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Global Geospatial Information Management
for Africa**Capacity Building Workshops on Climate,
Environmental Geospatial Data Collection Using
Cloud Platforms, and Disaster-Related Indicators

Namibia (2-5 December 2025)

Workshop Report**Introduction**

1. Climate change and environmental degradation present pressing challenges for sustainable development, particularly in African countries such as Burundi and Namibia. Effective responses to these challenges require robust, timely, and accurate data on environmental and climatic conditions. Geospatial technologies encompassing Geographic Information Systems (GIS), remote sensing, and spatial analysis have emerged as critical tools for collecting, managing, and interpreting environmental data to inform policy and action.
2. With the rapid advancement of cloud computing, the capacity to collect, store, process, and share large volumes of geospatial data has been significantly enhanced. Cloud platforms now enable scalable, efficient, and collaborative geospatial data management, making advanced spatial analytics accessible even in resource constrained settings. This technological shift is particularly relevant for countries like Burundi and Namibia, where the need for improved environmental monitoring and climate resilience is acute.
3. Disasters both natural and human-induced pose significant threats to human life, economic development, and environmental sustainability. In countries such as Burundi, where vulnerability is heightened by socio-economic challenges and environmental degradation, the capacity to systematically monitor, assess, and respond to disaster risks is essential. Burundi faces a range of hazards, including floods, landslides, droughts, and epidemics. Factors such as high population density, ongoing environmental degradation, and limited infrastructure further amplify the country's exposure to disaster risks.
4. A persistent challenge in disaster risk management (DRM) is the absence of standardized, reliable, and accessible data. Data collection efforts are often fragmented across institutions, with varying definitions, formats, and methodologies. This lack of harmonization undermines the ability to comprehensively assess disaster risks, monitor progress in risk reduction, inform evidence-based policies and planning, and fulfil international reporting obligations under frameworks such as the Sendai Framework for Disaster Risk Reduction, the Sustainable Development Goals (SDGs), and the African Union Programme of Action.

5. To address these challenges, the development of a Compendium of Disaster-Related Indicators has become a strategic priority. Such a compendium will empower national institutions to pinpoint high-risk areas and vulnerable populations, prioritize investments in risk reduction, enhance coordination across sectors and government levels, and foster a culture of prevention and resilience. Serving as a centralized and harmonized reference, the compendium will consolidate key indicators spanning the dimensions of hazard, exposure, vulnerability, capacity, and impact.
6. The capacity building training workshop aligns with the African Centre for Statistics' implementation of the United Nations Development Account (DA14) project, "Resilient and Agile National Statistical Systems to Meet Post-COVID-19 Data Needs to Recover Better." This initiative aims to strengthen national statistical systems (NSS) to address emerging data needs in the post-pandemic context, with a specific workstream dedicated to climate change and disaster-related statistics.
7. Within the framework of the DA14 project—and in accordance with global and regional commitments to disaster risk reduction, including the Sendai Framework and the African Union Programme of Action—the United Nations Economic Commission for Africa (ECA) is developing a comprehensive Compendium of Disaster-Related Indicators for the Government of Burundi. As the target country for workstream 2.1: Climate Change and Disaster-Related Statistics, Burundi and Namibia will benefit from a standardized framework for monitoring, reporting, and managing disaster risks across all sectors.
8. The Capacity building workshop, therefore, focused on climate and environmental geospatial data collection using cloud platforms aim to bridge the technical and knowledge gaps among practitioners, policymakers, and researchers. These workshops will provide participants with both theoretical foundations and practical skills in leveraging cloud-based geospatial tools for environmental monitoring, climate change assessment, and sustainable resource management. By fostering expertise in cloud-enabled geospatial data workflows, the workshops will empower local institutions to meet national and international reporting obligations, such as those related to the Sustainable Development Goals (SDGs) and multilateral environmental agreements.
9. Through hands-on training, case studies, and collaborative exercises, participants from Burundi and Namibia gain the competencies needed to harness geospatial data for evidence-based decision-making, enhance cross-sectoral collaboration, and support the development of resilient, data-driven environmental policies. This initiative represents a strategic investment in human capital, positioning both countries to lead in the adoption of innovative technologies for environmental stewardship and sustainable development.
10. Building on this foundation, the capacity building workshop targeted a diverse group of stakeholders, including government officials, academic researchers, environmental practitioners, and representatives from non-governmental organizations. By bringing together participants from Burundi and Namibia, the workshops will also encourage regional knowledge exchange and foster networks for ongoing collaboration.
11. The training sessions focused on practical applications of leading cloud-based geospatial platforms such as Google Earth Engine, ArcGIS Online, and open-source alternatives. Participants will learn how to access, process, and analyse real-time climate and environmental datasets, including satellite imagery and sensor data. Special emphasis will be placed on using these tools for local and regional priorities, such as monitoring deforestation, tracking land use changes, assessing water resources, and evaluating the impacts of climate variability.

12. In addition to technical skills, the workshop addressed best practices in data management, data sharing, and ethical considerations in environmental data collection. Participants guided through the process of developing their own geospatial data projects, from conceptualization to implementation, ensuring that the knowledge gained is directly applicable to their professional contexts. Ultimately, the workshops aim to create a cadre of skilled professionals capable of leveraging cloud-based geospatial technologies to support evidence-based environmental governance. By strengthening local capacity, Burundi and Namibia will be better equipped to respond to environmental challenges, attract international research collaborations, and contribute to global efforts in climate adaptation and mitigation. This initiative not only aligns with national development strategies but also supports the broader vision of building resilient, knowledge-driven societies that can thrive in the face of environmental change.

Background

13. The capacity-building workshops for Burundi and Namibia is strategically aligned with the implementation by African Centre for Statistics, of the United Nations Development Account (DA14) project, specifically under the initiative titled “Resilient and Agile National Statistical Systems to Meet Post-COVID-19 Data Needs to Recover Better.” This project seeks to strengthen national statistical systems (NSS) to address emerging data needs in the wake of the COVID-19 pandemic, with a focus on environmental, climate change, and disaster related statistics. The workshop directly supports the DA14 component dedicated to enhancing the capacity of national institutions to collect, analyse, and disseminate climate and environmental data using innovative technologies.

14. Within the DA14 framework, the workshop is closely linked to two key workstreams. The first, Workstream 2.1 emphasizes climate change and disaster-related statistics. By providing hands-on training in cloud-based geospatial tools such as Google Earth Engine and ArcGIS Online, the workshop enabled participants to process and analyse real-time climate data, including satellite imagery for monitoring deforestation and land-use and other changes. The workshop also aimed to promote the use of harmonized disaster related indicators through the development of compendium of disaster indicators to facilitate the reporting to the global development frameworks such as the Sendai Framework for Disaster Risk Reduction, Sustainable Development Goals and Paris Agreement on Climate Change.

15. The second relevant workstream, Workstream 2.4, focuses on assessing the economy’s impact on the environment. Here, the workshops will train participants in environmental-economic accounting, allowing them to quantify the effects of environmental changes such as deforestation on key sectors like agriculture and livelihoods. This approach promotes cross-sectoral collaboration by bringing together statistical offices, environmental agencies, and academic institutions to harmonize data collection and analysis workflows. By integrating cloud-based technologies with traditional data collection methods, the workshops will foster a more comprehensive and agile approach to environmental monitoring.

16. The content and methodologies of the workshop are informed by international standards, such as the UN Framework for the Development of Environment Statistics (FDES), ensuring that participants are equipped with globally recognized best practices. Additionally, the workshop aimed to guide participants in identifying and addressing gaps within their national statistical systems, supporting the development of actionable roadmaps for improving data quality and timeliness.

17. The design of this workshop also reflects DA14's emphasis on regional knowledge exchange and peer learning. By convening stakeholders from both Burundi and Namibia, the initiative facilitates the sharing of experiences and solutions to common challenges, such as climate-induced food insecurity and resource management. Furthermore, the workshop included practical exercises focused on Sustainable Development Goals (SDGs), particularly SDG 13 (Climate Action) and SDG 15 (Life on Land), ensuring that participants can directly apply their new skills to track and report on relevant indicators.

18. Following the workshop, participants will benefit from continued support through DA14's remote advisory services and virtual follow-up activities. This sustained engagement will reinforce the technical skills acquired and help institutionalize best practices within national systems. Ultimately, the workshop is expected to enhance the agility and resilience of Burundi's and Namibia's NSS, enabling them to generate timely, high-quality climate and environmental statistics. This will not only inform national policy and post-disaster recovery efforts but also ensure compliance with global reporting obligations under frameworks such as the Paris Agreement, the Sendai Framework for Disaster Risk Reduction and the Sustainable Development Goals.

19. By embedding these capacity-building activities within the DA14 project, Burundi and Namibia are taking significant steps toward building resilient, data-driven governance structures. The initiative positions both countries as regional leaders in leveraging geospatial and statistical innovations for sustainable development and climate resilience.

