



**INTEGRATED USE OF MULTISOURCE REMOTE SENSING DATA FOR NATIONAL SCALE
AGRICULTURAL DROUGHT MONITORING IN KENYA
ADM-KENYA**

Policy Traceability Matrix analysis



**Ministry of Agriculture &
Livestock Development**



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1. Executive Summary: Overview of the document

1.1. Summary

The Agricultural Drought Monitoring (ADM) policy traceability matrix analysis outlines key policies related to drought management in Kenya. Policy traceability analysis, in general, provides valuable insights into the strengths and weaknesses of existing policies and helps to identify areas for improvement. It can also help to ensure that policies are evidence-based, effective, and responsive to the needs of affected communities.

The analysis synthesizes government reports, outputs and recommendations of past activities, legislations, and governance policies of institutions related to drought management. The analysis reviews the existing policies in light of the response to drought management and identifies gaps and opportunities that can be harnessed from the ADM-Kenya project. Furthermore, the trade-off between the previously set policies and what may be feasible within the project's scope is addressed.

1.2. Beneficiaries and needs

The beneficiaries of the Earth Observation (EO) based drought monitoring cover many users from the local to the government level. Livelihood-oriented policies can be developed based on the developed indicators for various geographical and livelihood contexts. The government can also initiate pragmatic decisions based on the conditions of these contexts. Also, in light of the past drought response and preparedness, the ADM-Kenya can help the government to assess the effectiveness of the past policies and align the current decisions from the contributions of the project. Decisions such as resource allocation, strengthening emergency response, optimization of resources, and tapping of missed opportunities are part of the desired outcomes from the project.

Another beneficiary is the county governments. The project outputs can be integrated into the existing operations/activities in food security departments in the counties. The same institutions can also use the information as a baseline for enacting laws that govern food security management.

2. Review of the current policies

Kenya has several policies and programs in place to address the impact of drought on its population and economy, including those related to agriculture. The following sections outline the central policies, programs and initiatives.

2.1. National Level

- National Drought Management Authority (NDMA)¹ – NDMA was established in 2011 to coordinate and implement drought management activities nationwide. The authority is responsible for developing early warning systems, providing emergency relief, and promoting sustainable drought management practices. NDMA has recognized the potential benefits of digital technologies in enhancing the accuracy and speed of collecting

¹ <https://www.ndma.go.ke/>

and communicating early warning data. In line with this, the authority has integrated technology into its drought Early Warning Systems (EWS) and drought response. The use of satellite imagery has been particularly effective in strengthening and improving the EWS. In the Kenya Drought Response Guidelines (NDMA, 2018) the use of remote sensing based indicators related to meteorological and agricultural drought is recommended. NDMA provides monthly national drought bulletins and county early warning bulletins, where EO data has been used. Specifically, vegetation condition index (VCI) based classification of vegetation condition is provided, aggregated to administrative boundaries.

- National Climate Change Action Plan (NCCAP)² - NCCAP is a government-led initiative that aims to build resilience to climate change and promote sustainable development in Kenya. The NCCAP includes measures to address the impact of drought on agriculture, such as the promotion of crop diversification, water harvesting, and the development of drought-resistant crop varieties. No section or segment of the document focused on Earth observation data.
- National Agricultural Policy (NAP) – The policy enacted in 2021 provides a baseline for legislation, strategies, plans, and programs for agricultural development. The policy identifies challenges in the agricultural sector and outlines practical guidelines to address them. No section or segment of the document focused on Earth observation data.
- National Expanded Irrigation Programme (NEIP)² - The NEIP is a government-led initiative aimed at increasing the area of land under irrigation in Kenya. The program aims to promote irrigation development and modernize irrigation systems to increase water availability for crop production during dry periods.
- Kenya Livestock Insurance Program (KLIP) - The KLIP is an insurance program for livestock farmers in Kenya. The program provides insurance coverage for farmers against loss of livestock due to drought, disease, or other risks. The program uses EO products (e.g., NDVI) to determine forage availability and assess the pastoral communities' vulnerability. Subsequently, this helps to determine payouts to the individual pastoralists.
- Kenya Agricultural Productivity Project (KAPP) – The KAPP is an initiative aimed at increasing agricultural productivity in Kenya. KAPP focused on increasing agricultural productivity and competitiveness (including increased resilience to drought), improving access to markets and trade, and strengthening the institutional capacity of key agricultural institutions in Kenya. No section or segment of the document focused on EO data.

