

EVALUATION OF WATERSHED DEVELOPMENT PROGRAMMES IN INDIA

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Abstract

A survey was conducted at 37 watershed locations under different agro-eco regions in India during 2001. Data were collected from primary stakeholders pertaining to physical (ground water, soil erosion, runoff reduction, etc.), biological (afforestation, cropping intensity, productivity levels of dryland crops) and socio-economic parameters (additional benefit-cost ratio, additional annuity value, etc. and additional employment and reduction in out-migration of labour, participation of farmers in watershed programmes) in watershed programme areas compared to non-watershed areas. The analysis indicated that there was an increase in all factors in watershed area villages compared to non-watershed area villages. However, there is no significant difference among the project implementing agencies viz., National Watershed Development Programme for Rainfed Agriculture (Ministry of Agriculture), Ministry of Rural Development, with regard to reduction in soil erosion, etc. It is also recommended that Non-Governmental Organizations may be encouraged to take up watershed programme works on their own funds only. Government of India, Indian Council of Agricultural Research and Non-Governmental Organizations have succeeded in achieving the results in watershed development programme. Logit regression equations were fitted to different factors in relation to additional income per hectare, but distance to market was found to be significant but other factors were not significant. Finally it is recommended that water harvesting structures may be constructed at suitable places and it is essential to establish vegetation for optimal success of the programme.

Additional Keywords: tank cascades, soil and water conservation interventions, water resources, canopy, capacity building, socio-economic status

Introduction

The concept of watershed management is as old as the concept of crops grown under irrigated conditions and this concept led to development of tanks/reservoirs for increasing the production to meet the demand of ever growing population – since ages. Different rulers in different regions realized and executed works based on the availability of funds, needs of the people, available natural resources in the area, etc., to meet population demands and requirement of food needs. The beneficiaries were taxed and revenue was collected from them. Sir Arthur Cotton submitted two reports during 1844 and 1845 to the then British Government after surveying entire area from Papi hills to Sagaram in Godavari river area and this made the construction of a storage type barrage at Dhawaleswaram in Godavari district for utilizing river water for agricultural development in the area and planned for utilization of run-off water to construct dams to Kalirune river water in Tanjavur district of Tamil Nadu and to Tungabhadra river water near Bellary in addition to planning Kurnool-Cuddapah (K.C.) Canal with a distance of 306 km for effective utilization of run-off water for improving productivity/production of agricultural crops through better utilization of natural resources. The need to maintain better environment and preserve natural resources like soil, water and vegetation was realized by early rulers and managed through different kinds of village institutions (eg. village level officials, Gram Panchayat, village rulers/administrators) in different regions. Punishments were awarded if attempts were made to damage natural resources.

After India achieved Independence, the importance to executive authorities at village level has gradually declined in India due to changes in policies in the democratic setup and liberalization of spirit of freedom. This led to more damage to vegetation in rural areas leading to deterioration in environment through soil degradation. Hence, Government of India and different provincial Governments took up amelioration measures such as, afforestation measures, soil conservation measures, run-off water utilization programmes, etc. However, expected results did not forth come on constant and continuous basis. Therefore, Government of India launched watershed development programmes (WDPs) in 1983-84 in a big way to conserve and utilize natural resources for enhanced and productivity and higher socio-economic status. Up-scaling of watershed development programme was carried out by spending about Rs. 100,000 millions per annum since then till now. Though, it has been carried out since 1983-84, the impact of watershed programme is to be evaluated for evolving better strategies/policies to preserve, conserve and utilize natural resources for betterment of ever growing population.

Model Watersheds

Indian Council of Agricultural Research (ICAR), New Delhi, adopted 47 watersheds by providing expertise and technical guidance through Central Research Institute for Dryland Agriculture, Hyderabad and Central Soil & Water Conservation Research & Training Institute, Dehradun during 1983-84 to 1989-90. These watersheds were selected under different agro-eco regions in India to study variability, impacts on productivity of crops, employment, stakeholders' income, alternative prices/enterprises, etc., in addition to improving micro-climatic conditions. Bench Mark surveys were carried out before initiation at each watershed location and then concurrent / post evaluation studies were also made by these organizations. The results obtained at these locations encouraged the policy makers to invest on WDPs since then. The watersheds managed by Institutions yielded high, favourable and encouraging results, as these were managed on scientific lines under the direct expertise and supervision of Scientists. Hence, a project was initiated to evaluate watersheds with particular reference to biophysical and socio-economic aspects under different rainfed agro-eco regions in India.

