CropWatch *online resources:*

A. Definition of spatial units

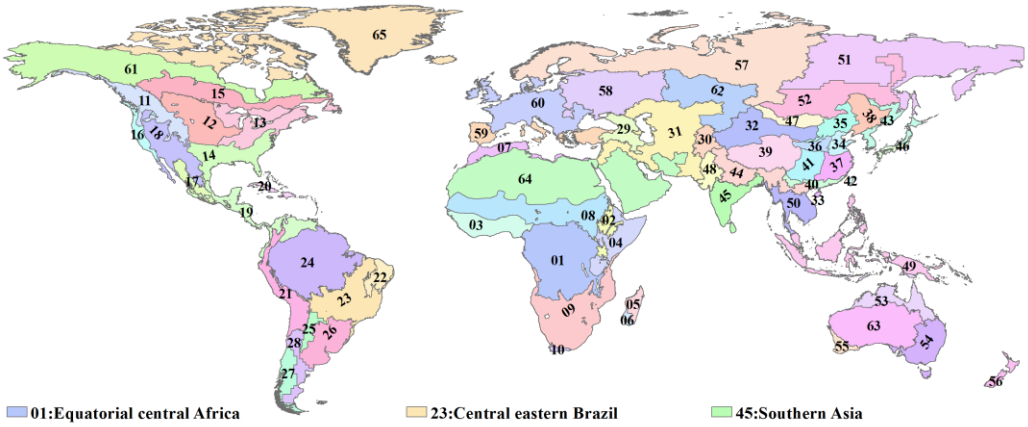
[updated November 30 2015]

CropWatch analyses use a hierarchical approach with different indicators for different spatial scales. The four organizational levels used for CropWatch are the (i) Monitoring and Reporting Units (MRUs) for global-level analyses, (ii) Major Production Zones (MPZ) for regional analyses, (iii) individual countries, and (iv) sub-national levels (for large countries only). The location, choice, and boundaries for each are described below. (For more details about country boundaries, see also the Online Resource: Methodology.)

1. Monitoring and Reporting Units (MRU)

Sixty-five agro-ecological/agro-economic units are used to support global analysis, mostly for environmental indicators, and support analysis at higher levels (figure 1).

Figure 1 Global map of CropWatch Monitoring and Reporting Units



01:Equatorial central Africa
02:East African highlands
03:Gulf of Guinea
04:Horn of Africa
05:Madagascar (main)
06:Southwest Madagascar
07:North Africa Mediterranean
08:Sahel
09:Southern Africa
10:Western Cape (South Africa)
11:British Columbia to Colorado
12:Northern Great Plains
13:Corn Belt
14:Cotton Belt to Mexican Noreste
15:Sub-boreal America
16:West Coast (North America)
17:Sierra Madre
18:Southwest U.S. and north Mexican highlands
19:Northern South and Central America
20:Caribbean
21:Central-northern Andes
22:Nordeste (Brazil)
23:Central eastern Brazil
24:Amazon
25:Central-north Argentina
26:Pampas
27:Western Patagonia
28:Semi-arid Southern Cone
29:Caucasus
30:Pamir area
31:Western Asia
32:Gansu-Xinjiang (China)
33:Hainan (China)
34:Huanghuaihai (China)
35:Inner Mongolia (China)
36:Loess region (China)
37:Lower Yangtze (China)
38:Northeast China
39:Qinghai-Tibet (China)
40:Southern China
41:Southwest China
42:Taiwan (China)
43:East Asia
44:Southern Himalayas
45:Southern Asia
46:Southern Japan and Korea
47:Southern Mongolia
48:Punjab to Gujarat
49:Maritime Southeast Asia
50:Mainland Southeast Asia
51:Eastern Siberia
52:Eastern Central Asia
53:Northern Australia
54:Queensland to Victoria
55:Nullarbor to Darling
56:New Zealand
57:Boreal Eurasia
58:Ukraine to Ural mountains
59:Mediterranean Europe and Turkey
60:W. Europe (non Mediterranean)
61:Boreal America
62:Ural to Altai mountains
63:Australian desert
64:Sahara to Afghan deserts
65:Sub-arctic America

MRUs are reasonably homogeneous agro-ecological/agro-economic units spanning the globe, selected to capture major variations in worldwide farming and crops patterns while at the same time providing a

manageable (limited) number of spatial units to be used as the basis for the analysis of environmental factors affecting crops. A limited number of units (e.g., MRU-63 to 65) are not relevant for the crops currently monitored by CropWatch but are included to allow for more complete coverage of global production.

