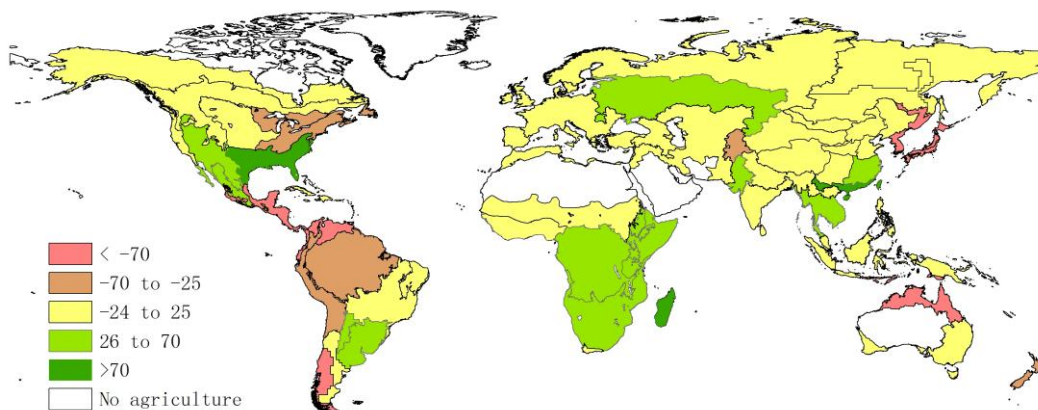


## Annex B Environmental Indices for Crop Production System Zones

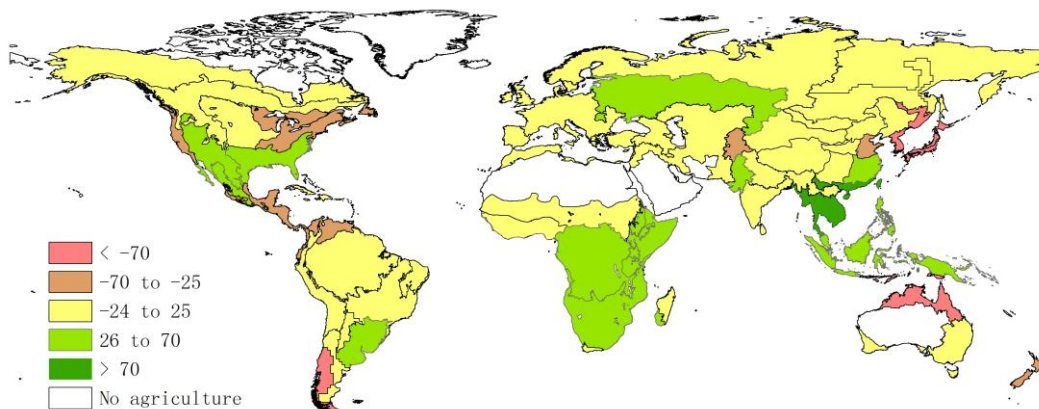
Figures B.1, B.2, and B.3 and tables B.1, B.2, and B.3 illustrate and describe accumulated rainfall, temperature accumulation, and accumulated photosynthetically active radiation (PAR) for the 60 crop production system zones (CPSZ) for the period October 2012 to September 2013. The figures each show the values' departure from the five-year average for 2008-12 (a), departure from the twelve-year average (2001-12) (b), and the trend for 2001-13 normalized by dividing it by the twelve-year average (c). The tables B.1, B.2, and B.3 provide the data itself, adding the correlation and significance of the trend. Data is based on 0.25 degree pixels over agricultural areas using NPPP weighting and Spot Vegetation derived monthly average growing season masks. Figure B.4 shows temperature and rainfall anomaly for shorter time periods.

**Figure B.1 CPSZ October 2012-September 2013 rainfall accumulation (mm)**

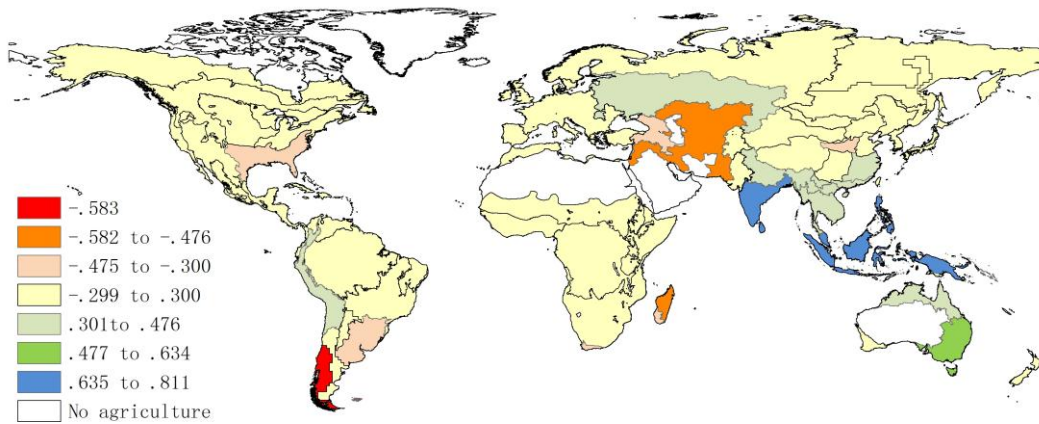
a. 2013 accumulated rainfall departure from the five-year average