Selected Watersheds

A total of forty-one watersheds under different rainfed agro-eco regions were selected for the study and the authors visited these watersheds to conduct surveys during 2001-2002 managed by different implementing agencies viz. National Watershed Development Programme for Rainfed Areas (NWDPA), Ministry of Rural Development (MoRD), ICAR Institutions, International Agency (IA) funded watersheds and Non-Governmental Organization managed watersheds. The data on various aspects like, run-off, soil erosion, groundwater recharge, vegetation, productivity of crops, employment generation and income generation, improvement in standard of living including education and health, etc., were collected, compiled from the watershed areas and analyzed.

Norms For Evaluation of WDPs

Standard survey techniques were employed on the basis of 'Before' and 'After' / 'Now' in case of bio-physical factors and 'with' and 'without' procedure through group discussion with farmers and project implementing agencies (PIAs) at each location. In case of socio-economic factors, 'with' (watershed villages) and 'without' (non-watershed villages) procedure was followed. Authors surveyed 37 watersheds in semi-arid regions of India and collated socio-economic data from the watershed officials and primary stakeholders. Some of the observations made during visits/discussions are presented in the paper.

Integrated Watershed Development Programme

It constitutes (i) soil and water conservation interventions (ii) vegetation development including crops, plantations, orchards, agro-forestry systems and (iii) alternative livelihood supported enterprises like, dairy, goatry, poultry, duckry, sheep rearing and fisheries. Technologies adopted in these aspects are many, varied and complex and therefore it is for the farmers to choose relevant technologies based on different options. Nevertheless, desired adoption levels of technologies, socio-economic improvement in people, maintenance of agro forestry/forestry systems/vegetation and soil conservation structures at farmer level were satisfactory but committed leadership and pro-watershed policies are the need of the hour.

Impact of Watershed Programmes During Execution Phase

There was increased employment to rural people due to implementation of soil & water conservation interventions and this improved their income in watershed villages and reduced out-migration of labour from these villages. Soil and water conservation structures in arable and non-arable lands reduced runoff and soil loss and increased rainwater infiltration, groundwater table, surface storage leading to increased cropping intensity, productivity of crops, etc. Saplings of different forest tree species, horticultural plants and grasses were popularized through planting/saving in Government lands, arable lands. In some of the watersheds dairy, sheep rearing, goatry, poultry, duckry, fishery, etc. were also popularized to raise the income levels and thereby standard of living of rural people. As long as works were carried out based on funding by Government and subsidies provided for supporting income-generating enterprises, the impact was positive. Ten years after withdrawal from WDPs, the difference in maintenance of natural resources and crop production technologies in watershed villages and non-watershed villages was observed to be not significant. There were no institutions to maintain the watershed infrastructure also.

After 1994-95, there was a proposal from the Government that people should contribute 5-10% or so towards soil and water conservation works/orchards. Farmers contributed in some of the watersheds based on the direct benefits derived from such activities. Otherwise only book adjustments were made to complete works. Though, Watershed

Committees/Associations, User Groups (UGs), Self Help Groups (SHGs), etc., were formed, for handing over the development activities for maintenance, the position is more or less same as in case of prior 1994 or so.

Soil And Water Conservation Interventions

Soil and water conservation works comprised of bunding (mechanical and mechanical-cum-vegetative barriers and terracing, gully plugging, *in situ* moisture conservation practices (eg. deep ploughing, dead furrow, levelling and smoothening) and these are maintained based on the need, convenience, time availability, etc. Water harvesting components include water ways, diversion channels, farm ponds, sunken ponds, percolation tanks/wells, check dams, Nala bunds, etc. These structures are not maintained by the farmers due to lack of direct benefits. These structures were constructed largely in community / revenue / Government lands. Ground water recharge becomes common property resource and hence this component was given due emphasis in Watershed Development Programmes. Earthen dams and cement check dams/nala bunds helped in groundwater recharge in several watersheds. Nevertheless, water-harvesting structures increased surface and groundwater resources substantially in watershed villages and these works provided direct employment to people in the area particularly during drought periods. These structures also improved drinking water facility.

