

Meliadine Turf Transplant, Supplemental Info.

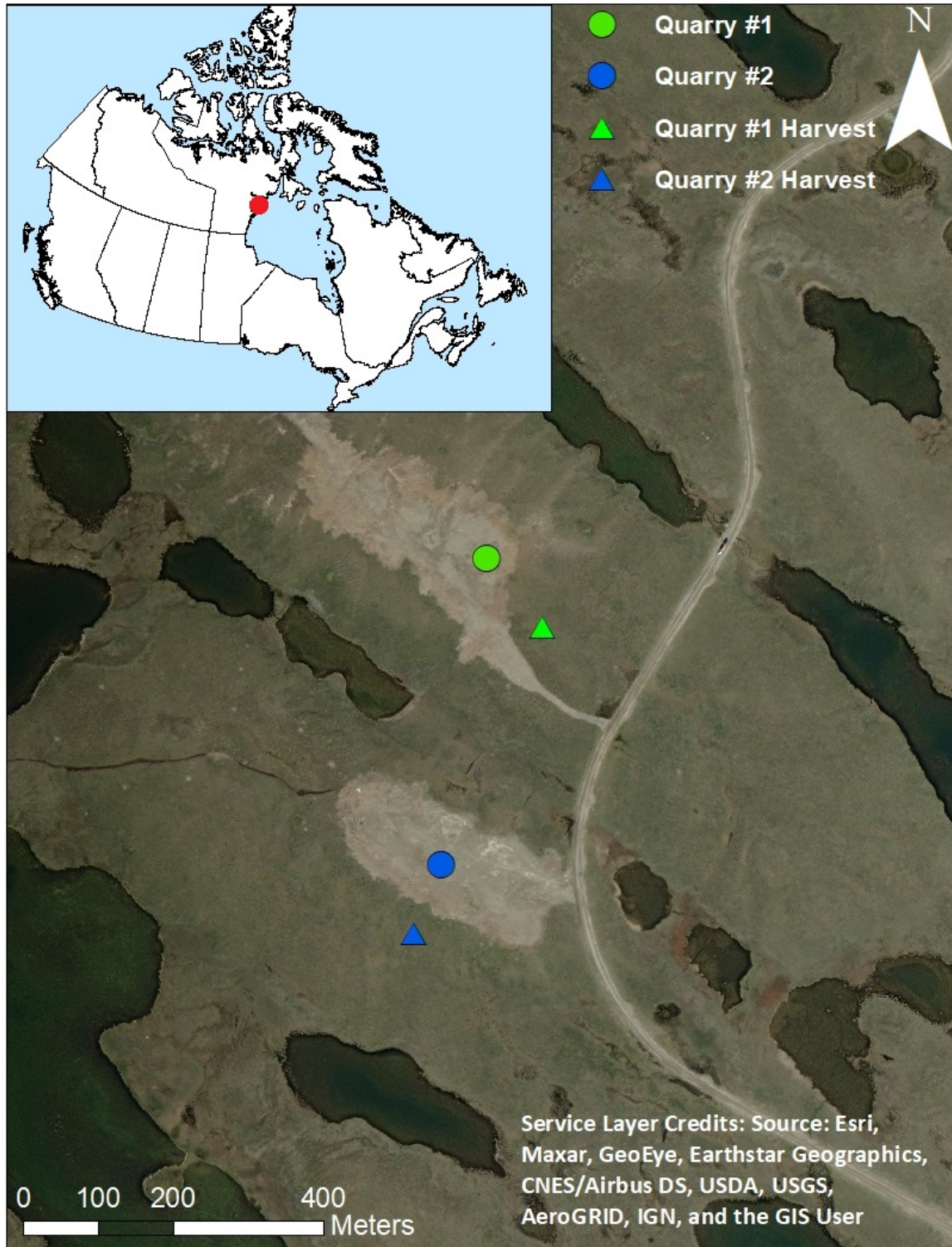


Figure S1: Location of the two restoration trials established in 2019, and associated harvesting/reference systems. Study sites are located near the coast of Hudson Bay, approximately 25 km northwest of Rankin Inlet, Nunavut, Canada (red circle).

Table S1: Depth values of organic and mineral layers across all turfs used at each restoration trial, and soil particle size fractions expressed as a percentage of weight, with contribution of soil separates expressed in parentheses. Soil separate fractions were analyzed using a Horiba LA950 Particle Size Analyzer (Japan). Depth of organic and mineral layer values are means with standard deviation (n = 20 turfs per site).

