GEOIMPACT WEST AFRICA | Q2 2025 EDITION

EMPOWERING WEST AFRICA WITH LOCATION INTELLIGENCE

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Foreword

It is with great pleasure that I welcome you to this edition of GeoImpact West Africa, our newsletter dedicated to showcasing how geospatial technology is shaping a smarter, more sustainable, and more connected region.

At Sambus Geospatial, we believe that location intelligence is no longer a luxury — it's a necessity. Across sectors, from government and telecommunications to agriculture and education, spatial thinking is enabling more informed decisions, greater transparency, and impactful innovation. This newsletter captures just a few of those compelling stories.

In this issue, we spotlight how geospatial intelligence empowered the Nigeria Communications Commission to enhance its regulatory oversight, and how cutting-edge drone and GIS training under the ACReSAL project is contributing to sustainable land management in Northern Nigeria. Our Innovation Spotlight explores the transformative role GIS plays in driving transparency within Nigeria's Agro Pocket Initiative — proof that even complex national programs can benefit from simplified, scalable GIS solutions.

We also take pride in celebrating the next generation of spatial thinkers through our Young Scholar Award, and we shine a light on our partners and products that continue to expand the reach and relevance of GIS across the region.

As we look ahead to the upcoming Esri User Conference West Africa, we're reminded that transformation doesn't happen in isolation. It requires collaboration, vision, and a shared belief in the power of geography to solve real-world problems.

We hope this issue informs, inspires, and invites you to engage more deeply with the world of GIS.
Thank you for being part of the journey.

Akua Aboabea Aboah
MD - Sambus Geospatial

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Editorial

Navigating a Data-Driven Future with Purpose and Precision

Welcome to a new quarter of possibilities and another edition of GeoImpact, Sambus Geospatial quarterly publication where we share how geospatial technologies are shaping industries, empowering professionals, and transforming lives across West Africa.

As we progress through 2025, the role of location intelligence in driving decision-making has never been more critical. From urban development to disaster response, agriculture to infrastructure, the value of spatial data lies not only in where things happen but in why they happen, how they evolve, and what we can do next.

At Sambus Geospatial, we go beyond distributing tools and deliver integrated solutions that turn data into decisions. As the exclusive distributor of Esri, and an authorized distributor of Wingtra, Trimble, and NV5 Geospatial, our mission is to drive West Africa's growth through world-class technology, local expertise, and a strong commitment to capacity development.

GeoAI: Adding Intelligence to Spatial Data

Artificial Intelligence is changing how we interpret the world around us and when paired with GIS, it gives rise to GeoAI. This powerful fusion enables automated feature detection, predictive modeling, and smarter decision-making.

Today, organizations are using GeoAI to monitor land cover changes, forecast disease spread, and identify vulnerable populations during disasters. Governments are deploying AI-enabled workflows in ArcGIS Pro to streamline urban planning and infrastructure development, while environmental agencies use machine learning to analyze satellite imagery for real-time deforestation alerts.

With GeoAI, spatial data becomes more than a snapshot it becomes a living, evolving source of insight.

Drone Innovation: Seeing More, Faster

Drones are no longer experimental tools; they are essential assets for data collection, especially in hard-to-reach or large-scale areas. Powered by Wingtra fixed-wing drone technology, organizations across West Africa are surveying land, mapping flood zones, inspecting infrastructure, and monitoring crops with unprecedented precision and speed.

What makes drone data truly valuable is its integration into GIS systems. With ArcGIS, users can bring drone imagery into operational dashboards, run spatial analyses, and inform cross-departmental workflows.

Whether in agriculture, energy, or disaster management, drone-to-GIS pipelines are improving how quickly and accurately decisions are made and how effectively field teams collaborate.

Smart Mapping: From Maps to Meaning

Smart mapping goes beyond visualizing locations about creating interactive, insightful, and actionable maps that drive decisions in real time.

Through platforms like ArcGIS Online, organizations can design live dashboards that track service delivery, field operations, or resource distribution across regions. Mobile tools like Survey123, Field Maps, and QuickCapture are empowering field teams to collect data on the go and sync instantly with command centers.

