Chapter 5. Focus and perspectives

Building on the CropWatch analyses presented in chapters 1 through 4, this chapter presents first early outlook of crop production for 2020 (section 5.1), as well as sections on recent disaster events (section 5.2), and an update on El Niño (5.3).

The unprecedented "triple" La Niña event ended in the spring of this year. The likelihood of a strong El Niño event in the summer is increasing, raising the risk of extreme weather events. As a result, global agricultural production may continue to face significant challenges.

5.1 CropWatch food production estimates

Methodological introduction

CropWatch production estimates are based on a combination of remote-sensing models combined with CropWatch global agro-climatic and agronomic indicators as well as meteorological data from over 20,000 meteorological weather stations around the world. The major grain crops (maize, rice, wheat) and soybean production of 47 major producers and exporters are estimated and predicted for 2021. The results are as follows.

Production estimates

Based on the global agro-climatic conditions and agricultural indicators, global wheat production is forecast to be 746 million tonnes with an increase of 5.47 million tonnes (+0.7%); global soybean production is 327 million tonnes with an increase of 7.13 million tonnes (+2.2%); global corn production is 1049 million tonnes with an increase of 0.4%; global rice production is 751 million tonnes with a decrease of 0.5%. From January to April 2023, agro-climatic conditions were generally normal in the wheat-producing countries in the northern hemisphere, and the wheat production is good. Drought-season rice in South and Southeast Asia, which is largely dependent on irrigation, experiences a slight change in yields. All in all, the global food production is expected to be normal.

Wheat: In 2022-2023, global wheat production is estimated to be 746 million tonnes with an increase of 5.47 million tonnes over 2021-2022. Most European countries, Morocco and other wheat producing countries experienced a relatively large recovery and production increase. The most noteworthy improvements were estimated for Romania, Hungary, Morocco and Belarus, resulting in increases in production by 18.1%, 16.7%, 14.8% and 11.6%, respectively. Turkey suffered from a strong earthquake and a rainfall deficit in February, but the earthquake had a more limited effect on crops. The abundant rainfall since March has eased the drought conditions, leading to an increase in wheat production by 12.7%. In India and Pakistan, wheat yields and total production increased slightly to 94.99 million tonnes and 25.89 million tonnes, respectively, due to generally normal agro-climatic conditions and the absence of extreme heat which had caused yield losses in March 2022. Wheat cultivation area increased by 1.8% in China, leading to a recovery in wheat production to 136.33 million tonnes with an increase of 2.14 million tonnes (+1.6%). In Afghanistan, Uzbekistan and the main production areas in USA, wheat production was

affected by drougth conditions, causing a reduction in area and yield. This led to a decrease in production by 14.6% in Afghanistan, by 12.4% in Uzbekistand and 5.2% in the USA. In Russia, wheat cultivation area fell by 4.9%, with total wheat production falling by 5.4%. Global wheat production is good, but global wheat supply and demand will remain tight due to the Ukraine crisis.

Soybean: Soybean production in Brazil and Argentina, two major agricultural countries in South America, reached 150.41 million tonnes, with an increase of 3.5 million tonnes by 2.4%. Although neighbors, Brazil and Argentina have very different agro-climatic conditions and soybean production. In Argentina, the major soybean production areas experienced prolonged dry weather throughout the growing season, with drought conditions not only affecting soybean planting but also leading to a substantial reduction in soybean yields. As a result, soybean production in Argentina fell by as much as 9.77 million tonnes to 42.01 million tonnes, which is the biggest drop in five years. In contrast, rainfall was basically the same as last year in main Brazilian soybean production areas. Rainfall was normal during the flowering period, resulting in significantly higher yields than in 2022. Coupled with a small increase in soybean cultivation area, soybean production in Brazil recovered to 108.4 million tonnes. This is an increase of 13.9%, reversing the momentum of two consecutive years of declining yields.

Maize: Total maize production in the countries of the Southern Hemisphere and Equatorial region was 201.25 million tonnes, with an increase of 4.16 million tonnes or 2.1%. Maize production increases or decreases in the major producing countries vary. The first maize production in Brazil decreased, while the cultivation area of second maize increased and irrigated yields increased, so that second maize production is expected to increase substantially, bringing Brazilian maize production to 100.68 million tonnes, with an increase of 10.3%. In Kenya, an increase of maize cultivation area in the long rainy season compensated for the impact of the short rainy season and the reduction in maize production due to drought. Thus, the national maize production increased by 5.3%. In Argentina, the main maize producing areas suffered from a prolonged drought and maize production fell sharply by 9.6%. The rest of the countries experienced relatively small changes in maize production.

Early monitoring indicators of crop cultivation area based on remote sensing indicate that the progress of maize planting in the United States and Canada is slower, lagging behind by 8% and 10%，respectively. However, maize planting in most European countries is progressing much faster.

Rice: In 2023, irrigated rice production in the dry winter-season was generally normal in South and Southeast Asia, with small increases in rice production in Indonesia, Thailand, Vietnam and Sri Lanka, but small decreases in rice cultivation area in Bangladesh, Cambodia, Myanmar, India and the Philippines, with rice production in each country decreasing by 3.0%, 2.2%, 1.7%, 1.4% and 0.8%, respectively. As a result, global rice production decreased by 3.71 million tonnes. Angola, Argentina and Brazil, the countries of the Southern Hemisphere, experienced varying degrees of decline in rice cultivation area, with rice production falling by 4.5%, 3.0% and 0.6%, respectively..

