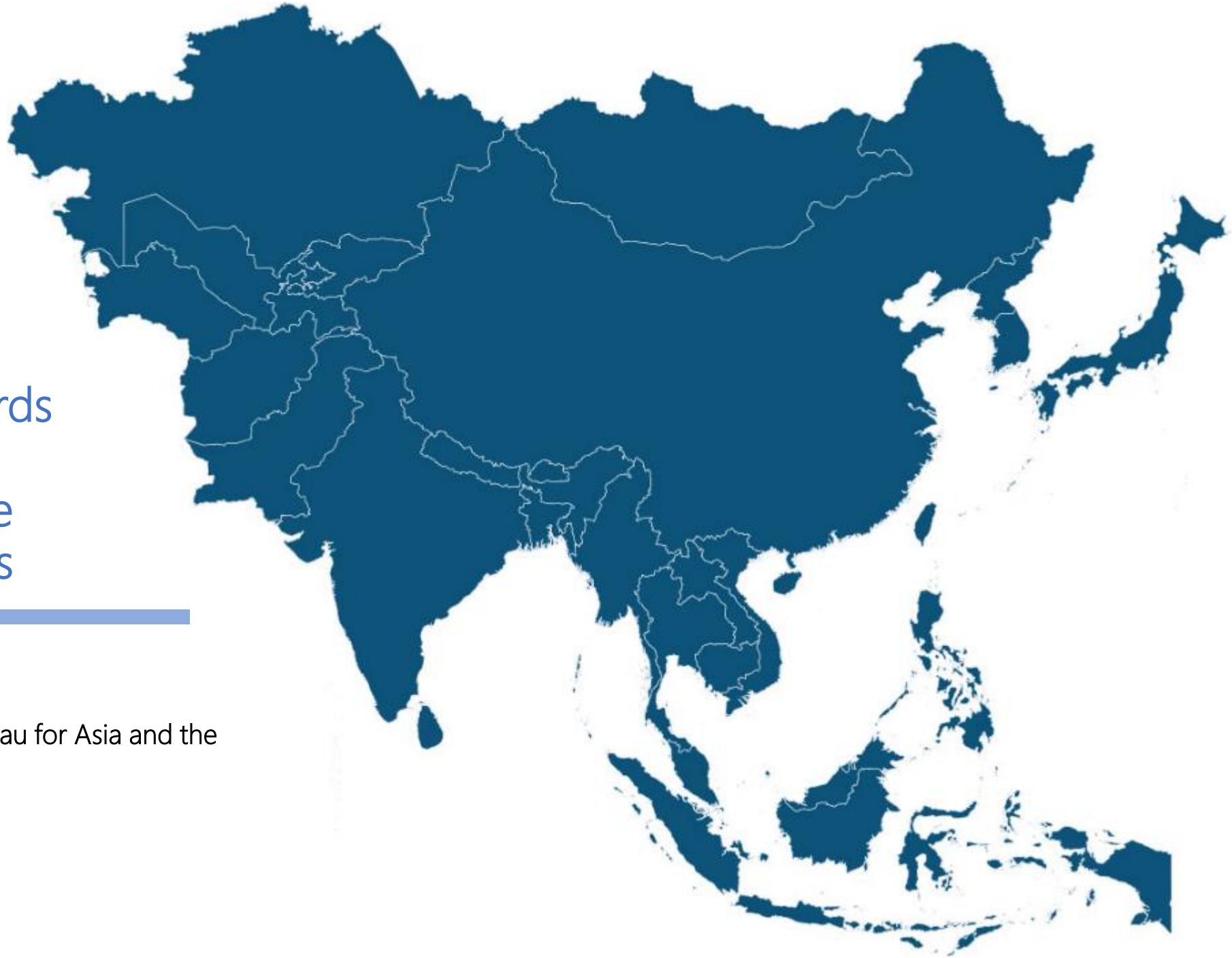
Groundwater for sustainability: contributions towards the 2030 Agenda and the Sustainable Development Goals



Hans Dencker Thulstrup
Senior Programme Specialist
UNESCO Regional Sciences Bureau for Asia and the Pacific

SUSTAINABLE DEVELOPMENT GOALS

… a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity.
The 17 SDGs are integrated—they recognize that action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability.

Groundwater management is most directly associated with SDG 6: Clean Water And Sanitation.

However, it is also related SDG 1, 2, 3, 9, 11,13, 15, and 17, because groundwater systems are complex and relate directly or indirectly to consumption patterns, economic activities, climate change, biodiversity, and more.

It could be said that water flows through all of the Sustainable Development Goals.

