Storing water: A new integrated approach for resilient development

Winston Yu, GWP Technical Committee
Co-Authors: William Rex, Matthew McCartney, Stefan Uhlenbrook, Rachel von Gnechten (IWMI) and Jerry Priscoli (TEC)

Global Water Partnership

IWMI International Water Management Institute

February 24, 2021

Highlights

- There is a need for a new agenda on storage to support resilient development.
- Growing storage gaps will limit socio-economic development.
- Storage of all types are available and need to be better integrated, taking a service perspective.

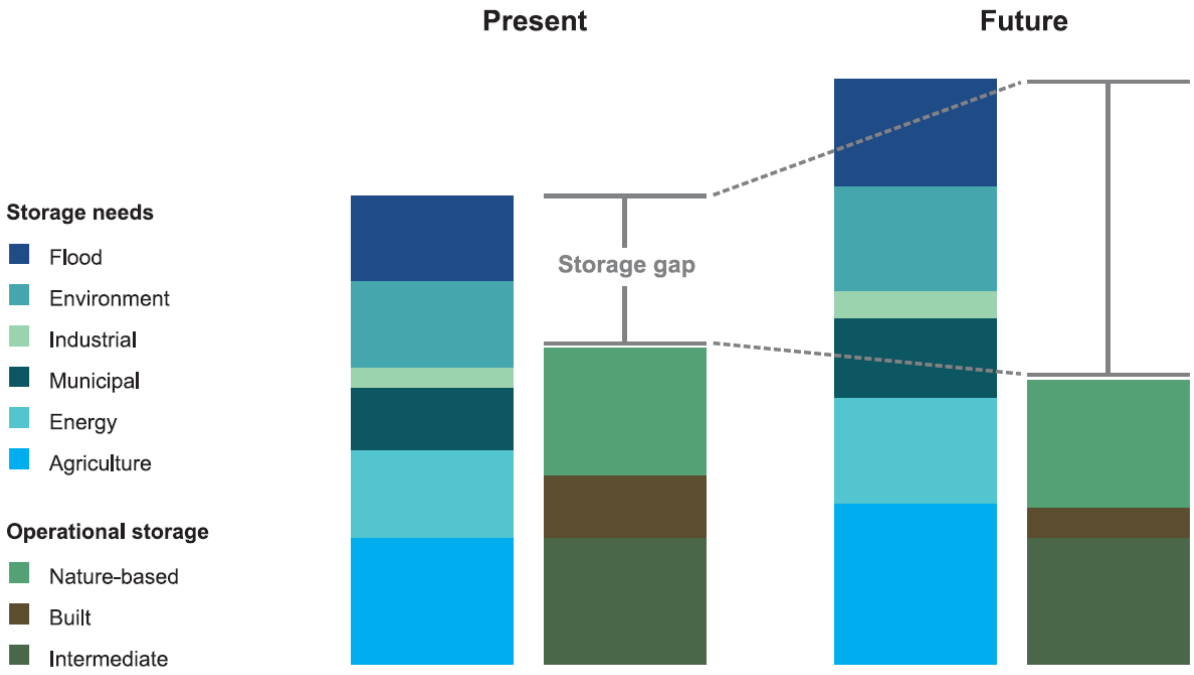
Why the need for a new agenda on storage?

- Increasing pressures on the resource, increasing variability and uncertainty, especially in the context of climate change
  - Storage shifts resource availability across time and space. Storing water to balance inter-temporal problems is fundamental to meeting the variable and uncertain needs of users and society.
- Interest in building “resilience” to climate change and variability, and other exogenous shocks (e.g., pandemics)
- Perception that storage is only about dams
- Recognition of the opportunities for nature-based solutions and green infrastructure; and not full appreciation nor understanding of the co-dependency between natural and built systems

