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Farmers Perception on Soil and Water Conservation Treatment in a Government Watershed Intervention in Karnataka, India

G.Ananda Vadivelu

Indian Institute of Forest Management, Bhopal, India. Email: gananda@iifm.ac.in

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ABSTRACT

In the dryland regions of India, watershed development is one of the key strategies of development and it has been demonstrated that soil and water conservation investments can improve the productivity of dry land agriculture. But farm households are reluctant to invest due to the uncertainty of returns. Interventions have tended to subsidise the cost of the investments to address the low benefit cost ratio of such investments. The Drought Prone Areas Program(DPAP) was a significant intervention by the Ministry of Rural Development to develop the rainfed areas with the objective of catalyzing bottom up planning and ensure effective soil and water conservation treatment. The purpose of this paper is to examine the farmers perception with respect to the quality of the soil and water conservation treatment undertaken in their land. The study is based on evidence from DPAP field sites in Chitradurga district of Karnataka based on data collected from 150 farm households in five villages. The soil and water conservation intervention (Farm bunds, boulder checks and check dams) was undertaken under a scenario of poor rainfall in the years preceding the intervention and farmers were pessimistic about the possibilities that were available from rainfed farming. While farmers were dissatisfied with the quality of the soil and water conservation treatment, 91 percent of the farmers did not complain to the government staff and 88 percent of the farmers choose not to take any corrective action to repair the damage to the structures. Since there was no financial contribution by the farmers, and poor rainfall preceding the intervention, they were pessimistic about the benefits that would accrue due to Soil and Water Conservation (SWC) treatments. Our evidence points out that in dry land environment, the subsidy driven approach towards investment in SWC treatment is a necessary but not sufficient condition to induce interest among farm households and arena for further research have been identified.

Keywords: Soil and Water Conservation Investment, Efficacy, Drought Prone Areas Program, Chitradurga, Karnataka.

1. INTRODUCTION

Due to poor resource endowment and high variation in the rainfall, returns from agriculture in the dryland regions are uncertain (Walker and Ryan, 1990). While research has demonstrated that soil and water conservation investments can increase the productivity of dryland agriculture (Wani, *et.al*, 2002 and 2003), farm households are reluctant to invest in Soil and Water Conservation (SWC). The reasons are as follows. The private benefit-cost ratio of SWC is low as compared to investment in groundwater irrigation and agricultural intensification (Walker and Ryan, 1990). The uncertainty of returns from the crops cultivated under dry land, low farm gate prices for the produce and the higher opportunity cost of labour due to better off farm employment opportunities, make investment in rainfed agriculture unattractive. Farm households go for short term benefits rather than investing in sustained productivity (Bardhan and Udry, 1999). Farmer tend to adopt newer practices and technologies only when there are additional gains either in terms of higher returns, lower risks or both (Lee, 2005). Therefore, they tend to defer undertaking such conservation investments until the gains from such investment are perceived to be at least equal to the next best investment opportunity available to them (Kerr and Sanghi, 1992). The incentive for private investment in soil and water conservation are often low and the impact of the intervention often does not lead to any substantial benefits (Kerr, 2002, Reddy, et.al, 2001). Interventions often tend to subsidise the costs of SWC work as a part of the program design strategy to address the low benefit cost ratio of such investments. However, when the perceived economic benefits are low, famers either fail to adopt the recommended practices or abandon them once the subsidised projects are completed (Lutz, et.al, 1994 and Reddy, et.al, 2001).

In the dryland regions of India, watershed development is one of the key strategies of development. However, it is pointed out that without better returns to investment in soil and water conservation and without local institutions to coordinate investment in the long run, the sustainability of participatory watershed management is seriously threatened. (Bouma, et.al, 2007). The purpose of this paper is examine the efficacy of the intervention based on the farmer's perception on the quality of the SWC treatment undertaken under the Drought Prone Areas Programme (DPAP) funded by the Ministry of Rural Development, Government of India.

