Print : ISSN 0970-7662

Journal of Tree Sciences
online available at www.ists.in

Volume 28 No.1&2 June and December, 2009

Status of Watershed Works and Its Ecological Impact in Forest Fringe Villages of Mehboobnagar Division, Nothern Dry Zone of Andhra Pradesh

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ABSTRACT

The present investigation was carried out in the Mehboobnagar division of northern dry zone of Andhra Pradesh. In this division three forest ranges were selected and form each range two Vana Samrakshana Samithi (VSSs) were selected to ascertain the status of watershed development works and its ecological impact. Most of the villages' sampled falls under dry zones with an average annual rainfall ranges between 500-660 mm. The various schemes of soil and moisture conservation (SMC) works implemented in the study areas were APFP, APCFM, IWLDP, DPADP, NTFP and MGNREGA. Rock filled dams and mini-percolation tanks are most common SMC structures followed by continuous contour trenches, percolation tanks, check dams and sunken ponds etc., in the sampled areas. Implementations of SMC works had better impact on water sources with higher water yield and thus increased the irrigation potential of bore wells from 1-1.5 to 1.5-3.5 inches in the sampled VSSs. This has lead to a moderate increase in tree density and natural regeneration in the sampled areas after the implementation of SMC works. In almost all villages sampled, before the implementation of SMC works villagers had to travel to a distance of 0.5-3.0 kms to fetch drinking water but, now the drinking water problem is completely solved due to sufficient recharging of ground water resources. Therefore impact is more visible in terms of large quantity of water harvest and enriched greenery around the structures built.

Keywords:

SMC works, VSSs, watershed development, drinking water

INTRODUCTION

The conventional soil conservation approaches and technologies in India were started in the form of public works to control the soil erosion for minimizing the siltation of multipurpose reservoirs. Most of the benefits accrued to down-stream people through canal irrigation. Many state Governments enacted Soil Conservation Acts/Land Improvement Acts and armed themselves with measures to implement soil and water conservation effectively. Water is one of the requirements for both economic development and quality of life yet, water scarcity is becoming epidemic. Conservation of water in the

forestry sectors is essential as water is necessary for the growth of crops and plants. Depleting water table and rise in salinity due to over exploitation of ground water and over use of chemical fertilizers and pesticides is a common scenario in India. Soil and Moisture Conservation (SMC) is crucial in successful implementation of all forestry related programmes and in forming systems especially in drier zones. Sustainable productivity is dependent on soil and moisture conservation activities. Drastic reduction in rainfall and erratic rains, both with respect to intensity and frequency prolonged dry spells, denudation of the tree cover, severe summer coupled with decrease in annual average number of rainy days and decline in ground water table are the compelling factors which have led to major emphasis to SMC works in the afforestation programmes as well. SMC measures are executed to prevent the unchecked flow of rain water which causes soil erosion. The rain water is divided into overland flow, surface flow and sub surface flow. The surface and sub surface flow increases the availability of ground water in different geological formations. SMC measures are needed to increase availability of ground water. The indiscriminate and unscientific soil and water management has rendered a major portion of land erosion prone. The undulating topography with high intensity of rainfall have caused high rate of soil erosion, resulting in the sedimentation of river banks, siltation of drainage channels and irrigation channels around reservoirs (Bhaskar et al. 2007).

Many states have taken-up development of degraded areas under the watershed approach in forest fringe villages. A shift in the approach to watershed development took place in 1995-96 with the adoption of new guidelines formulated by Government of India. The rise in population, growing industrialization and increasing agriculture activities have pushed up the demand for water over the years. Efforts have been made to meet this demand by constructing dams, reservoirs and digging wells. The idea of ground water recharging by harvesting rain water has gained momentum particularly in arid and semi-arid regions of India. Over the years, SMC techniques have been developed primarily in agriculture land, however of late, adoption of SMC measures is made part of afforestation programmes, especially after introduction of Joint Forest Management (JFM) concept. During the earlier plan periods, major emphasis was given to tree planting by contour trenches for water conservation and soil stabilization. During 9th and 10th five-year plans, importance has been given for SMC as a separate component under State, Central and externally aided schemes by fixing percentage of the total sanctioned plantation cost.

In order to achieve the objectives of development in villages, people's participation is essential. It is required to involve them actively in project activities by respecting their traditional knowledge and experience. As a consequence, JFM programme has been implemented from 1993 onwards in various states. Village Forest Committees are engaged in regeneration of degraded forests, enrichment planting, cultural operations, soil and moisture conservation works, raising of multi-purpose plantations etc in JFM areas. In Andhra Pradesh, SMC work was introduced and implemented for the first time in afforestation projects by Andhra Pradesh Forest Development Corporation (APFDC). Since 1993, after implementation of JFM, SMC works have been implemented in degraded forest areas treated on ridge to valley concept.

