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NARMADA WATER SUPPLY IN SAURASHTRA: INCREASE IN WATER LEVEL AND ITS EFFECT ON FARMING

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ABSTRACT

There have been a number of unfavourable outcomes as a result of the uncontrolled utilization of the alluvial aquifer in Saurashtra for the purpose of irrigation. This is the case despite the fact that the region is home to a substantial quantity of natural resources in this particular location. By making use of the water resources that are not being utilized from the "Narmada basin", there is a significant possibility that the aquifer system might be replenished into its original capacity. The strategy that is now being implemented asks for the water to be redirected to the "Saurashtra region of Gujarat" through the "Narmada main canal". After that, a decentralized recharging process will be launched by making use of tiny ponds, tanks, and the canal networks that are already in existence in the region or to be developed. The subject is explored from both a physical and a financial point of view along the course of this article's breadth. After conducting an analysis of two distinct recharge scenarios in the "Saurashtra region of Gujarat", it has been concluded that the utilization of pumped water for the purpose of recharging outside of the designated command area could not be cost-effective unless there is a considerable increase in water demand. This conclusion was reached as a result of the conclusions drawn from the previous analysis done by various scholars. If it were possible to recharge the grounds within the command centre, the expenses associated with doing so would be significantly reduced.

KEY WORDS: Water Recharge, Farming, Irrigation, Narmada Basin, Resources.

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INTRODUCTION

Agricultural development in the state has been centred on the semi-arid and dry Saurashtra region over the past forty years. This is due to the region's plentiful and large alluvial aquifers as well as its extremely enterprising farming population. The fast decreasing water levels and the poor quality of the water are both indicators that the groundwater resources in the region are experiencing significant stress. The overuse of this resource for irrigated agriculture in Saurashtra, which exceeds the natural replenishment that occurs as a result of rainfall, is the root cause of the groundwater management issue in that region. Due to the fact that tube wells and open wells drain more than 3,000 million cubic meters of groundwater yearly, there is a shortfall of around 600 million cubic meters in the process of replenishing groundwater in the Saurashtra region. The government of the state is concerned about the economic ramifications that may result from the withdrawal of groundwater. A subsidy of Rs 300 crore is provided on an annual basis for the energy that is utilized in well irrigation in the "Saurashtra region of Gujarat". Groundwater irrigation is becoming increasingly expensive, which is making farming less economically viable for farmers. This is despite the fact that there are substantial subsidies for the power that is required to raise water. There have always been a variety of alternative designs for the transfer of water because of the unequal distribution of resources throughout the state. Each year, the territory of Dangs in the south of the state receives more than 2,000 millimetres of precipitation, while the region of Kachchh, which is located in the north of the state, receives just 350 millimetres. For the purpose of alleviating water shortage in the "Saurashtra region of Gujarat", Gujarati leader Vithallbhai Patel has proposed the idea of linking the hydrological systems of the north and south of the state. This idea is relevant to the ongoing issue on the importation of water. Based on the information provided by the Government of Gujarat in 1989, the first plan for the "Sardar Sarovar project" included the recycling of water from the downstream pumping system of the power plant in order to deliver water to "three large and nine medium irrigation projects located in the Saurashtra region of Gujarat". Under these circumstances, the water storage capacity of the projects would be increased, and the safety of over 2.3 lakh hectares of irrigated land would be ensured. Within the context of a water resource planning assessment conducted for the Gujarat government, some Consulting

Engineers suggested that the "Narmada River" serve as a supply of imported water for the purpose of recharging vessels. During the course of the project, the possibility of artificially refilling "aquifers in Saurashtra" was investigated, and approaches for spreading in higher regional aquifers and riverbeds were suggested (GoG 1996). As a result of the "Sardar Sarovar Dam" reaching a height that is high enough to "direct water into the main canal", the concept of importing water appears to be coming into fruition. Because water shortages are anticipated in some industries, notably agriculture, there is a big opportunity to use this water for ecological objectives, such as recharging the diminishing "aquifers in Saurashtra". This is one of the many opportunities that exist. It is possible that the current initiatives being undertaken by the government may not have prior planning, but they have the potential to improve the socioeconomic status of communities and the environment if they are carried out in a methodical manner over a certain period. Talking about aim of study is to identify the most feasible way for recharging "aquifers in Saurashtra" by comparing two different recharge alternatives that make use of "Narmada water". The comparison is based on the physical and economic feasibility of the two choices.

