Food and Agriculture Organization of the United Nations

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GIEWS Update

El Niño to return in 2023 following a three-year La Niña phase

Highlights

- El Niño oceanographic phenomenon forecast to return in June 2023, following three years of La Niña.
- Dry weather conditions expected in key cropping areas of Central America, Southern Africa and Far East Asia, while excessive rainfall and possible flooding foreseen in Near East Asia and East Africa.

Forecast to return in June 2023, the El Niño oceanographic phenomenon is a key driver of extreme weather events that pose high risks to global food security. Already in 2022, the number of people facing acute food insecurity was projected to reach up to 222 million in 53 countries/territories, the highest level on record according to the latest Hunger Hotspots report.[i] The escalation in food insecurity is a consequence of the combined effects of conflicts, economic shocks and weather extremes.

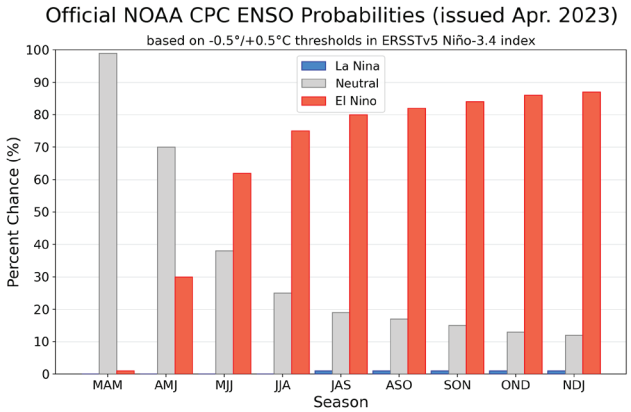
Triple La Niña event

The world experienced a third consecutive La Niña event in 2022 and early 2023, a rare occurrence that has happened only twice since 1950. La Niña events are commonly associated with wetter conditions in Australia and drier conditions in the United States of America, South America and East Africa. Reflecting these typical weather patterns, widespread flooding occurred in Australia where also bumper wheat outputs were recorded in 2021 and 2022, while drought conditions curbed wheat and maize yields in the United States of America as well as in Near East Asian countries. In East Africa, the effects on cereal production were particularly devastating, with several countries experiencing multiple seasons of failed crops that triggered famine alerts in Somalia in the first half of 2022.[ii] The 2023 La Niña event officially dissipated in March 2023.[iii]

El Niño to return in 2023

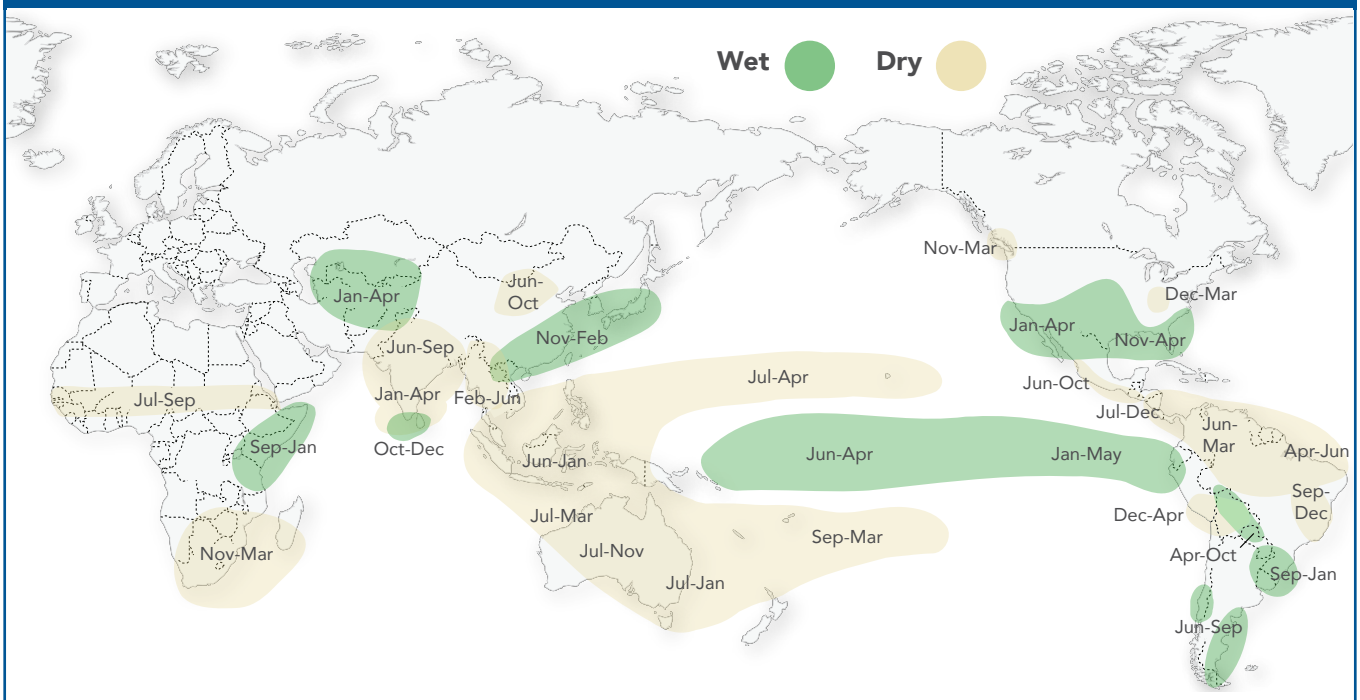
Weather forecasts point to a transition to an El Niño state in the second half of 2023 (Figure 1). Rainfall patterns during El Niño events tend to be the reverse of La Niña. For example, in East Africa and Near East Asian countries there is a tendency for wetter conditions. Conversely, drier conditions are generally observed in West Africa, Southern Africa, India, South East Asia, Australia, northern areas of South America and Central America (Map 1).

