Phylogenetic relatedness and invader success:

… an experimental approach of Darwin's naturalization conundrum

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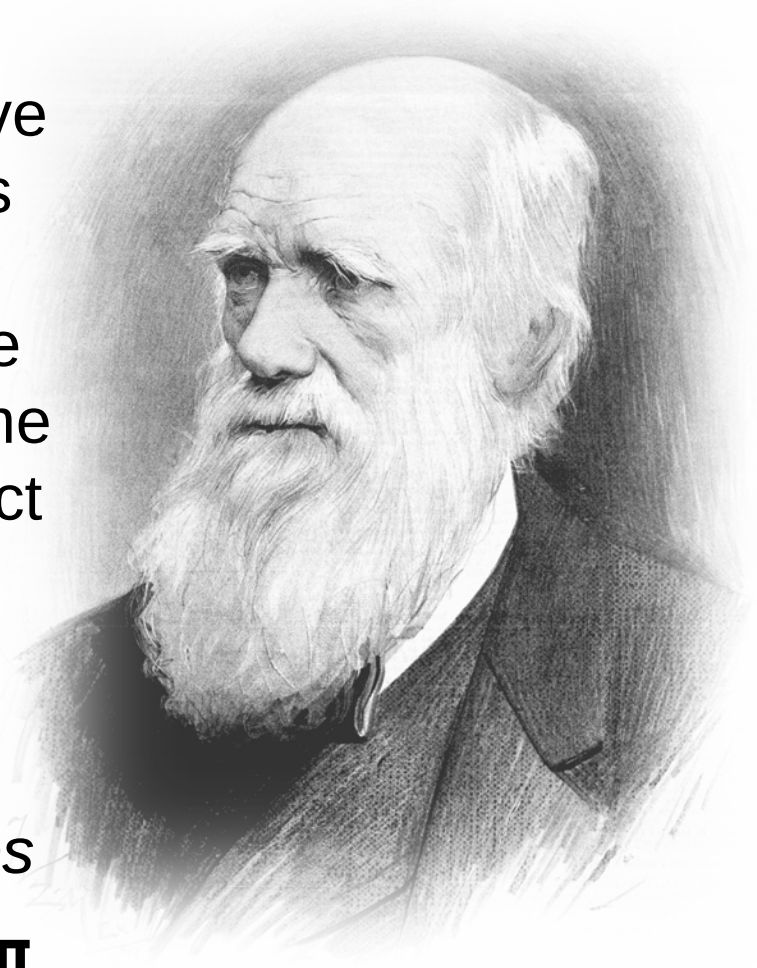
Understanding the factors that determine species invasiveness and habitat invasibility is a central theme in invasion ecology

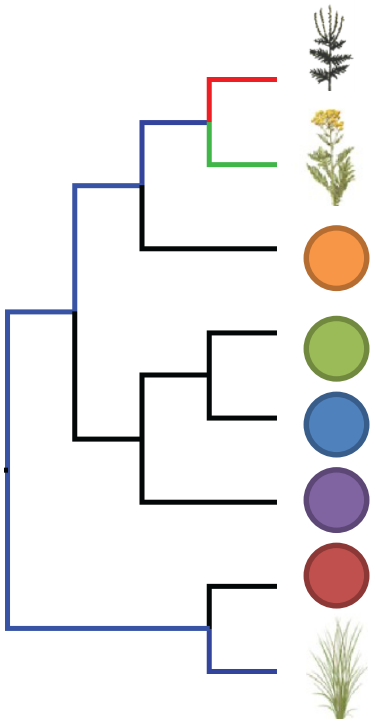
“As species of the same genus have usually… some similarity in habits and constitution, and always in structure, the struggle will be more severe between species of the same genus, when they come into contact with each other…”

