World Geospatial Industry Council

AGFUND

GEOACTION AFRICA









"The role of geospatial information as foundational data acting as a lens to understand and mitigate the impact of our changing climate cannot be understated, especially in developing and emergent nations such as Africa."

Geospatial Information for Climate Resilience – What Does UN-GGIM Do? Discussion Paper, Ordnance Survey 2023



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Acknowledgment

Commercial capabilities are often underutilized and under-appreciated in many international and global governance mechanisms. Over the past few years, WGIC has played a crucial role in amplifying these capabilities by offering a consistent and clear voice to enhance communication and collaboration efforts.

Building on the successes of our members, we focus on establishing strong relationships to enhance global awareness of geospatial tools and services that support climate initiatives. WGIC is building on previous climate action efforts by demonstrating the societal and economic benefits of geospatial technologies through its GeoAction Africa initiative.

Our deepest gratitude goes to AGFUND and the team which selected WGIC as the recipient of the 2022 Prince Talal International Prize for Human Development. We also extend our thanks to the team that supports our progress.

This program would not be possible without the contributions of many organizations, including Connect AID, the Alliance for African Partnerships, and Michigan State University, whose tireless work with those impacted by climate change brings awareness and transformation to emerging nations.

We also appreciate the Global Marketing Insights team for market research and Novum Intelligence, our African media partner, for bringing the right contacts and exposure, ensuring quality inputs into our work.

We are grateful to WGIC members who dedicated their time and expertise to demonstrating the value of their geospatial capabilities through GeoAction Africa, with a focus on climate impacts in agriculture, smallholder farms, fisheries, and flood-related disaster resilience.

A special mention must be made of Barbara Ryan, former WGIC Executive Director, under whose leadership the project was launched. She has been a continuous guide and source of inspiration, ensuring the project's success.

Lastly, we express our gratitude to the over 200+ individual respondents who participated in the GeoAction Africa survey, as well as the 50 in-continent organizations that sponsored the survey and contributed valuable geospatial climate initiative case studies. These contributions demonstrated the current level of effort and focus on climate issues.

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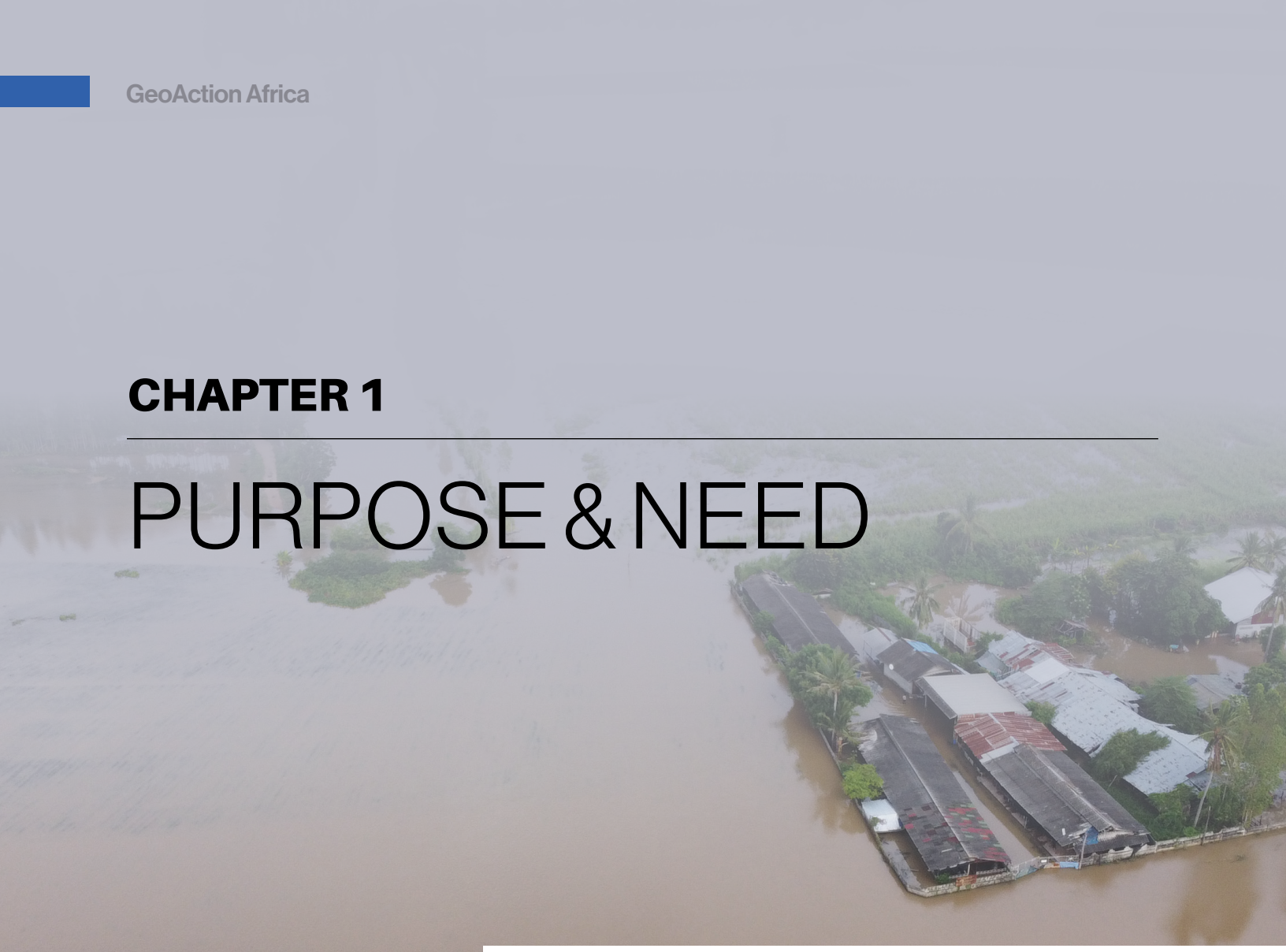
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CHAPTER 1

PURPOSE & NEED



> “Humanity has opened the gates of hell. Horrendous heat is having horrendous effects. Distraught farmers watching crops carried away by floods, sweltering temperatures spawning disease and thousands fleeing in fear as historic fires rage. Climate action is dwarfed by the scale of the challenge.”

António Guterres
Secretary General, the United Nations, at UN Climate Ambition Summit in New York, September 2023

Purpose & Need

From being a geographical phenomenon that could afford to be dismissed as an aberration even a decade ago, climate change has become a life-and-death phenomenon as the decade approaches its midway point. And nowhere are the effects of this trend experienced more disproportionately than in emerging nations.

The previous decade — 2011-2020 — was the warmest on record, with each of the preceding four decades warmer than any previous one since 1850. However, climate change is about more than rising temperatures. It brings droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms, and declining biodiversity.

These changes critically affect health, food security, housing, safety, and economic development. And, it leads to deaths. Africa is one of the most vulnerable regions globally.[1]

As the table below shows, approximately 250,000 lives could be lost each year in Africa in the three decades leading up to 2050, because of drought, malnutrition, malaria, and heat — primarily due to climate change.

The continent, in particular, faces staggering economic impacts from climate change, with consequences extending far beyond physical damage. This includes significant psychological consequences due to population displacement, and adverse lifestyle changes. As Africa urbanizes rapidly, the challenges become more pronounced.

TABLE 1: Climate-Related Impacts Africa

Climate-Related Impacts Africa	Years 1970 – 2019	Predictions by 2050
Population	**365,450,108[2] in 1970** **1.468 billion in 2023[3]**	**2.45 billion[4]**
Natural Disaster Events	**1,700+ Events[5]** Relative to 1970-1979, droughts and floods were three to tenfold more by 2010-2019 (growing from 34 to 100+ events per year)[6]	**Not Available –** (If the World Bank Group's Africa Pulse trend continues, climate-related events could reach thousands annually.)
Estimated Economic Loss (USD)	**38.5 billion total[5]** 37% of the economic loss is due to storms. Floods alone account for 34% of the loss	**50 billion[7]** Annual prediction
Lives Lost (majority occurring during the 1973 Ethiopia drought, and the 1981 and 1983 droughts in Mozambique and Sudan, respectively.)	**731,747** Droughts accounted for 95% of the lives lost[8]	+981,000 Additional 250,000 deaths per year from drought, malnutrition, malaria, and heat related to climate change[9]

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1. WMO: https://wmo.int/media/news/africa-suffers-disproportionately-from-climate-change
2. Macrotrends- https://www.macrotrends.net/countries/AFR/africa/population
3. Worldometer- https://www.worldometers.info/world-population/africa-population/
4. UN- https://www.un.org/en/desa/world-population-projected-reach-98-billion-2050-and-112-billion-2100#%3A~%3Atext%3DCOVID%2D19-
5. Statista - https://www.statista.com/statistics/1307451/number-of-climate-disasters-in-africa-by-country/
6. World Bank - https://openknowledge.worldbank.org/entities/publication/2293a0d4-8d89-566e-9628-e5cbd62c658d
7. WMO - https://wmo.int/news/media-centre/state-of-climate-africa-highlights-water-stress-and-hazards
8. WMO - https://wmo.int/media/news/weather-related-disasters-increase-over-past-50-years-causing-more-damage-fewer-deaths
9. WHO - https://www.afro.who.int/health-topics/climate-change

Urban flooding, for instance, is a critical issue across Africa, necessitating transformative change. Many cities struggle with infrastructure services that fail to keep pace with growing demand. Informal settlements, which now house over 50% of the population in many urban areas, lack access to safe and affordable food, water, and shelter.

These settlements are particularly vulnerable during extreme weather events due to inadequate sanitation, basic hygiene facilities, and steady and accessible potable water. Such deficiencies can lead to proliferation of vector- and water-borne diseases, further straining healthcare services, and complicating recuperation efforts.

Recognizing Challenges

The World Geospatial Industry Council (WGIC) recognizes the urgency of these challenges and is committed to leveraging geospatial technologies to mitigate climate-related impacts and urban enhance disaster resilience. WGIC members are uniquely equipped to help mitigate the effects of climate change on smallholder farms, and enhance urban disaster resilience against flooding through the application of advanced technology, financial support, and specialized training.

One of the key challenges lies in the oversight of climate change adaptation and its historical impacts in funding discussions, despite their proven cost-effectiveness, substantial contribution to long-term development goals, and sustainable impact.

GeoAction Africa is committed to changing this perspective and addressing the human impacts of both major and minor climate events. This program's primary focus is on flooding and agricultural devastation, with the aim to mitigate such challenges. Beyond these immediate concerns, the WGIC Partnership Ecosystem prioritizes advancing geospatial technologies for land, sea, and environmental monitoring in regions and among development agencies where the need is most acute.

WGIC members provide geospatial solutions in African countries in diverse areas. More than 50 current use cases were reviewed for this report, GeoAction Africa, focused on smallholder farms and disaster resilience flooding. These use cases demonstrate the unique ways geospatial data, tools and services are utilized, with each experience varying by country based on their specific and most urgent needs.

Another set of challenges that creates a hurdle in the way of wide use of geospatial data to mitigate climate change in Africa is country-to-country differences in legal systems and governing bodies, and partnership frameworks. The challenges further make hinder collaboration across borders. Additionally, few WGIC member companies have actual physical presence in Africa, and often conduct their businesses from a distance.



"We have the resources and capabilities to provide a greater amount of geospatial tools/services/solutions to mitigate the impacts of climate change and need pathways supported by the government in African countries that embrace geospatial programs. We have the capacity to help educate, provide [disaster] risk mitigation and recovery solutions, including land management programs and agricultural data and solutions. However, without government support it is slow going."

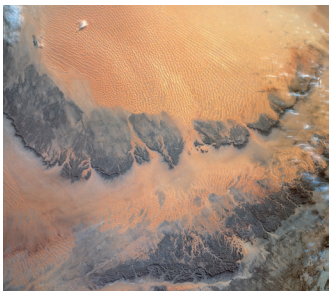
GIS Member, GeoAction Africa

Addressing Key Challenges

Financing

- Securing financing is crucial for acquiring and analyzing geospatial data, tools, and services to advance sustainable development goals (SDGs) across Africa. A shared vision and effective messaging are essential to convey the value of geospatial data, but without adequate funding, these efforts remain on paper.
- WGIC member organizations often have financial divisions and engage in Environment, Social, and Governance (ESG) initiatives. Capitalizing on these resources through Public-Private Partnerships (PPP) could accelerate the adoption of geospatial solutions in Africa.
- Establishing a collaborative financial system, potentially through partnerships with AGFUND, non-government organizations (NGOs), and government entities, would also enhance sustainable use of geospatial data across Africa.
- Utilizing geospatial information to mitigate the impacts of climatic disasters is crucial. Initiatives like advocating for a dedicated loss and damage fund for Africa at the United Nations Conferences of the Parties (COPs) underscore the value of geospatial tools in reducing associated costs.





Training

- Training and workforce development programs at the local level need to be established and executed in collaboration with WGIC members, alongside other NGOs and educational organizations. Several organizations, including the SDG Data Alliance and various universities, conduct workshops aimed at enhancing stakeholder engagement, and are eager to join forces with WGIC to broaden the reach of these initiatives across the continent.
- Besides, WGIC member organizations can contribute by offering internship positions to trained professionals in the continent to serve as facilitators for these training sessions. These geospatial training programs should target not only field personnel but also government officials and other decision-makers.





WGIC Partnership Ecosystem

The World Geospatial Industry Council is concerned about the increasing threats of climate change. Our focus ensure that key policy messages are delivered to impact sectors affected by climate change, and to demonstrate the current and emerging capabilities of space-based monitoring of greenhouse gases (GHGs) worldwide.

FIGURE 1:
Geospatial Data and Maps in Disaster Management



Preparedness
- Resource inventory
- Data fitness
- Evacuation planning
- Communications planning
- Needs assessment

Recovery & Rehabilitations
- Spatial planning
- Infrastructure
- Housing
- Livelihood

Prevention & Mitigation
- Scientific hazard analysis
- Simulation and modelling
- Vulnerability analysis
- Risk assessment & mapping
- Stock assessment

Relief
- Search and rescue
- Rubble and debris removal
- Logistics
- Delivery of relief supplies
- Prioriting actions

Response
- Common operations picture
- Crisis maps
- Information communication
- Evacuation and shelters
- Early damage assessment
- Coordination

Prediction & Warming
- Modelling
- Forecasting
- Early Warning
- Scenario identification

Geospatial Climate Data, Sensors, Tools, Services and Solutions Offerings from WGIC Member Organizations

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To deliver on this goal, WGIC collaborated with the Group on Earth Observations (GEO) and Climate TRACE on the report *GHG Monitoring from Space*[10] in 2021 to lay the groundwork for enhanced contributions to the Global Stocktake (GST) under the Paris Agreement. Among the policy messages reported, one was: "New opportunities are arising for analyzing remote sensing measurements with frontier IT technologies which call for further and continued transparency and capacity development.[11]

WGIC is diving deeper into supporting climate change mitigation efforts with a focus on the African continent as the most vulnerable to its impact.

Given the twin trends of rapid urbanization and the prevalence of informal settlements, flood mortality risk is soaring in sub-Saharan Africa. These factors amplify the risk of recurrent floods and pose significant challenges to urban resilience and rural agricultural areas.

The agricultural sector faces increased vulnerability to climate change, which becomes concerning given its crucial role in the African economy. Agriculture contributes approximately 60-70%[12] to the continent's total export value and accounts for about 23-25% of its GDP.[13] However, agriculture in Africa is among the least efficient globally, making it susceptible to extreme weather events.

10 GHG Monitoring from Space - WGIC, GEO, Climate TRACE
https://wgicouncil.org/wp-content/uploads/2023/10/WGIC-Policy-Report-2021-03-GHG-Report.pdf

11 The Role of Systematic Earth Observations in the Global Stocktake - UNFCC
https://unfccc.int/sites/default/files/resource/202203012343_SO_in_GST_2022_final.pdf

12. https://africaupclose.wilsoncenter.org/women-smallholder-farmers/

13. https://tradingeconomics.com/country-list/gdp?continent=africa

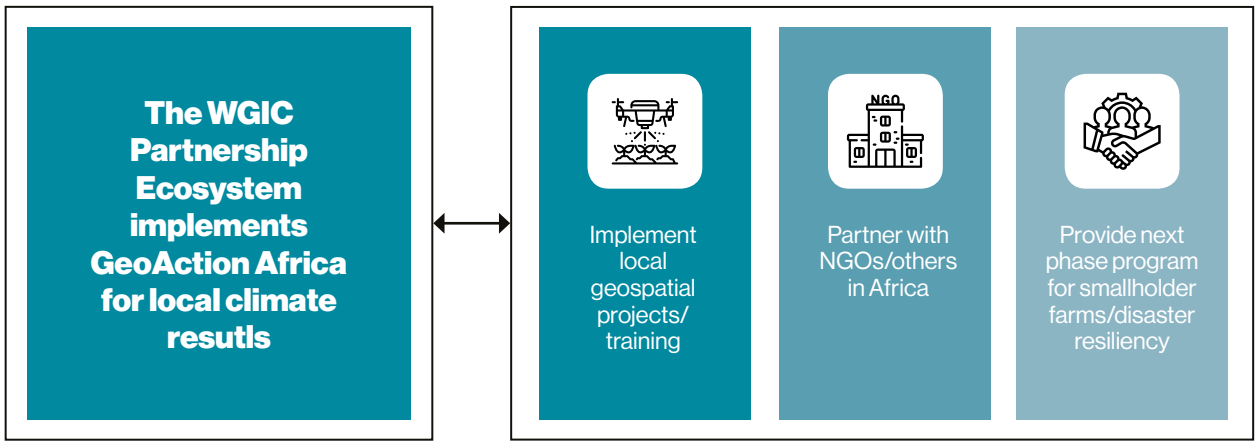
The economy of Sub-Saharan African nations relies heavily on rain-fed agriculture, predominantly managed by smallholder farms engaged in small-scale, subsistence farming practices. **These farmers are at the forefront of climate impacts, underscoring the urgent need for adaptive strategies and resilient agricultural practices.**[14]

Unmet Expectations

There are hundreds of widely used geospatial inputs and over 71 climate-based organizations in Africa. The region is overrun with climate assistance websites, tools, financing links, and different geospatial resources, etc. It's clear there is a need and high value placed on geospatial resources.

With over 200 African survey respondents (comprising 100+ hours of personal interviews), the GeoAction Africa message is made clear by a respondent "There is too much confusion about this thing called 'geospatial' at the upper and local levels of government and NGOs, and too many confusing geospatial resources with 'nothing' reaching the local farmer level that they can understand and implement."

FIGURE 2. **WGIC-AGFUND GeoAction and Beyond**



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14. Mckinsey - https://www.mckinsey.com/industries/agriculture/our-insights/winning-in-africas-agricultural-market

Expectations from WGIC

The WGIC Partnership Ecosystem requires monitoring of progress and milestones, along with a clear timeline, to ensure effective implementation of partnership initiatives. Establishing clear timelines, addressing both short-term and long-term objectives, is essential for initiating and evaluating the initiative's impact. Well-equipped for the task, WGIC is focused on tracking financial commitments, auditing funds usage, and measuring the return on investment to effectively demonstrate the initiative's benefits.

The Alliance for African Partnership (AAP), in collaboration with WGIC and Michigan State University, can influence government policies and lead climate change initiatives. While AAP is not solely focused on geospatial information, this partnership has the potential to enhance collaboration between the commercial geospatial sector and academia, driving geospatial solutions to mitigate the impacts of climate change across Africa.

Climate change adaptation initiatives in the past have seldom been identified as potential activities to be funded despite their proven cost-effectiveness,[15] contribution to long-term development objectives, and the sustainable nature of the impact.

GeoAction Africa is committed to helping change this narrative. Whether these climate change impacts are manifested through flooding and agricultural environmental devastation (the focus of this program), biodiversity loss and migration, disease outbreaks and human migration, the WGIC Partnership Ecosystem is dedicated to deploying its land, ocean and atmospheric monitoring geospatial technologies to help the countries most in need.

The Next Steps

WGIC and the Arab Gulf Program for Development (AGFUND) will collaborate on the following initiatives:



Implementing WGIC Partnership Ecosystem Capabilities

- Manage, execute, and report on climate initiative geospatial projects.
- Establish consistent geospatial/Earth Observation project management and reporting mechanisms to support AGFUND's SDG goals.
- Engage policymakers to highlight risk mitigation and poverty reduction benefits of successful geospatial projects.



Developing Geospatial Stories

- Create impactful outreach materials highlighting the success stories of AGFUND's Geospatial SDG/Climate Initiative projects.
- Develop and share deliverables for African respondents based on GeoAction Africa inputs.



Supporting African Initiatives

- Organize specialized workshops and forums at African industry conferences, emphasizing access to commercial sensors, data, tools, and expertise.
- Offer continued support through Geospatial Africa Public Private Partnership how-to guides.
- Provide successful geospatial climate initiative use cases at African meetings, workshops, forums, and conferences.
- Ensure convenient access to our NGO partners, including the Alliance for African Partnerships, Novum Intelligence, One Acre, IFAD, Connect AID, Climact, and our members with local distribution capabilities.



Advocacy and Outreach

- Promote the WGIC Partnership Ecosystem message at future COP events, prioritizing geospatial solutions for Africa's challenges in disaster resilience, water scarcity, flooding, and agriculture (smallholder farms, fisheries, and resilient cities).
- Highlight continued development and provisioning of geospatial sensors and data, alongside further digital infrastructure development with hardware, software tools, and training. This ensures GeoAction Africa progress towards environmentally sustainable development.

15. https://www.climatepolicyinitiative.org/publication/state-and-trends-in-climate-adaptation-finance-2023/

GeoAction Africa Respondents Speak Out on Geospatial Needs for Climate Initiative



Without local governments and stakeholders understanding the value of geospatial tools, data, and analysis, progress will be limited. Help us educate them.



Local partners are essential for business success. Engage with and train them in each country.



You can't focus on smart cities without addressing basic needs like clean water. We must start with fundamental solutions to today's local problems and work towards future goals.



We have satellite, aerial, and terrestrial data available for climate change applications in Africa, but much of it is outdated. Accessing the most up-to-date data requires funding. Governments and other stakeholders must support this effort, or the lack of recent data will undermine geospatial initiatives and their effectiveness.



We don't need more assessments. What's needed now is funding for in-country geospatial tools and training to empower individuals to take action on the ground.



Africa's fragmentation by country makes it difficult to scale geo-businesses. We must have in-country teams to effectively deliver global solutions.



Focus on water scarcity, floods and agriculture. We must prioritize this and climate actions will follow.

