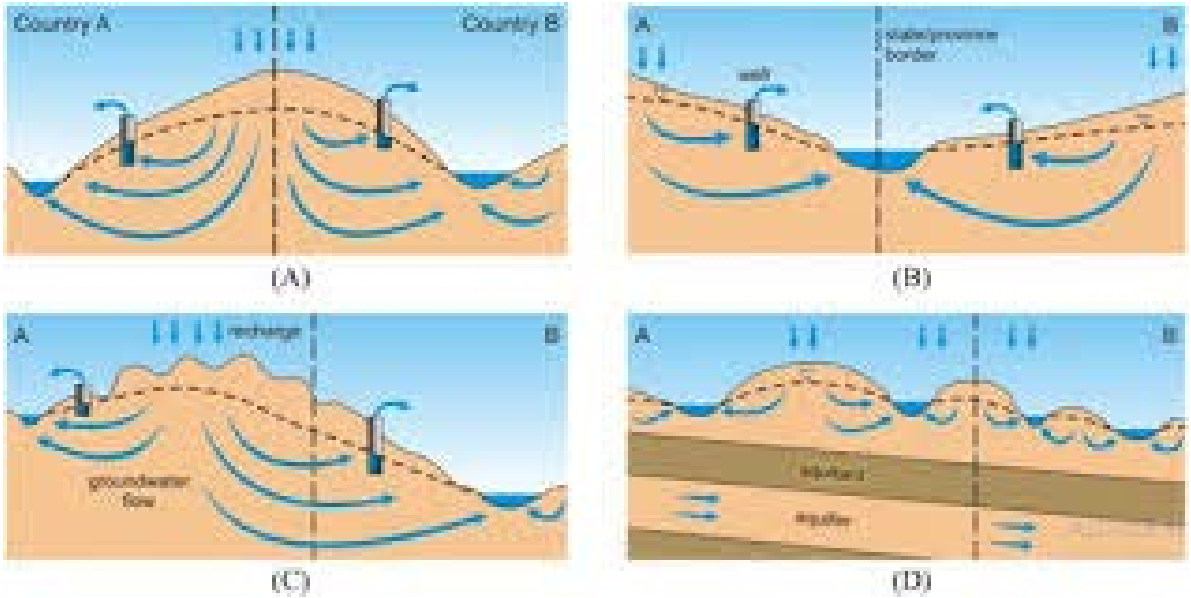
Challenges and Opportunities for Transboundary Aquifer Management in the Mekong Region

Ashim Das Gupta, Sangam Shrestha, Thi Phuoc Lai Nguyen and Saurav KC



Ashim Das Gupta
Visiting Professor, University Technology Sydney (UTS), Sydney, Australia
Emeritus Professor, Asian Institute of Technology (AIT), Bangkok, Thailand