WATER RESOURCES IN SAURASHTRA

Saurashtra had a considerable increase in the number of tube wells equipped with high-capacity pump sets from 1960 - 1990. This was to satisfy growing need for water in agriculture, which was occurring at a time when surface water resources were restricted. Groundwater extraction was higher than recharge rates, despite the fact that irrigated farmland were doing quite well. As a consequence of an excessive amount of groundwater extraction, "open wells and dug-cum-bored wells in the alluvial regions of Saurashtra Gujarat" became dry. The "falling groundwater resulted in an increase in both the fixed costs of constructing the tube well as well as the variable expenses" of the power that was required to gather water and maintain the well. "Irrigation accounts for more than 36 percent of the total input expenditures in the Saurashtra area, which leads to poorer net returns per unit of land for crops like groundnut, wheat and cotton when compared to other regions in Gujarat (IRMA 2001)". The already precarious situation with groundwater is made much worse by "limited amount of surface water in the region". From the hilly terrain in the north-eastern part, rivers from that region of Gujarat run in direction of either "Gulf of Khambat or Rann of Kachchh". The cyclical nature of these systems means that they are only capable of conveying stream flows for three to four months out of the year. There is a significant degree of unpredictability in the yearly river flows, and when there is a lack of precipitation, the river flows regularly stop flowing (Kumar 2002: 19). Due to the fact that they were intended for low dependability run-off, the large and medium irrigation systems in Saurashtra are greatly influenced by the changing run-off. According to Kumar (2002), the excessive use of runoff by Sue has resulted in these reservoirs frequently discharging water onto settlements located further downstream. For the month of April in the year 2000, there were around six million cubic meters of storage available out of a total capacity of two hundred and eighteen million cubic meters in thirteen dams, both major and minor, located in the “Saurashtra region of Gujarat”. These “reservoirs have been filled to less than fifty percent of their capacity (GoG 1989: 437)”. In light of the fact that further large-scale surface water projects in Saurashtra that make use of indigenous water sources are not feasible, the only realistic alternative to maintain a continuous water supply in the region is through the proper management of groundwater.

NARMADA WATER & AQUIFIRES OF SAURASHTRA

After conducting an analysis of the volumetric shortage of groundwater in comparison to the feasible recharge volumes, we will be able to determine the amount of “Narmada water recharge” that is necessary to put an end to the trend of groundwater degradation. When the yearly useful recharge is subtracted from the yearly draft, the groundwater deficit that results is 562.39 mcm, which is equivalent to 600 mcm more. The yearly gross water need that is a result of induced recharge has been calculated to be one billion cubic meters, according to our conclusions. As a result of the extraction of water from deep aquifers, there has been a complete and absolute deficit of water throughout history. In order to make up for this shortfall, an additional 400 million cubic meters of water is required each year. In the event that the “Narmada River” surpasses the designated 11,100 mcm (9.0 maf) for the state of Gujarat and the “Sardar Sarovar Dam” site is reached, the surplus water from the dam might be employed for the purpose of irrigating the “Saurashtra region of Gujarat”. It is important to note that the approved quantity for Gujarat does not take into account environmental factors such as the replenishment of depleted aquifers. In the planned command area, the remaining 9,800 mcm of water will be distributed to priority irrigation districts, with the exception of 1,300 mcm that would be authorized for use by residential and commercial establishments. As a result, the surplus water that is produced by the “Sardar Sarovar Dam” needs to be utilized in order to redirect flows to the eastern region of Gujarat, particularly during the monsoon season. It is estimated that around 10% of the 11,100 mcm allotment in Gujarat is accounted for by the need for 1,000 mcm recharge in Saurashtra. It is necessary for the basin to provide an additional 35,500 mcm of water to the recipient states on an annual basis in order to create an additional 1,000 mcm of water at SSP. This is in addition to the present distribution of 34,500 mcm. The annual run-offs are expected to surpass 35,500 mcm, according to the inflow data from 1891-1990. There is a 70% possibility that this will occur. In light of this, it can be deduced that a total of one billion cubic meters of overflow would be accessible seventy percent of the time during the course of one hundred years. In the event that the current pattern of stream flows in the “Narmada basin” persists, there is a possibility that the likelihood of a flood occurring will be greatly reduced. To obtain further information on the hydrology of the basin, please refer to Kumar et al., 2004a. It is quite unlikely that the amounts we estimated for the surplus flow would be inflated for at least the next twenty years. According to the calculations that we have done, the state of Madhya Pradesh is going to begin using the 22,500 mcm of water that it has been allotted from the “Narmada River” very soon. A comprehensive plan for the development of the “Narmada valley”, which includes the construction of 3,500 minor dams, 135 medium dams, and 29 big dams upstream of the “Sardar Sarovar project”, must be put into action in order for this to take place. Until they attain a dependability of seventy percent, more flows will be accessible.

