Plant species diversity and dominant plant functional types control productivity in a reclaimed mineland prairie

Supplemental Material

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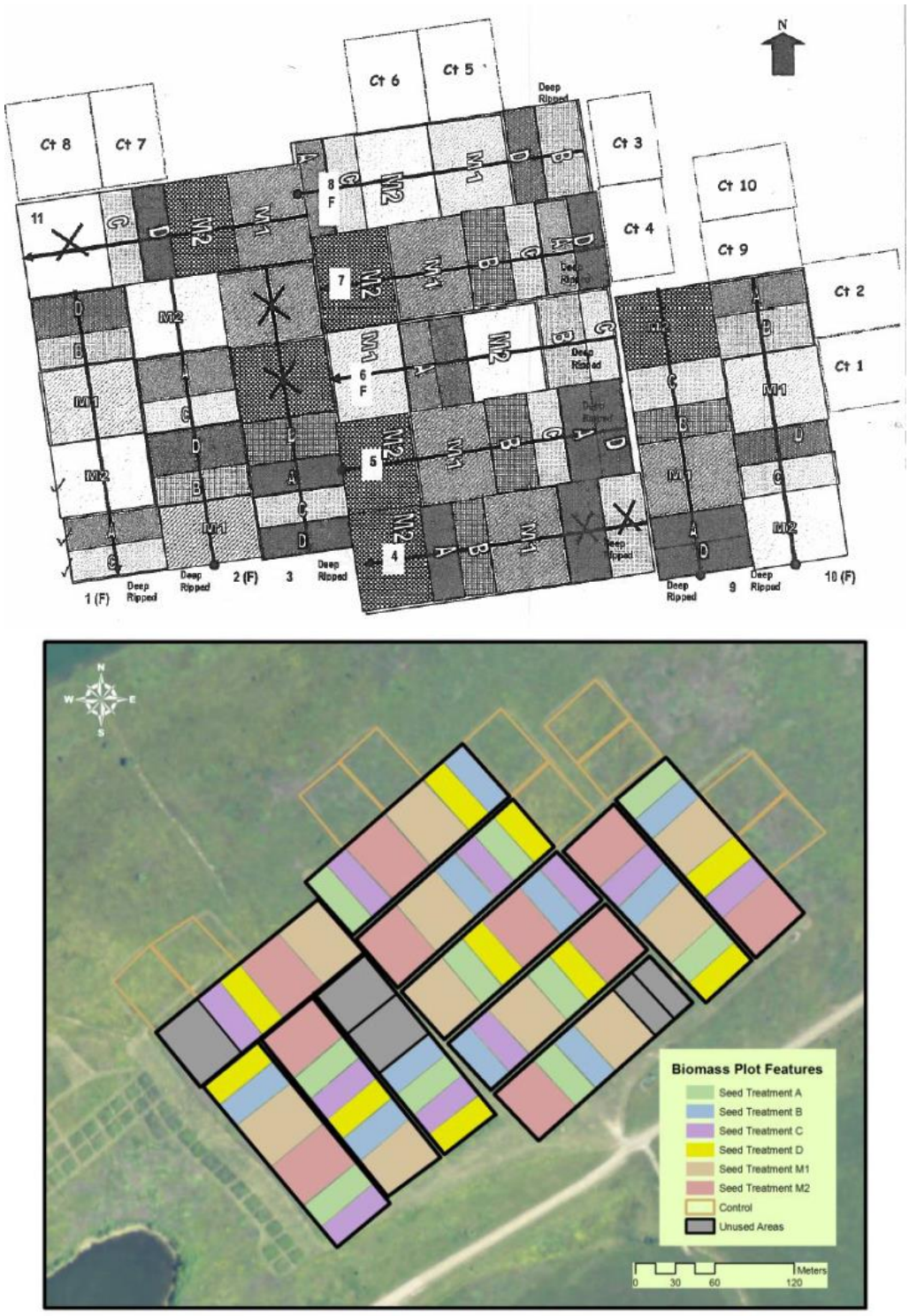


Figure S1: Original experimental design map (top) showing the distribution of tillage, fertilization and seeding treatments across the site; and a colourized version of showing the seed treatments. The map does not show individual plot replicates (Table S1) but rather the area covered by each treatment within a block. Unused areas were rejected during establishment due to anomalous conditions (e.g. standing water). Control plots were not considered in the current study.



