



# EO for Africa Symposium 2024

23 - 26 September 2024  
ESA | ESRIN, Frascati (IT)



## Integrating knowledge-based expert fuzzy model and agricultural landscape conditions analysis for maize yield loss potential mapping

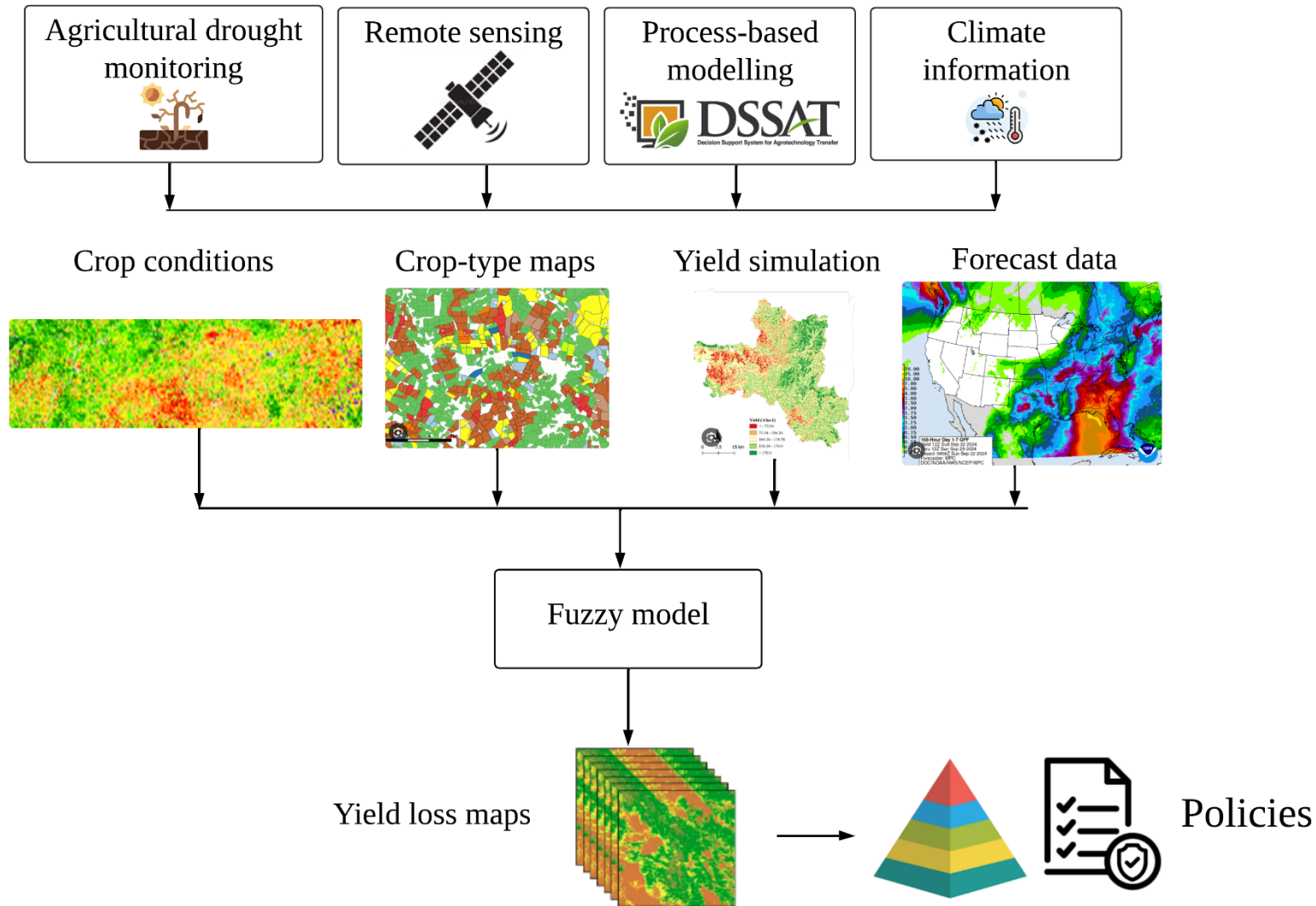
Harison Kipkulei<sup>1,2,3</sup>, Pamela Ochungo<sup>4</sup>, Francis Oloo<sup>4</sup>, Hussein Farah<sup>4</sup>, Stefan Sieber<sup>1,2</sup>, and Gohar Ghazaryan<sup>1,5</sup>

1 - ZALF, Germany, 2 - Augsburg, Germany, 3 - JKUAT, Kenya, 4 - TUK, Kenya, Kenya, 5 - Humboldt, Germany



24/07/2024

# Cropclim Concept



**Process-based modelling:**

How does the production vary?

**Remote sensing:**

What is grown where?

