Magyar Tudományos Akadémia
Agrártudományi Kutatóközpont
Talajtani és Agrokémiai Intézet
Környezetinformatikai Osztály

Pásztor László:
Térbeli Talajinformációs Rendszerek/ Bevezetés a digitális talajtérképezésbe

PhD kurzus

4. Nemzetközi talajinformációs rendszerek

Budapest, Herman Ottó út 15.
Tel/fax.: 36-1-356-3694
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www.mta-taki.hu

Nemzetközi talajinformációs rendszerek

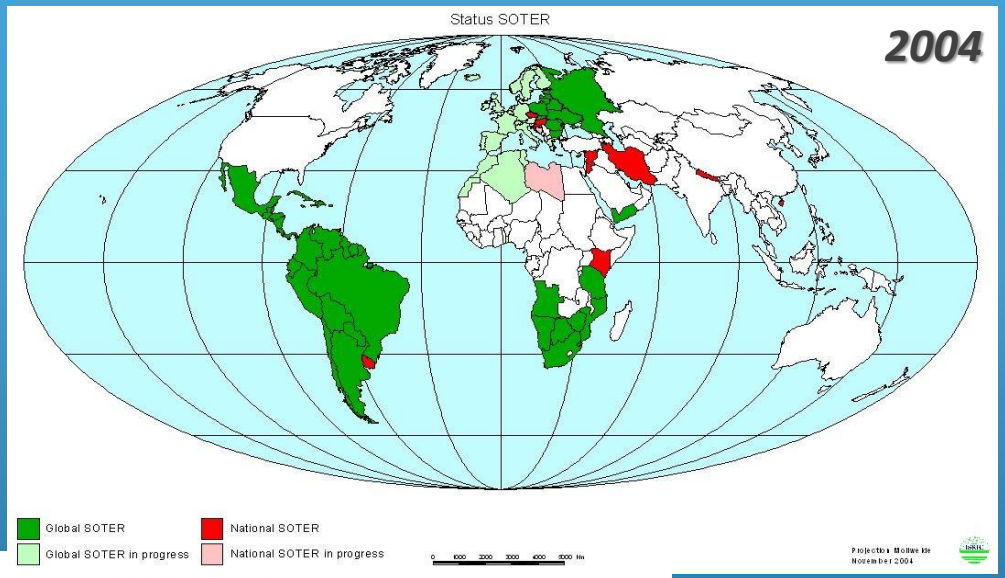
Előadás vázlat

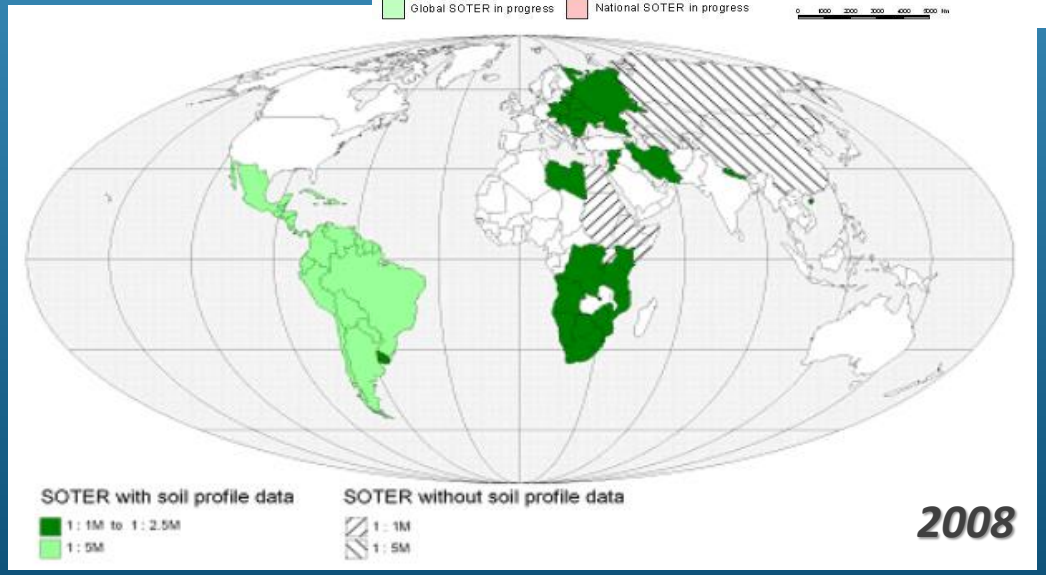
- *SOTER, e-SOTER, SOVEUR*
- *MERA*
- *Európa*
- *USA*
- *Globális stratégia*

A SOTER (Soil and Terrain Database) adatbázis

A SOTER 1:1.000.000 MÉRETARÁNYÚ GLOBÁLIS LÉPTÉKŰ TALAJTANI ÉS DOMBORZATI DIGITÁLIS ADATBÁZIS.

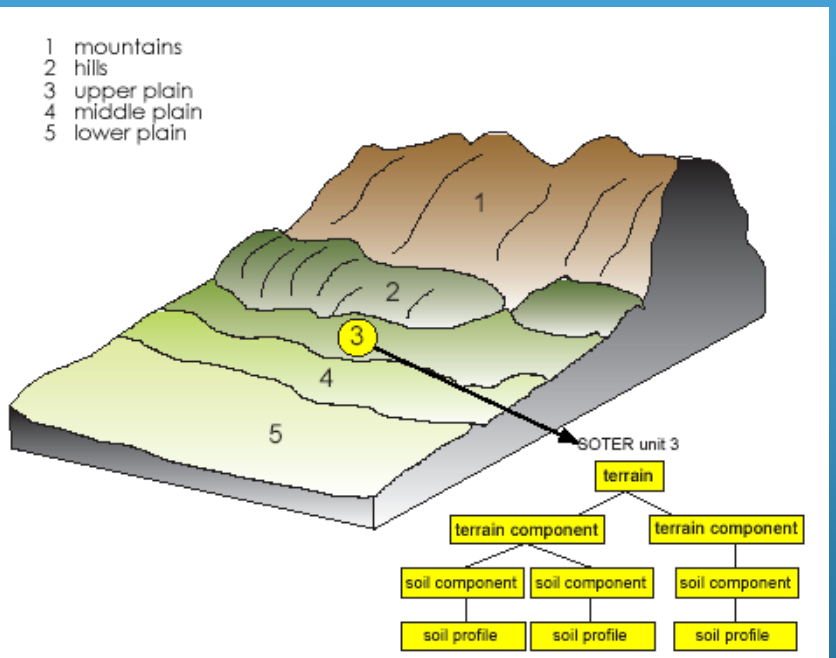
A SOTER NEM EGY TELJESEN FELTÖLTÖTT ÉS CENTRALIZÁLT ADATBÁZIS, MINDÖSSZE AZ EGYMÁSTÓL FÜGGETLEN ADATBÁZISOK EGYSÉGESÍTÉSÉNEK LEHETŐSÉGÉT BIZTOSÍTJA

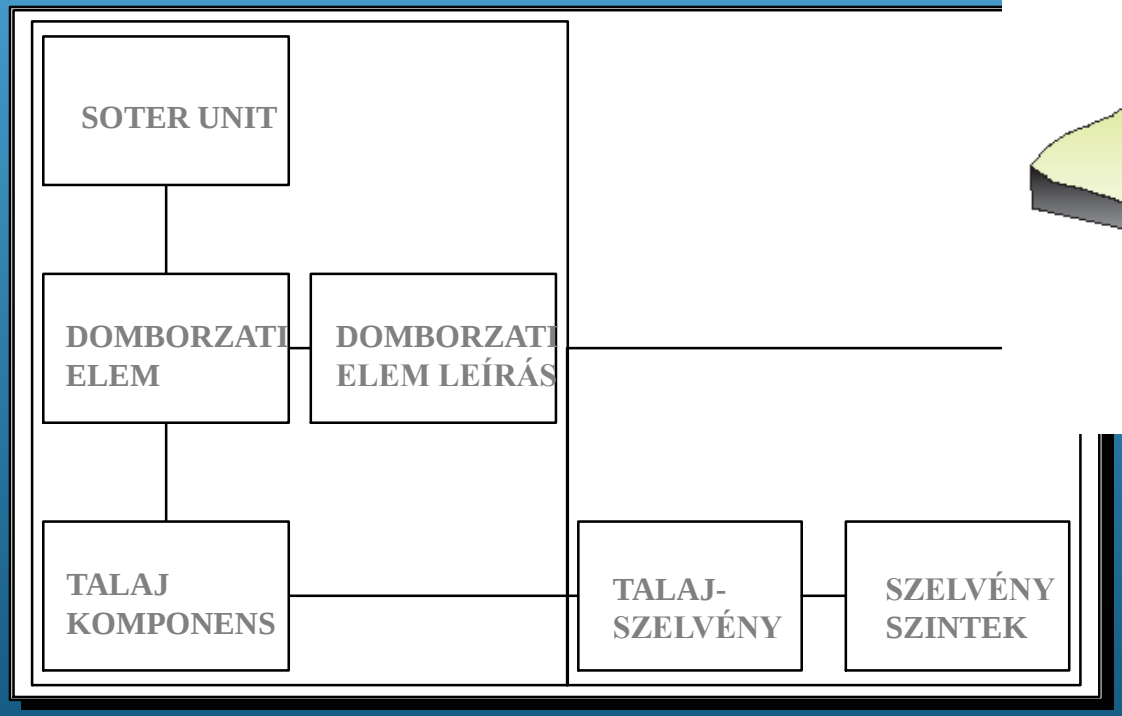




NAPJAINKIG A SOTER ADATBÁZIS CSAK NÉHÁNY MINTATERÜLETRE KÉSZÜLT EL A METODOLÓGIA TESZTELÉSE CÉLJÁBÓL, 1:5.000.000 - 1:100.000 MÉRETARÁNYBAN.

A SOTER (Soil and Terrain Database) adatbázis



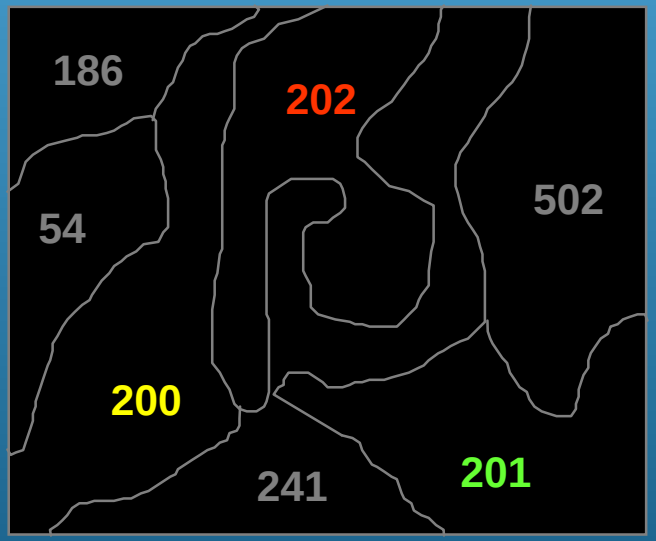


A SOTER METODOLÓGIA OLYAN KOMPLEX ÉS HIERARCHIKUS STRUKTÚRÁJÚ ADATSZERKEZETET HATÁROZOTT MEG, AMELY ELTÉRŐ FELBONTÁSÚ ÉS TERÜLETI KITERJEDÉSŰ ADATOK KEZELÉSÉT TESZI LEHETŐVÉ. ALAPEGYSÉGE A *SOTER UNIT*, AMELYBŐL A GEOMETRIAI ADATBÁZIS ÉPÍTKEZIK.

A SOTER (Soil and Terrain Database) adatbázis

A *SOTER UNITOKON* BELÜL ELŐFORDULÓ DOMBORZATI (TERRAIN) ÉS TALAJ-KOMPONENSEK (SOIL) CSAK SZÁZALÉKOS TERÜLETI RÉSZARÁNYUKKAL ÉRTELMEZHETŐK, MIVEL AZ ADATBÁZIS FELBONTÁSA NEM TESZI LEHETŐVÉ EZEK TÉRKÉPI ÁBRÁZOLÁSÁT.

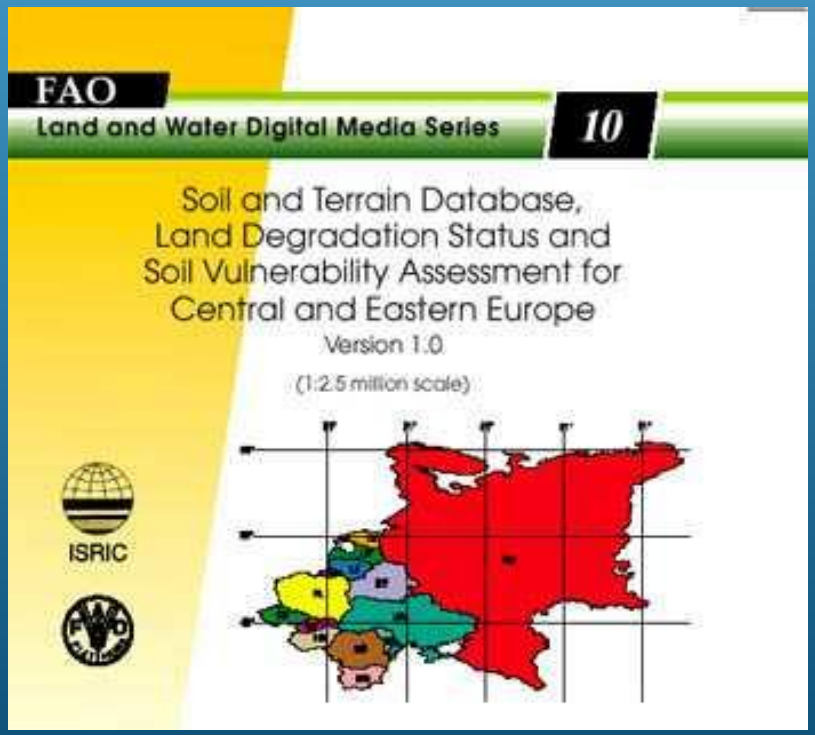
SOTER UNITOK

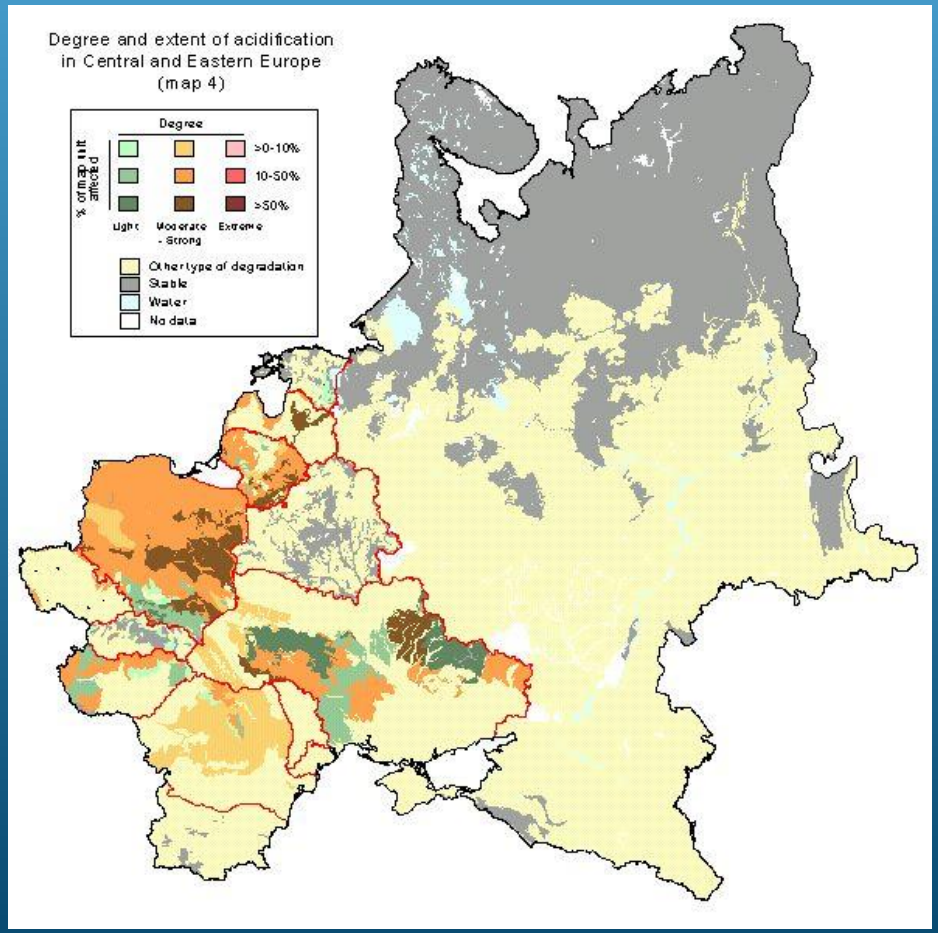


SOTER UNIT _ID	TERRAIN COMPONENT _ID	%
200	1	50
200	2	30
200	3	20
201	1	100
202	1	70
202	2	30

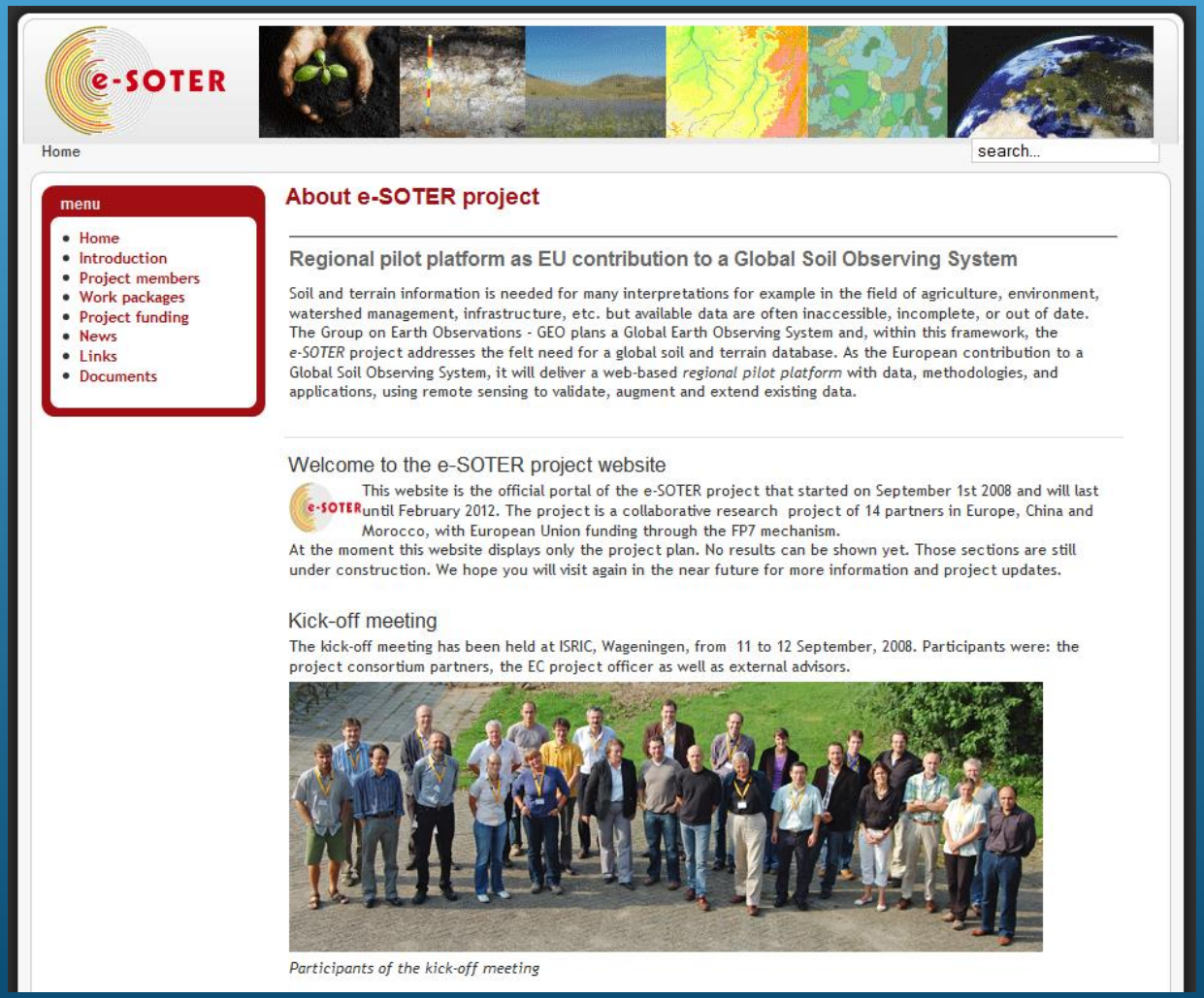
SOTER UNIT _ID	TERRAIN COMPONENT _ID	SOIL COMPONENT _ID	%
200	1	1	15
200	1	2	15
200	2	1	30
200	2	2	10
200	3	1	10
200	3	2	10
200	3	3	10

A SOVEUR (Soil and Terrain Database, Land Degradation Status & Soil Vulnerability Assessment for Central & Eastern Europe 1:2.5M) projekt



