Supplementary Information
Predicting bat distributions and diversity hotspots in southern Africa.
Cooper-Bohannon R., Rebelo H., Jones G., Cotterill F. (Woody), Monadjem A., Schoeman M.C., Taylor P., Park K.

Table S1: Seventy-six eco-geographical variables (EGVs) trialled to build Maxent model for focal bat species in southern Africa. The final EGVs selected are highlighted in grey.

Variable categories	Description	Source
Climate (19)	BIO1 - annual mean temperature	WorldClim – Global Climate Data (http://www.worldclim.org/)
	BIO2 – mean diurnal range (mean of monthly (max temp – min temp))	"
	BIO3 – isothermality (BIO2/BIO7) ($\times$ 100)	"
	BIO4 – temperature seasonality (standard deviation ($\times$ 100)	"
	BIO5 – max temperature of warmest month	"
	BIO6 – min temperature of coldest month	"
	BIO7 – temperature annual range (BIO5 – BIO6)	"
	BIO8 – mean temperature of wettest quarter	"
	BIO9 – mean temperature of driest quarter	"
	BIO10 – mean temperature of warmest quarter	"
	BIO11 – mean temperature of coldest quarter	"
	BIO12 – annual precipitation	"
	BIO13 – precipitation of wettest month	"
	BIO14 – precipitation of driest month	"
	BIO15 – precipitation seasonality (coefficient of variation)	"
	BIO16 – precipitation of wettest quarter	"
	BIO17 – precipitation of driest quarter	"
	BIO18 – precipitation of warmest quarter	"
	BIO19 – precipitation of coldest quarter	"
Topography (2)	altitude	
	slope	created in ArcGIS 10.2 based on altitude layer
Geology (1)	distance to karst	University of Auckland (http://web.env.auckland.ac.nz/our_research/karst)
Water availability (4)	distance to permanent water bodies	ESRI
	distance to temporary water bodies	"
	distance to permanent linear water	"
	distance to temporary linear water	"
SPOT-Water (36)	GWWR (satellite water bodies detection) – January (1998–2012)	Geoland|2 (www.geoland2.eu)
	GWWR – February (1998–2012)	"
	GWWR – March (1998–2012)	"
	GWWR – April (1998–2012)	"
	GWWR – May (1998–2012)	"
	GWWR – June (1998–2012)	"
	GWWR – July (1998–2012)	"
	GWWR – August (1998–2012)	"
	GWWR – September (1998–2012)	"
	GWWR – October (1998–2012)	"
	GWWR – November (1998–2012)	"
	GWWR – December (1998–2012)	"
	SWB (satellite small water bodies detection) – January (1998–2012)	"
	SWB – February (1998–2012)	"
	SWB – March (1998–2012)	"
	SWB – April (1998–2012)	"
	SWB – May (1998–2012)	"
	SWB – June (1998–2012)	"

Table S1 (continued)

Variable categories	Description	Source
	SWB – July (1998–2012)	"
	SWB – August (1998–2012)	"
	SWB – September (1998–2012)	"
	SWB – October (1998–2012)	"
	SWB – November (1998–2012)	"
SPOT-Water	SWB – December (1998–2012)	Geoland|2 (www.geoland2.eu)
	GWWR + SWB – January (1998–2012)	"
	GWWR + SWB – February (1998–2012)	"
	GWWR + SWB – March (1998–2012)	"
	GWWR + SWB – April (1998–2012)	"
	GWWR + SWB – May (1998–2012)	"
	GWWR + SWB – June (1998–2012)	"
	GWWR + SWB – July (1998–2012)	"
	GWWR + SWB – August (1998–2012)	"
	GWWR + SWB – September (1998–2012)	"
	GWWR + SWB – October (1998–2012)	"
	GWWR + SWB – November (1998–2012)	"
	GWWR + SWB – December (1998–2012)	"
SPOT-Vegetation (12)	NDVI (normalised difference vegetation index) – January (1998–2012)	SPOT Programme (www.vgt.vito.be)
	NDVI – February (1998–2012)	"
	NDVI – March (1998–2012)	"
	NDVI – April (1998–2012)	"
	NDVI – May (1998–2012)	"
	NDVI – June (1998–2012)	"
	NDVI – July (1998–2012)	"
	NDVI – August (1998–2012)	"
	NDVI – September (1998–2012)	"
	NDVI – October (1998–2012)	"
	NDVI – November (1998–2012)	"
	NDVI – December (1998–2012)	"
Landcover	landcover	Global Land Cover (http://glcf.umd.edu/)
Biomes	biotic zones created from WWF ecoregions map	WWF (https://worldwildlife.org/pages/conservation-science-data-and-tools/)

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Table S2: Species information and modelling prediction results, including: species considered to be either endemic (**) or near-endemic (*) (majority of range within study area but few records beyond) are highlighted and species cave-roosting preferences are marked as cave-dependent (▲▲), predominantly cave-dwelling (▲) or caves as well as other roosts (△) (e.g. trees, buildings). Models were run after removing spatial autocorrelation data. Results include occupied area (as a proportion of the entire study area) per species, percentage of cover per species within each biotic region, and three ecogeographical variables (EGVs) considered to be most influential in the models: alt – altitude, BIO2 – mean diurnal range, BIO4 – °C seasonality, BIO10 – mean °C of warmest quarter, BIO11 – mean °C of coldest quarter, bzo – biotic zones, dtk – distance to karst, gwbm – GWWR SWB – satellite imagery for small water bodies (May), gwbj – GWWR SWB (July), ilw - intermittent linear water, iwb - intermittent water bodies, ndva – NDVI – normalised difference vegetation index (April), plw - permanent linear water, pwb - permanent water bodies, pwq - precipitation of wettest quarter, and slo – slope. Water variables are highlighted in bold. mdr –, tcq -, twq -, and tse. IUCN status highlighted in bold indicates a species with a threatened or data deficient status.

