Rejuvenation of Rivulets: Farm Pond Based Watershed Development

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Abstract: After the realization of fact that only watershed based development approach can solve the problems of rural economy, large-scale watershed development projects are being implemented in India. However, in most of the areas conventional practices of soil and water conservation have been followed. While certain innovative approaches are being evolved, which have very high potential to replicate in arid and semi-arid regions of the country. Paper presents an innovative approach of watershed development using farm-pond network. Paper is based on a successful project in a watershed of 1,004 ha in Adihhali-Myllanhalli village area of Hassan district in Karnataka, India.

After the implementation of farm-pond based watershed development project during 1996 to 2000, whole ecosystem and socio-economic scenario has been changed in the area. Availability of water for drinking and agriculture, establishment of orchards and agroforestry in farmlands, increase in overall agricultural production and creation of local self-employment are some visible impacts. This watershed approach has been already adopted by at least 10-12 other organizations in Karnataka, India and is being replicated in their respective programme areas.

Keywords: watershed development, farm pond network, surface and sub-surface flow dynamics, ecosystem and socio-economic status

1 Introduction

After the realization of fact that only watershed based development approach can solve the problems of rural economy, watershed development projects are being implemented on a large-scale in India. In most of the projects conventional practices of soil and water conservation are followed. While certain innovative approaches are being evolved, which have very high potential to replicate in arid and semi-arid regions of the country. One such successful innovative approach of watershed development using farm-pond network has been evolved in Adihhali-Myllanhalli village area of Hassan district in Karnataka, India.

Adihalli-Myllanhalli village area is a drought prone, rainfed agriculture area and is socio-economically backward. The project has been implemented since 1996, by BAIF Development Research Foundation and Village Watershed Committees (VWC) with the financial support from India Canada Environment Facility (ICEF). The total area of watershed is 1,004 ha, covering 400 households. Farm pond based soil and water conservation measures were conceived mainly to address three basic issues in a decentralized manner. First, satisfying the water demand of individual farmers located in different reaches of the watershed; second, recharging the ground water for overall improvement in water availability within the watershed; and third, *in-situ* conservation of soil.

2 Farm pond network

The area has been treated with trench cum bund, which channelizes water (with non-scouring velocity) to the farm pond located at the corner of the farmland. The dimensions of ponds vary from 20’×20’×10’ to 30’×30’×10’. Each pond has an inlet chamber to trap the silt and outlet for allowing excess water to flow out, which then joins the next pond in the chain. Stone pitching is provided at inlet and outlet channels to protect them from scouring. The excess water from the first pond goes to the second and from the second to the subsequent one in the chain. In this manner, the entire runoff water is

harvested in the area itself through the web of ponds. About 350 ponds have been constructed on a treatable area of 700 ha in 1,004 ha watershed. Fig. 1 shows farm pond network in Adihalli-Myllanhalli watershed and Fig. 2 shows a plan and section of pond. The streams receive water mostly through seepage. Other conventional measures such as contour trenching in wastelands, gully plugging and checkdams in the rivulets have been also done. Initial reluctance of people was turned into full participation of both men and women, in project planning and implementation, after seeing the effects in second year.

