

Ecography

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Gillingham, P. K., Palmer, S. C. F., Huntley, B., Kunin, W. E., Chipperfield, J. D. and Thomas, C. D. 2011. The relative importance of climate and habitat in determining the distributions of species at different spatial scales: a case study with ground beetles in Great Britain. – *Ecography* 34: xxx–xxx.

Supplementary material

Appendix 1

Table A1. Summary of relationships between best models for each type of variable and species presence/absence for the Glen Finglas field site. The best model as selected by AIC is highlighted in bold. Species marked with † are those for which the residuals remained spatially autocorrelated.

Species	Latitude	Habitat	AIC	AUC	Temperature	AIC	AUC
<i>Carabus glabratus</i>	56.04	-AG -M -RG -OSH	51.6	0.83	NULL	63.1	0.50
<i>Patrobus assimilis</i>	55.27	+M +DSH +E	31.9	0.76	-MAMEAN +ANMEAN	30.6	0.87
<i>Pterostichus adstrictus</i>	54.60	-RG -AG +B -NL	43.7	0.78	-ANMIN	39.6	0.84
<i>Pterostichus aethiops</i>	54.04	-RG	40.7	0.61	NULL	41.9	0.50
<i>Carabus problematicus</i>	54.01	-Br +M	54.9	0.59	-ANMIN	47.7	0.80 †
<i>Pterostichus niger</i>	53.85	-RG +E	27.8	0.82	+E	29.4	0.62
<i>Pterostichus nigrita</i> agg.	53.55	-E -RG	21.5	0.87	-E	21.8	0.78
<i>Cychrus caraboides</i>	53.51	NULL	51.1	0.50	+ANMAX -ANMIN +E	45.5	0.81
<i>Carabus arvensis</i>	53.44	+AG +RG +E +M	39.3	0.94	+ANMAX +E	58.1	0.78
<i>Loricera pilicornis</i>	53.40	+M +OSH	30.2	0.82	-ANMAX	32.0	0.73
<i>Pterostichus diligens</i>	53.27	+NL	63.1	0.63	-ANMAX	61.4	0.66 †
<i>Pterostichus madidus</i>	53.20	+E -OSH	60.0	0.70	+ANMEAN - MAMEAN + E	40.7	0.93
<i>Agonum fuliginosum</i>	53.17	+OSH +B +Br -NL	58.9	0.78	-ANMEAN	63.4	0.66
<i>Carabus violaceus</i>	53.14	-Br	57.4	0.54	-ANMIN +E	49.9	0.80
<i>Pterostichus melanarius</i>	53.13	-NL	34.8	0.75	+ANMAX -ANMIN +ANMEAN	24.3	0.94
<i>Amara lunicollis</i>	53.10	-OSH -M -NL	50.4	0.77	+ANMEAN -ANMIN -E +MAMEAN	10	1
<i>Abax parallelepipedu s</i>	52.81	+E	33.8	0.62	+E +ANMAX	29.3	0.85
<i>Poecilus versicolor</i>	52.75	+AG +RG -NL	48.1	0.85	+ANMEAN -ANMIN	26.8	0.97

Variable Codes: E = Log trap effort, OSH = Open Shrub Heath, DSH = Dense Shrub Heath, RG = Rough Grass, AG= Acid Grass, Br = Bracken, B = Bog, M=Montane, NL = Number of land cover categories in buffered area, ANMIN = Annual absolute minimum temperature, ANMAX = Annual absolute maximum temperature, ANMEAN = Annual mean temperature, MAMEAN = Mean temperature during trapping season (Start of May to end of August).

NULL indicates instances where no variables were retained in the best model as selected by AIC

AUC: Area under receiver operating characteristic curve

Table A2. Summary of relationships between best models for each type of variable and species presence/absence for the Lake Vyrnwy field site. The best model as selected by AIC is highlighted in bold. Species marked with † are those for which the residuals remained spatially autocorrelated.

Species	Latitude	Habitat	AIC	AUC	Temperature	AIC	AUC
<i>Carabus glabratus</i>	56.04	-AG – OSH	47.1	0.74 †	-ANMAX	50.1	0.71
<i>Carabus problematicus</i>	54.01	+NL	38.3	0.70	+ANMIN	36.5	0.67
<i>Pterostichus niger</i>	53.85	NULL	57.1	0.50	NULL	57.1	0.50
<i>Pterostichus nigrita</i> agg.	53.55	-E +DSH	36.8	0.76	-E	37.5	0.70
<i>Cychrus caraboides</i>	53.51	+E	55.6	0.62	-ANMEAN	53.6	0.71
<i>Carabus arvensis</i>	53.44	NULL	57.4	0.50	+ANMEAN	51.7	0.79
<i>Notiophilus biguttatus</i>	53.43	-AG +OSH	42.9	0.69	-ANMIN	41.7	0.73
<i>Pterostichus diligens</i>	53.27	-IBG	43.6	0.56	NULL	44.7	0.50
<i>Pterostichus madidus</i>	53.20	+NL –OSH	54.7	0.69	+ANMEAN	54.7	0.74
<i>Agonum fuliginosum</i>	53.17	NULL	55.8	0.50	-ANMEAN	54.8	0.63
<i>Carabus violaceus</i>	53.14	-AG +E +NL	34.2	0.86	-MAMEAN +E	37.3	0.77
<i>Amara lunicollis</i>	53.10	NULL	39.1	0.50	+ANMAX	38.2	0.68
<i>Abax parallelepipedus</i>	52.81	NULL	39.1	0.50	-ANMAX +ANMEAN +E	25.1	0.94
<i>Poecilus versicolor</i>	52.75	+AG –NL	34.7	0.87	+MAMEAN +ANMAX +E	34.9	0.86

Variable Codes: E = Log trap effort, OSH = Open Shrub Heath, DSH = Dense Shrub Heath, AG= Acid Grass, IBG=Inland Bare Ground, CW=Coniferous Woodland, NL = Number of land cover categories in buffered area, ANMIN = Annual absolute minimum temperature, ANMAX = Annual absolute maximum temperature, ANMEAN = Annual mean temperature, MAMEAN = Mean temperature during trapping season (Start of May to end of August).

