Data gathering for Water Security: a contextualised approach

Giacomo Butte

2021-01-25

Contents

Chapter 1

Introduction

This is a guidance document for the Water Security Contextualized Assessment Tool developed within the Water Security Hub at Newcastle University. The project aim is to support decision making on data gathering by addressing the (apparently simple) question: **"What data do we need to assess Water Security?"**

The proposed process consist of several steps and each of them has a dedicated chapter.The first section of each chapter (*Concepts*) gives the a brief theoretical background, and provides reference to key ideas. The second one (*Tools*) recommends some existing tools and suggest new ones, that could support the task described inthe chapter.The third section (*An example*) shows an application of the method.

In the case study, for simplification, a single dimension of Water Security (WS) was taken into analysis: water quality. The study site is the Akaki river basin located in Ethiopia.

1.1 Do we need another assessment tool?

WS has emerged as a predominant framework in the assessment and understanding of the relationship between the environment and society. Past research has produced a variety of definitions, indexes, Data and information are the foundations of any assessment of WS.

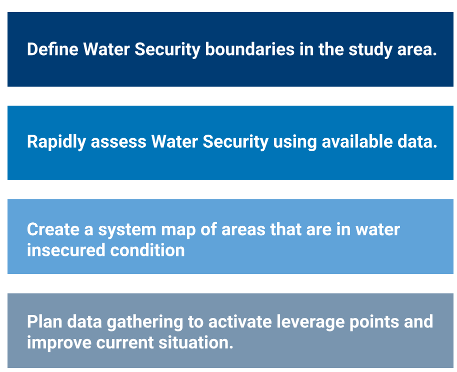
Place-based application – Once operationalized, WS definitions and framing adapt to specific contexts (Gerlak et al., 2018). It is therefore essential to incorporate community context. Therefore, rather than a rigid set of standards and rules a method to build a data gathering strategy is suggested. The user will need to understand what boundaries, threshold, methods, risks are more relevant to the study site.

The need for data - Deputy Secretary-General Eliasson referred to data as the "lifeblood of decision-making and the raw material for accountability" (UN Water, 2016). Several barriers exist before reaching well-integrated, accessible and global data. Collecting data requires resources year (Espey et al., 2015). Data ownership, management and access add additional layer of complexity to the issue (Hering, 2017). As a consequence, data gaps still exist (Schmidt-Traub et al., 2017; UN-Water, 2019) and will affect decision-making (York and Bamberger, 2020).

The need for data gathering strategies - When data exist, it may not necessarily translate into information. In several cases "data seems to be collected without a clear statement to be evaluated" (Rose and Smith, 1992). To reduce this possibility, it is essential to elaborate an efficient and robust data gathering strategy through careful experimental design. This aspect is not always given the right amount of attention and sampling errors "are believed to dominate the errors of analytical measurement during the entire environmental data acquisition process" (Zhang and Zhang, 2012) and will produce different results (Abbatangelo et al., 2019; Wang et al., 2015). A data gathering strategy (DGS) becomes an essential activity to optimize resources, address leverage points, transform research into impact and reduce uncertainties.

1.2 Process steps

\begin{figure}



{

}

\caption{*Figure 1: assigning a magnitude value for each segment based on its tributaries. The centroid is located (left image)at the nearest segment of $M_o/2$. In this case segment with magnitude 7, since 16/2=8. The network would be divided into two segments of magnitude 7 and 9 (given by 16-7). With the* *same procedure the following sampling points would be determined near the half magnitude of each segment (on the right)* . Source: Sharp (1971)} \end{figure}

The approach is divided into five steps:

- **Definition of study site**
- **Boundaries definition for Water Security** From existing WS indexes, compile a context appropriate short-list of indicators to assess different dimensions of WS. Threshold values are usually attached to each indicator but could be revised to suit local condition. Section: WS boundaries.
- **Rapid Water in-Security assessment** using available data from global datasets, published literature, local knowledge and national data. The research aims at finding evidence for likelihood of Water in-Security for a given dimension, identifying a possible hazard and possible impact. The gathered secondary data is used for a quick assessment of the different dimensions of WS. Dimensions / sub-dimension likely of being in a water insecurity (hazard id) states are identified for additional primary data gathering. Section: Water Security rapid assessment
- **System mapping.**The previously identified WS dimension in a possible state of Water inSecurity are analysed as systems. Determining causes and impacts of water insecurity are identified. Comparison with available data allows for the identification of knowledge gaps and possible leverage points to move the WS dimension into a state of water security.
- **Data gathering for research for impact**. The previous analysis allows to identify research areas that could lead to larger impact in the improvement of water security. This could involve better spatio-temporal characterization, risk assessment, forecasting, identification of mitigation practices. Particularly attention should be given to the communication of findings to relevant stakeholders

