



Supplement of

Soil carbon accrual and biopore formation across a plant diversity gradient

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Table S1: Plant species and diversity information in the studied diversity systems.

Treatment	CE1	CE7	CE8	CE9	CE10	CE12
Plant species	- (Bare soil)	Switchgrass (<i>Panicum virgatum</i>), C4	Switchgrass (<i>Panicum virgatum</i>), C4 Canada wild rye (<i>Elymus canadensis</i>), C3	Switchgrass (<i>Panicum virgatum</i>), C4 Big bluestem (<i>Andropogon gerardii</i>), C4 Little bluestem (<i>Schizachyrium scoparium</i>), C4 Indian grass (<i>Sorghastrum nutans</i>), C4 Canada wild rye (<i>Elymus canadensis</i>), C3 Prairie June grass (<i>Koeleria cristata</i>), C3	Switchgrass (<i>Panicum virgatum</i>), C4 Big bluestem (<i>Andropogon gerardii</i>), C4 Little bluestem (<i>Schizachyrium scoparium</i>), C4 Indian grass (<i>Sorghastrum nutans</i>), C4 Canada wild rye (<i>Elymus canadensis</i>), C3 Prairie June grass (<i>Koeleria cristata</i>), C3 <i>Desmodium canadense</i> , forb <i>Rudbeckia hirta</i> L., forb <i>Monarda Firstulosa</i> , forb <i>Solidago rigida</i> , forb <i>Lespedeza capitata</i> , forb <i>Baptisia leucanta</i> , forb <i>Amorpha canescens</i> , forb <i>Desmodium illinoense</i> , forb <i>Dalea purpureum</i> , forb <i>Anemone canadensis</i> L., forb <i>Asclepias tuberosa</i> L., forb <i>Euphorbia corollata</i> L., forb <i>Tradescantia ohiensis</i> , forb <i>Zizia aurea</i> , forb <i>Silphium perfoliatum</i> L., forb <i>Ratibida pinnata</i> , forb <i>Coreopsis tripteris</i> L., forb <i>Asclepias syriaca</i> L., forb <i>Oenothera biennis</i> L., forb <i>Solidago speciosa</i> L., forb <i>Aster novae-angliae</i> L., forb <i>Aster pilosus</i> , forb <i>Solidago nemoralis</i> , forb <i>Aster laevis</i> L., forb	Switchgrass (<i>Panicum virgatum</i>), C4 Big bluestem (<i>Andropogon gerardii</i>), C4 Little bluestem (<i>Schizachyrium scoparium</i>), C4 Indian grass (<i>Sorghastrum nutans</i>), C4 Canada wild rye (<i>Elymus canadensis</i>), C3 Prairie June grass (<i>Koeleria cristata</i>), C3 <i>Desmodium canadense</i> , forb <i>Rudbeckia hirta</i> L., forb <i>Monarda Firstulosa</i> , forb <i>Solidago rigida</i> , forb <i>Lespedeza capitata</i> , forb <i>Baptisia leucanta</i> , forb <i>Amorpha canescens</i> , forb <i>Desmodium illinoense</i> , forb <i>Dalea purpureum</i> , forb <i>Anemone canadensis</i> L., forb <i>Asclepias tuberosa</i> L., forb <i>Euphorbia corollata</i> L., forb <i>Tradescantia ohiensis</i> , forb <i>Zizia aurea</i> , forb <i>Silphium perfoliatum</i> L., forb <i>Ratibida pinnata</i> , forb <i>Coreopsis tripteris</i> L., forb <i>Asclepias syriaca</i> L., forb <i>Oenothera biennis</i> L., forb <i>Solidago speciosa</i> L., forb <i>Aster novae-angliae</i> L., forb <i>Aster pilosus</i> , forb <i>Solidago nemoralis</i> , forb <i>Aster laevis</i> L., forb
Plant species diversity	0	1	2	6	10	30
Plant functional Diversity	0	1	2	2	3	3

Table S2: Data used in the main article (Figs. 1, 3-5). Values represent means, and numbers in parentheses indicate the standard error of the mean. Species richness does not have standard errors (treatments).

