Chapter 5. Focus and perspectives

Building on the CropWatch analyses presented in chapters 1 through 4, this chapter presents first the global crop production index as of January 2023 (section 5.1), early outlook of crop production for 2023 (section 5.2), sections on recent regional conflict and disaster events (section 5.3), and an update on El Niño (section 5.4).
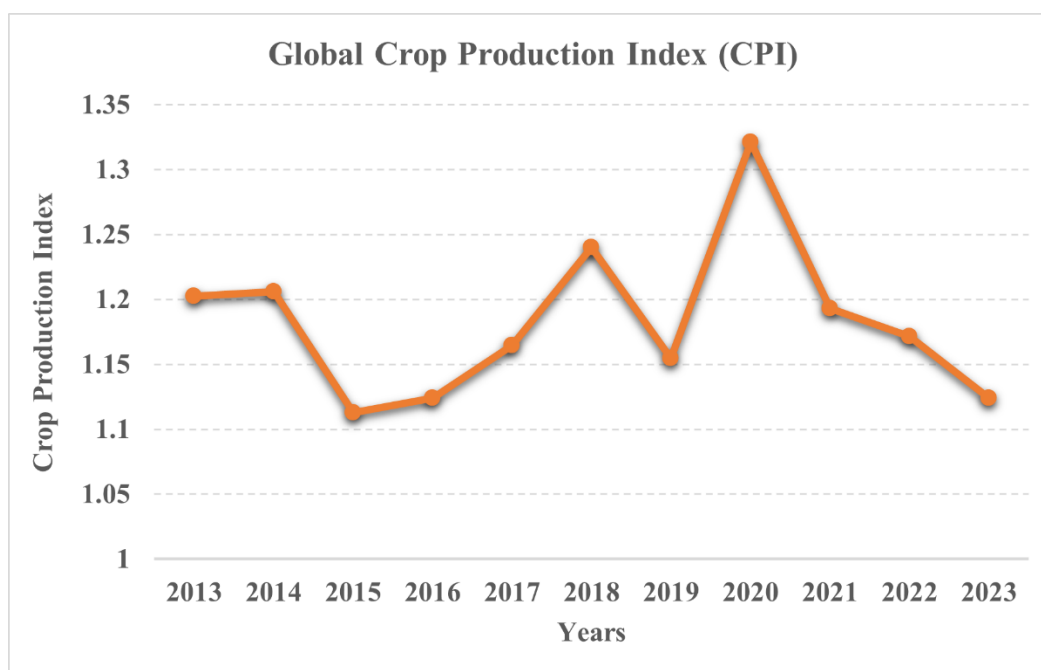
5.1 Global Crop Production Index

Figure 5.1 Global CPI for the past 11 years during the current monitoring period (from October of the previous year to January of the current year).

For the current monitoring period, the Crop Production Index (CPI) for global crop production reached its highest level in almost 11 years in 2020. However, from 2021 onwards, the global CPI declines for three consecutive years, from 1.19 to 1.12 in 2023, which is close to the lowest level in the past 11 years (i.e. 1.11 in 2015) and the second lowest level in nearly 11 years. The downward trend in the CPI over the past three years indicates that global agricultural production is facing severe challenges, which are expected to continue in 2023. The causes of this trend are complex, but climate change and extreme weather events appear to be key factors. Effective strategies are needed to mitigate the impact of these factors and ensure sustainable agricultural production to meet the growing global demand for food.

The Crop Production Index (CPI) is an indicator proposed by CropWatch to characterize the agricultural production situation in a designated area. The index takes into account the distribution of irrigated and rainfed cropland, VCIx, CALF, land productivity, and crop acreage in a designated area to measure the production situation in a given growing season in a normalized value.

5.2 CropWatch food production estimates

Production estimates

In order to ensure the accuracy of crop yield forecasting, this bulletin focuses on the major food producing countries in the equatorial region and the southern hemisphere, as well as forecasts the summer crop yields of a few countries in the northern hemisphere (e.g., Pakistan and India).

The CropWatch system for estimating crop yields mainly uses remote sensing data as the primary data source for agricultural producing countries, and combines ground-based measurement, crop masks, and statistical data from some foreign countries. The calibration of the yield prediction model is carried out separately for different crops (Table 5.1). Based on vegetation indices and cultivated land ratios of different crop masks, the system monitors the annual variations in crop yield and cultivated area, and predicts the yield for the current year by combining with the previous year's production.

