Citizen-derived data as an important tool in tackling the climate emergency

Case Study: water management in Malawi

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Background

Hydro Nation Scholar

Civil & Environmental Engineering Department – but *not* an engineer!

Malawi

Research positioning & ethics

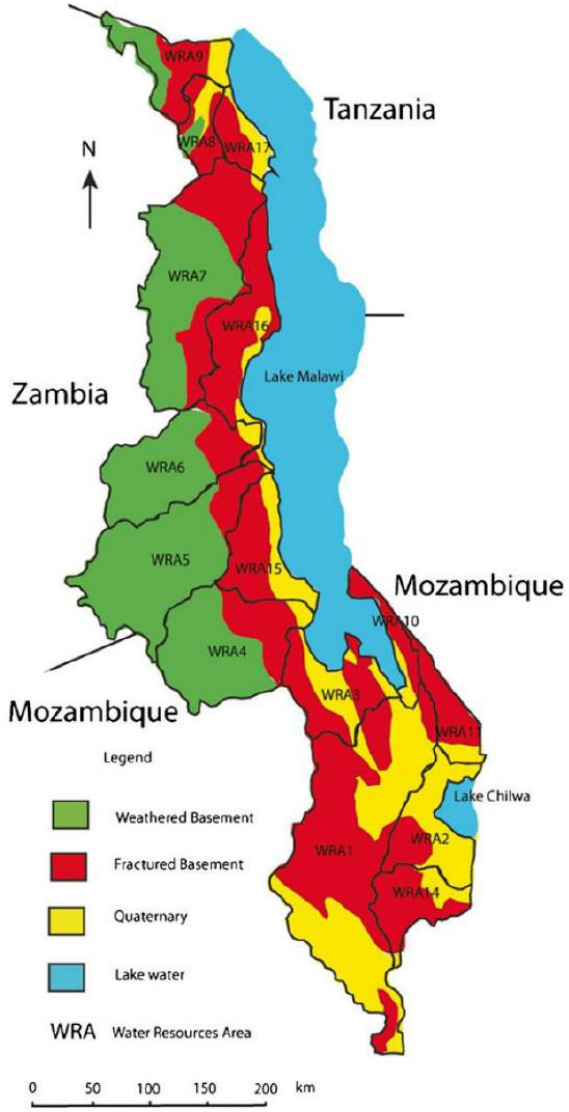
Why Malawi?

Malawi & Scotland
- History
- Government
- Water resources

Malawi context
- Resource ‘poor’
- Competing resource demands

Malawi and global significance
- **Climate** change –> water challenges
- Water **management** issues
- **Data challenges**

Google maps



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Climate, management, and data

