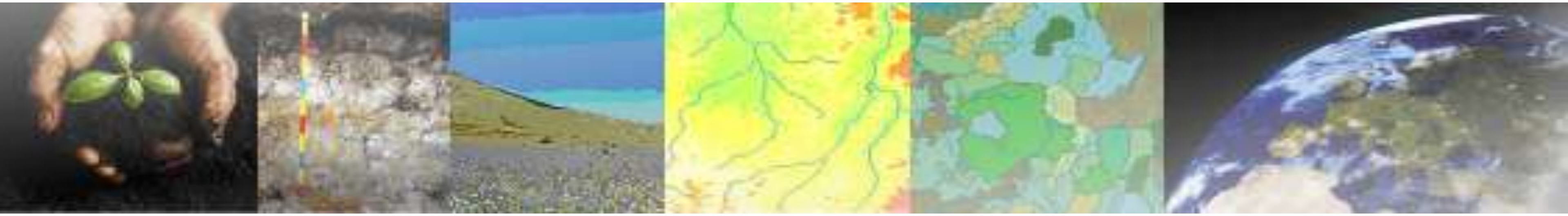
Developing the soil component of e-SOTER

Szent István University Soil Team

(Erika Michéli, Vince Láng present here)



Contributors

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LIST of subtasks

- Working out methodology for the spatial definition of soil units
- Revise the SOTER soil component data structure
- Compilation of the soil data base for the 1:1M windows (Filling the soil attribute database)

⇧

- Development of translation and correlation tools for harmonizing soil data

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Required input (from training data set)

ID	Loc X	Loc Y	Mollic	Argic	Eutric	Distric	Calcic	Vertic	…
1	34567	543213	1	1	1	0		1	0
2	345678	987654	0	1			1	1	0
3	345456	456778	1	0	1	0	1		0
…									
n									

1= present 0 = not present

e-SOTER

Argic Class Probability CE

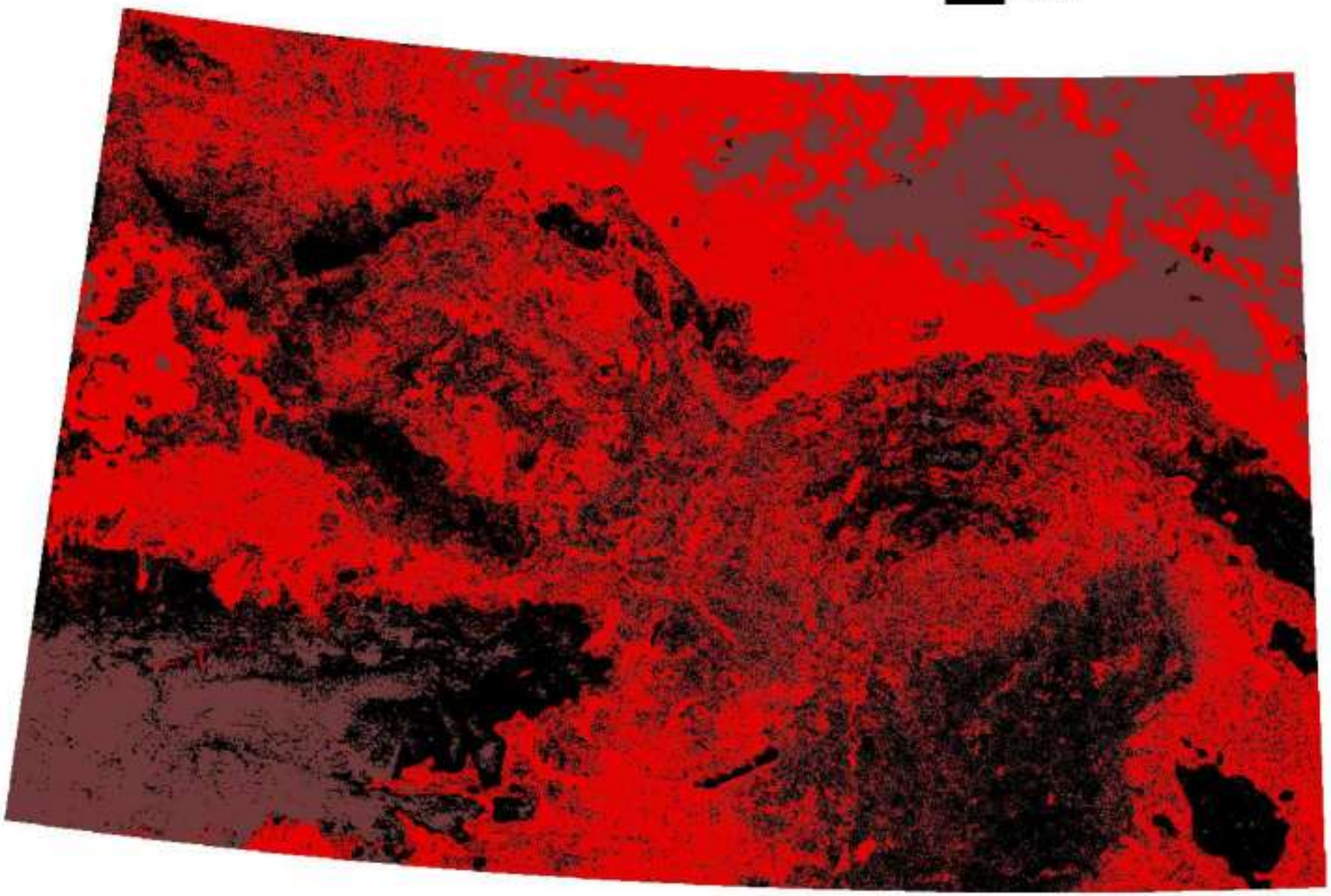
Classification_Layerstack_final_wo0_clipped_ce.img

Value

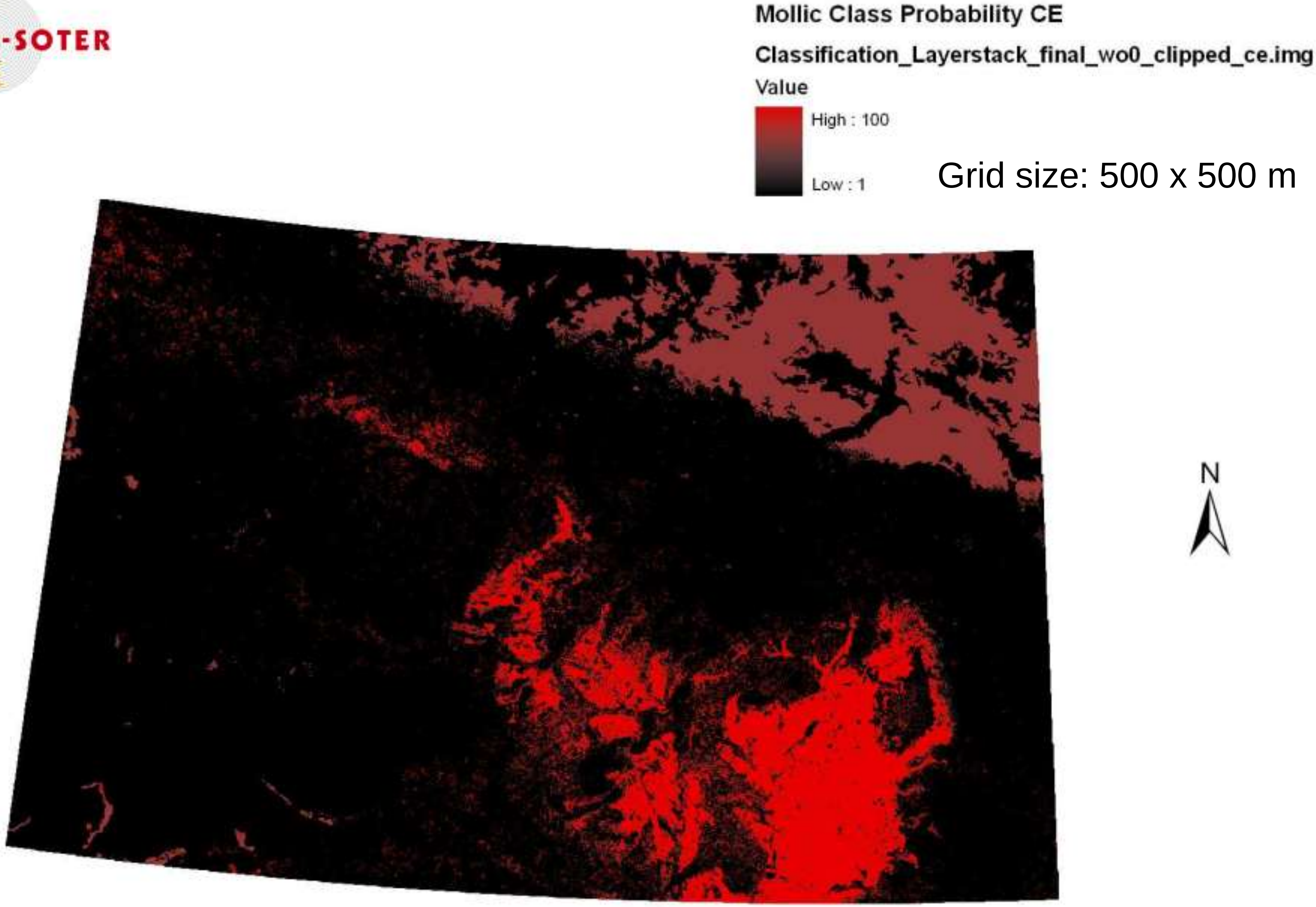
High : 100

Low : 1

Grid size: 500 x 500 m



Points extrapolated with RS and DSM tools



Points extrapolated with RS and DSM tools

RSG Classification
the combined, standardised image

Terrain type with 5 classes (reclassified from the SOTER polygons developed in WP1) :

fine plain, coarse plain, hill, mountain, water

Consolidated-unconsolidated image developed in WP1:

