Supplemental Materials: Supplement 1

Example of calculating a weighted average for a buffer-level covariate

In this example we use percent forb cover at the 400m scale to illustrate how we calculated the average percent understory cover of forbs covariate. To calculate our weighted average (ω), we weighted each stand-specific covariate measurement (M_i where *i* indexes the stand) by the percentage of RCW habitat within the buffer that was made up by that stand (H_i).

$$\omega = H_1 * M_1 + H_2 * M_2 + H_3 * M_3 + \ldots + H_n * M_n$$

For example, if forb cover was 50% in a stand that made up 60% of total RCW habitat within the 400m buffer, and forb cover was 80% in a stand that made up 40% of the total RCW habitat in the 400m buffer, the weighted average was calculated as:

$$\omega_{forb} = 0.5 * 0.6 + 0.8 * 0.4$$

$$\omega_{forb} = 0.62$$

Tables & Figures

Table S1: Requirements for Good Quality Foraging Habitat for red-cockaded woodpeckers (*Dryobates borealis;* RCW) according to the Recovery Standards in the RCW Recovery Plan (USFWS 2003); BA = basal area, DBH = diameter at breast height.

Stratum	Requirement
Overstory	BA of all pines ≥ 25.4 cm, DBH ≥ 2.1 m^2/ha
	Overstory hardwoods ≤ 10% of overstory trees in longleaf pine stands
	Overstory hardwoods ≤ 30% of overstory trees in loblolly stands
Midstory	Sparse to non-existent hardwood midstory
Understory	Herbaceous understory cover ≥ 40%
Fragmentation	Foraging habitat is not separated by > 61 m of non-foraging areas such as predominantly hardwood forest, pine stands < 30 years in age, cleared land, paved roadways, utility rights of way, and bodies of water

Table S2: Covariates measured within 400 m or 800 m of red-cockaded woodpecker clusters (*Dryobates borealis*; RCW) with an indicator δ with posterior mean ≥ 0.5, which according to stochastic search variable selection indicates that the covariate is important in the model. The δ posterior mean associated with a covariate (row) in a model of red-cockaded woodpecker reproductive output (column) is recorded.

Measured within 400 m of the cluster	Number of eggs lost	If ≥ 1 egg was lost	Proportion of eggs lost	Measured within 800 m of the cluster	Number of eggs lost	If ≥ 1 egg was lost	Proportion of eggs lost
Mean BA of pines with ≥ 25.4 cm DBH		0.74		Mean BA of pines with ≥ 25.4 cm DBH		0.81	
Mean BA of pines with < 25.4 cm DBH but with ≥ 10 cm DBH	0.52	0.71	0.84	Mean BA of pines with < 25.4 cm DBH but with ≥ 10 cm DBH			
Number of active RCW clusters within the buffer	0.60			Number of active RCW clusters within the buffer			
Mean number of days since RCW habitat has been burned				Mean number of days since RCW habitat has been burned		0.54	
Mean number of years since RCW habitat has been burned				Mean number of years since RCW habitat has been burned		0.63	
% RCW habitat last burned during the dormant season	0.66	0.60	0.50	% RCW habitat last burned during the dormant season	0.75	0.62	0.54
% RCW habitat last burned during the growing season	0.67	0.60	0.50	% RCW habitat last burned during the growing season	0.75	0.61	0.53

