

Supplement

Table S1: Localization and field description of the soil profiles collected at the Gradient site in 2019 (Eight Mile Lake, Interior Alaska, USA).

Soil profile	n	Permafrost category	GPS coordinates		Active layer thickness (cm)	Organic layer thickness (cm)
			Latitude N	Longitude W		
Min1	13	Poorly thawed	63°52'34.3''	149°14'55.1''	55	45
Min3	15	Poorly thawed	63°52'33.3''	149°14'57''	60	40
Mod1	13	Poorly thawed	63°52'40.4''	149°15'18''	50	45
Mod2	9	Highly thawed	63°52'39.6''	149°15'19.4''	88	10
Mod3	14	Highly thawed	63°52'39.7''	149°15'17.6''	75	20
Ext1	11	Poorly thawed	63°52'43.7''	149°15'28.7''	48	40
Ext3	11	Highly thawed	63°52'46.6''	149°15'27.8''	65	30

Table S2: Soil characterization data (pH_{KCl} , $\text{pH}_{\text{H}_2\text{O}}$, total organic carbon (TOC) and organic carbon (OC) stocks) at Eight Mile Lake (Interior Alaska, USA). Soil horizons in grey-italic are fictive, they were approximated by the average value of the two adjacent lower and upper horizons for the estimation of cumulated organic carbon (OC) stocks within the top 100 cm of incomplete soil profiles. Asterisks specifically refer to the total OC stock within the top 100 cm of soil profiles.

Thermo- karst area	Permafrost category	Soil profile	Depth (cm)	pH_{KCl}	$\text{pH}_{\text{H}_2\text{O}}$	TOC (%)	BD (g cm^{-3})	Cumulated OC stock (g C/m^2)	Cumulated OC stock in the top 100cm (kg C/m^2)
			0-5	3.04	3.88	48.1	0.0362	870.36	0.87
			5-10	2.99	3.85	47.6	0.0462	1968.44	1.97
			10-15	3.12	3.81	47.0	0.0572	3312.43	3.31
			15-20	3.22	3.93	45.2	0.0887	5319.06	5.32
Minimal	Poorly thawed	Min1	20-25	3.3	3.97	43.9	0.1143	7825.69	7.83
			25-30	3.36	4.03	44.6	0.1010	10077.88	10.08
			30-32.5	3.47	4.21	44.6	0.0997	11190.81	11.19
			32.5-35	3.52	4.17	42.9	0.1317	12603.12	12.60
			<i>35-45</i>	<i>nd</i>	<i>nd</i>	<i>25.7</i>	<i>0.4481</i>	<i>24119.90</i>	<i>24.12</i>

			45-55	3.75	4.19	8.5	0.7646	30587.51	30.59
			55-65	3.72	4.65	2.6	0.8714	32937.12	32.94
			65-75	3.76	4.68	2.2	0.8798	34862.61	34.86
			75-85	3.86	4.78	3.9	0.8481	38181.52	38.18
			85-120	3.95	4.64	5.6	0.8167	54250.51	*45.07
			0-5	3.20	4.11	48.5	0.0284	688.04	0.69
			5-10	3.02	3.81	46.9	0.0587	2063.02	2.06
			10-15	3.12	3.88	46.4	0.0682	3643.52	3.64
			15-20	3.17	3.85	45.8	0.0787	5445.43	5.45
			20-25	3.30	3.93	44.4	0.1050	7775.02	7.78
			25-30	<i>nd</i>	<i>nd</i>	<i>43.1</i>	<i>0.1280</i>	<i>10533.64</i>	<i>10.53</i>
			30-35	3.68	4.35	41.9	0.1509	13692.61	13.69
			35-40	3.89	4.57	20.3	0.5476	19242.62	19.24
Minimal	Poorly thawed	Min3	40-55	3.85	4.32	15.3	0.6388	33908.75	33.91
			55-60	3.92	4.49	22.5	0.5074	39606.42	39.61
			60-65	4.09	4.71	23.5	0.4876	45344.42	45.34
			65-75	4.24	4.84	15.3	0.6394	55109.68	55.11
			75-85	4.08	5.12	2.9	0.8658	57663.56	57.66
			85-95	4.49	5.35	9.3	0.7496	64614.81	64.61
			95-105	4.49	5.46	2.3	0.8782	66613.80	*65.61
			105-115	5.25	5.84	4.7	0.8345	70497.09	-
			0-5	3.36	4.16	46.7	0.0628	1465.40	1.47
			5-10	3.13	3.76	46.7	0.0624	2920.74	2.92
			10-15	2.87	3.54	47.8	0.0410	3901.11	3.90
			15-20	2.85	3.56	47.4	0.0494	5071.78	5.07
			20-25	3.17	4.05	47.2	0.0534	6331.51	6.33
			25-30	3.48	4.07	45.3	0.0884	8331.94	8.33
			30-35	3.55	4.25	43.3	0.1253	11042.69	11.04
			35-40	3.69	4.45	42.1	0.1473	14140.76	14.14
			40-45	<i>nd</i>	<i>nd</i>	<i>24.8</i>	<i>0.4637</i>	<i>19899.13</i>	<i>19.90</i>
			40-55	3.76	4.47	7.6	0.7802	25836.96	25.84
			55-65	3.92	4.58	12.5	0.6912	34445.92	34.45
			65-75	4.05	4.78	28.0	0.4055	45801.83	45.80
			75-80	4.19	4.86	32.1	0.3305	51104.36	51.10
			80-85	<i>nd</i>	<i>nd</i>	<i>17.7</i>	<i>0.5949</i>	<i>56368.17</i>	<i>56.37</i>
			85-105	4.28	5.25	3.3	0.8592	62055.98	*60.63
Moderate		Mod2	0-10	3.45	3.92	49.7	0.0066	327.84	0.33