The Drought Prone Areas Program (DPAP) was a significant intervention by Government of India to develop the dry lands of the country. The Hanumantha Rao Committee (GOI 1994a: 8), in its historical review of the programmes, observed that there has been a lack of conceptual clarity about the programme, which has led to shifts in the programme emphasis in various plan periods. Reviewing the impact of DPAP and DDP, the following observations were made: There has been poor participation of the people in the planning and implementation of the programme. Maintenance of the assets created was found to be poor. Most of the work undertaken was on community land and the "treatment of farmers' fields was conspicuous by its absence in most states" (*Ibid*:10-15). The planning of the programmes continued to be on an *ad hoc* basis based on arithmetical consolidation of sectoral budgetary proposals. There was no integration of the various sectoral plans either at the district

or taluk level. A wide range of activities undertaken under the programmes resulted in a thin spread of resources over widely dispersed areas and limited impact.

This lacuna was to be rectified by the formulation of the Common Guidelines (GOI, 1994b) to change the governance structure of watershed programmes implemented by the Ministry of Rural Development. The attempt was to reverse the earlier top-down mode of implementation by encouraging measures to ensure bottom up planning. The government staff were supposed to assist in formation of Self Help Groups, Watershed Development committee and decision making on soil and water conservation treatment was to be done in consultation with the farmers in their own land and a final decision was to be taken in a meeting of the watershed development committee. Further farmers were supposed to contribute 10 % for private land treatment and 5% contribution was to be mobilised for common land treatment. The program was therefore implemented based on a subsidy driven approach.

We found that since there was poor rainfall preceding the intervention, there was pessimism prevailing in the study villages and when the government staff got a sense that farmers would not be contributing to the program as per the norm, 95% of the respondents we surveyed were not even asked to contribute. Further, under such a scenario, wherein wage employment could have been generated to enthuse participation and interest in the program, the intervention was implemented in many cases using machinery and in some study villages during the night. The evidence from the DPAP project reveals that no conditionalities were imposed on the farmers on their participation in the programme to get the desired benefits. Therefore, there was no incentive for them to be part of the processes and the crucial requirement of the farmers, wage labour was not available which was the immediate need of the small farmers in particular. The staff also did not have the incentive to involve farmers in the processes, as they could afford to compromise on the quantum and quality of the treatments to show that farmers made the required contribution as per the norm (10 per cent of the costs).

The evidence on this from our field sites has been presented in an earlier paper (Vadivelu, 2008) while the purpose of this paper is to examine an intermediary outcome of the project, the efficacy of the soil and water conservation treatment done. While the project was attempting to usher in bottom up planning, it is important to examine the implications of such efforts in terms of the quality of the intervention. It is important to understand the efficacy of the investments in watershed development projects in the context of the increased public investment by the government facilitated by the tax mobilised from the citizens.

In the Indian context, there have been empirical investigations efficacy of the soil and water conservation treatment. In this paper, we illustrate the findings from a few studies. Our review reveals that a research gap exists particularly with respect to an understanding of the farmer's perception of the quality of the work and his response to it.

Shah, A (1997), examining the watershed programmes in western Gujarat, found that in terms of acceptability of different components of the watershed technology, in the 'dynamic' rainfed region that returns from capital intensive technology was higher therefore there was more interest to adopt such measures. Other measures like *in situ* conservation including through vegetative barriers did not evoke much interest, as their income enhancing capabilities were perceived as lower. A study covering various modes of implementation (NGO, ICAR, NWDPRA, Ministry of Rural Development) across 37 watersheds across the country found that the performance of NGO watersheds was better in soil conservation followed by international funded watersheds (Sastry*et al* 2003). The post-project maintenance was poor, this was more in the case of ICAR and NWDPRA projects, while monitoring and evaluation was good in high rainfall watershed areas and in water centred programmes. The monitoring and evaluation was only based on the amount that has been spent and/or the number of structures that have been built.

The structure of the paper is as follows. In Section 2, we present the methodology of the study, followed by the presentation on the rainfall status in the field sites (Section 3), followed by the findings in section 4 and then we conclude the paper (Section 5).

2. METHODOLOGY

We have selected Karnataka state for our enquiry, which is the third highest state in the country in the proportion of dry land area (88%) (Shah *et al* 1998: 121). Chitradurga district from Karnataka state has been selected for the study for the following reason. This is a semi-arid and backward district with 460,797 ha of area requiring watershed intervention. The mean annual rainfall in the district was 565 mm during the 1901 to 1990 period. Chitradurga District falls under the Central Dry Agro Climatic Zone, which comprises 17 taluks from Chitradurga as well as Tumkur districts. Molkalmuru taluk was chosen for the study as this taluk presented us to study both the DPAP and a bilaterally funded Karnataka Watershed Development Agency (KAWAD) in the same field setting. This was as part of a wider study.