Global Groundwater Sustainability: A Call for Action

Put the spotlight on global groundwater sustainability

Manage and govern groundwater sustainability from local to global scales

Invest in groundwater governance and management

https://www.groundwaterstatement.org/

Key Message

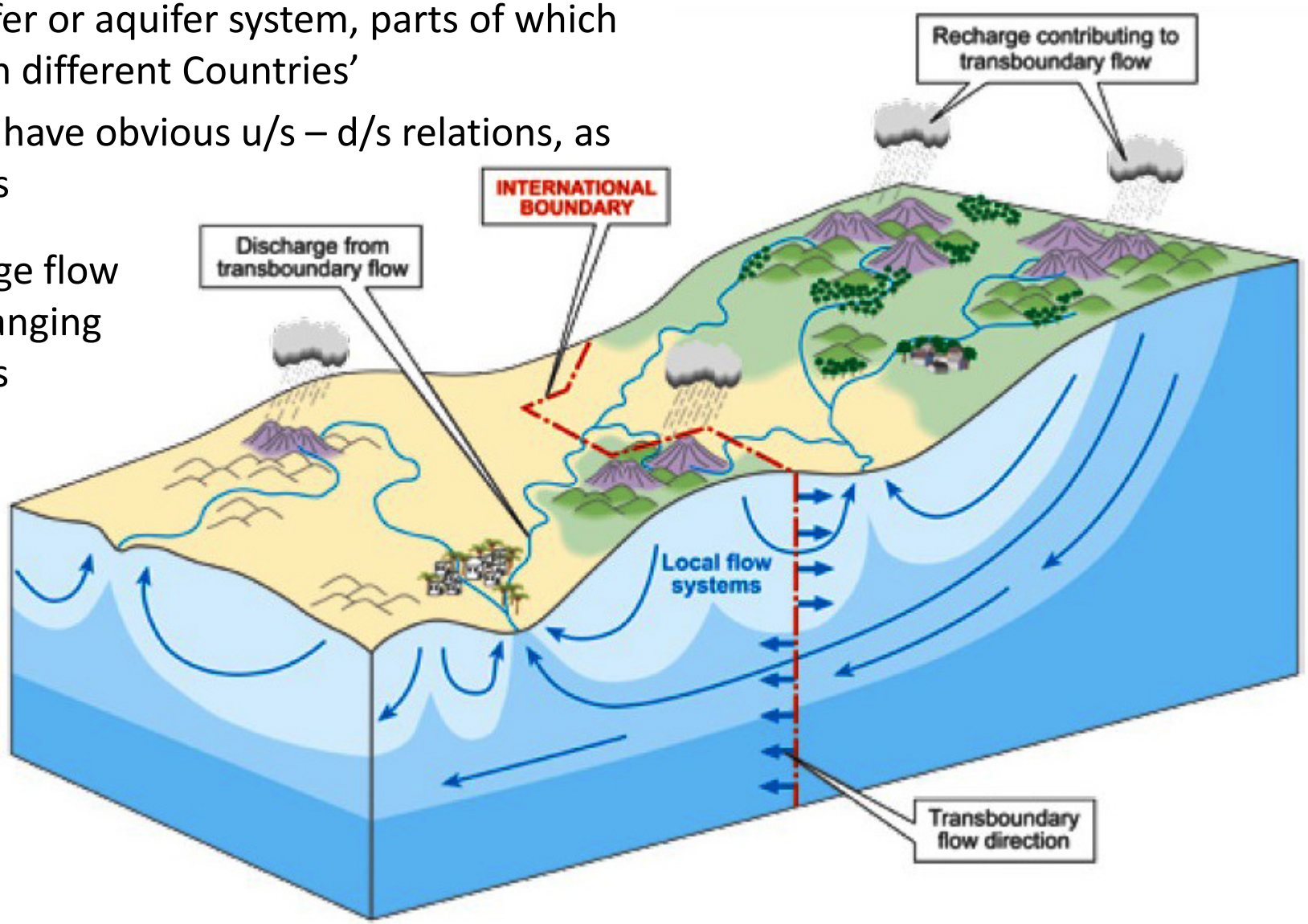
- WATER ignores political/administrative boundaries
- WATER evades institutional classifications
- WATER eludes legislative generalizations
- GROUNDWATER, the hidden resource, consists of >90% of all accessible freshwater – so, transboundary aquifers need significant more attention….. Why?

Transboundary Aquifer: Groundwater (1/4)

TBA: ‘an aquifer or aquifer system, parts of which are situated in different Countries’

