

Supplementary Materials

Text S1. Model diagnostics

Standard model diagnostics were conducted for all zone-based and pattern-specific regression models.

1. **Multicollinearity.** Multicollinearity was assessed using variance inflation factors (VIFs). VIFs are not informative for near-zone models because land-cover proportions are compositional (constant-sum constraint). Elevated VIFs in the middle and far zones reflect correlations among configuration metrics; these variables were retained based on AIC and theoretical relevance, and coefficients are interpreted with caution.
2. **Model specification.** Stepwise AIC-based selection was used as a robustness check rather than as the primary basis for inference.
3. **Residual diagnostics.** Residual-fitted and leverage diagnostics did not indicate strong nonlinearity or influential observations. Mild heteroskedasticity and non-normal residual tails were observed, which are common in perception-related and spatial data. Overall, diagnostics support the use of linear models for comparative inference across viewing distance zones and landscape patterns.
4. **Spatial autocorrelation.** Because viewpoints are georeferenced, residual spatial autocorrelation was assessed using Moran's I based on a Queen contiguity spatial weights matrix with row standardization (Tables S2 and S4). Tables S3 and S5 report spatial error model (SEM) estimates used to assess the robustness of the ordinary least squares (OLS) results to spatial autocorrelation.

Table S1: Summary of variance inflation factors

Zone	Variables	Max VIF	Note
Near	Composition	n/a	compositional
Middle	Composition + configuration	high	PD, ED, SDI
Far	Composition + configuration	high	PD, ED, SDI

Note: PD = Patch Density; ED = Edge Density; SDI = Shannon Diversity Index. High VIF values reflect correlations among configuration metrics.