Site	Organic Depth (cm)	Mineral Depth (cm)	Clay	Silt	Sand	Gravel
Q1	7.0 ± 4.2	3.08 ± 3.52	0% (0%)	9% (12%)	64% (88%)	27%
Q2	9.1 ± 3.2	1.46 ± 2.10	0% (0%)	8% (16%)	45% (84%)	47%

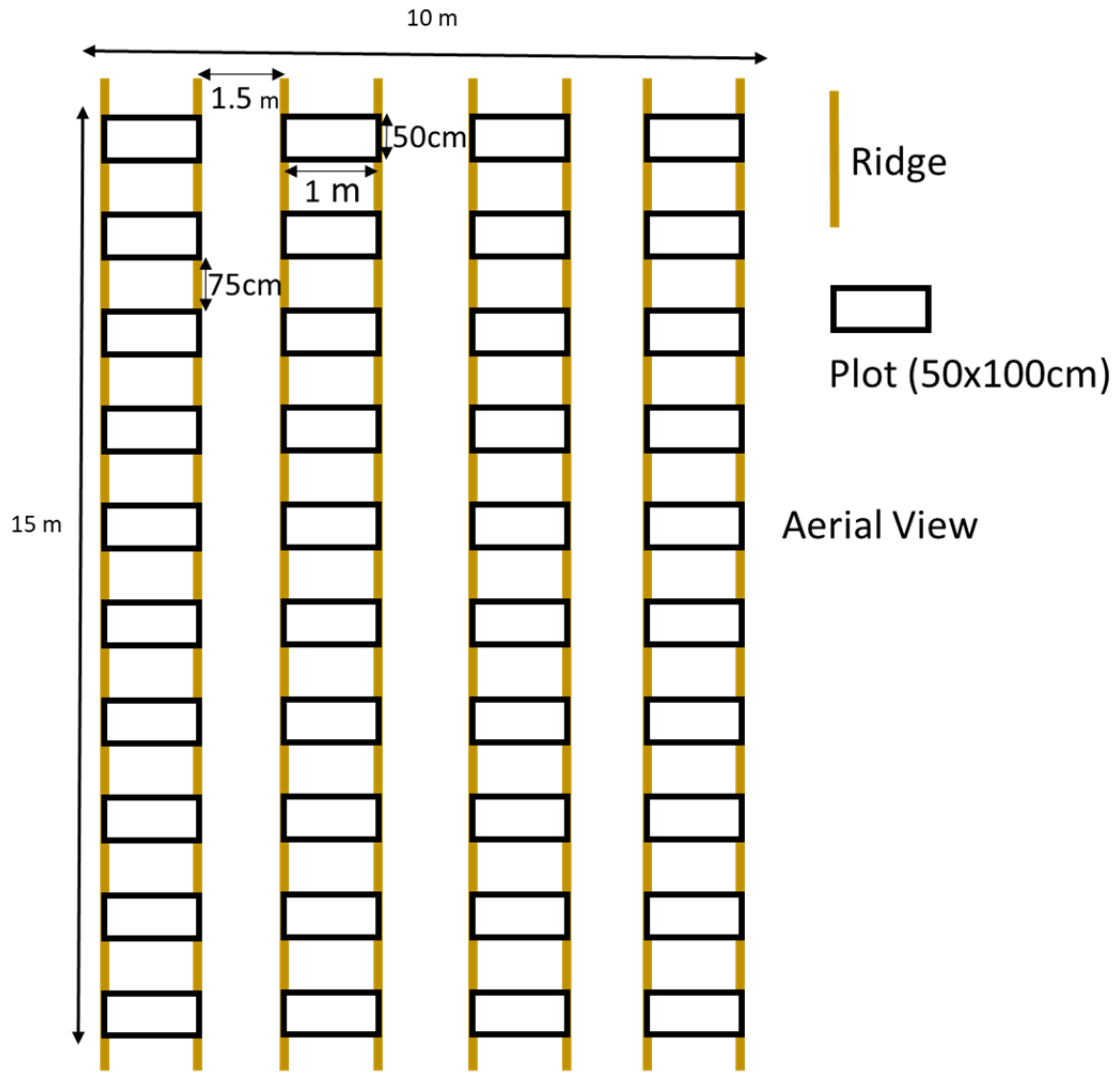


Figure S2: Conceptual diagram of the restoration trials created at Q1 and Q2. Each row contained ten plots (50 x 100 cm), separated by 0.75 m, for a total of 40 plots per site. Rows were separated by 1.5 m, with each hummock roughly 50 cm high. Treatments were placed in a randomized complete block design,

Table S2: Description, dimensions (length, width, depth) and diagram of the four treatments applied within the hollow-hummock plot.





Treatment	Description	Dimensions	Diagram
Turf (T)	Intact vegetative sod placed in bottom (center) of hollow	40 x 40 x ~10-15 cm	
Shredded (S)	Vegetative sods shredded and homogenized, spread over the entire plot	3000 cm ³ shredded material spread across plot at 2 cm depth	
Turfs + Shredded (TS)	Intact vegetative sod placed in bottom (center) of hollow and shredded material spread on hummock sides	40 x 40 x ~10-15 cm and 1800 cm ³ shredded material spread at a 2 cm depth	
Control (C)	Control plot	No material added	

Table S3: Results of Permutational Multivariate Analysis of Variation (PerMANOVA) analysis on all treatment's (Control, Turfs, Turfs + Shredded, and Shredded) community compositions following two years after treatment implementation, using block nested within site as random factors. Boldface indicates significance ($p = < 0.05$).