TB-GW: may not have obvious u/s – d/s relations, as opposed to rivers

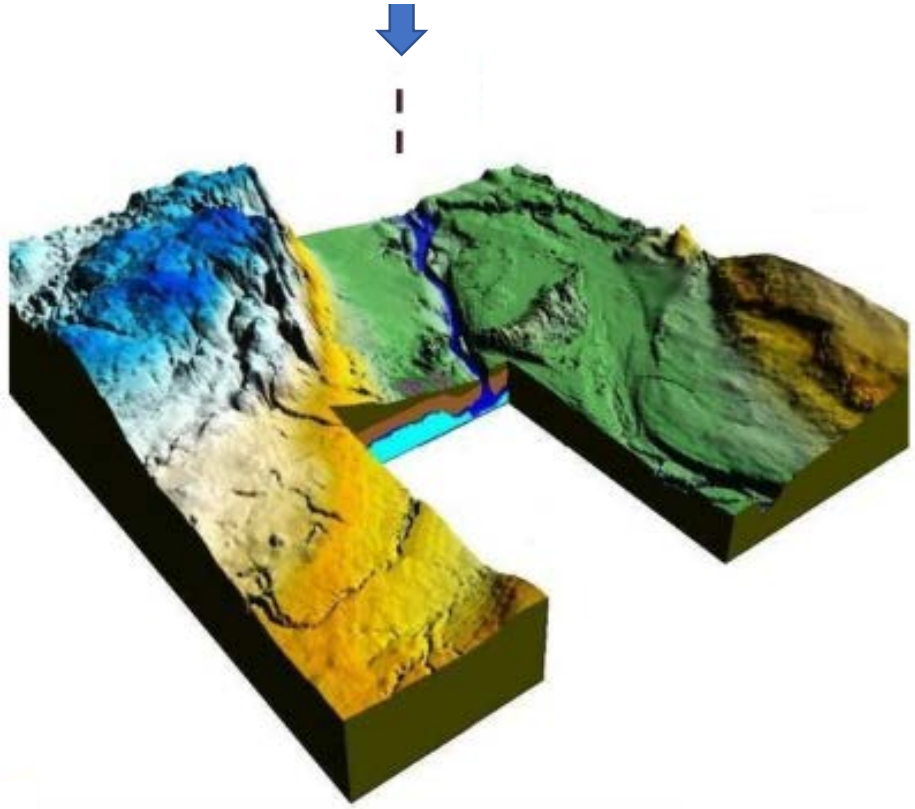
GW may even change flow direction due to changing abstraction patterns



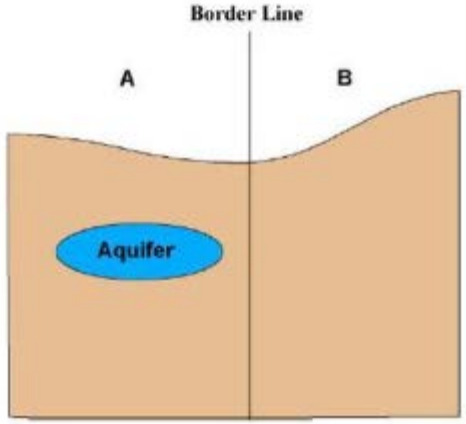
Transboundary Aquifer: Groundwater (2/4)

Transboundary Aquifer: Groundwater (3/4)

International boundaries may follow natural physical features as river in this case, aquifer(s) underlying them do not

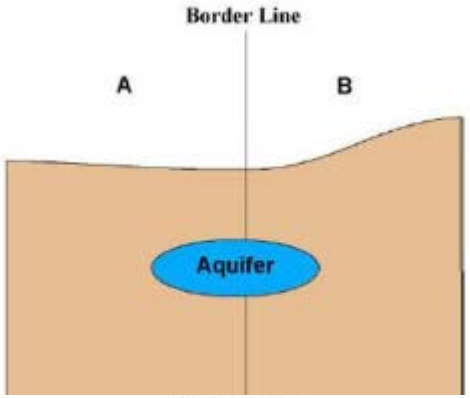


TBAs: Probable Conceptualization (4/4)



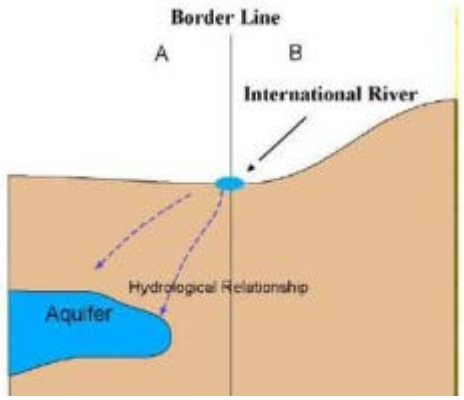
(1)