File Edit Plot Help

Author GMD Site ABER Date 27/08/02 Help

Dataset name ABER 2, Tall Cv + Vm

Edit grid Calculate from moss surface Force top of canopy Graph Biomass labels Saved grid

Stick no	1
Band wid	10
Veg type	
Top sp	
Moss dep	0
All obs	0
Part obs	0
Max ht	0
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	
O	
P	

Stick no	Mean(SD)	1	2	3	4	5	6	7	8	9
Band wid		10	10	10	10	10	10	10	10	10
Veg type		Cv	Cv	Cv	Cv	Cv	Cv	Cv	Cv	Cv
Top sp		Cv	Cv	Cv	Cv	Cv	Cv	Cv	Cv	Cv
Moss dep	10.0 (2.5)	10	10	10	15	10	5	10	10	10
All obs	12.2 (8.3)	20	20	20	10	10	0	20	10	0
Part obs	53.3 (12.2)	70	60	60	50	60	50	30	60	40
Max ht	46.9 (11.8)	62	40	51	40	61	50	35	55	28
10% h	28.10 (9.81)	42.78	35.99	33.02	21.69	25.33	31.04	16.62	33.96	12.48
50% h	17.32 (8.65)	31.27	28.73	21.22	14.48	11.14	13.52	8.94	20.18	6.39
Volume	16.44 (8.43)	30.20	28.66	21.18	14.48	11.06	13.76	9.16	13.16	6.28
Intercept	3.188 (2.474)	4.5656	8.4683	3.8941	4.4016	1.2911	1.2247	2.5562	0.4383	1.8511
Slope	-0.205 (0.096)	-0.1508	-0.2951	-0.1843	-0.3040	-0.1375	-0.1066	-0.2861	-0.0668	-0.3155
A		100	100	100	100	100	50	100	100	99
B		100	100	100	99	60	75	100	75	35
C		95	99	75	75	30	50	15	10	1
D		40	55	30	15	25	10		10	1
E		25	15	10	1	1	5		40	
F		40	1	1		1			25	
G		1								
H										
I										
J										

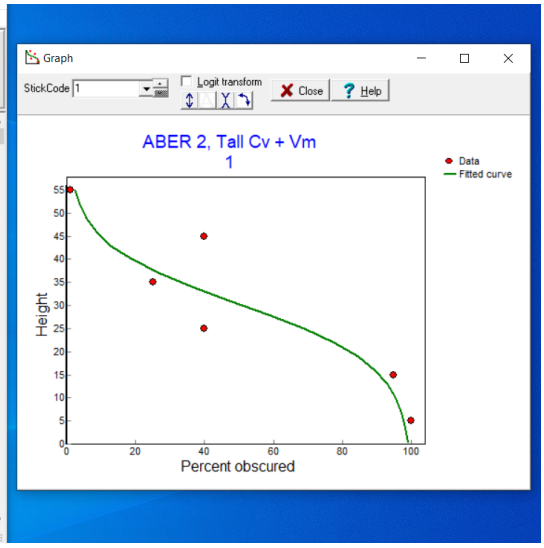


Figure S2: Utilization of the “FuelRule” methodology for assessment of vegetation biomass indices and plant community composition and diversity. Top: use of the FuelRule to assess vegetation structure in a 1 x 1 m calibration quadrat. Bottom: example of the data inputs and output fuel structure metrics from the PObscured program (Legg 2002).

