Policy Brief
October 2025

Climate Security Watch: Advancing SDG Indicator 13.1.1 to Improve Disaster-Impact Assessment in the Sahel

SDGs-EYES service – Monitoring Sustainable Development Goal 13 – Using Earth observation (EO) data to monitor disaster impacts in the Sahel countries

13 CLIMATE ACTION

Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population (SDG Indicator 13.1.1)

KEY MESSAGES

Timely data for disaster impact.
In fragile environments, information on who is affected when disasters strike is often delayed or missing. The Climate Security Watch: The Sahel Impact Tracker service fills this gap with fast, decision-ready insights.

Near-real-time flood impact estimates.
The service converts EO-detected flood footprints, combined with population and building-footprint exposure, into near-real-time, event-level estimates of affected people and buildings - aligned with SDG 13 - immediately after flood events, supporting response and reporting.

SDG-aligned modelling (13.1.1).
In the Climate Security Watch: The Sahel Impact Tracker, precipitation-derived flood potentials are fused with population and building-footprint exposure. A trained, region-specific model, calibrated on documented Sahel flood events, then generates event-level estimates of affected people and buildings aligned with SDG 13.1.1. These standardized figures are delivered as tables for direct use in disaster-management workflows and in national SDG/Sendai reporting.

Co-designed, workflow-ready service.
The service was co-created with end users so outputs plug directly into disaster-management and SDG-reporting routines.

Validated and ready to operate.
A validation across the Sahel and a dedicated user survey indicate operational readiness and clear preferences for event-based updates, high spatial resolution, and web-delivered digital products.

SDGs EYES

Funded by the European Union

Scene Setting

Stretching from Senegal to Djibouti, the Sahel is home to around one hundred million people living with a volatile mix of climate extremes and structural fragility. Recurrent floods and droughts intersect with poverty, demographic pressure and competition for land and water, turning climate shocks into risks for livelihoods and stability. In this context, the official SDG indicator 13.1.1 - Number of deaths, missing persons and directly affected people per 100,000 population - remains under-reported because ground observations are sparse and slow to compile. Without timely, standardised figures, authorities - including national disaster management/civil protection agencies and statistics offices across Sahelian countries, regional bodies (e.g., ECOWAS, IGAD, AU, CILSS), and UN/humanitarian actors (e.g., OCHA, UNDP, WFP, UNICEF and the humanitarian clusters - struggle to target aid, plan resilient infrastructure or anticipate displacement. Earth observation data is a key asset to support authorities in decision-making processes. Flood-related datasets (precipitation, soil moisture, hydro-modelling from digital elevation models) help estimate the number of affected houses; population and infrastructure datasets quantify exposure; and disaster databases such as DesInventar[1] provide ground truth for training models. The SDGs-EYES Climate Security Watch: The Sahel Impact Tracker - developed within the SDGs-EYES project - brings these strands together, using ecoregion-specific model training and machine learning regression to predict the number of houses and people affected by floods, which allows to support resilience programming and to inform the climate–security nexus.

Transforming Climate-Security Monitoring with Earth Observation: Advancing SDG 13 and Resilience in the Sahel

Focusing first on flood impacts, the Climate Security Watch service delivers a scalable Earth observation–driven platform that identifies where hazards meet human presence. Flood-related datasets (precipitation, soil moisture, hydro-modelling from digital elevation models) are combined with exposure layers such as population and infrastructure to generate near-real-time, event-level estimates of affected people and buildings aligned with SDG indicator 13.1.1. An online interface allows users to explore spatial patterns, drill down to affected settlements and follow how impacts accumulate over time. Regular updates via a cloud-hosted, automated, event-triggered workflow overcome delays typical of manual reporting, giving decision-makers a current picture of needs on the ground.

Developed within the SDGs-EYES project and co-designed with end users, the service has been iteratively refined with stakeholders involved in climate security and SDG reporting across Africa and Europe, ensuring compatibility with existing institutional practices and reporting routines - from civil protection and humanitarian response to national statistics and international SDG/Sendai reporting. Results are delivered through an interactive web interface as maps and tables, with ready-to-use digital products for further analysis or archiving.

