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Sustainable groundwater management in India needs a water-energy-food nexus approach

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Key messages

Groundwater, if managed well, will be critical for climate resilient agriculture in the future.

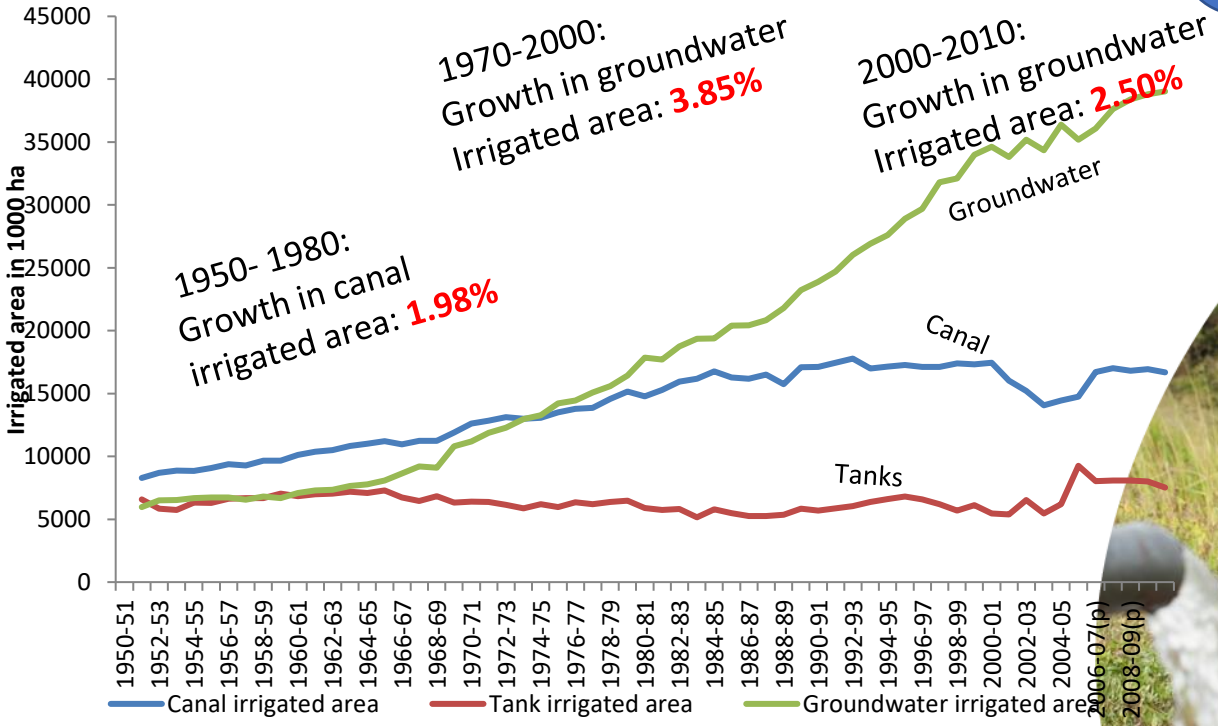
Managing GW requires a WEF nexus approach