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%
Afghanistan					3,090	-14.6		
Angola	2,730	-0.2	50	-4.5				

	Maize		Rice		Wheat		Soybean	
	2023	Δ%	2023	Δ%	2023	Δ%	2023	Δ%
Argentina	49,690	-9.6	1,790	-3			42,010	-18.9
Bangladesh			46,540	-3				
Belarus					3,340	11.6		
Brazil	100,680	10.3	11,280	-0.6			108,400	13.9
Cambodia			9,580	-2.2				
China					136,330	1.6		
Egypt					11,410	1.5		
France					33,610	0.7		
Germany					25,680	2.3		
Hungary					5,200	16.7		
India			173,620	-1.4	94,990	1.9		
Indonesia	19,250	0.5	65,460	0.3				
Iran					12,040	9.7		
Italy					7,730	4.9		
Kenya	2,040	5.3						
Morocco					6,940	14.8		
Mozambique	2,190	-0.5	420	4.4				
Myanmar	1,980	2.4	24,200	-1.7				
Pakistan					25,890	1.2		
Philippines	7,470	0.6	21,120	-0.8				
Poland					11,060	7.5		
Romania					8,200	18.1		
Russia					81,540	-5.4		
South Africa	11,710	-1.3						
Sri Lanka			2,520	1.3				
Thailand			39,080	0.6				
Turkey					18,990	12.7		
Ukraine					23,340	8.9		
United Kingdom					12,360	-2.3		
United States					48,870	-5.2		
Uzbekistan					7,300	-12.4		
Vietnam			47,380	1.5				
Zambia	3,510	-1.3						
Sub-total	**201,250**	**2.1**	**443,040**	**-0.8**	**577,920**	**1**	**150,410**	**2.4**
Global	**1,049,340**	**0.4**	**750,870**	**-0.5**	**745,530**	**0.7**	**327,170**	**2.2**

5.2 Disaster events

Introduction

This section covers the January-April 2023 disaster events worldwide. Apart from floods, cyclones, and droughts, this section also highlights the current situation of the Desert locust across the globe as well as the current food production situation in war-torn Ukraine.

Extreme conditions by type

Russia-Ukraine conflict

Ukraine and Russia collectively supply around one-third of the wheat that is traded globally. They are also significant providers of fertilizer, cooking oil, and feed grains like maize. These nations play a vital role as suppliers to numerous countries in the Middle East and Africa. However, the Russian invasion of Ukraine caused a severe disruption in the wheat supply. This disruption has led to a surge in prices and far-reaching consequences, affecting various agricultural products such as maize, vegetable oil, and fertilizer on a global scale. Nevertheless, a year after the invasion, some positive developments in crop production can be observed. According to the Remote Sensing CropWatch monitoring system, agronomic indicators show that between January and April 2023, the national cropped arable land fraction (CALF) increased by 7% compared to the average of the past five years. The southern wheat and maize regions experienced even higher increases in CALF, with respective growth rates of 14% and 6%. Moreover, despite a decrease in photosynthetic active radiation (RADPAR) by 16%, the country recorded an overall increase in biomass production by 5% due to above-average rainfall.

If the grain exports from Ukraine can be sustained in the coming months, supply and demand on the international grain market may become better balanced, resulting in lower food prices for those who are suffering from hunger.

Desert Locust situation

The desert locust is a grasshopper found in the desert and semi-arid regions of Africa, the Middle East, and Asia. They form swarms and can cause significant crop damage and they have been a threat to food security for centuries and remain a concern for affected countries. This section highlights the desert situation during the period of January to March 2023. The spatial distribution of the desert locust thought the reporting period is shown in Figure 1. At the beginning of the reporting period, the Desert Locust situation remained calm. In the southern Western Sahara of Morocco, scattered hoppers and adults were observed, including a few adult groups. Similarly, in nearby Mauritania, there was a decline in locust numbers. Ground teams treated a total area of 467 hectares in Morocco and 35 hectares in Mauritania. Sudan's Red Sea coast had hoppers and adults present, and a few hopper groups began to form. In Sudan, a total of 204 hectares were treated. Yemen's coast had low numbers of adults, and a few adults were seen in Saudi Arabia, Eritrea, and northwest Somalia. In February, the Desert Locust situation remained relatively stable. However, like in January, there were sightings of small groups of adult locusts in scattered locations, particularly in the southern Western Sahara region of Morocco, where some mating behavior was observed. To address this issue, a total of 606 hectares were treated. In Sudan, adult

locust groups increased along the Red Sea coast and subcoastal areas as vegetation began to dry out. A total of 3,826 hectares were treated to control the population. In Saudi Arabia, a few mature groups of adult locusts were observed mating on the northern Red Sea coast, and 410 hectares were treated to address this issue. Only a small number of adult locusts were present in southeast Egypt and the Red Sea coast of Yemen.

Throughout March, the Desert Locust situation remained relatively calm, with breeding occurring in Saudi Arabia. At the end of the winter season, small numbers of solitary adult locusts and a few groups were observed in various regions, including southern Western Sahara, south of the Atlas Mountains in Morocco, and the Red Sea coasts of Sudan and southeast Egypt. In Saudi Arabia, adult locust groups had been laying eggs since the end of February in two small areas along the northern coast. By March, these eggs had hatched, resulting in new hoppers that had formed small groups and some bands. Meanwhile, in Yemen, only a small number of adult locusts were observed along the Red Sea and Gulf of Aden coast. During the month of April, the Desert Locust situation remained calm. However, the small outbreak that developed from the spring breeding in March increased in Saudi Arabia in April. By the end of April, some late hopper groups, bands, and new immature adult groups were observed. Furthermore, in Northwest Africa, there were small hopper groups and bands present in the south of the Atlas Mountains in Morocco, as well as further south in Western Sahara, and control measures were carried out.

