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Supporting Information for

Extreme drought impacts have been underestimated in grasslands and shrublands globally

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This PDF file includes:

Figs. S1 to S2

Tables S1 to S11

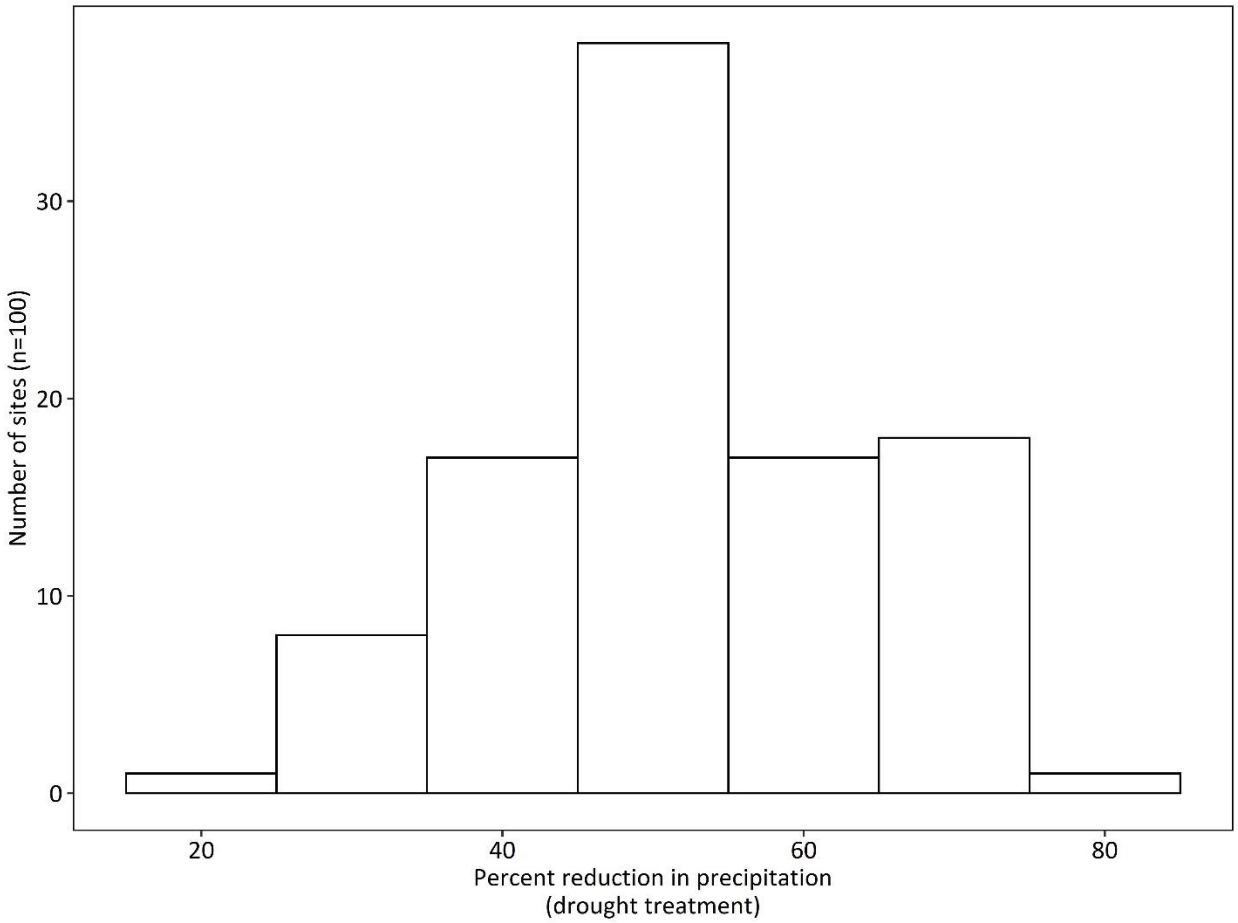

Figure S1. Frequency of sites imposing a level of percent reduction in precipitation for the extreme drought treatment. Bars represent 10% reduction in precipitation.

