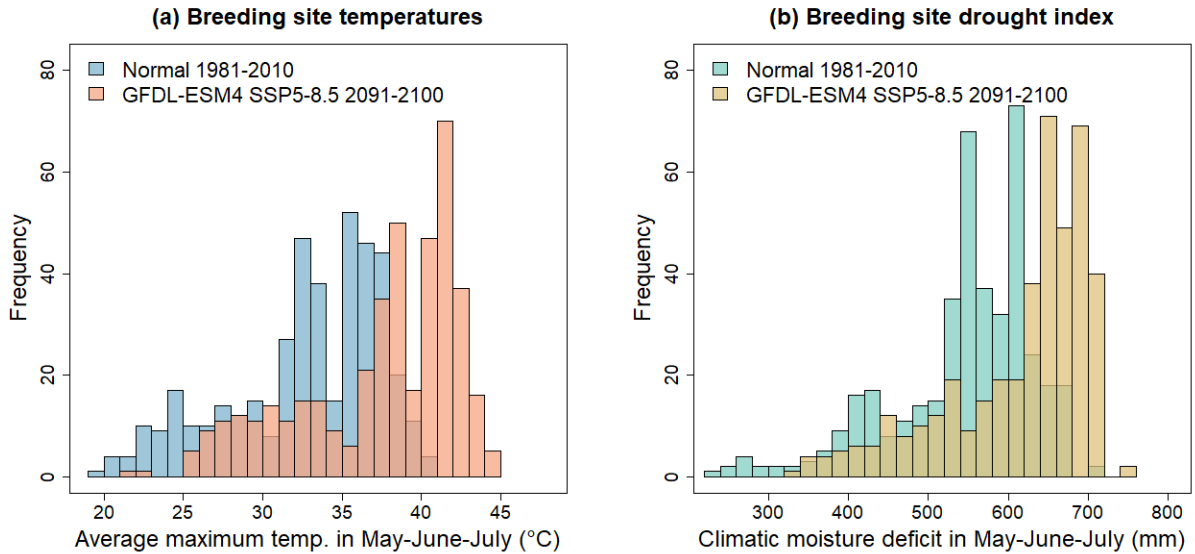
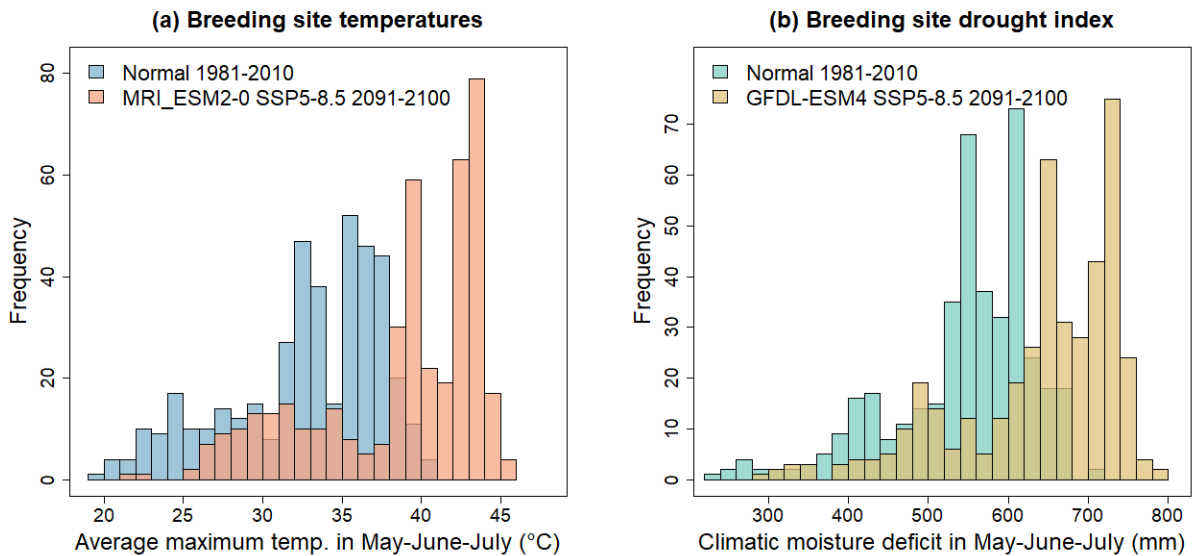


