Supplementary Data for "Structural diversity as a predictor of ecosystem function"

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Appendix S1: Additional details on statistical methods.

To determine if D-EF were significant at a regional level while controlling for site-level heterogeneity, we resampled from the slope estimates of individual sites. Specifically, we resampled the sum of the conditional and fixed slope estimates for each site 10,000 times with a bootstrapping approach. We then calculated bias corrected, accelerated 95% confidence interval of each generated distribution (Efron and Tibshirani 1986). If the 95% CI deviated from zero, then these regional slope estimates were considered to be significantly positive or negative. We also interpreted larger 95% CI values to indicate greater environmental heterogeneity influencing the D-EF.

Supplemental Data References

Efron, B.R., & Tibshirani. (1986). Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy. *Stat Sci* 1, 54–75.

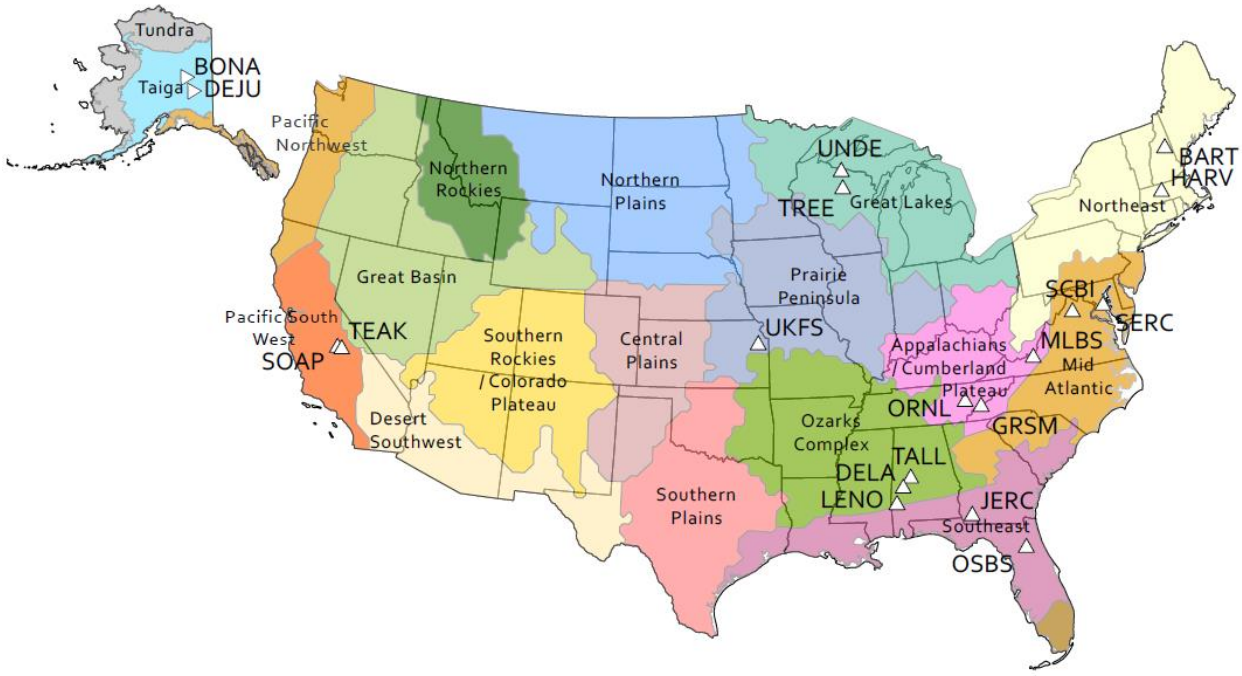

Figure S1. NEON sites from nine ecoclimatic domains across the USA. White triangles indicate forested sites included in this study.

Table S1. NEON forest site locations and plot sample size

Site	Acronym	State	Ecoclimatic domain	Forest type	Latitude	Longitude	Year	No. plots
Talladega National Forest	TALL	AL	Ozarks	Mixed	32.95046	-87.39327	2016	31
Dead Lake	DELA	AL	Ozarks	Evergreen	32.541727	-87.803877	2016	31
Lenoir Landing	LENO	AL	Ozarks	Deciduous	31.853861	-88.161181	2016	31
Delta Junction	DEJU	AK	Taiga	Evergreen	63.8812	-145.75136	2017	22
Caribou Creek-Poker Flats	BONA	AK	Taiga	Mixed	65.15401	-147.50258	2017	22
Soaproot Saddle	SOAP	CA	Pacific Southwest	Evergreen	37.03337	-119.26219	2017	5
Lower Teakettle	TEAK	CA	Pacific Southwest	Evergreen	37.00583	-119.00602	2017	5
Ordway-Swisher Biological Station	OSBS	FL	Southeast	Evergreen	29.689282	-81.993431	2016	24
The University of Kansas Field Station	UKFS	KS	Prairie	Deciduous	39.040431	-95.19215	2017	25
Jones Ecological Research Center	JERC	GA	Southeast	Mixed	31.194839	-84.468623	2016	32
Smithsonian Environmental Center	SERC	MD	MidAtlantic	Deciduous	38.890131	-76.560014	2017	26
Harvard Forest	HARV	MA	Northeast	Mixed	42.53691	-72.17265	2016	28
UNDERC	UNDE	MI	Great Lakes	Mixed	46.23391	-89.537254	2016	31
Bartlett Experimental Forest	BART	NH	Northeast	Mixed	44.063889	-71.287375	2016	30
Great Smoky Mts. National Park	GRSM	TN	Appalachians	Mixed	35.68896	-83.50195	2016	32
Oak Ridge	ORNL	TN	Appalachians	Mixed	35.964128	-84.282588	2017	31
Mtn. Lake Biological Station	MLBS	VA	Appalachians	Deciduous	37.378314	-80.524847	2017	14
Smithsonian Conservation Biology	SCBI	VA	MidAtlantic	Mixed	38.892925	-78.139494	2017	19
Treehaven	TREE	WI	Great Lakes	Mixed	45.49369	-89.58571	2017	17

Table S2. Data products from the National Ecological Observatory Network (NEON) Data Portal used in data analysis (https://data.neonscience.org/home). All data was accessed in April 2018. Data product years can be found in Table S1.