The MRUs were essentially derived from the FAO Global Ecological Zones map (GEZ) after adjustments were made based on a recent 1976-2000 Köppen climate map (Grieser et al, 2006c). Next, ecological zones for China (from Sun He) were inserted, to overlay the GEZ map with crop-based maps and to simplify and bring it in line with crop zones. The GEZ was found to be very largely compatible with the cereal suitability map (FAO 2007) and the map of major crop types that is part of FAO 2010. Agricultural and non-agricultural areas were included in order to provide global coverage and to include some agriculturally marginal areas, such as low-rainfall rangeland at the edge of deserts. (China's agroecological zones are published in Chinese by Sun He (7); an English language description can be found in Hu Zizhi and Zhang Degang (8).)

Tables 1 and 2 describe agronomic variables and environmental and seasonality/time variability for the MRUs.

Table 1. Spatially averaged values of agronomic variables by MRU

Note: A1=Percentage of arable land per pixel (%); A2=Percentage of pixel area equipped for irrigation (%); A3=Percentage of pixels where barley is cultivated (%); A4=Average barley yield (ton/ha); A5=Average cassava yield (ton/ha); A6=Percentage of pixels where maize is cultivated (%); A7=Average maize yield (ton/ha); A8=Percentage of pixels where potato is cultivated (%); A9=Average potato yield (ton/ha); A10=Percentage of pixels where rice is cultivated (%); A11=Average paddy yield (ton/ha); A12=Percentage of pixels where soybean is cultivated (%); A13=Average soybean yield (ton/ha); A14=Percentage of pixels where wheat is cultivated (%); A15=Average wheat yield (ton/ha).

		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15
1	Equatorial central Africa	52	0	0	-	9.15	50	1.99	5	10.1	19	2.17	0	-	7	2.18
2	East African highlands	84	0	26	2.04	-	88	2.51	14	11.7	0	-	0	-	65	1.97
3	Gulf of Guinea	89	0	0	-	9.6	62	1.8	7	9.2	41	2.24	0	-	9	2.46
4	Horn of Africa	25	0	1	2.23	9.36	28	2.27	3	13.5	5	3.76	0	-	4	1.76
5	Madagascar (main)	74	2	0	-	7.97	35	2	8	9.4	69	2.77	0	-	5	2.38
6	Southwest Madagascar	67	1	0	-	8.38	97	2.14	0	-	0	-	0	-	0	-
7	North Africa-Mediterranean	71	5	56	2.34	-	8	4.8	41	22.3	2	5.1	0	-	78	2.85
8	Sahel	53	1	0	-	8.99	14	2.47	0	-	8	2.88	0	-	7	2.35
9	Southern Africa	52	0	0	-	9.05	30	1.91	1	15.7	4	2.32	0	-	16	2.67
10	Western Cape (South Africa)	74	4	0	-	-	0	-	0	-	0	-	0	-	100	2.55
11	British Columbia to Colorado	5	0	0	-	-	0	-	0	-	0	-	0	-	0	-
12	Northern Great Plains	99	4	12	3.37	-	32	6.68	8	32.4	0	-	29	2.49	88	3.01
13	Corn Belt	83	1	0	-	-	29	4.11	10	23.1	0	-	27	2.06	24	2.94
14	Cotton Belt to Mexican Noreste	96	5	0	-	-	9	3.95	1	24.6	4	4.75	15	2.09	48	3.03
15	Sub-boreal America	27	0	3	3.17	-	0	-	1	25.5	0	-	0	-	9	2.98
16	West Coast (North America)	62	9	2	2.92	-	1	4.4	8	23.7	2	4.63	0	-	29	3.09
17	Sierra Madre	97	4	2	2.48	11.72	49	3.28	5	24.8	0	-	0	-	3	4.14
18	Southwest U.S. and north Mexican highlands	63	3	1	2.88	-	2	4.38	7	25.8	0	-	0	-	12	3.52
19	Northern South and Central America	79	2	0	-	10.45	27	2.53	5	19.4	2	4.22	0	-	0	-

