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Wildlife Research

Supplementary Material

Pampas fox spatial and temporal variation in Argentinean agroecosystems

Antonella Gorosábel[A,*], *María Paula Barral*[A], *Lucía Bernad*[A], *Sebastián Darío Muñoz*[A], *Jaime Bernardos*[B], *and Julieta Pedrana*[C]

[A]Instituto de Innovación para la Producción Agropecuaria y el Desarrollo Sostenible (IPADS) Balcarce, INTA-CONICET, Ruta 226 Km 73.5, 7620 Balcarce, Argentina.

[B]INTA EEA Ing. Agr. Guillermo Covas, Ruta 5 km 580, Anguil, La Pampa 6326, Argentina.

[C]Departamento de Medio Ambiente, Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Facultad Regional Mar Del Plata, Universidad Tecnológica Nacional, Av. Dorrego 281, Mar del Plata 7600, Argentina.

[*]Correspondence to: Antonella Gorosábel Instituto de Innovación para la Producción Agropecuaria y el Desarrollo Sostenible (IPADS) Balcarce, INTA-CONICET, Ruta 226 Km 73.5, 7620 Balcarce, Argentina
Email: gorosabel.antonella@inta.gob.ar

Pampas fox spatial and temporal variation in Argentinean agroecosystems

Supplementary material 1

Sampling design and data collection

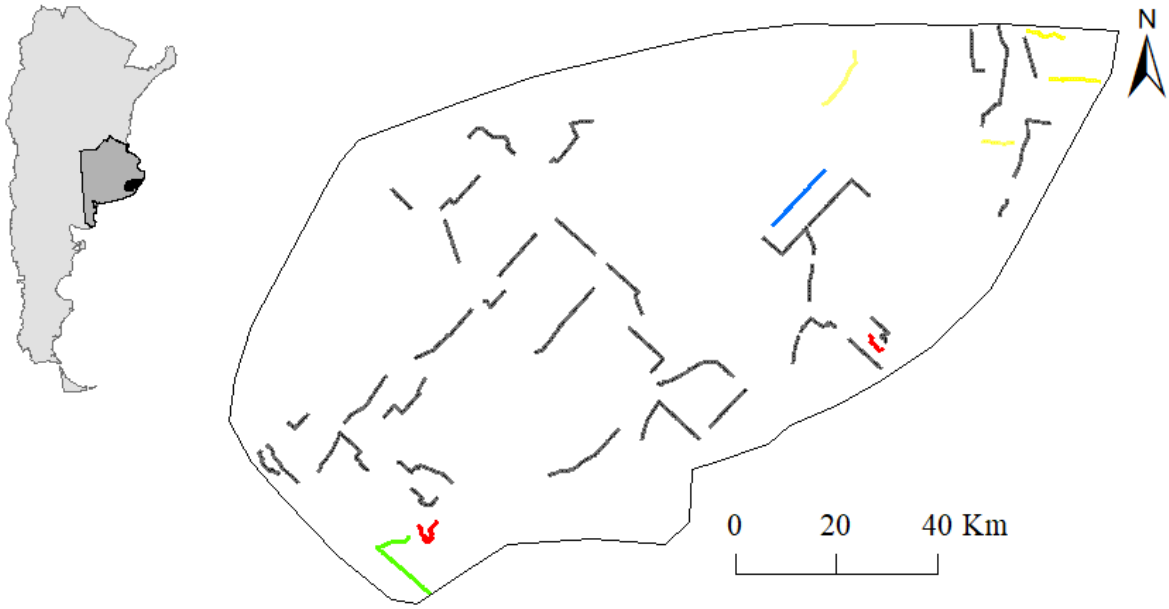

Figure S1.1: Transects located in the Mar Chiquita basin, Buenos Aires province, Argentina. Transects that were not surveyed during the non-reproductive season of 2017 are in red, in the reproductive season of 2016 are in blue, and in the reproductive season of 2017 are in yellow. Finally, transect in green was not surveyed during the non-reproductive and reproductive season of 2017. In the non-reproductive season of 2016 all transects were conducted.

