Special Session organized by the French Committee, the Swiss Committee, and the World Bank

Integrated Water Storage Development and Management

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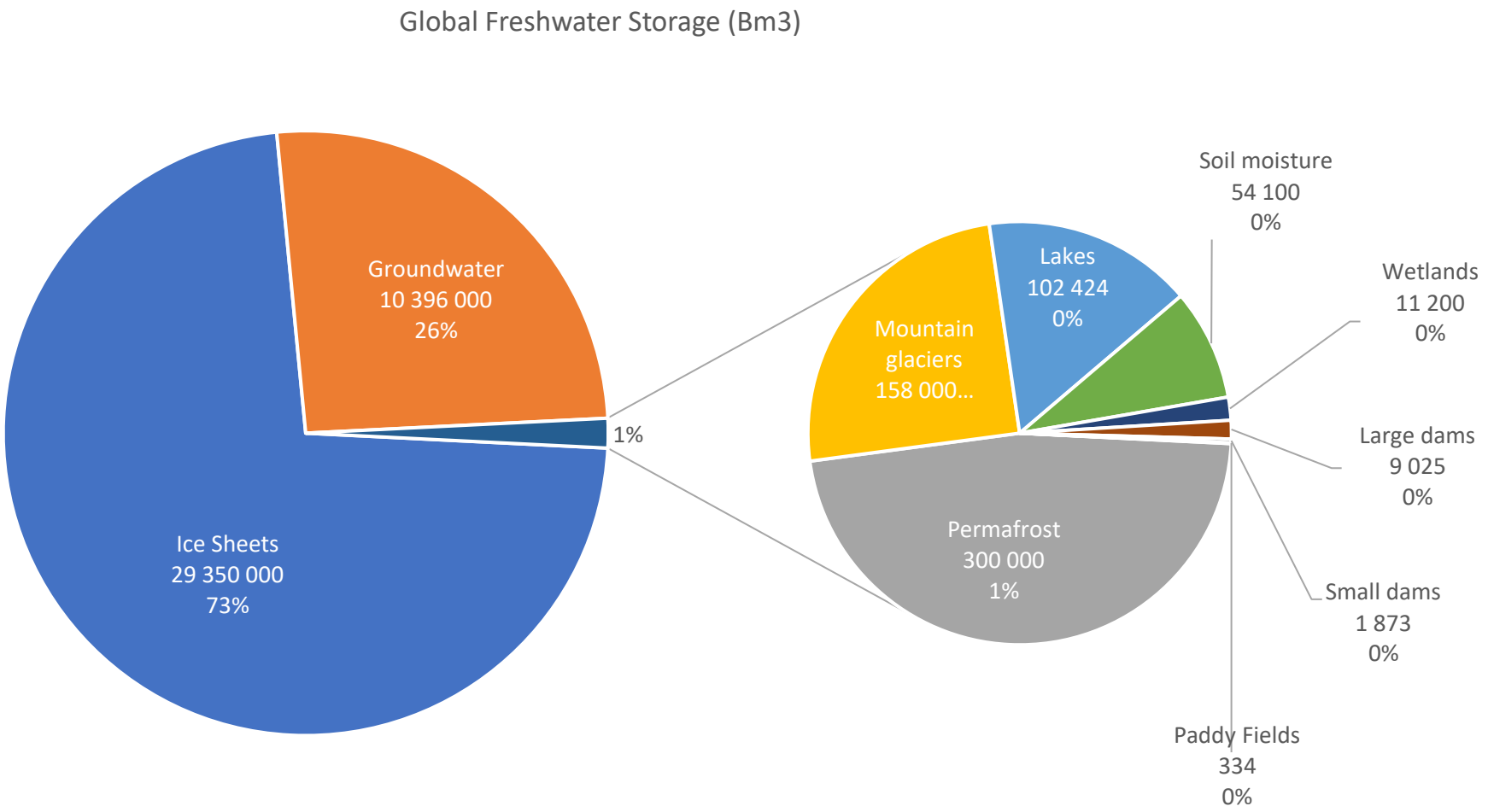
World Bank

Life as we know it depends on freshwater storage

Water storage provides 3 core services that we rely on:

1. Increasing water availability in drier times
2. Attenuation of floods
3. Regulating flows for hydropower, navigation, irrigation, etc.

