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Under the PMKSY-watershed project-Kurnool-batch-IV projects, natural resource management activities boosted soil and water conservation

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Abstract

Andhra Pradesh has witnessed severe droughts in several places over the past few decades. Insufficient precipitation, groundwater depletion, soil erosion, low agriculture yield and deficiency of fodder are the consequences of the shortage of annual mean rainfall. These have resulted in insufficient livelihoods which lead people migration to other areas for employment. The broad objectives of this research study is to understand the various suitable NRM works to control the soil erosion, protection and conservation of the soil and water in the Batch-IV projects of Kurnool district and to understand how all these structures helped to conserve the natural resources and its impact of change in different parameters. The study also evaluated to assess the impact of the watershed projects on the socio-economic conditions of the people and also on other aspects such as environment, land use, cropping pattern, production & productivity of the crops, changes in water resources availability, etc., in the micro-watershed area.

Keywords: Precipitation, groundwater depletion, soil erosion, production & productivity

Introduction

The present projects under Batch-IV in Kurnool district were initiated during 2012-13 and completed in 2019-20. Kurnool district lies in the northern part of the state of Andhra Pradesh between latitude 14° 54' N to 16° 18' N and longitudes 76° 58' E to 79° 34' E at an average altitude of about 128 m from sea level. Watershed Development under Batch-IV projects is undertaken in 8 mandals through 8 projects. The total area covered under these 8 projects is 34,394 Ha. The whole area is spread over 32 micro-watersheds. These micro-watersheds are having 11,948 households. The watersheds are developed following the guidelines issued by the National Rainfed Area Authority (NRAA) under Ministry of Rural Development, GOI. The action plans thus developed are approved by DWMA and finally by State Level Nodal Agency (SLNA). The programs thus approved are implemented by the Watershed Committees (WC) in partnership with User Groups (UGs) and SHGs facilitated by WDT/PIA. The programme is being implemented in all the 8 watershed projects located in 8 mandals of Kurnool District.

Specific objective of the study

The broad objectives of this research study is to understand the various suitable NRM works to control the soil erosion, protection and conservation of the soil and water in the Batch-IV projects of Kurnool district and to understand how all these structures helped to conserve the natural resources and its impact of change in different parameters.

The study also evaluated to assess the impact of the watershed projects on the socio-economic conditions of the people and also on other aspects such as environment, land use, cropping pattern, production & productivity of the crops, changes in water resources availability, etc., in the micro-watershed area. The specific objectives of the study, as suggested by SLNA, are as follows.

Material and Methods

The Secondary data were collected from PMKSY-watershed project Kurnool district and collected data from project wise of Batch-IV projects of Kurnool pertaining to the Natural Resource Management Works. The data were scrutinized and verified for correctness and consistency.

Simple statistical tools like averages and percentages were used to analyze and interpret the data. The report is presented in the following pages.

Study Area

The IWMP Batch-IV consists of 8 projects in Kurnool

district. The list of the projects along with details of micro-watersheds and villages covered under IWMP Batch-IV in Kurnool are presented in Table 2. The 8 projects located in Kurnool district are located in 8 mandals and sub divided into 32 micro-watersheds

Table 1: Details of Projects Covered under IWMP Batch-IV in Kurnool District

Sl. No.	IWMP Project	Mandal	Net Area Proposed (Ha)	No. of MWS	Population
1	Chippagiri	Chippagiri	4,855	4	10,971
2	Chityala	Krishnagiri	4,640	3	4,347
3	Ganjihalli	Gonegandla	4,479	3	8,323
4	Itikala	Kolimigundla	4,216	4	4,487
5	Nallachelimila	Devanakonda	4,418	4	6,073
6	Nanadavaram	Banaganapalle	4,241	6	5,615
7	Peddakadabur	Peddakadabur	4,845	4	3,145
8	Peddakopperla	Koilakuntla	2,700	4	2,059
Total			34,394	32	45,020

Various activities under Kurnool-Batch-IV projects-Kurnool

Watershed development involves structural and non-structural activities so as to bring changes in ecological variables such as land use, vegetative cover, soil moisture, augmenting groundwater and overall economics. The major activities undertaken as part of PMKSY-watershed project implementation are as given below.

