Tools to facilitate the use of Soil Maps in Emilia-Romagna region (Italy)

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Soil maps Vs Thematic maps

Soil maps are not easy to manage. Legends are usually based on soil classifications (e.g. Soil Taxonomy, W.R.B., local classifications) understandable by a limited number of users (mostly soil scientists).

- Strategy n. 1- Translation of soil maps to more comprehensible documents (thematic maps).
- Strategy n. 2 – Easing the use of soil maps for users.
- Means: use of interactive soil websites.

Soil websites Vs printed maps

ERMES agriCOLTURA

EMIRO ti augura buona navigazione

ERMES AGRICOLTURA | HOME CATALOGO

CATALOGO DEI SUOLI

HOME

- Istruzioni d'uso
- Campionamento
- Attività sperimentali
- Glossario
- Ricerche sulla base dati
- Autori

CATALOGO REGIONALE DEI TIPI DI SUOLO DELLA PIANURA EMILIANO-ROMAGNOLA

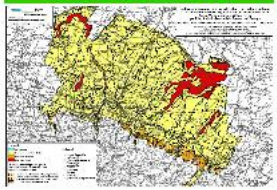
Il Catalogo è un inventario dei principali caratteri chimico-fisici e delle più importanti qualità dei suoli, che fornisce strumenti e informazioni utili alla gestione agricola ed ambientale, sulla base delle migliori pratiche.

La navigazione può seguire 3 percorsi:

- **riconoscimento** del suolo aziendale, calcolo dei piani di concimazione, di irrigazione o di utilizzazione (gestione) di reflui zootecnici e fanghi
- consultazione di **carte applicative**, schemi di valutazione e guide validate da esperti
- accesso diretto alle **schede informative** dei 183 suoli della pianura regionale

SUOLO AZIENDALE

CARTE APPLICATIVE



ELENCO SUOLI

Fine

Internet

100%

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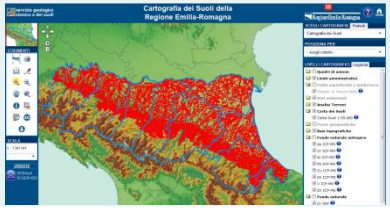
Soil websites in Emilia-Romagna /1

Over the years, the Web sites on soils have become **three**, based on different technologies and addressed to different users.

Site name	The soils of Emilia-Romagna on Google Earth	Soil maps of Emilia-Romagna region	Soil Inventory of Emilia-Romagna
Short name	CARTPEDO	WEBGIS	CATALOGO
Link	http://geo.regione.emilia-romagna.it/cartpedo/	http://ambiente.regione.emilia-romagna.it/geologia/cartografia/webgis-banchedati/webgis-suoli	https://agri.regione.emilia-romagna.it/Suoli/
Homepage			
Owner	Geological, Seismic and Soil Survey	Geological, Seismic and Soil Survey	Informative-Informatic Agricultural System Service
Data Usability	Viewing and querying soil maps at different scales. All the derived thematic maps. Soil Inventory.	Viewing and querying 50k soil map and some derived thematic maps by an integrated approach. Geological maps, land use maps, Extension Service soil analyses, heavy metal analyses, shallow water table measurement sites are also available.	Plot drawing, soil identification, fertilization plan calculation. Extension Service soil analyses. Water table measurement sites.
Download	NO	YES	NO

Soil websites in Emilia-Romagna /2

The three websites are based on the **same geodatabase** and share the **same approach** of data usage.

