Combining Multiple Data Sources to Predict IUCN Conservation Status of Reptiles

Results of the experiments performed for the paper submitted to the Application Track of The 8th IEEE International Conference on Data Science and Advanced Analytics (IEEE DSAA 2021).

The following tables show the results of final models for each combination of model and dataset. Each table details the values for the six metrics used, sensitivity, specificity, precision, $F_{\beta=0.5}$, AUC and TSS, for each of the six groups of species. They also contain the results of the paired one-sided Wilcoxon tests done using the AOO_EOO dataset as baseline, or the AllFeatures or AllFeatures_FS in the case of the tests done between the EcoFeatures and AllFeatures datasets, see eco-all columns. Values marked with a bold color represent models where performance, for that particular metric and algorithm, was, significatively, improved relative to the AOO_EOO dataset. Values of the Wilcoxon tests marked with one or two asterisks (*, **) indicate significance values higher than 95%, or 99%, respectively.

Amphisbaenians

Sensitivity

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.913	0.014	0.896	0.019	0.986	**0.943**	0.017	0.003**	0.998	0.886	0.018	0.997	**0.945**	0.015	0.003**	0.998
xgboost	0.917	0.015	0.895	0.024	0.986	**0.949**	0.012	0.003**	1.000	0.864	0.017	1.000	**0.943**	0.013	0.005**	1.000
c50	0.885	0.020	0.769	0.049	1.000	**0.908**	0.034	0.038*	0.998	0.777	0.038	1.000	**0.925**	0.021	0.004**	0.998
knn	0.916	0.014	0.854	0.023	1.000	0.795	0.024	0.998	0.003**	0.844	0.023	1.000	0.824	0.019	1.000	0.005**
glm	0.783	0.258	0.748	0.034	0.615	0.851	0.025	0.539	0.998	0.741	0.030	0.652	0.861	0.022	0.539	0.998
rpart	0.879	0.023	0.717	0.085	1.000	0.879	0.027	0.500	1.000	0.692	0.095	1.000	0.879	0.027	0.500	0.998

Specificity

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.717	0.032	0.724	0.018	0.500	**0.767**	0.022	0.001**	0.998	0.709	0.020	0.884	**0.778**	0.022	0.001**	0.998
xgboost	0.760	0.030	0.710	0.023	0.997	0.749	0.025	0.986	1.000	0.726	0.021	0.997	0.760	0.025	0.561	1.000
c50	0.752	0.022	0.715	0.029	0.997	0.768	0.037	0.323	0.999	0.717	0.052	0.981	0.751	0.025	0.620	0.938
knn	0.766	0.029	0.706	0.022	1.000	0.760	0.025	0.682	0.998	0.709	0.024	1.000	0.749	0.022	0.981	1.000
glm	0.695	0.171	0.748	0.019	0.161	0.736	0.020	0.188	0.007**	0.726	0.020	0.312	0.727	0.023	0.278	0.594
rpart	0.783	0.025	0.699	0.095	0.990	0.780	0.029	0.814	0.989	0.704	0.071	0.990	0.780	0.029	0.814	0.990

Precision

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.620	0.028	0.620	0.018	0.688	**0.671**	0.023	0.001**	1.000	0.606	0.019	0.935	**0.683**	0.023	0.001**	1.000
xgboost	0.658	0.029	0.608	0.024	1.000	0.656	0.023	0.862	1.000	0.614	0.021	1.000	0.665	0.023	0.278	1.000
c50	0.643	0.023	0.576	0.021	1.000	0.665	0.037	0.065	1.000	0.582	0.039	1.000	0.652	0.024	0.161	1.000
knn	0.664	0.030	0.594	0.023	1.000	0.625	0.028	0.997	1.000	0.594	0.024	1.000	0.623	0.024	0.999	1.000
glm	0.592	0.091	0.599	0.022	0.385	0.619	0.021	0.188	1.000	0.576	0.022	0.754	0.614	0.021	0.312	1.000
rpart	0.672	0.026	0.554	0.056	1.000	0.669	0.027	0.814	1.000	0.544	0.029	1.000	0.669	0.027	0.814	1.000

F1 0.5

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.834	0.016	0.823	0.017	0.947	**0.872**	0.016	0.001**	1.000	0.811	0.018	0.990	**0.877**	0.016	0.001**	1.000
xgboost	0.850	0.017	0.818	0.024	0.999	**0.871**	0.012	0.001**	1.000	0.799	0.017	1.000	**0.870**	0.011	0.002**	1.000
c50	0.823	0.020	0.720	0.035	1.000	**0.845**	0.025	0.007**	1.000	0.727	0.028	1.000	**0.853**	0.015	0.003**	1.000
knn	0.851	0.017	0.785	0.022	1.000	0.754	0.023	1.000	0.001**	0.778	0.022	1.000	0.774	0.019	1.000	0.246
glm	0.711	0.188	0.712	0.029	0.577	0.791	0.022	0.461	1.000	0.700	0.026	0.577	0.796	0.019	0.423	1.000
rpart	0.828	0.018	0.672	0.050	1.000	0.827	0.019	0.814	1.000	0.653	0.065	1.000	0.827	0.019	0.814	1.000