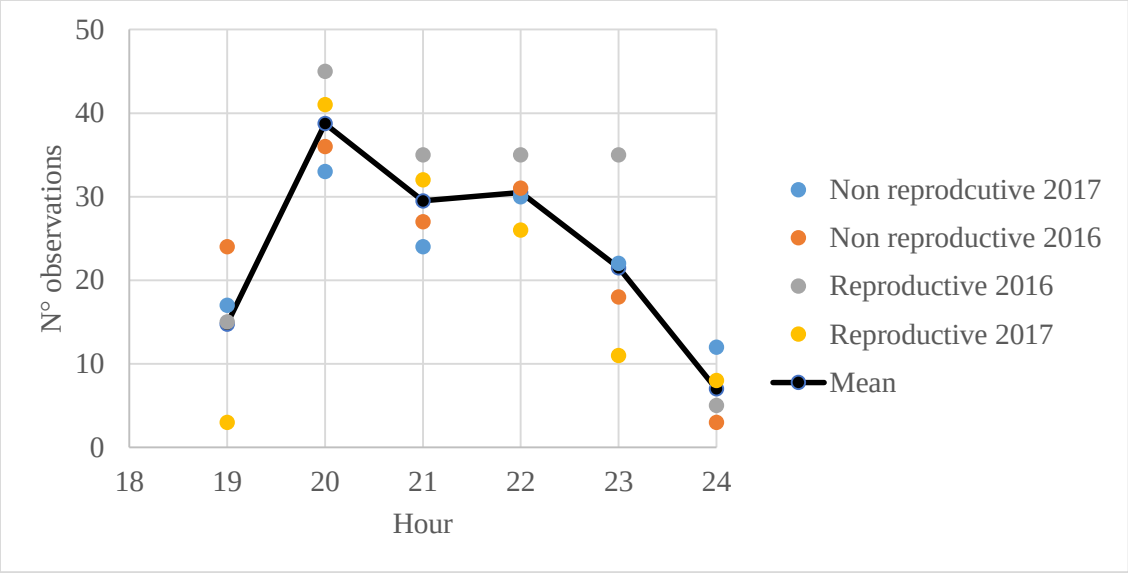

Figure S1.2: Number of observation per hour in each survey season. The mean number of observations in each hour is indicated with a black line.

Detection probability

Table S1.1: Probability of detection functions for each surveyed season of the Pampas fox. Tested covariates are indicated in parentheses and selected models are in bold type. P-value of the Cramer-von Mises test, AIC and its difference (ΔAIC) are included. Competitive models (AIC >2) are informed for each season.

Models	ΔAIC	AIC	Cramer-von Mises p-value
Non-reproductive season 2016			
Half-normal + cosine adjustment	**0**	**1187.07**	**0.25**
Half-normal + Hermit adjustment	0	1187.07	0.25
Uniform + cosine adjustment	0.14	1187.21	0.26
Uniform + simple polynomial adjustment	1.09	1188.16	0.15
Half-normal (%crop)+ cosine adjustment	1.20	1188.26	0.31
Half-normal (Temperature)+ cosine adjustment	1.88	1188.95	0.27
Half-normal (Traffic)+ cosine adjustment	1.97	1189.04	0.26
Non-reproductive season 2017			
Uniform + cosine adjustment	**0**	**1215.67**	**0.30**
Uniform + simple polynomial adjustment	1.98	1217.75	0.30
Reproductive season 2016			
Hazard-rate + cosine adjustment	0	1364.63	0.55
Hazard-rate + simple polynomial adjustment	0	1364.63	0.55
Half-normal + cosine adjustment	**0.64**	**1365.27**	**0.30**
Half-normal + Hermit adjustment	0.64	1365.27	0.30
Hazard-rate (Traffic) + cosine adjustment	0.77	1365.40	0.51
Uniform + cosine adjustment	0.80	1365.43	0.56
Hazard-rate (Slope) + cosine adjustment	1.42	1366.05	0.49
Uniform + simple polynomial adjustment	1.43	1366.06	0.40
Half-normal (Slope)+ cosine adjustment	1.51	1366.14	0.34
Half-normal (Traffic)+ cosine adjustment	1.86	1366.49	0.28
Reproductive season 2017			
Half-normal (%crop)+ cosine adjustment	0.00	1063.97	0.72
Uniform + simple polynomial adjustment	0.47	1064.44	0.86
Half-normal + cosine adjustment	**0.81**	**1064.78**	**0.81**
Half-normal + Hermit adjustment	0.81	1064.78	0.81
Uniform + cosine adjustment	1.62	1065.59	0.71
Half-normal (Slope)+ cosine adjustment	1.94	1065.92	0.69

Table S1.2: Selected models of the probability of detection function (p) for each surveyed season of the Pampas fox. Estimate value and its standard error (Estimate ± SE), the average probability of detection and its standard error (Average p ± SE).

