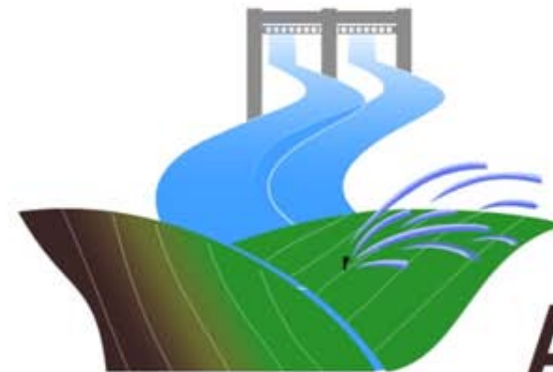


Evolution of irrigation practices: Are large scale irrigation systems still relevant?

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IWMI



**Asian
Irrigation Forum**

11-12 April 2012 • Asian Development Bank, Manila, Philippines



Evidence and arguments : Evolution of irrigation

- From 1950s to 1990s, nature and form of irrigation has changed from public canals to private groundwater
- Since 2000s, run away growth in groundwater has slowed down
- What then are the implications of recent trends for large scale public irrigation systems?

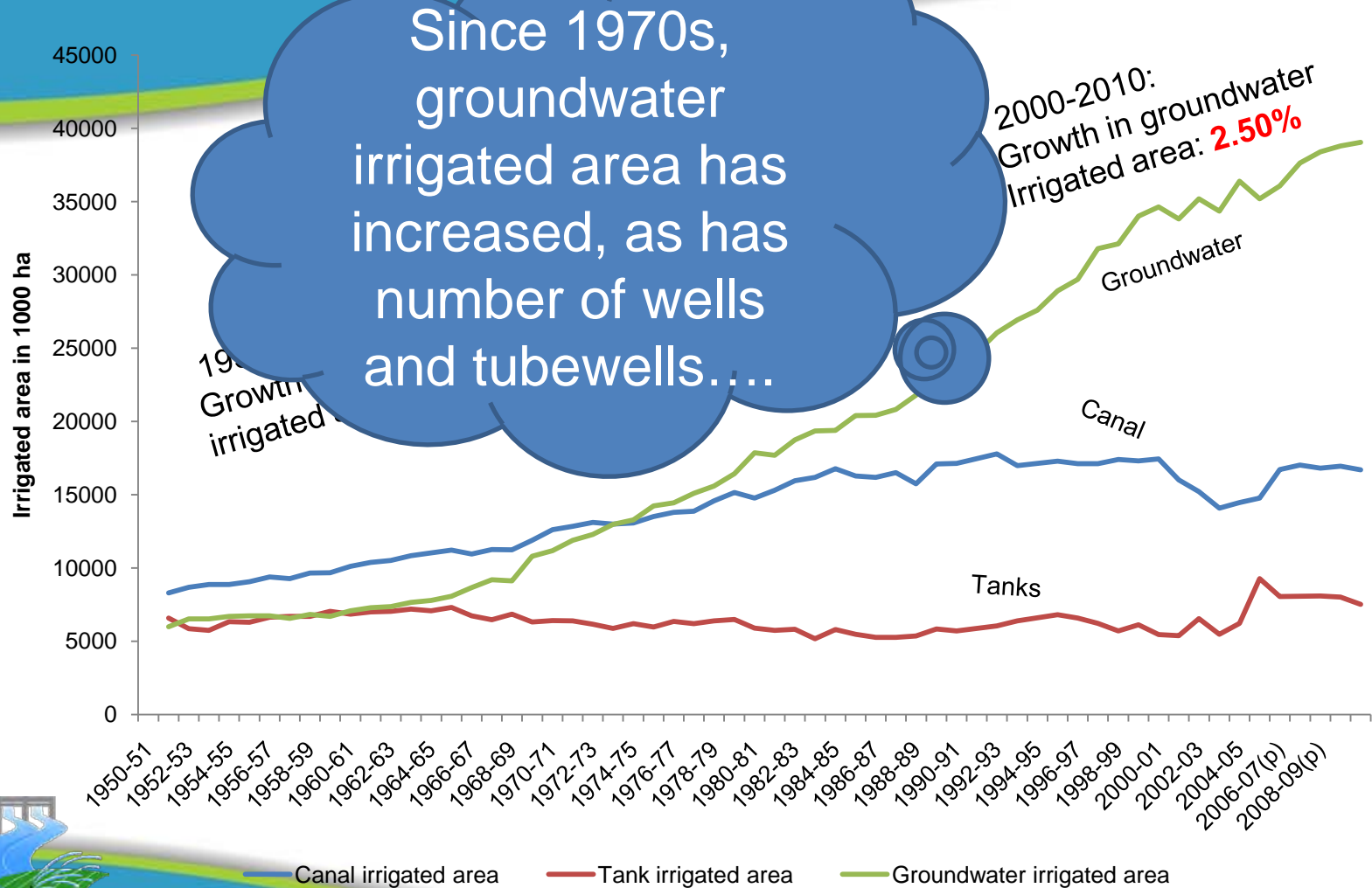


Phases of irrigation in India

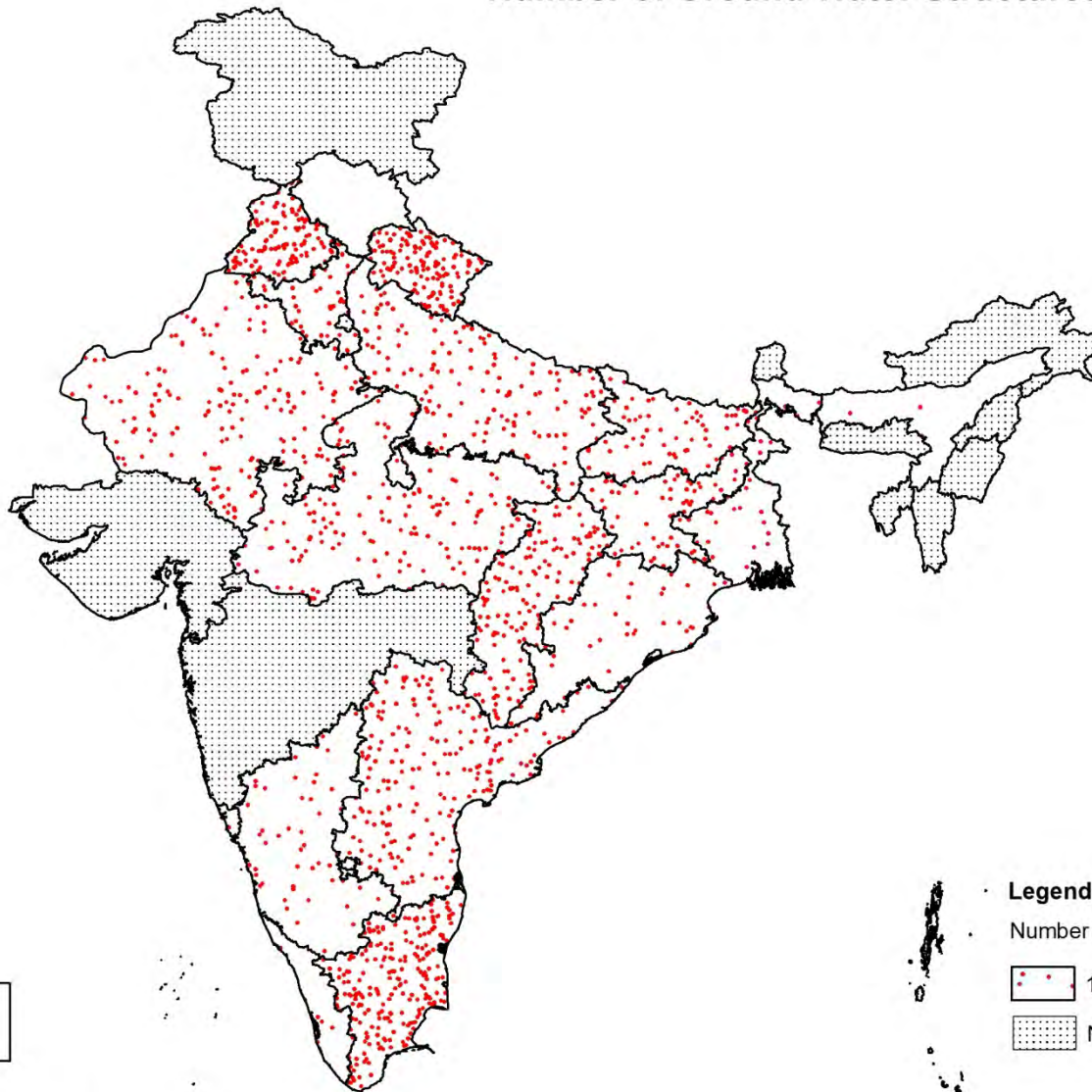
- **Phase 1 (till end 1960s):** Public investments and large scale irrigation systems drove expansion in irrigated area
- **Phase 2 (early 1970s to end 1990s):** Private investment in groundwater took over
- **Phase 3 (since early 2000s):** Slowdown in growth in groundwater irrigation



