

Impact Assessment of Groundwater Collectivisation in Andhra Pradesh and Telangana



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Key Features

- The **pipeline grid** is the centrepiece of the programme—it enables water access, increases land productivity, and establishes a pseudo market.
- Non-borewell owners are assured (3-4) irrigations in monsoon.
- Borewell farmers get to irrigate their fragmented fields away from the borewells.
- The **pipeline system + water user association** enable shared above-ground management of a common underground resource.

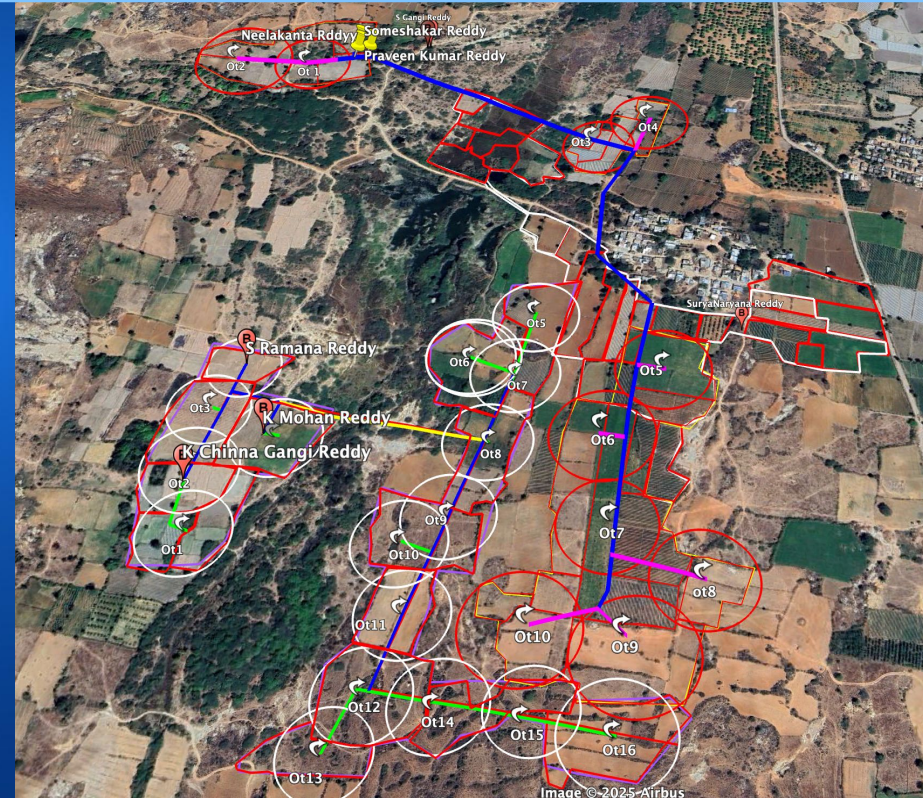
Groundwater Collectivisation Programme



Initial Impressions

- **Protective irrigation** for rainfed farmers.
- A **solution to the challenge** that uplands in granitic areas often have lower borewell success than valleys.
- Ban on digging borewells, crop diversification, and improved irrigation efficiency to **balance rising irrigation access**.
- But do the farmers see it as a 'pipeline programme' more than a 'groundwater collectivisation programme'?