Species	IUCN status 2008 (2004)	No. of data points initial (final)	AUC training (test) *diff*	Sensitivity (%)	Predicted area of occupancy km²	%	Dominant biotic zones (% cover)	SW arid	SW Cape	high veld	montane	dry savanna	moist savanna	coastal forest	Var 1	Var 2	Var 3
							Pteropodidae (fruit bats)										
Eidolon helvum	**NT** (LC)	67 (59)	0.879 (0.677) *0.202*	78	1091925	17	1. Savanna (33%) 2. SW arid (28%) 3. High veld (17%) 4. Afromontane (13%)	21	0	95	44	2	17	42	bzo	**pwb**	gwbⱼ
Epomophorus angolensis**	**NT** **(NT)**	19 (19)	0.986 (0.893) *0.093*	100	339737	5	1. Savanna (62%) 2. SW arid (26%)	5	0	0	6	4	7	4	bzo	BIO4	**iwb**
Epomophorus crypturus**	LC (LC)	112 (78)	0.915 (0.826) *0.089*	91	1213597	19	1. Savanna (88%)	0	0	2	13	36	17	38	**pwb**	**plw**	pwq
Epomophorus labiatus	LC (LC)	23 (23)	0.987 (0.927) *0.060*	96	436697	7	1. Savanna (90%)	0	0	0	0	4	17	4	**pwb**	**ilw**	BIO2
Epomophorus wahlbergi	LC (LC)	159 (66)	0.901 (0.730) *0.171*	86	1327859	21	1. Savanna (63%) 2. Afromontane (18%) 3. Coastal mosaic (14%)	1	30	0	73	12	33	77	**bzo**	**pwb**	BIO4
Epomops dobsonii**	LC (LC)	28 (28)	0.959 (0.883) *0.076*	93	503585	8	1. Savanna (94%)	0	0	0	9	0	26	0	bzo	**ilw**	BIO11
Rousettus aegyptiacus▲▲	LC (LC)	66 (38)	0.943 (0.765) *0.178*	83	692896	11	1. Savanna (60%) 2. Afromontane (22%)	3	32	0	47	16	5	9	BIO2	slo	**plw**

Species	IUCN status 2008 (2004)	No. of data points initial (final)	AUC training (test) *diff*	Sensitivity (%)	Predicted area of occupancy km²	%	Dominant biotic zones (% cover)	SW arid	SW Cape	high veld	montane	dry savanna	moist savanna	coastal forest	Var 1	Var 2	Var 3
Hipposideridae (trident / leaf-nosed bats)																	
Cloeotis percivali*▲▲	LC **(VU)**	33 (29)	0.952 (0.878) *0.074*	86	955464	15	1. Savanna (79%) 2. Afromontane (12%)	0	0	23	36	25	11	16	**pwb**	**gwb$_j$**	**iwb**
Hipposideros caffer▲	LC (LC)	233 (131)	0.904 (0.739) *0.165*	83	1581888	25	1. Savanna (75%) 2. SW arid (10%)	10	0	0	42	36	22	38	BIO4	**pwb**	slo
Hipposideros ruber△	LC (LC)	27 (20)	0.971 (0.758) *0.213*	95	625018	10	1. Savanna (87%)	0	0	0	7	0	29	13	bzo	slo	**pwb**
Hipposideros vittatus▲▲	**NT** (n/a)	80 (69)	0.909 (0.812) *0.097*	79	1043916	17	1. Savanna (81%)	7	0	0	18	29	12	17	**iwb**	**pwb**	pwq
Rhinolophidae (horseshoe bats)																	
Rhinolophus blasii*▲▲	LC **(NT)**	45 (42)	0.973 (0.925) *0.048*	95	602154	10	1. Savanna (70%) 2. Afromontane (18%)	0	0	15	34	16	4	14	**gwb$_m$**	slo	dtk
Rhinolophus capensis**▲▲	LC **(NT)**	25 (25)	0.991 (0.955) *0.036*	95	277925	4	1. SW arid (38%) 2. SW Cape (34%) 3. Afromontane (24%)	2	90	0	21	0	0	0	**iwb**	bzo	alt
Rhinolophus clivosus▲▲	LC (LC)	188 (90)	0.912 (0.850) *0.062*	85	1120944	18	1. Savanna (41%) 2. Afromontane (24%) 3. SW arid (13%) 4. High veld (11%)	9	71	62	85	16	7	21	slo	bzo	BIO10
Rhinolophus darlingi**▲	LC (LC)	140 (98)	0.903 (0.837) *0.066*	88	1217047	19	1. Savanna (64%) 2. SW arid (26%)	22	0	6	29	35	1	8	**iwb**	bzo	**gwb$_m$**
Rhinolophus denti**▲	LC **(DD)**	19 (19)	0.966 (0.827) *0.139*	95	781091	12	1. SW arid (55%) 2. Savanna (41%)	37	0	12	1	15	0	0	**ilw**	dtk	bzo
Rhinolophus fumigatus▲▲	LC (LC)	85 (74)	0.929 (0.865) *0.064*	93	1246343	20	1. Savanna (80%) 2. SW arid (11%)	10	0	0	17	29	20	15	BIO4	BIO11	alt

Table S2 (continued)

