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- B.sc Geography (Human Geography and GIS) University of Ibadan, Nigeria.
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- Geospatial Consultant, Flood and Drought Researcher United Nations International Organization for Migration and Action Against Hunger.
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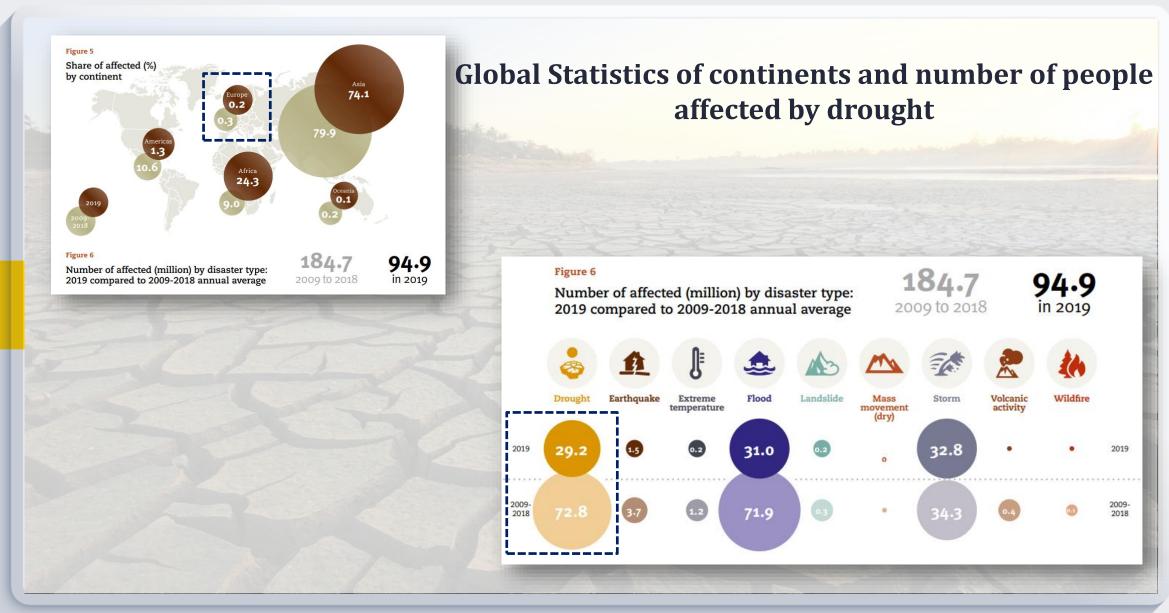


Taiwo Ogunwumi



Multi-criteria modelling of drought: a study of Brandenburg, Germany





Source: Centre for Research on the Epidemiology of Disasters (CRED), Natural Disasters 2019. Brussels: CRED; 2020

