Problems and Solutions in Harmonizing Soil Survey Data in the EU

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Content of the presentation

- EU expectations on harmonized digital of soil information
- The EU and the WRB / other standards
  → problems /solutions (?)
- Outside Europe

EU Thematic Strategy for Soil Protection, the development of the Soil Framework Directive and other EU and international programmes has resulted in an increasing demand for **harmonized** soil information.

Adopted by the European Commission 22nd of September 2006

- COMMUNICATION COM(2006) 231 on the **Thematic Strategy for Soil Protection**
- Draft DIRECTIVE COM(2006) 232 establishing a **framework for the protection of soil** and amending Directive 2004/35/EC
- IMPACT ASSESSMENT SEC(2006) 620 of the Thematic Strategy for Soil Protection

The importance of the strategy

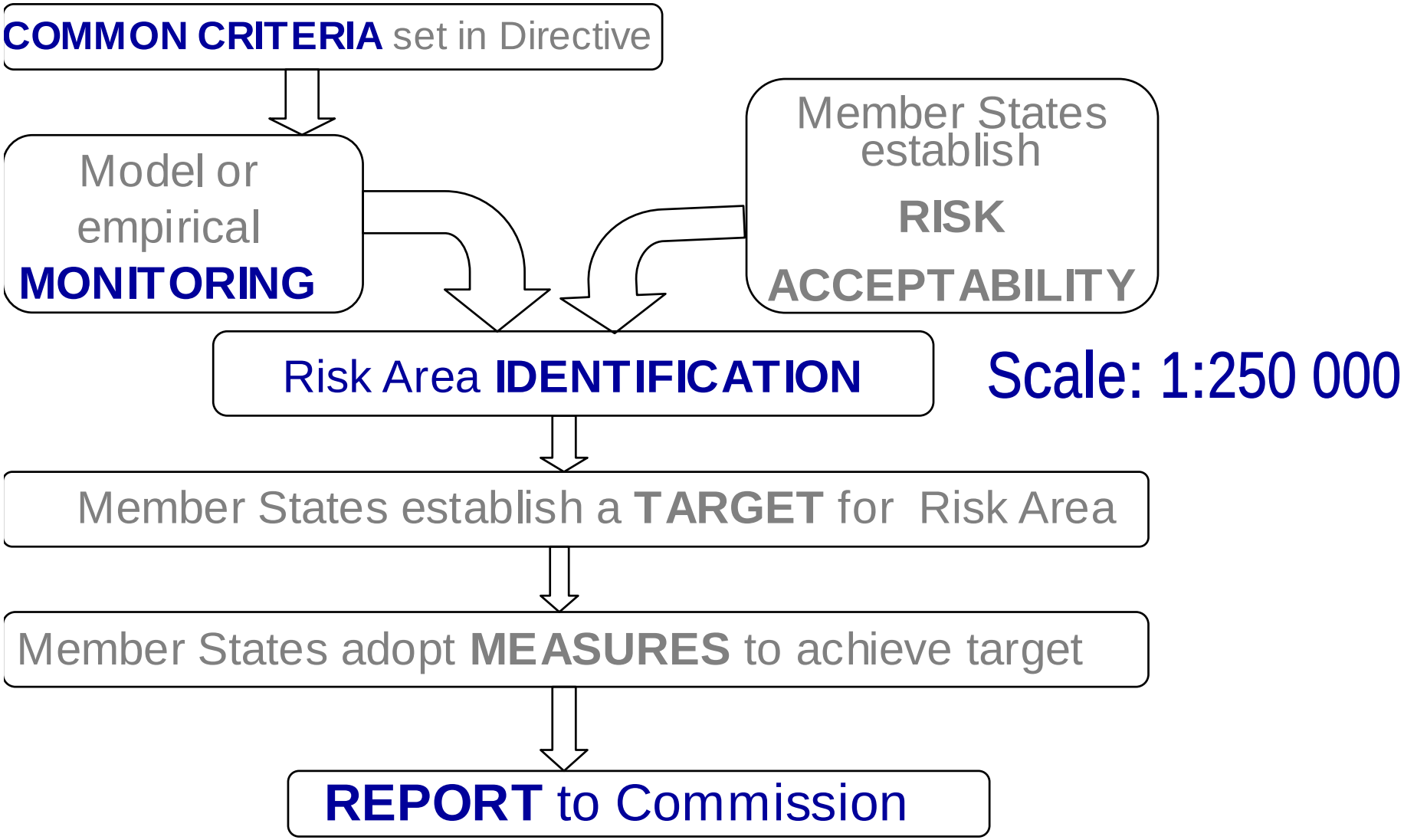
- Soil and it’s functions defined
- Influence on human life / health defined
- Need for protection on it’s own defined
- Threats to normal functions defined
- Several publicizing material got funded

Threats to soil functions as originally identified in COM(2002) 179

- Erosion
- Decline in organic matter
- Soil contamination
- Soil sealing
- Soil compaction
- Decline in soil biodiversity
- Salinization
- Floods and landslides

Framework legislation (1)

Erosion, organic matter decline, salinization, acidification, compaction and landslides



Expectations / needs

- Harmonized maps on soil resources
- Harmonized observations / data bases and maps mainly on properties limiting soil functions (property / functional maps)
- Definition and delineation of „risk areas”

Problems

- Data collection methods of inventory and monitoring are very diverse
- Almost all member states have their own national soil classification systems
- Data base structures and availability are diverse

→ comparison of soil conditions difficult at EU level

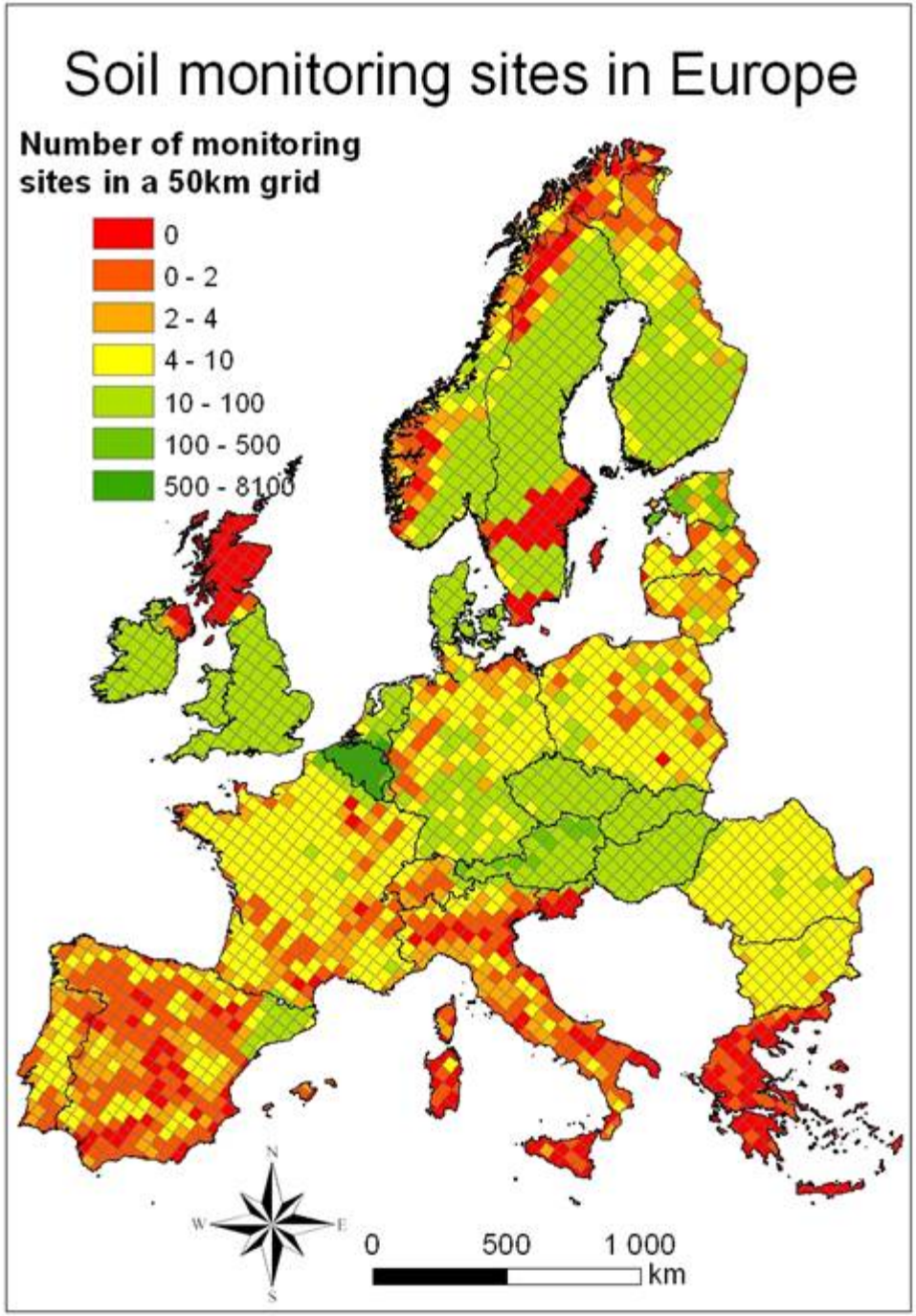
Solutions

- Development of common soil characterization methods (EU funded integrated projects);
- The European Commission JRC has adopted the WRB as a correlating scheme for harmonized soil information / maps in Europe;
- Working Groups have been set up for developing guidelines for the 1:250 000 maps and data bases.

