



Impact Assessment of Watershed Works on Socio - Economical Development in Mutukula Watershed, Prakasam District

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ABSTRACT

Participatory integrated watershed management programme approach demonstrated on Mutukula watershed at Pullalacheruvu Mandal in Prakasam District of Andhra Pradesh State. The sampling frame of study consists of 270 farmers, out of which 83 sample farmers were interviewed. The study focused on population details, live stock details, crops and cropping pattern, change in ground water status, change in land use, cropping intensity and watershed brought under cultivation, change in crops productivity, major sources of household income, and change in migration status, claiming success. Watershed development and management is the only mean to control degradation of land, conserve much water and improve the productivity and production. The study revealed that the gross cropped area and cropping intensity increases in the watersheds. It was further observed that income generated from the agriculture has increased many folds and migration from the watershed has reduced tremendously to zero in all villages. It was concluded that participatory watershed management programmes like IWMP led improvement of the socio-economic status of the stakeholders in the watershed.

Key words: DWMA, Ground water, IWMP, Socio-economic, Questionnaire, Watersheds.

Watershed development programme is aimed at improving the productivity, production through water harvest, resource conservation and pasture development. It is also emphasized that the benefits of watershed development programme are manifold (Ningareddy *et al.*, 2006). The quantifiable employment and the resultant food availability are good indicators of watershed development programme. Indian Agriculture is primarily rain dependent. Rain is the only source of water for dry land crops. Rain fed agriculture supports 40 per cent of human population contributing 44 per cent to the total food production (Pendke *et al.*, 2000). The treatment to stabilize and to enhance productivity in dry land agriculture depends upon conservation of rain water. In rain fed agriculture, watershed programme is the only solution to meet the accelerating demand of food grain and other agriculture commodities. A large portion of the rain fed areas in India is characterized by low productivity, high risk and uncertainty, low level of technology change and vulnerability to degradation of natural resources (Satishkumar and Tevari, 2013).

A watershed is commonly defined as an area in which all water drains to a common point (Aher and Pawar, 2013). From a hydrological perspective, a watershed is a useful unit of operation and analysis because it facilitates a systems approach to land and water use in interconnected upstream and downstream areas. Watershed projects aim to maximize the quantity of water available for crops, livestock and human consumption through *situ* soil and moisture conservation, infiltration into aquifers, and safe runoff into surface ponds. Integrated Wasteland Development Programme (IWDP) was introduced during 1992 with 100% Central assistance. The measures IWDP make afforestation and soil & moisture conservation in waste lands under Government or community or private control as its predominant activity, without much focus on saturation of complete micro watershed and participation of people. Hence taking the concern of huge investments, Government of India allocating for watershed development programme in the five year plans, it is felt highly essential to work on impact assessment studies on this developed

watersheds using advanced tools such as RS and GIS for operational convenience it is proposed to take up studies in nearby watersheds where such focus is being carried out by District Water Management Agency (DWMA).

Prakasam district, Andhra Pradesh is selected the present study. There are two reasons to select the district. The district is having not only huge area under rain fed and rainfall is scarce and erratic, but also having more number of watershed programmes. Secondly, it is one of the few districts not only in Andhra Pradesh, but also in the country where a number of watershed programmes have been launched in the rain-fed areas (Prabhakar *et al.*, 2010).

The Mutukula watershed area with an extent of 51 km² lies in Pullalacheruvu Mandal, Prakasam District in Andhra Pradesh. This area is located between 16°10'45.4" to 16°16'52.9" Northern latitude and 79°20'53.5" to 79°33'28.2" Eastern longitude, with average elevation ranging 620 m above MSL (Mean Sea Level). The watershed receives average annual rainfall of 600.2 mm, the minimum and maximum temperature is in range of 25°C to 45°C. The central portion of the district contains large tracts of low shrubs and Jungle diversified with rocky hills and stony plains, which is a peculiar feature of the District.

The present study was conducted with an objective to assess the impact of watershed works on socio-economical development, for Mutukula watershed, Prakasam (District) in Andhra Pradesh.

