Ecological Bulletins

EB54-10
Ping, C.-L., Michaelson, G. J. Stiles, C. A. and González, G. 2013. Soil characteristics, carbon stores, and nutrient distribution in eight forest types along an elevation gradient, eastern Puerto Rico. – Ecol. Bull. 54: 67–86.

Supplementary material

Appendix 1. Morphological properties of soils along the elevation gradient, Puerto Rico.

Site & Horizon	Depth cm	Munsell Color (moist)	Field texture	Sand	Silt	Clay	Structure	Consistency moist wet	Roots	Boundary	>2mm %	B.D. Mg m^{-3}
				----------% ----------								
Elfm Woodland												
1. 22-1 Cloud Forest, Pico del Este												
Ag	0 - 22	10YR3/3 5YR4/6 PL	SIL	66	20	14	2MSBK to 2MGR	FR, MSM, SS SP	3 F,M,C	CB		0.54
Bg	22-28	5GY6/1 (60%), PL 7.5YR6/8	GRSIC	29	45	26	1MSBK	FI, WSM, SS MP	3VF,F, 1M 2f,vf RC	AW	30, SAP	0.97
CRt	28-45	7.5YR6/8 (90%) 10YR4/8	GRVCL	1	70	29	MA	FI, MS MP	1m		65, SAP	1.10
2. 23-1Cloud Forest, Pico del Oeste												
Oi/Oe	0-1		PT							AS		
Ag1	1-10	10YR3/2, 20% Fe PL 5YR4/6	SIL	42	40	18	1MSBK, 2MGR	FR, SS SP	3VF,F,M	CS		0.55
Ag2	10-23	2.5Y4/2, 20% Mn PL 10YR2/1 5% PL 7.5YR5/8	SICL	34	44	22	1CSBK, 5% 1MGR	FR, MS SP	3VF,F, 2M	AW		0.55
Bt/A	23-31	7.5YR5/8, 15%10YR4/3	C	29	21	50	1CSBK	FR, MS MP	3VF,F	CS		0.72
Bt1 012	31-49	7.5YR5/8, 10% 10YR3/6 (Sapo), 5% 7.5YR4/4	C	17	25	58	1FMSBK	FI, SS SP	1F,VF 3F,M, RC	CS		0.90
Bt2	49-74	7.5YR5/8, 5% 10YR6/8. 5% 5YR5/8	C	13	25	62	MA	FI, SS MP	1VF,F,M	AW		0.87
CRt	74-105	2.5YR5/8, 20%10YR4/8, 15%5Y8/1, 5% Mn 7.5YR2.5/1	STXCL	21	45	34	MA	FI, MS MP	1VF,F		65, FBR	1.08
3. 24-1 Cloud Forest, Yunque												
Ag1 (05-10)	0-21	10YR3/2, 20% Fe 7.5YR3/3	SICL	76	14	10	1MSBK	FR, SS MP	2VF, 3F,M	CS		0.44
Ag2	21-28	2.5Y5/2, 35% 5YR4/6PL, 5% 7.5YR6/8 M, 20% Kr 7.5YR4/3	SICL	70	14	16	1MSBK	FR, MS MP	2VF,F, 3M	CW		0.62
Ag/B	28-44	2.5Y6/8, 25% 7.5YR6/8, 20% Kr 5YR4/6	GRSIC	57	13	29	1MSBK	FR, MS MP	2VF,F,1M	CW	30, SAP	0.84
Bw1	44-72	7.5YR6/8, 45% 10YR7/8	GRVCL	27	19	54	MA	FI, MS VP	15% Kr, 1F rt chn,	CS	40, SAP	0.94

Appendix 1. Morphological properties of soils along the elevation gradient, Puerto Rico (con't)

