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## **Socio-economic Impact of Watershed Development in Kanpur**

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### **Abstract**

The socio-economic impact of a watershed project in Kanpur Dehat district of Uttar Pradesh has been evaluated in a 'before and after' framework. The implementation of the project has facilitated area expansion during the post-rainy season, which was fallow before initiation of the project. The productivity of most of the crops has also increased. Besides, the project could arrest degradation of the land, which was very severe in the command area and was acting as a limitation in improving the crop productivity. Livestock population has also increased considerably. These improvements in the agricultural activity have led to an increase in the on-farm employment opportunities for the farmers of the area. Smallholders have been benefited the most from the project.

### **Introduction**

Together with improved technologies, conservation and judicious use of natural resources is the key to improving productivity and sustainability of agriculture. Soil and water are two most important resources that need to be conserved and utilized efficiently to increase agricultural production. To achieve this, watershed development programmes have been started in many regions of India, particularly in the arid and semi-arid regions. Apart from resource conservation, watersheds help the farmers in diversifying and intensifying the agricultural activity in a manner that enables them to augment their income and employment. This paper evaluates the socio-economic and environmental impacts of a watershed in Uttar Pradesh.

### **Methodology**

A watershed development project, completed by the Department of Agriculture, Government of Uttar Pradesh, in Bagaria village of Kanpur

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Dehat district was selected for assessing its socio-economic and environmental impact. The watershed development unit is a part of the National Watershed Development Programme for Rainfed Agriculture (NWDPRA). The watershed components adopted in the project were: vegetative filter stripes, contour vegetative hedges, gully control measures, contour dead furrow and repairing of old structures for arable lands; and live fencing, contour vegetative hedges, gully control measures, planting of shrubs, raising of grass and legumes for pasture, planting trees on nalabank, stabilization of nalabank, live check dams, earthen structures, and small, medium and large dugout ponds for non-arable lands. The situation of arability was studied for making a comparison in context of 'before and after' the project.

## Results and Discussion

Watershed creates both short-term and long-term impacts. Short-term impacts include crop diversification/intensification and improvements in crop productivity, livestock numbers and employment, and are largely economic in nature. Long-term impacts include improvements in degraded land and expansion of arable land and these concern the sustainability of the agricultural production system.

### Short-term Impacts

#### Area Expansion

The changes in crop area due to implementation of the watershed project are shown in Table 1. It is revealed that the project could bring about substantial changes in the cropped area. Gross cropped area in the command area increased from 157 to 204 hectares. Area under wheat expanded considerably; from 15.97 per cent in the pre-watershed period to 54.97 per cent during the post-watershed period. Area under mustard almost doubled after the implementation of the project. So was the area under lentil. It may be noted that these crops are grown during the post-rainy season when water scarcity is a major problem. In other words, creation of watershed improved farmers' access to irrigation water and facilitated utilization of land during the post-rainy season which otherwise would have remained fallow.

Smallholders appeared to have been benefited the most from the watershed. Wheat area expanded 4 to 5-times on the holdings below less than 6 ha. Area expansion was also considerable on holdings lying between 6 and 9 hectares. So was in the case of other crops whose area expanded after implementation of the project. Area under the *kharif* crops also

