

Supplementary Information

for

Topographic controls on soil organic carbon on soil mantled landscapes

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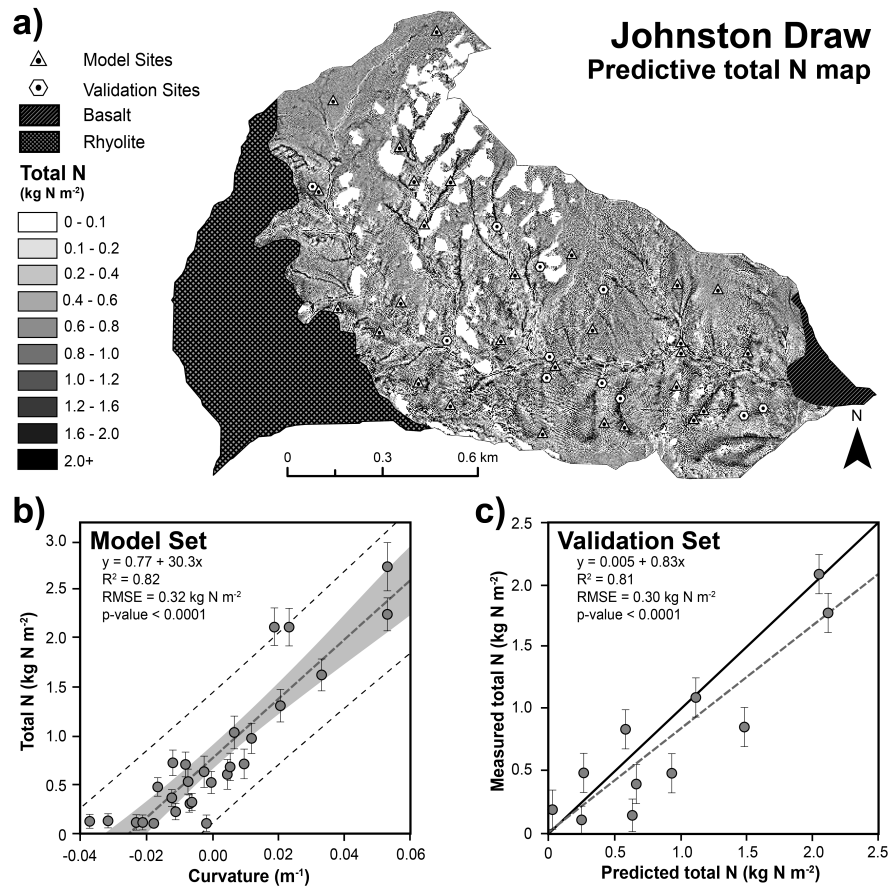
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Supplementary Figure 1

Supplementary Table 1



Supplementary Figure 1: Soil total nitrogen (N)-curvature relationship. (a) A 3 m predictive total nitrogen map of Johnston Draw. Figure depicts the location of the model (triangles) and validation sites (hexagons) within the soil mantled, granitic portion of Johnston Draw watershed. (b) Curvature to total nitrogen (curvature-N) function for the entire watershed showing a positive linear relationship (dashed line) bounded by 95% confidence limits (dotted line) ($n=28$, $R^2 = 0.82$, $RMSE = 0.32 \text{ kg N m}^{-2}$, $p < 0.0001$). Curvature-N functions were derived from a model set consisting of 70% of all sites. (c) The remaining 30% of sites were utilized as a validation set and evaluated against a 1:1 line (solid line) in predicted versus measured graph (dashed line). Total N validation sets showed that predicted total-profile N agreed well with observed values ($n=11$, $R^2 = 0.81$, $RMSE = 0.30 \text{ kg N m}^{-2}$, $p < 0.0001$).

Supplementary Table 1: Field soil descriptions of representative soil profiles on convergent and divergent topography and south and north facing aspects at different locations (Eastings and Northings, respectively, using NAD 83 UTM Zone 11T). Boundaries (BDRY) determined by ocular inspection, Munsell color (hue (H), value (V), chroma (C) was determined when soil was dry (D) and moist (M), structure refers to the grade (0– 3, structureless to strong), size (vf, very fine; f, fine; m, medium; co, coarse) and type (gr, granular; abk, angular blocky, sbk, subangular blocky; m, massive, pl, platy), and roots and pores refers to the grade (1-3 few to many) and size (vf, very fine; f, fine; m, medium; co, coarse), bioturbation, absence/presence, and vegetation.