Groundwater Collectivisation Programme

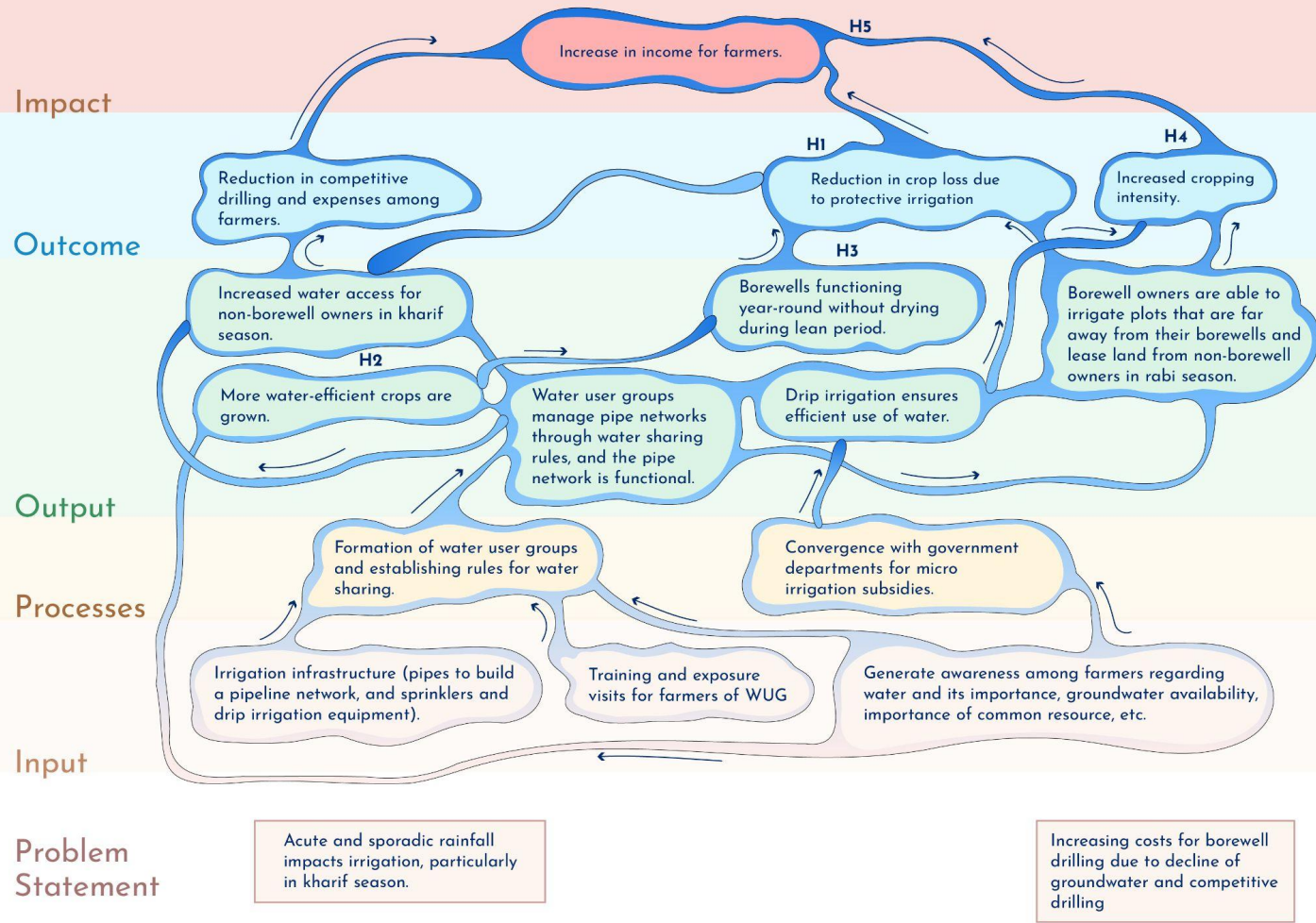


Rules of a Water User Association:

When a borewell pooling committee was formed, all the farmers in the committee had to signed an agreement that was submitted in the mandal office. This agreement laid down a set of rules that would govern the smooth functioning of the committee:

1. Water to be shared **irrespective of borewell ownership.**
2. Water will be shared with the non-borewell owners to **protect the kharif crop.**
3. Crop plans will be based on the **availability of water.**
4. Area under paddy cultivation will be **progressively reduced.**
5. **No new borewell** will be drilled for 10 years.
6. Borewell owners will **contribute** ₹100/acre and non-borewell farmers ₹1,000/acre in the beginning of every season for maintenance of pipelines, repairs, etc.