Whether its a city using dashboards to monitor waste collection, or a utility mapping every asset in its network, smart maps are transforming how public and private institutions operate with greater speed, clarity, and accountability.

Thank You for Walking This Journey With Us

To our clients, partners, and collaborators thank you for being part of the Sambus community. Your projects, insights, and feedback continue to inspire our team to innovate, educate, and elevate the standard of geospatial excellence in West Africa.

In this edition of GeoImpact, we invite you to explore the solutions, stories, and strategies shaping our collective future. As always, we are here to support you at every scale, on every project, and in every decision.

Together, we are not just mapping change. We are driving it.

Geo-Impact in Action

Transforming Oversight with Geospatial Intelligence

The Nigerian Communications Commission (NCC) has embraced geospatial technology to modernize telecom regulation, improve broadband implementation, and enhance operational oversight. With the integration of Esri ArcGIS platform, the Commission now operates with real-time spatial awareness, ensuring more efficient, data-driven decision-making across departments.

The integration of GIS technology has been a game-changer for our organization, enabling us to make data-driven decisions, enhance regulatory oversight, and drive sustainable development in the telecommunications sector. - NCC Management

Before GIS: Challenges Hindering Efficiency

Prior to adopting ArcGIS, NCC faced systemic limitations:

- Reports were text-heavy with minimal data visualization.
- Regulatory verifications were manual and random, risking oversight gaps.
- Large telecom datasets were cumbersome to manage, analyze, or map.
- Broadband strategies lacked geospatial insight, affecting reach and target realism.
- Time-enabled trend analysis and interactive dashboards were non-existent.

"We were limited by flat reporting and slow analysis. Today, with GIS, our reports are alive with interactivity, and our insights are more actionable." - NCC GIS Analyst

ArcGIS Technologies Driving Innovation

GIS is now foundational at NCC, powered by the following ArcGIS tools:

- **ArcGIS Pro:** Mapping telecom towers, generating coverage maps (2G/5G), conducting environmental impact assessments, and enforcing attribute rules for data quality.
- **ArcGIS Online:** Hosting data for organization-wide collaboration and insight sharing.
- **ArcGIS Experience Builder:** Creating public-facing and internal apps for microwave link visibility and coverage insights.
- **ArcGIS Field Maps & Survey123:** Enabling GPS-smart field verification for microwave links worth over $10M annually replacing inefficient paper-based data collection.
- **ArcGIS Dashboards:** Powering decision-making with real-time visuals for network deployments and interference resolution.
- **Map Viewer + Arcade:** Enhancing data interactivity with custom pop-ups and contextual filters.

Before vs After GIS: Tangible Transformation

Old Method	With GIS
Paper-based field surveys	Smart forms with Survey123 and Field Maps
Random compliance checks	Targeted, data-driven verification
Worded reports	Interactive dashboards and visual maps
No broadband visibility	Real-time coverage maps with measurable milestones

With GIS, we don't just see the data we see the impact Stakeholder, NCC

Results That Matter

- Over 176,000 polling units mapped to assist INEC elections.
- $10M+ in government revenue protected via accurate microwave link oversight.
- Broadband coverage gaps closed using visual, geo-enabled strategies.
- Real-time dashboards serve Management, Spectrum, and Broadband Teams.
- ITU, CBN, and other federal bodies now request NCC GIS-generated datasets.

"We've moved from fragmented datasets to unified platforms that empower every department from compliance to broadband planning." - NCC Leadership

Strategic Impact on Goals

- GIS has enabled NCC to: Enhance regulatory oversight and interference resolution.
- Improve data accuracy and foster transparency.
- Empower broadband rollout through measurable tracking of NNBP (2020 - 2025).
- Collaborate better with stakeholders through centralized, accessible GIS infrastructure.