ROLE OF GROUNDWATER IN WATER AND FOOD SECURITY IN INDIA

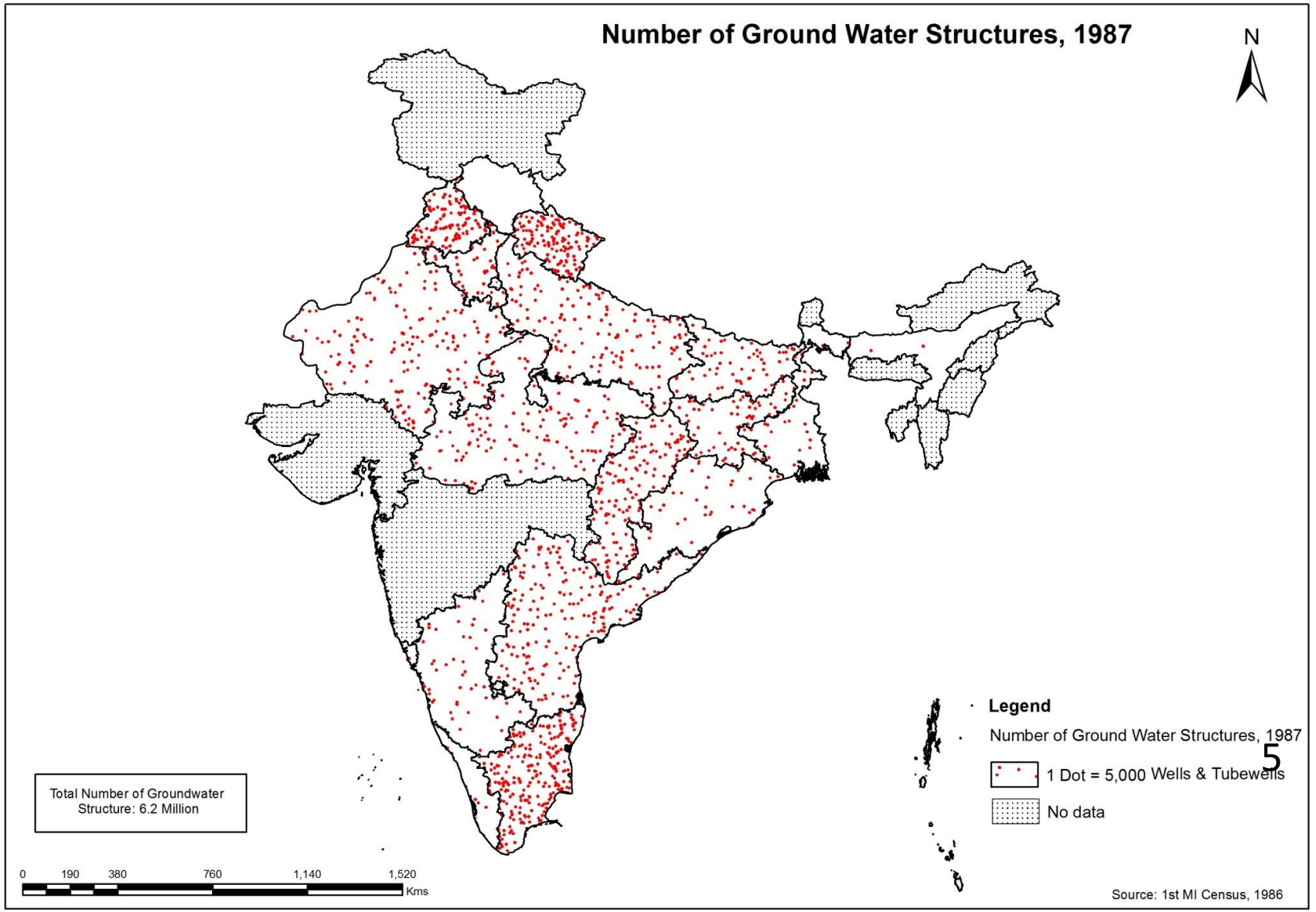
- ~60% of India's irrigated area gets irrigation from 20.5 million groundwater wells
- 50% of rice and 70% of wheat are grown with groundwater irrigation;
- ~88% of all water extracted from groundwater wells is used for irrigation (IDFC, 2013)
- 700 million rural India depend on groundwater for meeting all their needs (Kulkarni et al. 2015)
- Nearly 48% of the urban water share is derived from groundwater (Centre for Science and Environment, 2012)

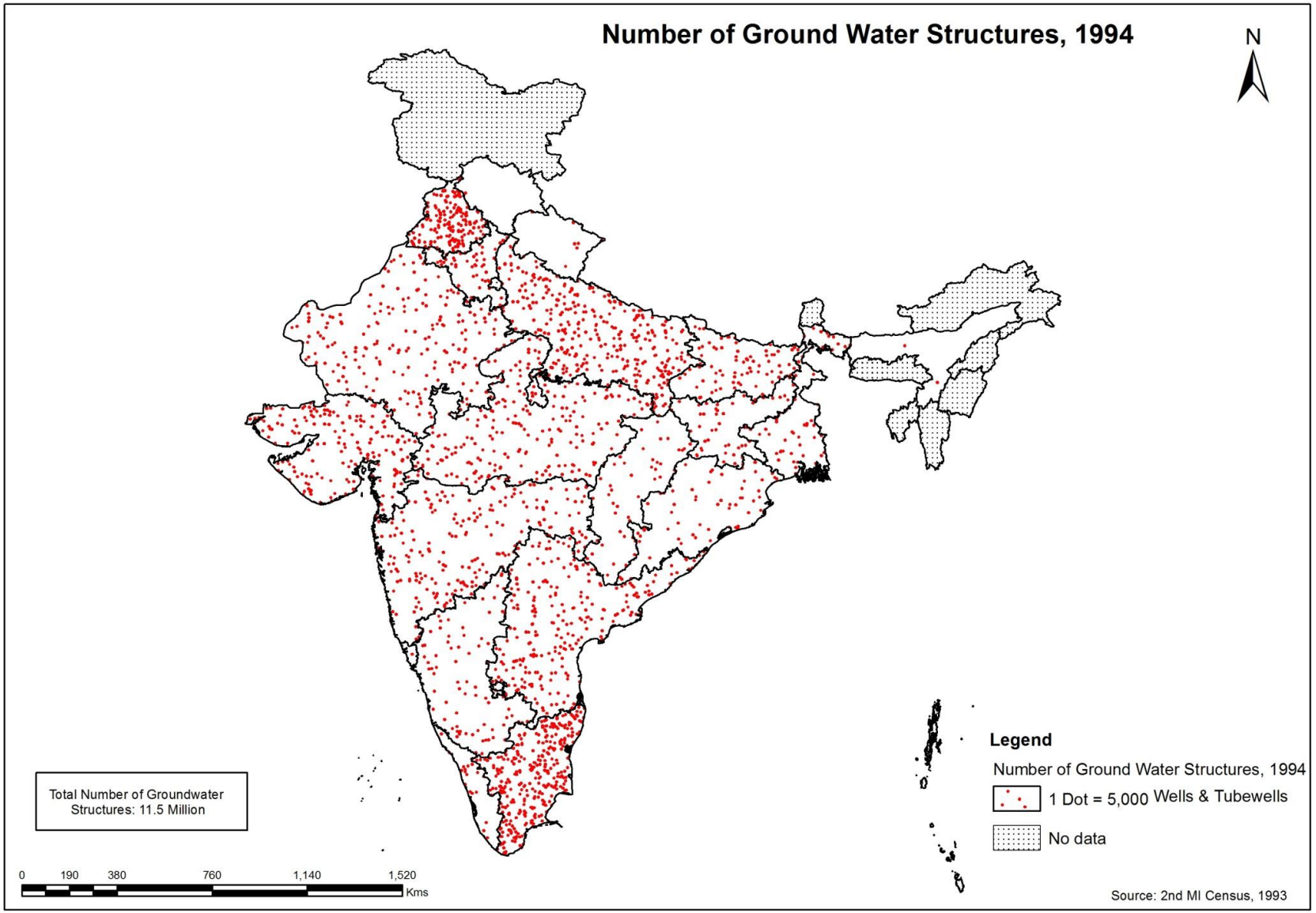
Unsustainable Groundwater Use – A legacy of Green Revolution

