El Nino & IOD Conditions in Eastern Africa

Past Experiences & Anticipated Impacts in 2023/2024

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5th October 2023

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HIGHLIGHTS

- EL Nino events are associated with the warming of the Sea Surface Temperatures (SST) over the tropical Pacific Ocean, which significantly influences rainfall in various parts of the world. Recent El Nino events occurred in 1982/83, 1987/88, 1991/92, 1997/98, 2002/03, 2004/05, 2006/07, 2009/10 and 2015/16 but at varying strength.

- In the eastern Horn of Africa, rainfall performance during El Nino events is associated with the perturbations in the Sea Surface Temperature (SST) over the Pacific ocean in addition to the Indian Ocean Dipole (IOD) i.e., the warming of the sea surface temperatures in the western pole of the Indian Ocean relative to the east.

- In June 2023, the World Meteorological Organisation (WMO) declared the development of El Nino conditions in the tropical Pacific, and the probabilities of occurrence have remained high, setting the stage for a likely surge in global temperatures and disruptive weather and climate patterns. Similarly, the IOD has been positive since August. The occurrence of El Nino and IOD events in positive status indicates favourable conditions to trigger enhanced rainfall during the October-December season.

- Past El Nino events led to significant climatic, environmental, and socio-economic impacts in the Greater Horn of Africa. This include depressed rains during the June-September rainfall season in parts of Sudan, Ethiopia, Eritrea, and Djibouti. On the contrary, in the south (equatorial) of the region (Kenya, Somalia, south-southeast Ethiopia, Uganda and to some extent Burundi and Rwanda), enhanced/wetter-than-normal rains have been experienced during the October-December season.

- In 2023, even though the El Nino has been declared, the June-September seasonal rains have performed favourably in Sudan, western Ethiopia, western Eritrea, and parts of northern South Sudan. Depressed rains have only been experienced in parts of Ethiopia (southwest, central and northeast), central Eritrea, northern and northeast Uganda, and northern Somalia since July. This implies that the impact this year will be less than during previous events.

- Past El Nino events significantly influenced the vegetation dynamics given the moisture variation. Depressed rains during the June-September period led to insufficient regeneration of the vegetation and poor crop development leading to below-average conditions. This consequently impacted on the availability of livestock grazing resources during the dry season in affected areas. In the equatorial areas, on the other hand, significant vegetation improvement took place due to rangelands recovery, pasture and browse regeneration, and optimal crops development. The abundant vegetation resources provided the much-needed livestock grazing resources during the January-February dry season in the following year.

- During the strong El Nino events (such as the 1997/98, 2006/07 and 2015/16), the enhanced rains and associated floods, landslides and storms led to increased number of affected people especially in Somalia, Kenya, Ethiopia and Uganda.

HIGHLIGHTS

- Wetter-than-normal conditions (due to El Nino/IOD events) generally lead to declining numbers of food insecure populations as demonstrated by statistics for Kenya and Somalia. This is due to improved food production (crops) and availability, and abundant livestock grazing resources in pastoral and agropastoral areas that allow for improved livestock body condition, and increased milk production and consumption. It is therefore anticipated that a wetter-than-normal October-December 2023 will allow communities to recover from the effects of the prolonged 2020-2023 drought.

- Cereals production during years with El Nino events show mixed performance across countries when compared with the year before the event. This is dependent on the magnitude of the rains and the associated impacts. The Deyr seasonal production in Somalia however shows improved production during wetter-than-normal seasons. This is also likely in 2023 despite challenges associated with flooding and crop damage along river basins.

- The performance of post-harvest market prices during El Nino/IOD events vary across countries and markets depending on climate induced production and other factors (macroeconomic, conflicts etc). It is therefore inconclusive to associate price dynamics to climate shocks alone.

- Rainfall forecasts for the October-December 2023 season infer a likely wetter-than-normal season because both the El Nino phenomenon and the Indian Ocean dipole (IOD) are in positive status. Enhanced rains are particularly forecast in Somalia, eastern and northern Kenya, and southern-southeast Ethiopia.

- Given past experiences during El Nino/IOD events, it is expected that the enhanced rains from October through early 2024 will improve water and pastures/browse resources for livestock in pastoral and agropastoral areas, support continued recovery of rangelands from the effects of the prolonged 2020-2023 drought, and enhance seasonal crop production. This will be critical in alleviating food insecurity in the region in coming months.

- Negatively, the enhanced rains will trigger flooding (riverine and flash floods) leading to human displacement and increased needs, damage to properties and croplands/planted crops in flood prone areas, hinder transportation and supply of goods and services in flood affected areas, limit access to services (such as schools and health facilities), increase chances of water-borne diseases (cholera and malaria), and facilitate an upsurge of plant and livestock pests and diseases. Flood displaced populations might be subject to food insecurity, water-borne diseases, protection and gender-based violence (GBV) risks, as well as other humanitarian challenges.

- Moreover, the resulting climatic and vegetation conditions might trigger the breeding and spread of Desert Locusts. Currently, some small swarms and adults have been reported in highlands northeast of Tigray in Ethiopia, Sudan, northern Somalia and Yemen.

- There is therefore the need to strengthen preparedness measures to mitigate or respond to the impacts of a wetter-than-normal October-December season.

Introduction: El Nino Events

- The El Nino Southern Oscillation (ENSO) is an irregular periodic variation in winds and sea surface temperatures over the tropical eastern Pacific Ocean, which leads to significant influence on rainfall across the world[1,2]. It has three (3) phases: EL Nino, La Nina and Neutral.
- The **El Nino** phase is characterised by warming of the sea surface (above-average sea surface Temperatures (SST)) over the central and eastern Pacific while **La Nina** is the cooling of the sea surface (below-average SST) over the same area [3]).
- Historically, El Niño and La Niña events are known to occur every two to seven years, though not on a regular schedule. The El Niño event is more frequent than the La Niña[4]. When they occur, El Nino and La Nina conditions last nine to twelve months but at times can last longer.
- Since 1980, the El Nino and La Nina conditions have occurred on several occasions[5] (Figure 1). The El Nino events have been reported in 1982/83, 1987/88, 1991/92, 1997/98, 2002/03, 2004/05, 2006/07, 2009/10 and 2015/16 with the 1982/83, 1997/98 and the 2015/16 events being very strong and with significant impacts across the globe while the rest were either strong or moderate.

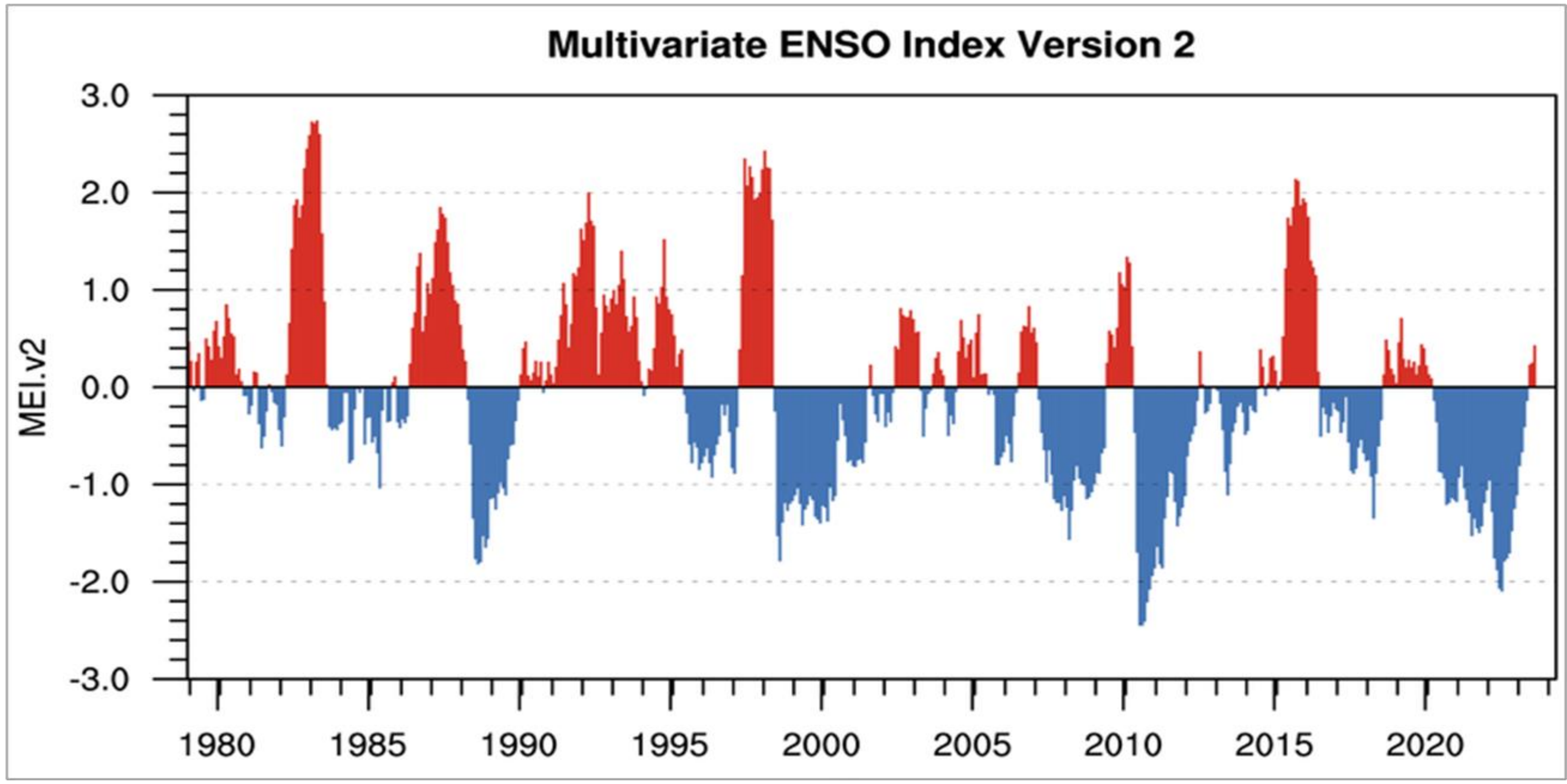
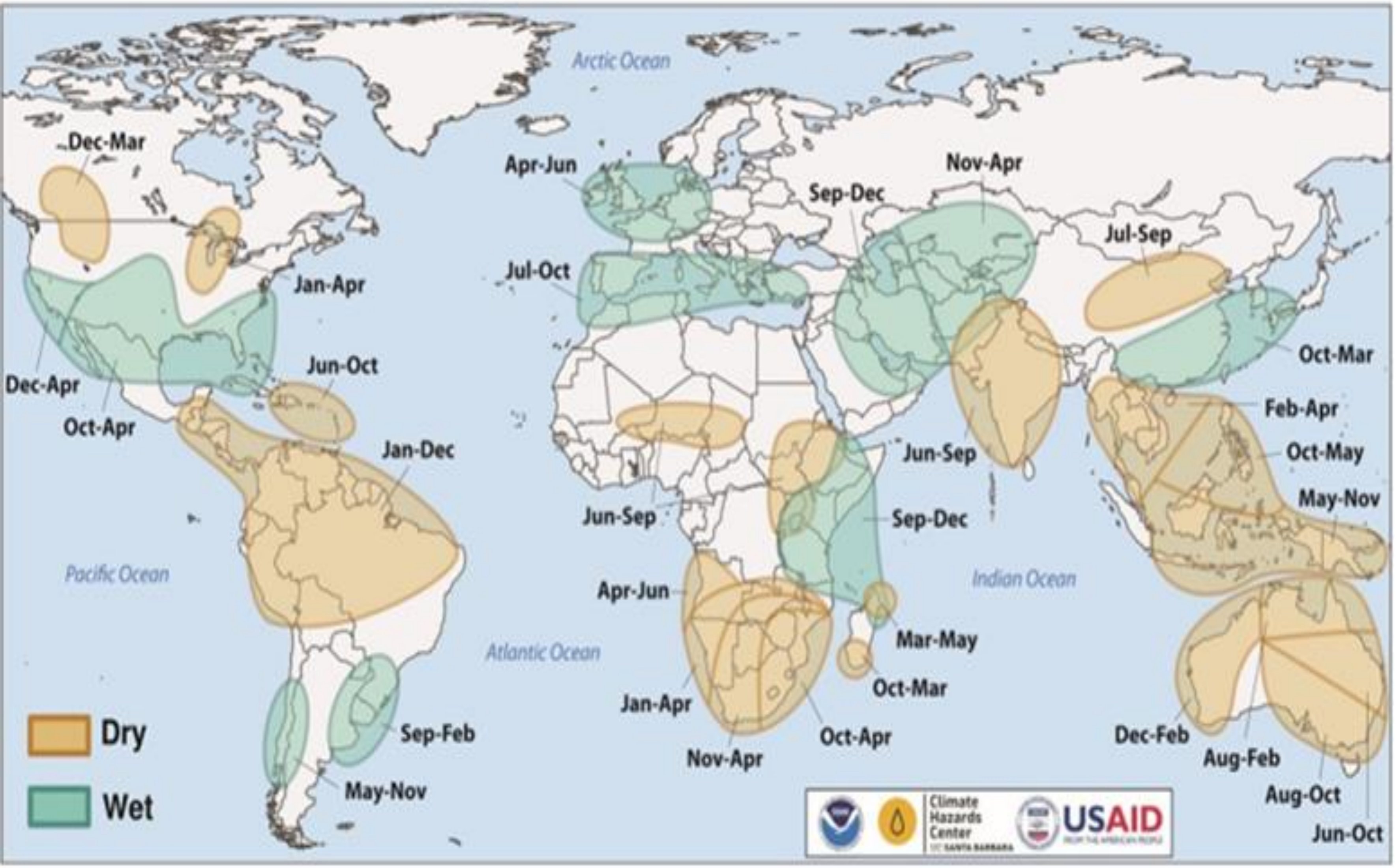


Figure 1: Timelines of the ENSO Index events (Source: NOAA.): Red spikes show occurrence of El Nino events, Blue show La Nina events, and Grey show neutral conditions

- An occurrence of an El Nino event is closely associated with increased likelihood of depressed rainfall or wetter-than-normal precipitation in some parts of the world as shown in Map 1 (slide 5)[5].
- In the Sub-Saharan areas of central and eastern Sahel, it is associated with dry conditions between July-September, which normally affects the main rainfall and growing season in parts of Sudan, Ethiopia, Eritrea, Djibouti, northern South Sudan, and to some extent northern Uganda.

1 El Nino Southern Oscillation: https://en.wikipedia.org/wiki/El_Ni%C3%B1o%E2%80%93Southern_Oscillation
2 What is ENSO: https://www.weather.gov/mhx/ensowhat
3 What is El Nino – Southern Oscillation in a nutshell? - https://www.climate.gov/news-features/blogs/enso/what-el-ni%C3%B1o%E2%80%93southern-oscillation-enso-nutshell
4 What are El Nino and La Nina: https://oceanservice.noaa.gov/facts/ninonina.html
5 NOAA Multivariate ENSO Index Version 2 (MEI.v2): https://psl.noaa.gov/enso/mei/
6 El Nino and precipitation: https://fews.net/sites/default/files/uploads/2pager_elnino_FINAL0.pdf

An Introduction: El Nino Events (conti..)



Map 1: Timing of wet and dry conditions associated with El Nino conditions: Shades of Brown indicate dry conditions and light green shades indicate enhanced rains (Source: Fews Net/USGS

- In the eastern Horn of Africa, the impact of an El Nino event is aggravated by the status of the Indian Ocean Dipole[6] – i.e., the anomaly difference in SST between western and eastern Indian Ocean.
- This is because the warming of the western Indian Ocean relative to the east, increases moisture influx into the eastern areas of the Horn of Africa that enhances rainfall during the October-December season particularly in south-central Somalia, eastern and northern Kenya, and southern-southeastern Ethiopia.
- While El Nino events share some characteristics, each one of them is somewhat different in magnitude, duration, and the resulting climatic impacts[7].
- In 2019, the entire region experienced enhanced rains due to a positive IOD resulting in one of the wettest seasons in record both in the north of the region and in equatorial areas.

