Chapter 5. Focus and perspectives

Building on the CropWatch analyses presented in chapters 1 through 4, this chapter presents revised CropWatch food production estimates for 2017 (section 5.1), as well as sections on recent disaster events (5.2), the rangeland management in Africa (5.3), and an update on El Niño (5.4)..

5.1 CropWatch food production estimates

Methodological introduction

Table 5.1 presents global 2017 production estimates for maize, rice, wheat, and soybean. Earlier estimates, published in recent bulletins, were prepared by the CropWatch team in May and August. The current version is the last revision for 2017 production. It is based on a combination of remote-sensing models (for major commodities at the national level) and statistical trend-based projections for minor producers with a national output approximately between 100 thousand and one million tons. The table includes China and the 30 countries ("30+1 countries") which, together, make up at least 80% of production and exports of the main cereals and soybean.

For the current reporting period, virtually all 2017 crops have been harvested in the temperate northern hemisphere, while in many tropical areas in both hemispheres rice crops are growing (to be harvested in early 2018) or are close to harvest. In the southern hemisphere the summer season/monsoon season is ongoing.

CropWatch estimates differ from global production data published by some other national and international institutions in two important ways: (1) they are modeled based on actual and direct geophysical observations of climate and crops, including up-to-date crop by crop distribution maps. For each crop, both yield variation and cultivated area variation are taken into account; (2) most of them (those shown in red in Table 5.1) are independent of FAOSTAT [1], being based on sub-national country statistics.

The numbers in red in Table 5.1 represent 22% (for soybean) to 89% (wheat) of the countries; when production amounts are considered, the modeled percentages vary from 96% (soybean) to 100% (wheat). This corresponds to 85% (wheat) to 89% (soybean and rice) of the worldwide production when trend-based production estimates for minor producers [2] are included. Numbers in black were derived based on trends computed from FAOSTAT data and previous CropWatch estimates [3]. They include minor crops for the major producers (such as rice in France or wheat in Myanmar), the sum of all minor producers at the global scale (including the 151 countries from Afghanistan and Angola to Zambia and Zimbabwe, which are shown as "Others" in Table 5.1), as well as the total production, which logically combines all data.

Production estimates by country

CropWatch put the total output of the crops produced during 2017 at 2,509 million tons of major grains and 326 million tons of soybeans. The major grains are made up almost exactly by 41% maize (1,027,897 thousand ton, +2.5% over last year's output), 30% rice (as paddy, 745,448 thousand tons, +1.0% from the previous year), and 29% wheat (735,587 thousand tons, down -0.5% from 2016). The 2016 shares were 40% for maize and 30% for wheat; The differences are small but show the continuing global trend of the growth of maize at the expense of rice and wheat.

As often happens, the bulk of minor producers ("Others" in Table 5.1), where food is grown more for local consumption by people and animals than for industrial uses and export, generally perform better than the major producers, among others because most of them have not reached the environmental and economic constraints that prevent the expansion of land and the increase of yields. For instance, maize production by the minor producers is up 5.9%, rice increases 1.0%, wheat 4.1%, and soybeans 13.1%, illustrating the appeal for maize and the efforts in many countries to satisfy the ever growing demand for soybean at the national and international levels.

Among the three major cereal producers, the output of China reached 519,584 thousand tons (down 1.9% from 2016), while 435,918 thousand tons were produced in the United States (+0.1%) and a significantly lower amount of 275,676 thousand tons in India (+5,4%). Although India remains a relatively minor producer of maize (19,034 thousand tonnes), it still out-produces the 4th and 5th cereal producers in terms of total cereal output (Brazil with 103,483 thousand tonnes, +16.2%; Indonesia with 86,202 thousand tonnes, -1.6%).

Most eastern and southeastern Asian countries suffered unfavorable weather conditions (mostly excess precipitation), which directly impacted their cereal productions. In addition to the already mentioned drop in China, other countries with reduced rainfall include Bangladesh (RAIN -4.8%), Thailand (-2,8%), Indonesia (-1.6%), and Myanmar (-0.6%). Notable exceptions are the Philippines (RAIN +0.5%) and especially Vietnam (+5.8%). Some of the listed countries suffered severely from El Niño induced drought in 2016.

Table 5.1. Summary of 2017 estimates of cereal and soybean output of major producers and variation (%), compared with 2016

Region	Maize		Rice		Wheat		Soybean	
	Production	Δ%	Production	Δ%	Production	Δ%	Production	Δ%
Argentina	29, 946	16. 5	1, 789	5. 6	11, 740	0. 9	51, 116	0. 1
Australia	491	−1. 7	1, 335	4. 7	24, 606	–22. 1	117	−0. 9
Bangladesh	2, 245	−5. 5	45, 274	−5. 1	1, 344	11. 7	129	15. 1
Brazil	84, 019	19. 3	11, 344	2. 6	8, 120	7. 6	96, 726	5. 4
Cambodia	512	–21. 0	8, 792	2. 4			192	6. 3
Canada	11, 881	1. 5			30, 679	−7. 8	5, 471	1. 6
China	189, 904	−5. 2	200, 623	0	118, 901	0. 3	13, 745	3. 4
Egypt	5, 918	3. 8	6, 545	4	10, 963	7. 4	42	8. 3
Ethiopia	7, 154	0	147	4. 1	4, 180	–11. 9	109	8. 3
France	14, 577	−0. 9	1, 632	21. 3	38, 051	0. 2	271	18. 6
Germany	4, 755	3. 3			28, 130	0. 1	30	22. 7
India	19, 034	2. 1	163, 146	4. 1	93, 496	8. 6	12, 159	−0. 1
Indonesia	17, 791	−2. 9	68, 411	−1. 3			940	3. 5
Iran	2, 535	−5. 8	2, 272	–17. 8	12, 735	–20. 8	213	3. 7
Kazakhstan	812	8. 1	378	1. 7	16, 595	−8. 8	305	8. 9
Mexico	23, 858	0. 3	245	6. 3	3, 283	−7. 5	509	13. 6
Myanmar	1, 702	−2. 5	25, 407	−0. 5	193	0. 6	76	–13. 4
Nigeria	11, 165	3. 7	4, 684	2. 1	6	–66. 1	809	5
Pakistan	4, 904	8. 3	9, 904	8. 3	24, 283	−1. 4		

