

Ecography

ECOG-04240

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Supplementary material

1 **Appendix 1**

2 *Table A1. Annual delineation of productivity periods used in the RSF analysis. Delineation is based on a*
 3 *mixture-modelling clustering of NDVI in three groups. Lower values are associated to the dry period,*
 4 *intermediate to the transition period and the higher values to the wet period.*

Date	Start of period	Date	Start of period	Date	Start of period	Date	Start of period
1/1/2001	Wet	2/10/2005	Trans	10/12/2009	Trans	10/21/2013	Trans
1/24/2001	Trans	4/18/2005	Wet	10/24/2009	Wet	10/29/2013	Wet
2/16/2001	Dry	6/18/2005	Trans	1/21/2010	Trans	1/8/2014	Trans
3/15/2001	Trans	7/26/2005	Dry	3/1/2010	Wet	3/19/2014	Wet
3/26/2001	Wet	10/30/2005	Trans	6/2/2010	Trans	5/3/2014	Trans
5/19/2001	Trans	11/18/2005	Wet	7/7/2010	Dry	6/4/2014	Dry
6/2/2001	Dry	11/21/2005	Trans	7/21/2010	Trans	8/25/2014	Trans
10/26/2001	Trans	12/26/2005	Dry	8/7/2010	Dry	9/21/2014	Dry
11/4/2001	Wet	3/24/2006	Trans	10/25/2010	Trans	10/10/2014	Trans
1/1/2002	Trans	3/30/2006	Wet	12/9/2010	Dry	11/12/2014	Wet
2/2/2002	Dry	5/23/2006	Trans	4/22/2011	Trans	12/19/2014	Trans
2/26/2002	Trans	6/11/2006	Dry	5/21/2011	Dry	1/10/2015	Dry
3/10/2002	Trans	10/13/2006	Trans	10/6/2011	Trans	3/23/2015	Trans
3/11/2002	Wet	10/21/2006	Wet	10/14/2011	Wet	4/12/2015	Wet
6/25/2002	Trans	2/23/2007	Trans	1/23/2012	Trans	5/22/2015	Trans
8/5/2002	Dry	3/20/2007	Wet	3/3/2012	Dry	6/9/2015	Dry
10/16/2002	Trans	6/28/2007	Trans	3/27/2012	Trans	10/28/2015	Trans
10/26/2002	Wet	11/3/2007	Wet	4/11/2012	Wet	11/4/2015	Wet
2/13/2003	Trans	2/12/2008	Trans	6/5/2012	Trans	1/28/2016	Trans
4/8/2003	Wet	3/19/2008	Wet	8/11/2012	Dry	3/14/2016	Dry
7/3/2003	Trans	5/24/2008	Trans	10/4/2012	Trans	4/2/2016	Trans
10/29/2003	Wet	6/10/2008	Dry	10/14/2012	Wet	4/20/2016	Wet
2/8/2004	Trans	10/1/2008	Trans	1/21/2013	Trans	6/8/2016	Trans
3/24/2004	Wet	10/8/2008	Wet	2/18/2013	Dry	7/16/2016	Dry
6/4/2004	Trans	12/18/2008	Trans	3/12/2013	Trans	11/7/2016	Trans
7/5/2004	Dry	1/31/2009	Dry	3/22/2013	Wet	11/17/2016	Wet
9/30/2004	Trans	3/30/2009	Trans	6/1/2013	Trans	12/19/2016	Trans
10/19/2004	Wet	5/14/2009	Dry	7/26/2013	Dry		

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Table A2. Third-order resource selection functions of 101 elephants in the Laikipia/Samburu ecosystem during dry, transition, and wet period. Mixed-effects exponential regressions were used to evaluate selection during each period during the night and day and overall annually. PIKE represents the proportion of illegal killing of elephants while HF stand for human features. Positive coefficients represent selection while negative coefficients represent avoidance of a resource. Coefficients are given with their 95% confidence intervals.

