Extended Supplementary Material

Evaluation of environmental predictors

We evaluated (1) the degree to which the potential environmental predictor variables differentiated nest sites from background sites; and (2) correlations among predictor variables. Our selection of the full suite of predictor variables was based on justifiable, limited information, so it was important for us to evaluate which variables contained redundant information. Our evaluation consisted of two steps. First, we used principal components analysis (PCA) to visualize the interrelationships among the variables and evaluate the degree to which nest sites and randomly located background sites within the modeling domain diverged along the PCA axes. For background data we randomly selected 1960 points (equal to the number of grid-cells in the modeled domain with petrel nest sites) from the entire modeling domain, then used the *rda* function in the vegan package in R (Oksanen et al. 2020) for PCA. Variables were standardized and we retained eigen vectors (i.e. the PCA axes) with eigenvalues > 1. Two of the variables, Mean Growing Season (MGS) Normalized Difference Vegetation Index (NDVI) and Length of Growing Season (LOS), had little variation and distorted the PCA axes; therefore, they were dropped from the predictive modeling. Vectors of the variables along the PCA axes were used to make an initial evaluation of their relationships to one another. To evaluate overlap in ordination space, we generated 95% confidence ellipses around the PC ordination space for predictor variables associated with nest site and background sites separately.

The first four PCA axes explained 81.3% of the variation among the 13 continuous predictor variables (Table S1). The first axis (36.9% variation explained) was dominated by multi-scaled roughness indices, the second by multi-scaled Topographic Position Index (TPI; 22.5%), the third (13.8%) by elevation, wind and rain, and the fourth (8.1%) by Heat Load Index (HLI). The PCA indicated nest sites differed from background sites along gradients defined by the predictor variables (Fig. S1). There was some overlap in 95% confidence ellipses, but environmental conditions at nest sites clearly diverged from background conditions along multiple gradients defined by the predictor variables (Fig. S1).

Most of the pairwise correlations for 1960 grid-cell locations containing nest site counts (Table S2) were of weak to moderate strength, but some stronger ones did occur (Fig. S2). Mean Growing Season NDVI (MGS) and length of growing season (LOS) were strongly correlated ($r = 0.96$), and roughness values at all four scales were strongly correlated among themselves and with slope ($0.73 \leq r \geq 0.97$). TPI03, TPI05 and TPI10 also were strongly correlated ($0.76 \leq r \geq 0.97$), but TPI100 was less correlated with finer-scale TPI ($0.23 \leq r \geq 0.35$) (Fig. S2). Based on correlations and the PCA, we retained a set of ten predictor variables for predictive RF modeling (Table 2). In preliminary model runs, MGS had negative variable importance (VI; see Model performance, below) values within each model group; therefore, we excluded MGS and LOS from the final model (Model 1).

References

Oksanen, J., Blanchet, F.G., Kindt, R., Legendre, P., Minchin, P.R., O'hara, R.B., Simpson, G.L., Solymos, P., Stevens, M.H.H. and Wagner, H., 2020. Vegan: community ecology package. R package version 2.3-0; 2015. Scientific Reports, 10, p.20354.

Table S1. Results of a principal components analysis (PCA) of 13 variables used to predict Hawaiian petrel nest site density on Haleakalā, east Maui. The four PC axes with eigenvalues (λ) >1 are shown. Variables include Elevation, Heat Load Index (HLI), roughness at four scales, slope, Topographic Position Index (TPI) at four scales, rain, and wind. Definitions are provided in Table 2.

	Axis 1	Axis 2	Axis 3	Axis 4
λ	4.800	2.924	1.794	1.052
Variation (%)	0.369	0.225	0.138	0.081
Cumulative Variation (%)	0.369	0.594	0.732	0.813
Variable				
Elevation	2.060	-1.695	-2.753	-0.299
HLI	-0.292	-0.278	-0.087	3.983
Rough03	3.499	1.857	0.092	-0.129
Rough05	3.604	1.847	0.092	-0.122
Rough10	3.717	1.502	0.136	-0.115
Rough100	2.502	1.317	0.932	0.960
Slope	3.546	1.584	-0.073	0.310
TPI03	1.439	-3.139	1.926	-0.035
TPI05	1.551	-3.247	1.901	-0.034
TPI10	2.661	-2.368	1.311	0.227
TPI100	2.512	-1.970	-0.719	-0.128
Rain	-0.065	1.085	2.460	-1.027
Wind	1.818	-1.842	-2.655	-0.361