Objectives

The primary objectives of the workshops are to:

- a. **Enhance Technical Capacity:** Equip participants with practical skills in collecting, processing, and analysing climate, environmental, and disaster-related geospatial data using leading cloud-based platforms such as Google Earth Engine, Digital Earth Africa and ArcGIS Online.
- b. **Strengthen National Statistical Systems (NSS):** Support Burundi and Namibia in identifying and addressing gaps in their national statistical systems related to climate change, environmental, and disaster statistics, in line with international standards and best practices.
- c. **Promote Data-Driven Decision Making:** Enable stakeholders to generate and utilize high-quality, timely data for evidence-based policy formulation, planning, and reporting on climate action, environmental sustainability, and disaster risk reduction.
- d. **Facilitate Cross-Sectoral Collaboration:** Foster collaboration among government agencies, academia, civil society, and other stakeholders to harmonize geospatial data collection and analysis workflows, including those related to disaster risk management.
- e. **Support SDG and International Reporting:** Build capacity for monitoring, tracking, and reporting on relevant Sustainable Development Goals (SDGs) particularly SDG 13 (Climate Action), SDG 15 (Life on Land), and SDG 11 (Sustainable Cities and Communities) as well as compliance with global frameworks such as the Paris Agreement and the Sendai Framework for Disaster Risk Reduction.
- f. **Encourage Regional Knowledge Exchange:** Promote peer learning and the sharing of experiences between Burundi and Namibia to address common environmental and disaster-related challenges and strengthen regional networks.

- g. Institutionalize Best Practices: Guide participants in developing actionable plans and roadmaps for integrating cloud-based geospatial technologies and data management practices including disaster-related statistics into their respective institutions for long-term sustainability.

Venue of the Workshop

20. Capacity Building Workshops on Climate, Environmental Geospatial Data Collection Using Cloud Platforms, and Disaster-Related Indicators took place at Hilton Hotel, Windhoek, Namibia from the (2-5 December 2025).

Participants

21. The 24 workshop participants represented a diverse mix of stakeholders from Burundi and Namibia, including government officials from national statistical offices, environmental institutions, and ministries responsible for climate change, natural resources, and sustainable development, alongside GIS analysts, remote sensing specialists, and data managers from the public agencies involved in local environmental data collection and climate resilience initiatives. The group also included academics, and researchers, in environmental science, geography, climate change, and geospatial technologies. involved in local environmental data collection and climate resilience initiatives.

Workshop Proceedings

22. The opening remarks delivered at the commencement of the workshop by the representative of the Namibian Bureau of Statistics (NBS), established the strategic context and institutional significance of the four-day gathering. The opening speaker acknowledged the formal nature of the occasion while emphasizing the collaborative spirit necessary for productive deliberations. The speaker expressed genuine appreciation for the commitment demonstrated by all participants in attending the workshop, recognizing that their participation represented institutional investments of time and resources. The remarks conveyed the expectation that the forthcoming four days would prove both substantive and transformative for participants, fostering professional relationships extending beyond the workshop conclusion and contributing to long-term capacity development across the participating institutions and nations.

23. The Namibia Statistics Agency fielded multiple representatives reflecting the Agency's investment in the workshop. The Head of Geographic Information Systems and National Spatial Reference Coordination introduced himself as coordinating the Agency's spatial data infrastructure activities. The Head of Economic Statistics represented the Agency's broader statistical production mandate. The Manager for IT Solutions addressed the Agency's information technology infrastructure and modernization efforts. The Environmental Statistics specialist represented the Agency's newly established environmental subdivision. Representatives from the Agency's departmental leadership conveyed institutional commitment to the workshop and engagement with its outcomes.

24. The Office of the Prime Minister, Directorate of Disaster Risk Management, was represented by professionals responsible for coordinating the national disaster risk management system and implementing the National Platform for Disaster Prevention and Management. These representatives brought operational experience with disaster response, early warning systems, and disaster risk monitoring. Their participation ensured that workshop discussions remained grounded in practical national disaster management realities and that technical discussions addressed genuine institutional needs.

25. The Ministry of Environment, Forestry, and Tourism fielded representatives responsible for greenhouse gas inventory compilation and environmental data production within the ministry's mandate. These participants brought sectoral perspectives on environmental monitoring, land cover assessment, forest resources management, and climate-related data production. Their participation ensured that workshop discussions incorporated environmental agency perspectives and that capacity building addressed needs of sectoral data producers.

26. Additional government representatives included personnel from the Ministry of International Relations and Trade, and the Ministry of Industrialization, Mines and Energy. Participants from academia such as University of Namibia and local NGO, the Namibia Nature Foundation were represented. This diverse representation ensured that the workshop engaged the full range of government institutions involved with or dependent upon environmental, climate, and disaster-related data.

27. The opening remarks situated the workshop within the broader context of African development challenges and opportunities. Climate variability, environmental change, and escalating disaster risks have become defining characteristics of the contemporary development landscape across the continent. Namibia, like many African nations, faces mounting pressures from drought, land degradation, environmental contamination, and climate-induced shocks affecting ecosystems and human communities. The frequency and intensity of these challenges appear to be increasing: annual drought events affecting pastoral and agricultural communities, degradation of rangelands and forests reducing productive capacity, wildfires destroying valuable natural resources and threatening human settlements, flooding displacing communities and destroying livelihoods, cyclones bringing devastating impacts across entire regions. These mounting pressures underscore the urgent necessity for enhanced data, improved understanding, and coordinated responses grounded in scientific evidence rather than ad hoc reactions.

28. The opening remarks from the representative of the ECA, emphasized that responding effectively to these multifaceted challenges requires strengthened capacity for data generation, analysis, and knowledge utilization. Environmental statistics have transitioned from optional components of national statistical systems to essential elements of governance. The capacity to generate timely, accurate, harmonized environmental data has become central to sustainable development, climate adaptation, disaster risk reduction, and informed decision-making at all administrative levels. Contemporary information technologies offer unprecedented opportunities to strengthen data systems if institutions commit to embracing modern approaches and investing in requisite capacity. The workshop was positioned as an opportunity to explore these technologies, develop practical competencies, and establish foundations for long-term institutional modernization.

Workshop Activities

29. The Namibia Statistics Agency (NSA) representative explained that the NSA serves as Namibia's central repository for official statistics, coordinating the national statistical system, standardizing methods across sectoral producers, and preventing duplication. The presentation emphasized that while the Agency historically prioritized demographic, economic, and social statistics, it has recently elevated environmental statistics by establishing a dedicated Environmental Statistics subdivision, signalling that environmental data will now be managed with the same quality assurance and professional standards as other core domains. The representative also described the NSA's leadership role in building the National Spatial Data Infrastructure (NSDI), which acts as a clearing house for spatial data and metadata but noted that realizing its full potential requires stronger inter-agency data-sharing agreements, coordination mechanisms, and empowered governance structures. Finally, the presentation highlighted NSA's collaboration with the UN Development Account Project (DA-14) under the workstream on Climate and Disaster-Related Statistics, which is helping the Agency in identifying data gaps, integrate spatial and administrative data, and develop standardized climate and disaster-related statistics through targeted capacity-building and system improvements.

30. The United Nations Economic Commission for Africa (ECA) presentations situated the workshop within ECA's broader mandate to support African countries in sustainable development, regional integration, and strengthening institutional capacity, with a focus on the strategic importance of environmental and disaster-related data for the continent. ECA highlighted that decades of satellite Earth observation, climate models, and environmental monitoring systems have transformed the problem from data scarcity to data abundance, with extensive historical archives and near-real-time streams now available for variables such as climate, vegetation, water, and land conditions. The core challenge, they stressed, is not the lack of data but limited national capacity to discover, understand, and operationalize these resources, owing to gaps in technical skills, institutional coordination, computational infrastructure, and data integration frameworks, which necessitate long-term investments in capacity building, modernized institutions, and enabling policies to turn existing environmental and disaster-related data into actionable information for decision-making in African countries.

31. Climate, environmental, and disaster-related geospatial data has become a core asset for modern governance because it underpins how countries respond to global environmental challenges and fulfil international commitments such as the Paris Agreement, the Convention on Biological Diversity, the Sustainable Development Goals, and the Sendai Framework for Disaster Risk Reduction. These frameworks require standardized, comparable data on climate hazards, ecosystem change, land and water conditions, and disaster risks so that governments can track progress, identify emerging threats, and prioritize limited resources based on evidence rather than assumptions. For African countries, which are acutely vulnerable to droughts, floods, storms, and land degradation, this type of data is especially critical to monitor rapidly evolving risks, support early warning, and design targeted adaptation and resilience measures for the most exposed communities.

32. At the national level, geospatially enabled climate and environmental data directly strengthens decision-making and planning across nearly all sectors of government. Development planners need it to chart climate-compatible growth paths, disaster managers to map hazard exposure and vulnerable populations, agriculture ministries to align crops and agricultural practices with soil, water, and climate conditions, and infrastructure agencies to site and design roads, dams, and settlements outside of high-risk zones. Health, water, and energy planning likewise depend on understanding environmental drivers of disease, hydrological variability, and resource competition, meaning that timely, accurate, and spatially detailed environmental and disaster-related data has become indispensable for integrated, risk-informed governance and sustainable development strategies.