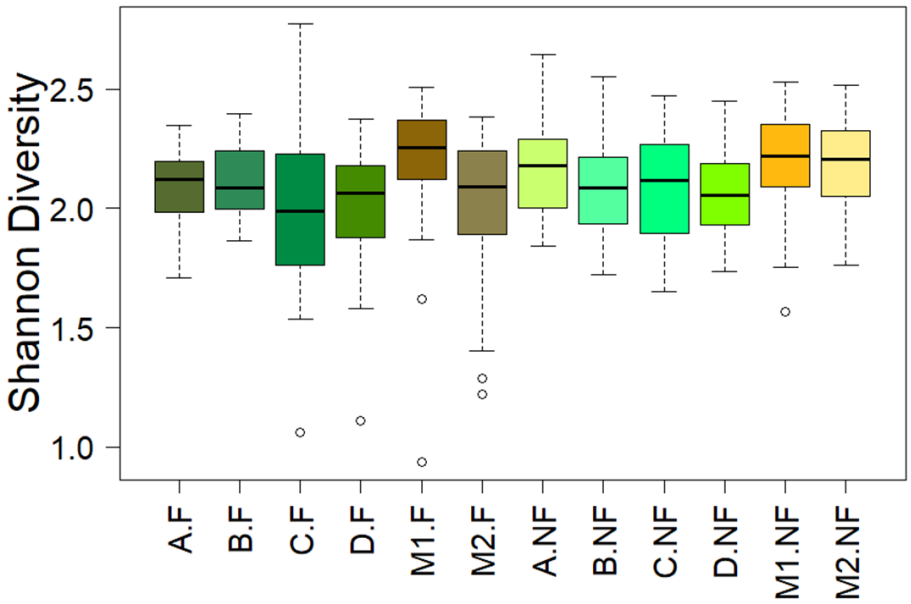


Figure S3: Variation in plot-level Shannon Diversity as a function of historic seed mix and fertilizer application during site preparation (F = fertilized, NF = not fertilized). Seed mix codes are described in Table 1 of the full paper.

Table S1: Level of replication for each seed mix x fertilizer x tillage treatment combination across the study. All plots within the study measured 15 m x 20 m. Plots treated with mixed seeding treatments (M1 and M2) received additional replications compared to the monoculture seeding treatments. Seed mix codes and their associated species can be found in the main paper. Fertilizer treatment consisted of a single application of di-ammonium phosphate at 112 kg ha-1. The site received no further fertilizer applications or other management prior to our surveys in 2016. Control plots were not considered in the present study

Seed Mix	Fertilizer	Tillage	Replicates
A	Yes	Tilled	10
B	Yes	Tilled	10
C	Yes	Tilled	10
D	Yes	Tilled	10
M1	Yes	Tilled	20
M2	Yes	Tilled	20
A	Yes	Deep rip	10
B	Yes	Deep rip	10
C	Yes	Deep rip	10
D	Yes	Deep rip	10
M1	Yes	Deep rip	20
M2	Yes	Deep rip	20
A	No	Tilled	10
B	No	Tilled	10
C	No	Tilled	10
D	No	Tilled	10
M1	No	Tilled	20
M2	No	Tilled	20
A	No	Deep rip	10
B	No	Deep rip	10
C	No	Deep rip	10
D	No	Deep rip	10
M1	No	Deep rip	20
M2	No	Deep rip	20
Control (not seeded)	Control (no fertilizer)	Control (no tillage)	10

Table S2: Vegetation structure indices recorded using the FuelRule method and/or subsequently calculated using the PObscured software. Full details of the design, operation and calibration procedure for the FuelRule are described in Davies et al. (2006).