Irrigated area in India by source: 1950 to 2010



Number of Ground Water Structures, 1987



Total Number of Groundwater
Structure: 6.2 Million

Legend

Number of Ground Water Structures, 1987

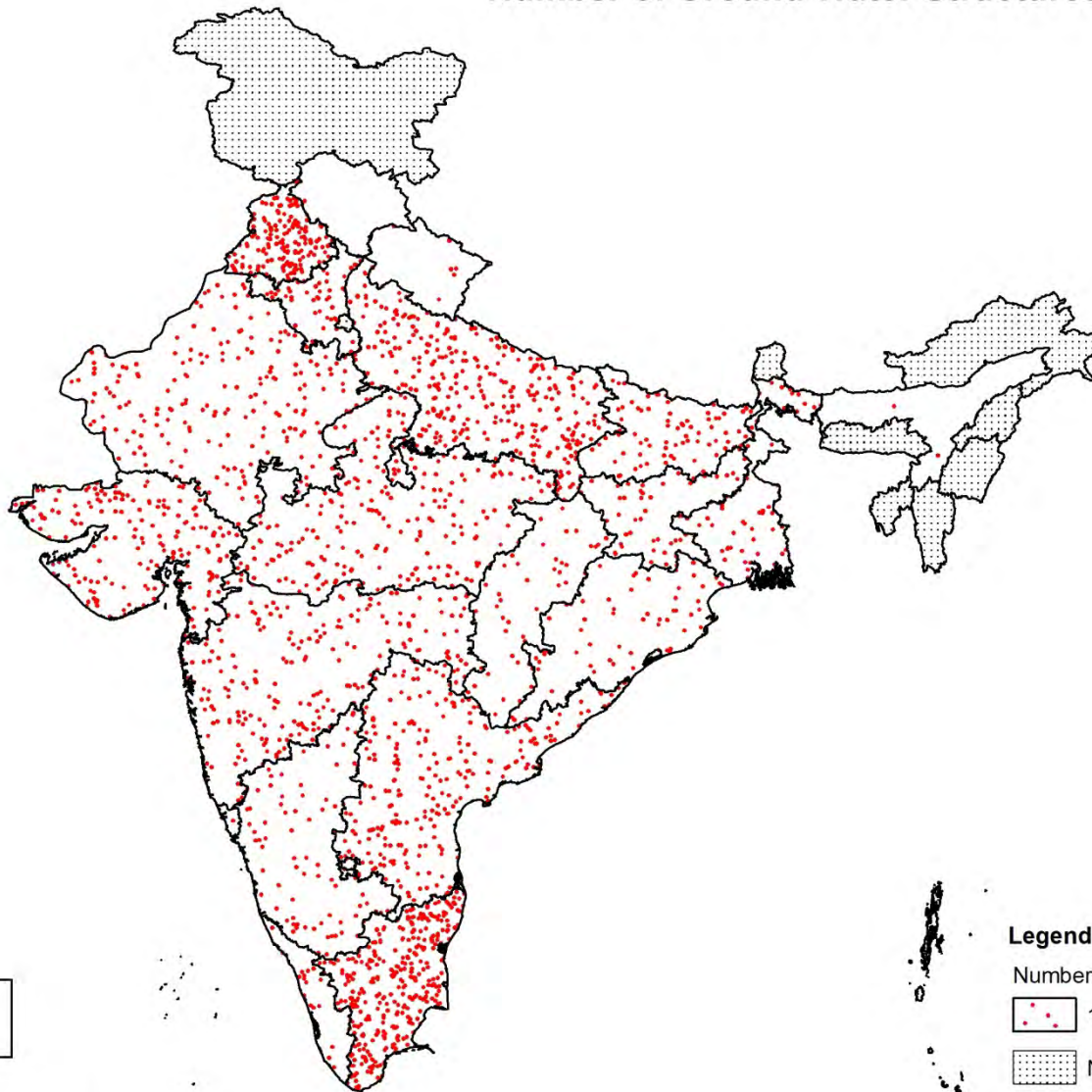
1 Dot = 5,000 Wells & Tubewells

No data

0 190 380 760 1,140 1,520
Kms

Source: 1st MI Census, 1986

Number of Ground Water Structures, 1994



Total Number of Groundwater
Structures: 11.5 Million

Legend

Number of Ground Water Structures, 1994

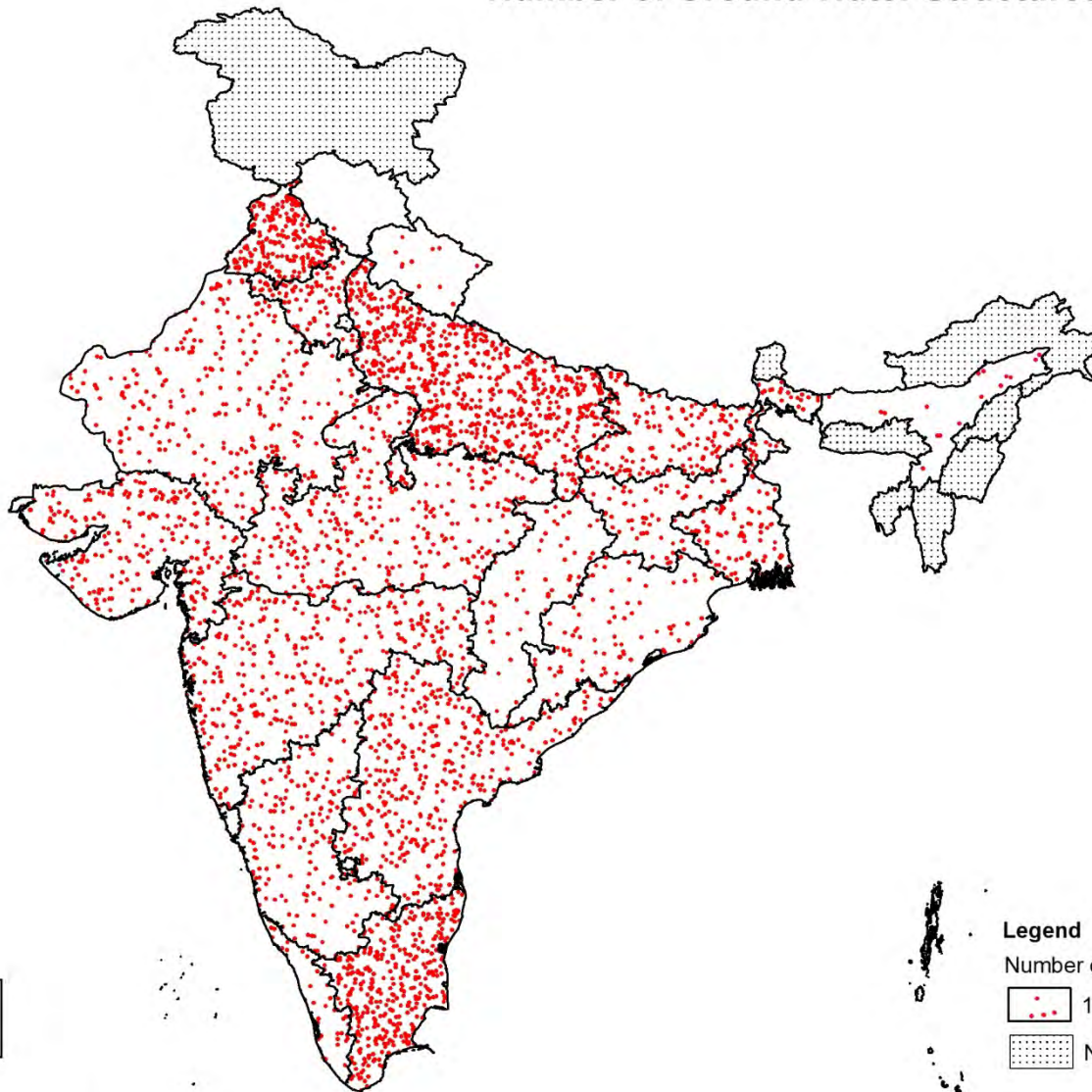
1 Dot = 5,000 Wells & Tubewells

No data