			10-15	3.67	4.24	8.4	0.7660	3537.57	3.54
			15-20	3.65	4.47	3.7	0.8512	5131.29	5.13
			20-65	3.61	4.64	2.1	0.8819	13351.18	13.35
		Highly thawed	65-75	3.64	4.50	2.6	0.8719	15634.71	15.63
			75-85	3.70	4.41	2.8	0.8689	18051.51	18.05
			85-95	3.84	4.69	3.1	0.8632	20718.77	20.72
			95-105	4.13	5.05	3.4	0.8570	23656.33	*22.19
			105-110	5.25	6.21	1.0	0.9012	24118.13	-
			0-5	3.20	3.87	47.5	0.0480	1138.73	1.14
			5-10	3.24	3.99	46.0	0.0750	2862.62	2.86
			10-15	3.32	3.96	45.0	0.0933	4962.67	4.96
			15-20	3.54	4.22	35.8	0.2617	9651.61	9.65
			20-25	3.75	4.57	3.6	0.8539	11188.52	11.19
			25-30	3.68	4.78	2.2	0.8800	12147.18	12.15
Moderate	Highly thawed	Mod3	30-35	3.67	4.85	2.3	0.8774	13164.75	13.16
			35-65	3.77	4.89	3.9	0.8490	23158.18	23.16
			65-75	4.52	5.25	6.2	0.8060	28158.76	28.16
			75-85	4.44	5.34	3.3	0.8599	30972.43	30.97
			85-95	4.99	6.01	1.4	0.8946	32208.97	32.21
			95-105	5.37	6.20	1.7	0.8881	33749.15	*32.98
			105-115	5.94	6.57	1.6	0.8900	35203.13	-
			115-120	6.80	7.52	0.7	0.9062	35542.93	-
			0-5	2.96	3.81	47.7	0.0431	1029.47	nd
			5-10	2.80	3.73	49.0	0.0193	1503.45	nd
			10-15	2.82	3.74	48.6	0.0272	2165.00	nd
			15-20	3.14	3.91	46.6	0.0631	3637.11	nd
			20-25	3.45	3.92	42.2	0.1456	6705.79	nd
Extensive	Poorly thawed	Ext1	25-30	3.69	4.26	40.6	0.1733	10227.10	nd
			30-35	3.70	4.29	41.7	0.1543	13442.76	nd
			35-40	3.54	4.47	29.4	0.3808	19030.71	nd
			40-48	3.96	4.83	4.8	0.8325	22202.22	nd
			48-55	4.33	5.16	4.7	0.8331	24960.99	nd
			55-65	4.45	5.12	5.4	0.8208	29394.56	nd
			0-5	2.98	3.78	48.7	0.0261	633.91	nd
Extensive	Highly thawed	Ext3	5-10	2.82	3.84	48.1	0.0370	1523.24	nd
			10-15	2.79	3.60	48.0	0.0387	2451.82	nd
			15-20	2.93	3.83	46.4	0.0671	4008.40	nd

20-25	3.23	3.87	39.9	0.1865	7731.65	nd
25-30	3.54	4.43	21.5	0.5251	13375.18	nd
30-35	3.75	4.53	6.3	0.8048	15898.14	nd
35-40	3.81	4.53	5.6	0.8172	18184.12	nd
40-65	3.92	4.60	8.4	0.7664	34207.07	nd
65-75	4.27	4.85	15.2	0.6403	43956.04	nd
75-85	4.58	5.29	6.5	0.7999	49183.97	nd
89-90	4.62	5.52	1.1	0.9000	49674.13	nd

Table S3: Characterization of the total and exchangeable fraction of permafrost soils at Eight Mile Lake (Interior Alaska, USA): cation exchange capacity (CEC), base saturation (BS), concentrations in exchangeable Ca, K, Mg, Na, concentrations in total Ca, K, Mg, Na, Total Reserve in Bases (TRB).

Thermo- karst area	Permafrost degradation	Soil profile	Depth (cm)	CEC ($\text{cmol}_c \text{ kg}^{-1}$)	Base saturation	Ca_{exch} (g kg^{-1})	K_{exch} (g kg^{-1})	Mg_{exch} (g kg^{-1})	Na_{exch} (g kg^{-1})	Ca_{bulk} (g kg^{-1})	K_{bulk} (g kg^{-1})	Mg_{bulk} (g kg^{-1})	Na_{bulk} (g kg^{-1})	TRB ($\text{cmol}_c \text{ kg}^{-1}$)
Minimal	Poorly thawed	Min1	0-5	85.73	29%	2.59	1.38	0.95	0.20	2.82	5.49	1.33	0.69	42.10
			5-10	93.62	28%	2.67	1.00	1.06	0.37	2.69	3.70	1.43	0.52	36.89
			10-15	100.87	21%	2.11	0.82	0.75	0.49	2.38	2.91	1.30	0.78	33.40
			15-20	110.85	14%	1.48	0.56	0.49	0.67	2.22	4.75	1.26	1.36	39.47
			20-25	139.72	10%	1.46	0.28	0.47	0.42	2.21	1.57	1.15	1.09	29.24
			25-30	113.52	13%	1.56	0.38	0.49	0.48	2.25	1.83	1.25	1.24	31.66
			30-32.5	87.14	14%	1.38	0.17	0.46	0.34	2.40	4.88	1.49	1.93	45.13
			32.5-35	89.41	15%	1.42	0.10	0.47	0.42	2.42	7.86	1.69	2.51	57.04
			45-55	22.62	25%	0.46	0.06	0.18	0.41	6.55	15.59	6.62	10.97	174.71
			55-65	7.86	73%	0.44	0.05	0.19	0.43	8.84	14.78	7.05	11.30	189.07
			65-75	8.78	71%	0.49	0.04	0.22	0.44	8.55	15.13	6.81	12.25	190.68
			75-85	10.79	78%	0.70	0.05	0.30	0.53	8.03	14.90	7.43	11.97	191.39
85-120	15.03	50%	0.69	0.05	0.24	0.44	7.15	15.64	6.41	10.98	176.18			
Minimal	Poorly thawed	Min3	0-5	73.34	31%	2.38	1.17	0.84	0.16	2.91	5.55	nd	nd	nd
			5-10	85.34	31%	2.75	1.17	1.01	0.24	2.81	4.83	nd	nd	nd
			10-15	72.57	23%	1.77	0.69	0.60	0.28	2.54	3.14	nd	nd	nd
			15-20	108.86	14%	1.57	0.57	0.50	0.30	2.29	2.71	nd	nd	nd
			20-25	138.24	10%	1.47	0.33	0.42	0.34	2.15	3.17	nd	nd	nd
			30-35	75.23	14%	1.10	0.19	0.38	0.29	2.15	8.22	nd	nd	nd

