Combined Drought Indicator (CDI)

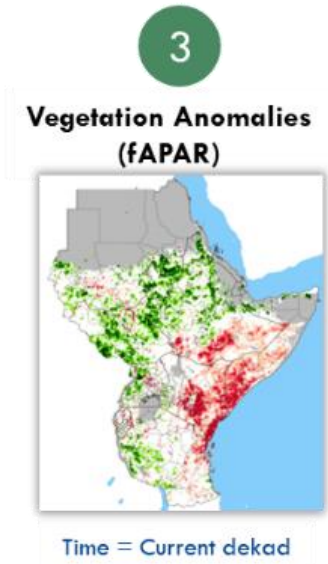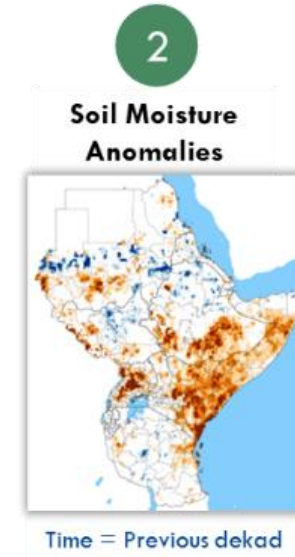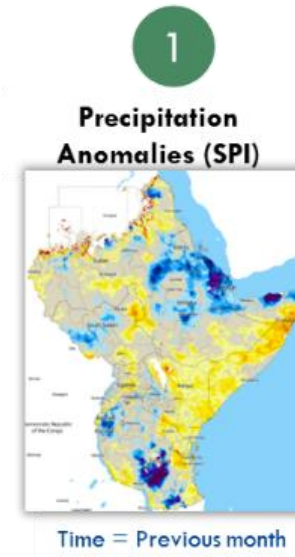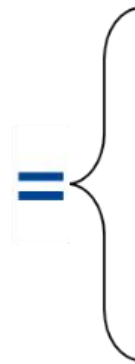*The Combined Drought Indicator (CDI) identifies areas with the potential to suffer agricultural drought, areas where the vegetation is already affected by drought conditions, and areas in the process of recovery to normal conditions after a drought episode.*
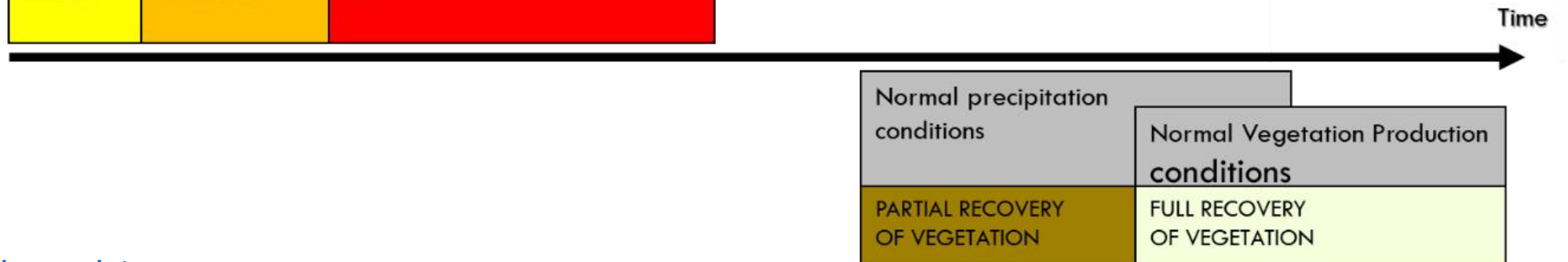
Colour	Level	Classification description
🟨	Watch	A relevant precipitation deficit is observed
🟧	Warning	The above precipitation deficit is accompanied by soil moisture deficit
🟥	Alert	The above two conditions are accompanied by a negative anomaly of vegetation growth
🟫	Partial recovery	When after a drought episode, the meteorologivcal conditions are recovered to normal but the vegetation conditions are yet to recover
🟩	Full recovery of vegetation	When after a drought episode both the meteorological and vegetation conditions have recovered to normal
⬜	No drought conditions	