The case for groundwater

Sustainable groundwater is a key element in global resilience to climate change, a shield against ecosystem loss, and a defense against human deprivation and poverty.

Groundwater underpins irrigated agriculture and energy production. It supports food security and economic development. It is essential to the health of all living things.

Groundwater provides drinking water to at least 50% of the global population, and worldwide, approximately 2.5 billion people depend solely on groundwater resources to satisfy their basic daily water needs.

UNESCO World Water Development Report 2012

...however:

Groundwater is a hidden and vulnerable resource and is not physically visible, which can make it difficult for the general population and decision-makers to connect up with the challenges affecting this resource. Appreciation of groundwater is not taught in elementary schools. Many university programs do not have hydrogeology courses in their undergraduate curricula. (IGRAC 2021)

The challenge

- Appreciation of groundwater is not taught in elementary schools.
- Many university programs do not have hydrogeology courses in their undergraduate curricula.
- Many people do not know that surface water and groundwater are closely connected, that pollution of one can pollute the other, that rivers and lakes derive water from underground baseflow.
- Many decision makers do not know that, in drylands, slight changes in groundwater levels, due to over-pumping or climate change, can diminish or eradicate springs and wells.
- Many people do not know that an estimated 20% of the world' s aquifers being over-exploited (IGRAC).

- In spite of all this, groundwater is closely associated with human civilizations across the world and across millennia – a sacred treasure, a prized resource and a source of conflict.

The consequences

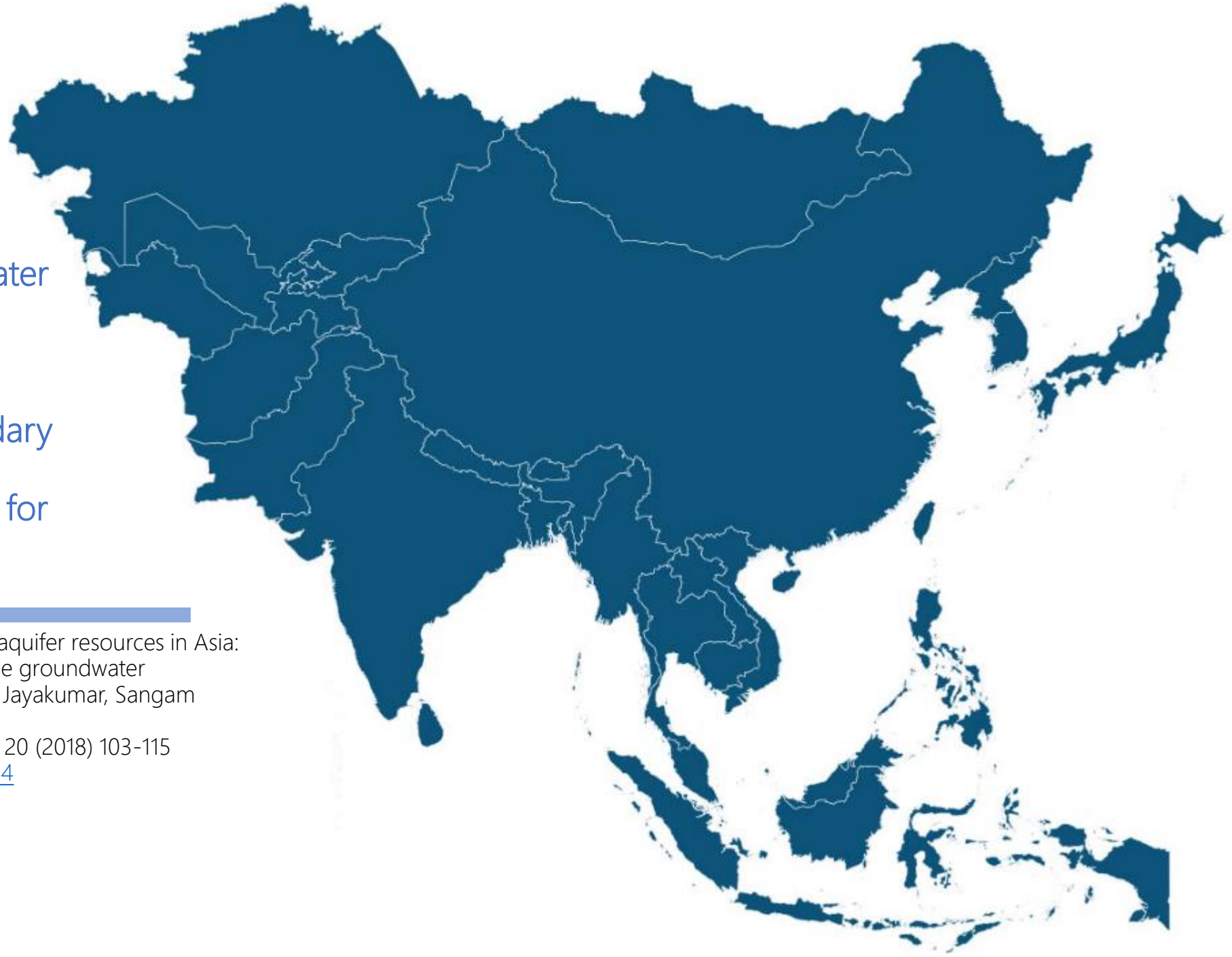
The lack of systematic communication and data information on groundwater is one of the most significant impediments to its sound management and governance.