Site & Horizon	Depth cm	Munsell Color (moist)	Field texture	Sand	Silt	Clay %	Structure	Consistency moist wet	Roots	Bound-ary	>2mm %	B.D. Mg m^{-3}
Bw2	72-96	5YR5/8, 10YR4/8 PL, 2.5YR4/8 K,PL	CBVL	14	24	62	MA	Fi, MS VP	1M rt chn 10%K red	CS	20, CB 20, SAP	1.04
BCr (05-14)	96-110	5YR5/8, 7.5YR6/8, 5% N2.5, 10% Mn, 7.5YR6/8 K PL.	CBVL	16	38	46	MA	Fi, MS MP			15, CB 35, SAP	1.02
4. 16-1 Palm (nido) Forest												
A	0-34	10YR4/3	SIL	52	28	20	2FSBK	FR, SS SP	3VF,F,M	CS		0.67
BA	34-54	10YR5/6, 10YR4/3Kr, 2.5YR3/6 Fe, 25% 7.5YR6/8PL	GRCL	14	35	51	1CSBK	FI, MS VP	1 F,M; 2 rt chn	CS	18, SAP	1.12
Bw	54-83	7.5YR6/8, 5% Kr 5YR3/3; 35% 5YR4/6 PL; 10G6/1 SAP	CBVCL	17	40	43	MA	FI, MS MP	1F; 1 rt chn	CS	35, SAP, CB	1.05
BC	83-105	10YR6/8; 5% Kr 10YR/4;5% 5YR4/6 PL	CBVCL	12	37	51	MA	FI, MS MP	Tr F; rt chn		45, SAP	0.98
5. Sierra Palm, Icacos 17-1												
A1	0-10	10YR4/4; 5Y4/1 K	SICL	78	11	11	2MGR	VFR, MS MP	3F,M,C; 2VF	CS		0.92
A2	10-19	10YR5/8; 5% Fe-dep. 2.5Y6/4; 10% Fe conc 5YR5/6	L	71	11	18	2MSBK	FR, MS MP	2VF,F; 3M	CS		1.00
Bg	19-30	10YR5/6; 15% Fe-dep. 10YR6/1; 10%Fe conc PL PS 5YR5/8	L	57	13	30	MA	FR, MS MP	2M; 1F; 2F,M Rt chn	CS		1.15
Bw1	30-43	7.5YR5/8; 10% F-dep. 10YR6/8 PL	L	58	13	29	2MSBK	FR, SS MP	1F,M; 2F, 3 M rt chn	GS		1.21
Bw2	43-64	5YR5/8; 5% 10YR7/8 PL	L	43	35	22	1MSBK	FR, SS MP	1VF,F,M; 1F Rt rm	AS		1.17
Bw3	64-81	5YR5/8; 5% Fe conc 2.5YR4/8 PL	SICL	39	39	22	MA	FR, MS MP	1F,M; 1F, M rt chn	AW		1.19
Ab	81-109	7.5YR3/3; 10% Fe conc 5YR5/8; 5% RC 10YR3/3 10% Mn 10G2.5/1	SL	43	39	18	3MGR	VFR, SS SP	1VF,F, 2M; 2F rt rm	CW		1.11
Bwb	109-120	7.5YR5/8; 10YR4/8 SAP; 5YR5/8	GRL	47	41	12	MA	FR, MS MP	1F		20, GR	1.12

Appendix 1.. Morphological properties of soils along the elevation gradient, Puerto Rico (con't)