Variable in data analysis	NEON data product	Data product ID	Sites
Structural diversity metrics	Discrete return LiDAR point cloud	DP1.30003.001	BART, BONA, DEJU, DELA, GRSM, HARV, JERC, LENO, MLBS, ORNL, OSBS, SCBI, SERC, SOAP, TALL, TEAK, TREE, UKFS, UNDE
Plant species richness	Plant presence and percent cover	DP1.10058.001	BART, BONA, DEJU, DELA, GRSM, HARV, JERC, LENO, MLBS, ORNL, OSBS, SCBI, SERC, SOAP, TALL, TEAK, TREE, UKFS, UNDE
Basal area	Woody plant vegetation structure	DP1.10098.001	BART, BONA, DEJU, GRSM, HARV, LENO, ORNL, OSBS, SCBI, SERC, TALL, TREE
Coarse woody debris	Coarse downed wood log survey	DP1.10010.001	BART, BONA, DELA, GRSM, LENO, MLBS, ORNL, OSBS, SCBI, SERC, TALL, TREE
fPAR	fPAR – spectrometer – mosaic	DP3.30014.001	BART, BONA, DEJU, DELA, GRSM, HARV, JERC, LENO, MLBS, ORNL, OSBS, SCBI, SERC, SOAP, TALL, TEAK, UKFS, UNDE
LAI	LAI – spectrometer - mosaic	DP3.30012.001	BART, BONA, DEJU, DELA, GRSM, HARV, JERC, LENO, MLBS, ORNL, OSBS, SCBI, SERC, SOAP, TALL, TEAK, UKFS, UNDE
Total soil nitrogen	Soil chemical properties (Megapit)	DP1.00097.001	BART, BONA, DEJU, DELA, GRSM, HARV, JERC, LENO, MLBS, ORNL, OSBS, SCBI, SERC, SOAP, TALL, TEAK, TREE, UKFS, UNDE

Table S3. Linear lopes and 95% bootstrapped confidence intervals of slopes of site-level D-EF relationships. N_{plots} is the number of plots at a site within each univariate regression. To test for regional differences in the slope of B-EF relationships (either positive or negative) at a local scale we conducted site-level univariate linear regressions. First, we tested for significant relationships between D-EF at each site with univariate linear regressions; a standardized diversity metric was the predictor and ecosystem function the response variable in each analysis. To determine if D-EF relationships were significant, we resampled the univariate linear slope estimates 10,000 times with a bootstrapping approach. Finally, we calculated bias corrected, accelerated 95% confidence interval of each generated distribution (Efron and Tibshirani 1986) and if the 95% confidence interval did not overlap with zero, then it was considered to be significant (indicated as a bolded slope and 95% confidence interval).