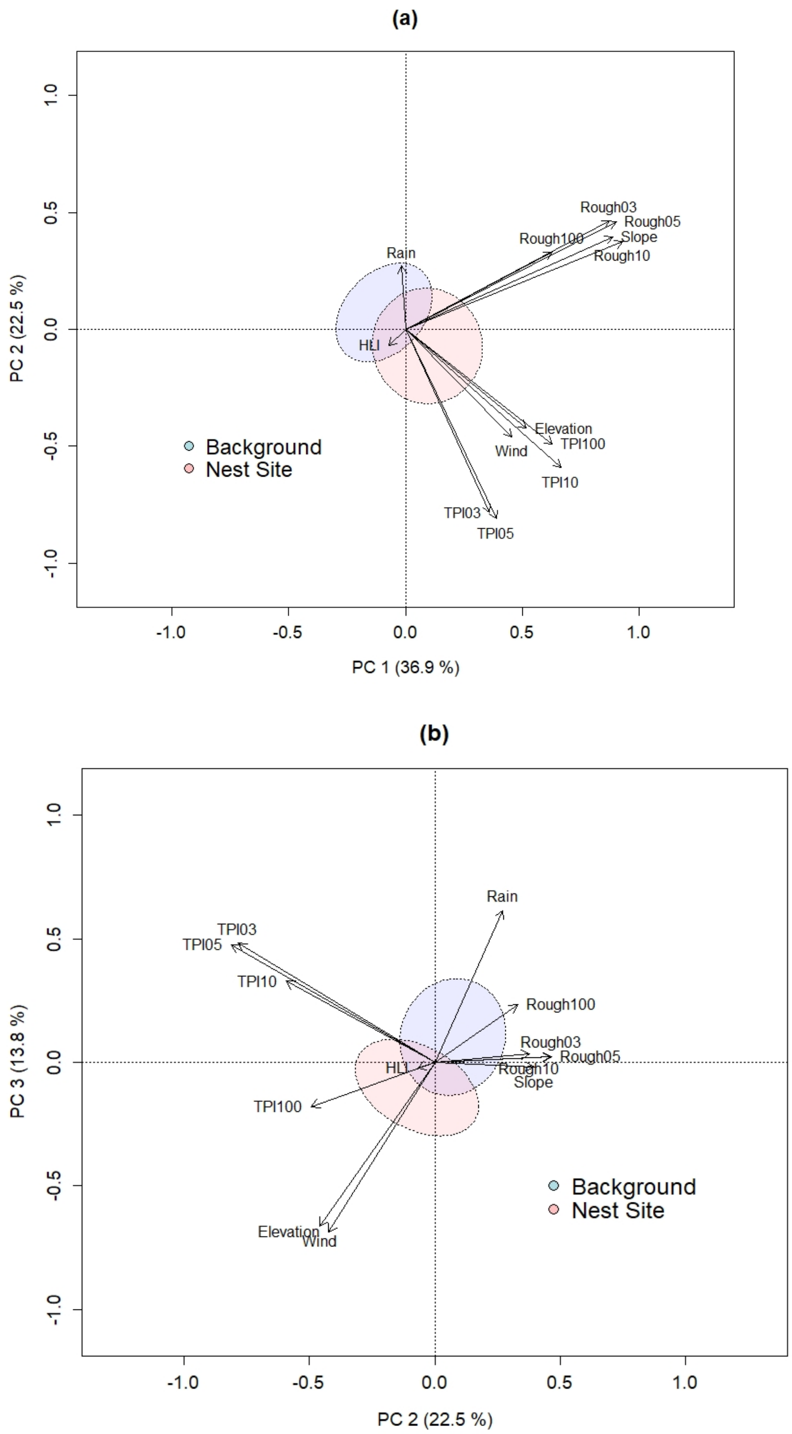

Fig. S1. Principal components analysis (PCA) of 13 potential environmental variables evaluated to predict Hawaiian petrel nest sites on Haleakalā, east Maui. There were 1960 100-m^2 grid cells with nest sites present and an equal number of randomly selected out of 50 000 total background grid cells used in the PCA. 95% confidence ellipses for the nest-site cells (red shaded) and randomly selected background cells (blue shaded) are shown for axes 1 and 2 (a) and 2 and 3 (b).

Table S2. Pairwise Pearson correlations between potential predictor variables for modeling Hawaiian petrel nesting sites on Haleakalā, east Maui. Correlations are based on 1960 grid-cell locations containing nest site counts.

	Elevation	HLI	Slope	Rain	Wind	LOS	MGS	Rough03	Rough05	Rough10	Rough100	TPI03	TPI05	TPI10	TPI100
Elevation	1.000														
HLI	0.051	1.000													
Slope	0.038	0.115	1.000												
Rain	-0.324	-0.235	0.178	1.000											
Wind	0.572	0.120	-0.012	-0.189	1.000										
LOS	-0.083	0.001	-0.007	-0.033	-0.098	1.000									
MGS	-0.090	0.006	-0.007	-0.034	-0.102	0.972	1.000								
Rough03	-0.027	-0.044	0.789	0.165	-0.055	-0.015	-0.016	1.000							
Rough05	-0.025	-0.036	0.817	0.179	-0.054	-0.017	-0.017	0.976	1.000						
Rough10	-0.016	-0.019	0.823	0.196	-0.048	-0.018	-0.019	0.899	0.958	1.000					
Rough100	-0.051	0.137	0.734	0.186	-0.060	0.003	0.001	0.554	0.596	0.653	1.000				
TPI03	0.021	0.004	0.019	0.024	0.017	-0.007	-0.008	0.006	0.014	0.022	0.011	1.000			
TPI05	0.025	0.001	0.018	0.029	0.022	-0.008	-0.008	0.010	0.017	0.029	0.014	0.971	1.000		
TPI10	0.028	0.126	0.143	0.044	0.023	-0.041	-0.045	0.124	0.140	0.170	0.197	0.687	0.758	1.000	
TPI100	0.213	0.027	0.195	0.146	0.321	-0.024	-0.021	0.123	0.131	0.150	0.077	0.226	0.270	0.356	1.000