Model	Detection function parameters	Adjustment term coefficient	Estimate ± SE	Average p ± SE
Non-reproductive 2016	Intercept	-	4.30 ± 0.12	0.66 ± 0.05
Non- reproductive 2017	Null	cos, order 1	0.49 ± 0.11	0.67 ± 0.05
Reproductive 2016	Intercept	-	4.25 ± 0.11	0.66 ± 0.05
Reproductive 2017	Intercept	-	4.35 ± 0.16	0.73 ± 0.07

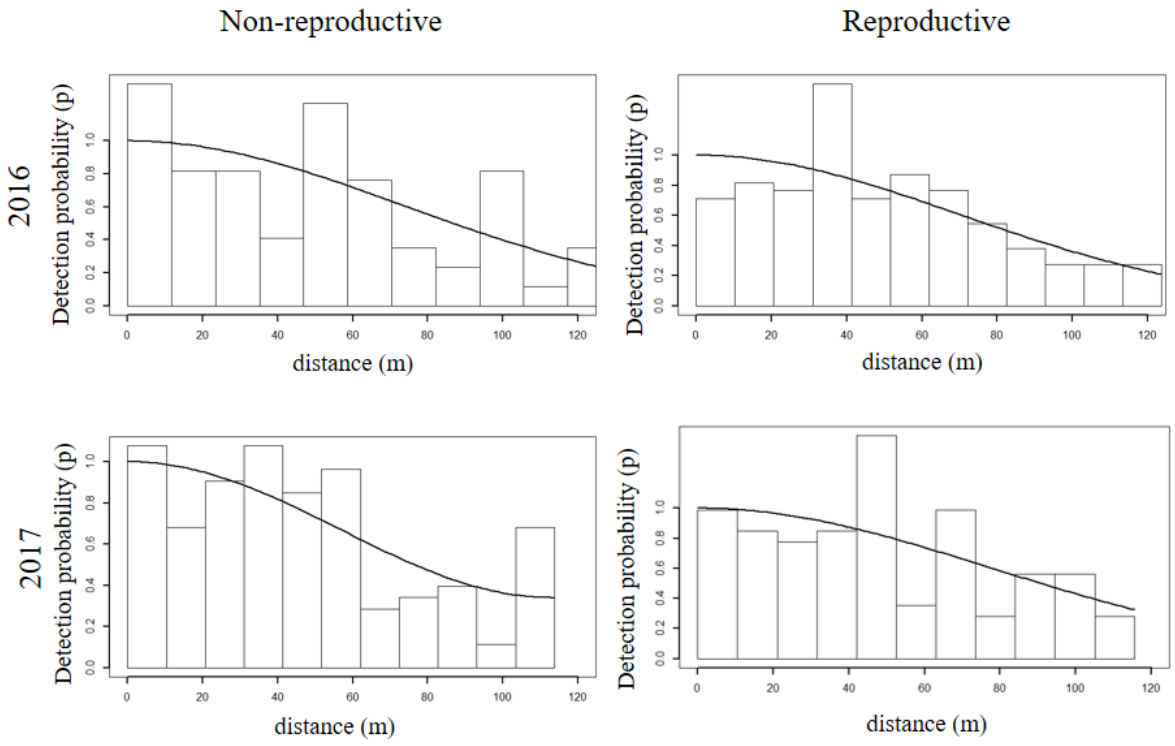

Figure S1.3: Pampas fox probability histograms for the detection function (p) of the selected models for each surveyed season.

