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Toward early warning of drought impacts: a framework for predicting drought impacts in the UK

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Table S1 Model Parameters found in calibration of the models in R caret package

Model	Resampling Strategy	Folds	Repeats	Best Tuning Parameters	Preprocessing (Threshold / ICA Components)	Adaptive Resampling (Min / Alpha)
RF_CV1	Repeated CV	10	3	mtry = 5		
RF_CV2	CV	44	-	mtry = 5		
QRF	Repeated CV	10	3	mtry = 5		
XGBoost	Repeated CV	10	3	nrounds = 50 max_depth = 5 eta = 0.1 gamma = 0.1 colsample_bytree = 0.75 min_child_weight = 1 subsample = 0.5	Threshold = 0.95 ICA Components = 3	Min = 5 Alpha = 0.05
Lasso_CV	Repeated CV	10	3	alpha = 1, lambda = 0		
Lineer Reg.	Repeated CV	10	5	intercept = FALSE		

Table S2 Information about NUTS1 Regions; post-processed (PP) total number of impact occurrences (NI), Number of months with observed impact data, Arable Area Ratio (AAR) and Population Ratio (PopR)

NUTS1 ID	Name	NI (PP)	# Months (NI>0)	AAR (%)	PopR (%)
DE1	**Baden-Württemberg**	**980**	**136**	**7.35**	**13.28**
DE6	Hamburg	10	4	0.04	2.12
DE7	Hessen	85	31	4.09	7.58
DE8	Mecklenburg-Vorpommern	43	25	8.65	1.84
DE9	Niedersachsen	87	32	16.23	9.72
DEA	Nordrhein-Westfalen	87	27	9.77	21.8
DEB	Rheinland-Pfalz	116	33	3.35	5.1
DEC	Saarland	7	3	0.28	1.18
DED	**Sachsen**	**187**	**38**	**5.81**	**4.83**
DEE	Sachsen-Anhalt	44	22	8.44	2.64
DEF	Schleswig-Holstein	30	14	5.33	3.48
DEG	Thüringen	13	4	5.15	2.53
DE2	Bayern	790	27	17.41	15.98
DE3	Berlin	15	11	0.03	3.99
DE4	**Brandenburg**	**199**	**51**	**8.07**	**3.17**
DE5	Bremen	12	3	0.01	0.76
DE	**Germany**	**2705**	**461**	**100.0**	**100**