This has direct impacts on the contributions of groundwater to the SDGs. This is particularly true in the case of transboundary aquifers.

IGRAC, 2021: https://www.un-igrac.org/stories/groundwater-key-sustainable-development-goals-sdgs

Transboundary groundwater in Focus: progress in Asia towards indicator 6.5.2

Proportion of transboundary basin area with an operational arrangement for water cooperation



Source: Assessment of transboundary aquifer resources in Asia: Status and progress towards sustainable groundwater management. Eunhee Lee, Ramasamy Jayakumar, Sangam Shrestha, Zaisheng Han
Journal of Hydrology: Regional Studies 20 (2018) 103-115
https://doi.org/10.1016/j.ejrh.2018.01.004

INVENTORY OF TBAS IN ASIA

- There are 129 shared aquifers in Asia (2015). The total area of TBAs in Asia measures approximately 9 million km2, covering about 20% of the entire region.
- According to the global TBA inventory, a total of 38 countries in Asia are identified as having internationally shared aquifer basins.
- Aquifer stress (AQSI)* for Asia' s aquifers has increased more than 250% over the last 50 years. For example, Saq-Ram Aquifer System between Saudi Arabia and Jordan and Mekong Delta region.
- A survey by TWAP (Transboundary Water Assessment Programme) identified that among 25 TBAs in South, Southeast and East Asia, only about 50% of the region' s TBAs are suitable for human consumption due to showed serious groundwater quality problems. Notable case, Indus River Plain Aquifer, estimated about 80% of the aquifer area within the Pakistan territory is unsuitable for human consumption as a result of elevated amounts of natural salinity as well as high levels of fluoride and arsenic. In addition, Mekong Delta aquifer intensive extraction for agriculture has led to seawater intrusion into the aquifer.

LEGAL AND INSTITUTIONAL FRAMEWORKS FOR TBA MANAGEMENT IN ASIA

Given the significant role of TBAs in linking hydrological, social, and economic sectors between neighboring countries, shared aquifer management should be dealt with by institutional and legal frameworks

However, across much of Asia, the issues have been scarcely addressed in international water policy, legislation, and institutional instruments

