Table S1. Linear regression parameters for habitat connectivity-distance relationships across four taxonomic groups for each of the three highways.

Animal	Highway	Year	Slope	R^2
Reptiles	HXJ	2000	-0.86	0.95
		2005	-0.67	0.93
		2010	-0.68	0.91
		2015	-0.42	0.75
		2020	-0.57	0.89
		2023	-0.56	0.92
	CT	2000	-0.29	0.92
		2005	-0.22	0.97
		2010	-0.24	0.97
		2015	-0.27	0.96
		2020	-0.24	0.95
		2023	-0.18	0.82
	LLW	2000	-0.18	0.86
		2005	-0.18	0.87
		2010	-0.17	0.87
		2015	-0.16	0.88
		2020	-0.16	0.86
		2023	-0.16	0.94
Amphibians	HXJ	2000	-1.26	0.95
		2005	-1.01	0.96
		2010	-1.04	0.95
		2015	-0.74	0.83
		2020	-0.93	0.93
		2023	-0.87	0.94
	CT	2000	-0.44	0.92
		2005	-0.34	0.97

		2010	-0.37	0.97
		2015	-0.32	0.98
		2020	-0.36	0.97
		2023	-0.28	0.88
	LLW	2000	-0.28	0.93
		2005	-0.27	0.95
		2010	-0.25	0.95
		2015	-0.25	0.95
		2020	-0.25	0.95
		2023	-0.25	0.96
Mammals	HXJ	2000	-1.62	0.97
		2005	-1.29	0.96
		2010	-1.33	0.97
		2015	-1.00	0.87
		2020	-1.17	0.95
		2023	-1.09	0.97
	CT	2000	-0.58	0.94
		2005	-0.46	0.99
		2010	-0.49	0.98
		2015	-0.44	0.99
		2020	-0.45	0.98
		2023	-0.38	0.92
	LLW	2000	-0.36	0.96
		2005	-0.35	0.96
		2010	-0.32	0.97
		2015	-0.32	0.97
		2020	-0.33	0.97
		2023	-0.329	0.98
Birds	HXJ	2000	-2.05	0.99

		2005	-1.66	0.97
		2010	-1.76	0.99
		2015	-1.28	0.93
		2020	-1.52	0.98
		2023	-1.37	0.99
	CT	2000	-0.78	0.97
		2005	-0.60	0.98
		2010	-0.64	0.98
		2015	-0.61	0.99
		2020	-0.55	0.96
		2023	-0.48	0.96
	LLW	2000	-0.46	0.99
		2005	-0.44	1.00
		2010	-0.40	1.00
		2015	-0.41	1.00
		2020	-0.43	1.00
		2023	-0.39	0.99
Animal	Highway	Year	Slope	R^2
Reptiles	HXJ	2000	-0.86	0.95
		2005	-0.67	0.93
		2010	-0.68	0.91
		2015	-0.42	0.75
		2020	-0.57	0.89
		2023	-0.56	0.92
	CT	2000	-0.29	0.92
		2005	-0.22	0.97
		2010	-0.24	0.97
		2015	-0.27	0.96

		2020	-0.24	0.95
		2023	-0.18	0.82
	LLW	2000	-0.18	0.86
		2005	-0.18	0.87
		2010	-0.17	0.87
		2015	-0.16	0.88
		2020	-0.16	0.86
		2023	-0.16	0.94
Amphibians	HXJ	2000	-1.26	0.95
		2005	-1.01	0.96
		2010	-1.04	0.95
		2015	-0.74	0.83
		2020	-0.93	0.93
		2023	-0.87	0.94
	CT	2000	-0.44	0.92
		2005	-0.34	0.97
		2010	-0.37	0.97
		2015	-0.32	0.98
		2020	-0.36	0.97
		2023	-0.28	0.88
	LLW	2000	-0.28	0.93
		2005	-0.27	0.95
		2010	-0.25	0.95
		2015	-0.25	0.95
		2020	-0.25	0.95
		2023	-0.25	0.96
Mammals	HXJ	2000	-1.62	0.97
		2005	-1.29	0.96
		2010	-1.33	0.97

		2015	-1.00	0.87
		2020	-1.17	0.95
		2023	-1.09	0.97
	CT	2000	-0.58	0.94
		2005	-0.46	0.99
		2010	-0.49	0.98
		2015	-0.44	0.99
		2020	-0.45	0.98
		2023	-0.38	0.92
	LLW	2000	-0.36	0.96
		2005	-0.35	0.96
		2010	-0.32	0.97
		2015	-0.32	0.97
		2020	-0.33	0.97
		2023	-0.329	0.98
Birds	HXJ	2000	-2.05	0.99
		2005	-1.66	0.97
		2010	-1.76	0.99
		2015	-1.28	0.93
		2020	-1.52	0.98
		2023	-1.37	0.99
	CT	2000	-0.78	0.97
		2005	-0.60	0.98
		2010	-0.64	0.98
		2015	-0.61	0.99
		2020	-0.55	0.96
		2023	-0.48	0.96
	LLW	2000	-0.46	0.99

