

Urban Ecosystems

Carnivore coexistence in Chicago: niche partitioning of coyotes and red foxes

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Supplementary Information

Table S1 Model selection results for initial occupancy of coyotes in the Chicago metropolitan area in 2011. ΔAIC_c is the difference between the AIC_c (Akaike Information Criterion for small sample sizes) for each model and the lowest model AIC_c , W is the AIC_c weight, LL is the log likelihood, and K is the number of parameters

<i>Model</i>	ΔAIC_c	W	LL	K
Habitat	0	0.36	-1245.06	8
Habitat + Human Photographic Rate	1.11	0.21	-1244.42	9
Human Photographic Rate + Urban	1.84	0.14	-1247.14	7
Habitat + Urban	2.15	0.12	-1244.94	9
Habitat + Human Photographic Rate + Urban	3.46	0.06	-1244.39	10
Urban	3.46	0.06	-1249.09	6
Human Photographic Rate	4.12	0.05	-1249.42	6
Null	15.73	0	-1256.34	5

Table S2 Model selection results for colonization of coyotes in the Chicago metropolitan area between 2011-2018. ΔAIC_c is the difference between the AIC_c (Akaike Information Criterion for small sample sizes) for each model and the lowest model AIC_c , W is the AIC_c weight, LL is the log likelihood, and K is the number of parameters

<i>Model</i>	ΔAIC_c	W	LL	K
Habitat + Urban	0	0.57	-1224.02	12
Habitat	2.36	0.18	-1226.46	11
Habitat + Human Photographic Rate + Urban	2.56	0.16	-1224.01	13
Habitat + Human Photographic Rate	4.73	0.05	-1226.38	12
Urban	5.85	0.03	-1230.65	9
Human Photographic Rate + Urban	7.78	0.01	-1230.41	10
Human Photographic Rate	25.27	0	-1240.36	9
Null	32.28	0	-1245.06	8

Table S3 Model selection results for extinction of coyotes in the Chicago metropolitan area between 2011-2018. ΔAIC_c is the difference between the AIC_c (Akaike Information Criterion for small sample sizes) for each model and the lowest model AIC_c , W is the AIC_c weight, LL is the log likelihood, and K is the number of parameters

<i>Model</i>	ΔAIC_c	W	LL	K
Urban	0	0.70	-1217.65	13
Human Photographic Rate + Urban	2.49	0.20	-1217.58	14
Habitat + Urban	5.47	0.05	-1216.35	16
Habitat	6.86	0.02	-1218.42	15
Habitat + Human Photographic Rate + Urban	8.22	0.01	-1216.33	17
Human Photographic Rate	9.28	0.01	-1222.29	13
Human Photographic Rate + Habitat	9.58	0.01	-1218.41	16
Null	10.17	0	-1224.02	12

Table S4 Model selection results for initial occupancy of red foxes in the Chicago metropolitan area in 2011. ΔAIC_c is the difference between the AIC_c (Akaike Information Criterion for small sample sizes) for each model and the lowest model AIC_c , W is the AIC_c weight, LL is the log likelihood, and K is the number of parameters

<i>Model</i>	ΔAIC_c	W	LL	K
Human Photographic Rate + Urban	0	0.27	-261.26	7
Urban	0.40	0.22	-262.60	6
Null	2.15	0.09	-264.60	5
Coyote Photographic Rate + Human Photographic Rate + Urban	2.31	0.08	-261.25	8
Coyote Photographic Rate + Urban	2.64	0.07	-262.58	7
Habitat + Urban	2.81	0.07	-260.32	9
Habitat + Human Photographic Rate + Urban	3.87	0.04	-259.64	10
Coyote Photographic Rate	4.13	0.03	-264.47	6
Human Photographic Rate	4.16	0.03	-264.48	6
Coyote Photographic Rate * Urban	4.93	0.02	-262.56	8
Coyote Photographic Rate + Habitat + Urban	5.24	0.02	-260.32	10
Coyote Photographic Rate + Human Photographic Rate	6.05	0.01	-264.29	7
Coyote Photographic Rate + Habitat + Human Photographic Rate + Urban	6.34	0.01	-259.63	11
Habitat	7.14	0.01	-263.67	8
Coyote Photographic Rate * Human Photographic Rate	8.01	0	-264.10	8
Habitat + Human Photographic Rate	8.55	0	-263.19	9
Coyote Photographic Rate + Habitat	9.20	0	-263.51	9
Coyote Photographic Rate + Habitat + Human Photographic Rate	10.61	0	-263.00	10