6 Drivers and impacts of Eastern African rainfall variability: https://www.nature.com/articles/s43017-023-00397-x
7 Karanja, F.K. & F. M. Mutua (2000), Impacts of the 1997-98 El Nino event in Kenya: https://archive.unu.edu/env/govern/ElNIno/CountryReports/pdf/kenya.pdf

Current Global Status of the El Nino Event

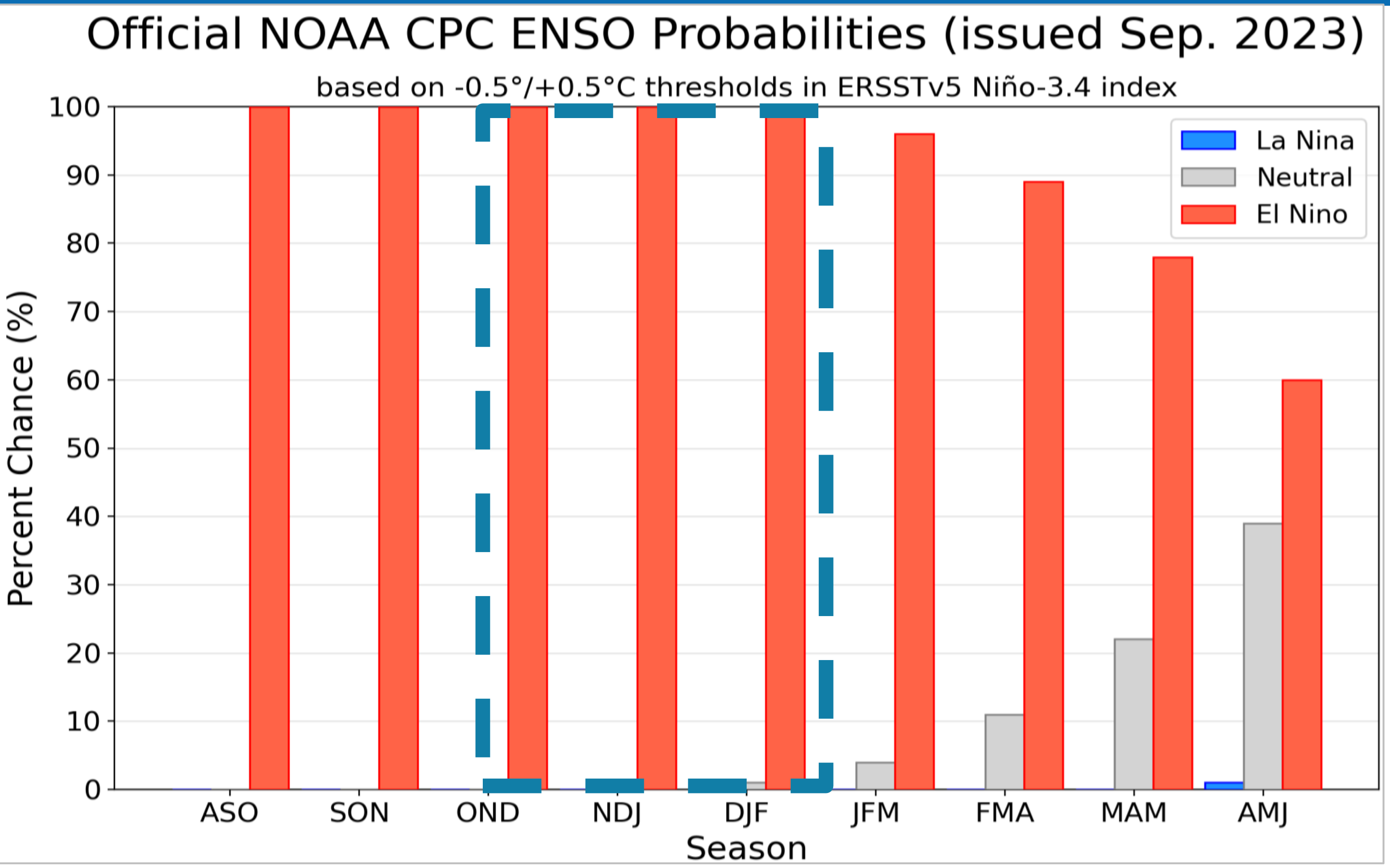


Figure 2: ENSO probabilities for the Nino 3.4 Sea Surface Temperature Index by September 2023 (source: IRI Columbia University)

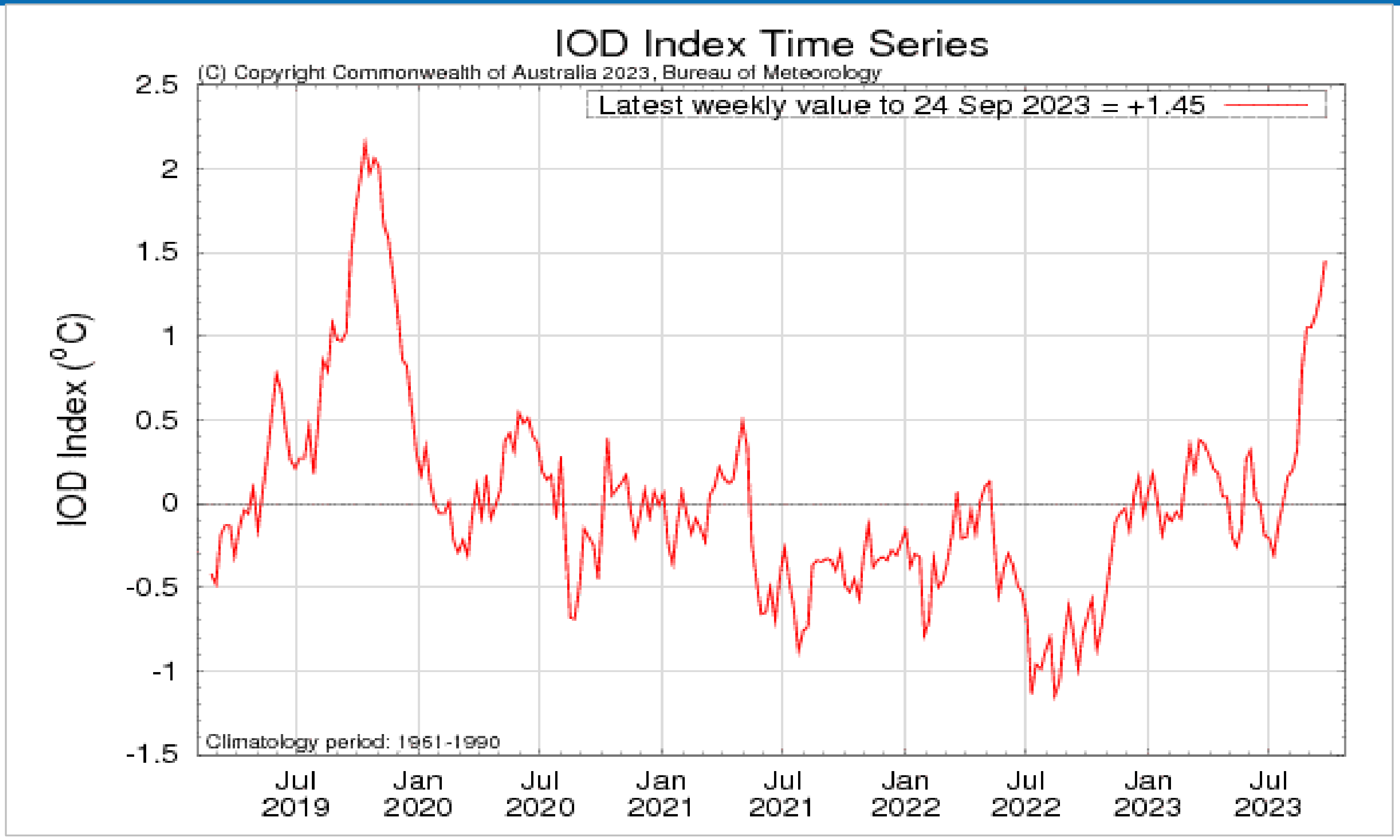


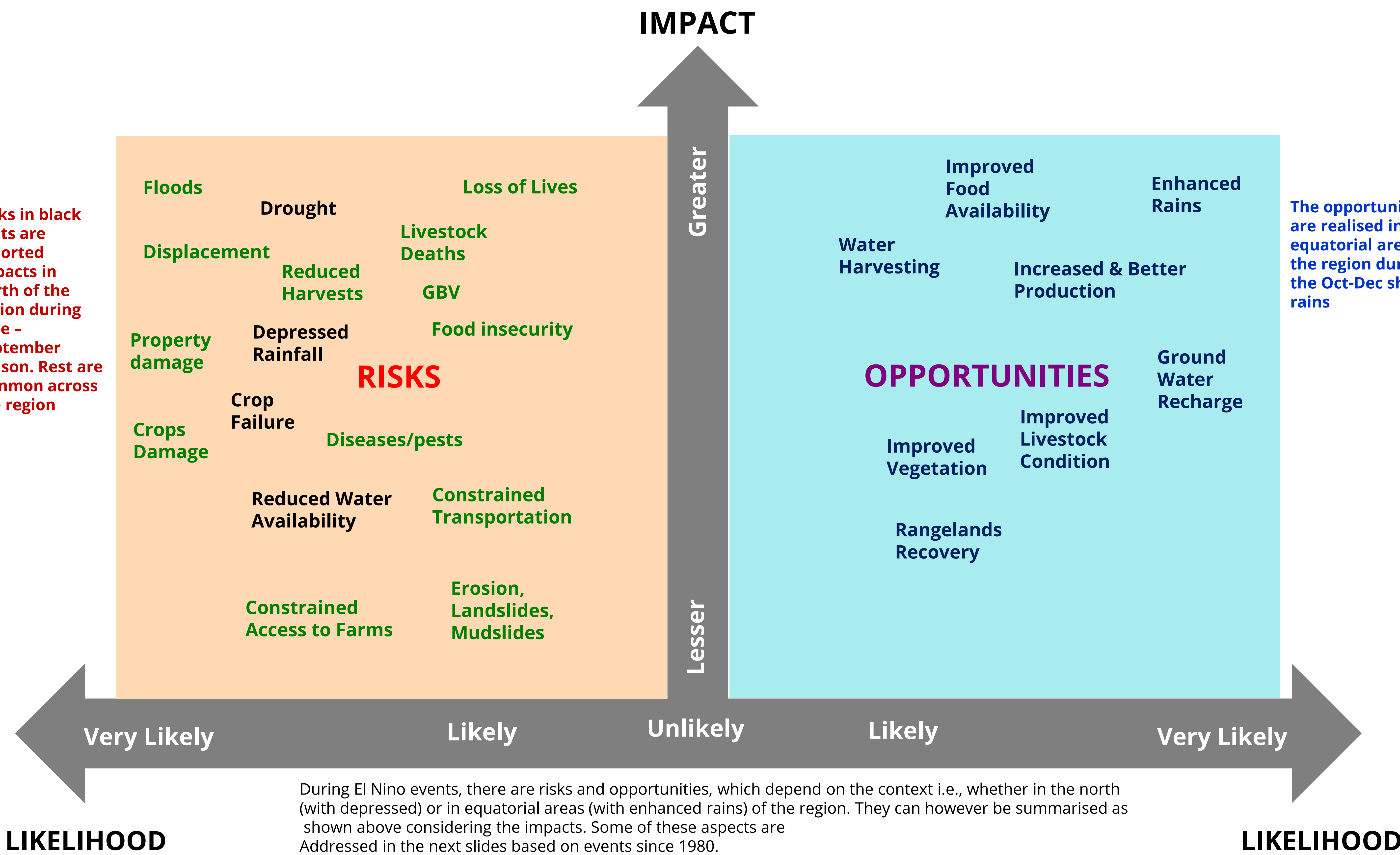
Figure 3: IOD index timeseries from January 2019 – September 2023 (source: Commonwealth of Australia, Bureau of Meteorology

- In June 2023, the **World Meteorological Organisation (WMO)**[8] declared the development of El Nino conditions in the tropical Pacific, setting the stage for a likely surge in global temperatures and disruptive weather and climate patterns.
- An update in September by the **Climate Prediction Center (CPC) of the National Oceanic and Atmospheric Administration Climate Prediction Centre (NOAA)** indicates there are high probabilities (over 80 percent) of El Nino conditions persisting up-to April 2024[9] (Figure 2).
- The IOD index, on the other hand, has been positive since August 2023 according to the **Commonwealth of Australia, Bureau of Meteorology**[10] (Figure 3). It surpassed the +0.4ºC threshold that is linked with wetter-than-normal short rains in eastern Horn of Africa.
- Hence, the current situation where both the El Nino and IOD events are positive signal favourable conditions that can trigger enhanced rainfall during the October-December short rains season in the region.

8 World Meteorological Organization declares onset of El Niño conditions: https://public.wmo.int/en/media/press-release/world-meteorological-organization-declares-onset-of-el-ni%C3%B1o-conditions
9 ENSO forecast - CPC Official probabilistic ENSO forecast: https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/?enso_tab=enso-cpc_plume
10 Commonwealth of Australia, Bureau of Meteorology, Climate monitoring graphs - Sea Surface Temperature (SST) indices and Southern Oscillation Index (SOI): http://www.bom.gov.au/climate/enso/indices.shtml

Risks & Opportunities During El Nino/IOD Events

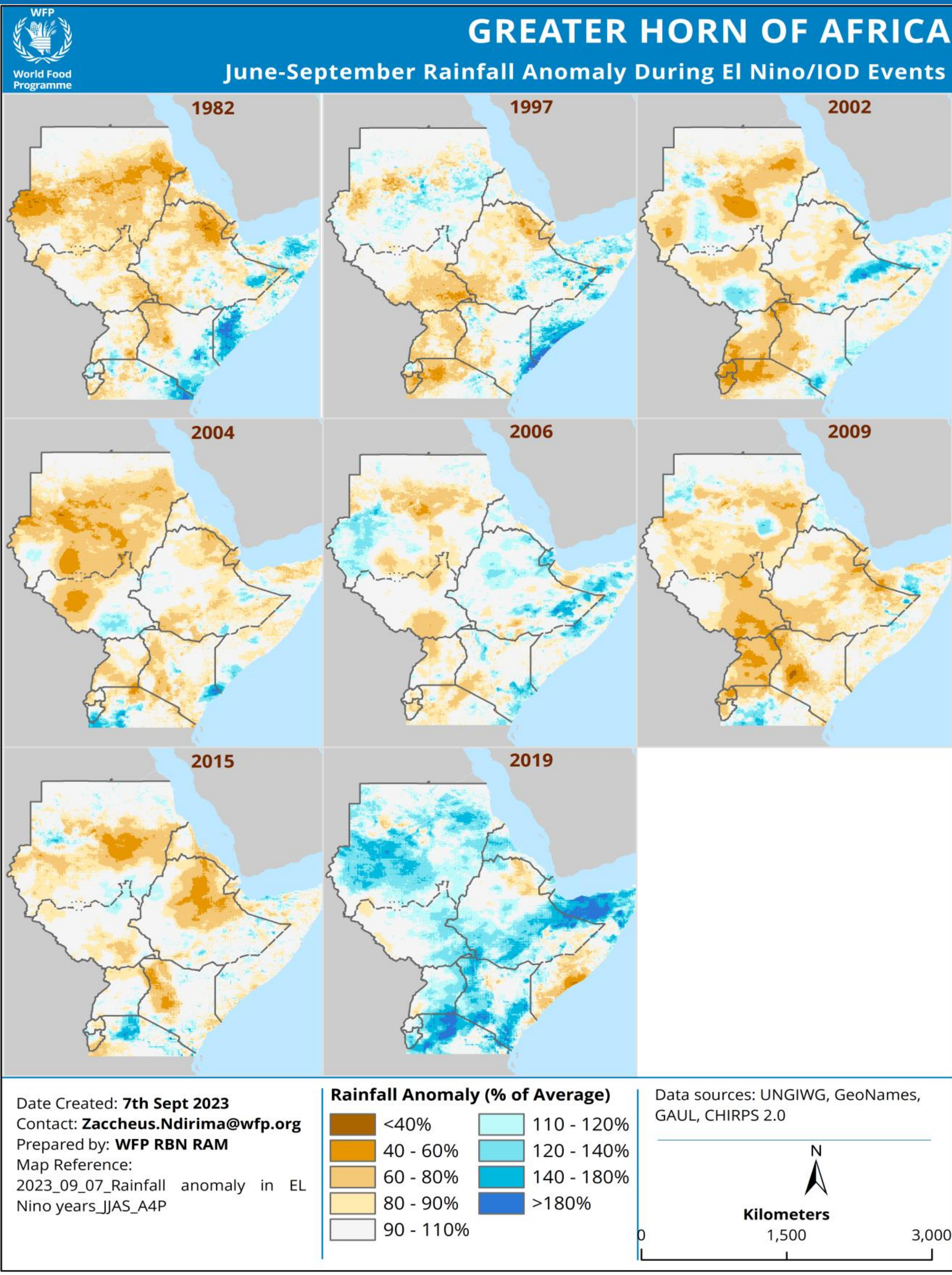
Risks in black fonts are reported impacts in north of the region during June – September season. Rest are common across the region



