Community Monitoring and Modelling for Catchment Management and Restoration

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Abstract

Catchment managers require data on a local level to understand the water environment but this is often limited in small rural catchments. A 'citizen science' approach has the potential to collect useful data but has yet to be implemented within the UK's catchment management process. This research project is encouraging communities to monitor the water environment themselves. Convincing 'professionals' that this type of data reliable is a significant challenge which is why quality is being assessed and the data used itself to improve the performance of catchment models. To keep communities involved throughout the management process, modelled outputs will be presented back to the community in a meaningful way. Community monitoring has successfully commenced within the Haltwhistle Burn catchment (Northumberland, UK) and key findings to date are presented here.

Introduction

Catchments are complex systems making them difficult to understand and manage. However, small rural catchments do not usually benefit from monitoring networks which is problematic as local evidence is required to approve and support the construction of (for example) Natural Flood Management (NFM) schemes[1]. Although local communities, who live within a catchment, are full of knowledge about the water environment, this rich and unique source of information is still overlooked by professionals. Despite the growth in technology and communication, the abundance of local knowledge and the concept of using volunteers to assist researchers with collecting data, a 'citizen science' approach has still not been fully implemented to support the UK catchment management process. It is however being used in other environmental disciplines, such as ornithology[2], as it allows for mass data collection, it is low-cost and volunteers appreciate the connection with professionals.

"Citizen Science involves volunteers collecting and sharing data which contributes to expanding our knowledge of the natural environment" [2]

Aim: Determine whether 'community monitoring and modelling' can support the catchment management and restoration process within the UK. This citizen science approach is expected to provide valuable information about the behaviour and state of individual rural catchments as well as various social benefits.

Methodology

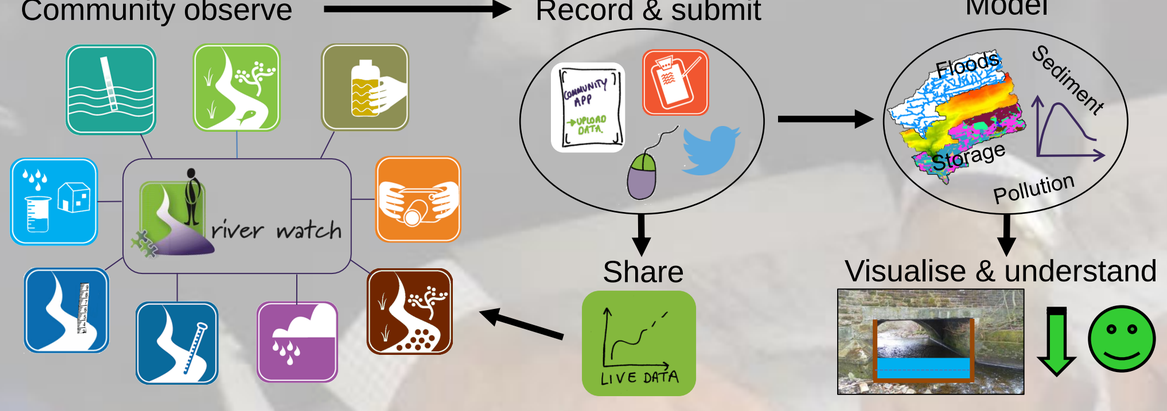

Figure 1 – *Community monitoring and modelling approach proposed*

A community monitoring and modelling approach is proposed (Figure 1) which involves engaging with the local community, encouraging them to share their local knowledge, monitor a range of catchment parameters and issues, submitting observations using a variety of tools and sharing this information with all catchment stakeholders. The modelling aspect involves assessing the quality and usability of the (quantitative and qualitative) data collected and actually using it within catchment models to improve their performance. Modelled outputs will be presented back to the community using appropriate visualisation tools to maximise understanding.

Case Study - Haltwhistle Burn Catchment

The 42km^2 predominantly rural Haltwhistle Burn catchment (Northumberland) is situated in the centre on Britain (see Figure 3). The catchment becomes steep and narrow towards it's confluence and outlet with the South Tyne River, as well as the town of Haltwhistle. This catchment has a history of flooding, with April and May 2014 events (Figure 2) being the most recent and is listed on the Environment Agency's Rapid Response Catchment register. The catchment also has 'poor' water quality under the EU Water Framework Directive and suffers from other pressures (e.g. rapid erosion and deposition), many of which the local community have highlighted themselves. Managed by Tyne Rivers Trust, the wider 'Haltwhistle Burn Total Catchment Approach' project is expected to implement a NFM scheme. This therefore provides a case study site to develop and test a community monitoring and modelling approach. The local community are also very enthusiastic and interested in learning about their catchment.

