Groundwater in Urban India

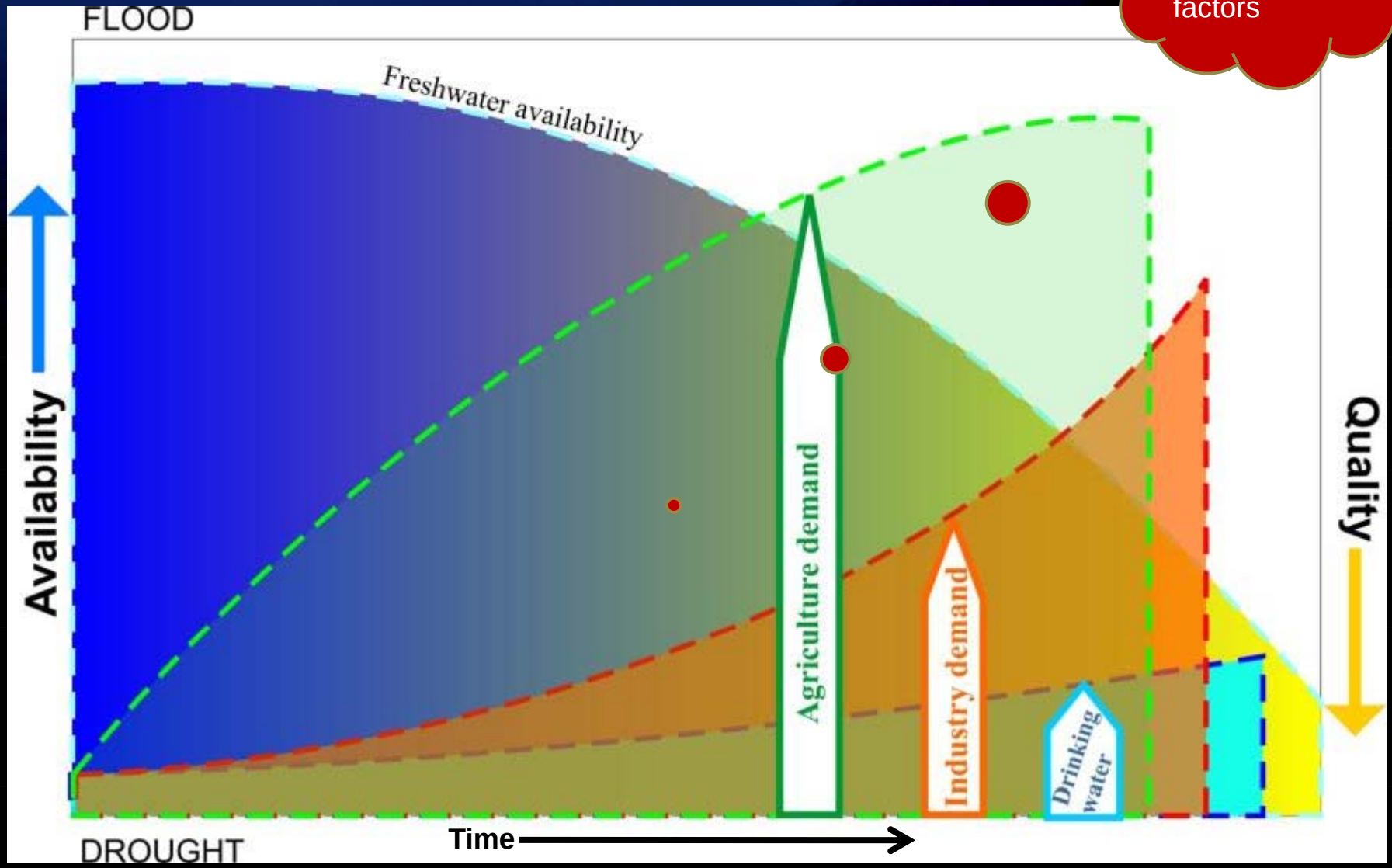
CSE: Anil Agarwal Dialogues, March 2013

The larger picture

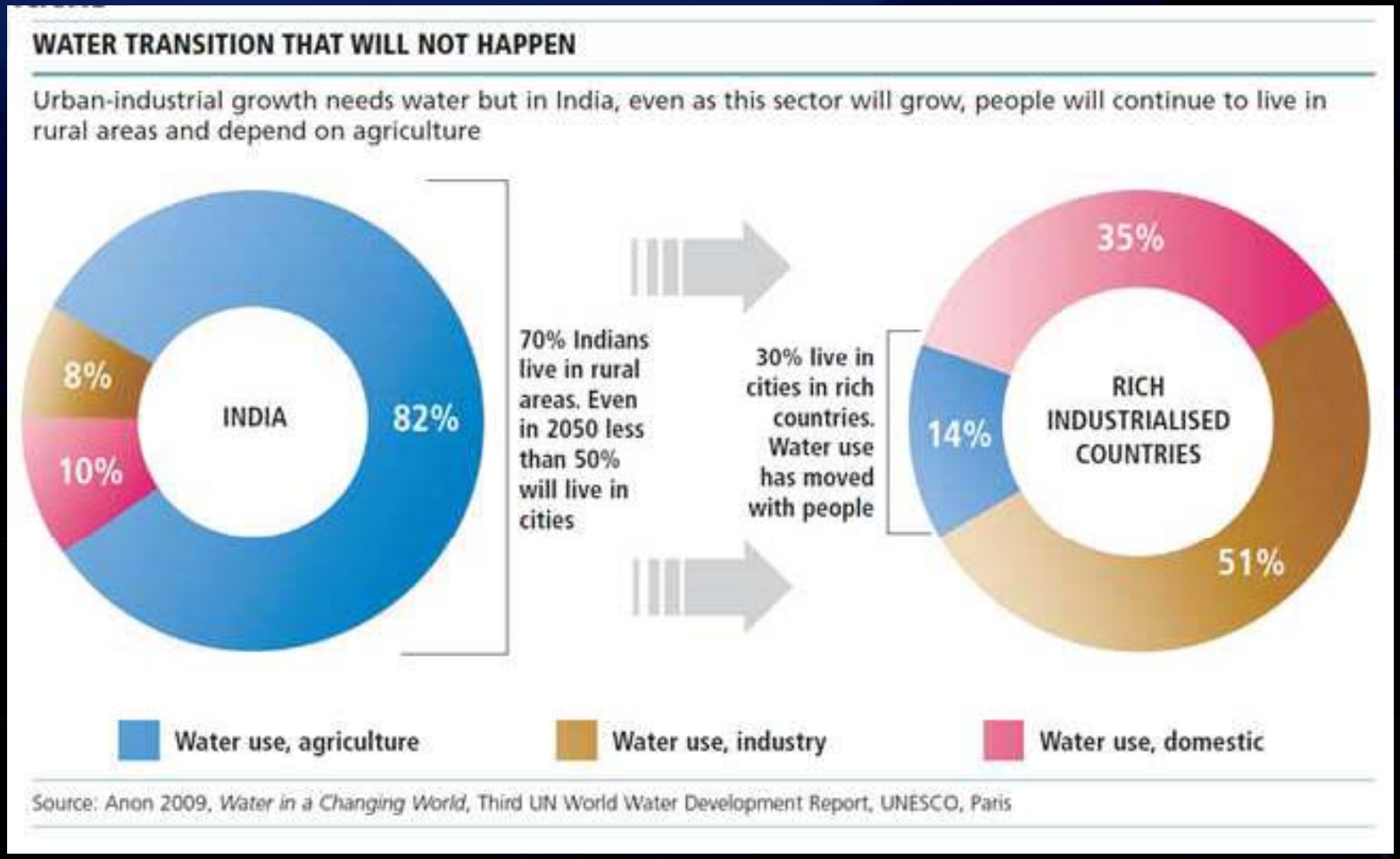
- Global estimate: more than 1.5 billion urban dwellers rely on groundwater, currently
- India: Groundwater share in urban water supply is 48% (*CSE, 2012)*
- Dependence on groundwater, especially in “developing cities”:
  - Population growth
  - Rapid urbanisation – city sprawl