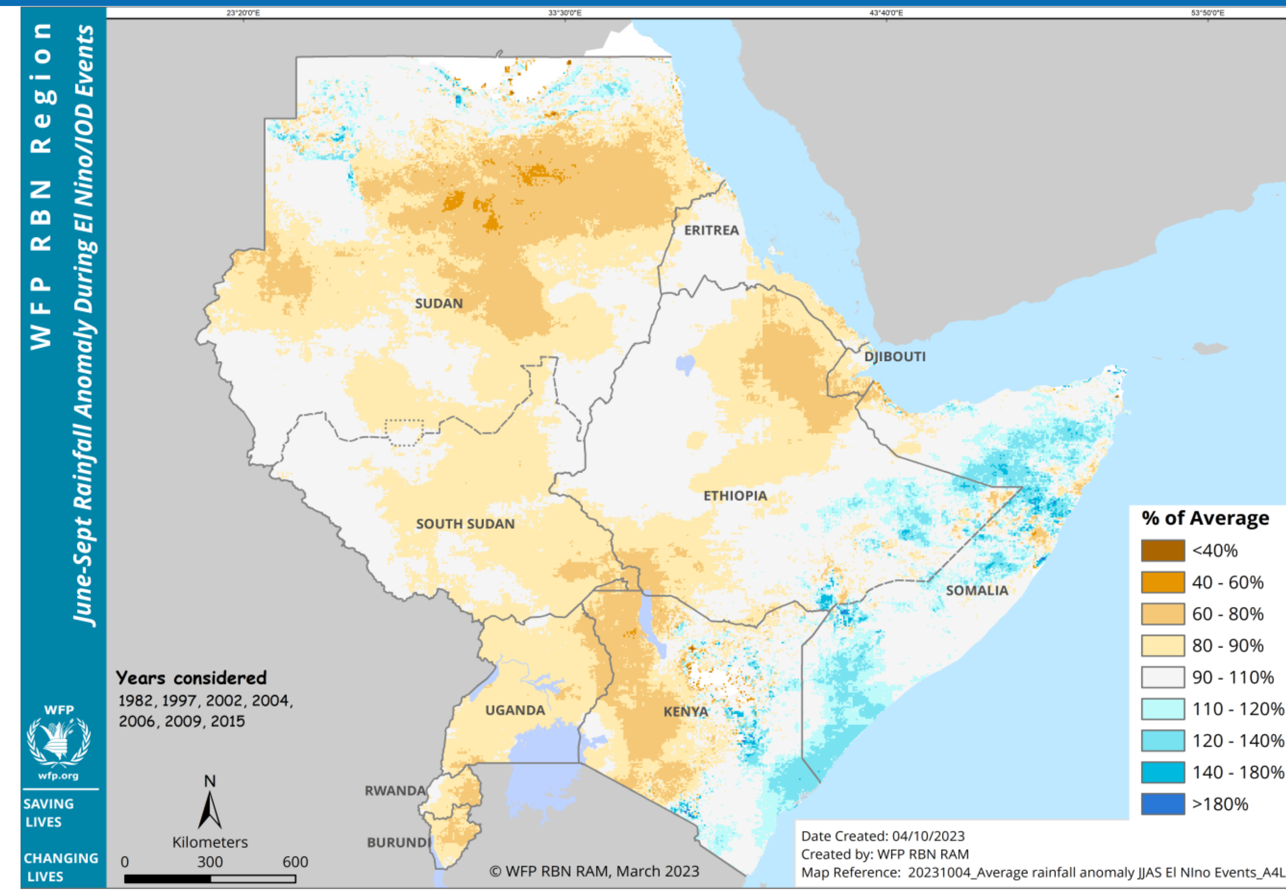
The opportunities are realised in the equatorial areas of the region during the Oct-Dec short rains

During El Nino events, there are risks and opportunities, which depend on the context i.e., whether in the north (with depressed) or in equatorial areas (with enhanced rains) of the region. They can however be summarised as shown above considering the impacts. Some of these aspects are Addressed in the next slides based on events since 1980.

Performance of June-September Rains During Past El Nino/IOD Events



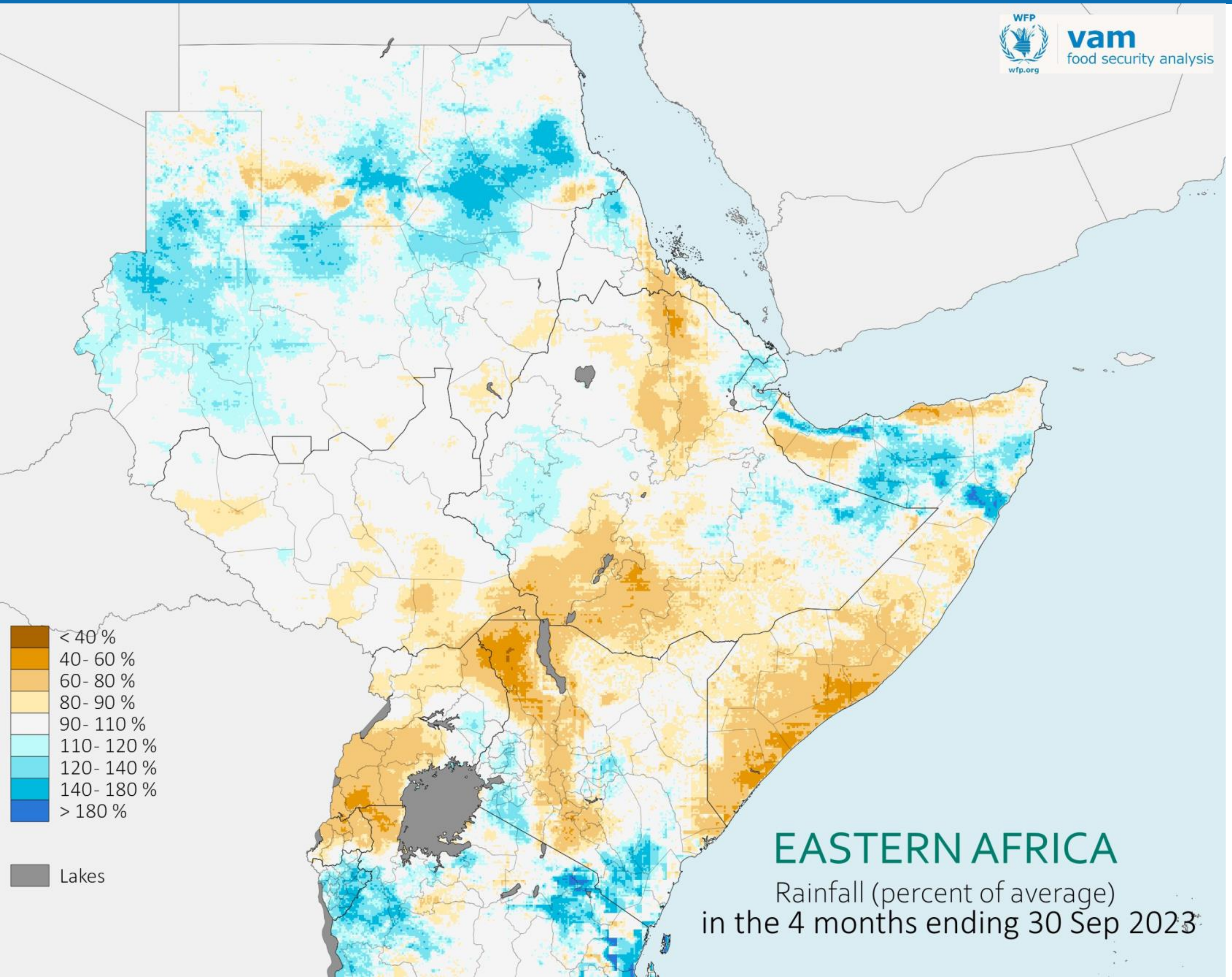
Map 2: Seasonal rainfall anomaly for June-September during El Nino/IOD years as a percentage of average. Brown shades indicate below-average rainfall; blue shades indicate above-average seasonal rainfall (Source: CHIRPS 2.0)



Map 3: Average rainfall anomaly for June-September (1982,1997, 2002, 2004, 2006, 2009 & 2015) as a percentage of long-term average. Brown shades indicate below-average rainfall; blue shades indicate above-average seasonal rainfall (Source: CHIRPS 2.0)

- Past El Nino/IOD events resulted in depressed rainfall during the June-September season (Map 2, Left) except in 2019 when the strong IOD influenced rainfall across the region. Depressed rainfall during the main season impacted on production in the benefiting areas of Sudan, northern South Sudan, Ethiopia (northeast, central and southwest), Eritrea, and Djibouti.
- The most recent El Niño event in 2015/16 led to depressed rains in northeastern and central Ethiopia as well as in Gedaref, Kassala, North Darfur, and North Kordofan states in Sudan, which resulted in a severe drought that grossly affected water replenishment, crop production, and pasture regeneration.
- Map 3 depicts depressed average rainfall conditions in Sudan, South Sudan, Ethiopia (northeast, central and southwest) as well as western Kenya and Uganda (northern and northeast) during El Nino/IOD events. During this period, these areas normally experience rains as part of the main rainfall season or part of the unimodal April-September/October rains in western Kenya and northern Uganda.

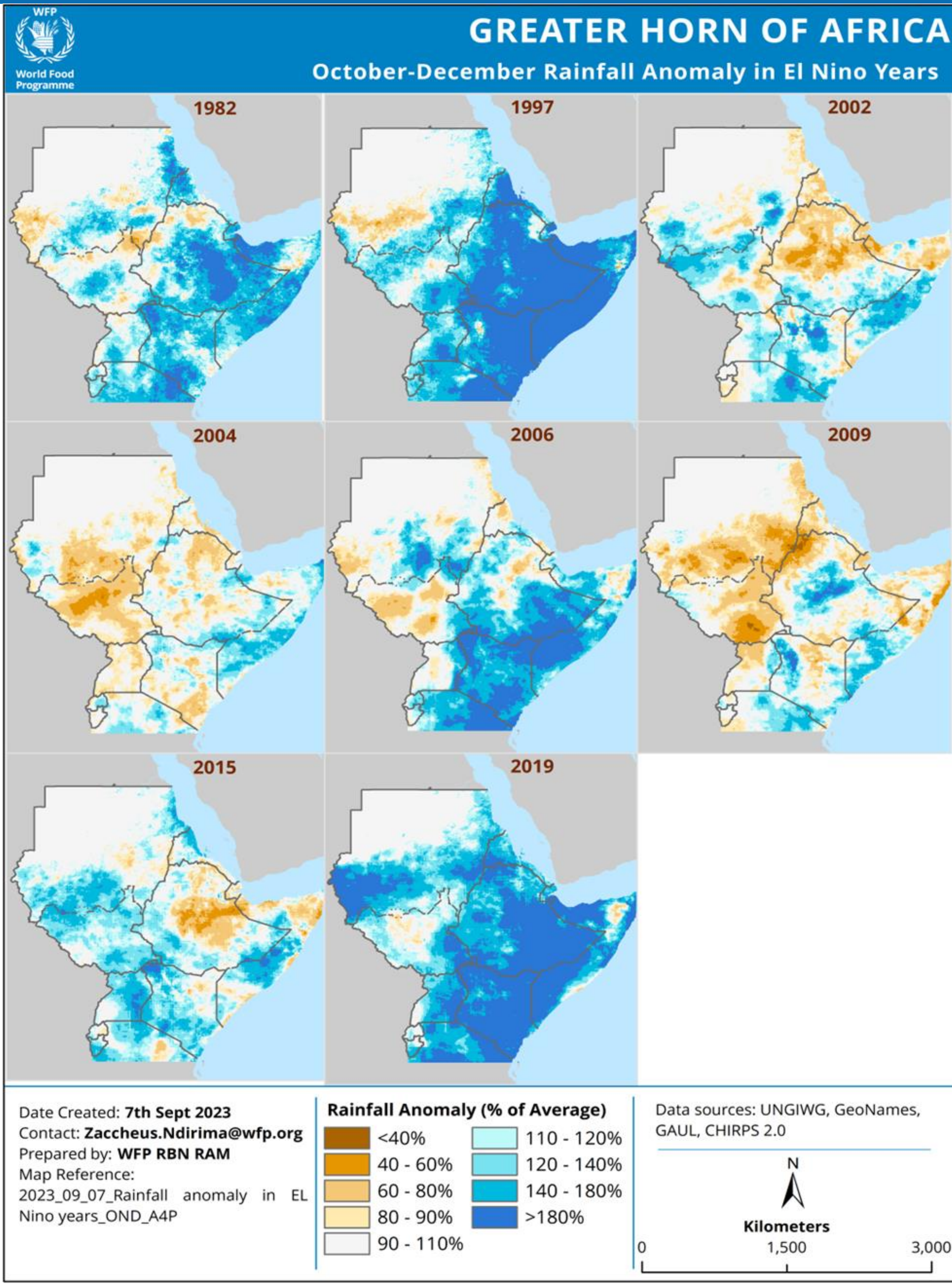
Performance of the June-September 2023 Rainfall Season



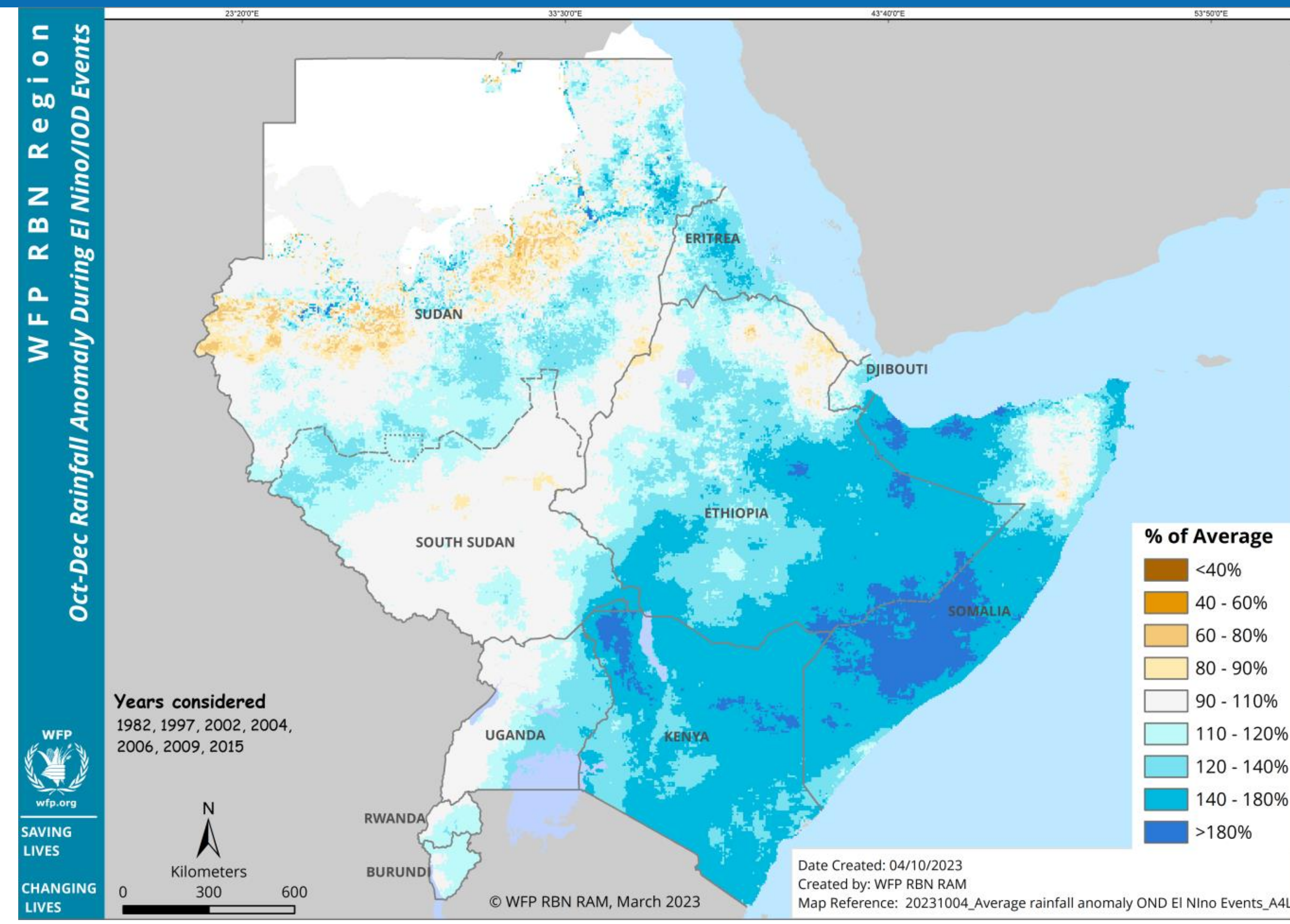
Map 4: Cumulative rainfall anomaly for June-September 2023 as a percentage of average. Brown shades indicate below-average rainfall; blue shades indicate above-average seasonal rainfall (Source: CHIRPS 2.0)

- While past El Nino/IOD events resulted in depressed rainfall during the June-September season, the situation has been different in 2023 despite the declaration of El Nino conditions in June.
- The season started well, and the rains performed favourably in June leading. The rains however declined from July in some areas.
- Unlike in past El Nino events, Sudan has received favourable rains (normal to above-normal rains in most areas) (Map 4). However, the ability of households in the Greater Darfur and greater Kordofan states to utilise the rains for agricultural production is constrained by conflicts and socio-economic factors. In the eastern states not much affected by conflicts, production is also constrained by limited access to inputs, equipment (for mechanised and irrigated agriculture) and finances. This will negatively impact on 2023 production.
- The cumulative seasonal rains are depressed in central and parts of western equatorial and western Bahr el Ghazal states in South Sudan; in northeast, central and southwest Ethiopia; parts of northern Somalia and central Eritrea.
- Because the season normally ends in September/early October, chances for recovery in affected areas are unlikely. This will compromise the seasonal food production and resources for livestock. As a result, the dire food insecurity situation in the affected areas could worsen in coming months and into 2024.
- During this period, depressed rains were also experienced in northern and northeast Uganda that impacted on the growing crops and below-average harvests are expected.
- The poor rains also delayed the start of the second season in bimodal areas of Uganda and equatorial South Sudan that starts in August/September. There are chances for recovery if the forecast above-average October-December rains materialise.