Bunding and terracing in agricultural lands was accepted by farmers in addition to strengthening existing bunds without any obstruction in their plot/fragment/land in dryland farming areas but they did not maintain subsequently due to no impact on productivity of crops. *In situ* moisture conservation measures increased yields manifold but did not compensate additional funds invested.

Vegetation

PIAs of WDPs took up afforestation measures in non-arable lands and also on bunds in arable lands in addition to development of horticulture through supply of saplings (*mango, guava, aonla, ber, pomegranate, etc.*) to farmers. However, species planted on bunds in arable areas were subjected to maximum damage by animals etc., during lean season. Farmers further reported that tree density was high but for illicit cutting and exploitation leading to social conflicts. Thus, vegetation on community lands was harvested in most of the watershed villages.

Other Activities

Activities such as dairy, goatry, sheep rearing, duckry, poultry, etc., were carried out on limited scale in a few watershed villages where there was a market for such activities. Thus, market-oriented activities required the attention of the farmers to improve their income generation.

Watershed Programmes – Selection of Institutions

Watershed Development Programme was implemented by different organizations. The authors however, selected five different institutions viz., National Watershed Development Project for Rainfed Areas (NWDPPRA); Ministry of Rural Development (MoRD); Indian Council of Agricultural Research (ICAR); Non-Government Organization (NGO); and, IA funded projects.

NWDPPRA: Sixteen watersheds were selected under this category in different rainfed agro-eco regions. In addition, soil and water conservation, vegetation development, etc., agriculture development were the parameters for evaluation of watersheds that affect improving the crop yields. The results were found to be encouraging during execution of phase of the programme. However, water harvesting structures / check dams that require a community effort to maintain were not maintained by the farmers/Institutions during post withdrawal period of programme. Ten years after withdrawal of WDPs, the difference between watershed and non-watershed villages is not significant. It may be because the farmers in India have been exposed to agriculture information media, and therefore the non-watershed farmers adopted watershed interventions through collateral learning. All villages have been covered under one programme or the other. Farmers are shifting fast to income-generating crops / activities based on the prevailing market and prices.

MoRD: Watershed Programmes were implemented in wastelands and emphasis was given to diversion drains, water harvesting structures, etc. for groundwater recharge as village level conflicts for land were minimal / non-existent. Sunken ponds / farm ponds were constructed in Chittoor district and these were fast filled with sediment. Stones / boulders were shifted from one watershed to another watershed for executing the works in Chittoor district. Silting took place in water harvesting structures due to lack of proper vegetative cover / maintenance and improper planning. Funds were not released to Department of Soil & Water Conservation in Punjab for the past five years due to diversion of funds.

ICAR: WDPs were implemented in 47 model watersheds during 1983-84 and later monitored till 1989-90. Identification and implementation of watershed interventions, their supervision, monitoring on different aspects were carried out in addition to transferring research results from experimental stations in implementation of interventions. All parameters were recorded systematically on scientific lines during those years. Again maintenance during post withdrawal period remained poor. Water harvesting structures have become dysfunctional (Bijapur, Karnataka). Horticulture (custard apple) and forest area (Eucalyptus and other tree species) were damaged in addition to breach of check dams (Mittemari watershed villages in Karnataka). This is attributed to lack of community mobilization efforts. However, water harvesting through different structures (Tejapura in U.P; Sukhomajri, Bunga, Nada, Rel Majra projects in Punjab) were responsible for bringing most area under irrigation in addition to reducing land damage due to high erosion losses of the order of 800-1000 t ha⁻¹. It is observed that stakeholders would develop confidence if water is made available for irrigating crops and resources are managed by themselves. These are not comparable with watersheds managed in rainfed agro-eco regions.

