

Ecography

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Oliver, T. H., Brereton, t. and Roy, D. B. 2012. Population resilience to an extreme drought is influenced by habitat area and fragmentation in the local landscape. – *Ecography* 35: xxx–xxx.

Supplementary material

Appendix 1

This appendix contains the following:

Table A1. Regressions of population count on year comparing a linear model with a quadratic model

Table A2. Association between woodland area and fragmentation (5km and 10km radius) and butterfly population sensitivity

Table A3. Association between woodland area and fragmentation (5km and 10km radius) and butterfly population recovery

Figure A1. Spatial correlogram for residuals of the population *sensitivity* model fitted to woodland cover data at 0.5km radius.

Figure A2. Spatial correlogram for residuals of the population *recovery* model fitted to woodland cover data at 0.5km radius.

Figure A3. Spatial correlogram for residuals of the population *sensitivity* model fitted to woodland cover data at 2km radius.

Figure A4. Spatial correlograms for residuals of the population *recovery* model fitted to woodland cover data at 2km radius.

Table A1. Regressions of population count on year comparing a linear model (model 1) with a quadratic model (model 2; only the coefficient for the quadratic term is shown). There was little evidence for curvature in population trajectories in the six years prior to the drought event. Significant p values ($p < 0.05$) are highlighted in bold font.

Site	Model 1				Model 2			
	Year coefficient	SE	t	p	Year ² coefficient	SE	t	p
1	89.69	47.78	1.88	0.134	50.68	23.89	2.12	0.124
2	86.51	26.94	3.21	0.033	3.75	21.19	0.18	0.871
3	78.74	8.84	8.91	0.001	-5.41	6.25	-0.87	0.450
4	77.29	24.15	3.20	0.033	28.34	9.83	2.88	0.063
5	66.43	17.34	3.83	0.019	2.73	13.62	0.20	0.854
6	65.37	41.50	1.58	0.190	-19.11	30.90	-0.62	0.580
7	64.06	45.34	1.41	0.231	39.38	27.72	1.42	0.251
8	61.69	39.88	1.55	0.197	36.73	23.32	1.57	0.213
9	51.09	11.60	4.40	0.012	-5.70	8.56	-0.67	0.553
10	48.43	36.55	1.32	0.256	36.00	20.08	1.79	0.171
11	44.83	51.91	0.86	0.437	-3.68	40.99	-0.09	0.934
12	41.20	21.76	1.89	0.131	-26.84	7.48	-3.59	0.037
13	39.31	61.18	0.64	0.555	-32.93	44.47	-0.74	0.513
14	36.63	9.06	4.04	0.016	6.79	5.99	1.13	0.340
15	35.43	37.29	0.95	0.396	-35.14	21.39	-1.64	0.199
16	32.34	15.35	2.11	0.103	-5.20	11.76	-0.44	0.689
17	31.31	11.08	2.83	0.048	-6.95	7.79	-0.89	0.438
18	29.03	13.95	2.08	0.106	-7.93	10.04	-0.79	0.487
19	27.14	6.05	4.49	0.011	1.95	4.65	0.42	0.704
20	26.51	5.53	4.80	0.009	-5.96	2.69	-2.22	0.113
21	24.17	17.15	1.41	0.231	-20.57	6.53	-3.15	0.051
22	23.54	9.75	2.42	0.073	-2.89	7.52	-0.38	0.726
23	23.26	22.76	1.02	0.365	-25.75	10.13	-2.54	0.085
24	23.14	12.32	1.88	0.133	-13.52	5.82	-2.32	0.103
25	22.83	10.25	2.23	0.090	1.23	8.07	0.15	0.888
26	21.74	7.16	3.04	0.039	-3.93	5.19	-0.76	0.504
27	21.71	45.23	0.48	0.656	-20.34	33.78	-0.60	0.590
28	20.37	6.67	3.05	0.038	-4.13	4.70	-0.88	0.445
29	18.06	4.41	4.10	0.015	0.88	3.45	0.25	0.816
30	17.31	16.64	1.04	0.357	7.86	12.35	0.64	0.570
31	16.54	2.36	7.02	0.002	0.54	1.84	0.29	0.789
32	14.49	12.59	1.15	0.314	-16.32	3.20	-5.11	0.015
33	14.26	8.83	1.61	0.182	-5.23	6.29	-0.83	0.467
34	14.17	21.80	0.65	0.551	-5.82	16.90	-0.34	0.753
35	13.29	4.99	2.66	0.056	-1.98	3.77	-0.53	0.636
36	12.40	7.79	1.59	0.186	-8.80	3.47	-2.54	0.085
37	11.89	23.15	0.51	0.635	-13.05	16.68	-0.78	0.491
38	10.57	12.61	0.84	0.449	2.68	9.85	0.27	0.803
39	9.17	3.78	2.42	0.073	3.45	2.23	1.54	0.221