Performance of October-December Rains During Past El Nino/IOD Events



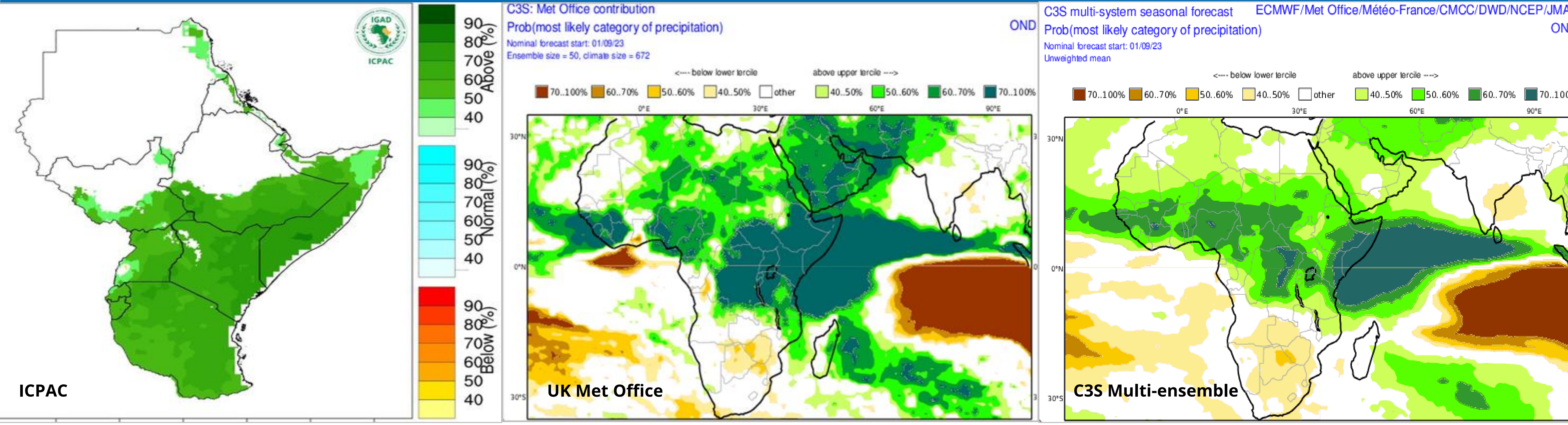
Map 5: Seasonal rainfall anomaly for Oct-Dec during El Nino/IOD events as a percentage of average. Brown shades indicate below-average rainfall; blue shades indicate above-average seasonal rainfall (Source: CHIRPS 2.0)



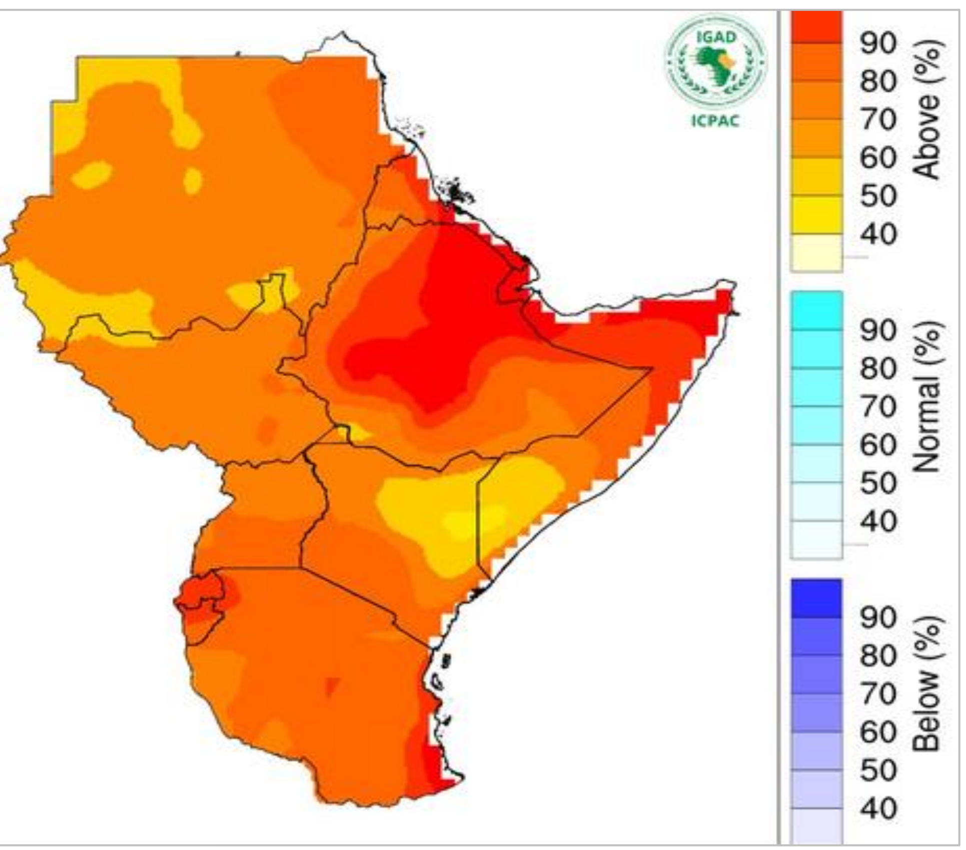
Map 6: Average rainfall anomaly for June-September (1982,1997, 2002, 2004, 2006, 2009 & 2015) as a percentage of long-term average. Brown shades indicate below-average rainfall; blue shades indicate above-average seasonal rainfall (Source: CHIRPS 2.0)

- Analysis shows that during El Nino events, parts of Kenya, Somalia, central southern and southeast Ethiopia, northern Tanzania, Uganda, Rwanda and Burundi experienced wetter-than-normal rainfall during the October-December season (Map 5, left).
- The magnitude of wetness depended on the strength of the El Nino event. For instance, the very strong events of 1982, 1997 and 2006 led to significantly enhanced rains with substantial impacts unlike in 1987 and 1991, dry conditions resulted.
- Map 6 shows the average rainfall situation during El Nino years/IOD events, which confirms the eastern areas of the region as having the highest chances of benefiting from the forecast El Nino/IOD conditions this year.

Likelihood of Enhanced Rains & Warmer Temperatures over Oct-Dec 2023



The probabilistic rainfall forecast for Oct-Dec 2023 by ICPAC (Map 7, left) , UK Met Office (Map 8, centre) and C3S Multi-ensemble (Map 9), right; green shades indicate above-normal rains and shades of brown/orange below-normal rains

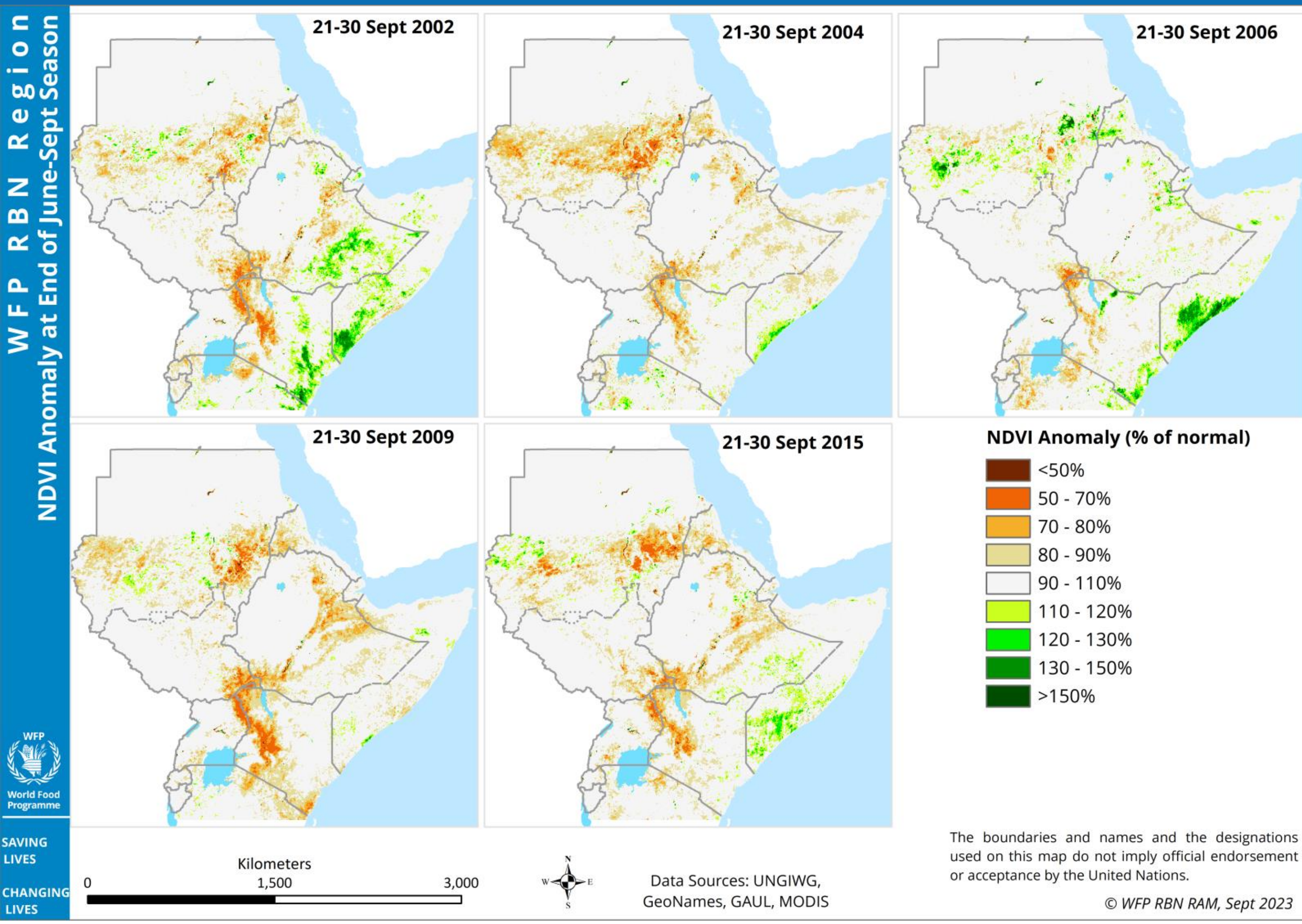


Map 10: Temperature probabilities across the region over the October-December 2023 season (Source: ICPAC)

- Rainfall forecasts for October-December 2023 season by ICPAC[11] (Map 7, Upper left), UK Met Office[12] (Map 8, centre) and C3S Multi-ensemble[12] (Map 9, right) among other global models point to a likelihood of enhanced rains in the eastern Horn of Africa given the positive status of both the El Nino event and the Indian Ocean Dipole (IOD). Probabilities of wetter-than-normal rains are highest over eastern Kenya, southern Somalia and southern Ethiopia.
- The region is also likely to experience warmer-than-normal temperatures according to the forecast by ICPAC (Map 10, lower left), which will increase water loss through evaporation from surfaces and transpiration from plants.
- Warmer-than-usual temperature will be problematic in areas that have experienced depressed rains during the June-September season such as northeastern Ethiopia because it will drive earlier-than-normal water and vegetation deterioration, impacting on the availability of livestock grazing resources.

11 ICPAC October-December 2023 Rainfall forecast: https://www.icpac.net/seasonal-forecast/;
12 UK Met Office precipitation 3-months: https://climate.copernicus.eu/charts/c3s_seasonal/

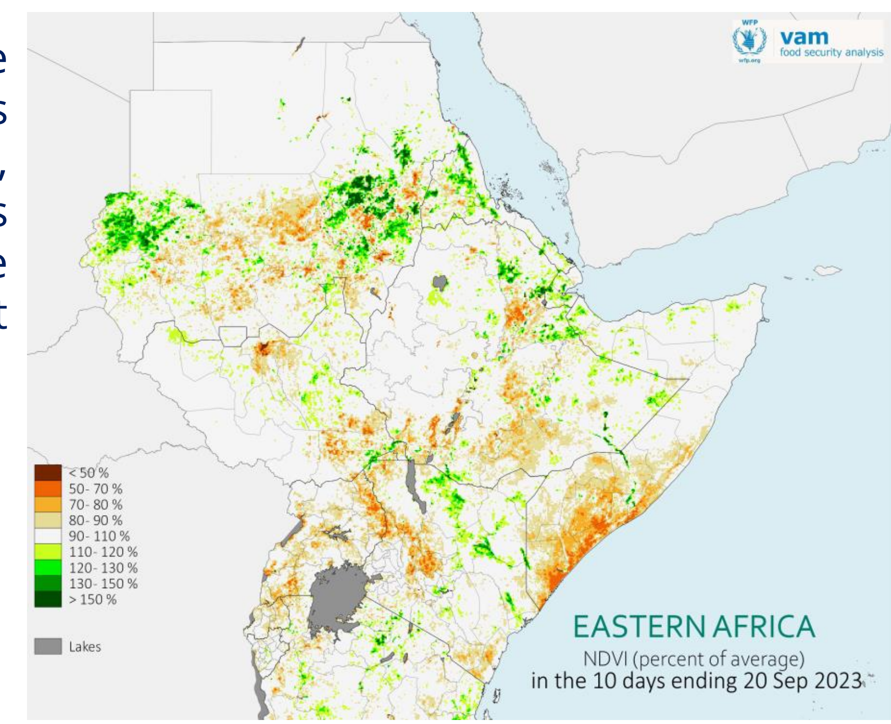
Vegetation by end of June-September Season During El Nino/IOD Events



NDVI anomaly at end of (21-30/1) September (Map 11) a percent of average (green shades for above average and brown shades for below average)

- During a normal June-September season, the vegetation improves significantly attaining high NDVI values or anomalies above 100 percent (in relation to long-term average) due to accumulated biomass and quality. This reflects abundance of livestock grazing resources (pasture/browse) and favourable development of crops before they mature for harvesting.
- However, during the past El Nino events, the vegetation condition at the end of the rainfall season was poor/below-normal in parts of Sudan, South Sudan, northeast Uganda, Eritrea and Djibouti due to insufficient moisture (Map 11). This implies that during those seasons, pastures/browse regeneration and crop development were sub-optimal, impacting on livestock grazing resources and food production.
- This year, data for mid (11-20th) September show vegetation deficits in parts of Ethiopia and South Sudan where rains have been depressed (Map 12, below). There are limited chances of recovery because the season is coming to an end. In Sudan, the poor vegetation reflect poor agricultural development due to conflict given that rains have been favourable for production.

In the south of the region, several areas have poor vegetation, but the situation is expected to improve from October as short rains/Deyr start.