AUC

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.815	0.019	0.810	0.015	0.862	**0.855**	0.016	0.001**	1.000	0.798	0.017	0.981	**0.862**	0.015	0.001**	0.998
xgboost	0.838	0.019	0.802	0.022	1.000	**0.849**	0.014	0.007**	1.000	0.795	0.016	1.000	**0.852**	0.012	0.005**	1.000
c50	0.819	0.018	0.742	0.020	1.000	**0.838**	0.021	0.005**	1.000	0.747	0.025	1.000	**0.838**	0.014	0.005**	1.000
knn	0.841	0.019	0.780	0.021	1.000	0.777	0.020	0.998	0.216	0.776	0.021	1.000	0.786	0.018	1.000	0.995
glm	0.739	0.073	0.748	0.020	0.348	**0.793**	0.017	0.019*	1.000	0.733	0.019	0.577	**0.794**	0.017	0.019*	1.000
rpart	0.831	0.015	0.708	0.022	1.000	0.830	0.014	0.963	1.000	0.698	0.020	1.000	0.830	0.014	0.963	1.000

TSS

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.630	0.038	0.620	0.031	0.862	**0.710**	0.031	0.001**	1.000	0.596	0.034	0.981	**0.723**	0.030	0.001**	1.000
xgboost	0.676	0.038	0.605	0.043	1.000	**0.698**	0.027	0.007**	1.000	0.590	0.032	1.000	**0.704**	0.025	0.005**	1.000
c50	0.637	0.036	0.484	0.040	1.000	**0.676**	0.041	0.005**	1.000	0.493	0.050	1.000	**0.676**	0.028	0.005**	1.000
knn	0.682	0.037	0.560	0.041	1.000	0.554	0.041	1.000	0.216	0.553	0.041	1.000	0.572	0.036	1.000	0.997
glm	0.478	0.146	0.496	0.041	0.348	**0.587**	0.035	0.019*	1.000	0.466	0.038	0.577	**0.587**	0.033	0.019*	1.000
rpart	0.662	0.031	0.416	0.044	1.000	0.660	0.029	0.963	1.000	0.396	0.039	1.000	0.660	0.029	0.963	1.000

Crocodiles

Sensitivity

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.917	0.18	0.95	0.158	0.5	1	0	0.186	0.5	0.95	0.158	0.5	1	0	0.186	0.5
xgboost	0.7	0.27	0.9	0.211	0.08	0.867	0.219	0.049*	0.707	0.95	0.158	0.027*	1	0	0.016*	0.5
c50	0.817	0.337	0.917	0.18	0.293	0.867	0.322	0.293	0.814	0.767	0.251	0.717	1	0	0.091	0.024*
knn	0.917	0.18	0.917	0.18	0.574	1	0	0.186	0.186	1	0	0.186	1	0	0.186	1
glm	0.917	0.18	0.6	0.402	0.972	0.6	0.402	0.972	1	0.95	0.158	0.5	1	0	0.186	0.5
rpart	1	0	1	0	1	1	0	1	1	1	0	1	1	0	1	1

Specificity

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.8	0.422	0.75	0.264	0.604	0.8	0.258	0.556	0.383	0.7	0.258	0.696	0.95	0.158	0.186	0.036*
xgboost	0.75	0.354	0.75	0.354	0.556	0.7	0.422	0.666	0.71	0.75	0.264	0.579	0.8	0.258	0.412	0.386
c50	0.9	0.211	0.65	0.242	0.958	0.6	0.211	0.995	0.725	0.75	0.264	0.89	0.6	0.211	0.995	0.978
knn	0.7	0.422	0.8	0.258	0.304	0.7	0.258	0.5	0.97	0.8	0.258	0.294	0.7	0.258	0.546	0.825
glm	0.7	0.422	0.65	0.412	0.672	0.65	0.412	0.672	1	0.75	0.264	0.396	0.9	0.211	0.036*	0.149
rpart	0	0	0	0	1	0	0	1	1	0	0	1	0	0	1	1

