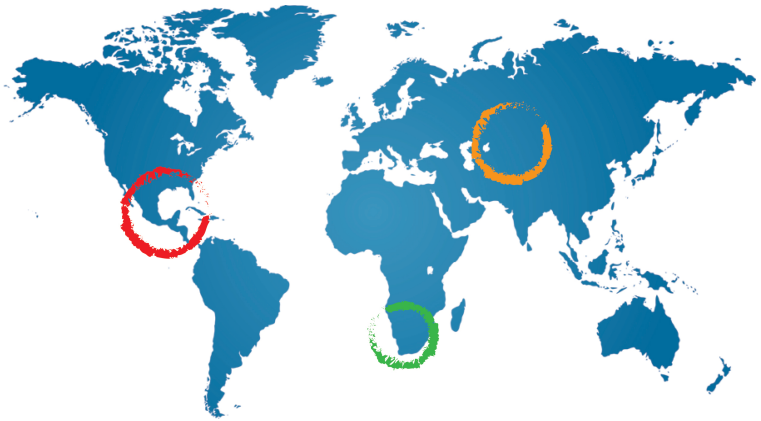
GROUNDWATER RESOURCES
GOVERNANCE
in TRANSBOUNDARY AQUIFERS

(GGRETA Project)



Stampriet – Kalahari/Karoo Aquifer Case Study

Technical Seminar on Project Implementation

Project Methodology

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Pretoria

GGRETA - Stampriet project at a glance

- Water Diplomacy Cluster of Swiss Agency for Development Cooperation (SDC)
- Project targets:
  - Improve knowledge and recognition of importance and vulnerability of TBAs
  - Enhance cooperation and water security
- 3 aquifers: Central America (Trifinio), Central Asia (Pretashkent), Southern Africa (Stampriet)
- Stampriet: South Africa, Botswana and Namibia
- Two components

GGRETA - Stampriet project at a glance

- Component 1:
  - Building recognition of the shared nature of the resource, and mutual trust through joint fact finding and science based diagnostics

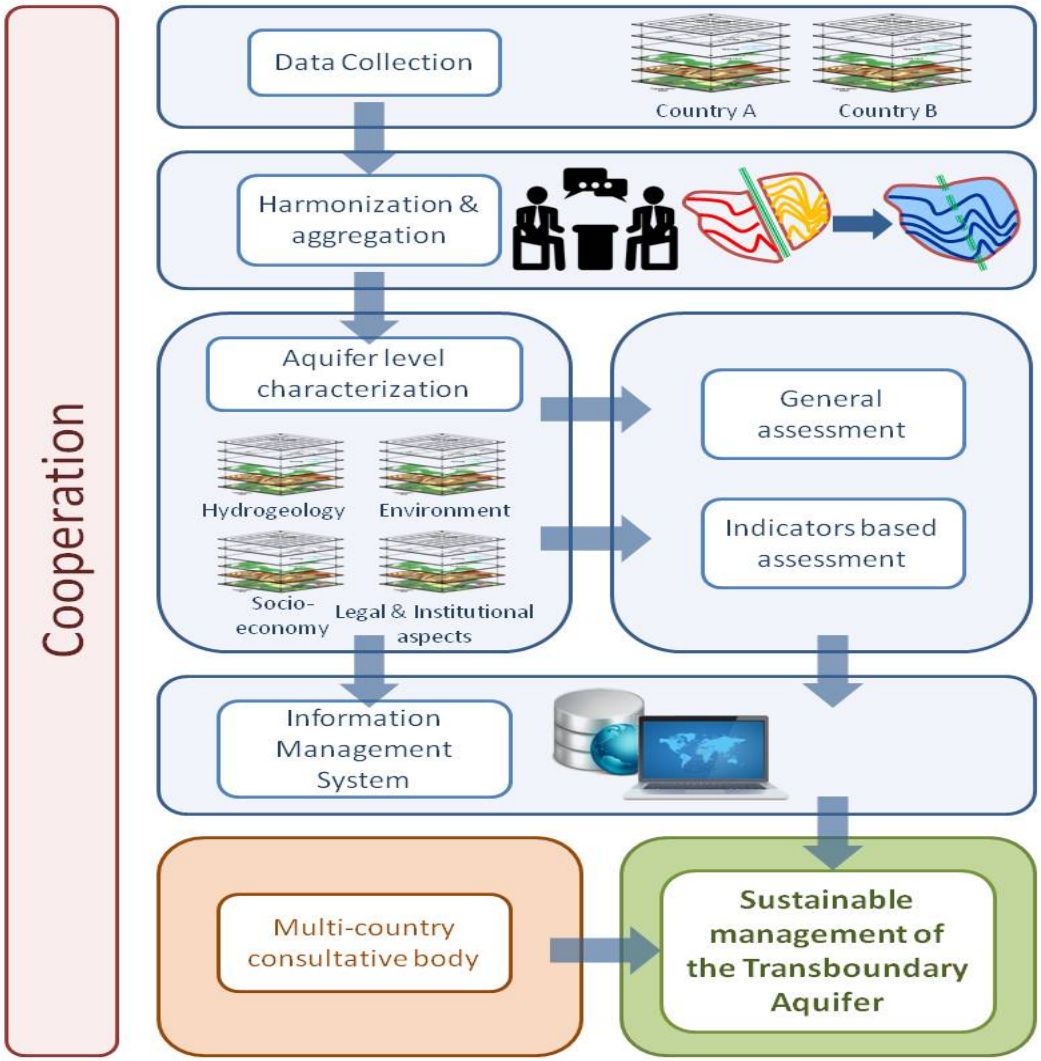
- Component 2:
  - Reaching consensus on transboundary governance mechanisms

