irrigated agriculture.

IV. POVERTY ALLEVIATION VERSUS MASS POISONING: THE DILEMMA OF GROUNDWATER IRRIGATION IN BANGLADESH

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The growth of groundwater irrigation has been the second most dramatic development in Asian agriculture of the last two decades, after the spread of green-revolution technology. While many countries in Asia have exploited their aquifers to supplement surface water supplies, no country in the region is as dependent on groundwater as Bangladesh. The total production and average yield of rice, the predominant crop, have grown from 9.8 million tons and 1.05 ton/ha respectively in 1972 to approximately 20 million tons and 1.97 ton/ha in 1999. These production increases have resulted from a substantial intensification of agriculture rather than from increases in cultivated area. Cropping intensity has grown substantially from 145% in 1975 to 175% in 1999. This growth in intensity was driven by increased cultivation during the dry season, made possible by the availability of irrigation by groundwater through the rapid increase in adoption of shallow tubewells. In 1999, of the 3.99 million ha of irrigated area, approximately 70% of irrigation was dependent on groundwater. Therefore, groundwater development coupled with the green revolution has gradually enabled Bangladesh to emerge from being a 'basket case' to partial self sufficiency in staple food production and significant reductions in poverty.

To put the poverty profile in Bangladesh in brief, extreme poverty prevails among 22.7% of rural households and moderate poverty among 29.2%. Besides these, another class of the poor with vulnerability to income erosion comprises about 21%. Another characteristic development is the decline of malnutrition, which reached the lowest level in 1996. Groundwater irrigation has helped mitigate the poverty. The most recent estimate of the Human Poverty Index (HPI) has dropped more than 20% during last 15 years (1981 to 1997). The development of groundwater irrigation has increased livelihood of the country. In one irrigation season, 3 laborers can get employment for 3 months per hectare of land. According to FAO, groundwater irrigation in Bangladesh has increased the employment in agriculture since 1985 by 250 percent. Thus groundwater irrigation has emerged as a formidable tool for livelihood improvement and poverty alleviation in Bangladesh.

The advantages of exploiting groundwater irrigation sources are under serious threat due to arsenic contamination. Recent evidence has shown that groundwater sources of 61 districts out of 64 are contaminated with arsenic. Some researchers attribute groundwater abstraction for irrigation as the cause of arsenic contamination whereas others suggest that the origin of arsenic rich groundwater is a natural phenomenon that has no relationship with excessive groundwater abstraction. Since the detection of arsenic in drinking water, a great deal of effort has been diverted towards the determination of the cause of contamination

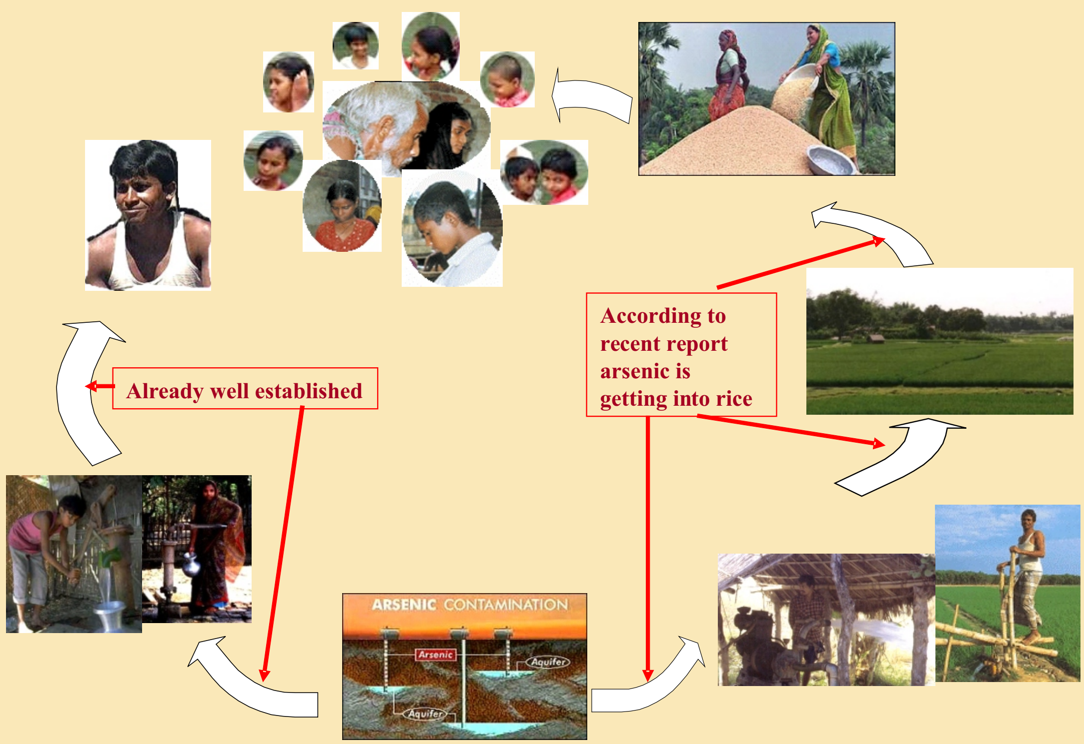
Figure 7

and the removal of arsenic from drinking water. It is estimated that 25 million people are potentially exposed to arsenic poisoning through drinking water. This has been described at the greatest mass poisoning in human history. However, even these figures may be surpassed if arsenic is shown to be entering the food chain through the consumption of crops irrigated by contaminated water. Recent studies suggest that arsenic from contaminated groundwater is being taken up by rice. Irrigation of paddy with arsenic contaminated water is also presenting in elevated arsenic levels in soils. In another study, it was found that arsenic levels in the soil were correlated with local well water concentrations, suggesting that the soils had become contaminated through irrigation with arsenic contaminated water. High levels of arsenic have also been found in soils which will have long-term impacts on crop productivity and quality.

However, no comprehensive studies have been undertaken to assess the consequence of arsenic entering the food chain through irrigation with contaminated groundwater, its impact on soil and crop productivity and overall livelihoods of the people. In this respect drinking water is a small proportion of the total groundwater consumed when compared to that used in the production of irrigated crops. While a great deal of attention has been given to find alternative sources of drinking water such as rain water harvesting, community ponds, and developing low-cost filters to remove the arsenic from contaminated water, scant attention has been given to alternatives to groundwater irrigation or reducing the dependence on contaminated groundwater for irrigation. Due to continued population growth, pressure on agricultural lands, and thereby on the groundwater is likely to stay on or even grow for several decades for producing food as well as supporting rural livelihoods if the present trend continues. Therefore, developing and managing groundwater resource in a sustainable manner poses many challenges such as:

1. What would be the impact of arsenic accumulation in soil on crop productivity and quality?
2. What would be the impact on irrigated agriculture, socio-economy and overall livelihoods of the people?
3. How to minimize these impacts?
4. Overall, how to make groundwater use sustainable?

Figure 8: Arsenic Contamination Cycle



There is clear evidence that groundwater irrigation is a formidable tool for poverty alleviation. Nevertheless, it could also be the cause of mass poisoning. There is serious risk that we may face a bigger catastrophe than we can visualize. If steps are not taken in the right direction arsenic contamination could threaten the very existence of our civilization.