The Road Ahead: Geo-AI & Beyond

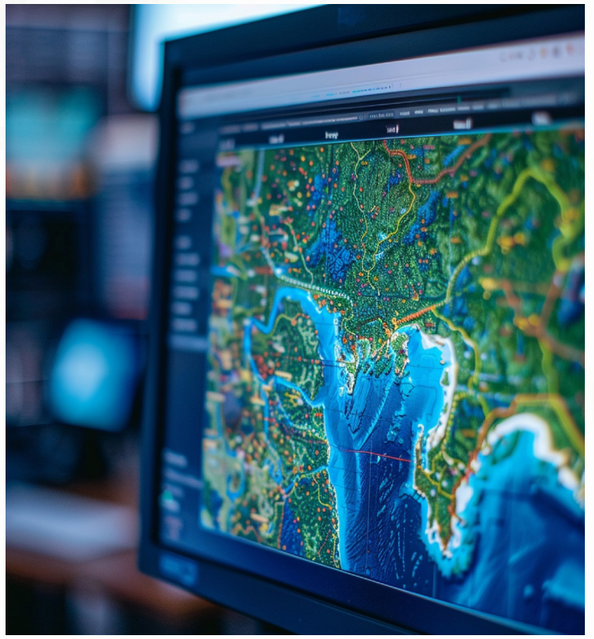
Looking forward, NCC plans to:

- Build a centralized GIS infrastructure with ArcGIS Enterprise and ArcGIS Hub.
- Upskill GIS staff to handle Geo-AI, Python-based automation, and machine learning.
- Develop open data policies for stakeholder collaboration and transparent governance.
- Continue using GIS to achieve universal broadband coverage, particularly in underserved areas.

"We envision becoming a global benchmark in using geospatial intelligence to regulate telecommunications effectively" - Avula Emmanuel Arimor, NCC.

Final Word

GIS has not only modernized the NCC workflows it has reshaped the future of telecom governance in Nigeria. Through innovation, collaboration, and Esri technology, the Commission is unlocking new levels of efficiency, transparency, and impact in service of national development.

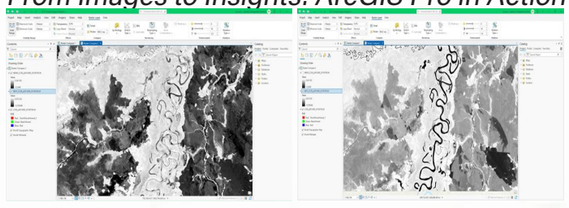


EMPOWERING SUSTAINABLE LAND MANAGEMENT IN NORTHERN NIGERIA: ACRESAL'S DRONE & GEO-SPATIAL TECHNOLOGY TRAINING

Northern Nigeria faces mounting environmental pressure deforestation, land degradation, fragmented habitat all made worse by climate change. These dynamics threaten biodiversity and the livelihoods of millions, amplifying the need for effective land management approaches that go beyond traditional practices.

In response, a recent two-day capacity-building workshop placed cutting-edge drone technology and geospatial analysis at the forefront for the FCT ACReSAL team. Organized and facilitated by Sambus Geospatial, the training introduced participants to powerful tools such as ArcGIS Pro and ArcGIS Drone2Map, enhancing their ability to leverage spatial data for addressing critical environmental challenges across Northern Nigeria.

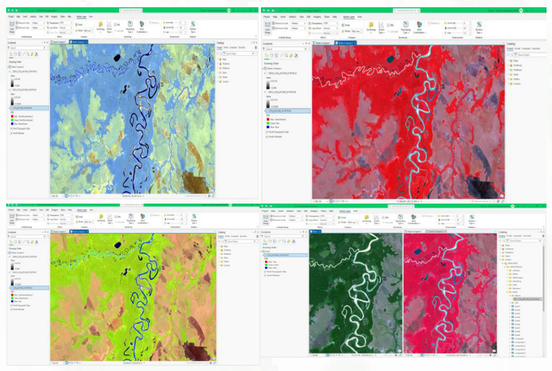
From Images to Insights: ArcGIS Pro in Action



The workshop began with ArcGIS Pro, teaching participants how to process drone imagery to derive key environmental metrics. These included:

- **NDVI (Normalized Difference Vegetation Index) for assessing vegetation health**
- **NDMI (Normalized Difference Moisture Index} for detecting moisture levels in the soil and vegetation**

These indices enable real-time monitoring of vegetation vitality, help pinpoint regions valuable for conservation, and track shifts in land use and land cover over time.