	Variable	df	Sum of Squares	Mean Squares	Pseudo-F	R ²	<i>p</i> -value
Treatment	Treatment	3	1.75	0.58	19.5	0.43	0.001
Community Composition	Residuals	76	2.28	0.03		0.57	
	Total	79	4.03			1.00	

Table S4: Summary output of linear mixed effect models including all treatments (test as a function of treatment, with block as a random factor) on species richness and cover of bare ground, vegetation, litter, and functional vegetative groups. Cover of deciduous and evergreen shrubs, forbs, graminoids, lichens and mosses were log transformed and vegetative cover square root transformed to meet statistical assumptions. Block was removed from the random error structure of biological soil crust (BSC) cover, due to singular fit errors. NumDf represents the numerator degrees of freedom, and DenDf represents the denominator degrees of freedom. Boldface indicates significance ($p = < 0.05$).

Cover/Variable	NumDf	DenDF	Sum of Squares	Mean Square	F-statistic	<i>p</i> -value
Species Richness	3	57	4890	1630	80.84	< 0.001
Bare ground	3	57	68903	22968	12.43	< 0.001
Total Vegetation	3	57	1698	566.1	143.3	< 0.001
Litter	3	57	354120	115040	117.48	< 0.001
Deciduous Shrubs	3	57	221.4	73.81	115.3	< 0.001
Evergreen Shrubs	3	57	192.6	64.19	118.6	< 0.001
Forbs	3	57	36.67	12.22	21.04	< 0.001
Graminoids	3	57	77.19	25.73	38.64	< 0.001
BSCs	3	N/A	0.70	0.23	1.69	0.177
Lichens	3	57	124.5	41.50	59.93	< 0.001
Mosses	3	57	56.79	18.93	21.96	< 0.001

Table S5: Means, standard deviations and significant difference indicators for all treatments on presence of flowers (i.e., number of quadrat cells containing flowering structures, per species). Significance groups determined through post-hoc comparisons of linear mixed effect models using block as a random factor.

Variable	Treatments			
	Turfs	Turfs + Shredded	Shredded	Control
Flower Density	13.8 ± 11.1 ^a	11.2 ± 16.3 ^a	1.2 ± 2.95 ^b	1.75 ± 4.76 ^b

Table S6: Summary output of linear mixed effect models including all treatments (test as a function of treatment, with block as a random factor) on flowering density. Flowering data was inverse transformed to meet statistical assumptions. NumDf represents the numerator degrees of freedom, and DenDf represents the denominator degrees of freedom. Boldface indicates significance ($p = < 0.05$).

Variable	NumDf	DenDF	Sum of Squares	Mean Square	F-statistic	<i>p</i> -value
Flower Density	3	57	7.06	2.35	26.05	< 0.001

Table S7: Means, standard deviations and significant differences on species richness, and cover of bare ground, vegetation, litter, and functional vegetative groups for Shredded treatments and shredded layers within Turf + Shredded treatments only. The term “bryophytes” was used in lieu of mosses, as all moss fragments were labelled as bryophytes during 2019. Significance groups determined through post-hoc comparisons of linear mixed effect models, using subject ID as a random factor.

Cover/Variable	2019	2021
Species Richness	11.6 ± 2.27 ^a	9.18 ± 4.88 ^b
Bare ground	96.0 ± 30.9 ^b	206 ± 51.8 ^a
Total Vegetation	97.6 ± 39.0 ^a	42.5 ± 29.3 ^b
Litter	220 ± 60.7 ^a	128 ± 51.5 ^b
Deciduous Shrub	7.5 ± 4.89 ^a	1.42 ± 3.31 ^b
Evergreen Shrub	15.6 ± 8.07 ^a	1.5 ± 3.18 ^b
Forb	0.40 ± 0.74 ^b	7.35 ± 8.63 ^a
Graminoid	3.05 ± 3.71 ^a	2.88 ± 2.67 ^a
Bryophyte	17.2 ± 13.5 ^a	6.3 ± 8.86 ^b
Lichen	53.8 ± 22.3 ^a	23.0 ± 18.5 ^b

Table S8: Summary output of linear mixed effect models (test as a function of year, with subject ID as a random factor) on species richness, and cover of bare ground, vegetation, litter, and functional vegetative groups within Shredded treatments and shredded layers within Turf + Shredded treatments only. Cover of evergreen shrubs, deciduous shrubs, and bryophytes were log transformed, and forb cover inverse transformed to meet statistical assumptions. Subject ID was removed from the random error structure of graminoid cover, due to singular fit errors. NumDf represents the numerator degrees of freedom, and DenDf represents the denominator degrees of freedom. Boldface indicates significance ($p < 0.05$).

Cover/Variable	dfNum	dfDen	Sum of Squares	Mean Square	F-statistic	<i>p</i> -value
Species Richness	1	39	117.61	117.61	9.91	0.003
Bare ground	1	39	239915	239915	167.1	< 0.001
Total Vegetation	1	39	60720	60720	72.68	< 0.001
Litter	1	39	172051	172051	226.96	< 0.001
Deciduous Shrub	1	39	44.56	44.56	86.29	< 0.001
Evergreen Shrub	1	39	89.03	89.03	167.69	< 0.001
Forb	1	39	5.70	5.70	64.60	< 0.001
Graminoid	1	N/A	0.61	0.61	0.06	0.810
Bryophyte	1	39	25.17	25.17	57.58	< 0.001
Lichen	1	39	18911	18911	70.92	< 0.001

Table S9: Permutational Multivariate Analysis of Variation (PerMANOVA) analysis on community composition of turfs only (including turfs of Turf and Turf + Shredded treatments) two years after treatment implementation, using a unique subject ID for each plot as a random factor. Boldface indicates significance ($p = < 0.05$).