			35-40	37.60	15%	0.55	0.11	0.20	0.24	2.38	13.21	nd	nd	nd
			40-55	32.26	18%	0.56	0.07	0.19	0.25	5.67	15.73	nd	nd	nd
			55-60	39.02	22%	1.18	0.06	0.16	0.34	2.28	16.10	nd	nd	nd
			60-65	38.22	31%	1.74	0.07	0.21	0.32	2.50	15.39	nd	nd	nd
			65-75	35.77	37%	1.89	0.08	0.25	0.37	8.02	15.50	nd	nd	nd
			75-85	15.87	55%	0.85	0.10	0.35	0.32	9.59	15.45	nd	nd	nd
			85-95	13.01	108%	1.40	0.08	0.63	0.37	9.20	18.02	nd	nd	nd
			95-105	10.07	70%	0.78	0.08	0.28	0.15	10.15	15.66	nd	nd	nd
			105-115	15.89	83%	1.83	0.03	0.41	0.16	12.52	15.85	nd	nd	nd
			0-5	82.83	37%	2.92	1.64	1.42	0.06	3.04	6.59	nd	nd	nd
			5-10	83.92	30%	2.13	1.54	1.24	0.05	2.56	5.02	nd	nd	nd
			10-15	92.48	21%	1.55	1.32	0.98	0.10	2.30	6.28	nd	nd	nd
			15-20	107.76	18%	1.93	1.19	0.81	0.10	2.41	2.75	nd	nd	nd
			20-25	129.90	17%	2.69	0.72	0.71	0.20	2.56	1.92	nd	nd	nd
			25-30	109.73	20%	2.77	0.44	0.75	0.19	2.57	1.86	nd	nd	nd
Moderate	Poorly thawed	Mod1	30-35	90.02	22%	2.52	0.30	0.70	0.24	2.53	3.50	nd	nd	nd
			35-40	68.14	23%	1.90	0.22	0.58	0.18	2.39	7.83	nd	nd	nd
			40-55	12.14	30%	0.37	0.02	0.16	0.09	6.65	15.00	nd	nd	nd
			55-65	29.80	31%	1.10	0.04	0.34	0.21	5.85	15.14	nd	nd	nd
			65-75	47.91	16%	1.06	0.04	0.22	0.09	2.52	14.97	nd	nd	nd
			75-80	53.64	24%	1.83	0.03	0.38	0.11	2.51	12.66	nd	nd	nd
			85-105	12.92	56%	0.92	0.04	0.26	0.11	7.80	16.34	nd	nd	nd
			0-10	94.27	24%	2.58	0.91	0.79	0.14	2.83	2.65	nd	nd	nd
			10-15	32.72	24%	0.94	0.08	0.30	0.10	7.08	15.07	nd	nd	nd
Moderate	Highly thawed	Mod2	15-20	19.15	41%	0.87	0.03	0.33	0.16	7.43	15.63	nd	nd	nd
			20-65	19.13	41%	0.80	0.03	0.37	0.17	7.12	15.61	nd	nd	nd
			65-75	18.15	33%	0.65	0.05	0.25	0.13	7.00	16.27	nd	nd	nd
			75-85	15.62	39%	0.67	0.09	0.24	0.11	8.82	16.07	nd	nd	nd

			85-95	14.17	56%	0.93	0.09	0.29	0.14	8.10	16.90	nd	nd	nd
			95-105	15.01	62%	1.16	0.08	0.33	0.13	8.28	16.80	nd	nd	nd
			105-110	10.27	102%	1.31	0.07	0.42	0.09	8.42	15.53	nd	nd	nd
Moderate	Highly thawed	Mod3	0-5	89.31	25%	2.63	1.09	0.70	0.06	2.95	7.01	1.31	0.84	47.08
			5-10	94.64	28%	2.78	0.76	1.07	0.46	2.82	4.18	1.83	1.26	45.28
			10-15	108.12	22%	2.67	0.65	0.98	0.11	2.76	3.28	1.53	0.69	37.73
			15-20	88.50	17%	1.94	0.28	0.52	0.09	2.42	4.76	2.25	2.30	52.76
			20-25	20.30	42%	0.97	0.03	0.37	0.13	7.24	15.13	7.49	11.09	184.68
			25-30	12.00	69%	0.95	0.02	0.34	0.16	7.37	15.97	7.22	11.21	185.79
			30-35	13.65	63%	0.98	0.03	0.35	0.17	7.38	15.99	6.56	10.33	176.57
			35-65	17.69	39%	0.83	0.03	0.26	0.14	7.09	16.36	7.47	11.43	188.38
			65-75	20.69	62%	1.81	0.07	0.36	0.13	8.85	15.85	7.71	10.53	193.98
			75-85	15.58	66%	1.35	0.08	0.33	0.12	9.22	16.63	8.16	11.76	206.86
			85-95	13.99	76%	1.36	0.09	0.40	0.09	8.60	16.65	8.20	11.67	203.73
			95-105	15.79	74%	1.53	0.09	0.42	0.09	8.24	15.75	8.35	11.53	200.26
			105-115	12.68	95%	1.61	0.10	0.42	0.08	9.96	15.31	9.21	12.08	217.18
			115-120	11.05	116%	1.61	0.10	0.49	0.11	8.90	15.99	7.98	11.37	200.50
Extensive	Poorly thawed	Ext1	0-5	99.61	20%	2.25	1.19	0.61	0.04	2.70	3.83	nd	nd	nd
			5-10	102.13	17%	1.78	0.96	0.67	0.04	2.47	3.71	nd	nd	nd
			10-15	114.00	14%	1.62	0.79	0.75	0.04	2.41	2.93	nd	nd	nd
			15-20	96.17	16%	1.87	0.41	0.54	0.08	2.60	4.72	nd	nd	nd
			20-25	81.47	16%	1.72	0.15	0.40	0.09	2.47	5.41	nd	nd	nd
			25-30	73.87	12%	1.18	0.08	0.26	0.08	2.29	6.13	nd	nd	nd
			30-35	82.33	10%	1.16	0.06	0.26	0.07	2.27	7.74	nd	nd	nd
			35-40	55.51	11%	0.81	0.03	0.20	0.06	2.31	11.15	nd	nd	nd
			40-48	20.30	28%	0.73	0.01	0.19	0.10	8.63	18.45	nd	nd	nd
			48-55	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
			55-65	15.42	57%	1.24	0.05	0.24	0.11	10.25	17.31	nd	nd	nd