Precision

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.883	0.249	0.833	0.188	0.633	0.875	0.163	0.706	0.392	0.8	0.185	0.714	0.967	0.105	0.186	0.06
xgboost	0.8	0.258	0.852	0.201	0.294	0.825	0.25	0.5	0.658	0.833	0.188	0.446	0.875	0.163	0.221	0.356
c50	0.85	0.337	0.758	0.178	0.784	0.675	0.273	0.991	0.741	0.825	0.194	0.633	0.75	0.136	0.911	0.915
knn	0.817	0.254	0.85	0.2	0.387	0.808	0.167	0.458	0.821	0.883	0.153	0.276	0.808	0.167	0.664	0.909
glm	0.817	0.254	0.683	0.404	0.828	0.683	0.404	0.828	1	0.833	0.188	0.416	0.933	0.141	0.049*	0.219
rpart	0.52	0.042	0.52	0.042	1	0.52	0.042	1	1	0.52	0.042	1	0.52	0.042	1	1

F1 0.5

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.9	0.185	0.919	0.152	0.4	0.966	0.044	0.337	0.392	0.91	0.15	0.472	0.991	0.029	0.091	0.06
xgboost	0.702	0.242	0.878	0.19	0.054	0.845	0.21	0.026*	0.735	0.919	0.152	0.026*	0.966	0.044	0.01**	0.231
c50	0.913	0.181	0.874	0.163	0.803	0.906	0.097	0.667	0.286	0.759	0.209	0.915	0.933	0.037	0.602	0.037*
knn	0.886	0.187	0.898	0.175	0.444	0.948	0.045	0.358	0.29	0.969	0.041	0.134	0.948	0.045	0.337	0.909
glm	0.882	0.178	0.733	0.216	0.882	0.733	0.216	0.882	1	0.919	0.152	0.311	0.982	0.038	0.029*	0.219
rpart	0.843	0.021	0.843	0.021	1	0.843	0.021	1	1	0.843	0.021	1	0.843	0.021	1	1

AUC

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.858	0.267	0.85	0.175	0.633	0.9	0.129	0.543	0.286	0.825	0.169	0.715	0.975	0.079	0.091	0.035*
xgboost	0.725	0.233	0.825	0.206	0.114	0.783	0.267	0.304	0.584	0.85	0.175	0.061	0.9	0.129	0.053	0.212
c50	0.858	0.267	0.783	0.172	0.782	0.733	0.211	0.967	0.672	0.758	0.154	0.837	0.8	0.105	0.81	0.328
knn	0.808	0.275	0.858	0.197	0.362	0.85	0.129	0.375	0.715	0.9	0.129	0.303	0.85	0.129	0.295	0.825
glm	0.808	0.258	0.625	0.297	0.927	0.625	0.297	0.927	1	0.85	0.175	0.471	0.95	0.105	0.027*	0.12
rpart	0.5	0	0.5	0	1	0.5	0	1	1	0.5	0	1	0.5	0	1	1

TSS

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.717	0.533	0.7	0.35	0.633	0.8	0.258	0.543	0.286	0.65	0.337	0.715	0.95	0.158	0.091	0.035*
xgboost	0.45	0.465	0.65	0.412	0.084	0.567	0.534	0.304	0.584	0.7	0.35	0.061	0.8	0.258	0.053	0.212
c50	0.717	0.533	0.567	0.344	0.782	0.467	0.422	0.967	0.672	0.517	0.309	0.837	0.6	0.211	0.81	0.328
knn	0.617	0.55	0.717	0.393	0.362	0.7	0.258	0.375	0.715	0.8	0.258	0.303	0.7	0.258	0.295	0.825
glm	0.617	0.516	0.25	0.594	0.927	0.25	0.594	0.927	1	0.7	0.35	0.471	0.9	0.211	0.027*	0.12
rpart	0	0	0	0	1	0	0	1	1	0	0	1	0	0	1	1

Lizards

Sensitivity

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.933	0.019	0.836	0.034	0.998	0.961	0.017	0.003**	0.003**	0.811	0.027	0.998	0.963	0.017	0.003**	0.001**
xgboost	0.942	0.023	0.851	0.022	0.998	0.956	0.015	0.006**	0.003**	0.812	0.025	0.998	0.958	0.018	0.009**	0.003**
c50	0.914	0.027	0.741	0.057	1	0.909	0.034	0.637	0.001**	0.718	0.059	0.998	0.912	0.034	0.528	0.001**
knn	0.945	0.022	0.777	0.05	0.998	0.805	0.039	1	0.019*	0.777	0.032	0.998	0.823	0.034	0.998	0.003**
glm	0.922	0.023	0.743	0.02	0.998	0.881	0.033	0.999	0.003**	0.757	0.023	1	0.884	0.03	0.997	0.001**
rpart	0.915	0.015	0.668	0.082	1	0.914	0.014	0.963	0.001**	0.69	0.085	1	0.914	0.014	0.963	0.001**

