

Appendix S1. Median effect sizes and 95% credibility intervals of habitat covariates and time since Pacific rat eradication

Median effect sizes and 95% credibility intervals (CI) of habitat covariates and time since Pacific rat eradication from a multivariate model predicting petrel burrow density on six islands in north-eastern New Zealand. Mauihaha is still inhabited by Pacific rats, Ruamaahuanui never had mammals introduced, and all other islands are ordered from top to bottom by increasing time since eradication. Habitat variables were selected based on Buxton et al. (2015). Italicised median values do not overlap 0.

Parameter	Island	Median	5% CI	95% CI
Time since eradication		<i>0.063</i>	0.047	0.079
Soil depth	Mauihaha	<i>0.018</i>	0.008	0.040
Soil depth	Taranga	<i>0.009</i>	0.008	0.025
Soil depth	Ohinau	0.024	-0.008	0.043
Soil depth	Kawhiti	0.015	-0.005	0.033
Soil depth	Korapuki	<i>0.033</i>	0.012	0.061
Soil depth	Ruamaahuanui	<i>0.024</i>	0.010	0.039
Slope	Mauihaha	<i>0.010</i>	0.012	0.033
Slope	Taranga	<i>0.013</i>	0.002	0.028
Slope	Ohinau	0.002	-0.021	0.022
Slope	Kawhiti	<i>0.019</i>	0.001	0.039
Slope	Korapuki	0.015	-0.004	0.037
Slope	Ruamaahuanui	-0.010	-0.035	1.251
Rock cover	Mauihaha	0.001	-0.027	0.022
Rock cover	Taranga	<i>0.010</i>	0.005	0.027
Rock cover	Ohinau	<i>0.006</i>	0.014	0.023
Rock cover	Kawhiti	0.007	-0.007	0.022
Rock cover	Korapuki	<i>0.018</i>	0.002	0.038
Rock cover	Ruamaahuanui	-0.007	-0.044	0.017
Southern aspect	Mauihaha	-0.004	-0.025	0.017
Southern aspect	Taranga	-0.005	-0.020	0.011
Southern aspect	Ohinau	0.008	-0.013	0.029
Southern aspect	Kawhiti	0.004	-0.013	0.021
Southern aspect	Korapuki	0.001	-0.022	0.024
Southern aspect	Ruamaahuanui	<i>0.068</i>	0.037	0.097
Western aspect	Mauihaha	0.008	-0.011	0.028
Western aspect	Taranga	0.008	-0.005	0.021
Western aspect	Ohinau	0.006	-0.009	0.019
Western aspect	Kawhiti	0.007	-0.005	0.020
Western aspect	Korapuki	0.006	-0.007	0.017
Western aspect	Ruamaahuanui	0.008	-0.006	0.026
Total small stem count	Mauihaha	-0.002	-0.015	0.020
Total small stem count	Taranga	-0.006	-0.019	5.972
Total small stem count	Ohinau	-0.005	-0.018	8.337
Total small stem count	Kawhiti	-0.003	-0.017	0.014
Total small stem count	Korapuki	-0.007	-0.023	5.884
Total small stem count	Ruamaahuanui	-0.008	-0.021	2.339
Māhoe stem count	Mauihaha	0.007	-0.028	0.045
Māhoe stem count	Taranga	0.003	-0.022	0.028
Māhoe stem count	Ohinau	0.007	-0.010	0.024
Māhoe stem count	Kawhiti	<i>0.028</i>	0.009	0.047
Māhoe stem count	Korapuki	-0.006	-0.025	0.013
Māhoe stem count	Ruamaahuanui	-0.024	-0.055	4.751
Māhoe stem count	Mauihaha	0.006	-0.015	0.026
Karamū stem count	Taranga	-0.003	-0.020	0.014
Karamū stem count	Ohinau	0.019	-0.012	0.052
Karamū stem count	Kawhiti	0.005	-0.012	0.022
Karamū stem count	Korapuki	-0.015	-0.035	4.742
Karamū stem count	Ruamaahuanui	<i>0.089</i>	0.051	0.127

Buxton, RT, Anderson D, Moller H, Jones CJ, Lyver POB 2015. Release of constraints on nest-site selection in burrow-nesting petrels following invasive rat eradication. *Biological Invasions* 17: 1453–1470.