b. 2013 accumulated rainfall departure from the twelve-year average

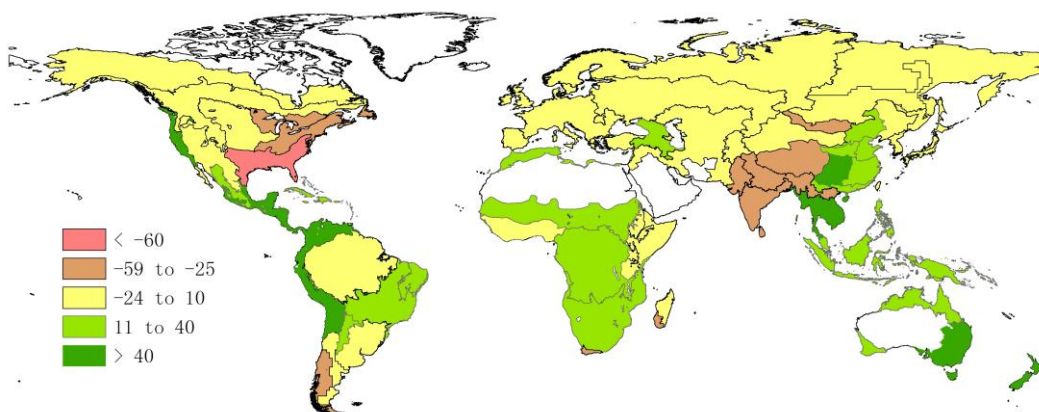


c. Accumulated rainfall trend for 2001-2013, expressed by the coefficient of correlation of rainfall regressed against time. Significance thresholds are 0.476 ( $p \leq 0.05$ ) and 0.635 ( $p \leq 0.01$ ).

