



RESEARCH PAPER

Impact of watershed management programme in Chikkanankuppam watershed of Vellore district

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Abstract : Watershed development projects have been taken up under different programmes launched by Government of India, State departments and also International Agencies. Watershed management is a concept which recognizes the judicious management of basic resources of soil, water and vegetation, on watershed basis, for achieving particular objective for the well being of the people. Realizing the significance of the watershed development investments on various watershed projects, a detailed study was carried out to evaluate the activities and their impacts. The impact of various activities on different aspects such as water resources, agricultural production, socio-economic aspects and institutional aspects was studied. The overall impact of watershed projects implemented under NABARD Watershed Development Fund (WDF) in Chikkanankuppam has been positive and significant.

Key Words : Impact, Bio-physical, Socio-economic, Environmental, Ecological parameters

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INTRODUCTION

A watershed is an area of land that captures rainfall and other precipitation and funnels it to a lake or stream or wetland. Watershed development is an important policy instrument for rural development in many developing countries. However, evidence of the distribution and magnitude of social impacts attributable to watershed interventions is often ambiguous. Watershed development programmes influence different aspects like agricultural production system, environment and socio-economic conditions of the watershed villages.

The country is facing severe water problem not because of inadequate rain but because of lack of proper water harvesting methods and approaches. Watershed management tries to bring about the best possible balance in the environment between the supply of natural resources and demand. Watershed development activities have received much attention in the recent times from the planners and policy makers of the state and central governments and various development agencies including financial institutions like NABARD and NGOs. Watershed Development Fund (WDF) was created in

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National Bank for Agriculture and Rural Development (NABARD) for unification of multiplicity of watershed development programmes into a single national initiative through involvement (participatory watershed development) of village level institutions and Project Facilitating Agencies (PFAs). The nodal agencies of the State Government may implement watershed development projects through NGOs which are funded out of WDF loan. Even if the Project Facilitating Agency (PFA) is other than NGO the same criteria is utilized with necessary modifications. The central/ state governments have initiated various programmes like WDF OF NABARD, DDP, DPAP, IWDP, IWMP, NWDPR etc., to promote watershed development activities in different phases.

In Tamil Nadu state, watershed development programmes are being implemented through different programmes. From the year 2004-05 with the assistance of the NABARD funds, Watershed Development Fund project has been planned to treat 100 watershed projects at a cost of Rs.6000 lakhs. Presently, 10 watersheds under full grant by NABARD and 152 watersheds under NABARD loan assistance are being implemented. In these 85 projects are in full implementation funded through TAWDEVA. During 2012-13, an area of 0.077 lakh ha has been treated at a cost of Rs.401 lakhs. Thus, the present research study was framed to assess the socio-economic impact in various interventions of NABARD supported watershed programme in Chikkanankuppam village of Vellore district for sustainable agricultural production. This promotes improved understanding of the performance of current watershed projects and provides inputs for the appropriate design of future rural development interventions.

MATERIAL AND METHODS

Chikkanankuppam watershed which has an area of 1469.42 ha was selected based on the discussion with the implementing agency. The data was collected from the watershed functionaries and also from farmers by making reference to the project activities and their impact before and after the completion of the activities. Impact assessment of the WDF of NABARD implemented by the government was taken up by the VWC and Bhumii trust the Project Facilitating Agency, Vellore district. Among WDF of NABARD watershed development programme implemented in Vellore district during the

period 2004-2011 one watershed is considered in the impact assessment. The impact assessment uses both secondary and primary data. A structured schedule for data collection was developed by the researcher to the study the impact of watershed development programme on different aspects such as water resources, agricultural production, socio-economic aspects and institutional aspects. However, the impact was assessed based on the feedback perceived from the farmers in Chikkanankuppam watershed, sample farmers were selected for collection of needed information. Only willing and cooperating farmers were chosen for the study. The data were analyzed using statistical techniques such as percentage change using pre and post implementation of watershed programme in Chikkanankuppam watershed.

RESULTS AND DISCUSSION

Different types of treatment activities are carried out in a watershed. They include soil and moisture conservation measures in agricultural lands (contour/field bunding and summer ploughing), drainage line treatment measures (loose boulder check dam, minor check dam, major check dam and retaining walls), water resource development/management (percolation pond, farm pond, and drip and sprinkler irrigation), crop demonstration, horticulture plantation and afforestation. Training in watershed development technologies and related skills is also given periodically to farmers in watersheds.

