CHAPTER 6.0: CASE STUDY-I

Andhra Pradesh Farmer Managed Groundwater Systems (APFAMGS) Project

APFAMGS project initiated in 2004 has successfully demonstrated that through involvement of community through improved knowledge, behavioural change can be brought about. Enlightened communities adopt voluntary self-regulation, leading to reduced groundwater pumping and improved water use efficiency. In seven drought-prone districts of Andhra Pradesh, thousands of farmers residing in 638 habitations spread over several hundred kilometres are voluntarily taking number of steps to reduce groundwater pumping, for tiding over problem of groundwater depletion. APFAMGS project is partnership with farmers for implementing Demand Side Groundwater Management (DSGM) concept.

The basic assumption around which APFAMGS is designed is that sustainable management of groundwater is feasible only if groundwater users understand the nature of its occurrence and the various parameters influencing the hydrologic cycle, which in turn will put them in a position to favourably alter the cycle at the individual farm/community level. In order to achieve this, the project has adopted an approach aimed at demystifying the science of groundwater by translating the scientific concepts of hydrogeology and groundwater management and making them accessible to groundwater users with or without literacy skills. The education is participatory and emphasizes non-formal modes of learning.

Recognizing the critical link between food production and groundwater use Andhra Pradesh Farmer Managed Groundwater Systems (APFAMGS) project worked on evolving an alternative model that encourage active involvement of local communities in data collection, capacity building and improved management of the available groundwater resources. APFAMGS project is

implemented by a network of Non Governmental Organization with the support of Food and Agriculture Organization (FAO) of the United Nations (UN).

APFAMGS project by its design partners with NGO's to mobilize the huge untapped potential of several thousand individual groundwater users to access knowledge and skills to collectively improve groundwater use efficiency and manage the crisis to the local groundwater system. The farmers collective through field level innovations are able to reduce groundwater use while at the same time generate increased wealth. APFAMGS is a Nationally Executed (NEX) project through a network of NGOs, under the close support and supervision of FAO India (FAOIN), New Delhi and technical backstopping of FAO Head Quarters (at Rome). Bharathi Integrated Rural Development Society (BIRDS) signed the contract with FAO and acts as the Nodal NGO for the project implementation.

APFAMGS project implementation spread over seven drought prone districts of Andhra Pradesh is underlain by hard rock aquifers. The project area selection is guided by technical criteria related to areas subjected to groundwater over-development as per the reports of Government of India4, Government of Andhra Pradesh along with due consideration of socio economic status. The project accomplishment is in 638 habitations falling under 63 Hydrological Units. All the groundwater issues in the project operational area are addressed under the institutional framework irrespective of economic status, caste, creed and religion. While the project does not offer any incentives for participation in the program or for taking tough decisions, the project partners with various government agencies for facilitating linkage with various government schemes.

To ensure sustainability and replicability of the project beyond the operational area, the focus is on building/strengthening local institutions. The institutionalization of the project helps in decentralization, encourages larger participation, increases local innovations and governance, reduces overheads and enables larger reach.

Capacity building is the focus, enabled largely through Farmer Water School (FWS), Farmer Field Schools (FFS) and training activities. Use of Non Formal Education (NFE) Tools in the capacity building activities enables demystification of science and easy understanding across the population. Project implementation is through partnership with stakeholders. Hydrological data collection by farmer volunteers across the project generates valuable data that has technical acceptability by researchers, government officials and planners. The scientific community is now acknowledging the scientific value for the farmer-collected data. The data is sold to number of research stations and funding agencies.

Participatory Hydrological Monitoring (PHM) and Crop Water Budgeting (CWB) are the two important processes that helps guide the farmers to change their groundwater management practices. Village level institution Groundwater Management Committee (GMC) and the Hydrologic Unit Network (HUN) level institution that is a federation of GMC's, help consider groundwater as a community resource and the need to look beyond the self-centered benefits. The project has organized 638 GMC's while 63 HUN's have been registered to take over data collection, analysis and management for ensuring sustainable groundwater management.

FAO-APFAMGS project continues to receive pro-active support at the project implementation level from various government agencies. The project has linkages with as many as 70 government programs at the field level which helps in the mobilization of funds to the tune of 147 million rupees (around 3 million US$) for supporting field infrastructure related to groundwater, land, soil, pest and crop management. At the program management and policy level, the project has close links with number of departments. Government of India (GOI), Ministry of Water Resources (MOWR) is up-dated periodically on the various activities and achievements at the project. MOWR has written to the various State Governments on the success of APFAMGS project with an

advice to replicate the methodology in the respective states for capacity building and empowerment of community with knowledge and skills to manage ground water distress.

