

## SUPPLEMENTARY MATERIAL

### Factors affecting the spatial distribution and breeding habitat of an insular cliff-nesting raptor community

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**Table S1.** Mean ( $\pm$ SD) nearest neighbour distances (in km) of cliff-nesting raptors and the common raven in Teno, Tenerife, Canary Islands (Np = *Neophron percnopterus*, Bb = *Buteo buteo*, Ph = *Pandion haliaetus*, Ft = *Falco tinnunculus*, Fp = *Falco peregrinus*, Cc = *Corvus corax*).

Sp	Np	Bb	Ph	Ft	Fp	Cc
<i>N. percnopterus</i>	0.83 $\pm$ 0.42	1.44 $\pm$ 0.73	3.26 $\pm$ 3.27	0.28 $\pm$ 0.18	0.81 $\pm$ 0.31	1.99 $\pm$ 3.02
<i>B. buteo</i>	2.51 $\pm$ 1.42	1.12 $\pm$ 0.56	6.88 $\pm$ 3.11	0.48 $\pm$ 0.41	2.13 $\pm$ 1.25	5.17 $\pm$ 3.35
<i>P. haliaetus</i>	0.95 $\pm$ 0.39	2.32 $\pm$ 0.36	1.48 $\pm$ 1.29	0.36 $\pm$ 0.23	0.56 $\pm$ 0.30	0.96 $\pm$ 0.24
<i>F. tinnunculus</i>	1.85 $\pm$ 1.47	1.17 $\pm$ 0.78	5.47 $\pm$ 3.68	0.41 $\pm$ 0.21	1.80 $\pm$ 1.26	3.59 $\pm$ 3.39
<i>F. peregrinus</i>	1.09 $\pm$ 0.92	1.45 $\pm$ 0.85	4.18 $\pm$ 3.67	0.22 $\pm$ 0.17	1.95 $\pm$ 0.56	2.24 $\pm$ 3.13
<i>C. corax</i>	0.64 $\pm$ 0.64	1.58 $\pm$ 0.68	2.62 $\pm$ 2.08	0.33 $\pm$ 0.17	0.78 $\pm$ 0.20	1.34 $\pm$ 0.55

**Table S2.** Results of the pairwise permutation tests ( $n = 9999$ ) of the different variables employed to describe habitat feature of nesting sites of cliff-nesting raptors and the common raven in Teno, Tenerife, Canary Islands.

### Cliff height

Comparison	W	P value	P adjust
<i>Buteo buteo</i> - <i>Corvus corax</i>	0.260	0.798	0.887
<i>Buteo buteo</i> - <i>Falco peregrinus</i>	-2.662	0.006	0.028
<i>Buteo buteo</i> - <i>Falco tinnunculus</i>	2.231	0.025	0.062
<i>Buteo buteo</i> - <i>Neophron percnopterus</i>	-0.086	0.933	0.933
<i>Corvus corax</i> - <i>Falco peregrinus</i>	-1.974	0.049	0.098
<i>Corvus corax</i> - <i>Falco tinnunculus</i>	1.022	0.086	0.143
<i>Corvus corax</i> - <i>Neophron percnopterus</i>	-0.449	0.689	0.861
<i>Falco peregrinus</i> - <i>Falco tinnunculus</i>	4.215	0.004	0.028
<i>Falco peregrinus</i> - <i>Neophron percnopterus</i>	2.258	0.019	0.062
<i>Falco tinnunculus</i> - <i>Neophron percnopterus</i>	-1.693	0.114	0.163