15   *Highlighted with bold NUTS1 regions are selected to use in the independent validation.
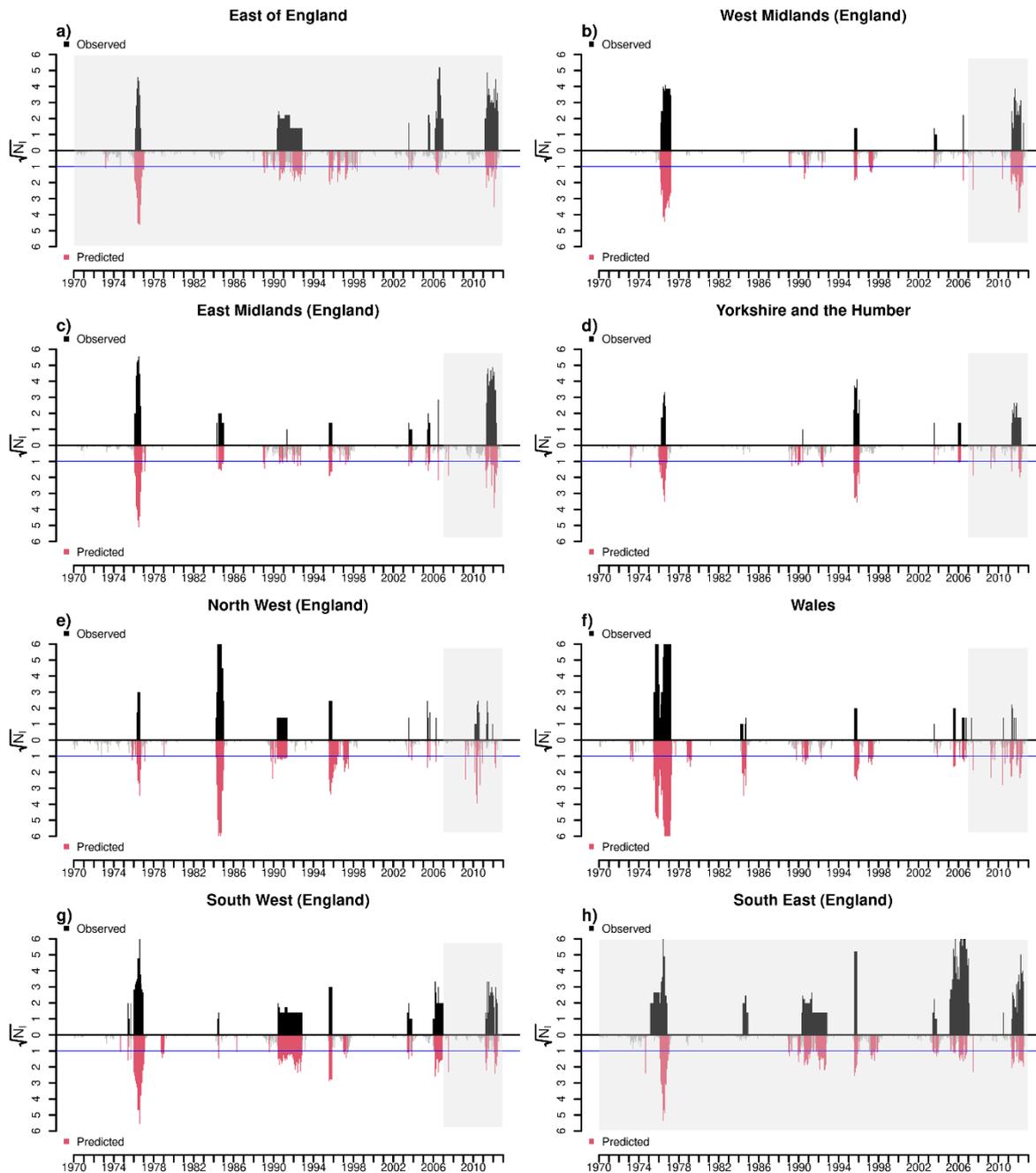
Figure S1 Observed and predicted NI values. Similar to Figure 1 Panel (a) in the main text but for all remaining UK NUTS1 regions.
