How technology, anticipatory action are transforming response to floods

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BY TREVOR LUTALO

In the flood-prone districts of western Uganda, disasters have long followed a familiar pattern.

Heavy rains fall on the slopes of the Rwenzori Mountains, rivers swell with little warning, and within hours, communities along the River Nyamwamba in Kasese, or the Rivers Semuliki in Bundibugyo and Ntoroko, are submerged.

For years, response came only after the damage was done, homes destroyed, crops washed away, and livelihoods disrupted, with over 6,900 households severely hit in 2024. Now, that pattern is beginning to change.

Across Kasese, Bundibugyo and Ntoroko, a shift is underway.

It is not driven by a single intervention, but by a layered system combining automatic weather stations, radar-based river monitoring and community-led anticipatory action.

Together, these are reshaping how floods are understood, predicted and managed in one of Uganda's most climate-vulnerable regions.

At the centre of this shift is the early warning centre at the Albert Water Management Zone offices in Kabarole District.

Inside, hydrologists monitor screens tracking weather and river systems in real time, translating streams of data into decisions that can determine whether communities stay or evacuate.

"In the early warning centre, we are looking at weather extremes around the Rwenzori region. We have six automatic weather stations and radar sensors that collect weather parameters and water levels, then transmit the information here," says Mr Frank Kigozi, a senior hydrological inspector at the Ministry of Water and Environment.

The monitoring network stretches across the region. Automatic weather stations are installed in Kasese, Bundibugyo and Ntoroko, while radar sensors are mounted along the Nyamwamba and Semuliki river systems. In practice, this means upstream events, heavy rainfall in the mountains or a rapid rise in river levels can be detected almost instantly.

"Whatever is happening in Kasese on the Nyamwamba system, and even Bundibugyo around Semuliki, we can receive it at this point," Mr Kigozi explains.

An automatic weather station installed at the Ntoroko District headquaters. The station relays data without manual monitoring. PHOTOS/TREVOR LUTALO

The embankment that protects the surrounding land from the Semuliki's overflow.

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Critical

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In a region where floods are often triggered by short bursts of intense rainfall, that immediacy is critical. Complementing this are radar sensors positioned above river channels, often mounted on bridges. These devices emit signals to measure the distance to the water surface, allowing them to detect even small changes in river height.

"A radar sensor is placed on a bridge where it faces the water. It keeps detecting the changes in height. When the water builds, the height keeps changing, and it captures those changes," Mr Kigozi says.

For hydrologists, these changes reveal more than what is visible. A slow, steady rise may signal manageable conditions, but a rapid increase, especially when combined with heavy rainfall data, can indicate imminent flooding.

This is where data turns into action. "We set triggers. When water reaches a certain level, we know this is a danger. Then we quickly alert the people," he says.

Measures in place

The response chain is structured. Data flows from sensors to the early warning centre, where it is analysed. Once thresholds are reached, alerts are issued to district leaders, who then mobilise communities. In some cases, people evacuate. In others, they secure property, move livestock or prepare for rising waters.

"Our main target is the district leaders. They are the ones we inform so they can alert the communities," Mr Kigozi adds.

In a landscape where floods can escalate within hours, even a short warning window can make a decisive difference. Yet technology alone cannot prevent floods. Its value lies in how communities respond and what measures are in place to reduce vulnerability.

In Ntoroko District, along River Semuliki, the impact of anticipatory action is already visible.

At Kayanja village, a section of riverbank that once served as a major entry point for floodwaters has been stabilised through a mix of engineering and ecological restoration.

"This was the major point where water would enter the community. When it flooded, it affected very many people across several sub-counties," says Mr Herbert Kamuhanda, the district environment officer.

Following destructive floods in 2023, the district conducted an assessment and, with support from the Ministry of Water and Environment and the Food and Agriculture Organisation (FAO), implemented mitigation measures. An embankment was constructed to contain the river and reduce overflow into nearby settlements.