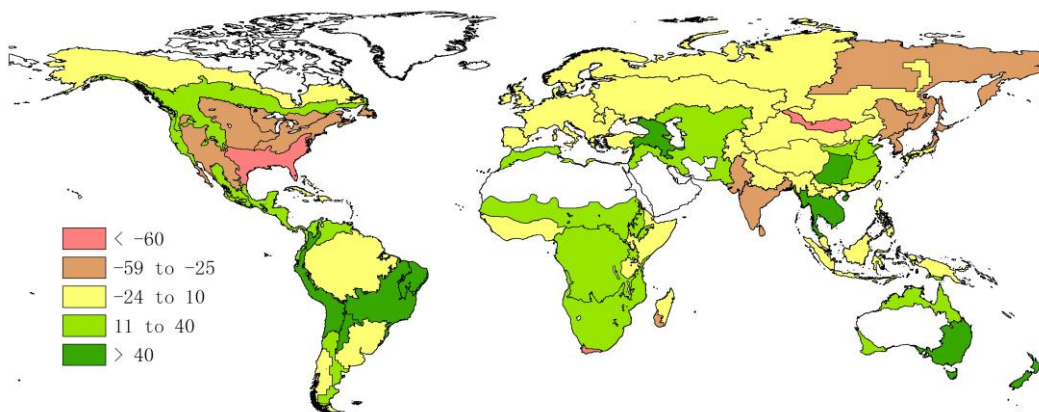


**Figure B.2 CPSZ October 2012-September 2013 temperature accumulation ( $^{\circ}\text{C}$ )**

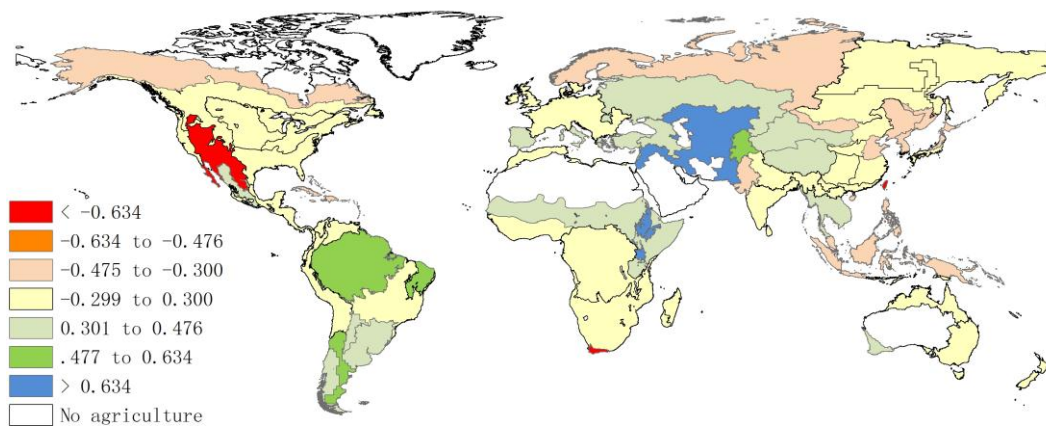
a. 2013 Temperature accumulation above  $5^{\circ}\text{C}$ , departure from the five-year average



b. 2013 Temperature accumulation above  $5^{\circ}\text{C}$ , departure from the twelve-year average

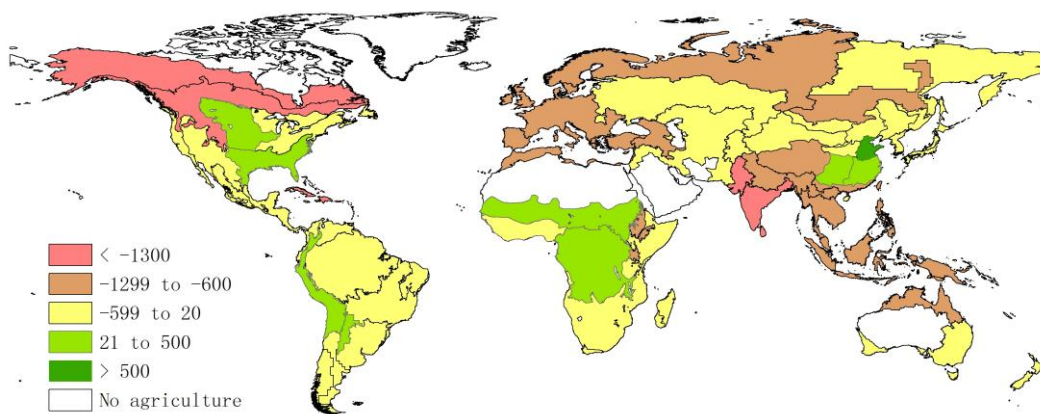


c. Temperature trend, 2001-2013 (refer to B1.c for details)