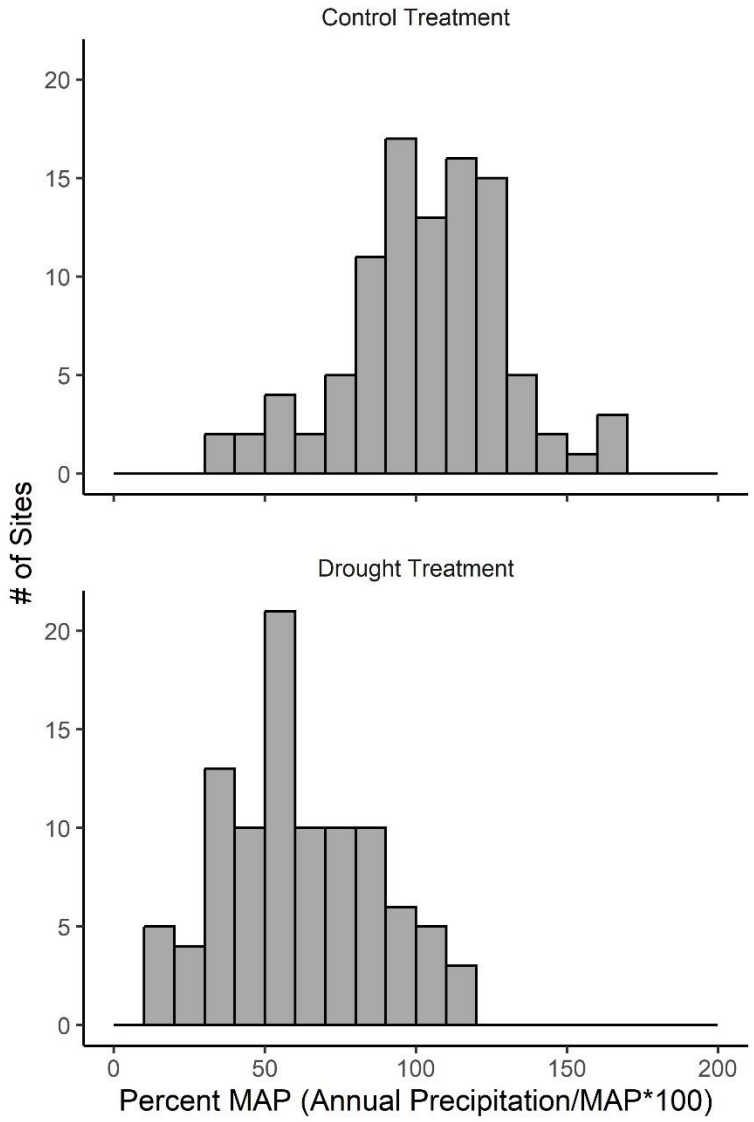

Figure S2. Percent of mean annual precipitation (MAP) received in drought vs. control plots.

Table S1. Full list of author contributions and funding sources. *Author contribution codes: 1= Idea generation; 2= Data management and analysis; 3= Manuscript writing; 4= Manuscript editing; 5= Code checking and clean up; 6= Site manager and/or data contributor; 7= Site PI; 8= IDE PI or Steering Committee Member

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Mathew R. Vankoughnett						X	X	

	Author Contributions*							
Full name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
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Glenda M. Wardle				X		X	X	
Cunzheng Wei						X		
Christiane Werner				X		X	X	
Georg Wiehl						X		
Jennifer L. Williams				X		X	X	
Amelia A. Wolf						X	X	
Michaela Zeiter				X		X	X	
Fawei Zhang						X		
Juntao Zhu						X		
Ning Zong						X		
Xiaoan Zuo						X		

Table S2. Information on IDE sites (n=100), including site codes that combine the site names and two-letter country codes. The table also provides information on country (Loc = two letter country codes), continent (Cont.) for each site, the ecosystem type (Eco type), latitude (Lat), longitude (Long), mean annual precipitation (MAP, mm), mean annual temperature (MAT, °C), the number of days the drought was imposed (Trt days), the ambient precipitation received in the year biomass was harvested (Amb precip), the target level of precipitation reduction (Target % precip reduc), the actual percent reduction achieved for the drought treatment in the year biomass was harvested (Actual % precip reduc; calculated as the percent reduction in precipitation received in drought versus ambient plots).

Site name	Site code	Loc.	Cont.	Eco type	Lat	Long	MAP	MAT	Trt days	Ambient precip	Target % precip reduc	Actual % precip reduc
Allmend Brachy	allmendb.ch	CH	Europe	Grassland	46.75	7.59	957.00	8.90	197	1080.43	32.00	23.26
Allmend Ovina	allmendo.ch	CH	Europe	Grassland	46.75	7.59	957.00	8.90	197	1080.43	33.00	23.99
Antelope	antelope.us	US	North America	Grassland	35.58	-111.51	215.00	12.50	123	349.17	50.00	31.92
Ayora Experimental Station	ayora.es	ES	Europe	Shrubland	39.12	-0.95	381.30	14.60	269	387.30	74.87	60.80
Bad Drought	baddrt.de	DE	Europe	Grassland	51.39	11.88	488.60	8.90	201	423.60	55.00	34.85
GCN-Bange	bange.cn	CN	Asia	Grassland	31.38	90.23	428.00	-0.26	221	440.54	50.00	31.95
Bayreuth	bayrdrt.de	DE	Europe	Grassland	49.92	11.58	724.00	8.20	417	695.70	40.00	40.00
BFL	bfl.us	US	North America	Grassland	30.28	-97.78	860.53	20.38	349	856.50	50.00	45.80
Biddulph	biddulph.ca	CA	North America	Grassland	51.91	-106.72	353.70	2.60	453	413.90	47.50	36.26
Boulder Drought	bldrdrt.us	US	North America	Grassland	39.92	-105.23	487.70	10.70	448	485.67	66.00	39.77
Broken Hill	brokenh.au	AU	Australia	Grassland	-31.98	141.56	283.00	18.30	383	123.20	65.00	65.00

Site name	Site code	Loc.	Cont.	Eco type	Lat	Long	MAP	MAT	Trt days	Ambient precip	Target % precip reduc	Actual % precip reduc
Brookdale	brookdale.ca	CA	North America	Grassland	50.05	-99.92	474.20	2.20	470	348.39	32.00	32.00
McDowell Mountain	capmcd.us	US	North America	Shrubland	33.64	-111.72	204.00	24.00	376	264.40	66.00	66.00
White Tank Mountain	capwhite.us	US	North America	Shrubland	33.60	-112.50	204.00	24.00	373	344.70	66.00	66.00
Cedar Creek Savanna	cedarsav.us	US	North America	Grassland	45.40	-93.18	682.00	7.50	116	842.52	43.00	19.87
Cedar Creek Trait	cedartrait.us	US	North America	Grassland	45.40	-93.19	682.00	7.50	153	758.95	43.00	24.80
Los Cerrillos	cerrillos.ar	AR	South America	Shrubland	-29.95	-65.87	390.00	21.00	224	331.82	50.00	46.90
Chacra Experimental Patagones	chacra.ar	AR	South America	Shrubland	-40.72	-62.90	400.00	14.40	279	513.73	50.00	31.35
Changling	chang.cn	CN	Asia	Grassland	44.75	123.75	444.90	6.10	482	577.00	70.00	62.09
Charleville	charleville.au	AU	Australia	Grassland	-26.36	146.15	451.00	21.00	387	164.60	65.00	65.00
Las Chilcas	chilcasdrt.ar	AR	South America	Grassland	-36.16	-58.16	950.00	16.00	368	823.03	50.00	50.00
Ciempozuelos	ciempoz.es	ES	Europe	Shrubland	40.19	-3.60	363.60	15.21	236	366.80	44.00	39.83
Cobar	cobar.au	AU	Australia	Grassland	-31.77	145.56	354.00	18.90	382	245.00	65.00	65.00
Cowichan	cowidrt.ca	CA	North America	Grassland	48.81	-123.63	1134.00	10.21	253	1146.83	50.00	45.63
CredoJ	credoj.au	AU	Australia	Shrubland	-30.47	120.81	259.60	18.75	342	319.54	60.00	57.29
CredoM	credom.au	AU	Australia	Shrubland	-30.47	120.81	259.60	18.75	342	319.54	60.00	57.29
GCN-Dangxiong	dang.cn	CN	Asia	Grassland	30.50	91.07	419.00	2.47	234	363.98	50.00	38.92
EEA	eea.br	BR	South America	Grassland	-30.10	-51.68	1440.00	19.61	184	1615.00	30.00	18.13
EE Elva	elvadrt.ee	EE	Europe	Grassland	58.26	26.36	680.00	5.80	442	606.20	62.00	62.00
ESW	esw.ca	CA	North America	Grassland	43.08	-81.34	1011.50	7.90	136	968.06	45.00	18.77