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CHAPTER 2

EXECUTIVE SUMMARY

> “We need a unified geospatial voice across all African countries to ensure the value of geospatial capabilities is heard and understood. A single, clear message—**‘geospatial tools reduce poverty and save lives’**—will drive government impact and advance climate awareness.”
>
> **WGIC 2023 GeoAction Africa Respondent**

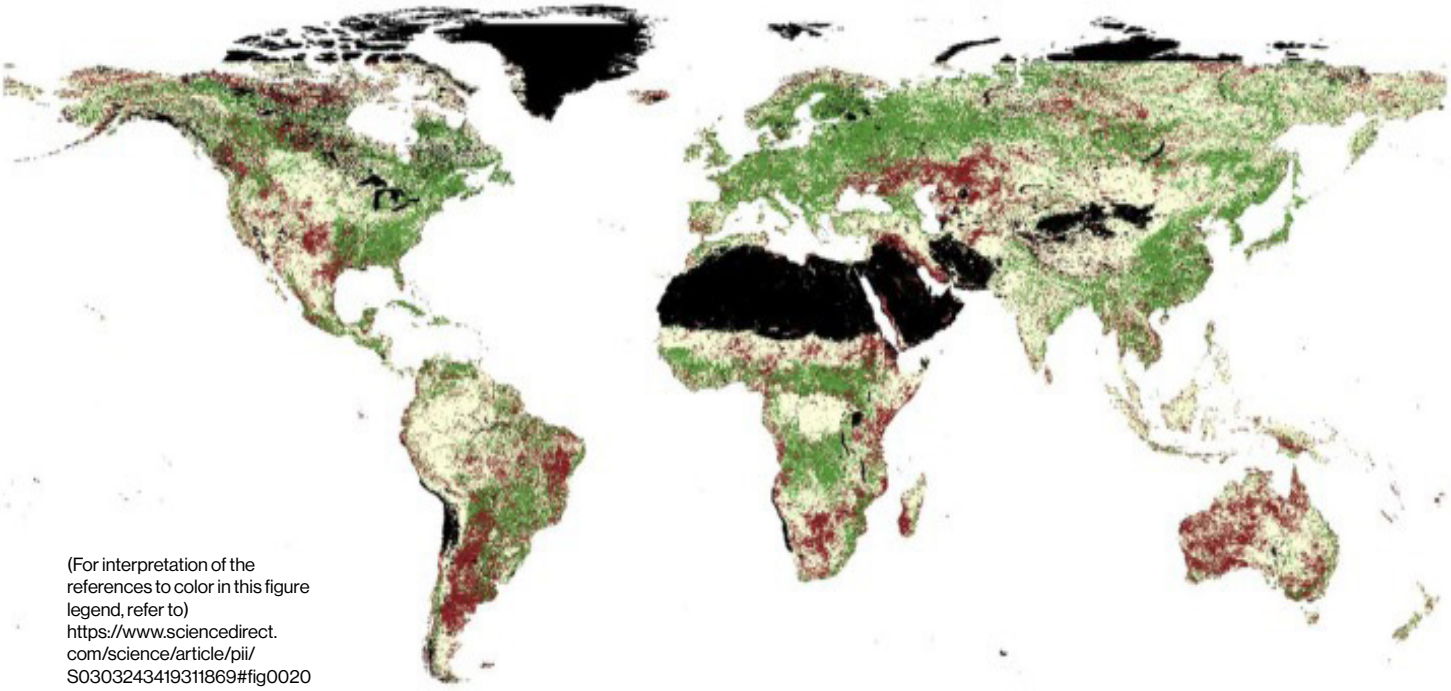
Executive Summary

While African nations are among the most vulnerable to climate change impacts, the narrative around their role in climate action has often been underrepresented. It's time to change this perspective and showcase Africa as a continent at the forefront of implementing Sustainable Development Goals (SDGs) for climate action, as also bring to light the role played by the dedicated community of scientists, academics, and professionals utilizing Earth Observation and geospatial technologies to drive this transformation and combat climate change.

A comprehensive geospatial story based on robust data is essential to accurately portray this shift.

A quantitative study was conducted to understand the range of geospatial offerings and projects currently underway, complemented by qualitative conversations and narratives capturing real-life impacts. These insights reveal Africa's proactive approach and innovative solutions in climate action, collectively representing GeoAction Africa.

FIGURE 3. Global Model of Land Degradation for SDG15.3.1 showing degraded (red), stable (yellow), improved (green) or no data (black) areas



(For interpretation of the references to color in this figure legend, refer to) https://www.sciencedirect.com/science/article/pii/S0303243419311869#fig0020

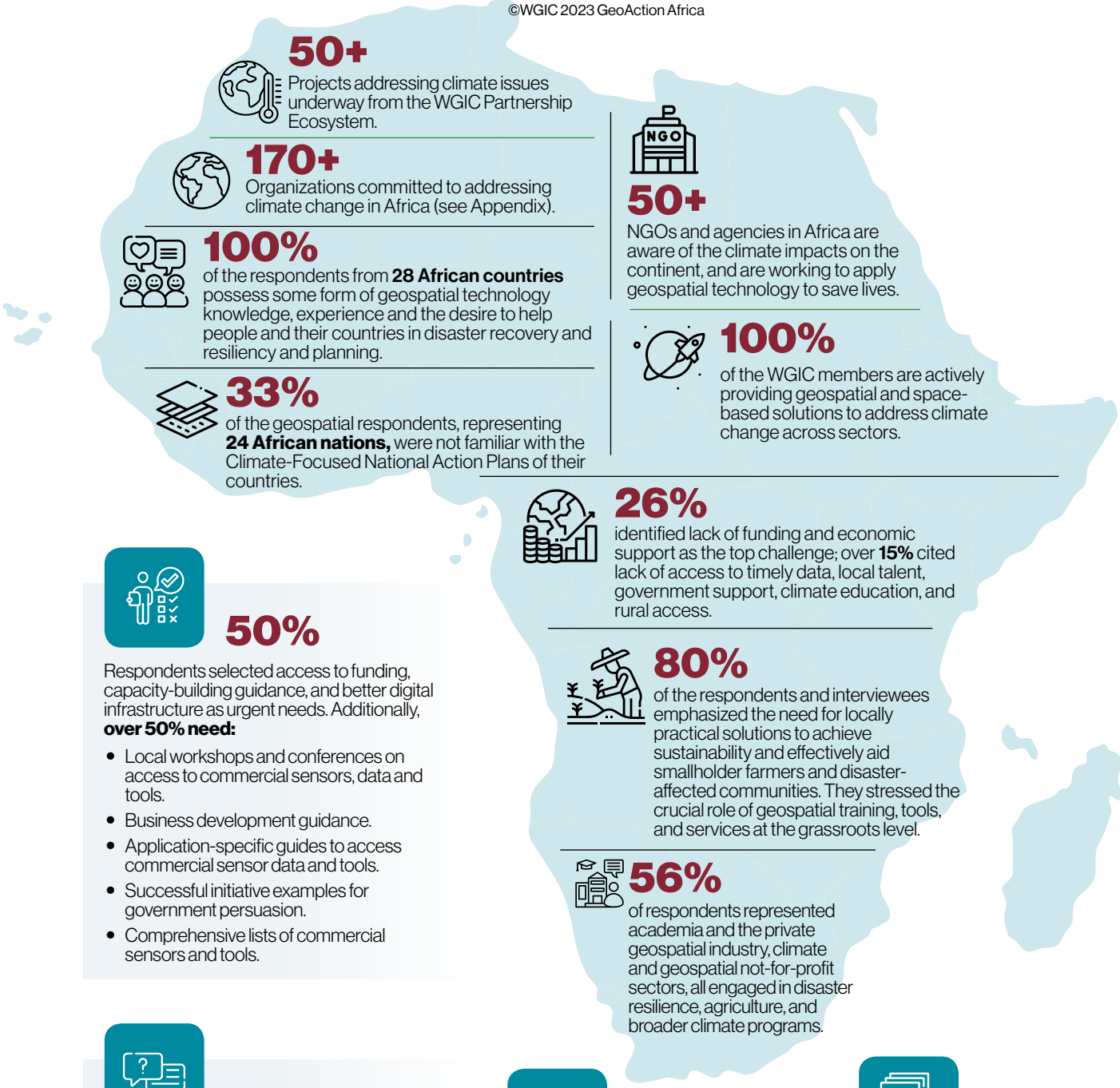
Data gleaned from 127 geospatial survey respondents (77.2% of them residing and working in Africa) and 92 interview respondents (66% of whom live and work in the continent) across 28 countries makes it clear that Africa is severely impacted by the global climate crisis. It is, however, equally evident that the continent is rich in talent and intellect, and is poised to tackle these challenges through the applied science of geospatial technology.

Additional geospatial climate initiative knowledge bases and prior works were reviewed to develop insights through literature reviews of academic writing on climate change in Africa. These sources were discovered by directly working with over 50 resources from African universities, funding organizations, online media, space-based associations, geospatial African news sources, and online searches.

GeoAction Africa provides and verifies insights many in the global space and geospatial technology profession have long recognized. It also highlights the capabilities available today to address and help address current geospatial climate challenges.

GeoAction Africa Key Insights

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50+
Projects addressing climate issues underway from the WGIC Partnership Ecosystem.

170+
Organizations committed to addressing climate change in Africa (see Appendix).

100%
of the respondents from **28 African countries** possess some form of geospatial technology knowledge, experience and the desire to help people and their countries in disaster recovery and resiliency and planning.

33%
of the geospatial respondents, representing **24 African nations,** were not familiar with the Climate-Focused National Action Plans of their countries.

50+
NGOs and agencies in Africa are aware of the climate impacts on the continent, and are working to apply geospatial technology to save lives.

100%
of the WGIC members are actively providing geospatial and space-based solutions to address climate change across sectors.

26%
identified lack of funding and economic support as the top challenge; over **15%** cited lack of access to timely data, local talent, government support, climate education, and rural access.

80%
of the respondents and interviewees emphasized the need for locally practical solutions to achieve sustainability and effectively aid smallholder farmers and disaster-affected communities. They stressed the crucial role of geospatial training, tools, and services at the grassroots level.

56%
of respondents represented academia and the private geospatial industry, climate and geospatial not-for-profit sectors, all engaged in disaster resilience, agriculture, and broader climate programs.

50%

Respondents selected access to funding, capacity-building guidance, and better digital infrastructure as urgent needs. Additionally, **over 50% need:**

- Local workshops and conferences on access to commercial sensors, data and tools.
- Business development guidance.
- Application-specific guides to access commercial sensor data and tools.
- Successful initiative examples for government persuasion.
- Comprehensive lists of commercial sensors and tools.

100%

GeoAction Africa respondents — both qualitative (interviews) and quantitative (survey) — were in geospatial and climate professions, with 80% holding advanced degrees.

44%

Respondents, representing government and NGOs, are using geospatial solutions for disaster resilience, including flooding and agriculture (smallholder farms), as well as broader climate and natural resource programs.

42%

Respondents stated that often policymakers do not understand the power of geospatial technology, which, when implemented, would help the continent solve issues related to poverty, flooding and smallholder farms' needs.

For more information, see Chapter 4: Datasets

GeoAction Africa Key Insights

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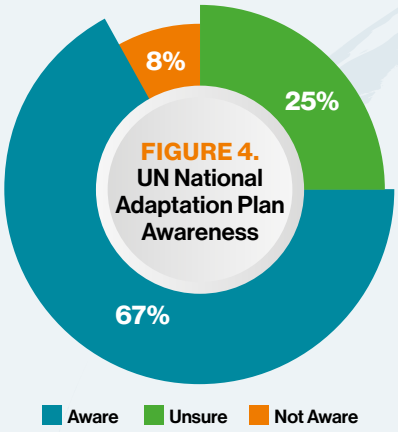


FIGURE 4. UN National Adaptation Plan Awareness

Awareness

67% of the respondents indicated awareness of their countries' National Adaptation Plan (NAP). Conversely, 8% reported being unaware, while 25% expressed uncertainty regarding their awareness levels.

Perception

Among respondents familiar with their country's NAP, 44.5% identified Agriculture and Land Use/ Land Cover as the primary focus. A small percentage (4.4%) indicated their belief that these plans encompass sustainable development initiatives aimed at uplifting marginalized populations and addressing gender vulnerabilities.

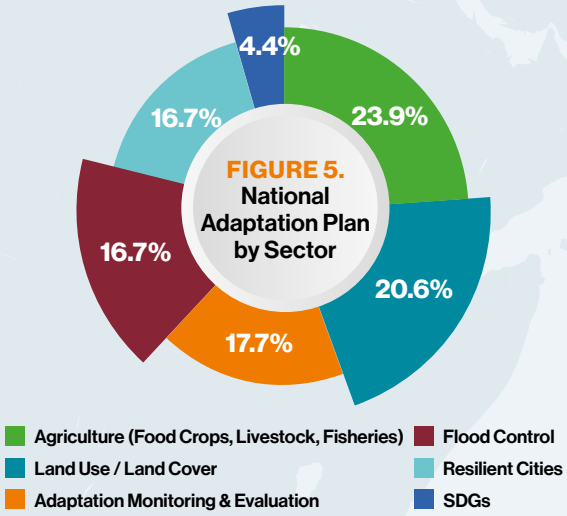


FIGURE 5. National Adaptation Plan by Sector

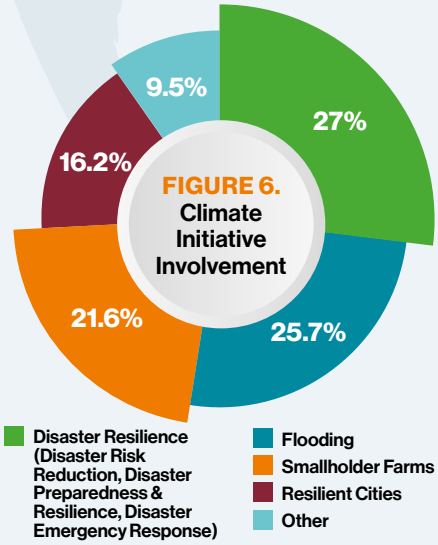


FIGURE 6. Climate Initiative Involvement

Climate Initiative Involvement

Disaster Resilience and Flooding were chosen by 52.7% of respondents, while 21.6% highlighted Smallholder Farms. When 'Resilient Cities' is included in these categories, it reaches a total of 68.9%, underscoring the significance of these issues to survey participants.

The African geospatial community is expanding despite financial challenges. Continuous education for government officials on the value of geospatial tech in flood planning and agriculture is crucial.

There are numerous geospatial events, and partnerships with global geospatial and space companies are on the rise in Africa.

Case studies from 22 countries, some of which do not have National Adaptation Plans, show disaster resilience in flooding and smallholder farm programs is growing despite limited funding and government support.

The geospatial industry in Africa is growing, despite financial challenges, with more regional cooperation. It's important to help policymakers understand how geospatial tools can improve infrastructure and environmental management for lasting progress.

> "Whether I know of the NAPs or not, climate change is real and impacting my family and my country daily."
>
> **WGIC 2023 GeoAction Africa Respondent**

CHAPTER 3

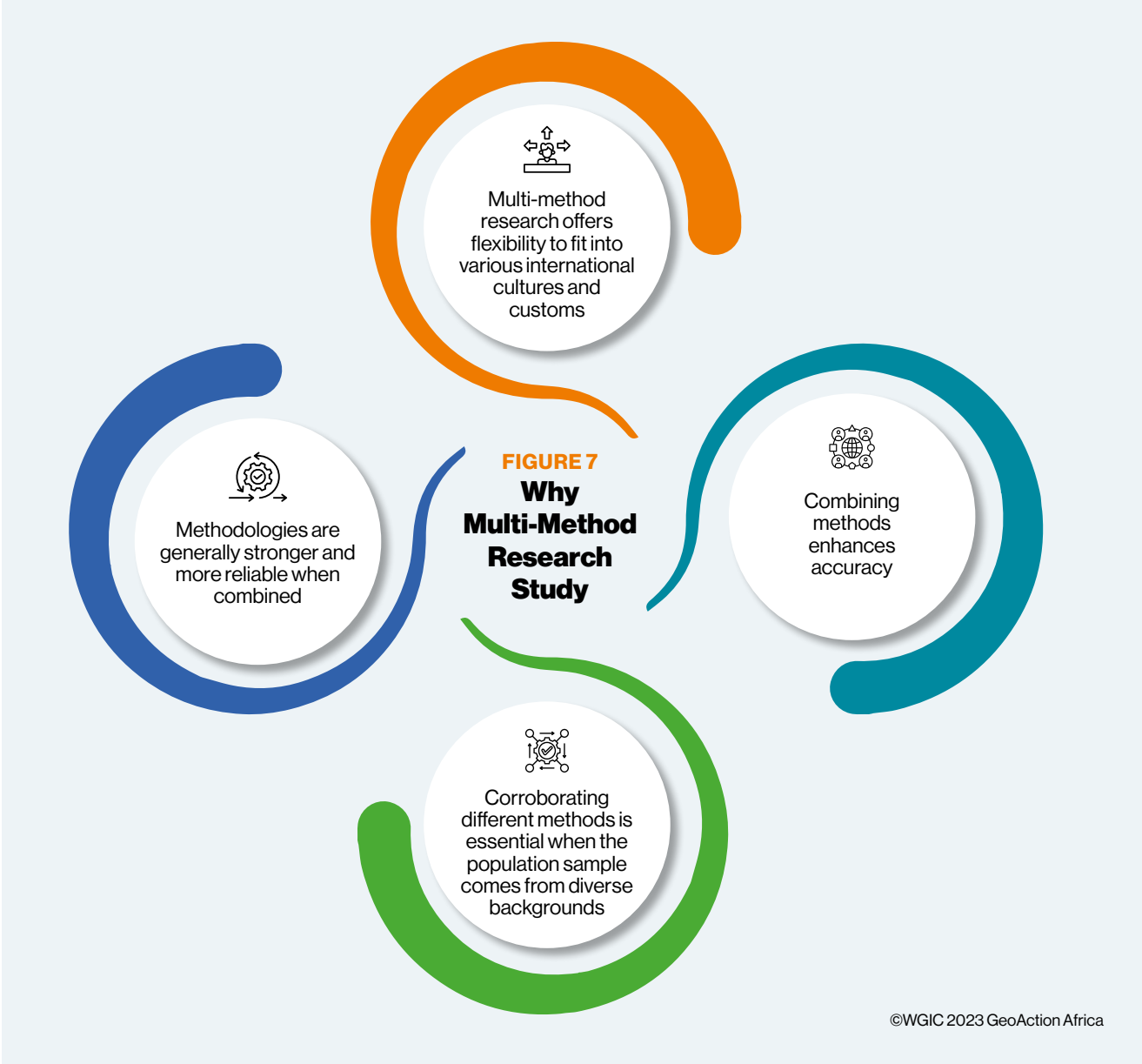
RESEARCH METHODOLOGY AND DATASETS

> “Climate change acts as a risk multiplier, amplifying the intensity of extreme weather events, increasing unpredictability and exacerbating vulnerabilities. Africa is one of the most vulnerable regions in the world to climate change.”
>
> **Global Center on Adaptation**

Research Methodology & Datasets

The research strategy and techniques employed by GeoAction Africa systematically examine pressing concerns affecting the continent. Our goal is to ensure the integrity and reliability of our findings, contributing to a more robust and ethical study of Africa's challenges and solutions in geospatial applications for climate adaptation and resilience.

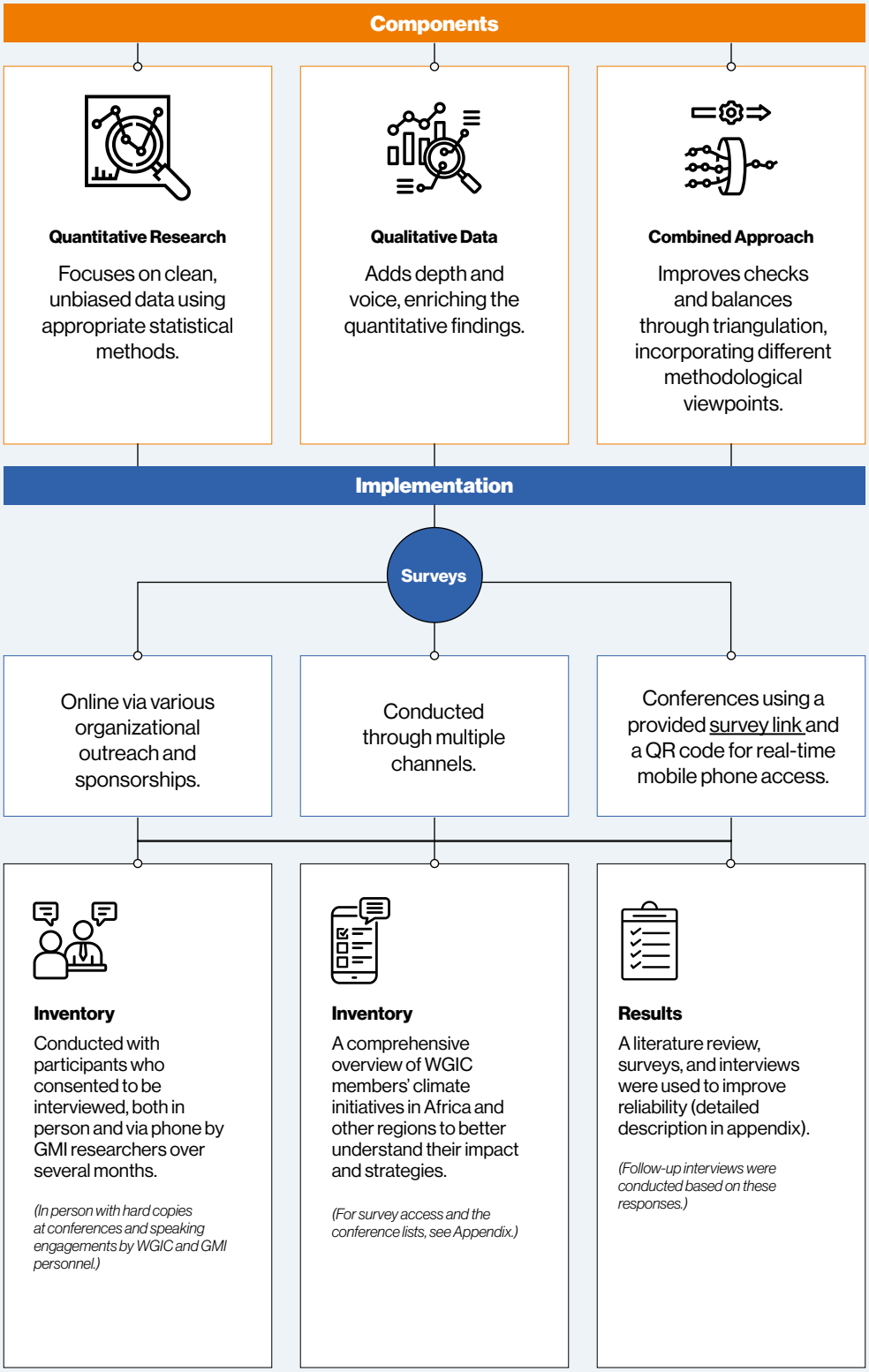
The observations in this study are based on a multi-method research style, utilized by combining qualitative and quantitative research with formal literature review and in situ evidence.



Multi-method research aims to minimize biases and add detail in survey reporting, enhancing overall study accuracy. The goal of quantitative research was to achieve valid statistical sample and keep the data "clean" and unbiased, and then validate the quantitative statistical data with qualitative data inputs for added meaning and richer descriptions and inputs.

The study methodology consists of several parts; As illustrated by the following chart.

Study Methodology



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Analysis of National Adaptation Plans and Geospatial Infrastructure

As of 2023, 17 National Adaptation Plans (NAPs) have been submitted to the United Nations by African countries. Each plan was examined in detail to determine its long-term goals, references to Disaster Resilience Flooding and/or Smallholder Farms, and the use of GIS, geospatial, and Earth Observation technologies (see Appendix).

Additionally, non-UN NAPs from five other countries were reviewed to develop suggestions for future adoption and expansion mechanisms, addressing not only Disaster Resilience Flooding and Smallholder Farms but also other climate-related issues (see Appendix).

Detailed analysis of commercial Earth Observation and geospatial capabilities was conducted to assess their application for climate action across all 17 NAP countries. The analysis included satellite ownership, Earth Observation capabilities (manned, unmanned, and terrestrial), geospatial data and services. (see Appendix).

Various use cases were evaluated to understand the use of geospatial infrastructure and Earth Observation in climate action, listing those specific to Africa and including at least one example for each country with a submitted NAP (see Appendix).

About the Respondents

Professional Insights

The quantitative survey engaged a highly professional group of respondents, with 44% holding CEO or Founder positions and 46.5% technical or program/project managers.

Among the qualitative interviews (Table 2), executives, comprising 28.4% of total respondents, showed strong interest in leading climate initiatives within their organizations. Technical personnel (making up 29.6% of the interviewees) were prominent in driving climate solutions and service offerings. Combining both qualitative and quantitative results, responses from executives and technical leaders consistently emerged as the top two categories.



TABLE 2: Professional Positions

Respondents Position Levels	Quantitative Survey Respondents*	Qualitative Survey Respondents*	Combined Survey Respondents
Executive	29%	28.4%	28.7%
Program/Project Managers	21.3%	25%	23.2%
Technical	25.2%	29.6%	27.4%
Founder	15%	6.8%	10.9%
Business	7.9%	10.2%	9%
Financial	1.6%	0%	0.8%

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Sector Insights

The analysis included a balanced representation of governments, NGOs, and the private geospatial industry.

