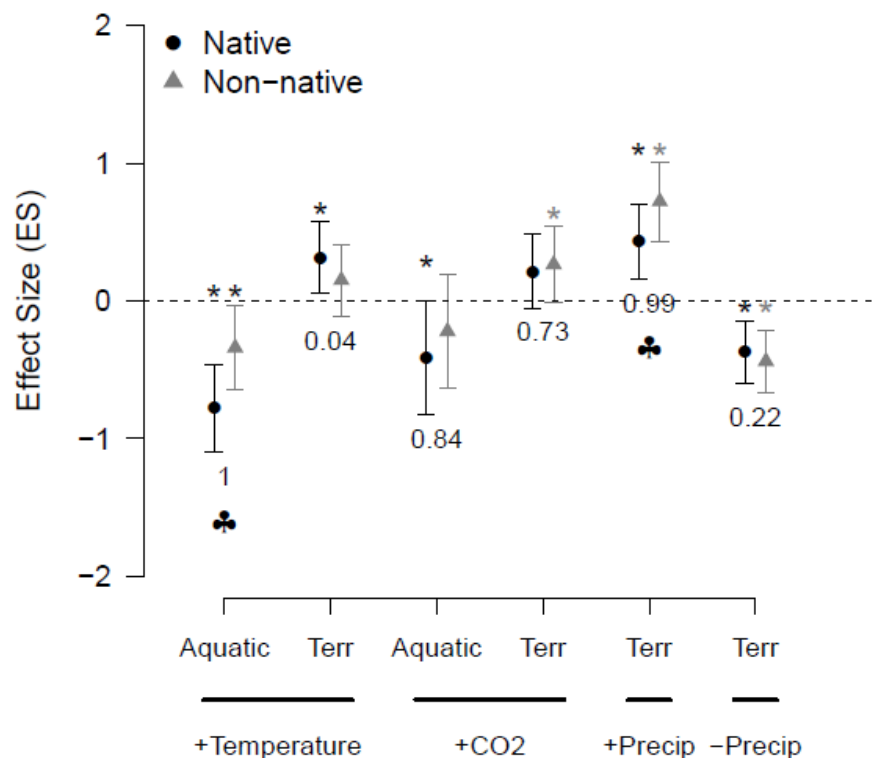


### Appendix S5 Results of mixed models used to assess effects of potential covariates.

All mixed models were run in OpenBUGS, called from R using the R2OpenBUGS package. Three chains were run for 10,000 iterations, thinning by 25, and convergence was assessed visually and using the Gelman-Rubin criteria.

**Model 1:** The first mixed model was the simplest, modeling effect size (difference-to-mean ratio  $ES$ ) as a function of origin-driver-system groups and including a random effect to account for studies.

$$ES \sim \alpha_{[\text{Origin, driver, System}]} + \text{RandomEffect}_{[\text{study}]}$$

