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Impact of Tejpura watershed project on socio-economic status of farmers

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Abstract

The study was conducted during 2002 to 2004 to assess the impact of Tejpura watershed project, located in the village Tejpura-Ghurat in Bangra Block of Jhansi district of UP, India, on the socio-economic status of the farming community of this watershed area. Ninety six farmers households were randomly selected and interviewed using well structured schedule and focused PRA including transect walk. The data was compared with the sample survey of year 1991. There had been an increase in number of households, human population, overall literacy and working population. Area under *kharif* crops cultivation was increased at a higher rate than that of *rabi* crops. The average family size of the households sampled decreased by 16.67 percent. The literate family members increased by 13.82 per cent. The average annual total employment days of family members increased. Agricultural (farm) sector employment increased in cases of small and large farmers only. The non-farm income increased by 153 per cent, except among the marginal farmers. The regression coefficient showed positive impact on the level of employment. The average income per household increased by 47.64 per cent, increase was more in case of small, medium and large farm households compare to marginal. Coefficient of multiple determination (adjusted squared multiple R) was 0.98. These results indicated that raising the level of household income is dependent on increasing level of investment on agriculture activities and non-farm opportunities for the agricultural .

Key words : Bundelkhand, Impact, Socio-economic status, Tejpura watershed

Introduction

Any production activity is guided by the needs of household and animal husbandry. The natural factors like low rainfall, lowering water table and depleting ground water resources have affected the cropping pattern resulting in reduction of gross cropped area and thus causes change in livelihood strategies. The interventions causing change in the land use pattern can be beneficial to the farmers. About 66 per cent of total area is cultivated In Bundelkhand region. The Tejpura watershed comprises of 775.7 ha area and is located in the village Tejpura-Ghurat in Bangra Block of Jhansi district of UP. The project was implemented by State Soil Conservation Department of U.P. under technical guidance of Indian Grassland and Fodder Research Institute (IGFRI), Jhansi from 1984 to 1986. In June 1987, the project was reorganized and further extended up to Kharaiya Nala ï Lakheri river (five sub watersheds). Any watershed development project take significant amount of time to achieve the potential impacts expected and is visible after some time. Hence, the study was conducted with the objectives of analyzing the (i) post development impact of Tejpura watershed on income level of farming community from crop, livestock and other sources and (ii) on employment status of the farming community.

Materials and methods

Among the 539 households in the village of Tejpura watershed area, 96 households were selected by applying random sampling technique. The information was gathered by interviewing the selected farmers of which, 29 were marginal farmers, 27 were small farmers, 25 were medium farmers and 14 were large farmers. Participatory Rural Appraisal (PRA) techniques were also used to obtain basic information during the years 1991 to 2002. Thus, to analyze the impact of this watershed, the socio-economic condition of the farm households during 1991 was compared with that in 2002 and presented in this paper. Numerous monitoring tools and their combinations, such as semi structured interviews, farmers own record, ground photographs, community evaluation of certain indicators, information gathered by other institutions and private enterprises were used to quantify the changes in indicator values over time (Singh, 1991; Ajora, 1998).

Employment Function: For quantitative estimation of factors influencing employment generation, the Multiple Linear Regression Analysis was carried out. The above analysis was carried out separately for the base year (1991) and for the post development period (2002). The equation (Ahuja, 2008) was as follows :

$Y= a+b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5+ u,$

Where,

Y = Employment per year (Man days of 8 hours),
x_1 = Family size (i.e. total number of family members),
x_2 = Holding size (ha),
x_3 = Net cCropped aArea (ha),
x_4 = Livestock (Total number of livestock owned by household),
x_5 = Total Off farm income in family (Rs.)
u = Random term

Income Function: Measurement of impact on income is the major yardstick of any development programme. Thus, man-days of productive employment and level of income were measured for the period after the watershed project implementation.

To examine the relative contribution of each independent variables influencing household income a Multiple Linear Regression Analysis was carried out separately for the base year (1991) and for the post development phase (2002). The equation (Ahuja, 2008) was as follows ;

$Y= a+b_1x_1+b_2x_2+b_3x_3$

Where,

Y = Total aAnnual iIncome of hHouseholds (Rs.) (i.e. farm income + non farm income)
x_1 = Holding size (ha)-tTotal area owned by an individual / joint family whether cultivated by family or rented out.
x_2 = Farm income (Rs.) (i.e. income from agriculture and livestock).
x_3 = Other income excluding farm income (Rs.)