Source: https://doi.org/10.1016/j.ejrh.2018.01.004

TBA STATUS

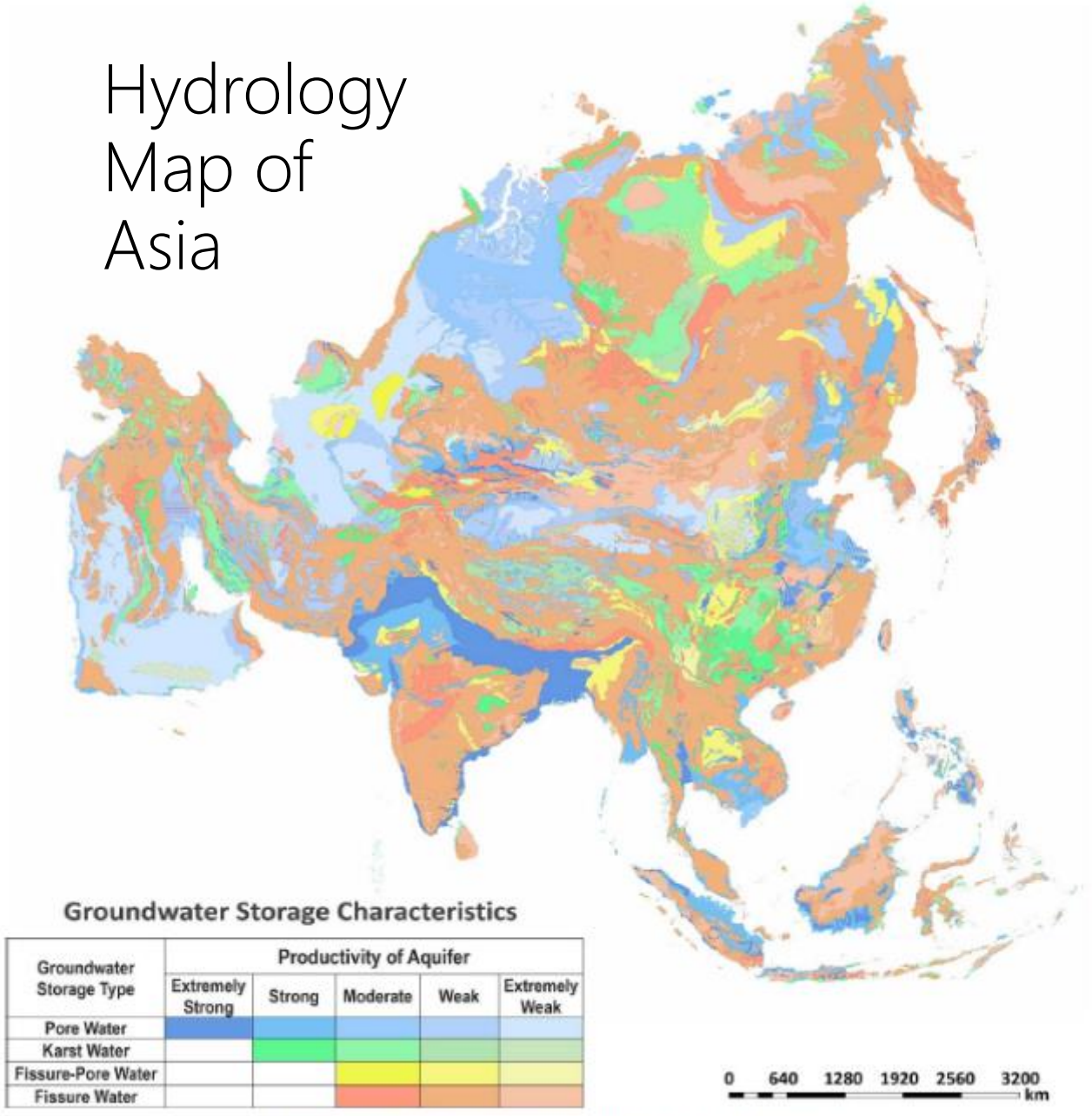
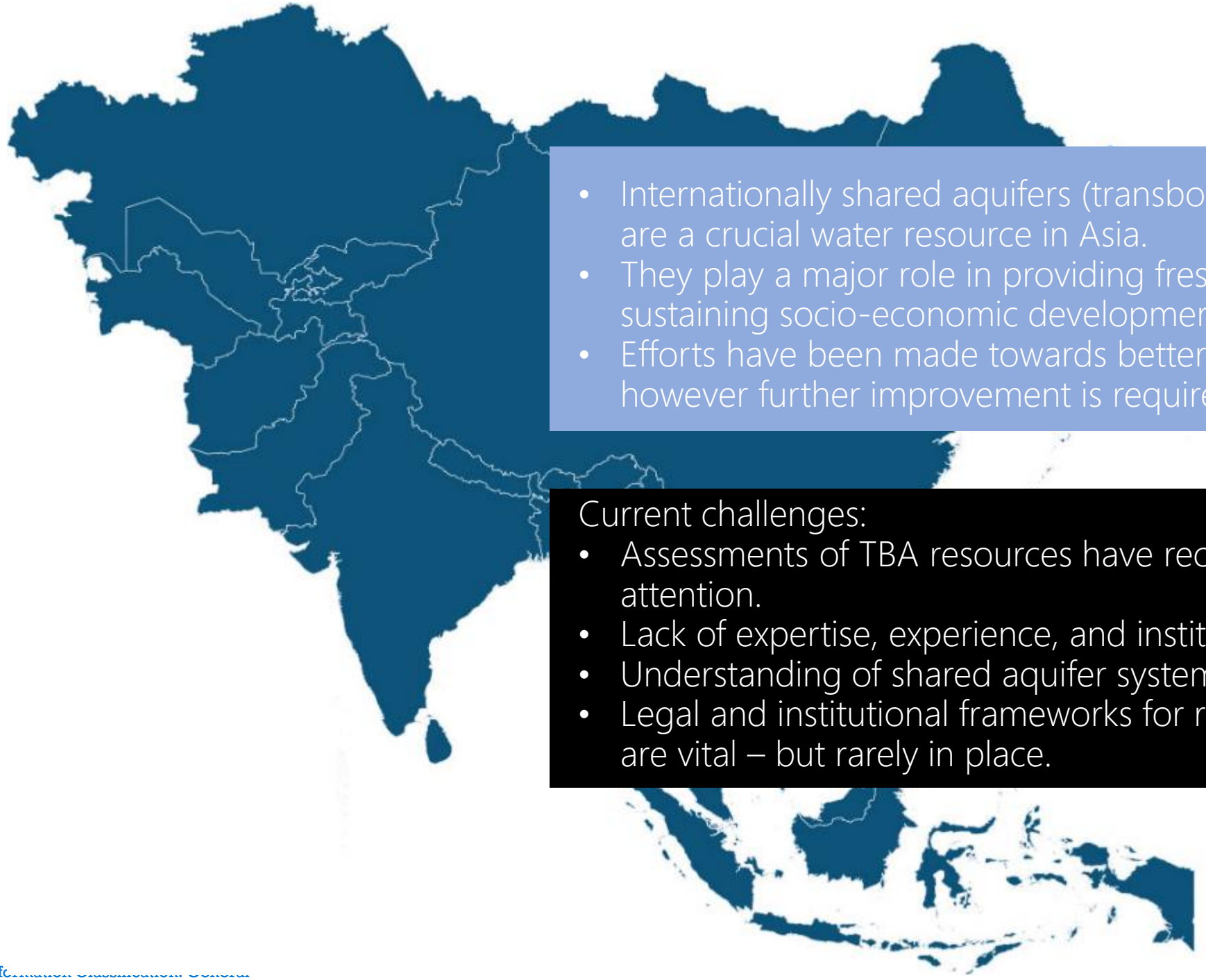


