Groundwater uses among electric and diesel farmers, and implications for SIP in Bangladesh

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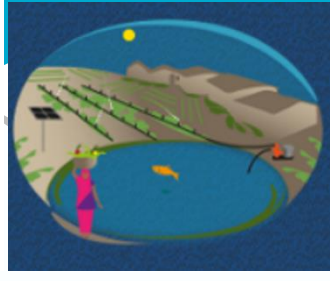
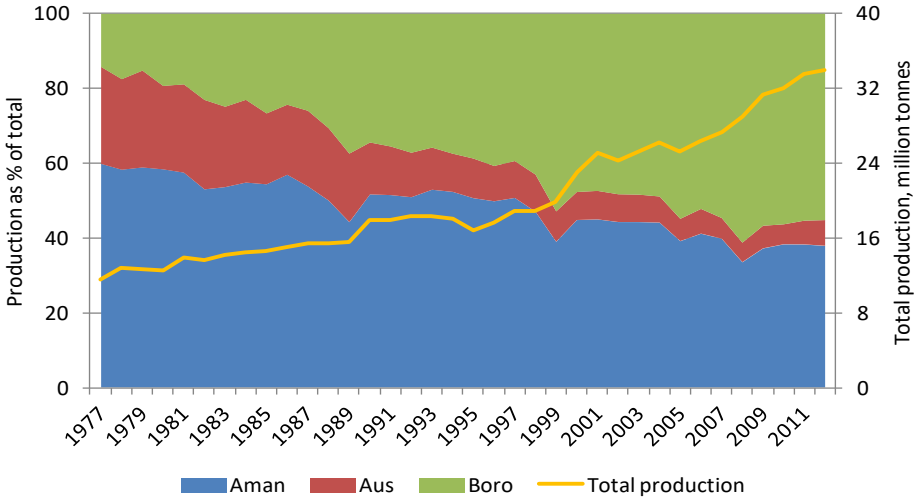
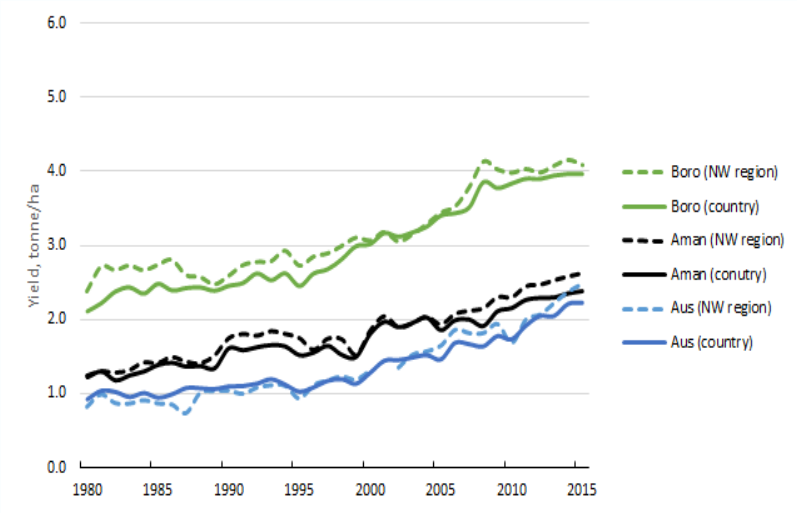


Bangladesh Agriculture

- Area is 146,589 Km2
- Current population is about 170 million
- Total cultivable area is about 8.2 million ha
- From rice importer with 75 million population to self sufficient with 160 million population
- Rice production – 152 Kg/capita in 1977 to 222 kg/capita in 2012
- More than 3-fold increase in production in 30 years
- Average rice yield increased more than 2-fold over the last 4 decades

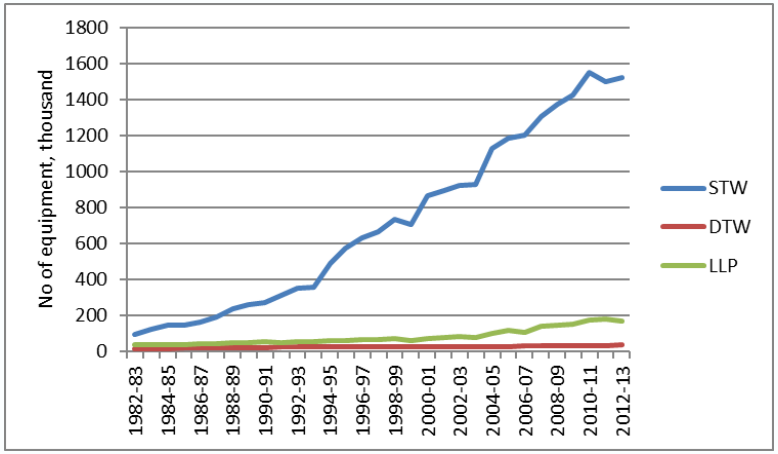


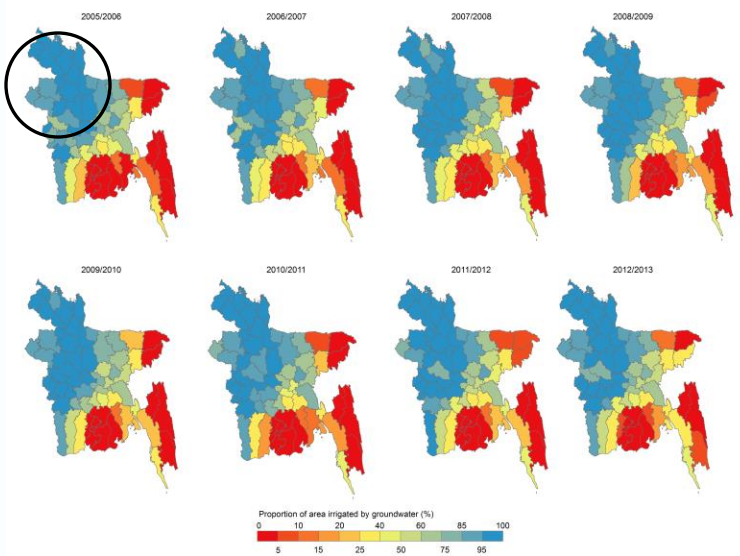


Agriculture sector has gone through a remarkable transformation

Development of Irrigation

- Transformation in agriculture was possible due to phenomenal growth in irrigation
- Driven by the use of groundwater - rapid increase in the adoption of STWs
- NW region has intensive use of groundwater. 97% of the irrigated area are by groundwater
- 95% of the DTW are operated by electric motor
- 83% of the STW are operated by diesel engine
- Now there are large solar pumps (run by NGOs), not individuals

