Supplemental materials

Supplemental materials for Ossanna & Gornish (2022), "Efficacy of labile carbon addition to reduce fast-growing, exotic invasive plants: A review and meta-analysis".

Table S1 & S2. Raw data
For Tables S1 & S2, see accompanying Zenodo archive under the same name as the paper title. The Zenodo archive also includes R Markdown documents detailing analysis and code.

Table S3. Systematic review: Publication types

Publication type	n	Percent (%)
peer-reviewed article	63	75.9
master's thesis	11	13.3
technical report	5	6.0
doctoral dissertation	3	3.6
conference	1	1.2

Table S4. Systematic review: Study regions

Region	n	Percent (%)
Rocky Mountains, USA	12	14.5
Great Basin, USA	11	13.3
southeast Australia	10	12.0
Midwest, USA	9	10.8
coastal CA, USA	8	9.6
Pacific Northwest, USA	8	9.6
central Canada	6	7.2
Great Plains, USA	5	6.0
Europe	3	3.6
HI, USA	3	3.6
northeast USA	2	2.4
South Africa	2	2.4
southwest USA	2	2.4
Gulf of Mexico, USA	1	1.2
Himalaya	1	1.2

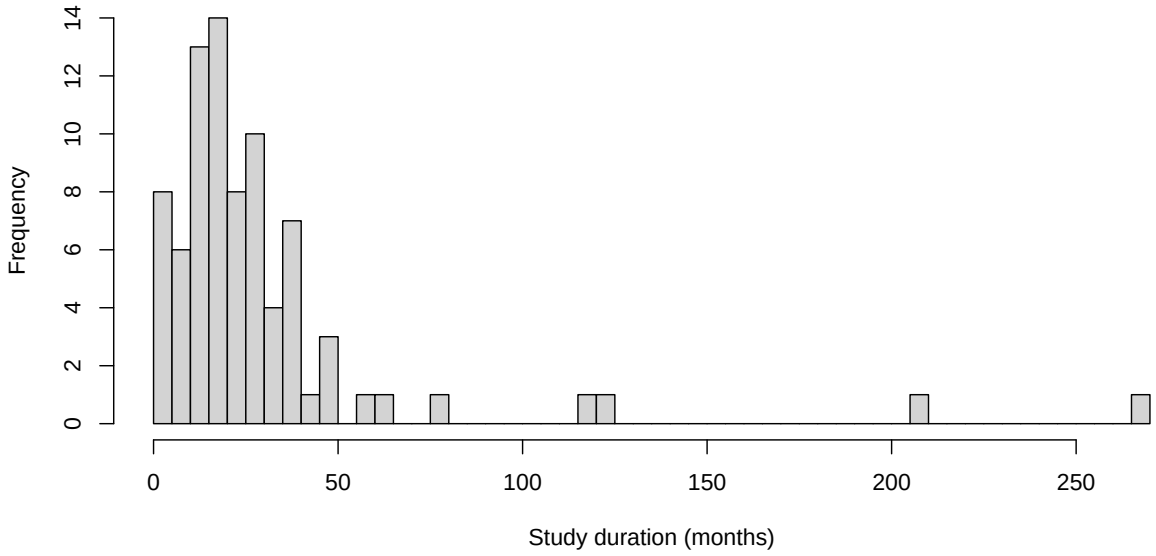


Figure S1. Study duration for systematic review, where study duration is defined as months from the first C application to the last plant measurements.

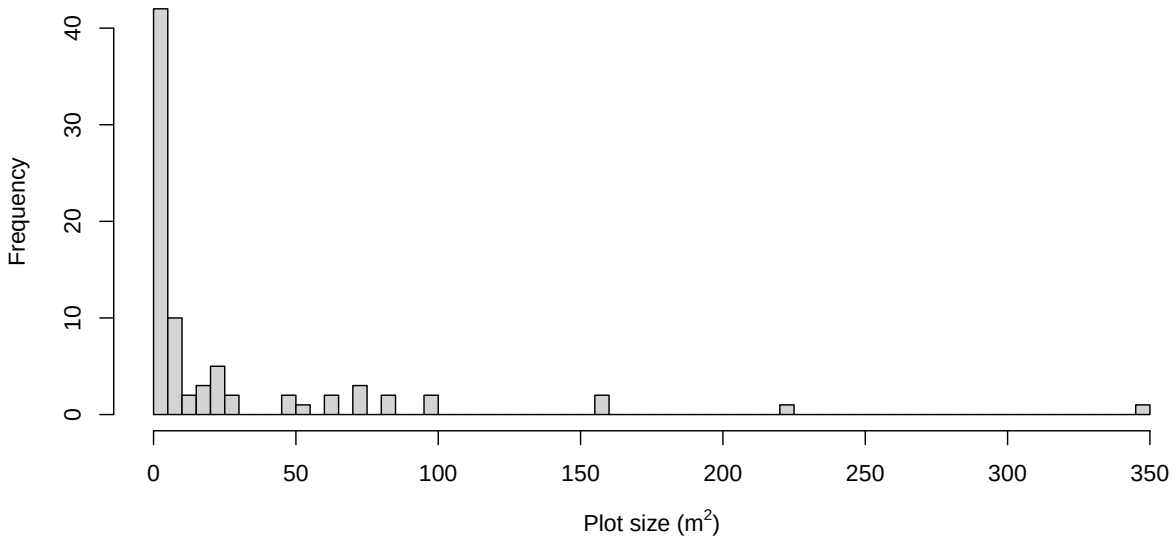


Figure S2. Plot size for systematic review.

Table S5. Systematic review: C types

C type	n	Percent (%)
sucrose	42	50.6
sawdust	19	22.9
sucrose AND sawdust	11	13.3
activated carbon	2	2.4
mulch	2	2.4
straw	2	2.4
woodchip	2	2.4
dextrose	1	1.2
wood mulch	1	1.2
woodchip mulch	1	1.2

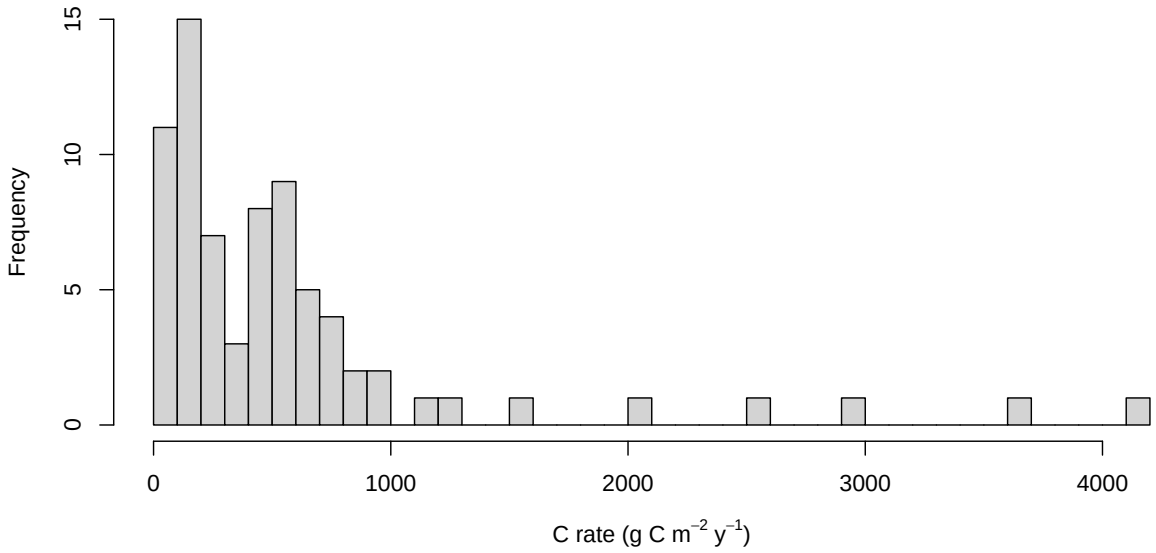


Figure S3. Average C rate for systematic review.

