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Supplementary information

Field experiments underestimate aboveground biomass response to drought

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Supplementary Information

to

Field experiments underestimate aboveground biomass response to drought

György Kröel-Dulay Andrea Mojzes, Katalin Szitár, Michael Bahn, Péter Batáry, Claus Beier, Mark Bilton, Hans J. De Boeck, Jeffrey S. Dukes, Marc Estiarte, Petr Holub, Anke Jentsch[1], Inger Kappel Schmidt, Juergen Kreyling, Sabine Reinsch, Klaus Steenberg Larsen, Marcelo Sternberg, Katja Tielbörger, Albert Tietema, Sara Vicca, Josep Peñuelas

Corresponding author: György Kröel-Dulay; E-mail: kroel-dulay.gyorgy@ecolres.hu

Supplementary Note 1 │ List of synthesis studies (reviews and meta-analyses) about the effect of drought on net primary production (NPP) or aboveground biomass (AGB)

1. Studies covering experimental droughts only

Gao J, Zhang L, Tang Z, Wu S (2019) A synthesis of ecosystem aboveground productivity and its process variables under simulated drought stress. Journal of Ecology 107: 2519-2531.

Li W, Li X, Zhao Y, Zheng S, Bai Y (2018) Ecosystem structure, functioning and stability under climate change and grazing in grasslands: current status and future prospects. Current Opinion in Environmental Sustainability 33: 124-135.

Matos IS, Menor IO, Rifai SW, Rosado, BHP (2020) Deciphering the stability of grassland productivity in response to rainfall manipulation experiments. Global Ecology and Biogeography 29: 558-572.

Orsenigo S, Mondoni A, Rossi G, Abeli T (2014) Some like it hot and some like it cold, but not too much: plant responses to climate extremes. Plant Ecology 215: 677-688.

Song J, Wan S, Piao S, Knapp AK, Classen AT, Vicca S, ..., Zheng M (2019) A meta-analysis of 1,119 manipulative experiments on terrestrial carbon-cycling responses to global change. Nature Ecology & Evolution 3: 1309-1320.

Unger S, Jongen M (2015) Consequences of changing precipitation patterns for ecosystem functioning in grasslands: a review. In: Lüttge U, Beyschlag W (eds) Progress in Botany 76. Springer, Cham, pp. 347-393.

Wang C, Sun Y, Chen HYH, Yang J, Ruan H (2021) Meta-analysis shows non-uniform responses of above-and belowground productivity to drought. Science of the Total Environment 782: 146901.

Wilcox KR, Shi Z, Gherardi LA, Lemoine NP, Koerner SE, Hoover DL, ..., Luo Y (2017) Asymmetric responses of primary productivity to precipitation extremes: a synthesis of grassland precipitation manipulation experiments. Global Change Biology 23: 4376-4385.

Wu Z, Dijkstra P, Koch GW, Peñuelas J, Hungate BA (2011) Responses of terrestrial ecosystems to temperature and precipitation change: a meta- analysis of experimental manipulation. Global Change Biology 17: 927-942.

Zhang F, Quan Q, Ma F, Tian D, Hoover DL, Zhou Q, Niu S (2019) When does extreme drought elicit extreme ecological responses? Journal of Ecology 107: 2553-2563.

Zhang C, Xi N (2021) Precipitation changes regulate plant and soil microbial biomass via plasticity in plant biomass allocation in grasslands: a meta-analysis. Frontiers in Plant Science 12: 614968.

2. Studies covering observational droughts only

Ruppert JC, Harmoney K, Henkin Z, Snyman HA, Sternberg M, Willms W, Linstädter A (2015) Quantifying drylands' drought resistance and recovery: the importance of drought intensity, dominant life history and grazing regime. Global Change Biology 21: 1258-1270.

3. Studies covering (but not comparing) observational and experimental droughts

Stuart-Haëntjens E, De Boeck HJ, Lemoine NP, Mänd P, Kröel-Dulay, Gy, Schmidt IK, Jentsch A, Stampfli A, Anderegg WRL, Bahn M, Kreyling J, Wohlgemuth T, Lloret F, Classen AT, Gough CM, Smith MD (2018) Mean annual precipitation predicts primary production resistance and resilience to extreme drought. Science of the Total Environment 636: 360-366.