### Altitude

Comparison	W	P value	P adjust
<i>Buteo buteo</i> - <i>Corvus corax</i>	1.353	0.181	0.452
<i>Buteo buteo</i> - <i>Falco peregrinus</i>	2.199	0.026	0.110
<i>Buteo buteo</i> - <i>Falco tinnunculus</i>	3.312	0.001	0.009
<i>Buteo buteo</i> - <i>Neophron percnopterus</i>	2.096	0.033	0.110
<i>Corvus corax</i> - <i>Falco peregrinus</i>	1.024	0.318	0.635
<i>Corvus corax</i> - <i>Falco tinnunculus</i>	0.518	0.611	0.775
<i>Corvus corax</i> - <i>Neophron percnopterus</i>	0.493	0.635	0.775
<i>Falco peregrinus</i> - <i>Falco tinnunculus</i>	-0.278	0.775	0.775
<i>Falco peregrinus</i> - <i>Neophron percnopterus</i>	-0.748	0.462	0.770
<i>Falco tinnunculus</i> - <i>Neophron percnopterus</i>	-0.286	0.774	0.775

### Distance to the nearest house

Comparison	W	P value	P adjust
<i>Buteo buteo</i> - <i>Corvus corax</i>	-4.065	0.000	0.000
<i>Buteo buteo</i> - <i>Falco peregrinus</i>	-4.520	0.000	0.000
<i>Buteo buteo</i> - <i>Falco tinnunculus</i>	-0.988	0.329	0.412
<i>Buteo buteo</i> - <i>Neophron percnopterus</i>	-4.741	0.000	0.000
<i>Corvus corax</i> - <i>Falco peregrinus</i>	-0.793	0.441	0.490
<i>Corvus corax</i> - <i>Falco tinnunculus</i>	2.842	0.007	0.012
<i>Corvus corax</i> - <i>Neophron percnopterus</i>	0.294	0.785	0.785
<i>Falco peregrinus</i> - <i>Falco tinnunculus</i>	4.331	0.000	0.000
<i>Falco peregrinus</i> - <i>Neophron percnopterus</i>	1.313	0.197	0.281
<i>Falco tinnunculus</i> - <i>Neophron percnopterus</i>	-3.357	0.002	0.003

### Distance to the nearest road

Comparison	W	P value	P adjust
<i>Buteo buteo</i> - <i>Corvus corax</i>	-4.972	0.000	0.000
<i>Buteo buteo</i> - <i>Falco peregrinus</i>	-3.918	0.000	0.000
<i>Buteo buteo</i> - <i>Falco tinnunculus</i>	-1.662	0.097	0.139
<i>Buteo buteo</i> - <i>Neophron percnopterus</i>	-4.505	0.000	0.000
<i>Corvus corax</i> - <i>Falco peregrinus</i>	0.467	0.665	0.665
<i>Corvus corax</i> - <i>Falco tinnunculus</i>	3.773	0.001	0.002
<i>Corvus corax</i> - <i>Neophron percnopterus</i>	1.222	0.226	0.282
<i>Falco peregrinus</i> - <i>Falco tinnunculus</i>	3.266	0.002	0.003
<i>Falco peregrinus</i> - <i>Neophron percnopterus</i>	0.485	0.635	0.665
<i>Falco tinnunculus</i> - <i>Neophron percnopterus</i>	-3.184	0.002	0.004

### Steepness

Comparison	W	P value	P adjust
<i>Buteo buteo</i> - <i>Corvus corax</i>	-3.737	0.000	0.000
<i>Buteo buteo</i> - <i>Falco peregrinus</i>	-3.515	0.000	0.000
<i>Buteo buteo</i> - <i>Falco tinnunculus</i>	1.235	0.217	0.271
<i>Buteo buteo</i> - <i>Neophron percnopterus</i>	-3.060	0.002	0.003
<i>Corvus corax</i> - <i>Falco peregrinus</i>	0.519	0.622	0.622
<i>Corvus corax</i> - <i>Falco tinnunculus</i>	3.752	0.000	0.000
<i>Corvus corax</i> - <i>Neophron percnopterus</i>	1.421	0.162	0.231
<i>Falco peregrinus</i> - <i>Falco tinnunculus</i>	3.710	0.000	0.000
<i>Falco peregrinus</i> - <i>Neophron percnopterus</i>	0.942	0.356	0.395
<i>Falco tinnunculus</i> - <i>Neophron percnopterus</i>	-3.505	0.000	0.000