Philippines	7, 626	0. 8	20, 188	0. 4				
Poland	4, 703	27. 8			10, 931	2. 1	1	0
Romania	11, 986	4. 3	39	−17. 8	7, 670	−0. 1	245	15. 9
Russia	12, 817	3. 9	996	−2. 0	58, 912	2. 4	2, 190	−3. 5
South Africa	14, 161	57	3	0. 5	1, 576	−7. 5	1, 198	12. 1
Thailand	4, 999	−1. 6	38, 495	−2. 9	2	7. 7	144	−37. 8
Turkey	6, 294	6. 3	817	−1. 7	19, 174	1	227	8. 7
Ukraine	31, 398	2	98	−8. 0	22, 662	−5. 8	3, 799	−16. 2
United Kingdom					14, 521	1. 3		
United States	370, 173	0. 6	10, 933	3. 8	54, 812	−3. 6	109, 649	−0. 3
Uzbekistan	550	8. 2	524	3. 6	6, 442	0. 8		
Vietnam	5, 113	−2. 3	45, 422	6. 7			47	−29. 0
Sub-total CW	903, 020	2. 1	669, 443	1	624, 006	−1. 2	300, 459	1. 6
Others	124, 877	5. 9	76, 005	1	111, 581	4. 1	25, 117	13. 1
Total	1, 027, 897	2. 5	745, 448	1	735, 587	−0. 5	325, 577	2. 4

*Notes: Numbers in red are model-based estimates by CropWatch calibrated against national data up to 2016; numbers in black are (or include: last line) statistical projections based on FAOSTAT data up to 2014 and earlier CropWatch estimates for 2015 and 2016. "Others" is based on the sum of individual projections for 151 countries; there are several reasons why this is preferable to the projection of the sum of productions.*Maize

Maize

Countries that have to be singled out for their good performance in terms of maize production include the two South American "giants" Argentina and Brazil, where maize production grew 16.5% and +19.3%, respectively. These increases come after the first country's production stagnated in 2016 and the second country's production actually decreased by more than 10% in the last season. Both are now back to "normal" production levels. Poland (+27.8%) and South Africa (+57%) deserve mentioning as well, with South Africa now actually recovering from the serious El Niño drought that led to a 32% production shortfall in 2016. Both Pakistan and Turkey did well (+8.3% and +6.3%) after a poor season in 2016 (-7% and 0%, respectively).

Poor conditions were already mentioned for cereals in general in Southeast and Eastern Asia, which also includes maize in Bangladesh (-5.5%, after years of steady growth), China (-5.2%, although the drop must be considered in a broader policy context that aims, among others, at relaunching soybean), Indonesia (-2.9%), and an important exporter in the region, Thailand (-1.6%).

Rice

As far as rice is concerned, southern Asia did well, starting with Pakistan (+8.3% in rice production, following a 3.0% dip the previous season) and India (+4.1%, in spite of widespread floods). Vietnam, with a production increase of +6.7%, did well also, as did Cambodia (+2.4). China, the major rice producer, stagnated, while Bangladesh, Thailand, Indonesia, and Myanmar underwent rice production decreases estimated to be -5.1%, -2.9%, -1.3%, and -0.5%, respectively. Rice did very poorly as well in Iran (-17.8% production) which, together with an even larger drop in wheat production (-20.8%) highlights Iran as the country where the largest drop in cereal production occurred. Wheat

Wheat

Australia suffered a drop in wheat production (-22.1%) that exceeds the combined loss of wheat and rice in Iran. Australia is followed by a long list of countries where wheat production declined, in the range from -4% to -8%. They include Ethiopia (-11.9%), Kazakhstan (-8.8%), Mexico (-7.8%), South Africa (-7.5%), Ukraine (-5.8%), and the United States (-3.6%). The largest increases occurred in already mentioned Brazil (+5.4%) and in India (+8.6%). We also mention Egypt (+7.4%), where the good wheat performance was accompanied by good maize (+3.8%) and rice (+4.0%) crops.

Soybean

The Indian soybean production of 12,159 thousand tons is marginally less (-0.1%) than the 2016 output. The major producer, the United States, suffered a slight decrease as well (-0.3%), equivalent to 375 thousand tons, which is largely compensated by the production increase in Brazil (+5.4%) equivalent to 4.9 million tons. For the last ten years, soybean production in the United States has on average exceeded Brazilian production by between 15 and 16 million tons annually, and it has not happened so far that Brazil has outperformed the United States. For the second year in a row, China has increased its soybean production, indicating that the new agricultural policy was apparently successful in halting the decade long period of decline in national production.

Production by importers and exporters

The variation in the global demand for maize, rice, wheat, and soybean can be roughly assessed through variations in the domestic production of major importers [4] (Table 5.2). The 10 major importers, which account for about 22% of global maize production, have suffered a decrease of their domestic output of the commodity (-4.1% for the top 10 importers). The top 5 rice importers lost 1% of their domestic production compared with 2016. This indicates that international demand will be sustained for maize and rice. In contrast, importers increased their output by just under 4%.

Table 5.2. 2017 production (million tons) and difference from 2016 of major importing and exporting countries

		Maize		Rice		Wheat		Soybean	
		Share%	Δ%	Share%	Δ%	Share%	Δ%	Share%	Δ%
Importers	Top 5	21	−4.4	4	−1.0	4	3.2	4	3.8
	Top 10	22	−4.1	40	−0.3	5	3.8	5	4.1
Exporters	Top 5	52	4	36	3.6	28	−4.7	85	2.5
	Top 10	57	5	41	3.1	40	−4.3	93	2.4

Notes: Share % is the fraction of global production that is contributed by the top 5 and the top 10 countries. The identification of major exporters and importers was obtained from the following sources. Wheat, maize and rice export data source (2015 data): ***http://www.worldstopexports.com/wheat-exports-country/****; Soybean exports combine meal and seeds:* ***http://legroupindustries.com/top-10-exporters-of-soybeans-and-soybean-meals-by-country/*** *(2013 data); maize imports (2016 estimates)* ***http://www.indexmundi.com/agriculture/?commodity=corn&graph=imports****; rice importer (2015)****http://www.worldatlas.com/articles/the-largest-rice-importers-in-the-world.html****; wheat imports* ***http://www.indexmundi.com/agriculture/?commodity=wheat&graph=imports****; soybean imports (2011)* ***www.earth-policy.org/datacenter/xls/book_fpep_ch9_3.xlsx****.*

Very similar situations prevail for wheat and soybean. The major importers account for about 5% of world production, and their domestic production increased by close to 4% (3.8% for wheat and 4.1 for soybean).

Considering that the volume of traded commodities is approximately equivalent for the top 10 importers and the top 10 exporters, the production deficit among importers is compensated by the increased production by exporters. For wheat, the opposite situation arises with increased production of importers reducing their import needs at a time when exporters globally reduced their production by 4.3%. As to soybean, the production increase among importers (especially China) will only marginally affect the markets of a commodity for which there is, at present, no apparent limit to demand.

[1] **http://www.fao.org/faostat/en/#data/QC**

[2] Their number varies from 65 for soybean to 136 for maize, which is the most widely cultivated crop in addition to being the first in terms of production.

[3] The FAOSTAT database includes national production data up to 2014. For 2015 and 2016, CropWatch estimates were used.

