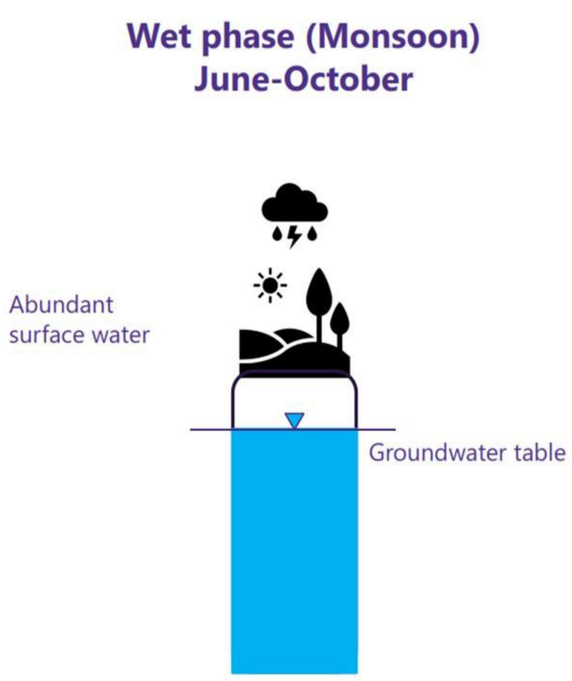
Green Technology in Quest of Reducing Overexploitation of Ground Water and Energy: A Case Study in Haor Region

Introduction: Growing population requires increased agricultural productivity. This consequently triggers a significant and often unsustainable extraction of groundwater in Bangladesh during the winter season (Nov.–May), locally known as Boro season. There is a clear correlation between groundwater depletion and increased agricultural productivity where the Monsoon rains have become insufficient to replenish the groundwater extracted during the previous dry season. Thus, an Integrated Rice Advisory System (IRAS) was launched for Northeastern Bangladesh. The impact evaluation was carried out in twelve Upazillas selected from seven districts in the Haor region of Bangladesh . The IRAS service, by virtue of being a collaborative project between DAE the University of Washington and EPRC has the potential to scale sustainably to entire Bangladesh.



