

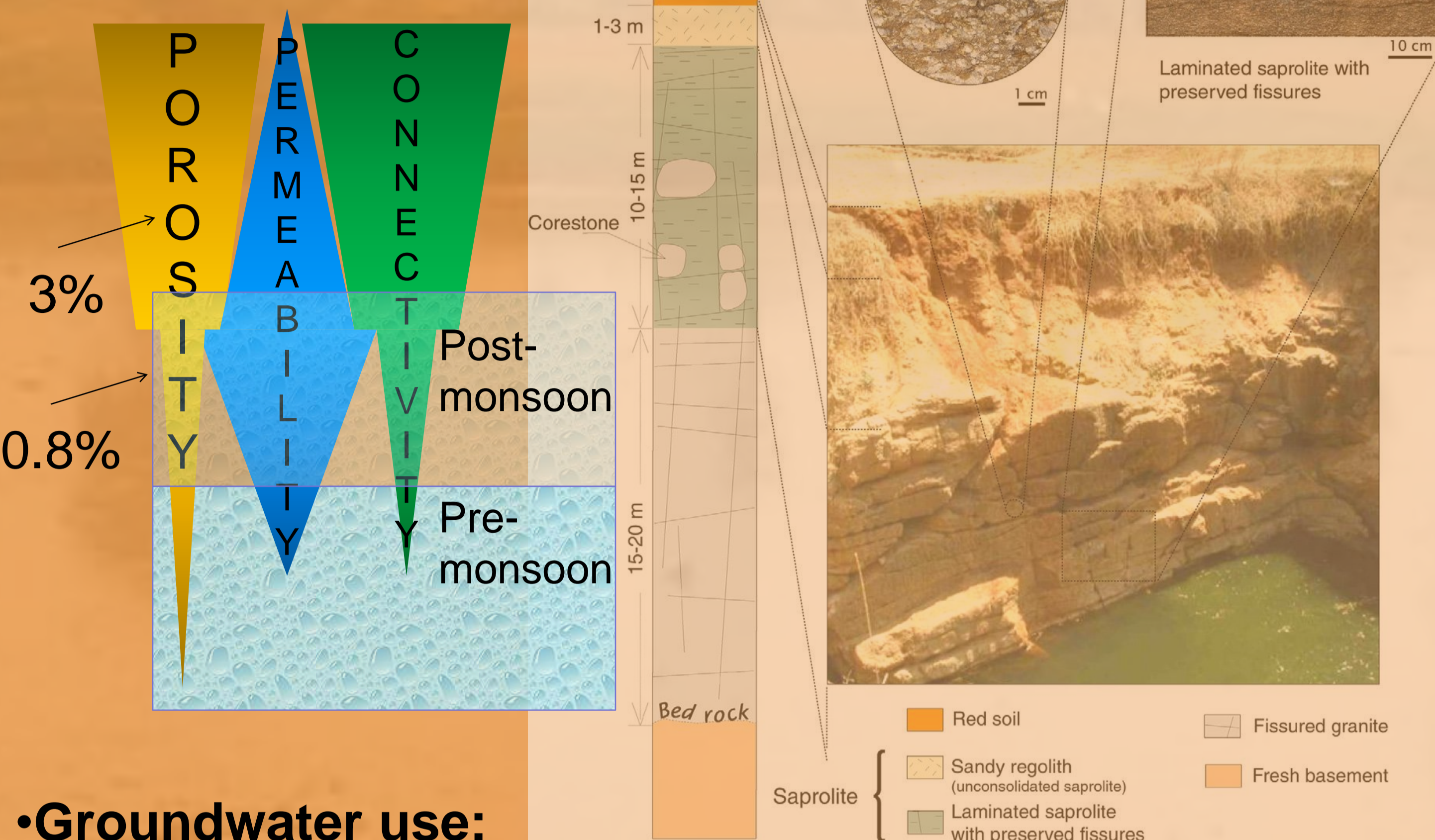
# Investigating the impact of global climatic and landuse changes on groundwater resources in hard rock areas of South India

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## 1. The Kudaliar river watershed: Hardrock, semi arid context of the Indian Deccan plateau:

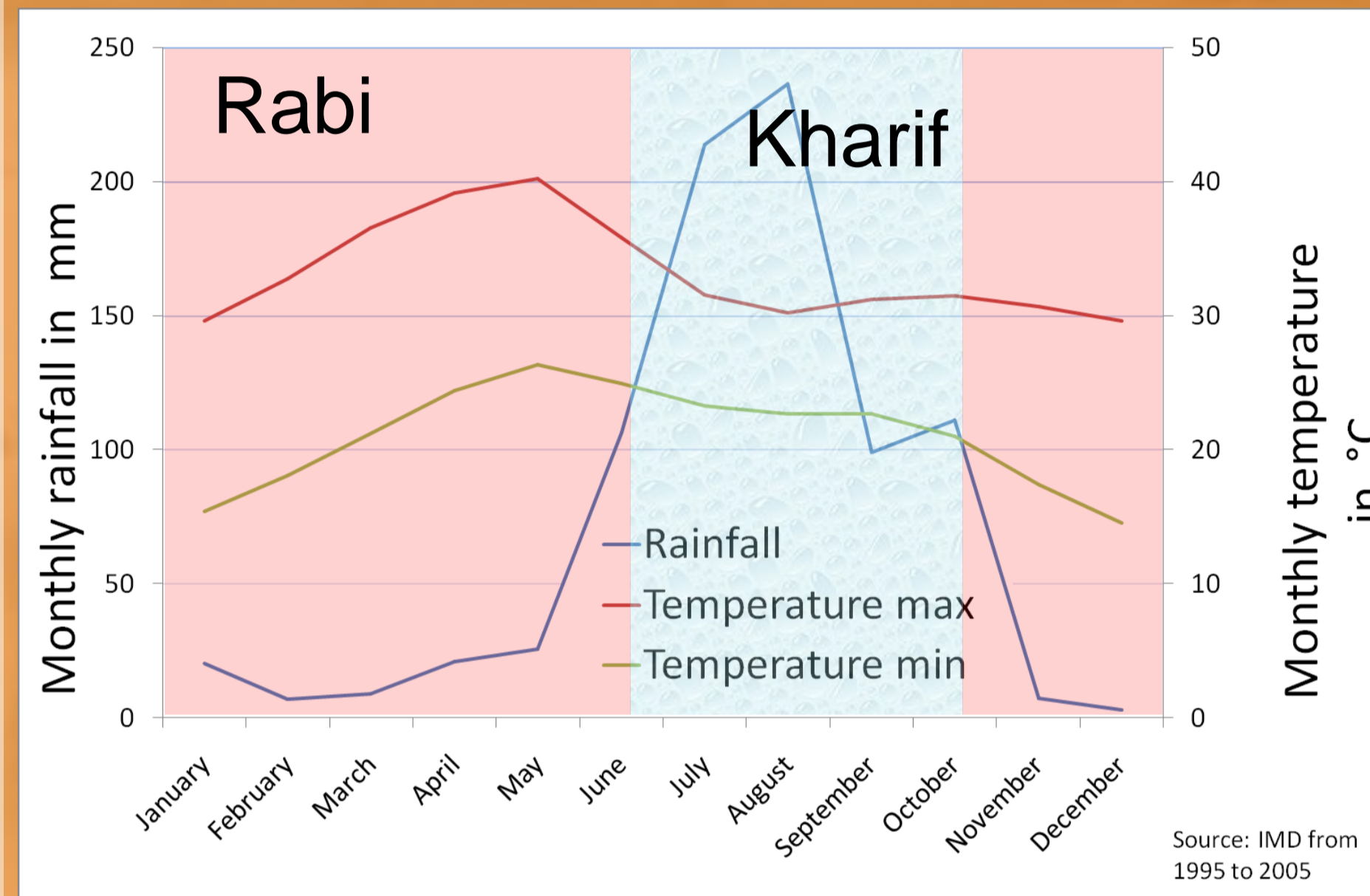
•Shallow aquifer: in saprolite and fissured Granite



•Landuse: 985 km<sup>2</sup>

- Small plots spread in the landscape
- ✓ 5 to 12% irrigated rice/vegetable paddies
- ✓ 20% cotton, 15%maize, 38% Fallow lands
- ✓ 5% urban area, 8% forested area, 3% pasture
- ✓ 2% of estimated arable land non used