² <https://www.irrigation.go.ke/projects/national-expanded-irrigation-programme/>

- National Adaptation Plan (NAP) - The NAP was established and envisaged to be achieved in 2015-2030. The ending year overlapped with the projection attainment of the Kenya Vision 2030 national goals. The plan sets out adaptation as a priority against the adverse socio-economic effects of climate change. The plan spells adaptation actions for different sectors of the economy. The adaptations include short-term, medium-term, and long-term adaptation actions to be implemented at the county levels. The adaptation plans anchor largely on a participatory approach, awareness creation, capacity building, actual creation, financing, implementation and upscaling of individual county plans. The specific targets on agriculture include the promotion of indigenous knowledge on crops, increasing awareness of climate change impacts on the agriculture value chain, conducting vulnerability assessments on the agriculture value chain, integrating climate change adaptation in agricultural extension services, promoting the uptake of climate-related services in agriculture, promote and upscale adaptation actions such as drought-tolerant varieties; high value and yielding crops with short crop cycles; water harvesting; index-based weather insurance; conservation agriculture; Agroforestry; and Integrated Soil Fertility Management (ISFM). No section or segment of the document focused on EO data.
- The National Policy for Disaster Management in Kenya
The policy was established in 2009 and encompassed a wide range of disasters, including drought. The policy's main aim was to strengthen disaster management institutions, enforce partnerships and networking, and mainstream disaster risk reduction in the development progress of various sectors of the economy to enhance the resilience of vulnerable groups to cope with disasters. No section or segment of the document focused on EO data but highlights the inadequacies such as limited data for disaster monitoring. The policy pointed out that the food sector has efficiently responded to emergencies. However, other sectors, such as the provision of water, agriculture and livestock care, have faced difficulties. This has been brought about by the high number of activities and actors involved and poor coordination.
- Crop condition bulletins and National Crop Monitor ³ – The crop condition bulletins by the Ministry of Agriculture and Livestock development provide regional information on the conditions of cropping systems in Kenya. The bulletins are published monthly and serve as an early warning to farmers in various regions on the imminent influence of deteriorating weather conditions. These products use the information derived from SERVIR Regional Cropland Assessment and Monitoring Service⁴. The primary EO data used include MODIS, VIIRS, CHIRPS Rainfall and satellite-derived data as well as crop masks derived from various systems, including Landsat and Sentinel 2.

Policies / Standards	Objective	Key Monitoring, Assessment, and Reporting Needs	How ADM-Kenya aligns
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³ <https://kilimo.go.ke/publications/>

⁴ <https://www.servirglobal.net/ServiceCatalogue/details/5c19008a935208d9a25c1275>

Kenya Vision 2030	Outlines Kenya's long-term development goals and Promotes sustainable development	Monitoring and evaluation of national development programs, Resource mobilization, Strategic planning and implementation, Data collection and analysis	Solutions can contribute to increasing food security
National Drought Management Authority Act (No. 4 of 2016)	Establishes the NDMA to coordinate drought management activities in Kenya Enhance drought preparedness, early warning and drought risk management	Improve early warning systems through technology and reliable data, establish drought monitoring and forecasting systems, and create an information platform for timely and effective drought response. <u>Moderate scale EO data are used in the current activities.</u>	Drought monitoring algorithms and data at local to national scales could be combined with the currently used data and improve drought risk management.
Crop condition bulletins and National Crop Monitor	Provide timely information for monitoring crop conditions	Provide regional information on the conditions of cropping systems in Kenya at a monthly time step. <u>Mainly moderate scale EO data are used in the current activities.</u>	The data products developed can contribute to the bulletins and provide improved drought impact-related products.
Ending Drought Emergencies (EDE) Strategy	End the cycle of drought emergencies and build resilience among vulnerable communities	Monitor and assess the impact of drought on agriculture and livestock, assess and report on the effectiveness of drought risk management interventions, and develop a mechanism for monitoring and reporting on progress towards the goals of the strategy.	Tailored site-specific solutions can be generated from the project data to improve the resilience of communities to drought events and enable them to adapt better.
National Agricultural Policy	Improve agricultural productivity and food security, promote climate-resilient agriculture, and enhance natural resource management	Promote the use of ICT in crops, livestock and fisheries services to improve communication and data management and sharing.	The developed drought-relevant agricultural information (e.g. cropping system maps) to promote climate-resilient agriculture and sustainable natural resource management.
National Climate Change Action Plan (Kenya)	Outlines Kenya's priorities and actions for climate change adaptation and mitigation, including the	Monitor and assess the impacts of climate change on agriculture, develop adaptation	The developed drought monitoring products/information can aid in designing