0 190 380 760 1,140 1,520
Kms

Source: 2nd MI Census, 1993

Number of Ground Water Structures, 2001



Total Number of Groundwater
Structures: 18.5 Million

Legend

Number of Ground Water Structures, 2001

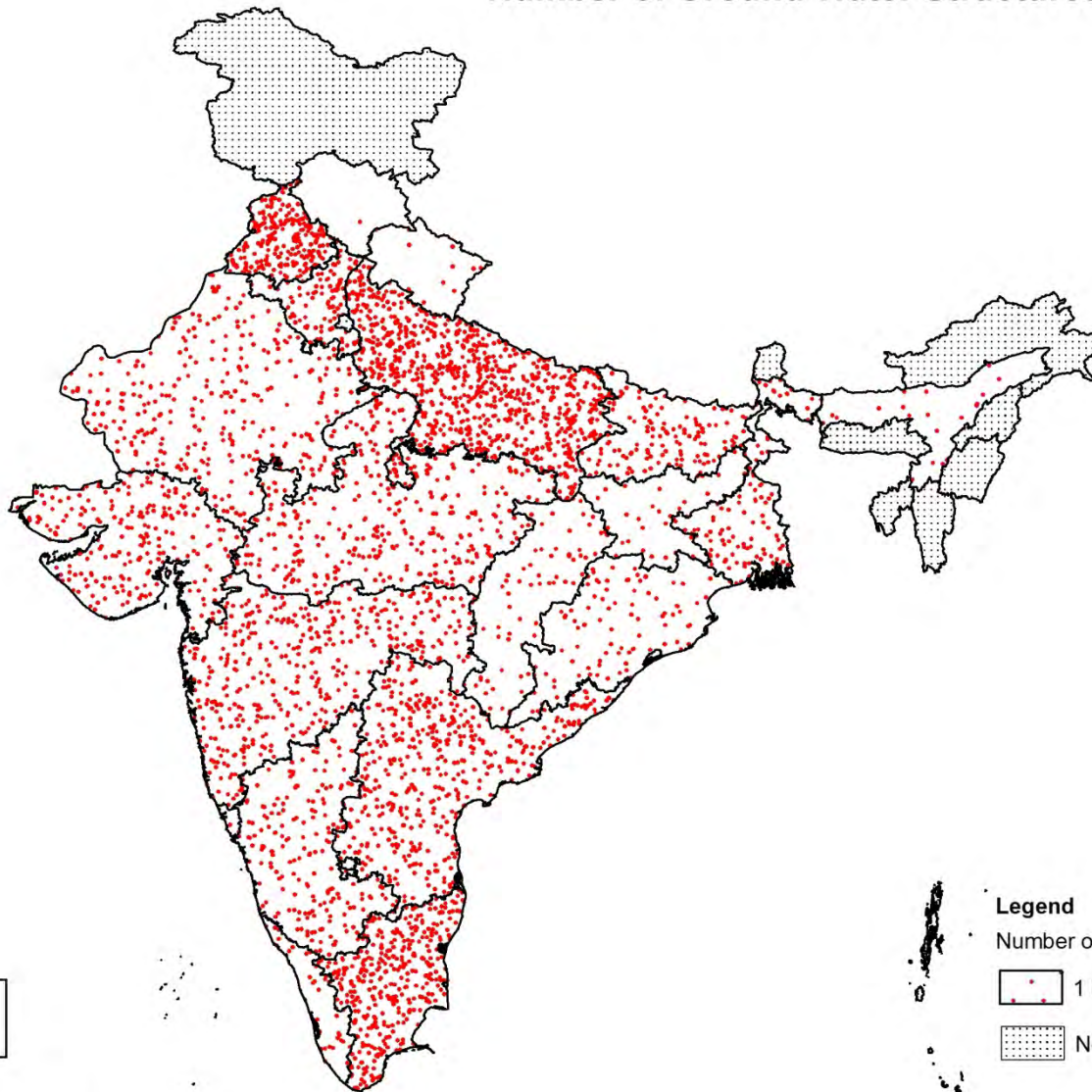
1 Dot = 5,000 Wells & Tubewells

No data

0 190 380 760 1,140 1,520
Kms

Source: 3rd MI Census, 2001

Number of Ground Water Structures, 2007



Total Number of Groundwater
Structures: 19.7 Million

Legend

Number of Ground Water Structures, 2007

1 Dot = 5,000 Wells & Tubewells

No data

0 190 380 760 1,140 1,520
Kms