MATERIAL AND METHODS

The main purpose of characterization of socio-economic systems in the watersheds is to identify existing and potential production constraints, and propose potential areas for targeting technology transfer for sustainable development (Anantha *et al.*, 2003). It requires huge information from a number of sources, published, unpublished and micro level field investigation. Identification of appropriate indicators may provide an opportunity for better implementation and monitoring of watershed development programs.

There are number of methods available to collect data for an enquiry. However, care should be taken to avoid error caused by multiple methods. The population of the study was taken in irrigated

areas of the IWMP project of Mutukula mega watershed in Pullalacheruvu Mandal, Prakasam district. The watershed further divided into five sub watersheds Murrivemula, Beerunenipalli, Tellagala, Chowtapalli and Satakodu. Villages were categorized on basis of access to water resources and soil profiles. These five villages were selected purposively representing bore well water availability and if any rain fed agriculture as selection criteria. A list frame was developed to select sample farmers using variables like number of household, family size, livestock population, size of land holding and education etc. Sample size was finally decided on the basis of number of household in a village and cultivated area owned.

A comprehensive questionnaire was designed to gather data on socio-economic characteristics including profile of village institutions and total agricultural land, demographic conditions availability of basic facilities, land and land use pattern, agriculture production, farm machinery, soil type, water resources, crops, crop duration, cropping system and yield, live stock details, household income, wage employment, rangelands utilization, marketing facilities and labor use etc. The questionnaire was thoroughly examined and discussed with other stake holders of project like CRIDA (Central Research Institute for Dry land Agriculture) for further improvements needed to obtain the required information regarding the study.

Through informal survey, based on title and in the light of objectives of study the questionnaire covering important aspects of output and input costs components was prepared and was tested in field for accuracy. During pre-testing there was observed some flaws and complications in questionnaire, those was removed in final questionnaire. Then formal survey was conducted. The collected data (year 2014-2015) was compared with the base line data (2009) which was also collected through various sources including primary and secondary data sources for assess the impact of watershed programmes on socio-economic development in the study area.

Secondary data is collected from District Water Management Agency, Ongole Mandal Development Office, Pullalacheruvu village and other government agencies about general characteristics of Pullalacheruvu Mandal. Primary

Table 1. Details of respondents for survey in Mutukula watershed.

S.No.	Village	Interviewed	Percentage (%)
1	Marrivemula	15	18.07
2	Beerunenipalli	15	18.07
3	Thellagatla	23	27.70
4	Chowtapalli	15	18.07
5	Satakodu	15	18.07

Table 2. Details of Population in Mutukula Watershed.

S.No.	Feature	Male	Female	Total
1	Population			
	SC	1779	1530	3309
	ST	187	176	363
	BC	1692	1544	3236
	Others OC	2838	2180	5018
2	Children (14years)	696	567	1263
3	Gender Ratio	200	295	495
4	Literacy			
	Literates	1638	1153	2791
	Illiterates	4990	3441	8431
5	Work Force			
	Agriculture	1372	1185	2557
	Industrial	-	-	-
	Service	2845	1965	4810

information was obtained from selected farmers, through personal interviewing using structured questionnaire. The sampling frame of study consists of 270 farmers, out of which 83 sample farmers were interviewed, and bore wells are the source irrigation in watershed study area, as enlisted in Table 1.

RESULTS AND DISCUSSIONS

The Mutukula watershed is further divided into five sub watersheds. The sub watersheds wise area is depicted in Figure 1. Beerunenipalli watershed have the highest area 1222 ha, and followed by Thellagatla 1192 ha, Chowtapalli 1120 ha, Marrivemula 936 ha, and Satakodu 627 ha. The entire Mutukula watershed has the 5100 ha of total area.

The target village consists of all categories of communities and other communities take the huge part in the village with the population of 5018

and followed by SC and BC population 3309 and 3236 respectively. It is observed that there are only 363 ST population in the villages, and also Children, Gender Ratio, Literacy, Work Force, are in Table 2.

Most of the families are engaged in the agriculture and it is observed that they are dependent on the agriculture. Others engaged in various work force like industrial and service oriented. Literacy rate is low in the cluster and it has to be focused, in Figure 2. The major crop that is grown in Kharif season in the project area Chillies which is around 1233.1 ha, followed by Red gram and Cotton with an extent of 1124.2 ha and 1082.9 ha, respectively, and Jowar also practiced in the project area. In Rabi season the main crop is Red gram which is around 463.9 ha, followed by Paddy cultivated around 374.4 ha, Jowar, Chillies, Ragi are placed next. In summer season Paddy and tobacco crops are cultivated in 131.5 ha and 192.3 ha, (Table 3.). Crops cost details for Prakasam District as per (2013-2014 prices).