Extensive	Highly thawed	Ext3	0-5	106.42	20%	2.38	1.05	0.74	0.07	2.80	5.30	1.11	0.49	38.83
			5-10	113.64	16%	1.81	0.97	0.81	0.04	2.48	5.25	1.17	0.37	37.05
			10-15	117.90	13%	1.36	0.80	0.73	0.05	2.34	4.94	1.33	0.83	38.88
			15-20	91.79	17%	1.71	0.49	0.69	0.07	2.51	3.99	1.38	1.30	39.71
			20-25	82.30	13%	1.27	0.33	0.43	0.07	2.36	6.38	2.02	2.47	55.43
			25-30	51.89	11%	0.73	0.07	0.20	0.06	2.51	12.19	1.60	2.33	67.02
			30-35	24.25	19%	0.50	0.02	0.19	0.11	7.72	16.27	7.82	11.37	193.94
			35-40	16.90	19%	0.34	0.02	0.13	0.09	7.37	15.64	7.05	11.45	184.61
			40-65	25.38	17%	0.54	0.02	0.14	0.12	6.87	14.85	6.74	10.52	173.44
			65-75	26.17	34%	1.32	0.04	0.20	0.12	6.43	17.73	4.96	8.77	156.34
			75-85	13.40	58%	1.10	0.05	0.23	0.07	8.55	14.33	6.00	10.14	172.83
			89-90	nd	nd	nd	nd	nd	nd	8.78	13.00	6.74	11.50	182.58

Table S4: Soil mineral composition at the Gradient site, Eight Mile Lake (Interior Alaska, USA).

Soil profile	Depth (cm)	Plagioclase	K-Feldspath	Amphibole	Quartz	Muscovite	Vermiculite	Kaolinite	Illite
Min 3	10-15	x	x	x	x	x	x	x	x
	20-25	x	x	x	x	x	x	x	x
	30-35	x	x	x	x	x	x	x	x
	35-40	x	x	x	x	x	x	x	x
	55-60	x	x	x	x	x	x	x	x
	65-75	x	x	x	x	x	x	x	x
	85-95	x	x	x	x	x	x	x	x
	105-115	x	x	x	x	x	x	x	x
Mod 2	10-15	x	x	x	x	x	x	x	x
	15-20	x	x	x	x	x	x	x	x
	20-65	x	x	x	x	x	x	x	x
	75-85	x	x	x	x	x	x	x	x
Mod 3	15-20	x	x	x	x	x	x	x	x
	65-75	x	x	x	x	x	x	x	x
	115-120	x	x	x	x	x	x	x	x
Ext 2	20-65	x	x	x	x	x	x	x	x
	65-75	x	x	x	x	x	x	x	x
	75-85	x	x	x	x	x	x	x	x
Ext 3	30-35	x	x	x	x	x	x	x	x
	40-65	x	x	x	x	x	x	x	x
	85-90	x	x	x	x	x	x	x	x

Table S5: Characterization of the exchangeable and total fraction of permafrost soils at Eight Mile Lake (Interior Alaska, USA): CEC density, stocks in exchangeable and total Ca, K, Mg, Na, proportion of exchangeable Ca, K, Mg, Na stock over the total stock of the respective cation.