Consolidated, unconsolidated

Texture image developed in WP1

Bare rock image developed in WP1

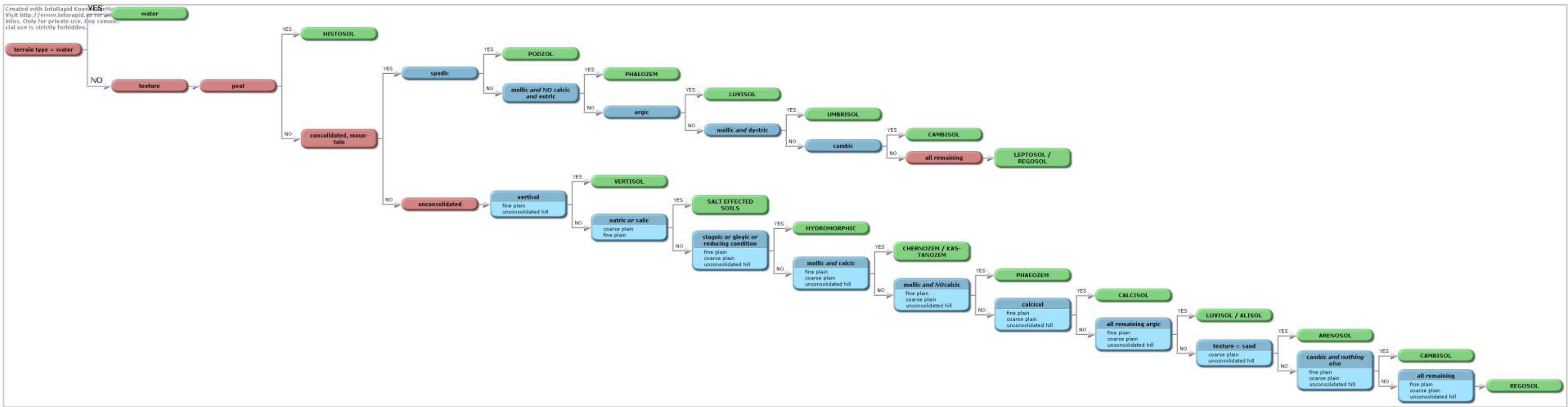
Diagnostics probabilty

- Spodic Horizon Class Probability
- Argic Horizon Class Probability
- Cambic Horizon Class Probability
- Vertisol Class Probability (only Vertisol vertic horizons)
- Salic Horizon Class Probability
- Natric Horizon Class Probability
- Gleyic-stagnic-Reducing cond. Class Probability
- Mollic Horizon Class Probability
- Calcic Horizon Class Probability
- Calcisol Class Probability (only Calcisol calcic horizons)
- Dystric Class Probability
- Eutric Class Probability

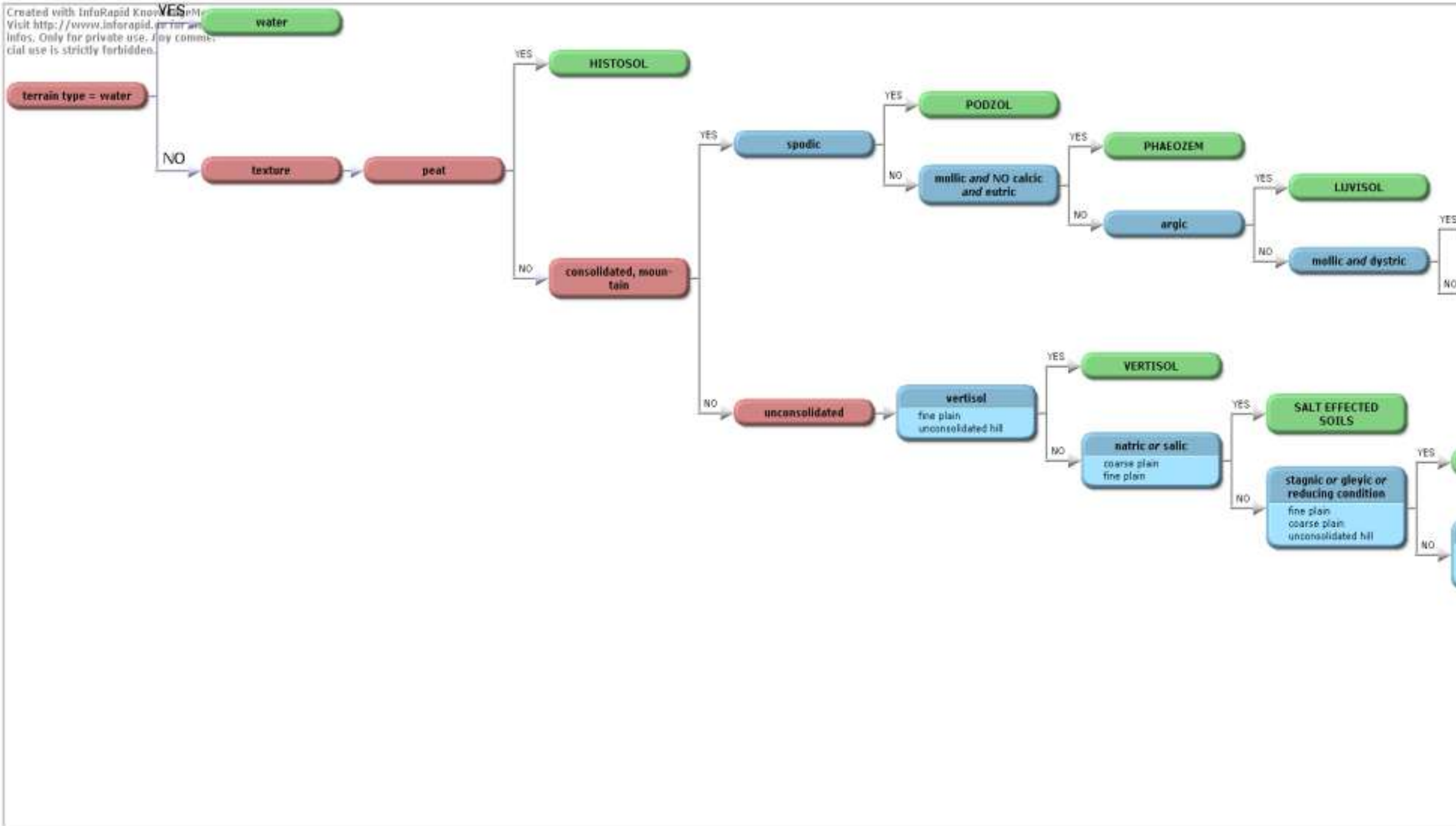
SUPPORT

1. Standardised ArcGIS tool has been developped to do the classification

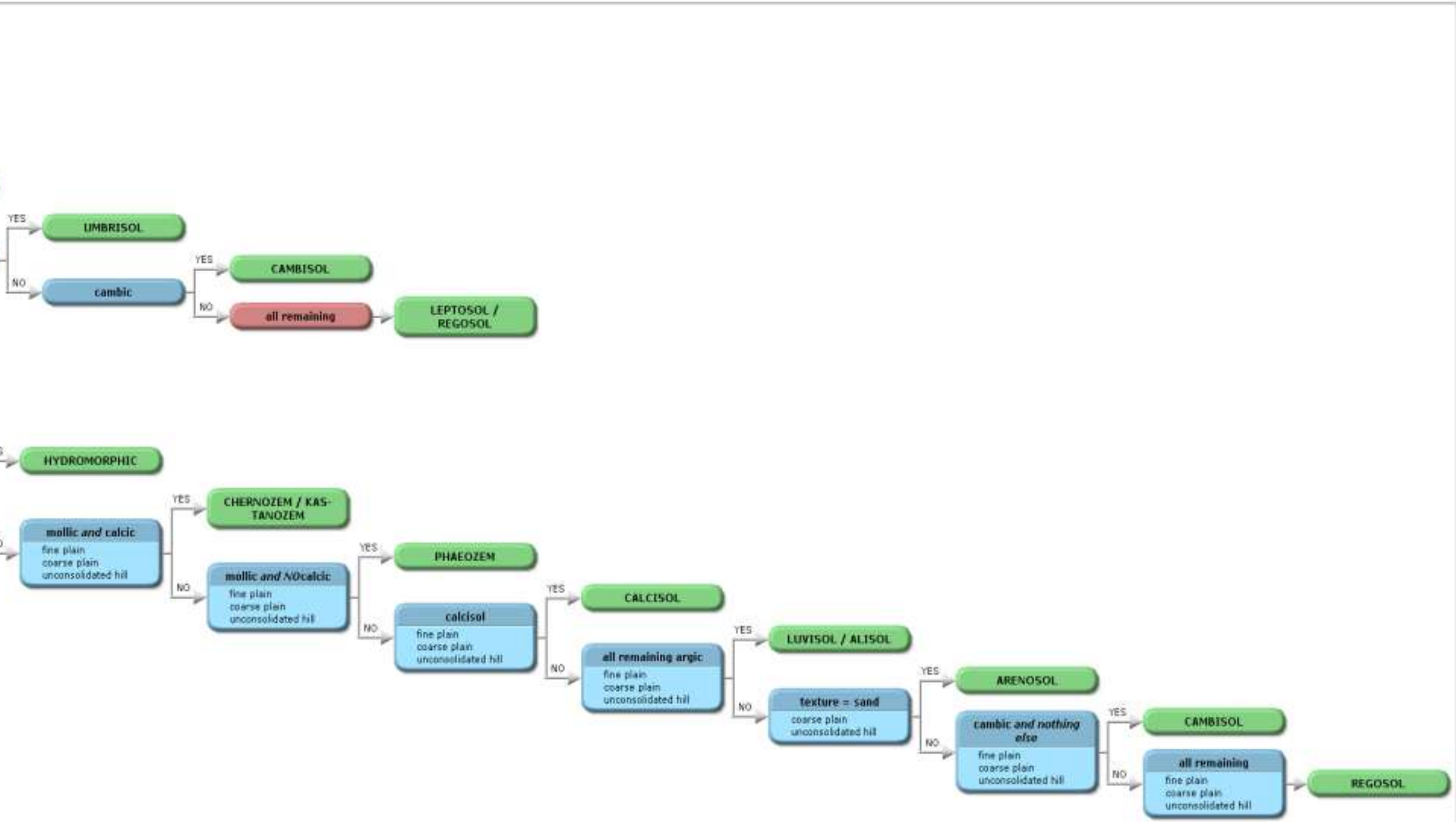
2. Input data standards has been defined