Drought condition indicator time-series. Source: East Africa Drought Watch

East Africa Drought Watch

ICPAC

Combined Drought Indicator – CDI

Combined Drought Indicator (CDI)
for Agricultural Drought

Time = Current dekad

$=$

1 Precipitation Anomalies (SPI)

Time = Previous month

2 Soil Moisture Anomalies

Time = Previous dekad

3 Vegetation Anomalies (fAPAR)

Time = Current dekad
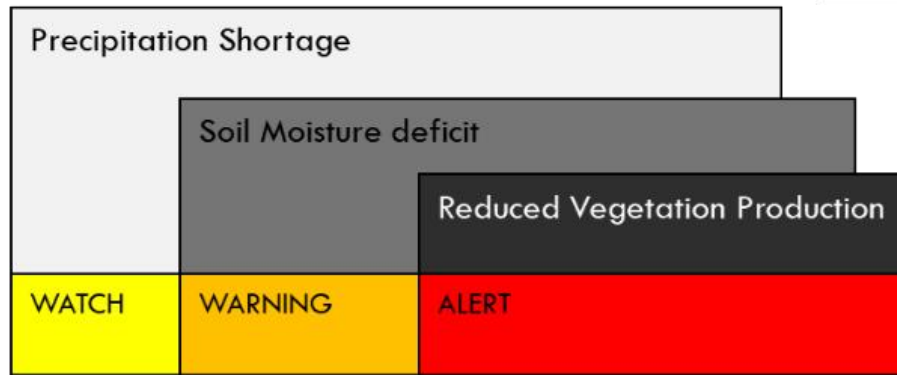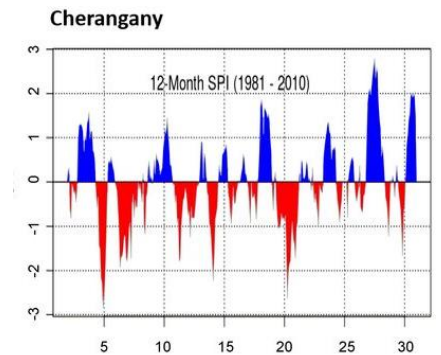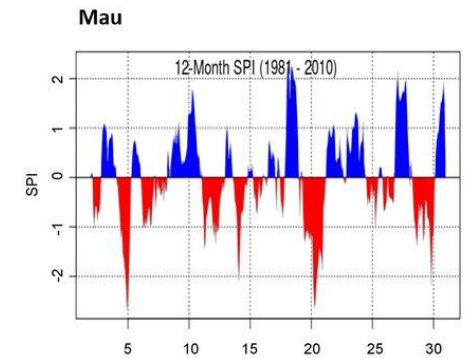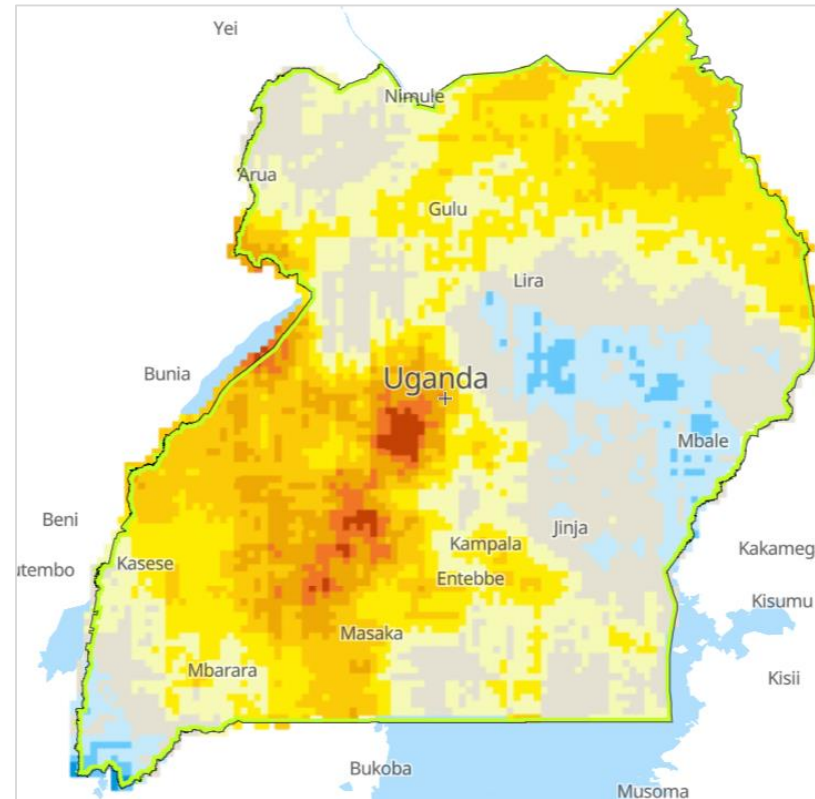
✓ 3 levels of Drought categories: Watch, Warning, Alert