In addition, members are also taken to other successful watershed models and research institutes for exposure. These efforts appear to be contributing to ground water recharge. The aim has been to ensure the availability of drinking water, fuel wood and fodder and raise income and employment for farmers and landless labourers through improvement in agricultural production and productivity. Today watershed development has become the main intervention for natural resource management. Watershed development programmes not only protect and conserve the environment, but also contribute to livelihood security. As part of the watershed implementation, various treatment activities have been carried out. They are as follows in Table 1.

Area treatment (52.00 %) followed by project management (19.00 %), drainage line treatment (15.41 %), women development activities (8.40 %), renovation work (3.74 %) and training demonstration (2.03 %). Majority of the works taken up under

watershed programme are related to NRM and are mostly soil and water conservation works. Based on the field visits at the ground level, the technical soundness and utility of these interventions was evaluated by the project implementing agency.

Bio-physical impact:

The watershed development activities were studied through various biophysical aspects, such as investment on soil and water conservation measures, changes in cropping pattern, expansion in cropped area, cropping intensity and soil erosion.

The evidence shows that the cropping intensity has increased from 120.00 to 146.88 per cent in the Kattampatti watershed and 102.14 to 112.08 per cent in the Kodangipalayam watershed (Palanisami and Suresh Kumar, 2005). The impact on cropped area under

different crops presented in the Table 2. Increased area is a good indicator of resources development and agricultural production.

It is expected that watershed treatment activities helped in development of water resources potential and thereby help the farmers going for irrigated crops. It is evident that the groundnut and cholam area have increased by 10.72 and 12.74 per cent, respectively. These two crops occupy major area in the watershed. The area under crops like red gram and mango cultivation has increased significantly. It might be due to intervention of watershed activity. Total cropped area also increased by 11.60 per cent. It was also evident that significant crop diversification has taken place. Thus, the watershed treatment activities helped the farmers to diversify the cropping pattern which in turn helped to enhance their farm income and welfare of the household.

Table 1: Type of work in selected watershed

Treatments	Physical achievement	% of physical achievement
Area treatment	3843821	51.91
Drainage line treatment	1141216	15.41
Renovation work	276659	3.74
Training demonstration	150000	2.03
Project management	1371309	18.52
Women development activities	622370	8.40
Total	7405375	100.00

Source: Records of project implementing agency

Table 2: Changes in cropping pattern in Chikkanankuppam watershed

Particulars	(in ha.)			
	Before implementation	After implementation	Difference	percentage change
Cholam	210.11	236.87	26.76	12.74
Ragi	58.23	68.51	10.28	17.65
Red gram	142.18	156.87	14.69	10.33
Horse gram	68.57	73.13	4.56	6.65
Paddy	82.98	93.49	10.51	12.67
Groundnut	230.17	254.85	24.68	10.72
Mango	129.70	150.17	20.47	15.78
Coconut	62.98	69.18	6.20	9.84
Others	155.76	169.89	14.13	9.07
Total area	1140.68	1273.02	132.34	11.60

Source: Field survey, November 2015

Table 3: Impact of cropped area, cropping intensity in selected watershed

Particulars	Before implementation	After implementation	Difference	Percentage change
Net cropped area (ha.)	1018.52	1018.52
Gross cropped area (ha.)	1140.68	1273.02	132.34	11.60
Cropping intensity (%)	111.99	124.99	13.00	..

Source: Field survey, November 2015

The analysis of impact of watershed treatment activities on expansion in cropped area indicate that increase in gross cropped area and there by cropping intensity was realized in the watershed. The cropping intensity indicates that there was an increase after the implementation of the project. (Table 3). There was no change in net sown area whereas gross cropped area has increased to 132.34 ha. Thus, the cropping intensity showed a significant difference of 13 per cent. It revealed that the cropped area has increased due to watershed intervention.

