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Supplementary material

Appendix 1

Table A1. Manual setting of model parameters in biomod2, adopted to prevent data overfitting based on a critical visual inspection of species-environment curves.

SPECIES	METHOD	SETTING
Water pipit	Random Forest	no. trees = 30; node size = 15
Anthus spinoletta	GBM	no. trees = 100; interaction depth = 1
Tawny pipit	ANN	no. of cross-validation = 2
Anthus campestris	Random Forest	no. trees = 100; node size = 20
	MARS	penalty = 3; threshold = 0.01
Northern wheatear	ANN	no. of cross-validation = 3
Oenanthe oenanthe		
Linnet	MARS	nk = 20; threshold = 0.01
Linaria cannabina	GBM	no. trees = 20
	ANN	no. of cross-validation = 3

Table A2. Summary of MaxEnt model performances ("rm" means regularization multiplier).

	rm	full AUC	Mean AUC	Var AUC	Mean AUC diff	w AIC	n° par	AUC bin1	AUC bin2
Water pipit	0.5	0.991	0.950	0.003	0.044	0.998	14	0.988	0.912
Tawny pipit	0.5	0.894	0.862	0.000	0.038	0.819	18	0.851	0.873
Northern wheatear	0.5	0.881	0.871	0.001	0.031	0.510	16	0.850	0.893
Linnet	0.5	0.853	0.815	0.001	0.052	0.708	18	0.792	0.839

Table A3. Criteria adopted for the evaluation of coherence between supposed (derived from the comparison between climatic niche of a species and climate of the study area) effects and relationships depicted by the models. “Null” effect means occurrence probability constant at a given value, irrespectively of variation in the predictor. Symbols used in tables for the effect are also reported (within brackets). Only effects eventually supposed based on the comparison between climatic niche at the national scale and climate within the study area are reported.

supposed effect	**coherent relationships (model)**
null (0)	null (0), slightly negative ((-)), slightly positive ((+))
negative (-)	negative (-), slightly negative ((-))
positive (+)	positive (+), slightly positive ((+))
quadratic (+/-)	quadratic (+/-), quadratic/negative (+/--), quadratic positive (++/-)
null/negative (0/-)	null (0), negative (-), slightly negative ((-))
quadratic/negative (+/--)	quadratic (+/-), quadratic/negative (+/--), slightly negative (-)

Table A4. Variable importance (percentage contribution and permutation importance, both expressed as percentages) for predictors included in the final MaxEnt models. Legend for land-cover variables: x2: discontinuous urban fabric, x18: pastures, x20: complex cultivation patterns, x23: broad-leaved forest, x24: coniferous forests, x25: mixed forests, x26: natural grassland, x27: moors and heathland, x29: transitional woodland-shrub, x31: bar rocks, x32: sparsely vegetated areas, 41: water bodies.

	bio1	**bio4**	**bio18**	**bio19**	**slope**	**solar_radiation**	**x2**	**x18**	**x20**	**x23**	**x24**	**x25**	**x26**	**x27**	**x29**	**x31**	**x32**	**x41**
water pipit	42.6/78.97		9.0/7.1	9.6/5.4	4.4/1.5	15.4/0.29				9.5/6.3			1.8/0.0			2.7/0.2	4.9/0.3	
tawny pipit	7.3/9.4		1.7/5.0	4.7/7.2	8.9/8.2		0.5/1.6	0.3/1.3			1.8/0.9	0.7/1.1	40.1/3.7		6.5/13.8			0.5/1.0
northern wheatear	10.7/17.9	0.7/9.8	1.9/0.4	5.4/11.1	7.7/20.2				0.3/1.1	11.8/20.8			57.7/16.5		2.3/2.2	0.7/0.1	0.7/0	
linnet	10.6/19.8	0.6/7.2	1.6/1.5	2.2/2.5	9.7/22.0				0.5/1.1	7.1/10.4			61.5/24.0	2.8/2.8	1.7/3.7			

Figure A1. Distribution of point counts within the study areas.