[4] This discussion does not include countries where the 2016 production was estimated based on trend, such as is the case for the "minor producers."

5.2 Disaster events

Disasters took a heavy toll on all continents during the period from July to October 2017. The period was characterized by the continuation of the complex emergency with a drought component in the Horn of Africa, heat waves and drought in Europa and North America, numerous tropical storms and cyclones essentially in Asia and especially the Caribbean, and exceptional floods in southern Asia.

Cyclones

Numerous tropical cyclones and storms occurred over the reporting period in the Pacific and Atlantic basins. Their tracks are illustrated in figure 5.1, and some of their features have been assembled in table 5.3. For now, only little quantitative information is available for some of them.

One of the earliest storms in the period (Talas) made landfall in the provinces of Nghe An and Ha Tinh in central Vietnam. Overall, about 100,000 hectares of crops were damaged as the event also affected South China (Hainan), Laos, Thailand, and Myanmar.

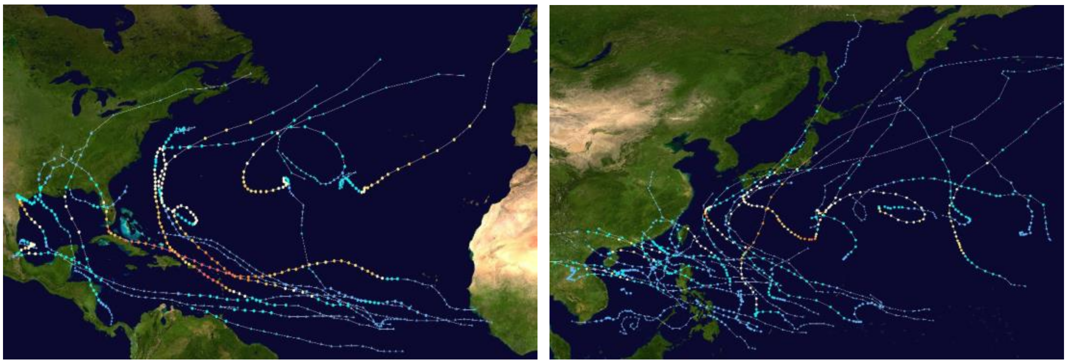
Other relatively minor events include Noru, Franklin, Hato, Doksuri, Khanum, Ophelia, and Odette. Each created havoc, sometimes severely affecting local economies, and most stood out for some specific feature. For instance, Noru, which affected essentially Japan, subsisted for an exceptionally long duration of more than three weeks. Hato (late August) formed near the Philippines and made landfall in China on 23 August. According to Xinhua News Agency, Hato was the strongest typhoon of the year, having destroyed 50,000 hectares of farmland and creating damage amounting US$1.87 billion. In spite of floods in Guangdong, Guangxi, Yunnan, Fujian, and Guizhou, as well as in Lào Cai in Vietnam, agricultural damage was contained. Doksuri (mid-September) affected the same countries as Hato, but also created damage in Laos and Thailand and, to a limited extent, in the Philippines. Khanum and Ophelia both occurred in October. The first was responsible for deadly floods and landslides in Vietnam. Ophelia is much of a curiosity as it moved eastward from the Caribbean, made landfall in Ireland on October 16 and eventually died at a unusually high latitude in Russia. This most easternmost hurricane on record created US$1.2 billion in damages in Ireland.

Table 5.3. Main characteristics of major cyclonic events occurring in July-October 2017

Name		Date		Wind speed	Countries affected	Fatalities	Damage	
International	Other	Start	End				Total	Agriculture
Talas		42930	42933	95 (10)	VNM, CHN (Hainan), LAO, THA, MMR	14	73 M (VNM)	100 kHa
Noru		42935	9 Aug.	175 (10)	JPN	2	55 M	?
Nesat	Gorio	42941	42946	150 (10)	PHL, CHN	2	118 M	6 M
Franklin		7 Aug.	10 Aug.	140 (1)	BLZ, CYM, MEX, USA	0	?	
Harvey		17 Aug.	3 Sep.	215 (1)	SUR, GUY, NIC, HND, BLZ, CYM, MEX, USA	63	200 G	150 M (USA)
Hato	Isang	19 Aug.	25 Aug.	185 (10)	PHL, CHN, VMM	26	5 G	0.2 kHa
Irma		30 Aug.	6 Sep.	295 (1)	CPV, CUB, USA	134	> 63 G	
Doksuri	Maring	10 Sep.	16 Sep.	150 (10)	PHL, CHN, VNM, LAO, THA, MMR, BGD, MYS	28	741 M	30 kHa (VNM)
Maria		16 Sep.	3 Oct.	280 (1)	DMA, DOM, HTI, KNA, USA	66	55 G	> 1 G
Nate		4 Oct.	11 Oct.	150 (1)	CRI, CYM, SLV, HND, GTM, NIC, PAN, CUB, USA	45	> 685 M	
Khanum	Odette	11 Oct.	16 Oct.	175 (10)	PHL, CHN	1	200 M	
Ophelia		9 Oct.	20 Oct.	185 (1)	PRT, ESP, FRA, IRL, GBR, NOR, SWE, RUS	3	> 1.2 G	

Notes: Wind speed is the "sustained" highest wind speed in km/hour, referring to a 10 or 1 minute period. Countries affected are identified by their 3-letter ISO 3166 codes, https://en.wikipedia.org/wiki/ISO_3166-1_alpha-3. Total damage is given in million (M) or billion (G) U.S. dollars. Agricultural damage is given as the total damage (M or G) or in thousands of hectares (kHa). Most impact estimates are very rough underestimates. They stem from several sources and mostly from Wikipedia. Unless otherwise indicated, the damage refers to the whole life cycle of the event.

Figure 5.1. Tracks of the 2017 season tropical cyclones in the Atlantic (a) and Pacific (b) basins



(a) (b)

Note: Colors identify the category on the Saffir-Simpson scale (SS) with blue then green for tropical storms and pale yellow to red for tropical cyclones proper. The SS scale is based on wind speeds. Source of images: Wikipedia.

Hurricanes Irma, Maria, and Nate followed roughly parallel northwest tracks and all eventually made landfall in the United States. The track of Irma remained north of the large Caribbean islands, but nevertheless affected the Dominican Republic, Haiti, Cuba, and eventually Florida in the United States, where the damage to agriculture (essentially citrus) was put at US$2.5 billion. Minor impact is reported from Puerto Rico and Georgia. Mid-September, Hurricane Maria literally destroyed agriculture in the Dominican Republic where all "trees" (bananas and palms) in the country were reported to have been "flattened" for a loss amounting to billions of U.S. dollars. Some sources even asserted that in some areas the destruction was beyond "agriculture" and affected the "ecosystem," meaning the roots of the local livelihoods system, for instance in Dominica. In relative terms, the island was the most severely affected in the whole Caribbean. In Puerto Rico, losses are estimated at US$50 billion. About 80 percent of agriculture was destroyed, amounting to a loss of US$780 million. Bananas were heavily affected throughout the region (such as with a 100 percent loss in Guadeloupe). At the beginning of October, Hurricane Nate followed a somewhat more southern track than Irma and Maria, hitting several central American countries. It was labelled “one of the main disasters in Costa Rica” by national sources. Rainfall locally exceeded 400 mm per day along the southern border, and 76 out of 85 cantons were declared in emergency. Among the hardest hit crops were 120,000 hectares of sugar cane, vegetables, grains, melons and papayas, and rice.