Objectives of the Project

The major objectives of the APFAMGS project are:

APFAMGS project is an enabling intervention for reinforcing the internal strength and coping mechanism of farmers to explore and find out stable solution to the issues of ground water depletion and its adverse consequences. The project implementation follows series of steps to make the invisible groundwater fully visible in the form of knowledge by the farmers and thereby take appropriate actions. The various steps include:

- Strengthen local institutions at the habitation and hydrologic unit level to bring on centre stage discussions on emerging water crisis especially on groundwater
- Demystify the science of hydrology through FWS and train the farmers to take over all data collection leading to proper understanding of local water resource availability
- Change perception of groundwater from private property to that of a "common good" (individual farmers take decisions for collective good) Articulate and share information across hydrological units through CWB
- Workshops for evolving common strategies that limit damage to the groundwater system without sacrificing individual interest Establish new relationship between farmers and groundwater by reducing stress on the aquifer
- Adopt numerous steps at the farm level in improving crop water efficiency, implement water saving techniques and reduce chemical pollution

- Implement local groundwater governance transgressing beyond individual holdings and habitations, without being coercive Enable farmers voluntarily take painful decisions (reduce pumping, prevent construction of new wells, crop diversification, reduced application of chemical fertilizer/pesticides)

PROJECT OUTPUTS

6.1.1 Hydro-Meteorological Network

The project has for the first time established Hydrological Monitoring Network (HMN) operated and maintained by the community. The data collection network acquires data from several thousand stations and makes available real time data to community for planning judicious use of available groundwater. Participatory Hydrological Monitoring (PHM) by the community helps transform individual groundwater users to water resource literates. Based on the data collection and analysis the farmers have a fair understanding of the groundwater quantity that is available. APFAMGS project farmers make cropping decisions based on fair understanding of the available groundwater for the ensuing cropping season.

2026 observation wells (one well for every square kilometre) are established across the project as part of the network. Fortnightly water level monitoring is carried out by farmer volunteer's (both women and men farmers). 190 Rain-gauge stations (one for every 5 sq. km.) are part of the network established in the lands donated by the farmers. Groundwater discharge measurements are also incorporated in the network. Discharge measurements are carried out in 700 monitoring observation wells using the calibrated drum method. The time taken to fill a known capacity of drum is measured using a stop clock. Along with the discharge, the farmers also measure the drawdown.

Farmer Data Collection

Hydro-metrological network is fully operated by farmer volunteers who undergo training (4 modules) to qualify and only successful candidates are

eligible to become a PHM volunteer. The project provides measuring tools like electrical water level indicator, stopwatch, measuring drums (which are shared by number of volunteers).

Farmer collected data includes: daily rainfall, fortnightly water levels, fortnightly bore-well discharge and daily stream-flows. Based on the established data of a particular station, the data is collected by the farmer volunteers. Seasonal groundwater quality measurements are carried out from public drinking water wells. Volunteers maintain a logbook of Hydrological Monitoring Records (HMR). The HMR data is also exhibited for public viewing on display boards maintained at strategic locations in the Habitation.

Technical data collected by the community provide information on available groundwater balance in the HU prior to the cropping season that helps guide decision making on crop plans. Such an approach has helped farmers reduce the risks especially with high input crops, reduce losses, limit groundwater extraction to safe limits, improve water use efficiency while generating more wealth.

Community Institutions

Institutional Intervention is integrated with technical component for managing groundwater depletion. A multi layer inclusive institution that is vertically integrated has been thought of in the project. Groundwater Monitoring Committee (GMC) has been conceived to be a village level institution of the farmers-men and women. Several GMCs within a given HU are grouped together to form a Hydrological Unit Network (HUN). The GMC, HUN are the critical instruments for providing the "demonstration effect" of the learning's from the project to the larger community of farmers beyond the project area. The institutions have equal membership of men and women. These institutions have provided good opportunities for women to come forward and lead in specific areas, while in many situations enabled men and women to come together and take actions leading to good impact. Literacy has never been a

criterion that determines participation, particularly since the project emphasizes Non Formal Education (NFE) methods for every aspect of implementation.

Over the years, all the HUNs have been provided with legal cover, which provides them the status to receive funds as well as carry out business activities. Most of the people's institutions continue to perform their roles with distinction and have achieved varied levels of maturity, prompting the local NGO's to hand over major responsibilities to the people's Institutions to run the program of curbing overuse of groundwater.

APFAMGS adopts the FWS approach to prepare the farmers to take charge of managing their ground water. FWS is an adaptation from FFS and follows the non-formal and participative approach for information sharing. FWS strategy adopted by APFAMGS project promotes group learning, improves the skills and capacities of farmers and shares knowledge amongst the farmers. The FWS creates a knowledge cycle (or knowledge value chain) in the community of farmers along with the supporting institution for helping the farmers to apply it to their life situation. Much of the knowledge shared in FWS is the accumulated experience of farmers and is second-hand which has been made explicit, in the sense in public domain rather than residing in mind or as experience. Under the FWS umbrella, all farmers meet once every 15 days through 300 water schools to learn about sustainable management of groundwater at the local level. Based on the understanding the farmers adopt suitable modification in their agricultural practices that can lead to significant reductions in groundwater use and improved crop water efficiency.