Theory of Change

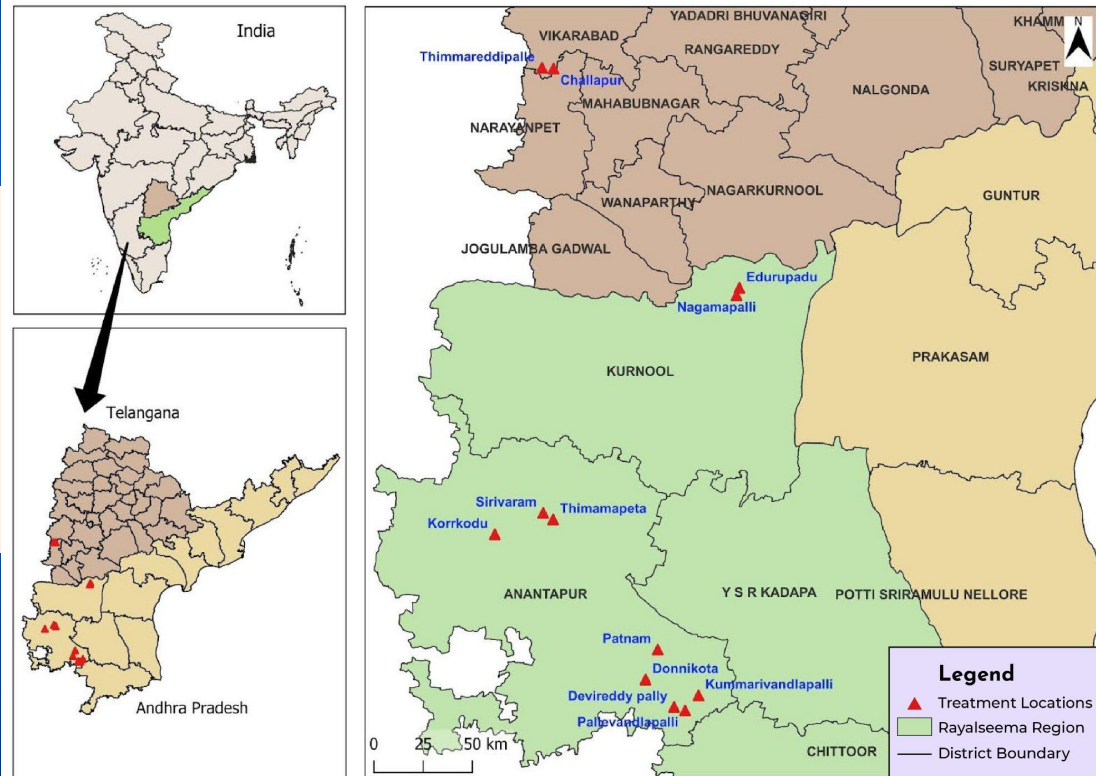


Location of the 12 Treatment Villages

Data collection across 12 treatment and 12 control villages:

- 606 farmer surveys
- A comprehensive borewell census for 3,287 borewells
- 17 FGDs and 33 in-depth interviews

























Larger samples for quantitative surveys can provide statistical significance, even for lower differences.






Research Questions

1. How has the programme improved the **overall economic status** of farmers?
2. What are the programme's effects on **yields** for both borewell and non-borewell farmers?
3. How has the programme affected **access to irrigation** water and cropping intensity?
4. How has groundwater pooling improved **water use efficiency**?
5. To what extent has the programme reduced **competitive groundwater** drilling and increased collective management?
6. Has the programme led to a stabilisation of **groundwater levels**, particularly in the dry season?

Summarised findings across indicators

											
Farmer Profit ¹	Crop Yield ²	Cropping Intensity	Leasing in Rabi	Micro Irrigation	Adoption of less water intensive crops ³	Borewell Digging	Borewell Depth	Borewell Cost	Water Level Borewell	Borewell Failure	Well Water Drying
											

Direction Of Impact

-  Positive Impact
-  No-difference
-  Negative

Level of Significance

-  Significant
-  Not Significant

*Direction of Impact is based on quantitative and qualitative analysis done on the primary data.