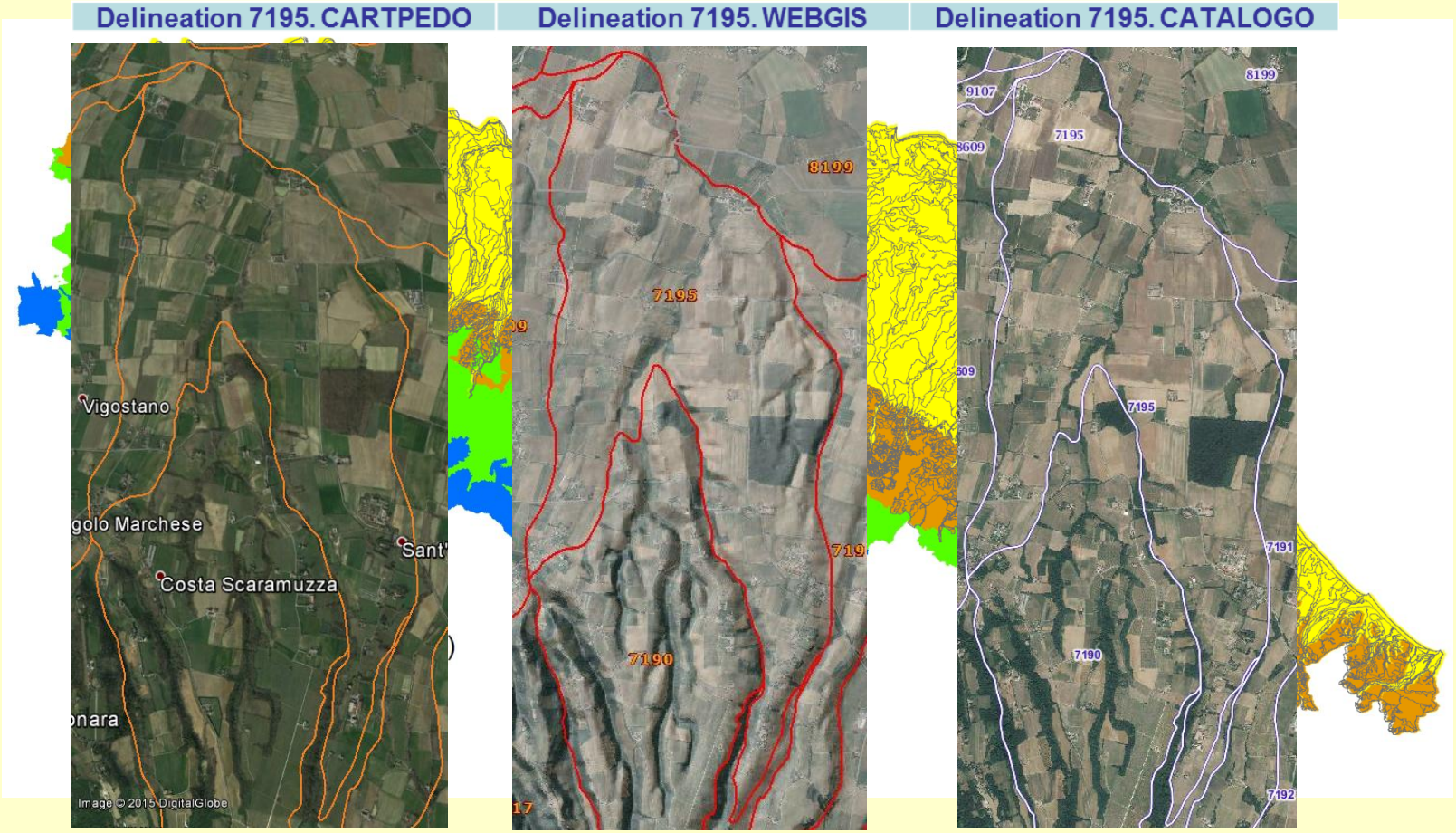
- use of polygons (**delineations**) of the 50k soil map as individual objects;
- soils within a delineation are described on the basis of their localization and percentage distribution;
- every soil, identified by a code and a name, is linked to a **benchmark local site** summarizing the main chemical and physical characters;
- use of an **identification tool (wizard)** of soil types inside a single delineation on the basis of a series of questions and answers (1 to 6 steps);
- use of **extension service soil analyses** (about 40,000) to identify soils and to input soil data necessary for the calculation of fertilization plans.

Soil description in single delineations. Why?

- The first website was directed to users (stake
sector: farmers, agricultural extension and ad
and farm offices.
- This kind of users is usually interested to loca
regarding their own cultivated fields.
- Mapping at scale 1: 50.000 was chosen beca
implementation time, but this type of map is n
site-specific analysis.
- From the beginning, to overcome this problen
the soil map not by Mapping Units (as usual),
(delineations), uniquely identified and describ
locally present soils.
- In the oldest website at most three soils had b
simplify the use for each delineation. They we
names (e.g. Cataldi), prioritizing them instead of soil classification. Over the years, users have become familiar with these names, which are commonly used by many stakeholders.

Soil polygons (delineations) of 50k Soil map

- Soil Map at 1:50.000 scale (2014 edition) covers the whole plain, 82% of the hills and a small part of the mountains.
- Each polygon (delineation) of the soil map is identified by a **numerical ID** and it has a specific and unique soil component (soil type, %, distribution). N. **6294** soil polygons are delineated in this map.



