Ecography

E7047
Pellissier, L., Pradervand, J.-N., Pottier, J., Dubuis, A., Maiorano, L. and Guisan, A. 2012. Climate-based empirical models show biased predictions of butterfly communities along environmental gradients. – Ecography 35: xxx–xxx.

Supplementary material

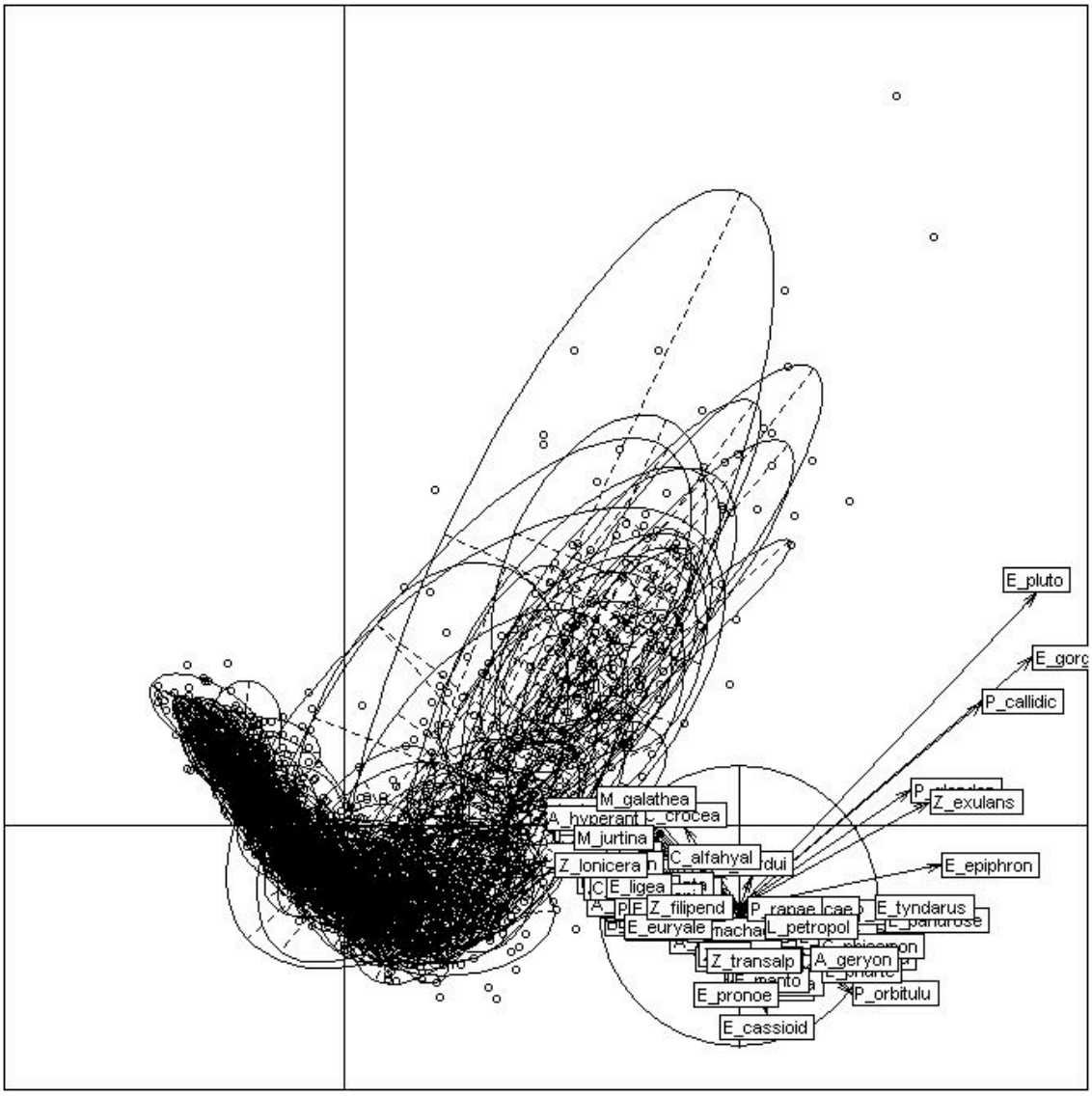
Appendix 1

Table A1. Area under the curve (AUC) values derived from the four modelling methods for the 77 butterfly species considered in the study.