Supplementary Note 2 | Results of N-weighted (replication-weighted) meta-analysis with log response ratio (lnRR) on the focal data set (grassland data with biomass estimates and site aridity index below 1)

Table 1 | Parameter estimates of the final minimum adequate model with the lowest AICc. AICc: 228.4, AIC: 232.0, R-squared: 0.091, number of data points: 158. Residual heterogeneity (Q_E) is 126.9 (DF = 154, P = 0.9458).

	Coefficient	SE	z-value	P-value	CI lower	CI upper
Intercept	-0.2768	0.0841	-3.29	0.0010	-0.4416	-0.1120
Study type Observational	-0.3120	0.1102	-2.83	0.0046	-0.5280	-0.0961
Site aridity	0.5772	0.2588	2.23	0.0257	0.0700	1.0843
Drought severity	0.5969	0.3059	1.95	0.0510	-0.0027	1.1965

Table 2 | ANOVA table of the final minimum adequate model with the lowest AICc. Variance inflation factor (VIF) is shown for the fixed effects to reveal potential multicollinearity.

	numDF, denDF	F-value	P-value	VIF
Study type	1,75	6.68	0.0117	1.02
Drought severity	1,75	5.87	0.0570	1.02
Site aridity	1,75	3.74	0.0178	1.01

Table 3 | Parameter estimates of the full model including all main effects, and the interactive effects of study type and the other explanatory variables (drought severity, site aridity, and drought length). AICc: 237.9, AIC: 236.6, R-squared: 0.110, number of data points: 158. Residual heterogeneity (Q_E) is 116.8 (DF = 150, P = 0.9793).

	Coefficient	SE	z-value	P-value	CI lower	CI upper
Intercept	-0.2881	0.0784	-3.67	0.0002	-0.4418	-0.1343
Study type Observational	-0.3296	0.1017	-3.24	0.0012	-0.5290	-0.1302
Drought severity	0.4423	0.4342	1.02	0.3083	-0.4086	1.2933
Site aridity	0.2054	0.4034	0.51	0.6106	-0.5852	0.9960
Drought length	0.0293	0.0393	0.74	0.4564	-0.0478	0.1063
Study type Obs: Drought severity	0.2592	0.5890	0.44	0.6598	-0.8952	1.4137
Study type Obs: Site aridity	0.4336	0.5099	0.85	0.3951	-0.5659	1.4331
Study type Obs: Drought length	-0.0770	0.0534	-1.44	0.1491	-0.1817	0.0276

Table 4 | ANOVA table of the full model including all main effects, and the interactive effects of study type and the other explanatory variables (drought severity, site aridity, and drought length). Variance inflation factor (VIF) is shown for the fixed effects to reveal potential multicollinearity.

	numDF, denDF	F-value	P-value	VIF
Study type	1,79	87.29	0.0070	1.05
Drought severity	1,71	3.83	0.0542	2.29
Site aridity	1,71	6.72	0.0116	2.96
Drought length	1,71	0.19	0.6671	2.04
Study type: Drought severity	1,71	0.18	0.6693	2.31
Study type: Site aridity	1,71	1.28	0.2621	3.11
Study type: Drought length	1,71	1.91	0.1714	2.52

Supplementary Note 3 | Results of variance-weighted meta-analysis with lnRR on a subset of the focal data set where variance estimates were available

Table 1 | Parameter estimates of the final minimum adequate model with the lowest AICc. AICc: 82.1, AIC: 81.8, R-squared: 0.154, number of data points: 120. Residual heterogeneity (Q_E) is 543.4 (DF = 116, P < 0.0001).

	Coefficient	SE	z-value	P-value	CI lower	CI upper
Intercept	-0.2679	0.0568	-4.71	<0.0001	-0.3793	-0.1565
Study type Observational	-0.2069	0.0862	-2.40	0.0163	-0.3758	-0.0381
Site aridity	0.3875	0.1484	2.61	0.0090	0.0966	0.6783
Drought severity	0.8205	0.1751	4.68	<0.0001	0.4772	1.1638

Table 2 | ANOVA table of the final minimum adequate model with the lowest AICc. Variance inflation factor (VIF) is shown for the fixed effects to reveal potential multicollinearity.

	numDF, denDF	F-value	P-value	VIF
Study type	1,60	3.54	0.0647	1.03
Drought severity	1,56	21.74	<0.0001	1.03
Site aridity	1,56	8.68	0.0047	1.01

Table 3 | Parameter estimates of the full model including all main effects, and the interactive effects of study type and the other explanatory variables (drought severity, site aridity, and drought length). AICc: 89.1, AIC: 87.4, R-squared: 0.183, number of data points: 120. Residual heterogeneity (Q_E) is 501.7 (DF = 112, P < 0.0001).