2018-2022	management of drought risks. The action plan emphasizes the importance of strengthening early warning systems, increasing the resilience of communities, and enhancing food security	measures, and report on progress toward reducing greenhouse gas emissions. <u>No explicit EO component.</u>	agronomic strategies for adapting to climate change and enhancing agricultural productivity.
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Table 1: The central policies and frameworks in Kenya that influence drought management and alignment of ADM-Kenya output

2.2. Regional, Continental and Global Level

Kenya has also been part of regional initiatives, especially in the Horn of Africa (HoA), that focus on the common agenda of increasing resilience to drought and enhancing the people's livelihoods. One such initiative from 2011 to 2022 was the Drought Resilience and Sustainable Livelihoods Programme (DRSLP) in the Horn of Africa. The program covered eight IGAD states, while in Kenya, it targeted six Arid and Semi-arid counties, namely Baringo, West Pokot, Turkana, Samburu, Isiolo and Marsabit, benefiting approximately 168,900 households. The program's purpose was to contribute to poverty reduction, food security and accelerated sustainable economic growth in the Horn of Africa (HoA) through enhanced rural incomes.

In addition to the existing government plans and programs, there are several projects and programs supported by the international organization/community. Some of the projects ended, whereas some are ongoing. The projects include:

- Drought resilience in Northern Kenya⁵. The project, which lasted between 2017 and 2020, was implemented by the German Federal Ministry for Economic Cooperation and Development (BMZ). The project targeted two ASAL counties (Turkana and Marsabit) and aimed at enhancing capacity and promoting rural development for increased coping with drought-related effects. The project does not mention EO data but highlights the development of plans for the agricultural sector and also to strengthen the capacities for using geographical information systems (GIS) to sustainably strengthen regional planning.
- Strengthening Drought Resilience for Small Holder Farmers and Pastoralists in the IGAD Region⁶

The program tailored for Arid and Semi-Arid countries in the Intergovernmental Authority for Development (IGAD) region commenced in 2020 and was funded by the Adaptation Fund Organization. The main goal of the program is to increase the resilience of smallholder farmers and pastoralists to climate change risks, mainly those related to

⁵ <https://www.giz.de/en/worldwide/40504.html>

⁶ <https://www.adaptation-fund.org/project/djibouti-kenya-sudan-and-uganda-strengthening-drought-resilience-for-small-holder-farmers-and-pastoralists-in-the-igad-region/>

drought, through the establishment of appropriate early warning systems and the implementation of drought adaptation actions. Part of the project's goals is to develop efficient and effective EWS by improving the existing early warning (EW) infrastructure and equipping EW information centres. This is implemented by blending traditional EW methods with EO-derived products, for example, time series of bioclimatic variables.

- Towards Ending Drought Emergencies: Ecosystem-Based Adaptation in Kenya's Arid and Semi-Arid Rangelands (TWENDE)⁷. The project, funded by the (Green Climate Fund) aims at reducing the cost of climate change-induced drought on Kenya's national economy by increasing the resilience of the livestock and other land use sectors in restored and effectively governed rangeland ecosystems. The project supports ASAL landscapes that span 11 counties and focuses on developing capacities for landscape planning, facilitating access to climate data and analysis, and enhancing access to markets and financial services. The project was conducted in 2021 and was jointly financed by the International Union for Conservation of Nature and Natural Resources (IUCN) and the Government of Kenya (GOK). The project involves the use of remote sensing as a means of verifying of coverage and scale of ecosystems protected/rehabilitated in response to climate change.
- Global Water Partnership East Africa⁸ - GWPEA is a regional initiative with nine member states and around 300 partners within the states that fosters the implementation of integrated water resources and land management to maximize economic and social welfare without compromising the sustainability of ecosystems and the environment. The partnership initiatives include strengthening the smallholder farmers' and pastoralists' capacity to climate change effects. Some of the initiatives by the project included developing small-scale water harvesting structures and mini-irrigation systems aimed at supporting crop growth at times of water stress.

Apart from the past and ongoing initiatives that align Kenya's policies with monitoring and managing drought, there are future policies and programs at the continental level that aim to develop joint initiatives from individual countries. Countries across Africa are affected by similar challenges, such as climate extremes, political instabilities, and perennial conflicts that disrupt agro-pastoral systems. These challenges require collective and transformative actions that integrate shared lessons and experiences to improve the continent's preparedness for disaster response. Additionally, joint country initiatives are effective for inclusive solutions and collective efforts, including funding sourcing.

