IInd International Conference
Sustainable Management of transboundary waters in Europe
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Challenges to management of transboundary aquifers: The ISARM Programme

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The Miedzyzdroje meeting: focus on sustainable management

Integrated Approach	Information & Communication	Challenges
●Concept with many facets	●'Adequate' information	●Structural & economic
●Beyond freshwater management*	●Involving the 'right' people	●Legal & Institutional

* Wolin Island aquifers

→ Groundwater in transboundary in water resources: ISARM

Session IV: EU Legislation & Water Convention

Overview

- Groundwater in the ECE Convention & other international frameworks
- Key features of transboundary aquifers – what is the big deal??
- Transboundary aquifers vs transboundary surface waters – how do they differ??
- Challenges for sustainable management of transboundary aquifers beyond the ECE region – a global issue??

Community water requirements and 'share' of transboundary waters?

Water is fundamental to environmental security & thus also to human security through its reliable provision, even in the face of increasing demand

261 rivers cross international boundaries

145 nations have part of their territory in a transboundary river basin

Large part of mankind thus a user of transboundary water

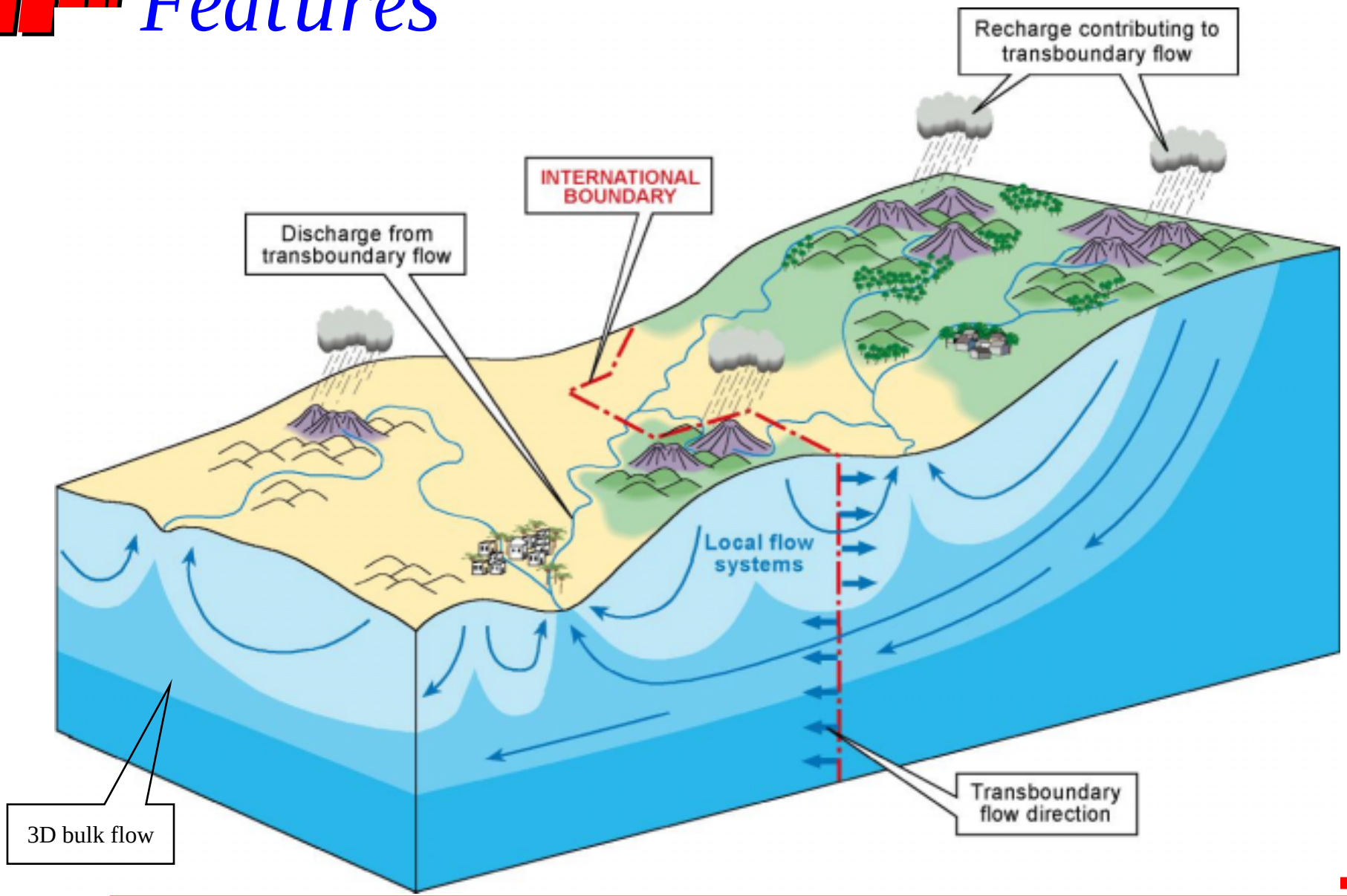
BUT, put "water" & "nations" together & what do we find??

Key message

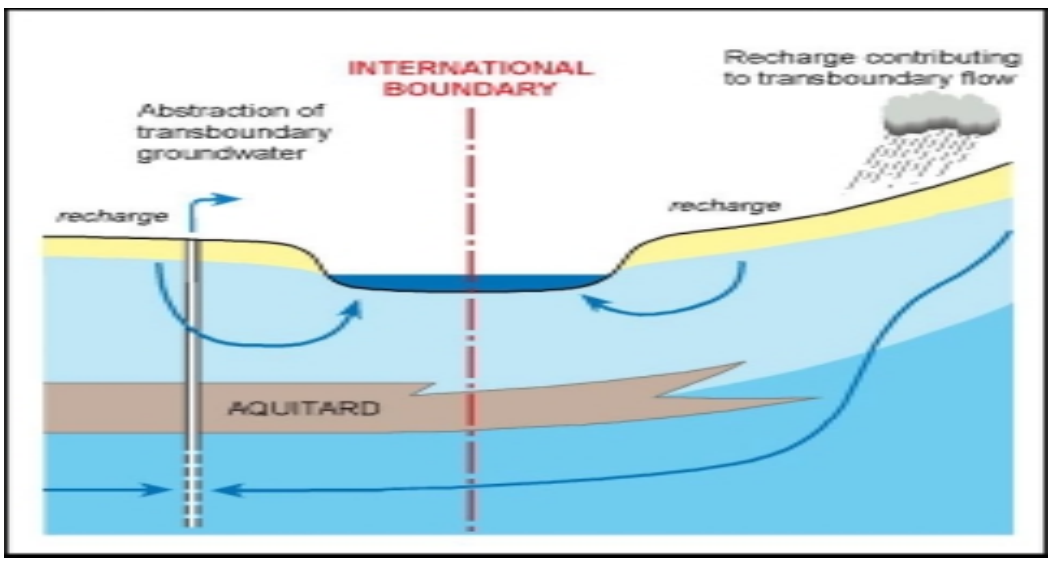
- WATER ignores political / admin boundaries
- WATER evades institutional classification
  - » How many municipal water supply agencies also manage agricultural / industrial demands?
- WATER eludes legislative generalisations
  - » International Water Law / International Court of Justice: limited record in resolving transboundary water issues

- … and GROUNDWATER, that hidden resource, consists of >90% of all accessible freshwater
  - – so, transboundary aquifers need significant more attention ….. Why?