Function	Site	External heterogeneity				Internal heterogeneity				Mean canopy height				Gap fraction				Native species richness				Tree species richness				Native PSR				Native PSV			
		N_{plots}	β	95% CI		N_{plots}	β	95% CI		N_{plots}	β	95% CI		N_{plots}	β	95% CI		N_{plots}	β	95% CI		N_{plots}	β	95% CI		N_{plots}	β	95% CI		N_{plots}	β	95% CI	
Basal area	BART	15	0.58	-0.20	1.18	15	0.6	-0.48	1.19	15	-0.84	-2.09	0.24	15	0.834	-0.14	1.54	15	0.40	-1.18	1.43	15	-0.29	-1.00	1.45	15	0.299	-0.22	0.57	15	0.45	0.18	0.70
	BONA	9	**0.39**	**0.02**	**0.81**	9	0.13	-0.31	0.42	9	**1.67**	**0.55**	**2.64**	9	-0.61	-1.17	0.31	9	0.03	-2.89	3.88	9	0.27	-1.74	1.57	9	1.488	-0.566	3.67	9	0.09	-0.41	0.29
	DEJU	10	**2.41**	**0.63**	**4.56**	10	**0.97**	**0.299**	**1.59**	10	**15.91**	**2.68**	**64.36**	10	0.163	-0.66	1.51	10	0.53	-0.13	1.35	10	0.38	-0.19	1.49	10	0.471	-0.213	1.88	10	-0.07	-0.27	-0.01
	GRSM	22	0.40	-0.58	1.59	22	0.73	-0.15	1.72	22	0.23	-0.33	0.91	22	-0.13	-1.52	1.10	22	0.03	-0.28	0.55	22	-0.31	-0.53	-0.05	22	0.14	-0.297	0.72	22	0.15	-0.29	0.40
	HARV	20	0.61	-0.37	1.27	20	0.35	-0.64	1.26	20	**0.81**	**0.27**	**1.63**	20	-0.6	-1.40	-0.09	20	-0.10	-0.76	0.55	20	0.02	-0.89	0.91	20	0.017	-0.43	0.38	20	0.73	-0.43	1.40
	LENO	21	0.51	-0.39	1.18	21	**0.47**	**0.131**	**0.84**	21	**0.91**	**0.44**	**1.55**	21	**-1.84**	**-4.38**	**-0.64**	21	0.36	-0.96	0.99	21	0.57	-0.58	1.31	21	0.122	-0.526	0.68	21	-0.03	-0.75	0.75
	ORNL	21	**0.55**	**0.26**	**0.92**	21	0.41	-0.01	0.86	21	**0.44**	**0.13**	**0.85**	21	-0.45	-0.74	0.39	21	0.12	-0.24	0.48	21	0.30	-0.08	0.51	21	0.143	-0.359	0.7	21	0.62	-0.43	2.22
	OSBS	18	0.23	-0.03	0.40	18	**0.31**	**0.043**	**0.57**	17	0.54	-0.01	0.86	17	-0.25	-0.46	0.05	18	0.10	-0.03	0.25	17	0.54	0.01	0.83	18	0.175	-0.017	0.42	17	0.06	-0.48	0.58
	SCBI	14	-0.08	-0.96	0.61	14	0.21	-0.23	0.55	14	0.39	-0.02	0.85	14	**-2.28**	**-4.69**	**-1.09**	14	-0.22	-2.66	1.33	14	0.14	-1.61	1.33	14	0.071	-1.233	1.02	14	0.06	-0.85	0.82
	SERC	20	-0.16	-0.64	0.35	20	0.07	-0.41	0.82	20	0.47	-0.14	1.24	20	-0.77	-2.19	0.42	20	0.12	-0.52	1.05	20	0.40	-0.32	1.29	20	-0.15	-0.794	0.42	20	-0.36	-1.63	0.30
	TALL	22	0.06	-0.21	0.30	22	-0.1	-0.43	0.23	21	0.09	-0.31	0.49	21	-0.07	-0.35	0.21	22	-0.14	-0.49	0.26	21	-0.08	-0.67	0.39	22	-0	-0.372	0.26	21	0.44	0.15	0.70
	TREE	12	**0.89**	**0.36**	**1.55**	12	0.21	-0.77	0.86	12	**1.15**	**0.51**	**1.51**	12	-0.51	-1.39	0.40	12	0.13	-0.70	1.66	12	0.25	-0.41	1.09	12	0.472	-0.556	1.11	12	-0.22	-0.68	0.28
LAI	BART	30	**-0.50**	**-0.85**	**-0.10**	30	**-0.9**	**-1.45**	**-0.41**	30	**1.01**	**0.10**	**1.82**	30	**-1.04**	**-1.58**	**-0.52**	30	0.37	-0.71	1.08	30	-0.04	-0.64	0.53	30	0.025	-0.354	0.27	30	-0.28	-0.52	0.00
	BONA	22	0.18	-0.17	0.41	22	0	-0.42	0.32	22	0.70	-0.26	1.41	22	**-0.56**	**-0.86**	**-0.33**	22	-0.97	-2.26	0.39	22	-0.27	-0.77	0.82	22	0.279	-0.888	1.88	22	0.06	-0.07	0.34