  - Increased per-capita use
  - Higher ambient temperatures
  - Reduced reliability of intakes, especially from rivers
  - Demand & supply factors
  - Modest cost of water-wells (especially in India!)
- Conundrum of depleting groundwater and deteriorating quality (sanitation, solid and liquid wastes)

Freshwater availability and demand

Urban water is related to all these factors

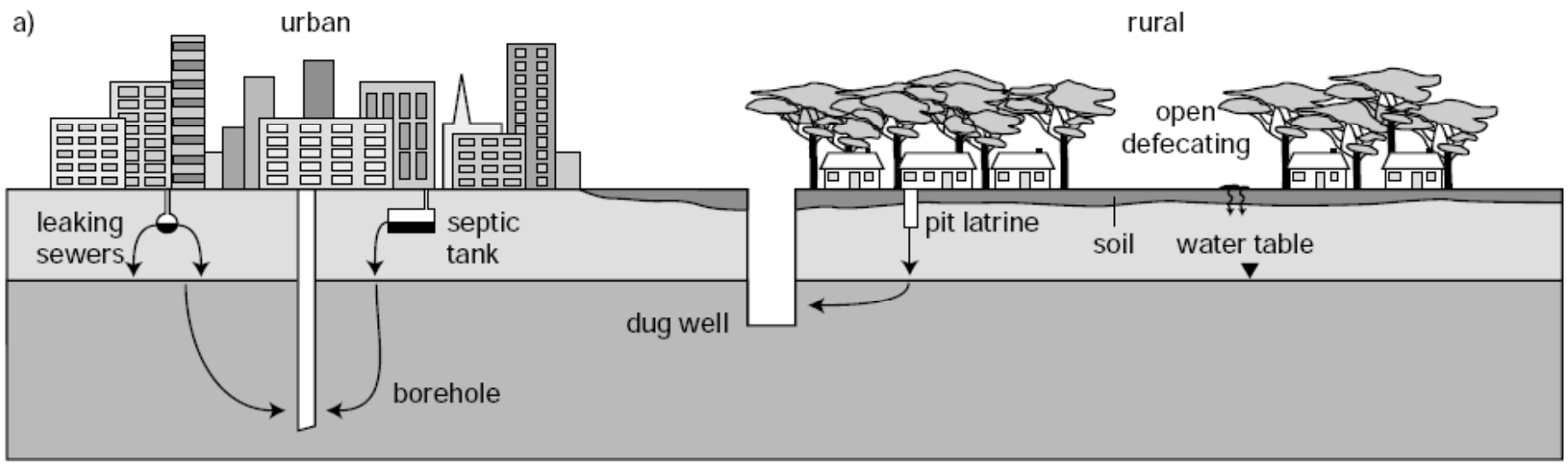


Will the picture change in India…?