Site	Model 1				Model 2			
	Year coefficient	SE	t	p	Year2 coefficient	SE	t	p
40	9.14	9.93	0.92	0.409	6.54	6.88	0.95	0.412
41	8.14	7.94	1.02	0.363	-7.14	4.74	-1.51	0.229
42	5.94	3.05	1.95	0.123	1.27	2.30	0.55	0.620
43	5.89	1.59	3.70	0.021	0.14	1.25	0.11	0.917
44	4.57	3.36	1.36	0.246	-0.09	2.66	-0.03	0.975
45	4.57	9.74	0.47	0.663	-7.41	6.40	-1.16	0.331
46	4.11	5.55	0.74	0.499	-6.46	2.30	-2.81	0.067
47	3.86	7.31	0.53	0.625	1.84	5.68	0.32	0.767
48	3.77	15.86	0.24	0.824	-19.64	5.36	-3.67	0.035
49	2.69	2.65	1.01	0.368	-2.73	1.38	-1.98	0.142
50	2.20	2.50	0.88	0.428	-2.61	1.28	-2.04	0.134
51	1.97	11.28	0.17	0.870	-5.36	8.37	-0.64	0.568
52	1.94	1.89	1.03	0.362	0.21	1.49	0.14	0.895
53	1.74	4.36	0.40	0.710	0.68	3.43	0.20	0.856
54	1.63	10.53	0.15	0.885	-5.82	7.61	-0.76	0.500
55	1.57	39.91	0.04	0.970	-47.52	15.58	-3.05	0.055
56	0.77	2.06	0.37	0.727	-0.02	1.63	-0.01	0.992
57	0.63	7.65	0.08	0.938	-8.52	3.52	-2.42	0.094
58	-0.23	8.73	-0.03	0.980	-6.52	5.79	-1.13	0.342
59	-0.69	2.18	-0.31	0.769	-1.75	1.40	-1.25	0.299
60	-0.77	11.42	-0.07	0.949	-9.84	7.01	-1.40	0.255
61	-1.43	7.15	-0.20	0.851	0.86	5.63	0.15	0.889
62	-1.94	0.95	-2.04	0.111	-0.46	0.70	-0.66	0.556
63	-7.11	44.84	-0.16	0.882	-49.23	21.19	-2.32	0.103
64	-7.43	6.77	-1.10	0.334	-4.88	4.55	-1.07	0.363
65	-8.14	5.02	-1.62	0.180	5.50	2.38	2.31	0.104
66	-9.20	11.70	-0.79	0.476	-8.59	7.81	-1.10	0.352
67	-9.80	19.70	-0.50	0.645	-18.80	11.17	-1.68	0.191
68	-10.89	6.34	-1.72	0.161	-2.68	4.77	-0.56	0.614
69	-11.26	8.74	-1.29	0.267	-7.21	5.51	-1.31	0.282
70	-13.94	55.01	-0.25	0.812	-6.00	43.35	-0.14	0.899
71	-14.94	7.39	-2.02	0.113	-3.18	5.54	-0.57	0.607
72	-17.51	85.49	-0.20	0.848	14.04	67.10	0.21	0.848
73	-17.77	57.93	-0.31	0.774	28.95	42.64	0.68	0.546
74	-22.49	104.20	-0.22	0.840	3.41	82.36	0.04	0.970
75	-24.49	8.54	-2.87	0.046	-5.79	5.86	-0.99	0.397
76	-25.11	7.62	-3.29	0.030	-8.59	3.43	-2.51	0.087
77	-40.06	35.18	-1.14	0.318	-16.91	26.05	-0.65	0.562
78	-55.00	49.76	-1.11	0.331	-61.00	17.54	-3.48	0.040
79	-72.80	70.74	-1.03	0.362	-70.48	38.37	-1.84	0.164
80	-74.57	95.40	-0.78	0.478	-92.88	53.04	-1.75	0.178

Table A2. Association between woodland area and fragmentation (5km and 10km radius) and the sensitivity of *Aphantopus hyperantus* populations to an extreme drought event. Positive coefficients indicate increased sensitivity to the drought event (i.e. greater magnitude of population decline).

BW Variable	Spatial scale (radius)	n	Coefficient	SE	t	p
Area	5km	79	-12.43	4.50	-2.76	0.007
Area	10km	79	-0.53	1.05	-0.50	0.617
Number of patches	5km	79	0.37	0.50	0.75	0.454
Number of patches	10km	79	0.08	0.09	0.90	0.370
Patch 'edginess'	5km	79	304.9	233.9	1.30	0.197
Patch 'edginess'	10km	79	344.6	418.1	0.82	0.413

Table A3. Association between woodland area and fragmentation (5km and 10km radius) and the recovery of *Aphantopus hyperantus* populations to an extreme drought event. Positive coefficients indicate more rapid recovery from the drought event.