SMC measures have been carried out and are also in progress under various schemes/ projects like ODA, CIDA, NAP, JBIC and APCFM etc. under the Ninth plan mid term appraisal by Planning Commission (Report of the Technical Committee on DPAP and DDP, Ministry of Rural Development, 1994) on impact of watershed development programme indicated beneficial effects such as increase in ground water recharge as a result of conservation measure. Reduction in soil erosion and run-off losses, lesser siltation effect and reduction in sedimentation at watershed level were observed. These projects have also generated employment and increase in family income but there are no studies yet to assess the impact of SMC works implemented under JFM programmes on water augmentation of the villagers in the forest fringe areas of Mehboobnagar District of northern dry zone of Andhra Pradesh. Hence, the present study was undertaken to assess its impact.

METHODOLOGY

The present study was undertaken in Northern part of Andhra Pradesh State during 2008-09 to assess the impact of watershed development works implemented by various line departments on rural water augmentation of the villagers in the forest fringe areas of Mehboobnagar District of northern dry zone of Andhra Pradesh. From this District, three forest Ranges were selected and from each Range two villages were chosen (Table - 1) and the data were collected as per the pre-structured schedule. Most of the villages' sampled treated under reserve forest with soil type black loamy soil falls under dry zones with an average annual rainfall between 500-660 mm covering S-W monsoon (June-Sept) and N-I monsoon (Sept-Nov) with on an average 80 rainy days with temperature Max (42˚C) and Min (20˚C).

Table 1: Details of sampled sites for the study on status of rainwater harvesting and watershed development for impact assessment in selected watershed villages in the forest fringe areas of Mehboobnagar division northern Andhra Pradesh

Division	Ranges	Name of the VFC/VSS	VSSSchemes
Mehboobnagar	Mehboobnagar	Dachikapally	APFP & APCFM
	Vanaparthy	Ayyawaripally	APFP & APCFM
	Kodangal	Sunkaramadahpally	APCFM
		Jaggaipally	DDD-VI, IWLDP & APCFM
		Chitlapally thanda	IWLDP, MGNREGA, DPADP, NTFP, APFP & APCFM
		Linganpally	DPADP, APFP, APCFM & MGNREGA

APFP - Andhra Pradesh Forest Project, APCFM - Andhra Pradesh Community Forest Management, IWDP - Integrated watershed Development Programme, DPADP - Drought Prone Area Development Programme, MGNREGA - Mahatma Gandhi National Rural Employment Guarantee Assurance Scheme and NTFP - Non-timber Forest Produce

RESULTS AND DISCUSSION

SMC Works Carried Out Under Different Schemes

In Mehaboobnagar division, SMC works are carried out under National Afforestation Programme (NAP) under FDA and JBIC schemes. Some of the other soil and water conservation works were carried out under various schemes viz., Andhra Pradesh Forest Project (APFP), Andhra Pradesh Community Forest Management (APCFM), Integrated watershed Development Programme (IWDP), Drought Prone Area Development Programme (DPADP), Mahatma Gandhi National Rural Employment Guarantee Assurance Scheme (MGNREGA) and Non-timber Forest Produce (NTFP). The main watershed development programmes are: Drought Prone Area Development Programme (DPADP) funded by central and state on 50:50 basis with an objective of drought proofing by taking up of soil and moisture conservation, water harvesting structures, afforestation and horticulture programmes on a comprehensive micro watershed basis. The other schemes are Employment Assurance Scheme (EAS) and Integrated watershed Development Programme (IWDP).

SMC Structures

In Mehboobnagar division, mini-percolation tanks, rock filled dams, continuous contour trench and semi lunar trenches etc., are the common SMC structures built for the conservation of soil and water. Checkdams have been constructed with straight drop spill way at the bottom of down hill to avoid the erosion losses. These straight drop spillways are either had a

concrete basement or filled with stones. Details of SMC works carried out under different schemes in selected forest fringe villages are given in Table-2. In this division, SMC works were implemented under APFP, APCFM, DDD, IWLDP, MGNREGA, DPADP and NTFP schemes. The size of catchment area approximately ranged from 210 ha to 500 ha in most of the forest fringe villages. Rock filled dams (RFDs) followed by Mini-percolation Tanks (PTs) are the most common SMC structures in the sampled VSSs. In general, the SMC structures built under APCFM are mainly continuous contour trenches, percolation tanks and checkdams while under RIDF scheme percolation tanks, checkdams, continuous contour trenches, mini-percolation tanks, are the most common SMC structures. Whereas staggered trenches, continuous contour trenches, percolation tanks built under MGNREGA. However, in recent years, more emphasis is given to percolation tanks irrespective of the schemes. This was done to increase employment for the local villagers by involving them under construction works as construction of PTs requires less skilled manpower compared to CDs. These finding receives support from Janardhana et. al. (2006) where they reported watershed development programmes through ridge to valley concept by catchment area treatment using most common SMC structures such as gully plug, rock fill dams, contour trenching and bunding, check dams, percolation tanks and subsurface dams.