An aquifer is entirely in one country



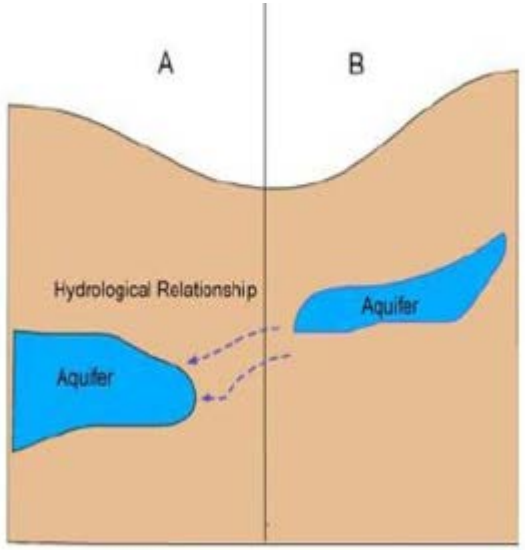
(2)

An aquifer is divided by international boundary



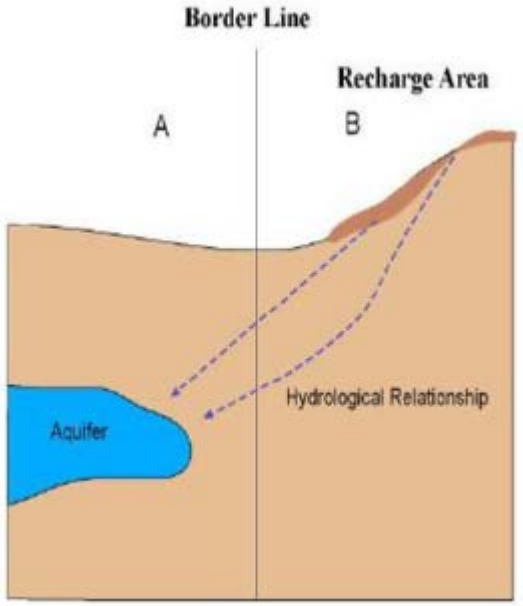
(3)

An aquifer is entirely in the territory of one country but is linked hydrologically to an international river



(4)

An aquifer is entirely in the territory of one country but is linked hydrologically with another aquifer in neighboring country



(5)

An aquifer is entirely in the territory of one country but its recharge area is in a neighboring country

Transboundary Rivers & Aquifers: Some Contrasts (1/2)

Rivers

- Long linear features
- Use of resources generally limited to the vicinity of the river channel
- Replenishment always from upstream sources
- Rapid and time constrained gain from replenishment

Aquifers

- Bulk 3-dimensional systems
- Resources may be extracted from and used extensively over out-crop and sub-crop
- Replenishment may take place from any, or all of 3-dimensions
- Replenishment could be slow, net gain could be drawn upon longer periods

Transboundary Rivers & Aquifers: Some Contrasts (2/2)

Rivers

- Abstraction has an immediate downstream impact
- Little impact on upstream riparian
- Pollution impacts transported downstream rapidly
- Pollutant transport invariably downstream, upstream source may be unaffected