Species	GLM	GAM	GBM	RF
Carterocephalus palaemon	0.597	0.654	0.640	0.694
Erynnis tages	0.652	0.623	0.589	0.604
Hesperia comma	0.823	0.864	0.835	0.852
Ochlodes venatus	0.841	0.833	0.814	0.806
Pyrgus alveus	0.548	0.538	0.555	0.505
Pyrgus andromedae	0.640	0.624	0.529	0.541
Pyrgus cacaliae	0.621	0.503	0.513	0.520
Pyrgus malvae	0.697	0.677	0.736	0.722
Pyrgus serratulae	0.734	0.721	0.724	0.691
Spialia sertorius	0.824	0.858	0.827	0.809
Thymelicus lineola	0.879	0.877	0.877	0.881
Thymelicus sylvestris	0.888	0.908	0.918	0.929
Aricia artaxerxes	0.657	0.634	0.658	0.603
Aricia eumedon	0.624	0.639	0.589	0.567
Callophrys rubi	0.691	0.675	0.712	0.740
Cupidos minimus	0.742	0.776	0.767	0.764
Haemeris lucina	0.817	0.931	0.848	0.842
Lyceana hippothoe	0.832	0.833	0.820	0.779
Lycaena tityrus	0.728	0.752	0.746	0.736
Maculinea arion	0.637	0.614	0.576	0.573
Argiades glandon	0.732	0.774	0.712	0.738
Albulina orbitulus	0.727	0.796	0.771	0.774
Plebeius argus	0.639	0.624	0.688	0.644
Polyommatus damon	0.648	0.543	0.631	0.731
Cyaniris semiargus	0.755	0.747	0.760	0.778
Lysandra bellargus	0.688	0.696	0.658	0.672
Lysandra coridon	0.694	0.682	0.678	0.585
Polyommatus eros	0.595	0.609	0.567	0.558
Polyommatus icarus	0.816	0.807	0.838	0.804
Polyommatus thersites	0.531	0.540	0.548	0.545
Argynnis adippe	0.800	0.798	0.767	0.721
Argynnis aglaja	0.819	0.831	0.794	0.774
Argynnis niobe	0.702	0.708	0.672	0.642
Boloria euphrosyne	0.714	0.692	0.717	0.705
Boloria titania	0.845	0.831	0.835	0.846
Boloria napaea	0.799	0.803	0.799	0.827
Boloria pales	0.903	0.909	0.862	0.915
Brenthis ino	0.822	0.836	0.851	0.846
Euphydryas aurinia	0.791	0.798	0.772	0.777
Melitea athalia	0.856	0.857	0.823	0.843
Melitea diamina	0.797	0.803	0.795	0.792

Papilio machaon	0.603	0.606	0.609	0.631
Parnassius apollo	0.746	0.703	0.714	0.668
Anthocharis cardamine	0.776	0.775	0.750	0.758
Aporia crataegi	0.864	0.851	0.830	0.823
Colias alfacariensis	0.760	0.740	0.669	0.727
Colias crocea	0.679	0.706	0.680	0.686
Colias phicomone	0.793	0.804	0.795	0.778
Pieris bryonae	0.679	0.696	0.661	0.662
Pontia callidice	0.854	0.886	0.881	0.856
Aphantopus hyperantus	0.916	0.909	0.904	0.895
Coenonympha gardetta	0.803	0.812	0.778	0.777
Coenonympha pamphilus	0.909	0.911	0.879	0.901
Erebia aethiops	0.748	0.736	0.731	0.709
Erebia cassioides	0.844	0.863	0.754	0.760
Erebia epiphron	0.889	0.869	0.859	0.856
Erebia euryale	0.745	0.729	0.698	0.676
Erebia gorge	0.834	0.937	0.946	0.927
Erebia ligea	0.843	0.842	0.863	0.856
Erebia manto	0.778	0.795	0.789	0.773
Erebia melampus	0.757	0.765	0.766	0.779
Erebia oeme	0.757	0.746	0.736	0.747
Erebia pandrose	0.849	0.879	0.850	0.826
Erebiapharte	0.772	0.790	0.774	0.792
Erebia pluto	0.866	0.880	0.940	0.916
Erebia pronoe	0.799	0.781	0.747	0.720
Erebia tyndarus	0.842	0.867	0.763	0.762
Lasiommata maera	0.653	0.655	0.621	0.587
Lasiommata petropolitana	0.644	0.623	0.607	0.564
Maniola jurtina	0.929	0.923	0.938	0.936
Melanargia galathea	0.847	0.841	0.856	0.859
Zygaena exulans	0.845	0.848	0.837	0.794
Zygaena filipendulae	0.745	0.750	0.778	0.753
Zygaena lonicera	0.773	0.777	0.767	0.794
Zygaena loti	0.783	0.732	0.788	0.783
Zygaena transalpina	0.604	0.639	0.596	0.530
Adscitas geryon	0.691	0.691	0.707	0.636

Figure A1. Factorial analysis using the ade4 package implemented in R on 10 draws of presences and absences from the model probabilities. Ellipses indicate the groups composed of the same community drawn 10 times from the probabilities using the rbinom function. The ellipse sizes are much larger for communities composed of high altitude butterflies, indicating greater variation of predicted communities between draws, which reflects the high stochasticity of butterfly communities at high altitude.



Supplementary analyses

In the following analyses, predictions of species distributions were obtained by classifying the probabilities into binary presence and absence data according to a ROC-optimised threshold, which is considered among the best-performing threshold-based approaches (Liu et al. 2005). S-SDMs were then obtained by stacking presence-absence predictions of all species. Even if this approach is different than the one used in the main text, it provides very similar results.