	Night			Day			Overall
	Dry	Trans	Wet	Dry	Trans	Wet	
Forest	-0.029 (-0.05, -0.008)	-0.353 (-0.38, -0.325)	-0.044 (-0.07, -0.018)	0.334 (0.316, 0.352)	-0.106 (-0.129, -0.084)	0.11 (0.088, 0.133)	0.328 (0.319, 0.337)
Wooded savannah	-0.117 (-0.126, -0.107)	0.104 (0.095, 0.113)	0.023 (0.013, 0.033)	-0.024 (-0.032, -0.015)	0.006 (-0.002, 0.013)	-0.058 (-0.067, -0.049)	0.029 (0.025, 0.033)
Other	0.003 (-0.023, 0.028)	-0.209 (-0.237, -0.181)	-0.114 (-0.145, -0.084)	0.381 (0.361, 0.402)	0.09 (0.069, 0.111)	0.204 (0.18, 0.228)	0.146 (0.136, 0.156)
Slope	-0.266 (-0.272, -0.26)	-0.3 (-0.306, -0.294)	-0.355 (-0.362, -0.347)	-0.511 (-0.517, -0.505)	-0.48 (-0.486, -0.473)	-0.599 (-0.607, -0.591)	-0.344 (-0.346, -0.341)
Unpredictability NDVI	-0.031 (-0.036, -0.027)	0.027 (0.022, 0.032)	-0.022 (-0.028, -0.017)	-0.051 (-0.055, -0.047)	0.007 (0.003, 0.011)	-0.068 (-0.073, -0.063)	0.025 (0.024, 0.027)
NDVI	0.949 (0.939, 0.958)	0.369 (0.364, 0.374)	0.753 (0.743, 0.762)	1.321 (1.312, 1.33)	0.384 (0.38, 0.389)	1.059 (1.05, 1.067)	0.37 (0.368, 0.372)
Dist water seasonal	-0.262 (-0.27, -0.254)	-0.126 (-0.134, -0.118)	-0.231 (-0.239, -0.223)	-0.315 (-0.321, -0.308)	-0.13 (-0.137, -0.123)	-0.26 (-0.267, -0.253)	-0.219 (-0.221, -0.216)
Dist water permanent	-0.39 (-0.4, -0.38)	0.042 (0.032, 0.052)	-0.334 (-0.345, -0.324)	-0.462 (-0.471, -0.453)	0.028 (0.019, 0.038)	-0.374 (-0.384, -0.364)	-0.259 (-0.264, -0.254)
Dist water seasonal:NDVI	0.108 (0.099, 0.117)	-0.021 (-0.027, -0.015)	0.009 (-0.001, 0.019)	-0.003 (-0.01, 0.005)	-0.036 (-0.041, -0.031)	-0.095 (-0.103, -0.086)	0.039 (0.036, 0.041)
Dist water permanent:NDVI	0.084 (0.076, 0.092)	-0.07 (-0.075, -0.064)	0.025 (0.019, 0.032)	0.012 (0.005, 0.019)	-0.054 (-0.058, -0.049)	-0.041 (-0.048, -0.035)	0.061 (0.059, 0.063)
Dist road secondary	-0.198 (-0.204, -0.192)	-0.112 (-0.118, -0.106)	-0.277 (-0.284, -0.27)	-0.222 (-0.227, -0.217)	-0.123 (-0.129, -0.118)	-0.309 (-0.316, -0.303)	-0.186 (-0.188, -0.184)
Dist road primary	0.105 (0.098, 0.112)	-0.175 (-0.182, -0.167)	-0.209 (-0.218, -0.201)	0.059 (0.053, 0.066)	-0.171 (-0.177, -0.164)	-0.239 (-0.247, -0.232)	-0.065 (-0.068, -0.062)
Dist agriculture	-0.217 (-0.222, -0.211)	0.169 (0.163, 0.174)	0.061 (0.054, 0.067)	-0.199 (-0.204, -0.195)	0.15 (0.146, 0.155)	0.083 (0.077, 0.089)	-0.025 (-0.027, -0.022)
Dist village	0.147 (0.14, 0.154)	-0.169 (-0.176, -0.161)	0.051 (0.042, 0.06)	0.126 (0.12, 0.132)	-0.174 (-0.18, -0.167)	0.026 (0.018, 0.034)	0.023 (0.02, 0.026)
Pike	-0.205 (-0.223, -0.187)	0.085 (0.069, 0.1)	0.018 (0, 0.037)	-0.085 (-0.101, -0.068)	0.02 (0.006, 0.034)	0.009 (-0.008, 0.026)	0.012 (0.005, 0.018)
Density permanent HF	-0.042 (-0.048, -0.036)	-0.133 (-0.142, -0.124)	-0.072 (-0.08, -0.064)	-0.007 (-0.012, -0.003)	0.019 (0.014, 0.023)	0.023 (0.018, 0.028)	-0.011 (-0.013, -0.009)
Density seasonal HF	-0.086 (-0.092, -0.079)	-0.104 (-0.111, -0.097)	-0.099 (-0.107, -0.092)	-0.223 (-0.23, -0.216)	-0.266 (-0.273, -0.259)	-0.284 (-0.293, -0.276)	-0.204 (-0.207, -0.202)
Pike: Dist village	0.016 (0, 0.032)	0.048 (0.032, 0.065)	0.048 (0.028, 0.067)	0.026 (0.011, 0.04)	0.063 (0.048, 0.078)	0.021 (0.004, 0.038)	0.057 (0.051, 0.064)
Pike: Density permanent HF	0.064 (0.053, 0.075)	0.057 (0.037, 0.077)	0.003 (-0.019, 0.026)	-0.049 (-0.061, -0.038)	-0.216 (-0.236, -0.196)	-0.128 (-0.148, -0.109)	-0.036 (-0.042, -0.03)
Pike: Density seasonal HF	-0.04 (-0.056, -0.023)	0.092 (0.076, 0.107)	-0.025 (-0.044, -0.005)	-0.113 (-0.133, -0.092)	0.13 (0.113, 0.146)	-0.016 (-0.038, 0.007)	0.032 (0.024, 0.039)
K fold R	> 0.999	> 0.999	> 0.999	> 0.999	> 0.999	> 0.999	0.988
Individual variance		0.8952	0.8844	0.9795	0.8952	0.8844	0.9795