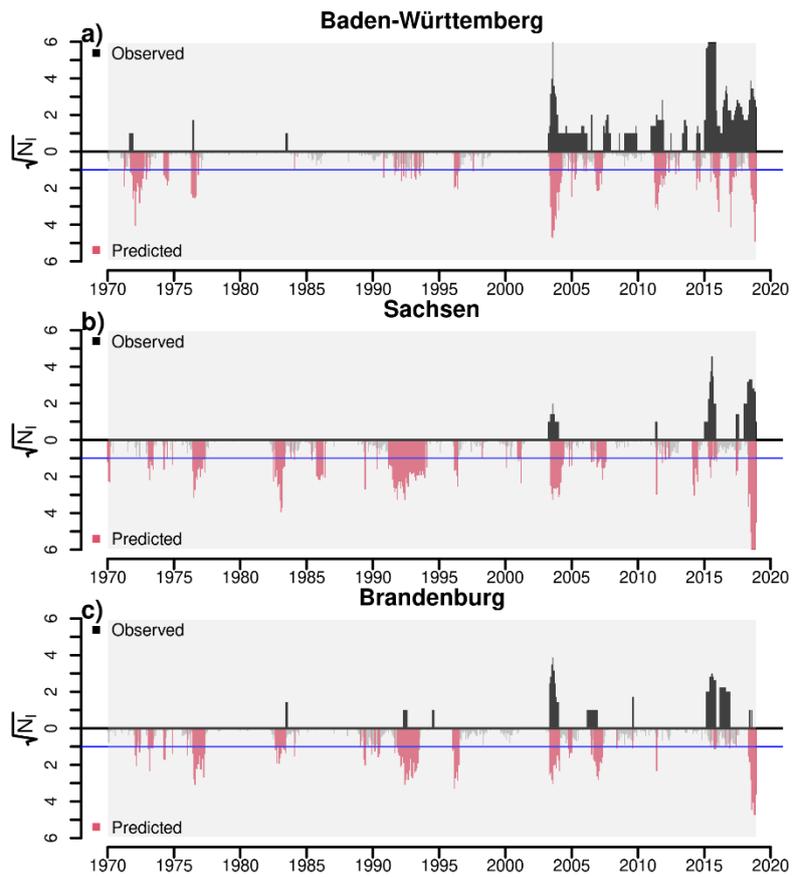
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Figure S2 Observed and predicted NI values. Similar to Figure 1 Panel (a) in the main text but for selected DE NUTS1 regions.
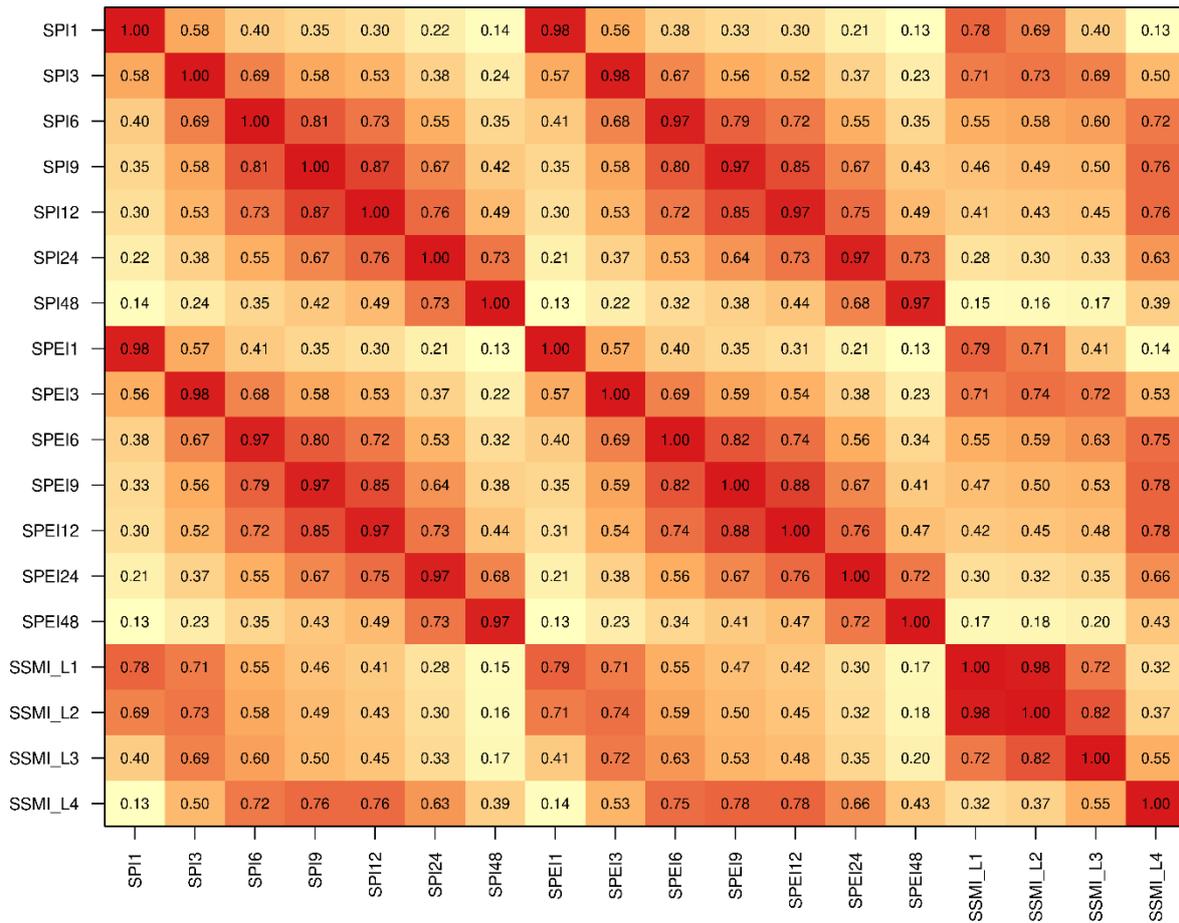
Correlation Heatmap of Drought Indices