Table S6. Systematic review: Number of treatment combinations with C addition

Number of additional treatments	n	Percent (%)
1 additional treatment	33	39.8
C addition only	31	37.3
2 additional treatments	15	18.1
3 additional treatments	4	4.8

Table S7. Systematic review: Types of treatment combinations with C addition

Additional treatments	n	Percent (%)
native seeded	13	28.9
burn	11	24.4
tilling	5	11.1
water manipulation	4	8.9
soil amendment	3	6.7
cutting	2	4.4
fertilizer	2	4.4
grazing	2	4.4
hand-pulling	2	4.4
litter removal	1	2.2

Table S8. Systematic review: Inclusion of cost

Cost inclusion	n	Percent (%)
absent	51	61.4
mentioned briefly	18	21.7
discussed in context of results	9	10.8
quantitative estimate	5	6.0

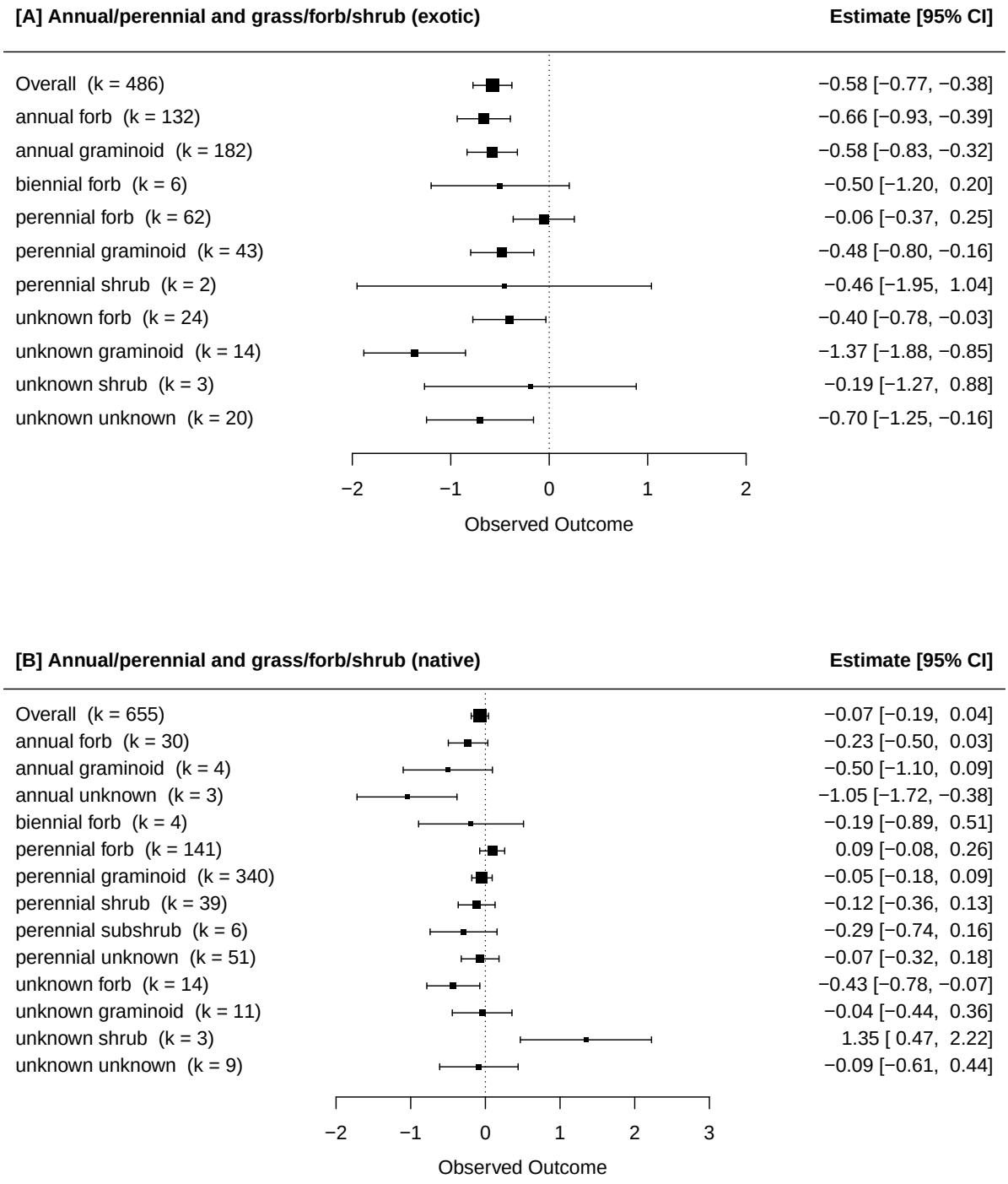


Figure S4. Standardized mean Hedges' g effect size ± 95% confidence interval (CI) for exotic (A) and native plant abundance (B) in response to C addition, categorized by plant lifeform and duration (annual/perennial and grass/forb/shrub), with number of comparisons k. CIs that do not overlap zero are considered significant.