Figure 2 – *Haltwhistle Burn at peak flow on 30th April 2014*

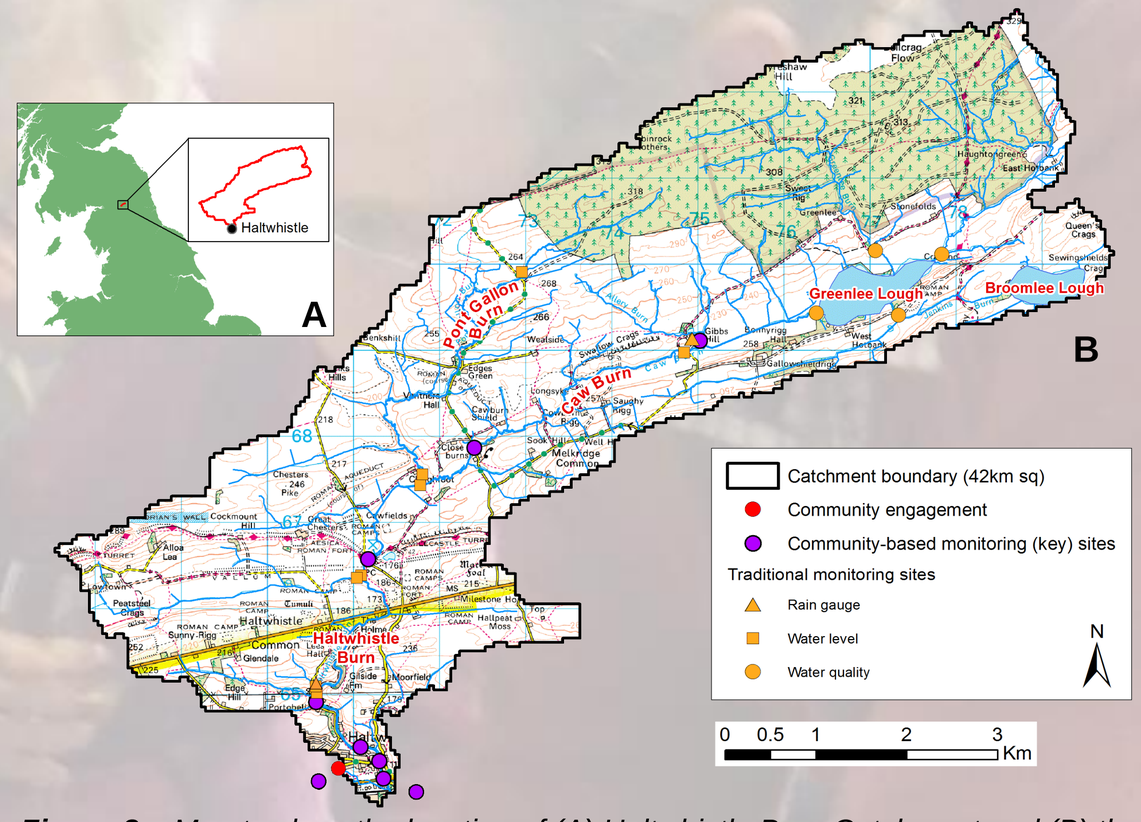

Figure 3 – *Map to show the location of (A) Haltwhistle Burn Catchment and (B) the river network and key monitoring and engagement sites within the catchment*

Progress to Date and Key Findings

Through various engagement techniques, the Haltwhistle community, including a 'River Watch Group' have shared their local knowledge and expressed their enthusiasm. A number of households have 'signed up' to monitor the catchment which will complement and be compared with data collected using traditional equipment (see Figure 3 for monitoring locations). Some volunteers are already monitoring daily rainfall and river levels (Figure 4) and the wider community has collected evidence during two recent and very localised flood events. These extreme events have highlighted the importance of local data. For example, one community member measured 41mm of rainfall (24 hour total) on the 30th April 2014 in Haltwhistle, yet a Met Office gauge measured just 17.2mm, despite being only 3.4km away. Positive feedback has already been received from the community, including "*I'm starting to understand the bigger picture*".

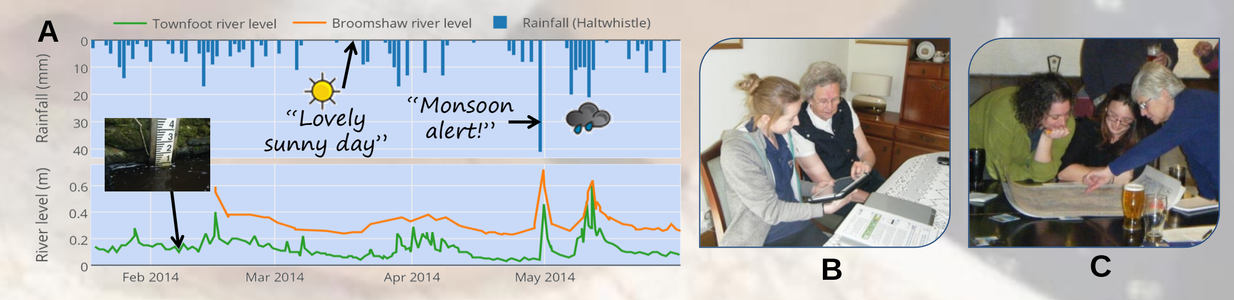

Figure 4 – *Examples of (A) community monitoring January to May 2014 (B) community engagement and (C) knowledge sharing through participatory GIS*

Conclusions and Next Steps

A community monitoring and modelling approach is expected to provide vital information about the water environment, thus increase all stakeholders understanding of individual catchments. It is envisaged to bridge the gap between local residents and professionals as well as facilitating decision making. The Haltwhistle community has already monitored rainfall and river levels and have gathered evidence during two flash flood events which wouldn't otherwise be available. These observations are significant as they highlight the importance of local evidence. Interest in monitoring other parameters has been shown and once lengthy datasets are available, they will be used to improve the performance of catchment models. Best practice will be shared with other communities within Northumberland (UK).

Key References

[1] **Nicholson, A. R., Wilkinson, M. E., O'Donnell, G. M. and Quinn, P. F. (2012)** 'Runoff attenuation features: a sustainable flood mitigation strategy in the Belford catchment, UK', Area, 44(4), pp. 463-469.

[2] **Pockock, M. J. O., Chapman, D. S., Sheppard, L. J., and Roy, H. E. (2014)** 'A strategic framework to support the implementation of citizen science for environmental monitoring. Final report to SEPA'. Centre for Ecology & Hydrology, Wallingford, Oxfordshire.

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A project part funded by Defra's Catchment Restoration Fund (CRF) Project

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