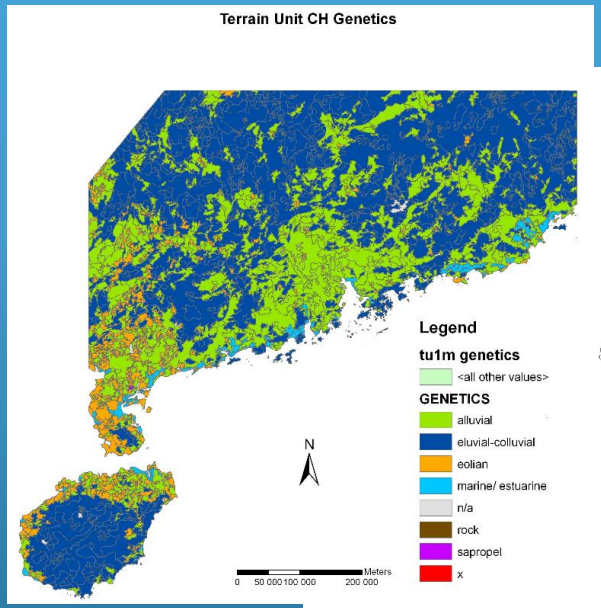


Az e-SOTER (Soil and Terrain Database) projekt



http://www.esoter.org

Az e-SOTER (Soil and Terrain Database) projekt



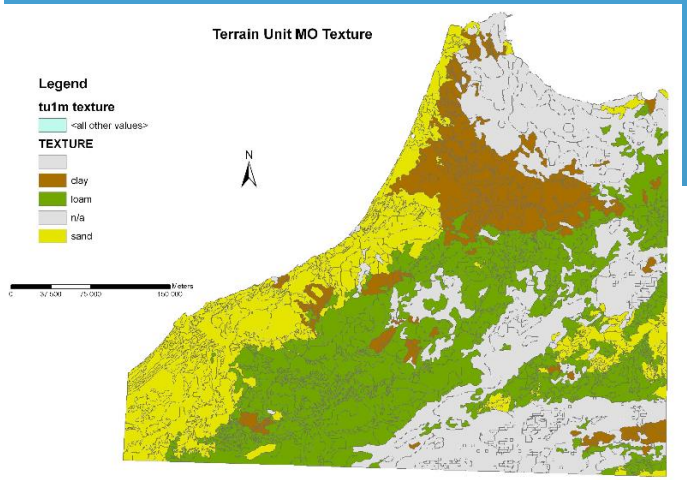
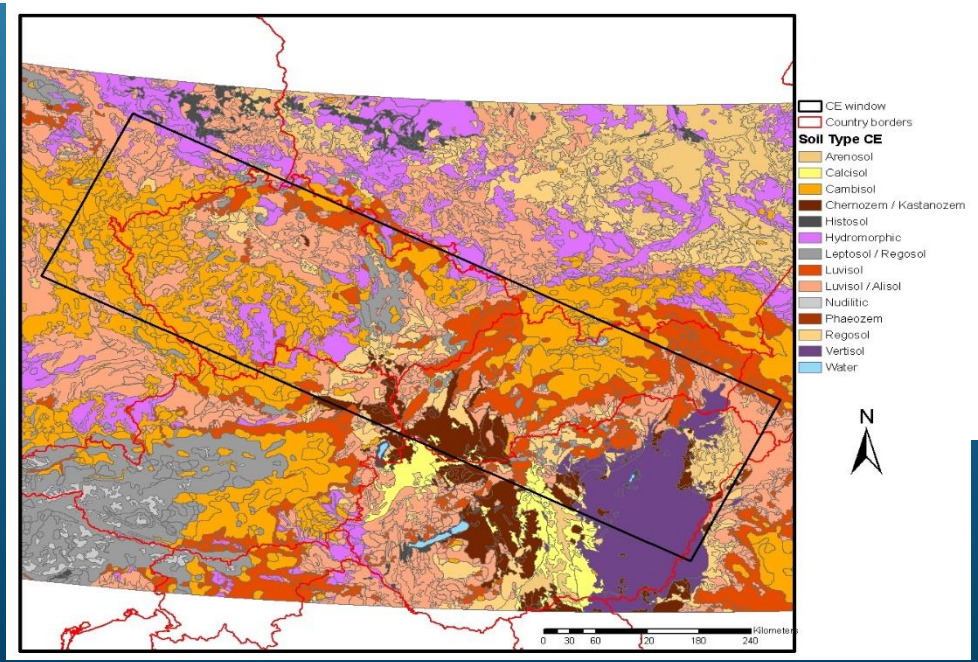
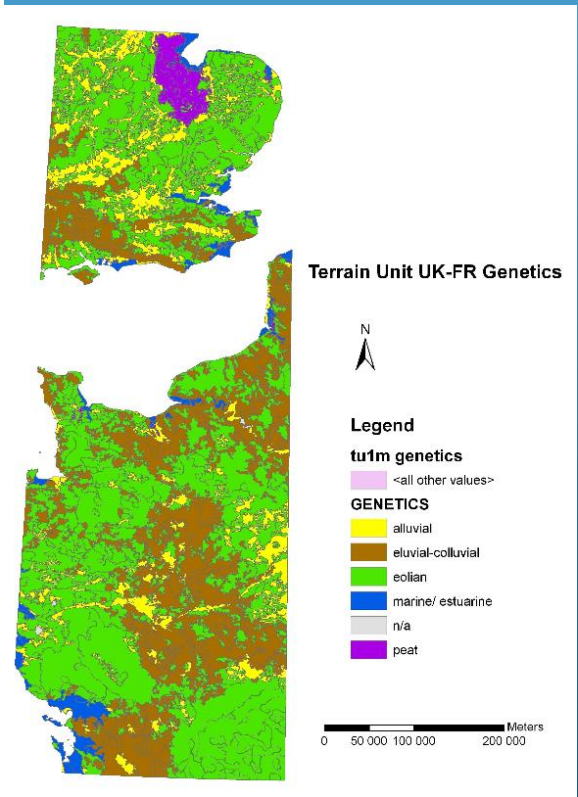
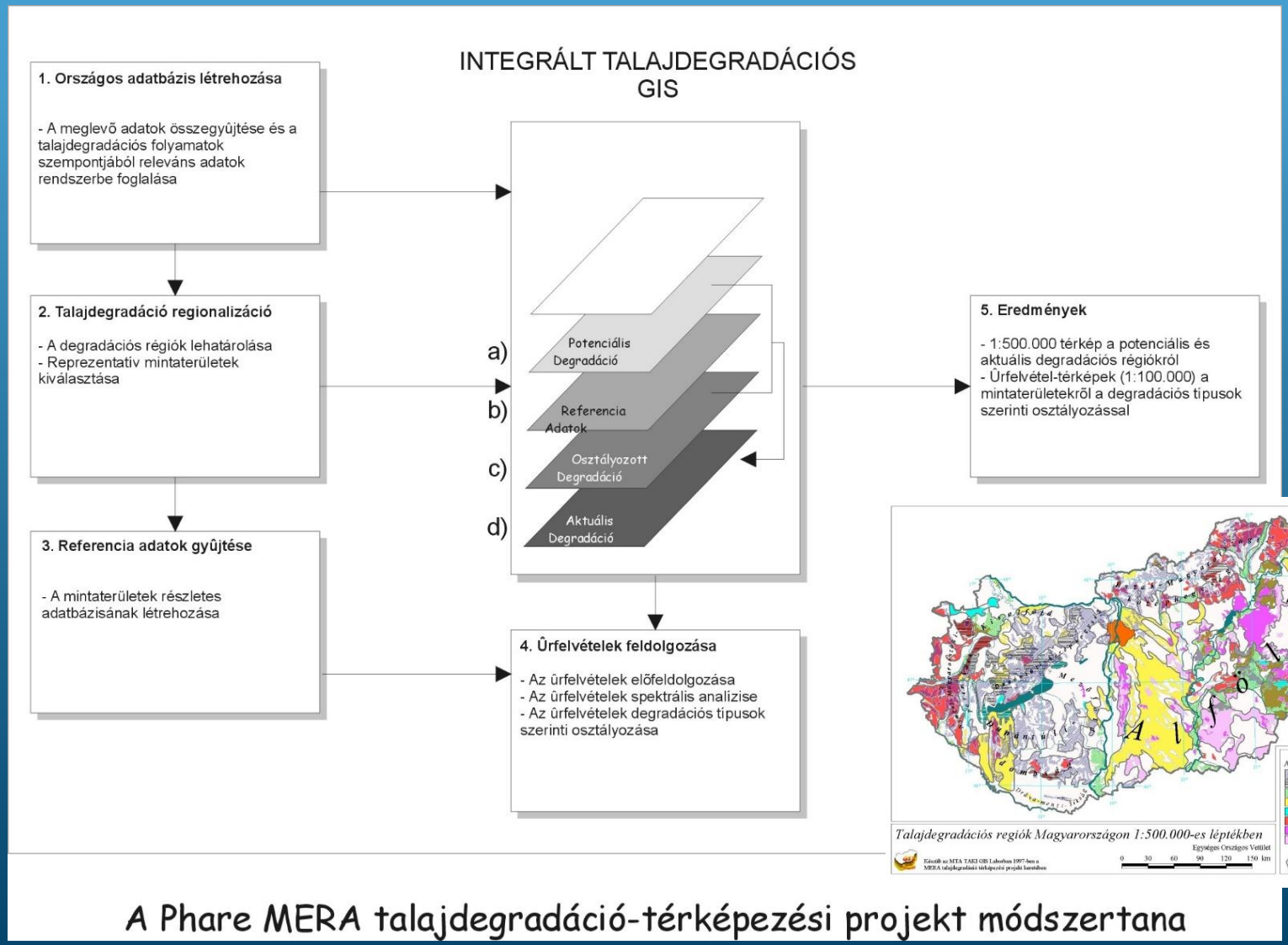


Fig 5.6. The texture classes of the Morocco window



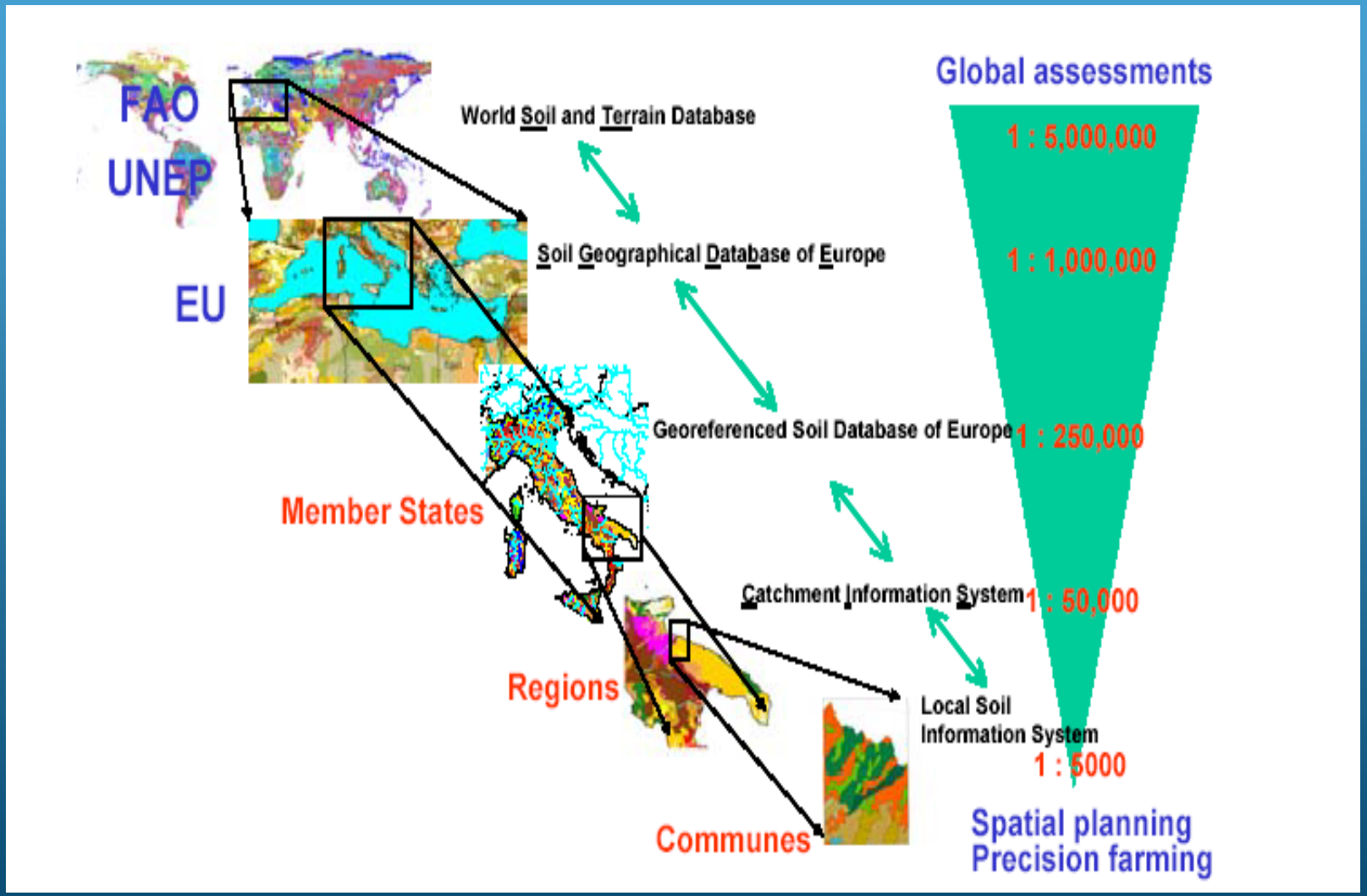


A MERA (MARS & Environment Related Applications; Land Degradation Mapping) projekt

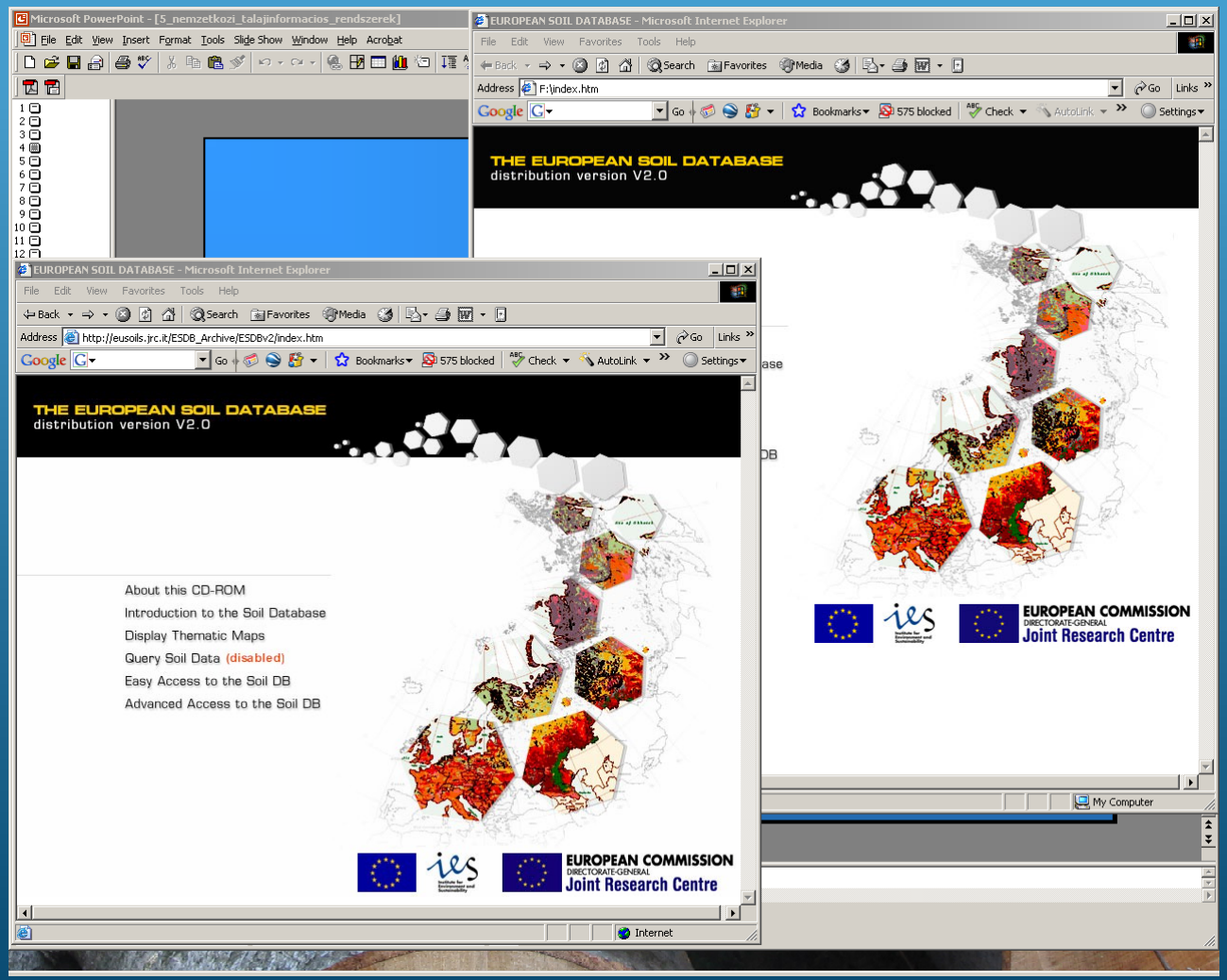


A Phare MERA talajdegradáció-térképezési projekt módszertana

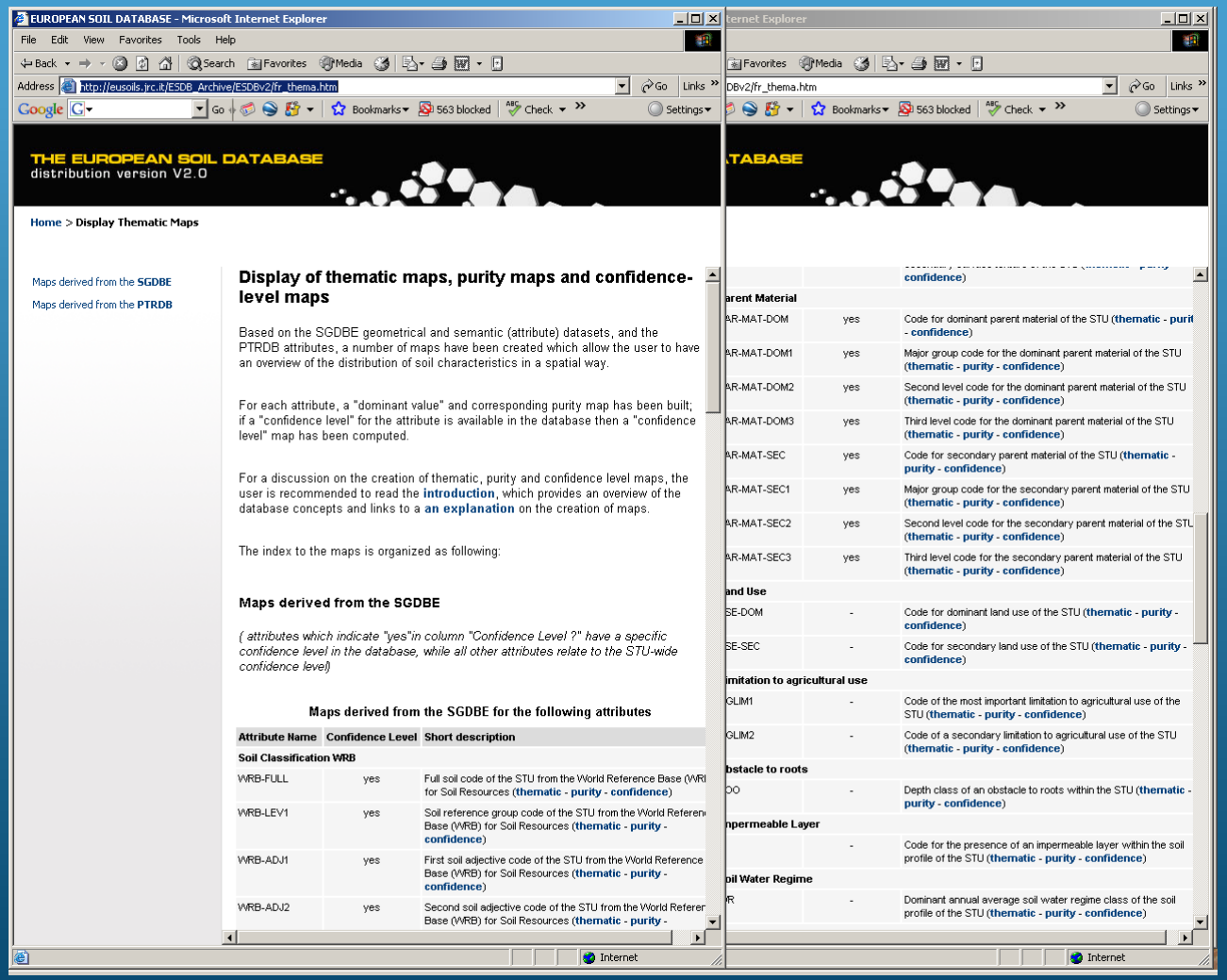
Térbeli talajinformációs rendszerek Európa



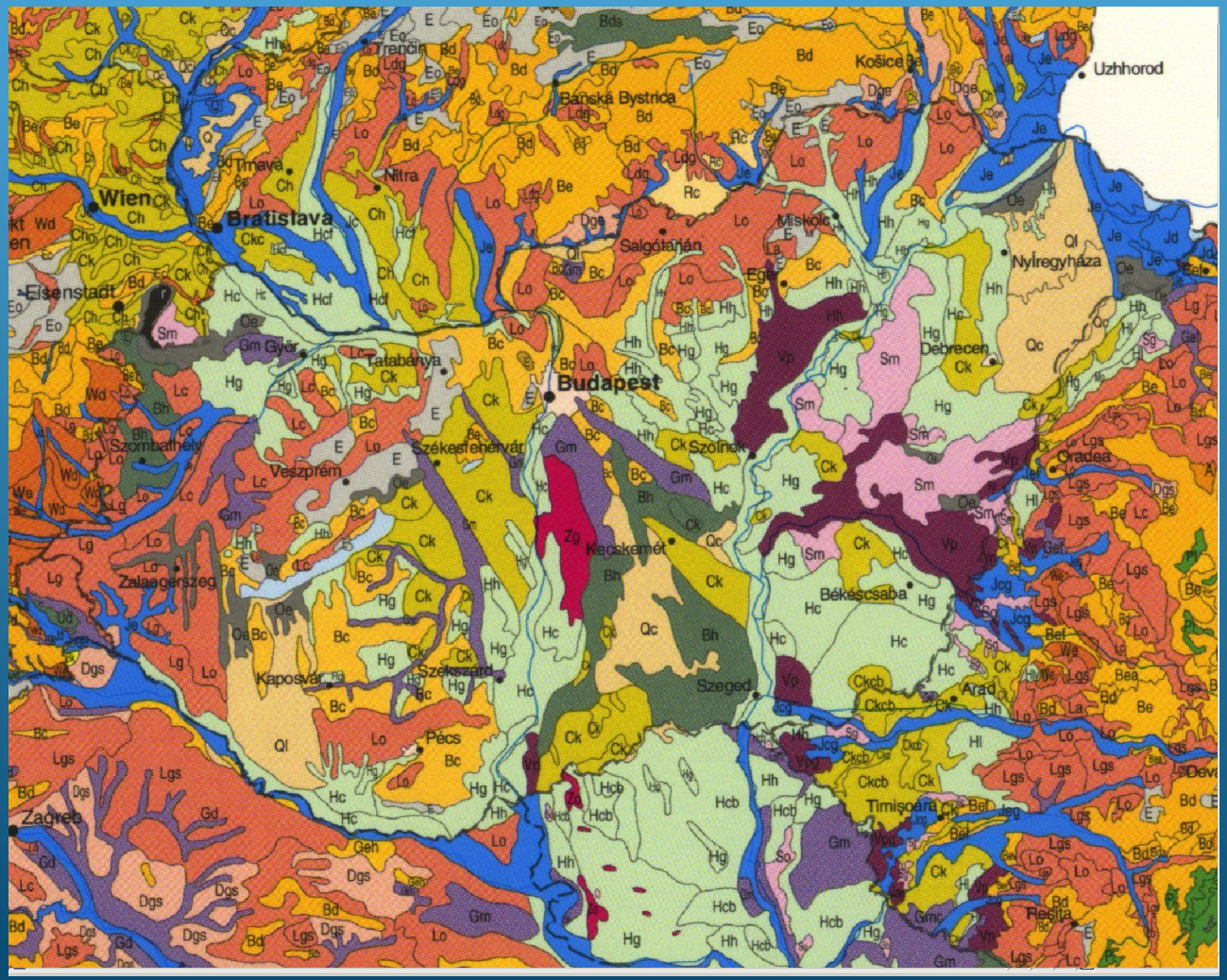
Térbeli talajinformációs rendszerek Európa