GROUND RECHARGE & STORAGE INFRACTURE IN SAURASHTRA

The inspection of big reservoirs and village ponds is necessary in order to determine the ability of these bodies of water to hold incoming flows until they are recharged. There are a “number of reservoirs located in the region of Saurashtra”, the most of which are located in the basins of small rivers of Saurashtra and Gir. For more than half of the years that were examined, these reservoirs have been regularly filled to less than fifty percent of their capacity (GoG 1989: 437). This suggests that there is a sufficient amount of space available for the storage of water that is imported. It is anticipated that, with the exception of years that see an excessive amount of rainfall, there would be a total of 1,000 million cubic meters (mcm) available for the storage of imported water which equivalents to twenty-five percent of the combined capacity of both large and minor reservoirs. Because of the region's beneficial geo-hydrological features, artificial groundwater recharge is a viable option in the Saurashtra region. The soils in the “Saurashtra region of Gujarat” are distinguished by their high permeability and capacity for infiltration with water. With an annual groundwater recharge rate of 0.106 million cubic meters per square kilometre, the region has considerable recharge rates as a result of the modest rainfall that occurs there. It is possible to find both the upper and lower aquifer units in this region. The uppermost layer is characterized by a high degree of unconfinedness and a thickness that ranges from 35 to 125 meters. Additionally, the bottom unit, which may be found at depths of up to 600 meters, is characterized by layers of clay and sand that alternate with one another and is frequently confined. An investigation that was carried out by the "United Nations Development Program (UNDP)" in the year 1986 in Junagadh & Rajkot shown that it is possible to artificially replenish the upper unconfined aquifer by employing spreading techniques like as spreading channels, recharging pits, and ponds. A number of different recharging methods were evaluated in this study. Between 19 and 96 centimeters per day was the range of the infiltration rates that were observed. The rates were found to be higher in regions that had water tables that were deeper and unsaturated zones that were more permeable. The groundwater mounds that were discovered during long-term recharge studies conducted on desilted ponds ranged in height from ten to eighteen meters and covered an area that was several thousand square kilometres in size. With an expected infiltration rate of 30 millimetres per day, 4,000 ponds in Saurashtra have the potential to efficiently refill a volume of 1,440 million cubic meters over the course of 120 days. This is accomplished by maintaining a steady water flow. The method of surface spreading has the potential to successfully replenish alluvial aquifers that are not constrained.