Chapter 2

Identifying study site

2.1 Concepts

2.2 Tools

2.3 An example

The study was conducted on the Akaki River basin (Awash Wenz 2 in Hydrosheds REF). The catchment is located in central Ethiopia along the western mar- gin of the Main Ethiopian Rift and geographically located between 8°46´–9°14´N and 38°34´–39°04´E, covering an area of about 1500 km2. It experiences a temperate Afro-Alpine climate with daily average temperatures from 9.9 to 24.6 °C and annual mean rainfall is 1254 mm, as measured at Addis Ababa Observatory .Three main seasons can be observed: the major rainy one, locally known as Kiremt from June to September, contributing about 70% of the total annual rainfall. A minor rainy season, locally known as Belg, from mid-February to mid-April. The remaining five months are dry season (Ethiopian Public health Institute, 2017).

Chapter 3

WS boundaries

Placeholder

3.1 Concepts

3.2 Tools

3.3 An example: WQ for Akaki river

3.3.1 Identifying sub-dimension for Water Quality

3.3.2 Identifying indicators for each sub-dimension

Chapter 4

Water Security rapid assessment

Placeholder

4.1 Concepts

4.2 Tools

4.3 An example

Chapter 5

Water Security system map

Some *significant* applications are demonstrated in this chapter.

5.1 Concepts

5.2 Tools

5.3 An example

The findings of the rapid assessment on water quality were visualized using the diagram developed during the Hub assembly in Ethiopia (Figure 4). The natural environment (N) is under stress due to discharges from anthropogenic activities and growing urbanization (axis GU-P-I-N). Low environmental awareness (AW) and a weak governance in implementing existing regulation (G) does not create a sufficient barrier to reduce pressure on the environment. This condition has implie The poor quality or river water and ecosystem has negative impact on population health(N-P) and economic resources (N-R).Low environmental awareness (AW) and a loose implementation of existing regulation does not reduce

Chapter 6

Data gathering strategy

Placeholder

6.1 Concepts

6.1.1 Location

6.1.2 Frequency

6.1.3 Parameters

6.2 Tools

6.3 An example

6.3.1 Location

6.3.2 Frequency

6.3.3 Parameters

References

Bibliography

Abbatangelo, J., Byrne, A., Butler, J. F., and Wilson, J. M. (2019). Application of multi-criteria decision analysis to assess sampling strategies in eutrophic urbanized waterbodies. *Environmental Monitoring and Assessment*, 191(9).

Espey, J., Swanson, E., Badiee, S., Christensen, Z., Fischer, A., Levy, M., Yetman, G., de Sherbinin, A., Chen, R., Yiu, Q., Greenwell, G., Klein, T., Jutting, J., Lantei Mills, S., and Motivans, M. (2015). Data for Development: A Needs Assessment for SDG Monitoring and Statistical Capacity Development. pages 1–82.

Gerlak, A. K., House-Peters, L., Varady, R. G., Albrecht, T., Zúñiga-Terán, A., de Grenade, R. R., Cook, C., and Scott, C. A. (2018). Water security: A review of place-based research. *Environmental Science and Policy*, 82(January):79–89.

Hering, J. G. (2017). Managing the 'monitoring imperative' in the context of SDG target 6.3 on water quality and wastewater. *Sustainability (Switzerland)*, 9(9):1–8.

Rose, K. A. and Smith, E. P. (1992). Experimental design: The neglected aspect of environmental monitoring. *Environmental Management*, 16(6):691–700.

Schmidt-Traub, G., Kroll, C., Teksoz, K., Durand-Delacre, D., and Sachs, J. D. (2017). National baselines for the Sustainable Development Goals assessed in the SDG Index and Dashboards. *Nature Geoscience*, 10(8):547–555.

Sharp, W. E. (1971). A Topologically Optimum Water-Sampling Plan for Rivers and Streams. *Water Resources Research*, 7(6):1641–1646.

UN Water (2016). Monitoring Water and Sanitation in the 2030 Agenda for Sustainable Development Water and sanitation in the 2030 Agenda for Sustainable Development. *Un Water*, (January 2013):1–4.

UN-Water (2019). UN-Water Inventory An overview of the UN-Water family ' s work on water and sanitation. (April).

Wang, Y., Wilson, J. M., and VanBriesen, J. M. (2015). The effect of sampling strategies on assessment of water quality criteria attainment. *Journal of Environmental Management*, 154:33–39.

York, P. and Bamberger, M. (2020). Measuring results and impact in the age of big data : The nexus of evaluation , analytics , and digital technology. (March).

Zhang, J. and Zhang, C. (2012). Sampling and sampling strategies for environmental analysis. *International Journal of Environmental Analytical Chemistry*, 92(4):466–478.