Térbeli talajinformációs rendszerek Európa



Térbeli talajinformációs rendszerek
Európa



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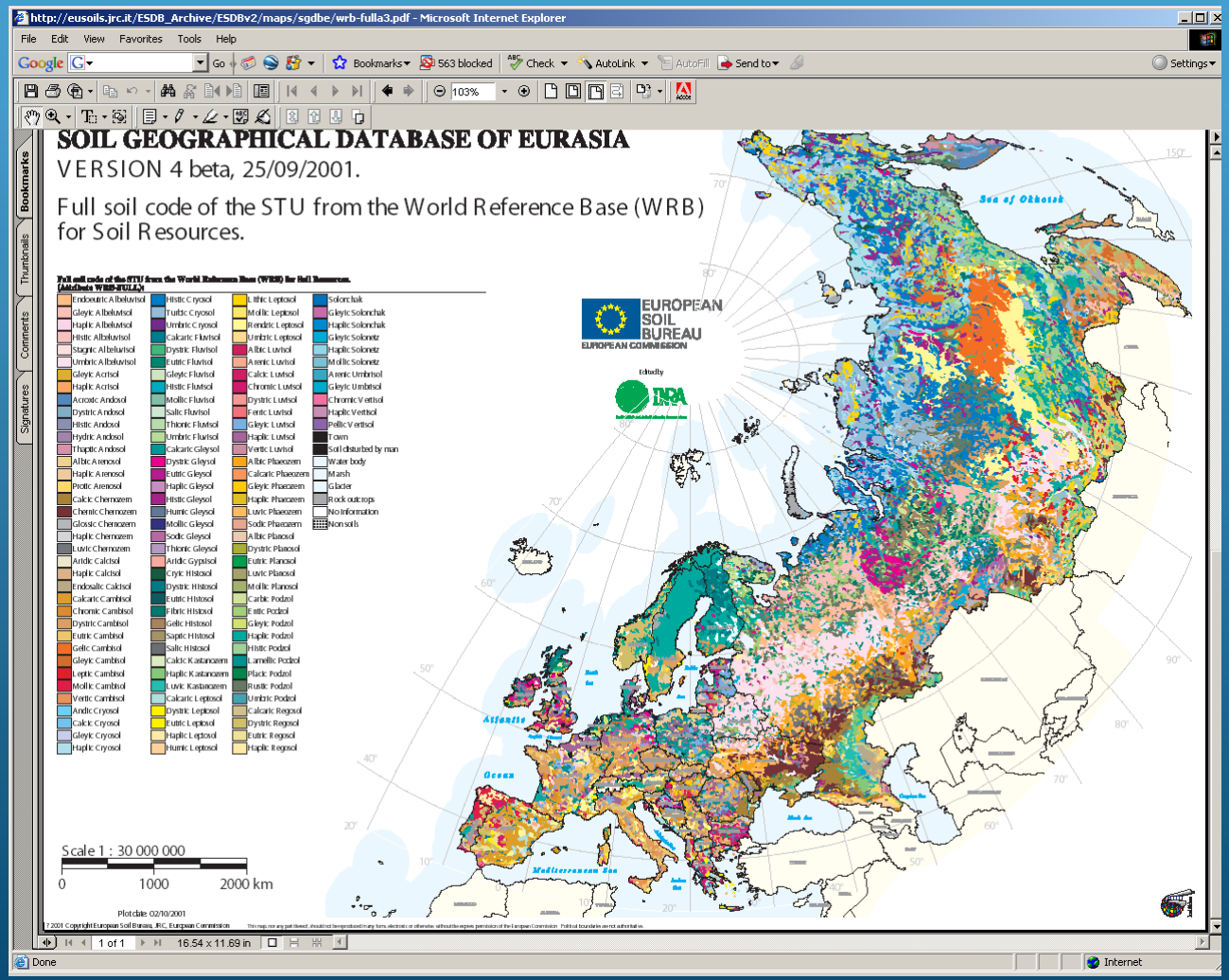

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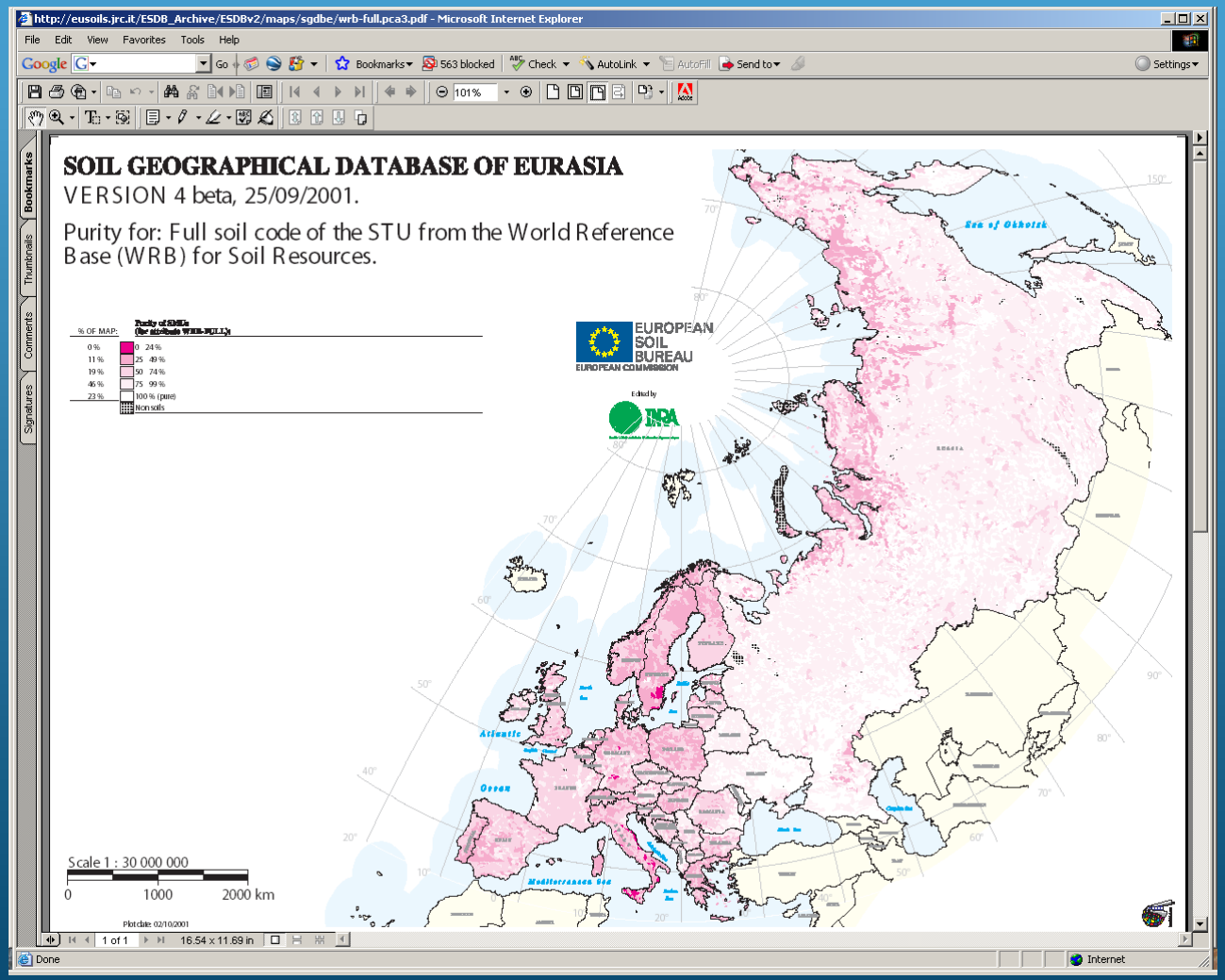

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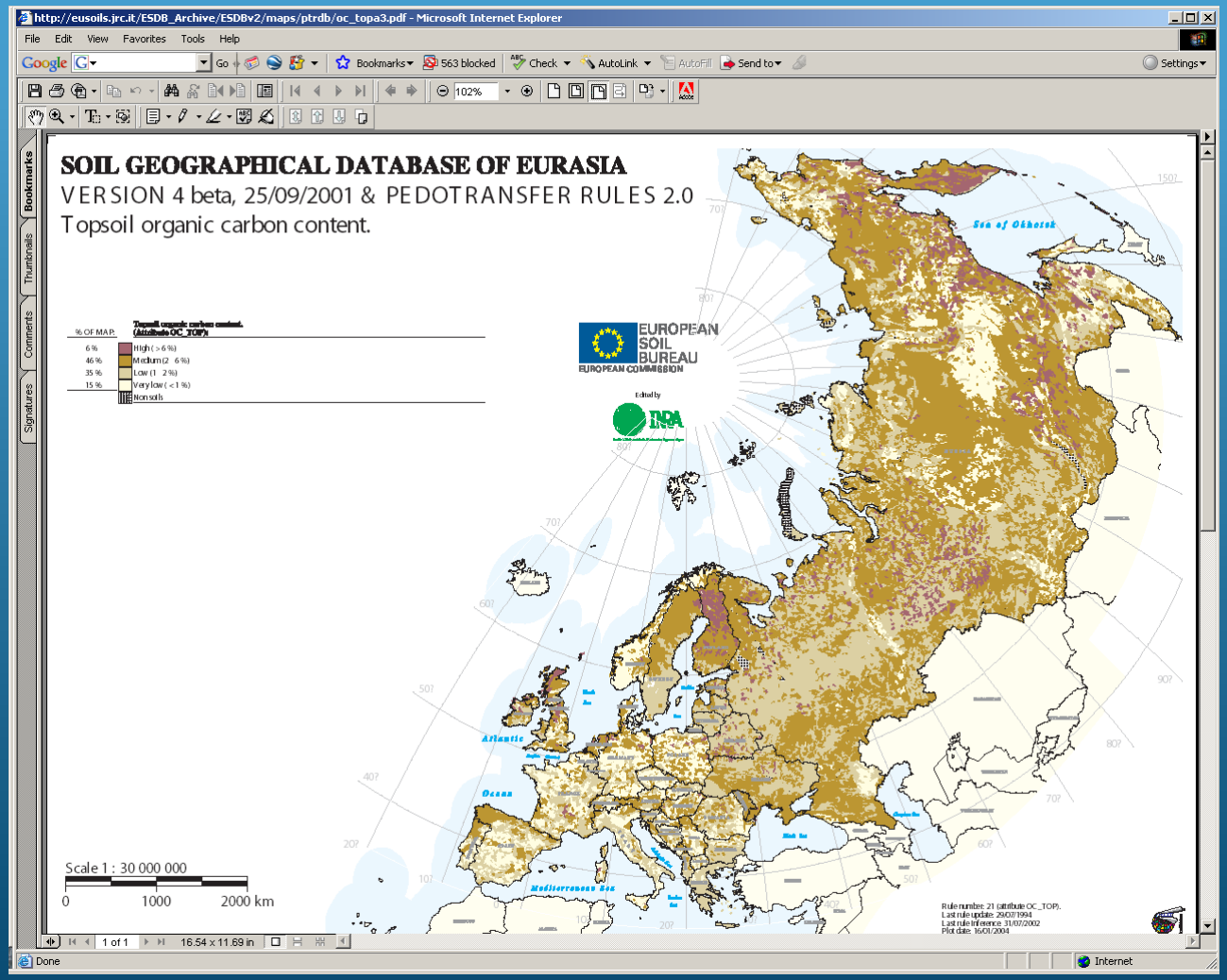

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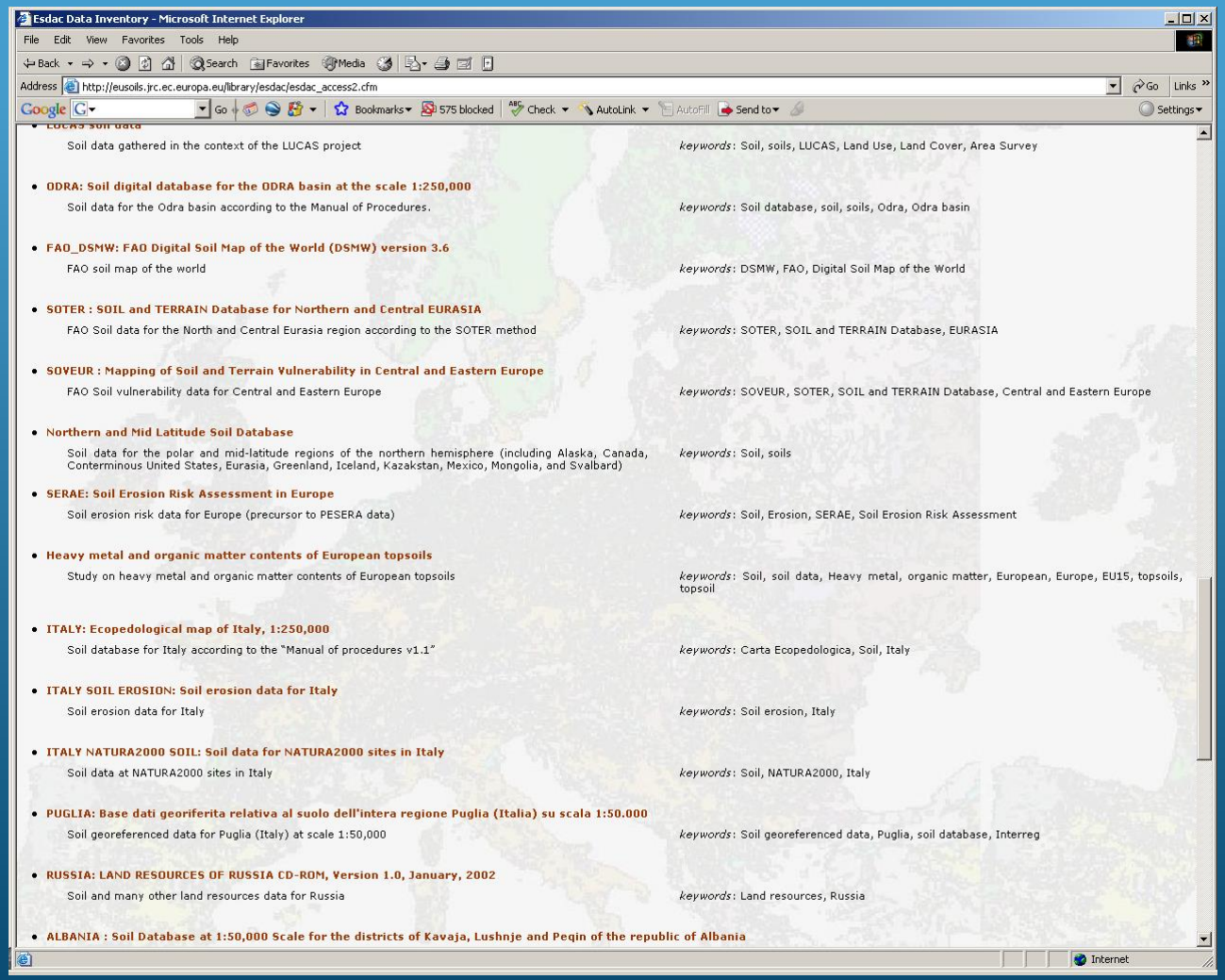
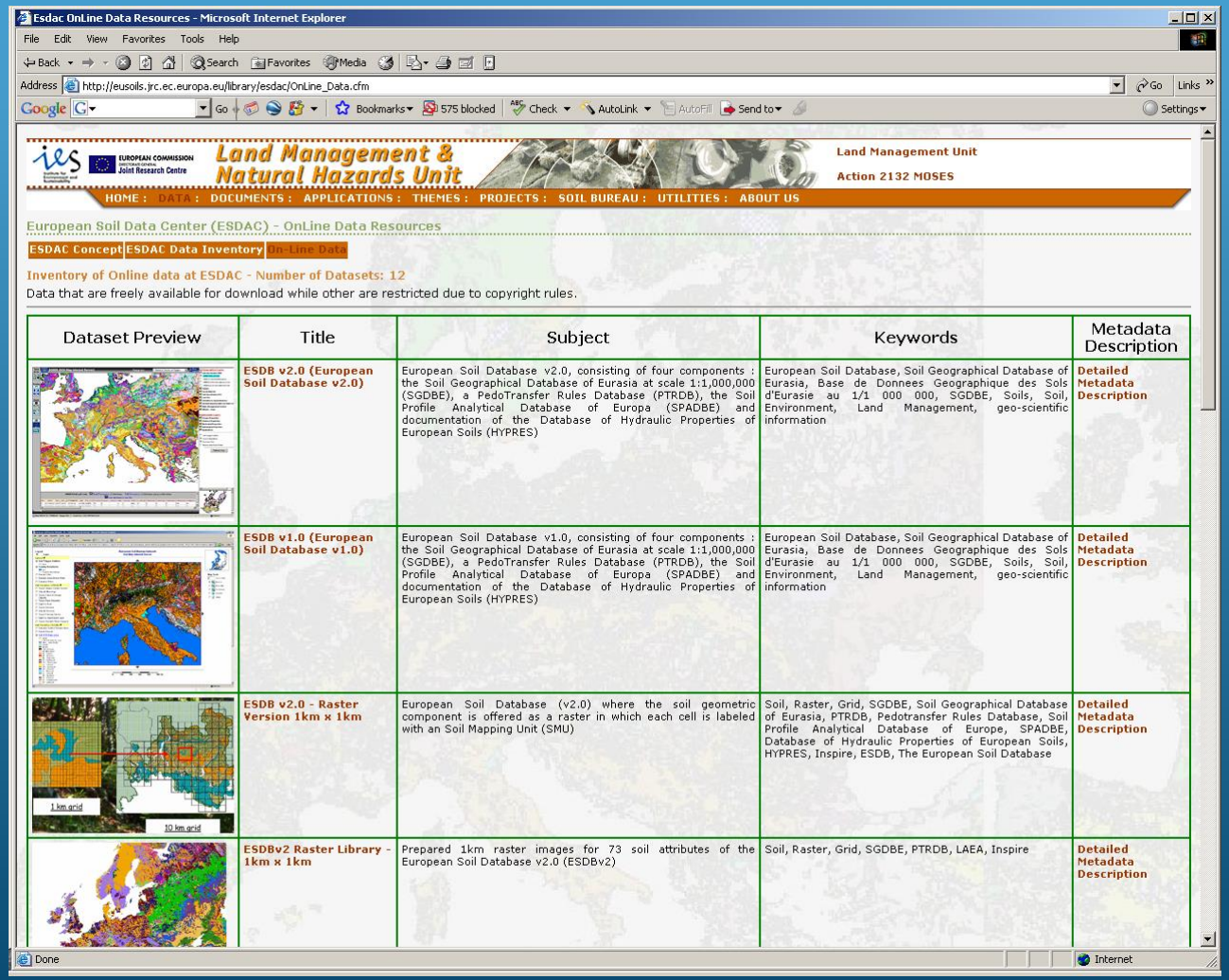


http://eusoils.jrc.ec.europa.eu

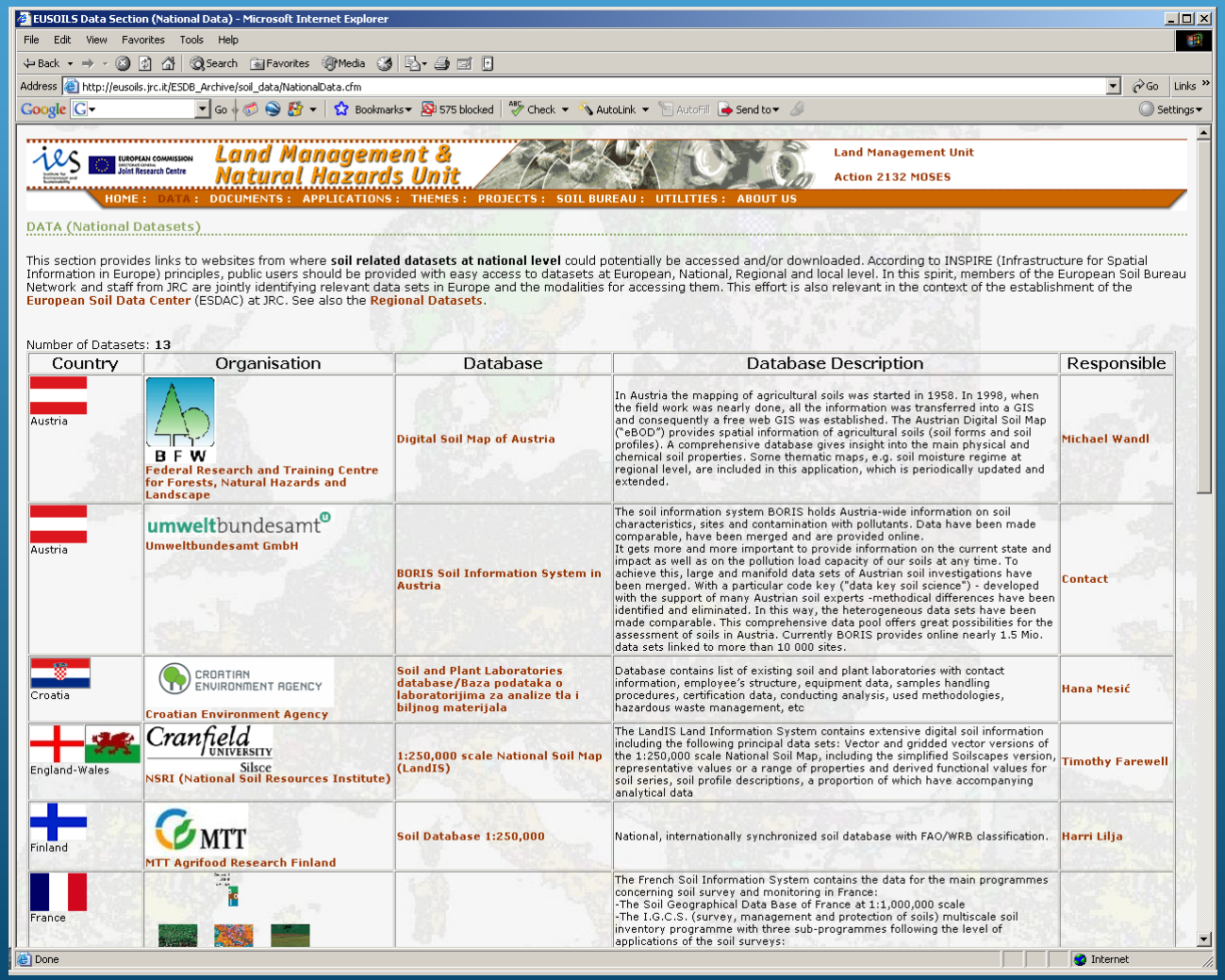
Térbeli talajinformációs rendszerek Európa