*Level of Significance is based on p-value when tested statistically.

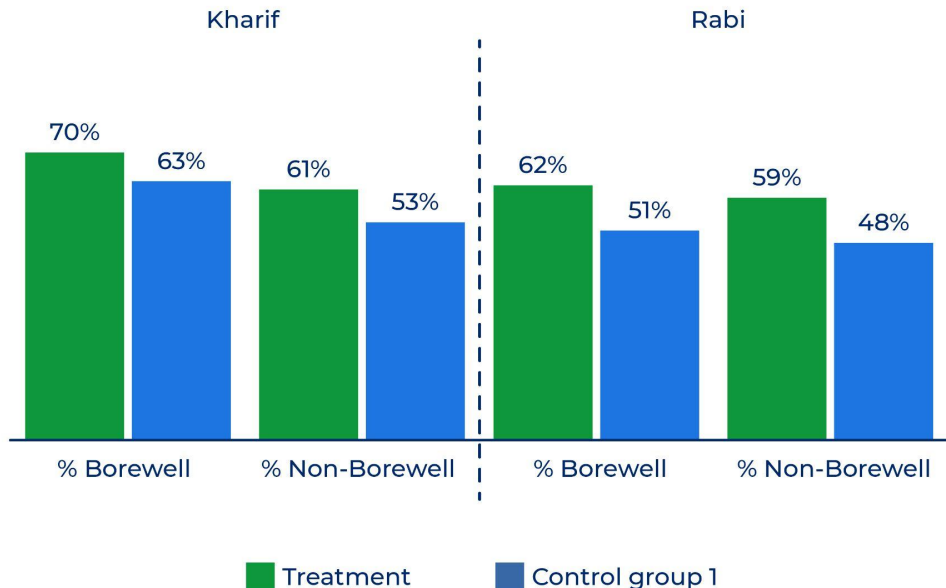
¹ Farmer Profit is statistically significant in Kharif.

² Crop yield is statistically significant in Rabi.

³ Adoption of low water intensive crops is statistically significant in Kharif and Reduction of high-water intensive crops is statistically significant in Rabi.

Agricultural profit has increased relatively more for the treatment group than for the control group.

Percentage change in profit per acre between 2011 and 2024



The increase is **statistically significant in the kharif season** and not in the rabi season.

Farmer quote:

"When we increase irrigation, our production and income also increase. For example, if I grow on one acre of land, I can earn around one lakh, and if I grow on a larger area, my production increases and income also increases."

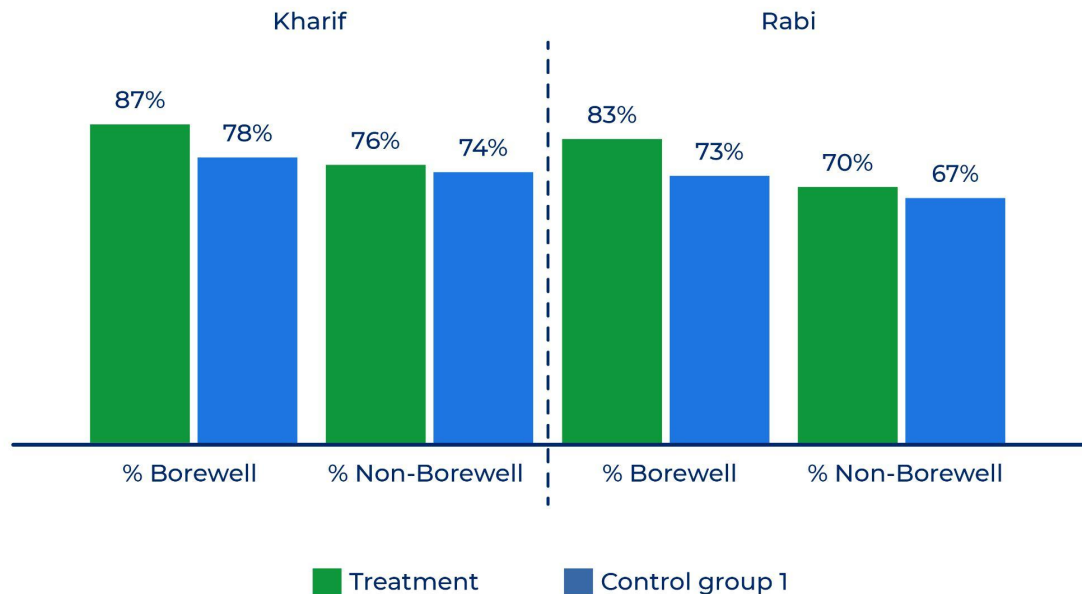
Crop yield has increased across all farmers over the years. The average increase in yield for the treatment group is somewhat higher than that in the control group.

