Ecography

E7683
Kharouba, H. M., McCune, J. L., Thuiller, W. and Huntley, B. 2012. BDo ecological differences between taxonomic groups influence the relationship between species' distributions and climate? A global meta-analysis using species distribution models. – Ecography 35: xxx–xxx.

Supplementary material

SUPPLEMENTARY MATERIAL

Appendix 1 Methodological attributes used to build SDMs for each study used in the analysis.

Appendix 2 Taxonomic attributes of studies used in the analysis.

Appendix 3 Full references for studies cited in Appendix 1 and 2.

Appendix 4 Attributes of studies that contained dispersal distances for species in our dataset.

Appendix 5 Full reference for studies cited in Appendix 4.

Appendix 6 Collinearity (Spearman r coefficients) between all continuous covariates (n=4317).

Appendix 7 Analysis of deviance table for the relationship between model accuracy, covariates and taxonomic group when studies that contributed more than half of the total number of species in one taxonomic group were removed.

Appendix 1. Methodological attributes used to build SDMs for each study used in the analysis. Presented are the model types, number of climatic variables used in the model, resolution (km^2) of the model, total spatial extent over which the model was built (km^2) and average absolute latitude of the region for which the model was built.

Study	Model type (s)	Variables	Resolution (km^2)	Spatial extent (km^2)	Latitude (^{o})
Araújo et al. 2005	GAM	7	2500	$1.105x10^7$	47
Huntley et al. 2006	GAM, locally weighted regression	4	12227	$2.40x10^7$	0
Huntley et al. 2008	locally weighted regression	3	2500	$1.105x10^7$	47
Huntley et al. 2004	locally weighted regression	3	2500	$1.105x10^7$	47
Beale et al. 2008	ANN	3	2500	$6.04x10^6$	47
Thuiller et al. 2006	GAM	6	256	$3.02x10^7$	0
McPherson and Jetz 2007	autologistic regression	1-28	2975	$8.27x10^6$	47
Elith et al. 2006	Mars, gdm, maxent, brt, domain, bruito, GAM, GARP, GLM, bioclim, lives	11	1	$1.465 x10^7$	14
Heikkinen et al. 2007	GAM	3	100,1600	$3.381 x10^5$	64

Luoto et al. 2005	GAM	3	100	3.381×10^5	47
Parra and Monahan 2008	maxent	19	16	4.240×10^5	15
Phillips et al. 2006	GARP, maxent	13	30.25	19621904	15
Thuiller 2003	GLM, CART	7	2500	5222500	15
Freedman et al. 2009	maxent	7	1	475442	6
Guisan and Hofer 2003	GLM	12	1	4.10×10^4	47
Venier et al. 2004	logistic regression	10	25	8.0×10^5	15
Pearson et al. 2006	ANN, GARP, GAM, CGM	5	2.56	1.22×10^6	15
McPherson et al. 2004	logistic regression, discriminant	61	648	2.77×10^6	15
Thuiller et al. 2004	GAM	4	2500	6.525×10^6	15
Thuiller et al. 2003	GLM	7	2500	1.105×10^7	15

Appendix 2. Taxonomic attributes of studies used in the analysis. Presented are the total number of unique species used, the number of birds, herptiles, butterflies, mammals, and plants.

Study	Total number of species	Birds	Herptiles	Butterflies	Mammals	Plants
Araújo et al. 2005	1778	157	103	0	152	1366
Huntley et al. 2006	1457	1457	0	0	0	0
Huntley et al. 2008	214	214	0	0	0	0
Huntley et al. 2004	173	36	0	37	0	100
Beale et al. 2008	42	42	0	0	0	0
Thuiller et al. 2006	272	0	0	0	272	0
McPherson and Jetz 2007	176	176	0	0	0	0
Elith et al. 2006	30	0	0	0	0	30
Heikkinen et al. 2007	2	2	0	0	0	0
Luoto et al. 2005	79	0	0	79	0	0
Parra and Monahan 2008	57	0	0	0	57	0
Phillips et al. 2006	2	0	0	0	2	0
Thuiller 2003	2	0	0	0	0	2

Freedman et al. 2009	3	0	3	0	0	0
Guisan and Hofer 2003	8	0	8	0	0	0
Venier et al. 2004	10	10	0	0	0	0
Pearson et al. 2006	4	0	0	0	0	4
McPherson et al. 2004	5	5	0	0	0	0
Thuiller et al. 2004	1	0	0	0	0	1
Thuiller et al. 2003	2	0	0	0	0	2

Appendix 3. Full references for studies cited in Appendix 1 and 2.

Araújo, M. B. et al. 2005. Downscaling European species atlas distributions to a finer resolution: implications for conservation planning. - Global Ecol. Biogeogr. 14: 17-30.

Beale, C. M. et al. 2008. Opening the climate envelope reveals no macroscale associations with climate in European birds. - Proc. Natl. Acad. Sci. USA 105: 14908-14912.

Elith, J. et al. 2006. Novel methods improve prediction of species' distributions from occurrence data. - Ecography 29: 129-151.

Freedman, A.H. et al. 2009. Modeling the effects of anthropogenic habitat change on savanna snake invasions into African rainforest. - Conserv. Biol. 23: 81-92

Guisan, A. and Hofer, U. 2003. Predicting reptile distributions at the mesoscale: relation to climate and topography. - J. Biogeogr. 30: 1233-1243.

Heikkinen, R. K. et al. 2007. Biotic interactions improve prediction of boreal bird distributions at macro-scales. - Global Ecol. Biogeogr. 16: 754-763.

Huntley, B. et al. 2004. The performance of models relating species geographical distributions to climate is independent of trophic level. - Ecol. Lett. 7: 417-426.