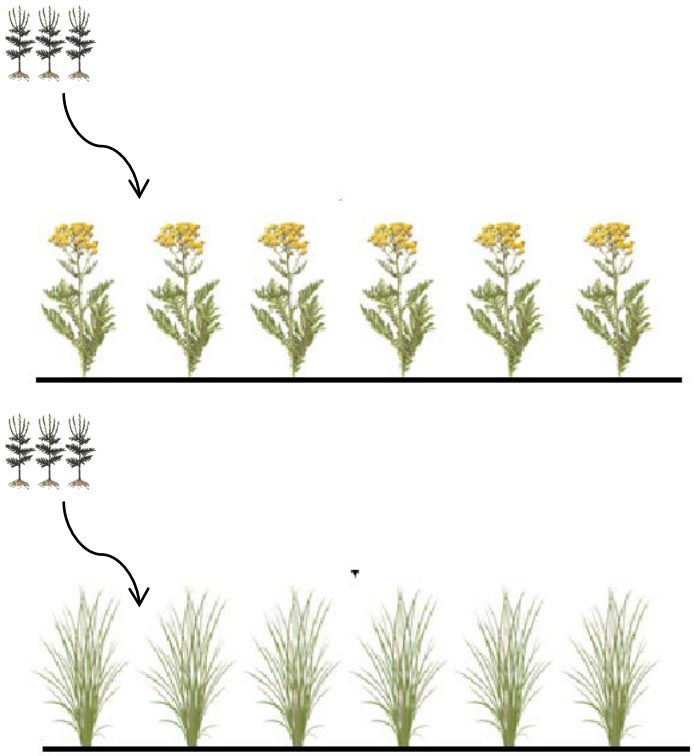


Darwin 1859, *The Origin of Species*

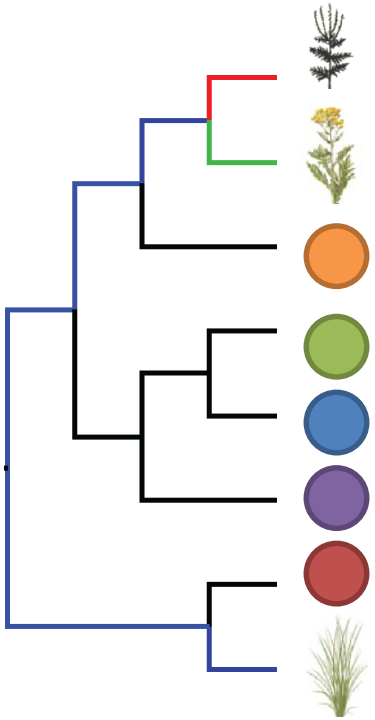
Chapter Ⅲ

Darwin’s naturalization hypothesis

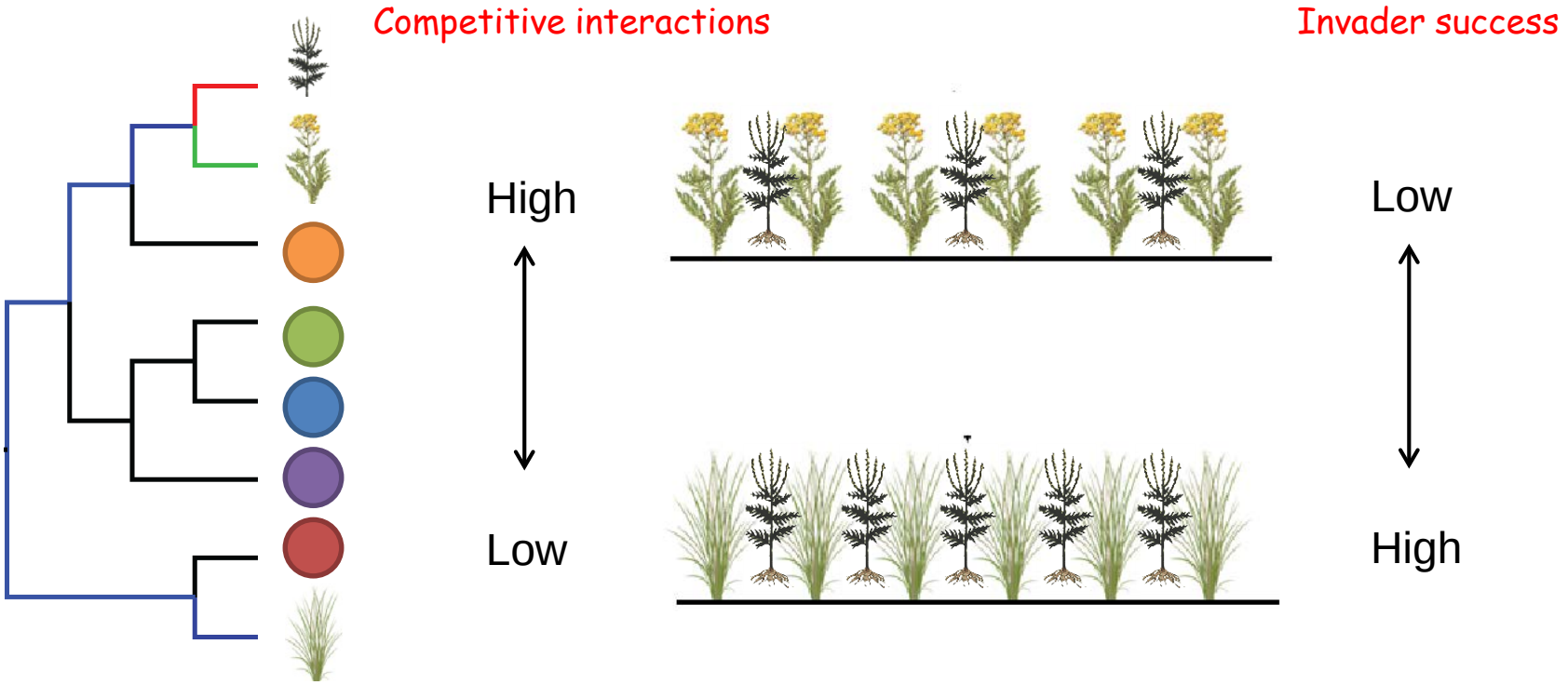


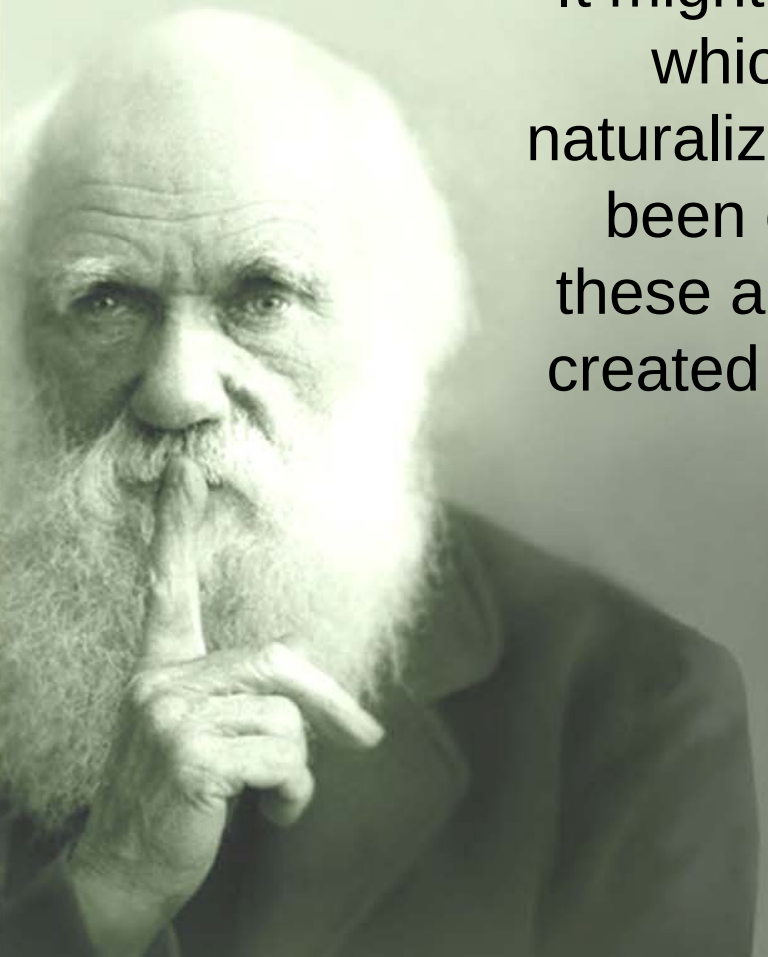


Darwin’s naturalization hypothesis



Darwin's naturalization hypothesis