Table 5.1 2023 cereal and soybean production estimates in thousand tonnes. Δ is the percentage of change of 2023 production when compared with corresponding 2022 values.

	Maize		Rice		Wheat		Soybean	
	2023	Δ%	2023	Δ%	2023	Δ%	2023	Δ%
Africa								
Angola	2,672	-2	36	-27				
Egypt					11,330	1		
Kenya	1,808	-7						
Morocco					7,917	31		
Mozambique	2,405	9	422	6				
Nigeria	11,377	-4						
South Africa	3,571	0						
Zambia	2,672	-2	36	-27				
Asia								
Bangladesh	3,713	0	45,839	-5				
Cambodia			9,575	-2				
India					92,557	-1		
Indonesia	19,586	2	66,538	2				
Myanmar			24,198	-2				
Pakistan					24,746	-3		
Philippines			22,407	5				
Sri Lanka			2,500	1				
Thailand			39,084	1				
Vietnam			46,895	0				
America								
Argentina	55,924	2	1,771	-4			50,022	-3

	Maize		Rice		Wheat		Soybean	
	2023	Δ%	2023	Δ%	2023	Δ%	2023	Δ%
Brazil	93,603	3	10,788	-5			105,178	11
Mexico	21,577	-7			4,138	3		

Maize

The predicted maize production of 10 major producing countries is listed in Table 5.1, including the second and third largest exporters (i.e., Brazil and Argentina). The total maize production of these 10 countries accounts for approximately 20% of global production. Due to the impact of persistent drought, the first maize production in central and southern Brazil has been reduced to 22.169 million tonnes by 3.5% on the basis of the 2021-2022. The second maize received rainfall close to the average in crop growth period, and irrigation in some areas ensured an increase of 4.5% second maize production. The total maize production in Brazil is expected to reach 93.603 million tonnes with an increase of 2.5%. In Argentina, continuous dry weather in the past four months has led to delayed sowing of autumn crops and poor growth conditions of early-planted maize. Some farmers are still rushing to plant maize since the significant increase in rainfall since January 2023. The improvement in rainfall will be favorable for the growth and development of late-planted maize. The maize production in Argentina is expected to be 55.924 million tonnes with a slight increase of 1.7%.

Drought has also spread to the major maize-producing countries in Africa. Among them, South Africa is the most severely affected by the drought, with rainfall in its maize-producing areas more than 40% below normal, resulting in a decrease in both maize yield and planting area, and a 4.1% decrease in total maize production. Kenya and Angola experienced continuous drought before and after maize planting, resulting in a 6.5% and 2.4% decrease in production, respectively. Slight drought also occurred in Mozambique's main maize-producing areas, resulting in a slight decrease in maize yield, but the increase in maize cultivation area offset the impact of the decrease in yield, resulting in a significant increase of 9.1% in total maize production. Indonesia had sufficient rainfall, providing adequate moisture for maize production, and total maize production increased to 19.586 million tonnes (+2.3%). Despite some areas alleviating the impact of drought through irrigation, the total maize production in Mexico's main maize-producing areas in the northwest was still 6.8% lower than in 2021-2022 due to persistent low rainfall. Maize production in Bangladesh and Zambia remained similar to the previous year.

Rice

The rice production forecast in this bulletin mainly covers the major rice-producing countries in South and Southeast Asia, including 12 major rice-producing countries. The rice production of the monitored countries accounts for 35% of the global production, and the overall production is expected to decrease slightly by 0.1%. Rice production in most countries in South and Southeast Asia is close to 2022. The rice cultivation area in Bangladesh has decreased compared to the 2021-2022, resulting in a 4.5% decrease in total rice production, while the agro-climatic conditions in the Philippines are generally better than last year, and rice production is expected to increase by 5.3%. There are significant differences in the growth conditions of drought-season rice in the Mekong sub-region countries. Cambodia is expected to experience a significant decline in drought-season rice production, with a decrease of 2.2% in whole country, while Thailand is expected to experience a slight increase in drought-season rice production, with a total rice production

increase of 0.6%. The changes in rice production in Indonesia, Myanmar, Sri Lanka, and Vietnam are all less than 2%. Rice yield and cultivation area in Brazil and Argentina have both decreased slightly, with total rice production decreasing by 5.0% and 4.1%, respectively.