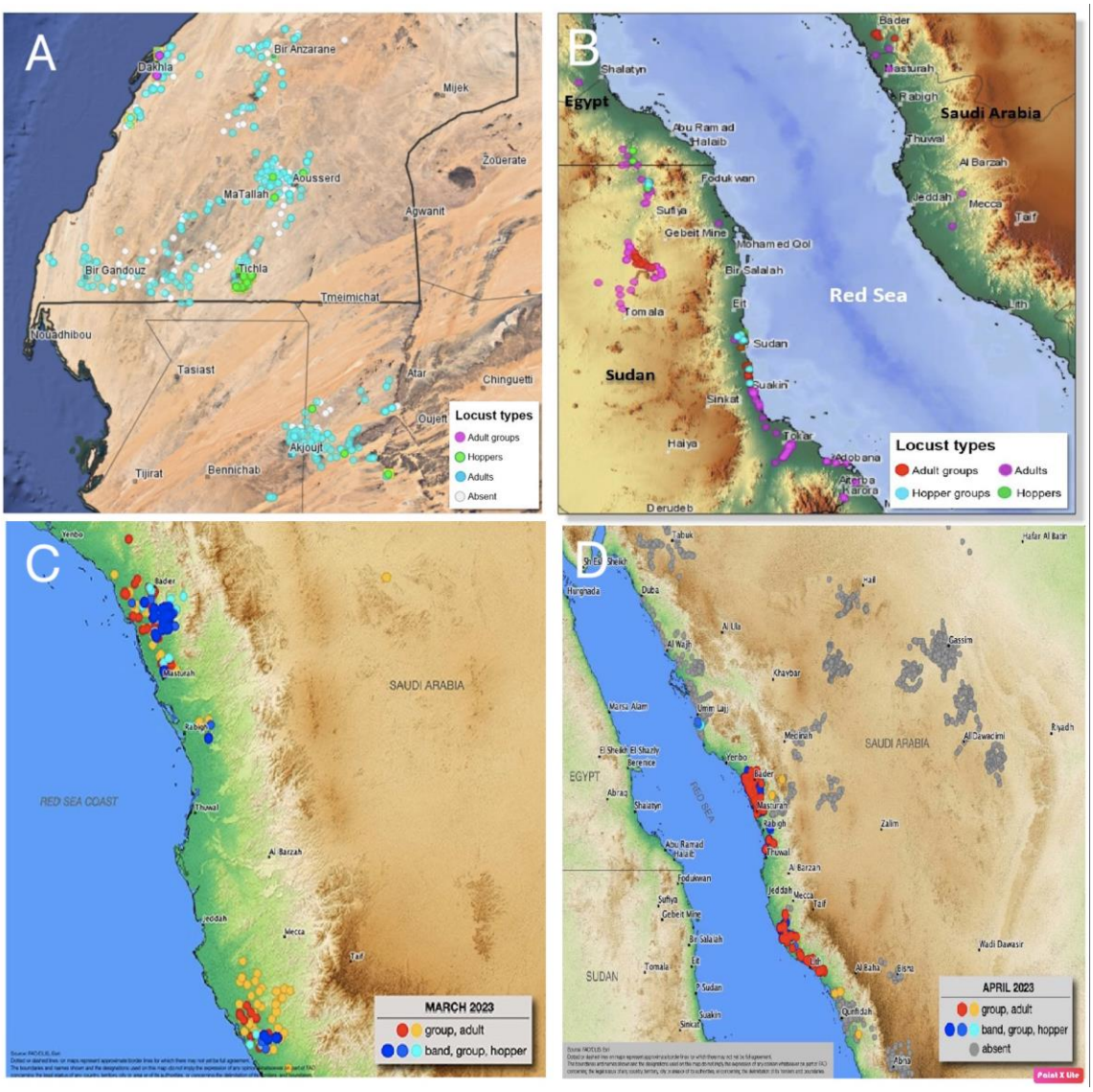

Figure 5.1 Desert locust situation during January-April 2023 (A-January, B-February, C-March, and D-April)

Cyclones, floods, and landslides

Cyclone Freddy's effects in Madagascar, Mozambique, and Malawi: On February 21, 2023, Tropical Cyclone Freddy struck the eastern coast of Madagascar. Initially a category 3 cyclone, Freddy then proceeded to impact Mozambique and Malawi. Its impact on the precipitation in Mozambique is shown in Figure 2.

The aftermath of this cyclone brought about widespread devastation, including extensive destruction, flooding, and relentless downpours, affecting over 1.4 million individuals across the three countries of Mozambique, Malawi, and Madagascar. This catastrophic event has pushed the capacities of healthcare facilities to their limits. Countless homes, schools, roads, and various forms of infrastructure have been either destroyed or severely damaged, while vast stretches of farmland have become inundated.

The devastating Tropical Cyclone Freddy, which made landfall in the Inhambane district of Vilanculos, Mozambique, on the 24th of February 2023, unleashed its fury upon the region, causing widespread destruction and upheaval. The National Institute for Risk and Disasters Management reported that the cyclone brought with it torrential rainfall, affecting nearly 166,600 people residing in the area. The impact was swift and severe, leaving a trail of devastation in its wake. According to the report, the agricultural sector bore the brunt of the cyclone's wrath, with approximately 38,100 hectares of cropland feeling the full force of its destructive power. The loss was further compounded by the destruction of over 18,700 hectares of land that had been cropped with diverse crops, a blow to the livelihoods and food security of the affected communities.

But the tale of destruction did not end there. After ravaging the Inhambane district, Cyclone Freddy continued its tumultuous journey across Mozambique. Unrelenting, it made a harrowing return and once again made landfall in Quelimane city, Zambezia province, between the 11th and 12th of March 2023. This time, the cyclone unleashed its fury with winds ranging from 106 to 170 kilometers per hour. The provinces of Sofala, Nampula, and Tete, in addition to Zambezia province, experienced the ferocity of Freddy's return. These regions, already reeling from the aftermath of weeks of intensive rainfall and flooding, found themselves subjected to further devastation and suffering. The southern and central parts of the country had already been significantly impacted, but Freddy's return intensified the scale of the disaster in the country, exuberating the current food shortages and the increasing international food prices. The consequences of Tropical Cyclone Freddy's reappearance were staggering. The lives of at least 9,369 people were directly affected, plunging them into a state of despair and uncertainty.

The occurrence of Cyclone Freddy in Malawi caused an outbreak of Cholera, further exacerbating the existing emergency in the country. The southern region of the country experienced the heaviest rainfall, particularly in districts such as Blantyre, Phalombe, Mulanje, Chikhwawa, and Nsanje. Devastating flash floods wreaked havoc in numerous areas, sweeping away homes, and people, and causing extensive damage to infrastructure. The impact of Freddy resulted in a tragic loss of life, with at least 1,216 people reported dead and 537 individuals still missing and presumed deceased. In addition, 1,332 injuries were reported. According to Médecins Sans Frontières, Blantyre alone accounted for at least 192 deaths, including 40 children, while Mulanje recorded 135 fatalities. The disaster forced approximately 180,000 people to evacuate their homes, affecting a total of 500,000 individuals across the country.