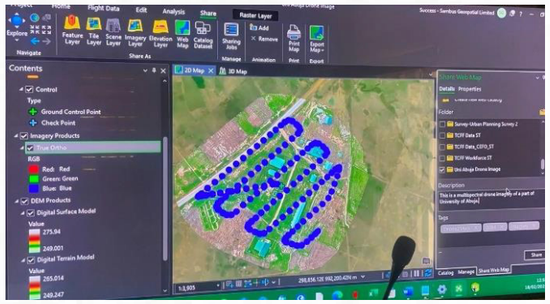


Unlocking the Power of Drone2Map

The second day focused on ArcGIS Drone2Map. ACReSAL team members learned to generate:

- Ortho-mosaics geometrically-accurate composite images
- Digital Elevation Models (DEMs)
- Digital Terrain Models (DTMs)

Using both multispectral and LiDAR data, they processed imagery to create true ortho imagers, dense-matched 2D maps, and robust 3D models for deeper spatial understanding.



Sharing Data for Collective Impact

An essential theme of the training was data dissemination. Participants learned how to package and share maps, analyse data and share insights with stakeholders from local government bodies to community groups fostering collaborative efforts and data-driven decision-making.

Geospatial Technology: A Force Multiplier for ACReSAL

By leveraging geospatial technology and drone-based mapping, ACReSAL can now:

- Monitor vegetation health: Track changes in vegetation cover, density, and health, enabling data-driven decision-making for conservation and management efforts.
- Identify areas of high conservation value: Pinpoint areas with high biodiversity, ecosystem services, or cultural significance, informing targeted conservation and restoration initiatives.
- Track land use and land cover changes: Analyze changes in land use and land cover over time, enabling the development of effective strategies to combat deforestation, land degradation, and habitat fragmentation.

These capabilities align with ACReSAL's mission to restore million hectares of degraded land by 2028 and support the broader objective of restoring 4 million hectares nationally by 2030.

The tools and insights gained during this training mark a pivotal step in their mission to combat climate change, protect ecosystems, and nurture resilient communities across Northern Nigeria.

Innovation Spotlight

Tech Talk: Simplified GIS Innovation Driving Transparency in Agriculture: GIS Powers Nigeria's Agro Pocket Initiative

In a bold step toward modernizing agricultural subsidy distribution, the Sambus Professional Services team developed a smart geospatial solution for Nigeria's Agro Pocket Initiative, aimed at supporting 60,000 ginger farmers. Using ArcGIS Survey123 and ArcGIS Dashboards, the team created an intuitive digital system that allows field officers to verify farmers on the ground, auto-generate unique IDs, and accurately capture land and payment details all in real-time. The system also integrates photo evidence and smart logic to validate information, detect duplicate records, and flag any inconsistencies, ensuring every entry is clean and accountable.

At the heart of this solution is a real-time dashboard that brings clarity to the field visualizing farmer locations, tracking subsidy payments, and showing verification progress at a glance. Though developed as a demonstration for the National Agricultural Growth Scheme Agro Pocket (NAGS-AP), this innovative GIS-powered approach proves the potential for scalable, transparent systems in agriculture. It's a leap toward eliminating fraud, streamlining field operations, and building trust in government support programs one farmer at a time.

AGRO POCKET INITIATIVE

- ArcGIS Dashboard + Survey123 used to track subsidies for 60,000 ginger farmers
- Real-time visual, field verification, and farmer ID generation
- As part of a demonstration for the National Agricultural Growth Scheme Agro Pocket (NAGS-AP), Sambus developed a digital solution using ArcGIS Survey123 and ArcGIS Dashboards to showcase how geospatial technology can enhance transparency and accountability in agricultural subsidy programs. The custom-built form enables field officers to distinguish between new and existing farmers, auto-generate or validate farmer IDs, capture georeferenced land areas, and record detailed payment information including photo evidence of receipts. Built-in logic automatically calculates land size, flags prior payments, and detects possible duplicates, ensuring data integrity throughout. This is complemented by a real-time dashboard that visualizes farmer locations, payment trends, and verification status, allowing stakeholders to monitor subsidy disbursement with precision. Though this was a demonstration, it highlights the potential for scalable, data-driven systems to support more transparent and efficient agricultural development efforts.