Source: 4th MI Census, 2006

Why did groundwater irrigation overtake canal irrigation in 1970s?

- **Green Revolution**

- Canals were not maintained

- **Population growth**

- Farming expanded

- **Post colonial decline**

- As a result many irrigation systems neglected

- **New technologies and energy subsidies made pumps cheaper**

- As a result farmers invested heavily in groundwater extraction

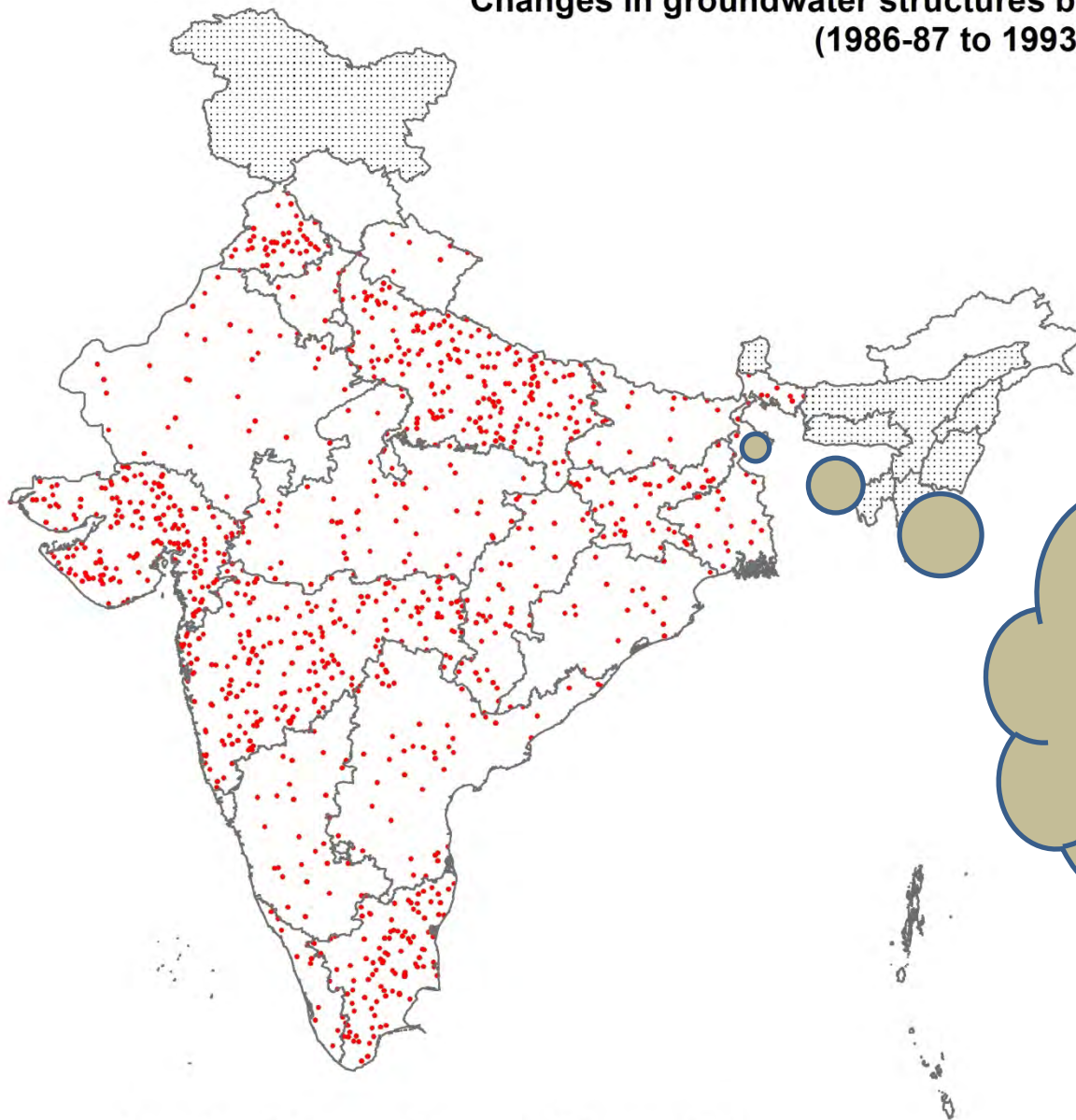
Groundwater provides **reliability and flexibility** – something that farmers demanded, but canals were never designed to provide



