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CAN WATERSHED-BASED INTERVENTIONS BE A PANACEA TO AGRARIAN DISTRESS IN VIDARBHA REGION OF MAHARASHTRA? A CASE STUDY

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ABSTRACT

Watershed-based interventions have brought a paradigm shift in the resource conservation and production across the rain-fed landscape of the country. Yet some regions still face agrarian distress and Vidarbha region is one among them. The present study explored this issue with a focus on watershed-based interventions. The historical agricultural development and agrarian distress of Vidarbha region were examined with respect to conservation of natural resource and its impact on mitigating the distress and absolving the locals of misery. This study proposed to test the hypotheses that watershed approach of decentralised water harvesting and utilisation are the remedy to overcome the agrarian stagnation suffered by the Vidarbha region. Participatory watershed management project funded by a development agency was taken up as a case study. The watershed programme undertaken in the region attempted to address the water shortage problem, apart from addressing credit needs of the local stakeholders. The programme was evaluated from socio-economic view point examining the impact on agricultural production, income, poverty reduction and migration. The study argued that despite positive changes in socio-economic condition of farmers resulting from watershed programme, the economic gain was too little to push them out of the vicious circle of misery. It was suggested to further strengthen the subsidiary input supply chain including market intelligence and remunerative prices of crop, apart from strengthening the existing conservation efforts.

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Introduction

Vidarbha, which has been in distress for long, is inhabited by the people belonging to the weaker sections of society such as Scheduled Castes, Scheduled Tribes and Other Backward Castes.The reason for backwardness is reported to be the diminution in development efforts suffered by this region in the State of Maharashtra (Phansalkar, 2005). Once a centre for public decision making in erstwhile Central Provinces and Berar in pre-Independence period, it lost this status to western Maharashtra subsequently.The regional disparities subsequently resulted in negligence of other developments including irrigation development (Shah et al., 2012; Phansalkar, 2005) leading to poor agrarian development in Vidarbha compared to other parts of Maharashtra. The spatial inequality had been cited, in literature, to be a complex interplay of factors viz., resource endowment, nature of population inhabiting the region, network of trade, history of investments on resource development and nature of polity addressing issues like infrastructure development, price policies encompassing both inputs and outputs in different sectors including levies and rebates (Frank, 1975; Amin, 2002; Phanslakar, 2005). Vidarbha region, historically, fared poorly in these factors in comparison to similar regions in other parts of the country. Despite the good resource endowment, the nature of polity practised over the years in Vidarbha led to its downfall, while similar regions advanced following proactive governance policy (Shah et al., 2012). The agrarian development in Vidarha was a fallout of the colonial feudal system coupled with fragmented peasant class, which never allowed Vidarbha to put a strong claim on the 'growth drivers', which were experienced in other parts of western Maharashtra even in the post-Independence period. For the same reason, the region which was prosperous in terms of natural resources suffered from neglect of irrigation development leading to weak agrarian base over which subsequent agricultural development could not pick up (Phansalkar, 2003).

There are various theories about Vidarbha's agrarian stagnation, each examined from a different perspective. Starting with lopsided irrigation development as documented by Phansalkar (2003), poor governance encompassing the historical Zamindari system, development backlog and weak institutional base leading to lopsided agricultural development led to stagnation (Shah et al, 2012). The causes identified and the remedies suggested, by and large, pointed towards at least one common remedy, viz., decentralised water resource development, apart from others.The decentralised water resource development by local stakeholders through watershed development approach of agricultural development played a crucial role. This was amply demonstrated by villagers in Ralegan Siddhi and Hivre Bazar watershed development works in Maharashtra.In this backdrop, the watershed development, governed by the localised geo-hydrological setting, suited best to address the water availability issues, which, coupled with improved agricultural intervention,could lead to agricultural development of the region.

Agricultural Distress and Watershed Development

That Vidarbha region remained agriculturally backward owing to poor irrigation infrastructure was amply documented. A government report observed that "though the State average for irrigation potential had increased and the residual backlog of fact-finding committee (Government of Maharashtra, 1984) had been taken into account, the presence of 57 per cent of the outstanding backlogs in Vidarbha indicate a rising trend of regional disparity in this sector" (Planning Commission, 2003). Further, the region witnessed a substantial shortfall in actual expenditure for the irrigation sector as against excess expenditure in the rest of Maharashtra (Planning Commission, 2006). All this resulted in lower share (27 to 28 per cent) of gross cropped area under irrigation in Vidarbha (Mohanty, 2009). Similar had been the fate of agricultural credit flow for agricultural inputs and machinery affecting, thereby, use of high value inputs and,in turn, agricultural production in the region. This, coupled with a complex interplay of social, economic and environmental factors, resulted in misery leading to farmers' suicides in the region.

The small holding size with rain-fed subsistence farming and poor credit and market support resulted in farmers falling prey to vicious circle of poverty. Under these circumstances, it was argued that scientific management of natural resources such as land and water in combination with capacity building to sustain livelihood enterprises could minimise the impact of socio-economic and environmental causes. The early experiences in 90's about the impact of watershed programmes in augmenting farm income through improved agricultural production and conservation of soil and water resources in rain-fed areas led Government of India to aggressively intensify watershed development programmes in fragile and resource-poor ecosystems, where the farm incomes markedly descended due to excessive soil erosion and moisture stress.

National Bank for Agriculture and Rural Development (NABARD) endeavoured to address this through watershed management programme, called NABARD supported Holistic Watershed Development Programme (NHWDP). The NHWDP launched on 2 October, 2006 in six distressed districts of Vidarbha,covered 90,000 ha in six districts as a participatory programme for micro level infrastructure development with regard to sustainable management of soil and water resources. The programme aimed not only at soil and water conservation measures but also support for overall development of families through integrated activities like livestock development, wadi (horticulture plantation), women's development and providing improved livelihood options to the landless families. Cluster approach (2500-3000 ha) was taken up in order to ensure efficiency and included participatory planning and management of natural resources for providing improved livelihood opportunities for the watershed dwellers. A cluster of five to six villages was considered a unit for implementation. The NABARD supported Holistic Watershed Development Programme

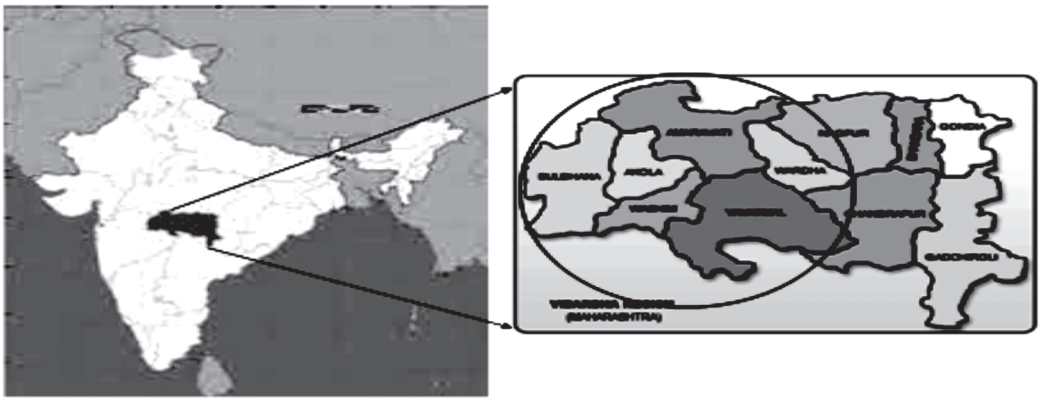
was taken as case study to examine the impact of watershed interventions in Vidarbha region.