The floodwaters submerged over 430 km^2 of land in Malawi, causing significant losses for smallholder farmers. Crops and fields were destroyed, with approximately 204,833 hectares of cropland being inundated. Of this total, 84,930 hectares were submerged, while 119,930 hectares were washed away. The timing of the storm's arrival was particularly devastating as it occurred just as farmers were preparing for harvest, compounding the nation's existing food insecurities. In addition to the agricultural damage, the storm also inflicted significant harm on farms, many of which were damaged or completely destroyed. Livestock suffered greatly as well, with 194,500 animals perishing and an additional 91,000 sustaining injuries. The overall impact of Cyclone Freddy was immense, causing widespread displacement, loss of life, destruction of infrastructure, and severe setbacks to the agricultural sector and local food security.

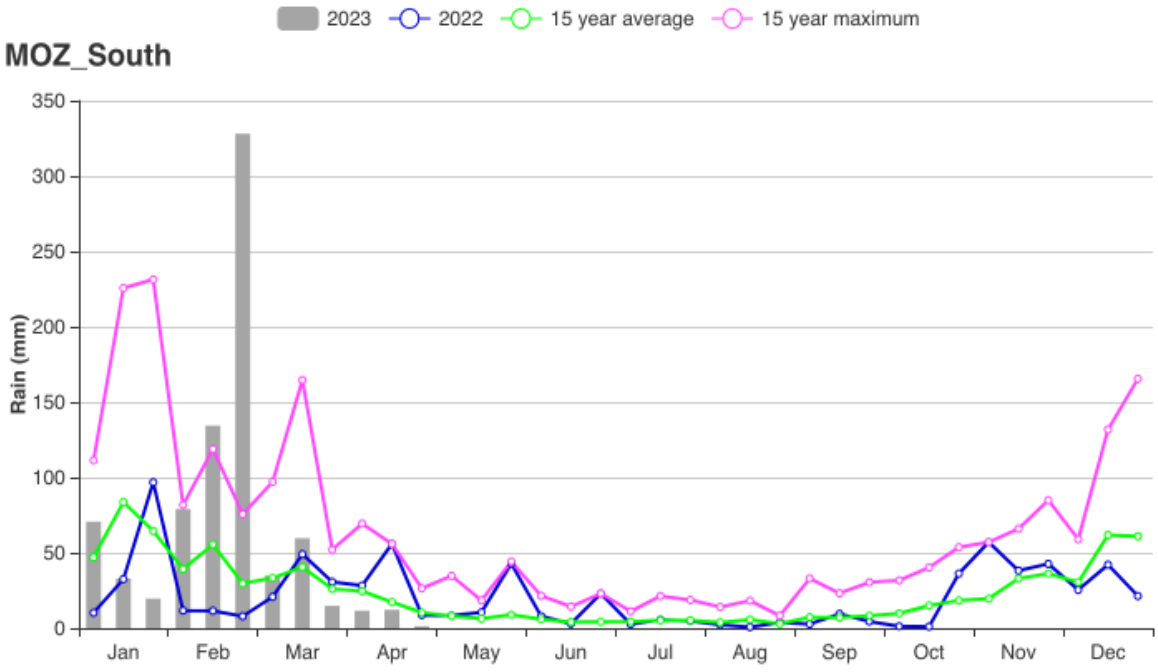

Figure 5.2 CropWatch's rainfall profile in the southern region of Mozambique (January-April 2023)

Türkiye: On 14-15 March 2023, Türkiye experienced heavy rainfall in the provinces of Adyaman and Sanliurfa in the southern region, resulting in devastating floods. In a span of 24 hours, Adyaman received approximately 136 mm of rainfall, while Sanliurfa witnessed around 111 mm of rainfall. Unfortunately, these intense floods have resulted in the loss of 14 lives, according to reports. This flood event occurred at a particularly challenging time for Turkey, as the country was already dealing with the aftermath of a recent earthquake. The combination of these natural disasters has further exacerbated the situation, leaving thousands of people in a state of emergency and in desperate need of food assistance.

California - USA: Since early January 2023, a sequence of nine powerful atmospheric river storms has relentlessly battered the state of California in the United States. These storms have brought heavy rains, snowfall, isolated thunderstorms, and gusty winds. The impact of the storms extends beyond residential areas, as agricultural land in the state has also been affected, posing a threat to California's agricultural production.

With flooded farm fields and the looming prospect of additional rainfall, the prices of food are expected to rise. California is responsible for producing approximately one-third of the vegetables and three-quarters of the fruits and nuts consumed in the US, according to the California Department of Food and Agriculture. Moreover, California holds the distinction of being America's

largest agricultural exporter, with exclusive exports of various products such as almonds, artichokes, dates, and garlic, among others, as indicated by the California Agricultural Statistics Review 2020-2021. The losses incurred in crops due to this series of storms could have repercussions on exports. While grocery prices have remained stable thus far, there is a possibility of an increase in the upcoming weeks if the situation deteriorates, as reported.

Earthquake

The devastating earthquake that occurred on February 6, 2023, in the southern part of Türkiye and the northern part of Syria had severe consequences for agriculture in both countries. In Türkiye, the earthquake had a significant impact on 11 key agricultural provinces, affecting approximately 15.73 million people and more than 20% of food production. Of the affected population, about one-third reside in rural communities and heavily rely on agriculture for their livelihoods, making their situation even more challenging.

In Syria, where an estimated 12.1 million people (over 50% of the country's population) already face food insecurity due to the civil war, the earthquake further exacerbated the situation. Additionally, more than 2.9 million people are at risk of slipping into hunger. The earthquake struck at a time when food prices were already soaring in the country. Agriculture remains a major source of livelihood in several parts of Syria, and the damage to agricultural infrastructure caused by the earthquake could jeopardize food production.

The earthquake's effects on agriculture can also be assessed through Copwatch's national crop development graph, which utilizes the Normalized Difference Vegetation Index (NDVI). During the reported period of the earthquake, the graph indicates below-average crop conditions in both Türkiye and Syria. These unfavorable conditions can have a detrimental impact on crop production, further worsening the existing food insecurity situation in both countries.

Drought

East Africa: Eastern Africa, particularly Somalia, has been teetering on the brink of famine for several months due to a combination of consecutive poor rainy seasons, escalating international food prices, and the rise of conflicts and displacement. The monitoring period has revealed a concerning drought situation in East Africa, characterized by vegetation stress caused by insufficient rainfall or soil moisture deficit, especially in southern Ethiopia and Somalia. Other regions experienced a watch condition due to the lack of rainfall (Figure 3).