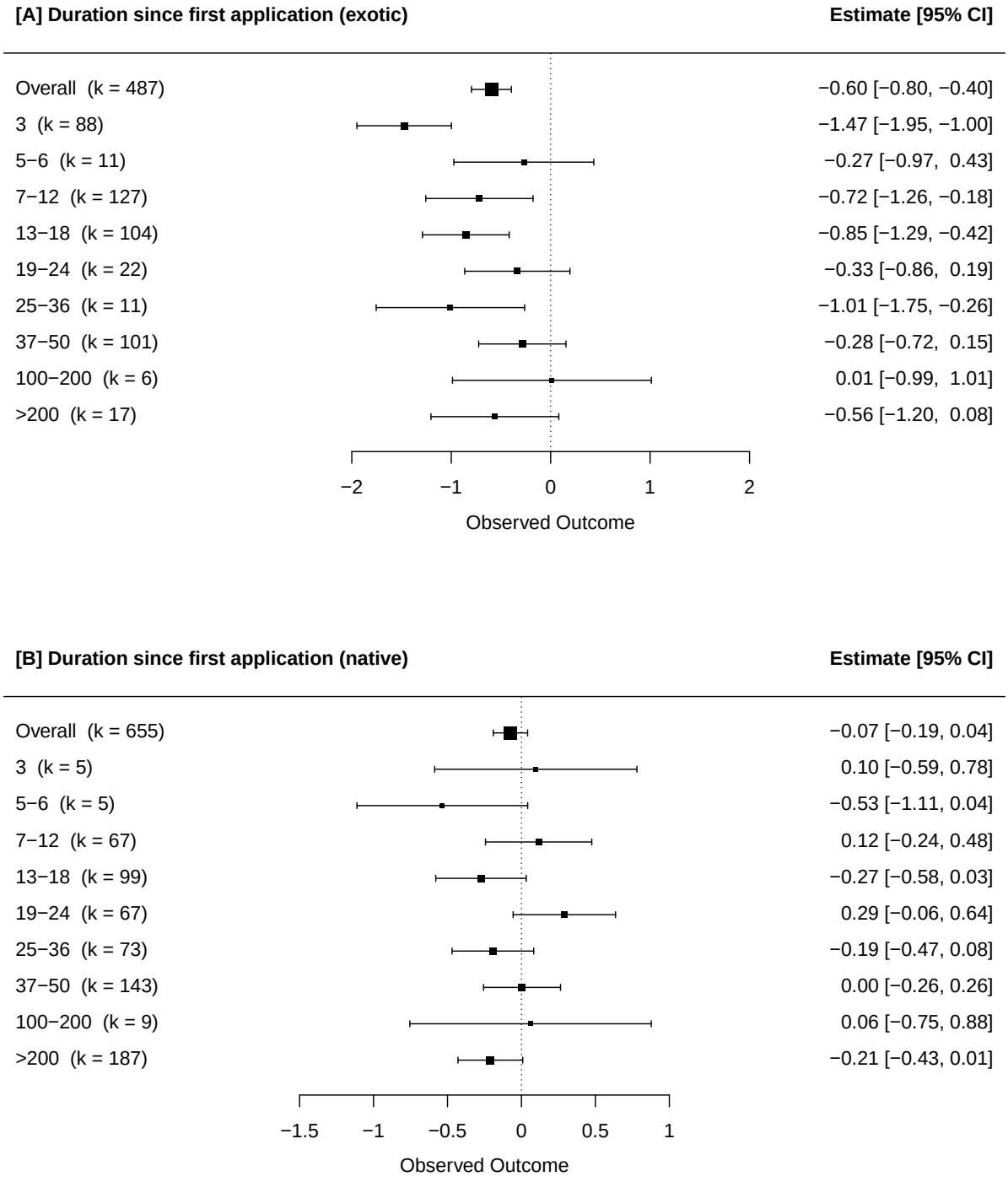
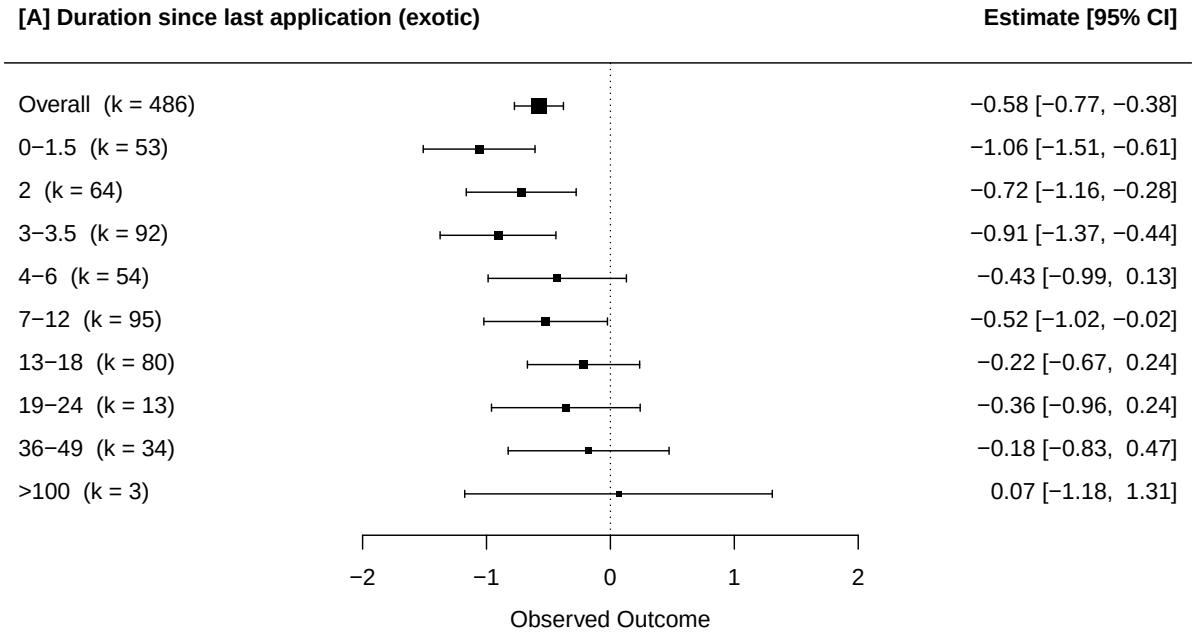


Figure S5. Standardized mean Hedges' g effect size $\pm$ 95% confidence interval (CI) for exotic (A) and native plant abundance (B) in response to C addition, categorized by study duration (months from first C application to when first plant measurements taken). CIs that do not overlap zero are considered significant.



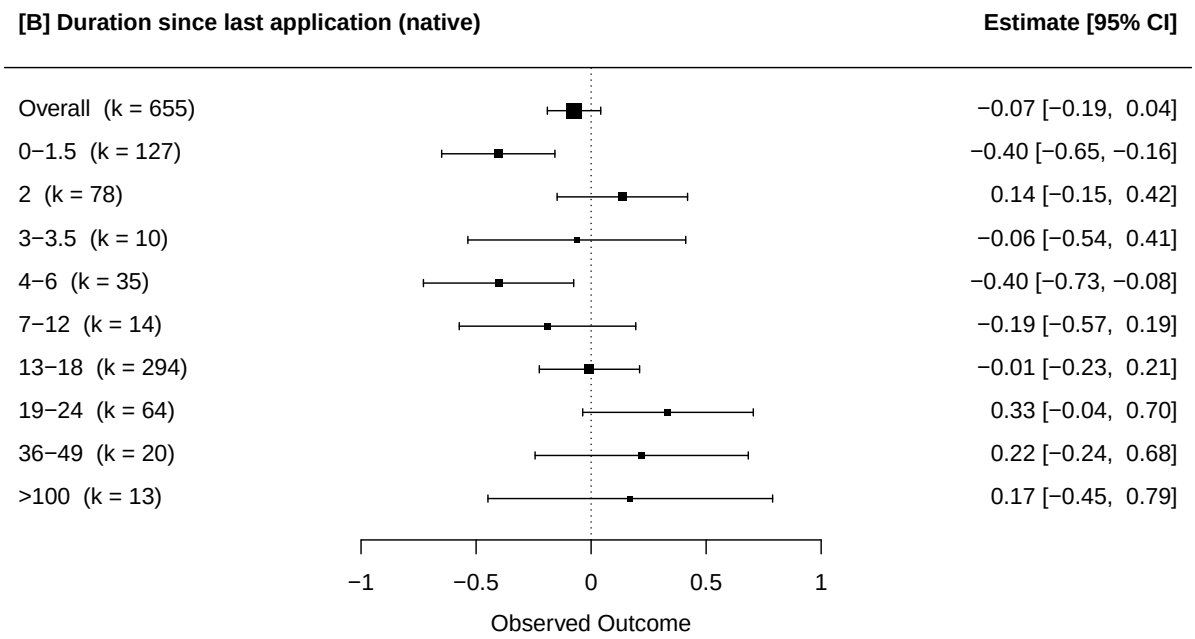


Figure S6. Standardized mean Hedges' g effect size ± 95% confidence interval (CI) for exotic (A) and native plant abundance (B) in response to C addition, categorized by study duration (months from first C application to when last plant measurements taken), with number of comparisons k. CIs that do not overlap zero are considered significant.