Treatment	Soil Organic Carbon (%)	10-day Mineralization (mgC/gsoil)	Plant species richness	Plant functional richness	Visible porosity (%)	Bioporosity (%)	Surface Area of Biopores (cm ²)	Mean Distance of Soil Matrix to Biopores (mm)
CE1	1.04 (0.07)	8.00 (0.13)	0	0	11.83 (0.99)	0.27 (0.04)	8.89 (0.13)	0.62 (0.04)
CE7	0.95 (0.08)	5.51 (0.61)	1	1	10.89 (0.91)	0.34 (0.03)	12.16 (0.91)	0.53 (0.03)
CE8	1.19 (0.08)	7.77 (0.62)	2	2	13.24 (1.35)	0.52 (0.04)	14.37 (0.62)	0.46 (0.01)
CE9	1.26 (0.08)	7.31 (0.76)	6	2	15.41 (1.03)	0.34 (0.05)	10.14 (1.12)	0.65 (0.05)
CE10	1.21 (0.09)	6.11 (0.18)	10	3	11.59 (1.09)	0.42 (0.07)	11.33 (0.51)	0.52 (0.02)
CE12	1.51 (0.09)	12.32 (1.32)	30	3	12.80 (0.85)	0.47 (0.04)	11.99 (0.75)	0.53 (0.02)

Table S3: Data used in the main article (Fig. 2). Values represent means, and errors are presented as the least significant difference (LSD) within each pore diameter group.

Treatments	CE1	CE7	CE8	CE9	CE10	CE12	LSD (least significant difference)
Pore diameter (μm)	Pore volume fraction (unitless)						
19.2	0.0214	0.0151	0.0053	0.0079	0.0094	0.0087	0.0065
57.6	0.1215	0.0871	0.0350	0.0615	0.0627	0.0465	0.0242
96	0.1410	0.1101	0.0562	0.1101	0.0889	0.0712	0.0340
134.4	0.1391	0.1229	0.0773	0.1344	0.1048	0.0898	0.0328
172.8	0.1077	0.1025	0.0765	0.1118	0.0898	0.0831	0.0237
211	0.0818	0.0780	0.0681	0.0852	0.0715	0.0711	0.0183
249.6	0.0646	0.0588	0.0586	0.0657	0.0576	0.0602	0.0155
288	0.0540	0.0471	0.0518	0.0538	0.0489	0.0532	0.0144
326.4	0.0510	0.0428	0.0503	0.0489	0.0470	0.0530	0.0146
364.8	0.0364	0.0298	0.0367	0.0341	0.0341	0.0393	0.0104
403.2	0.0300	0.0249	0.0312	0.0280	0.0291	0.0328	0.0082
441.6	0.0249	0.0210	0.0265	0.0235	0.0247	0.0278	0.0068
480	0.0211	0.0187	0.0243	0.0207	0.0219	0.0246	0.0062
518.4	0.0168	0.0148	0.0202	0.0171	0.0181	0.0199	0.0052
556.8	0.0127	0.0117	0.0164	0.0133	0.0145	0.0158	0.0043
595.2	0.0122	0.0116	0.0169	0.0130	0.0147	0.0154	0.0047
633.6	0.0101	0.0101	0.0152	0.0110	0.0126	0.0129	0.0040
672	0.0087	0.0088	0.0138	0.0097	0.0111	0.0116	0.0039
710.4	0.0070	0.0077	0.0119	0.0084	0.0093	0.0094	0.0034
748.8	0.0065	0.0074	0.0121	0.0079	0.0091	0.0090	0.0035
787.2	0.0059	0.0070	0.0122	0.0074	0.0091	0.0088	0.0033
825.6	0.0047	0.0061	0.0110	0.0066	0.0077	0.0081	0.0029
864	0.0042	0.0061	0.0102	0.0063	0.0074	0.0071	0.0027
902.4	0.0038	0.0056	0.0101	0.0062	0.0071	0.0065	0.0031
940.8	0.0036	0.0052	0.0099	0.0057	0.0075	0.0066	0.0027
979.2	0.0032	0.0045	0.0100	0.0054	0.0071	0.0059	0.0028