Nature provides most of our freshwater storage

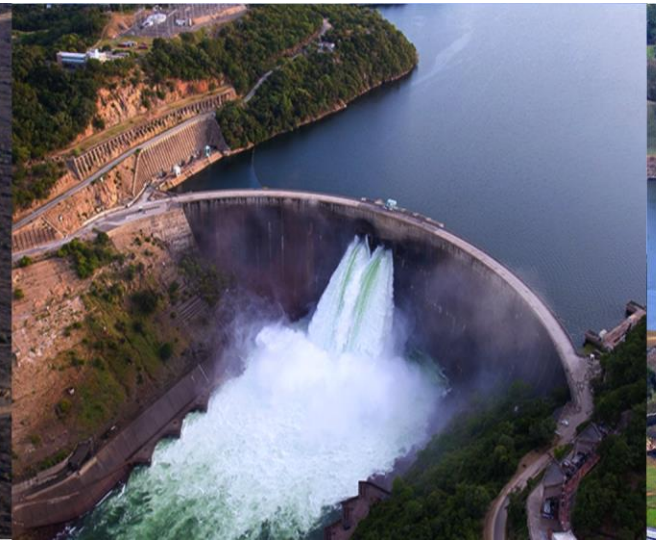


Source: McCartney, et al. 2022

Built storage allows more control over the resource

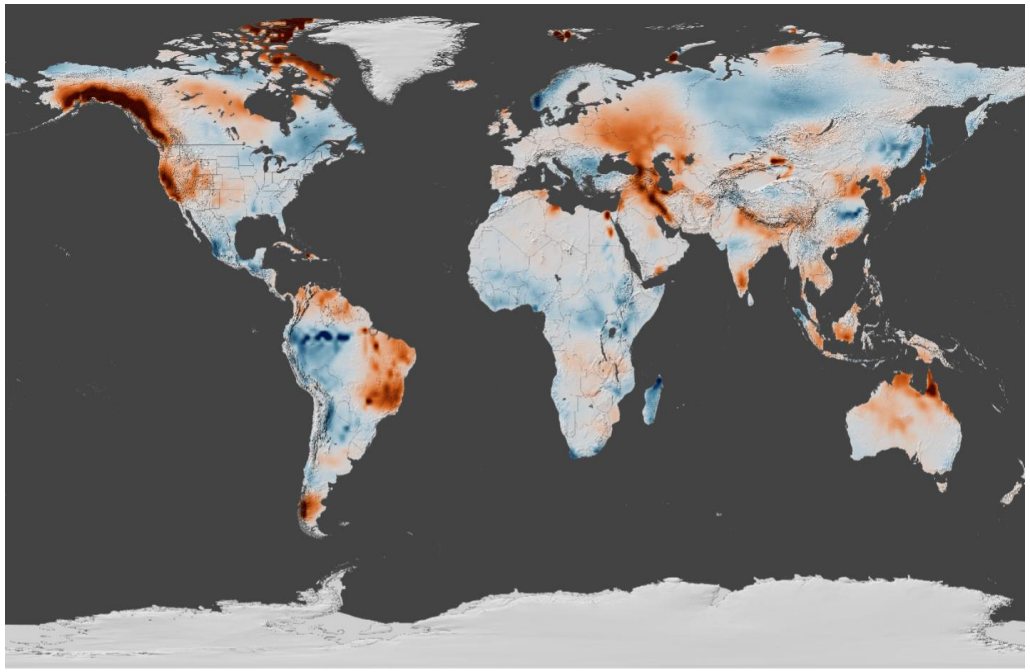
Built infrastructure has been instrumental in managing seasonal water variability and enabling key water-dependent services that have spurred economic progress

From small water harvesting tanks, to large dams and reservoirs, they have supported power generation, irrigation, and supplying cities with essential water.



