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Supplementary Information for

Plant species richness at archaeological sites suggests ecological legacy of Indigenous subsistence on the Colorado Plateau, USA.

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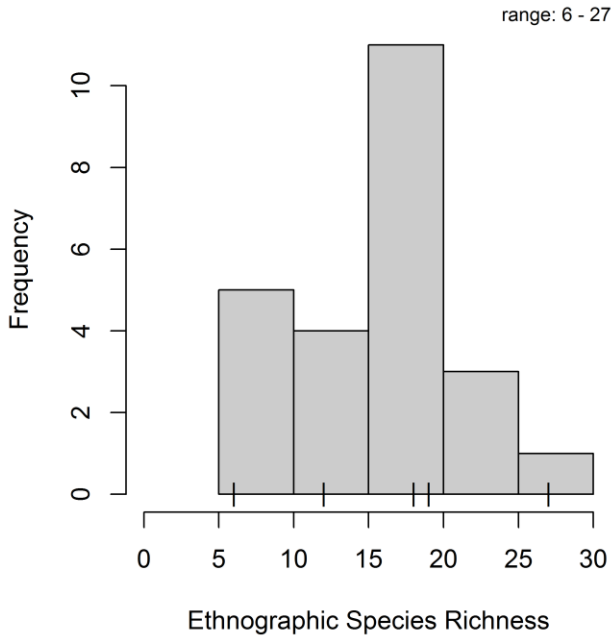

Figure S1. Distribution of ethnographic species richness with quantiles illustrated as ticks along the base of the x-axis at 6, 12, 18, 19, and 27.

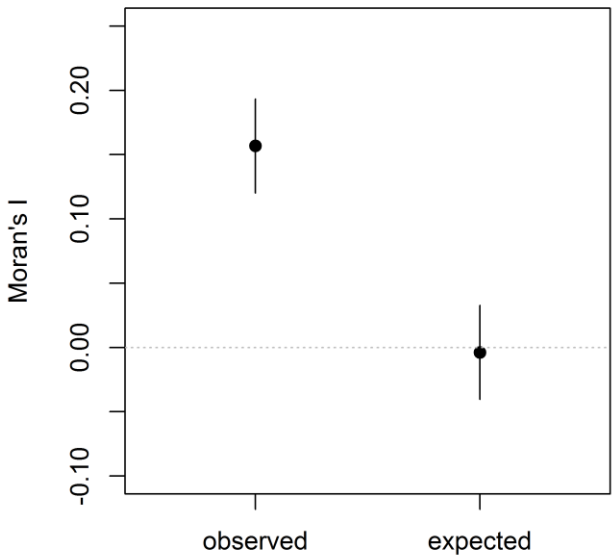

Figure S2. Results of global Moran's I statistic with 95% confidence intervals comparing the observed distribution of ethnographic species richness (ESR) relative to the theoretically expected value if ESR is not spatially correlated. Observed values are significantly higher than expected, indicating that neighboring sites have more similar ESR than would be expected by chance.

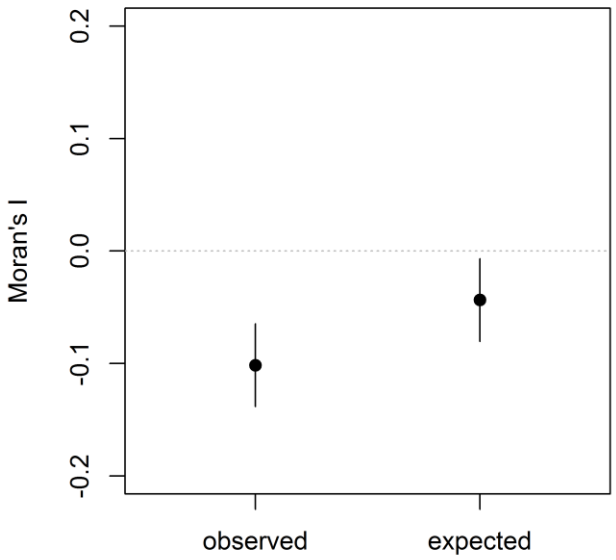

Figure S3. Results of global Moran's I statistic with 95% confidence intervals comparing the observed and expected distribution of model residuals. Observed values do not differ significantly from expected, indicating that the model adequately accounts for spatial autocorrelation in ESR.