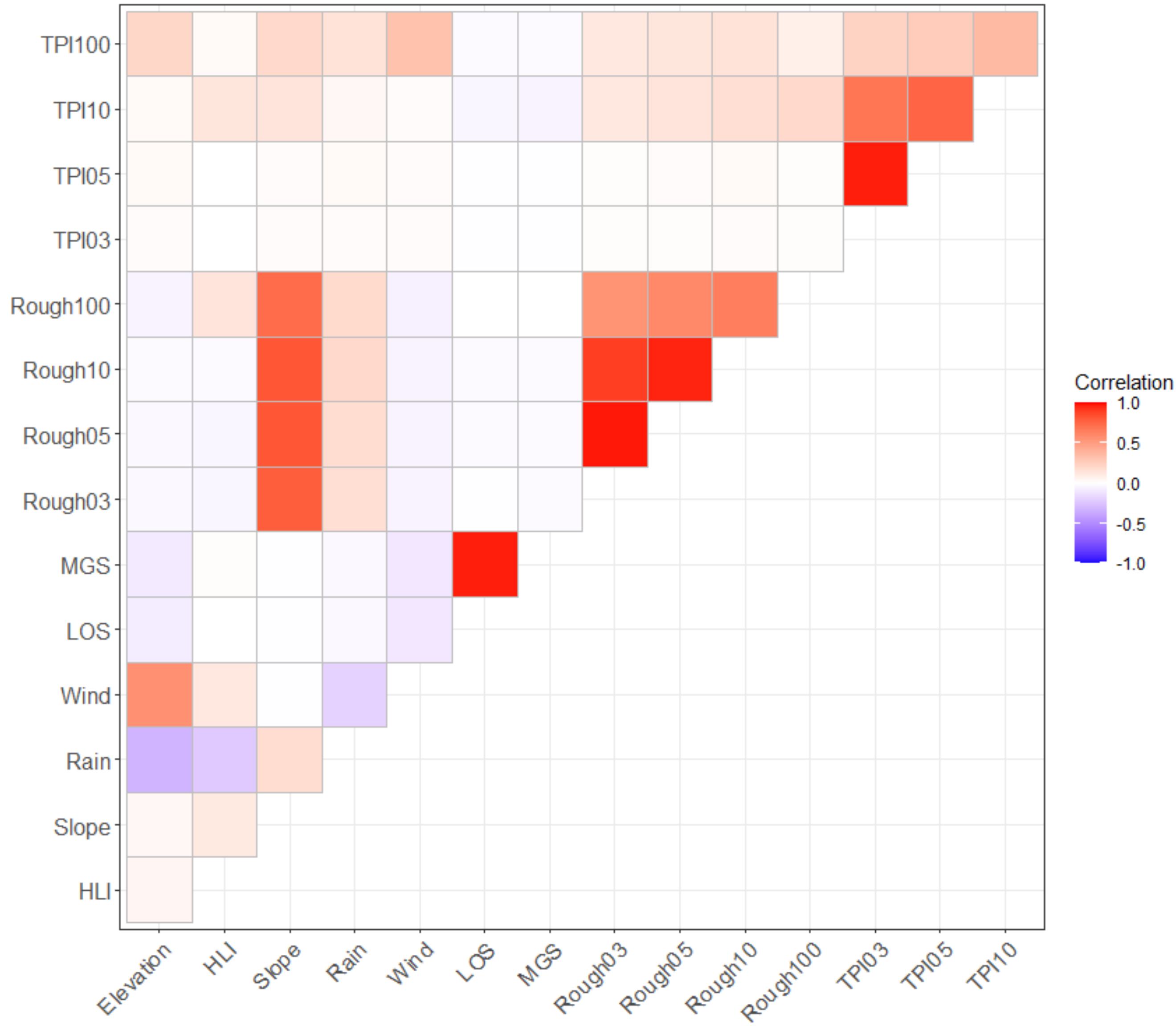

Fig. S2. Graphical representation of pairwise correlations among 15 variables evaluated to predict Hawaiian petrel nest site density on Haleakalā, east Maui. Correlations are based on 1960 grid-cell locations containing nest site counts. Variable names and definitions are provided in Table 2.

Model performance

We used three measures to evaluate performance within and between the models: (1) the stability of the model mean squared error (MSE) as the number of trees increased; (2) the MSE of the cross-validations; and (3) comparison with ordinary least square regression of pseudo-R^2 values ($1 – [MSE/\sigma^2]$) between training and test sets. Because MSE was expressed as a proportion, we used beta regression to compare values between the training and test datasets using package *betareg* in R (Cribari-Neto & Zeileis 2010). We used the absolute and proportional differences in predicted values as two additional measures of differences between models. We randomly selected 1000 grid cells from the prediction maps for each model and then did pairwise comparisons (N = 6) among them. The absolute differences were summarized in histograms (Fig. S3) and proportional differences were illustrated using empirical cumulative distribution functions (ECDF) (Fig. S4).

We evaluated variable importance (VI) as the proportional increase in MSE when a variable was not included in the models. The *randomForest* package in R returns VI as means and SDs across model runs. Therefore, to ensure uncertainty was propagated appropriately in the estimates, we used a simple Bayesian approach to calculate VI for each predictor across the 100 spatially thinned sets. Because VI is continuous and can be positive or negative, we estimated

$VI_i \sim N(\mu_i, \sigma_i)$

$\mu_i \sim N(\vartheta, \rho)$

$\vartheta \sim N(0,1)$

$\rho \sim Uniform(0,10)$

where σ_i are the SDs of each thinned set i, and ϑ and ρ are the overall mean estimate and its SD, respectively. We used the *R2jags* package in R (Su & Yajima, 2021) to implement Gibbs sampling of three Markov chain Monte Carlo chains with a burn-in of 1000 followed by 10 000 iterations with a thinning rate of 10, giving point estimates and 95% credible intervals from 3000 samples of the posterior distribution.

Gelman-Rubin statistics, effective number of samples (n.eff), and inspection of trace plots all indicated strong convergence of Bayesian estimates of VI; Gelman-Rubin statistics were ≤ 1.001 for all parameters, effective number of samples ranged from 10 000–30 000, and the chains in the trace plots showed complete mixing (figures not shown).

References

Cribari-Neto, F. and Zeileis, A., 2010. Beta regression in R. Journal of statistical software, 34, pp.1-24.

Su, Y.S. and Yajima, M., 2021. R2jags: Using R to Run 'JAGS'. R package version 0.6-1; 2020. URL https://CRAN. R-project. org/package= R2jags.

Table S3. Estimates and standard error (SE) of differences in mean square error (MSE) between training (75% of data) and test (25%) sets in each of 100 spatially-thinned datasets in four model groups with different combinations of predictor variables for modeling Hawaiian petrel nesting sites on Haleakalā, east Maui (see Table 2 for variables in the Topography, Substrate, Vegetation and Climate groups).