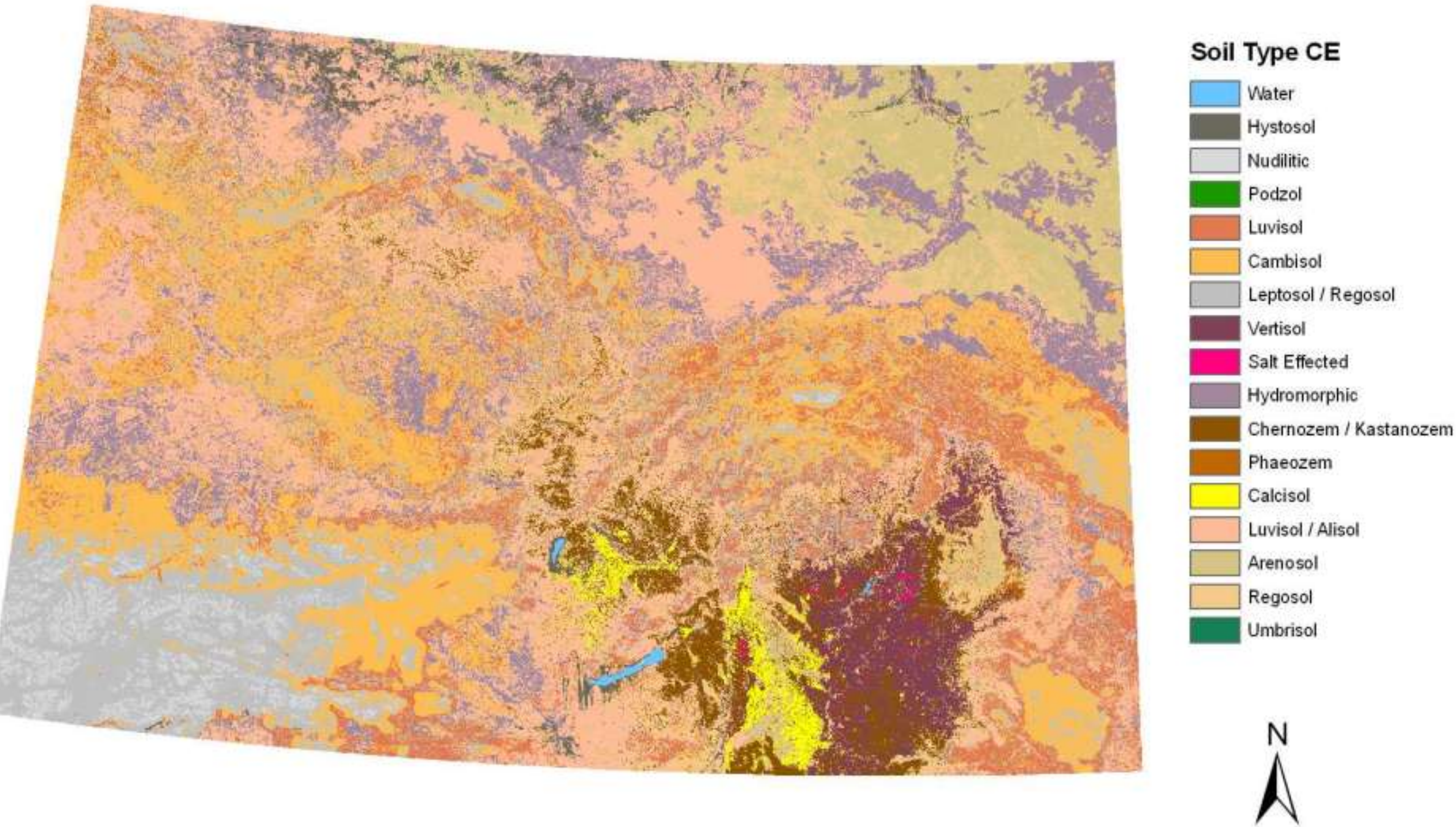
terrain type = water
YES
water
NO
texture
peat
YES
HISTOSOL
NO
consolidated, moun-tain
YES
spodic
YES
PODZOL
NO
mollic *and* NO calcic *and* eutric
YES
PHAEOZEM
NO
argic
YES
LUVISOL
NO
mollic *and* dystric
YES
UMBRISOL
NO
cambic
YES
CAMBISOL
NO
all remaining
LEPTOSOL / REGOSOL
NO
unconsolidated
vertisol
fine plain
unconsolidated hill
YES
VERTISOL
NO
natric *or* salic
coarse plain
fine plain
YES
SALT EFFECTED SOILS
NO
stagnic *or* gleyic *or* reducing condition
fine plain
coarse plain
unconsolidated hill
YES
HYDROMORPHIC
NO
mollic *and* calcic
fine plain
coarse plain
unconsolidated hill
YES
CHERNOZEM / KAS-TANOZEM
NO
mollic *and NO*calcic
fine plain
coarse plain
unconsolidated hill
YES
PHAEOZEM
NO
calcisol
fine plain
coarse plain
unconsolidated hill
YES
CALCISOL
NO
all remaining argic
fine plain
coarse plain
unconsolidated hill
YES
LUVISOL / ALISOL
NO
texture = sand
coarse plain
unconsolidated hill
YES
ARENOSOL
NO
cambic *and nothing else*
fine plain
coarse plain
unconsolidated hill
YES
CAMBISOL
NO
all remaining
fine plain
coarse plain
unconsolidated hill
REGOSOL

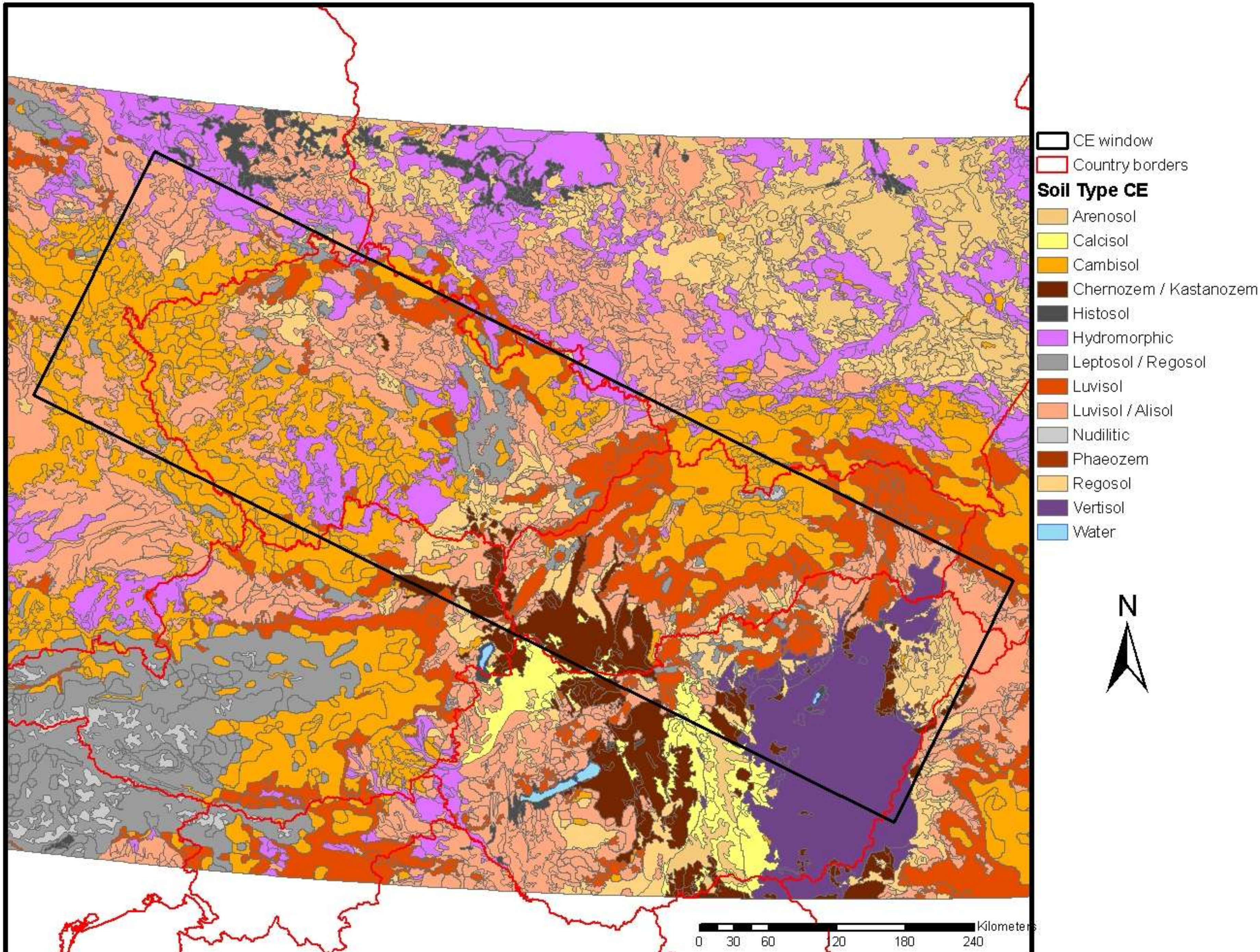


Created with InfoRapid KnowledgeMap. Visit http://www.inforapid.de for more infos. Only for private use. Any commercial use is strictly forbidden.
terrain type = water
YES
water
NO
texture
peat
YES
HISTOSOL
NO
consolidated, mountain
YES
spodic
YES
PODZOL
NO
mollic and NO calcic and eutric
YES
PHAEOZEM
NO
argic
YES
LUVISOL
NO
mollic and dystric
YES
NO
NO
unconsolidated
vertisol
fine plain
unconsolidated hill
YES
VERTISOL
NO
natric or salic
coarse plain
fine plain
YES
SALT EFFECTED SOILS
NO
stagnic or gleyic or reducing condition
fine plain
coarse plain
unconsolidated hill
YES
NO



YES
UMBRISOL
NO
cambic
YES
CAMBISOL
NO
all remaining
LEPTOSOL / REGOSOL
HYDROMORPHIC
mollic and calcic
fine plain
coarse plain
unconsolidated hill
YES
CHERNOZEM / KAS-TANOZEM
NO
mollic and NOcalcic
fine plain
coarse plain
unconsolidated hill
YES
PHAEOZEM
NO
calcisol
fine plain
coarse plain
unconsolidated hill
YES
CALCISOL
NO
all remaining argic
fine plain
coarse plain
unconsolidated hill
YES
LUVISOL / ALISOL
NO
texture = sand
coarse plain
unconsolidated hill
YES
ARENOSOL
NO
cambic and nothing else
fine plain
coarse plain
unconsolidated hill
YES
CAMBISOL
NO
all remaining
fine plain
coarse plain
unconsolidated hill
REGOSOL


Soil Type CE
Water
Hystosol
Nudilitic
Podzol
Luvisol
Cambisol
Leptosol / Regosol
Vertisol
Salt Effected
Hydromorphic
Chernozem / Kastanozem
Phaeozem
Calcisol
Luvisol / Alisol
Arenosol
Regosol
Umbrisol
N



CE window
Country borders
Soil Type CE
Arenosol
Calcisol
Cambisol
Chernozem / Kastanozem
Histosol
Hydromorphic
Leptosol / Regosol
Luvisol
Luvisol / Alisol
Nudilitic
Phaeozem
Regosol
Vertisol
Water
N
Kilometers
0 30 60 120 180 240

