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Groundwater Markets and Economic Impacts on Farming in Hard rock areas of India

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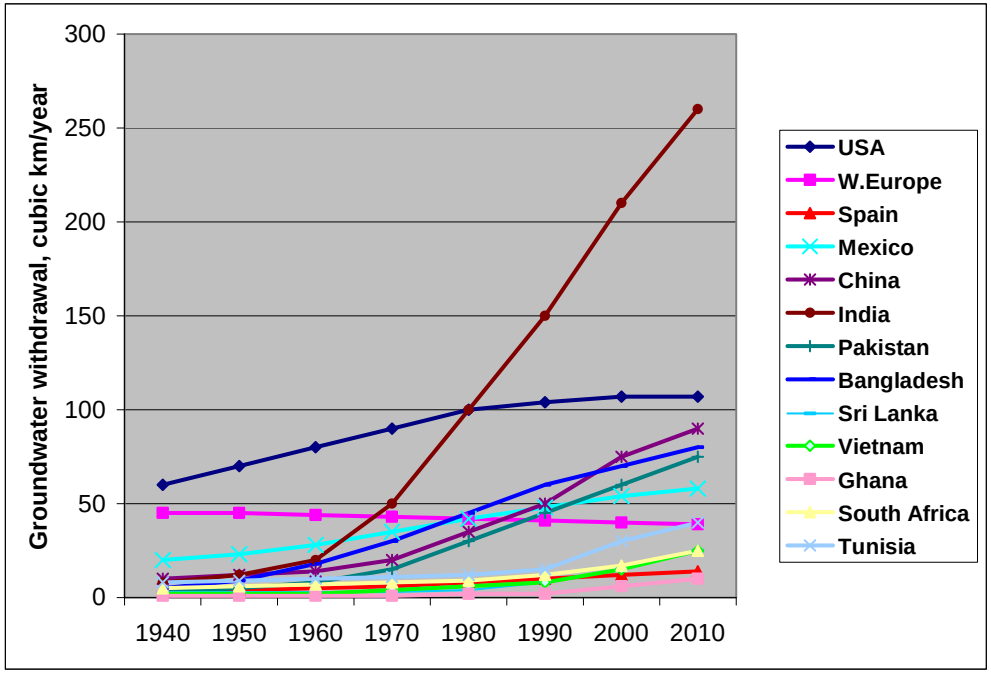
Content

- Introduction and research problem
- Data collection
- Analytical Methods
- Results
- Conclusions

1. Introduction

1.1 Importance of groundwater irrigation in India

- Groundwater: 60 % irrigated area, 70 to 80 % : value of irrigated output & 9% : GDP (Shah,2003;Sharda,2006;Gandhi & Namboodiri,2009).
- 2/3rd area is formed by hard rock, which lacks primary porosity and access to perennial rivers (Nagaraj et al., 1999).

