New soil information for the Mars Crop Yield Forecasting System[1]

ANNEX

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Annex

Annex 1 - Countries covered by the SINFO project

Country	Original soil name reference	Origin of soil data
Andorra	FAO74	SGDBE version 4.0
Albania	FAO90	SGDBE version 4.0
Algeria (northern part)	WRB	SGDBE version 4.0
Algeria (southern part)	FAO74	Digital soil map of the world
Armenia	FAO74	Digital soil map of the world
Austria	FAO74	SGDBE version 4.0
Azerbaijan	FAO74	Digital soil map of the world
Belarus	WRB	SGDBE version 4.0
Belgium	FAO74	SGDBE version 4.0
Bosnia and Herzegovina	FAO74	SGDBE version 4.0
Bulgaria	FAO74	SGDBE version 4.0
Croatia	FAO74	SGDBE version 4.0
Cyprus	FAO74	Digital soil map of the world
Czech Republic	FAO90	SGDBE version 4.0
Denmark	FAO74	SGDBE version 4.0
Egypt	WRB	SGDBE version 4.0
Estonia	FAO90	SGDBE version 4.0
Faroe Islands	FAO74	Digital soil map of the world
Finland	FAO74	SGDBE version 4.0
France	FAO74	SGDBE version 4.0
FYROM (Former Yugoslav Republic of Macedonia)	FAO74	SGDBE version 4.0
Georgia	FAO74	Digital soil map of the world
Germany	FAO74	SGDBE version 4.0
Gibraltar	FAO74	SGDBE version 4.0
Greece	FAO74	SGDBE version 4.0
Hungary	FAO90	SGDBE version 4.0
Iceland	FAO74	Digital soil map of the world
Ireland	FAO74	SGDBE version 4.0
Italy	FAO74	SGDBE version 4.0
Jordan	FAO74	Digital soil map of the world
Latvia	FAO90	SGDBE version 4.0
Lebanon	WRB	SGDBE version 4.0
Libya	FAO74	Digital soil map of the world
Liechtenstein	FAO74	SGDBE version 4.0
Lithuania	FAO90	SGDBE version 4.0
Luxembourg	FAO74	SGDBE version 4.0
Malta	FAO74	Digital soil map of the world

Country	Original soil name reference	Origin of soil data
Moldova	WRB	SGDBE version 4.0
Monaco	FAO74	SGDBE version 4.0
Morocco	FAO74	Digital soil map of the world
Netherlands	FAO74	SGDBE version 4.0
Norway	FAO90	SGDBE version 4.0
Palestine	WRB	SGDBE version 4.0
Poland	FAO74	SGDBE version 4.0
Portugal	FAO74	SGDBE version 4.0
Romania	FAO74	SGDBE version 4.0
Russia	WRB	SGDBE version 4.0
San Marino	FAO74	SGDBE version 4.0
Slovakia	FAO74	SGDBE version 4.0
Slovenia	FAO90	SGDBE version 4.0
Spain (except Canary Islands)	FAO74	SGDBE version 4.0
Spain (Canary Islands only)	FAO74	Digital soil map of the world
Sweden	FAO90	SGDBE version 4.0
Switzerland	FAO90	SGDBE version 4.0
Syria	FAO74	Digital soil map of the world
Tunisia	FAO74	Digital soil map of the world
Turkey	FAO74	Digital soil map of the world
Ukraine	WRB	SGDBE version 4.0
United Kingdom	FAO74	SGDBE version 4.0
Yugoslavia	FAO74	SGDBE version 4.0

Annex 2 - Conversions of soil names into WRB-classification

This Annex describes the conversion of FAO85-FULL or FAO90-FULL attributes into the WRB-classification (WRB-FULL attribute). The remarks column explains the consideration of the choice made, where necessary. In addition, some general remarks as per Major Soil Typological Unit are given:

Z (Solonchaks): No major difficulties in the conversion. Saline phases have not been considered, because Solonchaks are saline in themselves . Salt flats (888) have been classified as Petrosalic Solonchaks (SCps).

Y (Yermosols): No major difficulties in the conversion. Yl has been converted to LV only because there is no additional data available, and Aridic Luvisols are not an option in WRB.

X (Xerosols): No major difficulties in the conversion. Xl has been converted to LV only because there is no additional data available, and Aridic Luvisols are not an option in WRB.

W (Planosols): No major difficulties in the conversion.

V (Vertisols): No major difficulties in the conversion.

U (Rankers): Some difficulties were encountered converting the Rankers of FAO85 to soils in WRB98. These difficulties are related to the definition of Rankers, being "soils having an umbric A horizon which is not more than 25 cm thick; having no other diagnostic horizons", and the definition of Leptosols in WRB98, being "soils, which are limited in depth by continuous hard rock within 25 cm from the soil surface" (the relevant part of the Leptosol definition). An umbric A horizon in FAO85 should be at least 18 cm thick, therefore Rankers are at least 18 cm thick. If there is within 25 cm continuous hard rock, such soils should be converted to Umbric Leptosols (LPum). If, however, the continuous hard rock occurs below 25 cm, the soils should be converted to Epileptic Umbrisols (UMlep). INRA used the ROO attribute to complete the first estimation by ISRIC. When the ROO attribute takes the value 1 (no obstacle between 80 cm) or 2 (obstacle between 60 to 80 cm), INRA proposed endoleptic Umbrisol instead of epileptic Umbrisol.

T (Andosols): Some difficulties were encountered as the FAO85 classification is not directly reflecting the silica-aluminium chemistry of the Andosols, which is the primary basis for subdivision of Andosols in WRB98. The following choices have been made:
Mollic Andosols are non-acidic and therefore most likely have a silica-dominated chemistry → Silic Andosols (ANsi) in WRB98.
Humic Andosols are acidic and therefore have an aluminium-dominated chemistry → Umbric Andosols (ANum) in WRB98.
Ochric Andosols have no umbric A horizon, but are likely to be acidic as well → Dystric Andosols (ANdy) in WRB98.
Vitric Andosols in FAO85 remain Vitric Andosols (ANvi) in WRB98.

S (Solonetz): No major problems in the conversion.

R (Regosols): No major problems in the conversion. Petrogypsic and petrocalcic phases have been consistently converted to Petric Gypsisols (GYpt) and Petric Calcisols (CLpt) in WRB98.

Q (Arenosols): No major problems in the conversion. Where Arenosol only (Q) is given it is advisable that only AR is given in the STU table as Haplic Arenosol (ARha) suggests that all other differentiating criteria do not apply. Dunes or shifting sands (777) have been entered as Protic Arenosols (ARpr).

P (Podzols): No major problems in the conversion. The original conversion of Pl (Leptic Podzols; weakly developed Podzols) to PZle in WRB98 has been consistently replaced by PZet. PZle ("Leptic" Podzols) does not exist; these soils are classified in WRB98 as Entic Podzols (PZet).

O (Histosols): No major problems in the conversion.

M (Greyzems): Conversion already made.

L (Luvisols): Some problems were encountered in converting FAO85 Luvisols to WRB98. This is related to the fact that in FAO85 no distinction is made on cation exchange capacity of the clay fraction. From experience, ISRIC knows that in Europe only very few Luvisols exist that have a low cation exchange capacity. It is also unlikely that such soils occur in the countries around the Mediterranean and in Central Asia. Therefore the most appropriate conversion of the Luvisol in question, the Ferric Luvisol (Lf) in FAO85 is Ferric Luvisol (LVfr) in WRB98, not Ferric Lixisol (LXfr), which would be the conversion into WRB98 for low activity clay Luvisols. The interpretation of the FAO85 Lf code therefore has been that these are soils with coarse mottles or large iron concretions.

Another problem is the conversion of Plinthic Luvisols. WRB98 does not have a provision for Plinthic Luvisols. A conversion to Plinthic Alisols, as was done, is not logical, because Alisols have a low base saturation. Moreover, Alisols are typical tropical soils rather than temperate region soils. As Plinthic Luvisols are most likely strongly weathered, preference should be given to a conversion to Plinthic Lixisols (LXpl) in WRB98.

Thirdly, many of the existing conversions in the STU table did not take into account the phase characteristics. This has been consistently adapted.

K (Kastanozems): No major problems in the conversion.

J (Fluvisols): No major problems in the conversion. It should be noted that petrogypsic and petrocalcic horizons are not permitted for Fluvisols in WRB98, therefore the petrogypsic and petrocalcic phases occurring in the FAO85 Fluvisols have been converted to Gypsisols and Calcisols, respectively.

I (Lithosols): Lithosols in FAO85 are defined as "soils limited in depth by continuous coherent and hard rock within 10 cm of the surface". As such there is a 1:1 relationship with Lithic Leptosols in WRB98. Consequently, Lithosols have been converted to Lithic Leptosols (LPli). INRA proposed to convert some Lithosols to Regosols when the ROO attribute value is contradictory with the soil name Lithosol (that means ROO value not equal to 0 or 4). In general, these Lithosols are soils developed on soft materials, not on hard materials.

H (Phaeozems): No major problems in the conversion. A few existing conversions have been changed in the light of occurring phases (see table below).

G (Gleysols): No major problems in the conversion. A few existing conversions have been changed in the light of occurring phases (see table below). It must be noted that the single G code (FAO85) can at best be converted to GL (WRB98) as Haplic Gleysol (GLha) would imply that none of the other qualifiers apply.

E (Rendzinas): Rendzinas (FAO85) generally have a 1:1 relationship to Rendzic Leptosols (LPrz) in WRB98. However, INRA proposed to convert some Rendzinas to Regosols when the ROO attribute value is contradictory with the Leptosol definition (that means a depth less than 25 cm).

D (Podzoluvisols): No major problems in the conversion to Albeluvisols.

C (Chernozems): No major problems in the conversion.

B (Cambisols): As expected, conversion of Cambisols from FAO85 to WRB98 creates a number of problems. These are briefly highlighted below:
- Cambisols with a calcic horizon (Bk in FAO85) belong to the Calcisols (CL) in WRB98
- Cambisols with an umbric A horizon (Bh in FAO85) belong to the Umbrisols (UM) in WRB98
- Presence of the petrocalcic phase (FAO85) places the soil in Calcisols in WRB98
- Presence of lithic phase places the soils in Epileptic Cambisols, which key out before most other Cambisol groups.

A (Acrisols): Like Luvisols, conversion of FAO85 Acrisols to WRB98 soils poses problems, because cation exchange capacity of the clay is not taken into account. Again assuming that most FAO85 Acrisols in Europe have a cation exchange capacity of the clay fraction of more than 24 cmol(+). kg^{-1} clay, the most appropriate conversion is Dystric Luvisol (LVdy) in WRB98 (except when the FAO90 soil name is Alisol).

Plinthic Acrisols (Ap) in FAO85 pose a similar problem as in the Luvisols. Like with the Luvisols, it can be argued that Plinthic Acrisols are most likely strongly weathered and therefore have a low cation exchange capacity. In line with the logic of the Luvisols, preference should then be given to a conversion to Plinthic Acrisols (ACpl) in WRB98, although Plinthic Alisols (ALpl) could also be an option.

Finally, 999 (rock debris or desert detritus) has been converted to Hyperskeletic Leptosols (LPhk) in WRB98. Aric Anthrosols (FAO90) are converted to Aric Regosols (RGai) in WRB98, and Cumulic Anthrosols (FAO90) are converted to Terric Anthrosols (ATtr) in WRB98. The reason for the latter conversion is that Cumulic Anthrosols of FAO90 fall in two groups in WRB98, namely Irragric Anthrosols and Terric Anthrosols. As the soil mapping units (SMU) in question are located in central Europe (mainly the eastern part of Germany), it is unlikely that these soils have developed from long-continued irrigation, and thus do not fit the concept of Irragric Anthrosols.

INRA split the estimation in two groups following the original soil name which is used in priority. When the original soil name is FAO90, the estimation is generally easier as there are few differences at the group level. In some cases, it was necessary to use also the FAO85 soil name especially when some subdivisions disappeared in FAO90 like for Pellic Vertisols.

Conversion codes of FAO85 / FAO90 to WRB98

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
*	*	ARb*	o	*	*	*	ARha	
*	*	Arc	o	*	*	*	ARca	
*	*	ARg	o	*	*	*	ARgl	
*	*	ARh	o	*	*	*	ARha	
*	*	ARl	o	*	*	*	ARll	
*	*	AT	o	*	*	*	RGha	
*	*	ATa	o	*	*	*	RGai	
*	*	ATc	o	*	*	*	ATtr	
*	*	CHb	o	*	*	*	CHha	
*	*	CHh	o	*	*	*	CHha	
*	*	CHk*	o	*	*	*	CHcc	
*	*	CHl	o	*	*	*	CHlv	
*	*	CMc	o	4	*	4	CMlep	
*	*	CMc	o	6	*	*	CLpt	
*	*	CMd	o	3	4	1	CMlen	
*	*	CMd	o	3	4	4	CMlep	
*	*	CMd	o	4	*	4	CMlep	
*	*	CMd*	o	*	*	*	CMdy	
*	*	CMe	o	3	4	1	CMlen	
*	*	CMe	o	3	4	4	CMlep	
*	*	CMe	o	4	*	3	CMlep	
*	*	CMe*	o	*	*	*	CMeu	
*	*	CMg	o	*	*	*	CMgl	
*	*	CMg	o	6	*	*	CLpt	
*	*	CMh	o	*	*	*	UMha	
*	*	CMh	o	3	4	1	UMlen	
*	*	CMj*	o	*	*	*	CMst	
*	*	CMu	o	*	*	*	UMha	
*	*	CMu	o	4	*	3	UMlep	
*	*	CMu	o	4	*	4	UMlep	
*	*	CMv	o	*	*	*	CMvr	
*	*	CMx	o	*	*	*	CMcr	
*	*	CMx	o	3	4	1	CMlen	
*	*	CMx	o	4	*	1	CMlen	
*	*	FLc	o	*	*	*	FLca	
*	*	FLe*	o	*	*	*	FLeu	
*	*	FLm	o	*	*	*	FLmo	
*	*	GLd	o	*	*	*	GLdy	
*	*	GLe	o	*	*	*	GLeu	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
*	*	GLe	o	6	*	*	GLpc	
*	*	GLh	o	*	*	*	GLhu	
*	*	GLk	o	*	*	*	GLca	
*	*	GLm	o	*	*	*	GLmo	
*	*	GLm	o	7	8	*	GLsow	
*	*	GLu	o	*	*	*	Glum	
*	*	GRh	o	*	*	*	PHlv	
*	*	HSf	o	*	*	*	HSfi	
*	*	HSi	o	*	*	*	HSge	
*	*	HSs	o	*	*	*	HSsa	
*	*	LPd	o	*	*	4	LPdy	
*	*	LPe	o	*	*	0	LPeu	
*	*	LPe	o	*	*	4	LPeu	
*	*	LPe	o	*	*	2	RGlen	
*	*	LPk	o	*	*	1	RGlen	
*	*	LPk	o	*	*	3	RGlep	
*	*	LPk	o	*	*	4	LPrz	
*	*	LPk	o	6	*	*	CLpt	
*	*	LPm	o	*	*	0	LPmo	
*	*	LPm	o	*	*	4	LPmo	
*	*	LPq	o	*	*	0	LPli	
*	*	LPq	o	*	*	4	LPli	
*	*	LPr	o	*	*	3	RGlep	
*	*	LPu	o	*	*	1	UMlen	
*	*	LPu	o	*	*	4	LPum	
*	*	LVa*	o	*	*	*	LVab	
*	*	LVe	o	*	*	*	LVeu	
*	*	LVg	o	*	*	*	LVgl	
*	*	LVh	o	*	*	*	LVha	
*	*	LVj	o	*	*	*	LVst	
*	*	LVk	o	*	*	*	CLlv	
*	*	PDd	o	*	*	*	ABha	
*	*	PDe	o	*	*	*	ABeun	
*	*	PDg	o	*	*	*	ABgl	
*	*	PDj	o	*	*	*	ABst	
*	*	PHc	o	*	*	*	PHca	
*	*	PHg	o	*	*	*	PHgl	
*	*	PHh	o	*	*	*	PHha	
*	*	PHj	o	*	*	*	PHst	
*	*	PHl	o	*	*	*	PHlv	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
*	*	PLd	o	*	*	*	PLdy	
*	*	PLe	o	*	*	*	PLeu	
*	*	PZb	o	*	*	*	PZet	
*	*	PZc	o	*	*	*	PZum	
*	*	PZg	o	*	*	*	PZgl	
*	*	PZh*	o	*	*	*	PZha	
*	*	RGc	o	*	*	*	RGca	
*	*	RGc	o	3	4	3	RGlep	
*	*	RGc	o	4	3	3	RGlep	
*	*	RGc	o	4	3	4	RGlep	
*	*	RGc	o	6	*	*	CLpt	
*	*	RGd	o	*	*	*	RGdy	
*	*	RGd	o	4	*	0	RGlep	
*	*	RGe	o	3	4	3	RGlep	
*	*	RGe	o	3	4	4	RGlep	
*	*	RGe	o	4	*	4	RGlep	
*	*	RGe*	o	*	*	*	RGeu	
*	*	RGi	o	*	*	*	RGge	
*	*	RGu	o	*	*	*	UMha	
*	*	SC	o	*	*	*	SC	
*	*	SCg	o	*	*	*	SCgl	
*	*	SCg	o	7	8	*	SCsow	
*	*	SCh	o	1	1	*	SCha	
*	*	SCh	o	7	8	*	SCsow	
*	*	SCn	o	*	*	*	SCso	
*	*	SNh	o	*	*	*	SNha	
*	*	SNh	o	7	*	*	SNszw	
*	*	SNh	o	8	7	*	SNszw	
*	*	SNm	o	*	*	*	SNmo	
*	*	SNm	o	7	8	*	SNszw	
*	*	SNm	o	8	7	*	SNszw	
777	o			*	*	*	ARpr	
888	o			*	*	*	SCps	
999	o			*	*	*	LPhk	
A	o			*	*	*	LVdy	
A	o	AL	i	*	*	*	AL	
Af	o			*	*	*	LVdy	
Ag	o	ACg	i	*	*	*	ACgl	
Ah	o			*	*	*	LVdy	
Ao	o			*	*	*	LVdy	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Ao	o			20	4	0	LVlep	
Ao	o			4	*	0	LVlep	
Ao	o	ACh	i	*	*	*	ACha	
Ap	o			*	*	*	ACpl	
B	o			*	*	*	CM	
B	o			20	1	*	CMsk	
Ba	o			*	*	*	CMca	
Bc	o			20	1	*	CMsk	
Bc	o			6	1	*	CLpt	
Bc*	o			*	*	*	CMcr	
Bc*	o			3	4	3	CMlep	
Bc*	o			4	*	0	CMlep	
Bc*	o			4	*	1	CMlen	
Bc*	o			4	*	2	CMlen	
Bc*	o			4	*	3	CMlep	
Bc*	o			4	*	4	CMlep	
Bc*	o	CMx*	i	*	*	*	CMcr	
Bc*	o	CMx*	i	4	*	4	CMlep	
Bd	i	CMa	o	*	*	*	CMdy	
Bd	o			20	*	*	CMsk	
Bd*	o			*	*	*	CMdy	
Bd*	o			2	4	1	CMlen	
Bd*	o			2	4	3	CMlep	
Bd*	o			3	4	2	CMlen	
Bd*	o			3	4	3	CMlep	
Bd*	o			3	4	4	CMlep	
Bd*	o			3	4	2	CMlen	
Bd*	o			4	*	0	CMlep	
Bd*	o			4	*	1	CMlen	
Bd*	o			4	*	2	CMlen	
Bd*	o			4	*	3	CMlep	
Bd*	o			4	*	4	CMlep	
Bd*	o	CMd	i	2	4	4	CMlep	
Bd*	o	CMd*	i	*	*	*	CMdy	
Bd*	o	CMd*	*	2	4	2	CMlen	
Bd*	o	CMd*	i	4	*	0	CMlep	
Bd*	o	CMd*	i	4	*	2	CMlen	
Bd*	o	CMd*	i	4	*	3	CMlep	
Bd*	o	CMd*	i	4	*	4	CMlep	
Bd*	o	CMe	*	2	4	2	CMlen	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Be	o			2	4	2	CMlen	
Be	o			2	6	*	CLpt	
Be	o			20	*	*	CMsk	
Be	o			20	4	0	CMlep	
Be	o			3	4	2	CMlen	
Be	o			3	4	4	CMlep	
Be	o			4	*	0	CMlep	
Be	o			4	*	1	CMlen	
Be	o			4	*	2	CMlen	
Be	o			4	*	3	CMlep	
Be	o			4	*	4	CMlep	
Be	o	CMe	i	3	4	1	CMlen	
Be	o	CMe	i	3	4	3	CMlep	
Be	o	CMe	i	4	*	3	CMlep	
Be	o	CMe	i	4	*	4	CMlep	
Be*	o			*	*	*	CMeu	
Be*	o			4	*	3	CMlep	
Be*	o	CMe*	i	*	*	*	CMeu	
Bea	o			4	*	1	CMlen	
Bea	o	CMea	i	2	4	2	CMlen	
Bea	o	CMea	i	4	*	3	CMlep	
Bec	o			*	*	*	CMca	
Bec	o			4	*	1	CMlen	
Bec	o			4	*	3	CMlep	
Bec	o			4	*	4	CMlep	
Bg	o	CMg	i	*	*	*	CMgln	
Bg*	o			*	*	*	CMgln	
Bgg	o			*	*	*	CMstn	
Bh	o			*	*	*	UMha	
Bh	o			2	4	1	UMlen	
Bh	o			20	*	*	UMsk	
Bh	o			3	4	3	UMlep	
Bh	o			3	4	2	UMlen	
Bh	o			4	*	1	UMlen	
Bh	o			4	*	3	UMlep	
Bh	o	CMu	i	*	*	*	UMha	
Bh	o	CMu	i	2	4	2	UMlen	
Bh	o	CMu	i	4	1	4	UMlep	
Bh	o	RGu	i	2	4	3	UMlep	
Bh	o	RGu	i	4	*	4	UMlep	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Bk	o			*	*	*	CLha	Cambisol with calcic or gypsic horizon should be converted to Calcisol (or Gypsisol if gypsic horizon is present).
Bk	o			20	*	*	CLsk	
Bk	o			20	4	0	CLlep	
Bk	o			4	*	0	CLlep	
Bk	o			4	*	3	CLlep	
Bk	o			6	*	*	CLpt	
Bk	o			7	*	*	CLszw	
Bk	o	CLh	i	*	*	*	CLha	
Bk	o	CLh	i	2	6	*	CLpt	
Bk	o	CLh	i	3	4	3	CLlep	
Bk	o	CLh	i	4	*	4	CLlep	
Bk	o	CLh	i	4	*	3	CLlep	
Bk	o	CLh	i	4	*	2	CLlen	
Bk	o	CLh	i	6	*	*	CLpt	
Bk	o	CLp	i	*	*	*	CLpt	
Bk	o	CMc	i	*	*	*	CMca	
Bk	o	GYh	i	*	*	*	GYha	
Bkf	o			*	*	*	CLha	
Bkh	o			*	*	*	CLha	
Bkh	o			4	*	3	CLlep	
Bkv	o			*	*	*	CLvr	
Bv*	o			*	*	*	CMvr	
Bv*	o	CMv	i	*	*	*	CMvr	
C	o			*	*	*	CH	there are no useful criteria for subdivision
C	o	CHe	i	*	*	*	CHha	
Cgs	o	CHgs	i	*	*	*	CHgl	
Ch	o	Chi	i	*	*	*	CHha	
Ch*	o			*	*	*	CHha	
Ch*	o	CHh*	i	*	*	*	CHha	
Ck*	o			*	*	*	CHcc	
Ck*	o	CHk*	i	*	*	*	CHcc	
Cl	o			*	*	*	CHlv	
Cl	o	CHl	i	*	*	*	CHlv	
D	o			*	*	*	ABha	
Dd	o			*	*	*	ABha	
De	o			*	*	*	ABeun	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Dg	o			*	*	*	ABgl	
Dge	o			*	*	*	ABgl	
Dgs	o			*	*	*	ABst	
Dgs	o	PDj	i	*	*	*	ABst	
E	o			6	*	0	CLpt	
E	o	LPm	i	*	*	4	LPmo	
E*	o			*	*	0	LPrz	
E*	o			*	*	1	RGlen	
E*	o			*	*	2	RGlen	
E*	o			*	*	3	RGlep	
E*	o			*	*	4	LPrz	
E*	o	LP*	i	*	*	1	RGlen	
E*	o	LP*	i	*	*	2	RGlen	
E*	o	LP*	i	*	*	3	RGlep	
E*	o	LPk	i	*	*	0	LPrz	
E*	o	LPk	i	*	*	4	LPrz	
G	o			*	*	*	GL	
G	o			7	*	*	GLszw	
Gc	o			7	*	*	GLszw	
Gc*	o			*	*	*	GLca	
Gd*	o			*	*	*	GLdy	
Gd*	o	GLd*	i	*	*	*	GLdy	
Ge	o			7	*	*	GLszw	
Ge*	o			*	*	*	GLeu	
Ge*	o	GLe*	i	*	*	*	GLeu	
Gf*	o			*	*	*	FLgl	
Gh	o	GLm	i	*	*	*	GLmo	
Gh*	o			*	*	*	GLhu	
Ghh	i	GLdh	o	*	*	*	GLhi	
Ghh*	o			*	*	*	GLhi	
Gi*	o			*	*	*	GLhi	
Gl*	o			*	*	*	LVgl	
Gm*	o			*	*	*	GLmo	
Gm*	o	GLm*	i	*	*	*	GLmo	
Gmc	o	GLme	i	8	*	*	GLsow	
Gs	o			*	*	*	GLha	
Gtz	o			*	*	*	GLti	
Hc*	o			*	*	*	PHca	
Hc*	o	PHc*	i	*	*	*	PHca	
Hg*	o			*	*	*	PHgl	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Hg*	o	PHg*	i	*	*	*	PHgl	
Hg*	o	PHj*	i	*	*	*	PHst	
Hgs	o			*	*	*	PHst	
Hh*	o			*	*	*	PHha	
Hh*	o	PHh*	i	*	*	*	PHha	
Hl*	o			*	*	*	PHlv	
Hl*	o	PHh	i	*	*	*	PHlv	
Hl*	o	PHi	i	*	*	*	PHlv	
Hl*	o	PHl	i	*	*	*	PHlv	
Ho	o			*	*	*	PHha	
I	o			22	*	0	GYptp	
I	o			6	*	0	CLptp	
I*	o			*	*	0	LPli	All Lithosols (I) are shallow (less than 10 cm deep) and should therefore be shown as Lithic Leptosols (LPli).
I*	o			*	*	1	RGlen	ROO is contradictory with the name Lithosol. It should be a Regosol.
I*	o			*	*	2	RGlen	ROO is contradictory with the name Lithosol. It should be a Regosol.
I*	o			*	*	3	RGlep	ROO is contradictory with the name Lithosol. It should be a Regosol.
I*	o			*	*	4	LPli	
I*	o	LPq*	i	*	*	0	LPli	
I*	o	LPq*	i	*	*	4	LPli	
I*	o	LPq*	i	*	*	1	RGlen	ROO is contradictory with the name Lithosol. It should be a Regosol.
I*	o	LPq*	i	*	*	2	RGlen	ROO is contradictory with the name Lithosol. It should be a Regosol.
I*	o	LPq*	i	*	*	3	RGlep	ROO is contradictory with the name Lithosol. It should be a Regosol.
Ic	o	LPe	i	*	*	4	LPeu	
Id	o	LPd	i	*	*	4	LPdy	
Io	i	LPd	o	*	*	3	RGlep	
J	o			*	*	*	FL	
J	o			20	6	*	CLpt	
Jc	o			22	*	*	GYpt	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Jc	o			6	*	*	CLpt	
Jc*	o			*	*	*	FLca	
Jc*	o			7	*	*	FLszw	
Jc*	o	FLc*	i	*	*	*	FLca	
Jc*	o	FLc*	i	7	*	*	FLszw	
Jcg	o	ARcg	i	7	*	*	ARszw	
Jd	o			7	*	*	FLszw	
Jd*	o			*	*	*	FLdy	
Jd*	o	FLd*	i	*	*	*	FLdy	
Je	o			22	*	*	GYpt	Petrogypsic horizon not permitted in Fluvisols.
Je	o			6	*	*	CLpt	Petrocalcic horizon not permitted in Fluvisols.
Je*	o			*	*	*	FLeu	
Je*	o			7	*	*	FLszw	
Je*	o	FLe*	i	*	*	*	FLeu	
Jm*	o			*	*	*	FLmo	
Jt	o			*	*	*	FLti	
K	o			*	*	*	KS	
Kh	o			*	*	*	KSha	
Kk*	o			*	*	*	KScc	
Kk*	o			6	*	*	KSpc	
Kk*	o	KSk*	i	*	*	*	KScc	
Kl	o			*	*	*	KSlv	
Ko	o			*	*	*	KSha	
L	o			*	*	*	LV	
L	o			4	*	1	LVlen	
L	o			6	*	*	CLpt	
La	o			*	*	*	LVab	
La	o	LVa	i	*	*	*	LVab	
Lc	i	LPc	o	*	*	1	LVcr	
Lc*	o			*	*	*	LVcr	
Lc*	o			20	4	0	LVlep	
Lc*	o			4	*	0	LVlep	
Lc*	o			4	*	1	LVlen	
Lc*	o			4	*	2	LVlen	
Lc*	o			4	*	3	LVlep	
Lc*	o			4	*	4	LVlep	
Lc*	o	*	*	6	*	*	CLpt	
Lc*	o	LVx*	i	*	*	*	LVcr	
Ld*	o			*	*	*	LVdy	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Lf	o			*	*	*	LVfr	
Lf	o			2	4	3	LVlep	
Lf	o			4	*	3	LVlep	
Lg	o			6	1	*	CLpt	
Lg*	o			*	*	*	LVgl	
Lg*	o			4	*	0	LVlep	
Lg*	o			4	*	3	LVlep	
Lgs	o			*	*	*	LVst	
Lgs	o	LVj	i	*	*	*	LVst	
Lk*	o			*	*	*	CLlv	
Lk*	o			4	*	0	LVlep	
Lk*	o			4	*	3	LVlep	
Lk*	o			6	*	*	CLpt	
Lk*	o	LVk	i	*	*	*	CLlv	
Lk*	o	LVk	i	2	6	*	CLpt	
Lo	o			20	4	0	LVlep	
Lo	o			4	*	1	LVlen	
Lo	o			4	*	3	LVlep	
Lo	o			4	*	4	LVlep	
Lo*	o			*	*	*	LVha	
Lp	o			*	*	*	LXpl	
Lv*	o			*	*	*	LVvr	
Lv*	o	LVv	i	*	*	*	LVvr	
Mo	o			*	*	*	PHlv	
Mo	o	GRh	i	*	*	*	PHlv	
O	o			*	*	*	HS	
Od	o	HSf*	i	*	*	*	HSfi	
Od*	o			*	*	*	HSdy	
Od*	o	HS	i	*	*	*	HSdy	
Oe	o			*	*	*	HSeu	
Oe	o			7	1	*	HSszw	
Oe	o	HS	i	*	*	*	HSeu	
Oe	o	HSf	i	*	*	*	HSfi	
P	o						PZha	
p	o			*	*	*	ATpa	
Pf	o			*	*	*	PZha	
Pg	o	PZc	i	*	*	*	PZgl	
Pg	o	PZg	i	*	*	*	PZgl	
Pg*	o			*	*	*	PZgl	
Pgs	o			*	*	*	PZst	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Ph*	o			*	*	*	PZum	
Pl	o	PZb	i	*	*	*	PZet	
Pl*	o			*	*	*	PZet	Original conversion to PZle does not exist; consistently replaced by PZet.
Po	o	PZh	i	*	*	*	PZha	
Po*	o			*	*	*	PZha	
Pp	o			*	*	*	PZpi	
Q	o			*	*	*	ARha	
Qa	o			*	*	*	ARha	
Qc	o			20	4	*	RGlep	
Qc	o	ARb	i	*	*	*	ARha	
Qc*	o			*	*	*	ARha	
Qh	o			*	*	*	UMar	
Ql	o	ARl	i	*	*	*	ARll	
Ql*	o			*	*	*	ARll	
R	o			*	*	*	RG	Regosol only as no additional data is available.
R	o			20	1	*	RGye	In desert areas gravely or stony phases have been interpreted as Yermic horizon.
R	o			20	4	*	RGlep	
R	o			20	6	*	CLpt	
R	o			6	1	*	CLpt	
R	o			7	1	*	RGszw	
Rc	o			*	*	*	RGca	
Rc	o			2	4	1	RGlen	
Rc	o			20	1	*	RGye	In desert areas gravely or stony phases have been interpreted as Yermic horizon.
Rc	o			20	4	0	RGlep	
Rc	o			3	4	1	RGlen	
Rc	o			3	4	2	RGlen	
Rc	o			3	4	3	RGlep	
Rc	o			4	*	0	RGlep	
Rc	o			4	*	1	RGlen	
Rc	o			4	*	3	RGlep	
Rc	o			4	*	4	RGlep	
Rc	o			6	*	*	CLpt	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Rc	o			7	1	*	RGszw	
Rc	o	ARc	i	*	*	*	ARca	
Rc	o	RGc	i	*	*	*	RGca	
Rc	o	RGc	i	7	1	*	RGszw	
Rc	o	RGe	i	*	*	*	RGca	
Rd	o			*	4	2	RGlen	
Rd	o			*	4	3	RGlep	
Rd	o			4	*	3	RGlep	
Rd	o			4	*	2	RGlen	
Rd	o	LPd	i	4	*	4	LPdy	
Rd	o	RGd	i	*	*	*	RGdy	
Rd	o	RGd	i	3	1	1	RGsk	TEXT-SRF-DOM = 9 TEXT-SUB-DOM = 9
Rd	o	RGd	i	4	*	3	RGlep	
Rd*	o			*	*	*	RGdy	
Re	o			*	*	*	RGeu	
Re	o			*	4	1	RGlen	
Re	o			*	4	2	RGlen	
Re	o			*	4	3	RGlep	
Re	o			*	4	0	RGlep	
Re	o			20	1	*	RGye	
Re	o			22	*	*	GYpt	
Re	o			4	*	1	RGlen	
Re	o			4	*	2	RGlen	
Re	o			4	*	3	RGlep	
Re	o			4	*	0	RGlep	
Re	o			6	*	*	CLpt	
Re	o			7	*	*	RGszw	
Re	o	ARh	i	*	*	*	ARha	
Re	o	RGe	i	*	*	*	RGeu	
Re	o	RGe	i	4	*	4	RGlep	
Rx	i	LPi	o	*	*	*	RGge	
S	o			*	*	*	SNha	
S	o			7	*	*	SNszw	
Sg	o	SNg	i	*	*	*	SNgl	
Sm	o	SNm	i	7	*	*	SNszw	
So	o			*	*	*	SNha	
So	o			4	*	*	SNlep	
Sof	o	SNh	i	*	*	*	SNha	
T	o			*	*	*	AN	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Th	o			*	*	*	ANum	
Th	o	ANu	i	*	*	*	ANum	
Tm	o			*	*	*	ANsi	
To	o			*	*	*	ANdy	
To	o	ANh	i	*	*	*	ANdy	
Tv	o			*	*	*	ANvi	
U	i	LP	o	*	*	3	UMlep	
U	i	LPe	o	*	*	1	UMlen	
U	i	LPe	o	*	*	3	UMlep	
U	o			*	*	0	UM	Soil having an umbric horizon and should be converted to Umbrisol.
U	o			*	*	1	UM	
U	o			*	*	2	UM	
U	o			*	*	3	UMlep	
U	o			*	*	4	UMlep	
U	o			20	4	0	UMlep	
U	o			4	*	0	UMlep	
U	o			4	*	3	UMlep	
U	o			4	*	4	UMlep	
U	o			4	*	4	LPum	TEXT_DEP_CHG = 5 TEXT-SUB-DOM = 9
U	o	LPd	i	*	*	3	UMlep	
U	o	LPu	i	*	*	1	UM	
U	o	LPu	i	4	*	3	UMlep	
U	o	LPu	i	4	*	4	LPum	TEXT_DEP_CHG = 0 or 5 TEXT-SUB-DOM = 0
U	o	LPu	i	4	*	4	UMlep	TEXT_DEP_CHG = 2
Ud	i	LPd	o	*	*	1	UMdy	
Ud	i	LPd	o	*	*	3	UMlep	
Ud	o			*	*	1	UMdy	
V	o			*	*	*	VR	
V	o			7	*	*	VRszw	
Vc	i	VRe	o	*	*	*	VRcr	
Vc	o			*	*	*	VRcr	
Vc	o			7	1	*	VRszw	
Vc	o	VRe	i	*	*	*	VRcr	
Vcc	o			*	*	*	VRcc	
Vg	i	VRe	o	*	*	*	VReu	
Vp	i	VRd	o	*	*	*	VRpe	Pellic vertisol disappeared in FAO90.