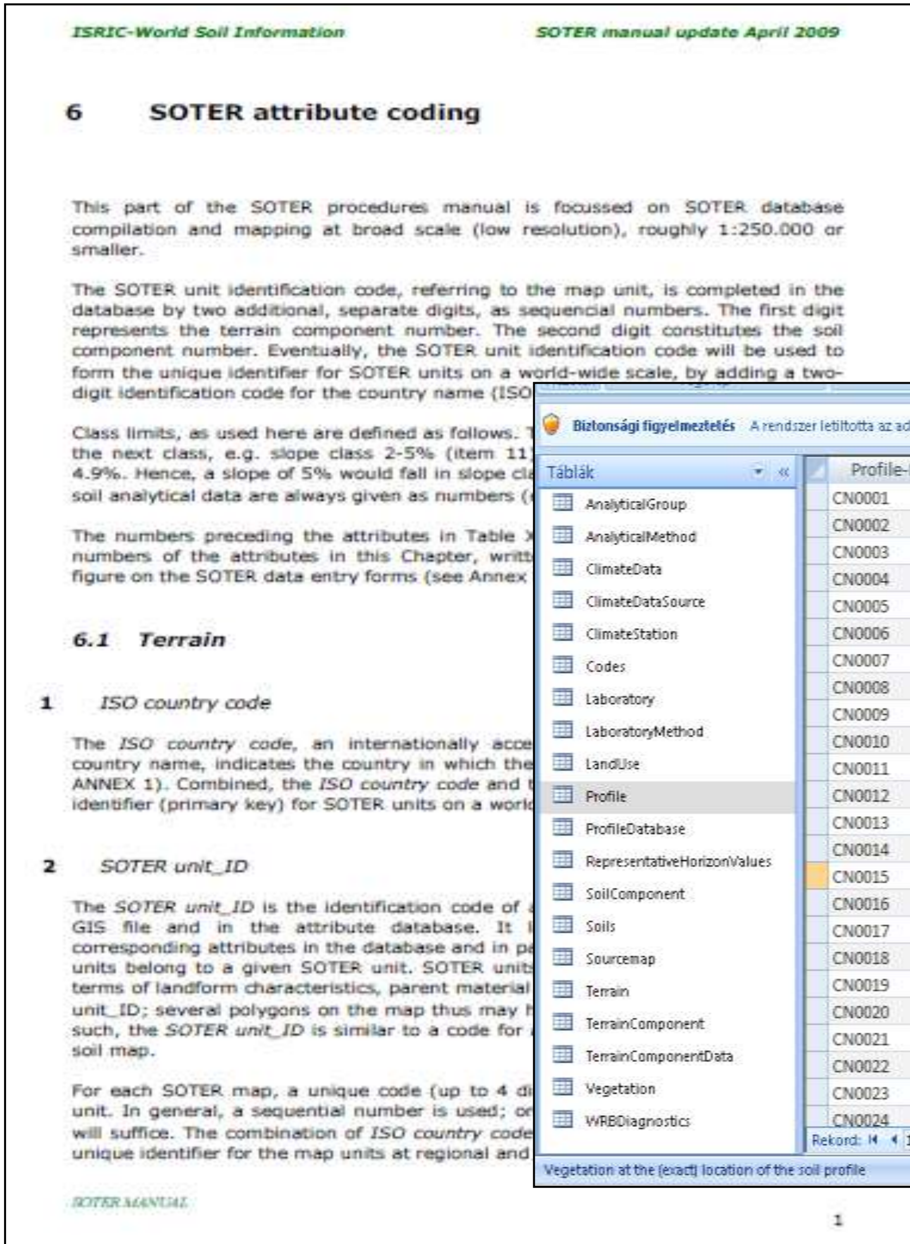
Revision of the SOTER soil component data structure

Based on and compatible with the original Procedures Manual (van Engelen and Wen, 1995), and

modified according to and harmonized by recent standards, and available data.
Terms, definitions and coding of soil profile and horizon descriptions follow the FAO Guidelines for Soil description (2006), the WRB (2006) (including the new guideline for map legend construction, 2010).

The data structure itself has not changed significantly.

The e-SOTER attribute coding guideline and the data entry format is available on the project team site



ISRIC-World Soil Information SOTER manual update April 2009

6 SOTER attribute coding

This part of the SOTER procedures manual is focussed on SOTER database compilation and mapping at broad scale (low resolution), roughly 1:250.000 or smaller.

The SOTER unit identification code, referring to the map unit, is completed in the database by two additional, separate digits, as sequencial numbers. The first digit represents the terrain component number. The second digit constitutes the soil component number. Eventually, the SOTER unit identification code will be used to form the unique identifier for SOTER units on a world-wide scale, by adding a two-digit identification code for the country name (ISO

Class limits, as used here are defined as follows. T the next class, e.g. slope class 2-5% (item 11 4.9%. Hence, a slope of 5% would fall in slope cla soil analytical data are always given as numbers (

The numbers preceding the attributes in Table X numbers of the attributes in this Chapter, writt figure on the SOTER data entry forms (see Annex

6.1 Terrain

1 *ISO country code*

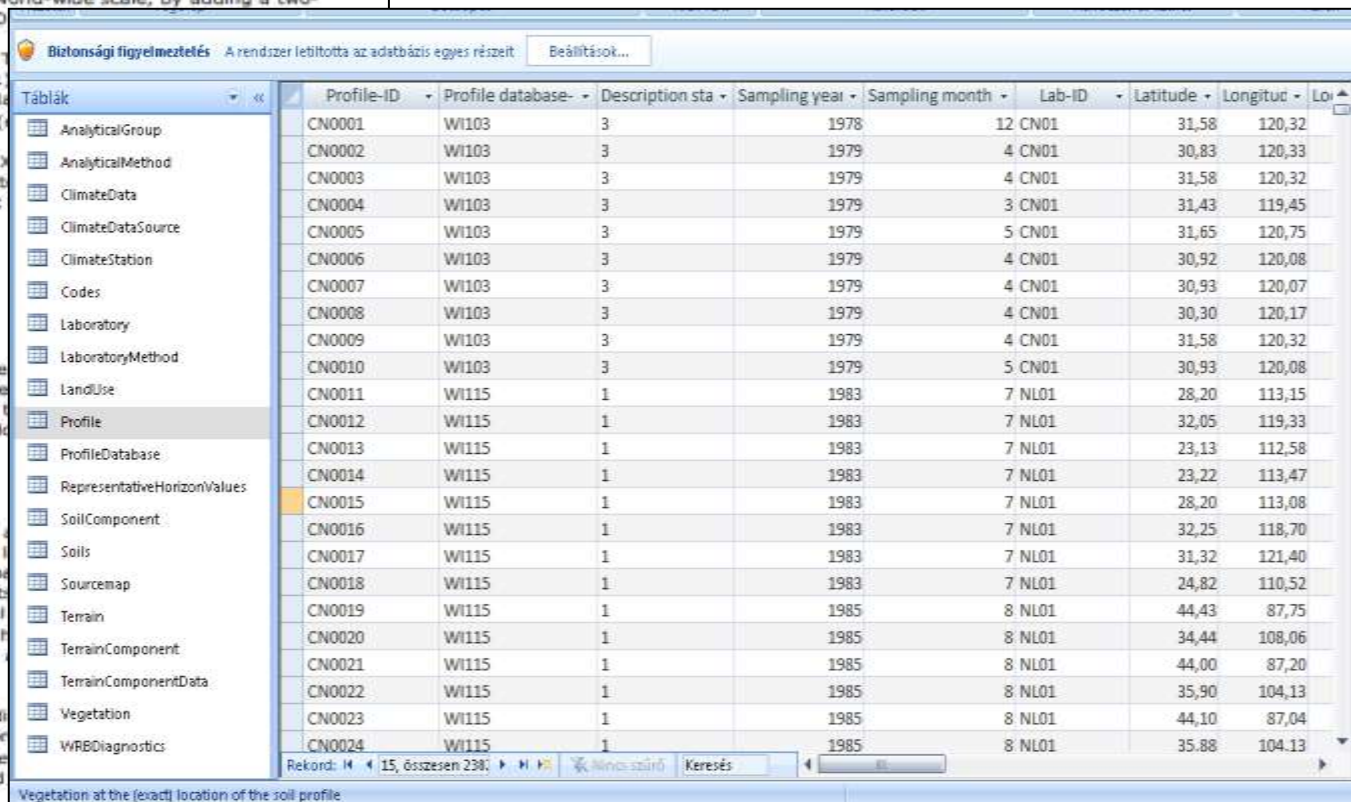
The *ISO country code*, an internationally acce country name, indicates the country in which the ANNEX 1). Combined, the *ISO country code* and t identifier (primary key) for SOTER units on a world

2 *SOTER unit_ID*

The *SOTER unit_ID* is the identification code of a GIS file and in the attribute database. It i corresponding attributes in the database and in pa units belong to a given SOTER unit. SOTER unit terms of landform characteristics, parent material unit_ID; several polygons on the map thus may h such, the *SOTER unit_ID* is similar to a code for a soil map.

For each SOTER map, a unique code (up to 4 di unit. In general, a sequential number is used; or will suffice. The combination of *ISO country code* unique identifier for the map units at regional and

SOTER MANUAL 1



Profile-ID	Profile database-	Description sta	Sampling year	Sampling month	Lab-ID	Latitude	Longitud
CN0001	WI103	3	1978	12	CN01	31,58	120,32
CN0002	WI103	3	1979	4	CN01	30,83	120,33
CN0003	WI103	3	1979	4	CN01	31,58	120,32
CN0004	WI103	3	1979	3	CN01	31,43	119,45
CN0005	WI103	3	1979	5	CN01	31,65	120,75
CN0006	WI103	3	1979	4	CN01	30,92	120,08
CN0007	WI103	3	1979	4	CN01	30,93	120,07
CN0008	WI103	3	1979	4	CN01	30,30	120,17
CN0009	WI103	3	1979	4	CN01	31,58	120,32
CN0010	WI103	3	1979	5	CN01	30,93	120,08
CN0011	WI115	1	1983	7	NL01	28,20	113,15
CN0012	WI115	1	1983	7	NL01	32,05	119,33
CN0013	WI115	1	1983	7	NL01	23,13	112,58
CN0014	WI115	1	1983	7	NL01	23,22	113,47
CN0015	WI115	1	1983	7	NL01	28,20	113,08
CN0016	WI115	1	1983	7	NL01	32,25	118,70
CN0017	WI115	1	1983	7	NL01	31,32	121,40
CN0018	WI115	1	1983	7	NL01	24,82	110,52
CN0019	WI115	1	1985	8	NL01	44,43	87,75
CN0020	WI115	1	1985	8	NL01	34,44	108,06
CN0021	WI115	1	1985	8	NL01	44,00	87,20
CN0022	WI115	1	1985	8	NL01	35,90	104,13
CN0023	WI115	1	1985	8	NL01	44,10	87,04
CN0024	WI115	1	1985	8	NL01	35,88	104,13

e-SOTER

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⇧

- Development of translation and correlation tools for harmonizing soil data

e-SOTER

Compilation of the soil data base for the 1:1M windows (Filling the soil attribute database)

