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The Eastern Horn of Africa faces an exceptional prolonged and persistent agro-pastoral drought sequence

Highlights

1. An exceptional three-season drought sequence has struck the Eastern Horn of Africa
   a. Poor rains in October-December 2020 and March-May 2021 have been followed by an extremely dry October-December 2021 season.
   b. All warning systems and indicators converge on exceptional drought. Kenya and Somalia have declared drought emergencies.
   c. Rainfall totals and vegetation imagery suggest lowest-on-record values in many areas.
   d. The land surface is much hotter than normal.
   e. Vegetation conditions and water levels will decay rapidly over the next few months.
2. The food security situation is likely to deteriorate rapidly
   a. In southern and eastern Ethiopia, Kenya and Somalia, the food security situation has already drastically deteriorated in 2021, with severe food insecurity conditions (IPC Phase 3 "Crisis" and Phase 4 "Emergency") currently prevailing.
   b. The prolonged dry weather conditions have resulted in poor harvests and livestock body conditions, leading to a reduction of crop and livestock production which severely affected food availability and access.
   c. Poor households are experiencing significant reductions in food access and availability and income, and food prices are rising or expected to rise soon.
   d. The impacts of drought conditions in parts of Kenya, Ethiopia and Somalia are intensifying, and there are reports of people migrating to near-by towns in search of humanitarian assistance in Somalia.
3. Climate change and La Niña are working together to produce prolonged and persistent dryness.
   a. Current climate forecasts indicate a 90 percent chance of a La Niña-like climate in March-May 2022 and the most recent ICPAC weather assessment anticipates cumulative dry conditions through May 2022. This assessment indicates that even if MAM rains are normal, the region will experience lingering long-term rainfall deficits.
   b. Climate change has increased the frequency of poor March-May rains during La Niña-like seasons.
   c. A poor March-May 2022 season would result in an unprecedented (since 1981) sequence of four below-normal rainfall seasons, which could further exacerbate the current humanitarian challenges.
4. Scaled-up humanitarian responses are needed.
   a. There is urgent need for extensive and coordinated humanitarian responses following the detailed indications of the Global Report on Food Crises September update and latest IPC Acute Food Insecurity Analyses in the region.
   b. There is an immediate need to activate and scale-up response mechanisms, especially provision of food, water, nutrition assistance and livelihood protection programs, including water-trucking, feed supply and cash-transfers.
   c. There is a need to release government funds to allow the affected districts and localities to provide adequate supplies of food and non-food items.
   d. We call on development partners to make available resources for humanitarian response as a priority to save lives and protect livelihoods, and to support ongoing actions by governments, relevant international organizations and other local actors.
   e. Due to the observed increase in the frequency of extreme weather events, interventions should not be limited to the immediate humanitarian response. Countries in the region need to become more resilient to climate shocks and need support to fragile livelihoods and agri-food systems. Access to early warning and risk preparedness information needs to be strengthened and better linked to early action. Development support aiming at improved climate change adaptation and increased food systems sustainability needs to be prioritized.

f. There is a need to renew commitment to medium- and long-term actions to prevent the collapse of local agri-food systems and for the protection of fragile livelihoods in continuity with resilience-building humanitarian aid.
g. We favour the integration of conflict-sensitive approaches, such as promoting social cohesion between displaced and host communities into country programme strategies. or supporting conflict sensitivity approaches between farmers and herders.

Overview: convergent analyses indicate exceptional dryness and drought impacts

This multi-agency alert draws from recent analyses prepared by several partners[1] to emphasize the severe risks associated with three sequential droughts that have affected the eastern part of the Horn of Africa since the poor October-November-December (OND) 2020 rainy season. Rainfall amounts between January and March in this region are ordinarily extremely low, due to the southern migration of the rains, and there is potential for a fourth below-normal rainy season during the March, April and May (MAM) 2022 long rains season. This collaboration hopes to draw attention to this exceptional series of drought shocks and the anticipated impacts on food security. This document is based on several analyses that show the exceptional nature of the past three dry rainy seasons (Section 1), the drought impact on agriculture, livestock, prices and food security (Section 2) and a pessimistic outlook for the MAM 2022 rainy season, due to the combined influence of climate change and La Niña (Section 3).