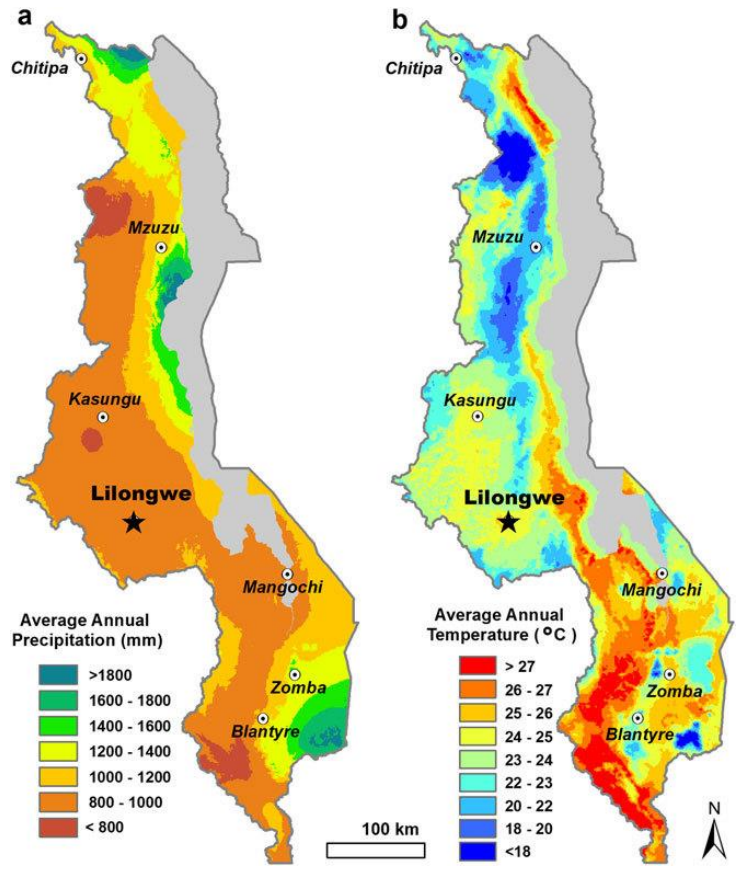
Abundance and scarcity

Resilience to water challenges = low

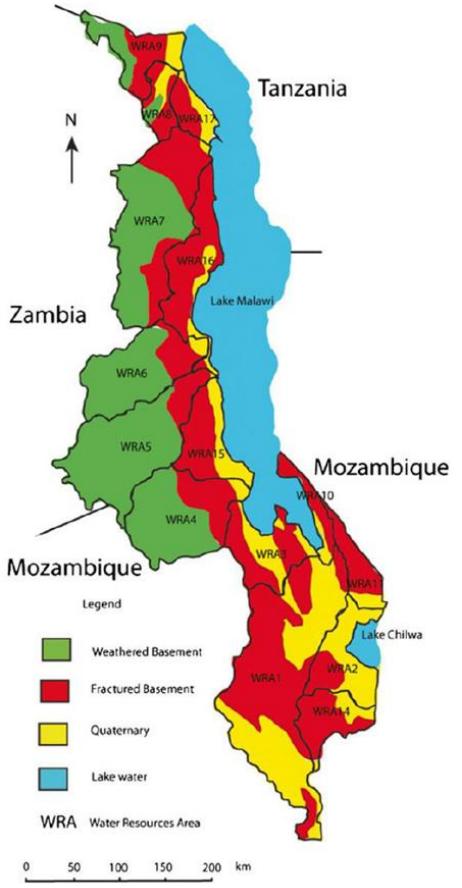
Changing hydrologic patterns

Natural disasters

- Flooding
- Drought



Guiying et. al (2017)



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Climate, management, and data