In Molkalmuru taluk, the DPAP project has been implemented in several phases. But, we have considered only Phase II villages for the study for the following reason. Since the watershed programmes as per the Common Guidelines were initiated in 1999 and completed in 2003, Phase II villages provided an opportunity to examine and analyse the processes and outcomes.

The primary data was collected from five villages (Table 1). A list of households belonging to different strata was prepared after undertaking the transect walk from upper to lower reaches of the micro watershed. The basic information of the farm households was collected during the transect walk undertaken by the researcher. This information was used to stratify the households and select the sample households. Two levels of stratification were followed. At the first level, the reach of the farmer (upper or lower reach) was identified based on the location of the plot in the micro watershed. The

demarcation of the watershed into upper and lower reach was done in the transect walk with the help of the cadastral maps and in discussion with key informants and officials. At the second level, farm households were classified into small, medium and large based on size of landholding. The stratification across location and landholding size was undertaken to study the differential processes and outcomes based on the location of the plot and landholding size. The strata arrived at were as follows: upper small, upper medium, upper large, lower small, lower medium and lower large[1]. From the list of treated farm households, 25 per cent were selected from each stratum using the lottery method. Totally, 150 households were interviewed from the above six strata using a pre-tested structured interview schedule.

Table 1: Profile of the Study Villages

Sl. No.	Name of the Village	Number of House-holds	Total Area (ha)	Water-shed Area (ha)	Dry land (ha)	Irrigated Area (ha)	Cultivable Waste (Ha)	Not Available for Cultivation (Ha)
1	Devasamudra	428	1,476.43	526.52	408.61	177.83	356.21	77.15
2	Vittalapura	51	379.98	375.34	54.33	25.97	25.97	2.94
3	Venkatapura	301	374.38	370.01	219.28	88.04	40.18	26.88
4	Bommadevarahalli	210	1,029.94	307.00	568.03	4.86	92.46	34.92
5	Muthigarahalli	208	1,543.49	496.64	426.58	30.0	26.49	153.23

Source: DPAP project documents (Number of Households and Watershed area) and the rest from GOI (1991).

3. RAINFALL IN THE STUDY AREA

Chitradurga historically has been a rainfall-deficient district. The problem is much severe in Molkalmuru taluk. Although the average rainfall during the period 1901 - 1990 was 565.5 mm this varied considerably across the seasons. Since the land is predominantly dry, a majority of the farmers cultivated only during the kharif period. Hence, the rainfall received during the South-West Monsoon becomes more relevant to the farmers. The taluk faced 19 droughts during the ninety-year period ending with 1990. Thus, one in every 4 - 5 years has been a drought year in the taluk.

For our study, it is important to examine the pattern of rainfall in the taluk during the period 1999 to 2003, when the DPAP project was implemented. The rainfall in the district during 1999 was 33 per cent more than normal (GOK 1999:48) while the rainfall in Molkalmuru taluk was excess by 59 per cent. The quantum of rainfall declined after 1999 and during 2003, the annual rainfall was 243.99 mm. The rainfall received during the South-West monsoon for the 2000 to 2002 period ranged from 198.4 mm in 2002 to 399.3 mm in 2001

Was the rainfall in the study villages different? Going by the data collected from rain-gauge stations nearer to and/or located in the study villages, it can be concluded that the rainfall during the completion year of the project (2003) was low and deficient not only in terms of total rainfall but also in terms of rainy days as compared to the pre-project intervention year (1999)

The rainfall data shows that the Ramapura station (nearest to Bommadevarahalli village) recorded rainfall of 206.94 mm (26 rainy days) (63.37% lower than normal rainfall) in 2003, while the average rainfall in 1999 was marginally better at 274.88 mm (36 rainy days). At Devasamudra station (nearest to Venkatapura and Vittalapura villages), the rainfall recorded in 2003 was 351.6 mm while it was 563.2 mm (with 27 rainy days) in 1999. At B.G. Kere station (nearest to Muthigarahalli village), the total rainfall was 351.66 mm (20 rainy days) in 2003 as compared to 424 mm (with 32 rainy days) in 1999. It needs to be, therefore, kept in mind that the lower rainfall in the completion year of the project would influence the project outcomes.