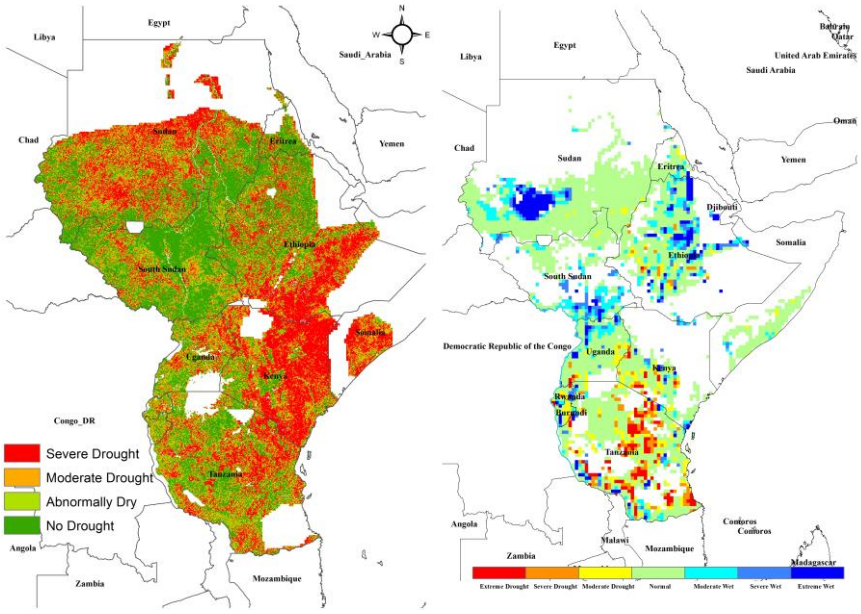

Figure 5.3 Cmbined drought indicator for West Africa from January-April 2023 (left: VHI, right: SPI)

During February, an alert situation persisted in Ethiopia, Somalia, and southern Kenya, with vegetation stress intensifying following inadequate rainfall or soil moisture. By March, the situation further deteriorated in southern Tanzania. The severity of the drought has resulted in a dire food insecurity crisis in the affected areas. Unfortunately, this crisis is expected to persist, leading to elevated humanitarian needs throughout 2023. Forecasts indicate the likelihood of a sixth consecutive failed rainy season extending until May 2023, exacerbating the ongoing food shortage.

South America: South America is currently experiencing a prolonged and extensive drought, resulting from a combination of multi-annual rainfall deficits, above-average temperatures, and a series of heatwaves. The severe drought initially affected Brazil and later spread to the southwest region, currently impacting Uruguay, northern Argentina, and southern Patagonia. This phenomenon is significantly affecting hydrology, river flow, and energy production, consequently leading to vegetation stress and hindering crop development throughout the region. As a consequence, crop yields have significantly decreased. In Argentina, soybean production in 2023 is anticipated to be 44% lower than the average of the previous five years, marking the lowest soy harvest since 1988/89. Figure 4 highlights the drought situation in South America as of April 2023 based on the Standardized Precipitation Index with 4 years accumulation period.

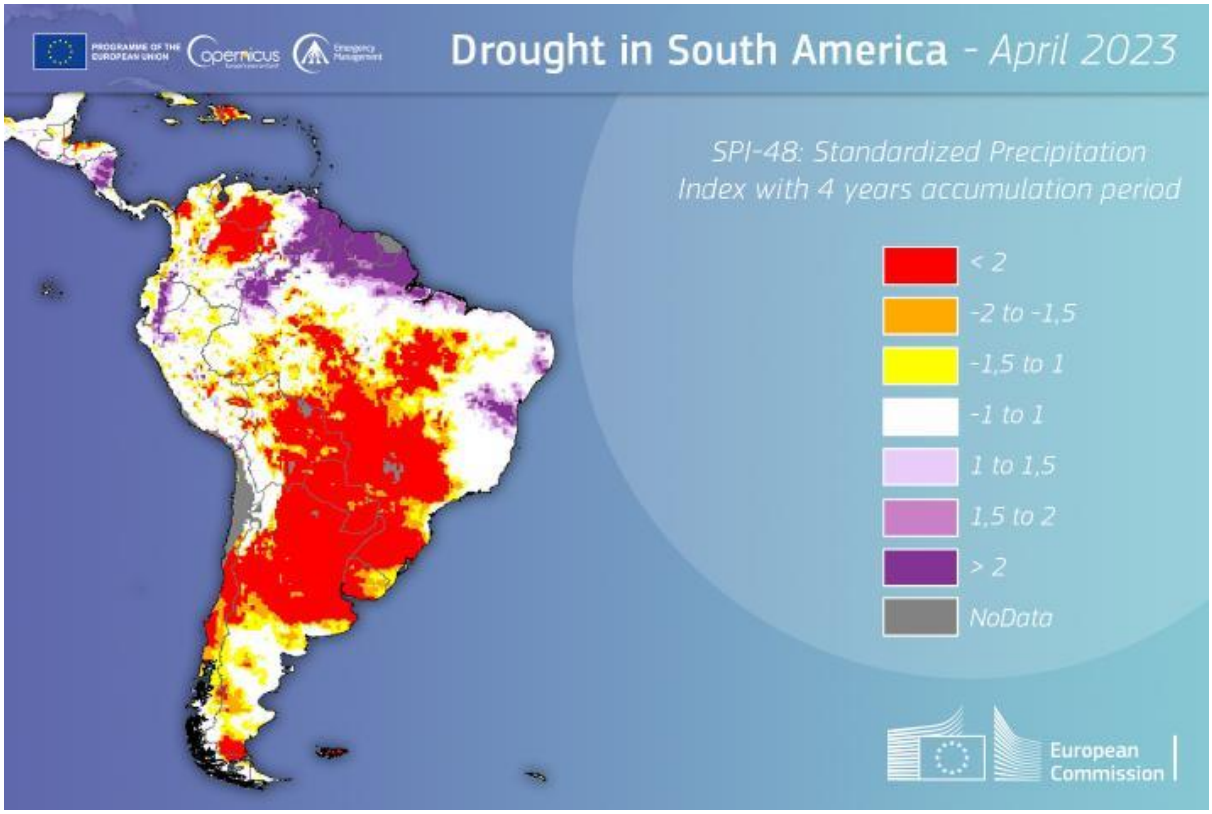

Figure 5.4 Drought situation in South America as of April 2023 based on the Standardized Precipitation Index with 4 years accumulation period.