Soil desc

The description of each poly
not possible using a Mappin
types (Soil Typological Units

At present **389 Soil Typolo**
(210 in the plain, 144 in the
of these soils are widespre
others are rare and they ar
Each soil is described, at r
that is representative of so

DELINEAZIONI CARTA DEI SUOLI 1: 50.000

ID delin	Tipo	Data Agg
7195	rilevata e descritta singolarmente	09/12/200

Lotto UC	Cod UC	Sigla UC
A9005	0145	CTD1

I Cittadella non presentano incremento di argilla in

Geomorfologia
ripiani su terrazzi con superficie ondulata

Suoli presenti			
Archivio	Suolo	Nome Suolo	R
F5008	CTD1	CITTADELLA franco limosi, 1-5% pendenti	Oss
F5008	RIV1	RIVERGARO franco limosi	Oss rapp

UNITA' TIPOL

Arc
F5

I suoli CITTA
nella parte su
franca argillo
sabbiose cal
I suoli CITTA
pendenza va

(2010) Aquic

N°	OrizGe
1	A(p)
2	(B)E(B
3	Bt(g)
4	B(t)c
5	2B(g)t

CITTADELLA franco limosi, 1-5% pendenti

Descrizione introduttiva

I suoli CITTADELLA franco limosi, 1-5% pendenti sono molto profondi e non calcarei; sono da debolmente acidi a debolmente alcalini ed a tessitura franca limosa nella parte superiore; nella parte inferiore sono presenti strati a tessitura franca limosa da molto fortemente a moderatamente acidi ed a tessitura franca limosa o franca argillosa limosa, da neutri a debolmente alcalini. È presente ghiaia alterata oltre i 150 cm di profondità. Il substrato è costituito da alluvioni ghiaioso-sabbiose calcaree.
I suoli CITTADELLA franco limosi, 1-5% pendenti sono in parti sommitali e di versante alto di conoidi molto antiche della piana pedemontana. In queste terre la pendenza varia dall'1 al 5%. La densità di urbanizzazione è elevata. L'uso del suolo è a seminativo semplice e prati poliennali; rari i boschi di latifoglie.

Classificazione Soil Taxonomy

(2010) Aquic Paleustalfs fine silty, mixed, superactive, mesic

Classificazione WRB

(2007) Cutanic Stagnic Luvisols

Profilo rappresentativo

Orizzonti genetici del suolo (valori modali)

N°	OrizGen	ProfLimSup	Spes	Arg	Sab	% Schel	S.O.	CalcTot	pH	Ksat	BD	Concentrazioni	% Conc	Qualità
1	A(p)	0	50	20	15	0	1.5	0	6.5	0.0714	1.52	noduli di ferro e manganese		bassa
2	(B)E(B)	50	40	15	17	0	1.7	0	4.5	0.08052	1.57	noduli di ferro e manganese		bassa
3	Bt(g)	50	70	23	10	0	0.2	0	7.2	0.02489	1.6	noduli di ferro e manganese	5	bassa
4	B(t)c	90	10	28	10	0	0.2	0	7.9	0.01464	1.59	noduli di ferro e manganese	50	bassa
5	2B(g)tb	100		40	7	0	0.2	0	7.3	0.00317	1.57	noduli di ferro e manganese	5	media

Qualità specifiche

Parametro	Valore
Calcare attivo entro 80 cm	0 %
Capacità di scambio cationico nello strato superficiale	>10 meq/100g
Salinità strato 0-50 cm	non salino (Ece < 2 dS/m)
Salinità strato 50-100 cm	non salino (Ece < 2 dS/m)
Sodicità entro 60 cm (ESP)	da 0 a 6
Sodicità entro 120 cm (ESP)	da 0 a 7
Disponibilità di ossigeno	moderata
Rischio di incrostamento superficiale	forte
Fessurabilità	bassa

Benchmark local sites /1

Every soil in every polygon has been linked to an analyzed site that has been surveyed in the same polygon or in adjacent ones. The choice of these sites (**benchmark sites**) accounts of the local variability.

For this purpose, **2869** observation sites (profiles and auger holes) with these analytical data, at least to a depth of **100 cm** have been selected:

- **sand, silt and clay;**
- **pH**
- **organic carbon**
- **total calcium carbonate**

For each site, on average n. 4 samples are available from the surface to a medium depth of 145 cm. The depth ranges from **30 cm** (skeletal soils or soils with lithic or paralithic contact within 100 cm) to **500 cm** (strongly weathered soils). Benchmark sites can be used for many applications, such as:

- Soil Type Identification;
- Input data for irrigation projects;
- Input data for Water Balance Models (e.g. MACRO, PELMO);
- Input data for fertilization models;
- Input data for Risk Assessment Models for contaminated sites (e.g. ASTM E2081).
- Building of derived maps as Land Capability Map or Permeability Map.