Model 1 = Topography + Substrate + Vegetation				
	Estimate	SE	*z*	*P*
Intercept	-2.943	0.020	-146.031	< 0.0001
Train	0.045	0.004	11.237	< 0.0001
2	-0.050	0.029	-1.727	0.084
3	-0.059	0.029	-2.066	0.039
4	-0.118	0.029	-4.057	< 0.0001
5	-0.030	0.029	-1.052	0.293
6	-0.150	0.029	-5.117	< 0.0001
7	-0.007	0.028	-0.230	0.818
8	-0.057	0.029	-1.986	0.047
9	0.031	0.028	1.108	0.268
10	-0.066	0.029	-2.292	0.022
11	-0.068	0.029	-2.364	0.018
12	-0.079	0.029	-2.740	0.006
13	0.178	0.027	6.519	< 0.0001
14	0.075	0.028	2.703	0.007
15	-0.141	0.029	-4.807	< 0.0001
16	-0.077	0.029	-2.659	0.008
17	-0.019	0.028	-0.665	0.506
18	-0.041	0.029	-1.449	0.147
19	-0.045	0.029	-1.573	0.116
20	-0.035	0.029	-1.232	0.218
21	0.005	0.028	0.174	0.862
22	-0.129	0.029	-4.426	< 0.0001
23	0.041	0.028	1.463	0.144
24	-0.123	0.029	-4.226	< 0.0001
25	0.137	0.028	4.958	< 0.0001
26	0.013	0.028	0.473	0.636
27	0.140	0.028	5.096	< 0.0001
28	-0.003	0.028	-0.101	0.920
29	-0.027	0.029	-0.939	0.348
30	0.001	0.028	0.040	0.968
31	0.153	0.027	5.575	< 0.0001
32	-0.143	0.029	-4.866	< 0.0001
33	0.058	0.028	2.070	0.038
34	-0.180	0.030	-6.101	< 0.0001
35	-0.011	0.028	-0.371	0.711
36	0.042	0.028	1.497	0.134
37	0.071	0.028	2.530	0.011
38	-0.071	0.029	-2.462	0.014
39	0.173	0.027	6.328	< 0.0001
40	0.006	0.028	0.223	0.823
41	-0.008	0.028	-0.278	0.781
42	-0.059	0.029	-2.049	0.041
43	-0.060	0.029	-2.073	0.038
44	0.043	0.028	1.520	0.129
45	0.008	0.028	0.274	0.784
46	-0.113	0.029	-3.886	< 0.0001
47	-0.036	0.029	-1.253	0.210
48	0.157	0.027	5.725	< 0.0001
49	0.033	0.028	1.158	0.247
50	0.020	0.028	0.694	0.488

Table S3 continued.

	Estimate	SE	*z*	*P*
51	0.066	0.028	2.365	0.018
52	-0.074	0.029	-2.563	0.010
53	-0.089	0.029	-3.084	0.002
54	-0.084	0.029	-2.911	0.004
55	-0.082	0.029	-2.834	0.005
56	-0.041	0.029	-1.424	0.154
57	-0.061	0.029	-2.123	0.034
58	0.042	0.028	1.498	0.134
59	0.110	0.028	3.982	< 0.0001
60	-0.229	0.030	-7.636	< 0.0001
61	0.166	0.027	6.073	< 0.0001
62	0.012	0.028	0.428	0.668
63	-0.021	0.028	-0.722	0.470
64	-0.011	0.028	-0.374	0.708
65	-0.012	0.028	-0.432	0.666
66	-0.056	0.029	-1.939	0.053
67	0.125	0.028	4.547	< 0.0001
68	-0.058	0.029	-2.006	0.045
69	-0.049	0.029	-1.692	0.091
70	-0.155	0.029	-5.267	< 0.0001
71	-0.001	0.028	-0.025	0.980
72	-0.053	0.029	-1.846	0.065
73	-0.030	0.029	-1.052	0.293
74	0.076	0.028	2.738	0.006
75	-0.079	0.029	-2.725	0.006
76	0.108	0.028	3.916	< 0.0001
77	0.007	0.028	0.241	0.809
78	0.048	0.028	1.706	0.088
79	-0.055	0.029	-1.910	0.056
80	0.040	0.028	1.439	0.150
81	-0.071	0.029	-2.472	0.013
82	0.056	0.028	1.995	0.046
83	-0.101	0.029	-3.467	0.001
84	0.059	0.028	2.092	0.036
85	-0.023	0.029	-0.812	0.417
86	-0.087	0.029	-3.006	0.003
87	0.159	0.027	5.795	< 0.0001
88	-0.100	0.029	-3.443	0.001
89	0.026	0.028	0.910	0.363
90	-0.014	0.028	-0.492	0.623
91	0.002	0.028	0.071	0.944
92	-0.032	0.029	-1.136	0.256
93	0.082	0.028	2.944	0.003
94	-0.033	0.029	-1.142	0.253
95	0.021	0.028	0.743	0.457
96	-0.022	0.029	-0.779	0.436
97	-0.066	0.029	-2.282	0.022
98	0.052	0.028	1.845	0.065
99	-0.080	0.029	-2.787	0.005
100	-0.094	0.029	-3.239	0.001

Table S3 continued.

