

Impact of Preservation of Subsoil Water Act on Groundwater Depletion: The Case of Punjab, India

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Background

- Early transplanting of rice has been noticed widely due to availability of irrigation based on ground water.
- The above phenomenon, particularly during periods of high evaporative demand, resulted in the increased mining of groundwater.
- Increasing temperature because of climate increases evaporative demand.
- The Government of Punjab enacted the Preservation of Subsoil Water Act in 2009, which mandated delayed paddy nursery and sowing activities by farmers in Punjab.

Objective and Methods

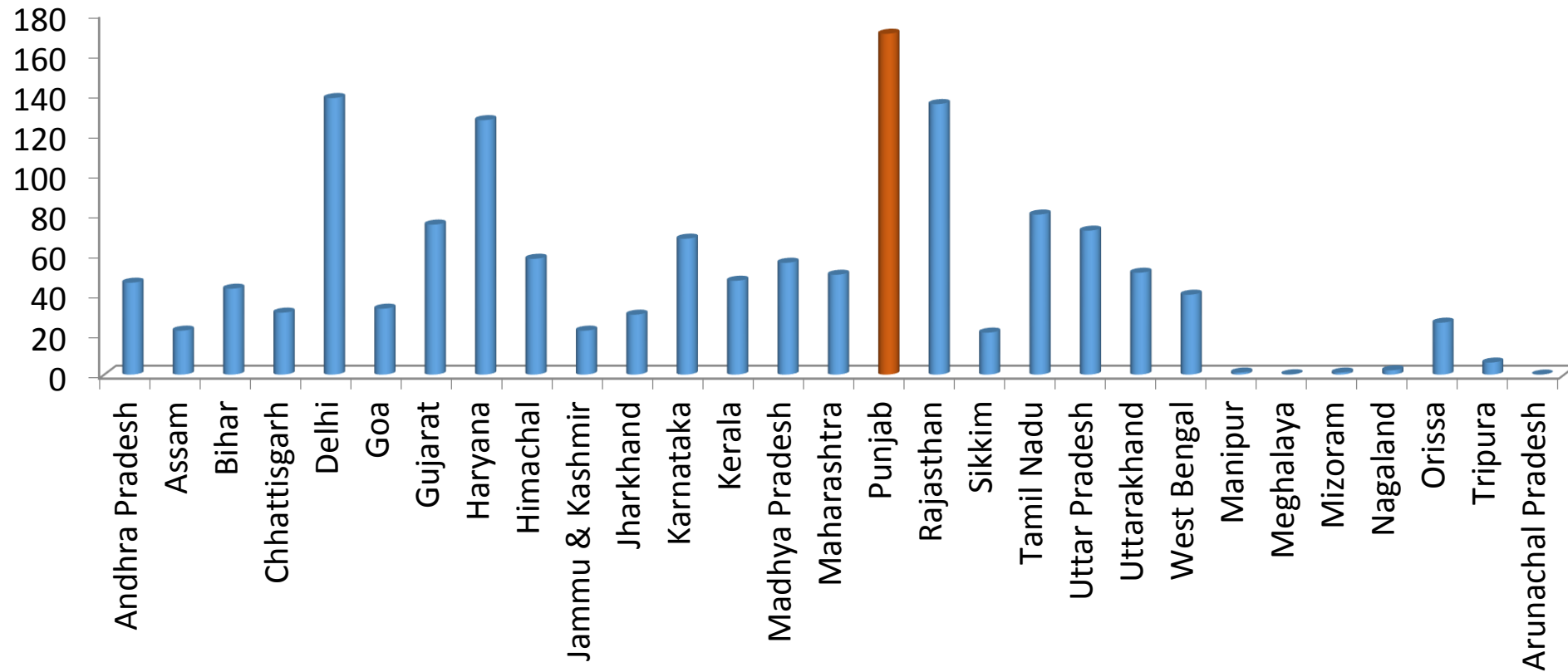
- Evaluation of the impact of the Punjab Preservation of Subsoil Water Act on the level of groundwater depletion in the state.
- Groundwater level was regressed on a policy dummy variable indicating the above act by controlling other covariates of groundwater levels.
- Covariates were decided based on both demand and supply aspects of groundwater.
- This regression model based on panel data of districts of Punjab for the period 1985–1986 to 2011–2012 was regressed using the GLS estimation procedure.

Punjab Preservation of Subsoil Water Act, 2009

- Its main purpose is to save groundwater by prohibiting sowing and transplanting paddy before specified dates in the hot and dry summer period.
- It prohibits farmers from sowing nursery of paddy before May 10 and from transplanting paddy before June 10 in a given year.
- Any farmer who contravenes the provisions of the act shall be liable for a penalty of Rs. 10,000 for every month or part thereof, per hectare of the land until such contravention ends.