### Habitat diversity (Shannon Index)

Comparison	W	P value	P adjust
<i>Buteo buteo</i> - <i>Corvus corax</i>	0.390	0.706	0.883
<i>Buteo buteo</i> - <i>Falco peregrinus</i>	-0.203	0.852	0.947
<i>Buteo buteo</i> - <i>Falco tinnunculus</i>	0.938	0.351	0.827
<i>Buteo buteo</i> - <i>Neophron percnopterus</i>	1.248	0.207	0.827
<i>Corvus corax</i> - <i>Falco peregrinus</i>	-0.530	0.603	0.861
<i>Corvus corax</i> - <i>Falco tinnunculus</i>	0.060	0.954	0.954
<i>Corvus corax</i> - <i>Neophron percnopterus</i>	0.587	0.564	0.861
<i>Falco peregrinus</i> - <i>Falco tinnunculus</i>	0.822	0.413	0.827
<i>Falco peregrinus</i> - <i>Neophron percnopterus</i>	1.165	0.256	0.827
<i>Falco tinnunculus</i> - <i>Neophron percnopterus</i>	0.962	0.342	0.827

**Table S3.** Candidate models for estimating the probability of occupation of nest sites and using the nearest neighbour distances (NND) as explanatory variables.

**Common Buzzard**

Model	Degree of freedom	logLik	AICc	Delta	Weight
23	3	-93.08	192.26	0.00	0.45
2	2	-94.32	192.68	0.42	0.37
123	4	-92.96	194.08	1.82	0.18

Term codes: common buzzard = 1; Raven = 2; common kestrel = 3

**Common Kestrel**

Model	Degree of freedom	logLik	AICc	Delta	Weight
(Null)	1	-129.15	260.31	0.00	0.43
1	2	-128.79	261.63	1.32	0.22
2	2	-128.96	261.96	1.65	0.19
3	2	-129.10	262.24	1.93	0.16

Term codes: common buzzard = 1; raven = 2; Barbary falcon = 3

**Barbary Falcon**

Model	Degree of freedom	logLik	AICc	Delta	Weight
24	3	-38.82	83.75	0.00	0.21
234	4	-37.86	83.89	0.14	0.20
14	3	-39.01	84.11	0.36	0.18
4	2	-40.08	84.20	0.45	0.17
124	4	-38.29	84.74	0.99	0.13
1234	5	-37.40	85.05	1.30	0.11

Term codes: common buzzard = 1; raven = 2; Barbary falcon = 3; common kestrel = 4

**Common Raven**

Model	Degree of freedom	logLik	AICc	Delta	Weight
13	3	-32.18	70.46	0.00	0.24
23	3	-32.25	70.59	0.13	0.22
123	4	-31.62	71.41	0.95	0.15
3	2	-33.78	71.60	1.14	0.14
134	4	-31.78	71.71	1.25	0.13
234	4	-31.80	71.75	1.29	0.13

Term codes: common buzzard = 1; raven = 2; Barbary falcon = 3; common kestrel = 4

**Table S4.** Results of the multimodel inference models for abundance of territories and number of species of cliff-nesting raptors and common raven in Teno, Tenerife, Canary Islands. In bold variables that represent maximum importance (sum of weight of evidence [w] = 1).

**Abundance (all species)**

Model-averaged coefficients	Importance	Estimate	Std. Error	Lower CI	Upper CI
(Intercept)	-	-0.5164	0.3626	-1.233	0.201
<b>Land covered by forests</b>	1	-0.0117	0.0050	-0.022	-0.002
<b>Land covered by grasses</b>	1	-0.0196	0.0096	-0.039	-0.001
<b>Mean altitude</b>	1	-0.0008	0.0003	-0.001	0.000
<b>Mean Slope</b>	1	0.0278	0.0075	0.013	0.043
<b>Habitat diversity</b>	1	1.5268	0.6258	0.290	2.764
<b>Land covered by shrubs</b>	1	0.0102	0.0041	0.002	0.018
Land covered by urbanized areas	0.64	-0.0204	0.0121	-0.044	0.004
Mean Curvature	0.40	0.8853	0.7152	-0.529	2.300