Table 2: Different SMC works carried out for rainwater harvesting and watershed development in selected forest fringe villages of Mehboobnagar division, Andhra Pradesh

SMC structures built									
Range	**Name of the VSS**	**Scheme**	**Catchment area (ha)**	**Type**	**Dimension (ht x length)**	**Nos.**	**Cost**	**Year**	**Approximate volume of water harvested/year (m^3)**
Mehboob nagar	Dechikapally	APFP	-	Borewell	-	1	21,870	1995-96	-
			220	RFD's	1m x 6m	25	51,000	1996-97	2,700
			200	RFD's	1m x 10m	83	1,65,380	1997-98	24,900
			280	RFD's	1.5m x 12m	77	1,53,725	1998-99	41,580
		APCFM	220	RFD's	1.75m x 10m	69	1,39,000	1999-00	36,225
			229.72	CCT	0.5m x 10m	12583 cu.m	5,43,050	2002-03	62,915
			220	Min-PTs	1.5m x 8m	5	11,000	2003-04	1440
			240	RFD's	1m x 8m	7	10,720	2004-05	1344
	Ayyawaripally	APFPAPCFM	220	PT	3m x 25m	2	81,198	2004-05	4500
			228	CD	1.75m x 8m	1	20,000	2004-05	336
			230	RFD	1.5m x 2.5m	50	1,00,000	1998-99	5,625
			240	RFD	1.5m x 2.5m	180	3,50,000	1999-00	20,250
			270	RFD	1.5m x 2.5m	20	50,000	2000-01	2,250
			210	RFD	1.5m x 2.5m	66	1,06,275	2001-02	7,425
			210	RFD	1.5m x 2.5m	57	90,000	2002-03	6,412.5
			245	RFD	1.5m x 2.5m	15	30,100	2003-04	1,687.5
			220	CD	12m x 1.5m	1	5,200	2003-04	540
			242	Sunken pond	1m x 8m	1	2,900	2003-04	288
			258	Mini-PT	1.5m x 12m	7	26,000	2003-04	3,780
	Sunkaramaiahpally	APCFM	243	PT	2.5m x 18m	2	81,000	2004-05	4,050
			280	CD	2.75m x 36m	1	1,70,000	2005-06	5,940
			240	CD	2.5m x 25m	2	1,44,180	2006-07	7,500
			250	CCT	1.5m x 5m	1500 cu.m	75,000	2001-01	3,75,000
Vanaparthy		APCFM	210	TCP	1m x 0.5m x 0.30m	2250 cu.m	60,000	2007-08	11,250
			250	CCT	1.5m x 5m	3000 cu.m	1,50,000	2001-02	15,000
			270	Min-PT	1.5m x 12m	10	31,000	2003-04	5,400