The difference is **statistically significant in the rabi season** (p-value is 0.038) and not in the kharif season.

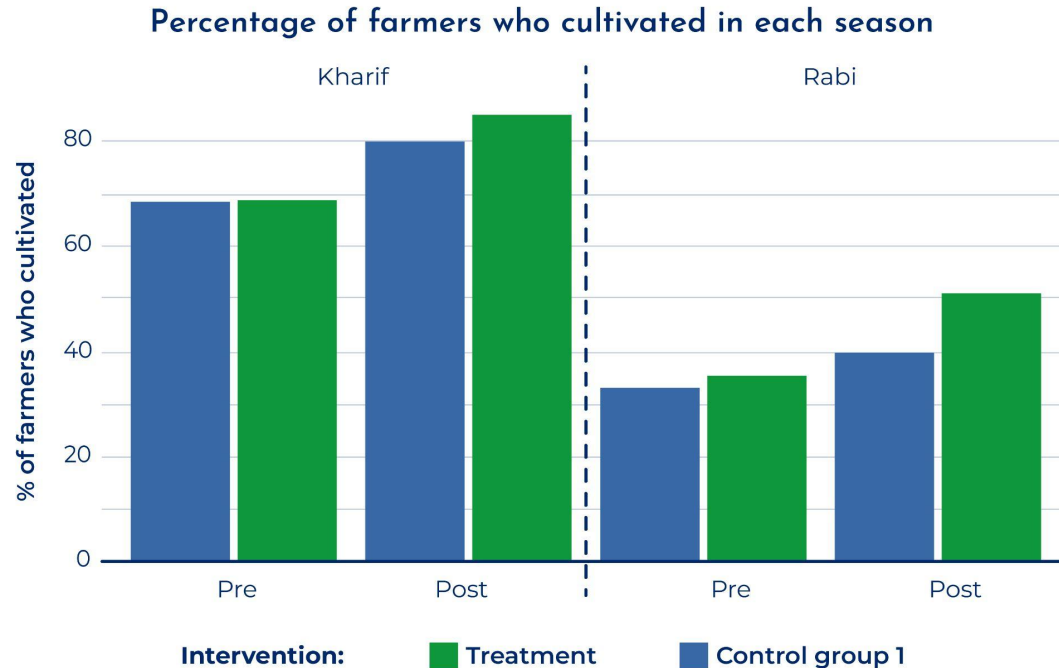
Anecdotal response from a farmer who was not part of the water user group:

“They are growing the groundnut or tur dal and getting the crop without fail. Instead of five bags, they are getting 10, as they are getting water 2-3 times by adjusting from 3-4 borewells. At least they can survive from it.”

Percentage change in yield between 2011 and 2024



Cropping intensity was similar for the groups earlier. Both increased by treatment increased somewhat more.



Increase in rabi significantly higher.