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Vp	i	VRe	o	*	*	*	VRpe	
Vp	i	VRe	o	8	*	*	VRsow	
Vp	i	VRk	o	*	*	*	VRpe	
Vp	o			*	*	*	VRpe	
Vp	o	VRe	i	*	*	*	VRpe	
Vp	o	VRe	i	7	*	*	VRszw	
Vpc	o			*	*	*	VRpe	
Vpc	o	VRk	i	*	*	*	VRpe	
Vpg	o			*	*	*	VRpe	
Vpg	o	VReg	i	*	*	*	VRpe	
Vpg	o	VRej	i	*	*	*	VRpe	
Vpn	o	VRen	i	*	*	*	VRpe	
W	o			*	*	*	PLha	
Wd	o			*	*	*	PLdy	
Wd	o	PLd	i	*	*	*	PLdy	
Wdv	o	PLd	i	*	*	*	PLdy	
We	o			*	*	*	PLeu	
We	o	LPe	i	*	*	*	PLeu	
We	o	PLe	i	*	*	*	PLeu	
Wev	o	PLe	i	*	*	*	PLeu	
Wev	o	PLev	i	*	*	*	PLeu	
Wm	o			*	*	*	PLmo	
X	o			*	*	*	RGad	Aridic because no additional data available.
X	o			20	1	*	RGye	In desert areas gravely or stony phases have been interpreted as Yermic horizon.
X	o			4	1	*	RGlep	
X	o			6	1	*	CLpt	
X	o			7	1	*	RGszw	
Xh	o			*	*	*	RGad	Aridic because no additional data available.
Xh	o			20	4	*	RGlep	
Xh	o			4	1	*	RGlep	
Xk	o			*	*	*	CLad	Aridic because no additional data available.

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Xk	o			20	1	*	CLye	In desert areas gravely or stony phases have been interpreted as Yermic horizon.
Xk	o			20	4	*	CLlep	
Xk	o			4	1	*	CLlep	
Xk	o			6	1	*	CLpt	
Xk	o			7	1	*	CLszw	
Xk	o	CLh	i	*	*	*	Clad	
Xk	o	CLh	i	7	1	*	CLszw	
Xk	o	CLp	i	*	*	*	CLpt	
Xl	o			*	*	*	LV	Luvisol only because no additional data available.
Xl	o			20	4	*	LVlep	
Xl	o			4	1	*	LVlep	
Xl	o			6	1	*	CLpt	
Xl	o			7	1	*	LVszw	
Xl	o	LVk	i	10	6	*	LVpc	
Xy	o			*	*	*	GYad	Aridic because no additional data available.
Xy	o			20	1	*	GYye	In desert areas gravely or stony phases have been interpreted as Yermic horizon.
Xy	o			20	4	*	GYlep	
Xy	o			4	1	*	GYlep	
Xy	o			6	1		GYpc	
Xy	o	GYh	i	*	*	*	GYad	
Xy	o	GYh	i	7	1	*	GYszw	
Y	o			*	*	*	RGad	Aridic because no additional data available.
Y	o			20	1	*	RGye	In desert areas gravely or stony phases have been interpreted as Yermic horizon.
Y	o			20	4	*	RGlep	
Y	o			20	6	*	CLpt	
Y	o			4	1	*	RGlep	
Y	o			6	1	*	CLpt	
Y	o			7	1	*	RGszw	

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Yh	o			*	*	*	RGad	Aridic because no additional data available.
Yh	o			20	1	*	RGye	In desert areas gravely or stony phases have been interpreted as Yermic horizon.
Yh	o			6	1	*	CLpt	
Yh	o			7	1	*	RGszw	
Yk	o			*	*	*	CLad	Aridic because no additional data available.
Yk	o			20	1	*	CLye	In desert areas gravely or stony phases have been interpreted as Yermic horizon.
Yk	o			20	4	*	CLlep	
Yk	o			20	6	*	CLpt	
Yk	o			22	1	*	GYpt	
Yk	o			4	1	*	CLlep	
Yk	o			6	1	*	CLpt	
Yk	o			7	1	*	CLszw	
Yl	o			*	*	*	LV	Luvisol only because no additional data available.
Yt	o			*	*	*	RGty	Regosol because no additional data available; could also be Cambisol.
Yy	o			*	*	*	GYad	Aridic because no additional data available.
Yy	o			20	1	*	GYye	In desert areas gravely or stony phases have been interpreted as Yermic horizon.
Yy	o			20	4		GYlep	
Yy	o			20	6	*	GYpc	
Yy	o			22	*	*	GYpt	
Yy	o			4	1	*	GYlep	
Yy	o			6	1	*	GYpc	
Z	o			*	*	*	SC	Solonchak only because no additional data available.

FAO85	FAO85.CL	FAO90	FAO90.CL	AGLIM1	AGLIM2	ROO	WRB	Remarks
Z	o			20	1	*	SCye	In desert areas gravely or stony phases have been interpreted as Yermic horizon.
Z	o			20	4	*	SClep	
Z	o			20	6	*	SCpc	
Z	o			4	1	*	SClep	
Z	o			6	1	*	SCpc	
Zg	o			*	*	*	SCgl	
Zg	o			7	8	*	SCsow	
Zg	o			8	*	*	SCsow	
Zg*	o	SCg	i	*	*	*	SCgl	
Zm	o			*	*	*	SCmo	
Zo	o			*	*	*	SCoh	Originally classified as Haplic Solonchak (SCha) in WRB, but Ochric comes before Haplic.
Zo	o			22	*	*	SCpg	
Zo	o			8	*	*	SCsow	
Zo	o	SCh	i	*	*	*	SCoh	Originally classified as Haplic Solonchak (SCha) in WRB, but Ochric comes before Haplic, and there is no Ochric in FAO90.
Zo	o	SCy	i	*	*	*	SCgy	
Zt	o			*	*	*	SCty	
Zt	o			4	*	*	SClep	
Zt	o			8	1	*	SCsow	
Zt	o	SCh	i	*	*	*	SCty	The takyric option disappeared from the FAO90 legend which explains the choice of SCh for the FAO90 attribute.

Annex 3 - PTR for salinity, alkalinity, chemical toxicity and drainage

New rule for salinity

FAO85-FULL	FAO85-FULL.CL	FAO90-FULL	FAO90-FULL.CL	WRB-FULL	WRB-FULL.CL	AGLIM1	AGLIM2	MAT1	SALINITY	CL
*	*	*	*	*	*	*	*	*	low	high
*	*	*	*	*	*	7	*	*	medium	medium
*	*	*	*	*	*	*	7	*	medium	medium
*	*	*	*	*	*	1	7	*	low	low
8	o	*	*	*	*	*	*	*	high	high
J**	o	*	*	*	*	7	*	120	high	medium
J**	o	*	*	*	*	7	*	44*	high	medium
G**	o	*	*	*	*	7	*	120	medium	low
G**	o	*	*	*	*	7	*	44*	medium	low
Gtz	o	*	*	*	*	*	*	*	medium	medium
Z**	o	*	*	*	*	*	*	*	high	high
*	*	SC*	o	*	*	*	*	*	high	high
*	*	FLs	o	*	*	*	*	*	high	high
*	*	*	*	SC**	o	*	*	*	high	high
*	*	*	*	**sz	o	*	*	*	high	high
*	*	*	*	**szn	o	*	*	*	high	high
*	*	*	*	**szp	o	*	*	*	high	high
*	*	*	*	**szh	o	*	*	*	high	high
*	*	*	*	**szw	o	*	*	*	medium	medium
*	*	*	*	**ps	o	*	*	*	high	medium

New rule for alkalinity

FAO85-FULL	FAO85-FULL.CL	FAO90-FULL	FAO90-FULL.CL	WRB-FULL	WRB-FULL.CL	AGLIM1	AGLIM2	ALKALINITY	CL
*	*	*	*	*	*	*	*	low	high
*	*	*	*	*	*	8	*	medium	medium
*	*	*	*	*	*	*	8	medium	medium
*	*	*	*	*	*	1	8	low	low
S**	o	*	*	*	*	*	*	high	high
Vpn	o	*	*	*	*	*	*	medium	low
Ws	o	*	*	*	*	*	*	medium	low
*	*	SN*	o	*	*	*	*	high	high
*	*	SCn	o	*	*	*	*	high	high
*	*	*	*	SN**	o	*	*	high	high
*	*	*	*	**na	o	*	*	high	high
*	*	*	*	**so	o	*	*	high	high
*	*	*	*	**sow	o	*	*	medium	medium

New rule for chemical toxicity

FAO85-FULL	FAO85-FULL.CL	WRB-FULL	WRB-FULL.CL	AGLIM1	ROO	CHEMICAL TOXICITY	CL
*	*	*	*	*	*	low	high
Gtz	o	*	*	*	*	high	medium
Ght	o	*	*	*	*	high	medium
Jt	o	*	*	*	*	high	high
Xy	o	*	*	*		medium	medium
Xy	o	*	*	1	1	medium	high
Xy	o	*	*	1	3	medium	high
Yy	o	*	*	*	*	medium	medium
*	*	*	*	22	*	high	medium
I	o	*	*	22	*	high	high
Xy	o	*	*	22	*	high	high
Yk	o	*	*	22	*	high	high
Yy	o	*	*	22	*	high	high
*	*	FLti	o	*	*	high	high
*	*	**gy	o	*	*	medium	medium
*	*	**gy	o	*	6	high	high
*	*	**gy	o	*	4	high	high
*	*	**gyh	o	*	*	high	high
*	*	**gyw	o	*	*	medium	high
*	*	GY**	o	*	*	medium	medium
*	*	GY**	o	*	1	medium	high
*	*	GY**	o	*	2	medium	high
*	*	GYgyh	o	*	*	high	high
*	*	GYpt	o	*	*	high	medium

New rule for drainage

WR	IL	TEXT-SRF-DOM	FAO85-FULL	FAO85-FULL.CL	FAO90-FULL	FAO90-FULL.CL	WRB-FULL	WRB-FULL.CL	DRAINAGE	CL
4	*	*	***	*	***	*	****	*	VP	high
3	*	*	***	*	***	*	****	*	I	medium
3	3	*	***	*	***	*	****	*	TP	medium
3	4	*	***	*	***	*	****	*	TP	high
3	*	*	G**	o	***	*	****	*	P	high
3	*	*	O**	o	***	*	****	*	P	high
3	*	*	W**	o	***	*	****	*	TP	high
3	*	*	*g*	o	***	*	****	*	P	high
3	*	*	**g	o	***	*	****	*	P	high

WR	IL	TEXT-SRF-DOM	FAO85-FULL	FAO85-FULL.CL	FAO90-FULL	FAO90-FULL.CL	WRB-FULL	WRB-FULL.CL	DRAINAGE	CL
3	*	*	Bg*	o	***	*	****	*	I	high
3	*	*	B*g	o	***	*	****	*	I	high
3	3	*	Bg*	o	***	*	****	*	TP	medium
3	3	*	B*g	o	***	*	****	*	TP	medium
3	4	*	Bg*	o	***	*	****	*	TP	high
3	4	*	B*g	o	***	*	****	*	TP	high
3	*	*	***	*	GL*	o	****	*	P	high
3	*	*	***	*	HS*	o	****	*	P	high
3	*	*	***	*	PL*	o	****	*	TP	high
3	*	*	***	*	**g	o	****	*	P	high
3	*	*	***	*	**i	o	****	*	P	high
3	*	*	***	*	**j	o	****	*	TP	high
3	*	*	***	*	***	*	CR**	o	P	high
3	*	*	***	*	***	*	GL**	o	P	high
3	*	*	***	*	***	*	HS**	o	P	high
3	*	*	***	*	***	*	PL**	o	TP	high
3	*	*	***	*	***	*	**gl	o	P	high
3	*	*	***	*	***	*	**ge	o	P	high
3	*	*	***	*	***	*	**hi	o	P	high
3	*	*	***	*	***	*	**ti	o	P	high
3	*	*	***	*	***	*	**pn	o	TP	medium
3	*	*	***	*	***	*	**st	o	TP	medium
2	*	*	***	*	***	*	****	*	MW	high
2	3	*	***	*	***	*	****	*	TP	medium
2	4	*	***	*	***	*	****	*	TP	medium
2	*	*	G**	o	***	*	****	*	I	high
2	*	*	O**	o	***	*	****	*	I	high
2	*	*	*g*	o	***	*	****	*	I	high
2	*	*	**g	o	***	*	****	*	I	high
2	*	*	***	*	GL*	o	****	*	I	high
2	*	*	***	*	HS*	o	****	*	I	high
2	*	*	***	*	PL*	o	****	*	TP	medium
2	*	*	***	*	**g	o	****	*	I	high
2	*	*	***	*	**i	o	****	*	I	high
2	*	*	***	*	**j	o	****	*	TP	medium
2	*	*	***	*	***	*	CR**	o	I	high
2	*	*	***	*	***	*	GL**	o	I	high
2	*	*	***	*	***	*	HS**	o	I	high
2	*	*	***	*	***	*	HSrh	o	TP	high

WR	IL	TEXT-SRF-DOM	FAO85-FULL	FAO85-FULL.CL	FAO90-FULL	FAO90-FULL.CL	WRB-FULL	WRB-FULL.CL	DRAINAGE	CL
2	*	*	***	*	***	*	HSfo	o	MW	high
2	*	*	***	*	***	*	PL**	o	TP	medium
2	*	*	***	*	***	*	**gl	o	I	high
2	*	*	***	*	***	*	**ge	o	I	high
2	*	*	***	*	***	*	**hi	o	I	high
2	*	*	***	*	***	*	**ti	o	I	high
2	*	*	***	*	***	*	**pn	o	TP	medium
2	*	*	***	*	***	*	**st	o	TP	medium
1	*	*	***	*	***	*	****	*	W	high
1	*	1	***	*	***	*	****	*	EX	high
1	*	*	Q**	o	***	*	****	*	EX	high
1	*	*	***	*	AR*	o	****	*	EX	high
1	*	*	***	*	***	*	AR**	o	EX	high
1	*	*	***	*	***	*	**ar	o	EX	high
0	*	*	***	*	***	*	****	*	W	high
0	*	1	***	*	***	*	****	*	EX	high
0	3	*	***	*	***	*	****	*	TP	medium
0	4	*	***	*	***	*	****	*	TP	high
0	*	*	D**	o	***	*	****	*	W	medium
0	*	*	G**	o	***	*	****	*	P	medium
0	*	*	Gh*	o	***	*	****	*	VP	medium
0	*	*	G*h	o	***	*	****	*	VP	medium
0	*	*	J**	o	***	*	****	*	W	medium
0	*	*	O**	o	***	*	****	*	VP	high
0	*	*	Pp*	o	***	*	****	*	VP	medium
0	*	*	Q**	o	***	*	****	*	EX	high
0	*	*	S**	o	***	*	****	*	MW	medium
0	*	*	W**	o	***	*	****	*	TP	low
0	*	*	*g*	o	***	*	****	*	I	high
0	*	*	**g	o	***	*	****	*	I	high
0	*	*	***	*	PD*	o	****	*	W	medium
0	*	*	***	*	FL*	o	****	*	W	medium
0	*	*	***	*	GL*	o	****	*	P	medium
0	*	*	***	*	HS*	o	****	*	VP	high
0	*	*	***	*	HSI	o	****	*	W	high
0	*	*	***	*	AR*	o	****	*	EX	high
0	*	*	***	*	SN*	o	****	*	MW	medium
0	*	*	***	*	PL*	o	****	*	TP	low
0	*	*	***	*	**g	o	****	*	I	medium

WR	IL	TEXT-SRF-DOM	FAO85-FULL	FAO85-FULL.CL	FAO90-FULL	FAO90-FULL.CL	WRB-FULL	WRB-FULL.CL	DRAINAGE	CL
0	*	*	***	*	**i	o	****	*	TP	medium
0	*	*	***	*	**j	o	****	*	TP	medium
0	*	*	***	*	***	*	PD**	o	W	medium
0	*	*	***	*	***	*	FL**	o	W	medium
0	*	*	***	*	***	*	FLhi	o	VP	high
0	*	*	***	*	***	*	GL**	o	P	medium
0	*	*	***	*	***	*	GLhi	o	VP	medium
0	*	*	***	*	***	*	HS**	o	VP	high
0	*	*	***	*	***	*	HSfo	o	W	high
0	*	*	***	*	***	*	AR**	o	EX	high
0	*	*	***	*	***	*	SN**	o	MW	medium
0	*	*	***	*	***	*	PL**	o	TP	low
0	*	*	***	*	***	*	**gl	o	I	medium
0	*	*	***	*	***	*	**ge	o	TP	medium
0	*	*	***	*	***	*	**st	o	TP	medium
0	*	*	***	*	***	*	**ti	o	VP	medium
0	*	*	***	*	***	*	**ar	o	EX	high
*	*	*	1**	o	***	*	****	*	NE	high
*	*	*	3**	o	***	*	****	*	NE	high
*	*	*	4**	o	***	*	****	*	NE	high
*	*	*	5**	o	***	*	****	*	NE	high
*	*	*	6**	o	***	*	****	*	NE	high
*	*	*	7**	o	***	*	****	*	NE	high
*	*	*	8**	o	***	*	****	*	NE	high
*	*	*	9**	o	***	*	****	*	NE	high
*	*	*	***	*	1**	o	****	*	NE	high
*	*	*	***	*	2**	o	****	*	NE	high
*	*	*	***	*	3**	o	****	*	NE	high
*	*	*	***	*	4**	o	****	*	NE	high
*	*	*	***	*	5**	o	****	*	NE	high
*	*	*	***	*	6**	o	****	*	NE	high
*	*	*	***	*	***	*	1***	o	NE	high
*	*	*	***	*	***	*	2***	o	NE	high
*	*	*	***	*	***	*	3***	o	NE	high
*	*	*	***	*	***	*	4***	o	NE	high
*	*	*	***	*	***	*	5***	o	NE	high
*	*	*	***	*	***	*	6***	o	NE	high

Annex 4 - Review of PTRs for determining the SWAP

1. Pedo-transfer rule 1 (PTR01): depth to a textural change (PDT)

This rule mainly converts the soil parameter 'depth class to a textural change' on the basis of soil name and the difference between texture of top and sub soil into depth of textural change (cm).

