

United Nations/Canada Space4Women Expert Meeting

Building capacity to promote and advance gender equality in the space sector

October 30th – November 3, 2023 | Montreal, Canada

She Space Nigeria: Using exposure to satellite remote sensing to encourage pre-teens to learn about STEM subjects

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Abstract

This presentation illustrates how satellite remote sensing was used, to make STEM education accessible and inspiring to selected school children in Nigeria through the She Space International Program. The vision of She Space International is to enable school aged students to **experience academic research, team-work and international collaboration in an all-female setting**, designed to empower young women to continue in space science and research. The She Space Nigeria team comprised of seven preteen girls, aged 8 to 12 years. The girls, representing 5 out of the 6 geopolitical zones in Nigeria, were selected based on parental support. By introducing the girls to ArcGIS and using the Google Earth Engine to learn coding and cloud computing for visualizing and processing satellite data, the girls are trained on how to analyze the impact of flood incidences in the “Food Basket State” of Nigeria. The results of the analysis, the different skills acquisition, and the learning experience, as described by the girls, will be presented. The steps involved in implementing this multi-disciplinary, project-based learning program, in collaboration with She Space International, will also be highlighted. The presentation will conclude on how pre-teen girls can engage in academic research, from a very early age, and be encouraged to design and execute mini projects, using satellite derived and other types of remotely sensed data, to address local environmental issues.

Outline

- Background on collaboration with She Space International
- Implementation of She Space Nigeria
 - Selection criteria for participants
 - Concluded Research Activities and Results
 - Projected Research Activities
 - Skills acquisition and learning experience of the girls
- Conclusion on viable methods of promoting gender equality in the space sector



Main Goals:

- Students will experience academic research, team work and international collaboration in an all-female setting designed to empower young women to continue in space science and research
- Students will utilize interdisciplinary remote sensing concepts to explore the status of vegetation under climatic conditions specific to each of their respective countries, which will integrate physics (optics and remote sensing), geography (climate and image analysis), and biology & chemistry (plant health and the factors affecting it)
- Students will gain experience presenting their scientific findings in diverse groups (to the other international participants)
- Students will learn about the space agencies and satellites launched by their various countries from the other participants
- Each group will present their impressions and understanding of the current status of women and the balance of genders in space sciences (and more generally) in their respective countries; the total group will discuss together how to encourage female participation in research and how to act as ambassadors for women in space science

Background on collaboration with She Space International

- Met the Director of She Space International (Shimrit) during the Space4Women Expert Meeting held in South Korea (2022)

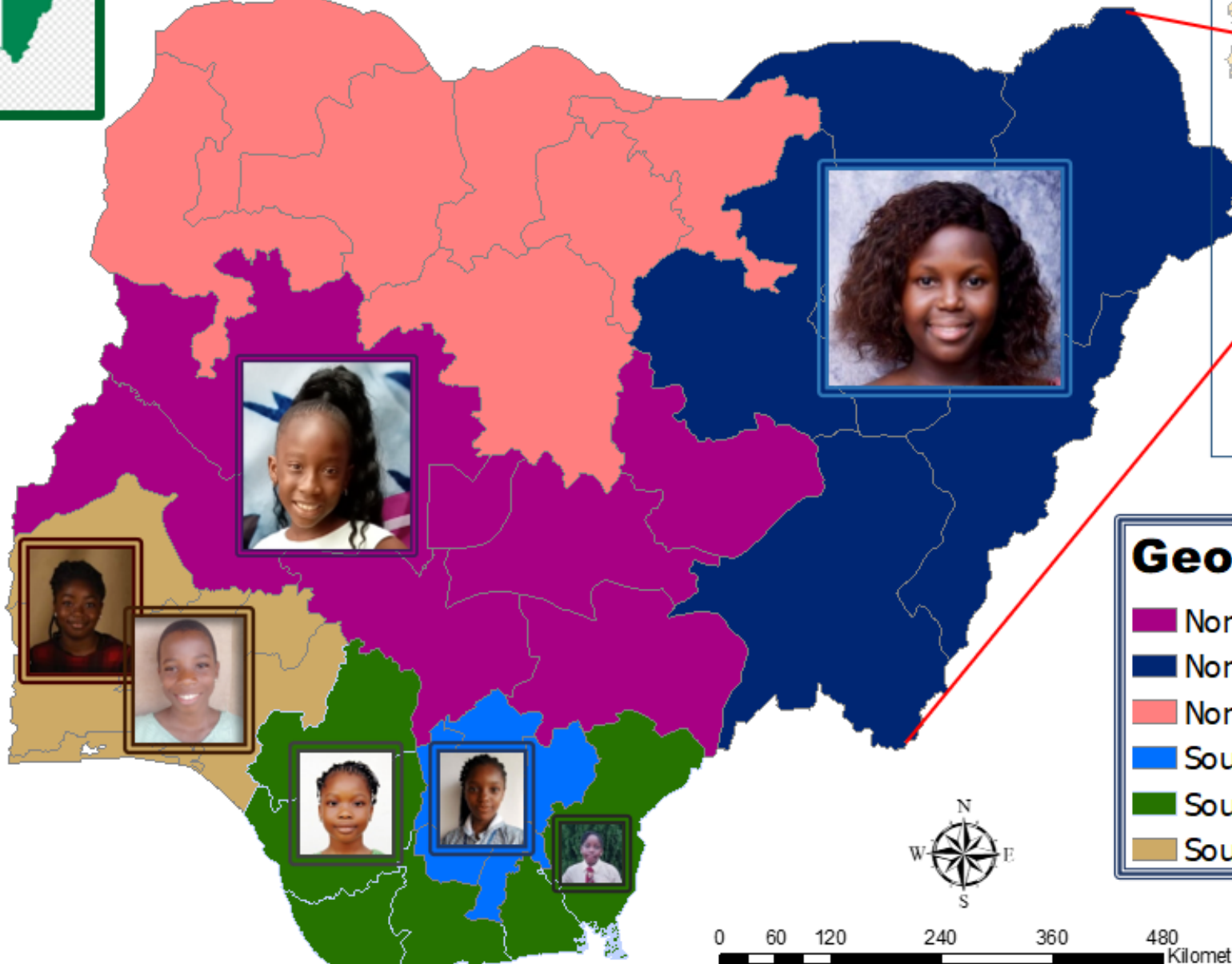
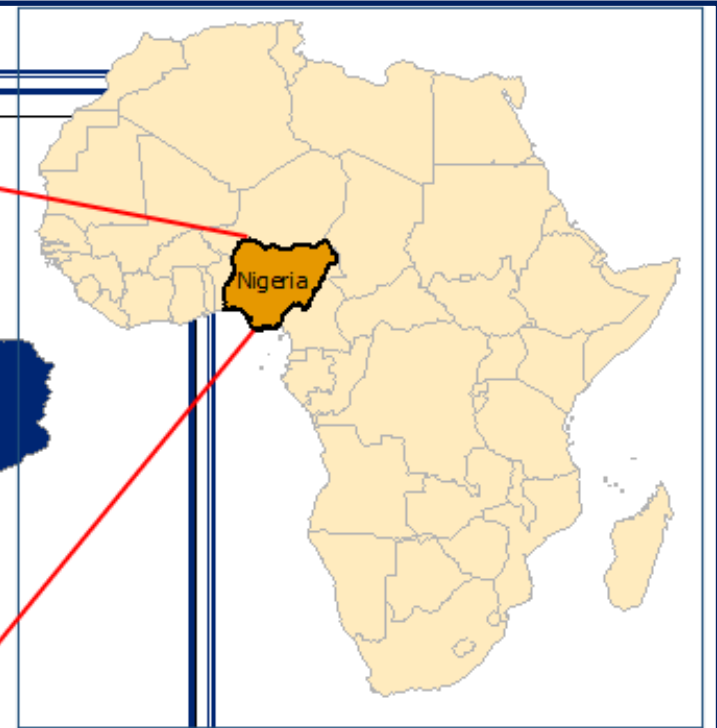
Participating Countries:

- Germany
- Israel
- Ivory Coast
- **Nigeria (2023)**
- South Korea
- Spain
- Switzerland
- Togo
- USA





She Space Nigeria



Geopolitical Zones

- North Central
- North East
- North West
- South East
- South South
- South West



0 60 120 240 360 480 Kilometers

The She Space Nigeria team is made up of seven preteen girls, aged 8 to 12 years

Selection of Participants with Parental Support



- The parents (especially the fathers) were actively involved and closely monitored the progress of their daughters

