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Assessing drought and food security data for use in trigger design

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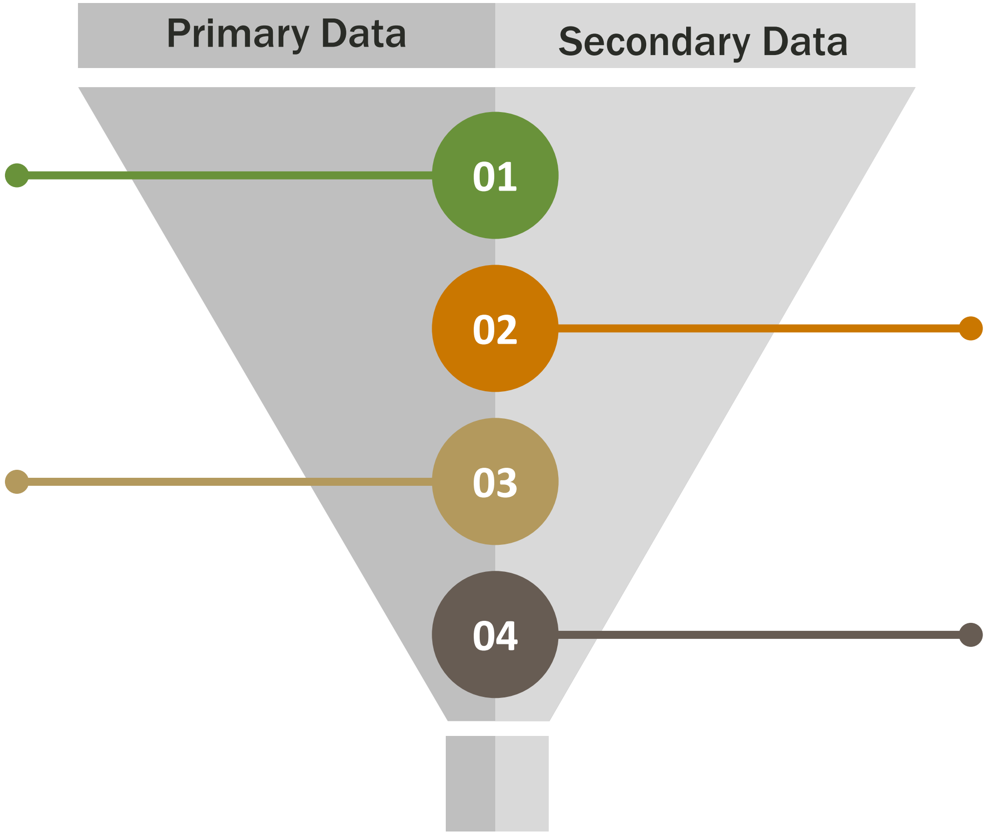
Objectives

1. Review the use of data in the design of trigger mechanisms for shock responsive social protection
2. Review available data for Malawi
3. Present preliminary analysis on what the data tells us in Malawi

Overview of Trigger Mechanisms Design Process



Review available data sources

Review primary and secondary data to assess usability in trigger design. Define correlations between data food insecurity.

Screen risk models

Review drought risk models used in Malawi and similar contexts to identify lessons and options

Develop trigger mechanism

Develop trigger design options and test them for priority districts, assessing basis risk, robustness, etc.

Capacity building and training

Build knowledge and capacity to use trigger tools and analysis

Trigger Mechanism for Drought-related food insecurity

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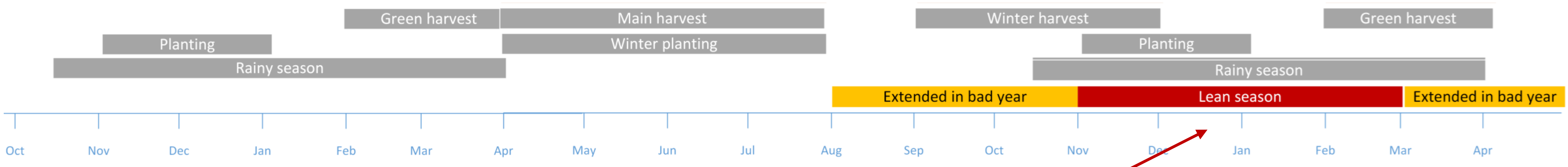
Assessing data for use in trigger design

Part 1: Using data to define trigger indicators

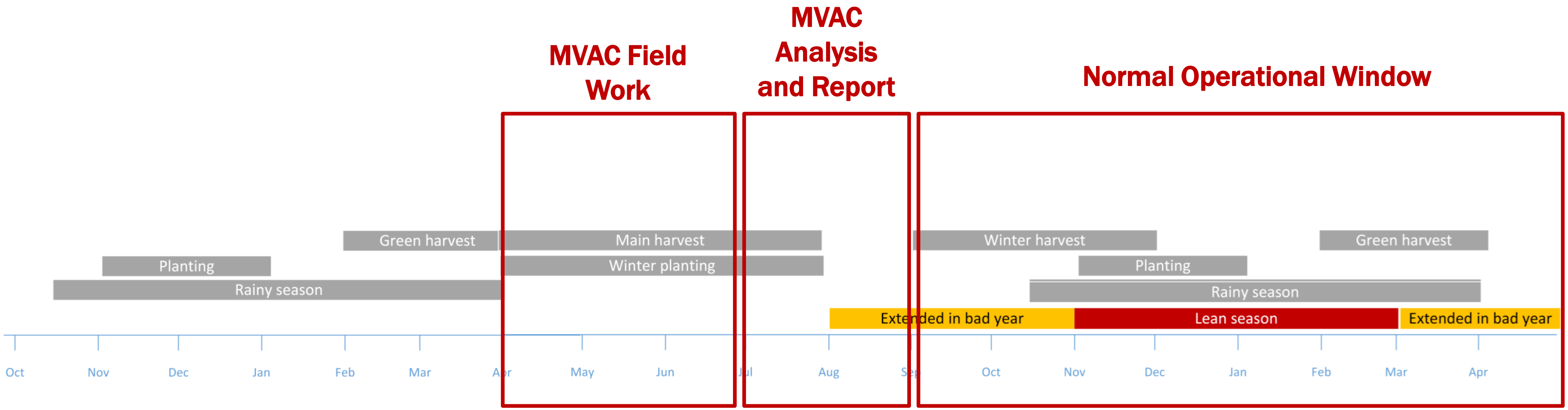
Linking data to trigger design

Key principle: Understanding the links between livelihoods, food security, and shocks is the foundation of selecting indicators and designing triggers



Food insecurity peaks seasonally during the lean season

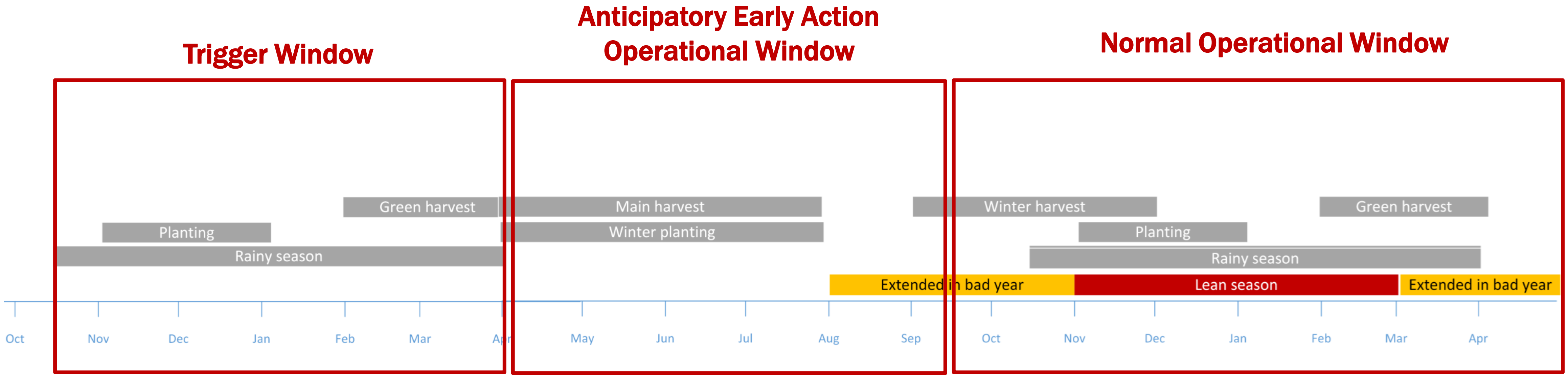
Current MVAC Assessment Process



Key Points?

- The MVAC provides a comprehensive national assessment each year
- Can other indicators complement the MVAC results to trigger earlier anticipatory action?

Linking data to trigger design – Trigger and Operational Windows



Key Questions

- What indicators can we reliably collect during the trigger window?
- Do they have a high correlation to negative food security outcomes during the lean season?