The organic carbon has increased by 37 per cent due to watershed intervention (Sikka *et al.*, 2000) and most studies have revealed that there is a significant reduction in soil erosion. Soil erosion is a common phenomenon in every piece of land, because most of them are undulated, slope and devoid of any vegetation. The soil erosion was acute in the pre watershed project period. It was controlled moderately in agricultural land. Even the highly elevated hillocks were also treated by means of water absorption trenches, continuous contour trenches, percolation ponds etc. Before establishing those watershed structures, there was a huge extent of soil erosion and no water was retained. The run-off water will be taking away all the top soil of the land area. Presently the soil erosion was controlled to a greater extent.

Environmental impacts:

The watershed development interventions create significant positive externalities which have a bearing on improving agricultural production, productivity and socio-economic status of the people directly or indirectly

depend on the watershed for their livelihoods. The environmental indicators include changes in irrigated area and irrigation intensity, surface water storage capacity, rise in water level and differences in number of wells.

The moisture available in the soil plays a vital role in the crop performance and the intensity of cropping which ultimately reflects on production. Watershed activities aim at moisture conservation and increase the water storage and recharge. The impact of watershed treatment activities on area irrigated was presented in Table 4.

Surface water storage capacity:

One of the important activities of the watershed development is the water conservation. Depending upon the land slope and natural drainage, the water harvesting structures are designed. Percolation ponds, farm ponds, water absorption trenches (WAT) and renovation of existing ponds, tanks and channels have been taken up in the watershed. The details on surface water storage capacity for the study watershed are given in Table 5.

It is evidenced that the total surface water storage capacity created has been worked out to 41418M³ comprising of 2700M³ from percolation ponds, 4538M³ from farm ponds, 25000M³ from WAT and 9180M³ from renovation of ponds, lakes and channels. This water storage structures help in improving groundwater recharge and water availability for livestock and other non- domestic uses in the villages as a result of watershed treatment activities. On the basis of the data collected from project implementing agency (PIA) that the water level in the open wells has risen upto 0.84 meters in the watershed. It is mainly due to the construction of

Table 4: Impact on area irrigated at watershed level

Particulars	Before implementation	After implementation	Difference	Percentage change
Net area irrigated(ha)	332.14	348.72	16.58	4.99
Gross area irrigated(ha)	374.94	442.04	67.10	17.90
Irrigation intensity (%)	112.89	126.76	13.87	..

Source: Field survey, November 2015

Table 5: Additional surface water storage capacity created

Particulars (Cum)	Surface water storage capacity (M ³)
Percolation ponds	2700
Farm ponds	4538
Water absorption trench	25000
Renovation of ponds, lakes and channels	9180
Total storage	41418

Source: Field survey, November 2015

percolation ponds and major and minor check dams. Though, the major and minor check dams are mainly constructed for gully erosion control, these structures help in a big way for groundwater recharge as well. For instance, the average water level in the wells in the watershed village was 0.36 meters before implementation and was 1.20 meters after the implementation of the project.

The watershed development activities generate significant positive externalities which have bearing on environmental aspects. It include water level in the wells, changes in irrigated area, duration of water availability, water table of wells, surface water storage capacity, differences in number of wells, number of wells recharged/defunct, differences in Irrigation intensity. Construction of new percolation ponds, major and minor check dams and rejuvenation of existing ponds/tanks has enhanced the available storage capacity in the watersheds to store run-off water for surface water use and groundwater recharge. Water resources of particular watershed are given in the Table 7.

Open wells and bore wells formed the major source of irrigation in the selected watershed. It could be observed from the Table 7 that the number of functional open wells has increased by 48.81 per cent after the implementation of the project. The number of less functional and also dysfunctional wells has decreased by 27.54 and 44.74 per cent, respectively. Similarly the functional bore well has increased significantly. The number of less functional and dysfunctional bore wells has also decreased by 63 and 37 per cent, respectively. Increase in number of functional wells indicates the effectiveness of watershed harvesting structures.