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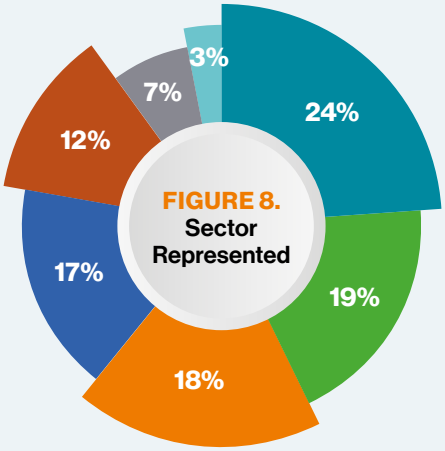


FIGURE 8. Sector Represented

Academic Background

The 92 interviewees in the qualitative survey were knowledgeable in geospatial technologies, space and remote sensing, and climate studies, with Bachelors, Master's, Doctoral, and/or Post-Doctoral degrees.

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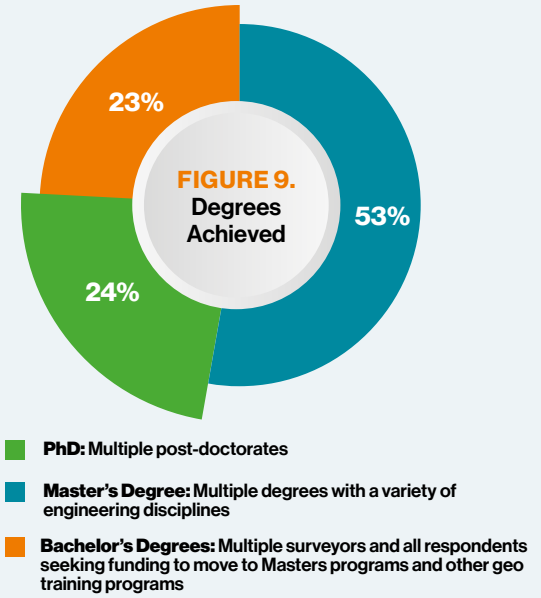
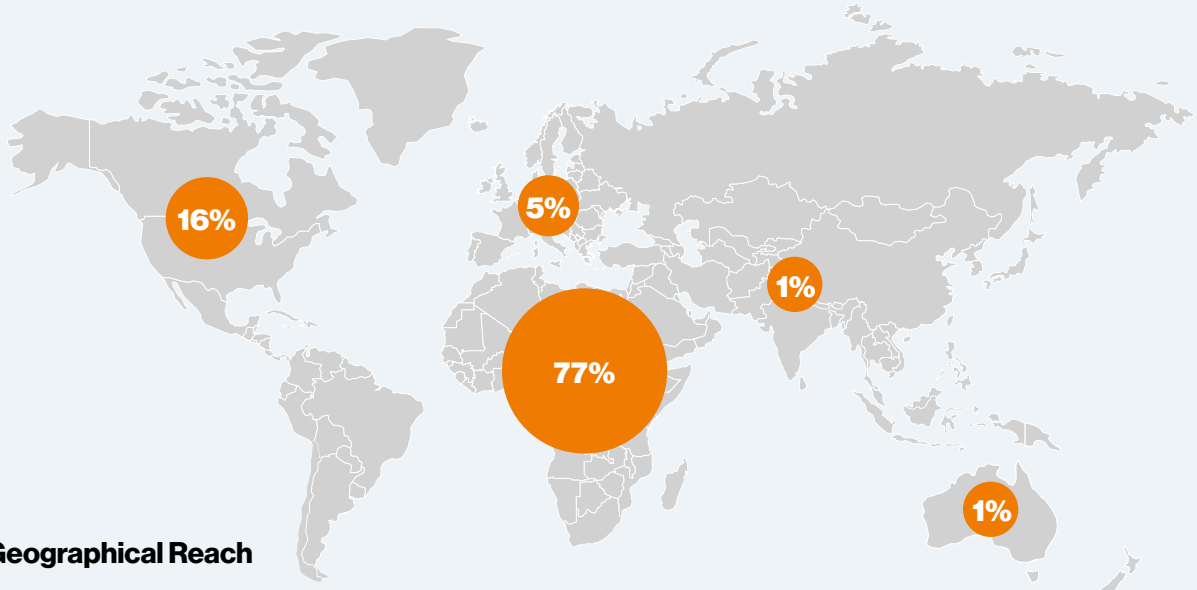


FIGURE 9. Degrees Achieved

FIGURE 10. Respondents by Continent

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Geographical Reach

Of the total respondents, 77% lived and worked in Africa, while the remaining respondents had direct working relationships in Africa but reside on other continents.

End User

Respondents from Africa primarily utilized space-based commercial sensors and GIS software/tools, notably Landsat and Sentinel imagery, accessible through platforms such as Africa GeoPortal and Digital Earth Africa. Terrestrial sensors and government-provided data from space, terrestrial, and aerial sources were also commonly cited.

Aerial-based sensors, particularly for aerial photos, were frequently mentioned in the 'Other' category, with over 40% of interviewees expressing concerns about date timelines and procurement cycles, and the reliance on outdated aerial photos spanning up to 30-40 years.

Additionally, respondents identified various datasets and tools essential for addressing challenges related to Smallholder Farms (SHF), Disaster Resilience Flooding (DRF), and climate related issues across multiple geospatial applications. These included agricutural data, python libraries, BIM software, soil information from NASA, environmental degradation maps from NOAA. Access to robust platforms and scalable data-sharing methods were also highlighted.

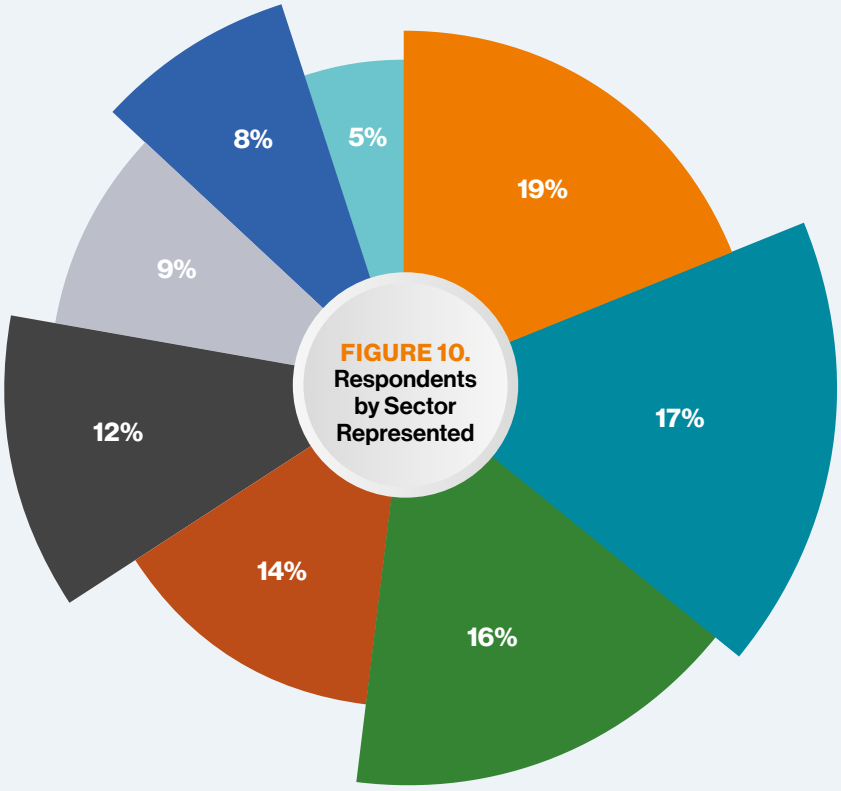


FIGURE 10. Respondents by Sector Represented

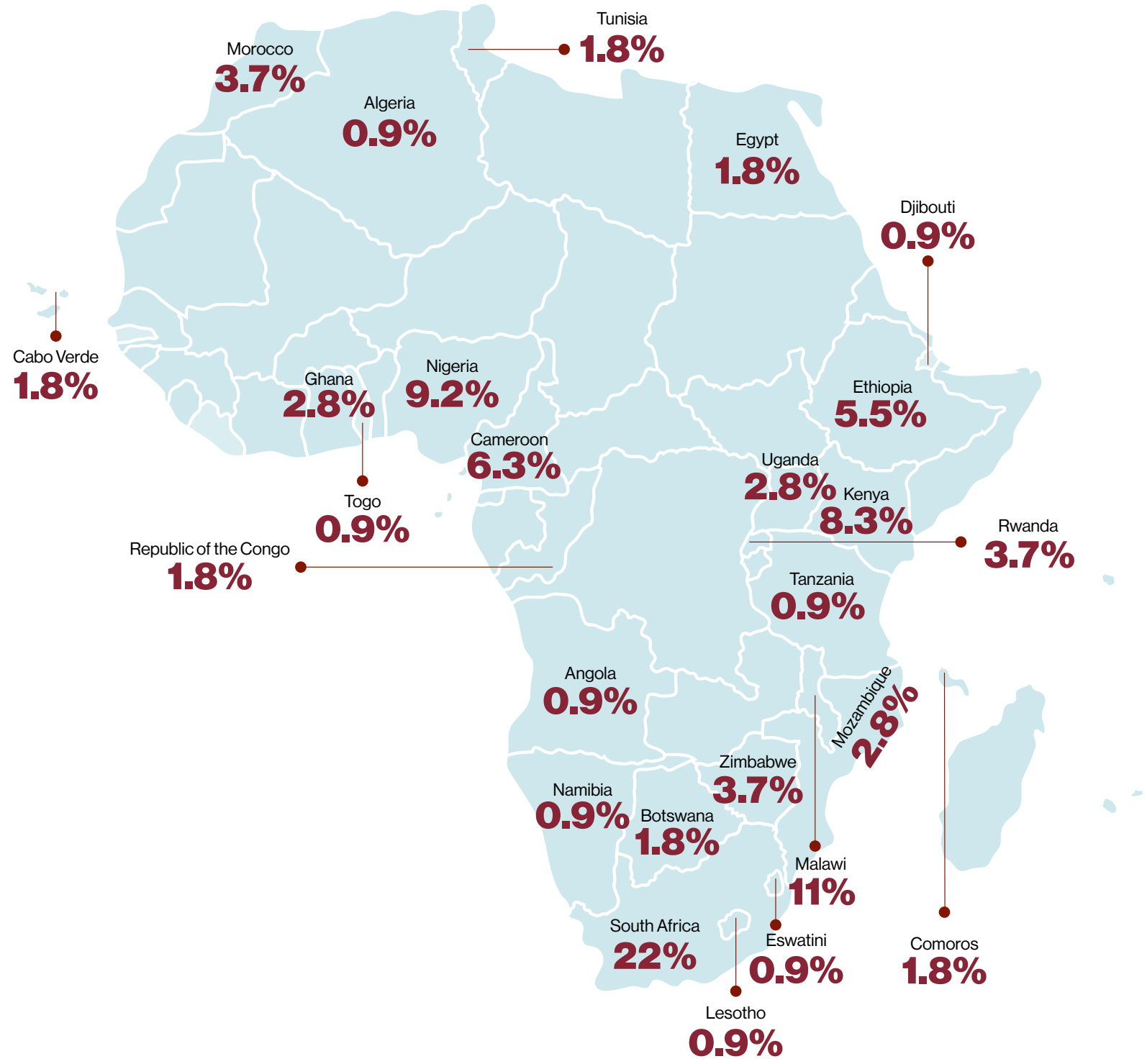
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- GIS software/tools and products
- Space-based commercial sensors: Earth Observation, weather, chemical, aerosols, etc.
- Government provided sensor data: Space, aerial, terrestrial etc.
- Terrestrial sensors: Earth Observation, weather, chemical, aerosols, etc.
- Aerial Sensors: Earth Observation, weather, chemical, aerosols, etc.
- Drone
- Other
- None

FIGURE 12. African Respondents by Country

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(Sierra Leone and Benin represented in the qualitative interviews for a total of 28 African countries)



42% of the African respondents said their policymakers do not understand the power of geospatial technologies, which when implemented, would help the continent solve issues related to poverty, flooding and smallholder farmer needs.

> "In addition to lack of understanding about geospatial technologies, there is lack of funding and economic support from the governments."
>
> **WGIC 2023 GeoAction Africa Respondent**

33% of the geospatial respondents, representing 24 African countries, were not familiar with the climate focused National Adaptation Plans of their countries.

> "Climate change is real, and the impacts are visible in our environment, and on our families and communities every day."
>
> **WGIC 2023 GeoAction Africa Respondent**





CHAPTER 4

KEY APPLICATION AREAS

> “Smallholder farmers and poor rural people bear the brunt of climate change and the degradation of natural resources. Extreme weather events, such as droughts, storms, and floods, are putting pressure on the ecosystems that farmers depend on, as are gradual processes such as rising sea levels and melting glaciers.”

International Fund for Agriculture Development

Key Application Areas: Transforming Agriculture and Urban Resilience

Geospatial technologies are game-changers for understanding climate and environmental challenges. Their unique ability to capture, analyze, and visualize data empowers informed decision-making and strategic planning. By integrating these insights into climate adaptation and resilience strategies, stakeholders gain a clearer picture of vulnerabilities. This allows for proactive measures to mitigate risks, predict future impacts, and address both immediate needs and long-term sustainability goals. Greater investment in smallholder agriculture could enable many countries to improve productivity and reduce poverty.

GeoAction Africa Focus Areas

Agriculture, with a specific emphasis on supporting smallholder farms (SHF). While the definition of "smallholder farm" can vary — ranging from 2 to 10 hectares — these typically family-run operations are prevalent across Africa. It also includes fisheries, livestock, and pastoral land. African smallholder farms tend to be on the small end of this range.

Disaster resilience, with a focus on flood mitigation and development of smart cities. .









Agriculture Smallholder Farms (SHF)

In Africa, agriculture is a major economic component, contributing around 25% of the Gross Domestic Product and predominantly consisting of smallholder farms. Despite accounting for only about 12% of the world's farmland, these smallholder farms contribute to 70% of Africa's food.[16] Between 60% and 70% of the population in sub-Saharan Africa is engaged in smallholder farming, contributing 23% to 25% of the region's GDP.[17] In Africa, there are an estimated 33 million smallholder farms and with greater investment in smallholder agriculture, many countries have the potential to increase food production and reduce poverty.[18]

Smallholder fisheries account for 46% of global marine and inland fish catches, rising to 54% in developing countries.[16] Climate change poses threats to livestock production, affecting feed crop quality, water availability, animal health, milk production, diseases, reproduction, and biodiversity, compounded by greenhouse gas emissions impacting climate change.

Table 3 presents the GDP of various African countries (with National Adaptation Plan Countries highlighted in bold) alongside the available climate impact data.

16. IFAD - https://www.ifad.org/thefieldreport/
17. ClimateMakers - https://www.theclimakers.org/wp/wp-content/uploads/2022/10/TCM-Stories-from-the-Field-Special-Edition-Africa-2022.pdf
18. WorldWeatherAttribution.org - https://www.worldweatherattribution.org/wp-content/uploads/Nigeriafloods_scientific-report.pdf

TABLE 3: GDP of Various African Countries Alongside the Available Climate Impact Data

African Countries (National Adaptation Plan countries in bold)	GDP in 2022 (USD Billion)	Climate Impact (Damages estimated in USD Billion from deaths, affected populations, and economic losses due to reported events such as floods, storms, droughts, wildfires, and landslides)
Algeria	192	-
Angola	107	-
Benin	**17.40**	**-**
Botswana	20.35	-
Burkina Faso	**18.88**	**-**
Burundi	3.07	-
Cameroon	**44.34**	**1.05**
Cabo Verde	**2.31**	**-**
Central African Republic	**2.38**	**-**
Chad	**12.7**	**-**
Comoros	1.24	-
Cote d'Ivoire	70.02	-
Democratic Republic of the Congo	**58.07**	**-**
Djibouti	3.52	-
Egypt	477	-
Equatorial Guinea	11.80	-
Eritrea	3.80	-
Eswatini	4.20	-
Ethiopia	**127**	**0.64**
Gabon	21.07	-
Gambia	2.27	-
Ghana	72.84	-
Guinea	21.23	-
Guinea-Bissau	1.63	-
Kenya	**113**	**.64**
Lesotho	2.55	-
Liberia	4	-
Libya	45.75	-
Madagascar	**14.95**	**-**
Malawi	13.16	-
Mali	18.83	1.05
Mauritania	N.A.	-
Mauritius	12.90	-
Morocco	134	-
Mozambique	17.85	-
Namibia	4.6	-
Niger	**13.97**	**1.05**
Nigeria	477	1.05
Republic of the Congo	14.62	-
Rwanda	13.31	-
Sao Tome and Principe	0.53	-
Senegal	27.68	-
Seychelles	1.59	-
Sierra Leone	**3.97**	**-**
Somalia	8.13	0.64
South Africa	**407**	**3.5**
South Sudan	**7.87**	**-**
Sudan	**51.66**	**-**
Tanzania	74.71	-
Togo	**8.13**	**-**
Tunisia	46.66	-
Uganda	45.56	-
Zambia	29.78	-
Zimbabwe	20.68	-
NAPs GDP Total	**907.63**	**6.88**
Pan Africa Total	**2,980.1**	**8.5**
Ag - Small Holder Farms Component of GDP (25%)	**745.025**	

Source: GDP data: https://tradingeconomics.com/country-list/gdp?continent=africa
Source: https://wmo.int/news/media-centre/africa-faces-disproportionate-burden-from-climate-change-and-adaptation-costs

Seven Key Characteristics of African SHF

(As identified by One Acre Fund, an African NGO)

1. **Smallholder farming is often rain-fed,** meaning the only source of water comes from natural rainfall with little to no irrigation available.

2. **Small farms depend predominantly on family labor,** although they may hire outside when resources allow.

3. **Smallholder farmers produce relatively small total food volumes** on small plots of land compared to large or commercial-scale farmers.

4. **SHFs produce primarily for local consumption,** but commodities such as maize, macadamia, and avocado can find their way into the export market.

5. **SHFs generally have fewer resources and technology** as compared to commercial-scale farmers. For example, they might till their land by hand instead of tractors.

6. **Smallholder farms are often considered part of the informal economy** — their livelihoods depend on the natural resource base and informal networks to access markets.

7. **Smallholder farmers are more vulnerable** to climate-related and market price fluctuations.

Major Challenges Faced by SHFs

Access to Finance

Limited access to affordable agricultural financing prevents farmers from purchasing essential planting supplies like seeds and fertilizer. This often delays planting at the critical onset of the rainy season, which is vital for rain-fed agriculture. As a result, farms fail to reach their production potential, jeopardizing already strained food security, nutrition, and livelihoods.

Understanding Climate Change

Farmers prioritize improving crop yields to sustain their livelihoods. Once they understand how geospatial resources can enhance their practices, they become more receptive to learning about climate change and adapting accordingly. Climate change significantly impacts smallholder farms, altering growing conditions, making production unpredictable, and exacerbating environmental degradation.

Market Access

Smallholder farmers often struggle to access reliable and fair markets due to their remote locations. High transportation costs and inadequate storage facilities make it difficult to get produce to market promptly after harvest, further complicating their ability to sell at fair prices.

Using Geospatial Data in Support of SHFs

Many local farmers remain skeptical or unaware of the benefits of geospatial technologies. According to a cartographer from Zimbabwe Statistics Agency approximately 80% of such farmers cling to outdated practices due to overwhelming frequency of "confusing messages", while less than 20% are adopting modern techniques using geospatial and global data for "better yield and success". This slow progress highlights the need for a unified, validated geospatial approach.

Despite the abundance of geospatial resources and climate-based organizations in Africa, confusion persists at both governmental and local levels. The GeoAction Africa initiative reveals that many resources do not effectively reach or assist local farmers. WGIC and its partners aim to bridge this gap through Last Mile Geospatial Partnerships, tailored to address local challenges faced by smallholder farms, particularly those impacted by flooding and drought.

WGIC's approach involves providing comprehensive solutions through:

- **Financing/Crop Insurance/Carbon Credit Management:** Many WGIC members already have financial divisions as part of their corporate structure, and several have ESG (Environment, Social, and Governance) initiatives that could be used to fund projects in innovative sustainable funding frameworks. The development of a collaborative financial commitment by AGFUND and WGIC would move financing options to the local SHF level with the use of geospatial capabilities in Africa. This commitment could be enhanced through last-mile partnerships with the WGIC Partnership Ecosystem and its current relationships with NGOs, local government entities, and land planning commissions.
- **Training:** Training and workforce development programs in many areas are developed but need to be driven to the SHF local field level through last mile partnerships and would be sponsored by WGIC, in collaboration with other NGOs and educational organizations. Numerous organizations such as the SDG Data Alliance already offer workshops that increase stakeholder engagement. Interns hired by WGIC member organizations, who are already trained professionals, will also act as facilitators for the training sessions.

The WGIC Partnership Ecosystem, in collaboration with AGFUND and Africa consortium partners, will advance geospatial knowledge for smallholder farms to achieve Sustainable Development Goals (SDGs).

Disaster Resilience, Flooding, Smart Cities (DRF)

Africa, the second most flood-affected continent after Asia, experiences extensive damage, high casualty rates, and frequent occurrences.[19] The West African region, in particular, faces heavy rains from June to early October, leading to widespread flooding across much of Sub-Saharan Africa.[20] In the past decade, floods have surpassed droughts in terms of the number of people affected across the continent.

Although detailed annual data on climate-related hazards can be scarce, the following table (Table 4) provides an overview of major impact areas by region.

While data collection on climate-related hazards may be inconsistent, data in Table 4 reveals a significant increase in the number of people impacted across Africa during the 2021-2022 period, showing an alarming rise of 219.3% compared to the previous decade. This increase in impact is consistent with the growing frequency of extreme weather events as global temperatures rise. Although many Africans still live in rural areas, the continent is undergoing rapid urbanization, with the urban population projected to grow from 548 million in 2018 to approximately 1.5 billion by 2050.[21]

Urban flooding is an increasingly critical issue in the continent, particularly in coastal cities where extreme floods annually damage houses, roads, communication infrastructure, motorways, and bridges. These floods also elevate the risk of water-borne diseases, such as cholera, due to inadequate sanitation and hygiene in displaced communities.[22]

19. https://www.worldweatherattribution.org/wp-content/uploads/Nigeriafloods_scientific-report.pdf
20. Wiley Online Library - https://onlinelibrary.wiley.com/doi/epdf/10.1111/jfr3.12612
21. UN - https://population.un.org/wup/
22. https://reliefweb.int/report/cote-divoire/frequent-flooding-african-coastal-cities-demands-holistic-recovery-pathways

TABLE 4: Climate-Related Impacts Africa By Region Yearly Averages

Climate-Related Impacts in Africa – Yearly Averages (from storms, droughts, wildfires, floods, landslides)	Persons Impacted 2011-2020 (from deaths, injuries, and in need of food, water, shelter, and medical attention)	Persons Impacted 2021-2022 (from deaths, injuries, and in need of food, water, shelter, and medical attention)	% Change In 2 Years Over Prior 10 Year Time Frame
Eastern Africa	8,574,000	33,411,000	+289.7%
Western Africa	5,244,000	4,856,000	-7.4%
Northern Africa	1,300,000	1,455,000	+11.9%
Central Africa	1,083,000	2,950,000	+172.4%
Southern Africa	966,000	12,140,000	+1,156%
Total	**17,167,000**	**54,812,000**	**+219.3%**

Source: EM-DAT data Africa January 1, 2011 – December 31, 2022 Note: only when data was available by region.

Geospatial Tools For Flood Resilience

WGIC members have intensified their efforts in Africa as disasters become increasingly frequent and varied. The definition of disaster has broadened to include not only natural calamities such as droughts, heatwaves, and wildfires but also geophysical events such as volcanoes, earthquakes, and tsunamis; hydrological incidents like floods; meteorological phenomena, including storms, cyclones, and monsoons; and biological outbreaks such as epidemics, and insect infestations.

Governments, NGOs, donor communities, and humanitarian organizations are showing growing interest in understanding and enhancing disaster resilience in Africa. This focus is part of a long-term strategy to mitigate the impact and devastation caused by these diverse and increasingly frequent disasters.