- She received a laptop from daddy for her birthday gift

Spatio-temporal analysis of the impact of 2022 flood incident on the “Food Basket State” of Nigeria

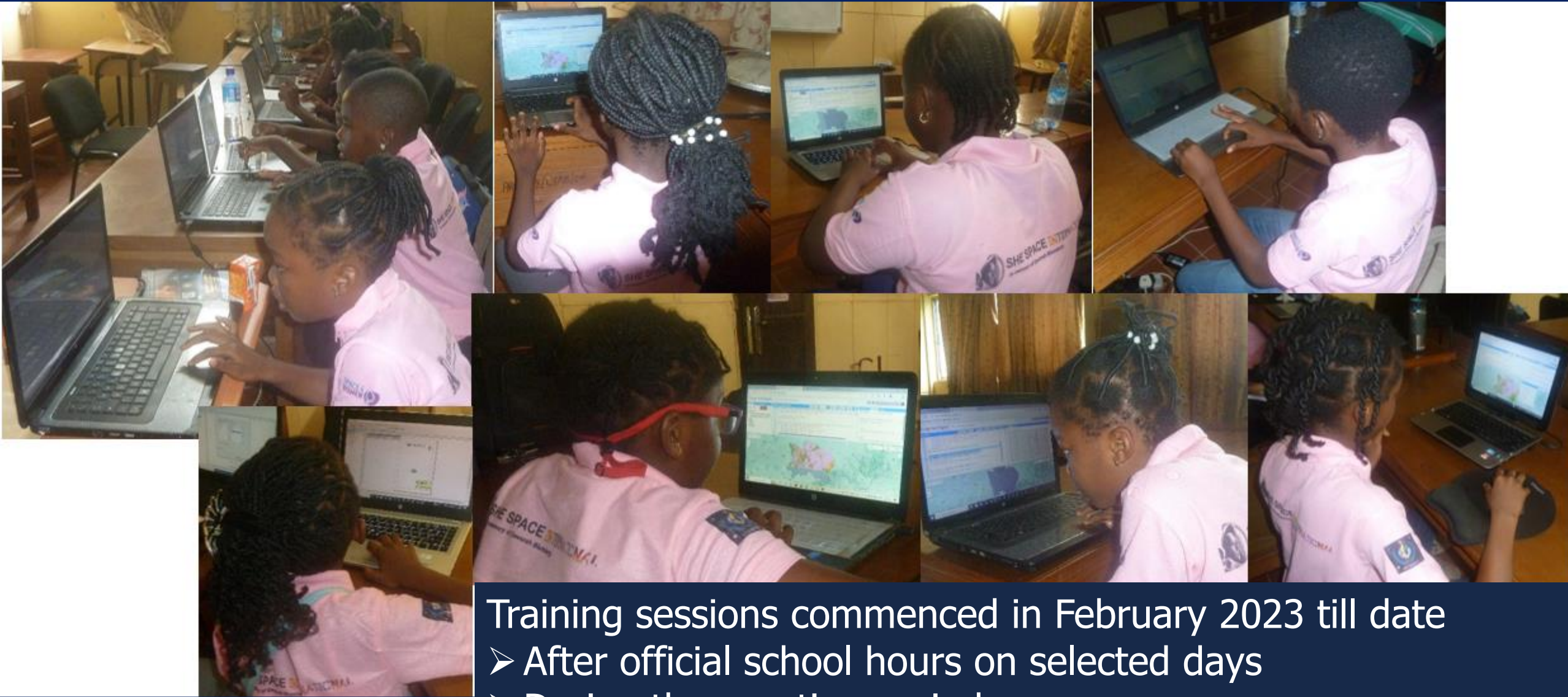
Aim:

To analyze the impact of 2022 flood incident on the crop land in Benue State, Nigeria

Objectives

- Analysis of ground measured rainfall data (2012 to 2022) with Excel Spread Sheets
- Use satellite derived data and the Google Earth Engine to prepare flood maps
- Estimate how much crop land was destroyed by the flood in 2022

Training the Girls



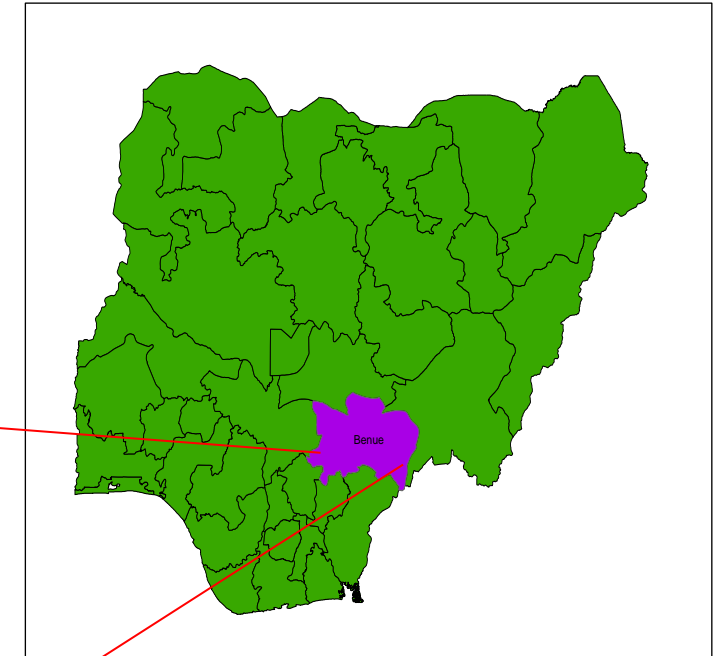
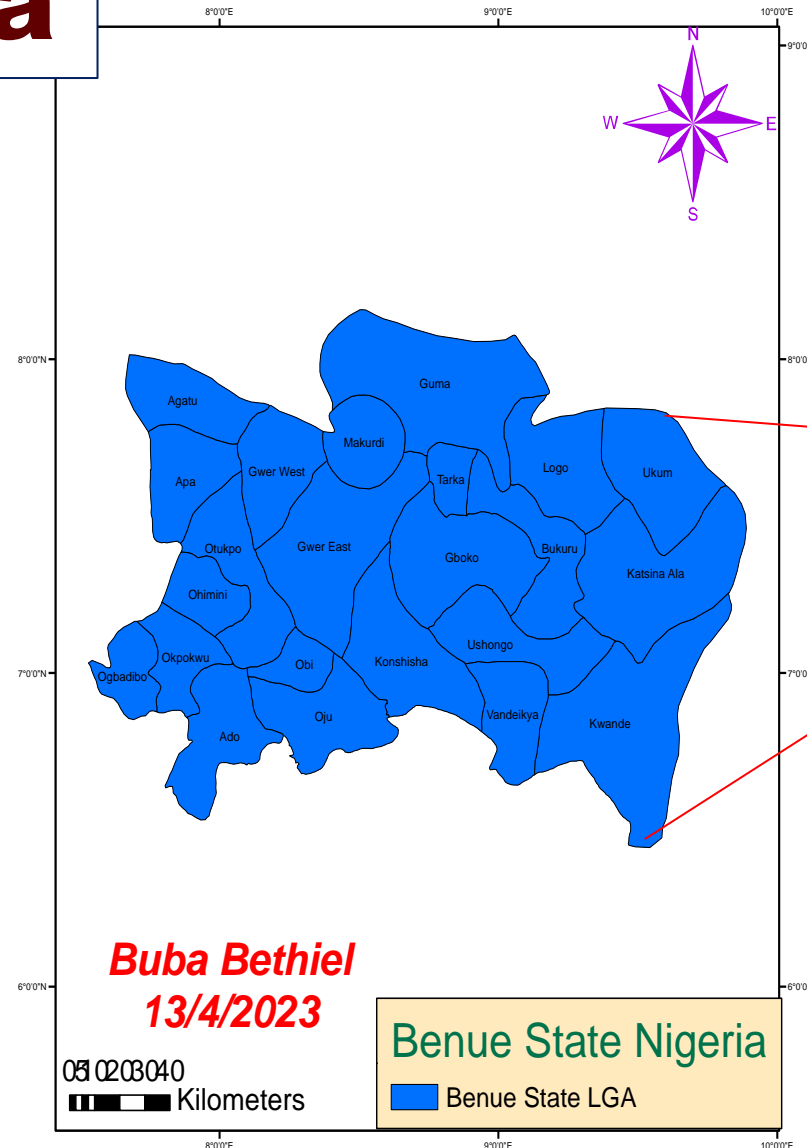
- Training sessions commenced in February 2023 till date
- After official school hours on selected days
 - During the vacation periods

Introduction to the Study

- While Nigeria typically experiences seasonal flooding, the floods of 2022 were the worst in the country since the flood incidents recorded ten years ago, in 2012.
- The flooding has been blamed on unusually *heavy rains* and climate change as well as the release of water from the Lagdo Dam in neighbouring Cameroon, which began on 13 September 2022.
- The 2022 floods in Nigeria affected most of the country, displacing over 1.4 million people, killing over 600, and injuring more than 2,400.
- Over 200,000 homes were completely or partially destroyed by the floods, and vast farmlands were ruined.