GGRETA - Methodology

To simplify complex systems

GGRETA - Methodology

- **Multi-disciplinary assessment:**
  - Hydrogeology
  - Environmental & Socio-economic (incl. gender)
  - Legal & Institutional (incl. gender)
- **Indicators based assessment**
  - Existing data
- **Target group for outputs is non-technical:**
  - Managers, Decision makers, Stakeholders incl. general Public



GGRETA – Data to be collected

Parameters and variables to be collected	Priority for data collection*	Indicators** 1.1 Mean annual groundwater recharge depth (mean annual recharge volume per unit of area)	1.2 Annual amount of renewable groundwater resources per capita	1.3 Natural background groundwater quality	1.4 Aquifer buffering capacity	1.5 Aquifer vulnerability to climate change	1.6 Aquifer vulnerability to pollution	2.1 Human dependency on groundwater (Is definition of "human water uses" unambiguous?)	2.2 Human dependency on groundwater for domestic water supply	2.3 Human dependency on groundwater for agricultural water supply	2.4 Human dependency on groundwater for industrial water supply	2.5 Ecosystem dependency on groundwater	2.6 Prevalence of springs	3.1 Groundwater depletion	3.2 Groundwater pollution	4.1 Population density	4.2 Groundwater development stress	5.1 Transboundary legal framework****	5.2 Transboundary institutional framework****	6.1 Control of groundwater abstraction****	6.2 Groundwater quality protection****
A. Physiography and climate																					
A.1. Temperature***	1	X	X		X	X															
A.2. Precipitation***	1	X	X		X	X															
A.3. Evapo-transpiration	1	X	X		X	X															
A.4. Land use / land cover***																					
A.4.1. Groundwater-fed agricultural land	3																				
A.4.2. Groundwater irrigated land	3																				
A.4.3. Groundwater supported wetlands and ecosystems	3																				
A.4.4. Areas with land subsidence	3																				
A.5. Topography and elevation***	2						X														
A.6. Surface water network (rivers, lakes, swamps, reservoirs, canals, etc)	3																				
B. Aquifer Geometry																					
B.1. Hydrogeological map	3																				
B.2. Geo-referenced boundary of the Transboundary Aquifer	1	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
B.3. Depth of water table/piezometric surface	2						X														
B.4. Depth to top of aquifer formation	2					X															
B.5. Vertical thickness of the aquifer																					
B.6. Degree of confinement						X															
B.7. Representative cross-sections																					
C. Hydrogeological characteristics																					
C.1. Aquifer recharge																					
C.1.1. Natural recharge						X											X				
C.1.2. Return flows from irrigation						X											X				

1. Data to be collected

2. Indicators calculated from data collected

GGRETA – Data to be collected

- **Hydrogeology:**

A. Physiography and Climate

Temperature, Precipitation, Evapo-trasnpiration, Land use, Topography and Surface water network

B. Aquifer geometry

Hydrogeological map, Geo-referenced boundary of the Transboundary Aquifer, Depth of water table/piezometric surface, Depth to top of aquifer formation, Vertical thickness of the aquifer, Degree of confinement, Aquifer's cross section

C. Hydrogeological Characteristics

Aquifer recharge, Aquifer lithology, Soil types, Porosity, Transmissivity and vertical connectivity, Total groundwater volume, Groundwater depletion, Natural discharge mechanism, Discharge by springs

GGRETA – Data to be collected

- **Environmental & Socio-economic:**

D. Environmental

Suitable for human consumption (natural groundwater quality), Groundwater pollution, Solid Waste and waste water control, Shallow groundwater table

E. Socio-economic

Population (total and density), Groundwater and Surface water use, Dependence of industry and agriculture on groundwater, Percentage of population covered by public water supply, Percentage of population covered by public sanitation