	2005	-0.44	1.00
	2010	-0.40	1.00
	2015	-0.41	1.00
	2020	-0.43	1.00
	2023	-0.39	0.99

Table S2. Indicator loadings, weights, communality values for the structural equation model

Indicator		Weight	Loading	Communality
Waterbody				
	Area of waterbody	0.58	0.94	0.88
	AI of waterbody	0.15	0.81	0.65
	LPI of waterbody	0.36	0.94	0.88
Forest				
	Area of Forest	0.69	0.91	0.84
	AI of Forest	0.46	0.80	0.64
Cropland				
	Area of Cropland	0.38	0.87	0.75
	AI of Cropland	0.32	0.89	0.79
	LPI of Cropland	0.44	0.88	0.77
Construction				
	Area of Construction	0.39	0.63	0.40
	PD of Construction	-0.81	-0.93	0.86

Table S3 Land use transition matrix and the changes of land-use area along the highways from 2000 to 2023 (%)

Highway	Buffer distance	2000	2023						
			Grassland	Cropland	Construction	Transportation	Forest	Water body	Change
HXJ	1	Grassland	0.00	31.92	7.68	0.00	31.76	28.64	-4.19
		Cropland	0.02	24.37	32.14	8.34	34.29	0.85	-61.07
		Construction	0.00	17.40	60.59	8.49	10.62	2.91	215.02
		Transportation	0.00	15.10	44.46	34.20	2.94	3.30	248.67
		Forest	0.04	8.68	9.82	3.42	77.48	0.56	9.37
		Water body	0.00	8.15	7.90	3.84	13.08	67.03	-1.10
	2	Grassland	0.00	12.44	2.66	0.00	73.22	11.69	-12.24
		Cropland	0.06	25.65	31.16	5.68	36.14	1.31	-61.07
		Construction	0.00	14.84	66.43	5.84	10.30	2.60	184.49
		Transportation	0.07	15.25	47.78	26.50	7.34	3.05	124.36
		Forest	0.03	5.91	7.38	1.92	84.27	0.49	11.06
		Water body	0.00	7.30	6.91	2.66	10.26	72.87	2.84
	3	Grassland	0.00	39.97	9.84	0.00	46.59	3.60	-74.50

	Cropland	0.10	24.40	31.92	4.11	37.96	1.51	-61.92
	Construction	0.05	15.46	67.11	4.50	10.50	2.38	194.36
	Transportation	0.13	15.41	47.27	19.83	13.74	3.62	76.16
	Forest	0.03	5.38	6.54	1.66	85.95	0.44	11.45
	Water body	0.01	6.10	7.12	2.10	10.13	74.54	3.55
	Grassland	1.69	33.01	7.68	0.00	54.21	3.41	-73.29
4	Cropland	0.23	23.58	31.32	3.44	39.96	1.47	-62.38
	Construction	0.19	15.97	66.66	3.61	11.13	2.44	188.69
	Transportation	0.23	17.12	46.45	16.13	15.43	4.64	57.92
	Forest	0.03	4.77	5.59	1.41	87.79	0.41	11.84
	Water body	0.25	5.49	7.48	1.91	9.65	75.21	2.95
	Grassland	0.84	18.19	6.06	0.18	72.68	2.04	-79.61
	Cropland	0.25	22.98	30.25	3.13	41.94	1.45	-62.55
	Construction	0.24	15.87	64.05	3.46	13.98	2.39	184.02
5	Transportation	0.22	19.60	45.17	14.36	15.75	4.90	50.32
	Forest	0.08	4.28	4.75	1.16	89.36	0.38	11.54
	Water body	0.21	5.05	7.86	1.60	9.60	75.67	2.66