Species	IUCN status 2008 (2004)	No. of data points initial (final)	AUC training (test) *diff*	Sensitivity (%)	Predicted area of occupancy km²	%	Dominant biotic zones (% cover)	SW arid	SW Cape	high veld	montane	dry savanna	moist savanna	coastal forest	Var 1	Var 2	Var 3
Rhinolophus hildebrandtii▲	LC (LC)	153 (110)	0.945 (0.877) *0.068*	90	946716	15	1. Savanna (92%)	0	0	0	13	29	14	8	**plw**	BIO2	**iwb**
Rhinolophus landeri▲	LC (LC)	50 (36)	0.942 (0.809) *0.133*	89	1008924	16	1. Savanna (89%)	0	0	0	21	23	22	17	**pwb**	**gwb$_j$**	BIO10
Rhinolophus simulator▲▲	LC (LC)	91 (49)	0.950 (0.877) *0.073*	85	855537	14	1. Savanna (71%) 2. Afromontane (18%)	1	0	14	48	25	4	19	**gwb$_j$**	dtk	**gwb$_m$**
Rhinolophus swinnyi*▲▲	LC (NT)	48 (31)	0.938 (0.792) *0.146*	87	1054284	17	1. Savanna (77%) 2. Afromontane (18%)	0	0	0	60	23	17	20	**ilw**	**plw**	dtk
Emballonuridae (sheath-tailed bats)																	
Taphozous mauritianus	LC (LC)	97 (82)	0.901 (0.824) *0.077*	87	1454841	23	1. Savanna (75%) 2. Afromontane (10%)	4	25	27	46	39	14	23	**pwb**	ndv$_a$	BIO4
Nycteridae (slit-faced bats)																	
Nycteris hispida△	LC (LC)	40 (34)	0.966 (0.867) *0.099*	91	710458	7	1. Savanna (84%)	0	0	0	15	7	22	13	**pwb**	**ilw**	pwq
Nycteris macrotis△	LC (LC)	44 (41)	0.921 (0.725) *0.196*	80	1466326	23	1. Savanna (81%)	0	0	0	23	29	40	13	**pwq**	**gwb$_j$**	plw
Nycteris thebaica▲	LC (LC)	349 (235)	0.864 (0.730) *0.134*	86	1704632	27	1. Savanna (63%) 2. SW arid (18%) 3. Afromontane (10%)	20	60	0	53	40	12	32	**pwb**	BIO4	**gwb$_m$**
Nycteris woodi**▲	LC (NT)	25 (25)	0.977 (0.938) *0.039*	82	308190	5	1. Savanna (99%)	0	0	0	0	11	4	0	**pwb**	**ilw**	bzo
Molossidae (free-tailed bats)																	
Tadarida aegyptiaca▲	LC (LC)	176 (119)	0.910 (0.739) *0.171*	87	1214127	19	1. Savanna (32%) 2. SW arid (29%) 3. Afromontane (17%) 4. High veld (14%)	23	61	90	65	17	1	11	**ilw**	BIO117 slo	

Species	IUCN status 2008 (2004)	No. of data points initial (final)	AUC training (test) *diff*	Sensitivity (%)	Predicted area of occupancy km²	%	Dominant biotic zones (% cover)	SW arid	SW Cape	high veld	montane	dry savanna	moist savanna	coastal forest	Var 1	Var 2	Var 3
Chaerephon ansorgei	LC (LC)	31 (31)	0.966 (0.841) *0.125*	94	673792	11	1. Savanna (92%)	0	0	0	0	0	0	5	ndv$_a$	bzo	**pwb**
Mops condylurus▲	LC (LC)	106 (72)	0.941 (0.877) *0.064*	84	1057626	17	1. Savanna (79%) 2. Coastal mosaic (11%)	0	0	0	28	25	17	50	**pwb**	alt	**ilw**
Tadarida fulminans	LC (LC)	18 (18)	0.966 (0.861) *0.105*	94	541523	9	1. Savanna (90%)	0	0	0	14	20	3	0	**ilw**	**plw**	bzo
Mops midas	LC (LC)	36 (32)	0.974 (0.882) *0.092*	91	441324	7	1. Savanna (94%)	0	0	0	9	19	0	0	**iwb**	bzo	BIO10
Chaerephon nigeriae▲	LC (LC)	41 (40)	0.941 (0.821) *0.120*	90	1133308	18	1. Savanna (98%)	1	0	0	0	30	26	0	BIO11	bzo	alt
Mops niveiventer	LC (LC)	19 (19)	0.976 (0.864) *0.112*	100	722774	12	1. Savanna (98%)	0	0	0	5	2	37	0	bzo	**ilw**	pwq
Chaerephon pumilus	LC (LC)	186 (59)	0.935 (0.828) *0.107*	86	809867	13	1. Savanna (78%) 2. Coastal mosaic (10%)	0	0	0	8	17	15	54	**pwb**	alt	bzo
*Sauromys petrophilus***	LC (LC)	63 (31)	0.951 (0.835) *0.116*	81	915652	15	1. Savanna (54%) 2. SW arid (36%)	16	65	8	4	23	0	0	**ilw**	bzo	slo
Miniopteridae (long-fingered bats)																	
Miniopterus fraterculus*▲▲	LC (LC)	23 (23)	0.993 (0.972) *0.021*	96	297363	5	1. Afromontane (61%) 2. Savanna (15%) 3. Coastal mosaic (13%)	0	7	10	57	2	0	17	bzo	slo	**gwb$_m$**
Miniopterus natalensis▲▲	LC **(NT)**	224 (149)	0.901 (0.770) *0.131*	84	1227870	20	1. Savanna (54%) 2. Afromontane (16%) 3. SW arid (14%)	12	59	32	62	24	8	30	dtk	**pwb**	plw

