COUNTRY PROFILE OF NIGERIA ON AGRICULTURE DEVELOPMENT AND CROP MONITORING FOR FOOD SECURITY

BY

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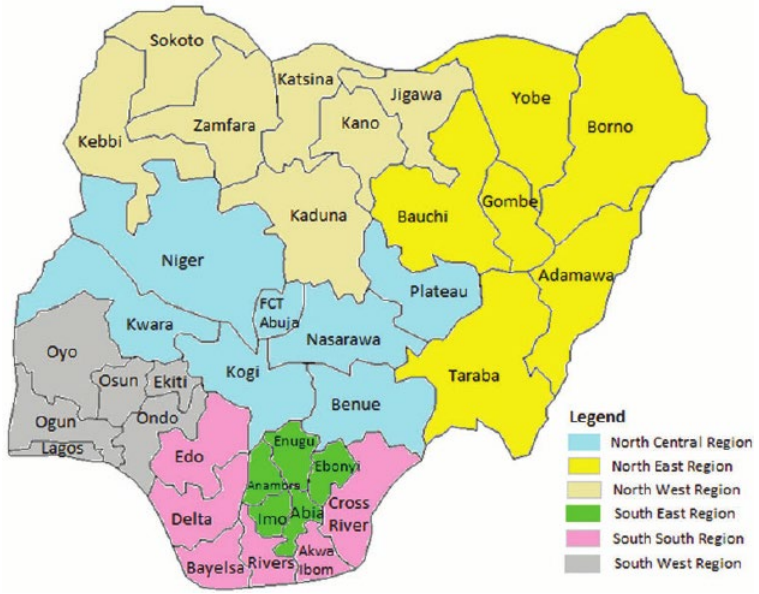
Presentation Outline

- Introduce the agriculture development in Nigeria,
- The basic information for agriculture,
- Crop phenology for main crops,
- Existed agricultural projects related to remote sensing,
- Requirements and expectation.

INTRODUCTION

- Food Security is a priority for every Nation.
- The importance of agriculture has received renewed impetus by the Nigerian administration as the government seeks to diversify the Nigerian economy.
- As such, sustainable approaches towards effective monitoring of agricultural produce to optimise yield have become imperative.
- Technologies and innovations are critical for boosting farm productivity.
- Remote sensing technologies have been identified as a reliable proxy for providing accurate and up-to-date information on crop yield and phenology for farmers, agronomists, and research.



PROFILE OF NIGERIA

Nigeria is located in the tropical zone of West Africa and has a total area of

- **923 770 km²** (FAO, 2016).
- latitude **4⁰N** and **14⁰N** of the equator and longitude **3⁰E** and **15⁰E** of the Greenwich meridian.
- Bordered to
- the west by **Benin**
- the northern by **Niger**,
- the northeast by **Chad**
- the east by **Cameroon**,
- The by southern is **Atlantic Ocean**
- Nigeria has **36 States and FCT-Abuja.**
- **Population: over 200 million people.**
- **Total agricultural land = almost 71 million ha, (77 % of the total area of the country)**
- **Water Bodies = 1.3 million ha**
- **Irrigated Land = 3.14 million ha**
- **Coastal Line = 800km**

NIGERIA AGRICULTURAL POLICIES

The EGRP and Agriculture

- The Federal Government of Nigeria (FGN) has made agriculture one of the major pillars of its strategic vision for growth and development through the Next level policy.
- The Next Level policy is operated through the Economic Growth and Recovery Plan (EGRP).

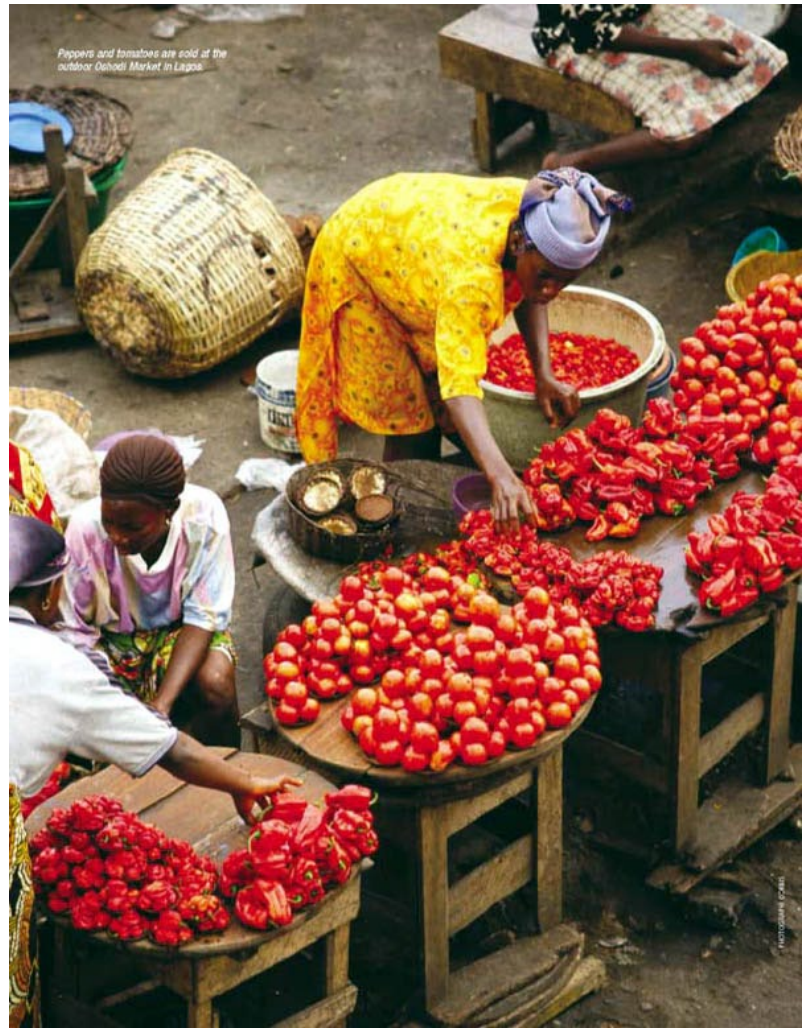
The government's long-term interest to promote agricultural growth has been exemplified in different long term and medium-term plans implemented in the country. For instance,

- The National Accelerated Food Production Programme
- Green Revolution
- Nigerian Vision 20: 2020
- Agricultural Transformation Agenda,
- Agricultural Promotion Policy etc.

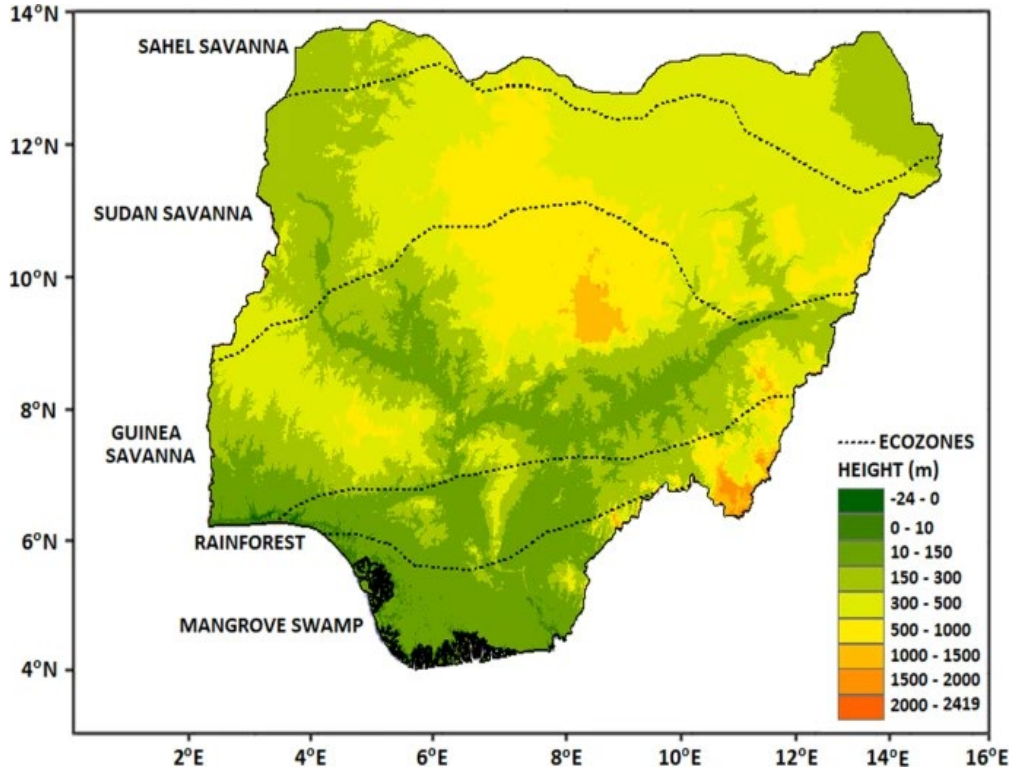
The New President of Federal Government of Nigeria declared State of Emergency on food insecurity.

