

## APPENDIX XIII

### SOIL MOISTURE STORAGE CAPACITY FOR THE SOIL UNITS OF THE SOIL MAP OF THE WORLD

The growing period for most crops continues beyond the rainy season and, to a greater or lesser extent, crops mature on moisture stored in the soil profile. However, the amount of soil moisture stored in the soil profile, and available to a crop, varies, e.g., with depth of the soil profile, the soil physical characteristics, and the rooting pattern of the crop. Depletion of soil moisture reserves causes the actual evapotranspiration to fall short of the potential rate. Soil moisture storage capacity of soils ( $S_{max}$ ) depends on soil physical and chemical characteristics, but above all on effective soil depth or volume. For the soil units of the Legend of the Soil Map of the World (FAO, 1974), FAO has developed procedures for the estimation of  $S_{max}$  (FAO, 1995c).

As a first step the soil group and soil units are grouped in eight sets which reflect fundamental differences in soil depth, textural changes with depth, influence of parent material or seasonal flooding conditions. These sets are:

1. *Histosols, Fluvisols and Gleysols*: which are considered as wetlands or water collecting sites.
2. *Andosols*: which due to parent material influence have a very high  $S_{max}$  (except Vitric Andosols).
3. *Vertisols*: specific characteristics set this group of soils apart.
4. *Lithosols and miscellaneous land units*: Lithosols and 'rock' units are characterized by a very limited soil depth.
5. *Rendzinas and Rankers*: both these soil groups are shallow by definition.
6. *Soil groups and soil units with no implied clay increase with depth*: this group combines soils in which the topsoil texture is considered representative of the whole profile. These are: Solonchaks, Regosols, Podzols, Cambisols, Arenosols, Vitric Andosols, Greyzems and the non-luvic soil units of the Xerosols, Yermosols, Kastanozems, Chernozems and Phaeozems.
7. *Soil groups and soil units with an implied clay increase with depth*: this set combines soils in which subsoil texture is finer than the topsoil texture. These are Solonetz, Podzoluvisols, Nitisols, Acrisols, Ferralsols and luvic units of the Xerosols, Yermosols, Kastanozems, Chernozems and Phaeozems.
8. *Planosols*: This soil group is considered to have a fine textured subsoil regardless of the topsoil texture which separates these soils from those discussed under 6 and 7.

Water availability to plants grown on Histosols, Gleysols and Fluvisols is mainly a function of groundwater or surface water levels and flooding.

Although an *S<sub>max</sub>* value can be deduced for these soils, this is largely irrelevant for practical purposes. Hence these soil groups are considered here as 'water collecting sites' and no *S<sub>max</sub>* is determined for them. For tropical soils (Ferralsols, Acrisols, Nitisols, Ferralic Cambisols and Ferric Luvisols) *S<sub>max</sub>* is decreased by 10% as compared to similar textural classes for other soils.

Gravel, stones, boulders and rock fragments when present in the profile reduce considerably the capacity of a soil to store moisture. The Legend of the Soil Map of the World uses this criterion when defining the stony phase reflecting the presence of coarse fragments in the surface layers or at the surface to an extent that it makes the use of mechanized equipment impracticable. Soil groups and units such as Vitric Andosols, Rendzinas and Lithosols generally contain a significant amount of gravel, while in other soils such as Ferralsols (stone line), Regosols, Acrisols, and soils with a petrocalcic or petrogypsic phase gravel occurrence is more common but largely dependent on local conditions. In the present general approach it is suggested to reduce *S<sub>max</sub>* by 50% when a stony or petric phase is present in a mapping unit of the DSMW. These adjustments are location specific and modify the evaluation of the respective soil units listed in the tables below (see Table 6 in Chapter 3).

