

About Me



- **B.sc Geography (Human Geography and GIS)**
University of Ibadan, Nigeria.
- **M.Sc. Environmental Risk and Human Security (In view)**
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- **Geospatial Consultant, Flood and Drought Researcher**
United Nations International Organization for Migration and Action Against Hunger.
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**Multi-criteria modelling of drought: a study of
Brandenburg, Germany**



Figure 5
Share of affected (%)
by continent

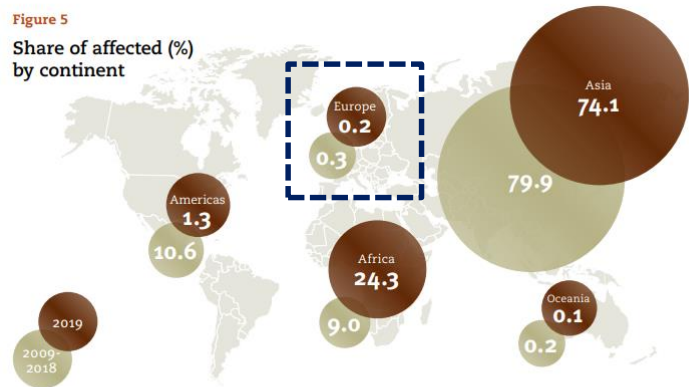


Figure 6

Number of affected (million) by disaster type:
2019 compared to 2009-2018 annual average

184.7
2009 to 2018

94.9
in 2019

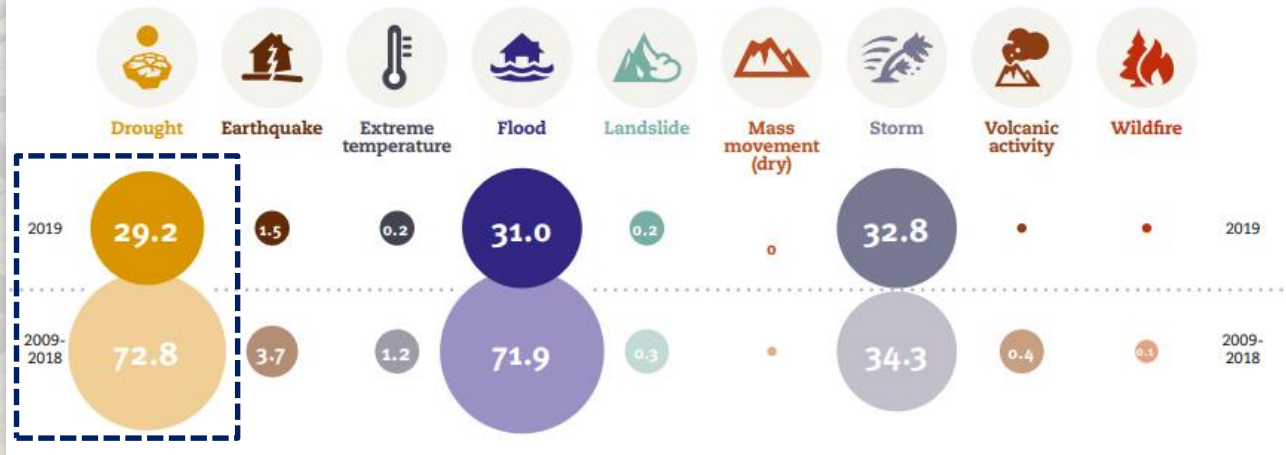
Global Statistics of continents and number of people affected by drought

Figure 6

Number of affected (million) by disaster type:
2019 compared to 2009-2018 annual average

184.7
2009 to 2018

94.9
in 2019



Drought in Germany (2018)

- According to the measurements of the **German Institute for Drought Monitoring** (Helmholtz Centre for Environmental Research), they confirmed “**Germany was affected by a historic drought event in 2018**”.
- The **German Farmers Association** announced that due to the continued **drought** in large parts of Germany, **significant crop failures** threatened existence of farmers.

Research Objectives

1. Model the **spatial variation of drought prevalence** during the year 2018.
2. Examine the intensity of the drought on **agricultural land and food security**.
3. Suggest possible solution to **improve drought monitoring and management**.