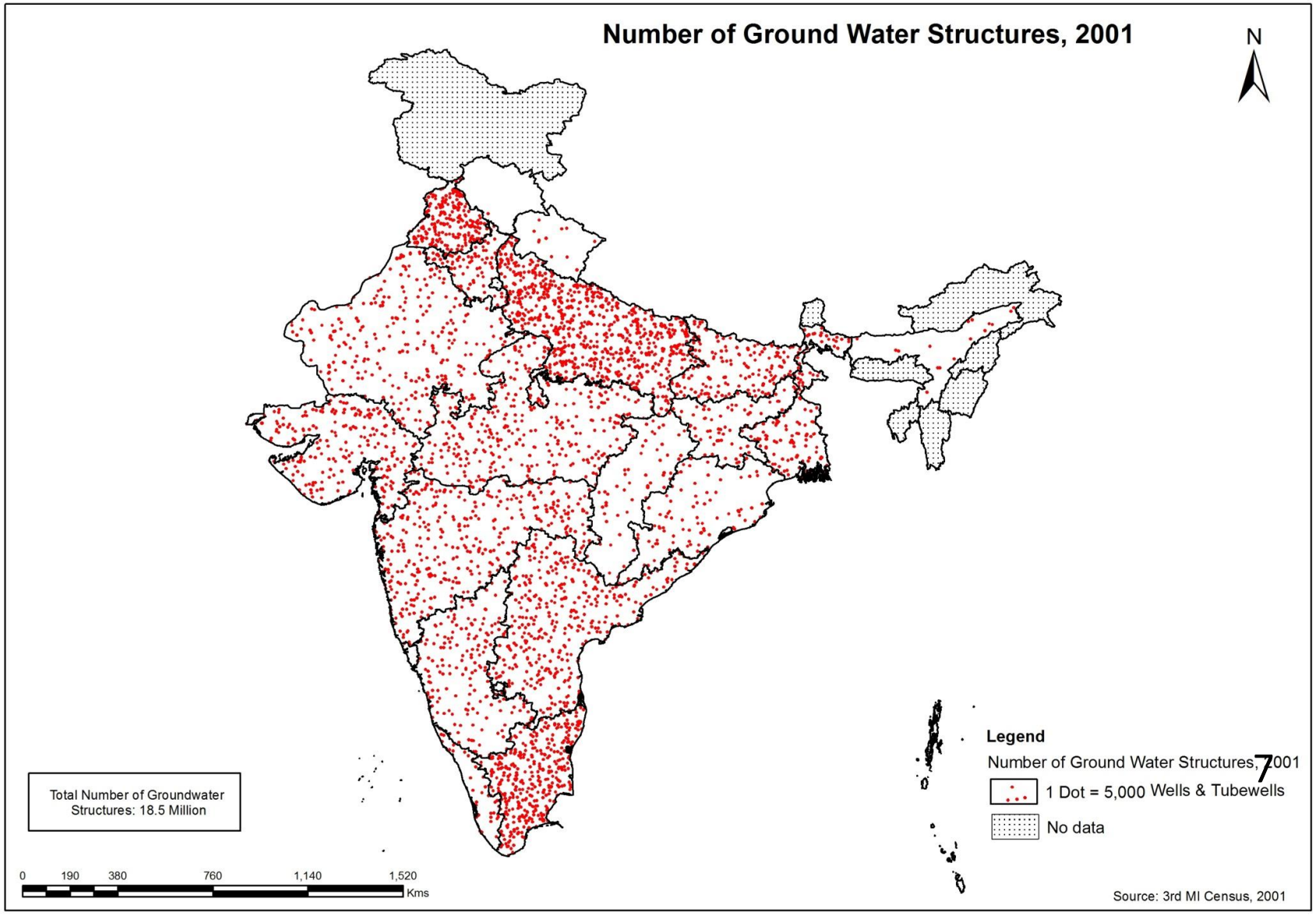
Since 1970s, groundwater irrigated area has increased, as has number of wells and tubewells….