	Variable	df	Sum of Squares	Mean Squares	Pseudo-F	R ²	<i>p</i> -value
Plot	Year	1	2.00	2.00	14.97	0.16	0.001
Community Composition	Residuals	76	10.44	0.13		0.83	
	Total	79	12.44			1.00	

Table S10: Means, standard deviations and significant differences on species richness, and cover of bare ground, vegetation, litter, and functional vegetative groups for turfs only (including turfs of Turf and Turf + Shredded treatments). Significance groups determined through post-hoc comparisons of linear mixed effect models, using subject ID as a random factor.

Cover/Variable	2019	2021
Species Richness	19.6 ± 3.4 ^a	18.0 ± 4.9 ^a
Bare ground	15.8 ± 11.4 ^b	28.8 ± 18.9 ^a
Total Vegetation	180 ± 24.7 ^a	153 ± 54.1 ^b
Litter	11.3 ± 7.5 ^b	47.6 ± 17.5 ^a
Deciduous Shrub	34.5 ± 12.9 ^a	34.0 ± 18.9 ^a
Evergreen Shrub	45.6 ± 14.4 ^a	31.4 ± 19.4 ^b
Forb	7.02 ± 7.27 ^b	12.9 ± 12.1 ^a
Graminoid	8.8 ± 8.8 ^b	14.3 ± 11.4 ^a
BSC	0.9 ± 1.9 ^a	0.28 ± 0.78 ^a
Lichen	66.2 ± 24.9 ^a	47.0 ± 31.6 ^b
Moss	16.6 ± 13.6 ^a	13.4 ± 12.9 ^b

Table S11: Summary output of linear mixed effect models (test as a function of treatment, with subject ID as a random factor) on species richness, and cover of bare ground, vegetation, litter, and functional vegetative groups for turfs only (including turfs of Turf and Turf + Shredded treatments). Cover of bare ground, litter, BSC, forbs and graminoids were square root transformed and total vegetation log transformed to meet statistical assumptions. Subject ID was removed from the BSC cover random error structure due to singular fit errors. NumDf represents the numerator degrees of freedom, and DenDf represents the denominator degrees of freedom. Boldface indicates significance ($p = < 0.05$).

Cover/Variable	dfNum	dfDen	Sum of Sq	Mean Sq	F-statistic	<i>p</i> -value
Species Richness	1	39	51.2	51.2	3.87	0.056
Bare ground	1	39	35.98	35.98	27.87	< 0.001
Total Vegetation	1	39	1.09	1.09	12.63	< 0.001
Litter	1	39	248.6	248.6	202.28	< 0.001
Deciduous Shrub	1	39	5.00	5.00	0.05	0.832
Evergreen Shrub	1	39	4047	4047	31.04	< 0.001
Forb	1	39	14.03	14.03	14.90	< 0.001
Graminoid	1	39	10.90	10.90	24.22	< 0.001
BSC	1	N/A	0.56	0.56	3.24	0.076
Lichen	1	39	7334	7334	32.96	< 0.001
Moss	1	39	201.61	201.61	7.04	0.012

Table S12: Means, standard deviations and significant difference indicators for both sites and both years on species richness, and cover of bare ground, vegetation, litter, and functional vegetative groups for turfs only (including turfs of Turf and Turf + Shredded treatments). Significance groups determined through post-hoc comparisons of linear mixed effect models, using Subject ID as a random factor. Total vegetation did not meet model assumptions, and so significance indicators are not presented.

Year	2019		2021	
	Quarry 1	Quarry 2	Quarry 1	Quarry 2
Species Richness	18.4 ± 3.9 ^a	20.7 ± 2.4 ^a	17.3 ± 5.9 ^a	18.6 ± 3.6 ^a
Bare ground	16.0 ± 12.7 ^{bc}	15.5 ± 10.3 ^c	31.0 ± 21.1 ^a	26.6 ± 16.7 ^{ab}
Total Vegetation	175 ± 26.0 ^a	184 ± 23.1 ^a	145 ± 67.4 ^b	161 ± 36.5 ^{ab}
Litter	8.8 ± 6.5 ^b	13.8 ± 7.7 ^b	47.2 ± 21.5 ^a	47.9 ± 12.9 ^a
Deciduous Shrub	27.8 ± 11.9 ^b	41.2 ± 10.3 ^a	23.3 ± 18.3 ^b	44.7 ± 12.4 ^a
Evergreen Shrub	43.8 ± 14.9 ^{ab}	47.5 ± 14.0 ^a	28.0 ± 21.3 ^c	34.8 ± 17.1 ^{bc}
Forb	4.1 ± 5.1 ^b	10.0 ± 8.0 ^{ab}	11.4 ± 13.8 ^a	14.3 ± 10.3 ^a
Graminoid	8.2 ± 7.9 ^b	9.4 ± 7.9 ^{ab}	16.0 ± 13.7 ^a	12.6 ± 8.36 ^{ab}
BSC	1.1 ± 2.3 ^a	0.7 ± 1.4 ^a	1.35 ± 2.6 ^a	0.9 ± 1.68 ^a
Lichen	78.5 ± 24.5 ^a	53.8 ± 18.7 ^b	59.6 ± 30.9 ^b	34.4 ± 27.4 ^c
Moss	11.8 ± 11.3 ^a	21.5 ± 14.2 ^a	6.4 ± 9.8 ^b	20.5 ± 11.9 ^a