GGRETA – Data to be collected

- **Legal & Institutional:**

  F. Transboundary legal and institutional framework

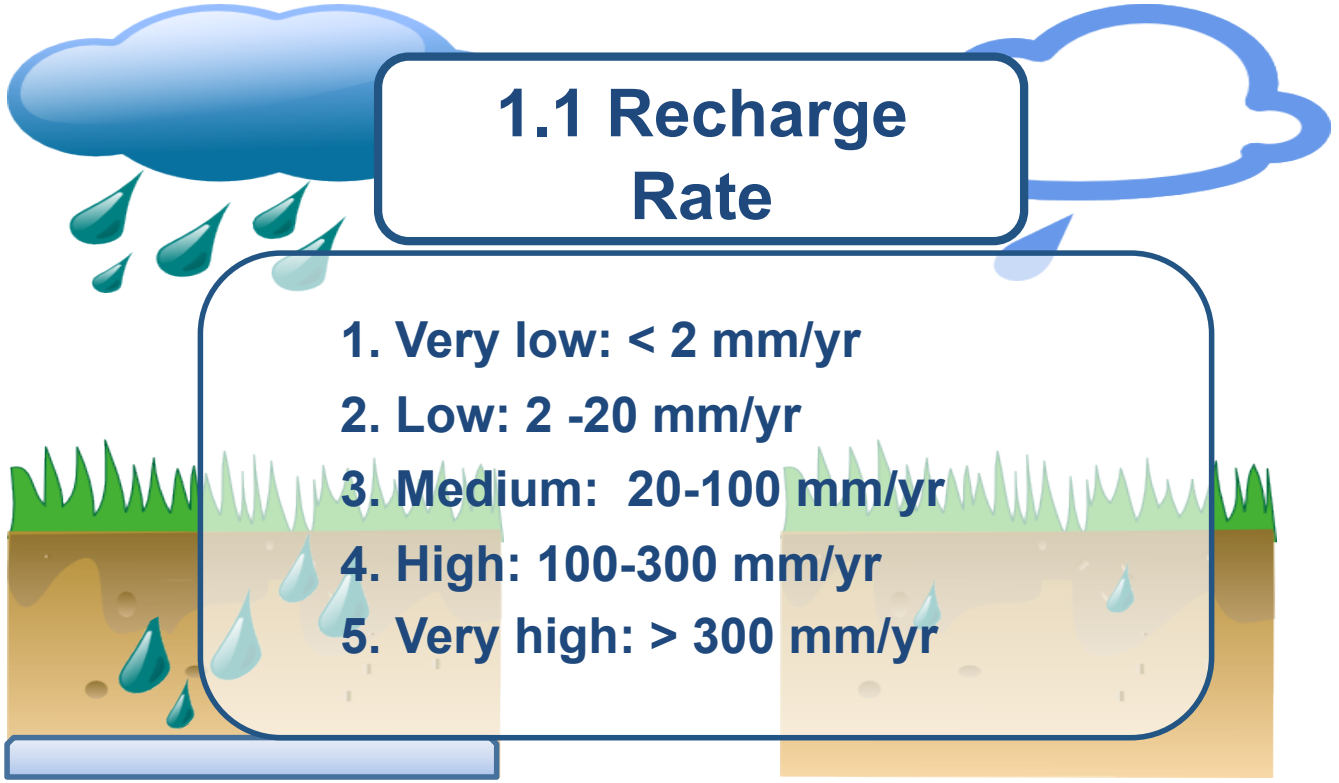
  Agreement, treaty, MoU

  I. Domestic legal and institutional framework

  Ownership of groundwater, Water resources planning, Groundwater resources abstraction and use, Abatement and control of groundwater pollution, Water resources protection measures, Government and non-government (including informal) water institutions, Implementation, administration and enforcement of the legislation on the statute books

GGRETA – Indicators

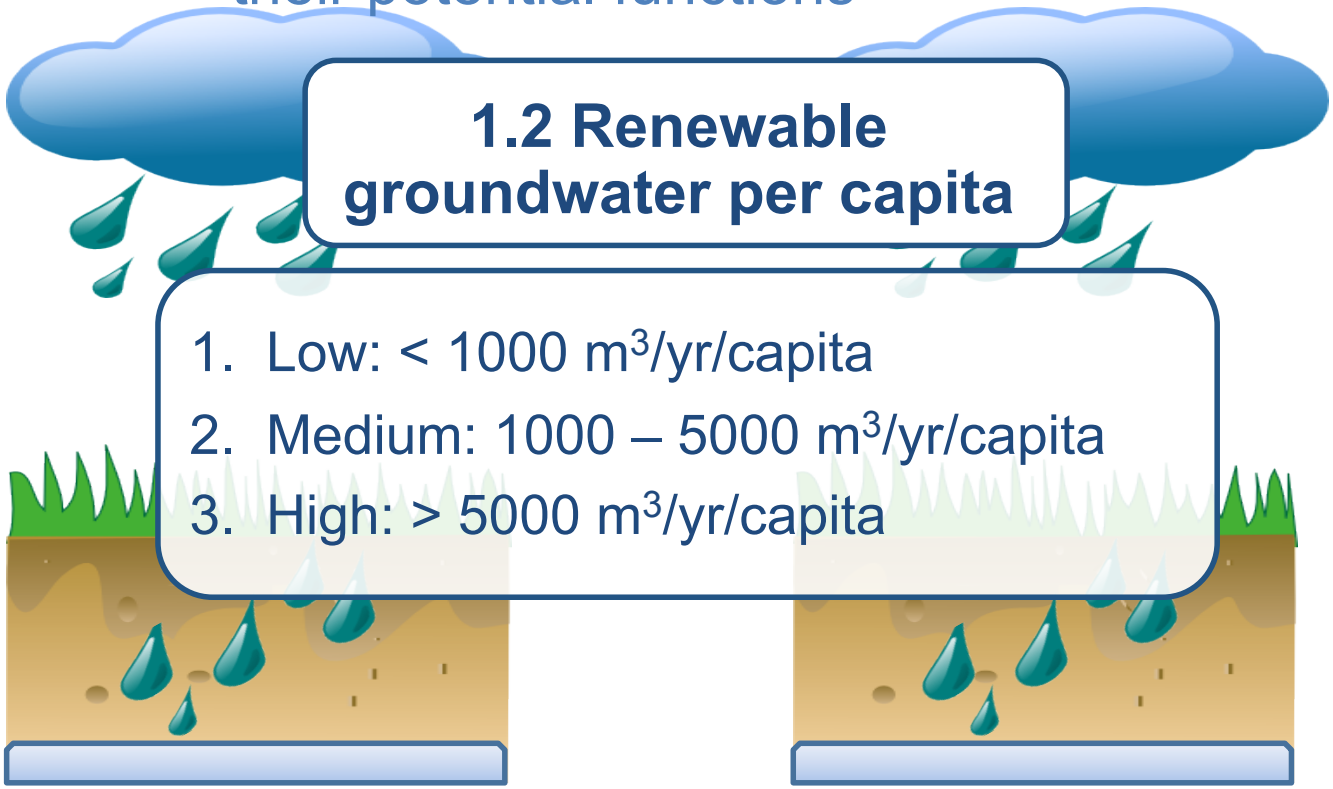
Indicator group 1: Defining or constraining the value of aquifers and their potential functions