4.FINDINGS

We present the findings on how decision making took place with respect to the SWC treatment, the SWC treatment undertaken, the perception of the farmers on the quality of the work, adequacy of the work and their response to the inadequate treatment.

4.1 Decision making on SWC treatment

In the DPAP intervention, the decision on the SWC treatment was taken in a participatory manner with the discussion on this taking place in the farmer's land with a discussion between the concerned farmer, Watershed Development Committee (WDC) members and the government staff, the lowest level bureaucrat - The Agricultural Assistant. This preliminary discussion was supposed to be discussed in a meeting of the WDC and based on the deliberations, the action plan for the micro watershed was also supposed to be finalised.

Our investigation found that that 30 per cent of the farmers were never consulted (Table 2), while 24 per cent of them were consulted and consent was taken. In 36 per cent of the cases, the farmer made a request, while active lobbying was done by 10 per cent of the farmers. The disaggregated data (Table 2) clearly show that the proportion of households, which were not consulted, was higher among the small farmers in both the upper and lower reaches (39 and 35 per cent respectively). The proportion was the least among the larger farmers in the upper and lower reaches (20 and 18 per cent respectively) because they themselves were actively involved in lobbying to get the desired treatments. This is more so in the case of farmers in the lower large (18%) and upper reaches (10%). These farmers largely took the initiative to meet the Agricultural Assistant and request the required treatment.

Table 2: Distribution of farmers (%) by farm categories and decision making on SWC treatment

Strata	Treatment done without consultation	Farmer's consent taken	Farmer stating his request	Farmer undertaking 'proactive' action	Total
Upper Small	39	15	46	0	100 (26)
Upper Medium	35	23	27	15	100 (26)
Upper Large	20	35	35	10	100 (20)
Lower Small	35	21	32	12	100 (34)
Lower Medium	27	36	32	5	100 (22)
Lower Large	18	18	46	18	100 (22)
Total	30 (45)	24(36)	36 (54)	10 (15)	100 (150)

Note: Figures in parentheses are actual numbers

For the Agricultural Assistant, such farmers were more easily accessible whenever he decided to visit the village. However, in the case of small farmers, it was more difficult to meet them as their livelihoods depended not only in terms of the

[1]A farm household is called as small if landholding is less than 5 acres, medium if it owns between 5 to 10 acres and large if it owned more than 10 acres. One acre of irrigated land is considered to be equivalent to 2 acres of dry land.

crops that they cultivate, but also on the wage employment for which they frequently had to go to the neighbouring villages[2].

4.2 SWC Treatment

The proportion of area treated by the project was 58 per cent (Table 3). The head-end village of Devasamudra had a greater proportion of their land treated. The proportion of land treated was considerably low in Venkatapura, while it was comparatively higher in Vittalapura (60%). This reflects the inequitable distribution of resources within the same micro-watershed area. The decision of the Venkatapura and Vittalapura farmers to lobby for a single WDC was a step in the right direction as multiple WDCs would have probably meant that this proportion would have been even lower as Devasamudra farmers would have lobbied for a greater share and pressurised the Agricultural Assistant to spend greater quantum of the resources in their village.

Across the farm categories, the proportion of the land treated was the highest among small farmers and the least among large farmers. Since the resources available had to be spent across the watershed area, the SWC treatment had to be spread out. Therefore, the small farmers were able to get a significant proportion of their land treated. As the landholding size increased, the proportion of area treated to total land owned declined.

Table 3: Land treated (%) by farm categories and villages

Strata	Bommdevarahalli	Venkata-pura	Devasa-mudra	Vittala-pura	Muthigarahalli	Total
Upper Small	76	87	100	100	100	93
Upper Medium	80	70	70	48	54	75
Upper large	40	24	46	92	87	47
Lower Small	90	46	74	100	73	78
Lower medium	61	65	100	76	63	77
Lower large	52	28	49	25	100	43
Total	57	36	72	60	81	58

We proceed to examine the evidence on type of SWC treatment by decision-making modes. A major component of the SWC treatment was the construction of farm bunds. The decision to construct farm bund took place either after receiving a specific request from the farmer (40%) or through consent taken by the Agricultural Assistant (25%). Significantly, 32 per cent of the land was treated with the construction of farm bunds without taking consent from farmers (Table 4).