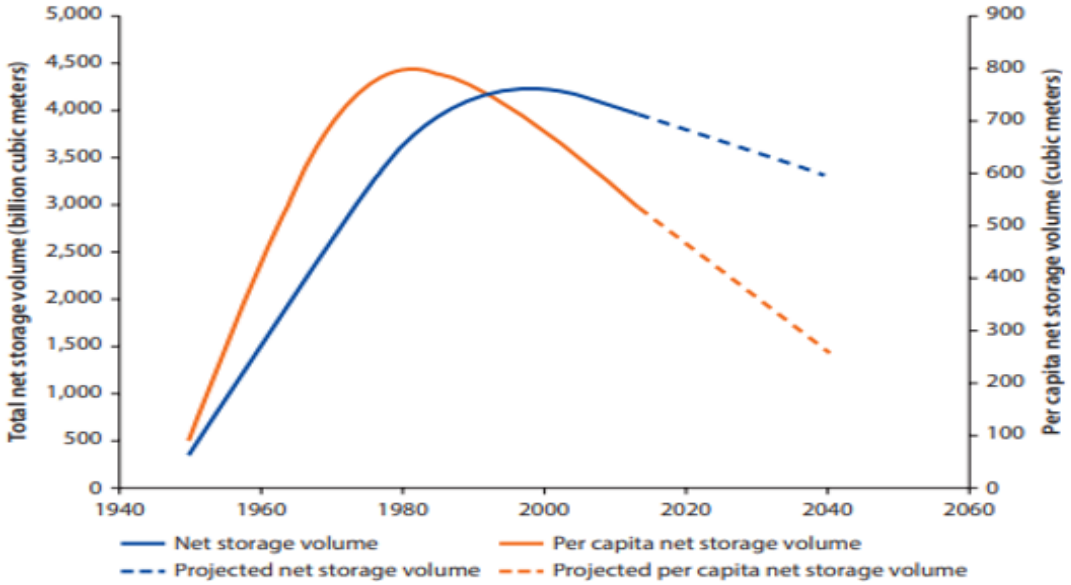
But both natural and built storage are in decline