But the groundwater juggernaut of India is slowing down



Changes in groundwater structures between census period (1986-87 to 1993-94)



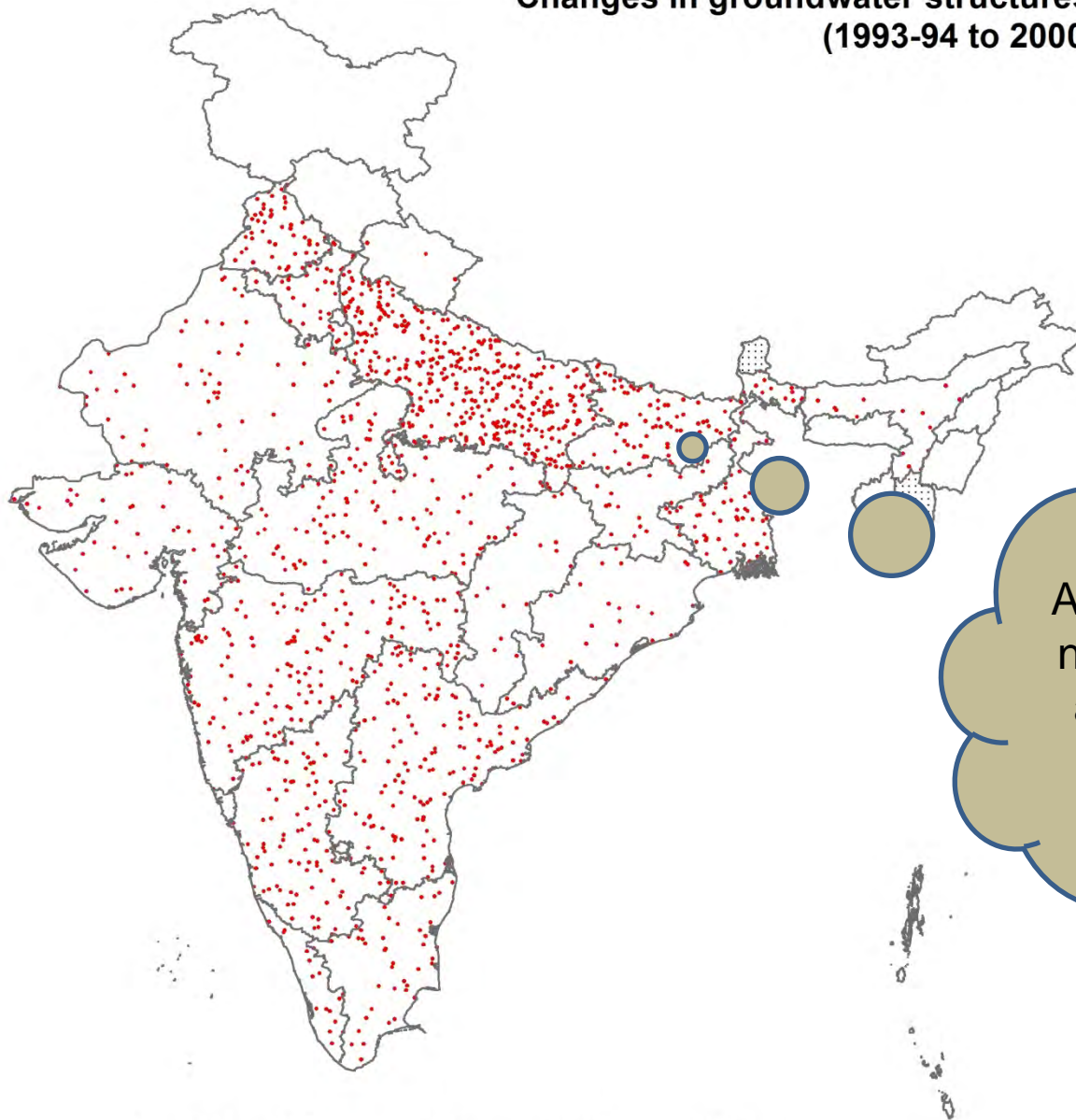
5.5 million new
pumps were
added between
1987 to 1993

Legend

- 1 Dot = 5,000
- 1986-87 to 1993-94
- Zero to Negative Data

0 220 440 880 1,320 1,760
Kms

Changes in groundwater structures between census period (1993-94 to 2000-01)