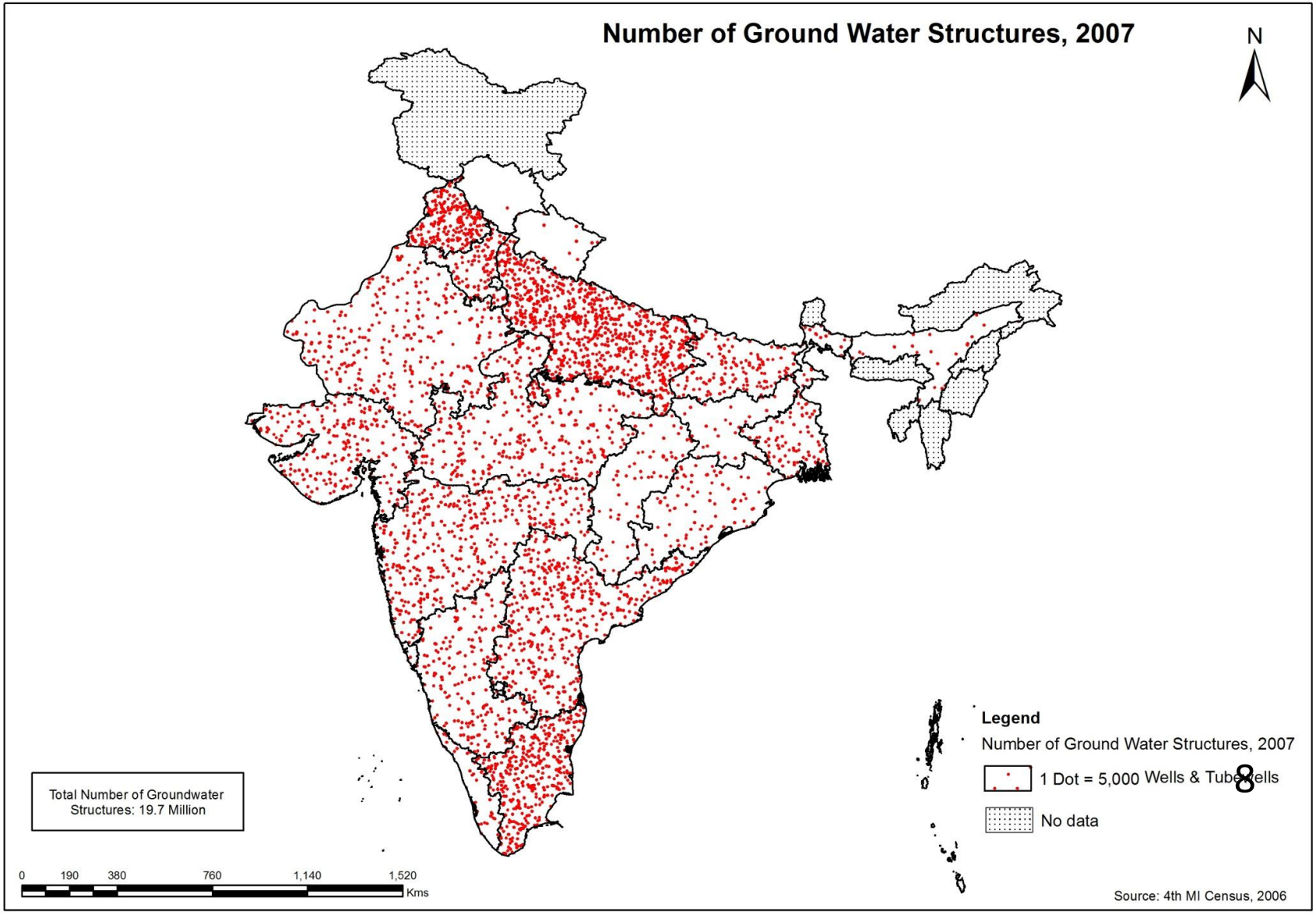


Mukherji, A., S. Rawat and T. Shah. 2013. Major insights from India's Minor Irrigation Censuses: 1986-87 to 2006-07. *Economic and Political Weekly*, Vol 48(26 & 27): 115-124