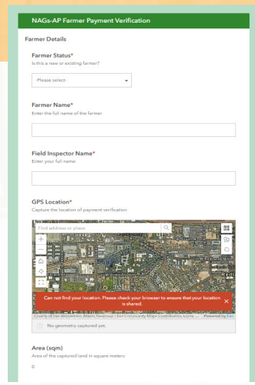
How it Works:

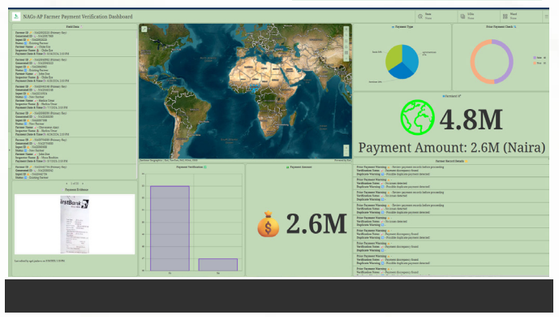
FIELD DATA COLLECTION

- **COLLECT RECEIPIANT INFORMATION:** The field officer collects farmer info. The form generates Alpha numeric codes for new farmers as ID, while for subsequent use, the ID is provided. For existing farmers, it checks through the feature layer to see if there was any existing payment that has been made.
- **FARMLAND SKETCH:** You can sketch the farmland on the app and automatically get the size of the farmland to ensure equity in resource allocation.
- **SELECT PAYMENT TYPE:** This carries the resource type in this case fertilizers, seeds and the amount.
- **ADD PAYMENT DATE & TIME:** Helps the viewers to filter for payments made on different dates or within a range of days or even hours.
- **PAYMENT CONFIRMATION:** Used to confirm if the payment went through, in cases where there might be hitches with network reception considering the fact that these farmers are usually in rural areas.
- **SUBMISSION:** The form is then submitted by clicking the Submit button at the bottom

AFTER SUBMISSION:

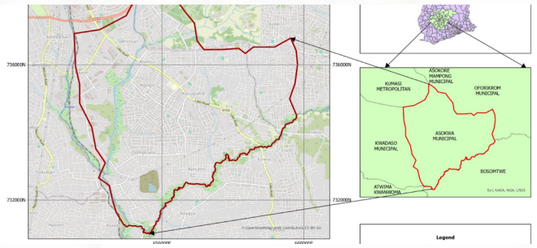
The information above is automatically integrated into a dashboard where it can be monitored and queried by supervisors and decision makers in the office, ensuring office-field collaboration and transparency in the process.

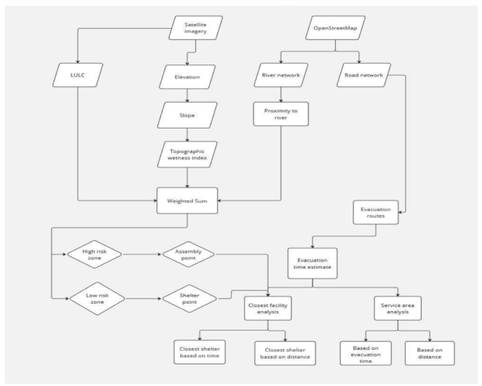




Celebrating Our Future Leaders: The Young Scholar Award

A GIS Based Approach for Planning Evacuation Routes In Flood Prone Areas In Asokwa Municipal, Kumasi, Ghana





er network data.

- **Flood Susceptibility Mapping:** Used weighted sum technique to classify flood risk into Very low, low, moderate, high and very high risk zones
- **Evacuation route mapping:** Applied ArcGIS network analyst (Closest Facility and Service Area Analysis) to find the safest and fastest routes(Parajuli *et al.*, 2023).