Model 2 = Topography + Substrate

	Estimate	SE	*z*	*P*
Intercept	-2.868	0.024	-121.374	< 0.0001
Train	-0.010	0.005	-2.167	0.030
2	-0.043	0.034	-1.289	0.197
3	-0.148	0.034	-4.294	< 0.0001
4	-0.002	0.033	-0.070	0.945
5	-0.079	0.034	-2.323	0.020
6	-0.148	0.034	-4.299	< 0.0001
7	-0.047	0.034	-1.394	0.163
8	-0.125	0.034	-3.660	< 0.0001
9	-0.103	0.034	-3.020	0.003
10	-0.063	0.034	-1.864	0.062
11	-0.123	0.034	-3.611	< 0.0001
12	-0.102	0.034	-3.005	0.003
13	-0.005	0.033	-0.158	0.874
14	0.137	0.032	4.232	< 0.0001
15	-0.074	0.034	-2.189	0.029
16	-0.134	0.034	-3.905	< 0.0001
17	-0.079	0.034	-2.334	0.020
18	-0.075	0.034	-2.219	0.027
19	-0.067	0.034	-1.984	0.047
20	-0.097	0.034	-2.843	0.004
21	0.064	0.033	1.939	0.053
22	-0.017	0.033	-0.518	0.605
23	-0.030	0.033	-0.888	0.375
24	-0.031	0.033	-0.915	0.360
25	-0.001	0.033	-0.020	0.984
26	-0.078	0.034	-2.309	0.021
27	-0.017	0.033	-0.497	0.620
28	-0.004	0.033	-0.130	0.896
29	-0.082	0.034	-2.426	0.015
30	-0.016	0.033	-0.465	0.642
31	0.046	0.033	1.388	0.165
32	-0.142	0.034	-4.128	< 0.0001
33	0.010	0.033	0.303	0.762
34	-0.206	0.035	-5.898	< 0.0001
35	-0.090	0.034	-2.653	0.008
36	0.187	0.032	5.850	< 0.0001
37	-0.037	0.034	-1.093	0.274
38	-0.024	0.033	-0.704	0.481
39	0.052	0.033	1.581	0.114
40	-0.157	0.034	-4.543	< 0.0001
41	-0.090	0.034	-2.652	0.008
42	-0.066	0.034	-1.945	0.052
43	-0.101	0.034	-2.957	0.003
44	0.009	0.033	0.285	0.776
45	-0.137	0.034	-3.980	< 0.0001
46	-0.055	0.034	-1.633	0.103
47	-0.022	0.033	-0.645	0.519
48	0.232	0.032	7.328	< 0.0001
49	-0.075	0.034	-2.215	0.027
50	-0.082	0.034	-2.432	0.015

Table S3 continued.

	Estimate	SE	*z*	*P*
51	0.169	0.032	5.268	< 0.0001
52	0.085	0.033	2.617	0.009
53	-0.066	0.034	-1.965	0.049
54	-0.172	0.035	-4.972	< 0.0001
55	-0.055	0.034	-1.648	0.099
56	-0.027	0.033	-0.793	0.428
57	-0.083	0.034	-2.444	0.015
58	-0.086	0.034	-2.524	0.012
59	-0.005	0.033	-0.141	0.888
60	-0.151	0.034	-4.383	< 0.0001
61	-0.005	0.033	-0.160	0.873
62	-0.065	0.034	-1.929	0.054
63	-0.164	0.035	-4.740	< 0.0001
64	-0.002	0.033	-0.050	0.960
65	-0.037	0.034	-1.100	0.271
66	-0.083	0.034	-2.463	0.014
67	0.096	0.033	2.950	0.003
68	-0.040	0.034	-1.185	0.236
69	-0.156	0.034	-4.527	< 0.0001
70	-0.314	0.036	-8.765	< 0.0001
71	-0.101	0.034	-2.980	0.003
72	-0.084	0.034	-2.487	0.013
73	-0.016	0.033	-0.468	0.640
74	0.138	0.032	4.272	< 0.0001
75	-0.177	0.035	-5.116	< 0.0001
76	0.011	0.033	0.336	0.737
77	-0.053	0.034	-1.571	0.116
78	-0.058	0.034	-1.719	0.086
79	-0.053	0.034	-1.571	0.116
80	-0.059	0.034	-1.754	0.079
81	-0.087	0.034	-2.566	0.010
82	0.084	0.033	2.585	0.010
83	-0.141	0.034	-4.108	< 0.0001
84	-0.095	0.034	-2.808	0.005
85	-0.198	0.035	-5.684	< 0.0001
86	-0.013	0.033	-0.388	0.698
87	0.062	0.033	1.879	0.060
88	-0.239	0.035	-6.788	< 0.0001
89	-0.007	0.033	-0.217	0.829
90	-0.007	0.033	-0.202	0.840
91	0.115	0.032	3.531	< 0.0001
92	-0.072	0.034	-2.132	0.033
93	0.086	0.033	2.628	0.009
94	-0.110	0.034	-3.240	0.001
95	-0.058	0.034	-1.719	0.086
96	0.061	0.033	1.844	0.065
97	-0.116	0.034	-3.409	0.001
98	0.020	0.033	0.612	0.541
99	0.005	0.033	0.136	0.892
100	-0.127	0.034	-3.698	< 0.0001

Table S3 continued.

Model 3 = Topography + Substrate + Vegetation + Climate (wind; no rain)