Table S5 Model selection results for colonization of red foxes in the Chicago metropolitan area between 2011-2018. ΔAIC_c is the difference between the AIC_c (Akaike Information Criterion for small sample sizes) for each model and the lowest model AIC_c , W is the AIC_c weight, LL is the log likelihood, and K is the number of parameters

<i>Model</i>	<i>ΔAIC_c</i>	<i>W</i>	<i>LL</i>	<i>K</i>
Null	0	0.21	-262.60	6
Human Photographic Rate	0.34	0.18	-261.63	7
Coyote Photographic Rate + Human Photographic Rate	1.39	0.10	-260.99	8
Coyote Photographic Rate	1.57	0.10	-262.24	7
Urban	1.87	0.08	-262.40	7
Human Photographic Rate + Urban	2.67	0.05	-261.63	8
Coyote Photographic Rate + Urban	3.00	0.05	-263.79	8
Habitat + Human Photographic Rate	3.65	0.03	-259.72	10
Coyote Photographic Rate + Human Photographic Rate + Urban	3.67	0.03	-260.94	9
Coyote Photographic Rate * Human Photographic Rate	3.76	0.03	-260.99	9
Habitat+ Human Photographic Rate +Urban	3.78	0.03	-258.55	11
Habitat + Urban	4.29	0.02	-260.04	10
Habitat	5.18	0.02	-261.70	9
Coyote Photographic Rate * Urban	5.22	0.01	-261.72	9
Coyote Photographic Rate + Habitat + Human Photographic Rate + Urban	5.33	0.01	-258.06	12
Coyote Photographic Rate + Habitat + Human Photographic Rate	5.41	0.01	-259.37	11
Coyote Photographic Rate + Habitat+ Urban	5.90	0.01	-259.61	11
Coyote Photographic Rate + Habitat	7.05	0.01	-261.42	10

Table S6 Model selection results for extinction of red foxes in the Chicago metropolitan area between 2011-2018. ΔAIC_c is the difference between the AIC_c (Akaike Information Criterion for small sample sizes) for each model and the lowest model AIC_c , W is the AIC_c weight, LL is the log likelihood, and K is the number of parameters

<i>Model</i>	ΔAIC_c	ω	LL	K
Coyote Photographic Rate * Human Photographic Rate	0	0.83	-255.61	9
Coyote Photographic Rate	6.87	0.03	-261.39	7
Null	7.01	0.02	-262.60	6
Coyote Photographic Rate + Habitat + Human Photographic Rate	8.02	0.02	-257.17	11
Human Photographic Rate	8.40	0.01	-262.16	7
Urban	8.49	0.01	-262.20	7
Habitat + Human Photographic Rate + Urban	8.80	0.01	-257.56	11
Coyote Photographic Rate + Human Photographic Rate	8.93	0.01	-261.26	8
Coyote Photographic Rate + Habitat	9.08	0.01	-258.93	10
Coyote Photographic Rate + Urban	9.19	0.01	-261.39	8
Habitat+ Human Photographic Rate	9.34	0.01	-259.06	10
Coyote Photographic Rate + Habitat + Human Photographic Rate + Urban	9.40	0.01	-256.60	12
Coyote Photographic Rate * Urban	9.98	0.01	-260.59	9
Habitat + Urban	10.14	0.01	-259.47	10
Coyote Photographic Rate + Habitat + Urban	10.23	0	-258.27	11
Human Photographic Rate + Urban	10.27	0	-261.93	8
Habitat	11.06	0	-261.14	9
Coyote Photographic Rate + Human Photographic Rate + Urban	11.31	0	-261.26	9