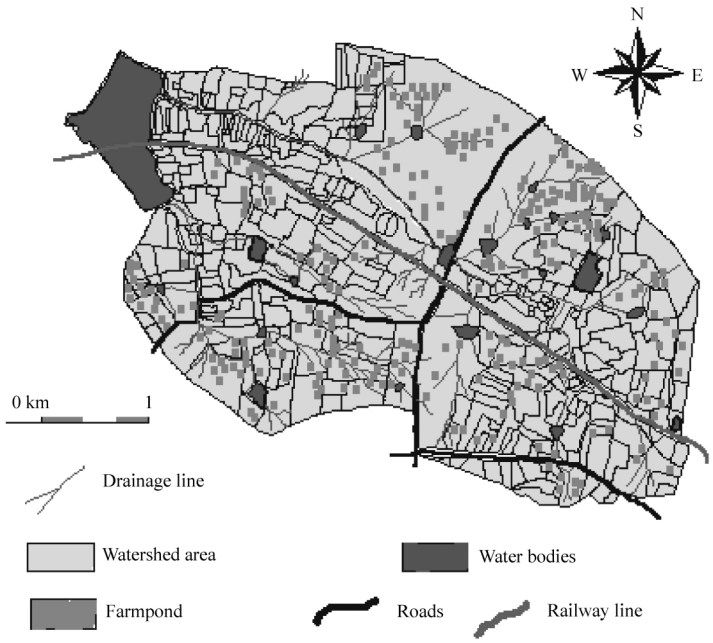

Fig. 1 Farm pond network in Adihalli-Myllanhalli watershed

Cropping is rainfed, with most of the area bearing signs of cultivation and regular tillage. Coconut plantations occupy these portions adjoining the main drainage channel. About 20%—25 % area is under coconut plantation. On the upper reaches including common and private land, about 2%—5% area is barren or with little pasture.

After the project implementation on 1,004 ha area, the land use has been changed during last 5 years. Project has developed horticulture of mango, cashew and coconut on 349 ha while plantation along the bunds has been developed on 414 ha area. About 10 ha area is covered with afforestation and silvipasture.

Pre and post watershed development discharge is calculated based on the above parameters. Rainfall Intensity for 10 years recurrence interval referred from the Isohytal Map of India is 60 mm/hr.

3 Pre and post watershed development discharge

Peak runoff from recharge zone of the watershed calculated using the rational formula is about 30% of rainfall (Kakade, 1997), which comes to 5 cumec from a micro-catchment of 100 ha. Due to change in vegetation cover, trenches and farm ponds, there is 90 % reduction of runoff at the peak intensity of rainfall (60mm/hr) with recurrence interval of 10 years. This indicates that if the intensity of rainfall is less than 54 mm/hr, runoff is practically zero. Rainfall data for last ten years shows that on an average only two times in a year the rainfall intensity crosses 54mm/hr (IMD, 2001).

The rate of loss of water from the ponds (infiltration plus evaporation) is 8.3 mm/hr (BAIF Report, 2001). Hence in absence of rains, ponds in recharge areas dry up within 15 days. In other words, water is available for protective irrigation for 15 days during dry spells.