•Climat: semi-arid, two season



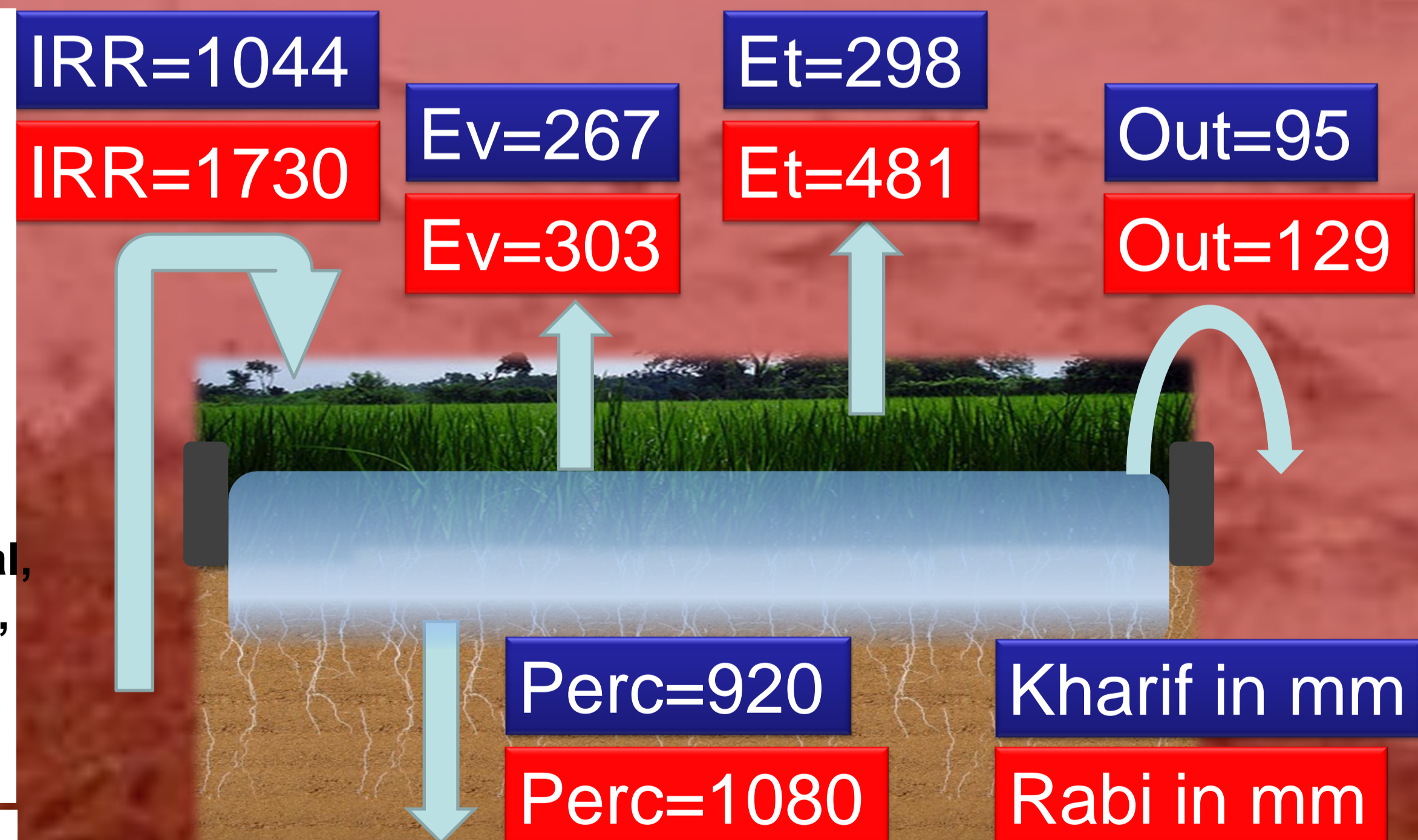