ENVASSO

ENVironmental ASsessment of Soil for mOnitoring

The objective was to define and document a soil monitoring system for implementation in support of a Soil Framework Directive, aimed at protecting soil in the EU

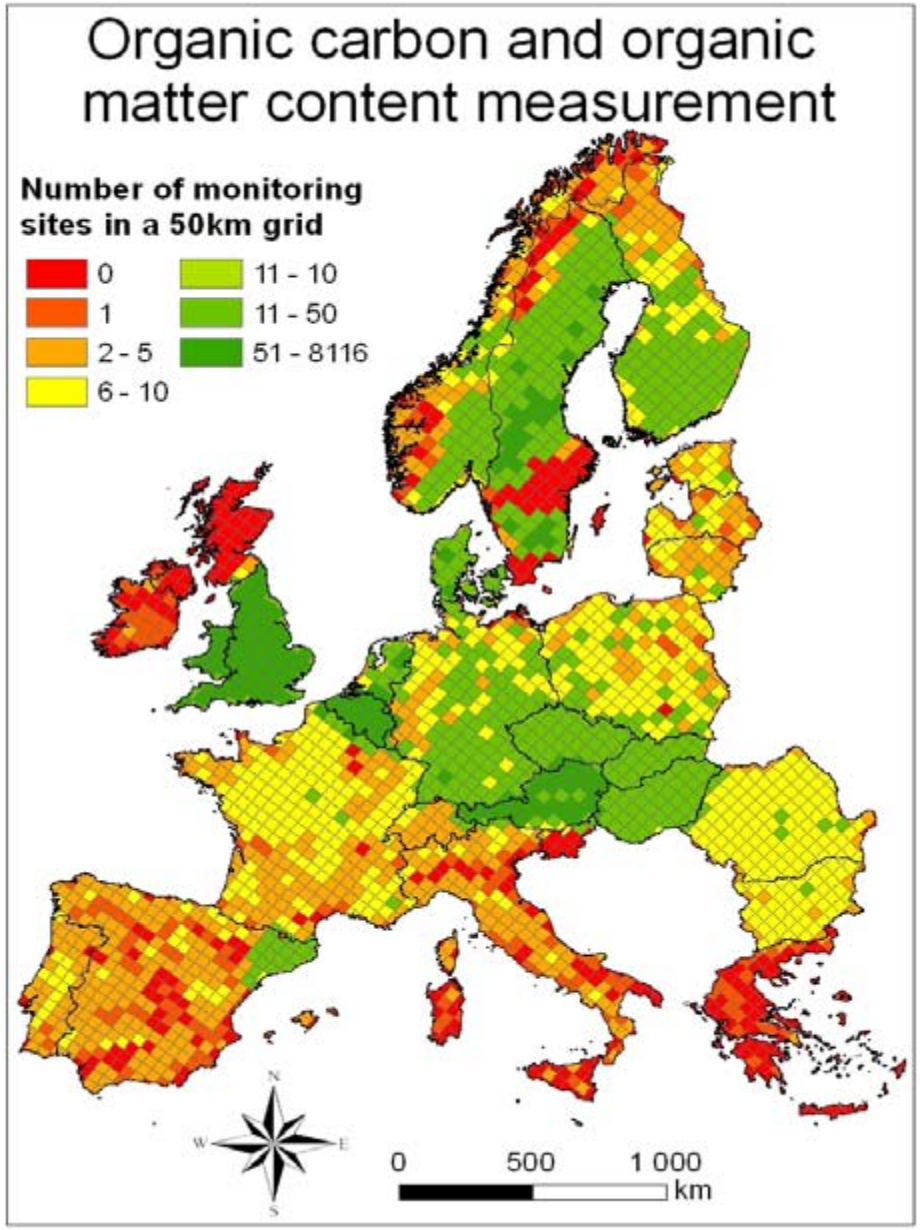


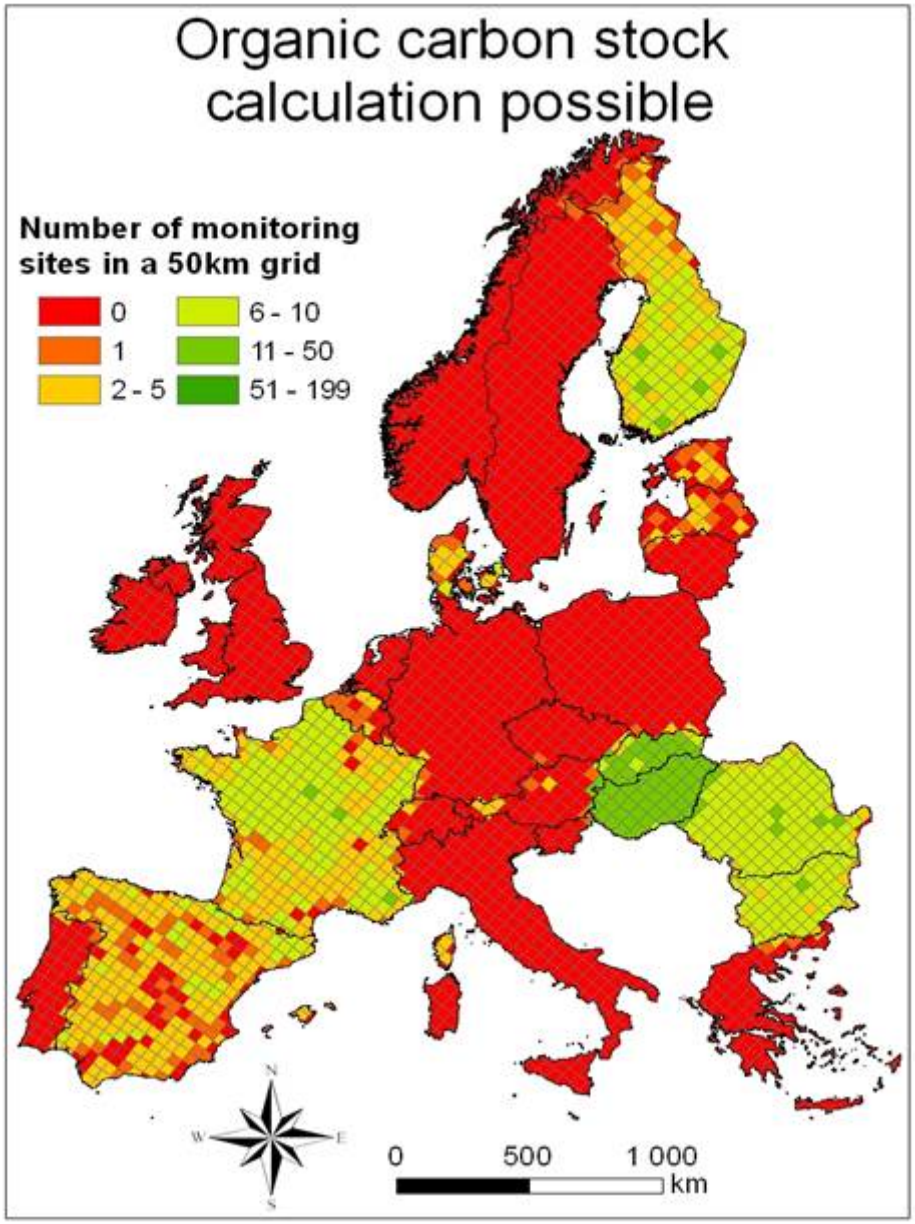
Aggregation on a 50 to 50 km grid

=>

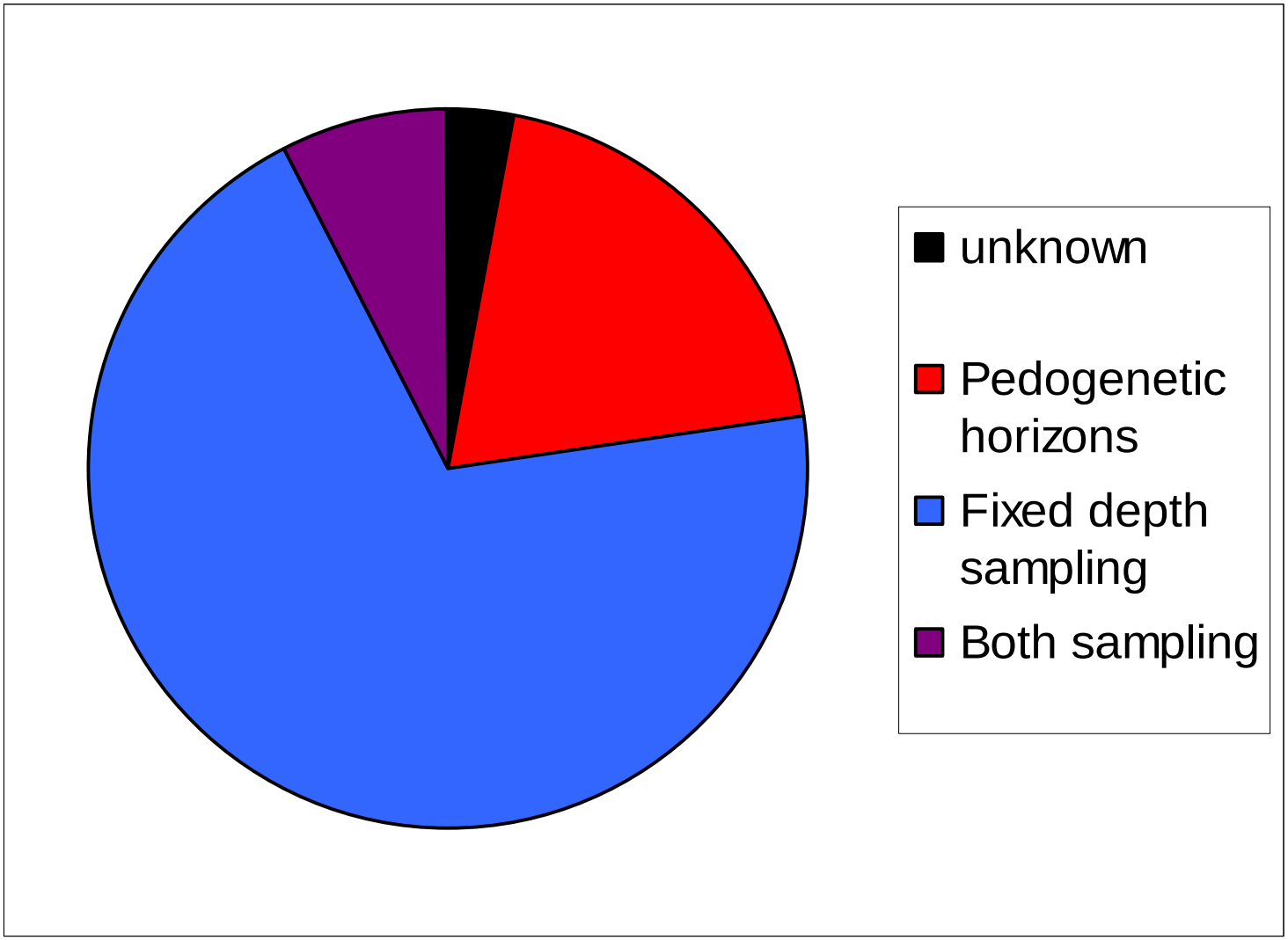
A great heterogeneity

Gaps in southern EU

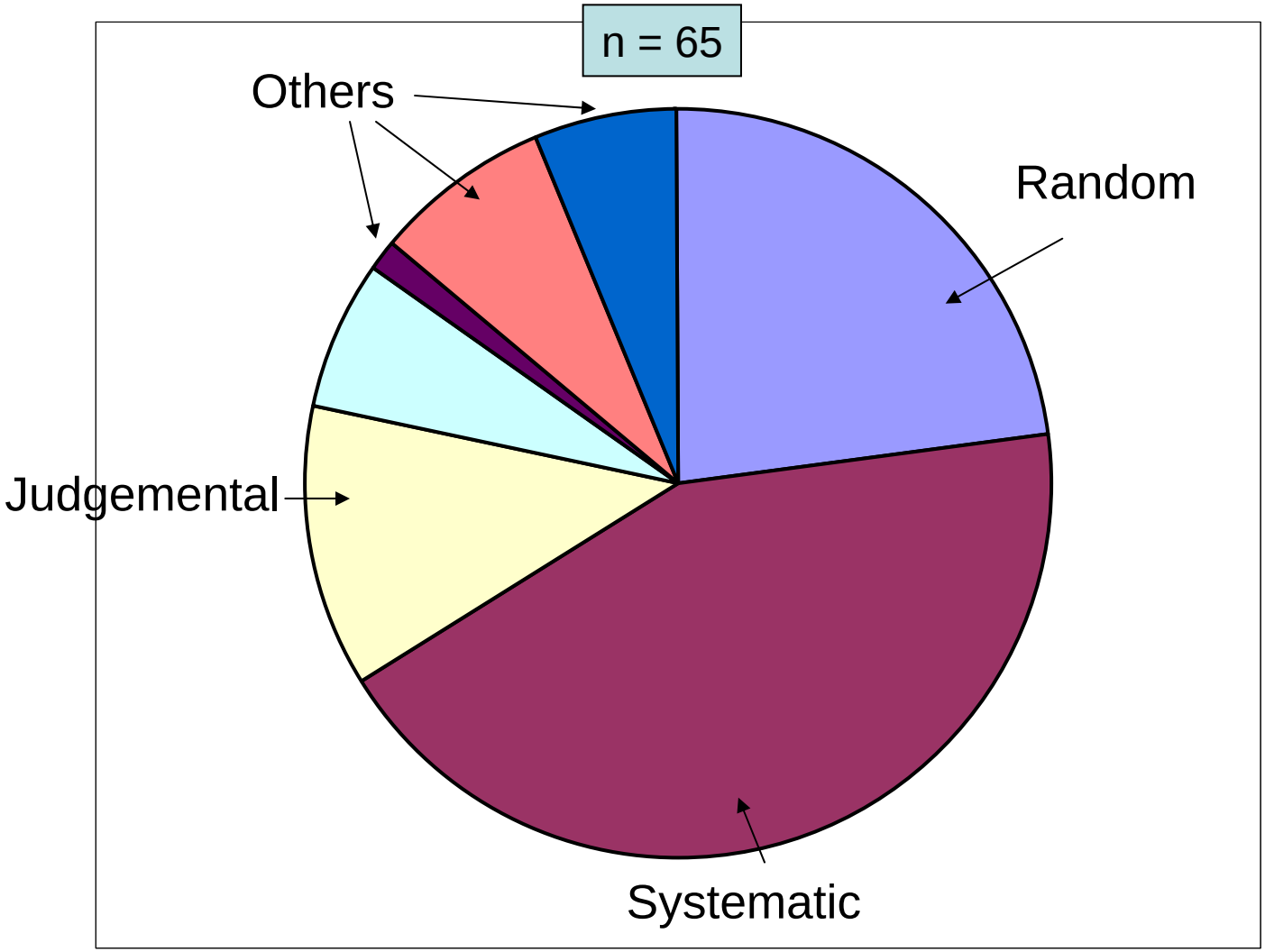

Organic carbon and organic matter content measurement