Credit: UNICEF

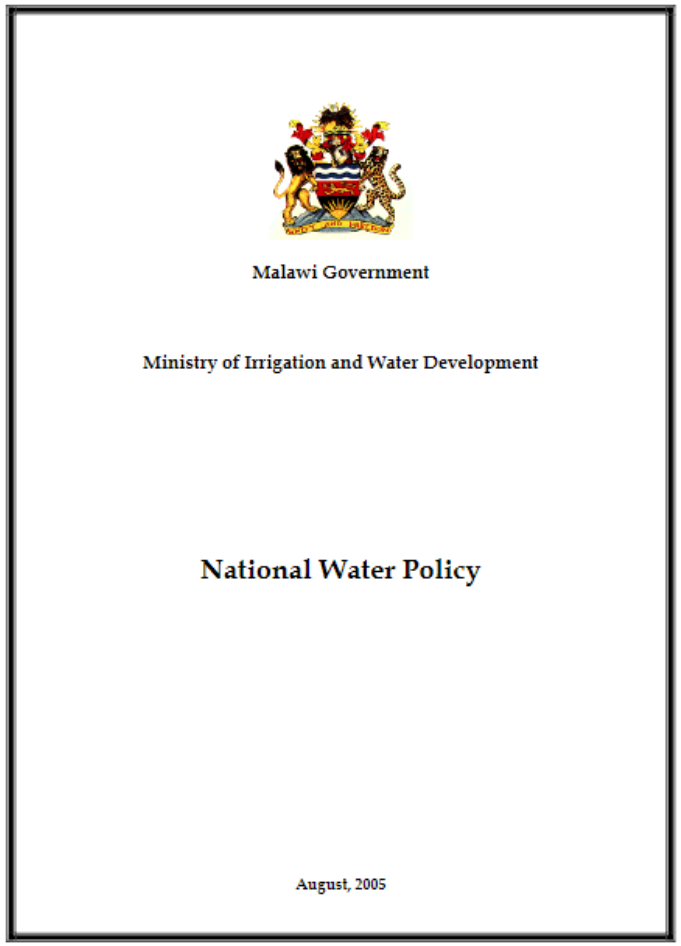
Storm Flooding

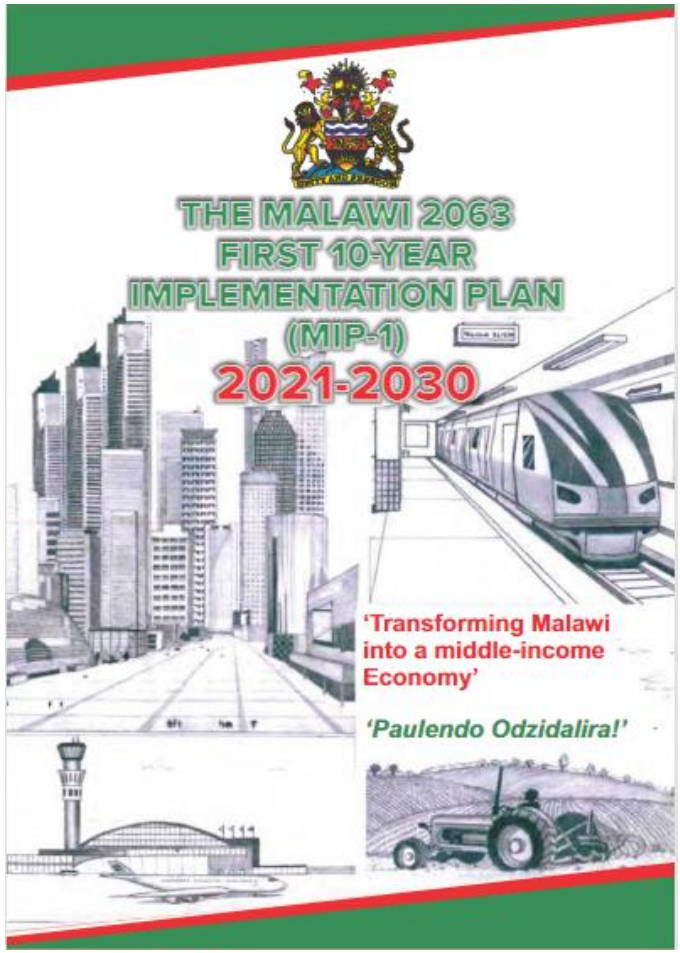
- Chedza (2015) **~200 000** displaced
- Idai (2019) **~90 000** displaced
- Ana (2022) **~150 000** displaced

Cyclone Idai 2019

Credit: BASEflow, Malawi

Climate, management, and data





- Localise decision making
- Improve transparency & accountability
- Science & technology utilisation
- Reprioritise and rethink
- Fill data & knowledge gaps

-> involves people

Sounds familiar…

Rivers

Citizen scientists to monitor English rivers in £7m scheme

Scheme gets under way as data suggests Environment Agency's own monitoring leaves rivers unprotected