"The next flooding in 2024 affected fewer community members because this major hotspot had been worked on," Mr Kamuhanda says.

What stands out is what followed. Over time, vegetation began to regenerate along the stabilised banks, strengthening the structure and improving resilience.

"We can now see natural regeneration taking place," he notes.

This blending of infrastructure with ecological recovery reflects a broader shift in climate adaptation, one that recognises nature as part of the solution.

However, realities on the ground complicate this approach. For many communities, riverbanks are sources of firewood, grazing land and daily survival. This creates tension between conservation and livelihoods.

"We realise the lack of sources of firewood, so people end up cutting down the trees," Mr Kamuhanda says.

The consequences are immediate. As vegetation is cleared, riverbanks weaken, erosion accelerates and flood risk increases.

Regreening environment

"If they continue cutting, they will accelerate the rate at which the bank is breaking and destabilise our structures," he warns.

To address this, interventions are expanding beyond physical infrastructure to community-focused solutions. Households are being provided with tree seedlings, while bamboo is being introduced as an alternative source of biomass.

"We are giving out seedlings to households and planting bamboo. Bamboo can provide biomass, so people don't depend on cutting the natural vegetation," he explains.

Local authorities are also stepping up community engagement, emphasising the role of vegetation as a frontline defence against floods. Another key element of the new approach is the identification of flood hotspots. Rather than treating flooding as a uniform risk, districts are mapping specific locations where water is most likely to breach riverbanks.

Some areas are driven mainly by river overflow, while others, such as Vodiva, are influenced by both river systems and Lake Albert.

"The one in Vodiva is tricky. Water comes from both the river and the lake," Mr Kamuhanda says.

Different strategies are applied depending on the level of risk. In highly vulnerable zones, structural measures such as embankments are prioritised.

In less critical areas, natural regeneration is encouraged through fencing, while alternative watering points are constructed to prevent livestock from degrading riverbanks.

"We fenced off areas and constructed watering points away from the river so animals stop accessing it. It has worked," he says.

HOW IT WORKS

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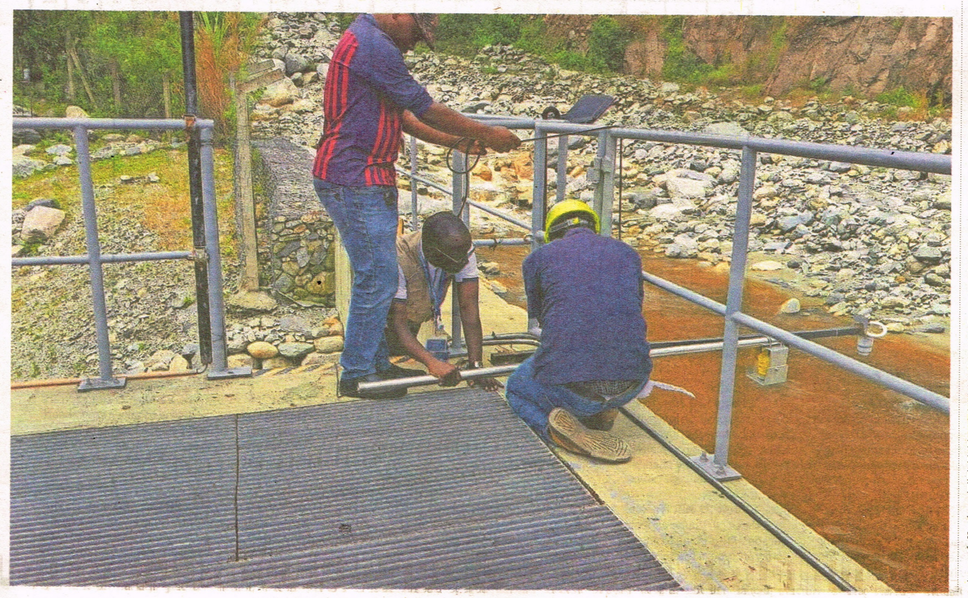

Technicians install a radar sensor on River Nyamwamba.

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