Metric	Definition	Units	Method
Moss dep	Depth of the layer of moss, litter and thatch lying immediately above the soil surface	cm	Field
AllObs	Height of the top of the tallest FueRule band completely obscured by vegetation	cm	Field
PartObs	Height of the top of the tallest FuelRule band partially obscured by vegetation	cm	Field
Max ht	Height of the tallest point at which vegetation touches the FuelRule	cm	Field
10% h	Estimated height of the band at which 10 % of the Fuelule is obscured by vegetation	cm	PObscured
50% h	Estimated height of the band at which 50 % of the Fuelule is obscured by vegetation	cm	PObscured
Biomass Measure (Volume)	Estimated area under the regression line of FuelRule band height on the logit transformation of the proportion of the band obscured by vegetation. Larger Volume values correspond to greater biomass		PObscured
Canopy Density Index (Slope)	Estimated slope of the regression of FuelRule band height on the logit transformation of the proportion of the band obscured by vegetation. Steeper CDI values correspond to denser vegetation		PObscured
Intercept	Estimated intercept of the regression line of FuelRule band height on the logit transformation of the proportion of the band obscured by vegetation.		PObscured

Table S3: Results of estimated marginal means analyses of pairwise contrasts in species richness as a function of the interaction of seed mix and fertilizer application (R package “emmeans” (Lenth 2022); function “emmeans”).

UNFERTILIZED PLOTS

Contrast	Estimate	SE	df	t	p
A - B	-2.95	1.39	279	-2.117	0.281
A - C	-1.20	1.39	279	-0.861	0.955
A - D	0.70	1.39	279	0.502	0.996
A - M1	-3.00	1.21	279	-2.486	0.132
A - M2	1.44	1.27	280	1.134	0.867
B - C	1.75	1.39	279	1.256	0.809
B - D	3.65	1.39	279	2.620	0.096
B - M1	-0.05	1.21	279	-0.041	1.000
B - M2	4.39	1.27	280	3.454	0.008
C - D	1.90	1.39	279	1.364	0.749
C - M1	-1.80	1.21	279	-1.492	0.670
C - M2	2.64	1.27	280	2.078	0.302
D - M1	-3.70	1.21	279	-3.066	0.029
D - M2	0.74	1.27	280	0.583	0.992
M1 - M2	4.44	1.06	280	4.176	0.001

FERTILIZED PLOTS

Contrast	Estimate	SE	df	t	p
A - B	0.70	1.39	279	0.502	0.996
A - C	-0.30	1.42	280	-0.208	1.000
A - D	3.51	1.42	280	2.473	0.136
A - M1	-2.23	1.24	281	-1.798	0.469
A - M2	-2.73	1.24	281	-2.200	0.241
B - C	-1.00	1.42	280	-0.702	0.982
B - D	2.81	1.42	280	1.979	0.357
B - M1	-2.93	1.24	281	-2.361	0.174
B - M2	-3.43	1.24	281	-2.763	0.067
C - D	3.80	1.39	279	2.727	0.073
C - M1	-1.94	1.24	281	-1.560	0.625
C - M2	-2.44	1.24	281	-1.963	0.367
D - M1	-5.74	1.24	281	-4.618	0.000
D - M2	-6.24	1.24	281	-5.020	< 0.001
M1 - M2	-0.50	0.99	279	-0.508	0.996

Table S4: Results of estimated marginal means analyses of pairwise contrasts in biomass as a function of seed mix (R package “emmeans” (Lenth 2022); function “emmeans”).

Contrast	Estimate	SE	df	t	p
A - B	-78.83	34.70	278	-2.272	0.209
A - C	-369.06	35.20	279	-10.473	< 0.001
A - D	46.79	35.30	279	1.325	0.771
A - M1	-199.34	30.70	280	-6.483	< 0.001
A - M2	-84.47	31.30	280	-2.699	0.079
B - C	-290.24	35.20	279	-8.250	< 0.001
B - D	125.61	35.30	279	3.563	0.006
B - M1	-120.52	30.80	280	-3.911	0.002
B - M2	-5.64	31.30	280	-0.180	1.000
C - D	415.85	34.70	278	11.984	< 0.001
C - M1	169.72	31.60	281	5.379	< 0.001
C - M2	284.60	31.60	280	9.015	< 0.001
D - M1	-246.13	31.70	281	-7.759	< 0.001
D - M2	-131.26	31.70	280	-4.146	0.001
M1 - M2	114.87	25.80	279	4.446	< 0.001