Table 3. Details of Crops production and productivity.

Season	Crops sown	Area (ha)	Production (t yr ⁻¹)	Productivity (t ha ⁻¹)
Kharif	Cotton	1082.9	640	0.59
	Chillies	1233.1	2050	1.66
	Red gram	1124.2	109	0.09
	Jowar	272.0	160	0.58
Rabi	Jowar	141.7	800	5.64
	Chillies	164.3	420	2.55
	Ragi	121.4	120	0.98
	Red gram	463.9	3	0.006
	Paddy	374.4	7	0.01
Summer	Paddy	131.5	4	0.03
	Tobacco	192.3	86	0.44

Table 4. Change in land use and wastelands brought under cultivation.

Particulars	Marrivemula		Beerunenipalli		Thellagatla		Chowtapalli		Satakodu	
	Base line	Current	Base line	Current	Base line	Current	Base line	Current	Base line	Current
Net sown area (ha)	20.8	34.6	33.2	47.2	47.7	72.6	27	42	24.8	43.6
Gross cropped area (ha)	21.2	38.2	34	50.4	48.4	76.6	28	46	26.8	46.4
Cropping intensity (%)	102	110	102	106	101	105	103	109	108	106
Irrigation area brought under cultivation (ha)	3.7	18.4	20.2	27.7	31.2	41.1	25.2	29.2	21.7	39.4

Figure 1. Area wise sub Watersheds in Mutukula watershed

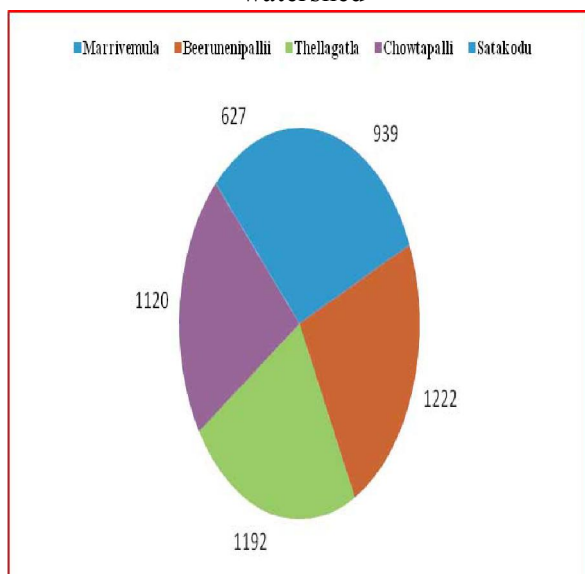


Figure 2. Population details of Mutukula watershed

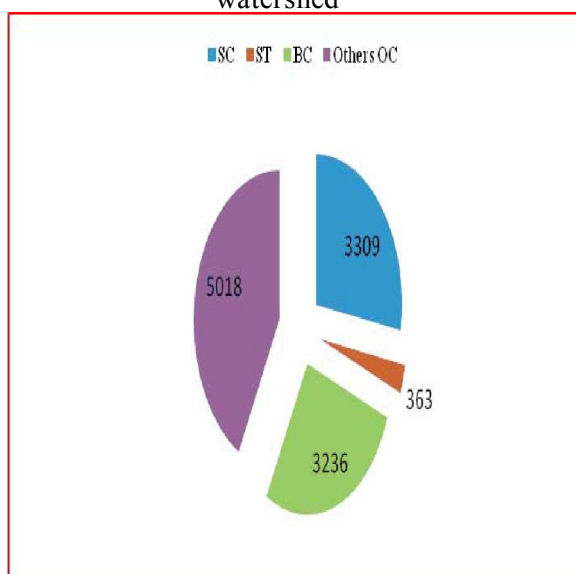


Figure 3. Change in land use and wastelands brought under cultivation.