Benchmark local sites /2

PARAMETRI ANALITICI/STIMA DEL SITO DI RIFERIMENTO

DELINEAZIONE N. 7195, SUOLO: CTD1 — METADATI

		ORIZZONTI DEL SITO										ANALISI											
		Orizzonte genetico				Prof.orizzonte			Campione			Analisi chimico-fisiche										Analisi fisiche	
SITO	N. oriz	Discont	Orizmast	Sufalf	Sufnum	min cm	max cm	Schel.%	N.camp	min cm	max cm	Sabbia	Limo	Argilla	Classe	pH-H20	C.org.	Sost.org.	Calc.Tot.	Calc.Att.	C.S.C.	Dens.App.	KSat
516	1		A	p		0	50	0	1	0	50	34	51	15	FL	6,5	0,29	0,5	1	1		1,53	0,287
516	2		B	t		50	90	0	1	50	90	31	46	23	F	7,2	0,58	1	0	0,3		1,61	0,076
516	3		B	tg		90	120	0	1	90	120	28	48	24	F	7,5	0,29	0,5	1	0,4		1,63	0,047
516	4		B	tc		120	140	0	1	120	140	36	41	23	F	7,9	0,232	0,4	0	0,6		1,61	0,11

METADATI DEI PARAMETRI ANALITICI/STIMA

DELINEAZIONE N. 7195, SUOLO: CTD1

		ORIZZONTI DEL SITO										ANALISI											
		Orizzonte genetico				Prof.orizzonte			Campione			Analisi chimico-fisiche										Analisi fisiche	
SITO	N. oriz	Discont	Orizmast	Sufalf	Sufnum	min cm	max cm	Schel.%	N.camp	min cm	max cm	Sabbia	Limo	Argilla	pH-H20	C.org.	Calc.Tot.	Calc.Att.	C.S.C.	Dens.App.	KSat		
516	1		A	p		0	50	0	1	0	50	93	93	93	110	87	80	79		1298	1094		
516	2		B	t		50	90	0	1	50	90	93	93	93	110	87	80	79		1299	1094		
516	3		B	tg		90	12																
516	4		B	tc		120	14																

Codice	Descrizione
A	strato di suolo alterato superficiale. Quando c'e' il suffisso b vuol dire che e' sepolto