Methodology

Vidarbha region of Maharashtra State, which lies between 18^0 45' and 21^0 45' north latitude and $76^0$0' and $81^0$0' east longitude in the eastern region of Maharashtra State of India, is mostly characterised by dryland farming. The region has tropical/semi-arid and sub-humid monsoon type of climate. The annual rainfall varies between 760 mm to 1600 mm. The mean annual maximum and minimum temperatures vary from 30.9^0 C to 34.0^0 C and 20.3^0 C to 21.3^0 C, respectively. The geological formations are Precambrian, Cuddapah and Vindhyas, Deccan trap and recent deposits. The climatic conditions of this region can be broadly described as semi-arid. The mean annual rainfall ranges from 700 mm in the West to 1700 mm in the East. The region experiences sub-humid to humid conditions in monsoon season, semi-arid in winter season and arid in summer season. The region receives adequate rainfall but suffers from vagaries of distribution and consequently the scarcity and semi-scarcity conditions. Soil is sandy loam to loam and has poor depth. To address the problem of water scarcity and low productivity, the watershed management programme was undertaken in the region.

Vidarbha region comprises two revenue divisions e.g.,Nagpur and Amravati and consists of eleven districts e.g., Akola, Amravati, Bhandara, Buldhana,Chandrapur,Gadchiroli,Gondia, Nagpur, Wardha,Washim and Yavatmal. Vidarbha occupies 31.6 per cent of the total area and holds 21.3 per cent of total population of Maharashtra. It is plagued by poverty and malnutrition and is less economically prosperous compared to the rest of Maharashtra. The land degradation statistics indicate Amravati, Chandrapur, Gadchiroli and Yavatmal to have high degraded and wastelands and Nagpur, Buldana districts to have moderate degraded and wastelands. Akola, Bhandara, Gondia, Wardha and Washim are the districts having less degraded and wastelands (ICAR and NAAS, 2010).

Figure 1: Micro Watershed Clusters of Vidarbha Region Surveyed



The study aims to test the hypotheses about the positive role of watershed-based approach of natural resource conservation to address the agrarian distress of the region. Hence, sample design was concentrated on the watershed management programme of NABARD executed in six districts in a cluster mode. All the six clusters where watershed management programme was launched were selected for the study. They are1) Dudhlam Cluster, Taluka & District Akola developed by Dilasa Janvikas Pratishthan, Akola, 2) Asoli Cluster, Taluka Ghatanji, District Yavatmal developed by Maharashtra Institute of Technology Transfer for Rural Areas (MITRA), Nasik, 3) Berala – Yeota Cluster, Taluka Chikhli, District Buldana developed by Savata Mali Samaj Vikas Shaikshanik & Bahuddeshiya Mandal, Buldana & Berala-Yeota Cluster Level Watershed Committee, Buldana, 4) Mothegaon Cluster, Taluka Risod, District Washim, developed by SEVA, Ahmednagar, 5) Dharampur Cluster, Taluka Nangaon Khandeshwar, District Amravati developed by Sanjeevani Institute for Empowerment & Development (SIED), Aurangabad and 6) Dahegaon Cluster, Taluka Arvi, District Wardha (Figure1). Both primary and secondary data were used to examine various socio-economic dimensions of local stakeholders. Secondary data were procured from various reports of the project implementing agencies. Primary data were collected through stakeholders' surveys following random sampling procedure during 2011-12 from a sample of 151 farmers (Table 1) through a detailed survey.

Table 1: Sample Unit Distribution in the Study Area

Watershed Cluster	District	Taluka	Holding Size Range (Acres)	Village	Farmers (Numbers)
Dudhalam cluster	Akola	Akola	1.00-2.50	Dudhlam	25
Berala-Yeota cluster	Buldhana	Chikhali	2.50-2.50	Yeota	9
				Jambhora	6
				Berala	5
				Bhankhed	5
Mothegaon cluster	Washim	Risod	3.00-11.00	Ganeshpur	10
				Mothegaon	14
Asoli cluster	Yavatmal	Pandhakarwada	4.00-10.00	Asoli	14
		Ghatanji		Dadapur	6
		Karanji		Kodesari	5
Dharampur cluster	Amravati	Nandgaon	5.50-10.00	Pushner	9
				Dharampur	11
				Dhavalsar	5
Dahegaon cluster	Wardha	Arvi	10.00-17.00	Barkhedi	12

The data collected included socio-economic and bio-physical attributes such as demographic features, vegetation status, land use, soil fertility status, cropping pattern, geo-hydro-morphological features, input-output data on crops, income and employment and productivity.

In addition, interactions were held with field functionaries following focus group and personal interviews. Besides the traditional survey techniques, use of geomatic tools such as remote sensing and GIS were relied upon to corroborate the information supplied by beneficiaries about the changes brought about due to watershed interventions.

The standard evaluation approaches were used to assess the impact of watershed programme on different parameters. Before and after data comparison technique was adopted for all the socio-economic parameters. Statistical averages computed for the two periods were compared and analysed for impact assessment at constant prices of the year 2006-07, the period of initiation of watershed management programmes. The economic analysis was done by following discounted cash flow technique and economic viability parameters were computed.