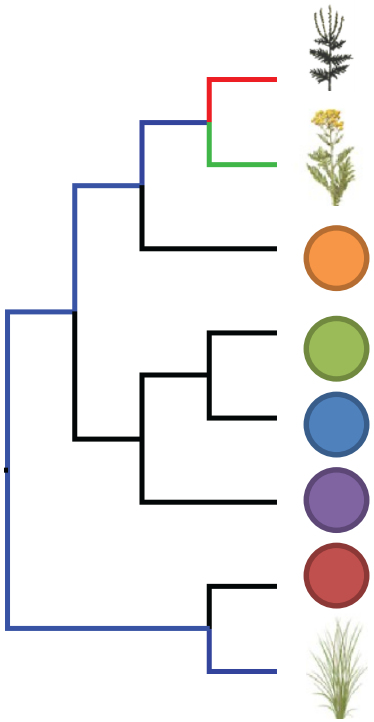


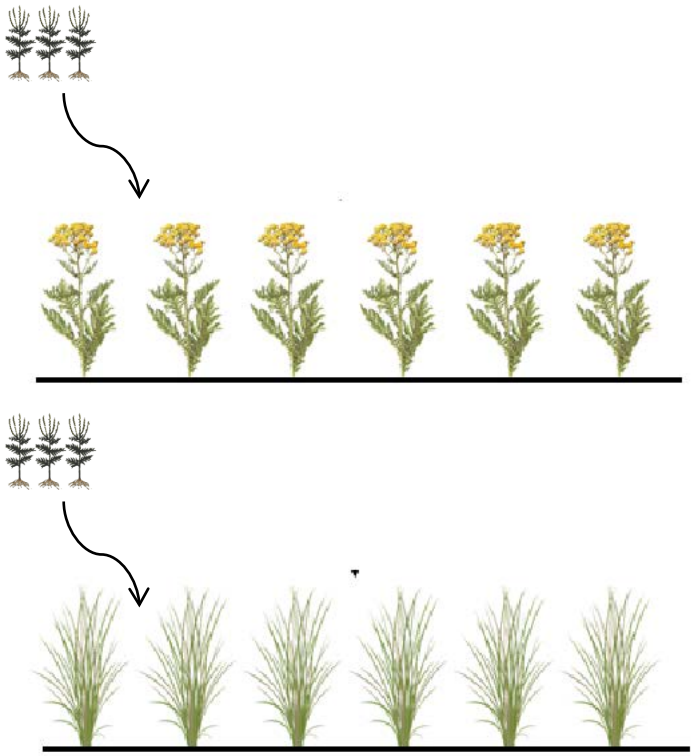
“It might have been expected that the plants which have succeeded in becoming naturalized in any land would generally have been closely allied to the indigenes; for these are commonly looked at as specially created and adapted for their own country.”