Table S13: Summary output of linear mixed effect models (test as a function of year, site and their interaction, using Subject ID as a random factor) on species richness, and cover of bare ground, litter, and functional vegetative groups for turfs only (including turfs of Turf and Turf + Shredded treatments). Cover of bare ground, litter, BSC, forbs and graminoids were square root transformed and total vegetation log transformed to meet statistical assumptions. Subject ID was removed from the BSC cover random error structure due to singular fit errors. dfNum indicates degrees of freedom numerator, dfDen indicates degrees of freedom denominator. Sum of Sq indicates sum of squares, Mean sq indicates the mean squares. Boldface indicates significant differences ($p < 0.05$).

Cover/Variable	Factor	dfNum	dfDen	Sum of Squares	Mean Square	F-statistic	<i>p</i> -value
Species Richness	Year	1	38	51.20	51.20	3.80	0.059
	Site	1	38	41.86	41.86	3.11	0.086
	Year:Site	1	38	4.05	4.05	0.30	0.587
Bare ground	Year	1	38	35.98	35.98	27.64	< 0.001
	Site	1	38	0.19	0.19	0.15	0.705
	Year:Site	1	38	0.87	0.87	0.67	0.418
Total Vegetation	Year	1	38	1.09	1.09	13.48	< 0.001
	Site	1	38	0.21	0.21	2.59	0.116
	Year:Site	1	38	0.15	0.15	1.84	0.184
Litter	Year	1	38	248.56	248.56	205.11	< 0.001
	Site	1	38	2.81	2.81	2.32	0.136
	Year:Site	1	38	1.87	1.87	1.55	0.221
Deciduous Shrub	Year	1	38	5.00	5.00	0.05	0.827
	Site	1	38	2360.07	2360.07	22.77	< 0.001
	Year:Site	1	38	328.05	328.05	3.17	0.083
Evergreen Shrub	Year	1	38	4047.00	4047.00	30.54	< 0.001
	Site	1	38	163.80	163.80	1.24	0.273
	Year:Site	1	38	49.60	49.60	0.37	0.544
Forb	Year	1	38	14.03	14.03	15.07	< 0.001
	Site	1	38	4.23	4.23	4.54	0.040
	Year:Site	1	38	1.36	1.36	1.47	0.233
Graminoid	Year	1	38	10.90	10.90	25.04	< 0.001
	Site	1	38	0.01	0.01	0.01	0.930
	Year:Site	1	38	1.01	1.01	2.32	0.136

BSC	Year	1	N/A	0.56	0.56	3.19	0.078
	Site	1	N/A	0.18	0.18	1.00	0.321
	Year:Site	1	N/A	0.01	0.01	0.04	0.827
Lichen	Year	1	38	7334.40	7334.40	32.12	< 0.001
	Site	1	38	2797.80	2797.80	11.37	0.002
	Year:Site	1	38	1.80	1.80	0.01	0.930
Moss	Year	1	38	201.61	201.61	7.49	0.009
	Site	1	38	299.30	299.30	11.13	0.002
	Year:Site	1	38	94.61	94.61	3.52	0.068

Table S14: Summary output of linear mixed effect models (test as a function of treatment, distance and the interaction, with block as random factors) on vascular and non-vascular cover expanding from the central plot of all treatments. Both vascular and non-vascular cover were log-transformed to meet statistical assumptions. NumDf represents the numerator degrees of freedom, and DenDf represents the denominator degrees of freedom. Boldface indicates significance ($p = < 0.05$).

Cover	Variable	dfNum	dfDen	Sum of Squares	Mean Square	F-statistic	<i>p</i> -value
Vascular	Treatment	3	209	28.16	9.39	20.79	< 0.001
	Distance	2	209	37.47	18.74	41.50	< 0.001
	Treatment: Distance	6	209	20.79	3.47	7.67	< 0.001
Non-vascular	Treatment	3	209	11.25	3.75	10.60	< 0.001
	Distance	2	209	11.66	5.83	16.50	< 0.001
	Treatment: Distance	6	209	2.22	0.37	1.05	0.397

Table S15: Summary output of linear models (test as a function of distance) on bare ground, litter, vascular and non-vascular cover and non-vascular cover expanding from the central plot of Turf and Turf + Shredded treatments. Litter cover was log transformed and vascular and non-vascular cover was square root transformed to meet statistical assumptions. Boldface indicates significance ($p = < 0.05$).

Cover	Variable	df	Sum of Squares	Mean Squares	F-Statistic	<i>p</i> -value
Bare ground	Distance	2	465.62	232.81	10.25	< 0.001
	Residuals	117	2657.85	22.72		
Litter	Distance	2	18.73	9.36	11.00	< 0.001
	Residuals	117	99.61	0.85		
Vascular	Distance	2	56.29	28.15	32.36	< 0.001
	Residuals	117	101.77	0.87		
Non-vascular	Distance	2	11.04	5.52	8.41	< 0.001
	Residuals	117	76.83	0.66		

Table S16: Mean relative cover and standard deviation of functional vegetative groups across all harvest plots (n = 46) in 2021. Relative cover was calculated as: cover of functional group/total cover of all functional groups.