- Organizing soil and water conservation measures in cultivated and degraded lands;
- Afforestation including block and avenue plantation;
- Horticulture development to provide resilience to agricultural income;
- Drainage line treatment with engineering and bio-engineering structures;
- Crop demonstration with improved cultivation practices;
- Repairs, renovation and up-gradation of existing common property assets to obtain sustained benefits from previous public investments; and
- Promotion and propagation of energy conservation devices.
- The expected benefits due to the above indicated activities under the PMKSY-watershed project implementation are:
 - Developing degraded lands and conservation of natural resources
 - Overall socio-economic development;
 - Mitigation of drought; and
 - Poverty alleviation

Importance of NRM activities and significance

Natural resource management is the management of natural resources such as land, water, soil, plants, and animals, with particular focus on how management affects the quality of life for both present and future generations. Natural resource management specifically focuses on a scientific and technical understanding of resources and ecology and the life-supporting capacity of those resources. Natural resource management in a watershed is made up of physical and hydrological natural resources. Management of watershed thus involves the rational utilization of land and water resources for optimum production but with minimum hazards to natural and human resources.

The NRM works are focused on ensuring higher incomes to farmers by improving both the area under cultivation and yield of crops. This is done by improving the productivity of land and increasing the water availability. The major works taken up under NRM include check dam, ponds, renovation of traditional water bodies, land development, field funds, field channels, plantations, contour trenches and so on for the development of the community.

Impact of NRM works on various aspects of environment

The study found increase in productivity, incomes, fodder availability, acreage, and even rise in water table on account of the NRM works. The impact of NRM works can be observed in changes in water resources and recharge of groundwater table through conservative measures like dug out open wells and bore wells. Changes in crops and cropping pattern occurred through changing land use and climatic conditions by introducing new crops accordingly. This brings latest changes in the agricultural pattern in the specific regions especially changes in the production values which have impact on the household income level. Milk based production and productivity through the watershed interventions at various levels. These have implemented by involving people with creating assets through capacity building trainings.

The table-2 describes explain about the details of NRM works undertaken as part of the PMKSY-watershed project programme in Batch-IV projects in Kurnool district, the number of works proposed, name of the work, estimated cost of the works, number of works completed, and the total expenditure incurred.

Land development works such as Boulder removal with machinery (for other farmers) Boulder removal with machinery (for SC/ST farmers), NADEP Compost pit, Compost pit Generation, Threshing Floor in community lands works were carried in all batch-IV projects. All of these works were done on dry lands that were turned into cultivable land after the work was done, and farmers began to cultivate various crops on their lands.

Soil moisture conservation works such as staggered trenches, staggered trenches (EGS), staggered trenches (hillock areas), water absorption trench at foot hills, loose boulder structure.

