Supplement of Biogeosciences, 22, 6097–6117, 2025 https://doi.org/10.5194/bg-22-6097-2025-supplement © Author(s) 2025. CC BY 4.0 License.





Supplement of

Soil signals of key mechanisms driving greater protection of organic carbon under aspen compared to spruce forests in a North American montane ecosystem

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Supplementary Material: Soils signal key mechanisms driving greater protection of organic carbon under aspen compared to spruce forests in a North American montane ecosystem

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Table S1: Pit descriptions using NRCS field descriptions. Depth, boundary type, color, texture, structure, consistency, pedvoid surface features, roots, pores, and effervescence were recorded per each horizon at each pit. Abbreviations follow NRCS methods, although a key for abbreviations is provided at the bottom of the figure.

Depth	Depth								Structure ^d	Cons				PVSFf	Roots	Pores ^h	Efferv
	Dopui		O Moist		Gr	Cb	St	В		Dry	Moist	Stick	Plast				
Sandston	e Site) - [38.	863078	, -107.04991	7] 975	6 ft.,	160°											
	4-3.5	as													2vf,fT		
0-4	3.5-0	as													2vf,fT		
4-22	0-18	gw	10YR2/2	sl	2	0	0	0	1vf,f,mgr, 1-	s		SS	sp	0fpOSF	3vf,2f,1m,c	3vflG,	ne
22-30	18-26	cw	7.5YR3/2	scl	4	0	0	0	2f,vfgr,	s		SS	ро	OfpCLF?	2vf,1f,2m,1	2vf,1fDT,	ne
30-43	26-39	cw	7.5YR3/2	scl	2	0	0	0	1vfsbk,	s		ms	sp	OfpOAF?	1vfR,	1f,mDT	ne
43-59	39-55	aw	7.5YR3/3	cl	2	0	0	0	1msbk / 1-	s	vfr	SS	mp	0fpCLF	2vf1f,m,c,vc	2vflG,	ne
59-97+	55-93+		7.5YR3/2	cl	2	2	0	0	1m.cosbk /	sh		ms	mp	1dpCLF			ne
								C	C1 Notes								
					Α	pproxi	imatel	v 5	mm charcoal	conce	ntration	s obser	ved				
			Quantit	v of the										ions observ	ed		
		2-5															
			70, 1 0 1111110					0.00	orroa, some	01 1110	0000100			outror ou un	a supremue		
e; Is, loamy	/ sand; sl, sa	ndy loai	m; scl, sandy	clay lo	am;	cl, clay	/ loam	ı; si	cl, silty clay lo	am; si	c, silty o	clay.					
b, cobbles	; St, Stones;	Bd, bo	ulder.														
noderate: 3	3. strong: vf.	very fin	e; f, fine; m,	mediur	n: co	. coars	se; vc	. ve	rv coarse; gr.	granu	lar: sbk.	subano	ular blo	cky: sq. sin	ale grained: ma	a. massive:	-, to:/.
	1-22 22-30 30-43 33-59 59-97+ ry; v, very ;; ls, loamy b, cobbles	1-22 0-18 12-30 18-26 10-43 26-39 13-59 39-55 19-97+ 55-93+ 17y; v, very abrupt; a, ab; t; ls, loamy sand; sl, sa b, cobbles; St, Stones;	1-22 0-18 gw 12-30 18-26 cw 10-43 26-39 cw 13-59 39-55 aw 13-59 39-55 - 3+ 13-59 39-55 - 3+ 2-5 7y; v, very abrupt; a, abrupt; c, t; ls, loamy sand; sl, sandy loat b, cobbles; St, Stones; Bd, bo	1-22 0-18 gw 10YR2/2 12-30 18-26 cw 7.5YR3/2 13-59 39-55 aw 7.5YR3/2 13-59 39-55 aw 7.5YR3/2 Quantit 2-5%, 1-3 mm c 17; v, very abrupt; a, abrupt; c, clear; g, grav; Is, loamy sand; sl, sandy loam; scl, sandy b, cobbles; St, Stones; Bd, boulder.	1-22	1-22	1-22	1-22	1-22	1-22	1-22	1-22	1-22	1-22	1-22	1-22	1-22

^{9 0,} very few; 1, few; 2, common; 3, many; vf, very fine; f, fine; m, medium; c, coarse; vc, very coarse; T, throughout; R, matted around rock fragments. h 1, few; 2, common; 3, many; vf, very fine; f, fine; m, medium; c, coarse; vc, very coarse; DT, dendritic tubular; IG, irregular; TU, tubular; IR, interstitial.