✓ 2 levels of Recovery categories: Partial Recovery, Full Recovery

Precipitation Shortage

Soil Moisture deficit

Reduced Vegetation Production

| WATCH | WARNING | ALERT |

Time

Normal precipitation conditions

Normal Vegetation Production conditions

| PARTIAL RECOVERY OF VEGETATION | FULL RECOVERY OF VEGETATION |

https://droughtwatch.icpac.net

Drought condition indicator time-series. Source: East Africa Drought Watch

Standardised Precipitation Index (SPI)
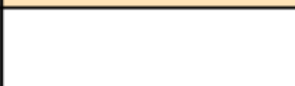
- Standardized Precipitation Index is the most commonly used drought index based only on precipitation.
- Above zero values indicate wet conditions while below zero values indicate dry conditions.
- SPI is generated over different time-scales: 1, 3, 6, 9, 12,24, months timescale providing indication of different types of drought: meteorological, agricultural and hydrological

Symbol	Values	Class Definition
	<= -3.0	Extremely dry
	-3.0 - -2.5	
	-2.5 - -2.0	Severely dry
	-2.0 - -1.5	
	-1.5 - -1.0	Moderately dry
	-1.0 - -0.5	
	-0.5 - 0.5	Near Normal
	0.5 - 1.0	
	1.0 - 1.5	Moderately wet
	1.5 - 2.0	
	2.0 - 2.5	Very wet
	2.5 - 3.0	
	>= 3.0	Extremely wet

https://droughtwatch.icpac.net

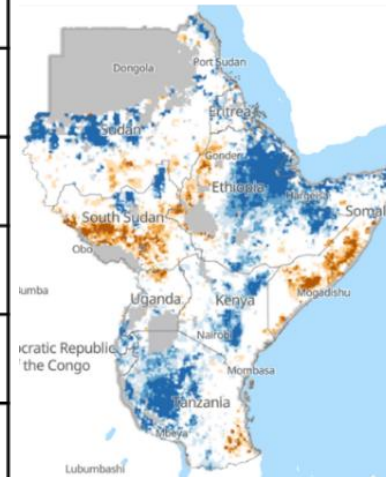Drought condition indicator time-series. Source: East Africa Drought Watch
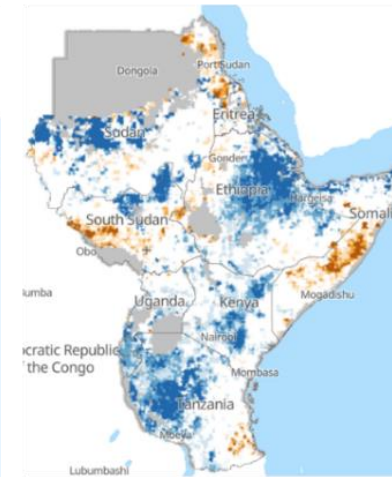
Soil Moisture Anomaly (SM)

- Soil moisture anomaly is useful in indicating the start and duration of agricultural drought conditions which arise when soil moisture availability to plants drops to such levels that it adversely affects crop yield and hence agricultural production

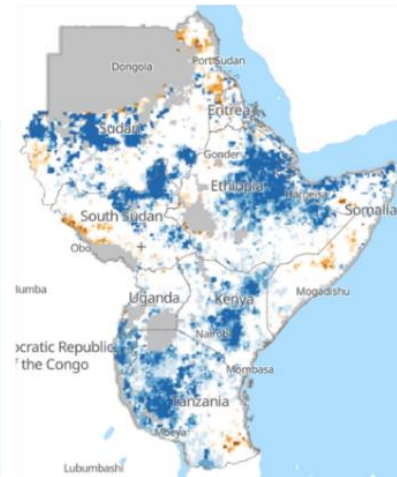| Symbol	Values	Class definition
	>=-2	**Extremely dry**
	-2 to -1.5	Severely dry
	-1.5 to -1	Moderately dry
	-1 to +1	Near normal conditions
	1 to 1.5	Moderately wet
	1.5 to 2	Very wet
	>=2	Extremely wet
		No data

3rd Dekad May 2023 | 2nd Dekad May 2023 | 1st Dekad May 2023

Drought condition indicator time-series. Source: East Africa Drought Watch

East Africa Drought Watch
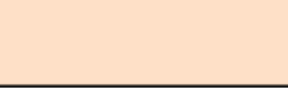
Vegetation Anomaly (fapar)