Wheat

Wheat completed harvesting in Argentina, Australia, Brazil, Ethiopia, South Africa, and Zambia in the southern hemisphere in 2022. This bulletin focuses on wheat-producing countries in tropical and subtropical regions, including Egypt, Morocco, India, Pakistan, and Mexico. Compared to 2021-2022, agro-climatic conditions in Morocco have improved significantly, leading to a recovery in both wheat yield and cultivation area, and total production has increased significantly to 7.917 million tonnes (+30.9%), but still significantly lower than the high-yield year in 2020-2021. The agro-climatic conditions in the wheat production areas in northern Mexico are better than the national average, with an increase in wheat planting area, leading to a 3.1% increase in wheat production. Wheat planting mostly adopts irrigation measures in Egypt, India, and Pakistan, with relatively small changes in wheat yield. Remote sensing data shows that the wheat planting area has decreased slightly in India and Pakistan, while that in Egypt has increased, and it is expected that wheat production in Pakistan and India will decrease by 3.2% and 0.7%, respectively, and wheat production in Egypt will increase by 0.8%.

Soybean

The soybean production of Brazil and Argentina is only second to that of the United States. CropWatch predicts that Brazil's soybean production will increase significantly to reach 105.178 million tonnes (+ 10.6%), with the main reason being the expansion of soybean cultivation area. The planted area of soybeans in Argentina has also increased, but drought occurred in the main soybean producing areas, which led to a delay in the soybean sowing period. Although rainfall returned to normal in January 2023 and the growth of late-planted soybeans improved, the delay in the phenological period will affect the yield of late-planted soybeans, and it is expected that the national average soybean yield will decrease by 5.7%, with a total production decrease to 50.022 million tonnes (-3.4%).

5.3 Conflicts and Disaster events

This section covers the October 2022 - January 2023 disaster events worldwide. Apart from floods, cyclones and droughts, this section also highlights the current situation of the Desert locust across the globe.

Russia-Ukraine conflict

The large-scale conflict between Russia and Ukraine, which broke out on February 24, 2022, continues to devastate the region. As the conflict approaches its first anniversary, there appears to be no end in sight. The conflict has also had far-reaching impacts, disrupting the global agricultural system, which is struggling to cope with the adverse effects of climate change and the COVID-19 pandemic. The impact of the crisis is alarming, not only threatening supply chains but also posing significant food production and trade risks.

As the conflict's first anniversary approaches, some positive developments occurred in agriculture of Ukraine, such as the national cropped arable land fraction, which according to the Remote Sensing CropWatch monitoring system, has increased by 13% from October 2022-January 2023

compared to the average of the past five years. The Southern wheat and winter crops area have seen an increase by 29%, while in the Central wheat area, it has increased by 14%, which could lead to an increase in total grain production. However, these developments must be viewed in the context of the ongoing conflict, as reports indicate that global market conditions might not provide short-term relief, leading to more pain for communities that are already suffering from hunger.

Flood and Landslide

During the initial week of 2023, 18 floods and 6 landslides impacted Indonesia and the Philippines. As per reports from the Badan Nasional Penanggulangan Bencana (BNPB), Banten, West Java, Central Java, East Java, East Nusa Tenggara, West Sulawesi, and South Sulawesi areas were affected by floods, landslides, and wind-related disasters that were triggered by moderate to heavy rainfall, overflowing rivers, and strong winds. In early October, Costa Rica was overwhelmed by Cyclone Julia which brought together rains which exceeded 200 mm, causing rivers and streams to overflow.

THE PHILIPPINES: Starting around December 23, 2022, a combination of a Shear Line storm and a trough of low pressure caused extensive damage, including floods and landslides, throughout the Philippines. The calamity initially impacted around 200,000 people and resulted in 17 fatalities as of December 27, 2022. However, only four days later on January 1, 2023, the number of affected people skyrocketed to nearly 600,000, and the fatality count rose by over 100% to 51. As of January 8, 2023, the number of dead reached 52, with 18 people still missing and 16 injured. Over 600,000 people were affected. Additionally, a separate incident involving a Low-Pressure system caused flooding due to continuous light to moderate heavy rains in various municipalities in MIMAROPA as of January 4, 2023. This episode affected a total of 3,275 people across 18 flooded areas.