1017.6	0.0027	0.0048	0.0095	0.0053	0.0064	0.0056	0.0027
1056	0.0029	0.0041	0.0094	0.0049	0.0066	0.0055	0.0026
1094.4	0.0025	0.0041	0.0091	0.0044	0.0062	0.0049	0.0026
1132.8	0.0025	0.0036	0.0085	0.0039	0.0062	0.0049	0.0028
1171.2	0.0022	0.0033	0.0082	0.0036	0.0057	0.0046	0.0028
1209.6	0.0020	0.0030	0.0081	0.0035	0.0056	0.0048	0.0028
1248	0.0019	0.0031	0.0076	0.0034	0.0055	0.0046	0.0026
1286.4	0.0019	0.0033	0.0074	0.0037	0.0054	0.0045	0.0030
1324.8	0.0017	0.0035	0.0077	0.0034	0.0045	0.0046	0.0029
1363.2	0.0016	0.0036	0.0080	0.0031	0.0046	0.0044	0.0030
1401.6	0.0019	0.0034	0.0068	0.0036	0.0040	0.0038	0.0029
1440	0.0016	0.0032	0.0072	0.0030	0.0037	0.0041	0.0028
1478.4	0.0017	0.0032	0.0072	0.0029	0.0033	0.0042	0.0029
1516.8	0.0014	0.0037	0.0073	0.0032	0.0043	0.0041	0.0030