Site & Horizon	Depth cm	Munsell Color (moist)	Field texture	Sand	Silt	Clay	Structure	Consistency moist wet	Roots	Bound-ary	>2mm %	B.D. Mg m^{-3}
				----------% --------								
6. Sierra Palm, Mt. Britton												
A	0-9	10YR4/2	SIL	71	18	11	1MGR	FR, SS SP MSMR	2VF, 3F,M	CW		0.50
Bw	9-21	10YR4/2; 10% Fe-conc5YR5/6 PL; 5% Mn 10YR2/1	CBVL	59	26	15	1FSBK, 1MGR	MS MP SSMR	3VF,F,2M; 2rt chn rm	CS	40, ACB	0.50
Ab1	21-40	2.5Y2.5/1; 10% Fe-con 5YR4/4PL; 2.5Y5/2 Fe-dep	CBVSIL	64	24	12	1MSBK	FR, SS SP	3VF,F 2M; 1rt rm	CW	40, ACB	0.63
Ab2	40-60	10YR3/1;	STVSIL	70	22	8	2MSBK	FR, MS MP	2VF,F	CS	20, ACB 30, AST	0.48
Ab3	60-98	10YR3/1; 5%5 YR4/6 PL	STVSICL	66	21	13	MA	FR, MS MP	1F rt rm		40, AST	0.54
Ab4	98-128	2.5Y3/1; 5% RC 10YR2/1	CBVL	60	24	16	MA	FR, MS MP	15% C rt rm		40, ACB	0.58
7. Sierra Palm												
Oi/Oa	0-10	7.5YR2.5/2	CBXMK	88	8	4	1FMGR	VFR, NS P	2VF, 3F,M	AS	70, VCB	0.15
Bw	10-32	10YR4/3	CBXSICL	76	16	8	1FMSBK, GR	FR, NS MP	2VF,F, 3M	CS	60, VCB	0.50
Ab	32-53	10YR3/2; 10% mottles 2.5Y5/3;3% Fe conc 7.5YR5/6 PL	CBXSIC	73	12	15	2MSBK 2FGR	FR, SS MP	3VF,F, 1M	CS	65, VCB	0.64
Bgb	53-85	2.5Y5/3, 5Y5/3; 15% Fe 7.5Y4/3; 10% 2.5R3/3; 3% 2.5Y7/6	CBVCL	45	33	22	2CSBK	FI, SS SP	3VF,F, 1M	AS	40, VCB	0.79
BCb	85-101	2.5Y5/3, 10YR6/8, 10YR4/2; 20% 10YR4/3; 10% 2.5YR5/8; 2.5Y7/6	CBC	45	33	22	2CSBK	FI, SS SP	1F	CS	30, VCB	0.81
C		2.5Y5/4; 30%10YR4/2; 10%2.5YR4/3, 3/4 PL	C	37	37	26	3CSBK	FI, SS SP			10,VCB	0.92
8. Palo Colorado, 19-1												
A1	0-21	10YR4/3	SIL, MSMR	58	28	14	2FSBK,2GR	VFR, NS SP	3VF,F,M	CS		
A2	21-34	10YR4/4	L, MSMR	74	12	14	1FMSBK	VFR, NS SP	3VF,F,2M	AW		0.91
Btg	34-44	10YR4/6;4/3; 20%Fe-dep 5Y7/2;15%Fe-conc 5YR5/8 PL	CL	64	18	18	1FMSBK	FR, SS SP	1VF,F	AS		1.07
Bt1	44-72	7.5YR5/8; 10% 2.5YR6/8, 2.5Y7/3	CL	53	13	34	1FMSBK	FI, SS SP	1VF,F	CS		0.98
Bt2	72-99	7.5YR6/8; 10%; 2.5YR6/8;8/3	CL	49	17	34	MA	FI, NS SP	1VF,F; 3F rt cast	CS	2, QTS 10, mica	1.34
BC	99-122	2.5YR4/6; 40%7.5YR6/8	CL	53	25	22	MA	FI, NS SP	3M rt cast		2, QTS 15, mica	1.34

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Site & Horizon	Depth cm	Munsell Color (moist)	Field texture	Sand	Silt	Clay	Structure	Consistency moist	wet	Roots	Bound -ary	>2mm %	B.D. Mg m^{-3}
				---------- % -------									
9. Palo Colorado, El Toro 1													
Oi	0-1		PT	na	na	na					AW		0.15
A	1-5	10YR4/4	CL	35	22	43	2FMGR	FR, MS VP		2VF,F,3M,C	AS		0.68
BtA	5-24	10YR5/8; 4/4	C	8	22	69	2FMSBK	FI, VS VP		2VF,F,3M,C	CS		0.84
Bt1	24-51	10YR5/8; 20% 2.5Y2.5/1 PF	STVC	3	24	72	3FMSBK	FI, VS VP		1F, 2M	CS	50, AST	0.93
Bt2	51-67	7.5YR6/8; 2.5YR4/8; 5BG2.5/1 PF	STVC	3	22	75	3FMSBK	FI, VS VP		1F,M; 2M rt cast	CW	50 ,AST	0.96
BC	67-101	2.5YR4/8; 25% 7.5YR6/8	STVC	1	24	75	3FMSBK	FI, VS VP		1M rt cast		40, AST, CB	0.92
10. Palo Colorado El Toro 2													
Oi	0-1		PT	na	na	na							0.16
A	1-15	10YR4/4; 5/8	C	27	13	60	2MGR	FR, SS VP		2VF,3F,M,C	CS		0.61
BA	15-26	7.5YR6/8; 10YR5/4	C	14	16	70	2MGR	FI, MS VP		2VF, 3F,M,C	CS		0.91
Bt1	26-47	10YR6/8; 8/6	C	2	28	70	3MSBK	FI, MS VP		2VF,F,M; 1K 2F,M RM	CS		0.94
Bt2	47-73	10YR7/8; 2.5YR8/4 15%, 5% 5Y7/RC	C	<.1	20	80	3MSBK	FI, MS VP		1VF,F,M	GS		0.89
Bt3	73-95	10YR6/8; 4/8; 15% 2.5YR7/6; 5% 2.5Y3/1 RC	C	1	22	77	3MSBK	FI, MS VP		1F,M	CS		0.81
BC	95-115	2.5Y8/6;5/8; 25% 5YR5/8, 2.5YR8/2	C	3	28	69	2MABK	VFI, MS VP		1F; 1F rt cast			1.11
11. Tabonuco (El Verde)													
A	0-13	7.5YR4/6	CL	49	9	42	2MSBK; MGR	FR, MS SP		3VF,F,M	CW		0.74
Bw1	13-28	7.5YR5/8	C	13	13	74	2MSBK	FI, SS MP		2VF,F,M	CS		1.11
Bw2	28-47	7.5YR6/8; 7.5YR5/8 worm casting	C	13	13	74	2CSBK	FI, SS MP		1VF,F,M	CS		1.15
Bw3	47-62	7.5YR5/8; 10%Fe-conc 2.5YR5/8; 1F Mn concr.	C	9	13	78	2CSBK	FI, SS MP		1VF,F,M 2F RM	AW		1.11
BC	62-86	7.5YR5/8; 5YR5/4; 20% Fe-conc 2.5YR5/8	BYVCL	21	17	62	2FSBK	FR, MS MP		1F; 1F RM	AI	45, VBDR	0.97
C	86-130	7.5YR6/8; 30% Fe-conc 10YR4/8; 2.5YR4/8; 5% 5YR3/2 PF	BYVCL	29	13	58	2MSBK; 2FSBK	FI, MS MP		1F; 1F RM		50, VBDR 15, GR	0.94

