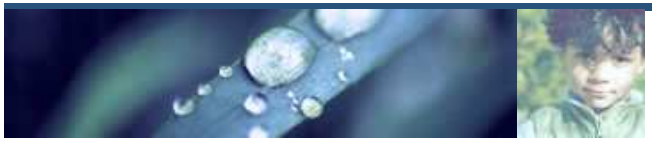


SOIL ANALYSIS FOR SOIL MAPPING

8th EUREGEO

Barcelona, 15-17 June 2015

Miquel Aran
Eurofins Agroambiental

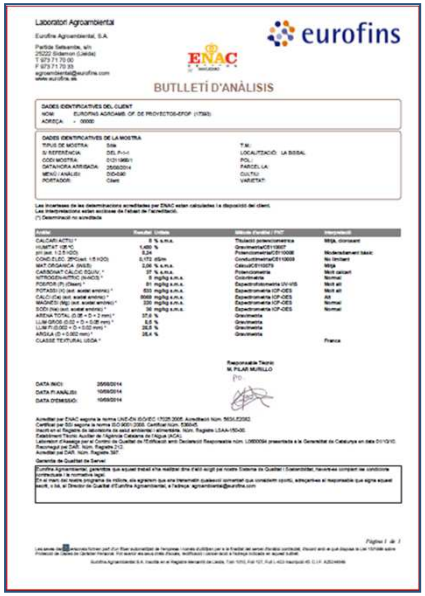
Key points

1.- Soil knowledge and soil mapping
2.- The soil laboratory
3.- Soil survey procedures and soil analysis
4.- Use of soil analysis in soil mapping
5.- Soil analysis mostly used in soil mapping
6.- New methods of soil data generation
7.- Additional notes and conclusions

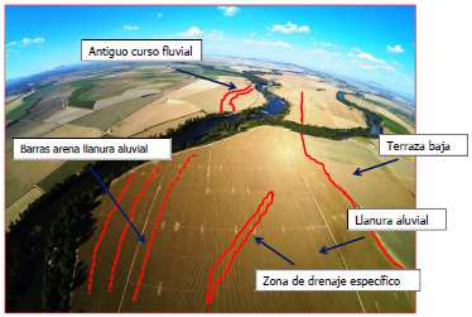
1.- Soil knowledge and soil mapping

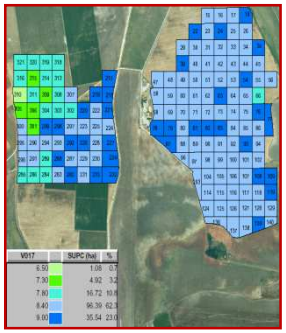
1.- Soil mapping: a wide range of utilities

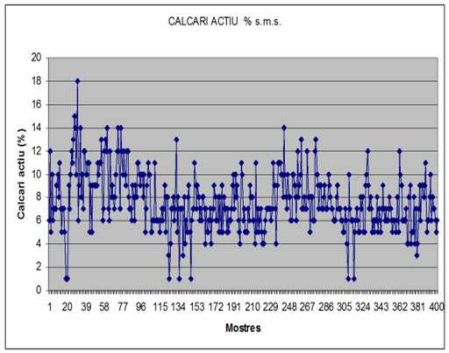
2.- Soil laboratory and soil data



Soil analysis: a compulsory task for soil mapping







2.- Soil laboratory

EUROFINS AGROAMBIENTAL

Almost 25 years providing soil analytical data for a wide number of users.

Soil mapping is as a relevant consumer of soil analytical data.

Laboratory data: 40.000 samples/year. 25000 of them soil samples

- **National projects**
- **International projects**
- **Classical soil survey and soil mapping projects**
- **Data base generation often associated with map production**

3.- Soil survey procedure and soil analysis

Steps in soil survey procedures:

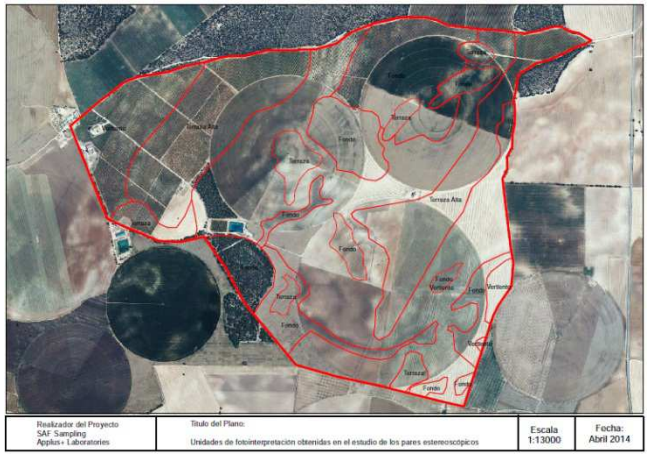
1.- Area reconnaissance
2.- Soil, geology, climate…data gathering, compilation
3.- Photointerpretation (PI), pre- delineation
4.- Soil description in the field (field survey, FS)
5.- Soil analysis (SA)
6.- Mapping units delineation (FS + PI)
7.- Final rapport and map