Aquifers

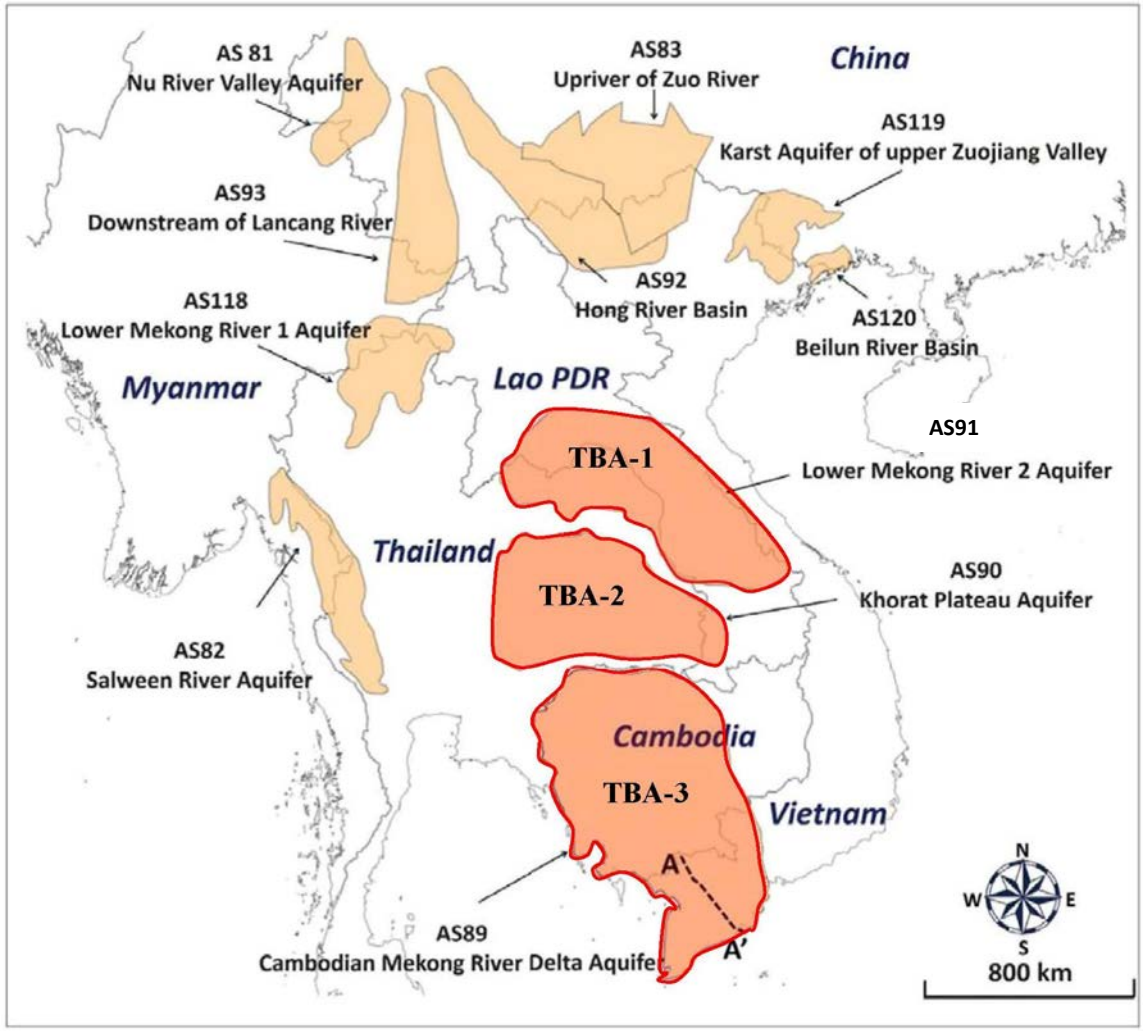
- Abstraction impact can be much slower – can be 10's of years
- Could have an equal impact on both upstream and downstream riparian
- Slow movement of pollution
- Pollutant transport controlled by local hydraulics. An operating well may induce 'upstream' movement towards itself

Distribution of TBAs in GMS

AS89 (TBA-3)

200.000 km^2
(63% of TBA in Cambodia)

Annual RF:
1400-2200 mm/yr



AS91 (TBA-1)

122,000 km^2
TBA distribution:
Lao PDR (73%)
Thailand (21%)
Vietnam (6%)

AS90 (TBA-2)

109,000 km^2
(91,000 km^2 in Thailand, Lao PDR accounts for a small portion in the northeastern area)

Annual RF:
1000 mm/yr

TBAs in Greater Mekong Sub-region and adjacent region (modified from IGRAC, 2015)