Reduction in Natural Water Storage



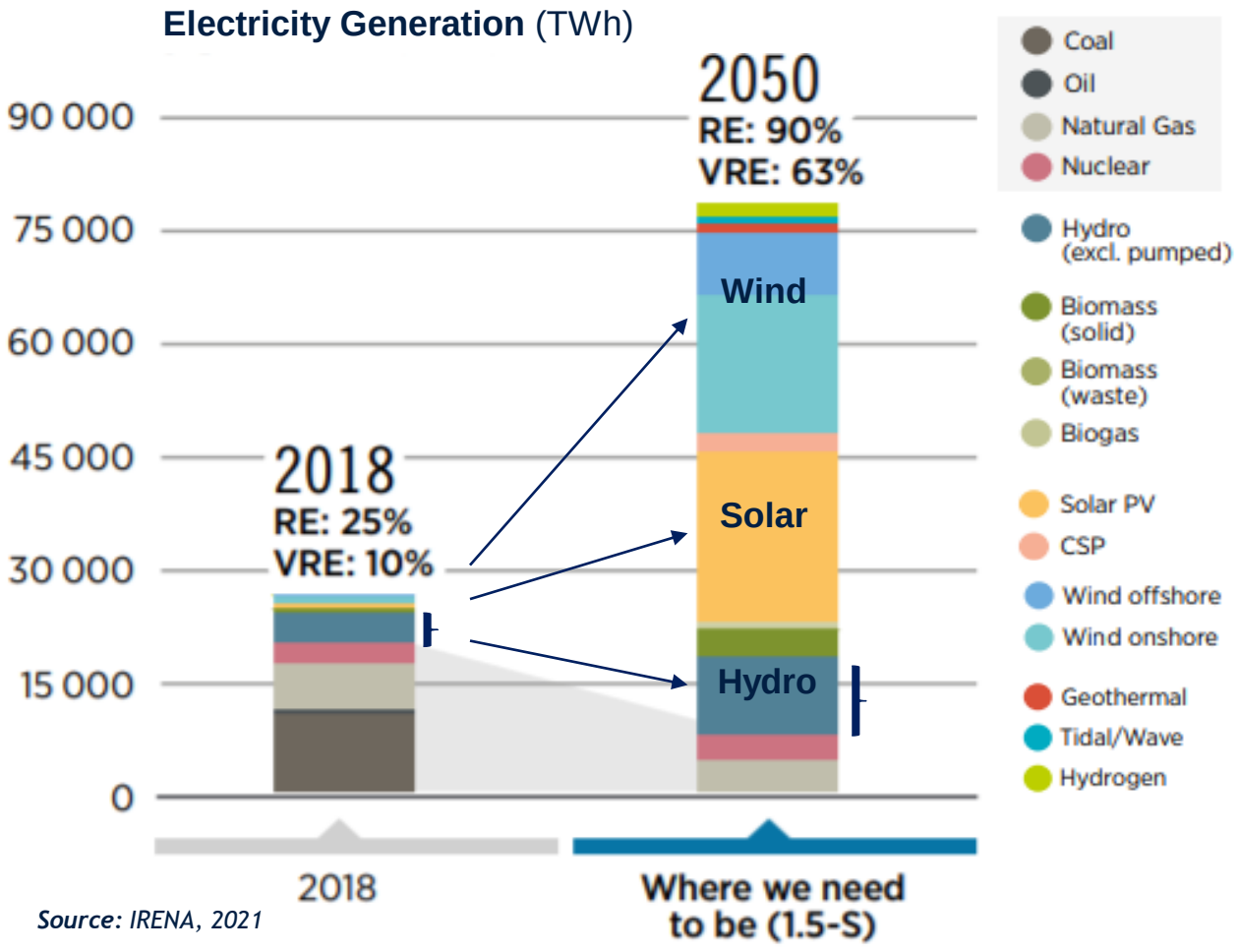
Decline in Built Water Storage

Figure 3.15 Net Global Reservoir Storage Volume, Accounting for Storage Loss from Reservoir Sedimentation



Source: Annandale 2013.

While we need more storage for the green transition



Source: IRENA, 2021

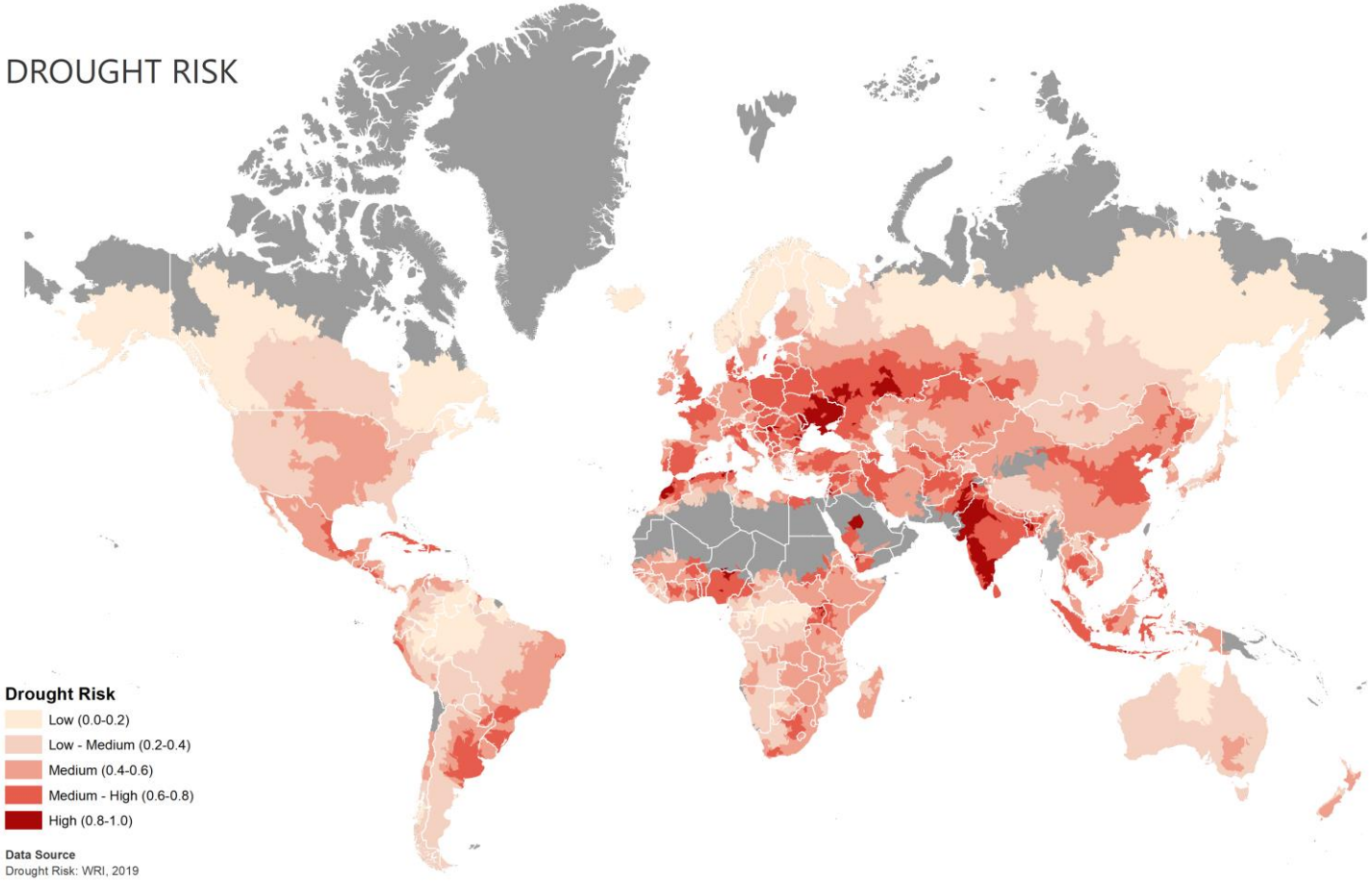
Hydropower currently contributes **60%** of **renewable energy production**[1] and allows for incorporation of other renewables (solar, wind) into the energy grid.