## Soil moisture storage capacity ( $S_{max}$ ) classes derived for FAO soil units of Legend '74

FAO Legend '74 Soil Unit	SLU	coarse		medium		fine		FAO Legend '74 Soil Unit	SLU	coarse		medium		fine	
		mm	CL	mm	CL	mm	CL			mm	CL	mm	CL	mm	CL
Eutric Gleysols	Ge	n.a.	1	n.a.	1	n.a.	1	Eutric Cambisols	Be	106	3	180	1	165	1
Calcaric Gleysols	Gc	n.a.	1	n.a.	1	n.a.	1	Dystric Cambisols	Bd	106	3	180	1	165	1
Dystric Gleysols	Gd	n.a.	1	n.a.	1	n.a.	1	Humic Cambisols	Bh	106	3	180	1	165	1
Mollic Gleysols	Gm	n.a.	1	n.a.	1	n.a.	1	Gleyic Cambisols	Bg	106	3	180	1	165	1
Humic Gleysols	Gh	n.a.	1	n.a.	1	n.a.	1	Gelic Cambisols	Bx	106	3	180	1	165	1
Plinthic Gleysols	Gp	n.a.	1	n.a.	1	n.a.	1	Calcic Cambisols	Bk	106	3	180	1	165	1
Gelic Gleysols	Gx	n.a.	1	n.a.	1	n.a.	1	Chromic Cambisols	Bc	106	3	180	1	165	1
Eutric Regosols	Re	106	3	180	1	165	1	Vertic Cambisols	Bv	106	3	180	1	165	1
Calcaric Regosols	Rc	106	3	180	1	165	1	Ferralic Cambisols	Bf	95	3	162	1	148	1
Dystric Regosols	Rd	106	3	180	1	165	1	Orthic Luvisols	Lo	162	1	180	1	175	1
Gelic Regosols	Rx	106	3	180	1	165	1	Chromic Luvisols	Lc	162	1	180	1	175	1
Lithosols	l	13	6	19	6	18	6	Calcic Luvisols	Lk	162	1	180	1	175	1
Cambic Arenosols	Qc	106	3	180	1	165	1	Vertic Luvisols	Lv	162	1	180	1	175	1
Luvic Arenosols	Ql	106	3	180	1	165	1	Ferric Luvisols	Lf	146	1	162	1	157	1
Ferralic Arenosols	Qf	106	3	180	1	165	1	Albic Luvisols	La	162	1	180	1	175	1
Albic Arenosols	Qa	106	3	180	1	165	1	Plinthic Luvisols	Lp	162	1	180	1	175	1
Rendzinas	E	39	5	57	5	53	5	Gleyic Luvisols	Lg	162	1	180	1	175	1
Rankers	U	39	5	57	5	53	5	Eutric Podzoluvisols	De	162	1	180	1	175	1
Ochric Andosols	To	200	1	200	1	200	1	Dystric Podzoluvisol	Dd	162	1	180	1	175	1
Mollic Andosols	Tm	200	1	200	1	200	1	Gleyic Podzoluvisols	Dg	162	1	180	1	175	1
Humic Andosols	Th	200	1	200	1	200	1	Orthic Podzols	Po	106	3	180	1	165	1
Vitric Andosols	Tv	200	1	200	1	200	1	Leptic Podzols	Pl	106	3	180	1	165	1
Pellic Vertisols	Vp	135	2	135	2	135	2	Ferric Podzols	Pf	106	3	180	1	165	1
Chromic Vertisols	Vc	135	2	135	2	135	2	Humic Podzols	Ph	106	3	180	1	165	1
Orthic Solonchaks	Zo	106	3	180	1	165	1	Placic Podzols	Pp	106	3	180	1	165	1
Mollic Solonchaks	Zm	106	3	180	1	165	1	Gleyic Podzols	Pg	106	3	180	1	165	1
Takyric Solonchaks	Zt	106	3	180	1	165	1	Eutric Planosols	We	152	1	169	1	165	1
Gleyic Solonchaks	Zg	106	3	180	1	165	1	Dystric Planosols	Wd	152	1	169	1	165	1
Orthic Solonetz	So	106	3	180	1	165	1	Mollic Planosols	Wm	152	1	169	1	165	1
Mollic Solonetz	Sm	106	3	180	1	165	1	Humic Planosols	Wh	152	1	169	1	165	1
Gleyic Solonetz	Sg	106	3	180	1	165	1	Sodic Planosols	Ws	152	1	169	1	165	1
Haplic Yermosols	Yh	106	3	180	1	165	1	Gelic Planosols	Wx	152	1	169	1	165	1
Calcic Yermosols	Yk	106	3	180	1	165	1	Orthic Acrisols	Ao	146	1	162	1	157	1
Gypsic Yermosols	Yy	106	3	180	1	165	1	Ferric Acrisols	Af	146	1	162	1	157	1
Luvic Yermosols	Yl	162	1	180	1	175	1	Humic Acrisols	Ah	146	1	162	1	157	1
Takyric Yermosols	Yt	106	3	180	1	165	1	Plinthic Acrisols	Ap	146	1	162	1	157	1
Haplic Xerosols	Xh	106	3	180	1	165	1	Gleyic Acrisols	Ag	146	1	162	1	157	1
Calcic Xerosols	Xk	106	3	180	1	165	1	Eutric Nitrosols	Ne	146	1	162	1	157	1
Gypsic Xerosols	Xy	106	3	180	1	165	1	Dystric Nitrosols	Nd	146	1	162	1	157	1
Luvic Xerosols	Xl	162	1	180	1	175	1	Humic Nitrosols	Nh	146	1	162	1	157	1
Haplic Kastanozems	Kh	106	3	180	1	165	1	Orthic Ferralsols	Fo	146	1	162	1	148	1
Calcic Kastanozems	Kk	106	3	180	1	165	1	Xanthic Ferralsols	Fx	146	1	162	1	148	1
Luvic Kastanozems	Kl	162	1	180	1	175	1	Rhodic Ferralsols	Fr	146	1	162	1	148	1
Haplic Chernozems	Ch	106	3	180	1	165	1	Humic Ferralsols	Fh	146	1	162	1	148	1
Calcic Chernozems	Ck	106	3	180	1	165	1	Acric Ferralsols	Fa	146	1	162	1	148	1
Luvic Chernozems	Cl	162	1	180	1	175	1	Plinthic Ferralsols	Fp	146	1	162	1	148	1
Glossic Chernozems	Cg	106	3	180	1	165	1	Eutric Histosols	Oe	n.a.	1	n.a.	1	n.a.	1
Haplic Phaeozems	Hh	106	3	180	1	165	1	Dystric Histosols	Od	n.a.	1	n.a.	1	n.a.	1
Calcaric Phaeozems	Hc	106	3	180	1	165	1	Gelic Histosols	Ox	n.a.	1	n.a.	1	n.a.	1
Luvic Phaeozems	Hi	162	1	180	1	175	1	Eutric Fluvisols	Je	n.a.	1	n.a.	1	n.a.	1
Gleyic Phaeozems	Hg	106	3	180	1	165	1	Calcaric Fluvisols	Jc	n.a.	1	n.a.	1	n.a.	1
Orthic Greyzems	Mo	106	3	180	1	165	1	Dystric Fluvisols	Jd	n.a.	1	n.a.	1	n.a.	1
Gleyic Greyzems	Mg	106	3	180	1	165	1	Thionic Fluvisols	Jt	n.a.	1	n.a.	1	n.a.	1