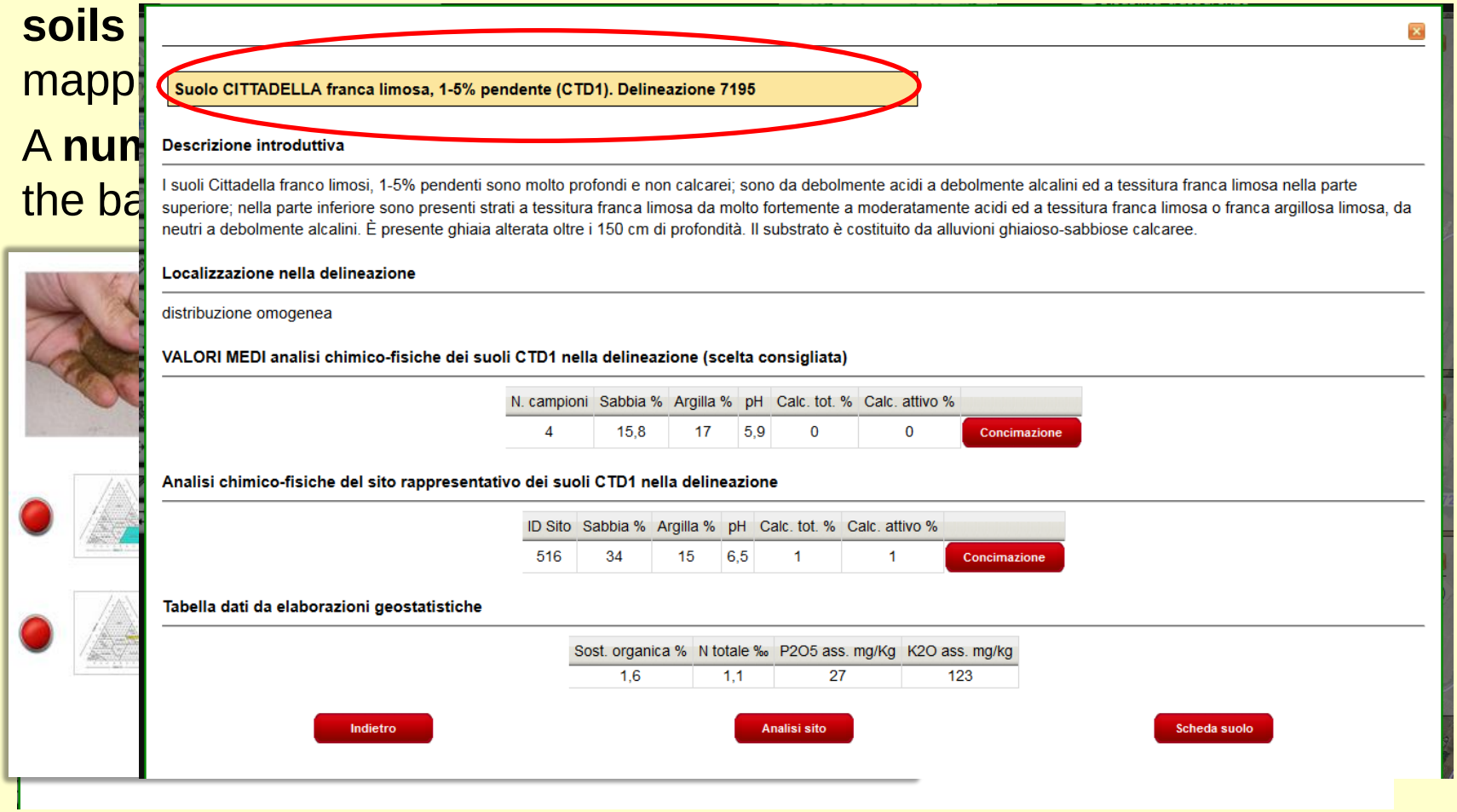
Archivio | Suolo | Nome Suolo | Ra

Metodo	Attributo	Metodo misura/stima	Unità di misura	Bibliografia
93	SABBIA_LIMO_ARGILLA	Granulometria: densimetro (Bouycous)	g/kg-1	MiPAF. ONP - METODI UFFICIALI DI ANALISI CHIMICA DEL SUOLO. 2000. Metodo II.6

tativo	nella delineazione
	nella delineazione

Tool for identifying different Soil Types (WIZARD) /1

- This tool works by following a **dichotomous path**: the users must choose between different options until a single result. **88 groups of soils** mapp
- A **num** the ba



Tool for identifying different Soil Types (WIZARD) /2

19 parameters, displayed as questions, can be used to make the choices. Each parameter corresponds to a **set of values (2 to 32)** and each value corresponds to an answer.

PARAMETER	QUESTION
DRAINAGE	How is the soil drainage?
TOPSOIL CALCIUM CARBONATE	What is the amount of topsoil calcium carbonate?
SHRINK-SWELL BEHAVIOUR	What is the natural tendency to cracking in dry periods?
PEAT LAYERS	Are there peat layers? How deep are them?
FLOODING RISK	What is the flooding risk?
CALCIUM CARBONATE CONCRETION PRESENCE	Are there calcium carbonate concretions? How deep are them?
SLOPE	What is the average gradient of slopes?
ELEVATION	What is the main elevation above mean sea level?
TOPSOIL TEXTURE CLASS	What is the texture class (USDA triangle) of topsoil?
SKELETON CONTENT	What is the rock fragment content?
LAND USE	What is the main land use?
SUBSOIL TEXTURE	What is the content of sand or clay (determined through the manipulation of a subsoil sample)?
TOPSOIL COLOR	What is the color of topsoil?
CALCIUM CARBONATE TREND	What is the trend in the percentage of calcium carbonate in depth?
LANDSCAPE POSITION	What is the landscape position of soils?
BEDROCK DEPTH	How deep is bedrock (lithic or paralithic layer)?
SALINITY	Are there layers with high salinity content?
TYPICAL SOIL COLOUR	What is the typical colour of soil?
ALLUVIAL PARENT MATERIAL	How deep is the unaltered alluvial parent material?

Tool for identifying different Soil Types (WIZARD) /3

PARAM. 1	VALUE	STU
LANDSCAPE POSITION	Top surfaces	CTD1
		RIV1
		ARC2
		CBE1
	Slopes	ARC1
		CAT1
		CPL1
		RIR1
	Upper slopes	CTD2
		MCA1
		TAV
		ARC2
		CAT2
		CBE1
		CDV2
	Lower slopes	CAT2
	Medium slopes	TAV

PARAM. 2	VALUE	STU
TOPSOIL TEXTURE CLASS	Silty clay	CAT1
		CAT2
		CBE1
		CDV2
	Loam	CPL1
	Clay loam	MCA1
		TAV
	Silty clay loam	RIV1
		TAV
		ARC1
		ARC2
		CAT1
		CAT2
		CDV2
	Silt loam	CTD1
		CTD2
	Sandy loam	RIR1

PARAM. 3	VALUE	STU
TOPSOIL CALCIUM CARBONATE	0%	CTD1
		RIV1
		CTD2
		MCA1
		TAV
	0-2%	ARC1
		ARC2
		CBE1
		CDV2
	2-5%	CBE1
		CDV2
	>5%	CAT1
		CAT2
		RIR1
	5-10 %	CBE1
		CDV2
		CPL1

PARAM. 4	VALUE	STU
CALCIUM CARBONATE CONCRETION PRESENCE	Missing	CTD1
		RIV1
		CTD2
		MCA1
		TAV
		ARC1
		ARC2
		RIR1
	everywhere	CDV2
	> 50 cm	CPL1
	> 80 cm	CAT1
		CAT2
		CBE1