	Jaggaip ally	DDD-VI	290	PT	2.5m x 18m	3	81,560	2004-05	6,075
		IWLDP	240	PT	2.5m x 18m	1	16,800	2007-08	2,025
		APCFM	500	CD	1.5m x 12m	1	50,000	2000-01	540
			-	OHT	-	1	1,00,000	2000-01	-
			-	Borewell	-	1	45,000	1998-99	-
Kodangal			225	Mini-PT	1.5m x 12m	15	28,300	2003-04	8,100
			225	Mini-PT	1.5m x 8m	1	3,299	2004-05	3,600
		IWLDP	225	RFD	2m x 20m	3	66,381	2004-05	3,600
		MGNREGA	258	RFD	1.5m x 25m	1	5,100	2007-08	112.5
	Chitlapally	MGNREGA	238	CD	1.75m x 15m	1	40,000	2001-02	787.5
	thanda	DPADP	225	CD	2m x 12m	1	25,000	2000-01	720
		NTFP	220	PT	2.5m x 125m	1	10,00,000	2008-09	70,312
			280	PT	2.0m x 102m	1	8,00,000	2008-09	45,900
			240	Staggered	2.5m x 0.5m x 0.1m	2400 cu.m	1,25,000	2008-09	1,500
			500	trenches	2.0m x 18m	1	34,000	2002-03	1,620
				PT					
			250	Semi lunar	0.30m x 2m	15,000 cu.m	7,50,000	2004-05	75,000
				trenches					
	Linganpally	APFP	290	RFD	1.75m x 5m	1	15,000	2000-01	183.75
			265	RFD	1.5m x 8m	1	20,000	1999-00	252
			278	PT	1.5m x 15m	2	36,695	2004-05	1,350
			225	RFD	2m x 12m	1	30,000	2004-05	720
		APCFM	-	Borewell	-	1	30,000	2004-05	-
			280	Silt traps &	0.6m x 2.5m	1	2,433	2004-05	112.5
				sunken					
				ponds	2.5m x 20m	2	2,04,700	2006-07	5,100
			275	CD	2.5m x 0.5m x 0.1m	1200 cu.m	30,000	2006-07	6,000
			220	Staggered					
				trench					
		DPADP	500	PT	2m x 25m	2	50,000	1998-99	5,400
			500	Ponds	2.5m x 10m	20	60,000	1998-99	15,000
			500	RFD	1.5m x 10m	2	48,000	1998-99	720
		APFP	251	CD	1.5m x 12m	2	50,000	2002-03	1,080
			220	RFD	1.5m x 15m	1	30,000	2002-03	675
			210	Sunken	0.6m x 2.5m	14	25,418	2003-04	52.5
				ponds					
		APCFM	235	Mini-PT	1m x 8m	2	5,000	2004-05	384
			265	PT	1.5m x 8m	1	14,644	2004-05	288
			298	RFD	2.5m x 18m	1	47,073	2004-08	2,025
			257	CD	2.0 x 8m	2	31,800	2006-07	768
		MGNREGA	220	Staggered	2.5m x 0.5m x 0.10m	1200 cu.m	62,500	2007-08	6,000
				trenches					

PT- Percolation Tank ;PT- Percolation Tank ; CD- Checkdam ;CCT-Continuous Contour Trench ; RFD- Rock Filled Dam;

Impact of SMC works

Ecological Impact

The details of impact of SMC works carried out in selected forest fringe villages of Andhra Pradesh on various ecological parameters are given in Tables-3&4

a) Water Sources

There was increase in the number of borewells and their water yield after the initiation of SMC works in almost all the sampled VSSs of Mehboobnagar division. The water yield of borewells was increased on an average ranges

from 1.5-3.5 inches (Table 3). On the contrary, in Ayyawaripally VSS of this division there was decrease in the water level of open wells after the implementation of SMC works. This may be due to prevalence of drought conditions in the area and also due to installation of higher number of borewells in respective sampled villages. Presently there are no such studies conducted on impact of watershed development works on the livelihood security of the villagers in the Mehboobnagar division of northern dry zone of Andhra Pradesh. Thus, these findings receive support from Agarwal and Narain (1997) where they reported rainwater harvesting by runoff conservation structures (gully plug, rockfill dams, check dam and bench trenching) is basically intended to slow or stop the running water (contour trenching and subsurface dams) and to infiltrate into the underground. Besides this they observed, in drought prone areas rainwater harvesting is undertaken to address the serious problems of drought and water scarcity. Water conservation measures in Wagarwadi watershed, Maharastra, are responsible for raising the water table by about 2 m in the wells located within 200 m on the down-stream side of nala (i.e. stream) bunds and in other wells located adjacent to the water conservation structures. Water conservation structures of Wagarwadi watershed are responsible for groundwater recharge estimated at a rise of 0.5 to 2.5 m of the water table at different locations (Gore et. al. 1995).

b) Increase In Wetlands

There was an increase in the area of wetlands of sampled VSSs in Mehboobnagar division. The increase was directly attributed to increase in the number of borewells with sufficient water yield. After increase in water yield, villagers relied more on borewells, as sufficient quantity of water was available following SMC works in these villages. However, in some of the VSSs due to lack of power supply during summer no crop was taken even though there was sufficient quantity of water available in borewells. Among the sampled VSSs, the major impact was in Linganpally of Kodangal range, which had only 28.35 ha wetlands before the initiation of SMC works; now the village has 76.95 ha of area under wetlands and cultivating two crops in a year. There was an increase in the area under wetlands in all the sampled VSSs and this may be due to either increase in the number of open wells or borewells coupled with increase in water yield by implementing SMC works.

c) Increase In Tree Density And Eco-restoration

A marginal increase in tree density in the reserve forest areas of sampled VSSs was observed due to the impact of SMC works. The increase was a minimum of 15% in Sunkaramaiahpally, Jaggaipally of Vanaparthy range and Kondangal range of Chitlapally thanda and Linganpally VSSs. The increase was a maximum of 30% in Ayyawaripally of Mehboobnagar range (Table–4). The villagers attributed that the increase in tree density to decrease in dependency on forest. Moreover, there was also an increase in the natural regeneration and improvement in green cover wherever SMC structures are built.