## Soil moisture storage capacity classes derived for FAO soil units of Revised Legend '90

FAO Legend '90 Soil Unit	SLU	coarse		medium		fine		FAO Legend '90 Soil Unit	SLU	coarse		medium		fine	
		mm	CL	mm	CL	mm	CL			mm	CL	mm	CL	mm	CL
Ferric Acrisols	ACf	146	1	162	1	157	1	Eutric Gleysols	GLe	n.a.	1	n.a.	1	n.a.	1
Gleyic Acrisols	ACg	146	1	162	1	157	1	Gelic Gleysols	GLi	n.a.	1	n.a.	1	n.a.	1
Haplic Acrisols	ACh	146	1	162	1	157	1	Calcic Gleysols	GLk	n.a.	1	n.a.	1	n.a.	1
Plinthic Acrisols	ACp	146	1	162	1	157	1	Mollic Gleysols	GLm	n.a.	1	n.a.	1	n.a.	1
Humic Acrisols	ACu	146	1	162	1	157	1	Thionic Gleysols	GLt	n.a.	1	n.a.	1	n.a.	1
Ferric Alisols	ALf	146	1	162	1	157	1	Umbric Gleysols	GLu	n.a.	1	n.a.	1	n.a.	1
Gleyic Alisols	ALg	146	1	162	1	157	1	Gleyic Greyzems	GRg	106	3	180	1	165	1
Haplic Alisols	ALh	146	1	162	1	157	1	Haplic Greyzems	GRh	106	3	180	1	165	1
Stagnic Alisols	ALj	146	1	162	1	157	1	Haplic Gypsisols	GYh	106	3	180	1	165	1
Plinthic Alisols	ALp	146	1	162	1	157	1	Calcic Gypsisols	GYk	106	3	180	1	165	1
Humic Alisols	ALu	146	1	162	1	157	1	Luvic Gypsisols	GYl	162	1	180	1	175	1
Gleyic Andosols	ANg	200	1	200	1	200	1	Petric Gypsisols	GYp	79	4	135	2	123	2
Haplic Andosols	ANh	200	1	200	1	200	1	Fibric Histosols	HSf	n.a.	1	n.a.	1	n.a.	1
Gelic Andosols	ANi	200	1	200	1	200	1	Gelic Histosols	HSi	n.a.	1	n.a.	1	n.a.	1
Mollic Andosols	ANm	200	1	200	1	200	1	Folic Histosols	HSI	n.a.	1	n.a.	1	n.a.	1
Umbric Andosols	ANu	200	1	200	1	200	1	Teric Histosols	HSS	n.a.	1	n.a.	1	n.a.	1
Vitric Andosols	ANz	200	1	200	1	200	1	Thionic Histosols	HSt	n.a.	1	n.a.	1	n.a.	1
Albic Arenosols	ARa	106	3	180	1	165	1	Haplic Kastanozems	KSh	106	3	180	1	165	1
Cambic Arenosols	ARb	106	3	180	1	165	1	Calcic Kastanozems	KSk	106	3	180	1	165	1
Calcaric Arenosols	ARc	106	3	180	1	165	1	Luvic Kastanozems	KSI	162	1	180	1	175	1
Gleyic Arenosols	ARf	106	3	180	1	165	1	Gypsic Kastanozems	KSy	106	3	180	1	165	1
Haplic Arenosols	ARg	106	3	180	1	165	1	Dystric Leptosols	LPd	13	6	19	6	18	6
Luvic Arenosols	ARl	106	3	180	1	165	1	Eutric Leptosols	LPe	13	6	19	6	18	6
Ferralic Arenosols	ARo	106	3	180	1	165	1	Gelic Leptosols	LPi	13	6	19	6	18	6
Aric Anthrosols	ATa	200	1	200	1	200	1	Rendzic Leptosols	LPk	39	5	57	5	53	5
Cumulic Anthrosols	ATc	250	1	250	1	250	1	Mollic Leptosols	LPm	13	6	19	6	18	6
Fimic Anthrosols	ATf	200	1	200	1	200	1	Lithic Leptosols	LPq	13	6	19	6	18	6
Urbic Anthrosols	ATu	200	1	200	1	200	1	Umbric Leptosols	LPu	13	6	19	6	18	6
Gleyic Chernozems	CHg	106	3	180	1	165	1	Albic Luvisols	LVa	162	1	180	1	175	1