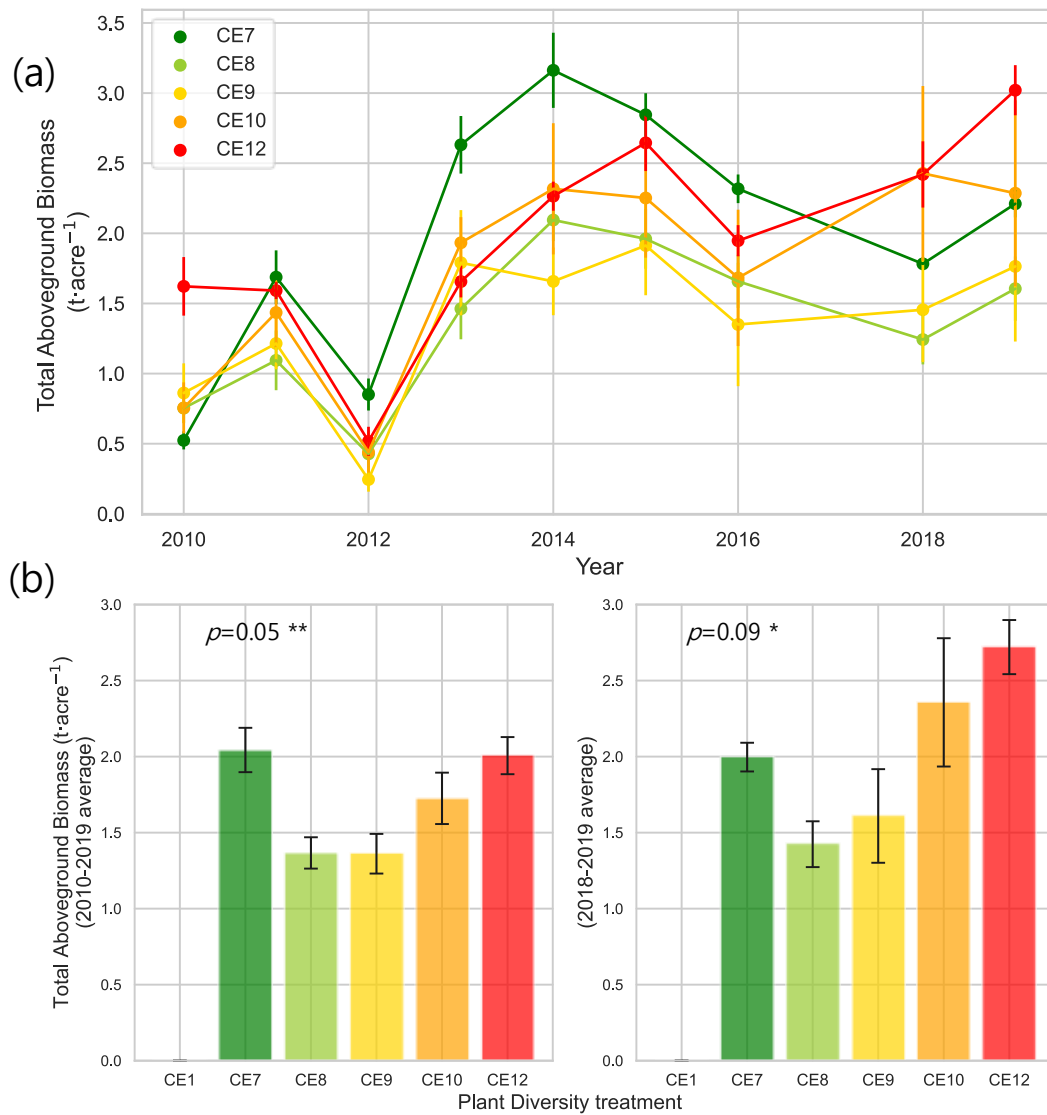


Figure S1: Total aboveground biomass during the entire study period (a), and the average total aboveground biomass (b) during the same period (2010-2019) (left) and from 2018 to 2019 (right). Error bars show standard error of the mean. Asterisks * and ** indicate statistically significant differences among plant diversity treatments at $p < 0.10$ and 0.05 , respectively. Letters indicate significant differences between plant diversity treatments ($p < 0.05$).

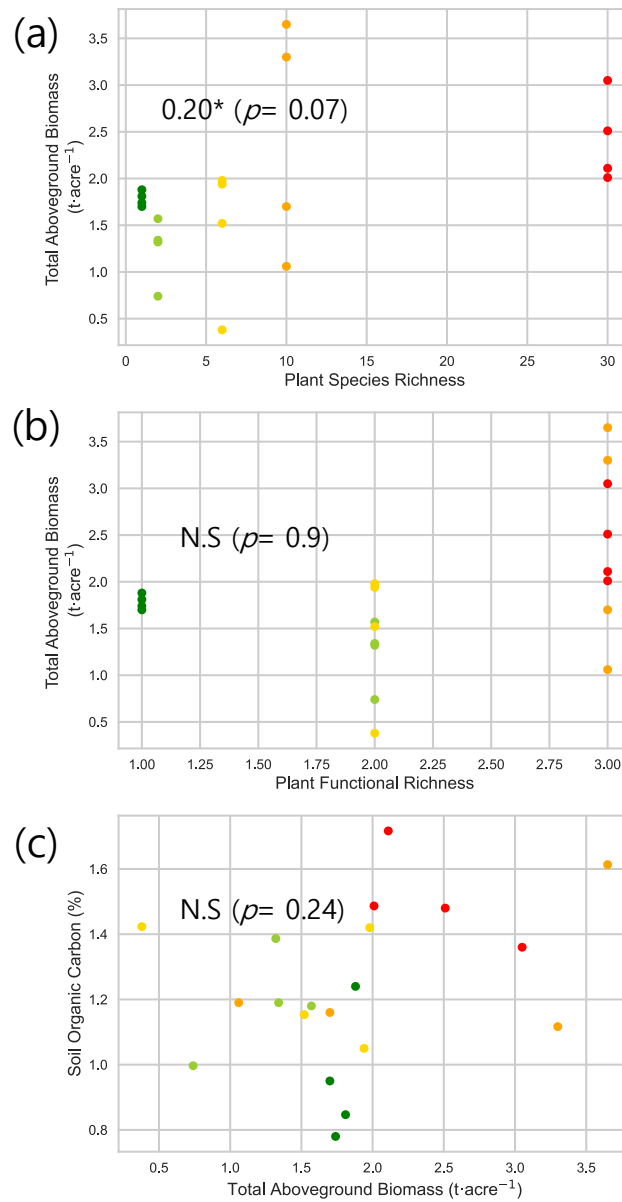


Figure S2: Correlation between plant species richness and total aboveground biomass in 2018 11/22/2025(a), plant functional richness and total aboveground biomass (b), and between total aboveground biomass and soil organic carbon (c). When $p < 0.10$, R^2 values are provided. Asterisk * indicates statistically significant regression models at $p < 0.10$, and N.S indicates no significant regression.