Long term mean groundwater recharge, incl. man-made components.

GGRETA – Indicators

Indicator group 1: Defining or constraining the value of aquifers and their potential functions



Long term mean groundwater recharge volume, incl. man-made components, divided by inhabitants on aquifer.

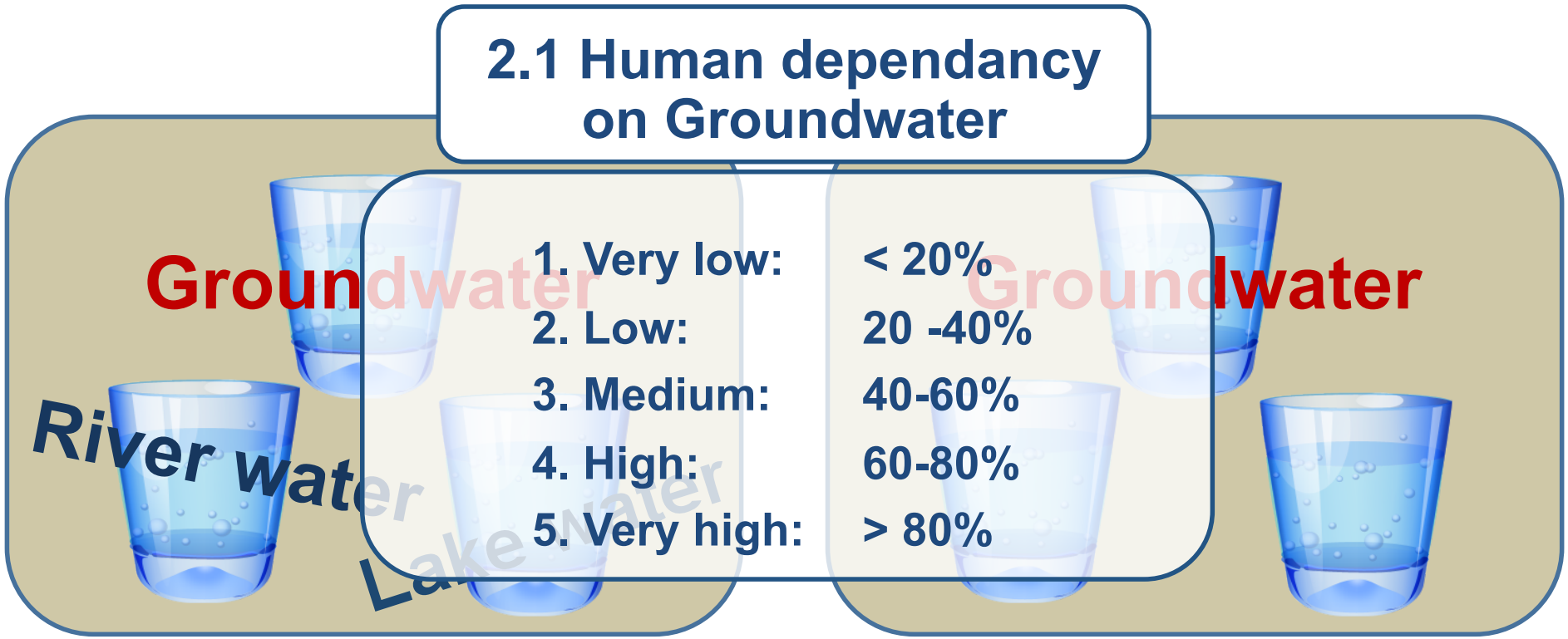
GGRETA – Indicators

Indicator group 1: Defining or constraining the value of aquifers and their potential functions

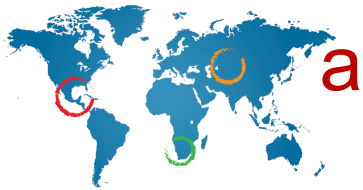
Percentage of aquifer area with natural groundwater quality satisfying local drinking water standards.

