Supplementary Materials for

Discrimination among climate, human activities, and ecosystem functional-induced land degradation in Southern Africa

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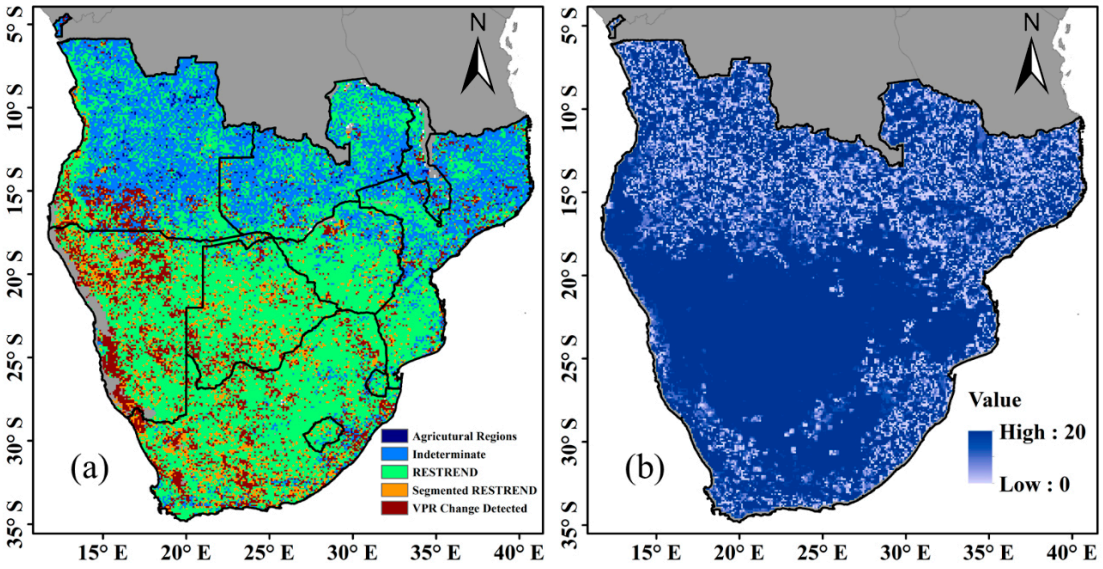
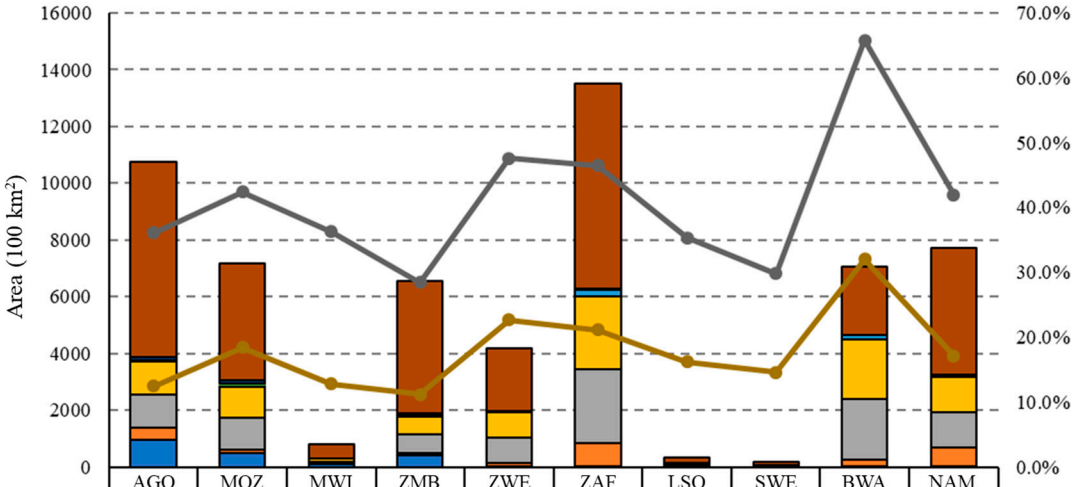


Figure S1. (a) Pixels with a non-significant sensitivity of vegetation to rainfall (SVR) relationship in the TSS-RESTREND method; (b) the number of combinations of 15 years/3 pixels for the temporal and spatial windows that had a significant SVR on pixel scale.

		spatial window (pixels)			
		1×1	3×3	5×5	7×7
temporal window (years)	5	22.13	58.64	68.46	73.20
	10	39.99	71.63	77.45	81.55
	15	50.60	77.16	81.63	84.99
	20	59.29	80.49	84.23	87.09
	25	66.98	82.83	86.07	88.61
	30	72.87	84.41	87.29	89.53

Figure S2. The percentage of significant rainfall–vegetation relationships in each combination of spatial and temporal windows.