Efferv, effervescence; ne, non-effervescent.

Horizon	Original	Correcte	Corrected Bnda Color			th Co	arse F	racti	on	Structured	Con	sisten	iceº		PVSF ^f	Roots	Pores ^h	Efferv ¹
	Depth	Depth		D Moist		Gr	Cb	Cb St E	В	1	Dry	Moi	st Stick	Plas	t			
CC2 (Coni	ifer-Sandsto	ne Site) - [38.8627	03, -107.033	522] 93	357 ft.	, 352°	•										
Oe	0-5	5-0	aw													3vf,1fT		
Α	5-21	0-16	as	7.5YR3/2	cl	2	8	0	0	2vf,fgr, 1-	s		VS	vp		1vf,f,3m,1c	3vfIG, 1fDT	ne
B/Ct	21-61.5	16-56.5	VS	10YR4/4	sl	5	2	0	0	1vf,f,msbk,	sh		SS	ро	1dpFEFpf	1vf,f,2mT	3vfIG, 2fDT	ne
2A	61.5-64	56.5-59	VS	10YR3/2	sicl	0	0	0	0	ma		vfr	ms	vp		1vfT	3vfIR	ne
2Bwt	64-70	59-65	VS	10YR5/4	scl	0	0	0	0	1vfsbk, sg		vfr	VS	vp	0dpCLFpf	1fT		ne
2Bt	70-72	65-67	VS	10YR5/4	sic	0	0	0	0	ma		vfr	VS	vp	2fcCLFcf	1f,m,cT	3vfIR	ne
2CBw	72-96+	67-91+		10YR4/6	ls	0	2	0	O	1vf,fsbk, sg		vfr	SS	sp		1f,2mT	3vfIR	ne
									C	C2 Notes								
Oe																		
Α					Text	ure ap	peare	d to I	be s	omewhat vari	able in	differ	ent locati	ons in	the pit			
B/Ct	8 cn	n diameter k	krotovina	observed fro	om 12-	25 cm	belov	w the	sur	face; 5 mm ch	narcoa	conce	entrations	obser	ved in the ba	ckfilled mater	ial of the kroto	ovina
2A	2-5 mm c	harcoal cor	ncentratio	ons observed	i; brow	n-redo	dish st	ains o	obs	erved just belo	ow this	horizo	on interpr	eted as	possible the	ermal transfor	mation from g	oethite to
2Bwt																		
2Bt							Hori	izon i	nter	preted as a 2	-cm thi	ck clay	y lamellae	9				
2CBw							2-	-10 m	ım c	harcoal conc	entratio	ons ob	served					
a Rnd hour	ndarv v verv	abrunt a	abrunt: c	clear a ara	dual: s	smo	oth: w	way	v· i	irregular; b, b	roken							
						,				icl. silty clay k			v clav					

Gr, gravel; Cb, cobbles; St, Stones; Bd, boulder.

d 1, weak; 2, moderate; 3, strong; vf, very fine; f, fine; m, medium; co, coarse; vc, very coarse; gr, granular; sbk, subangular blocky; sg, single grained; ma, massive; -, to; /, e Stick, stickiness; plast, plasticity; s, soft; sh, slightly hard; vfr, very friable; ss, slightly sticky; ms, moderately sticky; vs, very sticky; po, non-plastic; sp, slightly plastic; mp,

PVSF, ped/void surface features; 0, very few (<5%), 1, few (5-25%); f, faint; d, distinct; r, prominent; p, patchy; n, discontinuous; c, continuous; CLF, clay films; BRF, clay

^{9 0,} very few; 1, few; 2, common; 3, many; vf, very fine; f, fine; m, medium; c, coarse; vc, very coarse; T, throughout; R, matted around rock fragments. h 1, few; 2, common; 3, many; vf, very fine; f, fine; m, medium; c, coarse; vc, very coarse; DT, dendritic tubular; IG, irregular; TU, tubular; IR, interstitial.