Fig. 1. Hydrogeology Map of Asia (Scale: 1: 8 000 000, modified from OGS (2012)).

- Asia consumes more than 70% of global groundwater; supported growth of the agricultural sector
- Many TBAs are vastly exploited, led to the reduction and deterioration of groundwater resources. With increased population density and economic development, stress on shared aquifers is expected to increase further in the future.
- These challenges to likely exacerbate regional conflicts by countries competing over the limited water resources

- Many activities have been undertaken to develop TBA inventories and gain a better understanding of shared aquifer systems
- Lack of reliable TBA data, particularly for the developing countries, cooperation in identification, assessment, and governance mechanisms
- Initiatives have been launched to promote the establishment of legal/institutional frameworks for TBA cooperation, which has led to the recognition of the importance of TBAs and the need to cooperate
- Several countries have cooperated internationally by establishing TBA institutes and agreements with neighboring countries - a significant milestone.
- Many developing countries do not have the capacity to carry out groundwater investigation and proper groundwater management practices
- More attention should be paid to establish a link between hydrogeological knowledge on groundwater management practices

Source: https://doi.org/10.1016/j.ejrh.2018.01.004



- Internationally shared aquifers (transboundary aquifers or TBAs) are a crucial water resource in Asia.
- They play a major role in providing freshwater resources and sustaining socio-economic development.
- Efforts have been made towards better management system, however further improvement is required.

Current challenges:

- Assessments of TBA resources have received relatively less attention.
- Lack of expertise, experience, and institutional support
- Understanding of shared aquifer systems remains limited.
- Legal and institutional frameworks for regional TBA cooperation are vital – but rarely in place.