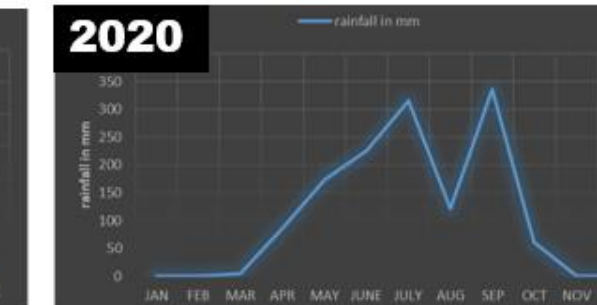
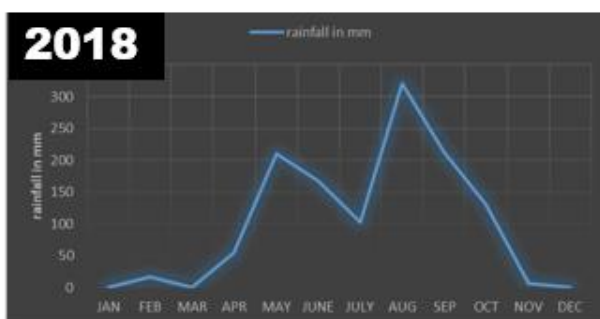
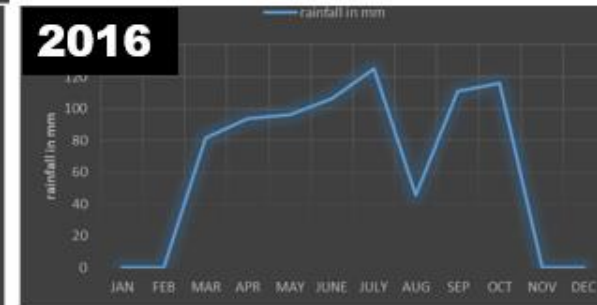
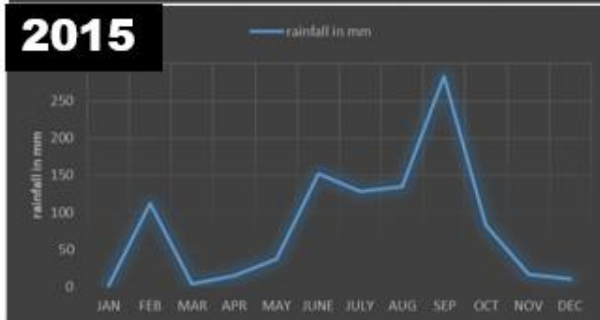
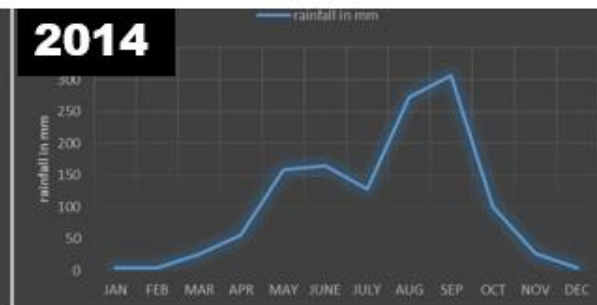
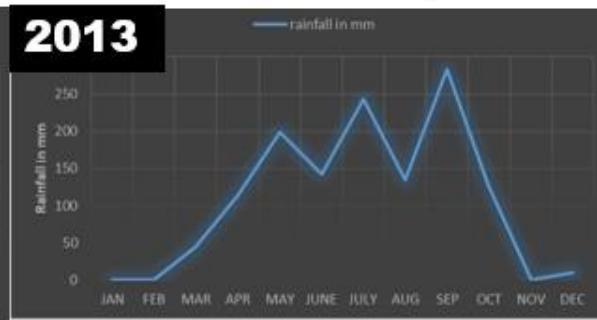
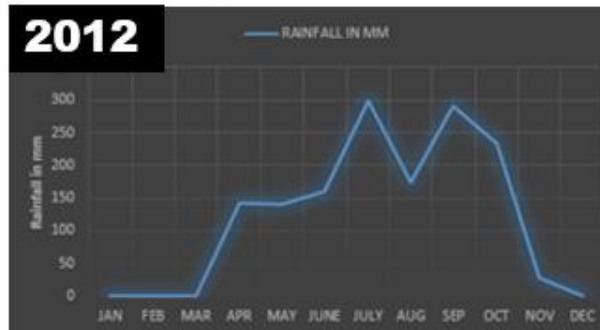
The Study Area

- Nigeria is made up of 36 States and the Federal Capital Territory (FCT)
- Benue State is known as the “Food Basket of the Nation”
- Because of the rich agricultural produce which include yam, rice, beans, cassava, potatoes, maize, soya beans, sorghum, millet and cocoyam.



Results

Monthly Rainfall Trend: Makurdi, Benue State (2012 - 2022)

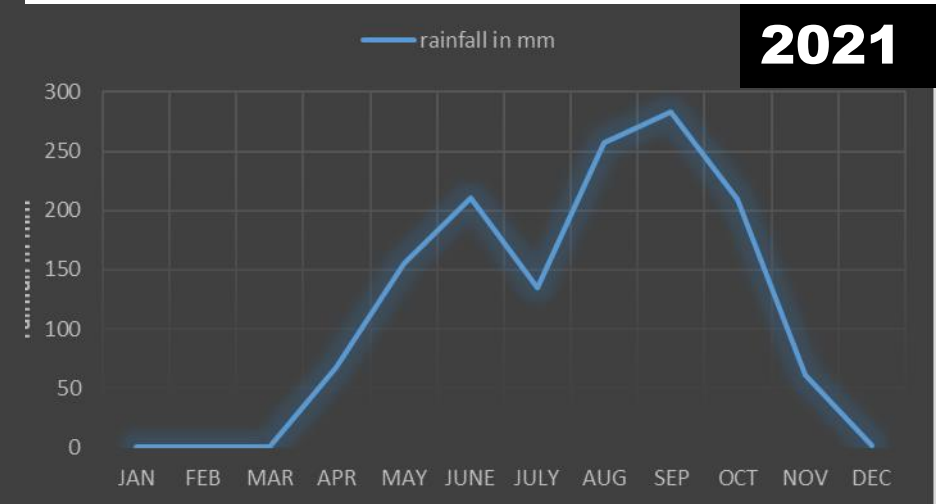
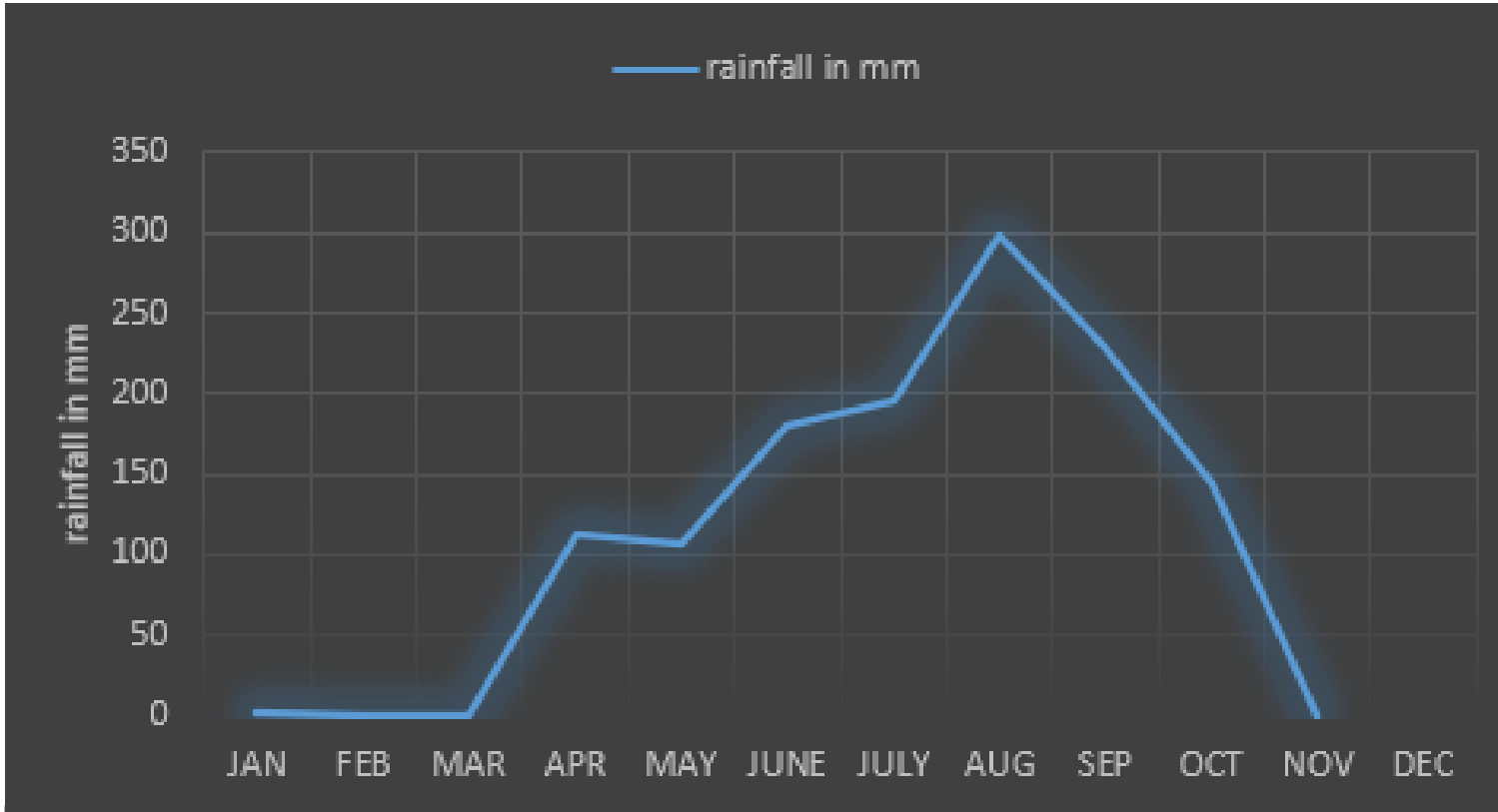