¹ Efferv, effervescence; ne, non-effervescent.

Table S1 Continued

Horizon Origi	Original	Corrected	Bnda		Text	Coa	rse F	ractio	n	Structured	Cons	sistence		PVSFf F	Roots	Pores ^h	Efferv ⁱ
	Depth	Depth		D Moist		Gr	Cb	St	В		Dry	Moist Stick	Plast				
CC3 (Conit	fer-Granite	Elk Site) - [3	8.8591	11, -107.066	0691 99	902 ft.	. 36°										
Oi	0-1	2-1	as	,	,		,		0						2vf,1f,m,c,v		
Oe	1-2	1-0	as						0						2vf,1f,3m,1		
A	2-10	0-8	aw	10YR3/2	I	2	5	0	0	1-2m,cosbk	sh	ms	mp		1vf,2f,2m,c, 1vcT	2vf,fDT 3vflG	ne
Bt1	10-21	8-19	cw	7.5YR6/4	sicl	2	10	0	0	1cosbk / 1msbk	sh	ms	mp	0fpCLFdt, 0dpCLF,FE Frf	1vf,2f,m,3c, 2vcT	3vflG 2fDT	ne
2Bt2	21-61	19-59	gw	7.5YR4/3	scl	40	10	30	0	3vfsbk	I	VS		0- 1dpBRFfg, 3d,rcCLF,F EFgr,cb	3vf,f,2m,1c, vcT	3f,m,c,vcIR	ne
2Bt3	61-92+	59-90+			scl	25	5	50	0	2vfsbk	I	ms			1vf,2f,m,1v cT	2m,3c,vcIR 3vf,fIG	ne
									(CC3 Notes				-			
Oi Oe A						F	ew (5	-25%) 1-:	3 mm charcoa	al cond	entrations obse	erved				
Bt1						F	ew (5	-25%	1-3	3 mm charco	al cond	entrations obse	erved				
2Bt2		Text	ure wa	s assessed w	ithout a	siev	e in th	e field	; m	any of the str	uctural	units are assoc	ciated v	vith very fine	and fine root	masses	
2Bt3							Tex	cture v	vas	assessed wit	hout a	sieve in the fie	ld				

¹ Efferv, effervescence; ne, non-effervescent.

Horizon	Original	Corrected	Bnda	Color	Textb	Coa	rse F	raction	Structured	Con	sistence		PVSF ^f	Roots	Pores ^h	Efferv ¹
	Depth	Depth		D Moist		Gr	Cb	St	В	Dry	Moist Stick	Plast	t			
CC4 (Aspe	n-Granite E	lk Site)- [38	.858602	8,-107.0613	111] 97	67 ft.,	150	•								
Oi	0-1	1-0	as													
A	1-10	0-9	as	7.5YR3/2	cl	5	0	0	2vf,fgr, 1m,cosbk / 1vf,fsbk	s	SS	mp		3vf,f,1coT	3vf,3fDT	ne
Bw	10-40	9-39	gw	7.5YR3/3	cl	7	0	0	2m,cosbk/ 2vf,fsbk	sh	SS	mp		1vf,f,mT 2vfR	3vf,2f,1mD T	ne
CBw1	40-58	39-57	gw	7.5YR3/3	sl	2	25	0	1m,vf,fsbk, sg		vfr ss	mp		2vf,1fT	2vf,1f,1mD T	ne
2CBw2	58-73	57-72	cw	7.5YR4/4	scl	5	5	20	1vf,fsbk, sg		fr ss	sp	0fpCLF,FEF	2vf,1fT	2vf,1f,1mD T	ne
C/R, R/C?	73-86+	72-85+		7.5YR4/6		0	0	0			SS	sp	0dpFEFgr	2vfT		ne
									CC4 Notes							

Α Very few (2-5%) <2 mm charcoal concentrations observed Bw Very few (~2%) <1 mm charcoal concentrations observed

CBw1 2CBw2 C/R, R/C?