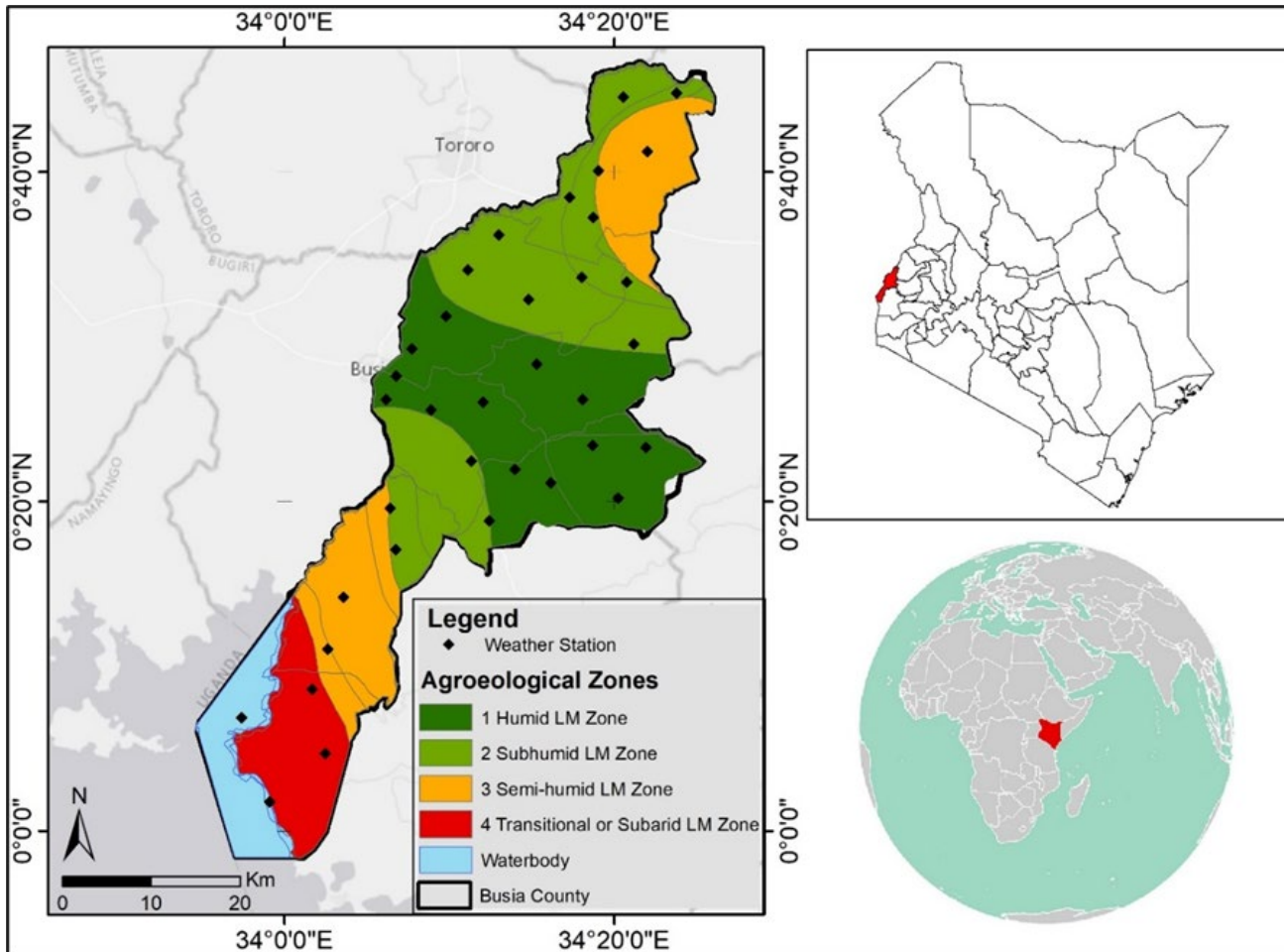
**Climate information:**

What are the likely climatic conditions?

**Crop condition:**

How do seasonal crop conditions vary?

# Why Busia?



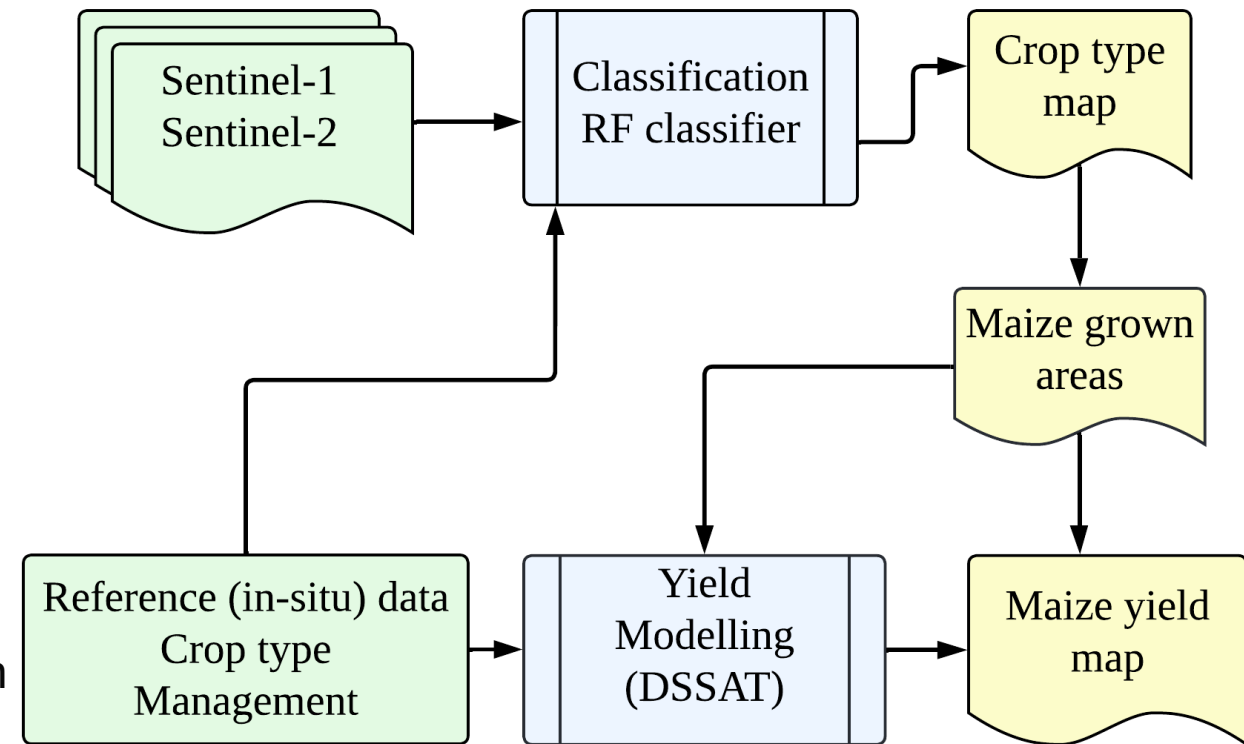
- Complex cropping systems (over 27 crops – Cereals, tubers, legumes, oil, fruits, nuts, & vegetables).
- Wide range of climatic conditions – AEZs.
- Dense network of weather stations coverage.



Integration of **process-based models** and **remote sensing** for detailed quantitative assessments of agricultural landscapes.

Utilization of **seasonal weather forecasts** from local meteorological divisions and IGAD Climate Prediction & Applications Centre (ICPAC).

A **scalable approach** that combines remote sensing, modelling, and agricultural landscape conditions using an expert-based fuzzy model for decision-making.