	DEJU	24	-0.07	-1.43	1.14	24	**-0.4**	**-1.12**	**-0.11**	28	5.75	-5.86	23.33	28	**-1.85**	**-3.30**	**-0.85**	24	**-0.26**	**-0.63**	**-0.01**	24	0.02	-0.16	0.27	24	-0.34	-0.807	0	28	0.01	-0.18	0.09
	DELA	33	**-0.62**	**-1.12**	**-0.02**	33	**-0.7**	**-0.96**	**-0.36**	37	**0.59**	**0.19**	**1.15**	37	**-1.29**	**-1.60**	**-0.92**	33	-0.13	-0.72	0.35	33	0.11	-0.51	0.46	33	-0.25	-0.691	0.33	37	0.52	-0.13	1.52
	GRSM	32	**0.34**	**0.13**	**0.55**	32	**0.42**	**0.286**	**0.56**	32	**0.42**	**0.33**	**0.53**	32	**-0.87**	**-1.29**	**-0.56**	32	**0.22**	**0.06**	**0.33**	32	**0.21**	**0.07**	**0.34**	32	**0.189**	**0.0245**	**0.32**	32	-0.04	-0.17	0.13
	HARV	28	**-0.58**	**-0.94**	**-0.06**	28	**-0.4**	**-0.68**	**-0.1**	28	-0.20	-0.60	0.21	28	-0.03	-0.36	0.29	28	-0.17	-0.50	0.13	28	-0.24	-0.73	0.35	28	-0.08	-0.254	0.09	28	-0.17	-0.71	0.24
	JERC	32	0.15	-0.15	0.51	32	0.04	-0.11	0.23	32	0.00	-0.45	0.89	32	0.04	-0.37	0.40	32	0.02	-0.11	0.18	32	-0.02	-0.18	0.18	32	0.005	-0.2	0.2	32	0.52	-0.33	1.07
	LENO	31	0.00	-0.28	0.60	31	0	-0.21	0.21	31	-0.09	-0.42	0.17	31	**0.84**	**0.21**	**3.06**	31	**-0.32**	**-0.70**	**-0.07**	31	-0.17	-1.03	0.24	31	**-0.19**	**-0.35**	**-0.03**	31	-0.10	-0.44	0.26
	MLBS	14	-0.14	-0.35	0.05	14	**-0.2**	**-0.43**	**-0.01**	14	-0.03	-0.46	0.48	14	**-0.26**	**-0.51**	**-0.05**	14	-0.24	-0.86	0.06	14	-0.06	-0.29	0.11	14	0.003	-0.428	0.29	14	**0.23**	**0.10**	**0.35**
	ORNL	62	0.07	-0.08	0.21	62	0.12	-0.03	0.28	62	**0.18**	**0.02**	**0.33**	62	-0.01	-0.14	0.12	62	**-0.29**	**-0.40**	**-0.17**	62	**-0.12**	**-0.23**	**-0.03**	62	**-0.35**	**-0.494**	**-0.18**	62	-0.08	-0.59	0.66
	OSBS	24	0.09	-0.25	0.32	24	-0.1	-0.34	0.15	23	0.24	-0.61	0.68	23	-0.21	-0.44	0.20	24	0.02	-0.20	0.23	24	0.24	-0.02	0.45	24	-0	-0.231	0.22	23	0.07	-0.50	0.42
	SCBI	19	-0.13	-0.22	0.06	19	**-0.1**	**-0.18**	**-0.09**	19	-0.09	-0.16	0.02	19	0.06	-0.22	0.47	19	-0.05	-0.35	0.40	19	-0.05	-0.17	0.20	19	-0.04	-0.209	0.26	19	-0.15	-0.28	0.01
	SERC	26	-0.10	-0.18	0.02	26	**-0.1**	**-0.2**	**-0.03**	26	-0.10	-0.18	0.00	26	**0.15**	**0.03**	**0.26**	26	-0.09	-0.20	0.12	26	-0.07	-0.17	0.15	26	-0.06	-0.156	0.09	26	-0.15	-0.34	0.05
	TALL	31	**0.42**	**0.32**	**0.51**	31	0.01	-0.29	0.36	30	**0.56**	**0.42**	**0.73**	30	**-0.50**	**-0.64**	**-0.34**	31	-0.19	-0.49	0.09	30	-0.03	-0.48	0.54	31	**0.289**	**0.0206**	**0.53**	30	**0.36**	**0.06**	**0.76**
	UKFS	25	0.26	-0.19	0.83	25	0.13	-0.13	0.79	25	**0.37**	**0.03**	**0.82**	25	**-0.44**	**-0.64**	**-0.16**	25	**-0.21**	**-0.74**	**-0.11**	25	0.19	-0.30	0.99	25	-0.07	-0.291	0.56	25	-0.09	-1.49	0.37
	UNDE	31	**0.34**	**0.20**	**0.49**	31	**0.23**	**0.065**	**0.38**	31	**0.49**	**0.35**	**0.67**	31	**-0.24**	**-0.40**	**-0.13**	31	0.00	-0.22	0.22	31	0.07	-0.13	0.25	31	-0.08	-0.247	0.1	31	0.00	-0.10	0.12
fPAR	BART	30	**-0.09**	**-0.15**	**-0.03**	30	**-0.2**	**-0.25**	**-0.08**	30	**0.17**	**0.00**	**0.32**	30	**-0.19**	**-0.29**	**-0.10**	30	0.06	-0.14	0.17	30	0.00	-0.10	0.10	30	0.001	-0.071	0.04	30	-0.05	-0.09	0.00