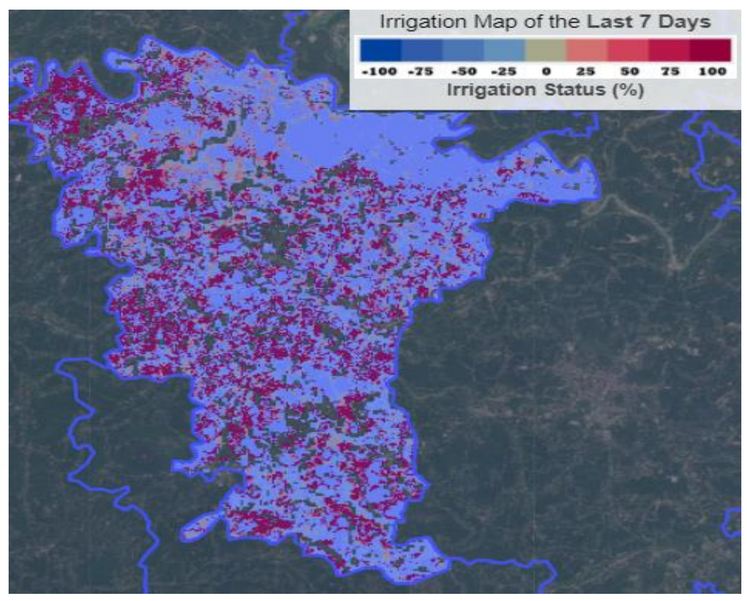
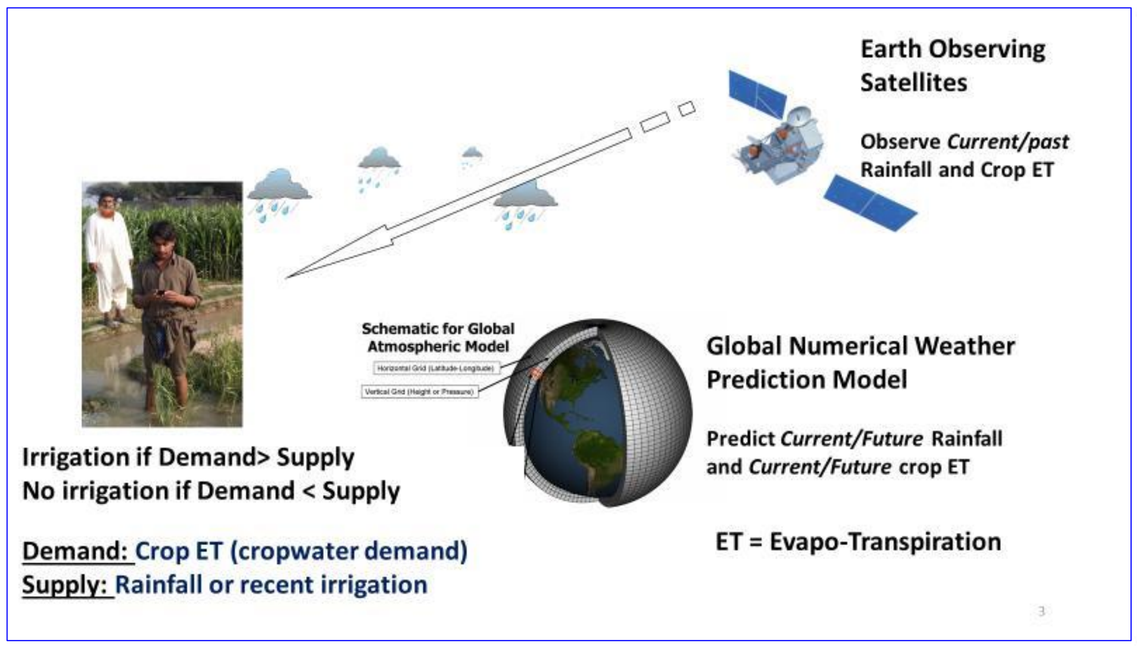


Fig- Zoomed view of the irrigation status for Purbadhala Upazilla for December 1, 2020 showing % of over (in red) or under (in blue) irrigation the past 7 days at 30X30m resolution

Methodology: The project identified the regions of rapid groundwater depletion by analyzing spatial and temporal trend of GRACE TWS anomaly. Considering Boro rice as a dominant crop during the dry season over Northeastern Bangladesh, the project compared SEBAL ET and Penman-Monteith ET and assess the nature of irrigation going on there. Finally, the project calculated the percent of over or under irrigation over those regions and observed how much water can potentially be saved with improved a IRAS during dry season. This information, together with future irrigation need and sent to farmers via SMS texting. The IRAS transmitted text advisory to farmers on optimum ways to irrigate while safeguarding crop yield. These texts were generated on the basis of weather, satellite data, estimated water consumption by crops and modeled crop water need. To quantify the impact of IRAS, a study was carried out for a cross sectional sample of 983 farmers and pump owners who were divided into control and experimental groups.