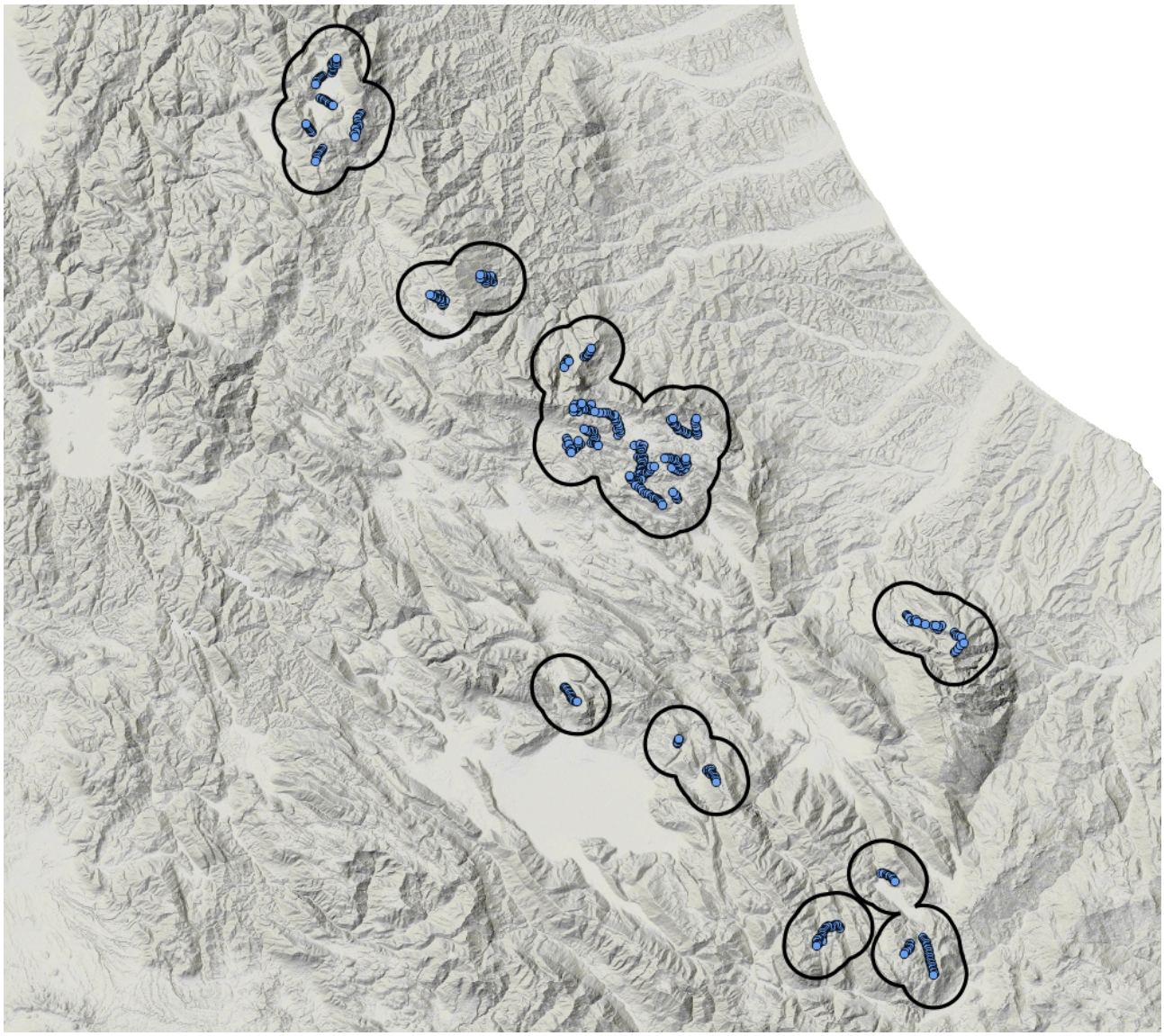