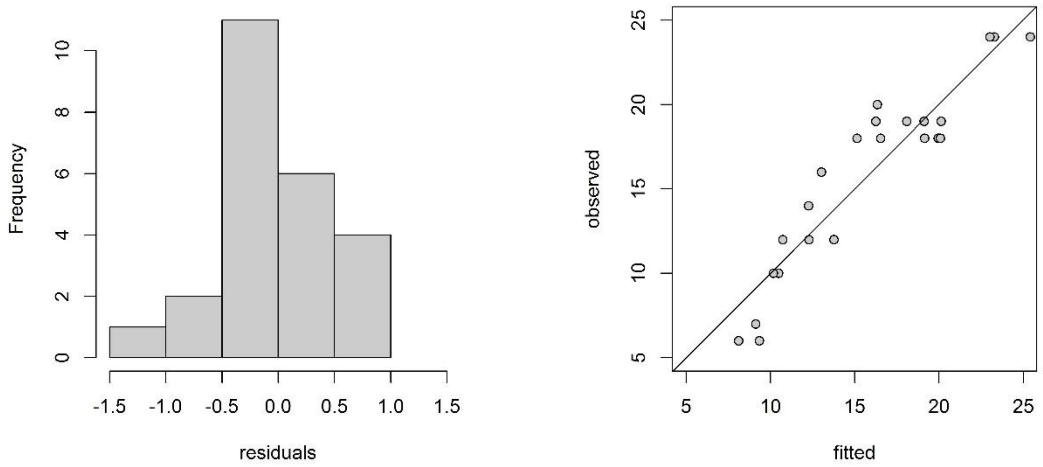

Figure S4. Model diagnostics showing the distribution of residuals (left) and the observed ESR values as a function of the fitted (predicted) values.

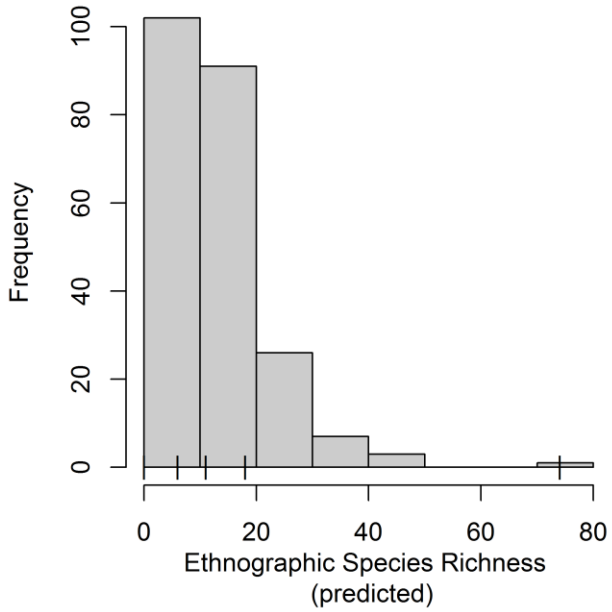

Figure S5. Distribution of predicted ethnographic species richness across all 265 documented Puebloan archaeological sites with quantiles illustrated as ticks along the base of the x-axis at 0, 6, 11, 18, and 74.