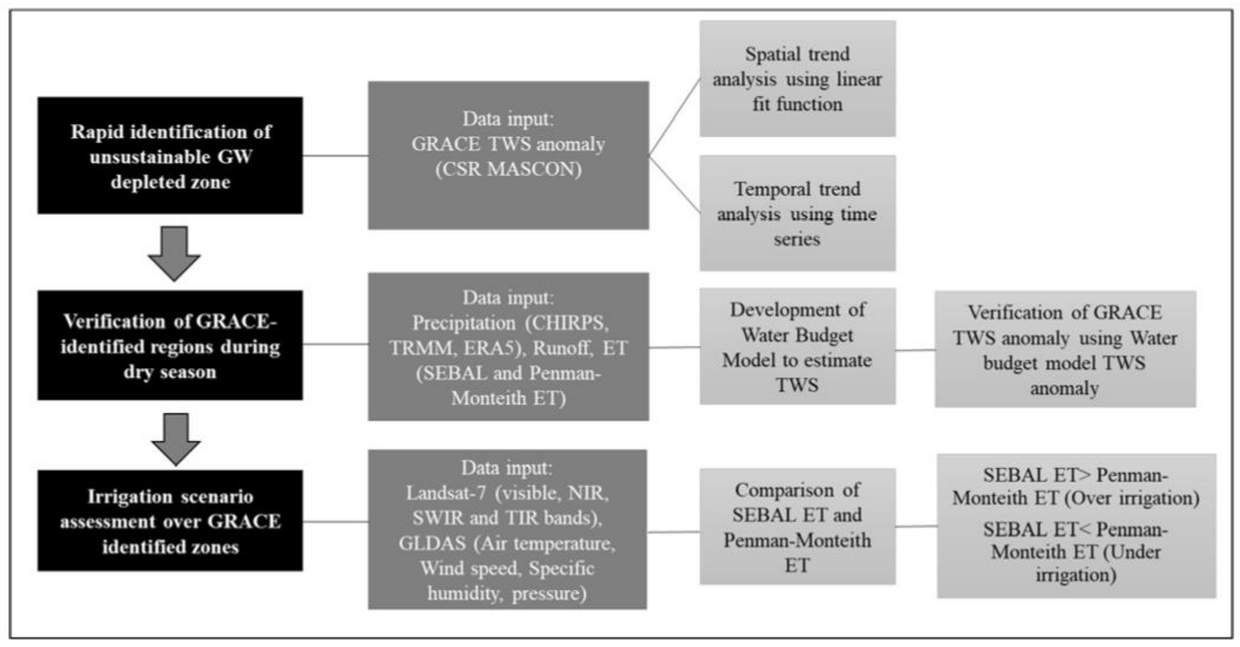
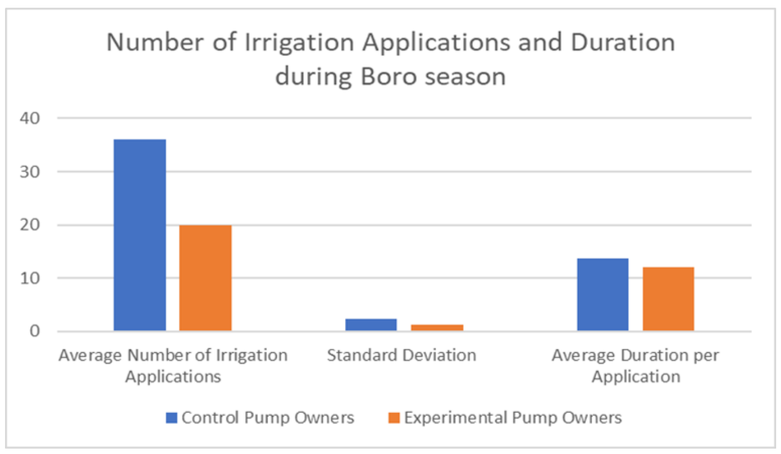
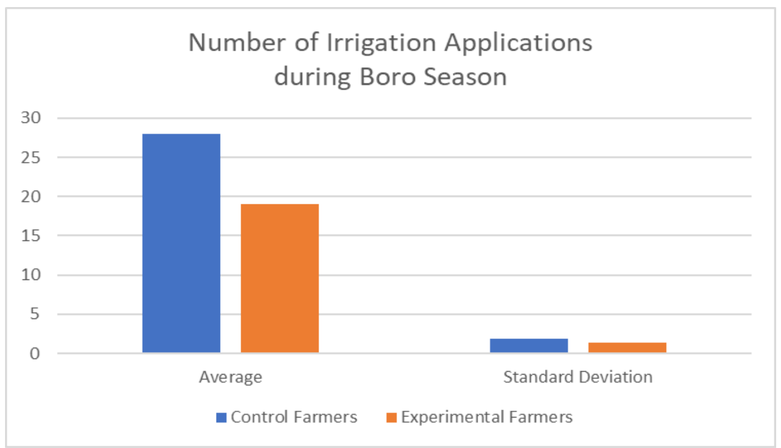
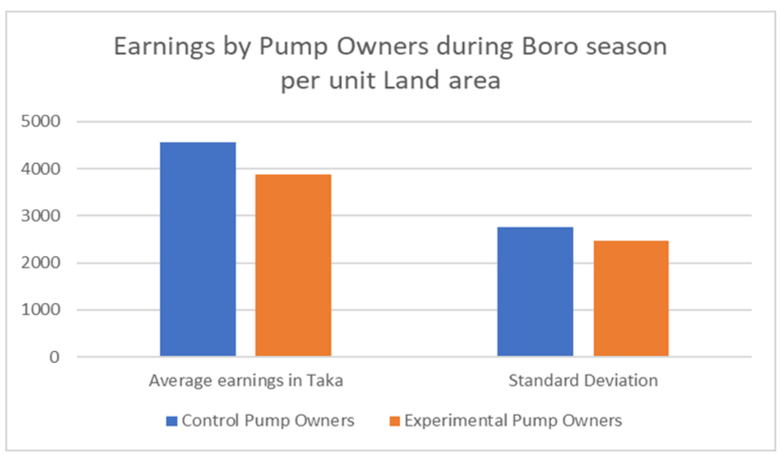