Cover	Relative cover and standard deviation
Deciduous Shrub	11.7% ± 5.9%
Evergreen Shrub	14.3% ± 7.5%
Forb	9.4% ± 5.6%
Graminoid	6.0% ± 5.0%
BSC	0.2% ± 1.4%
Lichen	28.9% ± 12.1%
Moss	10.7% ± 9.8%

Table S17: Means, standard deviations, and significance indicators for pH, and concentrations of chloride, sulfate, nitrate, sodium, ammonium, potassium, magnesium, calcium, total organic nitrogen, total inorganic nitrogen, total organic carbon, and total inorganic carbon within the turf harvesting locations (in 2019 and 2021), turfs within Turf and Turf + Shredded center plots, and substrates used at each site, separated by soil layer and site. TON, TOC, and TIC are presented as g/kg, with all other values aside from pH presented as mg/kg. Significance indicators are presented as differences between harvesting locations and turfs, within each soil layer, and within each site. Unless stated within parentheses, sample numbers were n = 10 for all harvesting sites (except for the mineral layer in Quarry #2, where only 9 samples were obtained in 2019), and n = 20 for all turfs in 2021. Total organic and inorganic carbon each contained n = 5 samples for each harvest site and turf. Only one composite sample of Quarry #1's substrate was obtained in 2019, and two composite samples for Quarry #2, due to different materials used to create the hummock-hollow microtopography.

Soil Layer	Site	Treatment	pH	Cl ⁻	SO ₄ ²⁻	NO ₃ ⁻	Na ⁺	NH ₄ ⁺	K ⁺	Mg ²⁺	Ca ²⁺	TON	TIN	TOC	TIC
Organic	Q1	H-19	5.8 ± 0.4 ^{ab}	35 ± 22 ^b	86 ± 93 ^a	2.5 ± 1.4 (9) ^{ab}	23 ± 12 ^b	4.2 ± 4.0 ^a	27 ± 13 ^a	15 ± 12 ^a	77 ± 73 ^b	11 ± 7.3 ^a	6.5 ± 3.9 ^a	171 ± 52 ^a	1.3 ± 0.67 ^a
		H-21	5.3 ± 1.0 ^b	52 ± 42 ^b	100 ± 114 ^a	0.29 ± 0.59 ^b	13 ± 11 ^b	9.2 ± 9.2 ^a	63 ± 43 ^a	16 ± 13 ^a	108 ± 85 ^{ab}	12 ± 7.2 ^a	9.5 ± 9.2 ^a	254 ± 112 ^a	1.8 ± 1.5 ^a
		T-21	6.3 ± 0.5 ^a	813 ± 1031 ^a	430 ± 478 ^a	15 ± 20 ^a	439 ± 670 ^a	6.7 ± 5.5 (16) ^a	52 ± 36 ^a	58 ± 91 ^a	291 ± 280 ^a	4.9 ± 2.6 ^b	24 ± 25 ^a	123 ± 65 ^a	1.2 ± 0.49 ^a
	Q2	H-19	6.2 ± 0.3 ^b	32 ± 15 ^b	53 ± 31 ^b	6.1 ± 2.8 (9) ^a	24 ± 7.4 ^b	4.9 ± 9.4 ^b	57 ± 42 ^a	24 ± 11 ^a	152 ± 65 ^b	15 ± 6.3 ^a	11 ± 11 ^b	250 ± 38 ^a	2.6 ± 0.55 ^a
		H-21	6.4 ± 0.3 ^{ab}	53 ± 40 ^b	45 ± 16 ^b	3.1 ± 4.1 ^b	35 ± 71 ^b	18 ± 11 (8) ^a	51 ± 18 ^a	12 ± 4.2 ^b	119 ± 32 ^b	17 ± 5.2 ^a	18 ± 11 ^{ab}	334 ± 73 ^a	3.0 ± 1.2 ^a
		T-21	6.5 ± 0.3 ^a	151 ± 215 ^a	492 ± 280 ^a	0.38 ± 1.2 ^c	152 ± 124 ^a	20 ± 8.7 ^a	69 ± 28 ^a	30 ± 15 ^a	245 ± 141 ^a	13 ± 3.5 ^a	21 ± 8.5 ^a	279 ± 70 ^a	2.8 ± 0.84 ^a
Mineral	Q1	H-19	6.5 ± 0.4 ^b	4.2 ± 1.6 ^b	11 ± 11 ^b	0.61 ± 0.30 (7) ^b	5.5 ± 1.7 ^b	0.27 ± 0.57 ^b	0.69 ± 0.94 ^b	3.7 ± 2.0 ^b	22 ± 12 ^b	0.70 ± 0.36 ^a	0.70 ± 0.63 ^b	11 ± 5.3 ^a	0 ± 0 ^b
		H-21	5.4 ± 0.6 ^c	6.5 ± 6.7 ^b	14 ± 13 ^b	0.41 ± 1.3 ^b	0.30 ± 0.81 ^c	1.4 ± 1.2 ^a	5.2 ± 7.6 ^b	2.5 ± 1.2 ^b	21 ± 13 ^b	1.6 ± 1.4 ^a	1.8 ± 2.2 ^b	16 ± 18 ^a	0.12 ± 0.27 ^b
		T-21	7.2 ± 0.4 ^a	156 ± 113 ^a	143 ± 93 ^a	8.8 ± 6.6 ^a	101 ± 83 ^a	0.31 ± 0.09 (3) ^{ab}	9.3 ± 4.6 ^a	13 ± 8.2 (19) ^a	82 ± 34 (19) ^a	0.8 ± 0.4 ^a	8.9 ± 6.6 ^a	14 ± 8.5 ^a	1.5 ± 0.61 ^a
	Q2	Q1	7.0	10	20	17	10	0	1.6	5.1	41	0.95	17	17	0.90
		H-19	6.8 ± 0.2 ^b	2.9 ± 2.1 ^c	10 ± 4.8 ^b	1.3 ± 1.1 (5) ^a	8.1 ± 1.5 ^b	0.02 ± 0.05 ^c	0.25 ± 0.74 ^b	4.9 ± 1.7 ^{ab}	36 ± 11 ^b	0.83 ± 0.43 ^{ab}	0.73 ± 1.1 ^b	13 ± 7.4 ^b	0.10 ± 0.22 ^b
		H-21	6.2 ± 0.4 ^c	8.1 ± 6.5 ^b	11 ± 7.9 ^b	0.99 ± 1.7 ^a	1.1 ± 2.2 ^c	2.3 ± 2.0 (6) ^a	4.6 ± 6.9 ^{ab}	2.7 ± 1.4 ^b	30 ± 15 ^b	0.17 ± 0.15 ^a	2.4 ± 2.9 ^{ab}	44 ± 30 ^a	0.48 ± 0.48 ^b
		T-21	7.7 ± 0.2 ^a	26 ± 27 ^a	111 ± 125 ^a	3.3 ± 3.5 ^a	34 ± 25 ^a	0.72 ± 0.49 (17) ^b	9.9 ± 9.2 ^a	8.1 ± 4.4 ^a	89 ± 60 ^a	0.51 ± 0.32 ^b	3.9 ± 3.5 ^a	8.0 ± 3.1 ^b	1.8 ± 0.48 ^a
		Q2	7.6 ± 0.4	19 ± 27	111 ± 149	4.8 ± 3.5	26 ± 33	0.80 ± 1.1	0 ± 0	9.0 ± 5.6	79 ± 60	0.23 ± 0.32	2.0 ± 2.8	4.7 ± 1.3	1.8 ± 1.6