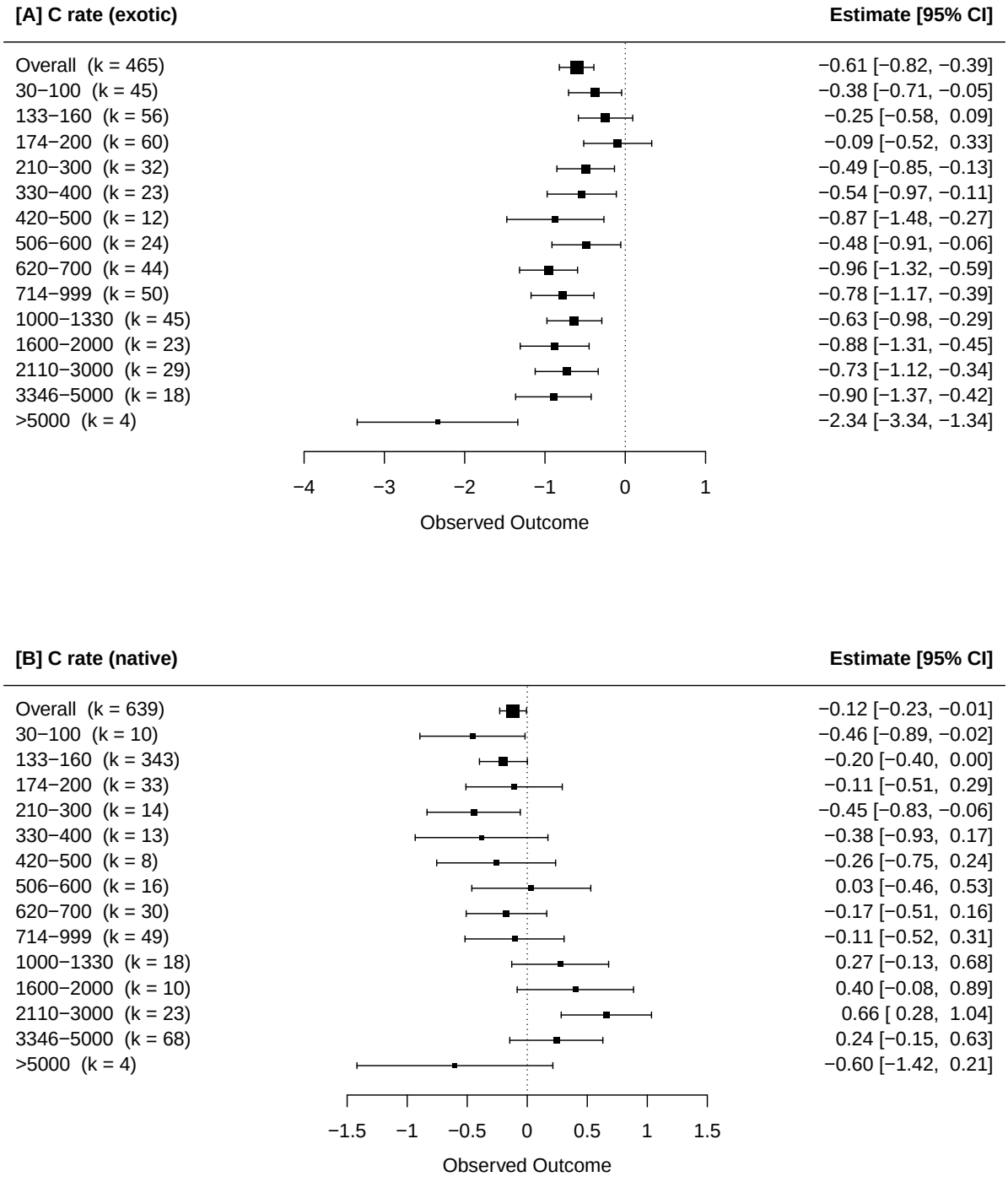


Figure S7. Standardized mean Hedges' g effect size ± 95% confidence interval (CI) for exotic (A) and native plant abundance (B) in response to C addition, categorized by C rate (g C m^{-2} y^{-1}), with number of comparisons k. CIs that do not overlap zero are considered significant.

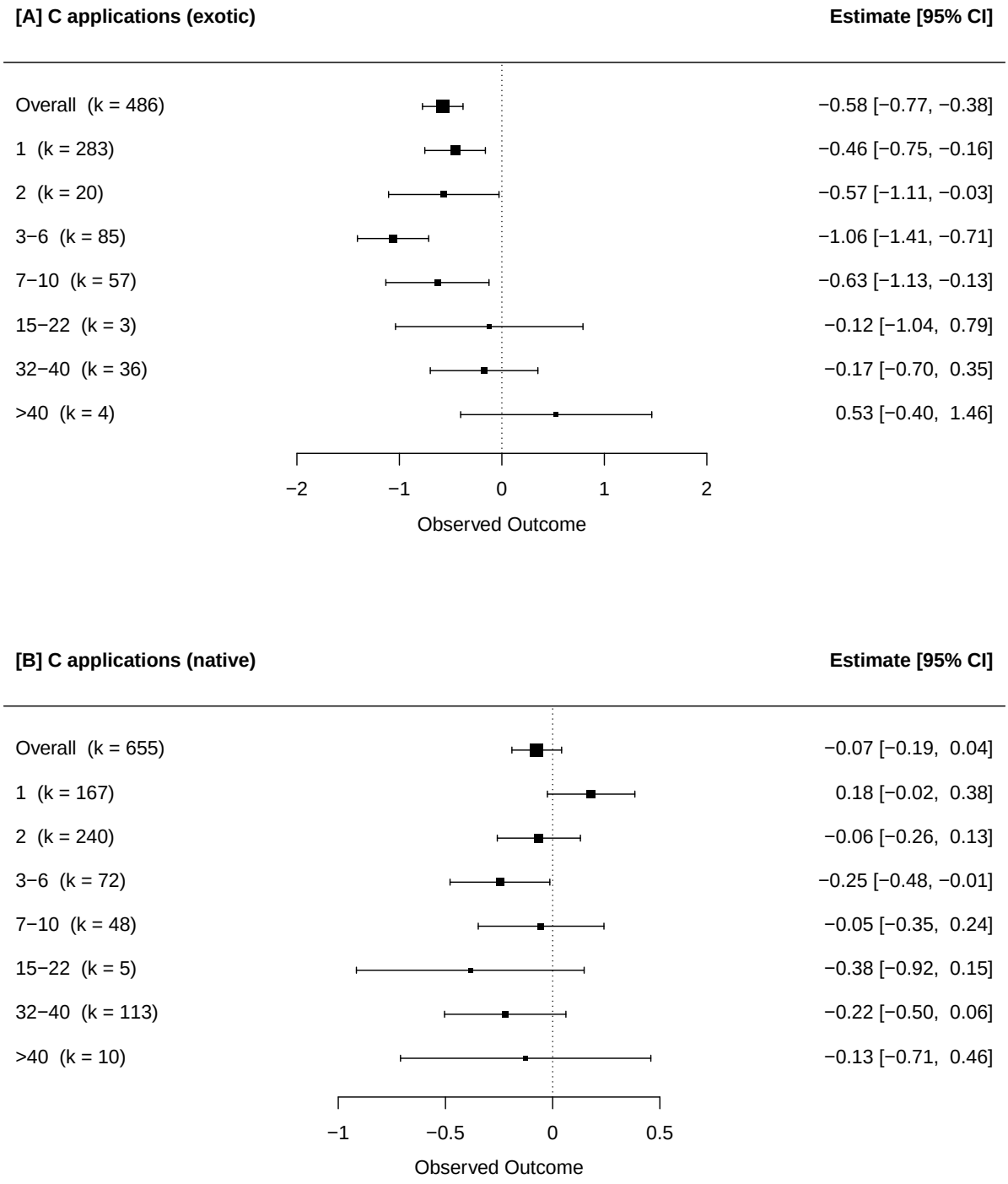


Figure S8. Standardized mean Hedges' g effect size ± 95% confidence interval (CI) for exotic (A) and native plant abundance (B) in response to C addition, categorized by total number of C applications, with number of comparisons k. CIs that do not overlap zero are considered significant.