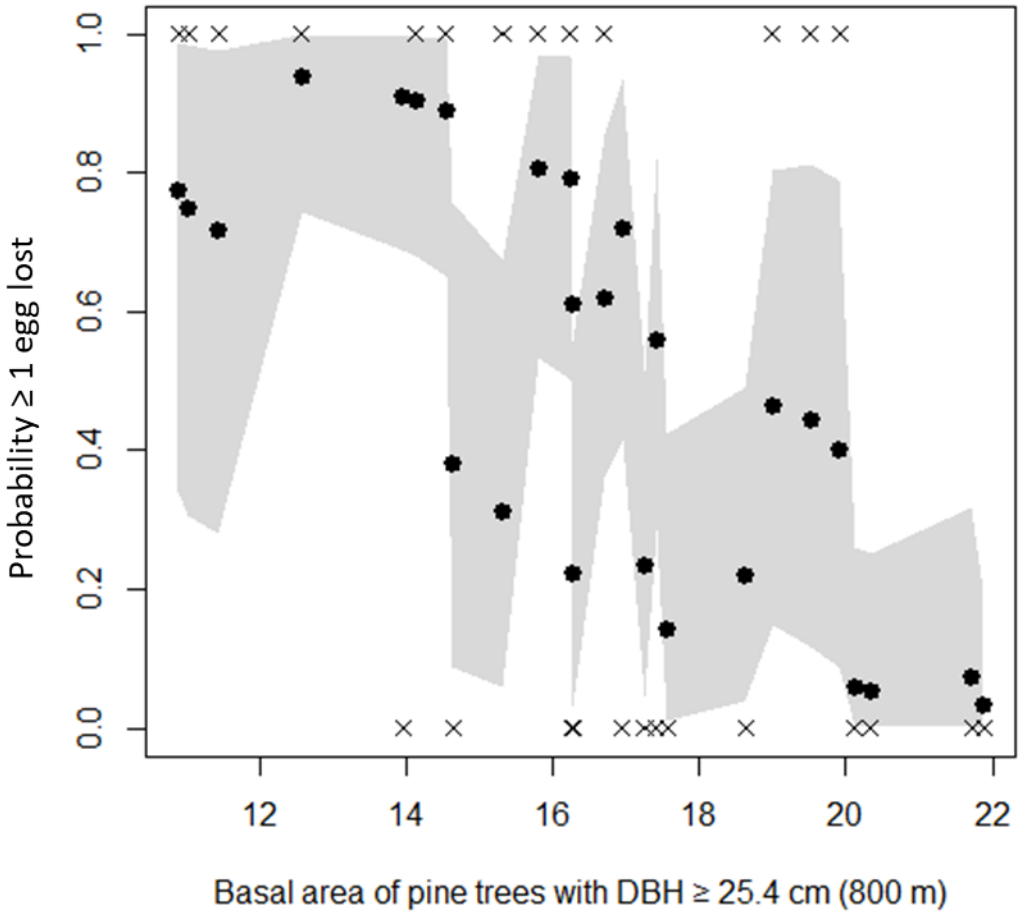

Figure S1: Estimated relationship between the mean basal area of pines with ≥ 25.4 cm diameter at breast height (DBH) within 800m of the red-cockaded woodpecker (*Dryobates borealis*; RCW) cluster and the probability that ≥ 1 egg was lost. Black dots are the posterior mean and grey shading shows the 95% Bayesian credible intervals from the model with the covariates mean basal area of pines with ≥ 25.4 cm DBH within 800m and percent RCW habitat last burned during the growing season within 800m. Black x's indicate observed data, where 0 indicates all eggs produced hatchlings and 1 indicates at least 1 egg was lost.