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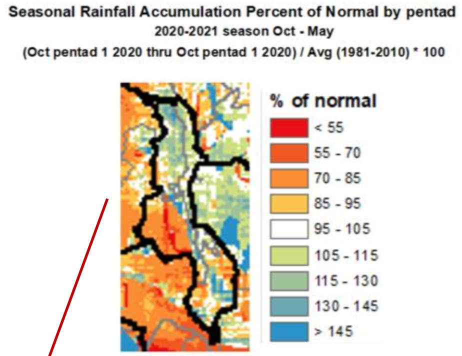
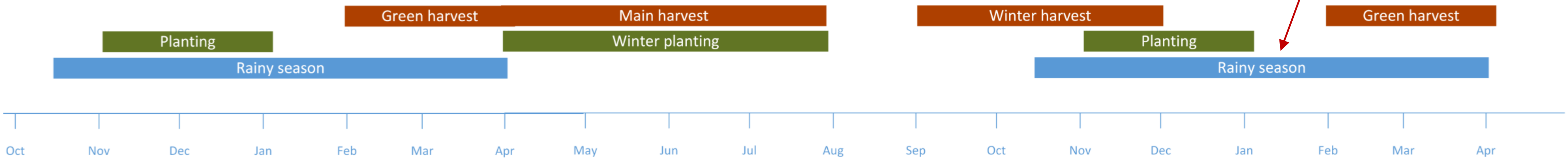
Linking data to trigger design: Key data types

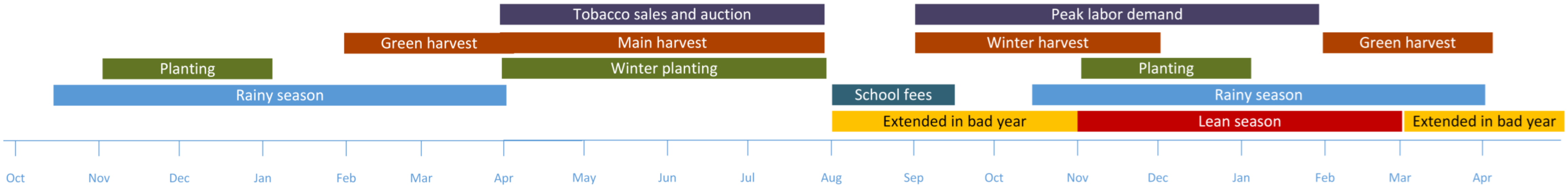




Key Data: Agricultural Season Monitoring

- Remote sensing
- Weather data
- Crop cuts
- Food prices
- Input availability
- Pest and disease

Linking data to trigger design: Key data types



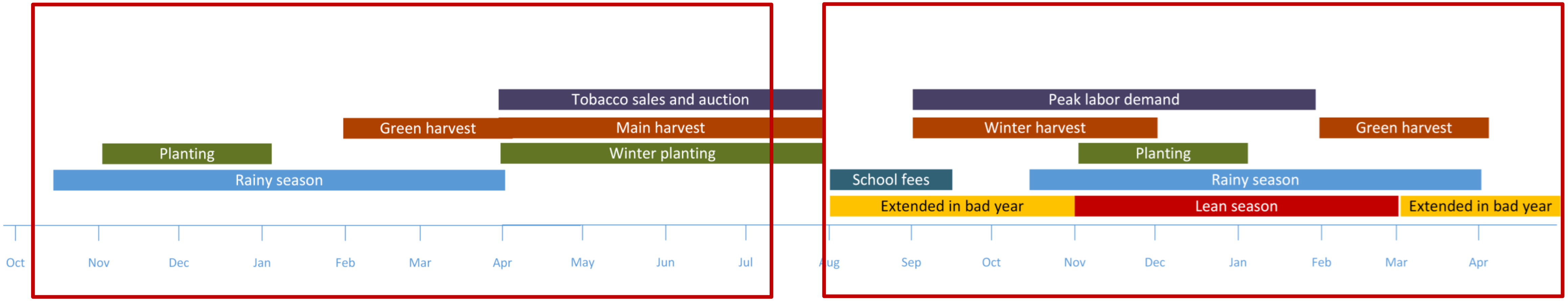
Key Data: Food Security Monitoring

- Food prices
- Food consumption
- Malnutrition
- Coping Strategies
- Labor opportunities

Linking data to trigger design: Leading and Trailing Indicators

Leading Indicators

Trailing Indicators



Early indicators of shocks, stressors, and early signs of food insecurity stress

Food security outcome indicators that indicate a food crisis is occurring, e.g. increased wasting

Assessing data for use in trigger design

Part 2: Review of drought and food security indicators for Malawi

Quick question: What criteria would you use to evaluate data for triggering response?

Trigger Data Review Criteria

First Level Criteria

- Historical availability
- Temporal resolution
- Data latency
- Cost
- Spatial resolution and coverage
- Experience in index insurance
- Continuity
- Rigor

Second Level Criteria

- Statistical analysis
- Ease of understanding
- Transparency
- Ease of access
- Consistency
- Correlation to drought, agricultural loss, food insecurity, farmer feedback
- Exposure to microclimate conditions

Primary Trigger Remote Sensed Data Sources & Ratings

No.	Product	Indicator	Rating %
1	**TAMSAT**	**Rainfall**	**100%**
2	**CHIRPS**	**Rainfall**	**100%**
3	**ARC2**	**Rainfall**	**95%**
4	Landsat NDVI	Vegetation Index	89%
5	**MOD13 NDVI**	**Vegetation Index**	**88%**
6	MOD16 ET	Evapotranspiration	87%
7	RFE	Rainfall	84%
8	ECOSTRESS	Evapotranspiration	76%
9	SPOT-VGT	Vegetation Index	76%
10	SMAP	Soil Moisture	72%
11	**SMOS**	**Soil Moisture**	**72%**
12	TRMM/GPM	Rainfall	69%
13	AVHRR NDVI	Vegetation Index	64%
14	OCO-2 SIF	Chlorophyll Fluorescence	52%
15	GRACE-FO	Ground-water	33%

Recommended primary trigger data sources

Data Source	Indicator	Overview
TAMSAT	Rainfall Index	TAMSAT produces daily rainfall estimates for all of Africa at 4km resolution. The TAMSAT archive spans 1983 to the delayed present. The longevity of the dataset makes it especially suitable for risk assessment.
CHIRPS	Rainfall Index	Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) is a 35+ year global rainfall data set. CHIRPS incorporates multiple inputs to create a gridded rainfall time series for trend analysis and seasonal drought monitoring.
ARC2	Rainfall Index	Developed by NOAA, ARC2 combines satellite and quality-controlled ground weather station data to create an improved rainfall data set. ARC2 data slightly underestimate rainfall levels
MOD13 NDVI	Vegetation Index	Maintained by NASA, NDVI measures vegetation and is commonly used for crop monitoring. Optical satellite images can be hampered by cloud cover, but though techniques such as profile smoothing this can be addressed.
SMOS	Soil Moisture Index	Maintained by ESA. Previous studies have shown good correlation with SMOS soil moisture drought intensity, especially in arid and semi-arid areas. Data is available for the last 10 years.

Potential Secondary Trigger Data Sources

- **FEWS NET Food Security Outlook (Current and Projection)***
- **Food prices***
- MVAC IPC Assessment (Medium Term Projection)
- CRW Global IPC Trigger
- Household Economy Analysis (Scenario and post-harvest)
- Crop production
- Wasting (GAM, SAM, MUAC)
- Labor rates/Availability
- SAFEX Futures Prices
- Food Consumption Score (FCS)
- Coping Strategies Index (CSI and rCSI)
- Household Hunger Scale
- Household Dietary Diversity Score (HHDD)
- Mortality (CDR, U5DR)
- Pest and disease surveillance

* Most promising candidates

Assessing drought and food security data for use in trigger design

Part 3: Preliminary Analysis Overview

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Interactive Poll:

What districts are most at risk from drought and food insecurity?