Training on using Microsoft Excel Sheet to analyze data and prepare Charts

Data from the Nigerian Meteorological Agency ([NiMeT](#))

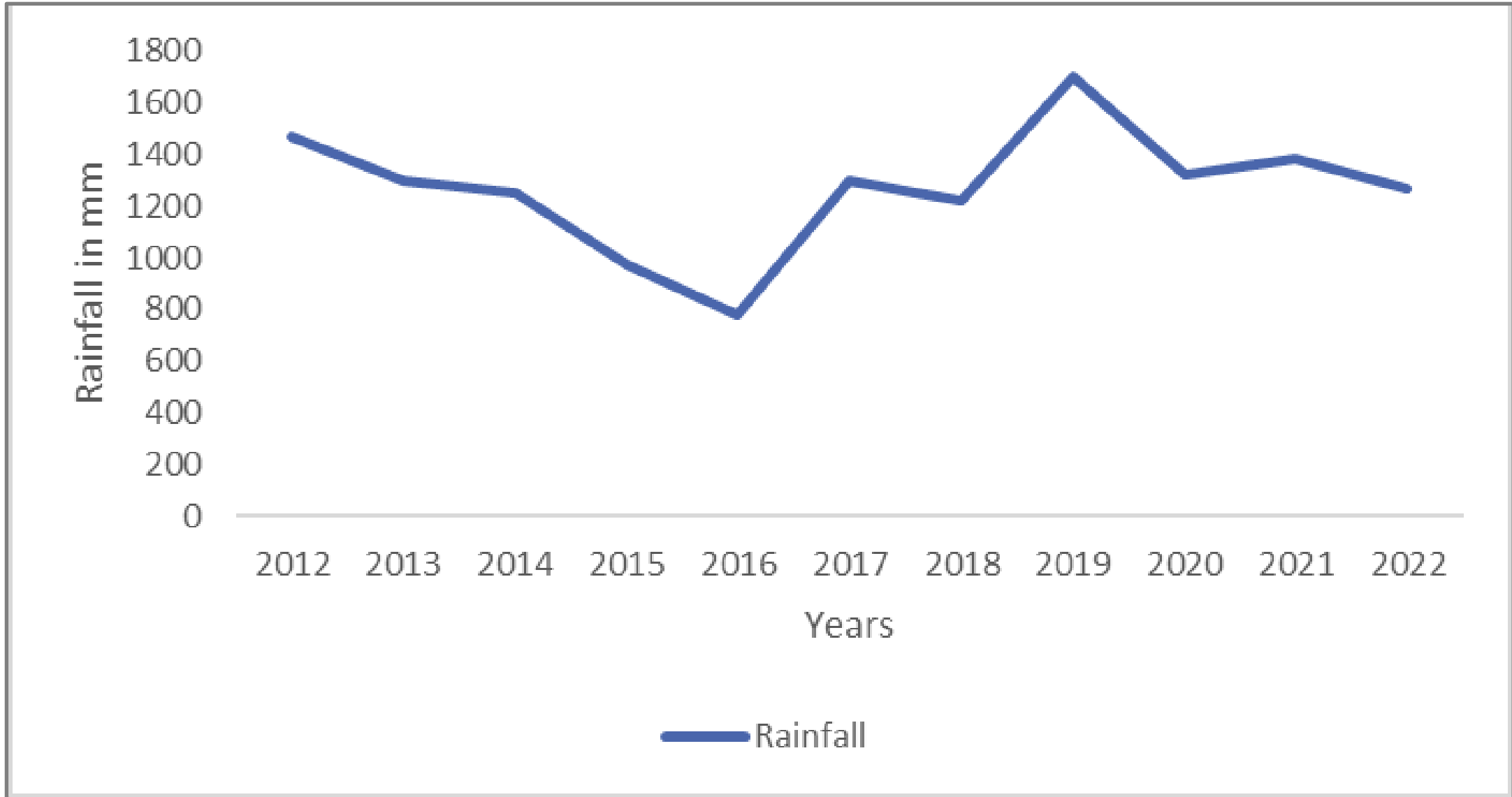
Results

Rainfall in Makurdi, Benue State in 2022

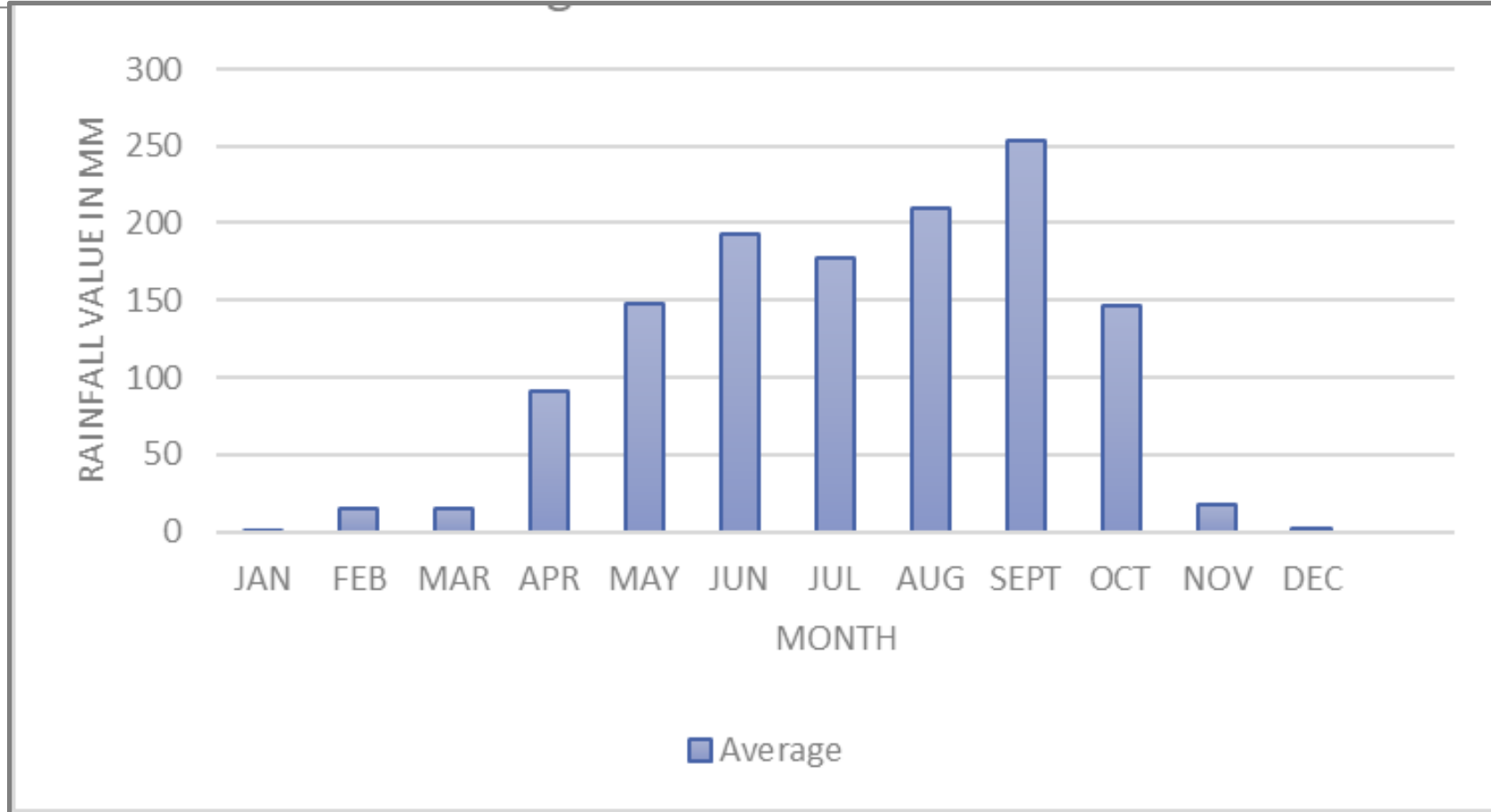


Data from the Nigerian Meteorological Agency (NiMeT)

Annual Rainfall Trend in Makurdi, Benue State (2012-2022)



Average Monthly Rainfall in Makurdi, Benue State (2012-2022)



Data from the Nigerian Meteorological Agency (NiMeT)

Results

Google Earth Engine

Training on using the Google Earth Engine to modify codes to select, analyze and display SAR data

The screenshot displays the Google Earth Engine console interface. On the left, a code editor shows a JavaScript script for processing Sentinel-1 SAR data. The script includes steps for loading a shapefile, filtering an image collection by instrument mode and orbit properties, and then mosaicking and displaying specific images. On the right, the 'Inspector' panel shows the execution results, including the type and ID of the image collection and a list of 36 individual image features.

```
Link c999c0275b4870978b155ec6b68231ae *
1 // OPTIONAL- Load the shapefile for your area of interest
2 var roi = ee.FeatureCollection("FAO/GAUL_SIMPLIFIED_500m/2015/level1").filter(ee.Filter.eq('ADM1_NAME', 'Benue'));
3 Map.addLayer(roi, {color: 'gray'}, 'Study Area',0);
4
5 // Set Google Terrain as the basemap
6 Map.setOptions('TERRAIN');
7
8 var collection = ee.ImageCollection('COPERNICUS/S1_GRD')
9   .filter(ee.Filter.eq('instrumentMode', 'IW'))
10  .filter(ee.Filter.eq('orbitProperties_pass', 'ASCENDING'))
11  .filterMetadata('resolution_meters', 'equals', 10)
12  .filterDate('2022-09-01', '2022-12-31')
13  .filterBounds(roi);
14 print(collection, 'Sentinel-1 Collection');
15 var collection_list=ee.ImageCollection(collection).toList(999);
16
17 var image1=ee.Image(ee.List(collection_list).get(4)).clip(roi);
18 var image2 =ee.Image(ee.List(collection_list).get(5)).clip(roi);
19 var sep_14 = ee.ImageCollection([image1, image2]).mosaic();
20 Map.centerObject(roi, 10);
21 Map.addLayer(sep_14.select('VH'), {min:-25,max:-5}, 'S1 Sep. 14, 2022 VH', 1);
22
23 var image3 =ee.Image(ee.List(collection_list).get(8)).clip(roi);
24 var image4 =ee.Image(ee.List(collection_list).get(9)).clip(roi);
25 var sep_26 = ee.ImageCollection([image3, image4]).mosaic();
26 Map.centerObject(roi, 10);
27 Map.addLayer(sep_26.select('VH'), {min:-25,max:-5}, 'S1 Sep. 26, 2022 VH', 1);
28
29 var image5=ee.Image(ee.List(collection_list).get(32)).clip(roi);
30 var image6 =ee.Image(ee.List(collection_list).get(33)).clip(roi);
31 var dec_19 = ee.ImageCollection([image5, image6]).mosaic();
32 Map.centerObject(roi, 10);
33 Map.addLayer(dec_19.select('VH'), {min:-25,max:-5}, 'S1 Dec. 19, 2022 VH', 1);
34
35
36 //////////////////////////////////////////////////+++++Apply a speckle filter+++++////////////////////////////////////
37 var SMOOTHING_RADIUS = 30;