Site name	Site code	Loc.	Cont.	Eco type	Lat	Long	MAP	MAT	Trt days	Ambient precip	Target % precip reduc	Actual % precip reduc
Falls Creek	falls.au	AU	Australia	Grassland	-36.88	147.25	1239.00	9.40	368	1338.52	40.00	40.00
Freiburg	freiburg.de	DE	Europe	Grassland	48.02	7.83	934.00	11.40	122	955.70	35.00	17.39
Granite Cover	gmgranite.us	US	North America	Shrubland	34.78	-115.65	220.00	29.28	364	226.75	66.00	66.00
Molar Junction	gmmolar.us	US	North America	Shrubland	34.78	-115.65	220.00	29.28	364	226.75	66.00	66.00
Guaribas	guaribas.br	BR	South America	Grassland	-6.74	-35.14	1908.00	27.00	240	1072.33	46.00	28.42
GCN-Haibei	haibei.cn	CN	Asia	Grassland	37.61	101.31	469.00	-0.70	591	747.31	50.00	50.00
Hardware Ranch	hard.us	US	North America	Shrubland	41.61	-111.57	462.00	9.00	124	497.30	47.00	12.16
HOIDE	hoide.de	DE	Europe	Shrubland	54.55	13.10	541.15	8.53	469	603.00	40.00	40.00
GCN-Hongyuan	hong.cn	CN	Asia	Grassland	32.83	102.58	703.00	2.97	230	931.50	50.00	31.04
GCN-Hulunber	hulun.cn	CN	Asia	Grassland	49.33	119.95	360.00	-1.83	235	348.93	50.00	39.46
HYIDE	hyide.de	DE	Europe	Shrubland	54.55	13.10	541.15	8.53	470	603.00	40.00	40.00
Jornada LTER	jorndrt.us	US	North America	Grassland	32.60	-106.83	241.88	16.10	355	172.00	80.00	76.60
JRN Chihuahuan	jrnchi.us	US	North America	Shrubland	32.55	-106.77	246.60	18.10	366	315.98	70.00	70.00
Kernen-burned	kernb.ca	CA	North America	Grassland	52.17	-106.53	353.70	2.60	449	414.70	47.50	36.29
Kernen-unburned	kernnu.ca	CA	North America	Grassland	52.17	-106.53	353.70	2.60	449	414.70	47.50	36.29
Kinsella	kinsella.ca	CA	North America	Grassland	53.03	-111.56	406.24	2.40	420	443.40	45.00	28.23
Kiskunsag	kiskun.hu	HU	Europe	Grassland	46.87	19.42	596.00	11.00	137	776.60	40.00	18.87
Konza	konzadrt.us	US	North America	Grassland	39.11	-96.61	830.00	12.00	175	1104.20	60.00	46.30
Lygra intermediate	lygraint.no	NO	Europe	Shrubland	60.65	5.09	2234.00	7.40	113	2687.90	50.00	13.49
Lygra old	lygraold.no	NO	Europe	Shrubland	60.65	5.10	2234.00	7.40	113	2687.90	50.00	13.49

Site name	Site code	Loc.	Cont.	Eco type	Lat	Long	MAP	MAT	Trt days	Ambient precip	Target % precip reduc	Actual % precip reduc
Lygra young	lygrayng.no	NO	Europe	Shrubland	60.65	5.09	2234.00	7.40	113	2687.90	50.00	13.49
Mar Chiquita	marcdrt.ar	AR	South America	Grassland	-37.72	-57.42	927.90	20.70	143	1088.20	50.00	11.87
Matador	matador.ca	CA	North America	Grassland	50.70	-107.73	358.40	4.20	451	390.60	47.50	35.66
Matta LTER	matta.il	IL	Asia	Shrubland	31.71	35.06	540.00	17.70	213	510.84	66.00	64.54
Mattheis	mattheis.ca	CA	North America	Grassland	50.90	-111.88	329.11	4.09	377	330.90	55.00	40.57
Milparinka	milparinka.au	AU	Australia	Grassland	-29.61	141.71	192.00	20.40	385	228.20	65.00	65.00
Monte Oriental	morient.ar	AR	South America	Shrubland	-39.68	-64.85	382.70	14.10	349	464.13	47.00	46.27
Naposta	naposta.ar	AR	South America	Grassland	-38.42	-62.29	553.00	15.00	365	645.70	44.00	44.00
GCN-Naqu	naqu.cn	CN	Asia	Grassland	31.64	92.01	430.00	-1.45	226	495.46	50.00	31.30
NNSS Mojave	nnss.us	US	North America	Shrubland	36.83	-116.02	132.80	19.80	347	167.13	60.00	58.27
North Platte	nplatte.us	US	North America	Shrubland	42.71	-106.57	305.00	8.00	124	288.20	63.00	42.15
Nyngan	nyngan.au	AU	Australia	Grassland	-31.64	146.65	441.00	18.70	382	219.60	65.00	65.00
OCTC GreatBasin	octc.us	US	North America	Shrubland	43.25	-116.22	297.90	10.30	377	284.99	40.00	40.00
Oklahoma (KAEFS-OK)	oklah.us	US	North America	Grassland	34.98	-97.53	880.00	16.36	153	1069.59	42.63	22.49
ORE IDE AA	oreaa.us	US	North America	Shrubland	42.18	-121.02	497.00	7.10	384	465.16	41.00	41.00
ORE IDE AC	oreac.us	US	North America	Shrubland	42.18	-121.02	497.00	7.10	382	465.16	41.00	41.00
Potrok Aike	paike.ar	AR	South America	Grassland	-51.92	-70.41	202.00	5.00	469	205.92	54.00	54.00
Passo Gavia	passogavia.it	IT	Europe	Grassland	46.35	10.49	1281.00	-2.10	438	827.95	43.00	19.66
Pineta	pineta.es	ES	Europe	Grassland	42.66	0.12	1356.60	7.30	214	763.50	32.82	18.14