Features


Recharge contributing to transboundary flow
INTERNATIONAL BOUNDARY
Discharge from transboundary flow
Local flow systems
3D bulk flow
Transboundary flow direction

Coincidence with rivers ?



Multiple stresses on aquifers

Why bring transboundary aquifers into the international policy arena?

- Some contain drinking water needs for the whole planet for tens of decades
- Surface water is tangible – aquifers 'out of sight, etc …..'
- Difficult for Decision Maker to conceptualise
- Their significance may not be well understood: provide buffer during droughts
- Lack of awareness might leave them at risk & potential conflict

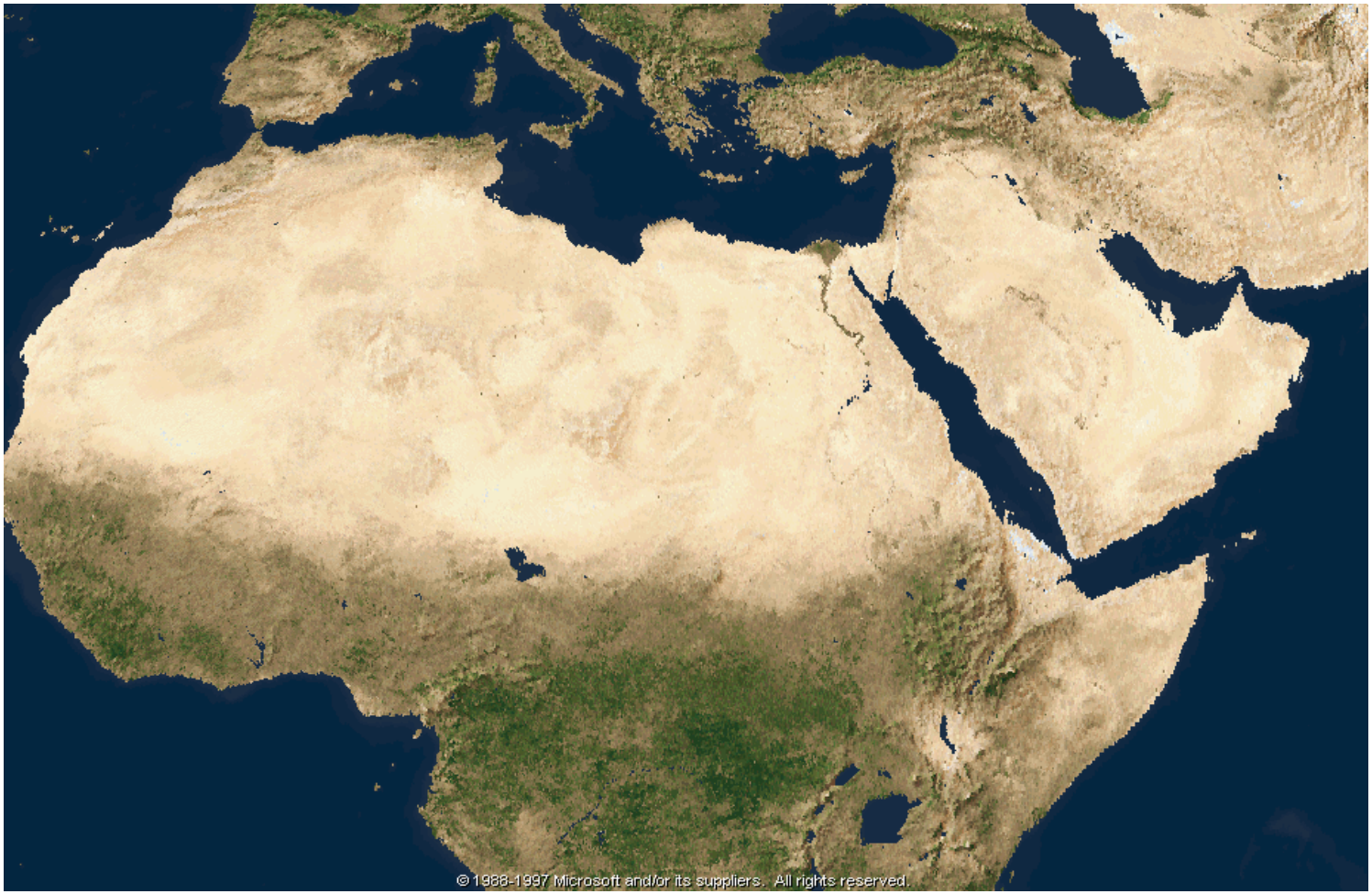
Exploration water drilling to 1500m depth