38 var sep_14_filt = sep_14.focal_mean(SMOOTHING_RADIUS, 'circle', 'meters');
39 var sep_26_filt = sep_26.focal_mean(SMOOTHING_RADIUS, 'circle', 'meters');
40 var dec_19_filt = dec_19.focal_mean(SMOOTHING_RADIUS, 'circle', 'meters');
41
```

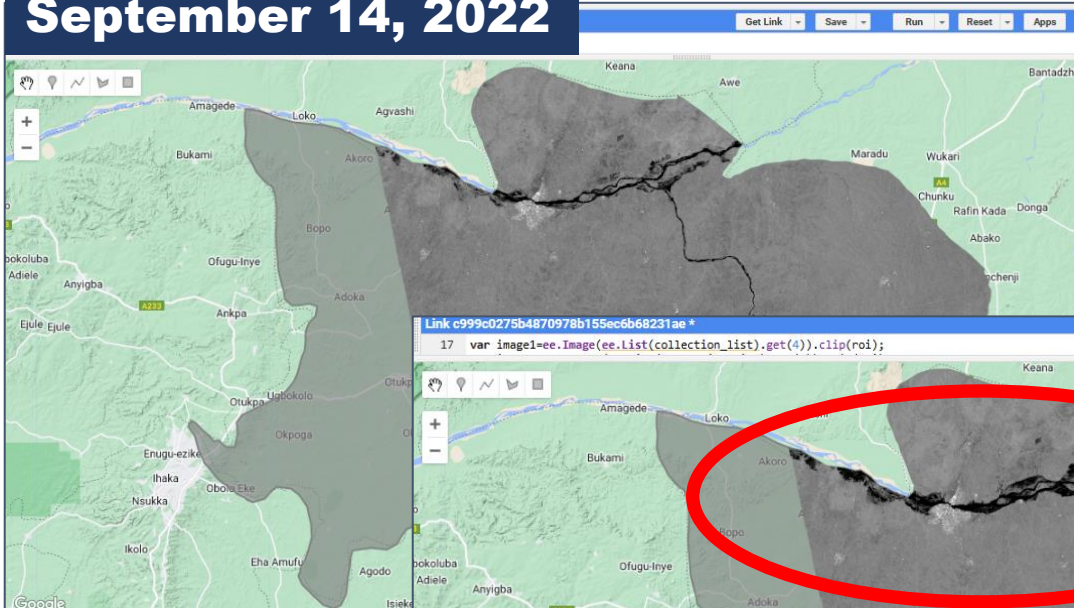
Inspector Console Tasks

Use print(...) to write to this console.

- ImageCollection COPERNICUS/S1_GRD (36 elements) JSON
 - type: ImageCollection
 - id: COPERNICUS/S1_GRD
 - version: 1687940684963146
 - bands: []
 - features: List (36 elements)
 - 0: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20220902T173729_20220902T...
 - 1: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20220902T173754_20220902T...
 - 2: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20220907T174542_20220907T...
 - 3: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20220907T174607_20220907T...
 - 4: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20220914T173729_20220914T...
 - 5: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20220914T173754_20220914T...
 - 6: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20220919T174541_20220919T...
 - 7: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20220919T174606_20220919T...
 - 8: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20220926T173729_20220926T...
 - 9: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20220926T173754_20220926T...
 - 10: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221008T173729_20221008...
 - 11: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221008T173754_20221008...
 - 12: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221013T174542_20221013...
 - 13: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221013T174607_20221013...
 - 14: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221025T174542_20221025...
 - 15: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221025T174607_20221025...
 - 16: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221101T173729_20221101...
 - 17: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221101T173754_20221101...
 - 18: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221106T174542_20221106...
 - 19: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221106T174607_20221106...
 - 20: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221113T173729_20221113...
 - 21: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221113T173754_20221113...
 - 22: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221118T174542_20221118...
 - 23: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221118T174607_20221118...
 - 24: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221125T173729_20221125...
 - 25: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221125T173754_20221125...
 - 26: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221130T174541_20221130...
 - 27: Image COPERNICUS/S1_GRD/S1A_IW_GRDH_1SDV_20221130T174606_20221130...
 - 28: Image COPERNICUS/S1 GRD/S1A IW GRDH 1SDV 20221207T173728 20221207...

