Assessing India's Drip Irrigation Boom:
Social Institutions and Policy Implications in Rajasthan

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Global Water

- 70% water withdrawals go to irrigation globally (UN 2013)
  - 60% of GW globally
  - 88-91%~ of GW across India (Shah 2010)
- Indian GW Decline
    - GRACE (groundwater recovery and climate experiment)
      - 2002-2008
- Policy Response?

GW Policy in India

- GW regulation purview of individual States
- *Model Bill to Regulate and Control the Development and Management of Ground Water*, 1970
  - Revised: 1992, 1996, 2005, 2011
  - Enacted by 13 (?) states; not Rajasthan
- Addressing GW use and efficiency by other means….

Addressing GW and Climate Change

- National Action Plan on CC, 2008
  - National Mission for Sustainable Agriculture, 2010
    - Recognize "risks to Indian agriculture sector due to climatic variabilities [sic] and extreme events"
    - 'encourage adoption of technologies for enhancing water use efficiency'
  - National Water Mission, 2011
    - "Increase water use efficiency by 20%" to enhance climate resilience
    - National Bureau of Water Use Efficiency: coming soon

What is efficiency?

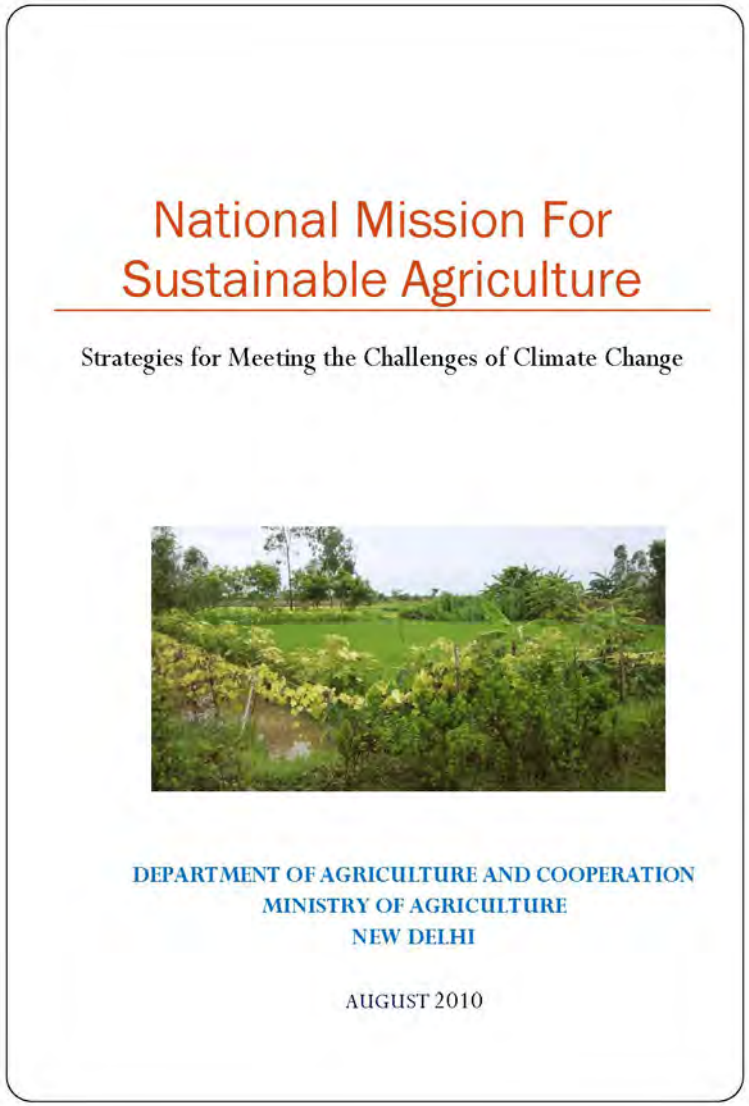
- Global consensus on "Efficiency" (Boelens et al 2012)
  - Physical efficiency:
    - Enhance productivity
    - "More crop per drop"
  - Economic efficiency:
    - More surplus/unit water
    - Direct water towards higher marginal returns
- Global problem → global solution

Universal(izing) Technology

- Drip Irrigation
  - Supplies water directly to plant stems or roots
  - Doubles water use efficiency, *as productivity* (Worldwatch Institute 2013)
  - Climate Adaptive
    - Viewed as lynchpin in agricultural resilience

Enhancing Efficiency

- National Mission for Sustainable Agriculture, 2010
  - 2014-15 outlays
    - India: 1500 Crore ($US 235 million)
    - Rajasthan: 150 Crore (US$ 24)
  - Implemented by States
  - 1 ha increments



The diffusion of drip irrigation

- 10.3 million ha globally (ICID 2015)
  - 6-fold expansion over last 20 years
- 2.0 million ha in India (ibid)
  - 111-fold expansion in 20 years


JAIN
Jain Irrigation Systems Ltd.
SCREEN FILTER


JAIN
MEDIA FILTER
SILICA SAND


JAIN
Jain Irrigation Systems Ltd.
FERTIGATION EQUIPMENT
CAPACITY : 60 LITER
BATCH NO. : 082592