Darwin 1859, *The Origin of Species*

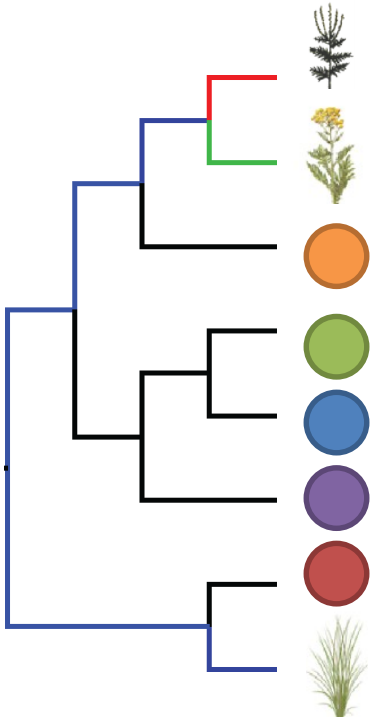
Chapter IV

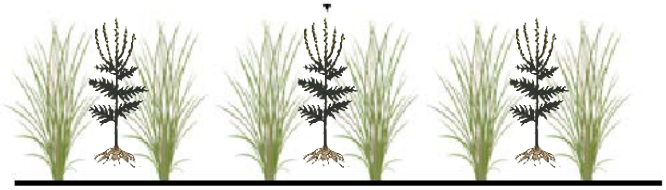
Pre-adaption hypothesis



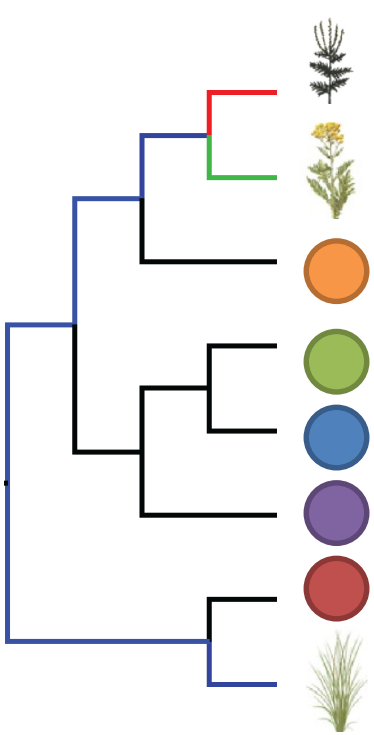


Pre-adaption hypothesis





Pre-adaption hypothesis



Environmental filtering

Low

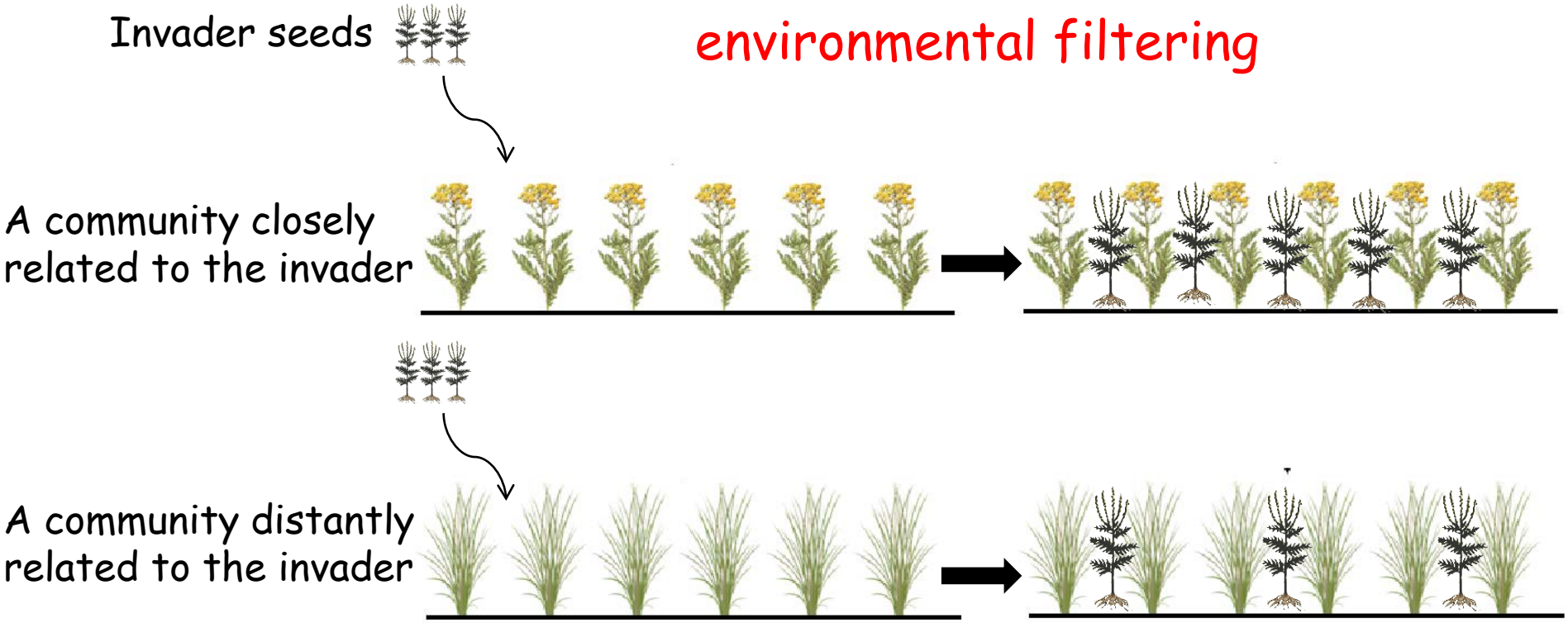
High

Invader success

High

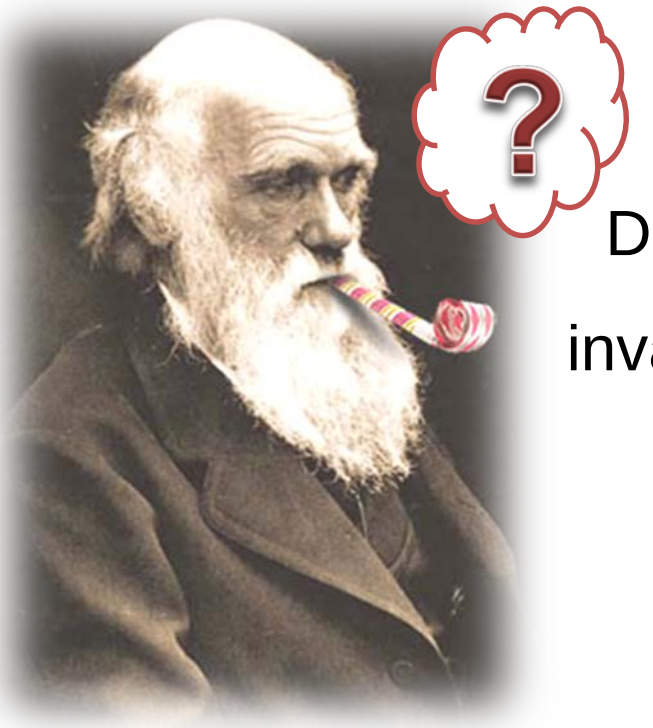
Low

Pre-adaption hypothesis



Daehler 2001; Duncan & Williams 2002; Diez et al. 2008, 2009; Maitner et al. 2012

Darwin's naturalization conundrum

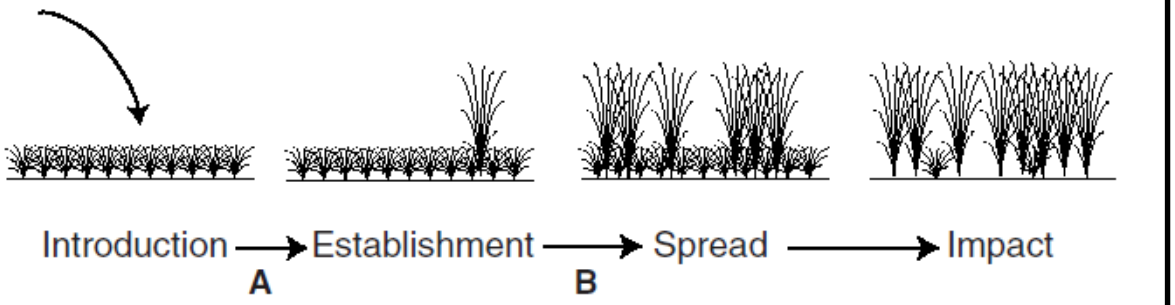


Does the phylogenetic relatedness of invaders to native communities promote or hamper invader naturalization/success?

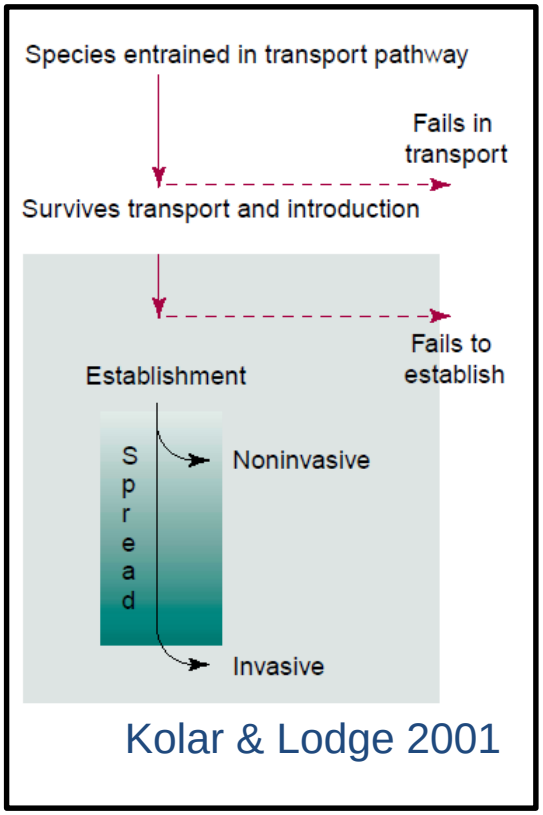
…recent studies produced mixed results.