Despite contributing only 4% of global carbon emissions, two-thirds of the continent's cities are at extreme risk from climate-related shocks. This vulnerability is heightened by limited economic development, inadequate infrastructure, and weak institutional structures.[23]

As African cities expand rapidly, urban infrastructure often fails to keep up, especially in informal settlements where more than 50% of city populations reside. These areas typically lack reliable, safe, or affordable basic services.[23] The WGIC community includes many members dedicated to implementing Disaster Resilient Smart City strategies, with a significant focus on ensuring access to clean water. Without clean water, business operations, ecosystems, and community health systems face serious threats.

The International Institute for Management Development currently recognizes five African cities as global leaders in smart city development: Cairo (Egypt), Algiers (Algeria), Cape Town (South Africa), Rabat (Morocco), and Tunis (Tunisia). The high rankings reflect the cities' efforts in enhancing the climate resilience of their urban populations. Apart from this, cities such as Abidjan (Ivory Coast), Dakar (Senegal), and Oranjemund (Namibia) are initiating transformations to accelerate the implementation of the Sustainable Development Goals (SDGs).[24] Other cities are expected to follow.

WGIC members are actively supporting this trend towards smart city development by providing a range of geospatial solutions. These include tools and services for smart agriculture, strategic planning and development, Building Information Modeling, Digital Twin software, models, and tools, as well as comprehensive data and equipment.

23. https://www.wri.org/wri-africa/creating-thriving-resilient-cities-africa
24. https://www.afrik21.africa/en/africa-rabat-tunis-and-cairo-among-the-worlds-best-smart-cities/

Three Key Challenges Cities Face in Disaster Resilience



Access to Finance and Quality Inputs

The World Bank estimates that Sub-Saharan Africa will require between US $15 billion and $16 billion from 2010 to 2050 to adapt to climate change and enhance resilience to disasters.[25] To address this need, African organizations are supporting Regional Economic Communities (RECs) by developing policies, sharing information, and promoting mutual learning, training, and capacity building. This regional integration aims to streamline access to financing, which in turn supports further training and capacity development efforts.



Climate Change

The increasing frequency and intensity of weather events and natural disasters over recent decades have jeopardized socio-economic progress. As a result, organizations and governments are enhancing their disaster response strategies and fostering regional coordination, as weather patterns do not adhere to national boundaries. It is also recognized that the risks and impacts of climate-induced hazards are unevenly distributed across different sectors of society.[26] Informal settlements in urban areas are particularly vulnerable during extreme weather events due to inadequate sanitation, hygiene facilities, and access to potable water. This deficiency can lead to the proliferation of water-borne diseases, placing additional strain on health services and recovery efforts.



Market Access

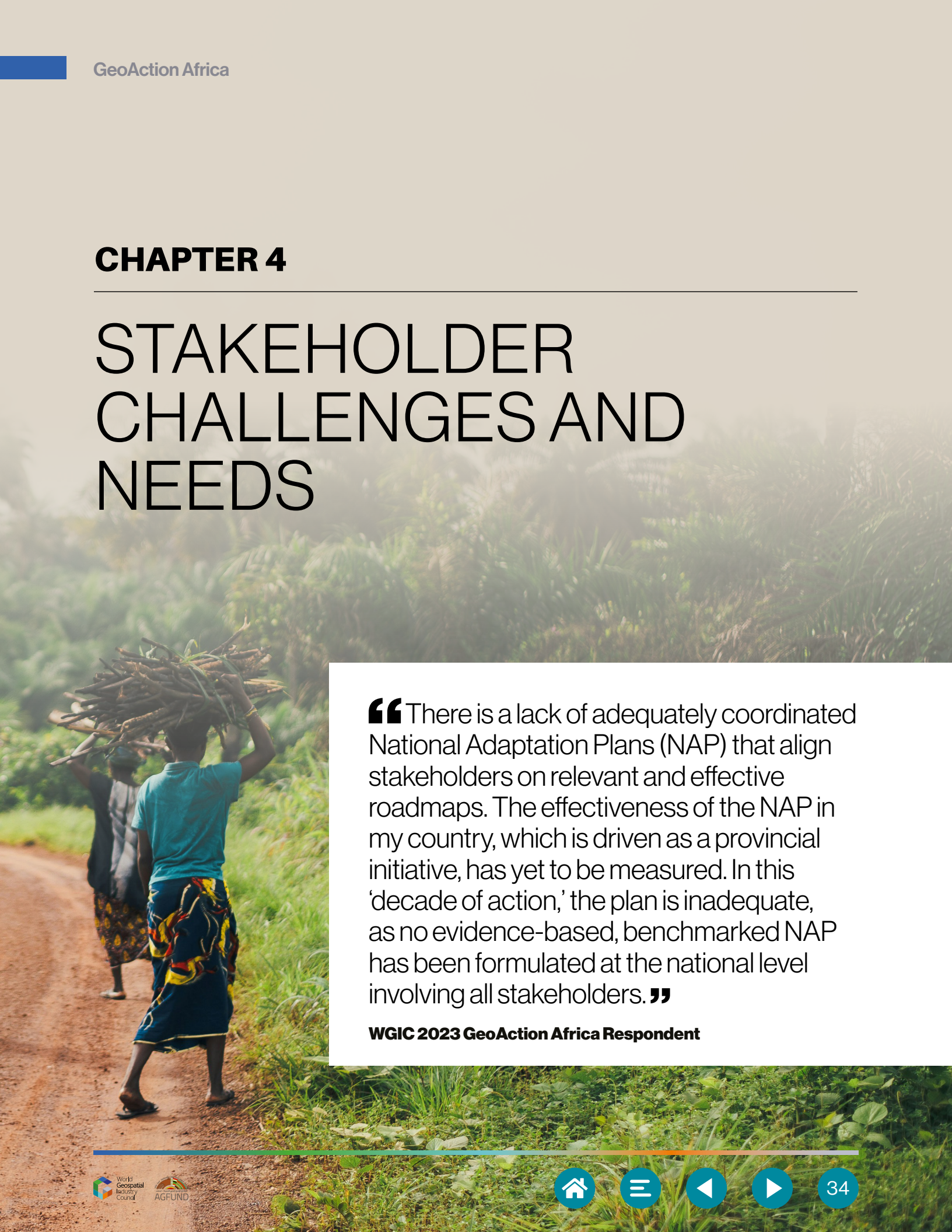
Developing disaster-resilient cities often requires intervention from large international institutions, and NGOs, and guarantees from these entities to secure private funding. In many cases, public funding alone is insufficient, making Public-Private Partnerships a viable approach to achieve disaster resilience goals.

> “Support local efforts with practical training and geospatial tools, and ensure the message reaches political and governing bodies. Local training is crucial for long-term resilience.”
>
> **WGIC 2023 GeoAction Africa Respondents**

25. World Bank 2021: Towards Disaster Resilience in Sub-Saharan Africa: Building Regional Capacity for Coordination, Planning and Policy Advice in Disaster Risk Management https://www.gfdrr.org/en/publication/towards-disaster-resilience-sub-saharan-africa-building-regional-capacity-planning-and
26. GFDRR, World Bank Group: ECOWAS Disaster Risk Reduction Gender Strategy and Action Plan 2020 -2030 - https://www.gfdrr.org/sites/default/files/publication/ECOWAS%20GSAP_EN_Final.pdf

CHAPTER 4

STAKEHOLDER CHALLENGES AND NEEDS



> “There is a lack of adequately coordinated National Adaptation Plans (NAP) that align stakeholders on relevant and effective roadmaps. The effectiveness of the NAP in my country, which is driven as a provincial initiative, has yet to be measured. In this ‘decade of action,’ the plan is inadequate, as no evidence-based, benchmarked NAP has been formulated at the national level involving all stakeholders.”

WGIC 2023 GeoAction Africa Respondent

Stakeholder Challenges and Needs

In implementing climate initiatives across Africa, stakeholders face several significant challenges. Key issues identified include inadequate financing, lack of coordination, limited access to critical data and technology, and insufficient government understanding of geospatial technologies.

There were 127 respondents to the formal quantitative GeoAction Africa survey, and 92 respondents were personally interviewed, who discussed their challenges and needs related to climate initiatives.

Access to funding was cited most frequently, followed closely by an almost equal split between lack of access to data and insufficient resources in terms of talent and technology. Notably, a close fourth was the lack of government understanding regarding the positive impacts of geospatial tools on climate change.

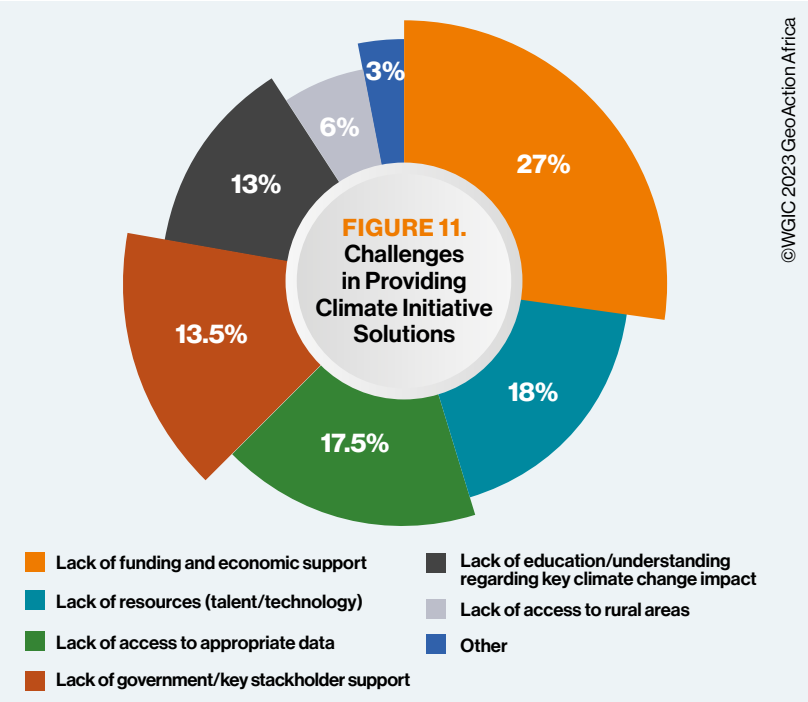


FIGURE 11. Challenges in Providing Climate Initiative Solutions

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Interview respondents and survey participants cited similar challenges, emphasizing the need for enhanced training, education, and collaboration between the government and the geospatial community. This collaboration is crucial to recognize the importance of and to secure funding for water and food resource management, including Smallholder Farms, Disaster Resiliency Flooding, and Smart City applications.

Respondents' needs addressed by the geospatial community include:

- Provision of funding
- Capacity-building guidance and training
- Improved access to digital infrastructure

Interestingly, both respondents and WGIC members consistently highlighted the robust geospatial education and high-level talent availability in Africa. However, they also pointed out a significant gap in local workers' geospatial skills training, which must be addressed through apprenticeship programs and education.

TABLE 5: Challenges to Geospatial Climate Action

Qualitative Interviews – Top Challenges - Climate Initiatives Africa	Respondents %
Industry and govt don't work together: Lack of trust, interest and communication to demonstrate to the public why climate initiatives are important	39%
Govt lacks knowledge of value regarding geospatial technologies: Lack of understanding about geospatial tools and technologies, and climate approaches, or how they can reduce poverty and have economic, personal, and lifesaving impacts	31%
Funding and open access to data: were tied	22% [each]
Other: Lack of digital infrastructure, skills to do work, and time	36%

Need for Tools and Services

The most common response was access to funding, followed by the need for capacity-building guidance and improved access to digital infrastructure. Respondents also emphasized the importance of business development guidance, access to best practices, and successful use-case examples of climate initiatives.

In the 'Other' category, respondents highlighted specific needs, including:

- Specific business opportunities related to climate initiatives and monetization strategies.
- Cultural challenges related to perceptions of wealth and emissions, such as attitudes towards meat consumption versus alternative diets.
- Overcoming cultural barriers to transparency, with concerns about perceived barriers to change and sustainable business development focusing on issues like SHF and DRF.
- Free access to geospatial tools and water infrastructure engineering data.

Qualitative interview respondents echoed the needs identified in the quantitative survey, offering multiple solutions to address them. More than half the respondents highlighted the urgent need for accessible geospatial tools and government support.

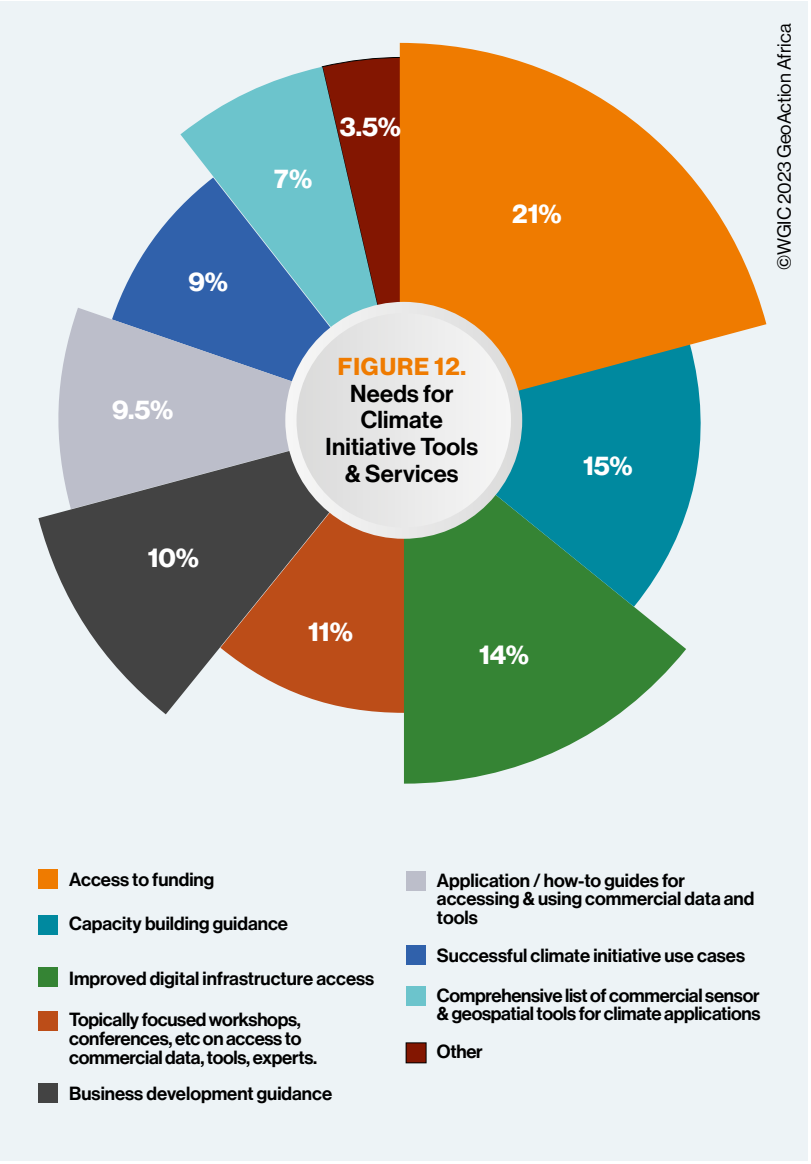


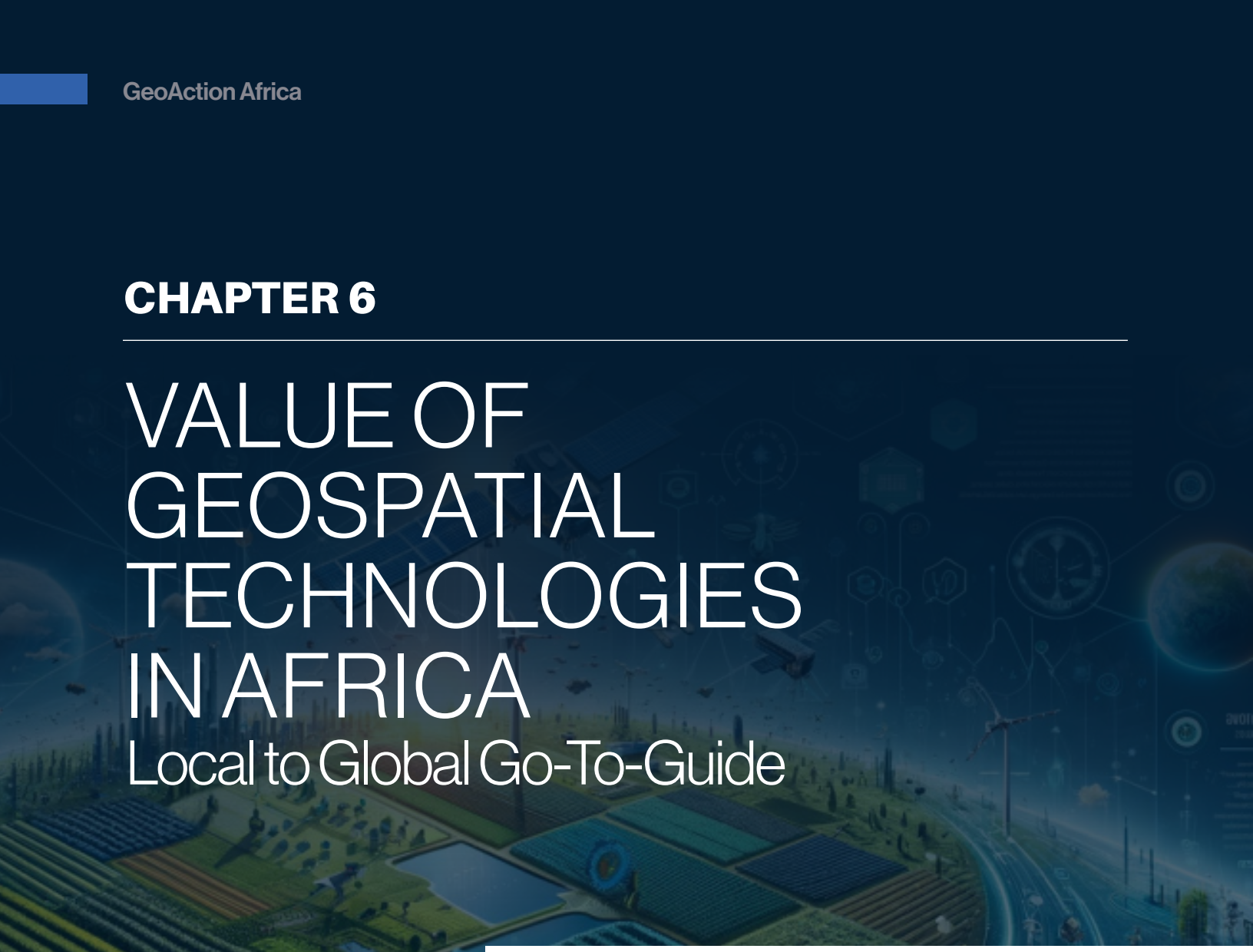
TABLE 6: Needs for Geospatial Climate Action

Qualitative Respondents' Needs for Climate Action Initiatives In Africa	Respondents
Funding	**37%**
Government Support: Training is needed for understanding geospatial data and its role in reducing poverty	**34%**
Access to Data	**23%**
Other: Capacity development, training, insurance coverage, time, one continental government agency to address climate impacts with funding for all countries	**52%**

CHAPTER 6

VALUE OF GEOSPATIAL TECHNOLOGIES IN AFRICA

Local to Global Go-To-Guide



> “Please inform investors that African geospatial groups, companies, and national agencies are fully capable of advancing climate tools but require additional funding and government support. Without this, the WGIC GeoAction Africa report risks becoming just another report with no real impact on those addressing climate issues daily in Africa.”
>
> **WGIC GeoAction Africa 2023 Respondent**

Value of Geospatial Technologies in Africa: Local to Global Go-To-Guide

The WGIC Partnership Ecosystem offers a broad array of geospatial data, tools, solutions, and services, which were used to develop this knowledge-based guide.

Smallholder Farms

The WGIC Partnership Ecosystem also provides a wide range of geospatial tools and solutions specifically designed to address the needs of smallholder farms. These tools help enhance climate resilience through geospatially enabled Climate-Smart Agriculture (see Appendix). As the world strives to combat climate change, agriculture is a key area for adaptation and mitigation efforts. Climate-Smart Agriculture (CSA) aims to make agricultural systems more resistant to the effects of global warming. Precision agriculture platforms, also attempting to boost farm efficiency and productivity with little environmental impact, have contributed to the widespread adoption of Climate-Smart Agriculture.[27]

CSA is a comprehensive strategy to manage farmlands, crops, livestock, and forests that counteracts the negative impacts of climate change on agricultural productivity.

Main Objectives of CSA

Productivity
By enhancing crop and livestock production and farm profitability, the comprehensive strategy works to raise overall agricultural productivity, and provide greater food security.

Adaptation
The farming strategy fortifies agricultural infrastructure against the destructive effects of global warming and minimizes susceptibility to climate-related threats like floods, droughts, or extreme heat.

Mitigation
One primary goals is to reduce the amount of greenhouse gases released into the atmosphere because of farming activities, including methane emissions from livestock, rice cultivation, and synthetic fertilizer use.[27]

The three pillars of Climate-Smart Agriculture are interconnected. Taking this into account, Climate-Smart Agriculture promotes combining traditional and contemporary knowledge and geospatial technologies to create agricultural practices that are resilient and resistant to global warming effects. Typically, farmers who adopt Climate-Smart Agriculture practices see a rise in income while also helping to combat climate change and strengthen global food security.

27. Climate Smart Agriculture, EOS - https://eos.com/blog/climate-smart-agriculture/

Farmers in developing countries face challenges adopting geospatial technology for Climate-Smart Agriculture. These practices require strong support and promotion from governments and NGOs. The WGIC Partnership Ecosystem is well-positioned to develop the necessary capabilities.



Building Climate-Resilient Agriculture

Cultivating Climate-Resilient Crop Varieties: Growing crops that are more resistant to temperature and precipitation extremes can help farmers mitigate the impact of global warming on crop production. With agricultural expansion into unfavorable locations and formerly unsuitable terrain becomes the norm, the need to cultivate climate-resilient crops is rising. Improving yield stability and minimizing susceptibility to climatic hazards can be achieved through geospatially enabled Climate-Smart Agriculture practices like the selective breeding of crop varieties with features appropriate to the local environment.

Conservation Agriculture: No-till and reduced-tillage cultivation, which employs crop leftovers and cover crops to keep the land permanently covered, and rotating crops are all examples of climate-smart conservation agriculture techniques that are put into place to protect soil quality. By boosting soil health, reducing erosion, and enhancing water absorption and land drainage, these methods promote resilience to climate changes.

Agroforestry: Agroforestry is the practice of growing trees alongside crops or livestock. Trees create shade and windbreaks and improve nutrient cycling for their "neighbors," while also sequestering agri-related carbon dioxide emissions. Agroforestry systems, which incorporate trees and shrubs into farmland to improve biodiversity and soil fertility, can be used to create more robust agricultural landscapes.

Water Management: Precision irrigation, drip irrigation, and collecting rainwater are all examples of effective Climate Smart Agriculture strategies that can be used to maximize water consumption efficiency and reduce negative effects on the environment. In times of drought or erratic precipitation, these methods guarantee crops receive enough water with minimal wastage.[28]

Disaster Resilient Smart Cities

The WGIC Partnership Ecosystem delivers geospatially based disaster resilience and flooding tools and solutions. Almost all WGIC members focus on disaster risk, mitigation and resiliency in some form through Disaster Resiliency and the Critical Infrastructures of Smart Cities. WGIC members provided multiple uses cases for their work in Africa on Disaster Resiliency Flooding.

28. World Bank 2021: Towards Disaster Resilience in Sub-Saharan Africa:
Building Regional Capacity for Coordination, Planning and Policy Advice in Disaster Risk Management
https://www.gfdrr.org/en/publication/towards-disaster-resilience-sub-saharan-africa-building-regional-capacity-planning-and

Characteristics of a Resilient City

Strong Leadership and Coordination
- Clear delineation of responsibilities in disaster risk management.
- Effective stakeholder engagement, well-defined policies and strategies, and distribution of tasks.
- Efficient communication lines and mechanisms that facilitate risk management.