Specificity

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.715	0.034	0.75	0.033	0.007**	0.711	0.026	0.639	0.997	0.74	0.029	0.038*	0.717	0.025	0.383	0.98
xgboost	0.738	0.031	0.703	0.028	0.991	0.703	0.023	0.998	0.601	0.712	0.032	0.976	0.701	0.028	0.998	0.903
c50	0.721	0.048	0.695	0.085	0.882	0.733	0.054	0.5	0.053	0.719	0.057	0.472	0.742	0.042	0.363	0.118
knn	0.713	0.025	0.746	0.029	0.007**	0.738	0.038	0.046*	0.899	0.73	0.035	0.078	0.737	0.037	0.023*	0.246
glm	0.718	0.069	0.732	0.031	0.238	0.711	0.037	0.784	0.974	0.735	0.024	0.312	0.713	0.033	0.722	0.991
rpart	0.757	0.025	0.744	0.067	0.652	0.756	0.025	0.963	0.385	0.723	0.073	0.923	0.756	0.025	0.963	0.092

Precision

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.632	0.03	0.637	0.031	0.312	0.635	0.023	0.246	0.615	0.62	0.024	0.839	0.64	0.022	0.097	0.007**
xgboost	0.653	0.032	0.6	0.024	1	0.628	0.021	1	0.001**	0.597	0.026	1	0.626	0.023	1	0.002**
c50	0.633	0.043	0.566	0.057	1	0.643	0.042	0.5	0.001**	0.574	0.038	1	0.65	0.035	0.277	0.001**
knn	0.632	0.024	0.615	0.035	0.903	0.617	0.038	0.839	0.615	0.602	0.031	0.999	0.621	0.034	0.935	0.042*
glm	0.635	0.055	0.592	0.031	0.997	0.615	0.032	0.958	0.007**	0.599	0.023	0.986	0.617	0.03	0.947	0.01**
rpart	0.664	0.025	0.582	0.042	1	0.662	0.024	0.969	0.001**	0.571	0.048	1	0.662	0.024	0.969	0.001**

F1 0.5

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.852	0.019	0.787	0.028	1	0.872	0.018	0.001**	0.001**	0.763	0.022	1	0.874	0.016	0.001**	0.001**
xgboost	0.865	0.025	0.785	0.019	1	0.866	0.017	0.246	0.001**	0.757	0.02	1	0.866	0.017	0.246	0.001**
c50	0.839	0.029	0.695	0.036	1	0.839	0.024	0.5	0.001**	0.682	0.041	1	0.843	0.027	0.318	0.001**
knn	0.859	0.022	0.738	0.044	1	0.759	0.034	1	0.032*	0.734	0.027	1	0.772	0.027	1	0.001**
glm	0.845	0.025	0.707	0.021	1	0.81	0.028	0.999	0.001**	0.719	0.02	1	0.813	0.027	0.999	0.001**
rpart	0.851	0.016	0.646	0.059	1	0.849	0.015	0.969	0.001**	0.659	0.061	1	0.849	0.015	0.969	0.001**

AUC

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.824	0.021	0.793	0.023	0.998	0.836	0.018	0.014*	0.001**	0.775	0.017	1	0.84	0.017	0.005**	0.001**
xgboost	0.84	0.025	0.777	0.018	1	0.83	0.017	0.986	0.001**	0.762	0.018	1	0.829	0.018	0.986	0.001**
c50	0.817	0.032	0.718	0.031	1	0.821	0.024	0.318	0.001**	0.718	0.025	1	0.827	0.024	0.062	0.003**
knn	0.829	0.02	0.762	0.033	1	0.772	0.029	1	0.097	0.754	0.022	1	0.78	0.023	1	0.001**
glm	0.82	0.035	0.738	0.021	1	0.796	0.026	0.998	0.001**	0.746	0.017	1	0.798	0.024	0.993	0.001**
rpart	0.836	0.017	0.706	0.026	1	0.835	0.016	0.969	0.001**	0.706	0.028	1	0.835	0.016	0.969	0.001**

TSS

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.648	0.042	0.586	0.045	0.998	0.672	0.037	0.014*	0.001**	0.551	0.035	1	0.68	0.034	0.005**	0.001**
xgboost	0.68	0.049	0.554	0.035	1	0.66	0.035	0.986	0.001**	0.524	0.036	1	0.659	0.036	0.986	0.001**
c50	0.635	0.063	0.436	0.061	1	0.643	0.048	0.318	0.001**	0.437	0.05	1	0.654	0.049	0.062	0.003**
knn	0.657	0.041	0.523	0.065	1	0.543	0.059	1	0.097	0.507	0.044	1	0.56	0.046	1	0.001**
glm	0.641	0.07	0.475	0.042	1	0.592	0.052	0.998	0.001**	0.492	0.034	1	0.596	0.049	0.993	0.001**
rpart	0.673	0.034	0.412	0.051	1	0.67	0.033	0.969	0.001**	0.413	0.056	1	0.67	0.033	0.969	0.001**