Thermo- karst area	Permafrost category	Soil profile	Depth (cm)	CEC density ($\text{cmol}_c \text{ m}^{-3}$)	Stock (g m^{-3})								$\text{Ca}_{\text{exch}} / \text{K}_{\text{exch}} / \text{Mg}_{\text{exch}} / \text{Na}_{\text{exch}} /$			
					Ca_{exch}	K_{exch}	Mg_{exch}	Na_{exch}	Ca_{bulk}	K_{bulk}	Mg_{bulk}	Na_{bulk}	Ca_{bulk}	K_{bulk}	Mg_{bulk}	Na_{bulk}
Minimal	Poorly thawed	Min1	0-5	3102.21	93.55	50.04	34.30	7.06	102.11	198.75	48.23	24.94	91.6%	25.2%	71.1%	28.3%
			5-10	4322.70	123.33	46.20	49.00	17.12	124.31	170.78	65.87	23.95	99.2%	27.1%	74.4%	71.5%
			10-15	5773.50	120.64	46.93	42.92	28.21	136.49	166.40	74.33	44.48	88.4%	28.2%	57.7%	63.4%
			15-20	9831.31	131.35	49.49	43.49	59.51	196.94	421.31	111.47	120.31	66.7%	11.7%	39.0%	49.5%
			20-25	15972.64	166.65	32.28	53.19	48.06	252.68	179.75	131.11	124.87	66.0%	18.0%	40.6%	38.5%
			25-30	11471.02	157.87	38.83	49.68	48.39	227.47	185.31	126.81	125.75	69.4%	21.0%	39.2%	38.5%
			30-32.5	8688.04	137.90	17.27	45.63	33.59	239.78	486.36	148.49	192.60	57.5%	3.6%	30.7%	17.4%
			32.5-35	11770.93	186.46	13.61	61.24	54.65	318.96	1034.89	222.96	330.12	58.5%	1.3%	27.5%	16.6%
			45-55	17294.60	354.90	46.84	136.63	310.68	5006.70	11922.66	5059.87	8384.37	7.1%	0.4%	2.7%	3.7%
			55-65	6981.84	388.00	46.09	170.70	383.97	7854.05	13133.29	6263.83	10038.09	4.9%	0.4%	2.7%	3.8%
			65-75	7724.48	431.54	34.97	191.61	386.92	7519.25	13313.23	5993.07	10776.11	5.7%	0.3%	3.2%	3.6%
			75-85	9154.72	596.80	41.30	251.23	449.08	6806.08	12636.05	6302.80	10155.36	8.8%	0.3%	4.0%	4.4%
			85-120	12272.35	565.99	37.59	195.65	360.86	5837.33	12776.78	5236.20	8965.31	9.7%	0.3%	3.7%	4.0%
Minimal	Poorly thawed	Min3	0-5	2079.49	67.47	33.09	23.87	4.62	82.46	157.31	nd	nd	81.8%	21.0%	nd	nd
			5-10	5005.84	161.41	68.81	59.01	13.91	164.73	283.06	nd	nd	98.0%	24.3%	nd	nd
			10-15	4947.44	120.95	46.72	40.67	19.02	172.98	214.19	nd	nd	69.9%	21.8%	nd	nd
			15-20	8567.29	123.91	44.80	39.65	23.96	180.59	213.05	nd	nd	68.6%	21.0%	nd	nd
			20-25	14519.63	154.81	34.48	44.38	35.88	225.65	333.40	nd	nd	68.6%	10.3%	nd	nd
			30-35	11353.67	165.59	29.42	57.30	43.45	324.00	1240.60	nd	nd	51.1%	2.4%	nd	nd
			35-40	20591.07	298.72	61.16	109.91	133.59	1301.12	7232.80	nd	nd	23.0%	0.8%	nd	nd
			40-55	20609.81	358.49	43.62	123.58	162.49	3622.04	10051.13	nd	nd	9.9%	0.4%	nd	nd
			55-60	19796.63	596.94	29.75	78.86	171.90	1158.60	8166.79	nd	nd	51.5%	0.4%	nd	nd
			60-65	18637.19	848.07	32.04	100.38	158.07	1218.90	7504.63	nd	nd	69.6%	0.4%	nd	nd
			65-75	22871.14	1208.19	52.34	156.66	239.27	5129.39	9911.69	nd	nd	23.6%	0.5%	nd	nd
			75-85	13743.07	737.02	84.88	301.65	280.58	8299.50	13375.20	nd	nd	8.9%	0.6%	nd	nd
			85-95	9749.59	1047.52	63.08	475.44	274.93	6893.20	13505.39	nd	nd	15.2%	0.5%	nd	nd
95-105	8840.28	684.33	69.60	241.80	134.11	8909.44	13752.62	nd	nd	7.7%	0.5%	nd	nd			

Moderate	Poorly thawed	Mod1	105-115	13262.55	1523.36	28.08	338.05	131.75	10450.69	13229.84	nd	nd	14.6%	0.2%	nd	nd
			0-5	5203.19	183.56	102.84	88.89	3.90	190.86	413.73	nd	nd	96.2%	24.9%	nd	nd
			5-10	5232.19	132.87	95.98	77.54	3.42	159.51	312.75	nd	nd	83.3%	30.7%	nd	nd
			10-15	3789.94	63.50	53.98	40.03	4.08	94.10	257.46	nd	nd	67.5%	21.0%	nd	nd
			15-20	5324.29	95.49	58.88	40.16	5.16	119.06	135.78	nd	nd	80.2%	43.4%	nd	nd
			20-25	6938.39	143.61	38.66	37.68	10.94	136.99	102.58	nd	nd	104.8%	37.7%	nd	nd
			25-30	9698.95	244.49	38.56	66.31	16.98	227.33	164.64	nd	nd	107.6%	23.4%	nd	nd
			30-35	11283.24	316.26	37.19	87.68	30.37	316.77	438.31	nd	nd	99.8%	8.5%	nd	nd
			35-40	10039.42	280.41	32.77	85.53	26.76	351.53	1153.02	nd	nd	79.8%	2.8%	nd	nd
			40-55	9469.81	284.80	18.09	125.05	72.60	5185.92	11701.26	nd	nd	5.5%	0.2%	nd	nd
			55-65	20595.35	761.22	28.85	233.57	142.08	4045.17	10462.08	nd	nd	18.8%	0.3%	nd	nd
			65-75	19426.75	427.87	16.34	89.83	35.83	1023.42	6069.44	nd	nd	41.8%	0.3%	nd	nd
			75-80	17728.69	604.31	10.23	126.32	34.90	829.63	4183.67	nd	nd	72.8%	0.2%	nd	nd
			85-105	11104.61	788.38	32.91	219.49	97.38	6702.24	14037.46	nd	nd	11.8%	0.2%	nd	nd
Moderate	Highly thawed	Mod2	0-10	621.61	17.04	5.97	5.21	0.89	18.69	17.50	nd	nd	91.2%	34.1%	nd	nd
			10-15	25067.30	723.61	58.89	231.95	75.46	5425.66	11546.78	nd	nd	13.3%	0.5%	nd	nd
			15-20	16301.07	744.41	28.89	284.68	132.89	6324.25	13308.46	nd	nd	11.8%	0.2%	nd	nd
			20-65	16872.40	708.12	26.15	322.12	146.02	6281.99	13769.73	nd	nd	11.3%	0.2%	nd	nd
			65-75	15827.50	566.20	44.91	215.11	109.19	6105.96	14187.32	nd	nd	9.3%	0.3%	nd	nd
			75-85	13573.08	583.41	74.03	209.61	99.09	7660.73	13967.10	nd	nd	7.6%	0.5%	nd	nd
			85-95	12233.44	804.23	80.31	248.60	123.21	6995.70	14587.29	nd	nd	11.5%	0.6%	nd	nd
			95-105	12866.33	994.80	70.03	279.66	109.11	7092.70	14400.01	nd	nd	14.0%	0.5%	nd	nd
			105-110	9257.35	1176.90	59.44	374.68	82.54	7591.68	13991.68	nd	nd	15.5%	0.4%	nd	nd
			0-5	4285.48	126.07	52.48	33.72	2.74	141.55	336.46	62.79	40.32	89.1%	15.6%	53.7%	6.8%
Moderate	Highly thawed	Mod3	5-10	7093.84	208.10	57.09	80.52	34.52	211.66	313.56	136.81	94.22	98.3%	18.2%	58.9%	36.6%
			10-15	10092.37	248.93	60.99	91.05	10.35	257.86	306.44	142.42	64.29	96.5%	19.9%	63.9%	16.1%
			15-20	23163.86	508.15	72.06	135.32	23.88	634.09	1245.71	588.21	601.91	80.1%	5.8%	23.0%	4.0%
			20-25	17335.95	826.15	23.47	316.65	110.13	6179.97	12920.09	6393.11	9471.15	13.4%	0.2%	5.0%	1.2%
			25-30	10558.95	836.59	15.21	300.64	140.13	6488.59	14051.78	6351.24	9864.01	12.9%	0.1%	4.7%	1.4%
			30-35	11979.90	861.50	22.93	303.65	145.93	6475.80	14026.47	5751.32	9059.51	13.3%	0.2%	5.3%	1.6%
			35-65	15246.68	712.72	27.13	220.24	118.38	6111.97	14098.41	6434.83	9848.25	11.7%	0.2%	3.4%	1.2%
			65-75	16675.54	1461.13	59.55	292.87	106.71	7132.41	12774.16	6217.85	8487.71	20.5%	0.5%	4.7%	1.3%
			75-85	13398.17	1160.34	68.93	286.62	105.90	7928.07	14303.66	7015.72	10114.26	14.6%	0.5%	4.1%	1.0%
			85-95	12515.28	1214.58	76.30	353.79	83.41	7692.48	14899.23	7335.38	10437.59	15.8%	0.5%	4.8%	0.8%