(Adopted from Lee et al. (2018): Assessment of transboundary aquifer resources in Asia: Status and progress towards sustainable groundwater management, Journal of Hydrology: Regional Studies, 20, pp. 103–115)

Why highlight TBAs and their consideration in policy & decision-making platform? (1/2)

- Some TBAs contain enormous water volume that will meet the drinking water needs of a large population, if not the whole planet
- Surface water is tangible – aquifers 'out of sight, many a times out of mind …..', estimates are subject to uncertainty. Only realization comes when facing critical consequences

Why highlight TBAs and their consideration in policy & decision-making platform? (2/2)

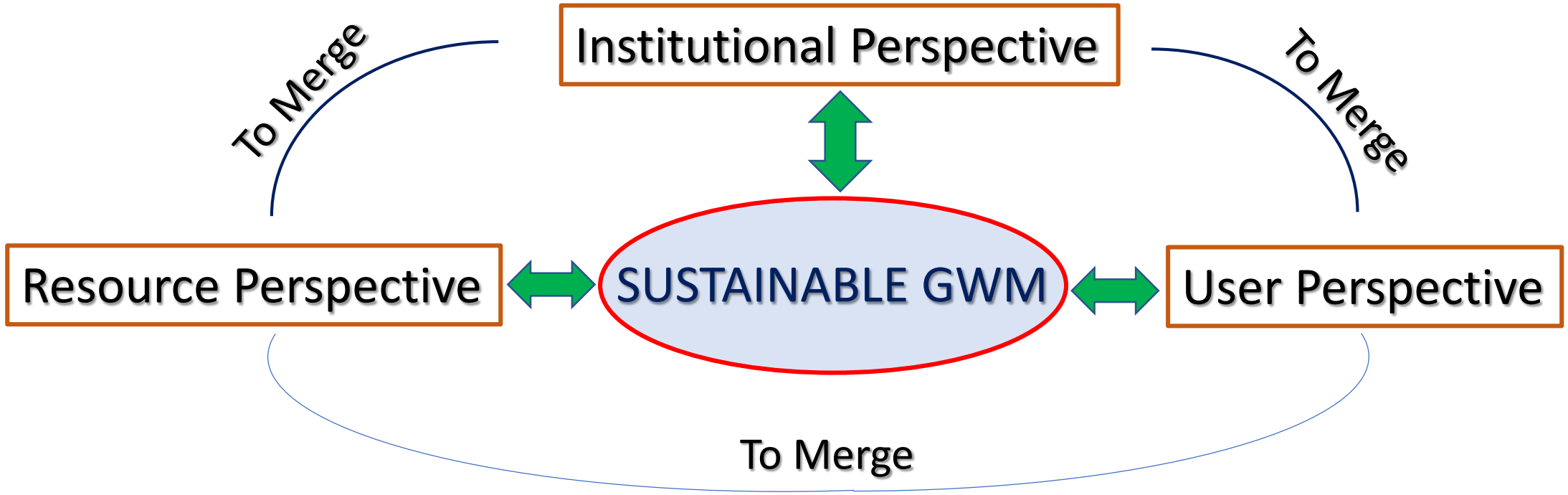
- Difficult for Decision Maker to conceptualize in the absence of reliable hydro-geological information with spatial and temporal resolution associated with good interpretation
- Significance of TBAs may not be well understood: provide buffer during droughts
- Lack of awareness might leave them at risk and potential conflict

