

ENHANCING COMMUNITY RESILIENCE TO FLOODS AND ADAPTING TO EXTREME WEATHER EVENTS WITH DATA-DRIVEN CITIZEN SCIENCE

POLICY BRIEF



Policy Brief

This briefing is based on the findings of the Waterproofing Data and Global Challenges Research Fund Translation Award research projects, which aimed to investigate and rethink the governance of water-related risks, with a focus on social and cultural aspects of data practices. The researchers worked together with school students, teachers, community members and official agencies to co-produce knowledge and design strategies to reduce the impact of flood-related events. The projects developed a social data innovation combining community engagement, citizen science and data analytics to improve the resilience of communities to flooding. It includes a citizen-science mobile app, a model curriculum for schools, and a data analytics platform for developing early-warning models.

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Executive summary

Research found that engaging school students with citizen science projects to map their local communities, monitor rainfall levels and record flood impacts helped young people to understand flooding risks and increased their awareness of how climate-related hazards affect their neighbourhoods, whilst also generating valuable data for flood management agencies.

Schools and teachers can set up their own citizen science projects by using open digital tools such as the Waterproofing Data app and the free educational resources available at: <https://www.ubdc.ac.uk/research/research-projects/urban-sustainability-participation/waterproofing-data/>

Context

Climate change is causing extreme weather events to become more frequent and more severe. This raises serious challenges for many communities, including those vulnerable to flooding and other rain-related hazards. Extreme rainfall events can be particularly devastating in more physically and socially vulnerable areas, such as poor neighbourhoods in Brazil and in the global South. The Waterproofing Data project explored how to build communities' resilience to flooding, by engaging them in the process of generating the data used to predict when floods will occur. The project team developed a functional citizen-science mobile app prototype and a model

school curriculum, which has been successfully co-produced and trialled with more than 300 students from over 20 schools and civil protection agencies of five Brazilian states (Acre, Mato Grosso, Pernambuco, Santa Catarina and Sao Paulo). The app and curriculum enabled the communities involved to democratise flood data, raise awareness of flood risks, and co-design new initiatives to reduce disaster risks to communities. This landmark success sparked positive media reports stating our approach "could change the way communities deal with floods in Brazil", as covered in 170+ outlets, including interviews given for 5 national broadcast TV programmes and 6 major newspapers.

While this research was conducted in Brazil, the impacts of engaging citizens in generating data as a climate adaptation measure could be applied in other regions across the world, especially in areas which are in situations of physical or social vulnerability.

KEY FINDINGS

1 We urgently need to create data about the risks of extreme weather events in vulnerable neighbourhoods.

Impoverished neighbourhoods are often vulnerable to natural hazards due to rapid urbanisation, their location within flood-prone areas, and a lack of durable housing, water and sanitation infrastructure, or natural drainage. Data about the risks and impacts of flooding and other natural hazards are often missing from poor neighbourhoods. A lack of sufficient data about rainfall and flooding in an area, as well as a lack of data about the physical and social characteristics of neighbourhoods make it very hard to predict when floods may occur. This increases the risk to these communities as they are less likely to receive warnings before flood events.

2 Community-based climate adaptation action could prevent deaths and reduce impacts on communities.

It is estimated that 1.81 billion people (23% of the world population) are directly exposed to significant flood risk, a number which is likely to increase due to climate change and socioeconomic development patterns. Improving the capacity of communities to cope with flood risks can make cities more resilient to extreme weather events and reduce the number of deaths and the number of people affected by water-related disasters, with a focus on protecting the poor and people in



vulnerable situations. The benefits of better early-warning and effective community-based risk reduction programmes could save human lives and mitigate the significant economic impact of disasters, which are estimated by the World Bank to have caused R\$ 336 billion losses (£48 billion) in Brazil from 1995 to 2019.

3 From data gathering to ‘data gardening’: Engaging citizens as knowledge co-producers can increase their awareness of flood risks and help disaster monitoring agencies to improve risk models.

Waterproofing Data activities have shown it is possible to promote data literacy and critical learning about climate change impacts in schools and vulnerable communities, whilst at the same time generating invaluable data. This requires a shift from seeing citizen science only as a “data gathering” activity to empowering citizens as knowledge co-producers, in a process we call “data gardening”. By observing the correlations between climate hazards (e.g., extreme rainfall) and the impacts on the ground, citizens gain a deeper understanding of the risks in their communities and can take further action, such as advocacy and community-driven risk reduction initiatives. In addition, the generated data can feed wider adaptation measures such as flood early-warning systems. This allows flood monitoring agencies to use these data streams to develop better flood models that incorporate lessons from past rainfall and flood events in order to improve the accuracy of future warnings.

4 Engaging schools and local protection agencies in citizen science and community data generation can effectively contribute to equitable transformative adaptation and disaster risk reduction.

The Waterproofing Data project gathered sound evidence about the positive impact for the communities involved in data generation, enabling them to democratise flood data, raise awareness, and co-design new initiatives to reduce disaster risks. Citizen science programmes that connect school students and local civil protection agencies can be an effective means to co-produce data innovations for disaster risk reduction. The results achieved have shown that by democratising data literacy, improving early warnings, and empowering communities and young people to take action, it is possible to improve the resilience of communities

to vulnerable situations, thus contributing in the long term towards significantly reducing the number of deaths and economic losses caused by disasters globally (Sustainable Development Goals 11 and 13), whilst expanding access to quality education and digital literacy skills (Sustainable Development Goal 4).

5 Schools, communities, and disaster risk reduction agencies can engage in citizen science initiatives for climate adaptation with the support of the open educational resources developed in the Waterproofing Data project, including: a mobile app and a model school elective course.

The mobile app ‘Dados à Prova D’Água’ allows citizens and especially school students to collect, analyse and understand flood-related data. The app is the result of a collaborative and equitable design process in which the perspectives and interests of community members actively shaped how the app works. The mobile app is complemented by the Waterproofing Data Dashboard, which enables the creation of a citizen monitoring network by enabling them to visualise data about rainfall and local flood impacts, whilst providing integrated access to citizen-generated and official data sources.

The school model curriculum Waterproofing Data (‘Dados à Prova D’Água’) offers a template for an elective course to support school teachers to adopt an integrated critical pedagogical approach which enable students to learn concepts about data, flooding risk, vulnerability, and resilience. Students learn to act as citizen scientists by generating and analysing data about their own neighbourhoods. They learn how to construct self-made rainfall gauges with plastic bottles and how to use the Waterproofing Data tools to record their rainfall measurements and impacts on the neighbourhood. They also will learn about open digital mapping tools and participatory mapping of risk perceptions using open digital mapping tools such as OpenStreetMap.

All of the educational materials can be downloaded here: <https://www.ubdc.ac.uk/research/research-projects/urban-sustainability-participation/waterproofing-data/>

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WATERPROOFING DATA

The Waterproofing Data project (<http://warwick.ac.uk/waterproofingdata>) was financially supported by the Belmont Forum and NORFACE Joint Research Programme on Transformations to Sustainability, which is co-funded by DLR/BMBF, ESRC (ES/ S006982/1), FAPESP, and the European Commission through Horizon 2020 under grant agreement No 730211. The UKRI GCRF Translation Award project (EP/ T015683/1) is a UKRI Collective Fund Award supported by EPSRC and the Global Challenges Research Fund. This policy brief was also supported by the University of Warwick ESRC IAA grant ES/T502054/1.