Dataset Preview	Title	Subject	Keywords	Metadata Description
	ESDB v2.0 (European Soil Database v2.0)	European Soil Database v2.0, consisting of four components : the Soil Geographical Database of Eurasia at scale 1:1,000,000 (SGDBE), a PedoTransfer Rules Database (PTRDB), the Soil Profile Analytical Database of Europa (SPADBE) and documentation of the Database of Hydraulic Properties of European Soils (HYPRES)	European Soil Database, Soil Geographical Database of Eurasia, Base de Donnees Geographique des Sols d'Eurasie au 1/1 000 000, SGDBE, Soils, Soil, Environment, Land Management, geo-scientific information	Detailed Metadata Description
	ESDB v1.0 (European Soil Database v1.0)	European Soil Database v1.0, consisting of four components : the Soil Geographical Database of Eurasia at scale 1:1,000,000 (SGDBE), a PedoTransfer Rules Database (PTRDB), the Soil Profile Analytical Database of Europa (SPADBE) and documentation of the Database of Hydraulic Properties of European Soils (HYPRES)	European Soil Database, Soil Geographical Database of Eurasia, Base de Donnees Geographique des Sols d'Eurasie au 1/1 000 000, SGDBE, Soils, Soil, Environment, Land Management, geo-scientific information	Detailed Metadata Description
	ESDB v2.0 - Raster Version 1km x 1km	European Soil Database (v2.0) where the soil geometric component is offered as a raster in which each cell is labeled with an Soil Mapping Unit (SMU)	Soil, Raster, Grid, SGDBE, Soil Geographical Database of Eurasia, PTRDB, Pedotransfer Rules Database, Soil Profile Analytical Database of Europe, SPADBE, Database of Hydraulic Properties of European Soils, HYPRES, Inspire, ESDB, The European Soil Database	Detailed Metadata Description
	ESDBv2 Raster Library - 1km x 1km	Prepared 1km raster images for 73 soil attributes of the European Soil Database v2.0 (ESDBv2)	Soil, Raster, Grid, SGDBE, PTRDB, LAEA, Inspire	Detailed Metadata Description

http://eusoils.jrc.ec.europa.eu

Térbeli talajinformációs rendszerek Európa



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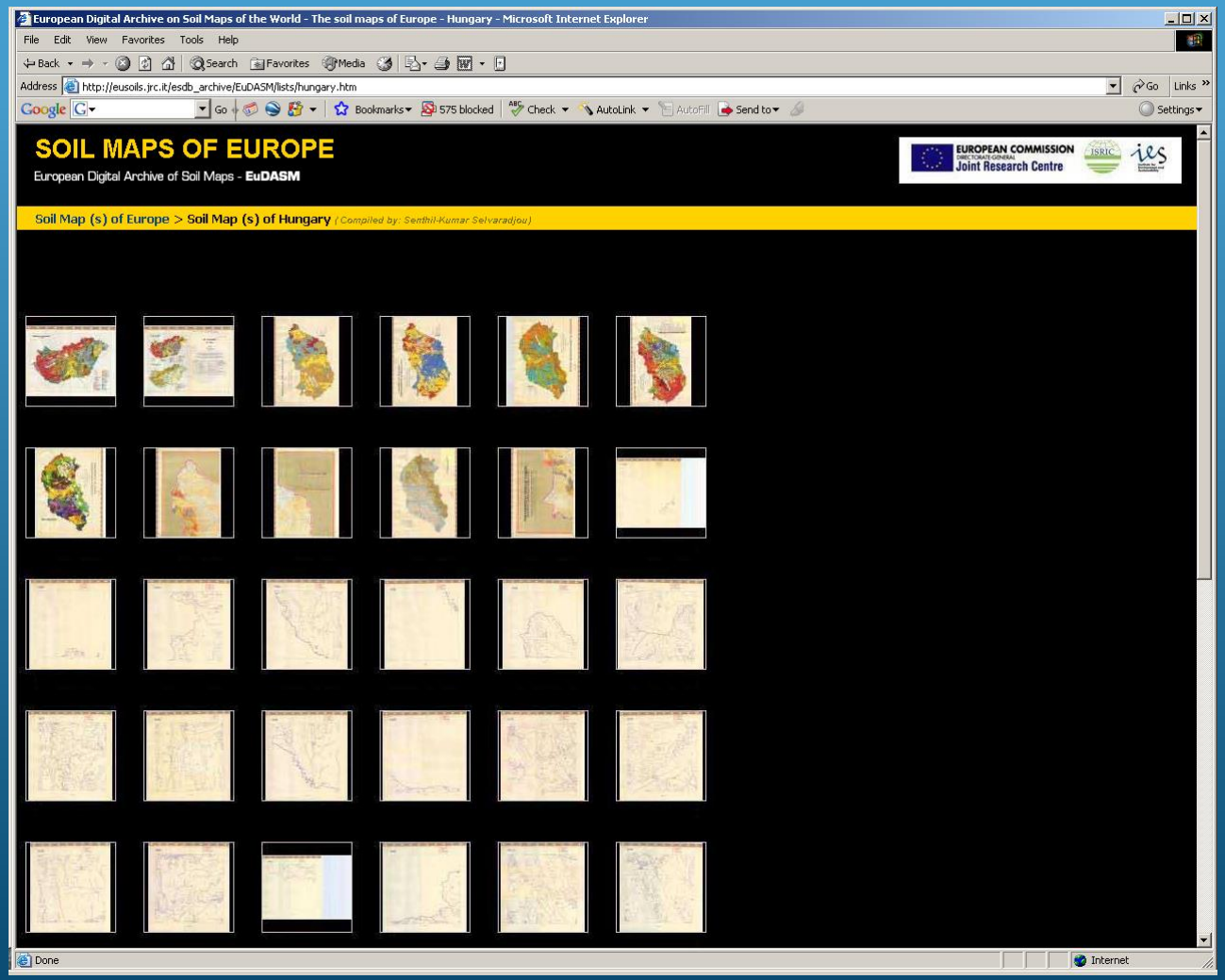

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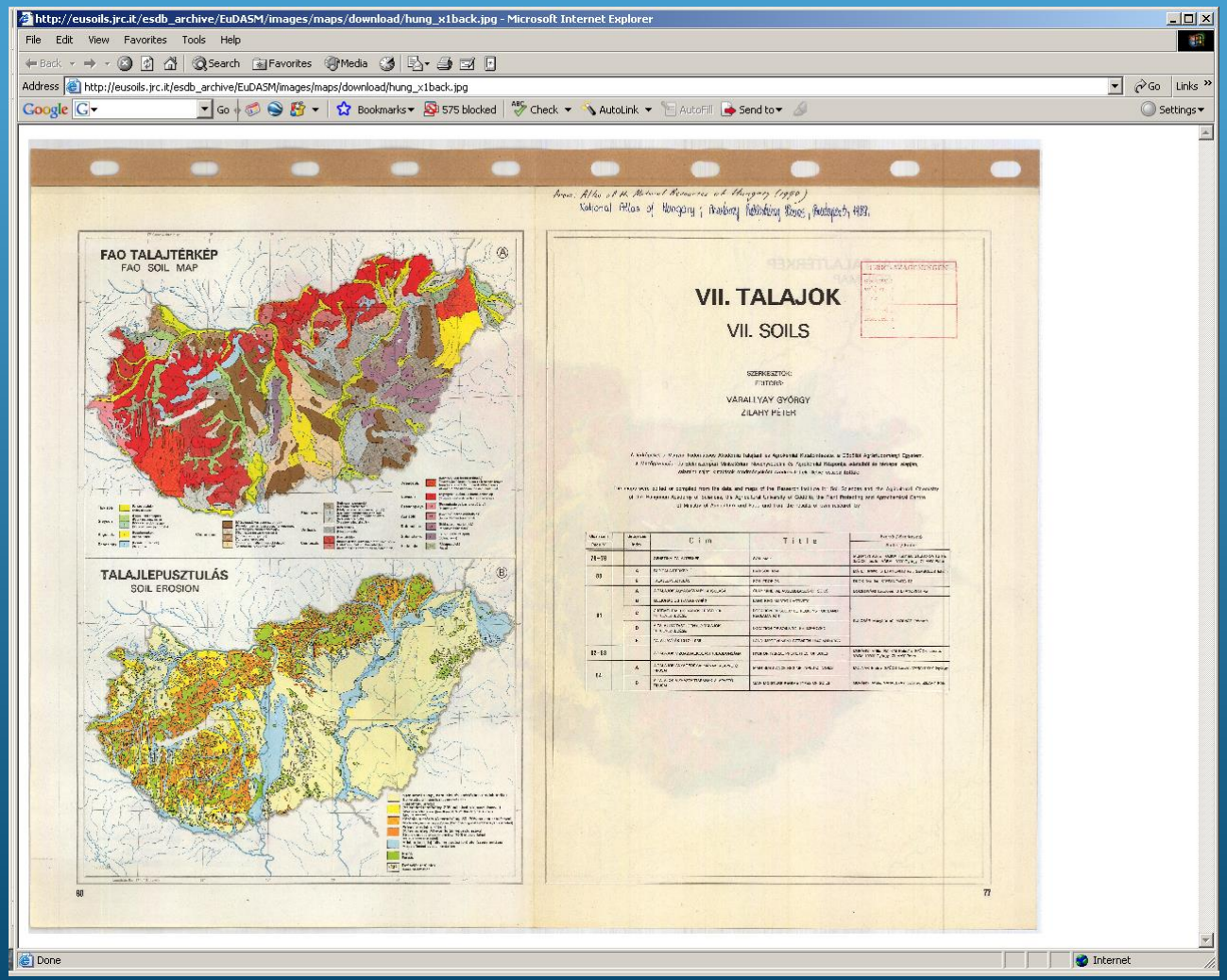


http://eusoils.jrc.ec.europa.eu

Térbeli talajinformációs rendszerek Európa

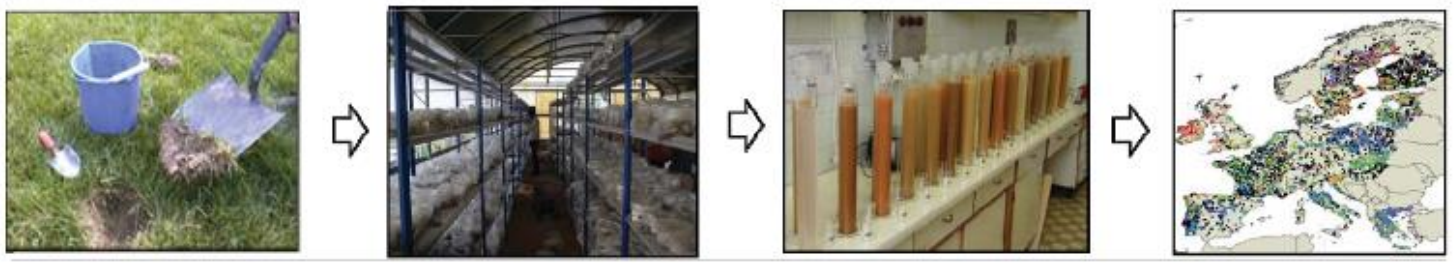
LUCAS Topsoil

LUCAS Topsoil Survey

methodology, data and results

G. Tóth, A. Jones and L. Montanarella (eds.)

2013



Térbeli talajinformációs rendszerek Európa

LUCAS Topsoil

Térbeli talajinformációs rendszerek Európa

LUCAS Topsoil

389285Table 2.1 LUCAS 2009 Topsoil samples by countries and main land uses*

Country	Total number of samples	Cropland annual crops	Cropland permanent crops	Woodland	Shrubland	Grassland
Austria	420	145	3	121	6	134
Belgium	71	35	1	15	-	18
Cyprus	90	25	9	14	14	25
Czech Republic	431	227	6	88	2	95
Denmark	232	166	1	25	2	34
Estonia	220	54	-	103	5	54
Finland	1716	314	1	1261	22	94
France	2952	1525	88	380	53	830
Germany	1947	928	27	410	3	549
Greece	491	150	100	64	60	88
Hungary	497	314	6	60	4	104
Ireland	233	11	-	19	9	174
Italy	1333	549	268	127	39	285
Latvia	349	78	-	126	8	132
Lithuania	356	137	1	69	2	141
Luxembourg	3	1	-	2	-	-
Malta	19	1	1	-	-	9
Netherlands	211	88	-	22	-	88
Poland	1648	829	21	304	11	446
Portugal	476	45	71	193	52	99
Slovakia	268	111	2	83	7	64
Slovenia	112	8	1	68	3	32
Spain	2696	1321	419	215	105	350
Sweden	2256	185	-	1802	47	146
UK	942	354	-	72	21	458
Total	19967	7601	1026	5643	475	4449

*The numbers given in this table correspond to samples which can be uniquely associated to a geographical reference.

Térbeli talajinformációs rendszerek Európa

LUCAS Topsoil

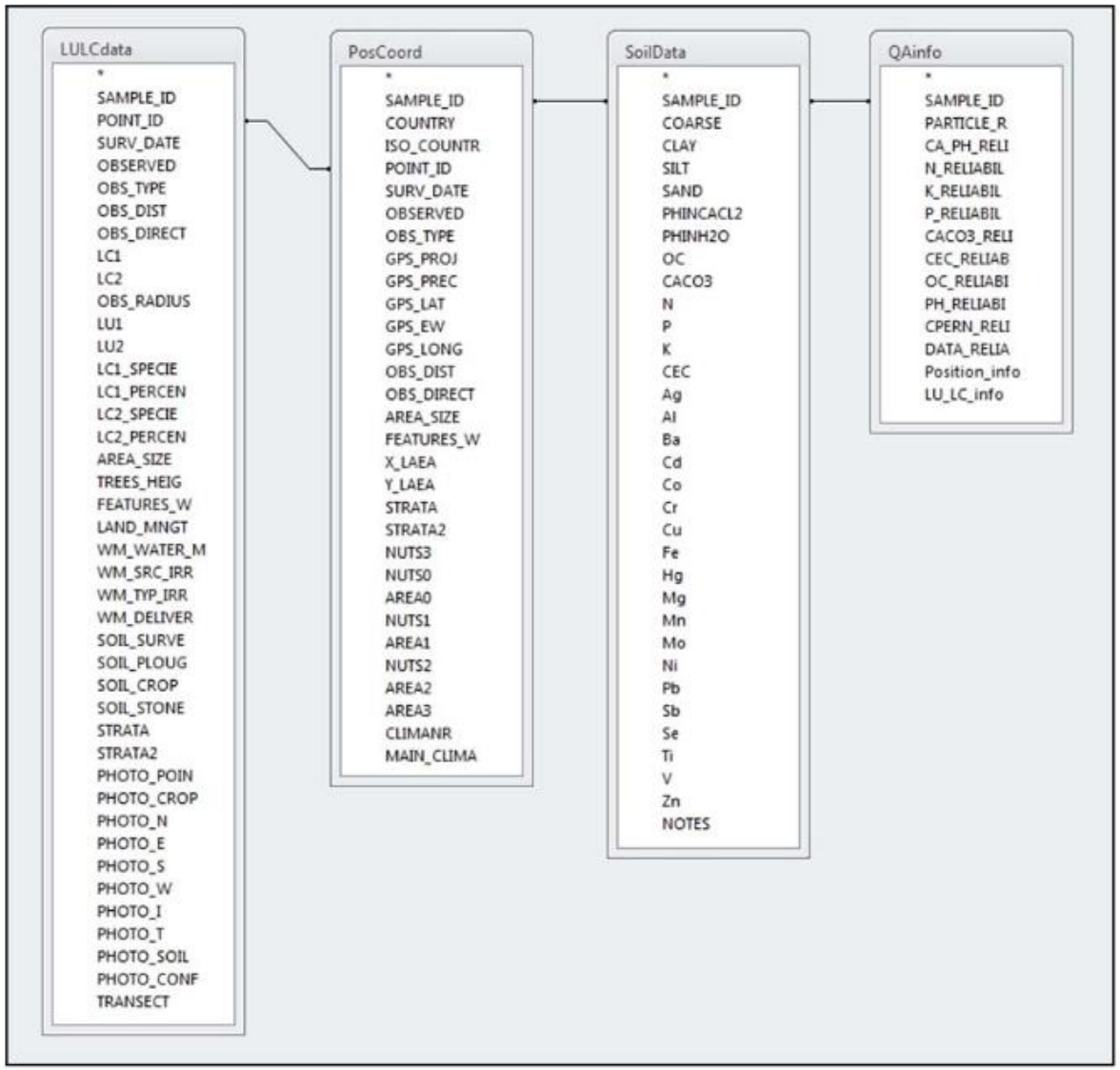


Figure 3.1 Structure and content of the LUCAS Topsoil Database V1.0

Térbeli talajinformációs rendszerek Európa

LUCAS Topsoil

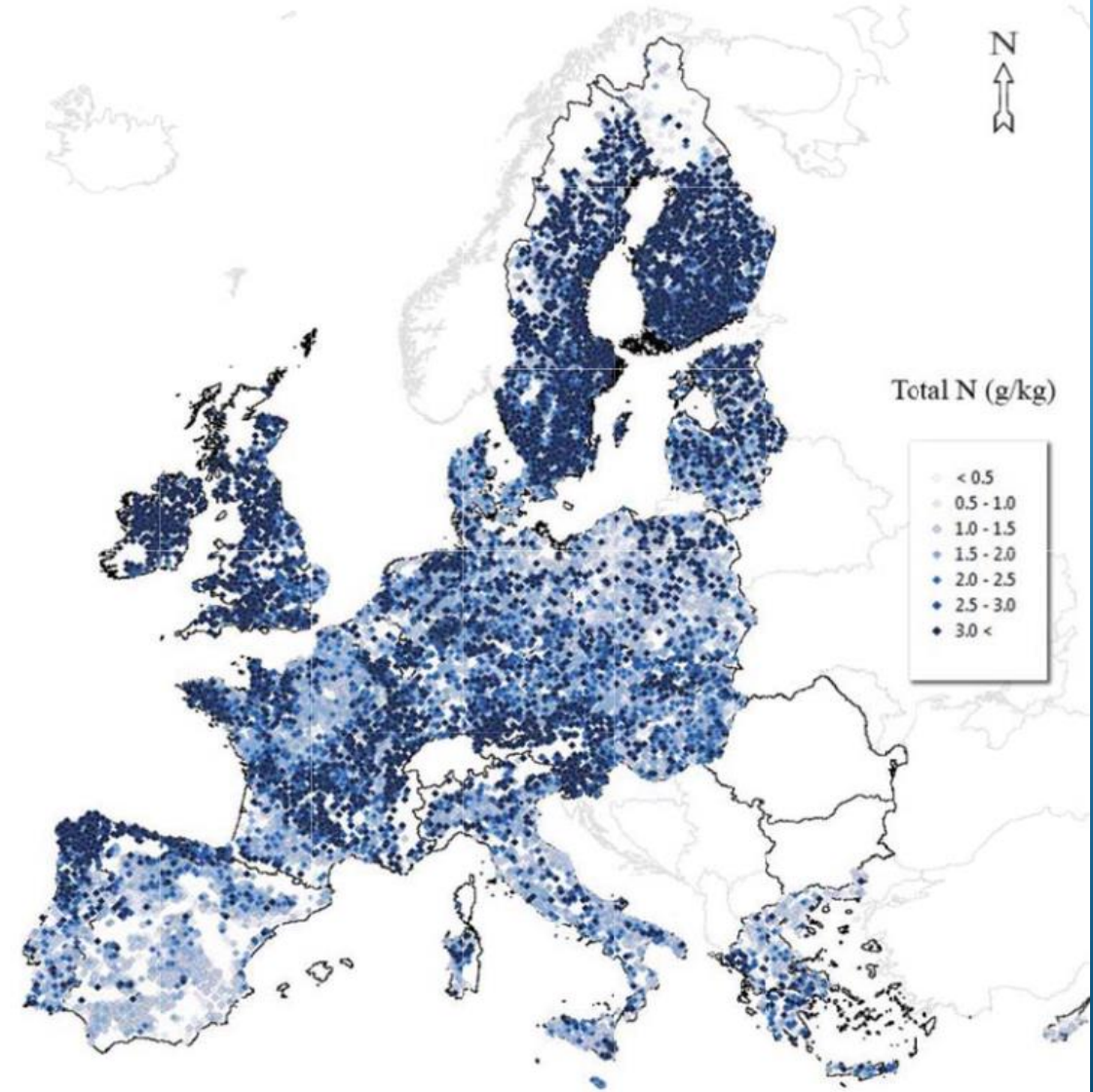


Figure 5.1 Spatial representation of topsoil total nitrogen content class of LUCAS samples.