Trigger design process

Operational Scale up Mechanism

1 — Step 1
Define Trigger Objectives: Enable scale up to prevent acute food insecurity

2 — Step 2
Assess drought-related food security risks and create baseline for assessing trigger indicators

3 — Step 3
Review and analyze potential primary and secondary trigger indicators and data

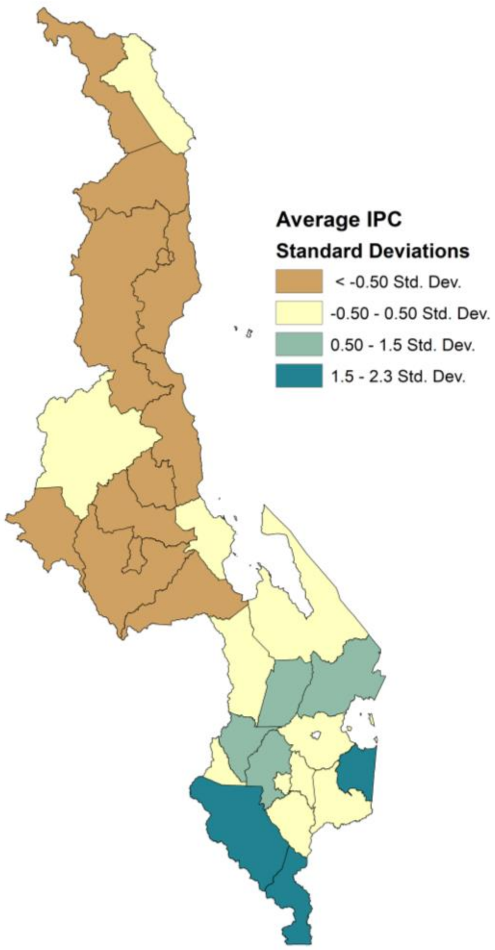
4 — Step 4
Define and test trigger options, configurations, and thresholds

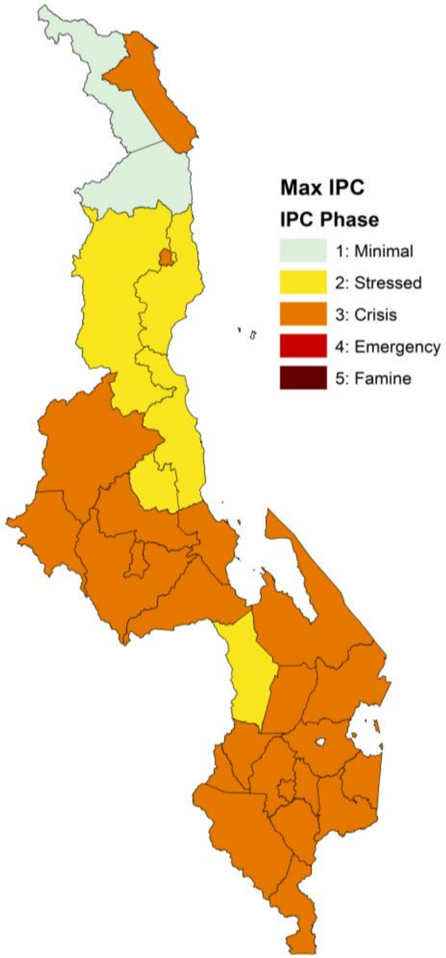
5 — Step 5
Select final trigger mechanism and thresholds

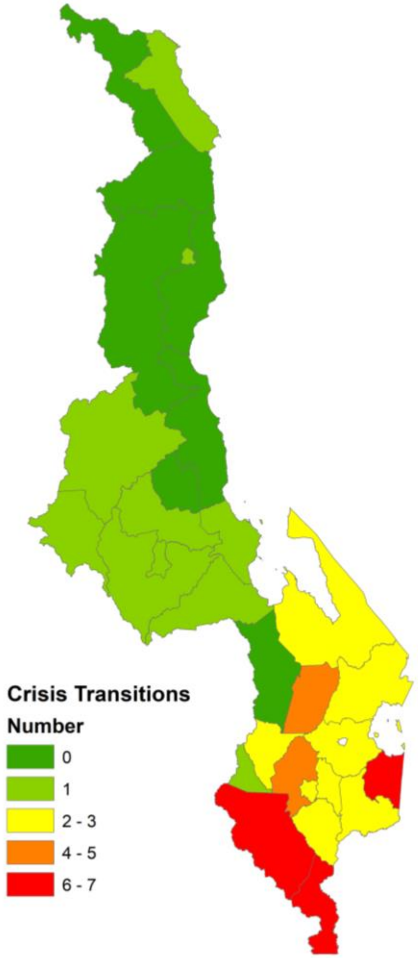
START

Measuring food insecurity and food crises

FEWS NET Average IPC	FEWS NET Maximum IPC	No. of Crisis Transitions







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Step 2

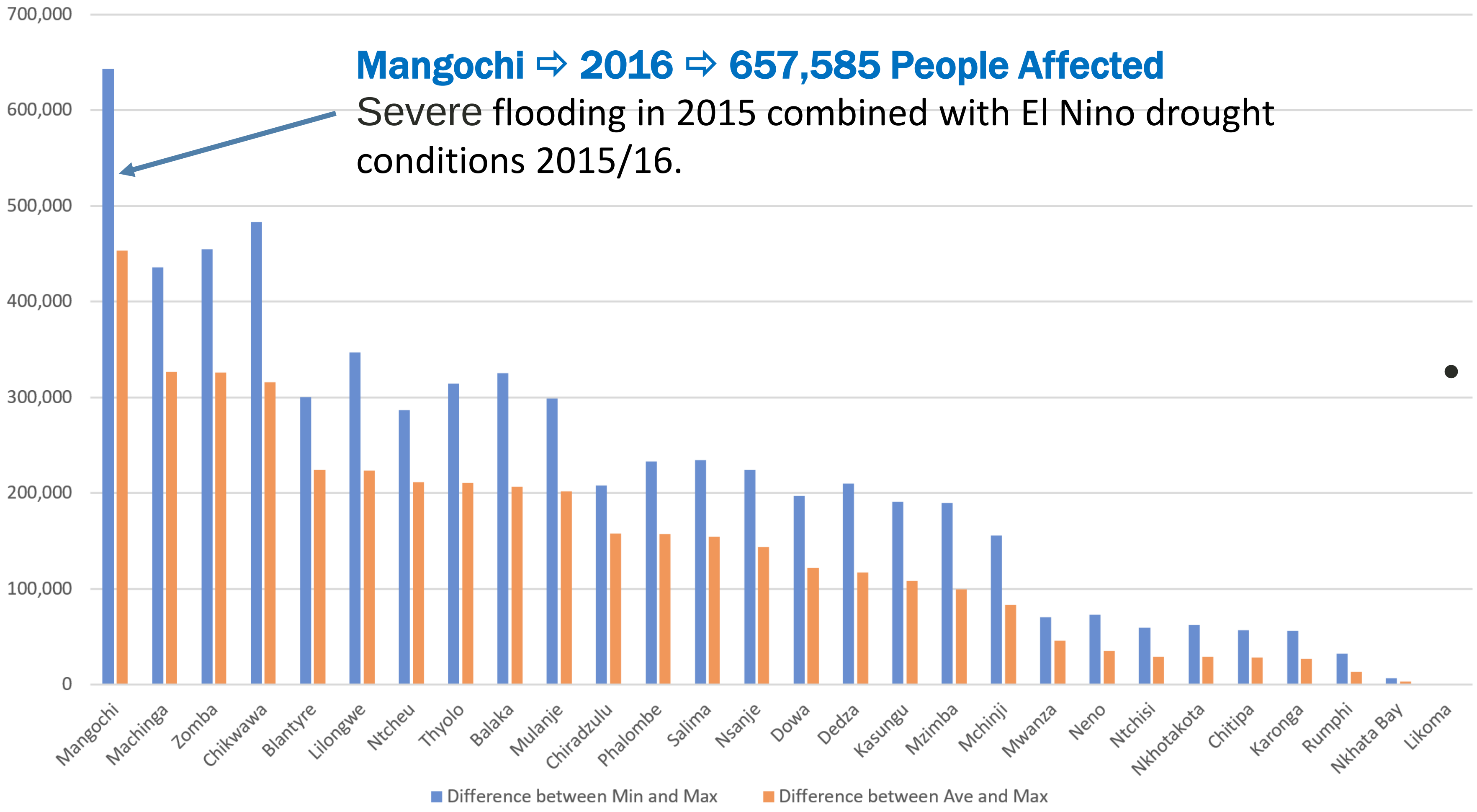
Assess food security risks and create baseline for assessing trigger indicators

Key Points

- Most districts have faced a food crisis in the last 10 years.
- Food crises are more common in the south.

Note: This analysis used FEWS NET Food Security Outlook data's CS layer. CS is the best available evaluation of current food security conditions based on evidence available and interpreted using IPC compatible analysis.