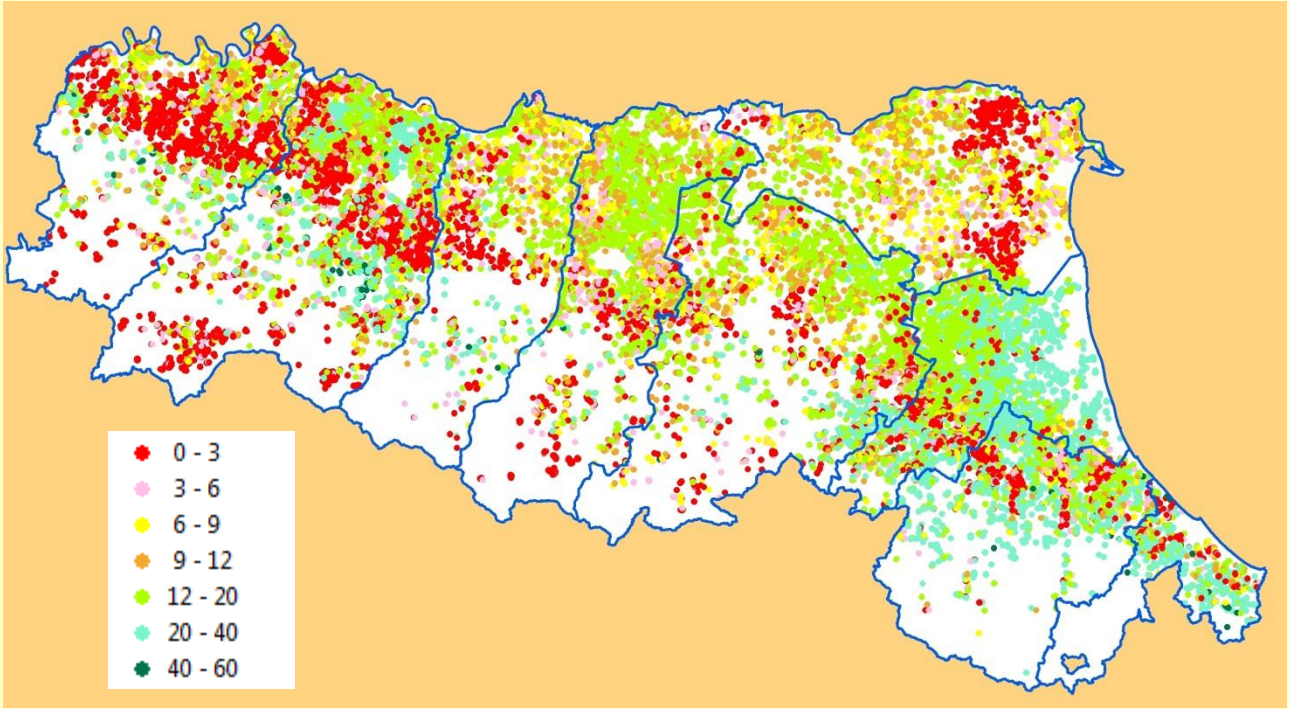
PARAM. 5	VALUE	STU
SUBSOIL TEXTURE	Clay >35%	RIV1
		TAV
		ARC1
		ARC2
		CAT1
		CAT2
		CDV2
	Clay <35% and Sand <50%	CTD1
		CTD2
		MCA1
		CPL1
	Clay>50%	CBE1
	Sand >50%	RIR1

For each soil group from **1 to 6 parameters** have been assigned to differentiate soil types.
Example on **GROUP 32.**

Use of Extension Service Soil Analyses

These data are **routine chemical-physical analyses** (sand, silt, clay, pH, total carbonate, active carbonate, organic matter, available K, available P, total N) of about **40,000** soil samples (mostly on superficial horizons). They can be used in different ways:

- Identification of a soil type;
- Input soil data necessary for the calculation of fertilization plans;
- Geostatistical processings.