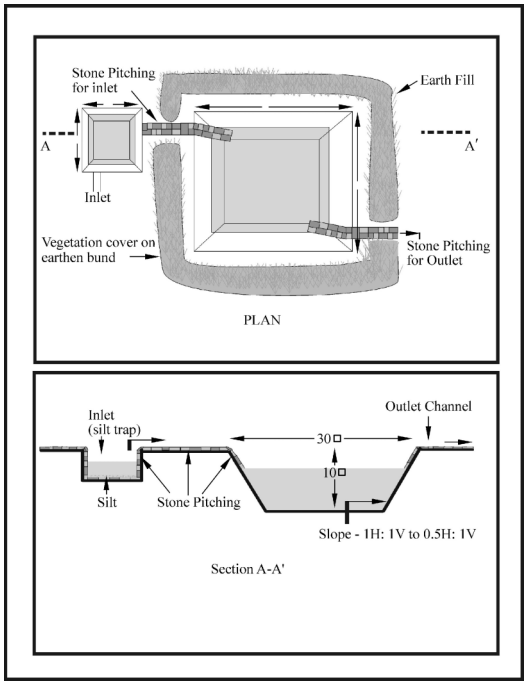

Fig. 2 Plan and section of a farm pond

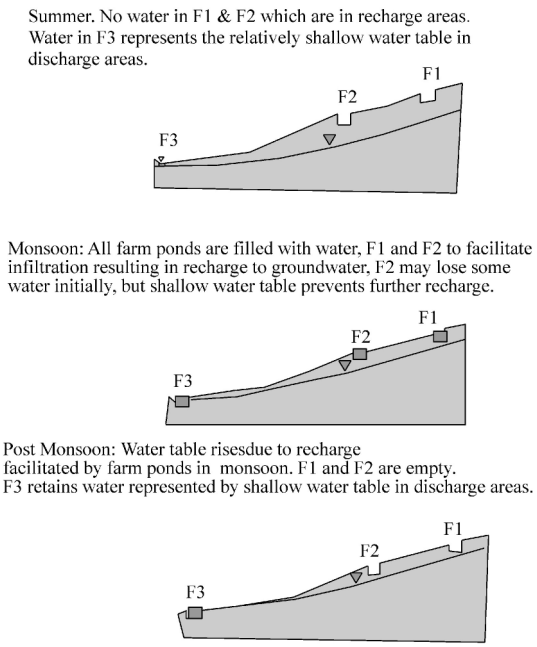

Fig. 3 Conceptual model of farm ponds in recharge and discharge areas

4 Sub-surface flow dynamics

The farm pond section in the Adihalli-Mylanhalli watershed is excavated through the regolith (soil + upper part - highly weathered material underlying the topsoil) and the upper portion of the bedrock. Once the zone of saturation is filled up to its maximum capacity, the water flows along the gradient. In the area, as the upper rock portion is jointed and has intrusions of veins, ground water flows without much hindrances. The water finds its way along the flow gradient through pores, joints and foliations present in the host rock.

The ground water system here consists of two aquifer types: the shallow aquifer and the deep aquifer. All the dug wells tap the shallow aquifer and the bore wells for irrigation tap the deeper aquifer. This aquifer has good capacity of storing water and supplying it to the wells. Ground water recharged from the recharge zone moves into the shallow and deep aquifers.

Part of the water emerges out in the streams, which have now become perennially flowing. About one-third of the ponds are in the discharge zone of the watershed. In these ponds (about 100), water remains throughout the year. Fig. 3 shows the conceptual model of farm ponds in recharge and discharge areas.

5 Results

The approach has shown immense replicability value. Outcomes of the project both on ecosystem (land, water, livestock and vegetation) and community are given below: (Kakade, *et.al.,* 2001).

5.1 Impact on ecosystem

Water

Surface water availability has gone upto 72.22 ha • m, which was just 8.57 ha • m before the project. Ground water table has gone up by 3.79 m. All the wells have sufficient yields throughout the year. Moreover, the withdrawal of water has been increased as is being observed from the increased area under

irrigation to 173.4 ha from earlier 44.4 ha. Two ephemeral streams now flow throughout the year. Fig. 4 shows Ground water table and annual rainfall over the years 1997 to 2000.

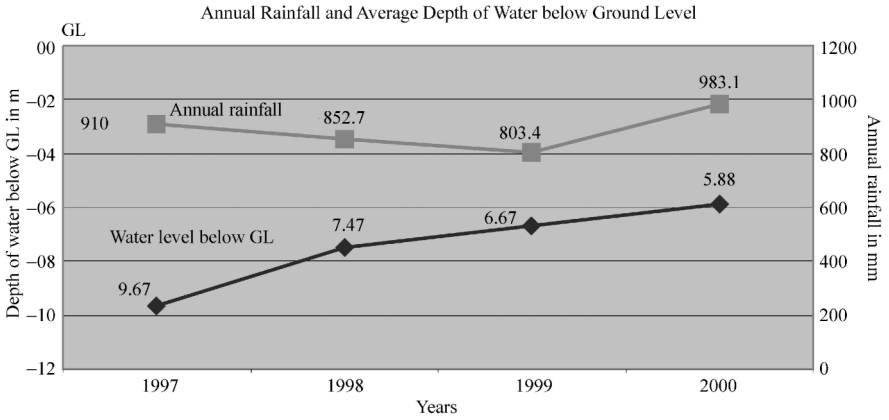

Fig. 4 Ground water table and annual rainfall over the years 1997 to 2000

Drinking water problem (which was common problem in watershed villages in summer) has been completely solved. Clean and hygienic environment is maintained around water sources and in the village.

Land

About 10% increase in single crop area to two-crop area. Area under three crops or perennial crops has increased from 140 ha to 349 ha (about 2.5 times more). Increase in yield of Kharif crop is 27.2 quintals/ha as compared to 18.59 quintals/ha at the baseline. The Rabi crop yield is now 99.4 quintals/ha whereas at the baseline it was 60.32 quintals/ha. Fig. 5 shows the change in irrigation area in Adihalli Myllanhalli watershed.