Results

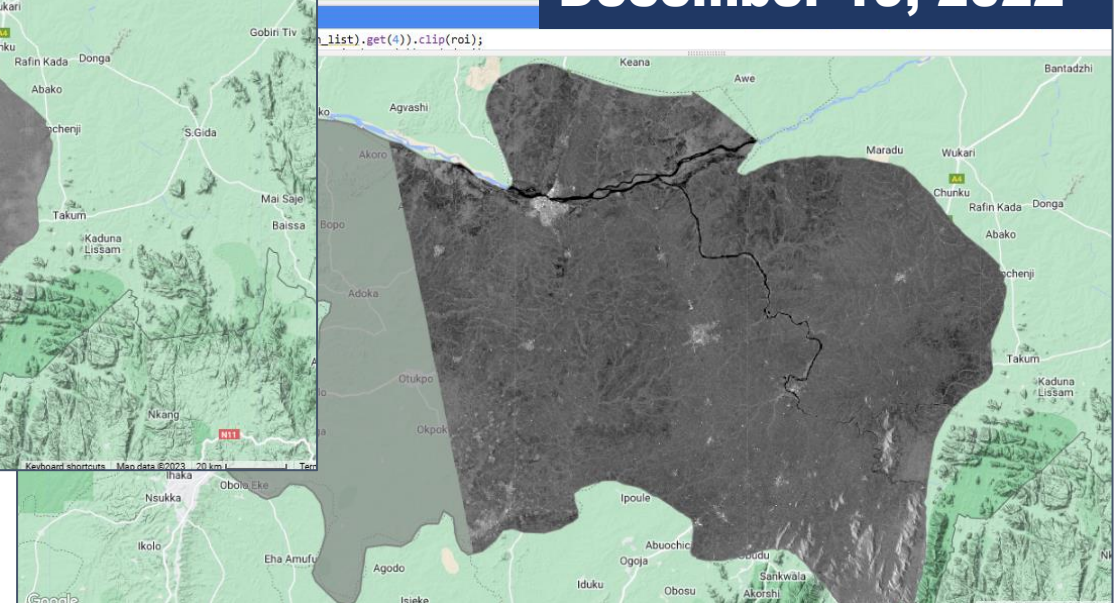
**Pre-Flood
September 14, 2022**



**Flood
September 26, 2022**



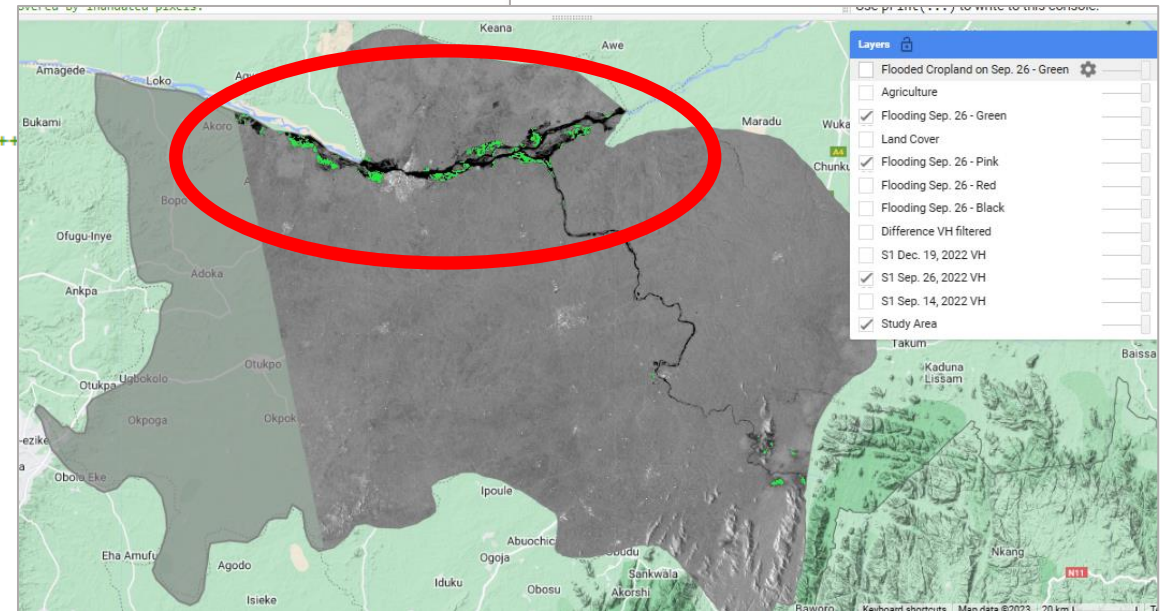
**Post Flood
December 19, 2022**



Results

Training on using the Google Earth Engine to modify codes to prepare flood maps

```
Link c999c0275b4870978b155ec6b68231ae *
42 //////////////////////////////////////////////////+Create difference images from before and after the event+////////////////////////////////////
43 //NOTE: In order to subtract logarithmic values (dB) - you must perform a division
44 var sep14_sep26_diff= sep_26_filt.select('VH').divide(sep_14_filt.select('VH'));
45 Map.addLayer(sep14_sep26_diff, {min: 0,max:2}, 'Difference VH filtered', 0);
46
47 //////////////////////////////////////////////////+Apply a threshold - based on the difference image values +////////////////////////////////////
48 var UPPER_THRESHOLD = 1.25;
49 var inundation_sep14_sep26 = sep14_sep26_diff.gt(UPPER_THRESHOLD)
50 Map.addLayer(inundation_sep14_sep26.updateMask(inundation_sep14_sep26),
51 {palette:"070908"},'Flooding Sep. 26 - Black',0);
52
53 //////////////////////////////////////////////////+Refine the flood map results with additional datasets+////////////////////////////////////
54 // Calculate pixel connectivity and remove those connected by
55 //8 pixels or less.
56 var connections = inundation_sep14_sep26.connectedPixelCount();
57 var inundation2_sep14_sep26 = inundation_sep14_sep26.updateMask(connections.gte(8));
58
59 Map.addLayer(inundation2_sep14_sep26.updateMask(inundation2_sep14_sep26),
60 {palette:"ee360c"},'Flooding Sep. 26 - Red',0);
61
62 // Remove misclassified pixels in areas where the slope is greater than
63 //5% using an SRTM DEM
64 var srtm = ee.Image('USGS/SRTMGL1_003');
65 var terrain = ee.Algorithms.Terrain(srtm);
66 var slope = terrain.select('slope');
67 var inundation3_sep14_sep26 = inundation2_sep14_sep26.updateMask(slope.lt(5));
68 Map.addLayer(inundation3_sep14_sep26.updateMask(inundation3_sep14_sep26),
69 {palette:"ec11d1"},'Flooding Sep. 26 - Pink',0);
70
71 // Remove misclassified pixels in areas where there is permanent open water using
72 // the Copernicus Global Land Service (CGLS) land cover map (100m)
73 var global_landcover = ee.Image("COPERNICUS/Landcover/100m/Proba-V-C3/Global/2019").select('discrete_classification');
74 var landcover_roi = global_landcover.clip(roi);
75 Map.addLayer(landcover_roi, {}, "Land Cover", 0);
76
77 // Extract only water pixels from CGLS using class value equal to 80 or 200
78 //var water = landcover_roi.eq(80,200);
79 var water = landcover_roi.eq(80).or(landcover_roi.eq(200));
80 var watermask = inundation3_sep14_sep26.where(water,0);
81 var inundation4_sep14_sep26 = watermask.updateMask(watermask);
```