Table 4: Distribution of SWC treatments (%) by type of treatment and decision making modes

Type of Treatment	No consent	With consent	Farmer Request	Farmer lobbying	Total
Farm bunds	32	25	40	3	100 (128)
Boulder checks	17	0	83	0	100 (37)
Check dams	7	38	41	14	100 (25)

In contrast, the proportion of no-consent households was low in the case of check dams and boulder checks. This is due to the following reasons. Since check dams and boulder checks involved higher investment and were undertaken on a farmer's field purposively based on the technical requirement, the consent of the farmer became necessary. Farm bund treatments in contrast were largely universal in nature, with all the farmers in the purview of the watershed getting the benefit of the treatment based on the construction of farm bunds.

For the Agricultural Assistant, the consultative process for a boulder check or check dam was more crucial because the farmer would not later object to the treatment undertaken with significant costs already sunk. Therefore, in the case of check dams, the decision was made by farmer making a request (41%), consent taken (38%) and lobbying (14%). In the case of boulder checks, there were proactive attempts by the farmer to request the treatment (83%), although no consent treatments did take in 17 per cent of the cases (Table 4).

4.3 Quality of SWC treatment

As per the design, the WDC and the Agricultural Assistant were supposed to ensure good quality of the SWC treatment. It was expected that WDC with funds available from the watershed development fund would undertake Operations and Maintenance (O&M) work including the development of the assets created, after completion of the project. We now proceed to examine the evidence on each of the SWC treatments in our study villages.

4.3.1 Farm bunds

Across the farm categories, 37 per cent of the farmers stated that the farm bund treatment was of good quality (Table 5). The proportion of farmers stating that the treatment was good varied across the reaches and farm categories. About 14 per cent of farmers stated that the location of the structure was inappropriate and such a response was the highest among farmers in the lower medium reach. Only 11 per cent of the farmers felt that the work was of poor quality, this was the highest among the upper large farmers. About 25 per cent of the farmers (more in the case of upper medium and lower large farmers) reported that farm bund was broken.

Table 5: Farmers perception (%) on the quality of farm bund

Strata	Good	Inappropriate place	Poor	Broke	Average	Total
Upper Small	37	13	0	25	25	100 (24)
Upper Medium	26	11	5	37	21	100 (19)
Upper Large	32	0	37	21	10	100 (18)
Lower Small	43	24	0	23	10	100 (30)
Lower Medium	39	28	6	17	10	100(19)
Lower Large	39	5	28	28	0	100(18)
Total	37 (47)	14 (18)	11 (14)	25 (32)	13 (17)	100 (128)

Note: Figures in parentheses are actual numbers

During the transect walk, the researcher observed that the farm bund work involved only the strengthening of the bunds previously constructed and the height was very less. This effectively meant that the erosion of bunds took place at a faster rate. In certain villages it was noticed that the rains had damaged the bunds. There was also damage caused by livestock, which moved around in the plots, and the farmer had not taken any corrective steps to repair the damage caused. The village-wise evidence (Table 6) shows that only 39 per cent of the farmers from Bommadevarahalli stated that the quality of farm bund work was of good quality. In this

[2]See Vadivelu (2008) for further discussion on the reason for the low participation of farmers in this crucial aspect of the planning process.

village, 52 per cent of the treatment decisions were undertaken without the consent of the farmer The highest proportion of damages were reported from Devasamudra were a large proportion of decisions were undertaken without the consent of the farmer. About 44 per cent of the farmers from Venkatapura reported that the treatment was good. The reason for this is the farmers actively lobbied for the programme and supervised the work with greater vigilance. In contrast, 46 per cent of the farmers from Devasamudra and 43 per cent from the village of Muthigarahalli reported damage to the structures. In Muthigarahalli, a significant proportion of treatment was done without consent of the farmer, and in many cases during the night time.

Table 6: Farmers perception (%) on the quality of farm bund treatment by villages

Village	Good	Inappropriate place	Poor	Broke	Average	Total
Bommadevarahalli	39	10	16	19	16	100 (28)
Venkatapura	44	4	16	12	24	100 (25)
Devasamudra	42	0	8	46	4	100 (24)
Vittalapura	36	36	9	9	10	100 (23)
Muthigarahalli	21	21	7	43	8	100 (28)

Note: Figures in parentheses are actual numbers

4.3.2 Boulder check

Across the farm categories, 28 per cent of the farmers perceived the quality of the boulder check was good, while an equal proportion perceived it to be poor (Table 7). About 25 per cent of the farmers stated that the boulder checks constructed were already damaged and this proportion was the highest among the upper medium farmers.