GGRETA – Indicators

Indicator group 2: Role and importance of groundwater for humans & environment



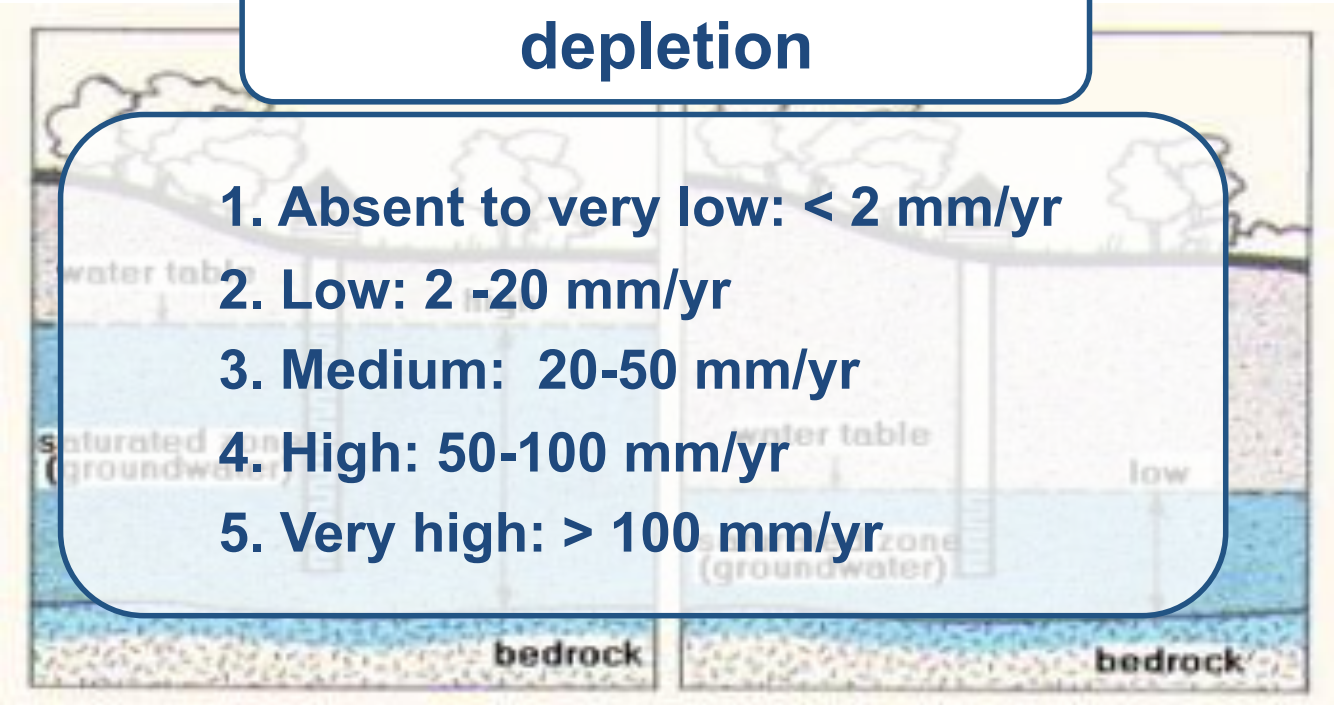
Percentage of groundwater in total water abstraction for all human water uses.



GGRETA – Indicators

Indicator group 3: Changes in groundwater state

3.1 Groundwater depletion

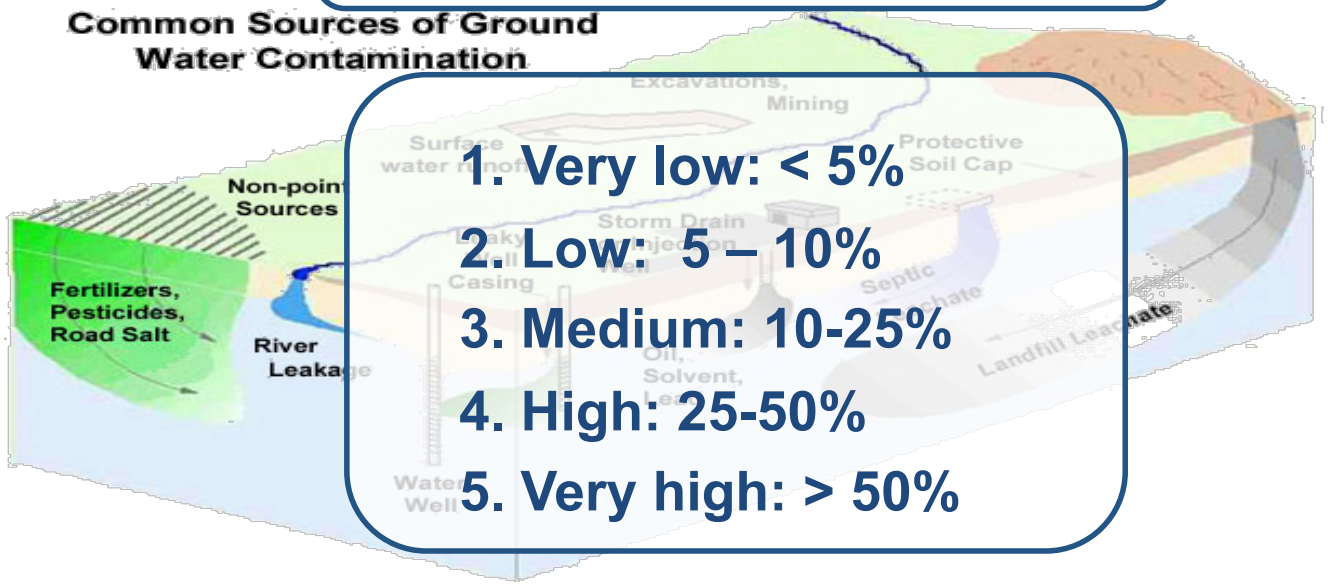


Current rate of long term decrease of groundwater storage averaged over aquifer area.