Diez et al. 2008; Proches et al. 2008; Thuiller et al. 2010

However, invasion process could be divided into different stages …

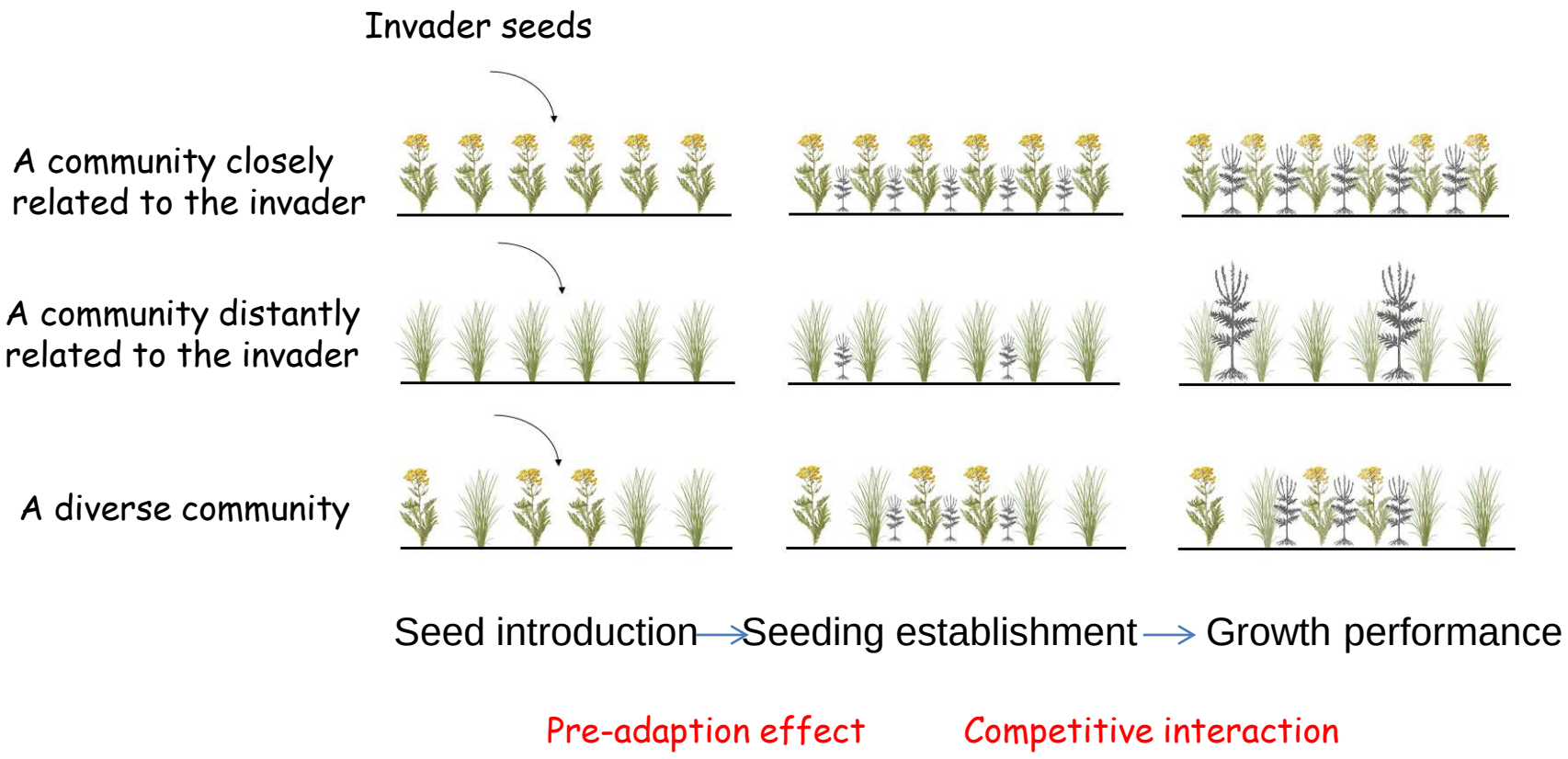


Levine et al. 2004



Kolar & Lodge 2001

Our hypothesis



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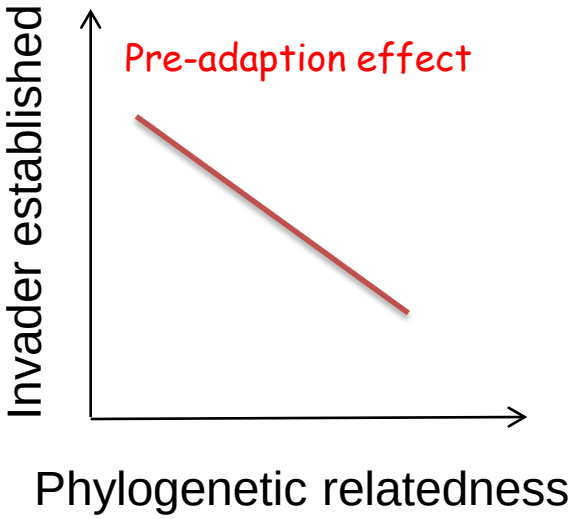
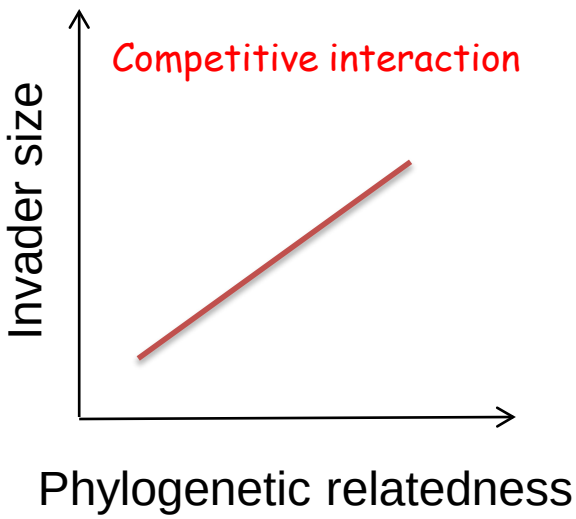
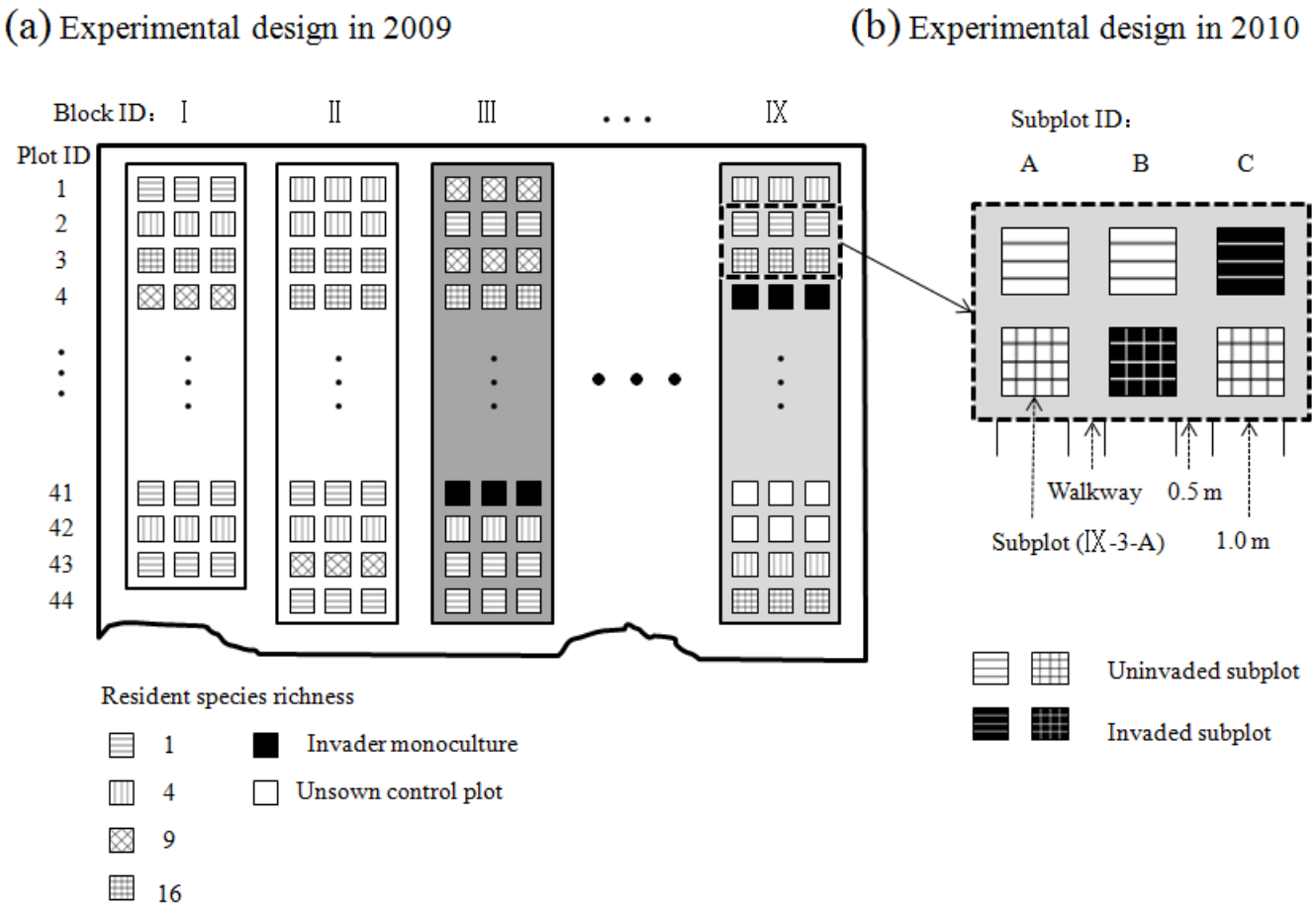