Flood conditioning factors

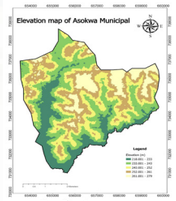


Fig2: Elevation map

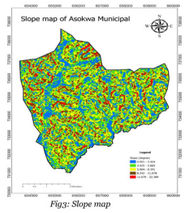


Fig3: Slope map

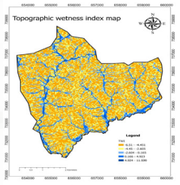


Fig4: Topographic Wetness Index map

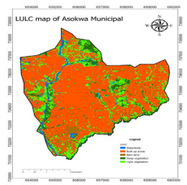


Fig5: Land use/land cover map

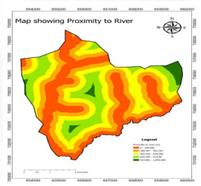


Fig6: River proximity map

Software used:

This study utilized ArcGIS Pro, a software, powerful for GIS spatial analysis, flood susceptibility mapping, and evacuation route optimization.

Results and Key findings

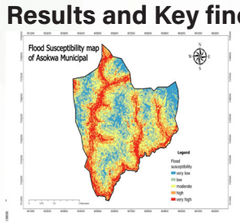


Fig7: Flood susceptibility map

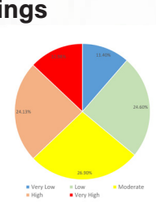


Fig8: Flood susceptibility chart

- 37% of Asokwa Municipal falls within high to very high flood risk zones (Fig 8)
- Low lying areas near the water bodies are

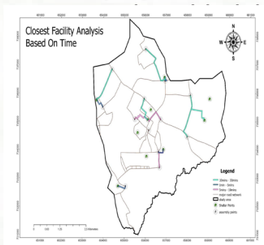


Fig9: Closest facility map(Time)

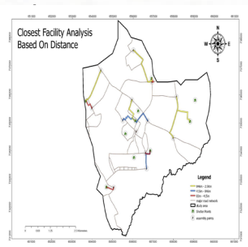


Fig10: Closest facility map(Distance)

- 13Assemblypoints and 10 shelter points were identified within safe zones and the Network Analyst Tool effectively identified the safest and shortest routes based on

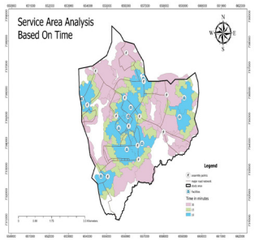


Fig11: Service area map(Time)

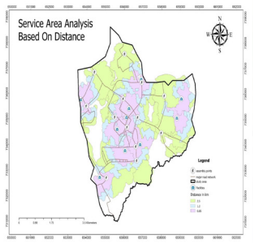


Fig12: Service Area map(Distance)

- Identified the coverage of emergency services(eg. Hospitals) based on time(Fig 11) and distance(Fig12) to determine how quickly people can reach them.
- The model can help prioritize emergency infrastructure placement in safe zone

Conclusion

This study demonstrated the effectiveness of GIS in identifying flood-prone areas and optimizing evacuation planning in Asokwa Municipal. Using ArcGIS, a flood susceptibility map was generated, revealing that areas near riverbanks are at very high risk of flooding. Closest Facility and Service Area Analysis helped identify optimal evacuation routes, reducing travel time and improving emergency response. Additionally, 13 assembly points and 10 shelters were strategically located in safe zones to support displaced individuals. These findings confirm that the study's objectives were achieved, and the approach can serve as decision-support tool for emergency responders, urban planners, and policymakers.

Recommendations

- Integrate flood susceptibility maps into urban planning to prevent construction in high-risk areas.
- Enhance community awareness and preparedness through education programs.
- Future research can incorporate mobile GIS applications to enhance emergency response and community safety.