Understanding the Reality

TBAs: growing attention among aquifer riparians and the international community

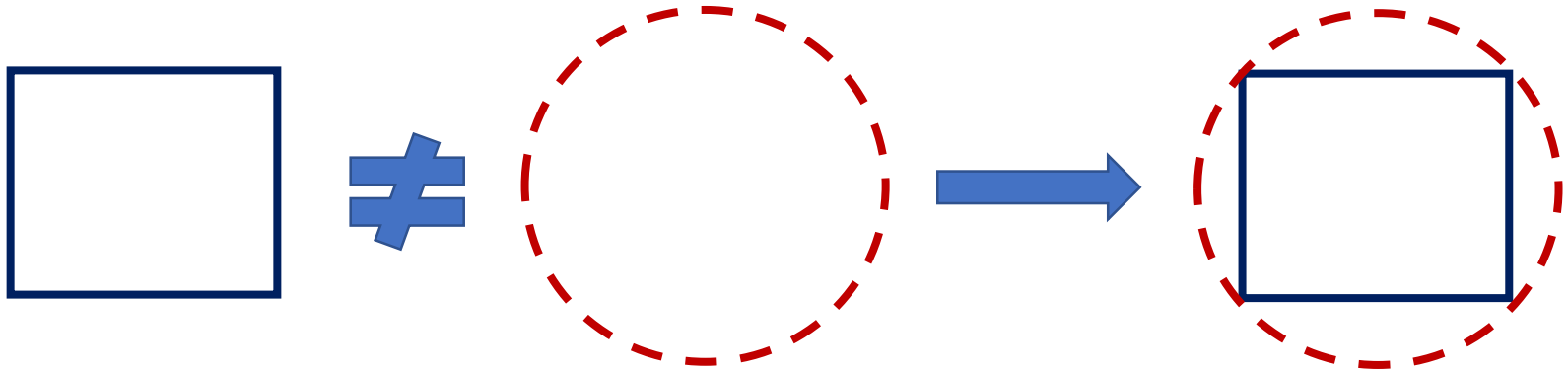
- The mechanisms for governing shared groundwater resources,
- The rights that aquifer riparians enjoy from a transboundary aquifer (TBA), and
- The responsibilities that these nations might owe to other aquifer riparians.

How to address the Challenges of SGWM?



An adequate knowledge and understanding of the physical behaviour and functioning of the aquifer system, its state and extent of usage and their future trend is needed to plan for sustainable use and management of the resource

GW Governance: Current Approach



Current Approach to GW Governance (managerial focused)

GW Governance Reality

Problem definition under current approaches not adjusted to reality produces the wrong type of solutions

Way Forward: A Paradigm Shift in Problem Solving Process Needed

Scientific Assessment (Expert science & traditional risk analysis)