Results



The screenshot displays the Google Earth Engine interface. On the left, a code editor shows JavaScript code for calculating inundated cropland. On the right, the console shows the output of the code, with a red circle highlighting the results.

```
Link c999c0275b4870978b155ec6b68231ae *
95   bestEffort: false
96   });
97
98   // Convert inundated extent to hectares
99   var inundation_area_ha_sep26 = inundation_stats_sep26.getNumber("VH").divide(10000).round();
100  print(inundation_area_ha_sep26, 'Hectares of Inundated Area for Sep. 26');
101
102  //////////////////////////////////////////////////+++++++Calculate Flooded Cropland+++++++////////////////////////////////////
103  // Use the Copernicus Global Land Service (CGLS) land cover (100m) map to identify cropland
104  // Extract only cropland pixels from the CGLS. The cropland class value is equal to 40
105  var crop = landcover_roi.eq(40);
106  var cropmask = landcover_roi.updateMask(crop);
107
108  // Calculate the affected cropland using the flood layer from Sep. 26
109  var cropland_affected_sep26 = inundation4_sep14_sep26.updateMask(cropmask);
110  // Calculate the pixel area where there are crops and it is flooded
111  var crop_pixelarea = cropland_affected_sep26.multiply(ee.Image.pixelArea());
112  // Sum pixels of affected cropland layer
113  var crop_stats = crop_pixelarea.reduceRegion({
114    reducer: ee.Reducer.sum(), //sum all pixels with area information
115    geometry: roi,
116    scale: 10,
117    maxPixels: 1e9
118  });
119  // Convert area to hectares
120  var crop_area_ha_sep26 = crop_stats.getNumber("VH").divide(10000).round();
121  // Print results
122  print (crop_area_ha_sep26, 'Hectares of Inundated Cropland on Sep. 26');
123
124  // Add crop layer to map
125  Map.addLayer(cropmask, {}, 'Agriculture', 0);
126
127  // Add flooded crop area to map
128  Map.addLayer(cropland_affected_sep26, {palette:"22ec3b"}, 'Flooded Cropland on Sep. 26 - Green', 0);
129
130
131
132
133
134
```

Inspector Console Tasks

Use print(...) to write to this console.

- ImageCollection COPERNICUS/S1_GRD (36 elements)
 - type: ImageCollection
 - id: COPERNICUS/S1_GRD
 - version: 1687940684963146
 - bands: []
 - features: List (36 elements)
- Sentinel-1 Collection
 - 24725
Hectares of Inundated Area for Sep. 26
 - 8558
Hectares of Inundated Cropland on Sep. 26

Training on using the Google Earth Engine to modify codes to estimate Inundated Cropland

Summary of Results

The study observed that:

- The monthly series analysis of ground measured rainfall data from 2012 to 2022 revealed an inconsistent rainfall pattern.
- The maximum annual rainfall occurred in 2019, even though the worst flood incident was recorded in 2022. Furthermore, although the greatest amount of rainfall in 2022 was recorded by NiMET in August, the flood incident was most pronounced in September. Thus indicating that the flood occurrence is not due only to rainfall. The release of water from the Lagdo Dam in neighbouring Cameroon is also a major cause of flood in Benue State.
- The flood maps prepared with the Google Earth Engine revealed that most of the flooded areas were located along the river line.
- About 35% of the flooded area in Benue State in 2022 was crop land.



Virtual Presentation by She Space Nigeria, during the Final Call for She Space International



Spatio-temporal analysis of the impact of 2022 flood incident on the “Food Basket State” of Nigeria

Presentation by

She Space Nigeria



Participants: Dominion ABULELE; Eniola ADEBAYO; Abigail AKINPELUMI; Sylvia ANIH; Testimony AYANYEMI; Bethiel BUBA; Goshen EBEIYAMB

Staff: Adenike AKINPELUMI



5:38 / 2:00:50



Phase One

Skills Acquisition (Software)

Microsoft Excel

- Analyze NiMeT rainfall data

ArcGIS (ArcMap)

- Prepare Map of Study Area

Google Earth Engine

- Create Flood Maps using Synthetic Aperture Radar (SAR) data from the Sentinel-1
- Estimate how much crop is destroyed



SHE SPACE INTERNATIONAL

In memory of Devorah Blumberg

NIGERIA TEAM

Participants: Dominion ABULELE; Eniola ADEBAYO; Abigail AKINPELUMI; Sylvia ANIH; Testimony AYANYEMI; Bethiel BUBA; and Goshen EBEIYAMBA

Staff: Adenike AKINPELUMI



African Regional Centre for Space Science and Technology Education in English
 Omowumi Alabi, PhD
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Spatio-Temporal Analysis of the Impact of Flood on the “Food Basket State” of Nigeria

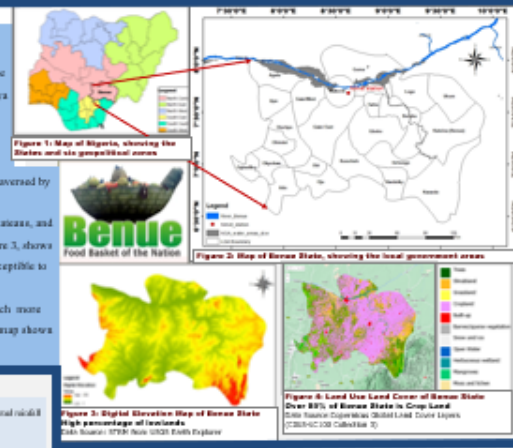
Introduction

Flood is recognized as a global natural disaster which is prominent in densely populated areas, located within the tropical regions. Nigeria, the most populous nation in Africa, and the 7th most populous country in the world, with an estimated population of over 200 million people, is located in the tropical region and experiences annual flood events. While Nigeria typically experiences seasonal flooding, the floods of 2022 were the worst in the country since the flood incidents recorded in 2012. The flooding has been blamed on unusually heavy rains and climate change as well as the release of water from the Lagdo Dam in neighboring Cameroon. The 2022 floods in Nigeria affected most of the country, displacing over 1.4 million people, killing over 600, and injuring more than 2,400. Over 200,000 homes were completely or partially destroyed by the floods, and vast farmlands were ruined.

The aim of this project is to analyze the impact of the 2022 flood incident on the crop land in Benue State, Nigeria. The specific objectives are to analyze the ground measured rainfall data from 2012 to 2022; prepare flood maps with satellite derived data, using the cloud computing facility of the Google Earth Engine; and estimate how much crop land was destroyed by the flood.

The Study Area

- The study area, Benue State, Nigeria, is known as the “Food Basket of the Nation” because of the rich agricultural produce which include yam, rice, beans, cassava, potatoes, maize, soyya beans, sorghum, millet and cocoyams.
- Benue State, shown in figure 1, is in the North Central geopolitical zone of Nigeria.
- Benue State is made up of 23 local government areas, and traversed by the Benue River in the northern part, as shown in figure 2.
- The study area has diverse landscapes including lowlands, plateaus, and floodplains. The digital elevation map of Benue State in figure 3, shows a high percentage of lowlands, making the region highly susceptible to floods.
- Benue State covers approximately 3,145,700 hectares of which more than 85% is crop land as depicted in the land use/land cover map shown in figure 4.



Methods

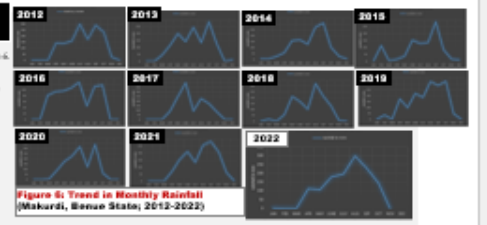
The data used for the study included in-situ and satellite derived data. The in-situ ground rainfall data, from 2012 to 2022, for Makurdi, Benue State, was obtained from the Nigeria Meteorological Agency (NiMeT). The location of the NiMeT station where the rainfall data was recorded is shown in figure 5. The ground measured rainfall data was analyzed with Microsoft Excel Spreadsheet to obtain the monthly and annual rainfall trends shown in figure 6. Synthetic Aperture Radar (SAR) data, from the Sentinel-1 satellites, and other satellite derived data, including the Shuttle Radar Topography Mission (SRTM30) (Figure 3) and Copernicus Global Land Cover Layers (Figure 4), were processed through the Google Earth Engine (GEE) by using a GEE code for Time Series Flood Mapping: <https://code.earthengine.google.com/1816443330740400184717100>. This code was modified to prepare the map of the flood incidents (Figure 9) and estimate the magnitude of the crop land destroyed by the flood (Figure 10).