Figure 5.2. Trees downed by Hurricane Maria in Dominica

Source: ***http://wp.caribbeannewsnow.com/2017/09/28/agriculture-sector-dominica-destroyed-hurricane-maria/***

The three hurricanes affected countries where tourism contributes a fair share to the national income, but where nonetheless at least 25 percent of the population lives off the land. Based on the recent experience with Hurricane Matthew in Haiti and Enawo in Madagascar, rebuilding the agricultural sector is likely to take long, resulting in deteriorated food security for many months to come.

Drought and fires

In Asia, drought is reported mainly from the Democratic People’s Republic of Korea (Korea DPR) and Mongolia. At the end of July, FAO and Reliefweb reported that the shortage of rainfall in some key crop producing areas in the country was such that rice (the main staple), maize, potatoes, and soybean could drop by as much as 30 percent in the provinces of South and North Pyongyang, South and North Hwanghae, and Nampo City. The Mongolian drought follows a long spell of above average rainfall and occurred from mid-August.

A heat wave (dry weather and high temperature) that affected much of western Europe started in June and affected England, France, Belgium, the Netherlands, Switzerland, and the Mediterranean. Fires were widespread especially around the Mediterranean (Greece, France, and especially Corsica, Spain, Portugal, Italy, Albania, and Tunisia). Winds that accompanied hurricane Ophelia made the situation worse in Spain and Portugal. More than 60 people died and hundreds of thousands of forest hectares were lost.

In North America, wildfires became widespread in the western United States and Canada, mostly in California, south-central Oregon, Nevada, and British Columbia. The fires have destroyed at least 5,700 homes and businesses, making them the deadliest and most destructive group of wildfires in the history of California. At least 32 people were killed and at mid-October hundreds remained unaccounted for. Also in mid-October, the total burned area in the United States and Canada combined was estimated at 6.4 million hectares, with about equal areas in each country.

Floods and landslides

Floods are reported from all continents, but mostly from Asia where they were associated with the listed tropical cyclones or a particularly active monsoon in southern Asia.

Figure 5.3. A man cleans his house in Freetown after the mudslides

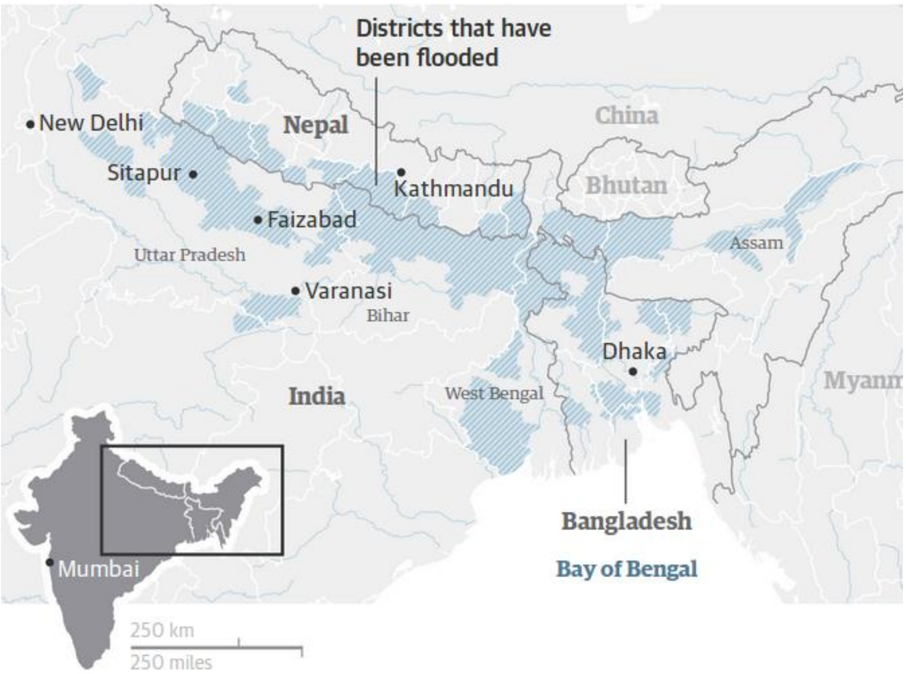
Source:OliviaAcland,UNDP2017, ***https://reliefweb.int/sites/reliefweb.int/files/resources/Sierra%20Leone%20Sit%20Update%20no%208.pdf***.

In Africa in July, Ghana experienced major floods in several regions, including Greater Accra, Central Region, Western Region, and Eastern Region, which were all declared flood emergency areas. In Freetown, the capital of Sierra Leone, devastating mudslides and floods claimed over 500 lives in mid-August; many are still missing and presumed dead. At the end of August, floods were also reported from Nigeria and Ethiopia.

In South America, August and mid-September witnessed excess precipitation and resulting floods over most of the national territory in Guatemala, with the exceptions of Santa Rosa and Chimaltenango Departments. Alta Verapaz, Petén, and Suchitepéquez were particularly wet. In Peru, floods occurred at the end of July and early August, including some areas already affected by the Putumayo floods that were reported on in the previous CropWatch bulletins.

Floods of exceptional extent occurred at the end of July and during August in parts of southern and southeast Asia, including the Philippines, Vietnam (with landslides and flash floods especially in the north), and Nepal (Koshi, and neighboring Bihar in India) where about 50 percent of the districts have been affected by landslides and flooding in late August. Floods also occurred in Thailand and Myanmar (140,000 people affected), and especially in several Indian states (11 million affected) including Manipur, Arunachal Pradesh, Gujarat, Bihar, Uttarkand, Orissa, and Uttar Pradesh where about 104 people have died, more than 3000 villages were submerged, and almost 3 million villagers have been affected by flooding, according to local officials. In Assam alone, heavy rain created havoc for close to 1,100,000 people in over 3300 villages in 21 out of 32 districts. Flooding worsened on 22 July, when new areas were submerged by the rising waters of the Brahmaputra River and its tributaries.