Results

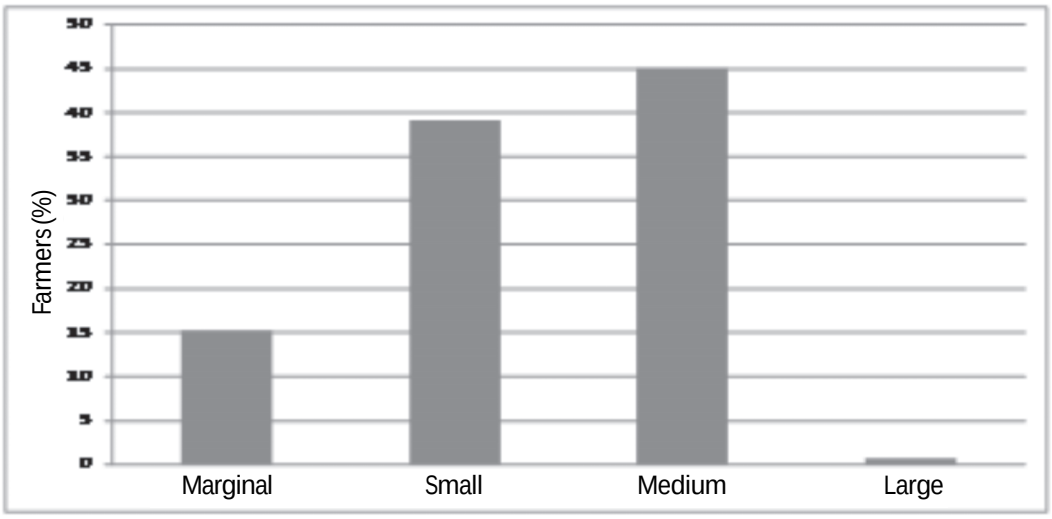
***Rainfall Pattern in the Cluster*:** From the analysis of rainfall data collected, it is evident that the rainy season begins in mid-June and is completed by beginning of October in these clusters. July and August are the wettest months of the year. The average rainfall is around 849 mm during the project period. Maximum rainfall (1120.66 mm) was recorded in Dahegaon cluster and minimum (678.63 mm) in the Dudhlam cluster. The rainfall data recorded during last five years are presented in Table 2.

Table 2: Rainfall Pattern Observed in the Cluster

Cluster	Rainfall (mm)					Average
	Year					
	2006	2007	2008	2009	2010	
Asoli	1293.0	-	635.0	275.0	1168.0	842.7
BerlaYeota	1083.0	740.0	-	-	-	911.5
Dahegaon	-	2225.2	781.5	424.9	1051.0	1120.6
Dharampur	786.9	775.8	501.0	390.0	1211.6	733.1
Dudhlam	-	1109.0	621.5	393.5	590.5	678.6
Mothegaon	723.0	892.0	714.0	835.0	873.0	807.4
Average	971.5	1148.4	650.6	463.7	978.2	849.0

Socio-economic Profile of Farmers: Among the farmers, 15 per cent are marginal farmers (with up to 2.5 acres of agriculture land), 39 per cent are small farmers (with 2.6-5.0 acres), 45 per cent are medium farmers (with 5.1-25.0 acres) and just one per cent are large farmers (with more than 25 acres). Majority of the farmers belonged to weaker sections of society with low economic profile (Figure 2). The average family size is 4.73, with female to male ratio of 0.79. The major crops included cotton and soyabean both pure as well as intercrop. Livestock is not very well integrated in the production system. The average number of milch animals per household is 0.12. Working animals (bullocks) constitute the highest number (50 per cent) followed by indigenous cows (29

Figure 2: Socio-economic Profile of Farmers in the Watersheds



per cent). Buffalo and cross bred cows constitute only 14 and 3 per cent of the total standard cattle units, respectively. The latter have higher productivity and supplement the livelihood of rural people in terms of income. The per capita expenditure on food items in the pre-programme phase worked out as ₹ 289/ month. The distribution of expenditure showed poor consumption of pulses in daily diet.

Land Use Pattern and Watershed Interventions: This land use pattern of the watershed is given in Tables 3a and 3b.About 77 per cent of the geographical area is under cultivation.

Table 3a: Land Use Pattern in the Watershed

S. No.	Particulars	Total Area (ha)	Per cent Area
A	Watershed land use		
	i Forest land	945.96	33.5
	ii Revenue land	837.05	29.7
	Iii Panchayat land	679.00	24.0
	iv Gaothan (land occupied by household)	96.74	3.5
V	Submerged area under tank	262.20	9.3
	Sub-total	2820.95	
B	Land privately owned		
	i Cropped area		
A	Seasonally irrigated	1273.16	10.8
B	Perennially irrigated	62.93	0.5
C	Rain-fed	9384.53	79.9
	ii Fallow land	624.18	5.4
	iii Unculturable land	393.56	3.4
	Sub-total	11738.36	
	Grand total	14559.31	

Source: Project records of agencies involved in watershed programme.

Table 3b: Distribution of Land Use Pattern Across Clusters

Land Use	Total Area (ha)					
	Asoli	Berala-Yeota	Dahegaon (Gondi)	Dharampur	Mothegaon	Dudhalam
Watershed land use						
Forest land	306.2 [39.5] (38.0-268.2)	-	42.0 [5.2]	-	-	597.7 [94.4] (54.7-542.9)
Panchayat land	397.6 [51.3] (39.4-160.3)	-	-	78.7 [52.0] (8.1-24.1)	212.6 [79.9] (44.5-168.0)	-
Revenue land	-	121.0 [61.6] (10.0-72.0)	661.2 [81.6]	33.1 [21.9] (12.3-20.8)	-	21.7 [3.4] (8.3-13.3)
Gaothan	12.3 [1.58] (1.5-5.9)	19.4[9.87] (3.1-6.3)	7.28 [0.9]	39.4 [26.1] (4.0-11.5)	9.6 [3.6] (3.0-6.5)	8.7 [1.3] (1.4-4.4)
Submergence area	58.3 [7.52] (3.6-24.6)	56.0[28.5] (7.0-25.0)	99.5 [12.3]	-	43.8 [16.4]	4.5 [0.7]
Sub-total	774.4	196.4	809.9	151.2	266.0	632.6
Land privately owned						
Seasonally irrigated land	23.8 [1.25] (0.8-10.0)	337.5 (48.4-126.0)	168.0 [20.3]	100.3 [4.9] (8.0-28.0)	478.1 [18.6] (6.0-452.4)	165.0 [8.5] (24.3-101.2)
Perennially irrigated	4.0 [0.21]	5.0	43.4 [5.2]	6.5 [0.3] (2.5-4.0)	-	4.0 [0.2] (1.0-3.0)
Rain-fed	1653.7 [86.9] (150.9-515.9)	1781.1 (200.3-913.5)	468.0 [56.8]	1792.5 [89.2] (224.1-475.0)	2072.0 [80.7] (307.8-1322.8)	1598.9 [82.7] (256.2-692.8)
Fallow land	5.79 [0.30]	289.8 (19.3-194.0)	144.4 [17.5]	51.8 [2.5] (9.8-21.5)	17.0 [0.6] (8.3-8.7)	115.3 [5.9] (19.2-65.3)
Uncultivable land	214.6 [11.2] (20.0-84.9)	82.3 (12.0-39.2)	-	57.6 [2.8] (5.0-14.9)	-	49.0 [2.5]
Sub-total	1901.9	892.7	823.8	2008.7	2567.1	1932.2

Source: Project records of agencies involved in watershed programme.