Under food security program of Nigeria:

- 200,000 metric tons of grains from the national reserve to be released
- 225,000 MT of fertilizers and seedlings to go to farmers
- N50bn to cultivate rice
- N50bn to cultivate casava and wheat



Basic Information for Agriculture



Between January and March 2021, the agriculture contributed to **22.35%** of the total Gross Domestic Product (GDP). Over **70%** of Nigerians engage in the agriculture sector mainly at a subsistence level. (https://www.fao.org/nigeria/fao-in-nigeria/nigeria-at-a-glance/en/)

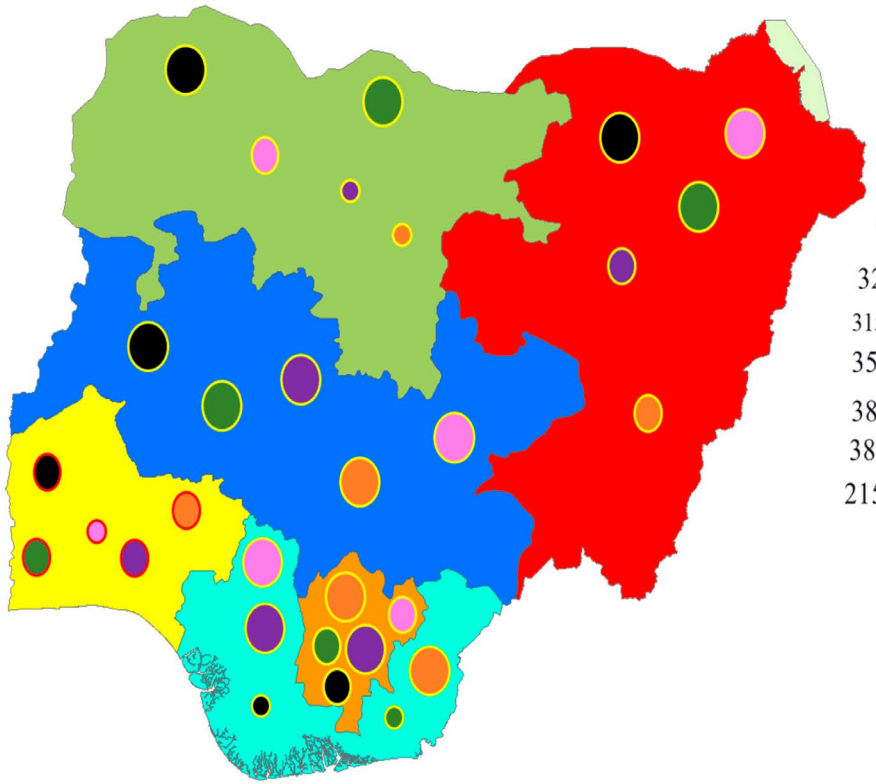
Nigeria's agricultural sector faces many challenges which impact on its productivity. These include; **poor land tenure system, low level of irrigation farming, climate change and land degradation. Others are low technology, high production cost and poor distribution of inputs, limited financing, high post-harvest losses and poor access to markets, storage facilities and road networks.**

These challenges have stifled agricultural productivity affecting the sector's contribution to the country's GDP as well as increased food imports due to population rise hence declining levels of food sufficiency.

- Land cover ranges from thick mangrove and dense rain forests in the south to a near-desert condition in the northeastern corner of the country.
- Nigeria ecological zones are: the northern Sudan Savannah, the Guinea Savannah zone or Middle Belt, and the southern rainforest zone, mountainous zone is found at the border with Cameroon and the plateau zone in the center of the country.

Agriculture and Food Security

Nigeria has 70.8 million hectares of agriculture land area with maize, cassava, guinea corn, yam beans, millet and rice being the major crops.



Aggregated food per capita consumption quantity

321.80 kg /capita/year	North Central
315.20 kg /capita /year	North West
357.12 kg /capita/year	North East
381.06 kg/capita/year	South East
383.47kg/capita/year	South South
215.49 kg /capita/year	South West

Per capita consumption index

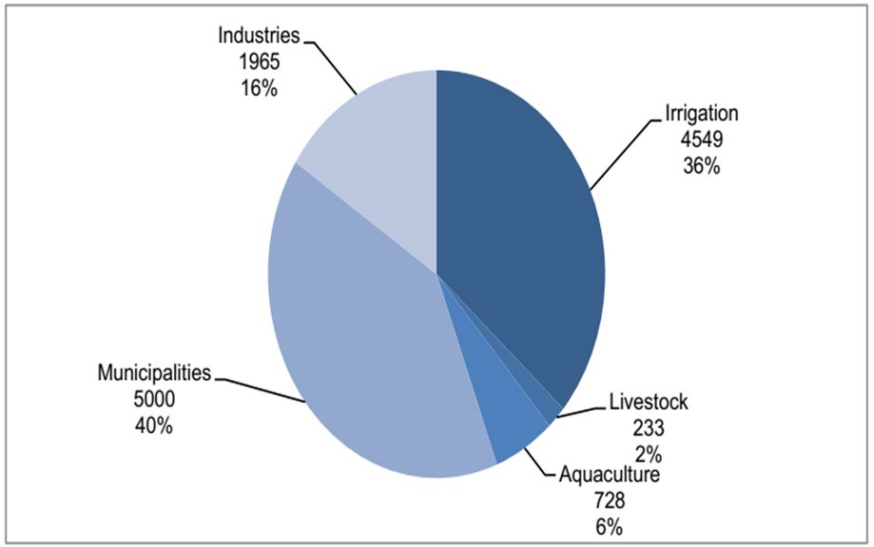
- Rice
- Maize
- Cassava
- Yam
- Cowpea

High corresponding with colors

Medium corresponding with colors

Low corresponding with colors

Water withdrawal by sector (Total 12 475million m^3 in 2010) (FAO/AQUASTAT, 2016)



Water Resources and Uses

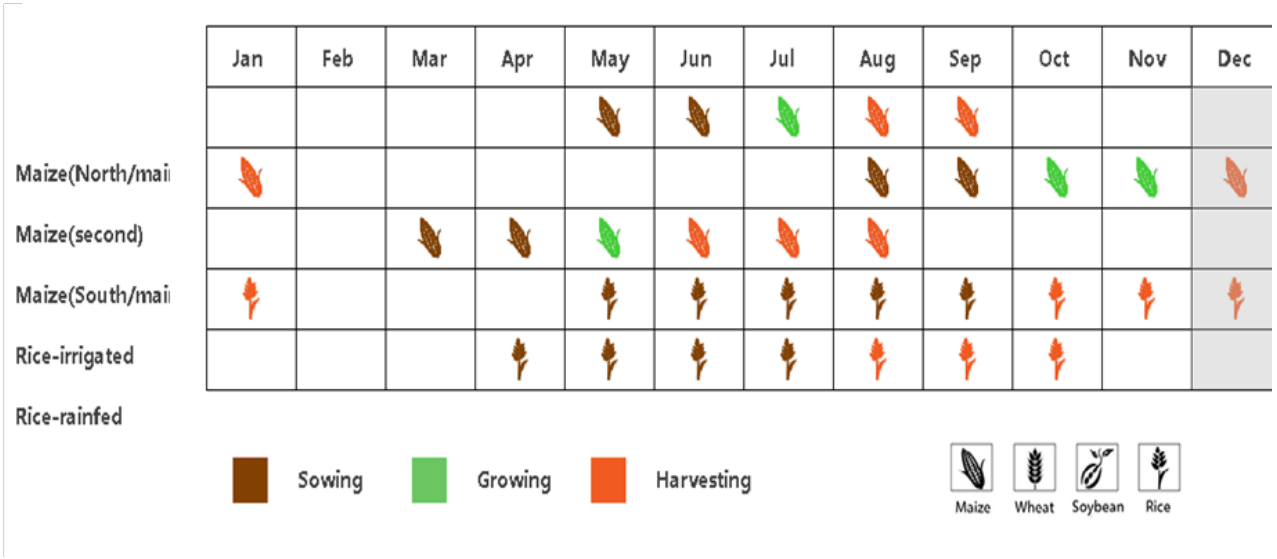
Nigeria Crop Phenology for Main Crops

Crops produced in Nigeria

There are varieties of crops produced in Nigeria, and these crops are produced by the Nigerian farmers on the bi-yearly basis in part of the country as a result of the favourable climate in some part of the country, while others produced on yearly basis.

Some of these crops include: Cocoa, cocoa yam, cassava, yam, maize, beans, millet, sorghum, onions, rice, potatoes, carrot, and pear among others.

The cropping calendar (Phenology) served as a proxy for generating RS spectral-temporal metrics (STMs) to map land cover and crop types as well as plan a fieldtrip.



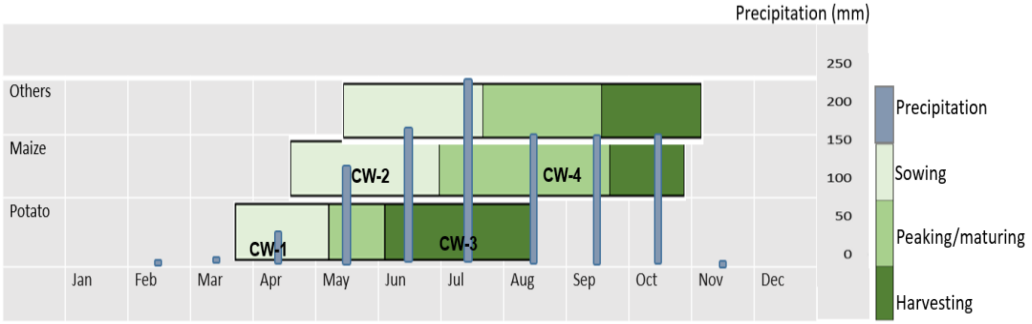


Figure 3. Cropping calendar showing critical windows (CW) and the 2019 mean monthly precipitation on the Jos Plateau (precipitation data accessed from http://www.worldweatheronline.com/ (accessed on 10 November 2020)).

THE NIGERIAN SPACE PROGRAMME

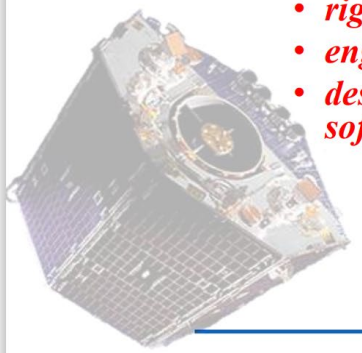
National Space Research and Development Agency:

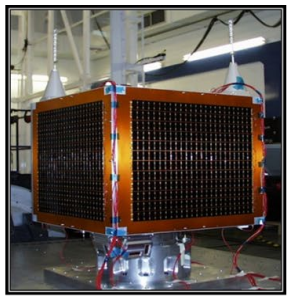
- NASRDA was established in 1999 with the clear mandate to:

"vigorously pursue the attainment of space capabilities as an essential tool for the socio-economic development and the enhancement of the quality of life of Nigerians".