As South America prepares for the shift to El Niño conditions, seasonal forecasts indicate warmer temperatures and fluctuating precipitation levels. Dryer-than-average conditions are expected in northern Argentina and Uruguay from May to June 2023. Brazil is projected to have average conditions, while central and coastal Peru may experience slightly wetter conditions. It is crucial to closely monitor the situation to gain a better understanding of the precise impacts during the upcoming months. Nevertheless, the prolonged absence of rainfall, severe heatwaves, and the forecasted above-average temperatures are highly likely to further reduce river flows, directly impacting agriculture, ecosystems, and energy production.

Spain: Since the start of the hydrological year, Spain has experienced a significant decrease in rainfall, with current reports indicating a reduction of 28%. This lack of rain has had various consequences, including depleted reservoirs, withered olive groves, and the implementation of water restrictions nationwide. A recent report by Copernicus Climate Change Services highlights that soil moisture levels throughout Europe in 2022 were the second lowest in the past 50 years.

The prolonged drought was further intensified by unseasonable heat. On April 26, a hot air mass from North Africa swept over southern Spain, causing the temperature at Córdoba airport to reach 38.8°C, the highest recorded April temperature in Spain. The effects of the drought are also visible through vegetation stress. Figure 5 presents a map of satellite-derived normalized vegetation conditions across the country. Based on MODIS data, figure 5 displays the anomalies in NDVI (Normalized Difference Vegetation Index) from March 25 to April 23, 2023, compared to the long-term average (2000-2010) for the same period. Southern Spain, being a crucial agricultural region, exhibits negative anomalies, indicating poor vegetation conditions. This is further supported by Figure 6, which depicts the CropWatch National NDVI-based crop conditions development, revealing below-average crop conditions throughout the entire reporting period (2022). These conditions may result in below-average crop production in the country.

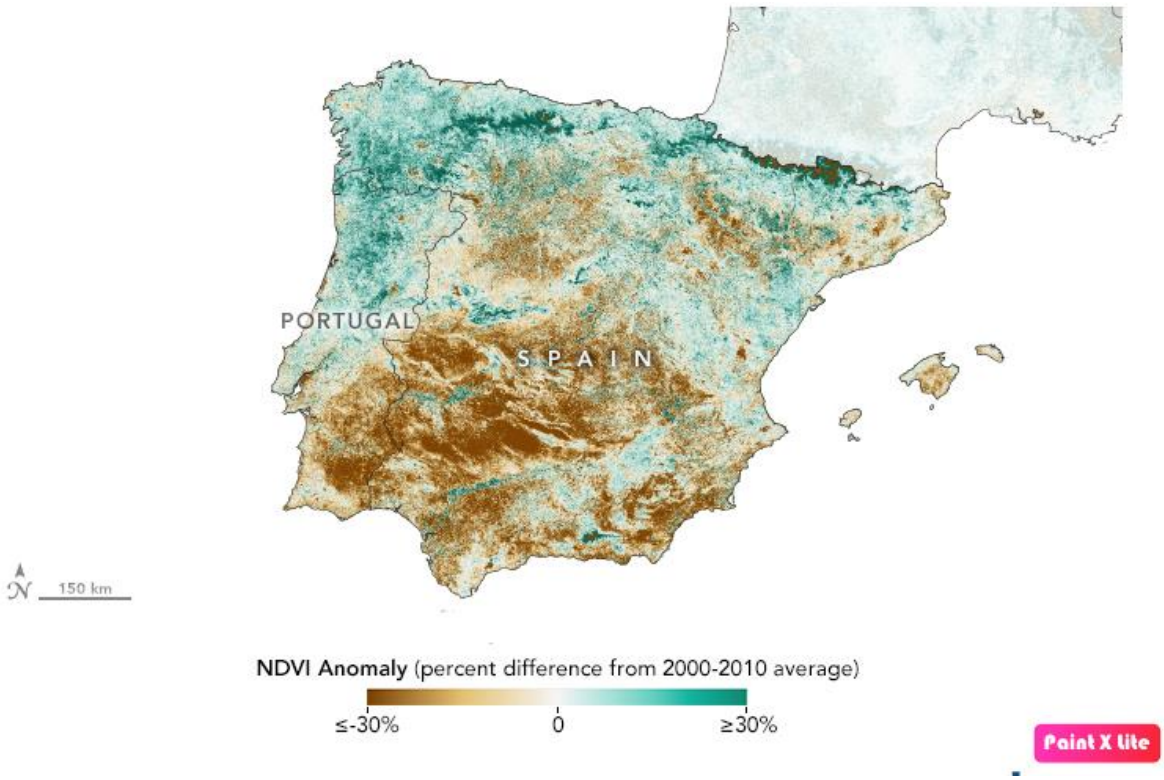

Figure 5.5 Spatial distribution of vegetation conditions based on the NDVI across Spain (March-April 2023) source: https://eoimages.gsfc.nasa.gov/images/imagerecords/151000/151366/iberianndvi_tmo_2023084_2023113_lrg.jpg)