Figure 5.4. Flooded areas in India, Nepal, and Bangladesh as of 29 August 2017



Source: ***https://www.theguardian.com/world/2017/aug/30/mumbai-paralysed-by-floods-as-india-and-region-hit-by-worst-monsoon-rains-in-years****.*

In the same region, neighboring Bangladesh is said to be the victim of "unprecedented conditions," perhaps the worst floods in 100 years, accompanied by numerous landslides in the hilly areas of Chittagong. In total, 4.8 million people in 26 districts were affected by the floods, especially after rivers broke embankments in low-lying areas such as Sylhet, Moulvibazar, and eight more districts. At the maximum extension of floods, one third of the country was estimated to be under water. Xinhua reported on 19 August that, according to the International Federation of Red Cross and the Red Crescent Societies, a major humanitarian crisis was unfolding across large areas in South Asia, with more than 16 million people affected by monsoon floods.

In India, Nepal, and Bangladesh, the three countries where the worst floods occurred, 40 million people had their lives disrupted, a million houses were lost, and at least 1200 persons died. In Bihar alone over 700,000 hectares have been destroyed. In Nepal food crops have been wiped out by the floods in the major farming lands in the southern lowlands. As most farmers in the region practice subsistence agriculture and food production, the resulting nutritional state of the population is bound to suffer.

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Introduction

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Drought

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Ophelia fires

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South Asia floods

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Cyclones including Harvey

https://globalnews.ca/news/3708870/hurricane-harvey-south-asian-floods/; https://www.scientificamerican.com/article/hurricane-harvey-why-is-it-so-extreme/; J Rosen 2017 How an ocean climate cycle favored Harvey, Human factors may prolong storm-boosting Atlantic Multidecadal Oscillation phase. Science 357(6354)853-

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South America

https://reliefweb.int/disaster/fl-2017-000130-gtm; https://reliefweb.int/report/mexico/declara-la-secretar-de-gobernaci-n-emergencia-para-70-municipios-del-estado-de;

[1] Integrated PhaseClassification, an internationally agreed and accepted classification of emergencies on a scale from 1 to 5.

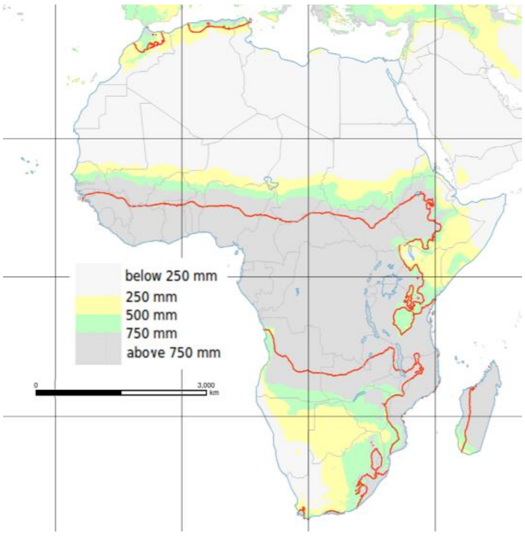
See http://www.fao.org/docrep/010/i0275e/i0275e.pdfor http://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/IPC-Manual-2-Interactive.pdf.

5.3 Focus: Rangeland management and issues in Africa

Agroclimatic environment of rangelands

Rangelands are a land-use category in which pastoralists and their livestock play a significant, and often predominant, part in the agricultural economy. Rangelands typically occur in the dry-lands bordering the general areas of the Sahara and the Kalahari deserts, with rainfall amounts between virtually nil to 750 mm (figure 5.5).

Figure 5.5. Major semi-arid precipitation zones in Africa



Note: The red line indicates the limit of the 180-day growing season. It is based on the 1961-90 reference values from GAEZ (GAEZ, 2012); the precipitation grid is from the WORDCLIM database (Hijmans, 2005).

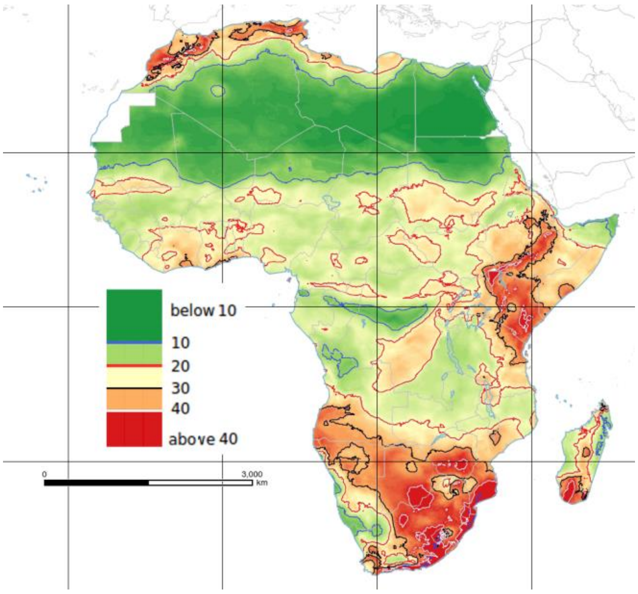
According to the authors of the African Union sponsored report on the rational use of rangelands and fodder crop development in Africa (Inter-African Bureau for Animal Resources, AU-IBAR 2012; an important source for several sections of this note), "dry-lands" are better defined by the length of the rainless period than by rainfall amounts. This is because of seasonality (two or more rainy and rainless periods); the relations between evapotranspiration, temperature, and elevation; and rainfall distribution patterns over the year. The common definition of dry-lands puts the length of the rainless period at 180 days, which often allows for some combination of crop agriculture and livestock husbandry. When, however, rainfall drops below 200 or 250 mm, most crop farming without irrigation becomes mostly impossible or, at least, extremely risky.

It is stressed that, contrary to the arid Sahara, most of the Kalahari "desert" is, in fact, semi-arid: precipitation is generally between 250 and 500 mm (Figure 5.5, centered around Botswana). In many ways, the region is comparable to the Sahelian zone in West Africa, and it is frequently covered by sparse "forest." The Namib desert, which includes the border area between South Africa and Namibia, from the coast to southwest Botswana, is the driest area of he Kalahari; it is mostly sand desert akin to much of the Sahara.

Dry-lands (delimited by the 180-day season line in figure 5.5) make up 43 percent of Africa's inhabited surface and are home to 40 percent of the continent's population. Dry-lands include areas that are climatically sub-humid, semi-arid, and arid in the BS, BW, and CW classes in the Köppen Climate Classification System. In parallel with the decreasing gradient of rainfall, the economy changes from agro-pastoralism to pure pastoralism. As stressed above about the Kalahari "desert," the vegetation of African rangelands reflects amounts of precipitation and may include mixed woodland/grassland "forest" (miombo), shrub-lands, and grasslands. AU-IBAR (2012) stresses that in African dry-lands, dwarf shrubs account for a larger share of cattle nutrition than perennial grasses.