		Grassland	14.93	5.05	7.76	16.07	0.00	56.19	56.30
		Cropland	0.21	64.09	23.18	5.59	5.52	1.42	-26.56
		Construction	0.52	11.23	79.22	5.78	1.55	1.69	40.08
	1	Transportation	0.00	3.13	3.67	92.33	0.49	0.38	100.34
		Forest	0.00	4.79	2.21	0.38	92.55	0.07	6.57
		Water body	0.29	11.24	9.39	4.74	1.05	73.28	-13.47
		Grassland	15.42	3.66	5.62	11.64	0.00	63.66	68.45
		Cropland	0.11	65.07	23.38	4.14	5.93	1.36	-26.16
CT		Construction	0.53	11.84	80.42	4.40	1.38	1.44	45.76
	2	Transportation	0.00	4.11	4.04	91.08	0.39	0.38	114.78
		Forest	0.00	3.60	1.43	0.30	94.61	0.07	7.74
		Water body	0.22	10.09	10.27	3.58	1.29	74.54	-14.16
		Grassland	23.62	4.63	4.47	10.35	1.22	55.71	67.61
		Cropland	0.11	66.41	22.27	3.62	6.02	1.57	-24.35
	3	Construction	0.38	13.05	79.68	3.89	1.60	1.40	45.44
		Transportation	0.00	5.96	4.07	88.96	0.33	0.69	120.41
		Forest	0.00	3.51	1.04	0.25	95.10	0.11	7.34

		Water body	0.21	9.90	10.76	3.03	1.41	74.68	-13.72
		Grassland	27.32	16.41	7.30	7.20	3.19	38.56	58.75
		Cropland	0.14	67.31	21.41	3.52	6.04	1.58	-23.28
		Construction	0.38	13.29	79.67	3.46	1.80	1.39	45.49
	4	Transportation	0.01	5.93	4.30	88.81	0.34	0.62	126.93
		Forest	0.00	3.63	0.90	0.23	95.09	0.16	6.39
		Water body	0.17	9.44	10.74	2.64	1.39	75.63	-13.24
		Grassland	28.98	22.74	8.16	6.19	3.86	30.09	67.32
		Cropland	0.18	67.58	21.14	3.40	6.19	1.51	-23.12
		Construction	0.32	13.41	79.06	3.52	2.32	1.38	46.78
	5	Transportation	0.01	5.18	4.06	89.92	0.29	0.53	134.30
		Forest	0.05	3.75	0.85	0.22	94.91	0.21	6.27
		Water body	0.19	8.61	10.87	2.40	1.39	76.53	-13.01
		Grassland	0.00	0.25	0.00	0.00	99.75	0.00	-82.19
		Cropland	0.00	33.65	26.50	3.85	33.89	2.07	-58.39
LLW	1	Construction	0.00	26.67	45.44	3.32	21.68	2.89	173.65
		Transportation	0.00	24.61	35.57	26.51	11.54	1.78	308.87

2	Forest	0.07	3.61	2.49	0.89	92.45	0.49	35.55
	Water body	0.00	13.23	16.43	2.90	14.96	52.48	-1.55
	Grassland	0.00	0.36	0.00	0.00	99.64	0.00	-83.26
	Cropland	0.00	34.93	24.53	2.81	34.85	2.85	-56.18
	Construction	0.00	28.94	43.95	2.41	20.30	4.39	147.68
	Transportation	0.00	24.07	35.10	27.79	11.61	1.43	211.26
3	Forest	0.04	3.13	1.69	0.44	94.30	0.38	26.62
	Water body	0.00	12.03	14.76	2.30	14.43	56.47	18.00
	Grassland	0.00	2.56	0.08	0.00	97.37	0.00	-82.01
	Cropland	0.00	35.12	23.93	2.35	35.67	2.90	-55.01
	Construction	0.00	29.76	44.98	2.54	18.31	4.39	124.00
	Transportation	0.00	23.09	35.51	28.85	11.02	1.53	164.27
4	Forest	0.05	2.95	1.42	0.31	94.91	0.31	23.15
	Water body	0.00	10.98	13.99	2.04	13.73	59.26	19.60
	Grassland	0.00	1.58	0.05	0.00	98.37	0.00	-85.45
	Cropland	0.01	35.52	23.14	2.06	36.47	2.73	-54.51
	Construction	0.00	29.36	45.66	2.35	18.08	4.55	110.55

	Transportation	0.00	21.91	35.09	30.71	10.52	1.77	132.46
	Forest	0.05	2.82	1.29	0.27	95.21	0.27	22.62
	Water body	0.00	11.25	13.51	1.95	13.57	59.72	25.10
	Grassland	0.00	1.48	0.04	0.00	98.48	0.00	-82.17
	Cropland	0.01	35.51	22.93	1.79	37.23	2.48	-54.71
	Construction	0.00	29.53	45.98	2.06	18.10	4.32	115.41
5	Transportation	0.00	20.81	39.72	29.27	8.69	1.52	100.94
	Forest	0.05	2.79	1.26	0.26	95.32	0.24	23.03
	Water body	0.00	11.22	13.18	1.71	14.17	59.72	22.24