	Coefficient	SE	z-value	P-value	CI lower	CI upper
Intercept	-0.2627	0.0553	-4.75	<0.0001	-0.3711	-0.1542
Study type Observational	-0.2209	0.0871	-2.54	0.0112	-0.3915	-0.0502
Drought severity	0.7258	0.1885	3.85	0.0001	0.3563	1.0953
Site aridity	0.3665	0.1795	2.04	0.0411	0.0148	0.7182
Drought length	-0.0143	0.0221	-0.65	0.5175	-0.0577	0.0290
Study type Obs: Drought severity	0.5438	0.4879	1.12	0.2650	-0.4124	1.5000
Study type Obs: Site aridity	-0.0355	0.3234	-0.11	0.9126	-0.6693	0.5984
Study type Obs: Drought length	0.0269	0.0388	0.70	0.4877	-0.0492	0.1031

Table 4 | ANOVA table of the full model including all main effects, and the interactive effects of study type and the other explanatory variables (drought severity, site aridity, and drought length). Variance inflation factor (VIF) is shown for the fixed effects to reveal potential multicollinearity.

	numDF, denDF	F-value	P-value	VIF
Study type	1,59	3.56	0.0642	1.16
Drought severity	1,59	21.82	<0.0001	1.24
Site aridity	1,53	8.67	0.0048	1.55
Drought length	1,53	0.001	0.9749	1.67
Study type: Drought severity	1,53	1.51	0.2245	1.50
Study type: Site aridity	1,53	0.09	0.7717	1.74
Study type: Drought length	1,59	0.45	0.5048	1.87

Supplementary Note 4 | Results of unweighted meta-analysis with lnRR on the focal data set (grassland data with biomass estimates and site aridity index below 1)

Table 1 | Parameter estimates of the final minimum adequate model with the lowest AICc. AICc: 327.0, AIC: 330.5, R-squared: 0.017, number of data points: 159. Residual heterogeneity (Q_E) is 32.3 (DF = 157, P = 1).

	Coefficient	SE	z-value	P-value	CI lower	CI upper
Intercept	-0.3249	0.1155	-2.81	0.0049	-0.5513	-0.0986
Study type Observational	-0.2644	0.1589	-1.66	0.0961	-0.5757	0.0470

Table 2 | ANOVA table of the final minimum adequate model with the lowest AICc.

	numDF, denDF	F-value	P-value
Study type	1,78	2.77	0.1001

Table 3 | Parameter estimates of the full model including all main effects, and the interactive effects of study type and the other explanatory variables (drought severity, site aridity, and drought length). AICc: 340.6, AIC: 339.4, R-squared: 0.036, number of data points: 159. Residual heterogeneity (Q_E) is 29.2 (DF = 151, P = 1).

	Coefficient	SE	z-value	P-value	CI lower	CI upper
Intercept	-0.3187	0.1188	-2.68	0.0073	-0.5515	-0.0858
Study type Observational	-0.2869	0.1641	-1.75	0.0804	-0.6085	0.0347
Drought severity	0.4387	0.7136	0.61	0.5387	-0.9599	1.8372
Site aridity	0.2725	0.5986	0.46	0.6490	-0.9007	1.4457
Drought length	0.0166	0.0503	0.03	0.7419	-0.0821	0.1153
Study type Obs: Drought severity	0.0608	1.0453	0.06	0.9536	-1.9879	2.1095
Study type Obs: Site aridity	0.3993	0.8249	0.48	0.6284	-1.2175	2.0161
Study type Obs: Drought length	-0.0181	0.0782	-0.23	0.8165	-0.1714	0.1351

Table 4 | ANOVA table of the full model including all main effects, and the interactive effects of study type and the other explanatory variables (drought severity, site aridity, and drought length). Variance inflation factor (VIF) is shown for the fixed effects to reveal potential multicollinearity.

	numDF, denDF	F-value	P-value	VIF
Study type	1,79	2.77	0.1004	1.07
Drought severity	1,72	0.91	0.3434	1.99
Site aridity	1,72	1.81	0.1827	2.31
Drought length	1,72	0.03	0.8575	1.88
Study type: Drought severity	1,72	0.01	0.9332	2.05
Study type: Site aridity	1,72	0.30	0.5875	2.48
Study type: Drought length	1,72	0.05	0.8172	2.00

**Supplementary Note 5 | ** Results of the separate N-weighted meta-analysis with lnRR on the data that were left out from the focal data set (shrublands, grasslands with cover estimates and/or site aridity index exceeding 1)

Table 1 | Parameter estimates of the model with study type as a single explanatory variable. AICc: 111.2, AIC: 110.9, R-squared: 0.04, number of data points: 80. Residual heterogeneity (Q_E) is 39.6 (DF = 78, P = 0.9999).

