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ASARECA
Transforming Agriculture for Improved Livelihoods

Harnessing Satellite Technology for Climate Resilience and Increased Agricultural Productivity in Kenya

Joshua Sikhu Okonya[1], Enock Warinda[1], Annet Wanyana[1], Hilda Manzi[2], Ermias Aynekulu[3], Francis Oloo[4], Tobias Landmann[5], Julius Buyengo[6], Bulle Hallo Dabasso[7], Kenneth Mubea[8] & Wellington Michael[9]

Key Messages

- Timely, accurate and reliable information is critical for early warning to mitigate and verify the impact of climatic shocks.
- Satellite data helps in monitoring crop conditions and performance, e.g., through yield estimation and production forecasting.
- Limited technical capacity to analyse satellite data, lack of cross sector/industry/stakeholder collaboration, and spatial resolution are major challenges to harnessing the benefits of satellite data in Kenya.
- ASARECA and its partners offer opportunities to stakeholders to receive continuous training in the use of satellite data, processing tools, products, and services.
- There is a need to strengthen the science-policy interface for more effective, evidence-based policies to facilitate the use of satellite data, products, and services in agriculture and food security.

POLICY BRIEF
KENYA - June 2023

Background

Despite the adaptation and mitigation measures that have been put in place to counter the negative effects of climate change and food insecurity, over 5.4 million people are at risk of hunger in Kenya (IPC 2023). This comes against the backdrop of declining agricultural productivity attributed to several factors including high cost of inputs, high incidence of pests and diseases, low input use and extreme weather conditions (droughts, floods, erratic rainfalls, etc).

The traditional methods of drought prediction (in-situ physical rain gauges) used in most of the rural areas of Kenya is unreliable and does not consider explicit information on risk profiles/sectors and provides short-term forecasts. Satellite technology helps in monitoring drought impacts and provides early warning information.

Satellite Technology

Satellite Technology entails continuous observation of land characteristics using a space-borne platform that orbits the earth's surface. It is specifically the process of detecting and monitoring the physical and biochemical characteristics of objects on the earth's surface through measuring their reflected and emitted radiation at a distance. A special sensor with the capability of detecting reflected and emitted radiation over a wide range of electromagnetic spectrum is used to gather target reflected and emitted radiation and form an image. Satellite Technology offers a synoptic view of objects on the earth's surface and has the advantage of obtaining earth's data in near-real time over large areas easily and effectively, and that gives it the capability to collect information on the weather, land use, crop health, and other important parameters. Satellite images are collected, processed, analysed, and converted into useful information that stakeholders within the food security programs can use to make informed policy decisions.

Contribution of Satellite Technology to Improved Food Security in Kenya

Satellites provides regular data on the weather, land use, crop production, and other important parameters to facilitate effective and better decision making. Among others, Satellite images provide useful information through.

1. soil, crop, and pasture health monitoring, including yields and production forecasting.
2. weather and drought early warning systems.
3. weather-based insurance schemes.
4. mapping disease and pest prevalence, ed to early warning digital advisories.
5. providing forecasts on crop production, consumption, cross-border trade, and stocks using digital food balance sheets.

Barriers to Adoption of Satellite based agricultural solutions in Kenya.

Despite the immense benefits of using satellite data in monitoring agricultural production to ensure food security and multiple Sustainable Development Goals (SDGs), the following factors limit its use:

1. Lack of awareness and confidence in/of available satellite data, products, and services.
2. Absence of relevant policies or platforms for hosting and sharing of satellite data among institutions.
3. Limited Information and communication technologies (ICT) infrastructure to support data processing and management.
4. Inadequate data interoperability, sharing mechanisms and lack of collaboration among institutions within the Earth Observation (EO) data value chain, and
5. Over reliance on international models used in predicting crop yields compromises accuracy at local scales.

Key Actions required to Enhance Utilization of Satellite Technology in Agriculture for Kenya.