Snakes

Sensitivity

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.942	0.032	0.914	0.04	0.968	0.967	0.028	0.007**	0.004**	0.91	0.044	0.984	0.973	0.028	0.007**	0.003**
xgboost	0.949	0.025	0.93	0.039	0.975	0.965	0.029	0.011*	0.011*	0.926	0.04	0.993	0.967	0.024	0.007**	0.006**
c50	0.856	0.077	0.797	0.088	0.916	0.838	0.052	0.807	0.096	0.809	0.067	0.946	0.821	0.051	0.899	0.253
knn	0.945	0.032	0.908	0.051	0.986	0.959	0.033	0.276	0.003**	0.914	0.035	0.984	0.947	0.033	0.5	0.004**
glm	0.971	0.025	0.918	0.037	0.995	0.953	0.035	0.979	0.007**	0.92	0.036	0.995	0.949	0.037	0.986	0.011*
rpart	0.846	0.081	0.825	0.084	0.763	0.838	0.083	0.663	0.27	0.809	0.085	0.931	0.84	0.081	0.534	0.041*

Specificity

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.82	0.036	0.756	0.041	0.997	0.722	0.036	0.998	0.996	0.756	0.042	0.997	0.71	0.037	1	0.998
xgboost	0.794	0.042	0.75	0.038	0.989	0.75	0.041	1	0.417	0.752	0.028	0.989	0.757	0.039	0.997	0.312
c50	0.867	0.043	0.818	0.05	0.984	0.878	0.028	0.181	0.006**	0.82	0.061	0.976	0.881	0.029	0.193	0.005**
knn	0.851	0.032	0.751	0.045	0.998	0.716	0.051	0.998	0.994	0.741	0.043	1	0.745	0.043	0.998	0.419
glm	0.621	0.071	0.759	0.041	0.001**	0.743	0.046	0.001**	0.953	0.751	0.043	0.003**	0.745	0.047	0.002**	0.73
rpart	0.87	0.033	0.754	0.123	0.995	0.867	0.03	0.825	0.005**	0.776	0.135	0.995	0.868	0.032	0.778	0.012*

Precision

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.657	0.044	0.577	0.041	1	0.558	0.032	1	0.976	0.576	0.042	0.999	0.549	0.035	1	0.99
xgboost	0.627	0.048	0.575	0.036	0.998	0.585	0.04	1	0.216	0.574	0.028	0.999	0.591	0.041	0.999	0.08
c50	0.706	0.056	0.618	0.054	1	0.715	0.042	0.312	0.001**	0.626	0.066	0.998	0.717	0.048	0.278	0.002**
knn	0.699	0.045	0.571	0.051	1	0.552	0.044	1	0.968	0.562	0.041	1	0.575	0.038	1	0.08
glm	0.484	0.044	0.581	0.038	0.001**	0.576	0.041	0.001**	0.779	0.574	0.04	0.001**	0.576	0.043	0.002**	0.385
rpart	0.705	0.048	0.567	0.081	1	0.696	0.043	0.853	0.001**	0.592	0.096	1	0.7	0.044	0.819	0.003**

F1 0.5

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.866	0.024	0.818	0.034	0.999	0.843	0.023	0.993	0.005**	0.815	0.037	0.999	0.842	0.025	0.99	0.001**
xgboost	0.86	0.022	0.827	0.031	1	0.853	0.026	0.947	0.007**	0.824	0.031	1	0.857	0.025	0.784	0.001**
c50	0.818	0.052	0.751	0.066	0.999	0.809	0.037	0.688	0.014*	0.762	0.049	0.995	0.797	0.038	0.754	0.097
knn	0.882	0.028	0.811	0.044	0.999	0.835	0.026	1	0.014*	0.811	0.029	1	0.838	0.023	1	0.002**
glm	0.806	0.026	0.822	0.029	0.032*	0.841	0.021	0.002**	0.009**	0.82	0.028	0.032*	0.839	0.024	0.003**	0.01**
rpart	0.812	0.062	0.748	0.038	0.997	0.804	0.062	0.779	0.01**	0.744	0.03	0.999	0.806	0.059	0.528	0.003**

AUC

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.881	0.019	0.835	0.028	1	0.845	0.021	0.999	0.053	0.833	0.03	1	0.841	0.023	1	0.161
xgboost	0.872	0.021	0.84	0.026	1	0.858	0.024	0.984	0.014*	0.839	0.023	1	0.862	0.024	0.981	0.002**
c50	0.862	0.029	0.808	0.041	1	0.858	0.021	0.539	0.002**	0.814	0.036	0.999	0.851	0.023	0.722	0.019*
knn	0.898	0.022	0.83	0.036	1	0.837	0.025	1	0.138	0.827	0.025	1	0.846	0.02	1	0.003**
glm	0.796	0.034	0.839	0.025	0.002**	0.848	0.019	0.001**	0.016*	0.836	0.025	0.003**	0.847	0.021	0.002**	0.032*
rpart	0.858	0.038	0.789	0.035	1	0.853	0.037	0.853	0.001**	0.793	0.034	1	0.854	0.035	0.583	0.003**