Site name	Site code	Loc.	Cont.	Eco type	Lat	Long	MAP	MAT	Trt days	Ambient precip	Target % precip reduc	Actual % precip reduc
University of Wisconsin-Platteville Greenhouses	plattev.us	US	North America	Grassland	42.73	-90.49	961.60	8.10	518	1042.10	50.00	50.00
PNE IDE- burned	pneburn.br	BR	South America	Grassland	-17.92	-52.99	1568.26	24.60	301	1284.69	30.00	25.03
PNE IDE-unburned	pneunburn.br	BR	South America	Grassland	-17.92	-52.99	1568.26	24.60	301	1284.69	30.00	25.03
Los Pozos	pozos.ar	AR	South America	Grassland	-51.39	-69.25	244.00	7.50	386	281.00	50.00	50.00
Purdue Wildlife Area	purdue.us	US	North America	Grassland	40.45	-87.05	950.00	11.10	119	1067.56	40.00	16.11
Quilpie	quilpie.au	AU	Australia	Grassland	-26.58	144.62	354.00	22.00	386	134.60	65.00	65.00
Rhijnauwen	rhijn.nl	NL	Europe	Grassland	52.07	5.18	796.92	9.50	462	656.40	51.40	51.40
Rio Mayo	riomayo.ar	AR	South America	Shrubland	-45.40	-70.31	155.00	9.50	358	118.85	67.00	66.33
San Claudio	sclaudio.ar	AR	South America	Grassland	-35.92	-61.15	950.00	16.00	176	1016.41	50.00	18.59
Santa Cruz High	scruzh.us	US	North America	Grassland	37.02	-122.08	745.00	13.90	156	1148.70	60.00	54.98
Santa Cruz Low	scruzl.us	US	North America	Grassland	36.95	-122.06	745.00	13.90	154	825.90	60.00	51.30
Santa Cruz Middle	scruzm.us	US	North America	Grassland	36.95	-122.06	745.00	13.90	163	999.96	60.00	54.20
Sedgwick Reserve	sedgwick.us	US	North America	Grassland	34.72	-120.04	380.00	15.00	116	304.00	75.00	56.05
Sevilleta Black	sevblack.us	US	North America	Grassland	34.34	-106.69	249.00	14.00	360	245.00	66.00	65.34
Sevilleta Blue	sevblue.us	US	North America	Grassland	34.34	-106.62	255.00	15.00	365	229.60	66.00	66.00
Sevilleta Mixed	sevmixed.us	US	North America	Grassland	34.36	-106.69	234.00	14.00	365	227.08	66.00	66.00

Site name	Site code	Loc.	Cont.	Eco type	Lat	Long	MAP	MAT	Trt days	Ambient precip	Target % precip reduc	Actual % precip reduc
Shortgrass Steppe	sgsdrt.us	US	North America	Grassland	40.81	-104.71	341.00	8.60	439	319.30	66.00	66.00
Skotsvaer	skotsvar.no	NO	Europe	Shrubland	65.80	12.22	1766.00	5.50	466	998.20	60.00	60.00
SLP	slp.us	US	North America	Grassland	30.08	-97.17	930.70	20.11	334	888.49	50.00	46.80
Sonora Agrilife Research Station	sonora.us	US	North America	Grassland	30.27	-100.56	567.90	17.94	246	565.15	69.00	62.43
San Pablo Valdes	spvdrt.ar	AR	South America	Grassland	-42.65	-64.17	220.60	20.70	135	247.09	50.00	24.77
Syferkuil (Drought Act Limpopo)	syferkuil.za	ZA	Africa	Grassland	-23.85	29.70	478.00	17.10	217	421.51	66.00	42.07
Torla	torla.es	ES	Europe	Grassland	42.65	-0.07	1405.36	7.40	195	1759.93	19.55	11.29
Ukulinga IDE	ukulingadrt.za	ZA	Africa	Grassland	-29.67	30.40	732.60	18.60	210	644.60	50.00	43.75
GCN-Urat	urat.cn	CN	Asia	Grassland	41.42	106.97	152.00	4.83	237	196.85	50.00	43.87
Validate	validate.fr	FR	Europe	Grassland	45.72	3.02	790.00	8.19	474	707.40	68.00	68.00
Wytham Rain Drop	wytham.uk	UK	Europe	Grassland	51.77	-1.33	743.60	9.93	335	591.49	50.00	19.21
GCN-Xilinhot	xilin.cn	CN	Asia	Grassland	43.55	116.74	338.00	1.08	242	295.00	50.00	42.47
GCN-Yanchi	yanchi.cn	CN	Asia	Grassland	37.31	106.93	337.00	8.06	227	460.51	50.00	40.56
Yarramundi	yarradrt.au	AU	Australia	Grassland	-33.61	150.74	800.00	17.60	274	1131.00	65.00	41.57
GCN-Youyu	youyu.cn	CN	Asia	Grassland	39.99	112.32	390.00	4.63	235	552.64	50.00	39.39

Table S3. Results from one-sided t-tests examining whether nominal or extreme droughts reduced ANPP of grasslands, shrublands, or both. Mean drought response by overall level of drought extremeness (extreme or nominal) and drought extremeness by ecosystem types (grassland or shrubland) were significantly less than 0 (no difference in ANPP between drought and control plots). The table includes model estimates (Est.), degrees of freedom (df), t-value (t), and p-value (p). Drought response is defined as ln(average $ANPP_{DROUGHT}$/average $ANPP_{CONTROL}$).