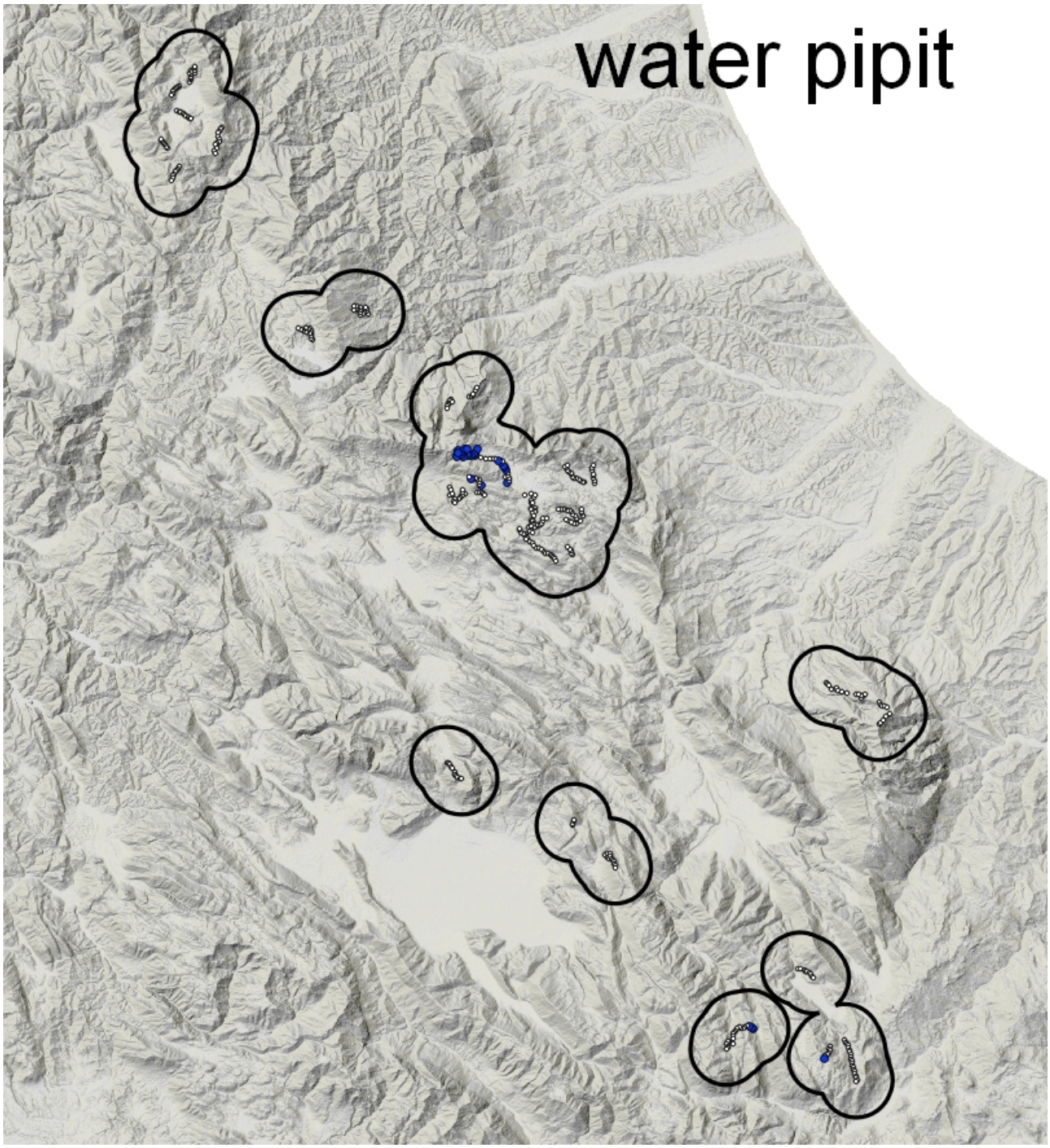
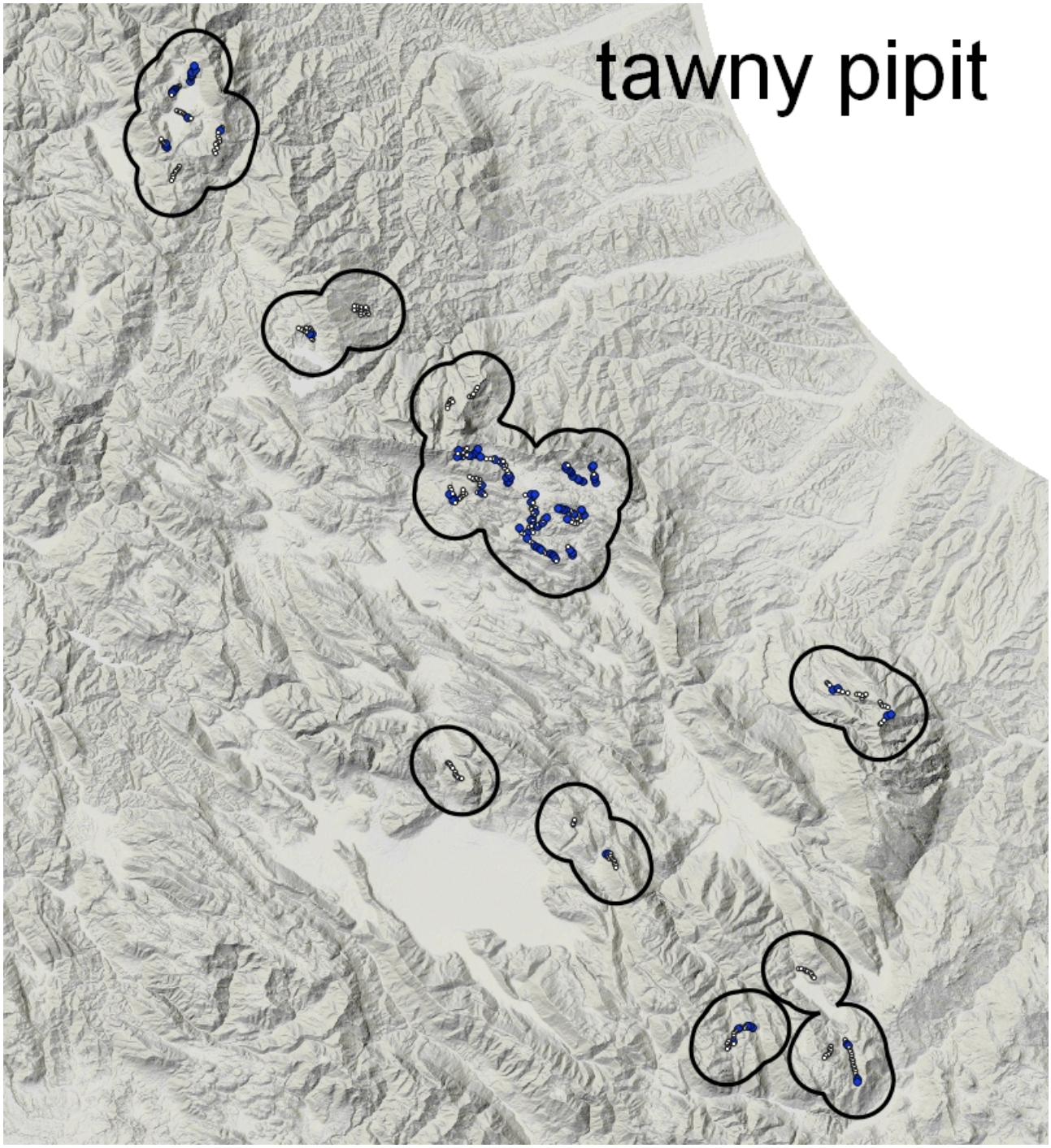