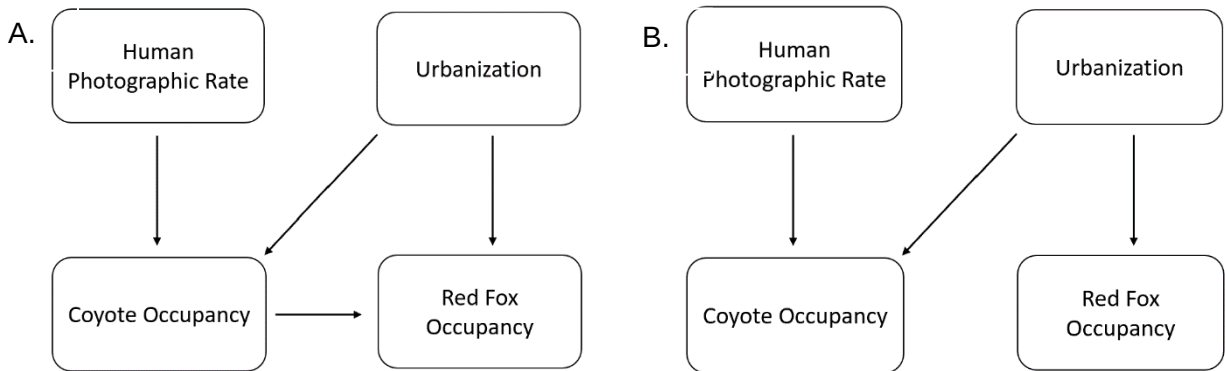


Fig. S1 Unsaturated structural equation models (SEM) for interactions between coyotes and red foxes across the Chicago metropolitan area that were used to gauge model fit for our saturate SEM model