Site	Location and Topographic position	Soil Horizon	Depth (cm)	B _{DRY}	Color (dry)	Color (wet)	Structure	Roots	Pores	Clay Films	Bioturbation	Vegetation	
Johnston Draw (JDT 2g NRP)	517,404.683 4,774,666.411 (m)	A1	0-15	CW	7.5YR 4/4	7.5YR 3/3	1Gr Vf-F	3 Vf-F	No	No	No	<i>Artemisia tridentate</i> ssp. <i>wyomingensis</i>	
		A2	15-30	GW	7.5YR 4/4	7.5YR 3/3	2Sbk Vf-M	3 Vf	No	No	No	<i>Juniperus occidentalis</i>	
		CR	30-90	D Ir	7.5YR 6/6	7.5YR 6/5	Massive	No	No	No	No	<i>Purshia stansburyana</i>	
	South-facing Divergent Topography	R	90+	-	-	-	-	-	No	No	No		
Johnston Draw (JDT 3e NRP)	517,505.977 4,774,359.875 (m)	A1	0-30	CS	10YR 3/2	10YR 2/1	3Sbk Vf-M	3 Vf	1 Vf	No	No	<i>Artemisia tridentate</i> ssp. <i>wyomingensis</i>	
		A2	30-92	CS	10YR 3/3	10YR 2/2	3Sbk M-Co	3 Vf	1 Vf	No	No	<i>Symphoricarpos parishii</i>	
		North-facing Convergent Topography	AC1	92-148	CS	10YR 4/4	10YR 3/3	3Sbk M-Co	3 Vf	1 Vf	No	Yes	
		AC2	148-175	CS	10YR 4/4	10YR 3/4	3Sbk Co-VC	3 Vf	1 Vf	No	Yes		
		CA1	175-200	CS	10YR 4/4	10YR 3/4	3Sbk Vf-M	3 Vf	1 Vf	No	Yes		
		CA2	200-213	CS	10YR 5/4	10YR 3/6	3Sbk Vf-M	3 Vf	1 Vf	No	No	No	
CR	+213	-	-	-	-	-	-	No	No	No			
Johnston Draw (JDT 5c NRP)	516,800.011 4,774,750.710 (m)	A	0-18	C Ir	10YR 5/3	10YR 3/3	1Gr Vf-F	3 Vf	No	No	No	<i>Artemisia tridentate</i> ssp. <i>wyomingensis</i>	
		South-facing Divergent Topography	R	+18	-	-	-	-	-	No	No	No	<i>Cercocarpus ledifolius</i>
Johnston Draw (JDT 5d NRP)	517,103.179 4,774,994.265 (m)	A	0-10	CS	10YR 4/3	10YR 3/2	1Gr Vf	3 Vf	3 Vf	No	No	<i>Artemisia tridentate</i> ssp. <i>wyomingensis</i>	
		South-facing Planar Topography	AC	10-25	GS	10YR 4/3	10YR 2/2	2Sbk Vf-F	3 Vf	3 Vf	No	No	<i>Cercocarpus ledifolius</i>
		C	25-75	GS	10YR 4/3	10YR 3/3	2Sbk Vf-F	1 Vf	1 Vf	No	No	No	
		R	+75	-	-	-	-	-	-	No	No	No	
Johnston Draw (JDT 5e NRP)	516,731.729 4,774,660.012 (m)	A1	0-12	GS	10YR 2/1	10YR 2/1	1Gr F	3 Vf-F	No	No	Yes	<i>Populus tremuloides</i>	
		North-facing Planar Topography	A2	12-52	GW	10YR 3/1	10YR 2/1	3Sbk M-VC	3 Vf-VC	1 Vf	No	Yes	
		A3	52-78	CS	10YR 4/3	10YR 3/3	2Sbk M-VC	2 Vf-VC	2 Vf	No	Yes		
		Bw	78-94	G Ir	10YR 4/3	10YR 3/3	2Sbk Co-VC	1 F	3 Vf	No	Yes		
		C	94-132	CS	10YR 6/4	10YR 4/6	2Sbk M-VC	3 Vf-F	1 Vf	No	Yes		
		CR	+132	-	-	-	-	-	-	No	No	No	
Johnston Draw (JDT 6k NRP)	516,601.553 4,774,732.500 (m)	A	0-17	C Ir	10YR 4/2	10YR 2/1	1Gr Vf-F		3 Vf	No	No	<i>Artemisia arbuscula</i> <i>Artemisia tridentate</i> ssp. <i>wyomingensis</i>	
		North-facing Divergent Topography	R	+17	-	-	-	-	-	No	No	No	