1.1 Current rule

```
Column 1 = soil name FAO-85

Column 2 = depth class to a textural change
 0   No information
 1   Textural change between 20 and 40 cm depth
 2   Textural change between 40 and 60 cm depth
 3   Textural change between 60 and 80 cm depth
 4   Textural change between 80 and 120 cm depth
 5   No textural change between 20 and 120 cm depth
 6   Textural change between 20 and 60 cm depth
 7   Textural change between 60 and 120 cm depth

Column 3 = depth class of an obstacle to roots
 0   No information
 1   No obstacle to roots between 0 and 80 cm
 2   Obstacle to roots between 60 and 80 cm depth
 3   Obstacle to roots between 40 and 60 cm depth
 4   Obstacle to roots between 20 and 40 cm depth
 5   Obstacle to roots between 0 and 80 cm depth
 6   Obstacle to roots between 0 and 20 cm depth

Column 4 = code for the presence of an impermeable layer
 0   No information
 1   No impermeable layer within 150 cm
 2   Impermeable layer between 80 and 150 cm
 3   Impermeable layer between 40 and 80 cm
 4   Impermeable layer within 40 cm

Column 5 = dominant surface texture class
 0   No information
 9   No mineral texture (peat soils, stony soils)
 1   Coarse (clay < 18% and sand > 65%)
 2   Medium (18% < clay < 35% and sand < 65%,
     or clay < 18% and 15% < sand < 65%)
 3   Medium fine (clay < 35% and sand < 15%)
 4   Fine (35% < clay < 60%)
 5   Very fine (clay > 60 %)

Column 6 = dominant sub-surface texture class
See column 5 for explanation

Column 7 = depth to a textural change (PDT)
Units in cm

Column 8 = confidence level
 1   very low
 2   low
 3   moderate
 4   high
```

```
Rule PTR01
         *** 0 *   *   *   *   30 3
             0 0   0   0   0    0 4
         g   0 0   0   0   0    0 4
         Gh* 0 0   0   *   0   20 3
         Gm* 0 0   0   *   0   20 3
         I** 0 0   *   *   *   10 4
         O** 0 0   *   *   0   10 3
         r   0 0   0   *   0   10 4
         r   0 0   0   0   0    0 4
         r   0 0   0   9   0    0 4
         S** 0 0   0   *   0   20 3
         U** 0 0   0   *   0   20 3
         Z** 0 0   0   *   0   20 3
         I** 0 4   *   *   0   10 3
         r   0 4   1   0   0    0 3
         r   0 5   0   9   0    0 3
         O** 0 5   1   9   0   10 3
         *** 1 *   *   *   *   30 4
         I** 1 4   1   *   0   10 3
         I** 1 4   1   *   9   10 3
         I** 1 4   4   *   0   10 3
         I** 1 4   4   *   9   10 3
         *** 2 *   *   *   *   50 4
         I** 2 0   1   *   *   10 3
         U** 2 3   0   2   2   40 3
         *** 2 4   1   *   *   40 3
         *** 2 *   *   *   9   30 3
         *** 3 *   *   *   *   70 4
         *** 3 *   *   *   9   30 3
         *** 4 *   *   *   *  100 4
         I** 4 4   1   *   0   10 3
         *** 5 *   *   *   *   30 4
         *** 5 *   *   9   *   20 3
         *** 5 *   *   9   0   30 3
         *** 5 *   *   9   9   30 3
         g   5 *   *   9   9    0 3
         I** 5 0   *   *   0   10 3
         I** 5 1   1   *   0   10 3
         I** 5 4   *   *   0   10 3
         I** 5 0   0   *   9   10 3
         I** 5 4   1   *   9   10 3
         I** 5 *   *   0   *   10 3
         r   5 4   1   *   0   10 3
         r   5 *   *   9   9    0 3
         O** 5 0   1   9   9   10 3
         *** 6 *   *   *   *   40 4
         *** 6 *   *   *   0   30 3
         *** 6 *   *   *   9   30 3
         *** 7 *   *   *   *   90 4
         *** 7 5   *   *   *   60 3
         *** 7 *   *   *   9   30 3
```

1.2 Review rule

1. The rules of PTR01 as they are entered above are only based on the contents of the former database. Some of the rules are very specific and could (and should) work in a more generic way. If they are defined in a more generic way, they will also function well when the contents of the database changes.

2. PTR01 defines the depth to textural change mainly on the basis of depth class to textural change. The central value of the class range is assigned as value of PDT (depth to a textural change in cm)(see table below).

Code	Depth class to textural change	Default Depth to Text Change (PDT)
0	No information	30 cm
1	Textural change between 20 and 40 cm depth	30 cm
2	Textural change between 40 and 60 cm depth	50 cm
3	Textural change between 60 and 80 cm depth	70 cm
4	Textural change between 80 and 120 cm depth	100 cm
5	No textural change between 20 and 120 cm depth	20 cm
6	Textural change between 20 and 60 cm depth	40 cm
7	Textural change between 60 and 120 cm depth	90 cm

3. Modifications of the PDT are on the basis of Soil Name and mineral texture of the sub soil.
   a. All Litosols (I**) have PDT = 10 cm
   b. All rocks (r) have PDT = 10 (if surface texture is 1,2, 3, 4, 5, 6 or 7) or = 0 cm
   c. All glaciers (g) have PDT = 0 cm
   d. No mineral texture in sub soil or no information (code 0 or 9) leads to PDT = 30 cm
   Notice, the FAO-74 surface texture classes 6 (combining 2 and 3) and 7 (combining 4 and 5) are not covered. The new rule will cover this.

4. Probably most Histosols (O**) have PDT = 10 cm

5. For a Ranker U** PDT is set at 40 cm.

6. Note that PTR01 does not define depth rules for Rendzina's.

7. If there is no information at all on depth class to a textural change, ROO and IL then PDT = 20 cm for a number of STU's, defined as Gh*, Gm*, S**, U**, Z**.

8. It appears that the variables ROO and IL do not have a logical influence on the results of PTR01. These variables can be skipped.

9. In addition the rules must be able to handle the other classifications of FAO90 and WRB. For the conversion please consult the table below.

FAO85	FAO90	WRB	comment
O**	HS*	HS**	Histosol, Organic soil, Peat soil
I**	LP*	LP**	Lithosol, Leptosol (but not E** rendzina, LPrz)
r	6 66	6 6 6	rock, same as 666
g	5 55	5 5 5	glacier, same as 555
U**	LP*	LP**	Ranker (is thicker and occurs less widespread than Lithosol (Id and U** are both LPdy))
Gh*	GLh	GLhu	Humic Gleysol
Gm*	GLm	GLmo	Mollic Gleysol
S**	SN*	SN**	Solonetz
Z**	SC*	SC**	Solonchak

1.3 New rule

Column 1 = soil name FAO-85

Column 2 = confidence level soil name FAO-85
 h High
 m Moderate

```
 l   Low
 v   Very low or unknown confidence level
 o   Data originates from author no pedo-transfer interpretation)

Column 3 = soil name FAO-90

Column 4 = confidence level soil name FAO-90
 See column 2 for explanation

Column 5 = soil name WRB

Column 6 = confidence level soil name WRB
 See column 2 for explanation

Column 7 = depth class to a textural change
 0   No information
 1   Textural change between 20 and 40 cm depth
 2   Textural change between 40 and 60 cm depth
 3   Textural change between 60 and 80 cm depth
 4   Textural change between 80 and 120 cm depth
 5   No textural change between 20 and 120 cm depth
 6   Textural change between 20 and 60 cm depth
 7   Textural change between 60 and 120 cm depth

Column 8 = dominant surface texture class
 0   No information
 9   No mineral texture (peat soils, stony soils)
 1   Coarse (clay < 18% and sand > 65%)
 2   Medium (18% < clay < 35% and sand < 65%,
     or clay < 18% and 15% < sand < 65%)
 3   Medium fine (clay < 35% and sand < 15%)
 4   Fine (35% < clay < 60%)
 5   Very fine (clay > 60 %)
 6   Medium (18% < clay < 35%, or clay < 18% and sand < 65%)
     for use with the Digital Soil Map of the World only
 7   Fine (clay > 35%)
     for use with the Digital Soil Map of the World only

Column 9 = dominant sub-surface texture class
See column 8 for explanation

Column 10 = depth to a textural change (PDT)
Units in cm

Column 11 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR01
***   *     ****  *     *****  *     0     *     *     30    3
S**   o     ****  *     *****  *     0     *     *     20    3
U**   o     ****  *     *****  *     0     *     *     20    3
Z**   o     ****  *     *****  *     0     *     *     20    3
Gh*   o     ****  *     *****  *     0     *     *     20    3
Gm*   o     ****  *     *****  *     0     *     *     20    3
O**   o     ****  *     *****  *     0     *     *     10    3
***   *     SN**  o     *****  *     0     *     *     20    3
***   *     LP**  o     *****  *     0     *     *     20    3
***   *     SC**  o     *****  *     0     *     *     20    3
***   *     GLh*  o     *****  *     0     *     *     20    3
***   *     GLdh  o     *****  *     0     *     *     20    3
***   *     GLm*  o     *****  *     0     *     *     20    3
```

***	*	HS**	o	*****	*	0	*	*	10	3
***	*	****	*	SN***	o	0	*	*	20	3
***	*	****	*	LP***	o	0	*	*	20	3
***	*	****	*	SC***	o	0	*	*	20	3
***	*	****	*	GLhu*	o	0	*	*	20	3
***	*	****	*	GLti*	o	0	*	*	20	3
***	*	****	*	GLmo*	o	0	*	*	20	3
***	*	****	*	HS***	o	0	*	*	10	3
***	*	****	*	*****	*	1	*	*	30	4
***	*	****	*	*****	*	2	*	*	50	4
U**	o	****	*	*****	*	2	*	*	40	3
***	*	LP**	o	*****	*	2	*	*	40	3
***	*	****	*	LP***	o	2	*	*	40	3
***	*	****	*	*****	*	3	*	*	70	4
***	*	****	*	*****	*	4	*	*	100	4
***	*	****	*	*****	*	5	*	*	20	4
O**	o	****	*	*****	*	5	*	*	10	3
***	*	HS**	o	*****	*	5	*	*	10	3
***	*	****	*	HS***	o	5	*	*	10	3
***	*	****	*	*****	*	6	*	*	40	4
***	*	****	*	*****	*	7	*	*	90	4
***	*	****	*	*****	*	*	1	9	30	4
***	*	****	*	*****	*	*	1	0	30	4
***	*	****	*	*****	*	*	2	9	30	4
***	*	****	*	*****	*	*	2	0	30	4
***	*	****	*	*****	*	*	3	9	30	4
***	*	****	*	*****	*	*	3	0	30	4
***	*	****	*	*****	*	*	4	9	30	4
***	*	****	*	*****	*	*	4	0	30	4
***	*	****	*	*****	*	*	5	9	30	4
***	*	****	*	*****	*	*	5	0	30	4
***	*	****	*	*****	*	*	6	9	30	4
***	*	****	*	*****	*	*	6	0	30	4
***	*	****	*	*****	*	*	7	9	30	4
***	*	****	*	*****	*	*	7	0	30	4
555	o	****	*	*****	*	*	*	*	0	4
I**	o	****	*	*****	*	*	*	*	10	4
666	o	****	*	*****	*	*	*	*	10	4
666	o	****	*	*****	*	*	0	*	0	4
666	o	****	*	*****	*	*	9	*	0	4
***	*	5 55	o	*****	*	*	*	*	0	4
***	*	LP**	o	*****	*	*	*	*	10	4
***	*	6 66	o	*****	*	*	*	*	10	4
***	*	6 66	o	*****	*	*	0	*	0	4
***	*	6 66	o	*****	*	*	9	*	0	4
***	*	****	*	5 5 5	o	*	*	*	0	4
***	*	****	*	LP***	o	*	*	*	10	4
***	*	****	*	6 6 6	o	*	*	*	10	4
***	*	****	*	6 6 6	o	*	0	*	0	4
***	*	****	*	6 6 6	o	*	9	*	0	4

2. Pedo-transfer rule 2 (PTR02): rooting depth

ROO	TEXT_DEP_CHG	IL	FAO85	CL	FAO90	CL	WRB	CL	MAT1	MAT1.CL	TEXT_SUB_DOM	AGLIM1	AGLIM2	ROOT	CL
*	*	*	1**	o	***	*	*****	*	***	*	*	*	*	1	h
*	*	*	***	*	1 *	o	*****	*	***	*	*	*	*	1	h
*	*	*	***	*	***	*	1 ***	o	***	*	*	*	*	1	h
*	*	*	2**	o	***	*	*****	*	***	*	*	*	*	1	h
*	*	*	2**	h	***	*	*****	*	***	*	*	*	*	1	l
*	*	*	***	*	2 *	o	*****	*	***	*	*	*	*	1	h
*	*	*	***	*	***	*	2 ****	o	***	*	*	*	*	1	h
*	*	*	3**	o	***	*	*****	*	***	*	*	*	*	1	h
*	*	*	***	*	3 *	o	*****	*	***	*	*	*	*	1	h
*	*	*	***	*	***	*	3 ***	o	***	*	*	*	*	1	h
*	*	*	4**	o	***	*	*****	*	***	*	*	*	*	1	h
*	*	*	***	*	4 *	o	*****	*	***	*	*	*	*	1	h
*	*	*	***	*	***	*	4 ***	o	***	*	*	*	*	1	h
*	*	*	5**	o	***	*	*****	*	***	*	*	*	*	1	h
*	*	*	***	*	5 *	o	*****	*	***	*	*	*	*	1	h
*	*	*	***	*	***	*	5 ***	o	***	*	*	*	*	1	h
*	*	*	6**	o	***	*	*****	*	***	*	*	*	*	1	h
*	*	*	***	*	6 *	o	*****	*	***	*	*	*	*	1	h
*	*	*	***	*	***	*	6 ***	o	***	*	*	*	*	1	h
*	*	*	7**	o	***	*	*****	*	***	*	*	*	*	1	h
*	*	*	8**	o	***	*	*****	*	***	*	*	*	*	1	h
*	*	*	9**	o	***	*	*****	*	***	*	*	*	*	1	h
0	*	*	A**	o	***	*	*****	*	***	*	*	*	*	6	m
0	*	*	A**	o	***	*	*****	*	7**	o	*	*	*	5	m
0	*	*	B**	o	***	*	*****	*	***	*	*	*	*	6	h
0	*	*	Bc*	o	***	*	*****	*	***	*	*	*	*	6	m
0	*	*	Bc*	o	***	*	*****	*	2**	o	*	*	*	4	m
0	*	*	Bc*	o	***	*	*****	*	***	*	*	4	*	4	l
0	*	*	Bd*	o	***	*	*****	*	***	*	*	*	*	6	m
0	*	*	Bd*	o	***	*	*****	*	***	*	*	4	*	4	m
0	*	*	Bd*	o	***	*	*****	*	7**	o	*	*	*	6	l
0	*	*	Bd*	o	***	*	*****	*	7**	o	*	4	*	3	m
0	5	1	Bd*	o	***	*	*****	*	7**	o	*	4	*	3	l
0	*	*	Be*	o	***	*	*****	*	***	*	*	*	*	6	h
0	5	1	Be*	o	***	*	*****	*	***	*	9	*	*	8	m
0	*	*	Be*	o	***	*	*****	*	2**	o	*	*	*	6	m
0	*	*	Be*	o	***	*	*****	*	45*	o	*	*	*	6	m
0	*	*	Be*	o	***	*	*****	*	7**	o	*	*	*	5	l
0	1	3	Be*	o	***	*	*****	*	7**	o	*	*	*	5	l
0	*	*	Bec	o	***	*	*****	*	***	*	*	*	*	6	m
0	*	*	Bec	o	***	*	*****	*	***	*	*	4	*	4	m
0	*	*	Bec	o	***	*	*****	*	2**	o	*	*	*	6	l
0	*	*	Bec	o	***	*	*****	*	2**	o	*	4	*	4	l
0	*	*	Bec	o	***	*	*****	*	23*	o	*	*	*	6	m
0	*	*	Bh*	o	***	*	*****	*	***	*	*	*	*	5	m
0	*	*	Bh*	o	***	*	*****	*	***	*	*	4	*	3	l
0	*	*	Bk*	o	***	*	*****	*	***	*	*	*	*	4	l
0	*	*	Bk*	o	***	*	*****	*	***	*	*	4	*	4	m
0	*	*	Bk*	o	***	*	*****	*	23*	o	*	*	*	6	h
0	*	*	Bv*	o	***	*	*****	*	***	*	*	*	*	6	h
0	*	*	***	*	CMe	o	*****	*	***	*	*	*	*	6	m
0	*	*	***	*	***	*	CMca*	o	***	*	*	*	*	6	m
0	*	*	***	*	***	*	CMlep	o	***	*	*	*	*	3	m
0	*	*	C**	o	***	*	*****	*	***	*	*	*	*	7	h
0	*	*	D**	o	***	*	*****	*	***	*	*	*	*	8	h
0	*	*	E**	o	***	*	*****	*	***	*	*	*	*	4	m

ROO	TEXT_DEP_CHG	IL	FAO85	CL	FAO90	CL	WRB	CL	MAT1	MAT1.CL	TEXT_SUB_DOM	AGLIM1	AGLIM2	ROOT	CL
0	*	*	E**	o	***	*	*****	*	***	*	*	4	*	3	h
0	*	*	G**	o	***	*	*****	*	***	*	*	*	*	7	h
0	*	*	***	*	GLe	o	*****	*	***	*	*	*	*	7	h
0	*	*	***	*	GLh	o	*****	*	***	*	*	*	*	7	h
0	5	2	***	*	GLh	o	*****	*	***	*	*	*	*	8	h
0	*	*	H**	o	***	*	*****	*	***	*	*	*	*	8	h
0	*	*	I**	o	***	*	*****	*	***	*	*	*	*	1	h
0	2	1	I**	o	***	*	*****	*	***	*	9	*	*	4	m
0	*	*	***	*	LPq	o	*****	*	***	*	*	*	*	1	h
0	*	*	***	*	LPm	o	*****	*	***	*	*	*	*	3	h
0	*	*	***	*	LPe	o	*****	*	***	*	*	*	*	4	l
0	*	*	J**	o	***	*	*****	*	***	*	*	*	*	7	h
0	*	*	***	*	FLe	o	*****	*	***	*	*	*	*	7	h
0	*	*	K**	o	***	*	*****	*	***	*	*	*	*	7	h
0	*	*	L**	o	***	*	*****	*	***	*	*	*	*	7	h
0	*	*	Lc*	o	***	*	*****	*	***	*	*	*	*	6	h
0	*	*	Lc*	o	***	*	*****	*	2**	o	*	*	*	4	l
0	*	*	Lc*	o	***	*	*****	*	7**	o	*	*	*	2	m
0	*	*	Lc*	o	***	*	*****	*	7**	o	*	4	*	3	h
0	*	*	Lo*	o	***	*	*****	*	***	*	*	*	*	8	h
0	*	*	Lo*	o	***	*	*****	*	7**	o	*	*	*	6	l
0	*	*	O**	o	***	*	*****	*	***	*	*	*	*	6	h
0	*	*	***	*	HSf	o	*****	*	***	*	*	*	*	3	m
0	*	*	***	*	HSs	o	*****	*	***	*	*	*	*	6	h
0	*	*	P**	o	***	*	*****	*	***	*	*	*	*	6	m
0	*	*	Pp*	o	***	*	*****	*	***	*	*	*	*	4	m
0	*	*	***	*	PZg	o	*****	*	***	*	*	*	*	6	m
0	*	*	***	*	PZg	o	*****	*	131	o	*	*	*	4	m
0	*	*	Q**	o	***	*	*****	*	***	*	*	*	*	7	h
0	4	*	***	*	ARha	o	*****	*	***	*	*	*	*	8	h
0	*	*	R**	o	****	*	*****	*	***	*	*	*	*	7	h
0	*	*	***	*	RGd	o	*****	*	***	*	*	*	*	4	h
0	*	*	***	*	***	*	RG***	o	***	*	*	*	*	7	l
0	*	*	S**	o	***	*	*****	*	***	*	*	*	*	6	h
0	*	*	***	*	***	*	SNha*	o	***	*	*	*	*	6	m
0	*	*	T**	o	***	*	*****	*	***	*	*	*	*	6	h
0	*	*	U**	o	***	*	*****	*	***	*	*	*	*	4	m
0	*	*	U**	o	***	*	*****	*	***	*	*	4	*	3	h
0	*	*	V**	o	***	*	*****	*	***	*	*	*	*	6	h
0	*	*	W**	o	***	*	*****	*	***	*	*	*	*	6	h
0	*	*	X**	o	***	*	*****	*	***	*	*	*	*	4	m
0	*	*	X**	o	***	*	*****	*	23**	o	*	*	*	6	m
0	*	*	X**	o	***	*	*****	*	***	*	*	6	*	3	h
0	*	*	X**	o	***	*	*****	*	***	*	*	*	6	3	h
0	*	*	Y**	o	***	*	*****	*	***	*	*	*	*	6	m
0	*	*	Y**	o	***	*	*****	*	***	*	*	6	*	3	h
0	*	*	Y**	o	***	*	*****	*	***	*	*	22	*	3	h
0	*	*	Y**	o	***	*	*****	*	***	*	*	*	6	3	h
0	*	*	Y**	o	***	*	*****	*	***	*	*	*	4	3	h
0	*	*	Z**	o	***	*	*****	*	***	*	*	*	*	6	h
0	*	*	***	*	***	*	SCha*	o	***	*	*	*	*	6	l
0	*	*	p	o	***	*	*****	*	***	*	*	*	*	6	h
0	2	*	***	*	***	*	ATtr*	o	***	*	*	*	*	6	m
0	*	*	***	*	***	*	CLha*	o	***	*	*	4	*	4	l
1	*	*	***	*	***	*	*****	*	***	*	*	*	*	6	h
1	*	*	C**	o	***	*	*****	*	***	*	*	*	*	7	h
1	*	*	D**	o	***	*	*****	*	***	*	*	*	*	8	h
1	*	*	G**	o	***	*	*****	*	***	*	*	*	*	7	h
1	*	*	H**	o	***	*	*****	*	***	*	*	*	*	8	h