		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15
20	Caribbean	87	6	0	-	8.27	12	1.65	0	-	0	-	0	-	0	-
21	Central-northern Andes	54	2	0	-	10.07	2	3.33	49	13.8	2	4.53	1	1.95	0	-
22	Nordeste (Brazil)	76	1	0	-	10.95	22	3.24	6	18.3	0	-	2	1.87	0	-
23	Central eastern Brazil	81	1	0	-	11.78	15	3.48	5	17.3	2	4.17	29	2.18	6	2.44
24	Amazon	26	0	0	-	11.42	0	-	0	-	1	4.22	1	1.86	0	-
25	Central-north Argentina	63	1	0	-	11.5	4	4.52	9	17.3	0	-	19	2.3	14	2.63
26	Pampas	90	1	1	3.1	11.38	36	4.56	5	19.1	9	6.01	47	2.26	54	2.85
27	Western Patagonia	20	2	0	-	-	0	-	8	21.6	0	-	0	-	0	-
28	Semi-arid Southern Cone	8	1	0	-	-	0	-	1	22	0	-	0	-	1	3.35
29	Caucasus	97	7	20	2.09	-	3	5.61	68	18.4	3	4.37	0	-	81	2.44
30	Pamir area	68	8	0	-	-	8	7.12	62	19.3	2	4.19	0	-	37	2.48
31	Western Asia	44	5	10	1.97	-	0	-	18	18.3	2	3.77	0	-	37	2.6
32	Gansu-Xinjiang (China)	18	3	0	-	-	2	5.13	1	16.7	0	-	0	-	12	2.77
33	Hainan (China)	98	7	0	-	17.83	0	-	99	15.3	100	4.24	0	-	0	-
34	Huanghuaihai (China)	100	35	0	-	-	98	4.09	94	18.1	24	4.78	60	1.49	97	2.93
35	Inner Mongolia (China)	63	4	0	-	-	23	4.08	36	17.6	0	-	5	1.48	29	2.87
36	Loess region (China)	96	9	0	-	-	47	4.88	97	16.4	0	-	24	1.61	87	3.67
37	Lower Yangtze (China)	99	17	0	-	-	6	4.23	98	17.6	98	4.46	2	1.5	30	2.85
38	Northeast China	76	6	0	-	-	45	3.44	27	18.7	13	4.76	40	1.41	41	2.73
39	Qinghai-Tibet (China)	10	0	0	-	-	0	-	1	15.5	0	-	0	-	2	2.69
40	Southern China	99	8	0	-	16.92	17	4.31	74	16.6	90	4.05	0	-	1	2.43
41	Southwest China	98	6	0	-	-	65	4.55	91	16.5	55	4.46	3	1.52	51	2.92
42	Taiwan (China)	63	13	0	-	-	0	-	0	-	99	4.28	0	-	0	-
43	East Asia	70	4	0	-	-	8	3.43	52	21.2	31	5.25	3	1.48	0	-
44	Southern Himalayas	87	18	0	-	-	26	4.02	46	16.3	62	3.64	5	1.24	42	2.35
45	Southern Asia	100	17	0	-	22.51	17	3.98	11	17.5	74	3.64	16	1.36	17	2.65
46	Southern Japan and Korea	86	9	0	-	-	0	-	81	25.5	88	6	0	-	1	3.38