Fire

RECORD BURNING IN THE AMAZON RAINFOREST: The role played by the Amazon rainforest in regulating the Earth's climate is crucial, making it one of the most significant ecosystems on the planet. Regrettably, in recent years, there has been an unprecedented surge in forest fires, with 2022 experiencing a notable increase.
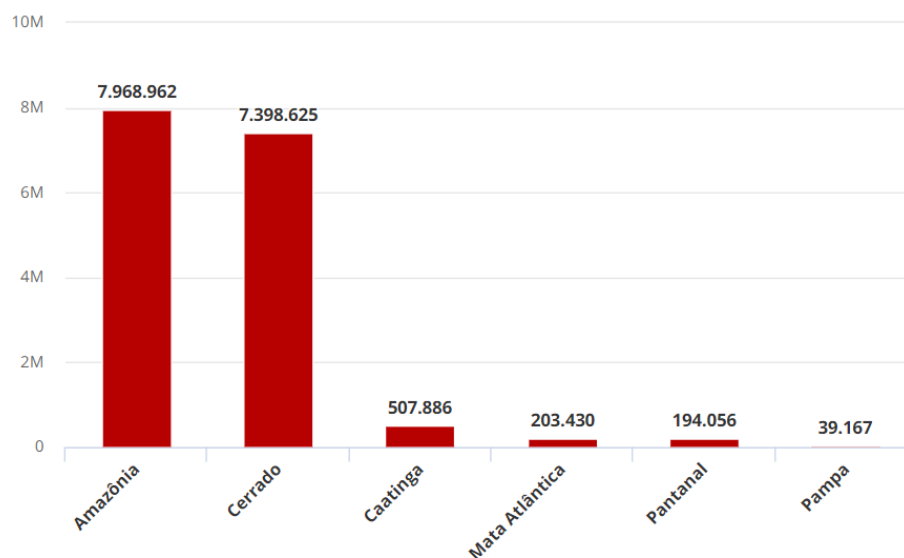
Figure 5.2 Territories most affected by wildfires (in hectares) (Source: https://g1.globo.com/meio-ambiente/noticia/2023/01/31/area-de-florestas-queimadas-quase-dobra-em-1-ano-diz-mapbiomas.ghtml).

In 2022, there were high levels of fires in the Amazon. The Instituto Nacional de Pesquisas Espaciais's (INPE) Fire Program registered almost 115,000 fire outbreaks, the highest number since 2010 and a 53% increase from 2021.

In December alone, there were 2,743 fire outbreaks in the Amazon rainforest, which is an unusual situation for the period as it is typically marked by rainfall and low number of fires. This represents a 73% increase from the same period the previous year when 1,584 fire outbreaks were identified. Fires are not a natural occurrence in the humid, tropical Amazon rainforest. Instead, farmers resort to deforestation and burning of trees to clear land, and on occasion, these fires spiral out of control. Although fires may lead to deforestation in the Amazon rainforest, which alters the climate patterns, the newly created agricultural fields may, at some point, lead to increases in grain production, at least in the short term. This could potentially alleviate global food insecurity through grain exports. However, in the long run crop production will drop and become erratic, because of a reduction in rainfall and prolonged droughts.