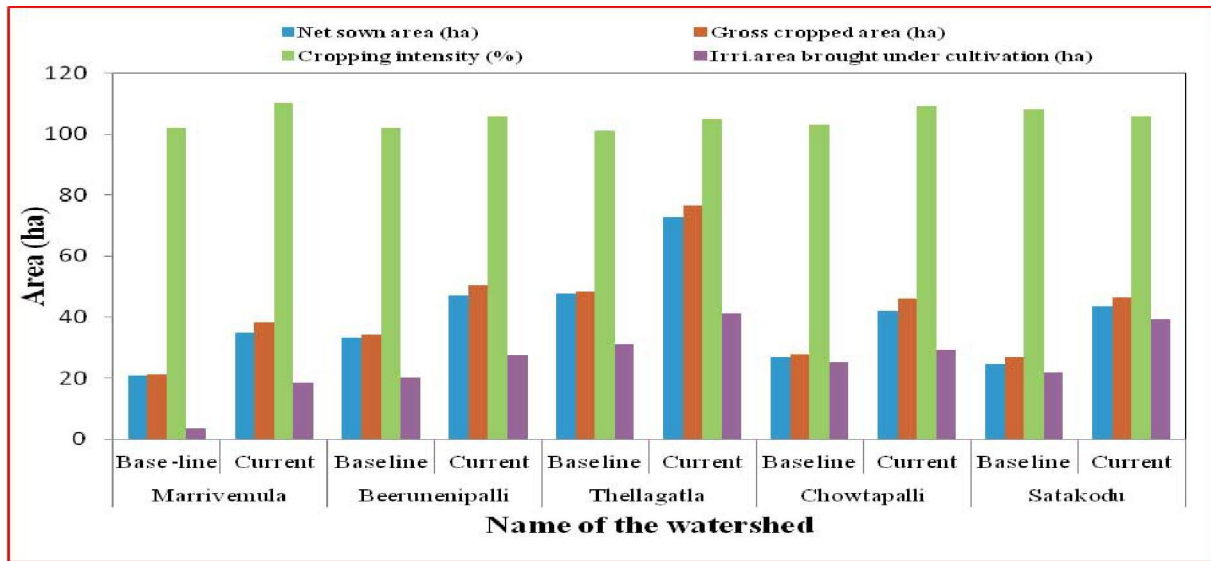


Figure 4. Impact of watershed interventions on crop productivity.

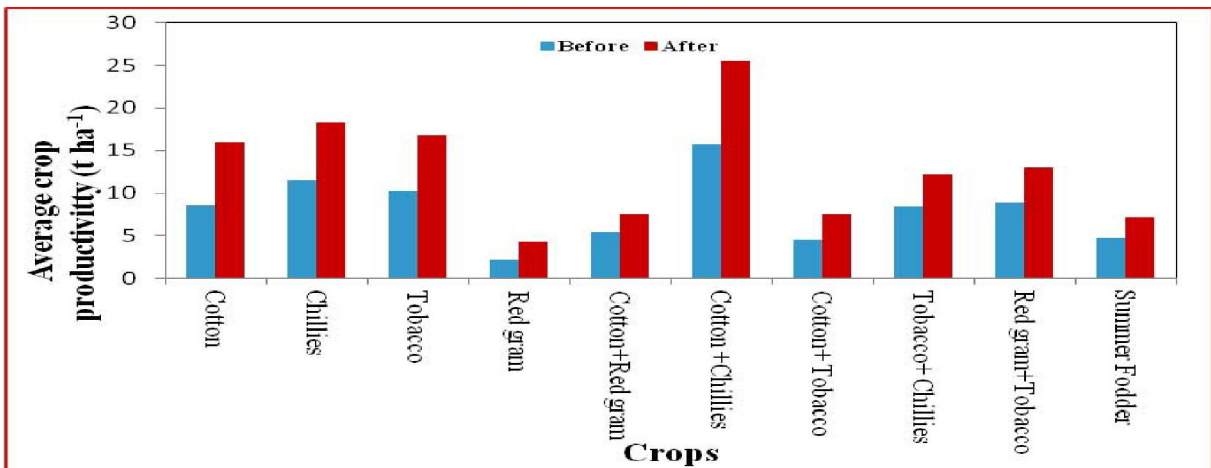


Figure 5. Change in total household income (Rs./ Year at 2013-14 prices)

