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RESEARCH ARTICLE

SOCIO-ECONOMIC AND ENVIRONMENTAL OUTCOME OF WATERSHED DEVELOPMENT PROGRAM: A CASE STUDY OF CHARTHA – SELUD WATERSHED IN AURANGABAD, MAHARASHTRA (INDIA)

***Ajgaonkar, S.S. and Patil, S.S.**

Dept. of Environmental Science, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (MS) India – 431001

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ABSTRACT

Watershed is powerful tool of socio-economic development ensuring sustainable rural development. Natural resource management leads to livelihood security through agriculture and allied activities. The rain-fed agricultural production can be improved by adopting ridge to valley watershed approach. Chartha-Selud watershed project is a unique example of watershed programme of run by various departments of government. The present study evaluates the socio-economic and environmental impact of watershed program on these villages in comparison with neighboring villages Hatmali and Naigavhan. The watershed program in these villages partially fulfills the objectives of sustainable rural development. There is increase in agricultural productivity and water availability. The watershed program had an impact on the cropping intensity, crop diversification, land use pattern etc. There is more adoption of cash crop and perennial fruit crops in watershed villages with support of micro-irrigation and farm ponds. There is not any significant difference in livestock population, use of farm implements and transport and communication means.

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INTRODUCTION

A watershed development is a tool to harvest rainwater to develop scarce water resources and conserve soil for agricultural production and natural resource conservation. The watershed management projects aim to capture water during rainy periods for subsequent use in dry periods (Farrington, Turton, and James, 1999). The population in India is expected to stabilize around 1640 million and total water requirement of the country will be 1450m^3/yr by the year 2050 which is the significantly more than current estimate of utilizable water resources potential (1122m^3/yr) through conventional development strategies (Gupta and Deshpande 2004). To overcome the present situation watershed development approach is very important. Watershed management is a way to increase agricultural production, conserve natural resources and ultimately reduce poverty. ICRISAT-led consortium revealed that integrated watershed can become the growth engine for sustainable development of dry land areas by improving the performance of 2/3rd watersheds in the country (Wani *et al*. 2008).

****Corresponding author:*** **Ajgaonkar, S.S.**
Dept. of Environmental Science, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (MS) India – 431001.

Local institution support play key role in the watershed development program. Bogati, (1999) indicated that the institutional aspect, which plays a vital role not only for effective implementation of program activities but also for the sustainability of development activities, has been ignored.The top-down approach in watershed has numerous pitfalls, especially the non-involvement of watershed inhabitants in management planning, which questions the success and validity of the programs (Chambers, 1993; Brooks, 1993). Micro watershed development ensures water for agriculture and roof top rain water harvesting are solutions to overcome water scarcity in such areas (Pawar and Patil, 2011).

METHODS AND MATERIALS

The objective of the study was to make an analysis of the effectiveness of watershed management at Chartha-Selud in terms of resource status, agricultural revenue and socio-economic welfare as compared with Hatmali and Naigavhan as control villages of Aurangabad block and District. The data regarding agriculture and socio economic conditionduring pre-watershed work i.e. in 2007 and post watershed work i.e. 2015 have been collected from 80 farmers using questionnaire. Equal farmers from watershed and control villages have been selected randomly from each class of farmers in village from

study area and individually interviewed. Questionnaire data were summarized in statistical software SPSS 20 and the data related to watershed activities is collected from group discussion with members of watershed development committee and Gram Panchayat, Gramsevak, elder villagers and government officers of concern departments. The data regarding wells of the area is referred from Census of India series 14, 1991. Well characteristics were evaluated by reviewing the inventory developed by Geoforum of 89 (13 percent) wells and selecting 20 for more detailed study.