Table S18: Summary output of linear models on pH, concentrations of chloride, sulfate, nitrate, sodium, ammonium, potassium, magnesium, calcium, total organic nitrogen, total inorganic nitrogen, total organic carbon, and total inorganic carbon within the turf harvesting locations (in 2019 and 2021) and turfs within Turf and Turf + Shredded center plots, separated by soil layer and site. Cl^- , SO_4^{2-} , NO_3^- , Na^+ , NH_4^+ (mineral, Q1 organic), Mg^{2+} (organic), Ca^{2+} (organic), TIN (mineral), TON (mineral, Q1 organic), and TOC (mineral) were log-transformed, and K^+ , Mg^{2+} (mineral), and TON (Q1 organic) were square root-transformed to meet statistical assumptions. Boldface indicates significance ($p < 0.05$).

Nutrient/ ion	Soil Layer	Site	Variable	df	Sum of Squares	Mean Squares	F- Statistic	<i>p</i> - value
pH	Organic	Q1	Treatment	2	5.71	2.85	7.23	0.002
			Residuals	37	14.61	0.39		
		Q2	Treatment	2	0.59	0.29	4.36	0.020
			Residuals	37	2.50	0.07		
	Mineral	Q1	Treatment	2	21.02	10.51	48.75	< 0.001
			Residuals	37	7.98	0.21		
		Q2	Treatment	2	16.07	8.04	114.09	< 0.001
			Residuals	37	2.54	0.07		
Cl^-	Organic	Q1	Treatment	2	58.18	29.09	17.80	< 0.001
			Residuals	37	60.47	1.63		
		Q2	Treatment	2	11.39	5.69	11.21	< 0.001
			Residuals	37	18.80	0.51		
	Mineral	Q1	Treatment	2	99.56	49.78	74.52	< 0.001
			Residuals	37	24.72	0.67		
		Q2	Treatment	2	21.83	10.91	20.29	< 0.001
			Residuals	36	19.36	0.54		
SO_4^{2-}	Organic	Q1	Treatment	2	11.64	5.82	1.84	0.172
			Residuals	37	116.50	3.15		
		Q2	Treatment	2	50.81	25.40	82.46	< 0.001
			Residuals	37	11.40	0.31		
	Mineral	Q1	Treatment	2	63.36	31.68	30.27	< 0.001
			Residuals	37	38.72	1.05		
		Q2	Treatment	2	45.62	22.81	40.32	< 0.001
			Residuals	36	20.37	0.57		
NO_3^-	Organic	Q1	Treatment	2	18.58	9.29	6.92	0.003
			Residuals	36	46.34	1.34		
		Q2	Treatment	2	18.69	9.35	22.19	< 0.001
			Residuals	36	15.16	0.42		
	Mineral	Q1	Treatment	2	28.20	14.10	31.64	< 0.001
			Residuals	34	15.15	0.45		
		Q2	Treatment	2	3.26	1.63	2.86	0.072
			Residuals	32	18.23	0.57		
Na^+	Organic	Q1	Treatment	2	56.39	28.20	16.59	< 0.001
			Residuals	37	62.90	1.70		