Results and Discussion

Respondents Profile: There were 539 households in the village. The population of males and females was about 54 and 46 per cent, respectively in year 2002. The ratio was distorted towards male population across all categories of farmers. The sex ratio was comfortable in the age group of 1-3 years (50:50). Distortion in this situation started after 4 years of age, which was due to higher female mortality at childhood stage. The average family size was about 6, 8, 9 and 9 members, respectively for marginal, small, medium and large farmers while the village average was 8. The working population (18-60 years of age) was 54.55 per cent, whereas about 7 per cent was above 60 years of age and about 38 per cent was below 18 years. It clearly indicates that existence of more productive population in study area.

The overall literacy among sample farmers was 59.56 per cent. The average male literacy among marginal, small, medium, and large farmers was 55.55, 66.94, 74.75, and 90.12 per cent, respectively. The average male literacy was 70.82 per cent. The average female literacy among marginal, small, medium, and large farmers was 26.47, 36, 58.69, 61.97 per cent, respectively. The average female literacy was 45.92 per cent. The literacy level increased with size of holding in case of both male and female population. The female education was neglected among all categories especially among marginal, small and medium farmers.

The sample survey of 1991 indicated that the average family size was 9.31 having 5.17 males and 4.14 females. The literacy percentage was 52.07 per cent of which, 69. 55 per cent in males and 30.24 per cent in females. About 44.98 per cent population belonged to working class. The sex ratio was normal up to 6 years of age. Beyond this stage, serious distortions started i.e. female population showed a sharp decrease. Table 1 revealed that 34.28 per cent farmers were belonging to general caste category, whereas backward, schedule caste and schedule tribe were 27.75, 29.94 and 12.93 percent respectively.

Table 1 : Household (no.) according to community and land holding (2002)

Farmers	Large	Medi-mum	Small	Marg-inal	Land less	Total
General	43	52	60	31	0	184
Backward	0	35	33	54	1	123
SC	2	41	41	77	1	162
ST	0	0	30	40	0	70
Total	45	128	164	202	2	539

Majority of farmers were falling under marginal (38%) and small (30%) land holding categories, whereas medium and large farmers were 24 and 8 percent. Only two households were not having any kind of agricultural land in the study area.

The livelihood of the farmers was dependent mainly on crop, livestock husbandry, services and wages. The marginal farmers were dependant mainly on wages, dairying, other jobs and crops production, whereas it was dairying, crops and services for small farmers, for the medium farmers crops, dairying and other jobs, for large farmers dairying, crops, other jobs and services.

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Socio-economic aspects: The number of households increased by 115 as compared to year 1991 (Table 2). The increase in human population was 473 (231 males and 241 females). The working population increased from 44.98 to 54.55 per cent. The overall literacy rate increased by 7.49 per cent (1.27 % in males and 15.68 % in females). The increase in female literacy was important indicator of development. Sex ratio distortion (less females) and higher female mortality in childhood were still continued.

Farm Size: The farm size declined from 2.86 ha to 2.14 ha per family in 2002 as compared year 1991. The decline was more in marginal as compared to others due to more fragmentation. The average farm size declined by 22.62, 15.85, 7.78 and 3.58 per cent in marginal, medium, small and large categories, respectively considering 1991 as the base year (Table 2).

Significant change happened in average size of family which declined from 9.3 in 1991 to 8 in 2002. After the implementation of Tejpura watershed project the income per family has increased substantially, along with education and literacy rate and consequently resulted in reduction of size of family.

Livestock per household: The number of livestock per household (ACU) was declined substantially from 1991 to 2002. Due to increase in area under high yielding varieties and area under irrigation, the cropping pattern got diversified resulting in less number of livestock kept for the subsistence livestock rearing.

Family size: The average family size of the sampled households was decreased by 16.67 percent during the project period. Maximum decline was in the category of large and marginal farmers with 32.28 and 23.47 per cent, respectively which indicates more fragmentation of holding in these categories.

Off- farm income: Average non-farm income among sample household increased by 153 per cent over the base year. Among the marginal farmers, the non-farm income decreased by 3.39 per cent. The off-farm income of small, medium and large categories of households increased by 134.80, 97.99 and 645.06 per cent, respectively.

Literacy: The average number of literate family members increased by 13.79 per cent in sample households except in marginal farmers where, it declined by 1.67 per cent during the study period. Highest increase in literacy rate was observed on medium size household (55.27%), followed by large (37.69%) and small farmers (29.85%).

Employment

One of the most important aspects that need to be considered in the assessment of overall impact of watershed is the employment generation for rural population. Employment avenues of the rural populations exist in farming and non-farm or off farm ventures including services. Watershed development is expected to augment such opportunities.

The average annual total employment days of family members employed in case of marginal, small, medium and large farmers in 2002 reached 366, 501, 549 and 1405 respectively as compared to base year (1991) employment of 665, 555, 649 and 985 by the respective households. While only the large farmers achieved significantly higher level of (42.66%) employment after implementation of the watershed project. The employment per hectare in other group rather declined. There was an increase in the agricultural (farm) sector employment in respect of small and large farmers by 5.20 and 8.24 percent respectively in the post development phase. In the case of marginal and medium, it showed a reduction of 12.06 and 20.22 per cent, respectively (Table 2).