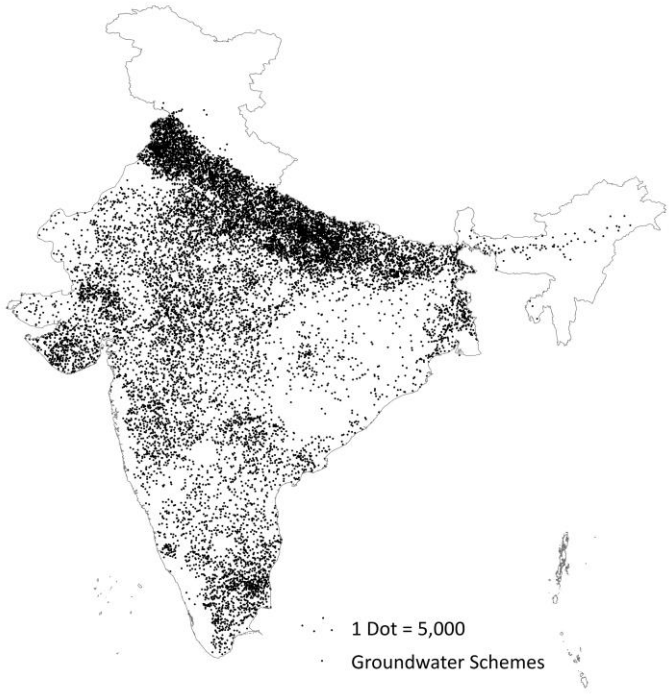

Number of Ground Water Structures, 1987
N
Legend
Number of Ground Water Structures, 1987
1 Dot = 5,000 Wells & Tubewells
No data
Total Number of Groundwater Structure: 6.2 Million
0 190 380 760 1,140 1,520
Kms
Source: 1st MI Census, 1986


Number of Ground Water Structures, 1994
N
Total Number of Groundwater Structures: 11.5 Million
0 190 380 760 1,140 1,520
Kms
Legend
Number of Ground Water Structures, 1994
1 Dot = 5,000 Wells & Tubewells
No data
Source: 2nd MI Census, 1993


Number of Ground Water Structures, 2001
N
Legend
Number of Ground Water Structures, 2001
1 Dot = 5,000 Wells & Tubewells
No data
Total Number of Groundwater Structures: 18.5 Million
0 190 380 760 1,140 1,520
Kms
Source: 3rd MI Census, 2001

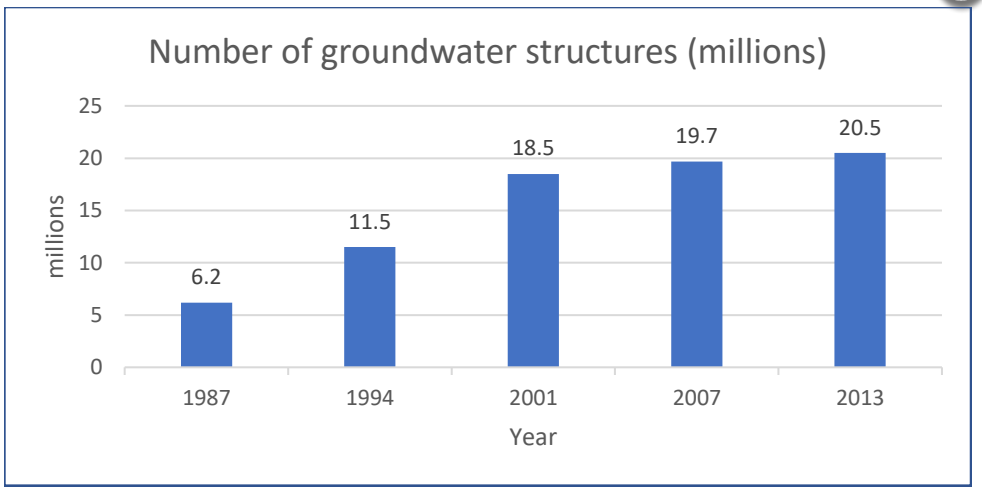

Number of Ground Water Structures, 2007
N
Legend
Number of Ground Water Structures, 2007
1 Dot = 5,000 Wells & Tube Wells
No data
Total Number of Groundwater Structures: 19.7 Million
0 190 380 760 1,140 1,520
Kms
Source: 4th MI Census, 2006