Note: Figures in brackets are percentages of area in the cluster and figures in parentheses are range in different villages within a cluster.

The remaining land is fallow and unculturable land. Of the total cultivated area, 87 per cent is rain-fed and the remaining is under seasonal or perennial irrigation. However, there is variation in the land use pattern among the watershed clusters (Figure 3) and the watershed interventions varied across micro watershed clusters. The expenditure on watershed across micro watershed clusters also varied from ₹ 6 million to ₹ 27 million (Table 4). Among the interventions, highest expenditure was made on loose boulder structures followed by check dams and nala (local stream) bunds.

Figure 3: Land Use Pattern in Different Watershed Clusters in Vidarbaha Region

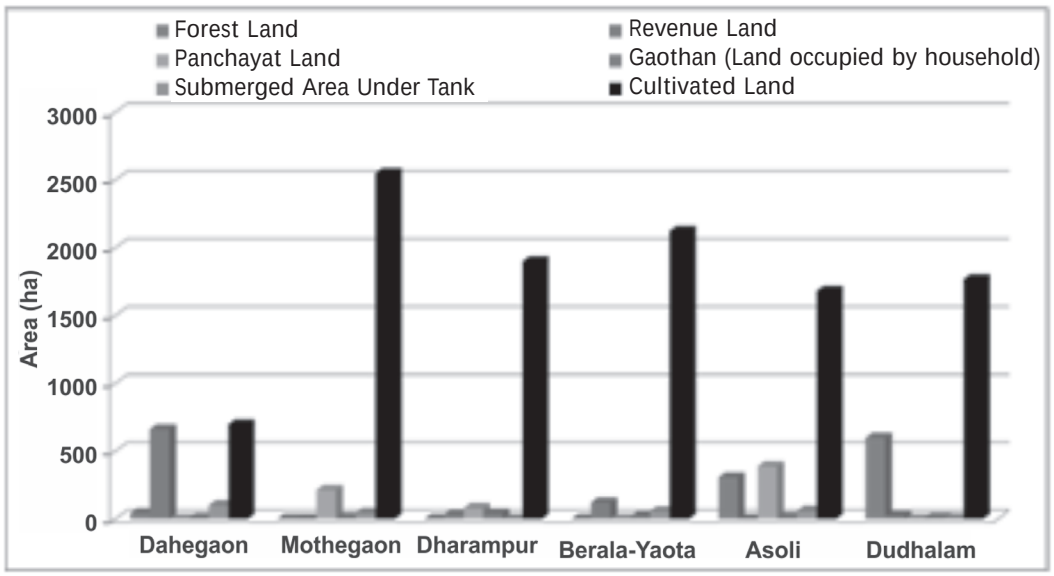


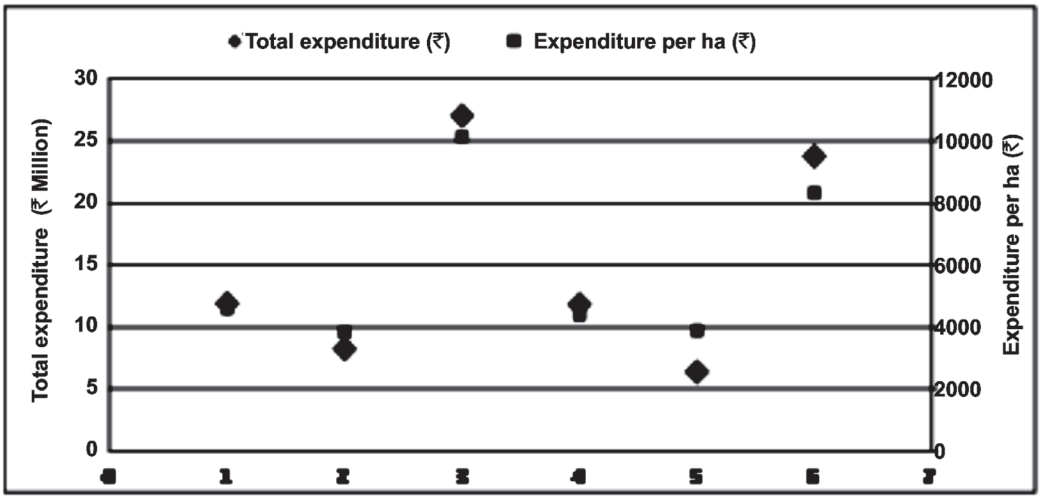
Table 4: Expenditure on Watershed Interventions in Vidarbha

S. No.	Land Use	Total Expenditure (₹)						
		Dudhalam	Dharampur	Berala-Yeota	Mothegaon	Dahegaon	Asoli	Total
1	Agro-forestry	4516093 (37.8)	-	-	1982462 (8.3)	2707295 (42.0)	-	9205850
2	Afforestation	341454 (2.9)	481624 (5.8)	-	-	-	-	823078
3	Crop cultivation	5049055 (42.3)	7501912 (90.6)	9671729 (81.4)	15142229 (63.6)	2021135 (31.4)	7422834 (27.4)	46808894
4	Dry land horticulture	173230 (1.4)	28500 (0.3)	389046 (3.3)	241189 (1.0)	44727 (0.7)	229857 (0.8)	1106549
5	Agrihorticulture	264551 (2.2)	265550 (3.2)	460000 (3.9)	176700 (0.7)	118753 (1.8)	5460684 (20.2)	6746238
6	Loose boulder structure	246961 (2.1)	-	63140 (0.5)	-	56879 (0.9)	13958625 (51.6)	14325605
7	Earthen gully plug	80880 (0.7)	-	-	-	-	-	80880
8	Gabion(No)	172920 (1.4)	-	-	-	147009 (2.3)	-	319929
9	Check dam	107652 (0.9)	-	1259478 (10.6)	5395100 (22.7)	1344178 (20.9)	-	8106408
10	Cement nala Bund (Number)	997349 (8.3)	-	34298 (0.3)	866800 (3.6)	-	-	1898447
	Total	11950145	8277586	11877691	23804480	6439976	27072000	89421877

Source: Project records of agencies involved in watershed programme.
Note: Figures in parentheses are percentages to total expenditure in each cluster.