GGRETA – Indicators

Indicator group 3: Changes in groundwater state

3.2 Groundwater Pollution



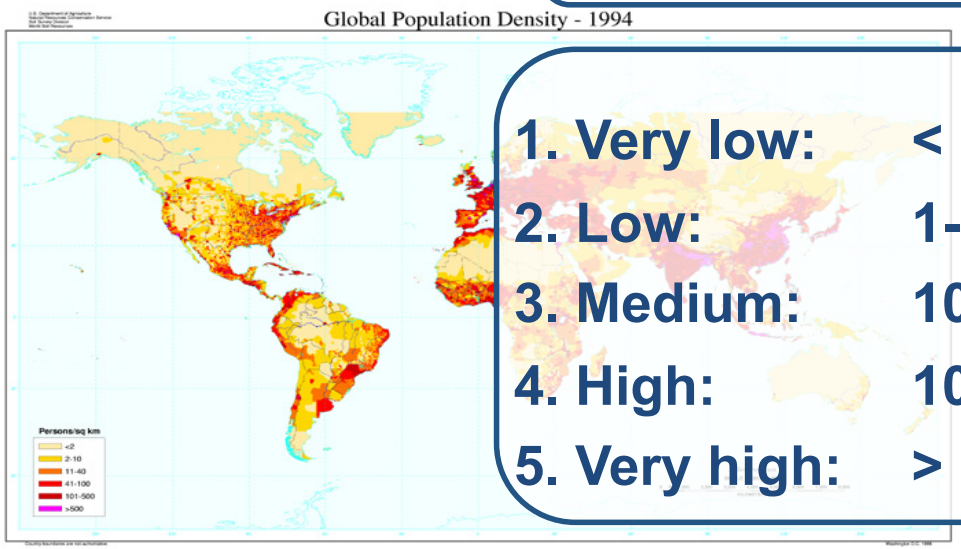
1. Very low: < 5%
2. Low: 5 – 10%
3. Medium: 10-25%
4. High: 25-50%
5. Very high: > 50%

Observed polluted zones as percentage of total aquifer.

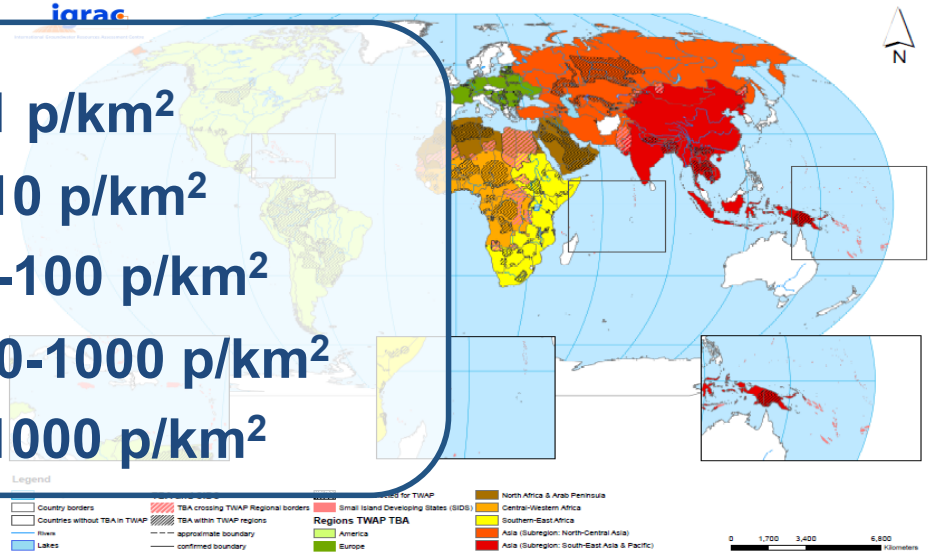
GGRETA – Indicators

Indicator group 4: Drivers of change and pressures

4.1 Population Density on Transboundary Aquifer



1. **Very low:** < 1 p/km²
2. **Low:** 1-10 p/km²
3. **Medium:** 10-100 p/km²
4. **High:** 100-1000 p/km²
5. **Very high:** > 1000 p/km²