Section 1. East Africa has experienced an exceptional three season drought sequence

Fig. 1A and B places these consecutive droughts in historic context by presenting time-series of Standardized Precipitation Index (SPI[2]) values for the Eastern Horn of Africa (EHoA, Kenya, Ethiopia and Somalia east and south of 38°E and 8°N)[3]. MAM SPI values are shown with either blue or red bars and OND SPI values are shown with green and orange bars. Blue/green bars are used when the rains were normal or above-normal. Red/orange bars are used when rains were below normal, below the SPI threshold of -0.44Z.

Since 1981, three consecutive dry seasons have only happened once - in 1983/84. Amplifying the exceptional risks associated with the sequential dry OND2020-MAM2021-OND2021 sequence is the fact that MAM 2022 sea surface temperatures forecasts anticipate conditions very similar to past dry MAM seasons (discussed below), resulting in a high likelihood of yet-another below normal MAM season. Figure 1B zooms into the SPI time-series to better depict EHoA's exceptional sequence of hydro-climatic shocks, (please note that these are regional averages, central Somalia had average-to-wetter rainfall during OND 2020). If MAM 2022 is dry as anticipated, the EHoA region will experience an unprecedented (since 1981) four-season dry sequence. Since OND 2016, there will certainly be six and will probably be seven dry seasons. Interspersed with these dry seasons we find three exceptionally wet seasons (MAM 2018, OND 2019 and MAM 2020), which have been associated with flooding, displacement and a damaging locust outbreak. Just two seasons have been normal -- OND 2017 and OND 2018. The extreme rains in 2019 were very disruptive, and led to

[1] The IGAD Climate Prediction and Applications Center (ICPAC), the Famine Early Warning Systems Network (FEWS NET), the Food and Agriculture Organization Global Information and Early Warning System (FAO GIEWS), the World Food Programme (WFP) and the Joint Research Center (JRC). "This statement reflects a shared view of current conditions and the likely evolution of the situation in East Africa by major actors involved in global food security monitoring and early warning and will contribute to the 2022 Global Report on Food Crises being prepared in the context of the Global Network against Food Crises."

[2] A globally recognized index to characterize drought, recommended by the World Meteorological Organization: https://library.wmo.int/doc_num.php?explnum_id=7768.

[3] The -0.44Z and +0.44Z thresholds align with tercile boundaries delineating 1-in-3 year dry and wet events. Thus, seasons with SPI values of less than -0.44Z are below-normal, and seasons with SPI > -0.44Z are considered above-normal.

widespread floods, resulting in the displacement of hundreds of thousands of people and causing crop and livestock losses that affected approximately 3.4 million people. These exceptionally moist conditions led to a massive locust outbreak that was the worst in 25 years in Ethiopia and Somalia and in 75 years in Kenya. So, the region not only faces three or four sequential droughts, but these droughts come on top of excessive rain, flooding and locust outbreaks. These compound shocks are also exacerbated by COVID-19, which created massive economic upheaval.