	Estimate	SE	*z*	*P*
Intercept	-2.749	0.020	-134.625	< 0.0001
Train	0.016	0.004	3.739	< 0.0001
2	-0.157	0.030	-5.276	< 0.0001
3	-0.298	0.031	-9.674	< 0.0001
4	-0.248	0.030	-8.157	< 0.0001
5	-0.211	0.030	-7.001	< 0.0001
6	-0.185	0.030	-6.175	< 0.0001
7	-0.252	0.030	-8.288	< 0.0001
8	-0.261	0.031	-8.551	< 0.0001
9	-0.169	0.030	-5.653	< 0.0001
10	-0.250	0.030	-8.212	< 0.0001
11	-0.149	0.030	-5.026	< 0.0001
12	-0.200	0.030	-6.667	< 0.0001
13	-0.134	0.030	-4.516	< 0.0001
14	-0.191	0.030	-6.363	< 0.0001
15	-0.329	0.031	-10.598	< 0.0001
16	-0.091	0.029	-3.120	0.002
17	-0.197	0.030	-6.565	< 0.0001
18	-0.232	0.030	-7.668	< 0.0001
19	-0.151	0.030	-5.068	< 0.0001
20	-0.279	0.031	-9.095	< 0.0001
21	-0.172	0.030	-5.752	< 0.0001
22	-0.199	0.030	-6.621	< 0.0001
23	-0.213	0.030	-7.063	< 0.0001
24	-0.228	0.030	-7.532	< 0.0001
25	-0.130	0.030	-4.386	< 0.0001
26	-0.242	0.030	-7.979	< 0.0001
27	-0.185	0.030	-6.186	< 0.0001
28	-0.068	0.029	-2.336	0.019
29	-0.216	0.030	-7.146	< 0.0001
30	-0.197	0.030	-6.544	< 0.0001
31	-0.202	0.030	-6.708	< 0.0001
32	-0.314	0.031	-10.147	< 0.0001
33	-0.228	0.030	-7.520	< 0.0001
34	-0.266	0.031	-8.717	< 0.0001
35	-0.198	0.030	-6.603	< 0.0001
36	-0.204	0.030	-6.778	< 0.0001
37	-0.135	0.030	-4.559	< 0.0001
38	-0.228	0.030	-7.544	< 0.0001
39	-0.009	0.029	-0.324	0.746
40	-0.196	0.030	-6.537	< 0.0001
41	-0.190	0.030	-6.323	< 0.0001
42	-0.243	0.030	-8.001	< 0.0001
43	-0.262	0.031	-8.580	< 0.0001
44	-0.120	0.030	-4.078	< 0.0001
45	-0.161	0.030	-5.403	< 0.0001
46	-0.298	0.031	-9.675	< 0.0001
47	-0.258	0.030	-8.457	< 0.0001
48	-0.091	0.029	-3.119	0.002
49	-0.219	0.030	-7.239	< 0.0001
50	-0.213	0.030	-7.061	< 0.0001

Table S3 continued.

	Estimate	SE	*z*	*P*
51	-0.172	0.030	-5.747	< 0.0001
52	-0.086	0.029	-2.931	0.003
53	-0.262	0.031	-8.591	< 0.0001
54	-0.266	0.031	-8.711	< 0.0001
55	-0.192	0.030	-6.409	< 0.0001
56	-0.172	0.030	-5.766	< 0.0001
57	-0.117	0.029	-3.955	< 0.0001
58	-0.191	0.030	-6.353	< 0.0001
59	-0.171	0.030	-5.731	< 0.0001
60	-0.377	0.031	-11.997	< 0.0001
61	-0.114	0.029	-3.866	< 0.0001
62	-0.176	0.030	-5.887	< 0.0001
63	-0.244	0.030	-8.035	< 0.0001
64	-0.159	0.030	-5.336	< 0.0001
65	-0.226	0.030	-7.461	< 0.0001
66	-0.324	0.031	-10.451	< 0.0001
67	-0.125	0.030	-4.229	< 0.0001
68	-0.266	0.031	-8.716	< 0.0001
69	-0.306	0.031	-9.925	< 0.0001
70	-0.249	0.030	-8.176	< 0.0001
71	-0.119	0.029	-4.045	< 0.0001
72	-0.226	0.030	-7.468	< 0.0001
73	-0.273	0.031	-8.923	< 0.0001
74	0.038	0.028	1.346	0.178
75	-0.259	0.031	-8.505	< 0.0001
76	-0.034	0.029	-1.174	0.240
77	-0.149	0.030	-5.011	< 0.0001
78	-0.072	0.029	-2.458	0.014
79	-0.077	0.029	-2.636	0.008
80	-0.194	0.030	-6.451	< 0.0001
81	-0.186	0.030	-6.203	< 0.0001
82	-0.093	0.029	-3.161	0.002
83	-0.141	0.030	-4.771	< 0.0001
84	-0.111	0.029	-3.764	< 0.0001
85	-0.207	0.030	-6.883	< 0.0001
86	-0.221	0.030	-7.301	< 0.0001
87	-0.019	0.029	-0.649	0.516
88	-0.254	0.030	-8.322	< 0.0001
89	-0.157	0.030	-5.261	< 0.0001
90	-0.194	0.030	-6.462	< 0.0001
91	-0.060	0.029	-2.075	0.038
92	-0.237	0.030	-7.816	< 0.0001
93	-0.178	0.030	-5.963	< 0.0001
94	-0.220	0.030	-7.267	< 0.0001
95	-0.102	0.029	-3.475	0.001
96	-0.211	0.030	-7.012	< 0.0001
97	-0.313	0.031	-10.118	< 0.0001
98	-0.103	0.029	-3.506	< 0.0001
99	-0.193	0.030	-6.423	< 0.0001
100	-0.209	0.030	-6.935	< 0.0001

Table S3 continued.