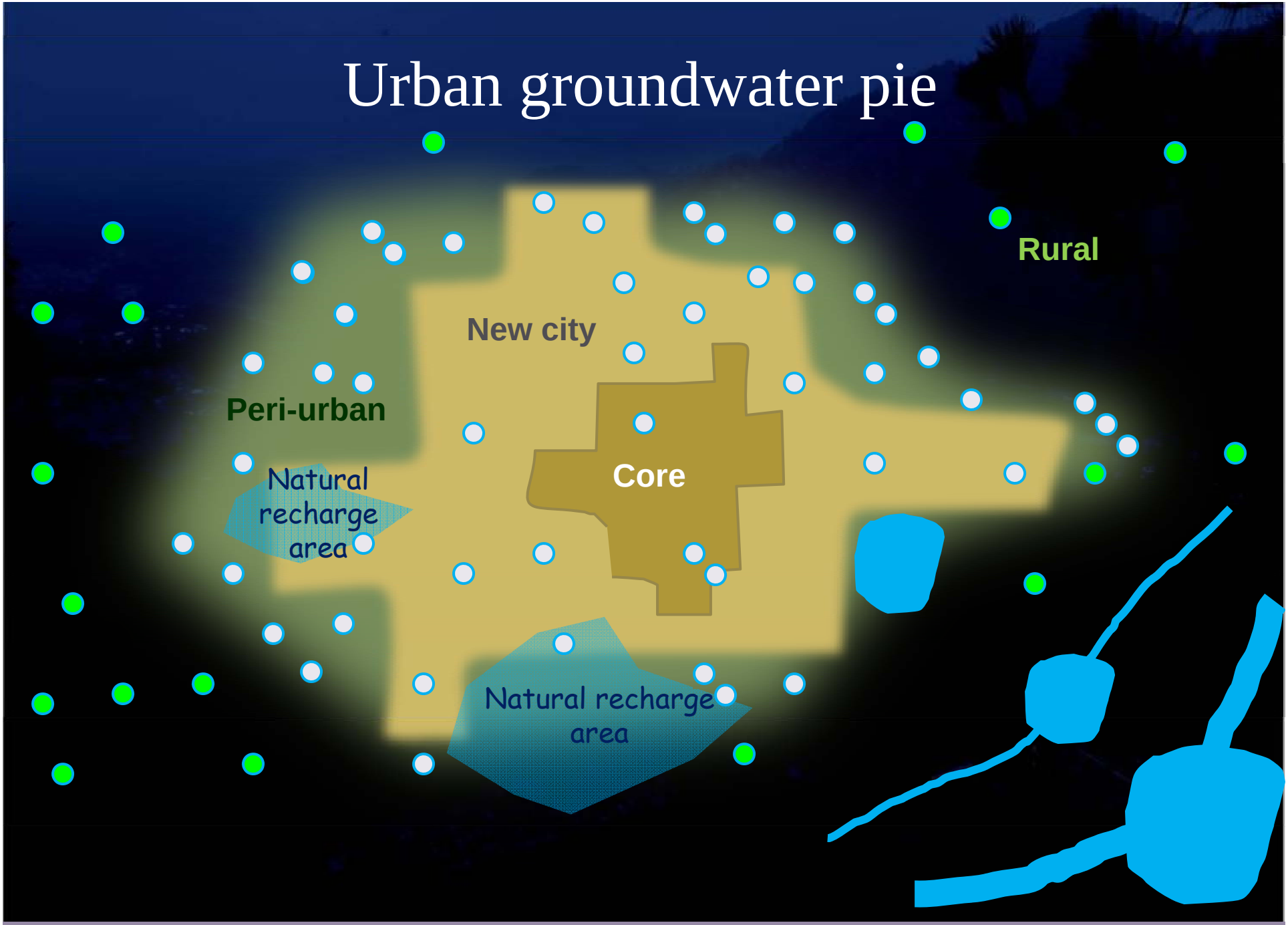
Excreta Matters, CSE (2012)