MVAC Population Affected – Difference between Minimum, Maximum and Average by District (2011 – 2018)



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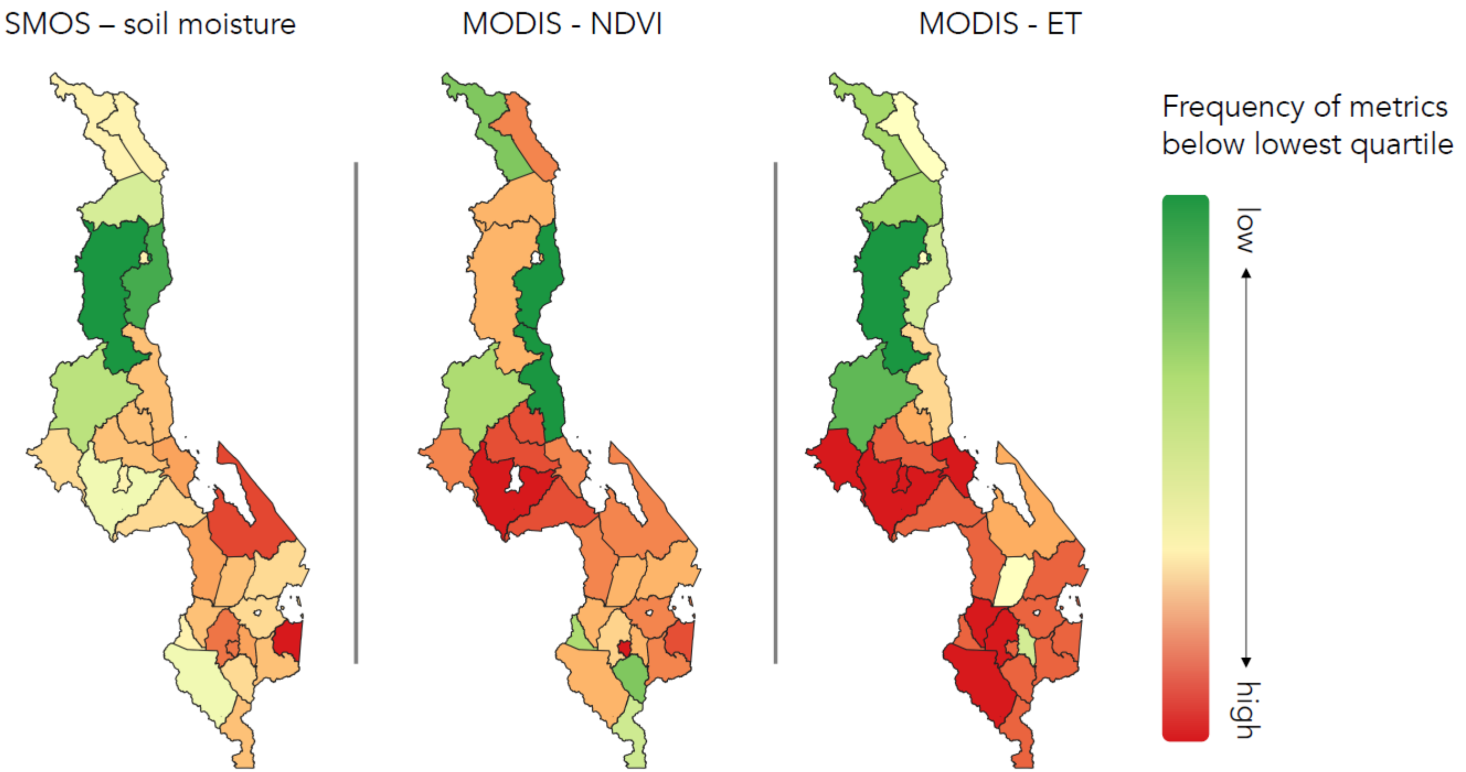
Step 2

Assess food security risks and create baseline for assessing trigger indicators

Key Point

- Many districts have faced significant scale up events over the last 10 years

Drought frequency



These maps show the frequency of each district having a value in the lowest quartile of each data set over the last 10 years.

Step 3

Review and analyze potential primary and secondary trigger indicators and data

Key Points

- **Different data sources show different aspects of drought**
- **South and Center more frequently experience drought**

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Drought anomalies

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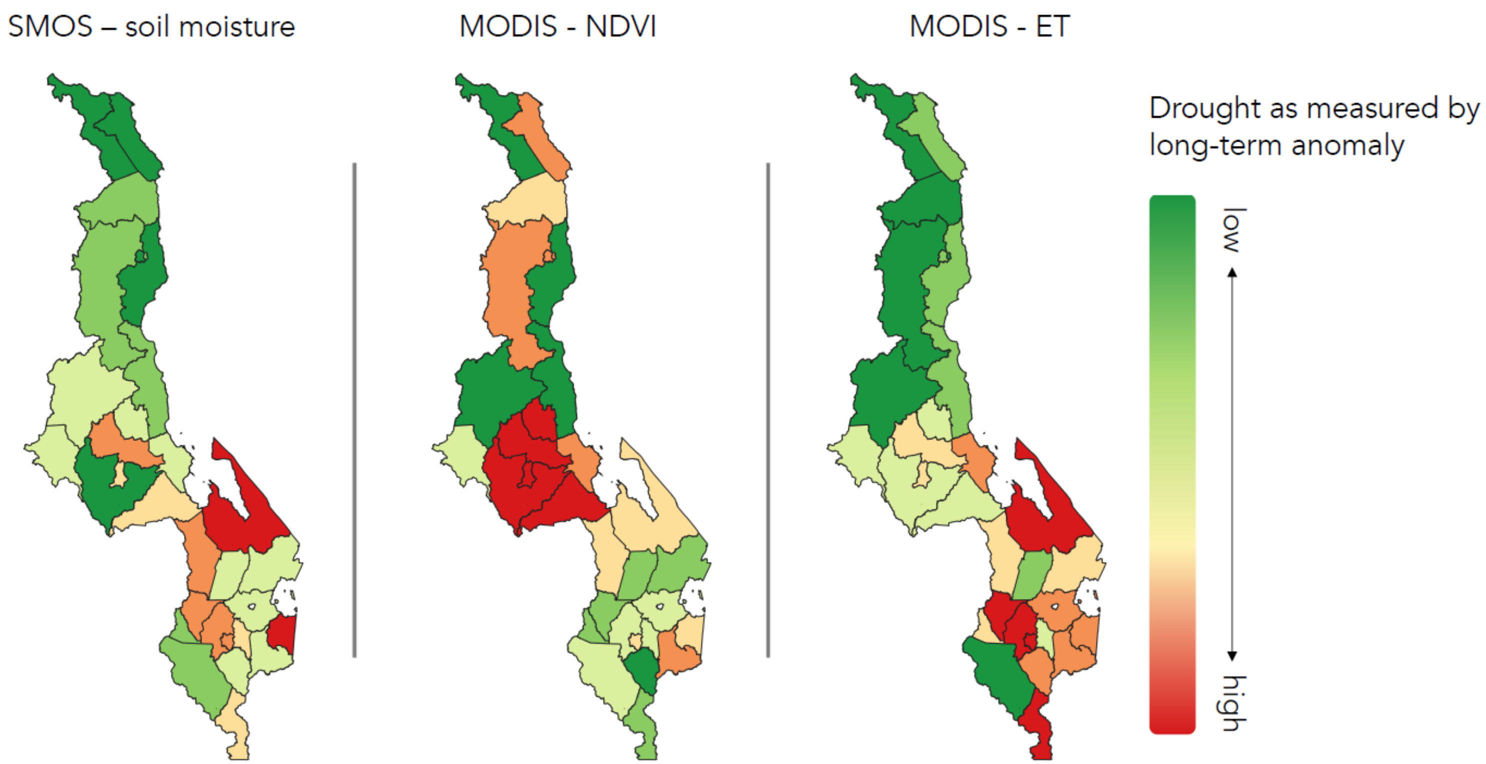
Step 3