Geographical details of Watershed area

These villages are part of watershed GP- 9 in Dudhana basin of river Godavari in Aurangabad district in Maharashtra state of India. Charatha-Selud watershed is having 6.02 KM^2 geographical areas with altitude in range of 580 to 680 M from Mean sea level while Hatmali- Naigavhan watershed is adjoining watershed villages having 18.98 KM^2 geographical areas with altitude in range of 600 to 700 M from Mean sea level. Chartha-Selud have moderately dissected plateau with slightly undulating topography with general slope towards south east direction. The hill ranges of Selud are part of Satmala ranges. The Hatmali has moderately dissected plateau with moderately undulating Deccan trap topography. There are prominent hill ranges in north and south west part of the village. The village Naigavhan exhibits moderately dissected plateau with moderately undulating Deccan Trap topography with general slope towards north east direction. There are prominent hill ranges in north and south west part of the village. The slope percentage is 3 percent. The area receives about 95 percent of rainfall from the southwest monsoon and 5 percent from northeast monsoon. The rainfall data from 1991 to 2015 shows that, there is deficit of rainfall in 9 years and excess rainfall in 14 years with the average rainfall of 700.9 MM.

The soil of Chartha village is the Black cotton soil with thickness varies from 0.50 m. to 1.20 m. The southern part of the Selud village is coarse mixed soil while along drainage soil become loamy. The central part of Hatmali village has loamy soil and in north-western and south-western plateau part of village have black cotton soil. The eastern part of the Naigavhan village has deep loamy soil; well drainage clayey soils on moderate sloping plateau with narrow valleys exist.
The Groundwater Survey and Development Agency (GSDA) of Government of Maharashtra has mapped the hydro-geological characters of these villages for Jalswaraj project of World Bank in 2005. The entire four villages are covered by basaltic lava flows of various thicknesses with very low groundwater potential. The vesicles in the zeolotic trap are interconnected in Chartha and Naigavhan. The horizontal as well as vertical joints and the fractures are quite prominent in massive basalt. The vesicles are partially or completely filled by Zeolites or calcite which occur a secondary minerals. The north-east part of Chartha village falls in the runoff zone while the central portion lies in recharge zone and south portion is in storage zone. The Selud village has unconfined aquifer. The southern part of the village falls in the runoff zone while the central portion lies in storage zone and northern recharge zone. The northern and southern part of the village falls in the runoff zone while the central portion lies in storage zone and along gentle slopes there is recharge zone. The north-east part of the Naigavhan village falls in the runoff zone while the central portion lies in recharge zone. The south-west portion of the village is in storage zone. GSDA's Report on the dynamic ground water resources of Maharashtra (2011-12) declared this watershed as semi-critical.

Watershed development works in village

The watershed works at Chartha and Selud have been carried out under Vasundhara Integrated Management program by Department of Agriculture of Government of Maharashtra and Non Government Organization in 2011 - 2014. The Hatmali and Naigavhan watershed development work is under various programs of Department of Agriculture, Department of Forest and Jilha Parishad. The watershed work is also going on with State Government Program of Jalyukta Shivar. There is inactive maintenance system for watershed work caused silting and reduced the water storage capacity of water structures. But the watershed work by various departments is scanty and not as per top to bottom principle. Majority of farm land is leveled and bunded. The continuous contour trenches are silted and get damaged.

Table 1. Watershed activities in villages

Watershed activities	Chartha	Selud	Hatmali	Naigavhan
CCT	29	20	10	10
CCB	130	300	140	130
LBS	15	10	14	10
Nala Bunding	6	3	7	3
Earthen Bund	0	2	5	5
Percolation Tank	2	1	3	2
Farm Pond	7	55	25	1
Cement Weir	4	2	3	5
KTW	2	3	2	2