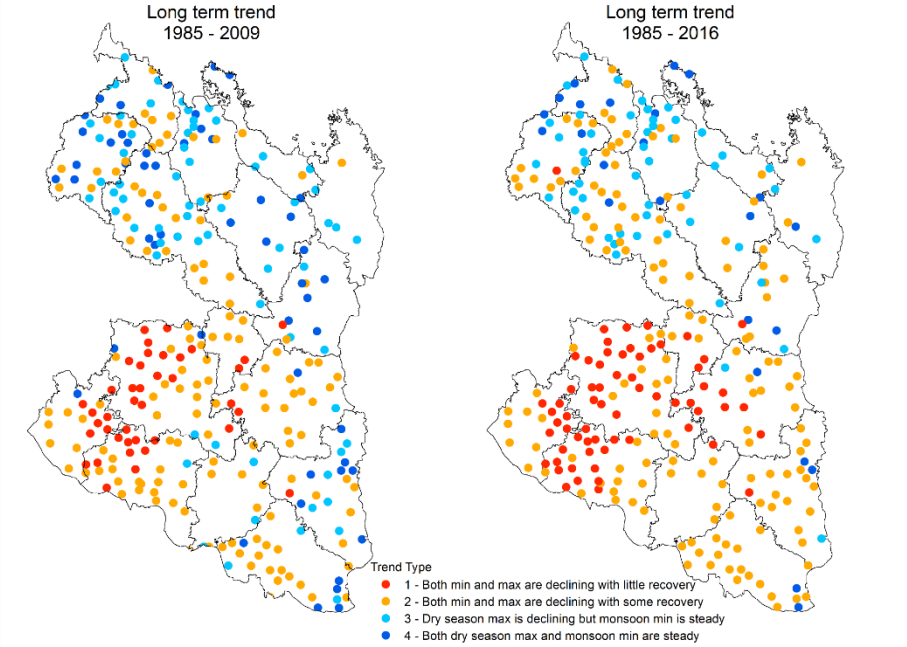


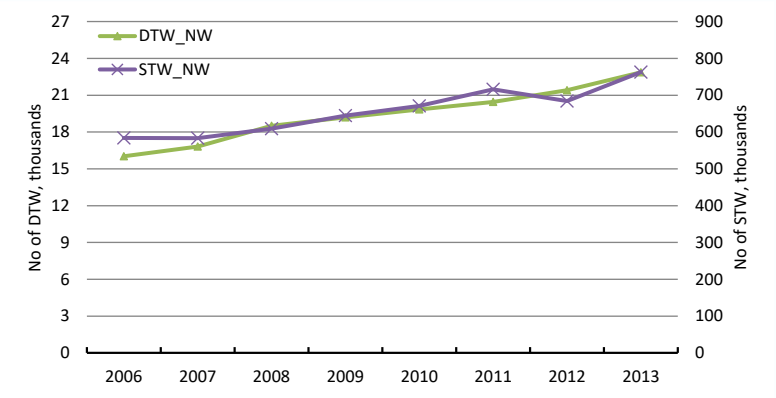


	Bangladesh	N-W Region
DTW	36,034, 92% electrical	23,516 (65%), 95% Electrical
STW	1,563,791, 82% diesel	726,579 (47%), 83% diesel

Is groundwater irrigation sustainable?

- There are evidences that GW levels are falling in some parts of the northwest region
- Water table drops below suction limit of HTW and STW in some areas
- Still use of STW and DTW is increasing
- There is no increase in area. Instead of buying water from others, some farmers are having their own STW
- In some areas, due to GW decline, some farmers are shifting to DTW or STW with submersible pump





No of STW and DTW in northwest region

Causes of groundwater decline

- There is general and strong perception that over use of water for Boro rice is the only cause of groundwater decline in the NW region
- General perception is 3000-5000 lit of water is required to grow a kg of rice
- No evidences from the field
- So lot of water-saving irrigation technologies such as AWD, conservation agricultures are being promoted

We investigated water use and productivity of Boro rice in the NW region by extensive field monitoring during 2015-2018

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Why Farmers in Bangladesh Waste 800 Liters of Water to Produce 1 Kg of Paddy

By Masudul Hoque

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This report is produced by UNB United News of Bangladesh and IPS Inter Press Service.

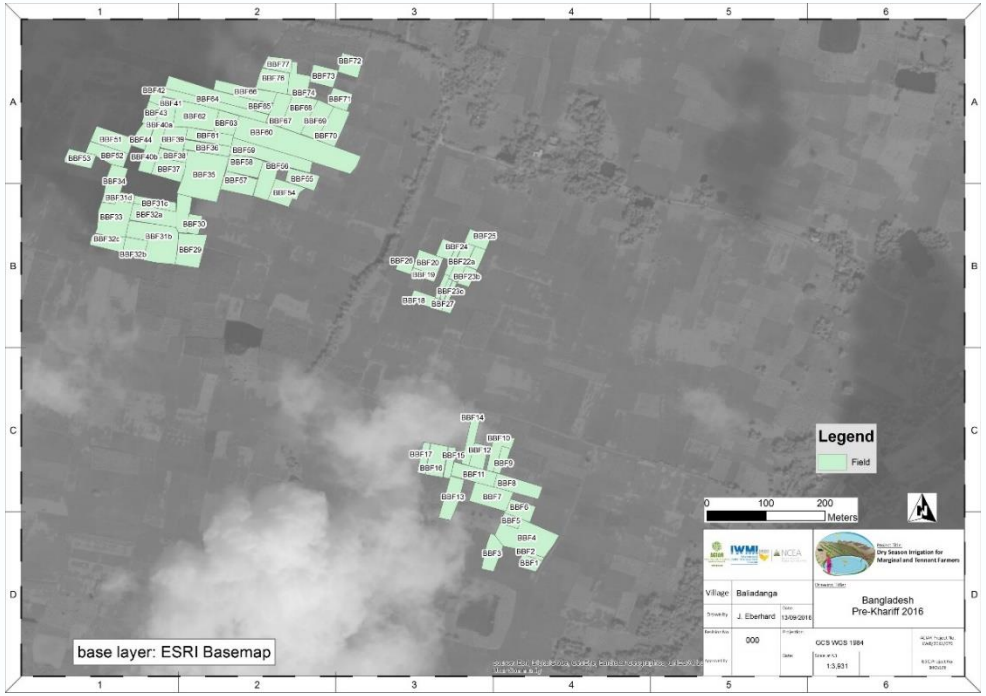
A farmer's wife, dries the rice. Credit: Naimul Haq/IPS

DHAKA, Bangladesh, Dec 24 2018 - Farmers across the country are misusing some 800 liters of water in producing each kilogram of paddy. Even though it is possible to produce 1 kg of paddy using 2,500 liters of water, currently they are using 3,300 liters for the same only for lack of awareness of certain techniques that can reduce the amount of water needed as input.

Nasiruzzaman, secretary in-charge of Bangladesh's Ministry of Agriculture, told UNB how farmers in the past used 5,000 liters of water for producing one kg of paddy, and now that has come down to 3,300 liters.

"A farmer has to pay a fixed amount to deep tube-well (used as water source) owner for irrigating a certain size of paddy field for a full season. As a result, there is no incentive for him to save on irrigation as he has to pay the full amount. This is how he misuses the water," Nasiruzzaman said.