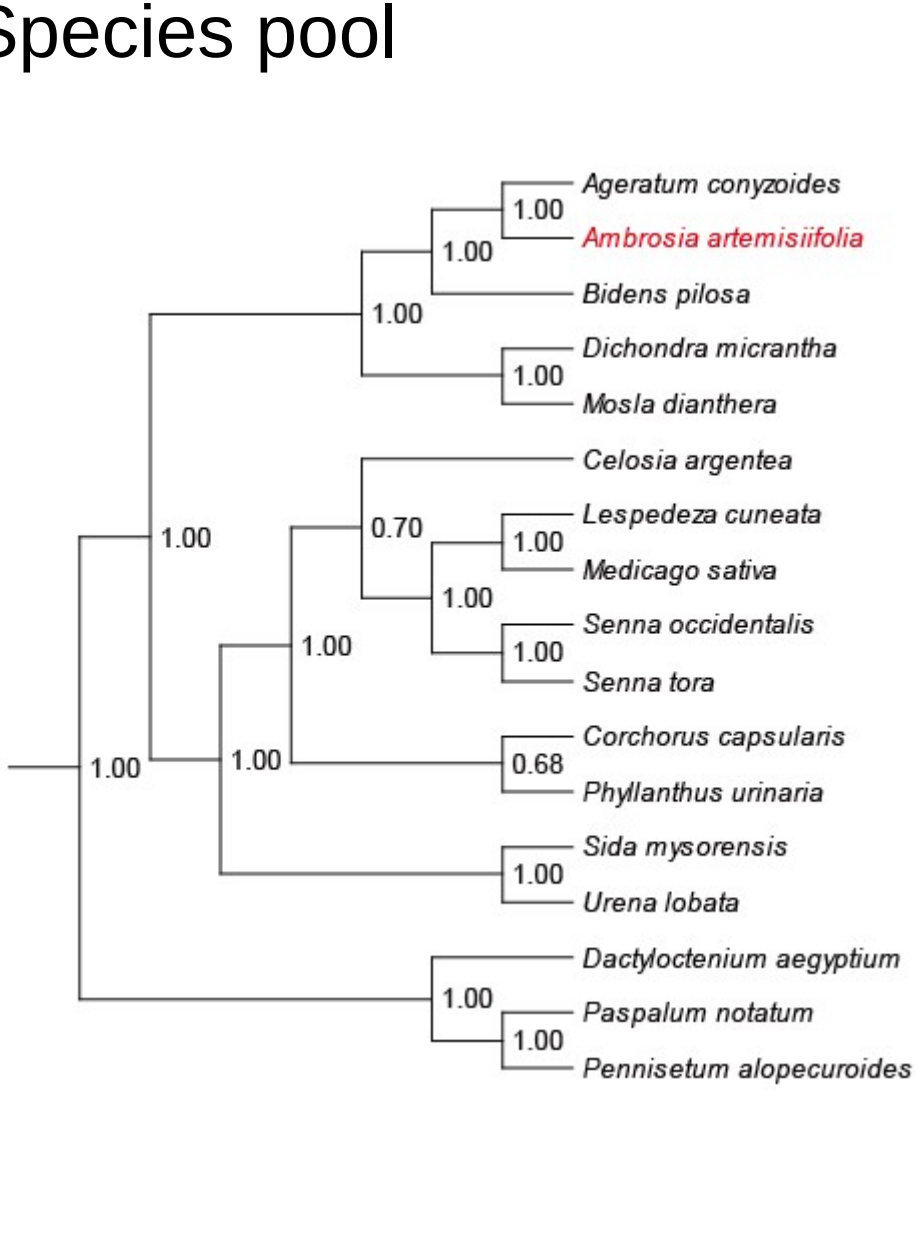


Experimental design



Experimental design

Species pool



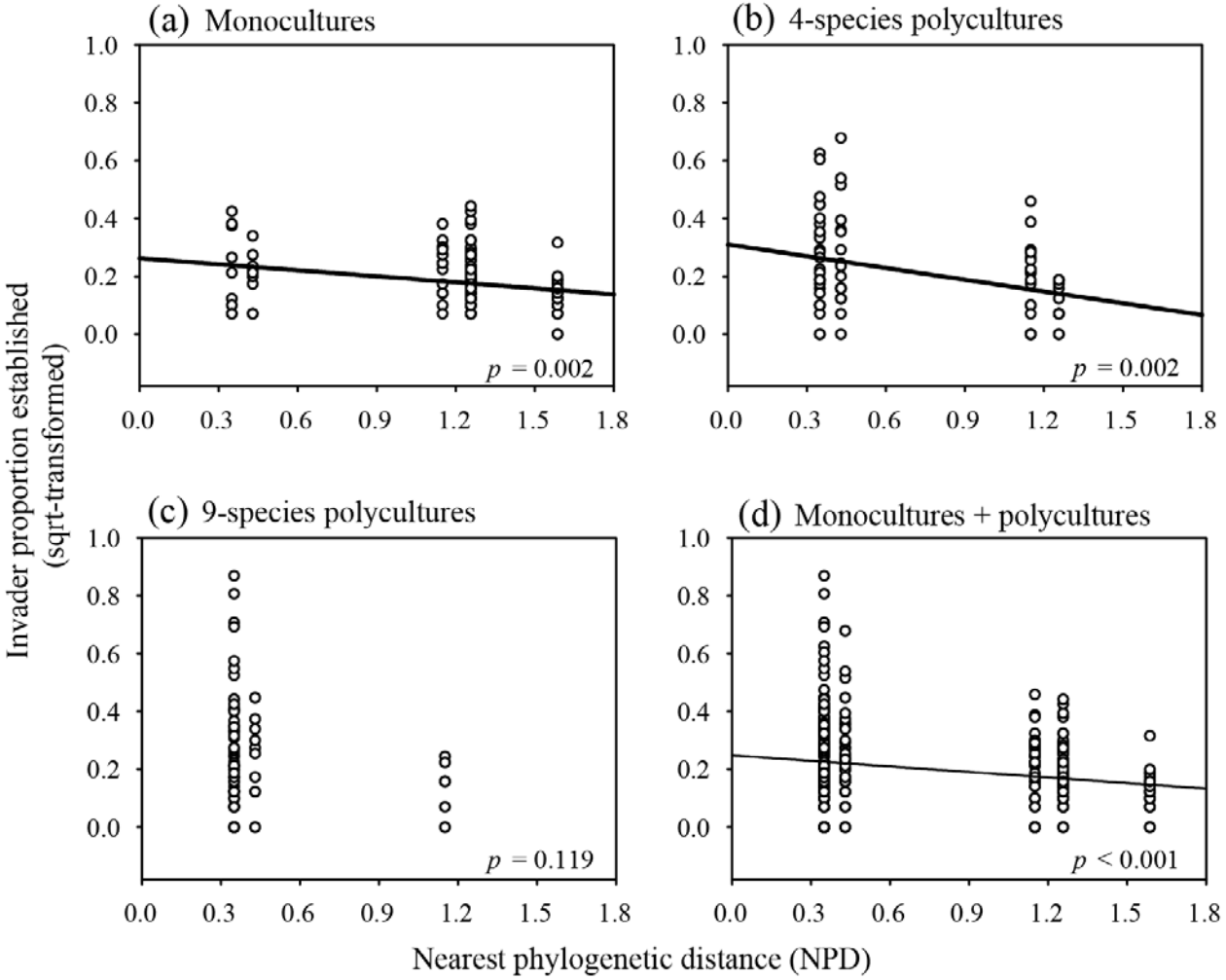