To enhance utilization of EO data for spatially and temporally explicit agricultural planning, food, and nutrition security, the following actions are recommended:

1. **Improve temporal accuracy of 6-hr and 10-day weather forecasts.** Kenya's Department of Meteorology to consider running models on daily basis and provide gridded values to end-users.
2. **Develop local models suitable for African communities.** Kenyan Geographical Information System (GIS) and Remote Sensing experts ought to develop local crop and pasture models suitable for their localities. Sufficient ground truthing data also needs to be collected to train and improve accuracy of the developed models.
3. **Use satellite data for weather monitoring and forecasting in remote areas**: Since ground weather station data are usually neither evenly distributed nor sufficient, augmentation of station data with remote sensing data is critical for seasonal weather monitoring and forecasting. In hard-to-reach areas or regions without ground weather stations, satellite data forms the basis of forecasts.
4. **Increase awareness and dissemination:** To increase awareness of the available EO data, products and services, there is need to diversify the types of knowledge products or materials but also increase dissemination channels targeting the different stakeholder categories. At local scale, the knowledge products and materials should be developed in simplified formats that are easily understandable by local communities. Access to ICT infrastructure to supports digitalization of farm operations is key.
5. **Strengthen capacity of stakeholders**: Generally, there is limited capacity of County, Subcounty and ward agricultural experts to analyse EO data and provide insights in specific areas of agricultural production such as measurement of soil moisture, crop suitability analysis, crop type mapping, crop conditions monitoring, crop yield and production forecasting. This can be improved through the delivery of customised continuous short trainings and refresher courses for technical staff on how to use latest technology (the how) to enhance crop production and food security in Kenya.
6. **Scaling of pilot projects or interventions.** Scaling ground truth data collection, use and sharing to promote advanced crop analytics through innovative EO applications (crop modelling) and phased pilots to strengthen validation (Tetra Tech, 2021). Sufficient data and research are needed to support evidence-based policymaking and the role of the private sector in scaling that utilization of EO data, products and services cannot be over-emphasized.
7. **Create enabling policy environment:** Unclear or absence of relevant policies to guide the establishment and use of a national geospatial data infrastructure to serve as a one-stop-centre for all users of satellite data. Unclear, strict, or changing data protection policies that regulate quality of data or the use of artificial intelligence in agriculture also limit cloud computing, storage and sharing of some high-resolution data sets. For effective implementation, there is need to categorize EO data and mainstream EO data policies, laws, and regulations into sector planning

processes at various administrative levels.

8. **Reduce the cost curve for very high-resolution imagery:** In special cases such as pest outbreaks, a supplementary budget needs to be availed to county government staff with a foresight function (especially planners) to be able to access commercial very high-resolution imagery to increase the accuracy of predictions to reduce the impact of emerging pests and diseases on food security (early warning). Affordable high-resolution imagery will also improve yield predictions and field level monitoring.

9. **Identify and address barriers in science education during early years.** There is need to develop a curriculum and mentorship programs on the use of EO data in schools. This will interest students including women to study Science, Technology, Engineering and Mathematics (STEM). More opportunities and incentives need to be provided to women to study STEM and become experts in GIS and Remote Sensing.

10. **Establishment of multistakeholder partnerships:** Collaborative frameworks with national, continental, and global key stakeholders and programmes in the EO data value chain can facilitate capacity strengthening, sharing of data, but also reduce the cost of high-resolution data to complement the use of medium resolution open data. Such stakeholders include SANSA, ASARECA, DE-Africa, Geoscience Australia, Esri, African Space Agency, Radiat Earth, Regional Center for mapping of Resources for Development (RCMRD), The United Nations Commission on Science and Technology for Development (CSTD), The Alliance of International Science Organizations (ANSO) and the Aerospace Information Research Institute (AIR) of the Chinese Academy of Sciences (CAS), the World Resources Institute (WRI), Airbus, private companies in Analytics and Agricultural boards. Relevant programmes include SERVIR ESA, The Global Monitoring of Environment and Security (GMES) Programme among others.

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[1]Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), Entebbe, Uganda
[2]Geo-Spatial Research International, Nairobi, Kenya
[3]CIFOR-ICRAF, Nairobi, Kenya
[4]Technical University of Kenya, Nairobi, Kenya
[5]International Centre of Insect Physiology and Ecology (ICIPE), Nairobi, Kenya
[6]Regional Centre for Mapping of Resources for Development (RCMRD), Nairobi, Kenya
[7]Kenya Agricultural and Livestock Research Organisation (KALRO) Marsabit, Kenya
[8]Digital Earth Africa (DE-Africa), Nairobi, Kenya
[9]Geosciences Australia, Canberra, Australia

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Australian Government
Geoscience Australia

Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA)
Plot 5, Mpigi Road | P. O. Box 765, Entebbe, Uganda
Tel: +258 414 320 556, +258 414 321 885
Email: secretariat@asareca.org | **Website:** www.asareca.org