



Technological improvements to flood early warning systems in Vietnam

Summary

The early warning system in Huế City, Vietnam, was strengthened with the installation of two automatic river water level gauges with radar sensors for improved accuracy, two inland smart flood warning towers that register flood depth and send data to the hydrometeorological monitoring system, and two high-power warning sirens with back-up power systems to use as a last resort for flood and storm warning communication. Together, these devices help to improve data availability, connectivity, and usefulness, and facilitate timely flood warning delivery to the hardest-to-reach communities.

Our approach

ISET-International (ISET) applied the Flood Resilience Measurement for Communities, which has now evolved into the Climate Resilience Measurement for Communities (CRMC) tool, to develop information about the strengths and weaknesses of flood-vulnerable communities. ISET then discussed with communities and the provincial DRM agency how weaknesses could be addressed and strengths leveraged. Gaps in flood early warnings were identified, including weaknesses in the river and localized flood monitoring systems, and a lack of redundancy (fail-safe capacity) in early warning system alerts during power outages.

Facts and figures



Cost of an automatic river water level gauge: US\$3,740 (incl. installation)

Cost of a smart flood warning tower: US\$4,400 (incl. installation)

Cost of a high-power siren: US\$3,000 (incl. shipping and installation)



Ongoing cost/maintenance:

~US\$1,200/year, covered by provincial disaster risk management (DRM) budget



Time to set up:

one to two months for approval procedures and site selection, one week for installation



Easy to replicate?

Yes, based on existing DRM system and transferrable technology



Vietnam



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What was the problem?

The Vietnamese system of rainfall and water level monitoring has improved over recent decades but remains limited in terms of number and functionality of stations, lacks reliability and data connectivity, and there is often no contingency plan in case of failures. Flood maps, if they exist, are typically outdated, resulting in a poor understanding of how rainfall and river levels correspond to localized flooding. Additionally, flood forecasting and flood early warnings are increasingly challenged by changes in flood timing, severity, and location due to both climatic and non-climatic factors. Dissemination of early warnings to communities is also compromised by the lack of equipment and/or regular maintenance of existing equipment.

What was the solution?

Two automatic water level gauges for real-time monitoring were installed on the Hương River and Bồ River, close to the locations of existing water level monitoring stations. The new gauges – lidar sensors mounted on tall bridges – provide complementary data to the existing stations, which have increasingly been delayed or failed in relaying data during the last few years, affecting reservoir operation decision-making and flood early warnings.

Two smart flood warning towers were installed in Trung Làng village (Quảng Thái commune) and Phò Nam A village (Quảng Thọ commune). These towers record flood water levels and send real-time data to the provincial hydrometeorological monitoring system and a city-wide app called Hue-S, which is regularly used by nearly 80 per cent of the province's population. As a local backup, the siren in the towers emits a loud

Climate Resilience Measurement for Communities (CRMC)

The Climate Resilience Measurement for Communities (CRMC) is a data-driven process, complemented by a web-based tool and mobile app, which helps communities to evaluate and measure how resilient they are to climate hazards. Using the results, they can identify and implement resilience-building interventions and run additional measurements to track improvements.

Find out more: ZCRAlliance.org/crmc

warning sound and a rotating red light turns on when flooding reaches a dangerous level. The towers are resistant to floods, winds, and tropical storms and are equipped with solar batteries that can operate without power for up to 30 days. Half of the cost of equipment and installation of the towers was contributed by a private company, Watec.

The project also installed two sets of high-power sirens in densely populated areas of Huế City. These can be operated remotely with a range of 5 km and can serve as a last-resort warning channel. This type of high-powered siren system is new to Vietnam; Huế is the first city to trial it.

How does it increase resilience?

The river water gauges improve the rapidity and redundancy of flood forecasting in Huế City by providing a reliable source of river water level information.

The smart flood warning towers improve the accuracy and timeliness of warning information by registering and immediately transmitting flood depth data from the community to the central system. Together with the high-power sirens, they help to diversify flood early warning methods and support the delivery of flood warnings to the hardest-to-reach community members, during night-time, times of power outages, and other times when other communication channels have failed or are less effective.

The warning towers provide redundancy by using two methods to transmit flood warnings to the community: via the attached sirens and lights, and by sending data to the central system to notify people via mobile phones (SMS messages and through the Hue-S app). Thanks to their robust structure, the towers continue to operate during hazard events, including when other information transmission measures are compromised.



Da Vien bridge river gauge. © Photo: ISET-International

Other benefits

- Based on the success of the pilot towers, the provincial DRM office successfully secured additional donor and government funding, and 50 more towers are planned across the province.
- Upon seeing the effectiveness of the high-power sirens, the provincial government has approved their replication in the entire province.
- The river gauge and smart flood warning tower data contribute to the database for flood risk assessment in relation to land use and infrastructure changes.

Common conditions for success

Q: *Is this intervention appropriate for other communities?*

A: Yes, the provincial government has recognized their value and approved their replication.

Q: *What conditions are needed for the interventions?*

A: Funding for installation and maintenance; connection to the central system; back-up systems.

Q: *Was there anything special about the communities where interventions were effective?*

A: Strong commitment and support of local governments.

Early Warning Systems (EWS)

EWS are one of the best-proven and effective measures for saving lives and minimising losses and harm caused by disasters. They help those at risk of floods, heatwaves, wildfires and other climate hazards to take risk-informed, timely, meaningful and impactful early action to keep themselves and their assets safe. The Alliance works across all eight components of an EWS so that they deliver essential services for the most vulnerable women, men, and children, supporting communities to be resilient to climate hazards, enabling them to thrive.



Success story

A smart flood warning tower was installed in Phò Nam A village of Quảng Thọ commune.

When flooding happens, flood-level data from the warning tower is updated on the website of Quảng Thọ commune. We also send updates to the village heads, who inform community members so they can take timely and appropriate action. The data from the flood tower in Pho Nam A village can be used to predict flood level in other locations in the ward, so it will be useful to other villages in our commune, too."



Lê Thanh Xuân
DRM official of Quảng Thọ commune



A smart flood warning tower. © Photo: Huế DRM Office

Expert view

Being one of the most flood-prone provinces in Vietnam, our province needs robust and innovative measures to strengthen its flood early warning system. We appreciate the project support for the river water gauges, the smart flood warning towers, and the sirens. They provide us with timely data and help us deliver prompt warnings to communities. We have acquired the [provincial government] budget allocation for the annual operation and maintenance costs of the installed pieces of equipment."



Đặng Văn Hoà
Director of the Huế DRM office



Installing a siren in Huế City. © Photo: Huế DRM Office

Lessons learnt

- To build resilience at the community level, we often have to take action across different levels. In this case, working at the community level alone is insufficient; only by acting at the community, city, and provincial levels can we effectively address community resilience needs.
- This intervention is a great example of how sophisticated high-tech solutions and locally adapted low-tech measures can complement each other in strengthening early warnings for communities.

Get in touch

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