3.- Soil survey procedure and soil analysis

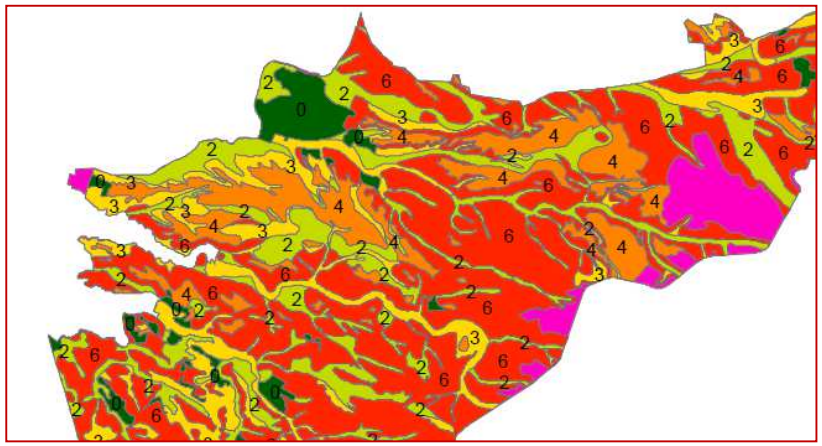
FS 1

FS 2

SA

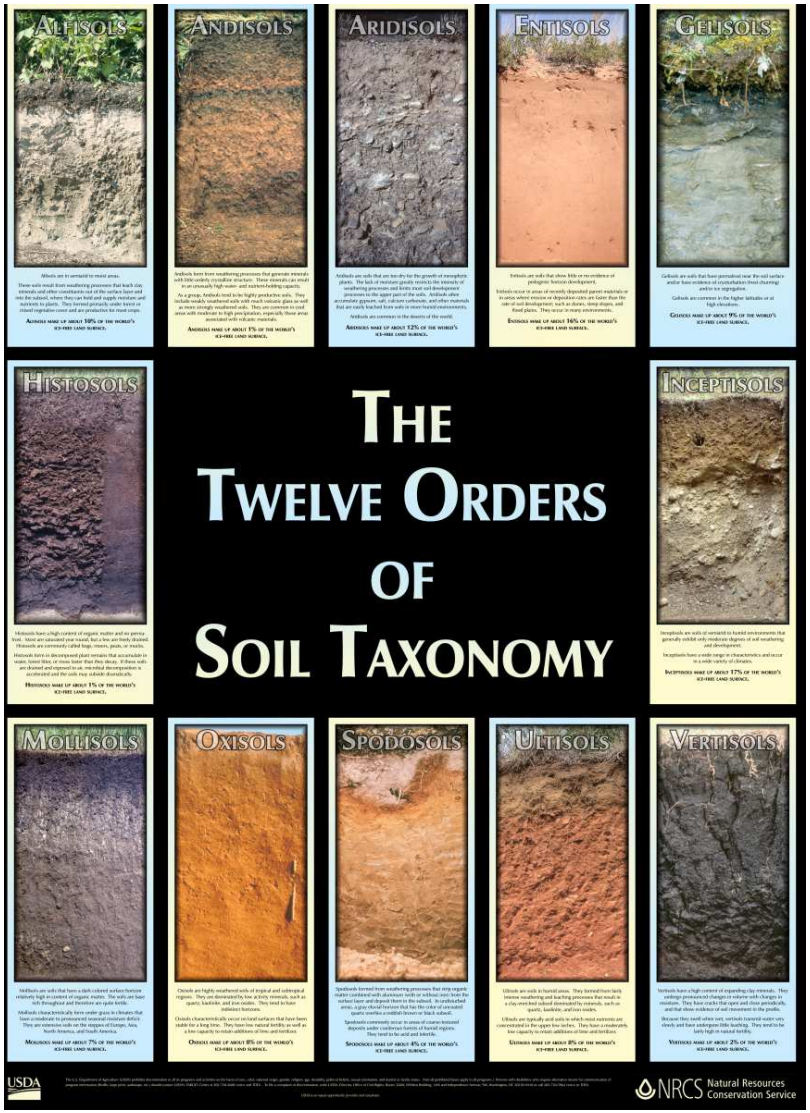


PI



3.- Soil survey procedure and soil analysis

Analytical data are essential for soil classification procedures



3.- …the soil report and the soil map

A3g, Complex FONGUERA-ABELLER; arenosa 15-30% de pendent, no pedregosa, poc gravenca

Soil mapping unit

Analytical data

Soil serie

Anàlisi del pèdon IS-3-05

Horitzó	Profunditat	pH	Matèria orgànica (%)	Carbonat càlcic equivalent (%)	CE (dS/m a 25 ºC) 1:5
O	-1				
A	0-10/22	7,0	1,7	0	0,1
B_w/R	>10/22	8,1	1,1	0	

Horitzó	Profunditat	Textura USDA							
		ArG (%)	ArF (%)	Ar_{total} (%)	LG (%)	LF (%)	L_{total} (%)	a (%)	Textura (USDA)
O	-1								
A	0-10/22	75	16	91	2	2	4	5	Arenosa
B_w/R	>10/22	69	19	88	2	3	5	7	Arenofranca

Horitzó	Profunditat	Cations de canvi				
		Ca^{2+} $cmol_c\ Kg^{-1}$	K^+ $cmol_c\ Kg^{-1}$	Mg^{2+} $cmol_c\ Kg^{-1}$	Na^+ $cmol_c\ Kg^{-1}$	CIC $cmol_c\ Kg^{-1}$
O	-1					
A	0-10/22	2,2	0,0	0,2	0,1	4,3
B_w/R	>10/22					

Horitzó	Profunditat	Fertilitat			
		$N\text{-}NO_3$ mg Kg^{-1}	Nkj (%)	P mg Kg^{-1}	K mg Kg^{-1}
O	-1				
A	0-10/22	1	0,04	2	24
B_w/R	>10/22				

4.- Use of soil analysis in soil mapping

- Soil recognition
- Soil horizon definition
- Soil classification
- Soil mapping delineation
- Soil data base
- Soil evolution/ monitoring

- Soil Mapping for “static” or “dinamic” output products

4.- Use of soil analysis in soil mapping

Some examples:

- **Soil recognition.-** eg …How much carbonates?
- **Soil horizon definition.-** eg…Which % of organic carbon?
- **Soil classification.-** eg…% how much clay in two consecutive horizons
- **Soil mapping delineation.-** eg…specific soil sample chemical properties for supporting map unit delineation
- **Soil data base.-** eg… heavy metal geological background
- **Soil evolution/monitoring** eg…soil nutrient evolution (P, Zn…), OC

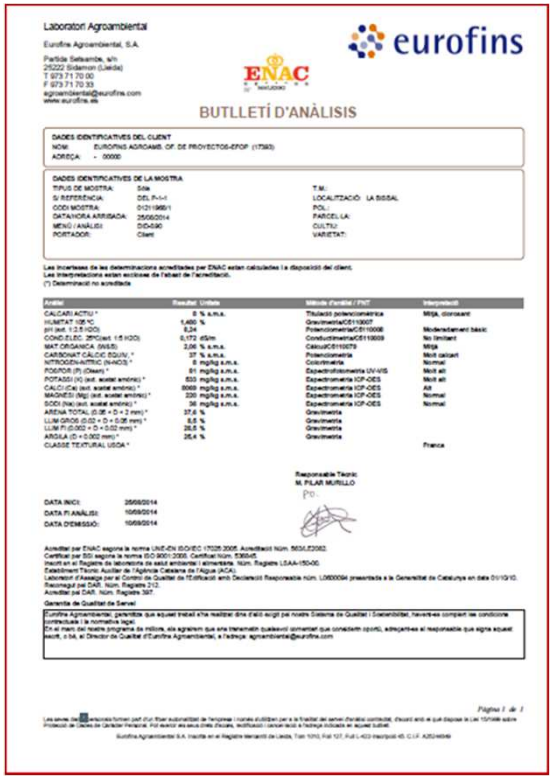
4.- Use of soil analysis in soil mapping