	Est.	df	t	p
All sites, extreme (n= 44)	-0.42	43	-6.31	<0.001
All sites, nominal (n= 56)	-0.23	55	-3.43	<0.001
Grassland, extreme (n= 35)	-0.47	34	-5.93	<0.001
Grassland, nominal (n= 39)	-0.24	38	-3.13	0.002
Shrubland, extreme (n= 9)	-0.23	8	-2.75	0.01
Shrubland, nominal (n= 17)	-0.22	16	-1.52	0.07

Table S4. Linear mixed-effects model results (site set as a random effect) testing the effects of ecosystem type (grassland or shrubland) on drought response for all sites (n= 100). The table includes the intercept (slope for grassland), predictor variable (Shrubland), model estimates (Est., slope for shrubland), standard error (SE), degrees of freedom (df), t-value (t), p-value (Pr(>|t|)), and adjusted R^2 (R^2). Drought response is defined as ln(average $ANPP_{DROUGHT}$/average $ANPP_{CONTROL}$).

	Est.	SE	df	t	Pr(>|t|)	R^2
Intercept	-0.35	0.06	98	-6.10	<0.001	0.003
Shrubland	0.13	0.11		1.05	0.25	

Table S5. Site codes (refer to Table S2 for full site names) and information for each site on drought response (Drt resp), drought severity (Drt sev), previous year's precipitation (Prev year's precip, the precipitation in the 365-730 days preceding the biomass harvest), interannual % coefficient of variation in MAP (CV), natural log of the aridity index (ln(AI)), average percent sand (Sand), average proportion of graminoids (Gram), and the average plot-level richness (Ave rich). For sites with -- in a column, this datum was unavailable. *Previous year's precipitation was relativized by MAP.

Site code	Drt resp	Drt sev	Prev year's precip*	CV	ln(AI)	Sand	Gram	Ave rich
allmendb.ch	-0.03	-0.13	977.20	11.84	0.17	42.13	0.65	28.27
allmendo.ch	0.32	-0.14	977.20	11.84	0.17	42.13	0.70	24.80
antelope.us	-0.49	0.11	310.33	26.82	-1.61	53.92	0.83	3.87
ayora.es	0.43	-0.60	309.20	18.37	-0.71	40.79	--	14.10
baddrt.de	-0.18	-0.44	372.80	19.75	-0.41	40.79	0.14	7.22
bange.cn	0.14	-0.30	353.24	21.96	-0.81	63.21	0.39	--
bayrdrt.de	-0.25	-0.42	518.04	15.29	-0.17	41.53	0.65	6.56
bfl.us	-0.06	-0.46	1210.10	29.57	-0.60	32.54	--	10.92
biddulph.ca	-0.76	-0.25	443.30	25.11	-0.79	46.42	--	6.06
bldrdrt.us	-0.43	-0.40	487.43	21.95	-0.95	36.50	--	--
brokenh.au	-1.67	-0.85	362.00	52.57	-1.67	59.35	0.26	3.88
brookdale.ca	-0.01	-0.50	540.16	19.80	-0.50	28.45	0.47	9.50
capmcd.us	0.08	-0.56	310.70	33.59	-1.68	45.43	0.31	5.57
capwhite.us	-1.44	-0.43	265.80	36.41	-2.03	57.04	0.52	7.64
cedarsav.us	-0.34	-0.01	847.09	15.18	-0.17	75.37	0.75	11.50
cedartrait.us	-0.45	-0.16	888.24	18.19	-0.18	76.98	0.43	10.48
cerrillos.ar	-0.58	-0.55	545.16	20.61	-1.40	66.28	0.62	11.67
chacra.ar	-0.11	-0.12	442.60	21.92	-1.27	60.09	1.00	5.85
chang.cn	-0.83	-0.51	504.17	31.89	-0.69	52.92	0.89	4.42
charleville.au	-0.23	-0.87	656.74	45.82	-1.24	54.82	0.02	2.25
chilcasdrt.ar	-0.31	-0.57	946.45	27.33	-0.31	35.84	0.98	8.00
ciempoz.es	0.21	-0.39	333.60	21.68	-0.98	37.60	0.00	2.69
cobar.au	-0.85	-0.76	533.00	36.70	-1.41	52.19	0.24	6.00
cowidrt.ca	-0.37	-0.45	1054.28	16.83	0.44	37.59	0.63	19.56
credoj.au	-0.45	-0.47	269.42	27.46	-1.76	61.94	0.19	9.20
credom.au	-0.31	-0.47	269.42	27.46	-1.76	61.94	0.12	9.24
dang.cn	0.08	-0.47	493.21	17.76	-0.91	51.74	0.73	--
eea.br	-0.12	-0.08	1836.60	19.32	0.06	31.54	--	26.80