**Table 1. Changes in area under crops after implementation of the watershed project**

Crop	Landholding size (ha)				Total / average (ha)	Landholding size (ha)				Total / average (ha)
	0-3	3-6	6-9	> 9		0-3	3-6	6-9	> 9	
	← Before project implementation →					← After project implementation →				
Sorghum	0.83 (14.84)	4.48 (13.64)	3.41 (9.08)	8.87 (10.91)	17.58 (11.18)	2.04 (10.22)	7.18 (10.17)	3.50 (5.55)	2.05 (4.05)	14.77 (7.23)
Bajra	0.70 (12.63)	2.73 (8.32)	2.95 (7.85)	5.97 (7.35)	14.47 (9.20)	1.95 (9.81)	4.43 (6.28)	2.37 (3.76)	1.80 (3.56)	13.10 (6.41)
Pigeon-pea	0.68 (12.31)	4.34 (13.22)	4.25 (11.30)	9.65 (11.87)	18.92 (12.03)	2.37 (11.89)	7.04 (9.97)	5.14 (8.14)	4.55 (8.98)	19.10 (9.35)
Wheat	0.79 (14.15)	4.39 (13.39)	6.51 (17.31)	13.42 (16.51)	25.11 (15.97)	4.26 (21.37)	16.51 (23.38)	19.02 (30.13)	15.18 (29.97)	54.97 (26.90)
Mustard	0.55 (9.86)	3.97 (12.08)	4.67 (12.43)	10.02 (12.32)	19.20 (12.21)	3.04 (15.28)	12.75 (18.06)	12.49 (19.79)	10.46 (20.65)	38.74 (18.96)
Lentil	0.43 (7.71)	3.11 (9.47)	4.54 (12.08)	9.07 (11.16)	17.15 (10.91)	2.21 (11.10)	10.31 (14.60)	11.81 (18.71)	9.41 (18.58)	33.74 (16.52)
Barley	0.45 (8.17)	2.56 (7.79)	2.05 (5.45)	4.17 (5.13)	11.27 (7.17)	1.93 (9.67)	6.08 (8.61)	4.34 (6.88)	3.56 (7.02)	17.14 (8.39)
Linseed	0.35 (6.23)	2.23 (6.79)	1.37 (3.64)	3.24 (3.99)	9.09 (5.78)	0.55 (2.75)	1.43 (2.02)	0.66 (1.05)	0.88 (1.74)	4.09 (2.00)
Others	0.78 (14.09)	5.02 (15.28)	7.83 (20.85)	16.87 (20.75)	24.44 (15.55)	1.58 (7.91)	4.88 (6.91)	3.78 (5.99)	2.76 (5.45)	8.66 (4.24)
CGA	5.56 (100.00)	32.81 (100.00)	37.57 (100.00)	81.28 (100.00)	157.23 (100.00)	19.92 (100.00)	70.61 (100.00)	63.12 (100.00)	50.65 (100.00)	204.30 (100.00)

Figures within the parentheses are percentages to total

**Table 2. Change in livestock population**

S. N.	Particulars	Landholding size (ha)				(Number)
		0-3	3-6	6-9	> 9	Total /
						average
<b>Before project implementation</b>						
1	Goats	6	12	5	48	71
2	Sheep	-	5	-	7	12
3	Buffaloes	8	15	17	21	61
4	Cows	6	12	15	21	54
5	Total livestock	20	44	37	97	198
<b>After project implementation</b>						
1	Goats	27	61	44	64	196
2	Sheep	10	-	-	15	25
3	Buffalos	24	55	31	19	129
4	Cows	30	47	16	10	103
5	Total livestock	91	163	91	108	453

expanded considerably on these holdings. On the other hand, area expansion on holdings above 9 ha was marginal during the *rabi* season while the *kharif* crops witnessed a contraction in the area.

### Livestock Population

Not surprisingly, crop-livestock linkages improved after implementation of the watershed programme in the village, as was indicated by increase in the livestock population (Table 2). The total livestock population in the villages increased from 198 to 453. Population of goats, sheep, buffaloes and cows increased at a tremendous rate on all categories of farms. The increase in the livestock population was much higher on smallholdings. This indicated that watershed has helped in the diversification of crop-livestock mixes and reduced risks.

### Crop Productivity

Since irrigation is critical to crop productivity, with creation of watershed there was a significant increase in the crop productivity (Table 3). On an average, the wheat yield increased from 7.49 quintals/ha during the pre-watershed period to 16.18 quintals/ha during the post-watershed period. Yield of mustard almost doubled, and those of pigeonpea and sorghum increased by 1.5-times. Crop productivity improved on all the categories of farms, bit more on larger farms.

