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Impact of Sujala-III watershed programme on livestock in low rainfall semi-arid region of Northern Eastern Karnataka

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Abstract

The study on economic impact of Sujala-III watershed project was conducted in North-Eastern Karnataka to assess the economic impact of Sujala-III watershed programme on livestock wherein, the primary data was collected from Kalaburagi and Raichur districts. The comparative analysis of data was carried out through the *ex-ante* (2014-15) and the *ex-post* (2018-19) approaches in Dotikol and Nagalapur-1 micro-watersheds from Chincholi and Lingasugur talukas, respectively. The result of the study indicated that there was effective performance of these two micro-watersheds in terms of increase in gross and net cropped area by 13.94 and 2.94 per cent respectively which in turn resulted in positive change in cropping intensity (11.17%) of agricultural crops in general, *rabi* and perennial crops in particular. Similarly, there was significant increase in the population of livestock which in turn increased the income from cow, buffalo, bullock, sheep, goat and poultry by 10.49, 8.95, 9.05, 7.42, 5.98 and 5.51 per cent respectively which was mainly due to sufficient availability of water and fodder in watershed area. The impact of Sujala watershed project indicated that maximum area was under perennial crops (31.16%) followed by *rabi* (27.81%) and *kharif* (10.14%) crops. There was significant increase in the livestock population which in turn increased the income of farmers to the extent of 5 -10 per cent.

Keywords: Watershed, cropping intensity, income and livestock

Introduction

Indian agriculture largely depends on monsoon rains and these rains are critical to almost 60 per cent of India's rainfed agriculture. Dryland farming in India not only constitute about three-fourth of the land mass under arid, semi-arid and dry-humid zones, but also account for nearly 57 per cent of the agricultural land spread across large parts of the country (Pushpendra *et al.* 2012). In case of Karnataka, it is subjected to repetitive droughts, since the state has the largest proportion (79.00%) of drought prone area among all major states in the country. Karnataka has a geographical area of 19.05 million hectares, of which 75 per cent of the cropped area in the state depends on low and uncertain rainfall. The state depends on dryland for more than half of its food production. The reduced water resources coupled with soil erosion has led to a situation of rapid deterioration of soil fertility, decrease in crop yield, deforestation, decline in the biomass production, depletion of underground and surface water bodies and distraction of natural vegetation, these in turn affect the natural environment.

To tackle such issues, Governments have taken various initiatives by Watershed Development programme which is one among the flagship programmes. Since, a watershed refers to a geographical area that drains to a common point to conserve soil and maximize the utilization of surface and subsurface water. In Karnataka, out of 116.90 lakh hectares of dryland available for watershed development, of which nearly 75 lakh hectares is treated through watershed approach by various programmes. Hence, Sujala Watershed programme was initiated from 2002. With the success of the Sujala-I and Sujala-II watershed projects, Government of Karnataka intended Sujala-III watershed project which was designed by the GOK and implemented by the Watershed Development Department of Karnataka with tripartite cost-sharing arrangements, with the financial assistance from World Bank. KWDP-II (Sujala-III) project aims at improving the agriculture productivity and vegetative cover, augmenting horticulture, dairy, fodder and fuel availability, reducing soil erosion, runoff and nutrient loss, improving water table enhancing household income and quality of life among local communities, it ensures institutional support with Watershed Development Department as

facilitator and NGOs for strengthening community organization.

Further, North Eastern region of Karnataka shares 70 per cent of dryland proportion and irrigated land constitute only 24 per cent. Agriculture in this region is characterized by low crop productivity resulting in degraded natural resources and wide spread poverty. The development of rainfed areas through the watershed approach is currently given high priority in NEK region. Meanwhile, Sujala watershed project in NEK region found very effective in meeting these objectives by achieving significant impacts on the social, economic, institutional and environmental aspects.