a Bnd, boundary; v, very abrupt; a, abrupt; c, clear; g, gradual; s, smooth; w, wavy; i, irregular; b, broken.
b Text, Texture; Is, loamy sand; sl, sandy loam; scl, sandy clay loam; cl, clay loam; sicl, silty clay loam; sic, silty clay.

c Gr, gravel; Cb, cobbles; St, Stones; Bd, boulder.
d 1, weak; 2, moderate; 3, strong; vf, very fine; f, fine; m, medium; co, coarse; vc, very coarse; gr, granular; sbk, subangular blocky; sg, single grained; ma, massive; -, to; /,

Stick, stickiness; plast plasticity; s, soft; sh, slightly hard; vfr, very friable; ss, slightly sticky; ns, moderately sticky; vs, very sticky; po, non-plastic; sp, slightly flastic; mp, f PVSF, ped/void surface features; 0, very few (<5%), 1, few (5-25%); f, faint; d, distinct; r, prominent; p, patchy; n, discontinuous; c, continuous; CLF, clay films; BRF, clay 9 0, very few; 1, few; 2, common; 3, many; vf, very fine; f, fine; m, medium; c, coarse; vc, very coarse; T, throughout; R, matted around rock fragments.

h 1, few; 2, common; 3, many; vf, very fine; f, fine; m, medium; c, coarse; vc, very coarse; DT, dendritic tubular; IG, irregular; TU, tubular; IR, interstitial.

a Bnd, boundary; v, very abrupt; a, abrupt; c, clear; g, gradual; s, smooth; w, wavy; i, irregular; b, broken.
b Text, Texture; Is, loamy sand; sl, sandy loam; scl, sandy clay loam; cl, clay loam; sicl, silty clay loam; sic, silty clay.

c Gr, gravel; Cb, cobbles; St, Stones; Bd, boulder.

d 1, weak; 2, moderate; 3, strong; vf, very fine; f, fine; m, medium; co, coarse; vc, very coarse; gr, granular; sbk, subangular blocky; sg, single grained; ma, massive; -, to; /,

Stick, stickiness; plast, plasticity; s, soft; sh, slightly hard; vfr, very friable; ss, slightly sticky; ms, moderately sticky; rs, very sticky; po, non-plastic; sp, slightly plastic; mp, PVSF, ped/void surface features; 0, very few (<5%), 1, few (5-25%); f, faint; d, distinct; r, prominent; p, patchy; n, discontinuous; c, continuous; CLF, clay films; BRF, clay 9, very few; 1, few; 2, common; 3, many; vf, very fine; f, fine; m, medium; c, coarse; vc, very coarse; T, throughout; R, matted around rock fragments.

h 1, few; 2, common; 3, many; vf, very fine; f, fine; m, medium; c, coarse; vc, very coarse; DT, dendritic tubular; IG, irregular; TU, tubular; IR, interstitial.

¹ Efferv, effervescence; ne, non-effervescent.

Table S1 Continued:

Horizon	Original	Corrected	Bnda	Color	Textb	Coa	rse F	ractio	n	Structured	Cons	sistence		PVSF [†]	Roots	Pores ^h	Efferv ¹
	Depth	Depth		D Moist				St	В		Dry	Moist Stick	Plast			1fDT 3vflG, 1mDT 3vf,fDT 3vf,fDT 2vf,fDT	
				, -107.066397	9875	ft., 36	°°										
Oe	0-4	4-0	vw	10YR2/2							S	so	ро		2vf,fT	400.	ne
A	4-7	0-3	aw	7.5YR4/4		<2	0	0	0	2vf,f,mgr, 1vfsbk	S	SS	mp		3vf,f,mT		ne
E	7-15	3-11	cs	7.5YR4/3	1	0	0	5	0	3vf,fgr, 1fsbk / 2vfgr	S	SS	mp		3vf,f,2m,1c, vcT		ne
E/Bt1	15-21	11-17	gs	10YR5/3	ı	30	10	5	0	3vf,fgr, 1cosbk / 2vfgr	s	ms	mp	2fnCLF,FEF	3vf,f,1mT	3vf,fDT	ne
E/Bt2	21-37.5	17-33.5	cw	10YR4/4	cl	30	15	0	<5	3vf,fgr, 2cosbk / 2msbk	s	ss	vp	1fpCLF,FEF	3vf,2f,1mT, 3vf,fR	3vf,fDT	ne
Bt1	37.5-53	33.5-49	ci	7.5YR4/4	cl	5	5	15	0	2fsbk / 2vfsbk	s	ss	mp	2dnCLF,FE F	3vf,2f,1m,2 vcT	3vf,fDT	ne
Bt2	53-69	49-65	aw	10YR3/6	sl	40	25	15	0	2vf,fgr, 1cosbk /	s	so	ро	2dcFEFpf, 1dcBRFcs,f	3vf,fR		ne
Cr	69-100+	65-96+		10YR4/4	Is			45		2fsbk 3vf,fgr, sg	mh	so	ро	g 3rcSNF, 1nCLF,FEF cs,fg, 0dpFEFwb	0mfT	2fR	ne
									C	C5 Notes							
Oe A							Tex	ture w	as a	assessed wit	nout a	sieve in the fiel	d				
E							Tex	ture w	as a	assessed wit	nout a	sieve in the fiel	d				
E/Bt1				т.										the besieve			
												charcoal obse					
E/Bt2	Texture	was assesse	d with	out a sieve in t								rithin 21-53 cm d material of th			nm) concentra	ations (33 c	m below t
Bt1					Textu	e wa	s ass	essed	with	out a sieve i	the fi	ield; 2 large bo	ılders ir	n profile			
Bt2							Tex	ture w	as a	assessed with	nout a	sieve in the fiel	d				
Cr			Textu	re was assess	ed with	out a	sieve	in the	e fie	ld; clay films	and fe	rriargillans were	e obser	ved within bed	drock fracture	es	
Rnd hou	ndarv: v ven	/ahrunt-a al	hrunt:	c clear a ara	qual. e	smo	oth: v	, wav	v-i	irregular h k	roken						

Bnd, boundary; v, very abrupt; a, abrupt; c, clear; g, gradual; s, smooth; w, wavy; i, irregular; b, broken

¹ Efferv, effervescence; ne, non-effervescent.

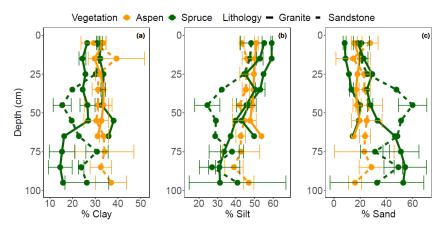


Figure S1: The mean and standard deviation of (a) %zclay (<6.6μm), (b). % silt (<60.33μm), and (c) % sand. Colors are associated with vegetation, aspen (orange) and spruce (green), while line types are associated with lithology, granite (solid) and sandstone (dotted).

b Text, Texture; Is, loamy sand; sl, sandy loam; scl, sandy clay loam; cl, clay loam; sicl, silty clay loam; sic, silty clay.

Gr, gravel; Cb, cobbles; St, Stones; Bd, boulder.

^{1,} weak; 2, moderate; 3, strong; vf, very fine; f, fine; m, medium; co, coarse; vc, very coarse; gr, granular; sbk, subangular blocky; sg, single grained; ma, massive; -, to; /, Stick, stickiness; plast, plasticity; s, soft; sh, slightly hard; vfr, very friable; ss, slightly sticky; ms, moderately sticky; vs, very sticky; po, non-plastic; sp, slightly plastic; mp,

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h 1, few; 2, common; 3, many; vf, very fine; f, fine; m, medium; c, coarse; vc, very coarse; DT, dendritic tubular; IG, irregular; TU, tubular; IR, interstitial.

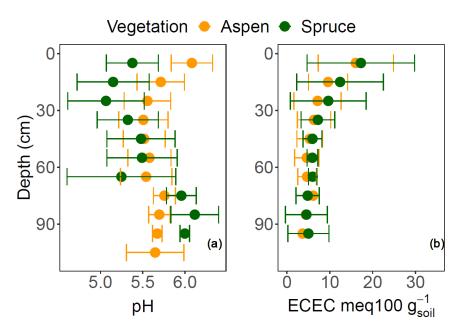


Figure S2: The mean and standard deviation of (a) soil pH and (b) effective cation exchange capacity under two vegetation types with depth, aspen (orange) and spruce (green).