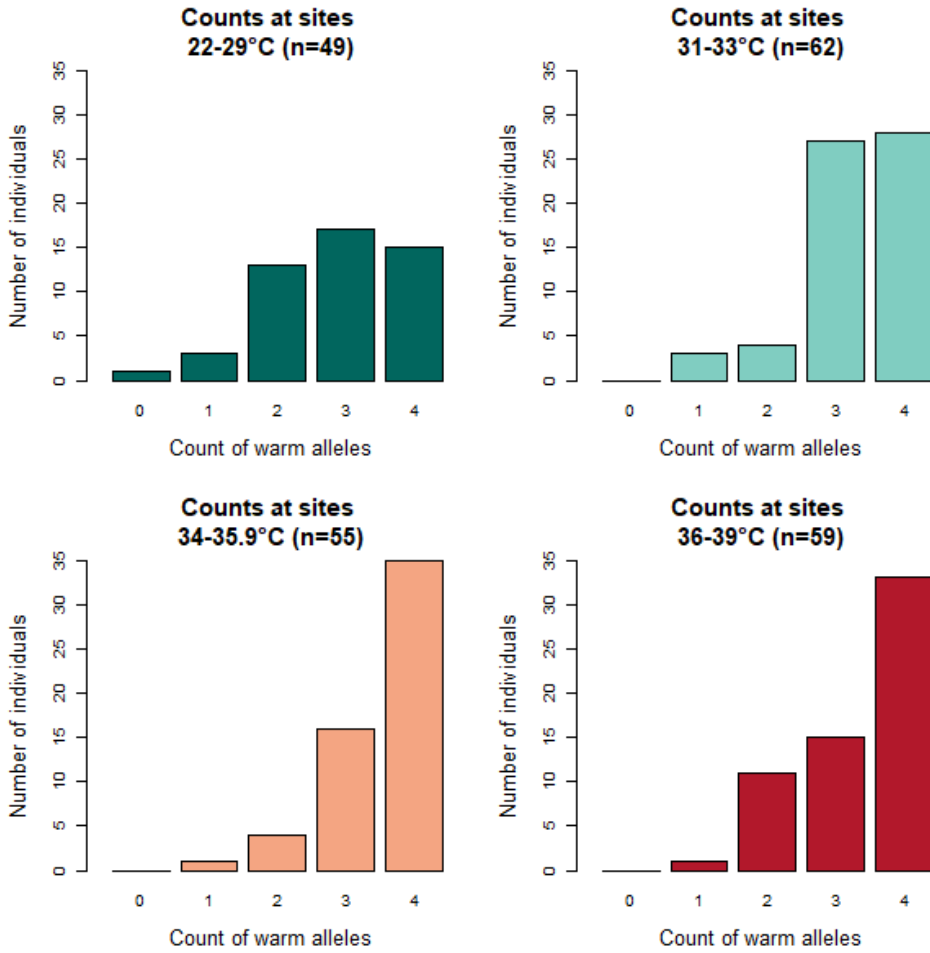
**Supplemental Information: Evolutionary potential mitigates extinction risk in the endangered southwestern willow flycatcher**