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ENHANCING DISASTER RESPONSE AND RESILIENCE THROUGH NEAR-TIME GIS FOR FLOOD MONITORING AND ANALYSIS IN NIGER RIVER BASIN, NIGERIA

ABSTRACT

Nigeria continues to experience devastating floods that endanger lives, damage infrastructure, and displace communities, particularly in flood-prone regions like the Niger River Basin. With climate variability and rapid urbanization intensifying these risks, there is a growing need for real-time tools that enhance disaster preparedness and response. This study proposes a Real-time GIS-based flood monitoring and analysis framework using ArcGIS Pro, integrating satellite data, sensor feeds, and spatial analytics to improve situational awareness and decision-making. The methodology involved deriving flood extent and vulnerability maps through time-series Landsat imagery and Digital Elevation Models (DEMs), alongside community-sourced reports. Results show that between March and October 2022, the flooded area expanded by over 50%, impacting approximately 143,000 residents and inundating over 15,000 hectares of vegetation.
Combining spatial analysis with real-time data streams significantly improved the identification of flood hotspots, risk zones, and vulnerable populations. This research highlights the transformative role of geospatial technologies in developing early warning systems and proactive response mechanisms. The framework supports more resilient urban planning and emergency management strategies in Nigeria and other flood-vulnerable regions.

AIM & OBJECTIVES

This study aims to enhance flood disaster response and resilience in the River Niger Basin of Nigeria by implementing a near real-time GIS-based flood monitoring and analysis framework for informed disaster risk reduction and management strategies. The specific objectives are:

- To develop a GIS framework for integrating and visualizing real-time data from multiple sources during flood events;
- To automate the extraction of relevant flood-related information using satellite imagery and crowd-sourced platforms such as social media;
- To generate interactive maps and visual tools that provide decision makers with real-time insights into flood extent, infrastructure impact, and affected populations;
- To apply spatial analysis techniques for identifying high-risk areas, assessing community vulnerability, and guiding timely and effective disaster response actions.

METHODOLOGY

This study adopted a geospatial approach using ArcGIS Pro to enhance flood
disaster response and resilience through near real-time monitoring and analysis in the River Niger Basin, Nigeria. A systematic workflow was developed to integrate diverse data sources, including satellite imagery and hydrological data.
Satellite-based flood data were acquired from the Sentinel-1 Synthetic Aperture Radar (SAR) sensor due to its cloud-penetrating capabilities, enabling accurate water surface detection during heavy rainfall. The data were processed in ArcGIS Pro using image classification and thresholding techniques to delineate inundated areas.
To enhance situational awareness, ancillary data such as population, building networks, and critical infrastructure (e.g., health centres and schools) were overlaid with the flood extent maps. Spatial analysis tools in ArcGIS Pro were applied to identify high-risk zones and prioritize affected communities. Social media feeds and volunteered geographic information (VGI) were analyzed to capture ground-level reports, providing additional validation and real-time updates. The final outputs included time-series flood maps that guided recommendations for targeted response efforts and long-term flood resilience planning.
NDWI: Normalized Difference Water Index: LULC: Land Use / Land Cover Classification

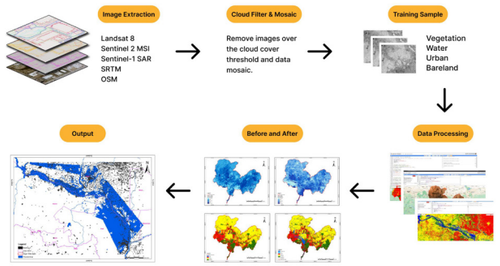
DATA AND SOFTWARE

The study utilized multi-source geospatial datasets including Sentinel-1 SAR imagery for flood extent mapping, Landsat 8, DEM, administrative boundaries, and critical infrastructure layers. These datasets were sourced from platforms such as Google Earth Engine, Copernicus Open Access Hub, and the Humanitarian Data Exchange (HDX).
ArcGIS Pro was the primary software used for data preprocessing, spatial analysis, and visualization. The platform supported advanced tools for flood detection, hotspot mapping, and integration of real-time data. Additional tools such as the ArcGIS Spatial Analyst extension were employed for terrain analysis and impact assessment.