Haplic Chernozems	CHh	106	3	180	1	165	1	Ferric Luvisols	LVf	146	1	162	1	157	1
Calcic Chernozems	CHk	106	3	180	1	165	1	Gleyic Luvisols	LVg	162	1	180	1	175	1
Luvic Chernozems	CHl	162	1	180	1	175	1	Haplic Luvisols	LVh	162	1	180	1	175	1
Glossic Chernozems	CHw	106	3	180	1	165	1	Stagnic Luvisols	LVj	162	1	180	1	175	1
Haplic Calcisols	CLh	106	3	180	1	165	1	Calcic Luvisols	LVk	162	1	180	1	175	1
Luvic Calcisols	CLi	162	1	180	1	175	1	Vertic Luvisols	LVv	162	1	180	1	175	1
Petric Calcisols	CLp	79	4	135	2	123	2	Chromic Luvisols	LVx	162	1	180	1	175	1
Calcaric Cambisols	CMc	106	3	180	1	165	1	Albic Lixisols	LXa	146	1	162	1	157	1
Dystric Cambisols	CMd	106	3	180	1	165	1	Ferric Lixisols	LXf	146	1	162	1	157	1
Eutric Cambisols	CMe	106	3	180	1	165	1	Gleyic Lixisols	LXg	146	1	162	1	157	1
Gleyic Cambisols	CMg	106	3	180	1	165	1	Haplic Lixisols	LXh	146	1	162	1	157	1
Gelic Cambisols	CMi	106	3	180	1	165	1	Stagnic Lixisols	LXj	146	1	162	1	157	1
Ferralic Cambisols	CMo	95	3	162	1	148	1	Plinthic Lixisols	LXp	146	1	162	1	157	1
Humic Cambisols	CMu	106	3	180	1	165	1	Haplic Nitisols	NTh	146	1	162	1	157	1
Vertic Cambisols	CMv	106	3	180	1	165	1	Rhodic Nitisols	NTr	146	1	162	1	157	1
Chromic Cambisols	CMx	106	3	180	1	165	1	Humic Nitisols	NTu	146	1	162	1	157	1
Calcaric Fluvisols	FLc	n.a.	1	n.a.	1	n.a.	1	Dystric Podzoluvisol	PDd	162	1	180	1	175	1
Dystric Fluvisols	FLd	n.a.	1	n.a.	1	n.a.	1	Eutric Podzoluvisols	PDe	162	1	180	1	175	1
Eutric Fluvisols	FLe	n.a.	1	n.a.	1	n.a.	1	Gleyic Podzoluvisols	PDg	162	1	180	1	175	1
Mollic Fluvisols	FLm	n.a.	1	n.a.	1	n.a.	1	Gelic Podzoluvisols	PDi	162	1	180	1	175	1
Salic Fluvisols	FLs	n.a.	1	n.a.	1	n.a.	1	Stagnic Podzoluvisol	PDj	162	1	180	1	175	1
Thionic Fluvisols	FLt	n.a.	1	n.a.	1	n.a.	1	Calcaric Phaeozems	PHc	106	3	180	1	165	1
Umbric Fluvisols	FLu	n.a.	1	n.a.	1	n.a.	1	Gleyic Phaeozems	PHg	106	3	180	1	165	1
Geric Ferralsols	FRg	146	1	162	1	148	1	Haplic Phaeozems	PHh	106	3	180	1	165	1
Haplic Ferralsols	FRh	146	1	162	1	148	1	Stagnic Phaeozems	PHj	106	3	180	1	165	1
Plinthic Ferralsols	FRp	146	1	162	1	148	1	Luvic Phaeozems	PHl	162	1	180	1	175	1
Rhodic Ferralsols	FRr	146	1	162	1	148	1	Dystric Planosols	PLd	152	1	169	1	165	1
Humic Ferralsols	FRu	146	1	162	1	148	1	Eutric Planosols	PLe	152	1	169	1	165	1
Xanthic Ferralsols	FRx	146	1	162	1	148	1	Gelic Planosols	PLi	152	1	169	1	165	1
Andic Gleysols	GLa	n.a.	1	n.a.	1	n.a.	1	Mollic Planosols	PLm	152	1	169	1	165	1
Dystric Gleysols	GLd	n.a.	1	n.a.	1	n.a.	1	Umbric Planosols	PLu	152	1	169	1	165	1