[1] DesInventar Sendai (UNDRR) — an open-source disaster loss database system used by countries to record and analyse disaster impacts: https://www.desinventar.net

Main Features of Climate Security Watch

More accurate and realistic data. The Climate Security Watch: The Sahel Impact Tracker integrates multiple data sources in an automated, cloud-based workflow. Flood-related datasets (precipitation, soil moisture, and hydro-modelling from digital elevation models) are combined, while exposure is represented with gridded population and building-footprint layers. A predictive ecoregion-specific model, trained and validated on documented flood events in the region, translates the intensity and extent of flooding into event-level estimates of affected people and buildings for each event, aligned with SDG 13.1.1. Outputs are delivered at operational spatial scales and are presented as tables that can be exported as digital products for further analysis or archiving. The service's exploitation plan identifies concrete assets for its sustainability and growth: a climate-security-adapted SDG 13.1.1 indicator, harmonised input bundles for precipitation and exposure, services and scripts for indicator calculation, validation reports and a multi-risk dashboard. Together, these assets underpin repeatable production and facilitate uptake by operational agencies.

Near-real-time data. When rainfall and river conditions indicate a flood, the cloud-based workflow can automatically ingest the latest EO and model data, update the flood potential footprint and publish near-real-time impact estimates. The web interface lets users explore spatial patterns, drill down to affected settlements and track how impacts accumulate over time. Event-triggered updates overcome delays typical of manual reporting, giving decision-makers a current, comparable picture of needs on the ground.

Co-design process. Developed within SDGs-EYES and co-designed with end users across Africa and Europe, the service is aligned with existing institutional practices - from civil protection and humanitarian response to national statistics and international SDG/Sendai reporting. Validation and user feedback sessions indicated preferences for event-based updates, 10–100 m spatial detail and web-delivered digital products, which are reflected in the interface and product set to ease operational uptake.

From pilot to sustained use. An exploitation plan underpins continuity and growth: a climate-security-adapted SDG 13.1.1 indicator, harmonised input bundles for precipitation and exposure, services and scripts for indicator calculation, validation reports and a multi-risk dashboard. These assets enable repeatable production and adoption by operational agencies, while forward plans include scaling across Sahelian countries, linking outputs to national disaster-loss databases and international monitoring systems, and broadening the hazard portfolio (e.g., the ongoing drought demonstration in Niger) supported by continued capacity-building.

The Technical Side of the Service

Under the hood, the pipeline consists of three elements: hazard detection, exposure mapping, and automated modelling.

- Hazard layers characterise where and how severely floods occur.
- Exposure layers quantify who and what is in harm's way.
- The modelling component estimates direct impacts by combining the two.

The workflow (see Figure 1) is containerised and runs in the cloud so that users do not need local computing resources. Stratification by eco-regions supports transferability across the Sahel's diverse landscapes. When rainfall and river conditions indicate a flood, the system can ingest the latest precipitation (CHIRPS) and soil-moisture (SMAP) datasets, delineate the upstream basin using the Copernicus DEM, overlay exposure data (building footprint from OpenStreetMap/WorldCover and population from GHSL), then update the flood-potential estimate and generate new SDG 13.1.1 impact estimates that can be viewed from the dashboard.

