Supplementary Information

Biodiversity stabilizes plant communities through statistical-averaging effects rather than compensatory dynamics

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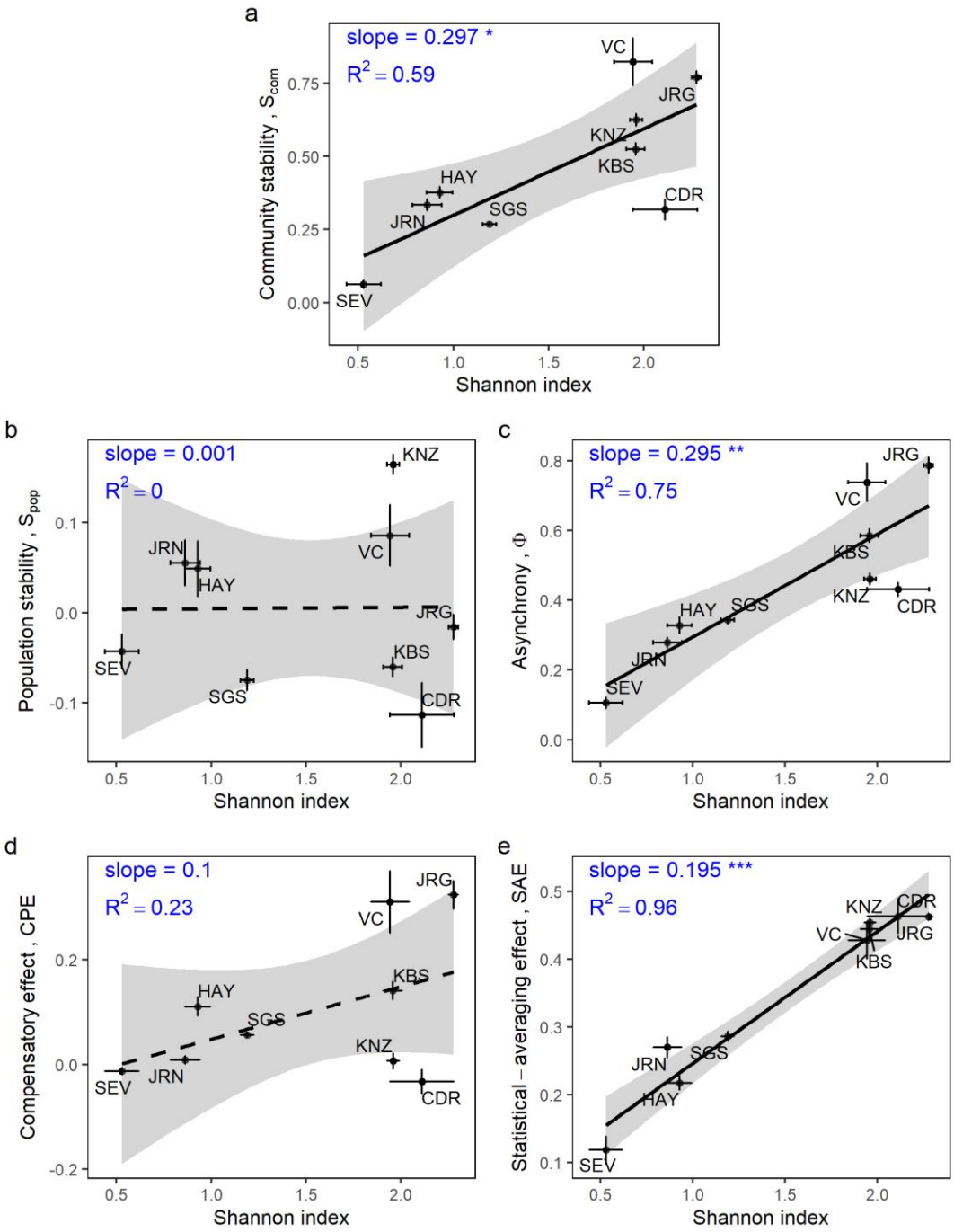
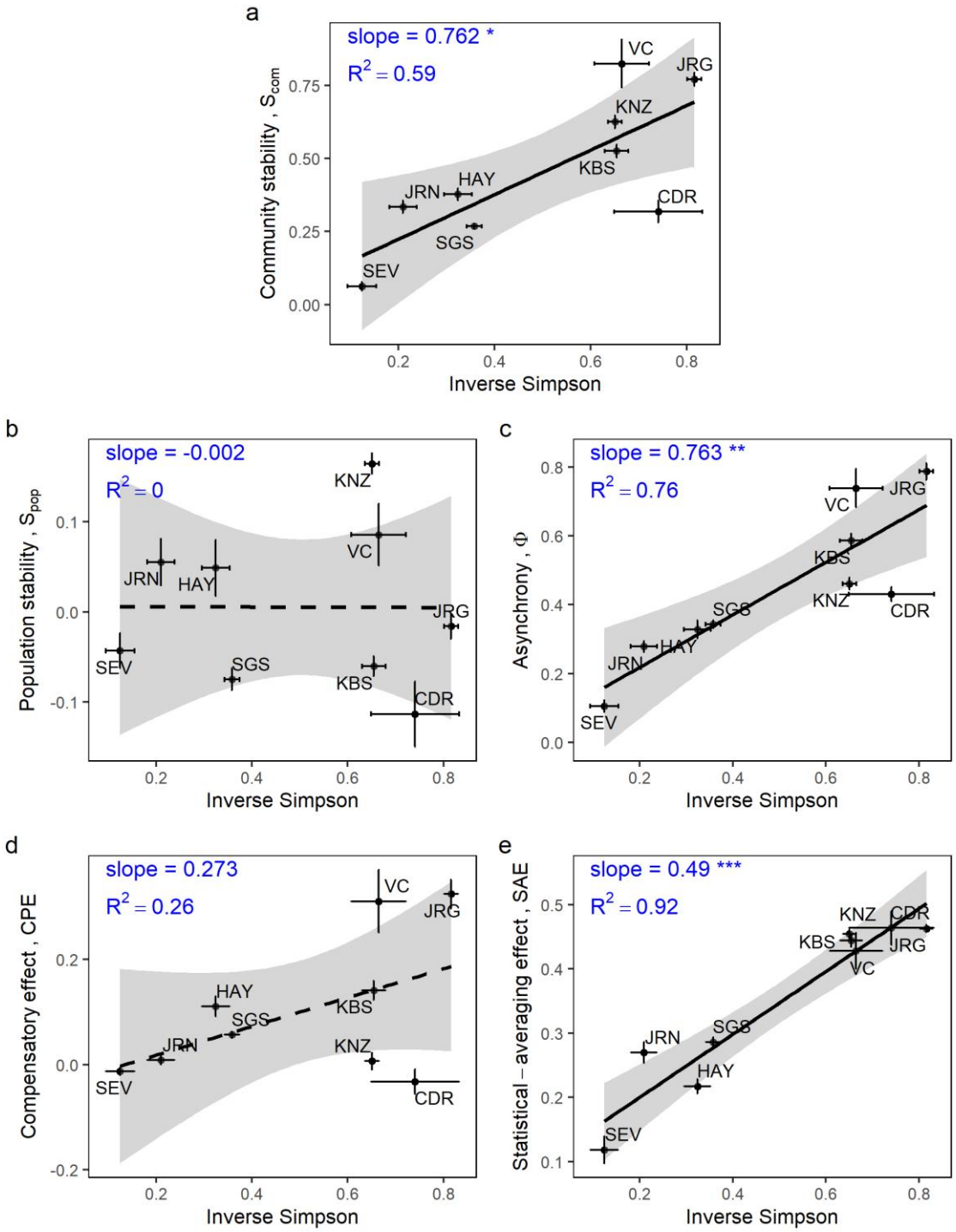
Supplementary Table 1: Significance of compensatory effects (*CPE*). Within each plot, the significance of *CPE* was assessed as compared to asynchronous surrogates (Methods). Each plot was deemed to have significantly compensatory dynamics (*CPE* significantly greater than 1), or significantly synchronous dynamics (*CPE* significantly less than 1), or neither.