Drip's Properties I

- Jevons Paradox
  - Increase Efficiency → more consumption

Drip's Properties II

- Labor intensive
  - *Female cultivators*, 2001-2011: -14%
  - *Female ag laborers*, 2001-2011: 24%

Drip irrigation's effects

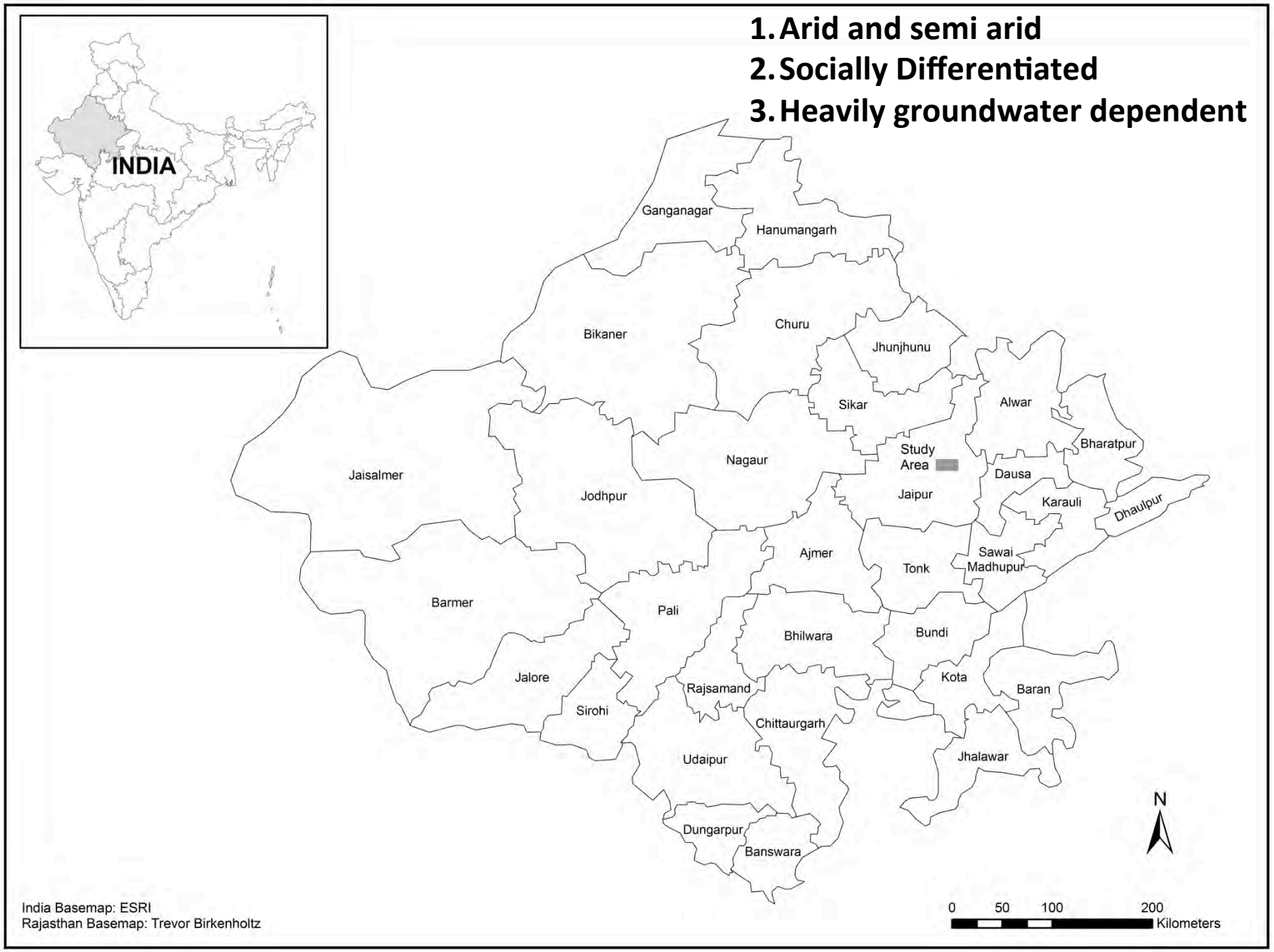
1) What are the origins of efficiency in drip irrigation productivity?

2) What effect is the spread of drip irrigation having on groundwater use and levels?

3) What are the GW policy implications?