Review and analyze potential primary and secondary trigger indicators and data

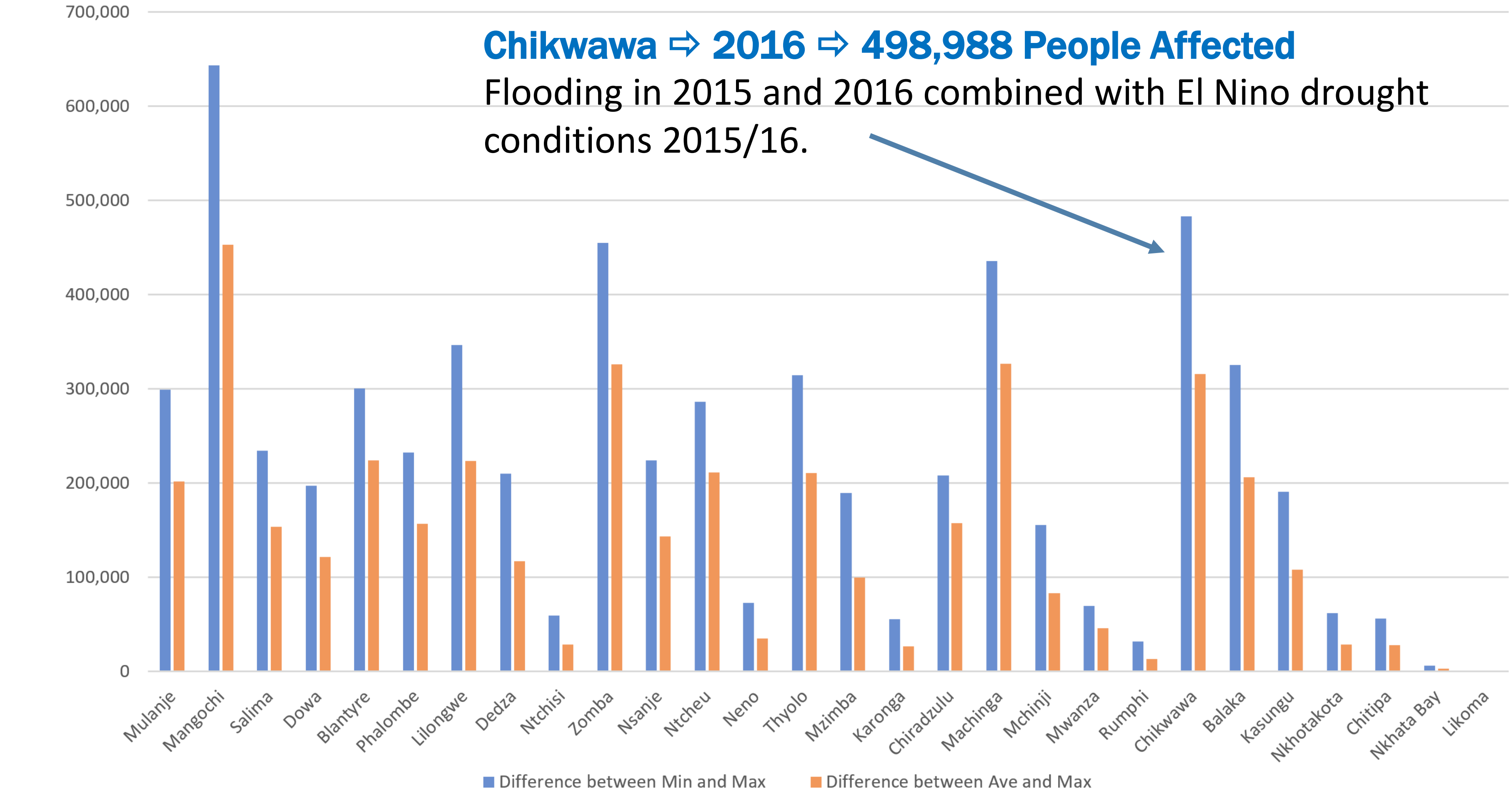


These maps show how often a district experienced a value below the long-term average for each indicator in the last 10 years.

Key Points

- **Anomalies are often more related to shocks.**
- **Assessing multiple options helps identify approaches which are fit for purpose.**

MVAC Population Affected – Difference between Minimum, Maximum and Average by District (2011 – 2018) - Reordered by drought anomalies



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Step 3

Review and analyze potential primary and secondary trigger indicators and data

Key Point

- Major droughts can have major impacts in areas that are less drought prone

Note: Districts have been reordered so that staring from left to right the districts are shown with the highest frequency of drought measured by an index of two drought measures.

MVAC Population Affected – Difference between Minimum, Maximum and Average by District (2011 – 2018) - Reordered by food security and drought risk

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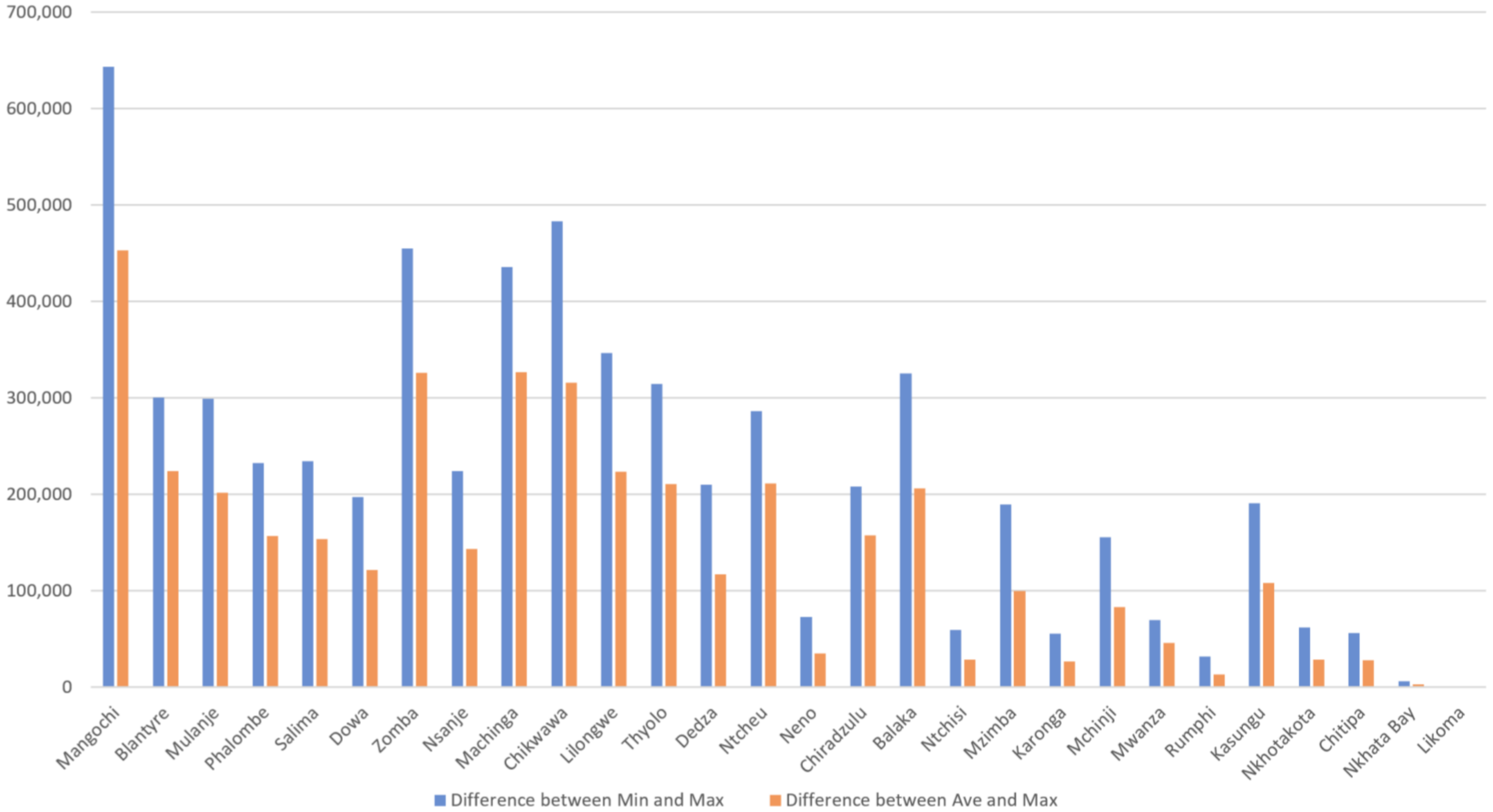
Step 3

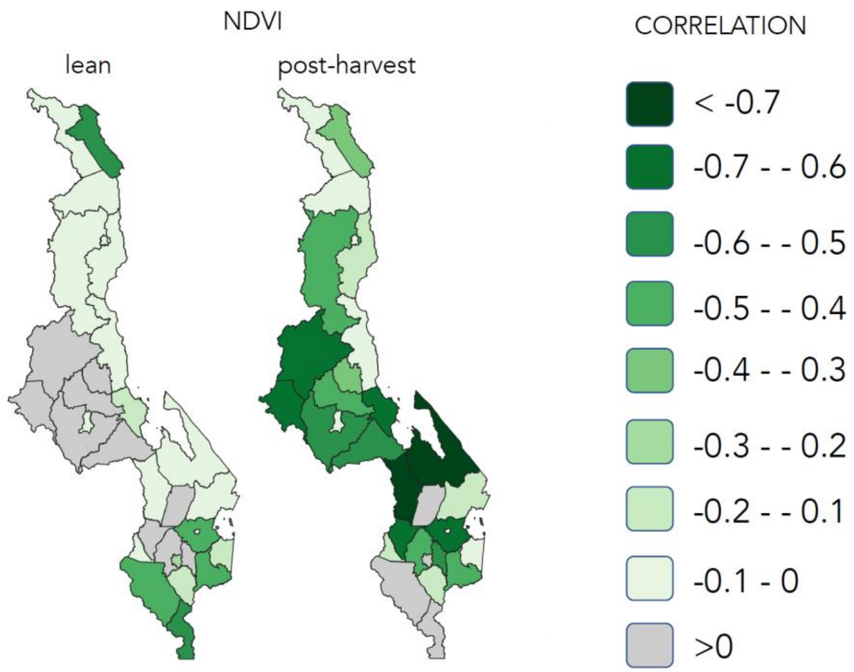
Review and analyze potential primary and secondary trigger indicators and data



Top 10 Districts Combined Risk
Mangochi
Blantyre
Phalombe
Mulanje
Zomba
Dowa
Nsanje
Salima
Chikwawa
Machinga

Note: Districts have been reordered based on a ranking index of food security risk (MVAC data and FEWS NET data) and two drought risk measures.