Table 2: NRM Works in Batch- IV Projects in Kurnool District

S. No	Name of the Activity	IWMP				EGS				Total			
		Admin Sanction		Expenditure		Admin Sanction		Expenditure		Admin Sanction		Expenditure	
		Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin	Phy	Fin
Land Development Works													
1	Boulder removal with machinery (for other farmers)	69	8.26	25	2.34	0	0	0	0	69	8.26	25	2.34
2	Boulder removal with machinery (for SC/ST farmers)	12	1.44	7	0.67	0	0	0	0	12	1.44	7	0.67
3	NADEP Compost pit	274	31.13	274	26.98	162	18.1	162	13.75	436	49.23	436	40.73
4	Compost pit Generation	11	1.2	11	0.3	0	0	0	0	11	1.2	11	0.3
5	Threshing Floor in community lands	32	51.61	26	32.48	0	0	0	0	32	51.61	26	32.48
6	Sub total	398	93.64	343	62.77	162	18.1	162	13.75	560	111.74	505	76.52
Soil Moisture Conservation Works													
7	Staggered Trenches	1	25.77	1	0.39	2	4.52	2	3.11	3	30.29	3	3.5
8	Staggered Trenches(EGS)	0	0	0	0	0	0	0	0	0	0	0	0
9	Staggered Trenches(Hillock Areas)	6	17.72	6	3.63	0	0	0	0	6	17.72	6	3.63
10	Water Absorption Trench at Foot Hills	7	3.32	7	1.89	0	0	0	0	7	3.32	7	1.89
11	Loose Boulder Structure	380	52.05	357	30.5	0	0	0	0	380	52.05	357	30.5
12	Rock Fill Dam	129	54.69	124	24.69	0	0	0	0	129	54.69	124	24.69
13	Gabion SMC	84	115.06	42	24.62	0	0	0	0	84	115.06	42	24.62
14	Earthen Bunding With Plantation	12	5.86	12	1.7	0	0	0	0	12	5.86	12	1.7
15	Staggered Trenches(Hillock Areas) 2018-19	1	5.34	1	1.37	0	0	0	0	1	5.34	1	1.37
	Sub total	620	279.81	550	88.79	2	4.52	2	3.11	622	284.33	552	91.9
Water Harvesting Structures													
16	Farm Pond	136	296.13	136	69.64	1892	3770.83	1819	1089.42	2028	4066.96	1955	1159.06
17	Mini Percolation Tank	3	4.05	0	0	0	0	0	0	3	4.05	0	0
18	Dugout Pond	205	390.74	205	103.87	661	1608.54	657	306.75	866	1999.28	862	410.62
19	Percolation Tank	49	403.31	35	166.44	0	0	0	0	49	403.31	35	166.44
20	Check Wall	73	116.57	33	31.43	0	0	0	0	73	116.57	33	31.43
21	Check Dam	378	1841.25	299	1076.94	0	0	0	0	378	1841.25	299	1076.94
22	Gabion WHS	16	23.77	14	12.64	0	0	0	0	16	23.77	14	12.64
23	Surface Storage Pond	81	47.07	31	12.6	0	0	0	0	81	47.07	31	12.6
24	Canal Drop	0	0	0	0	0	0	0	0	0	0	0	0
25	Dugout Pond for Injection well	13	17.72	9	6.75	0	0	0	0	13	17.72	9	6.75
	Farm Pond with Machine	0	0	0	0	0	0	0	0	0	0	0	0
26	WHS Others	4	2.59	3	1.64	0	0	0	0	4	2.59	3	1.64
27	Road Formation Around the Hill	0	0	0	0	0	0	0	0	0	0	0	0
28	Percolation Pond/Tank	0	0	0	0	0	0	0	0	0	0	0	0
29	Machine Farm Pond with Farm Bund	761	810.69	442	317.43	0	0	0	0	761	810.69	442	317.43
30	Injection well to harvest the runoff from field catchment in Water Bodies(in New Dugout Ponds)Type II Single Injection Well	13	7.77	10	2.53	0	0	0	0	13	7.77	10	2.53
	Sub total	1732	3961.66	1217	1801.91	2553	5379.37	2476	1396.17	4285	9341.03	3693	3198.08
Repairs To Existing Whs													
31	Repairs to Existing Check Dam	51	83.1	51	52.82	53	84	53	54.81	104	167.1	104	107.63
32	Repairs to Existing Check Wall	6	6.16	6	3.56	2	2.02	2	1.61	8	8.18	8	5.17
33	Repairs to Existing Mini Percolation Tank	0	0	0	0	0	0	0	0	0	0	0	0
34	Sub total	57	89.26	57	56.38	55	86.02	55	56.42	112	175.28	112	112.8
Afforestation Works													
35	Avenue Plantation	27	214.08	27	48.4	3	24.65	3	10.02	30	238.73	30	58.42
36	Bund Plantation	83	12.42	83	2.82	0	0	0	0	83	12.42	83	2.82
37	Greening of Hillocks	0	0	0	4.59	6	84.42	6	11.32	6	84.42	6	15.91
38	Sub total	110	226.5	110	55.81	9	109.07	9	21.34	119	335.57	119	77.15
Horticulture Works													
39	Dry Land Horticulture (Under EGS)	0	0	0	0	250	867.49	250	218.47	250	867.49	250	218.47
40	Dry Land Horticulture (Under IWMP)	1	1.07	1	0.38	0	0	0	0	1	1.07	1	0.38
41	Horticulture With MIP (Under IWMP)	0	0	0	0	0	0	0	0	0	0	0	0
42	Horticulture With MIP (Under EGS)	0	0	0	0	2	5.06	2	1.41	2	5.06	2	1.41
43	Others	0	0	0	0	0	0	0	0	0	0	0	0
	Sub total	1	1.07	1	0.38	252	872.55	252	219.88	253	873.62	253	220.26
Live Stock Related Works													
44	Raising of Perennial Fodder	19	2.56	19	0.62	10	1.35	10	0.98	29	3.91	29	1.6
45	Cattle Troughs	44	15.77	39	8.8	0	0	0	0	44	15.77	39	8.8
	Sub total	63	18.33	58	9.42	10	1.35	10	0.98	73	19.68	68	10.4
	Grand total	2981	4670.27	2336	2075.46	3044	6471.77	2967	1711.72	6025	11142.04	5303	3787.18