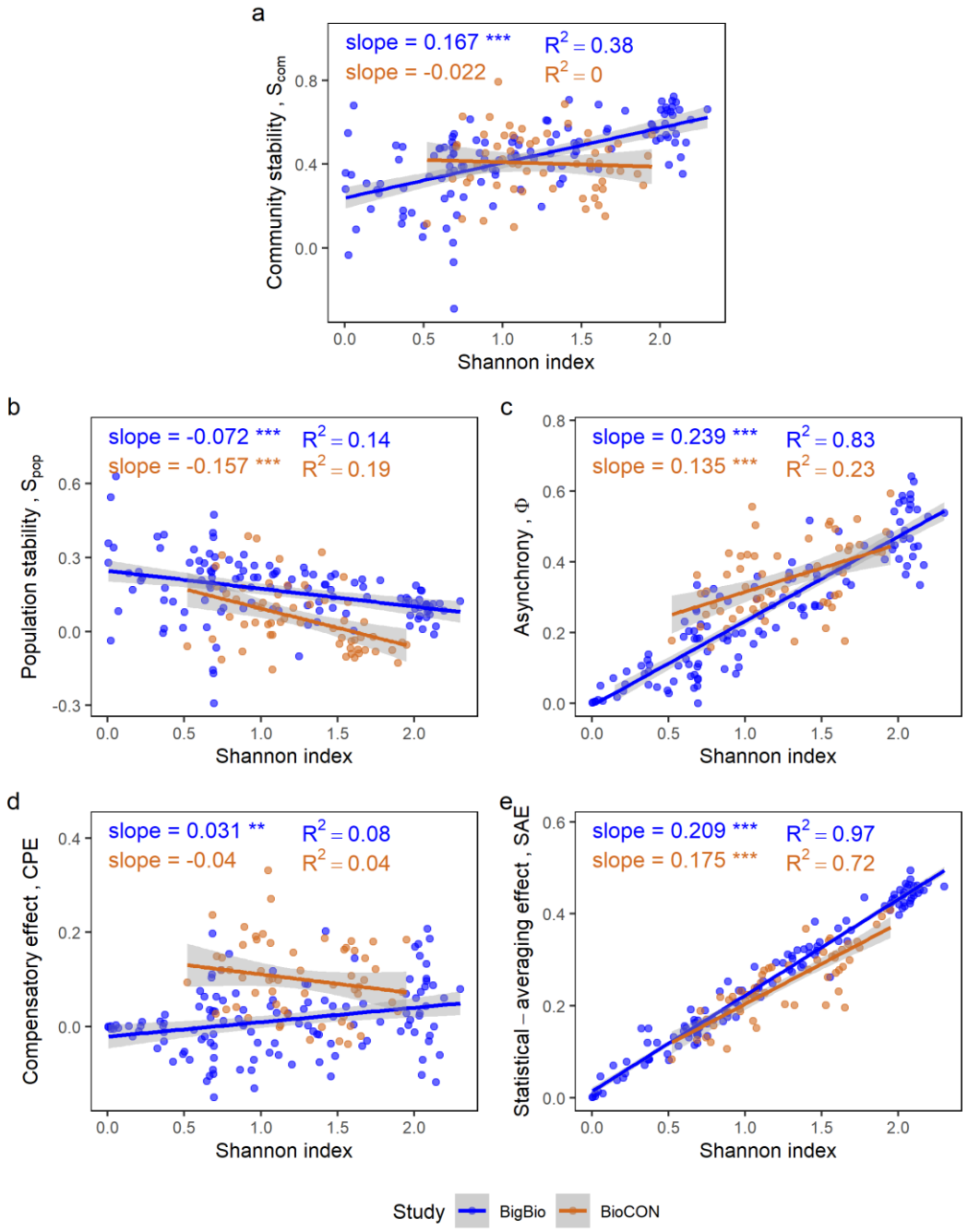
Dataset	Site	Plots	Proportion of plots showing significantly compensatory dynamics	Nonsignificance	Proportion of plots showing significantly synchronous dynamics
Plant Survey Dataset	JRG	18	100%	0%	0%
	KBS	30	30%	70%	0%
	HAY	13	46.2%	53.8%	0%
	JRN	47	12.5%	83.3%	4.2%
	KNZ	20	5%	90%	5%
	SEV	22	0%	90.9%	9.1%
	CDR	5	0%	100%	0%
	SGS	100	14%	86%	0%
	VC	6	66.7%	33.3%	0%
Biodiversity-manipulated Experiment Dataset	BigBio	122	4.8%	86.4%	8.8%
	BioCON	42	30.5%	69.5%	0%



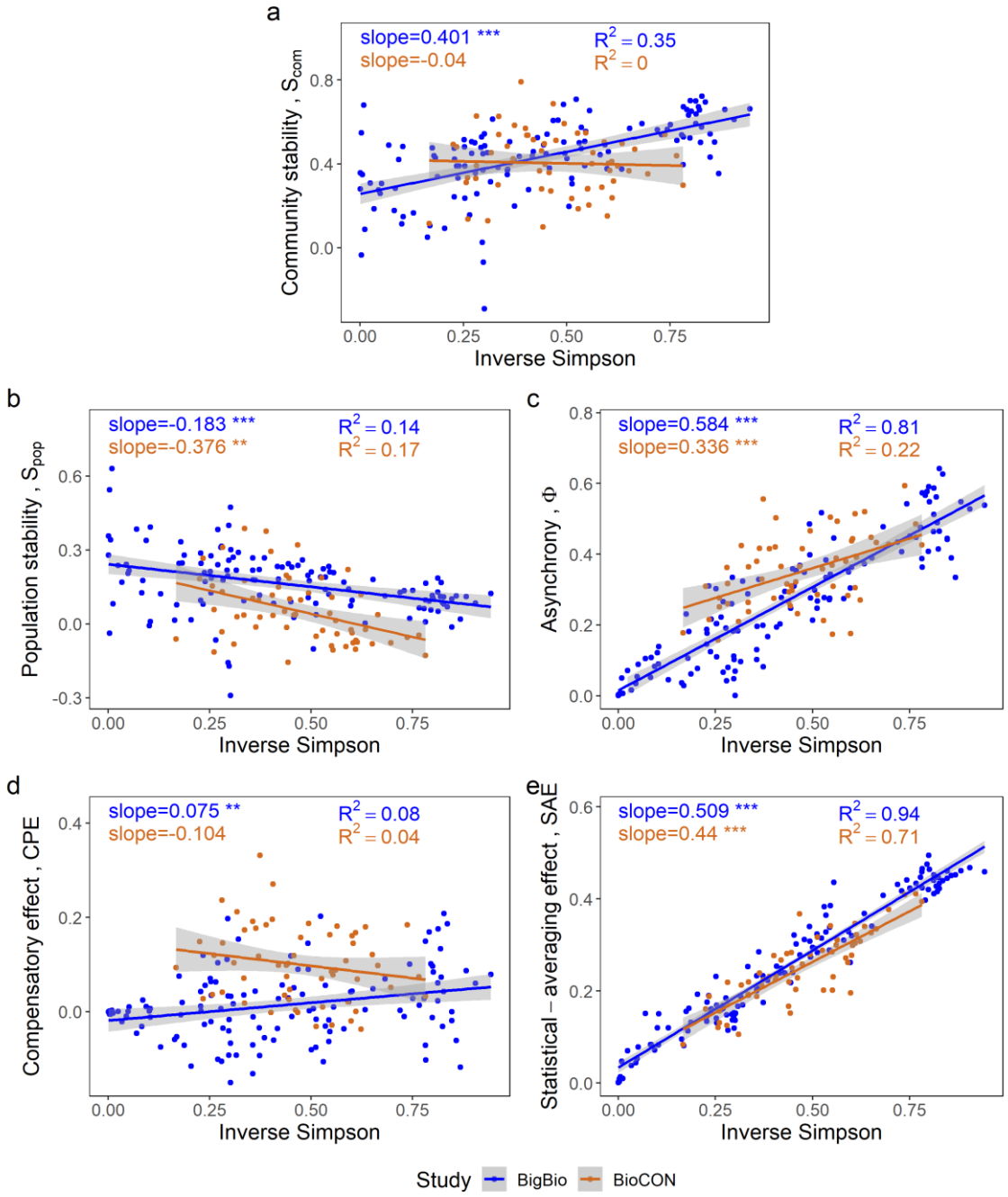
Supplementary Fig. 1: Effects of the Shannon index on community stability and its components across the nine sites in the plant survey dataset. Relationships are shown between the Shannon index and (**a**) community stability (p = 0.015), (**b**) population stability (p = 0.979), (**c**) asynchrony (p = 0.003), (**d**) the compensatory effect (p = 0.189), and (**e**) the statistical-averaging effect (p < 0.001). All values (including standard error) are $\log_{10}$ transformed except for the Shannon index. Regression and significance results formatted as in Fig. 2.