Térbeli talajinformációs rendszerek

Európa

LUCAS Topsoil

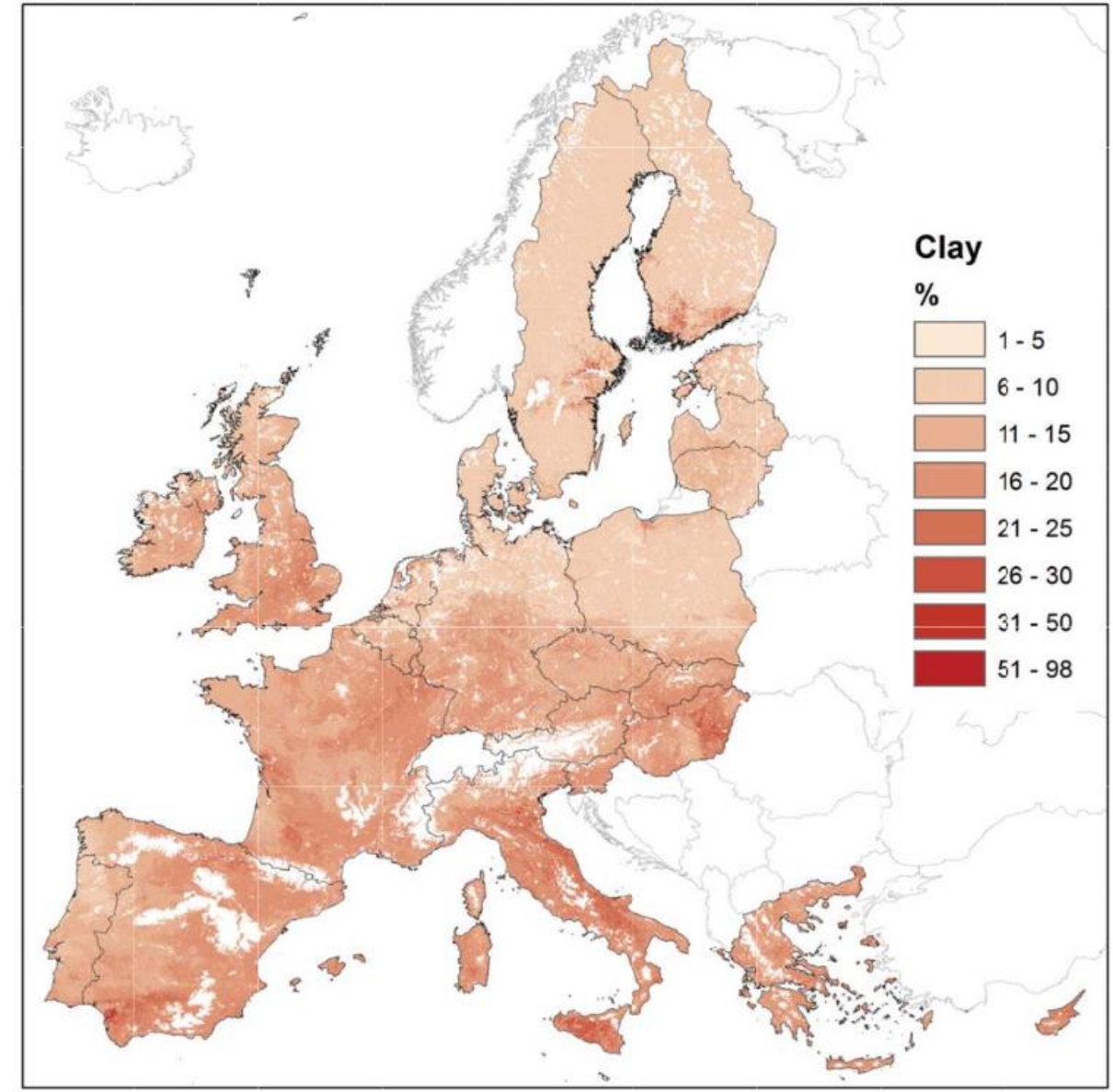


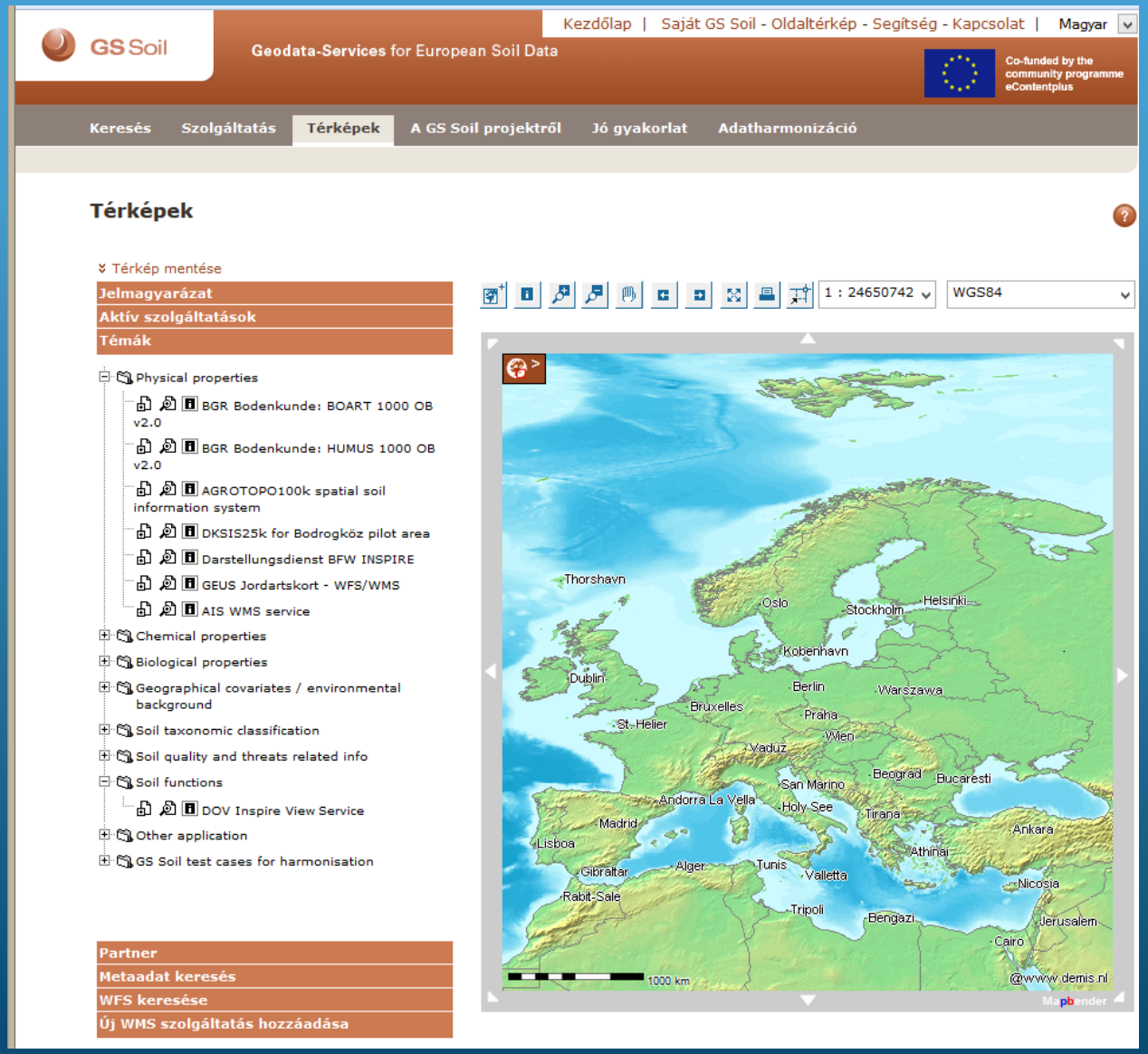
Figure 7.6 Predicted topsoil clay content (percentage) for the EU based on the LUCAS Topsoil Database.

Térbeli talajinformációs rendszerek Európa

INSPIRE

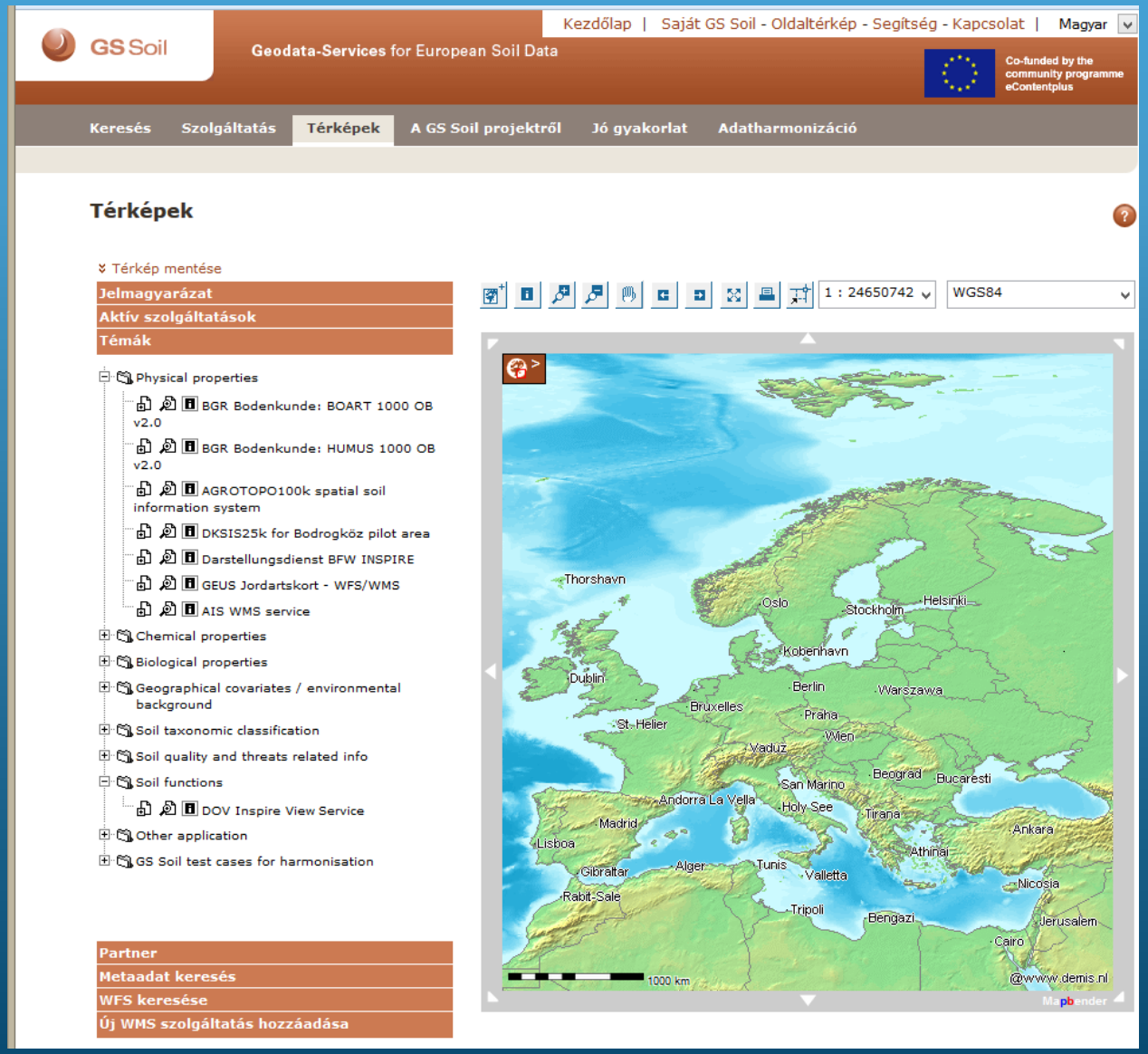
http://www.gssoil.eu/

Térbeli talajinformációs rendszerek Európa



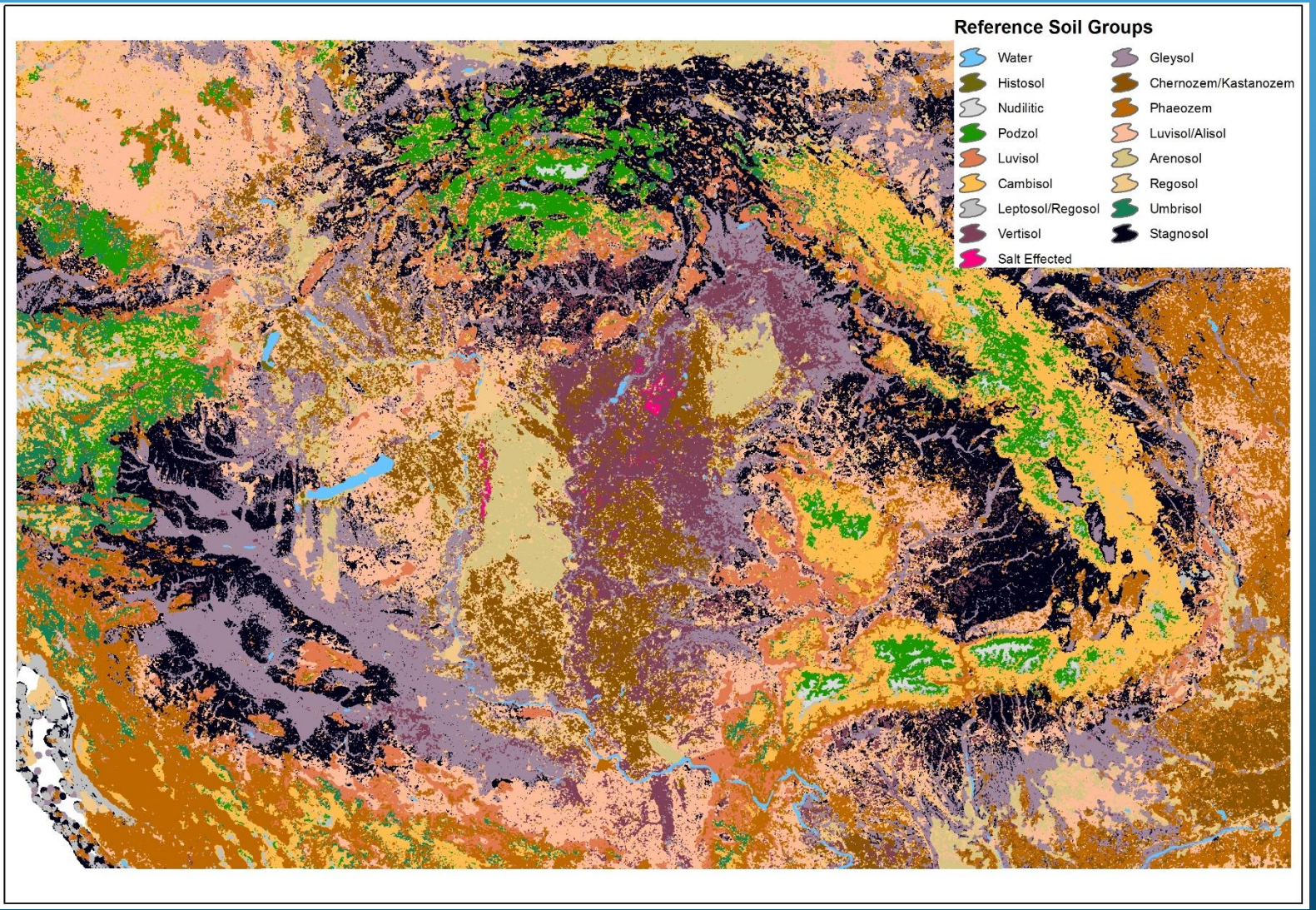
http://www.gssoil.eu/

Térbeli talajinformációs rendszerek Európa



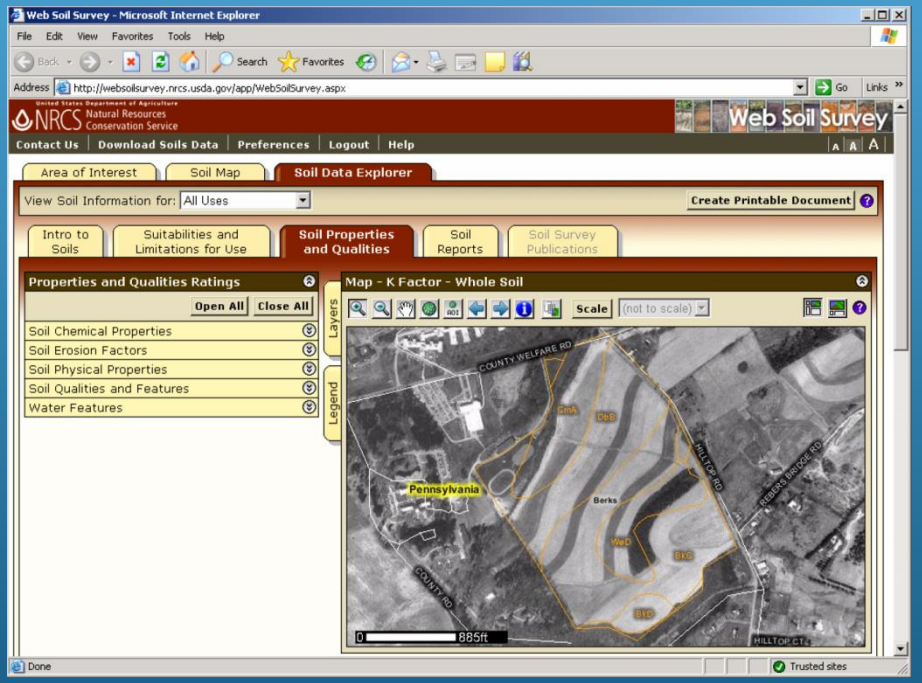
http://www.gssoil.eu/

Térbeli talajinformációs rendszerek
Európa



Térbeli talajinformációs rendszerek USA

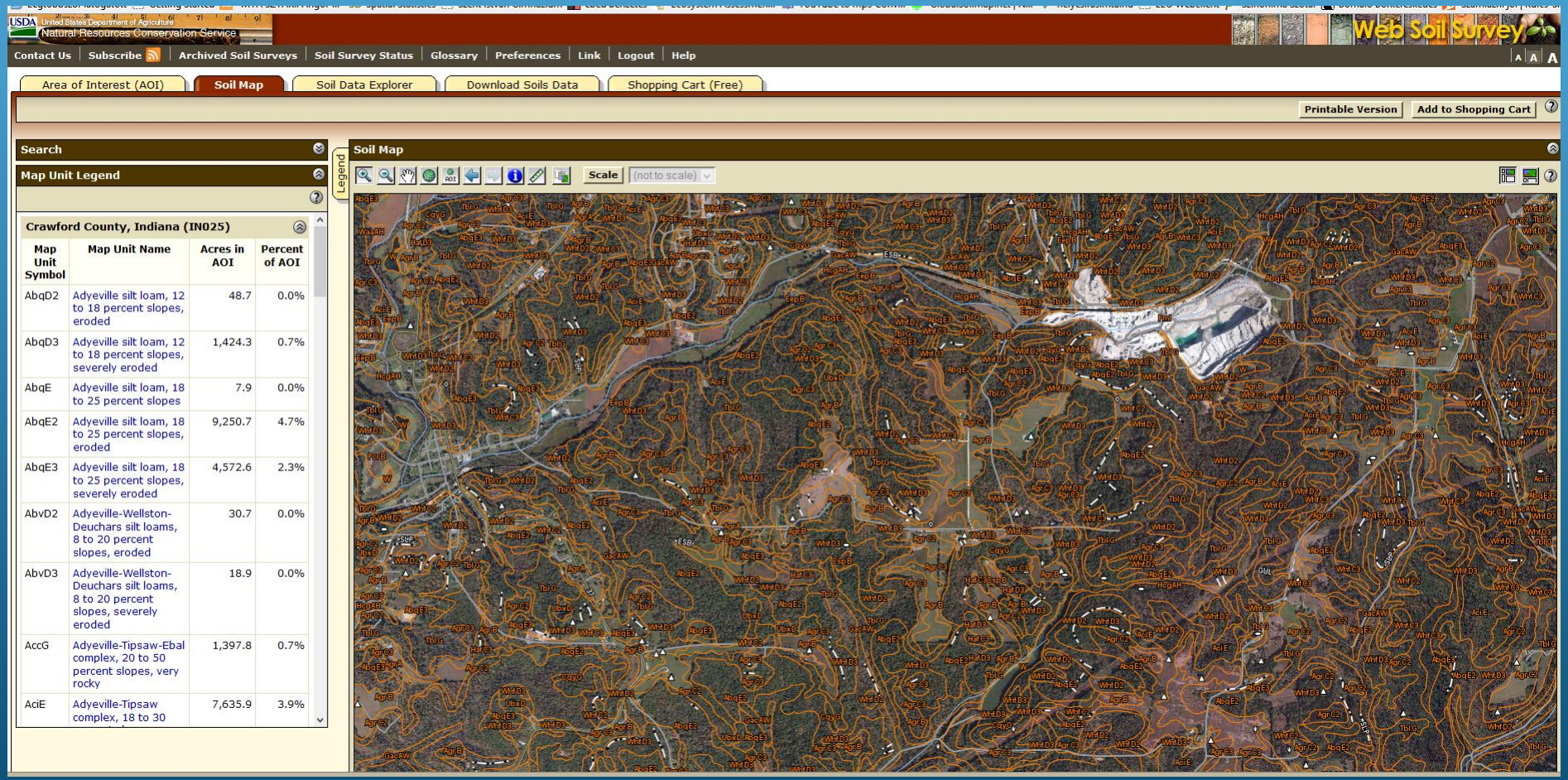
- Web Soil Survey is an internet based system of accessing soil survey data
- Information is always up up-to to-date
- You can gather soils information for just the area of interest
- You can download the information into your own GIS system



http:// soils.usda.gov gov/survey

Térbeli talajinformációs rendszerek

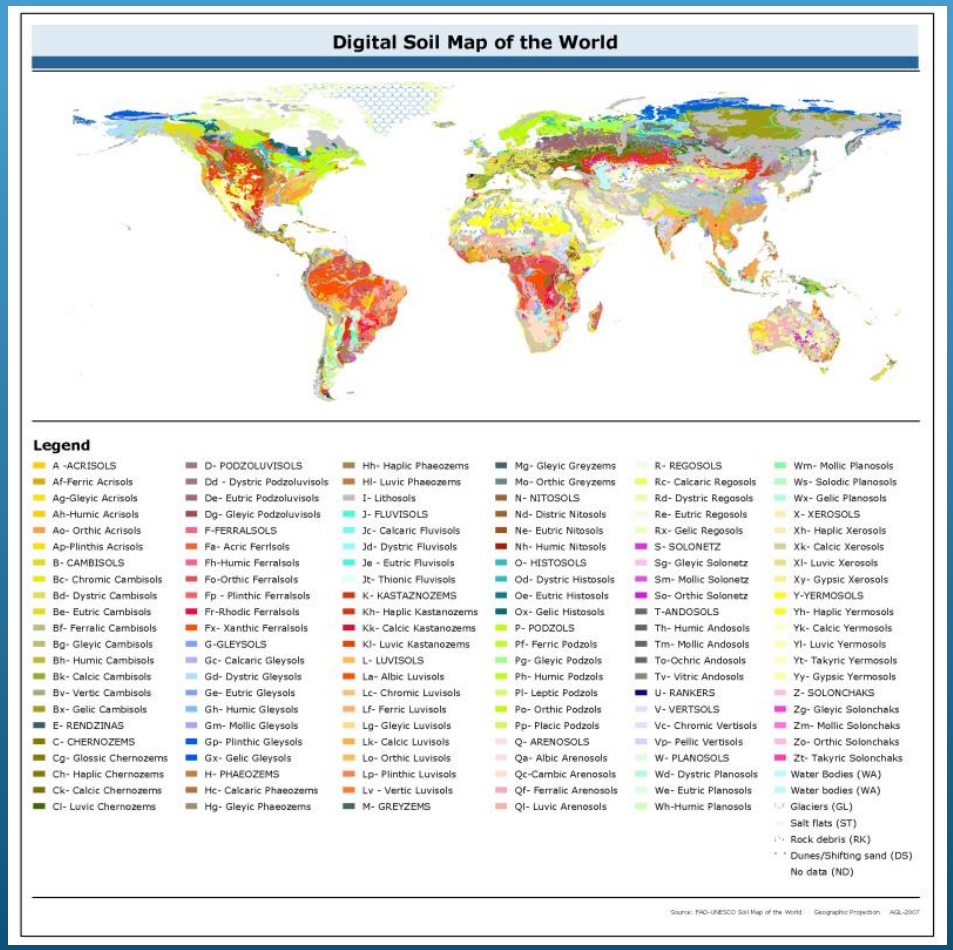
USA



http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

Térbeli talajinformációs rendszerek
Globális stratégia

Title	Digital Soil Map of the World
Date	2007-02-28
Date type	Revision: Date identifies when the resource was examined or re-examined and improved or amended
Edition	version 3.6
Presentation form	Digital map: Map represented in raster or vector form
Abstract	The vector data set is based on the FAO-UNESCO Soil Map of the World. The Digitized Soil Map of the World, at 1:5.000.000 scale, is in the Geographic projection (Latitude - Longitude) intersected with a template containing water related features (coastlines, lakes, glaciers and double-lined rivers). The Digital Soil Map of the World (except for the continent of Africa) was intersected with the Country Boundaries map from the World Data Bank II (with country boundaries updated to January 1994 at 1:3 000 000 scale), obtained from the US Government. For Africa, the country boundaries are derived from the FAO Country Boundaries on the original FAO/UNESCO Soil Map of the World. Country boundaries in both cases were checked and adjusted in certain places on the basis of FAO and UN conventions.
Purpose	Harmonized soil information.
Status	Completed: Production of the data has been completed



http://www.fao.org/nr/land/soils/digital-soil-map-of-the-world/en/

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http://www.globalsoilmap.net/