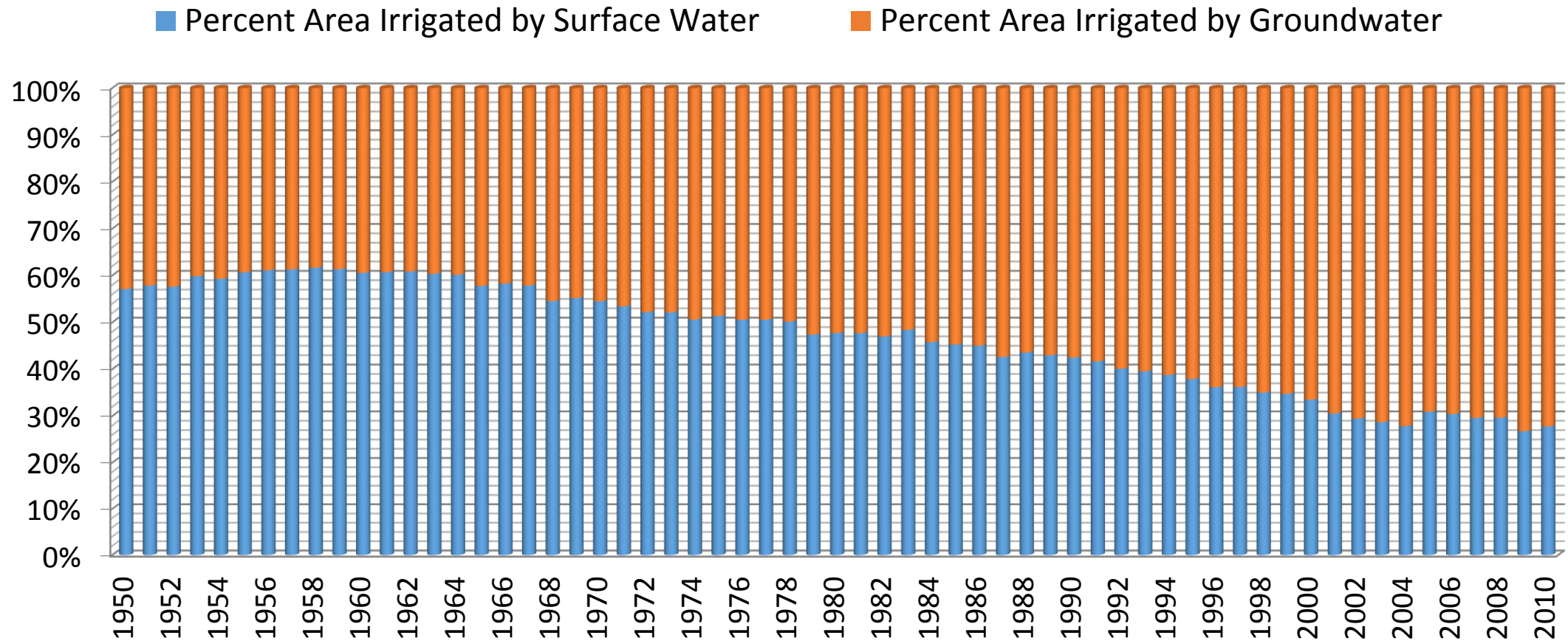
Results

Stage of groundwater development (Percent) across Indian states.