RESULTS AND DISCUSSION

Natural resource management ultimately leads to agriculture and associated changes by raising the water table to promote irrigation development (Kerr, 2002). The density of irrigation wells is high in the south-east portion of the Chartha village indicating high draft whereas the number of wells in the north portion is less. The wells are not uniformly distributed in the village area. The density of irrigation wells is high in the central portion of the Selud village indicating high draft whereas the number of wells in the southern portion is less. The depth of the irrigation wells in watershed villages varies from 4.80 M to 20.02 M and the diameter from 2.4 M to 7.5 M. The density of irrigation wells is high in the central and northern portion of the Hatmali village indicating high draft whereas the number of wells in the southern portion is less. The density of irrigation wells is high in the south-west portion of the Naigavhan village indicating high draft whereas the number of wells in the north-eastern portion is less. The depth of the irrigation wells varies from 6 M to as deep as 14.40 M and the diameter from 2.5 M to 7 M. The density well in watershed villages changed from 21.24 to 36.93 Wells / Km^2 after watershed work (Table 2). The strengthening of groundwater regime with water tables rising from 5.79 to 12.91 M in post-monsoon period and from 0.3 to 1.20 M in summer season in watershed villages, respectively whereas water tables rising from 5.5 m to 10.97 M in post-monsoon period and from 1.06 to 3.35 M in summer season, respectively in Kadavanchi Dist. – Jalna (Pawar *et al*. 2012). Foster *et al,* 2007 stated that the extension of perennially-saturated aquifer has reduced due to falling of groundwater table associated with increasing dry season irrigation and reducing monsoon rainfall in Hatmali.

The decline in water level is observed in 66 percent of wells. Declines are observed in major parts of Marathwada region prominently in Aurangabad, Jalna, Parbhani districts (Central Groundwater Board report –2015).

Table 2. Well status of villages

Wells (Pre – 1991, Post - 2015)	Watershed Villages		Control Villages	
	Pre	Post	Pre	Post
Dug wells	130	226	314	430
Bore wells	18	35	22	30
Farm Ponds	0	62	0	26
Well Density Wells / Km^2	21.24	36.93	16.54	22.65

The dug wells are increased by 73.5 percent in watershed villages whereas it is increased by 36.94 percent in control villages in the same period of time (Table 2). The 10 percent farmers have deepen their wells whereas more than 50 percent well have horizontal boring to increase effective well diameter. In Hivre Bazaar 20 percent new wells are constructed since intensive watershed conservation in 1993-95. The deepening existing well as well as horizontal boring is adopted in Hivre Bazaar (Foster *et al*, 2007). Farm ponds are emerging concept of storing water in earthen pond lined with plastic liner. It is useful in protective irrigation for crops suffering from water stress in long dry spell of monsoon in Kharip and enable fruit crops to survive in rain fall deficit year for protective irrigation. The pomegranate orchards supported with farm pond is new cash cropping pattern in this area. There are orchards on 72 ha supported by 62 farm ponds in watershed area whereas 46.60 ha pomegranate is supported by 26 farm ponds in control villages.

Change in cropping pattern

Watershed is powerful tool of socio-economic development. Crop diversification is an outcome of the watershed development program. The area under Kharip crop has reduced from 98.77 to 85.14 percent in watershed villages whereas it is decreased from 99.17 percent to 96.02 percent in control village. The area under rabbi crop which require soil moisture to be supported with irrigation is increased from 15.03 percent to 30.44 percent in watershed villages whereas it is increased from 12.03 percent to 16.81 percent in control villages. The area under perennial horticultural crops suggests availability of irrigation water throughout the year. The area under horticultural crops is increased from 0.24 percent to 15.54 percent in watershed villages whereas it is increased from 0.77 percent to 3.98 percent in control area (Table 3).Change in land use is spelled by increase in area under cultivation to 115 percent, vegetables 152 percent and perennial irrigation from 1.2 to 73 ha in watershed village. The area under cereal crops like pearl millet, sorghum is reduced by 30 percent and replaced by maize. Pulses like black gram, green gram, bengal gram and tur is decreasing in watershed villages. The area as well as the productivity of irrigated cash crop like vegetables Ginger, Wheat is increasing. There is remarkable increase in pomegranate plantation in watershed villages. There is not any remarkable change in cropping pattern of control villages (Table 4). Sundarwadi watershed development have resulted better adoption to commercial crops especially among the small and medium farmers cotton, fruits and vegetables instead of cereal crops. Total area under bajara cultivation significantly decreased from 36 to 28 acres whereas the areas under cotton cultivation increased from 20 to 35 (Aher and Pawar, 2013).

