Appendix

Step by Step: Using Integrated Step Selection Analysis to Simulate Wild Dog Dispersal and Assess Landscape Connectivity

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Running Title: Simulating Wild Dog Dispersal.

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A.1 Movement Models

Table S1: Results from the forward model selection procedure based on Akaike's Information Criterion (AIC; Burnham and Anderson, 2002) for the movement model. The base model upon which we based our movement model is depicted in the last row. We omitted all models with an AIC weight of zero.

Covariates	AIC	ΔAIC	Weight	LogLik
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + DTW:sl + sl:cos(ta)	89392.88	0.00	0.15	-44670.44
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + DTW:sl + sl:cos(ta) + SH:log(sl)	89393.92	1.04	0.09	-44669.96
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + DTW:sl + sl:cos(ta) + DTW:log(sl)	89394.13	1.25	0.08	-44670.06
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + DTW:sl + sl:cos(ta) + WO:log(sl)	89394.25	1.37	0.08	-44670.13
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + DTW:sl	89394.36	1.48	0.07	-44672.18
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + DTW:sl + sl:cos(ta) + log(sl):LA	89394.44	1.56	0.07	-44670.22
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + DTW:sl + sl:cos(ta) + HI:sl	89394.56	1.68	0.07	-44670.28
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + DTW:sl + sl:cos(ta) + WA:log(sl)	89394.57	1.69	0.07	-44670.29
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + DTW:sl + sl:cos(ta) + WO:cos(ta)	89394.59	1.71	0.07	-44670.30
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + DTW:sl + sl:cos(ta) + WA:cos(ta)	89394.63	1.75	0.06	-44670.31
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + sl:cos(ta)	89394.68	1.80	0.06	-44672.34
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + DTW:sl + sl:cos(ta) + HI:log(sl)	89394.69	1.81	0.06	-44670.35
Base Model + sl:LA + WA:sl + log(sl):cos(ta) + DTW:cos(ta) + WO:sl + HI:cos(ta) + SH:sl + DTW:sl + sl:cos(ta) + SH:cos(ta)	89394.84	1.96	0.06	-44670.42
⋮	⋮	⋮	⋮	⋮
Base Model: cos(ta) + sl + log(sl) + WA + WO + DTW + HI + SH	90091.40	787.67	0.00	-45030.70

Note: ta = Turning Angle, sl = Step Length, LA = Low Activity, WA = Water, DTW = Distance To Water, SH = Shrubs/Grassland, WO = Woodland, HI = Human Influence.