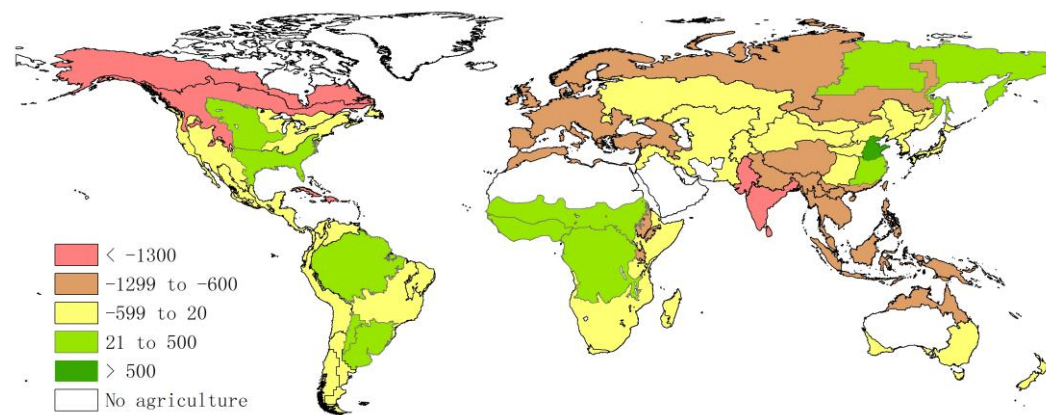


**Figure B.3 CPSZ October 2012-September 2013 accumulated PAR ( $W/m^2$ )**

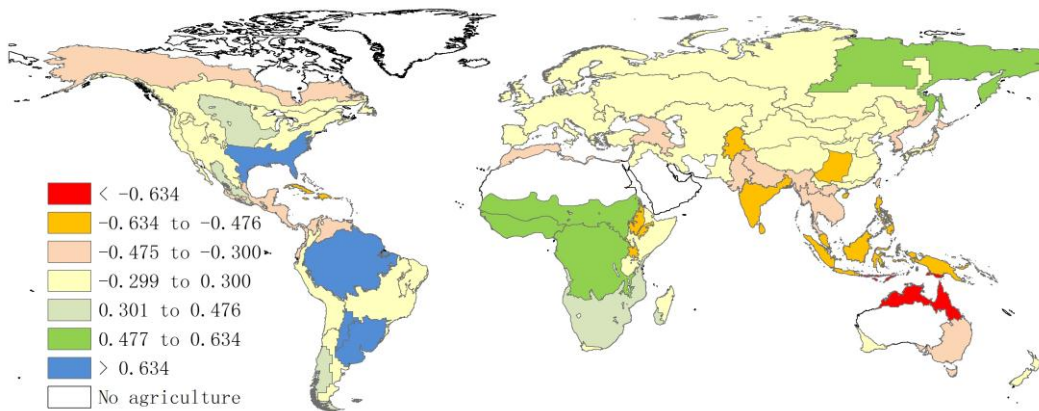
a. 2013 accumulated PAR departure from the five-year average



b. 2013 accumulated PAR departure from the twelve-year average

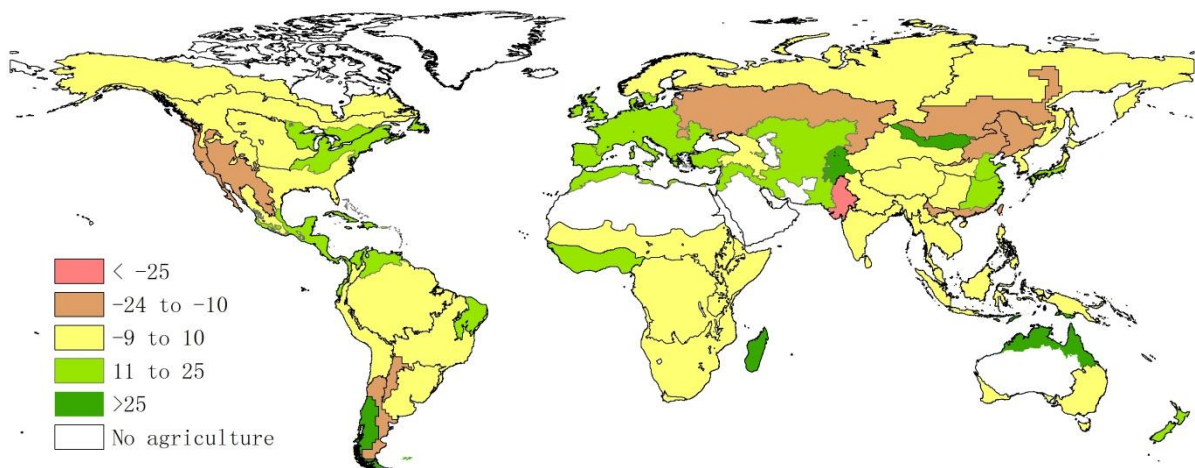


c. Accumulated PAR trend for 2001-2013 (Refer to B1.c for details)

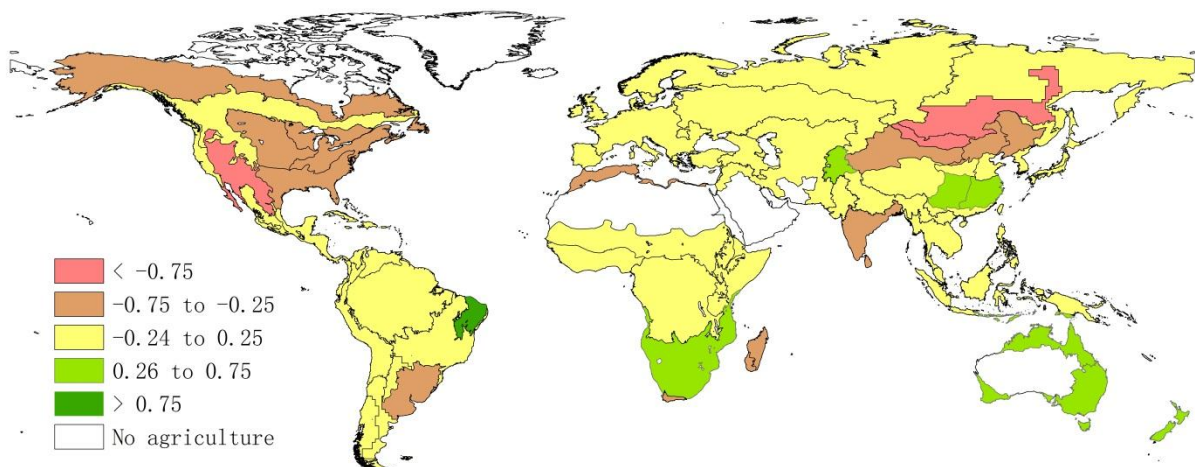


**Figure B.4 CPSZ temperature and rainfall anomaly indices**

a. Average rainfall index anomaly for crop production system zones, April-September (percent)



b. Average temperature index anomaly for crop production system zones, April-September (°C)