Some examples

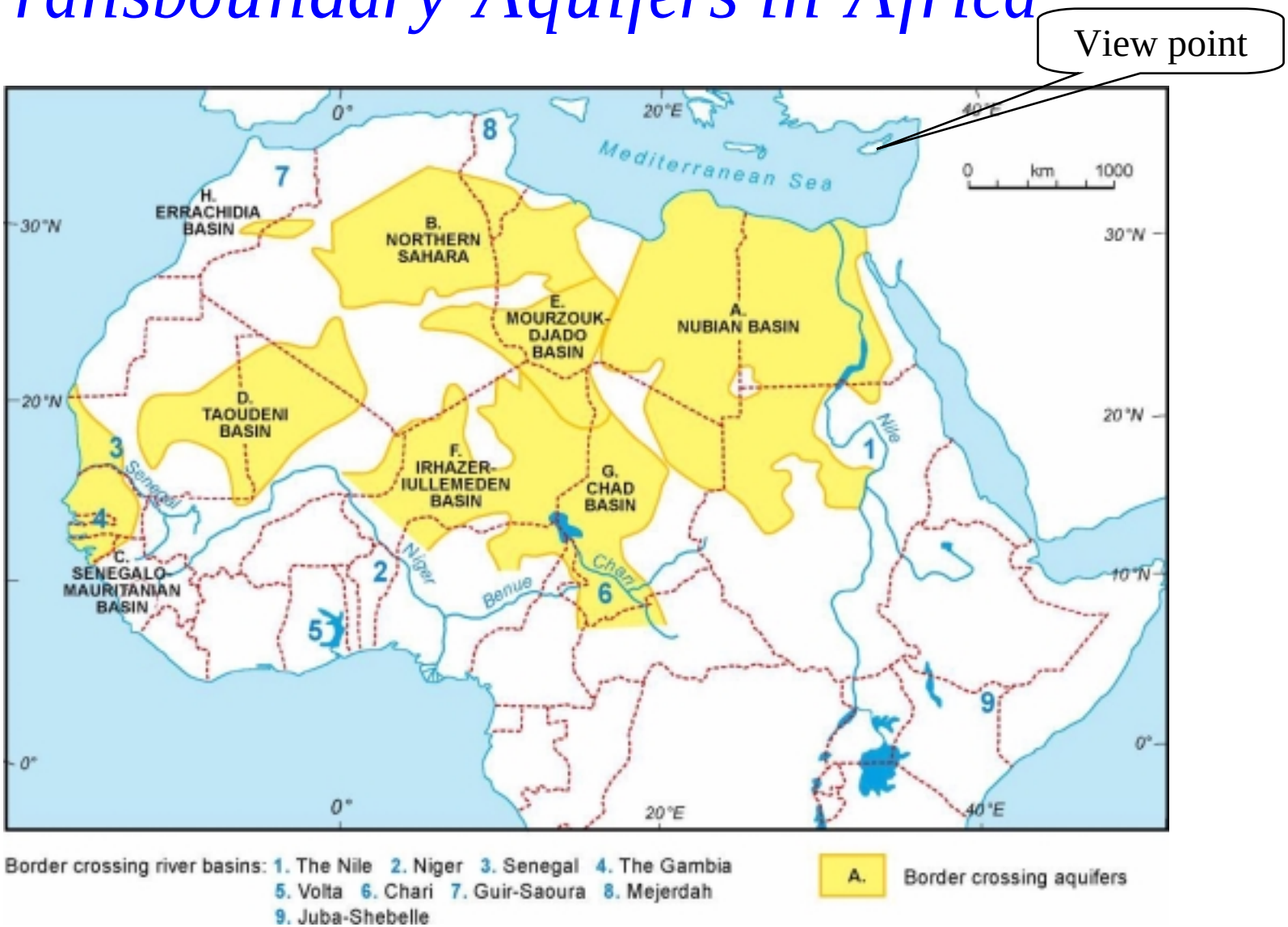
The Guarani aquifer system

International border
National border
Limit of Guarani Aquifer
Confined aquifer Paraná Basin
Confined aquifer Chaco-Paraná Basin
Unconfined aquifer

