

Supplementary material

Table S1. Number of records in calibration datasets for each species using native range occurrences (NRO), native and invasive occurrences (NIO) and invaded range occurrences (IRO), coupled with within native range pseudo-absences random extraction (NRA), native and invasive ranges pseudo-absences random extraction (NIA) and the common spatially worldwide random pseudo-absences (WRA). Occurrence records in NRO and IRO models correspond to 80% of total records collected for each species in its respective range. NIO models include an equal number of native and invasive occurrences corresponding each to the minimum available of one of the ranges. These occurrences were coupled with a same number of pseudo-absences for each pseudo-absence type. For maximizing their representativeness we made 20 replicate datasets for each combination, each containing an independently drawn set of pseudo-absences.

Model	<i>C. destructor</i>	<i>E. sinensis</i>	<i>P. leniusculus</i>	<i>P. clarkii</i>
NRO-NRA	82 (native)	81 (native)	100 (native)	138 (native)
NRO-NIA	82 (native)	81 (native)	100 (native)	138 (native)
NRO-WRA	82 (native)	81 (native)	100 (native)	138 (native)
NIO-NRA	82 (41 native + 41 invasive)	162 (81 native + 81 invasive)	200 (100 native + 100 invasive)	276 (138 native + 138 invasive)
NIO-NIA	82 (41 native + 41 invasive)	162 (81 native + 81 invasive)	200 (100 native + 100 invasive)	276 (138 native + 138 invasive)
NIO-WRA	82 (41 native + 41 invasive)	162 (81 native + 81 invasive)	200 (100 native + 100 invasive)	276 (138 native + 138 invasive)
IRO-NRA	41 (invasive)	155 (invasive)	352 (invasive)	340 (invasive)
IRO-NIA	41 (invasive)	155 (invasive)	352 (invasive)	340 (invasive)
IRO-WRA	41 (invasive)	155 (invasive)	352 (invasive)	340 (invasive)

Table S2. Best mean root mean squared errors (RMSE) its standard deviation (SD) and number of nodes in the artificial neural network providing it during the training sessions. Number of nodes was based on the number of calibration cases (n) in each calibration dataset type. Models were built using native range occurrences (NRO), native and invasive occurrences (NIO) and invaded range occurrences (IRO), coupled with within native range pseudo-absences random extraction (NRA), native and invasive ranges pseudo-absences random extraction (NIA) and the common spatially worldwide random pseudo-absences (WRA).

Species	Pseudo-absences	NRO			NIO			IRO		
		Best mean RMSE	SD	Nodes in network	Best mean RMSE	SD	Nodes in network	Best mean RMSE	SD	Nodes in network
<i>C. destructor</i>	NRA	0.49	0.11	0	0.44	0.07	(n/10)/2	0.16	0.04	0
	NIA	0.47	0.1	(n/10)/2	0.49	0.08	(n/10)/2	0.43	0.06	n/10
	WRA	0.30	0.07	(n/10)/2	0.30	0.54	n/10	0.34	0.07	n/10
<i>E. sinensis</i>	NRA	0.43	0.09	(n/10)/2	0.34	0.05	(n/10)/2	0.15	0.04	0
	NIA	0.34	0.08	(n/10)/2	0.36	0.06	(n/10)/2	0.23	0.05	(n/10)/2
	WRA	0.23	0.05	n/10	0.29	0.04	(n/10)/2	0.24	0.06	n/10
<i>P. leniusculus</i>	NRA	0.44	0.09	n/10	0.38	0.06	0	0.19	0.05	(n/10)/2
	NIA	0.38	0.06	(n/10)/2	0.37	0.06	(n/10)/2	0.31	0.05	n/10
	WRA	0.35	0.09	n/10	0.27	0.07	(n/10)/2	0.27	0.06	0
<i>P. clarkii</i>	NRA	0.42	0.11	n/10	0.38	0.11	(n/10)/2	0.18	0.05	n/10
	NIA	0.3	0.05	n/10	0.39	0.07	(n/10)/2	0.28	0.03	(n/10)/2
	WRA	0.22	0.03	(n/10)/2	0.32	0.04	n/10	0.30	0.04	(n/10)/2

Table S3. Number of records used for evaluating the predictions. Numbers of occurrences correspond to 20% of total records collected for each species in its respective range. These records were coupled with an equal number of worldwide random pseudo-absences. For maximizing the representativeness of pseudo-absences we made 10 replicates of each validation dataset, each containing an independently drawn set of pseudo-absences.