		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15
47	Southern Mongolia	0	0	0	-	-	0	-	0	-	0	-	0	-	0	-
48	Punjab to Gujarat	96	25	0	-	-	17	4.74	28	18.5	33	3.62	6	1.08	71	2.64
49	Maritime Southeast Asia	86	3	0	-	14.12	13	4.34	2	13.9	29	3.32	2	1.46	0	-
50	Mainland Southeast Asia	88	9	0	-	18.4	12	4.25	2	15.8	79	3.68	0	-	0	-
51	Eastern Siberia	1	0	0	-	-	0	-	0	-	0	-	0	-	0	-
52	Eastern Central Asia	25	0	0	-	-	0	-	6	17	0	-	0	-	4	2.58
53	Northern Australia	14	1	0	-	-	2	4.27	0	-	3	4.41	0	-	2	2.55
54	Queensland to Victoria	64	2	14	2.7	-	0	-	1	22.9	0	-	0	-	59	2.93
55	Nullarbor to Darling	80	0	11	2.51	-	0	-	0	-	0	-	0	-	84	2.64
56	New Zealand	34	2	2	5.69	-	0	-	6	44.3	0	-	0	-	0	-
57	Boreal Eurasia	10	0	3	2.63	-	0	-	8	19	0	-	0	-	5	3.07
58	Ukraine to Ural mountains	85	1	9	2.72	-	1	5.62	89	18.8	0	-	0	-	61	3.24
59	Mediterranean Europe and Turkey	99	7	35	2.69	-	5	7.34	46	22.8	0	-	0	-	65	3.07
60	W. Europe (non Mediterranean)	98	4	29	4.43	-	26	7.39	69	27.7	1	5.14	0	-	73	5.15
61	Boreal America	46	1	1	3.07	-	0	-	2	25.4	0	-	0	-	16	3.05
62	Ural to Altai mountains	69	1	7	2.1	-	0	-	43	17.9	0	-	0	-	62	2.57
63	Australian desert	1	0	1	2.24	-	0	-	0	-	0	-	0	-	3	2.28
64	Sahara to Afghan deserts	8	1	0	-	-	0	-	2	19.2	0	-	0	-	4	2.78
65	Sub-arctic America	1	0	0	-	-	0	-	0	-	0	-	0	-	0	-

Table 2. Spatially averaged values for environmental and seasonality/time variability for each MRU

Note: E1=Area in thousands of Km²; E2=Altitude; E3=Annual rainfall total in mm; E4=Average annual temperature; E5=Annual mean radiation total (MJ/m^2); E6=Average annual NDVI (2+5+8+11)/4; E7=Easily available soil moisture; E8=Net Primary production potential (gDM/m^2); S1=Fraction of annual precipitation that falls from May to October; S2=Difference between average Feb and average Aug temperature; S3=Temperature seasonality, coefficient of variation of monthly temperature; S4=Temperature of warmest week-temperature of coldest week; S5=Average difference between Feb and Aug NDVI; S6=Variability of NDVI over time (standard deviation).