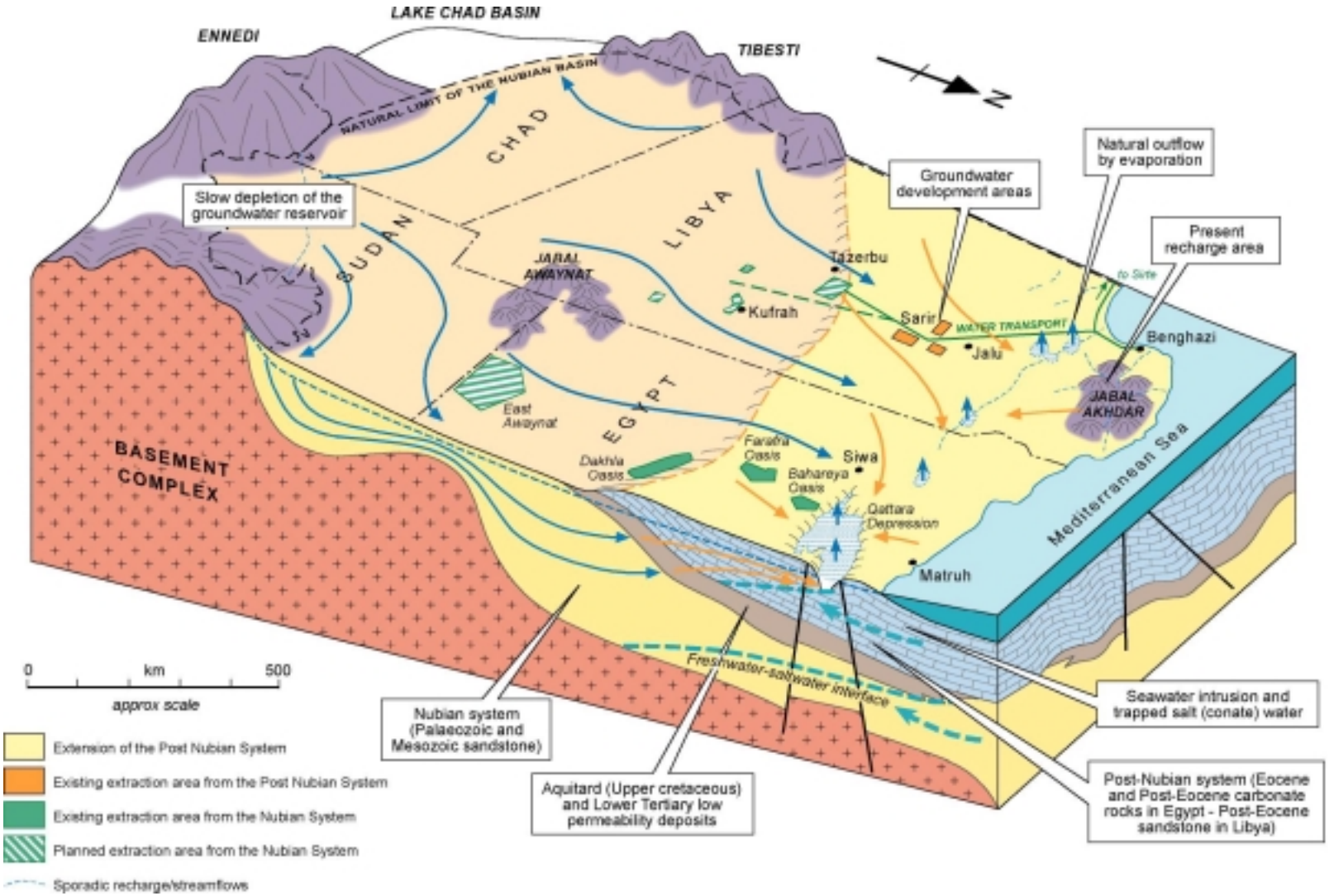
Regions of severe water shortage



Transboundary Aquifers in Africa



The Nubian system



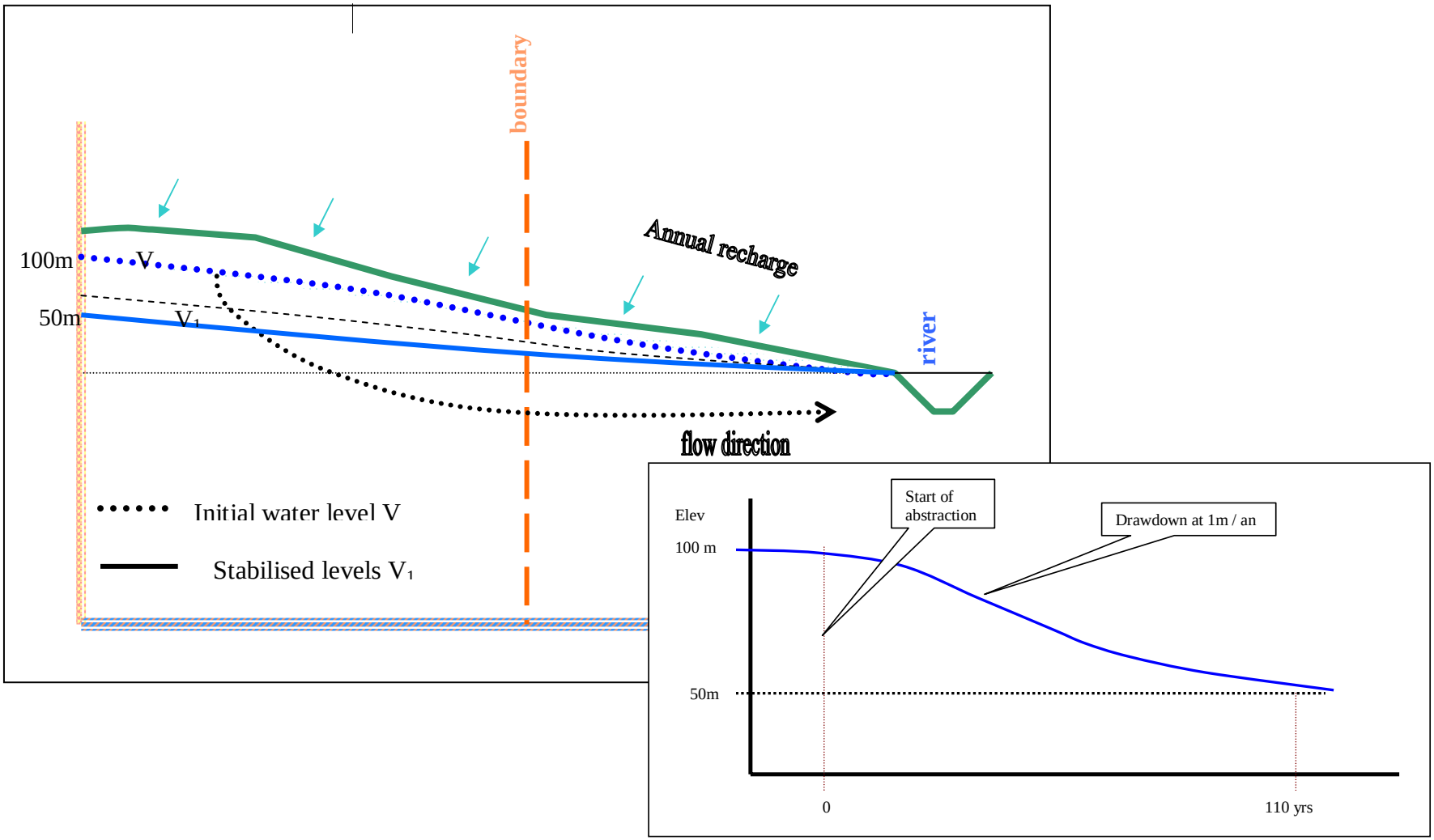
Water Resources Nubian Sandstone (Km^3)

Total surface area 2 176 800 km^2

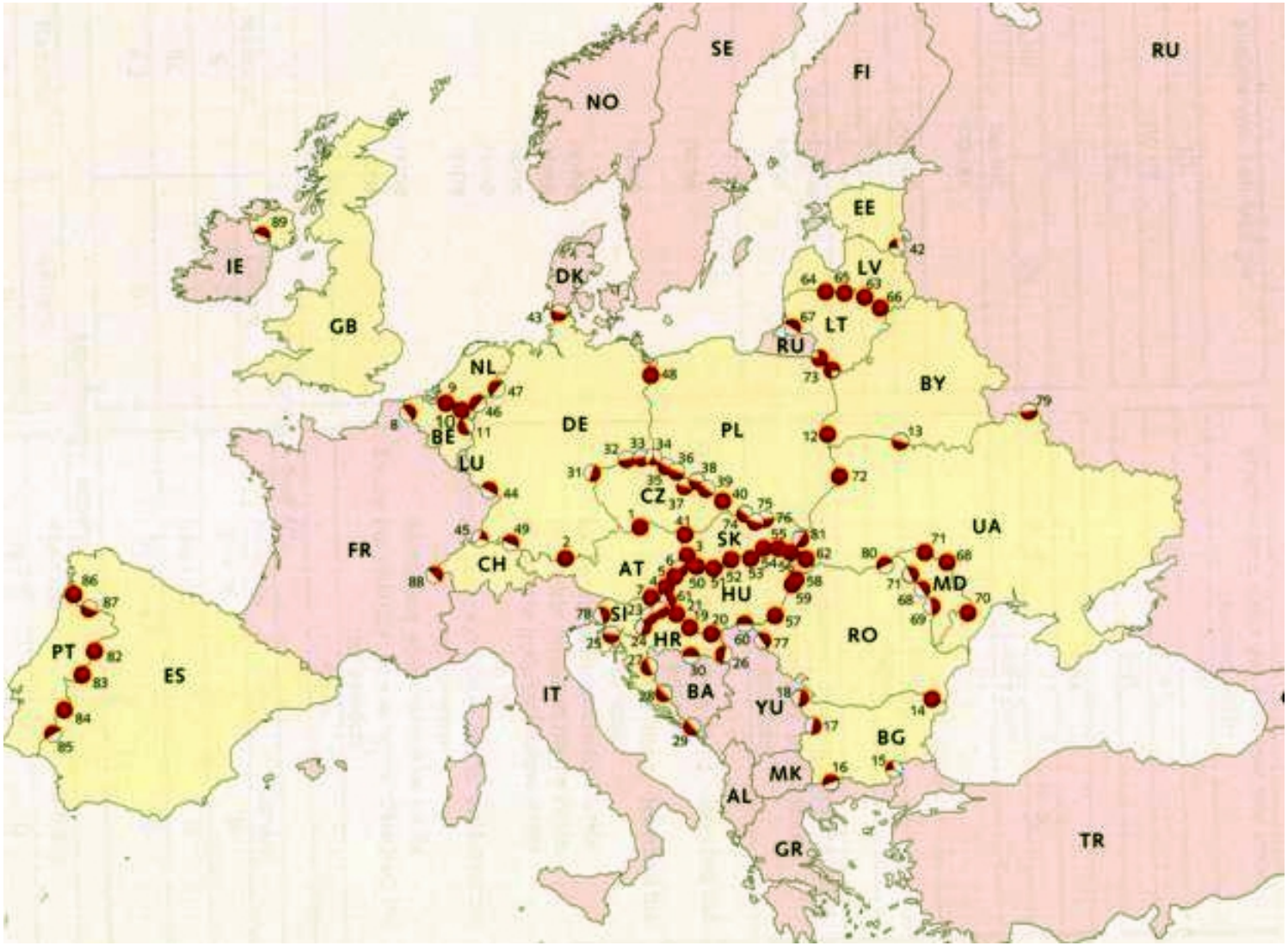
Country	**Total volume**	**Estimate of Recoverable volume**	**Present use Km^3/an**
Egypt	252210	5180	0.506
Libya	208280	5920	0.831
Chad	47810	1630	0.0
Sudan	33880	2160	0.833*