Change in Livestock, Farm implement and Transportation and Communication

The cross breeds cows as well as buffalos increased by 65 and 24 numbers with reduction in indigenous cows (Table 5).

Table 3. Cropping Pattern season-wise

Land Use Ha	Watershed Villages				Control Villages			
Cultivable area	469.8				1171.69			
Pre – 2007, Post - 2015	Pre		Post		Pre		Post	
	Ha	percent	Ha	percent	Ha	percent	Ha	percent
Crop Kharip Ha	464	98.77	400	85.14	1162	99.17	1125	96.02
Crop Rabbi	70.6	15.03	143	30.44	141.65	12.03	197	16.81
Horticultural crops	1.2	0.26	73	15.54	9.04	0.77	46.60	3.98

Table 4. Crop-wise area and productivity of crop

Crop	Watershed				Control			
	Pre		Post		Pre		Post	
	A	P	A	P	A	P	A	P
Pearl Millet	75	500	48	533	249	595	226	520
Black Gram	19	535	15	550	36	545	26	520
Green Gram	19	525	15	560	39	513	38	510
Maize	42	4660	63	4770	152	4450	179	4475
Cotton	237	2260	220	2890	614	2130	573	2328
Sorghum	32	960	26	850	39	915	54	875
Wheat	20	4165	57	4250	80	4300	94	4305
Bengal Gram	26	840	24	1025	13	900	42	1075
Vegetable	24.6		62		48.65		61	
Tur	40	850	13	1150	33	950	29	1000
Pomegranate	1.2	5550	73	5600	9.04	5450	46.67	5500
Total	535.8		616		1312.69		1368.67	

A - Area in Hector, P – Productivity in Kg/ha, Pre – 2007, Post – 2015

Approximately 800 liters milk is being collected regularly milk collection center in watershed villages whereas the control villages do not have milk collection center. The watershed witnessed a sudden shift to cross-bred cows; however due to lack of knowledge on rearing and management practices, a drastic fall in cross-bred cows was subsequently observed. A shift from cross-bred cows to buffaloes was also observed;

Table 5.Livestock, Farm implement and Transportation and Communication

Sr. No.	Livestock (Pre – 2007; Post – 2015)	Watershed		Control	
		Pre	Post	Pre	Post
1	Cross Breed cows	205	270	170	160
2	Indigenous Cows	63	21	170	65
3	Farm animals (Bullocks)	383	382	335	300
4	Buffaloes	15	39	35	29
5	Sheep	563	355		
6	Goats	421	287	360	277
7	Poultry	472	509	250	322
8	Tractors	5	16	4	13
9	Threshers	1	3	1	3
10	Power Sprayers	1	30	2	19
11	Chaff Cutters	1	4	1	5
12	Drip Irrigation Sets	2	44	1	24
13	Two Wheelers	33	340	130	390
14	Jeeps	2	4	4	11
15	Tempo	2	6	4	8
16	Television	41	290	26	320
17	Phones Mobile	60	590	80	580

however, it was restricted only to small farmers (Watershed Development and Livestock rearing report, South Asia Pro Poor Livestock Policy Programme: A joint initiative of NDDB and FAO, 2012). Two fold increase in crossbred cows and three-fold decrease in indigenous cows is observed due to increase in fodder availability by 1.5 times in Kadavanchi (Pawar *et al*. 2012). There is increase in use of farm implements in watershed villages after post watershed and drip irrigation sets from 2 to 44 ha in watershed villages and from 1 to 24 ha in control villages (table 5). A significant number of farmers have adopted drip irrigation technology in Hivre Bazaar. 61 and 17 ha respectively of horticultural production are currently under sprinkler and drip irrigation (Foster *et al*, 2007).Change in Transportation and Communication of villagers bettered to an extent that they could purchase household facilities (Motorcycles from 33 to 340, TV sets from 41 to 290 & Cell phones from 60 to 590 connections) because of increase in their savings due to good agricultural production. Strengthening of infrastructure like drinking water, sanitary facilities, biogas, postal, baking, roads, schools, health centers etc. are developed with the participation of the community and by availing Government schemes at Ralegan Siddhi (Mishra, 1993).The changes in cropping pattern, productivity, area under cash crops are indicator of socio economic development. There is increase in number of livestock, use of farm implement and use of communication and transportation. These suggest distinct positive impact of watershed work on the livelihood of the villagers.