Table A3. Model selection for third-order resource selection functions of 101 elephants in the Laikipia/Samburu ecosystem during dry, transition, and wet period. Mixed-effects exponential regressions were used to evaluate selection during each period during the night and day and overall annually. “Day” is a dummy variable associate to day/night. “HF” and “Dist water” represent the suite of variables associated to the human features and distance to water respectively. PIKE represents the proportion of illegal killing of elephants. The base model includes variables associate land cover, topography and single effects of NDVI, predictability of NDVI, human features and distance to road and water.

Models	Dry period			Wet period			Transition period		
	AICc	Delta_AICc	AICcWt	AICc	Delta_AICc	AICcWt	AICc	Delta_AICc	AICcWt
1 (Base):Day	2533213	1381.01	0	2779903	2398.85	0	2022802	938.82	0
2 (Base+Dist water:NDVI):Day	2532191	359.19	0	2778506	1002.15	0	2022097	233.59	0
3 (Base+HF:Pike):Day	2532848	1016.31	0	2778906	1402.63	0	2022573	709.28	0
4 (Base+Dist water:NDVI+HF:Pike):Day	2531832	0	1	2777504	0	1	2021864	0	1
5 Single effects (base)	2541404	9571.95	0	2784565	7061.07	0	2028774	6910.07	0
6 Base+Dist water:NDVI	2541010	9178.19	0	2783175	5671.65	0	2028519	6655.36	0
7 Base+HF:Pike	2541265	9432.91	0	2783823	6318.74	0	2028605	6741.72	0
8 Base+Dist water:NDVI+HF:Pike	2540888	9055.4	0	2782422	4918.37	0	2028346	6482.29	0

Table A4. Model selection interval from linear mixed-model of mean squared displacement (MSD) observed for 101 African elephants in the Laikipia-Samburu ecosystem.