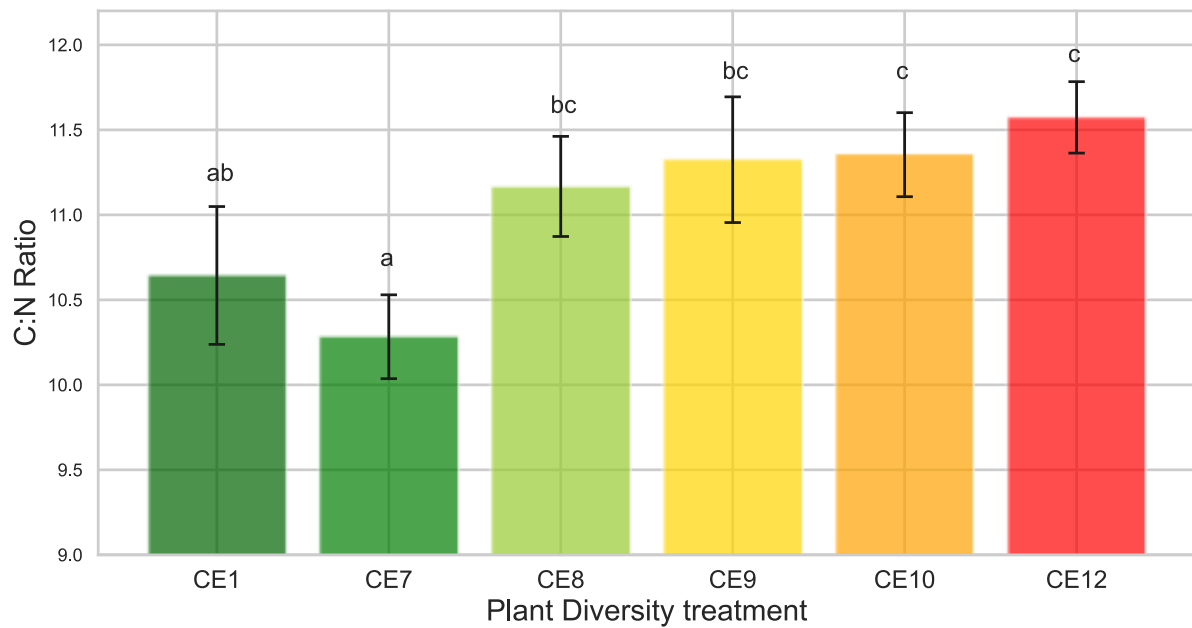


Figure S3: Carbon to Nitrogen ratio (C:N) of the soil in different plant diversity systems. Error bars show standard error of the mean. Letters indicate significant differences between plant diversity treatments ($p < 0.05$).

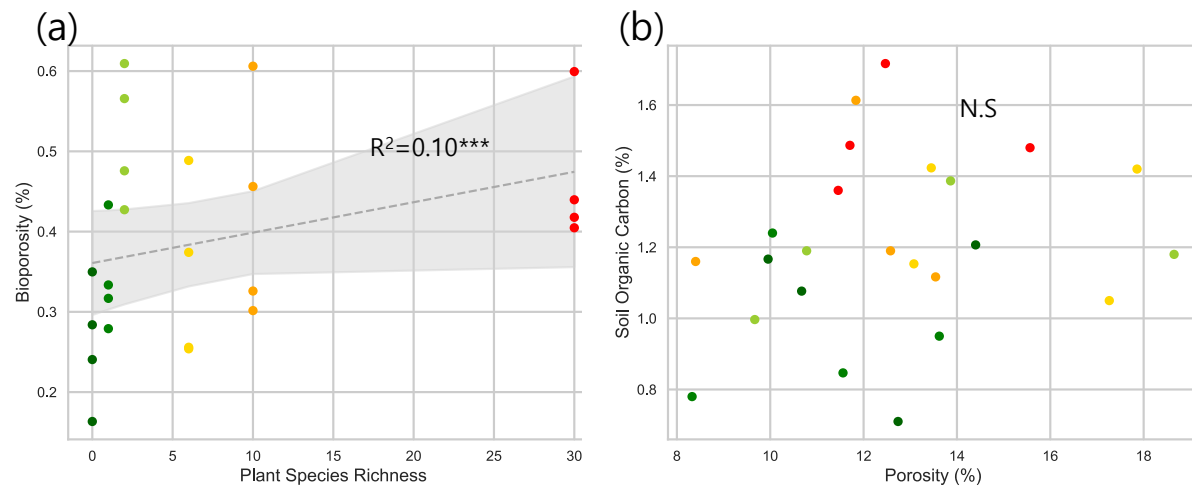


Figure S4: Correlation between plant species richness and bioporosity (a), and between porosity and soil organic carbon (b). R^2 values are provided for each model. Dotted gray lines represent fitted regression models, with light gray shaded area denoting 95% confidence interval. Asterisks *** indicate statistically significant regression models at $p < 0.01$, and N.S indicates no significant regression.