ROO	TEXT_DEP_CHG	IL	FAO85	CL	FAO90	CL	WRB	CL	MAT1	MAT1.CL	TEXT_SUB_DOM	AGLIM1	AGLIM2	ROOT	CL
1	*	*	J**	o	***	*	*****	*	***	*	*	*	*	7	h
1	*	*	L**	o	***	*	*****	*	***	*	*	*	*	7	h
1	*	*	Lc*	o	***	*	*****	*	***	*	*	*	*	6	h
1	*	*	Lo*	o	***	*	*****	*	***	*	*	*	*	8	h
1	*	*	Lo*	o	***	*	*****	*	7**	o	*	*	*	6	m
1	*	*	Q**	o	***	*	*****	*	***	*	*	*	*	7	h
1	*	*	R**	o	***	*	*****	*	***	*	*	*	*	7	h
1	4	*	***	*	***	*	*****	*	***	*	*	*	*	8	m
1	5	1	***	o	***	*	*****	*	***	*	9	*	*	8	m
1	5	3	***	o	***	*	*****	*	***	*	9	*	*	8	m
1	5	4	***	o	***	*	*****	*	***	*	9	*	*	8	m
1	5	1	O**	o	***	*	*****	*	***	*	9	*	*	6	m
1	5	3	O***	o	***	*	*****	*	***	*	9	*	*	6	m
1	5	4	O**	o	***	*	*****	*	***	*	9	*	*	6	m
1	7	*	***	o	***	*	*****	*	***	*	*	*	*	6	m
1	7	*	D**	o	***	*	*****	*	***	*	*	*	*	8	h
1	7	*	G**	o	***	*	*****	*	***	*	9	*	*	7	h
1	7	*	L**	o	***	*	*****	*	***	*	*	*	*	7	h
1	7	*	Lc*	o	***	*	*****	*	***	*	*	*	*	6	m
1	7	*	Lo*	o	***	*	*****	*	***	*	*	*	*	8	h
1	7	*	Lo*	o	***	*	*****	*	7**	o	*	*	*	6	l
1	7	*	Lo*	o	***	*	*****	*	***	*	9	*	*	6	m
1	*	*	***	*	AR*	o	*****	*	***	*	*	*	*	7	h
1	*	*	***	*	CH*	o	*****	*	***	*	*	*	*	7	h
1	*	*	***	*	GL*	o	*****	*	***	*	*	*	*	7	h
1	*	*	***	*	FL*	o	*****	*	***	*	*	*	*	7	h
1	*	*	***	*	LV*	o	*****	*	***	*	*	*	*	7	h
1	*	*	***	*	LVa	o	*****	*	***	*	*	*	*	6	l
1	*	*	***	*	LVj	o	*****	*	***	*	*	*	*	7	m
1	*	*	***	*	LVh	o	*****	*	***	*	*	*	*	8	h
1	*	*	***	*	LVx	o	*****	*	***	*	*	*	*	7	m
1	*	*	***	*	PD*	o	*****	*	***	*	*	*	*	8	h
1	*	*	***	*	PH*	o	*****	*	***	*	*	*	*	8	h
1	*	2	***	*	***	*	*****	*	***	*	*	*	*	8	h
1	*	*	***	*	***	*	AR***	o	***	*	*	*	*	7	h
1	*	*	***	*	***	*	GL***	o	***	*	*	*	*	7	h
1	*	*	***	*	***	*	LV***	o	***	*	*	*	*	7	h
1	*	*	***	*	***	*	FL***	o	***	*	*	*	*	7	h
1	*	*	***	*	***	*	CH***	o	***	*	*	*	*	7	h
1	*	*	***	*	***	*	PH***	o	***	*	*	*	*	8	h
1	*	*	***	*	***	*	**le*	o	***	*	*	*	*	6	h
2	*	*	***	*	***	*	*****	*	***	*	*	*	*	5	h
3	*	*	***	*	***	*	*****	*	***	*	*	*	*	4	h
4	*	*	***	*	***	*	*****	*	***	*	*	*	*	3	h
4	*	*	5**	o	***	*	*****	*	***	*	*	*	*	1	h
4	*	*	6**	o	***	*	*****	*	***	*	*	*	*	1	h
4	*	*	I**	o	***	*	*****	*	***	*	*	*	*	1	h
4	*	*	***	*	LPq	o	*****	*	***	*	*	*	*	1	h
5	*	*	***	*	***	*	*****	*	***	*	*	*	*	5	m
5	2	*	***	o	***	*	*****	*	***	*	9	*	*	4	m
5	6	*	***	o	***	*	*****	*	***	*	9	*	*	4	h
5	7	*	***	o	***	*	*****	*	***	*	9	*	*	5	h
5	0	*	***	*	6 *	o	*****	*	***	*	*	*	*	1	h
5	0	*	***	*	HSs	o	*****	*	***	*	*	*	*	5	m
5	*	*	***	*	***	*	LP***	o	***	*	*	*	*	3	m
5	*	*	***	*	***	*	LPlir	o	***	*	*	*	*	1	m
5	*	*	***	*	***	*	HSfi*	o	***	*	*	*	*	3	l
5	*	*	***	*	***	*	HScy*	o	***	*	*	*	*	3	l
5	*	*	***	*	***	*	CLcch	o	***	*	*	*	*	5	l

ROO	TEXT_ DEP _CHG	IL	FAO85	CL	FAO90	CL	WRB	CL	MAT1	MAT1. CL	TEXT_ SUB _DOM	AGLIM1	AGLIM2	ROOT	CL
5	*	*	***	*	***	*	RGye*	o	***	*	*	*	*	3	l
6	*	*	***	*	***	*	*****	*	***	*	*	*	*	2	h
6	*	*	***	*	***	*	**li*	o	***	*	*	*	*	1	h
6	*	*	***	*	***	*	6 ***	o	***	*	*	*	*	1	h

3. Pedo-transfer rule 3 (PTR03): top soil texture class (TEXTS)

This rule corrects the top soil texture class on the basis of soil name, parent material and sub soil texture class. The texture classification is changed by adding classes 7 for rocks and 8 for peat.

3.1 Current rule

```
Column 1 = soil name FAO-85

Column 2 = dominant surface texture class
 0   No information
 9   No mineral texture (peat soils, stony soils)
 1   Coarse (clay < 18% and sand > 65%)
 2   Medium (18% < clay < 35% and sand < 65%,
     or clay < 18% and 15% < sand < 65%)
 3   Medium fine (clay < 35% and sand < 15%)
 4   Fine (35% < clay < 60%)
 5   Very fine (clay > 60 %)

Column 3 = dominant sub-surface texture class
 See column 2 for explanation

Column 4 = top soil texture class
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class

Column 5 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR03
         *** 1 *  1 4
         *** 2 *  2 4
         *** 3 *  3 4
         *** 4 *  4 4
         *** 5 *  5 4
         *** 0 *  0 4
         g   0 *  7 4
         Gh* 0 *  8 4
         Gm* 0 *  8 4
         Pp* 0 *  8 3
         O** 0 *  8 4
```

```
U** 0 *  8 3
r   0 *  7 4
g   9 *  7 4
Gh* 9 *  8 4
Gi* 9 *  8 4
Gm* 9 *  8 4
I** 9 1  1 3
Jmg 9 *  8 3
O** 9 *  8 4
Pp* 9 *  8 3
r   9 *  7 4
U** 9 *  8 3
```

3.2 Review rule

1. The rules of PTR03 as they are entered above are only based on the contents of the former database. Some of the rules are very specific and could (and should) work in a more generic way. If they are defined in a more generic way, they will also function well when the contents of the database changes.

2. Basically the top soil texture classification is an extension of the old dominant surface texture classification by adding the classes 7 for rocks, and 8 for peat.

3. However, the FAO-74 surface texture classes 6 (combining 2 and 3) and 7 (combining 4 and 5) are not covered. The new rule should cover this.

4. Mainly, PTR03 assigns the dominant surface class code to the top soil surface; this is a copy-action. Because 7 (rocks) and 8 (peat) are new classes the rule assigns them in addition to the copying.

5. The meaning of the new top soil texture class 9 is different from the original class 9 for dominant surface texture. However, note that the new class 9 is not assigned to any STU.

6. In case of „No information" (code 0) or „no mineral texture" (code 9) part of the STU's are labelled as having a top soil of peat or rocks. This assignment is based on the soil name.

7. There is an initial line assigning TEXRT_SRF_DOM = 0 to TEXTS = 0 (*** 0 * 0 4), but this is not done for code 9. So part of the STU's with code 9 are not covered by the PTR03. This will be added in the new rule.

8. In addition to the copying, PTR03 assigns TEXTS = 7 (rocks) to STU's with name g (glaciers) and r (rocks) when TEXT_SRF_DOM = 0 or = 9.

9. In addition to the copying, PTR03 assigns TEXTS = 8 (peat) to STU's with a name implying that the soil may have a peaty top soil in case that TEXT_SRF_DOM = 0 or = 9.

10. The remaining soils affected by PTR03 include a rather small number of STU's. The rules are plausible, as they relate acidic humic soils with peaty top soil. However we doubt that Gm* and Jmg, which are wet soils with mollic (not humic) epipedon, could have a peaty top soil. However, the national expert did not give a mineral class which explains the conversion into a peaty top soil.

11. Sub soil information is only applied in a very strangely defined STU: any lithosol (I**) without mineral top soil (stony) and a coarse textured sub soil. However, a Lithosol is officially 10 cm deep, thus it should not have a sub soil texture. In PTR03 this Lithosol sub soil code is used to translate TEXT_SUB_DOM = 9 into TEXTS = 1.

12. In addition, the rules must be able to handle the other classifications of FAO90 and WRB. For the conversion please consult table below.

FAO85	FAO90	WRB	comment
g	5 55	5 5 5	glacier, same as 555
Gh*	GLh	GLhu	humic gleysol
Ghf	GLh	GLhu	fluvi-humic gleysol
Ghh	GLdh	GLhu	histo-humic gleysol
Ghhc	GLh	GLhu	humic gleysol
Ght	not defined	GLti	thiono-humic gleysol
Gm*	GLm	GLmo	mollic gleysol
Pp*	not defined	PZpi	placic podzol
O**	HS*	HS**	histosol, peat soil, organic soil
U**	LPu; LPd	LPha; LPdy, LPhu	Ranker, leptosol
r	6 66	6 6 6	rock, same as 666
g	5 55	5 5 5	glacier, same as 555
Gi*	not defined	GLhi	histic gleysol
Jmg	FLm	FLmo	gleyo-mollic fluvisol
r	6 66	6 6 6	rock, same as 666

3.3 New rule

```
Column 1 = soil name FAO-85

Column 2 = confidence level soil name FAO-85
 h   High
 m   Moderate
 l   Low
 v   Very low or unknown confidence level
 o   Data originates from author (no pedo-transfer interpretation)

Column 3 = soil name FAO-90

Column 4 = confidence level soil name FAO-90
See column 2 for explanation

Column 5 = soil name WRB

Column 6 = confidence level soil name WRB
See column 2 for explanation

Column 7 = dominant surface texture class
 0   No information
 9   No mineral texture (peat soils, stony soils)
 1   Coarse (clay < 18% and sand > 65%)
 2   Medium (18% < clay < 35% and sand < 65%,
     or clay < 18% and 15% < sand < 65%)
 3   Medium fine (clay < 35% and sand < 15%)
 4   Fine (35% < clay < 60%)
 5   Very fine (clay > 60 %)
 6   Medium (18% < clay < 35%, or clay < 18% and sand < 65%)
     for use with the Digital Soil Map of the World only
 7   Fine (clay > 35%)
     for use with the Digital Soil Map of the World only

Column 8 = dominant sub-surface texture class
See column 7 for explanation
```

```
Column 9 = parent material
 521 Loess
 823 Andesite
 825 Volcanic tuff

Column 10 = top soil texture class
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class (not assigned to any STU)

Column 11 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR03
***   *     ****  *     *****  *     *     *     ***   0     3
***   *     ****  *     *****  *     1     *     ***   1     4
***   *     ****  *     *****  *     2     *     ***   2     4
***   *     ****  *     *****  *     3     *     ***   3     4
***   *     ****  *     *****  *     4     *     ***   4     4
***   *     ****  *     *****  *     5     *     ***   5     4
***   *     ****  *     *****  *     6     *     ***   2     3
***   *     ****  *     *****  *     7     *     ***   4     3
***   *     ****  *     *****  *     6     *     521   3     3
***   *     ****  *     *****  *     6     *     823   3     3
***   *     ****  *     *****  *     6     *     825   3     3
***   *     ****  *     *****  *     0     *     ***   0     4
***   *     ****  *     *****  *     9     *     ***   0     4
555   o     ****  *     *****  *     0     *     ***   7     4
Gh*   o     ****  *     *****  *     0     *     ***   8     4
Gm*   o     ****  *     *****  *     0     *     ***   8     4
Pp*   o     ****  *     *****  *     0     *     ***   8     3
O**   o     ****  *     *****  *     0     *     ***   8     4
U**   o     ****  *     *****  *     0     *     ***   8     3
666   o     ****  *     *****  *     0     *     ***   7     4
555   o     ****  *     *****  *     9     *     ***   7     4
Gh*   o     ****  *     *****  *     9     *     ***   8     4
Gi*   o     ****  *     *****  *     9     *     ***   8     4
Gm*   o     ****  *     *****  *     9     *     ***   8     4
I**   o     ****  *     *****  *     9     1     ***   1     3
Jmg   o     ****  *     *****  *     9     *     ***   8     3
O**   o     ****  *     *****  *     9     *     ***   8     4
Pp*   o     ****  *     *****  *     9     *     ***   8     3
666   o     ****  *     *****  *     9     *     ***   7     4
U**   o     ****  *     *****  *     9     *     ***   8     3
***   *     5 55  o     *****  *     0     *     ***   7     4
***   *     GLh*  o     *****  *     0     *     ***   8     4
***   *     GLdh  o     *****  *     0     *     ***   8     4
***   *     GLm*  o     *****  *     0     *     ***   8     4
***   *     HS**  o     *****  *     0     *     ***   8     4
***   *     LPu*  o     *****  *     0     *     ***   8     3
***   *     LPd*  o     *****  *     0     *     ***   8     3
***   *     6 66  o     *****  *     0     *     ***   7     4
***   *     5 55  o     *****  *     9     *     ***   7     4
***   *     GLh*  o     *****  *     9     *     ***   8     4
***   *     GLdh  o     *****  *     9     *     ***   8     4
```

```
***   *     GLm*  o     ***** *     9     *     ***   8     4
***   *     LPq*  o     ***** *     9     1     ***   1     3
***   *     FLm*  o     ***** *     9     *     ***   8     3
***   *     HS**  o     ***** *     9     *     ***   8     4
***   *     6 66  o     ***** *     9     *     ***   7     4
***   *     LPu*  o     ***** *     9     *     ***   8     3
***   *     LPd*  o     ***** *     9     *     ***   8     3
***   *     ****  *     5 5 5 o     0     *     ***   7     4
***   *     ****  *     GLhu* o     0     *     ***   8     4
***   *     ****  *     GLti* o     0     *     ***   8     4
***   *     ****  *     GLmo* o     0     *     ***   8     4
***   *     ****  *     PZpi* o     0     *     ***   8     3
***   *     ****  *     HS*** o     0     *     ***   8     4
***   *     ****  *     LPha* o     0     *     ***   8     3
***   *     ****  *     LPdy* o     0     *     ***   8     3
***   *     ****  *     LPhu* o     0     *     ***   8     3
***   *     ****  *     6 6 6 o     0     *     ***   7     4
***   *     ****  *     5 5 5 o     9     *     ***   7     4
***   *     ****  *     GLhu* o     9     *     ***   8     4
***   *     ****  *     GLti* o     9     *     ***   8     4
***   *     ****  *     GLhi* o     9     *     ***   8     4
***   *     ****  *     GLmo* o     9     *     ***   8     4
***   *     ****  *     LPli* o     9     1     ***   1     3
***   *     ****  *     FLmo* o     9     *     ***   8     3
***   *     ****  *     HS*** o     9     *     ***   8     4
***   *     ****  *     PZpi* o     9     *     ***   8     3
***   *     ****  *     6 6 6 o     9     *     ***   7     4
***   *     ****  *     LPha* o     9     *     ***   8     3
***   *     ****  *     LPdy* o     9     *     ***   8     3
***   *     ****  *     LPhu* o     9     *     ***   8     3
```

4. Pedo-transfer rule 4 (PTR04): sub soil texture class (TEXTP)

This rule corrects the sub soil texture class on the basis of top soil texture class (PTR03), secondary sub soil texture class, rooting depth (PTR02), depth to textural change (PTR01) and parent material. As in PTR03 the texture classification is changed by adding classes 7 for rocks and 8 for peat.

4.1 Current rule

```
Column 1 = soil name FAO-85

Column 2 = dominant sub-surface texture class
 0   No information
 9   No mineral texture (peat soils, stony soils)
 1   Coarse (clay < 18% and sand > 65%)
 2   Medium (18% < clay < 35% and sand < 65%,
    or clay < 18% and 15% < sand < 65%)
 3   Medium fine (clay < 35% and sand < 15%)
 4   Fine (35% < clay < 60%)
 5   Very fine (clay > 60 %)

Column 3 = secondary sub-surface texture class
 See column 2 for explanation

Column 4 = top soil texture class (PTR03)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
```

```
 5   very fine
 7   rocks
 8   peat
 9   no texture class

Column 5 = soil depth determined by soil only (PTR02)
 1   10
 2   20
 3   40
 4   60
 5   80
 6   100
 7   120
 8   150

Column 6 = depth to a textural change (PTR01)
 Units in cm

Column 7 = sub soil texture class (TEXTP)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class

Column 8 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR04
          *** 0 *   0   *** *** 0 3
          *** 0 *   0   10  *** 7 4
          *** 0 *   1   *** *** 1 4
          *** 0 *   2   *** *** 2 4
          *** 0 *   3   *** *** 3 4
          *** 0 *   4   *** *** 4 4
          *** 0 *   5   *** *** 5 4
          *** 0 *   8   *** *** 8 4
          *** 0 2   2   *** *** 2 3
          *** 0 4   1   *** *** 4 3
          *** 0 4   2   *** *** 4 3
          *** 0 5   2   *** *** 5 3
          *** 0 5   5   *** *** 5 3
          *** 0 *   1   10  *** 7 4
          *** 0 *   2   10  *** 7 4
          *** 0 *   3   10  *** 7 4
          *** 0 *   4   10  *** 7 4
          *** 0 *   5   10  *** 7 4
          *** 0 *   8   10  *** 7 4
          *** 0 *   1   20  *** 7 4
          *** 0 *   2   20  *** 7 4
          *** 0 *   3   20  *** 7 4
          *** 0 *   4   20  *** 7 4
          *** 0 *   5   20  *** 7 4
          *** 0 *   8   20  *** 7 4
          *** 0 *   1   30  *** 7 4
          *** 0 *   2   30  *** 7 4
```

```
*** 0 *   3   30  *** 7 4
*** 0 *   4   30  *** 7 4
*** 0 *   5   30  *** 7 4
*** 0 *   8   30  *** 7 4
*** 0 *   7   *** *** 7 4
*** 0 *   9   10  *** 7 4
*** 1 *   *   *** *** 1 4
*** 1 *   *   10  *** 7 4
*** 1 *   *   30  30  7 4
*** 1 *   *   30  20  1 4
*** 2 *   *   *** *** 2 4
*** 2 *   *   10  *** 7 4
*** 2 *   *   30  30  7 4
*** 2 *   *   30  20  2 4
*** 3 *   *   *** *** 3 4
*** 3 *   *   30  30  7 4
*** 3 *   *   30  20  3 4
*** 4 *   *   *** *** 4 4
*** 4 *   *   30  30  7 4
*** 4 *   *   30  20  4 4
*** 5 *   *   *** *** 5 4
*** 9 *   1   *** *** 1 4
*** 9 *   1   10  *** 7 4
*** 9 *   2   *** *** 2 4
*** 9 *   2   10  *** 7 4
*** 9 *   2   30  30  7 4
*** 9 *   3   *** *** 3 4
*** 9 *   3   10  *** 7 4
*** 9 *   3   30  30  7 4
*** 9 *   4   *** *** 4 4
0** 9 *   4   *** *** 8 4
*** 9 *   7   0   *** 7 4
*** 9 *   8   *** *** 8 4
*** 9 *   8   10  *** 7 4
*** 9 *   8   30  30  7 4
*** 9 *   9   *** *** 9 4
*** 9 9   9   10  *** 7 4
```

4.2 Review

1. The rules of PTR04 as they are entered above are only based on the contents of the former database. Some of the rules are very specific and could (and should) work in a more generic way. If they are defined in a more generic way, they will also function well when the contents of the database changes.

2. The sub soil texture classification is identical to the new surface texture classification applied in PTR03 (new classes 7 for rocks, and 8 for peat, and a new meaning for 9 (no texture class). The FAO-74 classes 6 medium and 7 fine are not included. The new rule will include these classes.

3. Mainly, PTR04 assigns the dominant subsurface class code to the sub soil texture class, this is a copy-action. Because 7 rocks and 8 peat are new classes, the rule assigns them in addition to the copying. Other information is used in addition to the dominant texture class - see next point.

4. The hierarchy in information used to assign the sub soil texture class to a STU is as follows:
   a. dominant subsurface class code.
   b. top soil texture from PTR03.
   c. modified on the basis of secondary subsurface class code.

d. modified into rock on the basis of soil depth. In the new rule this should also be checked on the presence of rock assigned to the top soil texture.
e. modified into peat on the basis of soil name O** if sub surface texture class is 9. This is not necessary because STUs with O** have already a peat top soil via PTR03 and this information can be used to convert sub surface texture class to peat in case of value 9.

5. If there is no information (code 0) or no mineral texture (code 9) then top soil texture is assigned to sub soil. This is overruled in some cases by assigning the secondary sub soil class to the sub soil texture (in case of code 0). This is done when the secondary sub soil is heavy textured (classes 4 and 5). At the same time the confidence level is set at 3 instead of 4.

6. Next, in all cases a sub soil texture is labelled as 7 rocks for all soil depths of 10/20/30 cm. But, in the case that soils of 30 cm deep have a textural change at 20 cm deep, then the sub soil texture (valid for the 20-30 cm layer) is again set at the original sub soil surface texture class. In the new rule this can be more refined because it should handle all possible combinations of shallow rooting depths and depths to textural change.

7. It seems that not all possible combinations of input codes are covered. As already mentioned under 5, all occurring combinations, especially of shallow depth classes, must be covered. The following remarks relate to potentially missing combinations:
   a. There is no check on depth when dominant subsurface texture is 5.
   b. Not all secondary sub soil – top soil texture combinations are foreseen.
   c. When dominant sub soil texture is 9 (no mineral texture) the modifications of sub soil texture for certain soil depths is not done for texture classes 4 and 5.

8. In the classification for dominant subsurface texture a peaty subsurface soil is included in class 9. When dominant subsurface texture is 0 or 9, PTR04 assigns peaty sub soil in all cases that the top soil is peat (result from PTR03). In the case of shallow peat soils the sub soil is modified to 7 rock.

9. There is one particular case: a histosol with a mineral top layer of texture class 4. PTR04 correctly assigns peat sub soil to this STU. Only in this particular case the rule uses the soil name as input. This is not necessary because STUs with O** have already a peat top soil via PTR03 and this information can be used to convert sub surface texture class to peat in case of value 9. Thus the soil code can be skipped.

10. Note that in contrast to PTR03, PTR04 assigns the code 9 to some STU's (as output). This is only used when the results of PTR03 has value 9. But PTR03 does not lead to value 9 so these rules can be skipped.

4.3 New rule

```
Column 1 = dominant sub surface texture class
 0   No information
 9   No mineral texture (peat soils, stony soils)
 1   Coarse (clay < 18% and sand > 65%)
 2   Medium (18% < clay < 35% and sand < 65%,
     or clay < 18% and 15% < sand < 65%)
 3   Medium fine (clay < 35% and sand < 15%)
 4   Fine (35% < clay < 60%)
 5   Very fine (clay > 60 %)
 6   Medium (18% < clay < 35%, or clay < 18% and sand < 65%)
     for use with the Digital Soil Map of the World only
 7   Fine (clay > 35%)
     for use with the Digital Soil Map of the World only

Column 2 = secondary sub surface texture class
See column 1 for explanation
```

```
Column 3 = top soil texture class (PTR03)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class (does not appear in PTR03)

Column 4 = soil depth determined by soil only
Units in cm

Column 5 = depth to a textural change (PTR01)
Units in cm

Column 6 = parent material
 521 Loess
 823 Andesite
 825 Volcanic tuff

Column 7 = sub soil texture class
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class (not assigned to any STU)

Column 8 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR04
0     *     0     *     ***   ***   0     3
0     *     1     *     ***   ***   1     4
0     *     2     *     ***   ***   2     4
0     *     3     *     ***   ***   3     4
0     *     4     *     ***   ***   4     4
0     *     5     *     ***   ***   5     4
0     *     7     *     ***   ***   7     4
0     *     8     *     ***   ***   8     4
0     *     *     1     ***   ***   7     4
0     *     *     2     **    ***   7     4
0     *     *     3     **    ***   7     4
1     *     *     *     ***   ***   1     4
1     *     *     1     ***   ***   7     4
1     *     *     2     **    ***   7     4
1     *     *     3     **    ***   7     4
1     *     *     2     10    ***   1     4
1     *     *     3     10    ***   1     4
1     *     *     3     20    ***   1     4
1     *     7     *     ***   ***   7     4
2     *     *     *     ***   ***   2     4
2     *     *     1     ***   ***   7     4
2     *     *     2     **    ***   7     4
2     *     *     3     **    ***   7     4
```

```
2     *     *     2     10    ***   2     4
2     *     *     3     10    ***   2     4
2     *     *     3     20    ***   2     4
2     *     7     *     ***   ***   7     4
3     *     *     *     ***   ***   3     4
3     *     *     1     ***   ***   7     4
3     *     *     2     **    ***   7     4
3     *     *     3     **    ***   7     4
3     *     *     2     10    ***   3     4
3     *     *     3     10    ***   3     4
3     *     *     3     20    ***   3     4
3     *     7     *     ***   ***   7     4
4     *     *     *     ***   ***   4     4
4     *     *     1     ***   ***   7     4
4     *     *     2     **    ***   7     4
4     *     *     3     **    ***   7     4
4     *     *     2     10    ***   4     4
4     *     *     3     10    ***   4     4
4     *     *     3     20    ***   4     4
4     *     7     *     ***   ***   7     4
5     *     *     *     ***   ***   5     4
5     *     *     1     ***   ***   7     4
5     *     *     2     **    ***   7     4
5     *     *     3     **    ***   7     4
5     *     *     2     10    ***   5     4
5     *     *     3     10    ***   5     4
5     *     *     3     20    ***   5     4
5     *     7     *     ***   ***   7     4
6     *     *     *     ***   ***   2     4
6     *     *     1     ***   ***   7     4
6     *     *     2     **    ***   7     4
6     *     *     3     **    ***   7     4
6     *     *     2     10    ***   2     4
6     *     *     3     10    ***   2     4
6     *     *     3     20    ***   2     4
6     *     7     *     ***   ***   7     4
6     *     *     *     ***   521   3     4
6     *     *     1     ***   521   7     4
6     *     *     2     **    521   7     4
6     *     *     3     **    521   7     4
6     *     *     2     10    521   3     4
6     *     *     3     10    521   3     4
6     *     *     3     20    521   3     4
6     *     7     *     ***   521   7     4
6     *     *     *     ***   823   3     4
6     *     *     1     ***   823   7     4
6     *     *     2     **    823   7     4
6     *     *     3     **    823   7     4
6     *     *     2     10    823   3     4
6     *     *     3     10    823   3     4
6     *     *     3     20    823   3     4
6     *     7     *     ***   823   7     4
6     *     *     *     ***   825   3     4
6     *     *     1     ***   825   7     4
6     *     *     2     **    825   7     4
6     *     *     3     **    825   7     4
6     *     *     2     10    825   3     4
6     *     *     3     10    825   3     4
6     *     *     3     20    825   3     4
6     *     7     *     ***   825   7     4
7     *     *     *     ***   ***   4     4
7     *     *     1     ***   ***   7     4
7     *     *     2     **    ***   7     4
7     *     *     3     **    ***   7     4
```

```
7     *     *     2     10    ***   4     4
7     *     *     3     10    ***   4     4
7     *     *     3     20    ***   4     4
7     *     7     *     ***   ***   7     4
9     *     0     ***   ***   ***   0     4
9     *     1     ***   ***   ***   1     4
9     *     2     ***   ***   ***   2     4
9     *     3     ***   ***   ***   3     4
9     *     4     ***   ***   ***   4     4
9     *     5     ***   ***   ***   5     4
9     *     7     ***   ***   ***   7     4
9     *     8     ***   ***   ***   8     4
9     *     *     1     ***   ***   7     4
9     *     *     2     **    ***   7     4
9     *     *     3     **    ***   7     4
```

5. Pedo-transfer rule 5 (PTR05): top soil structure class (STS)

This rule determines the top soil structure class on the basis of top soil texture class and soil name.

