Supplemental Material

Supplement to:
A.N. Stillman, R.B. Siegel, R.L. Wilkerson, M. Johnson, C.A. Howell, and M.W. Tingley. (2019) Nest site selection and nest survival of Black-backed Woodpeckers after wildfire. *The Condor: Ornithological Applications*.

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Table S1. Additional information on six wildfires where we monitored Black-backed Woodpecker nests between 2011 and 2018. Burn severity is shown as the percent change in canopy cover from pre-fire to immediately after fire, binned into four severity categories (0–24%, 25–49%, 50–74%, 75–100% change in canopy cover). Pre-fire habitat type is presented as the dominate California Wildlife Habitat Relationships (CWHR) classification within the fire area. Definitions of each habitat classification are provided at https://www.wildlife.ca.gov/Data/CWHR/Wildlife-Habitats.

Fire name	National forest name	Ignition date	Fire size (ha)	Burn severity proportion by class		Dominant pre-fire habitat type (CWHR)
Peterson	Lassen	6/21 2018	3307	0–24%:	0.52	Eastside Pine (EPN)
				25–49%:	0.12	
				50–74%:	0.10	
				75–100%:	0.27	
Sugarloaf	Lassen	8/1 2009	3864	0–24%:	0.24	Ponderosa Pine (PPN)
				25–49%:	0.12	
				50–74%:	0.11	
				75–100%:	0.54	
Wheeler	Plumas	7/5 2007	9484	0–24%:	0.23	Sierra Mixed Conifer (SMC)
				25–49%:	0.09	
				50–74%:	0.10	
				75–100%:	0.58	
Moonlight	Plumas	9/3 2007	26509	0–24%:	0.27	Sierra Mixed Conifer
				25–49%:	0.08	
				50–74%:	0.08	
				75–100%:	0.56	
Chips	Plumas/Lassen	7/28 2012	31114	0–24%:	0.63	Sierra Mixed Conifer, White Fir (WFR)
				25–49%:	0.08	
				50–74%:	0.06	
				75–100%:	0.23	
Bald	Lassen/Shasta	7/30 2014	16258	0–24%:	0.21	Eastside Pine
				25–49%:	0.12	
				50–74%:	0.12	
				75–100%:	0.55	

Table S2. Summary of field sampling effort for Black-backed Woodpecker nests in six post-fire areas of northern California, showing the number of nests monitored and the total number of observation intervals (i.e. the period between consecutive nest visits) recorded for each fire-year combination.

Fire name	Year	Time since fire (years)	Nests	Observation intervals
Peterson	2011	3	5	40
Sugarloaf	2011	2	6	33
Wheeler	2012	5	12	73
	2013	6	9	159
Moonlight	2014	7	13	134
	2015	8	15	148
	2016	9	9	93
	2017	10	13	55
Chips	2017	5	10	35
	2018	6	10	67
Bald	2017	3	8	61
	2018	4	8	58
Total:	**2011–2018**	**2–10**	**118**	**956**

Table S3. We created a set of 14 candidate models based on hypotheses about Black-backed Woodpecker nest survival relationships in post-fire forests. We grouped model covariates into three categories (habitat characteristics, nest tree characteristics, and abiotic/temporal variables) and evaluated every combination of these three groups. We also tested specific hypotheses regarding different mechanisms of nest survival risk, including predation, temperature/weather extremes, and nest abandonment due to low foraging success or cavity eviction. Models are shown in order of increasing LOOIC to facilitate comparisons to Table 2 in the main text. WAIC (Widely Applicable Information Criterion) model selection results are shown for the 14 candidate models, with ΔWAIC given as the difference between each candidate model and the model with the lowest WAIC. WAIC values were calculated using pointwise log-likelihood values from 4500 posterior draws.

Model covariates	**Hypothesis and rationale**	**WAIC**	**ΔWAIC**
Initiation date + Nest day	Temporal factors alone influence nest survival.	283.23	0
Initiation date + Nest day + Temp anomaly	Abiotic/temporal factors influence nest survival.	286.12	2.89
Intercept only	Nest survival is random with regards to the habitat characteristics, nest characteristics, and abiotic/temporal characteristics that we measured (null model).	285.50	2.27
Initiation date + Snag count + Burn severity + Distance to edge + Time since fire	Habitat characteristics, as well as initiation date, influence nest survival.	291.15	7.92
Initiation date + Tree DBH + Cavity height + Orientation	Nest characteristics, as well as initiation date, influence nest survival.	294.64	11.41
Burn severity + Time since fire	Burn severity and time since fire, which are potential indicators of foraging habitat quality, influence nest survival.	292.15	8.92
Tree DBH + Cavity height + Orientation	Nest characteristics influence nest survival.	292.41	9.18
Cavity height + Distance to edge	Cavity height and distance to patch edge, which reflect potential predation risk, influence nest survival.	296.00	12.77
Initiation date + Nest day + Temp anomaly + Snag count + Burn severity + Distance to edge + Time since fire	Abiotic/temporal factors and habitat characteristics, but not nest characteristics, influence nest survival.	300.68	17.45