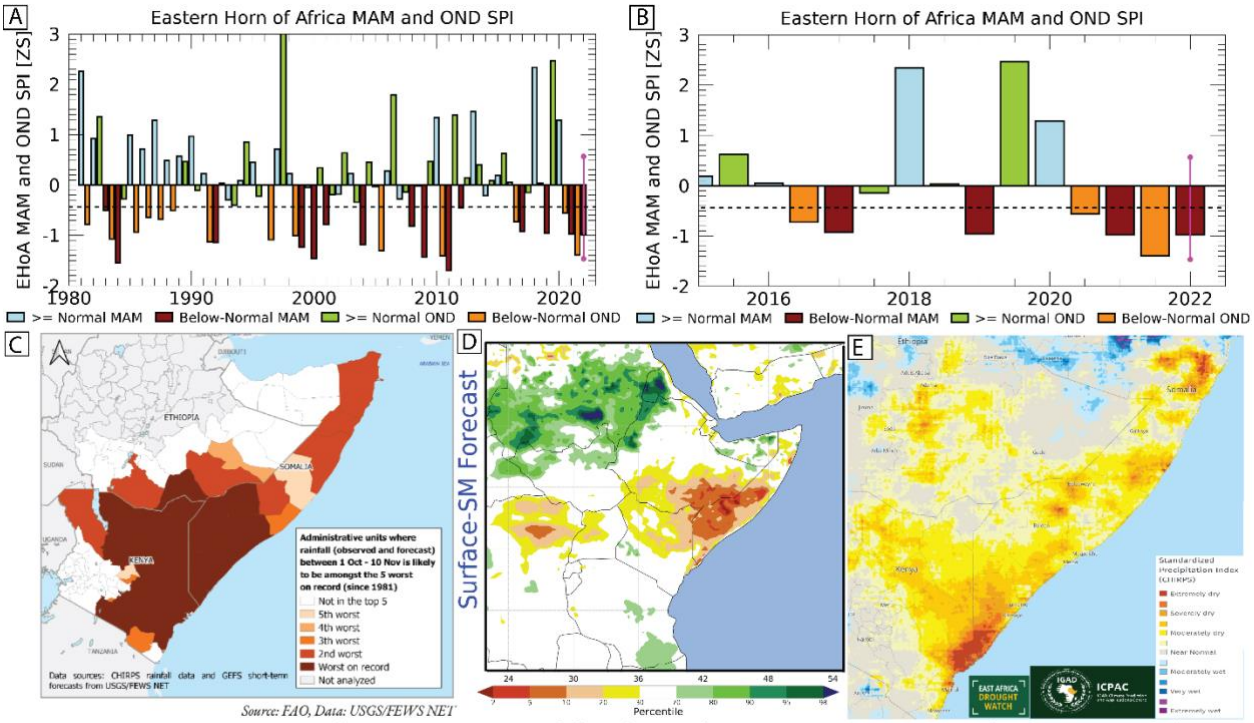

Figure 1. A-B. CHIRPS MAM and OND EEA SPI. C. Rainfall Ranks. D. Feb 2022 NHyFAS crop zone soil moisture percentile forecasts. E. 12 month (November 2020-December 2021) CHIRPS SPI from ICPAC - https://droughtwatch.icpac.net/mapviewer/

While regional averages, such as those shown in Fig. 1AB may obscure local details, this generalization enables us to see the alarming historical context of the recent droughts for the region overall -- a long sequence like this is very rare, with the last possibly being nearly 40 years ago, during 1983/84. Since 1983, the population of Kenya/Ethiopia/Somalia has tripled, dramatically increasing the number of people exposed to drought hazards.

The last orange and red bars shown in Fig. 1A are assessments of the likely outcomes for OND 2021 (orange bar with a value of ~-1.4Z) and MAM 2022[4] (red bar with a value of -1Z). The OND 2021 value is extremely concerning. The current short rainy season will be very dry, similar to seasons like 2010 and 2016, and we are already seeing extensive impacts on agriculture, grasslands, and water resources.

As discussed in the November 2021 FSNWG alert and illustrated in Fig. 1C "*the start of the 2021 October – December rainy season has been significantly delayed with little to no rainfall observed to date across much of eastern and northern Kenya, southern and central Somalia, southern Ethiopia, bimodal areas of northern Tanzania, and localized areas of Uganda…. and ICPAC reports "drier than usual conditions expected over northern and eastern Kenya, southern Somalia, and western Tanzania" between November and January 2021 … given the cropping calendars in the affected areas, it is unlikely that crops will recover*

[4] The MAM outlook is described in more detail below. The pink vertical line shows the 80% confidence intervals (-1.5Z to +0.6Z).

regardless of rainfall that occurs during the remainder of the season. Current rangeland conditions are also extremely poor". In the Shabelle-Juba river basins, current rainfall totals are the lowest on record since 1981, drier than 2010 and 2016, and many areas of central-eastern Kenya and Somalia appear likely to have lowest-on-record OND 2021 rains. NHyFAS soil moisture forecasts (Figure 1D) anticipate substantial moisture deficits through February. Going into the 2022 February-March-April lean period, the eastern Horn of Africa will certainly experience a further deterioration in rangeland conditions and water availability - and rangeland conditions and water availability levels are already extremely poor. Figure 1E shows 12-month SPI from the ICPAC Drought Viewer portal. For the past 12 months, persistent dry conditions have prevailed over eastern Kenya, Somalia, and southern and eastern Ethiopia.

Convergent Evidence for Exceptional Aridity: Convergence of evidence from multiple data sources can build confidence and support earlier and more effective intervention. To this end, Figure 2A presents a time series of cumulative September 1st to November 10th precipitation produced by the Ethiopian National Meteorological Agency and the CHC as part of their mid-November Dekadal Monitoring Report for Ethiopia. The regional average SPI is very low and similar to recent signature drought years like 2010 and 2016.