Figure 1: Forecasts point to a high likelihood of El Niño developing from June 2023



Source: IRI 2023. *ENSO Forecast*. International Research Institute for Climate Prediction, Lamont-Doherty Earth Observatory, Columbia Climate School, Columbia University. Palisades, New York, 2023. https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/.

Map 1: Typical precipitation patterns under El Niño conditions (teleconnection)



Note: Teleconnection in atmospheric science refers to climate anomalies being related to each other at large distances (typically thousands of kilometres).
Source: IRI. 2023. *ENSO Resources*. International Research Institute for Climate Prediction, Lamont-Doherty Earth Observatory, Columbia Climate School - Columbia University. Palisades, New York, 2023. https://iri.columbia.edu/our-expertise/climate/enso/.

Mapping agricultural areas of concern

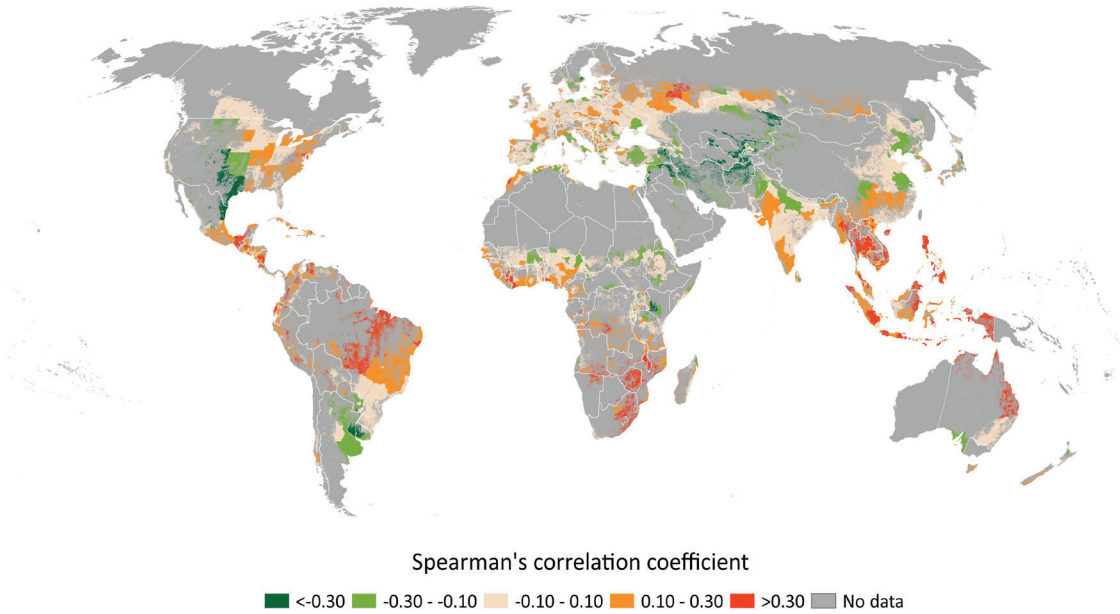
Given the high probability of recurrent weather patterns under El Niño conditions, the potential effects on agriculture can be mapped as a means to support interventions that minimize adverse impacts. This report primarily focuses on dry weather conditions, considering the significant impact that water stress has on agricultural production and that a larger area of cropland is affected by rainfall deficits compared to areas expected to receive above-normal precipitation. The analysis examines cereal crops, given their high share of calories in total food consumption, notably in low-income countries and, therefore, their importance for food security.[iv] There are, in addition, hazards associated with El Niño-induced wetter conditions, primarily floods, and areas with a high likelihood of excessive rainfall are also mapped.