Initiation date + Nest day + Temp anomaly + Tree DBH + Cavity height + Orientation	Abiotic/temporal factors and nest characteristics, but not habitat characteristics, influence nest survival.	304.74	21.51
Cavity height + Distance to edge + Time since fire + Nest day	Predation risk increases with time since fire and decreases with distance to edge and increasing cavity height. Older nests, which have more vocal nestlings, will have a higher predation risk.	300.11	16.88
Snag count + Burn severity + Distance to edge + Time since fire	Habitat characteristics influence nest survival.	302.27	19.04
Snag count + Burn severity + Distance to edge + Time since fire + Tree DBH + Cavity height + Orientation	Habitat characteristics and nest characteristics, but not abiotic/temporal variables, influence nest survival.	301.19	17.96
Initiation date + Nest day + Temp anomaly + Snag count + Burn severity + Distance to edge + Time since fire + Tree DBH + Cavity height + Orientation	All habitat characteristics, nest characteristics, and abiotic/temporal characteristics that we measured influence nest survival (global model).	311.53	28.3

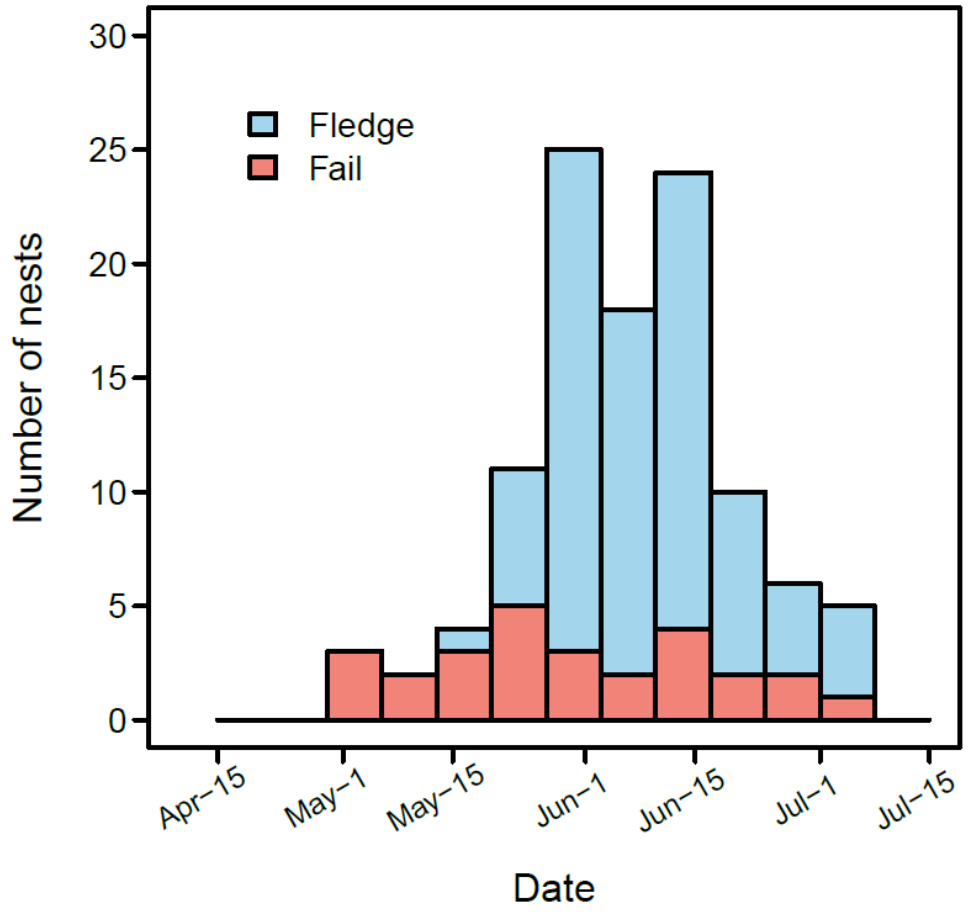

Figure S1. Fledging dates (at least one young permanently left the nest) and nest failure dates (nest confirmed depredated or abandoned) for Black-backed Woodpecker nests in northern California. Out of 118 nests, 81 fledged successfully, 27 failed, and 10 had an undetermined fate.