	BONA	22	0.04	-0.03	0.09	22	0	-0.08	0.07	22	0.15	-0.03	0.30	22	**-0.12**	**-0.18**	**-0.07**	22	-0.17	-0.47	0.11	22	-0.06	-0.16	0.14	22	0.069	-0.166	0.38	22	0.01	-0.01	0.06
	DEJU	24	-0.03	-0.42	0.27	24	**-0.1**	**-0.29**	**-0.03**	28	1.50	-1.73	6.23	28	**-0.50**	**-0.90**	**-0.26**	24	-0.07	-0.17	0.00	24	0.00	-0.04	0.07	24	-0.09	-0.219	0	28	0.01	-0.04	0.03
	DELA	33	-0.10	-0.18	0.00	33	**-0.1**	**-0.16**	**-0.06**	37	**0.10**	**0.04**	**0.20**	37	**-0.21**	**-0.27**	**-0.15**	33	-0.02	-0.11	0.06	33	0.02	-0.07	0.07	33	-0.04	-0.114	0.05	37	0.08	-0.03	0.24
	GRSM	32	**0.07**	**0.03**	**0.12**	32	**0.09**	**0.061**	**0.13**	32	**0.09**	**0.07**	**0.12**	32	**-0.20**	**-0.31**	**-0.13**	32	**0.05**	**0.01**	**0.08**	32	**0.05**	**0.02**	**0.07**	32	**0.043**	**0.0018**	**0.07**	32	-0.01	-0.04	0.03
	HARV	28	**-0.10**	**-0.18**	**0.00**	28	**-0.1**	**-0.12**	**-0.02**	28	-0.04	-0.11	0.04	28	0.00	-0.07	**0.07**	28	-0.04	-0.11	0.03	28	-0.04	-0.13	0.06	28	-0.02	-0.057	0.02	28	-0.03	-0.13	0.06
	JERC	32	0.03	-0.01	0.05	32	0.01	-0.01	0.03	32	0.03	-0.15	0.08	32	-0.01	-0.04	**0.13**	32	0.01	-0.01	0.02	32	0.01	-0.02	0.03	32	0.006	-0.012	0.03	32	0.00	-0.15	0.09
	LENO	31	0.01	-0.03	0.13	31	0	-0.02	0.04	31	-0.01	-0.06	0.03	31	**0.14**	**0.03**	**0.57**	31	**-0.05**	**-0.11**	**-0.01**	31	-0.03	-0.18	0.03	31	**-0.03**	**-0.049**	**-0**	31	-0.01	-0.06	0.05
	MLBS	14	-0.02	-0.05	0.01	14	-0	-0.06	0	14	0.00	-0.05	0.07	14	**-0.04**	**-0.07**	**-0.01**	14	-0.03	-0.11	0.01	14	-0.01	-0.04	0.01	14	1E-04	-0.052	0.04	14	**0.03**	**0.01**	**0.05**
	ORNL	31	0.01	-0.02	0.05	31	0.02	-0.02	0.06	31	0.03	0.00	0.07	31	0.00	-0.03	0.03	31	**-0.05**	**-0.07**	**-0.01**	31	-0.02	-0.04	0.00	31	**-0.06**	**-0.089**	**-0.01**	31	0.00	-0.11	0.22
	OSBS	24	0.02	-0.07	0.08	24	-0	-0.09	0.05	23	0.06	-0.18	0.17	23	-0.05	-0.11	0.07	24	0.01	-0.05	0.07	23	0.05	-0.03	0.13	24	0.007	-0.056	0.07	23	0.01	-0.15	0.10
	SCBI	19	-0.02	-0.03	0.00	19	**-0**	**-0.03**	**-0.01**	19	-0.01	-0.02	0.01	19	0.00	-0.04	0.06	19	-0.01	-0.06	0.06	19	0.00	-0.02	0.03	19	-0.01	-0.037	0.03	19	-0.03	-0.05	0.00
	SERC	26	-0.01	-0.02	0.00	26	**-0**	**-0.03**	**-0**	26	-0.01	-0.02	0.01	26	0.02	0.00	0.04	26	-0.01	-0.03	0.02	26	-0.01	-0.02	0.03	26	-0.01	-0.021	0.01	26	-0.02	-0.05	0.01
	TALL	31	**0.08**	**0.06**	**0.10**	31	0.01	-0.05	0.08	30	**0.10**	**0.08**	**0.14**	30	**-0.09**	**-0.12**	**-0.06**	31	-0.04	-0.09	0.02	30	0.00	-0.09	0.11	31	0.051	0.0026	0.1	30	**0.07**	**0.02**	**0.15**
	UKFS	25	0.01	-0.04	0.07	25	0.01	-0.03	0.06	25	-0.01	-0.04	0.05	25	0.02	-0.05	0.05	25	-0.01	-0.04	0.06	25	-0.02	-0.06	0.05	25	-0	-0.069	0.06	25	-0.06	-0.17	0.05
	UNDE	31	**0.05**	**0.00**	**0.08**	31	0.04	-0.02	0.08	31	**0.11**	**0.07**	**0.16**	31	**-0.06**	**-0.10**	**-0.03**	31	0.01	-0.04	0.06	31	0.00	-0.04	0.04	31	-0.02	-0.059	0.02	31	-0.01	-0.04	0.02