Supplementary Table 1 continuation: Laboratory soil descriptions of representative soil profiles on convergent and divergent topography and south and north facing aspects. Particle size distribution as sand, silt, clay, bulk density (BD), % coarse fraction (CF) were determined with modified hydrometer where the sand fraction was sieved through a 0.53 um sieve. BD was determined using a CF adjusted bulk density method described by Patton *et al.*⁸⁰. Soil organic matter (%) is based on loss on ignition (dried samples combusted at 8 hr at 450 °C), soil total N % and soil organic carbon % based on methods detailed in paper. Soil pH and electrical conductivity (EC) were determined in the field on 2:1 water to soil slurries after sitting for 60 minutes. Presence/absence of carbonates (EFF) determined by effervescence (application of 10% HCl to soil).

Site	Soil Horizon	Depth (cm)	Sand %	Silt %	Clay %	BD (g/cm ³)	% CF (wt/wt)	Soil Organic Material (%)	% Soil Total Nitrogen (wt/wt)	% Soil Organic Carbon (wt/wt)	pH (2:1)	EC (μS/cm)	EFF
Johnston Draw (JDT 2g NRP)	A1	0-15	82	8	10	1.21	19	2.1	0.08	0.92	5.98	44.30	No
	A2	15-30	83	6	11	1.12	27	1.2	0.05	0.43	6.13	2.50	No
	CR	30-90	88	6	6	-	29	0.4	0.01	0.09	6.65	11.23	No
	R	90+	-	-	-	-	-	-	-	-	-	-	No
Johnston Draw (JDT 3e NRP)	A1	0-30	66	11	23	1.37	18	9.8	0.33	5.74	5.82	89.23	No
	A2	30-92	53	24	24	1.32	18	7.6	0.26	3.65	5.49	23.71	No
	AC1	92-148	61	18	21	1.48	27	3.5	0.13	1.58	5.47	12.23	No
	AC2	148-175	67	15	19	1.53	30	3.1	0.07	0.98	5.55	11.68	No
	CA1	175-200	67	13	20	1.67	36	2.9	0.04	0.59	5.86	11.55	No
	CA2	200-213	74	11	15	1.39	35	1.8	0.01	0.24	5.65	8.37	No
	CR	+213	-	-	-	-	-	-	-	-	-	-	-
Johnston Draw (JDT 5c NRP)	A	0-18	66	15	19	1.44	39	2.9	0.09	1.03	6.5	44.07	No
	R	+18	-	-	-	-	-	-	-	-	-	-	No
Johnston Draw (JDT 5d NRP)	A	0-10	74	13	13	0.93	20	5.1	0.17	2.28	5.19	142.77	No
	AC	10-25	78	13	9	1.09	24	4.4	0.12	1.48	5.92	43.80	No
	C	25-75	78	10	12	1.47	32	2.5	0.06	0.48	6.01	42.27	No
	R	+75	-	-	-	-	-	-	0.02	0.19	-	-	No
Johnston Draw (JDT 5e NRP)	A1	0-12	53	33	13	1.31	19	12.1	0.54	7.23	5.62	713.67	No
	A2	12-52	45	40	14	1.12	17	10.1	0.33	4.16	5.56	102.47	No
	A3	52-78	42	41	17	1.21	27	7.4	0.11	1.23	6.01	16.87	No
	Bw	78-94	46	34	19	1.27	36	4.4	0.05	0.44	5.57	13.23	No
	C	94-132	69	16	14	1.39	55	2.3	0.04	0.33	5.50	22.07	No
	CR	+132	-	-	-	-	-	-	0.00	0.05	-	-	No
Johnston Draw (JDT 6k NRP)	A	0-17	54	28	18	1.03	50	7.7	0.16	2.16	6.62	191.90	No
	R	+17	-	-	-	-	-	-	-	-	-	-	No