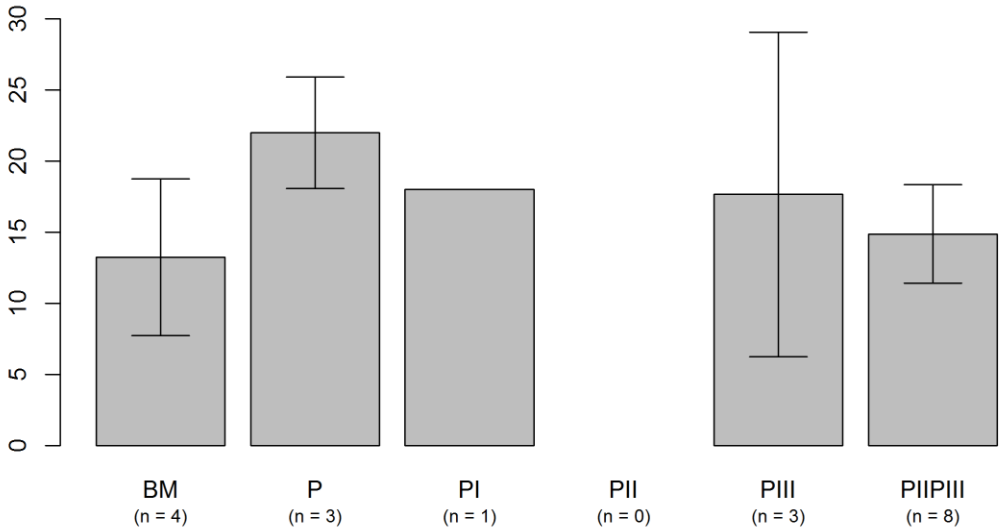

Figure S6. Distribution of mean ethnographic species richness (ESR) documented across formative agricultural periods. Basketmaker (BM), generic Pueblo (P, unknown), Pueblo I (P1), Pueblo II (PII), Pueblo III (PIII), and multicomponent Pueblo II-III (PIIPIII). There was only one observation at PI sties and no observations at PII sites. Whiskers show the 95% standard error, which overlaps for all time periods for which the standard error could be calculated, indicating that there are no meaningful differences in ESR through time.

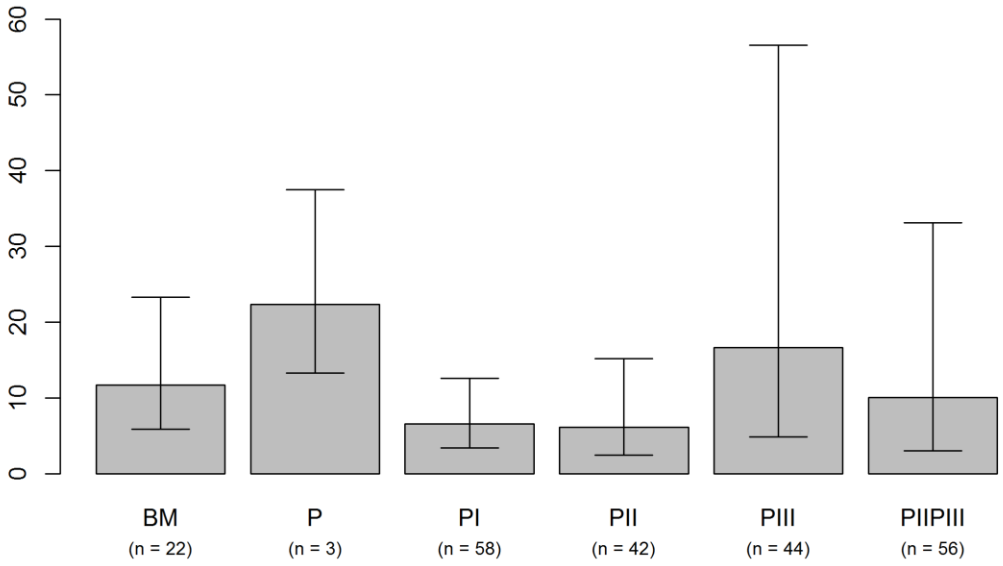

Figure S7. Distribution of mean predicted ethnographic species richness (ESR) across formative agricultural periods predicted by our model. Basketmaker (BM), generic Pueblo (P, unknown), Pueblo I (P1), Pueblo II (PII), Pueblo III (PIII), and multicomponent Pueblo II-III (PIIPIII). Whiskers show the 95% standard error, all of which overlap except a minor (0.3) gap between the lower confidence interval of the general Pueblo period (95% CI = 13.3-38) and the upper confidence interval of the PI period (95% CI = 3.5-13), indicating that there is minimal to no meaningful difference in predicted ESR over time.