	Coefficient	SE	z-value	P-value	CI lower	CI upper
Intercept	-0.2532	0.1090	-2.32	0.0202	-0.4670	-0.0395
Study type Observational	-0.2716	0.1274	-2.13	0.0330	-0.5214	-0.0219

Table 2 | ANOVA table of the model with study type as a single explanatory variable.

	numDF, denDF	F-value	P-value
Study type	1,34	4.43	0.0427

Supplementary Note 6 | Results of the comparison of site aridity, drought length, drought severity, and aboveground biomass (biomass data for non-drought year(s) in observational studies and for control plots in experimental studies) between the two study types of the focal data set (grassland data with biomass estimates and site aridity index below 1)

Table 1 | Mean and standard error of the mean (SE) of site aridity, drought length, drought severity, and aboveground biomass for the two study types (number of data points: 75 experimental and 84 observational).

	Mean		SE	
Study type	Experimental	Observational	Experimental	Observational
Site aridity	0.356	0.369	0.0225	0.0229
Drought length (years)	2.750	1.950	0.2670	0.2150
Drought severity	-0.386	-0.337	0.0188	0.0163
Biomass (g m^{-2})	249.1	257.4	34.32	18.57

Table 2 | Parameter estimates of the beta regression model used for the comparison of site aridity between the two study types with logit link function.

	Coefficient	SE	z-value	P-value
Intercept	-0.5322	0.1349	-3.95	<0.0001
Study type Obs	-0.1788	0.1745	-1.02	0.3060

Table 3 | Parameter estimates of the generalized mixed-effects model used for the comparison of drought length between the two study types with Poisson distribution and log link function.

	Coefficient	SE	z-value	P-value
Intercept	0.8665	0.1238	7.00	<0.0001
Study type Obs	-0.3828	0.1743	-2.20	0.0280

Table 4 | Parameter estimates of the linear mixed-effects model used for the comparison of drought severity between the two study types.

	Coefficient	SE	DF	t-value	P-value
Intercept	-0.3824	0.0239	79	-15.98	<0.0001
Study type Obs	0.0271	0.0322	78	0.84	0.4031

Table 5 | Parameter estimates of the linear mixed-effects model used for the comparison of aboveground biomass between the two study types. Biomass data were log-transformed to fulfil model assumptions.

	Coefficient	SE	DF	t-value	P-value
Intercept	5.1811	0.1204	79	43.03	<0.0001
Study type Obs	0.0927	0.1633	78	0.57	0.5718

Supplementary Note 7 | Results of the tests for detecting publication bias on the focal data set (grassland data with biomass estimates and site aridity index below 1)

Table 1 | Results of the fail-safe N calculation using the Rosenberg method.

	Experimental	Observational	Whole focal data set
Fail-safe N	373	3202	6472
Significance level	< 0.0001	< 0.0001	< 0.0001

Table 2 | Results of the Egger's regression test for funnel plot asymmetry based on N-weighted (replication-weighted) meta-analytic model with log response ratio (lnRR).

	Experimental	Observational	Whole focal data set
z-value	-0.1474	0.3173	1.1383
P-value	0.8828	0.7510	0.2550

Fig. 1 | Funnel plot of N-weighted meta-analytic model with lnRR (focal meta-analysis) on the experimental studies (number of data points: 75).

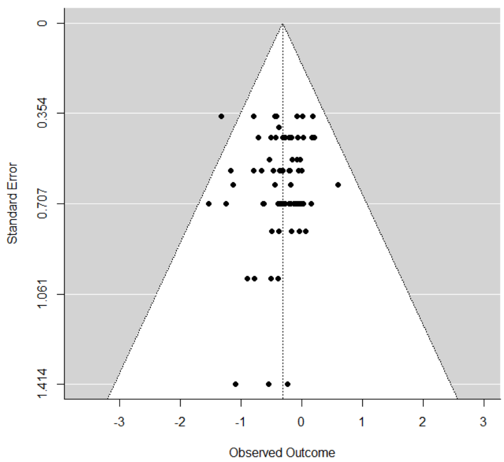


Fig. 2 | Funnel plot of N-weighted meta-analytic model with lnRR (focal meta-analysis) on the observational studies (number of data points: 83).