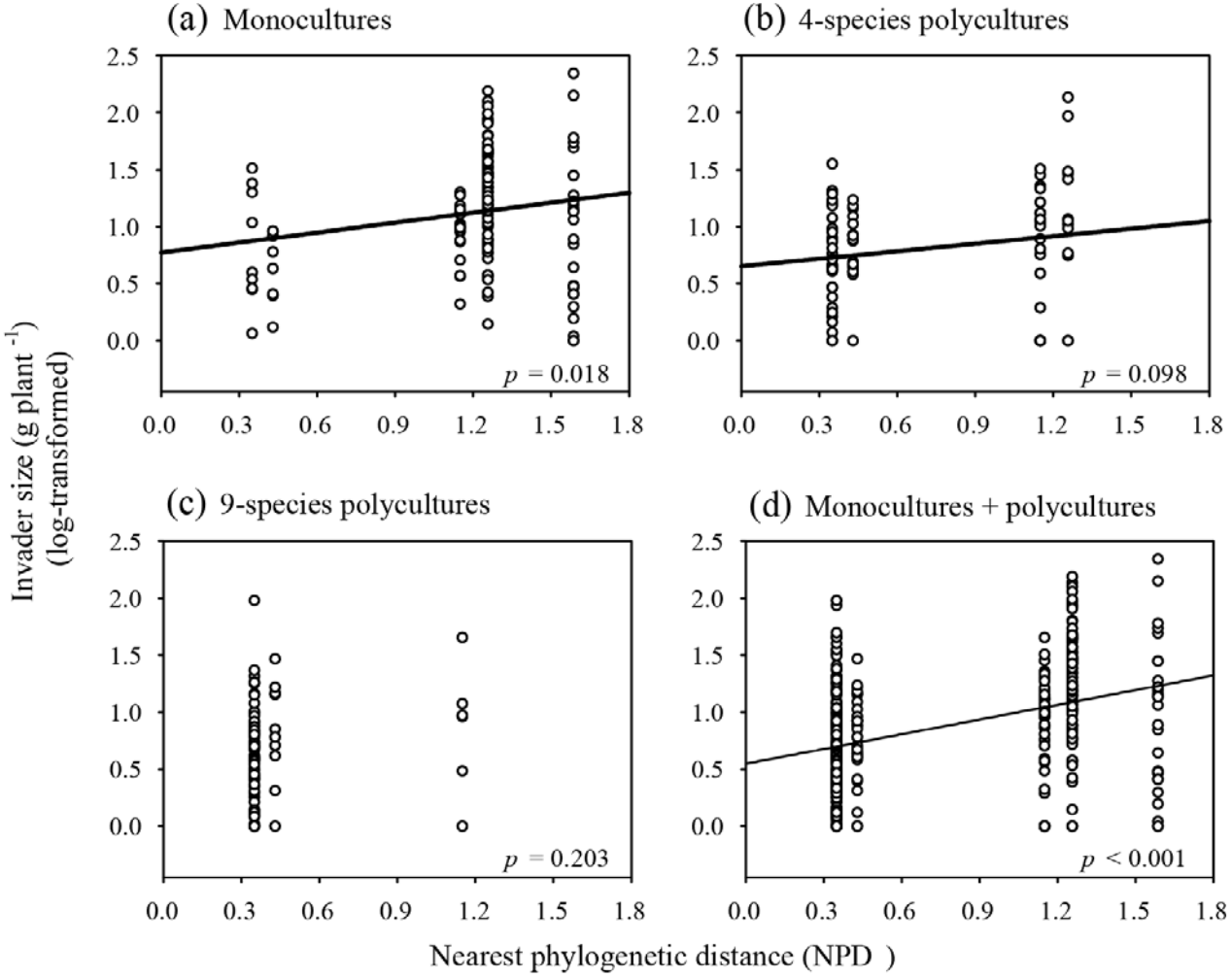




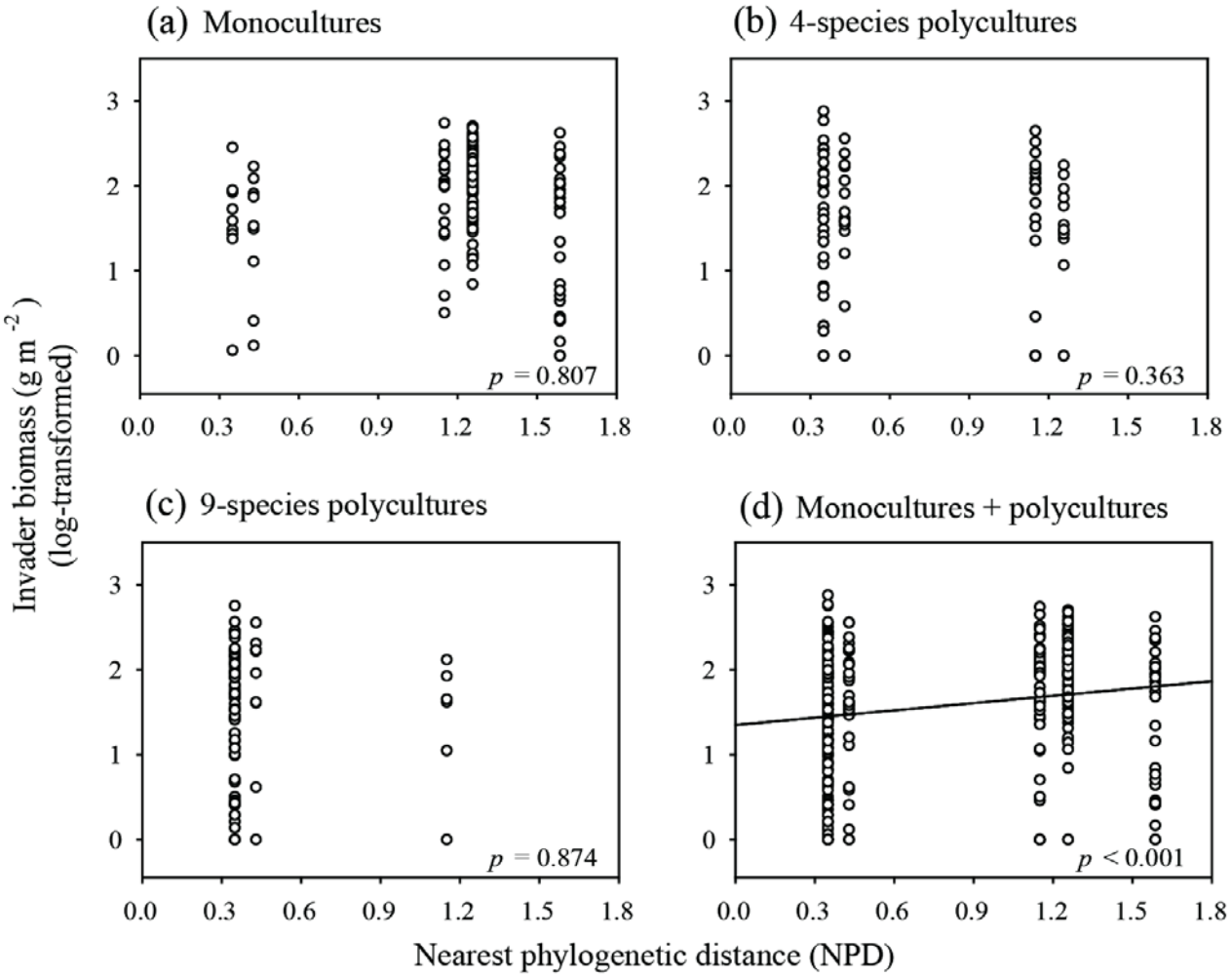
Effect of phylogenetic relatedness on the invader establishment