Pumped storage provides **96%** of installed energy storage capacity.

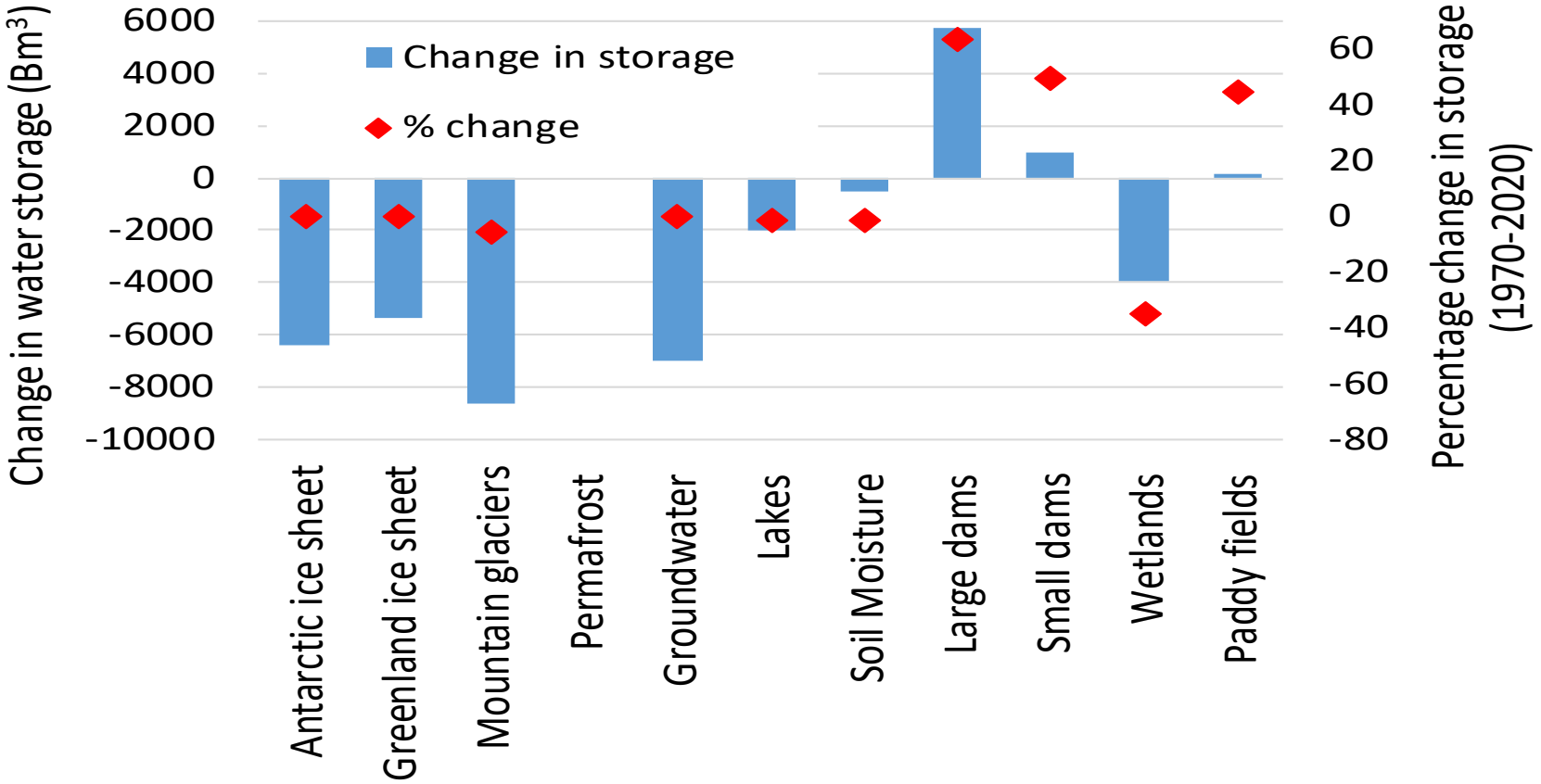
The world must **double** the capacity of hydropower and pumped storage systems to keep warming below 1.5C and support decarbonization. [2,3]