Remote Sensing Data Correlations to Food Insecurity



Key Point

- **High correlation between remote sensing indicators and food security data is a solid starting point for a trigger design.**

This maps show the correlations between a remote sensing indicator of drought and food security severity, comparing food security during the post harvest and lean season periods with the previous 3-month average values.

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Step 3

Review and analyze potential primary and secondary trigger indicators and data

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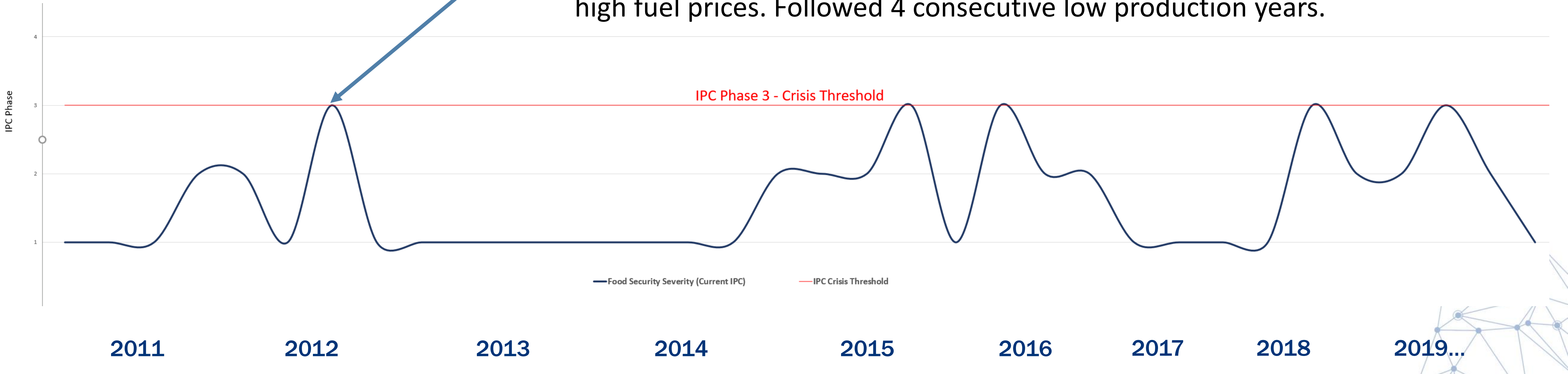
Assessing drought and food security data for use in trigger design

Part 3: Preliminary Analysis Overview – Balaka Case Study

Food Security Trends - Assessing whether triggers hit the mark -Balaka

2012 ⇨ 208,501 People Affected

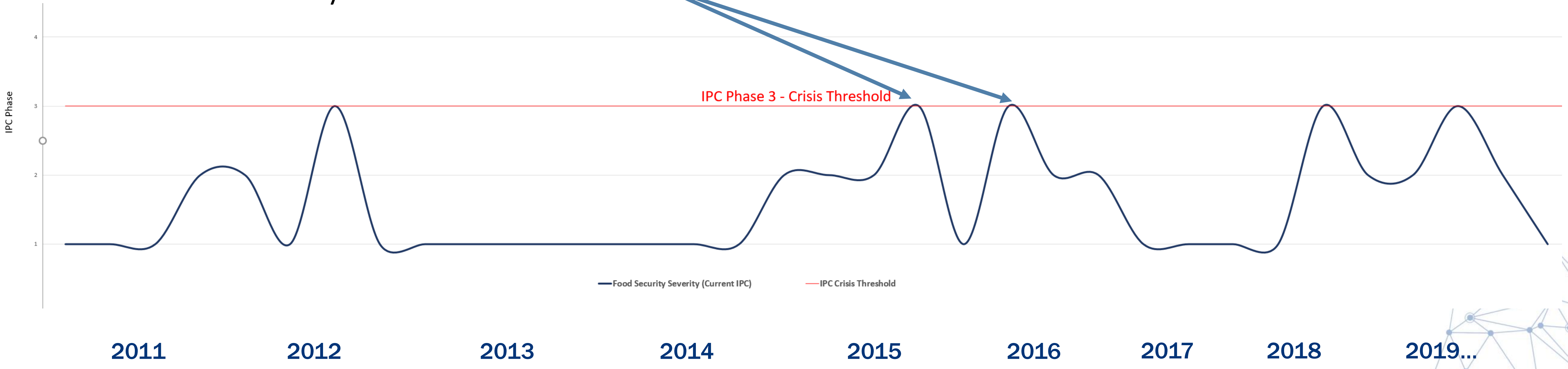
Below average maize production. Cyclone Funso caused erratic and heavy rains. Depressed *ganyu* availability. Maize prices higher than average due to high fuel prices. Followed 4 consecutive low production years.



Food Security Trends - Assessing whether triggers hit the mark -Balaka

2015/2016 ⇨ 333,943 People Affected

El Nino drought conditions led to stressed conditions and acute food insecurity



- **2015/16** - drought conditions led to stressed conditions and acute food insecurity.
- **2018/19** - prolonged dry spells and pest infestations followed by heavy rainfall and flooding from cyclone Idai

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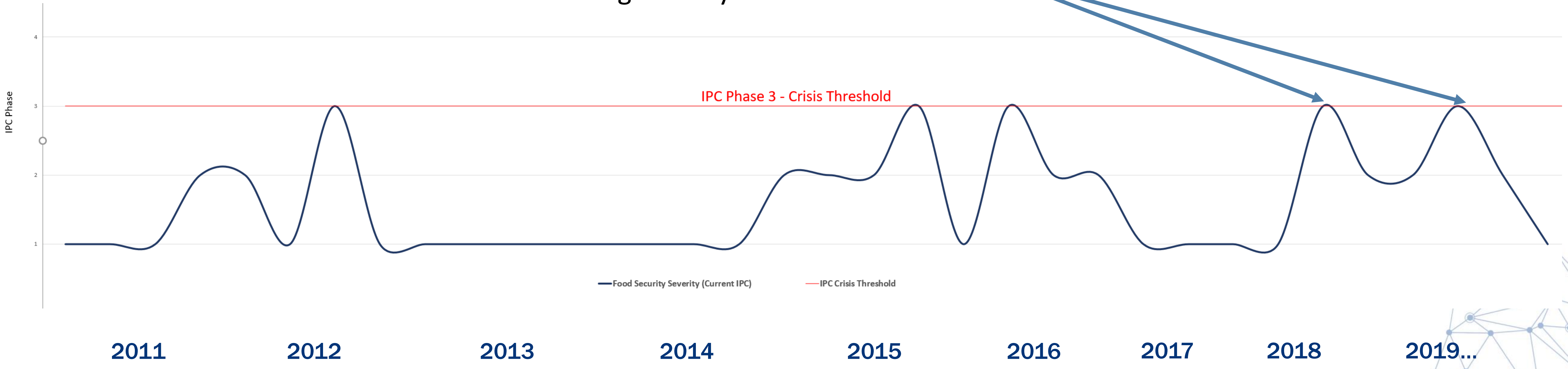
Food Security Trends - Assessing whether triggers hit the mark -Balaka

2018 ⇨ 166,036 People Affected

Prolonged dry spells and pest infestations followed by heavy rainfall and flooding from cyclone Idai