Results and Conclusions

The watershed development programme under PMKSY-watershed project in 8 projects is to develop 34,394 Ha. of land and increase household income levels of main stakeholders from the project areas. Main objective of the programme is to improve agricultural production through conservation of natural resources and their optimum utilization. Throughout the programme period adequate attention has been given to NRM works which are crucial for bringing ecological balance by the interventions of conservative measures. These are mainly comprised of construction of check dams, percolation tanks, farm ponds, machine farm pond with farm bund, dugout ponds, boulder removal, and gabion SMC. Results of these works can be observed in the way changes occurred in the agricultural fields, patterns, production and productivity. Also the necessary arrangements for higher growth in the agricultural production such as ground water table recharge, prevention of erratic climatic conditions by bringing the greening through pitting and plantation, increase supplement incomes through promoting horticulture, improving the individual income through holistic and inclusive growth where bringing various social groups into the watershed programme works and provide them the assets to survive and sustain. These social groups include big, small and marginal farmers, women, gram panchayat, wcc, cluster, mandal, and state level nodal agencies as necessary administrative support systems.

The impact assessment of Batch-IV projects in the Kurnool district is carried out as per the methodology suggested by SLNA. Salient features of the study can be observed in as perceived by the beneficiaries in the study region. However the qualification of exact increase in area, employment and incomes was not carried out in the present research study. In order to analyze these parameters another research studies have to be conducted separately which would focus on the impact assessment of Batch-IV projects.

The implementation of the program has been successful for the conservation of natural resources through the increase in land productivity, the introduction of additional areas for agriculture, horticulture and fodder, the generation of employment and social upliftment of beneficiaries living in rural areas. The major objective of the watershed development is to improve returns from agriculture and allied activities. Hence interventions are aimed to increase area under cultivation as well as irrigation to stabilize economy. The rain fed area is increased by 16% with reduction in fallow and waste lands. The area under irrigation is increased by 200.4% and area under horticulture increased by 210.5%. People started digging new bore wells which increased from 4,29 to 1,045 by the end of the project. Due to the increased number of bore wells and also increased duration of water availability rose up to 6 months.

The increase in productivity for each crop is different and it range from 5.7% to 306.4% for cereals, 15.3% to 45.6 % in oil seeds, 17.4% to 494.2 % in pulses, 15.2% to 104.2% in commercial crops and 9.5% to 128.3% in horticulture. The milk production which was at 3,255 thousand liters increased to 5,504 thousand liters registering a growth of 70.2%. The household income increased in all economic categories by 18.9%, 20.1%, 20.8% and 21.6% in landless, marginal farmers, small farmers and big farmers respectively.