Table A2. Results of the F-tests on the linear relationships between the butterfly richness residuals, the prediction success and Sorensen index related to altitude and plant species richness respectively.

	Altitude			**Plant Richness**			**Interaction**		
	Estimate	*F*	*P*	*Estimate*	*F*	*P*	*Estimate*	*F*	*P*
Richness	9.52e-04	1.47	0.22	-6.82e-02	15.5	0.0001	-5.52e-05	0.34	0.56
Prediction success	1.43e-04	87.31	<0.0001	2.71e-03	14.08	0.0002	-2.15e-06	6.9	0.009
Sorensen	-1.15e-04	11.85	0.0007	-1.12e-03	2.7	0.09	1.17e-06	0.31	0.57

Figure A2. Variation of observed and predicted species richness along an altitude gradient.

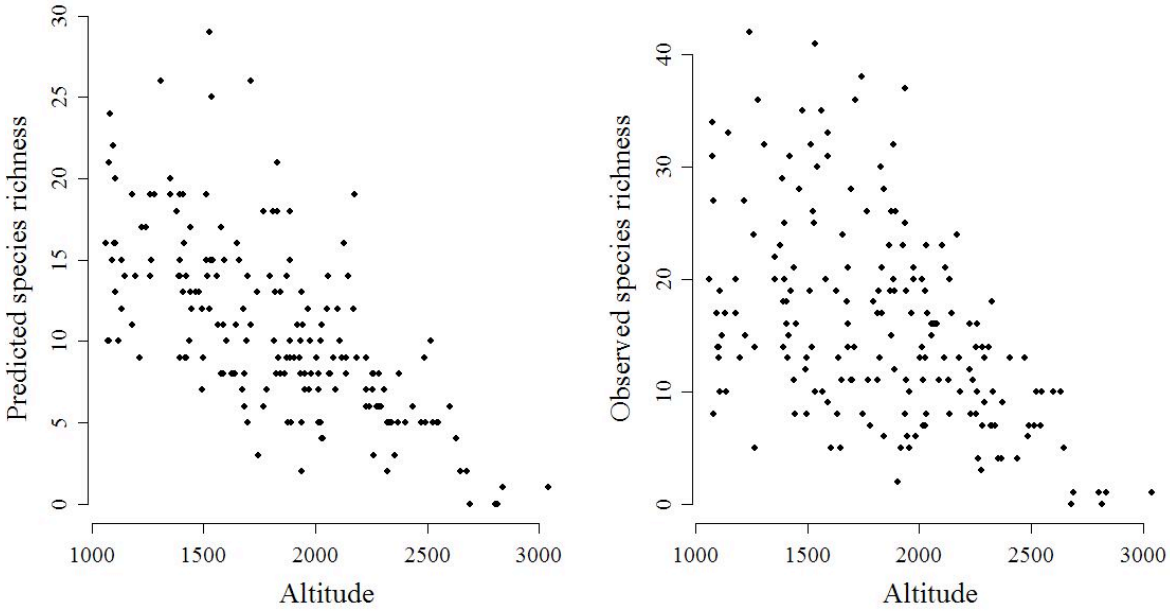


Figure A3. Relationship between the predicted and observed butterfly species richness. The dotted line corresponds to the regression between observed and predicted species richness; dashed lines correspond to the 1:1 line.

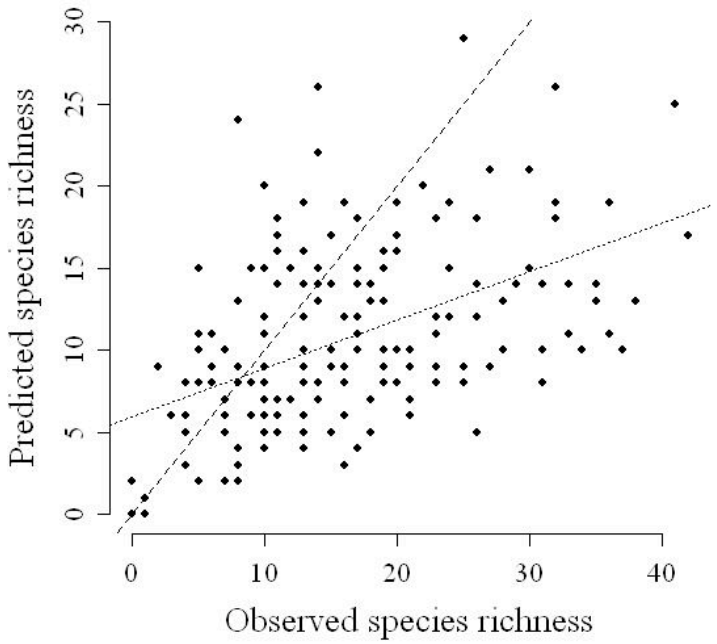


Figure A4. Prediction success (left) and Sorensen index (right), relative to altitude. The dotted and dashed lines correspond to the regression for plots with plant species richness under and over the average, respectively (n=32 plant species).