Number of monitoring sites in a 50km grid
0
1
2 - 5
6 - 10
11 - 10
11 - 50
51 - 8116
N
W
E
S
0
500
1 000
km


Organic carbon stock calculation possible
Number of monitoring sites in a 50km grid
0
1
2 - 5
6 - 10
11 - 50
51 - 199
N
W
E
S
0
500
1 000
km

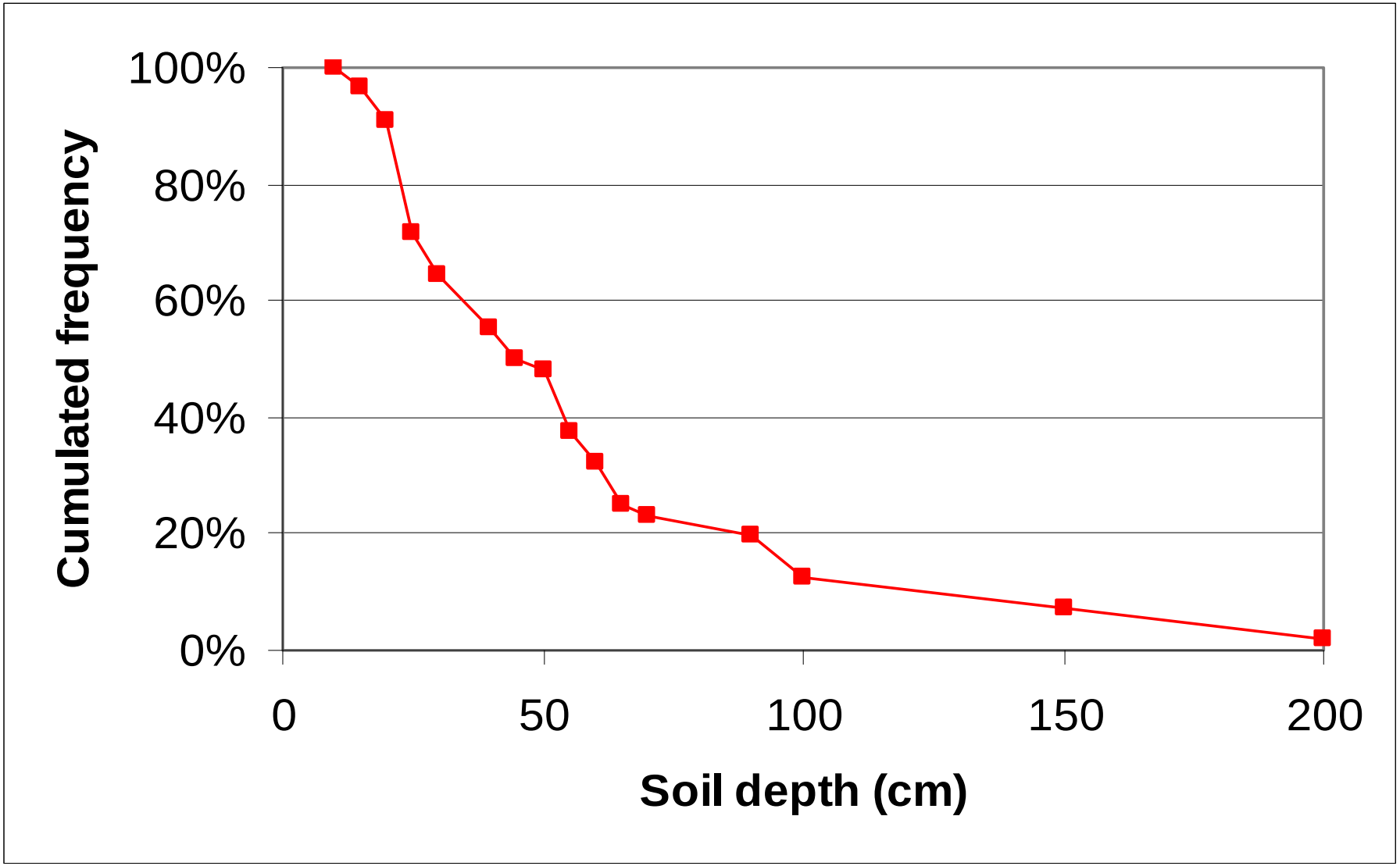
Vertical sampling design



Choosing sites



Maximal depth of sampling



Main outputs

1. **Measurable criteria for indicators** and thresholds for the assessment of soil status

2. **Procedures / protocols** for inventory and monitoring

IUSS Alert – 49 (May 2009)