Low water of the Rhine river with the cityscape of Duesseldorf on August 10, 2018 in Germany

Brandenburg, Germany

Geographic Information

- Located at the **North-East Germany**.
- Borders Germany's capital (**Berlin**).
- Occupies an area of **29,478skm**.
- One of the warmest region in Germany- **14 degree Celsius**.
- Mean Annual temperature is 10.9 Degree.
- **Precipitation** of less than **600mm**.
- **45%** of its area comprise of **Agricultural Land**.
- **77% Cropland** and **23% Permanent grassland**.

Map of Germany highlighting Brandenburg

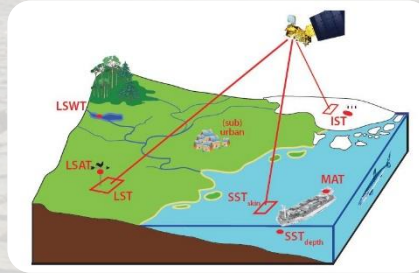


Space based dataset

- **Droughts** are characterized by complex interrelationships and factors.



Precipitation



Land Surface Temp

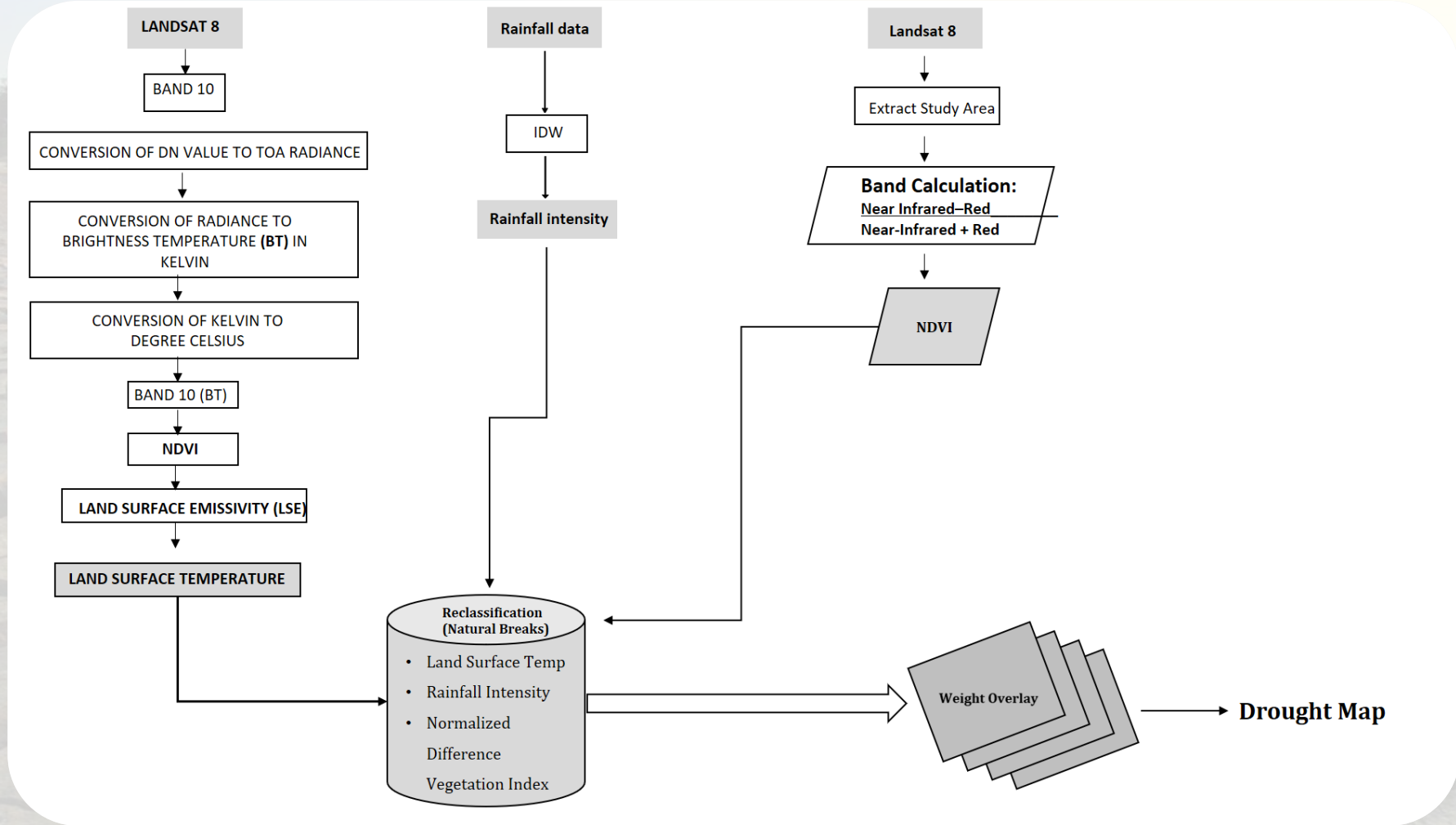


**Normalized Vegetation
Difference Index**



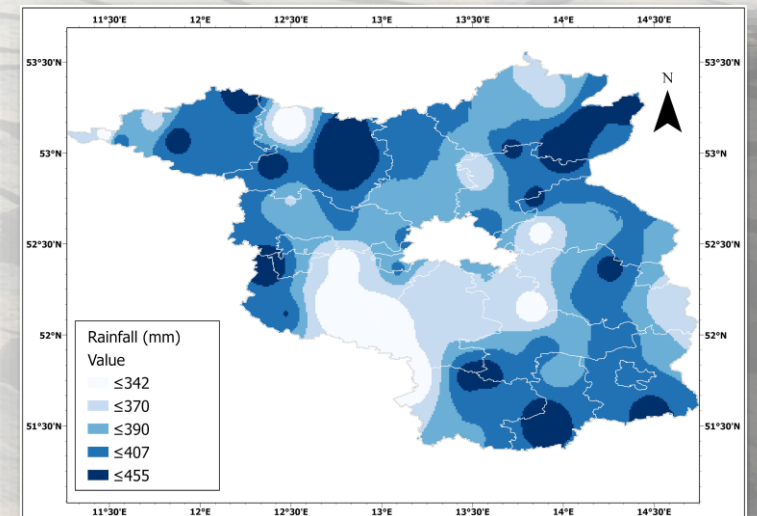
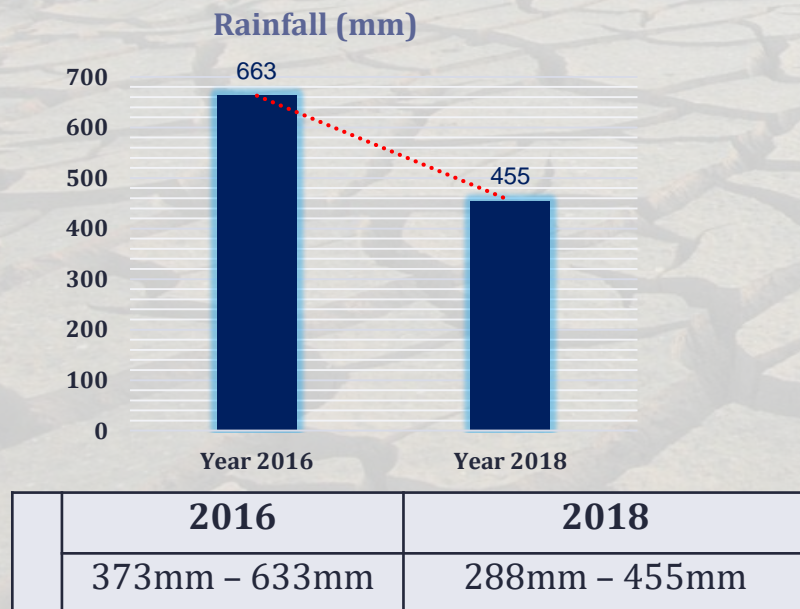
**Drought Prevalence
Map**

RESEARCH FRAMEWORK



PRECIPITATION

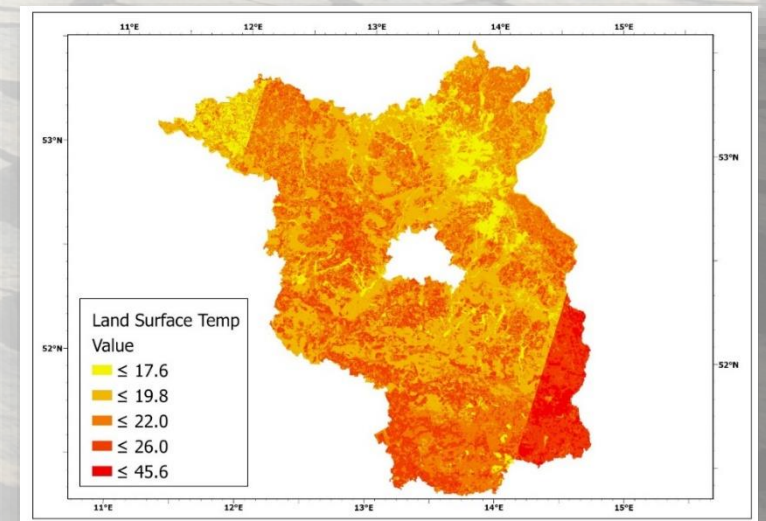
- Average annual rainfall recorded from **55 Weather Stations** in Brandenburg.
- Rainfall difference for the year 2018 compare to previous year (2016).
- Decline in precipitation amount in the year 2018 (figure below).