Sandra Laville
Environment correspondent

Wed 14 Sep 2022 06.00 BST

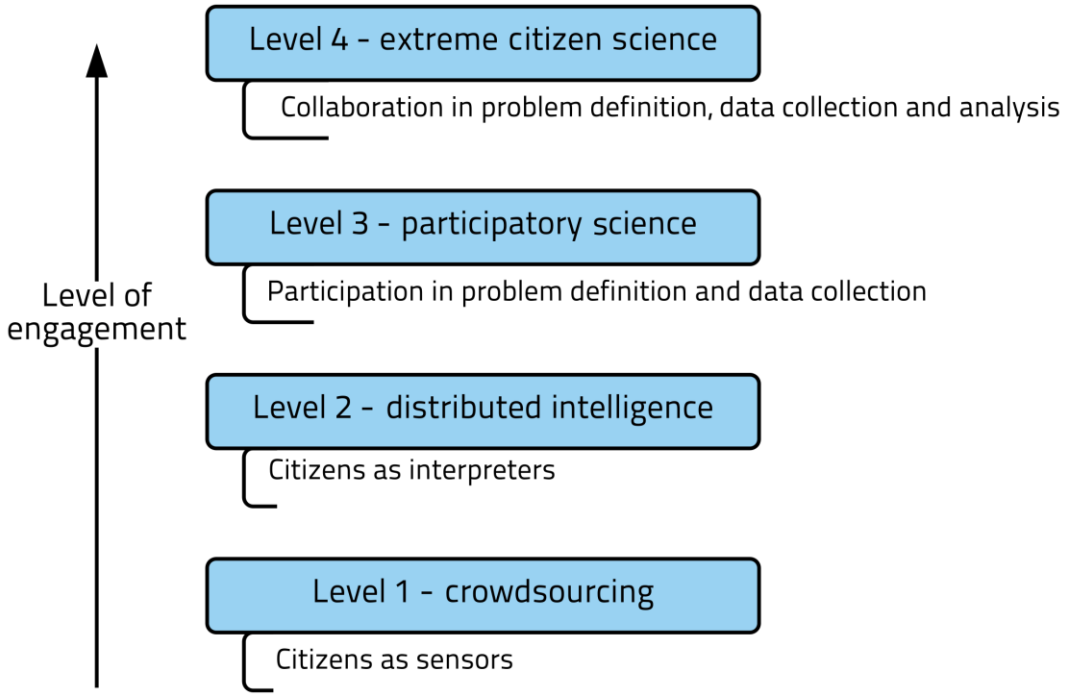
A glimpse of Haddon Hall with the River Wye in the foreground, near Bakewell, Derbyshire. Photograph: David Humphreys/Alamy

Citizen scientists are being trained as the best hope to protect rivers from pollution and over-abstraction as data suggests the Environment Agency's new monitoring programme leaves waterways unprotected.

