Eoclima
EARTH OBSERVATION FOR CLIMATE ACTION

gmv
INNOVATING SOLUTIONS

Eoclima for agriculture and food security

We present ***Eoclima,*** GMV solution to support climate action through climate-related geo-information products, derived from satellite-based Earth Observation data. We will show how ***Eoclima*** contributes to **addressing agriculture and food security challenges towards climate change resilience**, and supports climate risk management and adaptation.

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CHALLENGES

Climate variability and extremes are a key driver behind the recent rise in global hunger, one of the leading causes of severe food crises, and a contributing factor to the alarming levels of malnutrition seen in recent years. Increasing climate variability and extremes, linked to climate change, are negatively affecting all dimensions of **food security** and nutrition. Hunger is significantly worse in countries with agri-food systems highly sensitive to rainfall and temperature variability and extremes, and where a high proportion of the population depends on **agriculture for livelihoods**. Alarmingly, countries are increasingly exposed to multiple types of climate extremes. Drought leads to crop failure and creates food insecurity, although responses to droughts tend to be generally reactive in terms of crisis management. Without efforts to adapt to climate change, food insecurity will likely increase substantially.

SOLUTION

Data collection, monitoring and reporting on hazards and impacts at the subnational and national level need to be improved and harmonized across countries, to better inform sustainable development planning. Early warning and **monitoring of climate conditions and natural hazards** affecting agriculture are key elements to assess agriculture and food security conditions, as well as promote early action and to minimize damages and losses.

Earth Observation (EO) services are valuable tools for assessing degradation and understanding exposure to present and future risks, making them a crucial tool for managing agriculture and food security. GMV has worked on several projects to integrate EO services into the decision making processes to help solve agriculture challenges. As climate finance becomes increasingly aware of the strengths and benefits of EO data, they are being used for an even greater range of problem-solving to help build climate resilience in many different contexts.

Eoclima is GMV's catalogue of climate-related geo-information products to facilitate the management of environmental resources by organizations involved in the process: NGOs, multilateral climate finance initiatives, International Financial Institutions (IFIs), and environmental and conservation agencies as well as national and local Governments.

Eoclima meets all currently existing geospatial data standards so, our geospatial products can be downloaded into and/or consumed by any geo-viewer through Open Geospatial Consortium (OGC) standard services.

Eoclima SUPPORT FOR CLIMATE POLICY

Eoclima products support the climate resilient pathways through the societal transformational process to achieve long-term emissions reductions and sustainable resilient development. This support is decoupled into main broad applications that lead to climate services tailored into products, here presented, and EO-derived parameters.

Application	Service	Product	Parameter

Climate risk management and adaptation	Climate risk assessment and monitoring	Climate adaptation and mitigation synergies
- Water resources management - Coastal risk management - Ecosystem sustainability - Forest condition assessment - **Agriculture and food security** - Livestock - Cities and urban areas	- Floods - Landslides - Soil erosion - Water scarcity - Wildfire - Extreme temperatures - Compound risks	- REDD+ / LULUCF - Sustainable forestry

Eoclima **agriculture and food security** service offers the following **products**:

The **agricultural drought** product provides time-series information on agricultural droughts conditions. This product includes retrieval of vegetation biophysical variables and soil moisture from both satellite optical imagery measurements and meteorological reanalysis, and the analysis of dynamics and anomalies of key drought indicators.

The **climate indicator for agriculture** product provides a classification and quantification of the potential impacts of extreme climate events for agriculture. The indicators are derived from Earth Observation data, meteorological models and climate models, and calculated following the common definitions internationally agreed by the scientific community (ETCCDI).

The **crop monitoring and management** product provides Earth Observation-derived information to support climate-resilient irrigated agriculture. This includes monitoring and change assessment of crop area, crop type identification, water deficit estimated from soil moisture, determination of available water in reservoirs, and monitoring and trend analysis of ground water storage.

USE CASE: CROP CHANGE DETECTION IN CONFLICT-AFFECTED AREAS OF DROUGHT-PRONE NIGERIA, 2010-2021

The African continent is considered as very prone to droughts due to high variability of rainfall. A large number of extreme droughts have been observed in past years which caused famines and loss of millions of lives in Africa. Studies reported more erratic behaviour of climate due to climate change, and thus, potentially increase its severity in different countries including Nigeria. Numerous studies on the variability of climate and the changing nature of droughts using various indices have been conducted. Though major drought events have not occurred in Nigeria for the past decades, studies showed sharp increases in extreme heat and changes in precipitation patterns, and thus, potential increase in drought frequency and affected areas.