Materials and Methods

Kalaburagi district lies between 15° 12' and 17° 46' N latitude 76° 04' and 77° 42' E longitudes, with a geographical area of 10,958 Sq. Km. The district is covered by both black and red soils. Canals are the major source of irrigation constituting 73.66 per cent of total irrigated area followed by open wells and borewells (20.75%). Raichur district is situated in both North-Eastern Dry and Northern Dry Zones of Karnataka state. It lies between 15° 09' and 16° 34' N latitudes and 75° 46' and 77° 35' E longitudes with a geographical area of 8,383 Sq. Km. It has predominantly black cotton soils, with annual normal rainfall of about 449 mm. Canals are the major source of irrigation and is irrigating 1231.27 Sq. Km. area followed by borewells and open wells (375.40 Sq. Km) and other source like tanks (10.14 Sq. Km).

Sampling and data collection

Stratified sampling technique was employed for selection of respondents in the study. In the first stage, Kalaburagi and Raichur districts were selected, in the second stage Chincholi and Lingasugur talukas of respective districts were selected based on the maximum number of micro-watersheds chosen for implementing Sujala-III project. In the third stage, Dotikol and Nagalapur-1 micro-watersheds were selected from Chincholi and Lingasugur taluks respectively. Sample of 180 farmers were randomly selected, comprising 90 farmers from each selected micro-watershed. Further, four villages of Dotikol micro-watershed of Chincholi taluka and four villages of Nagalapur-1 micro-watershed of Lingasugur taluka were selected for the study. The selected sample farmers were interviewed randomly to elicit the required information about Sujala-III watershed project.

Analytical tools and techniques employed

Measures of central tendency and ratios

Weighted average and per cent change were computed in respect of cropping pattern, livestock population, income from livestock of the sample respondents to facilitate better comparison of the average farm situation before and after implementation of the Sujala-III watershed project.

Student paired t-test

In empirical study, generally it becomes necessary to compare the cropping pattern per acre, for two different independent sample *viz.* before implementation of watershed and after the implementation of watershed project. In analysing the data, students paired 't' test was used to see the significance difference between two means.

Suppose we have got two independent random samples, $x_1, x_2, x_3, \dots, x_n$ and $y_1, y_2, y_3, \dots, y_n$ of n sample size. Under null hypothesis, there is no significant difference between two means. The following statistics was used for the significance

difference between the means.

$$t = \frac{|d|}{Sp \sqrt{\frac{1}{n}}}$$

Where,

$$|d| = \frac{x_i - y_i}{n}$$

$X_i = n$ observation in first sample

$Y_i = n$ observation in second sample

$$Sp = \sqrt{\frac{1}{n-1} \left[\sum d^2 - \frac{(\sum d)^2}{n} \right]}$$

The calculated t value was compared with table 't' value at $n-1$ degrees of freedom to find out the significance.

Results and Discussion

Change in cropping pattern of sample farmers

The data presented in Table 1 revealed that watershed intervention resulted in increased gross cropped area (13.94%) and net cropped area (2.94%) in the study area. The season wise allocation of area under kharif and rabi season crops was increased by around 10.14 and 27.81 per cent, respectively. While, area under perennial crops was predominantly increased by 31.16 per cent after the implementation of the watershed project in the study area. Among the different agricultural crops cultivated, area under groundnut, sunflower, sorghum and bengalgram was increased by 37.50, 27.81, 28.77 and 25.42 per cents, respectively. Whereas, cropped area of blackgram, bajra and cotton crops declined by 5.32, 7.97 and 6.60 per cents respectively. This might be due to shift in cultivation of traditional crops to high value crops as a result of increased availability of water. However, among horticulture crops, pomegranate and mango showed a predominant increase in cropped area by 34.62 and 33.33 per cent respectively. Further, table also depicted that relative increase in gross cropped and net cropped area were higher in Dotikol micro-watershed (15.35% and 3.05%) in comparison with Nagalapur-1 micro-watershed (12.36% and 2.81%). The similar pattern was observed among the different crops grown in both the selected micro-watersheds.

It is evident from the above table that area under *rabi* and perennial crops dominated compared to *kharif* crops after the implementation of micro-watershed. There has been a positive change in cropping pattern by means of shift in cultivation of traditional crops to high value crops, particularly non-cereal crops *viz.*, sunflower, vegetables and groundnut during *kharif* season. The diversification towards such crops is mainly due to increased water availability for irrigation and higher income. It is worth to note that there was long dry spell and inadequate supply of water in *rabi* season but after the implementation of watershed farmers used the recharged water from these watershed structures resulted significant increase in area under *rabi* crops. The annual and perennial crops which were earlier grown for domestic use only, but now surplus products were sold in the market due to increase in area under these crops. It is the clear indication of the impact of micro-watersheds on cropping pattern, which has become more diversified, especially in case of *rabi* and perennial crops. The results are in agreement with reports of Abuj *et al.* (2010)^[1] and Kulshrestha *et al.* (2014)^[12].