	MRU	E1	E2	E3	E4	E5	E6	E7	E8	S1	S2	S3	S4	S5	S6	VSI
1	Equatorial central Africa	6401	809	1434	23.3	156	0.66	110	163	40	1.7	0.35	16.8	0.07	0.128	0.15
2	East African highlands	693	1820	1070	19.1	193	0.51	89	142	69	1.3	0.36	18.6	-0.16	0.123	0.25
3	Gulf of Guinea	1927	280	1506	26.4	157	0.55	91	169	84	2.5	0.45	17.5	-0.14	0.143	0.33
4	Horn of Africa	2023	680	440	25.3	200	0.32	88	90	42	0.3	0.45	17.7	0.07	0.083	0.07
5	Madagascar (main)	464	592	1582	22.6	173	0.58	108	185	12	4.7	0.67	17.6	0.13	0.111	0.35
6	Southwest Madagascar	131	357	690	23.8	183	0.47	101	126	11	6.1	0.88	21.7	0.24	0.115	0.44
7	North Africa-Mediterranean	817	723	349	16.6	176	0.25	89	57	29	-16.1	2.06	29.8	0.11	0.058	0.38
8	Sahel	4813	417	463	27.7	203	0.27	85	73	97	-2.2	0.91	25.1	-0.22	0.104	0.42
9	Southern Africa	4578	880	596	20.6	188	0.43	92	91	14	6.9	1.13	24.5	0.21	0.098	0.4
10	Western Cape (South Africa)	95	529	474	15.9	182	0.44	77	70	58	9.3	1.23	23.4	-0.13	0.075	0.22
11	British Columbia to Colorado	4465	494	422	-5.8	89	0.39	118	37	68	-32.6	4.81	46.6	-0.52	0.224	0.85
12	Northern Great Plains	2094	687	531	7.2	136	0.38	109	84	71	-26.4	3.72	44.1	-0.41	0.162	0.76
13	Corn Belt	2249	292	999	6.8	129	0.58	103	109	57	-25.5	3.45	39.6	-0.54	0.203	0.69
14	Cotton Belt to Mexican Noreste	2083	288	1070	17.1	157	0.58	106	141	58	-17.9	2.42	32.9	-0.21	0.083	0.44
15	Sub-boreal America	2097	424	632	-0.7	112	0.5	108	59	68	-31.2	4.51	47.4	-0.54	0.205	0.84
16	West Coast (North America)	479	740	981	11.2	151	0.58	90	101	20	-13.5	1.88	28.7	-0.04	0.093	0.4
17	Sierra Madre	668	1738	782	17.7	173	0.51	81	113	86	-6.8	1.11	26.2	-0.2	0.104	0.42
18	Southwest U.S. and north Mexican highlands	2070	1300	293	14	168	0.26	85	52	58	-17	2.41	36	-0.07	0.051	0.35
19	Northern South and Central America	2091	342	1890	25.3	170	0.67	113	183	75	-1.2	0.35	14.3	-0.09	0.106	0.16
20	Caribbean	227	213	1410	24.6	177	0.69	92	156	72	-4.4	0.52	14.9	-0.07	0.068	0.13