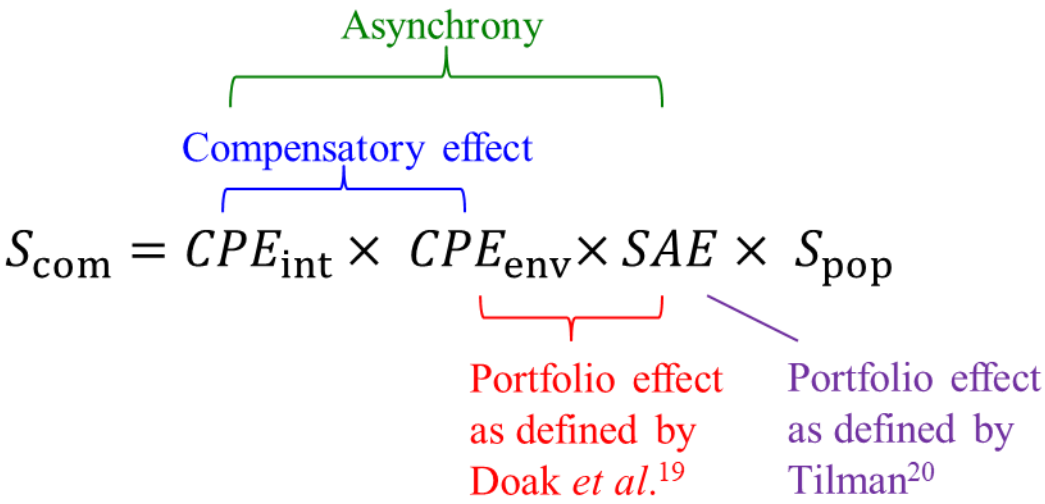
Supplementary Fig. 2: Effects of the inverse of Simpson's index on community stability and its components across the nine sites in the plant survey dataset. Relationships are shown between the inverse of Simpson's index and (a) community stability (p = 0.016), (b) population stability (p = 0.991), (c) asynchrony (p = 0.002), (d) the compensatory effect (p = 0.160), and (e) the statistical-averaging effect ($p < 0.0001$). All values (including standard error) are $\log_{10}$ transformed. Regression and significance results formatted as in Fig. 2.



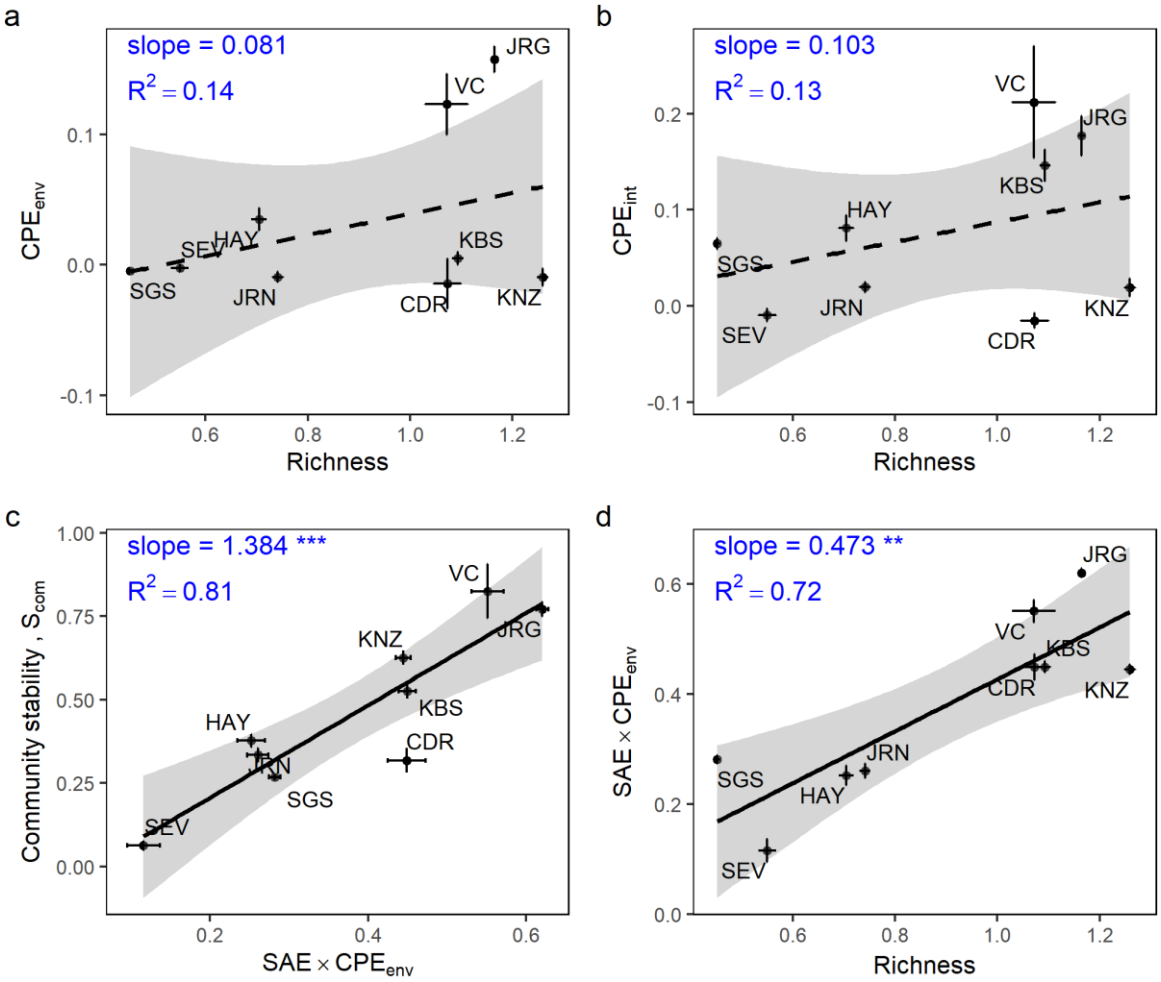
Supplementary Fig. 3: Effects of the Shannon index on community stability and its components in the biodiversity-manipulated experimental dataset. Relationships are shown between the Shannon index and (**a**) community stability ($p < 0.001$ for BigBio and $p = 0.675$ for BioCON), (**b**) population stability ($p < 0.001$ for both studies), (**c**) asynchrony ($p < 0.001$ for both studies), (**d**) the compensatory effect ($p = 0.002$ for BigBio and $p = 0.147$ for BioCON), and (**e**) the statistical-averaging effect ($p < 0.001$ for both studies) within two studies (indicated by different colours). All values are $\log_{10}$ transformed except for the Shannon index. Regression and significance results formatted as in Fig. 2.



