American International Journal of Multidisciplinary Scientific Research
Vol. 11, No. 1; 2021
ISSN 2638-1249 E-ISSN 2638-1273
Published by CRIBFB, USA

IRRIGATION DECISIONS AND USE OF GROUNDWATER IN BANGLADESH: PERSPECTIVES ON SOME EVOLVING CRISIS

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Received: September 29, 2021 Accepted: October 07, 2021 Online Published: October 23, 2021

DOI: 10.46281/aijmsr.v11i1.1400 URL: https://doi.org/10.46281/aijmsr.v11i1.1400

ABSTRACT

Groundwater is one of the vital rechargeable natural capitals, which serves as the main water source around the globe. In Bangladesh, about 79% of the cultivated area relies on groundwater irrigation. The perspective piece is intended to scrutinize the irrigation decisions and groundwater use in Bangladesh from published sources. The paper points that the reason behind the excessive groundwater mining is imbedded in the heavy dependence of Bangladesh on irrigated dry season rice to feed its huge populaces. Bangladesh has obtained rice self-sufficiency by foregoing environmental costs. The farming communities as a whole rarely adopted water-saving modern technologies and keep paddy fields abundantly irrigated as the marginal cost of irrigation is near zero. The irrigation water price is commonly pre-negotiated on the basis of per unit area for the whole crop season without considering the volume of water. The perspective suggests that the ignorance about the importance of groundwater and the consequent over-extraction cannot be stopped without thorough policy reforms. Bangladesh should move toward institutionalizing irrigation, design a participatory framework involving all the stakeholders in a water management network and piloting efficient water models across the country.

Keywords: Dry Season, Environmental Externalities, Rice, Volumetric Payment, Water Pricing.

INTRODUCTION

Groundwater is one of the vital rechargeable natural capitals available beneath the surface of the earth, which serves as the main water source for the household, industrial, and farming practices around the globe (Fitts, 2002; Nampak et al., 2014; Neshat et al., 2013). It provides half of the irrigation water and meets around 97% of the freshwater needs worldwide (Jakeman et al., 2016). The rapid growing dependency frequently causes excess withdrawal of groundwater and puts immense pressure on it (Arubalaji et al., 2019). Furthermore, groundwater depletion has reached a critical level, mostly in the tropic and subtropic areas, due to population pressure, changed climate and unplanned irrigation (Ahmed et al., 2021).

In Bangladesh, about 79% of the cultivated area relies on groundwater for irrigating crop fields (Qureshi et al., 2014). The drought-prone northwest part of Bangladesh is solely dependent on agriculture, and 95% of its water demand is met by groundwater (Mojid et al., 2019). Groundwater in Bangladesh

faces comprehensive withdrawal in the dry (Rabi) season for varied reasons and recharges naturally with monsoon rain and floodwater in the wet (Kharif) season (Neumann et al., 2009). Similarly, prolonged droughts are experienced, especially in the northwestern part of Bangladesh in the dry season due to low precipitation and high temperature, which consequently reduce the streamflow and hamper the production of dry season Rabi crops significantly (Alamgir et al., 2015). Moreover, frequent and severe droughts have become a common phenomenon in recent years, which urges for changes in agricultural decision makings particularly in crop selection and water management (Zimmermann et al., 2010). Unlike wise the needful, an unplanned over-dependency on continued farming practice, along with unscientific decision making on water usage, is endangering these scarce water resources in those areas (Anim-Gyampo et al., 2019; Campisi-Pinto et al., 2012).

RICE, GROUNDWATER MINING AND FORGONE ENVIRONMENTAL COSTS

The reason behind this excessive groundwater mining is imbedded in the heavy dependence of Bangladesh on rice to feed 165 million of its populaces. Expansion of irrigated plowing based on groundwater harvesting has enabled the country to intensify rice production through crop planting in multiple seasons along with the adoption of Hybrids and high-yielding rice varieties (Shew et al., 2019). In the last three decades, a quick increase in the area of the dry season irrigated rice (boro rice) has contributed significantly to wiping hunger and attaining self-sufficiency in rice cultivation (Hossain, 2009; Bell et al., 2015; Mainuddin et al., 2014). The contribution of the boro season is around 52% of the total annual rice production in Bangladesh. Increased utilization of shallow tube-wells (STWs) for extracting groundwater from the depth of 15 to 30 meter was the actual driver behind the expansion of irrigated dry season boro paddy area (Hossain, 2009).