Precipitation distribution in Brandenburg for 2018

Land Surface Temperature (LST)

- Mapped using Landsat 8 Satellite Imagery. (Free and openly available, Landsat 8 is an Earth-imaging satellite from NASA which launched in 2013)
- LST generated from Thermal band (Band 10) of Landsat 8.
- Its estimation depends on the albedo, vegetation cover and soil moisture of the object.
- Highest LST were recorded in the Southern parts of Brandenburg.



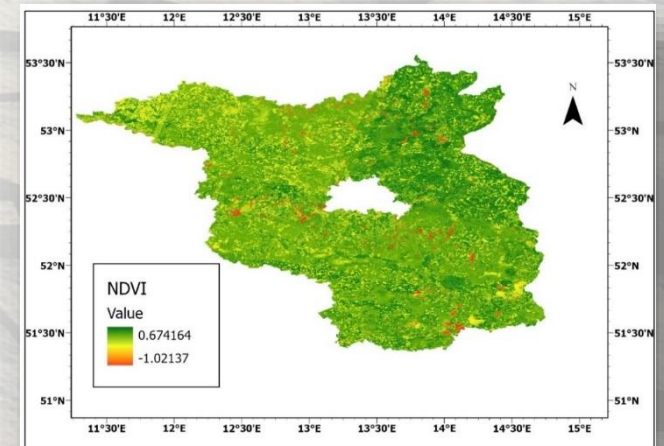
Normalized Difference Vegetation Index

- Mapped using Landsat 8 Satellite Imagery.
- The NDVI values range from – 1 to + 1. The negative limit value is highly like water, while the positive limit value indicates high vegetation health (dense green leaf).
- Diseased plants have less green leaf mass and thus lead to a lower NDVI.
- In 2018 NDVI value for Brandenburg ranges from – 1.02 to 0.67

NIR (Near-infrared)

$$NDVI = \frac{\text{band4} + \text{band3}}{\text{band4} - \text{band3}}$$

$$NDVI = \frac{(\text{NIR} - \text{Red})}{(\text{NIR} + \text{Red})}$$

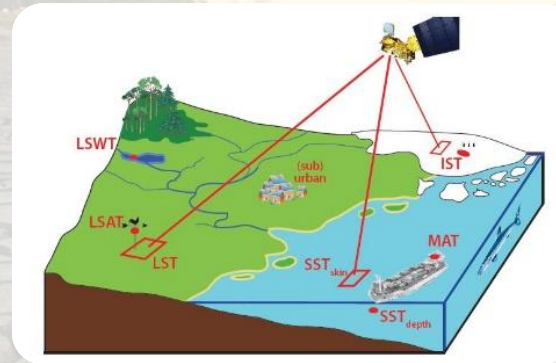


PLAN Model

- Performed a weight overlay analysis of all the three analyzed dataset



Precipitation



Land Surface Temp



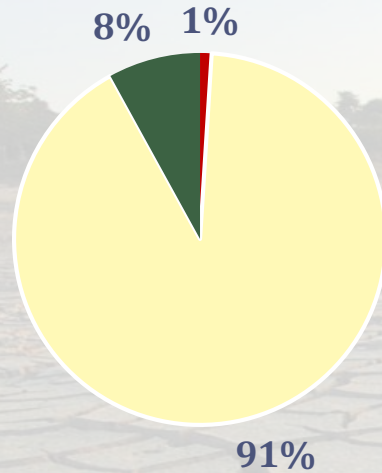
**Normalized Vegetation
Difference Index**