Pampas fox density maps

Table S1.3: Density Surface Models (DSMs) of the Pampas fox tested for each season. Covariates are indicated in parentheses and the selected model for each season are in bold type. AIC: Akaike Information Criterion; Rsq: Adjusted R square, REML: restricted maximum likelihood score, DevExpl: Deviance explained. Geographical coordinates (longitude: y, latitude: x). s: smooth term. Three response distributions families were tested (negative binomial, tweedie, and quasi-Poisson). The best four models of each season are presented.

Models	Family	DevExpl	Rsq	REML	AIC
Non-reproductive 2016					
s(y)* + s(d_Town) + s(d_Stream) + d_MC*+ s(RoadDensity) + d_PavedRoad + s(NDVI) + %stubble + %crop	**Tweedy**	**16.6**	**0.098**	**196.77**	**625.34**
s(y)* + s(d_Town) + s(d_Stream) + d_MC*+ s(RoadDensity) + d_PavedRoad + s(NDVI) + %crop	Tweedy	16.5	0.1	193.35	625.94
s(y)* + s(d_Town) + s(d_Stream) + d_MC*+ d_PavedRoad + s(NDVI) + %crop	Tweedy	16.4	0.099	191.99	625.55
s(y)* + s(d_Town) + d_MC*+ d_PavedRoad + s(NDVI) + %crop	Tweedy	16	0.099	191.02	636.16
Non-reproductive 2017					
s(x,y)* + s(RoadDensity) + NDVI + s(%crop)+ s(%stubble)*	**Tweedy**	**28.6**	**0.244**	**178.38**	**430.68**
s(x,y)* + s(RoadDensity) + s(NDVI) + s(%crop) + s(%stubble)*	Tweedy	28.6	0.244	176.44	430.69
s(x,y) + s(RoadDensity) + NDVI + s(%crop)+ s(%stubble)	Quassi Poisson	24.9	0.204	172.17	-
s(y)* + d_Town + s(d_MC) + d_Stream* + s(RoadDensity)* + s(d_PavedRoad) + s(NDVI) + s(%crop)* + % stubble	Tweedy	17.6	0.104	202.7	819.67
Reproductive 2016					
s(y) + s(d_City)+ d_Town*+ d_Stream + d_PavedRoad + RoadDensity + NDVI + %crop	**Tweedy**	**7.35**	**0.043**	**174.97**	**431.06**
s(y) + s(d_City) + d_Town*+ d_Stream + d_PavedRoad + NDVI + %crop	Quassi Poisson	7.2	0.046	182.98	-
s(y) + s(d_City)+ d_Town*+ d_Stream + d_PavedRoad + NDVI + %stubble + %crop	Negative binomial	6.97	0.04	309.47	548.74

s(x, y) + RoadDensity + NDVI + %stubble + s(%crop)	Quassi Poisson	6.49	0.038	160.46	-
Reproductive 2017					
s(y)* + d_City* + s(d_Town) + s(d_PavedRoad)* + s(%stubble) + s(%crop)*	**Tweedy**	**23.6**	**0.16**	**149.28**	**273.4**
s(y)* + d_City* + s(d_Town) + d_Stream + s(d_PavedRoad) + RoadDensity + NDVI + s(%stubble) + s(%crop)*	Tweedy	18.8	0.11	164.59	300.87
s(y)*+ d_City + s(d_Town) + d_Stream + s(d_PavedRoad) + RoadDensity + NDVI + s(%stubble) + s(%crop)	Quassi Poisson	17.9	0.1	168.37	-
s(y)*+ d_City + s(d_Town) + s(d_PavedRoad) + s(%stubble) + s(%crop)	Quassi Poisson	17.1	0.1	154	-