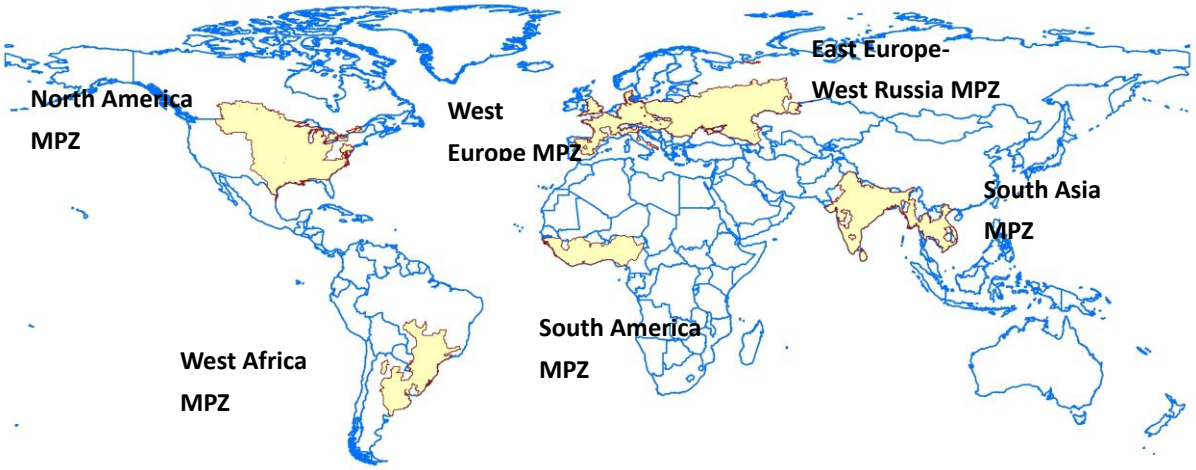
	MRU	E1	E2	E3	E4	E5	E6	E7	E8	S1	S2	S3	S4	S5	S6	VSI
21	Central-northern Andes	1835	2623	805	13.2	165	0.38	85	96	26	3.8	0.61	19.4	0.02	0.086	0.16
22	Nordeste (Brazil)	825	416	754	24.5	165	0.55	86	122	22	2.1	0.38	15	0.13	0.132	0.25
23	Central eastern Brazil	3675	437	1368	23.8	155	0.66	104	174	22	2.3	0.51	17.5	0.16	0.111	0.27
24	Amazon	6381	205	2318	25.8	137	0.77	115	218	39	0	0.17	13.2	-0.08	0.147	0.13
25	Central-north Argentina	459	348	668	20.8	179	0.58	108	119	18	9.2	1.46	26.6	0.25	0.109	0.45
26	Pampas	1844	218	1148	18.1	165	0.64	104	158	40	9.9	1.43	24.6	0.15	0.082	0.27
27	Western Patagonia	850	746	959	7.9	147	0.42	99	96	61	9.5	1.36	21.2	0.12	0.102	0.27
28	Semi-arid Southern Cone	863	935	231	11.4	164	0.25	101	50	46	11.2	1.66	26.5	0	0.056	0.16
29	Caucasus	972	1226	584	9.8	158	0.37	84	85	43	-22.6	2.9	35.1	-0.21	0.128	0.56
30	Pamir area	618	2614	515	5.6	169	0.23	67	65	36	-23.4	3.16	37.5	-0.15	0.084	0.51
31	Western Asia	4825	559	206	12.9	170	0.17	80	38	32	-26.2	3.56	41.8	-0.03	0.066	0.45
32	Gansu-Xinjiang (China)	2190	1740	113	5.9	156	0.1	71	20	83	-28.1	4.06	45.9	-0.09	0.068	0.58
33	Hainan (China)	34	190	1495	24.1	145	0.67	65	187	83	-7.9	1.14	17.2	-0.17	0.079	0.29
34	Huanghuaihai (China)	432	91	655	13.4	154	0.47	154	103	85	-25.3	3.43	37.7	-0.46	0.141	0.76
35	Inner Mongolia (China)	810	976	366	3.5	156	0.28	102	59	91	-32	4.61	48.6	-0.38	0.133	0.89
36	Loess region (China)	408	1355	523	9	151	0.37	97	79	85	-23	3.27	38.4	-0.39	0.115	0.73
37	Lower Yangtze (China)	945	259	1421	17	139	0.58	114	172	65	-21	2.67	30.5	-0.31	0.115	0.56
38	Northeast China	921	385	577	1.7	134	0.43	115	70	89	-35.6	5.14	52.4	-0.67	0.235	1
39	Qinghai-Tibet (China)	2263	4391	384	-1.3	155	0.21	65	49	89	-18.6	2.71	35.1	-0.19	0.09	0.62
40	Southern China	450	682	1517	20.2	141	0.61	82	183	79	-12	1.62	22.5	-0.15	0.115	0.44
41	Southwest China	1017	1234	1090	14.6	133	0.56	83	141	81	-16.9	2.24	27.5	-0.33	0.128	0.62
42	Taiwan (China)	36	785	2523	19.1	145	0.68	101	199	77	-9.4	1.19	17	-0.11	0.077	0.24
43	East Asia	701	381	993	4.3	128	0.53	104	91	76	-30.5	4.12	42.6	-0.6	0.219	0.84
44	Southern Himalayas	1947	992	1426	20.3	172	0.55	96	161	87	-10.1	1.66	26.7	-0.05	0.12	0.45
45	Southern Asia	1579	347	1264	26.3	194	0.48	104	158	88	-2.8	1.02	22.7	-0.06	0.105	0.31
46	Southern Japan and Korea	231	331	1860	13.4	134	0.65	112	161	67	-22.2	2.68	30.7	-0.25	0.091	0.53
47	Southern Mongolia	664	1491	118	2.8	165	0.11	87	24	89	-31	4.56	48.8	-0.09	0.046	0.65
48	Punjab to Gujarat	735	215	459	25.8	210	0.3	93	80	90	-11.1	1.97	32.9	-0.02	0.076	0.42
49	Maritime Southeast Asia	2879	381	2826	25	154	0.75	119	230	44	0.2	0.15	10.1	-0.01	0.109	0