- **2015/16** - drought conditions led to stressed conditions and acute food insecurity.
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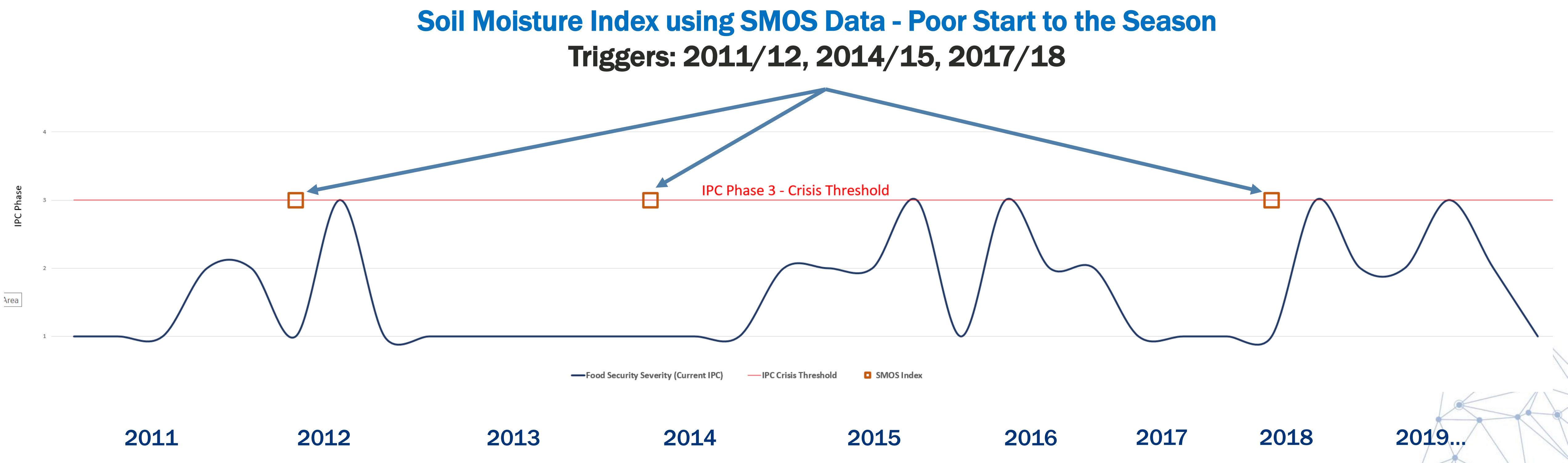
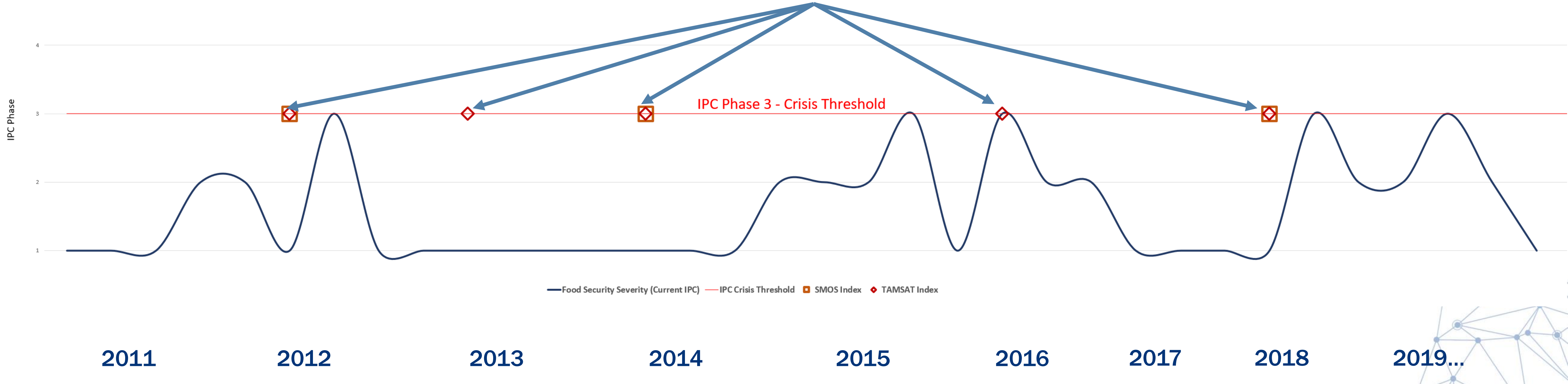
Assessing whether triggers hit the mark – Balaka – Prototype Soil Moisture Index



Assessing whether triggers hit the mark – Balaka – Prototype Rainfall Index

Rainfall Index using TAMSAT Data - Poor Start to the Season

Triggers: 2011/12, 2013/14, 2014/15, 201615/16, 2017/18



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Conclusions

- Multiple good data sets exist for primary trigger development.
- Preliminary analysis shows promising correlations between these data sets and food insecurity.
- Not all drought events lead to food crises and not all food crises are caused by drought.
- Secondary triggers help ensure crises are not missed.
- Understanding seasonality is critical to understanding which indicators are most indicative of food crises and fit for purpose in risk finance.

Next Steps

- Review additional data including rainfall, production and yield, food price and other data.
- Refine primary and secondary trigger indexes designs
- Finalize comprehensive evaluation of primary and secondary trigger correlations to food insecurity
- Develop and fully test trigger mechanism options

Thanks and questions?

Additional Slides

Remote Sensing Data Correlations to Food Insecurity

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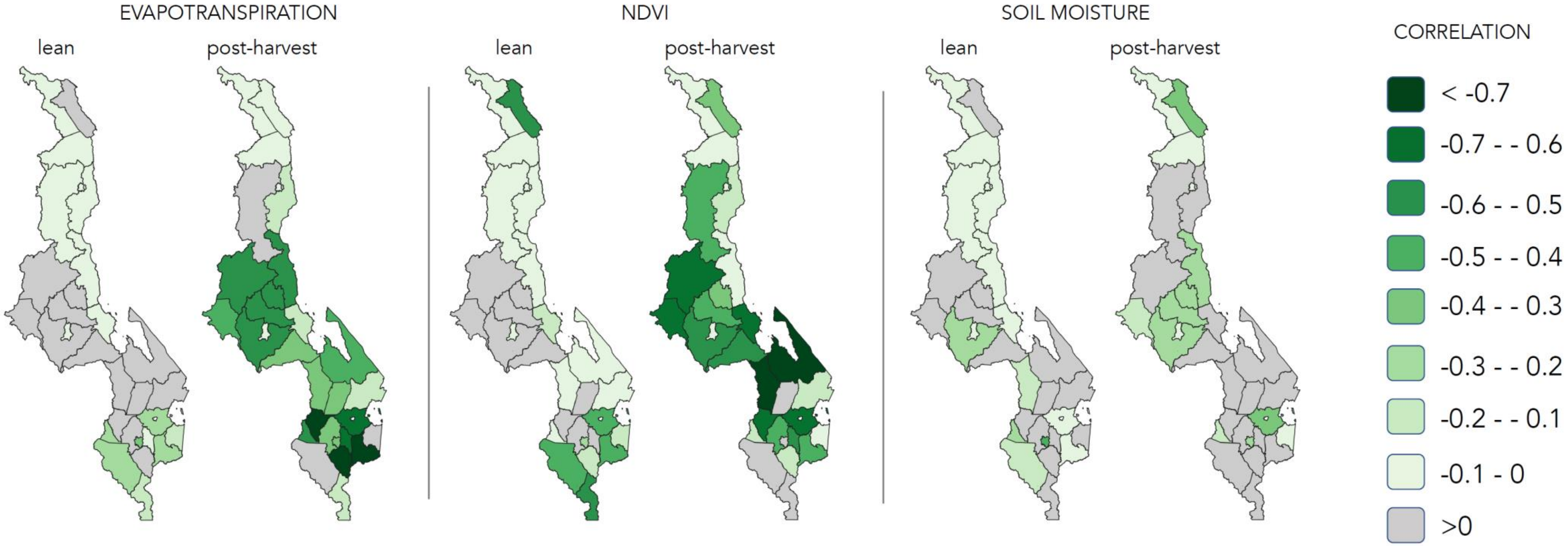
Step 3

Review and analyze potential primary and secondary trigger indicators and data



These maps show the correlations between remote sensing indicators of drought and food security severity, comparing food security during the post harvest and lean season periods with the previous 3-month average values.

Aligning Indicators through seasonal cycles

Leading Indicators – Seasonal Forecast

- Seasonal climate forecasts (SARCOF, ECMWF, JRC, FEWS NET, IRI, etc.)

Leading Indicators – Seasonal Monitoring

- Agro climatology – to date (RFE, NDVI, WRSI, EVI, etc)
- Agroclimatology - Extended to end of session (WRSI Extended, etc)
- Market price forecasts

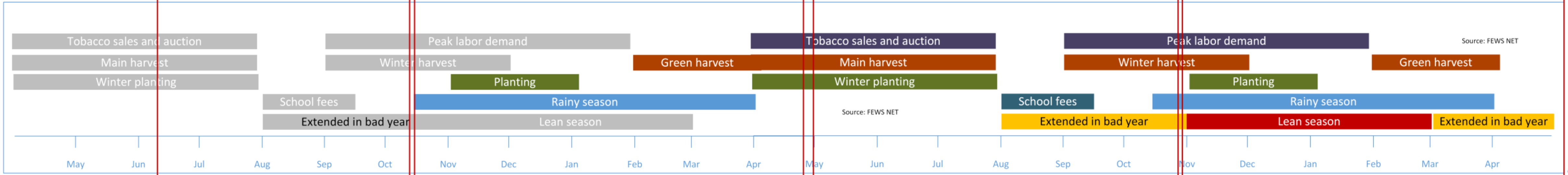
Trailing Indicators – Pre-crisis

- Unseasonable food insecurity (HHS, HEA, CSI)
- Poor harvest
- Reducing food consumption (HHDD, FCS)
- Worsening malnutrition (admissions rates, GAM, SAM, MUAC)
- Increasing food prices (market prices)
- Distress coping (e.g. kids out of school)

Trailing Indicators - Late

- Extreme food insecurity (HHS, HEA, CSI)
- Very poor consumption (HHDD, FCS)
- Wasting (GAM, SAM, MUAC)
- High mortality and morbidity (U5DR, CDR, etc.)
- Distress sale of assets
- Irreversible coping
- Distress migration

Seasonal Food Security Calendar



Food Security Assessments and Forecasts

- MVAC Field Work
- MVAC Annual Assessment – 1 year projection of need
- FEWS NET Outlook – 6-9 month projection
- FEWS NET Outlook – 6-9 month projection
- FEWS NET Outlook – 6-9 month projection
- FEWS NET Outlook – 6-9 month projection
- FEWS NET Outlook – 6-9 month projection
- FEWS NET Outlook – 6-9 month projection

Seasonal Trend of satellite datasets

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- Modelling of satellite based historical datasets (varying between 10-38 years) of Rainfall, Vegetation Index, Soil-Moisture and Evapotranspiration was done, based on the selected satellite datasets.