**Table B.1 Environmental indices for Crop Production System Zones: Rainfall accumulation (mm)**

	2013 rainfall (mm)	Twelve-year average (2001-12)	Five-year average (2008-12)	2001-13 normalized trend	Coefficient of correlation	Significance level of trend	Difference between 2013 and twelve-year average	Difference between 2013 and five-year average	
1	Equatorial central Africa	448	415	409	1.224	0.077	33	39	
2	East African highlands	377	347	333	-0.003	0	30	44	
3	Gulf of Guinea	446	467	469	0.03	0.002	-21	-23	
4	Horn of Africa	240	214	197	-6.743	-0.15	26	43	
5	Madagascar (main)	384	365	303	-21.633	-0.478	*	19	81
6	SW Madagascar	170	130	99	-24.362	-0.327	40	71	
7	North Africa Mediterranean	109	130	132	-7.031	-0.137	-21	-23	
8	Sahel	158	170	171	2.382	0.086	-12	-13	
9	Southern Africa	156	120	125	12.708	0.275	36	31	
10	S. Africa Western Cape	135	125	111	-19.632	-0.359	10	24	
11	Boreal North America	106	106	103	7.368	0.141	0	3	
12	America northern great plains	146	149	157	5.644	0.189	-3	-11	
13	America corn belt	146	205	202	-11.034	-0.288	-59	-56	
14	America cotton belt-Mexican coastal plain	405	345	325	-13.757	-0.39	60	80	
15	Sub-boreal North America	104	100	96	-4.04	-0.186	4	8	
16	America West Coast	194	225	211	-4.12	-0.107	-31	-17	
17	Sierra Madre	281	250	247	6.928	0.24	31	34	
18	SW Mexico and N. Mexico highlands	124	97	92	5.536	0.148	27	32	
19	Northern South and Central America	475	535	552	4.523	0.291	-60	-77	
20	Caribbean	395	390	383	-3.474	-0.198	5	12	
21	Central-Northern Andes	423	440	455	6.784	0.394	-17	-32	
22	Brazil Nordeste	163	162	164	-0.938	-0.018	1	-1	
23	Central-Eastern Brazil	264	278	276	0.835	0.049	-14	-12	
24	Amazon	595	615	622	2.989	0.252	-20	-27	
25	Central-North Argentina	150	125	112	-10.992	-0.246	25	38	
26	SE Brazil-Concepcion-Bahia Blanca	463	434	403	-14.972	-0.373	29	60	
27	SW Southern Cone	-9	293	274	-46.044	-0.583	*	-302	-283
28	Semi-arid Southern Cone	80	78	76	-2.833	-0.042	2	4	
29	Caucasus	162	177	166	-11.729	-0.46	-15	-4	
30	Central Asia Pamir mountains	100	140	142	-3.229	-0.056	-40	-42	
31	Western Asia	81	87	75	-24.529	-0.525	*	-6	6
32	China Gansu-Xinjiang	42	45	47	-5.511	-0.124	-3	-5	
33	China Hainan	694	490	585	32.786	0.372	204	109	
34	China Huang Huaihai	274	299	292	0.348	0.007	-25	-18	
35	China Inner Mongolia	76	83	86	0.614	0.01	-7	-10	
36	China Loess region	158	158	151	-10.487	-0.307	0	7	

		2013 rainfall (mm)	Twelve- year average (2001-12)	Five-year average (2008-12)	2001-13 normalized trend	Coefficient of correlation	Significanc e level of trend	Difference between 2013 and twelve- year average	Difference between 2013 and five-year average
37	China Lower Yangtze	406	357	375	13.092	0.398		49	31
38	North East China	69	86	88	10.36	0.192		-17	-19
39	China Qinghai-Tibet	347	356	361	1.98	0.123		-9	-14
40	Southern China	605	458	467	12.028	0.315		147	138
41	South-West China	256	233	237	4.571	0.201		23	19
42	Taiwan	815	554	587	20.181	0.265		261	228
43	East Asia	169	258	253	-0.771	-0.014		-89	-84
44	Southern Himalayas	527	525	545	7.219	0.404		2	-18
45	Southern Asia	481	475	490	15.413	0.65	**	6	-9
46	Southern Japan and Korea	407	490	484	-2.435	-0.071		-83	-77
47	Mongolia region	19	23	26	16.565	0.151		-4	-7
48	S. Asia Punjab to Gujarat	355	289	288	18.516	0.281		66	67
49	SE Asia islands	945	878	940	15.525	0.811	**	67	5
50	SE Asia mainland	741	670	682	6.546	0.301		71	59
51	Eastern Siberia	97	106	110	0.019	0		-9	-13
52	Eastern Central Asia	65	53	53	-3.623	-0.075		12	12
53	North Australia	238	314	354	20.261	0.393		-76	-116
54	Australia Queensland to Victoria	158	151	170	20.775	0.489	*	7	-12
55	Australia Nullarbor- Darling	93	89	88	1.461	0.022		4	5
56	New Zealand	367	407	399	-5.961	-0.273		-40	-32
57	Boreal Eurasia	116	117	117	-3.248	-0.086		-1	-1
58	Ukraine to Kazakhstan	125	89	90	16.899	0.462		36	35
59	Mediterranean Europe and Turkey	233	229	235	3.188	0.154		4	-2
60	W. Europe (non- Mediterranean)	248	231	229	-3.048	-0.111		17	19