BW Variable	Spatial scale (radius)	n	Coefficient	SE	t	p
Area	5km	66	0.80	0.81	0.99	0.327
Area	10km	66	0.23	0.25	0.93	0.357
Number of patches	5km	66	-0.07	0.09	-0.81	0.419
Number of patches	10km	66	-0.03	0.04	-0.83	0.412
Patch 'edginess'	5km	66	-65.3	78.3	-0.83	0.407
Patch 'edginess'	10km	66	-44.1	104.1	-0.42	0.673

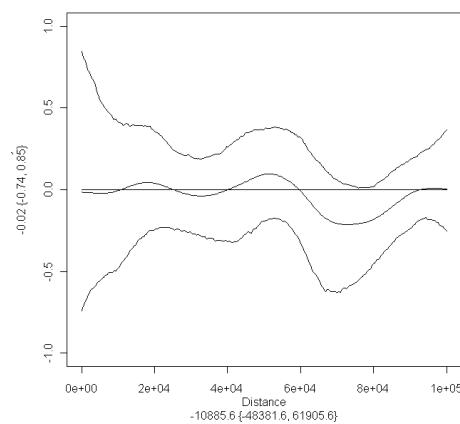


Figure A1. Spatial correlogram for residuals of the population sensitivity model fitted to woodland cover data at 0.5km radius. The outer lines show 95% confidence intervals. Hence, significant spatial autocorrelation is indicated if these lines cross the horizontal line of zero correlation.

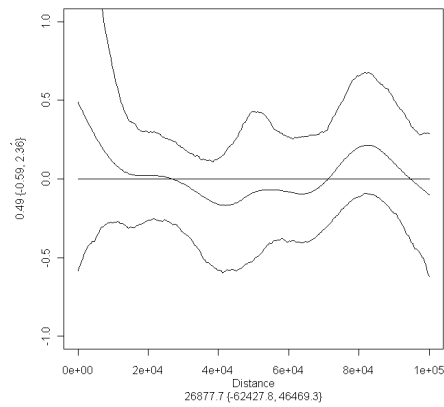


Figure A2. Spatial correlogram for residuals of the population recovery model fitted to woodland cover data at 0.5km radius. The outer lines show 95% confidence intervals. Hence, significant spatial autocorrelation is indicated if these lines cross the horizontal line of zero correlation.

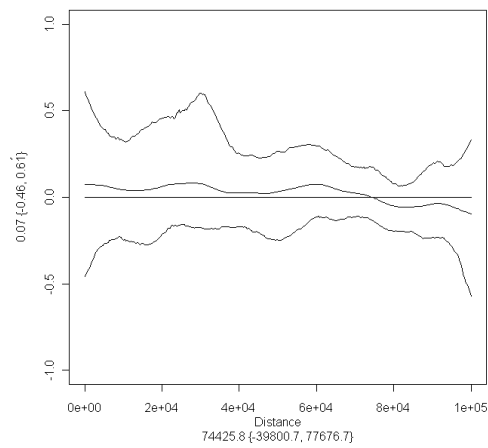


Figure A3. Spatial correlogram for residuals of the population sensitivity model fitted to woodland cover data at 2km radius. The outer lines show 95% confidence intervals. Hence, significant spatial autocorrelation is indicated if these lines cross the horizontal line of zero correlation.

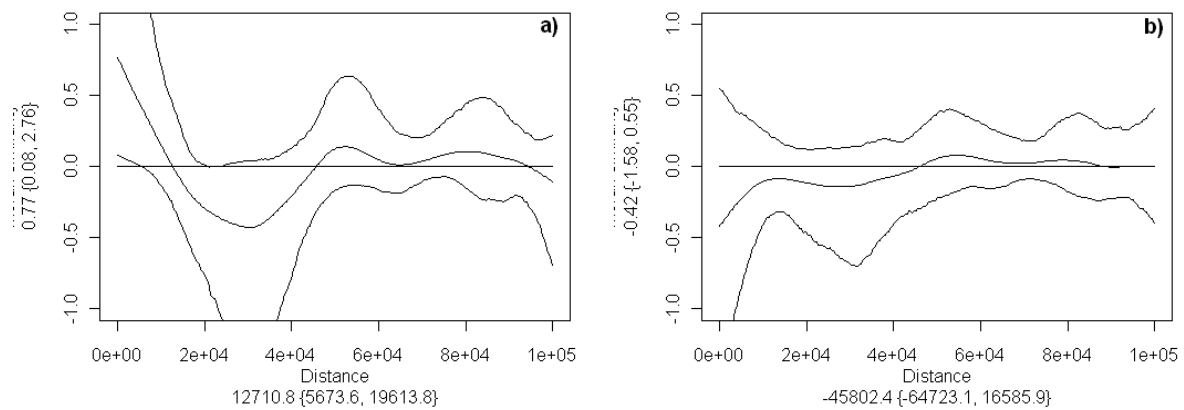


Figure A4. Spatial correlograms for residuals of the population recovery models fitted to woodland cover data at 2km radius. Panel a shows the statistical model without 10km neighbourhood as a random effect, panel b shows the statistical model including this term. The outer lines show 95% confidence intervals. Hence, significant spatial autocorrelation is indicated if these lines cross the horizontal line of zero correlation.