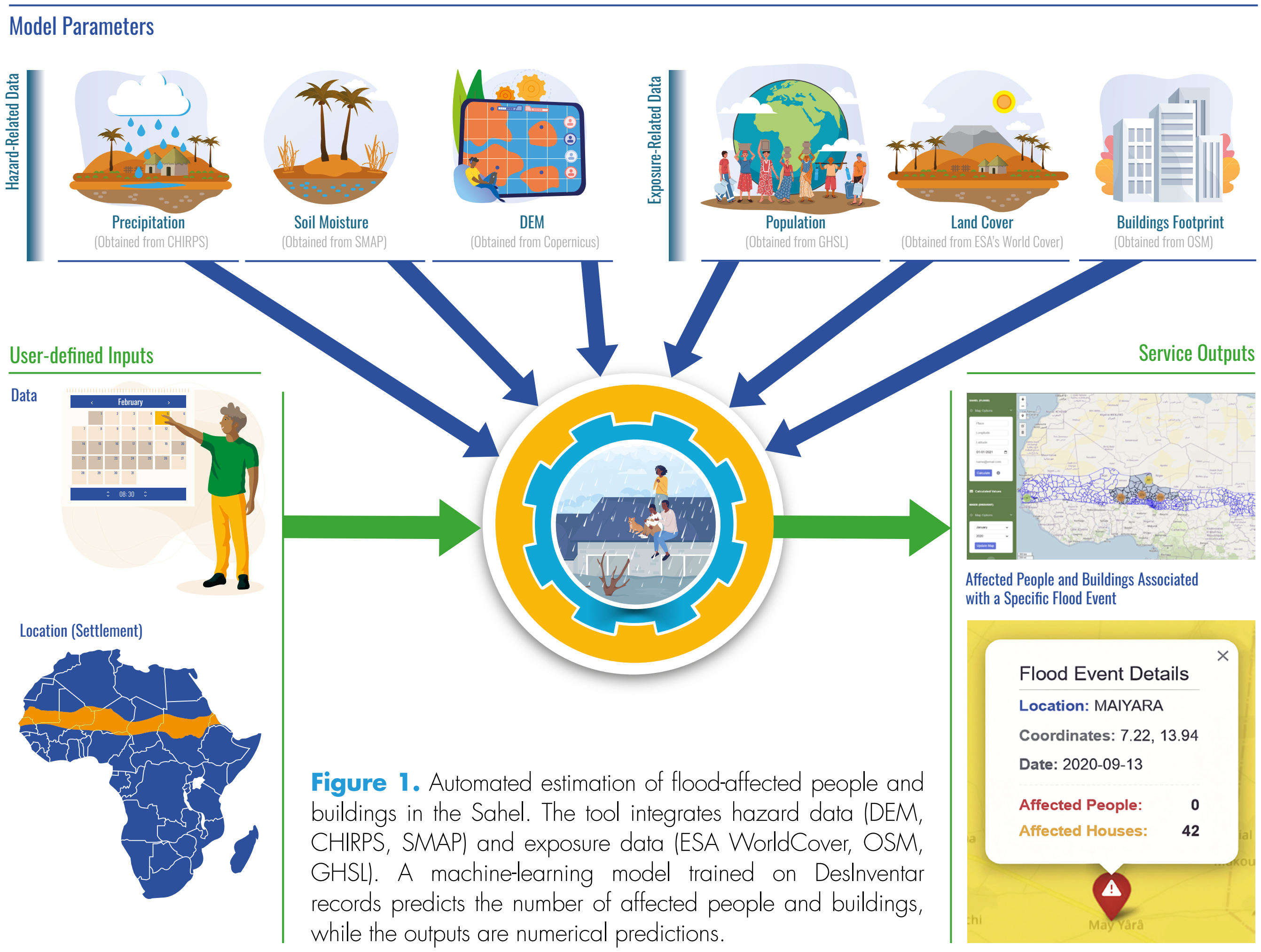


Figure 1. Automated estimation of flood-affected people and buildings in the Sahel. The tool integrates hazard data (DEM, CHIRPS, SMAP) and exposure data (ESA WorldCover, OSM, GHSL). A machine-learning model trained on DesInventar records predicts the number of affected people and buildings, while the outputs are numerical predictions.

What Does This Mean for Policy?

Ministries and regional bodies can use the estimates to prioritise emergency assistance, reinforce critical infrastructure and plan adaptation. Because the outputs are tied to SDG 13.1.1, they can feed national SDG submissions and the Sendai Framework's[2] loss accounting, improving the timeliness and comparability of official reporting. At regional level, the service can support early-warning and risk-analysis mandates by providing harmonised impact metrics across borders. Internationally, producing transparent, adaptation-relevant impact data aligns with calls to strengthen resilience reporting and to ground adaptation planning in evidence. The co-design approach builds confidence by ensuring the service complements existing practices and by validating model outputs against documented events before broader adoption.