Table 1: Cropping pattern of the sample farmers in the study area (acres)

Sl. No.	Particulars	Dotikol MWS			Nagalapur-1 MWS			Overall		
		BIW	AIW	% change	BIW	AIW	% change	BIW	AIW	% change
1	Kharif									
a	Pigeonpea	2.04	2.24	9.80	0.96	1.05	8.85	1.50	1.64	9.50
b	Greengram	1.08	1.17	8.33	-	-	-	1.08	1.17	8.33
c	Blackgram	0.94	0.89	-5.32	-	-	-	0.94	0.89	-5.32
d	Bajra	-	-	-	1.38	1.27	-7.97	1.38	1.27	-7.97
e	Cotton	-	-	-	1.06	0.99	-6.60	1.06	0.99	-6.60
f	Maize	1.02	1.24	21.57	0.97	1.16	19.59	1.00	1.20	20.60
g	Sunflower	-	-	-	0.34	0.43	26.47	0.34	0.43	26.47
h	Groundnut	0.94	1.12	19.15	0.41	0.54	31.71	0.68	0.83	22.96
i	Vegetables	0.42	0.58	38.10	0.22	0.30	36.36	0.32	0.44	37.50
	Sub total	6.44	7.24	12.42	5.34	5.74	7.40	5.89	6.49	10.14
2	Rabi									
a	Sorghum	0.41	0.54	31.71	0.32	0.40	25.00	0.37	0.47	28.77
b	Bengalgram	0.32	0.41	28.13	0.27	0.33	22.22	0.30	0.37	25.42
c	Sunflower	-	-	-	0.19	0.25	31.58	0.19	0.25	31.58
	Sub total	0.73	0.95	30.14	0.78	0.98	25.64	0.76	0.97	27.81
3	Perennial/Annual									
a	Lime	0.37	0.47	27.03	0.31	0.41	32.26	0.34	0.44	29.41
b	Sugarcane	-	-	-	0.23	0.30	30.43	0.23	0.30	30.43
c	Mango	0.21	0.28	33.33	-	-	-	0.21	0.28	33.33
d	Pomegranate	-	-	-	0.26	0.35	34.62	0.26	0.35	34.62
	Sub total	0.58	0.75	29.31	0.80	1.06	32.50	0.69	0.91	31.16
	Gross cropped area	7.75	8.94	15.35	6.92	7.78	12.36	7.34	8.36	13.94
	Net cropped area	7.21	7.43	3.05	6.75	6.94	2.81	6.98	7.19	2.94
	Cropping intensity (%)	107.49	120.32	12.83	102.52	112.03	9.51	105.00	116.18	11.17

Possession of livestock in the study area

Livestock plays a major role in farming system and it is recognized as one of the important components under watershed programme. Hence, attention should be drawn on livestock which is the major livelihood activity in the rainfed areas. The Table 2 depicts the population of livestock in the study area. It is interesting to note that the number of livestock increased significantly after the watershed implementation. Further, increase in higher number of buffalo

(50.00%) was observed followed by bullocks (25.93%), cows (25.00%), poultry (17.81%), goat (14.57%), sheep (10.77%) was observed due to establishment of watershed.

The positive change in livestock population was found due to improvement by trainings, from veterinary doctors, fodder availability, balanced feeding of animals and vaccinations in animals have also increased in the study area. Thus, watershed approach had shown positive impact on livestock, inturn improved the livelihood of farming community.