TSS

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.762	0.039	0.67	0.056	1	0.689	0.042	0.999	0.053	0.666	0.061	1	0.682	0.046	1	0.161
xgboost	0.743	0.042	0.68	0.051	1	0.715	0.048	0.984	0.014*	0.678	0.046	1	0.724	0.047	0.981	0.002**
c50	0.723	0.057	0.616	0.083	1	0.716	0.043	0.539	0.002**	0.629	0.072	0.999	0.702	0.046	0.722	0.019*
knn	0.797	0.044	0.659	0.072	1	0.675	0.05	1	0.138	0.655	0.051	1	0.692	0.039	1	0.003**
glm	0.591	0.067	0.678	0.05	0.002**	0.696	0.038	0.001**	0.016*	0.671	0.05	0.003**	0.694	0.041	0.002**	0.032*
rpart	0.716	0.075	0.579	0.071	1	0.705	0.074	0.853	0.001**	0.585	0.068	1	0.708	0.07	0.583	0.001**

Turtles

Sensitivity

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.736	0.123	0.742	0.14	0.276	0.742	0.131	0.453	0.583	0.769	0.136	0.077	0.758	0.125	0.18	0.5
xgboost	0.769	0.136	0.72	0.15	0.8	0.735	0.114	0.78	0.365	0.802	0.106	0.117	0.802	0.112	0.223	0.568
c50	0.608	0.263	0.539	0.435	0.73	0.691	0.176	0.109	0.239	0.713	0.274	0.142	0.741	0.142	0.032*	0.399
knn	0.687	0.153	0.576	0.125	0.97	0.687	0.129	0.571	0.101	0.742	0.073	0.102	0.748	0.104	0.262	0.433
glm	0.896	0.08	0.687	0.136	0.997	0.721	0.143	0.997	0.27	0.71	0.114	0.998	0.737	0.115	0.996	0.317
rpart	0.616	0.151	0.675	0.173	0.238	0.719	0.185	0.086	0.171	0.703	0.135	0.091	0.758	0.171	0.029*	0.064

Specificity

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.723	0.142	0.644	0.146	0.914	0.761	0.107	0.135	0.017*	0.724	0.183	0.453	0.707	0.156	0.583	0.856
xgboost	0.708	0.182	0.698	0.139	0.6	0.742	0.082	0.363	0.139	0.742	0.161	0.337	0.716	0.104	0.541	0.661
c50	0.661	0.382	0.663	0.272	0.571	0.577	0.25	0.797	0.779	0.6	0.244	0.73	0.602	0.182	0.762	0.524
knn	0.698	0.179	0.795	0.083	0.046*	0.733	0.117	0.311	0.955	0.642	0.143	0.781	0.661	0.092	0.696	0.429
glm	0.18	0.105	0.606	0.145	0.003**	0.67	0.156	0.003**	0.2	0.634	0.107	0.003**	0.687	0.123	0.003**	0.091
rpart	0.768	0.158	0.611	0.183	0.971	0.673	0.181	0.94	0.135	0.592	0.202	0.988	0.673	0.193	0.947	0.08

Precision

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.816	0.08	0.778	0.05	0.857	0.834	0.074	0.118	0.021*	0.83	0.076	0.312	0.814	0.074	0.385	0.754
xgboost	0.818	0.088	0.8	0.061	0.652	0.824	0.036	0.594	0.143	0.845	0.077	0.216	0.824	0.052	0.577	0.695
c50	0.806	0.123	0.701	0.101	0.922	0.759	0.14	0.938	0.188	0.755	0.082	0.819	0.765	0.104	0.882	0.285
knn	0.799	0.08	0.821	0.063	0.207	0.805	0.089	0.423	0.882	0.777	0.065	0.797	0.784	0.042	0.652	0.423
glm	0.64	0.031	0.742	0.071	0.002**	0.786	0.081	0.001**	0.188	0.762	0.046	0.001**	0.796	0.066	0.001**	0.08
rpart	0.825	0.091	0.743	0.104	0.958	0.791	0.119	0.884	0.037*	0.746	0.09	0.991	0.793	0.126	0.797	0.043*