			95-105	14025.02	1360.93	82.12	374.24	78.32	7315.85	13984.50	7419.22	10237.48	18.6%	0.6%	5.0%	0.8%
			105-115	11288.08	1433.15	88.60	370.75	69.71	8865.57	13624.02	8194.29	10751.76	16.2%	0.7%	4.5%	0.6%
			115-120	10010.04	1459.58	87.40	443.70	101.07	8068.23	14488.39	7235.49	10307.94	18.1%	0.6%	6.1%	1.0%
			0-5	4297.06	96.91	51.18	26.26	1.72	116.54	165.39	nd	nd	83.1%	30.9%	nd	nd
			5-10	1974.95	34.37	18.50	12.88	0.74	47.75	71.81	nd	nd	72.0%	25.8%	nd	nd
			10-15	3103.86	44.01	21.53	20.46	1.04	65.74	79.67	nd	nd	66.9%	27.0%	nd	nd
			15-20	6070.88	118.17	26.18	34.18	5.17	164.09	297.95	nd	nd	72.0%	8.8%	nd	nd
			20-25	11862.54	250.85	21.72	58.13	12.86	360.03	787.94	nd	nd	69.7%	2.8%	nd	nd
Extensive	Poorly thawed	Ext1	25-30	12798.79	204.73	14.05	44.28	13.67	397.45	1062.61	nd	nd	51.5%	1.3%	nd	nd
			30-35	12704.19	178.45	8.66	39.46	11.54	349.70	1194.99	nd	nd	51.0%	0.7%	nd	nd
			35-40	21136.43	307.29	10.23	75.98	23.41	879.11	4247.26	nd	nd	35.0%	0.2%	nd	nd
			40-48	16897.68	603.60	11.12	156.21	81.63	7183.20	15358.68	nd	nd	8.4%	0.1%	nd	nd
			48-55	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
			55-65	12653.81	1021.19	37.28	194.21	90.59	8412.49	14207.55	nd	nd	12.1%	0.3%	nd	nd
			0-5	2772.85	62.04	27.32	19.27	1.78	72.92	138.19	29.01	12.79	85.1%	19.8%	66.4%	13.9%
			5-10	4205.57	67.14	35.87	29.96	1.50	91.92	194.36	43.14	13.85	73.0%	18.5%	69.4%	10.8%
			10-15	4564.63	52.56	30.86	28.24	2.10	90.49	191.21	51.66	32.09	58.1%	16.1%	54.7%	6.5%
			15-20	6155.07	114.84	33.15	46.21	4.43	168.42	267.56	92.34	86.96	68.2%	12.4%	50.0%	5.1%
			20-25	15350.84	236.46	60.91	79.68	13.69	440.41	1189.15	376.13	460.75	53.7%	5.1%	21.2%	3.0%
			25-30	27243.70	382.98	35.11	106.49	30.53	1318.42	6401.34	840.46	1223.35	29.0%	0.5%	12.7%	2.5%
Extensive	Highly thawed	Ext3	30-35	19517.33	405.77	13.17	148.94	91.42	6211.24	13095.10	6296.08	9148.15	6.5%	0.1%	2.4%	1.0%
			35-40	13814.30	274.66	14.82	106.08	75.57	6025.11	12783.57	5759.32	9360.17	4.6%	0.1%	1.8%	0.8%
			40-65	19449.82	410.78	15.80	105.05	91.94	5261.14	11378.68	5163.02	8062.70	7.8%	0.1%	2.0%	1.1%
			65-75	16753.78	843.12	23.58	127.98	78.61	4115.02	11349.79	3173.45	5613.93	20.5%	0.2%	4.0%	1.4%
			75-85	10720.13	882.77	41.56	181.02	54.88	6837.23	11465.80	4802.23	8112.94	12.9%	0.4%	3.8%	0.7%
			89-90	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