Source: https://doi.org/10.1016/j.ejrh.2018.01.004

SDG INDICATOR 6.5.2

TRANSBOUNDARY WATER COOPERATION

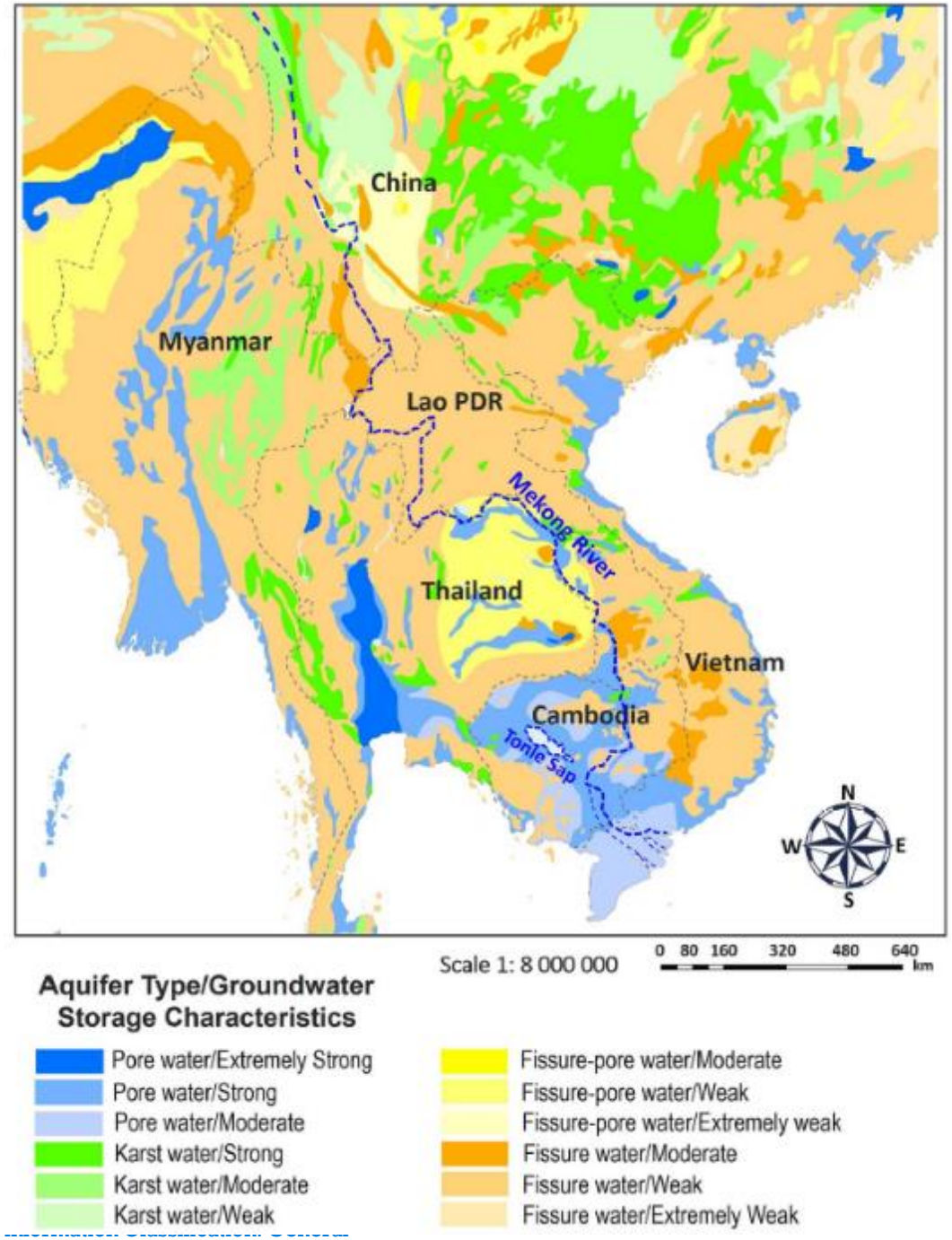
SDG target 6.5 calls for countries to "implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

Indicator 6.5.2 has been defined as the "proportion of transboundary basin area [within a country] with an operational arrangement for water cooperation

UNECE and UNESCO were entrusted as co-custodian agencies for indicator 6.5.2.

- Twenty-five out of 30 countries in the Central, Eastern, Southern and South-Eastern Asia region share transboundary river and lake basins.
- In 2017, river and lake basin data were only available for six countries within the region, whereas 2017–2020 combined data are now available for 15 countries.
- These combined data show that there is still a considerable number of countries where operational arrangements are lacking. Only six countries out of 25 sharing transboundary river and lake basins reported having operational arrangements covering 90 per cent or more of their basin area.
- These countries include several of the Mekong River Basin countries (Cambodia, Lao People's Democratic Republic (Lao PDR) and Thailand), as well as Kazakhstan, Uzbekistan and Indonesia.

STATUS AND MANAGEMENT OF TBAS IN THE GREATER MEKONG SUBREGION (GMS)



- Mekong River is the longest river in Southeast Asia
- The culture and livelihood of the GMS countries (Cambodia, Lao PDR, Myanmar, Thailand, and Vietnam) are closely interconnected.
- The TBA provides water for drinking, irrigation, and industry and supporting natural river water flows and associated ecosystems.
- One significant challenge is high exposure to climate-related risks (floods and droughts). Strong spatial and temporal variations rainfall is not uniformly distributed; about 80% of the total precipitation is concentrated during the wet season.