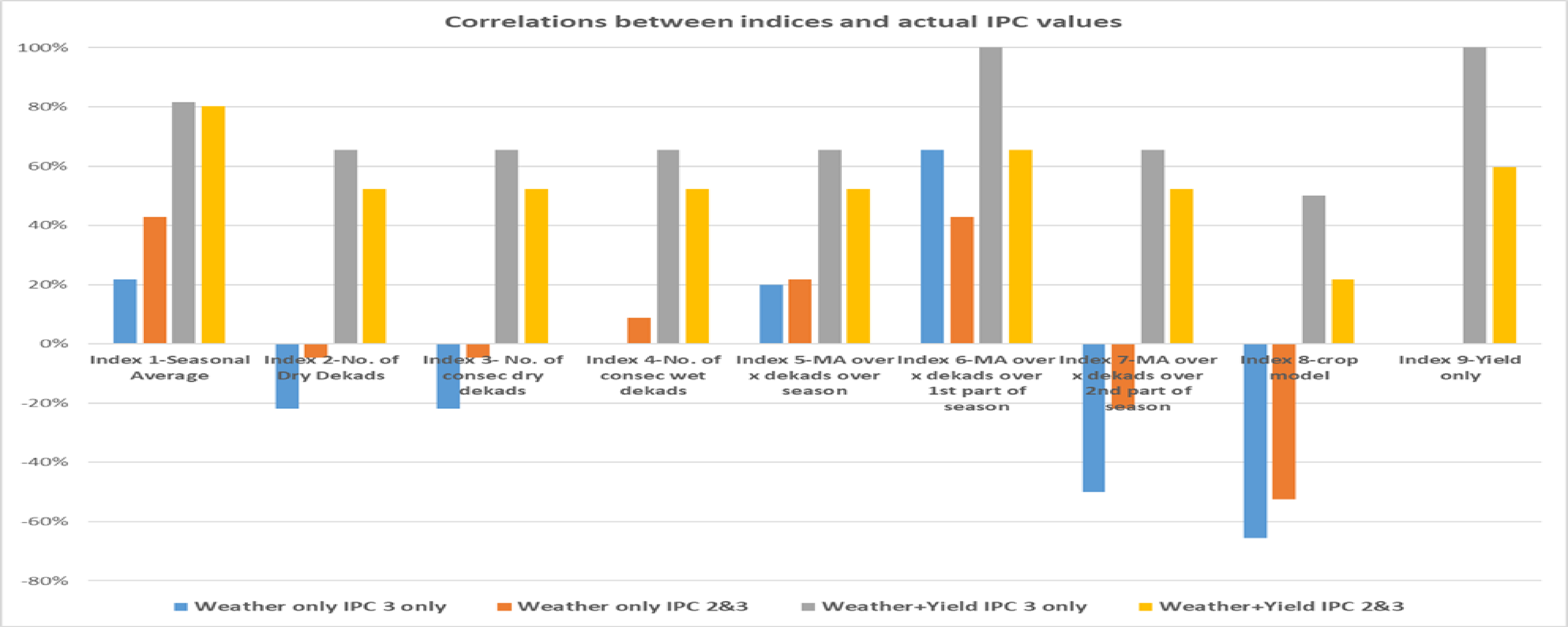
- Overall, the selected satellite datasets indicate the seasonal trends and detect major historical droughts

Selected Drought Indices

1. Index 1- seasonal drought (rainfall is low over the course of the rainy season)
2. Index2- Many dry dekads (10-days) in the season
3. Index 3- Many consecutive dry dekads in the season
4. Index 4- Low number of consecutive wet dekads in the season
5. Index 5- Low rainfall over 30 consecutive days during the season
6. Index 6- Low rainfall over 30 consecutive days over 21st Nov- 10th Feb
7. Index 7- Low rainfall over 30 consecutive days over 11th Jan- 31st March
8. Index 8- Low rainfall for specific phases of crop cycle for Maize

Soil-Moisture Correlations for Balaka district

Overall Index 6 (low rainfall/soil-moisture etc.) over 20-30 days over end of Nov to early Feb, seems to be performing well so far, in terms of correlations to IPC values.



Correlations between drought indices and IPC values for multiple districts

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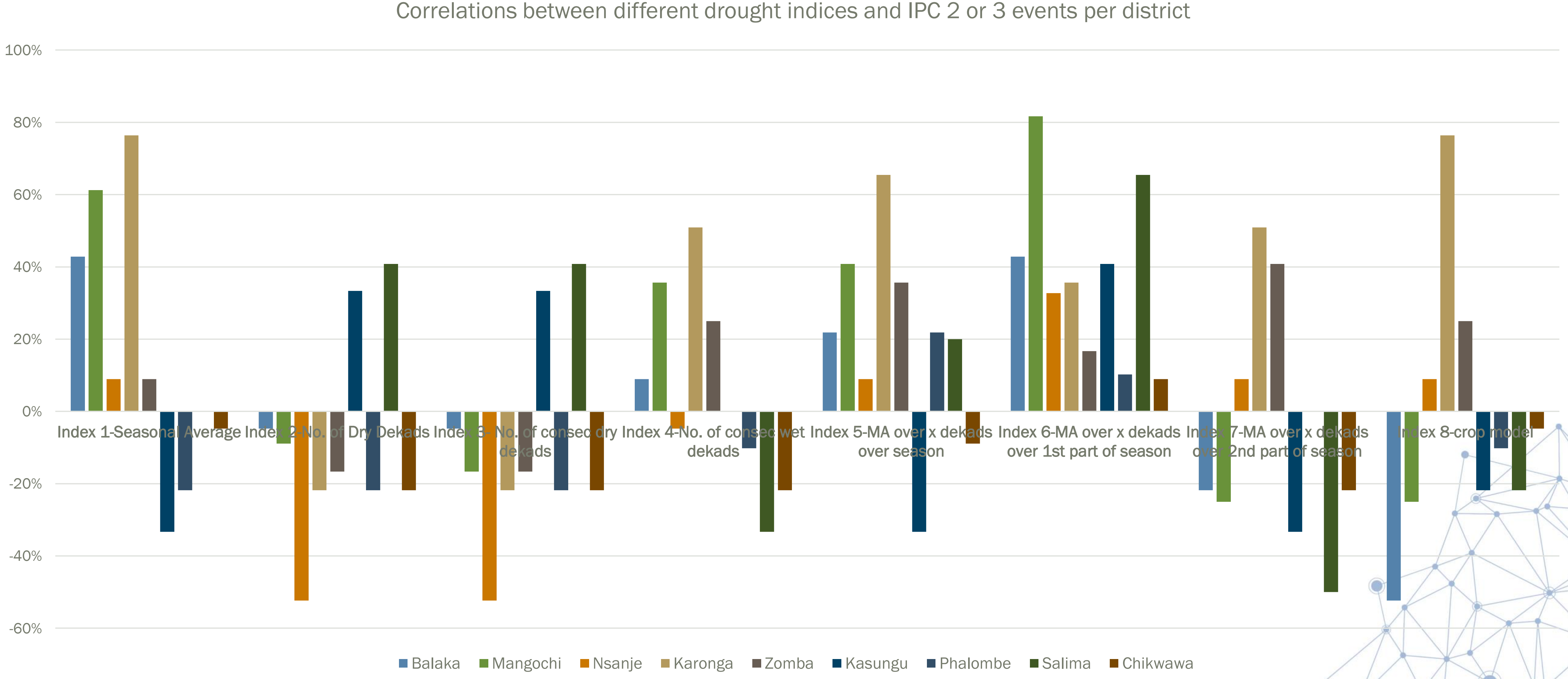

Drought Index Example

Index 6: Dry spell definition (based on TAMSAT)

a) Early Dry spell- Over 1st November to 31st January, if the total rainfall over 20 consecutive days is less than 70% of the normal rainfall for the same 20-day time period, then early dry spell triggers

b) Late Dry spell- Over 1st February to 31st March, if the total rainfall over 30 consecutive days is less than 70% of the normal rainfall for the same 30-day time period, then late dry spell triggers

Historical Drought Index Triggers for Balaka, based on TAMSAT rainfall data