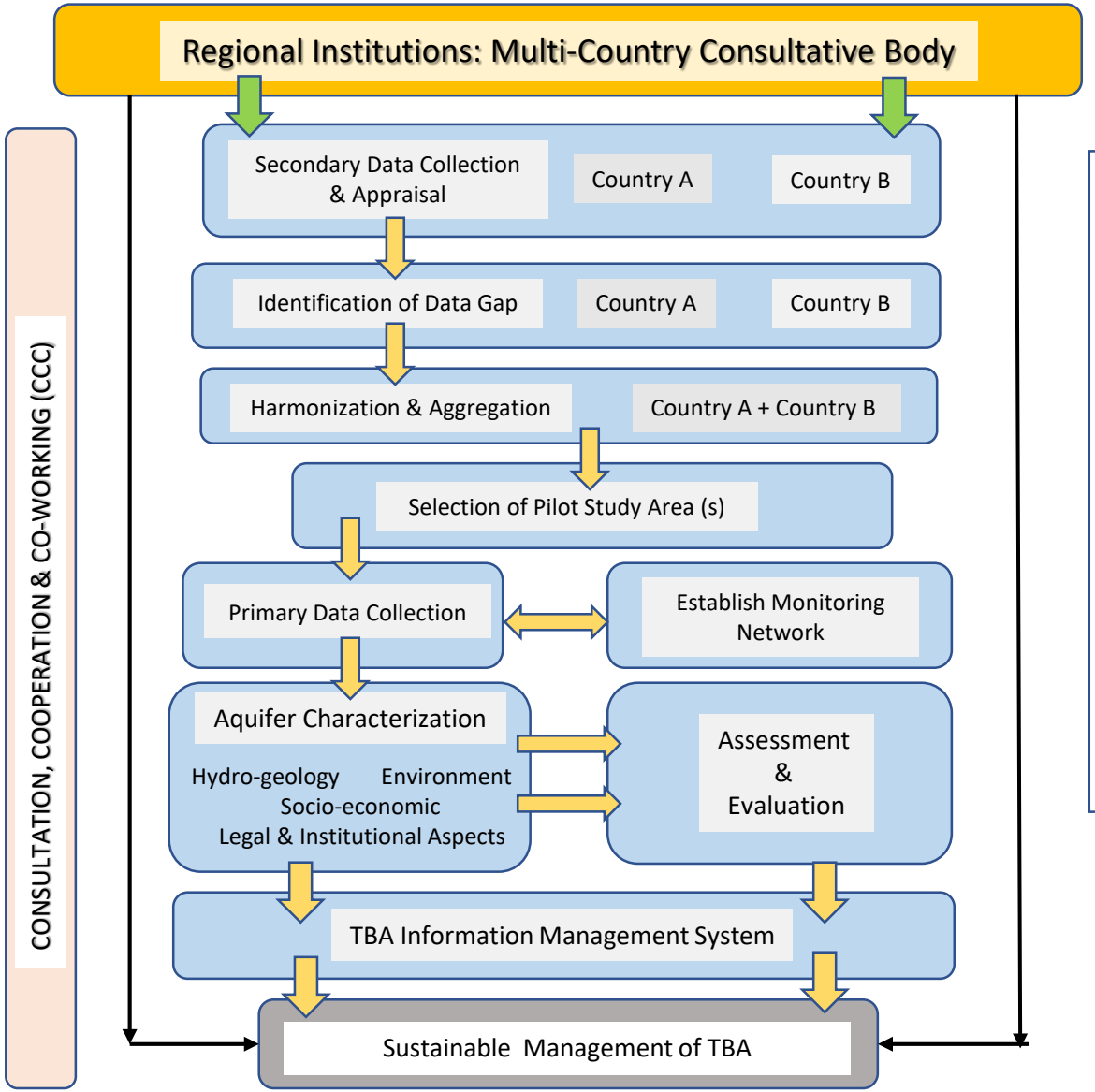
→

Quasi-Scientific Assessment (expert science, local knowledge, beliefs and values)

Governance & Management of TBA & GW

- Recognize aquifers and groundwater as critically important, finite, valuable, and vulnerable resources;
- Aquifer systems are unique and need to be well understood, and groundwater should be invisible no more;
- Data and information are key;
- We need to take care of what we have;
- Governing and managing groundwater require working with people; and
- Effective groundwater management of TBAs requires collaborative effort, robust stakeholder participation, and community engagement.

Assessment & Evaluation for TBAs & GW: Elements of Cooperation



Harmonization implies that the same standard (like the level of detail, the period of time and frequency of measurement, units, etc.) is agreed upon by MCs and used in observation and compilation of data for the entire TBA system; while,

Aggregation is the process of assembling all data and information from MCs in the same form for the TBA shared by countries to produce different mapping output in unified manner.

Transboundary GW Cooperation: Enabling Factors

- Existence of legal mechanisms, prior to cooperation
- Existence of regional institutions to facilitate cooperation, coordination & coworking
- Funding mechanisms: from sharing countries
- Adequate institutional capacities for TBA - GW management
- Existence of previous water cooperation
- Presence of scientific research: assessment of aquifer management…
- Existence of a strong political will: GWM high on political agenda
- Third party involvement

UNESCO (2021) The Role of Sound Groundwater Resources Management and Governance to Achieve Water Security

Concluding Remarks

- Collaborative assessment of TBAs is the foremost task for transboundary governance and management because it is difficult to manage aquifers that have not been characterized through an agreed-upon methodology.
- Regional Institutions are formed mainly dedicated to management of TBAs and groundwater use to enable cooperation among member countries coworking in monitoring, analysis and assessment, and management of TBAs.
- Effective groundwater management is critical to an integrated water management portfolio that is adaptive and resilient to drought and climate change.
- To be robust, policies of the agriculture, energy, environment, land-use planning, and urban development sectors must incorporate groundwater considerations.

Thank you very much for your Attention