Species	IUCN status 2008 (2004)	No. of data points initial (final)	AUC training (test) *diff*	Sensitivity (%)	Predicted area of occupancy km²	%	Dominant biotic zones (% cover)	SW arid	SW Cape	high veld	montane	dry savanna	moist savanna	coastal forest	Var 1	Var 2	Var 3
Vespertilionidae (plain-faced bats)																	
*Cistugo lesueuri***	LC **(VU)**	16 (16)	0.979 (0.946) *0.033*	88	673792	11	1. Afromontane (43%) 2. High veld (29%) 3. SW Cape (13%) 4. SW arid (11%)	0	37	45	13	26	4	5	BIO11	BIO10	bzo
Eptesicus hottentotus*△	LC (LC)	46 (39)	0.914 (0.749) 0.165	77	813384	13	1. Savanna (33%) 2. SW arid (28%) 3. Afromontane (20%) 4. SW Cape (10%)	12	80	23	52	12	1	9	bzo	slo	**plw**
Glauconycteris variegata	LC (LC)	38 (36)	0.950 (0.839) *0.111*	94	976983	16	1. Savanna (78%) 2. Coastal mosaic (12%)	0	0	0	22	21	17	52	**plw**	bzo	BIO11
Kerivoula argentata	LC (LC)	30 (29)	0.941 (0.739) *0.202*	85	752853	12	1. Savanna (79%) 2. Coastal mosaic (14%)	0	0	0	15	15	15	46	**plw**	BIO4	BIO2
Kerivoula lanosa	LC (LC)	27 (27)	0.954 (0.865) *0.089*	78	636522	10	1. Savanna (55%) 2. Afromontane (19%) 3. Coastal mosaic (15%)	1	42	0	38	11	7	42	**pwb**	bzo	**plw**
*Laephotis botswanae***	LC (LC)	25 (25)	0.944 (0.807) *0.137*	88	988632	16	1. Savanna (83%) 2. Afromontane (16%)	0	0	0	50	24	18	0	bzo	**plw**	BIO11
Myotis bocagii	LC (LC)	35 (29)	0.943 (0.809) *0.134*	93	594469	10	1. Savanna (82%)	0	0	0	12	11	13	20	**plw**	ndv$_a$	slo
Myotis tricolor▲▲	LC (LC)	58 (45)	0.931 (0.834) 0.097	91	820776	13	1. Savanna (37%) 2. Afromontane (28%) 3. High veld (14%)	2	65	61	71	12	3	24	dtk	bzo	slo
Myotis welwitschii	LC (LC)	33 (30)	0.929 (0.790) *0.139*	83	920261	15	1. Savanna (70%) 2. Afromontane (20%)	0	0	31	58	17	16	6	**gwb$_m$**	**plw**	slo
Nycticeinops schlieffeni	LC (LC)	145 (79)	0.914 (0.849) *0.065*	87	1003159	16	1. Savanna (86%)	3	0	0	3	35	6	26	bzo	**pwb**	BIO10