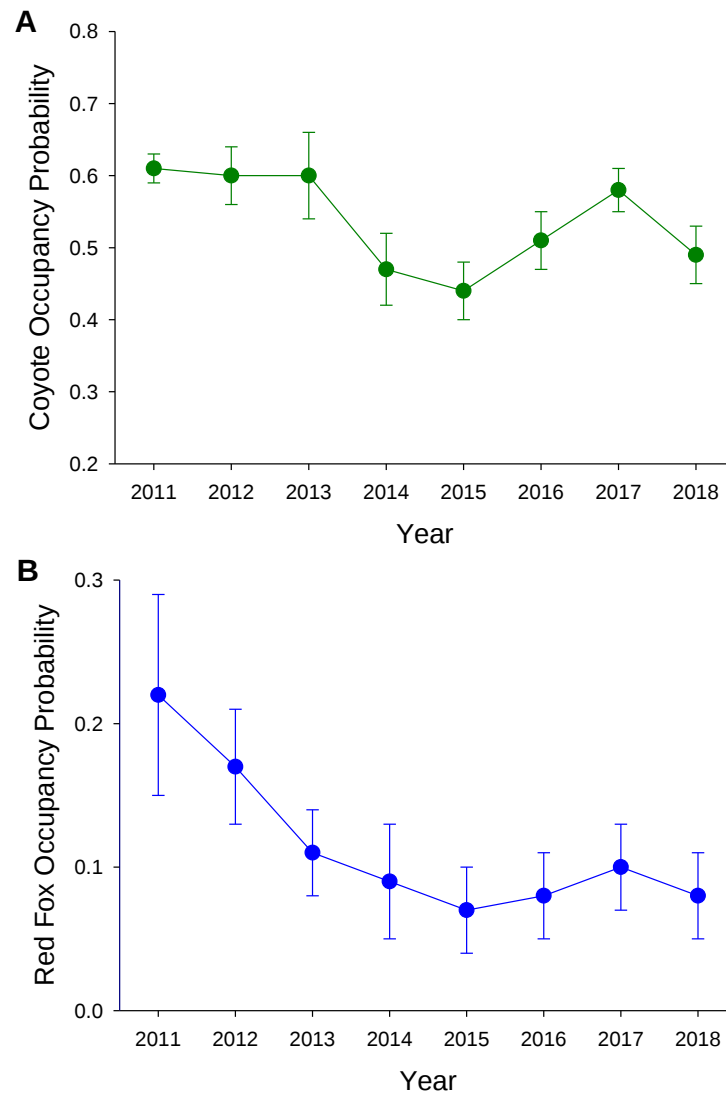


Fig. S2 Occupancy estimates (± 1 SE) between 2011 and 2018 for (A) coyotes and (B) red foxes across the Chicago metropolitan area. Estimates are from multi-season occupancy models using the recursive equation and estimates of local extinction and colonization (MacKenzie et al. 2003)