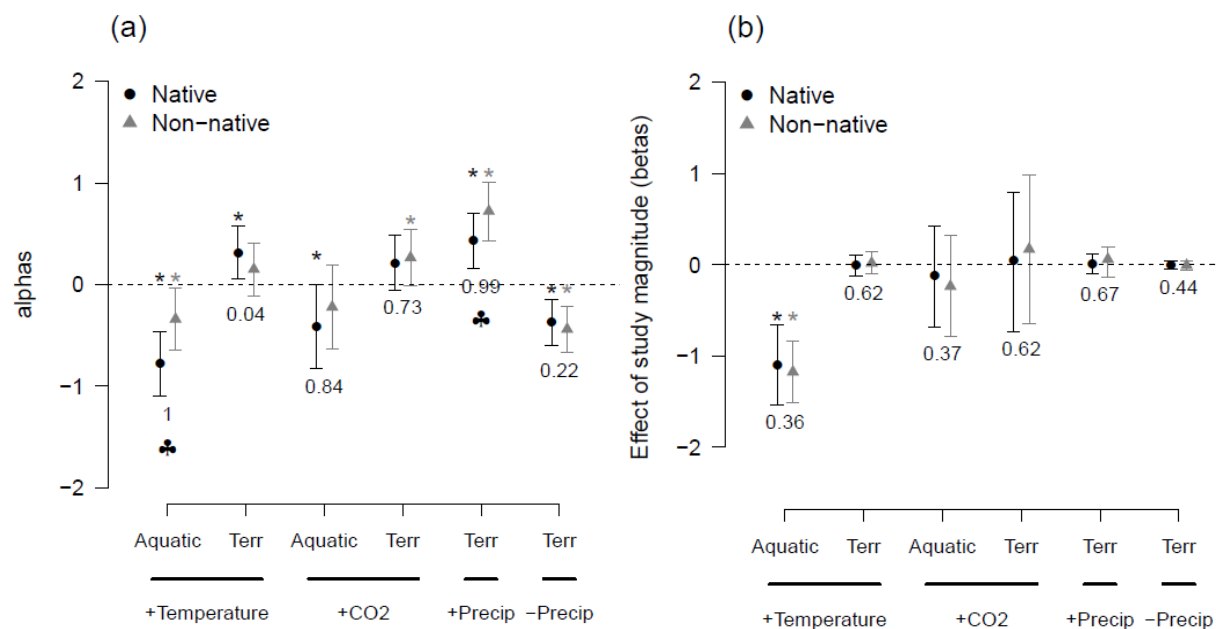


**Figure S5.1:** Results for Model 1. Points represent mean responses (difference-to-mean ratio  $ES$ ; see *Methods*) for each origin-driver-system combination, and error bars represent 95% credible intervals. Asterisks denote responses that are significantly different from zero for native (black circles) and non-native species (gray triangles). The number under each pair of responses gives the probability that the non-native species are responding more positively than the natives (calculated from the difference between the two in the model). Clover symbols mark those where non-natives show a statistically significant advantage over native species.

## Appendix S5 (con't)

**Model 2:** The second mixed model tested how effect size (difference-to-mean ratio  $ES$ ) varied as a function of origin-driver-system groups and the magnitude of study treatment, while again including a random effect to account for studies.

$$ES \sim \alpha_{[\text{Origin, driver, System}]} + \beta_{[\text{Origin, driver, System}]} * \text{Treatment Magnitude} + \text{RandomEffect}_{[\text{study}]}$$



**Figure S5.2.** Intercepts (a) and coefficients (b) describing the effect of study magnitude on responses in each of the driver-origin categories. Points represent mean parameter estimates for each origin-driver-system combination, and intervals are 95% credible intervals. Asterisks denote effect sizes that are significantly different from zero for native (black circles) and non-native species (gray triangles). The number under each pair of responses gives the probability that the non-natives are responding more positively than the native species (calculated from the difference between the two in the model). Clover symbols mark comparisons where non-native species show a statistically significant advantage over natives.

## Appendix S5 (con't)

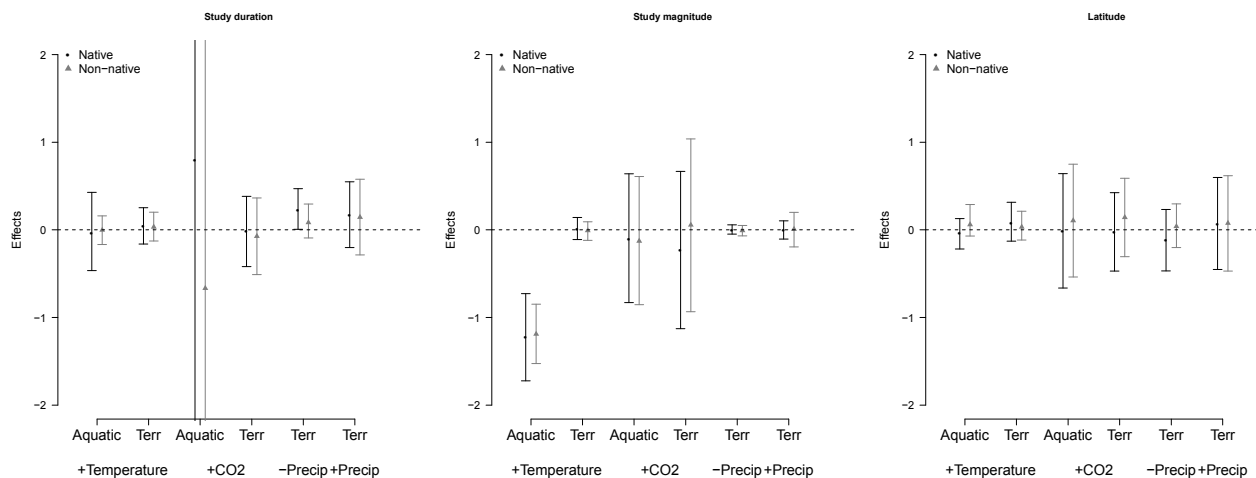
**Model 3.** The third mixed model explored the effects of multiple additional covariates, none of which were significant in this analysis:

Random effects:

- Latitude
- Study duration
- Study magnitude
- Study

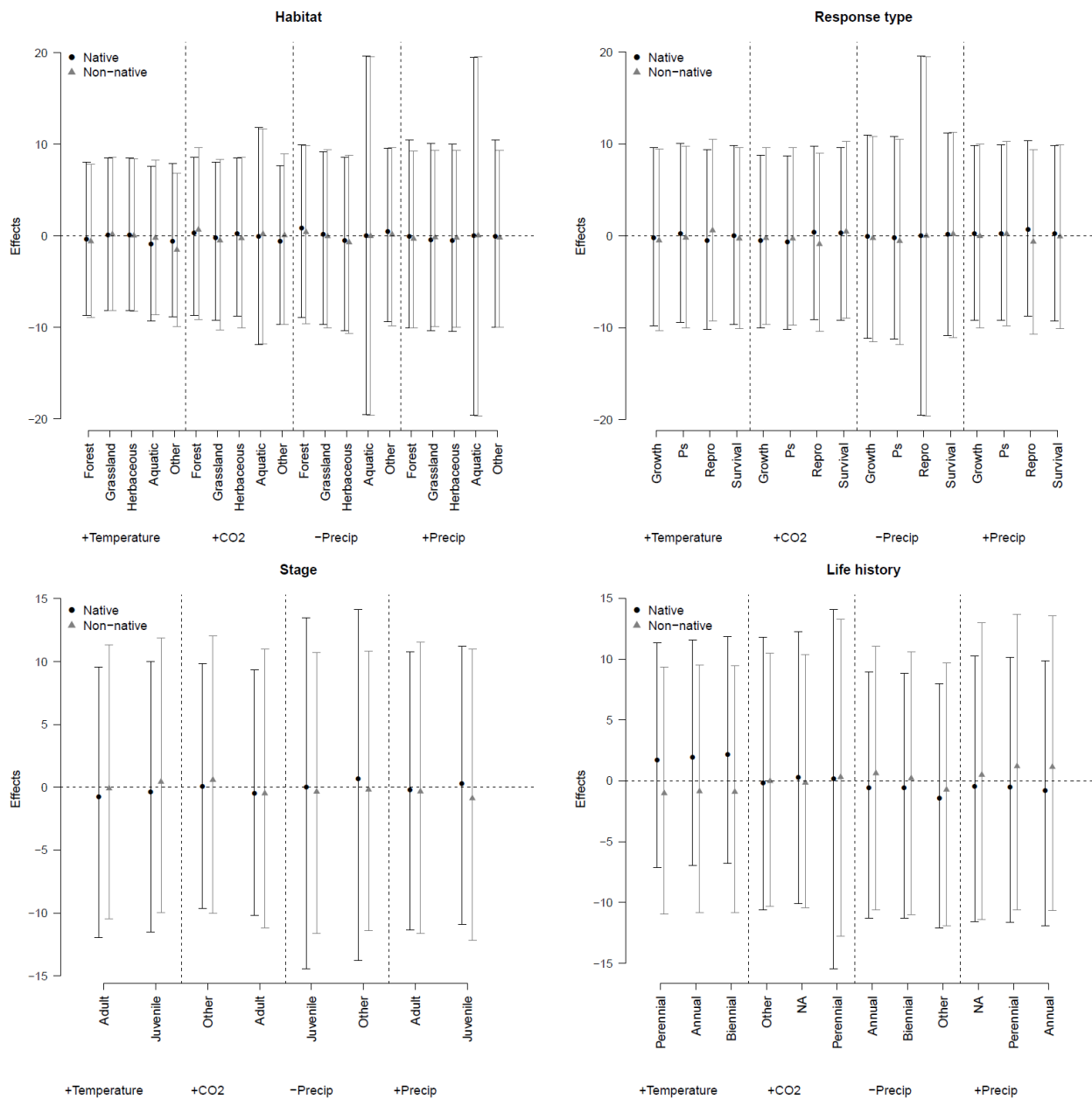
Fixed effects:

- Stage (Adult / Juvenile / Other)
- Habitat (Forest / Grassland / Herbaceous / Aquatic / Other)
- Response variable (Growth / Photosynth / Reproduction / Survival)
- Life history (Annual / Perennial / NA)



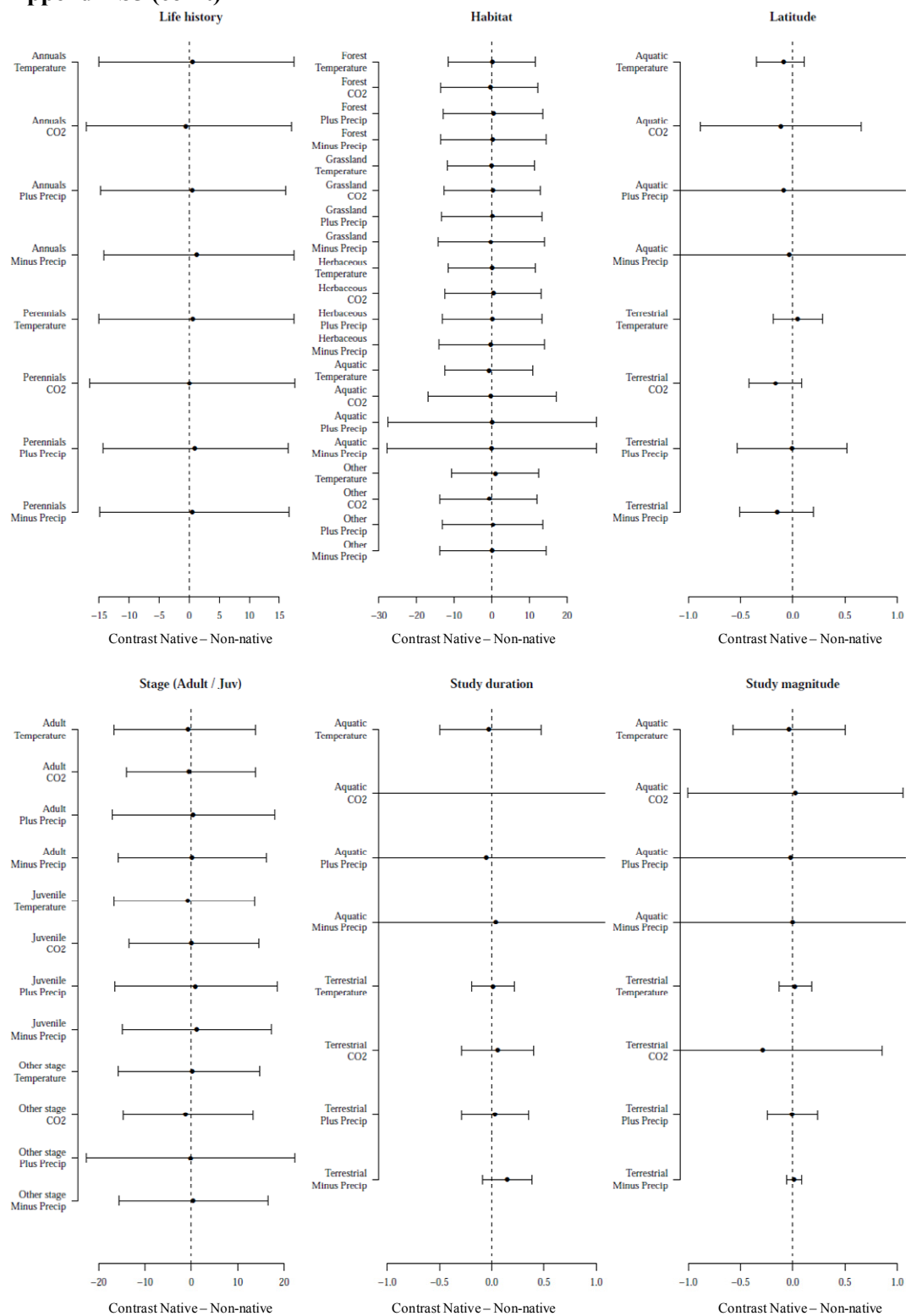
**Figure S5.3.** Parameter estimates for additional covariates. Points represent mean parameter estimates for each origin-driver-system combination, and intervals are 95% credible intervals.