* Nubian in the Nile Basin

The delayed response

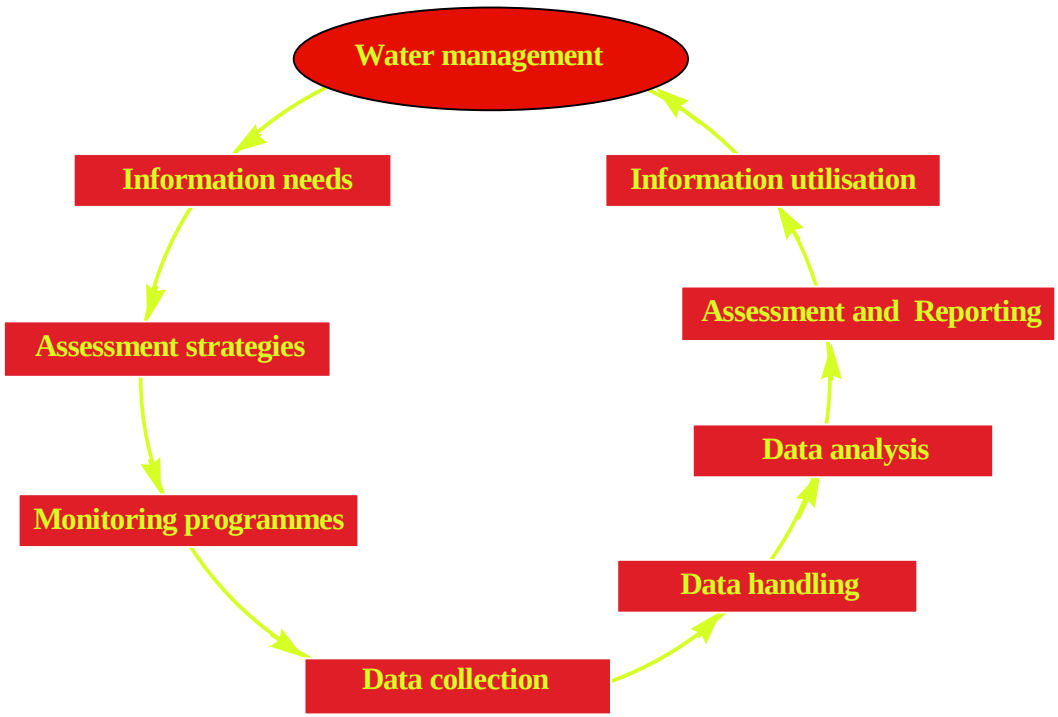


Transboundary aquifers in Europe



The UN ECE inventory for Europe: the lessons

- Guidelines for monitoring and assessment of transboundary aquifers
  - Identification / nomenclature
  - One aquifer = one monitoring system
  - Monitoring to be target oriented / tailor made
  - Standardisation of lab analysis, data storage & processing



Transboundary rivers & aquifers, some contrasts

Rivers	Aquifers
• Long linear features	• **Bulk 3-dimensional systems**
• Use of resources generally limited to vicinity of the river channels	• Resources may be extracted from and used extensively over outcrop & subcrop
• Replenishment always from upstream sources.	• **Replenishment may take place from any, or all of 3-dimensions.**
• Rapid & time constrained gain from replenishment	• Replenishment could be slow, net gain can be drawn upon over longer periods

Transboundary rivers & aquifers: some contrasts (2)

Rivers	Aquifers
• Abstraction has an immediate downstream impact	• **Abstraction impact can be much slower - can be 10's of years**
• Little impact on upstream riparian	• **Could have an equal impact on both upstream and downstream riparian**
• Pollution impacts transported down stream rapidly	• Slow movement of pollution
• Pollutant transport invariably downstream, upstream source may be unaffected	• Pollutant transport controlled by local hydraulics. An operating well may induce 'upstream' movement toward itself

Transboundary aquifers require careful evaluation

Because

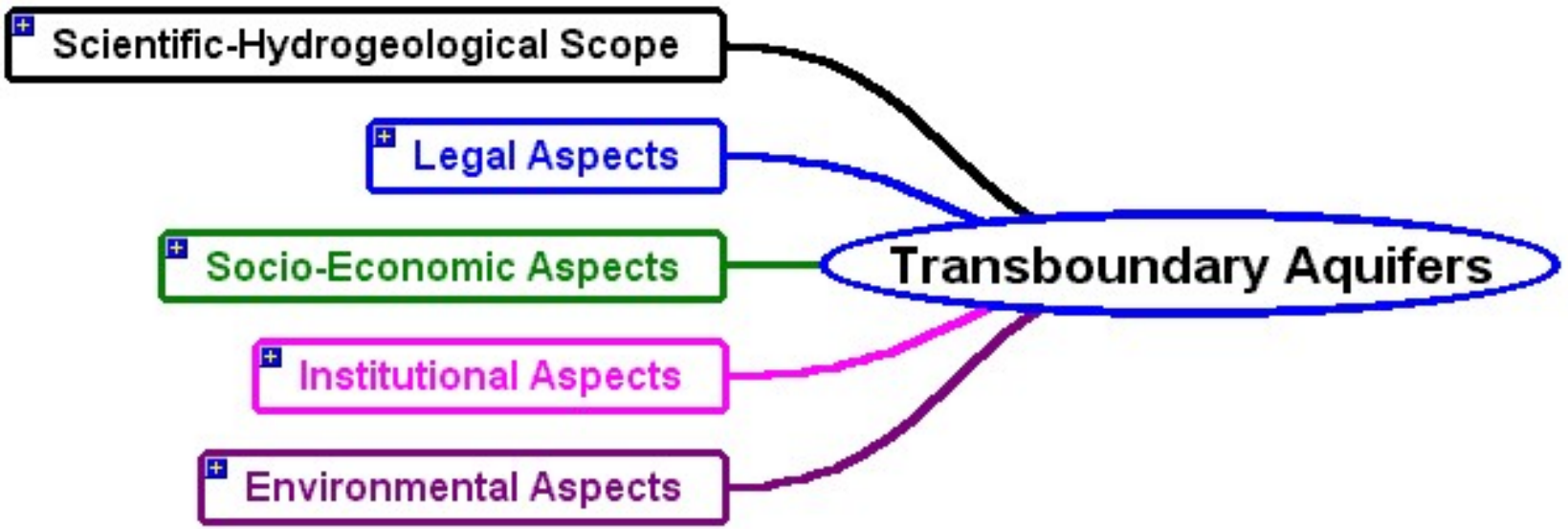
- Impacts are subtle
- Widely spread in space
- Delayed in time
- General lack of detailed data

What is the problem?