Another defining feature of African dry-lands is the variability of rainfall, which affects all facets of precipitation distribution: spatial, intra-seasonal, and inter-seasonal. Rainfall variability is the main source of risk in all African cropping and livestock production. As illustrated in figure 5.6, both the driest (arid) and wettest (equatorial) areas enjoy low variability. The largest inter-annual variability occurs in the driest areas in east Africa (especially the Horn of Africa), southern Africa, and southern Madagascar. In comparison, the Sahel enjoys relatively low variability.

Figure 5.6. Standard deviation (in days) of the length of the growing season over the reference period 1961-1990



Source: Based on gridded data in GAEZ (2012).

Varying degrees of nomadism

In the driest areas, rangeland management becomes an exercise in optimizing the use of scarce and dispersed biomass resources using the mobility of livestock. Livestock harvests an irregularly distributed resource, provided sufficient biomass and watering points are available to maintain the livestock healthy. It has been argued that pastoralism outperforms ranching in terms of returns (in cash) per hectare, meat production, and energy generation as firewood and cow-dung (de Jode 2010).

Somehow, at least in the driest areas, livestock production and rangeland management systems never reach equilibrium. The whole society and social arrangement, including land ownership and the nomadic live-style, are aimed at optimizing survival in the face of the extreme variability of resources.

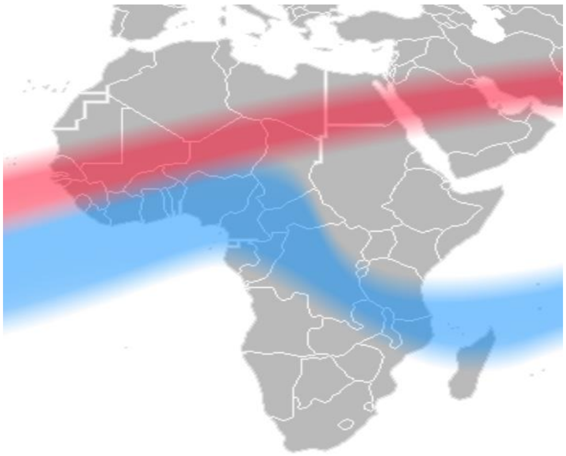
Nomadism essentially occurs at two spatial scales. At the largest scale, herders and their cattle follow the movements of rainfall-generating weather systems. These are the same systems that also condition the timing and number of rainy seasons in tropical areas, essentially the Inter-tropical Convergence zone (ITCZ); the same systems also trigger the spectacular migration of large wild ruminants in eastern Africa (figure 5.7).

Figure 5.7. Migration of gnus (wildebeest) in East Africa

Source: **https://commons.wikimedia.org/wiki/File:Wildebeest_Migration_in_Serengeti_National_Park,_Tanzania.jpg**.

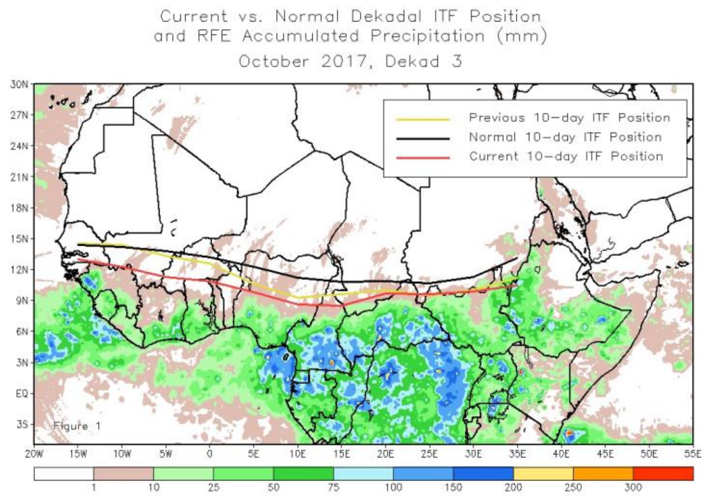
The ITCZ corresponds approximately to the "thermal equator," which is the latitudinally variable band area where highest temperatures are recorded [footnote 1]. Trade winds (blowing from the east) converge at the ITCZ and rise, thereby cooling and generating clouds and rainfall. Precipitation does not occur exactly at the position of the ITCZ, but usually 200 or 300 km closer to the geographic equator than the thermal equator. Throughout the year, the position of the ITCZ changes, with the zone being in the southern hemisphere in the months around January and in the northern hemisphere in the months around July (figure 5.8). The intensity of the color in the figure indicates the frequency of the presence of the ITCZ, highlighting the considerable uncertainty (inter-annual variability) that exists for the position of the ITCZ, which is a fundamental variable for rangeland and cattle monitoring, management, and information systems (figure 5.9). According to Sachs and Myhrvold (2011), current data indicate that climate change could entail a shift of the average position of the ITCZ by up to 5 latitudinal degrees, which would completely modify current cropping and rangeland patterns in Africa. It can be assumed that this would "re-green" the Sahara but turn the Kalahari into a true BW desert in the Köppen Climate Classification System.

Figure 5.8. Average position of the ITCZ during July (red) and January (blue)



Source: ***https://upload.wikimedia.org/wikipedia/commons/d/d7/ITCZ_january-july.png***.

Figure 5.9. Position of the Inter-tropical front (red) during the third dekad of October 2017



Source: ITCZ monitoring by NOAA, ***http://www.cpc.ncep.noaa.gov/products/international/itf/itcz.shtml****.*

The large-scale nomadism that is associated with the large movements of the ITCZ is usually referred to as transhumance. In addition to transhumance, there is also micro-nomadism, with cattle movements occurring within a limited region, especially during the rainy season in areas where this season lasts more than a couple of months. Many potential conflicts derive from the interaction during at least part of the year between crops and cattle, farmers and herders. Unless they are given feeds, animals need to move in search of biomass and water.

Characterization of livestock and rangelands in African economies

Grazing lands (rangelands combined with permanent meadows) occupy between 21 percent (in the middle of Africa) and 57 percent (in the south of the continent) of the total land area of African countries [footnote 2]. When considering agricultural land only, the percentages increase to 30 percent in the middle area to as much as 91 percent in southern Africa and around 70 percent in remaining areas (table 5.4). As shown in the table, these percentages have been decreasing over the last 15 or so years, especially in the east, while they have remained stable in the south. This finding is consistent with Nkonya et al. (2013), which stresses the increase of croplands at the expense of other land uses, including wetlands and “forest.”