Urban – rural continuum

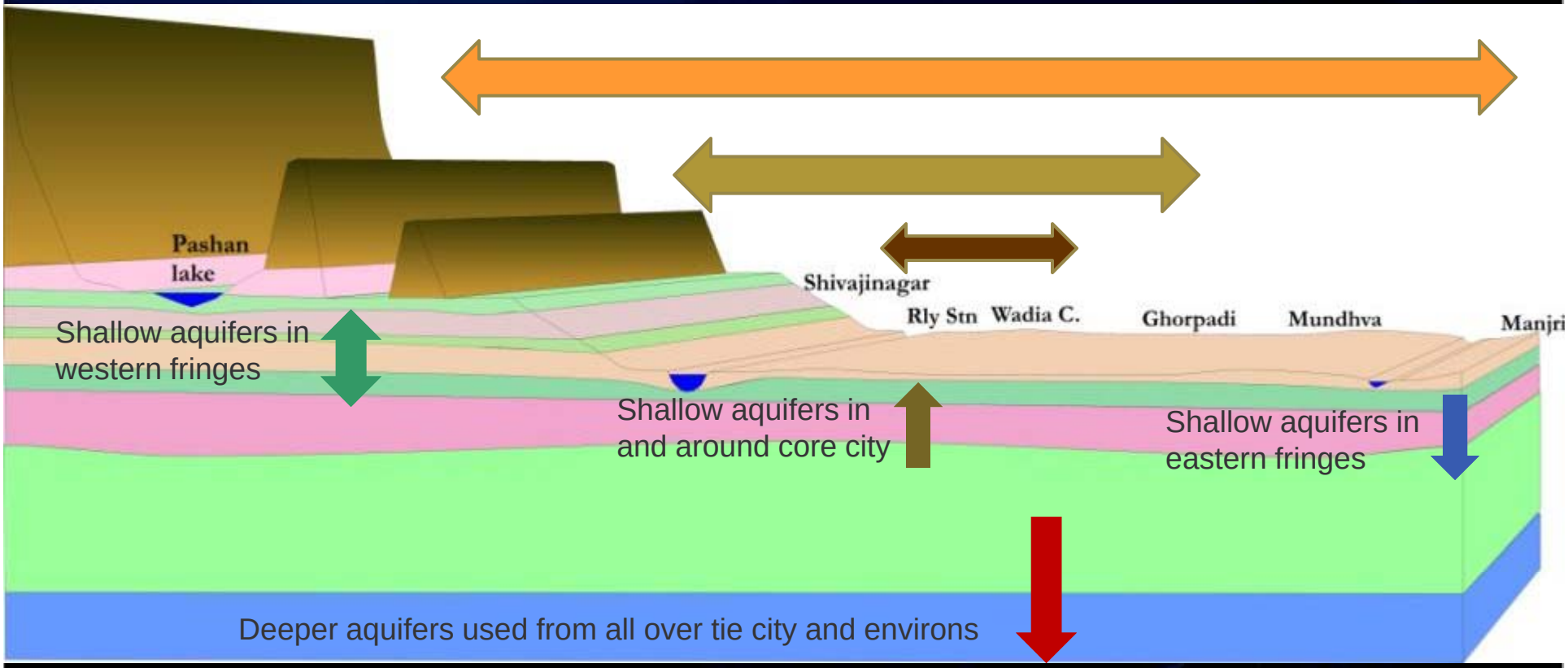


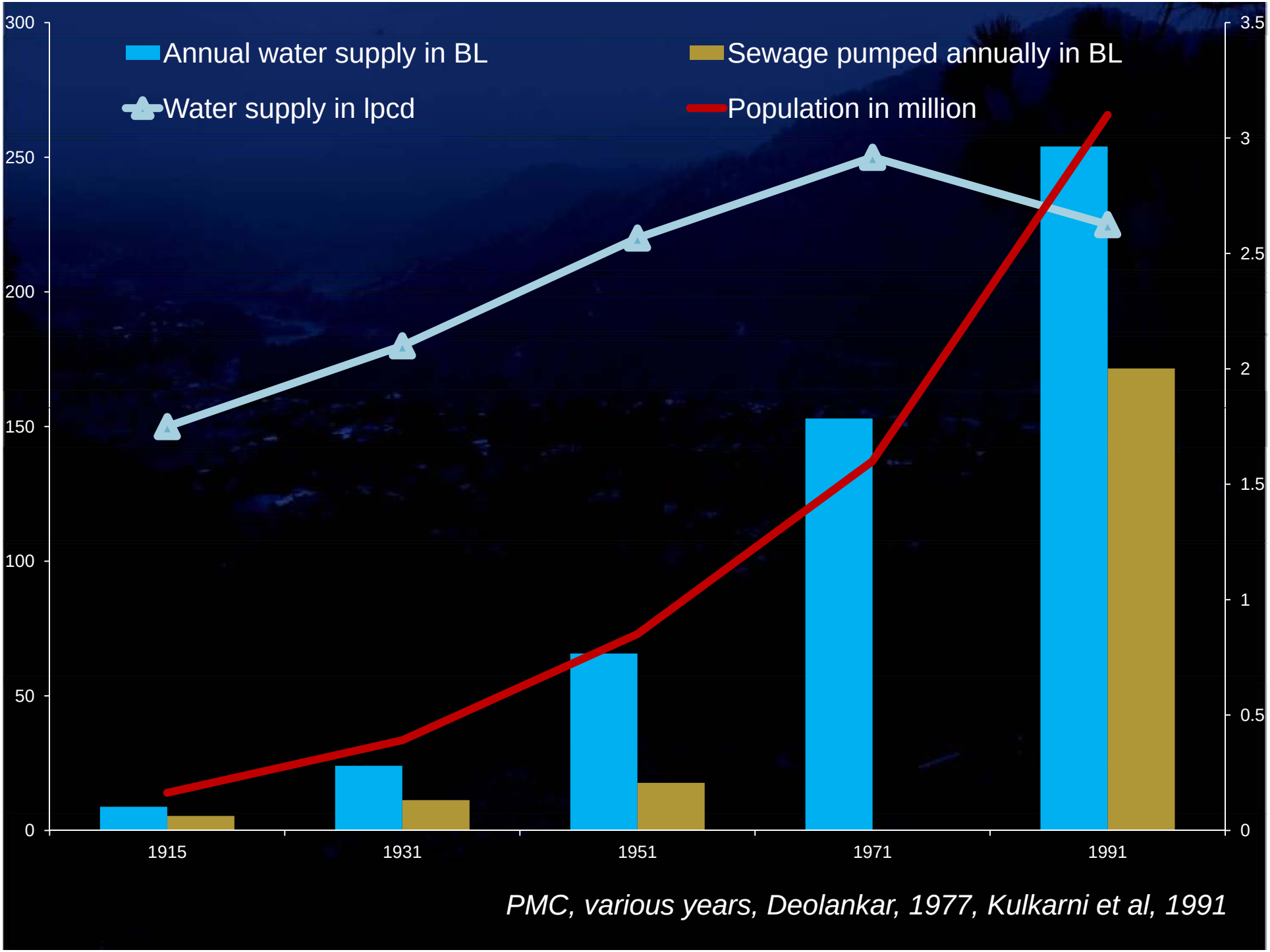
ARGOSS, 2001: BGS, UK

Urban groundwater pie

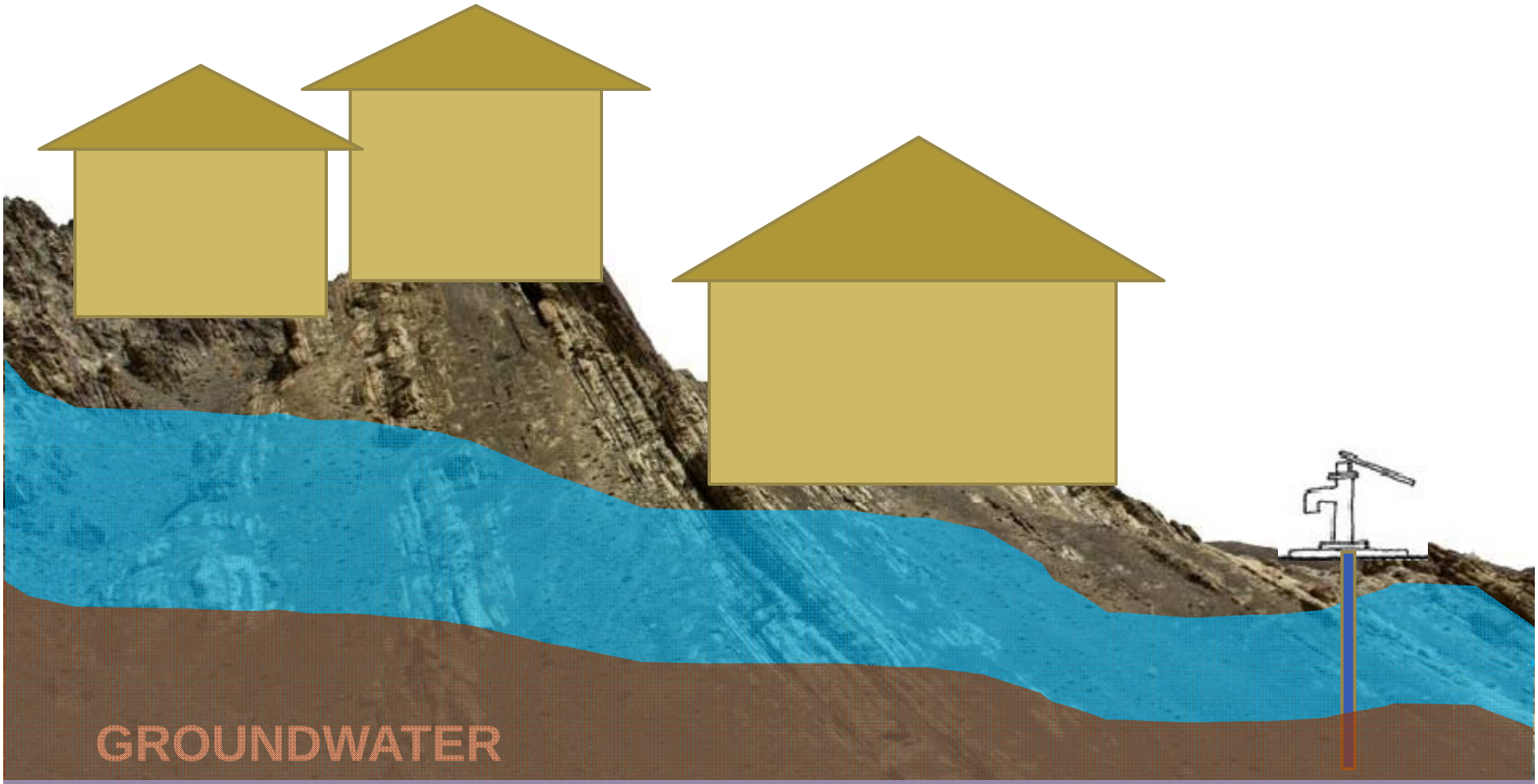


Slice of the pie: Pune city




Annual water supply in BL
Sewage pumped annually in BL
Water supply in lpcd
Population in million
300
250
200
150
100
50
0
3.5
3
2.5
2
1.5
1
0.5
0
1915
1931
1951
1971
1991
PMC, various years, Deolankar, 1977, Kulkarni et al, 1991