**Abundance (excluding Egyptian vulture)**

Model-averaged coefficients	Importance	Estimate	Std. Error	Lower CI	Upper CI
(Intercept)	-	-0.5512	0.3667	-1.276	0.174
<b>Land covered by forests</b>	1	-0.0107	0.0051	-0.021	-0.001
Land covered by grasses	0.83	-0.0176	0.0096	-0.036	0.001
<b>Mean altitude</b>	1	-0.0007	0.0003	-0.001	0.000
<b>Mean Slope</b>	1	0.0263	0.0078	0.011	0.042
<b>Habitat diversity</b>	1	1.4635	0.6450	0.189	2.738
<b>Land covered by shrubs</b>	1	0.0097	0.0042	0.001	0.018
Land covered by urbanized areas	0.54	-0.0185	0.0120	-0.042	0.005
Mean Curvature	0.17	0.6199	0.7590	-0.881	2.121

**Abundance (excluding common kestrel)**

Model-averaged coefficients	Importance	Estimate	Std. Error	Lower CI	Upper CI
(Intercept)	-	-3.5885	0.8277	-5.221	-1.956
Land covered by forests	0.12	0.0041	0.0057	-0.007	0.015
Land covered by grasses	0.51	-0.0286	0.0225	-0.073	0.016
Mean altitude	0.53	-0.0009	0.0006	-0.002	0.000
<b>Mean Slope</b>	1	0.0832	0.0143	0.055	0.111
<b>Habitat diversity</b>	1	2.5987	1.0460	0.532	4.665
Land covered by shrubs	0.19	0.0047	0.0064	-0.008	0.017
Land covered by urbanized areas	0.93	-0.0952	0.0571	-0.208	0.018
Mean Curvature	0.06	0.7201	1.1458	-1.546	2.986

**Abundance (excluding Egyptian vulture and common kestrel)**

Model-averaged coefficients	Importance	Estimate	Std. Error	Lower CI	Upper CI
(Intercept)	-	-4.5668	0.8443	-6.234	-2.900
Land covered by forests	0.41	0.0089	0.0058	-0.003	0.020
Land covered by grasses	0.12	-0.0210	0.0220	-0.064	0.022
Mean altitude	0.21	-0.0007	0.0007	-0.002	0.001
<b>Mean Slope</b>	1	0.0904	0.0164	0.058	0.123
<b>Habitat diversity</b>	1	3.3370	1.0932	1.176	5.498
Land covered by shrubs	0	-	-	-	-
Land covered by urbanized areas	0.77	-0.0817	0.0565	-0.193	0.030
Mean Curvature	0.08	-0.7915	1.3752	-3.511	1.928

**Abundance of common kestrel**

Model-averaged coefficients	Importance	Estimate	Std. Error	Lower CI	Upper CI
(Intercept)	-	-0.3148	0.4162	-1.136	0.506
<b>Land covered by forests</b>	1	-0.0281	0.0077	-0.043	-0.013
Land covered by grasses	0.89	-0.0203	0.0108	-0.042	0.001
Mean altitude	0.67	-0.0005	0.0003	-0.001	0.000
Mean Slope	0.66	0.0165	0.0095	-0.002	0.035
Habitat diversity	0.69	1.5006	0.7583	0.002	2.999
Land covered by shrubs	0.86	0.0115	0.0055	0.001	0.022
Land covered by urbanized areas	0.28	-0.0151	0.0123	-0.039	0.009
Mean Curvature	0.22	1.1253	0.9158	-0.686	2.936

**Richness (all species)**

Model-averaged coefficients	Importance	Estimate	Std. Error	Lower CI	Upper CI
(Intercept)	-	-0.4765	0.2663	-1.003	0.050
Land covered by forests	0.15	-0.0036	0.0038	-0.011	0.004
Land covered by grasses	0.11	-0.0063	0.0102	-0.026	0.014
<b>Mean altitude</b>	1	-0.0010	0.0003	-0.002	0.000
<b>Mean Slope</b>	1	0.0428	0.0073	0.028	0.057
Habitat diversity	0.10	0.1976	0.5662	-0.922	1.317
Land covered by shrubs	0.14	0.0031	0.0033	-0.004	0.010
Land covered by urbanized areas	0.13	-0.0096	0.0126	-0.035	0.015
Mean Curvature	0.10	0.4458	0.8935	-1.321	2.212