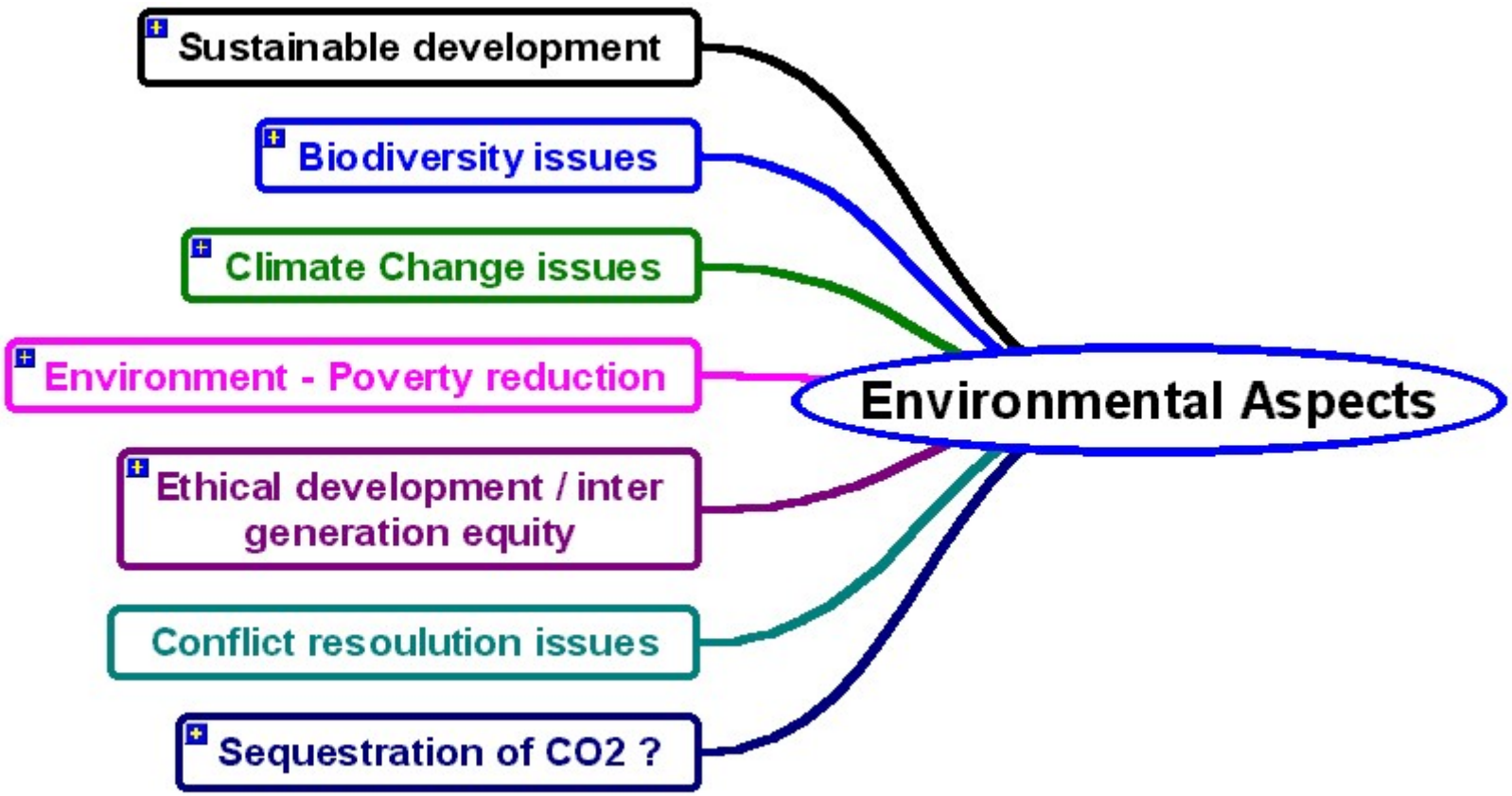
…….will virtual water do ??

The ISARM Programme:

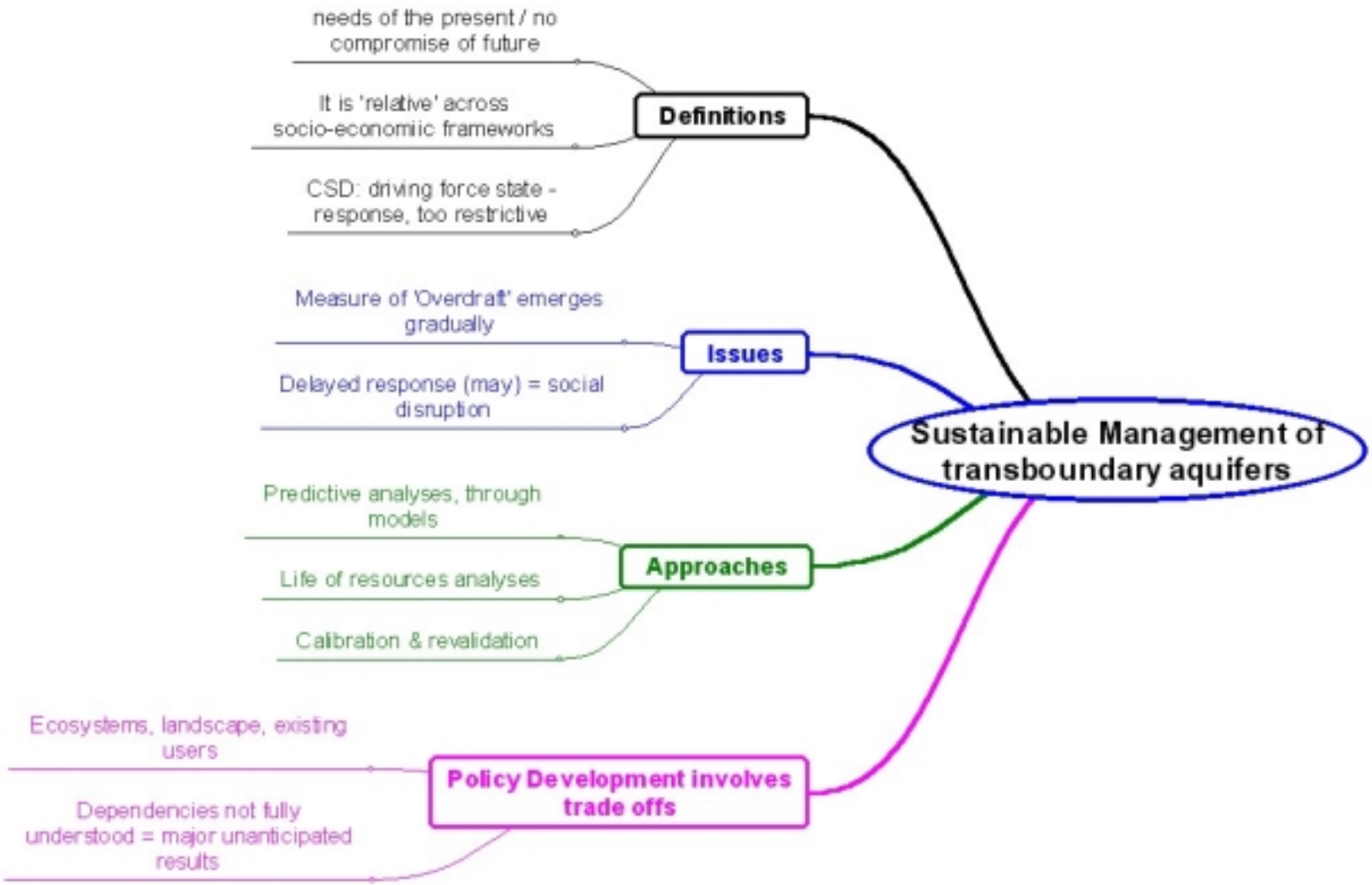
Multi disciplinary integrated approach



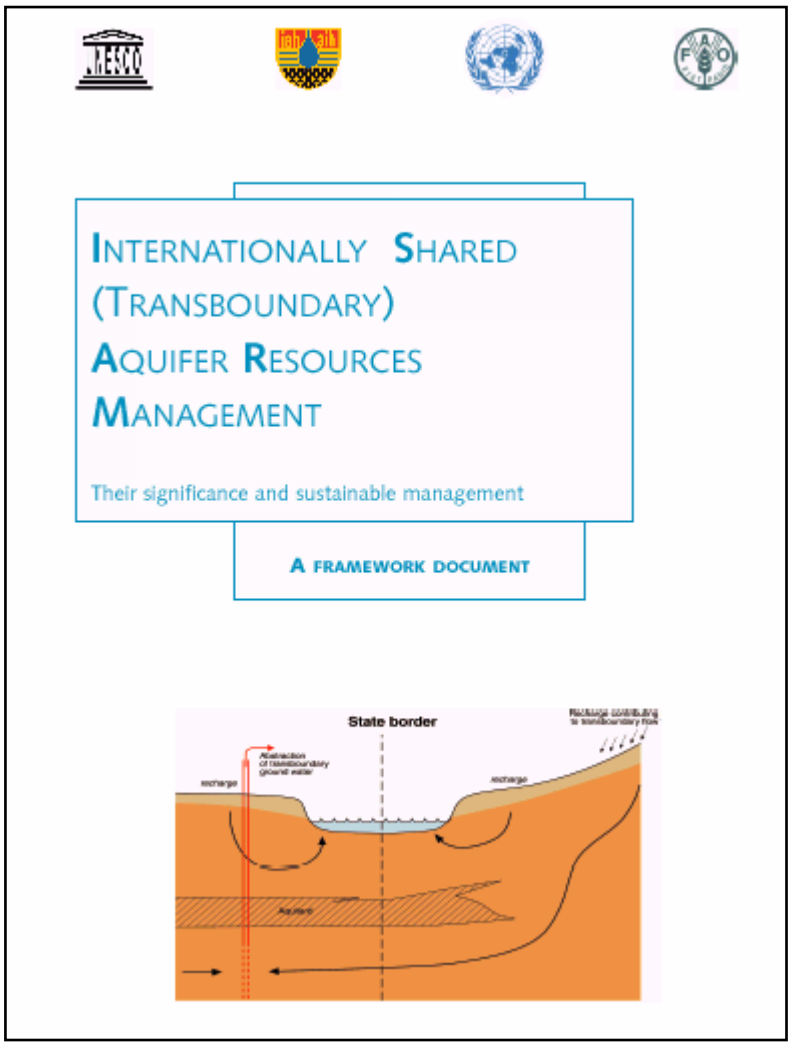
Environmental aspects



Sustainable Management of TAR's



A Framework Document



- Some copies & CD's available here
- Can be downloaded from the web

International Inventory of shared aquifers

Cooperation initiated with:

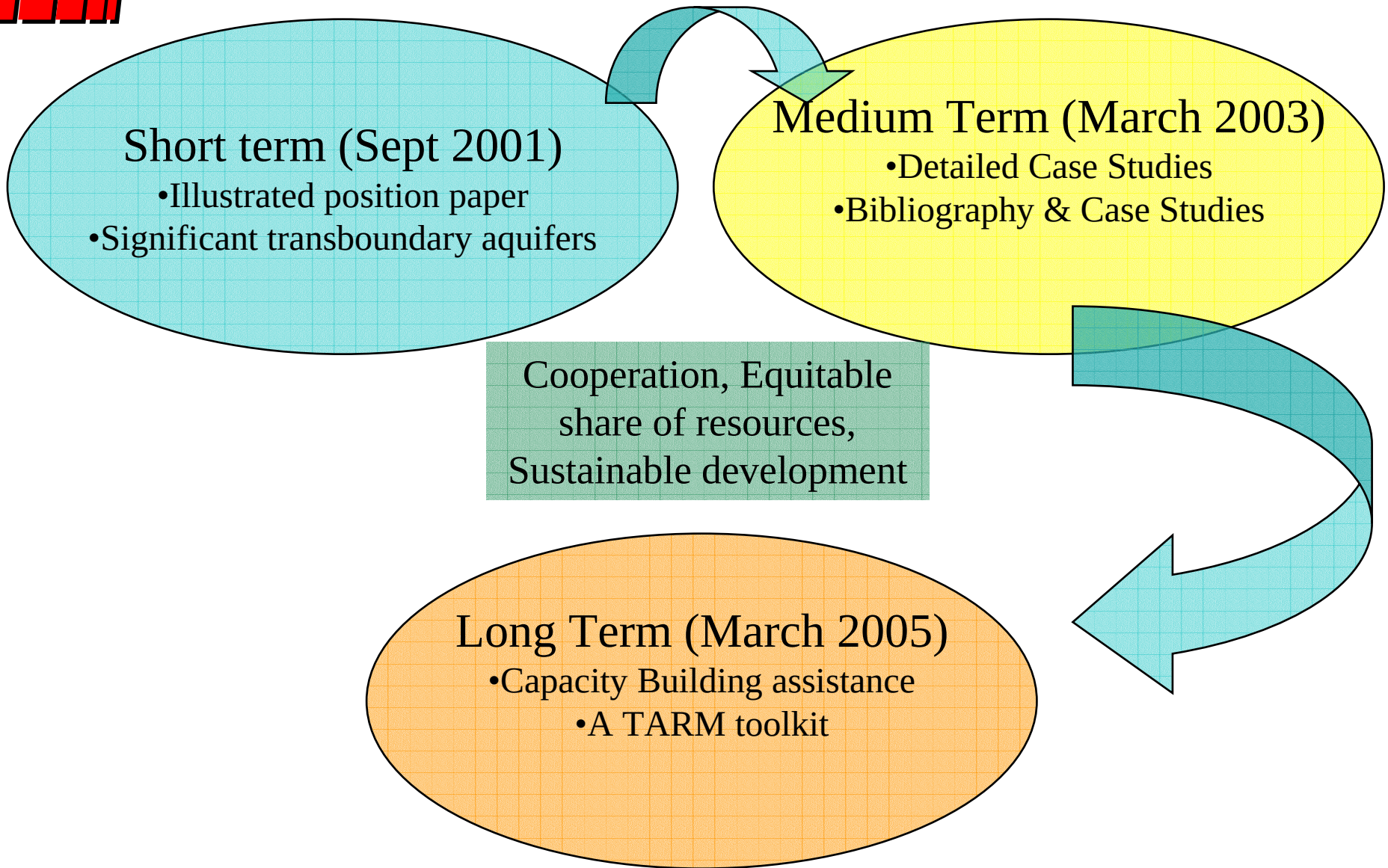
- SADC
- ESCWA
- EU Euro-Med Region
- UN ECE
- UN ECA
- OAS
- OSCE
- UNEP