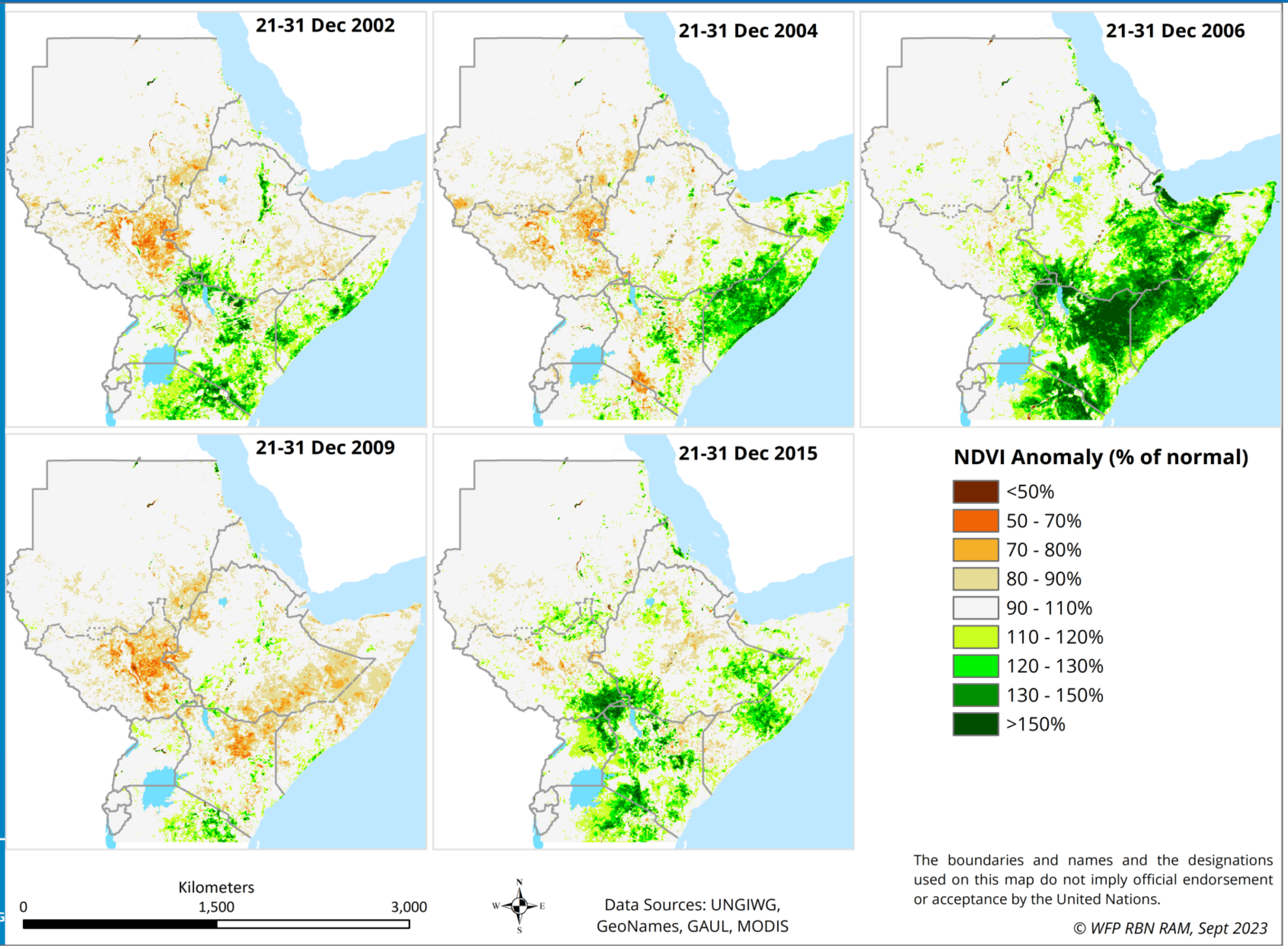


NDVI anomaly in mid-September 2023 (Map 12) a percent of average (greens for above average, browns for below average)

2015/16 El Nino Scenario

The 2015/16 El Niño event led to declined rainfall and a severe drought hit northeastern and central Ethiopia affecting 50–90 percent of Meher crops. Water resources dried up causing livestock deaths and poor pasture health, which in turn affected the livelihoods of pastoral and agropastoral communities. During the same season, Sudan experienced depressed seasonal rains, characterised by intermittent dry spells that delayed crop planting, significantly reduced the cultivated area, resulted in poor pasture regeneration, and drove water scarcity particularly in Gedaref, Kassala, North Darfur, and North Kordofan states.

Vegetation by end of October-December Season During El Nino/IOD Events



NDVI by end of October-December season (21-31) December (Map 13) a percent of average (green shades for above average and brown shades for below average)

- In contrast to the June-September season, favourable vegetation status prevailed at the end of October-December season (late December) in the pastoral and agropastoral areas of Kenya, Somalia, and southern-southeast Ethiopia except in 2009 (Map 13, left). This was made possible by the enhanced moisture that supported vegetation regeneration and crop development.
- Favourable vegetation not only signals possibility of good agricultural food production in agropastoral areas (e.g., in southeast Kenya, southern and northwest Somalia) but also the availability of livestock grazing resources that will support the livestock sector during the January-February dry season.
- A study by Kalisa et al (2019)[13] has revealed this association between ENSO conditions (from 1982-2015) and better-than-normal vegetation during the October-December period and into the following year in eastern Horn of Africa.

Influence of the 1997/98 El Nino Event in Kenya

Despite the wanton destruction of croplands and properties, the strong 1997/98 El Nino event led to tremendous improvement in production of fodder shrubs and pastures in ASALs, and Medium and High Agricultural Potential areas that greatly improved livestock performance[14].

Influence of the 2015/16 El Nino Event in Somalia

The 2015/16 El Nino event had double impact for Somalia. In southern areas, the heavy rains improved production (of both crops and pastures) besides displacing some people along the Juba and Shabelle basins due to floods. At the same time, the northern areas experienced depressed rains that culminated in poor pasture development, and poor crop growth[15].

13 Kalisa et al (2019), Assessment of climate impact on vegetation dynamics over East Africa from 1982 to 2015: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6856068/
14 UNU (2000), Impacts of the 1997-98 El Nino event in Kenya: https://archive.unu.edu/env/govern/ElNIno/CountryReports/pdf/kenya.pdf
15 USAID (2022), Success story - Confronting El Nino in Somalia: https://www.usaid.gov/sites/default/files/2022-05/success_story_elnino_08-05-2016.pdf

Impacts on Populations & Livelihoods

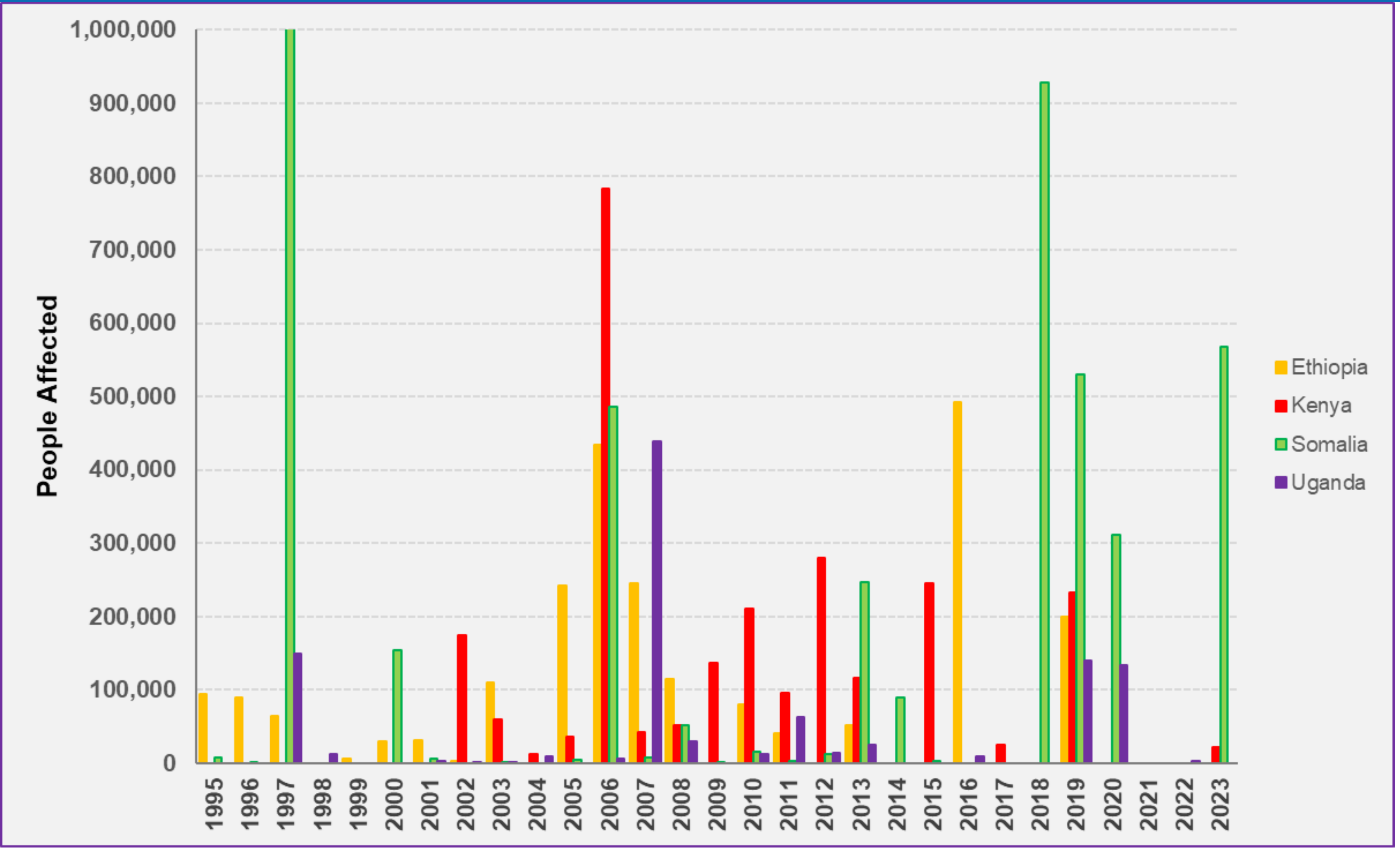


Figure 4: Number of people affected by floods, landslides and storms in four countries in the region (Source: EM DAT database)

- Although comprehensive data on impacts at regional level are lacking, available information in some countries show that enhanced rains and flooding affected populations through displacement, localized crop and livestock losses, damage to infrastructure, hindered transportation and accessibility to vital supplies (goods and services).
- Figure 4 summarises the number of people affected by floods, landslides and storms overtime. It is evident that the numbers increased during the 1997/98, 2006/07, and 2015/16 El Nino events, particularly in Somalia (EM DAT database[16]).
- A strong IOD in 2019 caused severe flooding across the region affecting over 3.4 million people[17], including 350 deaths, and 665,000 new displacements in Somalia, Kenya, Djibouti and Ethiopia[18]. Of the 665,000 new displacements, about 407,000 were in Somalia alone.

Flooding along Shabelle river in Somalia (Source: FAO)

- Flooding induced displacement subjects the affected population to food insecurity, an upsurge of vector and water-borne diseases, protection and GBV risks, among other humanitarian challenges.
- For instance, the 1997/98 El Nino led to destruction of about 331,000 hectares of croplands in Kenya valued at $121 million; over 2.2 million head of livestock (worth $113 million) were lost through diseases, being washed away by floods or other ways[19].
- Similar impacts are likely if the 2023 El Nino event materialises.

16 EM DAT The International disaster Database: https://www.emdat.be/
17 Fews Net (2020), 2019 Short Rains in East Africa Among the Wettest on Historical Record: https://fews.net/east-africa/special-report/january-2020#a-retrospective-look-at-2019-indian-ocean-extremes-and-rainfall-predictions
18 IDM (2019), Rainy season Horn of Africa: https://www.internal-displacement.org/sites/default/files/inline-files/GRID-2019-Disasters-Figure-Analysis-HoA-Rainy-Season.pdf
19 Karanja, F.K. & F. M. Mutua (2000), Impacts of the 1997-98 El Nino event in Kenya: https://archive.unu.edu/env/govern/ElNIno/CountryReports/pdf/kenya.pdf

Food Insecurity During El Nino/IOD Events

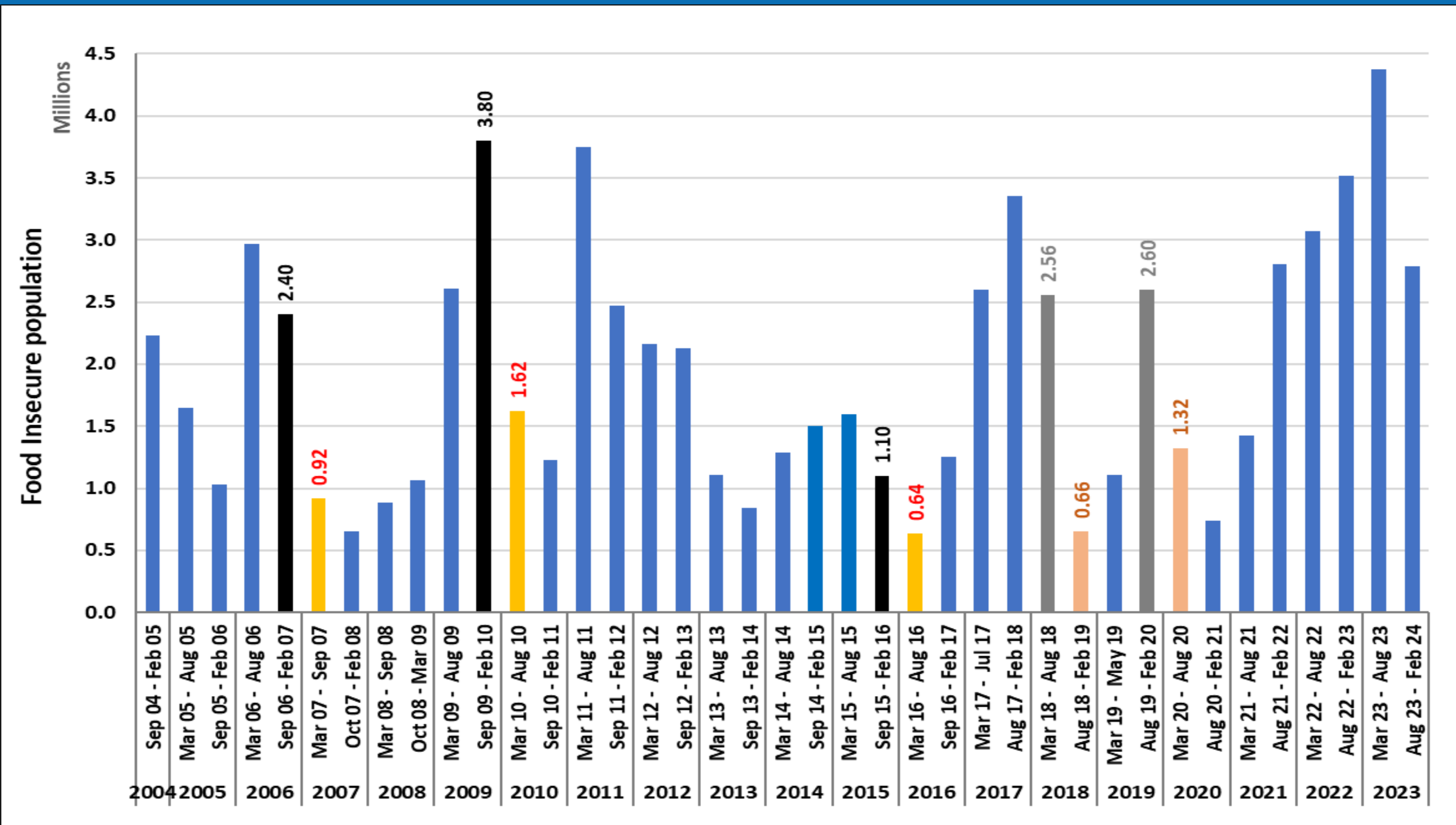


Figure 5: Trend in number of food insecure people in Kenya (Source: KFSSG). Orange bar reflect the outcome of the Oct-Dec short rains.

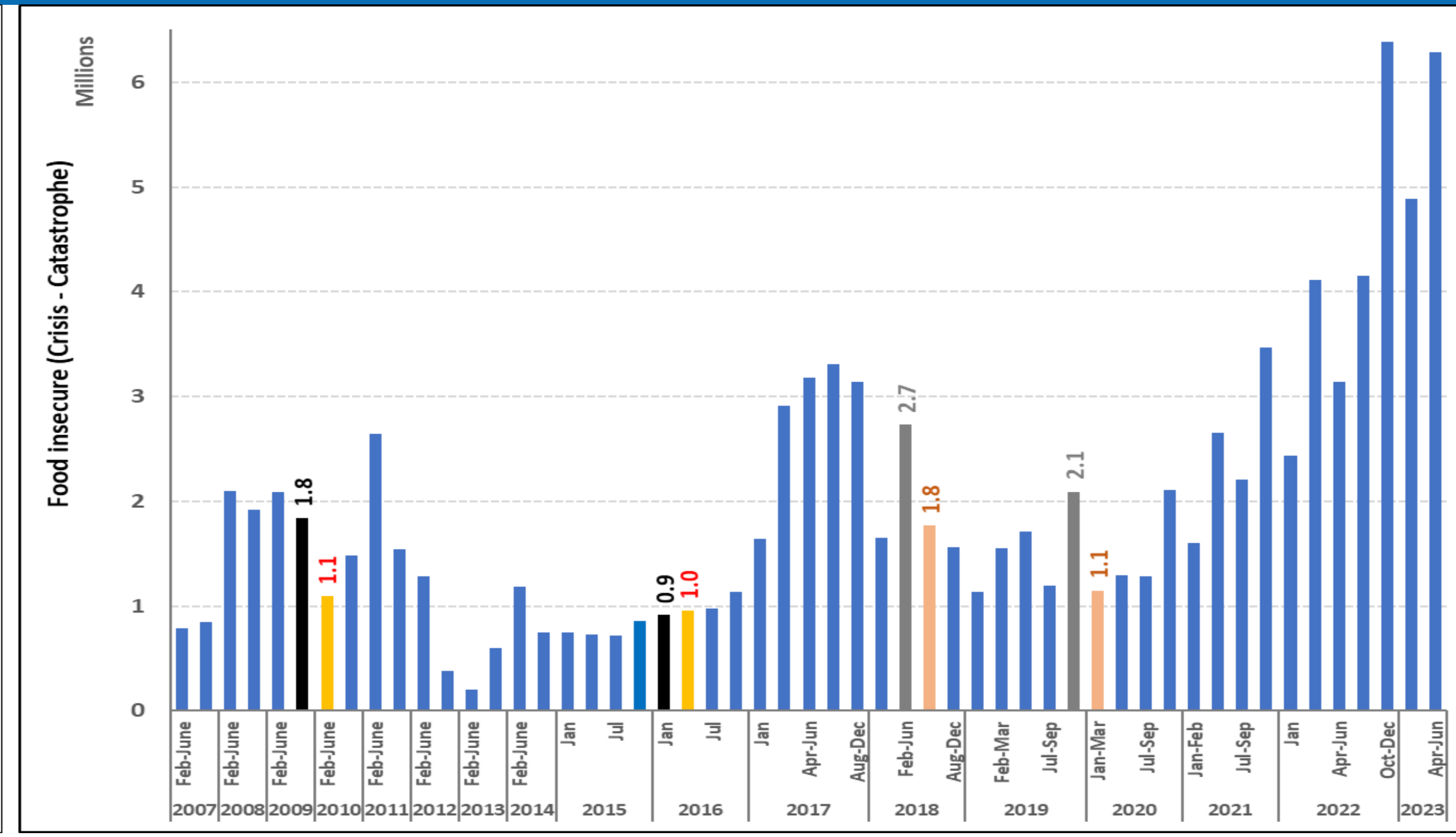


Figure 6: Number of food insecure people (IPC phase 3+) in Somalia (Source: FSNAU/IPC/WFP). Orange bar reflect the outcome of the Oct-Dec Deyr rains.