Site code	Drt resp	Drt sev	Prev year's precip*	CV	ln(AI)	Sand	Gram	Ave rich
elvadrt.ee	-0.35	-0.66	740.00	17.48	0.09	49.25	0.54	22.24
esw.ca	-0.23	-0.22	807.81	13.21	0.09	23.69	0.09	8.94
falls.au	0.05	-0.35	1719.33	24.91	0.69	59.48	0.37	11.61
freiburg.de	-0.27	-0.15	1064.10	16.03	0.03	29.98	0.63	--
gmgranite.us	0.38	-0.65	259.08	45.21	-1.73	63.76	0.35	6.86
gmmolar.us	0.31	-0.65	259.08	45.21	-1.76	63.95	0.26	12.14
guaribas.br	-0.68	-0.60	1090.05	19.25	-0.21	53.31	0.80	7.08
haibei.cn	-0.26	-0.20	695.83	9.49	-0.41	41.31	0.00	--
hard.us	0.11	-0.05	545.30	19.24	-0.87	27.38	0.27	7.61
hoide.de	-0.62	-0.33	614.70	16.16	-0.08	45.16	--	--
hong.cn	-0.03	-0.09	586.10	13.62	-0.15	40.04	0.42	--
hulun.cn	-0.55	-0.41	315.26	20.25	-0.68	22.70	0.46	--
hyide.de	-1.21	-0.33	614.70	16.16	-0.08	47.79	--	--
jorndrt.us	-0.11	-0.83	283.60	31.74	-1.81	70.69	0.81	4.11
jrnchi.us	-0.07	-0.62	245.36	32.12	-1.83	69.82	--	4.10
kernb.ca	-0.03	-0.25	488.50	30.82	-0.75	50.52	0.76	14.00
kernnu.ca	0.25	-0.25	488.50	30.82	-0.75	49.88	0.74	11.78
kinsella.ca	-0.28	-0.22	487.70	23.13	-0.52	38.01	--	2.48
kiskun.hu	-0.09	0.06	528.60	22.30	-0.53	79.25	--	11.73
konzadrt.us	-0.17	-0.29	965.85	18.77	-0.31	8.63	0.79	8.31
lygraint.no	0.58	0.04	2713.80	15.57	1.53	56.96	0.31	--
lygraold.no	-0.31	0.04	2713.80	15.57	1.53	56.70	0.39	--
lygrayng.no	0.37	0.04	2713.80	15.57	1.53	57.64	0.08	--
marcdrt.ar	-0.10	0.03	690.50	22.10	-0.29	--	0.97	8.52
matador.ca	-0.25	-0.30	646.20	27.18	-0.86	23.37	0.90	10.50
matta.il	-0.48	-0.66	654.56	33.70	-1.07	24.67	0.26	--
mattheis.ca	-0.12	-0.40	440.40	24.26	-0.97	41.76	--	3.97
milparinka.au	0.00	-0.58	333.20	58.47	-2.01	55.71	0.62	5.83
morient.ar	-0.64	-0.35	334.97	31.10	-1.59	66.31	0.77	--
naposta.ar	-1.95	-0.35	558.09	24.64	-0.66	35.31	--	6.07
naqu.cn	-0.22	-0.21	488.58	27.44	-0.56	63.54	0.69	--
nnss.us	-0.79	-0.47	216.15	43.98	-2.38	57.66	--	17.45
nplatte.us	0.00	-0.45	413.70	21.16	-1.37	33.25	0.98	5.28
nyngan.au	-0.53	-0.83	654.79	37.94	-1.19	50.71	0.27	--
octc.us	-0.19	-0.43	316.74	25.95	-1.40	33.27	--	3.35
oklah.us	-0.23	-0.06	1401.32	28.18	-0.42	31.05	--	14.67
oreaa.us	-0.33	-0.45	438.39	21.59	-0.89	44.76	--	11.85
oreac.us	-0.32	-0.45	438.39	21.59	-0.89	44.76	--	11.92
paike.ar	-0.31	-0.53	155.56	24.01	-1.23	72.71	0.84	17.61
passogavia.it	0.06	-0.48	755.51	18.21	1.33	42.11	0.53	14.92
pineta.es	-0.46	-0.54	964.40	18.18	0.27	34.95	0.95	8.75

Site code	Drt resp	Drt sev	Prev year's precip*	CV	ln(AI)	Sand	Gram	Ave rich
plattev.us	-0.93	-0.46	1119.30	16.63	-0.11	10.88	0.57	--
pneburn.br	-0.05	-0.39	1489.46	16.19	0.00	41.72	0.72	--
pneunburn.br	-1.27	-0.39	1489.46	16.19	0.00	42.41	0.49	--
pozos.ar	0.66	-0.42	287.68	18.37	-1.25	64.03	0.30	--
purdue.us	-0.38	-0.06	973.13	12.34	-0.09	18.37	--	4.42
quilpie.au	-0.57	-0.87	473.32	52.05	-1.55	48.64	0.17	4.06
rhijn.nl	-0.27	-0.60	952.30	11.94	0.15	36.91	0.79	15.33
riomayo.ar	-0.35	-0.74	142.68	24.82	-1.53	66.79	0.88	--
sclaudio.ar	-0.47	-0.13	951.86	25.24	-0.32	55.28	1.00	2.77
scruzh.us	0.19	-0.31	845.75	39.42	-0.21	51.33	--	10.30
scruzl.us	0.02	-0.46	574.70	36.97	-0.44	--	--	8.17
scruzm.us	-0.30	-0.39	757.70	36.97	-0.44	--	--	7.53
sedgwick.us	-0.49	-0.65	216.30	40.45	-0.92	32.42	0.84	--
sevblack.us	-1.08	-0.66	187.66	23.05	-1.73	49.69	0.50	3.86
sevblue.us	-0.24	-0.69	186.10	23.05	-1.64	43.21	0.97	2.71
sevmixed.us	-0.78	-0.67	201.74	23.05	-1.77	47.63	0.76	4.29
sgsdrt.us	-2.12	-0.68	298.70	19.06	-1.14	44.86	0.82	--
skotsvar.no	-0.03	-0.77	2347.10	17.55	1.59	--	0.03	--
slp.us	-0.29	-0.49	1331.90	28.32	-0.47	60.95	--	12.42
sonora.us	-0.49	-0.63	495.05	32.49	-1.00	12.99	0.51	--
spvdrt.ar	0.22	-0.16	150.59	15.28	-1.58	64.04	0.76	11.86
syferkuil.za	-0.19	-0.49	584.23	28.43	-0.48	54.20	0.96	--
torla.es	0.19	0.11	913.80	16.51	0.51	33.08	0.30	--
ukulingadrt.za	-0.17	-0.51	693.60	10.09	-0.45	22.84	0.93	12.93
urat.cn	-1.61	-0.27	152.76	39.47	-1.81	46.30	0.49	--
validate.fr	-0.47	-0.71	767.00	16.29	-0.01	44.82	--	6.50
wytham.uk	-0.76	-0.36	758.10	17.54	-0.04	24.93	0.61	--
xilin.cn	-0.40	-0.50	367.40	50.34	-0.78	51.99	0.85	--
yanchi.cn	-0.24	-0.19	314.70	19.42	-1.15	53.13	0.34	--
yarradrt.au	-0.03	-0.17	795.20	21.70	-0.41	57.02	0.96	5.79
youyu.cn	0.12	-0.14	526.75	19.04	-0.77	57.23	0.75	--