A.2 Convergence

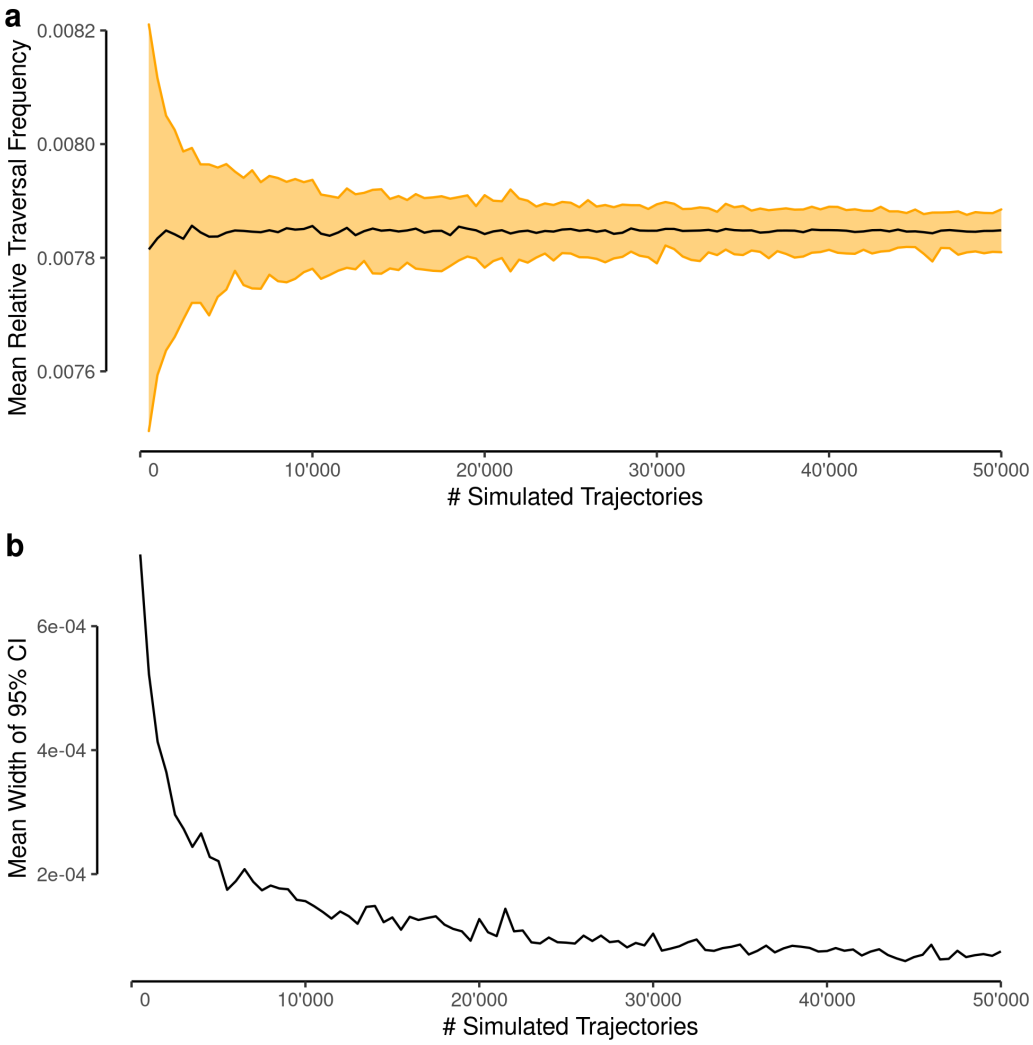

Figure S1

A.3 Evolution of Heatmaps

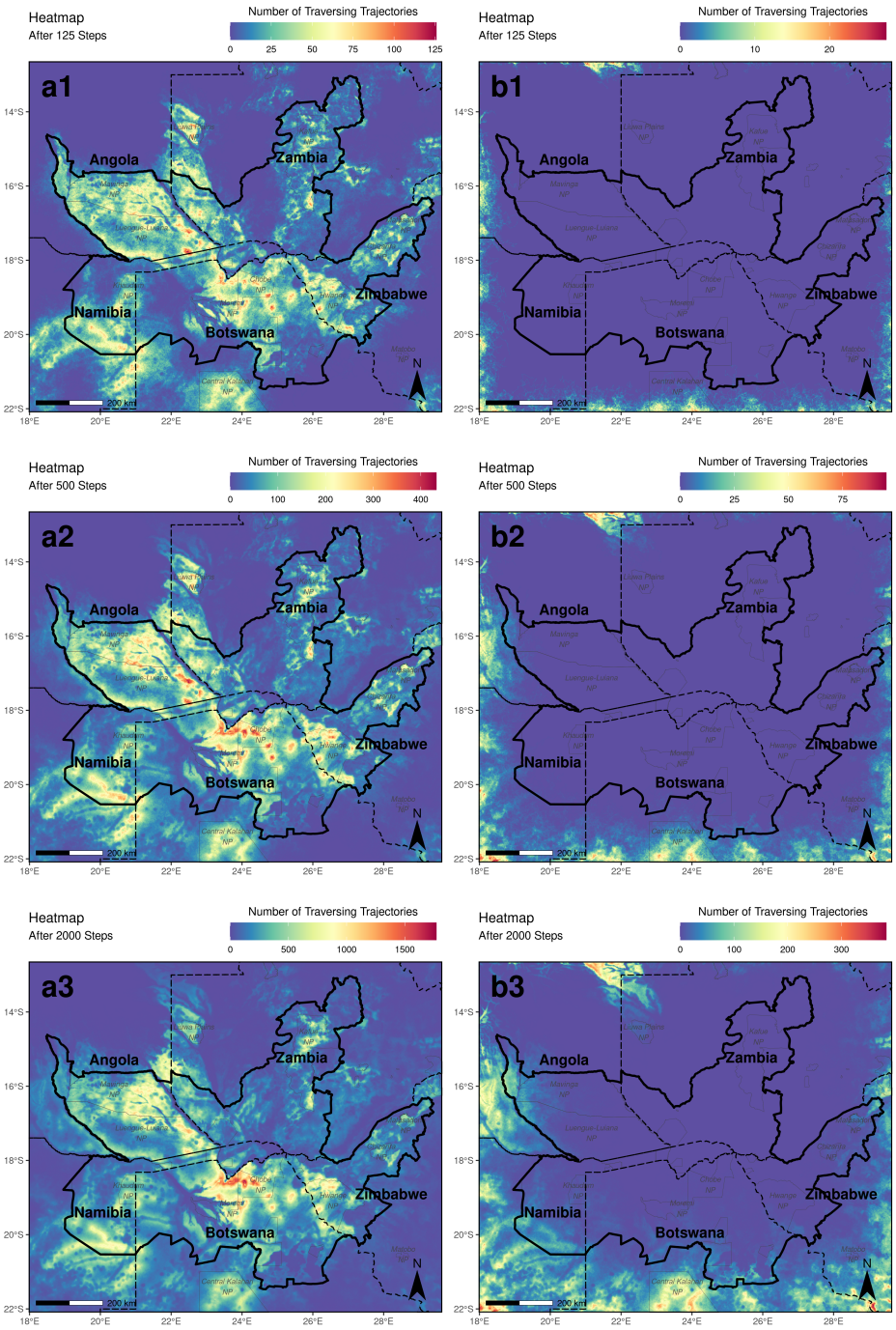

Figure S2: Heatmaps produced after 125, 500, and 2000 simulated steps, respectively. The left panel (a1, a2, a3) was generated based on simulations initiated within the main study area, the right panel (b1, b2, b3) was generated based on simulations initiated within the buffer area. To produce the heatmap presented in the main text, we summed up values from maps a3 and b3.