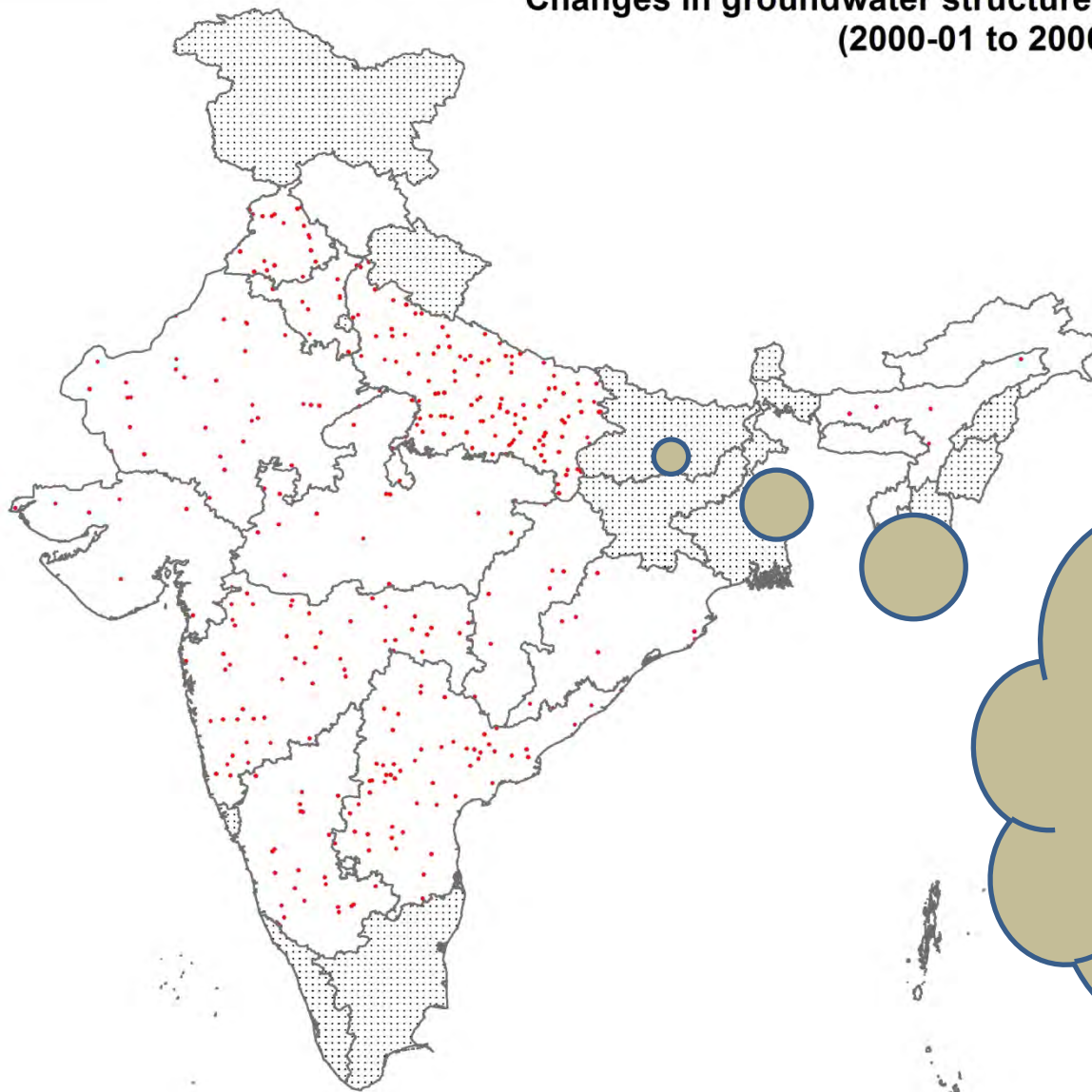


Almost 7.0 million
new pumps were
added between
1994 to 2000

Legend

- 1 Dot = 5,000
- 1993-94 to 2000-01
- Zero to Negative Data

Changes in groundwater structures between census period (2000-01 to 2006-07)



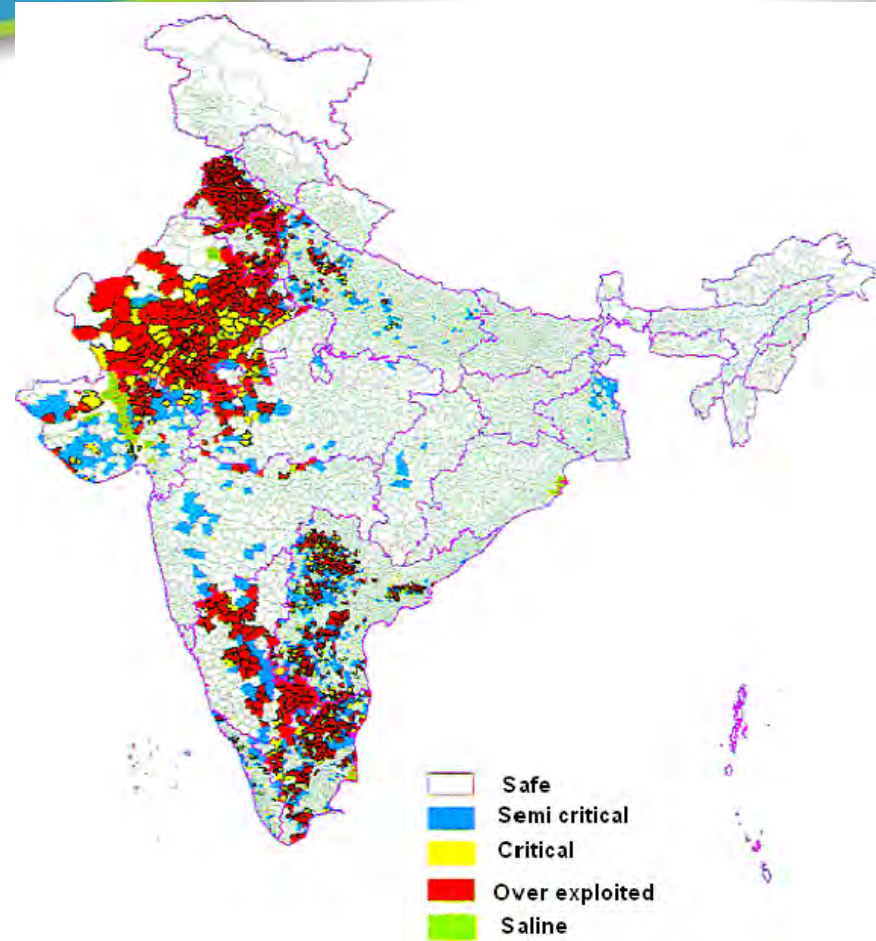
But only 1.2 million pumps came up between 2001 to 2007 and in some states like West Bengal, Bihar and Jharkhand, absolute number of pumps declined

0 187.5 375 750 1,125 1,500
Kms

Dot = 5,000
2000-01 to 2006-07
to_2006_
Zero to Negative Data

Why is it slowing down? The east vs. the rest

- There is simply not enough groundwater
- This explains slow down northern, western and southern India
- But not in eastern India where groundwater availability is high absolute size of groundwater economy has contracted



The energy irrigation nexus and the paradox of the East

- Low rates of pump electrification
- High diesel prices
- Low crop prices
- No public procurement system
- Poor roads and marketing



Therefore slow down in groundwater growth is a result of both resource and policy constraint.