Model 4 = Topography (no elevation) + Substrate + Vegetation + Climate

	Estimate	SE	*z*	*P*
Intercept	-2.886	0.021	-139.13	< 0.0001
Train	0.019	0.004	4.419	< 0.0001
2	-0.067	0.030	-2.245	0.025
3	-0.136	0.030	-4.51	< 0.0001
4	-0.065	0.030	-2.184	0.029
5	-0.039	0.029	-1.329	0.184
6	-0.069	0.030	-2.324	0.020
7	-0.123	0.030	-4.108	< 0.0001
8	0.012	0.029	0.426	0.670
9	0.006	0.029	0.218	0.827
10	-0.006	0.029	-0.198	0.843
11	-0.089	0.030	-2.99	0.003
12	0.013	0.029	0.45	0.653
13	0.030	0.029	1.051	0.293
14	0.059	0.029	2.045	0.041
15	-0.096	0.030	-3.208	0.001
16	-0.106	0.030	-3.545	< 0.0001
17	-0.012	0.029	-0.412	0.680
18	-0.129	0.030	-4.276	< 0.0001
19	-0.068	0.030	-2.305	0.021
20	-0.042	0.029	-1.42	0.156
21	-0.142	0.030	-4.713	< 0.0001
22	-0.077	0.030	-2.606	0.009
23	-0.102	0.030	-3.408	0.001
24	-0.196	0.031	-6.408	< 0.0001
25	0.038	0.029	1.312	0.190
26	0.023	0.029	0.778	0.437
27	-0.045	0.029	-1.514	0.130
28	-0.011	0.029	-0.369	0.712
29	-0.076	0.030	-2.548	0.011
30	-0.024	0.029	-0.805	0.421
31	0.125	0.028	4.408	< 0.0001
32	-0.028	0.029	-0.952	0.341
33	-0.037	0.029	-1.247	0.212
34	-0.101	0.030	-3.367	0.001
35	-0.078	0.030	-2.626	0.009
36	0.163	0.028	5.765	< 0.0001
37	-0.086	0.030	-2.889	0.004
38	-0.124	0.030	-4.120	< 0.0001
39	-0.040	0.029	-1.361	0.173
40	-0.042	0.029	-1.415	0.157
41	-0.051	0.030	-1.743	0.081
42	-0.101	0.030	-3.373	0.001
43	-0.068	0.030	-2.294	0.022
44	0.079	0.029	2.746	0.006
45	-0.107	0.030	-3.593	< 0.0001
46	-0.093	0.030	-3.111	0.002
47	0.058	0.029	2.009	0.045
48	0.196	0.028	6.991	< 0.0001
49	-0.096	0.030	-3.204	0.001
50	-0.079	0.030	-2.665	0.008

Table S3 continued.

	Estimate	SE	*z*	*P*
51	-0.027	0.029	-0.928	0.353
52	0.067	0.029	2.336	0.020
53	-0.099	0.030	-3.328	0.001
54	-0.134	0.030	-4.467	< 0.0001
55	-0.095	0.030	-3.183	0.001
56	0.001	0.029	0.021	0.983
57	-0.064	0.030	-2.177	0.029
58	-0.008	0.029	-0.283	0.777
59	-0.043	0.029	-1.475	0.140
60	-0.103	0.030	-3.440	0.001
61	0.161	0.028	5.716	< 0.0001
62	-0.056	0.030	-1.881	0.060
63	0.023	0.029	0.796	0.426
64	0.015	0.029	0.508	0.611
65	-0.054	0.030	-1.813	0.070
66	-0.159	0.030	-5.242	< 0.0001
67	0.013	0.029	0.448	0.654
68	-0.041	0.029	-1.403	0.161
69	-0.110	0.030	-3.677	< 0.0001
70	-0.261	0.031	-8.394	< 0.0001
71	0.025	0.029	0.849	0.396
72	-0.063	0.030	-2.143	0.032
73	-0.033	0.029	-1.133	0.257
74	0.056	0.029	1.959	0.050
75	-0.171	0.030	-5.617	< 0.0001
76	-0.011	0.029	-0.368	0.713
77	-0.036	0.029	-1.207	0.227
78	-0.030	0.029	-1.022	0.307
79	-0.064	0.030	-2.167	0.030
80	-0.074	0.030	-2.486	0.013
81	-0.048	0.030	-1.626	0.104
82	0.051	0.029	1.766	0.077
83	-0.106	0.030	-3.543	< 0.0001
84	0.195	0.028	6.945	< 0.0001
85	-0.091	0.030	-3.042	0.002
86	0.063	0.029	2.197	0.028
87	0.069	0.029	2.397	0.017
88	-0.111	0.030	-3.703	< 0.0001
89	0.043	0.029	1.488	0.137
90	-0.005	0.029	-0.159	0.873
91	0.020	0.029	0.679	0.497
92	-0.008	0.029	-0.269	0.788
93	0.070	0.029	2.440	0.015
94	-0.061	0.030	-2.054	0.040
95	0.019	0.029	0.652	0.514
96	-0.025	0.029	-0.863	0.388
97	-0.100	0.030	-3.357	0.001
98	0.045	0.029	1.550	0.121
99	-0.143	0.030	-4.730	< 0.0001
100	-0.096	0.030	-3.218	0.001