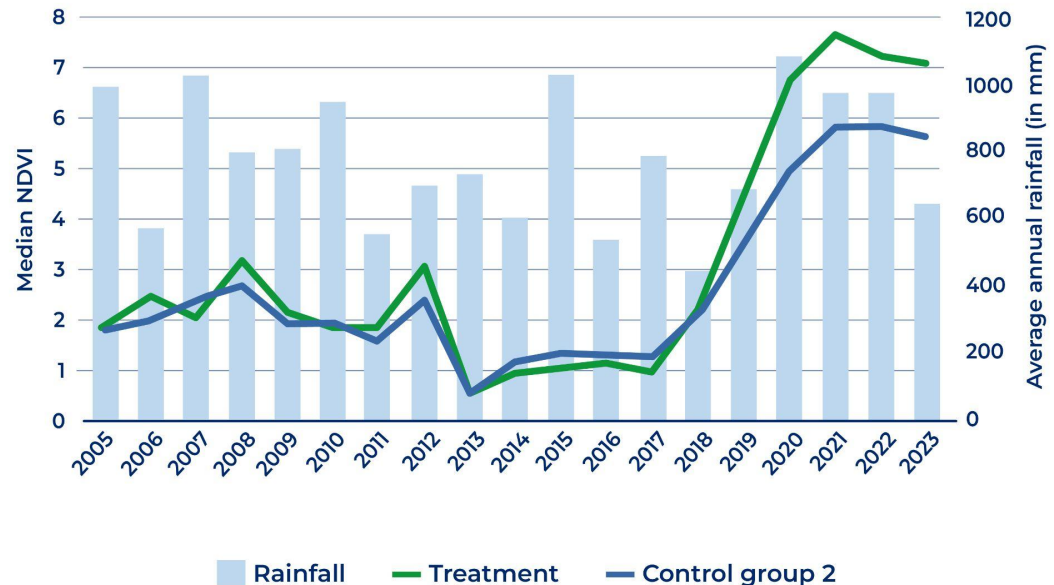
During an FGD, a farmer said:

“Our lands are scattered. But after forming the water user group, pipelines were extended to reach even the farthest fields.”

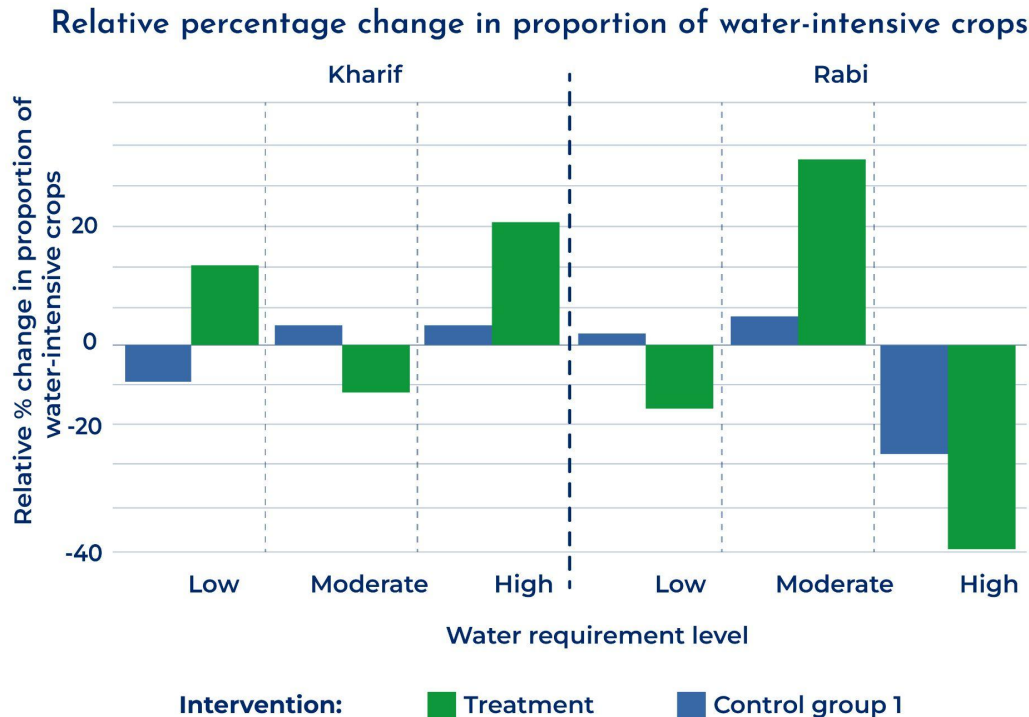
Remote sensing shows a similar pattern of increased rabi cropping; slightly higher in the treatment group.