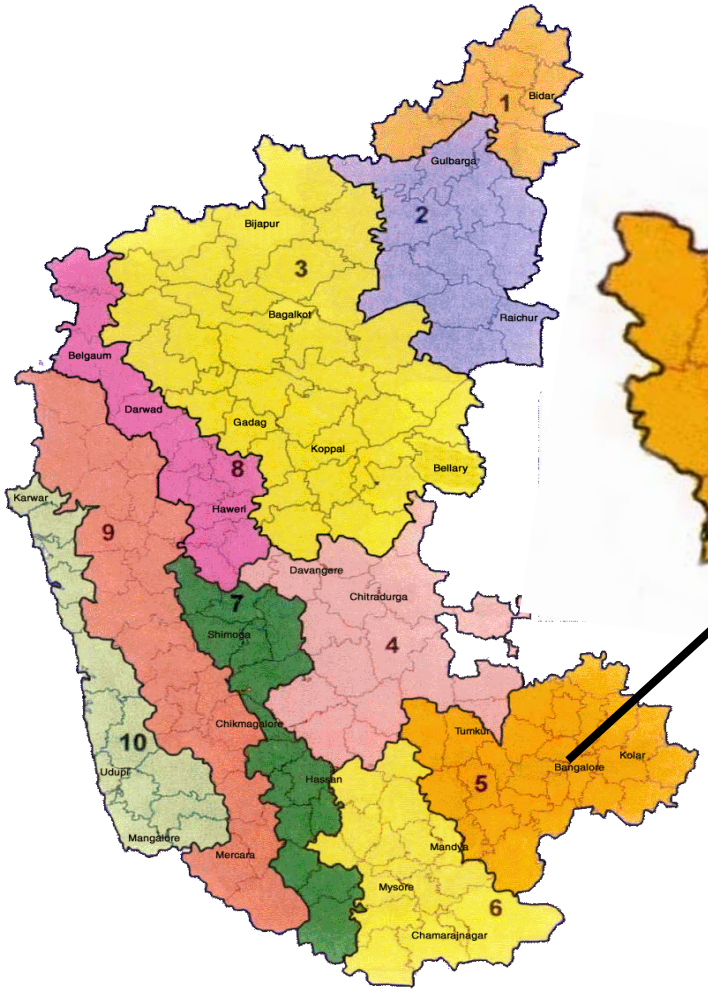


Development of groundwater in selected countries

1. Introduction

1.2 Study Area

India



Karnataka

Eastern Dry Zone

1. Introduction

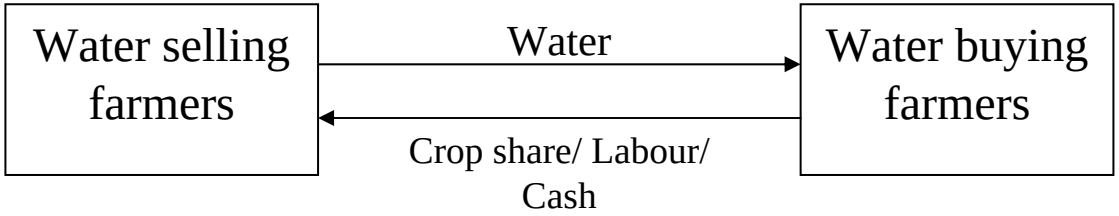
1.3 Research problem

- Market forces, energy subsidies, institutional finance and strategic behaviour of farmers…Groundwater depletion (Negri, 1990; Deepak et al.,2005;Manjunatha et al.,2011).
- The region is considered as over exploited zone (Nagaraj et al., 1999; Saleth, 1996)….no more credit..
- Informal water market is further threatening the resource (Diwakara and Nagaraj, 2003)
- Government failed to control groundwater depletion….Political reasons (Moench., 2001).
- Negative externalities: decline in water table, initial and premature failure of wells and increase in irrigation costs

1. Introduction

1.4 Water markets in India

- Water market describes a localized, fragmented, village-level informal arrangement …



- Currently these markets cover more than one-fifth of the total irrigated area in India.

Source: Easter et al.., 1999; Nirmal and Shreekant 2002;Mukherji,2004

2. Data Collection

- Primary data.....Purposive random sampling

  27 Water-sellers;

  40 Water-buyers;

  104 Non-traders

3. Analytical Methods

- Irrigation cost(IC) $$IC = \frac{ACBI}{TWU}$$
  - Amortized Cost of Bore Well Investment(ACBI)

$$ACBI = \left[(CC) \times \left\langle \frac{(1+r)^{Wy} \times r}{(1+r)^{Wy} - r} \right\rangle \right] + VC$$

  - Total Water Use (TWU) in all seasons $$TWU = \sum (WR + WW + WS)$$

- Gross Margin Analysis
- Negative externality per well = AC per functioning well - AC per well.

Source:Deepak *et al*, 2005; Diwakara & Chandrakanth, 2007

4. Results

4.1. Socio-economic characteristics of sample farmers

Variables	FPWM		FNPWM	F-value	P-value
	Water Sellers	Water Buyers	Non-Traders		
Demographics: Number					
Age (years)	45.19	44.85	46.31	0.341	0.711
Education level (years)	9.44	6.58	8.82	7.437	0.001
Family size(Number)	4.78	5.68	6.03	3.258	0.041
Agril. Labour(Number)	3.63	5.05	3.59	15.333	0.000
Land Holdings: Acres					
Rainfed (Acres)	2.84	1.27	2.35	5.496	0.005
Irrigated (Acres)	2.01	1.05	2.21	8.456	0.000
Fallow(Acres)	0.26	0.08	0.27	0.765	0.467

Note: One Acre = 0.40 hectare

FPWM= Farmers Participation in Water Market; FNPWM=Farmers Non-Participation in Water Market