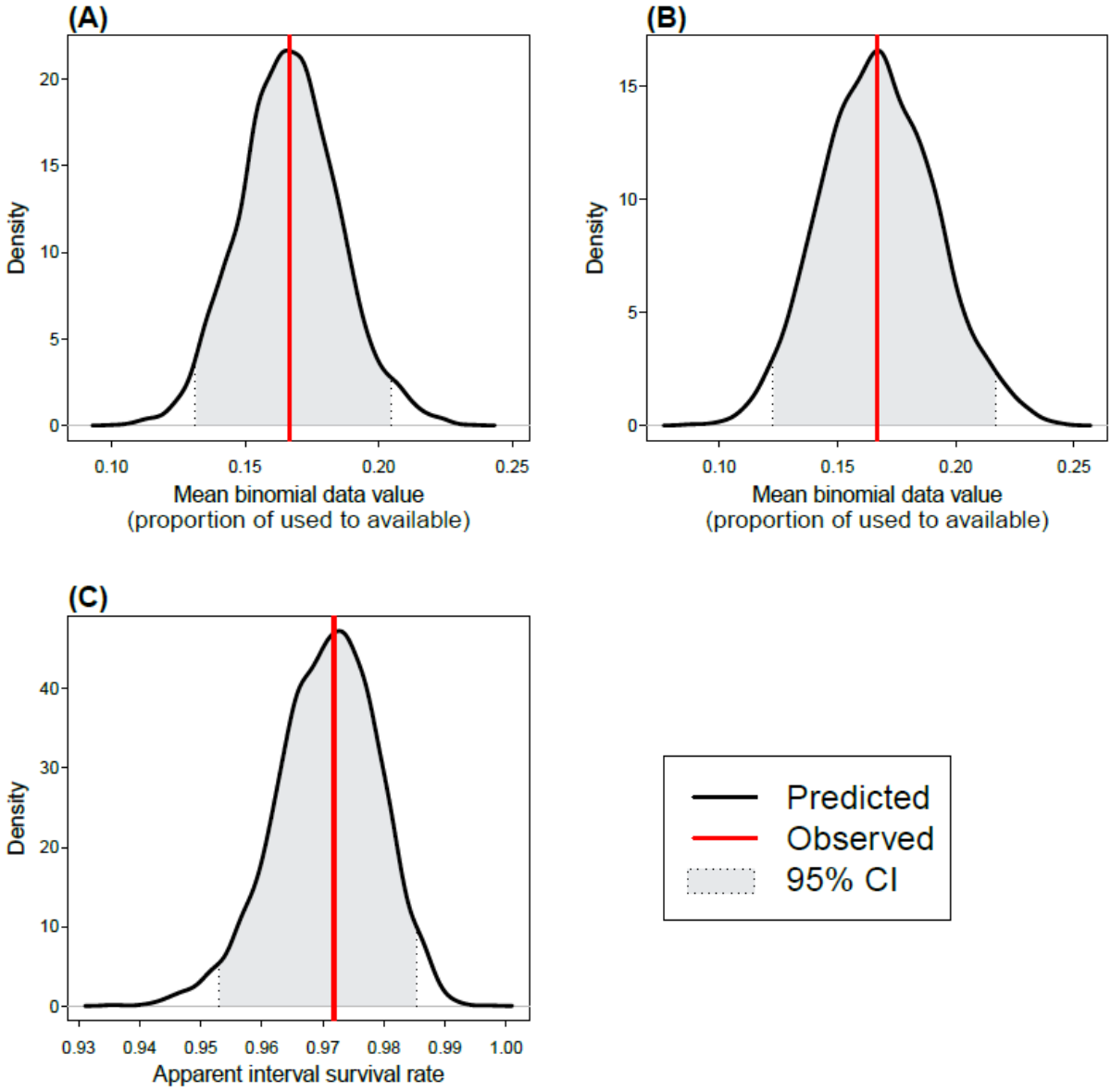

Figure S2. Posterior predictive checks indicated no evidence for lack of model fit for (A) the model of woodpecker nest stand selection, (B) the model of nest tree selection, and (C) the model of daily nest survival probability. A test statistic was created for each model based on the mean value of the observed response variable, which represents the ratio of used to available points in (A) and (B), and the apparent interval survival rate in (C). Red lines depict the observed value of the test statistic and solid black lines give the distribution of model-derived estimates with shaded 95% confidence intervals.