	AGO	MOZ	MWI	ZMB	ZWE	ZAF	LSO	SWE	BWA	NAM
A	6880	4119	513	4698	2181	7234	216	125	2422	4478
G	124	105	10	53	1	10	0	1	0	3
H	43	65	3	21	5	20	0	0	4	8
F	24	45	4	16	40	243	3	1	148	78
E	1150	1103	86	643	897	2590	51	24	2116	1234
D	1150	1103	86	643	897	2590	51	24	2116	1234
C	460	143	20	75	116	801	13	3	263	649
B	936	471	83	420	24	34	0	0	5	34
SD	36.1%	42.4%	36.3%	28.5%	47.6%	46.5%	35.3%	29.8%	65.8%	42.0%
MD	12.5%	18.4%	12.8%	11.2%	22.7%	21.2%	16.2%	14.6%	32.1%	17.1%

Figure S3. Area (100km²) and its proportions of land degradation situation in different countries. SD: single and multiple land degradation; MD: multiple land degradation.

	AGO	MOZ	MWI	ZMB	ZWE	ZAF	LSO	SWE	BWA	NAM
Forest land	681	271	14	246	13	7	0	0	0	0
Shrubland	158	144	35	105	4	8	0	0	3	12
Grassland	59	26	2	22	1	5	0	0	1	2
Sparse land	0	0	0	0	0	11	0	0	0	13
Bare land	2	0	0	0	0	0	0	0	1	2
Cropland	36	30	32	47	6	3	0	0	0	5

(a)

	AGO	MOZ	MWI	ZMB	ZWE	ZAF	LSO	SWE	BWA	NAM
Forest land	79	100	10	44	65	99	0	3	9	2
Shrubland	133	23	5	23	28	163	7	0	108	122
Grassland	118	6	1	5	0	174	3	0	88	179
Sparse land	0	0	0	0	0	311	0	0	13	176
Bare land	72	0	0	0	0	10	0	0	17	139
Cropland	58	14	4	3	23	44	3	0	28	31

(b)

	AGO	MOZ	MWI	ZMB	ZWE	ZAF	LSO	SWE	BWA	NAM
Forest land	867	700	43	455	355	377	1	22	145	1
Shrubland	132	182	21	120	274	686	36	2	1118	624
Grassland	127	99	2	24	0	582	4	0	747	385
Sparse land	0	0	0	0	0	276	0	0	4	170
Bare land	0	0	0	0	1	1	0	0	3	53
Cropland	24	122	20	44	267	668	10	0	200	1

(c)

	AGO	MOZ	MWI	ZMB	ZWE	ZAF	LSO	SWE	BWA	NAM
Forest land	226	222	16	93	26	43	0	1	2	0
Shrubland	195	58	22	36	4	48	1	0	20	13
Grassland	102	12	0	3	0	12	0	0	14	10
Sparse land	0	0	0	0	0	34	0	0	0	58
Bare land	38	0	0	0	0	1	0	0	6	17
Cropland	53	21	13	15	11	12	0	0	0	12

(d)

	AGO	MOZ	MWI	ZMB	ZWE	ZAF	LSO	SWE	BWA	NAM
Forest land	12	31	1	1	11	28	0	1	6	0
Shrubland	4	6	2	2	1	55	2	0	88	25
Grassland	6	3	0	0	3	81	1	0	44	29
Sparse land	0	0	0	0	0	60	0	0	0	21
Bare land	0	0	0	0	0	0	0	0	1	3
Cropland	1	5	1	1	1	7	0	0	9	0

(e)

	AGO	MOZ	MWI	ZMB	ZWE	ZAF	LSO	SWE	BWA	NAM
Forest land	90	66	1	28	0	0	0	0	0	0
Shrubland	20	29	3	16	1	5	0	1	0	1
Grassland	9	3	1	0	0	1	0	0	0	1
Sparse land	0	0	0	0	0	2	0	0	0	0
Bare land	0	0	0	0	0	0	0	0	0	0
Cropland	5	7	5	9	0	2	0	0	0	1

(f)

	AGO	MOZ	MWI	ZMB	ZWE	ZAF	LSO	SWE	BWA	NAM
Forest land	26	49	0	13	3	5	0	0	1	0
Shrubland	8	14	2	7	1	4	0	0	3	3
Grassland	5	1	0	0	0	2	0	0	0	0
Sparse land	0	0	0	0	0	7	0	0	0	4
Bare land	0	0	0	0	0	1	0	0	0	0
Cropland	4	1	1	1	1	1	0	0	0	1

(g)

Figure S4. The area (100 km^2) of degradation situation (a) B, (b) C, (c) D, (d) E, (e) F, (f) G, (g) H in different countries and land covers; the gray shaded cell indicates the number of pixels of the correspondent type less than 50.