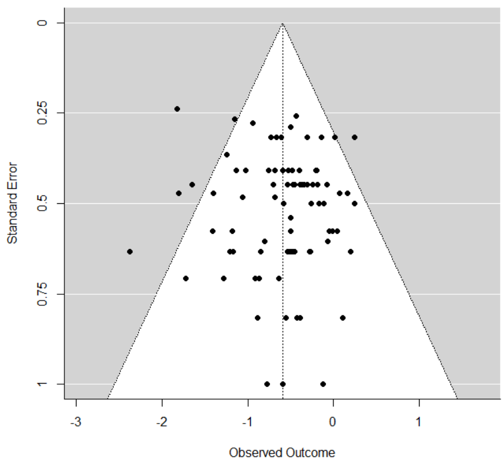
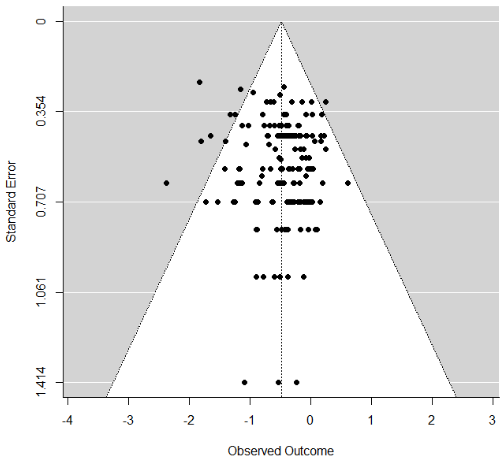


Fig. 3 | Funnel plot of N-weighted meta-analytic model with lnRR (focal meta-analysis) on the whole focal data set (number of data points: 158).



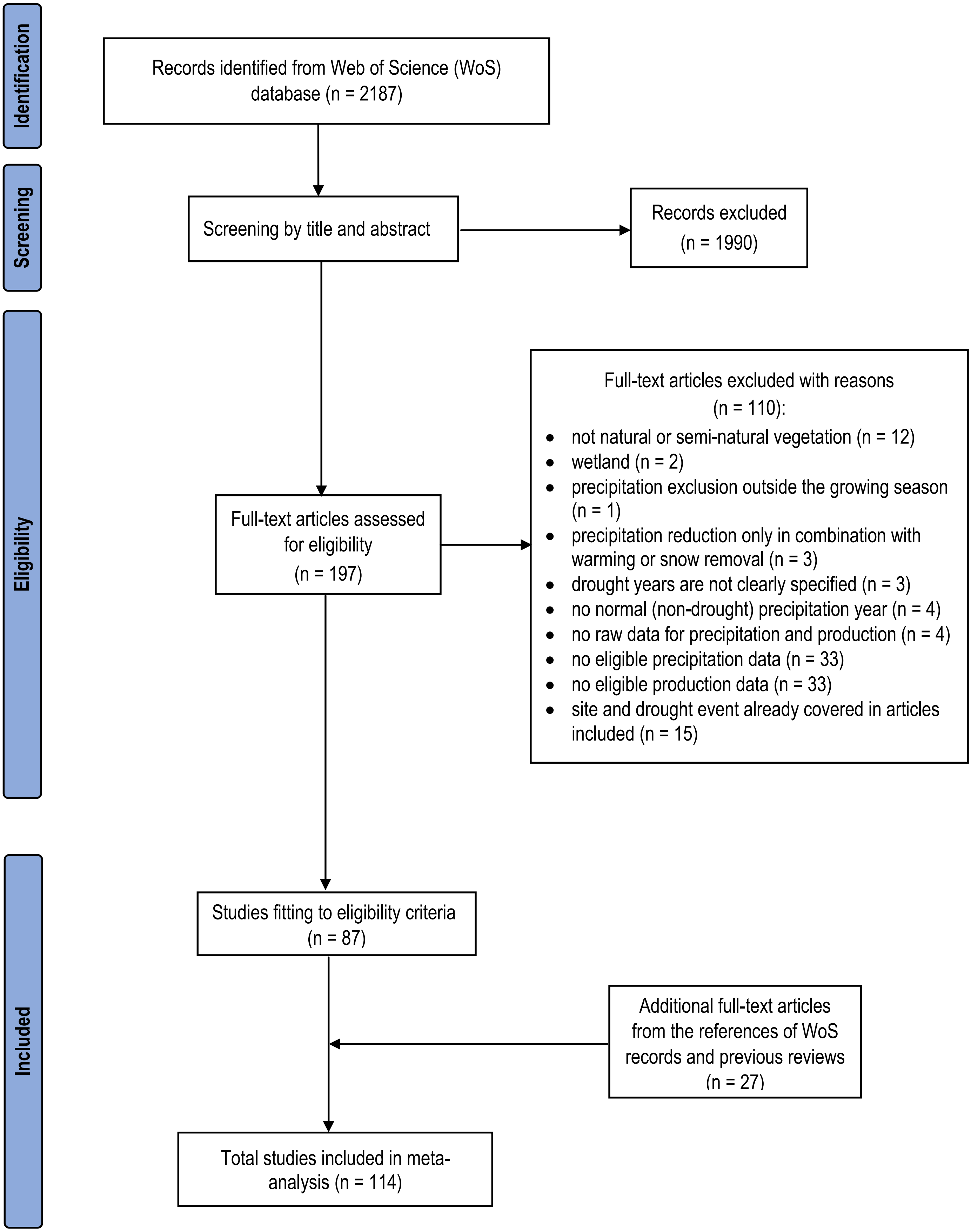
**Supplementary Note 8 | ** Results of N-weighted (replication-weighted) meta-analysis with lnRR on the experimental data points of the focal data set (grassland data with biomass estimates and site aridity index below 1) with treatment size (i.e. rainout shelter area, or if it was not reported in the paper, the experimental plot size) as a single explanatory variable