Monitoring and evaluation on selected sites

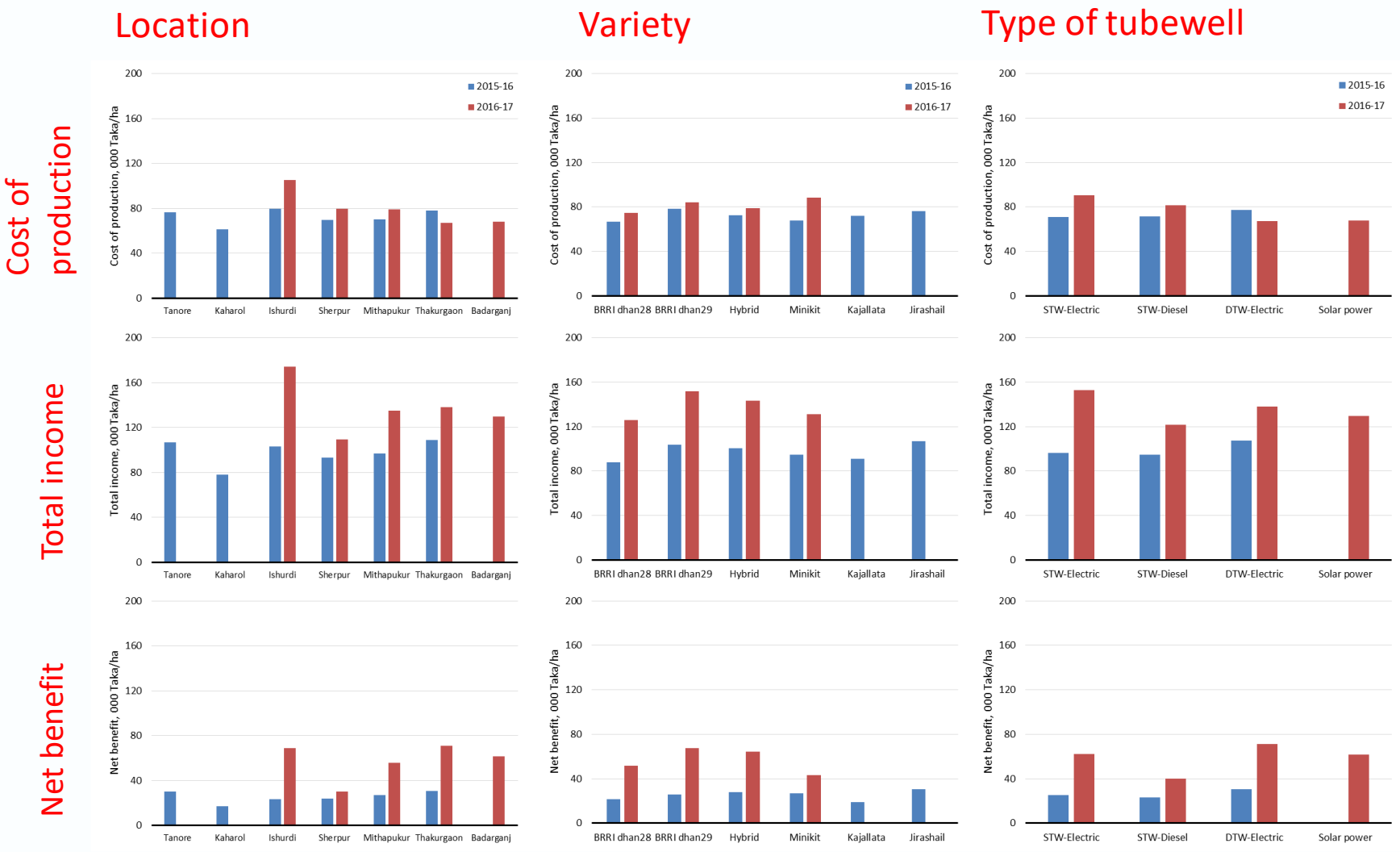


2015-16: 6 sites, 4 DTW (in 2 locations), 25 STW in 4 locations (both electric and diesel operated, total 235 rice plots, 101 other crops)

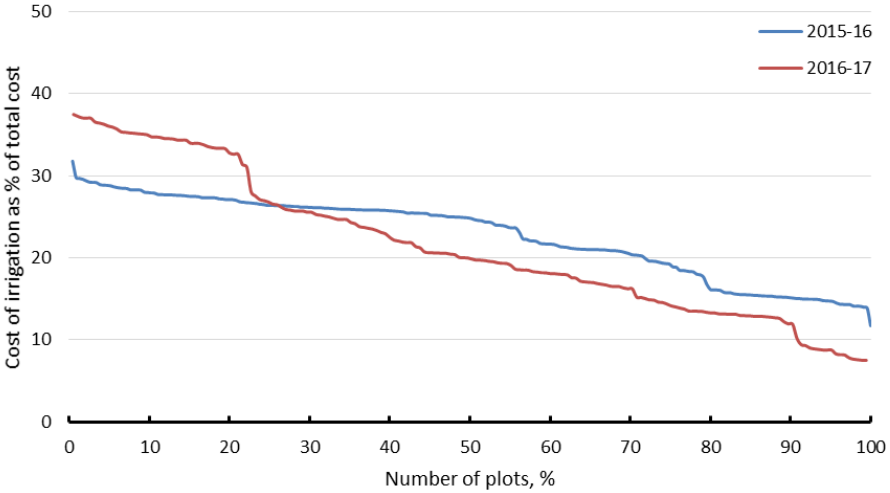
2016-17: 5 sites 1 DTW, 9 STW (in 3 locations), 1 solar irrigation project, 185 rice plot, 10 other crop plots

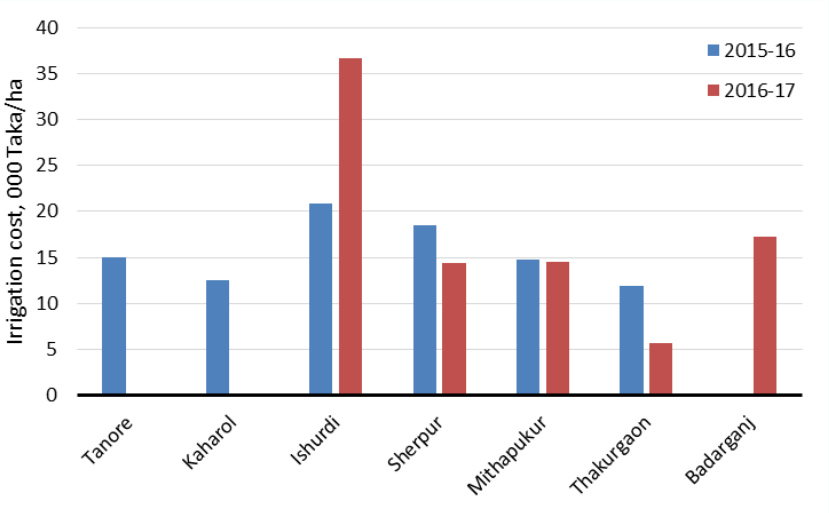
We have recorded all input, output, cost, labor, and water supply data of each plot