Table 7: Farmers perception (%) on the quality of the boulder check

Strata	Good	Inappropriate place	Poor	Damaged	Total
Upper Small	17	33	33	17	100 (6)
Upper Medium	17	17	17	49	100 (6)
Upper Large	20	0	60	20	100 (5)
Lower Small	57	29	0	14	100 (7)
Lower Medium	17	17	33	33	100 (7)
Lower Large	33	17	33	17	100 (6)
Average	28 (10)	19 (7)	28 (10)	25 (10)	100 (37)

Note: Figures in parentheses are actual numbers

The reason for the poor quality is largely due to the usage of the freely available local boulders (rather than machinery boulders), which got dislodged and disintegrated by heavy rainfall. The Agricultural Assistant preferred to use local boulders rather than machine boulders as a cost-cutting measure. The boulder checks were stated to be located in an inappropriate place by 19 per cent of the farmers while only 25 per cent of the farmers stated that the structure was damaged (Table 7). During the completion stage of the field work, the area witnessed heavy rainfall spells and greater damage might have occurred.

The proportion of farmers reporting poor quality treatment was the highest in village of Venkatapura followed by Muthigarahalli. This was due to deliberate compromises in the quantum and quality of the work (by the respective Agricultural Assistants) to factor in money to be 'saved' so that contribution amount could be shown. In Muthigarahalli, 50 per cent of the farmers reported that the treatment was good because the Agricultural Assistant decided to be selectively efficient to ensure good quality of structures located on the roadside so that the supervision by the higher-level authorities would lead to his work being considered as satisfactory. The highest proportion of damages took place in Bommadevarahalli due to the poor quality of the treatment undertaken which to a large extent was undertaken by the contractors, which was a violation of the guidelines.

Fifty per cent of the farmers from Devasamudra and Muthigarahalli stated that the treatment was good (Table 8). This is surprising given that high proportion of the farmers from the same village reported damages to farm bund. Good quality in the boulder check work can be attributed to the predominant decision making in this type of treatment, i.e., request was made by the farmers. Since the farmers themselves requested for boulder checks, they ensured good quality by supervising the work undertaken by the Agricultural Assistant.

Table 8: Farmers perception (%) on the quality of boulder check by villages

Village	Good	Inappropriate place	Poor	Broke	Total
Bommadevarahalli	14	29	24	33	100 (22)
Venkatapura	43	0	57	0	100 (7)
Devasamudra	50	17	17	16	100 (6)
Vittalapura	0	0	0	0	100 (0)
Muthigarahalli	50	0	50	0	100 (2)

Note: Figures in parentheses are actual numbers

4.3.3 Check dam

While 36 per cent stated that the check dams were either of poor quality or were damaged, such an opinion was highest in the tail-end village of Venkatapura. There is evidence to show that in 47 per cent of the cases, the contractors constructed the check dams, in violation of the common guidelines (GOI 1994b) while in 53 per cent of the cases, the work was done by the Agricultural Assistant.

The proportion of contractor constructed check dams was the highest in Bommadevarahalli. In this particular case, the Agricultural Assistant informed that he was under pressure to ensure contribution for the implementation of the World Bank funded watershed project (*Sujala*) in the other villages and this was his priority. The positive benefits of check dams have been limited in nature, due to low rainfall and poor quality of construction.

Table 9: Farmers perception (%) on the quality of check dams

Strata	Good	Average	Poor/ Damaged	Total
Upper Small	50	25	25	100 (4)
Upper Medium	20	0	80	100 (5)
Upper Large	100	0	0	100 (3)
Lower Small	60	20	20	100 (5)
Lower Medium	50	0	50	100 (2)
Lower Large	67	0	33	100 (6)
Total	56 (14)	8 (2)	36 (9)	100 (25)

Note: Figures in parentheses are actual numbers

[1] The information pertaining to Bommadevarahalli is, however, based on the qualifier, that such a perception might not be entirely accurate, as higher damages would have occurred as was evident to the researcher when physical verification of the structures took place, particularly in Bommadevarahalli.