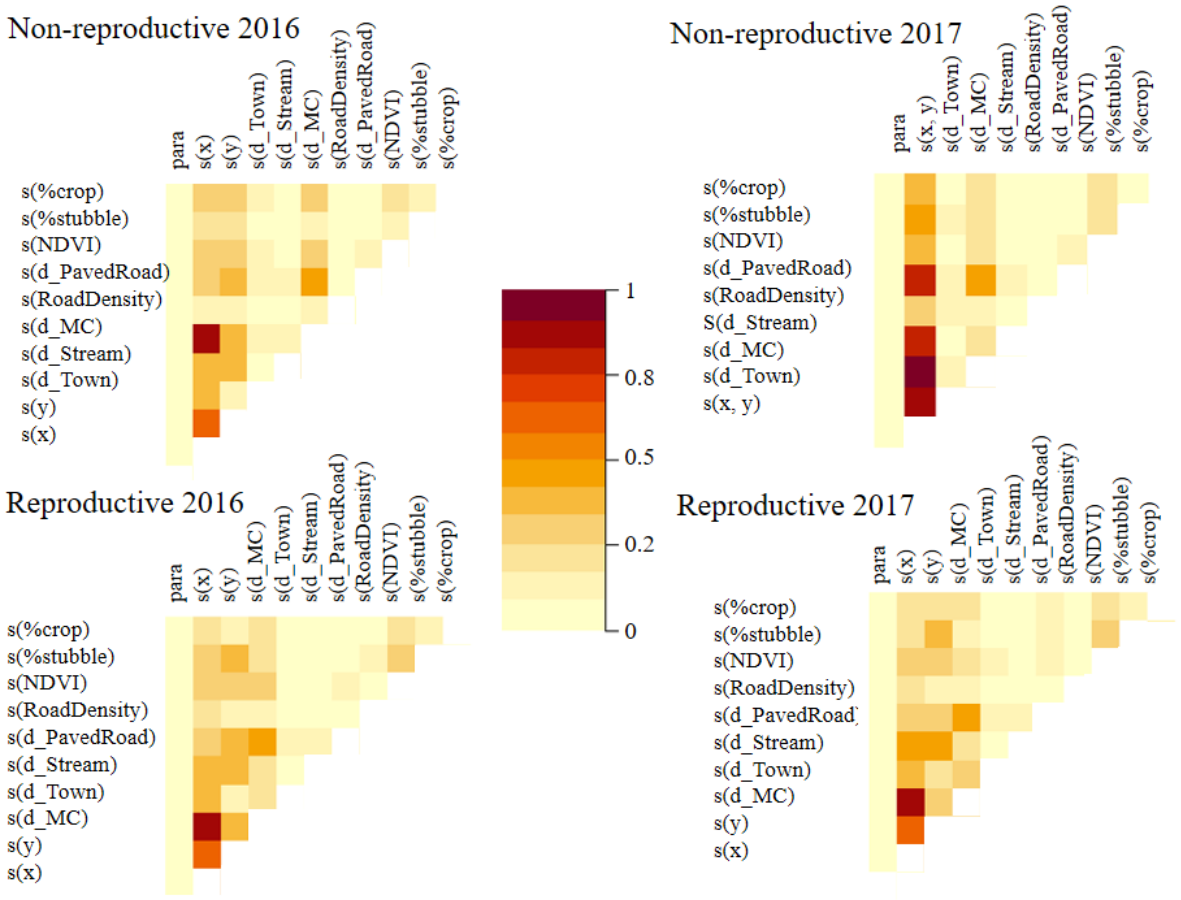

Figure S1.4: Pairwise concurvinity measures by the estimate indices between smooth terms for the full DSMs with Tweedie response distribution of each season tested for the Pampas fox in Mar Chiquita basin, Buenos Aires, Argentina. Geographical coordinates (longitude: y, latitude: x). s: smooth term.