Table S3 cont.

Ln(1 + CWD)	BART	21	0.34	-0.22	0.77	21	0.25	-0.7	1.16	21	0.17	-0.46	1.21	21	0.24	-0.47	1.01	21	**0.83**	**0.17**	**1.95**	21	-0.08	-0.87	0.79	21	**0.277**	**0.083**	**0.69**	21	0.10	-0.16	0.31
	BONA	10	**-0.31**	**-0.81**	**-0.04**	10	**-0.3**	**-0.83**	**-0.03**	10	**-0.97**	**-3.02**	**-0.12**	10	0.03	-0.55	0.36	10	0.49	-1.45	1.74					10	0.162	-0.634	1.38	10	0.04	-0.04	0.25
	DELA	18	-0.55	-1.15	0.17	18	**-0.7**	**-1.09**	**-0.3**	18	-0.33	-1.00	0.61	18	**-1.25**	**-2.49**	**-0.58**	18	0.83	-0.04	1.77	18	0.84	-0.44	2.06	18	**1.108**	**0.0886**	**2.15**	18	0.67	-0.52	1.84
	GRSM	20	-0.02	-0.84	0.74	20	-0.1	-1.08	0.51	20	-0.17	-0.80	0.34	20	0.73	-0.34	2.09	20	**-0.33**	**-0.69**	**-0.01**	20	**-0.40**	**-0.84**	**-0.11**	20	-0.31	-0.694	0.08	20	0.15	-0.39	0.43
	LENO	21	0.66	-0.20	1.70	21	**0.67**	**0.225**	**1.16**	21	0.54	-0.27	1.50	21	-1.20	-5.70	0.57	21	0.59	-0.54	1.15	21	0.96	-0.48	1.78	21	0.123	-0.604	0.59	21	**-1.01**	**-1.75**	**-0.34**
	ORNL	18	0.45	-0.24	1.08	18	0.47	-0.38	1.49	18	0.45	-0.13	1.08	18	-0.50	-1.93	0.54	18	-0.01	-0.35	0.47	18	-0.17	-0.71	0.46	18	-0.12	-0.499	0.49	18	-0.21	-1.35	3.14
	OSBS	11	**0.60**	**0.18**	**0.87**	11	**0.9**	**0.413**	**1.33**	11	**1.28**	**0.48**	**1.77**	11	**-0.62**	**-0.96**	**-0.19**	11	-0.16	-0.69	0.57	11	**1.47**	**0.20**	**2.07**	11	0.198	-0.356	1.02	11	**0.71**	**0.08**	**2.03**
	SCBI	14	0.34	-0.29	0.85	14	0.11	-0.33	0.64	14	0.28	-0.17	0.69	14	-0.17	-0.72	1.16	14	-0.30	-1.54	0.92	14	0.24	-0.64	1.02	14	-0.32	-0.913	0.4	14	-0.11	-0.95	0.99
	SERC	19	0.19	-0.34	0.68	19	**0.65**	**0.07**	**1.1**	19	0.65	-0.05	1.09	19	-0.16	-1.80	1.03	19	-0.16	-0.76	0.75	19	-0.23	-1.05	0.39	19	-0.05	-0.574	0.42	19	-0.13	-0.96	0.82
	TALL	21	**0.43**	**0.04**	**0.74**	21	0.21	-0.49	0.82	20	0.50	-0.09	1.23	20	-0.30	-0.82	0.11	21	0.44	-0.14	0.92	20	0.46	-0.52	1.94	21	**0.589**	**0.019**	**1.08**	20	-0.20	-0.84	0.36
	TREE	10	0.12	-0.73	1.02	10	0.03	-0.6	0.84	10	0.38	-0.99	1.71	10	-0.53	-1.23	0.30	10	0.29	-0.38	1.43	10	0.14	-0.48	1.00	10	0.147	-1.162	0.9	10	0.10	-0.71	0.39
Exotic species richness	BART	30	1.13	-3.31	4.37	30	2.35	-5.57	6.20	30	0.52	-7.74	8.45	30	0.93	-3.18	4.88	30	0.15	-4.39	3.64	30	0.03	-0.23	0.37	30	0.28	-0.48	1.20	30	0.84	-0.35	2.80
	BONA	22	-1.07	-2.85	0.22	22	-1.28	-4.11	0.04	22	-3.49	-11.54	0.76	22	0.06	-1.39	1.38	22	0.07	-4.80	5.67	22	0.33	-1.01	0.89	22	-3.44	-9.41	1.74	22	-0.21	-0.65	0.89
	DEJU	22	0.04	-1.60	12.45	22	2.41	0.00	9.72	24	-1.69	-55.79	8.07	24	0.86	-0.47	7.12	22	-0.51	-3.45	0.01	22	0.02	-0.01	0.16	22	**-3.30**	**-62.80**	**0.00**	24	0.42	0.00	4.54
	DELA	31	0.10	-0.18	0.39	31	0.00	-0.18	0.22	33	0.29	-0.15	0.70	33	-0.24	-0.53	0.08	31	**0.57**	**0.34**	**0.86**	31	**1.41**	**0.73**	**2.92**	31	**0.32**	**0.05**	**0.68**	33	-0.16	-0.43	0.26
	GRSM	32	0.61	-1.30	2.11	32	1.11	-1.39	2.60	32	0.97	-1.03	4.43	32	-6.03	-14.05	0.00	32	1.44	0.00	4.34	32	**0.11**	**0.03**	**0.30**	32	0.90	0.00	2.22	32	-0.06	-0.66	0.26
	HARV	28	0.54	-0.50	1.98	28	0.17	-0.66	1.17	28	0.30	-0.45	1.17	28	-0.63	-1.30	0.06	28	0.62	-0.46	1.18	28	**1.21**	**0.31**	**2.37**	28	0.31	-0.16	0.60	28	0.22	-0.78	1.35
	JERC	32	-0.31	-0.65	0.04	32	**-0.23**	**-0.41**	**-0.02**	32	-0.26	-1.51	0.37	32	0.09	-0.33	0.78	32	**-0.27**	**-0.40**	**-0.13**	32	**-1.07**	**-2.04**	**-0.25**	32	**-0.32**	**-0.50**	**-0.07**	32	**-1.07**	**-2.00**	**-0.44**