The over arching theme of the project is to help community collect all relevant data to assess the ground water balance, to help guide in crop planning. CWB workshop provides a platform for farmers to collectively estimate the water balance at the Hydrological Unit Level. Based on the estimation farmers project the most appropriate crop plans and thereby control groundwater over-exploitation. While CWB helps project the safe limits of groundwater

development the project does not advise on the choice of crops. The project respects the farmer's traditional knowledge and understands that the farmer has enough knowledge to be able to take relevant decisions.

Outcome of the project

The project has succeeded in beginning to build a link between water availability and water use for agriculture. The core message of the project, that groundwater abstraction over the long term needs to be aligned with water availability, is taking hold. This is suggested by the emerging positive correlation between water availability and water use in a number of HU's. In the years when water availability is low at the beginning of the Rabi season (either due to low rainfall and consequently low recharge, or due to high groundwater abstractions in the kharif season decreasing availability for the Rabi season), groundwater use is reduced in these aquifers. This dynamic is counter to the normal behaviour whereby water availability in the aquifers is not a factor influencing groundwater use, and aquifer depletion often worsens in drier years. This path-breaking achievement is beginning to emerge in a number of HU under the project, and is likely to result from the impact of groundwater availability information on farmer decision making, as agriculture accounts for the largest fraction of groundwater withdrawals.

The reductions in water use in these areas are achieved by a combination of crop diversification and water-saving irrigation methods. Across the project area under high-water-use crops (crops with more than 800 millimetres water requirement), is reported. In contrast, the total area under rabbi paddy in Andhra Pradesh continued to follow an upward trend, increasing by 5% around the same period.

It is important to note that farmers have not sacrificed profitability to reduce water use. Independent evaluation of the APFAMGS project by World Bank and revealed that project area farmers have consistently improved their

profitability, with the net value of outputs nearly doubling during the project period, with lower and more inconsistent results in similar non-project areas.

APFAMGS project while prioritizing on Demand Side Management has also successfully demonstrated a systematic methodology on supply side augmentation through Artificial Groundwater Recharge (AGR) structures essentially for favourably altering the groundwater balance. AGR is seen as an appropriate intervention in HU subjected to over exploitation. The strategy is to trap the flash floods in the abandoned open wells/bore wells or behind a small percolation pond/check-dam for recharging the aquifers. This approach has another major goal of unlocking the non-productive investments caught up in failed open wells. The methodology adopted looks at altering the groundwater recharge at the HUN level from the existing level to significantly higher levels. The aquifers are used to store peak flows generated during storms for reducing the disparity between existing demand and potential recharge.

AGR have been successfully demonstrated across the project area through a mix of structures such as open well recharge, tank induced recharge, artificial injection of runoff generated from peak storms at favourable locations. APFAMGS approach to improved recharge is recognized as the appropriate model for replication for a national level program on "Artificial Groundwater Recharge Using Open Dug wells".

Conclusions

The lessons emerging from the APFAMGS experience of knowledge based community management of groundwater lead to some key conclusions and recommendations.

Farmer's interests in groundwater management are linked to managing the production and livelihood risk. Farmers may have little interest in water conservation for its own sake. A focus on groundwater management alone is not sufficient. A package of measures to reduce the agricultural production risks have to be offered, linking groundwater use to sustainable crop production and the mitigation of pollution. Arguably, the project achieved water use reductions precisely because it avoided explicit negotiation of groundwater allocation.

The active projection of well researched hydrological, agronomic and environmental information into groundwater user communities can leverage autonomous shifts in agronomic practice and land use planning that reduce environmental pressures and raise productivity. Cost reduction on external input costs is achieved through a variety of methods such as: reducing the irrigation water demand, changing cropping patterns, irrigation techniques, and soil moisture conservation. This not only lead to improved water productivity but also resulted in good returns on the farm product. Thus, it is clear that sustainable groundwater management need not come at the price of sacrificing gain in agricultural incomes.

Making visible the otherwise invisible resource of groundwater is a prerequisite for building up a collective action. Demystifying relevant sections of science, using non-formal techniques, have effectively created a popular science movement encompassing multiple dimensions of water use and agriculture. The focus on farmer engagement in generating and sharing knowledge on local resources is the key to instil a sense of pride and possessiveness of the

scientific knowledge, which earlier was restricted to the realm of research institutes. This is in stark contrast with most of other natural resource management initiatives, wherein a majority of resources and efforts are concentrated on supporting physical work and on incentives such as subsidies for water-saving irrigation techniques. For community management efforts to succeed, it is clear that information, education, and social mobilization need to be recognized as core objectives.