F1 0.5

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.747	0.108	0.744	0.113	0.318	0.756	0.115	0.318	0.264	0.775	0.11	0.08	0.765	0.1	0.246	0.615
xgboost	0.773	0.117	0.729	0.125	0.839	0.749	0.094	0.797	0.246	0.806	0.083	0.053	0.803	0.091	0.278	0.577
c50	0.614	0.203	0.746	0.252	0.234	0.69	0.147	0.097	0.766	0.78	0.086	0.082	0.739	0.121	0.019*	0.545
knn	0.699	0.127	0.61	0.112	0.968	0.706	0.119	0.577	0.188	0.746	0.06	0.078	0.752	0.084	0.246	0.423
glm	0.828	0.057	0.694	0.114	0.999	0.729	0.122	0.99	0.312	0.716	0.093	1	0.745	0.1	0.981	0.216
rpart	0.642	0.131	0.682	0.147	0.246	0.725	0.163	0.097	0.188	0.706	0.114	0.118	0.761	0.154	0.024*	0.029*

AUC

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.729	0.082	0.693	0.055	0.905	0.751	0.086	0.142	0.04*	0.746	0.079	0.27	0.733	0.072	0.461	0.677
xgboost	0.738	0.094	0.709	0.071	0.821	0.739	0.043	0.5	0.065	0.772	0.071	0.161	0.759	0.058	0.5	0.754
c50	0.635	0.081	0.601	0.116	0.92	0.634	0.09	0.581	0.246	0.657	0.096	0.423	0.671	0.085	0.033*	0.254
knn	0.692	0.064	0.686	0.059	0.5	0.71	0.106	0.342	0.461	0.692	0.068	0.547	0.704	0.052	0.305	0.439
glm	0.538	0.052	0.646	0.079	0.002**	0.696	0.088	0.001**	0.188	0.672	0.046	0.001**	0.712	0.083	0.001**	0.092
rpart	0.692	0.069	0.643	0.109	0.903	0.696	0.118	0.216	0.024*	0.648	0.099	0.978	0.715	0.143	0.246	0.022*

TSS

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.458	0.164	0.386	0.111	0.914	0.502	0.171	0.143	0.04*	0.493	0.157	0.278	0.465	0.144	0.461	0.688
xgboost	0.476	0.188	0.417	0.143	0.821	0.478	0.086	0.5	0.08	0.544	0.141	0.161	0.518	0.116	0.5	0.754
c50	0.27	0.161	0.202	0.233	0.92	0.267	0.18	0.581	0.246	0.313	0.192	0.423	0.343	0.171	0.033*	0.246
knn	0.385	0.128	0.372	0.117	0.5	0.421	0.212	0.342	0.461	0.384	0.136	0.547	0.408	0.103	0.305	0.459
glm	0.076	0.103	0.293	0.159	0.002**	0.392	0.177	0.001**	0.188	0.344	0.093	0.001**	0.424	0.166	0.001**	0.097
rpart	0.384	0.139	0.286	0.218	0.903	0.393	0.235	0.216	0.023*	0.296	0.199	0.978	0.431	0.286	0.246	0.022*

All species

Sensitivity

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.913	0.014	0.896	0.019	0.986	**0.943**	0.017	0.003**	0.998	0.886	0.018	0.997	**0.945**	0.015	0.003**	0.998
xgboost	0.917	0.015	0.895	0.024	0.986	**0.949**	0.012	0.003**	1.000	0.864	0.017	1.000	**0.943**	0.013	0.005**	1.000
c50	0.885	0.020	0.769	0.049	1.000	**0.908**	0.034	0.038*	0.998	0.777	0.038	1.000	**0.925**	0.021	0.004**	0.998
knn	0.916	0.014	0.854	0.023	1.000	0.795	0.024	0.998	0.003**	0.844	0.023	1.000	0.824	0.019	1.000	0.005**
glm	0.783	0.258	0.748	0.034	0.615	0.851	0.025	0.539	0.998	0.741	0.030	0.652	0.861	0.022	0.539	0.998
rpart	0.879	0.023	0.717	0.085	1.000	0.879	0.027	0.500	1.000	0.692	0.095	1.000	0.879	0.027	0.500	0.998

Specificity

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.717	0.032	0.724	0.018	0.500	**0.767**	0.022	0.001**	0.998	0.709	0.020	0.884	**0.778**	0.022	0.001**	0.998
xgboost	0.760	0.030	0.710	0.023	0.997	0.749	0.025	0.986	1.000	0.726	0.021	0.997	0.760	0.025	0.561	1.000
c50	0.752	0.022	0.715	0.029	0.997	0.768	0.037	0.323	0.999	0.717	0.052	0.981	0.751	0.025	0.620	0.938
knn	0.766	0.029	0.706	0.022	1.000	0.760	0.025	0.682	0.998	0.709	0.024	1.000	0.749	0.022	0.981	1.000
glm	0.695	0.171	0.748	0.019	0.161	0.736	0.020	0.188	0.007**	0.726	0.020	0.312	0.727	0.023	0.278	0.594
rpart	0.783	0.025	0.699	0.095	0.990	0.780	0.029	0.814	0.989	0.704	0.071	0.990	0.780	0.029	0.814	0.990