33. The workshop highlighted that high-quality environmental and disaster-related data is a public good and a critical foundation for evidence-based governance, comparable to the role of medical research in shaping effective health policy. Presentations showed how near-real-time data from satellites, meteorological networks, and other sources now underpins national drought early warning, flood forecasting, wildfire detection, crop and food security monitoring, and land cover change assessment, allowing governments to anticipate crises, target interventions, and manage natural resources more effectively. Advances in satellite imaging, cloud computing, and artificial intelligence have dramatically reduced the time and cost required to generate actionable information, enabling large-scale, high-frequency monitoring and integrated analysis that combines environmental, economic, and social data for more comprehensive decision-making.

34. The presentations of ECA stressed that environmental and disaster-related data issues in Africa are inherently regional and continental, as many countries share exposure to the same droughts, floods, cyclones, river basins, and transboundary ecosystems, creating both common vulnerabilities and strong incentives for cross-border cooperation in monitoring and response. ECA highlighted that cloud-based platforms and global Earth observation systems already deliver continental-scale data for Africa at low or no cost, making it unnecessary for each country to build its own full monitoring infrastructure, but that fully benefiting from these shared systems depends on strengthening national and regional capacity to access, interpret, and use this data effectively for coordinated planning, risk reduction, and resource management.

35. Participants used the discussion and Q&A sessions to probe how geospatial data could concretely support their institutional mandates, raising detailed questions about applications in agriculture, natural resources, and disaster management. They learned that although satellite-derived vegetation indices and post-disaster imagery are widely available, turning these into actionable information for crop monitoring, food security analysis, and rapid damage assessment requires prior arrangements for timely data access, strong analytical capacity, and clear methodologies for integrating satellite products with national statistics and sectoral information systems.

36. Participants also focused on the limitations and gaps in available geospatial data, noting, for example, that AI-derived building footprints from high-resolution imagery are not yet globally comprehensive and that satellite data, while rich in environmental information, says little about the social and economic dimensions of risk. The ECA presenters acknowledged these constraints but emphasized that no dataset is perfect and that the key is to understand each source's properties, uncertainties, and suitable use cases rather than waiting for ideal data. They explained that imperfect products such as satellite-based rainfall estimates or partial building footprint layers can still add significant value for hydrology, agriculture, population mapping, and urban planning when used pragmatically and combined with socioeconomic and administrative data, provided users remain transparent about their limitations.

37. Participants emphasized that meaningful disaster and environmental risk analysis depends on integrating multiple data sources satellite- and model-based hazard data, census and administrative exposure data, survey-based vulnerability information, and administrative data on response capacities because no single dataset can capture the full picture. They noted that this integration is often done in an ad hoc, manual, and relationship-dependent way, which is slow, error-prone, and difficult to sustain, and highlighted the need for formal mechanisms such as shared data repositories, standardized formats, and inter-agency access protocols to make multidimensional, cross-sectoral analysis more efficient, reliable, and routine.

38. The discussions clarified that vast volumes of geospatial and environmental data are already freely available through global and regional platforms such as Google Earth Engine (hosting over 100 petabytes of satellite and environmental data), Microsoft's Planetary Computer, Copernicus climate and environmental services, Digital Earth Africa, and humanitarian data exchanges—accessible to governments and researchers with only internet access and basic technical skills. The real constraint is not data availability but limited capacity to discover, understand, and operationalize these resources: many officials are unaware of what exists or how to access it, and even when they are, constraints in skills, connectivity, software, and budgets (especially for paid high-resolution or proprietary products) often prevent effective use, making capacity development and strategic data investment decisions as important as the data itself.

39. The workshop conducted a structured assessment of disaster-related data in Namibia and Burundi, distinguishing between underused existing resources and genuine information gaps. Participants noted that large archives of satellite imagery, frequent contemporary Earth observation, and freely available global climate datasets are often not systematically exploited because national systems lack the capacity, tools, and institutional mechanisms for regular access, interpretation, and integration into decision-making. At the same time, real gaps persist, including sparse records for certain hazards (e.g., landslides, earthquakes), limited operational real-time monitoring, outdated or insufficiently disaggregated socioeconomic data for vulnerability analysis, and incomplete historical disaster databases. Disaster management officials underscored the need for timely hazard maps, early warning products, damage assessment, hazard intensity and extent mapping, vulnerability profiles, and systematic impact and recovery tracking, observing that such outputs are usually generated ad hoc for specific crises rather than embedded as routine, institutionalized products within national disaster risk management systems.

40. The workshop concluded that comprehensive disaster-related statistics require moving from ad hoc, event-driven data collection to routine, systematic recording of all disasters above agreed thresholds, supported by standardized definitions and methodologies that allow consistent comparison across regions and over time. It emphasized that hazard, exposure, vulnerability, and capacity data must be formally integrated rather than managed in silos, and that resulting information products must be delivered rapidly to decision-makers in formats tailored to their operational needs. Finally, participants stressed that disaster data systems must clearly demonstrate their value by improving preparedness, response, and recovery outcomes, since visible utility is critical for securing sustained political and financial support.

41. The workshop underscored that climate, environmental, and disaster-related data sit within a complex institutional ecosystem, requiring coordinated action across many actors rather than being the responsibility of a single agency. The Namibia Statistics Agency (NSA), as the coordinator of the national statistical system and custodian of official statistics, was highlighted as a natural hub for climate, environmental, and disaster-related statistics because it already sets standards, supports capacity development, and aggregates data from sectoral producers; however, this coordinating role depends on sector ministries accepting that their data contributes to a shared national system rather than remaining exclusively within their own mandates. The Office of the Prime Minister, through its leadership of the National Platform for Disaster Prevention and Management, was recognized as another pivotal stakeholder with the authority to convene agencies around disaster risk data integration, provided its convening role is backed by formal agreements and clear cooperation mechanisms rather than informal, voluntary arrangements.

42. Sectoral ministries and agencies were also identified as indispensable partners because they generate most of the primary data needed for comprehensive risk and adaptation analysis. The Ministry of Environment, Forest, and Tourism produces critical environmental and natural resource data; the Ministry of Agriculture contributes information on crops, livestock, and livelihoods relevant to drought and food security; the Ministry of Health holds data on disaster-related morbidity, mortality, and climate-sensitive diseases; the Meteorological Service provides weather and climate observations essential for hazard monitoring; and local government authorities play a frontline role in disaster response and community-level data collection. The workshop emphasized that while each institution has valuable, domain-specific datasets, current coordination is limited and often ad hoc, making the formalization of partnerships, data-sharing agreements, and joint governance arrangements across statistical, environmental, meteorological, disaster management, and local authorities a key requirement for building integrated, national climate and disaster-related data systems.

43. The workshop emphasized that effective multi-stakeholder coordination around climate, environmental, and disaster-related data goes beyond simply listing relevant institutions and requires formal, enforceable mechanisms that turn good intentions into sustained collaboration. Participants noted that bodies such as Namibia's National Platform for Disaster Prevention and Management can only function effectively if underpinned by written data-sharing agreements that specify access rights, confidentiality, and permitted uses; clear governance arrangements that designate lead agencies with explicit authority for data domains; and coordinated capacity development so all contributing agencies can meet shared standards. Discussions also highlighted the need for incentive structures that actively reward data sharing and joint analysis through recognition, performance metrics, and resource allocation so that agencies perceive tangible benefits from collaboration rather than reasons to protect data silos.

44. The workshop underscored the value of regional partnerships and cross-country learning, using the joint participation of Namibia and Burundi to illustrate how countries facing similar drought, flood, and shared water-resource challenges can learn from each other's experiences and approaches. By comparing institutional arrangements, data practices, and response strategies across national contexts, participants recognized that many environmental and disaster risks do not respect borders, making regional collaboration, knowledge exchange, and potentially shared monitoring and management mechanisms essential complements to purely national efforts.

45. The workshop used a structured framework to assess current practices in climate, environmental, and disaster-related data collection, examining institutional arrangements, methods and standards, technologies, quality assurance, cross-source integration, and use in decision-making in Namibia, Burundi, and the broader African context. The review showed that data is generated by many sectoral agencies environment, meteorology, agriculture, health, and disaster management each running its own systems and standards, which is appropriate for specialization but leads to fragmentation and weak integration for cross-cutting analysis. Although coordination mechanisms such as National Spatial Data Infrastructures and inter-agency disaster committees exist on paper in some countries, they tend to function mainly as policy forums rather than operational data-sharing platforms, with routine integrated products and formalized data exchange protocols still largely absent from day-to-day practice.

46. The assessment showed wide variation in data collection methodologies and standards for climate, environmental, and disaster-related information, with some datasets (such as land cover) aligned to international frameworks like Copernicus, while many others use agency- or country-specific approaches that limit comparability. Disaster loss data may be based on systematic post-event assessments in some settings and informal field reports in others, and household surveys for vulnerability and livelihoods often differ in design and indicators, making it difficult to combine or compare results across time and institutions. The workshop stressed that adopting and adapting international tools such as the Disaster-Related Indicators Compendium is crucial to harmonize methods across agencies and years, while still allowing necessary customization to reflect national definitions, priorities, and operational realities.