NULL indicates instances where no variables were retained in the best model as selected by AIC

AUC: Area under receiver operating characteristic curve

Table A3. Summary of relationships between best models for each type of variable and species presence/absence for the Peak District field site. The best model as selected by AIC is highlighted in bold.

Species	Latitude	Habitat	AIC	AUC	Temperature	AIC	AUC
<i>Pterostichus adstrictus</i>	54.60	-AG	43.9	0.58	NULL	45.2	0.50
<i>Carabus problematicus</i>	54.01	-AG	41.4	0.62	-ANMIN -ANMEAN +MAMEAN	26.6	0.94
<i>Pterostichus nigrita</i> agg.	53.55	NULL	46.4	0.50	NULL	46.4	0.50
<i>Cychrus caraboides</i>	53.51	+E -DSH	27.4	0.89	+E	29.01	0.85
<i>Nebria brevicollis</i>	53.42	+DSH +OSH	22.7	0.86	+ANMAX	29.6	0.73
<i>Pterostichus diligens</i>	53.27	-DSH -OSH +NL -IBG	37.6	0.85	+ANMIN	45.0	0.65
<i>Agonum fuliginosum</i>	53.17	+E -DSH	28.9	0.75	-ANMAX +E	26.5	0.81
<i>Carabus violaceus</i>	53.14	+E -DSH	24.0	0.84	+E	24.6	0.71
<i>Amara lunicollis</i>	53.10	-DSH +IBG	33.6	0.67	+ANMAX	31.2	0.78

Variable codes: E=Log trap effort, RG=Rough Grass, DSH=Dense Shrub Heath, IG=Improved Grass, AG=Acid Grass, OSH=Open Shrub Heath, IBG=Inland Bare Ground, NL=Number of land use categories in buffered area, ANMIN=Annual absolute minimum temperature, ANMEAN=Annual mean temperature, ANMAX=Annual absolute maximum temperature, MAMEAN=Mean temperature of trapping period (Beginning of May to end of August).

AUC: Area under receiver operating characteristic curve

Table A4. Summary of relationships between best models for each type of variable and species presence/absence for Great Britain. The best model as selected by AIC is highlighted in bold.

Species	Mean Latitude	Habitat*	AIC	AUC	Best temperature model	AIC	AUC
<i>Carabus glabratus</i>	56.04	7	708	0.89	+ANMEAN –ANMAX - ANMIN	795	0.86
<i>Patrobus assimilis</i>	55.27	8	965	0.85	-ANMEAN +ANMIN	1038	0.83
<i>Pterostichus adstrictus</i>	54.60	8	879	0.81	-ANMEAN + ANMAX	939	0.79
<i>Pterostichus aethiops</i>	54.04	4	438	0.84	-ANMAX	499	0.73
<i>Carabus problematicus</i>	54.01	6	2198	0.70	–ANMAX – ANMIN + ANMEAN	2289	0.65
<i>Pterostichus niger</i>	53.85	7	2822	0.58	+ANMIN	2849	0.51
<i>Pterostichus nigrita</i> agg.	53.55	7	2746	0.61	- ANMAX +ANMIN	2803	0.55
<i>Cychrus caraboides</i>	53.51	3	2303	0.61	NULL	2344	0.50
<i>Carabus arvensis</i>	53.44	6	742	0.76	-ANMAX	813	0.63
<i>Notiophilus biguttatus</i>	53.43	5	2963	0.60	+ANMAX –ANMEAN	2981	0.57
<i>Nebria brevicollis</i>	53.42	9	3007	0.59	ANMEAN	3043	0.53
<i>Loricera pilicornis</i>	53.40	6	2959	0.58	+ANMAX	2989	0.53
<i>Pterostichus diligens</i>	53.27	5	2308	0.65	NULL	2405	0.50
<i>Pterostichus madidus</i>	53.20	8	2954	0.63	+ANMAX	3007	0.59
<i>Agonum fuliginosum</i>	53.17	10	2545	0.63	+ANMAX –ANMEAN	2594	0.58
<i>Carabus violaceus</i>	53.14	6	2287	0.63	+ANMAX –ANMIN	2335	0.55
<i>Pterostichus melanarius</i>	53.13	10	2585	0.64	+ANMAX	2636	0.61
<i>Amara lunicollis</i>	53.10	7	1615	0.66	+ANMEAN	1671	0.53
<i>Abax parallelepipedu s</i>	52.81	10	2441	0.72	+ANMAX +ANMIN - ANMEAN	2574	0.63
<i>Poecilus versicolor</i>	52.75	8	1377	0.68	+ANMEAN	1432	0.58

* Number of land cover categories retained in the model, maximum is 15

AUC: Area under receiver operating characteristic curve

Variable codes: ANMIN: Mean temperature of the coldest month; ANMAX: Mean temperature of the hottest month; ANMEAN: Mean annual mean temperature. All temperature variables were calculated over the period 1961-1990.