Map 2 depicts the correlation between the El Niño-Southern Oscillation (ENSO) and vegetation conditions in cropland areas to illustrate and identify the effects of rainfall deviations under El Niño conditions. Positive values (orange and red tones) indicate an increased frequency of water stress in cropland areas. Negative values (green tones) infer that vegetation in cropland areas tend to exhibit healthier conditions. As one would expect, the correlation values generally mirror the well-established rainfall patterns that El Niño events engender (Map 1). Differences, however, do exist and these can in part be attributed to country-specific farm management practices and input use, including irrigation, which can lessen the impact of rainfall deficits. Additionally, as the vegetation indicator is an aggregated measurement over a year-long period, the occurrence of drought in only one season in a bimodal rainfall regime, for example, may not be detected.

Map 3 narrows down the area of analysis, depicting cropland areas with a statistically significant correlation between severe water stress and El Niño events (red areas). These croplands are identified as being most susceptible to El Niño-induced dry weather conditions, with potentially adverse implications on crop yields in 2023/24 if an El Niño event materializes.

To gain a more comprehensive understanding of the potential effects on cereal production and to help

Map 2: Correlation between vegetation conditions in croplands and El Niño events



Note: The map illustrates the correlation (using Spearman's Correlation) between a vegetation index (Agricultural Stress Index) and El Niño Southern Oscillation index (ENSO) over cropland areas. Orange and red colours infer stressed vegetation conditions due water scarcity, while green areas represent healthier vegetation conditions, reflecting the effects of above-normal rainfall due to El Niño events. Areas depicted in the beige colour indicate no correlation with El Niño events.

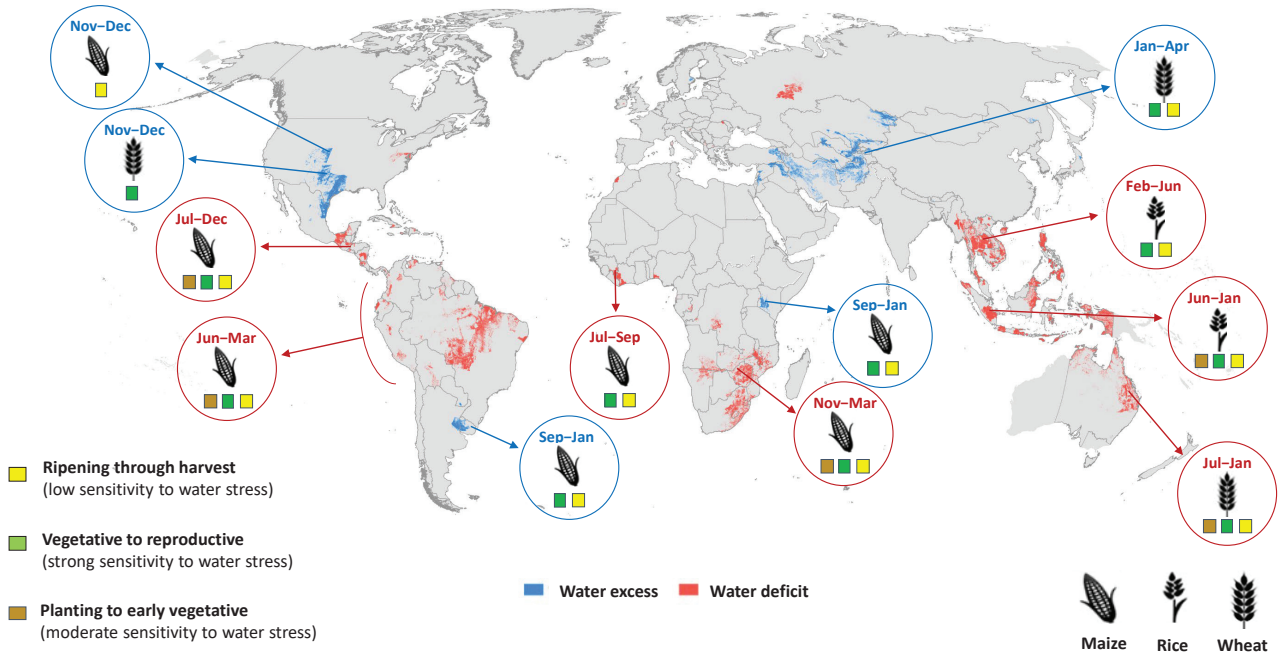
Source: Authors' own elaboration based on the data (1980–2022) from FAO and NOAA, 2023. https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php. Map is modified to comply with the United Nations map No. 4170 Rev. 19, 2020.