Risk-Informed Urban Planning
- Urban planning based on current risk information, focusing on vulnerable groups.
- Enforced realistic and risk-compliant building regulations to reduce physical risk.

Up-to-Date Hazard Knowledge
- Regular risk assessments for urban planning and long-term development.
- Informed investment decisions to improve resilience.

Critical Infrastructure Strategy
- Strategies to protect, update, and maintain critical infrastructure to ensure continued services and increase resilience against hazards and climate change impacts.

Protection of Natural Ecosystems
- Identification, protection, and monitoring of natural ecosystems to sustain their protective functions as natural buffers.

Strengthened Institutions
- Strengthening of institutions relevant to city resilience to ensure they have the capabilities to execute their roles.

Effective Disaster Response
- Creation and regular updation of preparedness plans, connection to Early Warning Systems, and enhancement of emergency management capacities through public preparedness drills.

Aligned Post-Disaster Recovery
- Recovery, rehabilitation, and reconstruction strategies aligned with long-term planning to improve the city environment after disasters.

Social Connectedness & Culture of Mutual Help
- Strengthened community, education, and communication channels to foster a culture of mutual support.

Financial Planning for Resilience
- Adequate financial plans that support and promote resilience resource allocation.



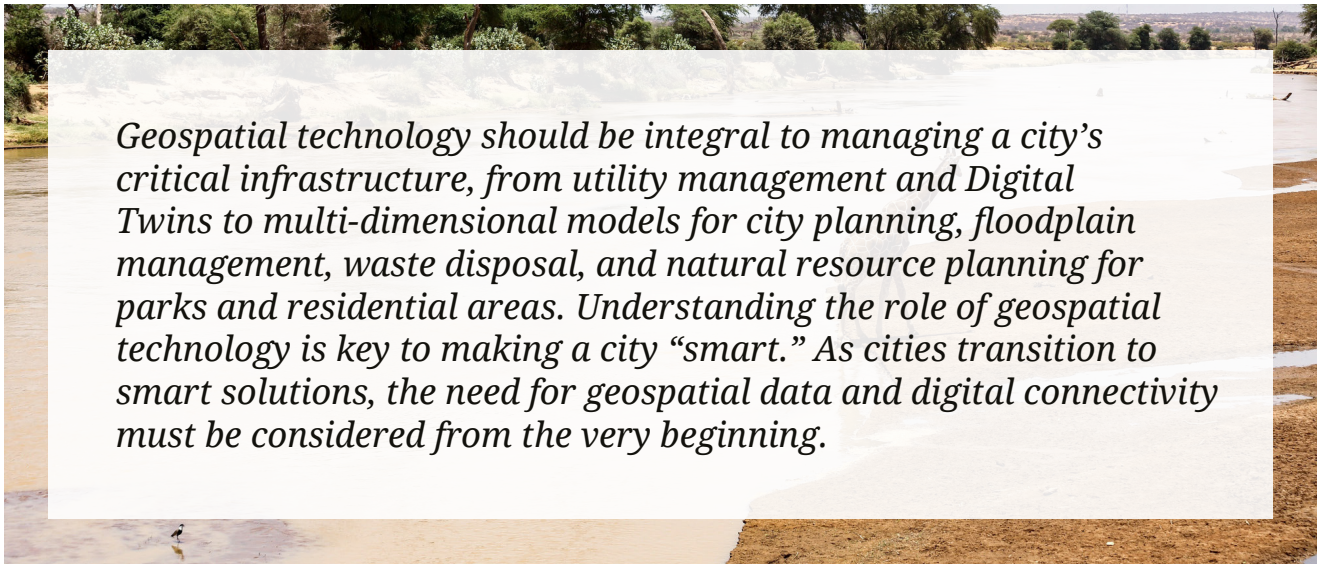
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WGIC: Empowering Disaster Resilience in Africa

A review of the WGIC Partnership Ecosystem offerings and interviews with member organizations revealed specific guidelines that enable the provision of disaster resiliency products, tools, services, and solutions. These offerings assist African partners and help them to:

- **Identify, understand, and use current and future risk scenarios:** Maintain up-to-date data on hazards and vulnerabilities. Prepare risk assessments based on participatory processes and use these as the basis for urban development. Undertake technical and multi-stakeholder analysis of current and future threats and hazards to identify city-wide exposure and vulnerability.
  - ✓ Identify the hazards that the city is prone to and carry out hazard assessments.
  - ✓ Include into risk assessments all identified hazards and cascading effects, taking into consideration trans-boundary risks.
  - ✓ Regularly update risk assessments through multi-stakeholder engagements.
  - ✓ Consider the impacts of climate change in risk assessments for urban development changes and future risk level.
- **Organize for disaster resilience:** Put in place an organizational structure with strong leadership and clarity of coordination and responsibilities. Establish Disaster Risk Reduction as a key consideration throughout city vision or strategic plan. Prepare key stakeholders who have the responsibility for resilience to gain access to risk information in order to make the appropriate decisions and responses during various stages of the disaster risk reduction cycle (e.g., mitigation, response, recovery). By improving assessment and diagnostic skills, and involving the use of satellite and terrestrial tools for weather monitoring and improved communication capabilities, both government officials and the public would be better prepared to prepare for weather events.
- **Strengthen financial capacity for resilience:** Prepare a financial plan by understanding and assessing the significant economic impacts of disasters. Identify and develop financial mechanisms to support resilience activities. Understanding the economic impact of disasters and developing financial mechanisms are essential to supporting resilience activities and strengthening opportunities for response and recovery.
- **Pursue resilient urban development and design:** Carry out risk-informed urban planning and development based on up-to-date risk assessments with a particular focus on vulnerable populations. Apply and enforce realistic, risk-compliant building regulations.

  Pursuing resilient urban development based on risk-informed urban plans is essential to reducing current disaster risks and the prevention of future ones. Participatory urban planning processes and focus on vulnerable groups will not only decrease risk and facilitate the implementation of urban plans but will also help in attaining equitable and sustainable development of urban communities.



Urban infrastructure is often inadequate and needs to be retrofitted to withstand the impacts of hazards and climate change. The Organization of Economic Co-operation and Development expects governments to spend approximately US $71 trillion by 2030 to provide adequate infrastructure for electricity, road and rail transport, telecommunications, and water across the globe.[29]

Investments in infrastructure in most developing economies are insufficient to maintain their quality, requiring the private sector to invest and facilitate various funding models. Further, US $6.3 trillion/year is needed through 2030 to meet development infrastructure goals and trillions more to meet the Paris Agreement goals with the major focus on Sub-Saharan Africa, South Asia and Latin America.[30]

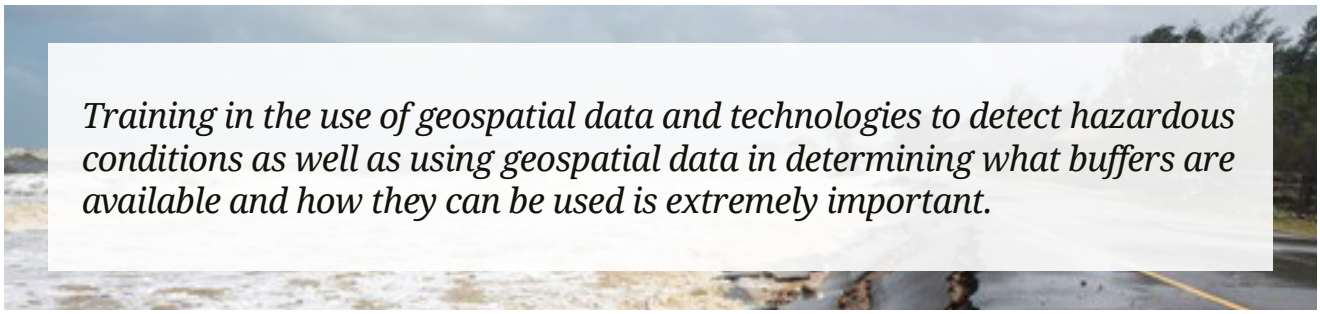
- **Safeguard natural buffers to enhance the protective functions offered by natural ecosystems:** Identify, protect, and monitor natural ecosystems both within and beyond city boundaries to enhance their role in risk reduction. Sustaining these ecosystems as natural buffers is crucial for safeguarding their protective functions. Ecosystems and their services not only support city functions, such as water provision, but can also reduce risks from the hazards and impacts of climate change. Together with ecosystems, green and blue infrastructure within urban areas have the potential to reduce risks from climatological as well as hydro-meteorological hazards.
- **Strengthen institutional capacity for resilience:** Understand institutional capacity for risk reduction, including those of governmental organizations, private sector, academia, professional and civil society organizations, to help detect and strengthen gaps in resilience capacity of a city.

  Maintain processes to facilitate top-down and bottom-up communication that strengthens the knowledge and awareness of the general public.

  - ✓ Cultivate reporting mechanisms that promote transparency and accountability across all sectors.
  - ✓ Maintain risk data that is easily accessible and share it with other organizations and citizens.
  - ✓ Ensure citizens can communicate with disaster responders by facilitating the flow of emergency information.
  - ✓ Utilize the capacity of the private sector and civil society for Disaster Resilience and Recovery (DRR), ensuring that the DRR stakeholders work effectively with the private sector and civil society.
- **Understand and strengthen societal capacity for resilience:** Identify and strengthen social connectedness and culture of mutual help through community and government initiatives and multimedia channels of communication.

  Social connectedness and a culture of mutual help have a major effect on the impact of disasters of any given magnitude. Understanding patterns of social vulnerability, developing a culture of risk reduction and adequately addressing the needs of the most vulnerable significantly contribute to increasing the city's coping capacity in the face of natural hazards.
- **Increase infrastructure resilience:** Develop a strategy for the protection and updating the maintenance of critical infrastructure. Develop risk mitigating infrastructure plans where needed. Emergency preparedness and response plans save lives and property, and often contribute to resilience and post-disaster recovery by lessening the impact of a disaster.

  Preparedness efforts and Early Warning Systems help ensure that cities, communities and individuals can act in sufficient time to reduce personal injury, loss of life and damage to property.



Training in the use of geospatial data and technologies to detect hazardous conditions as well as using geospatial data in determining what buffers are available and how they can be used is extremely important.

29. OECD Working Papers on Finance, Insurance and Private Pensions, No. 24, OECD Publishing, Paris, https://doi.org/10.1787/20797117
30. OECD Financing Climate Futures: Rethinking Infrastructure (2018) https://doi.org/10.1787/9789264308114-en

Prepare and implement a critical infrastructure plan or strategy to protect critical infrastructure, utilities and services.

- ✓ Promote a shared understanding of the risks between city and various utility providers for the points of stress on infrastructure systems and risks at the city scale.
- ✓ Maintain appropriate building codes, regulations and continuity arrangements that aid the construction of critical infrastructure in low-risk areas.
- ✓ Manage continuity plans for the provision of critical services.
- ✓ Invest sufficiently in the maintenance and upgrade of critical infrastructure.

Ensure that protective/risk mitigating infrastructure (e.g., flood defenses, seismic designs) is in place where needed and are properly maintained.

- ✓ Provide risk mitigation documentation to all stakeholders to ensure that existing protective infrastructure is well-designed and well-built, based on that risk information.
- ✓ Administer processes that maintain protective infrastructure and ensure the integrity and operability of critical assets.
- ✓ Create a comprehensive inventory or map of all critical infrastructure located within city limits.
- ✓ Have policies to enable monitoring, maintenance, and upgrade of drainage infrastructure (considering climate change).

- **Ensure effective preparedness and disaster response:** Create and regularly update preparedness plans, connect with Early Warning Systems and increase emergency and management capacities. After any disaster, ensure that the needs of the affected population are placed at the center of reconstruction.
  - ✓ Connect the city to relevant Early Warning Systems (EWS).
  - ✓ Ensure that EWS has access to information for relevant hazard events.
  - ✓ Establish that EWS broadcasts have sufficient citywide coverage to alert the population.
  - ✓ Prepare and maintain adequate resources and tools used for the dissemination of warnings through various means (social media, radio, SMS, sirens, etc.).
- **Expedite recovery and build back better:** Establish post-disaster recovery, rehabilitation, and reconstruction strategies that are aligned with long-term planning and provide an improved city environment.

  Ensuring that recovery, rehabilitation, and reconstruction are collectively aligned with long-term planning goals will result in an improved city environment and increased resilience for the affected community. A well-planned and participatory recovery and reconstruction process helps a city reactivate itself, restore and rebuild its damaged infrastructure and recover its economy, empowering citizens to rebuild their lives, housing, and livelihoods. This will also be a period to learn from past mistakes and to develop sound rebuilding and development strategies.

  Establish strategies for post-disaster recovery and reconstruction, including economics and societal aspects.

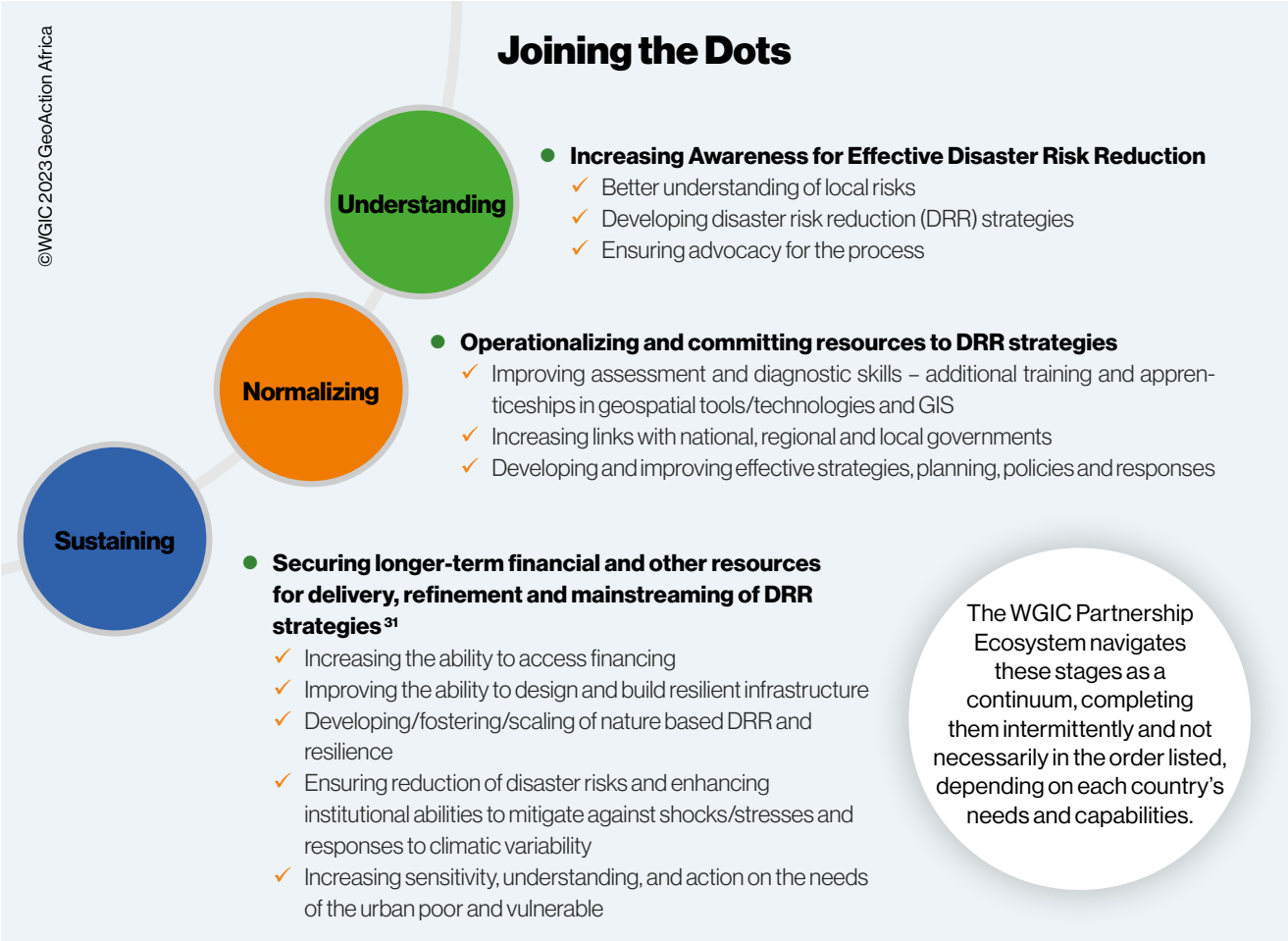
  - ✓ Maintain a financing mechanism that enables the access to and the distribution of funds for recovery.
  - ✓ Coordinate designated agencies, sectors, and committees for recovery as part of a wider multi-stakeholder process. Implement the concept of 'Build Back Better'.
  - ✓ Complete a post-event assessment to analyze successes, failures, skills and abilities and document the lessons learned to be integrated into recovery and reconstruction processes.
  - ✓ As part of the recovery process, identify new risks and other key information through reviews and updation of urban development plans and processes.

WGIC Partnership Ecosystem in Action

It is evident that in many, if not most, of these essential areas, the addition of geospatial data and tools always provides a significant improvement to the process of preparing for, adapting to, and follow-up to natural disasters. The WGIC Partnership Ecosystem provides early warning meteorological systems to help stakeholders to prepare for these events, drones for search and rescue missions, hydrological tools to determine flood water levels, and satellite and aerial images providing sources of data at multiple stages before and during the climate event.

Additionally, the WGIC Partnership Ecosystem works to improve knowledge and action within cities and sharing among cities based on every project they complete as they move onto the next.

The WGIC Partnership Ecosystem plays a key role in sponsoring and attending geospatial conferences. It amplifies the critical need to tackle the climate emergency during the United Nations Climate Change Conferences (COPs). WGIC emphasizes the importance of both adaptation and mitigation efforts and advocates for the creation of a loss and damage fund to assist nations most affected by climate change.



The WGIC Partnership Ecosystem understands in building better communication and delivery systems to prevent and better manage risks. This includes investing in resilient infrastructure that can withstand climate impacts and enhance economic and social opportunities.

WGIC members emphasize the importance of strengthening, sustaining, or enhancing legal and regulatory frameworks on a regional level. This is essential for improving coordination mechanisms for cooperative geospatial information management at the national level. This would enable the use of technological and innovative infrastructure to source, capture, curate, and build purpose-oriented datasets and spatially enabled services for informed decision-making. It is also necessary to have empowered spatially aware citizens with essential technological skills and ability to participate and contribute to this digital transformation in an information society. This would allow Africa to partner and collaborate within the geospatial information community worldwide on a more effective basis.

Geospatial Use Cases

There were over 50 current use cases reviewed during the completion of this report provided by African geospatial organizations focused on Smallholder Farms, and Disaster Resiliency/Flooding/Smart Cities. Of these current geospatial climate initiative case studies, 26 are highlighted across 22 African countries (see Appendix).

The WGIC member use cases provide examples of the diverse nature of the ways that geospatial data, tools, services and solutions assist smallholder farmers and the challenges presented by disaster resilience flooding.

31. UNDRR: Making Cities Resilient 2030 - https://mcr2030.undrr.org/

Geospatial Use Cases Highlights

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Drones

- In Togo, to increase crop yields.
- In Sierra Leone, to balance agricultural development and animal conservation.
- In Sierra Leone, to protect new forests plantings using geotagging monitored by drones.



Meteorological stations

- In Gabon, to help protect the coastline from coast erosion, landslides and floods.
- In Zimbabwe, to improve access to weather, climate, and hydrological information including river-gauging stations.
- In Cabo Verde, to meet a recognized need for monitoring advanced notification of weather hazards by using GIS and earth observation tools.



Geospatial tools, including remote sensing

- In Cameroon, to assess susceptibility to flooding in coastal and nearshore areas.
- In Benin, to map mangroves and reduce illegal deforestation.
- In Liberia, using GIS Cloud mapping mobile data to determine need for water filters in remote villages.
- In Chad, evaluating security issues related to climate change, water security, and increasing conflict in the area due to the decreased hydrography of Lake Chad.
- In Ethiopia, measure soil erosion to determine appropriate conservation measures.
- In Niger, use of remote sensing and GIS to measure the environmental health of the Niger and look at ecosystem decline.
- In South Sudan, an analysis of climate change as a "threat multiplier" to increase risks of conflict using GIS to evaluate vulnerability.
- In South Africa, use of GIS data and remote sensing to visualize impact of climate change on flooding to assist decision makers' plans for future occurrences.
- In Uganda, satellite data anomaly indicators were coupled with agroclimatic indicators and used to manage the disaster risk financing fund that provides seeds for farmers.



Mapping

- In Nigeria, interactive malaria risk mapping for intervention.
- In Burkina Faso, integrating land use planning at watershed scale.
- In Sudan, mapping of rainfall predictions that explain and extract general patterns of rain phenomenon and distribution.
- In Central African Republic, use of GIS to analyze organic waste-derived biomass production, determining the amount of biowaste and its distance from the site where it was converted into renewable energy.

(These are general categorizations. Every geospatial experience varies, based on a country's specific and most urgent needs. The approach taken by the WGIC Partnership Ecosystem is to address any climate related issue, understanding that approaches change from country to country due to difference in laws, governing bodies, and partnership frameworks.)

The following examples showcase how WGIC members use geospatial tools and services to positively impact climate change in Africa. These initiatives demonstrate the benefits of geospatial technology in reducing poverty, enhancing disaster risk mitigation and recovery, creating jobs, and combating the effects of climate change on the continent.