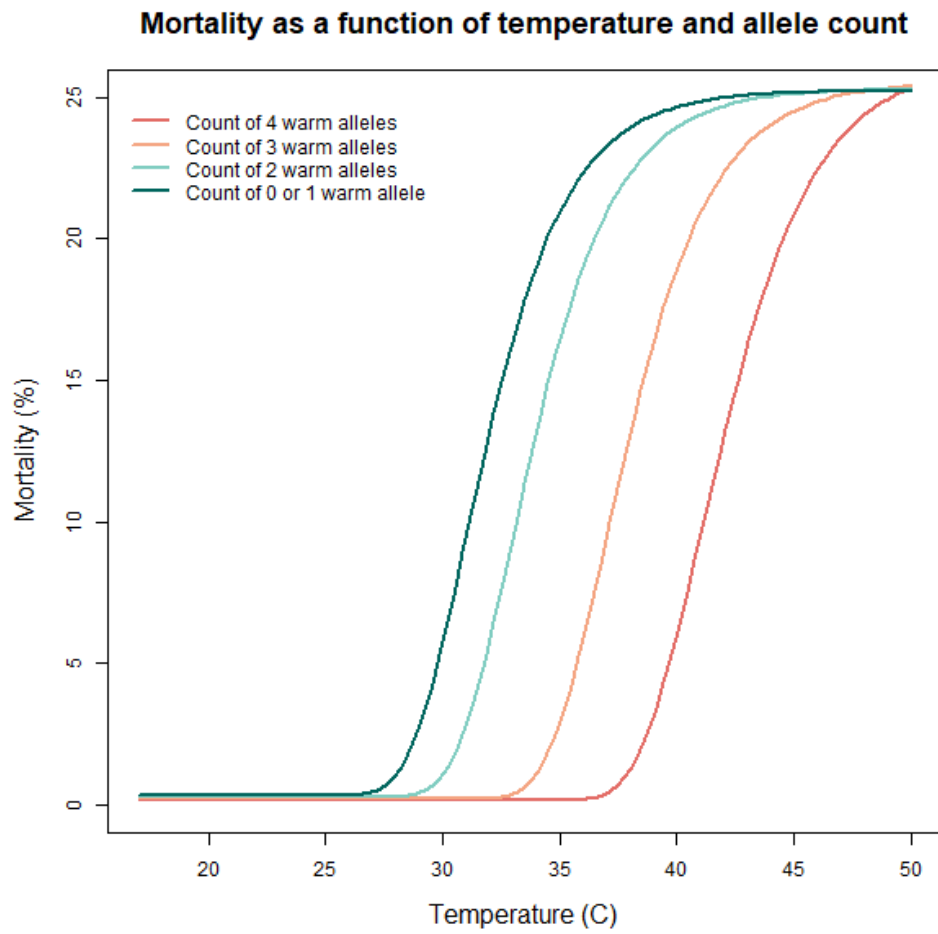
**Figure S1.** Frequency of (a) average maximum temperatures and (b) climatic moisture deficit during the southwestern willow flycatcher breeding season (May, June, July) at 418 breeding sites for the 1981-2010 period (blue) and 2091-2100 period, projected using the GFDL-ESM4 GCM under climate scenario SSP5-8.5.



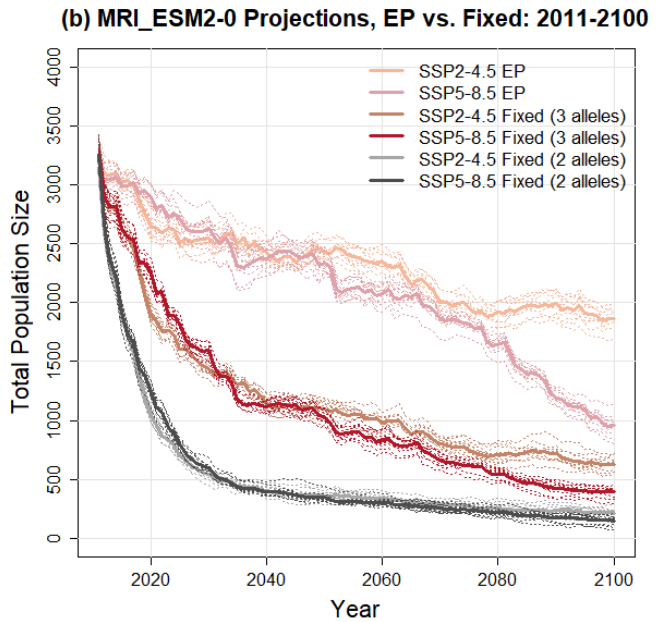
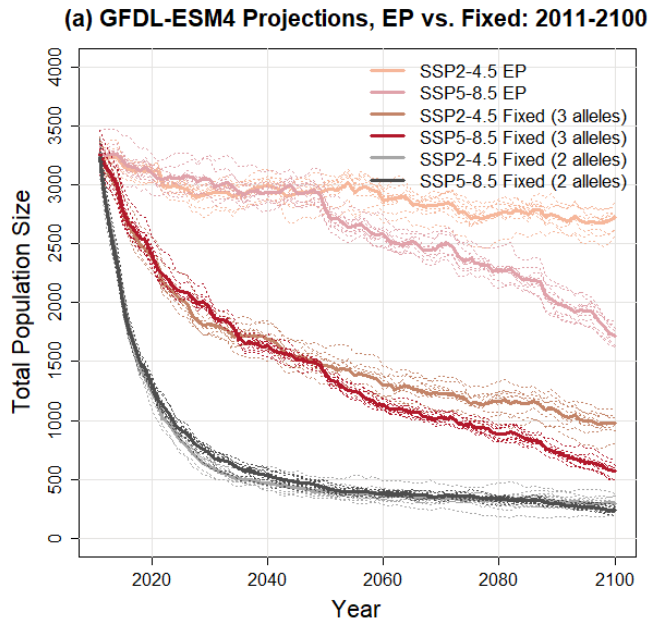
**Figure S2.** Frequency of (a) average maximum temperatures and (b) climatic moisture deficit during the southwestern willow flycatcher breeding season (May, June, July) at 418 breeding sites for the 1981-2010 period (blue) and 2091-2100 period, projected using the MRI\_ESM2-0 GCM under climate scenario SSP5-8.5.