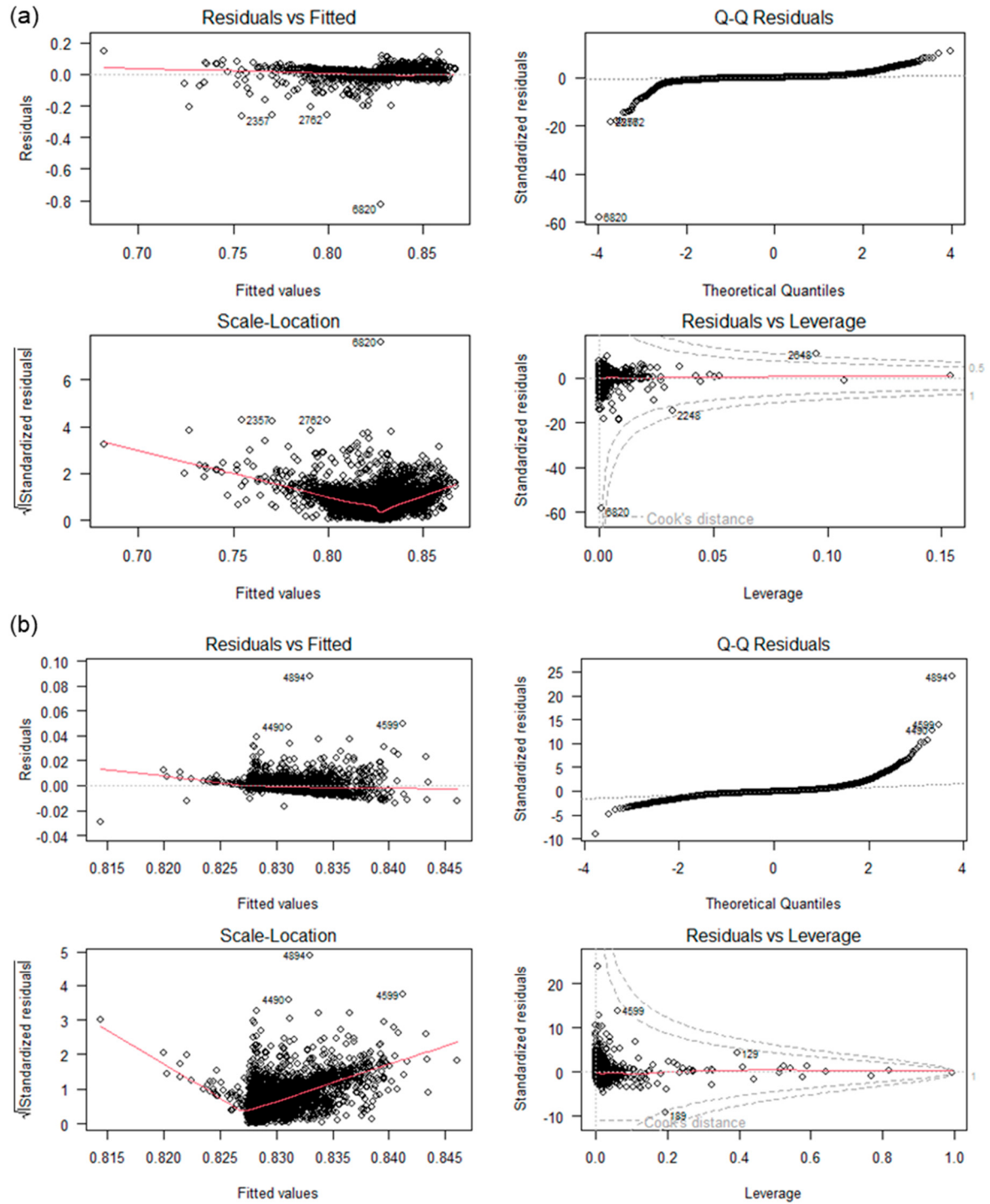


Figure S1. Representative residual diagnostics for regression models. Representative residual diagnostic plots are shown for (a) a near-zone regression model and (b) a pattern-specific regression model (Cluster 1). No systematic differences in residual behavior were observed across viewing distance zones or landscape patterns.

Table S2. SEM estimates for viewing-zone-specific models.**(a) Near-zone model**

Variable	Coefficient	Std. Error	z-Statistic	p-value
Constant	0.824	0.002	419.686	<0.001
Forest	0.003	0.002	1.681	0.093
Green spaces	-0.020	0.006	-3.272	0.001
Grassland	0.029	0.002	12.613	<0.001
Artificial land	-0.022	0.002	-11.075	<0.001
Residential buildings	-0.008	0.003	-2.964	0.003
Retail buildings	-0.097	0.005	-20.206	<0.001
Roads	0.002	0.001	1.513	0.130
Viewshed size	0.019	0.001	12.957	<0.001
lambda	0.464			

Note: $n = 14,891$; Pseudo $R^2 = 0.256$

(b) Middle-zone model

Variable	Coefficient	Std. Error	z-Statistic	p-value
Constant	0.826	0.000	2501.865	<0.001
Forest	0.004	0.001	6.244	<0.001
Arable	-0.002	0.004	-0.513	0.608
Grassland	0.017	0.003	6.151	<0.001
Artificial land	0.006	0.004	1.607	0.108
Retail buildings	-0.033	0.008	-4.130	<0.001
Roads	-0.003	0.004	-0.623	0.534
Viewshed size	0.028	0.008	3.340	0.001
Patch density	0.017	0.009	1.828	0.067
Shannon diversity index	0.022	0.006	3.515	<0.001
Edge density	-0.031	0.007	-4.351	<0.001
Contagion index	-0.010	0.001	-9.602	<0.001
lambda	0.544			

Note: $n = 14,891$; Pseudo $R^2 = 0.145$

(c) Far-zone model

Variable	Coefficient	Std. Error	z-Statistic	p-value
Constant	0.825	0.000	2149.009	<0.001
Forest	0.002	0.001	2.540	0.011
Grassland	0.006	0.003	2.529	0.011
Viewshed size	0.035	0.015	2.261	0.024
Patch density	0.065	0.012	5.303	<0.001
Shannon diversity index	0.038	0.013	2.854	0.004
Edge density	-0.049	0.012	-4.020	<0.001
Contagion index	-0.004	0.001	-3.244	0.001
lambda	0.556			

Note: $n = 14,891$; Pseudo $R^2 = 0.164$

Table S3. Global Moran's I for residuals of cluster-specific models.

Cluster model (residuals)	<i>n</i>	Moran's I	Expected I	z-score	p-value
Cluster 1	5989	0.141	-0.00017	12.921	<0.001
Cluster 2	1193	0.641	-0.00084	18.658	<0.001
Cluster 3	4955	0.127	-0.00020	8.947	<0.001
Cluster 4	2754	0.118	-0.00036	7.941	<0.001

Note: Moran's I was computed for residuals from the corresponding ordinary least squares models using Queen contiguity weights (row-standardized).

Table S4. SEM estimates for cluster-specific models.