Rice self-sufficiency in Bangladesh is obtained by foregoing environmental costs, hence, paved a major challenge to reduce the costs while keeping the pace of rice productivity uninterrupted (Basak et al., 2016; Uddin & Dhar, 2018). This tendency of sacrificing environmental cost is somewhat patronized by the policymakers and occupied strongly at the root-level by the farming communities as well. The boro rice is a water-fascinated crop, and it is tough to reduce the water use in dry season irrigation practice without sacrificing rice yield, particularly when stakeholders are ignorant of the future threats. Moreover, Bangladeshi farmers apply on an average 38% excess water than the actual requirement (Hossain et al. 2021). Water-saving modern technologies are rarely adopted by the community as a whole despite being economical and yield maximizing (Alauddin et al., 2020; Hossain et al., 2016).

IRRIGATION DECISIONS AND WATER PRICING

In reality, never does the pricing of irrigation water in Bangladesh give any economic incentive to use less water or adopt water-saving technologies. Hence traditionally, farmers keep paddy fields abundantly irrigated regardless of the crop stages, and water requirement only for mental satisfaction or soothing eyes as the marginal cost of irrigation is near zero. The irrigation system is a private domain, but the aquifers and natural water bodies in Bangladesh are open access, and water is commonly considered as public property or natural gift available free of charge or any pricing (Pandey et al., 2020). There are mainly three types of private payment systems for irrigation water between the irrigators and farmers in Bangladesh (Rahman, 2016). In all the types of payment contract, water is provided for the whole crop season on the basis of per unit area without considering the volume of water (Krupnik et al., 2015).

The irrigation water market in Bangladesh is more concerned about agronomic risks, additional cost of weeding and the risk of delayed irrigation due to possible power cut, diesel crisis or pumps being out of order, rather than the environmental externalities (Mottaleb et al., 2019). It led the price of irrigation

being negotiated prior to the crop season and allows farmers to keep the field flooded profligately instead of reducing water use by alternative wetting and drying practice (Pandey et al., 2020).

IMPACTS OF IRRIGATION DECISIONS

It is evident from examining the present scenario that the groundwater table is falling as the volume of water recharge is less than the withdrawal in some places. Consequently, the maximum groundwater level surpasses the suction limit of 8 meter for three months every year (Dey et al., 2013; Hossain et al., 2021; Hodgson et al., 2014). Regretfully, shallow aquifers being unsustainable means access to water resource for daily use, including the availability of safe drinking water, and a basic human need denied (Kirby et al., 2013).

On the other hand, the positive groundwater balance can be obtained even in the drought-prone districts simply by irrigating judicially. A calculation on the basis of the actual requirement of irrigation water by Hossain et al. (2021) showed how decision making by the community as a whole may convert the water scarcity into a positive water balance. According to the researchers, an observed long-term average annual groundwater shortage of 0.2 billion cubic meters (BCM) could have been diverted to recharge of 0.55 BCM.

Hence, the perspective says, changes in irrigation decisions can bring the ultimate solution, and the blame from the agriculture sector for destroying the environment can possibly be revoked as well. But the ignorance about the importance of groundwater and the consequent over-extraction cannot be stopped without thorough policy reforms. Otherwise, in the face of climatic vulnerabilities, if such unmindful depletion of groundwater continues regardless of the constant fall of water level, the agrarian economy may get threatened to lose sustainability (Ahmad et al., 2014).

THE WAY FORWARD

It is high time to call for mapping Spatio-temporal groundwater potential zone incorporating macroclimatic aspects for portraying the magnitude of future droughts (Rahmati et al., 2016). The latest progress in the arena of geospatial techniques has brought newer dimensions and abled managing big data with great accuracy (Sharma et al., 2018). The researchers, lately, are using a decent number of approaches under multi-criteria decision-making techniques and machine learning (Arabameri et al., 2020). The region and season-wise assessment of water resources would help mitigate drought through revising crop selection accordingly.

Bangladesh should move toward institutionalizing the irrigation for increasing water use efficiency. Persuading the farming community toward optimal water use decisions and proper crop planning is a must. Utilizing rainwater and surface water can reduce groundwater mining and increase the volume of recharged water as well. Awareness programs and robust policy reform is mandatory. The farmers who use water-saving technologies can be incentivized, for instance, by freeing their land development tax. The breeders should pay heed to introducing less water requiring rice varieties. Lastly, the foremost challenge for the Government is to design a participatory framework involving all the stakeholders in a volumetric payment-based water management network and piloting efficient water models across the country.

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