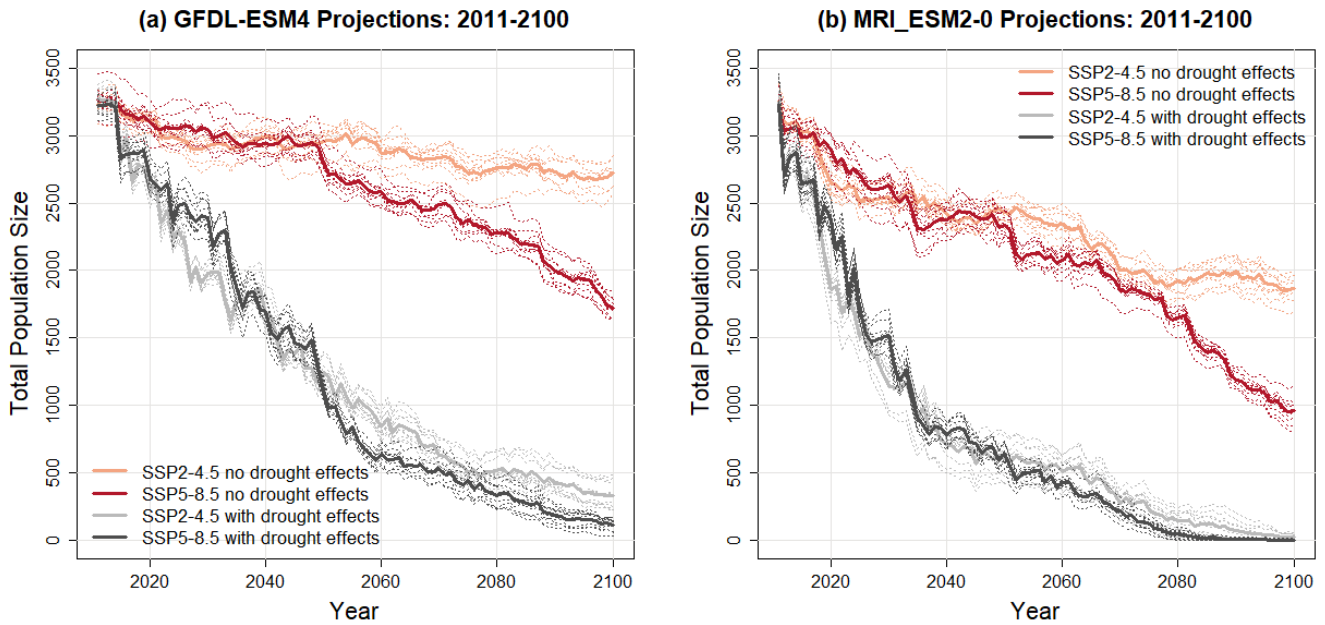
**Figure S3.** Histograms of warm-associated allele counts across site temperatures for two SNPs from 15 southwestern willow flycatcher sites and 225 individuals.