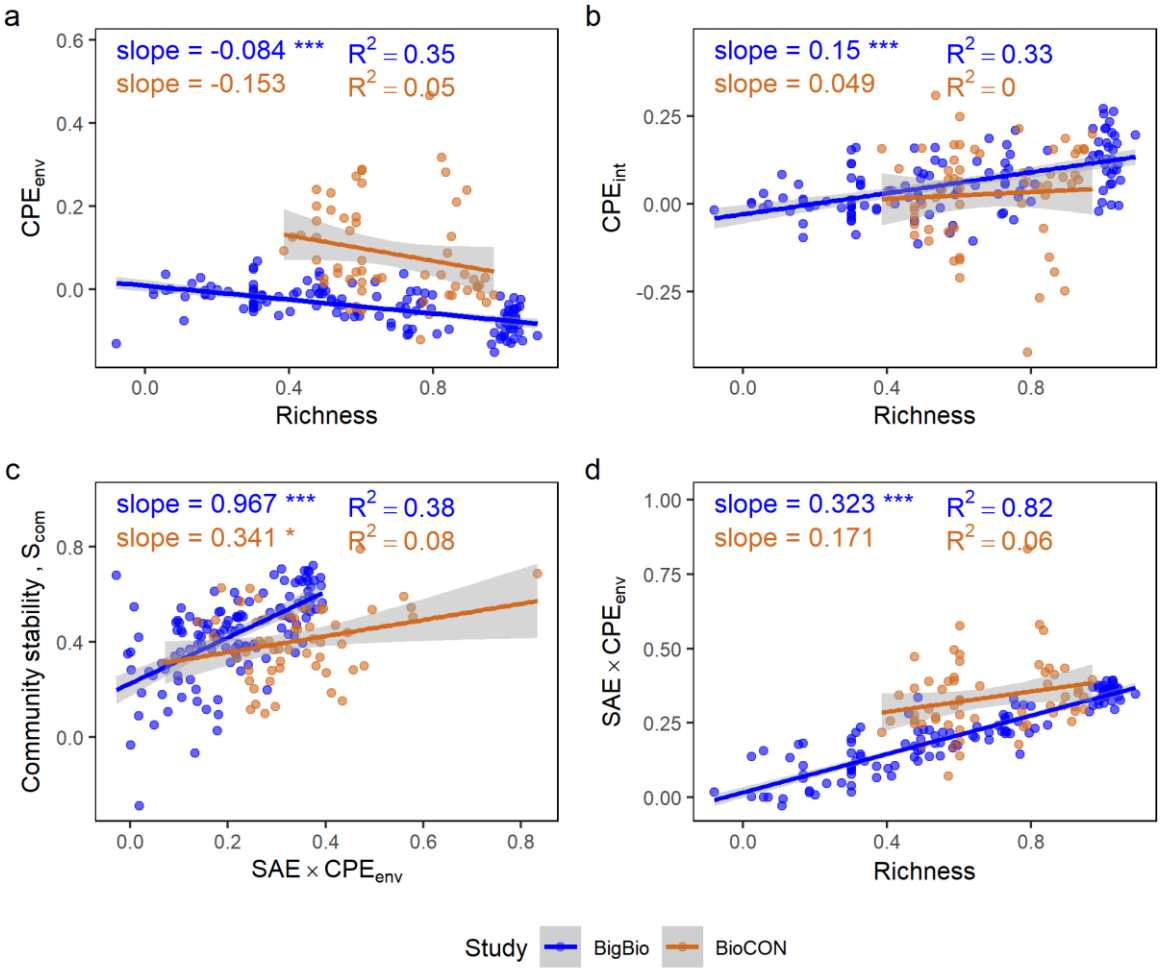
Supplementary Fig. 4: Effects of inverse Simpson's index on community stability and its components in the biodiversity-manipulated experimental dataset. Relationships are shown between the inverse Simpson's index and (**a**) community stability ($p < 0.001$ for BigBio and $p = 0.769$ for BioCON), (**b**) population stability ($p < 0.001$ for BigBio and $p = 0.001$ for BioCON), (**c**) asynchrony ($p < 0.001$ for both studies), (**d**) the compensatory effect ($p = 0.002$ for BigBio and $p = 0.147$ for BioCON), and (**e**) the statistical-averaging effect ($p < 0.001$ for both studies) within two studies (indicated by different colours). All values are log10 transformed. Regression and significance results formatted as in Fig. 2.



Supplementary Fig. 5: Summary equation of our full decomposition of community stability, and ecological meanings of components.



Supplementary Fig. 6: Relationships involving compensatory effects due to joint responses to environment fluctuations (CPE_{env}) and due to species interactions (CPE_{int}) across the nine sites in the plant survey dataset. Relationships are shown between (**a**) CPE_{env} and richness ($p = 0.329$), (**b**) CPE_{int} and richness ($p = 0.342$), (**c**) community stability and the product of statistical averaging effect and CPE_{env} ($p < 0.001$), and (**d**) richness and the product of statistical averaging effect and CPE_{env} ($p = 0.004$). All values (including standard errors) are $\log_{10}$ transformed. Regression and significance results formatted as in Fig. 2.



Supplementary Fig. 7: Relationships involving compensatory effects due to joint responses to environment fluctuations (CPE_{env}) and due to species interactions (CPE_{int}) within studies of the biodiversity-manipulated experimental dataset. Relationships are shown between (**a**) CPE_{env} and richness ($p < 0.001$ for BigBio and $p = 0.094$ for BioCON), (**b**) CPE_{int} and richness ($p < 0.001$ for BigBio and $p = 0.653$ for BioCON), (**c**) community stability and the product of statistical averaging effect and CPE_{env} ($p < 0.001$ for BigBio and $p = 0.029$ for BioCON), and (**d**) richness and the product of statistical averaging effect and CPE_{env} (($p < 0.001$ for BigBio and $p = 0.072$ for BioCON)). All values (including standard errors) are $\log_{10}$ transformed. Regression and significance results formatted as in Fig. 2.