	AGO	MOZ	MWI	ZMB	ZWE	ZAF	LSO	SWE	BWA	NAM	S
Forest land	0.21	0.77	0.38	0.29	1.47	1.49	0	0.68	2.19	0	0.62
Shrubland	0.19	0.45	0.9	0.07	1.34	1.68	1.1	0	3.8	1.22	1.41
Grassland	0.45	0.71	0	1.06	0	4.11	1.82	0	2.5	1.24	2.04
Sparse land	0	0	0	0	0	3.65	0	0	0	1.75	2.7
Bare land	0	0	0	0	0	0	0	0	1.67	0.36	0.35
Cropland	0.24	0.83	0.39	0.19	0.72	0.83	0	0	2.08	0	0.76

(a)

	AGO	MOZ	MWI	ZMB	ZWE	ZAF	LSO	SWE	BWA	NAM	S
Forest land	1.45	1.65	0.38	0.75	0	0	0	0	0	0	1.03
Shrubland	0.97	2.18	1.35	1.05	0.1	0.15	0	11.1	0	0.05	0.55
Grassland	0.68	0.71	3.85	0	0	0.05	0	0	0	0.04	0.18
Sparse land	0	0	0	0	0	0.12	0	0	0	0	0.07
Bare land	0	0	0	0	0	0	0	0	0	0	0
Cropland	1.19	1.16	1.96	1.7	0	0.09	0	0	0	0.68	0.51

(b)

	AGO	MOZ	MWI	ZMB	ZWE	ZAF	LSO	SWE	BWA	NAM	S
Forest land	0.42	1.22	0	0.35	0.22	0.27	0	0	0.36	0	0.54
Shrubland	0.39	1.05	0.9	0.46	0.1	0.12	0	0	0.13	0.15	0.3
Grassland	0.38	0.24	0	0	0	0.1	0	0	0	0	0.1
Sparse land	0	0	0	0	0	0.43	0	0	0	0.33	0.37
Bare land	0	0	0	0	0	3.03	0	0	0	0	0.09
Cropland	0.95	0.17	0.39	0.19	0.1	0.04	0	0	0	0.68	0.18

(c)

Figure S5. The area proportion (%) of land degradation situation (a) F, (b) G, and (d) H in each country and land cover. Darker colors show a higher proportion of land degradation; the gray shaded cells indicate the number of pixels of the correspondent type lower than 50. S represents the mean level of the whole study area.

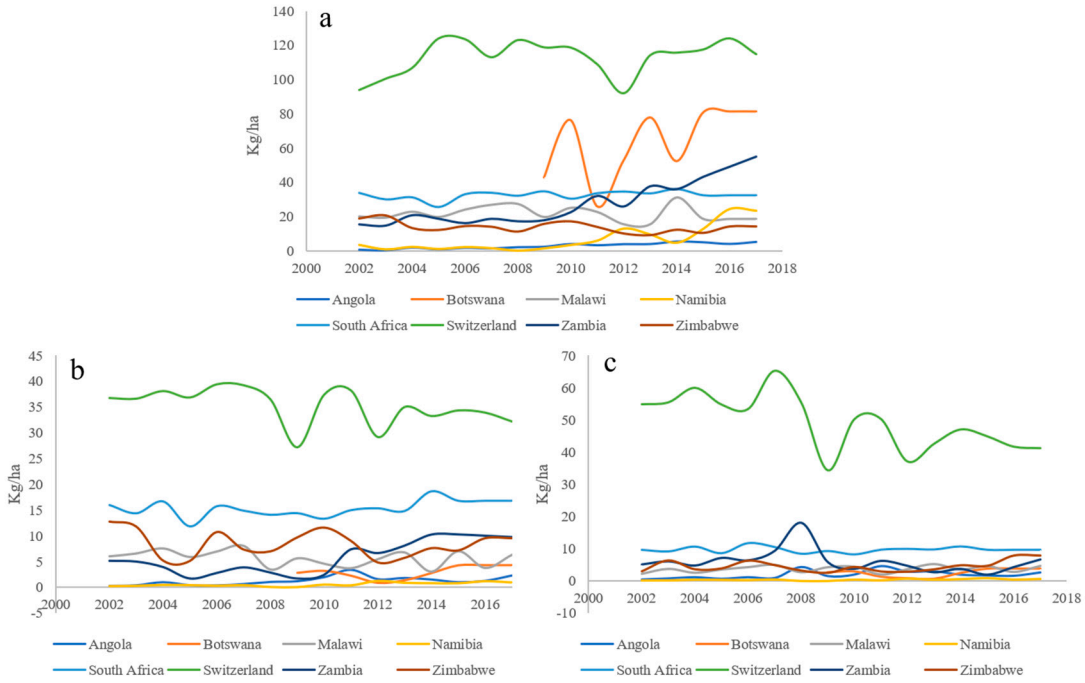


Figure S6. (a) N, (b) P, and (c) K input per unit area of cropland. Data from FAO datasets.