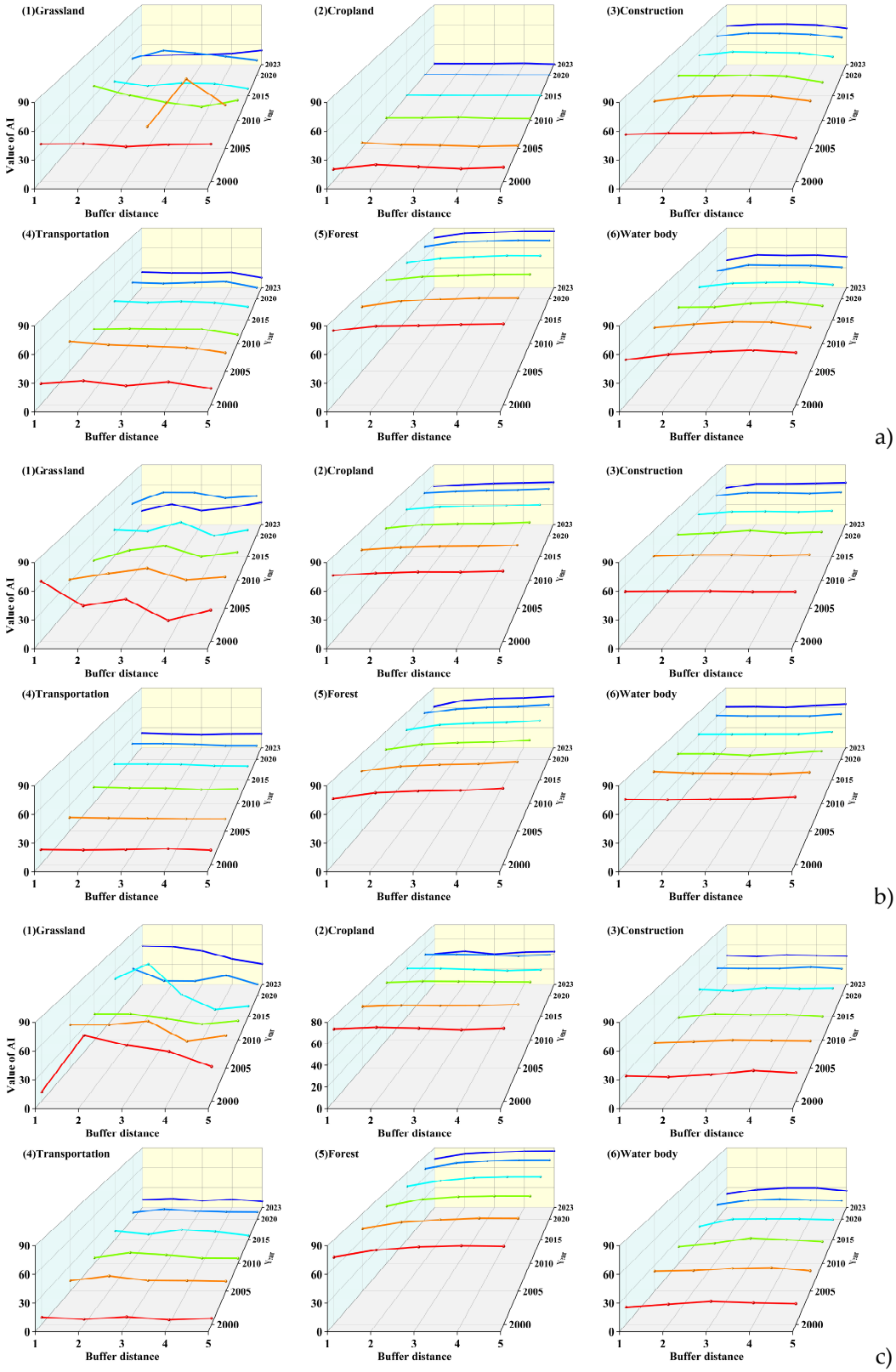

Figure. S1 Spatiotemporal variation in the Aggregation Index (AI) along the HXJ (a), CT (b) and LLW (c).Colors represent different study years: red (2000), orange (2005), cyan

(2010), light blue (2015), blue (2020), and dark blue (2023).