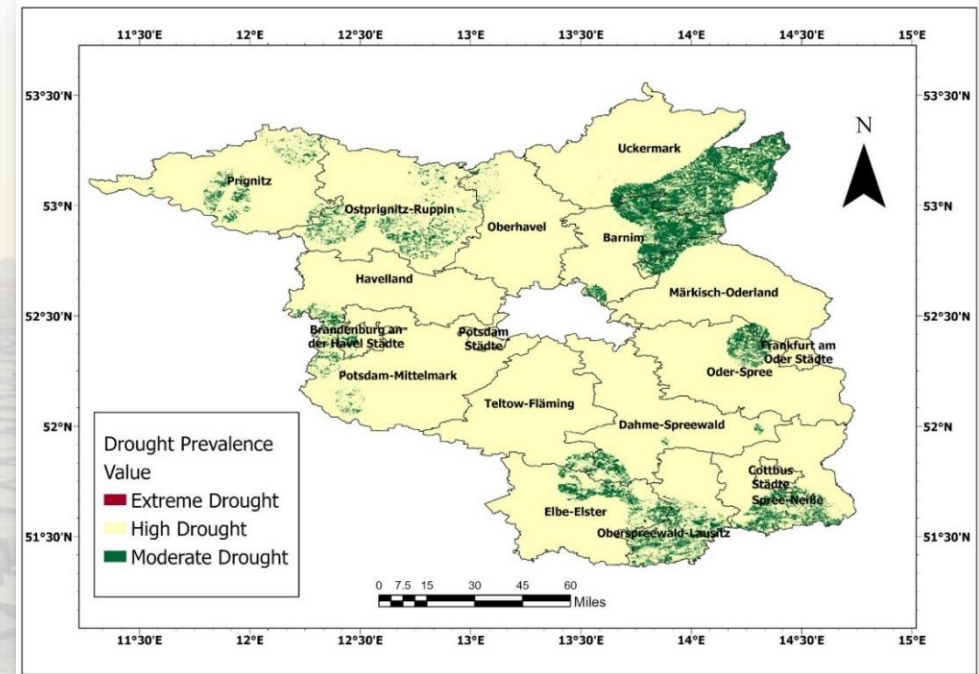
**Drought Prevalence
Map**

Drought Prevalence in Brandenburg (2018)

Percentage of Prevalence (2018)



■ Extreme Drought ■ High Drought
■ Moderate Drought



Drought Prevalence Map (2018)

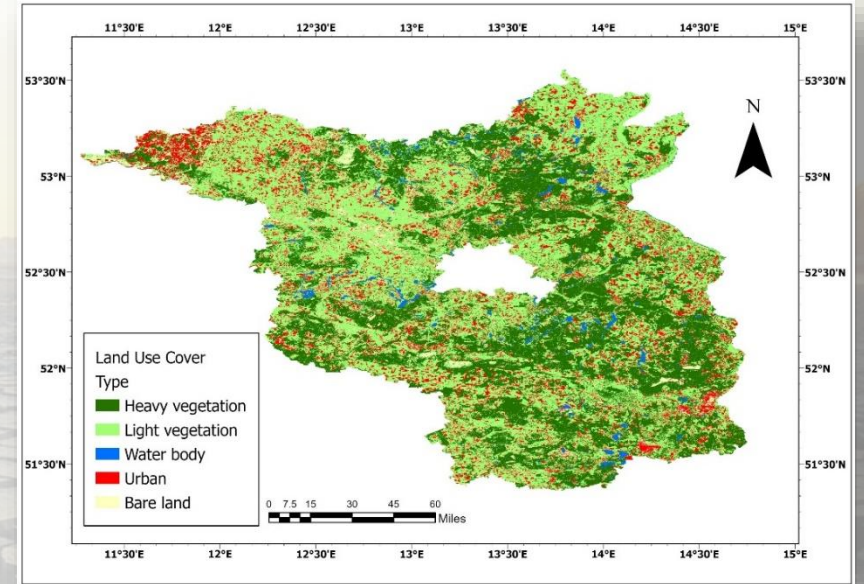
| Drought Prevalence | Area (SqKm) | Percentage |
|--------------------|------------------|------------|
| Extreme Drought | 0.19 | 1 |
| High Drought | 27,093.05 | 91 |
| Moderate Drought | 2384 | 8 |
| Total | 29,478 | 100% |

Land Use and Land Cover

- **Landsat 8** Satellite Imagery was used.
- Interactive **Supervised Classification Method**.