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Site & Horizon	Depth cm	Munsell Color (moist)	Field texture	Sand	Silt	Clay	Structure	Consistency moist wet	Roots	Boundary	>2mm %	B.D. Mg m^{-3}
				---------- % ----------								
12. Tabonuco (Rio Grande)												
	0-16	10YR4/3	CL				1FSBK;	FR, MS VP	2VF, 3F,M,C	CS		0.58
A				32	15	53	2MGR					
	16-26	7.5YR6/8; 10YR5/6	C				2MSBK;	FI, MS VP	2F, 3M,C	CS		0.83
BA				14	15	71	2MGR					
	26-39	7.5YR5/8; 10YR5/8 Kr-	C				3MABK	FI, VS VP	2VF,F,M, 1C	CS		0.95
Bt1		filling		10	14	76						
	39-70	5YR5/8; 4/6	C				3MSBK,AB	FI VS VP	2VF,F,M	CS		0.99
Bt2				6	38	56	K		3VF,F 2M RM			
	70-91	5YR4/6; 10YR6/4	C				1C,3FSBK	FR, MS VP	1VF,F; 2VF,F	CS		0.94
Bt3				21	23	56			RM			
BCr	91-110	5YR4/6; 20% 7.5YR5/8; 5% 2.5YR5/8	GRVL	12	42	46	3FSBK,AB K	FR, MS MP	2VF,F RM		40, FBR	1.05
13. Tabonuco (Sabana 4)												
A	0-10	5YR4/6; 5% clay coat 2.5YR2.5/1	CL	21	35	44	1FSBK, 2MGR	FI, SS SP	3VF,F,M,C	CS		0.76
BA	10-31	5YR4/6; 20% 1 0YR6/8 SAP	CL	28	34	38	2FMSBK	FR, MS SP	3VF,F,M	CW	20, SAP	0.94
Bw1	31-64	5YR5/8; Mn Conr 2.5YR2.5/1; 25% 7.5YR6/8 SAP	GRCL	35	28	37	2MSBK	FR MS VP	2VF,F,1M; 1F RM	CW	25, SAP	1.05
	64-87	5YR5/6; 7.5YR6/8 ;5% Mn	GRC				2MSBK	FR, MS VP	1VF,F,M;	CS	20, SAP	0.9
Bw2		mass 7.5YR2.5/1		15	27	58			1F RM			
BC	87-100	5YR4/6	GRVCL	15	32	53	2MSBK	FI, MS MP	1F RM		40, SAP	1.06
14. Lowland Moist Forest												
	0-4	10YR2.5/1	**CB**MKPT						3VF,F,M,1C	AS	30, ACB	0.24
Oe/Oi				na	na	na						
	4-36	7.5YR4/6; 10YR4/8 SAP	GRXCL				2FSBK;	FR, VS VP	2VF,F,M,1C	AW		0.92
A				35	19	46	1MGR				70, GR	
	36-73	5YR4/4; 2.5YR5/6 SAP	CBXCL				1FSBK;	FR, VS VP	1F,M,C; 1F RM	CS		0.75
Bw				30	18	52	1MGR				50, ACB	
	73-100	5YR4/6	CBXCL				1FSBK;	FR, VS VP	1F,M		65,	0.87
BC				33	16	51	2MGR				AVRK	
15. Lowland Moist Forest, Botanical Garden												
	0-1	10YR2.5/1	PT						3VF,F,M; 1F	AS		
Oi				na	na	na			RM			0.14