The continental initiatives and policies are:

- The Agenda 2063⁹ – The African Union (AU) has developed a blueprint to achieve a transformative continent 100 years after its inception. Health, nutrition, agricultural productivity and production are some priority areas for Agenda 2063. Achieving these priorities in a rapid population growing, urbanizing, and increasing degraded environment requires a delicate balance of utilization and conservation of the available natural

⁷ <https://www.greenclimate.fund/project/fp113>

⁸ <https://www.gwp.org/en/GWP-Eastern-Africa/>

⁹ <https://au.int/en/agenda2063/overview>

resources. The agenda 2063 emphasizes the importance of outer space strategy and technologies such as remote sensing for developing appropriate policies and strategies and regional integration in Africa.

- Prevention Web Africa¹⁰ - The initiative by the United Nations Office for Disaster Risk Reduction (UNDRR) coordinates drought risk reduction in 44 UN member states in Africa. The initiative works closely with the AU, regional economic blocks and other development partners to develop a knowledge-sharing base to reduce and enhance disaster resilience. The platform shares regular content related to disaster management, including droughts, through research briefs, resource guides, lessons learned from previous disasters, education materials, and policies and plans in various countries. The prevention web activities utilize EO data to map land cover and ecosystems and to monitor drought outlooks in countries of interest.
- Improving Drought Resilience in Africa¹¹ – The Windhoek declaration for enhancing resilience to drought in Africa brought together various African nations under a common resolution to develop a strategic framework and to channel support towards addressing drought needs in the continent. One of the innovative resolutions was to enhance the context-specific drought risk mitigation measures. Effectively, six key principles that mainly focus on policy and governance, underlying drivers and risk analysis, drought management and mitigation, awareness creation, vulnerability and impact assessment were established. The convention underscored the role of space technology and EO data in response to these principles.
- The African Drought Risk and Development Network (ADDN)¹² - The ADDN aim to promote an applied exchange of experience on critical issues linking drought risk and development in Africa. The network aims to improve access to information by various stakeholders and user groups to facilitate better reactions to drought-induced events in the region.
- SERVIR¹³ - SERVIR is a joint initiative by the United States Agency for International Development (USAID) and the National Aeronautics and Space Administration (NASA) that helps developing countries use satellite data to address environmental challenges, including croplands assessment, climate change impact analysis, rangeland and ecosystems management among other applications. The initiative leverages the EO data to develop geoinformation products that help decision-making in various economic sectors, including agriculture. The products include land cover maps and hazard maps showing risk locations and levels of exposure.
- Famine Early Warning Systems Network (FEWSNET)¹⁴ - The FEWSNET collaborates with international, regional and national partners to provide timely and rigorous early warning and vulnerability information on emerging and evolving food security issues. The project provides geospatial data, satellite products and derived data products for drought monitoring at a global scale. These products include precipitation, temperature, vegetation indices and

¹⁰ <https://www.preventionweb.net/knowledge-base/continents-countries/Africa>

¹¹ https://www.un-spider.org/sites/default/files/UNCCD-Policy-Options-for-Improved-Drought-Resilience-in-Africa_0.pdf

¹² <https://rmpportal.net/frame/communities/water/resources/community-topics/african-drought-risk-and-development-network-addn>

¹³ <https://servirglobal.net/Regions/ESAfrica>

¹⁴ <https://earlywarning.usgs.gov/fews>

evapotranspiration products at various spatial and temporal scales that are useful for drought monitoring.

- The Global Monitoring for Environment and Security and Africa (GMES & Africa)¹⁵ initiative of the EU and the African Union aims to support the use EO data to support sustainable development in Africa. It aims to improve African access to and use of EO data and develop African capacities to tackle issues such as understanding and mitigating the effects of climate change.
- African Space Strategy - African Space Strategy is a policy framework developed by the African Union Commission to promote the development of space science and technology in Africa, with the aim of supporting social, political, and economic integration on the continent. EO data and derived information has been identified as essential sources of information to support African food security policy frameworks (African Union Commission. 2019) such as the Comprehensive Africa Agriculture Development Program.
- The Intergovernmental Authority on Development (IGAD) Climate Prediction and Applications Centre (ICPAC)¹⁶ – The IGAD ICPAC delivers Climate Services to 11 East African Countries. The initiative aims to enhance the resilience of the region, which is deeply affected by climate extremes. In addition to climate services, the initiative also incorporates crop monitor services in its products. The crop monitor uses EO and ground data to monitor crop conditions in the region. The crop monitor services also integrate analysis of the agricultural landscapes, for example, related to the management of pests and adaptation strategies to climate change.

Overall, these policies highlight the need for EWS and risk reduction measures to improve drought preparedness and response. Additionally, they emphasize the importance of enhancing the resilience of vulnerable communities through sustainable water management, land use planning, and livelihood diversification.