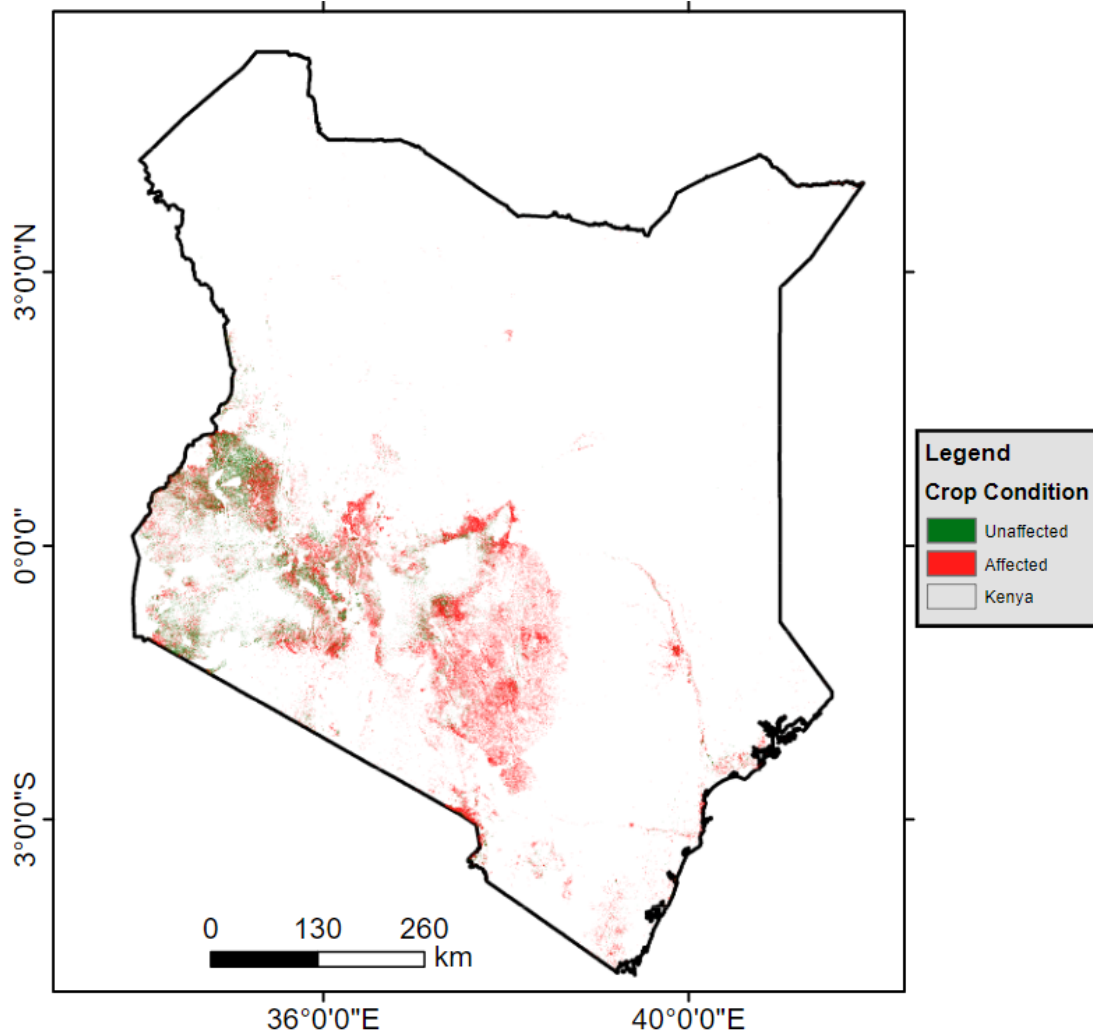


Crop type mapping and yield modelling framework (Own formulation)

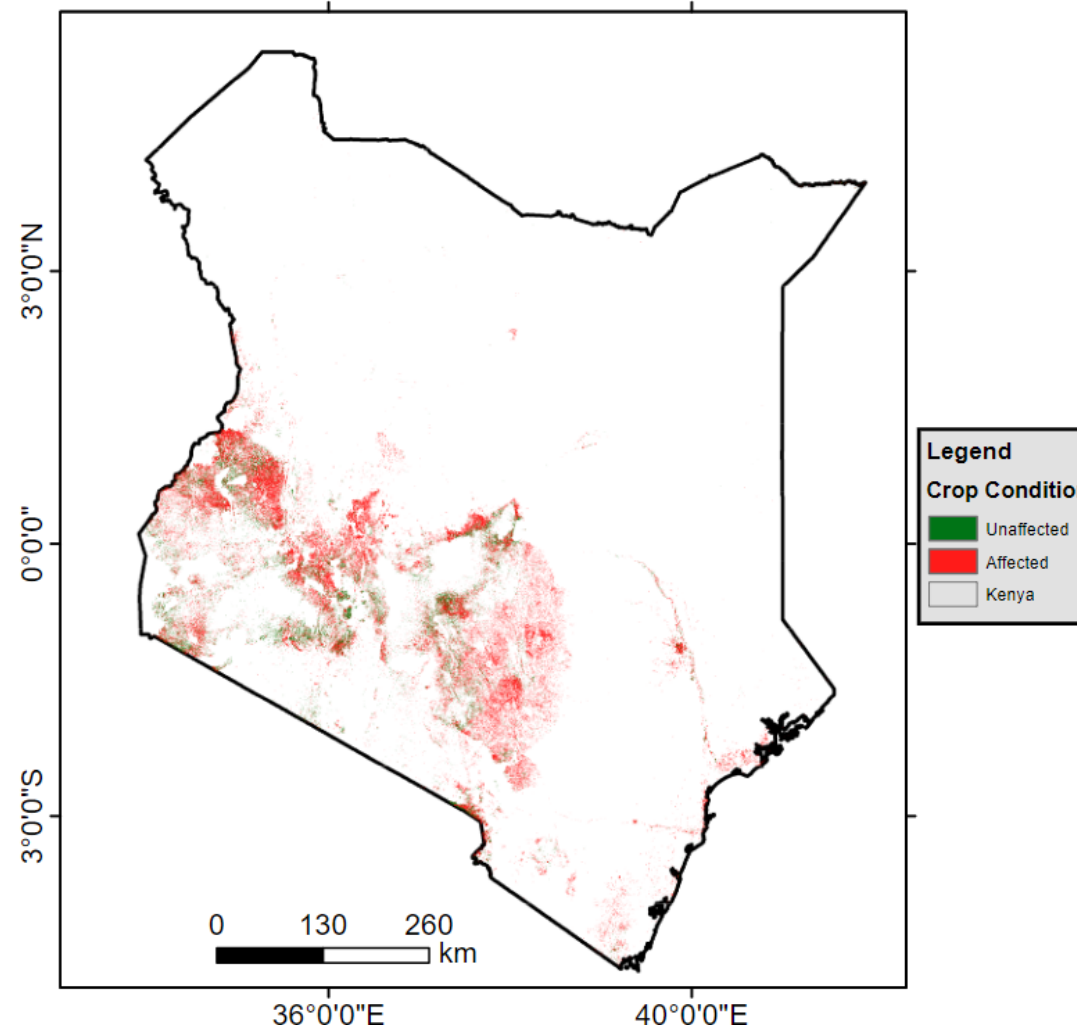
# Crop conditions maps (ADM-Kenya)