A	1- 20	10YR3/2	GRL	31	18	51	2MGR	FR, SS MP	2VF,F,M, 1C	CS	17, GR	0.90
	20-31	10YR3/2; 7.5YR5/6	GRVCL				2FSBK;	FR, VS VP	1VF,F,M	CS	40, GR	1.05
AB				41	15	44	2MGR					

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Site & Horizon	Depth cm	Munsell Color (moist)	Field texture	Sand	Silt	Clay	Structure	Consistency moist wet	Roots	Bound-ary	>2mm %	B.D. Mg m^{-3}
				----------% ----------								
15. (Cont'd)												
Bw1	31-52	7.5YR5/8; 2.5YR4/8 SAP	XKL	35	19	46	1FMSBK	FI, SS SP	1F,M	DS	60, GR	1.10
Bw2	52-100	7.5YR5/8; 2.5YR4/8, 10YR7/8 SAP	GRVCL	22	21	57	1FMSBK	FI, VS VP	1F,M		40, GR	1.10
16. Lowland Forest (Ford)												
A1	0-5	10YR3/2	CL	49	17	34	2MSBK; 2CGR	FI, MS MP	3VF,F,M, 2C	CS		
A2	5-18	10YR4/3	CL	37	13	50	2FMSBK	FI, MS MP	1F,M,C	CS		1.41
Bt1	18-42	7.5YR5/6 ,5/8; 15% mottle 2.5YR5/8; 5% Mn 10YR4/2 PL; 5% Fe-dep 2.5Y7/2	C	17	9	74	1MSBK	FI, VS VP	1F,M,C	CS		1.42
Bt2	42-56	7.5YR5/6, 5/8; 25% 2.5Y7/2 FE-dep; 5% 10YR4/2 Mn coating; 5% 5YR5/8 Fe-conc.	C	17	13	70	1MSBK	FI, VS VP	1VF	CS		1.44
Btg1	56-94	7.5YR5/8; 30% 2.5Y7/1 Fe-dep; 5%10YR4/2Mn PL; 2% 5YR5/8 Fe-conc.	C	17	9	74	2MSBK	FI, VS VP	1F	GS		1.41
Btg2	94-105	7.5YR5/8; 45% 2.5Y6/1 Fe-dep; 2% 10YR4/2 Mn coating; 2%5YR5/8 Fe-conc.	C	21	9	70	2MSBK	FI, VS VP				
17. Dry Forest (Ceiba)												
A	0-19	10YR3/1	STVCL	37	25	38	3MCSBK;3MGR	VFI, MS MP	3VF,M, 2C	CS	55, AVR	1.53
AB	19-35	10YR4/4; Mn concr. 2.5YR8/4 rt rm	STVC	25	12	63	3MSBK	XFI, MS VP	2VF,F,M		40, AVR	1.74
Bt1	35-57	10YR5/8; 2F Mn Cn	C	21	13	66	3CSBK	XFI, MS VP	2VF,F,M	CS	10, AVR	1.62
Bt2	57-73	10YR5/6;2F Mn Cn; 2.5YR8/4 PF	C	25	13	62	3CSBK	XFI, MS VP	1VF,F,M	DS		1.73
Bt3	73-98	2.5Y5/6;10% 10YR5/6; 5%7.5YR5/6; 5%2.5Y8/4 ;2M Mn Cn	C	17	25	58	2CSBK	VFI, VS VP	1VF,F,M	CS		1.5
BC	98-111	2.5Y6/6, 8/4; 30% GY6/1 dep-matrix; 10% PL 7.5YR6/6, 5% MN 2.5YR2.5/1	CL	13	29	58	2CSBK	FI, VS VP	1VF,F,M; 2VF,F RM	CS		1.54
Crt	111-125	2.5Y6/4; 30%2.5YR8/2; 10% Fe7/5YR6/8 PL	CL	21	33	46	2CSBK	FI, MS VP	1F,M; 1F,M RM			1.54

Appendix 1. Morphological properties of soil-study sites associated with black spruce, interior Alaska.