Table 1 | Parameter estimates of the model (number of data points: 75). Residual heterogeneity (Q_E) is 33.1 (DF = 73, P = 1).

	Coefficient	SE	z-value	P-value	CI lower	CI upper
Intercept	-0.3316	0.0673	-4.93	<0.0001	-0.4636	-0.1997
Treatment size	-0.0008	0.0007	-1.17	0.2415	-0.0021	0.0005

Table 2 | ANOVA table of the model.

	numDF, denDF	F-value	P-value
Treatment size	1,33	1.34	0.2562



Supplementary Figure 1 | PRISMA flow diagram describing the steps of selecting articles for inclusion in the meta-analysis

**Supplementary Note 9 | ** List of studies found in the literature search. The number of the paper corresponds to the study ID in the table of collected data (available in Figshare: https://doi.org/10.6084/m9.figshare.17881073). Shaded studies at the end of the list were not included in the focal meta-analysis, but were included in a separate replication-weighted meta-analysis (see Methods for details)

1. Abrams MD, Knapp AK, Hulbert LC (1986) A ten- year record of aboveground biomass in a Kansas tallgrass prairie: effects of fire and topographic position. American Journal of Botany 73: 1509-1515.
2. Aires LMI, Pio CA, Pereira JS (2008) Carbon dioxide exchange above a Mediterranean C3/C4 grassland during two climatologically contrasting years. Global Change Biology 14: 539-555.
3. Alon M, Sternberg M (2019) Effects of extreme drought on primary production, species composition and species diversity of a Mediterranean annual plant community. Journal of Vegetation Science 30: 1045-1055.
4. Arredondo T, Garcìa-Moya E, Huber-Sannwald E, Loescher HW, Delgado-Balbuena J, Luna-Luna M (2016) Drought manipulation and its direct and legacy effects on productivity of a monodominant and mixed-species semi-arid grassland. Agricultural and Forest Meteorology 223: 132-140.
5. Baoyin T, Li FY, Bao Q, Minggagud H, Zhong Y (2014) Effects of mowing regimes and climate variability on hay production of *Leymus chinensis* (Trin.) Tzvelev grassland in northern China. The Rangeland Journal 36: 593-600.
6. Bat-Oyun T, Shinoda M, Cheng Y, Purevdorj Y (2016) Effects of grazing and precipitation variability on vegetation dynamics in a Mongolian dry steppe. Journal of Plant Ecology 9: 508-519.
7. Briggs JM, Knapp AK (1995) Interannual variability in primary production in tallgrass prairie: climate, soil moisture, topographic position, and fire as determinants of aboveground biomass. American Journal of Botany 82: 1024-1030.
8. Brown JR, Archer S (1999) Shrub invasion of grassland: recruitment is continuous and not regulated by herbaceous biomass or density. Ecology 80: 2385-2396.
9. Byrne KM, Lauenroth WK, Adler PB (2013) Contrasting effects of precipitation manipulations on production in two sites within the central grassland region, USA. Ecosystems 16: 1039-1051.
10. Canarini A, Mariotte P, Ingram L, Merchant A, Dijkstra FA (2018) Mineral-associated soil carbon is resistant to drought but sensitive to legumes and microbial biomass in an Australian grassland. Ecosystems 21: 349-359.
11. Chen J, Shao C, Jiang S, Qu L, Zhao F, Dong G (2019) Effects of changes in precipitation on energy and water balance in a Eurasian meadow steppe. Ecological Processes 8: 17.
12. Cherwin K, Knapp A (2012) Unexpected patterns of sensitivity to drought in three semi-arid grasslands. Oecologia 169: 845-852.
13. Chieppa J, Nielsen UN, Tissue DT, Power SA (2019) Drought and phosphorus affect productivity of a mesic grassland via shifts in root traits of dominant species. Plant and Soil 444: 457-473.
14. Chimner RA, Welker JM, Morgan J, LeCain D, Reeder J (2010) Experimental manipulations of winter snow and summer rain influence ecosystem carbon cycling in a mixed-grass prairie, Wyoming, USA. Ecohydrology 3: 284-293.