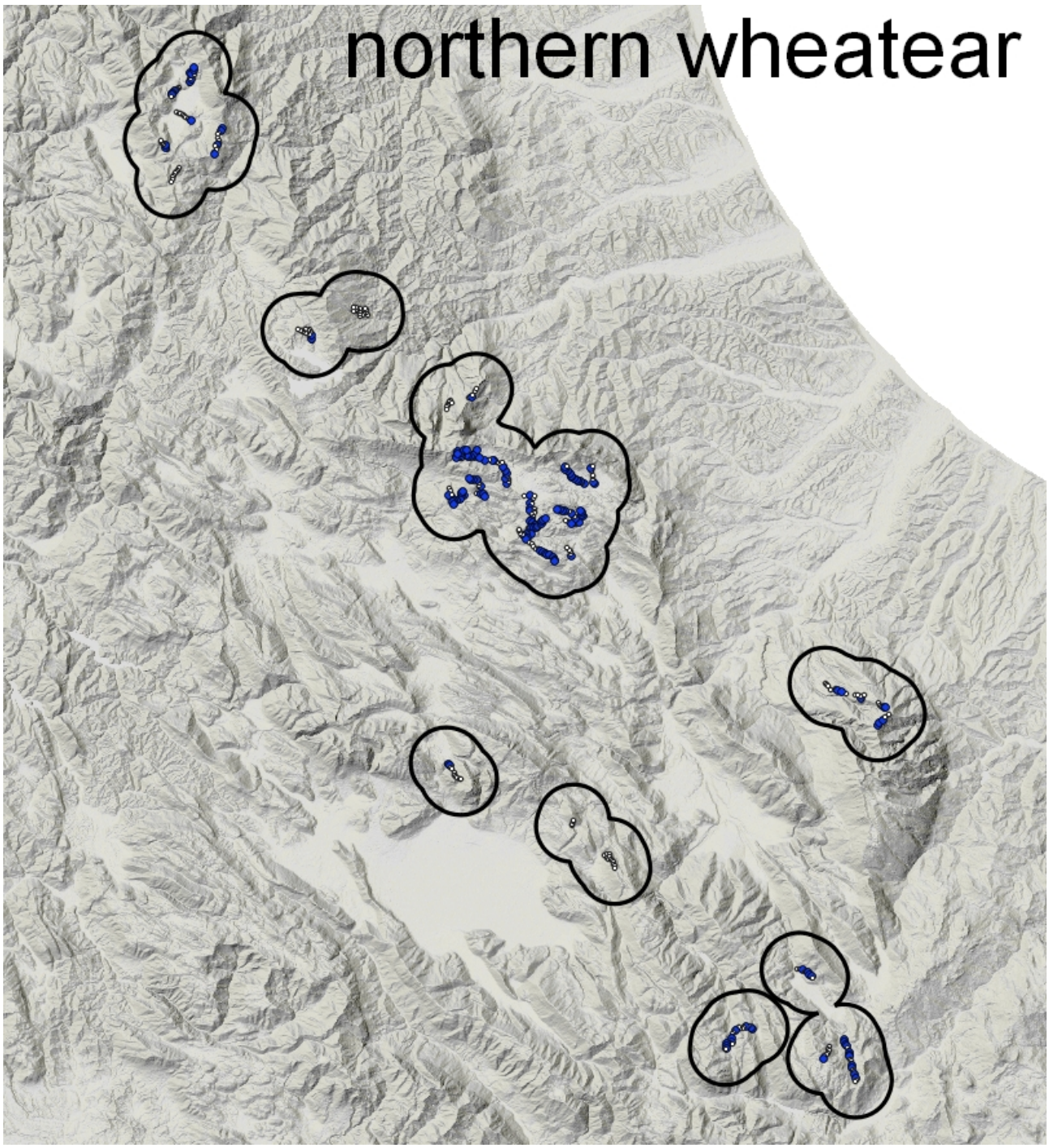


