Journal of Rural Development, Vol. 31, No. (1) pp. 17 - 23
NIRD, Hyderabad.

WATER USE PATTERN OF RURAL COMMUNITY IN GANGETIC WEST BENGAL – A CASE STUDY

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ABSTRACT

Water is the most precious natural resource acting as the lifeline of the rural community. It can be highly productive and support prosperous communities if properly used. This paper attempts to explore the water use pattern of rural community in Gangetic West Bengal. Primary data were collected in the East Midnapore district of West Bengal during 2008-2009. It has been observed that the level of per capita income does have a positive influence on the level of per capita domestic water consumption. Also, the proximity of the water source does increase domestic water consumption. Agriculture is the major occupation with the highest water dependence. It has also been found that water consumed for agriculture is directly influenced by the level of per capita income, the proximity of water source and water-intensive cropping pattern.

Introduction

Water is commonly regarded as plentiful in gangetic plain of West Bengal. However, the supply for man's use is definitely limited and its volume and quality are determined, to a great extent, by human activities. In rural part of gangetic West Bengal, water is predominantly consumed for drinking, sanitation and farm irrigation.

Kumar, A.C., Malhotra, K.C., Raghuram, S. and Pais, M. (2000) considered the water consumption behaviour of rural community of Tumkur district, Karnataka. This study had also shown the significance of water rights to increase equity in water use, systems of incentives for the use of water-saving devices and recycled water in agriculture, managing water systems including drinking water used by local communities, providing water education, introducing community managed irrigation systems and empowering women in water resource management. Bhattacharyya, D., Roy, G.B. and Das, J.K. (2008) studied the pattern and efficiency of water use on the basis of different socio- economic classes in Howrah district of West Bengal. Another study by Kumar, M., Gaur, D.R., Goel, M. and Mishra, R. (2009) revealed the water use pattern and behaviour of rural community in Beri block of Jhajjar district of Haryana.

The present study attempts to investigate the water use pattern of rural community in gangetic plain of West Bengal according to different socio–economic classes, different occupations, ease of access to water and different cropping patterns.

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Methodology

A two-stage stratified random sampling technique was used for the purpose of the study. With similar geographical and socio – economic features, two villages, namely, Barda and Chaitanyapur under No.3-Chaitanyapur Gram Panchayat, Sutahata Block of East Midnapore of West Bengal were selected. In the second stage, a complete enumeration of households according to monthly per head income(Y in ₹) was made. The households were then stratified into three major groups, i.e.,the Poor Class ($Y<1500$),the Middle Class ($1500 \leq Y <4000$) and the Rich Class ($Y \geq 4000$). From the total population, 100 households were selected at random consisting of 32 poor households, 56 middle class households and 12 rich households. The sample households were administered with well-designed semi-structured questionnaires to find required information. The data were collected in the year 2008-2009. The simple statistical tools like percentage and mean have been used to interpret the data in tabular form. Multiple Regression technique has been employed to know the impacts of income and proximity of water source upon the domestic consumption of water. We have also analysed the impacts of income, proximity of water source and cropping pattern on the consumption of water for farming. For this, we use the following log-lin equations:

$$\ln DWC = \beta 1 + \beta 2 \ln Y + \beta 3\ PX + u,$$

$$\ln FWC = \alpha 1 + \alpha 2 \ln Y + \alpha 3\ PX + \alpha 4\ CP + v,$$

where DWC = Domestic water consumption in liter per capita per day (lpcd),

FWC = Water consumption for farming (lit/ bigha),

Y = per head income (₹/month),

PX = proximity of the water source ; PX = 1 for distance < 300 meter,

= 0 otherwise

CP = Cropping pattern ;

CP = 1 for water-intensive cropping pattern, = 0 otherwise.

u and v are random error terms normally distributed with zero mean and finite variance and satisfying the assumptions of the Classical Linear Regression Model. $\beta 1$ and $\alpha 1$ are intercept coefficients. $\beta 2$, $\beta 3$, $\alpha 2$, $\alpha 3$ and $\alpha 4$ are the partial slope coefficients.

Study Area

Barda ($22^0 9'33''$N, $88^0 8'30''$E) and Chaitanyapur ($22^0 7'47''$N, $88^0 1'28''$E) villages are under No. 3 Chaitanyapur Gram Panchayat, Sutahata Block of East Midnapore district of West Bengal. The area comes under the gangetic plain agro-climatic zone of the State. The area is covered with loamy soil. The average temperature varies between 12^0C - 35^0C, while the average annual rainfall varies between 150 cm – 175 cm.