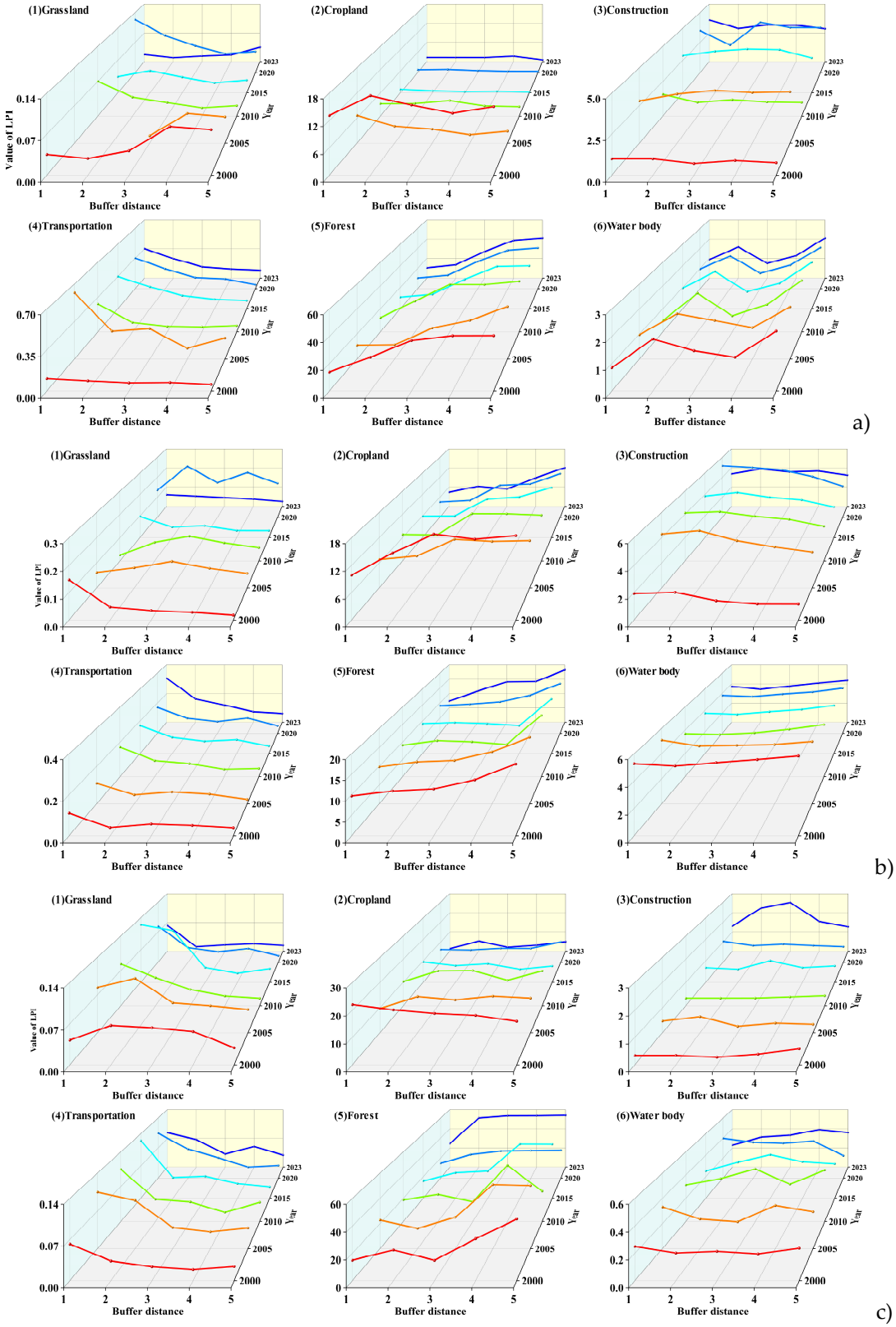

Figure. S2 Spatiotemporal variation in the Largest Patch Index (LPI) along the HXJ (a), CT (b) and LLW (c). Colors represent different study years: red (2000), orange (2005), cyan

(2010), light blue (2015), blue (2020), and dark blue (2023).