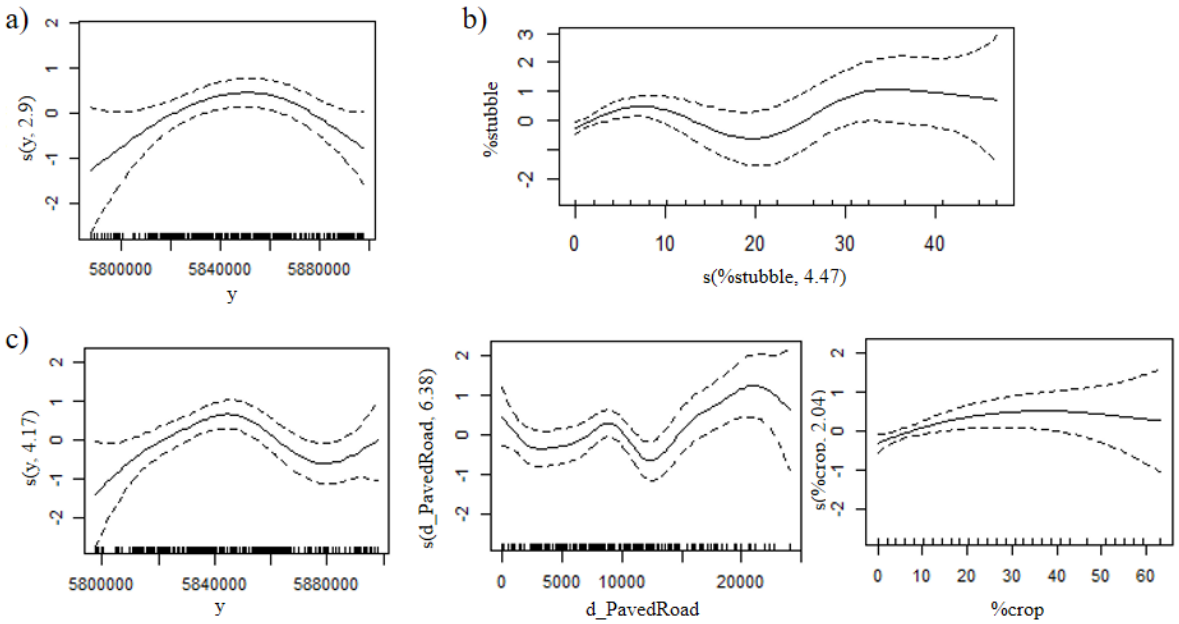

Figure S1.5: Non-linear significant variables (s: smooth term) of the selected DSMs of the Pampas fox in Mar Chiquita basin, Buenos Aires, Argentina for: a) the non-reproductive season of 2016, b) non-reproductive season of 2017 c) reproductive season 2017. The ticks on the x-axis indicate the range of the variable along the survey area. The number in parenthesis provides the effective degrees of freedom of each term. The dash lines represent the 95% confidence interval of each variable.

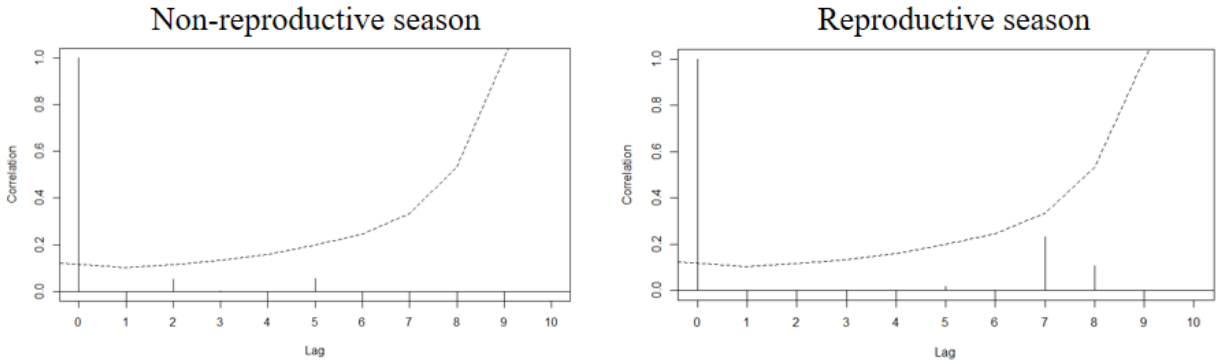

Figure S1.6: Spatial autocorrelation of the selected DSMs used to estimate the abundance of the Pampas fox. The dash line represents the 95% confidence interval, which increased in width as the number of lags increased. Lag 0 is the correlation between a segment and itself, Lag 1 between a segment and its immediate neighbors (segments that touch), Lag 2 between a segment and the segment one segment away, etc. Correlations are only calculated within a given transect. In both seasons, we observed a small spatial autocorrelation in residuals (<0.2) under the 95% confidence interval, thus we assumed that it did not affect the explanatory capacity of the model (Antún and Baldi 2019).

References

Antún M, Baldi R (2019). Modeling the spatial structure of the endemic mara (Dolichotis patagonum) across modified landscapes. *PeerJ* **7**, e6367. doi:10.7717/peerj.6367