While a detailed spatial analysis of drought-impacted regions is beyond the scope of this alert, comparison of the 2021 and 2010 MODIS Normalized Difference Vegetation Index (NDVI) and Land Surface Temperature (LST) anomalies (Fig. 2B-E) emphasize and reinforce that the level of aridity appears similar to the very severe and destructive 2010 OND drought. NDVI is a measure of vegetative health. While in 2010 some areas in central Somalia had larger NDVI reductions, overall vegetation conditions in southeastern Ethiopia and central and eastern Kenya appear to be worse in 2021. In arid regions, land surface temperatures can increase rapidly when soil moisture stores are depleted and evapotranspiration can no longer help offset intense incoming solar radiation. Thus, the extreme (>+5°C) LST anomalies in Fig. 2D-E indicate exceptional aridity and vegetation stress.

There is a strong spatial correspondence between the patterns of low rainfall, predicted soil moisture conditions (Fig 1A-B), low NDVI, and high LST. Many areas of north-eastern and eastern Kenya, southern and southeastern Ethiopia, and central and southern Somalia will almost certainly have an exceptionally dry OND season, with poor vegetation and crop conditions at present, and little chance of recovery before the MAM 2022 rains.

In the JRC´s Anomaly hot Spots of Agricultural Production (ASAP) platform, most countries in East Africa are flagged as agricultural hotspots from around mid-2021 due to different combinations of stressors, including drought conditions, floods and conflict. The ASAP analysis of crop condition indicators in November 2021 confirms strong negative anomalies in NDVI as well as in one and three month SPI, severe water deficits,

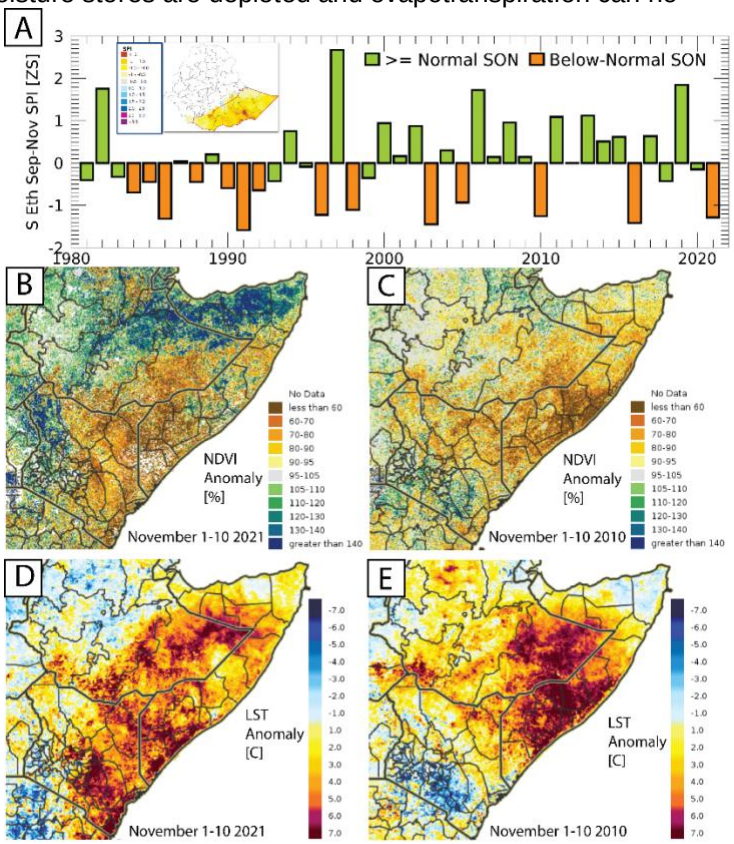

Figure 2. A. A time series regionally averaged SPI values for southern Ethiopia. B-C. November 1-10 NDVI, expressed as percent anomalies for 2021 and 2010. D-E 2021 and 2010 MODIS LST anomalies.

and extremely warm temperatures in the rangeland areas of Kenya, Somalia and southern Ethiopia, similar to those shown in Figure 2.

Section 2. Drought Impacts on Agriculture, Livestock, Prices and Food Security

The impact of the ongoing drought on agriculture, livestock, staple food prices and food security has been recently examined by FSNWG, FAO GIEWS, and FEWS NET. Their convergent and extremely concerning findings are summarized here.

