

Supplementary Online Material

Climate change and extinction risk of two globally threatened Ethiopian endemic bird species

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Table S1: Six Global Circulation Models (GCMs) used for the projection of bioclimate variables under future climate scenarios.

<u>Global Circulation Model (GCM)</u>	<u>Developers</u>	<u>Reference</u>
BCC-CSM1-1	Beijing Climate Center, Beijing, China	(Wu et al. 2013)
CCSM4	National Center for Atmospheric Research, Boulder, Colorado, USA	(Meehl et al. 2012)
HadGEM2-ES	Hadley Centre for Climate Science and Services, Exeter, UK	(Collins et al. 2008)
IPSL-CM5A-LR	Institut Pierre Simon Laplace, France	(Dufresne et al. 2013)
MIROC-ESM	Center for Climate System Research, Tokyo, Japan	(Hasumi and Emori 2004)
MRI-CGCM3	Meteorological Research Institute, Japan	(Yukimoto et al. 2012)

Table S2: Current and projected future values of five bioclimate variables within a convex hull fitted around the current distributions of the White-tailed Swallow and the Ethiopian Bush-crow. Current values are the minimum, mean and maximum values across all cells within the species' range. Projected values are the minimum, mean and maximum values of the mean across all cells within the species' current range under six different Global Circulation Models (Table S1) at each of two years (2050 and 2070) and under each of four Representative Concentration Pathway (RCP) scenarios (IPCC 2014). Bioclimate variables are abbreviated as follows: Precip wet = precipitation of the wettest quarter; Precip dry = precipitation of the driest quarter; Temp season = Temperature seasonality; Max temp = Maximum temperature of the warmest month; Temp range = Annual temperature range (Hijmans et al. 2005). The current range used for the swallow includes two hulls fitted around the core range and the Liben Plain independently, but does not include the area in between.

			White-tailed Swallow			Ethiopian Bush-crow		
Year	RCP	Bioclimate Variable	Min.	Mean	Max.	Min.	Mean	Max.
Current	-	Precip wet (mm)	196.0	305.1	433.7	241.9	307.8	385.3
Current	-	Precip dry (mm)	15.0	27.6	92.4	19.0	28.5	92.4
Current	-	Temp season	853.8	1308.4	1712.4	954.2	1269.2	1563.6
Current	-	Max temp (°C)	24.2	30.0	36.4	25.6	29.1	32.3
Current	-	Temp range (°C)	15.2	18.0	22.9	15.9	17.7	20.5
2050	2.6	Precip wet (mm)	282.3	427.2	823.1	283.1	430.4	833.4
2050	2.6	Precip dry (mm)	26.5	32.1	43.8	27.2	33.2	45.7
2050	2.6	Temp season	974.9	1272.4	1594.2	940.8	1230.7	1546.6
2050	2.6	Max temp (°C)	30.1	30.8	31.3	29.1	29.9	30.4
2050	2.6	Temp range (°C)	16.5	17.3	18.0	16.3	17.0	17.7

2070	2.6	Precip wet (mm)	319.3	429.6	661.0	322.1	434.5	672.1
2070	2.6	Precip dry (mm)	23.8	28.8	35.0	24.4	29.7	36.4
2070	2.6	Temp season	936.8	1291.1	1544.9	903.4	1251.3	1503.2
2070	2.6	Max temp (°C)	30.0	30.9	31.4	29.0	29.9	30.5
2070	2.6	Temp range (°C)	16.5	17.4	18.1	16.2	17.1	17.8
2050	4.5	Precip wet (mm)	257.1	434.6	960.5	258.3	440.3	973.8
2050	4.5	Precip dry (mm)	16.2	27.0	41.9	16.9	28.1	43.8
2050	4.5	Temp season	1133.9	1333.4	1578.9	1093.5	1290.3	1530.8
2050	4.5	Max temp (°C)	30.9	31.5	32.1	29.9	30.5	31.1
2050	4.5	Temp range (°C)	15.7	17.3	17.9	15.3	17.0	17.6
2070	4.5	Precip wet (mm)	306.9	504.3	1058.3	312.2	513.1	1075.8
2070	4.5	Precip dry (mm)	15.0	26.6	40.7	15.7	27.7	42.8
2070	4.5	Temp season	1065.5	1358.8	1580.6	1024.9	1315.4	1532.7
2070	4.5	Max temp (°C)	31.6	31.9	32.6	30.6	30.9	31.6
2070	4.5	Temp range (°C)	15.6	17.3	18.1	15.2	17.0	17.8
2050	6.0	Precip wet (mm)	294.9	404.3	621.1	297.4	408.2	626.5
2050	6.0	Precip dry (mm)	17.7	28.2	44.5	18.9	29.2	46.3
2050	6.0	Temp season	1208.9	1362.6	1507.4	1168.3	1319.1	1462.8
2050	6.0	Max temp (°C)	31.2	31.7	32.1	30.2	30.7	31.1
2050	6.0	Temp range (°C)	16.9	17.7	18.1	16.5	17.4	17.8
2070	6.0	Precip wet (mm)	321.0	457.8	925.3	322.1	463.0	933.4
2070	6.0	Precip dry (mm)	15.9	27.7	48.8	16.7	28.7	51.7
2070	6.0	Temp season	1165.2	1324.5	1556.0	1113.5	1280.5	1509.3