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

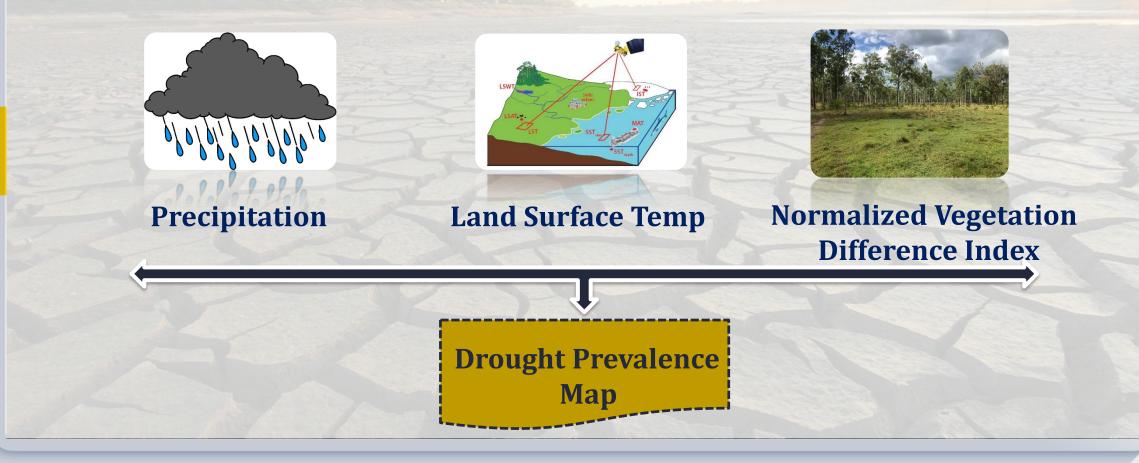
Geographic Information

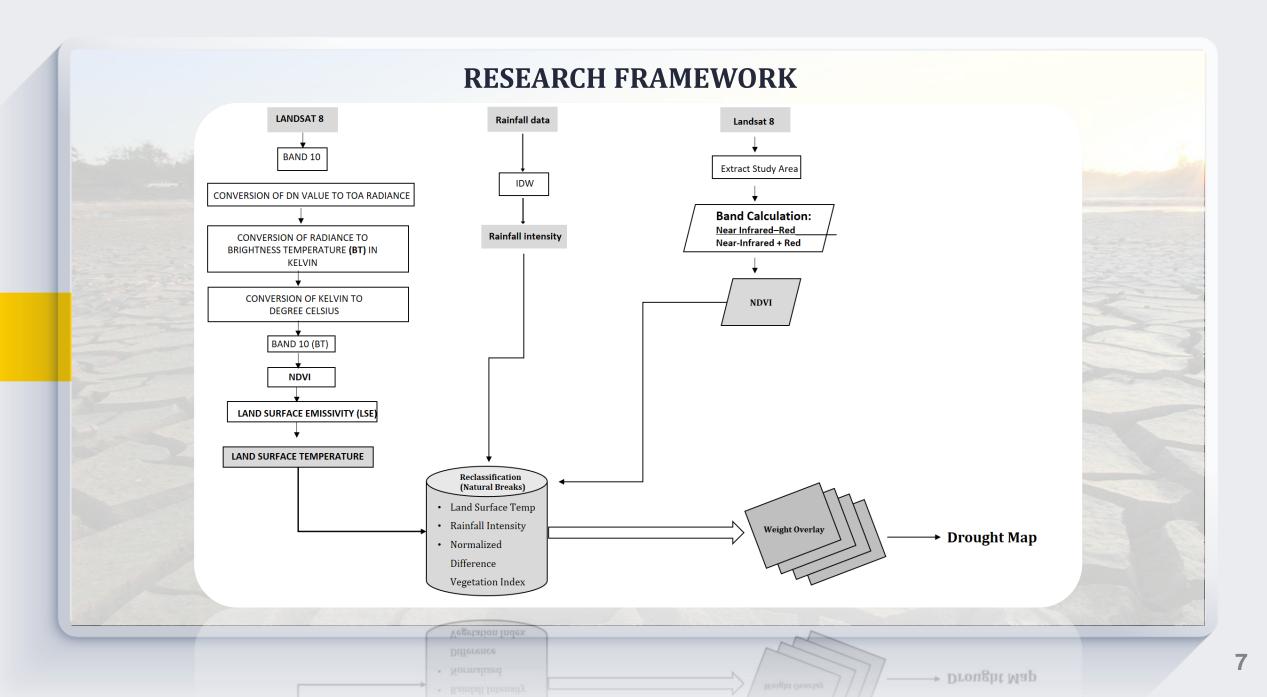
- Located at the North-East Germany.
- Borders Germany's capital (Berlin).
- Occupies an area of 29,478skm.
- One of the warmest region in Germany- 14 degree Celsius.
- Mean Annual temperature is 10.9 Degree.
- Precipitation of less than 600mm.
- 45% of its area comprise of Agricultural Land.
- 77% Cropland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



Space based dataset

Droughts are characterized by complex interrelationships and factors.





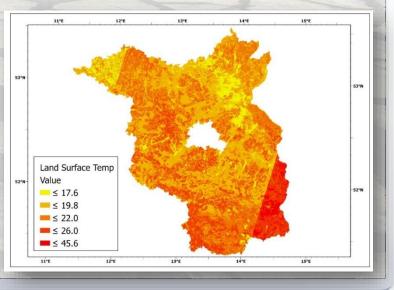
PRECIPITATION

- 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).