- NASRDA is to achieve this mandate through:

  - *research ,*
  - *rigorous education,*
  - *engineering development,*
  - *design and manufacture of appropriate hardware and software in space technology.*



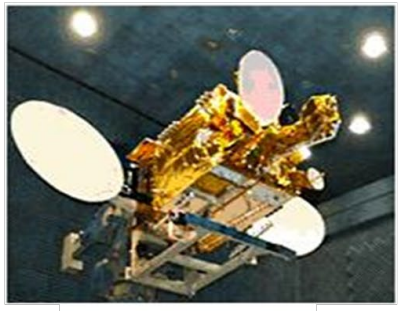


Nigeriasat-1 (2003)

NigComSat (2007)

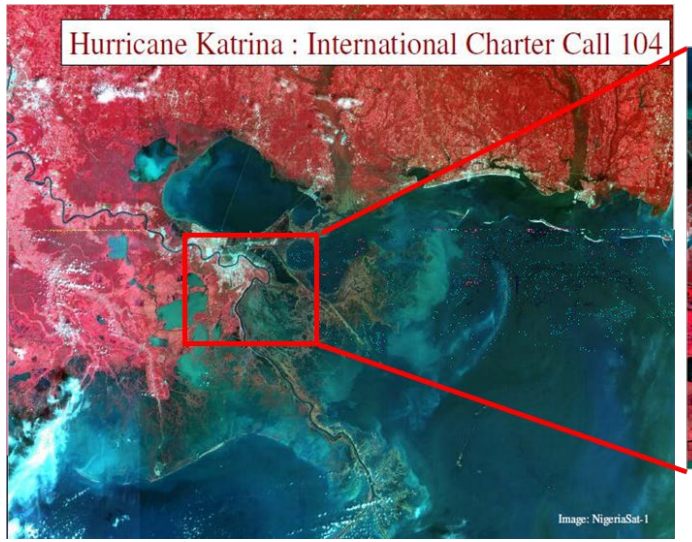
Nigeriasat-2 (2011)

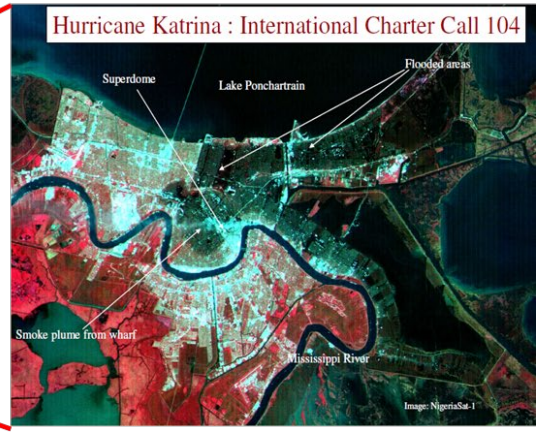
NigeriaSAT-X (2011)



NIGCOMSAT -1R (2011)

Nigeria EduSat-1 (2017)

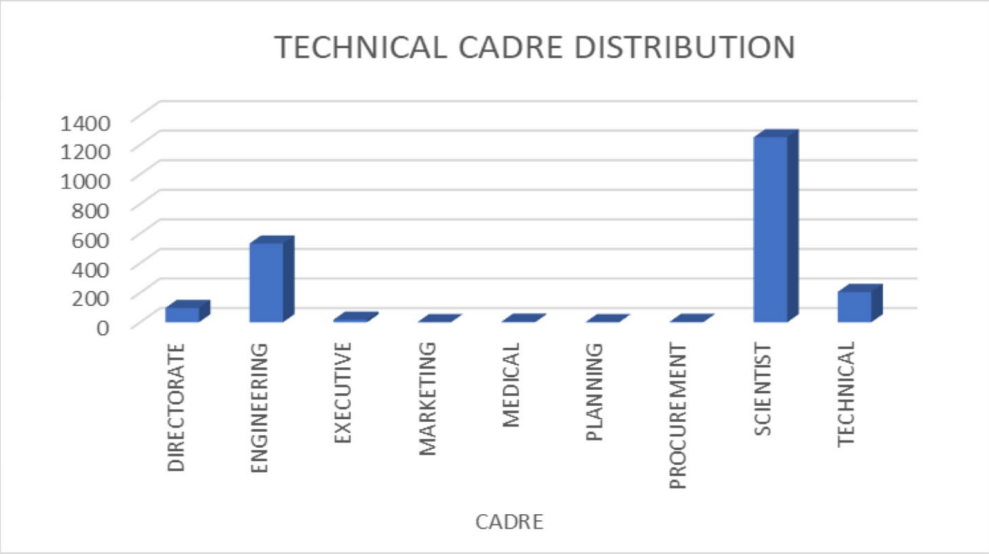


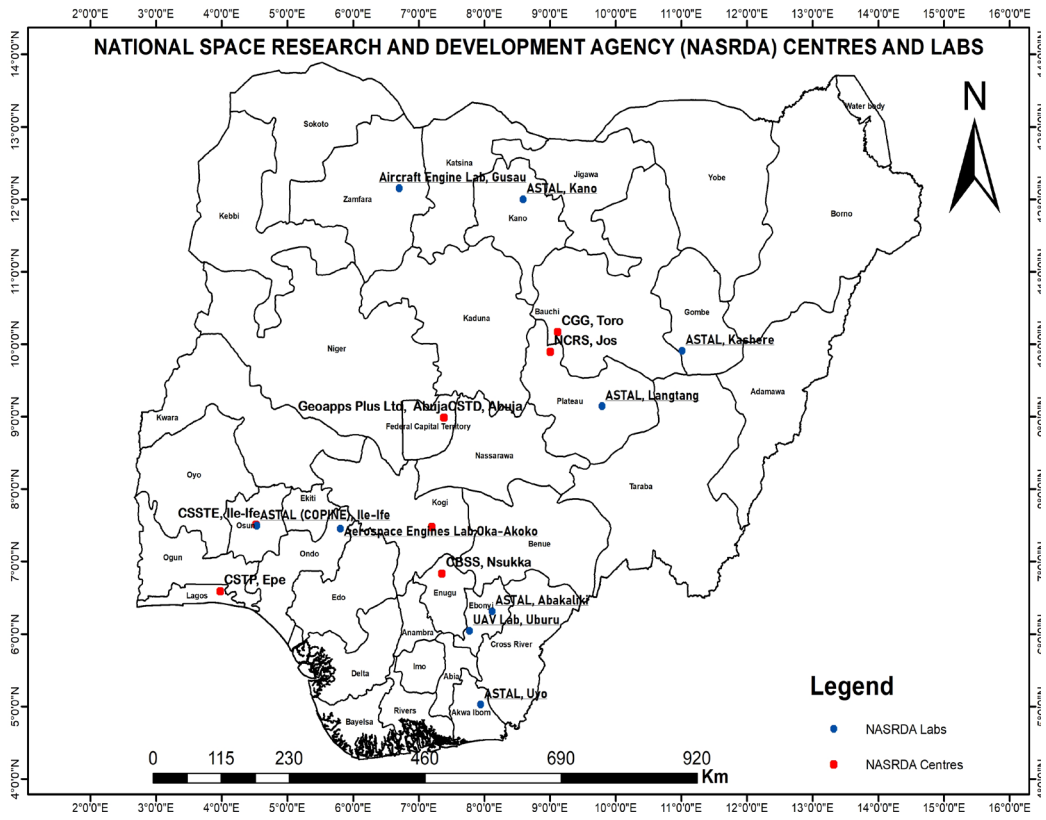


NASRDA AND ITS OPERATIONAL CENTRES/LABs

NASRDA has Staff strength of over 5000 workers: with almost 3000 Technical Expertise (Engineering, Sciences, Social Sciences etc).

Strategic Space Applications (SSA) department is located at NASRDA headquarter saddled with the responsibility of using Space derived data as a powerful planning tool to support Government Sustainable Programmes in environment, land use planning, agriculture, urban planning, water resources mapping, monitoring and management etc.





EXISTING NASRDA AGRICULTURAL PROJECTS

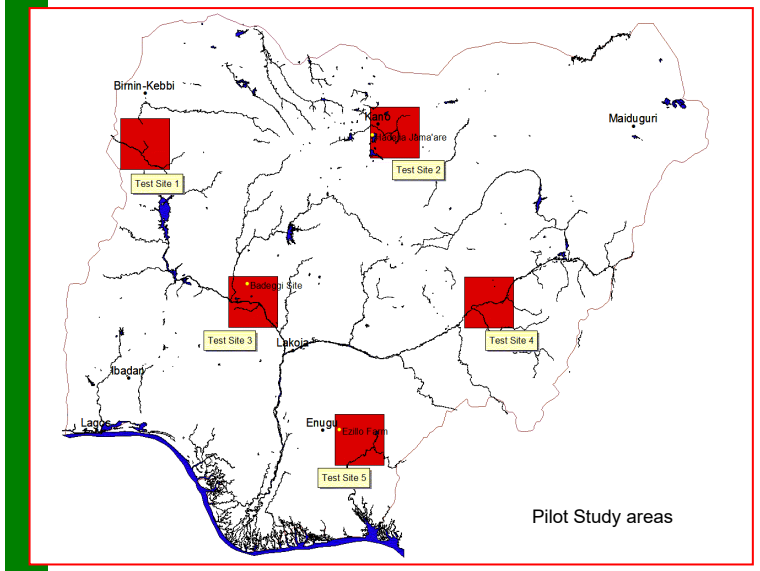
- NASRDA is a hotbed for innovative researchers who over the years have published several notable publications that cut across various fields and departments especially in area of Space Applications and Engineering for sustainable development.

- NASRDA as a Space Technology driven agency is saddle with responsibility of using geospatial technology for monitoring and improve agricultural productivity in line with the Nigeria Government programs for reviving agricultural sector.