Watershed Intervention and Expenditure: The various activities under the watershed management programme included drainage line treatment such as loose boulder structure, gully plug, earthen nala bund, and cement nala bund. Conservation treatment under arable land included farm bund with outlet and under non-arable land, contour staggered and continuous trench. The production activities, under the programme included improved crop cultivation, agri-horticulture and agro-forestry. Forest plantation and grass seeding was undertaken in non-arable land. The expenditure varied from ₹ 4900 ha^{-1} to ₹ 8100 ha^{-1} across clusters (Figure 4). The interventions for improved agriculture included demonstration on vermi-compost, compost pit and integrated pest management (IPM). Similarly, adoption of artificial in-semination and yielding crossbreeds and improved buffaloes were executed to improve livestock production. The programme brought out changes in production enterprise resulting in enhanced income and employment, household and farm asset augmentation, reduced poverty and out-migration during lean period, apart from improvement in social indicators. The discussion is organised into three major sections e.g., change in social indicators, change in production indicators and change in economic indicators followed by overall economic analysis of the programme.

Figure 4: Expenditure Pattern on Different Watershed Activities Across Clusters in Vidarbha



1-Dudhlam cluster, 2-Dharampur cluster, 3-Asoli culster, 4-Berala-Yeota cluster, 5-Dahegam cluster, 6-Mothegaon cluster

Impact of Watershed Intervention

Crop Production:The major crops prior to watershed intervention included soya bean, mung, wheat, gram & urd. Some area under desi cotton also existed. Introduction of Bt. cotton reduced area under desi cotton. The project interventions resulted in significant rise in area under rabi (winter) cultivation while kharif (rainy season) cultivated area did not show much change (Table 5). Maximum increase in area

Table 5: Change in Area and Cropping Intensity in the Clusters Studied

Watershed Cluster	Change	Kharif (ha)	Rabi(ha)	Summer (ha)	Total	Change in Cropping Intensity (%)
Asoli	BWI	1688.71	20.3	*	1709.01	
	AWI	1678.5	34	*	1712.5	0.81
Berla-Yeota	BWI	2117.52	867.56	*	2985.08	
	AWI	2124.98	1433.04	*	3558.02	18.78
Dahegaon	BWI	1672.03	366.98	*	2039.01	
	AWI	1690.71	505.7	*	2196.41	6.53
Dharmpur	BWI	1969.78	109	*	2078.78	
	AWI	1929.78	211	*	2140.78	5.12
Dudhlam	BWI	1753.67	134.85	22.26	1910.78	
	AWI	1753.67	301	56.16	2110.83	10.47
Mothegaon	BWI	2549.63	1542.79	*	4092.42	
	AWI	2574.84	1769.72	*	4344.56	5.12

Source: Project record of the agencies managing watershed.
* No crop taken in the micro watershed.
BWI – Before Watershed Intervention
AWI – After Watershed Intervention

under cultivation was recorded in Berla-Yeota cluster (572.94 ha) followed by Mothegaon cluster (252.14ha). Asoli cluster (3.49 ha) recorded minimum change in area under cultivation. The area under summer crops increased from 22.26 ha to 56.16 ha in Dudhlam cluster. Similarly, the average change in cropping intensity was recorded as 8.42 per cent, with maximum change in Berla-Yeota cluster (19per cent) and minimum change in Asoli cluster (1per cent). The average change in crop productivity was 35.4 per cent. Among the clusters maximum productivity was recorded in Berla-Yeota cluster (70.28 per cent) and least increase in productivity was recorded in Dahegaon cluster (15.82 per cent) (Table 6). The reason for increase in production in these clusters was increased availability of water due to soil and water conservation activities introduction of Bt. cotton, decrease in area under desi (local variety) cotton. The diversified area of cotton was used for cultivation of crops like soya bean, mung & urd and the additional area under soybean, mung & urd was used for double cropping with rabi crops

Table 6: Change in Crop Productivity in the Cluster

Watershed Cluster	Change	Kharif (q/ha)	Rabi (q/ha)	Summer (q/ha)	Total (q/ha)	Per cent Change
Asoli	BWI	9.09	9.22	*	18.31	
	AWI	12.87	12.21	*	25.08	36.97
Berla-Yeota	BWI	7.26	6.94	*	14.20	
	AWI	11.75	12.43	*	24.18	70.28
Dahegaon	BWI	8.28	10.43	*	18.71	
	AWI	11.05	10.62	*	21.67	15.82
Dharmpur	BWI	6.00	8.10	*	14.10	
	AWI	12.40	8.90	*	21.30	51.06
Dudhlam	BWI	5.11	12.00	17.07	34.18	
	AWI	8.52	15.23	25.58	49.33	44.32
Mothegaon	BWI	13.75	9.78	*	23.53	
	AWI	16.92	10.79	*	27.71	17.76

Source: Project record of the agencies managing watershed.
* No crop taken in the micro watershed.
BWI – Before Watershed Intervention
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like wheat & gram which ultimately resulted in increased crop production.The average change in crop production was 54.6 per cent, the change varying from 25 per cent in Mothegaon to 104 per cent in Dharampur watershed cluster (Table 7).

Table 7: Change in Crop Production in the Cluster

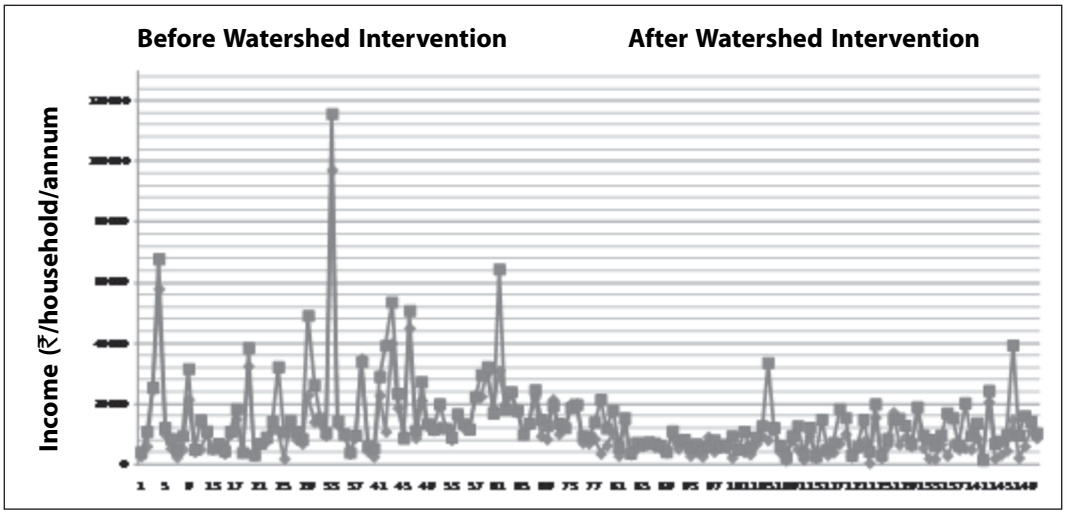
Watershed Cluster	Change	Kharif (Metric tonnes)	Rabi (Metric tonnes)	Summer (Metric tonnes)	Total (Metric tonnes)	Per cent Change
Asoli	BWI	1534.75	18.72	*	1553.47	
	AWI	2159.61	41.50	*	2201.11	41.69
Berla-Yeota	BWI	1537.69	602.52	*	2140.21	
	AWI	2497.91	1781.77	*	4279.68	99.97
Dahegaon	BWI	1384.10	382.63	*	1766.73	
	AWI	1867.66	536.93	*	2404.59	36.10
Dharmpur	BWI	1178.80	88.60	*	1267.40	
	AWI	2395.93	187.35	*	2583.28	103.83
Dudhlam	BWI	895.86	161.86	38.00	1095.71	
	AWI	1494.03	458.35	143.65	2096.04	91.29
Mothegaon	BWI	3504.78	1508.56	*	5013.34	
	AWI	4357.51	1908.68	*	6266.19	24.99