Drought

EAST AFRICA: As of October 2022, the drought situation in East Africa was in watch condition due to the deficit in rainfall with warning conditions in Ethiopia, Somalia, Kenya, and Uganda. The indicator showed a drought alert situation in Northwestern Tanzania and across Kenya, while the other regions were on watch. The watch situation prevailed over the region by the end of January with some warning conditions scattered across Kenya, Somalia, and Ethiopia.
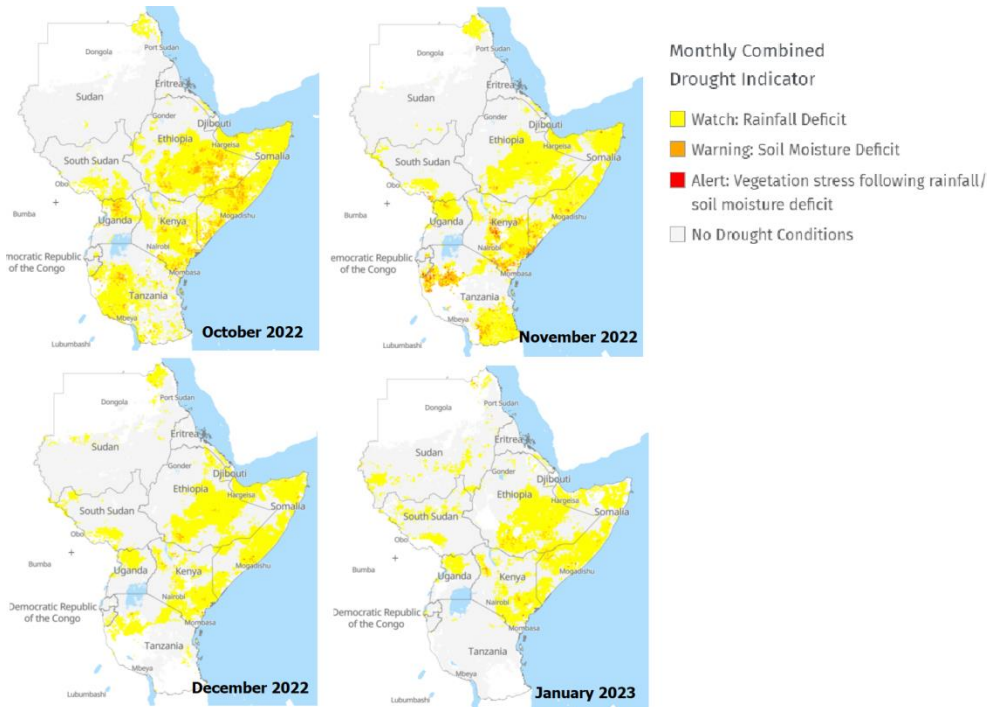

Figure 5.3 Monthly combined drought indicator for west Africa from October 2022-January 2023 (Source: https://droughtwatch.icpac.net/mapviewer/)

As of December 2022, many areas in the Horn of Africa have experienced their fifth consecutive failed rainy season, resulting in the most prolonged and severe drought that the region has encountered in recent history. This drought surpasses that of 2010-2011 and 2016-17. It was projected that about 21 million people could face acute food insecurity between October and

December 2022, and over 8.9 million livestock have died across the region. Furthermore, pastoralists are reportedly traveling further to find food and water for their livestock, which often leads to an increase in conflicts between communities. In some areas, agro-pastoralists and agriculturalists are experiencing poor crop yields due to prolonged crop moisture stress, resulting in a reduction of up to 70% in crop yields during the 2022 long rains season.

URUGUAY: The country has been facing severe droughts in its agricultural areas since 2018, which have led to reduced rainfall and increased temperatures during the summer seasons. According to reports, 60% of the country's territory is experiencing extreme or severe drought. Over 75,000 people have been affected by the emergency, with the lack of access to safe water being a pressing concern. To address the situation, the national government declared a state of agricultural emergency until the end of April 2023. The emergency declaration includes livestock, dairy, fruit, horticulture, agriculture, poultry, beekeeping, and forestry. Reports indicate that droughts are affecting the country, with 20.51% of the territory experiencing extreme drought. The situation remains a concern for the country's food security and rural development.

ARGENTINA: Since 2019, several parts of Argentina and neighboring countries have been experiencing drought conditions. During the months of September, October, November, and December 2022, the precipitation levels were below half of the average, marking the lowest rainfall in 35 years. The combination of low precipitation and high temperatures (with the country experiencing its warmest November-January) has led to widespread crop failure. Consequently, the country, which is one of the major wheat exporters, expects a 28% drop in total exports compared to the 2022 levels.

PERU: As of November 2022, Peru's government declared a state of emergency aimed at the drought situation in the country, which according to the national weather service, Senamhi, is one of the worst when compared to the past half century, which is exacerbated by the offshore La Nina weather phenomenon. The drought in the Peruvian Andes has ravaged alpaca flocks and withered potato crops. Also, the Andean hamlets for Quechua- and Aymara-speaking indigenous groups have faced critical losses of crops and livestock herds.

Türkiye: As of December 2021, the country experienced its warmest December in nearly 52 years, leading to a drastic decrease in rainfall and exacerbating the drought situation in Türkiye, particularly in many of its agricultural areas. The critically low dam levels resulting from the drought could negatively impact the country's agricultural output. The lack of snow and rain during winter worsens the drought conditions, putting many parts of the country at risk of further suffering. As the drought persists, the production of fruits and vegetables will most certainly be negatively affected, which will not only impact the agricultural sector but also put significant strain on the country's economy and food security. The great earthquake in Türkiye occurred after this monitoring period, and the impact of the earthquake will be the focus of the next monitoring period.