Table 2: Possession of livestock in the study area

Livestock (No.)	Dotikol MWS (n=90)			Nagalapur-1 MWS (n=90)			Overall (n=90)		
	BIW	AIW	% change	BIW	AIW	% change	BIW	AIW	% change
Cow	19	23	21.05	17	22	29.41	36	45	25.00
Buffalo	16	22	37.50	12	20	66.67	28	42	50.00
Bullock	28	34	21.42	26	34	30.77	54	68	25.93
Sheep	146	160	9.58	114	128	12.28	260	288	10.77
Goat	110	132	20.00	137	151	10.22	247	283	14.57
Poultry	190	220	15.78	175	210	20.00	365	430	17.81

Income realized from livestock by the sample farmers

It is apparent from the Table 3 that there was increase in income realized from livestock. In addition to providing income through sale of animals and its by-product, it also plays major role in improving crop productivity by providing manure and draught power. The impact of watershed interventions on livestock and income realized from it is elaborated below.

It is observed that there was significant increase in the population of livestock which inturn increased the income from cow, buffalo, bullock, sheep, goat and poultry by 10.49, 8.95, 9.05, 7.42, 5.98 and 5.51 per cents, respectively. As far as selected micro-watershed is concerned, income from cow, buffalo, bullock, goat and poultry was relatively increased in Dotikol micro-watershed compared to Nagalapur-1 micro-watershed. Whereas, in case of sheep, income realized was

comparatively higher in Nagalapur-1 micro-watershed (7.92%) in comparison with Dotikol micro-watershed (6.95%). It is worth to mention that the animal health camps, veterinary trainings *etc.*, conducted by watershed department helped the farmers to improve income from livestock farming. Similar results were reported by Biradar *et al.* (2012) [7] on income earned from livestock.

Hence, it can be concluded that substantial increase in daily milk production per animal was achieved which reflected through increased income, besides improving the nutritional value of food intake of farm families. Further, rearing of bullock, sheep, goat and poultry was increased which resulted in increased income. This might be due to knowledge gained through attending trainings, animal health camps *etc.* The findings are in line with the reports of Jain (2008) [11].

Therefore, in order to optimize livestock income, which need

to be addressed through synergy between animal husbandry and Watershed Development Departments. It can be achieved through incremental improvement and modification at various

levels through policy changes, change in operational procedures and greater inter-linkage between these two departments through capacity building.

Table 3: Income realized from livestock by the sample farmers (Income /Animal/ Annum)

Livestock	Dotikol MWS			Nagalapur-1 MWS			Overall			t- value
	BIW	AIW	% change	BIW	AIW	% change	BIW	AIW	% change	
Cow @	44652 (29.50)	49713 (29.87)	11.33	51845 (33.09)	56904 (33.48)	9.76	48248 (31.32)	53308 (31.69)	10.49	1.06
Buffalo @	54714 (36.14)	60312 (36.23)	10.23	52613 (33.58)	56625 (33.32)	7.63	53663 (34.84)	58468 (34.76)	8.95	2.29*
Bullock	34452 (22.76)	37697 (22.65)	9.42	36102 (23.04)	39245 (23.09)	8.71	35277 (22.90)	38471 (22.87)	9.05	1.75
Sheep	7451 (4.92)	7969 (4.79)	6.95	6904 (4.41)	7451 (4.38)	7.92	7177 (4.66)	7710 (4.58)	7.42	1.25
Goat	8957 (5.92)	9534 (5.73)	6.44	8230 (5.25)	8681 (5.11)	5.48	8593 (5.58)	9107 (5.41)	5.98	2.50*
Poultry	1150 (0.76)	1226 (0.74)	6.61	992 (0.63)	1034 (0.61)	4.23	1071 (0.695)	1130 (0.67)	5.51	1.42

Note: 1. @ Income from milch animals is exclusively from sale of milk; while others indicate hiring, sale of animals and eggs

2. Decimal values are rounded up to its nearest value

3. Figures in parenthesis indicate per cent to total income from livestock

4. ** Significant at 1 per cent level; * Significant at 5 per cent level

Conclusion

The impact of Sujala watershed project indicated that maximum area was under perennial crops (31.16%) followed by *rabi* (27.81%) and *kharif* (10.14%) crops. However, the increase in cropping intensity was meager by 11.17 per cent. There was significant increase in the livestock population which in turn increased the income of farmers to the extent of 5 -10 per cent. Farmers are reaping benefits from the watershed activities in the form of increase in irrigated area, reducing runoff water and improvement in groundwater level. Therefore, farmers need to be educated about watershed benefits for efficient use of watershed components for improving efficiency. Similar activities can be replicated in other watershed areas.

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