TABLE 7: Member Use Cases Climate Initiatives

WGIC Member	Geography	Project Name	Application*	Project Description	Contact Info.
Bentley	Egypt	Solar Park	RSC**	• Supply power to over 350,000 residential customers. • Create job opportunities.	https://www.bentley.com/company/esg-overview/
Bentley	Botswana	Screening Geothermal Energy	RSC**, Climate	• Botswana International University of Science & Technology to train and apply the science.	https://www.bentley.com/company/esg-overview/
Bentley	Cambodia	Solar Photovoltaic Power Plant	Climate	• Design and visualize all aspects of the project.	https://www.bentley.com/company/esg-overview/
Bentley	Yemen	Saltwater Intrusion	SHF***, Climate	• Modeling and monitoring.	https://www.bentley.com/company/esg-overview/
Bentley	Kenya	Flood Risk Analysis	DRF*	• Reduce the digital divide for Compute Power and AI	https://www.bentley.com/company/esg-overview/
Bentley	Uganda & South Sudan	Ground Water Relief	Climate	• Humanitarian relief.	https://www.bentley.com/company/esg-overview/
Bentley	Ethiopia	Water and Carbon	Climate	• Digital Twin development in Carbonomics and Skill Development – Nedamco Capital	https://www.bentley.com/company/esg-overview/
Bentley	Tanzania and Somalia	Ground Water Detection	DRF*, RSC**, SHF***	• Ground water detection to provide 1.2 million people with water and repeating process.	https://www.bentley.com/company/esg-overview/
Bentley	South Africa	Travel, Land Use Modeling	RSC**	• Building digital replicas and models.	https://www.bentley.com/company/esg-overview/
Esri	Africa	Geoportal Africa	Climate, GIS	• Provides location intelligence for creating outputs and solutions. • One of the most utilized data access sites across the African continent.	https://www.africageoportal.com/

Disaster Resilience Flooding: DRF* / Resilient Smart Cities: RSC** / Smallholder Farms: SHF*** / Natural resource Management: NRM****

WGIC Member	Geography	Project Name	Application*	Project Description	Contact Info.
Esri	Africa	Esri Geospatial Program for Agriculture in Africa	Agriculture, SHF***	• Offers organizations of all sizes a way to establish a database and baseline data. • Delivers tools to streamline planning, field data collection, monitoring, analysis, forecasting, and decision support. • Esri Geospatial Program for Agriculture in Africa supports governmental agencies focused on agriculture, aquaculture, or pastoral farming. • Helps establish a geospatial foundation in an affordable way.	https://www.esri.com/en-us/c/industry/natural-resources/esri-geospatial-program-for-agriculture-agencies-in-africa
Esri	Malawi	Development Gateway	Climate	• Tracks and reports the country's external funding. • Maps aid information along with data on climate change vulnerability and conflict incidents. • Shows whether aid effectively targets regions where climate change or conflict pose significant risks to sustainable development and political stability.	https://developmentgateway.org/
GHGSat	Trinidad and Tobago	Satellite-Based Monitoring Solutions for the National Gas Company	Climate, DRF*, SHF***	• Provides high-resolution satellite emissions data to Orbital Eye. • Integrates data into pipeline monitoring services. • Improves operational efficiency and environmental performance.	info@ghgsat.com
GHGSat	World	GHGSAT-Global Emissions Monitoring	Climate	• The satellite constellation is the only one in orbit capable of detecting methane emissions from individual industrial sources worldwide..	info@ghgsat.com
Hexagon	Developing Countries	The Global Geospatial Scholarship	Remote Sensing	• Training and Certificate Programs with Brilliant Remote Sensing Lab.	https://remote-sensing-portal.com/pages/scholarships/?AspxAutoDetectCookieSupport=1
Maxar	Antarctica	British Antarctica Whale Survey	NRM****	• Partnered with the British Antarctic Survey to develop a whale survey using high-resolution imagery. • This imagery can differentiate between species, identify whales beneath several feet of water, and assess whale health.	info@maxar.com
Maxar	Columbia	Illegal Gold Mining in the Amazon Rainforest	NRM****	• Illegal gold mining contaminates water and accelerates erosion. • Over 160 illegal mining barges have been detected since 2022 using satellite imagery.	info@maxar.com

Disaster Resilience Flooding: DRF* / Resilient Smart Cities: RSC** / Smallholder Farms: SHF*** / Natural resource Management: NRM****

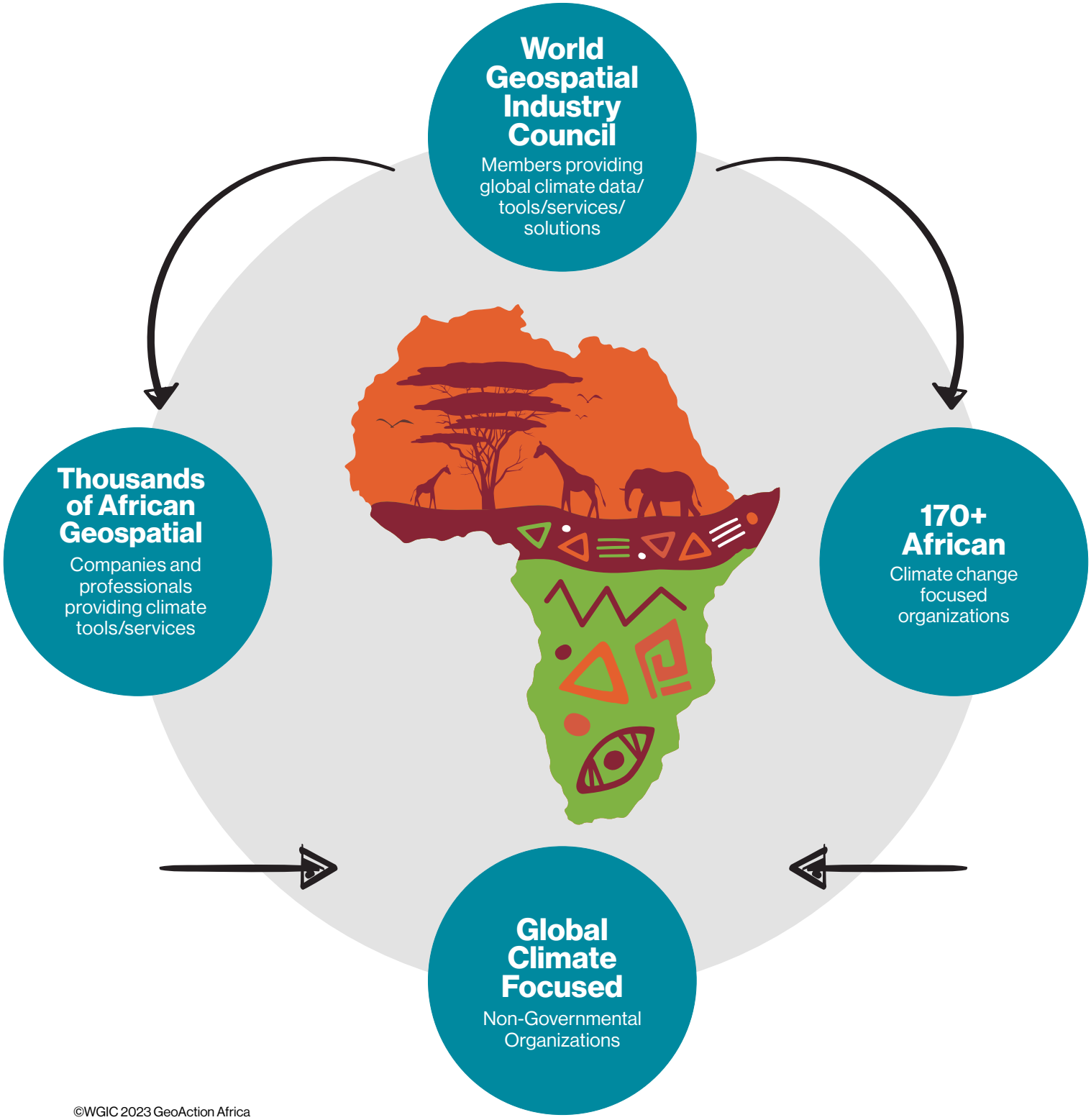
WGIC Member	Geography	Project Name	Application*	Project Description	Contact Info.
Spatial Vision	Australia	NRM **** planning for climate change	DRF*, NRM****	• The project identifies Victoria's natural environmental assets most at risk from anticipated climate changes. • Includes indirect impacts like sea level rise and storm surge in coastal areas.	Info@spatialvision.com
Spatial Vision	Australia	Coastal climate change impact assessment	DRF*	• The assessment involved a comprehensive state-wide spatial impact evaluation of all coastal assets. • This included coastal biophysical data, asset information, and research findings. • Goal is to inform communities about anticipated climate change and its likely impacts, facilitating evidence-based decision-making.	Info@spatialvision.com
Spatial Vision	Australia	Asset Vulnerability assessment & monitoring	DRF*	• Better understand how the South East Council's Climate Change Alliance member assets will be impacted by climate change and associated extreme weather events. • Assess the resulting impact on council finances.	Info@spatialvision.com
Spatial Vision	Australia	Savanna Burning Abatement Tool	SHF***, Climate	• SavBAT is a web-based application that automates the calculations needed to estimate carbon credits for savanna fire management projects under the Emissions Reduction Fund.	Info@spatialvision.com

Spatial Vision	Australia	Climate change and extreme weather using spatial data for impact & consequences	Weather, Climate	• Conducted a series of case studies to assist and inform decision-making regarding planning for extreme weather and climate change-related events. Analyzed the impact of:
				  • Heat waves
				  • Coastal erosion and inundation
				  • Overland flooding
				  • Wildfire risks
				  • Coastal landslips
					Info@spatialvision.com

Disaster Resilience Flooding: DRF* / Resilient Smart Cities: RSC** / Smallholder Farms: SHF*** / Natural resource Management: NRM****

Geospatial Capabilities in Africa

WGIC members offer global geospatial climate data, tools, services, and solutions that support the entire climate ecosystem. These capabilities are expanding through funding and awareness efforts led by climate-focused NGOs and in-country African organizations.



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CHAPTER 7

WGIC GEOACTION AFRICA CONCLUSIONS & CALL TO ACTION



> "The needs are clear, and WGIC GeoAction Africa must focus on leveraging existing resources — geospatial sensors, data, tools, platforms, and services at the local level — to support smallholder farms and mitigate flood risks and disasters."
>
> **GeoAction Africa Respondents**

WGIC GeoAction Africa Conclusions & Call to Action

The GeoAction Africa initiative underscores the vital role of geospatial tools in tackling key challenges across the continent. The findings of this study highlight the urgent need for advancing the deployment of geospatial technology to help smallholder farms and strengthen urban disaster resilience across Africa.

Africa needs significant support to enhance smallholder farms and improve disaster resilience, especially in flood-prone regions. Geospatial tools hold significant potential to address these needs effectively. The WGIC Partnership Ecosystem is well-positioned to continue the GeoAction Africa initiative.

The positive outcomes of the geospatial use cases presented, along with the vast potential for further action to mitigate the effects of climate change using geospatial data in Africa, underscore the continent's substantial needs. The WGIC Partnership Ecosystem is capable of meeting these demands.

Africa is building strong resources in geospatial technologies through university programs, climate research organizations, NGOs, and other entities, but continuous support is essential for sustained growth and development. The National Adaptation Plans prioritize interventions in key areas. Implementing these interventions will equip countries to mitigate the impacts of climate change.

Achieving the necessary change will require substantial effort and financial commitment. It will likely necessitate Public-Private Partnerships and commitments from all stakeholders, taking considerable time to accomplish.

Key Takeaways

01 **WGIC members are already engaged in GeoAction Africa.**

02 **Africa urgently needs geospatial local field training and tools,** and possesses great geospatial intellect already.

03 **WGIC should arrange for funds to help members** drive the required geospatial tools, sensors, and data for training to the local level.

04 **WGIC must continue to partner closely with other NGOs** (AGFUND, Alliance for African Partnerships, One Acre, IFAD, Connect Aid, Climact, GMI, SDG Alliance, UNGGIM, GEO, USAID, and many more) who are already working at local levels.

05 **WGIC must move to the next phase of African geospatial funding** by coupling financial providers with government entities for specific SHF and DRF projects focused on enhancing geospatial awareness and usage at the local level.

Data analysis by country revealed varied case studies and narratives that only scratch the surface of geospatial technology's impact on climate change in Africa. Despite differing narratives, the key message was consistent: greater government support and recognition of geospatial efforts are essential for effective mitigation and recovery from events such as floods and droughts.

The geospatial community is actively engaged locally in educating, monitoring, and providing mitigation capabilities to support disaster recovery and resilience. African citizens are taking the hazards of climate change seriously, and the level of education among geospatial specialists and professionals is among the highest in the world.

African geospatial technologists, scientists, academicians, and business owners are showing great enthusiasm in addressing climate change. They are actively engaged with African Geospatial and Space organizations, international NGOs, and media outlets such as Novum Intelligence and Space Africa, among others.

There are many global partners and geospatial technology providers already involved and ready to provide advanced geospatial capabilities. The coordination provided by the WGIC Partnership Ecosystem will accelerate these efforts.

WGIC is committed to being a "leader" who works with other organizations, and provide a coordinated, collaborative voice for Climate Risk Impacts and geospatial sectors worldwide. WGIC's role with the United Nations Committee of Experts on Global Geospatial Information Management (UNGGIM)w keeps the members at the forefront of political and climate-focused collaborations.

The WGIC Partnership Ecosystem is active in almost all of the 170+ climate-focused organizations in Africa (see Appendix) providing a wide array of offerings — from sensors to datasets, and tools to services and solutions.

WGIC supports the UN-GGIM (United Nations Global Geospatial Information Management) for Africa's goals which are:

- To promote and support technical activities for the development of standards, interoperability and streamlined electronic services delivery, in such a way to anticipate the potential use of geospatial resources on the continent,
- To strengthen and align the specific needs and interests of Africa with international mechanisms, and
- To encourage and facilitate the integration of statistics with geographies to help to monitor and track the attainment of the Sustainable Development Goals.

Steps to Boost GeoAction Africa's Impact



Government Adoption

Secure individual country acceptance from governments for available geospatial climate technologies, ensuring understanding of their value for disaster resilience and mitigation.



Increased Funding

Allocate funds to expand projects utilizing geospatial technology for flood risk management, smallholder farm development, and local education.



Integration into National Adaptation Plans

Ensure that geospatial technologies are included in National Adaptation Plans (NAPs) for each country. For countries lacking NAPs, prioritize integrating geospatial science into public policies. Encourage global geospatial providers to offer support, training, and workforce development to address climate challenges.



Field-Level Training and Workforce Development

Develop and implement training and workforce development programs focused on smallholder farms and disaster resilience, led by WGIC members across the African continent.

WGIC members support all efforts to increase diversity, equity, and inclusion (DEI) and their access to current and future activities, committees, and programs. The WGIC Partnership Ecosystem is committed to taking positive steps toward increasing workforce diversity. It is critical to put these considerations into action, an especially important component when focused on disaster resiliency and agriculture in africa.

GeoAction Africa can — and will — positively impact the climate and save lives. Addressing climate change is a local-to-global GeoAction.

What WGIC Needs from You



Join Our Global Network

Become a part of our extensive global geospatial partnership ecosystem. Visit www.wgicouncil.org for more details.



Support and Funding

Provide additional information and funding opportunities to bolster the African geospatial community.



Empower African Talent

Hire unemployed African PhDs and fund internships and apprenticeships to develop skills and training in geospatial fields, strengthening the GeoAction Africa community.



Promote Geospatial Knowledge

Enhance awareness of geospatial capabilities and tools among end users in disaster resilience and smallholder farming sectors.



Maintain Focus on Africa

Keep the spotlight on Africa and the global GeoAction needed to address climate change, continually sharing the story across various platforms and locations.

CHAPTER 8

APPENDIX



> "GeoAction Africa is supported by extensive research and data analysis, with the goal of making a significant impact on the climate and contributing to saving lives. Addressing climate change requires coordinated efforts from local to global scales, and we are prepared to support this mission at every step."
>
> **WGIC Partnership Ecosystem**

APPENDIX

Geospatial and Space African Universities

Country	SAMPLE of African Universities engaged in Geospatial / Space Capabilities	Department/Specific Study Area	NAP Submitted
Benin	University of Benin	Department of Geography	Yes
Botswana	University of Botswana	Department of Geography	
	Botswana International University of Science & Technology	Engineering and Technology – Smart Cities	
Cote d'Ivoire	University of Cocody in Abidjan	University Center for Applied Research in Teledetection (CURAT)	
Egypt	The National Authority for Remote Sensing and Space Sciences (NARSS)	Remote Sensing	
	Cairo University	Engineering Department	
Ethiopia	Addis Ababa University (AAU)	Remote Sensing/GIS	Yes
	University of Mekelle, Mekelle Bahr	Institute of Geo-Information and Earth Observation Sciences	
	Bahr Dar University	Faculty of Social Sciences (GIS)	
Ghana	University of Ghana	Dept. of Geography and Resource Development	
	The Kwame Nkrumah University of Science and Technology in Kumasi	—	
Kenya	Kenyatta University	School of Environmental Sciences	Yes
	University of Nairobi	The Institute of Computer Sciences	
	Jomo Kenyatta University of Agriculture and Technology	Agriculture	
Lesotho	The National University of Lesotho	—	
Morocco	Royal Center for Remote Sensing (CRTS)	Remote Sensing	
	Education and Training in Applied Remote Sensing in Africa (ARCSSTE-E)	Remote Sensing	
Namibia	The Polytechnic Institute of Namibia	—	
Nigeria	The University of Lagos	Laboratory for Cartography and Remote Sensing	
	The Federal University of Technology, Akure, (FUTA)	—	
	The National Center for Remote Sensing (NCRS)	Remote Sensing	
	UN Regional Center for Space Science and Technology Education (ARCSSTE-E)	Engineering	
Rwanda	National University of Rwanda	Dept. of Environmental and Geographical Science	
Senegal	Cheikh Anta Diop University, Dakar	Remote sensing and environmental science	

Country	SAMPLE of African Universities engaged in Geospatial / Space Capabilities	Department/Specific Study Area	NAP Submitted
South Africa	The University of Cape Town	—	Yes
	University of Pretoria and Geographical Information Technology	Geographical Information Technology (GIT)	
	Stellenbosch University	Space Engineering	
	The University of KwaZulu-Natal	—	
Sudan	University of Khartoum	Sudan university of Science and Technology (SUST)	
Tanzania	Ardhi University (ARU)	School of Geospatial Sciences and Technology	Yes
	Bagamoyo University	—	
	The University of Dar Es Salaam	—	
	Sokoine University of Agriculture (SUA)	—	
	Southern and Eastern Africa Mineral Center (SEAMIC)	—	
Uganda	The University of Makarere	—	
	Kabale University (KAB)	Dept. of Environmental and Natural Resources	
	Kampala International University	—	
Zambia	University of Zambia	Dept. of Geomatic Engineering	

APPENDIX

Climate Action Geospatial Organizations

African Climate Research Organizations – 171 Interactive Map and All Websites by Country – Carnegie Endowment for International Peace - 2022

NOTE: This chart is a subset; access the full data at the following link provided

https://carnegieendowment.org/features/african-climate-research-organizations?lang=en

A compilation of Africa-based research organizations working on climate-related technical and policy issues.

Filter by: All: 171 Forestry and Agriculture, General, Energy, Extractive Industries, Urban Development, Industry Represented

Country	Organization Name(s)	Thematic Focus
Algeria	Association de recherche sur le climate et l'environnement	General
Botswana	Botswana Institute for Development Policy Analysis	Forestry and Agriculture Extractive Industries
	Okavango Research Institute	Forestry and Agriculture General
Burkina Faso	Group for Research and Applied Analysis for Development (GRAAD)	Forestry and Agriculture General
	International Centre for Research and Development on Livestock in Sub-humid Areas	Forestry and Agriculture
Cabo Verde	ECOWAS Centre for Renewable Energy and Energy Efficiency	Energy

APPENDIX

Climate/Geospatial Focused Conferences in Africa

Sample of Climate Meetings - Africa	Focus	Anchor Sponsor or Company(s)	Location	Date
27th Conference of the Parties to the UN Framework Convention on Climate Change (UNFCC COP27)	Climate Change	United Nations	Sharm el-Sheikh, Egypt	November 7-18, 2022
GLOC 2023: The Global Space Conference on Climate Change	Earth Observation Geospatial Climate Change	IAF	Oslo, Norway,	May 23-24, 2023
UN GAN NAP Expo 27 March 2023	Framework Convention on Climate Change	United Nations	Santiago, Chile	March 27, 2023
ICOE Int'l Conf. on Earth Observation and Geospatial Information. ICOEGI 2023	Earth Observation Geospatial	ICOE	Algiers, Algeria	May 24-25, 2023
ICGEGIS 2023: 17. Int'l Conf. on Geospatial Engineering and GIS	Earth Observation, GIS, Geospatial Infrastructure and Engineering, Climate, Disaster Monitoring	ICGE	Cape Town, South Africa	April 13-14, 2023
ICCE International Conference on Climate Change	Economics, Climate	ICCE	Cape Town, South Africa	April 15, 2023
NewSpace Africa Conference	Space and Socioeconomic Transformation	Africa Space Policy and Strategy for Climate	Abidjan, Cote d'Ivoire	April 25-28, 2023
International Conference on Hydrocarbons	Climate Change	Common Ground	Adrar, Algeria	April 29-30, 2023
UN-GGIM	Committee of Experts	13th Session of UNGGIM	UNHQ, New York, NY	August 2-4, 2023
Climate Congress. 3rd Int'l Conf. on Climate Change	Climate Change	Climate Congress	Rome, Italy	May 19-20, 2023

Sample of Climate Meetings - Africa	Focus	Anchor Sponsor or Company(s)	Location	Date
International Conference on Environment and Natural Science	Climate, Engineering, Geospatial Inputs, Earth Observations		Bulaq, Egypt	July 12-13, 2023
International Conference on Environmental	Climate and Disaster Resilience	ICWRE	Lagos, Nigeria	August 9, 2023
CC2023 International Cartographic Association	Earth Observation Geospatial	International Cartographic Association	Cape Town, South Africa	August 14-18, 2023
UN-GGIM Africa	Earth Observation Geospatial Disaster Resilience	9th Meeting of the UN-GGIM Africa	Cape Town, South Africa	August 14-18, 2023
COP 28 UN Climate Change Conference	Climate Change	United Nations FCCC Secretariat	United Arab Emirates	Nov. 30 – Dec. 12, 2023



APPENDIX

Geospatial Use Cases for SHF and DR

Benin (NAP)

Project Name

Forest Health & Invasive Water Hyacinth in Benin

Project Description

Use of remote sensing data to map mangroves and government managed forests while reducing risks for illegal deforestation and fires. Also, Environmental Observatory uses NASA and Landsat data, drones, and water based sensors to track the spread of water hyacinth coverage and harvest by Green Keeper Africa.

Project Focus / NRM –Natural Resource Mgt.

Contact

National Center for Remote Sensing and Ecological Monitoring (CENATEL) in Benin,

MIT and Environmental Observatory

READ MORE >

Burkina Faso (NAP)

Project Name

Linking Participatory and GIS-based land use planning methods: A case study from Burkina Faso

Project Description

The VINVAL project aimed to contribute to sustainable land use planning, its overall objective being to develop a new method for integrated land use planning at watershed scale that contributes to improved sustainable agricultural production systems in small catchments in West Africa.

Project Focus

Smallholder Farms (SHF)

Project Focus

Soil Science Center, Alterra, Wageningen University, The Netherlands

READ MORE >

Cabo Verde (NAP)

Project Name

National Disaster Preparedness Baseline Assessment

Project Description

A comprehensive evaluation of the ability of Cabo Verde to respond to disasters and to develop resilience was conducted. One specific area that was noted as needing to be enhanced was monitoring advance notification using GIS and earth observation.

Project Focus

Disaster Resilience Flooding (DRF)

NRM –Natural Resource Mgt.

Contact

Pacific Disaster Center, Cabo Verde, Civil Protection

READ MORE >

Cameroon (NAP)

Project Name

Evaluation of Flood Susceptibility in Douala Estuary Cameroon Using GIS, Remote Sensing, and Logistic Regression

Project Description

Douala in Cameroon is highly susceptible to floods especially in the coastal and nearshore areas and using GIS, remote sensing techniques and logistic regression statistical models highlighted the possibility of using open-source data and tools to access susceptibility to flood with the aim to develop plans for flood emergency response/ preparedness plans.

Project Focus

Disaster Resilience Flooding (DRF)

READ MORE >

Central Africa Republic (NAP)

Project Name

Planting the seeds of resilience: How agroforestry is redefining cocoa farming in Central Africa

Project Description

Combining the farmers' deep-rooted knowledge with new sustainable methodologies, promoting robust agricultural processes, introducing more trees, and advocating for sustainable certification, shows a visible increase in cocoa production. Cocoa farming is being transformed by forest restoration through sustainable land use, forest conservation , and landscape restoration.

Project Focus

NRM –Natural Resource Mgt.

Smallholder Farms (SHF)

Contact

info@climakers.org

READ MORE >

Central African Republic (NAP)

Project Name

Feasibility Analysis of Biogas Production by Using GIS and Multicriteria Decision Aid Methods in the Central African Republic

Project Description

This study evaluates biogas production from organic waste for electricity in Bangui, Central African Republic. Using ArcGIS, it assesses biowaste availability and site proximity, and analyzes the plant's economic and environmental benefits, including electricity capacity and CO_2 reduction, relative to population growth and annual biogas production.

Project Focus

NRM –Natural Resource Mgt.

Contact

University of Science and Technology Beijing, Nanjing

Academy of Resources and Ecology Sciences

READ MORE >

Chad (NAP)

Project Name

Lake Chad Changing Hydrography Violent Extremism, and Climate- Conflict Intersection

Project Description

Study asserts that climate change has decreased the hydrography of Lake Chad by nearly 90% since 1960 and this has exacerbated the armed violence in water scarce Lake Chad Basin. Landsat data was used to evaluate the security issues related to climate change, water scarcity, and increasing conflict in the area.

Project Focus

Disaster Resilience Flooding (DRF)

Contact

Marine Corps University

READ MORE >

Cote D'Ivoire

Project Name

The Last Mile: Localizing Climate Action in Cote D'Ivoire

Project Description

The region of Belier is delivering their own vision for climate-resilient sustainable development as a means to create wealth and jobs and to increase clean energy access. This is part of the government's plan to ramp up renewable energy. One aspect is the use of solar panels, and other concrete actions that will improve the adaptive capacity and see a decrease in GHG emission of 21% by 2030, compared to business-as- usual. The Plan includes monitoring and evaluation and financing alternatives.

Project Focus

NRM –Natural Resource Mgt.