Besides the national and regional policies, some global policies and initiatives are relevant for drought monitoring and food security assessment:

- Sendai Framework for Disaster Risk Reduction (2015-2030)¹⁷ - This global framework provides guidelines for reducing disaster risk and enhancing resilience, including drought management. The Sendai Framework explicitly addresses the use of EO and technologies in Priority for Action 1: Understanding Risk, at the national and local levels.
- United Nations Sustainable Development Goals (UN SDGs) – SDGs serve as a global reference point for addressing drought-related challenges, such as food insecurity, water scarcity, and climate resilience. EO data has been adapted for several indicators, especially those related to SDG 2 and 15 (Paganini et al. 2018).
- United Nations Framework Convention on Climate Change (UNFCCC)¹⁸: This international treaty aims to address and respond to the impacts of climate change, including the increased frequency and intensity of droughts.

¹⁵ <http://gmes.africa-union.org/>

¹⁶ <https://www.icpac.net/>

¹⁷ <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>

¹⁸ <https://unfccc.int/>

While past policies and programs have helped to address the impact of drought in Kenya and Africa, there is still a need to continue to develop and implement effective drought management strategies to ensure the sustainable use of resources and support the population, especially farmers, affected by drought. Also, there is a need to continually review the impacts of existing programs with the aim of bridging emerging gaps by developing tailored solutions aimed at ensuring the sustainability of the programs. Importantly, there is a need to align future national plans, policies, and initiatives with science-based evidence to ensure the successful implementation of drought management-related interventions.

3. Future policy needs

Besides the current policies, several policy needs must be addressed:

Climate change adaptation: As drought frequency and severity are likely to increase, new policies are needed to help communities adapt to changing climate and increasing number of extreme events. This includes measures such as crop diversification, water harvesting, and rainwater management.

- **Crop diversification:** Diversifying crop production can help farmers adapt to changing weather patterns and reduce their dependence on rain-fed agriculture. This can include the promotion of drought-tolerant crops, early maturing varieties and the development of irrigation systems to support crop production during dry periods.
- **Livestock management:** Drought can also have a severe impact on livestock, leading to the loss of grazing land and water sources. To mitigate this, policies can be implemented to support livestock herders, such as providing supplementary feed and water during drought periods.
- **Water harvesting:** Drought can lead to water scarcity for crop irrigation. Water harvesting techniques, such as rainwater harvesting, can be promoted to increase water availability for irrigation during dry periods.

Community engagement: The need to involve communities in developing and implementing drought-related policies and actions is highlighted in several documents. This can include community-based water management, participatory drought monitoring, and capacity-building programs. Integration of the community in drought monitoring facilitates the uptake of technologies/recommendations from the project findings.

Agronomic management: As droughts manifest varied impacts on different cropping systems, farmers will need to adopt technically suitable and feasible agronomic interventions for their contexts. Such measures include micro-irrigation, varying sowing dates, use of different varieties, adopting mulching, intercropping, and residue retention.

Monitoring and Early warning systems: Despite significant progress, there is still a need to strengthen monitoring and early warning systems.

4. Conclusion & Project Impact

Addressing agricultural drought in Kenya requires a multifaceted approach that focuses on long-term adaptation and sustainable management of resources. Effective policy interventions will require reliable and timely data on agronomic management and crop condition, which can be derived from multisource earth observation data.

ADM-Kenya aligns with the identified priorities and reviewed policies by developing innovative solutions and enhancing existing methods based on EO data. Our focus encompasses several key aspects that will contribute significantly to the country's efforts in monitoring the impacts of drought and supporting the activities related to implementation policies at both regional and national levels. Drought monitoring algorithms and data at local to national scales could be combined with the currently used data and improve drought risk management. By improving the resolution of remote sensing-based products, we enable more precise monitoring of drought conditions and crop status, facilitating better decision-making and targeted interventions for affected areas. Additionally, we will work on developing advanced methods for mapping cropping systems. These new products will provide information on management practices (e.g., irrigation, mixed cropping), ensuring that policymakers and stakeholders can access the detailed data when making decisions.

In addition, capacity building is one of our main objectives which is highlighted in several policies described above. As we seek to empower local communities and stakeholders, ADM-Kenya will provide them with the necessary knowledge, skills, and resources to effectively monitor the effects of drought with the use of multisource EO data. Tailored trainings and workshops will be conducted to enhance the capacity of individuals and organizations involved in drought management and policy making.

Overall, ADM-Kenya will contribute to implementing several activities that align with national and regional policies, ultimately strengthening the country's resilience to drought and supporting the agricultural sector.

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