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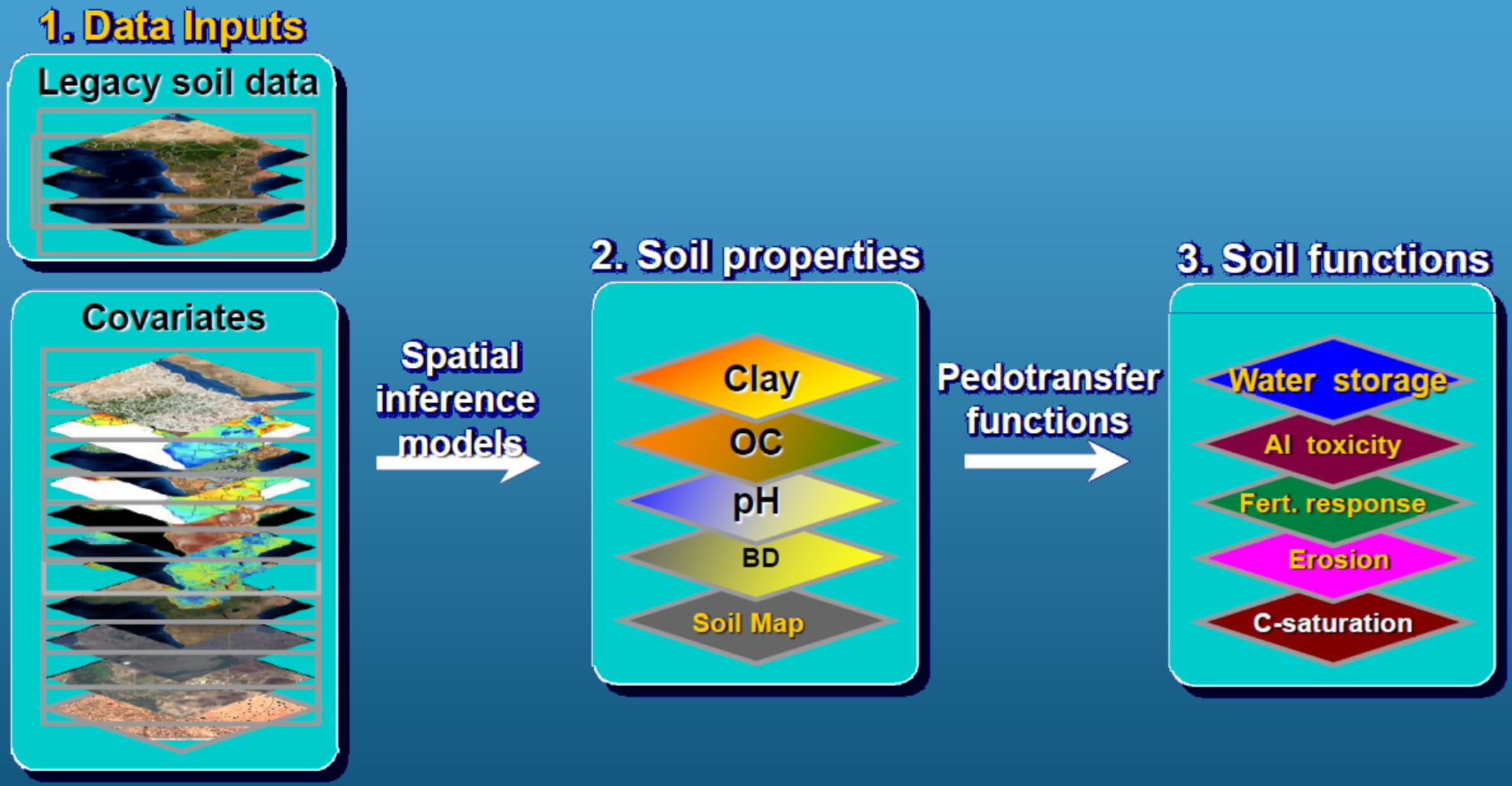

http://www.globalsoilmap.net/

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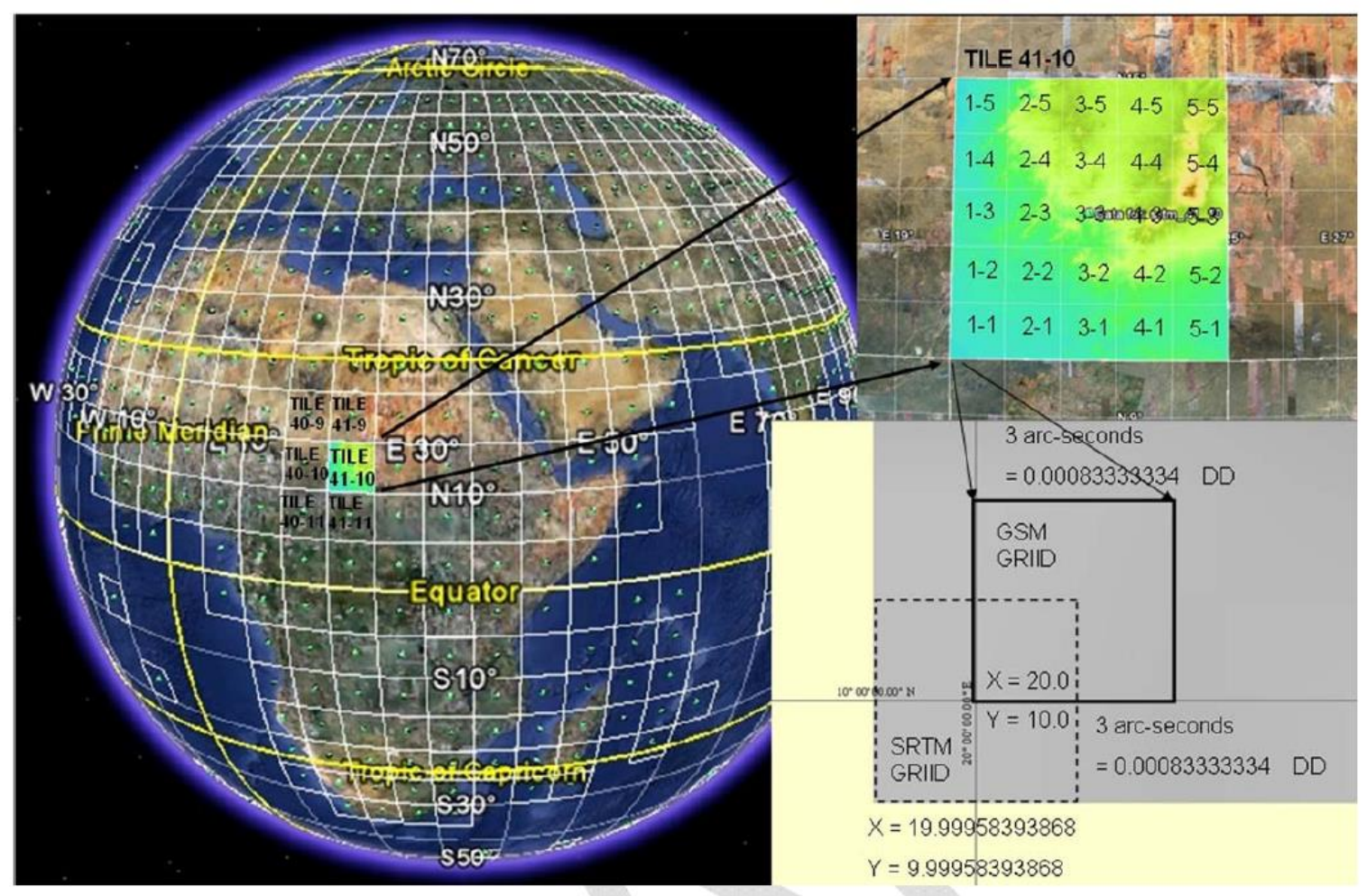

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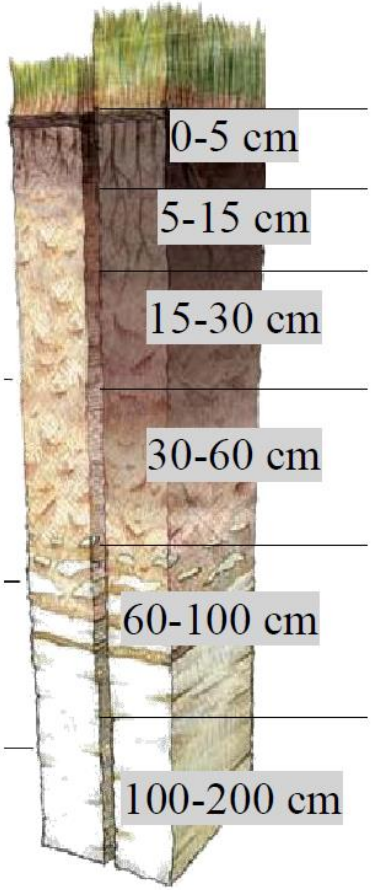
Globális stratégia



2. Soil Properties

2.1 Depth of Soil

In order to estimate soil properties at specific depth intervals, there is first a need to provide an estimate of the total depth of the soil within each grid cell. The project will estimate the following important depths for each grid cell.

Table 4. Specifications for properties related to reporting depth of soil

No.	Property	Units	Precision[7]	Reference	Description of Method
1	Depth to Rock	cm	N3.0	Soil Survey Division Staff, 1993 Chapter 1 page 5	Depth in cm to a lithic or paralithic contact as defined in USDA Soil Survey Manual. If depth is < 200 cm record actual depth in cm. If depth is > 200 cm record actual depth if known. If not known exactly, record depth as 999 cm
2	Plant Exploitable (Effective) Depth	cm	N3.0	Soil Survey Division Staff, 1993 Chapter 3 page 60	Effective depth in cm as defined in the USDA Soil Survey Manual. The lower limit of soil is normally the lower limit of biologic activity, which generally coincides with the common rooting depth of native perennial plants. This depth is where root penetration is strongly inhibited because of physical (including soil moisture or temperature) and/or chemical characteristics.

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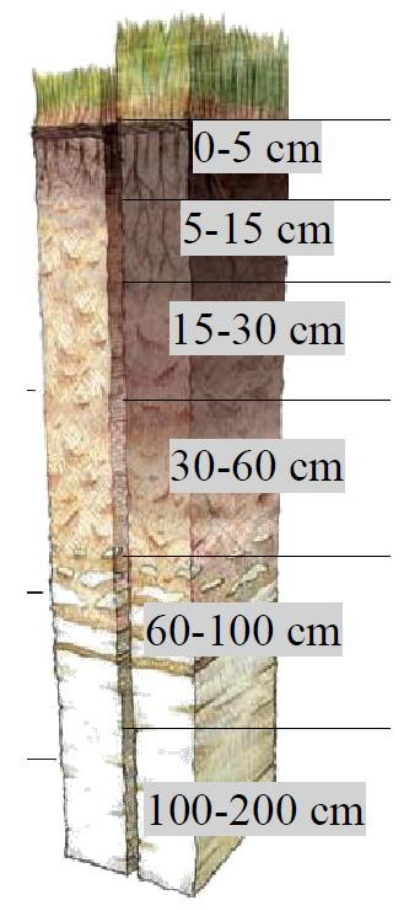

Table 5. Specifications for primary soil properties

No.	Property	Unit	Precision[4]	Reference	Description of Method
3	Organic Carbon	g/kg	N4.0	ISO 10694	mass fraction of carbon by weight in the < 2 mm soil material as determined by dry combustion at 900° C
4	pHx10		N3.0	ISO 10390	1:5 soil/water (divide by 10 to get correct pH)
5	Clay	g/kg	N3.0	Burt, 2004 Page 347	< 2 um mass fraction of the < 2 mm soil material determined using the pipette method
6	Silt	g/kg	N3.0	Burt, 2004 Page 347	2-50 um mass fraction of the < 2 mm soil material determined using the pipette method
7	Sand	g/kg	N3.0	Burt, 2004 Page 347	50 um - 2 mm mass fraction of the < 2 mm soil material determined using the pipette method
8	Coarse Fragments	$m^3\ m^{-3}$	N3.0	Burt, 2004 page 36	mass fraction of the soil material > 2 mm
9	ECEC	$mmol_c/kg$	N4.0	ISO 11260	Cations extracted using Barium Chloride ($BaCl_2$) plus exchangeable H + Al

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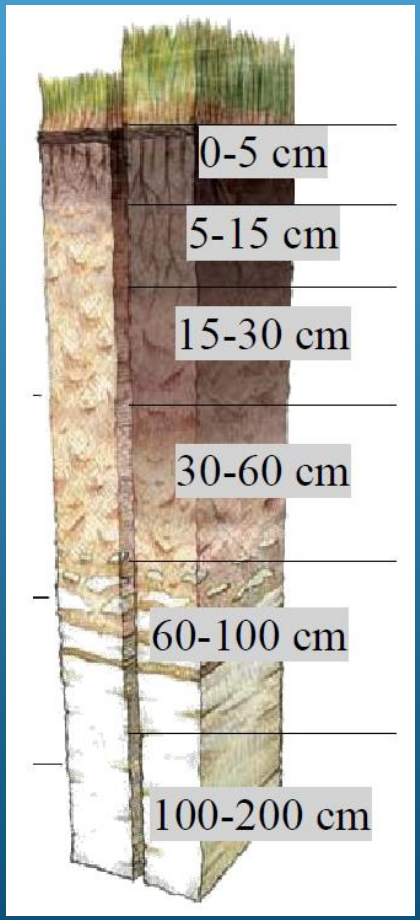

Table 6. Specifications for derived soil properties

No.	Property	Units	Precision[4]	Reference	Description of Method
10	Bulk Density	Mg/m^3	N3.1	ISO 11272	Bulk Density of the whole soil (including coarse fragments) in mass per unit volume by a method equivalent to the core method using a pedotransfer function
11	Bulk Density	Mg/m^3	N3.1	ISO 11272	Bulk Density of the fine earth fraction of the soil (< 2 mm) in mass per unit volume by a method equivalent to the core method using a pedotransfer function
12	Available Water Capacity	mm (total over the depth range)	N4.0	Burt, 2004 Page 137	Available water capacity computed for each of the specified depth increments using a specified pedotransfer function that references the values estimated above for organic carbon, sand, silt, clay and bulk density.

NOTE: AWC = *f* (total carbon, sand, silt, clay, % coarse fragments, bulk density) for the 6 depths. Profile-AWC is AWC summed over the effective depth.

Table 7. Specifications for secondary soil properties

No.	Property	Units	Precision[4]	Reference	Description of Method
13	Electrical Conductivity	mS/m	N4.1		Electrical conductivity in 1:1 saturated paste

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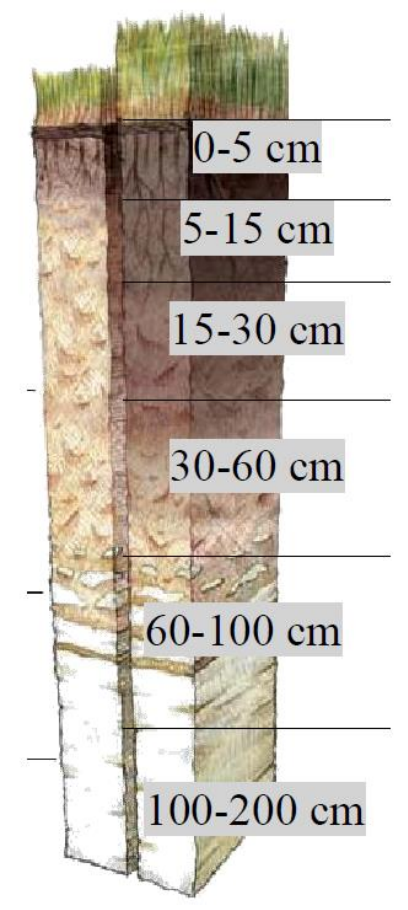

Table 8. Illustration of the minimum data required for each grid cell

Long (X)	Lat (Y)	Tile_ID	1 Deg Cell ID	AttributeAnalyzed	yearOfAnalysis	Top_Depth	Bottom_Depth
				For Example			
				pH			
				organic carbon			
				sand			
				silt			
				clay			
				gravel			
				BD			
				AWC			
				EC			
				ECEC			
				Profile depth			
				Effective Depth			
				Spline Smoothing Value			

AttributeValue	LowerUncertainty (5%)	Upper Uncertainty (95%)	Prediction Model	Pedo transfer Function

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Dánia

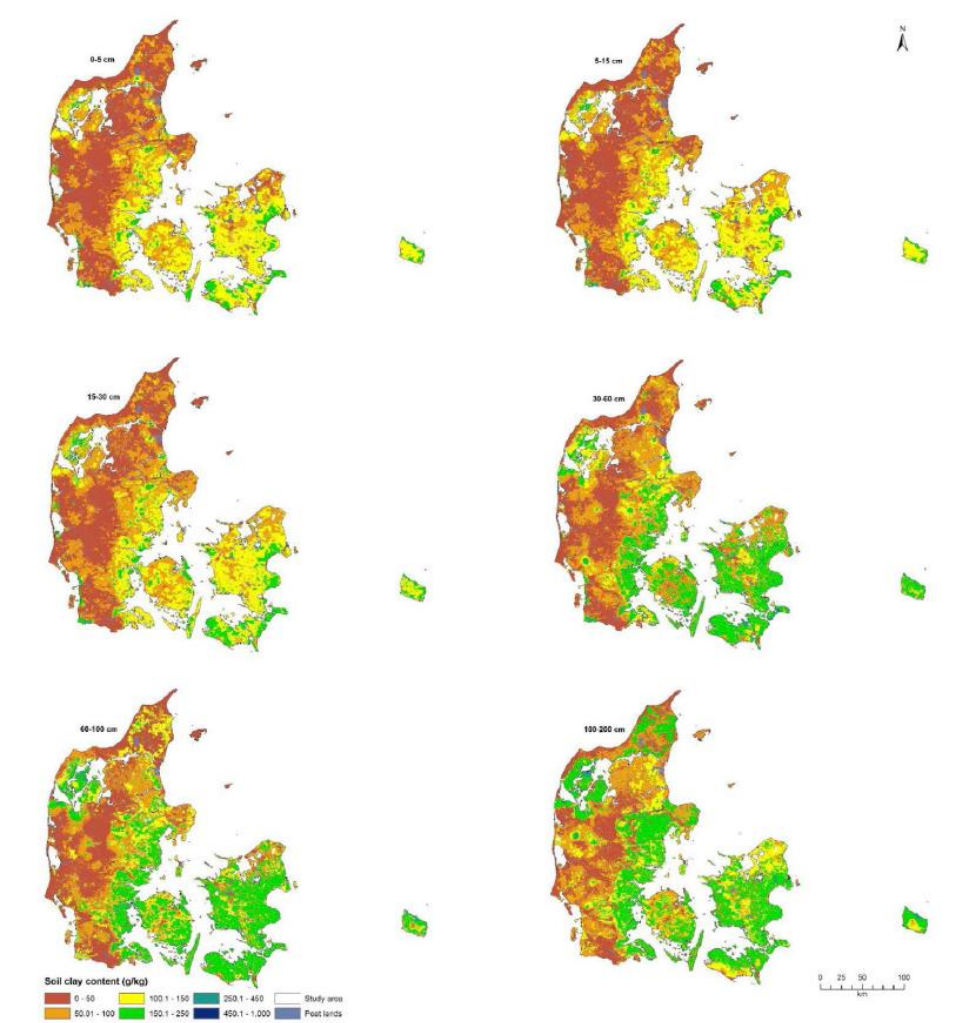

Fig. 3. Predicted clay content of Danish soils at six depths.

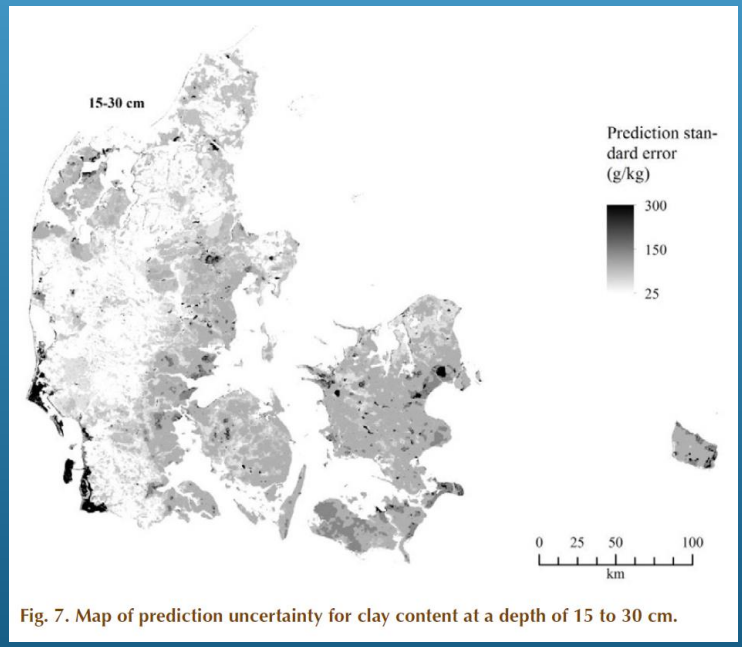

Fig. 7. Map of prediction uncertainty for clay content at a depth of 15 to 30 cm.