Source: Project record of the agencies managing watershed.
* No crop taken in the micro watershed.
BWI – Before Watershed Intervention
AWI – After Watershed Intervention

Change in Economic Profile

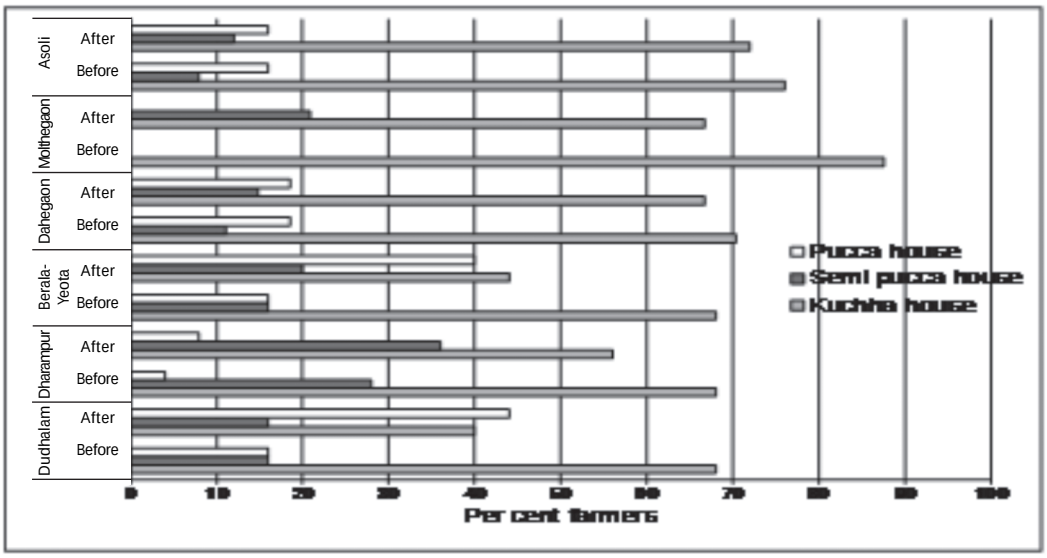
Income and Employment: As a result of the execution of watershed programme, the labour employment generated worked out to be 305,599 persondays per annum. Different activities such as crop production, livestock, horticulture accounted for 60 , 10 and 4 per cent, respectively. The remaining employment was accounted for by other activities like micro enterprise (8 per cent) and agricultural labour (18 per cent). As a result, the change in income was observed to the tune of 38 per cent (Figure 5). Increased income was invested on farm assets, consumer durables and also on livestock owned.

Figure 5: Change in Gross Income of Watershed Beneficiaries (2006 prices)



Consumer Durables and Farm Assets: The increased income during the project execution and after has been invested in creating farm assets, including pucca (permanent) house owned (Figure 6) and also for purchasing consumer durables (Table 8). The investment on well increased from ₹ 61,137 in the pre-project phase to ₹ 77,530 in the post-project phase, an increase of 25 per cent, which was a significant development. Similarly, per household investment on motor and pump owned before the project was ₹ 15,003 and ₹ 11,391, respectively before programme implementation. It increased to ₹ 18,558 (24 per cent) and ₹ 14,882 (31per cent) after programme implementation at constant prices. While the investment on bullock cart increased by 20.5 per cent, the value of cattleshed increased by only 2.6 per cent. The investment on thresher owned did not change. The farm households of Vidarbha region also invested on house construction, cooking gas, refrigerator, television, telephone (mobile) and motor cycle. Major investment was made on telephone (mainly mobile sets), refrigerator and television. The average investment on these assets before programme was ₹ 1262, ₹ 4689 and ₹ 31983, respectively. These increased to ₹ 2336, ₹ 8078 and ₹ 5510, respectively, after programme execution. The average value of investment on other durables increased only

Figure 6: Profile of House Across Watershed Clusters



(Before - Before watershed intervention) (After - After watershed intervention)

marginally, viz., 3.5 per cent in house, 8 per cent in motor cycle, in the post-programme phase. The investment on television increased by 16 per cent as a result of programme execution.

Table 8: Average Value of Asset Owned Before and After Watershed Intervention

S. No.	Asset	Average Value of Asset (₹/Household)		
		Before Programme*	After Programme*	Per cent Change*
A)	Farm asset			
1	Well	61,137	77,530	24.7 (1.8-113.5)
2	Motor	15,003	18,558	23.7 (1.4-245.7)
3	Thresher	49,383	49,383	0.0
4	Bullock cart	7,608	9,166	20.5 (4.6-235.7)
5	Cattleshed	19,168	19,666	2.6 (3.1-164.9)
6	Irrigation pump	11,391	14,882	30.6 (7.9-154)
B)	Consumer durables			
8	House	54,718	56,656	3.5 (2.1-40.0)
9	Cooking gas	3,198	5,510	72.3 (2.6-73.2)
10	Refrigerator	4,689	8,078	72.3 (1.23-75.0)
11	Television	4,492	5,238	16.6 (12.7-49.4)
12	Motor cycle	27,717	29,936	8.0 (1.67-35.2)
13	Telephone	1,262	2,336	85.0 (11.2-25.4)

Source: Data collected from field.
* At 2006 prices
Note: Figures in parentheses are ranges among the clusters.

Livestock Ownership: There was an increase in bullocks, cross bred cows, goats and poultry (Table 9). The maximum increase (five times) was observed in cross bred cows, followed by goat (79 per cent), poultry (78 per cent) and bullocks (12 per cent). The average income from milk production worked out to be ₹ 4115/year (1320-16800 ₹/annum).