Contact

UNDP

READ MORE >

Democratic Republic of the Congo (NAP)

Project Name

Climate Smart Agriculture in the Democratic Republic of the Congo

Project Description

This study looked at Climate Smart agriculture (CSA) practice in the DRC in the areas of Agroforestry, agronomy, and livestock and aquaculture. It determined that farmers in the DRC engage in several practices that aim to increase productivity, adapt to changing climate scenarios, and mitigate adverse effects of high carbon emissions.

Project Focus

NRM –Natural Resource Mgt.

Smallholder Farms (SHF)

Contact

National Institute of Agricultural Studies and Research, Ministry of Agriculture, FAO

READ MORE >

Ethiopia (NAP)

Project Name

GIS based quantification and mapping of climate change vulnerability hotspots in Addis Ababa

Project Description

Addis Ababa is vulnerable to climate change impacts to the ten sub-cities in Addis Ababa. All found to have differing levels of vulnerability to climate change. These vulnerabilities present a need to strengthen mitigation and adaptation activities and to prioritize sub-cities for intervention. Results were mapped using ArcGIS 10.2.

Project Focus

Disaster Resilience Flooding (DRF)

Contact

Ethiopian Institute of Architecture, Building Construction and City development and Environment Planning Program, Addis Ababa University

READ MORE >

Ethiopia (NAP)

Project Name

GIS based soil loss assessment using RUSLE model: case of Horo district, western Ethiopia

Project Description

Soil erosion is a global issue that impacts crop yields, livelihoods, and creates environmental crises. This study in Horo district, Western Ethiopia, used the RUSLE Model to measure soil loss, finding that farmland is particularly vulnerable. The information on annual soil loss is crucial for choosing effective conservation methods. Farmers, stakeholders, and the government should prioritize soil conservation and management, especially in areas with severe soil loss.

Project Focus

Smallholder Farms (SHF)

Contact

Department of Natural Resource Management, Wollega University Shambu Campus, Shambu, Ethiopia

READ MORE >

Gabon

Project Name

Building a climate-resilient Gabon one meteorological station at a time

Project Description

Six meteorological stations were installed along the coastline to provide proper climate information to forecast and communicate immediate and long-term risks to the local population. These will help agriculture, fisheries, and tourism to lessen exposure to natural hazards such as coastal erosion, landslides, and floods.

Project Focus

Climate NRM
Smallholder Farms (SHF)

Contact

Directorate of Meteorology, Gabon Sanctuary

READ MORE >

Kenya (NAP)

Project Name

Forests Hold the Key To Kenya's Climate Action

Project Description

Japan and Kenya's Ministry of Environment are working together to restore three key forests. The initiative involves planting indigenous seedlings and engaging local communities. In Kaptagat, farmers form associations to plant trees and sell seedlings. Schools in southern Kenya create seedling farms to combat drought. In Kakamega, efforts focus on replanting indigenous trees to restore the tropical rainforest, with local groups and the Kenya Forest Service leading the charge.

Project Focus

NRM –Natural Resource Mgt.

Contact

UNDP, Kenya Forestry Service, Ministry of the Environment and Forestry

READ MORE >

Liberia (NAP)

Project Name

Mapping Entire Liberia to Bring Clean Water to Everyone -GIS for NGOs

Project Description

Using the trained volunteers and GIS Cloud Mobile Data Collection app, NGOs conducted multiple surveys, managed people in the field as well as tracked the process and made decisions during the process. Water filters were a donation from a U.S. company, Sawyer Products, as wells installation was not always possible or were not accessible to all residents. GIS data collection with a mobile app tracked drilled wells, and the distribution of clean drinking filtration systems.

Project Focus

NRM –Natural Resource Mgt.

Contact

Sawyer Products and Give Clean Water

READ MORE >

Madagascar (NAP)

Project Name

Effects of future climate on the forests of Madagascar

Project Description

Madagascar is a hotspot for global biodiversity with approximately 85% of its plants and animals' endemic. Much of Madagascar's original forest cover has been deforested, mostly in the past 60 years. This study looked at the effect of climate change on the occurrence and distribution of four major forest types and highlighted that unmitigated climate change will have a negative impact on Madagascar's forests during the period up to the year 2090.

Project Focus

NRM –Natural Resource Mgt.

Contact

Scholl of Biological Sciences, The university of Bristol. UK and Bristol Zoological Society

READ MORE >

Niger (NAP)

Project Name

Using Remote Sensing and GIS in the Analysis of Ecosystem Decline along the River Niger Basin: The Case of Mali and Niger

Project Description

Used remote sensing and GIS as conduits for environmental health of the Niger River which is shared and is essential for the survival of the river and country inhabitants This study looked at the ecosystem decline along the river basin with the objective to develop a geospatial tool for riverine ecosystem management.

Project Focus

Disaster Resilience Flooding (DRF)

NRM –Natural Resource Mgt.

Contact

Jackson State University

READ MORE >

Nigeria

Project Name

Malaria Risk Map, USING GIS to Combat Malaria Disease in Nigeria

Project Description

Malaria is a big challenge in Sub-Saharan Africa, so a plan was developed to help people find out about malaria risk areas. An interactive malaria risk map was created with the help of the internet and SMS, as well as a dashboard for intervention. By knowing the best time to use the anti- malarial drugs, people can help to protect themselves and the platform also helps intervention teams in providing the best places to focus their aid.

Project Focus

NRM –Natural Resource Mgt.

Contact

National Space Agency of Nigeria

READ MORE >

Nigeria

Project Name

Salinity prediction in coastal zones

Project Description

Using GSDC portal and SMAP to predict salinity in the coastal zones of Nigeria and surrounding oceans.

Project Focus

NRM –Natural Resource Mgt.

Contact

Geo Inheritance

READ MORE >

Sierra Leone (NAP)

Project Name

UAVaid Brings Drones to Sierra Leone Reforestation Project

Project Description

With a loss of over 30% of tree cover since 2000, government committed to planting 25 million trees by 2030 over 960 thousand HA. Crown Agents and UAVAid (based in UK providing drones to Africa) partnering with UK Aids Frontier Technologies to monitor, report and verify (MRV) trees that are geo-tagged by long-range drones.

Project Focus

NRM –Natural Resource Mgt.

Contact

Crown Agents UAVaid

READ MORE >

Sierra Leone (NAP)

Project Name

Drone mapping Offers New Hope for Sierra Leone Chimpanzees

Project Description

Mapping of deforestation in Moyamba as result of subsistence farming as an attempt to balance chimpanzee conservation and industrialized agricultural development as these areas become candidates for big commercial enterprises.

Project Focus

NRM –Natural Resource Mgt.

Contact

Institute of Conservation and Ecology, University of Kent

Tacugama Chimpanzee Sanctuary

READ MORE >

Sierra Leone

Project Name

How Earth Observation Data is Saving the Mangrove Ecosystem in Sierra Leone

Project Description

Mangroves help to protect communities on the shoreline and the EPA had previously used earth observation data to protect mangroves. It is now using ARDC satellite data to show areas prone to flooring and associated disasters that affect the mangroves. associated disasters that affect the mangroves.

Project Focus

NRM –Natural Resource Mgt.

Contact

Space in Africa

READ MORE >

South Africa (NAP)

Project Name

Techniques of Remote Sensing and GIS as Tools for Visualizing impact of Climate Change- Induced Flood in the Southern African Region

Project Description

This study uses remote sensing and GIS data to assess flooding impacts in Southern Africa, aiding future planning. It employs DEM, Landsat ETM+, and MODIS satellite data to visualize damage and flooded areas, revealing significant impacts on social and natural environments, flood risk zones, and watercourses.

Project Focus

Disaster Resilience Flooding (DRF)
NRM –Natural Resource Mgt.

Contact

Jackson State University, Water Research Commission, South Africa,

Texas Department of Agriculture

READ MORE >

South Sudan (NAP)

Project Name

Climate Security and East Africa: A GIS Based Analysis of Vulnerability

Project Description

Since 2005, studies have identified climate security as a key issue, with weather-related events like droughts and floods acting as "threat multipliers" that could escalate conflict. A GIS study evaluated East Africa's vulnerability and highlighted the need to address these issues.

Project Focus

Disaster Resilience Flooding (DRF)

NRM –Natural Resource Mgt.

Contact

Institute for Peace and Security Studies, Addis Ababa

University and Strauss Center at University of Texas at Austin

READ MORE >

Sudan (NAP)

Project Name

Spatial Diversity of Monthly and Annual Rainfall in Sudan: Using Rainfall Predictions and Geographic Information Systems (GIS) to Produce Rainfall Maps

Project Description

This study maps Sudan's rainfall predictions using spatial analysis in ArcGIS. It highlights GIS's ability to identify and analyze rainfall patterns across Sudan from 2000 to 2012.

Project Focus

Disaster Resilience Flooding (DRF)

Contact

Shendi University Khartoum, Sudan

Central Bureau of Statistics, Sudan (CBS)

Machine Intelligence Research Lab, Scientific Network for Innovation and Research Excellence, Auburn, Washington, USA

READ MORE >

Togo (NAP)

Project Name

Togolese farmers turn to drones for better yields

Project Description

Disease detection and prevention for rice farms; also provide certification programs for drone use; Agriculture in Togo represents 86% of rural households and contributes 40% of the national wealth; E-Agri Sky was started as E-Agri Business

Project Focus

Smallholder Farms (SHF)

Contact

E-Agri Sky

READ MORE >

Uganda

Project Name

No pixel left behind: Toward integrating Earth Observation for agriculture into UN Sustainable Development Goals framework

Project Description

Uganda's Office of the Prime Minister uses satellite data to trigger disaster funds, enabling early action. This approach helps farmers buy seeds and reinvest in infrastructure, reducing costs and shifting from reactive to proactive measures.

Project Focus

NRM –Natural Resource Mgt.

Smallholder Farms (SHF)

Contact

GEOGLAM University of Maryland

University of Colorado, Boulder NASA

READ MORE >

Zimbabwe

Project Name

How smallholder farmers in Zimbabwe are raising bumper crops by adapting to a changing climate

Project Description

The Ministry of Lands, Agriculture, Water, and Rural Resettlement leads a project for over 2.3 million people, aiming to improve farmers' water access, climate-resilient inputs, and market access. It also enhances access to weather, climate, and hydrological data through automatic stations, rain gauges, and river-level gauges for better forecasting.

Project Focus

NRM –Natural Resource Mgt.
Smallholder Farms (SHF)

Contact

UNDP, Ministry of Lands, Agriculture, Water, and Rural Resettlement

READ MORE >

APPENDIX

Non-African NAP Countries for Reference

Non-African NAPs – Potential Adoption Methods	Geo. Representation	Disaster Resilience-Flooding (DRF)	Agriculture/ Smallholder Farms (SHF)	Other	Usefulness to African NAPs High=3, Medium=2, Low=1
Brazil	Maps for: • Forecasts Deforestation Systems • Early warning systems for weather, including flooding and drought prediction	• Flooding • Drought (Full context to reduce vulnerability of cities to climate change and developing resilient cities)	• Clearcutting Fire Drought (Financial compensation to family farms suffering crop failures due to drought; family farm insurance that offers income guarantees and support sustainable systems; adaptation of crops)	Strategies for: • Disaster risk management • Industry and mining infrastructure vulnerable populations water resources health • Food & nutritional security • Coastal zones	**[3]**
Chile	Maps for Weather forecasts	Agriculture Fishing Forestry	Urban Development	GHG Emission reduction Nature-based solutions	**[2]** Due to agriculture adaptation
Kuwait	Maps for: • Air quality • Rainfall • Weather	• Fishing is prevalent • Less than 1% of land is arable, most of agriculture is in plastic tunnels or greenhouses • Major products are cucumbers and tomatoes	• Soil erosion • High salinity in soil • Very little agriculture	High GHG emissions	**[1]** Not a good fit, as they have neither a significant agricultural sector nor a flood risk. They suffer from drought, dust storms and soil erosion. Also concerns regarding coastal issues
Peru	Maps	Agriculture Fishery and Aquaculture Forestry	N/A	Emphasis on intercultural and intergenerational programs	**[1]** Only in agriculture adaptation
Sri Lanka	Maps Agri-topologies	• Droughts • Flooding • Sea level rise Landslides	• 28% of population –agriculture • Land degradation • Food security • Fisheries pressure on agricultural exports	• Coastal forecasting & communication • Comprehensive disaster management programme • Coastal zone management plan • Plan for combatting land degradation • Conservation of threatened cultural • Assets	**[3]**

APPENDIX

Africa Country Readiness/Legal Structure Tables

Country – Africa	Legal Structure
Angola	French Civil and Islamic Law
Angola	Portuguese Civil Law
Benin	French Civil with some Customary Law
Botswana	Roman and Dutch Civil and Customary Law
Burkina Faso	French Civil Law
Burundi	Belgian Civil and Customary Law
Cameroon	English Common, French Civil and Customary Law
Cabo Verde	Portuguese Civil Law
Central African Republic	French Civil Law
Chad	Civil and Customary Law
Comoros	French, Islamic, and Customary Law
Cote d'Ivoire	French Civil
Democratic Republic of The Congo	Belgian Civil, Customary, and Tribal Law
Djibouti	French Civil, Islamic (Family) and Customary Law
Egypt	Napoleonic Civil/Penal, Islamic Religious, Colonial-era Law
Equatorial Guinea	Civil and Customary Law
Eritrea	Civil, Customary, and Islamic Law
Eswatini	Civil, Common, and Customary Law
Ethiopia	Civil Law
Gabon	French Civil and Customary Law
Gambia	English Common, Islamic, and Customary Law
Ghana	English Common and Customary Law
Guinea	French Civil Law
Guinea-Bissau	Portuguese Civil and Customary Law
Kenya	English Common, Islamic, and Customary Law
Lesotho	English Common and Roman and Dutch Civil Law
Liberia	Common and Customary Law
Libya	Law is in flux
Madagascar	French Civil and Customary Law
Malawi	English Common and Customary Law
Mali	French Civil and Customary Law
Mauritania	French Civil and Islamic Law
Mauritius	French Civil and some English Common Law
Morocco	French Civil and Islamic Law
Mozambique	Portuguese Civil and Customary Law
Namibia	Uncodified Civil based on Roman and Dutch and Customary Law
Niger	French Civil, Islamic, and Customary Law
Nigeria	English Common, Islamic, and Traditional Law
Republic of the Congo	French Civil and Customary
Rwanda	German and Belgium Civil and Customary Law
São Tomé and Príncipe	Portuguese Civil and Customary Law
Senegal	French Civil Law
Seychelles	English Common, French Civil and Customary Law
Sierra Leone	English Common and Customary Law
South Africa	Roman Dutch Civil, English Common, and Customary Law
South Sudan	Unknown
Sudan	English Common and Islamic Law
Tanzania	English Common Law
Togo	Customary Law
Tunisia	French Civil and Islamic (Sharia) Law
Uganda	English Common and Customary Law
Zambia	English Common and Customary Law
Zimbabwe	Roman Dutch Civil, English Common, and Customary Law

Africa - Country Readiness Table	Governing Public Private Partner (PPP) Laws and Frameworks
ALGERIA - Developing Nation	• Decree presidential no 15-247 (2015)
BURKINA FASO - Developing Nation	• Law 039-2016 of 30 December 2015
BURUNDI - Nascent Nation	• Law No 1/04 of 24 Jan 2018 modifying Law 1/10
CAMEROON - Nascent Nation	• Law No 2006-912 of 29 Dec 2016 on general regulations • Legal framework of PPPs in Cameroon
CABO VERDE - Nascent Nation	• Decree Law 53/2015
CENTRAL AFRICAN REPUBLIC - Nascent Nation	• No PPP Law
CHAD - Nascent Nation	• No PPP Law • Decree No. PR/PM/SGG 03-503 of 25 December 2003 on the Code of Public Contracts ("superseded by the Regulation of 11 December 2009 on the Code of Public contracts in the Central African Economic and Monetary Community)
COMOROS - Nascent Nation	• No PPP Law • Decree No. 2009-259 (amended in 2014) on the Code of Public Contracts • Decree No 2012-1151 of 19 December 2012 on the Powers, Organization and Operation of the Institutional Framework for the Management of Public Private Partnerships • Decree No 2014-246 of 8 May 2014 amending Decree No, 2012 -1152
CONGO - Nascent Nation	No PPP Law
DEMOCRATIC REPUBLIC OF THE CONGO - Nascent Nation	• Law No. 14/005 on the Regulation of Public Private Partnerships • Act no 18-016 "the PPP Law" August 2018
COTE D'IVOIRE - Developing Nation	• Decree No 2012-1151 and 1152 • Law No 62-253, 31 July 1962 concerning urban planning • Decree No 2005-261, 21 July 2005 fixing the manner of application of urban planning and housing matters according to governmental transfer • Order No 2151, 19 August 1985 fixing the procedure for approval of urban planning master plan
DJIBOUTI - Emergent Nation	• Law No. 2017-186 • Decree 2010-83
EGYPT - Developing Nation	• Law No 2017-186 of 29 May 2017 on Public Private Partnerships • Law 67 PPP Law of 2010
ERITREA - Nascent Nation	No PPP Law
ESWATINI - Nascent Nation	No PPP Law • Final PPP Policy of 2008
ETHIOPIA - Developing Nation	• Proclamation No 1076/2018 facilitating PPPs
EQUATORIAL GUINEA - Nascent Nation	-
GABON - Developing Nation	• Order No 009/PR/2015 of 11 February 2016 on Public Private Partnerships
GAMBIA - Emergent Nation	• The National Public Private Partnership Policy, 2015 -2020
GHANA - Developing Nation	• Act 1039 -Public Private Partnerships Act 2020 • Ghana Partnership Act - 2020 • ALLIED 2341 Law
GUINEA - Nascent Nation	• PPPs are governed by Law No. L/97/012/AN • Law No 2017-32 of 4 July 2017
GUINEA-BISSAU - Nascent Nation	• Law No 2/2021 The PPP Law

Africa - Country Readiness Table	Governing Public Private Partner (PPP) Laws and Frameworks
KENYA - Developing Nation	• Public Private Partnerships Act, 2021 • The PPP Directorate
LESOTHO - Developing Nation	• PPP Policy 2021
LIBERIA - Nascent Nation	• No PPP Law
LIBYA - Nascent Nation	• A draft PPP law is awaiting adoption • Libyan Public Procurement Law
MADAGASCAR - Emergent Nation	• Law No. 2015-039
MALAWI - Emergent Nation	• PPP Policy and Act • PPP Guidelines Manual
MALI - Developing Nation	• Law No. No 2016-061 of 30 December 2016
MAURITANIA - Nascent Nation	• No PPP Law
MAURITIUS - Emergent Nation	• Public Private Partnership Act of 2004 • Build Operate Transfer Projects Act 2016
MOROCCO - Developing Nation	• Bill No 46-18 modified in 2020 • Supplemented Law 86-12 relating to contracts
MOZAMBIQUE - Emergent Nation	• Law No. 15/2011 • Decree 69/2013
NAMIBIA - Developing Nation	• PPP Act • PPP Policy
NIGER - Emergent Nation	• Law No. 2014-12 of 31 March 2014
NIGERIA - Developing Nation	• National Policy on PPP • PPP Regulations Document • Infrastructure Concession Regulation
RWANDA - Developing Nation	• Law No. 006/2021 • PPP Guidelines
SAO TOME AND PRINCIPE - Nascent Nation	• Law No. 06/2018
SENEGAL - Developing Nation	• Law No. 2021-23 of 2 March 2021
SEYCHELLES - Nascent Nation	• No PPP Law • Seychelles Investment Act of 2010
SIERRA LEONE - Emergent Nation	• PPP Act of 2014 • PPP Policy
SOMALIA - Nascent Nation	• No PPP Law • Public Procurement, Concessions and Disposal Act of 2014
SOUTH AFRICA - Developing Nation	• No specific law relating to PPPs • National Treasury PPP Unit has published 9 PPP modules for each stage of the PPP process • Standardized PPP Provisions of 2004
SOUTH SUDAN - Nascent Nation	No
SUDAN - Developing Nation	No
TOGO - Emergent Nation	• Law No. 2014-014 of 22 October 2014 on Strengthening Public Policies in Support of the Economy • Law No 2009-13 of 30 June 2009 on Public Procurement and Public Service Concessions

Africa - Country Readiness Table	Governing Public Private Partner (PPP) Laws and Frameworks
TUNISIA - Developing Nation	• Law No. 49-2015 • Law No. 2019-47
UGANDA - Developing Nation	• PPP Act 2015 • PPP Framework Policy • PPP Regulations • PPP Guidelines
UNITED REPUBLIC OF TANZANIA - Developing Nation	• The Public Private Partnership Act • PPP Regulations, 2020 • PPP Policy 2009
ZAMBIA - Developing Nation	• PPP Act 2009 • Public Procurement Act 2020
ZIMBABWE - Developing Nation	• No dedicated PPP Law • PPP Guidelines of 2004 are under review by the Government • PPP Policy 0f 2010
TOTAL - 54 Countries	**44 with PPP Frameworks**

APPENDIX

Africa NAP Countries – Sample of In-Country Geospatial Companies and Capabilities

National Adaptation Plans (NAPs) Africa Countries (17 Submitted as of 26 April 2023) *Source: United Nations Framework Convention on Climate Change*	Sample of Geospatial Companies In-Country Locate through web search, name and country.	Satellites*	Earth Observation Manned and Unmanned	Geospatial Tools	Applications and Analytics	Geo Tools, Data , etc. Availability**
Benin	• MAPTOGIS • OSM Benin AFRIGIST		• Benin Drone Labs • BJ Images Du Monde • LYVAFILMS Co.	• Images Photos Surveys • Measurements	• Agriculture Mapping Weather Wildlife • Flooding/ Drought Coastal • Other monitoring	Fees based on project
Burkina Faso	• MAPTOGIS, • GIM Int'l • Digital Earth Africa • SERVIR West Africa		• Faso Drone • Ofek in the World	• Images • Photos • Surveys Measurements	• Agriculture • Mapping Weather Wildlife • Flooding/ Drought • Other monitoring	Fees based on project
Cabo Verde	• African ESRI • Fao.org (Hand-in-Hand) Aeolus (ESA)		• Cape Verdean • Drone Centre	• Images • Photos • Surveys Measurements	• Agriculture • Mapping Weather Wildlife • Flooding/ Drought Coastal • Other monitoring	Fees based on project
Cameroon	• GIS Cameroon • GeoView • MAPTOGIS • NM Geospatial • Geo-advantage		• AX Production	• GIS Tools and Services Instruments • Images Photos • Surveys • Measurements	• Agriculture Mapping Weather Wildlife • Flooding/ Drought Coastal • Other monitoring	Fees based on project
Central African Republic	None noted		• Drone Deploy • Ecolo-GIS	• Images Photos • Surveys • Measurements	• Agriculture Mapping Weather Wildlife • Flooding/ Drought Mining • Other monitoring	Fees based on project
Chad	• ESRI NA • East View Geospatial Mapmechanics • ECLAT Lake Chad • EOS Data Analytics	• TAIFA1 • LEO, MS = 32m • Pan = 16m Communications	• Drone-TECH Africa	• Images/Photos • Surveys • Measurements	• Agriculture Mapping Weather Wildlife • Flooding/ Drought • Other monitoring	Fees based on project