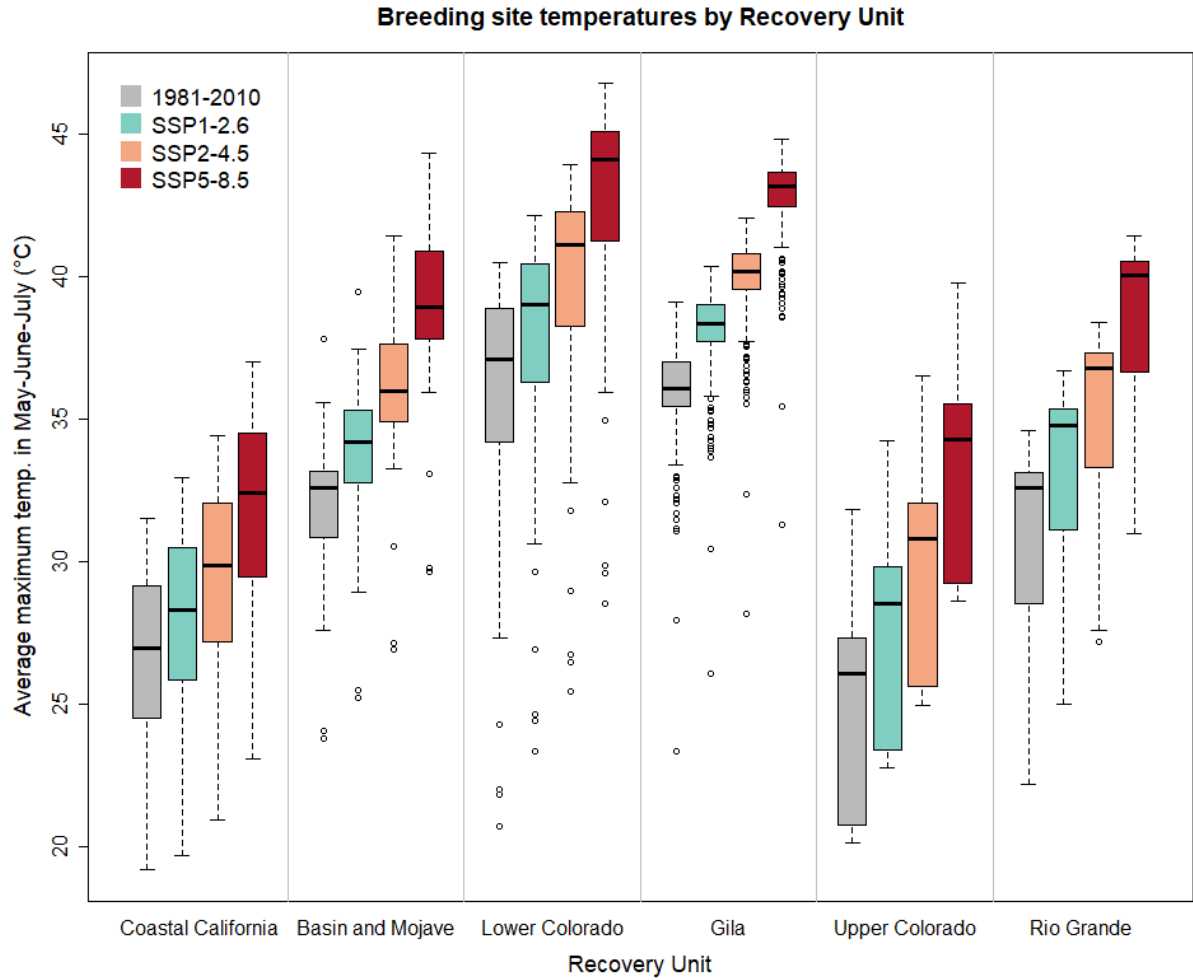
**Figure S4.** Mortality curves for warm-associated allele counts. Fitness impacts range from no mortality penalty to a 25% penalty as a function of genotype and temperature.