EXAMINING THE FINANCIAL ELEMENTS OF POTENTIAL RECHARGE PLANS

It is possible that the Saurashtra portion of Gujarat might be split into two different regions during the process of assessing groundwater recharge from SSP. Within the approved command area of the SSP, which is situated on the western bank of the "Narmada Main Canal (NMC)", the first part encompasses a total area of 4,500 square kilometres. This segment is located entirely within the SSP. The second half of this region encompasses around 23,500 square kilometres and is located on the opposite side of this region. Although the hydrogeological profiles and groundwater availability of both places are equivalent, the recharge system and economics will be substantially different from one another. This is because both locations have groundwater availability. During the process of replenishing the designated command area of the SSP, it is possible to draw water from the canal network that is planned and then distribute it to 800 ponds by means of a feeder network. The SSP is a tool that may be utilised to attain this goal. The water that is stored in these local reservoirs has the capacity to be diverted and to hold a total of two hundred million cubic metres of water for the purpose of having it replenished. Specialised pumping and conveyance equipment is required in order to carry water from pumping sites along the NMC to 14 large dams and around 3,200 village ponds in non-command zones to the east of the NMC. This is necessary in order to deliver water to these locations. One consequence of this is that the cost of water transport goes up by a significant amount. A consideration of the costs associated with irrigating with recharged water was taken into account in order to determine whether or not any of the two scenarios for water recharge would be economically viable. The expenditures associated in transporting water from NMC, recharging it, and extracting it for use in irrigation are included in these prices. According to Kumar et al. (2004b), who provided these calculations, the current economic value of groundwater consumption in irrigated agriculture is 3.41 rupees per cubic metre. This value was determined by the economic value of groundwater usage. This figure takes into account all of the costs associated with the inputs, with the exception of the expenditures with irrigation. The necessity of doing different economic assessments is contingent upon the specifics of the situation. The demonstration of recharging takes place in the control zone in the first scenario, but in the second scenario, the demonstration takes place in the zone that is not under control. For the purpose of determining the actual economic cost of recharging and transferring imported water, it is necessary to take into account the depreciation of infrastructure capital, the expenditures incurred by staff, the costs of repair and maintenance, the amount of energy required for water lifting, and the costs of de-silting reservoirs and ponds in order to achieve successful recharge. All of these factors must be taken into consideration. Scenario 2 takes into account a capital expenditure for infrastructure that is equal to 2,500 crores of rupees, but Scenario 1 does not take into account this cost. The reason for this is because the infrastructure that is being built as part of the SSP programme will be utilised for the purpose of recharging when it is finished. In the process of determining the cost of groundwater abstraction, the concept that replenishing the phreatic aquifer will result in significant increases in groundwater levels is taken into consideration. Because of this, it will be feasible to obtain groundwater through shallow drilled wells, which will, in turn, lower the amount of energy that is required for the extraction process. We have determined that pumps with a horsepower of five will be used for the extraction operation, and we have estimated the cost in accordance with this assumption. On the basis of a cost of 1.95 rupees per cubic metre for groundwater and an economic value of 3.41 rupees per cubic metre for groundwater irrigation, the economic cost of groundwater recharge in the SSP command area (Scenario 1) is justified. This is because groundwater irrigation has a higher economic value than groundwater recharge. Nevertheless, the second possibility, which entails lifting groundwater to a height of 75 metres in order to replace it outside of the command area, is not possible from an economic point of view. This is because the additional cost is exceedingly expensive.

CONCLUSION

Refilling aquifers in the command area and then rerouting the surplus recharge for irrigation looks to be a reasonable proposal from a financial standpoint, as demonstrated by this. However, when the potential value of the product that is produced is taken into consideration, the expense of using pumped water to irrigate non-command regions is not financially practical. Within the scope of our cost analysis, we took into account the actual marginal cost of using energy to pump groundwater. On the other hand, farmers have not yet been subjected to this expense; hence, the entire economic worth of groundwater is not officially recognised. The marginal cost of pumping groundwater is almost nonexistent as a result of the new billing system, which charges farmers based on the horsepower of the pump rather than the actual energy units that are required for pumping groundwater. By encouraging farmers to take into account marginal costs through proper pricing controls, producers may choose to cultivate economically efficient crops, which would result in an increase in the marginal value of groundwater products. The mismatch between the cost and economic value of recharged groundwater can be reduced by modifying the pricing of energy and instituting volumetric rationing for recharged water. This is one of the potential solutions that might be implemented to meet the difficulty that is presented in Scenario 2. Farmers would be encouraged to plant crops that are more water-efficient as a result of such incentives. When we were reviewing recharge programmes, we once again neglected to take into account the economic worth of the social and environmental costs that are linked with groundwater depletion, as well as the rising public health expenses that are tied to dirty groundwater. In the event that these benefits were taken into consideration throughout the evaluation process, the execution of Scenario 2 would be more financially justified.

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