Table S6. Linear regression results for separate models testing the effects of drought severity (Drt sev), mean annual precipitation (MAP), previous-year's precipitation (Prev yr), percent CV of MAP (CV), aridity (ln(AI)), percent sand (Sand), average proportion of graminoids (Gram), and average richness (Rich) on drought response, defined as ln(average $ANPP_{DROUGHT}$/average $ANPP_{CONTROL}$). The table includes the intercept (int), predictor variables, model estimates (Est.), standard error (SE), degrees of freedom (df), t-value (t), p-value (p), and adjusted R^2 (R^2). For each variable, sample size (n)= 100 and degrees of freedom (df)= 98, except where noted. **Indicates strong evidence at the α= 0.05 level; *Indicates moderate evidence at the α= 0.05 level.

	Est.	SE	t	p	R^2
Int	-0.11	0.09	-1.18	0.24	0.05
Drt. Sev**	0.53	0.20	2.65	0.009	
Int	-0.43	0.08	-5.25	8.72E-07	0.02
MAP	1.80E-04	1.03E-04	1.75	0.08	
Int	-0.33	0.05	-6.53	2.99E-09	-0.002
Prev Yr Precip	0.18	0.20	0.91	0.37	
Int	-0.13	0.13	-1.04	0.30	0.01
CV	-0.01	4.78E-03	-1.54	0.13	
Int	-0.22	0.06	-3.66	4.11E-04	0.05
logAI**	0.14	0.06	2.44	0.02	
Int	-0.46	0.17	-2.78	0.01	-0.003
Sand	0.00	3.39E-03	0.86	0.39	
Int	-0.20	0.12	-1.61	0.11	-0.002
Prop Gram	-0.18	0.19	-0.93	0.35	
Int	-0.46	0.10	-4.64	1.69E-05	0.05
Richness*	0.02	0.01	2.09	0.04	

[i] Sand: n= 96, df= 94
[ii] Graminoids: n= 77, df= 75
[iii] Richness: n= 68, df= 66

Table S7. Linear mixed effects model results (site set as a random effect) testing the additive and interactive effects of mean annual precipitation (MAP) and percent sand (Sand) on drought response for all sites (n= 96, df= 92). The table includes the intercept, predictor variables, model estimates (Est.), standard error (SE), t-value (t), and p-value (p), and adjusted R^2 (R^2). Drought response is defined as ln(average $ANPP_{DROUGHT}$/average $ANPP_{CONTROL}$).

	Est	SE	t	p	R^2
Intercept	-0.61	0.39	-1.55	0.12	0.01
MAP	1.58E-04	5.25E-04	0.30	0.76	
Sand	3.54E-03	7.39E-03	0.48	0.63	
MAP*Sand	7.17E-07	1.01E-05	0.07	0.94	

Table S8. Linear mixed effects model results (site set as a random effect) testing the additive effects of drought severity (Drt sev), mean annual precipitation (MAP), previous year's precipitation as relativized by MAP (Prev Yr Precip), percent CV of MAP (CV), percent sand (Sand), and graminoid abundance (Gram) on drought response for all sites (n= 74, df= 68). The table includes the intercept, predictor variables, model estimates (Est.), standard error (SE), degrees of freedom (df), t-value (t), p-value (p). and adjusted R^2 (R^2). Drought response is defined as ln(average $ANPP_{DROUGHT}$/average $ANPP_{CONTROL}$). *Indicates weak evidence at the α= 0.05 level.

	Est.	SE	t	p	R^2
Intercept	0.03	0.30	0.11	0.91	0.10
Drt sev*	0.50	0.28	1.79	0.08	
MAP	1.86E-05	1.28E-04	0.15	0.88	
Prev Yr Precip	0.34	0.25	1.34	0.19	
Prop gram	-0.17	0.20	-0.85	0.40	
Pct CV	-7.80E-03	7.20E-03	-1.08	0.28	
Pct sand	2.68E-03	3.77E-03	0.71	0.48	

Table S9. The number of sites excluded from our analyses based on each of six criteria for inclusion (n=100). There are 141 sites in the network, of which 100 were used for analyses presented here.

Criteria	Number of sites
Forest or forest understory	16
Drought shelters were not in place for 120-650 days (+/- one week)	5
Did not submit or report aboveground net primary production	10
Average aboveground net primary production outside range for biome	3
Did not reduce precipitation in drought plots by at least 15% compared to control plots	4
Did not follow IDE protocols	3

Table S10. Disturbance and management history for each site (refer to Table S2 for full site names). For each experimental location, site coordinators reported disturbances or management at their site, with 1 indicating a disturbance/management practice generally within three decades before establishment of the experiment and 0 indicating no disturbance/management practice. The plowing history column refers to mechanical disturbances that break up the soil surface such as agricultural practices. The fire history column refers to disturbance events of both natural and prescribed fire. The grazing history column refers to the presence of both natural and domesticated grazing animals. The mowing history column refers to a removal of aboveground biomass by mechanical means. Of the 100 sites that provided disturbance or management history, we know of 13 that continue to be actively mowed (n=6), burned (n=5), or experience occasional grazing (n=2). *Indicates that the activity occurred during the experiment.