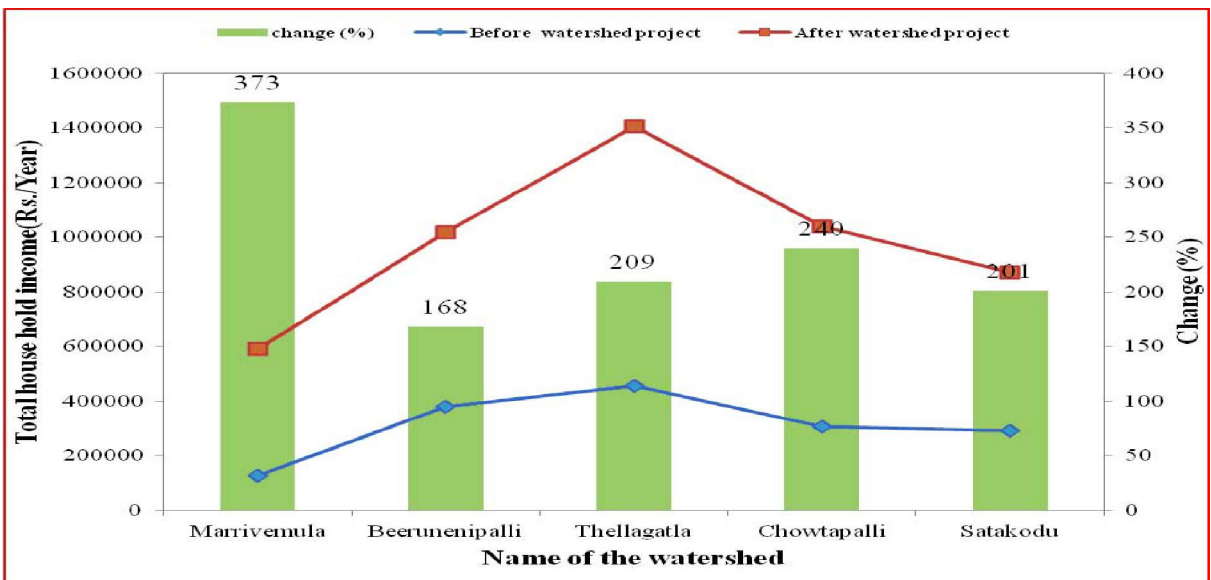
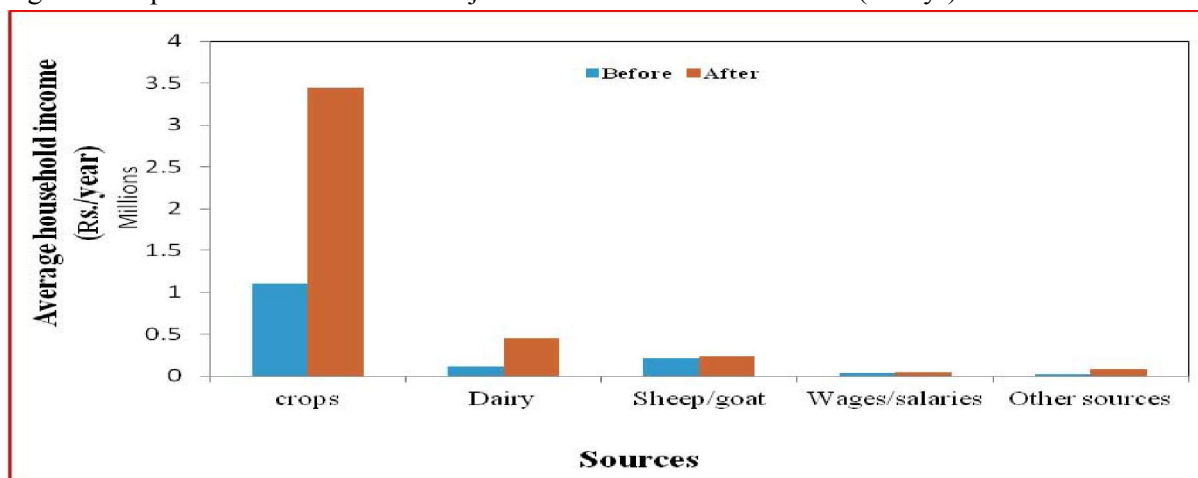


Figure 6. Impact of interventions on major sources of household income (Rs. /yr).