Models	AICc	Delta AICc	AICcWt
Period + Length	22289.69	0	1
Period + Length ²	22308.19	18.49	0
Period	22325.84	36.14	0

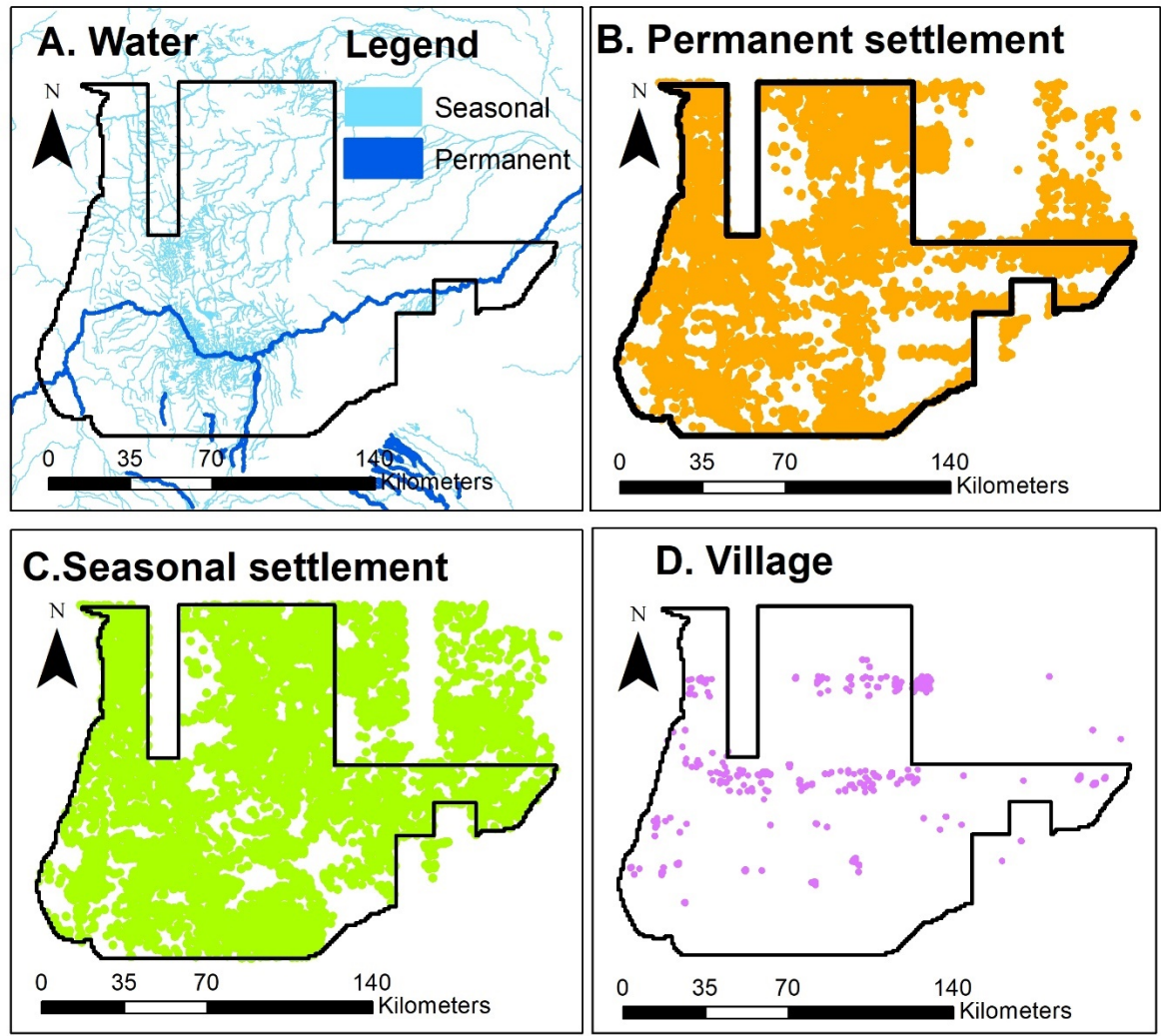


Figure A1. Distribution of water and human features in the study area. Extent of the study area is delineated by the black polygon.