**Richness (excluding Egyptian vulture)**

Model-averaged coefficients	Importance	Estimate	Std. Error	Lower CI	Upper CI
(Intercept)	-	-0.4329	0.2781	-0.9824	0.1166
Land covered by forests	0.14	-0.0003	0.0017	-0.0101	0.0051
Land covered by grasses	0.13	-0.0008	0.0042	-0.0261	0.0142
<b>Mean altitude</b>	1	-0.0010	0.0003	-0.0016	-0.0004
<b>Mean Slope</b>	1	0.0394	0.0074	0.0249	0.0539
Habitat diversity	0.14	0.0508	0.2483	-0.7670	1.5194
Land covered by shrubs	0.13	0.0003	0.0014	-0.0046	0.0089
Land covered by urbanized areas	0.15	-0.0014	0.0059	-0.0344	0.0154
Mean Curvature	0	-	-	-	-

**Table S5.** Candidate models for abundance of territories and number of species of cliff-nesting raptors and raven in Teno, Tenerife, Canary Islands.

**Abundance (all species)**

Model	Degree of freedom	logLik	AICc	Delta	Weight
1235678	8	-209.13	435.33	0	0.38
12345678	9	-208.36	436.08	0.75	0.26
123567	7	-210.82	436.46	1.14	0.22
1234567	8	-210.11	437.29	1.96	0.14
Null	1	-268.10	538.24	-	-

Term codes:

Land covered by forests = 1; Land covered by grasses = 2; Mean altitude = 3; Mean curvature = 4; Mean Slope = 5; Habitat diversity = 6; Land covered by shrubs = 7; Land covered by urbanized areas = 8

**Abundance (excluding Egyptian vulture)**

Model	Degree of freedom	logLik	AICc	Delta	Weight
1235678	8	-206.33	429.74	0	0.38
123567	7	-207.73	430.30	0.56	0.28
13567	6	-209.34	431.29	1.55	0.17
12345678	9	-206.00	431.36	1.62	0.17
Null	1	-133.49	269.02	-	-

Term codes:

Land covered by forests = 1; Land covered by grasses = 2; Mean altitude = 3; Mean curvature = 4; Mean Slope = 5; Habitat diversity = 6; Land covered by shrubs = 7; Land covered by urbanized areas = 8

**Abundance (excluding common kestrel)**

Model	Degree of freedom	logLik	AICc	Delta	Weight
568	4	-98.71	205.70	0	0.15
23568	6	-96.56	205.73	0.03	0.15
3568	5	-97.69	205.82	0.12	0.14
2568	5	-97.83	206.10	0.40	0.12
56	3	-100.54	207.26	1.55	0.07
13568	6	-97.36	207.34	1.64	0.07
5678	5	-98.47	207.37	1.67	0.07
25678	6	-97.43	207.49	1.78	0.06
235678	7	-96.35	207.53	1.82	0.06
234568	7	-96.37	207.56	1.86	0.06
123568	7	-96.39	207.61	1.91	0.06
Null	1	-133.49	269.02	-	-

Term codes:

Land covered by forests = 1; Land covered by grasses = 2; Mean altitude = 3; Mean curvature = 4; Mean Slope = 5; Habitat diversity = 6; Land covered by shrubs = 7; Land covered by urbanized areas = 8

**Abundance (excluding Egyptian vulture and common kestrel)**

Model	Degree of freedom	logLik	AICc	Delta	Weight
567	4	-86.54	181.37	0	0.20
1567	5	-85.70	181.84	0.48	0.16
156	4	-86.99	182.26	0.90	0.13
2567	5	-85.98	182.40	1.04	0.12
13567	6	-84.90	182.41	1.04	0.12
56	3	-88.29	182.74	1.38	0.10
3567	5	-86.29	183.02	1.65	0.09
4567	5	-86.37	183.17	1.80	0.08
Null	1	-114.01	230.06	-	-