Field level variation – economics of rice production

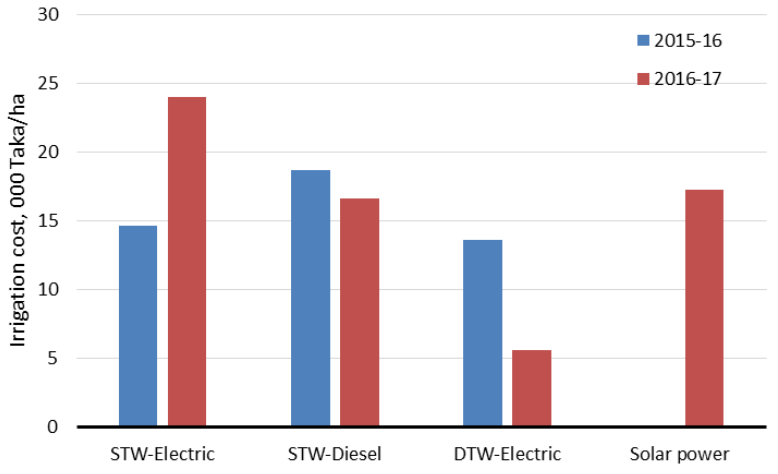


Field level variation - cost of irrigation as % of total cost





- High variation in cost of irrigation
- Cost of irrigation is as high as around 35% of the total production cost of rice
- Average cost was 25% in 2015-16, and 20% in 2016-17
- Cost of irrigation is very high in Ishurdi due to crop sharing
- DTW water is cheaper than STW
- Solar irrigation is costlier than STW (7,000 Taka/acre vs 4,000 taka/acre in Mithapukur)

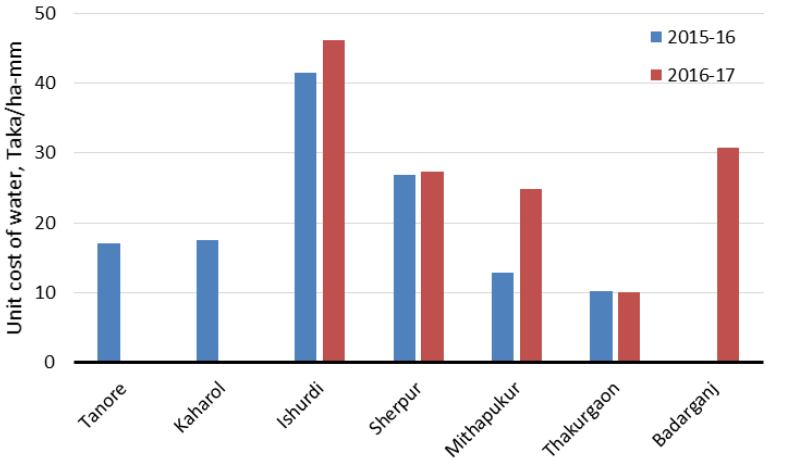


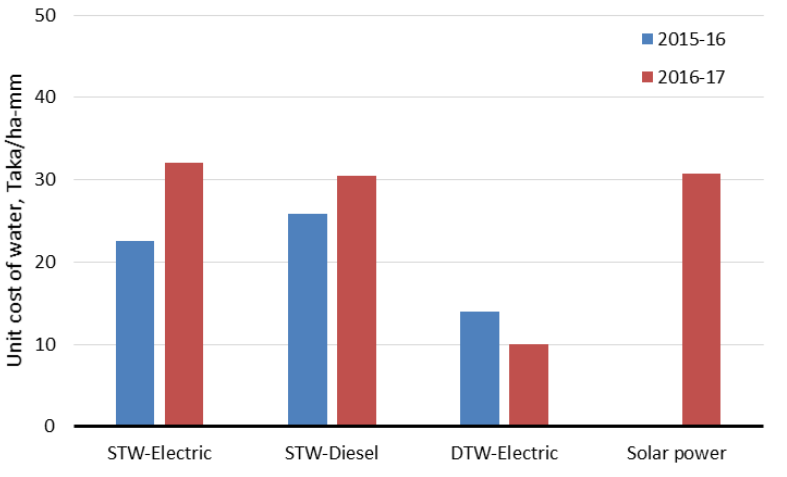
Water pricing system

Area	Crop	Mode of irrigation charge	Charge	Measurements
Mithapukur, Rangpur	Rice	Area basis (STW with electric motor) Mixed (STW with diesel engine)	Tk. 1800-2500/bigha Tk.24-26/decimal + Fuel	1 bigha =50 decimal
	Non-rice	Area basis (STW)	Tk. 600/irrigation/bigha	1 bigha =50 decimal
Badarganj, Rangpur	Rice	Area basis	70 Taka/decimal or 7,000 Taka/acre for rice	
	Non-rice	Area basis	6 Taka/decimal/irrigation or 600 Taka/acre/irrigation	1 acre = 100 decimal
Kaharol, Dinajpur	Rice	Area bases (STW with diesel engine) Area bases (STW with electric motor) Mixed	Tk. 3500/bigha Tk. 2500-3000/bigha Tk.26-28/decimal + Fuel	1 bigha =50 decimal
	Non-rice			
Thakurgaon Sadar, Thakurgaon	Rice	DTW (BMDA) STW (with diesel engine) STW (with electric motor)	Tk. 110-140/ hr Tk. 20/decimal+Fuel Tk. 1200-1500/bigha	1 bigha =50 decimal
	Non-rice	DTW (BMDA) STW (with diesel engine)	Tk. 110-140/hr Tk. `40/hr+Fuel	
Tanore, Rajshahi	Rice	Area based (private DTWs) DTW (BMDA)	Tk. 2000-2200 /bigha Tk. 120-140/ hr	
	Non-rice	DTW (BMDA and private)	Tk. 100-140/ hr	
Ishurdi, Pabna	Rice	Crop share (25% of unharvested crop)	Tk. 3500-4000/bigha	1 bigha = 33 decimal
	Non-rice			
Sherpur, Bogura	Rice	DTW STW (with diesel engine)	Tk. 2000 /bigha Tk. 3000-3200 /bigha	1 bigha = 33 decimal