Appendix S2. Multivariate varying intercept models

Multivariate varying intercept models investigating the effects of habitat covariates on the probability of petrel burrows being present in plots among islands off the north-eastern coast of New Zealand's North Island. The model with the best fit (largest AUC - area under Receiver Operating Characteristic curves – and smallest DIC – deviance information criterion) is indicated in bold.

Model	AUC ± SD	DIC
Slope + S + W + Elevation + Slope*Elevation + Slope*S + Slope*W + Elevation*S + Elevation*W + Slope*Elevation*S + Slope*Elevation*W	0.79 ± 0.02	1289.9
Slope + N + S + E + W + Elevation + Slope*Elevation + Slope*N + Slope*S + Slope*E + Slope*W + Elevation*N + Elevation*S + Elevation*E + Elevation*W + Slope*Elevation*N + Slope*Elevation*S + Slope*Elevation*E + Slope*Elevation*W	0.79 ± 0.02	1753.5
Slope + N + S + E + W + Elevation + Slope*N + Slope*S + Slope*E + Slope*W	0.77 ± 0.02	1229.0
Slope + N + S + E + W + Elevation + Slope*Elevation*N + Slope*Elevation*S + Slope*Elevation*E + Slope*Elevation*W	0.77 ± 0.02	1241.3
Slope + N + S + E + W + Elevation	0.76 ± 0.02	1028.3
Slope + N + S + E + W + Elevation + Slope*Elevation	0.76 ± 0.02	1068.8
Slope + N + S + E + W + Elevation + Slope*Elevation + Elevation*N + Elevation*S + Elevation*E + Elevation*W	0.76 ± 0.02	1351.2
Slope	0.73 ± 0.02	764.3
Slope + N + E + Elevation + Slope*Elevation + Slope*N + Slope*E + Elevation*N + Elevation*E + Slope*Elevation*N + Slope*Elevation*E	0.71 ± 0.02	1160.2
N	0.70 ± 0.02	785.4
Slope*Elevation*N + Slope*Elevation*S + Slope*Elevation*E + Slope*Elevation*W	0.70 ± 0.02	960.3
Slope + N + S + E + W + Elevation + Slope*Elevation + Slope*N + Slope*S + Slope*E + Slope*W + Elevation*N + Elevation*S + Elevation*E + Elevation*W	0.70 ± 0.02	1515.9
Elevation	0.67 ± 0.02	804
W	0.65 ± 0.02	798.3
E	0.65 ± 0.02	799.8
S	0.65 ± 0.02	800.4

Appendix S3. Median effect sizes and 95% credibility intervals (CI) from the top multivariate model predicting petrel burrow presence (Appendix S2)

Median values among islands were generated from varying intercept models, while median values for each island were generated from varying slope, varying intercept models. Islands are off the northeastern coast of New Zealand's North Island. Mauihaha is still inhabited by Pacific rats, *Rattus exulans*; Ruammahuanui never had mammals introduced and all other islands are ordered from top to bottom by increasing time since eradication. Italicised median values do not overlap 0.