47. The assessment showed very uneven use of technology for climate, environmental, and disaster-related data collection: some agencies already use digital forms, GIS, and mobile tools, while others still rely heavily on paper-based methods and manual data entry, with limited use of cloud platforms and modern spatial data infrastructures. This variability reflects not only technical gaps but also institutional and budget constraints, competing priorities, and slow organizational change, meaning that modernization requires deliberate investment in infrastructure, staff training, and integration of digital tools into standard procedures, supported by clear incentives and management commitment rather than ad hoc, project-based upgrades.

48. The assessment found that quality assurance and data validation practices for climate, environmental, and disaster-related data are highly uneven, with some institutions applying structured validation, error-checking, and correction protocols, while others operate with minimal controls and weak or missing metadata. This inconsistency makes it difficult for users to judge whether datasets are fit for analytical or policy purposes. Workshop discussions stressed that investing in robust quality assurance through standardized validation at the point of collection, systematic error detection and correction, periodic quality audits, and comprehensive metadata documenting methods, definitions, coverage, and limitations—significantly enhances the reliability, interpretability, and impact of data for evidence-based decision-making.

49. Participants with hands-on responsibility for climate, environmental, and disaster-related data collection described how operational realities often complicate the idealized models discussed in technical presentations, especially for rapid damage assessment after sudden-onset disasters where limited notice, access constraints, and the lack of standardized protocols hinder systematic data gathering. They highlighted difficulties in maintaining consistent methods and quality across large territories and long-time horizons for environmental monitoring, stressing the importance of clear standard operating procedures, regular field staff training, and active supervision. Practitioners involved in household surveys and livelihood assessments further noted the challenges of reaching remote or insecure communities, eliciting accurate responses on sensitive topics, and reconciling survey findings with other data sources, underscoring that even with advances in remote sensing and secondary data, robust primary data collection remains complex and resource-intensive.

50. Discussion highlighted several good practices that could be scaled up, including strong partnerships between government agencies and universities, where academic experts and students support technical work and field data collection while gaining practical experience. Participants also pointed to successful community-based data collection models that enlist residents to report hazards, disasters, and environmental observations often via mobile tools which both improves data coverage and strengthens community ownership of information systems. In addition, some institutions have built multi-year, consistently funded monitoring programmes that allow robust trend analysis and continuous methodological improvement, contrasting positively with short-lived, project-based efforts and underscoring the need to institutionalize data collection within stable budgets and mandates.

51. Workshop discussions revealed several systemic barriers to effective climate, environmental, and disaster-related data collection, starting with chronic underfunding and dependence on short-term externally financed projects rather than sustained domestic budget allocations. Limited financial resources mean many agencies cannot maintain regular surveys, monitoring networks, or geospatial analysis capacity once project funds end, undermining continuity and long-term trend analysis. At the same time, shortages of staff with skills in modern data management, GIS, remote sensing, and statistics combined with weak career paths and retention challenges for technical professionals constrain the sophistication and reliability of both data collection and analysis, even where tools and infrastructure exist.

52. Participants also emphasized that institutional and regulatory factors are major obstacles. Fragmented data systems, operated by autonomous agencies without robust sharing agreements or common standards, make it difficult to integrate hazard, exposure, vulnerability, and capacity information into a coherent national picture, and voluntary coordination mechanisms rarely overcome entrenched silos without high-level mandates. Furthermore, data protection and privacy regulations, while essential, can unintentionally block data sharing needed for legitimate public purposes such as comprehensive disaster risk assessment, highlighting the need for legal frameworks that enable controlled, purpose-specific sharing with strong safeguards rather than blanket restrictions that impede evidence-based risk management.

53. The Disaster-Related Indicators Compendium is a major milestone in global disaster risk reduction, providing a unified, internationally agreed framework for measuring disaster impacts, risks, and resilience in a consistent way across countries and over time. By offering a structured catalogue of indicators, concepts, and methods, the compendium gives countries a practical reference for designing disaster data systems that are internationally comparable yet adaptable to local realities.

54. Institutionally, the compendium is rooted in a multi-year, highly consultative UN process involving national governments, international organizations, academics, and humanitarian actors, and was recognized by participants from Namibia and Burundi as directly relevant to their national efforts to systematize disaster-related statistics. In 2017 UN General Assembly deliberations endorsed recommendations from an open-ended intergovernmental expert working group on disaster-related indicators and terminology. This political signal was followed in 2019 by the UN Statistical Commission's call for a stronger global focus on disaster statistics, and in 2020 by the creation of an Interagency and Expert Group on Disaster-related Statistics, with a formal mandate to develop a common framework for disaster-related statistics. Over the years, the expert group consulted widely and produced reports to the Statistical Commission in 2021 and 2023, gradually consolidating diverse practices into a single, coherent reference for national statistical systems and disaster management agencies.

55. At its core, the compendium responds to a long-standing problem: the absence of harmonized definitions and methods for disaster data, which has historically led to incompatible statistics between countries and even between agencies within the same country. Different systems have variously counted deaths and direct damage, or indirect losses, livelihood disruption, and long-term recovery costs, making cross-country comparisons and global aggregation extremely difficult. By setting out standard terminology, indicator definitions, and recommended methodologies, the compendium enables countries to collect and report disaster-related data in ways that are internally consistent, compatible with international benchmarks, and suitable for aggregation into regional and global statistics.

56. Workshop participants agreed that the Disaster-Related Indicators Compendium is highly relevant for Namibia and Burundi as a reference model for designing national disaster indicator frameworks that align with international standards, but they stressed that recognizing its value is only a first step. They distinguished between formally “adopting” a global standard and institutionalizing it in day-to-day practice, noting that implementation will require long-term institutional commitment, adequate technical capacity, and strong inter-agency coordination so that the compendium’s concepts move from documents into operational systems for data collection, analysis, and dissemination. Participants highlighted that this transition entails adapting compendium methods to national realities without losing comparability and embedding them in the mandates and workflows of national statistics offices and disaster management institutions.

57. Namibian and Burundian representatives described existing national structures—such as Namibia’s National Platform for Disaster Prevention and Management and similar platforms in Burundi that already convene multiple government agencies, academia, and partners around disaster risk reduction, creating a foundation for standardized disaster statistics. However, they acknowledged that data collection practices remain uneven and often ad hoc, with disaster statistics typically compiled by disaster management agencies or external partners in response to specific events rather than as part of official, routine statistical production. The workshop underscored that for the compendium to become operational, national statistical systems must explicitly adopt its definitions and methods, allocate resources to collect and compile the required indicators, train staff in standardized approaches, and introduce quality assurance processes that ensure outputs meet both national needs and international comparability criteria.

58. Participants also explored the compendium’s broader strategic implications for governance and reporting, noting that harmonized disaster statistics enable meaningful comparison of risk and impacts across countries, support regional analysis, and facilitate coordinated responses, as seen in experiences shared at the Global Forum for Producers and Users of Disaster-Related Statistics. By aligning national indicators with the indicators in the compendium, countries can better identify shared regional challenges, attract targeted international support, and coordinate cross-border risk reduction efforts. At the same time, the compendium offers a way to rationalize multiple overlapping reporting obligations to the Sendai Framework, SDGs, Paris Agreement, and regional protocols: instead of running separate, duplicative data systems for each framework, countries can build a single standardized disaster statistics system whose indicators satisfy multiple reporting requirements, improving efficiency and reducing the burden on already stretched institutions.

59. The compendium also has deep strategic significance because it operationalizes the data and statistics commitments embedded in global and regional policy frameworks. The Sendai Framework for Disaster Risk Reduction explicitly calls for robust, accessible disaster occurrence, impact, and recovery data as a foundation for risk-informed investment, policy making, and public accountability, while the SDGs, the Paris Agreement, and frameworks such as AU Agenda 2063 all include disaster- and resilience-related indicators. By aligning its indicators and methods with these agendas, the compendium provides countries with a concrete roadmap for producing the statistics needed to monitor Sendai targets, report on SDG and climate commitments, and support evidence-based risk governance.

60. The workshop underscored that the central challenge for climate, environmental, and disaster-related geospatial data is no longer availability but usability, with decision-makers facing a paradox of having vast volumes of data yet still lacking the specific, timely, and decision-ready information they need. Participants noted that data is fragmented across institutions, stored in different formats, and often too large or complex for traditional desktop tools to handle efficiently, which forces users to navigate multiple repositories and manually download and process multi-gigabyte satellite scenes or climate datasets. They highlighted that overcoming these barriers requires moving from siloed, file-based systems toward integrated, standards-based infrastructures and APIs that deliver harmonized, pre-processed, and up-to-date information at appropriate spatial and temporal scales for operational decision-making rather than raw data dumps.

61. Cloud-based platforms emerged as a key enabler of this transition because they host large archives of satellite and environmental data, provide standardized, value-added products (such as vegetation indices, land cover maps, and building footprints), and allow users to run analyses close to the data without needing high-end local hardware. The Namibia case where the Office of the Prime Minister used cloud-accessible satellite imagery and processing to generate rapid flood maps and household impact assessments within days illustrated how institutional adoption of cloud services can dramatically shorten the time from hazard onset to actionable information. Participants concluded that to make geospatial data truly accessible and usable, countries must complement global and regional platforms with national strategies that institutionalize cloud-based workflows, build user capacity to interpret products correctly, and embed these capabilities into routine disaster risk management and sectoral planning processes rather than relying on one-off, project-driven efforts.

