The impact of water users' associations on the productivity of irrigated agriculture in Pakistani Punjab

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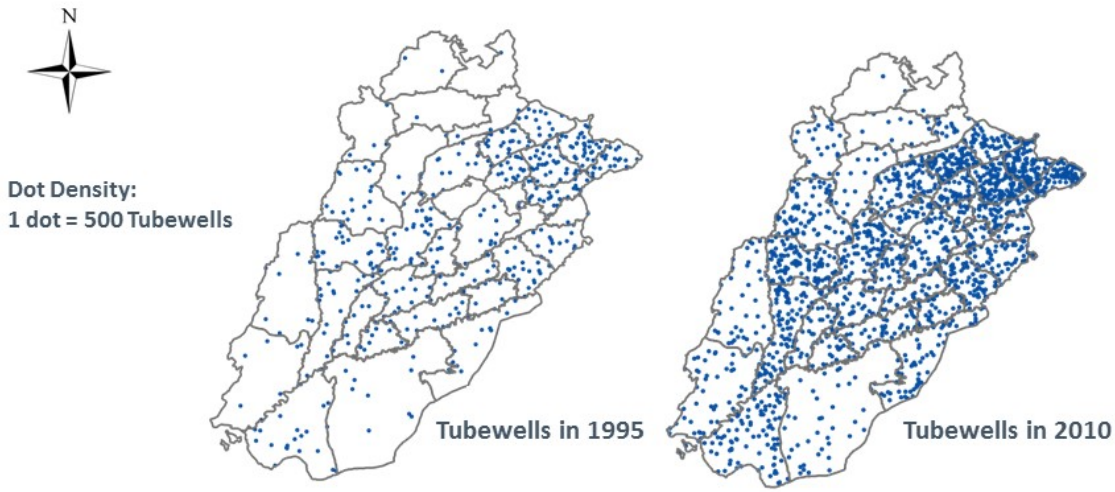
Webinar: Sustainability in the Water-Energy-Food Nexus
International Water Resources Association

Background: Indus Basin Irrigation System

- World's largest contiguous irrigation network
- Irrigates 35 million acres
- 107,000 watercourses stretching 1.6 million kms
- Irrigated agriculture is challenged by water scarcity, salinity, waterlogging, and high conveyance losses particularly at the watercourse level

A conjunctive irrigation system has emerged with surface and ground water use with heavy energy dependence



Using district level tubewell installation data, we used GIS Mapping to map pumping density in Punjab

Source: Siddiqi & Wescoat (2013).

- Energy intensity in agriculture increased by 80% in 15 years but crop production improvements were lower
- 20% of all energy consumed in Punjab is for direct use in agriculture, of which 61% goes to groundwater pumping
- Despite the energy crisis in Pakistan, GW irrigation continues to flourish

Objective

Is there a role for water institutions to address the water-food-energy challenges in this context?

Do WUAs (Khal Panchayats) lead to improved water management, which in turn would translate into increased resource use efficiency across the nexus in Punjab province of Pakistan?

Background: Formation of WUAs through OFWM

- Farmers have long relied on "khal committees" to mobilize labor for watercourse maintenance
- After the OFWM pilot project (1976-80), "khal committees" did not prove effective in organizing the labor needed to maintain the improved watercourses
- A need to organize them into a formal, legally-recognized WUA empowered to enforce watercourse maintenance
- Punjab, Baluchistan, and NWFP (in 1981) and Sindh (in 1982) each promulgated its own WUA Ordinance
- The OFWM office organized about 48,000 WUAs in the last 30 years in Punjab, though all may not be functional

Background: Formation of WUAs by the 1997 IMT

- In 1997, Pakistan decentralized its monolithic Irrigation Departments into autonomous organizations
- Khal Panchayats(KPs) or WUAs
  - Watercourse Level
  - Maintenance of watercourses, collection of abiana
- Farmer Organizations(FOs)
  - Distributary Level
  - Chairpersons of KPs
- Area Water Boards (AWBs)
  - Formed at the major canal level
  - Elected members from FOs and government appointees

Some WUAs are formed by AWBs because distributary and minor level FOs consist of chairpersons of WUAs

Data

- Pakistan Rural Household Panel Survey
- Detailed plot level information with highly disaggregated data on irrigation types, methods, and institutions
- Kharif (rainy season) 2011 and Rabi (dry season) 2011-2012
- We include rice, cotton, sugarcane, sorghum, and millet in Kharif, and wheat and berseem (a leguminous forage) in Rabi

Roles of WUAs identified by survey respondents

	Percentages
Collection of Abiana	70
Influencing the timing of water release	70
Maintenance of watercourse	70
Dispute settlement	40
Maintenance of canal	20
Observations	99

About 2/3rds of the WUAs are reported to have improved water management on the watercourse

Mechanisms through which WUAs lead to improved water Management

	Percentages
Less conflicts around water	80
Less water theft	70
Improved maintenance	60
Timely delivery of water	50
More information on when water arrives	10
Observations	61