15. Coupe MD, Stacey JN, Cahill Jr JF (2009) Limited effects of above- and belowground insects on community structure and function in a species- rich grassland. Journal of Vegetation Science 20: 121-129.

16. Czóbel Sz, Szirmai O, Németh Z, Gyuricza Cs, Házi J, Tóth A, Schellenberger J, Vasa L, Penksza K (2012) Short-term effects of grazing exclusion on net ecosystem CO_2 exchange and net primary production in a Pannonian sandy grassland. Notulae Botanicae Horti Agrobotanici Cluj-Napoca 40: 67-72.
17. Denton EM, Dietrich JD, Smith MD, Knapp AK (2017). Drought timing differentially affects above-and belowground productivity in a mesic grassland. Plant Ecology 218: 317-328.
18. Dong G, Guo J, Chen J, Sun G, Gao S, Hu L, Wang Y (2011) Effects of spring drought on carbon sequestration, evapotranspiration and water use efficiency in the Songnen meadow steppe in northeast China. Ecohydrology 4: 211-224.
19. Erichsen-Arychuk C, Bork EW, Bailey AW (2002) Northern dry mixed prairie responses to summer wildlife and drought. Journal of Range Management 164-170.
20. Evans SE, Burke IC (2013) Carbon and nitrogen decoupling under an 11-year drought in the shortgrass steppe. Ecosystems 16: 20-33.
21. Fahnestock JT, Detling JK (1999) Plant responses to defoliation and resource supplementation in the Pryor Mountains. Journal of Range Management 263-270.
22. Fay PA, Blair JM, Smith MD, Nippert JB, Carlisle JD, Knapp AK (2011) Relative effects of precipitation variability and warming on tallgrass prairie ecosystem function. Biogeosciences 8: 3053-3068.
23. February EC, Higgins SI, Bond WJ, Swemmer L (2013) Influence of competition and rainfall manipulation on the growth responses of savanna trees and grasses. Ecology 94: 1155-1164.
24. Fiala K, Tůma I, Holub P (2011) Effect of nitrogen addition and drought on above-ground biomass of expanding tall grasses *Calamagrostis epigejos* and *Arrhenatherum elatius*. Biologia 66: 275-281.
25. Flanagan LB, Adkinson AC (2011) Interacting controls on productivity in a northern Great Plains grassland and implications for response to ENSO events. Global Change Biology 17: 3293-3311.
26. Flanagan LB, Sharp EJ, Letts MG (2013) Response of plant biomass and soil respiration to experimental warming and precipitation manipulation in a Northern Great Plains grassland. Agricultural and Forest Meteorology 173: 40-52.
27. Frank DA (2007) Drought effects on above- and belowground production of a grazed temperate grassland ecosystem. Oecologia 152: 131-139.
28. Gamoun M (2016) Rain use efficiency, primary production and rainfall relationships in desert rangelands of Tunisia. Land Degradation and Development 27: 738-747.
29. Gao Y, Giese M, Brueck H, Yang H, Li Z (2013) The relation of biomass production with leaf traits varied under different land-use and precipitation conditions in an Inner Mongolia steppe. Ecological Research 28: 1029-1043.
30. Griffin-Nolan RJ, Carroll CJW, Denton EM, Johnston MK, Collins SL, Smith MD, Knapp AK (2018) Legacy effects of a regional drought on aboveground net primary production in six central US grasslands. Plant Ecology 219: 505-515.
31. Haddad NM, Tilman D, Knops JMH (2002) Long- term oscillations in grassland productivity induced by drought. Ecology Letters 5: 110-120.
32. Haferkamp MR, Heitschmidt RK, Karl MG (1997) Influence of Japanese brome on western wheatgrass yield. Journal of Range Management 50: 44-50.
33. Harrison SP, LaForgia ML, Latimer AM (2018) Climate- driven diversity change in annual grasslands: Drought plus deluge does not equal normal. Global Change Biology 24: 1782-1792.
34. Hein L (2006) The impacts of grazing and rainfall variability on the dynamics of a Sahelian rangeland. Journal of Arid Environments 64: 488-504.