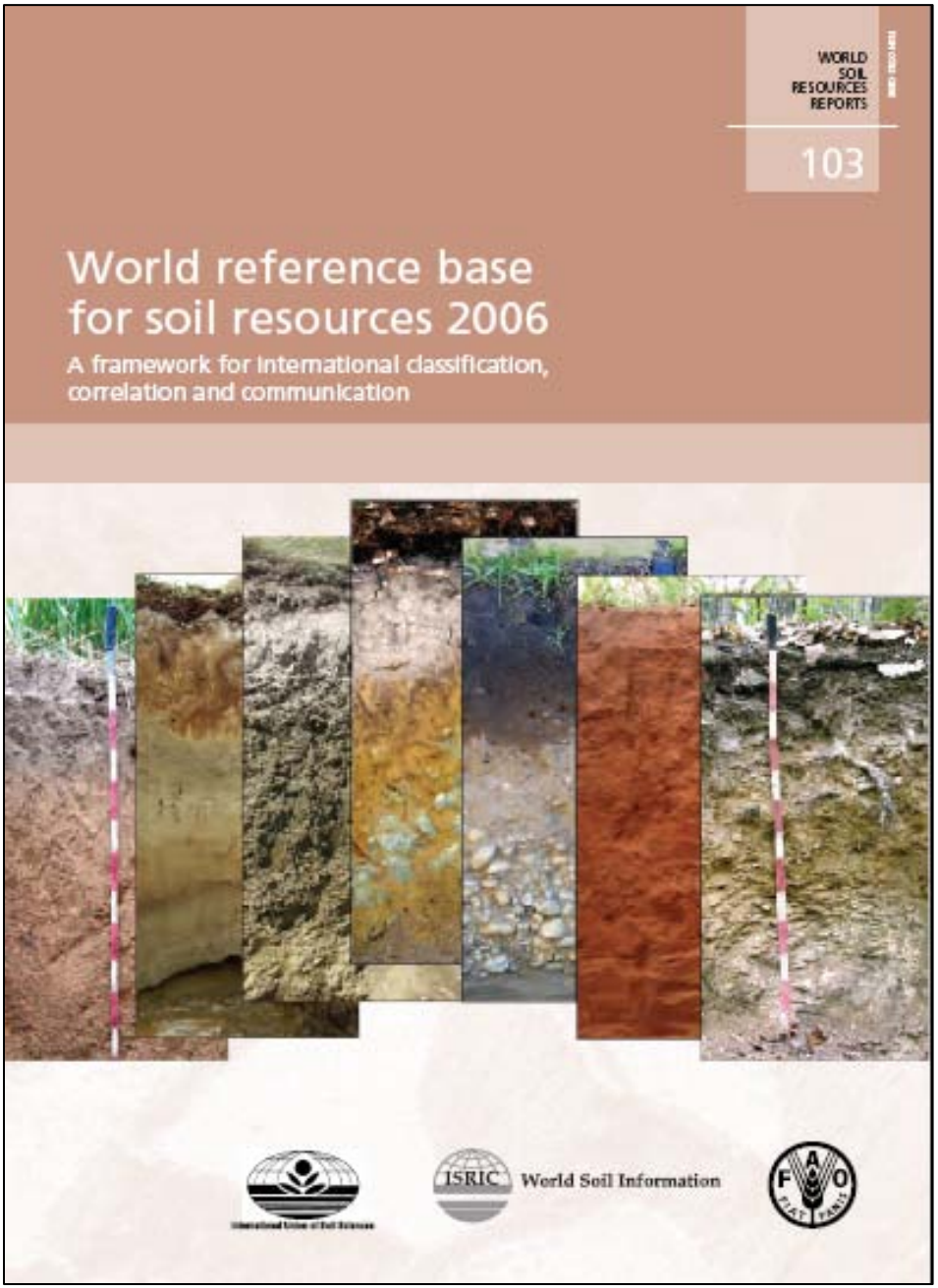
Information for and from the global soil science community

Bravo ENVASSO

- The ENVironmental ASsessment of Soil for mOnitoring (ENVASSO) Project was funded as Scientific Support to Policy (SSP) under the European Commission 6th Framework Programme. The project's main objective was to define and document a soil monitoring system for implementation in support of a Soil Framework Directive, aimed at protecting soil in the EU. The ENVASSO Consortium, comprising 37 partners drawn from 25 EU Member States, succeeded in reviewing existing soil inventories, monitoring programmes, soil indicators and criteria that could serve as a base for a soil monitoring system for Europe. Procedures and protocols appropriate for inclusion in a European soil monitoring system were defined and fully documented and 22 of these procedures were evaluated in 28 Pilot Areas. In conclusion, an outline European Soil Monitoring System, comprising a network of geo-referenced sites at which a qualified sampling process is or could be conducted, is presented.

The six final reports from the ENVASSO project can be downloaded here

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

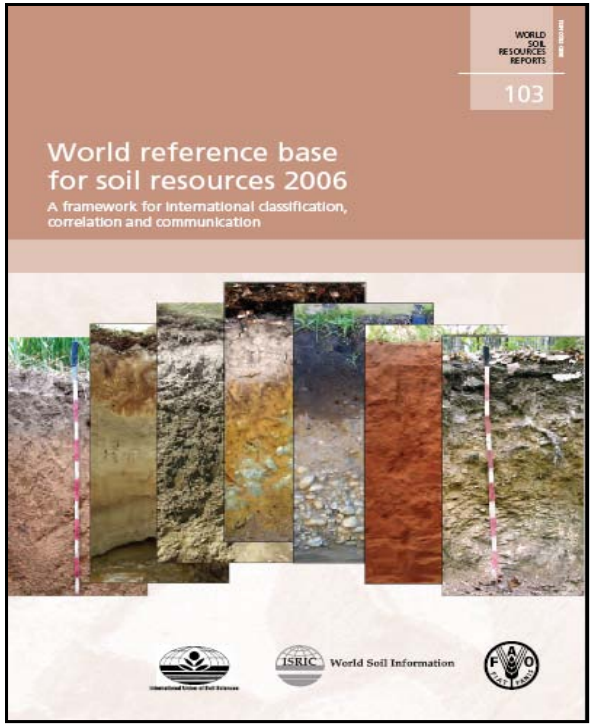


The WRB

The official soil correlation system of IUSS / for all soil scientists.

The EC JRC selected the WRB as common scheme for harmonized soil maps and databases for Europe

Basic questions



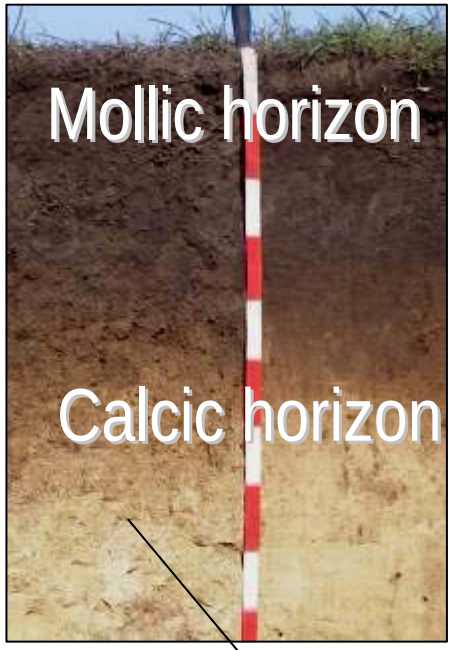
Can WRB (2006) be used :

- as a tool for unifying soil information?
- for identification /delineation risk areas?
- for building databases and map legends?

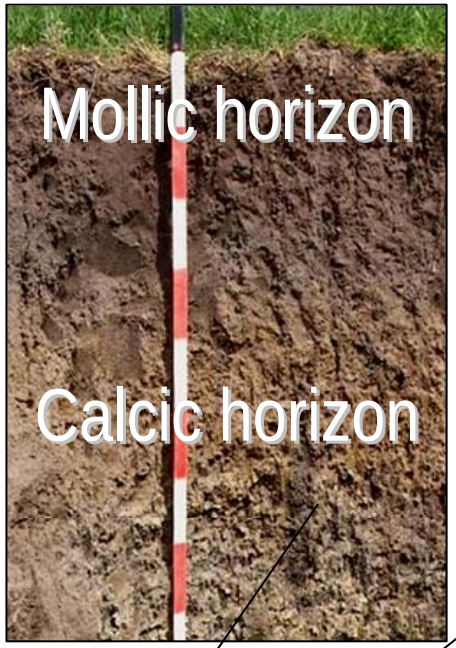
The WRB allows soils from different regions or countries to be identified and characterized with the same terminology.

Csernozjom (H)

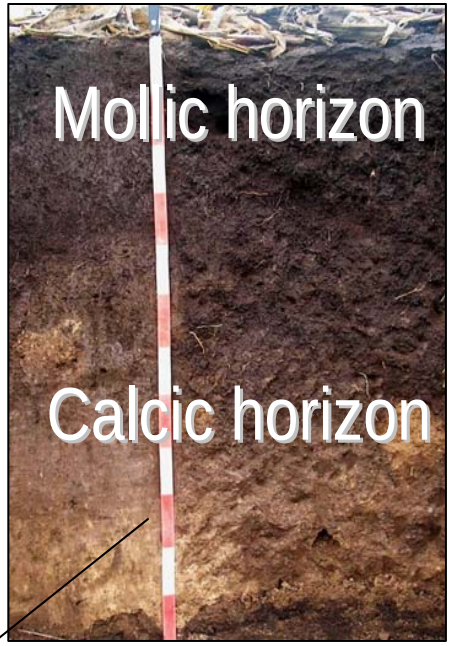
Cernice (Cz)



Schwarzerde (D)



Mollisol (USA)



Chernozems (WRB)

Allows soil from different regions or countries to be identified and characterized with the same terminology.