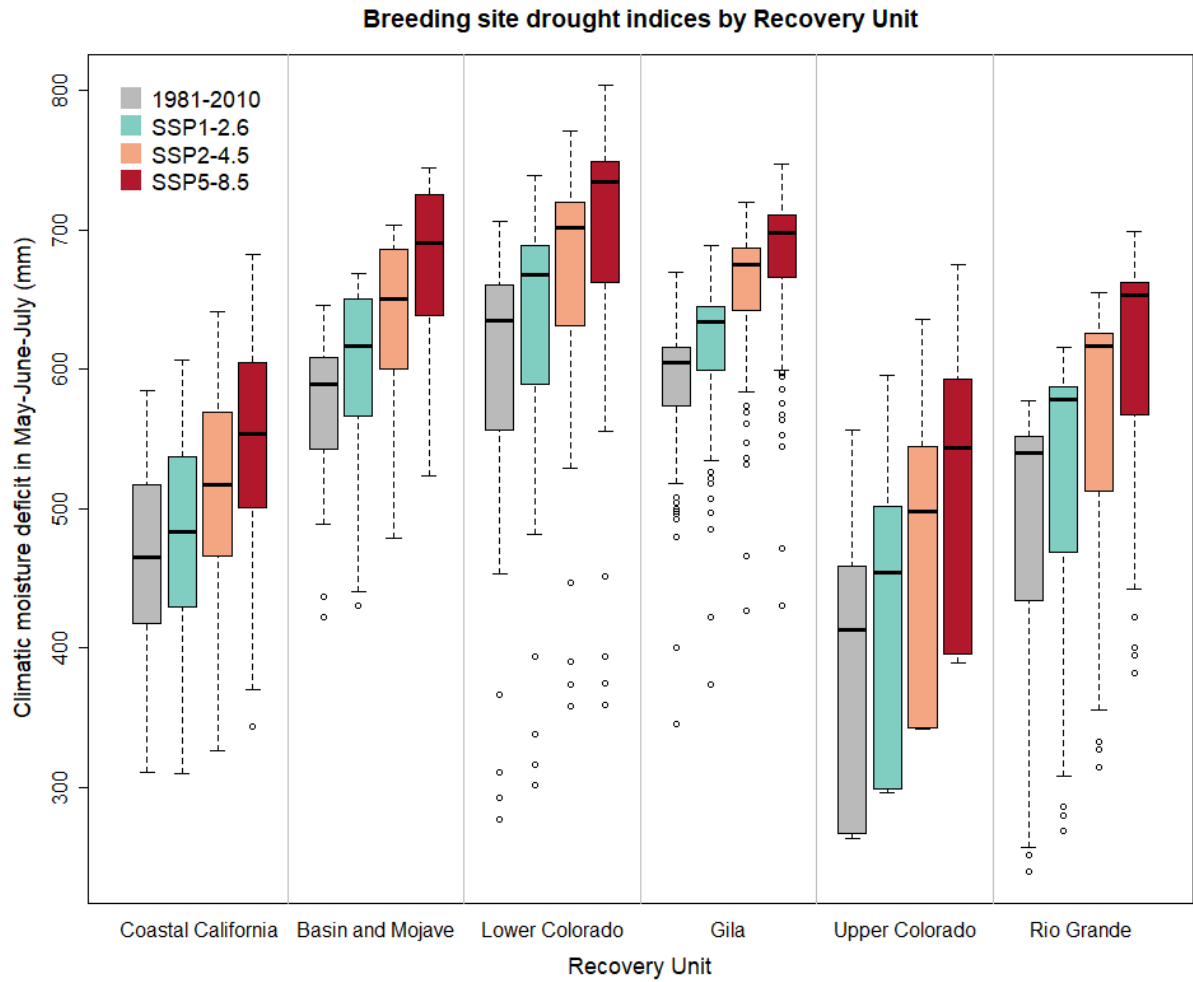
**Figure S5.** Population trajectories for southwestern willow flycatchers under variable selection due to climate change under the SSP2-4.5 and SSP5-8.5 scenarios for the (a) GFDL-ESM4 GCM and (b) MRI\_ESM2-0 GCM. Each scenario compares responses where populations can adapt to warming conditions (“EP” or evolutionary potential runs), and two cases where populations cannot adapt and are fixed for either three or two warm-associated alleles. Solid lines are the mean of 10 MC replicates (dotted lines).



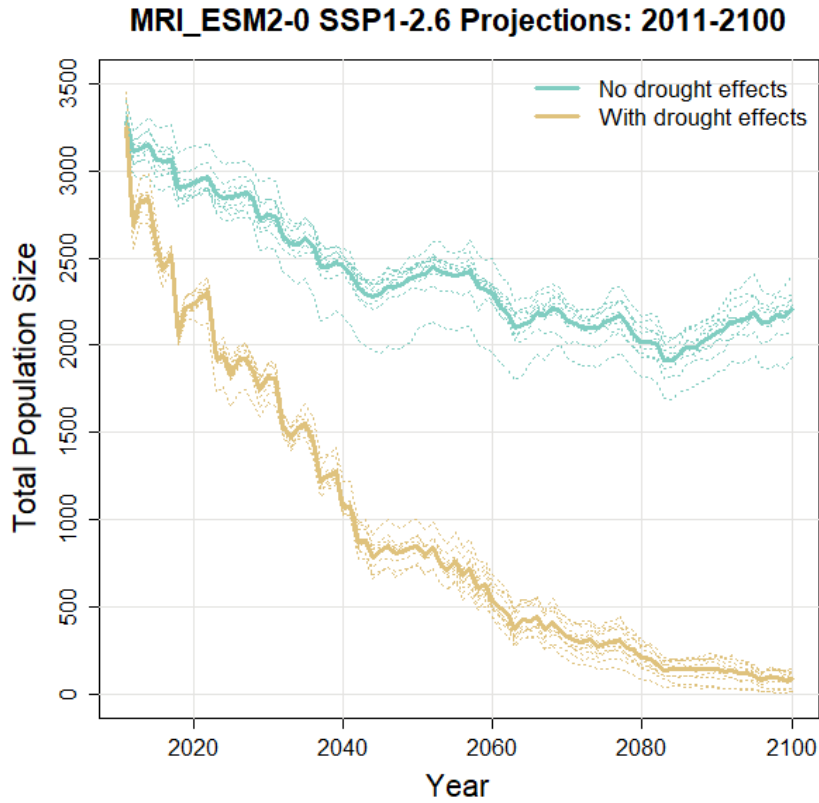
**Figure S6.** Population trajectories for southwestern willow flycatchers under variable selection due to climate change with and without drought effects on egg mortality under SSP2-4.5 and SSP5-8.5 for the (a) GFDL-ESM4 GCM and (b) MRI\_ESM2-0 GCM. Solid lines are the mean of 10 MC replicates (dotted lines).