## 2019 Season (Long season)



## 2021 Season (Long season)



# Crop conditions maps (ADM-Kenya)



Input: Sentinel-2 data  
Phenology Approach: Temporal filtering, AEZ-based Random Forest Model  
Validation: Comparison with other products, reports, User-based validation



9:15 am – 9:30 am

ID: 194 / 1.5: 3

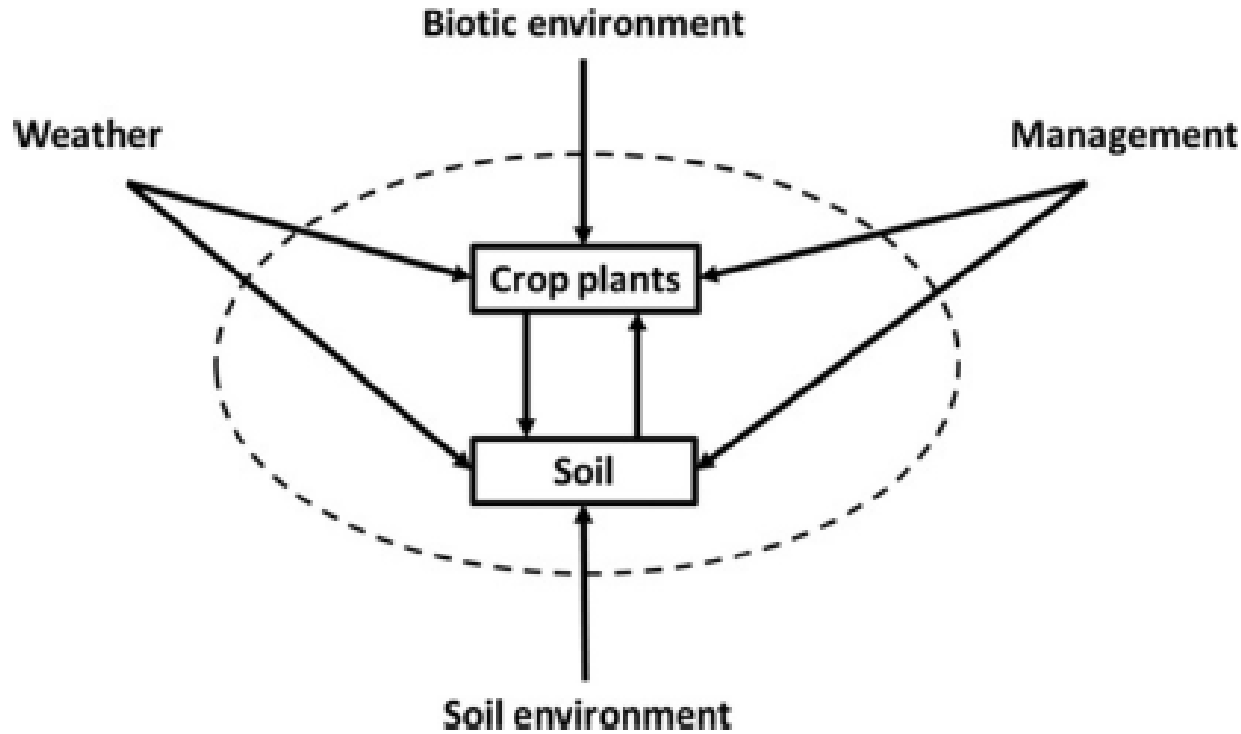
## Integrated use of Multisource Remote Sensing Data for National Scale Agricultural Drought Monitoring in Kenya: ADM-Kenya

Gohar Ghazaryan<sup>1,6</sup>, Maximilian Schwarz<sup>2</sup>, S. Mohammad Mirmazloumi<sup>1</sup>, Harison Kipkulei<sup>1</sup>, Tobias Landmann<sup>3</sup>, Henry Kyalo<sup>3</sup>, Rose Waswa<sup>4</sup>, Tom Dienya<sup>5</sup>

*Session Details:*

[Climate change and adaptation](#)

Time: 25/Sept/2024: 8:45am-10:00am · Location: Big Hall



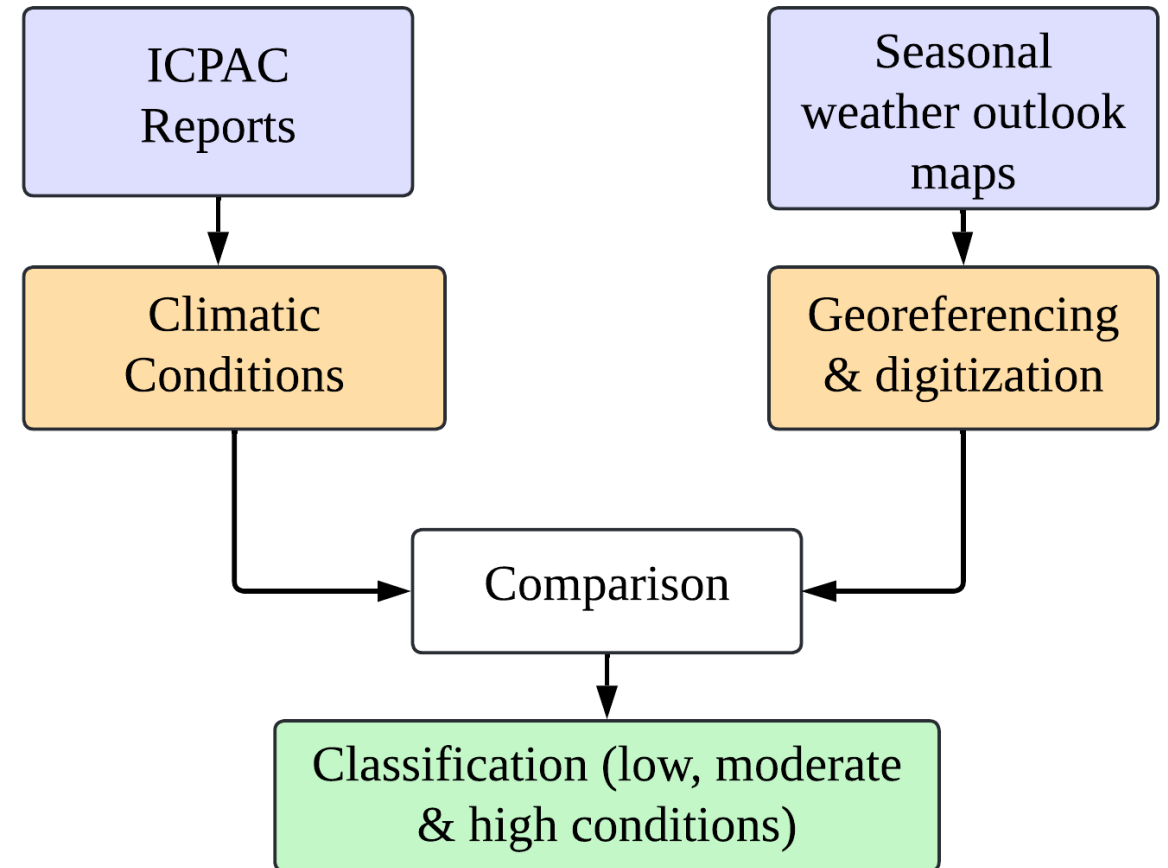
- Typical cropping systems model with interactions (Source: Wallach)