IA FUNDED WATERSHEDS: Indo-UK Project at Indore (M.P.), Maheswaram watershed in R.R. district in A.P. financed by World Bank, DANIDA financed watershed at Mandapam in Tamil Nadu were evaluated. Vegetative barriers using *khus-khus* grass, contour bunding on Government lands, graded bunding/with vegetative barriers, vegetation and most of the water harvesting structures disappeared in Maheswaram watershed. Similarly the Indo-UK project at Indore, some of the Gabion structures do exist even after 20 years after construction. Drainage lines were not well maintained. Water harvesting structures silted up due to lack of maintenance. At present, there is not much significant difference between watershed villages and non-watershed villages. This is due to lack of interest among the people to maintain for no sign of gains.

NGOs: Several NGOs were supported by Government of India to implement watershed development programmes. Watersheds managed by BAIF at Tiptur in Karnataka, MYRADA at Hosur in Tamil Nadu, RDT at Anapapur in Andhra Pradesh, AKRSP (I) at Gadu in Gujarat and KALYAN at Purulia in West Bengal, at Ralegan Siddhi in Maharashtra were evaluated. As the said NGOs have many rural development programmes/activities in different villages in the region and enjoy the confidence of people. The NGOs follow cost-effective methods in execution of watershed programmes based on their infra-structural facilities and funds. Watershed programme is incidental to the other programmes and it appears their programme is successful. Watershed programmes have been taken up since 1995 or so and managed, supervised and monitored efficiently and effectively. This may help in maintaining natural resources in better way. Watershed at Ralegan Siddhi was successful due to transparency in decision making and fund utilization in the village for development. If the transparency can be infused, the model can be replicated in similar agro-climatic conditions.

Success of Watershed Programmes

WDPs has been taken up in large scale in Kuppam constituency area in Chittoor district of Andhra Pradesh. Many water harvesting structures such as check dam cascades, percolation tanks and farm/sunken ponds were constructed to augment water resources in addition to canopy development. Thus, ground water recharge has increased tremendously (Sastry *et al.*, 2002). As a result many bore wells have been dug in the area and highly value added and exportable quality vegetable crops (Jerkin, baby corn, etc.) have been introduced and grown in this area under drip/sprinkler irrigation systems. Thus, water use efficiency has increased. The assured market for vegetables and high value crops made the farmers to adopt the technologies to net higher returns. The benefit-cost ratios, taking into consideration of even expenditure incurred on watershed development programme, exceed 3.0 due to cultivation of high value-added crops. The technical/scientific personnel of Isreal project provided all guidance and support in production and marketing of vegetables and products of other crops. The concept of conservation of rainwater where it falls through watershed programme coupled with support to farmers in production and marketing of produce of the crops would certainly, bring revolutionary change in agriculture in rainfed agro-eco regions in the country. Thus, judicious management of soil, rainwater, vegetation and agricultural crops would usher the prosperity of the farmers in rural areas.

Success of Other Activities

Non-land based activities such as dairy, goatry, sheep rearing, poultry, duckry, mushroom cultivation, SHGs, etc., were supported in watershed programme village with some support. The subsidy based activities had a set back after withdrawal of watershed programme. However, there are some activities that have been continuing even today (Reddy *et al.*, 2002):

- Vermicompost managed by SHGs in Dalit watershed in Medak district of Andhra Pradesh has been continuing as it is being sold at Rs. 2/- per kg to mango growers, etc. Deccan Development Society, an NGO has been helping SHGs by providing good market.
- Mushroom cultivation managed by SHGs in Kokriguda watershed in Koraput, district of Orissa state received continuing attention due to market for mushroom in the adjoining area. However, tribal people did not go for dairy programme because milking animal and drinking the milk is taboo for them and efforts made by PIA did not succeed although it is an economic proposition. Vegetable cultivation however gained momentum due to market availability.
- Although SHGs at Hirayur in Chitradurga district in Karnataka made a dent to develop processing unit for turmeric, chillies, fig, soapnuts, tomato sauce, etc., access to market is a problem. Policy amendments are a likely solution
- Duckry in Purulia watershed managed by KALYAN in West Bengal induced people to adopt for some additional income.
- SHGs at Mandapam area in Tamil Nadu have been investing on dairy, duckry, kitchen garden, piggery, poultry, etc., for additional income.
- Watershed Programmes at Gadu in Junagarh district of Gujarat improved the skills of artisans and provided economic assistance for fabricating agricultural equipments. Mango orchards are maintained by weaker sections in Tiptur watershed in Karnataka managed by BAIF.