Use of Extension Service Soil Analyses. Identification of Soil Type

Campioni Analisi Terreni

58602

58603

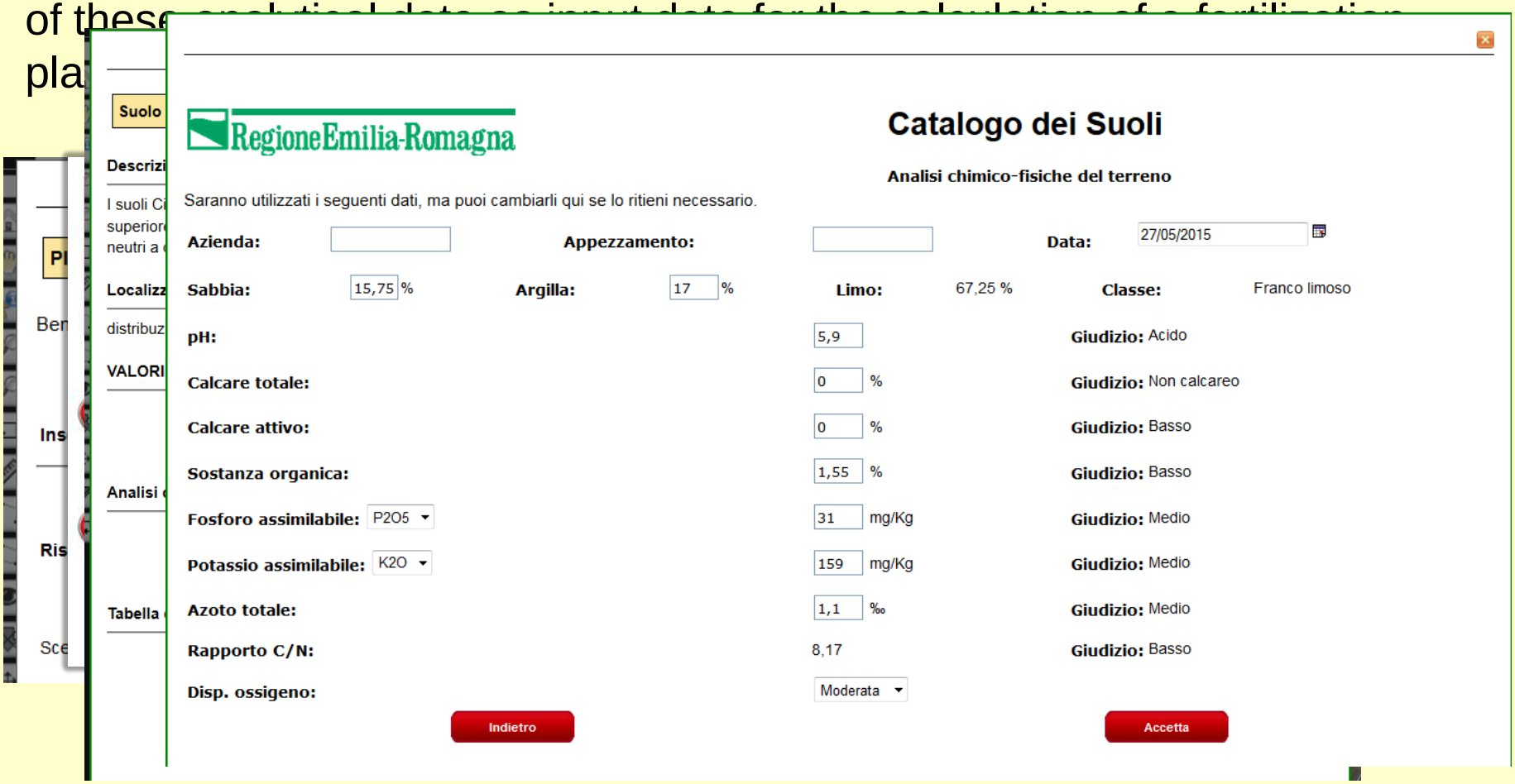
Carta Suoli 1:50.000

257

ID Sito SACT	58602
Precisione localizzazione	localizzato su C.T.R. 1:25.000 e digitalizzato a video
Data campionamento	12 August 2002 01:00:00
Profondità campione	superficiale
Profondità min (cm)	0
Profondità max (cm)	50
Sabbia (%)	49
Limo (%)	32
Argilla (%)	19
Classe argilla	argilla 19% - 27%
pH	7.7
Calcare totale (%)	12
Calcare attivo (%)	3
Sostanza organica (%)	1.3
K2O assimil. (ppm)	190
P2O5 assimil. (ppm)	32
N totale ‰	0.9
Tipo campione	Composito
Sigla suolo	VIL2
Nome suolo	VILLALTA franca
Note illustrative	Apri link

Use of Extension Service Soil Analyses. Input data for fertilization plans

The user has the chance to get its own soil analytical data or take advantage of the ones already available in the system. After selecting the type of soil, the user can exploit the **medium values** inside the delineation of these analytical data as input data for the calculation of a fertilization pla