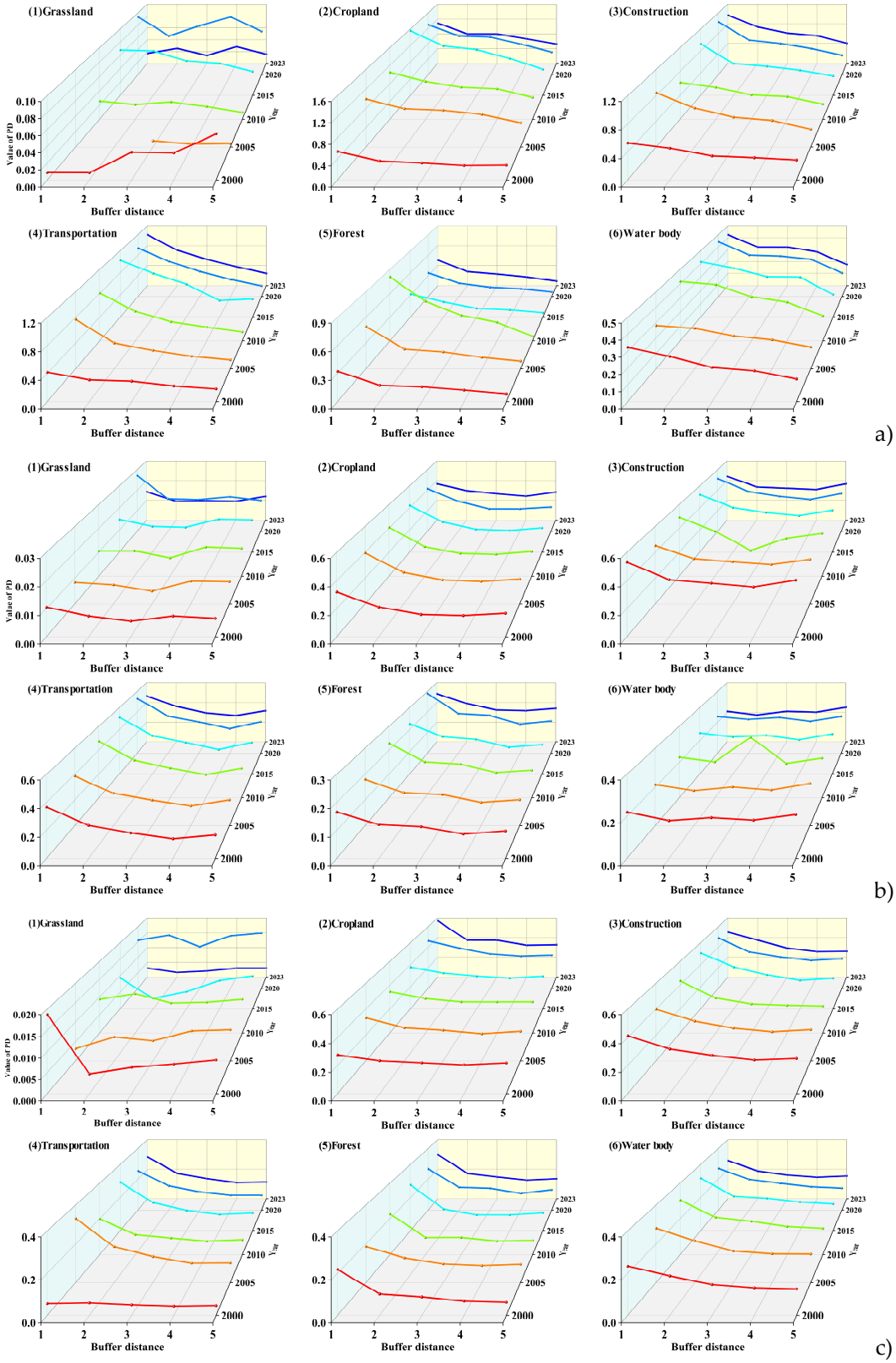

Figure. S3 Spatiotemporal variation in the Patch Density (PD) along the HXJ (a), CT (b) and LLW (c). Colors represent different study years: red (2000), orange (2005), cyan (2010),

light blue (2015), blue (2020), and dark blue (2023).