EXISTING NASRDA AGRICULTURAL PROJECTS

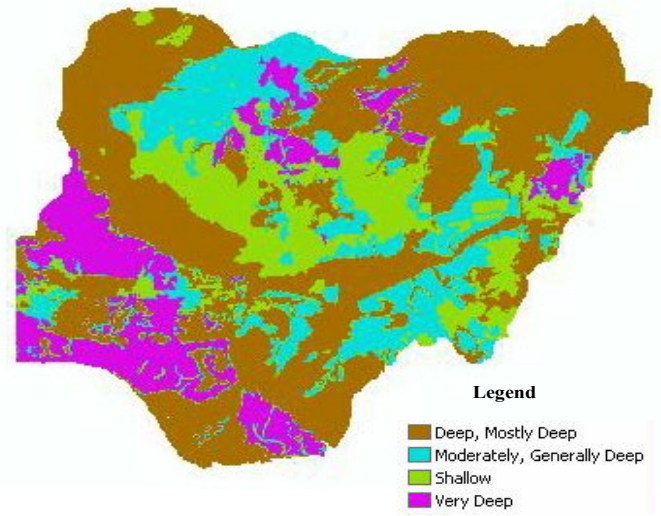
- Development of Early Warning Systems for Food Security in Nigeria Using NigeriaSat-1 and Other Satellite Data in collaboration with the university of Nsukka.
- Development of Models for Cassava Yield Prediction: An Exploratory Remote Sensing Option in conjunction with the International Institute for Tropical Agriculture (IITA), Ibadan.
- Mapping Spatial Distribution And Environmental Implication For Improve Cocoa Production In Nigeria with the Adekunle Ajasin University, Akungba Akoko.
- Cashew Mapping and Land Suitability Analysis in Nasarawa Egon Local Government Area, Nasarawa State.
- Spatiotemporal Analysis of NDVI, Rainfall and Vegetation Cover Response to Changes in Surface Water in Lake Chad Basin
- Vulnerability Assessment and Risk Management of Maize Supply Chain: A comparative analysis of maize production in Nigeria and Rwanda
- Monitoring Land Productivity and Degradation Trend Using Geospatial Technique In Lake Chad Basin (LCB) Under Space-Based Smart Agriculture For Food Security In Nigeria
- Farmland Inventory and Increase Agricultural Yield Using Space-Based Technology In Abuja, Nigeria
- Agricultural Monitoring Protocol using Remote Sensing Technologies
- Mapping of the Grazing Reserves and Stock Routes In Nigeria using Geospatial Technology under Space Based Smart Agriculture for Food Security in Nigeria
- Mapping Staple Crops using GoPro Camera in Northcentral Nigeria
- **Nigeria Cropwatch innovative project for food security under space-based smart agriculture for food security in Nigeria project.**

DEVELOPMENT OF FADAMA LAND INFORMATION MANAGEMENT SYSTEM (FLIMS)

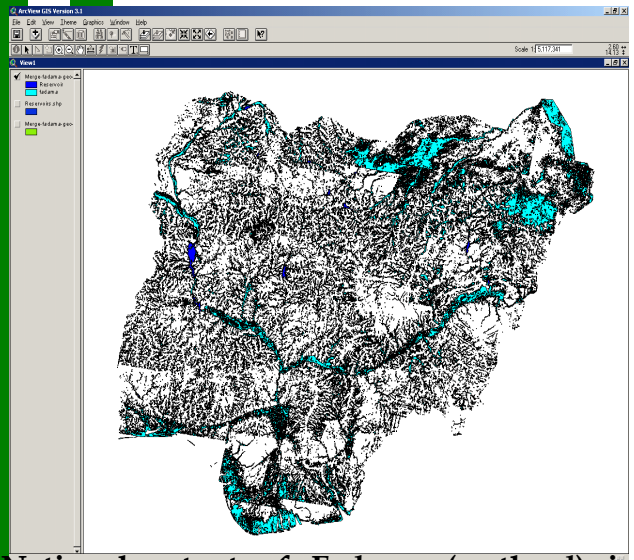


Study area and location of test sites for rice cultivation.

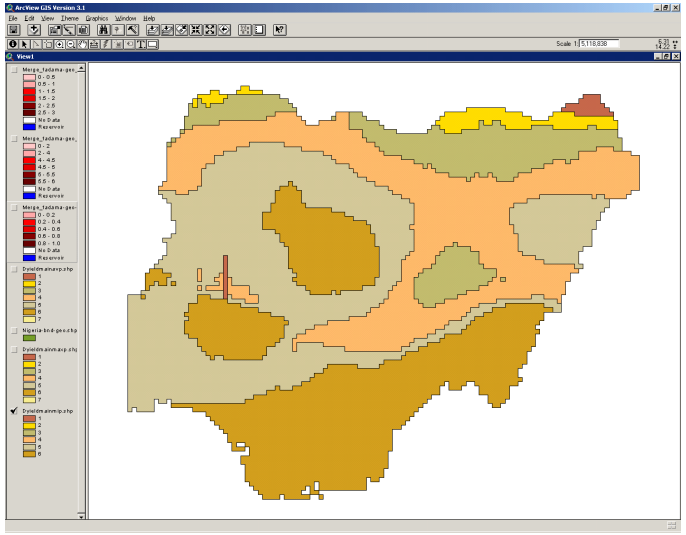
Development of Fadama Land Information Management System (FLIMS): To Boost Rice Production In Nigeria and to assist in the enhancement of fadama (or wetland) based rice cultivation. This project is seen to improve Nigeria's potentials for increased rice cultivation and rice production monitoring.



Soil Depth Classes of Nigeria



National extent of Fadama (wetland) in Nigeria



Min potential yield for Fadama rice

Project has established the use of satellite and climatic data to:

i. Map national extent of Fadama land (wetland) available in Nigeria.

ii. To identify suitable areas for up-land and Fadama rice production in Nigeria.

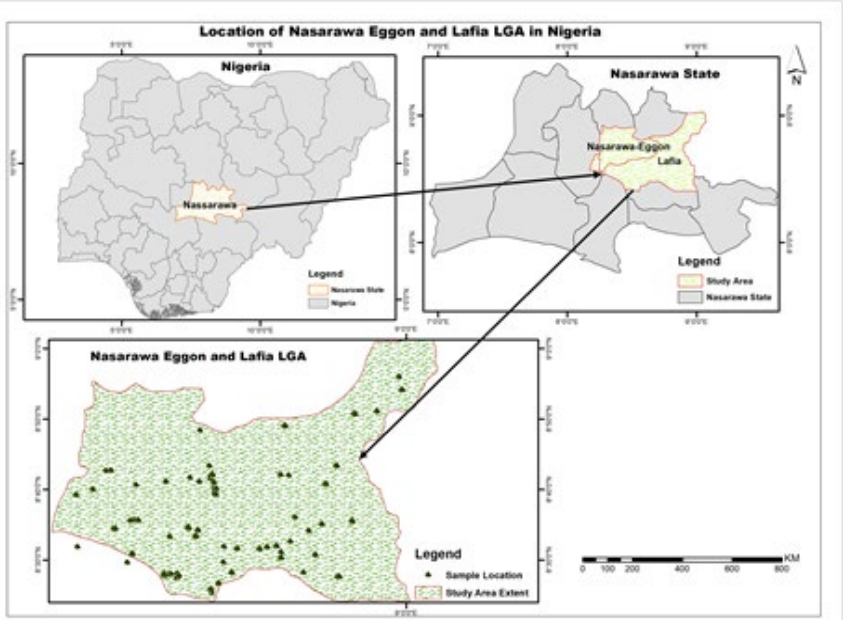
iii. Determine minimum, moderate and maximum potential yield of Fadama and upland rice for strategic national planning.

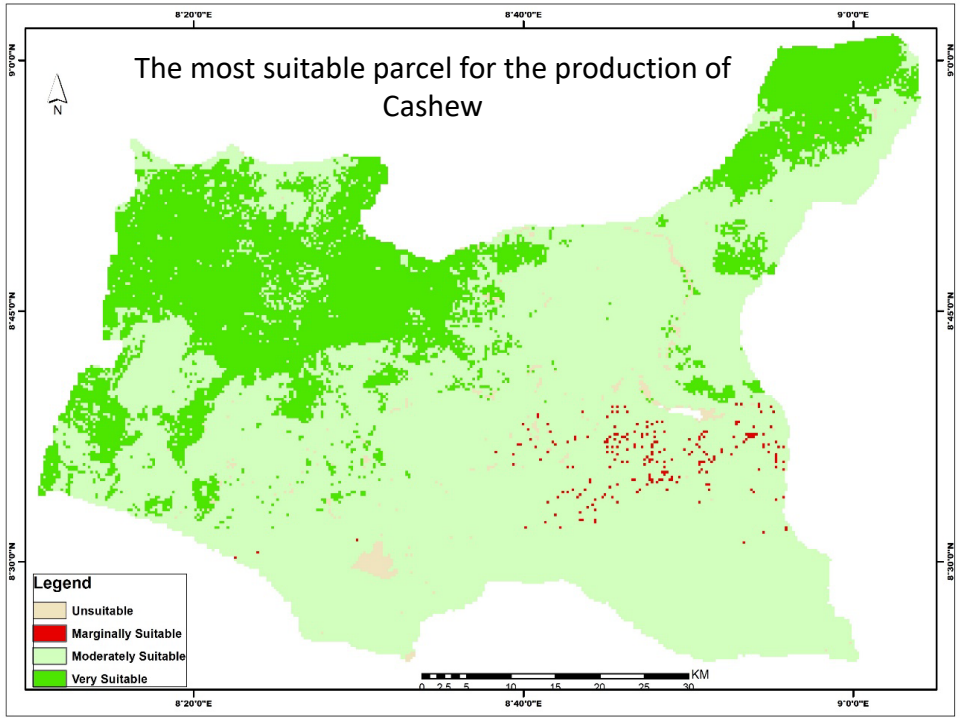
iv. Presently approximately 2M ha of Fadama Land is being cultivated for wetland rice.

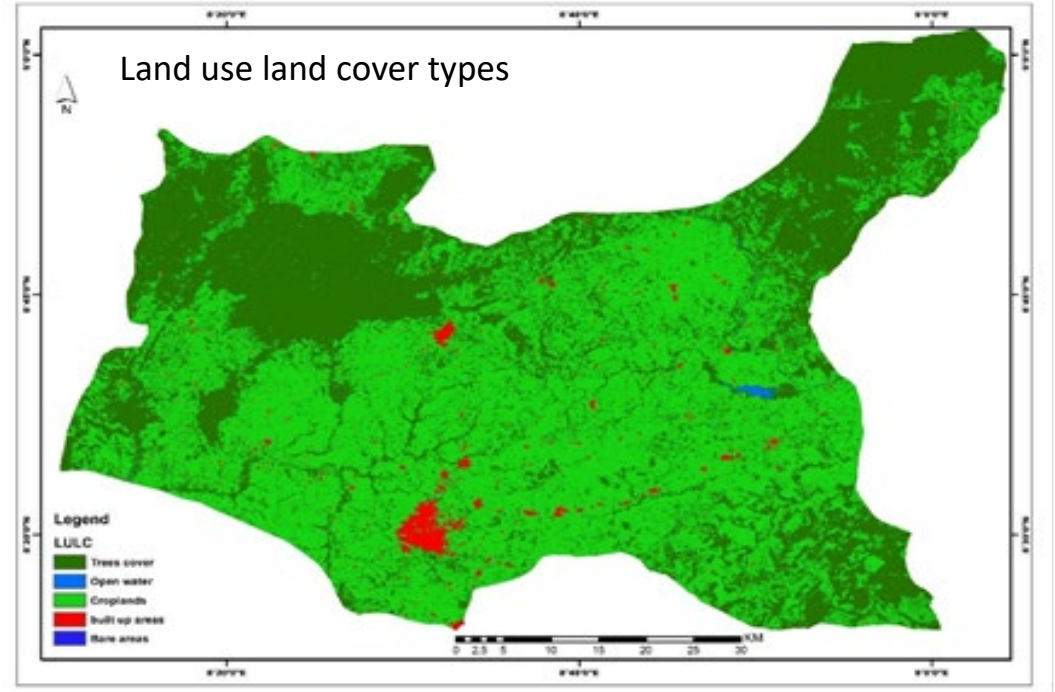
v. Over 3.5m ha of inland valley or Fadama land is available for strategic planning and cultivation to increase rice production in the country.