[1] IEG, 2020 [2] IEA, 2021 [3] IRENA, 2021

….And to build resilience

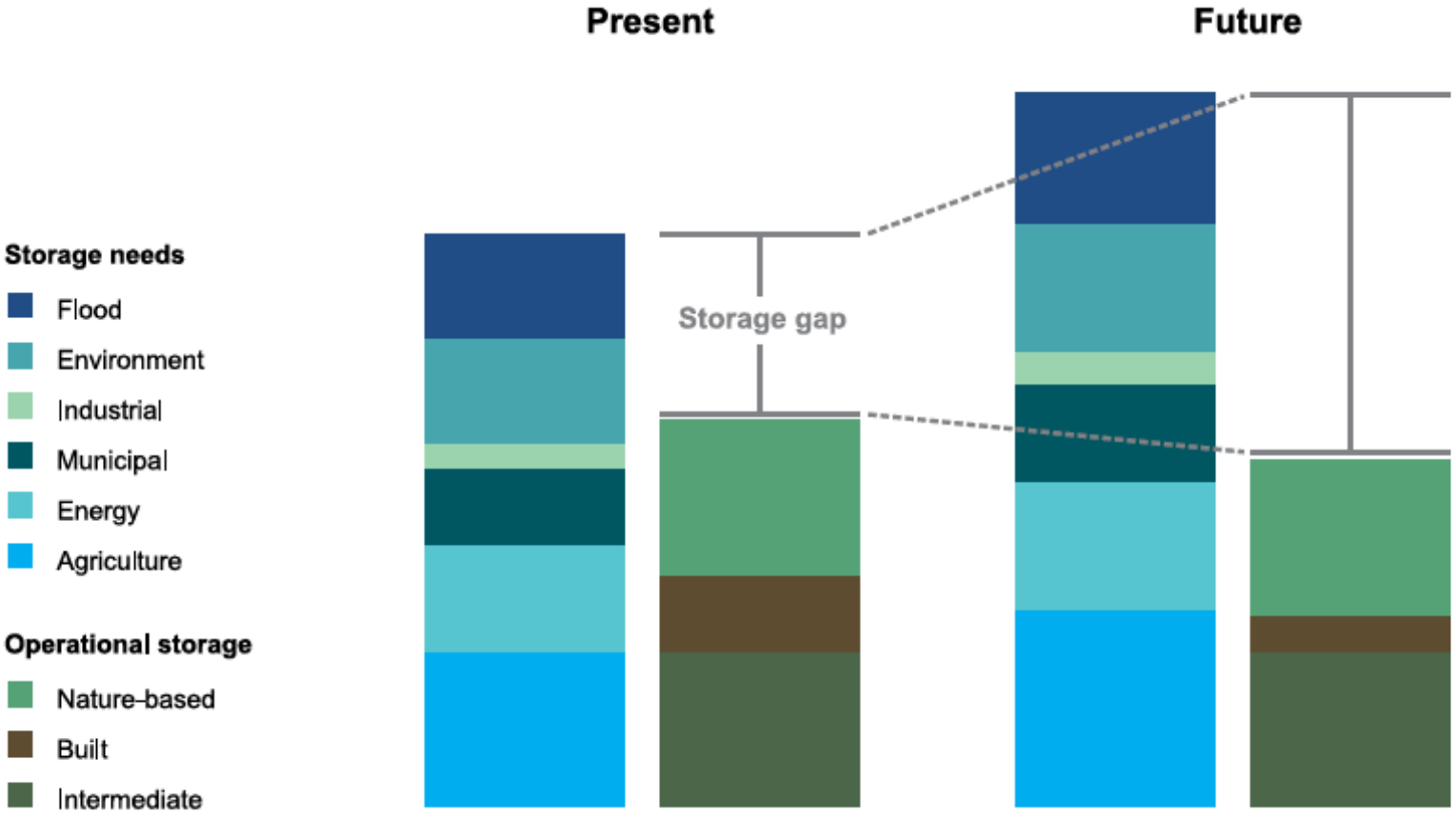


A growing water storage gap



Source: : McCartney, et al. 2022

We need more freshwater storage



Source: GWP and IWMI, 2021. Perspectives Paper. Storing water: A new integrated approach for resilient development

But the old paradigm is unsustainable

- **Insufficient attention to maintaining existing storage**:
  - Degradation of natural storage
  - Sedimentation of reservoirs
  - Lack of maintenance of existing infrastructure
- **Multiple competing storage systems** serving different stakeholders with different services, leading to uncoordinated development and reduction in total benefits
- **Overreliance on storage**, when there may be other solutions depending on the underlying problem
  - Demand management
  - Non-water alternatives for energy, transportation.
  - Supply-side augmentation through non-traditional sources or basin transfers