Note: Table data represents rainfall accumulation (mm) between October 2012 and September 2013. The normalized trend is the 2001-13 trend normalized by dividing it by the twelve-year average. The significance level of the trend is \* for  $p < 0.05$  and \*\* for  $p < 0.01$ . See figure B.1 for a graphical representation of some of the variables in this table.

**Table B.2 Environmental indices for Crop Production System Zones: Temperature accumulation above 5°C**

		2013	Twelve- year average (2001- 12)	Five-year average (2008-12)	2001-13 normalized trend	Coefficient of correlation	Significanc e level of trend	Difference between 2013 and twelve- year average	Difference between 2013 and five-year average
1	Equatorial central Africa	2109	2,097	2,098	0.756	0.204		12	11
2	East African highlands	1446	1,431	1,449	3.154	0.726	**	15	-3
3	Gulf of Guinea	2358	2,379	2,378	0.258	0.105		-21	-20
4	Horn of Africa	1812	1,820	1,826	1.174	0.347		-8	-14
5	Madagascar (main)	1256	1,271	1,275	0.628	0.185		-15	-19
6	SW Madagascar	1316	1,344	1,346	0.356	0.078		-28	-30
7	North Africa Mediterranean	961	947	944	1.308	0.159		14	17

	2013	Twelve-year average (2001-12)	Five-year average (2008-12)	2001-13 normalized trend	Coefficient of correlation	Significance level of trend	Difference between 2013 and twelve-year average	Difference between 2013 and five-year average
8 Sahel	1542	1,526	1,531	1.313	0.447		16	11
9 Southern Africa	1219	1,208	1205	0.351	0.081		11	14
10 S. Africa Western Cape	581	645	621	-10.124	-0.817	**	-64	-40
11 Boreal North America	50	64	59	-17.219	-0.422		-14	-9
12 America northern great plains	604	636	616	-3.145	-0.203		-32	-12
13 America corn belt	359	386	394	3.212	0.152		-27	-35
14 America cotton belt-Mexican coastal plain	1417	1,497	1,508	1.993	0.212		-80	-91
15 Sub-boreal North America	178	166	170	6.301	0.239		12	8
16 America West Coast	664	637	621	-2.812	-0.215		27	43
17 Sierra Madre	1105	1,084	1,091	1.813	0.415		21	14
18 SW Mexico and N. Mexico highlands	1004	1,046	1,019	-6.657	-0.817	**	-42	-15
19 Northern South and Central America	2173	2,137	2,132	0.287	0.105		36	41
20 Caribbean	1905	1,908	1,883	-2.031	-0.434		-3	22
21 Central-Northern Andes	1174	1,117	1,109	0.431	0.054		57	65
22 Brazil Nordeste	1649	1,565	1,620	6.06	0.597	*	84	29
23 Central-Eastern Brazil	1703	1,654	1,665	0.85	0.171		49	38
24 Amazon	2305	2,301	2,318	1.458	0.556	*	4	-13
25 Central-North Argentina	1195	1,144	1,162	3.787	0.458		51	33
26 SE Brazil-Concepcion-Bahia Blanca	1,498	1,497	1,520	1.85	0.334		1	-22
27 SW Southern Cone	564	577	595	4.419	0.325		-13	-31
28 Semi-arid Southern Cone	795	781	814	7.896	0.626	*	14	-19
29 Caucasus	790	749	775	6.661	0.45		41	15
30 Central Asia Pamir mountains	981	971	977	2.659	0.479	*	10	4
31 Western Asia	974	946	972	6.369	0.637	**	28	2
32 China Gansu-Xinjiang	560	554	556	5.458	0.415		6	4
33 China Hainan	1,737	1,685	1,651	-3.191	-0.423		52	86
34 China Huang Huaihai	1,564	1,553	1,532	-1.905	-0.312		11	32
35 China Inner Mongolia	544	544	532	-3.494	-0.208		0	12
36 China Loess region	779	766	759	0.168	0.018		13	20
37 China Lower Yangtze	1,288	1,266	1,260	-0.919	-0.143		22	28
38 North East China	402	432	422	-8.164	-0.353		-30	-20
39 China Qinghai-Tibet	403	420	429	3.117	0.325		-17	-26
40 Southern China	1,623	1,616	1,610	-0.613	-0.191		7	13
41 South-West China	905	845	847	1.782	0.181		60	58
42 Taiwan	1,713	1,724	1,707	-2.983	-0.672	**	-11	6
43 East Asia	465	490	484	-5.99	-0.41		-25	-19
44 Southern Himalayas	1,896	1,913	1,921	0.306	0.09		-17	-25
45 Southern Asia	2,015	2,044	2,048	-0.316	-0.118		-29	-33