Groundwater: source, sink with a unique set of dynamics…

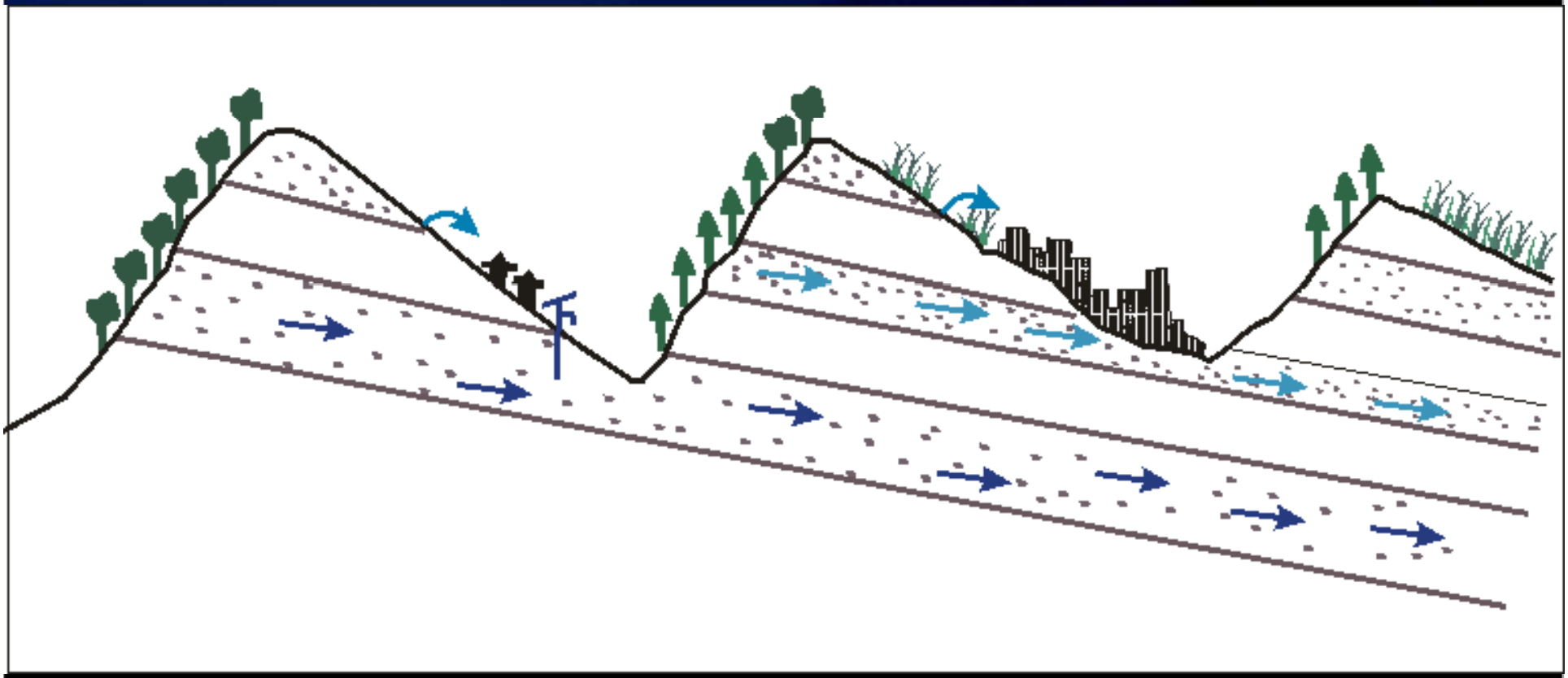


Urban groundwater: common issues

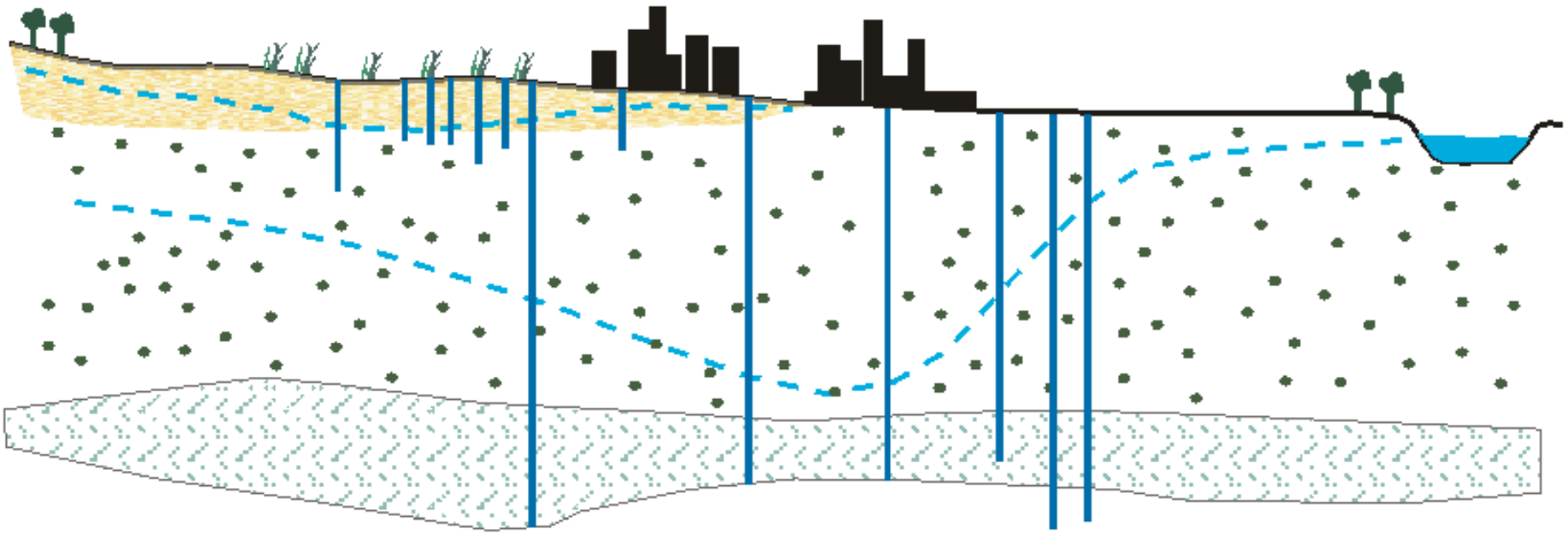
Foster et al, 2010: GW-MATE

- Modification of groundwater cycle on account of urbanisation
- Many problems around groundwater are *predictable*, few are *predicted*
- Conceptual hydrogeological model not constant – needs continuous modification
- Two major consequences:
  - Paradox of urban recharge – tradeoff between reduction in infiltration-facilitative surfaces and leaking mains and sewers
  - Contaminant loading of sub-surface systems – improper sanitation, poor sewerage and haphazard waste-disposal