Number of groundwater structures, 2013



Total number of GW structures:
20.5 million

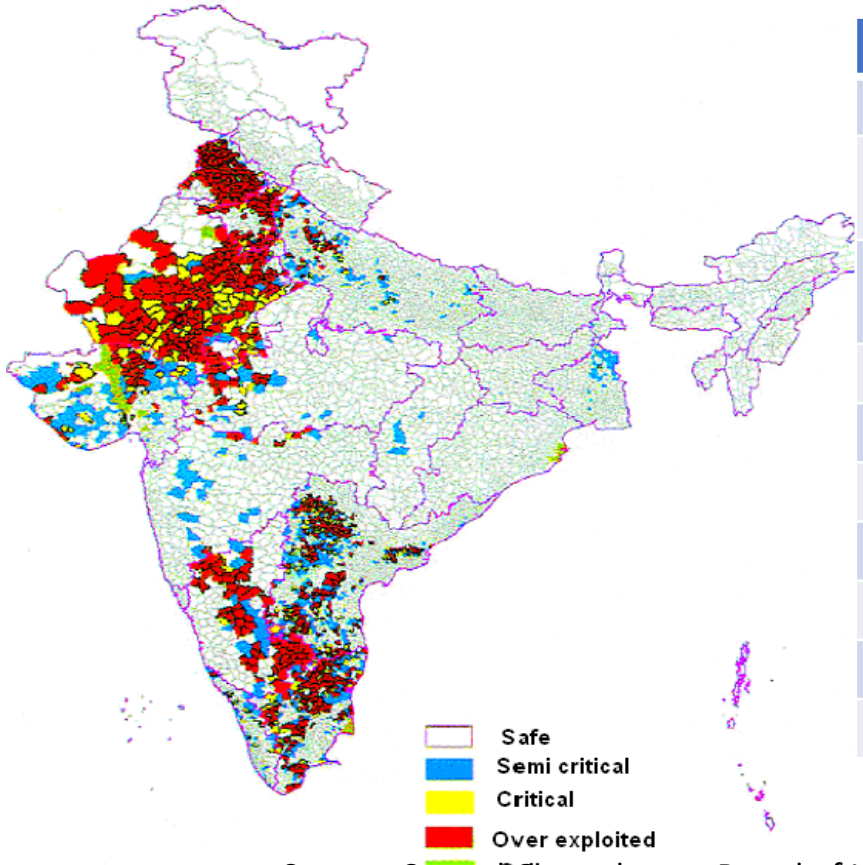
Source: 5th MI Census, 2013



- Pace of growth in India's groundwater structure is slowing down.
- But number of deep wells is on the rise
- There are deep regional divides

Mukherji, A. 2016. Evolution of irrigation sector, *Economic and Political Weekly*, Vol 51(52): 44-47

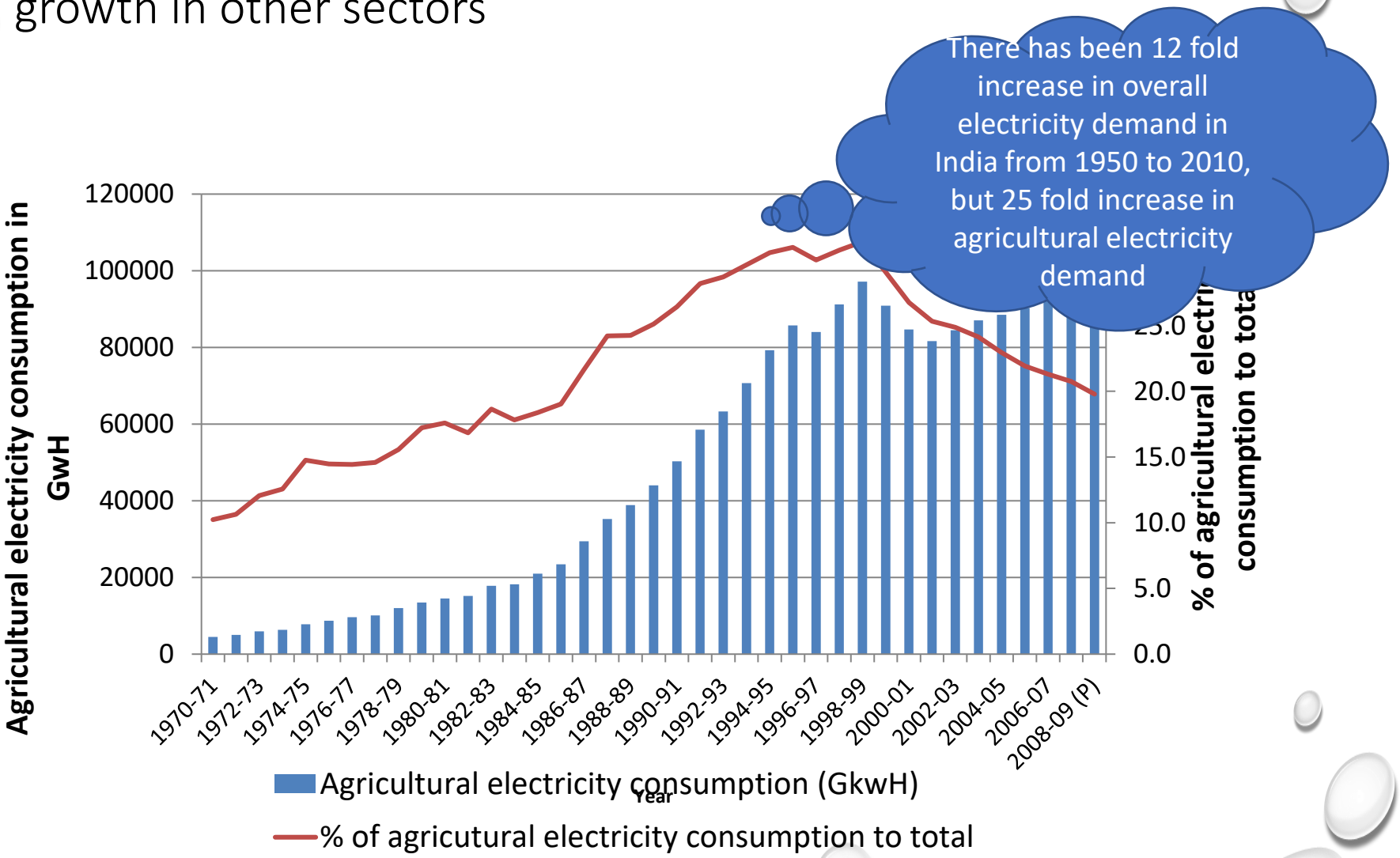
However, groundwater over-exploitation in India has clear regional dimensions: Eastern India has ‘under-developed’ groundwater resources