		Q2	Treatment	2	30.61	15.31	24.96	< 0.001
			Residuals	37	22.70	0.61		
	Mineral	Q1	Treatment	2	104.17	52.08	40.77	< 0.001
			Residuals	37	47.27	1.28		
		Q2	Treatment	2	55.65	27.83	73.31	< 0.001
			Residuals	36	13.66	0.38		
NH ₄ ⁺	Organic	Q1	Treatment	2	2.87	1.44	2.08	0.141
			Residuals	33	22.81	0.69		
		Q2	Treatment	2	1564	782.2	8.69	< 0.001
			Residuals	35	3150	90.00		
	Mineral	Q1	Treatment	2	2.02	1.01	7.04	0.005
			Residuals	20	2.87	0.14		
		Q2	Treatment	2	3.72	1.86	17.18	< 0.001
			Residuals	29	3.14	0.11		
K ⁺	Organic	Q1	Treatment	2	29.18	14.59	2.57	0.091
			Residuals	37	210.45	5.69		
		Q2	Treatment	2	2390	1195	1.33	0.277
			Residuals	37	33271	899.2		
	Mineral	Q1	Treatment	2	23.39	11.70	13.62	< 0.001
			Residuals	37	31.78	0.86		
		Q2	Treatment	2	25.51	12.75	10.62	< 0.001
			Residuals	36	43.23	1.20		
Mg ²⁺	Organic	Q1	Treatment	2	6.42	3.21	2.82	0.073
			Residuals	37	42.19	1.14		
		Q2	Treatment	2	4.69	2.34	15.61	< 0.001
			Residuals	37	5.56	0.15		
	Mineral	Q1	Treatment	2	27.08	13.54	17.93	< 0.001
			Residuals	36	27.19	0.76		
		Q2	Treatment	2	7.34	3.67	9.64	< 0.001
			Residuals	36	13.71	0.38		
Ca ²⁺	Organic	Q1	Treatment	2	12.74	6.37	6.08	0.005
			Residuals	37	38.80	1.05		
		Q2	Treatment	2	3.29	1.65	10.36	< 0.001
			Residuals	37	5.88	0.16		
	Mineral	Q1	Treatment	2	174.3	87.15	22.96	< 0.001
			Residuals	36	136.7	3.80		
		Q2	Treatment	2	110.2	55.08	9.86	< 0.001
			Residuals	36	201.2	5.59		
TON	Organic	Q1	Treatment	2	11566	5783	6.57	0.011
			Residuals	37	32557	879.9		
		Q2	Treatment	2	8.30x10 ⁷	4.15x10 ⁷	1.83	0.175
			Residuals	37	8.40x10 ⁸	2.27x10 ⁷		
	Mineral	Q1	Treatment	2	1.84	0.92	2.06	0.142
			Residuals	37	16.49	0.45		
		Q2	Treatment	2	7.62	3.81	6.10	0.005

			Residuals	36	22.48	0.62		
TIN	Organic	Q1	Treatment	2	4.64	2.32	2.21	0.124
			Residuals	37	38.88	1.05		
	Q2	Treatment	2	690.1	345.1	3.70	0.034	
		Residuals	37	3455	93.37			
	Mineral	Q1	Treatment	2	19.43	9.71	21.49	< 0.001
			Residuals	37	16.72	0.45		
Q2		Treatment	2	5.43	2.71	5.31	0.010	
		Residuals	36	18.41	0.51			
TOC	Organic	Q1	Treatment	2	4.34x10 ¹⁰	2.17x10 ¹⁰	3.37	0.069
			Residuals	12	7.72x10 ¹⁰	6.44x10 ⁹		
		Q2	Treatment	2	1.79x10 ¹⁰	8.94x10 ⁹	2.29	0.144
			Residuals	12	4.69x10 ¹⁰	3.91x10 ⁹		
	Mineral	Q1	Treatment	2	0.14	0.07	0.15	0.861
			Residuals	12	5.68	0.47		
Q2		Treatment	2	6.26	3.13	8.01	0.006	
		Residuals	12	4.69	0.39			
TIC	Organic	Q1	Treatment	2	1.03x10 ⁶	5.17x10 ⁵	0.54	0.599
			Residuals	12	1.16x10 ⁷	9.65x10 ⁵		
		Q2	Treatment	2	4.00x10 ⁵	2.00x10 ⁵	0.24	0.790
			Residuals	12	1.00x10 ⁷	8.33x10 ⁵		
	Mineral	Q1	Treatment	2	7.03x10 ⁶	3.51x10 ⁶	23.92	< 0.001
			Residuals	12	1.76x10 ⁶	1.47x10 ⁵		
Q2		Treatment	2	7.92x10 ⁶	3.96x10 ⁶	23.47	< 0.001	
		Residuals	12	2.02x10 ⁶	1.68x10 ⁵			