Table 9: Change in Livestock in Watersheds

S. No.	Livestock Category	Before Intervention	After Intervention	Per cent Change
1	Bullocks	2921	3272	(+) 12
2	Buffaloes	1340	1116	(-) 17
3	Cross bred cows	133	805	(+) 505
4	Indigenous cows	2009	1204	(-) 40
5	Sheep	146	25	(-) 83
6	Goats	2053	3677	(+) 79
7	Poultry	7557	13434	(+) 78

Household Indebtedness: Majority of the farmers availed of short and medium terms loans (Table 10).The short-term loan was taken by 81 per cent farmers and the average amount of loan worked out to be ₹ 54,138 out of which 11.5 per cent was repaid till the time of survey.

Table 10: Details of Loan Taken and Repaid by Beneficiaries in Selected Watersheds of Vidarbha Region

S. No.	Loan Type	Per cent Farmers	Average Amount (₹)		Loan Balance	Tenure (Years)	Interest Rate (%)	% Loan Repaid
			Loan Year	Loan Taken				
1	Short-term	1.32	2006	45000	15000	1	6	66.6
2	Short-term	4.64	2007	52143	52143	1	4	-
3	Short-term	1.99	2008	70000	70000	1	11	-
4	Short-term	12.58	2009	53295	52529	1	5	1.4
5	Short-term	60.93	2010	50252	49870	1	6	0.8
6	Medium-term	1.99	2006	40833	37833	3	13	7.3
7	Medium-term	1.32	2007	34000	34000	4	11	-
8	Medium-term	1.32	2009	24000	24000	4	11.75	-
9	Medium-term	1.32	2010	175000	175000	4	13	-
10	Long-term	0.66	2008	140000	140000	5	6	-

Similarly, about 6 per cent of the beneficiaries surveyed availed of medium-term loan, the average loan amount being ₹ 68,458. Only 2 per cent of the loan amount could be repaid till the time of survey. The whole amount of long-term loan was yet to be repaid as revealed by the farmers during the survey. Only 2 per cent of the surveyed families reported about the family migration in the pre-programme phase and this status reduced to 0.7 per cent during post-programme phase (Table 11). However, the duration of migration slightly reduced. While

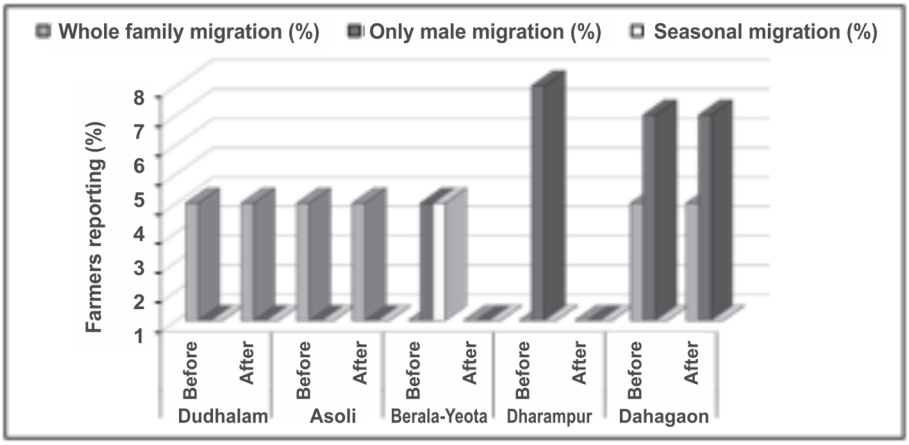
the families migrated for an average of 4 months in a year prior to programme implementation, this reduced to 3 months / year after the programme implementation. Similarly, male migration declined from 3.3 per cent before the programme to 1.3 per cent after the programme. The seasonal migration was reported by only 0.7 per cent farmers prior to watershed programme. Across the clusters, Amravati and Dahegaon reported high male migration as compared to other clusters. The whole family migration was about the same in all the clusters except for Amravati and Buldhana. On the other hand, clusters like Buldhana reported high incidence of seasonal migration, which was almost negligible in other clusters (Figure 7).

Table 11: Migration Profile of Families in Vidarbha Region

S. No.	Description	Before Watershed	After Watershed
1	Whole family migration (%)	2*	0.7**
2	Only male migration (%)	3.3	1.3
3	Seasonal migration (%)	0.7	0

*4 months in a year ** 3 months in a year

Figure 7: Change in Poverty Induced Migration Across Watershed Clusters

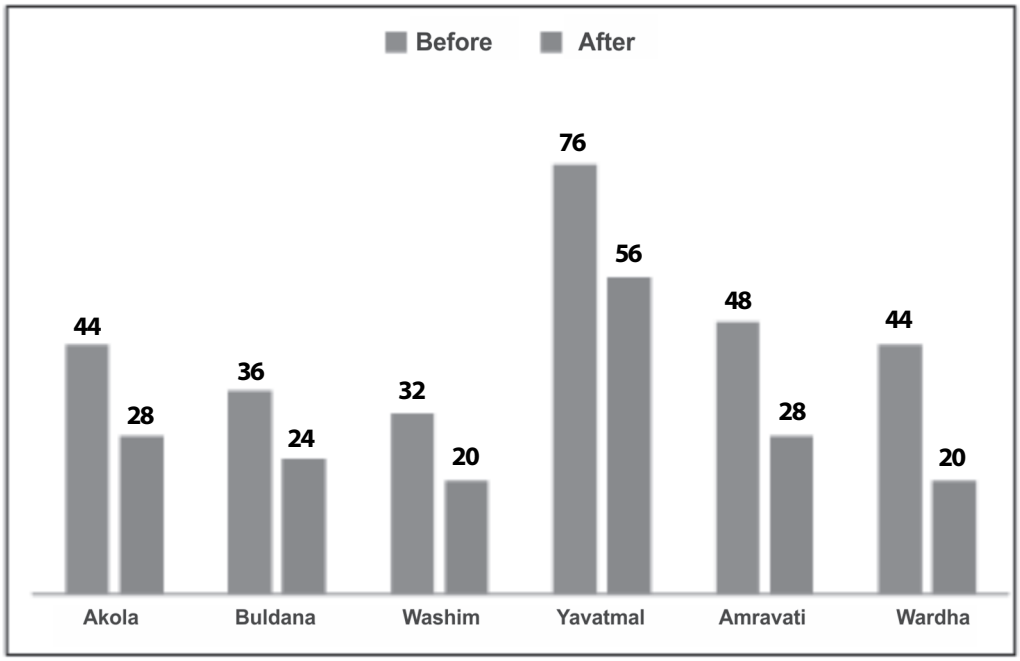


Note : Mothegaon farmers did not report about migration.