Median NDVI graphs alongside average annual rainfall gives the similar glimpse of **increase in cropping area** in the rabi season, post-intervention.

Median NDVI in agricultural land during rabi season (Dec - Apr)



The treatment group is cultivating a significantly **lesser amount of high water-intensity crops in the drier rabi season**, but not so in the kharif season.

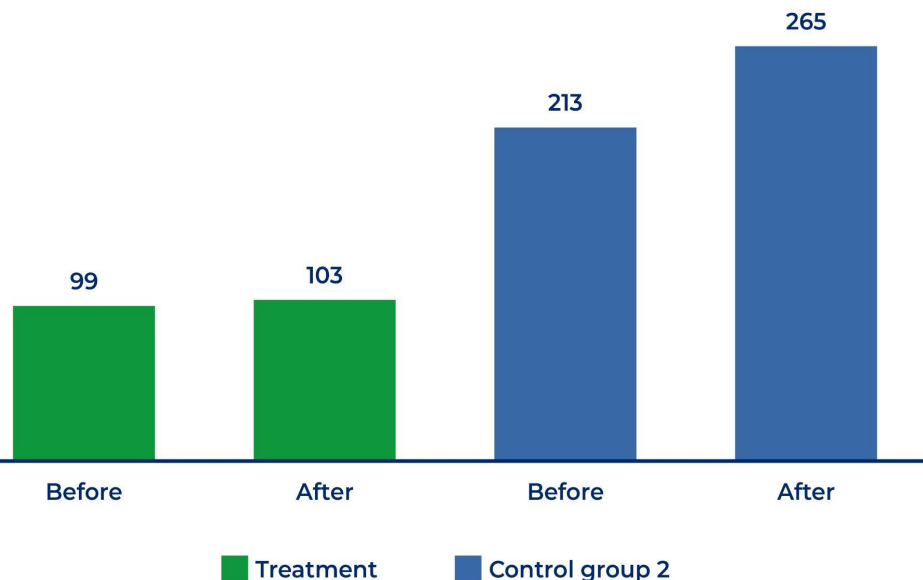


Note: Negative means declined in the post-intervention period and positive means increased.

- The overall cultivation of **paddy has reduced in the treatment group**, unlike in the control group.
- Crop prices and water availability both drive crop choice.
- **Years of adequate rainfall:** Farmers grow high water-intensive and perennial crops that offer better returns.
- **During drier years:** They adapt by selecting medium and low water-intensive crops such as vegetables, maize, groundnut, and horse gram.

Borewell drilling has continued across all groups but at a slower rate in the treatment villages. However, there was no significant difference in the depth of new borewells between the control and treatment groups.