Agriculture: Given the failure of the OND rains, poor crop production in Kenya and Somalia is almost certain. In Somalia, according to the Food Security and Nutrition Analysis Unit (FSNAU) and the Famine Early Warning Systems Network (FEWS NET), the 2021 "Deyr" cereal output is forecast to be 50 to 70 percent below the 10-year average. This would lead to a fourth consecutive season with a reduced cereal production. Maize and sorghum crop production was 15-25 percent below the 10-year average in the 2020 Gu and 2020 Deyr seasons and 50 percent below average in the 2021 Gu season (FEWS NET/FSNAU In southeastern and coastal Kenya, "short-rains" crops, accounting for about 20 percent of the annual cereal production and grown in bimodal rainfall cropping areas, have also been affected by early season dryness, with rains expected to be the driest on record since 1981 in many areas. Given the cropping calendars in the affected areas, it is unlikely that crops will recover regardless of rainfall that occurs during the remainder of the season. Substantial crop losses should be expected. This would lead to a fourth consecutive season with below-average cereal production in Somalia and a third in Kenya.

Rangelands and Livestock: FSNWG, GIEWS and FEWS NET analyses converge on a story of repetitive shocks capped by incredibly arid conditions at present. NDVI values are the lowest on record in many regions, confirming rainfall-based results. The latest GIEWS assessment provides a detailed description: *"The widespread and severe pasture (Figure 2B-C) and water shortages are resulting in the deterioration of livestock body conditions to very poor levels, in livestock deaths due to starvation and in drought-induced diseases. The dismal animal conditions are also resulting in abortions and very low birth rates. Herders are often unable to provide adequate feed and water to their animals and are forced to cull offspring to save milk-producing females. These losses are of particular concern as herd sizes are still below average, not having fully recovered from the large-scale deaths that occurred during the severe 2016/17 drought, the worst in recent years. Poor livestock health conditions and the loss of animals have caused a reduction in milk production and pastoral incomes. For example, in northern and northeastern pastoral areas of Kenya, milk production in September was estimated to be up to 55 percent below the average. According to the preliminary findings of a recent FAO assessment, the prolonged dry weather conditions and the poor start of the "Deyr/Hageya" rainy season severely affected pastoral livelihoods in southeastern pastoral areas of Ethiopia, including South Omo and Bale zones in SNNPR Region, Borena Zone of Oromia Region and southern Somali Region. Widespread shortages of water and pasture have caused atypical livestock migration, with reported herd movements of more than 200 to 300 km northwards in search of pasture and widespread abortions. According to the FAO assessment, about 60,000 animals have died due to starvation and milk production declined to about 80 percent below average levels".* Rainfall and NDVI data support the severity of this situation (Figure 2). FEWS NET finds that: "*Past trends also show household livestock holdings will most likely stagnate or decline and milk availability will be low, resulting from poor livestock reproduction, hunger-related disease incidence, and household coping strategies that include culling or selling off their livestock. FEWS NET's livestock herd model suggests goat and sheep herd sizes could drop to 20-50 percent below normal during the OND season in several pastoral livelihood zones. In a worst-case scenario where OND rainfall fails, excess livestock mortality would further accelerate in the subsequent January/February 2022 dry season*". The results presented here indicate that the worst-case scenario has occurred. Conflict due to competition for dwindling resources may exacerbate the situation.