DIGITAL MAPPING AND ASSESSMENT OF CASHEW PLANTATION IN NASSARAWA STATE USING GEO SPATIAL TECHNOLOGY

The aim of the study is to digitally map and assess Cashew plantations in Nasarawa State using geospatial techniques







Space Based Digital Farm Monitoring from space (CBN Anchor Borrower)

The project focuses on the monitoring of farms for the Central Bank of Nigeria using space based technology during the 2020 dry season farming.

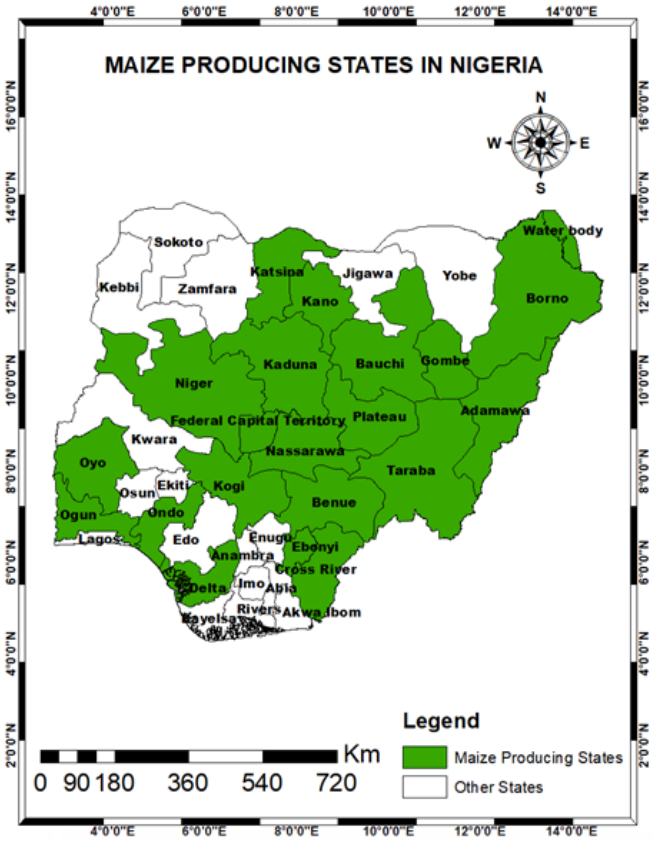
205 Farms have been validated from space and are currently being monitored for:

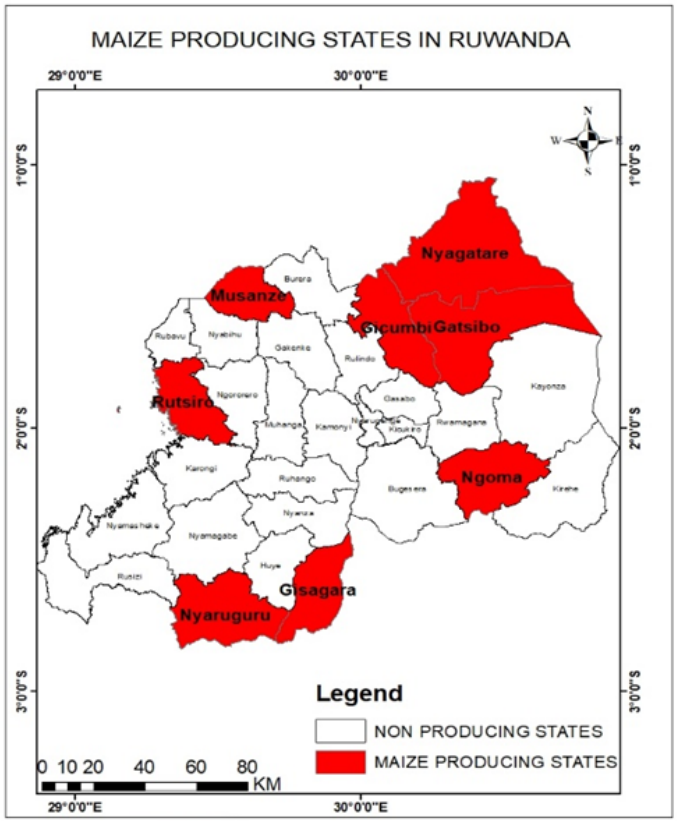
- Crop growth,
- Crop health,
- Crop Performance,
- Yield Estimates.

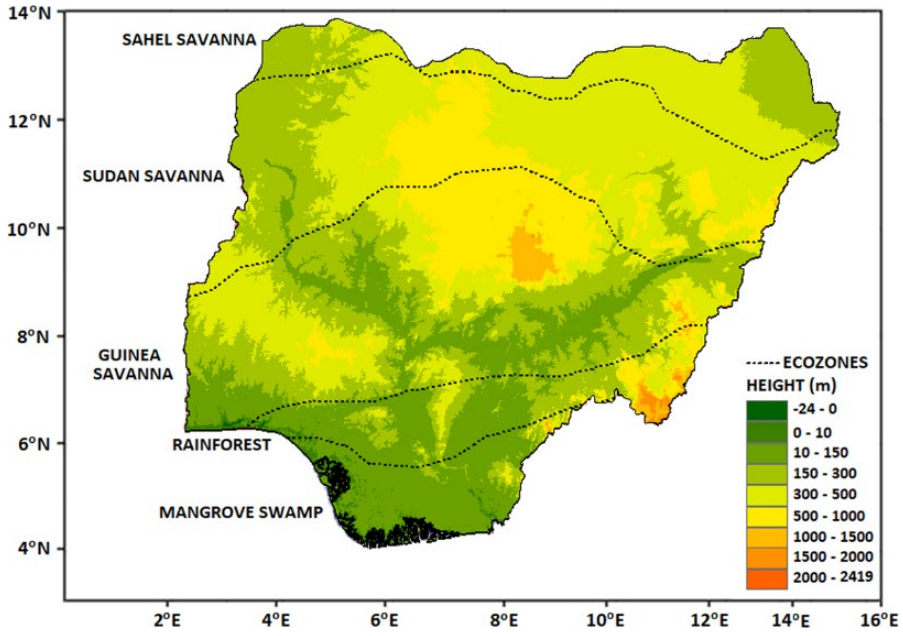
				4th October 2020					11th October 2020					18th October 2020				
Coordinates	Area	Group	Crop	Farm Status	Index value	Value change	Image date	Preview	Farm Status	Index value	Value change	Image date	Preview	Farm Status	Index value	Value change	Image date	Preview
8.07902°N 12.08659°E	4418.0 ha	Adamawa	Rice	Moderate Vegetation	0.57	+0.06	2020-10-03		Moderate Vegetation	0.57	+0.06	2020-10-03		Moderate Vegetation	0.57	+0.06	2020-10-03	
9.23086°N 12.59962°E	183.2 ha	Adamawa	Rice	2020-01-01	0.62	+0.17	2020-08-24		Dense Vegetation	0.62	+0.17	2020-08-24		Moderate Vegetation	0.55	+0.13	2020-10-18	

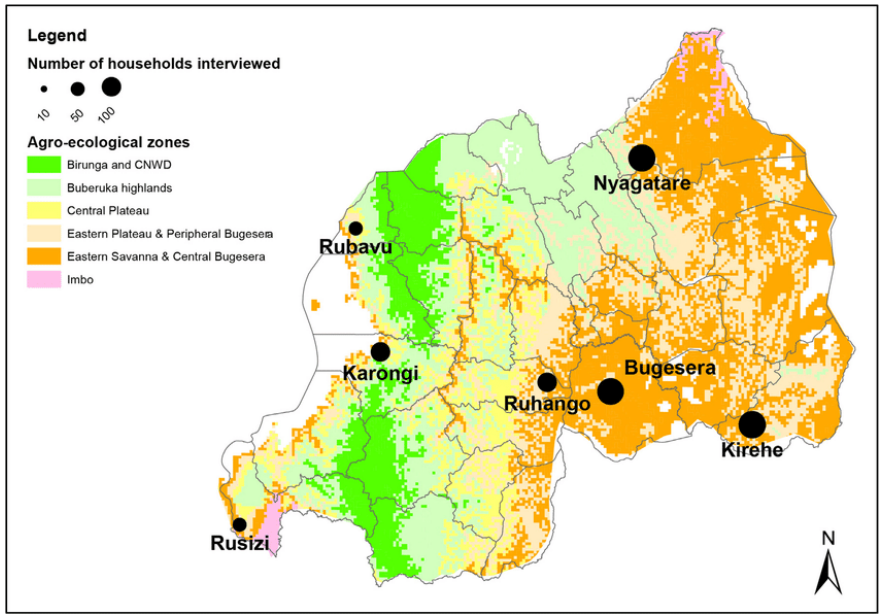
29th November 2020					6th December 2020				13th December 2020				
Farm Status	Index value	Value change	Image date	Preview	Farm Status	Index value	Value change	Image date	Preview	Farm Status	Index value	Value change	Image date	Preview
Sparse Vegetation	0.31	-0.03	2020-11-27		Sparse Vegetation	0.29	-0.02	2020-12-02		Sparse Vegetation	0.29	-0.02	2020-12-02	
Sparse Vegetation	0.29	-0.11	2020-11-27		Sparse Vegetation	0.28	-0.01	2020-12-02		Open Soil	0.22	-0.06	2020-12-12	