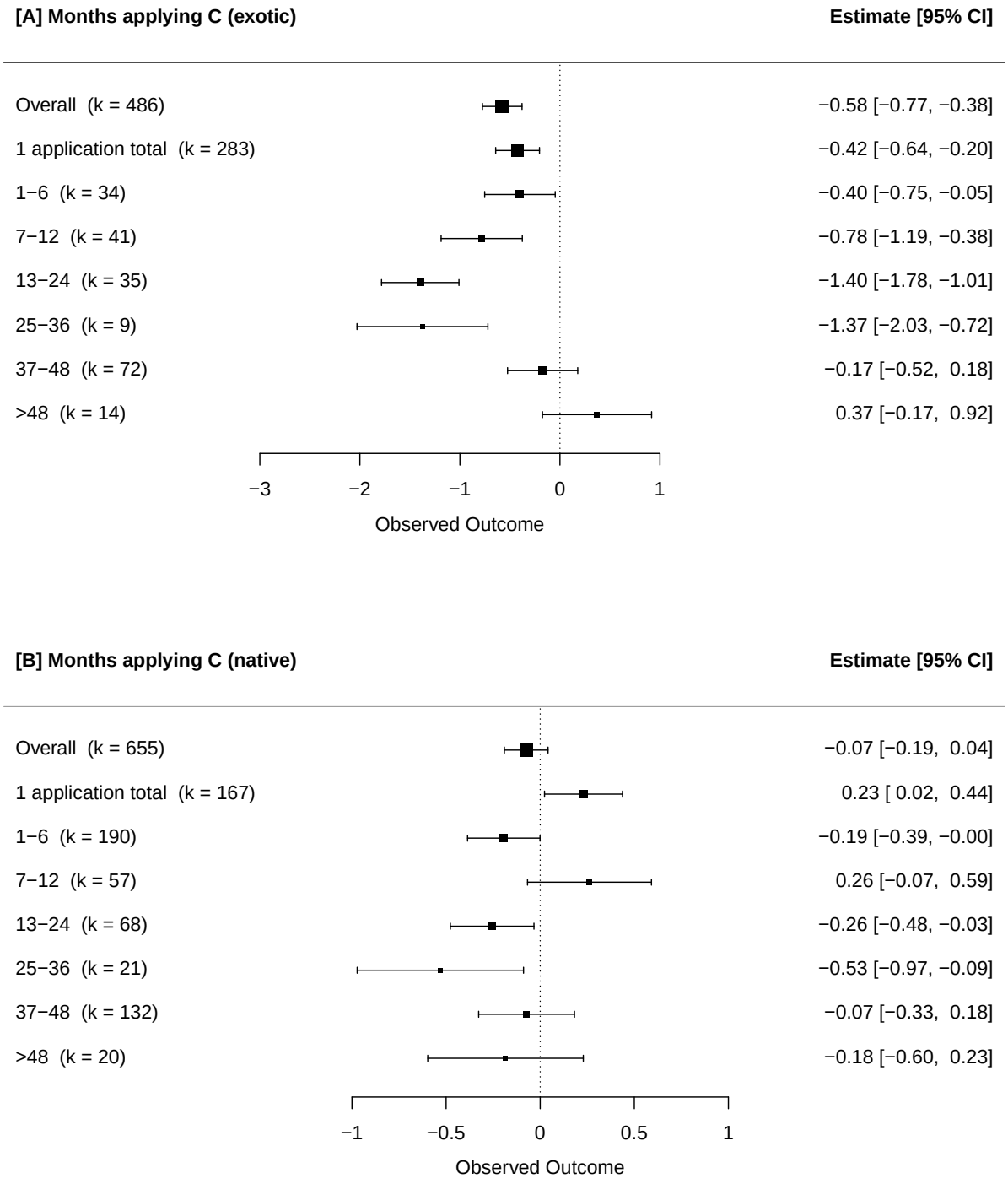


Figure S9. Standardized mean Hedges' g effect size ± 95% confidence interval (CI) for exotic (A) and native plant abundance (B) in response to C addition, categorized by number of months applying C (takes into account reapplication and study duration), with number of comparisons k. CIs that do not overlap zero are considered significant.

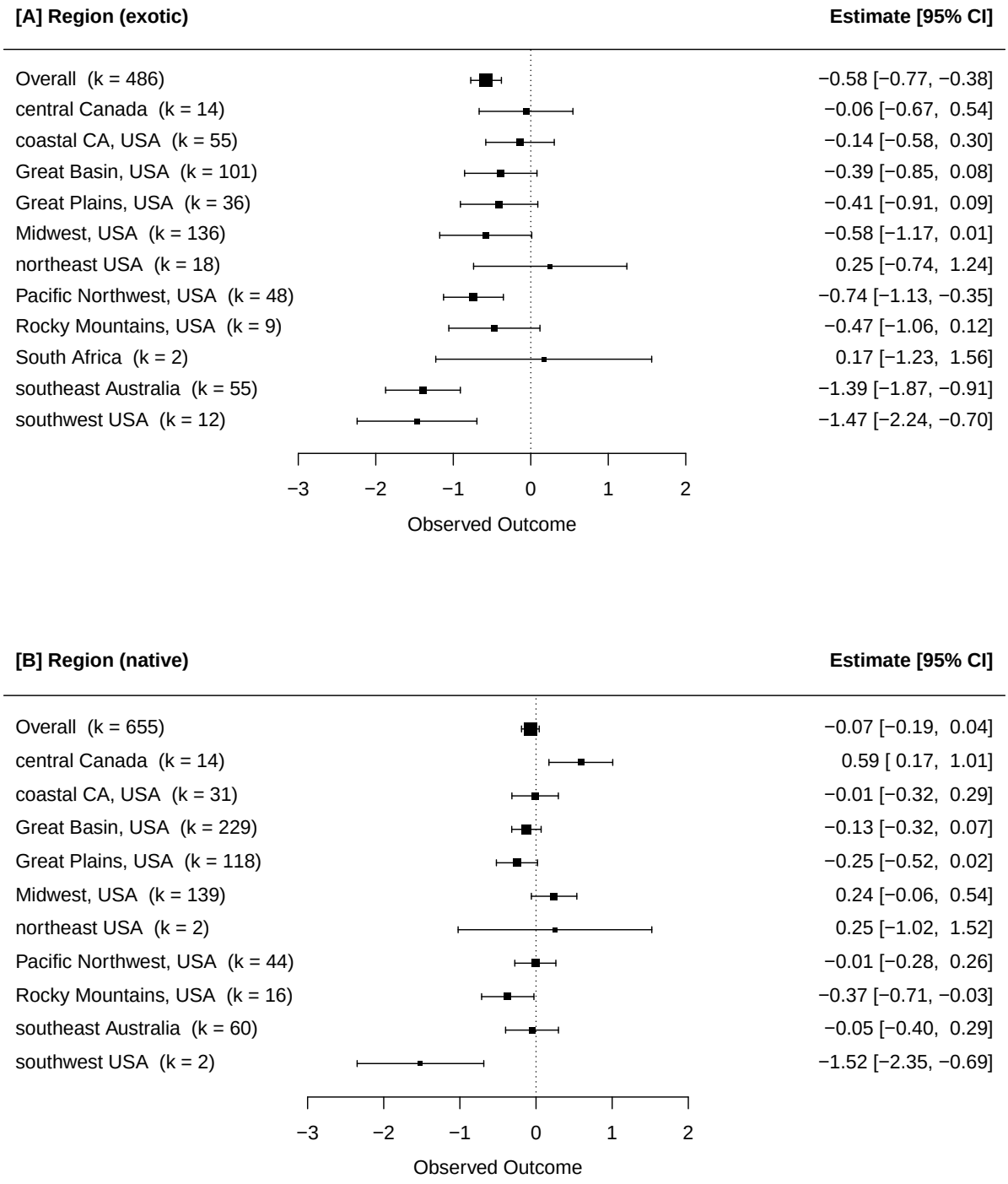


Figure S10. Standardized mean Hedges' g effect size ± 95% confidence interval (CI) for exotic (A) and native plant abundance (B) in response to C addition, categorized by study region, with number of comparisons k. CIs that do not overlap zero are considered significant.