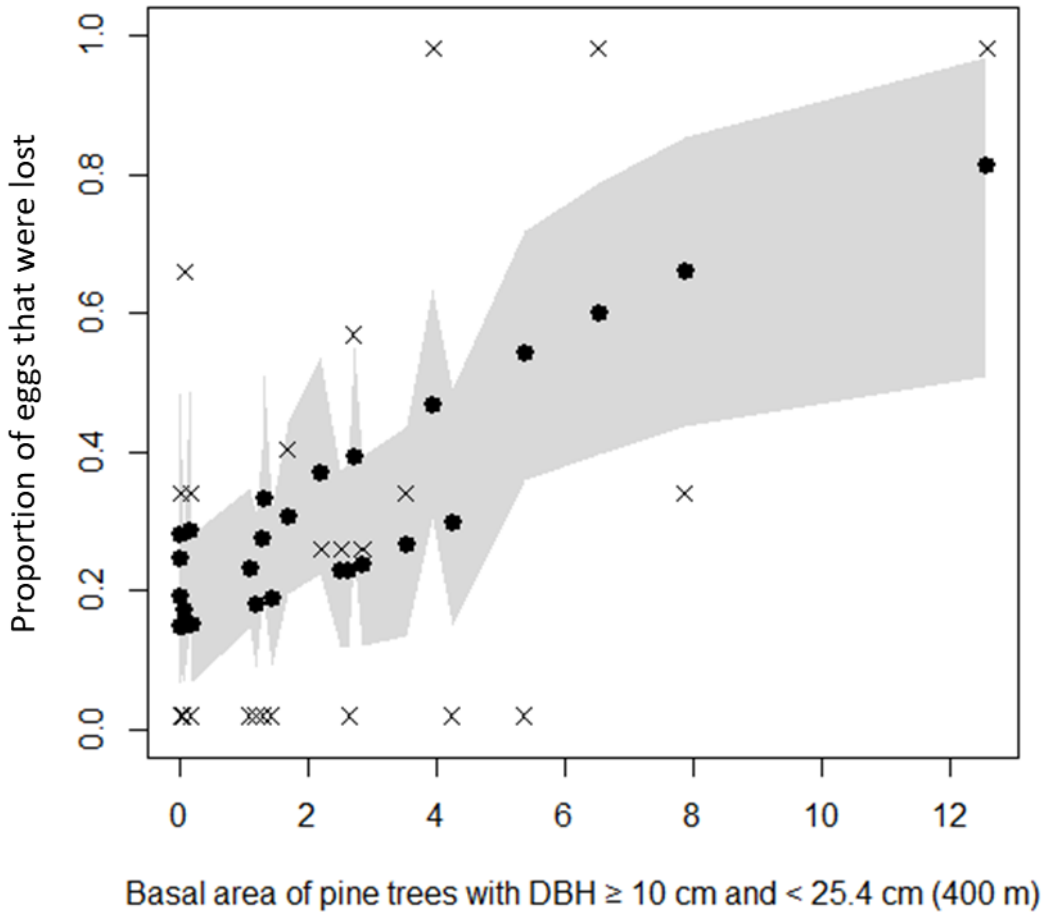

Figure S2: Estimated relationship between basal area of pine trees with diameter at breast height (DBH) ≥ 10 cm and < 25.4 cm within 400 m of a red-cockaded woodpecker (*Dryobates borealis*; RCW) cluster and the proportion of eggs that were lost. Black dots are the posterior mean and grey shading shows the 95% Bayesian credible intervals from the model with the covariates mean BA of pines with < 25.4 cm DBH but with ≥ 10 cm DBH within 400m and percent RCW habitat last burned during the growing season within 800m. Black x's indicate observed data, where 0 indicates all eggs produced hatchlings and 1 indicates all eggs were lost.