	LENO	31	-0.18	-0.67	0.47	31	-0.37	-0.73	0.06	31	-0.33	-0.78	0.14	31	0.00	-1.27	1.87	31	**0.53**	**0.02**	**1.16**	31	0.46	-1.06	2.03	31	0.03	-0.43	0.45	31	-0.27	-0.87	0.34
	MLBS	14	0.27	-2.48	2.19	14	0.34	-2.17	2.95	14	-0.71	-7.86	3.22	14	1.10	-1.27	3.90	14	-0.64	-3.86	3.69	14	-0.34	-0.59	0.23	14	0.41	-4.44	5.45	14	1.22	-0.39	3.57
	ORNL	31	**-0.45**	**-0.71**	**-0.21**	31	**-0.46**	**-0.91**	**-0.19**	31	**-0.54**	**-0.83**	**-0.29**	31	**0.38**	**0.11**	**0.71**	31	0.28	-0.22	0.72	31	-1.01	-3.10	0.66	31	0.34	-0.23	0.79	31	**-1.10**	**-3.19**	**-0.24**
	OSBS	24	-0.51	-1.44	0.21	24	0.31	-0.34	1.02	23	-1.44	-5.89	0.70	23	0.79	-0.32	2.85	24	**0.68**	**0.06**	**1.30**	23	0.14	-0.24	0.39	24	**0.68**	**0.00**	**1.33**	23	**-1.39**	**-2.57**	**-0.26**
	SCBI	19	-0.15	-0.33	0.05	19	**-0.17**	**-0.31**	**-0.01**	19	**-0.24**	**-0.40**	**-0.12**	19	**0.42**	**0.12**	**0.99**	19	-0.13	-0.67	0.78	19	-0.01	-1.76	3.39	19	-0.10	-0.49	0.45	19	0.00	-0.35	0.51
	SERC	26	**0.09**	**0.00**	**0.19**	26	0.07	-0.02	0.20	26	0.02	-0.17	0.09	26	-0.08	-0.14	0.24	26	**0.20**	**0.10**	**0.38**	26	**0.93**	**0.26**	**3.11**	26	**0.16**	**0.08**	**0.30**	26	0.09	-0.17	0.24
	TALL	31	0.11	-0.22	0.50	31	-0.05	-0.60	0.50	30	0.13	-0.30	0.58	30	-0.19	-0.60	0.18	31	0.25	-0.33	0.76	30	0.36	-0.22	0.94	31	0.29	-0.31	0.89	30	0.27	-0.32	0.70
	TREE	17	0.07	-0.31	0.81	17	-0.12	-0.85	0.17	17	0.14	-0.67	0.77	17	0.04	-0.99	0.65	17	**1.80**	**0.48**	**3.20**	17	-0.51	-2.70	3.43	17	**0.48**	**0.10**	**1.20**	17	0.29	-0.03	0.96
	UKFS	25	-0.40	-0.66	0.05	25	-0.39	-0.75	0.01	25	**-0.79**	**-1.18**	**-0.51**	25	**0.54**	**0.30**	**0.90**	25	**0.41**	**0.25**	**1.28**	25	-1.96	-7.24	3.71	25	0.49	-0.16	0.90	25	0.25	-1.59	2.33
	UNDE	31	**0.67**	**0.16**	**1.26**	31	0.30	-0.08	0.85	31	**0.73**	**0.10**	**1.40**	31	**-0.65**	**-1.21**	**-0.09**					31	**1.88**	**1.27**	**2.73**					31	0.07	-0.21	0.32
Ln(1 + Exotic PSR)	DELA	25	0.09	-0.10	0.33	25	0.01	-0.09	0.2	25	0.32	-0.39	0.72	25	-0.05	-0.49	0.33	25	**0.28**	**0.04**	**0.51**	25	**0.24**	**0.07**	**0.41**	25	0.113	-0.064	0.38	25	-0.18	-0.49	0.09
	JERC	19	-0.05	-0.18	0.14	19	-0	-0.14	0.08	19	0.08	-0.60	0.52	19	-0.09	-0.42	0.26	19	-0.06	-0.12	0.03	19	-0.03	-0.11	0.08	19	-0.06	-0.151	0.06	19	-0.25	-0.58	0.39
	LENO	16	0.02	-0.36	0.38	16	0.09	-0.17	0.39	16	-0.22	-0.52	0.22	16	-0.22	-1.13	1.57	16	**0.30**	**0.01**	**0.59**	16	**0.38**	**0.09**	**0.68**	16	0.112	-0.147	0.46	16	0.00	-0.43	0.71
	ORNL	17	**-0.15**	**-0.28**	**-0.03**	17	**-0.2**	**-0.34**	**-0.03**	17	**-0.39**	**-0.53**	**-0.26**	17	**0.29**	**0.15**	**0.45**	17	0.02	-0.18	0.20	17	-0.05	-0.16	0.05	17	0.015	-0.221	0.23	17	**-0.42**	**-1.14**	**0.00**
	SCBI	19	-0.08	-0.25	0.08	19	-0.1	-0.23	0.03	19	**-0.20**	**-0.28**	**-0.11**	19	**0.42**	**0.20**	**0.79**	19	-0.22	-0.59	0.31	19	-0.05	-0.27	0.25	19	-0.15	-0.431	0.18	19	-0.11	-0.41	0.25
	SERC	26	0.07	0.00	0.16	26	0.05	-0.02	0.15	26	0.01	-0.16	0.06	26	-0.05	-0.09	0.28	26	**0.14**	**0.06**	**0.32**	26	0.06	-0.01	0.18	26	**0.13**	**0.0627**	**0.26**	26	0.09	-0.13	0.24
	UKFS	23	-0.19	-0.38	0.05	23	-0.1	-0.38	0.05	23	**-0.45**	**-0.66**	**-0.28**	23	**0.35**	**0.21**	**0.67**	23	**0.24**	**0.10**	**0.68**	23	0.01	-0.29	0.39	23	0.124	-0.329	0.36	23	-0.12	-1.35	0.56
	UNDE	13	-0.10	-0.29	0.15	13	0.09	-0.11	0.3	13	0.07	-0.12	0.21	13	-0.08	-0.18	0.04	13	0.04	-0.13	0.19	13	-0.06	-0.24	0.20	13	0.035	-0.058	0.3	13	**0.17**	**0.06**	**0.26**