**Figure S7.** Average maximum temperatures during the breeding season by recovery unit and either climate normal or climate change scenario for the EC-Earth3 GCM.



**Figure S8.** Average climatic moisture deficit during the breeding season by recovery unit and either climate normal or climate change scenario for the EC-Earth3 GCM.



**Figure S9.** Population trajectories for southwestern willow flycatchers under variable selection due to climate change with and without drought effects on egg mortality under SSP1-2.6 for the MRI\_ESM2-0 GCM. Solid lines are the mean of 10 MC replicates (dotted lines).



**Table S1.** Demographic parameters for simulations.

<b>Age class</b>	<b>Mean mortality</b>	<b>Mean survivorship</b>	<b>Mean seasonal fecundity</b>	<b>Per capita fecundity</b>	<b>Post-breeding per capita fecundity</b>
0	0.66	0.34	0.00	0.00	0.34
1	0.42	0.58	0.70	0.58	1.04
2	0.35	0.65	1.30	1.17	1.17
3	0.33	0.67	1.00	1.21	1.14
4	0.21	0.79	0.90	1.34	1.42
5	0.11	0.89	0.80	1.60	0.00

**Table S2.** Age class structure (mean and for each MC replicate) from the demography only simulation in comparison with empirical data from Paxton *et al.* (2007).

	<b>MC0</b>	<b>MC1</b>	<b>MC2</b>	<b>MC3</b>	<b>MC4</b>	<b>MC5</b>	<b>MC6</b>	<b>MC7</b>	<b>MC8</b>	<b>MC9</b>	<b>Mean</b>	<b>Paxton <i>et al.</i> 2007</b>
<b>Second year</b>	0.45	0.45	0.45	0.45	0.45	0.45	0.46	0.45	0.45	0.44	0.45	0.52
<b>Third year</b>	0.24	0.24	0.24	0.24	0.24	0.25	0.24	0.25	0.25	0.25	0.24	0.25
<b>Fourth year</b>	0.15	0.14	0.13	0.15	0.16	0.14	0.15	0.15	0.15	0.15	0.15	0.09
<b>Fifth year</b>	0.09	0.09	0.10	0.10	0.09	0.09	0.08	0.09	0.09	0.10	0.09	0.07
<b>Sixth year</b>	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.07	0.07	0.04

**Table S3.** Natal and adult dispersal rates (mean and for each MC replicate) from the demography only simulation in comparison with empirical data from Paxton *et al.* (2007)

<b>Natal Dispersal</b>	<b>MC0</b>	<b>MC1</b>	<b>MC2</b>	<b>MC3</b>	<b>MC4</b>	<b>MC5</b>	<b>MC6</b>	<b>MC7</b>	<b>MC8</b>	<b>MC9</b>	<b>Mean</b>	<b>Paxton <i>et al.</i> 2007</b>
Site fidelity	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Within drainage	0.95	0.94	0.96	0.95	0.95	0.96	0.95	0.95	0.95	0.95	0.95	0.93
Between drainage	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.02	0.03	0.06

<b>Adult Dispersal</b>	<b>MC0</b>	<b>MC1</b>	<b>MC2</b>	<b>MC3</b>	<b>MC4</b>	<b>MC5</b>	<b>MC6</b>	<b>MC7</b>	<b>MC8</b>	<b>MC9</b>	<b>Mean</b>	<b>Paxton <i>et al.</i> 2007</b>
Site fidelity	0.32	0.32	0.34	0.33	0.34	0.33	0.34	0.33	0.33	0.31	0.33	0.33
Within drainage	0.67	0.66	0.65	0.66	0.65	0.66	0.65	0.64	0.66	0.67	0.66	0.64
Between drainage	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.02	0.03

**Table S4.** Maximum, mean, and minimum population sizes across MC replicates of all simulation scenarios, including percent decline in mean population size at 2100 compared to the starting population size of 3,258.