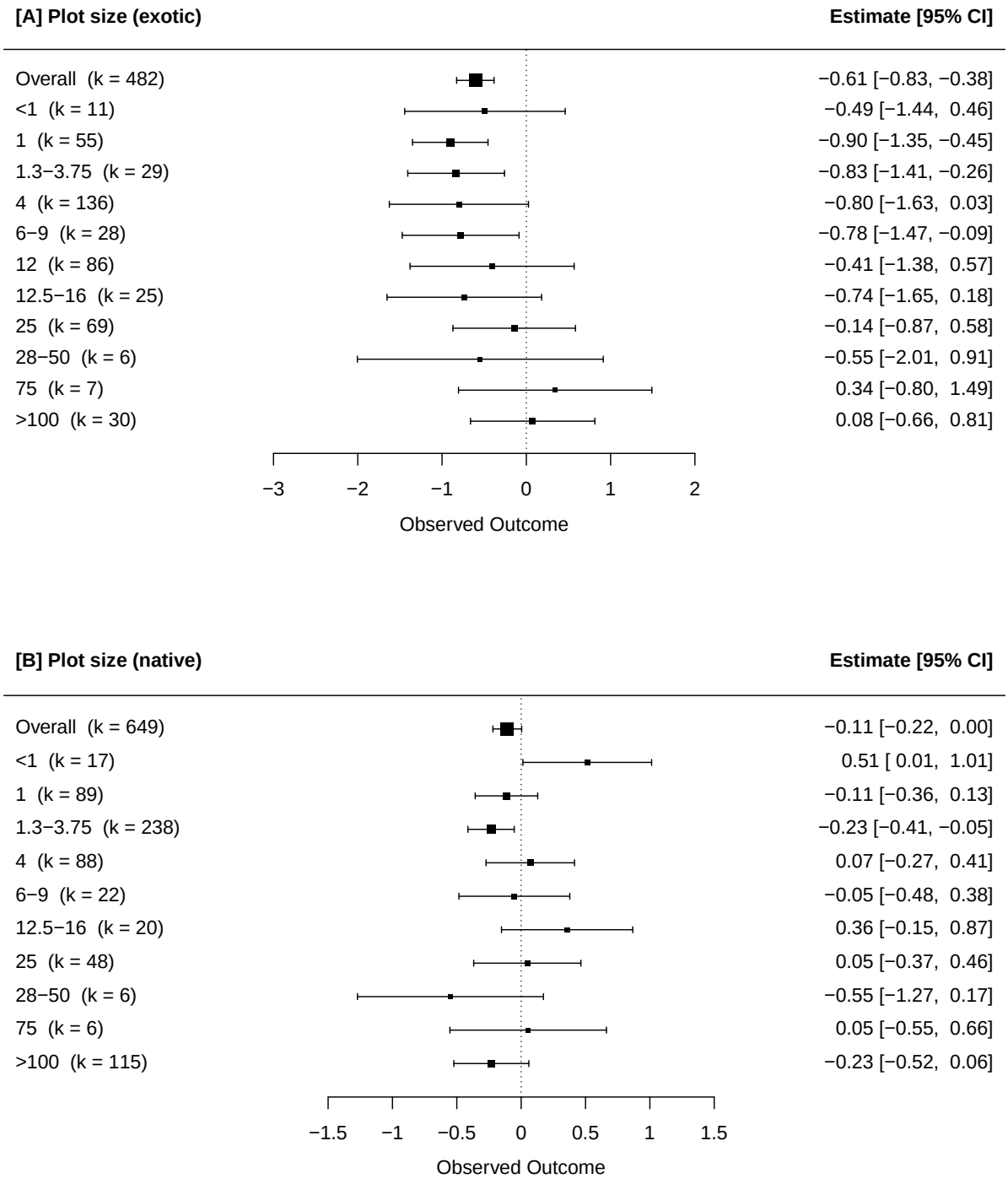
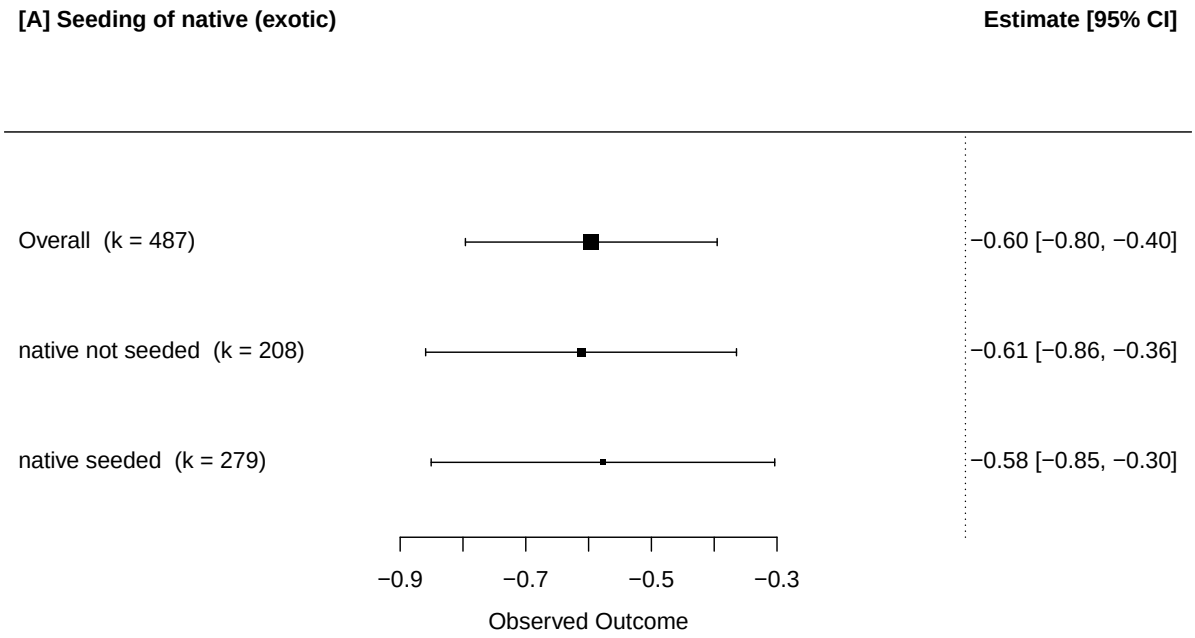


Figure S11. Standardized mean Hedges' g effect size ± 95% confidence interval (CI) for exotic (A) and native plant abundance (B) in response to C addition, categorized by plot size (m^2), with number of comparisons k. CIs that do not overlap zero are considered significant.



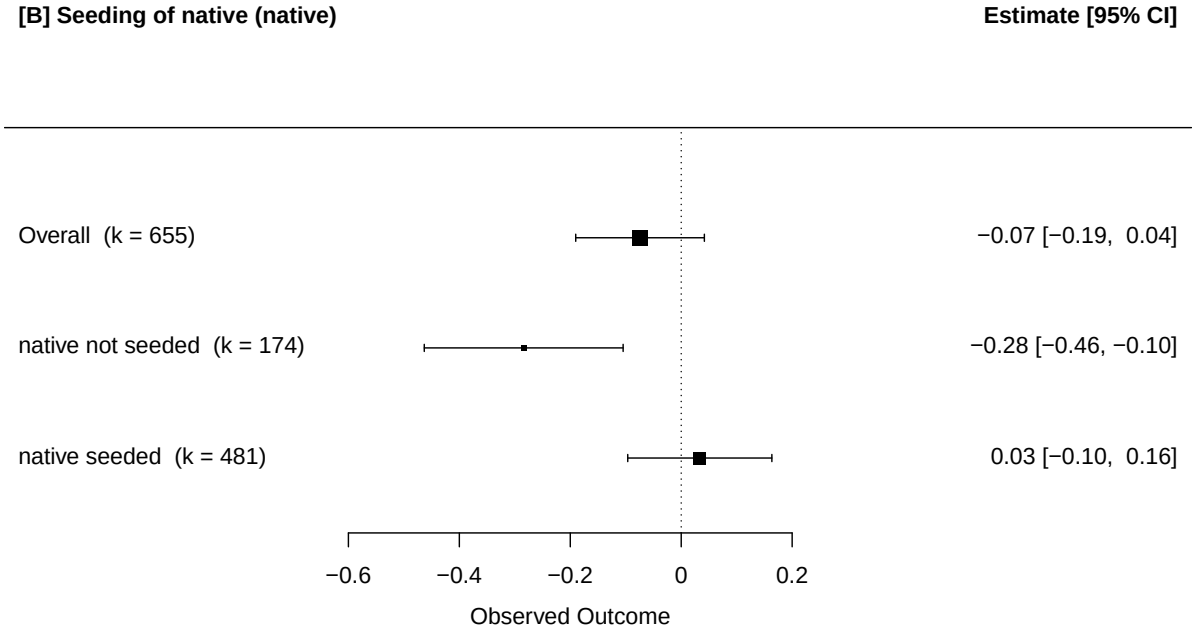


Figure S12. Standardized mean Hedges' g effect size ± 95% confidence interval (CI) for exotic (A) and native plant abundance (B) in response to C addition, categorized by seeding of native plant species (seeded/not seeded), with number of comparisons k. CIs that do not overlap zero are considered significant.