5.1 Current rule

```
Column 1 = soil name FAO-85

Column 2 = top soil texture class (PTR03)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class

Column 3 = top soil structure class (STS)
 1   good
 2   normal
 3   poor
 4   humic or peaty top soil

Column 4 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR05
         *** *  2 3
         Bea *  1 3
         Eo* *  1 3
         H** *  1 3
         T** *  1 3
         p   *  1 3
         Bm* *  1 3
         Gm* *  1 3
         Jm* *  1 3
         Sm* *  1 3
         Gfm *  1 3
         O** *  4 4
```

```
Ah* *  4 4
Bh* *  4 4
Gh* *  4 4
Eh* *  4 4
Lh* *  4 4
Th* *  4 4
Geh *  4 4
Bkh *  4 4
Ich *  4 4
Bch *  4 4
P** *  4 4
Gi* *  4 4
Gm* 8  4 3
U** 8  4 3
Jmg 8  4 3
*** 7  0 4
```

5.2 Review

1. The rules of PTR05 as they are entered above are only based on the contents of the former database. Some of the rules are very specific and could (and should) work in a more generic way. If they are defined in a more generic way, they will also function well when the contents of the database changes.

2. First all get structure class 2 normal.

3. Depending on soil name, some soils with mollic top soil get structure class 1 good and soils with humic or peaty top soil get structure class 4 humic or peaty top soil.

4. Class 3 poor is not assigned to any soil.

5. There is no definition for class 0 (rocky soils).

6. The three soil names combined with top soil texture class 8 (peaty top soil) could be replaced by the line *** 8 4 3. This would apply to all soils with top soil 8.

7. Some additional remarks that could be regarded as recommendations to improve the rules in future:
   a. PTR05 classifies all podzols as having humic or peaty top soil. We doubt this. Podzols usually have mineral sandy top soils, different from the many other humic or histic subgroups of the other soil groups.
   b. Geh is a strange soil name as it combines eutric (basic or neutral pH) with humic (acid reaction).
   c. The good structured top soils include Andosols and soils with mollic epipedons, and plaggen soils. What about other soils with mollic top soils such as Chernozems (C**), Kastanozems (K**) and geyzems (M**)? These soils are famous for their good structure and do not appear in the list, so they would have normal structure (STS class 2).
   d. On the other hand Planosols have a bad reputation for their structure. Maybe W** could have STS=3?
   e. PTR05 does not consider texture as determinant for structure. Although this would not be easy to define, there is a relationship between texture and structure, modified by clay mineralogy, organic matter and calcium carbonate.

8. In addition, the rules must be able to handle the other classifications of FAO90 and WRB. For the conversion please consult table below.

FAO85	FAO90	WRB	comments
Bea	CMea	CMeu	Ando-eutric cambisol
Eo*	LPk, LPr	LPrz	orthic rendzina, calcic leptosol
H**	PH*	PH*	phaeozem
T**	AN*	AN*	andosol
p	AT*	ATpa	plaggen, man-made, anthropic
Bm*	CM	CMmo	mollic Cambisol
Gm*	see PTR03	see PTR03	mollic Gleysol
Jm*	FLm	FLmo	mollic Fluvisol
Sm*	SNm	SNmo	mollic solonetz
Gfm	FLm	FLgl	mollic-fluvic gleysol
O**	see PTR03	see PTR03	histosol, peat soil, organic soil
Ah*	ACh	AChu	humic acrisol
Bh*	CMh	CMhu	humic cambisol
Gh*	see PTR03	see PTR03	humic gleysol
Eh*	LPk	LPrz	histic Rendzina
Lh*	PHl	PHlv	humic luvisol
Th*	ANh*	ANhi	
Geh	not defined	not defined	
Bkh	not defined	not defined	
Ich	not defined	not defined	
Bch	not defined	not defined	
P**	not defined	not defined	
Gi*	not defined	not defined	

5.3 New rule

Column 1 = soil name FAO-85

Column 2 = confidence level soil name FAO-85
- h High
- m Moderate
- l Low
- v Very low or unknown confidence level
- o Data originates from author no pedo-transfer interpretation)

Column 3 = soil name FAO-90

Column 4 = confidence level soil name FAO-90
See column 2 for explanation

Column 5 = soil name WRB

Column 6 = confidence level soil name WRB
See column 2 for explanation

Column 7 = top soil texture class (PTR03)
- 0 no information
- 1 coarse
- 2 medium
- 3 medium fine
- 4 fine
- 5 very fine
- 7 rocks
- 8 peat
- 9 no texture class (does not appear in PTR03)

Column 8 = top soil structure class (STS)
- 0 rocky soils
- 1 good

```
 2   normal
 3   poor (not assigned to any STU)
 4   humic or peaty top soil

Column 9 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR05
***   o     ****  *     *****  *     *     2     3
Bea   o     ****  *     *****  *     *     1     3
Eo*   o     ****  *     *****  *     *     1     3
H**   o     ****  *     *****  *     *     1     3
T**   o     ****  *     *****  *     *     1     3
p**   o     ****  *     *****  *     *     1     3
Bm*   o     ****  *     *****  *     *     1     3
Gm*   o     ****  *     *****  *     *     1     3
Jm*   o     ****  *     *****  *     *     1     3
Sm*   o     ****  *     *****  *     *     1     3
Gfm   o     ****  *     *****  *     *     1     3
O**   o     ****  *     *****  *     *     4     4
Ah*   o     ****  *     *****  *     *     4     4
Bh*   o     ****  *     *****  *     *     4     4
Gh*   o     ****  *     *****  *     *     4     4
Eh*   o     ****  *     *****  *     *     4     4
Lh*   o     ****  *     *****  *     *     4     4
Th*   o     ****  *     *****  *     *     4     4
Geh   o     ****  *     *****  *     *     4     4
Bkh   o     ****  *     *****  *     *     4     4
Ich   o     ****  *     *****  *     *     4     4
Bch   o     ****  *     *****  *     *     4     4
P**   o     ****  *     *****  *     *     4     4
Gi*   o     ****  *     *****  *     *     4     4
***   *     CMea  o     *****  *     *     1     3
***   *     LPk*  o     *****  *     *     1     3
***   *     LPr*  o     *****  *     *     1     3
***   *     PH**  o     *****  *     *     1     3
***   *     AN**  o     *****  *     *     1     3
***   *     AT**  o     *****  *     *     1     3
***   *     CM**  o     *****  *     *     1     3
***   *     GLm*  o     *****  *     *     1     3
***   *     FLm*  o     *****  *     *     1     3
***   *     SNm*  o     *****  *     *     1     3
***   *     FLm*  o     *****  *     *     1     3
***   *     HS**  o     *****  *     *     4     4
***   *     ACh*  o     *****  *     *     4     4
***   *     CMh*  o     *****  *     *     4     4
***   *     GLh*  o     *****  *     *     4     4
***   *     GLdh  o     *****  *     *     4     4
***   *     LPk*  o     *****  *     *     4     4
***   *     PHl*  o     *****  *     *     4     4
***   *     ANh*  o     *****  *     *     4     4
***   *     ****  *     CMeu*  o     *     1     3
***   *     ****  *     LPrz*  o     *     1     3
***   *     ****  *     PH***  o     *     1     3
***   *     ****  *     AN***  o     *     1     3
***   *     ****  *     ATpa*  o     *     1     3
***   *     ****  *     CMmo*  o     *     1     3
***   *     ****  *     GLmo*  o     *     1     3
***   *     ****  *     FLmo*  o     *     1     3
***   *     ****  *     SNmo*  o     *     1     3
***   *     ****  *     FLgl*  o     *     1     3
```

```
***   *     ****  *     HS*** o     *     4     4
***   *     ****  *     AChu* o     *     4     4
***   *     ****  *     CMhu* o     *     4     4
***   *     ****  *     GLhu* o     *     4     4
***   *     ****  *     GLti* o     *     4     4
***   *     ****  *     LPrz* o     *     4     4
***   *     ****  *     PHlv* o     *     4     4
***   *     ****  *     ANhi* o     *     4     4
***   *     ****  *     ***** *     8     4     3
***   *     ****  *     ***** *     7     0     4
```

6. Pedo-transfer rule 6 (PTR06): sub soil structure class (STP)

This rule determines the sub soil structure class on the basis of sub soil texture class and soil name.

6.1 Current rule

```
Column 1 = soil name FAO-85

Column 2 = sub soil texture class (PTR04/PTR03)
  (or top soil texture class in case of considered depth < depth of textural
change)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class

Column 3 = sub soil structure class (STP)
 1   good
 2   normal
 3   poor
 4   humic or peaty top soil

Column 4 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR06
         *** *   2 3
         Bcc *   1 2
         Bea *   1 3
         Bh* *   1 3
         Eo* *   1 3
         T** *   1 3
         p** *   1 3
         Bgg *   3 3
         Bv* *   3 3
         Cgs *   3 3
         Dgs *   3 3
         Gcs *   3 3
         Gds *   3 3
         Ges *   3 3
         Gls *   3 3
```

```
Hgs *   3 3
Lgs *   3 3
Pgs *   3 3
Gs* *   3 3
Lgp *   3 3
Lv* *   3 3
Vc* *   3 3
W** *   3 3
O** *   4 4
*** 8   4 4
*** 7   0 3
```

6.2 Review

1. The rules of PTR05 as they are entered above are only based on the contents of the former database. Some of the rules are very specific and could (and should) work in a more generic way. If they are defined in a more generic way, they will also function well when the contents of the database changes.

2. First, all get structure class normal.

3. Depending on soil name soils get structure class good or poor or humic or peaty top soil.

4. Some additional remarks that could be regarded as recommendations to improve the rules in future.
   a. The selection of soils with good sub soil structure is limited. Rendzina is primarily a shallow soil in limestone, and the sound of ploughing the rock can be noisy. The good structure is not everywhere in the sub soil. Again the Chernozem-Kastanozems could be included here for the sub soil as well.
   b. The poor sub soil structure is assigned to stagno-gleyic, vertic and planic subgroups. We agree. Some names of subgroups in these categories are lacking: Lap, Lcp, Lop. And what about Vp? Cgs is a strange soil name, stagnogleyic Chernozem (does it exist?).

5. In addition the rules must be able to handle the other classifications of FAO90 and WRB. For the conversion please consult the table below.

FAO85	FAO90	WRB	comments
Bcc	CMx	CMcr	calcaro-chromic cambisol
Bea	see PTR05	see PTR05	
Bh*	see PTR03	see PTR03	
Eo*	see PTR05	see PTR05	
T**	see PTR05	see PTR05	
p**	see PTR05	see PTR05	
Bgg	CMj; CMg	CMgl	stagnogleyic cambisol
Bv*	CMv	CMvr	vertic cambisol
Cgs	CHgs	CHgl	stagno-gleyic chernozem
Dgs	PDj	ABst, ABgl	stagno-gleyic podzoluvisol
Gcs	GLk	GLca	stagno-calcaric gleysol
Gds	GLu	UMgl, GLdy	stagno-dystric gleysol
Ges	not defined	GLeu	stagno-eutric gleysol
Gls	LVg	LVgl	stagno-luvic gleysol
Hgs	PHj	PHgl	stagno-gleyic phaeozem
Lgs	LVj, LVjp	LVgl	stagno-gleyic luvisol
Pgs	PZg	PZgl	stagno-gleyic podzol
Gs*	not defined	GLha	stagnic gleysol
Lgp	LVjp	LVgl	plano-gleyic luvisol

FAO85	FAO90	WRB	comments
Lv*	LVv	LVvr	vertic luvisol
Vc*	VRe	VRcr	chromic vertisol
W**	PL**	PL**	planosol
O**	see PTR03	see PTR03	histosol, peat soil, organic soil

6.3 New rule

```
Column 1 = soil name FAO-85

Column 2 = confidence level soil name FAO-85
 h   High
 m   Moderate
 l   Low
 v   Very low or unknown confidence level
 o   Data originates from author no pedo-transfer interpretation)

Column 3 = soil name FAO-90

Column 4 = confidence level soil name FAO-90
See column 2 for explanation

Column 5 = soil name WRB

Column 6 = confidence level soil name WRB
See column 2 for explanation

Column 7 = sub soil texture class (PTR04/PTR03)
  (or top soil texture class in case of considered depth < depth of textural change)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class (does not appear in PTR04)

Column 8 = sub soil structure class (STP)
 0   rocky soils
 1   good
 2   normal
 3   poor
 4   humic or peaty top soil

Column 9 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR06
***   *     ****  *     *****  *     *     2     3
Bcc   o     ****  *     *****  *     *     1     2
Bea   o     ****  *     *****  *     *     1     3
Bh*   o     ****  *     *****  *     *     1     3
Eo*   o     ****  *     *****  *     *     1     3
T**   o     ****  *     *****  *     *     1     3
p**   o     ****  *     *****  *     *     1     3
Bgg   o     ****  *     *****  *     *     3     3
```

Bv*	o	****	*	*****	*	*	3	3
Cgs	o	****	*	*****	*	*	3	3
Dgs	o	****	*	*****	*	*	3	3
Gcs	o	****	*	*****	*	*	3	3
Gds	o	****	*	*****	*	*	3	3
Ges	o	****	*	*****	*	*	3	3
Gls	o	****	*	*****	*	*	3	3
Hgs	o	****	*	*****	*	*	3	3
Lgs	o	****	*	*****	*	*	3	3
Pgs	o	****	*	*****	*	*	3	3
Gs*	o	****	*	*****	*	*	3	3
Lgp	o	****	*	*****	*	*	3	3
Lv*	o	****	*	*****	*	*	3	3
Vc*	o	****	*	*****	*	*	3	3
W**	o	****	*	*****	*	*	3	3
O**	o	****	*	*****	*	*	4	4
***	*	CMx*	o	*****	*	*	1	2
***	*	CMea	o	*****	*	*	1	3
***	*	CMh*	o	*****	*	*	1	3
***	*	LPk*	o	*****	*	*	1	3
***	*	LPr*	o	*****	*	*	1	3
***	*	AN**	o	*****	*	*	1	3
***	*	AT**	o	*****	*	*	1	3
***	*	CMj*	o	*****	*	*	3	3
***	*	CMg*	o	*****	*	*	3	3
***	*	CMv*	o	*****	*	*	3	3
***	*	CHgs	o	*****	*	*	3	3
***	*	PDj*	o	*****	*	*	3	3
***	*	GLk*	o	*****	*	*	3	3
***	*	GLu*	o	*****	*	*	3	3
***	*	LVg*	o	*****	*	*	3	3
***	*	PHj*	o	*****	*	*	3	3
***	*	LVj*	o	*****	*	*	3	3
***	*	PZg*	o	*****	*	*	3	3
***	*	LVv*	o	*****	*	*	3	3
***	*	VRe*	o	*****	*	*	3	3
***	*	PL**	o	*****	*	*	3	3
***	*	HS**	o	*****	*	*	4	4
***	*	****	*	CMcr*	o	*	1	2
***	*	****	*	CMeu*	o	*	1	3
***	*	****	*	CMhu*	o	*	1	3
***	*	****	*	LPrz*	o	*	1	3
***	*	****	*	AN***	o	*	1	3
***	*	****	*	ATpa*	o	*	1	3
***	*	****	*	CMgl*	o	*	3	3
***	*	****	*	CMvr*	o	*	3	3
***	*	****	*	CHgl*	o	*	3	3
***	*	****	*	ABst*	o	*	3	3
***	*	****	*	ABgl*	o	*	3	3
***	*	****	*	GLca*	o	*	3	3
***	*	****	*	UMgl*	o	*	3	3
***	*	****	*	GLdy*	o	*	3	3
***	*	****	*	GLeu*	o	*	3	3
***	*	****	*	LVgl*	o	*	3	3
***	*	****	*	PHgl*	o	*	3	3
***	*	****	*	PZgl*	o	*	3	3
***	*	****	*	GLha*	o	*	3	3
***	*	****	*	LVvr*	o	*	3	3
***	*	****	*	VRcr*	o	*	3	3
***	*	****	*	PL***	o	*	3	3
***	*	****	*	HS***	o	*	4	4
***	*	****	*	*****	*	8	4	4
***	*	****	*	*****	*	7	0	3

7. Pedo-transfer rule 7 (PTR07): top soil packing density class (PDS)

This rule determines the top soil packing density class on the basis of the top soil texture class and the top soil structure class.

7.1 Current rule

```
Column 1 = top soil structure class (PTR05)
 1   good
 2   normal
 3   poor
 4   humic or peaty top soil

Column 2 = top soil texture class (PTR03)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class

Column 3 = top soil packing density class (PDS)
 1   < 1.40 g/cm3
 2   1.40 to 1.75 g/cm3
 3   > 1.75 g/cm3

Column 4 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR07
         *   *   2 3
         0   *   0 3
         1   1   1 3
         1   2   1 3
         1   3   1 3
         4   *   1 3
```

7.2 Review

1. The rules of PTR07 as they are entered above are defined in a general way, they will also function well when the contents of the database changes.

2. PTR07 is straightforward and can be summarized as:
   a. All soils have normal packing density.
   b. But soils with top soil structure class = 0 (rocky soils) get value 0. This value was not described.
   c. Else: all coarse and medium textured soils with good top soil structure have low packing density.
   d. Else: all soils with humic or peaty top soil have also low packing density.

3. Packing density class = 3 (poor) does not occur in top soil.

4. The outcome of this rule is not relevant for estimating the top soil AWC because packing density is not differentiating within in PTR09.

5. Top soil packing density class = 0 is not used in the rules to determine AWC but according to this rule it can appear.

6. PTR07 has not been changed.

7.3 New rule

```
Column 1 = top soil structure class (PTR05)
 0   rocky soils
 1   good
 2   normal
 3   poor (does not appear in PTR05)
 4   humic or peaty top soil

Column 2 = top soil texture class (PTR03)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class (does not appear in PTR03)

Column 3 = top soil packing density class (PDS)
 0   rocky soils
 1   < 1.40 g/cm3 (low)
 2   1.40 to 1.75 g/cm3 (medium)
 3   > 1.75 g/cm3 (high) (not assigned to any STU)

Column 4 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR07
*     *     2     3
0     *     0     3
1     1     1     3
1     2     1     3
1     3     1     3
4     *     1     3
```

8. Pedo-transfer rule 8 (PTR08): sub soil packing density class (PDP)

This rule determines the sub soil packing density class on the basis of the sub soil texture class, sub soil structure class and soil name.

8.1 Current rule

```
Column 1 = sub soil structure class (PTR06)
 1   good
 2   normal
 3   poor
```

```
 4   humic or peaty top soil

Column 2 = sub soil texture class (PTR04/PTR03)
  (or top soil texture class in case of considered depth < depth of textural change)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class

Column 3 soil name FAO-85

Column 4 = sub soil packing density class (PDP)
 1   < 1.40 g/cm3
 2   1.40 to 1.75 g/cm3
 3   > 1.75 g/cm3

Column 5 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR08
         *   *   *** 2 3
         0   *   *** 0 2
         1   1   *** 1 3
         1   2   *** 1 2
         1   3   *** 1 2
         2   4   *** 3 3
         2   5   *** 3 3
         2   4   J** 3 2
         2   5   J** 3 2
         2   4   Bef 3 2
         2   5   Bkf 3 2
         2   5   Gcf 3 2
         2   5   Gef 3 2
         2   4   Ghf 3 2
         2   4   Gmf 3 2
         2   4   Hcf 3 2
         2   4   Sof 3 2
         2   5   Zgf 3 2
         2   5   Gf* 3 2
         3   *   *** 3 3
         3   1   *** 2 3
         4   *   *** 1 3
         *   7   *** 0 3
```

8.2 Review

1. The rules of PTR07 as they are entered above are defined in a general way, they will also function well when the contents of the database changes.

2. Soils with top soil structure class = 0 (rocky soils) get value 0. This value was not described.

3. First a medium packing density (class 2) is assigned.

4. Structure class good leads to low packing density (class 1) for all coarse and medium textured soils.

5. Structure class normal leads to high packing density when texture is fine or very fine. The extra column soil name does not differentiate in packing density; only the confidence level is lower for the named soils.

6. Structure class poor leads to high packing density (class 3) with exception for texture coarse, which has medium packing density (class 2). Structure class humic or peaty top soil leads to low packing density (class 1). Some soils in the Netherlands with a peaty sub soil are not classified into packing density low but into rocky soils. In the rules for sub soil texture class these soils, in the absence of sub soil information, are translated into rock on the basis of shallow rooting depths. It is recommended to improve these rules and find a way to exclude these peaty soils in the conversion to rocks.

7. The rule * 7 *** 0 3 is redundant because all STUs with sub soil texture class 7 lead to sub soil structure class 0 in PTR06 and via this value the packing density gets the value "rocky soils".

8. In addition, the rules must be able to handle the other classifications of FAO90 and WRB. For the conversion please consult table below.

FAO85	FAO90	WRB	comments
J**	FL**	FL**	fluvisols
Bef	CMef, CMe	CMeu	fluvi-eutric cambisol
Bkf	CLh, CMc	CMca	fluvi-calcic cambisol
Gcf	GLk	GLca	fluvi-calcaric gleysol
Gef	GLef	GLeu	fluvi-eutric gleysol
Ghf	see rule 3	GLhu	fluvi-humic gleysol
Gmf	GLmf	GLmo	fluvo-mollic gleysol
Hcf	PHc	PHca	fluvi-calcaric phaeozem
Sof	SNh	SNha	fluvi-orthic solonetz (only 1 STU)
Zgf	SCg	SCgl	fluvi-gleyic solonchak (only 1 STU)
Gf*	FLeg	FLgl	fluvic gleysols

8.3 New rule

```
Column 1 = sub soil structure class (PTR06/PTR05)
  (or top soil structure class in case of considered depth < depth of textural change)
 0   rocky soils
 1   good
 2   normal
 3   poor
 4   humic or peaty top soil

Column 2 = sub soil texture class (PTR04/PTR03)
  (or top soil texture class in case of considered depth < depth of textural change)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class (does not appear in PTR04/PTR03)
```

Column 3 = soil name FAO-85

Column 4 = confidence level soil name FAO-85
 h High
 m Moderate
 l Low
 v Very low or unknown confidence level
 o Data originates from author (no pedo-transfer interpretation)

Column 5 = soil name FAO-90

Column 6 = confidence level soil name FAO-90
 See column 4 for explanation

Column 7 = soil name WRB

Column 8 = confidence level soil name WRB
 See column 4 for explanation

Column 9 = sub soil packing density class (PDP)
 0 rocky soils
 1 < 1.40 g/cm3 (low)
 2 1.40 to 1.75 g/cm3 (medium)
 3 > 1.75 g/cm3 (high)

Column 10 = confidence level
 1 very low
 2 low
 3 moderate
 4 high

Rule PTR08

*	*	***	*	****	*	*****	*	2	3
0	*	***	*	****	*	*****	*	0	2
1	1	***	*	****	*	*****	*	1	3
1	2	***	*	****	*	*****	*	1	2
1	3	***	*	****	*	*****	*	1	2
2	4	***	*	****	*	*****	*	3	3
2	5	***	*	****	*	*****	*	3	3
2	4	J**	o	****	*	*****	*	3	2
2	5	J**	o	****	*	*****	*	3	2
2	4	Bef	o	****	*	*****	*	3	2
2	5	Bkf	o	****	*	*****	*	3	2
2	5	Gcf	o	****	*	*****	*	3	2
2	5	Gef	o	****	*	*****	*	3	2
2	4	Ghf	o	****	*	*****	*	3	2
2	4	Gmf	o	****	*	*****	*	3	2
2	4	Hcf	o	****	*	*****	*	3	2
2	4	Sof	o	****	*	*****	*	3	2
2	5	Zgf	o	****	*	*****	*	3	2
2	5	Gf*	o	****	*	*****	*	3	2
2	4	***	*	FL**	o	*****	*	3	2
2	5	***	*	FL**	o	*****	*	3	2
2	4	***	*	CMe*	o	*****	*	3	2
2	5	***	*	CLh*	o	*****	*	3	2
2	5	***	*	CMc*	o	*****	*	3	2
2	5	***	*	GLk*	o	*****	*	3	2
2	5	***	*	GLef	o	*****	*	3	2
2	4	***	*	GLh*	o	*****	*	3	2
2	4	***	*	GLmf	o	*****	*	3	2
2	4	***	*	PHc*	o	*****	*	3	2
2	4	***	*	SNh*	o	*****	*	3	2
2	5	***	*	SCg*	o	*****	*	3	2

```
2     4     ***   *     ****  *     FL*** o     3     2
2     5     ***   *     ****  *     FL*** o     3     2
2     4     ***   *     ****  *     CMeu* o     3     2
2     5     ***   *     ****  *     CMca* o     3     2
2     5     ***   *     ****  *     GLca* o     3     2
2     5     ***   *     ****  *     GLeu* o     3     2
2     4     ***   *     ****  *     GLhu* o     3     2
2     4     ***   *     ****  *     GLmo* o     3     2
2     4     ***   *     ****  *     PHca* o     3     2
2     4     ***   *     ****  *     SNha* o     3     2
2     5     ***   *     ****  *     SCgl* o     3     2
3     *     ***   *     ****  *     ***** *     3     3
3     1     ***   *     ****  *     ***** *     2     3
4     *     ***   *     ****  *     ***** *     1     3
```

9. Pedo-transfer rule 9 (PTR09): available and easy available water capacity top soil (RUS/RFUS)

This rule determines (easy) available water capacity of the top soil on the basis of top soil texture class and top soil packing density class.