- The Fraction of Absorbed Photosynthetically Active Radiation (FAPAR) is biophysical variable, derived from satellite observations, that represents the fraction of incident solar radiation that is absorbed by land vegetation for photosynthesis
- FAPAR values and their anomalies have been shown to be good indicators for detecting and assessing drought impacts on plant canopies, such as agricultural crops and natural vegetation

Symbol	Values	Class definition
	>=-2	Extremely low
	-2 to -1.5	Severely low
	-1.5 to -1	Moderately low
	-1 to +1	Near normal conditions
	1 to 1.5	Moderately high
	1.5 to 2	Very high
	>=2	Extremely high
		No data

https://droughtwatch.icpac.net

Drought condition indicator time-series. Source: East Africa Drought Watch
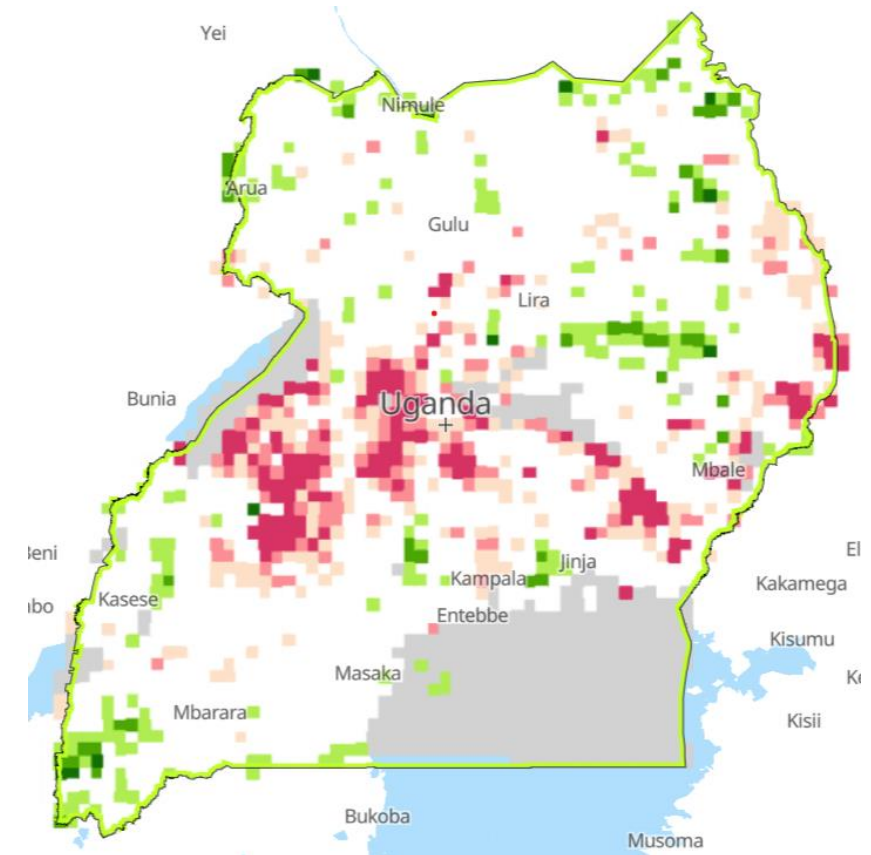
Methodology of Combined Drought Indicator

East Africa Drought Watch

Convergence of evidence

CDI value		SPI					Soil moisture anomaly	fAPAR anomaly
		SPI9/SPI12 < -1	SPI3 < -1	SPI1 < -2	$SPI3_{prev}$ < -1	$SPI1_{prev}$ < -2	SMA < −1	ΔfAPAR < -1
Watch	1			✔				
Watch	2		✔					
Watch	3	✔	✔					
Warning	4			✔			✔	
Warning	5		✔				✔	
Warning	6	✔	✔				✔	
Alert	7			✔				✔
Alert	8		✔					✔
Alert	9		✔				✔	✔
Alert	10	✔	✔				✔	✔
Partial recovery	11					✔		✔
Partial recovery	12				✔			✔
Full recovery	13					✔		
Full recovery	14				✔			

Increasing Dryness

Increasing Recovery

Precipitation shortage

Precipitation shortage + Soil Moisture Anomaly

Precipitation shortage + Soil Moisture Anomaly + Vegetation Anomaly

https://droughtwatch.icpac.net

Drought condition indicator time-series. Source: East Africa Drought Watch

Exercise
Characterizing the recent drought

a) Select a region and carry out drought analysis

  i. When was the peak of the drought?