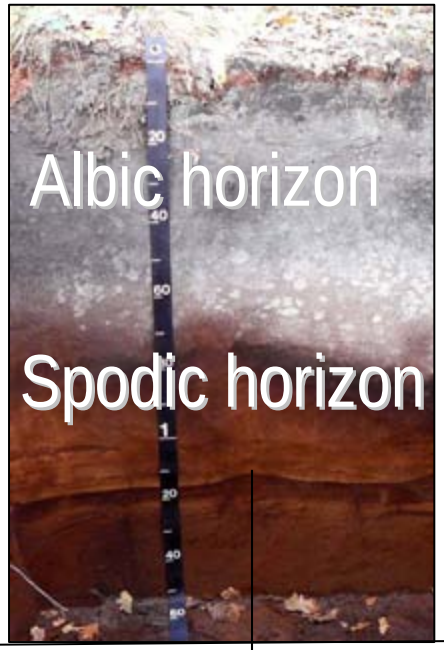
Podzol (H)

Alisol (WRB)

Podzol (Ir)

Luvisol (WRB)

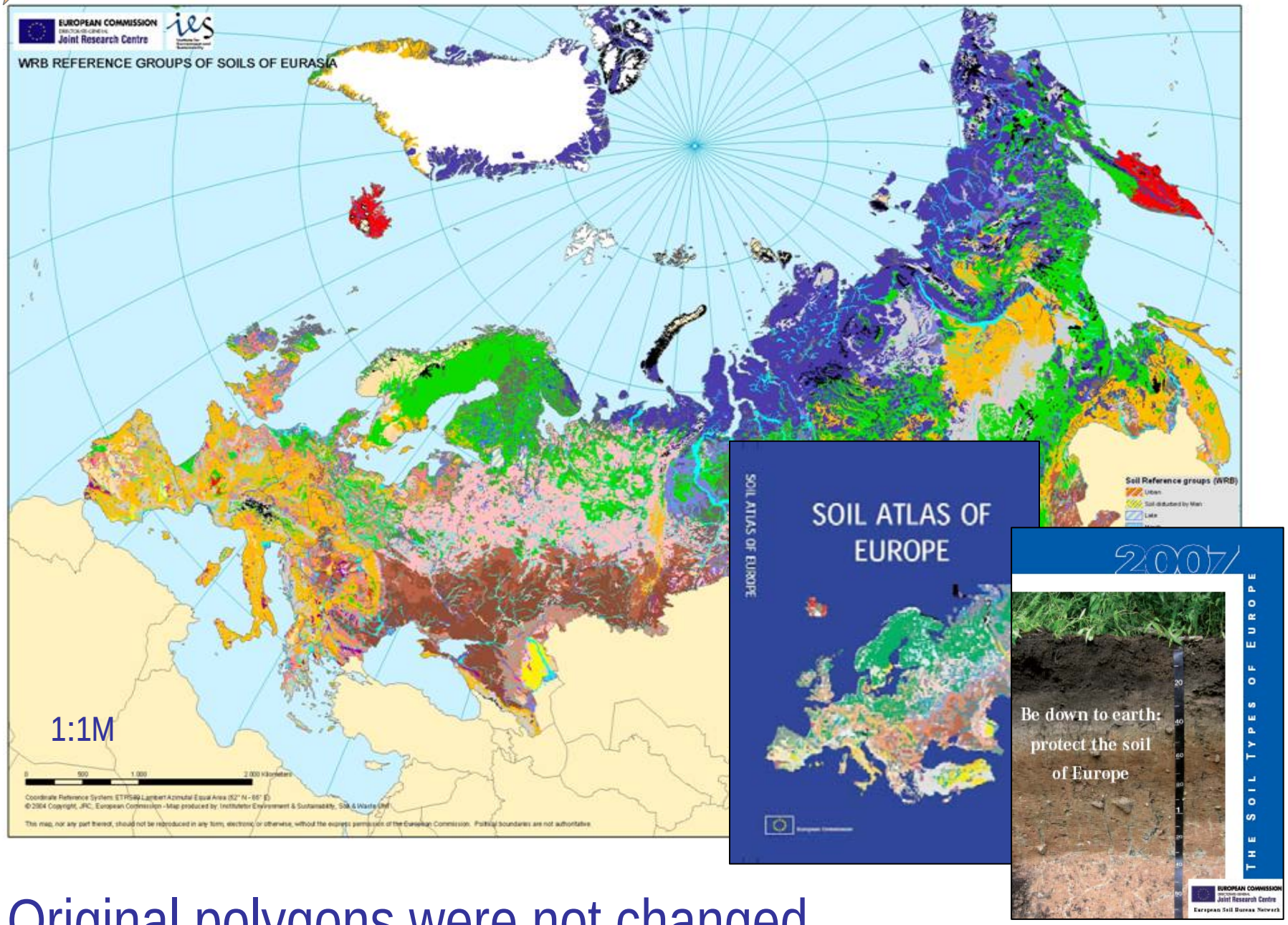
Podzol (Fr)



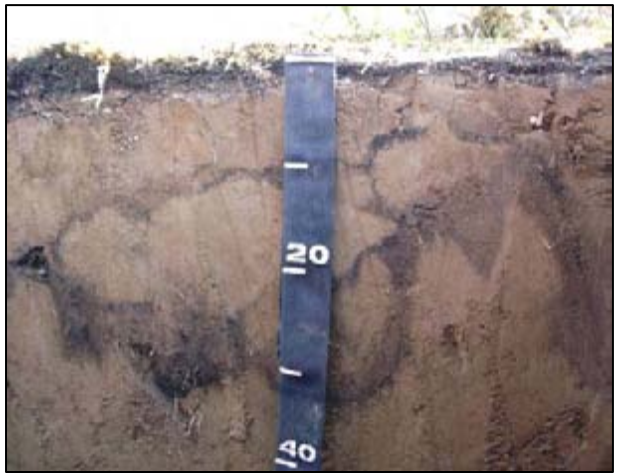
Podzol (WRB)

Podzol (Cz)

Podzol (WRB)

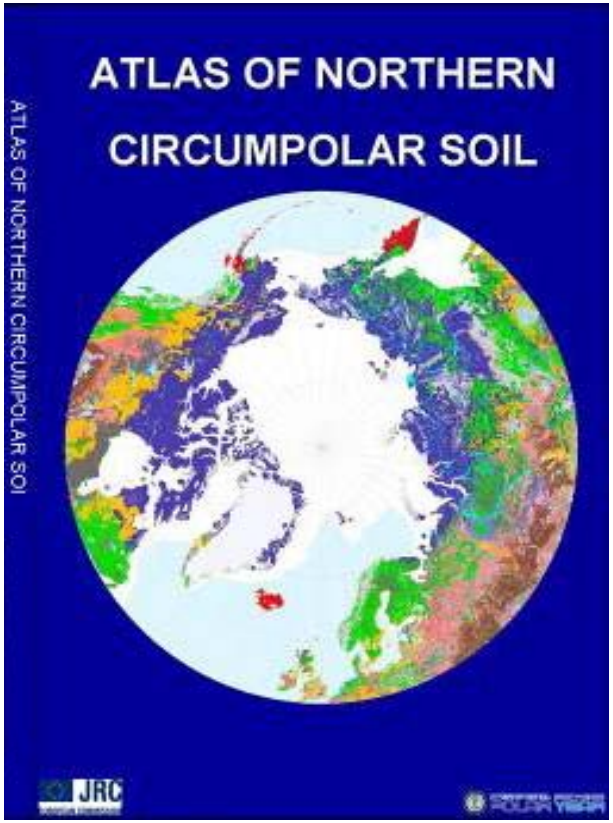


Original polygons were not changed



Gelisols (ST)

Cryozems (Russia)



Cryosols (WRB)

Conclusions

- In case of proper correlation, methodology and terminology problems occur;
- There are consequences on spatial distribution;

→ Pressure on member countries

(however there are good transnational examples)

Further problems

- Stability of the scheme (WRB 1998 / 2006)
  - New Major Reference Soil Groups
  - Qualifiers (some dropped, too (?) many new)

- Application of the WRB for map legends at scales larger than 1:1M does not work with the current set of qualifiers

Basic principles of the WRB

The classification of soils is based on soil properties defined in terms of diagnostic horizons, properties, materials

It comprises two categorical levels

- Reference Soil Groups (32) defined by key
- qualifiers (descriptive elements of important properties) only in priority listing

Qualifiers 2006

Prefix qualifiers

Most typical for the RSG

Intergrade qualifiers

Suffix qualifier

other qualifiers

diagnostic horizons,
properties or materials;
chemical characteristics;
physical characteristics;
mineralogical characteristics
surface characteristics
textural characteristic
colour
remaining qualifiers.