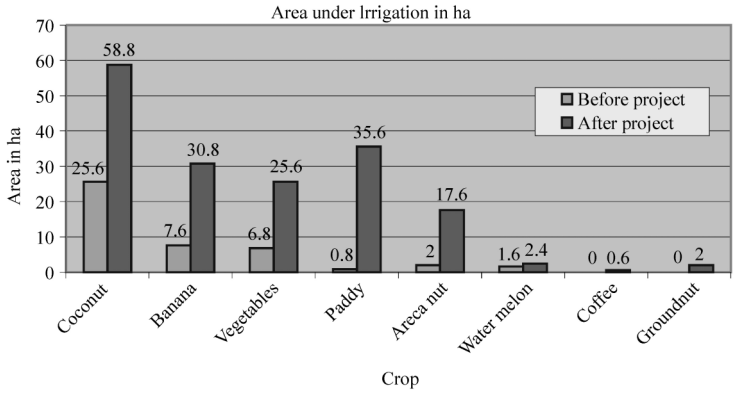

Fig. 5 Change in irrigation area in Adihalli Myllanhalli watershed

Livestock

Year-round availability of water and fodder has motivated farmers to opt for improved breeds of cattle. Artificial insemination programme was initiated in the project through which 129 cows are pregnant and 64 crossbred calves have born (June 2001). Milk yield has increased by about 20%. The tradition of leaving the cattle in open for grazing has stopped and stall-feeding is practiced everywhere.

Vegetation

About 50% of the watershed is green cover mainly with horticulture on 349ha and agroforestry on 118 ha. About 20 new major species of plants have been established in the area. The coconut plantation in the region has increased by about 75%—80%.

5.2 Impact on socio-economic status

Health

The staple food of people is both from ragi and paddy. Increased agricultural production has ensured the food security of watershed population. The families having self sufficiency in vegetable has gone up from 13 % to 58%.

Wealth

The increase in agricultural production has increased the income of the families. The income has increased in the range of 1.5—4 times. The percentage of families owning irrigation pump sets has increased from 11.7 % to 39.6%. The household assets have also increased in the area from 20% to 61.75%.

Equity and community

Like most of the rural areas, women's participation at community level was not common before the project. After formation of Self Help Groups to involve the women in various watershed activities, about 82% of women are involved in various public institutions. The women have formed a Stree Shakti Kendra, a small enterprise engaged in processing and marketing of value added agricultural products. The average time required for fetching water by the women folk has reduced to 25 minutes as against the earlier 72 minutes.

Due to decentralized availability of water, farmers located in upper reaches of the watershed also have access to the surface water as well as ground water.

Knowledge

About 800 persons have developed skills in soil and water conservation measures, energy recycling and conservation, nursery raising and small enterprise management.

Most of the children are now enrolled in schools. The drop out rate from primary schools has gone down to 11%.

People are empowered to manage and maintain the resources

6 Project costs and benefits

This project objective is holistic development of the people through watershed approach. Hence the project includes several activities other than soil and water conservation measures. The cost of combination of soil and water conservation measures (farm ponds, gully checks, all check dams, repairs of old structures) comes to *Rs*. 4,950 per ha. If all the activities are considered for holistic development, the cost per ha comes to about *Rs*. 7,500. In addition, there are expenses on capacity building of community, staff inputs and project management. In the watershed area of 1,004 ha, total investment excluding management costs is about *Rs*. 7,500,000.

The addition annual income over and above the pre-project income from the agriculture, micro-enterprises and wages within village is *Rs*. 6,033,300/- (average of 4th and 5th year). The orchards of mango, cashew, tamarind, etc. have also started producing the fruits and are expected to give net annual revenue of Rs. 2,612,500/- 10th year onwards.

7 Suitability of approach

The farm pond network has emerged as the most appropriate technology for watershed development in rainfed areas. This innovative model offers better option in India for watershed development in various regions. Topography, geology and geomorphology at regional scale suggests that the farm pond based recharge mechanism can work well in South, Central and Western India except the Western Ghats, Eastern Ghats and Central Indian mountain ranges. Leaving aside the Himalayan tracts, the approach will also be feasible in the Northern and Northeastern areas. Nevertheless, based on the surface and subsurface

characteristics, suitability can be assessed at micro watershed level. Potential negative impacts such as landslides and water logging should also be considered while assessing the technical feasibility.

There is tremendous potential for this innovative approach. Hence detailed water balance analysis is necessary for thorough understanding of the effects of the development on watershed.

Acknowledgements

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