**Table 3. Change in crop productivity**

(quintals/ hectare)

Crop	Landholding size (ha)				Overall	Landholding size (ha)				Overall
	0-3	3-6	6-9	> 9		0-3	3-6	6-9	> 9	
	Before project implementation					After project implementation				
Wheat	7.25	7.32	7.95	7.52	7.49	15.78	15.89	16.65	17.46	16.18
Mustard	3.23	3.25	3.45	3.75	3.44	6.51	6.98	7.25	7.11	6.92
Lentil	2.50	2.12	2.50	2.35	2.42	2.54	2.51	2.75	2.54	2.56
Pigeon-pea	3.98	4.25	4.15	4.50	4.28	6.50	6.57	7.02	7.15	6.50
Sorghum	3.78	4.15	4.25	4.75	4.31	6.25	6.89	7.58	8.42	7.03

**Table 4. Change in employment**

(mandays/ hectare)

Crop	Land holding size (ha)				Overall
	0-3	3-6	6-9	> 9	
<b>Before project implementation</b>					
Wheat	65.35	58.36	52.64	44.58	53.87
Mustard	42.36	36.27	32.50	28.64	33.97
Lentil	35.32	30.61	28.01	25.61	29.17
Pigeon-pea	42.16	38.21	35.58	29.98	36.65
Sorghum	45.64	38.28	35.61	33.64	37.30
<b>After project implementation</b>					
Wheat	87.58	85.74	80.45	79.80	84.60
Mustard	48.25	45.54	44.58	45.87	46.09
Lentil	42.54	39.65	36.58	37.25	39.56
Pigeon-pea	52.32	48.56	45.92	44.58	45.58
Sorghum	62.35	58.54	55.71	52.45	58.30

### Employment

Intensification and diversification of agricultural activity increased the opportunities for on-farm employment for the farmers. Crop-wise labour use presented in Table 4, reveals that labour-use in wheat increased from 53.87 to 84.60 mandays/ha (57%) after implementation of the project.

Labour-use in other crops also increased considerably. Another interesting observation emerged from the analysis was a negative relationship between labour-use and size of landholding, that smallholders can have opportunities of engaging surplus labour in watershed-led intensification of agriculture.

**Table 5. Degraded lands during pre- and post-watershed periods**

Lands-use category	Degradation category				Total (ha)
	Slight	Moderate	Severe	Very severe	
<b>Before project implementation (1991-92)</b>					
Arable land	21.56 (15.28)	30.04 (20.37)	63.61 (43.12)	31.32 (21.23)	147.53 (100.00)
<b>After project implementation (1999-2000)</b>					
Arable land	89.03 (60.35)	45.06 (30.54)	9.48 (6.43)	3.95 (2.68)	147.53 (100.00)
Change, %	+412.94	+150.09	-670.99	-792.91	-
<b>Before project implementation (1991-92)</b>					
Non-arable land	-	-	43.46 (45.37)	52.32 (54.63)	95.80 (100.00)
<b>After project implementation (1999-2000)</b>					
Non-arable land	-	12.15 (12.68)	57.07 (59.57)	26.58 (27.75)	95.80 (100.00)
Change, %	-	+100.00	+131.32	-50.80	

Figures within the parentheses indicate their percentage

### Long-term Impact

Degradation of agricultural land was a major problem in the study area before the watershed project was implemented. The major concerns were soil erosion, nutrient depletion, overgrazing, and soil compaction. These problems were causing adverse effect on crop production. The extent of land degradations before and after project implementation are given in Table 5. Of the 148 hectares arable land, about two-thirds was severely degraded. On implementation of the watershed project, this could be brought down to 9 per cent. Similarly, the non-arable land which was facing acute problem of degradation, could be improved after implementation of the project.

### Conclusions

It is found that implementation of watershed development project has resulted in area expansion, increase in livestock population, and improvement in crop productivity. Besides, the project could help arrest degradation of both arable and non-arable lands. All these have enhanced farmers' income and employment opportunities at the local level. Smallholders have been benefited the most from watershed development.