Effect of phylogenetic relatedness on average size of the invader



Effect of phylogenetic relatedness on invader biomass



Effect of species richness on invader establishment, size and biomass

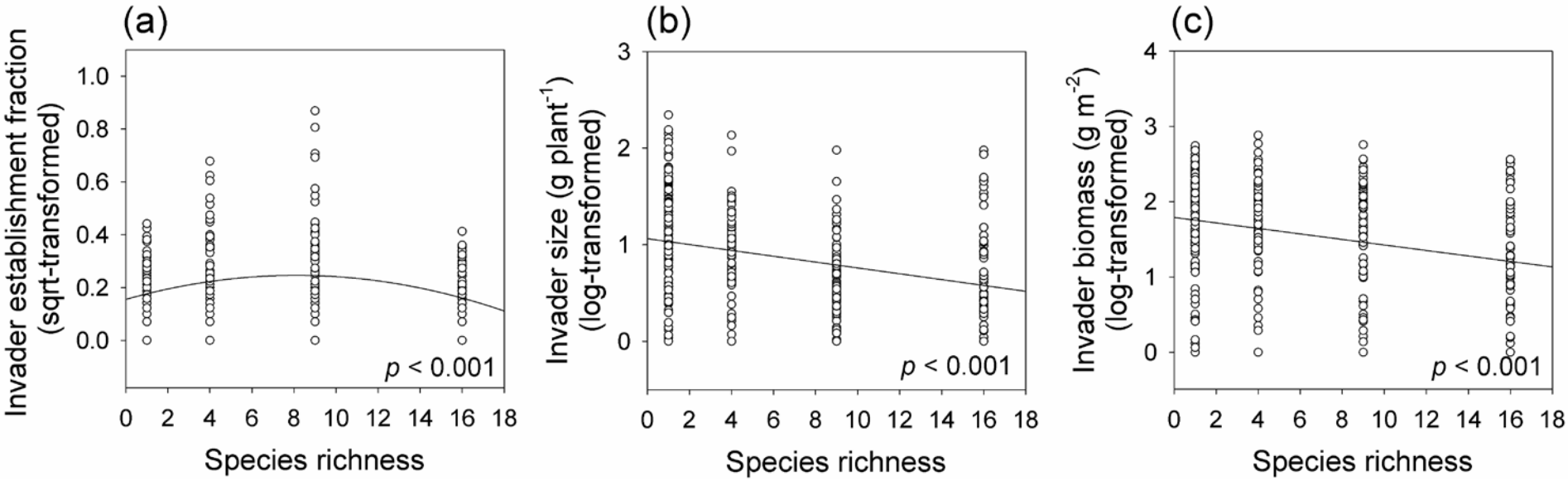


Table 1 Results of univariate models fitting the proportion established, average individual size and aboveground biomass of the invader via phylogenetic relatedness and species richness.

Dependent	Variable	*Slope*	*DF*	R^2	*P*	AIC
Sqrt (proportion established)	**NPD**	**-0.07**	**367**	**0.048**	**< 0.001**	**-438.48***
	MPD	-0.11	367	0.034	< 0.001	-432.94
	Species richness	0.00	367	< 0.001	0.959	-420.33
Log (invader size)	**NPD**	**0.43**	**367**	**0.149**	**< 0.001**	**511.00***
	MPD	0.39	367	0.029	0.001	559.91
	Species richness	-0.03	367	0.100	< 0.001	531.62
Log (invader biomass)	NPD	0.29	367	0.032	< 0.001	828.12
	MPD	0.03	367	< 0.001	0.865	840.02
	Species richness	**-0.04**	**367**	**0.070**	**< 0.001**	**813.18***

NPD, nearest phylogenetic distance. MPD, mean phylogenetic distance.
***The best single variable model, highlighted in bold.

Take home message…

- Phylogenetic relatedness has contrasting effects on invader establishment and growth performance;
- Some important mechanisms will be obscured when simply considering the presence or total biomass of an invader species as a single measure of its success.

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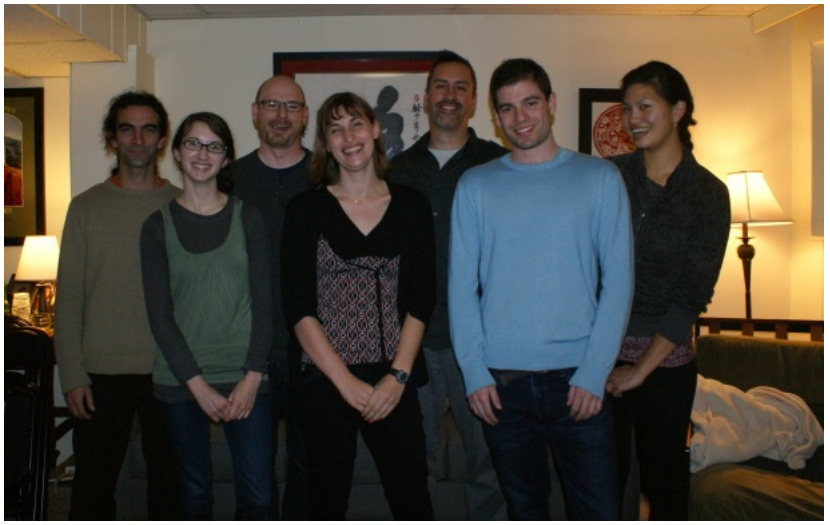

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