Source: https://doi.org/10.1016/j.ejrh.2018.01.004

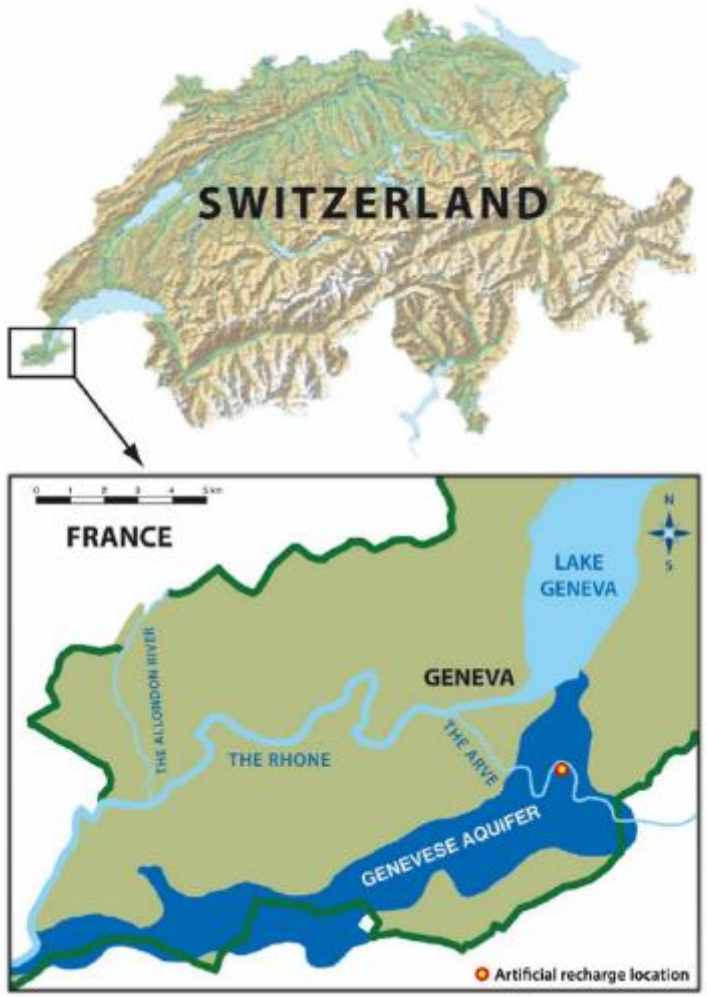
STATUS AND MANAGEMENT OF TBAS IN THE GREATER MEKONG SUBREGION (GMS)

TBA distribution in GMS: an example

- The Cambodia-Mekong River Delta Aquifer is shared by Cambodia and Vietnam, with 63% of the TBAs within Cambodia where the Tonle Sap lake serves as a natural regulating reservoir.
- Due rapidly increasing population and fast economic development, the demand for water resources is increasing, leading to the over-exploitation of groundwater. This results in groundwater reduction and quality deterioration threatening future GMS water security.
- Groundwater levels have significantly declined, while increased salinity has affected freshwater supply capacity.
- GMS is vulnerable to seawater intrusion, has experienced occurrence of arsenic pollution. In Cambodia, around 20% of aquifers are not suitable for human consumption, mainly associated with elevated levels of arsenic.
- Limited institutional framework for the co-investigation of TBAs and limited coordination among hydrological databases between the two countries; which have restricted the strategic planning of cooperative management.
- UNESCO contributes towards several new project proposals to address these challenges.

Source: https://doi.org/10.1016/j.ejrh.2018.01.004

THE GENEVESE TRANSBOUNDARY AQUIFER (SWITZERLAND-FRANCE): 40 years of successful transboundary management



The **Genevese** aquifer is used for the supply of drinking water harnessed from ten wells on the Swiss side and four on the French side.

During the 1960s and 1970s, over-pumping lowered the groundwater level by more than 7 m.

While technical and scientific studies were being undertaken to resolve the problem of over exploitation, negotiations were being conducted with various local and national authorities in France.