Reliability:

- **Strong points of soil data originated in an expert soil laboratory**
    - **Use of specific methodologies (recognized methodology of soil analysis)**
    - **Internal quality control**
    - **Intercomparaison studies**
    - **Accreditation of specific procedures**
    - **Systematic in soil analysis procedure**
    - **Specialized personnel**

4.- Use of soil analysis in soil mapping

The need of precise data



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eurofins

ENAC

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DADES IDENTIFICATIVES DEL CLIENT

NOM: EUROFINS AGROAMB. OF. DE PROYECTOS-EPOF (17393)
ADREÇA: - 00000

DADES IDENTIFICATIVES DE LA MOSTRA

TIPUS DE MOSTRA: Sòls
Nº REFERÈNCIA: DEL P-1-1
CODI MOSTRA: 01211968/1
DATA/HORA ARRIBADA: 25/09/2014
MENG I ANÀLISI: DIDA90
PORTADOR: Client

T.M.:
LOCALITZACIÓ: LA SISSAL
POL.:
PARCEL·LA:
CULTIU:
VARIETAT:

Les incerteses de les determinacions acreditades per ENAC estan calculades i a disposició del client.
Les interpretacions estan excloses de l'abast de l'acreditació.
(*) Determinació no acreditada

Anàlisi	Resultat	Unitats	Mètode d'anàlisi / PNT	Interpretació
CALCARI ACTIU *	0	% a.m.s.	Titulació potenciomètrica	Mitjà, clorosant
HUMITAT 105 ºC	1,480	%	Gravimetria/GC0110007	
pH (ext. 1:2.5 H2O)	8,24		Potenciometria/GC0110008	Moderadament bàsic
COND.ELEC. 25ºC(ext. 1:5 H2O)	0,172	dS/m	Conductimetria/GC0110009	No limitant
MAT.ORGÀNICA (WalB)	2,06	% a.m.s.	Càlcul/GC0110079	Mitjà
CARBONAT CÀLCIC EQUIV. *	37	% a.m.s.	Potenciometria	Molt calcari
NITROGEN-NÍTRIC (N-NO3) *	8	mg/kg a.m.s.	Colorimetria	Normal
FOSFOR (P) (Olsen) *	91	mg/kg a.m.s.	Espectrofotometria UV-VIS	Molt alt
POTASSI (K) (ext. acetat amònic) *	533	mg/kg a.m.s.	Espectrometria ICP-OES	Molt alt
CALCI (Ca) (ext. acetat amònic) *	8069	mg/kg a.m.s.	Espectrometria ICP-OES	Alt
MAGNESI (Mg) (ext. acetat amònic) *	230	mg/kg a.m.s.	Espectrometria ICP-OES	Normal
SODI (Na) (ext. acetat amònic) *	36	mg/kg a.m.s.	Espectrometria ICP-OES	Normal
ARENA TOTAL (0.05 < D < 2 mm) *	37,4	%	Gravimetria	
LLIM GROS (0.02 < D < 0.05 mm) *	8,6	%	Gravimetria	
LLIM FI (0.002 < D < 0.02 mm) *	28,5	%	Gravimetria	
ARGILA (D < 0.002 mm) *	25,4	%	Gravimetria	
CLASSE TEXTURAL USDA *				Franca

Responsable Tècnic
M. PILAR MURILLO

DATA INICI: 25/09/2014
DATA FI ANÀLISI: 10/09/2014
DATA D'EMISSIÓ: 10/09/2014

Acreditat per ENAC segons la norma UNE-EN ISO/IEC 17025:2005. Acreditació núm. 563/LE2062.
Certificat per SGI segons la norma ISO 9001:2008. Certificat núm. 536/45.
Inscrit en el Registre de laboratoris de sòls ambientals i alimentaris. Núm. Registre LSAA-150-00.
Establiment Tècnic Auxiliar de l'Agència Catalana de l'Aigua (ACA).
Laboratori d'Assaigs per al Control de Qualitat de l'Edificació amb Declaració Responsable núm. LD600094 presentada a la Generalitat de Catalunya en data 01/10/10.
Reconegut per DAR. Núm. Registre 212.
Acreditat pel DAR. Núm. Registre 307.