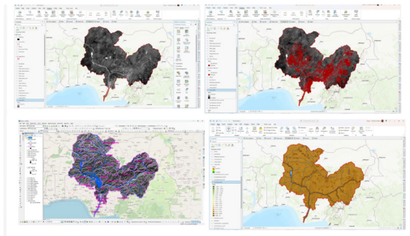
STUDY AREA

Figure 1. The Niger Basin in Nigeria

WORKFLOW

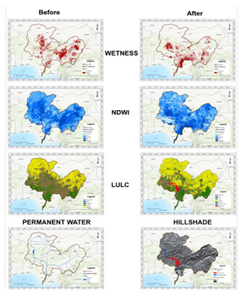


DATA PREPROCESSING



RESULTS AND DISCUSSION

The study demonstrated the effectiveness of using near real-time GIS and Sentinel-1 imagery in monitoring flood events across the Niger River Basin. The analysis identified highly impacted areas, notably in Kogi States, revealing widespread inundation of roads, settlements (buildings), and farmland.



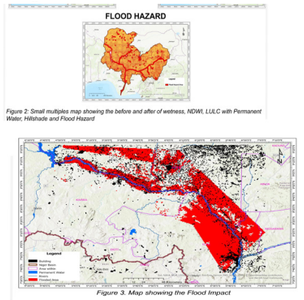


Figure 2: Small multiples map showing the before and after of wetness, NDWI, LULC with Permanent Water, Hillshade and Flood Hazard

Figure 3. Map showing the Flood Impact

ACCURACY ASSESSMENT

Feature	Water	Urban	Bareland	Vegetation	Total (User)
Water	29	0	0	0	29
Urban	0	29	0	0	29
Bareland	0	0	30	0	30
Vegetation	0	0	0	24	24
Total (Producer)	29	29	30	29	117

Table 1. Accuracy Assessment Before (2022/03/01 - 2022/05/31)

Overall accuracy = Total number of correctly classified pixels = 100%
Total number of reference pixels

Feature	Water	Urban	Bareland	Vegetation	Total (User)
Water	55	2	2	1	60
Urban	0	28	0	0	28
Bareland	0	3	15	1	19
Vegetation	0	2	0	13	15
Total (Producer)	55	35	17	15	122

Table 2. Accuracy Assessment After (2022/06/01 - 2022/10/31)

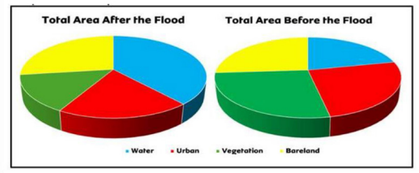
Overall accuracy = Total number of correctly classified pixels = 90%
Total number of reference pixels

IMPACT OF FLOOD AND AREA AFFECTED

Multi-Temporal Satellite data in ArcGIS Pro to assess 2022 flood impacts revealed over 15,000 hectares of flooded vegetation, with 3,000 hectares now unproductive wetlands. Floods affected 150,000 households and 143,000 residents, underscoring urgent needs for evacuation and recovery planning.

LULC TYPE	Total Area Before Flood Ha	Total Area Before Flood Percent	Total Area After Flood Ha	Total Area After Flood Percent
Water	25.9	21.5478	46.3	32.9165
Urban	30.3	25.2504	23.4	23.8697
Vegetation	32.6	27.1512	17.7	17.1195
Bareland	31.3	26.0506	32.5	26.0943

Table 3. Total area before and after flood



Total Area After (left) and Before (right) the Flood

CONCLUSION AND RECOMMENDATIONS

This study successfully demonstrated the potential of a near real-time GIS based flood monitoring and analysis framework to enhance disaster response and resilience in the River Niger Basin, Nigeria. By integrating multi-source geospatial data including Sentinel-1 SAR imagery, and critical infrastructure datasets into ArcGIS Pro, the study provided actionable insights during flood events. The framework enabled accurate detection of inundated areas, identification of high-risk zones, and real-time visualization of impacts on populations and infrastructure. The 2022 flood assessment, revealing extensive damage across over 15,000 hectares and affecting more than 143,000 people, underscores the urgency for proactive disaster preparedness and adaptive resilience strategies.
Ultimately, the study highlights the critical role of geospatial technologies in guiding informed decision-making, timely emergency responses, and sustainable flood risk management in vulnerable regions.

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