Conclusion

Watershed is powerful tool of socio-economic development ensuring environmental improvement and sustainable development. Natural resource management leads to livelihood security through agriculture and allied activities. The rain-fed agricultural production can be improved by adopting watershed approach in which development was not only confined with agricultural lands alone, but also covered all area, starting from the highest point of the area to the outlet of the natural stream at bottom. Chartha-Selud watershed project is a unique example of programme of run by government of Maharashtra. The watershed program in these villages partially fulfills the objectives of sustainable rural development as compared with neighboring villages Hatmali and Naigavhan.

There is increase in agricultural productivity and water availability. The watershed program had an impact on the cropping intensity, crop diversification, land use pattern etc. There is more adoption of cash crop such as vegetables, cotton and pomegranate in watershed villages with support of micro-irrigation and farm ponds. There is not any significant difference in livestock population, use of farm implements and transport and communication means.

REFERENCES

MishraB.1993. A successful case of participatory watershed management at Ralegan Siddhi Village in district Ahmadnagar, Maharashtra, India, http://www.fao.org/docrep/X5669E/x5669e06.htm, FAO.

BogatiR. 1999. DANIDA Supported Soil Conservation and Watershed Management Program in Nepal. Proceedings ofDANIDA's Third International Workshop on Watershed Development, Kathmandu, Nepal.

BrooksKN. 1993. Challenges in Upland Conservation: Asia and Pacific. FAO Regional Office, Bangkok, 1-41.

Central Groundwater Board report. 2015. Status of groundwater levels in Maharashtra and UT of Dadra & Nagar Haveli during May 2015, 1909/GWM/2015

ChambersR.1993.*Challenging the Professions Frontier for Rural Development*.Intermediate Technology Publications, London.

PawarCB, PatilSS and WasareP. 2012. *Journal of Entrepreneurship & Management*, 1 (1): 32-36

FarringtonJ, TurtonC and JamesAJ. 1999. Participatory watershed development: challenges for the twenty-First century. New Delhi: Oxford University Press.

http://www.slideshare.net/indiawaterportal/groundwater-experiences-in-maharashtra-gsda

KerrJ. 2002. Watershed Development, Environmental Services, and Poverty Alleviation in India, *World Development*, 30 (8): 1387–1400.

PawarCB and PatilSS. 2011. Roof -top Rainwater Harvesting: A Potential Assessment study of Renavi village, *Ashwattha*, 5 (1): 7 – 10.

Aher SB and Pawar JR. 2013.*Journal of Chemical, Biological and Physical Sciences*, 3(1): 637-645.

Gupta SKandDeshpandeRD. 2004. Water for Indian 2050: First order assessment of available option, *Current science*, 86(9): 1216 -1223.

FosterS, Garduño Hand Tuinhof, A. 2007. Confronting the Groundwater Management Challenge in the Deccan Traps Country of Maharashtra – India , Sustainable Groundwater Management Lessons from Practice, Case Profile Collection Number 18*, GW- MAT,* 18: 1-20.

Wani, S.P. 2008. A New Paradigm for Rain-fed Agriculture for Improving Livelihoods and Sustainable Development in India, Proceedings of the National Workshop on New Paradigm for Rain-fed Farming held at New Delhi during, 30-31.

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