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Pàgina 1 de 1

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From the soil sample to the soil analytical sheet

4.- Use of soil analysis in soil mapping

Challenges:

- **Speed or turn around time (soil sampling- soil analytical data)**
- **Cost of the analytical process in relation to the overall cost in Soil Mapping Projects**
- **A better interaction between Soil Map producers and Soil Analyst concerning soil data characteristics**
- **The introduction of new analytical data in the standard soil analysis procedure. E.g.: NIR data in soil laboratory samples**
- **The change of analytical methodologies when new methods could allow for a better soil data information**

5.- Soil analysis mostly used in soil mapping

About analytical methods:

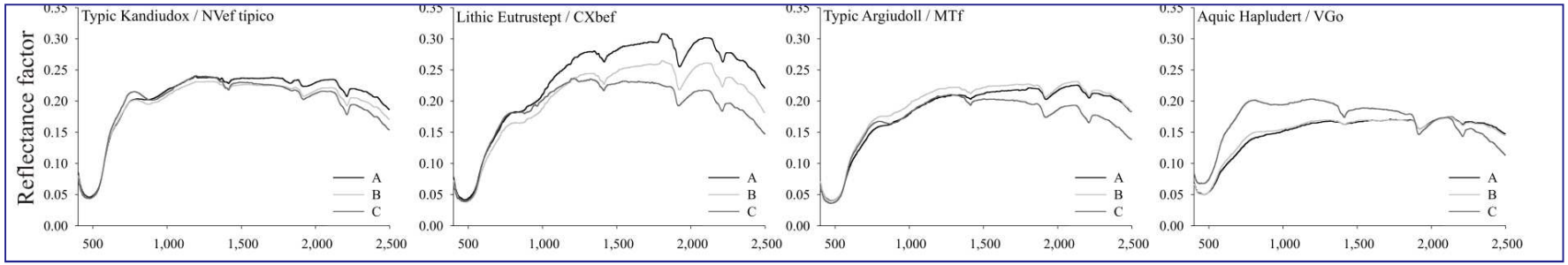
- **Some notes about analytical methods**
  - **“Most of them” are internationally applied. “Most of them” remain local or regional.**
  - **Soil analysis methodologies are difficult to change**
  - **Some analytical methods are country-adapted; they have a tradition for specificity soil local characteristics**
  - **International methods are submitted to inter-comparison exercises and they allow a better transfer of data between soil specialist teams**

4.- Most frequently requested analytical data

SOIL ANALYTICAL PARAMETER	OBSERVATION
pH	Certain variability in the method if not strictly applied
Electrical conductivity	Essential for soil salinity evaluation
	Additional analysis pHe, CEe, anions and cations for salinity diagnostic
Organic carbon	Two main methods of work
Calcium carbonate equivalent	Two main methods of work
soil granulometry	Different methods (Robinson, Bouyoucos), different limits between fractions
Cation exchange capacity	Different methods with several limitations
Soil water availability	Difficult soil analysis test
Soil nutrients	amonium acetate predominant for cations. P different extractants
Soil micronutrients	Dominant methods
Heavy metal	Different methods
Saliniyty parameters	Extract of saturated paste