(a) Cluster 1

Variable	Coefficient	Std. Error	z-Statistic	p-value
Constant	0.835	0.001	594.324	<0.001
Near zone				
Forest	-0.008	0.001	-5.845	<0.001
Arable	-0.010	0.002	-4.419	<0.001
Grassland	-0.003	0.002	-1.805	0.071
Artificial	-0.006	0.002	-3.038	0.002
Residential buildings	-0.010	0.003	-3.636	<0.001
Roads	-0.002	0.001	-3.780	<0.001
Viewshed size	0.009	0.001	9.538	<0.001
Middle zone				
Artificial	-0.017	0.002	-8.891	<0.001
Roads	0.005	0.002	2.952	0.003
Shannon diversity index	0.006	0.003	1.967	0.049
Edge density	0.012	0.002	4.998	<0.001
Viewshed size	-0.009	0.004	-2.330	0.020
Far zone				
Forest	0.000	0.000	0.712	0.476
Water	-0.006	0.002	-2.773	0.006
Residential buildings	-0.017	0.008	-2.201	0.028
Retail buildings	0.024	0.010	2.455	0.014
Patch density	-0.017	0.006	-2.717	0.007
Shannon diversity index	0.028	0.005	5.945	<0.001
Edge density	0.008	0.006	1.340	0.180
lambda	0.175			

Note: *n* = 5989; Pseudo R² = 0.278

(b) Cluster 2

Variable	Coefficient	Std. Error	z-Statistic	p-value
Constant	0.822	0.002	369.042	<0.001
Near zone				
Grassland	0.016	0.002	7.529	<0.001
Artificial	-0.016	0.004	-3.984	<0.001

Roads	0.000	0.005	-0.021	0.983
Middle zone				
Forest	0.005	0.002	2.210	0.027
Green spaces	-0.097	0.025	-3.933	<0.001
Arable	0.009	0.008	1.039	0.299
Grassland	0.019	0.005	3.676	<0.001
Water	-0.016	0.009	-1.826	0.068
Shannon diversity index	-0.037	0.013	-2.758	0.006
Contagion index	-0.005	0.002	-2.056	0.040
Viewshed size	0.074	0.015	5.094	<0.001
Far zone				
Forest	0.007	0.002	4.148	<0.001
Water	-0.031	0.018	-1.712	0.087
Grassland	0.010	0.005	2.135	0.033
Shannon diversity index	0.124	0.013	9.901	<0.001
Contagion index	-0.013	0.002	-5.177	<0.001
Viewshed size	-0.061	0.016	-3.879	<0.001
lambda	0.467			

Note: $n = 1193$; Pseudo $R^2 = 0.744$

(c) Cluster 3

Variable	Coefficient	Std. Error	z-Statistic	p-value
Constant	0.833	0.001	1315.605	<0.001
Near zone				
Forest	-0.007	0.001	-10.132	<0.001
Green spaces	-0.046	0.006	-8.014	<0.001
Arable	-0.008	0.002	-4.815	<0.001
Artificial	-0.016	0.002	-10.121	<0.001
Viewshed size	0.016	0.001	14.511	<0.001
Middle zone				
Grassland	0.006	0.002	3.517	<0.001
Water	-0.007	0.003	-2.520	0.012
Residential buildings	-0.003	0.004	-0.792	0.429
Retail buildings	-0.019	0.012	-1.539	0.124
Roads	-0.001	0.002	-0.599	0.549
Patch density	0.019	0.001	19.628	<0.001
Contagion index	0.000	0.000	-0.823	0.411
Far zone				
Patch density	0.064	0.010	6.456	<0.001
Shannon diversity index	-0.033	0.009	-3.643	<0.001
Edge density	-0.041	0.009	-4.777	<0.001
Viewshed size	0.085	0.015	5.738	<0.001
lambda	0.136			

Note: $N = 4955$; Pseudo $R^2 = 0.416$

(d) Cluster 4

Variable	Coefficient	Std. Error	z-Statistic	p-value
Constant	0.821	0.003	265.130	<0.001
Near zone				
Forest	-0.007	0.003	-2.185	0.029
Artificial	-0.019	0.004	-4.539	<0.001
Residential buildings	-0.015	0.005	-2.971	0.003
Retail buildings	-0.160	0.010	-16.016	<0.001
Middle zone				
Retail buildings	-0.034	0.020	-1.699	0.089
Edge density	0.045	0.006	7.618	<0.001
Far zone				
Viewshed size	0.107	0.017	6.197	<0.001
lambda	0.203			

Note: N = 2754; Pseudo R² = 0.245