35. Heitschmidt RK, Vermeire LT (2006) Can abundant summer precipitation counter losses in herbage production caused by spring drought? Rangeland Ecology and Management 59: 392-399.
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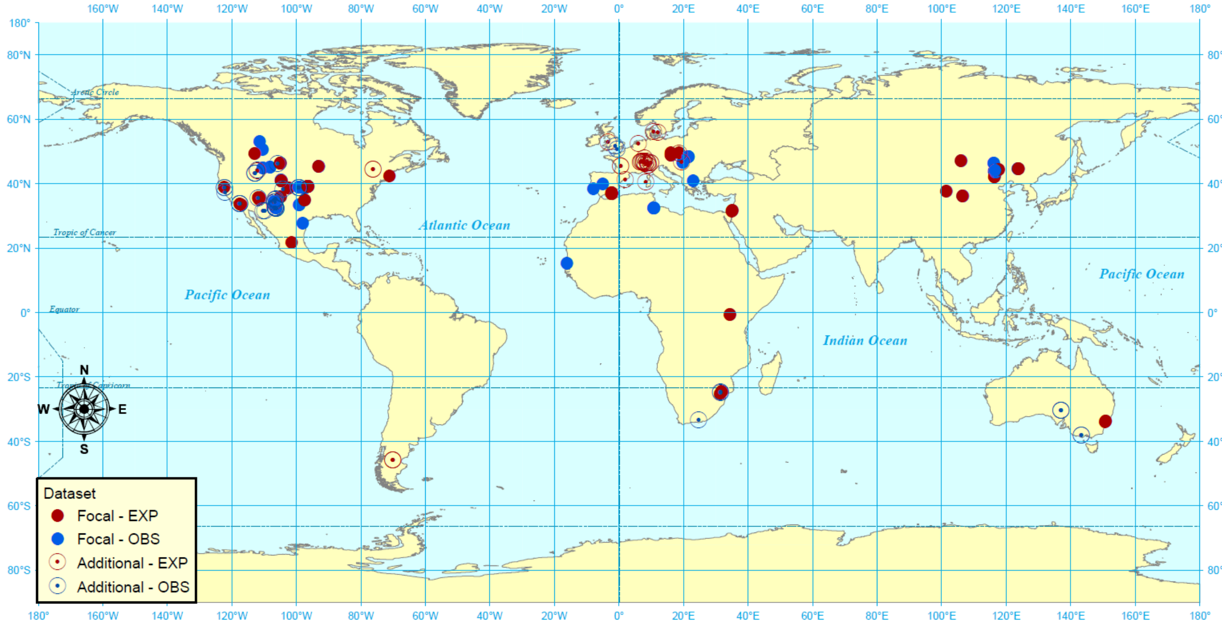

Supplementary Figure 2 │ Geographic setting of the studies included in the meta-analysis. EXP stands for experimental studies, and OBS stands for observational studies. Focal-EXP and Focal-OBS studies were included in the focal analysis, while Additional-EXP and Additional-OBS studies were left out of the focal analysis for various methodological reasons, but were analysed separately (See Methods for details). This map was created using ArcGIS® software by Esri. ArcGIS® is the intellectual property of Esri and is used herein under license. Copyright © Esri. All rights reserved.