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The benefits pertain to meeting the drinking water needs of livestock and this too was limited to those structures were damages were minimal. A majority of the farmers perceived that the check dam constructed was of good quality (Table 9) and such a perception was more evident in the villages of Bommadevarahalli[3] and Muthigarahalli (Table 10).

Table 10: Farmers perception (%) on the quality of check dams by villages

Village	Good	Average	Poor	Total
Bommadevarahalli	64	9	27	100 (11)
Venkatapura	40	0	60	100 (5)
Devasamudra	50	0	50	100 (4)
Vittalapura	0	0	0	0 (0)
Muthigarahalli	60	20	20	100 (5)

Note: Figures in parentheses are actual numbers

4.4 Adequacy of SWC treatment

About 69 per cent of the small farmers in the upper reach stated that the SWC treatment carried out in their plots was inadequate (Table 11). This proportion was the highest among those farmers who had an acute problem of the presence of stones and boulders in their plots (Table 12). On the whole, farmers having stones and boulders in the plot stated that the treatment was inadequate in nature. Since there was no provision for removal of boulders under the DPAP mode, such a perception can only be expected[4].

Table 11: Farmers perception (%) on adequacy of treatment by farm categories

Strata	Inadequate	Adequate	Total
Upper small	69	31	100 (26)
Upper medium	89	11	100 (26)
Upper large	85	15	100 (20)
Lower small	73	27	100 (34)
Lower medium	77	23	100 (22)
Lower large	91	9	100 (22)

Note: Figures in parentheses are actual numbers

Table 12: Distribution of upper reach farmers (%) by the SWC problem and adequacy of the treatment

Nature of the problem	Small		Medium		Large	
	Adequate	Inadequate	Adequate	Inadequate	Adequate	Inadequate
No problem - flat land	25	75	0	100	29	71
Stones and boulders	0	100	0	100	0	100
Soil erosion and gully formation	26	74	80	20	8	92

Among farmers who had soil erosion and gully formation problem, only 26 per cent of them felt that the treatment undertaken was adequate in nature. Among the farmers in the upper large reach, a greater proportion of the farmers expressed their dissatisfaction with the treatment undertaken in their plot. This proportion was the highest among those farmers who were having stones and boulders in their plots, followed by farmers with soil erosion and gully formation problems (Table 12). As far as the lower reach is concerned, the inadequacy of treatment was reported mostly in the larger farmers (Table 13).

[4]However we found that in Muthigarahalli certain farmers belonging to the *Lingayat* community without authorization used the earth moving equipment to remove the boulders from the plot.

Table 13: Distribution of lower reach farmers (%) by the SWC problem and adequacy of the treatment

Nature of the problem	Small		Medium		Large	
	Adequate	Inadequate	Adequate	Inadequate	Adequate	Inadequate
No problem - flat land	25	75	0	100	0	100
Stones and boulders	0	100	25	75	9	91
Soil erosion and gully formation	32	68	23	77	9	91

The reason for the high levels of dissatisfaction with the SWC treatment is due to two inter-related factors. First, the quantum of investment in terms of the per hectare was low (Rs. 4,000 per ha) and this amount effectively got reduced further due to the various compromises undertaken by the Agricultural assistant to show that the contribution was made by the farmers, while in reality no contribution was made. Second reason was that DPAP resources were thinly spread over a large area. This led to a lesser quantum of work getting done in a plot as compared to the variety SWC problems that land holdings of larger size might have.

4.5 Farmers Response to the Inadequate Treatment

The above discussion shows that SWC works were not adequate in a number of cases. How did farmers react to this? About 91 per cent of the farmers did not complain to the staff that the treatment was unsatisfactory (Table 14). Since there was no financial contribution from the farmers, their stake in the intervention was low and there was less interest in taking up maintenance activities. While only 4 per cent of the farmers complained about the inadequate nature of the work, a significant proportion of the larger farmers in the upper reach took the initiative to complain to the staff. Another perception that prevailed among the farmers was that, even if they had complained, there would be no initiative by the government staff to rectify the damage caused. The disenchantment with the SWC treatment resulted in some of the larger farmers to pick-up fights with the contractor. The farmers who took the initiative in terms of taking corrective measures in terms of investing money and labour for additional treatment work were only a minority in the upper reach. In Bommadevarahalli some farmers not only complained about the poor treatment but also picked up a fight with the contractors (Table 15). In contrast, nobody from Vittalapura bothered to complain to the staff. This was due to the disenchantment with the treatment process in the village, since there was contestation about the treatment process (as the farmers wanted to treat their land first before anybody else) fearing that the funds would get exhausted before their land got treated.