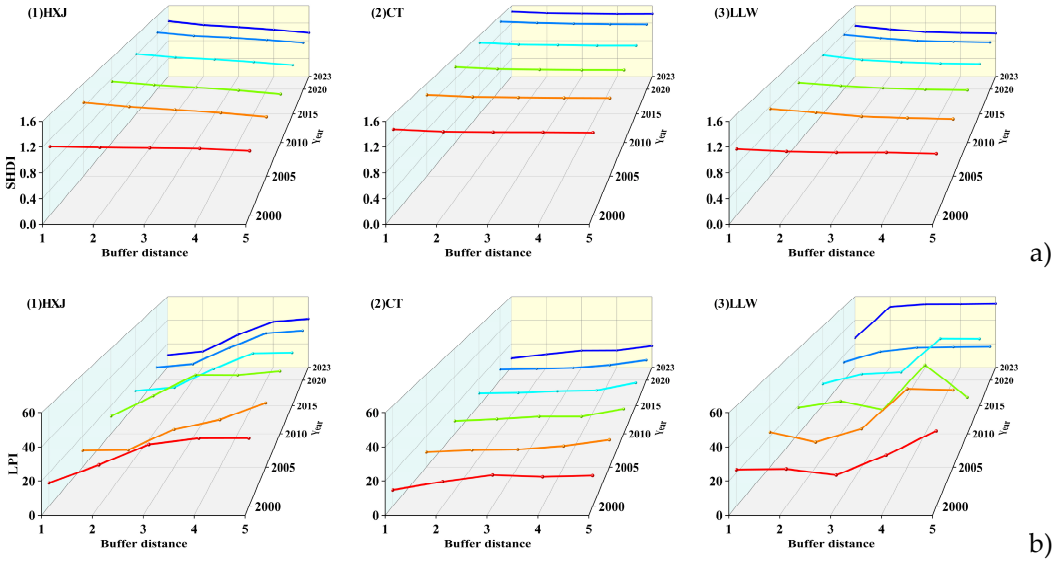

Figure. S4 Spatiotemporal variation in the SHDI (a) and LPI (b) along the highways. Colors represent different study years: red (2000), orange (2005), cyan (2010), light blue (2015), blue (2020), and dark blue (2023).

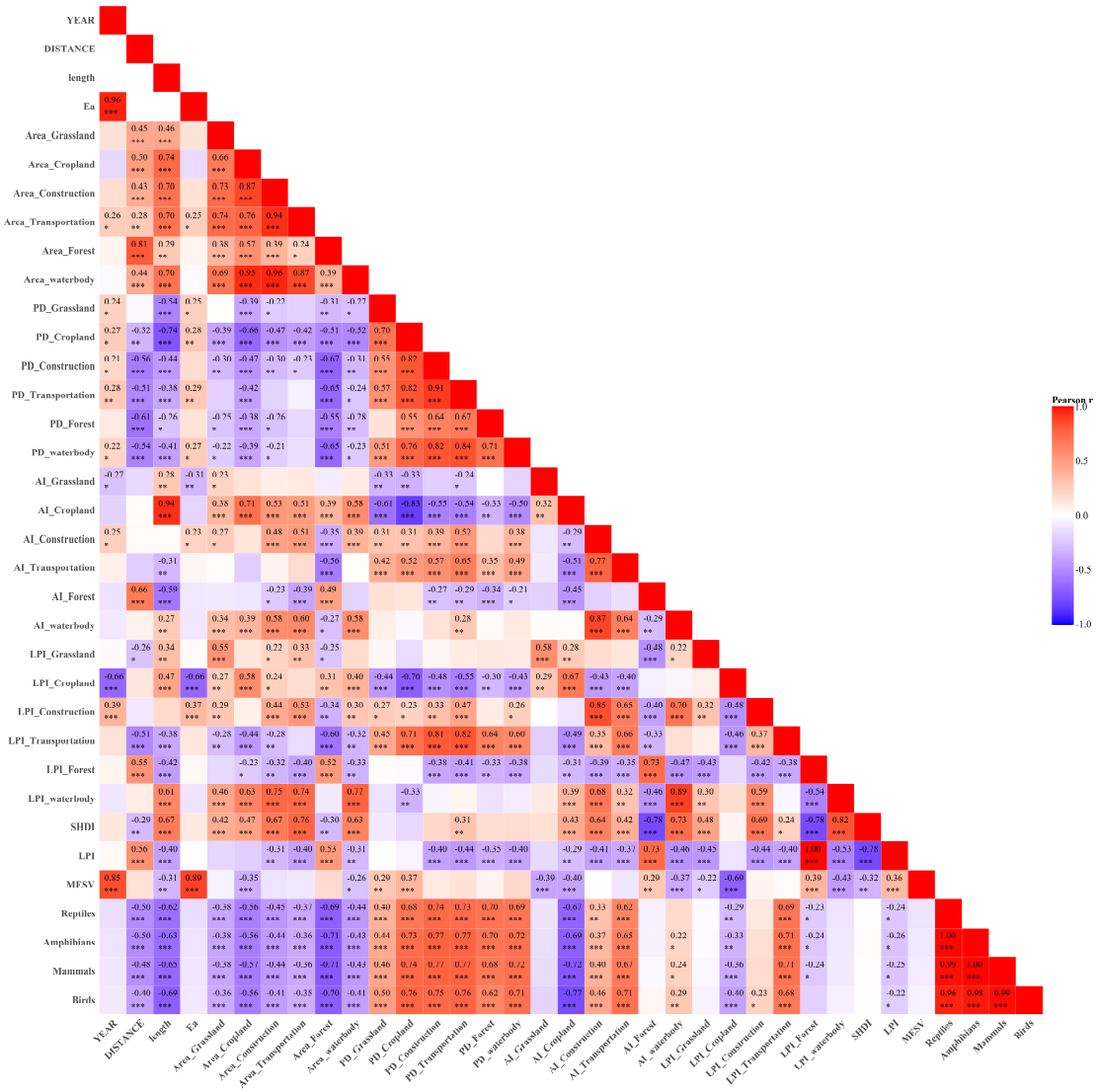

Figure. S5 The Pearson correlation of time, buffer distance, length of highways, Ea, land-use area, landscape metrics, MESV and CONNECT of different animals.

