VI. MICRO-MANAGEMENT OF GROUNDWATER: IWMI'S EXPERIMENT IN NORTH GUJARAT

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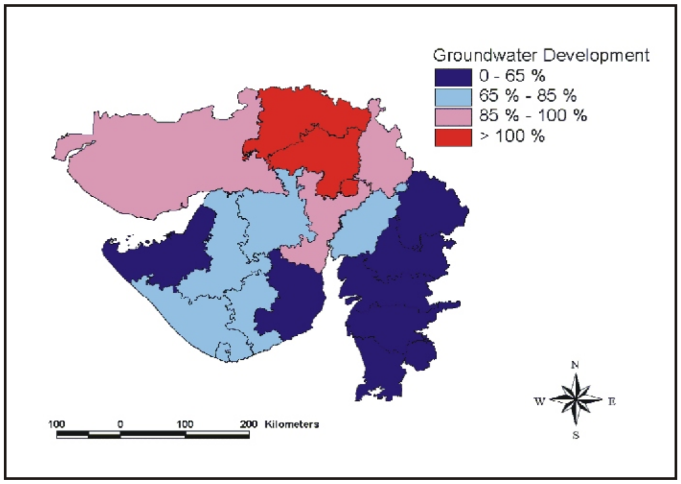
Uncontrolled abstraction of groundwater for irrigation has resulted in many problems in north Gujarat including mining of deep alluvial aquifers and secular decline in water levels; deterioration of groundwater quality manifested by high levels of salinity and fluorides in groundwater pumped from deep aquifers, making water non-potable, and sometime unusable for irrigation. Depletion problems in north Gujarat are very serious, owing to the extent of overdraft and mining, rate of depletion, the degree of dependence on groundwater for economic activities, and have far reaching consequences on the region's socio ecology. Legislative and regulatory measures to check overdraft that are socially viable and politically acceptable, have either not been worked out or have not been effectively enforced. The government interventions to protect the region from economic distress and collapse of the social fabric have, by and large, failed to make any positive impact. There are projects in pipeline to take up large-scale promotion of pressurized irrigation technologies. However, this is not based on sound understanding of the scope and limitations of these technologies. In recognition of the groundwater depletion problems and their adverse socioeconomic and ecological impacts, IWMI launched an action research project in 30 villages of Banaskantha district on community-based local groundwater management.

Hydrological Opportunities for Augmenting Groundwater

While on the one hand, the high inter-annual variability in the rainfall and runoff reduces the reliability of local water harvesting systems, on the other, it increases the hydrological opportunities available for these systems. The excessively high runoff generated in some of the years increases the potential of local water harvesting systems in terms of the amount of runoff available for harnessing. Thus the quantum of water, which is generated from 100 ha catchment, with 1/6th probability is sufficient to irrigate nearly 46 ha in one season. Large potential for water harvesting exists in the downstream of Dantiwada and Sipu reservoirs in Banaskantha district, as they are free catchments. In areas such as Danta in the eastern hilly tracts of Banaskantha, the minimum runoff that will be generated once in 6 years from a one-sq. km catchment will be as high as 0.559 MCM, which if captured underground can irrigate an additional area of nearly 110 hectares.

Figure 11: Level of Groundwater Development in Gujarat



The large unsaturated zones in the depleted alluvial aquifers provide excellent opportunities for recharging. This is complemented by the sandy soils, and the presence of local ponds that act as the sink for the local sheet runoff. But, at present only de-silting is practiced. This is not sufficient for getting optimum recharge of the stored water. During high rainfall years, the runoff generated even from a small catchment of 100 ha will be extremely high. This runoff is generated in a small amount of time given the fact high rainfall events that generate runoff are very few. The storage capacity of village ponds, which are generally in the size of 0.01 to 0.05 MCM (1 to 5 ha), will be too insufficient to capture all the runoff. The rate of percolation of water through the soil zone will be low. Also, owing to the large depth to groundwater table, a good fraction of the water while percolating down through the dry soil zone (vadose zone) will get absorbed by the soil particles are hygroscopic water. Therefore, recharge tube wells are required to increase the rate of intake of water. They can link the water in the pond to the aquifers that are tapped.

Physical Opportunities for "Wet Water" Saving

In villages where groundwater occurs under hard rock conditions, open wells and dug-cum- bore wells are used for irrigation. These wells have poor yield characteristics and run for 2-3 hours a day, much less than the hours of power supply. These are the most ideal situations for adopting water-saving technologies. The farmers can go for overhead sprinklers for crops such as wheat, bajra, jowar, mustard and elephant grass which are common. Micro sprinklers and mini sprinklers would be much suitable for alfalfa, which almost every farmer is growing. Drip systems will be feasible for crops such as castor, fennel, cotton, chilly and brinjal.

For large farmers having their own independent wells, but not sufficient water, conventional pressurized irrigation systems would prove to be technical feasible as well as economically viable. The Family Drip system being promoted by Netafim was found efficacious for irrigating alfalfa, with substantial water saving and yield gains. Sub-surface irrigation systems, FDS, micro-tube drip systems and "*Easy Drips*" do not require pressure head to run and therefore are most suitable for members of tube well partnerships and for water buyers. If the farmers shift to water saving technologies, the actual scope for water saving is high in these areas owing to: prevention of evaporation from the land surface; and prevention of deep percolation loss, which does not return to the pumped aquifer. Currently, farmers are tapping water from the deep confined aquifers, which are separated from the shallow aquifer, which is dry due to over-exploitation, by impervious layers. The seeping water takes long time travelling though the unsaturated zone; and may not reach the pumped aquifer.

What would work in Banaskantha?

Pressurized irrigation systems would eventually find greater acceptance among resource rich, large farmers who have independent irrigation sources, but not able to cover their entire command with traditional irrigation practices. Also, farmers who have poorly yielding wells, and are not able to utilise power supply fully, find great economic sense to go for pressurized irrigation systems. It will find least acceptance among farmers whose irrigation source have abundant supply potential, but are constrained by power supply shortages. Micro tube drip irrigation systems will make great sense for those who do not have their independent sources of water supply and for water buyers. The "*Easy Drip*" was tested to be efficacious for several of the horticultural crops. The FDS would find takers among water buyers and well owners for irrigating alfalfa.

The opportunities available for generating higher returns out of water efficient irrigation technologies would greatly depend on the agronomical practices. In the case of pressurised irrigation technologies, since the energy overheads are more for small plots, the small and marginal farmers will have to make greater investments to do agronomical practices such as mulching, use of organic fertilizers including farm yard manure, proper spacing of plants, which in turn can help improve the water and land use productivity.

What does IWMI do in Banaskantha?

IWMI is currently promoting: [1] a wide variety of water saving technologies micro tube drip irrigation systems for horticultural crops, easy drips for row crops such as castor, cotton and fennel, and mini sprinklers and family drip irrigation systems for alfalfa; [2] scientific composting and organic farming practices; sub-surface irrigation systems for water intensive field crops, row crops and horticultural crops; and [3] very low water intensive cash crops such as *jojoba*, date palm and horticultural crops, which can go along with drip irrigation. The strategy is to focus on water productivity and economic gains rather than water saving.