SMC structures (runoff conservation structures) such as gully plug, rock fill dams, contour trenching, bunding, check dams, percolation tanks and subsurface dams and structures will enables the slow or stop the running water and infiltrate into the underground and this results into increase in the number of borewells and their water yield, area under cultivation of agricultural crops (wetlands and dryland), number of crops cultivated per year, crop yields, fodder availability and tree density after the initiation of SMC works in almost all the sampled VSSs of Mehboobnagar division was observed due to the impact of SMC works. These finding receives support from Janardhana et al (2006) where they reported watershed development programmes through ridge to valley concept by catchment area treatment in the Swarnamukhi River basin. They reported, positive changes on various ecological parameters such as ground water recharge and land productivity.

Table 3: Impact of SMC works on water resources in selected forest fringe villages of Mehboobnagar division, Andhra Pradesh

Range	Name of the VSS	Before SMC works						After SMC works					
		No. of Bore wells	Water yield (inch)	Depth digging (ft)	No. of open wells	Water level (ft)	Depth digging (ft)	No. of Bore wells	Water yield (inch)	Depth digging (ft)	No. of open wells	Water level (ft)	Depth digging (ft)
Mehboob Nagar	Dachikapally	15	1.5	250	Nil	Nil	Nil	28	2.5	200	7	10.00	90
	Ayyawaripally	25	1.0	275	25	8-10	12	64	2.0-2.5	225-250	57	6-7	90-100
Vanaparthy	Sunkaramaiahpally	15	1.0	250-300	Nil	Nil	Nil	40	1.5-2.0	200	Nil	Nil	Nil
	Jaggaipally	15	1.5	350	Nil	Nil	Nil	25	2.0-3.0	300	Nil	Nil	Nil
Kodangal	Chilapally thanda	10	1.5	250-300	Nil	Nil	Nil	23	3.0	200-250	Nil	Nil	Nil
	Linganpally	20	1-1.5	250-300	Nil	Nil	Nil	60	3.0-3.5	150-200	Nil	Nil	Nil

Table 4: Impact of SMC works on various ecological parameters in selected forest fringe villages of Mehboobnagar division, Andhra Pradesh

Range	Name of the VSS	Before SMC works				After SMC works				
		No. of wells recharged	Dry lands (ha)	Wet lands (ha)	Agro-forestry (ha)	No. of wells recharged	Dry lands (ha)	Wet lands (ha)	Agro-forestry (ha)	Increase in tree density (%)
Mehboob Nagar	Dachikapally	Nil	52.65	20.25	8.10	3	48.60	36.45	16.20	20
	Ayyawaripally	Nil	24.30	8.10	4.05	5	16.20	22.68	10.12	30
Vanaparthy	Sunkaramaiahpally	Nil	295.65	20.25	8.10	5	287.55	40.50	16.20	15
	Jaggaipally	Nil	24.30	16.20	8.10	10	22.27	20.25	18.22	15
Kodangal	Chitlapally thanda	Nil	119.47	16.20	8.90	10	101.25	40.50	20.25	15
	Linganpally	Nil	303.75	28.35	32.40	5	263.25	76.95	64.80	15

CONCULSION

Implementation of SMC works had better impact on water sources with higher water yield and thus increased the irrigation potential in forest fringe villages of Mehboobnagar division of northern dry zone of Andhra Pradesh. This has lead to change in cropping pattern, higher crop yields and higher returns to the farmers. Increase in cropping area, fodder availability, increase in tree density and natural regeneration were also noticed. The positive impact of SMC works had directly resulted in increase in household income, employment generation, scope for allied agricultural activities etc. There is a decline in number of BPL families in forest fringe villages. In almost all villages sampled, the drinking water problem is almost solved due to sufficient recharging of ground water resources. Therefore impact is more visible in terms of large quantity of water harvest and enriched greenery around the structures built.

ACKNOWLEDGEMENTS

The authors are thankful to the MoEF, GoI for funding to this study and the help rendered by the Director, RC, NAEB and Associate Director of Research, GKVK, UAS, Bangalore-560 065, Karnataka is also duly acknowledged.

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