (en)
- WRB Soil Name Type (en)
- INSPIRE registry (en)
- INSPIRE Theme (en)
- Addresses (en)
- Administrative Unit (en); Unità amministrative (it)
- altitude (en); quota (it)
- Generic Conceptual Model (en)
- geology (en); geologia (it)
- Land Cover (en)
- Land Use (en); USO DEL SUOLO (it)

Central Panel (Term: Soil (en)):

Language	Term
English (en)	Soil (Preferred) W

Right Sidebar (Concepts):

- Soil (en)
- FAO Horizon Master (en)
- A (en)
- B (en)
- C (en)
- E (en)
- H (en)
- I (en)
- L (en)
- O (en)
- R (en)
- W (en)
- FAO Horizon Subordinate (en)
- Accumulation of carbonates (en); accumulo di carbonati secondari (it)
- Accumulation of gypsum (en); accumulo pedogenetico di gesso (it)
- Accumulation of jarosite (en); accumulo di jarosite (it)
- Accumulation of salts more soluble than gypsum (en); accumulo pedogenetico di sali più solubili del gesso (it)
- Accumulation of silica (en); accumulo di silice pedogenetica (it)
- Accumulation of silicate clay (en); accumulo di argilla silicata (it)
- Accumulation of sodium (en); accumulo pedogenetico di sodio scambiabile (it)

Diagram (Soil Horizons):

The diagram shows a cross-section of soil horizons labeled O, A, B, C, and R (Bedrock). The O horizon is the top layer, followed by A, B, C, and R (Bedrock) at the bottom.

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agINFRA Repository uses AllegroGraph WebView 4.11

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<http://202.45.139.84:10035/catalogs/fao/repositories/agINFRA#graph>

AllegroGraph WebView 4.11 repository agINFRA

« | Overview | Queries | User anonymous

WebView Beta | Documentation

Statements with **skos:Concept** » as the object.

[Open a graph view on this node.](#)

Subject	Predicate
c_3456	rdf:type
c_2661	rdf:type
c_3451	rdf:type
c_3454	rdf:type
c_2672	rdf:type
c_3452	rdf:type
c_3455	rdf:type
c_3457	rdf:type
c_2662	rdf:type
c_3362	rdf:type
c_3429	rdf:type
c_2667	rdf:type
c_3425	rdf:type
c_3427	rdf:type
c_3423	rdf:type
c_3556	rdf:type
c_2663	rdf:type
c_3579	rdf:type
c_2664	rdf:type
c_3396	rdf:type
c_3345	rdf:type
c_2665	rdf:type
c_3413	rdf:type
c_3522	rdf:type
c_3512	rdf:type
c_2674	rdf:type

AllegroGraph WebView 4.11 repository agINFRA

« | Overview | Queries | User anonymous

Statements with **c_3456** » as the subject.

Predicate	Object
rdf:type	skos:Concept
skos:inScheme	kos
skos:broader	c_2661
skos:broader	c_2672
prefLabel	xl_it_90
prefLabel	xl_en_90

AllegroGraph WebView 4.11 repository agINFRA

« | Overview | Queries | User anonymous

Statements with **xl_en_1** » as the subject.

Predicate	Object
rdf:type	Label
literalForm	"Bluish Black"

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About agINFRA Soil Terms Vocabulary

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- 1 Topconcept: INSPIRE registry
- 2 Languages: English/Italian
- 7 Linked Thesauri:
 - Agrovoc; inspire registry;
 - lod.nal.usda.gov/nalt; ge.imati.cnr.it;
 - secure.umweltbundesamt.at;
 - vocab.getty.edu; resource.geosciml.org
- 123 Definitions
- 1 Different URIs
- 5909 Concepts

How agINFRA Vocabularies could improve GACS

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The screenshot displays the GACS Beta interface with three main panels:

- texture class (en) CLASSE TESSITURALE USDA (it):** A list of soil texture classes. Red boxes highlight: "coarse loamy sand (en); sabbia franca grossolana (it)", "coarse sand (en); sabbia grossolana (it)", "coarse sandy loam (en); franco sabbiosa grossolana (it)", "fine loamy sand (en); sabbia franca fine (it)", "fine sand (en); sabbia fine (it)", "fine sandy loam (en); franco sabbiosa fine (it)", "silty clay (en); argilla limosa (it)", "silty clay loam (en); franco limoso argillosa (it)", "very fine loamy sand (en); sabbia franca molto fine (it)", "very fine sand (en); sabbia molto fine (it)", and "very fine sandy loam (en); franco sabbiosa molto fine (it)".
- GACS Beta:** A hierarchical tree view. Red boxes highlight "soil morphological features" and "textural soil types". A red box also highlights "soil physical properties?".
- soil morphological features (en):** A list of soil morphological features. Red boxes highlight: "coatings (en); rivestimenti (it)", "concentrations (en); concentrazioni (it)", "soil aggregates (en)", "soil mottles (en); SCREZIATURE (it)", "soil pans (en)", and "soil voids (en)".

Arrows indicate relationships: from "texture class (en)" to "textural soil types" in GACS Beta, from "soil morphological features" in GACS Beta to "soil morphological features (en)", and from "soil physical properties?" in GACS Beta to "soil physical properties?" in the list.

- 1) With new concepts
- 2) Adding or ~~reviewing~~ semantical organization to present concepts

Our Vision

G. L'Abate

"Improving Semantics in Agriculture" Workshop

Some work has been done toward CREA Linked Open Data implementation for Germoplasm and Soil, other collaborations with organizations on Soil Data Interoperability: Research Data Alliance, Open Geospatial consortium (Soil IE), and...



Why not an applications using CREA Open Data?
our dream is to see an application that implement every sort of data produced in CREA.

Smartphones could be used in Soil survey because of implementing: GPS, Camera, positional sensors (i.e. for slope) and other external sensors that could be connected to survey environmental data.



Thanks for your attention!

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<http://abp.entecra.it/>
<http://soilmaps.entecra.it/>

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