| Species	IUCN status 2008 (2004)	No. of data points initial (final)	AUC training (test) diff	Sensitivity (%)	Predicted area of occupancy km²	%	Dominant biotic zones (% cover)	SW arid	SW Cape	high veld	montane	dry savanna	moist savanna	coastal forest	Var 1	Var 2	Var 3
*Hypsugo anchietae***	LC (LC)	45 (39)	0.946 (0.856) 0.090	97	987832	16	1. Savanna (85%) 2. Coastal mosaic (10%)	0	0	0	16	26	16	42	**pwb**	bzo	BIO11
Neoromicia capensis	LC (LC)	376 (261)	0.871 (0.752) 0.119	81	1719255	27	1. Savanna (47%) 2. SW arid (20%) 3. Afromontane (15%)	22	85	100	79	36	2	16	bzo	BIO11	**ilw**
Pipistrellus hesperidus	LC (n/a)	62 (50)	0.948 (0.852) 0.096	85	820815	13	1. Savanna (62%) 2. Afromontane (22%) 3. Coastal mosaic (12%)	1	0	0	57	16	9	41	bzo	**pwb**	**plw**
Neoromicia nana	LC (LC)	199 (111)	0.915 (0.751) 0.164	87	1165508	19	1. Savanna (83%)	1	0	0	29	22	27	32	BIO4	**pwq**	**pwb**
Pipistrellus rueppelli	LC (LC)	38 (37)	0.974 (0.895) 0.079	89	477914	8	1. Savanna (82%) 2. Afromontane (11%)	1	0	0	17	14	6	3	**pwb**	**plw**	**gwbj**
Pipistrellus rusticus	LC (LC)	49 (43)	0.955 (0.861) 0.094	91	842481	13	1. Savanna (94%)	0	0	0	16	32	2	0	**iwb**	bzo	**pwb**
*Neoromicia zuluensis***	LC (LC)	88 (64)	0.905 (0.799) 0.106	77	1198714	19	1. Savanna (81%) 2. SW arid (10%)	7	0	0	21	37	9	18	**iwb**	BIO4	bzo
Scotoecus hirundo	LC **(DD)**	21 (21)	0.970 (0.875) 0.095	95	555102	9	1. Savanna (84%)	0	0	0	12	12	11	16	BIO11	pwq	**ilw**