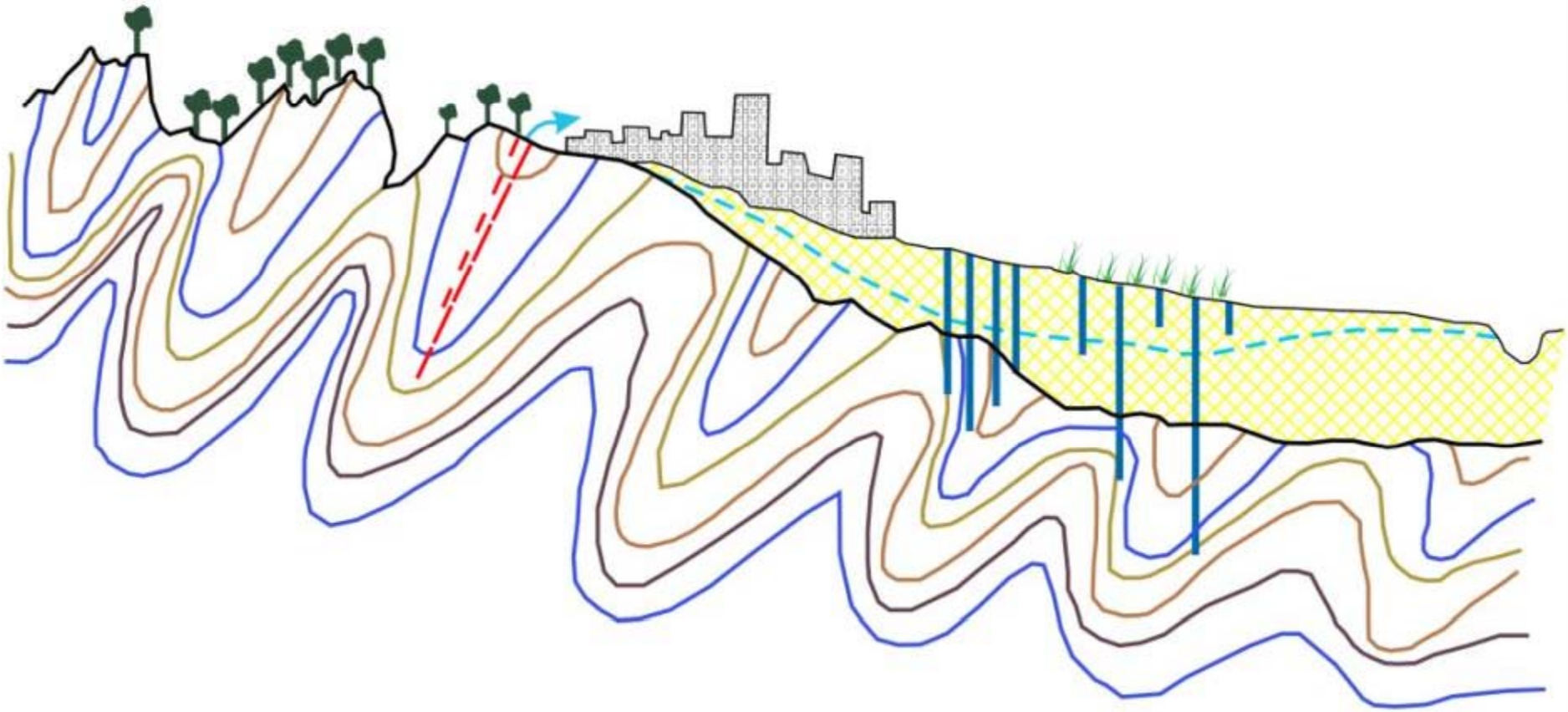
Himalayan



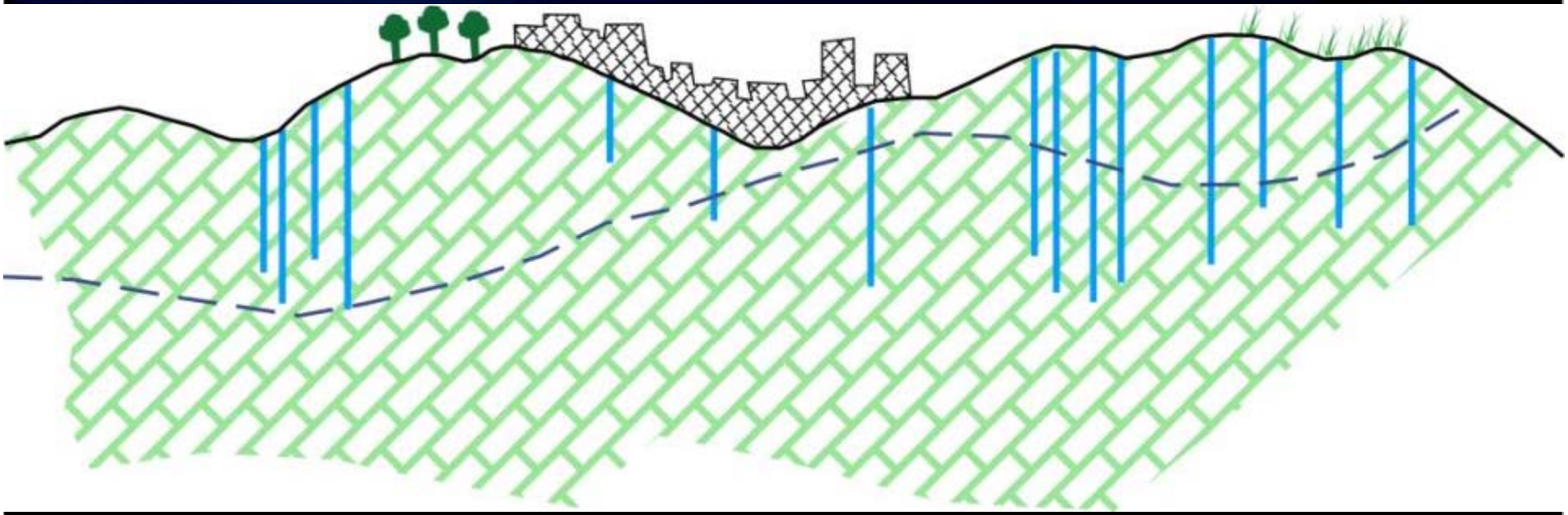
Alluvium

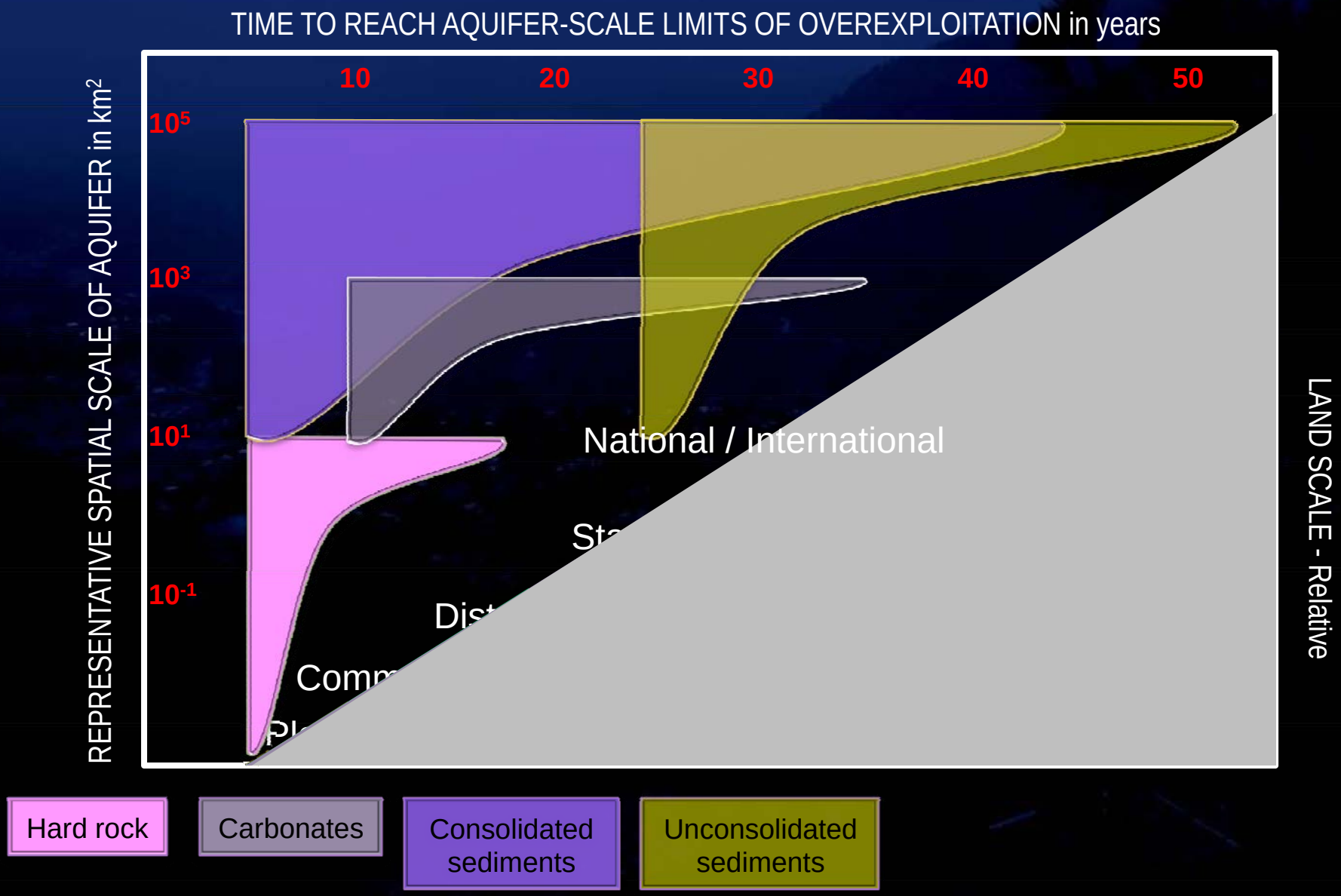


Transition



Carbonates - *karst*





Moench, Kulkarni & Burke, 2013

	RIVER / RESERVOIR	WELLS
Smaller towns	In-situ / close to the town, part of watersheds	Usually in-situ, mostly multiple aquifers now, may have begun water supply from a single aquifer
Larger cities and metros	Distant, larger river basins involved	In-situ and ex-situ, complex aquifer dynamics involved with large-scale inter-aquifer transfers

Components of a consolidated approach…

- Comprehensive understanding of groundwater resources (aquifers) required: KNOWLEDGE-ACTION agenda including *strategic urban recharge through an aquifer based approach*

- Information on sources, usage, impacts (especially recharge and quality): CROWD SOURCING, CAPACITY BUILDING leading to an *urban groundwater database*

- Logic of including groundwater in the *formal civic water supply system* – POLICY and PARTICIPATION

  – Link regulation and licensing to assured water supply and equitability
  – Major improvements in sanitation, sewerage, recycling and treatment
  – Improved groundwater literacy…

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