Desert locust

According to the FAO's reports, the Desert Locust situation in October 2022 was calm, with only low numbers of solitarious adults and hoppers observed in certain areas. In northwest Mauritania, a few copulating adults and transients' hoppers were treated in an area of 213 ha, while a group of adults was sighted in Sudan. Light rain fell intermittently along the Red Sea coast of Yemen, and rain had started in some parts of the coast of Sudan, Eritrea, and Saudi Arabia. No locusts or rain were reported in Southeast Asia during this period.

In November 2022, the CASEarth working group on Monitoring and assessment of desert locusts in Asia and Africa reported that suitable conditions for the survival and reproduction of the desert locust were observed in northwestern Somalia due to increased rainfall and vegetation. A total of 54.7 thousand hectares of vegetation were damaged during this period, including 0.2 thousand hectares of cropland, 2.1 thousand hectares of grassland, and 52.4 thousand hectares of shrub, which account for 2.06%, 0.5%, and 1.1% of the total country's area of cropland, grassland, and shrub, respectively. The north-West province had the largest damaged area of 23.3 thousand hectares, followed by Togdheer with 17.5 thousand hectares, and Sanaag and Awdal with 8.9 and 5.0 thousand hectares of affected areas, respectively. During the same period, the western coast of the Red Sea in Yemen reported the presence of Desert Locust due to the combination of low rainfall and sufficient vegetation, which creates favourable conditions for their survival and reproduction. The total vegetation damage in the region was about 64.4 thousand hectares, with 8.2 thousand hectares of grassland and 56.2 thousand hectares of shrub, accounting for 2.85% and 1.40% of the total area of grassland and shrub in Yemen, respectively. In December 2022, a very small outbreak continued in northwest Mauritania and low numbers of locust adults were observed in the southern Western Sahara of Morocco.
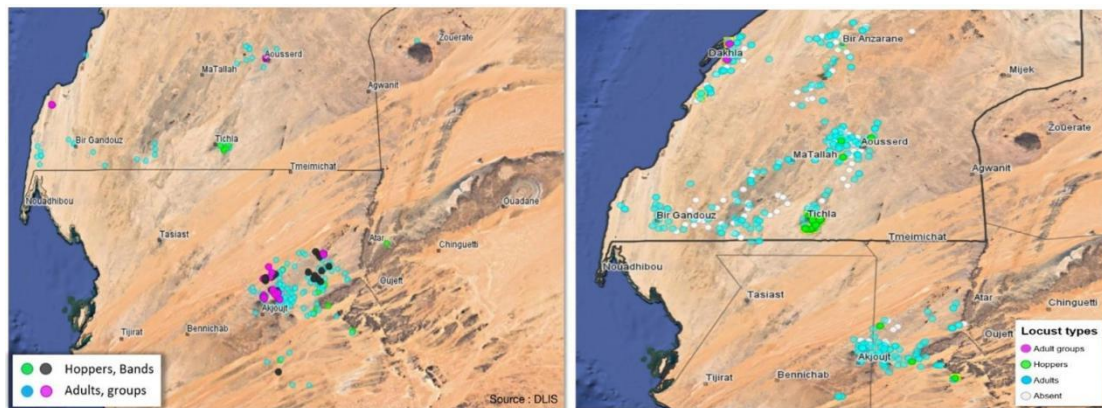

Figure 5.4 Desert locust situation as for December 2022, on the left (Source: http://desertlocust-crc.org/Pages/NewsDetails.aspx?lang=EN&Cat=2&I=0&DId=0&CId=0&CMSId=800362&id=2407045) and January 2023, on the right (Source: https://www.fao.org/ag/locusts/en/info/info/index.html)

In January 2023, scattered hoppers and adults with a few adult groups were present in the southern Western Sahara of Morocco. On the Red Sea coast, hoppers and adults were present in Sudan and low numbers of adults were present on the coast of Yemen, Saudi Arabia, Eritrea, and northwest Somalia.

5.4 Update on El Niño

According to the Australian Government Bureau of Meteorology, the La Niña event in the tropical Pacific Ocean is ongoing, and while oceanic indicators like sea surface temperatures have weakened to ENSO-neutral values, the atmosphere remains La Niña-like. Despite the weakening, La Niña can continue to impact global weather and climate. Forecasts suggest that sea surface temperatures in the central Pacific Ocean will warm further, but remain at neutral levels until at least mid-autumn.