Socio-economic impact:

The watershed development programmes influence bio-physical and environmental aspects and thereby bring changes in the socio-economic conditions of the people (Deshpande and Rajasekaran, 1997). The socio-economic indicators like changes in income, employment and migration were considered for the impact assessment. In the selected watershed, households need cash income

Table 6: Rise in water level

Particulars	Before implementation	After implementation	Average water level rise (m)	% changes
Average water level in the wells(meters)	0.36	1.20	0.84	233

Source: Field survey, November 2015

Table 7: Number of irrigation sources in the selected watershed (Numbers)

Particulars	Before implementation	After implementation	Difference	% change
Open well				
Functional	84	125	41	48.81
Less functional	87	63	24	-27.54
Dysfunctional	38	21	17	-44.74
Bore well				
Functional	25	84	59	236.00
Less functional	68	25	43	-63.23
Dysfunctional	24	15	9	-37.50

Table 8: Different sources of income among farm households

Particulars	(Rupees per household year)			
	Before implementation	After implementation	Difference	% change
Crop production	56,107	69,872	13,765	24.53
Livestock	17,847	19,533	1686	9.45
Off-farm income	15,547	28,480	12,933	83.19
Non-farm income	66,838	63,114	-3724	-5.57
Total family income	1,56,339	1,809,99	24,660	15.77

Source: Field survey, November 2015

to supplement agricultural production to meet the consumption needs, to pay for social obligations, school fees and healthcare. Most of this income is generated through off-farm and non-farm income activities. Table 8 represents the cash income and relative importance of different sources of income among farm households.

Generally the watershed treatment activities should help the farm households to derive more income from crop and livestock activities. It is evident that the households participate in crop production, livestock and off-farm income were higher after implantation of watershed activities except the non-farm income. The reduction of non-farm income indicates that people of Chikkanankuppam watershed has reduced their non-farm activities and engaged in farm and off-farm activities.

The impact on employment profile is presented in Table 9.

The pattern of seasonal and permanent migration in the study watershed is presented in Table 9. The Table 10 indicate a consistent pattern as far as seasonal and permanent migration is concerned. It could be seen that there is more of seasonal and permanent retention after the implementation of the project due to the favourable environment for agricultural activities.

Opinion on overall impact of the watershed activities:

The overall impact of watershed treatment activities as revealed by the farm households is presented in Table 11.

Table 9: Employment profile of the workers of the watershed

Particulars	Capacity building phase	Full implementation phase	Total labour man days
Temporary employment at the time of execution (Man days)			
Mason	85	229	314
Mazdoor	159	1060	1219
Stone breakers	19	771	790
Regular employment (Man days)	1277	14040	15317
Total	1540	16100	17640

Table 10: Seasonal and permanent migration of watershed level

Particulars	(Number of persons)		
	Before	After	Difference
Seasonal migration			
No. of households in-migrated	52	72	20
No. of households out-migrated	80	65	-15
Net in-migration	-28	7	5
Permanent migration			
No. of households in-migrated	16	24	8
No. of households out-migrated	20	11	-9
Net in-migration	-4	13	-1

Table 11: Opinion on overall impact of the watershed activities

Particulars	Mean score	Rank
Soil and water conservation improved	77.56	I
Soil fertility improved	66.73	II
Groundwater recharge	62.59	III
Farm diversification by way of addition of activities like livestock, agro forestry, etc.	54.95	IV
Yield increase	50.46	V
Helps to alter the cropping pattern	48.60	VI
Cropping intensity	42.67	VII
Resource saving	36.01	VIII
Increased fodder availability	31.64	IX
Increased fuel wood supply	28.78	X
Facilitates organic farming	19.67	XI

Source: Field survey, November 2015

Of the different beneficial impacts, the watershed treatment activities in Chikkanankuppam watershed exert more impact on improvement in soil and moisture conservation, improvement in soil fertility, groundwater recharge, farm diversification by way of addition of activities like livestock, agro forestry and increase in yield were revealed by the sample farms.

Conclusion:

The efforts made towards convergence of various activities and schemes on watershed basis have been well received. It has really helped in effective rapport and confidence building to mobilize community support and participation in other biophysical activities to be taken up under watershed programme. Watershed development programmes not only protect and conserve the environment, but also contribute to livelihood security. With the large investment of financial resources in the watershed programme, it is important that the programme becomes successful. For achieving the best results, people should be sensitized, empowered and involved in the programme. Local community leaders and stakeholders should necessarily be motivated about conjunctive use of water, prevention of soil erosion etc., through various media. The stakeholders at different levels should be involved at various stages of project activities, planning and implementation with the ultimate

objective of sustainability. In addition to the above, strengthening of community organizations within the watershed, implementation of the planned watershed management activities and encouraging linkages with other institutions will help motivate the people and make it a people movement. Our experience has once again shown that, bottom up approach with a blend of top down approach is fruitful in watershed management.

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