Highest production was observed in Chillies with productivity of 1.66 t ha^{-1} followed by Cotton 0.59 t ha^{-1} , in Kharif season. In Rabi season Jowar recorded highest productivity 5.64 t ha^{-1} , followed by Chillies 2.55 t ha^{-1} . Tobacco crop was the best option in summer which recorded productivity 0.44 t ha^{-1} . Tobacco farming is the profitable compared with the other crops, moreover, tobacco is having good market support in Prakasm District.

The net sown area in the Marrivemula, Beerunenipalli, Thellagatla, Chowtapalli and Satakodu sub watersheds increased mainly on account of bringing cultivable wastelands in to cultivation. The gross cropped area and cropping intensity increased in all the five watersheds by taking up two crops (Kharif and Rabi) from the same piece of lands (Table 4.). There is significant growth in net sown area and cropping intensity which indicates better water availability which is mainly due to the watershed project (Figure 3.).

It was observed that all the dominant crops productivity increased when compared with the base line data. The percentage change in crop productivities of dominant crops in the five sub watersheds given in (Table 5.). Percentage change of crop productivity in Tobacco, Cotton and Cotton+Chillies were observed as (85%), (83%), and (43%) in Marrivemula sub watershed. Similarly, the crops that registered higher productivity were Cotton (71%) and Red gram+Tobacco (53%) in Beerunenipalli sub watershed. Whereas Red gram (120%) and Cotton (85%) in Thellagatla sub watershed. Whereas Cotton (133%) Cotton+Chillies (128%) and Chillies (125%) were major gainers in Chowtapalli sub watershed and Chillies and Cotton+Tobacco (85%) and Cotton

(75%) in Satakodu sub watershed. Higher productivity of the crops obtained is attributed mainly due to the impact of watershed programme, (Figure 4.).

Among the five sub watersheds, the real income change was higher in Marrivemula (373%) and Chowtapalli (240%) sub watersheds (Table 6.), followed by and Thellagatla (209%), Satakodu (201%) and Beerunenipalli (168%) sub watersheds (Figure 5.).

Livestock forms an important part of the livelihoods of the rural poor in this sub watersheds particularly among the landless, small and marginal farmers and women are in Table 7.

It was observed that there were 26,518 livestock's of which sheep population accounts for 11,924. This was followed by Poultry (5955), Ox (675), Buffaloes (2755), Cows (520), He buffalo (119), and Goats (4570) and piggery (275). It is observed that milch animals occupied major share and which enables farmers to get alternative source of income. It may be alternate livelihood for many of the families and for some it may be the primary livelihood. It is observed that the fodder availability is not sufficient in the target area and both green & dry grass is not available in the area, the villagers are equally interested in sheep rearing and cattle rearing. Total milk production is 9497 liters from these watersheds.

It is observed that the highest change in household income due to cultivation of crops registered in Satakodu (402%) followed by Marrivemula (244%) sub watersheds. Sheep and Goat rearing registered Marrivemula (28%) and Beerunenipalli (20%) sub watersheds (Table 8.). Dairy as an enterprise has also resulted in

Table 5. Impact of watershed interventions on crop productivity (t ha⁻¹).