*Scotophilus dinganii***	LC (LC)	236 (127)	0.914 (0.773) 0.141	85	1251825	20	1. Savanna (80%)	4	0	0	37	40	8	34	**pwb**	**gwb$_m$**	bzo
Scotophilus leucogaster	LC (LC)	42 (42)	0.950 (0.888) 0.062	83	426596	7	1. Savanna (89%) 2. SW arid (10%)	2	0	0	1	17	0	0	**iwb**	bzo	**gwb$_m$**
Scotophilus viridis	LC (LC)	63 (53)	0.955 (0.895) 0.060	98	895732	14	1. Savanna (77%) 2. Coastal mosaic (13%)	0	0	7	19	30	1	49	bzo	**ilw**	alt
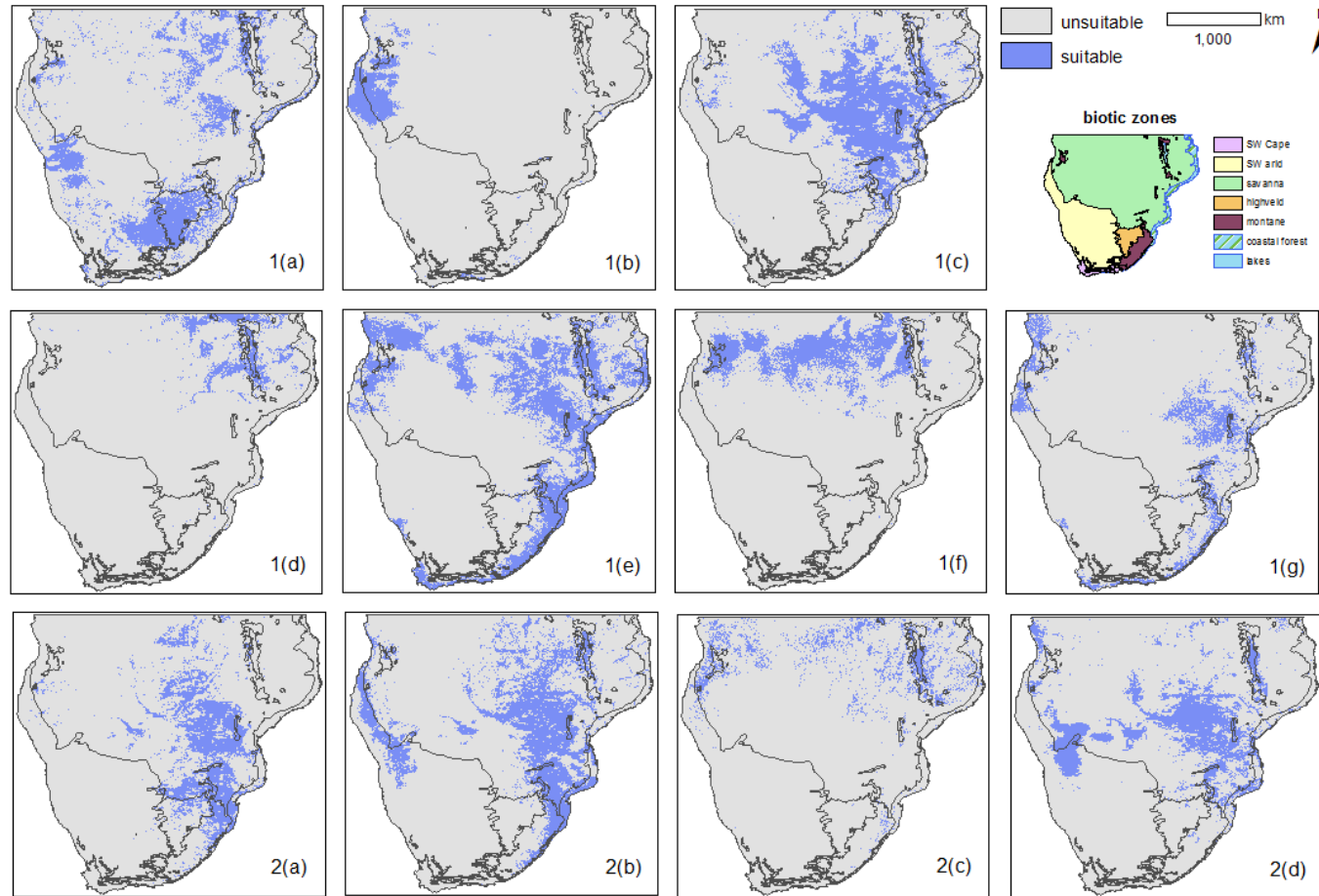
Figure S3: Species distribution maps. PTEROPODIDAE - 1(a) *Eidolon helvum*, (b) *Epomophorus angolensis*, (c) *E. cypturus*, (d) *E. labiatus*, (e) *E. wahlbergi*, (f) *Epomops dobsonii*, (g) *Rousettus aegyptiacus*. HIPPOSIDERIDAE - 2(a) *Cloeotis percivali*, (b) *Hipposideros caffer*, (c) *H. ruber*, and (d) *H. vittatus*.
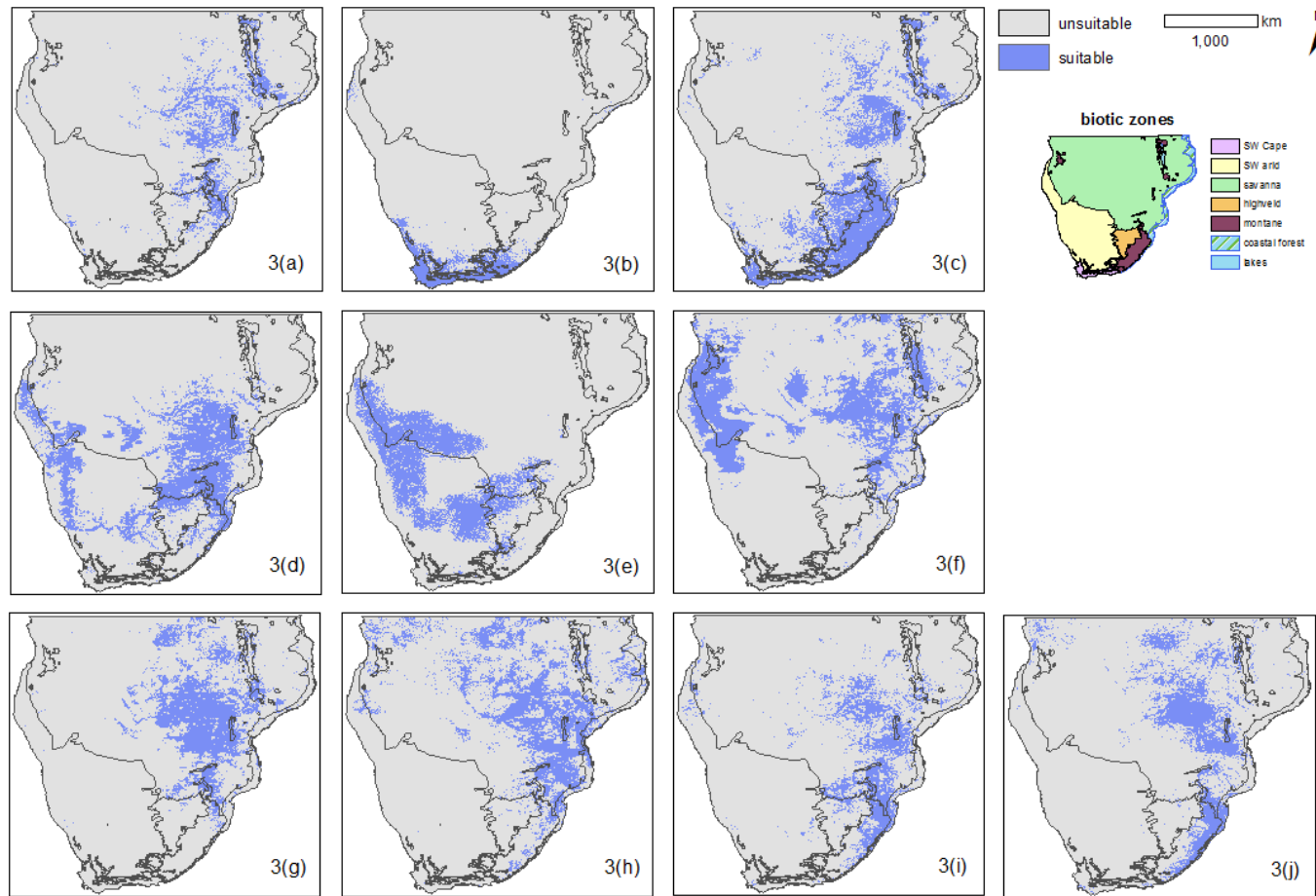
Figure S4: Species distribution maps. RHINOLOPHIDAE - 3(a) *Rhinolophus blasii*, (b) *R. capensis*, (c) *R. clivosus*, (d) *R. darlingi*, (e) *R. denti*, (f) *R. fumigatus*, (g) *R. hildebrandtii*, (h) *R. landeri*, (i) *R. simulator*, and (j) *R. swinnyi*.
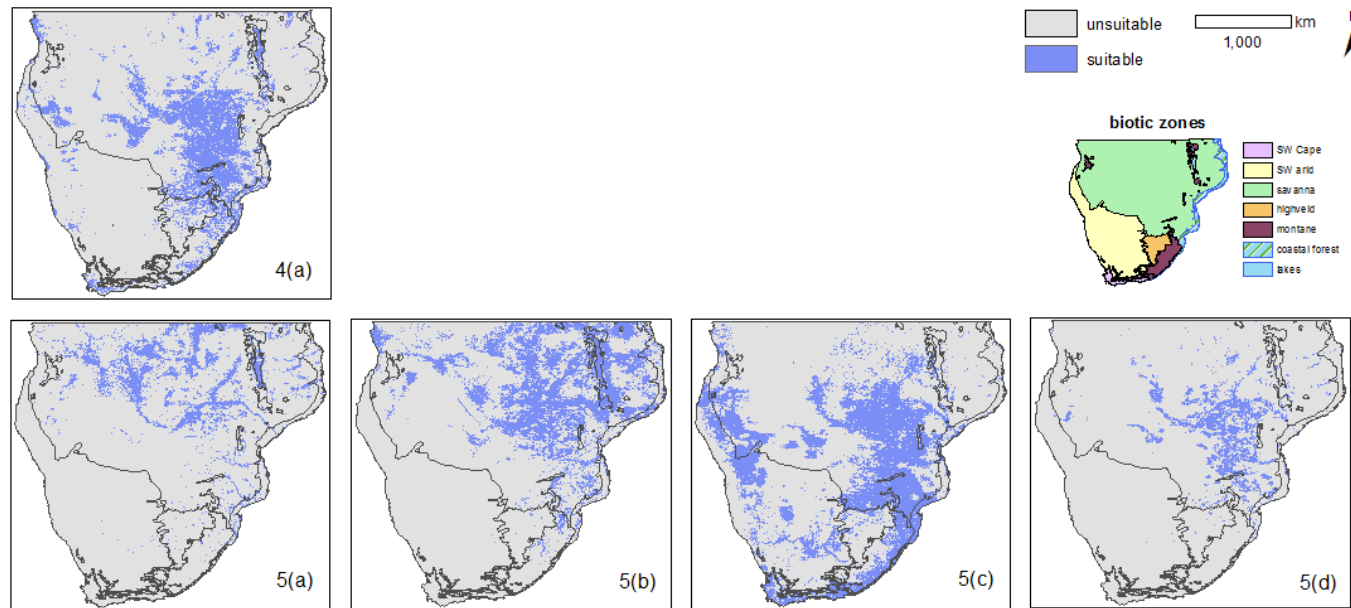
Figure S5: Species distribution maps. EMBALLONURIDAE - 4(a) *Taphozous mauritianus*. NYCTERIDAE - 5(a) *Nycteris hispida*, (b) *N. macrotis*, (c) *N. thebaica*, and (d) *N. woodi*.