- Increase in the rainfed area and area under irrigation
- Crop productivity improved varying from indifferent crops over the pre-project period

- Increase in production for different crops during end of the project varied from one crop to the other
- Increase in Milk production
- Income of the total household increased considerably by the end of the project

The above analysis clearly establishes that the watershed management and development works ensure conservation of resource resulting in production increase which ultimately leads to economic stability of all the stakeholders.

Case Studies

Table 3: Check dam augmented by groundwater in Kudagurthy

Name of the Project	Chippagiri
Name of the MWS	Kundanagurthi
Batch	IV -2012-13
Name of the work	Check Dam - 1
Work ID	136135304005010335
Expenditure	614645
Survey number	204
Location	Pedda Vanka
Latitude	15°14'49.00"
Longitude	77°18'19.00"

Water is a precious resource in agriculture. Watershed development as the name indicates, aims to conserve rainwater and use it wisely for improving production and thereby the economy in the region. As the rainfall varies across the state, the conservation strategies also vary. While the rainfall intensity varies, the ability to absorb rainfall by the soil has its limitations and is determined by its hydraulic conductivity. One of the successful strategies used in IWMP is increasing opportunity time for rainwater to soak-in and store excess runoff across drainage lines by constructing check dams. This not only improves water availability on Spatio-temporal scales resulting in improved socio-economic conditions but also re-establishes ecological balance. The successes achieved by the stakeholders under different situations are documented as part of monitoring, evaluation and documentation. The case study presented below represents one such.

Kundanagurthi is a small village in the Chippagiri area of Kurnool District. The village is sparsely populated and completely unaware of the need for water. The total extent area of Kundagurthi micro-watershed project is 835 ha. The village was granted a watershed scheme under the 2012-13 IWMP. As part of this, WRP trainings were conducted in the village to create awareness among the villagers on the need for water and water storage works in the watershed scheme. It provided a thorough understanding of farm ponds, check dams, culverts, stone dams, rock dunes and more. It was with this awareness that all the villagers came up with an idea.

The idea was to build a check dam at this bend which is a very wide large bend and deep near the village. Working with watershed officials to look at the area where the work was to be approved and assessed by the officials. The check dam was built within a month of the work started. The check dam was completely filled with water from the early rains. The villagers were overjoyed. Aging rainwater was retained by a check dam. This year, due to the lack of rains, the crops are drying up. Farmers around the check dam had a lightning idea. They used the water from the check dam for their crops to protect their crops. To the farmers of the fields around the

check dam, farmers are proud to say that the rest of the farmers' farms are very different, the crops are also green near the check dam which brings in extra income and also increases the groundwater. According to village elders and

villagers, such check dams can overcome any drought if the village has two or three and the farmers are proud to say that the village itself is grateful for the watershed scheme.



Fig 1: Watershed scheme



Fig 2: NRM activities photos - Kurnool Batch-IV

In this village nearly 9 check dams were constructed during the project period and most of the farmers were able to get benefitted through the check dams which were helped in raising the water table as well as controlled erosion. Initially, they were all feeling helpless as they were not able to save their crops in spite of a perennial stream flowing next to them. Being user group members, after constructing dams with vents which can be closed and kept open depending upon the requirement. The check dam was useful directly to the farmers along the stream and check dam. As a result, increase in yields and net returns especially with construction of Check Dam. It is also found that the ground water recharge increased drastically and the recharge of bore wells increased similarly, all the farmers were happy to have road cum check dam in

this village and thanked the watershed program. All of these check dams not only created a water facility, but also nearly 2531 employment days for wage seekers in the micro watershed.

The farmers got benefitted such as Harizana Naryana, Neelkanta, Dasari Peddaka, Narayana Reddy, Vishunvardhan reddy etc., The farmers in this area started cultivating crops in Khariff and Rabi season and ground water table recharges tremendously at end of the project. The below given table explains about the check dam details in Peddavanka location in Kundanagarthi micro watershed.

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