  ii. How many people were exposed during the peak?

  iii. What was the greatest extent of the drought?

  iv. Explain the evolution of the drought?

b) Outputs: time-series maps, time-series graphs

East Africa Drought Watch
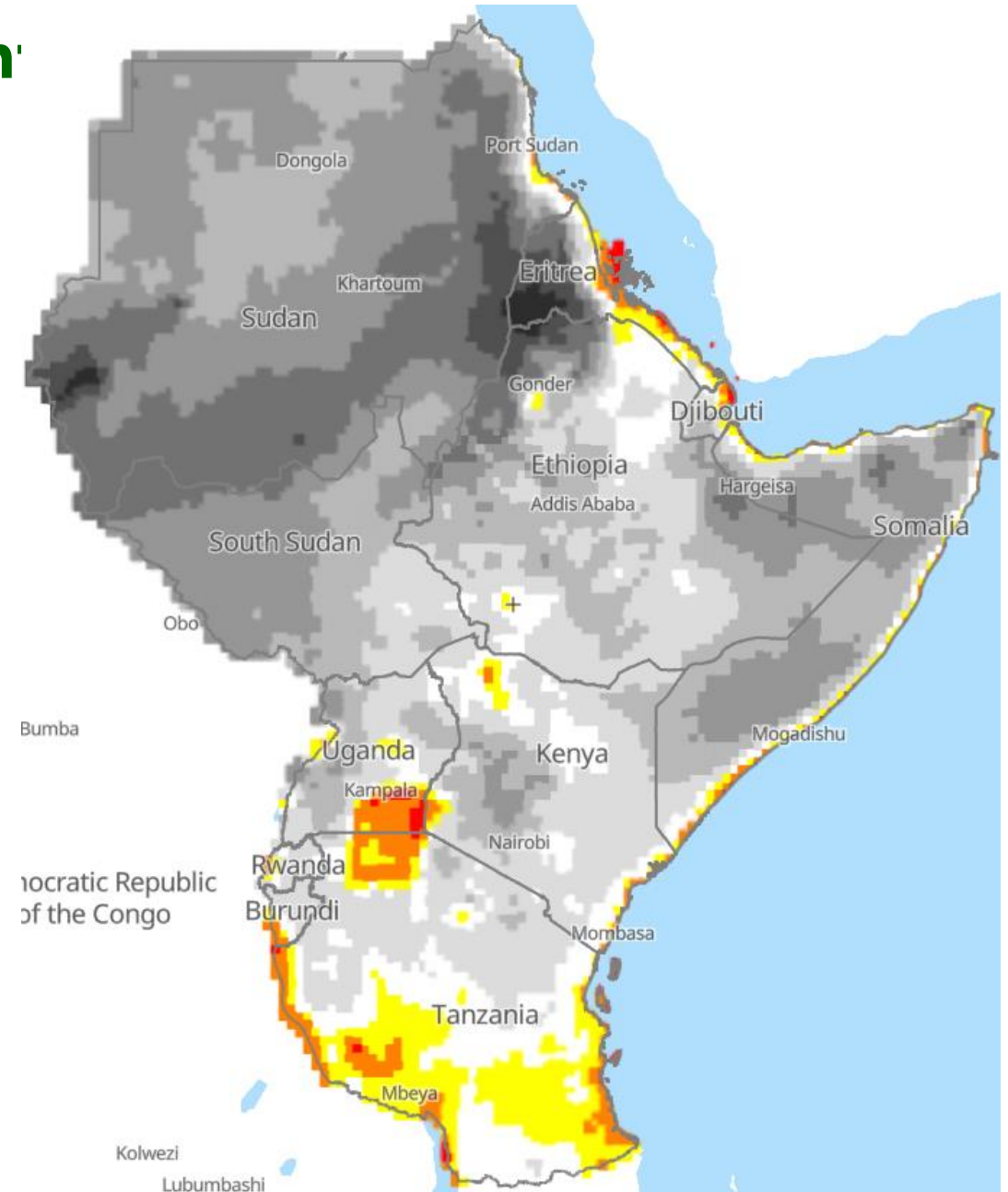
Integrating EADW into Bulletins

- Identifying the important informational components of national drought bulletin

- Develop a drought bulletin using the products on EADW and other sources (integration of info/convergence of evidence)

Thank You