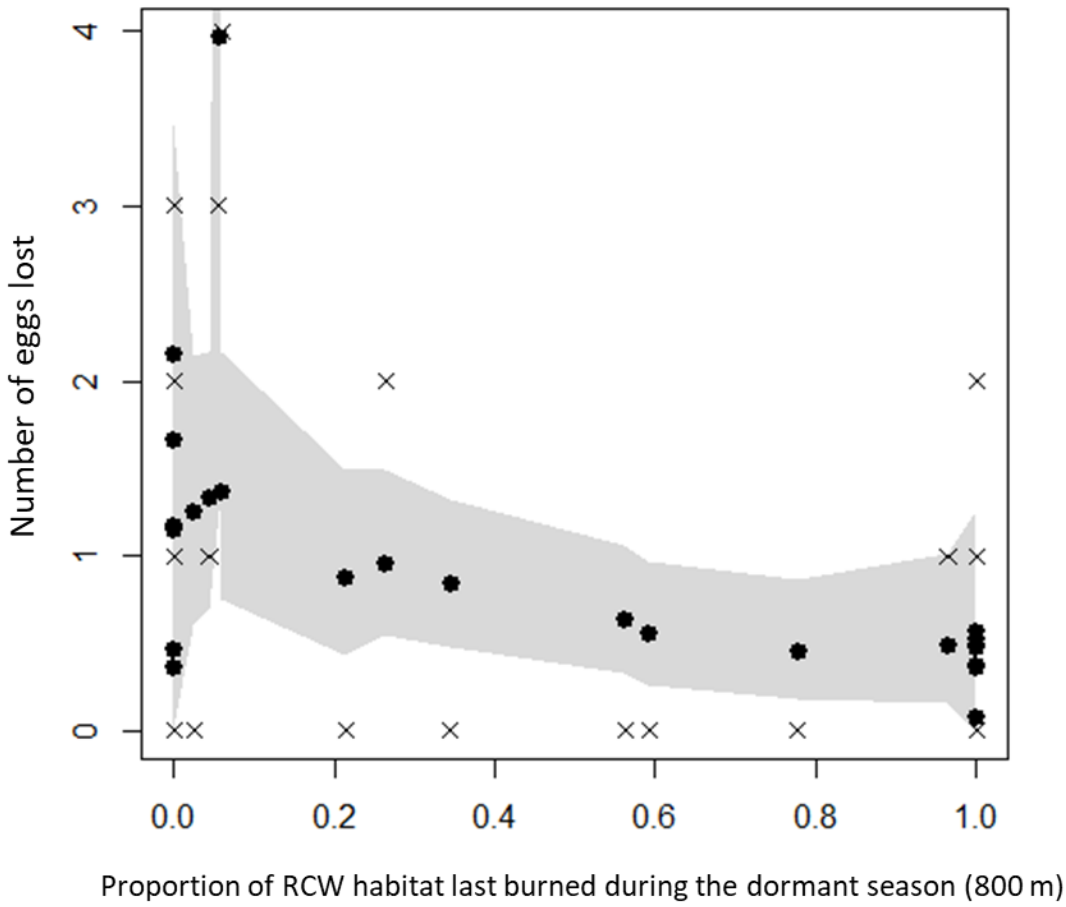

Figure S3: Estimated relationship between percent of red-cockaded woodpecker (*Dryobates borealis*; RCW) habitat last burned during the dormant season within 800m of the RCW cluster and the number of eggs lost. Black dots are the posterior mean and grey shading shows the 95% Bayesian credible intervals from the model with the covariates mean basal area of pines with < 25.4 cm diameter at breast height (DBH) but with ≥ 10 cm DBH within 400m, number of active RCW clusters within 400m, and percent RCW habitat last burned during the dormant season within 800m. Black x's indicate observed data.