9.1 Current rule

```
Column 1 = top soil texture class (PTR03)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class

Column 2 = top soil packing density class (PTR07)
 1   < 1.40 g/cm3
 2   1.40 to 1.75 g/cm3
 3   > 1.75 g/cm3

Column 3 = total available water capacity of the top soil (RUS)
Unit in mm water by m of soil.

Column 4 = easy available water capacity of the top soil (RFUS)
Unit in mm water by m of soil.

Column 5 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR09
         1 1 130 130 3
         2 1 180 180 3
         3 1 210 210 3
         4 1 170 170 3
         5 1 170 170 3
         8 1 439 439 4
         1 2 130 130 3
         2 2 180 180 3
```

```
3 2 210 210 3
4 2 170 170 3
5 2 170 170 3
8 2 439 439 4
1 3 130 130 3
2 3 180 180 3
3 3 210 210 3
4 3 170 170 3
5 3 170 170 3
8 3 439 439 4
```

9.2 Review

1. Peat has one value (439 mm) for top and sub soil (see also PTR10).

2. No difference between total and easy available water.

3. No difference between packing density classes (column 2 does not differentiate).

4. Texture class 3 is optimum, values for 2/4/5 are in the middle, 4/5 are even equal and 1 is lower.

5. PTR09 cannot handle texture classes 0 (no information) and 7 (rocks) and packing density value 0 (rocky soils) which could exist. Therefore the rules of PTR09 as they are entered above cannot handle all possible values. If they are defined in a more complete way, they will also function well when the contents of the database changes. We have added the rule '* * 1 1 3' which initalize all STUs with the value 1. The Fortran program Ceru32, adapted version by Alterra, does recognize this value in the further processing and calculation of the SWAP and treats this value as no information.

9.3 New rule

```
Column 1 = top soil texture class (PTR03)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class (does not appear in PTR03)

Column 2 = top soil packing density class (PTR07)
 0   rocky soils
 1   < 1.40 g/cm3 (low)
 2   1.40 to 1.75 g/cm3 (medium)
 3   > 1.75 g/cm3 (high) (does not appear in PTR07)

Column 3 = total available water capacity of the top soil (RUS)
Unit in mm water by m of soil. Value 1 will lead to no information
in the Fortran program.

Column 4 = easy available water capacity of the top soil (RFUS)
Unit in mm water by m of soil. Value 1 will lead to no information
in the Fortran program.

Column 5 = confidence level
 1   very low
```

```
 2   low
 3   moderate
 4   high

Rule PTR09
*      *      1      1      3
1      1      130    130    3
2      1      180    180    3
3      1      210    210    3
4      1      170    170    3
5      1      170    170    3
8      1      439    439    4
1      2      130    130    3
2      2      180    180    3
3      2      210    210    3
4      2      170    170    3
5      2      170    170    3
8      2      439    439    4
1      3      130    130    3
2      3      180    180    3
3      3      210    210    3
4      3      170    170    3
5      3      170    170    3
8      3      439    439    4
```

10. Pedo-transfer rule 10 (PTR10): available and easy available water capacity sub soil (RUP/RFUP)

This rule determines (easy) available water capacity of the sub soil on the basis of sub soil texture class and sub soil packing density class.

10.1 Current rule

```
Column 1 = sub soil texture class (PTR04/PTR03)
  (or top soil texture class in case of considered depth < depth of
textural change)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class

Column 2 = sub soil packing density class (PTR08)
 1   < 1.40 g/cm3
 2   1.40 to 1.75 g/cm3
 3   > 1.75 g/cm3

Column 3 = total available water capacity of the top soil (RUP)
Unit in mm water by m of soil.

Column 4 = easy available water capacity of the top soil (RFUP)
Unit in mm water by m of soil.

Column 5 = confidence level
 1   very low
 2   low
 3   moderate
 4   high
```

```
Rule PTR10
         1 1 120  80 3
         2 1 210 140 3
         3 1 220 140 3
         4 1 200 150 3
         5 1 210 150 3
         8 1 439 310 2
         1 2  80  60 3
         2 2 160 100 3
         3 2 190 120 3
         4 2 150  80 3
         5 2 150  80 3
         8 2 439 310 2
         1 3  80  60 3
         2 3 120  70 3
         3 3 130  70 3
         4 3 130  70 3
         5 3 130  70 3
         8 3 439 310 2
```

10.2 Review

1. Larger packing density classes give lower estimates, but not for total AWC for peat.

2. For low or medium packing density classes texture class 3 is optimal in high packing density class not much difference between texture classes only texture class 1 is lower.

3. Texture class 1 always lower.

4. PTR10 cannot handle texture classes 0 (no information) and 7 (rocks) and packing density value 0 (rocky soils) which could exist. Therefore, the rules of PTR09 as they are entered above cannot handle all possible values. If they are defined in a more complete way, they will also function well when the contents of the database changes. We have added the rule '* * 1 1 3' which initalize all STUs with the value 1. The Fortran program Ceru32, adapted version by Alterra, does recognize this value in the further processing and calculation of the SWAP and treats this value as no information.

10.3 New rule

```
Column 1 = sub soil texture class (PTR04/PTR03)
  (or top soil texture class in case of considered depth < depth of
textural change)
 0   no information
 1   coarse
 2   medium
 3   medium fine
 4   fine
 5   very fine
 7   rocks
 8   peat
 9   no texture class (does not appear in PTR04/PTR03)

Column 2 = sub soil packing density class (PTR08/PTR07)
  (or top soil packing density class in case of considered depth < depth
of textural change)
 0   rocky soils
 1   < 1.40 g/cm3 (low)
 2   1.40 to 1.75 g/cm3 (medium)
 3   > 1.75 g/cm3 (high)
```

```
Column 3 = total available water capacity of the sub soil (RUP)
Unit in mm water by m of soil. Value 1 will lead to no information
in the Fortran program.

Column 4 = easy available water capacity of the sub soil (RFUP)
Unit in mm water by m of soil. Value 1 will lead to no information
in the Fortran program.

Column 5 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR10
*      *      1      1      3
1      1      120    80     3
2      1      210    140    3
3      1      220    140    3
4      1      200    150    3
5      1      210    150    3
8      1      439    310    2
1      2      80     60     3
2      2      160    100    3
3      2      190    120    3
4      2      150    80     3
5      2      150    80     3
8      2      439    310    2
1      3      80     60     3
2      3      120    70     3
3      3      130    70     3
4      3      130    70     3
5      3      130    70     3
8      3      439    310    2
```

11. Pedo-transfer rule 11 (PTR11): correction due to agricultural constraints (COPH)

This rule determines a correction factor based on parent material and agricultural limiting phase to decrease the SWAP because of agricultural constraints.

11.1 Current rule

```
Column 1 = dominant parent material code
 200   Calcareous rocks
 209   Residuum from calcareous rocks
 210   Limestone
 211   Primary limestone (Carboniferous)
 212   Secondary limestone
 213   Tertiary limestone
 214   Ferrugineous limestone
 215   Hard limestone
 216   Soft limestone
 217   Marly limestone
 218   Chalky limestone
 219   Detrital limestone
 220   Secondary chalk
 230   Marl
 231   Secondary marl
 232   Tertiary marl
```

```
 233   Gypseous marl
 234   Schistose marl
 240   Gypsum
 250   Dolomite
 451   Calcareous sandstone (Macigno)

Column 2 = code of the most important limitation to agricultural use
 0 = no information
 1 = no phase
 2 = gravelly
 3 = stony
 4 = lithic
 5 = concretionary
 6 = petrocalcic
 7 = saline
 8 = sodic
 9 = glaciers and snowcaps
 10 = soils disturbed by man
 20 = fragic
 21 = drained
 22 = quasi permanently flooded
 30 = eroded, erosion
 31 = phreatic

Column 3 = correction due to agricultural constraints (COPH)
Unit: percentage to drop from the AWC calculation

Column 4 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR11
         ***  1    1 3
         ***  2   15 3
         2**  2   10 3
         451  2   10 3
         ***  3   15 3
         2**  3   10 3
         451  3   10 3
         ***  4    1 3
         ***  5   10 3
         ***  6   20 3
         ***  7    1 3
         ***  8    1 3
         ***  9    0 3
         *** 10    0 3
         *** 20    1 3
         *** 21    1 3
         *** 22    1 3
         *** 30    1 3
         *** 31    1 3
```

11.2 Review

1. The values 3, 5 and 6 of the limitation to agricultural use decrease the available water. If parent material is related to limestone this decrease is less. In fact the correction is done only for the limitations caused by gravel, stones, concretions, and petrocalcic. The correction is smaller when the dominant parent material is limestone or very calcareous.

2. It is strange to apply a correction of 1 percent in the case of no limitation, or of other limitations not influencing water holding capacity. We decided to set the correction factor for these cases at 0.

3. The old classification of the limitation for agricultural use has been partly changed. The codes 0-10 are the same. These codes play a role only in PTR11 In the new classification, 11-18 are new. To some extent the codes 20-22 and 30 and 31 of the old classification can be translated to these codes, 11-18. The codes 20-23 of the new classification originate from the Digital Soil Map of the World. We have extended the PTR11 so it can handle all possible limitations. In case of limitation 9 (glaciers and snowcaps) and 10 (soils disturbed by man) we give the value 99. The Fortran program Ceru32, adapted version by Alterra, does recognize this value in the further processing and calculation of the SWAP and treats this value as no information.

11.3 New rule

```
Column 1 = dominant parent material code
 200   Calcareous rocks
 209   Residuum from calcareous rocks
 210   Limestone
 211   Primary limestone (Carboniferous)
 212   Secondary limestone
 213   Tertiary limestone
 214   Ferrugineous limestone
 215   Hard limestone
 216   Soft limestone
 217   Marly limestone
 218   Chalky limestone
 219   Detrital limestone
 220   Secondary chalk
 230   Marl
 231   Secondary marl
 232   Tertiary marl
 233   Gypseous marl
 234   Schistose marl
 240   Gypsum
 250   Dolomite
 451   Calcareous sandstone (Macigno)

Column 2 = code of the most important limitation to agricultural use
 0 = no information
 1 = no phase
 2 = gravelly
 3 = stony
 4 = lithic
 5 = concretionary
 6 = petrocalcic
 7 = saline
 8 = sodic
 9 = glaciers and snowcaps
 10 = soils disturbed by man
 11 = Fragipans
 12 = Excessively drained
 13 = Almost always flooded
 14 = Eroded phase, erosion
 15 = Phreatic phase (shallow water table)
 16 = Duripan (silica and iron cemented sub soil horizon)
 17 = Petroferric horizon
 18 = Permafrost
 20 = stony (for use with the Digital Map of the World only)
```

```
      the stony phase in the Digital Map of the World corresponds
      to the gravelly and the stony phases of the SGDBE
 21 = Petric (for use with the Digital Map of the World only)
 22 = Petrogypsic (for use with the Digital Map of the World only)
 23 = Cerrado (for use with the Digital Map of the World only)

Column 3 = correction due to agricultural constraints (COPH)
Unit: percentage to drop from the AWC calculation. The value 99 will
 lead to no information in the Fortran program.

Column 4 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR11
***   0     0     3
***   1     0     3
***   2     15    3
2**   2     10    3
451   2     10    3
***   3     15    3
2**   3     10    3
451   3     10    3
***   4     0     3
***   5     10    3
***   6     20    3
***   7     0     3
***   8     0     3
***   9     99    3
***   10    99    3
***   11    0     3
***   12    0     3
***   13    0     3
***   14    0     3
***   15    0     3
***   16    0     3
***   17    0     3
***   18    0     3
***   20    15    3
2**   20    10    3
451   20    10    3
***   21    15    3
2**   21    10    3
451   21    10    3
***   22    0     3
***   23    0     3
```

12. Pedo-transfer rule 12 (PTR12): correction due to parent material (for capillary rise constraints (COMA)

This rule determines a correction factor based on parent material to increase the SWAP because of capillary rise originating from retained water stored in the parent material.

12.1 Current rule

```
Column 1 = dominant parent material code
  220   Secondary chalk
  521   Loess
```

```
Column 2 = correction due to parent material (capillary rise) (COMA)
Amount of mm water to add to the AWC calculation

Column 3 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR12
         *** 000 3
         220 130 3
         521 100 3
```

12.2 Review

1. No remark

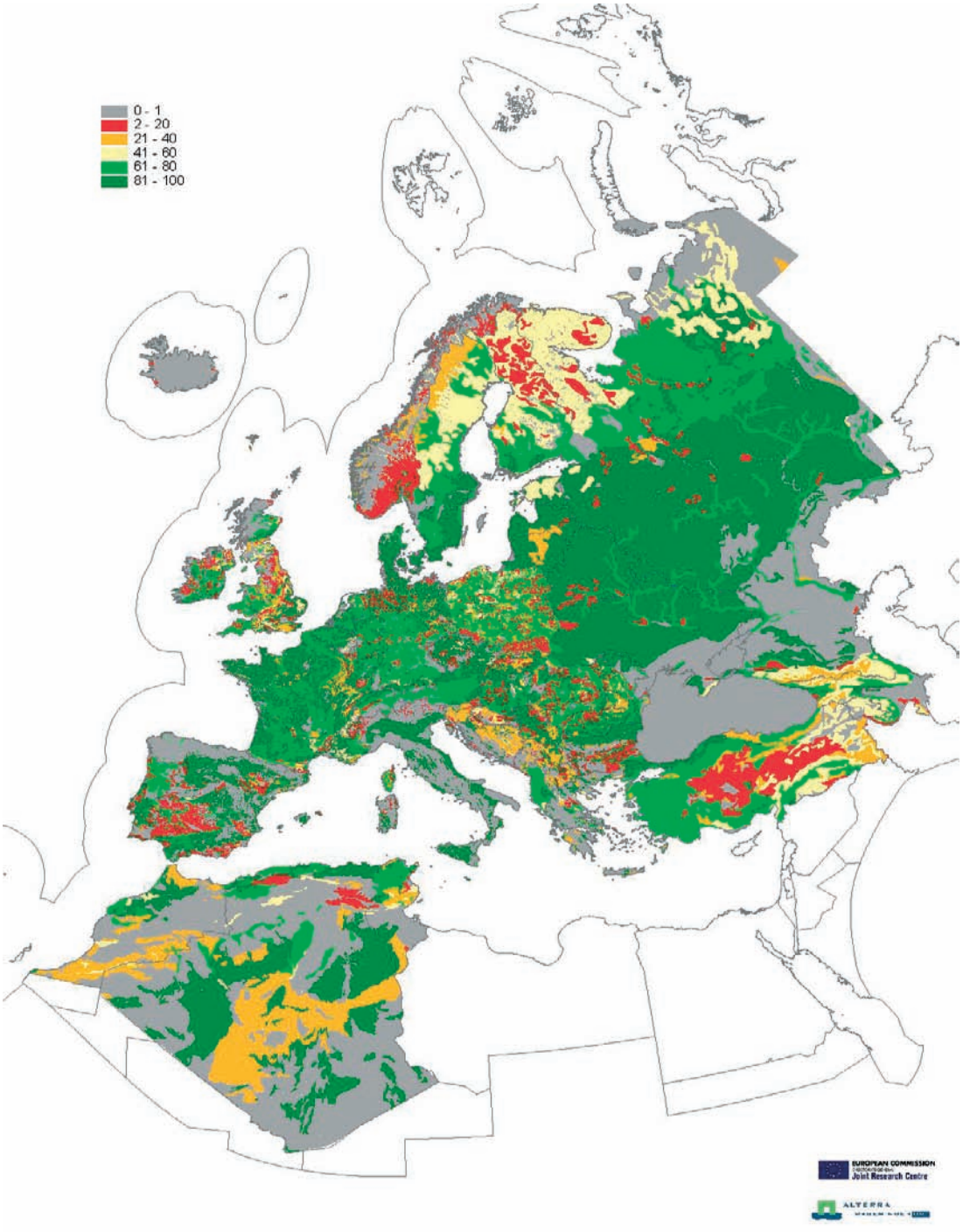
12.3 New rule

```
Column 1 = dominant parent material code
  220   Secondary chalk
  521   Loess

Column 2 = correction due to parent material (capillary rise) (COMA)
Amount of mm water to add to the AWC calculation

Column 3 = confidence level
 1   very low
 2   low
 3   moderate
 4   high

Rule PTR12
***    0     3
220    130   3
521    100   3
```

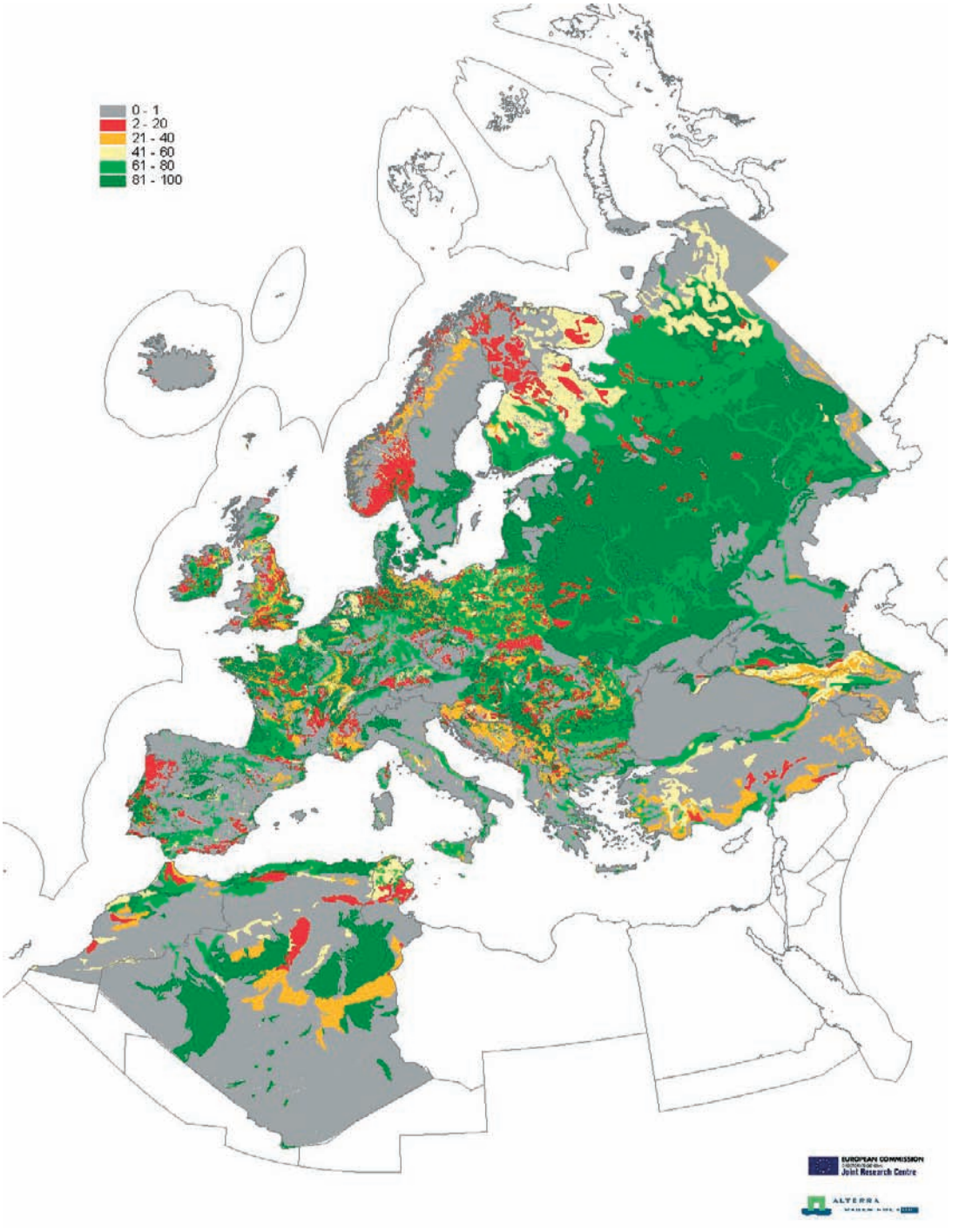
Annex 5 - Suitability maps

The following suitability maps are presented on the next pages:

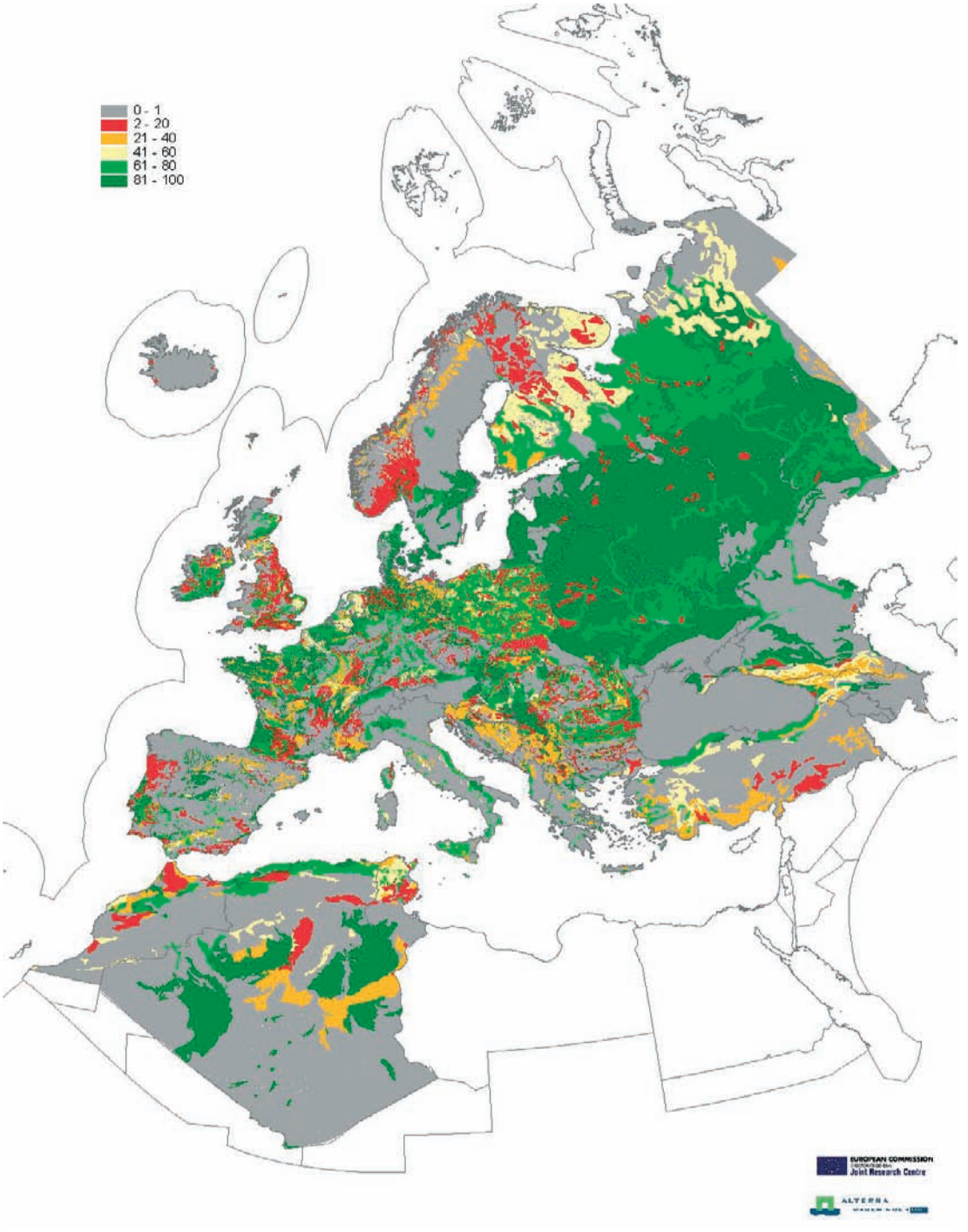
1. CGMS-rule based suitability map based on SGDBE version 3.2 – cereals
2. CGMS-rule based suitability map based on SGDBE version 3.2 – maize
3. CGMS-rule based suitability map based on SGDBE version 3.2 – root crops
4. CGMS-rule based suitability map based on SGDBE version 4.0 – cereals
5. CGMS-rule based suitability map based on SGDBE version 4.0 – maize
6. CGMS-rule based suitability map based on SGDBE version 4.0 – root crops
7. ESCAPE-rule based suitability map based on SGDBE version 4.0 – cereals
8. ESCAPE-rule based suitability map based on SGDBE version 4.0 – maize
9. ESCAPE-rule based suitability map based on SGDBE version 4.0 – root crops
10. ESCAPE-rule based suitability map based on SGDBE version 4.0 – oil seed rape
11. ESCAPE-rule based suitability map based on SGDBE version 4.0 – grass
12. SINFO-A7-rule based suitability map based on SGDBE version 4.0
13. SINFO-A6-rule based suitability map based on SGDBE version 4.0
14. SINFO-A5-4-rule based suitability map based on SGDBE version 4.0
15. SINFO-A3-rule based suitability map based on SGDBE version 4.0
16. SINFO-A1-rule based suitability map based on SGDBE version 4.0
17. SINFO-grass-rule based suitability map based on SGDBE version 4.0