Event-level, standardised impact figures strengthen disaster-risk-reduction planning, humanitarian targeting and security assessments.

[2] Sendai Framework for Disaster Risk Reduction 2015–2030 (UNDRR). Available at: https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030

From Barriers to Action: Enabling Earth Observation-based SDG Reporting

Data Fragmentation

The Challenge: EO and non-EO data live in separate, incompatible systems, hindering integration and comparability.

Strategic Response: Harmonise EO and non-EO inputs in a single workflow and align definitions and outputs with user requirements to produce consistent, SDG-ready indicators.

Institutional Inertia

The Challenge: Agencies are reluctant to change established reporting methods and processes.

Strategic Response: Align outputs to existing workflows and definitions so the service slots into current practices, lowering adoption friction.

Capacity Gap

The Challenge: Limited technical expertise and infrastructure to run EO pipelines locally.

Strategic Response: Deliver results via a user-friendly, cloud-hosted web platform that automates processing and keeps local infrastructure needs minimal.

Sustainability and Resources

The Challenge: Maintaining operations beyond a project's life and controlling costs.

Strategic Response: Openly disseminate code and data artefacts and pursue institutional integration - key levers that enable reuse, budget efficiency, and long-term continuity.

Methodological Limits

The Challenge: Small samples for certain flood types, difficulty detecting sudden flash floods, and reduced performance on very large events.

Strategic Response: Address these through interface improvements and targeted model refinements, expanding coverage and robustness over time.

Climate Security Watch: Experimental Results and Operational Validation

The validation showed that model outputs match the observed pattern and scale of past flood impacts, supporting their use for event-level SDG 13.1.1 estimation. Quantitative assessments across different ecoregions confirmed that the models provide reliable estimates of affected houses, with errors remaining within a reasonable range for operational applications. For instance, model predictions in flood-prone areas such as the Sahelian Acacia or the West Sudanian savanna reflected the distribution of affected settlements reported in historical disaster records. Besides, feedback gathered during a dedicated validation session reinforced this: most participants preferred receiving a new estimate whenever an event occurs, favoured 10–100 m spatial resolution and asked for digital products accessible via a dedicated web platform. The service was rated highly relevant to organisational needs, and many respondents requested training materials - clear signals of operational utility and demand.