62. For African countries, the compendium's value is particularly pronounced given the continent's high exposure to droughts, floods, storms, wildfires, and slow-onset climate impacts, combined with constrained institutional and financial capacity. A standardized disaster statistics framework allows governments to better understand hazard patterns and trends, quantify who and what is at risk, and measure the real economic and social costs of events, thereby informing the prioritization of scarce risk reduction resources and strengthening the case for both domestic and international investment. Countries that can systematically document and analyze disaster losses and risk drivers are better positioned to design targeted prevention and preparedness measures, optimize humanitarian and recovery responses, and integrate risk considerations into development planning so that future infrastructure, land-use decisions, and social programmes actively reduce vulnerability rather than inadvertently increasing it.

63. Participants discussed concrete barriers that limit data accessibility and usability despite the availability of powerful cloud platforms and large global datasets. Namibian officials emphasized that data protection rules prevent certain sensitive data—such as census and administrative records—from being stored on public clouds, even though disaster-related data from the Office of the Prime Minister can be hosted with commercial providers. This creates technical friction because tools like Google Earth Engine and Planetary Computer work best when satellite, climate, and demographic data are co-located, forcing agencies to build hybrid solutions where public geospatial and climate data are processed in commercial clouds while protected data remain on government servers and are accessed via secure, government-controlled APIs.

64. The workshop stressed that usability also hinges on matching data to purpose and context rather than if global products automatically meet national needs. Participants noted that standardized global land cover datasets or climate model outputs may use classifications, scales, or uncertainty ranges that do not align with local definitions or decision thresholds, meaning that uncritical use can mislead planning. Facilitators encouraged countries to treat such products as valuable starting points that should be evaluated, downscaled, or reclassified for national contexts, and to make decisions using the “best available” information while explicitly acknowledging uncertainties, rather than delaying action in search of perfect data that may never materialize.

65. Institutional fragmentation emerged as a major obstacle to usability, with environmental, agricultural, meteorological, health, and disaster agencies each holding pieces of the puzzle in separate systems, often without formal data-sharing arrangements. Both Namibia and Burundi participants described how post-disaster assessments require time-consuming, ad hoc negotiations to access crop data, health facility impacts, population figures, and infrastructure damage from multiple unlinked databases—sometimes discovering that critical information is not digitized or up to date. The discussions highlighted that investing upfront in integrated, multi-agency data architectures, standardized formats, and standing sharing agreements can dramatically speed up and improve the quality of disaster risk assessments and recovery planning, avoiding the need to “reinvent” coordination for every event.

66. Namibia and Burundi used the workshop to share detailed accounts of how they currently produce and use disaster-related data, grounding the technical discussions in concrete national practice. Namibia’s Office of the Prime Minister described how the Directorate of Disaster Risk Management manages systems such as the National Livelihood Vulnerability Assessment and Analysis, which gathers annual community-level data on food security, livelihoods, and vulnerability, and a beneficiary management system that tracks households receiving assistance and helps identify who is most at risk. These institutionalized mechanisms already provide rich inputs for disaster-related statistics, but participants recognized that they are not yet fully integrated with environmental monitoring, health information, and other sectoral datasets needed for comprehensive risk analysis.

67. Namibia emphasized the role of its National Platform for Disaster Prevention and Management as a central coordination forum that brings together the Office of the Prime Minister, with the ministries on environment and forestry, health, defense, interior, as well as regional and local authorities, NGOs, private sector actors, and international partners to prepare for and respond to disasters. While this platform facilitates multi-actor coordination, officials acknowledged persistent challenges in data sharing and standardization across institutions, noting that during events different agencies may rely on separate databases for affected populations and impacted areas, leading to inconsistencies, duplication, or gaps in reporting. Burundi presented a broadly similar institutional architecture, with a national platform involving civil protection, environment, agriculture, health, statistics, security forces, and others, but stressed that its small size, high population density, and exposure to frequent floods, landslides, and cyclone-related impacts heighten the urgency of robust disaster information systems. In Burundi as in Namibia, sector agencies maintain separate reporting channels, and a fully integrated national disaster information system has yet to be established.

68. Both countries highlighted ongoing capacity-building and partnership initiatives intended to strengthen disaster-related data systems. Namibia has been supported by the UN Development Account Project on Climate Change and Disaster-Related Statistics (DA-14) led by ECA and partners, which has helped to identify data needs and gaps, improve greenhouse gas inventories, advance land use/land cover mapping, and promote the integration of spatial data into official statistics. Burundi likewise noted participation in international programmes aimed at developing disaster indicator frameworks and enhancing data production capacity, though both countries underlined that turning project-based gains into permanent institutional capabilities remains a key challenge. Overall, the national experiences shared in the workshop demonstrated that while governance structures and some core data systems are in place, sustained investment in integration, standardization, and institutionalization is needed to realize the full value of disaster-related data for planning, early warning, and response.

69. Participants illustrated the concrete benefits of these efforts by sharing operational examples of data-informed response. Namibia described how, during severe flooding in the north, the Office of the Prime Minister used rapidly acquired satellite imagery and cloud-based processing to produce flood extent maps showing which areas and households were most heavily affected. These products guided helicopter food deliveries and other relief operations, allowing the government to prioritize the hardest-hit communities rather than distributing aid uniformly across all flooded zones. This case demonstrated how accessible, well-integrated hazard and exposure information can compress decision timelines from weeks to days and substantially improve the targeting and efficiency of response, reinforcing the workshop's message that such geospatially enabled capabilities should be institutionalized as routine elements of national disaster risk management systems rather than deployed only in exceptional, project-driven circumstances.

70. Participants agreed that, despite strong international mandates and clear national needs, producing comprehensive, standardized disaster-related statistics remains very challenging because technical, institutional, financial, and conceptual constraints reinforce each other. They noted that many countries lack the specialized skills, tools, and sustained funding required to run routine multi-hazard data systems, and that concepts like risk, exposure, and vulnerability are often interpreted differently across agencies, which complicates the design of shared indicators and methodologies.

71. The most persistent barrier identified in both Namibia and Burundi was institutional fragmentation and weak coordination among data-producing agencies, each of which maintains its own systems geared toward sector-specific needs rather than integrated national risk monitoring. Agriculture, environment, meteorology, health, and disaster management bodies all hold relevant datasets, but limited legal obligations for data sharing, inconsistent enforcement of NSDI or similar frameworks, and reliance on informal, relationship-based cooperation mean that crucial information frequently remains siloed or difficult to access when cross-sectoral disaster assessments are needed. Participants stressed that binding legal instruments, clear mandates for lead institutions, and enforceable data-sharing agreements are essential to move from ad hoc, personality-driven collaboration toward stable, institutionalized coordination.

72. Producing robust disaster-related statistics is significantly constrained by limited technical skills and weak IT infrastructure in many agencies, where few staff have training in geospatial analysis, modern data management, or cloud-based workflows, and institutional hiring practices rarely prioritize or retain such specialized profiles. This creates dependence on a small number of experts or external partners, leaving systems vulnerable when those individuals are unavailable. At the same time, many regional and local offices operate with unreliable internet and low-spec hardware procured for routine office tasks rather than intensive analysis, reducing their ability to use cloud platforms effectively even though such platforms can offset some infrastructure costs. Sustainable progress therefore requires not just short-term training, but long-term commitments to recruit and retain technical specialists and to invest in adequate connectivity and equipment so that cloud and other advanced tools can be used reliably.

73. Disaster-related data quality and consistency problems emerged as a pervasive concern, starting with the lack of standardized definitions across agencies and regions, which makes it difficult to aggregate or compare statistics. Some institutions count only deaths and direct physical damage, while others also include livelihood disruptions and indirect economic losses, and reporting on “damage” may cover buildings but omit crops, livestock, or infrastructure. Because these conceptual differences are rarely documented or harmonized, nominally similar indicators can represent very different realities in different places or time periods, undermining the reliability of trend analysis and cross-regional comparisons.

74. In practice, data collection methods and rigor vary widely across locations and over time, with some regional committees conducting structured hazard and vulnerability assessments and others relying on ad hoc reports when disasters occur. Household and community surveys suffer from variable enumerator training, supervision, and resourcing, and data gathered during emergencies tends to be less systematic than information collected under calmer conditions. Participants reported encountering obvious errors—such as unrealistic outliers, missing values, and incomplete coverage—in existing disaster datasets, which had not been caught due to the absence of systematic validation rules, automated checks, or routine quality audits.

75. Resource and funding constraints further weaken data quality, as comprehensive and regular disaster statistics require sustained financing for fieldwork, data management infrastructure, and skilled staff, but must compete with many other urgent priorities in fiscally constrained environments. Donor-funded projects have helped countries develop greenhouse gas inventories, land cover maps, and post-disaster assessments, yet these are often one-off efforts tied to specific project cycles; once external funding ends, there is rarely enough domestic budget to maintain, update, or institutionalize the systems, so products quickly become outdated and lose relevance. This stop-start pattern makes it difficult to build coherent long-term disaster datasets with consistent methodologies and time series.