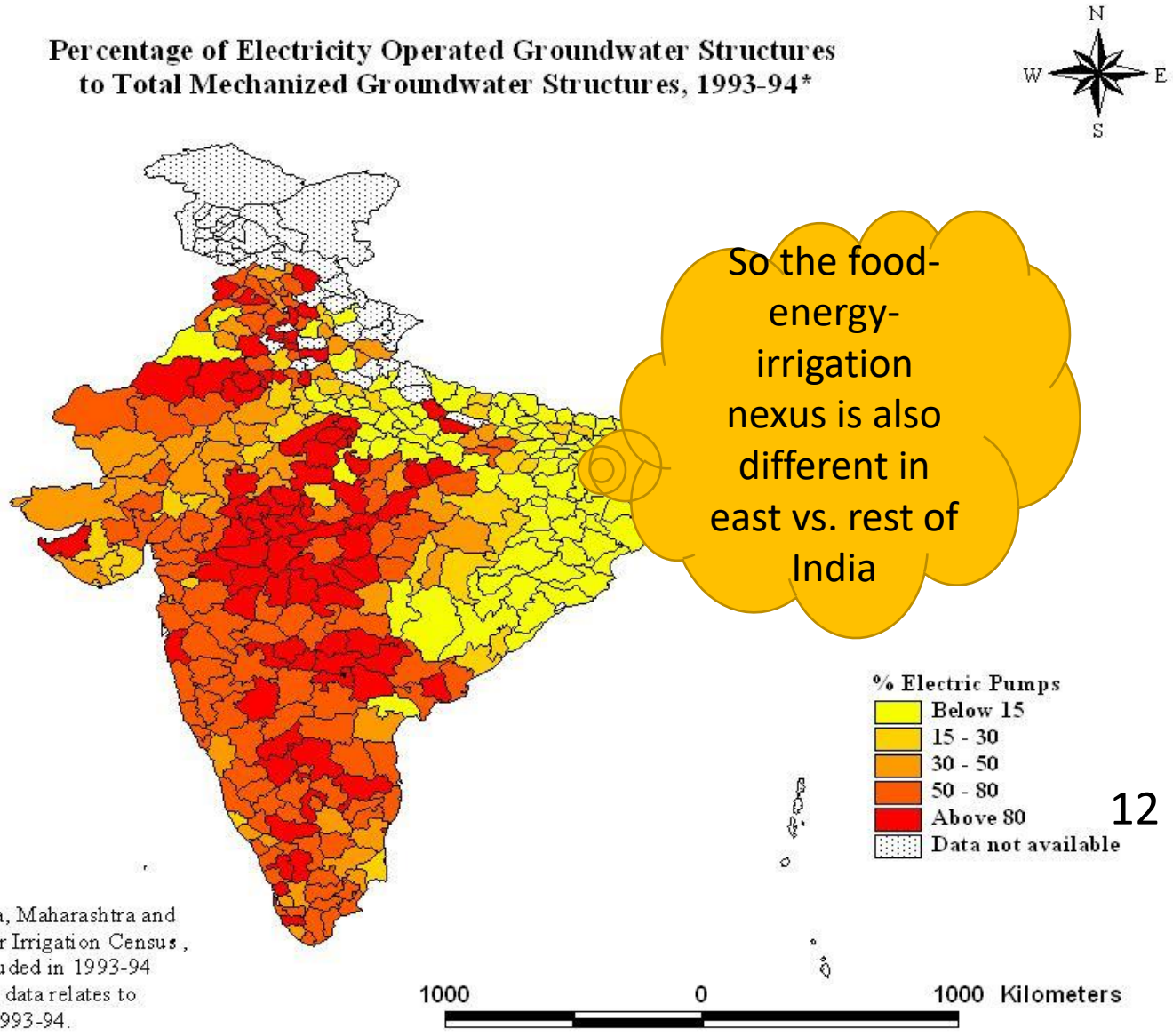
Source: Central Groundwater Board of India

Sl. No	Item	2017
1.	Annual Resources	431.8
2.	Annual groundwater draft	248.7
3.	Stage of groundwater development	63.3%
4. Categorization		
	Total assessment units	6881
	Safe	63%
	Semi-critical	14%
	Critical	5%
	Over-exploited	17%
	Saline	1%