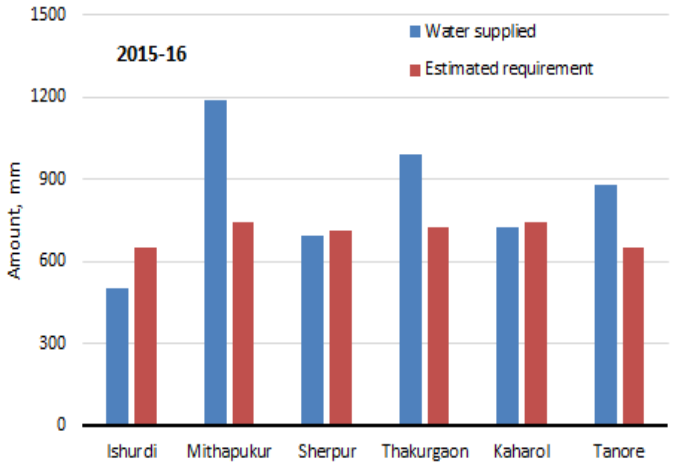
Estimated volumetric cost of water

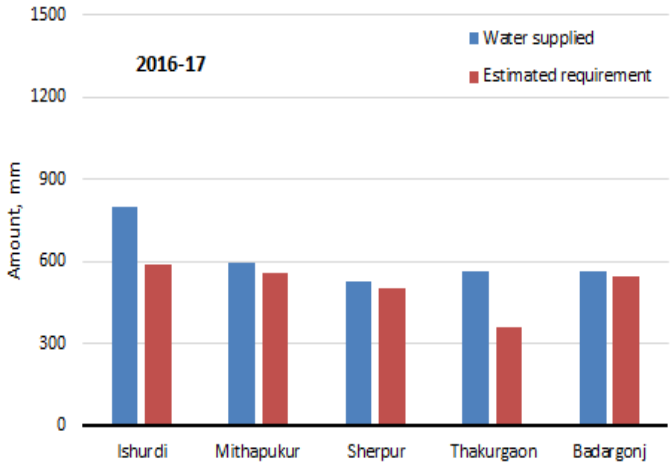
- Varies widely – 45 Taka/ha-mm to 10 Taka/ha-mm
- DTW is cheapest
- Solar irrigation is costlier (30 Taka/ha-mm) than STW (diesel or electric)



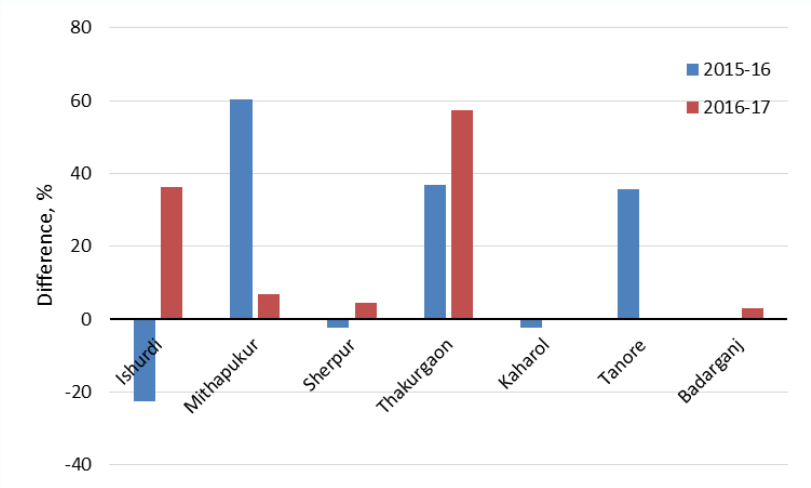


Comparison of irrigation water demand and use for rice

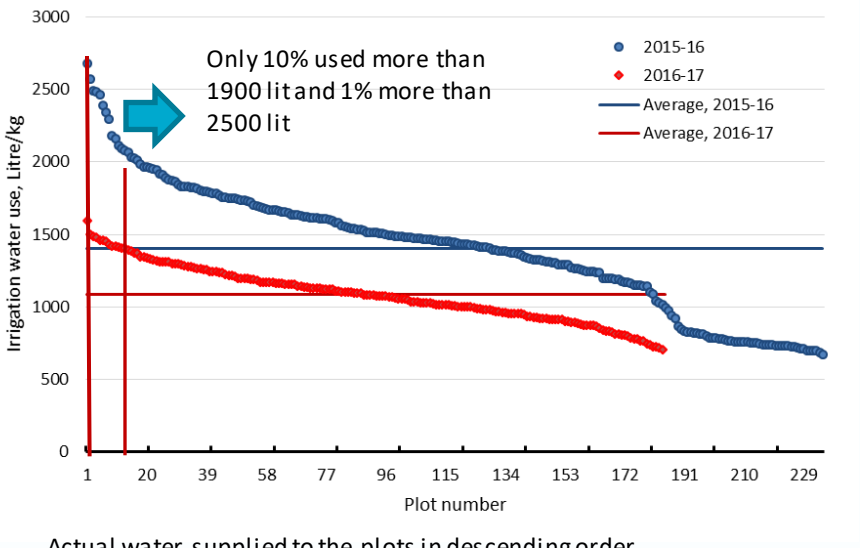




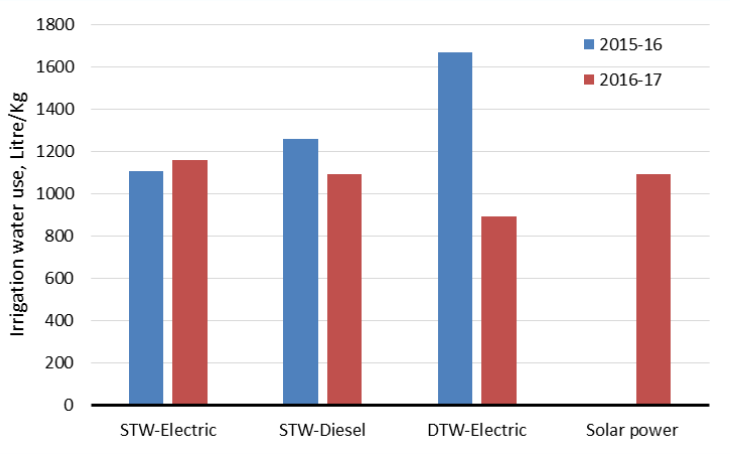
- In general, in STW sites farmers are very efficient in applying water
- DTW sites have some oversupply
- Solar irrigation also very efficient



Use of water for growing rice – perception vs reality



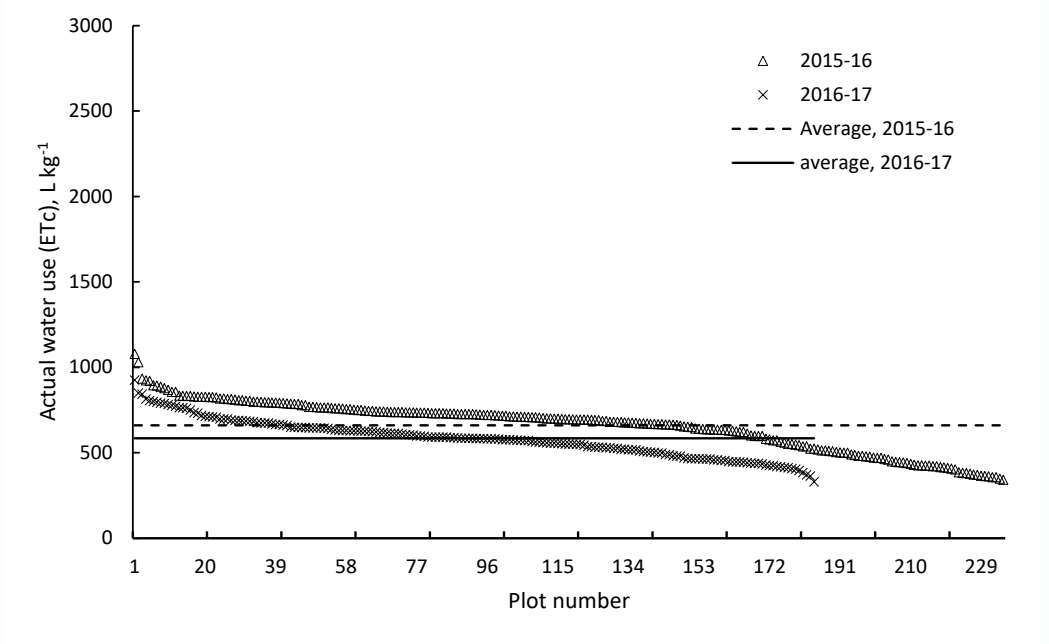
Actual water supplied to the plots in descending order