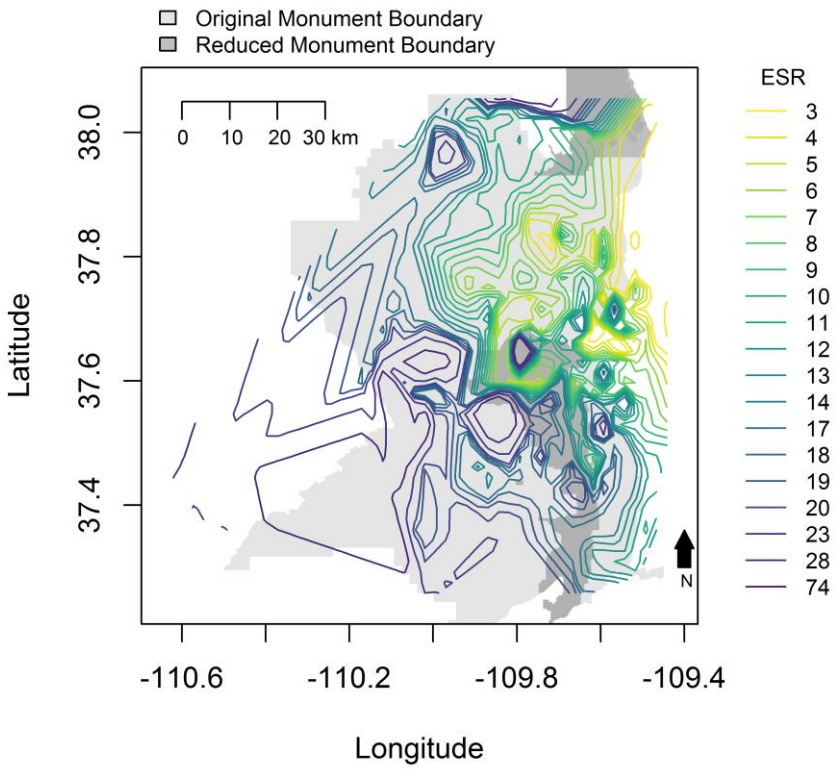

Figure S8. Interpolated ESR for all recorded archaeological sites across the study area.

Table S1. Supplementary Table 1. Compilation of ethnographic plant species from 25 archaeological sites in Bears Ears, from surveys in 2017, 2018 and 2019. N = Navajo, H = Hopi, UMU = Ute Mountain Ute, Z = Zuni, A = Apache. Corroborating sources: a = Heil et al. 2013, b = NAEB, c = Dunmire & Tierney 1995, d = Moerman 1998, e = Moerman 2009, f = Arnold Clifford (pers. comm.).

sp. #	SPECIES	FOOD					MEDICINE					CEREMONY					UTILITY				
		N	H	UMU	Z	A	N	H	UMU	Z	A	N	H	UMU	Z	A	N	H	UMU	Z	A
1	*Abronia fragrans* (incl. var. *fragrans*)						a,b,d,e			b,c,d,e											
2	*Acer negundo*					a,b,d											a,b,d				
3	*Achillea millefolium* var. *occidentalis*					a	b, d			b	a	b, d									
4	*Achnatherum hymenoides*	a,b	b		b	a,b											b				b
5	*Amaranthus powellii*		b,d																		
6	*Ambrosia acanthicarpa*									b,d,e		a,b,d									
7	*Amelanchier alnifolia*	b,d																			
8	*Amelanchier utahensis*	a,b,d					b,d,e					a,d	a,b,d					a,b			
9	*Antennaria parvifolia*	b,c.e					b,e					b,e									
10	*Arctostaphylos patula*	b,d					b,d,e					b,d,e									
11	*Artemisia carruthii*	b,d			b,d	b,d	a,b,d,e			b,c,d,e		a,b,d	b,d								
12	*Artemisia frigida*	d	b		b	d	b,d,e	d,e		e	b	a	b			b	b,d			b	
13	*Artemisia tridentata*	e	e			b	a,b,e	b		c,e		a,e					a				
14	*Astragalus mollissimus*						b					a					b,d				
15	*Atriplex canescens*						a						a		a		a	a			
16	*Atriplex confertifolia*		a				a	a													
17	*Bouteloua gracilis*	b,d,e	b,d,e			b,d,e	b,e					b,e						b,e		b,e	b,e
18	*Brickellia californica*						a,d,e					d,e					a				
19	*Castilleja integra*						b,d,e													b,d	b,d
20	*Castilleja linariifolia*		a,b,d				b,d,e	b,d,e					b,d					b			
21	*Celtis laevigata reticulata*						a														
22	*Cercocarpus intricatus*												a,b,d								
23	*Cercocarpus montanus*						b					b									
24	*Chamaesyce fendleri*						a	a,b,d,e													