Table 5.4. Select statistics about rangelands and cattle in Africa

	Grazing land (rangeland and permanent meadows) as part of total and agricultural land areas and change over time			Animal numbers		Herd composition				LSU	Exports		Imports	
	Total	Agricultural		million	% Change	Sheep	Goat	Beef			M$	%	M$	%
	%		Δ%	[1]	[2]	%	%	%	Δ[3]	[4]		[5]		[5]
North	24	77	−0.2	212	1	51	25	21	−3	0.14	276	172	418	301
West	30	64	−1.3	319	35	31	43	20	0	0.11	189	28	304	23
East	41	77	−2.7	375	54	21	33	39	−3	0.22	432	329	87	575
Middle	21	30	−1.6	67	23	14	40	35	−3	0.07	62	−3	42	132
South	57	91	0.5	61	−3	47	18	33	1	0.08	86	37	106	33

Notes: Imports and exports refer to live animals. Prepared with data extracted from FAOSTAT. For a list of countries in each region (North-South), see footnote 2.
[1] Beef cattle, camels, pigs, goats, and sheep, in millions, average 2010-14 numbers; [2] Change from 2001-5 to 2010-14 in percentage; [3] percentage point change from 2001-5 to 2010-14; [4] Livestock Unit (LSU) density in the agricultural area in LSU/hectare; [5] Percentage change between 2001-5 and 2009-13.

Livestock numbers are very similar to those of the human population throughout most of the continent, with the exception of central and eastern Africa where animals outnumber people by a factor of two to three. With the exception of the north and south, numbers have increased markedly over the last decade, up to 54 percent in east Africa, which includes some of the areas with large potential of conflicts because of human concentrations and large environmental variability (Figure 5.6).

Goats and sheep numbers generally exceed beef populations by a factor of two to three. This is explained by various factors that include the robustness of small animals and the preference for small amounts of meat when animals are slaughtered, as large volumes cannot be easily stored and need to be consumed immediately. In general the share of beef has been decreasing over the last decade. Other animals are also kept in Africa but nowhere reach the importance of the listed ruminants. They include water buffaloes (mostly in Egypt, FAO 2017a), camels, and pigs. Camels reach 3 percent in north and east Africa and--with the exception of north Africa where they are absent--pigs make up about 3 percent too, except in middle Africa where they reach 10 percent.

Table 1 also lists the density of livestock units (LSU) because the variable is a good measure of the pressure put on rangelands by the animals. An LSU [footnote 3] is, somehow, a measure of the “grazing power” of animals. A “modern dairy cow” is assigned a LSU value of 1, while FAO assigns tropical cattle a lower value of about 0.7. The small ruminants count as approximately 0.1, while camels reach or exceed 1.0. The LSU density, therefore, is a direct measure of the grazing pressure on agricultural land. Values are highest in east Africa (0.22 LSU/hectare) and lowest in the middle and south of the continent with values below 0.1 LSU/hectare). Much literature of the 1990s (for example, World Bank 1995) focused on the concept of Carrying Capacity (CC) of rangelands, which is the number of LSU a given area can sustain. It appears that the carrying capacity is difficult to handle when both livestock and biomass vary considerably over time due to the inherent variability of arid-lands, and equilibrium is never reached.

Most countries in Africa have a trade deficit in terms of live animals and meat products, with the exception of countries in the middle of Africa and, especially, east Africa. The latter region exports cattle mostly to the neighboring Arabian peninsula.

Problems and issues related to rangeland management in Africa

The sections above have stressed that livestock and the exploitation of rangelands are important sectors of the economy in most African regions. Many problems do, however, arise because of the risks connected with the exploitation of a spatially and temporally variable resource using mostly traditional techniques that compete with other sectors. Several good syntheses of the issues facing livestock and rangelands in Africa have been developed by the African Union (the already mentioned AU-IBAR of 2012), FAO and the CGIAR centers, especially ILRI (International Livestock Research Institute, Nairobi), and the World Agroforestry Centre (a brand name used by the International Centre for Research in Agroforestry, ICRAF, also based in Nairobi).

Restrictions to the short-range movements of cattle

Land, including grazing lands, is often collectively owned in Africa. Where this is the case, the lands are managed by traditional authorities who may assign parts to other uses, such as crop agriculture. The land use changes are driven by population and "development," such as construction, establishment of ranches, and large scale agriculture. This has frequently led to land fragmentation, a decrease of land available to herders, and impediments to free cattle movements. This, in turn, has entailed the degradation of rangelands and the over-exploitation of water resources. Conflicts frequently erupt in rangelands due to a variety of factors, including cattle rustling (stealing) and the weakening of traditional authorities, which generally results in ambiguous rights. Fencing of rangelands or croplands is now common, and farming tends to substitute other land uses including wetlands, which are essential for cattle survival during the dry season.

As mentioned above, woody biomass is a source of food for cattle that is as important as herbaceous vegetation, and fuel-wood collection by villagers (which has been increasing) directly competes with cattle. This is often compounded by refugee fluxes who also need fuel-wood and bring some cattle with them. Finally, livestock competes with wildlife for rangelands outside of protected areas, while livestock is not permitted into parks, many of which actually constitute the traditional herding areas or nomads in the low rainfall areas.

Limits to long-range (transhumance) movements

Most African countries are gradually introducing border controls in areas where transhumance had traditionally taken herders and their livestock across those border areas well before their establishment. Fortunately, recognition of the ecological and economic efficiency of pastoral land management is growing. Most regional associations (such as ECOWAS, EAC, and COMESA) have provided or work at developing a framework to enable trans-boundary movements of cattle in the form of International Transhumance certificates, which provide for the registration of the movements of herders and the identification of their cattle (ECOWAS 2017).

Land degradation and desertification

Overgrazing and the gradual decrease of the capacity of plant biomass (natural vegetation) to regenerate is one of the facets of land degradation. Many dry-lands, however, suffer from various types of degradation, including soil erosion, loss of biodiversity, salinization, and unsustainable use of water. According to some estimates, about three quarters of African rangelands are somehow degraded. Desertification is defined as land degradation in semi-arid areas. Its causes include the direct actions of humans in the area, but also, and to a growing extent, the effects of climate change.

Solutions?

Innovative systems have to be designed to tap the biomass of rangelands in a sustainable way, to ensure the preservation of traditional pastoralist knowledge, and to optimize the interaction between crop agriculture and herding. The whole community must be involved to ensure collective ownership of solutions. It is also essential to halt the impoverishment of nomads due to the loss of their traditional live-styles. This includes schooling systems suitable for nomadic children, as well as payment for environmental services, such as ecotourism, watershed management, water harvesting, and the sustainable management of the interface between wild animals and livestock.

There has been an increase in integrated crop-livestock systems, for instance when livestock can graze on crop residues, with the fields benefiting from cow dung as fertilizer. While clearly mobility must be regulated and coordinated with crop farmers and among pastoralist groups, additional solutions may come from multilateral environmental agreements such as the Convention to Combat Desertification (UNCDD), the Convention on Biodiversity (UNCBD), and especially the Framework Convention on Climate change (UNFCCC), using the mechanisms of carbon sequestration. Techniques suitable to store carbon in soil in rangelands would be of huge relevance considering the size of rangelands and the benefits associated with increased carbon, including improved soil fertility and better soil moisture storage capacity. According to Milne et al. (2016), relatively simple management techniques can contribute to improve soil carbon in sub-Saharan grazing lands. The international agreements are of direct relevance to dry-lands and the associated livelihood systems.