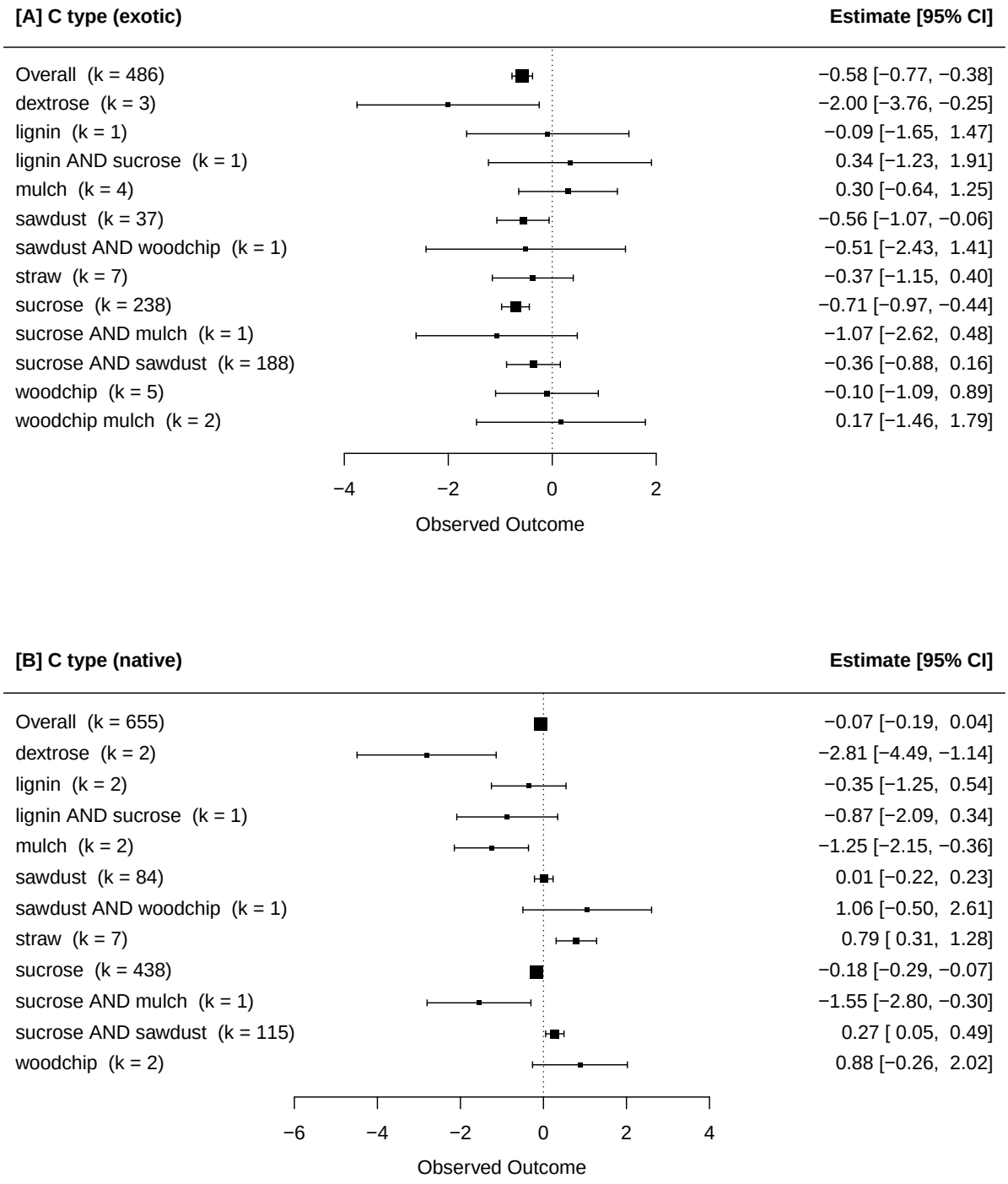
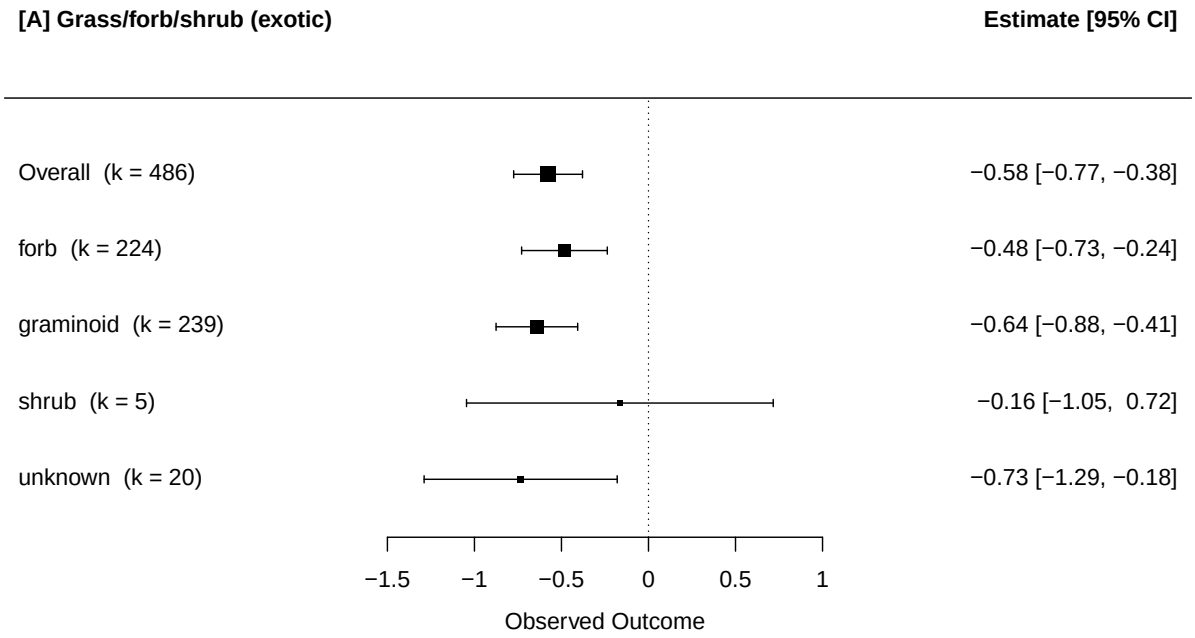


Figure S13. Standardized mean Hedges' g effect size ± 95% confidence interval (CI) for exotic (A) and native plant abundance (B) in response to C addition, categorized by C type, with number of comparisons k. CIs that do not overlap zero are considered significant.



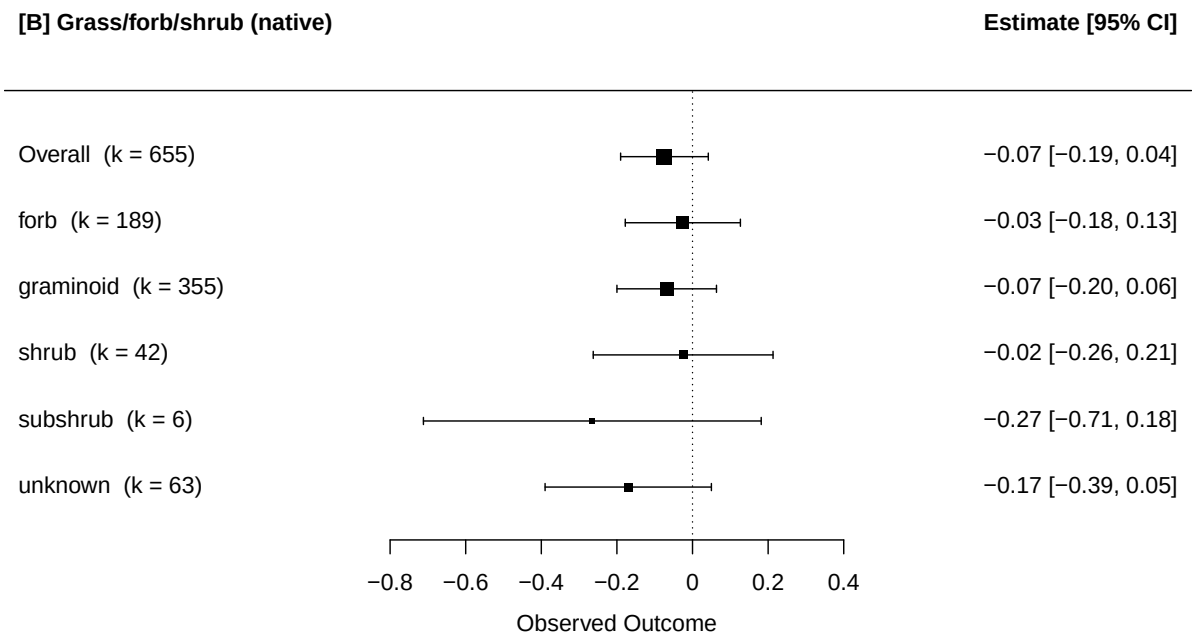


Figure S14. Standardized mean Hedges' g effect size ± 95% confidence interval (CI) for exotic (A) and native plant abundance (B) in response to C addition, categorized by plant lifeform (grass/forb/shrub), with number of comparisons k. CIs that do not overlap zero are considered significant.