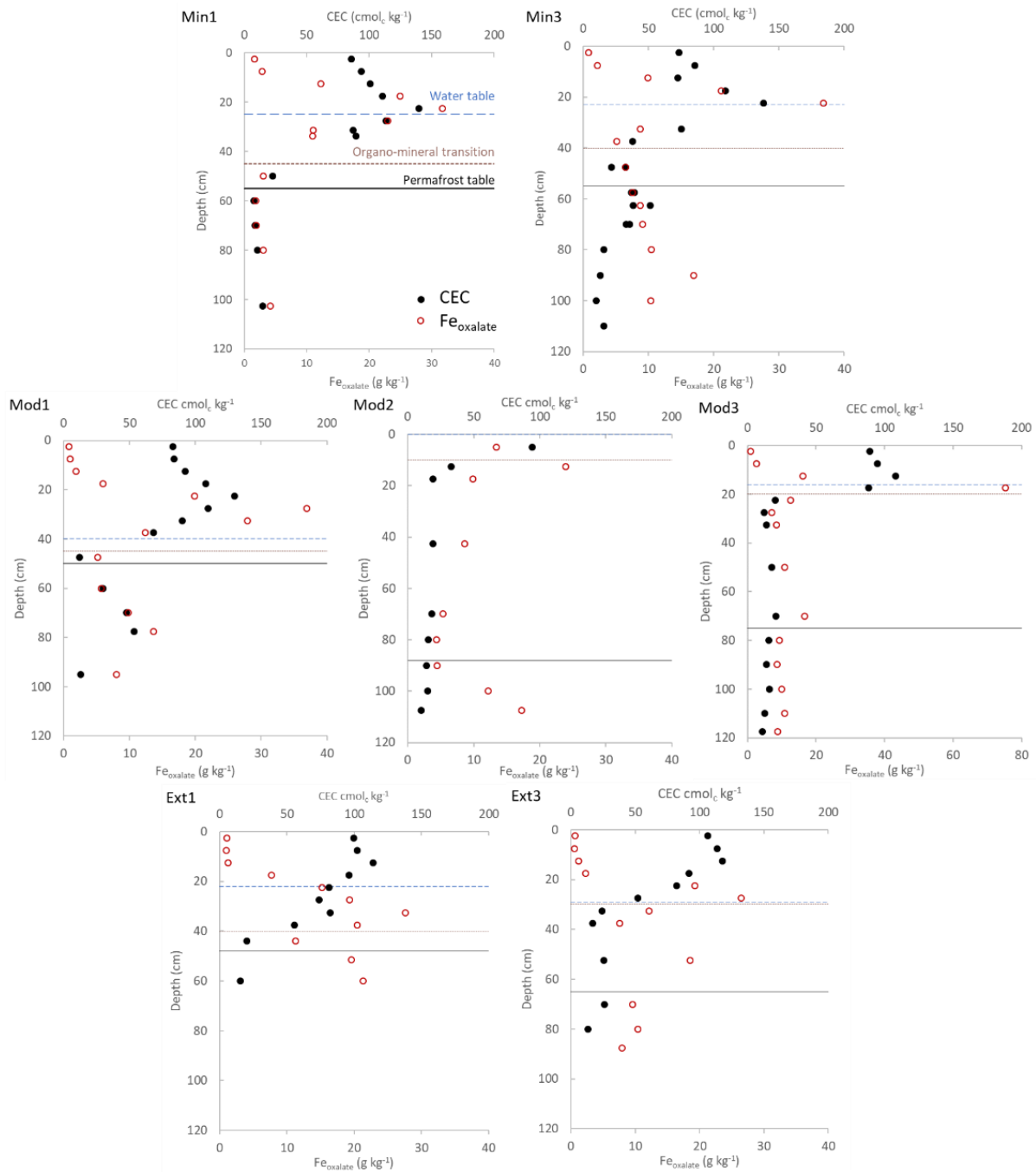


Figure S1: Distribution of the potential cation exchange capacity (CEC) and concentration in oxalate extractable Fe with depth, for the seven permafrost soil profiles (Min1, Min3, Mod1, Mod2, Mod3, Ext1, Ext3) at the Gradient site (Eight Mile Lake, Interior Alaska, USA). The oxalate extractable Fe data are from the project WeThaw (credits: A. Monhonval).