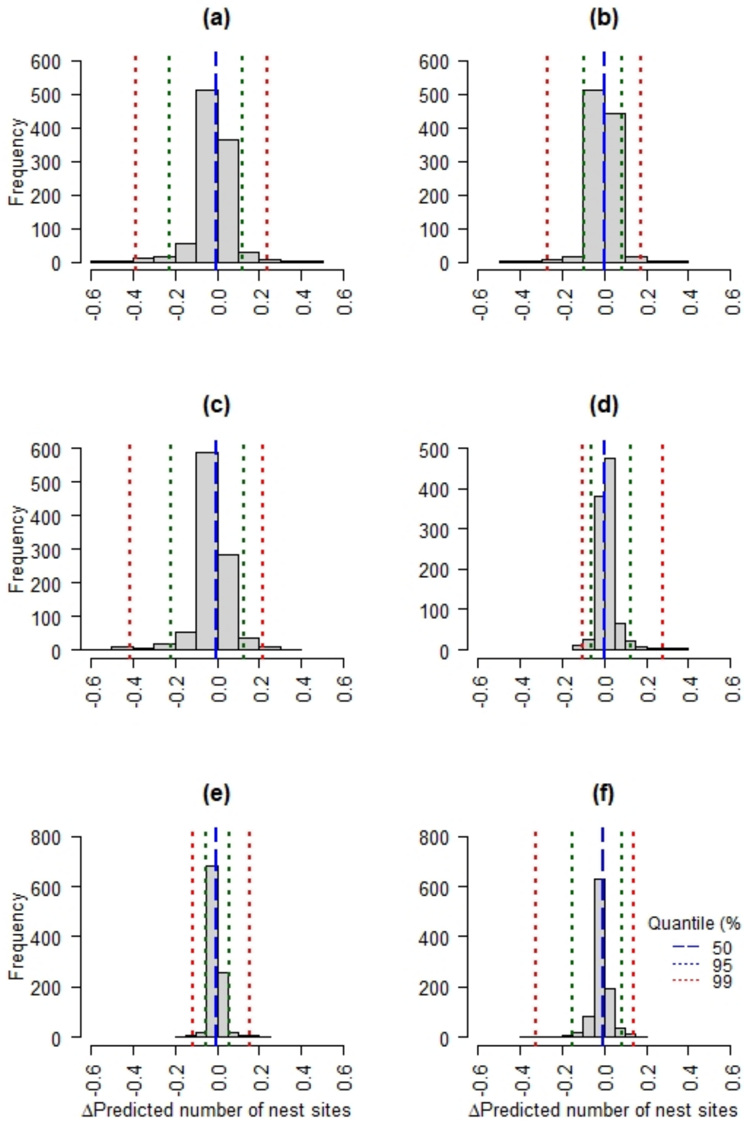

Fig. S3. Absolute pairwise differences in predicted number of Hawaiian petrel nest sites within 10×10-m grid cells on Haleakalā, east Maui. Predictions were derived from Random Forest models for four models with different combinations of variables associated with topography, substrate, climate, and vegetation. The purpose of the comparisons was to evaluate the relative influence of elevation, rain, wind and vegetation on predicted number of nests sites, therefore different combinations of those four variables were omitted from each pairwise comparison (see Table 2 for variables included in each of the model groups). (a) Model 1 vs. Model 4; (b) Model 2 vs. Model 4; (c) Model 3 vs. Model 4; (d) Model 1 vs. Model 2; (e) Model 1 vs. Model 3; (f) Model 2 vs. Model 3.

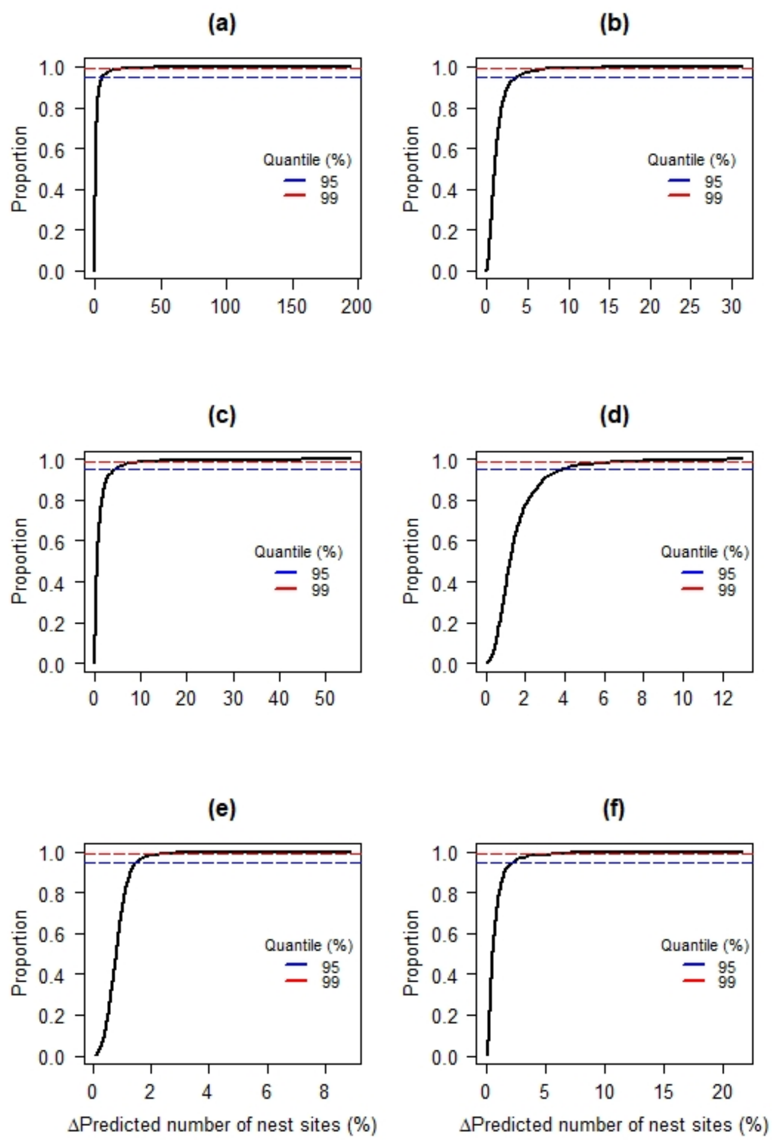

Fig. S4. Empirical cumulative distribution functions (ECDFs) of the percent differences in predicted number of Hawaiian petrel nest sites within 10×10-m grid cells on Haleakalā, east Maui. Note that x-axis scales differ and range from 0–8% (e) to 0–200% (a). Predictions were derived from Random Forest models for four model groups with different combinations of variables associated with topography, substrate, climate, and vegetation. The purpose of the comparisons was to evaluate the relative influence of elevation, rain, wind, and vegetation on the predicted number of nests sites, therefore different combinations of those four variable types (see Table 3) were omitted from each pairwise comparison. (a) Model 1 vs. Model 4; (b) Model 2 vs. Model 4; (c) Model 3 vs. Model 4; (d) Model 1 vs. Model 2; (e) Model 1 vs. Model 3; (f) Model 2 vs. Model 3.