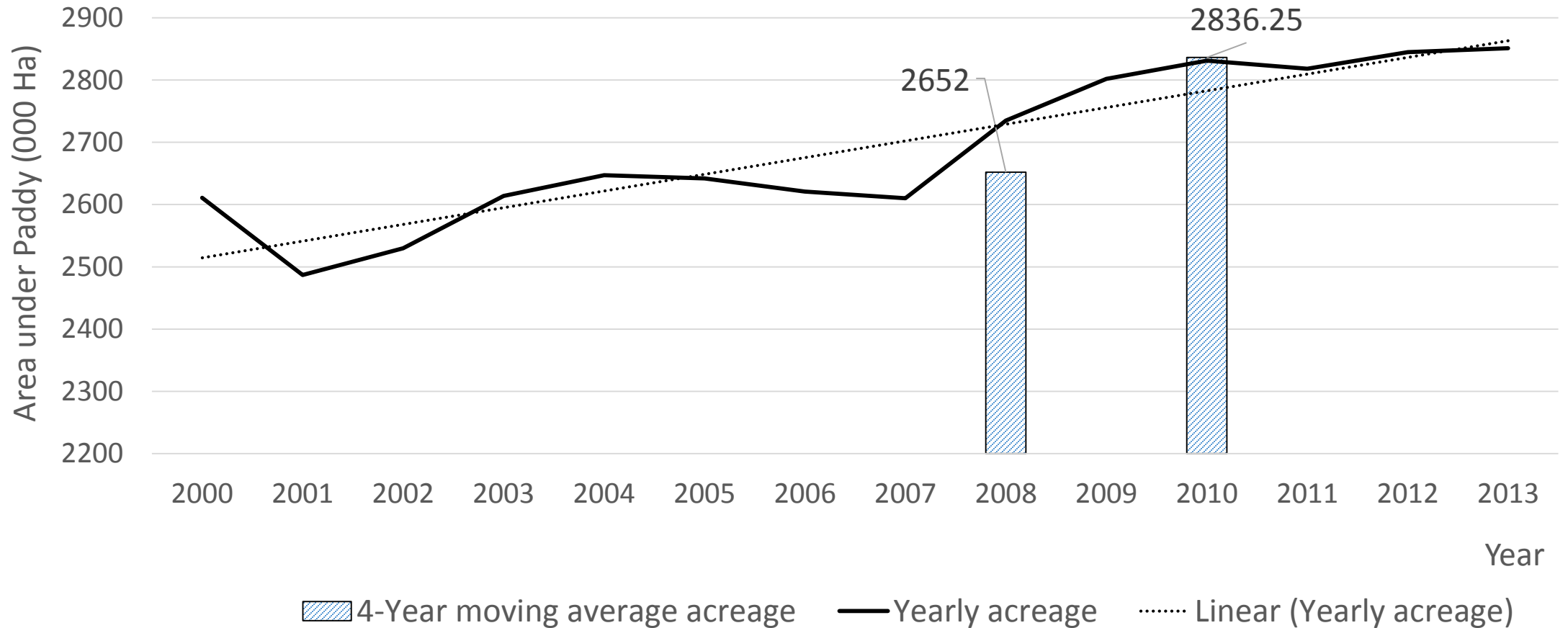
Data Source: Ground Water Year Book 2013-14, (CGWB, Ministry Of Water Resources & GOI)

Changing irrigation pattern for period 1950-51 to 2010-11.



Source: Directorate of Economic and Statistics, Ministry of Agriculture, Government of India, New Delhi.

Trend in cultivated area under Paddy in Punjab



Source: Ministry of Agriculture, Government of India, New Delhi.

Decline in water table (in meters) in Punjab (1986-2012)

Year	Average Annual Rate (m)
2000-2008	0.9
2008-2012	0.7

Source: Centre Ground Water Board, India.

Parameter estimates of three models, panel (1985-2011)

Variable	Model A	Model B	Model C
	(Pre-monsoon)	(Post-monsoon)	(Annual)
	Coefficient (Std. Dev.)	Coefficient (Std. Dev.)	Coefficient (Std. Dev.)
Share of tube wells to total cropped area (RTUBEW)	2.40*** (0.000)	2.77*** (0.000)	2.68*** (0.000)
Share of surface water irrigation (SWI)	-7.621** (0.000)	-6.211** (0.000)	-5.499*** (0.000)
Crop diversification (HHI)	-2.688 (0.000)	-3.618 (0.000)	-0.108 (0.000)
Rainfall level, June (Rain_J)	-0.003*** (0.000)	NA	NA
Rainfall level, October (Rain_O)	NA	-0.003*** (0.000)	NA
Rainfall level, Annual (Rain_A)	NA	NA	-0.001 (0.000)
Population density (PD)	0.009*** (0.000)	0.006*** (0.000)	0.006*** (0.000)
River dummy (DUMMY_R)	0.279 (0.000)	-2.336 (0.000)	-1.870 (0.000)
Policy dummy (DUMMY_P)	-2.795*** (0.000)	-2.310*** (0.000)	-2.115*** (0.000)
Constant	12.700 (0.000)	11.476 (0.000)	8.180 (0.000)
N	324	324	324
R ²	0.36	0.29	0.29
Wald chi-square	342.06***	347.96***	307.45***

Conclusion and Policy Implications

- A robust effect of the 2009 act in reducing groundwater depletion.
- A higher share of tube wells and increase in Population Density have significantly reduced the groundwater table.
- On the other hand, rainfall and the share of surface water used for irrigation have had an augmenting effect on the groundwater table.
- Seasonality also plays a key role in determining the groundwater table in Punjab.
- Monsoon rainfall has a very prominent impact on groundwater.

Thanks for valuable time