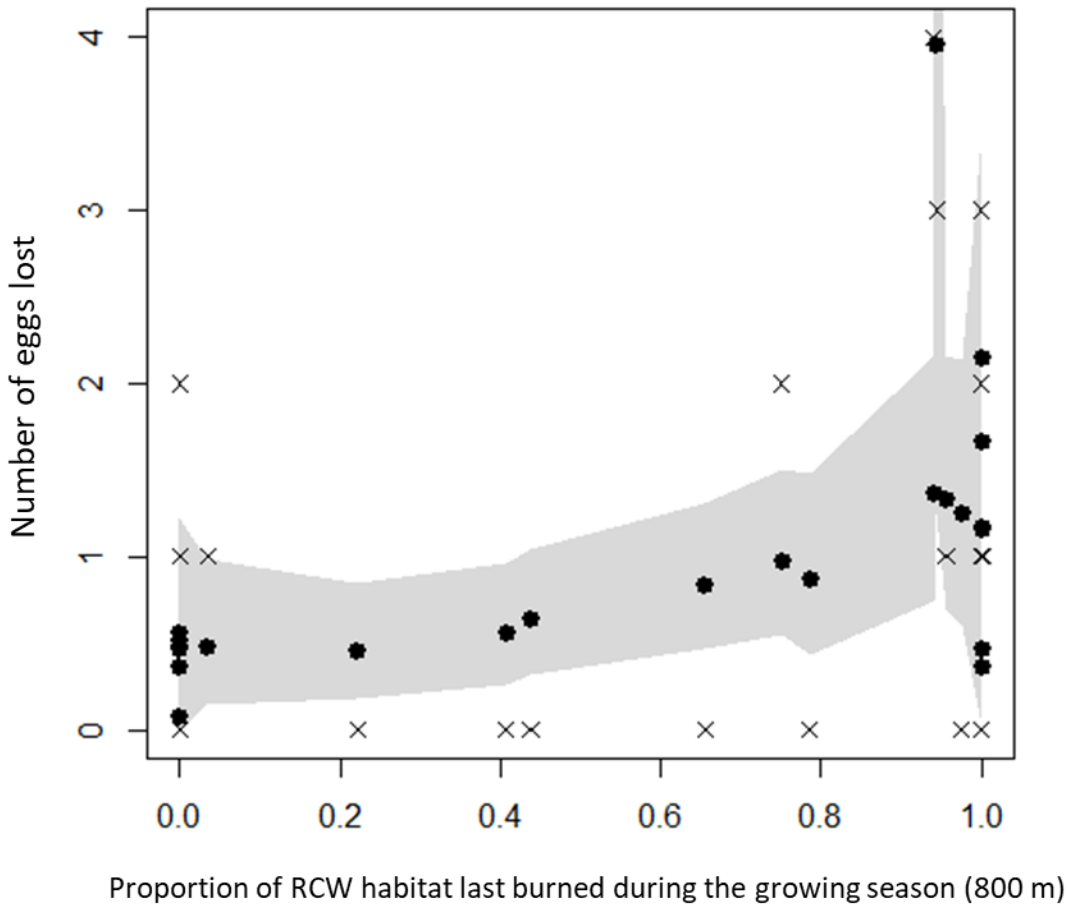

Figure S4: Estimated relationship between percent of red-cockaded woodpecker (*Dryobates borealis*; RCW) habitat last burned during the growing season within 800m of the RCW cluster and the number of eggs lost. Black dots are the posterior mean and grey shading shows the 95% Bayesian credible intervals from the model with the covariates mean basal area of pines with < 25.4 cm diameter at breast height (DBH) but with ≥ 10 cm DBH within 400m, number of active RCW clusters within 400m, and percent RCW habitat last burned during the growing season within 800m. Black x's indicate observed data.