Cutanic Luvisols

Cutanic
Calcic

Cutanic
Stagnic
Albic

Cutanic
Leptic
Albic

WRB 2006/2007
Luvisols
prefix qualifiers

Lamellic
Cutanic
Albic
Escalic
Technic
Leptic
Vertic
Gleyic
Vitric
Andic
Nitic
Stagnic
Calcic
Haplic

Solution

Addendum to the World Reference Base for Soil Resources was elaborated:

Guidelines for constructing small-scale map legends

- Rational for the new ranking
- Listing of the selected / ranked qualifiers
- Rules to apply the qualifiers for map scales of
  - 1 : 5 000 000 and smaller
  - 1 : 1 000 000 to 1 : 5 000 000
  - 1 : 250 000 to 1 : 1 000 000
- Examples

The guidelines are based on the following considerations

- The soil units and their ranking in the FAO-UNESCO Legend of the Soil Map of the World (SMW);
- The occurrence and significance of soil properties in other classification systems (ST and others);
- The relevance of the differentiation characteristics for environmental and management functions;
- The availability of soil information (legacy and modern);
- The mappability of soil characteristics at scales of 1:250 000 and smaller;

LUVISOLS

Main map unit qualifiers
Leptic/Skeletic
Gleyic
Stagnic
Albic
Vertic
Calcic
Manganiferric/Ferric
Arenic/Siltic
Rhodic/Chromic
Haplic

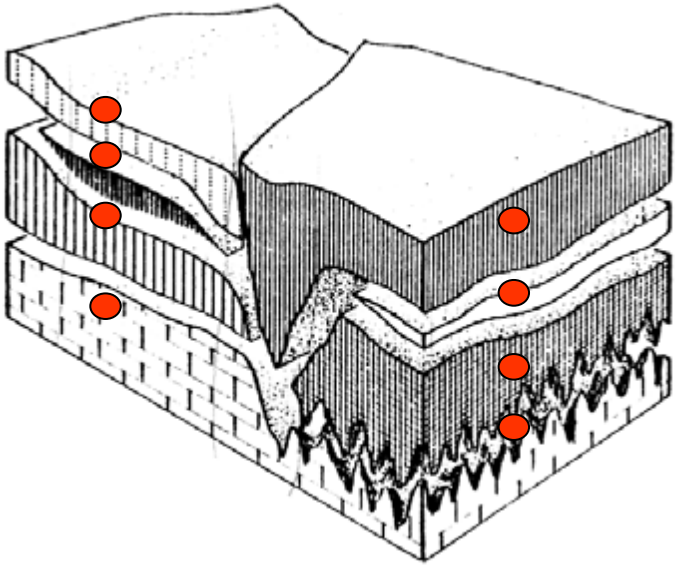
Optional map unit qualifiers
Abruptic
Andic
Anthric
Clayic
Cutanic
Densic
Epidystric
Escalic
Fragic
Gelic
Greyic
Humic
Hypereutric
Hyperochric
Lamellic
Nitic
Novic
Nudiargic
Oxyaquic
Profondic
Ruptic
Sodic
Technic
Transportic
Turbic
Vitric

The importance and applications
of the diagnostic categories and the qualifiers
in functional (property) map

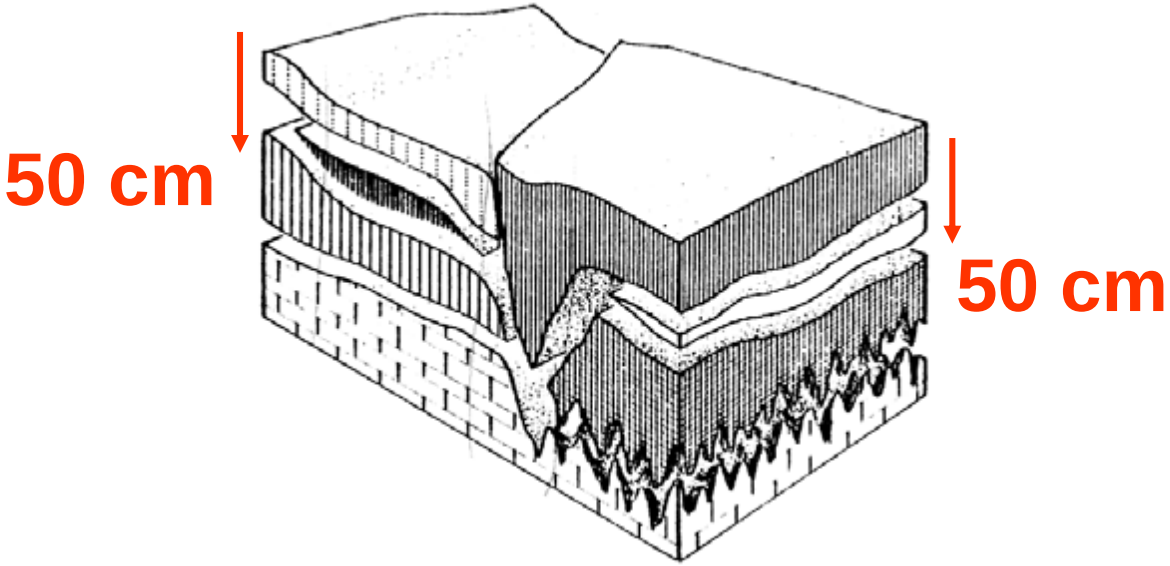
$\rightarrow$ risk area delineation

The diagnostics and the qualifiers are mostly quantitative and are generalized for different (the important) volume of the soil bodies.

- sample / single value



The diagnostics and the qualifiers are mostly quantitative and are generalized for different (the important) volume of the soil bodies. Definitions and limits cary important information on environmental and management functions.



Risk for Salinization

Risk = Sensitivity + Stress

Presence of

- soluble salts close to the surface
  (content, distribution, composition)
- shallow ground water table
  (or perched water)

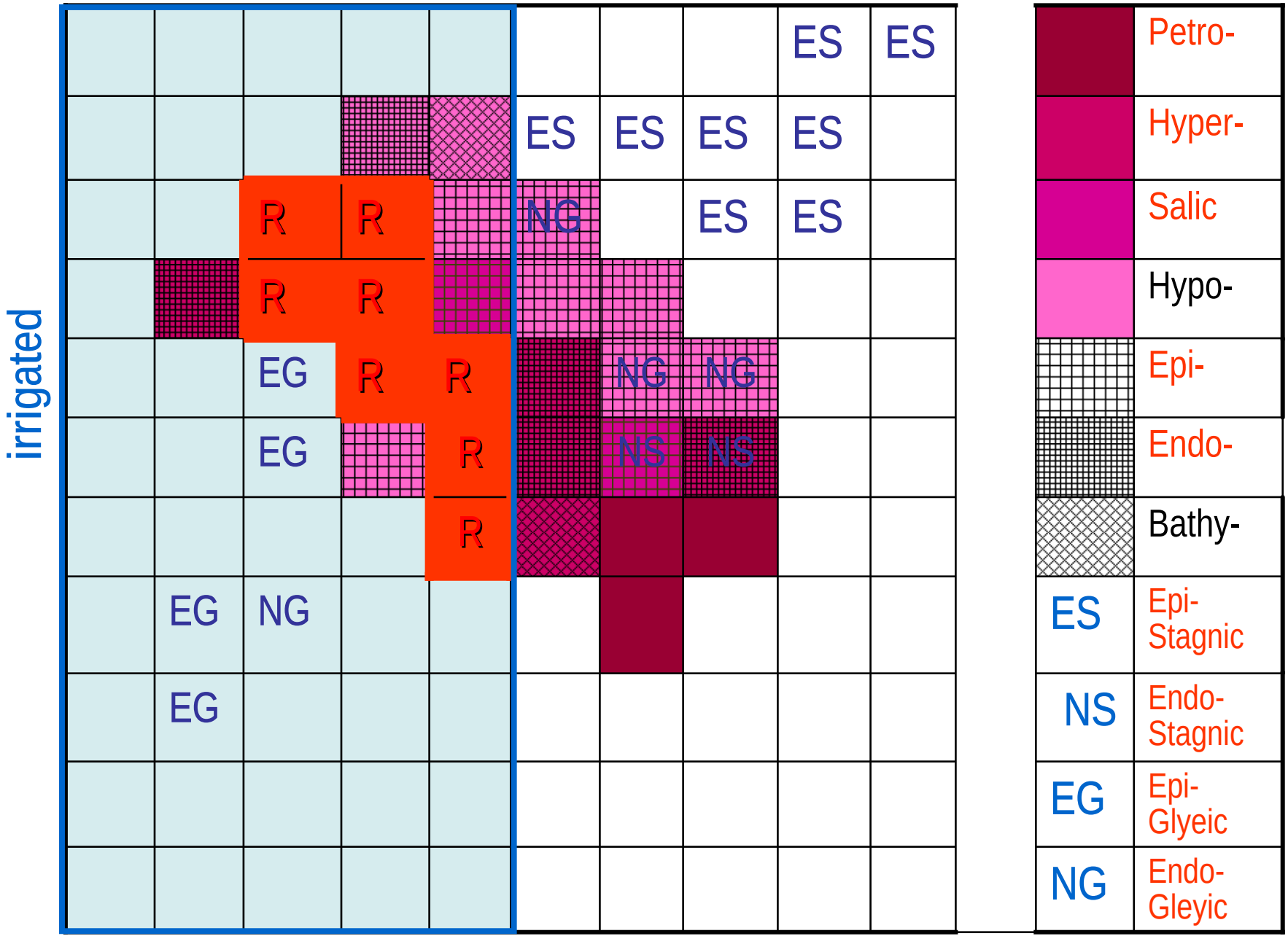
Irrigation

The diagnostic categories and qualifiers carrying „sensitivity" information, on salinization and sodification (WRB, 2006)

Category	Unit or description
Salt and Na content (Horizons/ qualifiers)	Salic horizon: EC $\geq$ 15 dS m-1 (or 8 dS m-1 if pH $\geq$ 8,5) Hypersalic qualifier: EC $\geq$ 30 dS m-1 (layer within100 cm) Hyposalic qualifier: EC $\geq$ 4 dS m-1 (layer within 100 cm Natric horizon: ESP $\geq$ 15 Sodic qualifier: Exchangeable Na + Mg $\geq$ 15% Hyposodic qualifier: Exchangeable Na + Mg $\geq$ 6%
Salt profile (depth specifier)	Epi-: within 50 cm of the soil surface. Endo-: between 50 and 100 cm Bathy-: between 100 and 200 cm
Hydrology (Diag. Properties)	Gleyic (Epi-, Endo-) shallow ground water table Stagnic (Epi-, Endo-): perched water

Potential Risk Area for Salinisation

(salt content + depth+ hydrology)