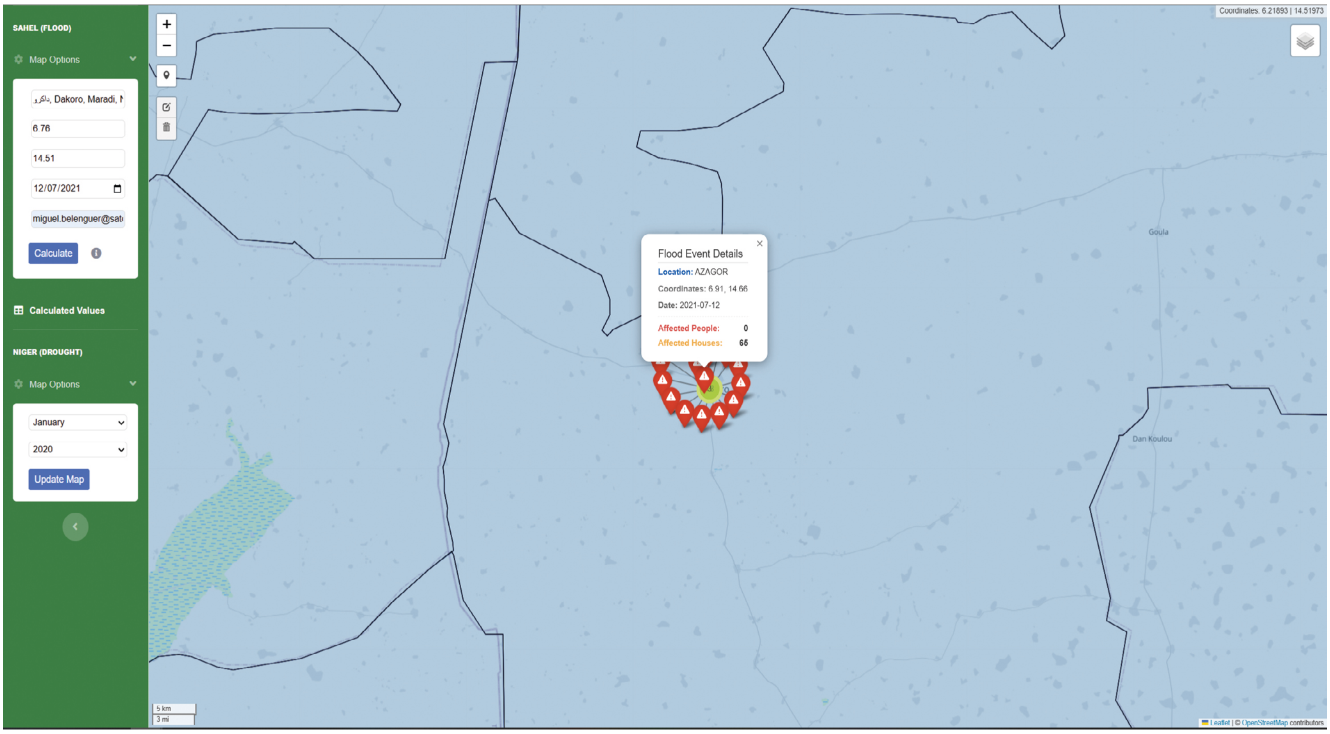


Figure 2. Example of the platform's dashboard capable of estimating the number of houses and buildings affected by floods in the Sahel. The displayed event corresponds to Azagor, on 12 July 2021.

Forward Looking

Next steps focus on scaling across Sahelian countries and broadening the hazard portfolio beyond floods, considering a drought demo already being implemented in Niger, so that local and national civil protection agencies can access impact estimates for multiple hazard types. Expanding the training dataset and refining models will further stabilise event-level estimates, improving the reliability of information for planning and response. Integrating outputs with national disaster-loss databases will streamline reporting and support evidence-based decision-making. Besides, the service pilot will evolve, expanding the training dataset will further stabilise estimates.

On the institutional side, by linking the Tracker's event-level estimates to international monitoring systems, statistical offices can more easily compile and report SDG 13.1.1 figures. Using the service's impact estimates as the "directly affected persons" component while separately accounting for deaths and missing persons will help ensure complete and timely SDG reporting and improve comparability across countries. This facilitates harmonised, cross-border monitoring in the Sahel. Expanding coverage beyond floods to other hazards and scaling to additional countries will enhance regional early-warning and risk-assessment mandates.

SDGs-EYES in short

SDGs-EYES aims to boost Europe's capacity to monitor the Sustainable Development Goals by harnessing the power of Copernicus Earth Observation data. The project focuses on building a portfolio of decision-support tools to enhance the production and use of SDG indicators, with an emphasis on accessibility, reliability, and impact.