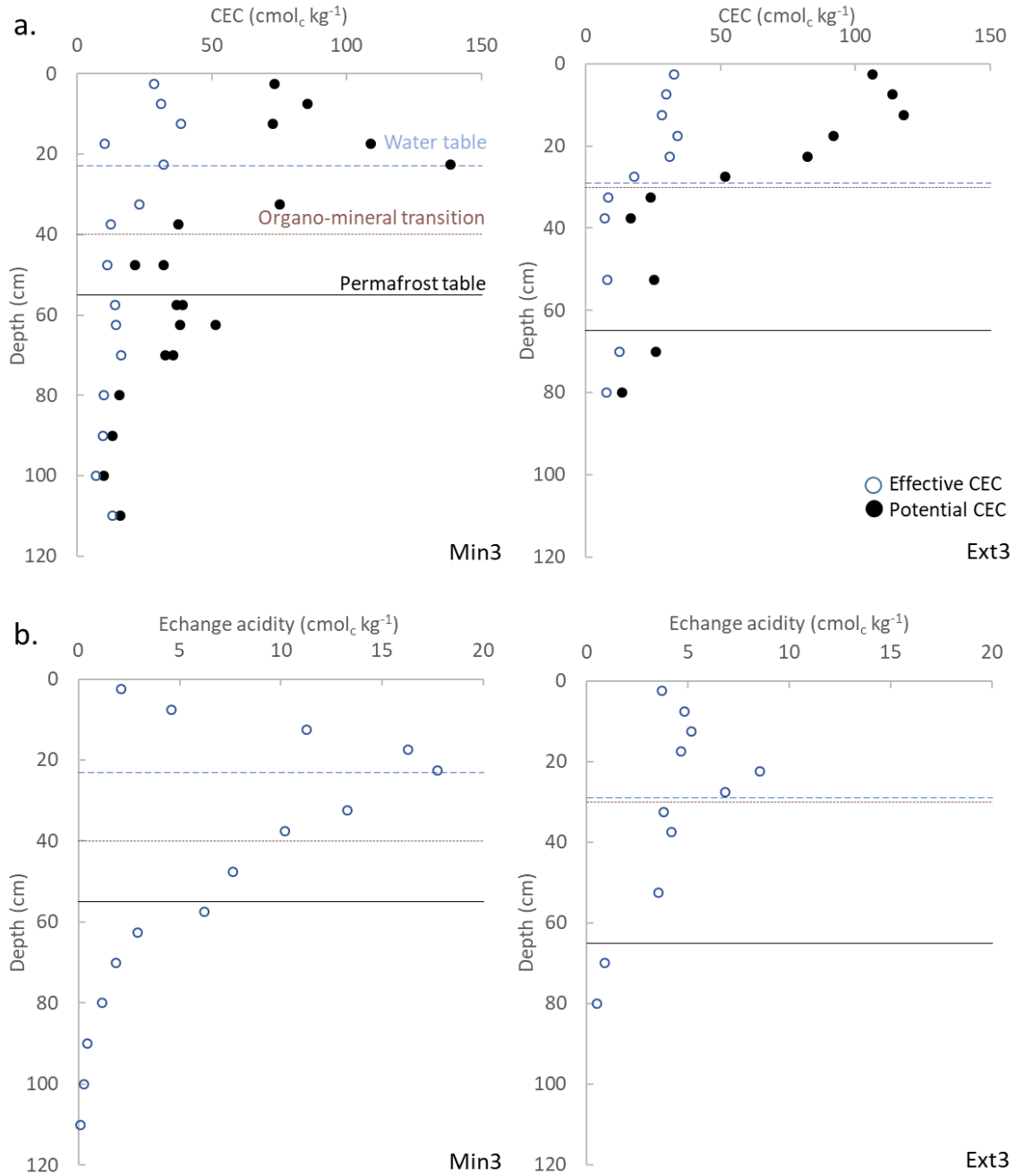


Figure S2: (a) Distribution of the effective (BaCl_2 extraction, method from Hendershot and Duquette, 1986) and the potential (NH_4Ac -extraction, method from Metson, 1956) cation exchange capacity (CEC). (b) Distribution of the exchange acidity ($\Sigma\text{Al}^{3+} + \text{H}^+$) with depth, for the poorly (Min3, $n = 15$) and highly (Ext3, $n = 11$) thawed permafrost soil profiles at the Gradient site (Eight Mile Lake, Interior Alaska, USA).

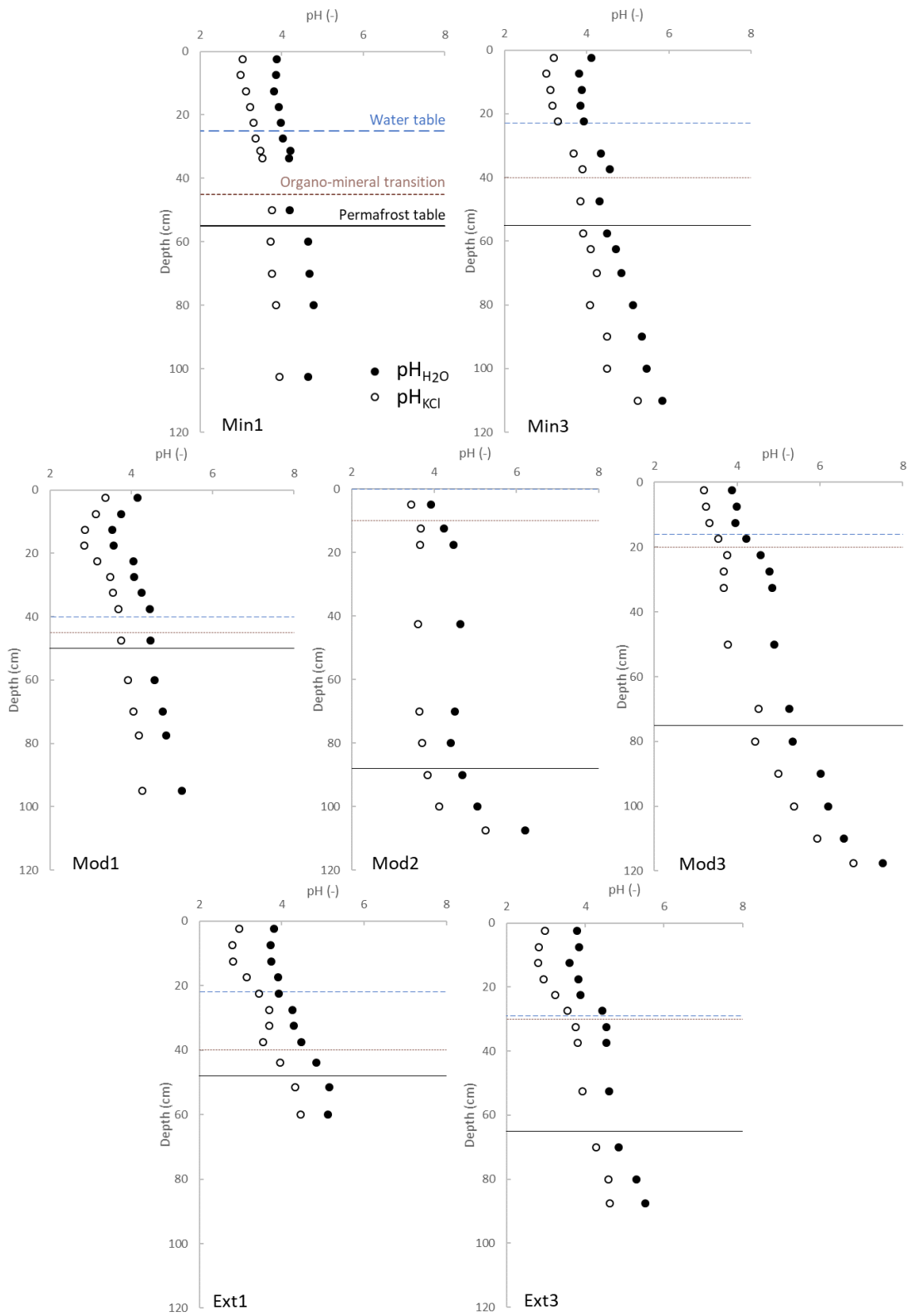


Figure S3: Evolution of pH_{H₂O} and pH_{KCl} with depth along the seven permafrost soil profiles (Min1, Min3, Mod1, Mod2, Mod3, Ext1, Ext3) at the Gradient site (Eight Mile Lake, Interior Alaska, USA).