- Average of 2015-16 was 1402 lit/kg, 2016-17 1086 lit/kg, that was supplied to the field not all used by plants (seepage and percolation contributed to the aquifer as return flow)
- Water supply in DTW area is higher particularly in 2015-16, low cost
- Water is costly in STW, so farmers are prudent in applying water
- Over the years, yield of rice increased linearly while water use becomes more efficient

Actual water use

- Real actual water use is actual ET – 661 lit/kg in 2016, 584 lit/kg in 2017



Solar irrigation system in Bangladesh

- Big system run by NGOs/private organization
- They received government subsidy (through a World Bank project) to install the system
- The area was earlier serviced by STWs
- Currently they run for 3/4 months only
- They are trying to diversify their income and sell electricity to the local grid

What are the benefits?

- Environmental benefit – low emission, renewable energy
- More efficient water supply as the system is run by professionals
- Provide other services such as rice milling, spice milling, etc. to the community

What are the concerns?

- Currently, cost of irrigation is as high as STW
- Risk of not getting water at the right time
- Low production due to cloudy days
- - servicing more area than possible to increase income
- - Influential farmers gets priority
- No choice for the farmers – must take water or not
- Water price is already high, could be higher to make profit

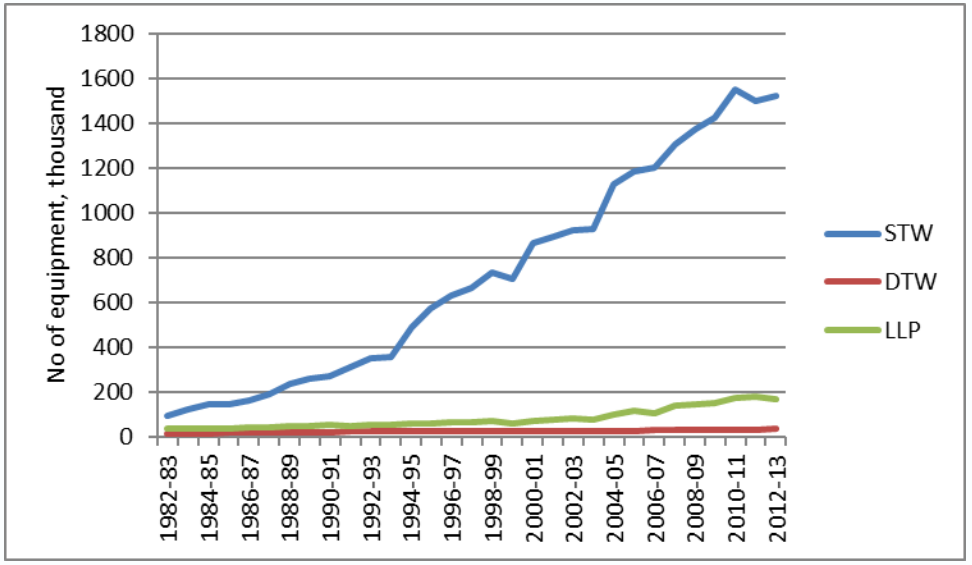
While there is environmental benefit, how does solar pump benefit farmers?

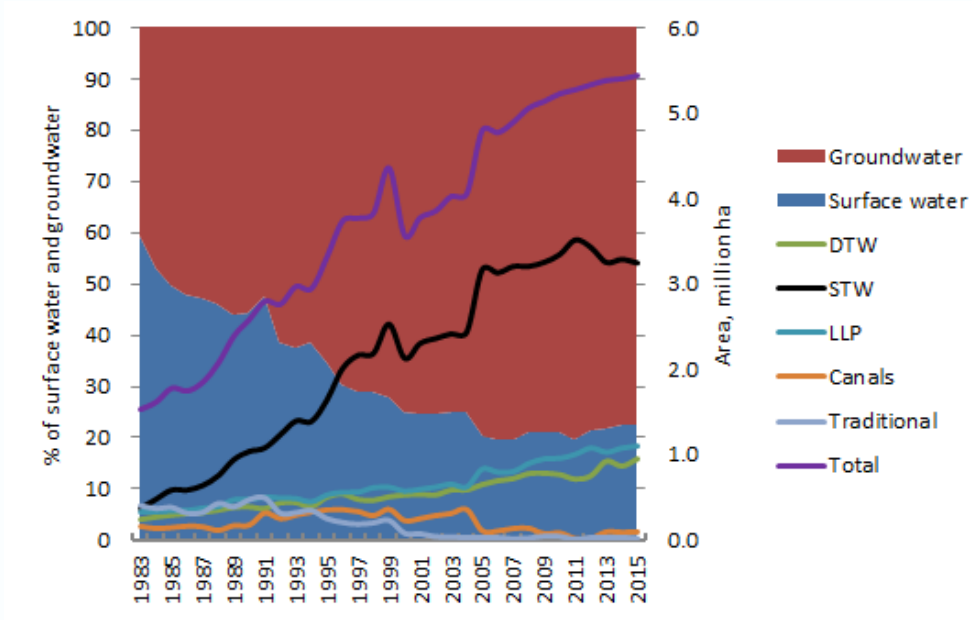
What are the concerns?

- Irrigation started in Bangladesh with DTW and LLP managed by agencies (BDWB, BADC, etc.)
- Due of lot of problems (mismanagement, corruptions, lengthy delays in repair, etc.), govt allowed STW without any restrictions
- STW and free water market was the trigger for irrigation revolution in Bangladesh

With this big solar system run by NGOs/private companies, are we going backwards?

Are we depriving the farmers of free choice?





What are the concerns?

- The minor irrigation act of 2017 (taking permissions from the local administration to install a STW) will further disadvantage farmers
- There are reports in the newspaper about the harassment to get the license
- This law and the influence of the solar companies have significant risk for the farmers

However, if service provider can reduce the price of water and provide good service then it would benefit farmers.