	MRU	E1	E2	E3	E4	E5	E6	E7	E8	S1	S2	S3	S4	S5	S6	VSI
50	Mainland Southeast Asia	1392	273	1858	25.7	161	0.64	104	199	86	-2.3	0.62	18	-0.04	0.108	0.25
51	Eastern Siberia	5316	416	348	-10.9	83	0.39	117	21	71	-41	6.3	55.9	-0.64	0.26	0.93
52	Eastern Central Asia	2763	1032	410	-5.4	117	0.35	87	36	86	-38.4	5.82	56.5	-0.54	0.214	0.96
53	Northern Australia	1707	211	939	25.7	197	0.48	91	126	10	6.1	1.02	22.1	0.09	0.086	0.33
54	Queensland to Victoria	1699	276	640	17	179	0.5	96	90	47	12.3	1.66	26.8	-0.11	0.098	0.31
55	Nullarbor to Darling	321	249	474	17.2	178	0.45	93	73	72	11.9	1.49	25.1	-0.3	0.127	0.49
56	New Zealand	266	498	1675	10.2	130	0.7	94	129	53	9.4	1.25	19.7	0.04	0.088	0.15
57	Boreal Eurasia	6494	266	490	-5.3	78	0.46	139	41	66	-32.1	4.61	45	-0.56	0.238	0.85
58	Ukraine to Ural mountains	3084	160	583	5.1	109	0.51	114	87	60	-26.1	3.58	37.1	-0.48	0.218	0.71
59	Mediterranean Europe and	1209	696	635	13.1	162	0.49	82	97	34	-16.5	2.13	27.9	0	0.082	0.31
60	W. Europe (non Mediterranean)	3092	335	779	9.1	119	0.58	105	107	55	-16.8	2.24	26.4	-0.26	0.139	0.47
61	Boreal America	1590	1523	737	2.7	118	0.44	83	70	50	-19	2.74	34.9	-0.34	0.156	0.56
62	Ural to Altai mountains	2551	427	390	2.3	119	0.39	108	60	65	-32.2	4.55	46.4	-0.41	0.189	0.8
63	Australian desert	4148	304	261	22.2	206	0.26	85	50	35	13.1	1.84	30.2	-0.01	0.043	0.25
64	Sahara to Afghan deserts	11682	512	51	24.1	215	0.1	59	14	45	-14.8	2.06	32.3	0.01	0.021	0.22
65	Sub-arctic America	4826	962	458	-15.7	75	0.23	88	16	64	-30.6	4.48	38.8	-0.35	0.227	0.75

2. Major Production Zones

The Major Production Zones (MPZs) are used for regional analyses. While the first CropWatch bulletin only used four zones, this was expanded to the current six: West Africa, North America, South America, South and Southeast Asia, Central Europe and Western Russia, and Western Europe. The zones are selected based essentially on a combined maize, rice, soybean and wheat distribution raster map based on JRC crop masks. For the areas of interest, each MPZ includes the area where at least one of the four crops is cultivated, bounded either by the area where none of the four crops is cultivated or by national or sub-national political boundaries. In one instance (central Europe and W. Russia), the northern limit was taken to coincide with MRU 58 ("Ukraine to Kazakhstan") and the eastern limit is given by MRU 62 ("Ural to Altai mountains"). Figure 2 illustrates the six MPZs.

Figure 2. Map of the CropWatch Major Crop Production Zones



Note: Figures shows only maize, rice, soybean and wheat. White background: none of the four crops is grown; light green: only one crop is grown; bright green: two crops are grown; dark green: three crops; brown: all four crops; very few areas cultivate all four crops (mostly in India).

3. Countries and sub-national administrative areas

The selection of countries was based on statistics published by FAO on production and trade, to include 80 percent of both. Several countries near the "end" of the list were included based on other considerations, e.g., their location in Asia (such as Uzbekistan) or in Africa (Ethiopia). Some generic information about the countries and their agriculture is provided in the 'Online Resource: Country Profiles.'

Large countries For some of the largest countries (Argentina, Australia, Brazil, Canada, China, India, Kazakhstan, Russia, and the United States), the first level administrative units are also covered in the analyses.

China For China, 24 province-level subdivisions are covered in the report, divided into seven official geographic regions, namely Northeast China, Inner Mongolia, Huanghuaihai, Loess region, Lower Yangtze region, Southwest China, and Southern China (9).

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