- Calibrated and evaluated for yield simulation in Kenya (Kipkulei et al., 2022; Kipkulei et al., 2024)



- Seasonal weather outlook maps (**precipitation**) by the Kenya Meteorological Department were acquired, georeferenced and digitised.
- The outlook maps were cross-referenced with ICPAC reports.
- The maps were then rasterized, resampled and re-classified (low, medium and high conditions).



# 2019 season characterization

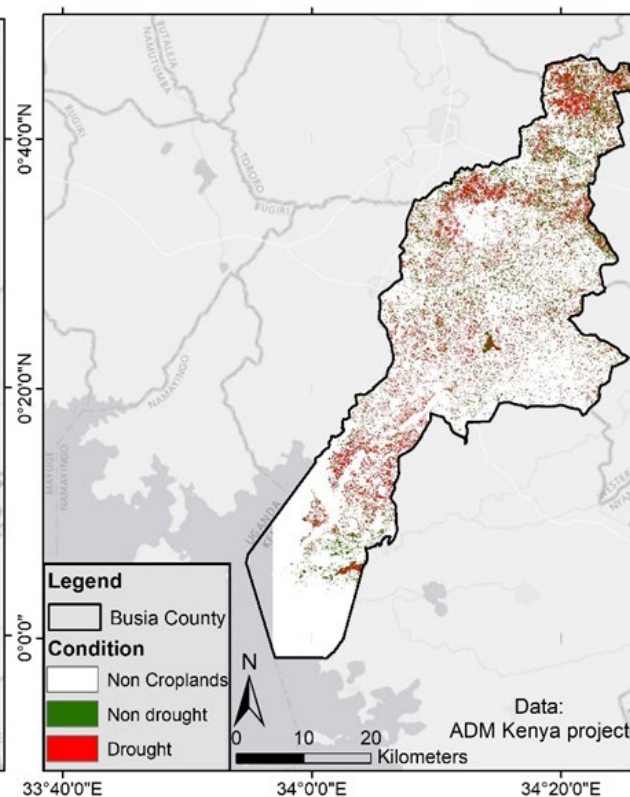
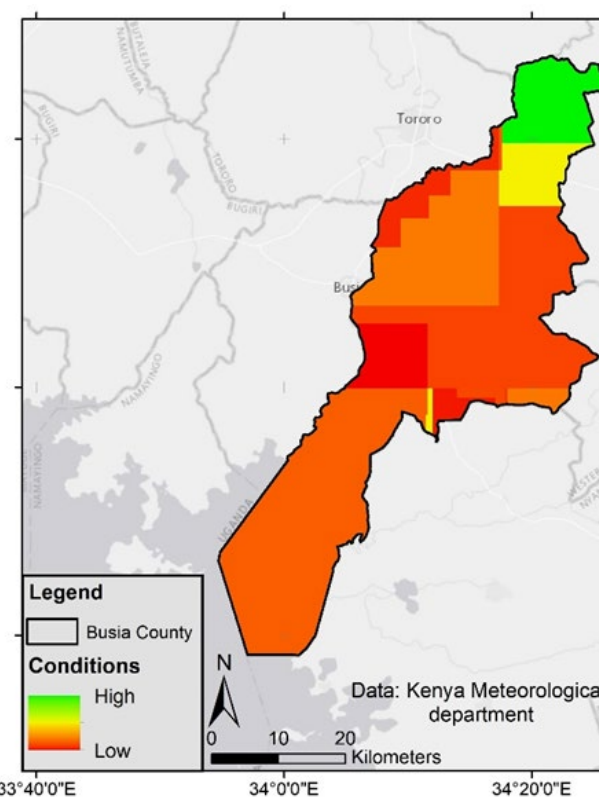
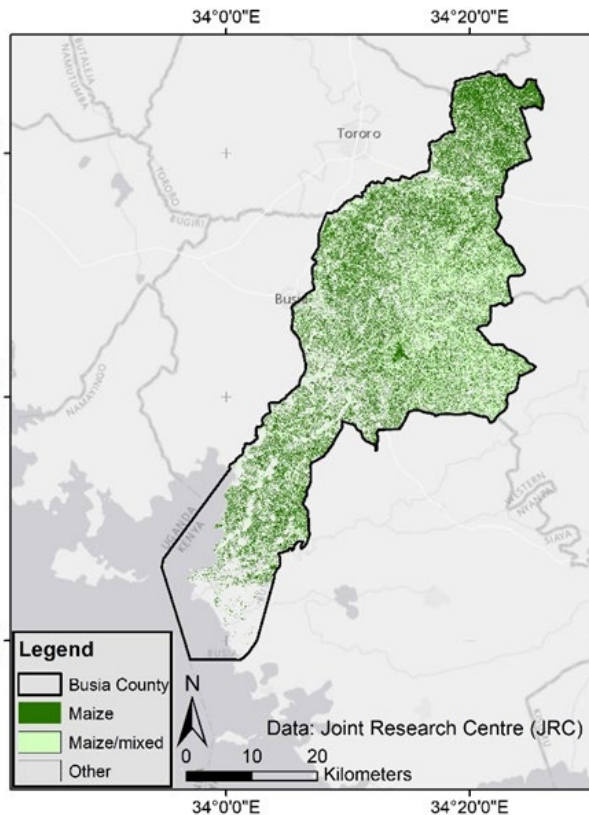
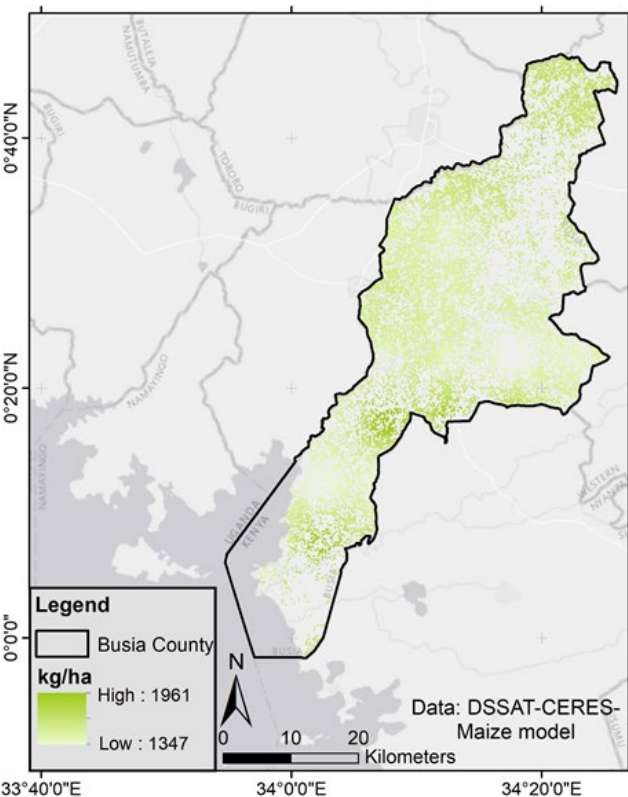