Precision

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.620	0.028	0.620	0.018	0.688	**0.671**	0.023	0.001**	1.000	0.606	0.019	0.935	**0.683**	0.023	0.001**	1.000
xgboost	0.658	0.029	0.608	0.024	1.000	0.656	0.023	0.862	1.000	0.614	0.021	1.000	0.665	0.023	0.278	1.000
c50	0.643	0.023	0.576	0.021	1.000	0.665	0.037	0.065	1.000	0.582	0.039	1.000	0.652	0.024	0.161	1.000
knn	0.664	0.030	0.594	0.023	1.000	0.625	0.028	0.997	1.000	0.594	0.024	1.000	0.623	0.024	0.999	1.000
glm	0.592	0.091	0.599	0.022	0.385	0.619	0.021	0.188	1.000	0.576	0.022	0.754	0.614	0.021	0.312	1.000
rpart	0.672	0.026	0.554	0.056	1.000	0.669	0.027	0.814	1.000	0.544	0.029	1.000	0.669	0.027	0.814	1.000

F1 0.5

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.834	0.016	0.823	0.017	0.947	**0.872**	0.016	0.001**	1.000	0.811	0.018	0.990	**0.877**	0.016	0.001**	1.000
xgboost	0.850	0.017	0.818	0.024	0.999	**0.871**	0.012	0.001**	1.000	0.799	0.017	1.000	**0.870**	0.011	0.002**	1.000
c50	0.823	0.020	0.720	0.035	1.000	**0.845**	0.025	0.007**	1.000	0.727	0.028	1.000	**0.853**	0.015	0.003**	1.000
knn	0.851	0.017	0.785	0.022	1.000	0.754	0.023	1.000	0.001**	0.778	0.022	1.000	0.774	0.019	1.000	0.246
glm	0.711	0.188	0.712	0.029	0.577	0.791	0.022	0.461	1.000	0.700	0.026	0.577	0.796	0.019	0.423	1.000
rpart	0.828	0.018	0.672	0.050	1.000	0.827	0.019	0.814	1.000	0.653	0.065	1.000	0.827	0.019	0.814	1.000

AUC

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.815	0.019	0.810	0.015	0.862	**0.855**	0.016	0.001**	1.000	0.798	0.017	0.981	**0.862**	0.015	0.001**	0.998
xgboost	0.838	0.019	0.802	0.022	1.000	**0.849**	0.014	0.007**	1.000	0.795	0.016	1.000	**0.852**	0.012	0.005**	1.000
c50	0.819	0.018	0.742	0.020	1.000	**0.838**	0.021	0.005**	1.000	0.747	0.025	1.000	**0.838**	0.014	0.005**	1.000
knn	0.841	0.019	0.780	0.021	1.000	0.777	0.020	0.998	0.216	0.776	0.021	1.000	0.786	0.018	1.000	0.995
glm	0.739	0.073	0.748	0.020	0.348	**0.793**	0.017	0.019*	1.000	0.733	0.019	0.577	**0.794**	0.017	0.019*	1.000
rpart	0.831	0.015	0.708	0.022	1.000	0.830	0.014	0.963	1.000	0.698	0.020	1.000	0.830	0.014	0.963	1.000

TSS

	AOO & EOO only (base)		Ecological features only			All features			eco-all	Ecological features only FS			All features FS			eco-all
	mean	sd	mean	sd	p-value	mean	sd	p-value	p-value	mean	sd	p-value	mean	sd	p-value	p-value
rf	0.630	0.038	0.620	0.031	0.862	**0.710**	0.031	0.001**	1.000	0.596	0.034	0.981	**0.723**	0.030	0.001**	1.000
xgboost	0.676	0.038	0.605	0.043	1.000	**0.698**	0.027	0.007**	1.000	0.590	0.032	1.000	**0.704**	0.025	0.005**	1.000
c50	0.637	0.036	0.484	0.040	1.000	**0.676**	0.041	0.005**	1.000	0.493	0.050	1.000	**0.676**	0.028	0.005**	1.000
knn	0.682	0.037	0.560	0.041	1.000	0.554	0.041	1.000	0.216	0.553	0.041	1.000	0.572	0.036	1.000	0.997
glm	0.478	0.146	0.496	0.041	0.348	**0.587**	0.035	0.019*	1.000	0.466	0.038	0.577	**0.587**	0.033	0.019*	1.000
rpart	0.662	0.031	0.416	0.044	1.000	0.660	0.029	0.963	1.000	0.396	0.039	1.000	0.660	0.029	0.963	1.000