Table 14: Farmers response (%) to the poor quality treatment

Strata	Did not complain	Complained	Will not repair it	Fought with the contractor	Did additional treatment	Total
Upper Small	87	0	7	0	6	100 (15)
Upper Medium	89	6	0	0	5	100 (17)
Upper Large	72	18	0	10	0	100 (11)
Lower Small	96	4	0	0	0	100 (25)
Lower Medium	100	0	0	0	0	100 (14)
Lower Large	94	0	0	6	0	100 (16)
Total	91 (88)	4 (4)	1 (1)	2 (3)	2 (2)	100 (98)

Note: Figures in parentheses are actual numbers

While the farmers were largely passive in the planning process, some of them did express either disenchantment with the process or took corrective action on their own. What

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was the response of the programme to repair the damaged structures? This question becomes relevant because the WDC is supposed to build up watershed fund through contributions to facilitate the operations and maintenance work. The discussion in the study villages revealed that although such a fund did exist but no utilisation of this fund was made. Majority of the farmers (88 per cent) chose to ignore the damage to structures (Table 16). None of the farmers from the lower reach invested either labour or money to rectify the damages.

Table 15: Farmers response (%) to the inadequate treatment

Village	Did not complain to staff	Complained to staff	Will not repair it	Fought with the contractor	Did additional treatment	Total
Bommadevarahalli	71	6	6	12	5	100 (17)
Venkatapura	92	8	0	0	0	100 (13)
Devasamudra	90	5	0	0	5	100 (19)
Vittalapura	100	0	0	0	0	100 (20)
Muthigarahalli	97	3	0	0	0	100 (29)

Note: Figures in parentheses are actual numbers

Table 16: Farmers response (%) to the damage of the structures

Strata	No repair done	Labour invested	Money invested	Total
Upper small	88	6	6	100 (16)
Upper medium	82	18	0	100 (17)
Upper large	91	0	9	100 (11)
Lower small	100	0	0	100 (24)
Lower medium	100	0	0	100 (14)
Lower large	100	0	0	100 (14)
All	88 (92)	6 (4)	6 (2)	100 (98)

Note: Figures in parentheses are actual numbers

The evidence from our study villages across the various SWC treatments has revealed that farmers have expressed dissatisfaction with the quality of the treatment. However, there was selective efficiency with the Agricultural Assistant ensuring that the structures constructed in the roadside agricultural plots were of better quality. This was to ensure that when the district level authorities visited the sites for inspection, they were satisfied with the quality of the work. The Agricultural Assistant was well aware that such an inspection, took place in structures located in close proximity to the village road.

We found that that the outcomes in terms of crop productivity, livestock assets and migration have been poor during the post project year largely due to poor rainfall since the implementation of the project. A detailed discussion is beyond the scope of this paper and the findings are available in a recent contribution (Vadivelu 2017).

5. CONCLUSION

Our evidence points out that in the dry lands were returns are uncertain, there are huge challenges in motivating farmers to work towards ensuring investments to ensure long term benefits as they are more interested in maximising short term gains. The subsidy driven approach towards investment in SWC treatment is a necessary but not sufficient condition to induce interest among farm households. The behaviour of individuals is based on the rewards that are available for certain behaviour vis-à-vis penalties that could be potentially imposed for various forms of violations. The behaviour of most of the DPAP farmers was based on their perception that they did not stand to gain from the intervention and therefore chose not to get involved in the processes. This they could afford to do so as there were no conditionality's imposed on them. Since there was poor participation of the farmers in planning and implementing the SWC treatments, they also show interest in supervising to ensure that good quality of treatment took place in their land. Therefore 91 per cent of the farmers did not complain to the staff that the treatment was unsatisfactory. Only by ensuring a greater contribution (in terms of cash or labour or both), would the farmers take an active interest in planning, implementing and supervising the SWC treatment in their land. An arena for further research is to estimate the returns from each of the Soil Water and Conservation structures extending upon the contribution of Shah (2005) so that we can obtain more accurate estimates of the returns that accrue from each SWC treatment. This would provide a more accurate ground for the practitioners to negotiate with the communities about cost-sharing norms.

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