76. Finally, participants underscored that national disaster statistics ultimately depend on the strength and reliability of local reporting, which is often uneven and vulnerable to information loss as data pass through multiple administrative layers. Local authorities and community leaders differ in capacity, and events reported at village or municipal level may be delayed, misclassified, or never fully captured in national databases, while community knowledge about risk-prone areas and historical events is seldom systematized. Emerging participatory approaches—such as using mobile apps to allow communities to report hazards and impacts directly—offer promise for richer, more timely data, but they also require investments in connectivity, training, and robust validation procedures to ensure that community-contributed information can be trusted and appropriately integrated into official disaster statistics systems.

77. Innovative technologies are shifting the core challenge in climate, environmental, and disaster-related data from scarcity to effective discovery, access, and use. Satellite remote sensing, environmental sensors, numerical climate models, cloud computing, and open data initiatives now provide high-volume, long-term, and near-real-time data that can dramatically improve disaster preparedness, environmental monitoring, and climate adaptation. Historical archives spanning 30–40 years support trend analysis, while modern satellites offer frequent, high-resolution coverage suitable for operational monitoring. When combined with institutional data and appropriate analytical methods, these resources can fill many of the long-standing information gaps that have constrained African disaster risk management and environmental governance.

78. Geo-AI has emerged as a transformative layer on top of this data landscape by combining geospatial analysis with machine learning and deep learning to automate pattern recognition, change detection, and prediction at scale. Image classification and segmentation models can generate land cover maps, identify specific objects such as buildings, and delineate flood or burn scars, while predictive models use historical satellite, climate, and environmental data to forecast hazards and environmental change. These approaches compress analysis timelines from weeks to minutes and enable operational services such as near-real-time hazard mapping and risk forecasting that were previously impossible with manual methods alone. Cloud computing platforms provide the computational backbone for this transformation, allowing users to process petabyte-scale datasets through APIs without needing to store or compute on local infrastructure.

79. The workshop illustrated concrete applications across the disaster risk management cycle. For floods, satellite imagery and machine learning models enable near-real-time flood extent mapping and forecasting based on rainfall patterns, river discharge, and historical flood behaviour, giving decision-makers days of lead time for early warning, evacuation, and resource pre-positioning. For droughts, vegetation indices derived from multispectral imagery combined with rainfall and climate data support early detection of emerging water stress and prediction of drought intensity, while integrating these with socioeconomic vulnerability data helps identify communities most likely to suffer severe impacts. In sudden-onset disasters, drones and AI-powered image analysis allow rapid damage assessments by mapping destroyed or damaged buildings, farmland, and infrastructure, cutting assessment times from weeks to hours and enabling better-targeted humanitarian response. Similar techniques underpin wildfire detection, population exposure estimation through building footprints, and urban risk mapping focused on informal settlements.

80. These innovations rely on, and are amplified by, emerging standards and platforms that make large, complex datasets accessible and interoperable. Open data standards such as Cloud Optimized GeoTIFF, Zarr, and STAC support efficient cloud-based streaming and machine-readable metadata, enabling automated discovery and analysis of distributed datasets. Platforms like Google Earth Engine and Microsoft Planetary Computer host decades of satellite and environmental data with pre-processed products and ready-to-use APIs for common applications such as deforestation monitoring, flood detection, and land cover change analysis, while regional initiatives like Digital Earth Africa and humanitarian data exchanges provide contextualized repositories for African use cases. Together, these tools have transformed geospatial data access from a highly specialized domain into one that a growing range of analysts, planners, and practitioners can use directly.

81. The workshop concluded that, given these technological advances, the main bottleneck is no longer access to data or tools but the capacity of national institutions to incorporate them into routine practice. Effective use of these technologies requires not just technical training but also institutional frameworks that support adoption of cloud-based workflows, inter-agency data sharing, standardized methods, and clear governance for data stewardship and privacy. Participants emphasized that investments in skills, organizational change, and coordinated data governance are now the critical levers for turning powerful geospatial and AI technologies into sustained improvements in disaster risk reduction, environmental management, and climate resilience.

82. Creating effective cloud-based data repositories for climate, environmental, and disaster information requires an institutional framework that prioritizes shared access, clear governance, and protection of sensitive data. Centralized, cloud-based systems allow multiple agencies to contribute and use data through common platforms instead of maintaining isolated files and databases, but they must balance openness with privacy, speed with quality control, and flexibility with standardization. In Namibia, systems such as the National Livelihood Vulnerability Assessment and Analysis and the beneficiary management database already provide national-scale foundations for cloud-native architectures, yet fully migrating to cloud-based repositories will demand investment in institutional capacity, explicit governance rules, and technical upgrades so that national, regional, and local structures can feed and use these systems efficiently.

83. Technically, cloud repositories must manage diverse data types—satellite imagery, weather observations, model outputs, hazard and sensor networks, censuses, surveys, administrative records, and infrastructure inventories—using standardized formats, robust metadata, and well-documented APIs. Decisions about hosting on global commercial platforms, regional clouds, or government data centers have to account for data sovereignty, security, and performance, often pointing toward hybrid models where public geospatial and climate data sit on international clouds and sensitive government data is held on sovereign infrastructure but exposed via secure interfaces. Because many disaster-related datasets currently suffer from missing values, inconsistent definitions, and reporting gaps, repositories must embed validation rules, conflict-resolution procedures, and strong metadata practices so users understand how data was collected, what indicators mean, and where limitations lie. Incorporating satellite data adds further complexity, as platforms need automated pipelines for ingesting, pre-processing, and updating imagery and derived products such as vegetation indices or flood layers at relevant temporal frequencies.

84. The usefulness of cloud repositories increases markedly when they are interoperable and integrated into a broader data ecosystem rather than functioning as stand-alone archives. Using open standards and APIs allows disaster agencies, researchers, private developers, humanitarian organizations, and local governments to plug repository data directly into their own tools, decision-support systems, and public communication products. Integration with international mechanisms such as the International Charter for Space and Major Disasters, global climate data services, and regional platforms like Digital Earth Africa means that national repositories can serve as “one-stop” access points aggregating both domestic and external data into coherent, nationally contextualized resources. This design supports rapid ingestion and use of external satellite and climate products during emergencies while maintaining national control over how they are combined with domestic statistics and operational systems.

85. A parallel transformation is the integration of satellite-derived geospatial data with socioeconomic statistics, which enables richer analysis than either data source alone could provide. Satellite imagery and derived products offer detailed, regularly updated information on land cover, vegetation health, water bodies, urban growth, and hazard footprints, but they cannot explain who is affected, how livelihoods are structured, or what institutional capacities exist. Household surveys, censuses, administrative records, and vulnerability assessments describe populations, economic activities, assets, and services, but are often spatially coarse and infrequent. Linking these two domains makes it possible to answer questions such as where drought will most severely affect subsistence farmers, which neighbourhoods in floodplains lack coping capacity, and how environmental change interacts with poverty, food security, and health outcomes. Namibia’s vulnerability assessment system, when geo-referenced and connected to satellite indicators, is a clear example of how such integration could identify whether food insecurity is driven primarily by environmental conditions or by other factors such as markets, conflict, or disease.

86.

87. Methodologically, successful integration requires careful alignment of spatial and temporal scales, and appropriate statistical techniques. Satellite data, usually continuous in space and frequent in time, must be aggregated to administrative units or survey clusters, or used as covariates in models that downscale socio-economic indicators to finer grids. Time-series methods can connect monthly or seasonal satellite signals with annual or less frequent survey data to reveal lagged relationships between environmental shocks and livelihood outcomes. Geostatistical and machine learning approaches can predict socio-economic variables (for example, poverty or food insecurity) from satellite-derived covariates like vegetation index, night-time lights, or building footprints, filling gaps between survey rounds and providing wall-to-wall estimates. These methods must also carefully consider confounders and validate model outputs against ground truth and local knowledge to ensure that observed correlations reflect plausible causal pathways rather than artefacts of data or modelling choices.

88. Applied to disaster and climate risk management, integrated satellite–socioeconomic analysis enables more precise targeting and prioritization. Drought vulnerability mapping that combines vegetation stress indicators, rainfall anomalies, and livelihoods data can identify communities at heightened risk before severe food insecurity appears, supporting early action and livelihood protection. Flood risk assessments that overlay satellite-derived flood extents with census-based population estimates, AI-derived building footprints, and infrastructure data can reveal which settlements, health facilities, and schools are most exposed, informing tailored preparedness and response strategies. Integrated land-use and livelihood analyses can show where agricultural potential is low but dependence on agriculture is high, signalling the need for diversification, or where high agricultural potential coexists with persistent poverty, pointing to market or governance constraints. Namibia’s geo-referenced Livelihood Vulnerability Assessment provides a concrete institutional base for such integrated approaches: once household locations and characteristics are linked to satellite observations via cloud platforms, authorities can generate near-real-time maps of emerging vulnerability and use them to shape contingency plans and proactive humanitarian interventions.