		2013	Twelve-year average (2001-12)	Five-year average (2008-12)	2001-13 normalized trend	Coefficient of correlation	Significance level of trend	Difference between 2013 and twelve-year average	Difference between 2013 and five-year average
46	Southern Japan and Korea	1,052	1,052	1,046	-1.572	-0.186		0	6
47	Mongolia region	472	536	530	-7.698	-0.306		-64	-58
48	S. Asia Punjab to Gujarat	2,394	2,445	2,438	-1.437	-0.332		-51	-44
49	SE Asia islands	2,242	2,232	2,222	-0.653	-0.358		10	20
50	SE Asia mainland	2,327	2,257	2,256	1.119	0.313		70	71
51	Eastern Siberia	87	112	106	-3.357	-0.074		-25	-19
52	Eastern Central Asia	85	96	89	-1.635	-0.028		-11	-4
53	North Australia	1,766	1,747	1,737	-0.953	-0.196		19	29
54	Australia Queensland to Victoria	950	908	898	-0.148	-0.018		42	52
55	Australia Nullarbor-Darling	633	597	602	3.714	0.399		36	31
56	New Zealand	753	699	696	0.155	0.012		54	57
57	Boreal Eurasia	52	65	59	-23.277	-0.389		-13	-7
58	Ukraine to Kazakhstan	305	312	321	9.237	0.427		-7	-16
59	Mediterranean Europe and Turkey	972	980	993	2.297	0.31		-8	-21
60	W. Europe (non-Mediterranean)	588	601	588	-2.899	-0.222		-13	0

Note: Table data represents temperature over a threshold of 5.0°C between October 2012 and September 2013. The normalized trend is the 2001-13 trend normalized by dividing it by the twelve-year average. Significance level of the trend is \* for  $p < 0.05$  and \*\* for  $p < 0.01$ . See figure B.2 for a graphical representation of some of the variables in this table.

**Table B.3 Environmental indices for Crop Production System Zones: accumulated PAR ( $W/m^2$ )**

		2013 PAR ( $W/m^2$ )	Twelve-year average (2001-12)	Five-year average (2008-12)	2001-13 normalized trend	Coefficient of correlation	Significance level of trend	Difference between 2013 and 12-year average	Difference between 2013 and 5-year average
1	Equatorial central Africa	11355	11232	11301	1.518	0.518	*	123	54
2	East African highlands	10799	11463	11416	-3.418	-0.551	*	-664	-617
3	Gulf of Guinea	11416	11390	11469	1.705	0.536	*	26	-53
4	Horn of Africa	10812	11208	11263	-0.541	-0.122		-396	-451
5	Madagascar (main)	7461	7884	8027	1.119	0.183		-423	-566
6	SW Madagascar	8368	8546	8646	1.196	0.313		-178	-278
7	North Africa Mediterranean	7480	8619	8679	-3.431	-0.333		-1139	-1199
8	Sahel	7856	7674	7721	1.937	0.549	*	182	135
9	Southern Africa	7715	7785	7813	1.278	0.324		-70	-98
10	S. Africa Western Cape	6411	6960	6993	-0.598	-0.082		-549	-582
11	Boreal North America	197	4527	4630	-28.865	-0.42		-4330	-4433
12	America northern great plains	7423	7072	7067	2.317	0.451		351	356
13	America corn belt	4857	5121	5186	0.558	0.087		-264	-329
14	America cotton	10513	10206	10432	6.401	0.768	**	307	81