Species	Range	Validation occurrences	Validation pseudo-absences
<i>C. destructor</i>	Native	21	21
	Invasive	10	10
<i>E. sinensis</i>	Native	20	20
	Invasive	39	39
<i>P. leniusculus</i>	Native	25	25
	Invasive	88	88
<i>P. clarkii</i>	Native	35	35
	Invasive	85	85

Table S4. Standard deviation of validation results of kappa statistic (k) and area under the curve of receiver-operating characteristic (ROC-AUC) for native ranges using native range occurrences (NRO), native and invasive occurrences (NIO) and invaded range occurrences (IRO), coupled with within native range pseudo-absences random extraction (NRA), native and invasive ranges pseudo-absences random extraction (NIA) and the common spatially worldwide random pseudo-absences (WRA).

Species	Pseudo-absences	NRO		NIO		IRO	
		SD (k)	SD (ROC-AUC)	SD (k)	SD (ROC-AUC)	SD (k)	SD (ROC-AUC)
<i>C. destructor</i>	NRA	0.066	0.061	0.072	0.060	0.050	0.061
	NIA	0.062	0.053	0.052	0.057	0.056	0.042
	WRA	0.031	0.029	0.031	0.028	0.029	0.021
<i>E. sinensis</i>	NRA	0.033	0.031	0.031	0.030	0.041	0.030
	NIA	0.029	0.035	0.045	0.032	0.042	0.046
	WRA	0.022	0.017	0.020	0.011	0.024	0.023
<i>P. leniusculus</i>	NRA	0.031	0.026	0.021	0.030	0.039	0.035
	NIA	0.055	0.032	0.041	0.034	0.061	0.047
	WRA	0.028	0.015	0.022	0.022	0.020	0.013
<i>P. clarkii</i>	NRA	0.022	0.020	0.037	0.042	0.009	0.011
	NIA	0.029	0.021	0.034	0.033	0.022	0.018
	WRA	0.019	0.011	0.022	0.014	0.028	0.024

Table S5. Standard deviation of validation results of kappa statistic (k) and area under the curve of receiver-operating characteristic (ROC-AUC) for invasive ranges using native range occurrences (NRO), native and invasive occurrences (NIO) and invaded range occurrences (IRO), coupled with within native range pseudo-absences random extraction (NRA), native and invasive ranges pseudo-absences random extraction (NIA) and the common spatially worldwide random pseudo-absences (WRA).

Species	Pseudo-absences	NRO		NIO		IRO	
		k SD	ROC-AUC SD	k SD	ROC-AUC SD	k SD	ROC-AUC SD
<i>C. destructor</i>	NRA	0.041	0.036	0.055	0.034	0.031	0.041
	NIA	0.042	0.041	0.050	0.038	0.031	0.033
	WRA	0.033	0.029	0.027	0.027	0.020	0.021
<i>E. sinensis</i>	NRA	0.042	0.036	0.028	0.028	0.034	0.032
	NIA	0.029	0.032	0.022	0.024	0.034	0.030
	WRA	0.025	0.017	0.028	0.022	0.023	0.019
<i>P. leniusculus</i>	NRA	0.036	0.033	0.039	0.042	0.035	0.036
	NIA	0.036	0.038	0.032	0.034	0.022	0.022
	WRA	0.031	0.029	0.026	0.023	0.022	0.019
<i>P. clarkii</i>	NRA	0.026	0.028	0.031	0.031	0.043	0.044
	NIA	0.036	0.037	0.022	0.025	0.032	0.029
	WRA	0.042	0.038	0.024	0.026	0.021	0.018

Table S6. Standard deviation of validation results of kappa statistic (k) and area under the curve of receiver-operating characteristic (ROC-AUC) of a weighted average of all single-models WA(all), a weighted average of all single-models using native range occurrences WA(NIO), a weighted average of all single-models using native and invasive occurrences WA(NIO), a weighted average of all single-models with invasive range occurrences WA(IRO), a weighted average of all single-models using native range pseudo-absences WA(NRA), a weighted average of all single-models using native and invasive ranges pseudo-absences random extraction WA(NIA) and a weighted average of all single-models using worldwide random pseudo-absences WA(WRA).