Ag Labor and Efficiency

- Commercial &/or contract farming relies on unpaid labor (Carney 1988; Ramamurthy 2010)
  - Married men and their families
- Feminine labor subsidy → productive & economic efficiency
- Yet, what reproduces it?
  - Specific political economies…


1. Arid and semi arid
2. Socially Differentiated
3. Heavily groundwater dependent
INDIA
Ganganagar
Hanumangarh
Bikaner
Churu
Jhunjhunu
Sikar
Alwar
Bharatpur
Nagaur
Study Area
Jaisalmer
Jodhpur
Dausa
Jaipur
Karauli
Dhaulpur
Ajmer
Tonk
Sawai Madhupur
Barmer
Pali
Bhilwara
Bundi
Jalore
Kota
Baran
Rajsamand
Sirohi
Chittaurgarh
Udaipur
Jhalawar
Dungarpur
Banswara
N
India Basemap: ESRI
Rajasthan Basemap: Trevor Birkenholtz
0 50 100 200
Kilometers

Rajasthan Water

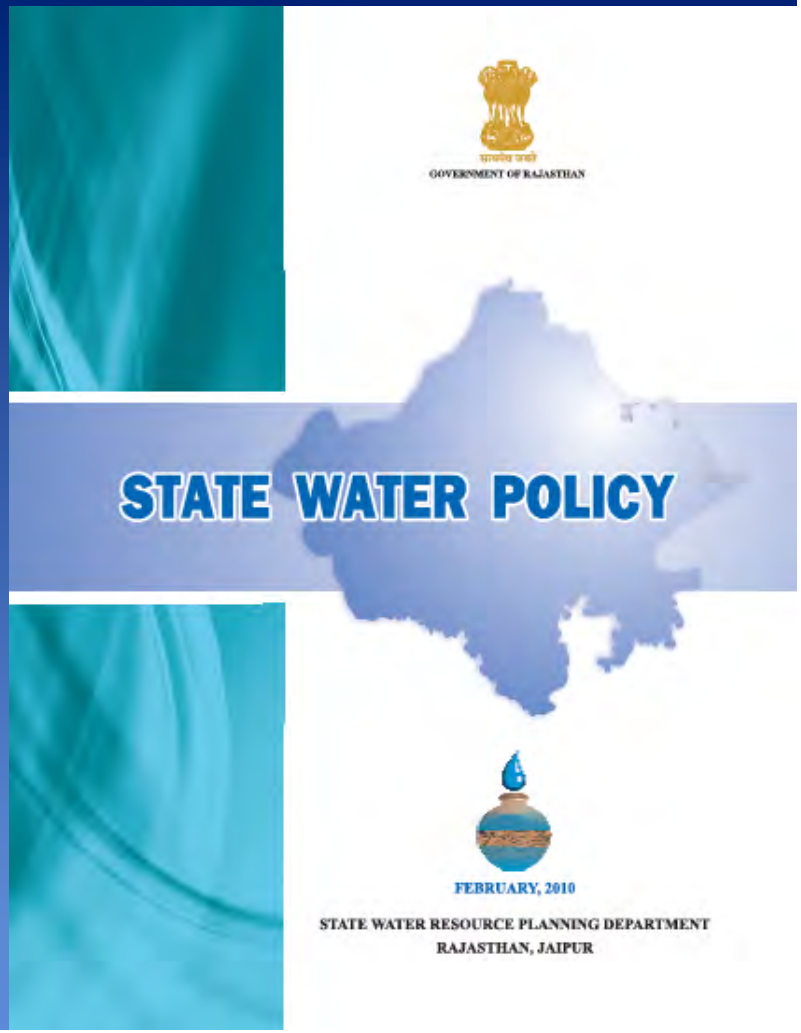
- Groundwater serves:
  - 76% of Rajasthani irrigated area – 4.0 million ha (GOR, 2014)
  - 80% of domestic water supply (ibid)
- Historically no state regulation

Rajasthan Water

- Rapid groundwater decline
  - 410 million m^3 / year overdraft in Rajasthan (GOR, 2006)

Efficiency and Irrigation

- Rajasthan State Water Policy 2010
  - Irrigation withdrawals:
    - 83% → 70%
  - "Section 1.3 Optimizing Water"
    - "groundwater will be better utilized…by facilitating drip irrigation techniques"



Case 1: Labor Contracting

- Cost
  - US$5,000/ha
  - 70-90% subsidy
- Contracting Labor
  - Mali women and Rajput fields 80 rps/day
- Precarity & Subsidizing capital
  - *We work when needed for clearing the holes and weeding* (Mali female laborer, 3/2011)
  - *We bring the children, because who will watch them. They do the work also* (ibid)

Case 2: Efficiency and Jevons Paradox

- Crop Intensification
  - Doubles productivity
  - 3 crops / year
- Jevons Paradox: Groundwater Decline
  - *Water will be depleted [beyond the solar pump] in three year's time…we will go deeper or sell* (landowner, Feb 2015)
  - *We went in for the drip to raise productivity* (ibid)
- Intensification and Efficiency
  - *They* [laborer women] *come around and we hire them if we have work, usually on daily rate. It would be difficult to manage without the laborers* (landowner, 2/2015)

Conclusions

- Jevons Paradox
  - Political economy of GW incentivizes intensification
  - Groundwater decline continues
  - Low redundancy = less resilience?
- Gendered Drip systems
  - Efficiency: Women provide flexible labor that subsidizes the system & displaces precariousness

Lessons and Implications

- Water Policy
  - What drives the paradox (efficiency-water use gap)?
    - Solutions: prices or water rights/entitlments?
  - National Mission for Sustainable Agriculture
    - Resilience?
    - Gender absence?

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