- Long-term data on food insecurity for Kenya and Somalia reveal the impact of enhanced rains such as during El Nino/IOD events. In Kenya's ASALs, the number of food insecure people declined after every season with enhanced/wetter-than-normal rains. This is evidenced by the figures for March-August, which reflect the outcomes of the October-December short rains season (Figure 5, left).
- In Somalia, the enhanced rains of 2009, 2018, and 2019 resulted in reduced number of food insecure population. This was not the case with the 2015/2016 el Nino event because the enhanced rains only occurred in the south-central areas while the northern and northeast areas were experiencing dry conditions that sustained high vulnerability (Figure 6, right).
- In both countries, the number of food insecure (IPC phase 3+) people declined during seasons with enhanced rains even though not associated with El Nino such as the 2018 March-May and the 2019 Oct-Dec IOD induced rains. This is because during enhanced rainy seasons, the pastoral and agropastoral areas in Kenya, Somalia as well as in southern-southeast Ethiopia, experience improved grazing resources (pastures and water) that improve the livestock body condition, milk production for consumption as well as food production among agropastoral communities.
- Currently, Kenya has an estimated 2.8 million food insecure population (July-Sept 2023) that is expected to decline to 1.5 million over Oct-Jan 2024 due to improvements brought about by El Nino enhanced rains. However, in Somalia, the number could rise from 3.7 million (Aug-Sept 2023) to 4.3 million (Oct-Dec 2023) despite improved crop and livestock production, owing to persistent effects of 2020-2023 drought, likely impacts of flooding and reduced humanitarian assistance due to funding shortfalls.

Cereal Production During El Nino Years in North of the Region

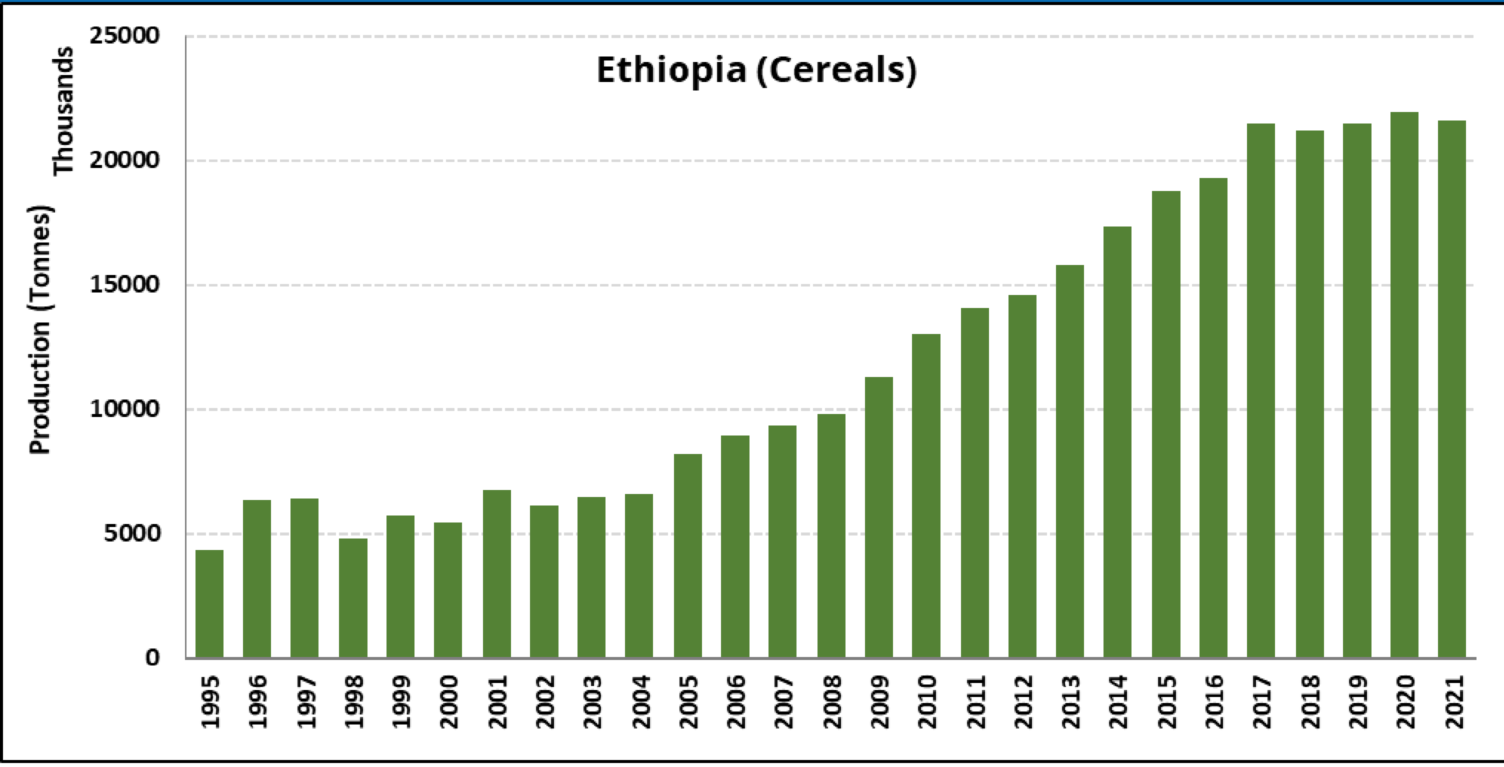


Figure 7: Annual cereals production (maize, sorghum, millet, wheat & rice) in Ethiopia (Source: FAOSTAT[20])

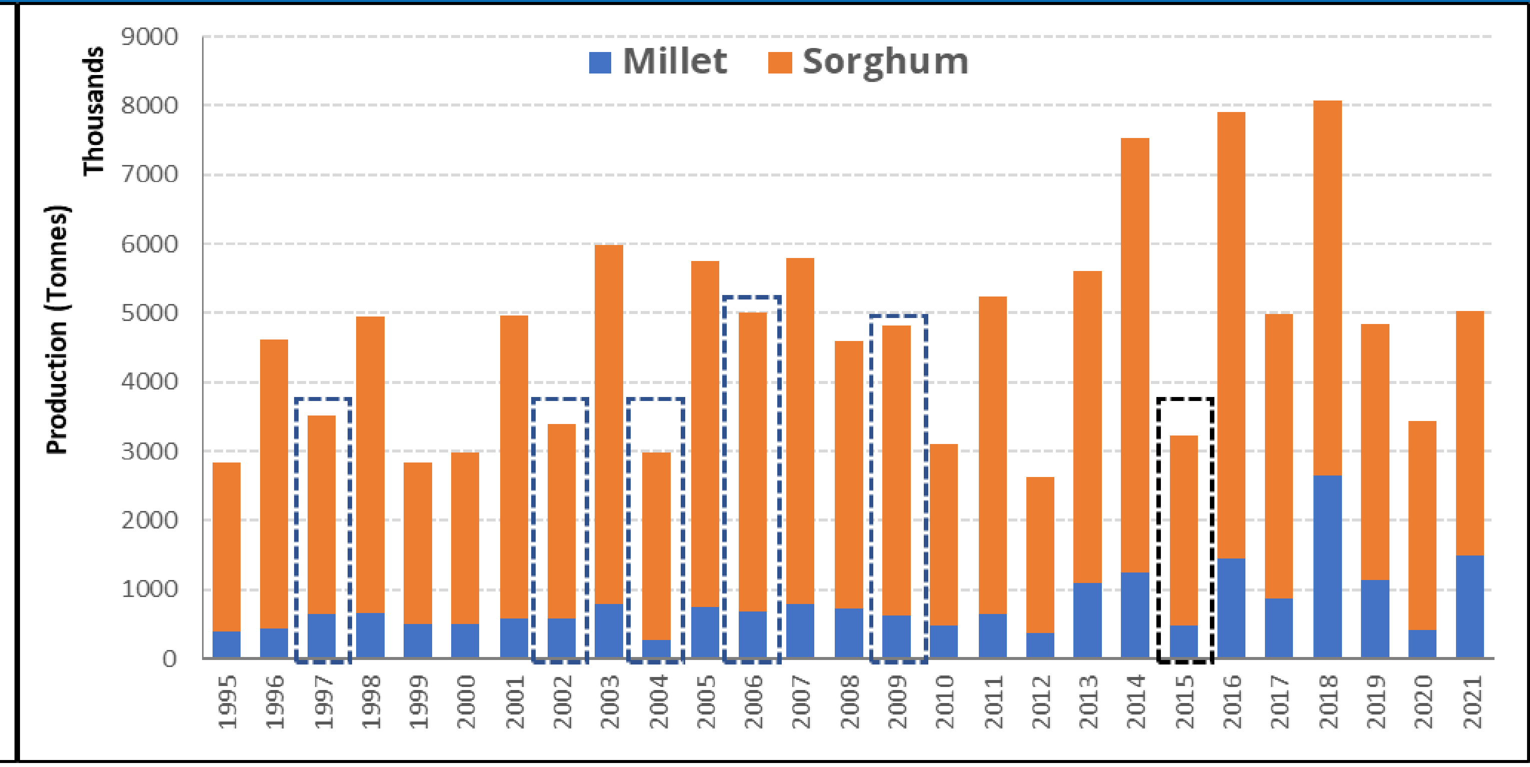


Figure 8: Annual sorghum and millet production in Sudan (Source: FAOSTAT[20])

- The annual cereal production in Ethiopia show a general increase since 1995 (Figure 7, left) even during the years of El Nino events. The increasing trend in production is attributed to substantial growth in cultivated area, yields, and production[21].
- During El Nino events, depressed rains mostly affect production in northeast, central and southwest areas while the main producing areas in the west remain favourable for production (see slide 8). Hence, the impact of El Nino events would be pronounced if analysis is undertaken at regional than national scale or at seasonal scale (Belg vs Meher).

- In the case of Sudan, production is influenced by several factors including climatic performance during the main June-September growing season, macro-economic situation, market prices dynamics in terms of food commodities prices as well as that of cash crops, and influences of conflicts.
- During years of bumper crop harvests, commodity prices fluctuate discouraging farmers from undertaking cultivation the following season. The opposite happens when prices are favourable, encouraging farmers to increase area under cultivation. Similarly, due to the mechanised and irrigated nature of production, macro-economic issues such as inflation as well as access to financial resources are a major factor in realised production.
- However, the influence of climate cannot be overruled especially for the drastic decline in production during the 1997, 2002, 2004, 2006 and 2015 that coincided with El Nino depressed rains (Figure 8).

20 FAOSTAT: https://www.fao.org/faostat/en/#data
21 Crop production in Ethiopia: Regional patterns and trends: https://www.researchgate.net/publication/290263344_Crop_production_in_Ethiopia_Regional_patterns_and_trends

Crop Production (Cereals) During El Nino Years in Equatorial Areas

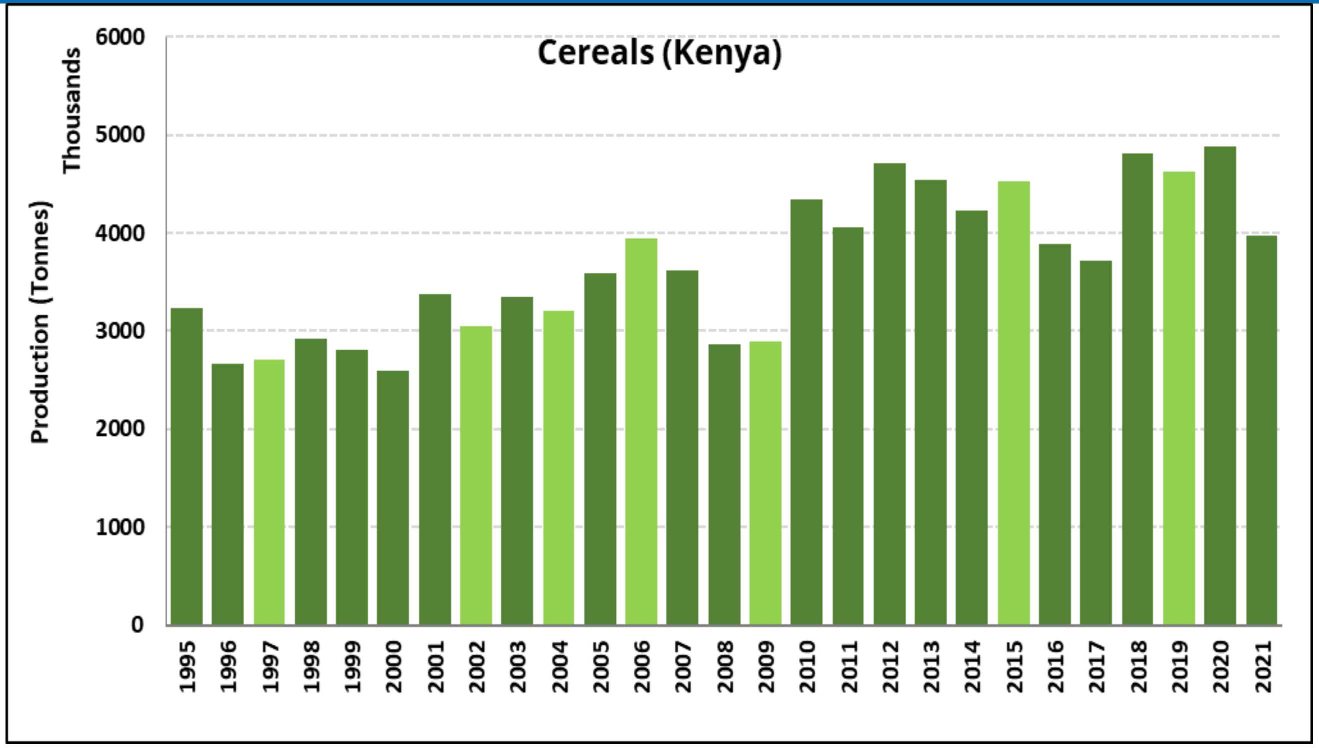


Figure 9: Annual cereal production (maize, sorghum, millet, wheat & rice) in Kenya (Source: FAOSTAT[20])

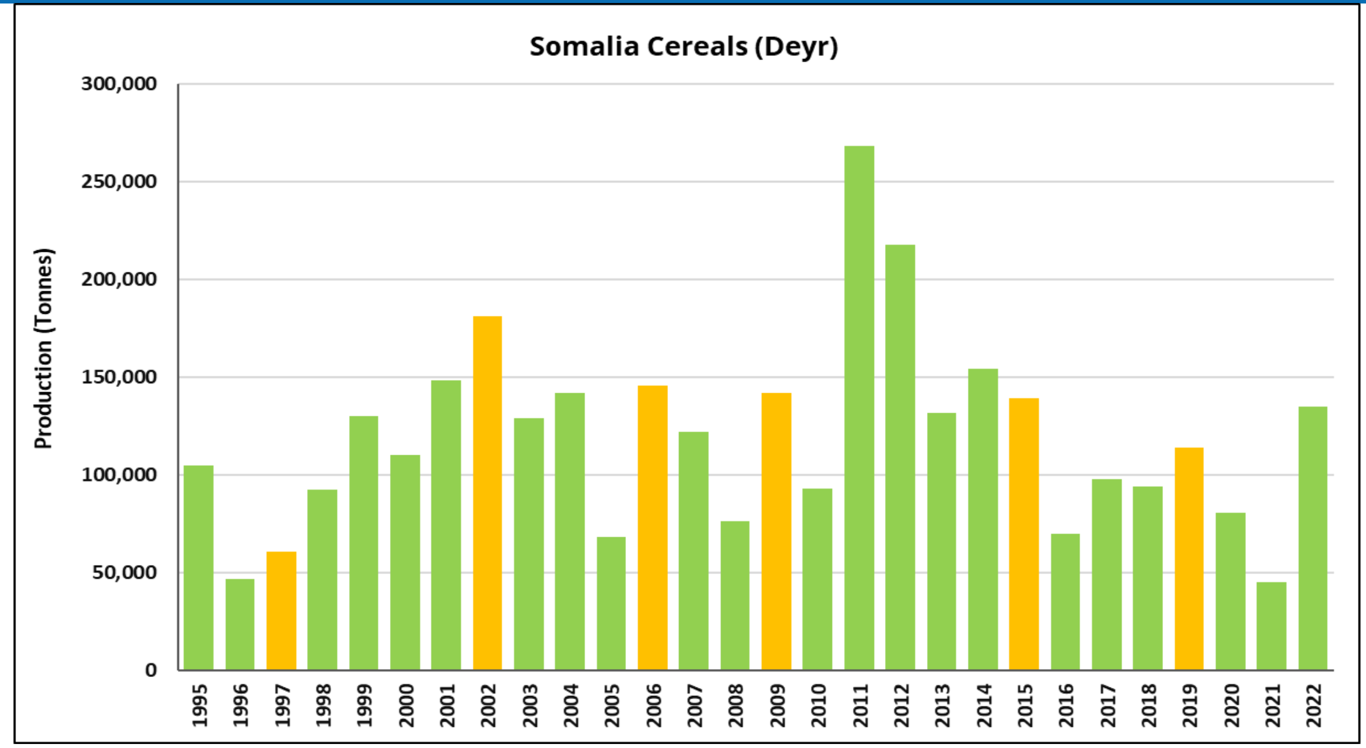


Figure 11: Cereal production (maize, sorghum, sesame & rice) in Somalia during Oct-Dec Deyr season (Source: FSNAU[21])