A Growing Storage Gap

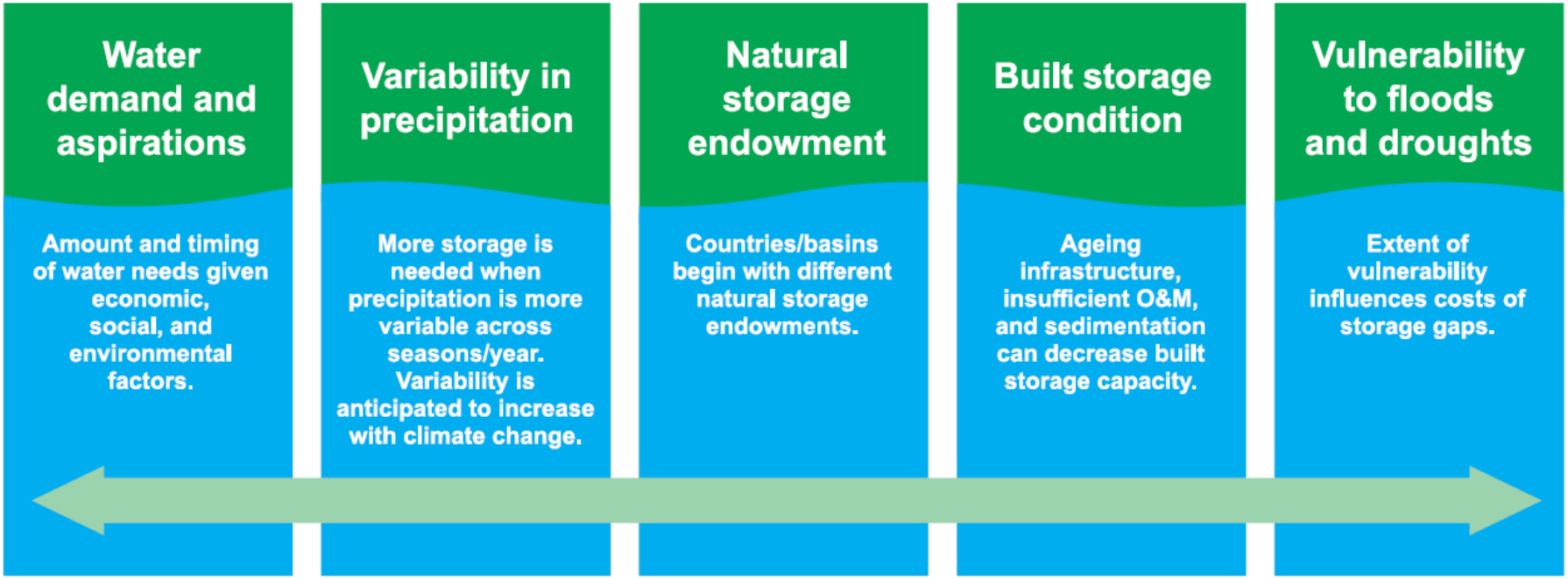
A ‘water storage gap’ is defined as the difference between the amount of water storage needed and the amount of storage that exists for a given time and place

Many infrastructure gap analyses do not explicitly look at storage requirements



Several key mega-trends suggest that the water storage gap in many places is growing, at least in relative terms

Factors that determine the size of the storage gap
(present and future)



The economic costs for countries of this increasing storage gap are potentially significant

Estimated terrestrial freshwater storage and change

(1970-2019)

Water stores	Current storage (BCM)	Change in storage (BCM)	Change is human (H) or climate (C) driven	Source
Mountain glaciers	158,000	−8,666	C	Total storage: Farinotti et al. (2019). Rate of change: WCRP (2018)
Groundwater	10,396,000*	−7,041	H/C	Total storage: Gleeson et al. (2016). Rate of change: de Graaf et al. (2017)
Lakes	102,424**	−1,975	C	Total storage: Messager et al. (2016). Rate of change: WCRP (2018)
Soil moisture	16,500	−519	C	Total storage: Shiklomanov (1993). Rate of change based on Deng et al. (2020)
Dam reservoirs (large and small)	11,270	7,160	H	Total storage: Frederikse et al. (2020). Rate of change: WCRP (2018); total small dam reservoir is estimated at 1,873 BCM with an estimated increase of 1,336 BCM (Lehner et al., 2011)
Forests	9,816	−1,029	H	Total storage based on forest area and Wada et al. (2017). Rate of change based on forest loss from FAO (1990), FAO and UNEP (2020), and Wada et al. (2017)
Wetlands	9,300	−3,784	H	Total storage based on wetland area and Wada et al. (2017). Rate of change: Darrah et al. (2019)
Paddy fields	836	150	H	Total storage and rate of change based on paddy area from Davidson et al. (2018) and this study
Total	**10,704,146**	**−15,704**		

M. McCartney et al. (forthcoming)

Minding the storage gap

- Better understanding about the storage gap at the country, river basin, and local levels is needed to identify solutions
- An **integrated approach** is needed whereby **different storage types** are considered as a system and conceptualized as a provider of services (all kinds) rather than a collection of individual storage facilities
- By thinking in terms of services, can compare storage across attributes e.g., *volume, feasibility, adaptability, controllability, reliability, vulnerability, sphere of control, cost, and sustainability*
- Need a clearer picture of the advantages and disadvantages of different storage types and their **co-dependencies and co-benefits**, particularly for nature-based approaches
- Operationalizing **resilience** for combined natural and built storage systems will be a challenge; storage is one part of a larger set of tools for more resilient WRM
- Strong **governance arrangements** on integrated storage management are needed

A New Agenda for Integrated Storage to Support Resilient Development

- Developing a framework for rethinking water storage as an integrated service
- Improving the inventory of water storage and its attributes
- Unpacking the effectiveness of nature-based solutions and co-dependencies
- Assessing the socio-economic costs and benefits (including co-benefits) of integrated storage systems
- Developing innovative approaches to water storage
- Optimizing integrated storage planning and operations

Let’s start the conversation!

wyu@worldbank.org


Global Water Partnership
25 YEARS
IWMI
International Water Management Institute
Storing water
A new integrated approach for resilient development
14:00-14:15 Welcome and Introductions
14:15-14:45 Presentation
14:45-15:25 Moderated Panel Discussion and Q&A
15:25-15:30 Closing Remarks
• For comments → Please use the Chat.
• For Q&A → Please use the Q&A function.