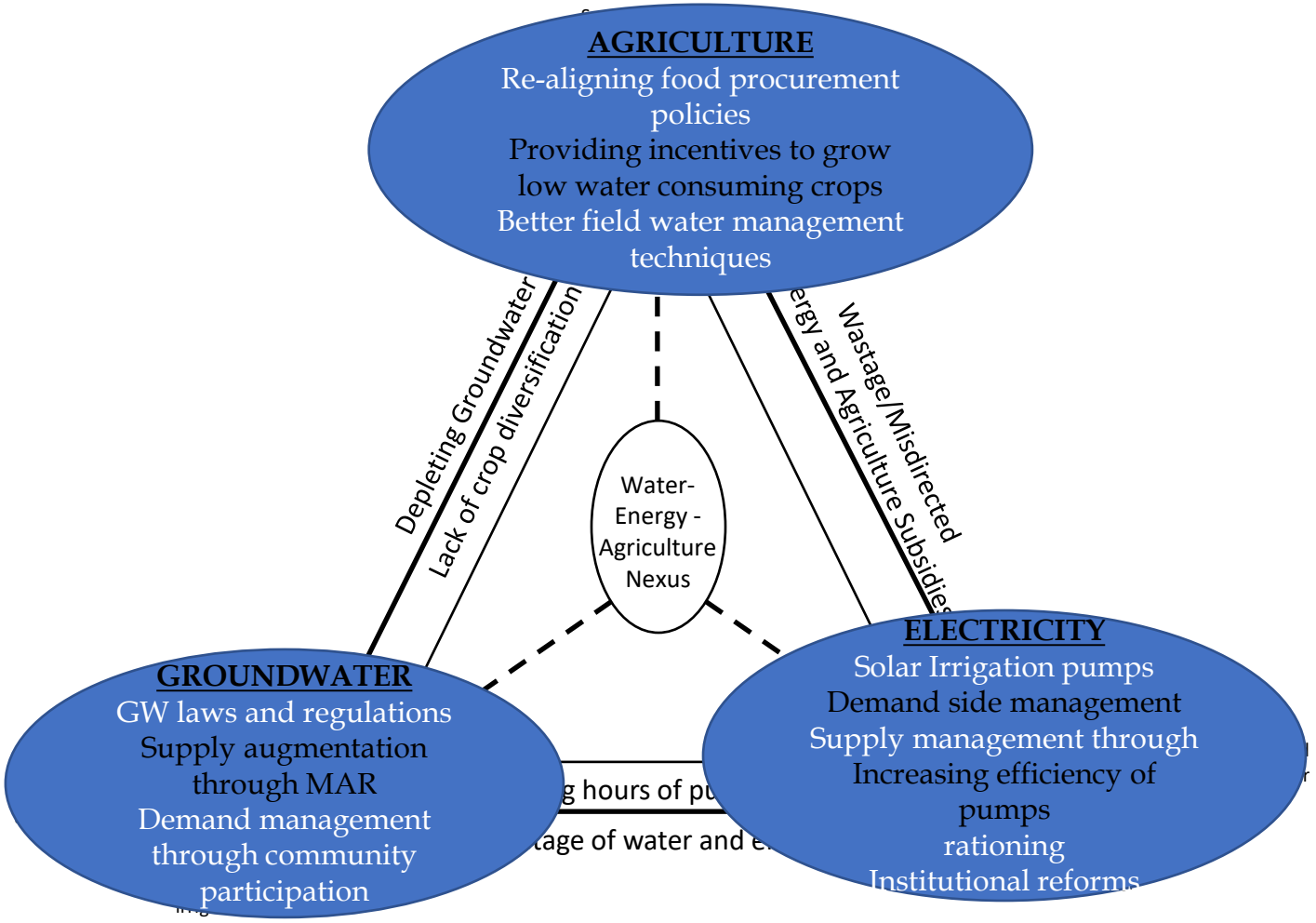
Growth in electricity consumption in agriculture has outpaced growth in other sectors



But then, there is the energy divide: Farmers in eastern India depend predominantly on diesel pumps, while rest of India has electric pumps



Using Water Energy Food (WEF) nexus to improve groundwater sustainability



Adapted from Sinha, Sharma and Scott, 2006

Groundwater management needs WEF approach

Water

Water policies needs to incorporate groundwater explicitly

Electricity

Electricity policies impacts groundwater use

Food

Food policies determines groundwater use

Look for solutions outside the water sector

Solutions in the electricity sector

- Metering of agricultural electricity, e.g. West Bengal
- Feeder segregation in several states, e.g. Gujarat, Punjab, etc.
- Grid connected solar pumps

Solutions in the food sector

- Higher prices for less water intensive, but more nutritious crops, like coarse cereals
- Growing water intensive crop in water abundant areas

Solutions in water sector

- Implementable GW laws

Look for solutions beyond the water sector. Food and energy sectors are key for GW management in South Asia

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Thank you