Problems

Data collection methods are very diverse

All project partners have their own national soil classification systems

Data base structures and availability are diverse

Lot of missing data (pedotransfers ☹)

Data statistics

	C-EU window				W-EU window			
	Hungary	Czech	Germany	Slovakia	France	UK	Morocco	China
Number of profiles	1247	561	113	34	58	92	67	210
In the window	503	538	60	33	3	60	44	31
Source of data	National (97%)	National (93%)	National (52%)	WISE (100%)	WISE (100%)	National (42%)	National (58%)	SOTER (71%)
	WISE (3%)	WISE (7%)	WISE (48%)	-	-	WISE (58%)	WISE (42%)	WISE (29%)
WRB diagnostics	Yes	Yes	No	No	No	No	No/Yes	No
WRB RSG	Yes	Yes	Yes	Yes	Yes	Yes	No/Yes	Yes
WRB qualifier	Yes	Yes	No	No	No	No	No	No

Number of profiles for RSGs per country

	Histosols	Leptosols	Vertisols	Fluvisols	Solonetz	Solonchak	Gleysols	Podzols	Nitisol	Ferralsol	Planosols	Stagnosols	Chernozems	Kastanozem	Phaeozems	Gypsisol	Calcisols	Albeluvisol	Alisols	Acrisol	Luvisols	Lixisols	Umbrisols	Arenosols	Cambisols	Regosols	**SUM**
Hungary		7	190	1	24	5	4						192	37	95		105		124		170		7	108	116	62	**1247**
Czech			4	43			19	5			1	31	52		27			35	34	1	145			8	146	10	**561**
Germany	2		3				11	4			1	11			17				3		21		7	2	29	2	**113**
Slovakia		2					2				1		3		8				2		4		1	2	8	1	**34**
France	1		3				6	9			4	3			2		2	1	4		9		3	2	9		**58**
UK	6	4	1	1			15	9			2	8		1	3		2		2	1	18		4	2	13		**92**
Morocco		1	14	2	2					2			4	1	14		3		4		11			1	4	4	**67**
China		1	2		1		4	1	18	7	1				6	1	1			60	9	32		16	39	9	**208**
SUM	9	15	217	47	27	5	61	28	18	9	10	53	251	39	172	1	113	36	173	62	387	32	22	141	364	88	2380

Data availability in the windows (CEU)

	No of horizons	Total %	CZ (%)	DE (%)	HU (%)	SK (%)	CEU window total (%)
Horizon designation	4889	96	100	100	99	71	99
Moist Color	2809	55	16	42	96	71	55
Particle size class	4769	94	95	72	97	100	94
pH H2O	3580	71	45	0	97	100	66
EC	1950	38	1	0	83	68	40
exNa	2404	47	4	0	95	30	45
CEC	3943	78	73	1	97	99	79
Carbonate	2046	40	32	2	47	100	39
OC	4175	82	85	0	94	98	83
BS	3585	71	86	0	94	0	80

Data availability in the windows (WEU, CN, MA)

	FR (%)	GB (%)	WEU window total (%)	CN (%)	CN window total (%)	MA (%)	MA window total (%)
Horizon designation	100	98	98	99	99	25	25
Moist Color	100	43	**45**	100	100	**25**	25
Particle size class	58	91	90	99	99	94	94
pH H2O	100	94	94	100	100	96	96
EC	0	33	32	39	39	20	20
exNa	308	28	40	77	77	86	86
CEC	92	48	**50**	100	100	70	70
Carbonate	100	76	77	42	42	25	25
OC	100	80	80	40	40	98	98
BS	0	7	**7**	0	0	0	0

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- Development of translation and correlation tools for harmonizing soil data

Methods for correlation

- Expert knowledge based

  (based on concept or actual data)

- Classification algorithm based (re-classification)

- Based on calculated taxonomic distances

Methods for correlation

Classification algorithm based (re-classification)

Step 1. definition of the diagnostics

Step 2. definition of the RSGs

Step 3. definition of the qualifiers

Mollic horizon

Diagnostic criteria

A mollic horizon, after mixing either the upper 20 cm of the mineral soil or, if *continuous rock*, a *cryic*, *petrocalcic*, *petroduric*, *petrogypsic* or *petroplinthic* horizon is present within 20 cm of the mineral soil surface, the entire mineral soil above, has:

1. a soil structure sufficiently strong that the horizon is not both massive and hard or very hard when dry in both the mixed part and the underlying unmixed part if the minimum thickness is larger than 20 cm (prisms larger than 30 cm in diameter are included in the meaning of massive if there is no secondary structure within the prisms); ***and***
2. Munsell colours with a chroma of 3 or less when moist, a value of 3 or less when moist and 5 or less when dry on broken samples in both the mixed part and the underlying unmixed part if the minimum thickness is greater than 20 cm. If there is 40 percent or more finely divided lime, the limits of dry colour value are waived; the colour value, moist, is 5 or less. The colour value is one unit or more darker than that of the parent material (both moist and dry), unless the parent material has a colour value of 4 or less, moist, in which case the colour contrast requirement is waived. If a parent material is not present, comparison must be made with the layer immediately underlying the surface layer; ***and***
3. an organic carbon content of 0.6 percent or more in both the mixed part and the underlying unmixed part if the minimum thickness is larger than 20 cm. The organic carbon content is 2.5 percent or more if the colour requirements are waived because of finely divided lime, or 0.6 percent more than in the parent material if the colour requirements are waived because of dark coloured parent materials; ***and***
4. a base saturation (by 1 *M* NH_4OAc) of 50 percent or more on a weighted average throughout the depth of the horizon; ***and***
5. a thickness of one of the following:
   a. 10 cm or more if directly overlying continuous rock, or a cryic, petrocalcic, petroduric, petrogypsic or petroplinthic horizon; ***or***
   b. 20 cm or more and one-third or more of the thickness between the soil surface and the upper boundary of continuous rock, or a calcic, cryic, gypsic, petrocalcic, petroduric, petrogypsic, petroplinthic or salic horizon or calcaric, fluvic or gypsyric material within 75 cm; ***or***
   c. 20 cm or more and one-third or more of the thickness between the soil surface and the lower boundary of the lowest diagnostic horizon within 75 cm and, if present, above any of the diagnostic horizons listed under b.; ***or***
   d. 25 cm or more.

Criteria	Availability
Structure	Partly available 45% of profiles missing
Munsell colour • moist • dry	Partly available 32% of profiles missing 94% of profiles missing
Organic carbon	Mostly available
Base saturation	Partly available (pH) 40% of profiles missing
Thickness	Not given - determined

6 major diagnostic requirements , 4 has sub requirements, 2 has 3rd level sub requirements, includes 10 *OR*s and 12 *AND*s

Simplified algorithm for mollic horizon

1. OC > 0,6%; and
2. a Munsell value (moist) of 3 and a chroma (moist) of 3 or less; and
3. a Munsell value (dry) of 5 and a chroma (dry) of 5 or less (if data available); and
4. B% > 50; and
5. a thickness > 25 cm;   or
6. a thickness > 10 cm if directly overlying continuous rock;
7. surface horizon

Argic horizon

Diagnostic criteria

An argic horizon:

1. has a texture of loamy sand or finer and 8 percent or more clay in the fine earth fraction; ***and***
2. one or both of the following:
   a. has, if an overlying coarser textured horizon is present that is not ploughed and not separated from the argic horizon by a *lithological discontinuity*, more total clay than this overlying horizon such that:
      i. if the overlying horizon has less than 15 percent clay in the fine earth fraction, the argic horizon must contain at least 3 percent more clay; ***or***
      ii. if the overlying horizon has 15 percent or more but less than 40 percent clay in the fine earth fraction, the ratio of clay in the argic horizon to that of the overlying horizon must be 1.2 or more; ***or***
      iii. if the overlying horizon has 40 percent or more total clay in the fine earth fraction, the argic horizon must contain at least 8 percent more clay; ***or***
   b. has evidence of clay illuviation in one or more of the following forms:
      i. oriented clay bridging the sand grains; ***or***
      ii. clay films lining pores; ***or***
      iii. clay films on both vertical and horizontal surfaces of soil aggregates; ***or***
      iv. in thin section, oriented clay bodies that constitute 1 percent or more of the section; ***or***
      v. a coefficient of linear extensibility (COLE) of 0.04 or higher, and a ratio of fine clay[1] to total clay in the argic horizon greater by 1.2 times or more than the ratio in the overlying coarser textured horizon; ***and***
3. has, if an overlying coarser textured horizon is present that is not ploughed and not separated from the argic horizon by a *lithological discontinuity*, an increase in clay content within a vertical distance of one of the following:
   a. 30 cm, if there is evidence of clay illuviation; ***or***
   b. 15 cm; ***and***
4. does not form part of a *natric* horizon; ***and***
5. has a thickness of one-tenth or more of the sum of the thicknesses of all overlying horizons, if present, and one of the following:
   a. 7.5 cm or more, if it is not entirely composed of lamellae (that are 0.5 cm or more thick) and the texture is finer than loamy sand; ***or***
   b. 15 cm or more (combined thickness, if composed entirely of lamellae that are

Argic horizon

Diagnostic criteria

An argic horizon:

1. has a texture of loamy sand or finer and 8 percent or more clay in the fine earth fraction; ***and***
2. one or both of the following:
   a. has, if an overlying coarser textured horizon is present that is not ploughed and not separated from the argic horizon by a *lithological discontinuity*, more total clay than this overlying horizon such that:
      i. if the overlying horizon has less than 15 percent clay in the fine earth fraction, the argic horizon must contain at least 3 percent more clay; ***or***
      ii. if the overlying horizon has 15 percent or more but less than 40 percent clay in the fine earth fraction, the ratio of clay in the argic horizon to that of the overlying horizon must be 1.2 or more; ***or***
      iii. if the overlying horizon has 40 percent or more total clay in the fine earth fraction, the argic horizon must contain at least 8 percent more clay; ***or***
   b. has evidence of clay illuviation in one or more of the following forms:
      i. oriented clay bridging the sand grains; ***or***
      ii. clay films lining pores; ***or***
      iii. clay films on both vertical and horizontal surfaces of soil aggregates; ***or***
      iv. in thin section, oriented clay bodies that constitute 1 percent or more of the section; ***or***
      v. a coefficient of linear extensibility (COLE) of 0.04 or higher, and a ratio of fine clay[1] to total clay in the argic horizon greater by 1.2 times or more than the ratio in the overlying coarser textured horizon; ***and***
3. has, if an overlying coarser textured horizon is present that is not ploughed and not separated from the argic horizon by a *lithological discontinuity*, an increase in clay content within a vertical distance of one of the following:
   a. 30 cm, if there is evidence of clay illuviation; ***or***
   b. 15 cm; ***and***
4. does not form part of a *natric* horizon; ***and***
5. has a thickness of one-tenth or more of the sum of the thicknesses of all overlying horizons, if present, and one of the following:
   a. 7.5 cm or more, if it is not entirely composed of lamellae (that are 0.5 cm or more thick) and the texture is finer than loamy sand; ***or***
   b. 15 cm or more (combined thickness, if composed entirely of lamellae that are 0.5 cm or more thick).