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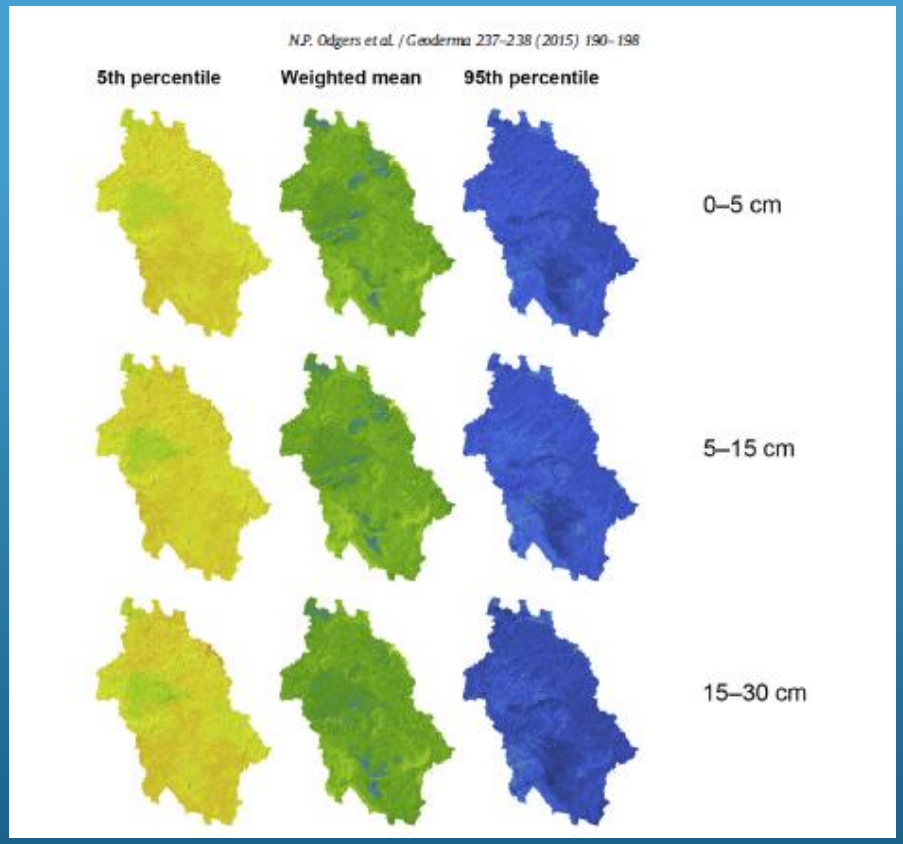

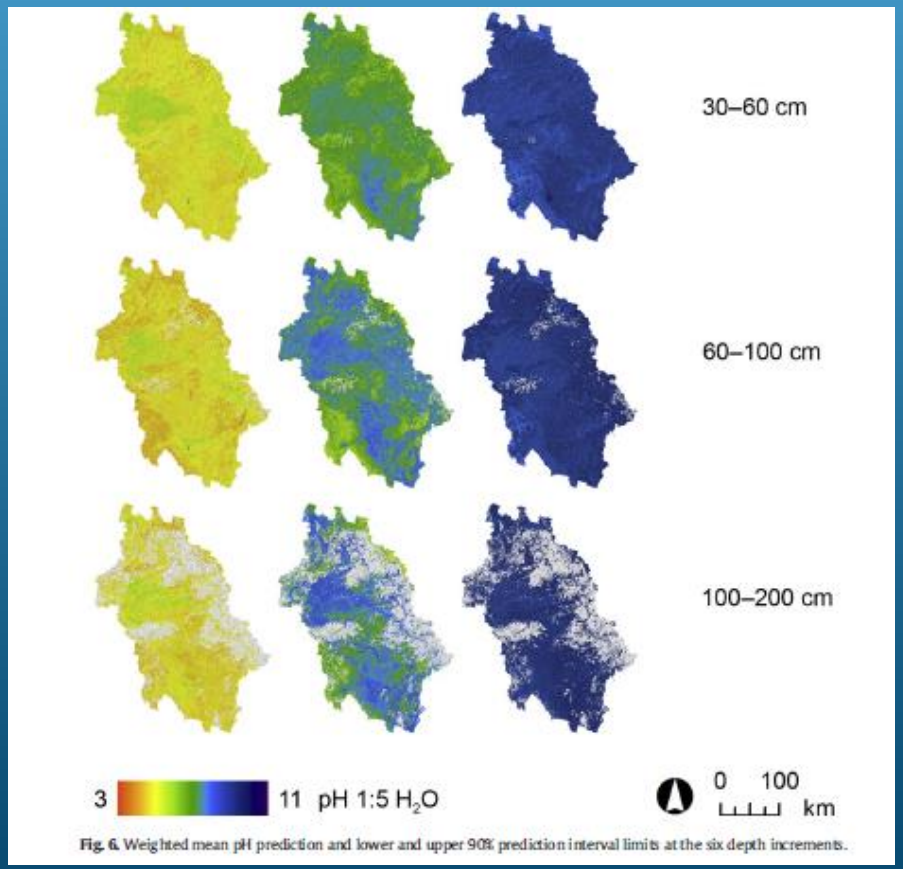

Fig. 6. Weighted mean pH prediction and lower and upper 90% prediction interval limits at the six depth increments.

Ausztrália, Queensland

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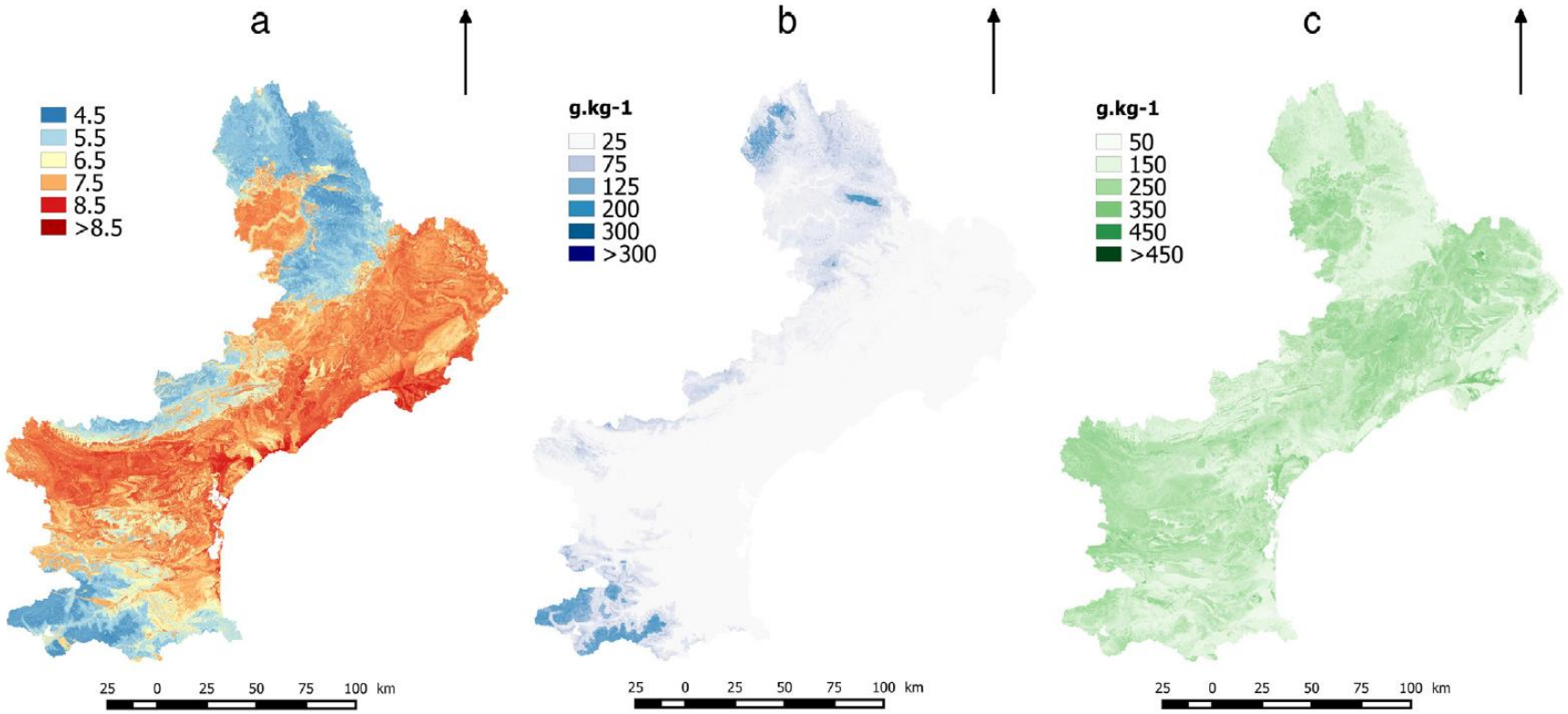

Fig. 5. Digital soil maps of three soil properties at 5–15 cm: a) pH (random forest); b) organic carbon (random forest) and c) clay content (random forest + kriging).

Franciaország, Languedoc-Roussillon

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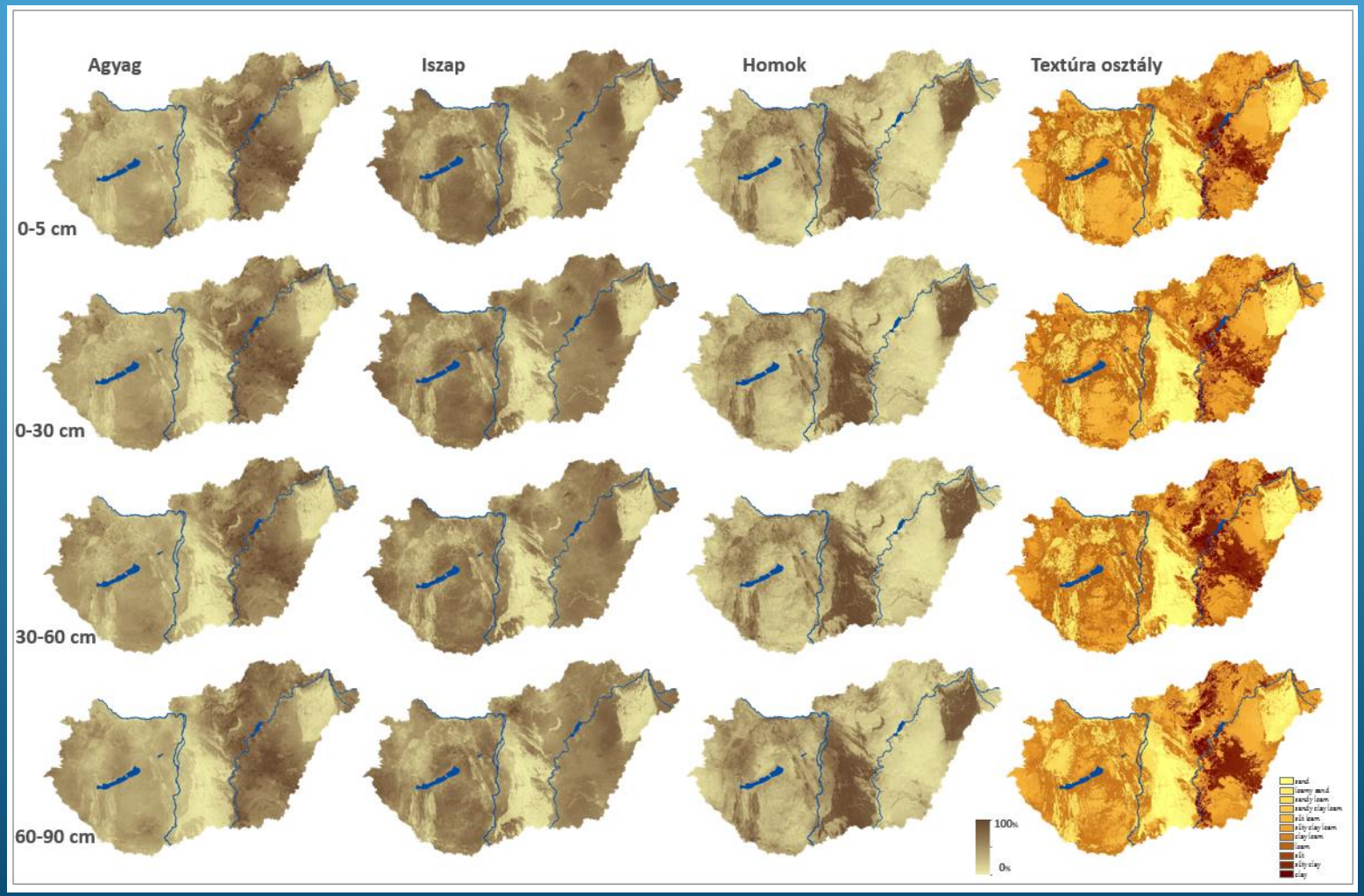

Magyarország

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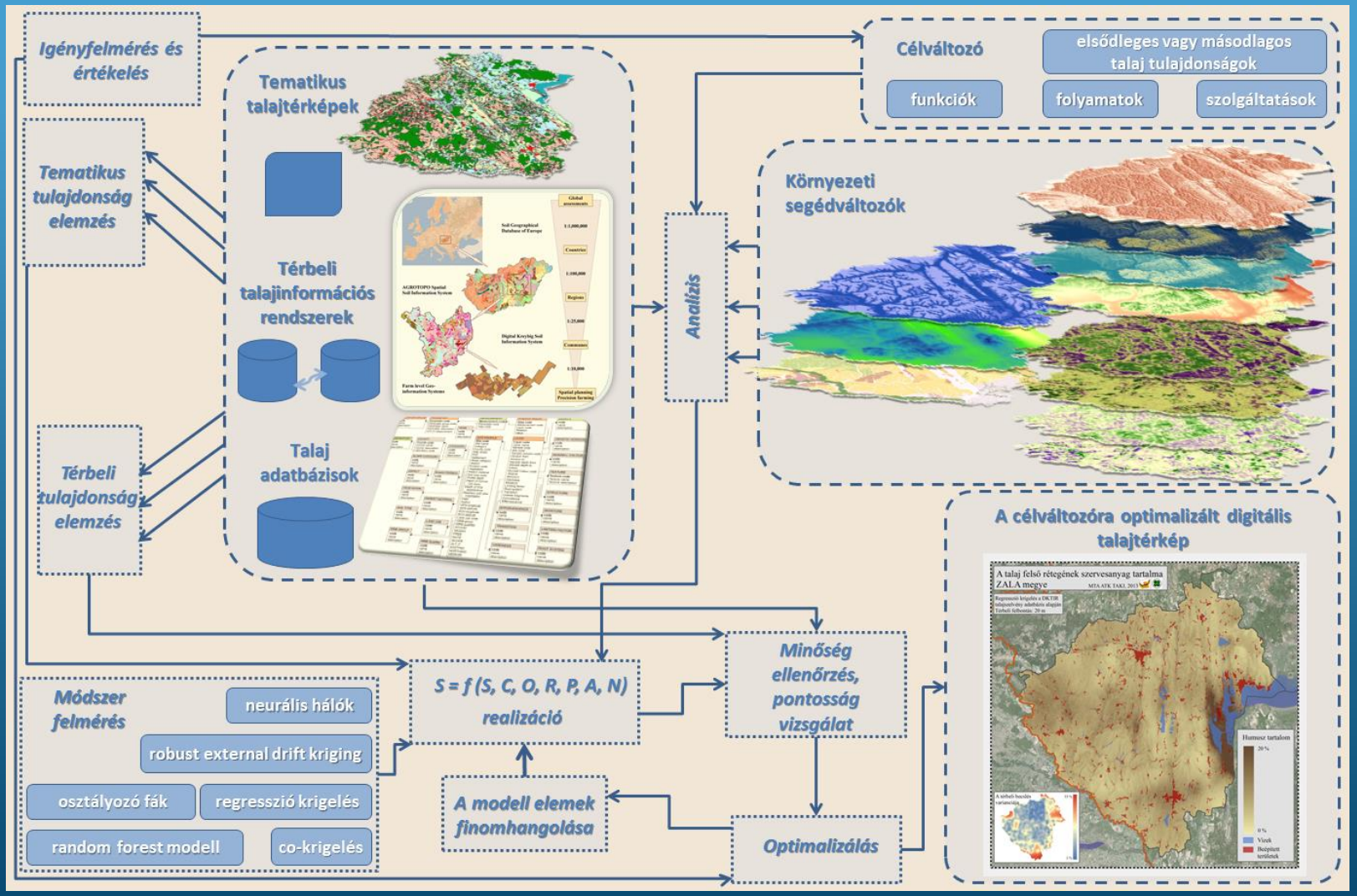
Globális stratégia



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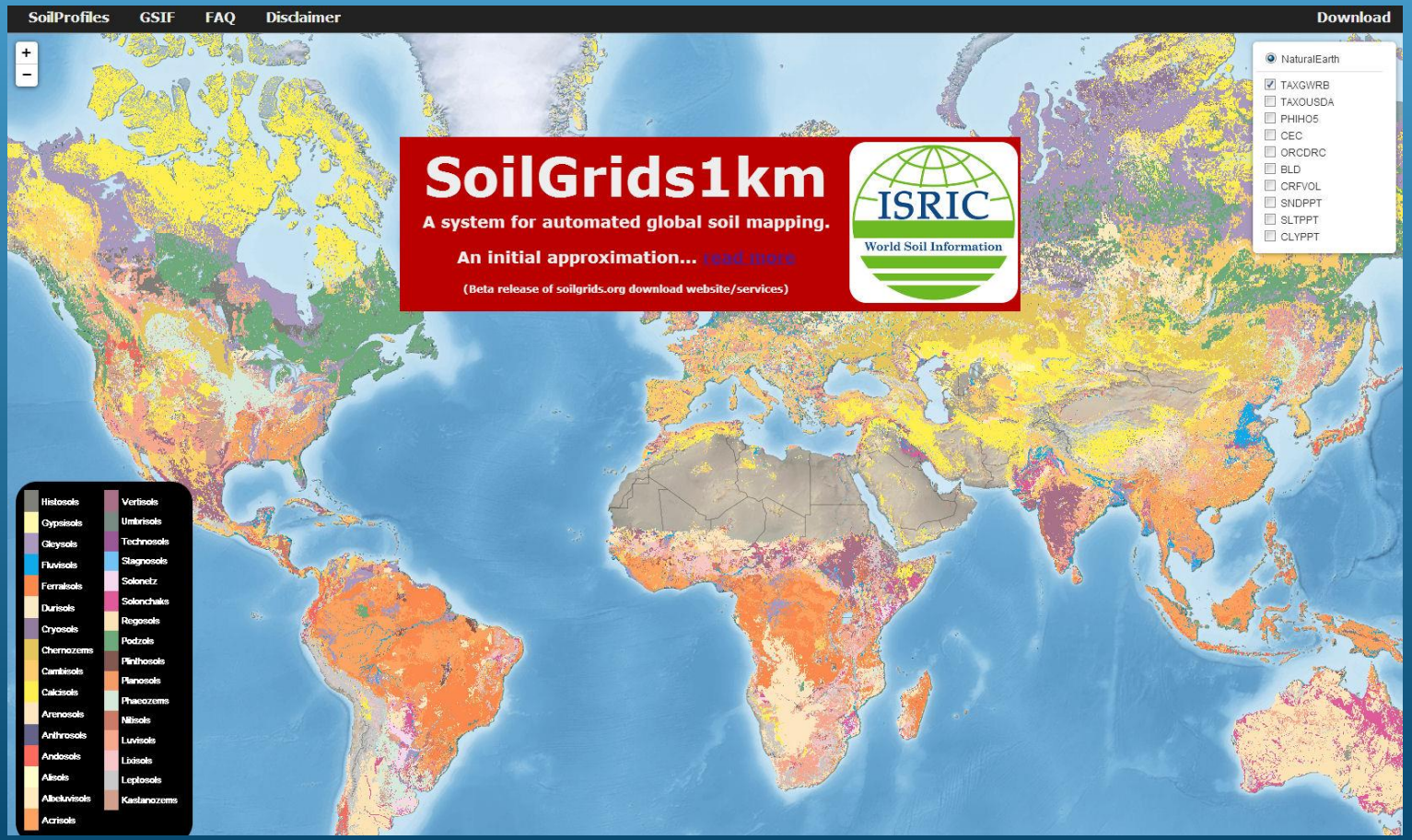
Globális stratégia

SoilGrids1km is a global soil data product generated at ISRIC — World Soil Information as a result of international collaboration



http://www.isric.org/content/soilgrids

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Globális stratégia

http://www.isric.org/content/soilgrids

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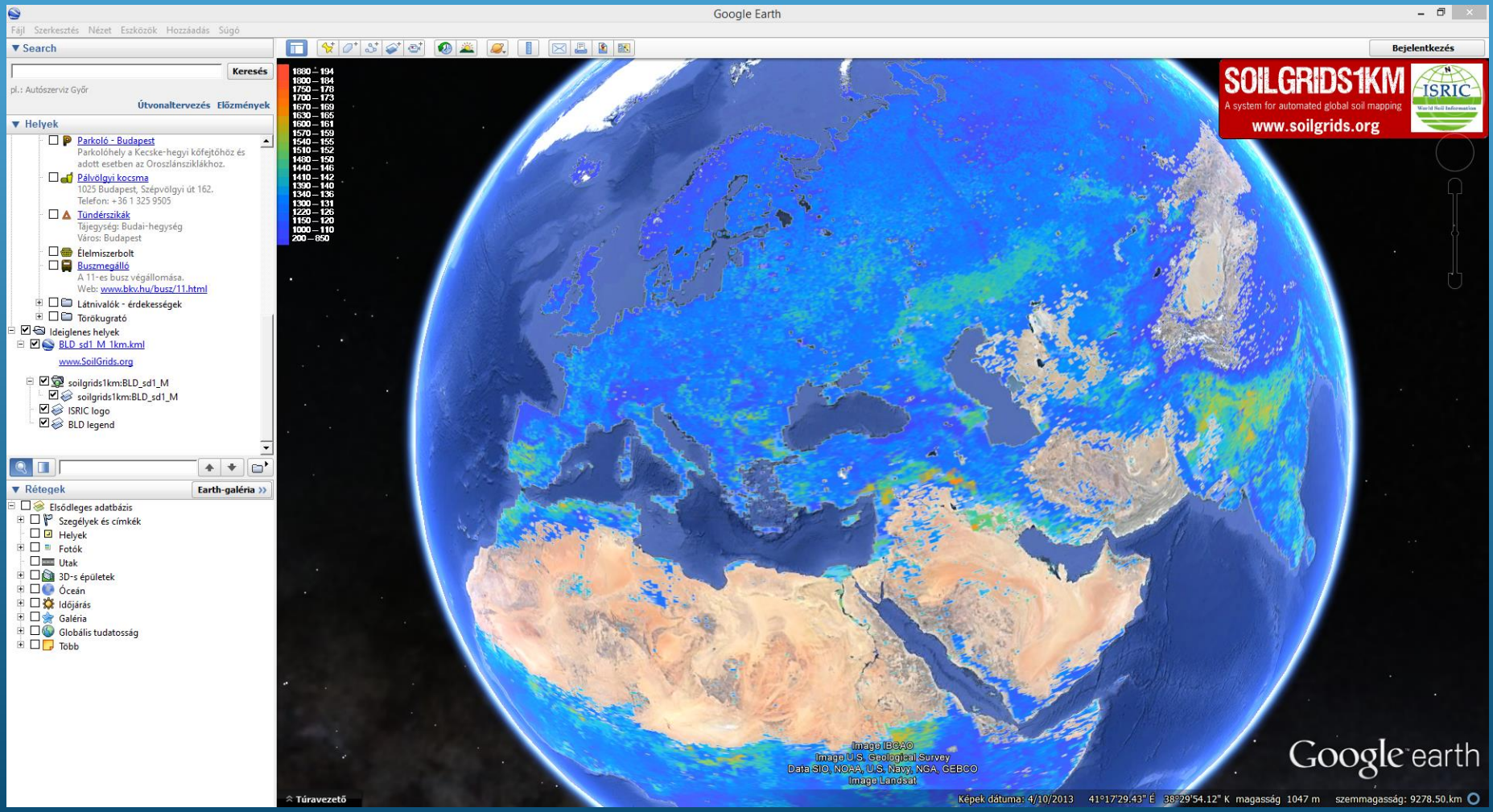
Globális stratégia