Towards integrated water storage systems

A forthcoming World Bank report on addressing the water storage gap

- The importance of water storage
- Water storage types and systems
- A planning framework
- Institutional considerations
- Case studies

Water storage types, systems, and services

Natural and built
Storage Types

- Snowpack
- Glaciers
- Lakes
- Aquifers
- Soil Moisture
- In-Stream Storage
- In-Field Storage
- Water Tanks
- Small Reservoirs/Retention Structures
- Large Reservoirs

...combine in natural, built, or hybrid
Storage Systems

- Wetlands
- Landscapes and Watersheds
- Floodplains
- Urban Retention Systems / Artificial Urban Wetlands
- Managed Aquifer Recharge Systems
- Cascades of dams, locks, or weirs

...to provide
Storage Services

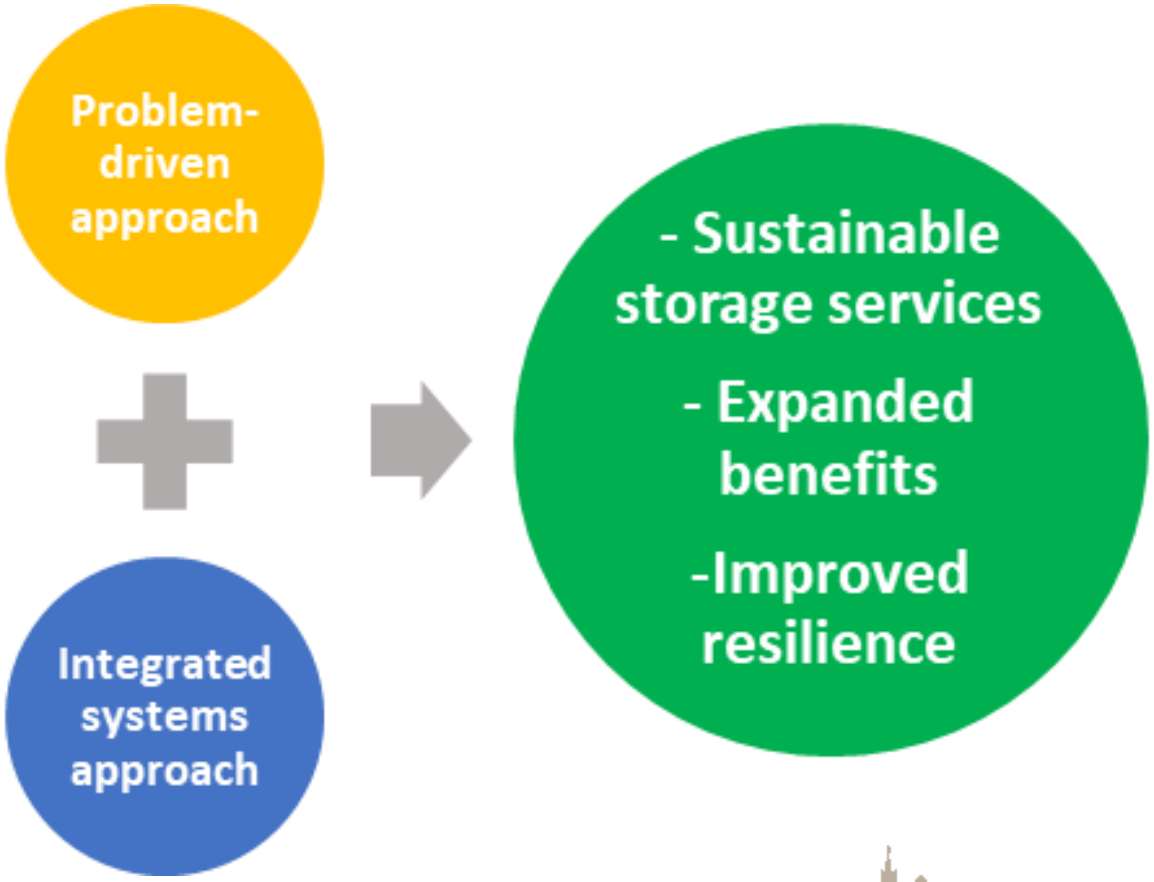
- **Increased Water Availability**
- **Flood Mitigation**
- **Flow Regulation** *for hydropower, navigation, etc.*