4. Results

4.2. Cropping pattern

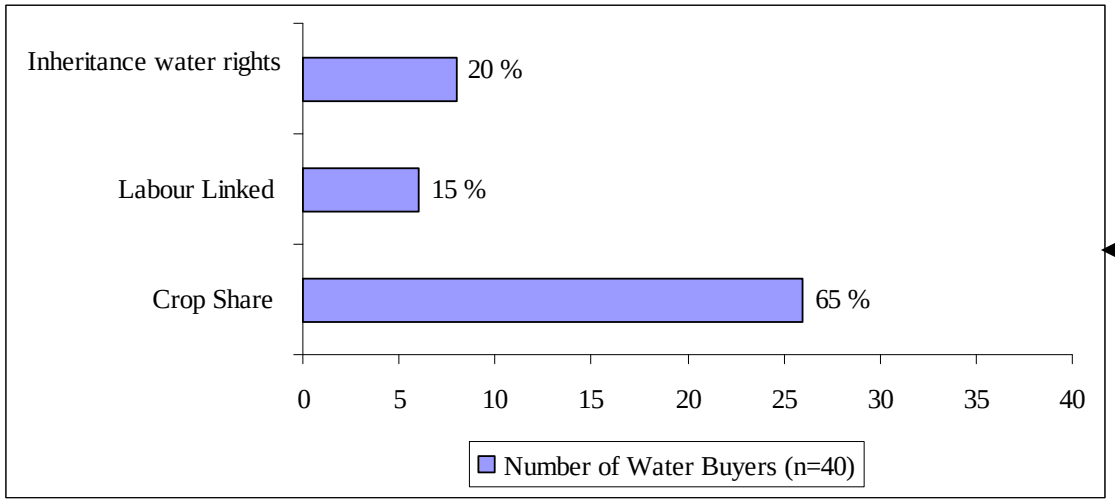
- In Irrigated land (all groups),

  - Mulberry, grape, tomato, carrot and cauliflower are the major crops

- Irrigation Intensity : > 200%

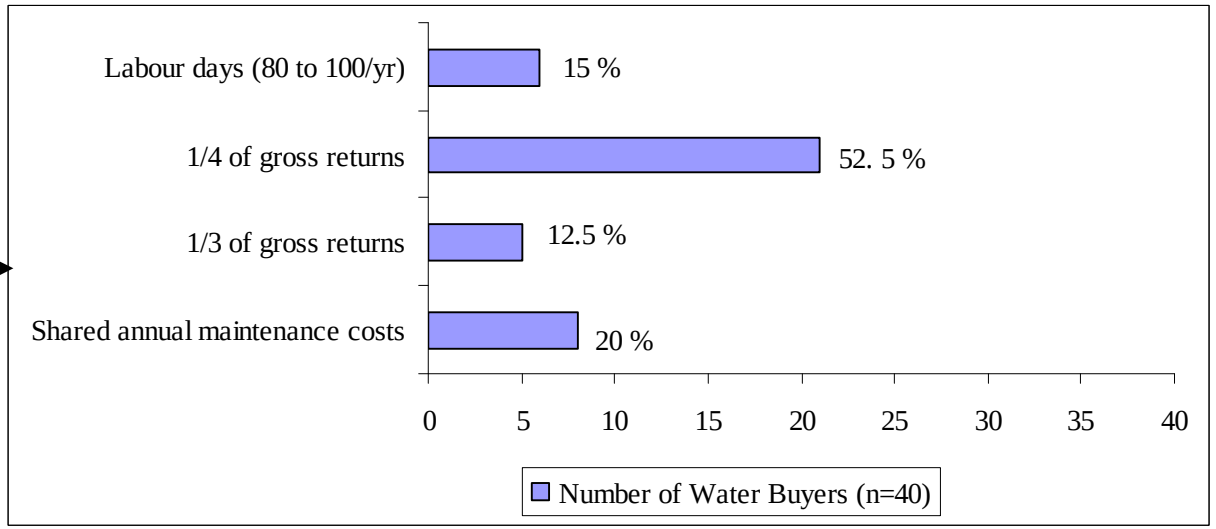
4. Results

4.4. Functioning of groundwater market



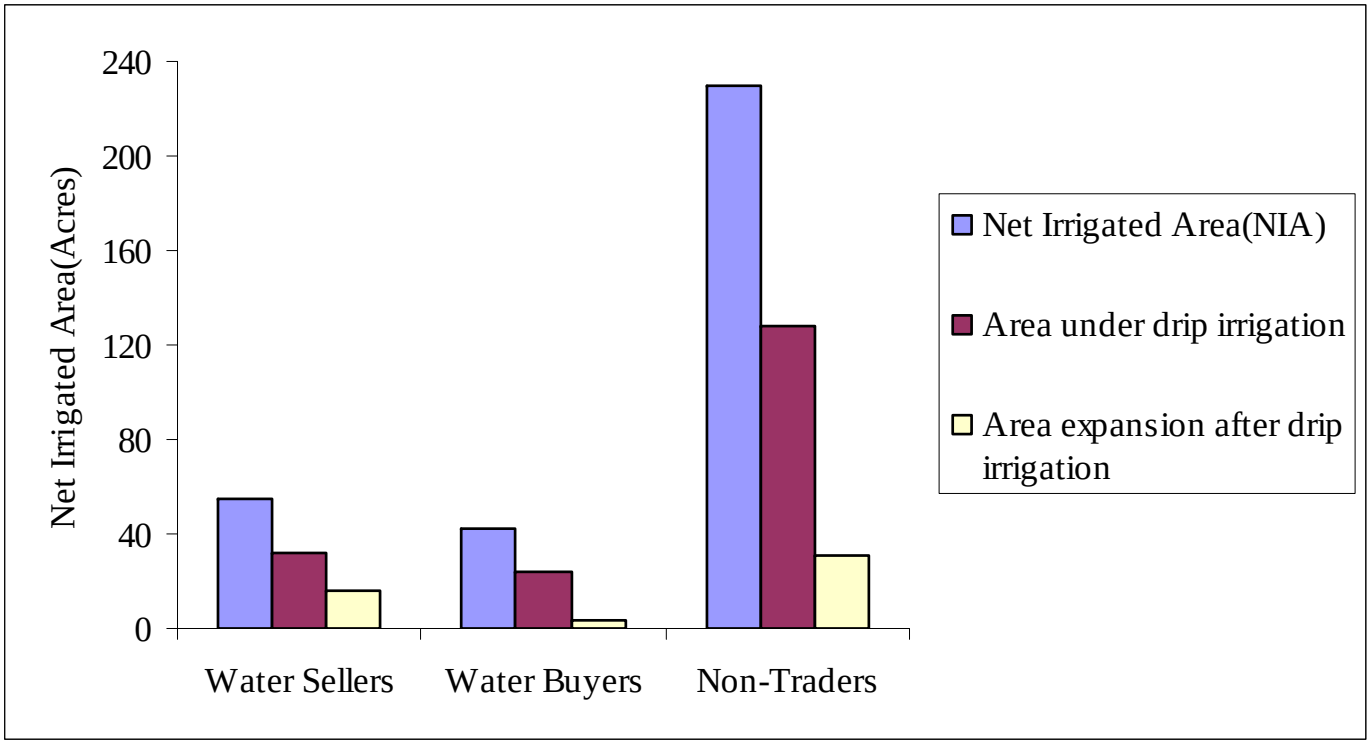
Types of water markets

Types of transaction



4. Results

4.5. Drip Irrigation particulars



4. Results

4.6. Irrigation details of farmers

Irrigation particulars	FPWM		FNPWM
	Water-Sellers	Water-Buyers	Non-Traders
Proportion of Well Failure (%)	61.4	108.3	61.8
Average working life of a bore well(Years)	6.5	8.6	7.7
Number of functioning wells	1.6	0.6	1.2

Notes: Proportion of well failure = (Non-functioning wells/ Functioning wells)*100

4. Results

4.7. Economics of groundwater irrigation

Irrigation particulars	FPWM		FNPWM
	Water Sellers	Water Buyers	Non-Traders
Negative Externality/ well (€)	147.8	175	119.2
Irrigation Cost /acre- inch (€)	6.3	5.9	5.4
Net returns per acre- inch of water (€)	41.3	52.8	33.7
Net returns per euro of irrigation cost (€)	6.5	8.9	6.2

Note: One acre inch = 102.79 cubic meter; One euro = INR 60 (approx.)

"*Poor but Efficient*" -Theodore W. Schultz….this apply to water-buyers

4. Results

4.8. Economic Benefits of informal groundwater markets

- Water-buyers:

  ➔1.3 acres/farm

  ➔ 219€/farm

- Water-sellers:

  ➔ 534€/farm

5. Conclusions

- Positive: equity, efficiency, improvement in income ….
- Negative: increased irrigation costs, reduced working years of wells, increased negative externality per well..
- Importance of family water sharing institution,interlocked nature of labour and water markets and negative implications of drip irrigation subsidies…

"When the well is dry, we know the worth of water" – Benjamin Franklin.