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.



Source: USGS Earth Explorer

Land Surface Temperature of Brandenburg in 2018

Normalized Difference Vegetation Index

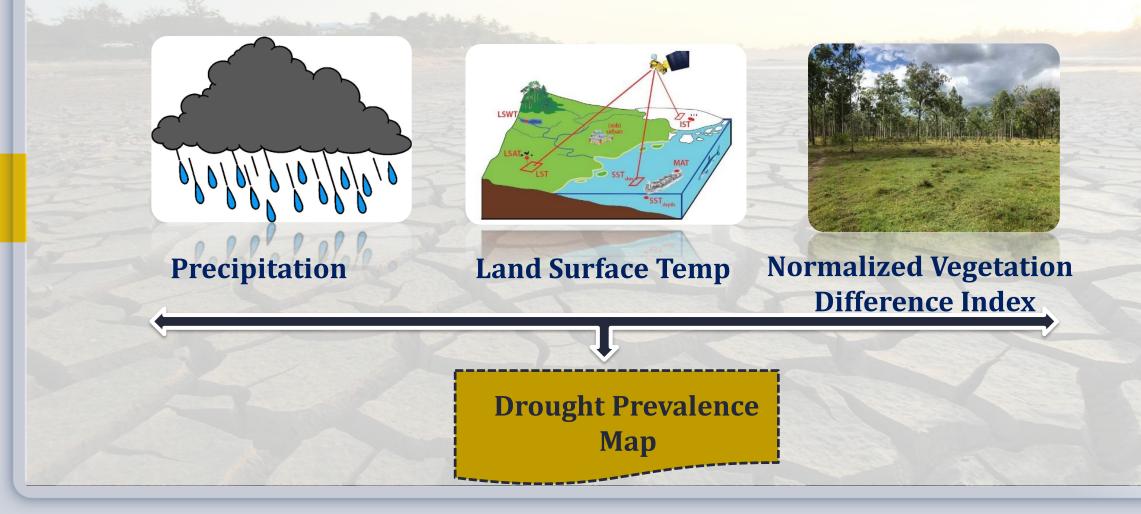
- Mapped using Landsat 8 Satellite Imagery.
- The NDVI values range from 1 to + 1. The negative limit value is highly like water, while the positive limit value indicates high vegetation health (dense green leaf).
- Diseased plants have less green leaf mass and thus lead to a lower NDVI.
- In 2018 NDVI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