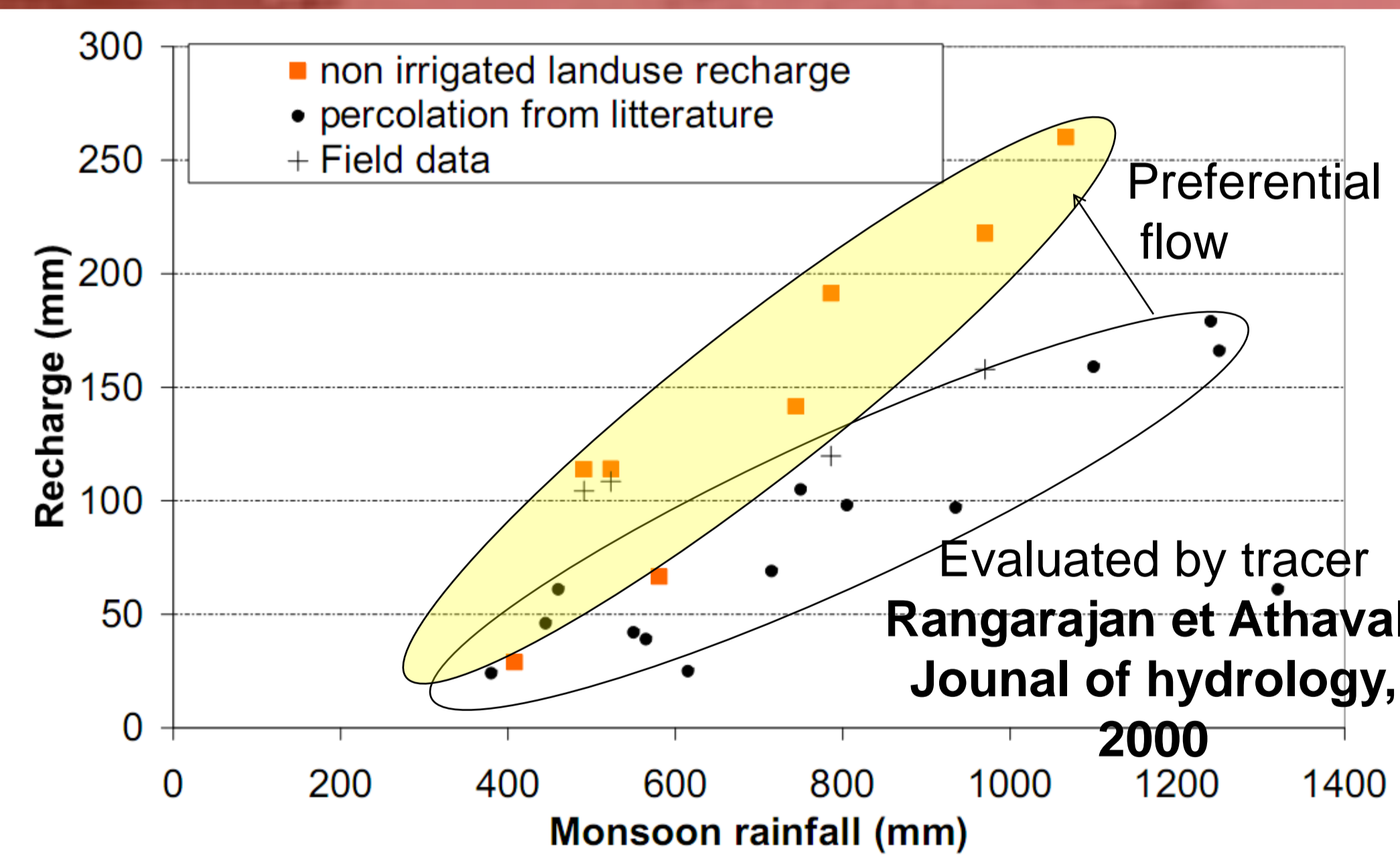
•Groundwater use:

- 10000 borewell → limit strongly regional flow
- ✓ Around 10mm/day in Kharif
- ✓ Around 15mm/day in Rabi
- ✓ Return flow around 50%

Irrigation – return flow ≈ Recharge

→ Ground water depletion → Spatial Farmer vulnerability

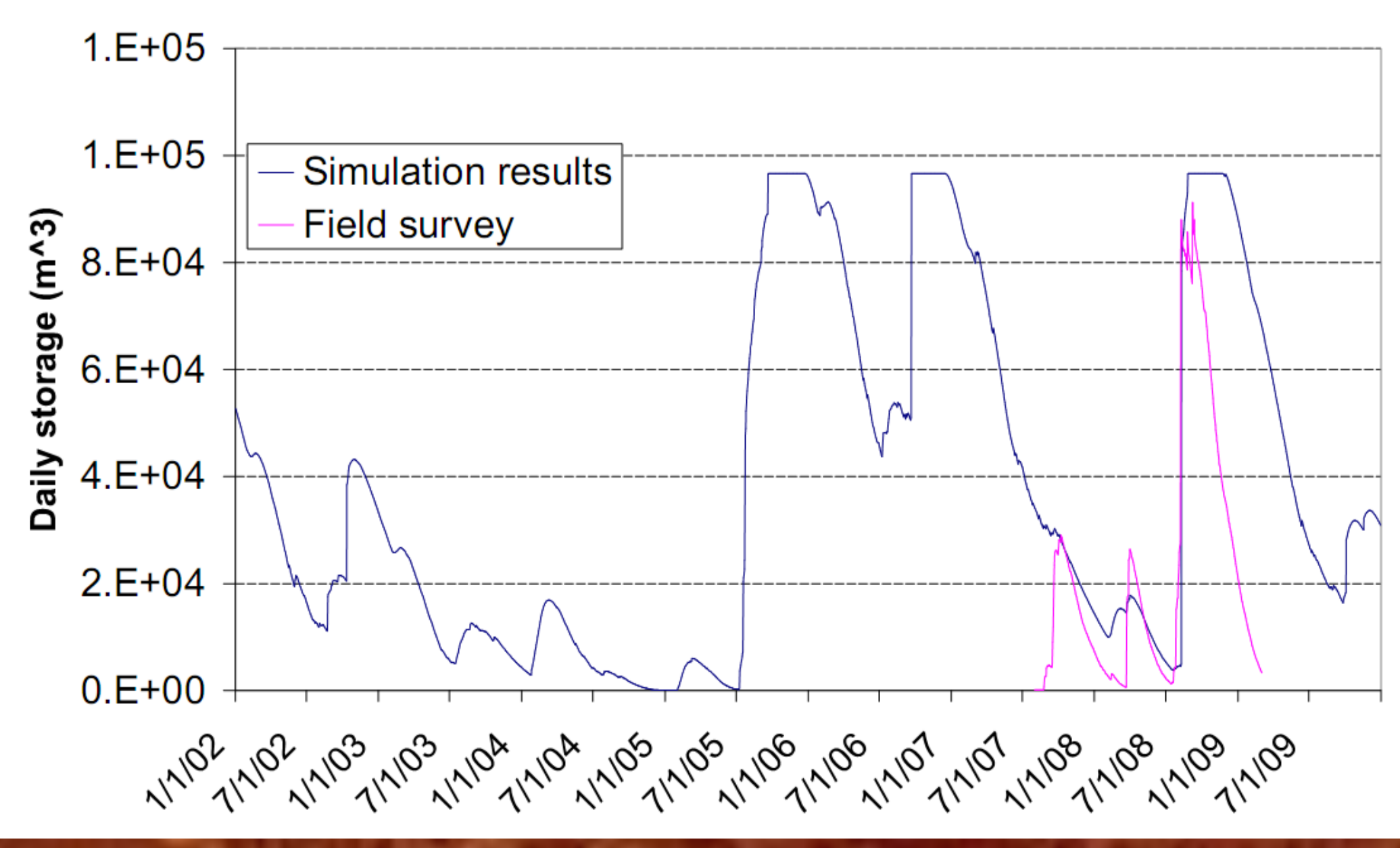
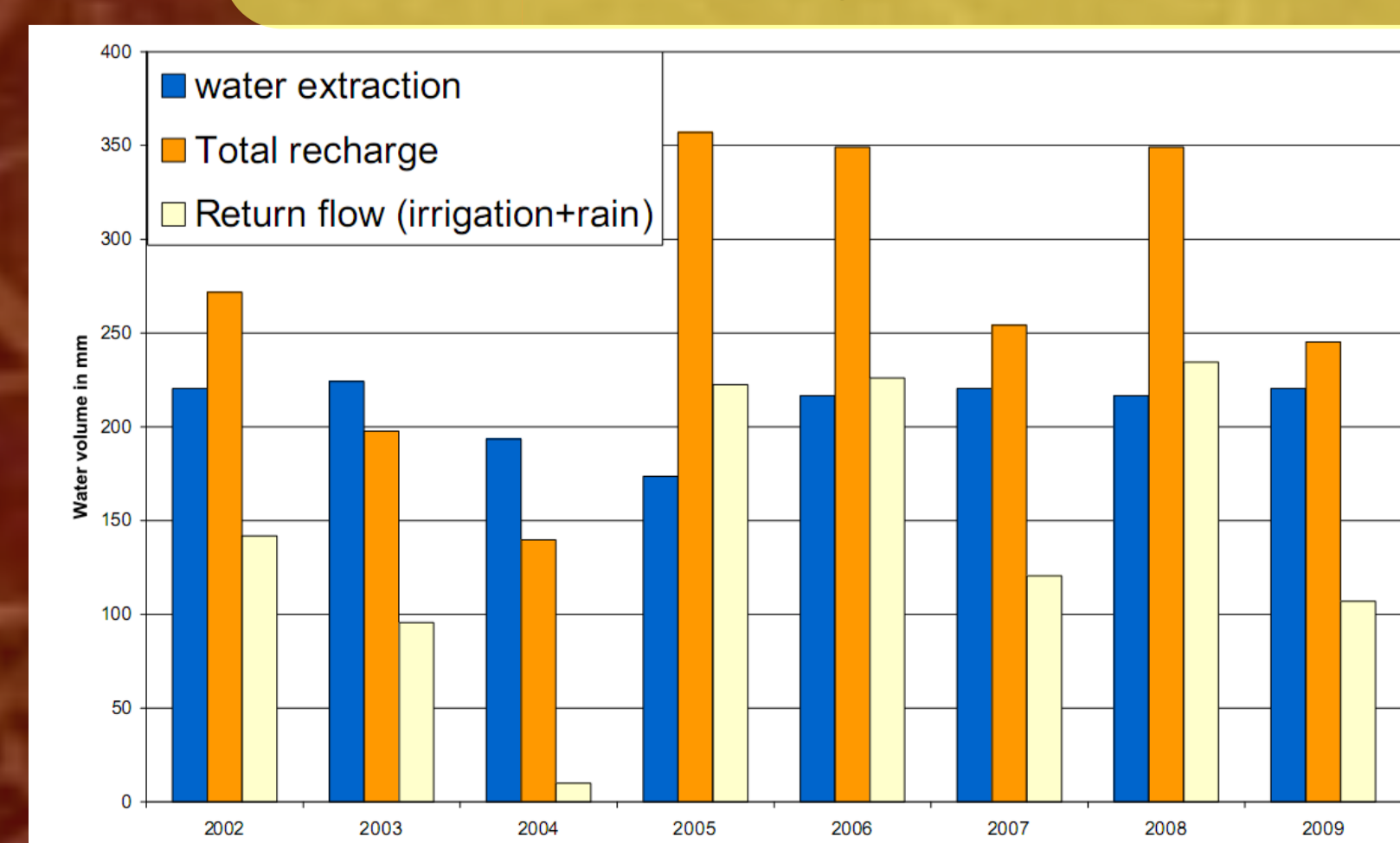
## 3. Calibration: recharge/runoff in natural areas, seasonal water budget in paddies:



•Tank Water storage and discharge

- SWAT reservoir = ∑ tank surface in subbasin
- ✓ SWAT reservoir geometry differs from each tank geometry
- ✓ Water surface for seepage and evaporation is underestimated
- ✓ River discharge filling reservoirs is: monsoon runoff, paddy outflow
- Water Harvesting highly variable: from 8 to 52 mm/year
- Discharge at the outlet: from 3 to 104 mm/year

•Water extraction and Water recharge  
Extraction ≈ Recharge



## 2. Modeling water budget and groundwater use, facing global changes:

•Hydrology

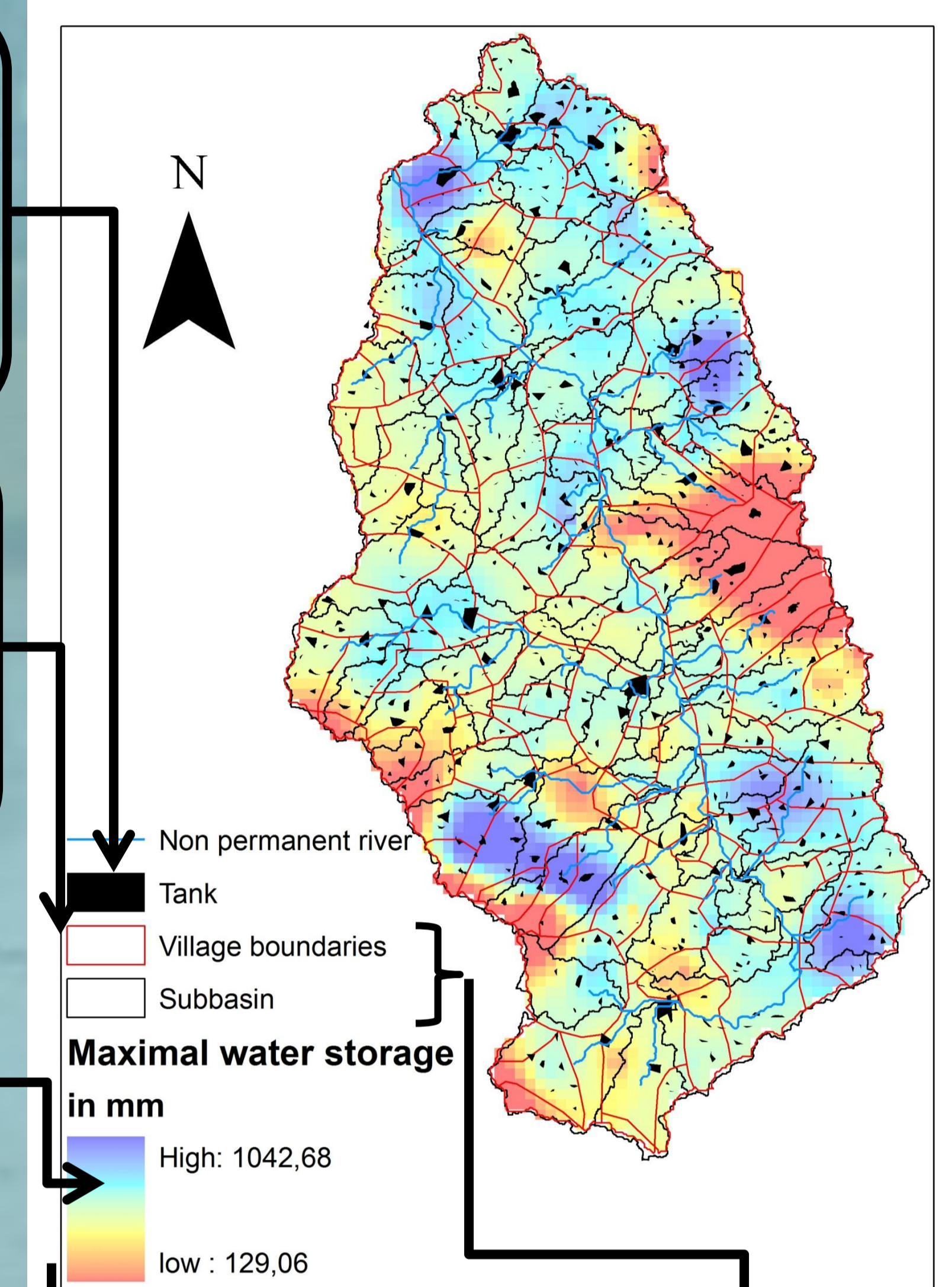
- No permanent river, monsoon runoff is:
- ✓ Stored in tanks
- ✓ Cascading from upstream to downstream tanks
- ✓ Discharged at the outlet as overflow
- Water harvesting system

•Socio-economical survey

- Enquiry per village
- ✓ Typology of farmers
- ✓ Crop rotation for 5 years (2005-2010)
- ✓ Agricultural practices
- Irrigated area extent for 5 years

•Hydro-geological survey

- 322 Dugwells, 30 Borewells with resistivity logging
- ✓ Saprolite thickness
- ✓ Fissured layer thickness
- ✓ Water level recorded in 200 bore well (nov09, June 2010)
- Spatial potential GW storage