- Agricultural Area
 - Heavy Vegetation**
 - Light Vegetation**

- Non Agricultural Area
 - Waterbody**
 - Urban**
 - Bareland**



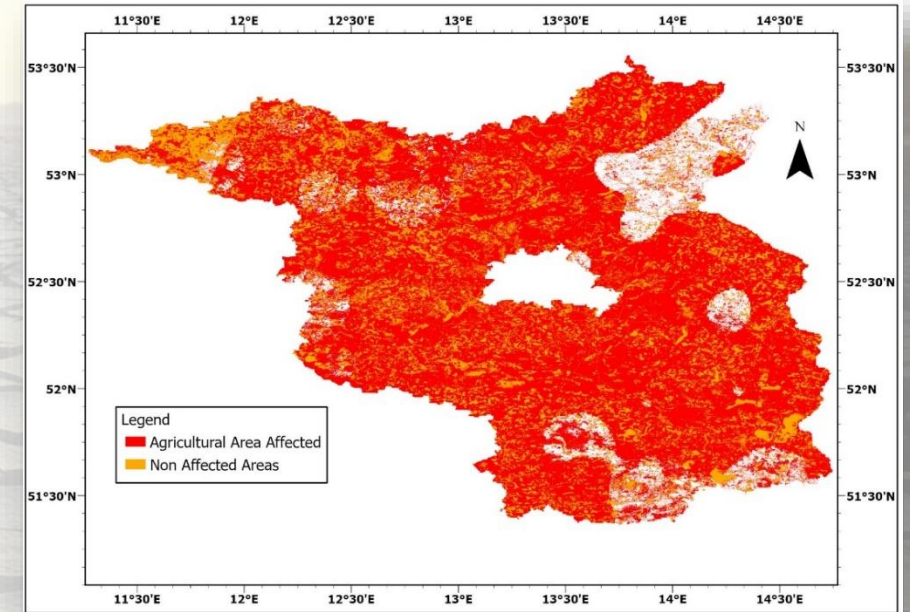
Landuse and Land cover map in 2018

| Reclassified LULC | Area (SqKm) | Percentage |
|---------------------------------------|-----------------|-------------|
| Agricultural area (vegetation) | 21.60837 | 73% |
| Non-agricultural area | 7869.63 | 27% |
| Total | 29,478 | 100% |

Drought and Agriculture

The **extent of agricultural lands** (including forests) impacted by the **2018 drought** in the region was examined.

| | |
|--|------------------|
| Total Agricultural lands (Sqkm) | 21,608.37 |
| Agricultural lands impacted by high drought | 16,756.06 |
| Percentage | 77% |
| | |



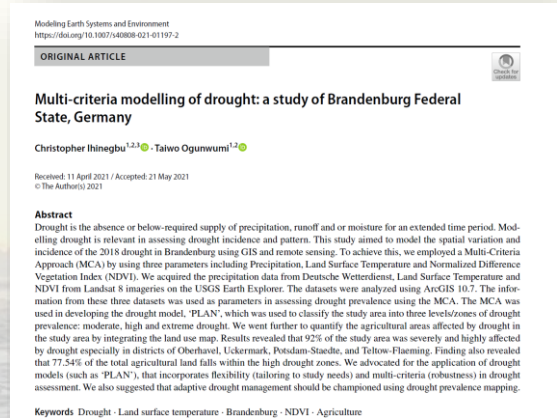
Agricultural Area affected by Drought

Conclusion and Recommendation

- Our analysis indicated the impact of the 2018 drought on agricultural area of Brandenburg.
- Research showcased the capability of Spaced Based Dataset and Remote Sensing Analysis.

Recommendation

- **Drought Relief Funds** should be disbursed to the affected farmers using the Drought Impact Map.
- Access and availability of Drought Early warning system (using the Space based dataset).
- Continuous funding by the Government should to support Drought research.
- **Adaptive drought management** is included in the disaster management plans.
- Suggesting the implementation of **drought insurance scheme** for farmers.
- We strongly recommend that **“PLAN Model”** is adopted in future study on Drought.



'The next pandemic': drought is a hidden global crisis, UN says

Countries urged to take urgent action on managing water and land and tackling the climate emergency



Over half of the world's population will live in water-stressed regions by 2050



Take urgent action to combat climate change and its impacts.

**Thank
YOU!**