Parameter	Island	Median	5% CI	95% CI
Intercept	Mauihaha	-0.103	-0.846	0.748
Intercept	Taranga	<i>0.821</i>	0.404	1.25
Intercept	Ohinau	<i>4.12</i>	2.04	8.52
Intercept	Kawhitsu	<i>1.08</i>	0.421	1.77
Intercept	Korapuki	0.302	-1.29	1.29
Intercept	Ruammahuanui	0.356	-0.209	0.932
All islands (see M_{α}, Eqn 3–4)				
Slope		<i>0.709</i>	0.297	1.13
N		0.31	-4.5	5.07
S		0.338	-4.31	4.95
E		0.195	-3.49	3.84
W		0.639	-3.93	5.24
Elevation		-0.322	-1.26	0.369
Slope*N		-1.11	-7.88	5.96
Slope*S		-1.11	-7.67	5.77
Slope*E		-0.978	-6.15	4.36
Slope*W		-0.903	-7.38	5.85
Individual islands (see β_{ik}, Eq. 7)				
Slope	Mauihaha	<i>0.665</i>	0.0364	1.25
Slope	Taranga	<i>0.772</i>	0.372	1.2
Slope	Ohinau	<i>0.815</i>	0.155	1.64
Slope	Kawhitsu	<i>0.682</i>	0.207	1.15
Slope	Korapuki	<i>0.553</i>	0.0571	1.02
Slope	Ruammahuanui	<i>0.754</i>	0.378	1.16
N	Mauihaha	0.153	-4.62	4.98
N	Taranga	0.28	-4.52	5.04
N	Ohinau	0.2	-4.58	5.05
N	Kawhitsu	0.377	-4.45	5.11
N	Korapuki	0.481	-4.29	5.27
N	Ruammahuanui	0.283	-4.54	5.07
S	Mauihaha	0.139	-4.51	4.78
S	Taranga	0.415	-4.22	5.01
S	Ohinau	0.308	-4.32	5.01
S	Kawhitsu	0.414	-4.25	5.04
S	Korapuki	0.247	-4.33	4.91
S	Ruammahuanui	0.357	-4.29	4.96
E	Mauihaha	0.357	-3.21	4.1
E	Taranga	0.138	-3.51	3.78
E	Ohinau	0.217	-3.46	3.94
E	Kawhitsu	0.0659	-3.58	3.68
E	Korapuki	0.223	-3.41	3.86
E	Ruammahuanui	0.0259	-3.67	3.69
W	Mauihaha	0.875	-3.7	5.77
W	Taranga	0.598	-3.98	5.22
W	Ohinau	0.558	-3.96	5.3
W	Kawhitsu	0.513	-4.1	5.1
W	Korapuki	0.351	-4.23	4.94
W	Ruammahuanui	0.81	-3.8	5.43
Elevation	Mauihaha	-0.167	-1.16	0.857
Elevation	Taranga	-0.509	-1.48	0.254
Elevation	Ohinau	-0.334	-2.02	0.889
Elevation	Kawhitsu	-0.0875	-1.01	0.885
Elevation	Korapuki	-0.936	-2.81	0.0974
Elevation	Ruammahuanui	0.0951	-0.204	0.407
Slope*N	Mauihaha	-0.971	-7.8	6.05
Slope*N	Taranga	-1.3	-8.02	5.78
Slope*N	Ohinau	-1.11	-7.91	6.02
Slope*N	Kawhitsu	-0.91	-7.68	6.18

Appendix S3 continued

Parameter	Island	Median	5% CI	95% CI
Slope*N	Korapuki	-1.2	-7.98	5.87
Slope*N	Ruammahuanui	-1.14	-7.93	5.88
Slope*S	Mauitaha	-1.08	-7.7	5.73
Slope*S	Taranga	-1.03	-7.57	5.84
Slope*S	Ohinau	-1.13	-7.72	5.74
Slope*S	Kawhitu	-1.24	-7.82	5.66
Slope*S	Korapuki	-1.06	-7.65	5.8
Slope*S	Ruammahuanui	-1.03	-7.61	5.8
Slope*E	Mauitaha	-1.22	-6.48	4.12
Slope*E	Taranga	-0.76	-5.92	4.61
Slope*E	Ohinau	-0.907	-6.1	4.4
Slope*E	Kawhitu	-0.716	-5.87	4.66
Slope*E	Korapuki	-0.992	-6.18	4.36
Slope*E	Ruammahuanui	-1.3	-6.47	4.01
Slope*W	Mauitaha	-0.906	-7.44	5.82
Slope*W	Taranga	-1.01	-7.48	5.77
Slope*W	Ohinau	-0.921	-7.43	5.86
Slope*W	Kawhitu	-1.14	-7.65	5.64
Slope*W	Korapuki	-0.767	-7.27	5.99
Slope*W	Ruammahuanui	-0.672	-7.19	6.04