Making the conceptual shifts

Topic	From	Towards
Defining Success	Storage volumes	Storage outcomes – the services enabled by storage
Storage approaches	Built storage	Natural and built storage and their interactions
Storage management	Facility level	System level, working across institutions
Storage development	New development	Getting more from current – through retrofitting, reoperation and rehabilitation -- and developing new
Risk Management	Infrastructure development	Diversification of storage types across storage systems

A framework for integrated storage planning

Combining a problem-driven approach and a systems approach



A framework for integrated storage planning

A 3-stage approach

The Problem: A Needs Assessment

- Defining Development Objectives
- Characterizing Water Service Requirements

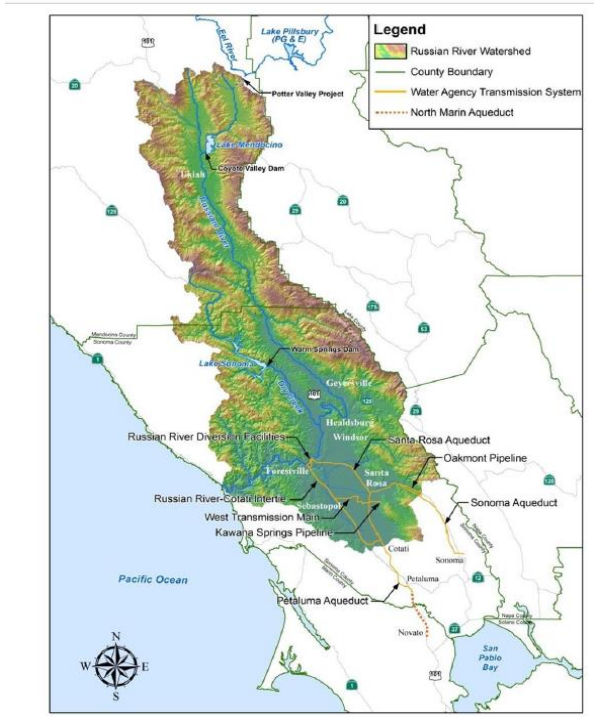
The System: Understanding Solutions

- Taking Stock of the Current System
- Solutions – Identifying Additional Options

Bringing it Together: Making Decisions

- Defining Storge Scenarios
- Establishing Decision Criteria
- Comparing and Assessing Scenarios

From principle to practice – case studies



Forecast-informed reservoir operations in California

Building resilience in Cape Town through diversification and increased storage

Strategic planning and development of hydropower in the Jhelum-Poonch Basin

And more…

Thank you!

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