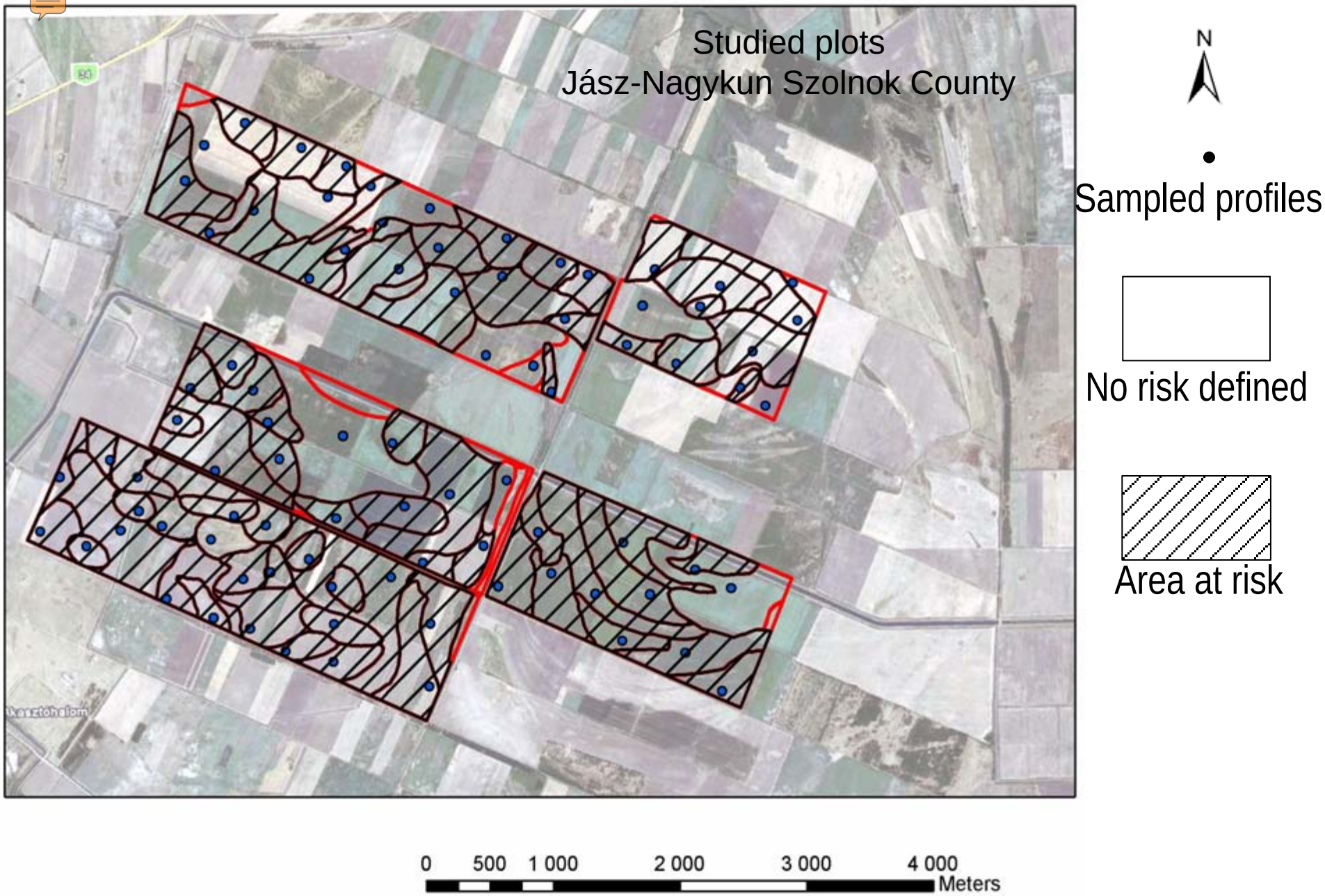
Test area

1400 ha in Jász-Nagykun Szolnok County (Hungarian Great Plain)

Soils: with soils of different levels of soluble salt and groundwater influence

(Chernozems with Gleyic and/or Sodic intergrades, small portion of Solonetz)

Irrigation and slurry application is practiced



Areas at risk to salinization and sodification delineated based WRB diagnostics

Conclusions

- The diagnostics and qualifiers carry most of the necessary information for the delineation of risk areas for several threats defined in the SP Strategy

  $\rightarrow$ recording all qualifiers ia very important

- The quantitative limits of units should be tested (reliable data needed)

Overall conclusions

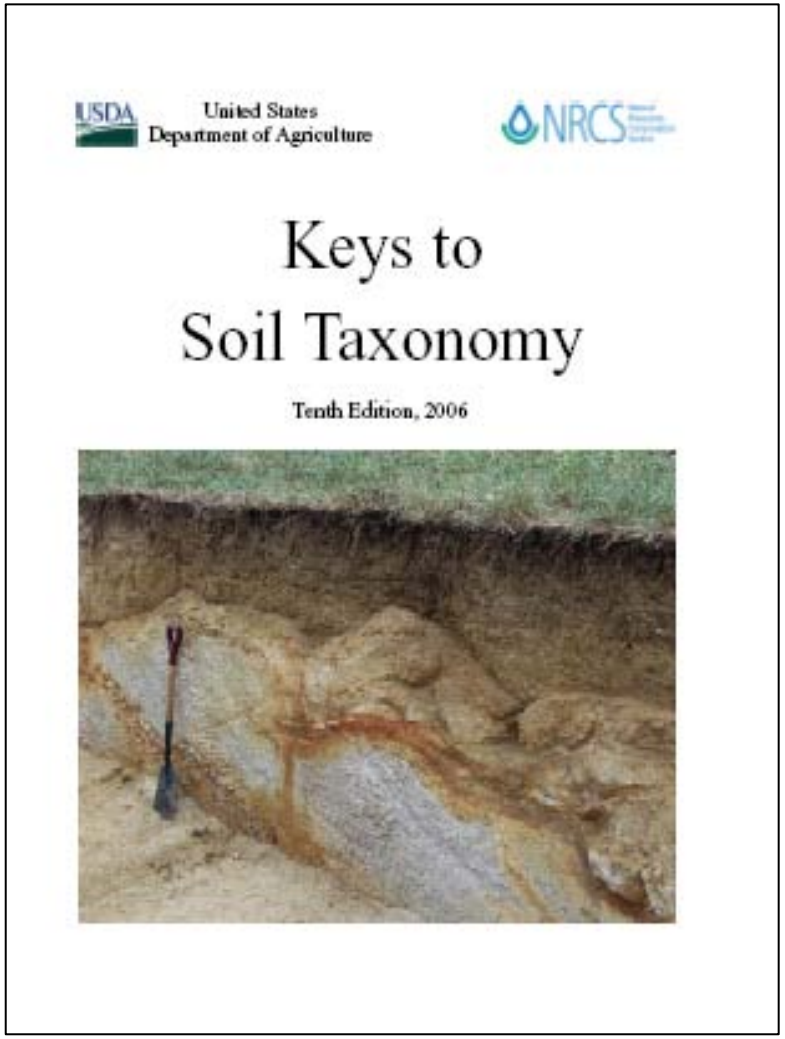
- The WRB could serve as a harmonizing tool for small scale maps / data bases in the EU
  - Methodology, terminology are very diverse
  - Correlator network does not exist
  - Operational network to coordinate surveys does not exist

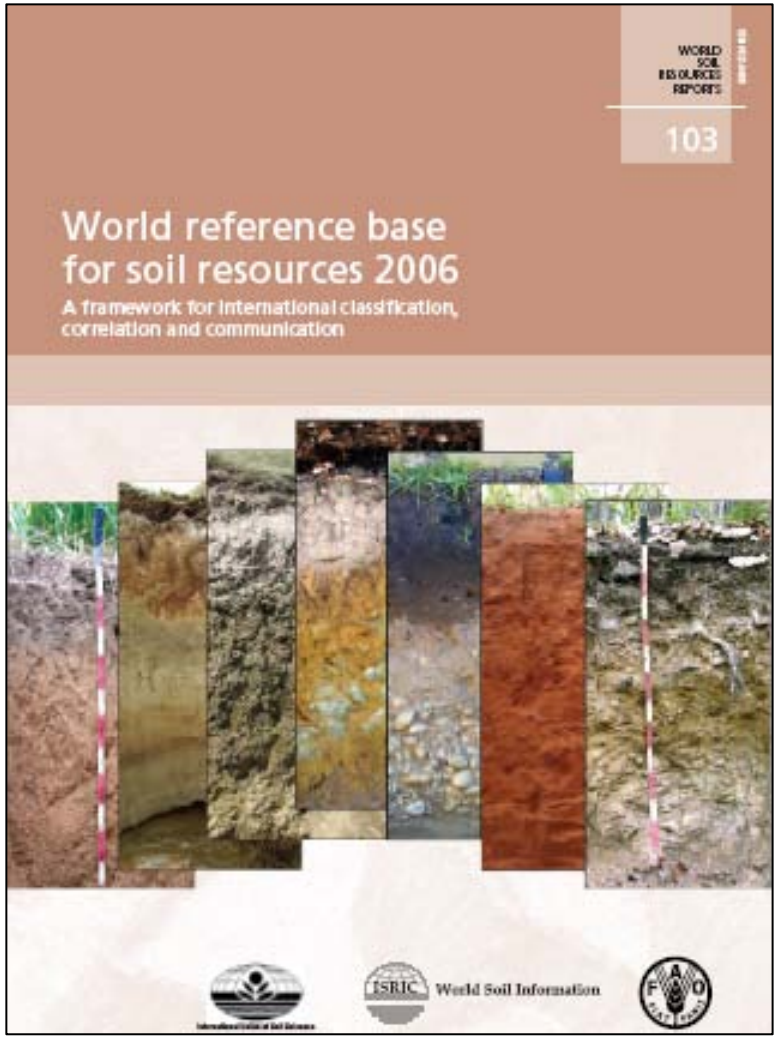
Outside Europe

- Global environmental problems exist
- Soil Classification (and other areas of soil science) lacks common terminology;
- That makes correlation difficult;
- Confusions in teaching soil classification;
- Other disciplines have difficulty using our info;

→ More and more non soil scientists are conducting soil research and create soil data and classes.