**Soil moisture storage capacity classes derived for FAO soil units of Revised Legend '90**  
**(continued)**

FAO Legend '90 Soil Unit	SLU	coarse		medium		fine		FAO Legend '90 Soil Unit	SLU	coarse		medium		fine	
		mm	CL	mm	CL	mm	CL			mm	CL	mm	CL	mm	CL
Albic Plinthosols	PTa	95	3	162	1	148	1	Gleyic Solonchaks	SCg	106	3	180	1	165	1
Dystric Plinthosols	PTd	95	3	162	1	148	1	Haplic Solonchaks	SCh	106	3	180	1	165	1
Eutric Plinthosols	PTe	95	3	162	1	148	1	Gelic Solonchaks	SCi	106	3	180	1	165	1
Humic Plinthosols	PTu	95	3	162	1	148	1	Calcic Solonchaks	SCK	106	3	180	1	165	1
Cambic Podzols	PZb	106	3	180	1	165	1	Mollic Solonchaks	SCm	106	3	180	1	165	1
Carbic Podzols	PZc	106	3	180	1	165	1	Sodic Solonchaks	SCn	106	3	180	1	165	1
Ferric Podzols	PZf	106	3	180	1	165	1	Gypsic Solonchaks	SCy	106	3	180	1	165	1
Gleyic Podzols	PZg	106	3	180	1	165	1	Gleyic Solonetz	SNg	106	3	180	1	165	1
Haplic Podzols	PZh	106	3	180	1	165	1	Haplic Solonetz	SNh	106	3	180	1	165	1
Gelic Podzols	PZi	106	3	180	1	165	1	Stagnic Solonetz	SNj	106	3	180	1	165	1
Calcaric Regosols	RGc	106	3	180	1	165	1	Calcic Solonetz	SNk	106	3	180	1	165	1
Dystric Regosols	RGd	106	3	180	1	165	1	Mollic Solonetz	SNm	106	3	180	1	165	1
Eutric Regosols	RGe	106	3	180	1	165	1	Gypsic Solonetz	SNy	106	3	180	1	165	1
Gelic Regosols	RGi	106	3	180	1	165	1	Dystric Vertisols	VRd	135	2	135	2	135	2
Umbric Regosols	RGu	106	3	180	1	165	1	Eutric Vertisols	VRe	135	2	135	2	135	2
Gypsic Regosols	RGy	106	3	180	1	165	1	Calcic Vertisols	VRk	135	2	135	2	135	2
								Gypsic Vertisols	VRy	135	2	135	2	135	2