New communications and observation technology can play an essential part in surveillance of rainfall and biomass, and the optimized management of rangelands and cattle. This could result in the rehabilitation of and improved conservation of rangelands, as well as the maintenance of biodiversity through controlled grazing, fire-control, rotations, and reseeding when required. Eventually it will also be necessary to adopt modern management techniques for rangelands and cattle, including animal health and breeds, as well as improved fodder production (which may involve trees and shrubs, Opuntia, and grasses). Improvements are also needed for the marketing of rangeland products (such as meat, milk, skins, wool, medicinal herbs, and other plants such as frankincense and gum Arabic, honey, and minerals).

According to FAO (2017b), per capita milk consumption decreased in sub-Saharan Africa over the two last decades. Compared with other regions of the world, milk consumption is medium (30 to 150 kg per capita per year) in northern and southern Africa and Kenya, and low (below 30 kg per capita per year) in most of central Africa. Milk provides 3 percent of the dietary energy supply in Africa, compared with 8 to 9 percent in Europe and Oceania, and 6 to 7 percent of dietary protein supply in Africa, compared with 19 percent in Europe. Milk is just one of several livestock products that has a good potential for development in Africa.

Conclusions

African rangelands are a huge resource at the continental scale. Because they occupy mostly dry-lands with low vegetation density, the use of small ruminants and beef cattle constitutes a well-tested and efficient form of biomass harvesting, as demonstrated by the importance of livestock in the economies of most African regions. Unfortunately, the harvesting of sparse biomass implies the mobility of cattle and their herders, at scales varying from local to international in the traditional transhumance movements by which cattle follow the rain. With economic development, the increase of crop agriculture and other land uses, cattle movements are more and more restricted, creating or fueling conflicts. This is compounded by climate change and--partially human-made--land degradation. The pastoralists' way of life has apparently become less sustainable, while their populations became impoverished. Yet, solutions and opportunities do exist. They imply technical improvements to the husbandry of livestock and rangelands, agreed and mutually beneficial arrangements between farmers and herders, improved ease of movement across borders, and the optimization of grazing through modern communication and observation techniques.

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Footnotes

[1] This latitude corresponds approximately to the declination of the sun.

[2] The groups of countries categorized under North, West, East, Middle and South Africa are those adopted by FAOSTAT, as follows: "Middle: approximately corresponds to central equatorial Africa, but East Africa extends south as far as Zambia, Zimbabwe and Malawi, which leaves only five countries in the South. West includes the Sahel and the Gulf of Guinea countries and corresponds approximately to ECOWAS. Using the three-letter ISO-3166 code for countries (https://en.wikipedia.org/wiki/ISO_3166-1_alpha-3), the exact grouping is as follows: North Africa: DZA, EGY, LBY, MAR, TUN; West Africa: BEN, BFA, CPV, CIV, GMB, GHA, GIN, GNB, LBR, MLI, MRT, NER, NGA, SHN, SEN, SLE, TGO; East Africa: BDI, COM, DJI, ERI, ETH, KEN, MWI, MOZ, RWA, SOM, SSD, UGA, TZA, ZMB, ZWE as well as the large (MDG) and small Indian Ocean islands (MUS, MYT, REU, SYC); Middle Africa: AGO, CMR, CAF, TCD, COG, COD, GNQ, GAB, STP; and South Africa: BWA, LSO, NAM, ZAF, SWZ.

[3] https://en.wikipedia.org/wiki/Livestock_grazing_comparison.

5.4 Update on El Niño

El Niño conditions have been neutral across the Pacific Ocean during the third quarter of 2017, but a La Niña event is likely to occur in late 2017. Figure 5.10 illustrates the behavior of the standard Southern Oscillation Index (SOI) of the Australian Bureau of Meteorology (BOM) from October 2016 to October 2017.

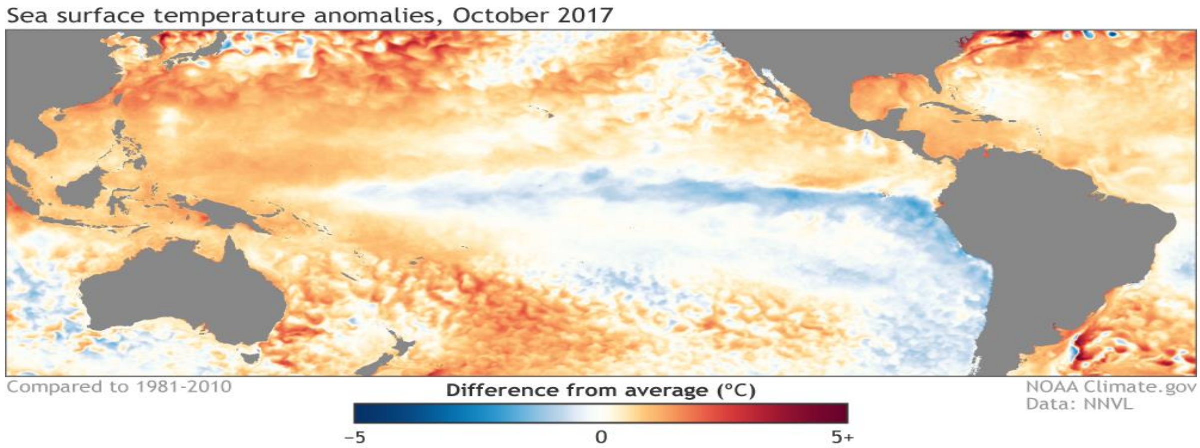
Sustained positive values of the SOI above +7 typically indicate La Niña while sustained negative values below −7 typically indicate El Niño. Values between about +7 and −7 generally indicate neutral conditions. During the current season, SOI increased from -10.4 in June directly to +8.1 in July, then decreased to 3.3 in August; however, it increased again to +6.9 in September and to +9.1 in October. The sustained large positive value indicates a La Niña might be coming. In the coming months, CropWatch will continue to monitor the condition of La Niña.

Figure 5.10. Monthly SOI-BOM time series for October 2016 to October 2017

Source: **http://www.bom.gov.au/climate/current/soi2.shtml**

As shown in figure 5.11, the sea surface temperature in the so called "Niño 3.4 region" in the central tropical Pacific Ocean, which is sensitive to El Niño events, is 0.5°C cooler than its 1981-2010 average, according to NOAA monitoring. BOM and NOAA agree that this overall cooler condition indicates that a La Niña event might occur in late 2017, but that it might not be so strong.

Figure 5.11. Sea surface temperature anomalies, October, 2017



Source: **https://www.climate.gov/sites/default/files/ENSO-NovEDD-Fig2_SSTA_map_large.jpg**