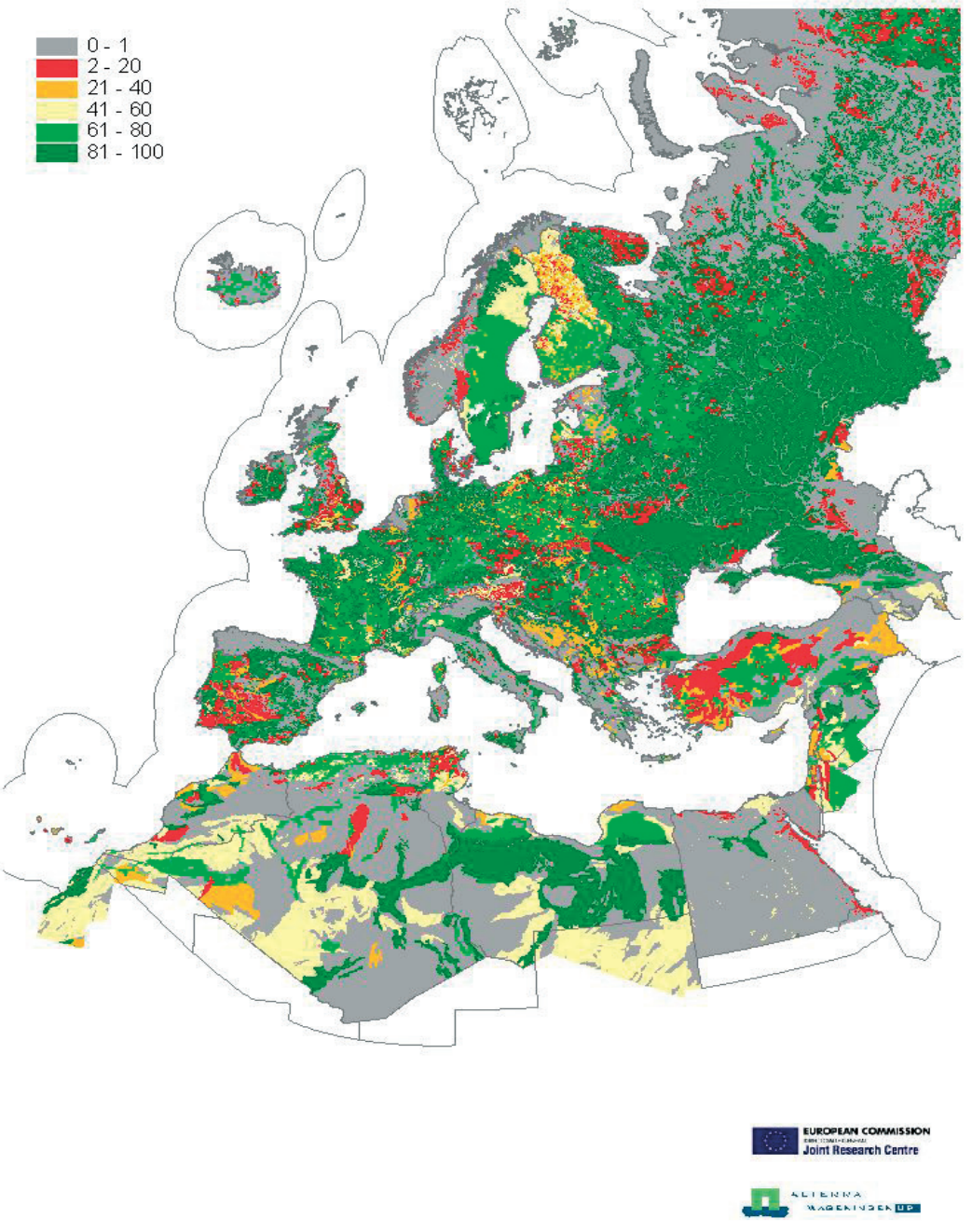
1. CGMS-rule based suitability map based on SGDBE version 3.2 – cereals



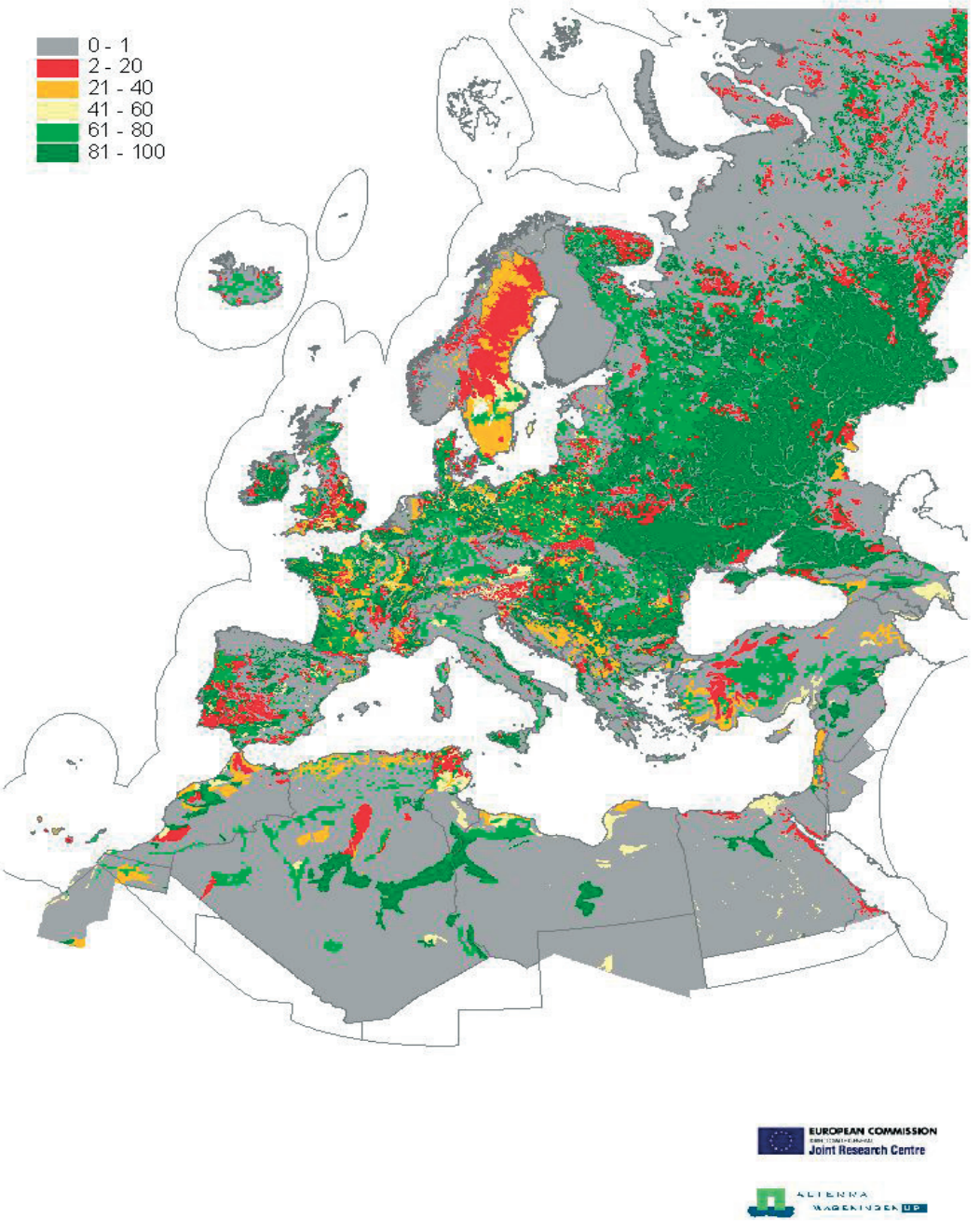
2. CGMS-rule based suitability map based on SGDBE version 3.2 – maize



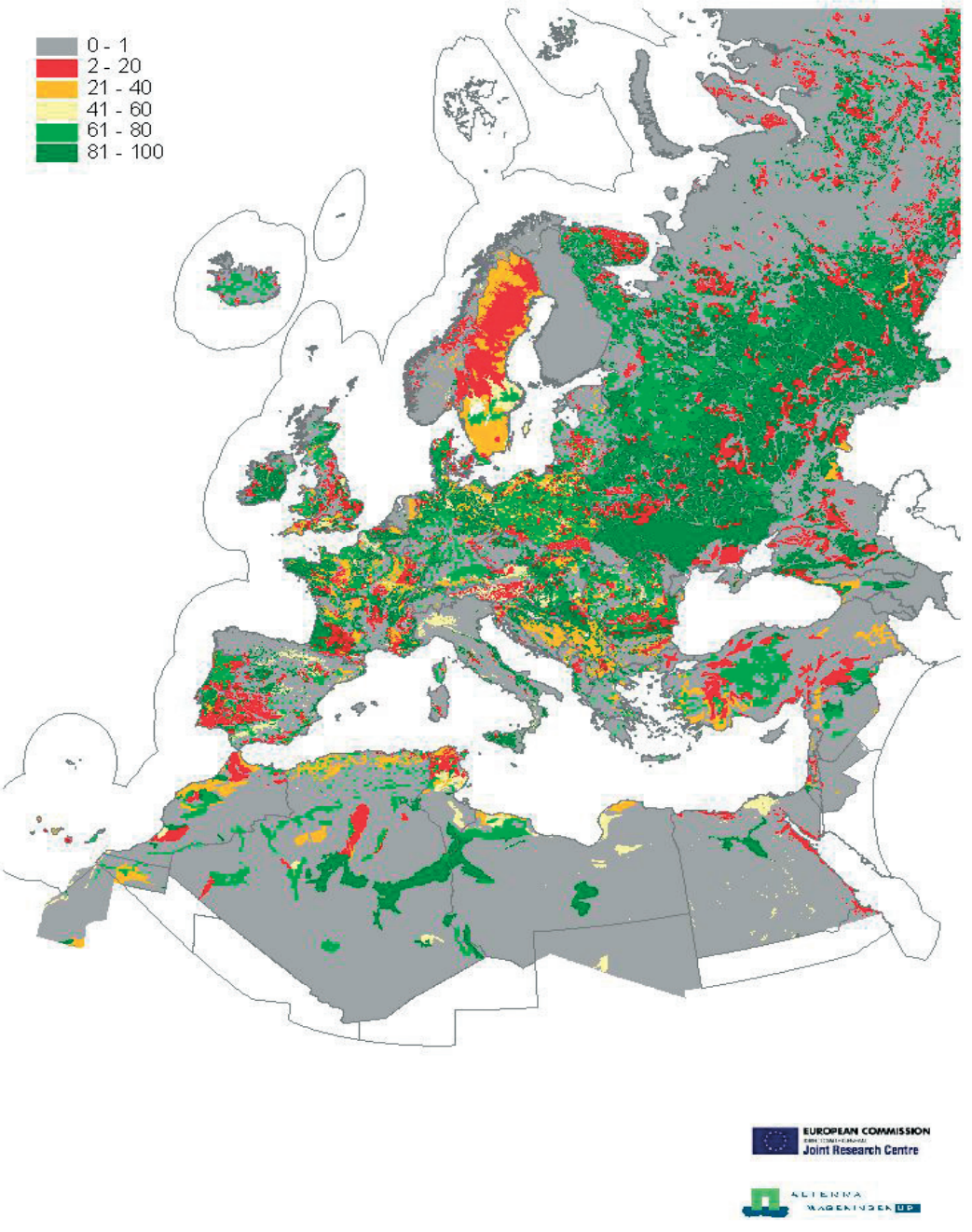
3. CGMS-rule based suitability map based on SGDBE version 3.2 – root crops



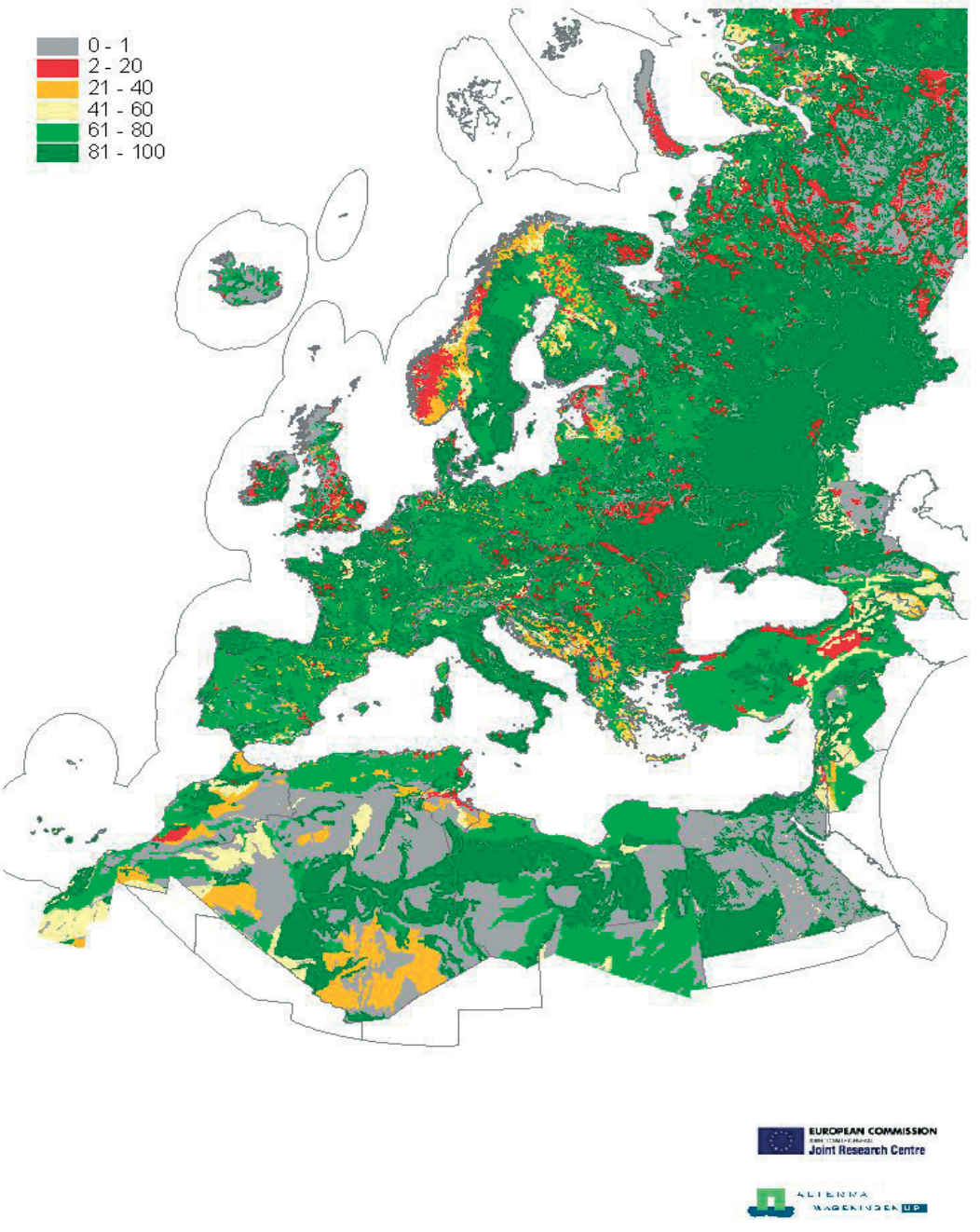
4. CGMS-rule based suitability map based on SGDBE version 4.0 – cereals



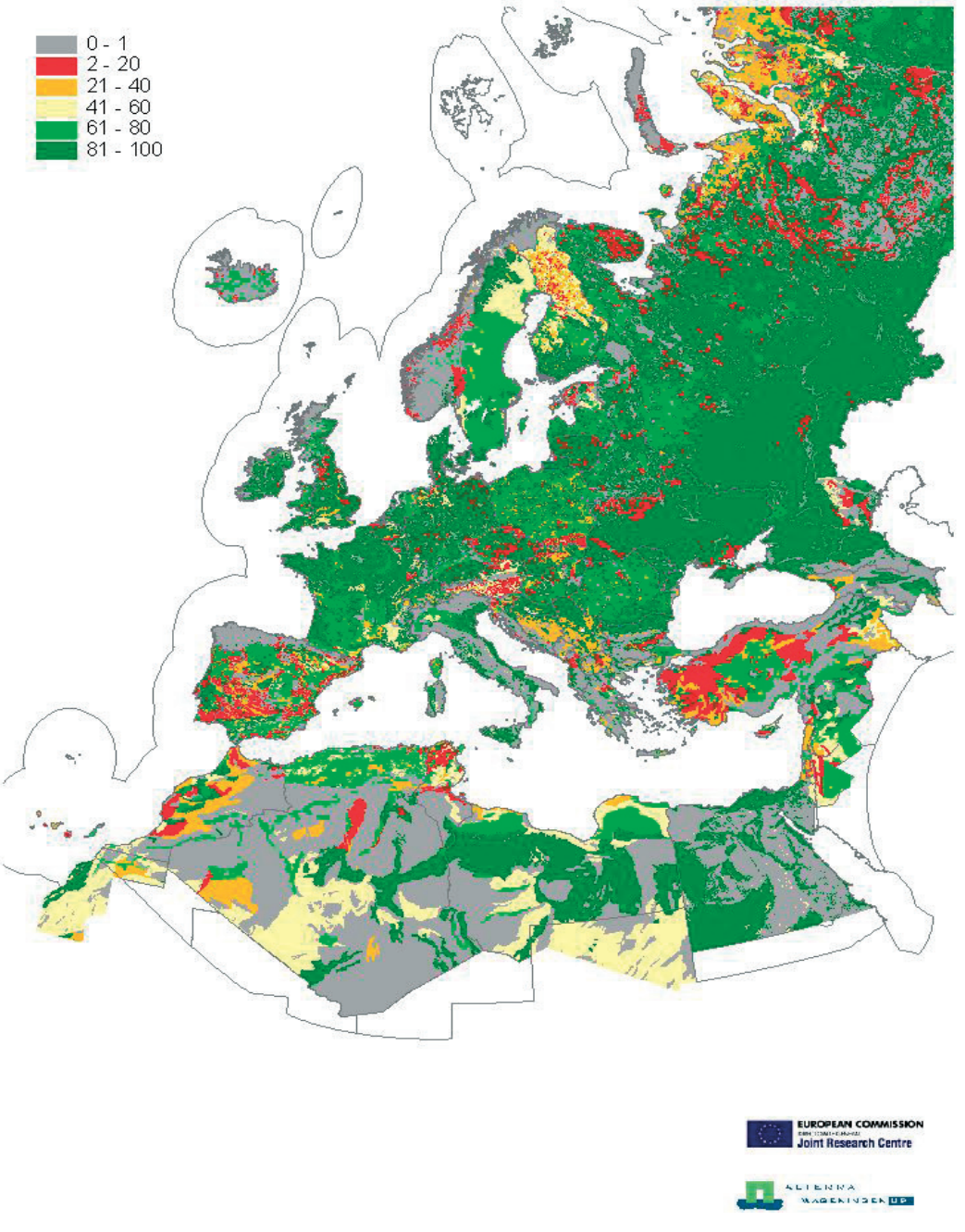
5. CGMS-rule based suitability map based on SGDBE version 4.0 – maize



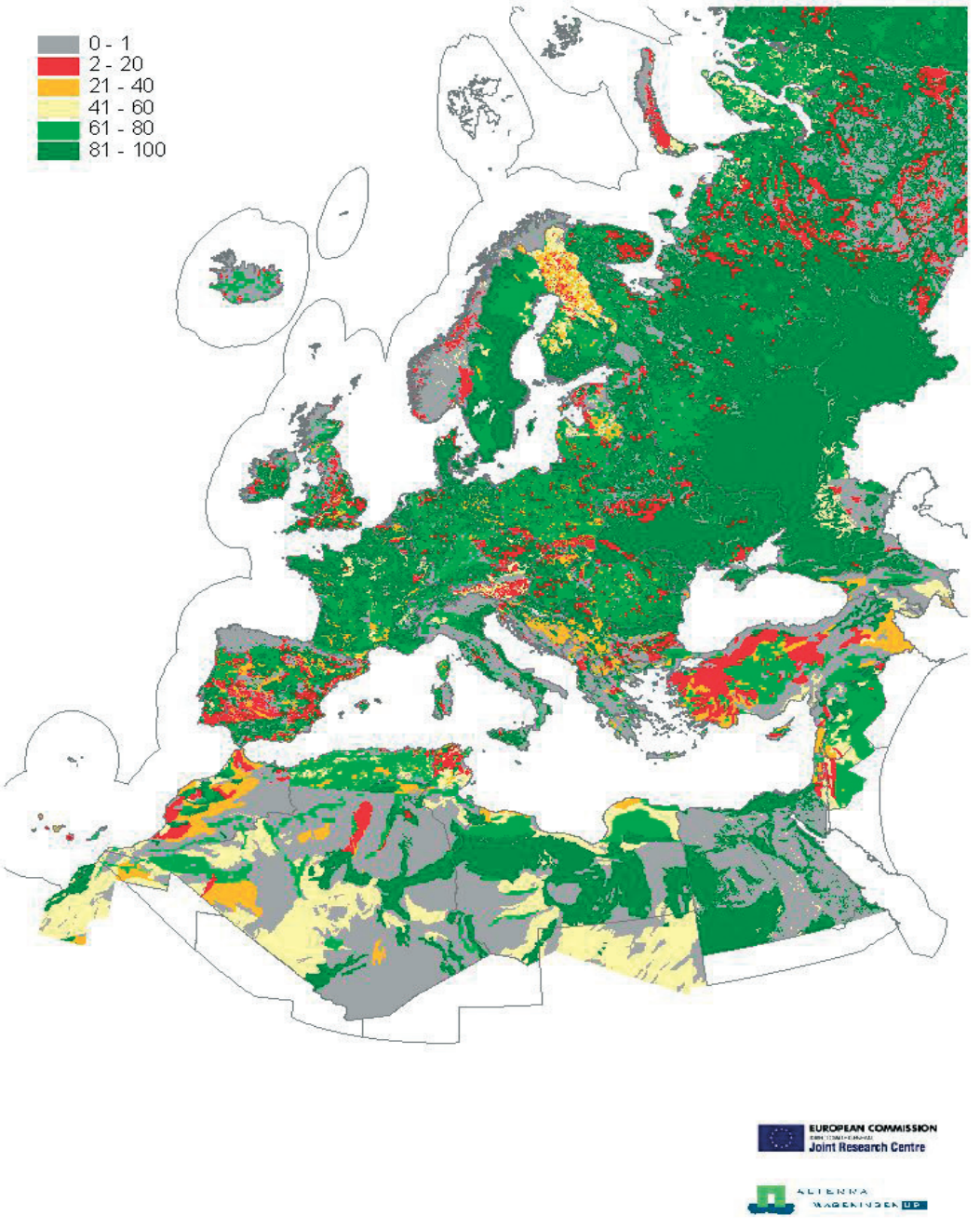
6. CGMS-rule based suitability map based on SGDBE version 4.0 – root crops



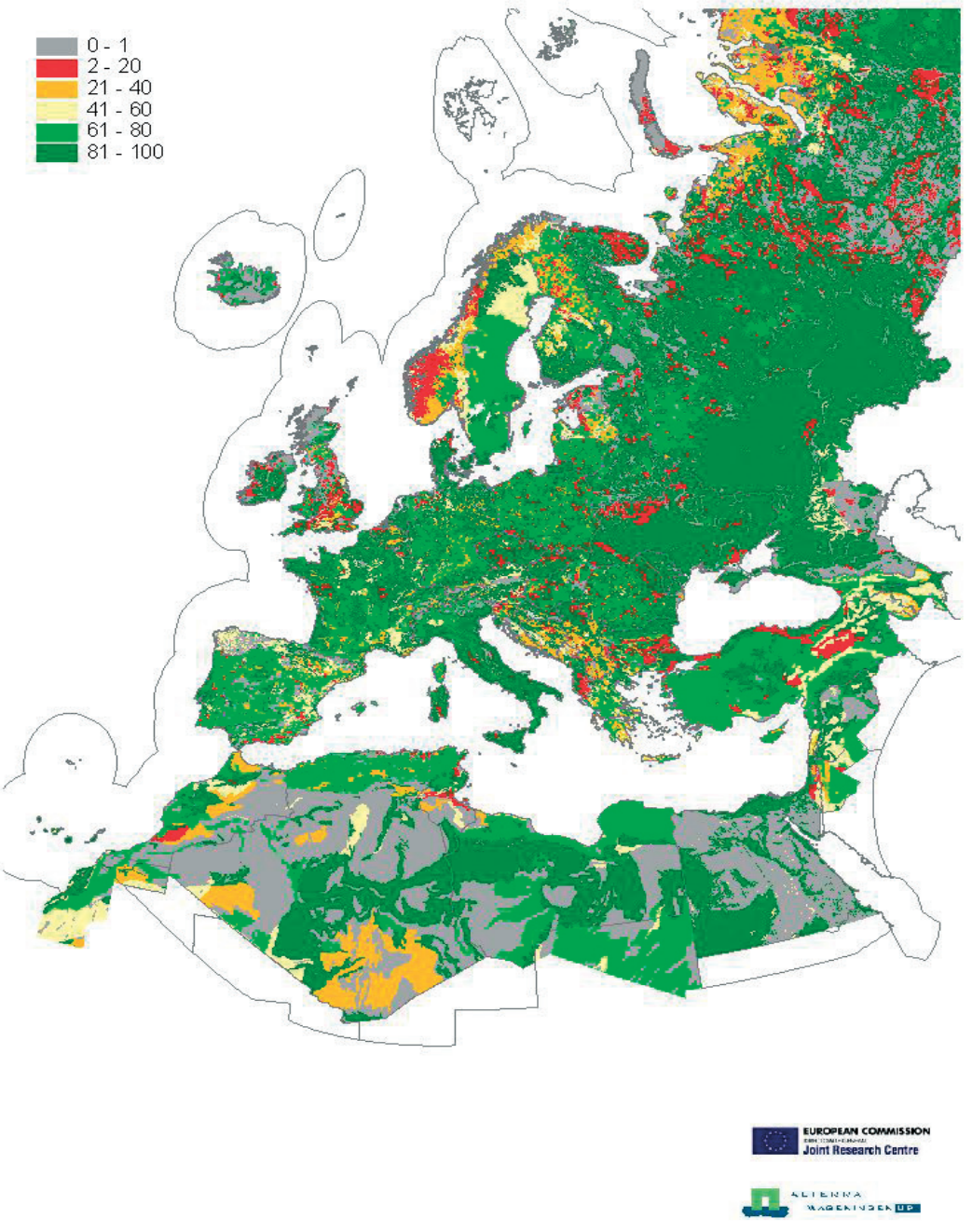
7. ESCAPE-rule based suitability map based on SGDBE version 4.0 – cereals