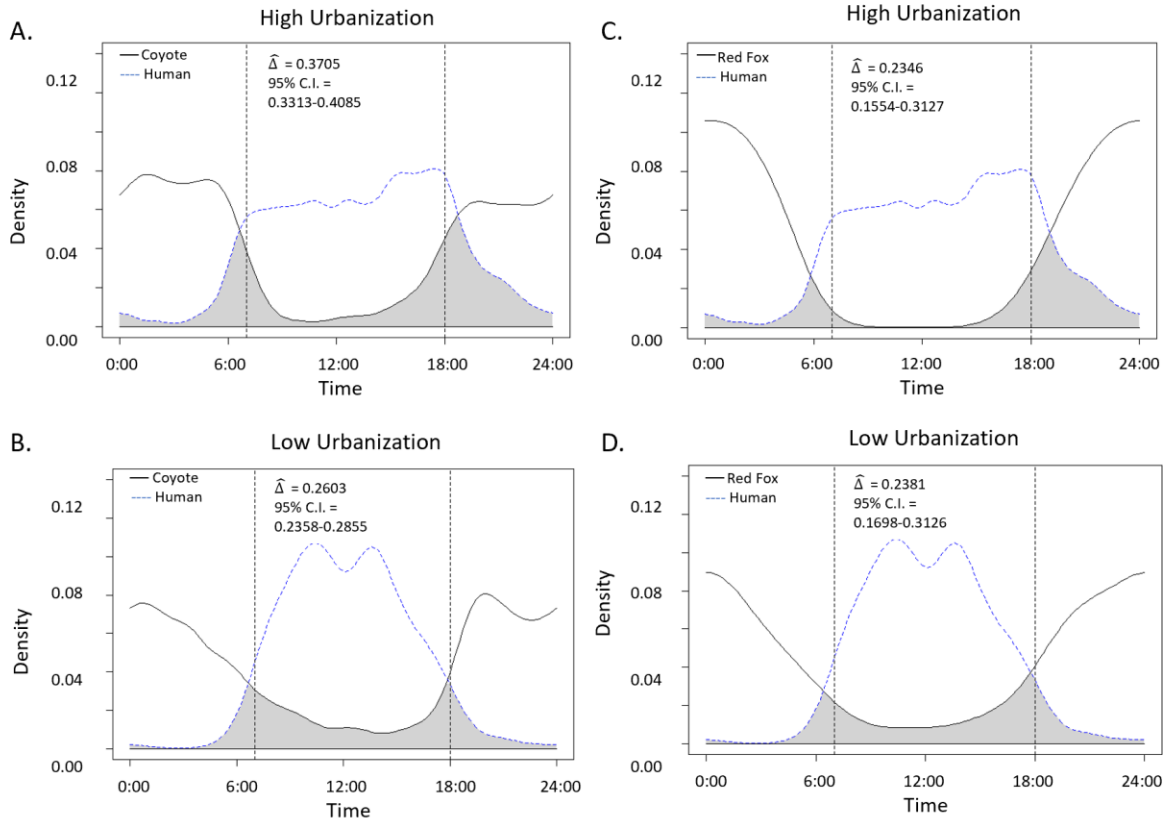
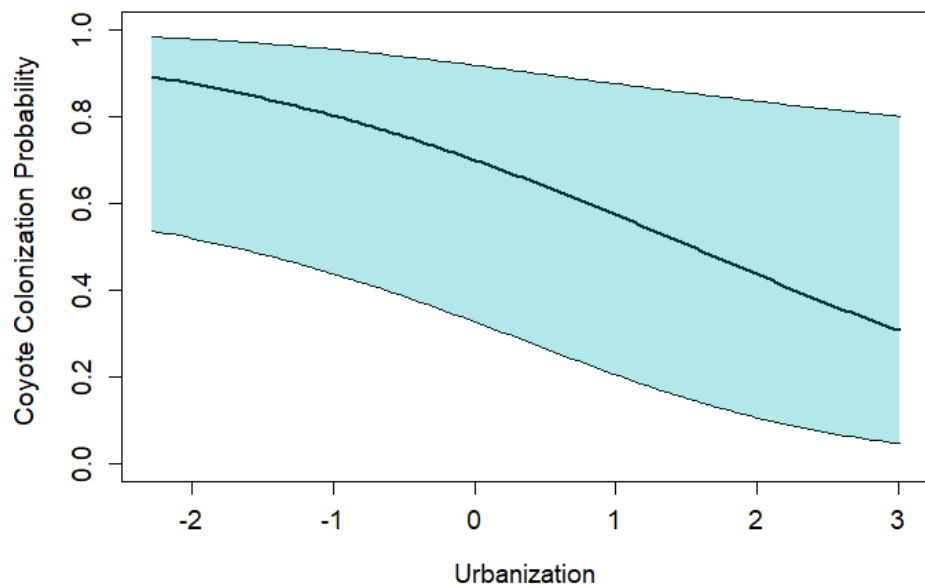
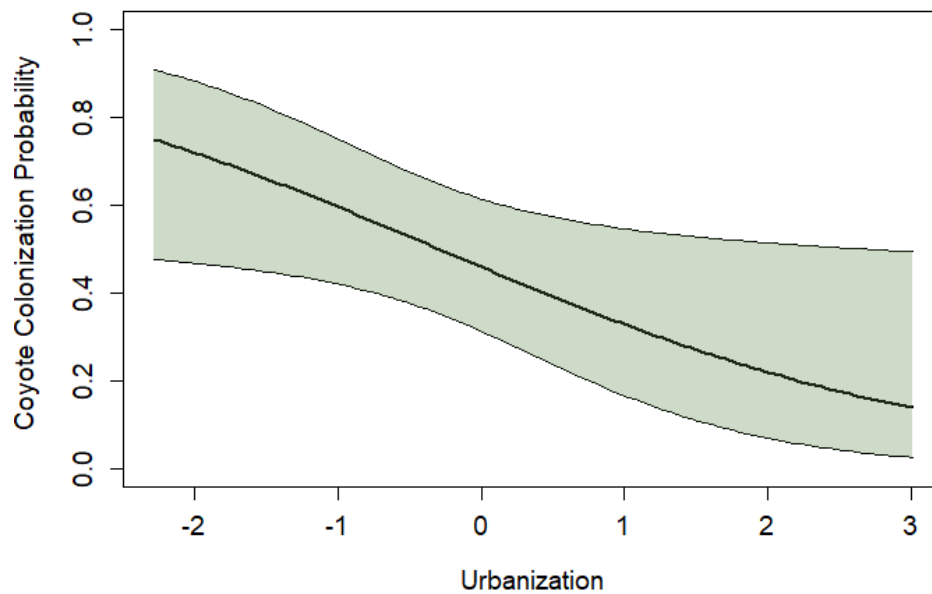