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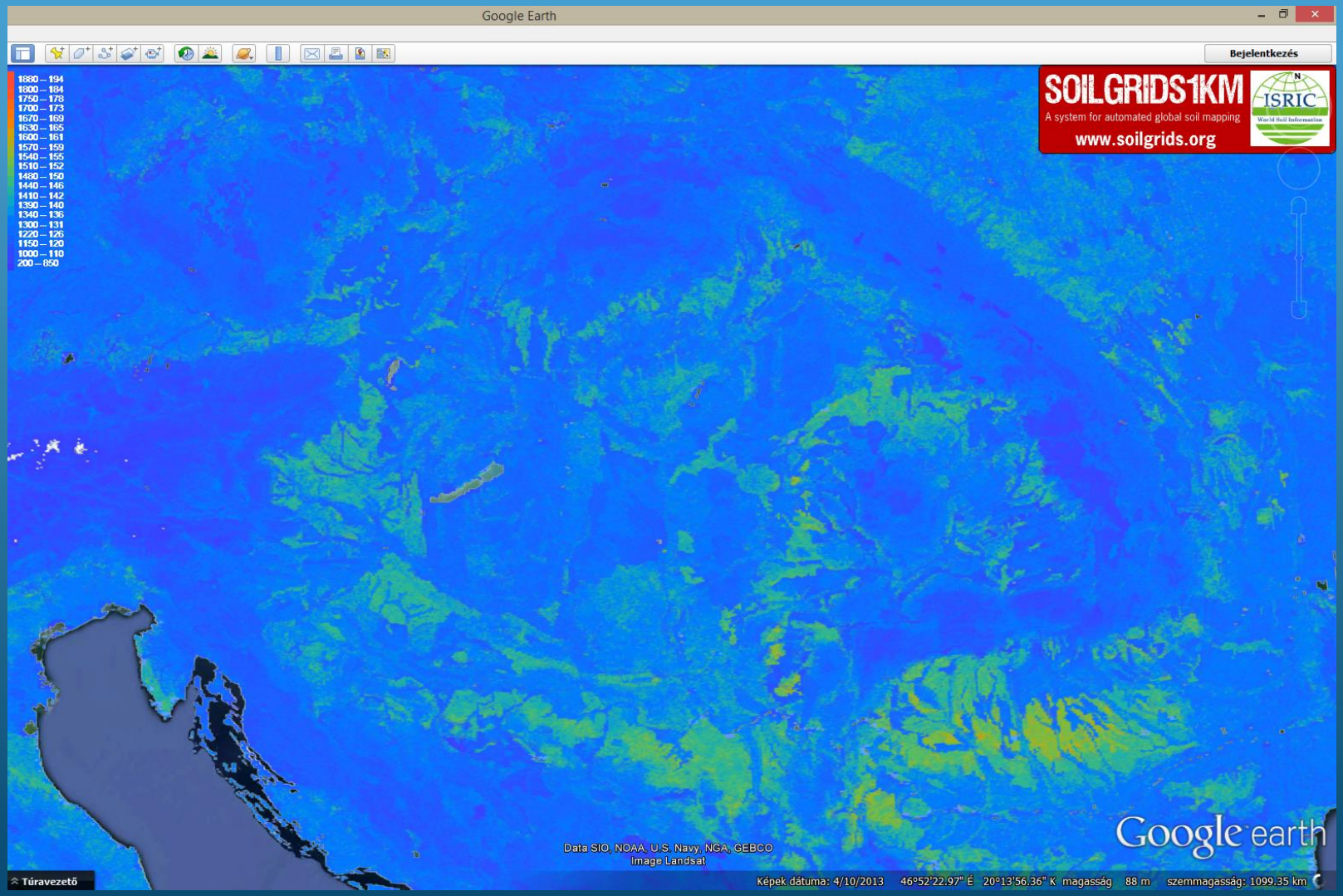
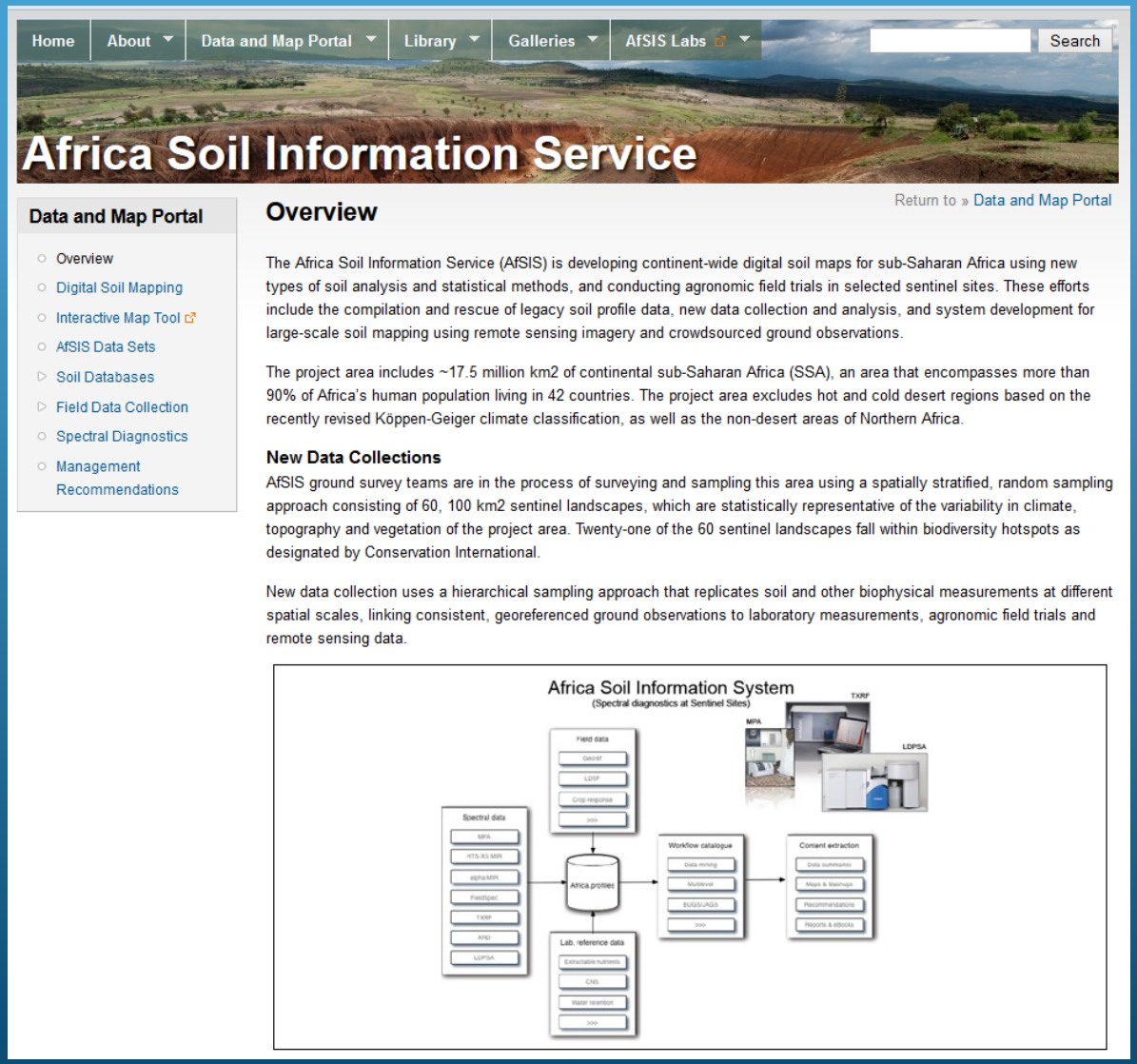
Globális stratégia



Térbeli talajinformációs rendszerek Afrika



http://www.africasoils.net

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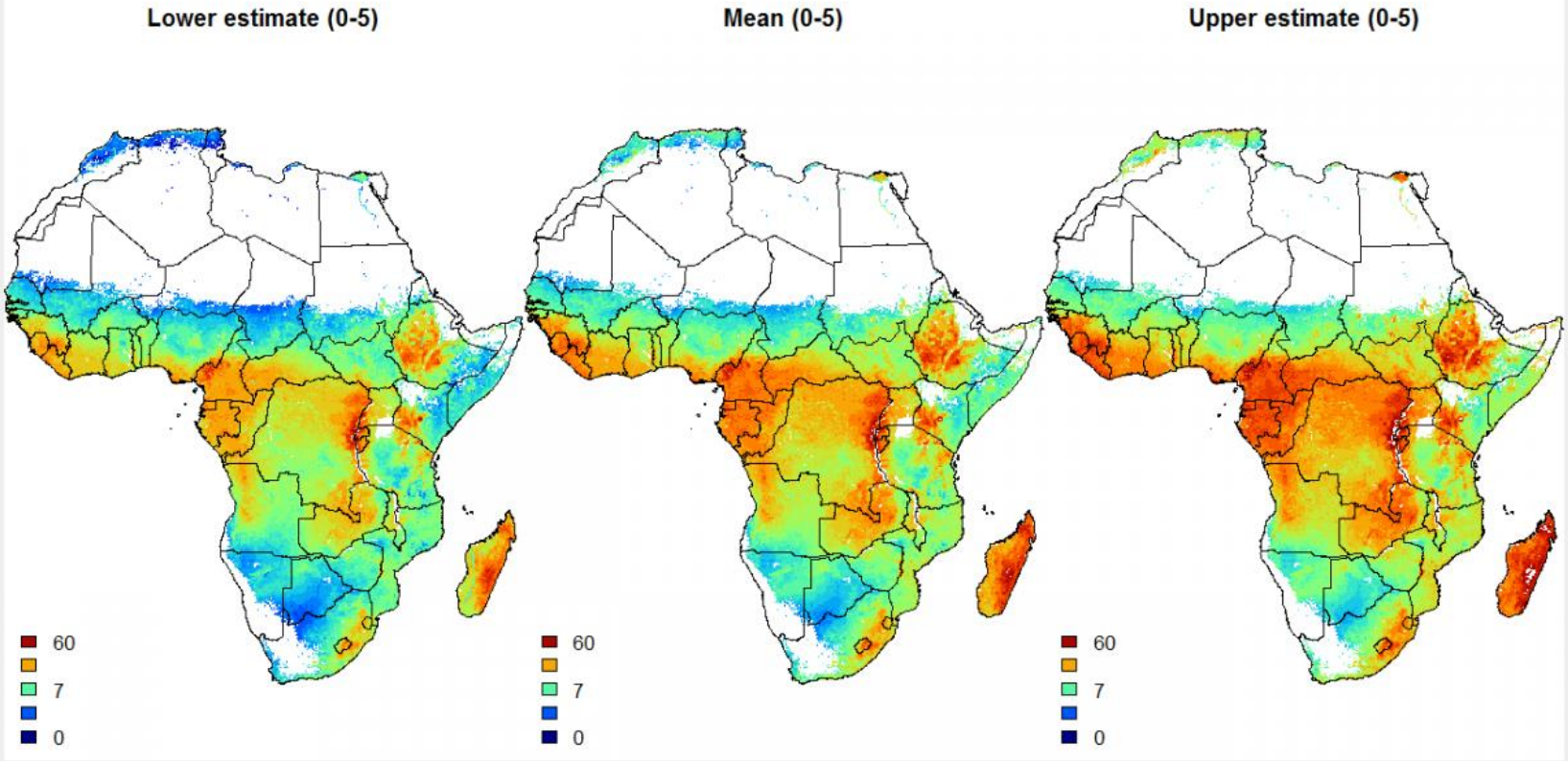
Soil property maps of Africa at 1 km

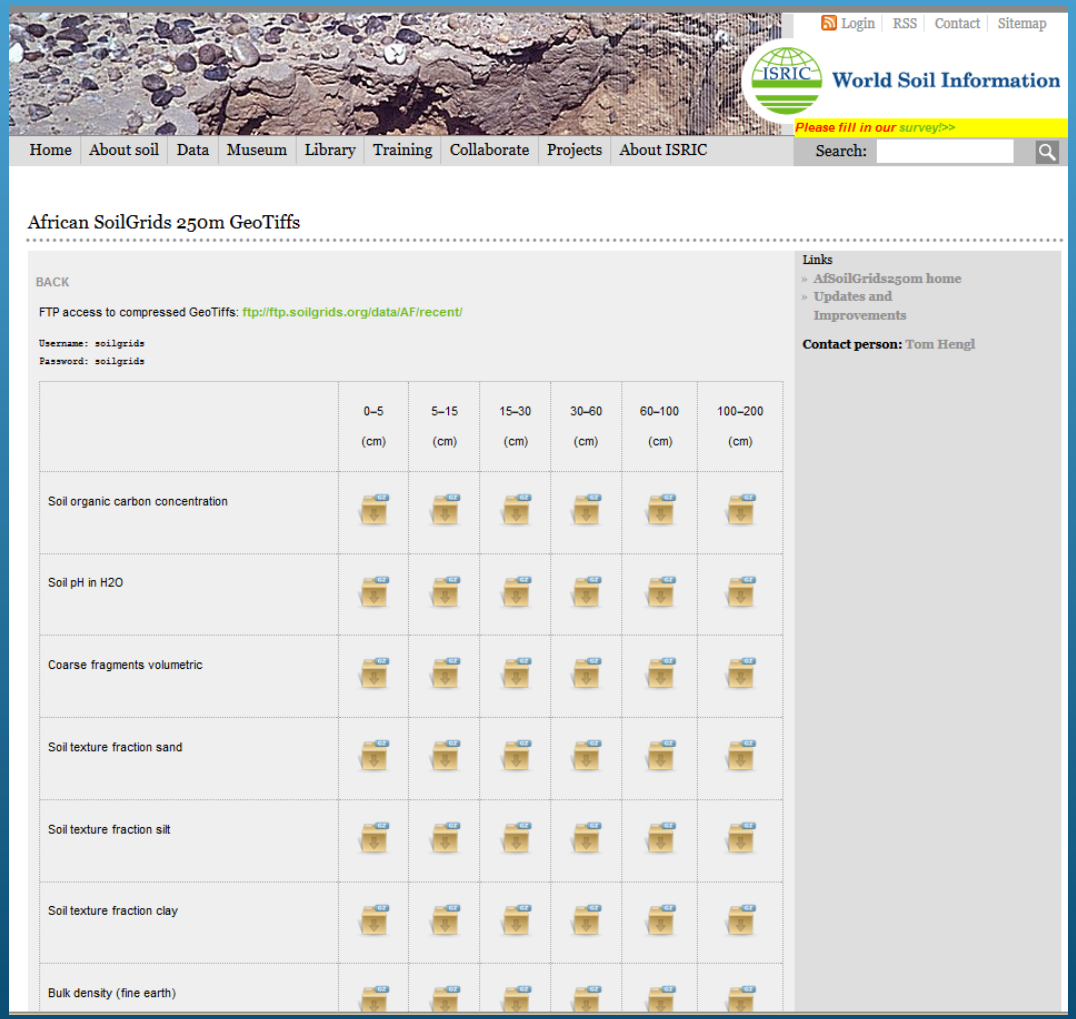


Prediction maps of the lower limit, mean and upper limit (90% prediction interval) for organic carbon (permille) for the first standard depth (0-5 White pixels indicate areas without any vegetation cover that have been masked out from the mapping.

http://www.africasoils.net

Térbeli talajinformációs rendszerek Afrika

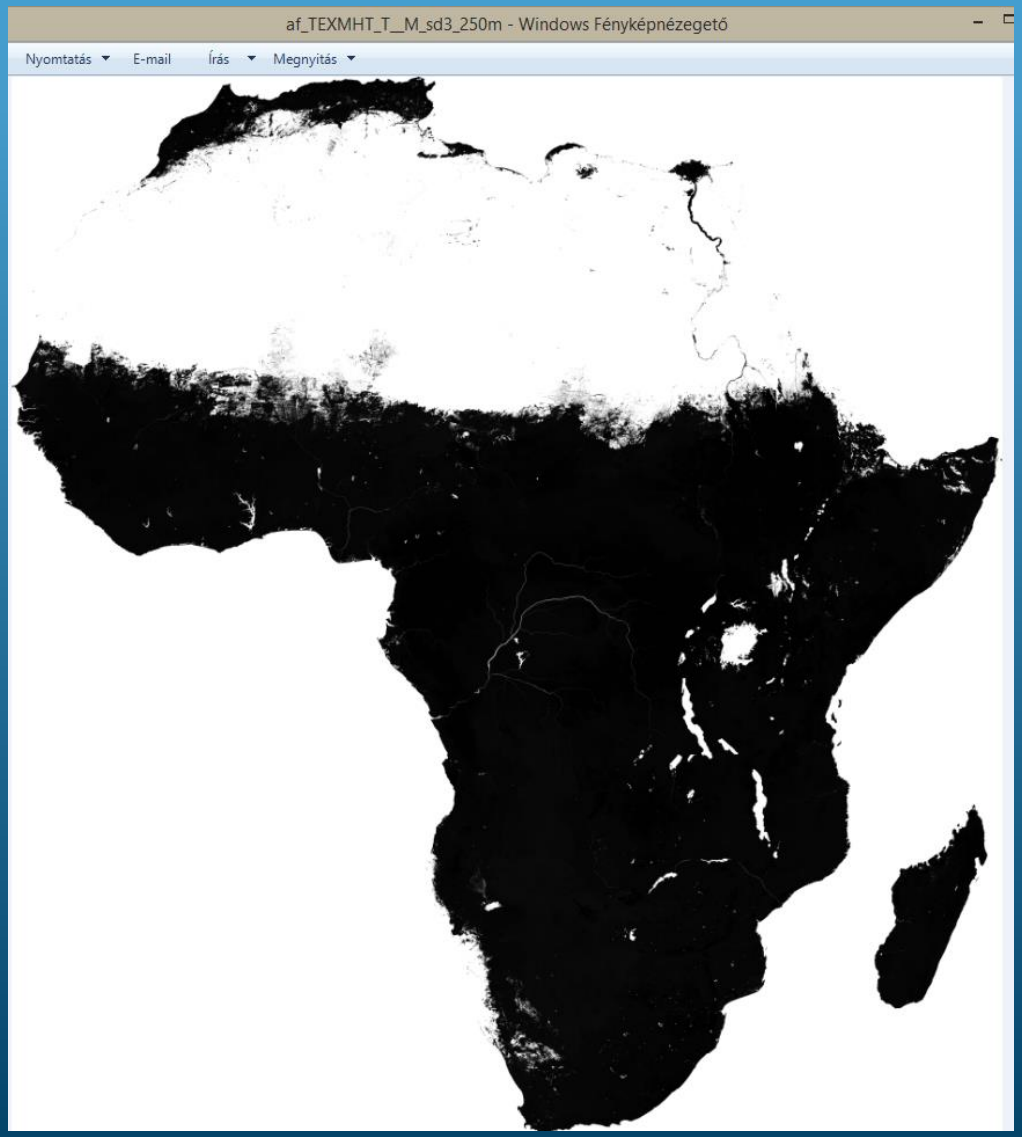
Soil property maps of Africa at 250 m



http://www.africasoils.net

Térbeli talajinformációs rendszerek
Afrika

Soil property maps of Africa at 250 m



Térbeli talajinformációs rendszerek Afrika

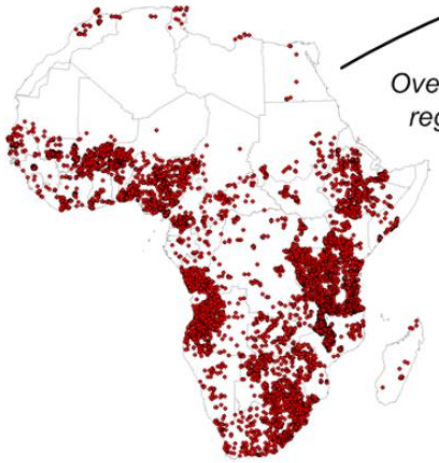
Soil property maps of Africa at 250 m

Soil covariates:

- MODIS and SRTM DEM land products,
- GlobeLand30 aggregated land cover data (30 m -> 250 m),
- SoilGrids1km (global models)

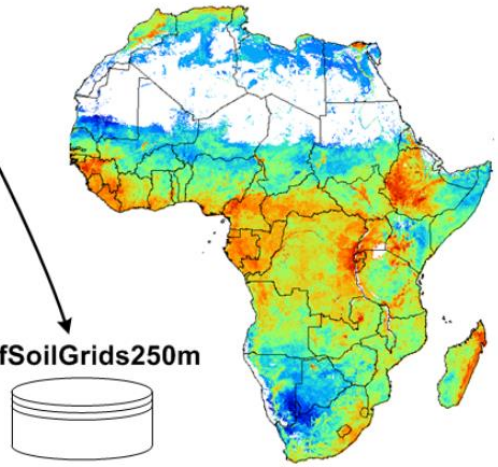
Fit models and generate predictions (random forests + kriging)

Overlay / generate a regression matrix



Soil profiles and soil samples (model calibration data)

AfSoilGrids250m



- soil organic carbon,
- soil pH,
- sand, silt and clay fractions,
- coarse fragments,
- bulk density,
- cation-exchange capacity,
- total nitrogen,
- exchangeable acidity,
- Al content,
- exchangeable bases (Ca, K, Mg, Na),
- available water capacity
- ...

ISRIC World Soil Information