The off-farm employment changed in the post development phase of watershed. There was decrease in the annual employment among all the categories except the large farmers who had increased employment (110.41%). This meant that only resource rich farmers could generate non-farm avenues. This also could be due to absence of mechanism for sustaining the pace generated initially during the project period. Expenses on crop production and livestock increased by 25.84 and 60.5 per cent, during post development period.

Employment Function

The above analysis was carried out separately for the base year (1991) and for the post development period (2002) (Table 3). The regression coefficients during 1991, associated with off farm income, number of livestock, family size and net crop area showed significant positive value ($p<0.01$) indicating positive impact on the level of employment. However, family size and farm size were not considered in step down method of analysis as the same was deleted due to the absence of impact on the dependant variable in the base year data of households. Among the independent variables, number of livestock had the highest value for the estimate (32.69) implying that the farmer possessing more number of livestock had more total family employment generation. The value of regression coefficient clearly indicated that the supply of

Table 2 : Indicators of employment and income

Category	Marginal		Small		Medium		Large		Pooled average		% Difference
	1991	2002	1991	2002	1991	2002	1991	2002	1991	2002	
Farm size (ha)	0.84	0.65	1.67	1.54	3.66	3.08	8.67	8.36	2.86	2.14	-25.17
Family size (no.)	7.33	5.61	7.57	8.04	11.20	9.13	13.64	9.23	9.30	7.75	-16.67
No. of livestock (ACU)	3.10	1.97	3.45	3.21	7.01	4.88	8.26	6.88	5.89	3.79	-35.65
No. of literate persons/ household	3.00	2.50	3.25	4.22	3.89	6.04	5.36	7.38	4.06	4.62	13.82
Total Employment /Family (no.)	664.97	366.04	554.80	500.96	659.43	549.25	984.97	1405.20	741.11	798.84	7.79
Employment in farm sector (no.)	224.47	179.08	296.28	311.70	470.49	413.73	653.11	706.92	445.17	322.90	-27.47
Off farm employment (no.)	440.50	186.89	258.51	189.26	188.94	135.54	331.86	698.28	295.94	475.91	60.81
Off farm income (Rs./household)	8782.50	5850.36	5633.75	13228.15	5866.67	11615.17	10909.09	81279.77	7957.79	20177.95	153.56
Cost Crop Production (Rs.)	6143.34	10268.39	9478.93	12455.82	16730.97	32828.84	38922.14	72514.89	20335.70	25591.39	25.84
Total Expenses on livestock (Rs.)	9889.74	19243.29	11684.55	29683.75	27474.33	44485.65	32552.01	67346.54	22298.71	35689.50	60.05
Cropping intensity	176.23	151.48	161.15	110.55	117.76	145.89	103.19	123.32	133.58	134.03	0.34
Total Farm income (Rs.)	16473.58	15648.75	21421.98	21523.35	44394.19	58171.85	71805.98	122729.29	42930.32	43596.75	1.55
Total income / family (Rs.)	16788.58	25774.82	22963.23	39415.39	48419.39	77823.26	82667.09	219704.06	47927.94	70758.93	47.64

ACU indicates Adult Cattle Unit

one productive animal could raise the level of employment to the extent of 32.69 labour days per annum, keeping other variables constant. The goodness of fit of the regression equation as indicated by the coefficient of adjusted multiple determination (R^2) was 0.85 inferring that the independent variables included in the function explained 85 percent of the variation in the dependant variable i.e. total employment.

In post implementation period (2002) of the watershed, regression coefficients associated with farm size, non-farm income were positive and significant ($p<0.01$) indicating positive impact on the level of employment.

Income: The income level per farm household of the watershed area, gross income from different sources was Rs. 47927.94 and Rs. 70758.93 during base year (1991) and 2002 respectively (Table 2). During this period the household income increased by 22830.99 (47.64 %). In marginal farmers group, increase was least from 16788.58 to 25774.82 equal to an increase of Rs. 8986.24 (53.53 %). Similarly in the case of small, medium and large farm households the average income were Rs.22963.23, Rs.48419.39 and Rs. 82667.09 in the base year and increased to Rs. 31415.39, Rs. 77823.26 and Rs. 219704.06 during post development period (2002) showing an increase of 71.65, 60.73, 165.77 per cent respectively. Evidently large categories of households could manage to have more income as compared to other.