Fig. S3 Overlap in temporal activity between coyotes and humans, and red foxes and humans, in high and low levels of urbanization across the Chicago metropolitan area, 2011-2018. $\hat{\Delta}$ is the coefficient of overlap between the two species. Dashed black lines represent the averaged sunrise and sunset times across sampling periods

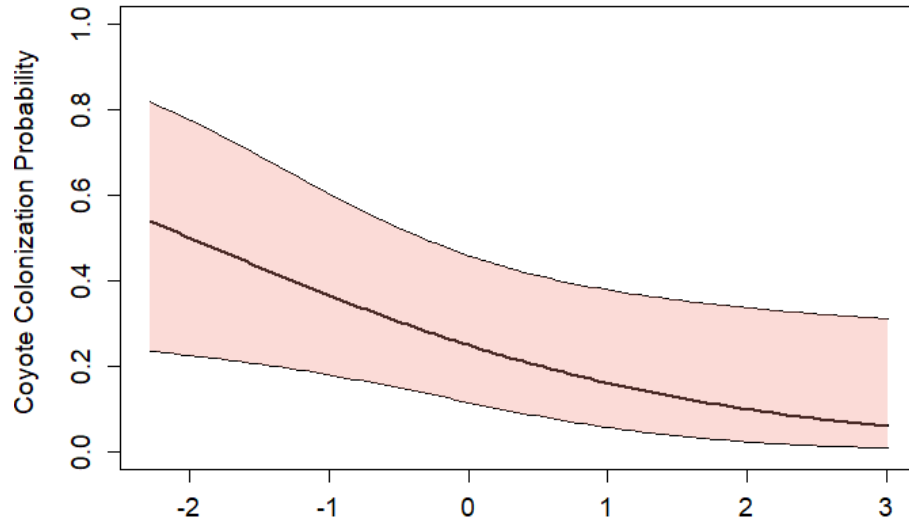
A.



B.



C.



D.

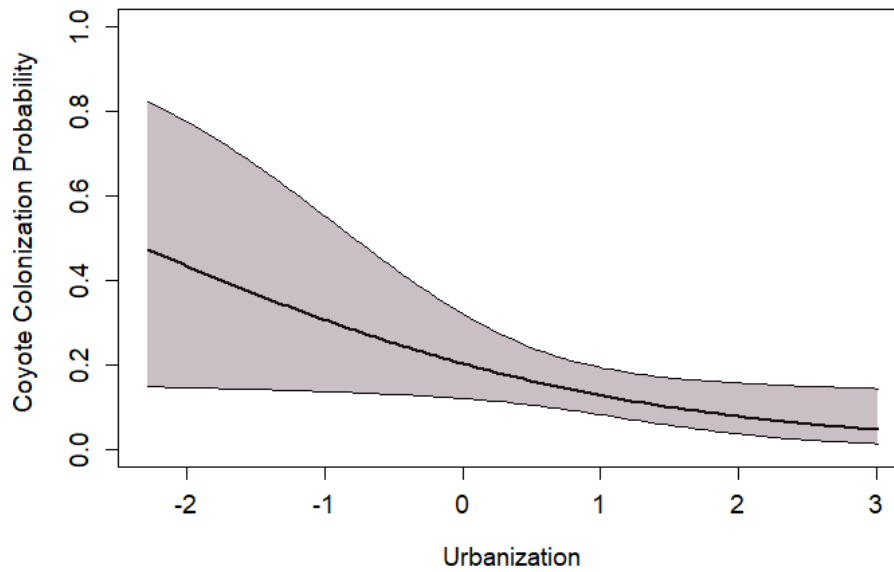


Fig. S4 Effects of urbanization on colonization probability for coyotes for (A) golf courses, (B) natural areas, (C) cemeteries, and (D) city parks across the Chicago metropolitan area from 2011-2018. Shaded areas are the 95% confidence intervals