Figure 5.4 depicts the standard Southern Oscillation Index (SOI) behavior from January 2022 to January 2023. The SOI has been positive and high (greater than +7) for the past four months, with the exception of November 2022. However, there has been a recent weakening trend, with the SOI declining from 20 in 2022 to 11.8 in 2023. This suggests a weakening of La Niña's influence, despite its continued presence during the monitoring period.
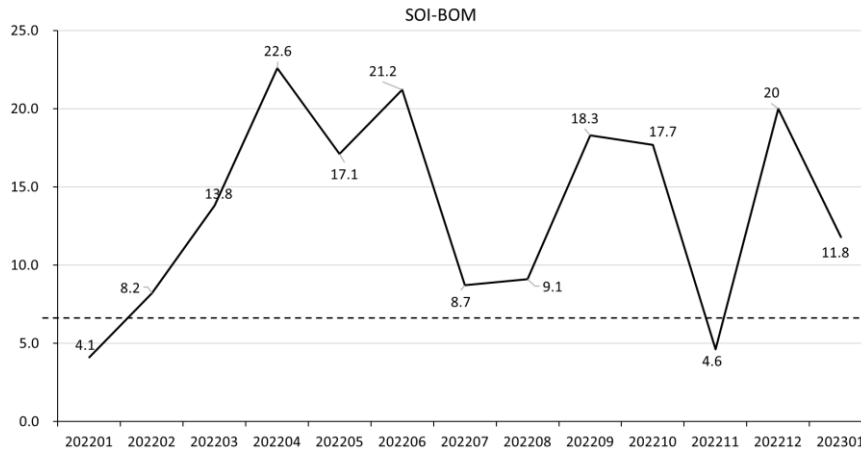
Figure 5.5 Monthly SOI-BOM time series from January 2022 to January 2023 (Source: http://www.bom.gov.au/climate/enso/soi/)

The Oceanic Niño Index (ONI) is another widely-used measure of El Niño. Figure 5.5 displays several ONIs and their respective locations. A quick analysis of Table 5.2 reveals that all three regions (NINO3, NINO3.4, and NINO4) had negative values throughout the four-month period, with the values for NINO3 and NINO3.4 regions consistently negative and of similar magnitude. The NINO4 region exhibited consistently negative values of less than -5°C, which is indicative of cooler-than-average sea surface temperatures and consistent with a La Niña event. It's worth noting that the negative values in the NINO indices suggest the persistence of La Niña conditions in the tropical Pacific Ocean during this period. However, the values for January 2023 were less negative than those of the previous three months, indicating a possible weakening or transition to neutral conditions.
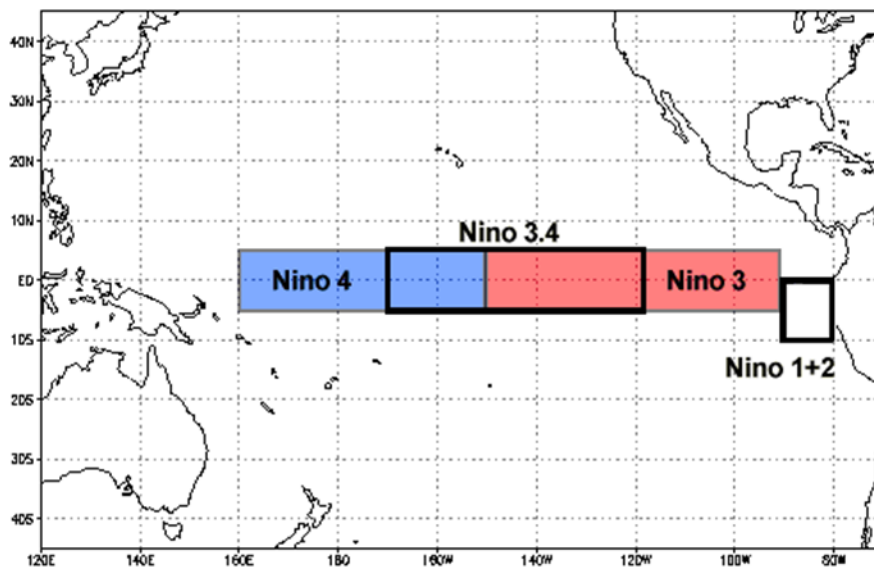

Figure 5.6 Map of NINO Region(Source: https://www.ncdc.noaa.gov/teleconnections/enso/sst)