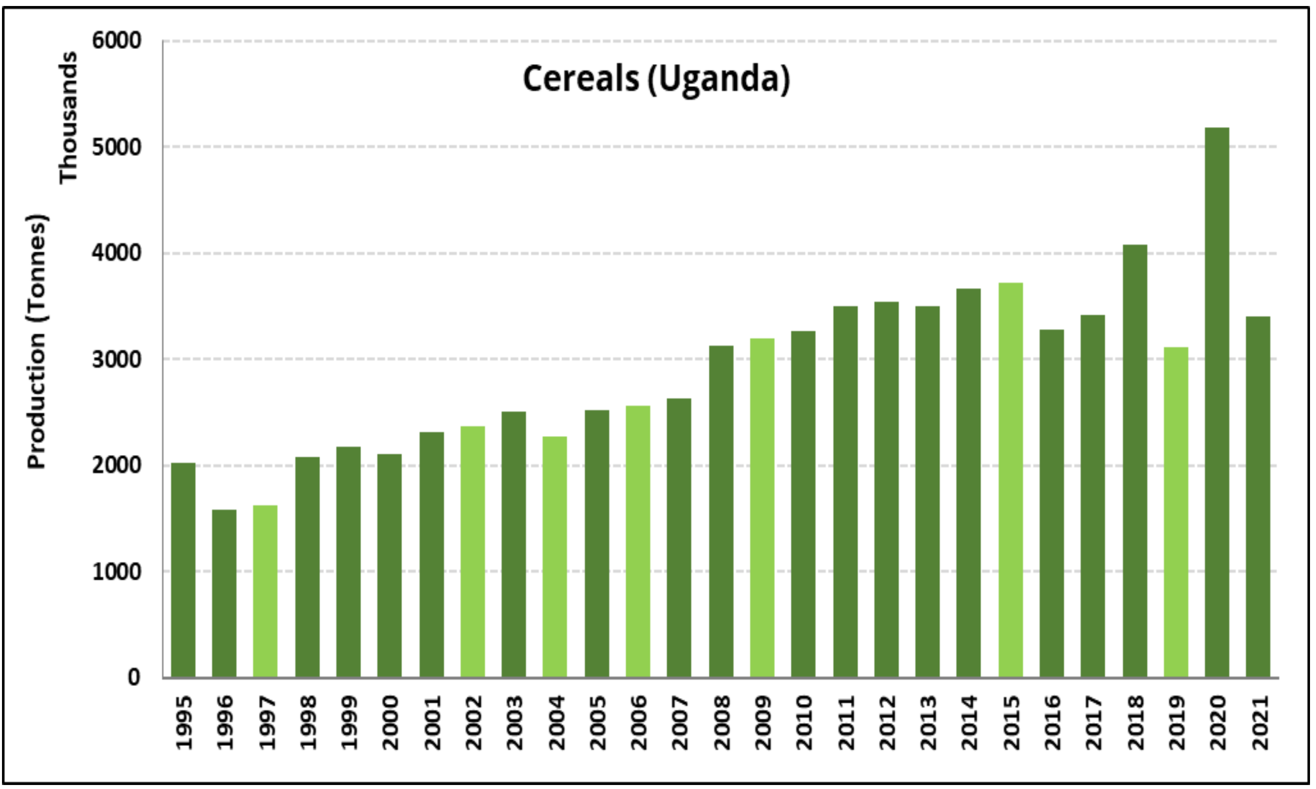


Figure 10: Annual cereal production (maize, sorghum, millet, wheat & rice) in Uganda (Source: FAOSTAT[20])

- The annual cereal (maize, millet, sorghum, wheat, rice) production data for Kenya and Uganda show improved production in some years and decline in others when compared to the year before the El Nino/IOD event. This can be attributed to the rainfall performance and associated impacts such as crops damage through flooding, waterlogging and/or post-harvest losses. Moreover, in both countries, most production takes place during the long rains from March. The October-December short rains are necessary for production in agropastoral areas of Kenya and Somalia. Hence, seasonal data might better reveal the impact of El Nino/IOD events than the available annual statistics.

- In Somalia, cereal (maize, sorghum, rice and sesame) production data during October-December Deyr season show improved production in years characterised by El Nino/IOD events except in 2015 when parts of the south and northwest had poor rains that may have impacted on the overall production.

20 FAOSTAT: https://www.fao.org/faostat/en/#data
21 Somalia crop production (Metric Tonnes): https://crops.fsnau.org/

Market Prices During Years of El Nino Event (Case of Sudan)

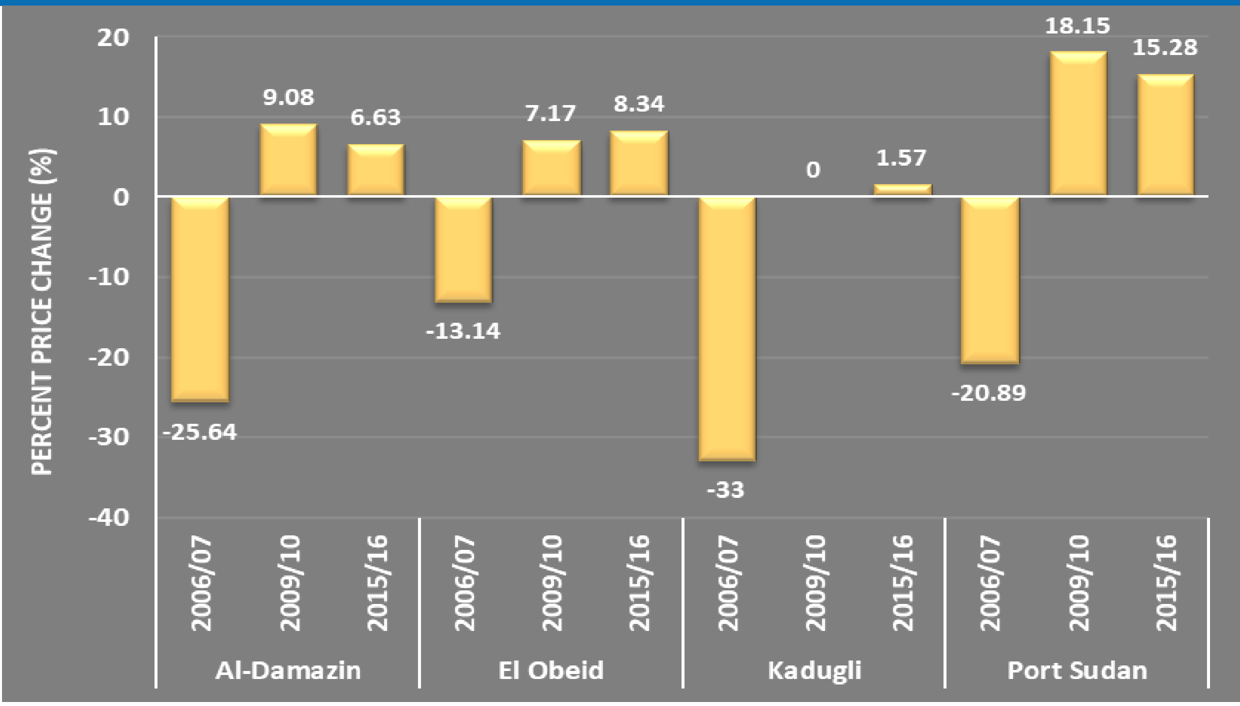


Figure 12: Percent average price change for sorghum over July-October vs Nov-Feb periods (Source: FAO GIEWS[22])

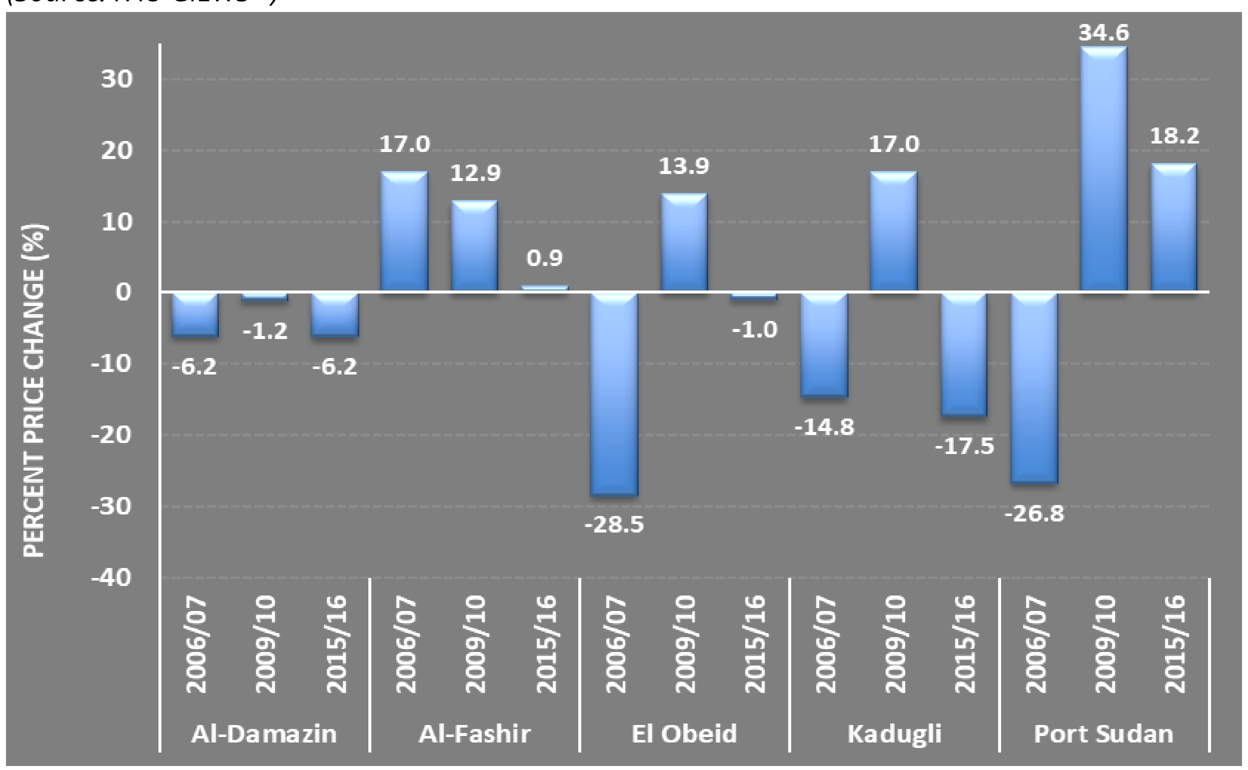
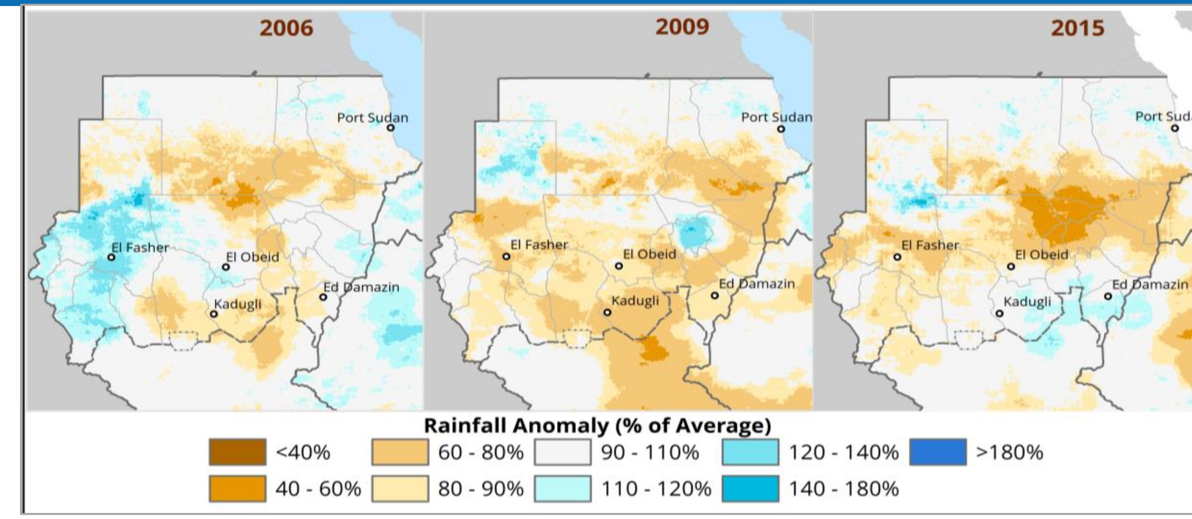


Figure 13: Percent average price change for millet over July-October vs Nov-Feb periods (Source: FAO GIEWS)



Map 14: June-September seasonal rainfall anomaly as a percentage of average. Brown shades indicate below-average rainfall; blue shades indicate above-average seasonal rainfall (Source: CHIRPS 2.0)

- Sorghum and millet are the main staples, although sorghum is most grown[23]. The annual average production for the 2000-2021 period was 4.1 million for sorghum against 0.85 million tonnes for millet.
- Generally, market prices are expected to drop after harvests as supply to markets improve. However, the average sorghum price change over the November – February (harvesting and post-harvesting period) period in comparison to July-October (part of the lean season) only declined in 2006/07 in the analysed markets while it increased during 2009/10 and 2015/16 (Figure 12).
- The June-September rainfall season performed poorly in 2009 and 2015 compared to 2006 (Map 14), which to some extent may have influenced the price dynamics owing to realised production.
- The average price change for millet was mixed across markets (Figure 13). Although Pearl Millet requires less water than other crops (including sorghum)[24] , such that it may have done well under depressed rains, other factors including demand and macroeconomic situation may have influenced the observed price changes than purely an aspect of production.