Species	Range	WA(all)		WA(NRO)		WA(NIO)		WA(IRO)		WA(NRA)		WA(NIA)		WA(WRA)	
		k	ROC-AUC	k	ROC-AUC	k	ROC-AUC	k	ROC-AUC	k	ROC-AUC	k	ROC-AUC	k	ROC-AUC
<i>C. destructor</i>	Native	0.58	0.72	0.71	0.81	0.57	0.69	0.47	0.57	0	0.15	0.17	0.32	0.9	0.98
	Invaded	0.61	0.73	0.53	0.64	0.66	0.8	0.64	0.74	0.23	0.52	0.27	0.4	0.79	0.96
<i>E. sinensis</i>	Native	0.64	0.73	0.75	0.87	0.65	0.79	0.34	0.38	0.12	0.49	0.38	0.55	0.62	0.88
	Invaded	0.73	0.85	0.64	0.74	0.79	0.89	0.79	0.9	0.7	0.89	0.71	0.82	0.86	0.97
<i>P. leniusculus</i>	Native	0.61	0.73	0.75	0.85	0.59	0.73	0.27	0.56	0.11	0.55	0.53	0.61	0.74	0.94
	Invaded	0.73	0.84	0.58	0.7	0.74	0.88	0.74	0.92	0.77	0.95	0.63	0.76	0.87	0.97
<i>P. clarkii</i>	Native	0.62	0.77	0.8	0.91	0.61	0.7	0.27	0.32	0	0.34	0.12	0.24	0.84	0.98
	Invaded	0.69	0.84	0.55	0.67	0.73	0.88	0.76	0.92	0.67	0.85	0.67	0.79	0.79	0.94

Table S7. Ranks of variable importance measured using the connection weights approach (Olden et al. 2004). Models were built using native range occurrences (NRO), native and invasive occurrences (NIO) and invaded range occurrences (IRO), coupled with within native range pseudo-absences random extraction (NRO), native and invasive ranges pseudo-absences random extraction (NIA), and the common spatially worldwide random pseudo-absences (WRA).

		Independent variables									
		alt	amtemp	anpre	disto	frost	maxtwm	mintcm	predr	prewm	trange
NRO – NRA	<i>C. destructor</i>	4	5	2	–	3	6	1	8	9	7
	<i>E. sinensis</i>	2	5	3	4	1	7	6	8	9	10
	<i>P. leniusculus</i>	5	3	2	–	4	8	1	7	6	9
	<i>P. clarkii</i>	5	6	8	–	1	2	4	7	3	9
NRO – NIA	<i>C. destructor</i>	5	2	4	–	1	6	3	8	9	7
	<i>E. sinensis</i>	1	4	7	2	5	9	3	6	10	8
	<i>P. leniusculus</i>	9	4	3	–	1	8	2	5	6	7
	<i>P. clarkii</i>	6	2	8	–	3	4	1	5	7	9
NRO – WRA	<i>C. destructor</i>	7	3	5	–	4	1	2	8	6	9
	<i>E. sinensis</i>	7	6	5	1	3	4	2	8	9	10
	<i>P. leniusculus</i>	8	5	2	–	4	3	1	9	6	7
	<i>P. clarkii</i>	9	2	5	–	6	1	3	4	8	7
NIO – NRA	<i>C. destructor</i>	7	2	4	–	3	1	6	5	9	8
	<i>E. sinensis</i>	1	3	5	6	2	9	4	8	7	10
	<i>P. leniusculus</i>	4	1	5	–	2	6	3	8	9	7
	<i>P. clarkii</i>	5	4	6	–	3	1	7	8	2	9
NIO – NIA	<i>C. destructor</i>	6	2	4	–	3	9	1	7	8	5
	<i>E. sinensis</i>	3	5	4	1	2	7	6	8	10	9
	<i>P. leniusculus</i>	8	1	6	–	2	7	3	4	5	9
	<i>P. clarkii</i>	6	3	4	–	2	5	1	9	8	7
NIO – WRA	<i>C. destructor</i>	8	2	6	–	5	3	1	7	4	9
	<i>E. sinensis</i>	6	4	7	1	2	3	5	8	10	9
	<i>P. leniusculus</i>	9	4	3	–	5	1	2	8	7	6
	<i>P. clarkii</i>	9	2	4	–	5	3	1	6	8	7
IRO – NRA	<i>C. destructor</i>	3	5	6	–	1	4	2	7	9	8
	<i>E. sinensis</i>	1	3	6	4	2	8	5	10	9	7
	<i>P. leniusculus</i>	4	3	5	–	2	7	1	6	9	8
	<i>P. clarkii</i>	4	7	6	–	3	1	2	9	8	5
IRO – NIA	<i>C. destructor</i>	4	1	8	–	3	5	2	6	9	7
	<i>E. sinensis</i>	3	4	6	1	2	7	5	8	10	9
	<i>P. leniusculus</i>	5	1	7	–	4	6	2	3	8	9
	<i>P. clarkii</i>	4	3	6	–	2	7	1	9	5	8
IRO – WRA	<i>C. destructor</i>	6	4	7	–	3	2	1	5	8	9
	<i>E. sinensis</i>	9	4	3	2	5	1	6	10	8	7
	<i>P. leniusculus</i>	7	5	4	–	3	2	1	6	9	8
	<i>P. clarkii</i>	9	3	2	–	7	4	1	5	8	6

References

Olden, J. D. et al. 2004. An accurate comparison of methods for quantifying variable importance in artificial neural networks using simulated data. – *Ecol. Model.* 178: 389–397.