

# Study shows challenge of promoting citizen science to help prevent disasters caused by flooding

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Waterproofing Data team interviewing residents of M'Boi Mirim district in São Paulo, 2019. Credit: Waterproofing Data

An application developed in collaboration with vulnerable communities to transmit early warnings of the risk of floods and environmental disasters has become public policy in Brazil, and the methodology is being replicated for use elsewhere. With practical results obtained in 2022, part of the discussions involving proposals to improve flood risk governance began at least two years ago.

An article published in *Disaster Prevention and Management: An International Journal* reflects one of the milestones of this process: a workshop held in June 2020 for researchers in Brazil and the United Kingdom to exchange knowledge as part of the Waterproofing Data project (WPD).

The project is an international partnership involving the Universities of Glasgow and Warwick (UK), the University of Heidelberg (Germany), and Getúlio Vargas Foundation (FGV) and the National Disaster Surveillance and Early Warning Center (CEMADEN) in Brazil.

The authors of the article note that the workshop participants identified major research gaps in both countries due to a lack of local data, of data integration systems and of data visualization tools, as well as a lack of communication between [flood](#) prevention agencies. The solutions advocated include interdisciplinary collaboration and exchange of knowledge focusing on tools, methods and policies used in Brazil and the UK, in an attempt to develop innovative initiatives that enhance flood risk governance.

"We realized from the discussions that both countries face the challenge of engaging citizens in flood prevention actions and getting the experts to talk in a way that reaches people at the grassroots. If the people who live in high-risk areas aren't involved, the actions are less effective. The ways and means chosen to surmount these challenges will differ. Strategies must be specific and suited to the characteristics of each

population," João Porto de Albuquerque, a researcher at the University of Glasgow and one of the authors of the article, told Agência FAPESP.

For Victor Marchezini, a researcher at CEMADEN and corresponding author of the article, Waterproofing Data is a particularly innovative project because it helps institutions use the methodology to promote [community participation](#) and conduct [citizen science](#).

"Too often institutions aren't prepared for this. There's cultural resistance to the potential of citizen science, which broadens involvement in the construction of flood warning and prevention systems," he said.

## **Innovative tools**

The WPD researchers set out to change the way flood data is produced, developing innovative tools that make data generation, circulation and usage more visible, and producing novel types of information at the local level via citizen engagement. The ultimate goal is to integrate the results by means of geo-computational techniques and help local communities become more flood resilient.

Along these lines, in January the project launched an app for use by Brazilians living in areas vulnerable to flooding, who can input data to early warning services and for local government to map high-risk areas in order to improve disaster prevention.

Using the principle of citizen science, the researchers trained state school students to set up homemade rain gauges using PET bottles and simple rulers to collect data for the system. Each student is responsible for recording the rainfall measured by a rain gauge every day and entering the data into the app, which sends it to the system's database.

The tool has been tested by teachers, students, civil defense agents and ordinary citizens in more than 20 towns and cities in the states of Pernambuco, Santa Catarina, Mato Grosso, Acre and São Paulo. A new version with a dashboard is available and will have nationwide coverage when it becomes a [public policy](#) system implemented by CEMADEN, which will be responsible for its management.

Furthermore, in June the project issued a learning guide to engage students in the production of data and knowledge about disasters caused by excessive water flows and lack of urban drainage in their neighborhoods and cities. The methodology will continue to be disseminated by CEMADEN's Education Program, which is a project partner.

"The article was published after the launch of the tool, but it was the basis for the approach used by the project," Albuquerque said. "We're aiming at participation by communities, civil defense personnel and end-users. The project's key contribution is this citizen science methodology."

He cited the example of Jaboatão dos Guararapes, a city in metropolitan Recife, Pernambuco state. Almost half of the 130 deaths reported in Pernambuco since the end of May due to flooding and storms occurred in the city.

"Some parts of the city partnered with us in piloting the app. People continued to use it. We heard that on May 25 one of the citizen scientists used it to warn people that there would be much heavier rain than usual for the time of year. The community mobilized and helped evacuate high-risk areas, avoiding deaths there. We did the training, people kept on using the tool, and effective precautions were taken," Albuquerque said.

According to the Intergovernmental Panel on Climate Change (IPCC),

flooding and extreme rainfall will tend to become more frequent as global warming proceeds. By 2050, 1 billion people will face the risk of coastal flooding due to rising sea levels and more people will be forced to leave their homes owing to extreme weather, especially floods.

Moreover, if the rise in the global average temperature reaches 1.5 °C above the pre-industrial average, the number of people exposed to flooding worldwide may increase by 24%.

## **Methods**

The online workshop took place on June 8, 2020. It lasted four hours and was attended by more than 40 civil servants, researchers in natural and social sciences, and a mix of practitioners and other technicians in flood forecasting, prevention and response in Brazil and the UK.

The first part focused on six individual presentations on flood risk governance and citizen science in the two countries. The second part was dedicated to focus groups. The participants split into four groups to discuss knowledge of flood risks, flood forecasting and monitoring, communication, and flood risk governance.

"An important aspect of the project is including the contributions of local communities and connecting the discussion to local universities, which can act as multipliers. When they're under threat, residents of high-risk areas look for information. The app is a way of linking a reliable system with participation by a range of actors," Marchezini said.

In Brazil, some 8.2 million people live in areas subject to landslides and flooding, according to an estimate by CEMADEN based on a study conducted in partnership with IBGE, the national bureau of statistics, in 872 municipalities.

On the other hand, only 1,538 (27.6%) of Brazil's 5,570 municipalities have a flood prevention plan.

**More information:** Victor Marchezini et al, Flood risk governance in Brazil and the UK: facilitating knowledge exchange through research gaps and the potential of citizen-generated data, *Disaster Prevention and Management: An International Journal* (2022). [DOI: 10.1108/DPM-01-2022-0016](https://doi.org/10.1108/DPM-01-2022-0016)

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