25	*Chenopodium berlanderi*																b				
26	*Chenopodium fremontii*	a,b,d	a,b															a,b,d				
27	*Chenopodium leptophyllum*	a,b,d	a,b,d		a,b	a,b,d															
28	*Chrysothamnus greenei*						a,b,d,e						a,b,d								
29	*Chrysothamnus viscidiflorus*		a,b				a	a,b,d					b,d				a,b	a,b,d			
30	*Clematis ligustifolia*						d,e														
31	*Cleome serrulata*	b	b				b					b					b				
32	*Conyza canadensis* (incl. var *canadensis*)						b,d,e	b,d,e		b,d,e											
33	*Cordylanthus wrightii*						a,b,d,e	a													
34	*Datura wrightii*	b,d				b,d	b,d,e	b,e		b,d,e	b,d,e	b			b,d						
35	*Elymus canadensis*																				
36	*Elymus elymoides* ssp. *elymoides*																b,d,e				
37	*Ephedra nevadensis*				b,c,d	b,d	b,d,e			b,c,d,e	b,d,e										
38	*Ephedra torreyana*	b,d					b,e	b,e									a				a
39	*Ephedra viridis*	b,d					a,b,e	b,e			a						a,b				a
40	*Eremogone eastwoodiae* [aka *Arenaria eastwoodiae* (incl. var. *eastwoodiae*)]							a,b,d,e													
41	*Erigeron flagellaris*						a,b,e					a,b.e					a				
42	*Eriogonum alatum*	a,b,d					a,b,d,e			b,c,d,e		a,b,d									
43	*Eriogonum corymbosum* var. *orbiculatum*		b																		
44	*Eriogonum leptophyllum*						a,b,d,e														
45	*Eriogonum racemosum*	b,d					a,b,d,e														
46	*Eriogonum umbellatum* (incl. var. *umbellatum*)						b,d,e														
47	*Forestiera pubescens* var. *pubescens*					b,d	b,d,e					a,b,d	b,d				a	b			
48	*Frasera speciosa*					b,d,e	e	b			b,e										b,e
49	*Fraxinus anomala*											a,b	a,b								
50	*Gaillardia pinnatifida*						b,d,e	b,d,e													
51	*Gutierrezia sarothrae*						b,e			b,e		b,e	b,e				b,e				
52	*Helianthus nuttallii*						b,d,e														
53	*Hesperostipa comata*																b				
54	*Hilaria jamesii* (aka *Pleuraphis jamesii*)						b,d,e						b,d				b,d	b,d			
55	*Ipomopsis gunnisonii*						a,b,d,e														
56	*Ipomopsis longiflora*						a,b,d,e	a,b,d,e		b,e		a,b			c					c	