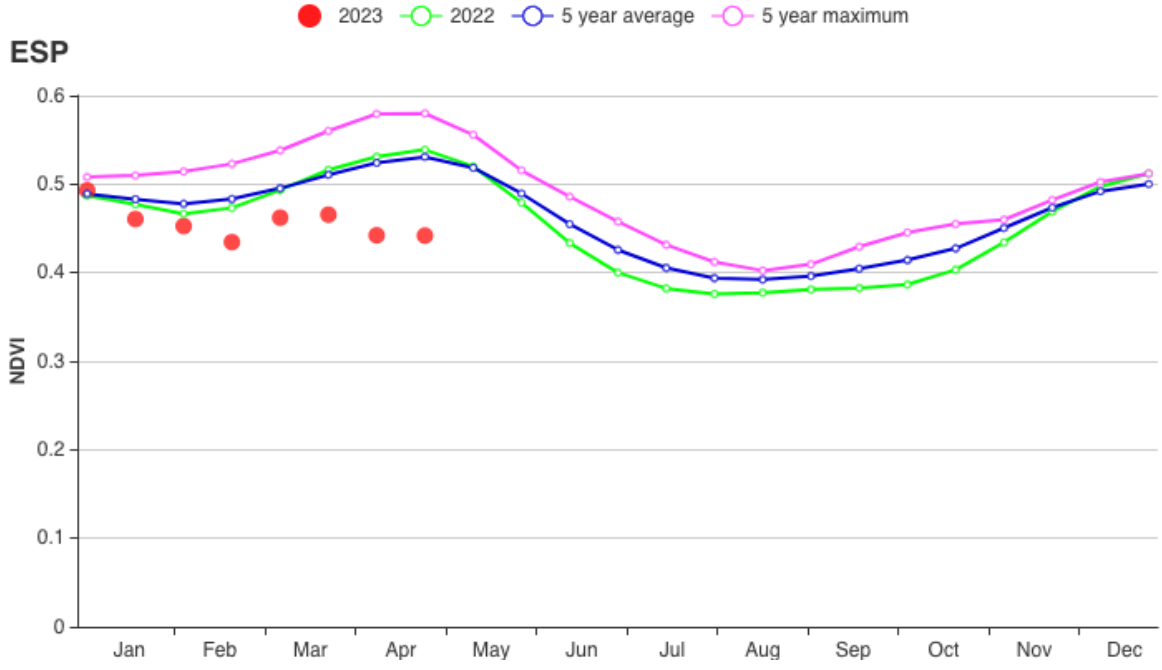

Figure 5.6 Spain crop conditions development graph based on NDVI (January-April 2023)

Maghreb region: The cereal production in the Maghreb region, stretching from Mauritania in the west to the western parts of Libya in the east, is severely affected by drought caused by a lack of rainfall. Cumulative NDVI (Normalized Difference Vegetation Index) anomalies for Morocco, Algeria, and Tunisia, compared to the medium-term period of 2013-2022, indicate unfavorable vegetation conditions and lower crop potential this year in North Africa (see Figure 7).

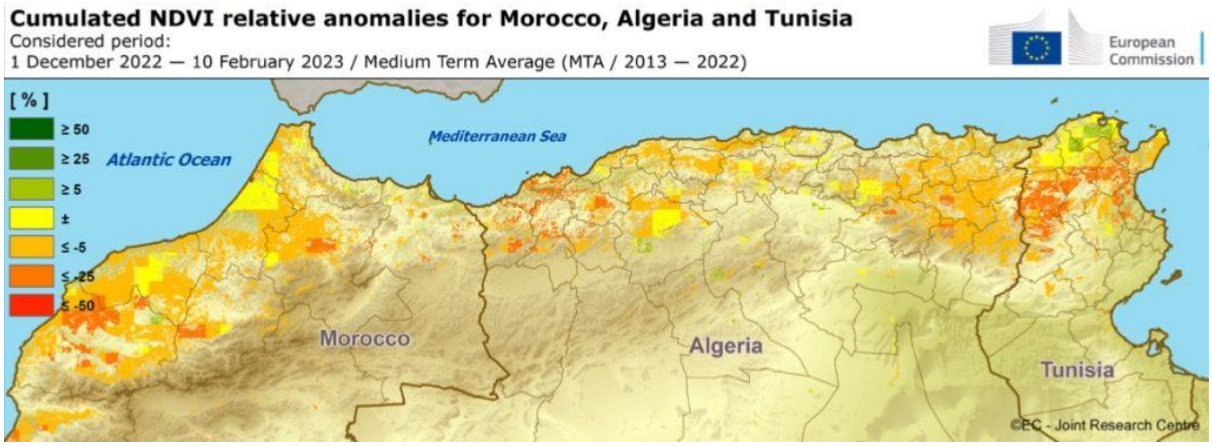

Figure 5.7 NDVI anomalies for Morocco, Algeria, and Tunisia, compared to the medium-term period of 2013-2022(source: https://www.graincentral.com/markets/maghreb-cereal-production-troubled-by-drought/)

Morocco experiences the most severe drought conditions, resulting in a significant loss of production potential. Rainfall levels recorded since September 2022 are the lowest in over 30 years. Consequently, the autumn sowing activity has been delayed by up to 30 days, and some farmlands are too dry for planting. Reports suggest that the wheat area planted in Morocco this season covers 2.38 million hectares, which is 11% lower than the average of the past five years. The expected harvest of 1.49 metric tonnes per hectare is 23% below the five-year average of 1.94 tonnes per hectare.

Tunisia has also been impacted by reduced rainfall, which has directly affected soil moisture levels, surpassing the growth rate of wheat and barley plants, except in irrigated areas. Wheat production is forecasted to be 0.99 million tonnes, 14% lower than the five-year average, considering an average planted area. Barley's output is expected to decrease by 29% compared to the five-year average, reaching 0.37 million tonnes.

The decline in cereal production throughout North Africa will inevitably lead to increased demand for European exports, which are already surpassing the levels seen in the 2021/22 marketing year.

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5.3 Update on El Niño

According to the Australian Government Bureau of Meteorology, The Pacific Ocean is currently ENSO- neutral (neither La Niña nor El Niño), with anomalous warmth in both the east and west of the basin. While oceanic ENSO indicators have continued to warm and are forecast to reach El Niño thresholds during winter, there has been little to no shift towards El Niño in atmospheric ENSO indicators. As a result, the ENSO Outlook remains at El Niño WATCH. This means there is approximately a 50% chance of El Niño developing in 2023 [1].

Figure 5.7 depicts the standard Southern Oscillation Index (SOI) behavior from April 2022 to April 2023. The SOI has been positive and high (greater than +7) in January and February 2023. However, there has been a significant weakening trend, with the SOI declining to -2 and +0.3 in March and April 2023, respectively. This indicates that the La Niña event has concluded.

The Oceanic Niño Index (ONI) is another widely-used measure of El Niño. Figure 5.8 displays several ONIs and their respective locations. The data analysis in Table 5.1 shows a transition from cooler conditions towards a warming trend in the central and eastern equatorial Pacific Ocean during the first four months of 2023. The NINO3, NINO4, and NINO3.4 indices consistently demonstrate this shift, with sea surface temperatures progressively approaching or surpassing average values.