Guardian Newspaper, 14th September 2022

So, Citizen Science…

participation of non-scientists in scientific research

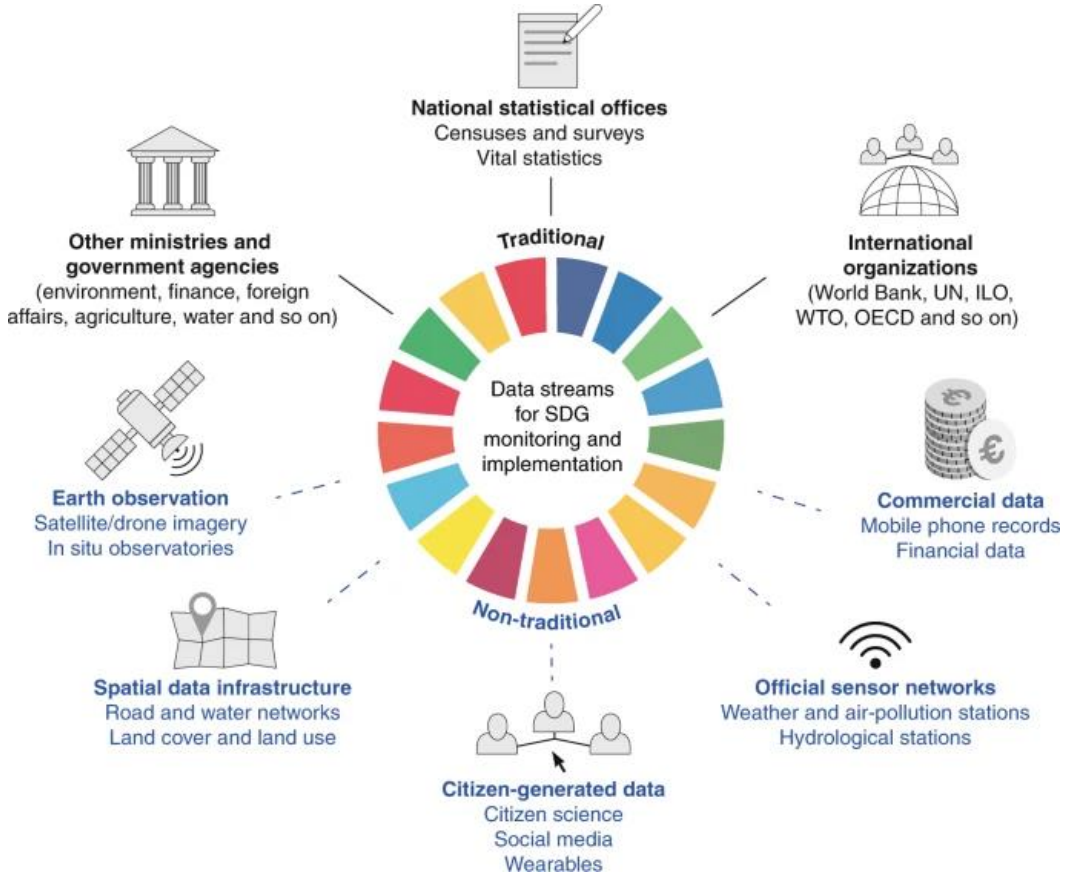


Assumpção e. al (2018)

Cited advantages:

- Easier - technological enabled
- Co-design
- Participatory
- Democratising
- Inclusive
- Increases reach
- Accountability
- Impact
- Cheaper data

More than a data source



Fritz et. al (2019)

CS typically generates data

Opportunity:

- Systemic change & deeper leverage points
- Achieve other policy goals
- SDG implementation
- Create advocates
- Climate resilience

Fritz, S., See, L., Carlson, T. *et al.* Citizen science and the United Nations Sustainable Development Goals. *Nat Sustain* **2**, 922–930 (2019). https://doi.org/10.1038/s41893-019-0390-3

Credit: UNICEF

Cyclone Idai 2019

Credit: BASEflow, Malawi

So, what now?

Projects -> sustainable programmes

- Integration with existing systems
- Revisiting our use of data
- Contextual drivers & barriers

Case studies and demonstrations

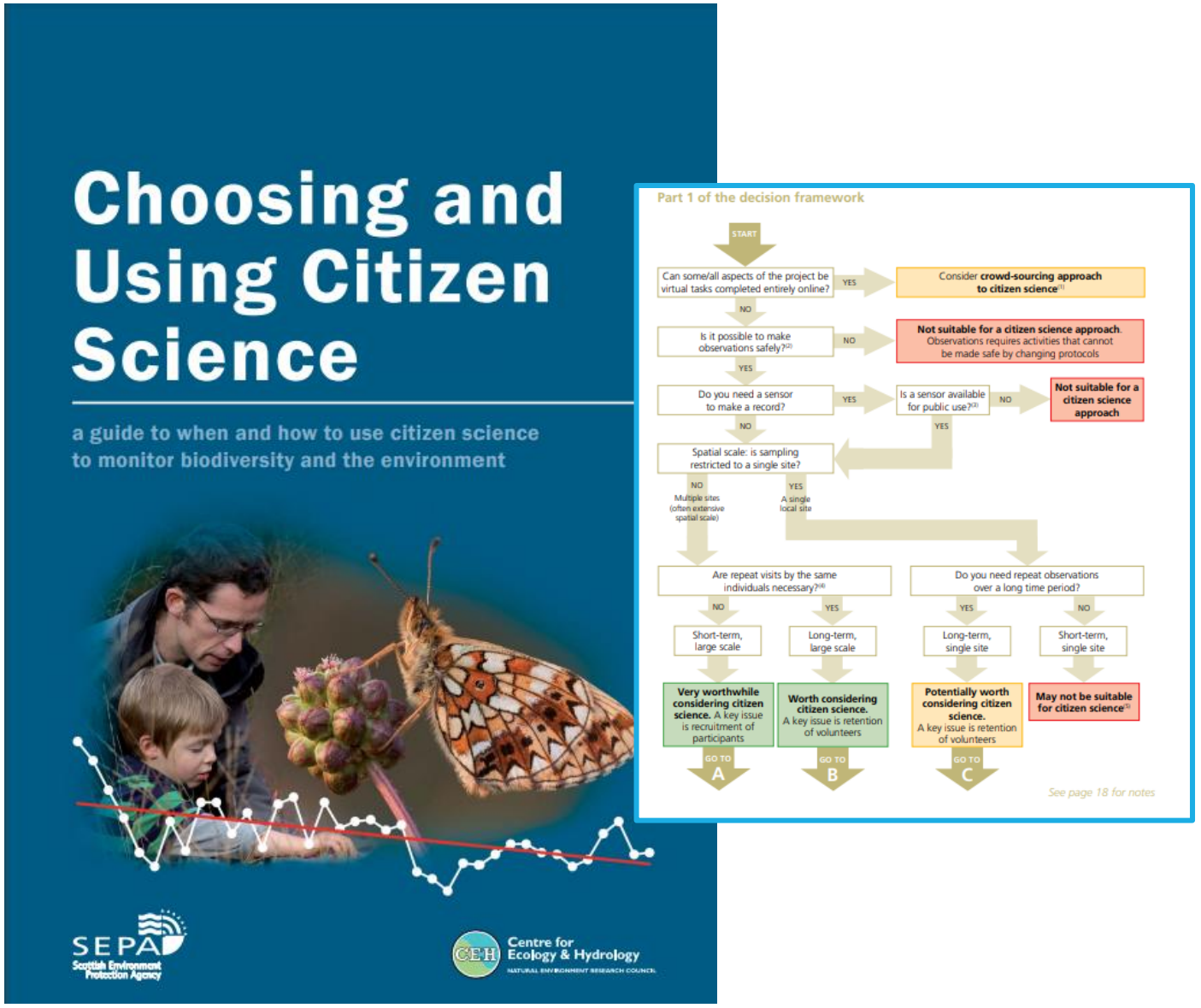
Understand the entry points to create change (leverage points)