Figure A2. Distribution of occurrence records (blu dots) and absence sites (white dots) used for the analyses at the territory level.




tawny pipit


northern wheatear

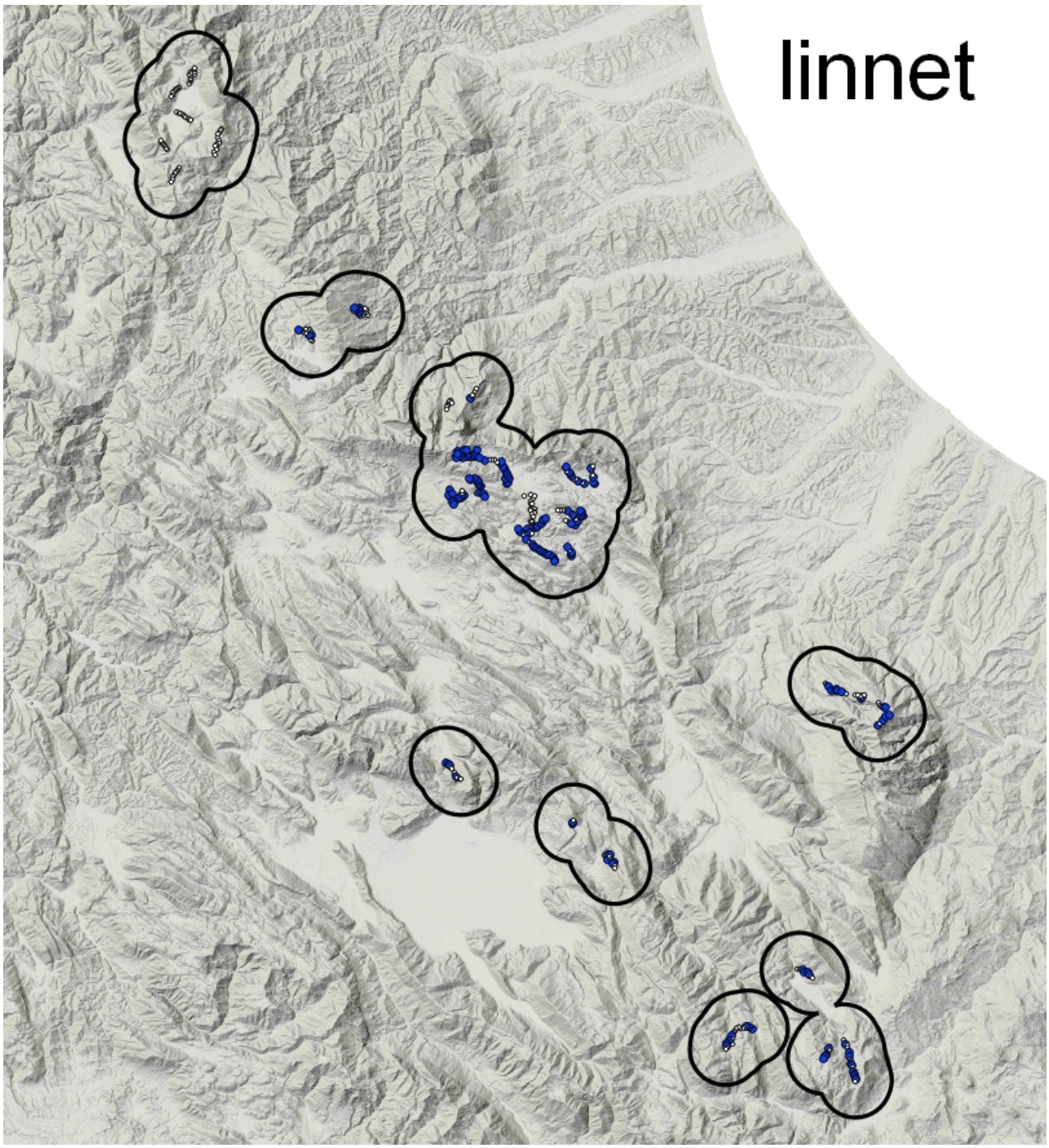