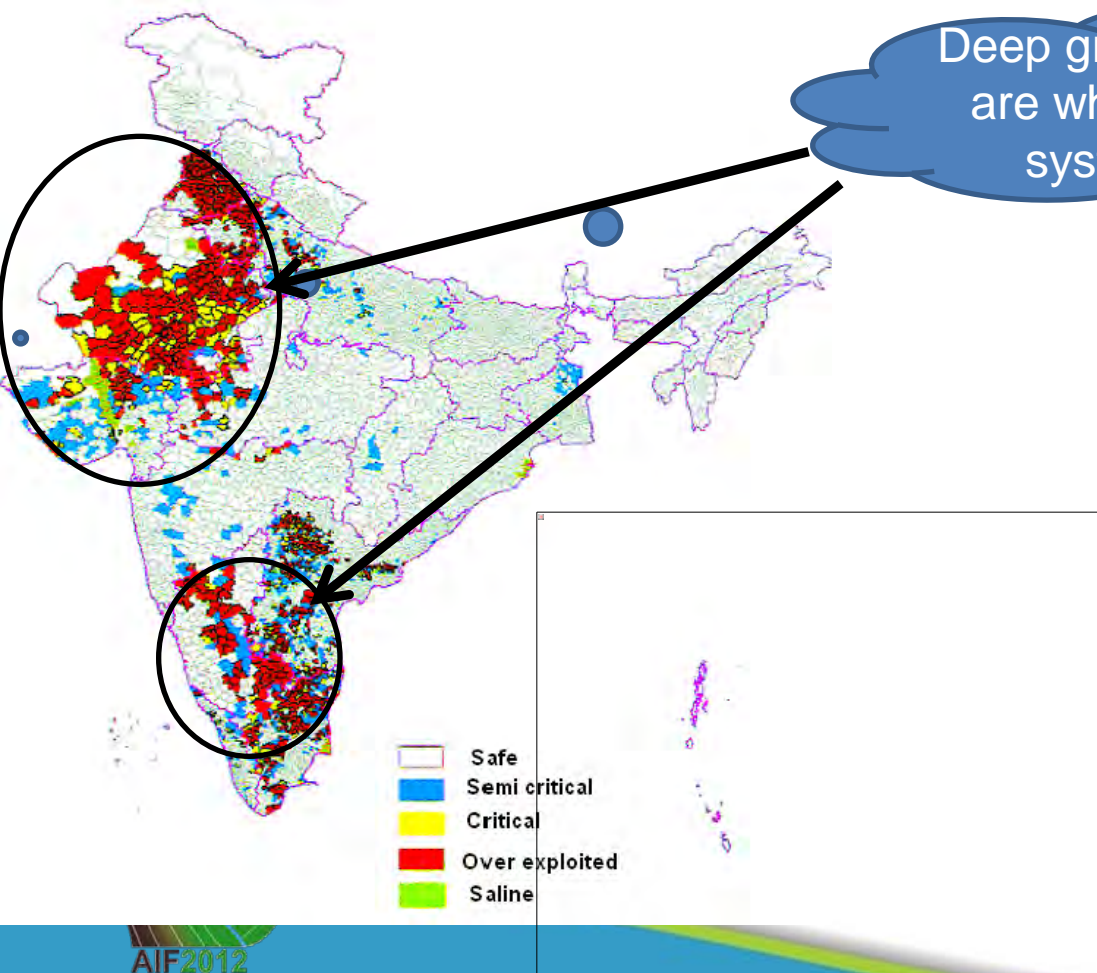
And this calls for suitably nuanced responses



Revitalizing irrigation in areas of groundwater over-exploitation



Revitalize Surface Irrigation: Deploy Surface Storage to Minimize Power Subsidies and Carbon Footprint of Irrigation:



Deep groundwater areas
are where large canal
systems operate

75-80 b kWh of power valued at
US \$ 9.0 billion/year mostly in
deep groundwater pumping.

Surface storages can reduce
power and carbon footprint:

Revitalize Irrigation Bureaucracy:

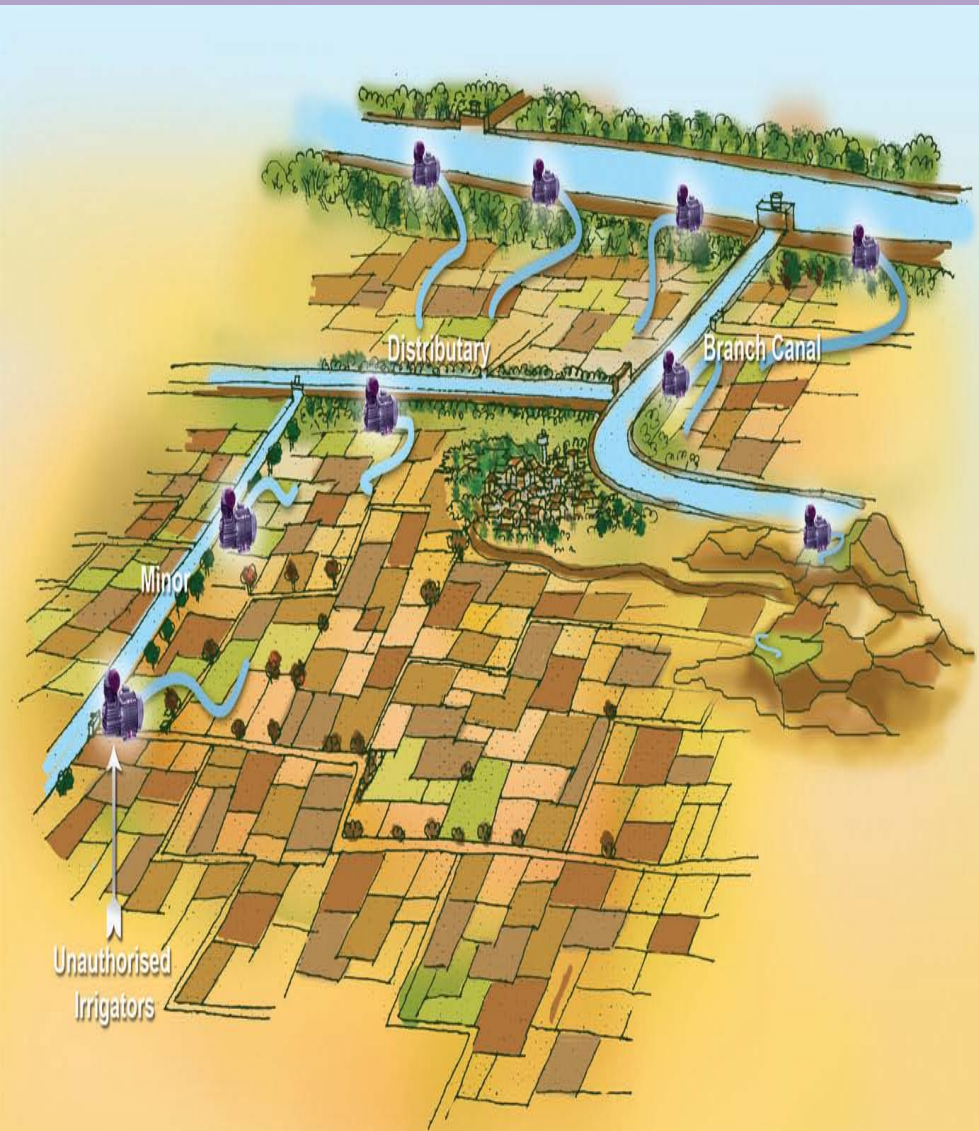
Incentives, Accountability, Performance Mgt, Culture Change.