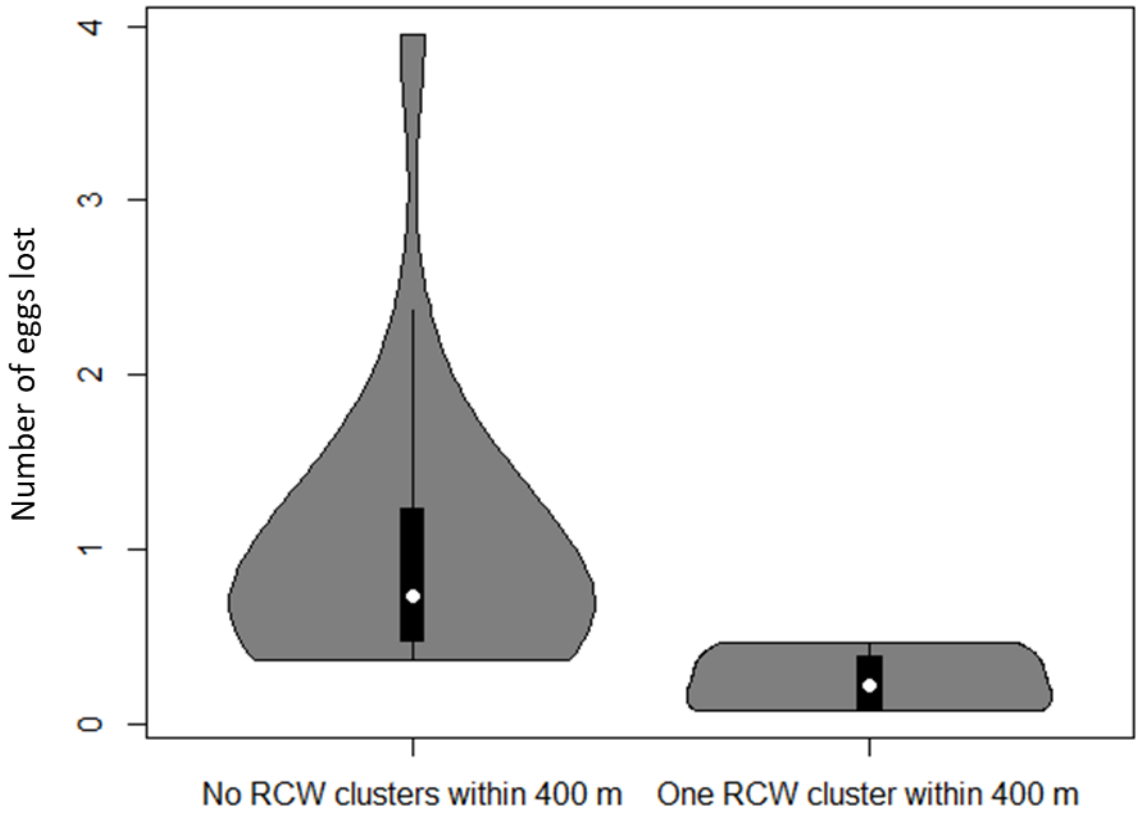

Figure S5: Estimated relationship between the number of red-cockaded woodpecker (*Dryobates borealis*; RCW) eggs that were lost and whether there was another active RCW cluster within 400 m. The violin plot shows the distribution of the posterior means from clusters, and the boxplots display the mean (white dot) and quantiles of the posterior means from clusters from the model with covariates mean basal area of pines with < 25.4 cm diameter at breast height (DBH) but with ≥ 10 cm DBH within 400m, number of active RCW clusters within 400m, and percent RCW habitat last burned during the growing season within 800m.

Table S3: Rates of reproductive output and brood loss reported in previous studies. MCBLC = Marine Corps Base Camp Lejeune, SH = North Carolina Sandhills, EAFB = Eglin Air Force Base. Numbers in parentheses are bounds of 95% confidence intervals.

	Number of eggs per nest	Number of eggs hatched (nestlings) per nest	Number of fledglings per nest	Number of eggs lost per nest	Percent of eggs that did not hatch	Percent of nestlings that did not fledge	Percent of nests with partial brood loss	Percent of nests that failed to produce fledglings
MCBCL (Williamson et al. 2016)	3.41 (3.29-3.53)		1.66 (1.58-1.75)	1.38 (1.31-1.45)				
SH (Williamson et al. 2016)	3.31 (3.26-3.37)		1.79 (1.75-1.83)	1.12 (1.09-1.14)				
EAFB (Williamson et al. 2016)	2.99 (2.76-3.23)		1.25 (1.10-1.41)	1.38 (1.26-1.51)				
Wood et al. 2014	3.2	2.8	2.0					
McCormick et al. 2003	3.35 (± 0.12 SE)	2.56 (± 10.13 SE)			23.4%	20.6%	35.3%	
LaBranche & Walters 1994	3.3	2.3	1.9				27.0%	21.6%
Butler & Tappe 2008	3.2±0.4	2.1±0.4	1.5±0.4					27.6% (12.7-47.2%)
Longleaf (Schaefer et al. 2004)	3.19		1.60					
Loblolly-shortleaf (Schaefer et al. 2004)	3.39		1.91					
Wigley et al. 1999	3.3 (range=1-4, SE=0.1)		1.8 (range =1-3, SE=0.3)					22%
1990 (Beyer et al. 1996)			1.05, SE = 0.09					
1991 (Beyer et al. 1996)			0.92, SE = 0.09					
1992 (Beyer et al. 1996)			1.31, SE = 0.10					
1993 (Beyer et al. 1996)			1.24, SE = 0.10					

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