Enhancing access and usability of Earth observation data

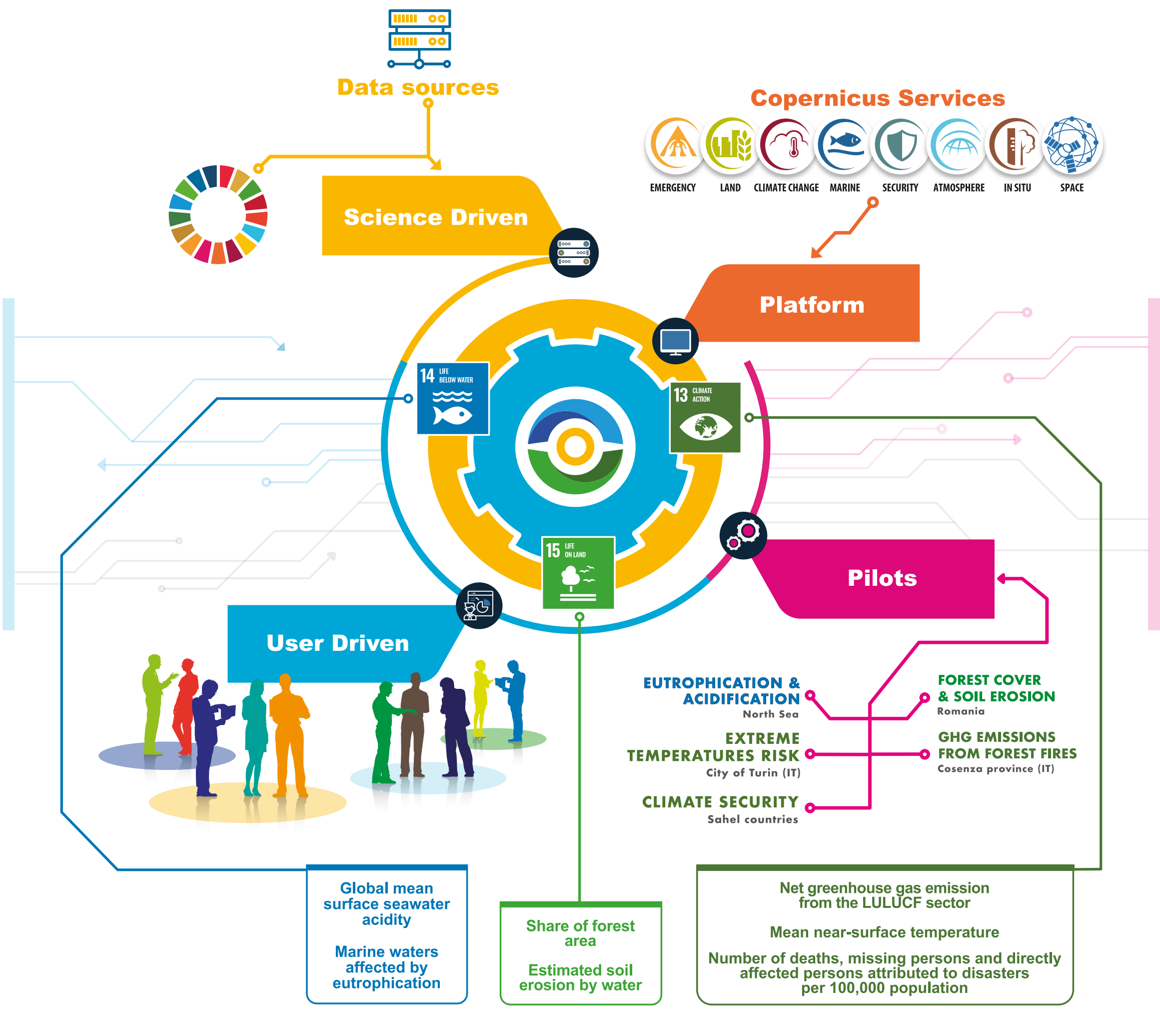
SDGs-EYES develops a scientific and technological framework to build robust and accurate indicators. It aggregates and processes data from Copernicus's six core services - along with space-based and in situ sources - to make Earth Observation information more accessible and actionable.

Improving the Quality of SDG Indicators

The project demonstrates Copernicus-enhanced measurement for indicators across six SDG goals, with a particular focus on SDG 13 - Climate Action, SDG 14 - Life Below Water, SDG 15 - Life on Land. A cross-cutting indicator has also been developed to assess the exposure of vulnerable communities to multiple and overlapping climate extremes.

Building stakeholder capacity for societal impact

SDGs-EYES delivers service-oriented data products that simplify the tracking and reporting of SDG indicators. These tools have been co-designed with users - including public authorities, researchers, and environmental agencies - to ensure usability and relevance in real-world decision-making contexts.



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SDGs EYES

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