Methodology

- We used the Hausman-Taylor panel data estimator
- Econometric details on the paper

Major Findings

WUAs can improve nexus outcomes including equity issues

- 10% productivity gain at the tail of the watercourse
- 8% productivity gain for those that rely solely on groundwater

- No evidence of WUAs improving productivity at the head and middle of the watercourse
- The differential impact of WUAs along the watercourse should be taken into account during the design and management of IMT

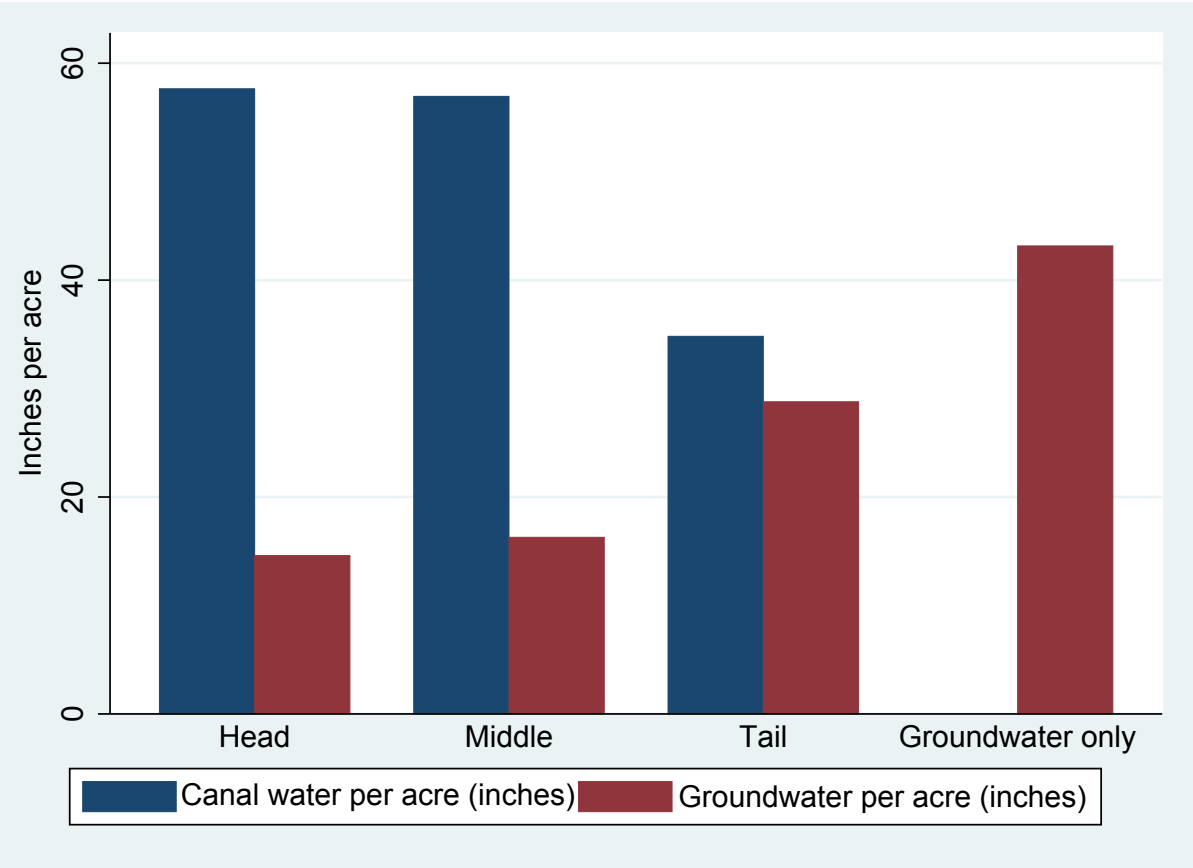
Why and how WUAs are constituted matters

- The productivity impact of WUAs is in part due to the initial investment on canal lining and land leveling made by OFWM, as well as the WUAs' ability to organize its members to maintain and upkeep the watercourse over time

- Canal lining provides more fresh surface water to a larger number of of farmers, reducing the need to pump groundwater, augmenting groundwater available to farmers at the tail of watercourses or those that solely rely on groundwater

Implications for the water-energy-food nexus

Figure 1: volume of canal and ground water by location of farms on a watercourse



Improving the management of surface water through functioning WUAs can be a viable option for reducing excessive reliance on groundwater

Conclusions

- Results indicate a degree of success of WUAs in improving the returns on irrigation land in the Punjab province of Pakistan
- The impact of WUAs on farm productivity varies by the location of farms on the watercourse with a potential to improve distributional equity in water uses across the watercourse
- The performance of WUAs is likely to face challenges from farmers at the head and middle of watercourses, and this has to be taken into account during the design and management of watercourse level farmers' organizations

THANK YOU