Criteria	Availability
Texture	Mostly available
Clay content	Mostly available
Morphological evidence of clay illuviation	Mostly NOT available
Vertical distance of clay increase	Mostly NOT available
No natric horizon	Not given determined
Thickness	Not given determined

Simplified algorithm for argic horizon

1. if the overlying horizon has < 15% clay, at least 3 percent more clay content increase in the underlying horizon; or
2. if the overlying horizon has a clay content between 15-40%, the ratio of clay in the underlying to that of the overlying horizon must be 1.2 or more; or
3. if the overlying horizon has > 40% or more clay, the underlying horizon must contain at least 8 percent more clay; or
4. morphological evidence of clay illuviation in soil description (i.e. cutanic qualifier); and
5. does not form part of a natric horizon.

Simplified key - Sequence kept!

Simplified set of diagnostics → WRB RSG

1	Organic matter > 40 cm deep	Yes →	HISTOSOLS
2	Cyric horizon	Yes →	CRYOSOLS
3	Human modifications	Yes →	ANTHROSOLS
4	Depth < 25 cm	Yes →	LEPTOSOLS
5	> 35% clay vertic horizon	Yes →	VERTISOLS
6	Fluvic materials	Yes →	FLUVISOLS
7	Salic horizon	Yes →	SOLONCHAKS
8	Gleyic properties	Yes →	GLEYSOLS
9	Andic or vitric horizon	Yes →	ANDOSOLS
10	Spodic horizon	Yes →	PODZOLS
11	Plinthite or petroplinthite within 50 cm	Yes →	PLINTHOSOLS
12	Ferralic horizon	Yes →	FERRALSOLS
13	Natric horizon	Yes →	SOLONETZ
14	Abrupt textural change	Yes →	PLANOSOLS
15	Chernic or blackish mollic horizon	Yes →	CHERNOZEMS
16	Brownish mollic horizon and secondary $CaCO_3$	Yes →	KASTANOZEMS
17	Mollic horizon	Yes →	PHAEOZEMS
18	Gypsic or petrogypsic horizon	Yes →	GYPSISOLS
19	Duric or petroduric horizon	Yes →	DURISOLS
20	Calcic or petrocalcic horizon	Yes →	CALCISOLS
21	Argic horizon and albeluvic tonguing	Yes →	ALBELUVISOLS
22	Argic horizon with $CEC_c > 24$, $Al_{sat} > 60\%$	Yes →	ALISOLS
23	Argic and nitic horizons	Yes →	NITISOLS
24	Argic horizon with $CEC_c < 24$, $BS < 50\%$	Yes →	ACRISOLS
25	Argic horizon with $CEC_c > 24$, $BS > 50\%$	Yes →	LUVISOLS
26	Argic horizon with $CEC_c < 24$, $BS > 50\%$	Yes →	LIXISOLS
27	Umbric horizon	Yes →	UMBRISOLS
28	Cambic horizon	Yes →	CAMBISOLS
29	Coarse texture > 100 cm	Yes →	ARENOSOLS
30	Other soils	→	REGOSOLS

(each "no" leads ↓ to the next step)

Step 2.

Simplified criteria (examples)

Clay ≥ 40% *(no morphological data!)* to 60 cm → **Vertisols**

Natric horizon → **Solonetz**

„Gleyic” records within 50 cm → **Gleysols**

„Stagnic” records within 50 cm → **Stagnosols**

Mollic horizon, and
Calcic horizon below mollic within 50 cm → **Chernozems**

Simplified criteria (examples)

Argic horizon, and
no lithological discontinuity, and
B ≥ 50 % → **Luvisols**

Argic horizon, and
no lithological discontinuity, and
B < 50 % → **Alisols (Acrisols)**

(CEC *when not available* neglected in CE, WE windows)

Step 3. definition of the qualifiers

Same (simplfied way as diagnostics)

Methods for correlation

- Expert knowledge based

  (based on concept or actual data)

- Classification algorithm based (re-classification)

- Based on calculated taxonomic distances

Taxonomic distance measurments were applied for correlation of national soil classes to WRB RSGs
(in the HU part of the CE window)

21 soil groups matched with the dominant identifiers

Soil Groups

18 Dominant identifiers

	Podzols	Planosols	Stagnosols	Chernozems	Kastanozem	Phaeozems	Calcisols	Alisols	Luvisols	Lixisols	Umbrisols	Arenosols	Cambisols	Regosols	Chernozem BFS	Ramann	Lesivated BFS	Podzolised BFS	Pseudogley BFS	Lamellic BFS	Acidic, non-podsolised, BFS
Histic, Folic																					
Vertic																					
Fluvic																					
Natric, Sodic																					
Salic																					
Gleyic																					
Spodic																					
Abrupt textural change																					
Stagnic																					
Mollic																					
Calcic, Calcaric																					
Umbric																					
Arenic																					
Cambic																					
Clay illuviation (high CEC, high base)																					
Clay illuviation (high CEC, low base)																					
Clay illuviation in forms of lamellaes																					
Acidic, low base																					

13 WRB RSGs

7 HU forest soiltypes

Codes express the likelyhood of the presence of the selected dominant identifiers such as:

0 - cannot be present,

0.5 – likely to be present,

1- must be present

The calculated taxonomic distances between the tested units

Euclidean distance

Euclidean distance is the „ordinary” distance between two points (soil profiles/types/groups etc.) and is calculated by the Pythagorean formula

$$d_{ij} = \sqrt{\left(\mathbf{x}_i - \mathbf{x}_j\right)^{\mathrm{T}}\left(\mathbf{x}_i - \mathbf{x}_j\right)}$$

where *dij* is the element of distance matrix *D* with size *(c×c), c* is the number of soil groups.

(Minasny et al., 2009)

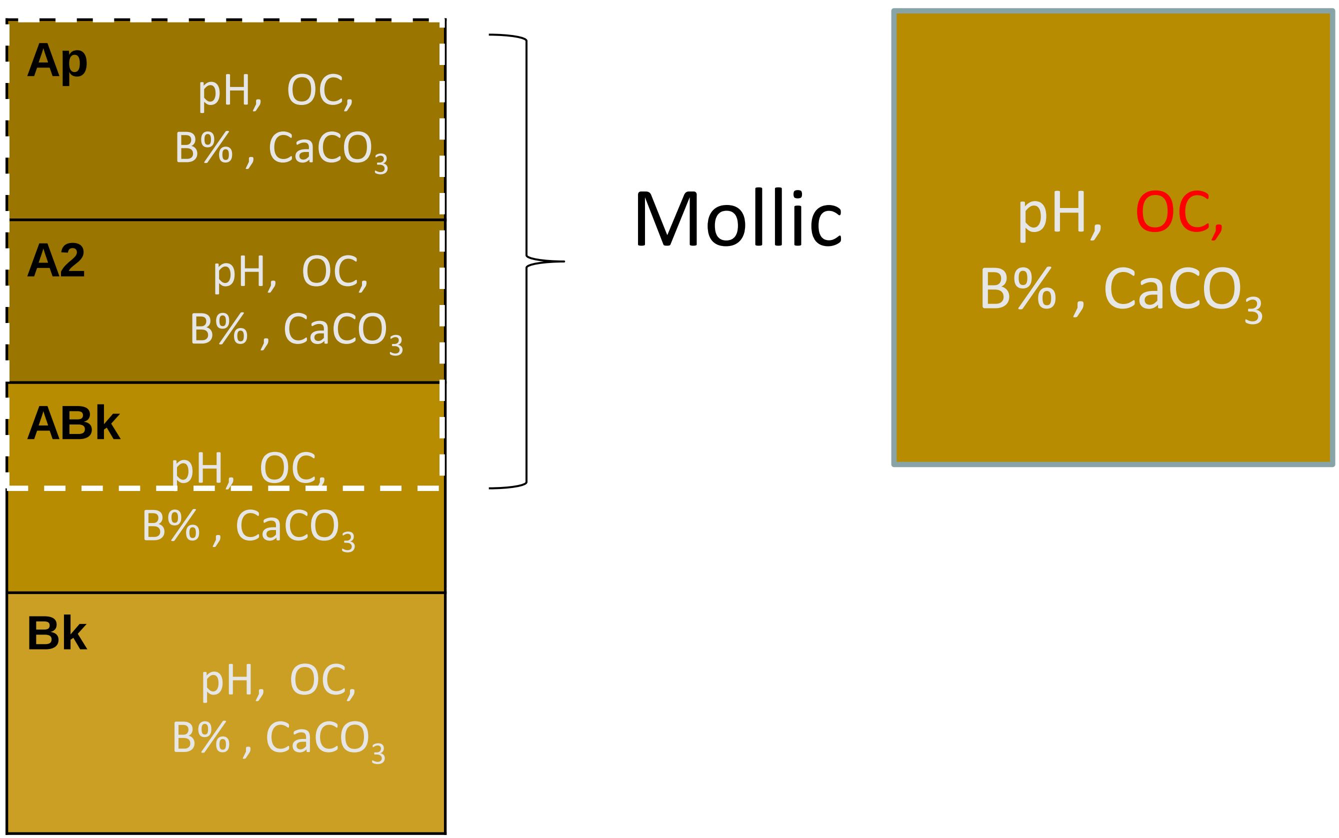
Taxonomic distance measurments were applid for correlation of national soil classes to WRB RSGs (in the HU part of the CE window)

Results promising but did not become operational in the e-SOTER project!