Change in Poverty Level: About 46 per cent of farmers surveyed were below the poverty line prior to watershed programme based on the sample survey data (Figure 8).This varied between 32 per cent in Washim to 76 per cent in Yavatmal. This decreased to 29 per cent after the programme implementation, varying between 20 per cent (Washim and Wardha) and 56 per cent (Yavatmal). The project had positive impact and helped people enhance income level, which

increased per capita expenditure on consumption of pulses (increased from 8 per cent of total food expenditure in pre-programme phase to 14 per cent in post-phase).

Figure 8: Population Below Povert Line (%)



Discussion

Vidarbha is mainly a rain-fed farming region and the crops are dependent on vagaries of monsoons. Due to frequent occurrence of dry spell, delayed onset of monsoon and early withdrawal, prospects of good crop were bleak without appropriate rainwater management.The groundwater level was declining because of excessive lifting of water in the absence of replenishment. Similarly, the uneven distribution of annual rainfall (700mm) of the region, which was sufficient to support the production system,in the absence of water conservation measures, remained unutilisable.This made living of the farmers unstable and difficult with uncertainty in yield and income. The region, emerged as the country's farmer suicide capital, had been reeling under its worst agrarian crisis ever due to truant rainfall leading to massive crop failure in cotton, paddy, pulses and soya bean. The low crop and animal productivity had resulted in low livelihood security. This, coupled with inadequate finance for agriculture, lack of supporting enterprises, such as post-harvest cottage and agro-based industries and non-availability of good quality seed, timely availability of desirable fertilisers and pesticides, had compounded the farmers' woes. Repeated crop failures and the resulting indebtedness had, infact, made their lives miserable. Under these

circumstances, watershed programme helped to have more availability of irrigation water due to water storage structures which resulted in stabilisation in production and improvement in crop income. This supplemented the income from enhanced milk production due to better vegetation status,which helped farmers improve their socio-economic conditions. Farm indebtedness, particularly the short-term loans, taken for purchase of agricultural inputs for crop cultivation declined as a result of watershed management as better crop production enabled them to partly repay it. Drought and uncertainty in agricultural production, also reasons for distress, improved and water conservation resulted in increased area during summer in some clusters. The changes, however, were not uniform for all the watershed clusters studied and the differential impact of the programme was attributed to rainfall, natural resource endowment and the efficacy of the programme activities across the clusters in the region. In fact, selection of sites, design and execution of watershed activities played a crucial role. Despite same average rainfall, Yavatmal reported higher crop production and productivity change as compared to Washim. This could be attributed to design, execution and maintenance of farm bunds with outlets. This was reflected in water availability including soil moisture regime. This supported production interventions resulted in increased income, poverty reduction and reduced migration outside the village. Similarly, Buldhana experienced improved cropping intensity and crop productivity in post-watershed programme due to better efficacy in execution of programme interventions like farm bunds with pipe outlet. Proper design, location and work execution of contour trenches in non-arable land of Dahegaon, similarly, resulted in better vegetative coverage post-monsoon. Little improvement in these aspects would further enhance the impact of the programme.

Despite positive change in socio-economic condition of farmers resulting from watershed programme, the economic gain from basic livelihood enterprise viz., agriculture was too little to push them out of the vicious circle of misery. This called for strengthening subsidiary input supply chain like market intelligence and remunerative prices of crop through convergence of different programmes with watershed management programme. The apathy of development agencies in the past should be more than compensated by vigorously addressing the issues of inclusive growth of the local stakeholders in Vidarbha region. The watershed programme funded by development agency like NABARD was a sincere attempt. The impact of watershed management, though was small, yet the change brought about on different socio-economic dimensions strengthened the argument for its replication to entire region with more intensity. As per the estimate of the Commissionerate, Government of Maharashtra, only 27 per cent of the area was available for watershed development, out of which 19 per cent area had been treated with watershed intervention. Of the 9.04 lakh hectares available area for watershed treatment in Vidarbha region, about 3.3 lakh hectares were under DPAP and

0.44 lakh hectares were under dark and grey watershed area,which was under priority. The Government of Maharashtra had earmarked ₹ 275000 crore for 12th Five Year Plan with emphasis on water conservation, rain-fed agriculture and allied sectors. This included interventions to protect dryland farming and consistent and predictable policy regime for pricing, marketing and export.

Higher risk to climate change in drought affected areas has, of late, been identified as a major challenge to mitigate the detrimental effect on agricultural sector of Vidarbha region. Changing rain patterns, long dry spells, deficit and excess rainfall in different parts of the region have adversely affected the crop production, adding to the misery of rural people. Water conservation in deficit areas and water management in rain excess areas can,to a large extent,address the vulnerabilities arising out of changing climate scenario.The Ministry of Environment,Forests and Climate Change (MoEFCC), Government of Maharashtra has emphasised on "Jalyukt Shivar" water conservation project in different parts of the State including Vidarbha region.This includes deepening and widening of streams, construction of cement and earthen stop dams, work on nullahs and digging of farm ponds. Jalyukta Shivar Campaign has become a people's movement in Maharashtra and it is proving to be useful for irrigation and enhancement of groundwater level. It would, however, not be out of place to emphasise the scientific approach in sustaining the campaign to realise the fruits of the conservation works carried out.

Conclusion

Vidarbha region's backwardness, despite glorious past during pre-Independence period, has been attributed to spatial disparities brought about by, among others, poor infrastructural development, a result of weak political commitment after the country's independence. The agrarian development over the period suffered from water resource development, among others. Various government programmes have attempted to address it by investing money on various developmental schemes.However,the desired change in the agricultural scene has not been witnessed and the farmers of the region have continued to take extreme steps of suicides. The local water harvesting and watershed management approach, practised elsewhere with similar characteristics, has been suggested as a cost-effective and efficient approach in the present paper. A case of the watershed management programme executed by the apex funding agency of the country has been evaluated. The socio-economic evaluation has revealed that with in-situ harvesting of rainwater, farmers have realised increased yields. The resulting increase in agricultural income has not only addressed the nutritional security, to some extent, but also the seasonal migration, apart from purchasing farm assets and consumer durables.The paper strongly recommends further strengthening of the watershed programme in the area so that the crux of the agrarian problem is addressed at the earliest. While the earlier

approach was scattered, the present approach is cluster-based, which addressed the natural resource management in a better way. In the agrarian setting of Vidarbha region, other developmental schemes can follow once the local peasantry is helped to stand on its legs with support to livelihood by strengthening the resources such as water and soil.

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