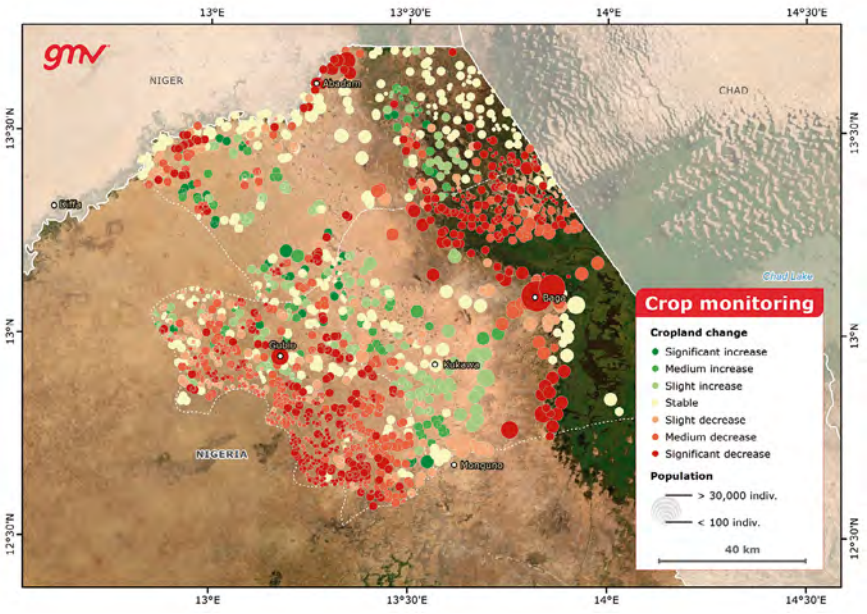
Situated on the edge of the Sahara Desert, Borno state in the northeast of Nigeria is amongst the most vulnerable states with a large percentage of its landmass, especially in the north, located within the semi-arid to arid zone and therefore subject to all the vagaries of climatic change including drought, floods, river desiccation and desertification. In addition, the conflicts in Borno state between Boko Haram, the Government and other groups started in 2009. Since then, attacks and fighting activities caused damages in the billions, killed thousands of people and displaced more than two million. As a second influencing driver for food insecurity, the effects of the climate change need to be emphasized. Especially the dwindling of Lake Chad has devastating effects in Borno state, where crop and livestock farming became unviable and the cultivated areas shift to the east into the drying up wetland. Paired with the violence and insecurity, it is difficult to adapt to the new climatic conditions, leading to hunger and poverty and increases the vulnerability of people to join an armed group. UNICEF reported that the agricultural sector has suffered mostly because of the Boko Haram insurgency. With approx. 55% Borno state has a very high prevalence of insufficient food consumption. The Famine Early Warning System Network indicates that acute food insecurity is currently at crisis and emergency stage for most of the Borno state, while remains the main battle area of the insurgency (making the provision of food and other needs to the region hardly possible), leading in conjunction with climate change, to a massive displacement of people.

Using **Earth Observation** data to identify and **monitor crop change detection is** an **essential** tool to **monitor agriculture and food security in conflict-affected areas**. GMV as part of the European Commision **Copernicus Emergency Service (EMS)** has worked since 2020 on three activations to monitor the crop change detection in conflict affected areas of Nigeria (EMSN063, EMSN083 and EMSN113). The scope of these activities is to support the **World Food Programme (WFP)** with geospatial analysis regarding the agriculture and food security and nutrition analysis situation in Nigeria.

The Borno region has been the scene of increasing violence for over 10 years. Many people have been displaced, causing significant losses in agricultural use and the resulting production of food. Cultivated croplands can be identified due to their cyclical behavior. The **cropland change analysis** required separate time stamps of the crop season per year combined as vegetation index composite. The dense and high-resolution coverage by Sentinel-2 of the region makes it an ideal sensor for capturing the post-event situation. The investigation of the abandonment of cropland was carried out primarily during management periods of the agricultural land (growing-harvesting season) which are related to the monsoon season in West Africa. This results in a monitoring period from June to October where the vegetation index is used to identify cropland areas.

Two thirds of the investigated localities **in the Borno region are affected by agricultural land loss comparing 2010 with 2020.** More than 55% of the places show even a medium to significant decline of arable land. The areas most affected by cropland loss from 2010 to 2020 are Marte (with 98% of the sites), Kala / Balge (92%), Guzamala (70%) and Kukawa (56%). In this regions and period, 90% of the population of Marte and more of the 80% of the population of Kala/ Balge are affected by medium or significant cropland loss.

Full report for the analysis up to 2010-2020 can be found on EMSN083. The analysis incorporating 2021 data has been published in early 2022 for EMSN113.



Crop change detection in conflicted areas in the Borno region in Nigeria between 2010 and 2020

Remote Sensing
&
Geospatial Analytics

For more information on the products under this service and the parameters included contact us on eoclima@gmv.com!

A product by:

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