## Yield

## Maize/maize mixed areas

## Forecast conditions

## Cropland conditions



# 2021 season characterization

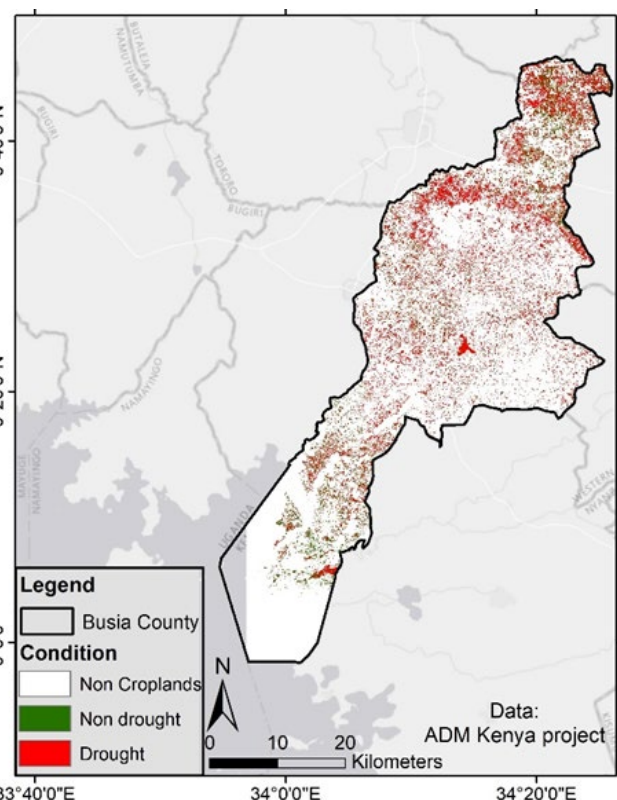
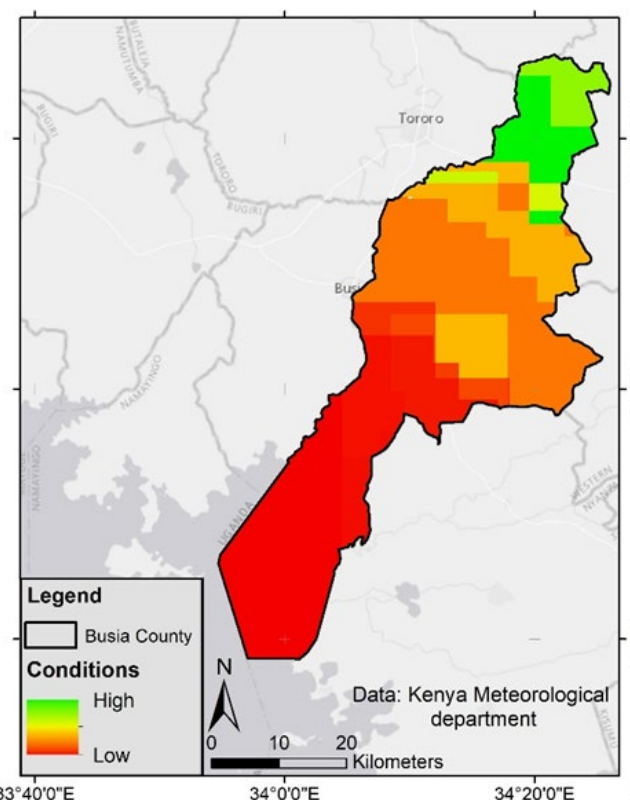
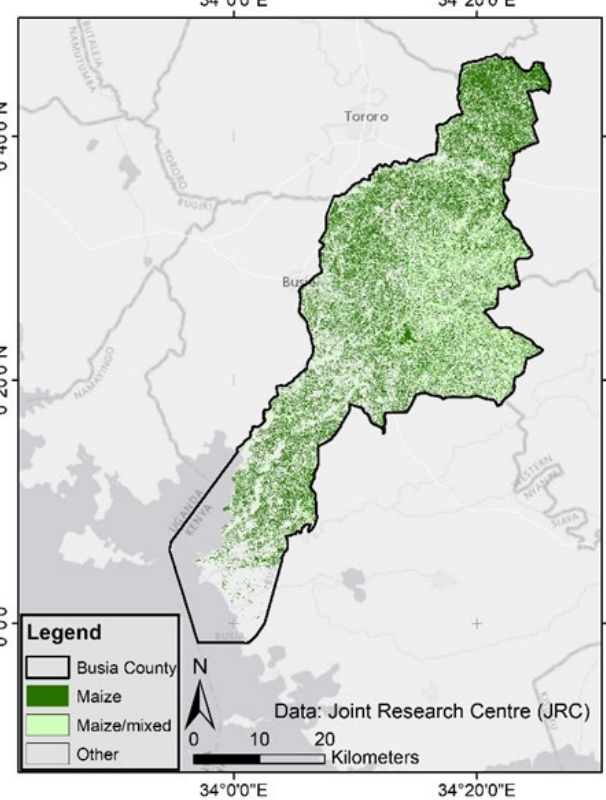
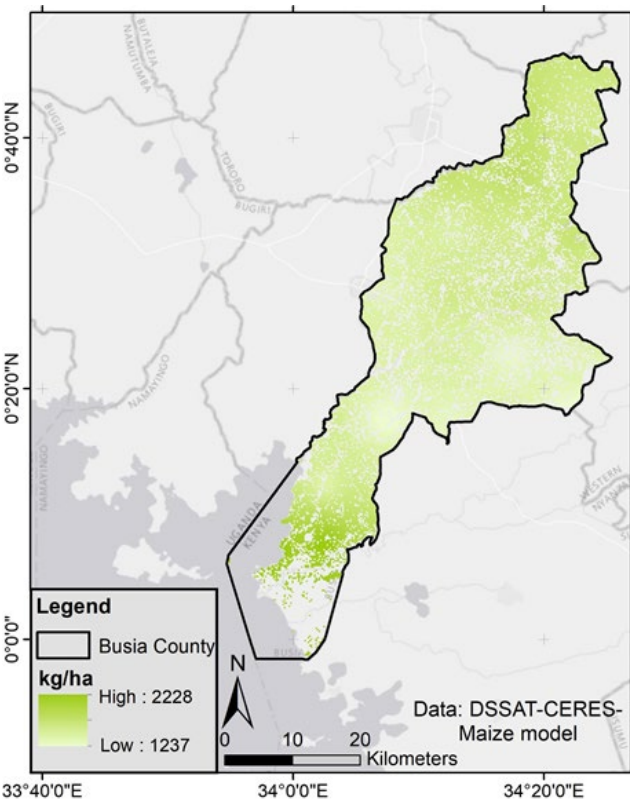