89. Data integration for climate, environmental, and disaster-related information is first and foremost a governance and institutional problem rather than a purely technical one. Agencies responsible for environment, agriculture, health, meteorology, statistics, and disaster management typically operate separate data systems built around their own mandates, methods, and priorities, which makes cross-cutting analysis difficult and encourages duplication, gaps, and inconsistent indicators. Overcoming this fragmentation requires high-level coordination mechanisms such as national spatial data infrastructures or disaster platforms backed by clear mandates, formal data-sharing obligations, and standard setting authority, so that sectoral systems are designed from the outset to contribute to a shared national risk information architecture rather than functioning as isolated silos.

90. Standardization and modern data access practices are central to making integration work in practice. Without agreed definitions of key concepts (disaster, damage, losses, affected population), common collection protocols, and harmonized formats, combining datasets from different sources can create confusion instead of insight. The workshop emphasized adopting open standards and moving from ad hoc file exchanges to API-based access, where agencies maintain authoritative datasets on servers or cloud platforms and external users can always pull the latest validated version programmatically. This shift reduces versioning problems, simplifies multi-source integration, and supports real-time or near-real-time dashboards and applications that depend on continuously updated data streams.

91. Since many climate and disaster risk cross borders, effective integration also has a regional and continental dimension. Shared river basins, storm tracks, drought regimes, and transboundary ecosystems mean that national systems benefit greatly from regional early warning centres, joint monitoring initiatives, and shared data platforms that aggregate and redistribute observations from multiple countries. Existing mechanisms—such as SADC or other regional disaster frameworks and the International Charter for Space and Major Disasters demonstrate how coordinated satellite tasking and information sharing can support post-event damage assessment, but workshop discussions pointed out that similar collaborative architectures are needed on the preventive side to support regional drought, flood, and cyclone early warning and climate risk analysis.

92. Within this broader landscape, cloud platforms were presented as a powerful enabler of integration because they provide common environments where heterogeneous datasets—satellite imagery, model outputs, in-situ measurements, administrative statistics, and survey microdata can be brought together and analysed at scale. The workshop framed the move from desktop GIS to cloud-native geospatial workflows as a necessary response to the sheer volume and frequency of modern earth observation data, highlighting that processing should happen “where the data lives” through APIs rather than by downloading multi-gigabyte scenes to local machines. Geo-AI tools running on these platforms can automate tasks such as image classification, change detection, hazard mapping, and exposure estimation, drastically reducing the time and effort needed to generate decision-ready products from integrated datasets.

93. Participants also stressed that successful integration depends on building interoperable cloud-based repositories that serve as shared, authoritative sources for multiple users and applications. Designing such repositories requires careful attention to data governance (who can contribute, who can access what, under which rules), quality assurance (validation, error handling, reconciliation of conflicting reports), and sovereignty and security (especially for sensitive census and administrative data). Hybrid architectures where public geospatial and climate data reside on commercial or regional clouds and sensitive national data stays on government infrastructure but is exposed through secure APIs were discussed as pragmatic pathways that preserve control while still enabling powerful integrated analysis.

94. Integrating satellite-derived geospatial data with socioeconomic statistics was highlighted as a key frontier that brings the value of data integration into focus. Satellite products provide spatially detailed, frequently updated views of land cover, vegetation, water, and hazards, while household surveys, censuses, and administrative records describe livelihoods, assets, health, and institutional capacity. When linked in consistent spatial and temporal frameworks, these sources can answer questions about who is affected by environmental change, where vulnerability is concentrated, and how different population groups and sectors respond to shocks. Examples discussed included combining vegetation indices with livelihood data for drought vulnerability analysis, overlaying flood extents with building footprints and population data for flood risk mapping, and using AI-derived building footprints plus census data to refine population distribution estimates in informal settlements.

95. Methodologically, this integration is non-trivial and demands careful treatment of scale, timing, and uncertainty. Satellite data must often be aggregated to administrative units or survey clusters or used as covariates in statistical and machine learning models that downscale socio-economic indicators; likewise, high-frequency environmental observations must be related to lower-frequency survey data through time-series techniques. Workshop discussions emphasized the importance of validating modelled outputs against ground truth and local knowledge, accounting for confounders (for example, differentiating between vegetation loss due to drought versus land-use change), and being transparent about uncertainty so that integrated products inform decisions without conveying a false sense of precision.

96. Beyond technical and methodological issues, participants highlighted persistent human and institutional capacity constraints as major obstacles to turning integrated data systems into operational assets. Many agencies lack staff who are comfortable with cloud platforms, APIs, and data engineering concepts, and procurement practices often prioritize low-spec hardware and limited connectivity that are poorly suited to modern workflows. The workshop called for comprehensive capacity development that combines hands-on training in platforms such as Google Earth Engine and Planetary Computer with organizational strategies for transitioning from file-based, map-centric GIS work to pipeline-based, decision-centric, cloud-native analysis. This includes redefining roles, updating standard operating procedures, and aligning performance incentives with data-sharing and integrated analysis objectives.

97. Regional knowledge exchange and peer learning were critical multipliers of integration efforts. By comparing national experiences from Namibia, Burundi, and other countries, participants identified common patterns such as fragmented mandates, project-dependent data systems, and similar technical gaps and shared concrete solutions such as spatial data infrastructures with strong mandates, national disaster indicator frameworks aligned to global standards, and multi-agency coordination committees. These exchanges reinforced the idea that while technical tools are widely shared, institutional configurations differ, so effective integration strategies must be tailored to context while still drawing on regional good practices and shared standards.

98. Finally, the workshop looked ahead to the transformative potential of integrated, cloud-native, Geo-AI-enabled data systems for disaster risk reduction and climate resilience. Real-time or near-real-time monitoring and early warning, predictive analytics for hazards and impacts, scenario modelling of cascading risks across sectors, and decision-support systems that link analysis directly to operational triggers all depend on seamless integration of multiple data sources. Participants agreed that realizing this potential will require sustained political commitment, stable financing, and long-term partnerships among governments, regional bodies, academia, private sector providers, and communities. The central message was that integration is not a one-off technical project but an ongoing governance and capacity-building process that must be embedded in how institutions plan, decide, and act on climate and disaster risks.

Workshop Reflection and Feedback

99. Participants concluded that cloud-native geospatial technologies and Geo-AI offer genuinely transformative potential for tackling climate, environmental, and disaster risks, but stressed that converting this potential into routine, decision-support systems requires overcoming deep institutional and capacity barriers. They highlighted persistent fragmentation of data and authority across agencies, with unclear mandates and siloed responsibilities illustrated by split ownership of land cover and forest data hindering the creation of integrated products that users actually need, and called for high-level coordination, clearer role definitions, and robust mechanisms for inter-agency collaboration. They also emphasized that the proliferation of freely available satellite and environmental data does not eliminate the need for rigorous evaluation of data quality and fitness-for-purpose, urging a shift from the assumption that “any data is good enough” toward more critical, application-sensitive data selection and use.

100. Reflecting on their own learning, participants underscored that meaningful adoption of cloud-native workflows and Geo-AI will require sustained, hands-on capacity development well beyond a single workshop, including ongoing mentorship, technical backstopping, and space for experimentation inside institutions. They noted that human capacity must be matched by institutional investments in infrastructure adequate hardware, reliable connectivity, and access to cloud platforms as well as updated organizational processes and procurement practices that reflect the needs of modern geospatial analytics rather than legacy desktop GIS models.

Conclusion

101. The closing session synthesized the workshop's central message: that the era of data scarcity has largely ended, and the primary challenge now is building the institutional and technical capacity needed to exploit abundant satellite, environmental, and cloud-based data for climate, environmental, and disaster risk management. Participants were urged to view cloud-native geospatial technologies and Geo-AI not as optional enhancements but as essential tools for modern governance in a risk-prone, climate-constrained world. The discussions reinforced that while the technological building blocks are already available, realizing their value hinges on deliberate efforts to integrate them into national systems and decision processes.

102. Participants were encouraged to pursue modernization pragmatically through incremental, well-focused steps rather than attempting to sweep, immediate overhauls. Suggestions included launching targeted pilot projects that apply Geo-AI and cloud-based analysis in high-risk areas, gradually embedding cloud data access into existing workflows, and nurturing communities of practice for ongoing peer learning. The workshop emphasized that no single professional can master the full stack of skills required for cloud-native geospatial work; instead, institutional teams and professional networks spanning data science, GIS, IT, and sectoral and subject matter expertise are needed to collectively build and sustain capacity.

103. Concrete calls to action were directed at governments and institutions, including those actively experimenting with the tools and platforms introduced during the workshop, promoting open data standards and cloud-native approaches, investing in connectivity and hardware suited to modern geospatial analysis, and formalizing data-sharing agreements and coordination frameworks. Participants were also advised on how to channel official requests for follow-up training and technical support through government ministries or agencies, underscoring that formal, government-endorsed requests are critical for mobilizing regional and international support for capacity development.

104. Ultimately, the closing remarks framed the adoption of modern geospatial technologies and cloud-native data practices to convert raw data into actionable intelligence that can save lives, protect livelihoods, and support climate-resilient development across Africa. The workshop concluded with a collective recognition that this transformation demands sustained, coordinated effort across institutions and countries through collaboration, data sharing, joint capacity building, and aligned implementation of new technologies while affirming that the knowledge, tools, and partnerships showcased over the four days provide a solid foundation for advancing disaster preparedness, climate adaptation, and environmental stewardship at national and regional scales.