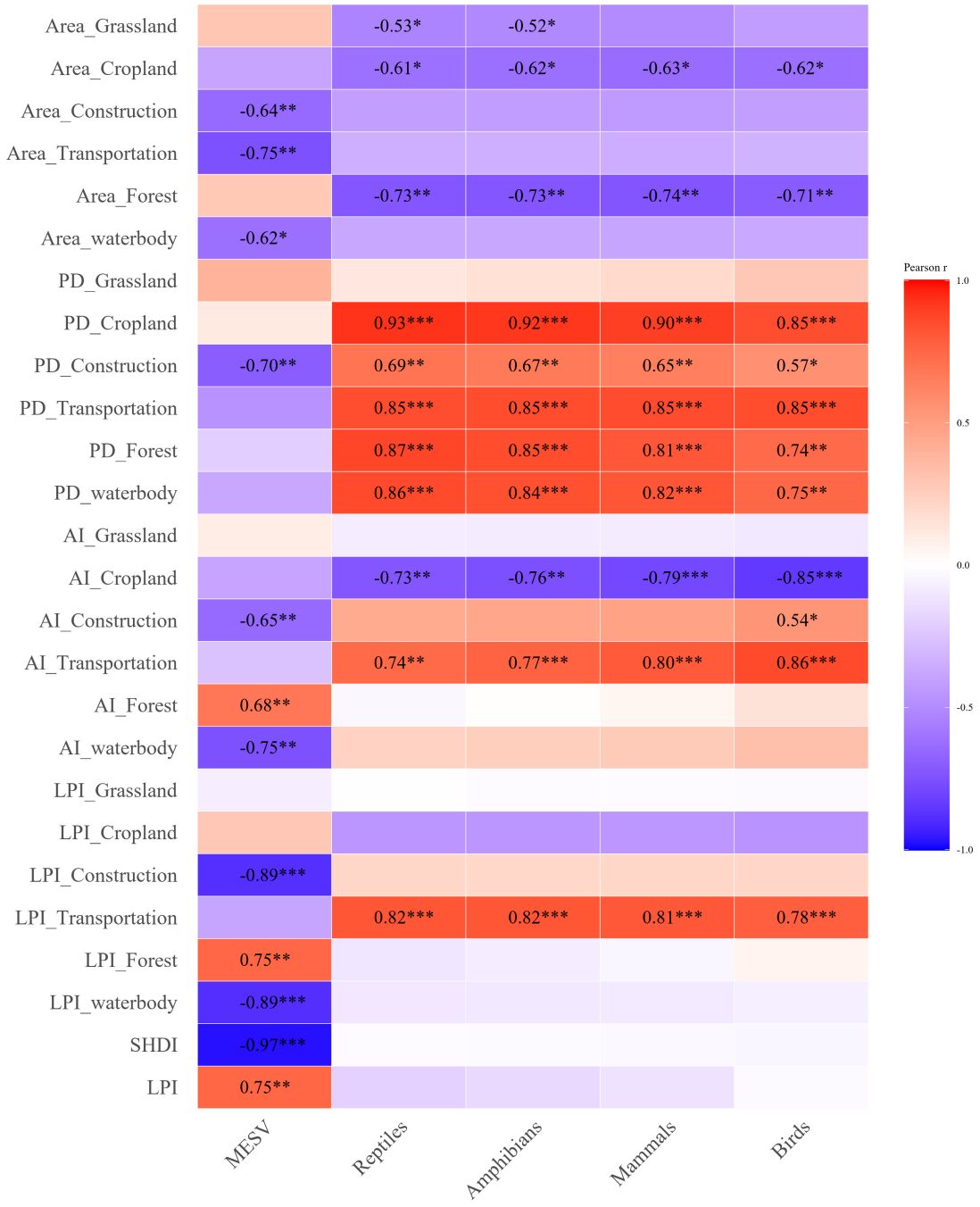

Fig. S6 The Pearson correlation of pre-existing landscape metrics, after-MESV and after-CONNECT of different animals.