Table 1 reveals that the average per head drinking water consumption is the highest for rich people (4.9 lpcd) followed by the middle class (4.8 lpcd) and the poor class (4.0 lpcd). The average per head consumption of water for sanitation is the highest for rich people (6.3 lpcd) followed by the middle class (4.8 lpcd) and the poor class (3.8 lpcd). The average total consumption of domestic water is the highest for the rich class (11.20 lpcd) followed by the middle class (9.60 lpcd) and the poor class (7.80 lpcd).

Table 2 shows that the average total domestic water consumption is the highest for households in farming (9.15 lpcd) followed by service (9.10 lpcd) and business (8.92 lpcd).

Result and Discussion

Table 1 : Domestic Consumption of Water by Different Income Classes and Occupations in Chaitanyapur and Barda, Sutahata Block, East Midnapore

Social Status		No. of Families	No. of Members	Water Consumption for Drinking (a)		Water Consumption for Sanitation (b)		Average Total Domestic Water Consumption (a+b)
				Total (lit/day)	Average (lpcd)	Total (lit/day)	Average (lpcd)	
	Farming	22	118	477.50	4.05	452.80	3.84	7.89
Poor	Non-farming	10	44	170.50	3.86	162.80	3.70	7.56
	Total	32	162	648.00	4.00	615.60	3.80	7.80
	Farming	40	213	1032.00	4.85	1029.60	4.83	9.68
Middle	Non-farming	16	48	220.80	4.60	223.20	4.65	9.25
	Total	56	261	1252.80	4.80	1252.80	4.80	9.60
	Farming	4	12	64.80	5.40	81.60	6.80	12.20
Rich	Non-farming	8	30	141.00	4.70	183.00	6.10	10.80
	Total	12	42	205.80	4.90	264.60	6.30	11.20
	Total	100	465	2106.60		2133.00		
	Mean				4.53		4.59	9.12

Source : Field Survey.

Table 2 : Domestic Consumption of Water by Different Occupational Groups in Chaitanyapur and Barda, Sutahata Block, East Midnapore

Occupation	No. of Families	No. of Members	Water Consumption for Drinking (a)		Water Consumption for Sanitation (b)		Average Total Domestic Water Consumption (a+b)
			Total (lit/day)	Average (lpcd)	Total (lit/day)	Average (lpcd)	
Farming	66	343	1574.30	4.59	1564.00	4.56	9.15
Business	14	50	230.50	4.61	215.50	4.31	8.92
Service	20	72	301.80	4.19	353.50	4.91	9.10
Total	100	465	2106.60	4.53	2133.00	4.59	9.12

Source : Field Survey.

Table 3 : Consumption of Water for Farming by Different Income Classes in Chaitanyapur & Barda, Sutahata Block, East Midnapore

Social Status	Occupation	No. of Families	Average Water Consumption for Farming (lit/ bigha)
Poor	Farming	22	2600
Middle	Farming	40	3500
Rich	Farming	4	4100

Source : Field Survey.

Table 3 shows that the average water consumption for farming is 2600 lit/bigha for the poor families who do not have enough money to spend on irrigation. The average water consumption for farming for the middle class families is 3500 lit/bigha who can afford to spend on irrigation. The average water consumption for farming is the highest (4100 lit/bigha) for the rich families.

Table 4 : Source of Water for Domestic Purpose and Farming Purpose

Social Status		No. of Families	Source of Water for Domestic Purpose	Source of Water for Farming
Poor	Farming	22	Small pond in the backyard for 17 families, common tube-well established by Panchayat.	Rain water, canal water supplied through manual system.
	Non-farming	10	Common tubewell established by Panchayat, small pond in the backyard for 7 families.	
Middle	Farming	40	Small pond in the backyard and common tubewell established by Panchayat for 30 families, large pond and own submersible pump for 10 families.	Rain water, canal water supplied through pump-set.
	Non-farming	16	Pond and common tubewell for 5 families, own submersible pump for 11 families.	
Rich	Farming	4	Own submersible pump.	Rain water, canal water supplied through pumpset.
	Non-farming	8	Own submersible pump.	

Source : Field Survey.

All the poor farming and non-farming families have small ponds in the backyard for domestic use except in the peak dry season. For drinking water, they depend on Panchayat-established common tubewells. Rainwater is the biggest source of water for farming for poor families. Besides this, they supply canal water manually to their lands when necessary. Most of the middle class farming and non-farming families rely upon own ponds for sanitation. For drinking water, 30 families use common tubewell provided by the Panchayat, 15 families use own tubewell and 11 families use own submersible pump. For farming, all the 40 families use rain water and canal water supplied through pumpset. All the rich families use own submersible pump for sanitation as well as drinking water. Rich farming families use rain water along with canal water supplied through pumpset for irrigation.

Table 5 : Cropping Pattern of the Families

Water-intensity	Crops cultivated
High	Aman paddy, jute, aus paddy, boro paddy, betel-nut, vegetables.
Low	Wheat, khesari (low quality pulse), sunflower, vegetables.