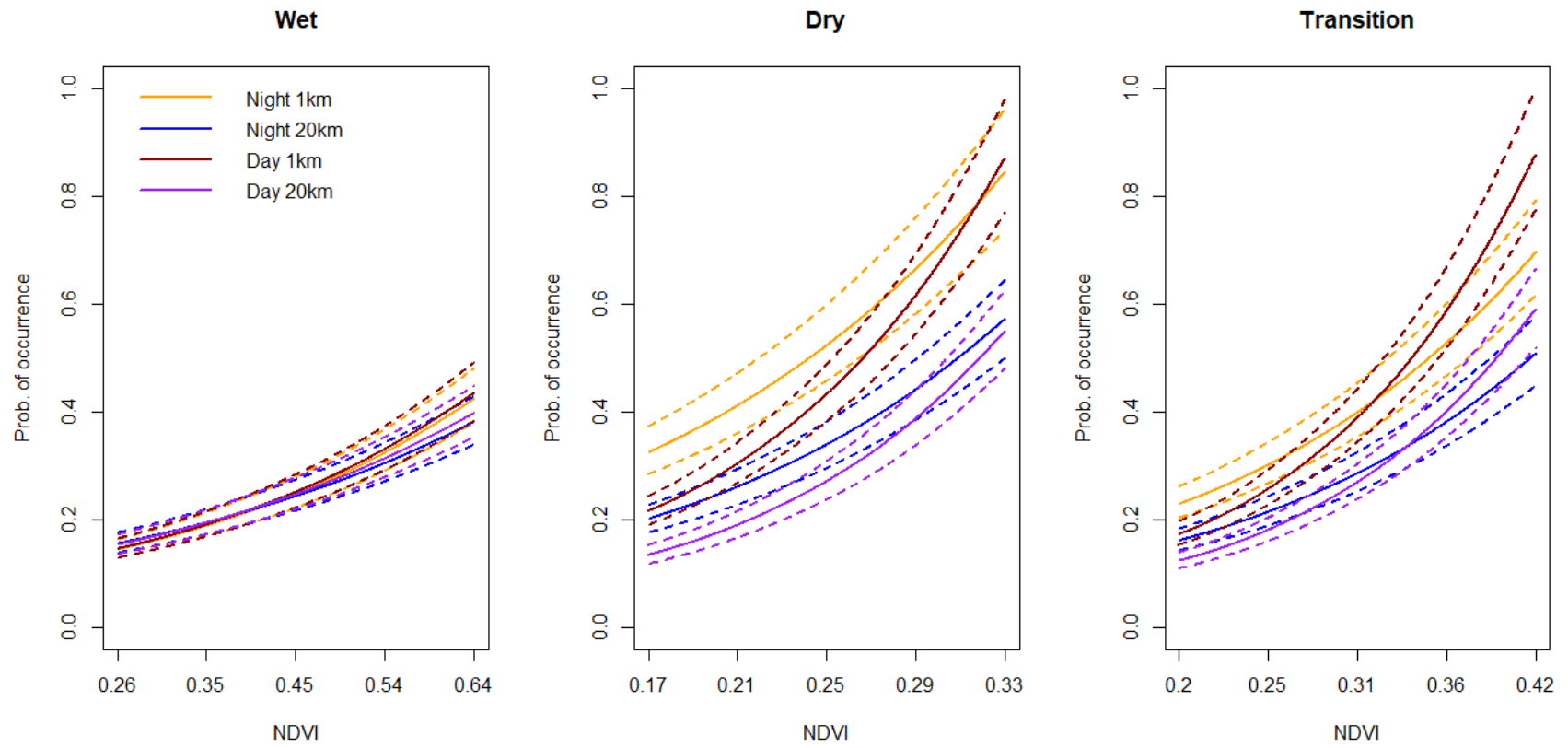


Figure A2. Example of changes in the relative probability of occurrence as a function of primary productivity (NDVI) and distance to permanent water. Plots present variation between day and night.

Figure A7. Relative probability of occurrence of 101 elephants in the Laikipia/Samburu ecosystem based on third-order resource selection function (RSF). Probability of occurrence were estimated on an annual basis, and during the dry, transition, and wet period.