EURO-MEDITERRANEAN REGION: SHARED AQUIFERS

Desk Survey carried out for ESCWA

INFORMATION	Country A	Country B	COMMENTS & FIGURES
Location:			
geographical region			
Length Shared Boundary (km)			
Areal Extent (km^2)			
Basic Hydrogeology:			
Aquifer Name			
Type			
Age			
Direction Flow			
Recharge			
Discharge			
Hydraulic Conductivity			
Storage			
Groundwater Resource Management			
Main Utilisation			
Monitoring			water levels
No. Obs BH			x-sections
Potential Risk			
Vulerbility			
Water quality			
Legal Framework			
Existing			
Proposed			
??? Law			
Socio-Economic Impacts			
Social Indicators			
GNP			
Environmental Issues			

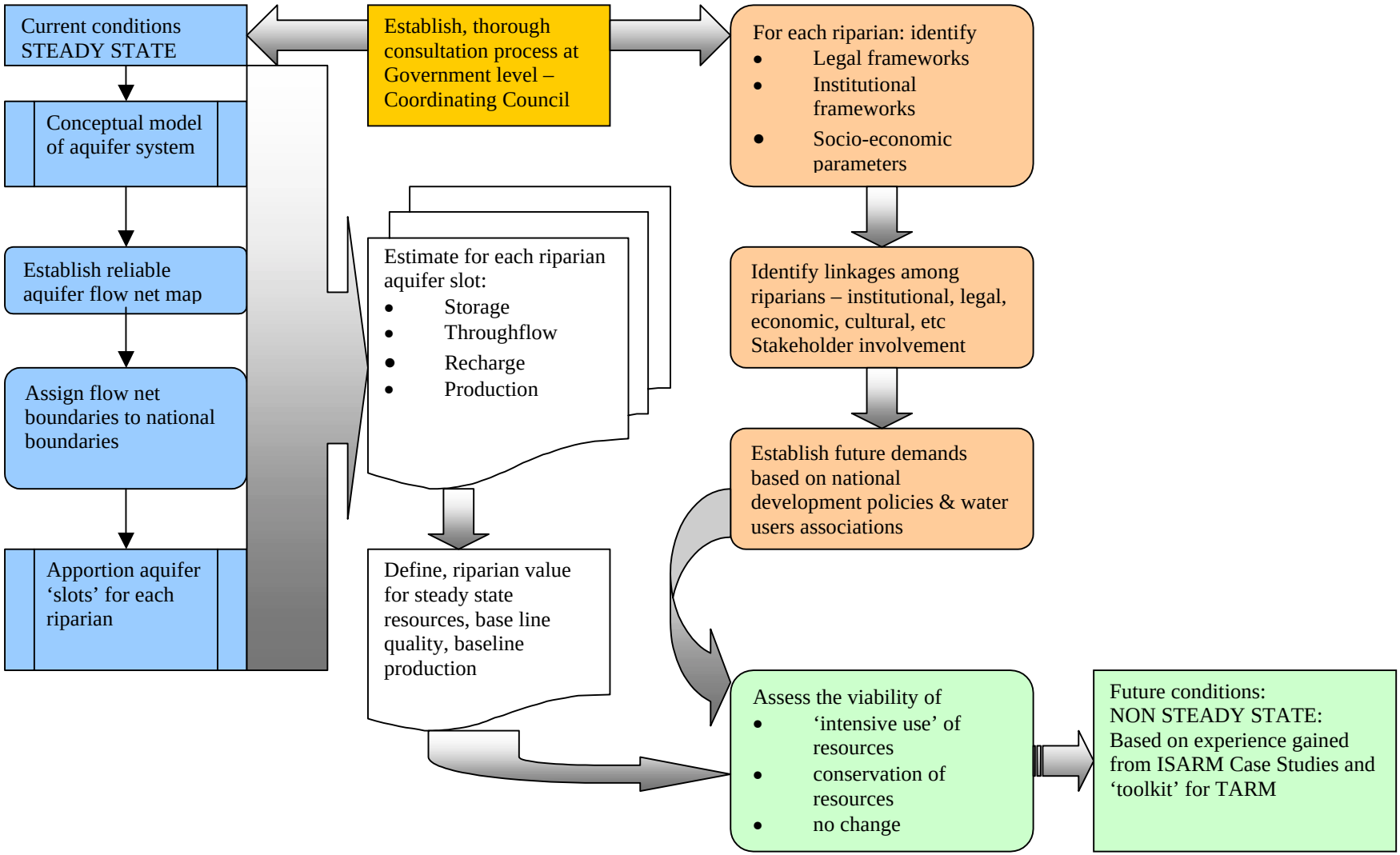
Six year work programme



Case Studies in ISARM Framework Document

North-western Sahara Aquifers Systems	• *Shared by Algeria, Tunisian & Libya*
The Nubian Aquifer System	• *shared by Egypt Libya, Sudan, Chad*
The Karoo / Kalahari Aquifer System	• *shared by Botswana, Namibia, Angola & Zaire*
The Iullemeden Aquifer System	• *shared by Algeria, Mali, Niger and partly in Nigeria.*
The Guarani Aquifer System	• *shared by Argentina, Brazil, Paraguay and Uruguay*
Vechte waterway	• *Shared by Netherlands, Germany*
Praded region	• *Shared by Czech Rep – Poland*
The Slovak Karst – Aggtelek aquifer	• *Shared by Slovak Rep – Hungary*

Approaches to sound management for intensive use



Some key challenges?

- How to integrate transboundary aquifers into transboundary water resources ?
- In river basins & aquifers that do not coincide, what policy issues to be addressed?
- Globally, how many *significant* transboundary aquifers are there ?
- How to adapt existing international regulation to the multifarious aquifer conditions ?
- Outreach of the ECE's pioneering survey – into the CIS Region, Euro-Med Region, ECA Region?

Aquifers only obey hydraulic heads !

Aquifers Know No Boundaries

International law and case studies have addressed transboundary surface water resources, but limited attention has been given to aquifers and the allocation of water rights. One case in point is the Rum-Saq Aquifer, which underlies Jordan and Saudi Arabia.

Scott Wilson Kirkpatrick (SWK), a development consultancy headquartered in Basingstoke, United Kingdom, investigated the Rum Aquifer from 1991 to 1996 for Jordan's Ministry of Water and Irrigation. This is the Qa Disi Aquifer referred to in the July 1995 *International Ground Water Technology* article, "A Look at Mideast Ground Water Resources" by John Houston.

Jordanian officials believe the Rum Aquifer has the potential to play a strategic role in meeting its national water demands. It supplies water to Aqaba, the Red Sea port, and it is recognized as vitally important to the entire country. A study is now being conducted to measure the feasibility of constructing a 350-kilometer pipeline to carry water abstracted from the aquifer beneath the southern Jordanian desert to Amman, the capital city in the north.

Based on 3-D model simulations and appropriate resource management strategies, we have estimated that the aquifer could supply 100 to 150 million cubic meters of water per year (MCM/year) for 40 years. This is in addition to existing abstractions, estimated in 1993 as 75 MCM/year, for a total of 175 to 225 MCM/year — far greater than the 17 to 19 MCM/year estimated in the late 1970s.

However, the question of further abstraction is clouded because the aquifer also underlies a large part of Saudi Arabia, where it's known as the Saq