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দৈনিক জনকণ্ঠ
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প্রচ্ছদ অনলাইন জাতীয় দেশের খবর বিদেশের খবর ব্যবসা বাণিজ্য খেলার খবর সংস্কৃতি লাইফস্টাইল চাকরির খবর

আজকের পত্রিকা প্রথম পাতা শেষের পাতা অন্য খবর দেশের খবর খেলার খবর সম্পাদকীয় মতামত ফিচার পাতা সাময়িকী

সর্বশেষ সমৃদ্ধির পথেই এগোতে হবে

প্রচ্ছদ প্রিন্ট মিডিয়া শেষের পাতা বিস্তারিত

বিএডিসি সেচ কমিটি ও পল্লী বিদ্যুতের অনিয়মে দিশেহারা কৃষক

স্টাফ রিপোর্টার, সিরাজগঞ্জ ॥ বিএডিসি সেচ কমিটি ও পল্লী বিদ্যুতের অনিয়মের কারণে তাড়াশের শস্যভাণ্ডারে উৎপাদক কৃষক দিশেহারা। উপজেলার দেশীগ্রাম ইউনিয়নের গুড়পিপুল গ্রামের শামছুল হক নামের এক কৃষক কৃষি জমিতে অগভীর নলকূপের লাইসেন্সের আবেদন করেও দুই বছরে লাইসেন্স পাননি। কিন্তু ওই গ্রামেরই তায়জুল হোসেন নামে এক কৃষকের আবেদনের অনুকূলে সমন্বিত ক্ষুদ্র সেচ নীতিমালা-২০১৭।

অগভীর নলকূপের লাইসেন্স প্রদান করার অভিযোগ রয়েছে। বিএডিসি সেচ কমিটি 'তায়জুল হোসেনের যে জমিতে কৃষি কাজে সেচের জন্য অগভীর নলকূপের লাইসেন্স দেয়া হয়েছে, তা বস্তুত পসলি নয়- সে জমির শ্রেণী পুকুর।

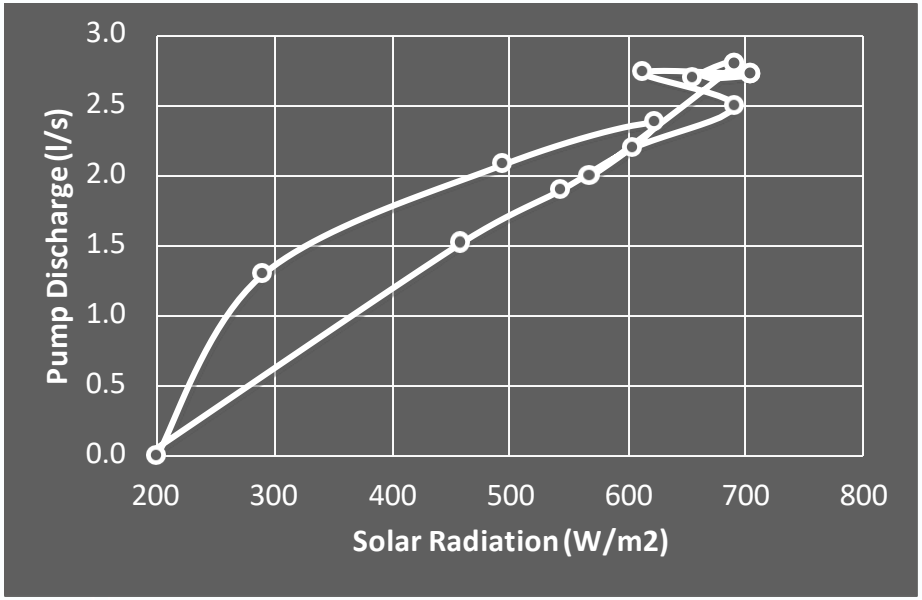
কৃষক শামছুল হক বিএডিসি সেচ কমিটি ও সিরাজগঞ্জ পল্লী বিদ্যুত সমিতি-১ তাড়াশ জোনাল অফিসের অনিয়ম ও দুর্নীতি হতে প্রতিকার চেয়ে সংশ্লিষ্টদের দ্বারে-দ্বারে ঘুরে অবশেষে তা না পেয়ে গত ২৪ ডিসেম্বর সিরাজগঞ্জের জেলা প্রশাসক ড. ফারুক আহাম্মদ বরাবর দরখাস্ত দিয়েছেন। এর আগে তাড়াশ উপজেলা নির্বাহী কর্মকর্তা ও উপজেলা সেচ কমিটির সভাপতি ও পল্লী বিদ্যুত সমিতি-১ তাড়াশ জোনাল অফিসের ডেপুটি জেনারেল ম্যানেজার বরাবর লিখিত অভিযোগ করেন।

Individual Solar Pump

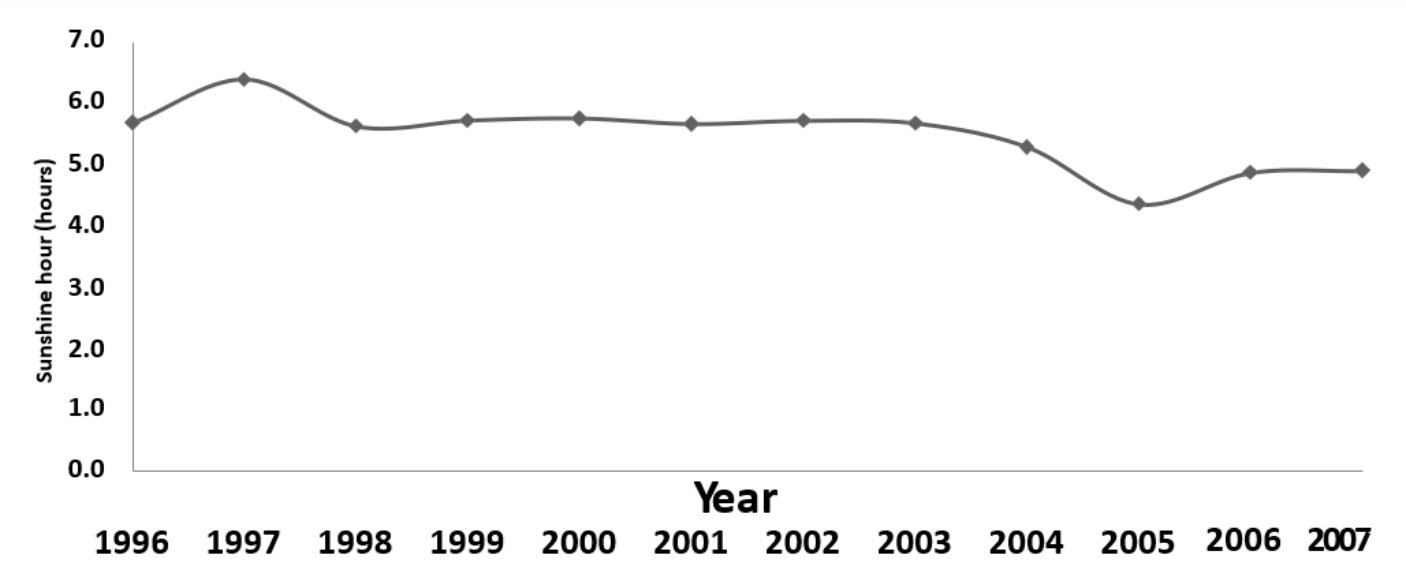
- To my knowledge, not used
  - High initial cost, no subsidy
  - Occupy land - not available
  - Other risks, foggy/cloudy days, dust, technical difficulties
  - early dry season is winter and sometimes there are several days without sun
- ACIAR funded project (DSI4MTF) installed small solar pump in Bihar and West Bengal and assessed their performance