Table S4. Environmental context dependency of diversity - ecosystem function relationships. The bolded terms are 95 % bootstrapped confidence intervals of the slope of the linear regression between site-level D-EF slopes and environmental context variables (maximum tree height, mean annual temperature, mean annual precipitation, total nitrogen in the O and A soil horizons).

Function	Diversity	Maximum tree height		MAT		MAP		Soil Total Nitrogen	
		Bca 95% CI		Bca 95% CI		Bca 95% CI		Bca 95% CI	
Basal area	External heterogeneity	**-0.085666**	**-0.002988**	**-0.129136**	**-0.009970**	-0.002126	0.000168	-0.093045	0.041353
	Internal heterogeneity	-0.029852	0.013266	-0.042650	0.009876	-0.000732	0.000599	-0.030451	0.047154
	Mean canopy height	**-0.637201**	**-0.009958**	-0.889519	0.017860	**-0.015388**	**-0.001111**	-1.044897	0.077167
	Gap fraction	-0.119693	0.006357	-0.107401	0.012977	-0.001144	0.001420	-0.159369	0.136664
	Native species richness	-0.022685	0.007034	-0.030424	0.010236	-0.000503	0.000253	-0.034859	0.029484
	Tree species richness	-0.027169	0.013209	-0.018512	0.042496	-0.000767	0.000104	-0.053266	0.025168
	Native PSR	**-0.069437**	**-0.012392**	**-0.087805**	**-0.011870**	**-0.001542**	**-0.000183**	-0.013553	0.166630
	Native PSV	-0.029928	0.019751	-0.022645	0.026520	0.000066	0.000935	-0.002971	0.094239
LAI	External heterogeneity	-0.017768	0.010901	-0.019622	0.027726	-0.000646	0.000291	-0.063899	0.005558
	Internal heterogeneity	-0.010852	0.019679	-0.016012	0.035952	-0.000711	0.000476	-0.075123	0.007475
	Mean canopy height	**-0.219744**	**-0.004686**	**-0.284836**	**-0.006938**	-0.005311	0.000293	-0.172147	0.050044
	Gap fraction	-0.000257	0.072412	-0.001921	0.093271	-0.000811	0.001705	-0.070431	0.060408
	Native species richness	-0.001576	0.042602	-0.013144	0.043189	**0.000039**	**0.001001**	-0.073672	0.034619
	Tree species richness	-0.009953	0.011266	-0.003506	0.018357	-0.000130	0.000359	**-0.041074**	**-0.002035**
	Native PSR	-0.013233	0.013477	-0.017230	0.015333	-0.000384	0.000364	-0.027683	0.025518
	Native PSV	-0.014267	0.008173	-0.001574	0.037089	-0.000103	0.000521	**-0.063145**	**-0.004769**
fPAR	External heterogeneity	-0.002472	0.002868	-0.002860	0.005681	-0.000098	0.000078	-0.011964	0.000335
	Internal heterogeneity	-0.001394	0.005124	-0.002613	0.007827	-0.000108	0.000133	-0.014004	0.001063
	Mean canopy height	**-0.057382**	**-0.000305**	**-0.074183**	**-0.001178**	-0.001412	0.000066	-0.055166	0.007036
	Gap fraction	-0.000896	0.018832	**0.001023**	**0.025415**	-0.000203	0.000452	-0.011921	0.016055
	Native species richness	-0.000601	0.007653	-0.001817	0.007944	**0.000015**	**0.000184**	-0.013278	0.005774
	Tree species richness	-0.001296	0.002687	-0.000541	0.003651	-0.000012	0.000078	-0.008314	0.000319
	Native PSR	-0.002868	0.003537	-0.003595	0.004230	-0.000084	0.000091	-0.004786	0.006155
	Native PSV	-0.001465	0.002407	-0.0008	0.005001	-0.000024	0.0001	**-0.009256**	**-0.000147**
Coarse woody debris	External heterogeneity	-0.026765	0.039369	-0.031327	0.042989	-0.000577	0.000889	-0.076800	0.039650
	Internal heterogeneity	-0.052868	0.044993	-0.034125	0.052615	-0.001050	0.000980	-0.093038	0.040473
	Mean canopy height	-0.061255	0.067375	-0.005296	0.095894	-0.001105	0.001768	-0.194309	0.013486
	Gap fraction	-0.046382	0.062089	**-0.115921**	**-0.005142**	-0.001145	0.001887	-0.028778	0.087334
	Native species richness	-0.068927	0.028005	-0.049792	0.042235	-0.000695	0.001301	-0.059914	0.068854
	Tree species richness	-0.113667	0.050180	**0.009292**	**0.195195**	-0.004678	0.002172	-0.216010	0.007449
	Native PSR	-0.051481	0.015553	-0.013329	0.081199	-0.000483	0.001253	-0.093328	0.026134
	Native PSV	**-0.086777**	**-0.000208**	-0.055632	0.042197	-0.001134	0.000495	-0.105979	0.033079
Exotic species richness	External heterogeneity	-0.005867	0.060205	-0.060867	0.040126	-0.000269	0.001396	-0.084760	0.080639
	Internal heterogeneity	-0.085471	0.053999	-0.127194	0.040846	-0.002196	0.001831	-0.122592	0.154088
	Mean canopy height	**0.039408**	**0.177905**	-0.060402	0.155156	**0.000084**	**0.003521**	-0.296130	0.067940
	Gap fraction	**-0.273795**	**-0.013456**	-0.090286	0.04005	-0.008667	0.000436	**0.012683**	**0.405948**
	Native species richness	-0.009727	0.058546	-0.068619	0.045353	-0.001586	0.001211	-0.152395	0.007357
	Tree species richness	-0.007408	0.090315	-0.086571	0.031505	-0.001655	0.001037	-0.155729	0.068056
	Native PSR	-0.017699	0.172599	-0.016130	0.213932	-0.000005	0.003863	-0.316733	0.052022
	Native PSV	-0.039966	0.03508	-0.106533	-0.012507	-0.001049	0.000316	**0.004321**	**0.180235**

Table S5. Correlations between forest structural diversity metrics and environmental conditions across 19 forested NEON sites with Spearman's correlation coefficients. Site-level means of each structural diversity was taken from plot-level LiDAR data. MAT = mean average temperature (°C), MAP = mean annual precipitation (mm), Soil N = nitrogen in the O and Z soil horizons. * indicates an $\alpha < 0.05$.

Structural diversity metric	MAT	MAP	Soil N
Mean canopy height	0.34	0.55*	0.23
Gap fraction	-0.26	-0.54*	-0.36
External heterogeneity	0.39	0.49*	0.03
Internal heterogeneity	0.55*	0.32	-0.41

Table S6. Correlations between forest structural diversity metrics across 19 forested NEON sites with Spearman's correlation coefficients. All tests were significant (N_{Plots} = 469).

Structural diversity metric	External heterogeneity	Internal heterogeneity	Mean canopy height
Internal heterogeneity	0.75		
Mean canopy height	-0.76	0.51	
Gap fraction	-0.50	-0.26	-0.90