MAPPING AND COMPARISON OF MAIZE PRODUCTS VALUE CHAINS IN NIGERIA AND RWANDA



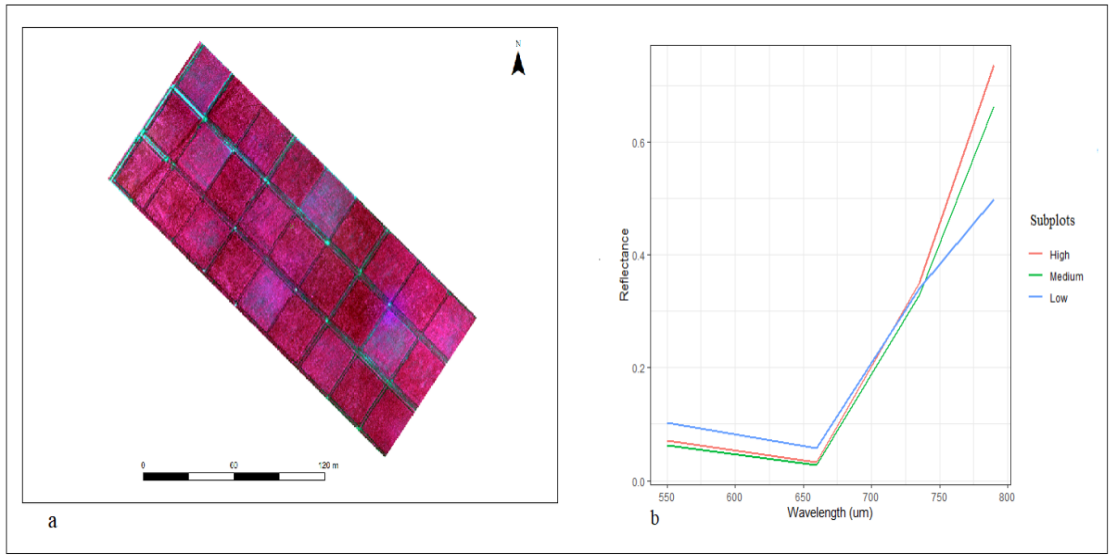






Agricultural Monitoring Protocol in Nigeria

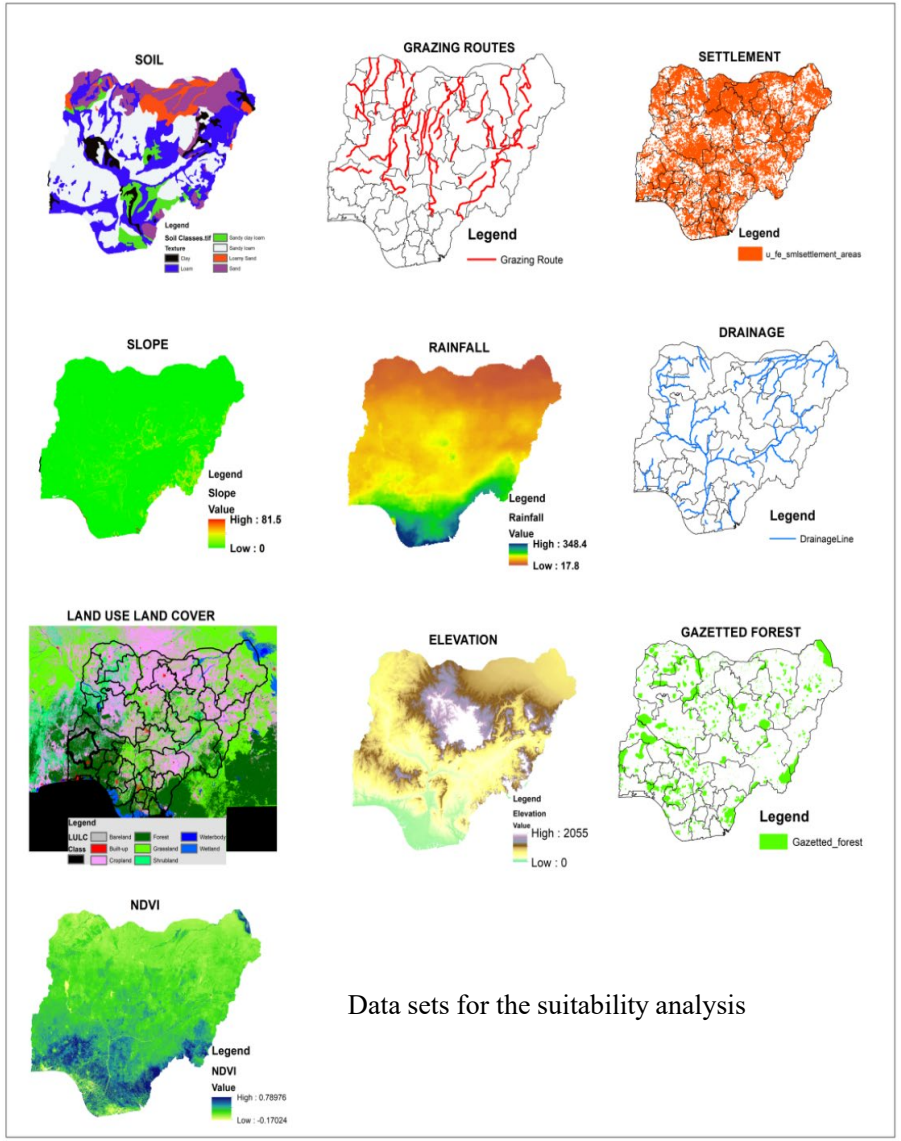
The aim of the project is to establish an agricultural monitoring protocol using remote sensing technologies in Nigeria. This involve establishing 2 Ha farm for obtaining accurate crop spectral signatures across the farm to access the performance of agricultural production at varying scales.



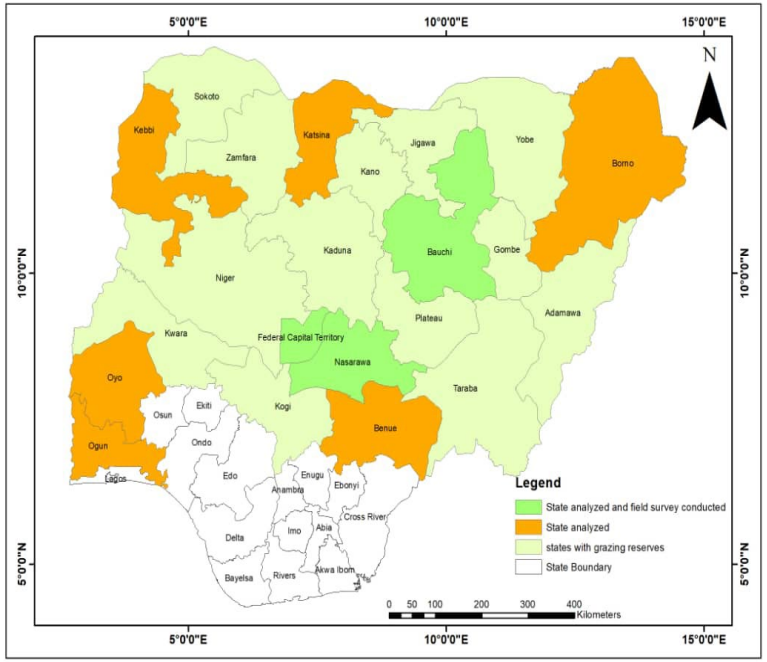
Assessment of rice fields with different applications of nitrogen and water using drones by NASRDA/Olam rice farm

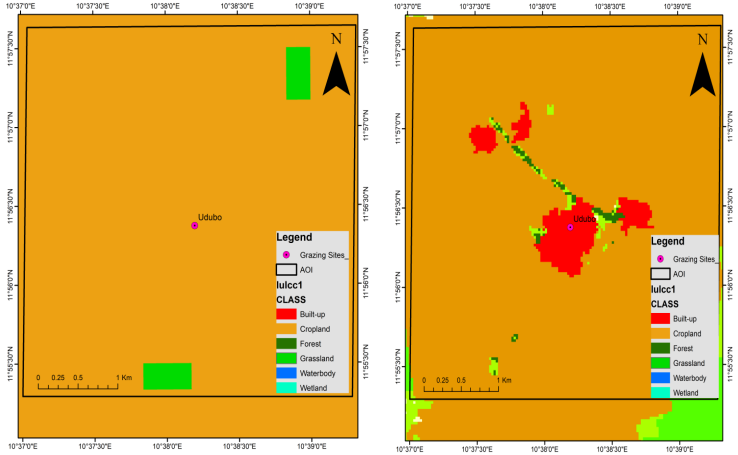
Technology is transforming nearly every aspect of our modern lives, and farming is no exception. Agriculture technology will become ever more computerized in the decades ahead.