6.- New methods of soil data generation

1.- NIR Analysis (in lab. with treated soil sample

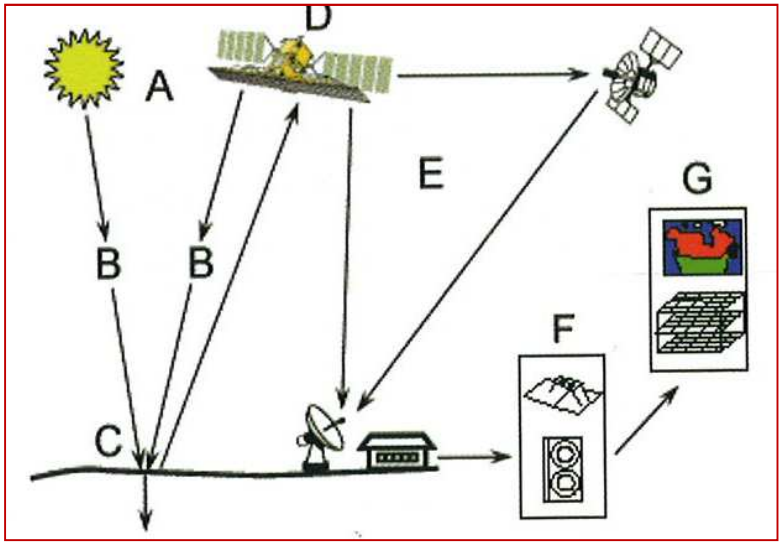


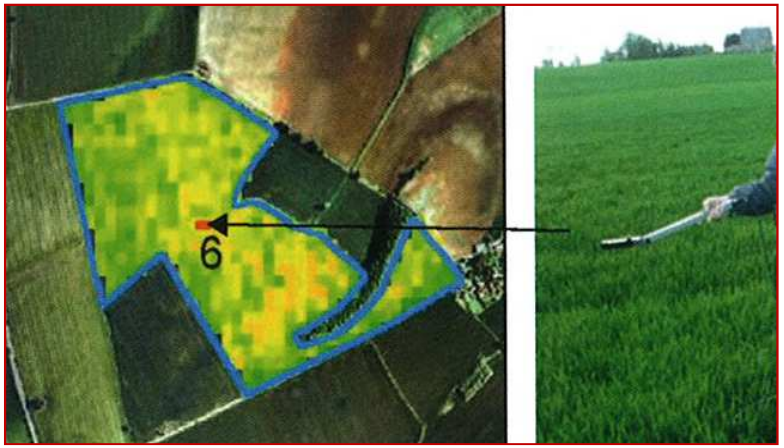
2.- Multi- extracting methods. Objectives:

- To optimize the analytical work
- To reduce time, cost

Problem: results interpretation

6.- New methods of soil data generation





Remote or proximal spectral sensing data (without soil sampling)
Constraints:

- **They mostly concern with vegetation spectral response**
- **Concerning soil they concern with soil surface reflectance**
- **Validation, robustness of the method**

7.- Additional notes and conclusions

- **Soil survey and soil mapping rely in objective, precise, soil analytical data**
- **Basics components of soil map (i.e. mapping units and soil description) are based upon reliable soil analytical data**
- **International, well known analytical methods are the reference. However “local” methods and historical data imply the use of local methods which are often oriented to local conditions**

7.- Additional notes and conclusions

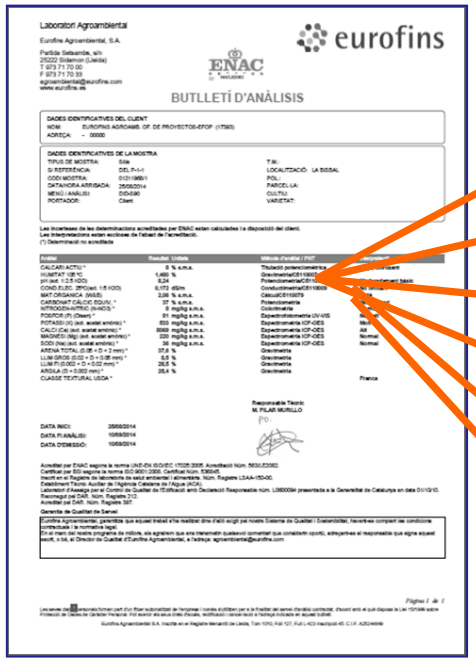
- **NIR methods could accelerate the soil analytical data production. They could amplify the number of samples to be analyzed in routine surveys**

- **Remote or proximal sensing methods obtaining spectral responses directly from the field are being incorporated to soil mapping. They are less related with soil analysis**

- **Soil surveyors and soil analyst should cooperate strongly in order to optimize the soil data generation and usefulness**

From the soil observation to the soil analytical data

Field data



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Laboratory data

- pH:7,1
- $CaCO_3$:12%
- OM:3,3%
- Clay: 9%
- P: 7 ppm
- Others

“Soil analysis: a tool for learning” (Blackmer, 2003)

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