- Restructure governance systems
- Unbundle irrigation agencies
- Benchmark performance
- Create incentives (better pay) and accountability.
- Realistic ISF and 100% collection



Encourage Distributed Storage:

Morph canal systems into Melon-on-vine systems



- To improve system flexibility and reliability
- Rajasthan: farm-storages
- Gujarat, Tamilnadu, Andhra Pradesh: village tanks replenished by canal water

Invest in electricity and markets in areas of high groundwater potential



Invest in electricity and markets in areas of high groundwater potential

- High groundwater potential, high rainfall and natural recharge



- Farmer already pay high electricity tariffs and therefore do not expect “free electricity”



- Food production in eastern India will ease pressure on over-exploited aquifers and also promote growth in this poverty stricken region

Slide 22

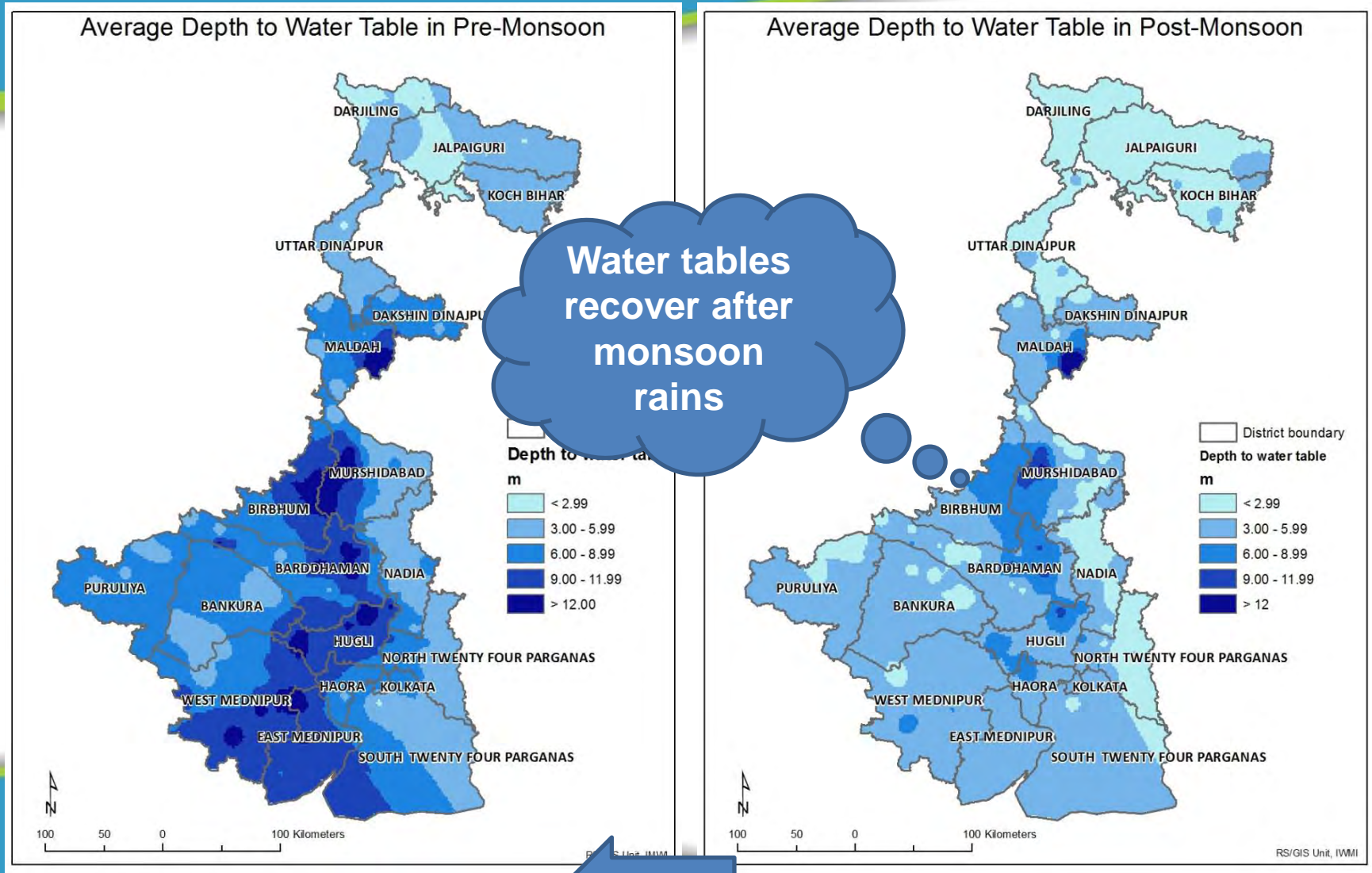
Thank you

For questions and comments, write to
Aditi Mukherji

a.mukherji@cgiar.org



Abundant groundwater and high natural recharge



Farmers pay high tariffs and electricity subsidy is not an issue