## Appendix S5 (con't)



**Figure S5.3 (cont.).** Parameter estimates for additional covariates. Points represent mean parameter estimates for each origin-driver-system combination, and intervals are 95% credible intervals.

## Appendix S5 (con't)



**Figure S5.4.** Contrasts showing the differences in effects between native and non-native species for the covariates in Model 3. None of the contrasts from Model 3 were significant.

## Appendix S5 (con't)

**Model 4.** The fourth mixed model included latitude only (as well as a random effect for study) and indicated a marginally significant effect of latitude in aquatic temperature studies.

**Table S5.1.** Parameter value estimates for the effect of latitude from Model 4, as well as contrasts between native and non-native species (the marginally significant contrast for effect of latitude is shown in bold).

System	Origin	Driver	parameter	mean	sd	val2.5pc	val97.5pc
Aquatic	Native	Temperature	beta.lat[1,1,1]	-0.1276	0.1177	-0.4065	0.04609
Aquatic	Native	CO2	beta.lat[1,1,2]	0.2541	0.1682	-0.0721	0.5876
Aquatic	Native	Plus Precip	beta.lat[1,1,3]	-0.0776	10.05	-20.06	19.57
Aquatic	Native	Minus Precip	beta.lat[1,1,4]	0.133	10.01	-19.58	19.87
Aquatic	Non-native	Temperature	beta.lat[1,2,1]	0.02346	0.07209	-0.1052	0.1989
Aquatic	Non-native	CO2	beta.lat[1,2,2]	0.2847	0.1676	-0.04197	0.6148
Aquatic	Non-native	Plus Precip	beta.lat[1,2,3]	-0.05197	10.04	-19.52	19.78
Aquatic	Non-native	Minus Precip	beta.lat[1,2,4]	0.104	9.834	-19.03	19.57
Terrestrial	Native	Temperature	beta.lat[2,1,1]	0.02218	0.07934	-0.1308	0.1878
Terrestrial	Native	CO2	beta.lat[2,1,2]	0.09549	0.135	-0.1694	0.3622
Terrestrial	Native	Plus Precip	beta.lat[2,1,3]	0.01722	0.1587	-0.2962	0.3271
Terrestrial	Native	Minus Precip	beta.lat[2,1,4]	0.05129	0.1279	-0.1983	0.2909
Terrestrial	Non-native	Temperature	beta.lat[2,2,1]	0.02884	0.07481	-0.109	0.1822
Terrestrial	Non-native	CO2	beta.lat[2,2,2]	0.1762	0.1366	-0.09007	0.4474
Terrestrial	Non-native	Plus Precip	beta.lat[2,2,3]	-0.01521	0.1564	-0.3197	0.2944
Terrestrial	Non-native	Minus Precip	beta.lat[2,2,4]	-0.002346	0.0933	-0.188	0.1804
Contrast Native – Non-native effects							
Aquatic		Temperature	<b>cont.lat[1,1]</b>	<b>-0.1511</b>	<b>0.1243</b>	<b>-0.4282</b>	<b>0.05067 *</b>
Aquatic		CO2	cont.lat[1,2]	-0.03065	0.1641	-0.3531	0.294
Aquatic		Plus Precip	cont.lat[1,3]	-0.02563	14.12	-27.77	27.54
Aquatic		Minus Precip	cont.lat[1,4]	0.02903	13.93	-27.49	27.15
Terrestrial		Temperature	cont.lat[2,1]	-0.006657	0.08758	-0.1791	0.1677
Terrestrial		CO2	cont.lat[2,2]	-0.08069	0.08064	-0.2403	0.0772
Terrestrial		Plus Precip	cont.lat[2,3]	0.03243	0.1334	-0.2299	0.2925
Terrestrial		Minus Precip	cont.lat[2,4]	0.05364	0.1169	-0.1805	0.2816