Site code	Plowing history	Grazing history	Burning history	Mowing history	Historically managed	Actively managed
allmendb.ch	0	0	0	1*	1	1
allmendo.ch	0	0	0	1*	1	1
antelope.us	0	1	0	0	1	0
ayora.es	0	0	1	0	0	0
baddrt.de	0	0	0	1*	1	1
bange.cn	0	0	0	0	0	0
bayrdrt.de	0	0	0	1*	0	1
bfl.us	0	1	1	1	0	0
biddulph.ca	0	0	0	0	0	0
bldrdrt.us	0	1	0	0	0	0
brokenh.au	0	1	0	0	1	0
brookdale.ca	0	0	0	0	0	0
capmcd.us	0	0	0	0	0	0
capwhite.us	0	0	0	0	0	0
cedarsav.us	0	0	1*	0	1	1
cedartrait.us	1	0	1*	0	1	1
cerrillos.ar	0	1	0	0	1	0
chacra.ar	0	0	0	0	0	0

Site code	Plowing history	Grazing history	Burning history	Mowing history	Historically managed	Actively managed
chang.cn	0	0	0	0	0	0
charleville.au	0	1	0	0	1	0
chilcasdrt.ar	0	1	0	0	0	0
ciempoz.es	0	0	0	0	0	0
cobar.au	0	1	0	0	1	0
cowidrt.ca	0	0	0	0	0	0
credoj.au	0	1	0	0	0	0
credom.au	0	1	0	0	0	0
dang.cn	0	0	0	0	0	0
eea.br	0	0	0	0	1	0
elvadrt.ee	1	0	0	1*	1	1
esw.ca	1	0	0	0	0	0
falls.au	0	0	0	0	0	0
freiburg.de	0	1	0	1*	1	1
gmgranite.us	0	0	0	0	0	0
gmmolar.us	0	0	0	0	0	0
guaribas.br	0	0	1	0	1	0
haibei.cn	0	0	0	0	0	0
hard.us	0	1	0	0	0	0
hoide.de	0	0	0	0	1	0
hong.cn	0	0	0	0	0	0
hulun.cn	0	0	0	0	0	0
hyide.de	0	0	0	0	1	0
jorndrt.us	0	0	0	0	0	0
jrnchi.us	0	1*	0	0	0	1
kernb.ca	0	1	1*	0	1	1
kernnu.ca	0	1	0	0	1	0
kinsella.ca	0	1	0	0	0	0
kiskun.hu	0	1	0	0	0	0
konzadrt.us	0	0	1*	0	0	1
lygraint.no	0	1	1	0	1	0
lygraold.no	0	1	1	0	1	0
lygrayng.no	0	1	1	0	1	0
marcdrt.ar	0	0	0	0	0	0
matador.ca	0	0	0	0	0	0
matta.il	0	1	0	0	0	0
mattheis.ca	0	1	0	0	0	0
milparinka.au	0	1	0	0	1	0
morient.ar	0	1	0	0	1	0
naposta.ar	0	0	0	0	0	0
naqu.cn	0	0	0	0	0	0

Site code	Plowing history	Grazing history	Burning history	Mowing history	Historically managed	Actively managed
nnss.us	0	0	0	0	0	0
nplatte.us	0	1	0	0	1	0
nyngan.au	0	1	0	0	1	0
octc.us	0	1	0	0	0	0
oklah.us	0	0	0	0	1	0
oreaa.us	0	0	0	0	0	0
oreac.us	0	0	0	0	0	0
paike.ar	0	0	0	0	0	0
passogavia.it	0	1*	0	0	0	1
pineta.es	0	0	0	0	0	0
plattev.us	0	0	0	0	0	0
pneburn.br	0	0	1*	0	0	1
pneunburn.br	0	0	1	0	0	0
pozos.ar	0	0	0	0	1	0
purdue.us	0	0	1	0	1	0
quilpie.au	0	1	0	0	1	0
rhijn.nl	0	1	0	0	1	0
riomayo.ar	0	1	0	0	1	0
sclaudio.ar	1	0	0	0	1	0
scruzh.us	1	0	0	0	1	0
scruzl.us	1	0	0	0	1	0
scruzm.us	1	0	0	0	1	0
sedgwick.us	0	1	0	0	1	0
sevblack.us	0	0	0	0	0	0
sevblue.us	0	0	0	0	0	0
sevmixed.us	0	0	0	0	0	0
sgsdrt.us	0	0	0	0	0	0
skotsvar.no	0	1	1	0	1	0
slp.us	0	1	1	1	0	0
sonora.us	0	1	1	0	0	0
spvdrt.ar	0	0	0	0	0	0
syferkuil.za	0	0	1	0	1	0
torla.es	0	0	0	0	0	0
ukulingadrt.za	0	0	0	1	1	0
urat.cn	0	0	0	0	0	0
validate.fr	0	0	0	1	1	0
wytham.uk	0	0	0	0	1	0
xilin.cn	0	0	0	0	0	0
yanchi.cn	0	0	0	0	0	0
yarradrt.au	0	1	0	0	0	0
youyu.cn	0	0	0	0	0	0

Table S11. AIC model results for comparing linear and non-linear models for drought severity, mean annual precipitation (MAP), previous year's precipitation, aridity index, and richness. Models tested included a simple linear regression (linear), asymptotic regression (asymptotic), and a generalized additive model (GAM) with the spline function set to 3. *The asymptotic regression failed to converge for previous year's precipitation and the aridity index.

Models compared	df	AIC	ΔAIC
Drought severity			
Linear	3	138.56	0.00
Asymptotic	4	140.62	2.06
GAM	3	140.14	1.58
MAP			
Linear	3	142.43	0.00
Asymptotic	4	143.94	1.51
GAM	3	145.22	2.79
Previous Year's Precipitation*			
Linear	3	144.66	0.00
GAM	3	145.66	1
Aridity Index*			
Linear	3	139.59	0.00
GAM	3	140.78	1.18
Richness			
Linear	3	80.11	0.00
Asymptotic	4	81.55	1.44
GAM	3	81.13	1.03