A.4 Evolution of Betweenness

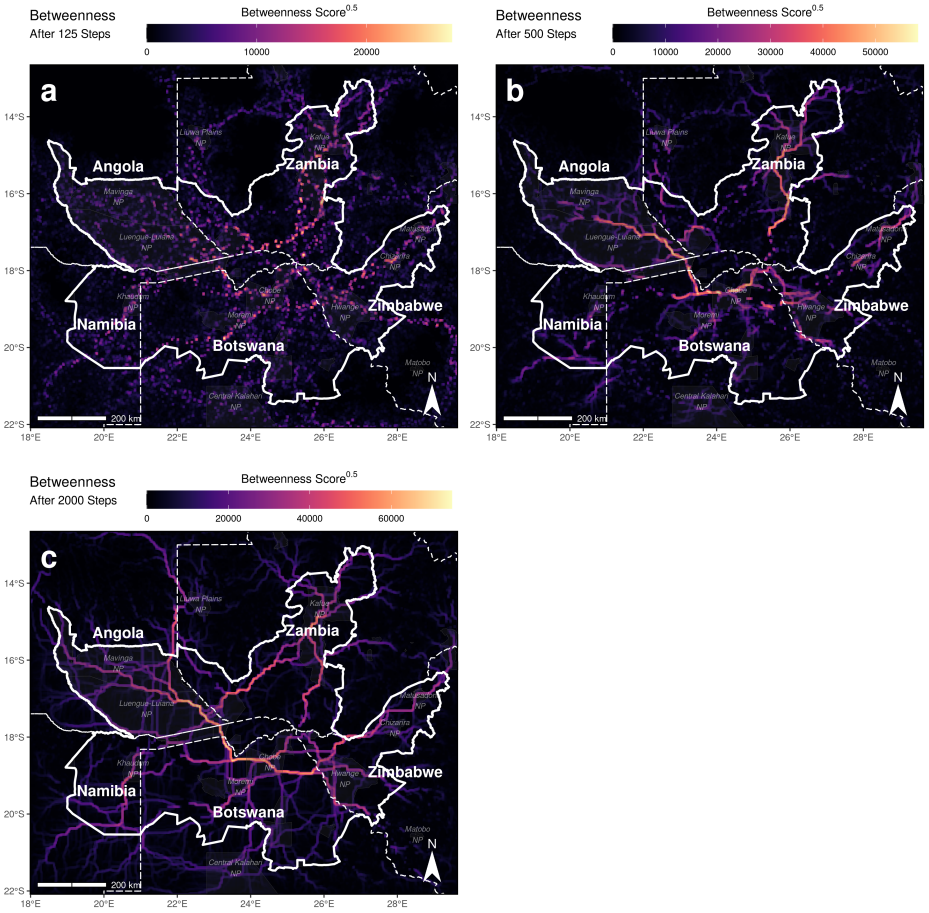

Figure S3: Maps of betweenness scores produced after 125 (a), 500 (b), and 2000 (c) simulated steps, respectively. A high betweenness score indicates that the respective area is paramount for linking other regions in the study area. It therefore highlights movement corridors that provide access to various destinations.

A.5 Step Selection Summary

Resource Selection Functions (RSFs) and Resource Selection Probability Functions (RSPFs) are routinely used to model habitat selection by animals using data from Very High Frequency (VHF) and Global Positioning System (GPS) locations. A RS(P)F is defined as any statistical model deployed to estimate the relative probability of selecting a resource unit versus alternative possible resource units (**?**).

Compared to a RSF, a RSPF yields the actual probability that an available resource unit is selected and can be estimated using weighted distribution theory (**?**).

Compared to RSFs, the key feature of SSFs is link- ing consecutive animal locations (most commonly taken at regular time intervals) that can be defined as steps (Turchin, 1998) (Figure 1).

With step selection functions, GPS trajectories are broken down into steps, each representing the straight line segment between two consecutive GPS relocations. Each observed step is then paired with a set of random steps, having the same starting point but differing in length and orientation (Fortin et al., 2005). To sample step lengths and orientations (i.e. turning angles), Fortin et al. (2005) sampled values from observed steps. Later studies, on the other hand, rely on parametrized distributions, fitted to observed steps. By comparing characteristics at observed and random steps using conditional logistic regression, features influencing elk movements can be determined. The step selection function takes the form (Fortin et al., 2005):

$$\hat{w}(x) = exp(\beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + ... + \beta_n x_n) \qquad \text{(Equation S1)}$$

Where coefficients β_1 to β_n are estimated using conditional logistic regression and are associated with environmental covariates x_1 to x_n, respectively. Ultimately, steps with higher $\hat{w}(x)$ have higher **odds** of being chosen.

As the time interval between relocations increases, it can be expected that autocorrelation in the data decreases.

How to state results:

- Assuming that other environmental factors remain constant, animals were less likely to ...
- Animals generally avoided steps in areas made up of a large proportion of ...
- An increase in ... did not generally decrease the odds of animals choosing these steps, as indicated by the positive association between ... and the probability of animals

making steps covering the two most widely available vegetation cover types

References

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