Problems:

- Allocation of diagnostics in the data base (one diagnostic horizon may overlap 2-3 genetic horizons - retrieve lab data for diagnostics is problematic)
- Results of computer assisted algorithm based correlation often did not match national expert decisions.
- Assigning of representative profiles
- Listing of all available qualifiers is problematic (only the first 2 pre-fixes can be listed, and all suffixes), limiting the producing of thematic info

Allocation of diagnostics in the data base
eg: One diagnostic horizon may overlap 2-3 genetic horizons. Associated lab data is problematic:



Expert / algorithm based decisions (Czech database)

	Number of RSG profiles			
	in the original database	in the new database	changed on RSG level	changed on lower level(s)
Albeluvisols	35	35	0	24
Alisols	0	34	34	34
Arenosols	5	5	0	4
Cambisols	205	128	86	100
Chernozems	55	52	5	53
Fluvisols	50	43	7	17
Gleysols	18	19	1	15
Leptosols	7	0	7	7
Luvisols	64	136	72	53
Phaeozems	19	24	8	18
Planosols	1	1	0	1
Podzols	13	5	9	11
Regosols	8	10	2	4
Stagnosols	41	29	14	36
Vertisols	2	2	0	2

Assigning representative profiles

Methodology:

Closest profiles of the same RSG with same parent material and texture (possibly same qualifiers)

Problems:

Often the closest is in other country or continent,
Only 2 qualifiers in the soil component data
→ great variation possible

PODZOLS

Main map unit qualifiers	***Optional map unit qualifiers***
Carbic/Rustic	Anthric
Albic/Entic	Densic
Gleyic	Drainic
Stagnic	Fragic
Folic/Histic/Umbric	Gelic
Hyperskeletic/Leptic	Hortic
Vitric/Silandic/Aluandic	Lamellic
Haplic	Novic
	Ornithic
	Ortsteinic
	Oxyaquic
	Placic
	Plaggic
	Ruptic
	Skeletic
	Technic
	Terric
	Transportic
	Turbic

Rustic
Entic
Leptic

Rustic
Albic
Skeletic

Carbic
Albic
Placic
Novic

Carbic
Entic

Rustic
Entic

Problems:

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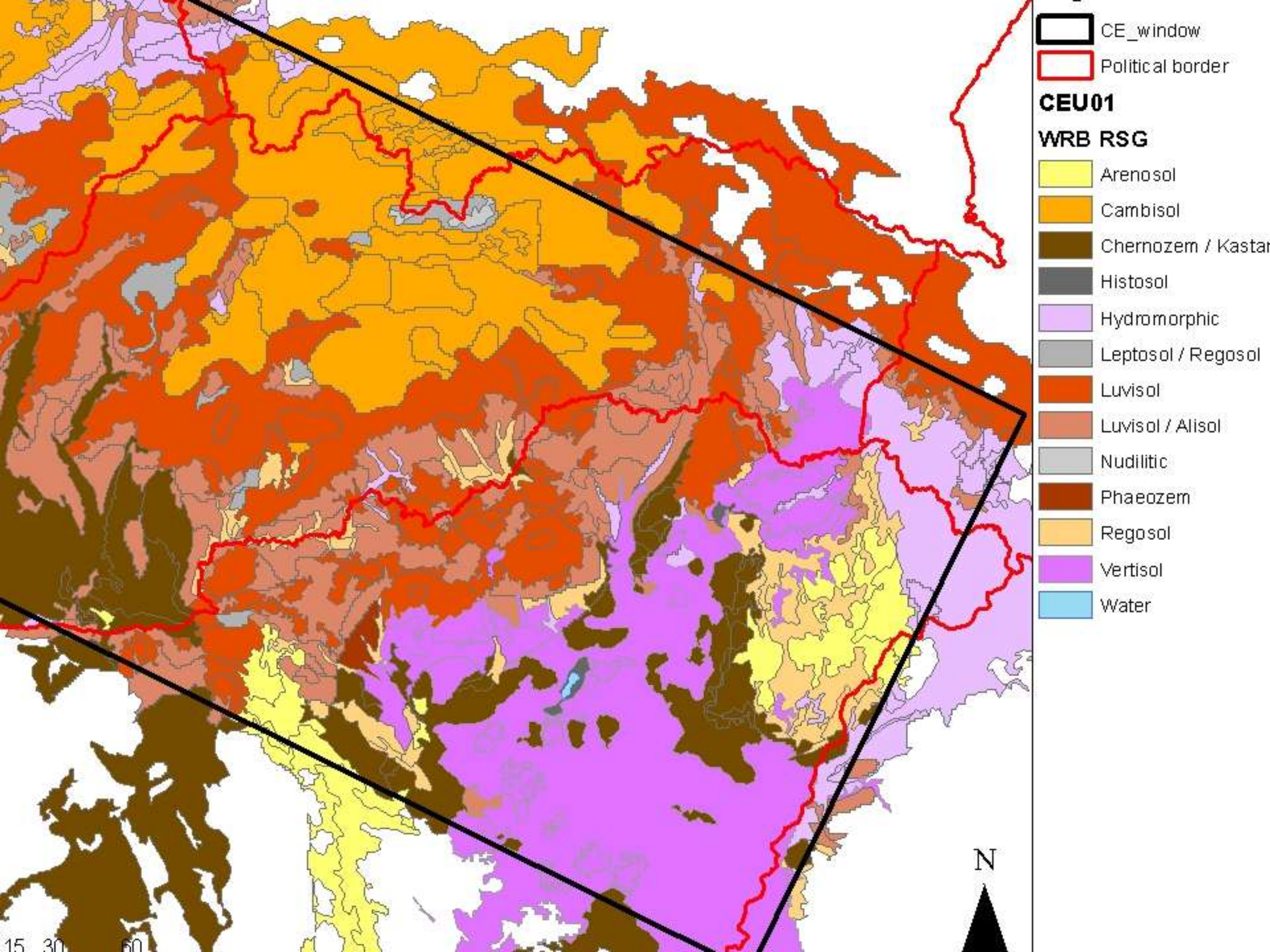
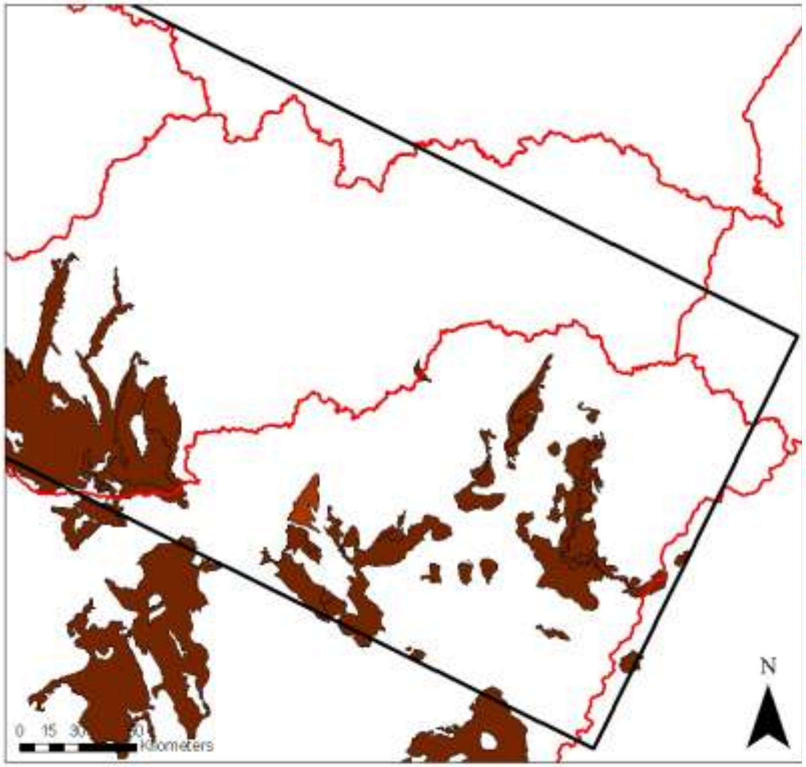
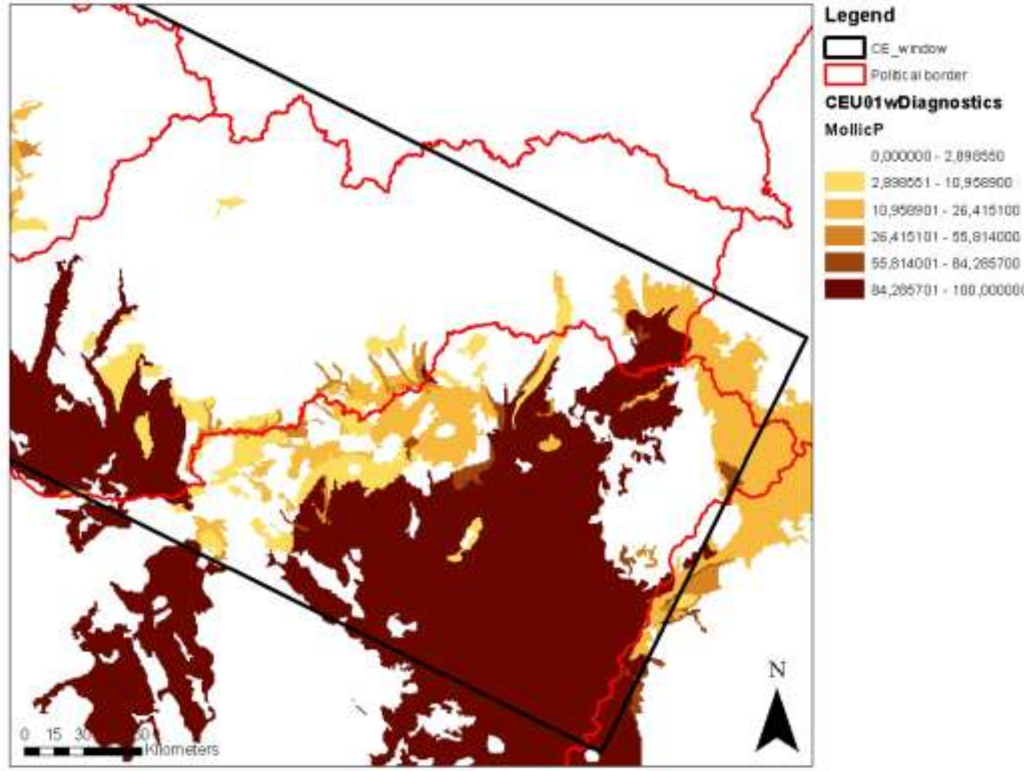
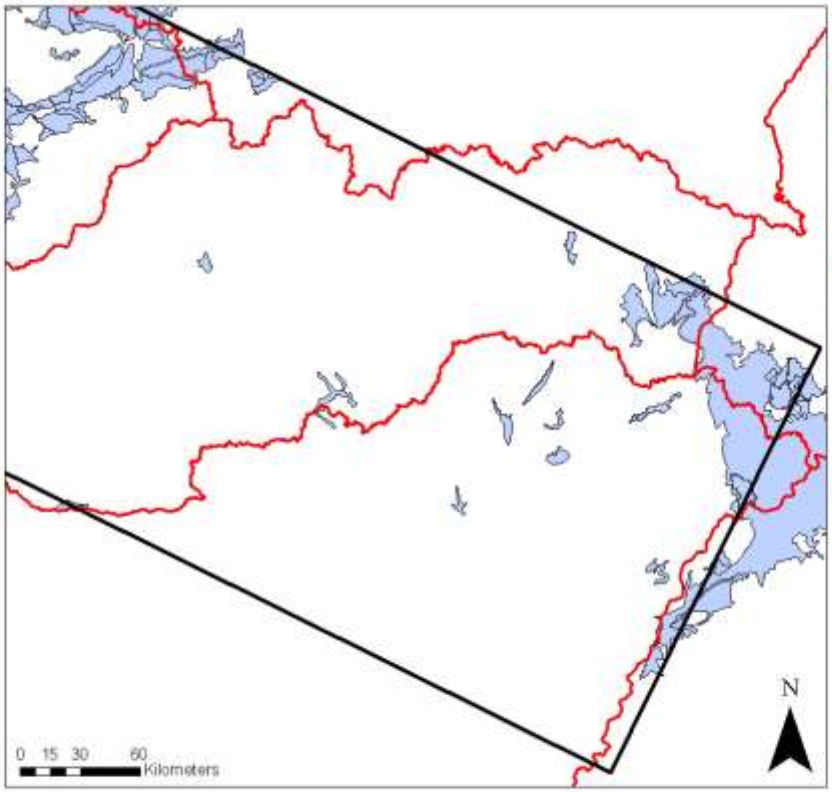