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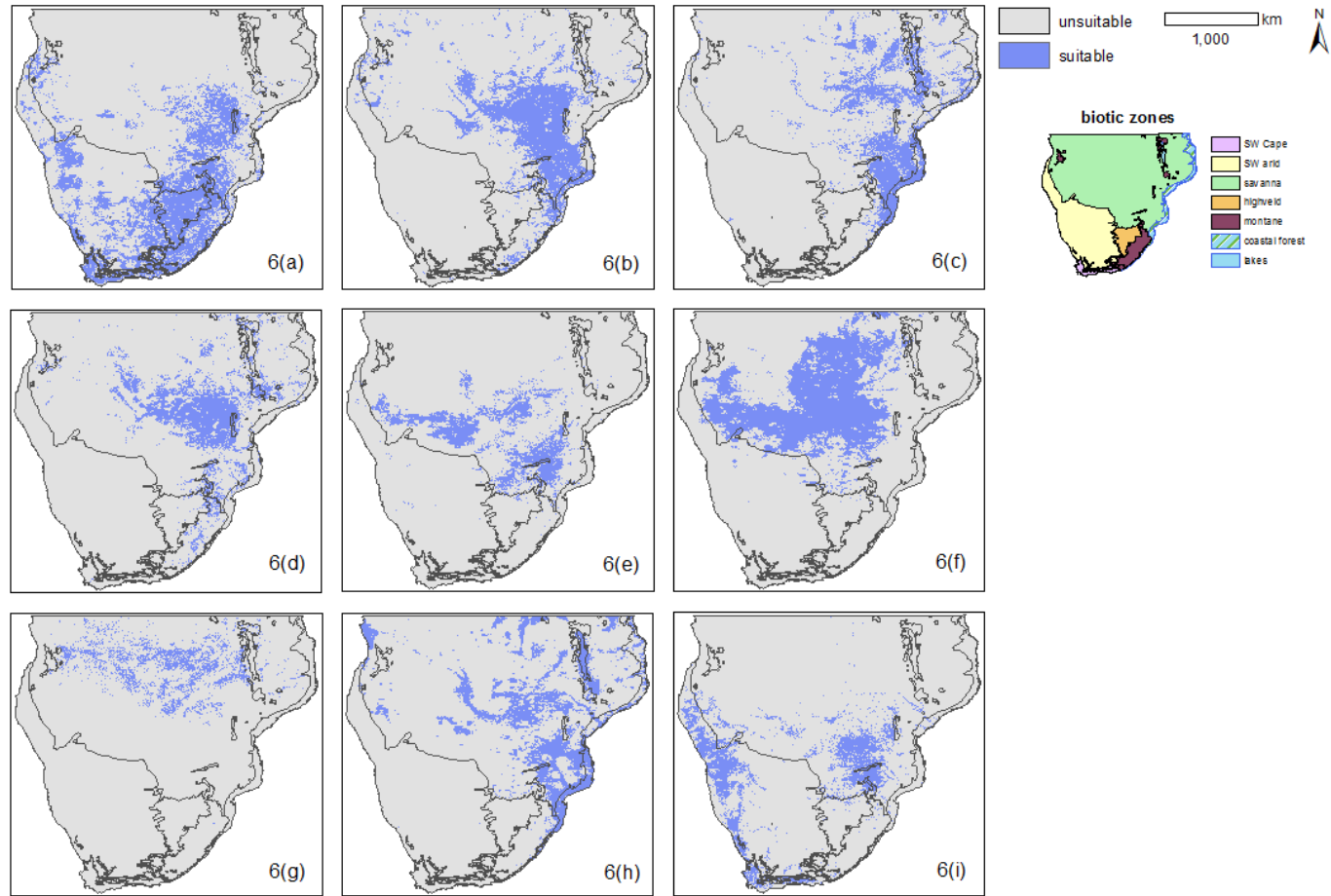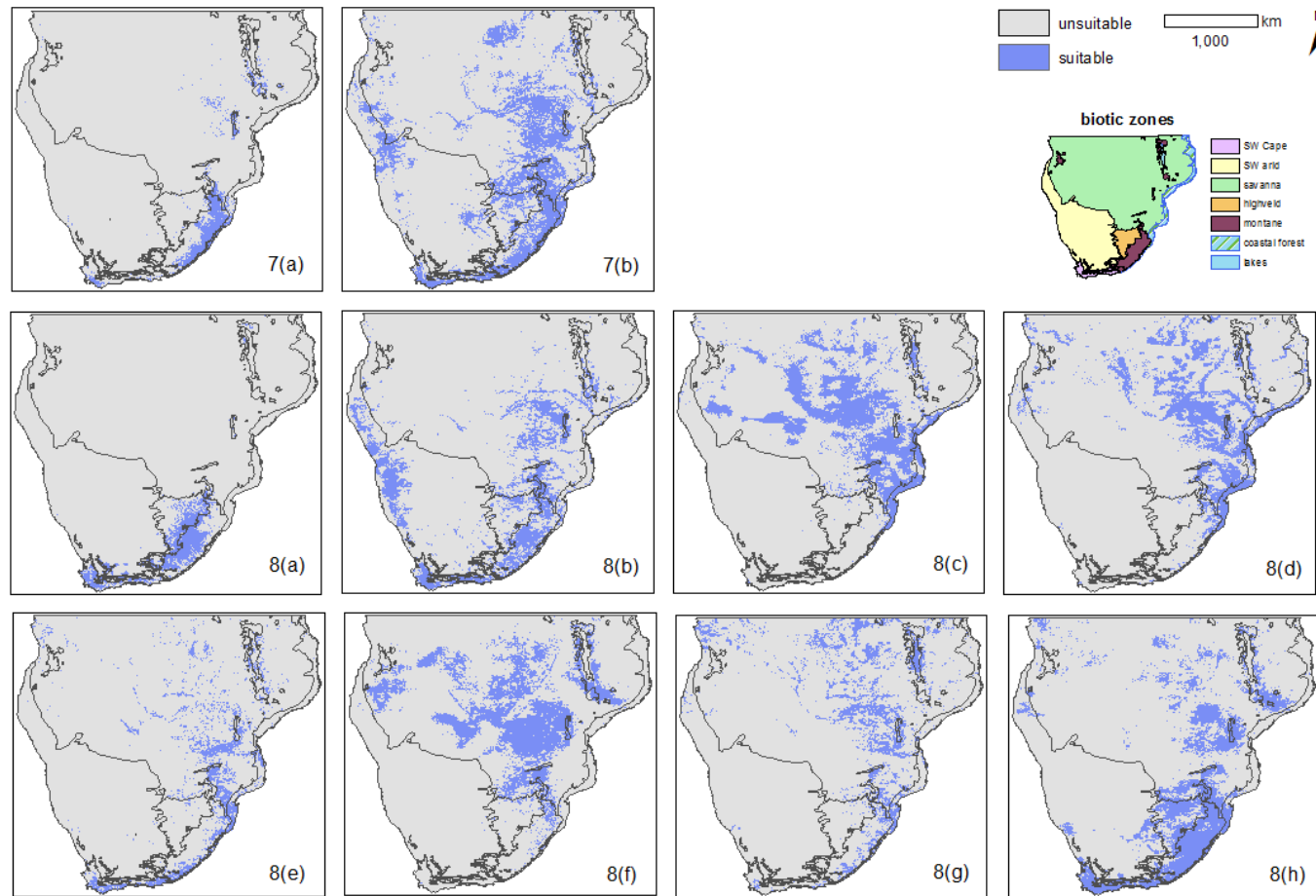