Markets and Prices: According to the FSNWG Market and Trade Analysis sub-working group, staple food prices are significantly above the five-year average across parts of the region, due to the combined effects of macro-economic challenges in certain countries and below-average harvests during the previous season in others. Poor households are experiencing significant reductions in food and income from on-farm sources, as well as increased competition for income from off-farm sources. In many pastoral and agropastoral livelihood zones, households have entered the OND 2021 season with already low herd sizes, as they have not fully recovered from the large-scale losses that occurred during the 2016/2017 drought. In addition, diverse economic shocks – such as rising fuel prices, currency depreciation, and inflation – are further constraining household purchasing power. In Kenya, for example, the price of livestock has fallen by 15-30 percent compared to last year. In Somalia, FSNWG/GIEWS/FEWS NET analyses all agree that consecutive below-average seasons have resulted in very high cereal prices. A drought impact assessment conducted by the FSNWG Market and Trade sub-working group found that, in the worst-affected areas of Somalia, such as Hudur and Belet Weyne, the recent below-average harvests has already caused sharp food price increases that are larger than those observed during Somalia's 2011 and 2017 drought emergencies, as well as the 2008 global food price crisis. According to the latest GIEWS assessment, in September 2021, prices of sorghum in Dinsoor, located in the "sorghum belt" of Bay Region, and prices of maize in Qoryoley, located in Lower Shabelle Region, the main maize producing areas, were about 70 percent higher than a year earlier and close to the levels reached during the 2016/17 severe drought. Similarly, in Baidoa, one of the main source markets in the sorghum belt of Somalia, the price of red sorghum has reached 10,100 SOS/kilogram, a price similar to that recorded during the 2016/2017 drought (Somalia Food Security Outlook). In Ethiopia, according to the Central Statistical Agency (CSA), the general inflation rate is at very high levels, with its food component estimated at more than 40 percent in September, among the highest rates recorded during the last nine years, resulting in severe food access constraints for vulnerable households across the country. In southeastern areas, according to the GIEWS alert, goat prices in October were about 35 percent lower than 12 months earlier, due to poor animal body conditions. By contrast, prices of cereals were at high levels, with those of maize, teff and rice in October reported to be 60 to 70 percent higher than their year-earlier values, mainly as a result of increasing costs of imports from Kenya due to the continuous devaluation of the Ethiopian birr against the Kenya shilling. As a result, the terms of trade of pastoralists deteriorated over the last 12 months and, in October 2021, the goat-to-cereals (maize, teff and rice) terms of trade were 60 to 70 percent lower than last year at the same time.

Food Security: This alert focuses on the extreme risks associated with four sequential droughts. Although it does not aim to provide estimates of the number and location of food insecure populations, the following three observations underscore the severity of the food security situation.

First, the poor OND 2020 and MAM 2021 are already having severe food security impacts: "*In many pastoral and agropastoral livelihood zones, households are entering the OND 2021 season with persistently low herd sizes, as they have not fully recovered from the large-scale losses that occurred during the 2016/2017 drought. In addition, diverse economic shocks – such as rising fuel prices, currency depreciation, and inflation – are further constraining household purchasing power". (FEWS NET). "Projections through the end of 2021 are already showing major increases in food insecurity" (FSNWG). "Food availability and access have been severely constrained in 2021 as prevailing dry weather conditions since late 2020 had a negative impact on crop and livestock production". (FSNWG).* According to the Global Report on Food Crises and latest official IPC estimates, the total numbers of food insecure people (Crisis IPC Phase 3 or higher) have already risen dramatically in Kenya and Somalia between late 2020 and late 2021. In Somalia, the share of the total population in need of food assistance is already approaching figures recorded in 2017; this need is reaching 22% of population in IPC Phase 3 and above (3.5 million people) (FEWS NET & FSNAU, 2021). The latest analysis in Kenya, which accounted for the effects of drought on rural population and their livelihoods found 16% IPC Phase 3 and above by end of 2021, mainly due to the drought effects (IPC TWG,

September 2021). While in Ethiopia, the most recent analysis finds very high severity and magnitude by June 2021, mainly due to effects of ongoing conflict. It also estimated a great deterioration of the proportion of people affected by end of 2021 due in part to the effects of erratic rainfall on food reserves by September 2021, which poses a great risk of very dire situation (IPC TWG, June, 2021).

Second, the very poor OND 2021 season will exacerbate limitations in food availability and access. "*The delayed and below-average OND 2021 season is expected to further erode household food and income from crop and livestock production, especially in the eastern Horn.* The most recent FSNAU/FEWS NET assessment suggests that crop production will be in the range of 50-70% below the 10-year average. *Crop losses will reduce local food availability and demand for agricultural labor, thereby contributing to spiking food prices and lower purchasing power before and after the January/February 2022 harvests*" (FEWS NET). It is evident that the extremely poor OND 2021 rains are producing rapid impacts on food availability and access that will need to be addressed quickly. The FSNWG "*encourages its members to implement appropriate, timely and well-targeted actions across affected areas of the region to anticipate the peak of the crisis. For the food security/agriculture sector, these actions could include cash and livestock livelihood protection programmes. Enhanced preparedness for a significant scale-up of emergency response is also needed*". Finally, there is a very real risk of yet-another poor season in MAM 2022, because the sea surface temperature forecasts are very similar to those in dry years like 2011, 2017 and 2021.