Site & Horizon	Depth cm	Munsell Color (moist)	Field texture	Sand	Silt	Clay	Structure	Consistency moist	Consistency wet	Roots	Boundary	>2mm %	B.D. Mg m^{-3}
				---------- % ---------									
18. Pterocarpus Swamp													
Oi	0-7	7.5YR2.5/1	PT	nd	nd	nd				3C	AS		0.02
Oa	7-22	2.5Y3/1; 50%5GY4/1	MKSIL	77	9	13	1TH PL	VFR, NS SP		2VF,F	CS		0.22
Bg1	22-45	10YR3/3	MKSIL	62	12	26	(SAT)	nd, NS SP		2VF,F	CS		0.41
Bg2	45-65	2.5Y4/3; 15%7.5YR5/8	SICL	33	25	42	nd			2VF,F,1M	AS		0.62
Bwb	65-85	2.5Y4/2	MKSIL	52	22	26	nd	nd		1VF	AS		0.41
Oa1	85-105	7.5YR2.5/1	MK	66	26	8							0.35
Oa2	105-130	2.5Y2.5/1	MK	61	32	7							0.39
Oa3	130-160	N2.5/1	MK	43	19	38							0.31
19. Mangrove													
Oa1	0-50	2.5Y3/2;3/3	PTMK	45	18	37				2F,M			0.4
Oa2	50-76	2.5Y3/2	MK	47	36	17				2VF,F,1M			0.4
Oa3	76-100	2.5Y3/2	MK	73	18	9				2VF,F,M; RM			0.4
Oa4	100-125	2.5Y3/1	MK	56	31	13				2VF,F,M; RM			0.4
Oa/g	125-155	2.5Y3/1; 40% 5Y4/2	MKSIC	43	50	7				3VF,F,M; RM			0.5

Note: Abbreviations for soil morphological properties (Schoeneberger et al., 2002):
Color: PL-pore lining; Fe-conc.-Iron concentration; Fe-dep-iron depletion; M-mottles in masses; Mnmanganese concentration or concretion; SAP-saprolite color; Kr-krotovina fillings. Field texture: PT- peat; MKPT- muck peat; MK-muck; SL-sandy loam; SIL-silt loam; L-loam; SICL-silty clay loam; CL-clay loam; C-clay. Texture modifier: GR-gravelly; GRV-very gravelly; GRX-extremely gravelly; CB-cobbly; CBV-very cobbly; CBX-extremely cobbly; ST-stony; STV-very stony; STX-extremely stony. Particle size distribution, nd: not determined. Structure, 1THPL- weak thin platy; 1MGR: weak, medium granular; 2MGR-moderate medium granular; 2FMGR-moderate fine and medium granular; 3MGR-strong medium granular; 2CGR-moderate coarse granular; 2MABK-moderate medium angular blocky; 3MABK-strong medium angular blocky; 1FSBK- weak fine subangular blocky- 2FSBK: moderate fine subangular blocky; 3FSBK- strong, fine subangular blocky; 1MSBK-weak medium subangular; 2MSBK: moderate medium subangular blocky; 3MSBK-strong medium subangular; 1CSBK-weak coarse subangular; 2CSBK-moderate coarse subangular; 3CSBK-strong coarse subangular; MA: massive.. Consistency, VFR-very friable; FR-friable; FI-firm; VFI- very firm; SS- slightly sticky; SP- slightly plastic; MS-moderately sticky; MP- moderately plastic; SSMR-slightly smeary; MSMR-moderately smeary. Roots, 3: many; 2: common; and 1: few; VF: very fine; F: fine: M: medium; and C: coarse; RM- root remains; rt cast-root cast. Boundary, AI- abrupt irregular; AS- abrupt smooth; CS- clear smooth; CW- clear wavy; DS- diffused smooth; GS-gradual smooth. >2mm fraction: SAP-saprolite; FBR-fractured bedrock; CB-cobble stone; GR-gravel; ACB-angular cobble stone; AST-angular stone; VCB-volcanic cobbles tones; VBDR-volcanic boulder; AVR-angular volcanic rock; QTZ-quartz.

Schoeneberger, P.J., Wysocki, D.A., Benham, E.C., and Broderson, W.D. 2002. Field book for describing and sampling soils, Version 2.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE. USA.