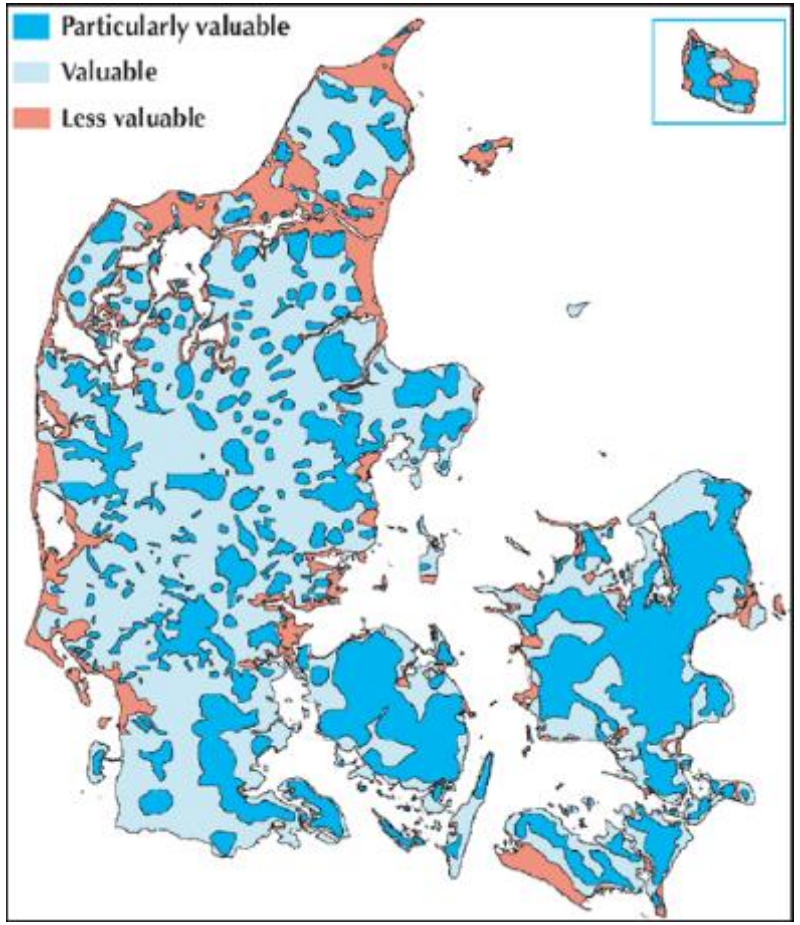
The aim was to engage in a collaborative effort to fund the work and to establish a joint water management system. The agreements signed in 1978 and in 2007 attest to the success of the joint management plan.

KEYS OF SUCCESS

- Focus on the common water resource
  safeguard the water resource from over exploitation.
  excellent technical data and monitoring of the groundwater
- The handling of the administrative and policy aspects of aquifer management at the local level
  Presence autonomy to local authority results in successful negotiations in the 1970s agreement. Autonomy makes local authorities feel at greater ease as signatories, accountable to their own citizens
- The ability of the canton of Geneva to handle transboundary matters directly
  The Canton of Geneva had led the recharge project and the management of the stakeholders, demonstrated its ability to guarantee optimal groundwater management over the first thirty years. Experience has shown that, whereas it might be necessary to deal with ten different interlocutors in a project with the French neighbours, in the State of Geneva there is usually only one entity with which to contend.

https://doi.org/10.1016/j.ejrh.2018.02.003

GROUNDWATER MANAGEMENT IN DENMARK



Thomsen, R., Søndergaard, V., Sørensen, K. (2004) 10.1007/s10040-004-0345-1

Denmark is entirely dependent on groundwater for drinking water supply.

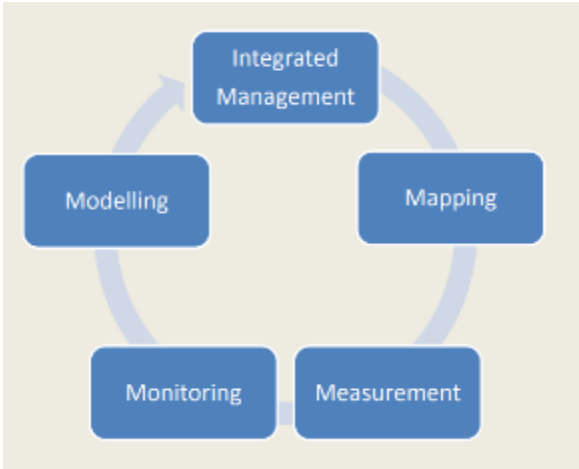
Factors that support sustainable groundwater management include:

- Tradition and history
- Strong knowledge and research base
- National commitment
- Transparent regulatory system
- Partnerships across sectors
- Public and political concern and awareness

Challenges include:

- Contamination from
- diffuse and point source pollution
- Over-abstraction and depletion due to geographically uneven recharge patterns
- Impacts of climate change

Bjørn Kaare Jensen (2015): https://circabc.europa.eu/sd/a/3f5806ff-aded-4937-917d-62542458a66c/China%20-%20Presentation%20-%20Integrated%20groundwater%20management%20in%20Denmark.pdf



Climate change impacts

- More precipitation and cloudbursts leading to groundwater flooding
- Enhanced transport of contaminants in soil and groundwater
- Enhanced saltwater intrusion in coastal areas due to sea level rise
- Enhanced breaking and leakage from sewer systems
- Drought leading to lowering of water table and soil subsidence requiring revised groundwater abstraction strategies
- Increased infiltration of rainwater in urban areas leading to elevated groundwater levels and potential damage to infrastructure

Thank you!

h.thulstrup@unesco.org