Solar pumping performance

- The maximum discharge was observed 2.88 l/s and 3.03 l/s for SWP-1 and SWP-2
- As the solar radiation is increase the pump discharge increases and attended its peaks discharge around noon and then decline
- The minimum drive frequency of pump motor is 13 Hz, which was available only when sun emits radiation around 300 to 330 W/m^2



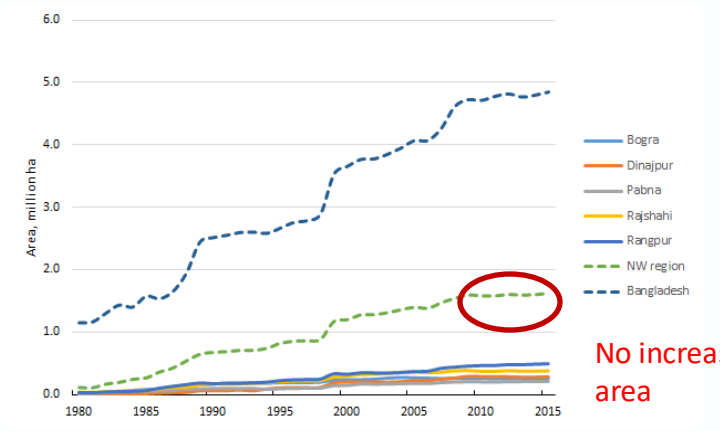
Key Learnings



- An average 5.5 hours sun is available every years
- 49.5 m^3 per day and considering 5 cm depth of irrigation, a total area of 990 m^2 can be irrigated per day
- Considering average ET demand 5 mm per day the irrigation interval would be 15 days
- SWP can be able used for irrigating vegetable crop
- Site selection is key, shadowing is a real problem

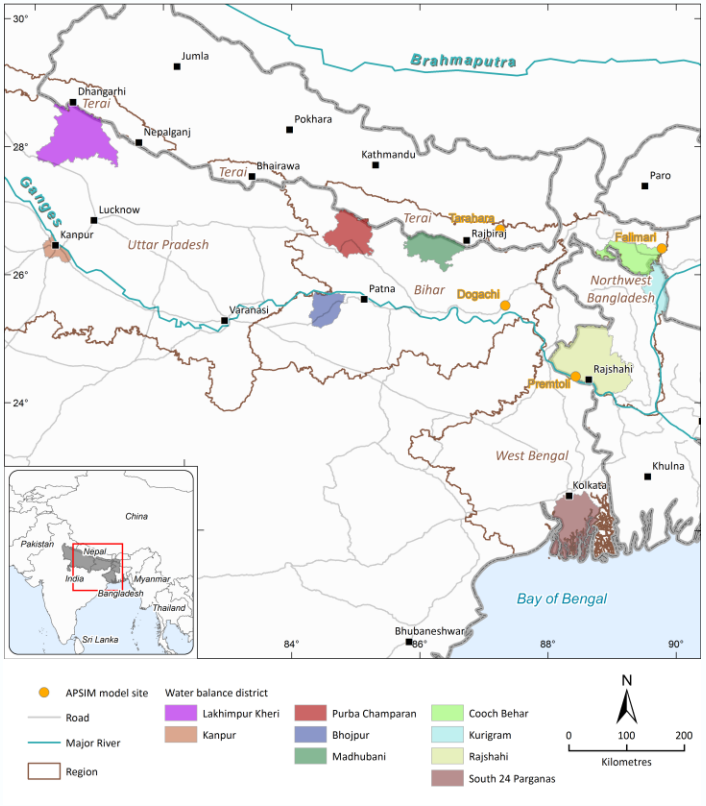
Can solar irrigation affect groundwater sustainability?

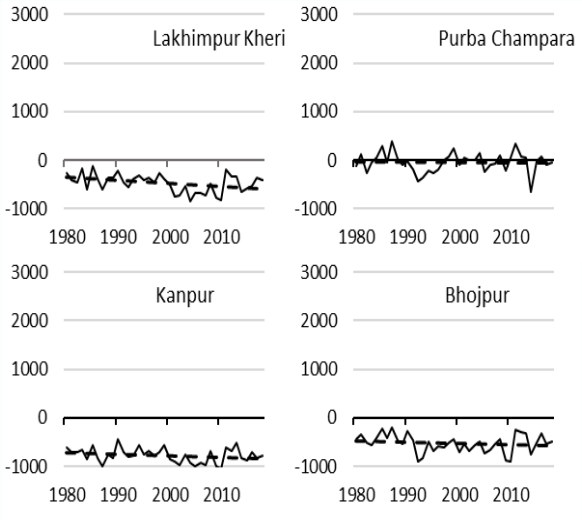
- Depends on the specific area
- In Bangladesh, irrigation has reached maximum potential at the current infrastructure condition
- All cultivable area is under irrigation. So, more pumping won't affect the net use of water or overall water balance
- More pumping of water does not mean water is lost from the system
- If there is no extension of area solar pumping unlikely to affect groundwater
- In some areas (with low rainfall), depending on the groundwater condition, extension of area may have impacts – more net use then recharge



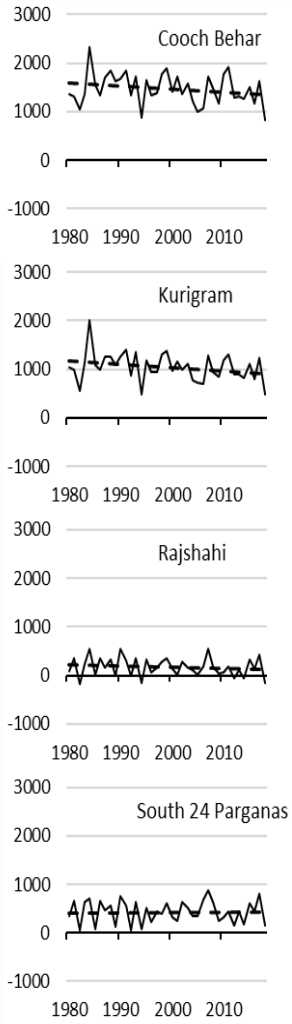
No increase in area

Solar irrigation impacts on groundwater in the EGP





Net surplus/deficit = Rain + annual GW decline - PET



- Water balance studies done at nine districts cover the region from E to W and N to S.
- The northeast of the region has a large excess of rainfall over PET. Solar irrigation is unlikely to have any impacts on groundwater.
- The southwest part of the region, around Kanpur, has a deficit of rainfall to satisfy PET. If there are areas for irrigation expansion, solar irrigation is likely to have impacts on groundwater

Conclusion

- There are lot of misconception related to irrigation water use
- There are reasons to be concerned for the current solar irrigation model in Bangladesh
- However, they could be good if they can reduce water price, provide better service to the farmers
- Impact of solar irrigation on groundwater depends on the local hydrogeological condition. In Bangladesh this is unlikely to have any impacts
- New system – need research to understand the long-terms benefits and gains

Questions and Discussion

Australian Government
Australian Centre for International Agricultural Research