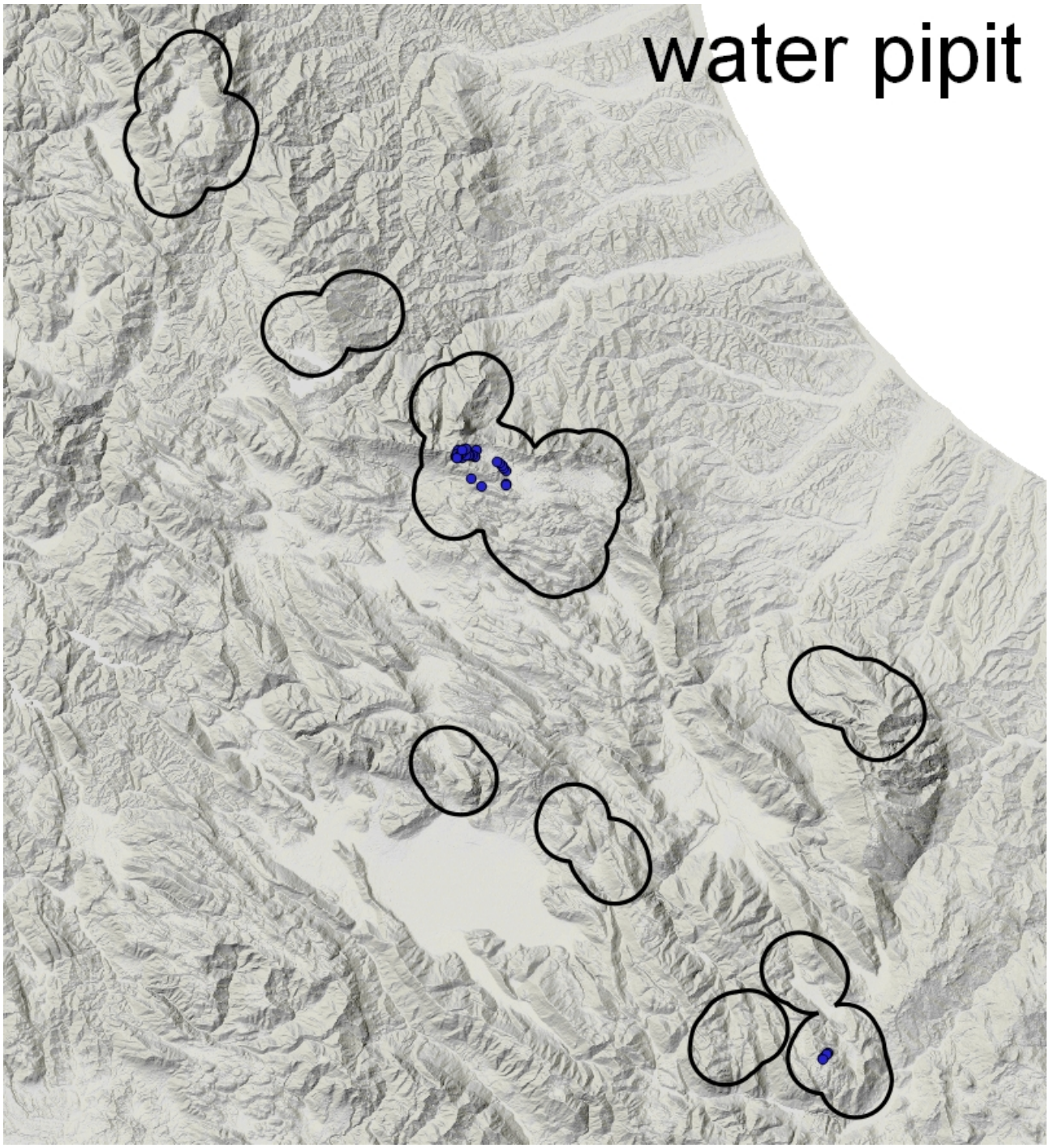
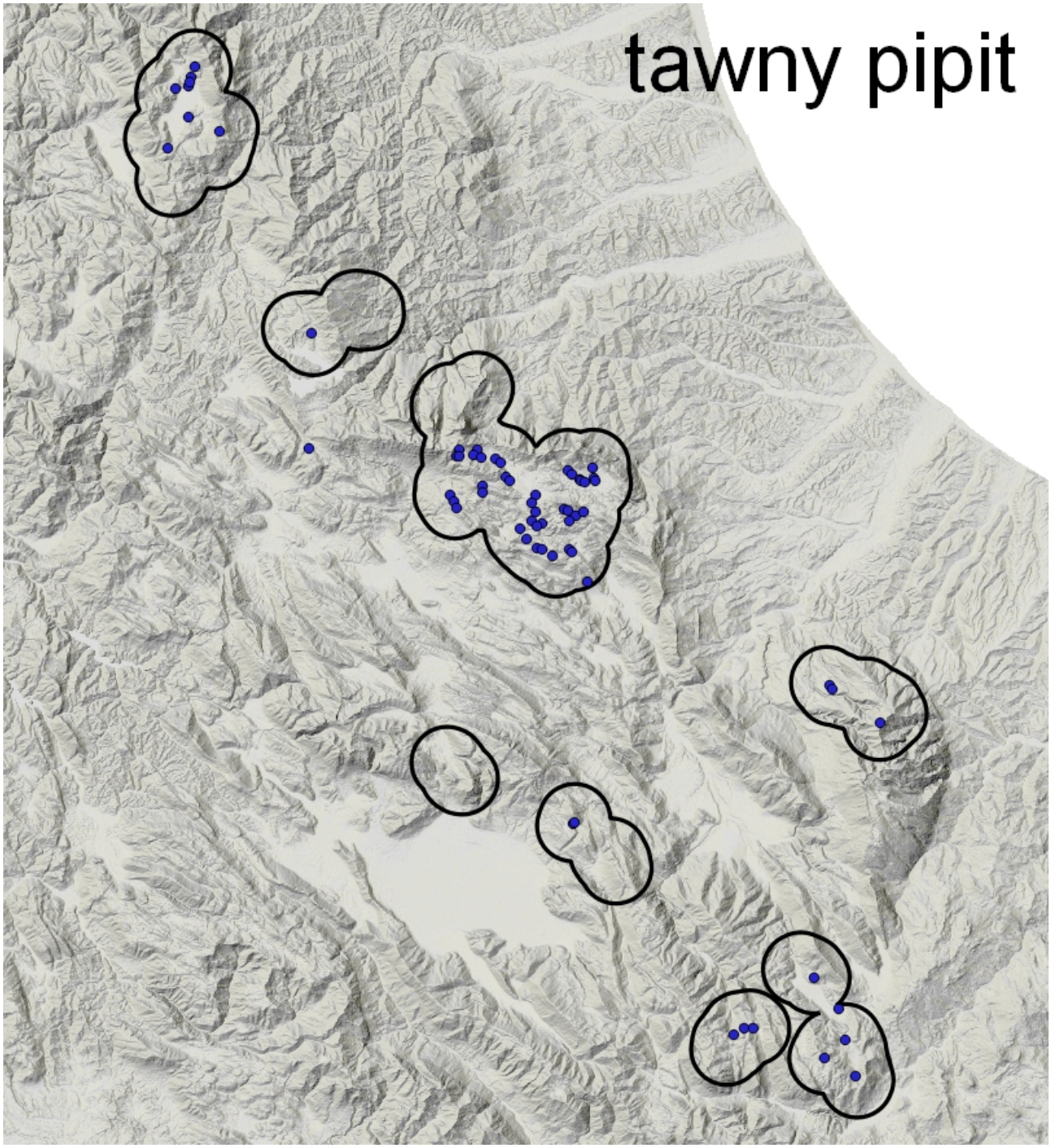
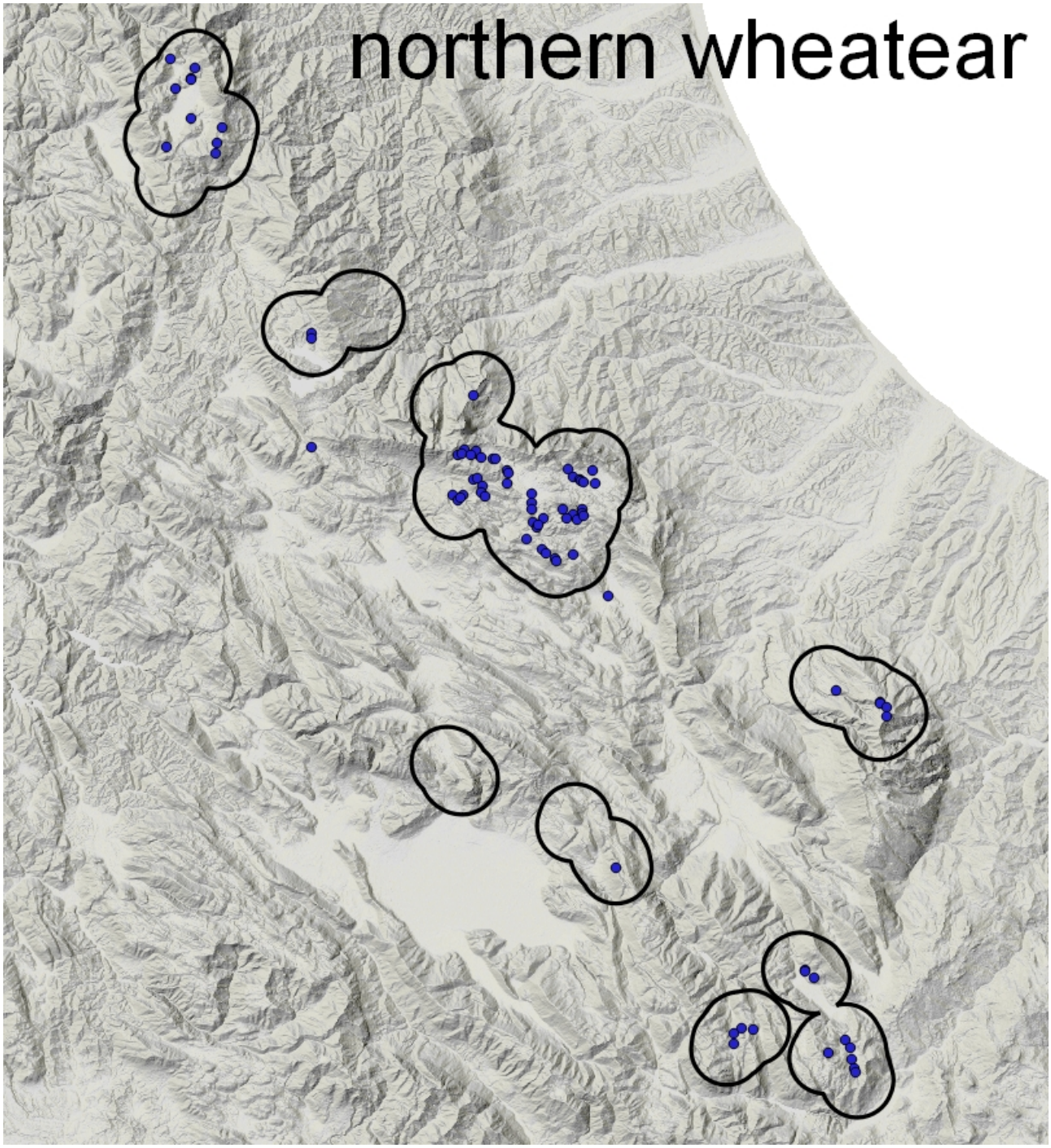