Term codes:

Land covered by forests = 1; Land covered by grasses = 2; Mean altitude = 3; Mean curvature = 4; Mean Slope = 5; Habitat diversity = 6; Land covered by urbanized areas = 7

**Abundance of common kestrel**

Model	Degree of freedom	logLik	AICc	Delta	Weight
12367	6	-180.31	373.24	0	0.09
123678	7	-179.21	373.25	0.01	0.09
123567	7	-179.21	373.26	0.01	0.09
12567	6	-180.59	373.79	0.55	0.07
125	4	-182.82	373.94	0.70	0.06
1234678	8	-178.43	373.94	0.70	0.06
123467	7	-179.57	373.96	0.72	0.06
1235678	8	-178.45	373.98	0.74	0.06
1234567	8	-178.54	374.15	0.91	0.06
12357	6	-180.83	374.27	1.03	0.05
1257	5	-181.98	374.39	1.15	0.05
12345678	9	-177.73	374.82	1.58	0.04
1267	5	-182.20	374.83	1.59	0.04
15	3	-184.33	374.83	1.59	0.04
1357	5	-182.24	374.92	1.68	0.04
1235	5	-182.32	375.07	1.83	0.04
157	4	-183.43	375.15	1.91	0.03
125678	7	-180.19	375.22	1.97	0.03
Null	1	-222.49	447.02	-	-

Term codes:

Land covered by forests = 1; Land covered by grasses = 2; Mean altitude = 3; Mean curvature = 4; Mean Slope = 5; Habitat diversity = 6; Land covered by shrubs = 7; Land covered by urbanized areas = 8



### Richness (all species)

Model	Degree of freedom	logLik	AICc	Delta	Weight
35	3	-162.34	330.86	0	0.27
135	4	-161.89	332.07	1.21	0.15
357	4	-161.92	332.13	1.28	0.14
358	4	-162.02	332.33	1.47	0.13
235	4	-162.14	332.57	1.71	0.11
345	4	-162.22	332.73	1.87	0.10
356	4	-162.28	332.85	2.00	0.10
Null	1	-188.09	378.22	-	-

Term codes:

Land covered by forests = 1; Land covered by grasses = 2; Mean altitude = 3; Mean curvature = 4; Mean Slope = 5; Habitat diversity = 6; Land covered by shrubs = 7; Land covered by urbanized areas = 8

### Richness (excluding Egyptian vulture)

Model	Degree of freedom	logLik	AICc	Delta	Weight
34	3	-160.43	327.04	0	0.31
347	4	-160.12	328.53	1.49	0.15
134	4	-160.21	328.71	1.67	0.14
345	4	-160.22	328.73	1.69	0.14
346	4	-160.24	328.77	1.73	0.13
234	4	-160.25	328.79	1.75	0.13
Null	1	-181.83	365.69	-	-

Term codes:

Land covered by forests = 1; Land covered by grasses = 2; Mean altitude = 3; Mean Slope = 4; Habitat diversity = 5; Land covered by shrubs = 6; Land covered by urbanized areas = 7

**Table S6.** Moran's index values for the response variable and the residuals of the averaged models of abundance and number of species (richness) of cliff-nesting raptors and the common raven in Teno, Tenerife, Canary Islands per 1x1 km cell.

	Response variable		Residuals	
	Moran's I	P-value	Moran's I	P-value
Abundance (all species)	0.0506	<0.001	0.0025	0.239
Abundance (excluding Egyptian Vulture)	0.0439	<0.001	0.0001	0.383
Abundance (excluding common kestrel)	0.0095	0.040	0.0453	<0.001
Abundance (excluding Egyptian vulture and common Kestrel)	-0.0045	0.749	0.0542	<0.001
Kestrel abundance	0.0543	<0.001	0.0175	0.003
Richness (all species)	0.0497	<0.001	-0.0134	0.4359
Richness (excluding Egyptian vulture)	0.0403	<0.001	-0.0100	0.7143