AN EMBEDDED SYSTEM AND MACHINE LEARNING BASED EARLY FLOOD MONITORING AND WARNING SYSTEM, THE CASE OF RIVER MANAFWA

DANIEL WAVAMUNNO
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INTRODUCTION

Floods are considered the most dangerous class of natural hazards, outranking volcanic eruptions, earthquakes, and tsunamis in terms of their impact on human life. During the 20th century, floods were responsible for 6.8 million deaths, and Asia accounted for nearly 50% of these flood-related deaths .

OBJECTIVES

- To investigate and analyse the problems caused by flooding around River Manafwa area.
- To develop an embedded system and machine learning based flood monitoring and detection system.
- To test and validate the system developed.

METHODOLOGY

The system integrates an ultrasonic sensor and water flow sensor to collect water level and flow rate readings. It also integrates a buzzer to send sound alerts when critical thresholds are reached. It also uses an LCD to display system updates.

The sensor readings are collected and stored in a google sheets drive. These readings are then used by a machine learning algorithm to predict future flooding events. These predictions can be accessed on a web app and the data is also visualized on a graph in real time.

SENSOR MOUNTING ON THE BRIDGE

Max distance 12 m

2.7 m footprint at 12 m
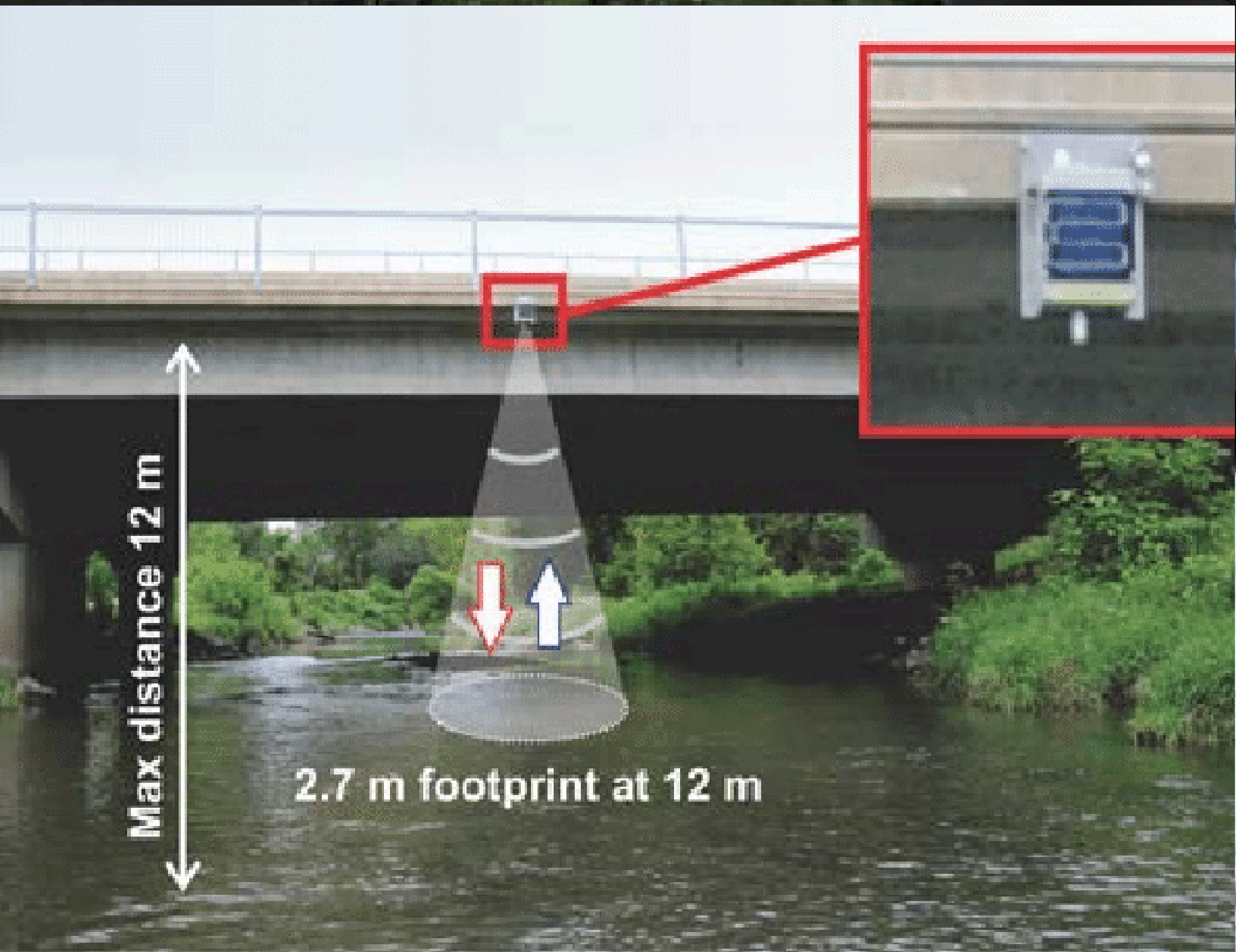
GRAPHICAL RESPENTATION OF SENSOR DATA COLLECTION IN REAL TIME
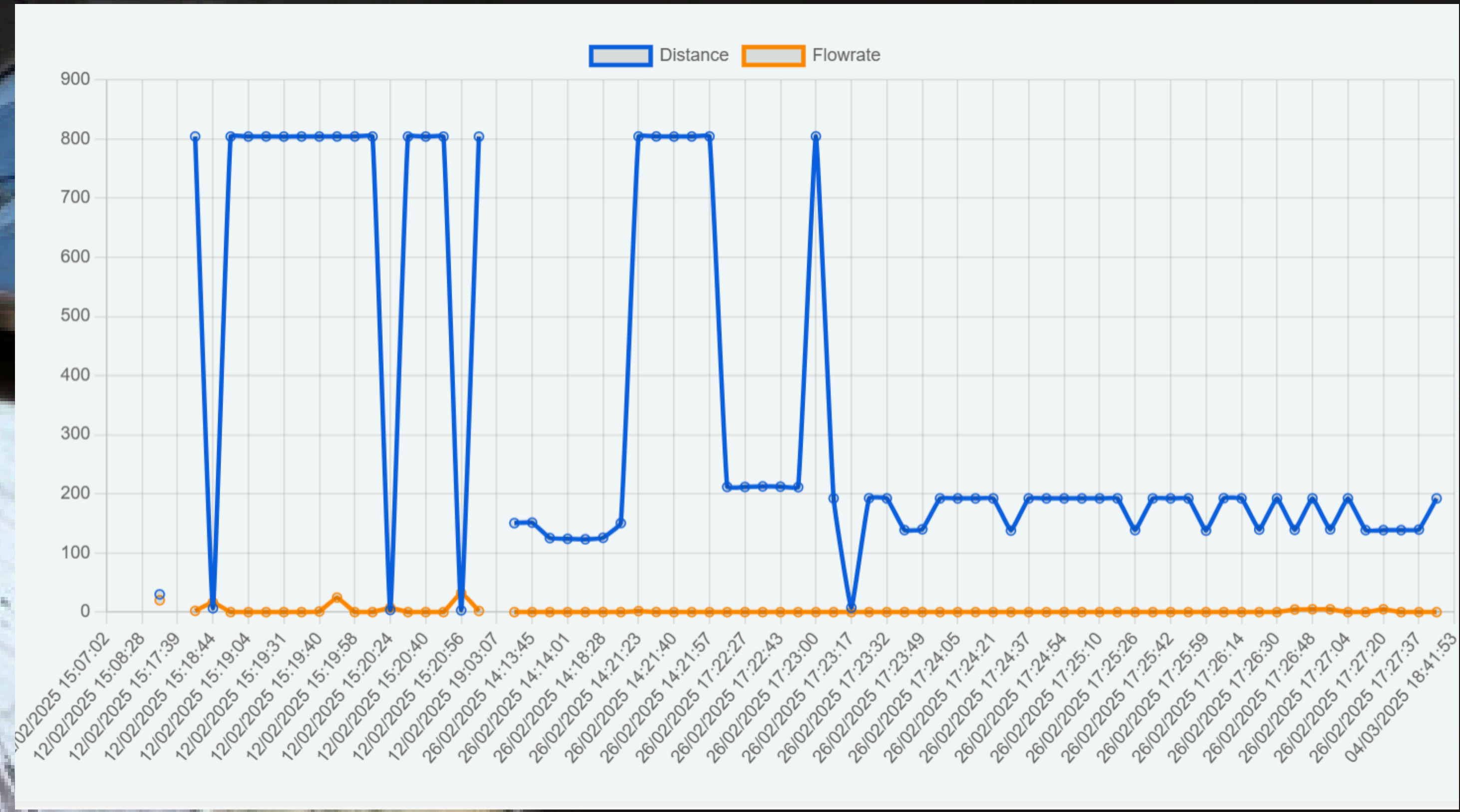
The collected data reveals correlations between water levels and flow rates, where a rapid increase in flow rate often precedes a rise in water levels, signaling potential flood risks. By analyzing historical trends, the Random Forest Classifier provides reliable predictions, with accuracy improving as more data is collected. The system's web interface enables real-time monitoring, allowing for proactive decision-making.

CONCLUSION

- Floods have severe social and economic negative impacts in Uganda.
- Improved management and prediction systems are critical to reducing damage.

REFERENCES

- S. Doocy et al., "The Human Impact of Floods: A Historical Review," PLoS Currents, 2013.
- US Government Accountability Office, 'Federal Emergency Management Agency (FEMA) FLOOD MAPS (Report to Congressional Committees),' 2021.