Source : Field Survey.

The common crops in our study area can be divided into two groups : (a) crops with high water intensity e.g. aman paddy, jute, aus paddy, boro paddy, betel-nut and vegetables which require heavy irrigation; and (b) crops with low water intensity e.g. wheat, khesari (low quality pulse), sunflower and some vegetables which require low to medium irrigation.

Determinants of Domestic and Farm Water Consumption Disparity

We have tried to analyse the contribution of income(Y) and proximity of water source (PX) to domestic water consumption (DWC) disparity between sample households. In our log-lin model, natural log of (DWC) is regressed upon natural log of (Y) and (PX) dummy. The estimated regression results are shown in Table 6.

Table 6 : Regression Result of Domestic Water Consumption Disparity

	Co-efficient	Standard error	t-statistic	p value
Intercept	0.382	0.152	2.508	0.028
ln Y	0.214	0.019	11.076	0.000
PX	0.107	0.035	3.101	0.009

N = 100, k = 3.

F- (2,97)d.f. = 72.698 , p value = 0.000.

R^2 = 0.924 , Adj R^2 = 0.911.

N (= 100) is the sample size and k (= 3) is the number of parameters to be estimated. The high t-values are indicative of the fact that all the estimated coefficients are statistically significant. The intercept coefficient ? $\beta1$ takes the value of 0.382 and is significant at 5 per cent level. The coefficient $\beta2$ (= 0.214) is the elasticity of ' domestic water consumption ' with respect to income . If per head income increases by 1 per cent, per head water consumption increases by 21 per cent. $\beta2$ is significant at any level. $\beta3$, the proximity dummy coefficient takes the value of 0.107 and is significant at 1 per cent level. $\beta3$ = 0.107 signifies that the average domestic water consumption increases by 11 per cent (approx.) for the households living near the water source compared to the others. F = 72.698 implies that all the coefficients are statistically different from zero and are significant at any level , d.f. = (2,97). R^2 = 0.924 signifies that approximately 92 per cent of the variation in the dependent variable (DWC) is explained by the regression model , R being the coefficient of multiple correlation. R^2 becomes 0.911 when adjusted for the degrees of freedom.

We have also studied the contribution of income(Y), proximity of water source (PX) and cropping pattern (CP) to farming water consumption (FWC) disparity between sample households. In our log-lin model, natural log of (FWC) is regressed upon natural log of (Y), (PX) dummy and (CP) dummy. The estimated regression results are shown in Table 7.

Table 7 : Regression Result of Farm Water Consumption Disparity

	Co-efficient	Standard error	t-statistic	p value
Intercept	2.078	0.156	13.287	0.000
ln Y	0.535	0.021	25.903	0.000
PX	0.299	0.122	2.455	0.032
CP	0.271	0.089	3.042	0.049

N = 66, k = 4.

F- (3,62)d.f. = 404.17, p value = 0.000.

R^2 = 0.991 , Adj R^2 = 0.989.

N (= 66) is the sample size and k (= 4) is the number of parameters to be estimated . The high t-values are indicative of the fact that all the estimated coefficients are statistically significant. The intercept coefficient $\alpha 1$ takes the value of 2.078 and is significant at any level. The coefficient $\alpha 2$ (= 0.535) is the elasticity of ' farming water consumption' with respect to income . If per head income increases by 1 per cent, per head water consumption for farming increases by 54 per cent. $\alpha 2$ is significant at any level. $\alpha 3$, the proximity dummy coefficient takes the value of 0.299 and is significant at 5 per cent level. $\alpha 3$ = 0.299 signifies that the average farming water consumption increases by 35 per cent (approx.) for the households living near the water source compared to the others. a4 , the coefficient for cropping pattern dummy takes the value of 0.271 and is significant at 5 per cent level. $\alpha 4$=0.271 signifies that the average farming water consumption increases by 31 per cent (approx.) for the households who practise high water-intensive cropping pattern compared to the others. F = 404.17 implies that all the coefficients are statistically different from zero and are significant at any level, d.f. = (3,62). R^2 = 0.991 signifies that approximately 99 per cent of the variation in the dependent variable (FWC) is explained by the regression model, R being the coefficient of multiple correlation. R^2 becomes 0.989 when adjusted for the degrees of freedom.

Conclusion

The case study reveals some interesting results. Water consumption is positively influenced by the level of income thereby justifying the claim by Frank, B. and Netboy, A. (1978) that "rising living standards mean higher per capita water consumption". The ease of access to water, captured by the proximity dummy, positively influences the domestic and farming water consumption. Last, but not least, it is the cropping pattern that influences the level of water consumption for farming and it is definitely supported by the findings of the case study.

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