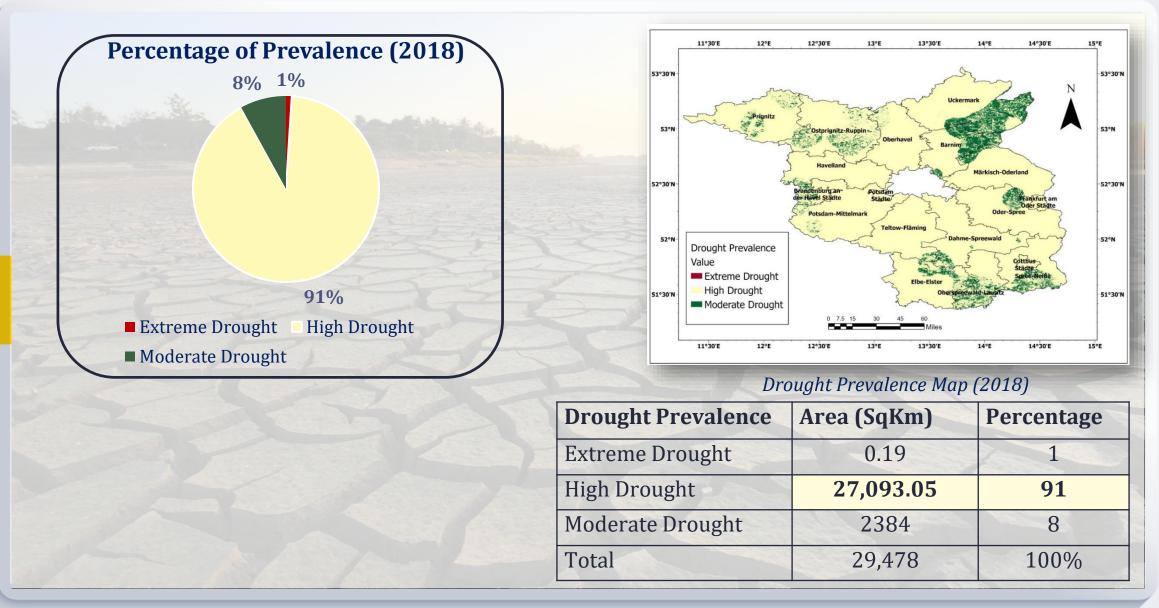
Source: USGS Earth Explorer

PLAN Model

Performed a weight overlay analysis of all the three analyzed dataset



Drought Prevalence in Brandenburg (2018)



Land Use and Land Cover

Landsat 8 Satellite Imagery was used. 11°30'E 53°30'N Interactive Supervised Classification Method. 530 52°30'N Agricultural Area Land Use Cover 52°N **Heavy Vegetation** Heavy vegetation Light vegetation Water body **Light Vegetation** Bare land 11°30'E

Landuse and Land cover map in 2018

13°30'E

14°E

14°30'E

14°30'E

52°N

15°E

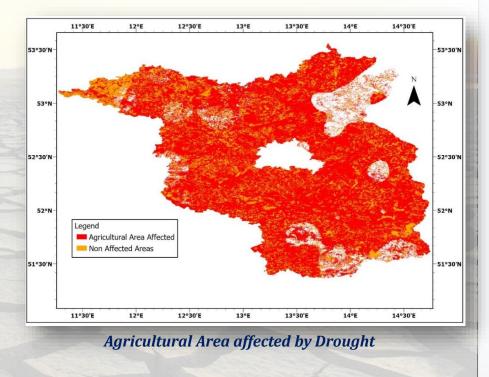
 Non Agricultural Area 	Reclassified LULC	Area (SqKm)	Percentage
U Waterbody			
	Agricultural area	21.60837	73%
🗆 Urban	(vegetation)		
Bareland	Non-agricultural area	7869.63	27%
u Dai ciallu	Total	29,478	100%

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Drought and Agriculture

The extent of agricultural lands (including forests) impacted by the 2018 drought

in the region was examined.



Total Agricultural lands (Sqkm)	1000
	21,608.37
Agricultural lands impacted by	
high drought	16,756.06
Percentage	77%

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

Modeling Careh Spans and Environment https://ddi.com/16.1007/A0080-021-01197-2 ORIGINAL ARTICLE Multi-criteria modelling of drought: a study of Brandenburg Federal State, Germany

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Received: 11 April 2021 / Accepted: 21 M © The Author(s) 2021

Abstract

Drought is the absence or below-required supply of precipitation, runoff and or moisture for an extended time period. Modelling dought is released in a sensing dought incidence and pattern. This study, and to two delt the guital variation and incidence or the 2018 drought in Brandenburg using GIS and remote sensing. To achieve this, we employed a Multi-Criteria Approach (MCA) by using there parameteria including Precipitation. Land Straffer & Temperature and Normalized Differences Vegatation Index. (NDVI). We couplied the precipitation data from Deutsche Wetterdienst, Land Surface Temperature and NDVI from Landset is imageries on the USOS E larth. Esplore. The datasets were analyzed using Arc(2018 10: 7. The information from these three datasets was used as parameters in assessing drought prevalence using the MCA. The MCA was used in developing the drought mode, PLAN, which was used to classify the stabulg area into three levels/conses of drought prevalence: moderate, high and extreme drought. We went further to quantify the agricultural areas affected by drought in the study area by integraring the land was may me. Results revealed the 92% of the study area was serverly and highly affected by drought especially in districts of Oberhavel, Uckermark, Postdam-Staceth, and Peltow-Flamming. Finding also revealed than 754% of the out agricultural land like within the high voglucy lance. We associate of the application of drought models (used) as 9LANY, but incorporates flexibility (tailoring to study needs) and multi-criteria (robustness) in drought assessment. We also suggested that adaptive drought management should be charging using also prevalence mapping.

words Drought · Land surface temperature · Brandenburg · NDVI · Agriculture

- 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!