Huntley, B. et al. 2006. Potential impacts of climatic change upon geographical distributions of birds. - Ibis 148: 8-28.

Huntley, B. et al. 2008. Potential impacts of climatic change on European breeding birds. - PLoS ONE 3: e1439.

Luoto, M. et al. 2005. Uncertainty of bioclimate envelope models based on the geographical distribution of species. - Global Ecol. Biogeogr. 14: 575-584.

McPherson, J. M. and Jetz, W. 2007. Effects of species' ecology on the accuracy of distribution models. - Ecography 30: 135-151.

McPherson, J. M. et al. 2004. The effects of species' range sizes on the accuracy of distribution models: ecological phenomenon or statistical artefact? - J. Appl. Ecol. 41: 811-823.

Parra, J. L. and Monahan, W. B. 2008. Variability in 20th century climate change reconstructions and its consequences for predicting geographic responses of California mammals. - Global Change Biol. 14: 2215-2231.

Pearson, R. G. et al. 2006. Model-based uncertainty in species range prediction. - J. Biogeogr. 33: 1704-1711.

Phillips, S. J. et al. 2006. Maximum entropy modeling of species geographic distributions. - Ecol. Model. 190: 231-259.

Thuiller, W. 2003. BIOMOD - optimizing predictions of species distributions and projecting potential future shifts under global change. - Global Change Biol. 9: 1353-1362.

Thuiller, W. et al. 2003. Generalized models vs. classification tree analysis: Predicting spatial distributions of plant species at different scales. - J. Veg. Sci. 14: 669-680.

Thuiller, W. et al. 2004. Effects of restricting environmental range of data to project current and future species distributions. - Ecography 27: 165-172.

Thuiller, W. et al. 2006. Vulnerability of African mammals to anthropogenic climate change under conservative land transformation assumptions. - Global Change Biol. 12: 424-440.

Venier, L. A. et al. 2004. Climate and satellite-derived land cover for predicting breeding bird distribution in the Great Lakes Basin. - J. Biogeogr. 31: 315-331.

Appendix 4. Attributes of studies that contained dispersal distances for species in our dataset.

Study	Taxonomic Group	Details
Bowman et al. 2002	mammals	Conducted a literature review to find maximum distance moved by adult mammals after translocation.
Cain et al. 1998	plants	Measured dispersal distance for *Asarum canadense* via direct observations of seed movement by ants; searched the literature for measured dispersal distances for other woodland herbs. Some of these were directly observed and others were based on measured fall rates of seeds combined with typical wind speeds.
Paradis et al. 1998	birds	Used survey data from the ringing scheme of the British Trust for Ornithology 1909-1994. Included only birds ringed and recovered during the breeding season (i.e. excluded migration distances). Estimated both natal and breeding dispersal distances.
Schneider 2003	butterflies	Compiled mean distances reported in mark-release-recapture studies.
Smith and Green 2005	amphibians	Compiled a list of the longest distances moved in both mark-recapture and displacement studies.
Sutherland et al. 2000	mammals and birds	Compiled data on natal dispersal distances from a literature search. Most data were based on incidental observations. Did not accept data from "likely migrants".

Appendix 5. Full references for studies cited in Appendix 4.

Bowman, J. et al. 2002. Dispersal distance of mammals is proportional to home range size. - Ecology 83: 2049-2055.

Cain, M. L. et al. 1998. Seed dispersal and the Holocene migration of woodland herbs. - Ecol. Monogr. 68: 325-347.

Paradis, E. et al. 1998. Patterns of natal and breeding dispersal in birds. - J. Animal Ecol. 67: 518-536.

Schneider, C. 2003. The influence of spatial scale on quantifying insect dispersal: an analysis of butterfly data. - Ecol. Entomol. 28: 252-256.

Smith, M. A. and Green, D. M. 2005. Dispersal and the metapopulation paradigm in amphibian ecology and conservation: are all amphibian populations metapopulations? - Ecography 28: 110-128.

Sutherland, G. D. et al. 2000. Scaling of natal dispersal distances in terrestrial birds and mammals. - Conserv. Ecol. 4: 44.

Appendix 6. Collinearity (Spearman r coefficients) between all continuous covariates (n=4317).

	latitude	area	resolution
area	-0.903		
resolution	-0.589	0.503	
variables	0.277	-0.290	-0.479

Appendix 7. Analysis of deviance table for the relationship between model accuracy, covariates and taxonomic group when studies that contributed more than half of the total number of species in one taxonomic group were removed. Presented are the differences in AIC and deviance between full and reduced models as well as the associated *p* value. The difference in degrees of freedom between full and reduced models was four for all comparisons and subsets. The full model includes number of variables, log(spatial extent), resolution and model type. When Huntley et al. 2006 is removed there are 2860 species from nineteen published studies, without Araújo et al. 2005 there are 2539 species from nineteen published studies and without Luoto et al. 2005 there are 4238 species from nineteen published studies.

Studies subset	Model for comparison	Model terms	ΔAIC	ΔDeviance	*p*
Without Huntley et al. 2006	Just intercept	+Taxonomic group	33.46	41.46	<0.0001
	Full model	+Taxonomic group	31.88	39.88	<0.0001
Without Araújo et al. 2005	Just intercept	+Taxonomic group	14.96	22.96	0.000129
	Full model*	+ Taxonomic group	15.18	23.18	0.000117
Without Luoto et al. 2005	Just intercept	+Taxonomic group	41.6	49.6	<0.0001
	Full model	+Taxonomic group	41.76	49.76	<0.0001

* Only includes spatial extent and resolution, none of the other covariates in the model led to estimation