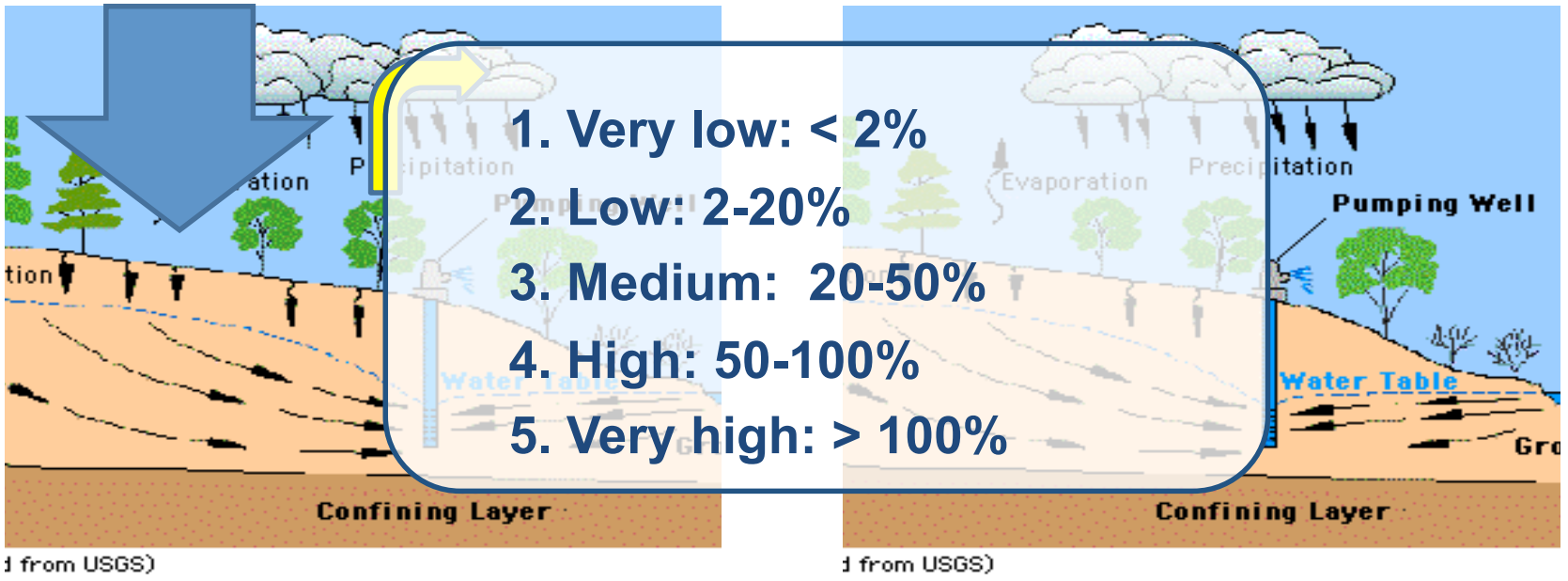


Number of people on top of aquifer per unit of area.

GGRETA – Indicators

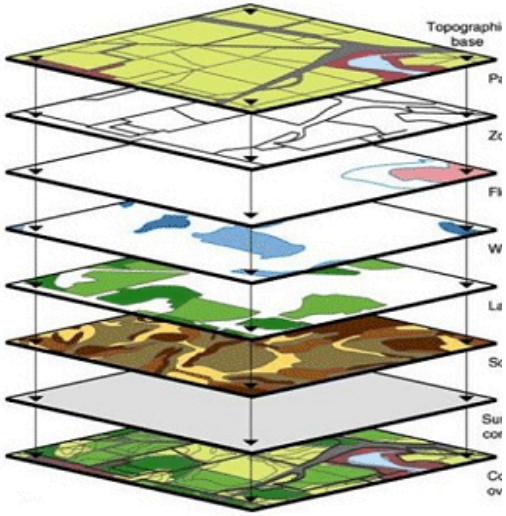
Indicator group 4: Drivers of change and pressures

4.2 Grondwater Development Stress (=Abstraction/Recharge)



Total annual groundwater abstraction divided by long-term mean annual recharge.