Table 5.2 Anomalies of ONIs (°C), October 2022 to January 2023(Source: https://www.cpc.ncep.noaa.gov/data/indices/sstoi.indices)

Year	Month	NINO3	NINO3.4	NINO4
2022	10	-0.92	-0.85	-1.08
2022	11	-0.89	-0.93	-0.90
2022	12	-0.78	-0.84	-0.73
2023	1	-0.50	-0.69	-0.60

Sea surface temperature (SSTs) (Figure 5.5) for January 2023 were cooler than average across the central tropical Pacific Ocean, extending from around 170°E to around 100°W, although anomalies were generally less than 1 degree cooler than average. Warm anomalies up to 2 degrees above average were observed in a band across the South Pacific stretching from the South American coast around 40°S towards the Coral Sea, while weaker warm anomalies were present across much of the Maritime Continent. Warm SST anomalies also continue to the south of Australia, especially around Tasmania and in waters close to New Zealand.
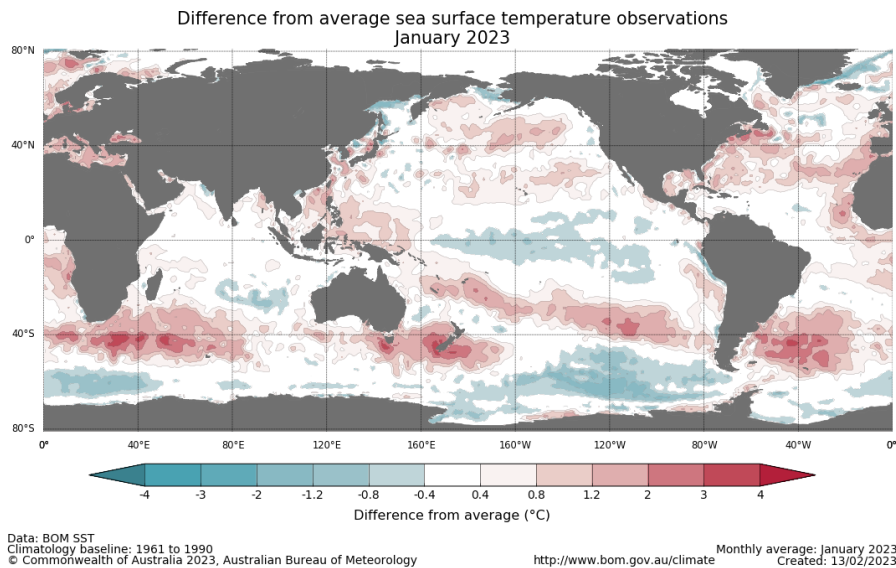

Figure 5.7 Monthly temperature anomalies for January 2023(Source: http://www.bom.gov.au/climate/enso/index.shtml#tabs=Pacific-Ocean)

La Niña has affected different regions in different ways, including more frequent and intense tropical cyclones in the western Pacific, increased rainfall in parts of Southeast Asia, Australia, and South America, drier conditions in parts of Indonesia, Malaysia, and the Philippines, and colder temperatures in some parts of North America. These effects are ongoing, but are expected to ease in the coming months.

East Africa

The Horn of Africa is currently facing its worst drought in over 40 years, with Ethiopia, Kenya, and Somalia experiencing persistent and widespread drought, particularly in the eastern coastal regions. The cause of this drought can be attributed to the jet stream, which is diverting moisture away from the region to areas with lower atmospheric pressure. Unfortunately, the drought is ongoing and is expected to likely continue through the summer of 2023. Urgent humanitarian aid is required on the ground to address the situation [2].

South America

This current La Niña event has persisted for an unusually long period of time and is the primary cause of the devastating drought that has been impacting central South America. The region has been experiencing drought since 2019, with Uruguay declaring an agricultural emergency in October of last year. In addition, the central region of Argentina has experienced its driest year since 1960, resulting in widespread crop failures (figure 5.7). The southern region of Brazil, including Rio Grande do Sul, has also been affected by the drought.

In summary, La Niña has continued to prevail over the past four months, but has begun to weaken. The impacts of La Niña on global weather and climate are ongoing, but it is difficult to predict specific climate events or disasters that may occur in a particular location during a specific time frame.

Figure 5.8 A general view of a farm shows corn and cotton that was planted where corn was ruined by the weather, in Tostado, northern Santa Fe Argentina in February 8, 2023.