<b>Simulation runs</b>	<b>GCM</b>	<b>Climate change scenario</b>	<b>Mean population size at 2100</b>	<b>% decline from start (N=3,258)</b>	<b>Minimum population size at 2100</b>	<b>Maximum population size at 2100</b>
Demography	None	None	4033.7	-24%	3855	4215
Constant selection	None	None	3576.9	-10%	3413	3678
Climate change	GFDL-EDM4	SSP2-4.5	2720.6	16%	2565	2856
Climate change	EC-Earth3	SSP2-4.5	2149.1	34%	1906	2305
Climate change	MRI-ESM2-0	SSP2-4.5	1868.6	43%	1685	1983
Climate change	GFDL-EDM4	SSP5-8.5	1717.1	47%	1615	1839
Climate change	EC-Earth3	SSP5-8.5	1083.8	67%	992	1164
Climate change	MRI-ESM2-0	SSP5-8.5	958.6	71%	799	1145
No EP - Fixed 3 alleles	GFDL-EDM4	SSP2-4.5	978.5	70%	801	1089
No EP - Fixed 3 alleles	EC-Earth3	SSP2-4.5	637.9	80%	569	689
No EP - Fixed 3 alleles	MRI-ESM2-0	SSP2-4.5	629.5	81%	541	716
No EP - Fixed 3 alleles	GFDL-EDM4	SSP5-8.5	571.4	82%	491	664
No EP - Fixed 3 alleles	EC-Earth3	SSP5-8.5	394.6	88%	337	475
No EP - Fixed 3 alleles	MRI-ESM2-0	SSP5-8.5	391.2	88%	292	454
No EP - Fixed 2 alleles	GFDL-EDM4	SSP2-4.5	296.7	91%	188	373
No EP - Fixed 2 alleles	EC-Earth3	SSP2-4.5	235.7	93%	158	309
No EP - Fixed 2 alleles	MRI-ESM2-0	SSP2-4.5	212.6	93%	145	281
No EP - Fixed 2 alleles	GFDL-EDM4	SSP5-8.5	237.3	93%	196	274
No EP - Fixed 2 alleles	EC-Earth3	SSP5-8.5	123.1	96%	63	169
No EP - Fixed 2 alleles	MRI-ESM2-0	SSP5-8.5	149.6	95%	71	209
Climate change + Drought	GFDL-EDM4	SSP2-4.5	331	90%	220	491
Climate change + Drought	EC-Earth3	SSP2-4.5	290	91%	195	365
Climate change + Drought	MRI-ESM2-0	SSP2-4.5	20.3	99%	0	51

<b>Simulation runs</b>	<b>GCM</b>	<b>Climate change scenario</b>	<b>Mean population size at 2100</b>	<b>% decline from start (N=3,258)</b>	<b>Minimum population size at 2100</b>	<b>Maximum population size at 2100</b>
Climate change + Drought	GFDL-EDM4	SSP5-8.5	114.5	96%	29	166
Climate change + Drought	EC-Earth3	SSP5-8.5	4.5	100%	0	16
Climate change + Drought	MRI-ESM2-0	SSP5-8.5	1.1	100%	0	11
Rapid climate change mitigation	GFDL-EDM4	SSP1-2.6	3066.9	6%	2972	3194
Rapid climate change mitigation	EC-Earth3	SSP1-2.6	2839.5	13%	2610	3021
Rapid climate change mitigation	MRI-ESM2-0	SSP1-2.6	2203.9	32%	1927	2400
Rapid climate change mitigation + Drought	GFDL-EDM4	SSP1-2.6	732.4	78%	596	889
Rapid climate change mitigation + Drought	EC-Earth3	SSP1-2.6	2027.6	38%	1833	2248
Rapid climate change mitigation + Drought	MRI-ESM2-0	SSP1-2.6	83.3	97%	14	141