Figure S6: Species distribution maps. MOLOSSIDAE - 6(a) *Tadarida aegyptiaca*, (b) *C. ansorgei*, (c) *Mops condylurus*, (d) *T. fulminans*, (e) *M. midas*, (f) *M. nigeriae*, (g) *M. niveiventer*, (h) *C. pumilus*, and (i) *Sauromys petrophilus*.

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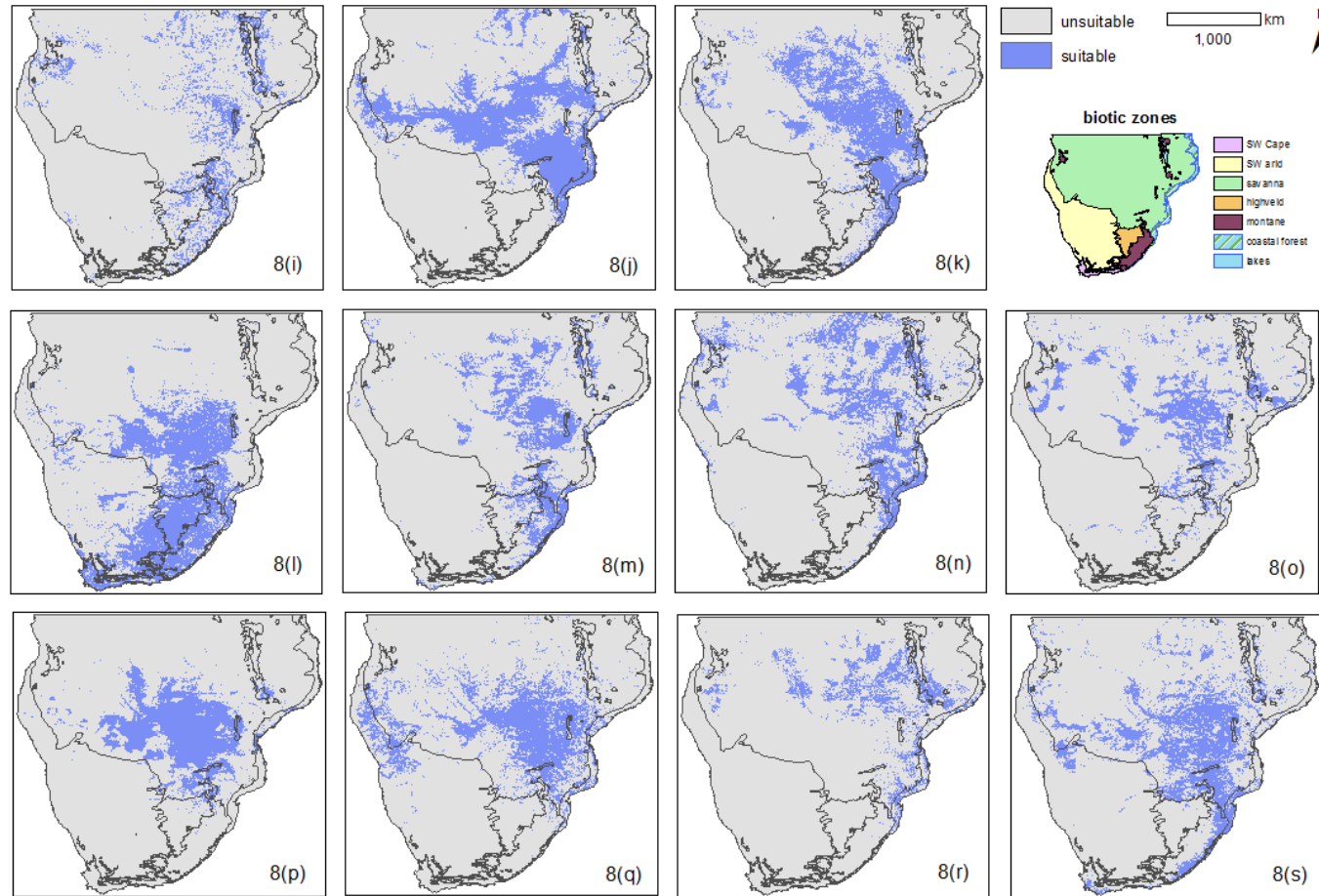
Figure S7: Species distribution maps. MINIOPTERIDAE - 7(a) *Miniopterus fraterculus* and (b) *M. natalensis*. VESPERTILIONIDAE - 8(a), *Cistugo lesueuri*, (b), *Eptesicus hottentotus*, (c) *Glauconycteris variegatus*, (d) *Kerivoula argentata*, (e) *K. lanosa*, (f) *Laephotis botswanae*, (g) *Myotis bocagii* and (h) *M. tricolor*.

Figure S8: Species distribution maps. VESPERTILIONIDAE (cont.) - 8(i) *Myotis welwitschii*, (j) *Nycticeinops schlieffeni*, (k) *Hypsugo anchietae*, (l) *Neoromicia capensis*, (m) *Pipistrellus hesperidus*, (n) *N. nana*, (o) *P. rueppelli*, (p) *P. rusticus*, (q) *N. zuluensis*, (r) *Scotoecus hirundo* and (s) *Scotophilus dinganii*.
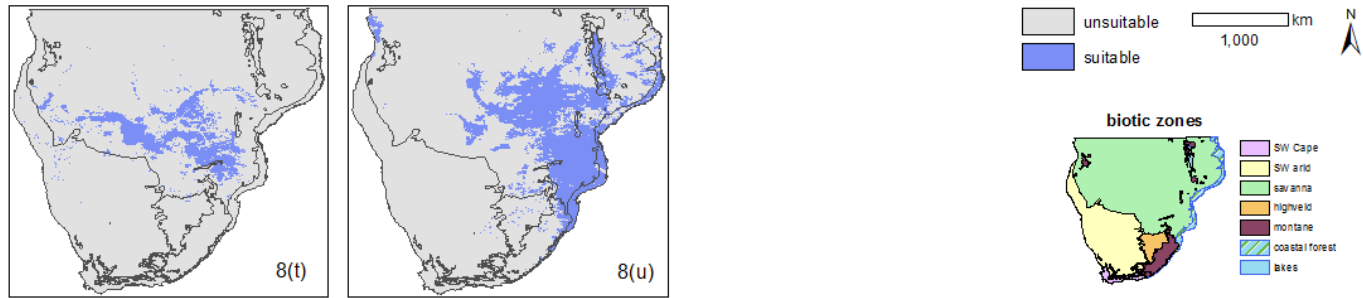
Figure S9: Species distribution maps. VESPERTILIONIDAE (cont.) - 8(t) *Scotophilus leucogaster* and (u) *S. viridis*.