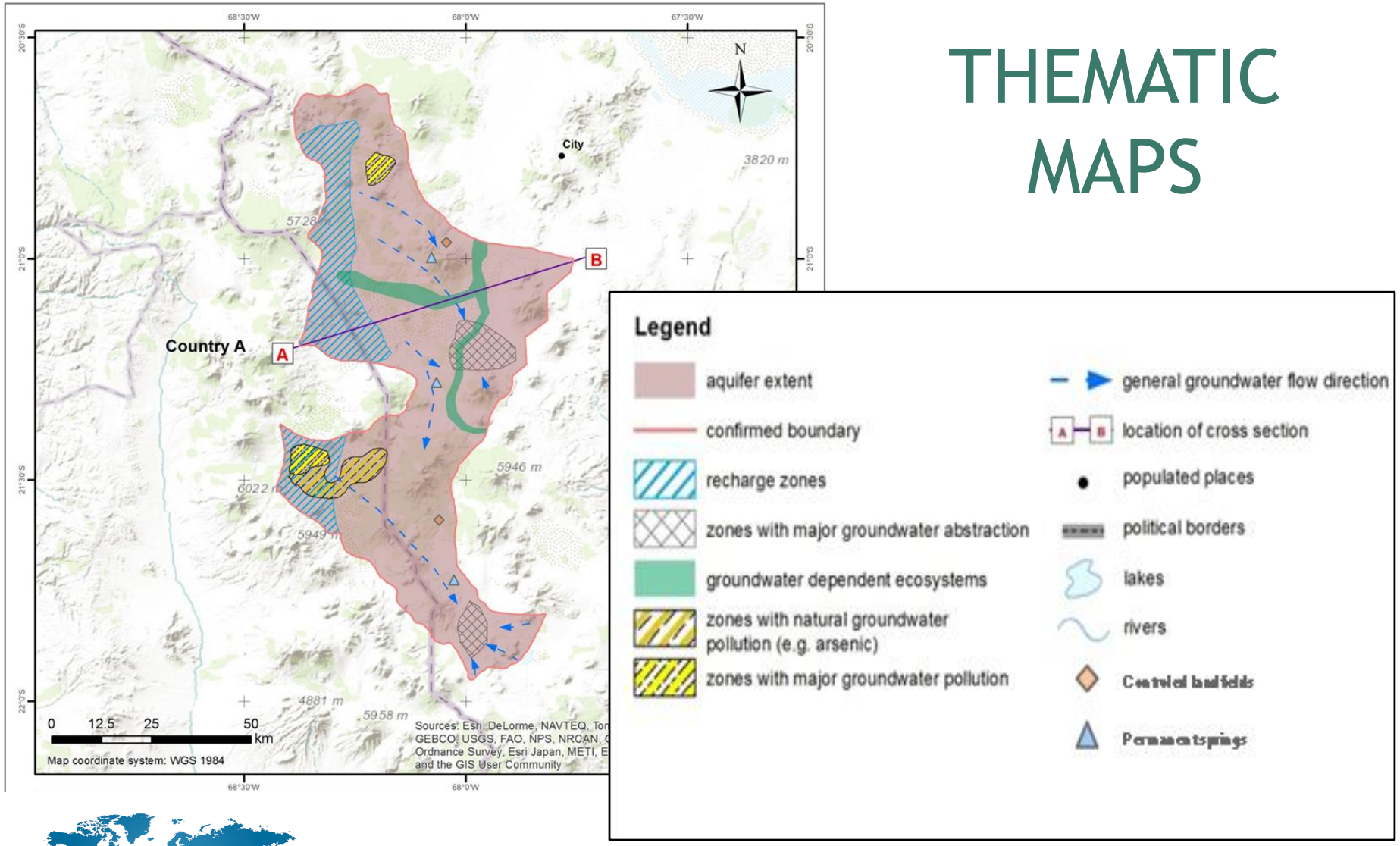
GGRETA – Visualization



- Not a database for ‘raw’ data, but a system which enable users to access interpreted data and documents.

- By combining / creating overlays of thematic maps new information is generated

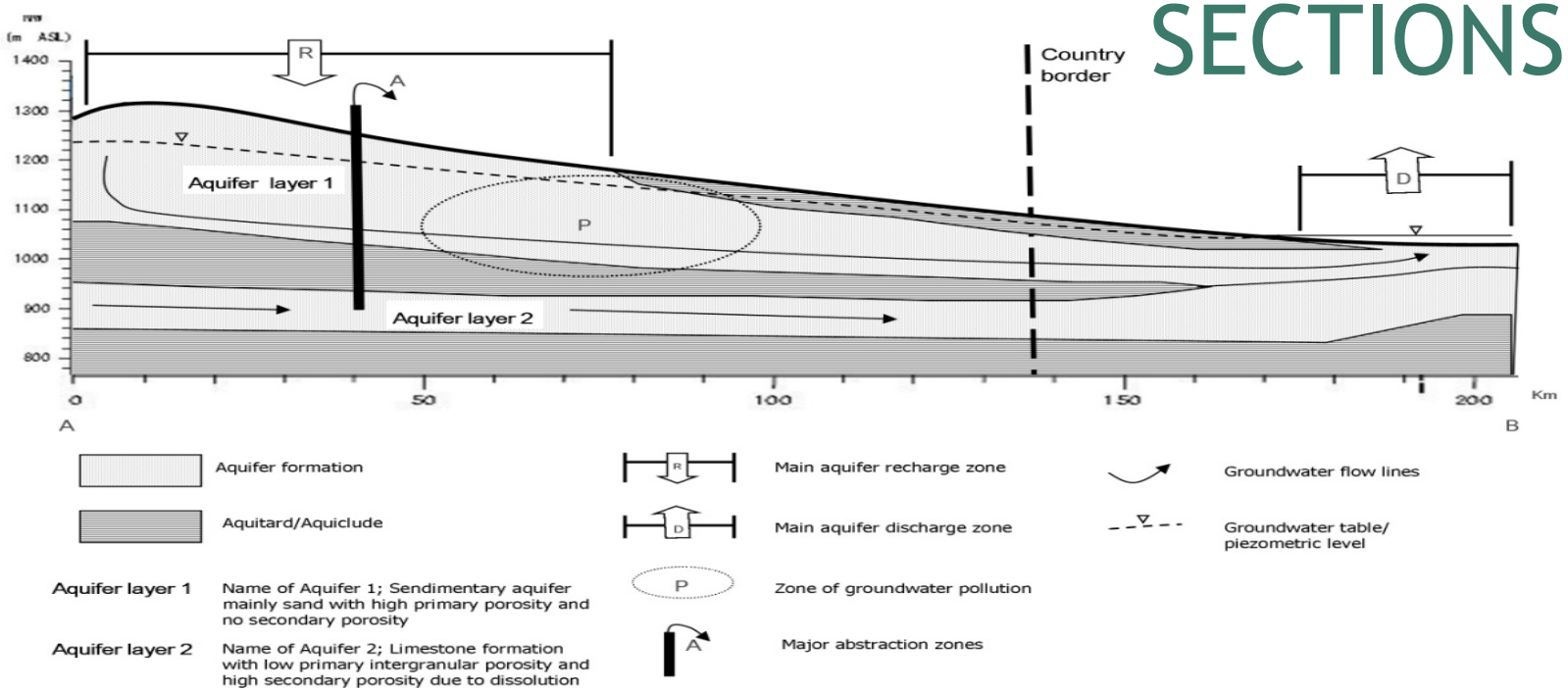
GGRETA – Visualization



THEMATIC MAPS

GGRETA – Visualization

SIMPLIFIED CROSS-SECTIONS



THANK YOU

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