Section 3. Climate forecasts indicate cumulative drought and La Niña-like SST gradients through May 2022

While considerable uncertainty remains regarding the MAM 2022 rains, Figure 3A shows the latest 15-month period SPI ending in May 2022, constructed from ICPAC's recalibrated objective precipitation forecast for November 2021 - May 2022 and CHIRPS/observations for March – October 2021. As the OND 2021 rains draw to a close, the current dry conditions (Figures 1 and 2) will persist through January, February and March, until relief may arrive as the long rainy season commences. ICPAC's current prediction (Figure 3A) suggests that even at the end of May 2022, we are likely to see lingering long-term rainfall deficits.

As recently discussed in the GEOGLAM Crop Monitor, the forecast for a La Niña-like Pacific Ocean sea surface temperature (SST) configuration (Fig. 3B) for MAM 2022 resembles SST patterns during previous below-normal EHoA MAM rainy seasons. If MAM 2022 SSTs exhibit a strong "Western V" gradient (WVG), such a gradient could lead to suppressed rainfall. The Western V index is based on the difference between eastern and western Pacific Ocean temperatures. When the west is warm and the east is cool, rainfall is enhanced in the area around Indonesia, but suppressed over the Eastern Horn. There is a 50 percent chance of a La Niña event during MAM, and a 90 percent chance of strong MAM WVG conditions. Five-month lead NMME forecasts for WVG conditions during MAM are skillful (Figure 3B), due to the models' ability to forecast La Niña-related SST variations and the strong warming trend in the western Pacific. In years when climate models forecast a strong negative WVG, as they do for MAM 2022 (red circle), many MAM seasons had below-normal rainfall (orange circles show all below-normal seasons). Using recent historical analogs as a guide, based on similar La Niña and WVG climate conditions, the chance for below-normal rainfall in MAM 2022 is higher than 50 percent in many locations in the eastern Horn. The latest ICPAC forecasts (Fig. 3A) and the expected structure of the MAM SST anomalies (Fig. 3B-C) converge on concerns for an exceptional prolonged and persistent agro-pastoral drought sequence.

Conclusion: climate variability, climate change, vulnerability and exposure are creating an exceptional level of risk for food security and livelihoods

After more than a decade of research, there is now a much better understanding of the drivers of sequential and often predictable East Horn of Africa droughts - climate change interacting with naturally occurring La Niña events that produce strong east-west sea surface temperature gradients in the Pacific Ocean that persist from October to May. Climate change has contributed to a dramatic increase in west

Pacific SSTs, which causes more strongly negative WVG events (Fig. 4A) that are associated with below-normal EHoA MAM rains, but predictable in November (Fig. 3B). The frequency of poor MAM seasons has increased substantially after 1998 as the Western V region warmed, increasing the chance of sequential droughts. Numerous studies have analyzed how the combination of warm west Pacific and cool East Pacific SST anomalies drive EHoA droughts (a, b, c, d, e, f, g), and these insights have been used to successfully anticipate dry seasons in 2016/17 and 2020/21. Understanding the link between climate change and natural climate variability provides opportunities for prediction. When the Pacific Ocean is in a La Niña-like state, there is an increased chance of sequential, often predictable dry seasons. When La Niña conditions prevail in OND, there has been a marked increase in the frequency of below-normal MAM rains the following year (Fig. 4B). Between 1950 and 1998, only 28 percent of OND La Niñas were followed by below-normal EHoA MAM rainy seasons. Since 1999, OND La Niñas were followed 78 percent of the time by poor EHoA MAM rainy seasons. This increase has set the stage for a four-season drought sequence.