Results

1. Trend in Rainfall

The trend in the rainfall varied across different months and years as shown in figure 6. During the study period, a distinct seasonal pattern is observed in figure 7. The averaged rainfall recorded for the months of April to October were consistently higher compared to the other months, indicating a wet season during this period. January, February, November, and December consistently had lower rainfall values, suggesting a relatively drier season in those months. Figure 8 revealed that the annual maximum rainfall was observed in 2019, while the least occurred in 2014.



2. Flood Maps

The flood maps, shown in figure 9, revealed that the peak of the flood observed on the satellite imagery occurred on September 26, 2022.

3. Flood Extent

The flood inundation map, shown in figure 10, revealed that most of the flooded areas were located along the river line. The total inundated area was estimated to be 24725 hectares, of which 85% hectares was cropland.

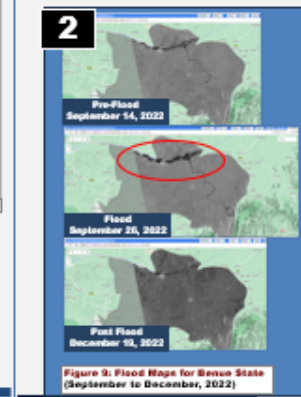


Figure 7: Averaged Monthly Rainfall (Makurdi, Benue State; 2012-2022)

Figure 8: Annual Rainfall (Makurdi, Benue State; 2012-2022)



Conclusions

- The study concluded that:
- Monthly series analysis of ground measured rainfall data from 2012 to 2022 revealed that the rainfall pattern was inconsistent. This trend in variation may be attributed to climate change.
 - The maximum amount of rainfall occurred in 2019, even though the worst flood incident was recorded in 2022, indicating that the flood occurrence was not due only to rainfall. The release of water from the Lagdo Dam in neighboring Cameroon is also a major cause of flood in Benue State.
 - The flood maps prepared with the Google Earth Engine revealed that most of the flooded areas were located along the river line, and about 85% of the flooded area in Benue State in 2022 was cropland.

This is an ongoing ongoing study for the Nigeria She Space Team, made up of pre-teen girls, aged 8 to 12 years. In the next phase, the girls will explore the impact of the flood on the NiMeT.

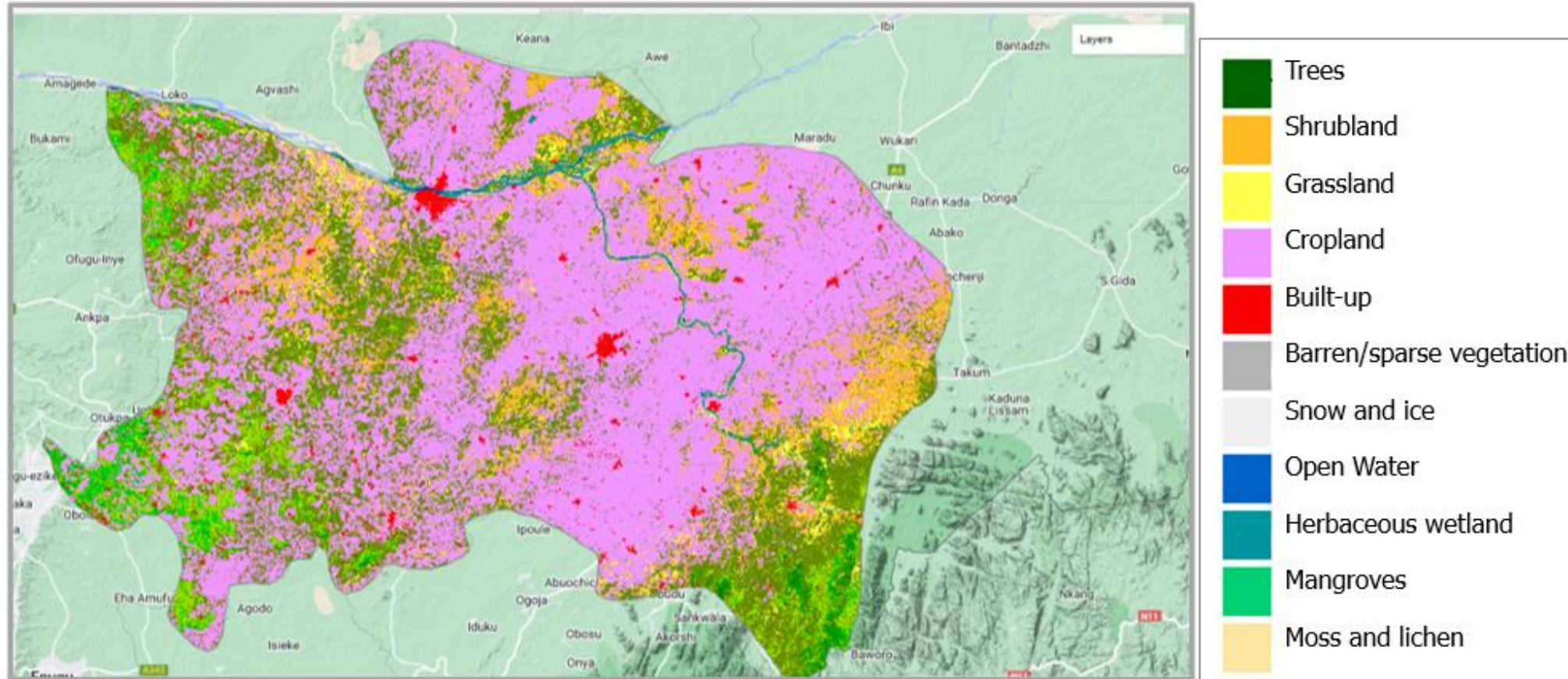
Phase Two

Use Satellite data to monitor impact of flood on Cropland: **NDVI Analysis**

Google Earth Engine

Land Use Land Cover of the Benue State, Nigeria

Data Source: Copernicus Global Land Cover Layers (CGLS-LC100 Collection 3)



Practical Session:

Monitor Plant Growth

- Transplant the Yellow Pepper Plants (8 weeks old) at home.
- Take care of the plants and collect data to monitor the growth.
- The plant will produce the yellow pepper that mummy will use to prepare fried rice during Christmas!
- **Collecting data to observe the different phases of growth in this ground monitoring practical session will help the girls to understand how satellite-derived data can be used to monitor plant growth and the impact of flood on cropland**



Encouraging the Girls to learn STEM in a fun-filled environment



My Personal Experience



Celebrating the Girls



- She Space Nigeria Team
- Space for Women Mentee
- Space for Women Mentor

MY PERSONAL EXPERIENCE

My name is Eniola Adebayo. I am ten (10) years old and I am the representative for the North Central Nigeria. I am from Kogi state but I currently live in Calabar with my family. I attend Kids N' Us School. I am in Primary six (6).

I made new friends and I enjoyed my stay in life. I also love my mentors for teaching and encouraging my friends and me to work hard in order to succeed and I have learnt a lot from both of them. They have inspired me! I joined She Space International because I want to learn how to use remote sensing, satellite data and how to collect data to analyze a problem.

In the course of the training, I learnt how to use ArcMap and Google Earth Engine to create maps, show features and legends, collect data and code on Google Earth Engine. This afforded me the opportunity to apply my knowledge of coding. The classes were very interesting and I really enjoyed break times because we always had something delicious to eat like; small chops, chicken, egg rolls, juice, biscuits, fries and ketchup.

Moreover, we had an in-house presentation where we rehearsed for the international presentation. Parents were present for the in-house presentation. After listening to us, they told us what we had to improve on and gave us thumbs up for the things we were very good at. At the International presentation, the Nigerian team was the youngest team and after we finished our presentation, the hosts and other teams were shocked that girls our age could do such things. We were really commended on our hard work.

The last day of the training was a fun day! We walked to the zoo, where we saw different animals like; lions, ostriches, crocodiles, sea turtles, snakes, a hyena and a crowned crane. It was a wonderful experience. On that same day, we surprised our mentor with a small birthday party. She was very happy.

In conclusion, my experience during the She Space program is great.

Conclusion: Viable Methods of promoting gender equality in the space sector

- “The Catch them Young approach”
 - Outreach programs to schools to identify brilliant girls, mentor the girls through a multi-disciplinary, project-based learning program. This could be an academic research, using satellite derived and other types of remotely sensed data, to address local environmental issues
- Mentorship Programs originating at the local level to feed into national and international mentorship programs. For example, She Space Nigeria, to She Space International and Space4Women Mentorship Program of UNOOSA
- Competitive Grants to support Mentors and Advocates with viable projects to promote gender equality in the space sector