S.No.	Name of the Crop	Marrivemula	Beerunenipalli	Thellagatla	Chowtapalli	Satakodu
1	Cotton					
	Before	1.5	1.75	1.75	1.5	2
	After	2.75	3	3.25	3.51	3.5
	% Change	83	71	85	33	75
2	Chillies					
	Before	2.75	2.5	2.5	2	1.75
	After	3.25	3.5	3.75	4.51	3.25
	% Change	18	40	50	25	85
3	Tobacco					
	Before	1.75	2.25	2	2.25	2
	After	3.25	3.25	3.25	3.75	3.25
	% Change	85	44	62	66	62
4	Red gram					
	Before	-	1	1.25	-	-
	After	-	1.5	2.75	-	-
	% Change	-	50	120	-	-
5	Cotton+Red gram					
	Before	-	-	-	3.75	1.75
	After	-	-	-	5.25	2.25
	% Change	-	-	-	40	28
6	Cotton +Chillies					
	Before	4	4.75	3.5	3.58	-
	After	5.75	6.5	5.25	1	-
	% Change	43	36	50	28	-
7	Cotton+ Tobacco					
	Before	-	-	-	2.75	1.75
	After	-	-	-	4.25	3.25
	% Change	-	-	-	54	85
8	Tobacco+ Chillies					
	Before	-	4.25	4.25	-	-
	After	-	6.25	6	-	-
	% Change	-	47	41	-	-
9	Red gram +Tobacco					
	Before	-	-	-	-	-
	After	-	3.25	34.7	-	2.75
	% Change	-	5	5	-	3.25
10	Summer Fodder					
	Before	-	53	58	-	18
	After	-	1.75	0.75	2.25	-
	% Change	-	2.25	1.25	3.75	-
			28	66	66	

improvement of the household income in the five sub watersheds. Satakodu (488%) in the income obtained from dairy followed by Marrivemula (456%) Thellagatla (199%) Beerunenipalli (169%) and Satakodu (117%) sub watersheds. The change in household income from wages accrued was the highest in both the Thellagatla and Satakodu (67%) followed by Chowtapalli (53%) Marrivemula (36%) and Beerunenipalli (19%) sub watersheds, (Figure 6.).

The extent of migration has reduced in all the four sub watersheds. However, the level of reduction is (100%) *i.e.* virtually reduced in Marrivemula (100%) followed by Beerunenipalli (100%), Thellagatla (100%) and Chowtapalli (100%) sub watersheds (Table 9.). There has been no migration in Satakodu sub watershed before and after watershed project.

Table 6. Change in total household income (Rs./ Year at 2013-14 prices)

Year/ Period	Marrivemula	Beerunenipalli	Thellagatla	Chowtapalli	Satakodu
Before watershed project	124733	379633	454483	304687	289100
After watershed project	590133	1018133	1406183	1038700	869408
Change (%)	373	168	209	240	201

Table 7. Details of Livestock in Mutukula Watershed.

S.No.	Feature	Quantity (No.)
1	Milch Animals	
	Cows	520
	Buffaloes	2755
	Sheep	11924
	Goat	4570
2	Draught Animals	
	Ox	675
	He Buffalo	119
3	Others	
	Poultry	5955
	Piggery	275
4	Total Milk production (liters/day)	9497
5	Fodder (tons)	12418
	Dry	12805
	Green	3805
6	Fuel wood(tons)	10220

CONCLUSION

The present study concluded that participatory watershed management programmes like IWMP led to the improvement of the socio-economic status of the stakeholders in the watershed. Additional area brought under cultivation due to watershed works and increase in water availability. It was concluded that there was significant increase in crop productivity and cropping intensity in the watershed. It was further concluded that income generated from agriculture was increased many folds and migration from the watershed has reduced tremendously to zero in all the villages served.

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Table 8. Impact of interventions on major sources of household income (Rs. / Year)

S.No. Source	Marrivemula	Beerunenipalli	Thellagatla	Chowtapalli	Satakodu
1 Crops					
Before	120683	282600	321625	216735	163026
After	414758	785150	832208	589833	818916
% change	244	177	158	172	402
2 Dairy					
Before	7350	24150	26250	17850	37800
After	40916	65100	78716	38800	222600
% change	456	169	199	117	488
3 Sheep / goats					
Before	17500	51500	53333	42166	46966
After	22500	62000	62000	45000	48333
% change	28	20	16	7	3
4 Wages / salaries					
Before	6250	6500	6166	5333	5166
After	8500	7750	10333	8166	8666
% change	36	19	67	53	67
5 Other sources					
Before	4700	4566	4716	4566	4617
After	18600	13700	23150	9250	13975
% change	295	200	390	102	202

Table 9. Change in migration status of Mutukula watershed.

S.No.	Name of sub watershed	% households in migration		
		Before	After	Decrease
1	Marrivemula	38	0	100
2	Beerunenipalli	6	0	100
3	Thellagatla	7	0	100
4	Chowtapalli	22	0	100
5	Satakodu	Nil	Nil	Nil

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