Table S1. Continued.

sp. #	SPECIES	FOOD					MEDICINE					CEREMONY					UTILITY				
		N	H	UMU	Z	A	N	H	UMU	Z	A	N	H	UMU	Z	A	N	H	UMU	Z	A
57	***Juncus arcticus* (incl. ssp. *littoralis*) (aka *Juncus balticus*)**												b,d								
58	*Juniperus osteosperma*		b,d			b,d	a,b,e	b,d,e									a,b,d	a,b			
59	*Juniperus scopulorum*	e			c	b,d,e	a,b,e					a,b									
60	***Krascheninnikovia lanata***						a,b,d,e	b,d,e		a,b,c,d,e		a,b,d,f	a,b,d				a,b,d				
61	***Lactuca serriola***											b,d,e									
62	*Lathyrus lanszwertii* var. *leucanthus*					b,d,e															
63	*Lepidium montanum*						a,b,e										b,d,e				
64	***Linanthus pungens* (aka *Leptodactylon pungens*)**						a,b,d,e														
65	*Lycium pallidum*	b,d	b		b,d		b,d,e	d,e				b,d	b,d		b						
66	***Machaeranthera tanacetifolia***						b,d,e	b,c,d,e		b,d,e											
67	*Mahonia fremontii*		a		a		a	b,d,e			d,e	a	a		a,b	b	a,b	a,b,d		a,b	
68	*Mahonia repens*						a,b,e					b,e	b,e					a			
69	***Mentzelia multiflora***	a,b,d					a,b,d,e					a,b,d									
70	*Mirabilis linearis* var. *linearis*	b					b				b										
71	*Oenothera elata* var. *hirsutissima*						a														
72	***Oenothera pallida***						a,b,d,e					b,d,e	a,b								
73	*Opuntia phaeacantha*	b			c															c	
74	***Packera multilobata***						a,b,d,e					a,b,d,e									
75	*Packera neomexicana* var. *neomexicana*						b					b									
76	***Penstemon barbatus* (inc. var. *barbatus*)**						b,d,e														
77	***Petradoria pumila***						b,d,e	b,d,e				b,d,e					b,d	b,d			
78	***Phacelia crenulata***							a,b,d,e													
79	*Phragmites australis*					b					e	b,e	b,e				b	b,e			b,e
80	*Pinus edulis*	b,d	b,d		b,d	b,d	b,d	b,d		b,d	b,d	b,d	b,d			b,d	b,d	b,d			b,d
81	*Pinus ponderosa*	d					b,d,e					a,b	a,b,d				b,d	b,d			
82	***Plantago patagonica***	a	b,d				a,b,d,e	a,b,d,e		b,c,d,e		a,b,d	a,b,d								
83	*Pleuraphis jamesii*						b						b					b			
84	*Poa fendleriana*	b,e						e					b,e				b				
85	***Polypogon monspeliensis***						b,d,e										b,d				
Tab	*Populus tremuloides*	b,d,e				b,d,e	e	e				b	b				b				
87	*Portulaca oleracea*	a,b,c,d	d		c	b	a,b,e														
88	*Prunus virginiana*	a			c	b,d	a,b,d,e					a									
89	*Pseudocymopterus montanus*	b,d,e	b,d,e				b,e					b									
90	*Pseudostellaria jamesiana*						b,e					a,b,e									
91	*Purshia tridentata*	b,d					a,b,d,e					a,b,d					a,b,d				
92	***Purshia stansburiana***						b,d,e	a,b,d,e				a,b,e	b,d				a,b,d	a,b,d			
93	*Quercus gambelii*	a,d	a			a,d	d,e					a,d	b,d				a,d				d
94	***Rhus trilobata***	b,d	b,d			b,d	b,d,e	b,d,e				b,d	b,d,e				b,d	b,d		b,d	b,d
95	*Rhus aromatica* var. *trilobata*	f					f					f					f				
96	*Rhus aromatica* var. *simplicifolia*	f					f					f					f	f			
97	*Rosa woodsii*																a				
98	*Rumex hymenosepalus*	b,d					a,b,d,e	a,b		c		a,d					a,b,d	a,b,c,d			
99	*Salix eriocephala*																		b		
100	*Salix exigua*	b,d					d,e			b,c,d,e		d			c						
101	*Sarcobatus vermiculatus*	b,d					a,d,e	b,e				b,d	b				b,d	a,d			
102	*Shepherdia rotundifolia*						b,e					b,e									
103	*Solanum jamesii*	a,d	b,d		c	b,d															
104	***Solanum physalifolium***																b,d				
105	***Solanum triflorum***				b,c,d		b,d,e										b,d				
106	*Solidago canadensis* var. *salebrosa*	b,d,e								b							b,e				
107	***Sphaeralcea coccinea***	a,b,d					a,b,d,e					a,e									
108	*Sphaeralcea parvifolia*							a,d,e					b								
109	*Stanleya pinnata* var. *pinnata*		d				a,b,d,e	b		b,e											
110	*Symphoricarpos longiflorus*							a													
111	*Symphoricarpos oreophilus*						b,e					b,e									
112	*Thalictrum fendleri*						e					b,e					b,e				
113	*Thermopsis montana* var. *montana*						a,b														
114	*Tradescantia occidentalis*		b,d				a,d,e														
115	*Viola nephrophylla*						a,b					a,b									
116	*Yucca angustissima* var. *angustissima*		b,d					b,d,e			b,d,e	a	b,d		c			b,d			b,d
117	*Yucca baileyi*							b,e					b,e					b,e			

Table S2. Summary of generalized additive model results including the estimate, standard error, z value and p-value for the parametric terms, and the estimated degrees of freedom (edf) reference degrees of freedom (ref.df), Chi square value and p-value for smoothed terms.

Parametric Terms					
	Estimate	**Std. Error**	**z**	**p-value**	
Intercept	-0.44	2.12	-0.21	0.8371	
Slope	0.01	0.03	0.22	0.8247	
MI	-26.88	14.47	-1.86	0.0632	
GDD	0.00	0.00	3.54	0.0004	***
Arch. Features	0.03	0.01	2.36	0.0181	*
Site Area	0.00	0.00	-1.49	0.1357	
Smoothed Terms					
	edf	**ref.df**	**Chi sq**	**p-value**	
s(X,Y)	4.028	5	25.3	<0.0001	***