MAPPING OF THE GRAZING RESERVES AND STOCK ROUTES IN NIGERIA USING GEOSPATIAL TECHNOLOGY

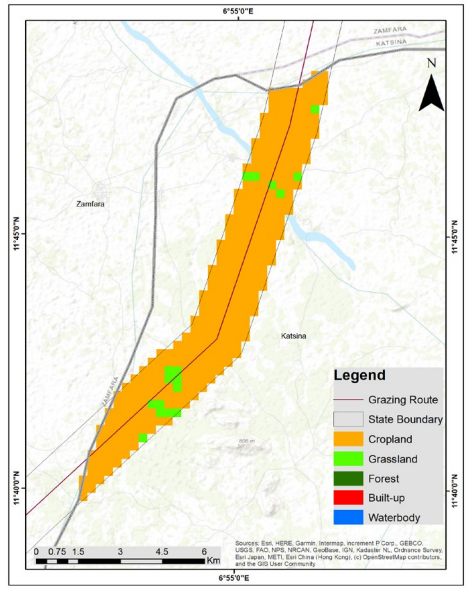


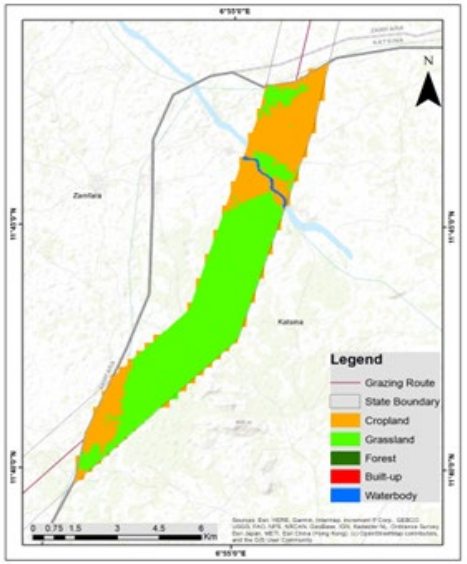
Data sets for the suitability analysis





Bauchi grazing reserve in 1990 and 2020



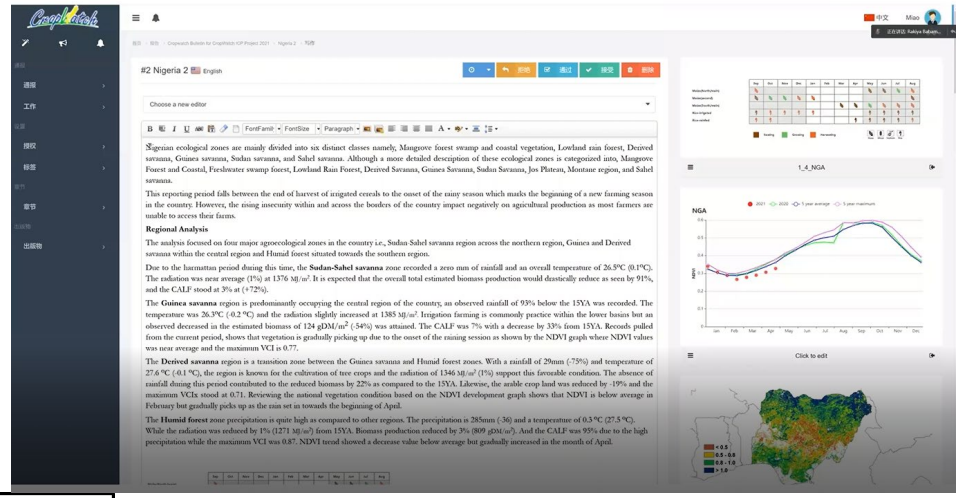


Katsina grazing route in 1990 and 2020.

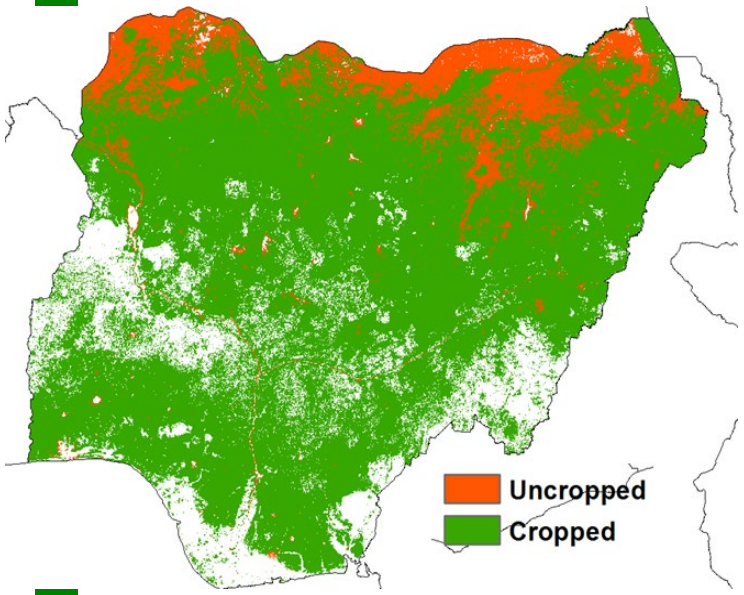
Customize Nigeria CropWatch-ICP Project (NASRDA and AIRCAS China) Supported by UNCTAD and ANSO

CropWatch Innovative Programme for Agricultural Monitoring (Crop-Watch) is to **facilitate and stimulate agricultural monitoring of the developing countries** for the advancement of the **SDG goal of zero hunger through joint research and capacity building.**

Nigeria draft analysis



CROP ARABLE LAND 2022 PRODUCED FROM CROPWATCH SITE



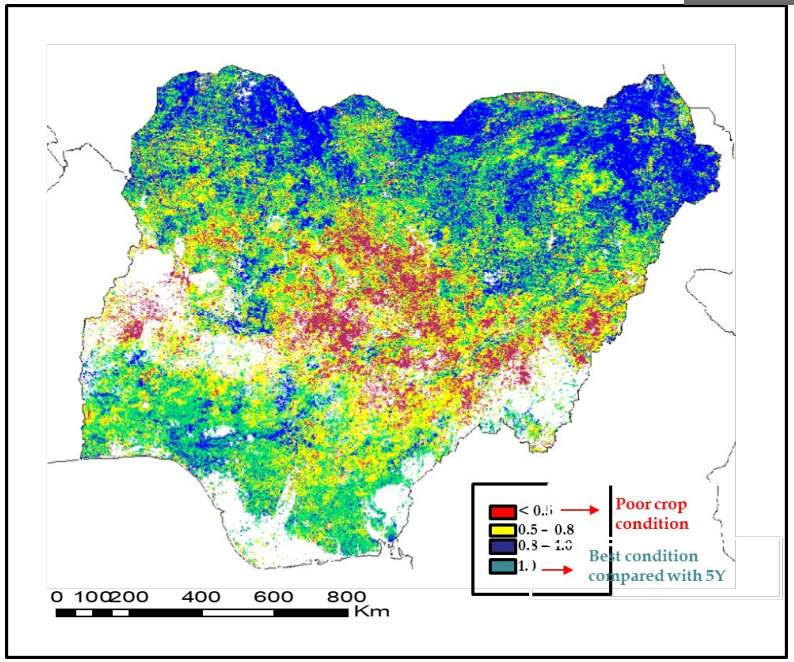
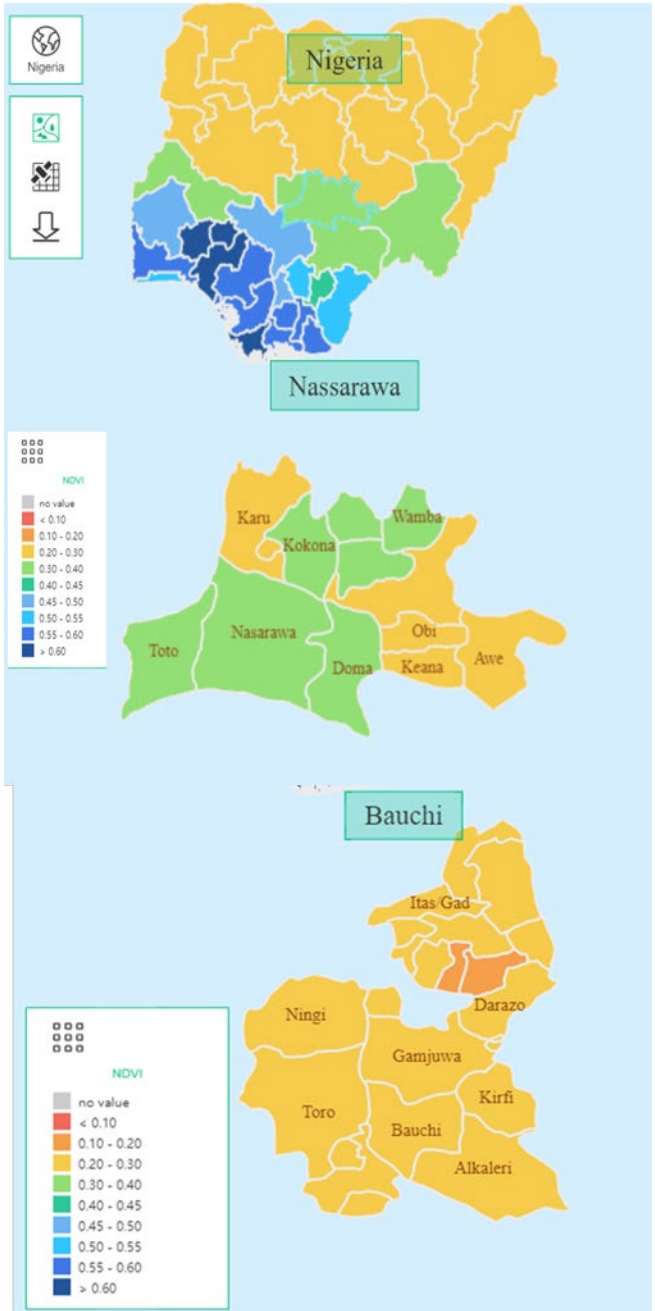
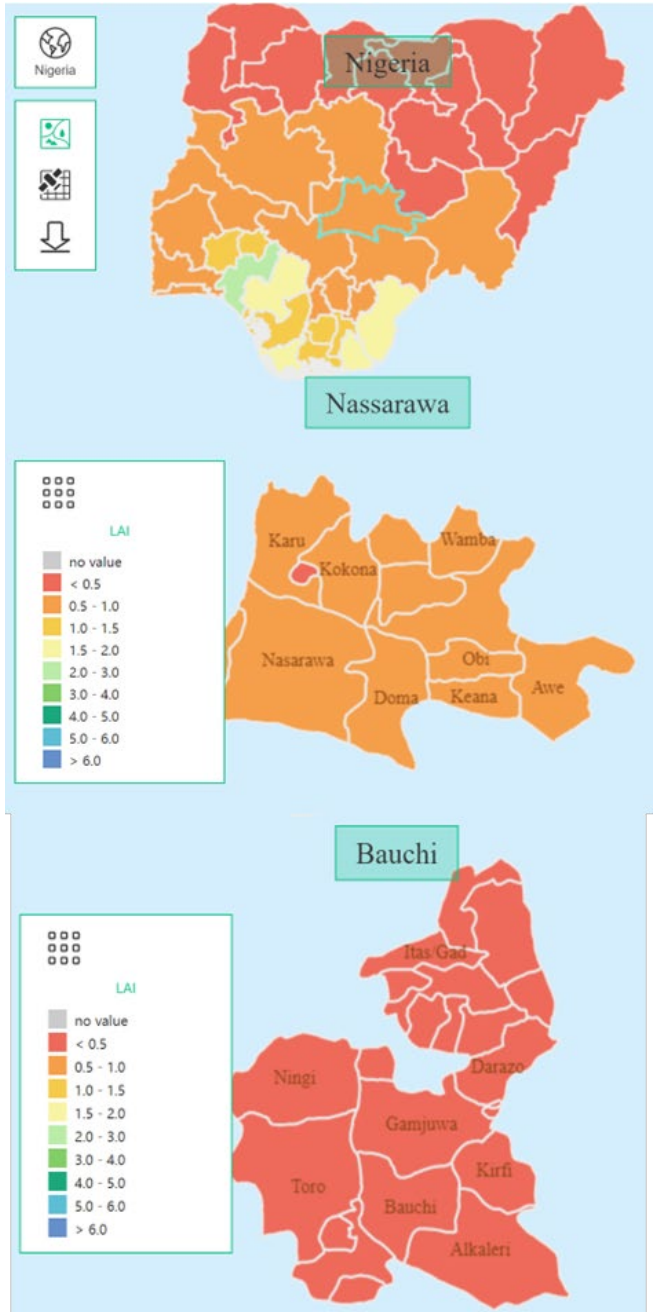