## Yield

## Maize/maize mixed areas

## Forecast conditions

## Cropland conditions

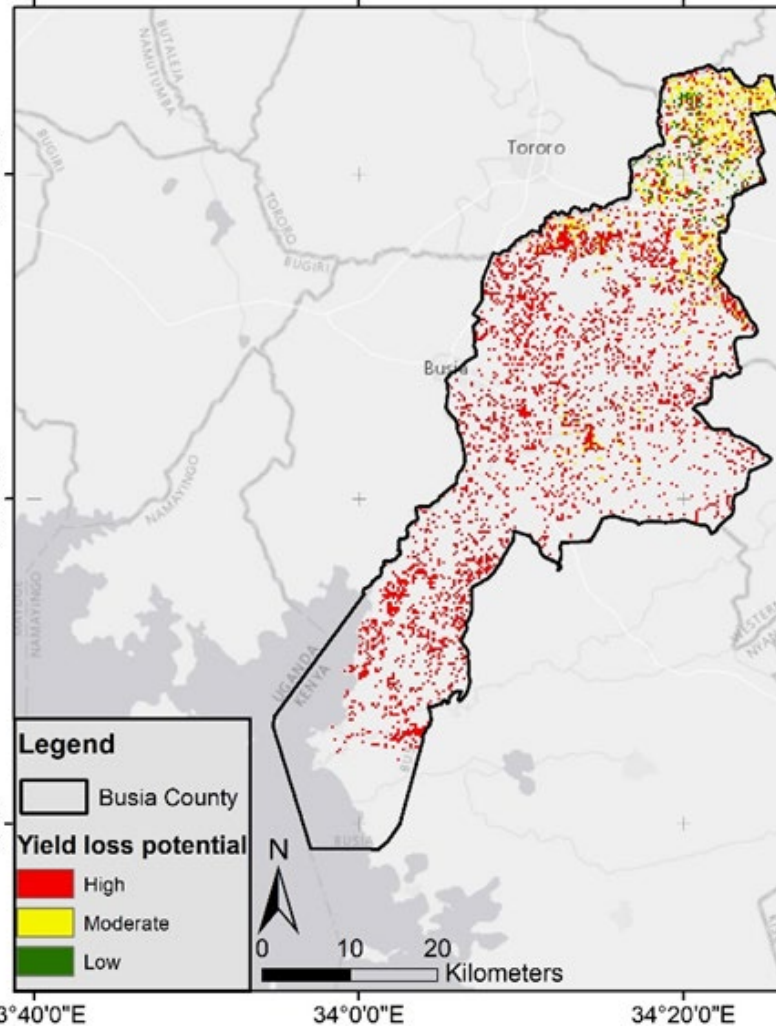
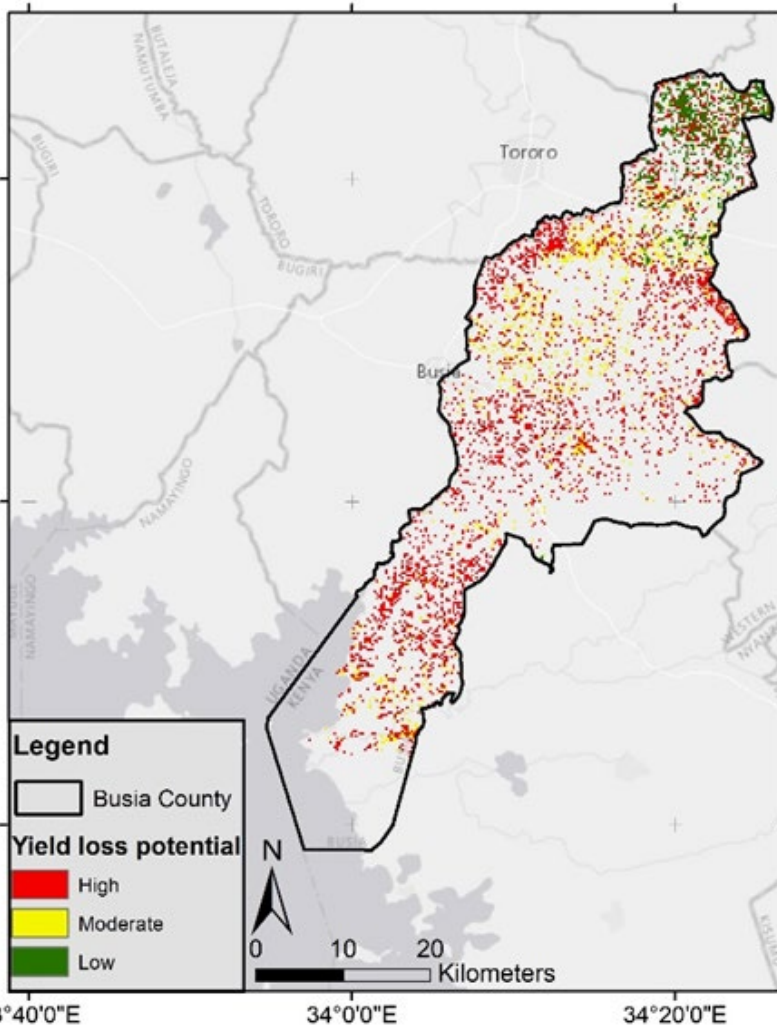


# Yield loss potential maps



## 2019 Season

## 2021 Season



The maps reflect the seasonal crop conditions

### 2019 – Marginal conditions

64% - High yield loss potential.