Sea surface temperature (SSTs) (Figure 5.9) for April 2023 were warmer than average over the eastern, southern, and far west of the tropical Pacific Ocean. Warm anomalies up to 2 °C warmer than average were present over these regions, increasing to more than 4 °C warmer than average off parts of the South American coast.

In conclusion, the recent La Niña event in winter has concluded, and the tropical Pacific is currently experiencing a warming phase. However, the atmospheric response to this warming trend remains minimal. It remains to be seen whether an El Niño event will occur in the future.

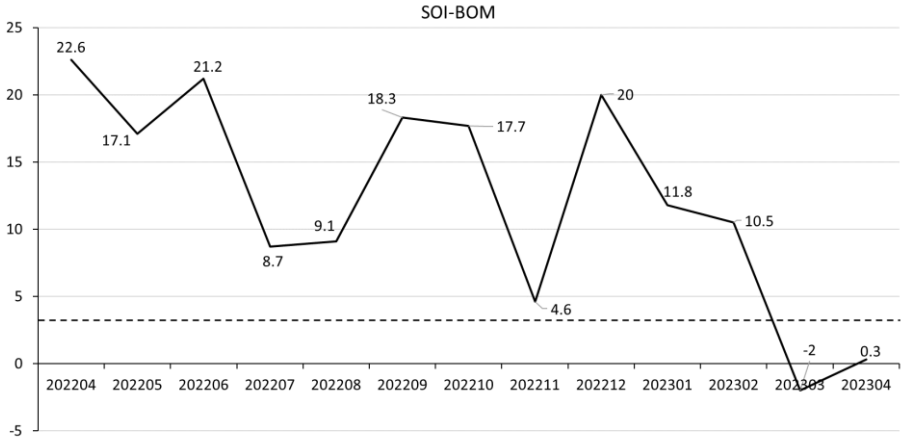

Figure 5.8 Monthly SOI-BOM time series from April 2022 to April 2023

(Source: http://www.bom.gov.au/climate/enso/soi/)

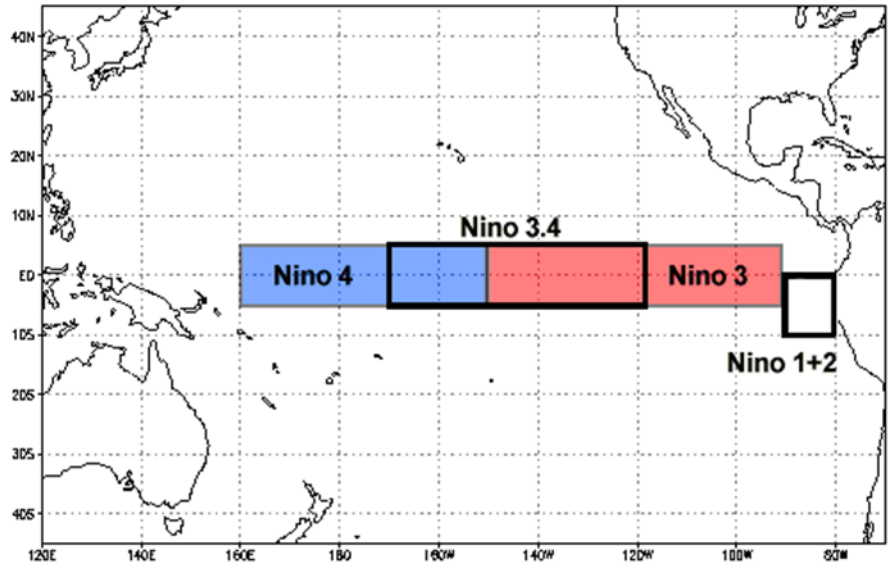

Figure 5.9 Map of NINO Region

(Source: https://www.ncdc.noaa.gov/teleconnections/enso/sst)

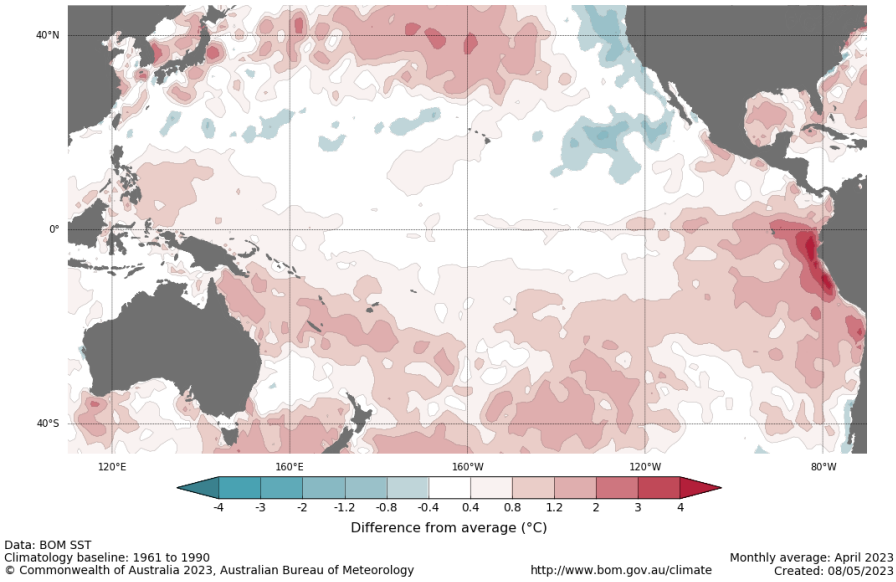

Figure 5.10 Monthly temperature anomalies for April 2023

(Source: http://www.bom.gov.au/climate/enso/index.shtml#tabs=Pacific-Ocean)

Table 5.2Anomalies of ONIs (°C), January to April 2023

(Source: https://www.cpc.ncep.noaa.gov/data/indices/sstoi.indices)

Year	Month	NINO3	NINO4	NINO3.4
2023	1	-0.50	-0.60	-0.69
2023	2	-0.13	-0.52	-0.44
2023	3	+0.36	-0.14	-0.01
2023	4	+0.44	+0.30	+0.19

Main Sources:

[1] http://www.bom.gov.au/climate/enso/index.shtml#tabs=Overview