2070	6.0	Max temp (°C)	30.8	31.9	32.7	29.8	30.9	31.8
2070	6.0	Temp range (°C)	15.7	17.3	18.0	15.3	17.0	17.8
2050	8.5	Precip wet (mm)	301.0	521.4	1165.5	300.3	531.0	1184.8
2050	8.5	Precip dry (mm)	14.4	29.9	51.8	15.1	31.1	54.8
2050	8.5	Temp season	1069.1	1364.1	1689.7	1025.8	1318.1	1637.9
2050	8.5	Max temp (°C)	31.3	31.9	32.7	30.3	30.9	31.7
2050	8.5	Temp range (°C)	15.6	17.2	18.1	15.2	16.9	17.8
2070	8.5	Precip wet (mm)	300.5	566.8	1537.6	301.0	576.1	1555.7
2070	8.5	Precip dry (mm)	19.0	32.7	62.3	20.1	33.7	65.2
2070	8.5	Temp season	1023.9	1395.6	1739.4	985.8	1350.3	1688.0
2070	8.5	Max temp (°C)	32.0	32.9	34.1	31.0	31.9	33.1
2070	8.5	Temp range (°C)	15.6	17.2	18.1	15.1	16.9	17.9

Table S3: Delta AUC scores for models of White-tailed Swallow distribution, fitted without each climate variable in turn, under the three best-performing model algorithms (MaxEnt, GLM, GAM), and compared to values for the best-performing model (a Boosted Regression Tree, BRT) for the Ethiopian Bush-crow, taken from Bladon et al. (2019).

	White-tailed Swallow			Ethiopian Bush-crow
Variable removed	MAXENT	GLM	GAM	BRT
Precipitation of the wettest quarter	0.011	-0.014	0.038	0.001
Precipitation of the driest quarter	0.146	0.047	0.089	0.018
Temperature seasonality	0.046	-0.015	-0.014	0.012
Maximum temperature	0.121	0.040	0.028	0.022
Annual temperature range	0.047	0.012	-0.044	0.000

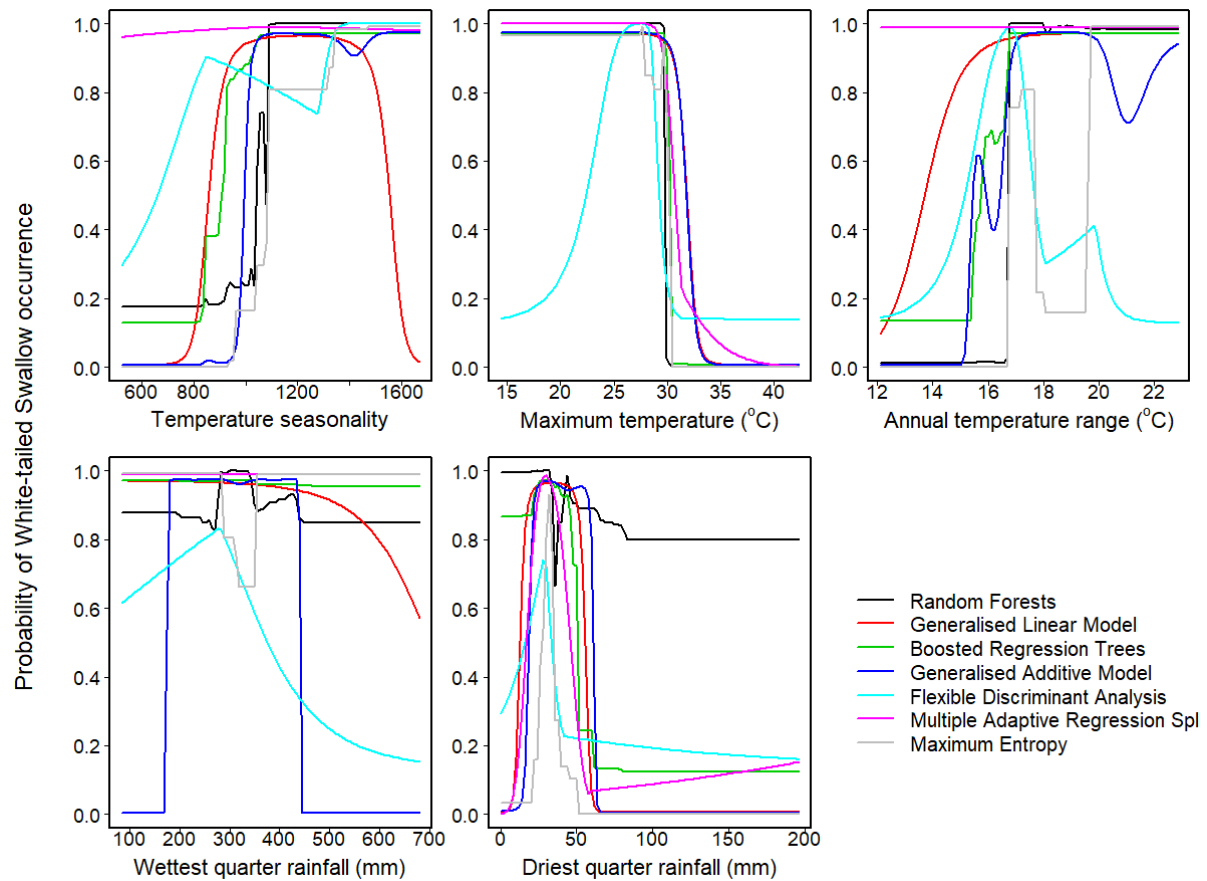


Figure S1: The response of partial probability of White-tailed Swallow occurrence to five bioclimatic variables. Lines show the predicted responses to each variable according to each of seven model algorithms fitted using the ‘biomod2’ package (Thuiller et al. 2012) in R (R Core Team 2019), with all other variables held constant.

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