The two most commonly used soil classification systems





Results of harmonization of diagnostics

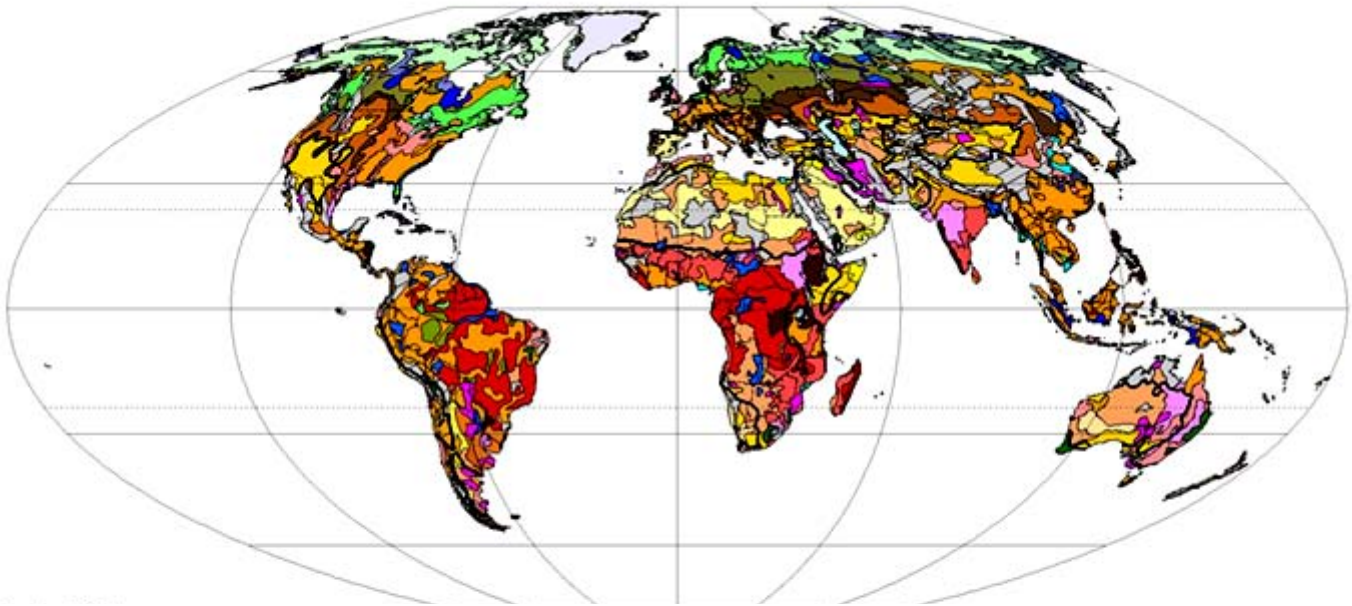
	WRB 1998	WRB 2006
Identical	2	3
Very Similar	8	22
Similar	22	17
Different	16	6
No counterpart	16	17

The harmonization efforts has been successful!

But there is still work to do…..

Thanks for having us here in your meeting!

ASA, SSSA meetings 2003, Co, USA



Suggestion for harmonized terminology in soil classification

Erika Micheli, SZIU, HU, WRB, IUSS
Bob Ahrens, USDA-NRCS, USA, Com. Soil Classification, IUSS
Luca Montanarella, EC, Joint Research Center, Ispra, I
Otto Spaargaren, WRB, ISRIC,Wageningen, NL

Basic principles

The classification of soils is based on soil properties defined in terms of diagnostic horizons, properties, materials

It comprises two categorical levels

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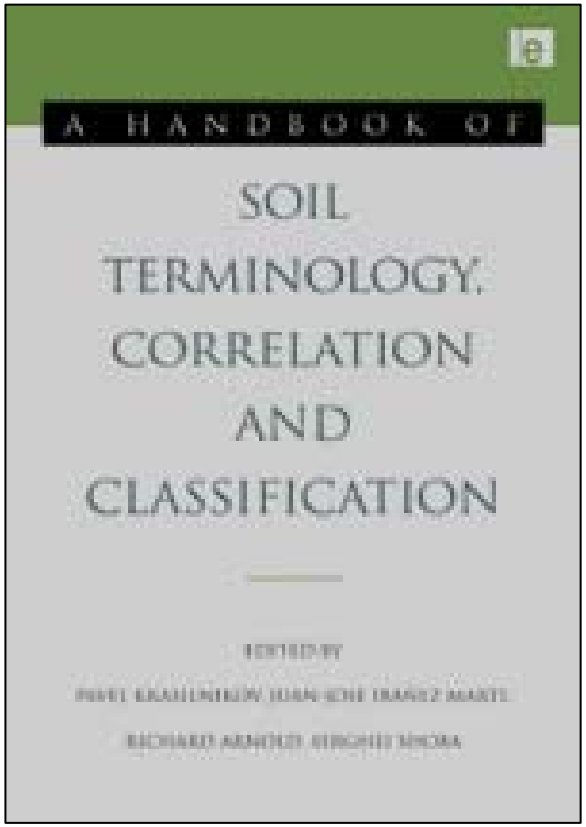
A Handbook of
Soil Terminology, Correlation and Classification



Edited by:
Pavel Krasilnikov,
Juan-Jose Ibanez Marti,
Richard Arnold,
Serghei Shoba

This book aims to clarify this position by describing and comparing different systems and evaluating them in the context of the World Reference Base (WRB) for Soil Resources.

Solution

Addendum to the World Reference Base for Soil Resources was elaborated:

Guidelines for constructing small-scale map legends

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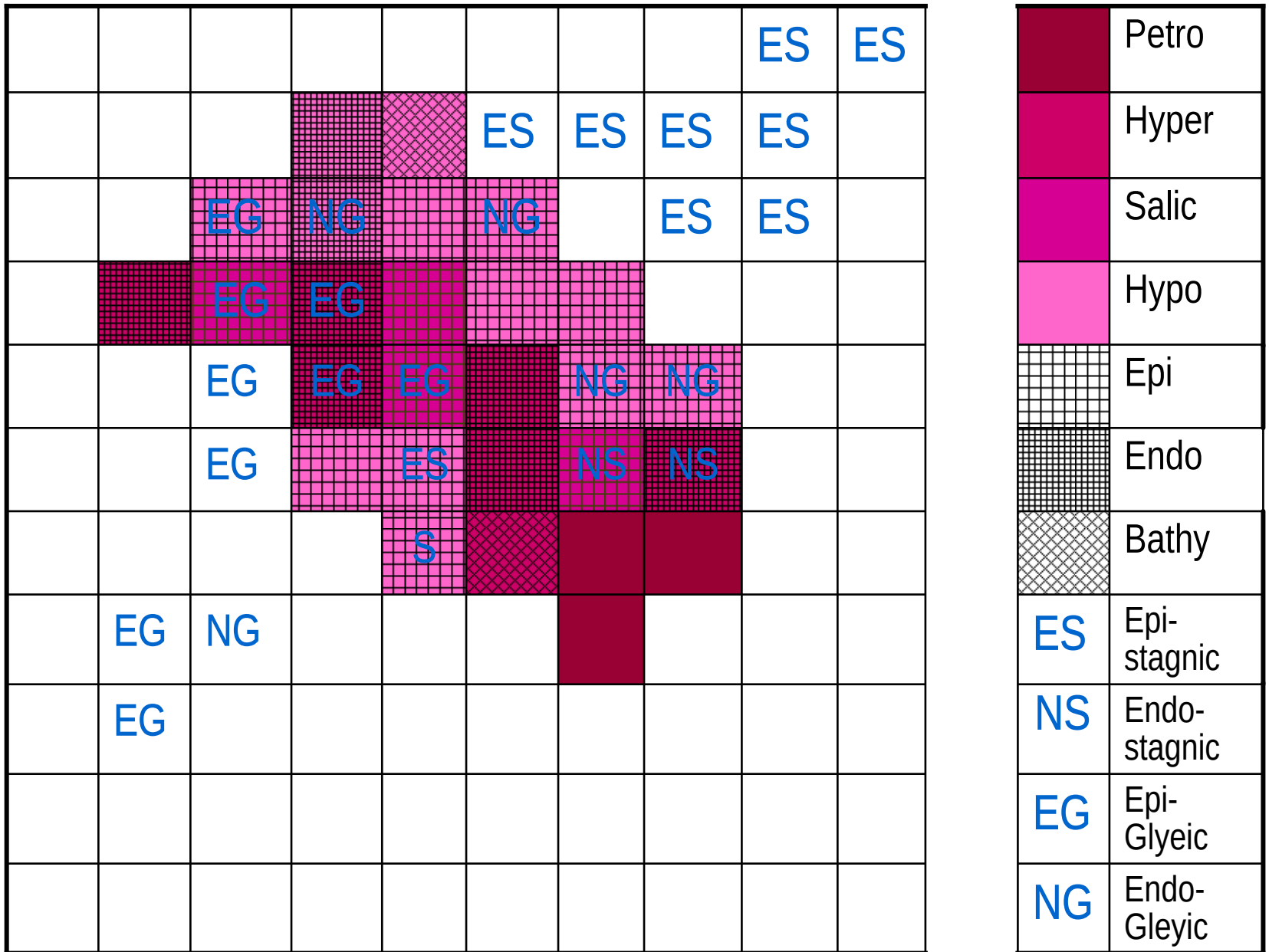
  1 : 1 000 000 to 1 : 5 000 000 (RSG + 2)

  1 : 250 000 to 1 : 1 000 000 (RSG + 3)
- Examples

Potential Risk Area for Salinisation
(salt content + depth+ hydrology)



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- Examples