Table 3. 55 Nigeria's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Derived Savannah	70	-54	28.1	-0.2	1270	0	584	-14
Freshwater Swamp Forest	398	-23	26.9	-0.2	1293	1	1038	-10
Guinea Savannah	15	-73	26.8	-0.5	1350	0	481	-12
Jos Plateau	7	-80	23.5	-0.5	1399	0	427	-14
Lowland Rainforest	256	-31	26.9	-0.2	1272	0	860	-12
Mangroove Forest	538	-21	26.7	-0.3	1308	0	1134	-10

Customize Nigeria CropWatch-ICP Project Cont'D





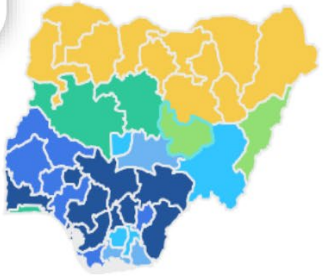
CROPWATCH

Nigerian CropWatch Platform for Effective Crop Monitoring

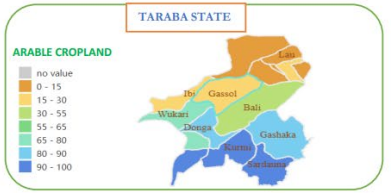
SOME DELIVERABLES FROM THE CROPWATCH PROJECTS

PHENOLOGY: Tells the farmer when it's safe to start planting various crops for the year in different regions of the country.

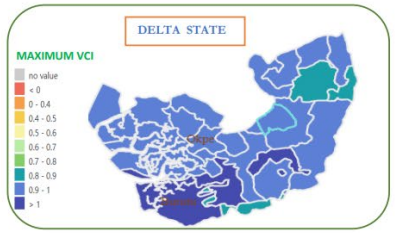
2023 NDVI @ NATIONAL LEVEL



Normalized Difference Vegetation Index: Helps quantify the greenness of the farm, plant stress, healthiness of plants determine drought and predict yield.



Arable Cropland: Information on the suitable land for cropping various crops.



Vegetation Condition Index: It focuses on the impact of drought on vegetation and can provide information on the onset, duration and severity of drought.

WHY CROPWATCH?

In Nigeria, 70% of the of the populace are engaged in subsistence farming with little or no access to information.

Leading to poor farm handling and poor yield.

SOLUTION

CropWatch is a system that uses satellite data to monitor crop conditions and integrates this with other climate-related data to produce near accurate, reliable, and timely information for appropriate decision making to improve crop yield.

National Space Research and Development Agency

Aerospace Information Research-Chinese Academy of Sciences

UNCTAD

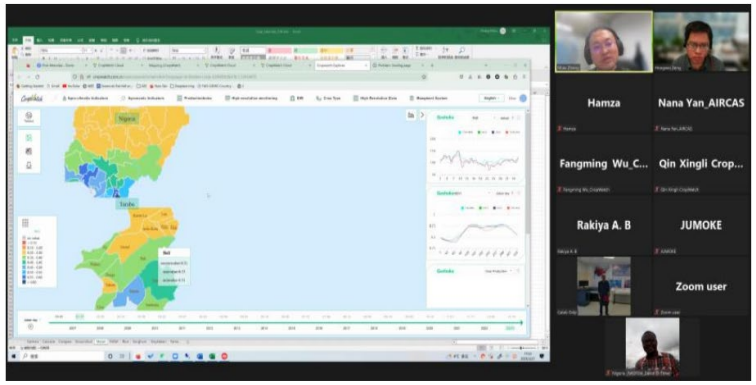
ANSO

Contact Us: NASRDA CropWatch Team. Phone: +2348068244724 Email: rakiya.babamaaji@gmail.com

Customize Nigeria CropWatch-ICP Project: Activities so far

The Status So far:

- The first NASRDA held stakeholders meeting and discussed the initiative which received a positive response: The meeting was well attended by representatives from various stakeholders. Among those that were in attendance are; NARSDA, AIRCAS (virtual), Federal Ministries (Agriculture and Rural Development, federal Water Resources, Environment, Nigerian Meteorological Agency, Nigeria Hydrological Services Agency, Nigeria Integrated Water Resources Management, Bureau of Statistics and SDG office. Some of the decisions taken at the meeting were: Type of crops to be monitored and the scope of the coverage area (National, State and Local level)



Exchanges on the system customization

- **CropWatch quarterly bulletin**

  NASRDA has been participating in the publication of cropwatch bulletin quarterly report on global crop production including Nigeria (from last quarter of 2021- first quarter of 2023)

Signing MOU online

- **MoU (Memorandum of Understanding)**

  An MOU was signed between NASRDA and AIRCAS. The online ceremony was chaired by Dr. Jie Liu, Chief of International Cooperation Department, Aerospace Information Research Institute, Chinese Academy of Science (AIRCAS) supported by ANSO and UNCTAD. It was a successful event that marks the beginning of Customization of Nigeria CropWatch.

Customize Nigeria CropWatch-ICP Project: Activities so far

- **CropWatch Platform down scaling data to local Government level**

  The deliverables such as Biomass, NDVI, VCI, Temperature, Precipitation etc can be access and download from National, State and Local Government level. This a tremendous improvement for Nigeria.

- **Knowledge Building**

✓ CropWatch-ICP Online Training: Video Conferencing, (22 March – 28 May 2021)

✓ Bilateral Research Exchange Workshops (August 2021 to January 2022):

✓ Consultative Meetings with NASRDA project implementation team

✓ CropWatch Bulletin Publications: 7 editions (from 2021 till date)

✓ Exchange of Data with AIRCAS:

✓ NASRDA Staff attended UNCTAD Geneva Meeting in March 2023

✓ NASRDA staff Attended the GEO Symposium and GEO Open Data and Open Knowledge Workshop as a young researcher representative from Africa

- **Second Stakeholders Briefing on the Update/use of the platform: July, 2023**
- **Plan Extension workers Training on basic GIS/RS September. 2023**
- **Plan Upcoming In-house and Field Work Sept/Oct. 2023**

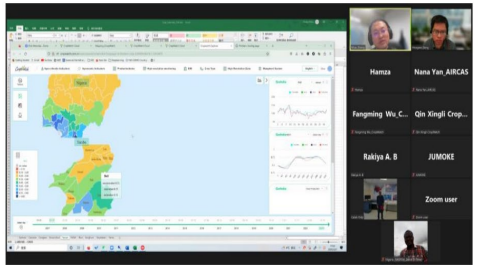
There is need for fieldwork to collect an insitu data and this is schedule for **Sept/Oct, 2023, in Nigeria: Data gathering on the farms and crops using GVG app.** All the information gathered will be subsequently used to support the calibration and validation of the model for CropWatch.

- **Regional Level:**

NASRDA will continue to liaise with ECOWAS directorate of Agriculture for possible involvement of other ECOWAS countries in the CropWach program.

DATA FOR CROPWATCH Shared by NASRDA

S/N	Data	Source	Resolution	Coverage	Date	Size
1	Agro-Ecological Zone	IITA, Ibadan	Shapefile	Nigeria	2021	0.253692 MB
2	LULC	Landsat	30m	Nigeria	2000,2010,2020	4.348 GB
4	Multispectral Satellite Image	NigeriaSat-X (NASRDA)	22m (Green, Red, Blue and NIR)	Nigeria	2011	4.0471 GB
5	Multispectral Satellite Image	NigeriaSat-1 (NASRDA)	32m (Green Red and NIR bands)	Nigeria	2007	13.0462 GB
6	Nigeria Administrative Boundary	OSGOF	Shapefile	Nigeria	2021	10.6502 MB
7	Nigeria Soil	FAO	1000m	Nigeria	2011	30.5527 MB
8	Rainfall	TRMM	0.25 degrees	Africa	1989-2017	27.1 MB
9	SPOT		2.5m	Nigeria	2015	294.6 GB Packed on Zip
10	Wetlands	FAO	1000m	Nigeria	2020	1.9866 GB
11	Weather Stations	NIMET	Shapefile	Nigeria	2022	0.0076929 MB



Exchanges on the system customization


Bilateral discussion

Requirements and expectation

In conclusion, with the increasing population, estimated to reach 400 million by 2050, enhanced agriculture productivity through adaptation of new technologies and innovations is necessary to ensure food security and nutrition. Support from all partners to the efforts by the federal and state governments is central for achieving this goal and SDG 2.

- Relevant stakeholders at the national and state levels to have the capacity and knowledge to use the customized cloud-based crop monitoring platform and the generated information on agro-climatic condition, agronomic and major production zone for the effective development of climate resilient agricultural practices in various crop production.
- Provide support in utilizing the cloud platform for monitoring crop condition, crop stress, and production at national to subnational level.
- For sustainability NASRDA need to train young scientist in RS applications in Agriculture especially support in sending staff in scholar visit to AIRCAS facilities or acquire M.Sc/PhD
- NASRDA Dedicated Equip Lab for CropWatch

ACCURATE DATA PANACEA FOR AGRICULTURAL REVOLUTION IN NIGERIA *- The Director General National Space Research and Development Agency, NASRDA, Dr Halilu Ahmad Shaba has emphasized the need for generating accurate data for the expansion of the country's agricultural frontiers especially at this sphere of it's developmental process.*

Thanks for listening