CE_window
Political border
CEU01
WRB RSG
Arenosol
Cambisol
Chernozem / Kastar
Histosol
Hydromorphic
Leptosol / Regosol
Luvisol
Luvisol / Alisol
Nudilitic
Phaeozem
Regosol
Vertisol
Water
N
15
30
60

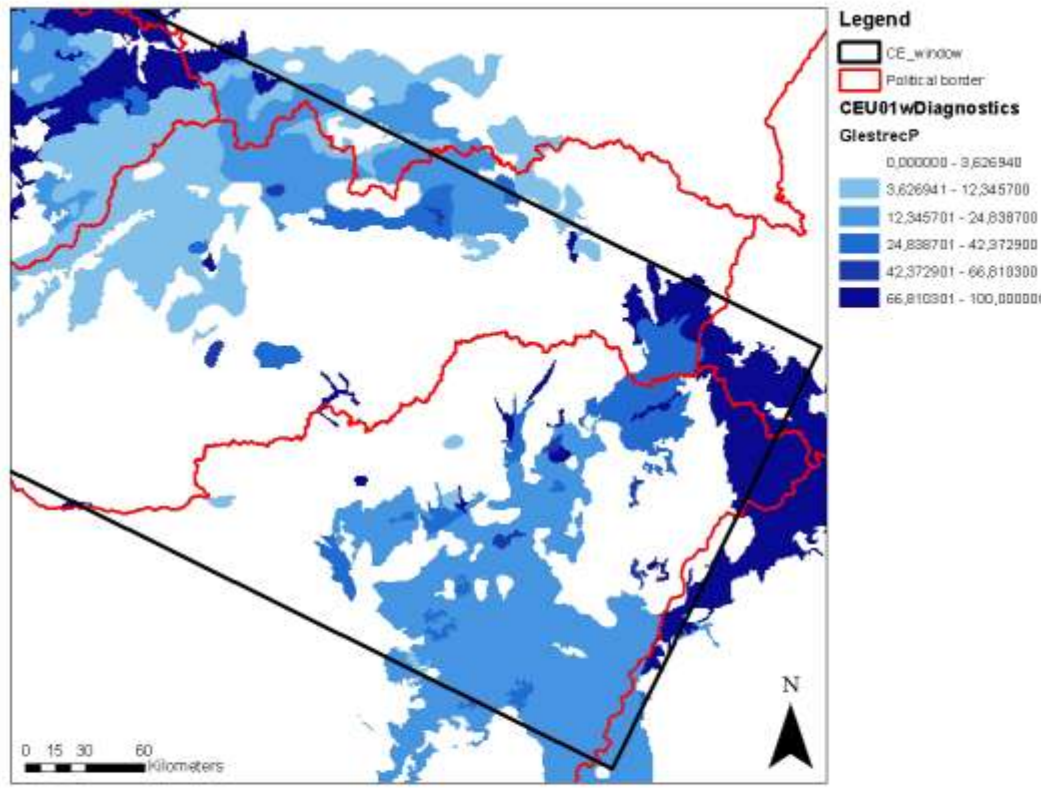




Kastanozems, Chernozems, Phaeozems

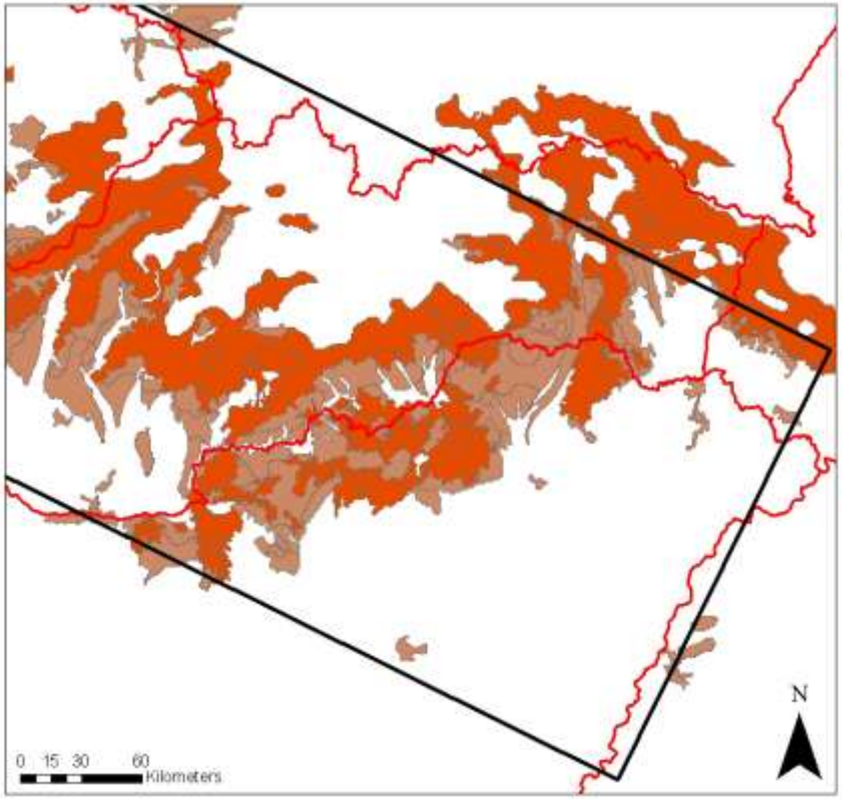
% presence of the mollic horizon



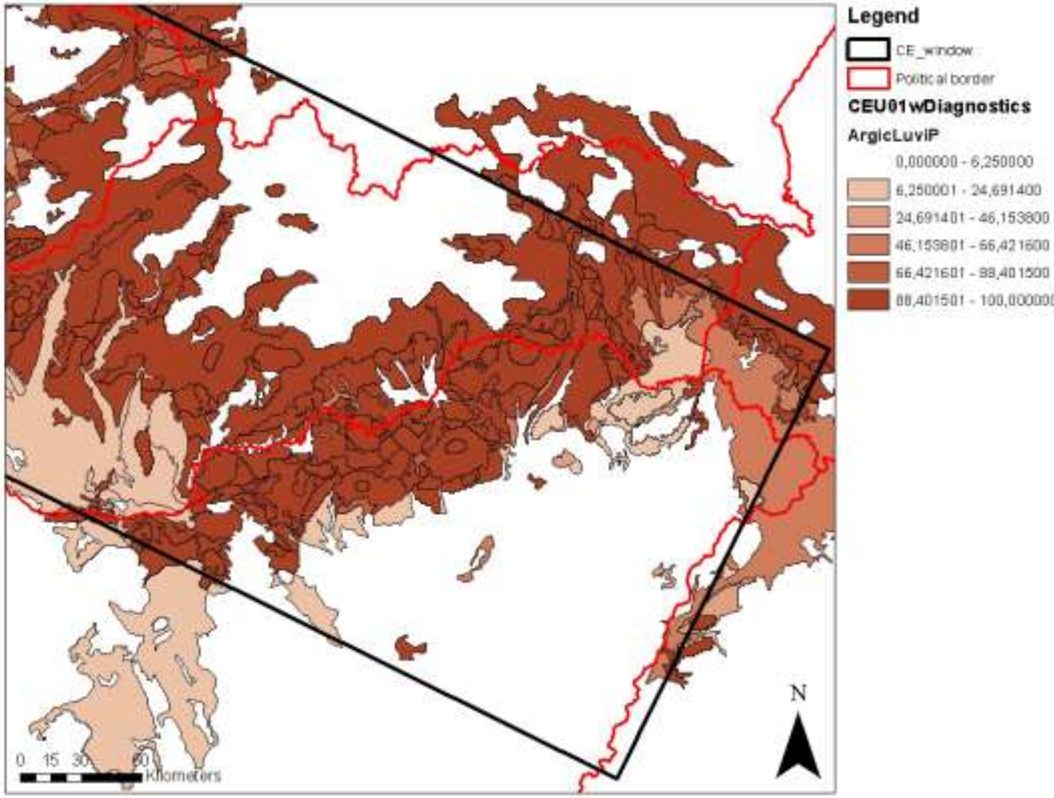


Gleysols, Stagnosols

% presence of gleyic and/or stagnic properties and/or reducing conditions



Luvisols, Alisols



% presence of the argic horizon

Conclusions

- We are happy with most methodologies developed
- Data availability / access / quality are the major limitations. In some cases this is CRITICAL
- Expert knowledge as well as better guidelines for soil observation and recording is still very important and need to be improved /harmonized!

Conclusions

- The diagnostics and qualifiers will be important elements for correlation, interpretations and thematic applications.
  Their allocation in data structure can be inproved!

- Distance methods and other numerical approaches are promising and should be further developed!

- Experiences and lessons of our work is hopefully very useful in future classification developments and (future) 1:250 K and other projects.

data data data data data data data data data data data data data data data

Tank you!