Thematic maps

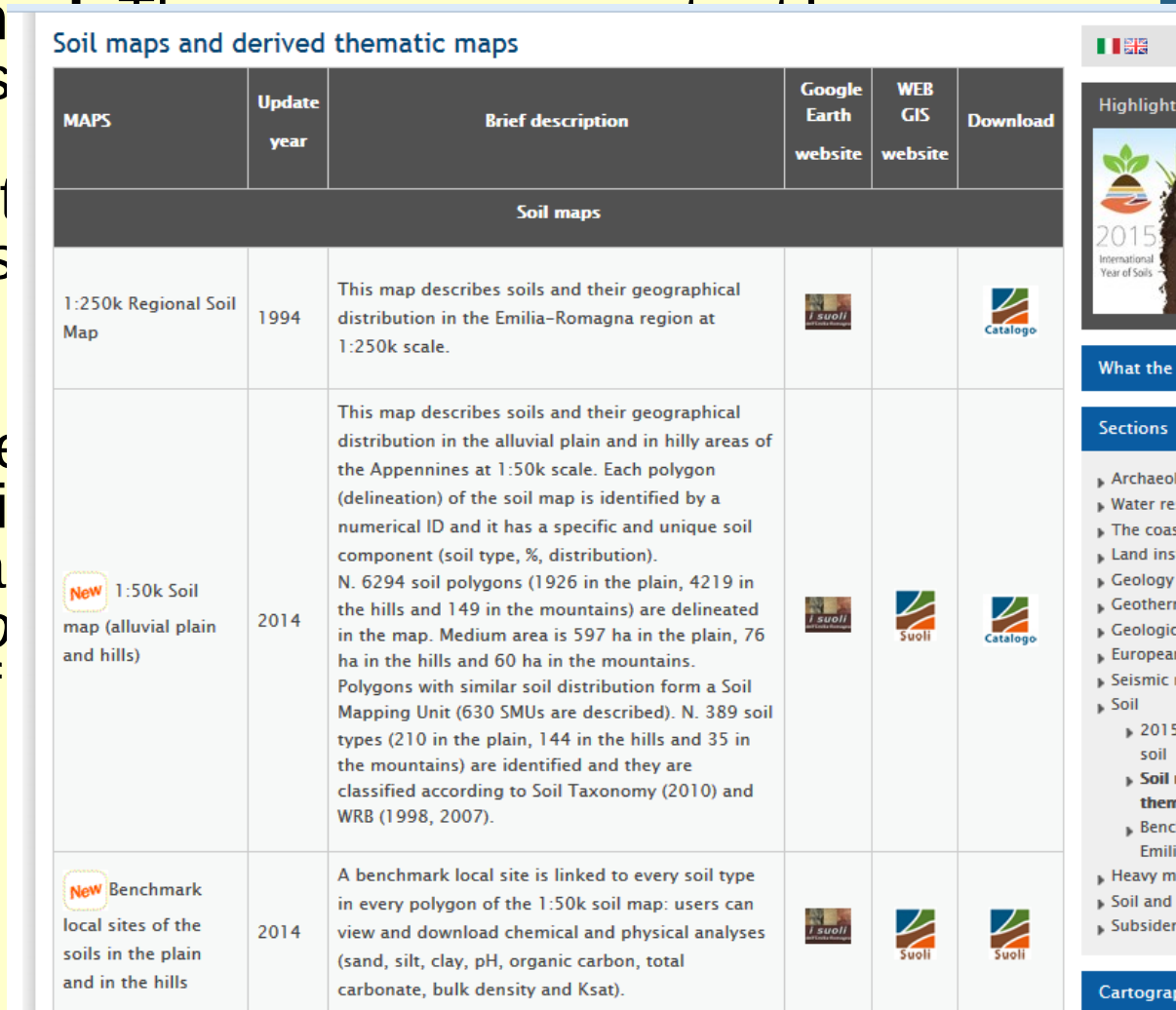
2 different approaches have been followed to building thematic maps:

Geostatistical meth

layers, with cells
Organic Carbon
salinity. This met
shows a *single s*

Maps derived from

of the soil perce
e.g. land capabi
This method ha
complex soil pro
building some of
used.



Soil maps and derived thematic maps

MAPS	Update year	Brief description	Google Earth website	WEB GIS website	Download
Soil maps					
1:250k Regional Soil Map	1994	This map describes soils and their geographical distribution in the Emilia-Romagna region at 1:250k scale.	i suoli		Catalogo
New 1:50k Soil map (alluvial plain and hills)	2014	This map describes soils and their geographical distribution in the alluvial plain and in hilly areas of the Appennines at 1:50k scale. Each polygon (delineation) of the soil map is identified by a numerical ID and it has a specific and unique soil component (soil type, %, distribution). N. 6294 soil polygons (1926 in the plain, 4219 in the hills and 149 in the mountains) are delineated in the map. Medium area is 597 ha in the plain, 76 ha in the hills and 60 ha in the mountains. Polygons with similar soil distribution form a Soil Mapping Unit (630 SMUs are described). N. 389 soil types (210 in the plain, 144 in the hills and 35 in the mountains) are identified and they are classified according to Soil Taxonomy (2010) and WRB (1998, 2007).	i suoli	Suoli	Catalogo
New Benchmark local sites of the soils in the plain and in the hills	2014	A benchmark local site is linked to every soil type in every polygon of the 1:50k soil map: users can view and download chemical and physical analyses (sand, silt, clay, pH, organic carbon, total carbonate, bulk density and Ksat).	i suoli	Suoli	Suoli

Highlight

2015 International Year of Soils

What the

Sections

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- Seismic
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  - Benc Emili
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- Soil and
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