inform what type of assistance would be required, typical rainfall patterns should be examined in combination with crop calendars. In fact, water stress normally has a disproportionately larger impact on final yields if it occurs at the reproductive stage, while rainfall deficits have more marginal effects during latter phenological stages. Crop calendars for key cereal crops are included in Map 3 to illustrate which crop phases would likely be affected by El Niño rainfall patterns.

Countries where the entire crop cycle is affected by drier-than-average weather conditions are of particular concern, as water deficits could curtail both plantings and yields with compounding negative impacts on final production. These countries are located in Central America, southern areas of Far East Asia, Southern Africa and northern parts of South America. In parts of West Africa and northern areas of Far East Asia, dry conditions tend to occur from the vegetative to the harvest period of key cropping seasons, inferring likely impacts on yields, but potentially limited effects on plantings and crop establishment. Potential production declines represent a threat to food security, particularly in Central America and the Caribbean, and Southern Africa, where the prevalence of food insecurity is already high and lower harvests could result in reduced food availability and income-earning opportunities for vulnerable households. In addition, several countries in these regions are currently suffering from economic instability, due to low economic growth, unsustainable debt levels and foreign exchange shortages, which have contributed to high inflation rates. In the event of a production shock, this economic instability could pose challenges for countries to increase needed imports.

Map 3 also highlights croplands where there exists a strong association between healthy vegetation conditions and El Niño events (blue areas). Although wetter conditions are normally conducive for agricultural production, excessive rainfall amounts raise the risk of flooding, with potentially negative repercussions for the agriculture sector through damage and losses of crops. Even without triggering floods, excessive humid conditions often raise the likelihood of an increased prevalence of crop pests and weeds, as well as outbreaks of crop and animal diseases.

Map 3: Agricultural areas with high correlation between dry/wet conditions and El Niño events, and main cereals indicating the phenological phase during months of historical impact



Note: The highlighted areas represent croplands where a statistically significant correlation was identified between El Niño events and areas experiencing drought conditions (water deficits) and abnormally healthy vegetation conditions (water excess). The Spearman's Rank Correlation Coefficient was used to measure the relationship between the Agricultural Stress Index (ASI) and ENSO values, and a cut-off factor of ≥ 0.3 and ≤ - 0.3 (signifying water deficits and water excess) was applied.

Source: Authors' own elaboration based on the data (1980–2022) from FAO and NOAA, 2023. https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php. Map is modified to comply with the United Nations map No. 4170 Rev. 19, 2020.

The identification of croplands most susceptible to El Niño effects is intended to support preparedness and response planning to minimize the negative impacts on agriculture and food security. The inclusion of the cropping calendars are to provide additional guidance on the type of support that would be most suitable for these countries. The list of the countries where these croplands are located is presented in the Annex.

Preparing for El Niño

FAO has developed Anticipatory Action (AA) standard procedures to be followed in most countries at risk of being affected by El Niño in 2023/24, where food security is a major concern. For instance, there are active AA protocols in Burkina Faso, Chad, the Niger, Madagascar, Malawi, Zimbabwe, the Philippines, Pakistan and in Central American countries. In addition, FAO is ready to implement agricultural and livelihood-based interventions, in coordination with governments and humanitarian partners, should the El Niño forecast materialize. Below is a list of anticipatory actions that countries can implement to minimize the potential impacts of droughts and floods on the agriculture sector. The list is non-exhaustive and actions would need to be adapted to each country.