### 2021 – Poor conditions

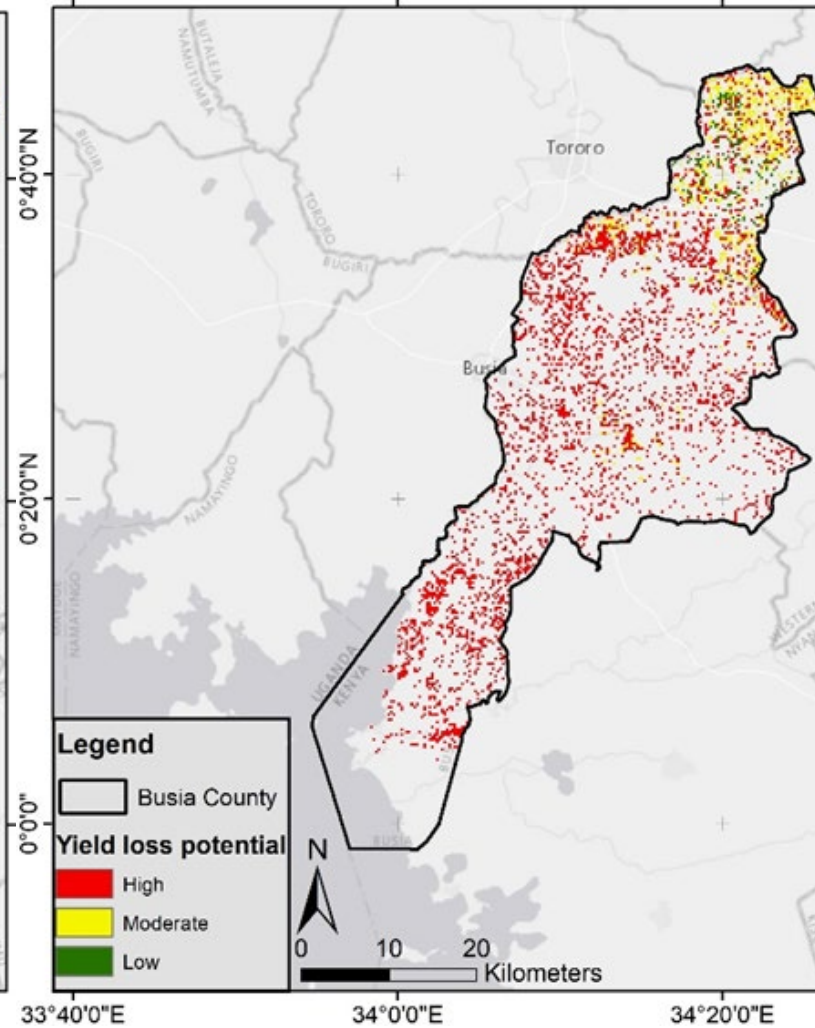
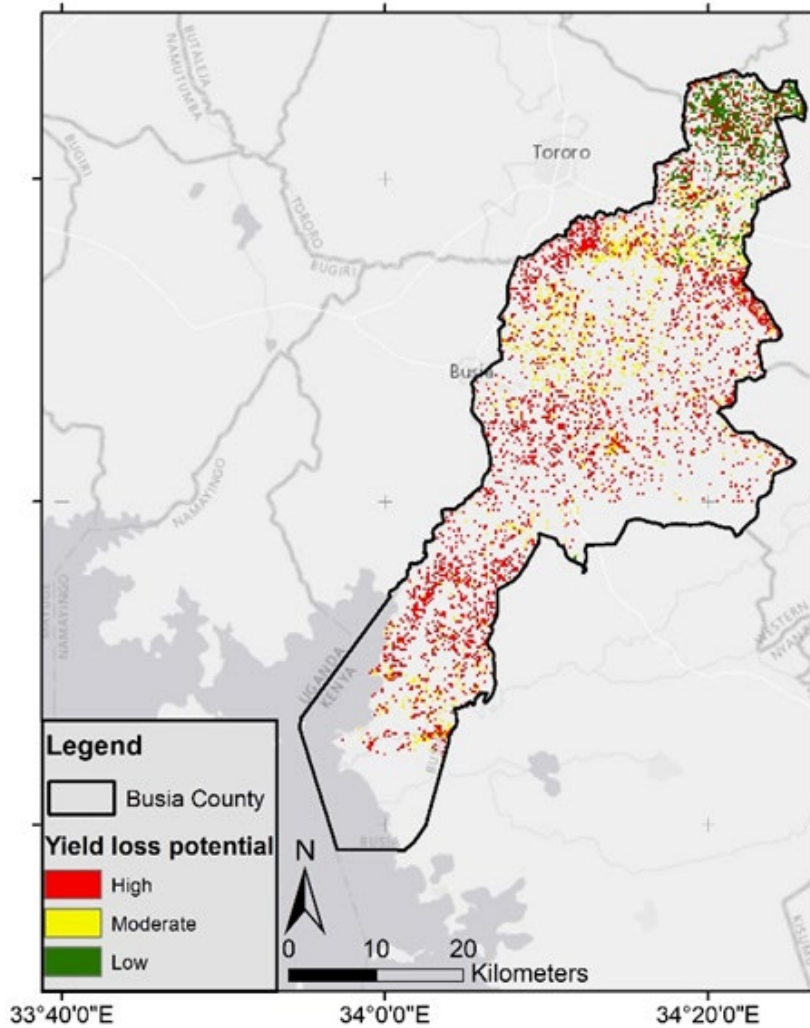
78% - High yield loss potential.

# Yield loss potential maps



## 2019 Season

## 2021 Season



The maps also reflect the landscape conditions.

**Sub-humid Zones – Southern parts**

High yield loss potential.

**Humid zones – Northern parts**

Low yield loss potential.



- Multi-season evaluation and comparisons.
- Assessing the yield production risks, especially in the marginal areas.
- Validating yield loss potential surfaces – User-based/field observations.



- Integration of multiple features of agricultural landscapes provides a holistic assessment for assessing yield loss potential.
- Expert-fuzzy models can potentially support extension and technology upscaling in smallholder agricultural contexts.



## Funding



## Data sources



## Institutions







**Thank you for your attention !!**

**Questions and comments**