The bottom-up approaches stemming from on-the-ground community action can be complemented by top-down measures that can create an enabling environment at the local level. Examples of possible policy measures that are pragmatic and can strengthen community groundwater management include endorsement of community groundwater management institutions, and improving institutional coordination amongst the various panchayati raj institutions dealing with different aspects of water resources at the village level.

The successful experiences of community-based groundwater management owe much to their design being particularly suited to the physical settings of groundwater use i.e., recharge and emptying dynamics of hard-rock aquifers, which cover approximately two-thirds of India's aquifer settings. While APFAMGS could provide a model for other hard-rock settings, it is not likely to work in geographically vast alluvial aquifers with significantly larger storage.

The success is also because of the socio-economic set-up Andhra Pradesh, which boasts of committed social networks at the grass-roots and a strong history of progressive social change in rural areas. It is probable that the APFAMGS model would be significantly challenged in settings with different social dynamics (for example, lower social capital or larger asymmetries in user populations).

Finally, it needs to be noted that the lessons emerging from the Andhra Pradesh experiments with community-based groundwater management are preliminary, and there is no hindsight to assess the long-term sustainability of the results achieved. Therefore, the available models of community groundwater management would need careful and innovative piloting before they can be replicated and scale interventions become possible.

Recommendations

The APFAMGS model is ready for replication. With an ever-increasing number of aquifers facing overexploitation, various government agencies see the need for exploring new approaches in managing groundwater decline. Absences of credible successful models on groundwater management have forced the agencies to look for successful approaches. APFAMGS project has demonstrated the success of community management of Groundwater. Central, State Government Agencies and International Donors have been a witness to the success. Empowerment of communities through knowledge, capacity and skills is seen as a necessity. Number of initiatives is in advanced stages of discussions for replicating the model in different hydro-geological and socio-economic settings and needs to be adopted.

State agencies need to have a much sharper appreciation of how to nurture and sustain people's institutions for managing water resources. Under the Indian Constitution, States have the primary responsibility for managing and ensuring the sustainability of groundwater resources. In addition to their constitutional mandate, state agencies have an advantage in promoting groundwater management on the ground. They are in a better position to facilitate cross-sectoral coordination of groundwater resources at the most critical (state) level, promote government–stakeholder interaction (especially considering that most state government departments have operational offices at district level, where many of the local management measures will need to be taken), design

groundwater management approaches specific to the typologies and user needs of local aquifers.

An alternative model for groundwater legislation needs to be rolled out: The existing instruments for controlling abstraction of groundwater through direct regulation have not halted the proliferation of boreholes. The lack of resources for policing and absence of substantial support for penalizing the defaulters have made a direct regulatory approach impossible to implement. The APFAMGS experience suggests that there is a viable option for voluntary regulation by the stake holders themselves. This needs to be driven through improved understanding of their aquifer systems and demonstrations of the positive impacts of improved natural resource management on livelihoods.

Policies to support community-based groundwater management will be essential. State governments can take policy action to facilitate formation of local groundwater user institutions and to ensure institutional coordination amongst different water- and groundwater-related departments at the level of individual aquifers.

Specific models that are recommended for ready replication are:

1) Hydrological Unit (HU) as unit of intervention and building community based institutions is replicable in dry land areas, supported by groundwater irrigation. Even in case of large alluvial aquifers, the unit of intervention can be delineated through mapping of aquifer system and defining the boundaries of the aquifer, thereby building the community based institutions at aquifer level.

2) Participatory Hydrological Monitoring in case of APFAMGS was limited only to those scientific and socio-economic parameters that control the usage of groundwater resource. Notwithstanding with this limitation, one can redesign the set of parameters to suite to their requirement. The bottom line is empowering communities with skills and knowledge to collect, collate,

understand implications of their present actions and triggering discussions on possible options before taking action at the farm level.

3) Crop Water Budgeting (CWB) at the beginning of Rabi season is crucial in case of groundwater farmers as it is observed that the pumping reaches its peak due to little or no rainfall during that cropping season. However, with necessary changes in the methodology, the concept of CWB is replicable even in command areas.

4) Farmer Water Schools proved to be a powerful tool due to its approach of experiential learning cycle. This tool is useful for educating and empowering communities with the knowledge and skills, on any topic.

5) Rural Folk Art played a major role in generating awareness among the community at large, on key concepts of groundwater management. This form of communication is the most powerful and efficient, apart from being near to hearts of the people. Thus, usage of rural folk are is recommended for any kind of developmental activity not only to ensure transparency but also to enlist wilful participation of communities in the intended program.