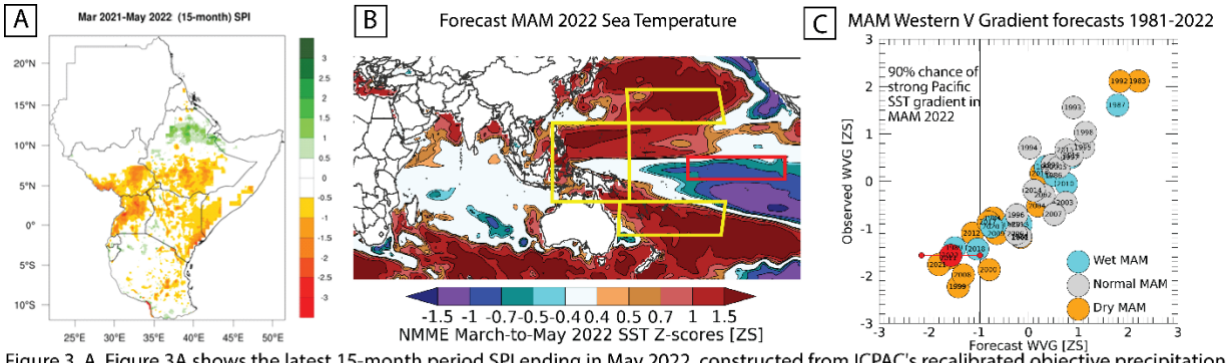

Figure 3. A. Figure 3A shows the latest 15-month period SPI ending in May 2022, constructed from ICPAC's recalibrated objective precipitation forecast for November 2021 - May 2022 and CHIRPS/observations for March - October 2021. B. Map showing November NMME model mean forecast sea surface temperatures for March-April-May (MAM) 2022, presented as standardized anomalies (Z-scores) to illustrate the historical forecast extremity of warm Western V-region SST (three connected western Pacific yellow boxes) and Nino 3.4 region SST (eastern yellow box). SST is standardized using a 1982-2021 baseline. C. Scatterplot of predicted and observed MAM Western V Gradient (WVG) values. The "Western V gradient" is the difference between standardized NINO3.4 and Western V time series. Forecasts based on October NMME predictions. There is a 90% chance of strong Pacific Ocean sea surface temperature WVG gradient conditions during MAM 2022. The red circle shows the 2022 WVG forecast. All below-normal eastern Horn of Africa MAM rainy seasons are noted with orange circles. Normal and above-normal seasons are shown with gray and blue circles. This is an updated analysis of results provided in a Climate Hazards Center Blog (http://blog.chc.ucsb.edu/?p=1030).

Rapid population growth has also increased exposure and placed increasing demands on limited water and rangeland resources. Between 2010 and 2020, according to UN population statistics, the population of Ethiopia, Kenya and Somalia grew by about 30 percent, from 142 million to 184 million people.

Intense poverty, growing populations, extreme air temperatures, three consecutive poor rainy seasons, dying livestock, poor harvests, and extremely limited water resources will result in an exceptional level of risk in the early 2022 lean season. An exceptional prolonged and persistent agro-pastoral drought sequence is going to cause a perilous and disruptive humanitarian disaster.

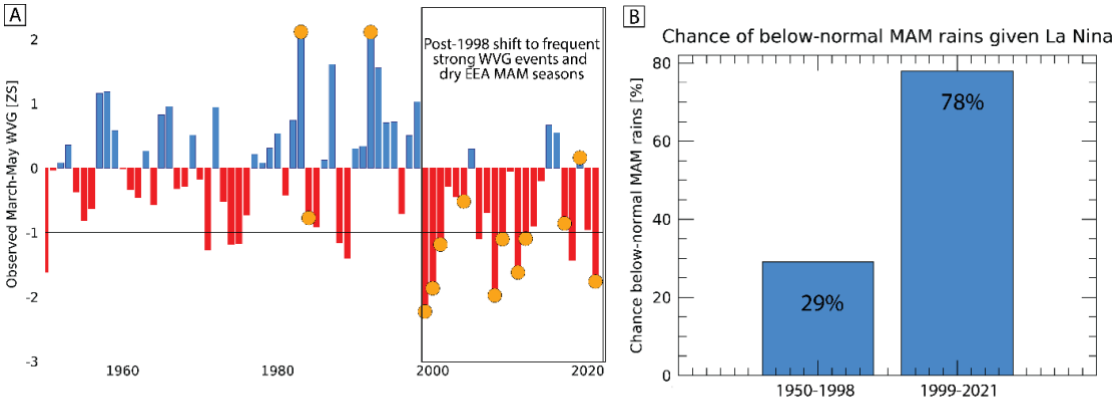

Figure 4. A. Observed March-May Western V Gradient values (bars). Orange circles show below-normal MAM rainy seasons. The time series was standardized using a 1981-2021 baseline. B. Barplot showing frequency of below-normal EEA MAM rains when the prior October-December season was a La Niña event.