Income function: The multiple regression equation analysis was carried out separately for base year (1991) and post development phase (2002). Primary data in its original form was fitted in regression equation. At the sample level (base year), the regression coefficient associated farm income (crop + livestock) was found positive and highly significant and non-farm income was found negative but significant ($p<0.10$). Regression coefficient of farm income indicated that farm income will increase the level of household income keeping other values constant. Coefficient of multiple determination (adjusted squared multiple R) was 0.968, which indicated that 97 per cent variation in the level of household income was explained by the independent variables (Table 4).

The second phase (model 2002) indicated that regression coefficients associated with farm income and non-farm employment were positive and highly significant indicating their positive impact on the level of household income. However farm sizes were omitted in the step down method of multiple regression analysis due to their non-significance. These results indicated that raising the level of household income is dependent on increasing level of investment on agriculture activities, livestock and non-farm opportunities for the agricultural communities rather than increase the supply of land, which is sinking resource. The adjusted value of R^2 (0.952) for this function was also satisfying.

According to Hazra and Singh (1995), the important aspect that needs to be considered in the overall impact of the watershed for the rural poor is the employment generation for these people. There were 12.4 percent landless farm families in the watershed and 33.4% of the population was below poverty line. The increase in human employment was to the tune of about three times increase over the base year and also in the form of bullock labour of similar magnitude. The landless poor constituting 12.4 percent of the entire population maintain about one-fourth of the animal population. This is a diabolic situation in a sense that these people although do not possess land but maintain such large herd harping on the others land and natural resources of the area. On the basis of their employment, they used to earn only about Rs. 2280/- per family annually which stood to be Rs. 190/per month before the initiation of watershed work. These people used to earn about Rs. 10800/- annually or Rs. 900/- monthly during the period of watershed work from 88-89. Subsequently, there was some dramatic turn in the working of these people. About 20 families started basket making during 1988-89 rabi season by collecting raw

Table 3: Employment Function

				1991			
Y =	a +	$b_1 x_1$ +	$b_2 x_2$ +	$b_3 x_3$ +	$b_4 x_4$ +	$b_5 x_5$	R^2
		Family size	Farm size	cropped area	Livestock no.	Non-farm income	Coefficient of multiple determination
Y =	179.39	-	-	23.865*** x_3 (5.736)	32.693*** x_4 (7.598)	0.030*** x_5 (0.003)	0.85
				2002			
Y	1925.14	-	-	12037.63** x_3	1018.52 **x_4	1.041^{NS} x_5	0.959
Y				(733.143)	(623.241)	(0.063)	

Table 4: Income function

			1991		
Y =	A +	b_1x_1 +	$b_2 x_2$ +	$b_3 x_3$	R^2
		Family	Farm	Non-farm	regression
	size		size	income	coefficient
Y =	297.871	-	1.63*** x_2	-7.818*	0.968
			(0.037)	(3.978)	
			2002		
Y	4691.08	-	0.969***	1.041***	0.959
Y			(0.062)	(2.970)	0.952

materials from forest mainly derived from unwanted common bush *Lantana camera* which has no economic value by making about 15 baskets daily and used to sell at a price of Rs. 3/- per basket. Thus a family brought home about Rs. 45/- per day for a period of three months additionally bringing Rs. 4050/ per family per annum. About 201 families engaged in basket making. On analyzing their income pattern during 1990-91, it was observed that each family earns about Rs. 14000/- annually that is about Rs. 1166/- per month, an increase by over 600 percent. Another important aspect is the fish production in the check dams and water harvesting bundhies of the watershed which fetched about Rs. 17000/-.

Hazra (1996) observed that in this watershed, if the plantation sites are adequately protected, it could lead to forest and this benefit could be harvested for pretty long time. The present tangible benefit that itself is available for immediate use is the forage and minor timber. In addition some minor forest produce are used for offfarm employment. For direct gain, the productivity of forages from treated hills and hillocks were observed to the extent of 5.3 t/ha on average basis. In addition to these direct gains, additional use of forest produce by landless people helped them in improving their income and standard of living. The cost : benefit ratio of afforestation was 1:2.87.

In context of development planning, it was observed that for post development sustainability, financial aid should be given. The owners of private land falling under catchments area, should be allotted alternate land so that they do not discharge the water for sowing purposes. The cropping pattern has become more need based and market driven giving more preference for cash crops.

Conclusion

In post development stage there had been several changes which were both positive and negative. Development in socio-economic aspects indicated over all prosperity and improvement in welfare as compared to that of the year 1991. The literacy rate increased in both male and female across all the farm size categories. There were both qualitative and quantitative changes in cropping pattern. All categories of farmers diversified their farm activities. The average family income showed an increase by 47.64 cent over 1991. The value of agricultural produce per unit area (ha) showed an increase by 164 per cent from 1991-92 to 2002. It could be concluded that the level of household income can be increased by increasing the level of investment on agriculture activities and non-farm opportunities for the agricultural communities.

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