	SPI1	SPI3	SPI6	SPI9	SPI12	SPI24	SPI48	SPEI1	SPEI3	SPEI6	SPEI9	SPEI12	SPEI24	SPEI48	SSMI_L1	SSMI_L2	SSMI_L3	SSMI_L4
SPI1	1.00	0.58	0.40	0.35	0.30	0.22	0.14	0.98	0.56	0.38	0.33	0.30	0.21	0.13	0.78	0.69	0.40	0.13
SPI3	0.58	1.00	0.69	0.58	0.53	0.38	0.24	0.57	0.98	0.67	0.56	0.52	0.37	0.23	0.71	0.73	0.69	0.50
SPI6	0.40	0.69	1.00	0.81	0.73	0.55	0.35	0.41	0.68	0.97	0.79	0.72	0.55	0.35	0.55	0.58	0.60	0.72
SPI9	0.35	0.58	0.81	1.00	0.87	0.67	0.42	0.35	0.58	0.80	0.97	0.85	0.67	0.43	0.46	0.49	0.50	0.76
SPI12	0.30	0.53	0.73	0.87	1.00	0.76	0.49	0.30	0.53	0.72	0.85	0.97	0.75	0.49	0.41	0.43	0.45	0.76
SPI24	0.22	0.38	0.55	0.67	0.76	1.00	0.73	0.21	0.37	0.53	0.64	0.73	0.97	0.73	0.28	0.30	0.33	0.63
SPI48	0.14	0.24	0.35	0.42	0.49	0.73	1.00	0.13	0.22	0.32	0.38	0.44	0.68	0.97	0.15	0.16	0.17	0.39
SPEI1	0.98	0.57	0.41	0.35	0.30	0.21	0.13	1.00	0.57	0.40	0.35	0.31	0.21	0.13	0.79	0.71	0.41	0.14
SPEI3	0.56	0.98	0.68	0.58	0.53	0.37	0.22	0.57	1.00	0.69	0.59	0.54	0.38	0.23	0.71	0.74	0.72	0.53
SPEI6	0.38	0.67	0.97	0.79	0.72	0.53	0.32	0.40	0.69	1.00	0.82	0.74	0.56	0.34	0.55	0.59	0.63	0.75
SPEI9	0.33	0.56	0.79	0.97	0.85	0.64	0.38	0.35	0.59	0.82	1.00	0.88	0.67	0.41	0.47	0.50	0.53	0.78
SPEI12	0.30	0.52	0.72	0.85	0.97	0.73	0.44	0.31	0.54	0.74	0.88	1.00	0.76	0.47	0.42	0.45	0.48	0.78
SPEI24	0.21	0.37	0.55	0.67	0.75	0.97	0.68	0.21	0.38	0.56	0.67	0.76	1.00	0.72	0.30	0.32	0.35	0.66
SPEI48	0.13	0.23	0.35	0.43	0.49	0.73	0.97	0.13	0.23	0.34	0.41	0.47	0.72	1.00	0.17	0.18	0.20	0.43
SSMI_L1	0.78	0.71	0.55	0.46	0.41	0.28	0.15	0.79	0.71	0.55	0.47	0.42	0.30	0.17	1.00	0.98	0.72	0.32
SSMI_L2	0.69	0.73	0.58	0.49	0.43	0.30	0.16	0.71	0.74	0.59	0.50	0.45	0.32	0.18	0.98	1.00	0.82	0.37
SSMI_L3	0.40	0.69	0.60	0.50	0.45	0.33	0.17	0.41	0.72	0.63	0.53	0.48	0.35	0.20	0.72	0.82	1.00	0.55
SSMI_L4	0.13	0.50	0.72	0.76	0.76	0.63	0.39	0.14	0.53	0.75	0.78	0.78	0.66	0.43	0.32	0.37	0.55	1.00

Figure S3 Correlation Heat Map of Drought Indices used in the Training Phase of the Models

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Table S3 Variance Inflation Factor (VIF) values for the Linear Regression model

SPI1	SPI3	SPI6	SPI9	SPI12	SPI24	SPI48
28.19	35.15	35.99	60.39	68.00	47.71	31.39
SPEI1	**SPEI3**	**SPEI6**	**SPEI9**	**SPEI12**	**SPEI24**	**SPEI48**
27.36	36.52	38.83	63.92	71.37	48.25	30.90
SSMI_L1	**SSMI_L2**	**SSMI_L3**	**SSMI_L4**	**PopR**	**AAR**	
51.91	58.35	6.24	4.34	2.05	2.04	