Recommended anticipatory actions

Drought conditions:

- Distribution of farming tools and seeds of drought-tolerant crop varieties well in advance of planting seasons.
- Distribution of feed and provision of animal health support, with particular emphasis on chemicals to ensure a regular dipping regime and appropriate vaccination of livestock.
- Rehabilitation of irrigation intakes, canals and other water points.
- Promotion of capacity development and support to farmers on water-harvesting techniques.
- Developing capacity of farmers and providing support on post-harvest management and processing to minimize losses.[v]

Flood conditions:

- Establishment of food storage sites and provision of storage equipment (e.g. hermetic bags) in order to reduce post-harvest losses.
- Monitoring of cyclones, preparation of actionable advisories and provision of humanitarian assistance (such as unconditional cash transfers) to vulnerable households upon early warnings and ahead of landfall.
- Establishment of evacuation routes for livestock and provision of veterinary support to curb the spread of diseases.
- Identification of dry-docks and safe havens to host boats, store fishing gear and agriculture tools.
- Promotion of early harvesting as soon as floods or cyclones are forecast and before the peak effects of the hazard.

Cross-cutting:

- Strengthening community-based early warning systems and showing communities how to link warnings to anticipatory action.
- Distribution of vegetable gardening inputs, short-cycle seeds and micro-irrigation systems to ensure availability of food ahead of the harvesting period.
- Provision of cash for work (ideally via government social protection systems) to facilitate support for the rapid construction/reinforcement of community infrastructures (e.g. evacuation centres for livestock, water drainage systems).
- Provision of Cash+ through government targeting system (the "+" will need to be tailored to community needs).
- Provision of unconditional cash transfers between the forecast hazard and the peak of its effects on local population.

Conclusion

The report aims to highlight countries where El Niño-induced dry weather conditions could occur and have an adverse impact on cereal production in 2023/24, potentially aggravating local food insecurity. It also serves to draw attention to countries where there is an increased risk of flooding because of a higher probability of above-average rainfall amounts. In this regard, the report provides a basis to facilitate anticipatory planning to prepare for such events. It must also be noted that, whilst this analysis is based on historical trends, a continual monitoring of weather forecasts is critical, as other regional oceanic and atmospheric phenomena can modulate the effects of El Niño and the consequent impact on the agriculture sector.

Annex : Countries at risk of the effects of El Niño

Countries at risk of dry conditions	Countries at risk of excessive rainfall
Australia	Afghanistan
Bolivia (Plurinational State of)	Argentina
Botswana	Armenia
Brazil	Azerbaijan
Cambodia	Bhutan
Colombia	Iran (Islamic Republic of)
Costa Rica	Iraq
Côte d'Ivoire	Kazakhstan
Democratic Republic of the Congo	Kenya
Dominican Republic	Kyrgyzstan
Ecuador	Mexico
El Salvador	Pakistan
Fiji	Paraguay
Gabon	Syrian Arab Republic
Guatemala	Tajikistan
Guyana	Türkiye
Haiti	Turkmenistan
Honduras	United States of America
Indonesia	Uruguay
Lao People's Democratic Republic	Uzbekistan
Lesotho	
Malawi	
Malaysia	
Mexico	
Mozambique	
Myanmar	
Namibia	
Nicaragua	
Nigeria	
Panama	
Papua New Guinea	
Peru	
Philippines	
South Africa	
Swaziland	
Thailand	
Timor-Leste	
Trinidad and Tobago	
Venezuela (Bolivarian Republic of)	
Viet Nam	
Zambia	
Zimbabwe	

Notes

i. **FAO-WFP**. 2022. *Hunger Hotspots FAO-WFP early warnings on acute food insecurity: October 2022 to January 2023 Outlook*. Rome. 2022. https://docs.wfp.org/api/documents/WFP-0000142656/download/?_ga=2.228611615.203409414.1679049882-1997184750.1674549163.

ii. **FAO**. 2023. *Crop Prospects and Food Situation March 2023*. – Quarterly Global Report No. 1, March 2023. Rome. https://doi.org/10.4060/cc4665en.

iii. **IRI**. 2023. *ENSO Forecast*. International Research Institute for Climate Prediction, Lamont-Doherty Earth Observatory, Columbia Climate School - Columbia University. Palisades, New York, 2023. https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/.

iv. **FAO**. 2021. *The impact of disasters and crises on agriculture and food security: 2021*. Rome. 2021. https://doi.org/10.4060/cb3673en.

v. **FAO**. 2022. *Striking before disasters do – Promoting phased Anticipatory Action for slow-onset hazards. Position paper*. Rome. https://doi.org/10.4060/cc2213en.

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