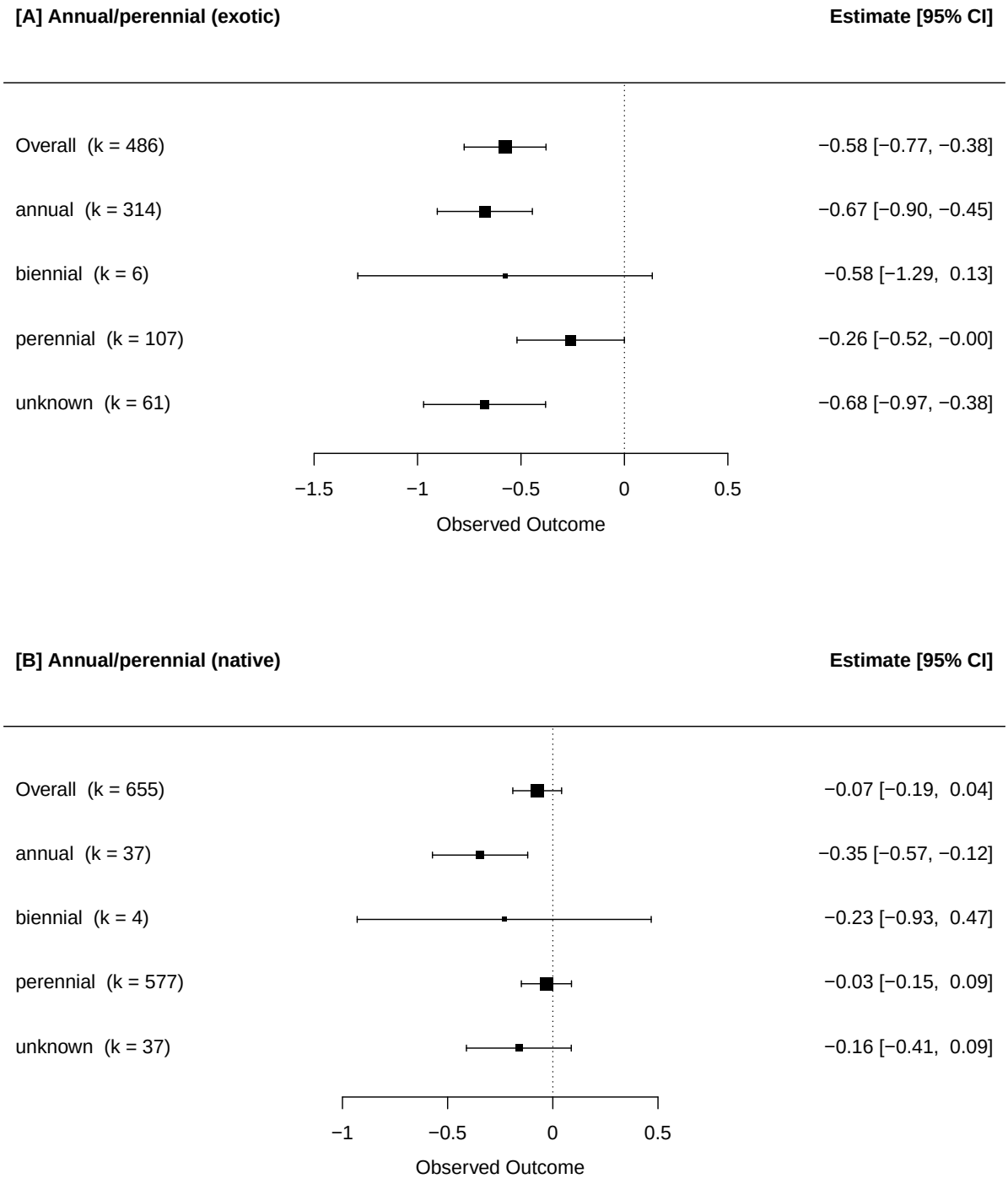


Figure S15. Standardized mean Hedges' g effect size ± 95% confidence interval (CI) for exotic (A) and native plant abundance (B) in response to C addition, categorized by plant duration (annual/perennial), with number of comparisons k. CIs that do not overlap zero are considered significant.

Table S9. Meta-analysis: Heterogeneity statistics

Model	QE	QE_df	QE_p	QM	QM_df	QM_p	QM_QT
Summary							
Exotic	1013.0	485	0.0e+00	32.680	1	0.0000000	0.031260
Native	925.8	654	0.0e+00	1.573	1	0.2097000	0.001697
Region							
Exotic	871.4	485	0.0e+00	71.990	11	0.0000000	0.076320
Native	841.8	654	3.0e-07	32.480	10	0.0003331	0.037150
Duration since first C app							
Exotic	959.4	486	0.0e+00	60.610	9	0.0000000	0.059420
Native	884.8	654	0.0e+00	13.620	9	0.1364000	0.015160
Duration since last C app							
Exotic	954.6	487	0.0e+00	64.110	9	0.0000000	0.062940
Native	883.2	654	0.0e+00	23.030	9	0.0061220	0.025420
C type							
Exotic	948.4	487	0.0e+00	42.870	12	0.0000238	0.043240
Native	814.0	654	5.6e-06	56.400	11	0.0000000	0.064800
C rate							
Exotic	879.8	464	0.0e+00	72.930	14	0.0000000	0.076540
Native	799.4	638	2.6e-06	41.870	14	0.0001297	0.049770
Total C applications							
Exotic	956.7	487	0.0e+00	49.720	7	0.0000000	0.049400
Native	875.6	654	0.0e+00	12.450	7	0.0867700	0.014020
Months applying C							
Exotic	890.9	487	0.0e+00	98.500	7	0.0000000	0.099550
Native	866.5	654	0.0e+00	19.860	7	0.0058790	0.022410
Grass/forb/shrub							
Exotic	1003.0	487	0.0e+00	48.880	4	0.0000000	0.046450
Native	909.1	654	0.0e+00	10.630	4	0.0310600	0.011560
Annual/perennial							
Exotic	1034.0	487	0.0e+00	33.070	4	0.0000012	0.030980
Native	918.8	654	0.0e+00	4.090	5	0.5365000	0.004432
Annual/perennial and grass/forb/shrub							
Exotic	973.9	487	0.0e+00	68.770	10	0.0000000	0.065950
Native	881.2	654	0.0e+00	37.230	13	0.0003817	0.040530
Plot size							
Exotic	937.3	481	0.0e+00	37.840	11	0.0000833	0.038800
Native	824.1	648	9.0e-07	18.570	10	0.0461400	0.022030
Seeding of native							
Exotic	1005.0	486	0.0e+00	33.420	2	0.0000001	0.032190
Native	894.7	654	0.0e+00	10.240	2	0.0059620	0.011320

QE, unexplained heterogeneity (dispersion); *QE_df*, corresponding degrees of freedom; *QE_p*, corresponding p-value; *QM*, heterogeneity explained by the model; *QM_df*, corresponding degrees of freedom; *QM_p*, corresponding p-value; *QM/QT*, proportion of observed (total) heterogeneity explained by the model.