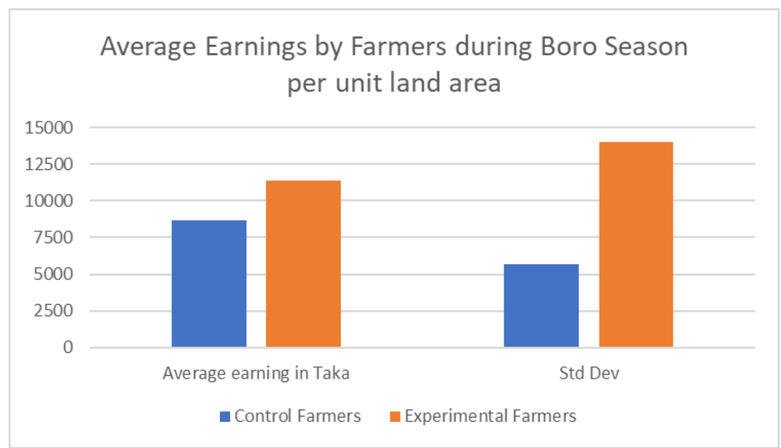
Figure: Schematic summary of steps followed in methodology





Results/Impacts: Greater impact of IRAS for pump owners on reducing irrigation and avoiding unnecessary irrigation is very clear. Finally, there appears to be the added benefit of reducing fuel consumption and cost of irrigation for pump owners. The impact on reduction of irrigation on an average, experimental farmers receiving IRAS advisory irrigated nine times (32%) less than the control group during the Boro season. Experimental pump owners with greater control of irrigation irrigated sixteen times (44%) less than control pump owners. Ninety-four percent of experimental farmers and 97% of experimental pump owners reported IRAS to be either useful or very useful. Eighty percent of experimental farmers and 87% of pump owners reported the weather forecast to be the most useful component for making decisions to avoid unnecessary irrigation. Experimental group of farmers on average reported 30% higher earnings, potentially also due to a greater amount of non-rice cash crops grown. The experimental group of pump owners however reported a 15% reduction in earnings possibly due to loss in revenue with reduced irrigation demanded by client farmers.





Sector Contribution:

- IRAS can make a significant reduction in the water and energy footprint of dry-season rice production in Bangladesh.
- Through a more optimal use of groundwater pumping, IRAS can also decarbonize the current farming system with less fossil-fuel consumption.
- Make rice production more resilient against future water scarcity while also safeguarding crop yield.

Environment and Population Research Centre (EPRC)

Courtesy: University of Washington, USA and Department of Agriculture Extension (DAE), Bangladesh