linnet

Figure A3. Distribution of occurrence records used for the analysis at the landscape level.




tawny pipit


northern wheatear

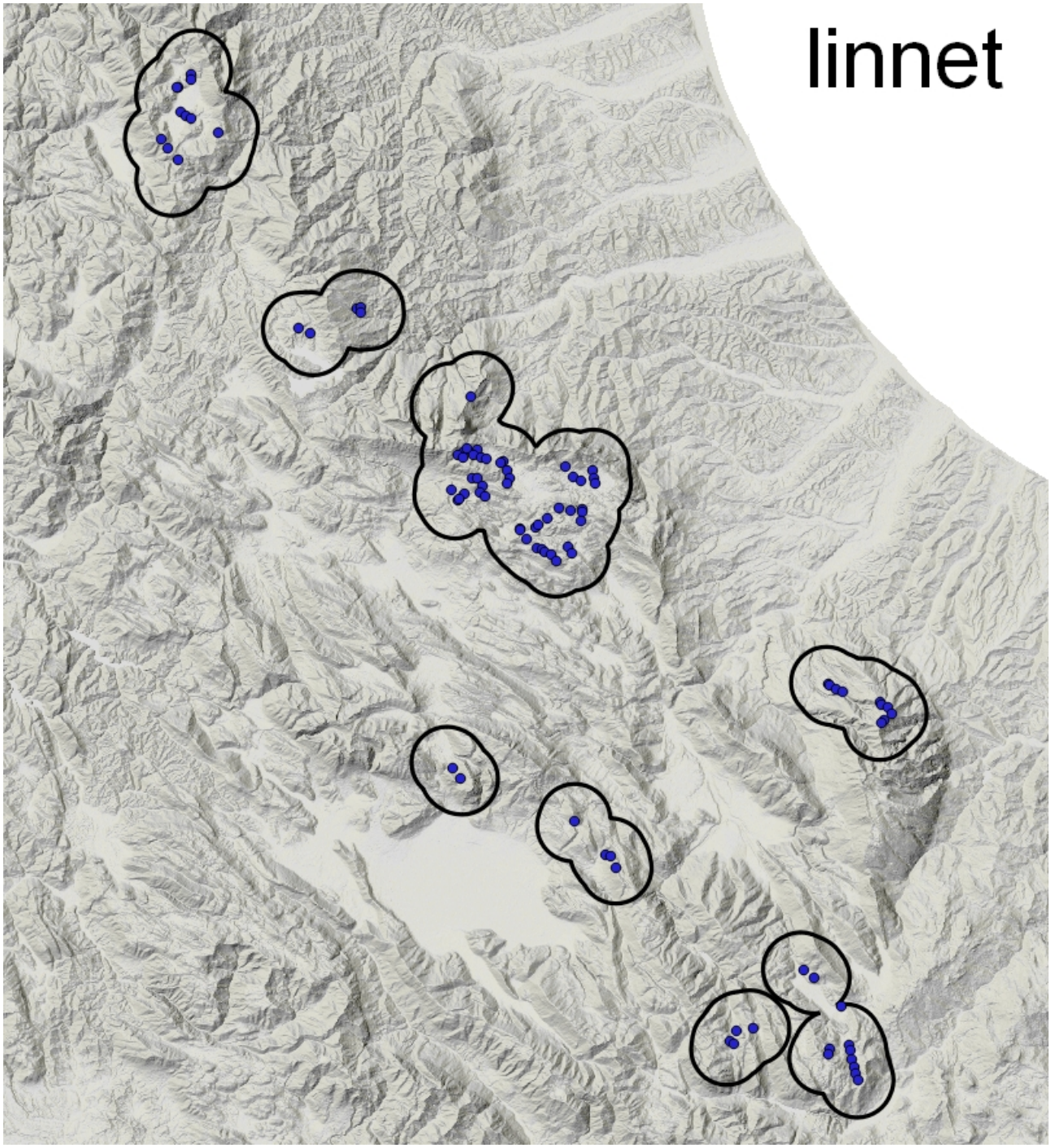

linnet

Figure A4. Comparison of bio1 effect on linnet *Linaria cannabina* occurrence (occurrence probability at the territory level, habitat suitability at the landscape scale).