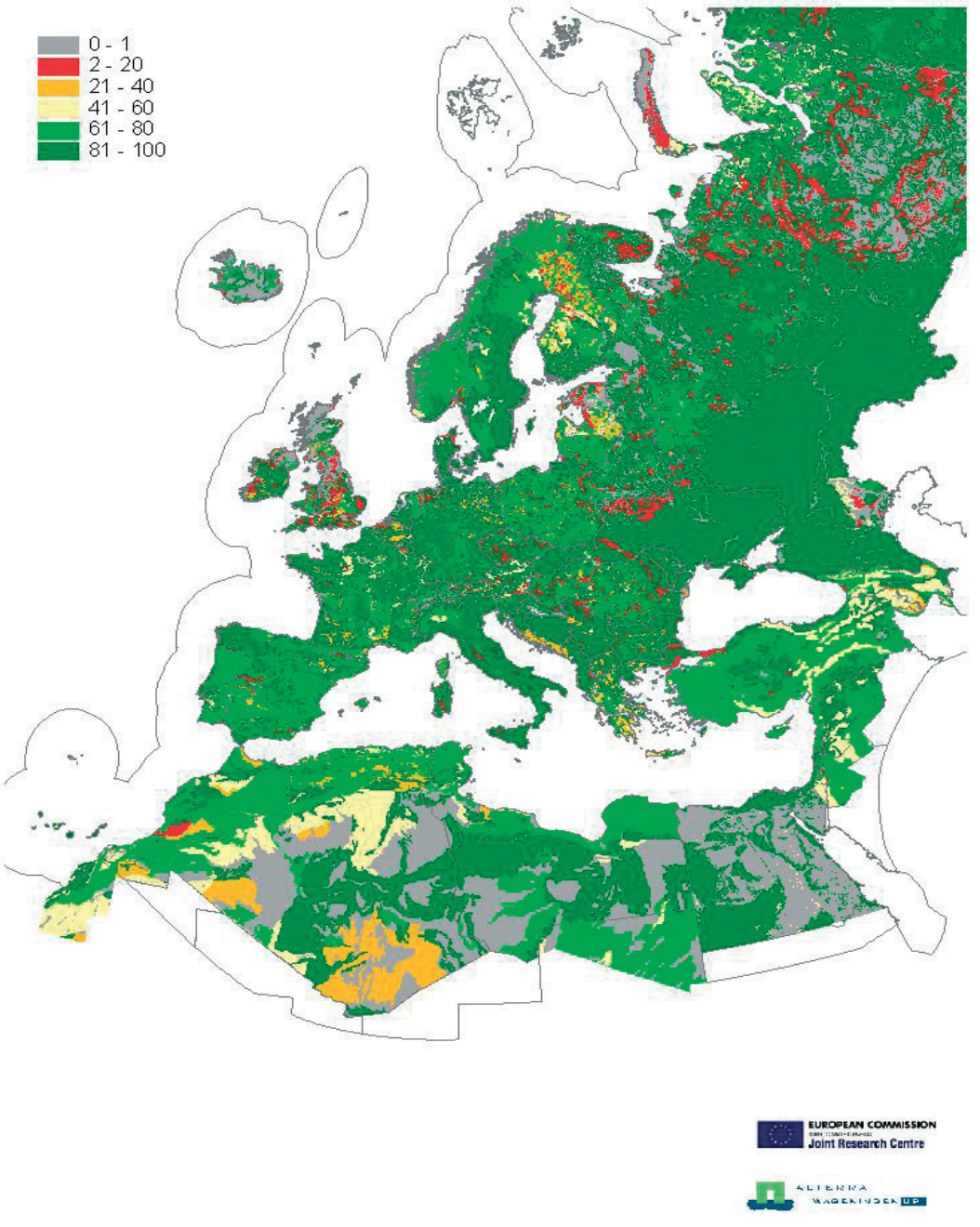
8. ESCAPE-rule based suitability map based on SGDBE version 4.0 – maize



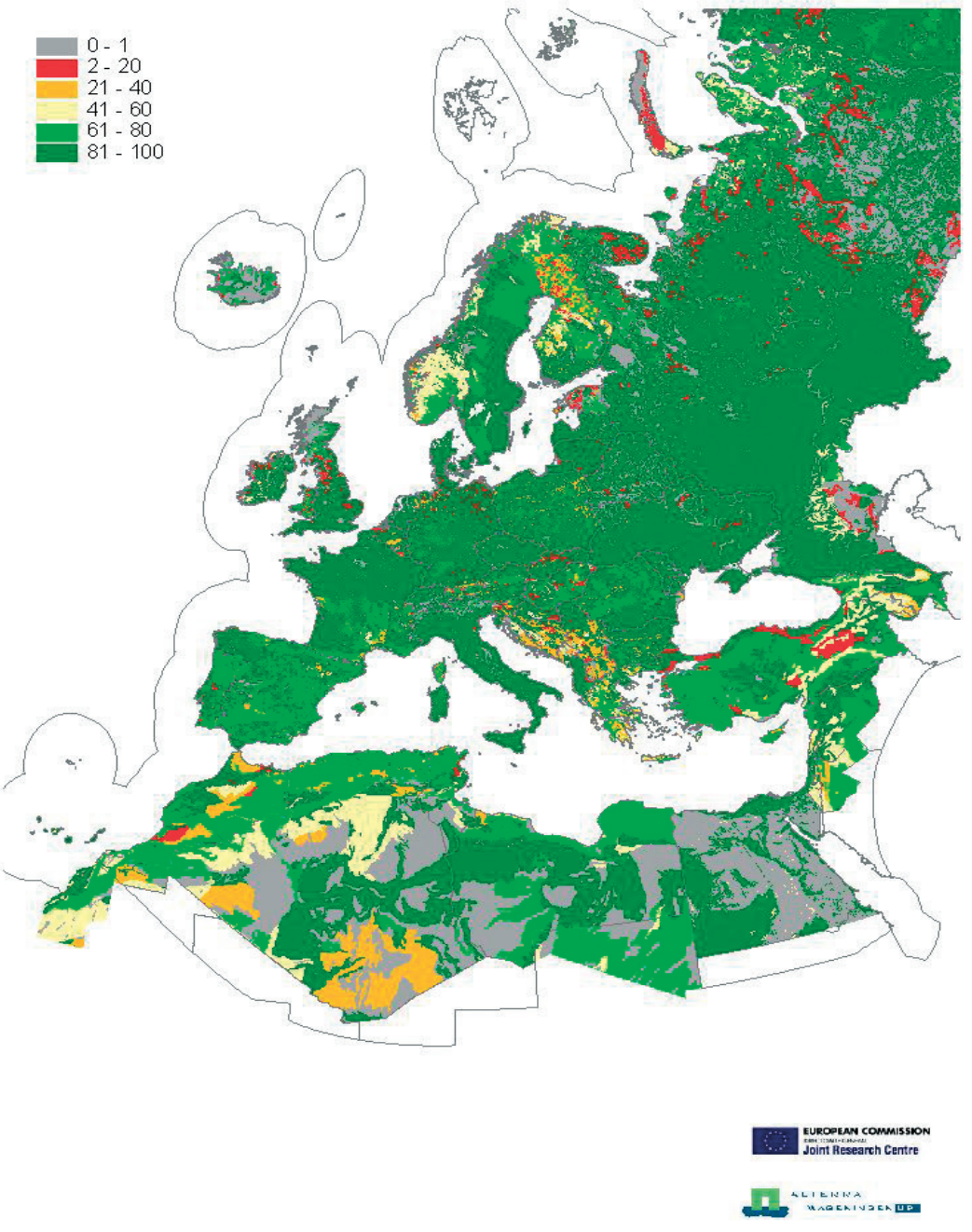
9. ESCAPE-rule based suitability map based on SGDBE version 4.0 – root crops



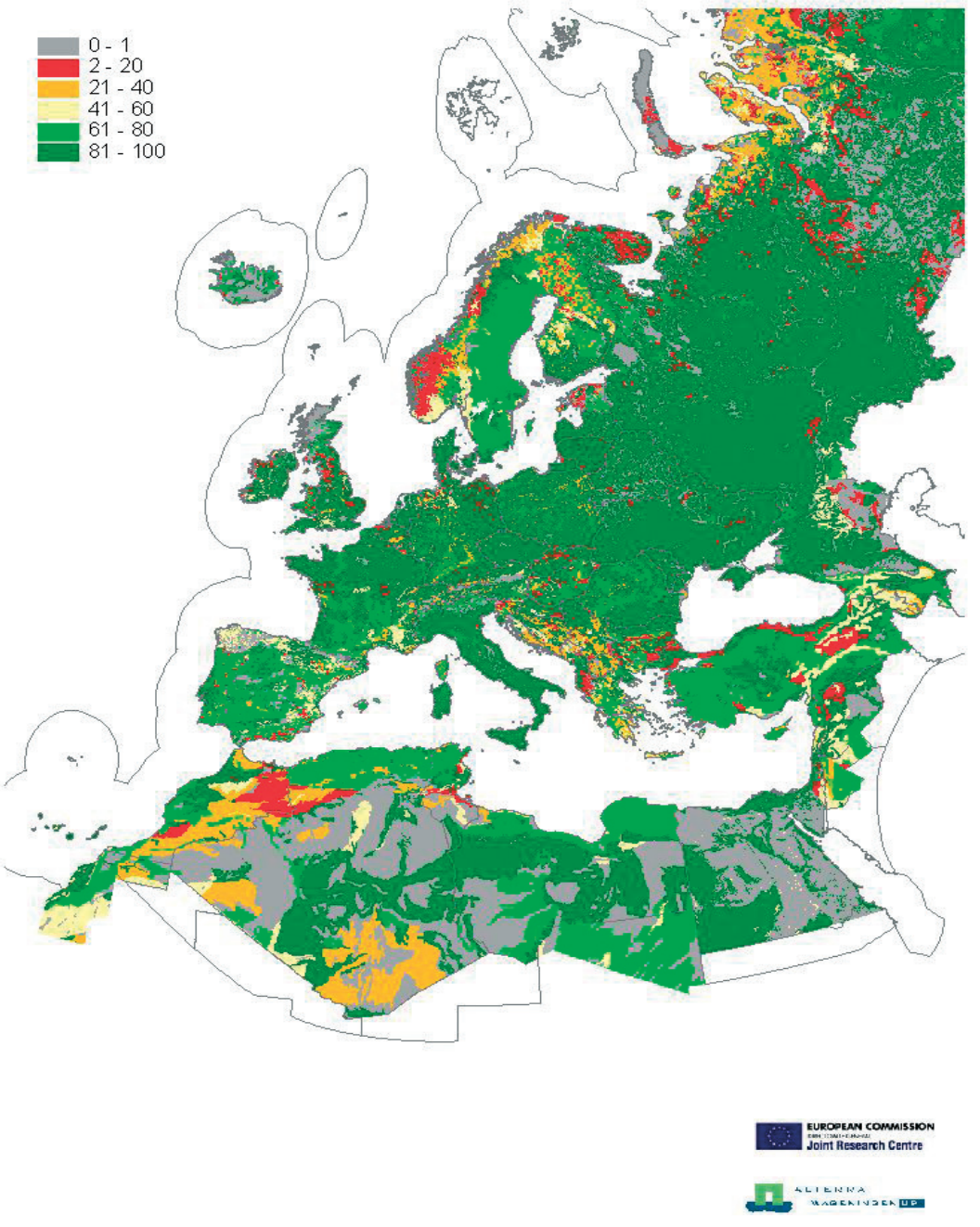
10. ESCAPE-rule based suitability map based on SGDBE version 4.0 – oil seed rape



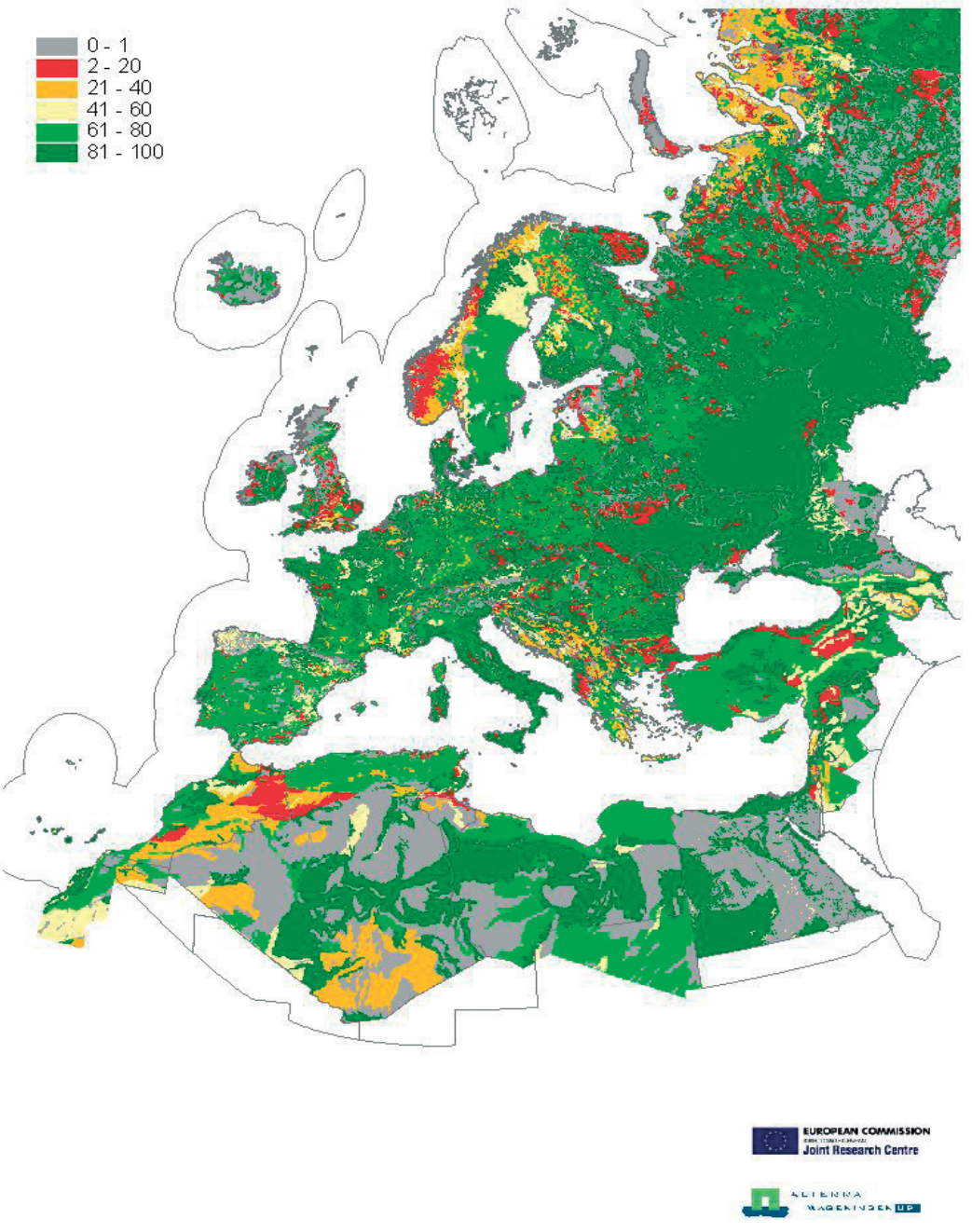
11. ESCAPE-rule based suitability map based on SGDBE version 4.0 – grass



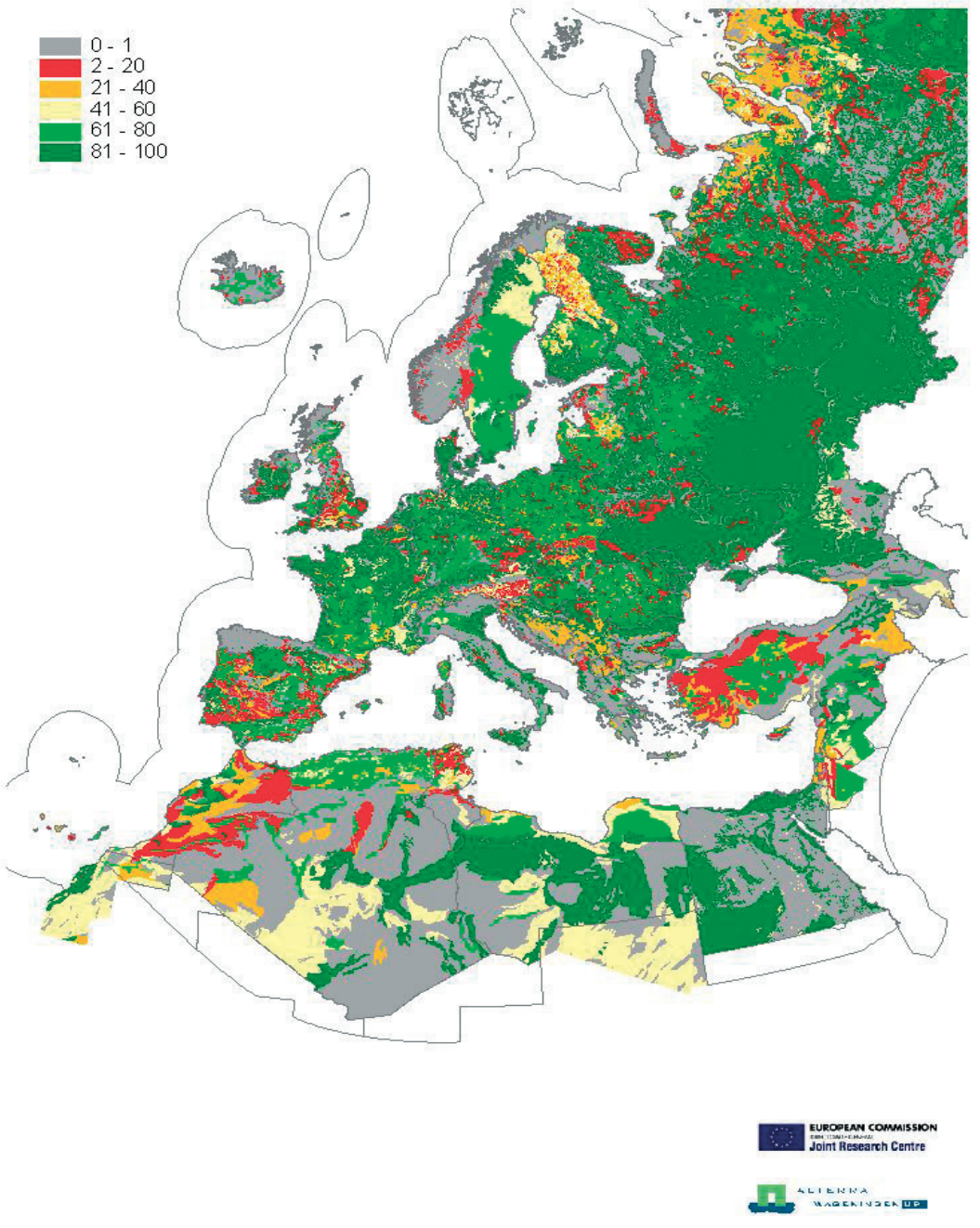
12. SINFO-A7-rule based suitability map based on SGDBE version 4.0



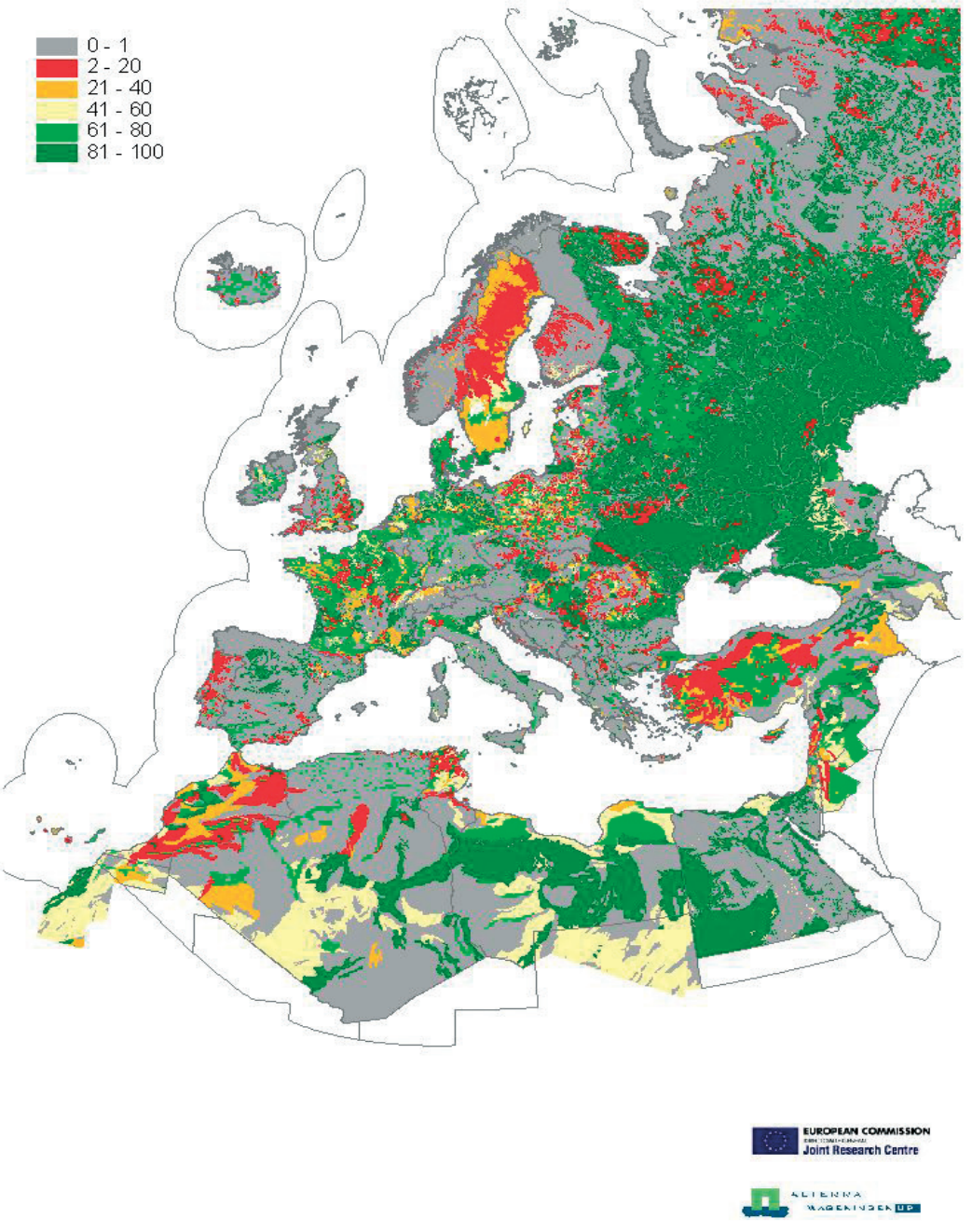
13. SINFO-A6-rule based suitability map based on SGDBE version 4.0



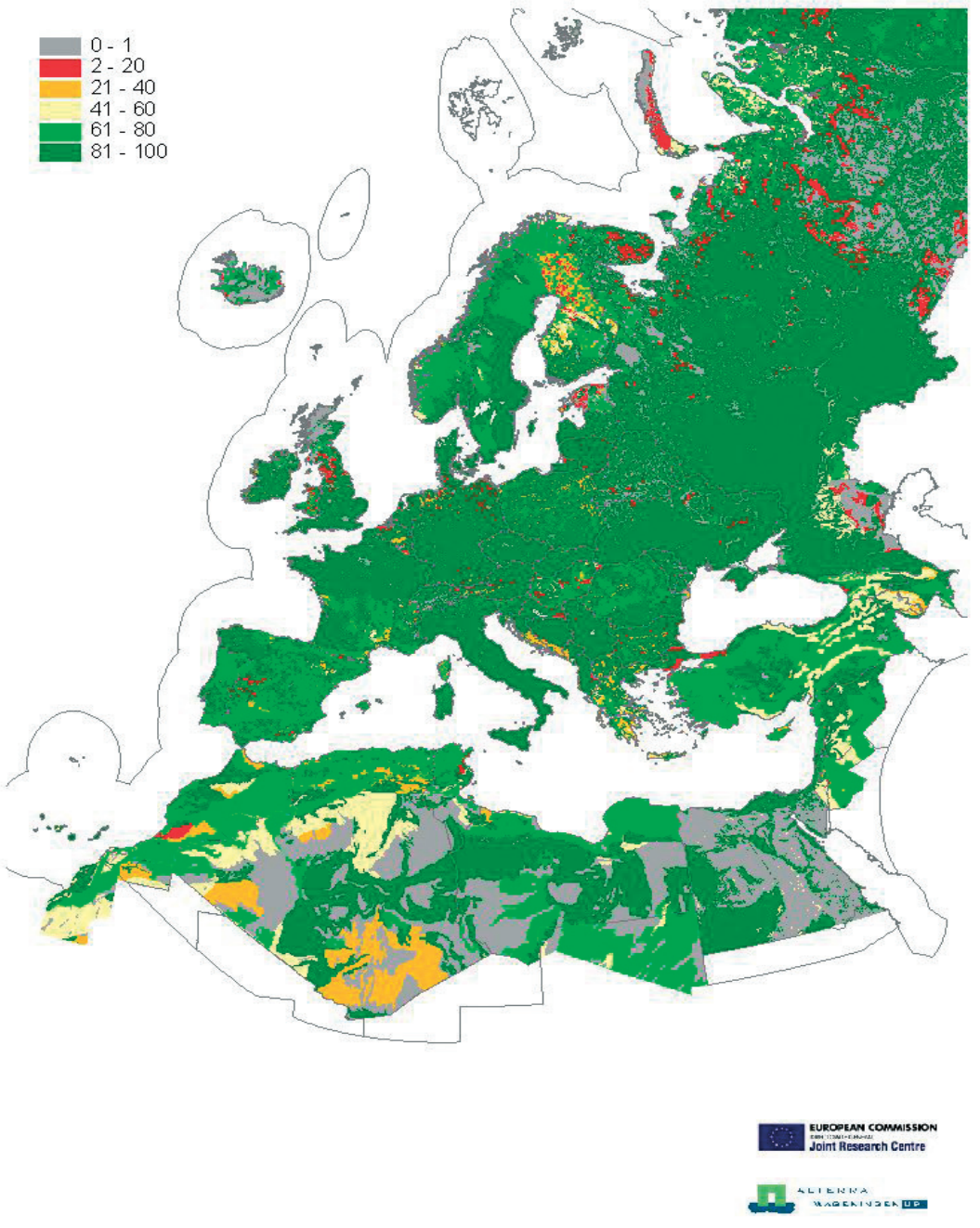
14. SINFO-A5-4-rule based suitability map based on SGDBE version 4.0



15. SINFO-A3-rule based suitability map based on SGDBE version 4.0



16. SINFO-A1-rule based suitability map based on SGDBE version 4.0



17. SINFO-grass-rule based suitability map based on SGDBE version 4.0

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