The above programmes were found successful in those watersheds particularly. The maintenance of other activities in watershed or non-watershed villages is more or less same due to the diffusion of technology.

Conclusion / Strategies

Most farmers across the country reported that the sustainability of agriculture is possible by harnessing rainwater and improving the groundwater, which is possible through soil and water conservation measures. Farmers also reported that soil erosion can be minimized and irrigation potential can be improved through soil and water conservation structures (Sastry *et al.*, 2003). In addition, suitable canopy development is a must for minimizing soil loss, further. Forestry/Agro-forestry/orchards system would improve micro-climatic conditions in this region.

Farmers also suggested alternate methods of funding for watersheds by different donors rather than from public exchequer. During discussion with officials and farmers in Jamnagar district Gujarat, it was reported that certain people in some villages donate 20-100 bags of cement for village community work while sending their daughter to bridegroom's residence. In Chittoor district of Andhra Pradesh, it was reported that rich farmers/ issueless couples/widows/widowers, etc., executed works on farm ponds, small check dams, tanks, stabilization of embankment of water channels, etc., in community lands / forest lands for the benefit of animals / people / environment in addition to protecting natural resources in the past.

People's participation in watershed activities was also poor except in case of wage earners/subsidy beneficiaries. By nature, people attend to their individual direct benefits rather than indirect/long term benefits. Most farmers expressed that improved, certified and guaranteed seeds in addition to enlarging water potential for sustainable agriculture and providing remunerative prices/market would usher agriculture growth in rainfed agro-eco regions. People's participation is expected based on the provision of direct benefits to farmers.

Though funds are allocated based on entire watershed area of 500 ha or so, the treated area in watershed is very low due to lack of proper planning, supervision and monitoring, official machinery/infrastructure facilities, etc. Thus, sporadic efforts were made to improve natural resources like soil, rainwater and vegetation. Even there were no entry and exit policies leading to improper selection/execution and no maintenance after withdrawal. Thus, entire programme came to original status. Nevertheless, farmers, landless people and officials in the country suggest strongly that natural resources – soil, rainwater, and vegetation should be maintained for improvement in groundwater and microclimate for sustainable growth of agriculture in the country.

As bunding, water/diversion channels, gully plugs, Gabion structures reduces soil loss and channelises for proper flow of water and water harvesting structures improve ground water potential in addition to surface water, vegetation covering the land with grasses, trees, orchard plants would reduce soil loss, soil erosion, etc. and improves microclimate. Hence, systematic planning and mapping is required to prepare a plan to develop and maintain natural resources – soil, water and vegetation for sustainable growth of agriculture in rainfed agro-eco regions in India.

Government may encourage to involve donors of different categories (progressive and rich farmers, industrialists, NGOs) with tax rebate on the amount donated to watershed programme in the country and all works may be entrusted to Soil Conservation/ Agriculture Department with proper accounting and responsibilities. NGOs or industrialists/others may also be encouraged to adopt area/village to execute soil, water and vegetation management works in rainfed agro-eco regions. Thus people can be involved rather making as Government Programme.

Government may create separate fund through public contributions with tax rebate only for preserving soil, water and vegetation for sustainable growth of agriculture in the country, as natural factors-viz: soil, water & vegetation are complimentary to each other and hence, plans should be made to sustain these factors for development in the present context of globalization, liberalization and privatization in the world. Capacity building is a prerequisite for effective implementation of WDPs.

In case of problems of any technology in watershed area this is to be entrusted Research Institutes for improvement so as to create a confidence among the farmers towards sustainable growth of agriculture in rainfed agro-eco regions.

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