22 FAO GIEWS – Food Price Monitoring and Analysis (FPMA) Tool: https://fpma.fao.org/giews/fpmat4/#/dashboard/tool/domestic
23 World Bank (2022), Agricultural productivity and poverty in Sudan: https://documents1.worldbank.org/curated/en/099605111302227222/pdf/IDU0281208e30f5890450508d8d03fbab20947f7.pdf
24 Maman et al. (2003), Pearl millet and grain sorghum yield response to water supply in Nebraska: https://www.researchgate.net/publication/228738710_Pearl_Millet_and_Grain_Sorghum_Yield_Response_to_Water_Supply_in_Nebraska

Market Prices During Years of El Nino Event (Case of Somalia)

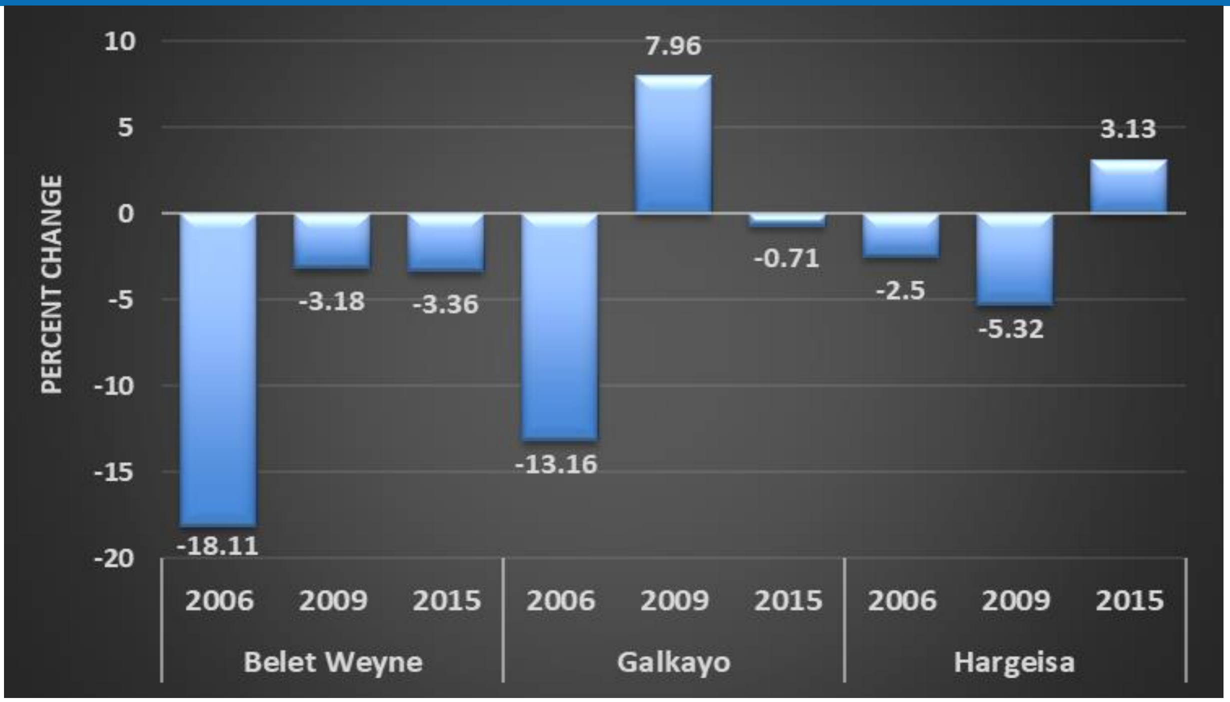
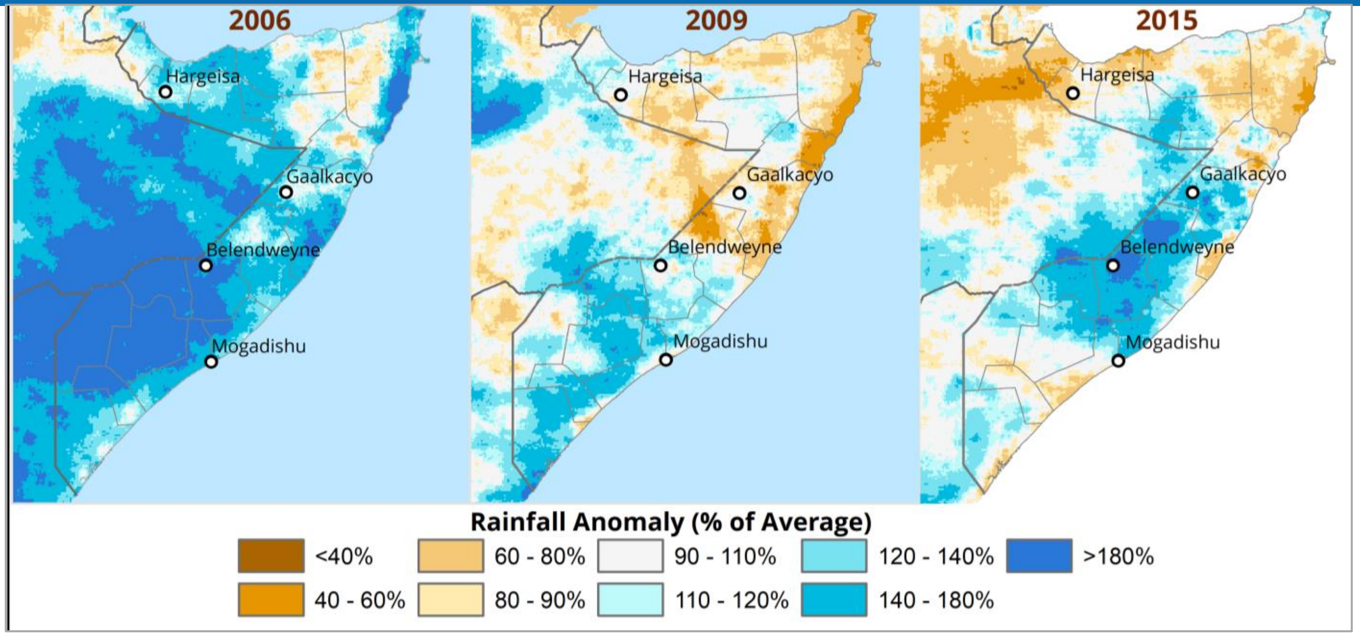


Figure 15: Percent average price change for white maize for June-September compared with October-January periods (Source: FAO GIEWS)



Map 15: June-September seasonal rainfall anomaly for Sudan during El Nino years as a percentage of average. Brown shades indicate below-average rainfall; blue shades indicate above-average seasonal rainfall (Source: CHIRPS 2.0)

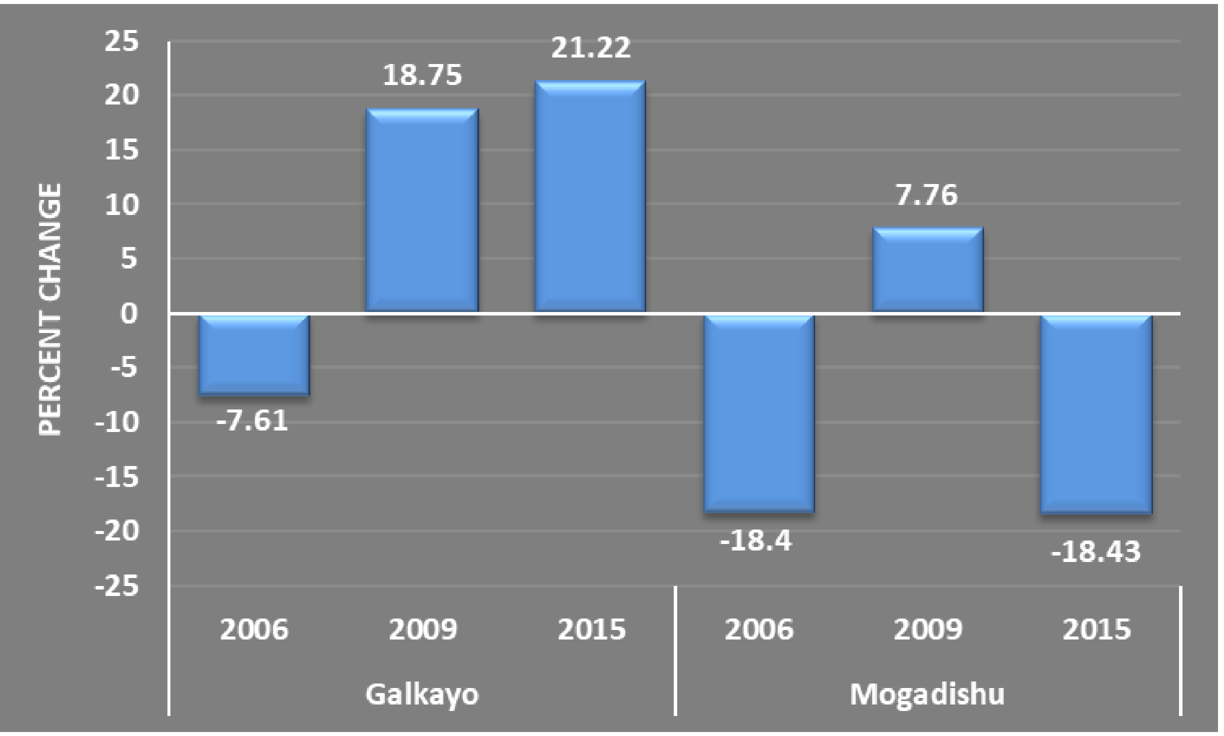
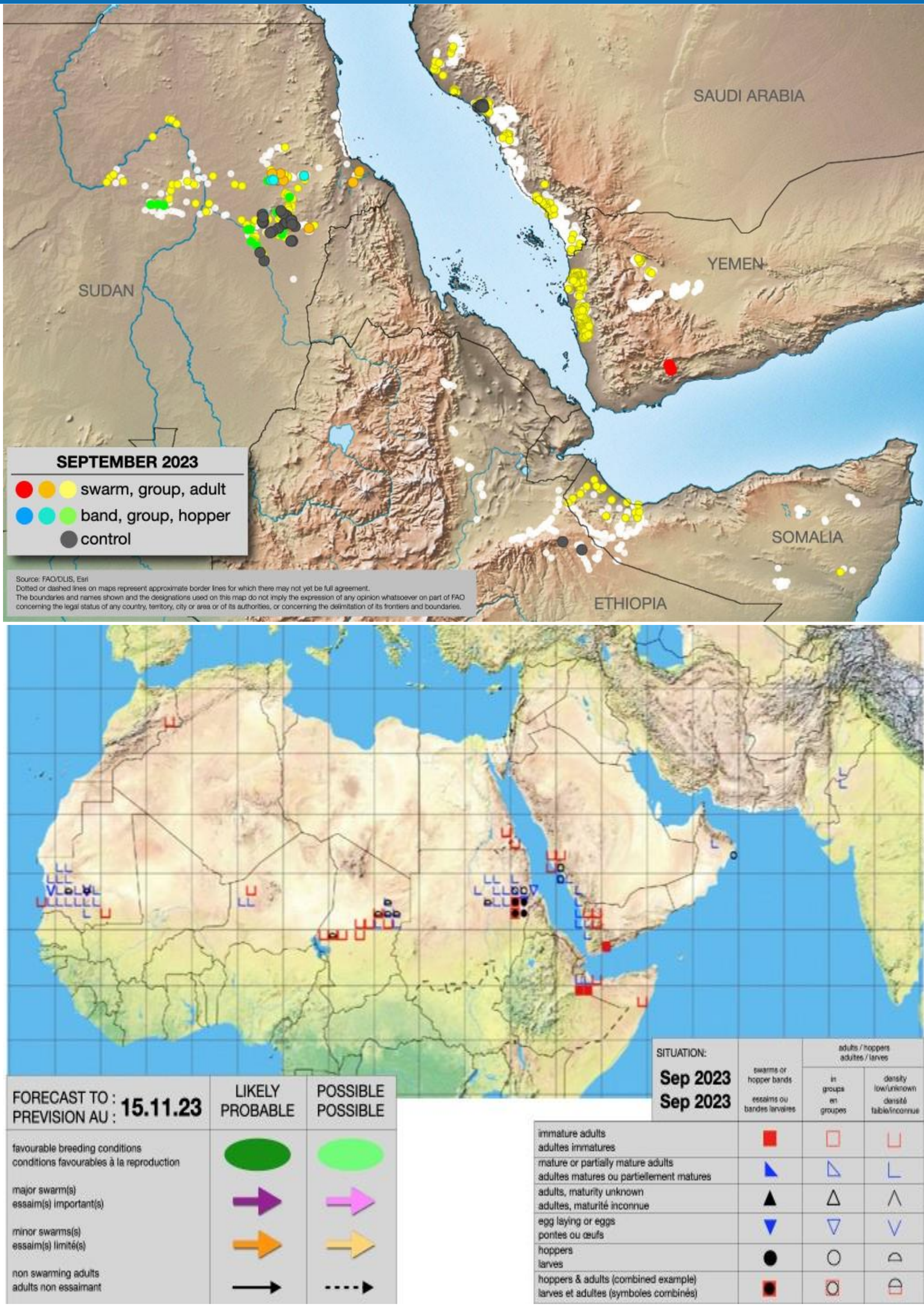


Figure 16: Percent average price change for red sorghum for June-September compared to October-January (Source: FAO GIEWS)

- Somalia experienced enhanced rains during the 2006 Oct-Dec Deyr season but in 2009 and 2015 only the central and southern were wetter-than-normal (Map 15). Enhanced rains are crucial for food production during Deyr season.
- The average market price of maize and red sorghum declined during the October 2006-January 2007 period compared to June-September, which ideally reflects the influence of supply. The average price change during the same periods in 2009 and 2015 was mixed across markets (Figure 15 & 16).
- In 2009, the April-June Gu rains were poor followed by depressed rains over Oct-Dec season, particularly in the north. The 2015 October-December rainfall season was equally poor in parts of the north and south. This may have impacted on production, supply and consequent prices during these two years. Nevertheless, market prices in Somalia are not only influenced by climate shocks and production but also by other factors.

Likely Favourable Conditions for the Spread of Desert Locusts



Map 16: Desert Locust risk situation in September 2023 (top map) and forecast for up-to mid-November 2023 (Source: FAO Desert Locust Watch)

- Towards the end of 2019, the region experienced wetter-than-normal rains due to a strong Indian Ocean Dipole event that greatly improved vegetation and soil moisture conditions. Coupled with warm temperatures and strong winds, the breeding and spread of Desert locusts in the region and middle east became possible.
- Between 2019 and 2021, the locust swarms affected Somalia, Kenya, Ethiopia, Djibouti, Eritrea and Sudan, and spread to Karamoja (Uganda) and South Sudan.
- The latest update by FAO[25] as of 4th October 2023 indicate that currently, a few swarms are in Ethiopia and Sudan, some groups are in Sudan, mature adults in northern Somalia and breeding is also taking place in Sudan.
- There are concerns that the likely enhanced rains and warmer-than-normal temperatures towards the end of 2023, and the consequent improved vegetation will support the breeding and spread of the Desert Locust swarms. Monitoring and control of existing swarms is necessary.

A snapshot showing Desert Locusts during the 2019-2021 invasion (Source: FAO Desert Locust Watch)

25 FAO Desert Locust watch Update, 4th October 2023: https://www.fao.org/ag/locusts/en/info/info/index.html

Anticipated Positive Impacts of Enhanced Rains in Equatorial Areas over October – December

Improved water replenishment & availability

Replenished water resources (surface water points, wells) for humans, livestock, wildlife, agriculture, industrial, and energy generation. Ground water aquifers will recharge availing water after the rainfall season.

Improved conditions for crop development

Favourable and adequate moisture for crop development and consequent improved food production in most growing areas.

Vegetation regeneration / development

Rangelands recovery from the prolonged effects of the 2020-2023 drought. This will be critical for south-central Somalia where Gu rains were insufficient to alleviate the effects of the prolonged drought.

Improved livestock condition & production

Improved livestock body condition due to water and pasture availability which will increase production, improve livestock market prices, and terms-of-trade between livestock and food staples. Livestock reproduction may occur due to availability of grazing resources. However, some households that lost livestock to drought will not realise these gains and might take longer for such households to fully rebuild their herds.

Improved livestock grazing resources (water & pastures)

Rangeland recovery and vegetation regeneration will lower the need for livestock outmigration and long-distance trekking in search of water and pastures in most areas. Significant improvement is expected in pastoral and agropastoral areas.

Improved milk production & consumption

Likely improved livestock body condition, milk production and consumption among households with livestock. This will to some extent alleviate the severe food and nutrition insecurity persisting in some pastoral and agropastoral areas. Households that lost livestock to drought will be disadvantaged.

Likely Negative Impacts of Enhanced Rains in Equatorial Areas over October – December

Heavy rainfall/storm/storm surges

Exceptionally wetter-than-normal conditions in some areas leading to varying negative implications. Higher probabilities are forecasted in eastern Kenya, southern Somalia and southern-southeast Ethiopia. Other localised areas may be affected.

Flash floods

Floods

Increased incidences of flooding (riverine and flash floods):

- Ethiopia & Somalia: Shabelle & Juba river basins in Ethiopia and Somalia;
- Kenya: Arid and Semi-Arid Lands (ASALs), Tana River catchment, Lake Victoria basin;
- Uganda: Bugishu, Bukedi, Teso, Busoga, Rakai, Karungu, West Nile, Lango, Acholi/Amolatar, Isingiro, Kisolo, & Kabale.
- Rwanda: western, southern & eastern areas
- Burundi: along shores of Lake Tanganyika,
- South Sudan: in flood prone areas along River Nile due to increased water levels in the river.

Damage to crops

Increased risk of damage to planted crops and reduced planting and harvests in flood prone areas such as the Shabelle & Juba river basins, Lake Victoria basin, and other localised areas causing reduced harvests.

Impeded transportation & supply of goods, services

Hindered transportation in locations where infrastructure is destroyed/impacted thereby disrupting the supply of goods and services.

Human displacement

Temporal displacement of people by floods that will increase humanitarian needs.

Landslides, mudslides, earth movements

Landslides, earth movements or mudslides are likely in hilly areas of western and northern Rwanda, eastern and western Uganda, and on Kenyan highlands (central, west and east of Rift Valley).

Damage to infrastructure & facilities

Localised damage of properties (including roads, buildings, bridges etc) by heavy rains or increased wetness. This will constrain access to facilities & services (e.g., schools and hospitals).

Diseases & pests

- Increased risk of plant and livestock pests (worms, ticks, lice) and diseases with economic implications such as East Coast Fever, Anthrax and pneumonia.
- Increased human health risks associated with water-borne diseases (cholera, Dengue fever and malaria).
- Likely breeding and spread of Desert Locusts unless adequately controlled. Some few swarms and adult groups are reported in northern Ethiopia (Tigray), Eritrea, Yemen and Sudan.

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