National Adaptation Plans (NAPs) Africa Countries (17 Submitted as of 26 April 2023) *Source: United Nations Framework Convention on Climate Change*	Sample of Geospatial Companies In-Country Locate through web search, name and country.	Satellites*	Earth Observation Manned and Unmanned	Geospatial Tools	Applications and Analytics	Geo Tools, Data , etc. Availability**
Democratic Republic of Congo	• East View Geospatial • MAPTOGIS	Communications Satellite	• Helios Aerial Photography • Delair Drone • Photography Services	• GIS Tools and Services Instruments • Images/Photos • Surveys • Measurements	• Agriculture Mapping Weather Wildlife • Flooding/ Drought Mining • Other monitoring	Fees based on project
Ethiopia	• Geospatial Consultants PVT LTD • GeoSAS Consulting Svc PLC • East View Geospatial • Raster Geospatial Consultants • Ethiopia Geoportal by ESRI • Prime Geospatial Solutions	• ETRSS-1 • LEO, 13.7 m, MS • ET-SMART_RSS LEO, 60m, MS • Communications	• Drone Services of Ethiopia • Ofek in the World	• GIS Tools and Services Instruments • Images/Photos • Surveys • Measurements	• Agriculture Mapping Weather Wildlife • Flooding/ Drought Mining/Oil • Other monitoring	Fees based on project
Kenya	• List of 24 companies at https:// victormara.com/ list- of-major-geospatial-emgineering-consultancy-firms-in-Kenya • Astral Aerial • Apollo Agriculture • Lentera Africa • Oakar Svcs	• TAIFA1 • LEO, MS = 32m • Pan = 16m Communications	• Anarts Technology Kemya • Pixova Digital Agency • Oramedia Kenya • 360 Imaging Ltd • Ramani Geosystems • Global Media Desk • Nature Surf Systems • Astral Aerial Solutions • Sand Piper Aviation • Mint Glint Media • Professional Dron Mapping Svcs. • White Rhino Films • Microdrone Africa • JapakGIS Ltd	• GIS Tools and Services Instruments • Images Photos Surveys • Measurements • Advanced • Space Stations	• Agriculture Mapping Weather Wildlife • Flooding/ Drought Coastal • Other monitoring	Fees based on project
Liberia	• Geoville • East View Geospatial Sambus Geospatial • Supergeo Technologies ESRI		• Drone Liberia Ltd.	• GIS Tools and Services Instruments • Images/Photos • Surveys • Measurements	• Agriculture Mapping Weather Wildlife • Flooding/ Drought Coastal • Other monitoring	Fees based on project

National Adaptation Plans (NAPs) Africa Countries (17 Submitted as of 26 April 2023) *Source: United Nations Framework Convention on Climate Change*	Sample of Geospatial Companies In-Country Locate through web search, name and country.	Satellites*	Earth Observation Manned and Unmanned	Geospatial Tools	Applications and Analytics	Geo Tools, Data , etc. Availability**
Madagascar	• GEOSYSTEMS • MAPTOGIS • Woolpert • Digital Earth Africa		• Unimage • Madagascar • Aerial Metric • /Madagascar Flying Labs • Drone Madagascar • Ck Aerial Surveys	• GIS Tools and Services • Instruments • Images Photos Surveys • Measurements	• Agriculture • Mapping • Weather • Wildlife Flooding/ Drought Coastal • Other monitoring	Fees based on project
Niger	• IGNN MAPTOGIS UP42 • SERVIR West Africa		• Drone Africa Service	• GIS Tools and Services Instruments • Images/Photos • Surveys • Measurements	• Agriculture Mapping Weather Wildlife • Flooding/ Drought Other monitoring	Fees based on project
Sierra Leone	• East View Geospatial GeoData SL • Digital Earth Africa		• Africa Bees • UAVaid • Aeroprecisa	• GIS Tools and Services Instruments • Images/Photos • Surveys • Measurements	• Agriculture Mapping Weather Wildlife • Flooding/ Drought Coastal • Other monitoring	Fees based on project
South Africa	• Southern Mapping • Terra Analytics • Kgothatso innovation • GeoTerra image • Amaya Space • Dragonfly Aerospace • Nature Conservation Corp. • Bentley Systems • DH Env. Consulting Environtech EU • SI Analytics • DETERCO • Civil GEO • Swift Geospatial • GEO Data Design • ESRI So Africa • SMC-Synergy • EVOLVE GIS • TGIS • GIS So. Africa • NewSpace	• MDASAT-1A MDASAT-1B MDASAT-1C (Constellation for a ship-tracking payload and will be used to validate the use case of employing nanosatellites in ocean vessel detection through the automatic identification system (AIS) protocol. Additionally, the satellite will carry medium resolution imagers as a secondary payload to demonstrate the feasibility of using a nanosatellite for imaging applications, such as ocean color monitoring and fire tracking.) • S-Band Transmitter. (ADCS System Developed by ESL at Stellenbosch University. L- Band Receiver. HF Beacon Payload. 5 MP Camera Payload. Detecting wildfires with a k-line Imager (Potassium Imager). Payload is a k-line imager developed by the CSIR and provides a method of detecting smaller fires (90 m2) more effectively. This data will be implemented into AFIS, which is the data delivery mechanism for this project.) • ZACUBE 1 • ZACUBE 2 • Radar VGA Matric • Camera (CMOS)	• Aerial/Lidar and • Photography • Tallow • Aerial Africa • AOC Geomatics • Geospace • Spectrum Air Ltd. • Whittle Trading • Woolpert/ Southern • Mapping • Tallow Aerial Africa • AOC Geomatics • Geospace • Spectrum Air Ltd. • Whittle Trading • Woolpert/ Southern Mapping • Integrated Aerial Systems/ Drones • Aerial Vision Africa Sensefly • Helmdall Tracking Aerobotics • KURAI • The MAGIC Venture • Dove Air • DroneSnap	• GIS Tools and Services Instruments • Images/Photos • Surveys • Measurements • Advanced Space Stations	• Agriculture Mapping Weather Wildlife • Flooding/ Drought Coastal • Mining • Other monitoring	Fees based on project

National Adaptation Plans (NAPs) Africa Countries (17 Submitted as of 26 April 2023) *Source: United Nations Framework Convention on Climate Change*	Sample of Geospatial Companies In-Country Locate through web search, name and country.	Satellites*	Earth Observation Manned and Unmanned	Geospatial Tools	Applications and Analytics	Geo Tools, Data , etc. Availability**
South Sudan Sudan	• Digital Earth • Geospatial Minds • IMPACT Initiatives • LeadDog Consulting • ESRI North Africa • GSM Limited • East View Geospatial • Yazan Solutions • LeadDog Solutions • ESRI North Africa • IPIS Sudan • BLUEBELL	• SRSS-1	• Ofek in the World • UAVOS • Primarily military	• GIS Tools and • Services Instruments • Images/photos • Surveys • Measurements • Advanced Space Stations	• Agriculture • Mapping Weather • Wildlife • Flooding/ Drought Other monitoring War Zones	Fees based on project
Togo	• African Geospace, Noviss, • Thales Alenia Space, • Prepa Coast (powered by Google Earth) • TOD'AERS Global		• Togo Flying Labs E-Agri Sky Geoinfotech	• GIS Tools and Services Instruments • Images/photos • Surveys • Measurements • -Advanced • Space Stations	• Agriculture Mapping Weather Wildlife • Flooding/ Drought Coastal • Other monitoring	Fees based on project

APPENDIX

NAP African Countries: Submission Date, Focus & Goals, Geospatial References

National Adaptation Plans (NAPS) Country & Website (17 Submittals as of April 26, 2023) *Source: United Nations Framework Convention on Climate Change*	Date	Main Focus	Geo Reference Within NAP Doc No=0 Yes=1 Other=2 (is a Geo Tool/Sv c.)	Geo Type	Refers to Disaster Resiliency Flooding / Smart Cities No=0 Yes=1	Refers to Ag & Small Holder Farms No=0 Yes=1	Goals	Sample Geo Companies
1. Benin https://unfccc.int/sites/default/files/resource/PNA_BENIN_2022_0.pdf	Ministry of the Living Environment and Sustainable Development. Directorate General for Environment and Climate 7/8/2022	Economy based on Agriculture and processing of ag products. Exports: Cotton 53%, Cashews, 9%, Oil seeds, 4.7% Most subsistence farming and rain-fed Secondary focus on Coastal Erosion.	1, 2	Maps	0	1	• Promote a resilient system of governance of the development sectors; • Promote a resilient natural resource management and exploitation system; and • Develop sustainable and inclusive socio- economic climate risk management mechanisms.	• MAPTOGIS • OSM Benin • AFRIGIST
2. Burkina Faso https://www4.unfccc.int/sites/NAPC/Documents/Parties/Burkina%20Faso%20NAP_English.pdf	Ministry of Environment & Fishery Resources 10/15/2015	Ensure sustainable food and nutrition security. Protect persons and goods from extreme climate events and natural disasters.	1, 2	Maps	1	1	• Reduce the vulnerability of natural, social and economic systems to climate change.	• MAPTOGIS • Digital Earth Africa • Burkina Sat • SERVIR West Africa
3. Cameroon https://www4.unfccc.int/sites/NAPC/Documents/Parties/PNACC_Cameroun_VF_Validée_24062015%20-%20FINAL.pdf	Ministry Of Environment, Protection of Nature and Sustainable Development 10/26/2015	Adapt to climate change by reducing the vulnerability of Cameroonians to the effects of climate change and increasing their resilience and quality of life; and improving adaptive capacities to create new opportunities to support the country's sustainable development.	1	Maps	1	1	• Improve knowledge on climate change in Cameroon • Inform, educate and mobilize the Cameroonian population to adapt to climatic changes • Reduce the vulnerability to climate change of the population in the main sectors and agro-ecological zones of the country. • Mainstream adaptation to climate change in strategies and policies national sectors.	• GIMS Cameroon • GeoView • MAPTOGIS • NM Geospatial • GeoAdvantage

National Adaptation Plans (NAPS) Country & Website (17 Submittals as of April 26, 2023) *Source: United Nations Framework Convention on Climate Change*	Date	Main Focus	Geo Reference Within NAP Doc No=0 Yes=1 Other= 2 (is a Geo Tool/Sv c.)	Geo Type	Refers to Disaster Resiliency Flooding / Smart Cities No=0 Yes=1	Refers to Ag & Small Holder Farms No=0 Yes=1	Goals	Sample Geo Companies
4. Cabo https://unfccc.int/sites/default/files/resource/NAP_Cabo%20Verde_EN.pdf	Ministry of Agriculture and Environment 10/23/20	Cabo Verde will minimize the impacts of climate change through planned and concerted actions at all levels and will be a safe small island state, with all the necessary capacities to take advantage of the opportunities provided by climate change to become more sustainable, innovative and resilient.	1	Maps	1	1	• Effective planning, research and adaptation action at the National and Local levels • Develop and implement coordinated responses to climate risk, when necessary, and take measures to prevent and minimize the damage that climate change can cause or take ad- vantage of opportunities that may arise.	• Africa GeoPortal by Esri • FAO (The Hand-in-Hand Initiative) • Aeolus (ESA)
5. Central African Republic https://unfccc.int/sites/default/files/resource/CAR-NAP-FR-web.pdf	Ministry of Environment and Sustainable Development 2/16/2022	Improve the country's resilience, particularly in the agricultural and food security, health, natural resource management and infrastructure sectors, to the adverse effects of climate change	1	Maps	1	1	• Become an emerging country, built on a diversified, sustainable harmoniously distributed economy over the national territory, a modern state open to the world, attached to an ethic and to technological innovation.	None noted
6. Chad https://unfccc.int/sites/default/files/resource/CHAD-NAP_EN-web.pdf	Ministry of the Environment 2/15/2022	Identifying and addressing key challenges to effective adaptation. Foster mutually reinforcing actions for sustainable and resilient development.	1	Maps	1	1	• Improve living conditions and reduce social inequalities while preserving natural resources and adapting to climate change.	• ESRI NA • East View Geospatial • MapMechanics • ECLAT Lake Chad • EOS Data Analytics
7. Democratic Republic of Congo https://unfccc.int/sites/default/files/resource/DRC-NAP_EN.pdf	Ministry of the Environment and Sustainable Develop ment 7/6/2022	Guide initiatives for the management and reduction of long-term climate risks in the country, requiring coordination and cooperation between different level of government sectors of the government and civil society.	1, mentions need for GIS data	Maps, Weat her foreca sting	0	1	• Create a prosperous, climate-resistant and low-carbon emission nation	• East View Geospatial • MAPTOGIS • CongaSat1

National Adaptation Plans (NAPS) Country & Website (17 Submittals as of April 26, 2023) *Source: United Nations Framework Convention on Climate Change*	Date	Main Focus	Geo Reference Within NAP Doc No=0 Yes=1 Other= 2 (is a Geo Tool/Sv c.)	Geo Type	Refers to Disaster Resiliency Flooding / Smart Cities No=0 Yes=1	Refers to Ag & Small Holder Farms No=0 Yes=1	Goals	Sample Geo Companies
8. Ethiopia https://www4.unfccc.int/sites/NAPC/Documents/Parties/NAP-ETH%20FINAL%20VERSION%20%20Mar%202019.pdf	3/1/2019	Strengthen holistic integration of climate change adaptation in Ethiopia's long-term development pathway, supported by effective institutions and governance structures, finance for implementation and capacity development and strengthened systems for disaster risk management and integration among different sectors.	1	• Maps, GeoCLIM, tools	1	1	• Reach middle income status before 2025 and a carbon neutral economy by 2030.	• Geospatial Consultants Pvt Ltd • GeoSAS Consulting • East View Geospatial • Raster Geospatial Consultants • Ethiopia Geoportal by Esri • Prime Geospatial S.C Solutions
9. Kenya https://www4.unfccc.int/sites/NAPC/Documents%20NAP/Kenya_NAP_Final.pdf	Republic Of Kenya Ministry of Environment and Natural Resource 2/20/2017	Consolidate the country's vision on adaptation supported by macro-level adaptation actions that relate with the economic sectors and country level vulnerabilities to enhance long term resilience and adaptive capacity. The key climatic hazards in Kenya are droughts, floods and sea- level rise with prioritized actions in the agriculture, livestock, water, environment, infrastructure, sustainable livelihoods, energy infrastructure and tourism areas.	1,2	Maps for • Drought risk management • Environment • Water • Energy • Agriculture • Livestock • Fisheries • Drought, rainfall • Floods, and sea-level rise maps • Agro • Climate zone maps • Flood mapping	1	1	• Enhanced climate resilience towards the attainment of Vision 2030. • Reduced climate-induced loss and damage, mainstreamed disaster risk reduction approaches in various sectors, reduced costs, humanitarian aid, and improved knowledge and learning for adaptation and the future protection of the country.	List of 24 companies At https://victormar a.com/list-of- major-geospatial- emgineering- consultancy- firms-in-Kenya Also launch of Taifa-1 satellite on April 18, 2023 • Astral Aerial • Apollo • Agriculture • Lentera • Africa • Oakar Svcs.

National Adaptation Plans (NAPS) Country & Website (17 Submittals as of April 26, 2023) *Source: United Nations Framework Convention on Climate Change*	Date	Main Focus	Geo Reference Within NAP Doc No=0 Yes=1 Other= 2 (is a Geo Tool/Sv c.)	Geo Type	Refers to Disaster Resiliency Flooding / Smart Cities No=0 Yes=1	Refers to Ag & Small Holder Farms No=0 Yes=1	Goals	Sample Geo Companies
10. Liberia https://unfccc.int/sites/default/files/resource/LIBERIA_%20NAP_%20FINAL_%20DOCUMENT.pdf	12/16/2021	Coordinate sectors (including both public and private sector stakeholders) as well as institutions on climate change risk management and universities using awareness with a focus on the improvement of climate risk management actions. Encourage participation from sector stakeholders and line agencies responsible for key sectors to identify and propose measures to promote adaptation to reduce climate change risk.	1,2	Maps	1	1	• Understanding the causes and potential consequences of global climate change on people and environment is essential in implementing strategies to reduce climate change in the future.	• Geoville • EastView Geospatial • Sambus Geospatial • Supergeo Technologies • Esri
11. Madagascar https://unfccc.int/sites/default/files/resource/PNA-Madagascar.pdf	Ministry of Environment and Sustainable Development 5/29/2022	Regreening of Madagascar Green and Blue Economy Climate Change and Energy Transition Info, Education, and Communication Green Diplomacy Improved Governance.	1	Maps for Early Warning Systems	1	1	• Capacity building to improve resilience in the face of climate change. Main effects to help populations, through the improvement of policies and planning, and/or by conducting targeted actions in the field and which are expected to scale up.	• GeoSystems • MAPTOGIS • Woolpert • Digital Earth Africa
12. Niger https://unfccc.int/sites/default/files/resource/Plan-National-d%-27Adaptation_Niger_Version-Finale.pdf	11/14/2022	Contribute to sustainable development by reducing negative impacts of climate change promote food security. Fight against poverty. Promote rational management of natural resources; increase the resilience of the population and ecosystems.	1, 2	Maps	1	1	• Need to strengthen the resilience-communities and systems.	• IGNN • MAPTOGIS • UP42 • SERVIR West Africa

National Adaptation Plans (NAPS) Country & Website (17 Submittals as of April 26, 2023) *Source: United Nations Framework Convention on Climate Change*	Date	Main Focus	Geo Reference Within NAP Doc No=0 Yes=1 Other= 2 (is a Geo Tool/Sv c.)	Geo Type	Refers to Disaster Resiliency Flooding / Smart Cities No=0 Yes=1	Refers to Ag & Small Holder Farms No=0 Yes=1	Goals	Sample Geo Companies
13. Sierra Leone https://unfccc.int/sites/default/files/resource/SierraLeone_iNAP_Final.pdf	Ministry of the Environment, Sierra Leone West Africa 2/8/2022	Adaptation measures were included for agriculture, forests, water resources and coastal zones. The SNC focused on agriculture, forestry, and water resources. Key Government stakeholders by priority Agriculture and food security • Ministry of Agriculture and Forestry, SL-Met, Planning Evaluation, Monitoring, Statistical Division (PEMSD) Environment Protection Agency • Municipality and district councils.	1,2	Maps for: • Agriculture and food security • Water resources and energy • Coastal zone management • Environment • Disaster management • Precipitation and temperature	1	1	Reduce vulnerability by half by 2030 through increased risk awareness, improvements in rule compliance, increased institutional capacity and an integrated gender- responsive approach to adaptation in development policy and programs across sectors and scales.	• East View Geospatial • GeoData SL • Digital Earth Africa
14. South Africa https://unfccc.int/sites/default/files/resource/SierraLeone_iNAP_Final.pdf	9/29/2021	Address the inevitable impacts of climate change and the means to make a fair contribution to global efforts to stabilize, and reduce, greenhouse gas emissions. the NCCAS is adopting a cluster approach. The clusters include: • Increased human resilience and adaptive capacity • Increased economic resilience and adaptive capacity • Increased environment and ecological infrastructure resilience and adaptive capacity • Increased physical infrastructure resilience and adaptive capacity.	1, 2	Maps for: • South African Flash Flood Guidance (SAFFG) system • Drought Early Warning Systems • Drought Monitoring Desk • National Fire Danger Rating System (NFDRS) • Severe Weather Warning System (SWWS) • Wide Area Monitoring Info. System	1	1	Outcome for this strategic intervention is: Increased resilience and adaptive capacity achieved in human, economic, environment, physical and ecological infrastructure.	• Southern Mapping • Terra Analytics • Kgothatso Innovations • GeoTerra Image • Amaya Space • Dragonfly Aerospace • Nature Conservation Corp. • Bentley Systems • DH Environmental Consulting • Environtech • SI Analytics • Dterco • CivilGEO • Swift Geospatial • GEO Data Design • Esri South Africa • SMC-Synergy • EvpIveGIS • TGIS • NewSpace • Woolpert

National Adaptation Plans (NAPS) Country & Website (17 Submittals as of April 26, 2023) *Source: United Nations Framework Convention on Climate Change*	Date	Main Focus	Geo Reference Within NAP Doc No=0 Yes=1 Other= 2 (is a Geo Tool/Sv c.)	Geo Type	Refers to Disaster Resiliency Flooding / Smart Cities No=0 Yes=1	Refers to Ag & Small Holder Farms No=0 Yes=1	Goals	Sample Geo Companies
15. South Sudan https://unfccc.int/sites/default/files/resource/South-Sudan-First-NAP%20.pdf	South Sudan Ministry Of Environment And Forestry 11/1/2021	The NAP prioritizes nine sectors: • Agriculture, livestock and fisheries • Disaster risk reduction • Energy • Environment, ecosystems and biodiversity conservation • Health • Human settlements • Tourism and recreation • Industry, infrastructure and transportation • Water resources.	1	Maps	1	1	Three priority pillars: • Building climate resilient communities; • Building a climate resilient economy and development trajectory; and • Building a climate- resilient environment and ecosystems.	• Digital Earth Africa • GeoSpatial Minds • IMPACT Initiatives • LeadDog Consulting • Esri North Africa • GSM Limited
16. Sudan https://www4.unfccc.int/sites/NAPC/Documents%20NAP/National%20Reports/Sudan%20NAP.pdf	Council for Environment and Natural Resources 9/29/2016	The underlying vision for Sudan's NAP is to contribute to climate change-resilient communities, businesses, and productive systems across the country in the future. Enhancing capacity for undertaking State-level adaptation planning was the core focus of the Sudan NAP. The primary objective of Sudan's NAP is to reduce vulnerability to the impacts of climate change by building adaptive capacity and resilience among state- and national-level institutions.	1,2	• Maps • GPS • AWSs • Regional climate modeling: Research and systematic observation. Vulnerability hotspot mapping: Climate proofing: • Models (water, agriculture, hot-spot, economic, etc.); and provide	1	1	• Build disaster-resilient communities, individuals and organizations where risks are defined and understood. • Effective response plans to anticipate and respond to the needs of the most vulnerable. • Take actions that are well coordinated across spatial (local & regional), institutional (inter-ministry as well as intra-ministry), and temporal (both near-term and long-term) scales.	• East View Geospatial • Yazan Solutions • LeadDog Solutions • Esri North Africa • IPIS Sudan • Blue Bell
17. Togo https://www4.unfccc.int/sites/NAPC/Documents%20NAP/Togo%20NAP.pdf	Ministry of the Environment and Forestry Resource 1/17/2018	Reduce vulnerability and strengthen resilience.	1,2	Maps	1	1	Accelerate growth to reduce poverty and inequality and create jobs, with multiplier effects on level of income, quality of life, and speed achieving development goals.	• African Geospace, • Noviss, • Thales Alenia Space, • PrepaCoast • Tod'Aérs Global Network

APPENDIX

Finance Institutions

DEVELOPMENT AND EXPORT FINANCE INSTITUTIONS 2021-2022*	
Multilateral Agencies	**Links**
Asian Development Bank (ADB	https://www.adb.org
African Development Bank	https://www.afdb.org
Asian Infrastructure Investment Bank (AIIB)	https://www.aiib.org
CAF- Development Bank of Latin America	https://www.caf.com
Emerging Africa Infrastructure Fund (EAIF)	https://www.eaif.com
European Bank for Reconstruction and Development (ERDB)	https://www.ebrd.com
European Investment Bank (EIB)	https://www.eib.org
Green Climate Fund	https://www.greenclimate.fund
IDB Invest	https://www.idbinvest.org
International Finance Corporation (IFC)	https://www.ifc.org
Interact Climate Change Facility	https://www.edfi.eu
Multilateral Investment Guarantee Agency (MIGA)	https://www.miga.org
OPEC Fund for International Development (OFID)	https://opecfund.org
Private Infrastructure Development Group	https://www.pidg.org
Sustainable Energy Fund for Africa	https://www.se4all-africa.org https://ndcpartnership.org https://www.icafrica.org
Bilateral Agencies	
Access to Energy Fund	https://www.fmo.nl/aef
Banco do Nordeste	https://www.bnb.gov.br
Brazilian Development Bank (BNDES)	https://www.bndes.gov.br
Canadian Climate Fund for the Private Sector in Asia II	https://www.adb.org/what-we-do/funds/canadian-climate-fund-for-the-private-sector-in-asia-2
Development Bank of Southern Africa (DBSA)	https://www.dbsa.org
German Investment Corporation (DEG)	https://www.deginvest.de
FMO (the Dutch Development Bank)	https://www.fmo.nl
Japan International Cooperation Agency (JICA)	https://www.jica.go.jp/english/
Kreditanstalt fuer Wiederaufbau (KfW)	https://www.kfw.de
Oesterreichische Entwicklungsbank AG	https://www.devex.com
Overseas Private Investment Corporation (OPIC)	https://oig.usaid.gov/OPIC
Prospero	https://prosperoinvest.com/about.html
U.S. International Development Finance Corporation	https://www.dfc.gov
Export Credit Agencies	
Export-import Bank of China	http://english.eximbank.gov.cn
Export Development Canada	https://www.edc.ca
Export Finance Australia	https://www.exportfinance.gov.au
Export-Import Bank of Korea	http://www.koreaexim.go.kr

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