	2013 PAR (W/m <sup>2</sup> )	Twelve- year average (2001-12)	Five-year average (2008-12)	2001-13 normalized trend	Coefficient of correlation	Significanc e level of trend	Difference between 2013 and 12-year average	Difference between 2013 and 5-year average
belt-Mexican coastal plain								
15 Sub-boreal North America	4396	5725	5824	-4.74	-0.272		-1329	-1428
16 America West Coast	8911	9177	9188	-1.14	-0.251		-266	-277
17 Sierra Madre	9133	9244	9321	1.406	0.301		-111	-188
18 SW Mexico and N. Mexico highlands	10036	10097	10126	-0.286	-0.105		-61	-90
19 Northern South and Central America	10399	10544	10542	-0.69	-0.354		-145	-143
20 Caribbean	8437	10373	10375	-6.465	-0.476		-1936	-1938
21 Central-Northern Andes	10066	10066	10031	-0.6	-0.252		0	35
22 Brazil Nordeste	8632	8828	8849	0.122	0.035		-196	-217
23 Central-Eastern Brazil	8973	9005	9024	-0.17	-0.048		-32	-51
24 Amazon	10934	10809	10958	2.583	0.66	**	125	-24
25 Central-North Argentina	7623	7202	7311	6.002	0.762	**	421	312
26 SE Brazil- Concepcion-Bahia Blanca	10948	10924	11185	5.632	0.661	**	24	-237
27 SW Southern Cone	8745	8898	9028	1.782	0.384		-153	-283
28 Semi-arid Southern Cone	9219	9500	9550	0.093	0.024		-281	-331
29 Caucasus	7716	8457	8438	-2.908	-0.371		-741	-722
30 Central Asia Pamir mountains	9835	10396	10345	-3.324	-0.599	*	-561	-510
31 Western Asia	8261	8747	8804	-0.817	-0.15		-486	-543
32 China Gansu- Xinjiang	6691	6750	6740	1.161	0.233		-59	-49
33 China Hainan	7226	7864	7735	-5.934	-0.599	*	-638	-509
34 China Huang Huaihai	10005	9179	9066	0.098	0.009		826	939
35 China Inner Mongolia	6499	6588	6618	1.515	0.183		-89	-119
36 China Loess region	6988	7116	7060	-0.185	-0.026		-128	-72
37 China Lower Yangtze	6920	6736	6656	-1.936	-0.273		184	264
38 North East China	5862	5891	5919	-0.239	-0.03		-29	-57
39 China Qinghai-Tibet	6823	7863	7879	-2.797	-0.263		-1040	-1056
40 Southern China	8051	8715	8750	-1.959	-0.275		-664	-699
41 South-West China	5823	5868	5802	-2.796	-0.545	*	-45	21
42 Taiwan	7909	9042	8984	-5.946	-0.455		-1133	-1075
43 East Asia	5754	6140	6163	-3.25	-0.344		-386	-409
44 Southern Himalayas	9519	10435	10468	-2.541	-0.354		-916	-949
45 Southern Asia	8564	9904	9882	-5.534	-0.535	*	-1340	-1318
46 Southern Japan and Korea	7413	7469	7500	-0.575	-0.064		-56	-87
47 Mongolia region	7298	7278	7348	2.025	0.241		20	-50
48 S. Asia Punjab to Gujarat	10430	11989	12011	-4.74	-0.453		-1559	-1581

		2013 PAR (W/m <sup>2</sup> )	Twelve- year average (2001-12)	Five-year average (2008-12)	2001-13 normalized trend	Coefficient of correlation	Significanc e level of trend	Difference between 2013 and 12-year average	Difference between 2013 and 5-year average
49	SE Asia islands	10316	11365	11316	-3.625	-0.527	*	-1049	-1000
50	SE Asia mainland	9954	10753	10716	-2.807	-0.369		-799	-762
51	Eastern Siberia	4844	4799	4862	4.4	0.513	*	45	-18
52	Eastern Central Asia	5115	5717	5791	0.704	0.059		-602	-676
53	North Australia	8747	9881	9712	-6.882	-0.663	**	-1134	-965
54	Australia Queensland to Victoria	8628	8965	8798	-3.179	-0.392		-337	-170
55	Australia Nullarbor- Darling	5671	6098	6169	1.136	0.151		-427	-498
56	New Zealand	9384	9695	9683	-1.012	-0.18		-311	-299
57	Boreal Eurasia	1765	2961	3009	-8.142	-0.27		-1196	-1244
58	Ukraine to Kazakhstan	4574	4770	4821	2	0.218		-196	-247
59	Mediterranean Europe and Turkey	8832	10039	10127	-1.543	-0.16		-1207	-1295
60	W. Europe (non- Mediterranean)	5483	6385	6501	1.349	0.096		-902	-1018

Note: Table data represents accumulated photosynthetically active radiation (PAR) (W/m<sup>2</sup>) over the growing season(s) between October 2012 and September 2013. The normalized trend is the 2001-13 trend normalized by dividing it by the twelve-year average. Significance level of the trend is \* for p<=0.05 and \*\* for p<=0.01. See figure B.3 for a graphical representation of some of the variables in this table.