Number of borewells drilled five years before and after intervention

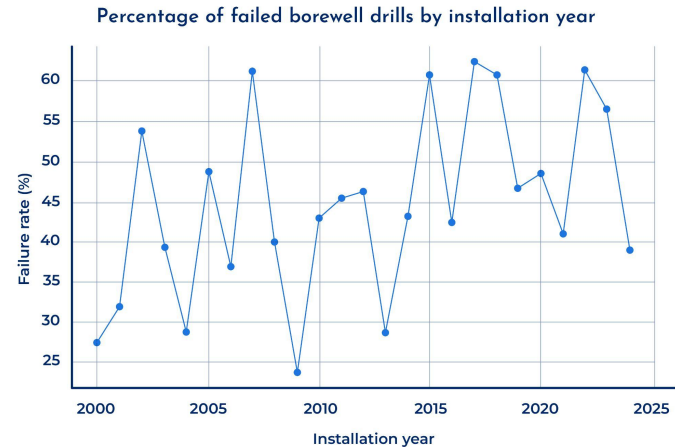
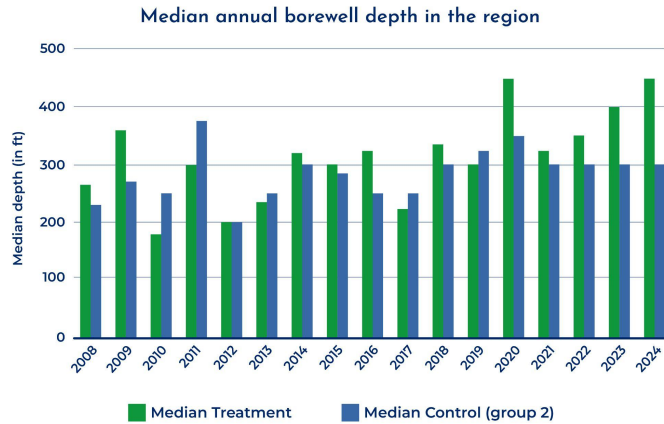


In spite of the ‘no new borewells’ rule, the treatment group continued drilling borewells post-intervention. Their **drilling rate, at around 100 wells in 5 years, across the 12 villages, remained relatively stable** before and after the intervention.

During the FGDs, WUG members ceded to digging new borewells:

“As non-borewell farmers in the group, we eventually started digging new borewells, even outside our boundaries. After saving up some money, we all managed to install our own borewells over the past few months.”

Borewell depths have increased over the years, and so has the borewell failure across the groups.



During the FGDs, one of the farmers talked about the impact of borewell failure on their livelihoods:

“We face frequent borewell failures, which result in significant losses. Out of the three borewells I own, only one works properly. Many of us have multiple borewells because of repeated failures. When a borewell fails, especially during critical cropping periods, it leads to total crop loss. We often have to wait for rain, as even digging up to 500 ft doesn’t guarantee water.”

Principles of Commons Management and WUG Functionality

- While many villages had **informal or formal agreements**, most lacked enforcement of these rules.
- Five water user groups (WUGs) continued to **meet regularly**, and only three had an active community resource person.
- None of the groups had **graduated sanctions** for rule violations and conflict resolution mechanisms in place.

Themes		Sub-themes	Components	Sampled villages											
				1	2	3	4	5	6	7	8	9	10	11	12
Conflict resolution mechanisms				●	●	●	●	●	●	●	●	●	●	●	●
Monitoring systems	Monitoring users(Active resource from the implementation agency)			●	●	●	✓	●	●	●	●	●	●	●	●
	Monitoring resources (Active community resource person)			✓	✓	✓	●	●	●	●	●	●	●	●	●
Collective choice arrangements	Agreements	Formal/written agreement		✓	✓	●	●	●	●	●	●	●	●	●	●
		Informal agreement		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Group meetings	Currently meeting regularly		✓	✓	✓	●	✓	✓	●	●	●	●	●	●
Graduated sanctions				●	●	●	●	●	●	●	●	●	●	●	●
Functionality Categories (see Annexures 4 and 5)															
● Good				● Absence of a component											
● Medium				✓ Presence of a component											
● Low															

Enablers and Barriers for the Success of the Programme

Enablers



Land fragmentation



Heterogeneity in aquifer characteristics within the village



Semi-arid areas with erratic monsoon rainfall



Inequity in access to irrigation among farmers



Small and socially homogeneous groups

Barriers



Free rider problem



Lack of incentives to decrease water use



Lack of monitoring and regulatory mechanisms



Lack of higher-level federated entities that would hinder scaling

Key Recommendations for Scaling the Programme

1. **Manage spillover effects** by matching the scale of the collectives to the scale of the aquifer.
2. Bridge scales by **incorporating water collectives** into larger governance networks.
3. Expand monitoring and incorporate **new information and communication technologies** (ICTs).
4. Design and implement **graduated incentives and sanctions**.





THANK YOU!

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