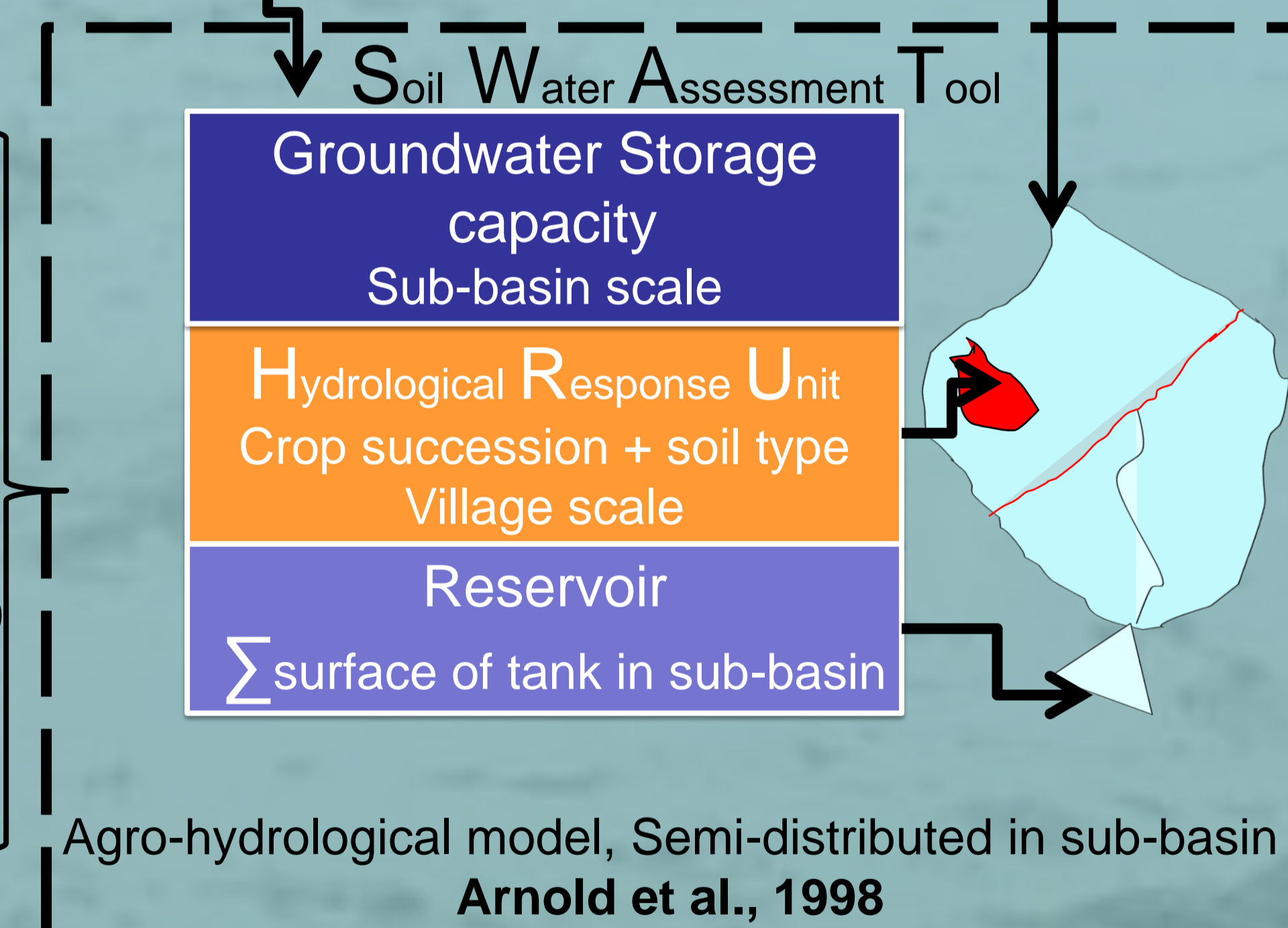


•Present and forecasted climate

- IMD data and GCMs IPCC-AR4 downscaled scenario (CDF transform)
- ✓ Present, 2020-2039, 2040-2060
- Daily past and forecasted rainfall and temperature

•Present and forecasted Land use

- 2 Pictures (Indian IRS satellite), oct 2009 and march 2010
- ✓ Natural and urban areas
- ✓ Tank as water harvesting system
- ✓ Irrigated area position and extent
- Spatial water use



## 4. Perspective: Simulate water availability to compute famers vulnerability

Main challenges:

- Water extraction evaluation: Even irrigation practices remain constant (free electricity during 6 hours and pump are always used), the extent of irrigated area is yearly variable (about 1 to 3 %) as an adaptive behavior to the water availability.
- Tank storage: Runoff is a minor part of the water budget, highly variable with monsoon intensity (from 400 to 1200mm). But runoff stored in the tanks provide water for irrigation or recharge.

Main perspective:

Using socio-economical forecasted landuse and climate to simulate water resource availability for the farmers

This work is a part of the SHIVA Project supported by ANR (National Research Agency-France)  
 SHIVA stands for "Socio-economic Assessment of the rural Vulnerability of water users under stressors of global changes in the Hard rock area of South India".  
<http://www.shiva-anr.org/>