Want more?

eu-citizen.science

Welcome to the platform for sharing citizen science projects, resources, tools, training and much more

citizenscience.gov



Assumpção, T.H., Popescu, I., Jonoski, A. and Solomatine, D.P., 2018. Citizen observations contributing to flood modelling: Opportunities and challenges. *Hydrology and Earth System Sciences*, *22*(2), pp.1473-1489.

Akpabio, E.M., Mwathunga, E. and Rowan, J.S. (2021) 'Understanding the challenges governing Malawi's water, sanitation and hygiene sector'. International Journal of Water Resources Development, 1-21

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Guardian Newspaper (online). (2022). 'Citizen scientists to monitor English rivers in £7m scheme'. Available: https://www.theguardian.com/environment/2022/sep/14/citizen-scientists-to-monitor-english-rivers-in-7m-scheme?CMP=share_btn_tw. Accessed: 14/09/22

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Pocock, M.J.O., Chapman, D.S., Sheppard, L.J. & Roy, H.E. (2014). Choosing and Using Citizen Science: a guide to when and how to use citizen science to monitor biodiversity and the environment. Centre for Ecology & Hydrology.

ABSTRACT

The climate crisis is a water crisis. Driven by a changing global climate, water-related challenges are becoming more common and impactful. With water sitting at a dynamic interface between the environmental, social, economic, and political pillars of sustainability, tackling these challenges requires scientists and wider society to think beyond traditional, discipline specific approaches to management. Popularised by initiatives like Integrated Water Resources Management, the demand for ‘data’ in water management has steadily increased, supporting the planning, modelling, and forecasting of current and future water related challenges. However, reliance on data-driven processes, particularly in resource poor settings, presents challenges of its own. Enter: citizen science. Citizen science, a rapidly growing field which facilitates public participation in science, presents opportunities for data hungry scientists, practitioners, and policy makers. Yet, citizen science, and the data derived from citizens, presents opportunity far beyond data generation including the incorporation of community voices, increasing the accessibility of data, creating inclusive and transparent decision making processes, and improved social learning. These opportunities match well against calls for improving water, and wider environmental, management practices in the face of a climate emergency. However, there remains a number of unknowns as to how citizen-derived data is effectively integrated into institutional practice and how best the potential benefits are harnessed beyond single project initiatives. Using Malawi as a case study, this presentation will discuss the key water challenges, the transformative role that citizen-derived data can have in them, and what questions still exist for water professionals to resolve.