Recommendations

Key recommendations from the report include:

Strengthen institutional coordination and governance

- a. Clarify mandates for climate, environmental, and disaster-related data, with NSA and the Office of the Prime Minister leading on standards, integration, and coordination.
- b. Formalize inter-agency data sharing through legislation or ministerial directives, including clear roles, access rights, confidentiality rules, and incentives for cooperation.

Institutionalize disaster-related statistics using the Compendium

- c. Officially adopt the Disaster-Related Indicators Compendium within national statistical systems and align national indicator frameworks with its concepts and methods.

- d. Make disaster-related statistics routine (not ad hoc), with standardized definitions, methodologies, and quality assurance integrated into official statistical production.

Build and modernize geospatial and cloud capacity

- e. Invest in sustained capacity development on cloud platforms (e.g. Google Earth Engine, Digital Earth Africa, Planetary Computer), Geo-AI, and API-driven data workflows, through repeated, hands-on training and mentoring.
- f. Upgrade institutional infrastructure (connectivity, hardware, secure access to cloud services) and develop organizational strategies for transitioning from desktop GIS to cloud-native geospatial workflows.

Develop integrated, cloud-based data repositories and APIs

- g. Create national cloud-based repositories that integrate satellite, climate, environmental, socioeconomic, and disaster data, with strong metadata, validation, and version control.
- h. Provide API-based access to authoritative datasets to support real-time integration into early warning systems, damage assessment, planning tools, and reporting platforms.

Standardize data quality, methods, and documentation

- i. Establish and enforce common standards for data collection, classifications, and indicator definitions across agencies, drawing on FDES, the Global Set on Climate Change and Disaster-Related Statistics, the Global Disaster Risk-related Statistics Framework and related frameworks.
- j. Institutionalize QA/QC procedures (validation rules, audits, error correction) and require full metadata for all climate, environmental, and disaster datasets.

Integrate satellite and socioeconomic data for risk analysis

- k. Systematically link EO data (land cover, vegetation indices, flood extents, building footprints) with survey, census, and administrative data for vulnerability, exposure, and impact analysis.
- l. Use Namibia's Livelihood Vulnerability Assessment and Analysis and similar systems as platforms for integrated drought, flood, and food security risk assessment.

Strengthen multi-level and community-based reporting

- m. Improve local and regional reporting systems so that community- and district-level disaster information is consistently captured, validated, and fed into national databases.
- n. Pilot and scale participatory approaches (e.g. mobile apps for community hazard and impact reporting) with clear validation and integration procedures.

Secure sustainable financing and reduce project-dependence

- o. Prioritize domestic budget allocations for continuous environmental and disaster data collection, system maintenance, and staff positions, rather than relying mainly on short-term projects.
- p. Design donor-supported initiatives (e.g. DA14 workstreams) to build durable systems and capacities that national institutions can sustain after external funding ends.

Align with and rationalize international reporting

- q. Use the Compendium and global standards to harmonize national data systems so that a single integrated system serves Sendai Framework, SDGs, Paris Agreement, and AU reporting needs.
- r. Develop integrated indicator roadmaps that minimize duplication and clarify how each dataset supports multiple frameworks.

Promote regional cooperation and peer learning

- s. Deepen collaboration between Namibia, Burundi, and other African countries on shared hazards (droughts, floods, cyclones), including regional early warning, data sharing, and joint analyses.
 - t. Participate in regional and global forums on disaster-related statistics and geospatial data to share good practices, tools, and governance models.
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Capacity Building Workshops on Climate, Environmental Geospatial Data Collection Using Cloud Platforms, and Disaster-Related Indicators

Namibia (2-5 December 2025)

United Nations Economic Commission for Africa, African Centre for Statistics, Geospatial Information Management Section, in Collaboration with
Namibia Statistics Agency

Agenda

Tuesday 2 December 2025		
Time Slot	Activity	Presenter/Facilitator
8:30 – 9:00 am	Arrival and registration	All
9:00 – 10:00 am	a) Opening remark b) Welcome remark c) Introduction of Participants d) Workshop overview e) Group photo	a) Representative of Namibian Statistics Agency (NSA) b) ECA c) ECA d) All e) All
10:00 – 10:30 am	<i>Coffee Break</i>	<i>All</i>
10:30 – 11:00 am	The importance of climate, environmental, and disaster-related geospatial data	Ayenika Godheart, ECA Aster Denekeew, ECA
11:00 – 11:30 am	Discussion and Q&A on the value of geospatial data for climate, environmental, and disaster risk management	Ayenika Godheart, ECA
11:30 am – 12:00 pm	Data gaps, needs, and requirements for disaster-related statistics	Aster Denekeew, ECA
12:00 – 2:00 pm	<i>Lunch</i>	<i>All</i>

2:00 – 2:30 pm	Identifying key stakeholders and partnerships in climate, environmental, and disaster-related data	National Statistical Agency (NSA) Representative
2:30 – 3:00 pm	Introducing key climate, environmental, and disaster agencies and networks	Representative from Burundi
3:00 – 3:30 pm	<i>Coffee Break</i>	<i>All</i>
3:30 – 4:15 pm	Profiling current practices in climate, environmental, and disaster-related data collection	Getu Abdissa, ECA Consultant
4:15 – 5:00 pm	Discussion on current data collection practices	Getu Abdissa, ECA Consultant
Wednesday 3 December 2025		
Time Slot	Activity	Presenter/Facilitator
9:00 – 10:00 am	Overview of the compendium and its strategic importance	Aster Denekeew, ECA
10:00 – 10:30 am	Discussion on compendium and strategic value	Aster Denekeew, ECA
10:30 – 11:00 am	<i>Coffee Break</i>	<i>All</i>
11:00 – 11:30 am	Making geospatial data on climate, environment, and disasters accessible and usable	Getu Abdissa, ECA Consultant
11:30 am – 12:00 pm	Discussion on data accessibility and usability	Getu Abdissa, ECA Consultant
12:00 – 2:00 pm	<i>Lunch</i>	<i>All</i>
2:00 – 2:30 pm	Profiling current practices in climate, environmental, and disaster-related data collection (continued)	Getu Abdissa, ECA Consultant,
2:30 – 3:00 pm	Discussions on data practices	Getu Abdissa, ECA Consultant, Ayenika Godheart, ECA, Aster Denekeew, ECA
3:00 – 3:30 pm	<i>Coffee Break</i>	<i>All</i>
3:30 – 5:00 pm	National experiences and approaches to producing and using DRR Data	Country representatives,

	Challenges in producing disaster-related statistics	Aster Denekeew, ECA
Thursday 4 December 2025		
Time Slot	Wednesday Activity	Presenter/Facilitator
9:00 – 9:45 am	Innovative technologies and methods to help address data gaps	Aster Denekeew, ECA Country Representatives (Namibia, Burundi)
9:45 – 10:30 am	Innovative technologies and methods to help address data gaps	Getu Abdissa, ECA Consultant
<i>10:30 – 11:00 am</i>	<i>Coffee Break</i>	<i>All</i>
11:00 – 12:00 pm	Innovative technologies and methods to help address data gaps	Getu Abdissa, ECA Consultant, Ayenika Godheart, ECA,
<i>12:00 – 2:00 pm</i>	<i>Lunch</i>	<i>All</i>
2:00 – 2:30 pm	Creating and managing cloud-based data repositories for climate, environment, and disasters	Getu Abdissa, ECA Consultant, Ayenika Godheart, ECA,
2:30 – 3:00 pm	Creating and managing cloud-based data repositories for climate, environment, and disasters	Getu Abdissa, ECA Consultant,
<i>3:00 – 3:30 pm</i>	<i>Coffee Break</i>	<i>All</i>
3:30 – 4:00 pm	Integrating satellite-derived data with socio-economic statistics	Getu Abdissa, ECA Consultant,
4:00 – 4:30 pm	Integrating satellite-derived data with socio-economic statistics	Getu Abdissa, ECA Consultant,
4:30 – 5:00 pm	Discussion on integration of data sources	Aster Denekeew, ECA, Getu Abdissa, ECA Consultant,
Friday 5 December 2025		
Time Slot	Thursday-Activity	Presenter/Facilitator

9:00 – 9:30 am	Using cloud platforms for climate, environmental, and disaster data integration and analysis	Getu Abdissa, ECA Consultant
9:30 – 10:00 am	Assessing capacity development needs for cloud platforms	Getu Abdissa, ECA Consultant
10:00 – 10:30 am	Regional knowledge exchange on disaster and climate resilience	Getu Abdissa, ECA Consultant
10:30 – 11:00 am	Coffee Break	All
11:00 – 11:30 am	Forward-looking opportunities for integrated disaster, climate, and environmental data	Getu Abdissa, ECA Consultant, Ayenika Godheart, ECA
11:30 am – 12:00 pm	Workshop reflection and feedback	NSA representative, Aster Denekeew, ECA
12:00 – 12:30 pm	Closing remarks	NSA representative, Ayenika Godheart, ECA
12:30 – 2:00 pm	Lunch	All

