T... l Domestic Water Consumption: A... ıdy of a Village Community With No C... Water Supply System

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ABSTRACT

Thai rural domestic water consumption of 282 households for 59 villages in Amphoe Nong Sua, Pathum Thani Province, Thailand, is examined in this study. The paper describes the pattern of rural domestic water use and evaluates the factors which affect per capita rural water consumption. Stepwise regression analysis was applied to assess the variables which were postulated to be associated with per capita rural water consumption. The variables that were found to be significantly associated with per capita rural water consumption were household size, average household age, level of education, average household income and number of baths per day.

INTRODUCTION

Access to an adequate, safe and convenient source of water supply is a basic human need which is indispensable for the national health and economic wellbeing of every society. Unfortunately, this access is not easily within the reach of every one as good quality fresh water is not uniformly distributed over the earth's surface. Even if fresh water is accessible, not every household is privileged to be served with it.

On a global scale in the 1970's the best available figures showed that only about 10 per cent of the rural populations had a safe source of water [1]. On a regional basis, the region of the Americas had the highest coverage at 19 per cent. Africa had 11 per cent, and Asia had 9 per cent [2].

According to W.H.O figures in 1970, among 71 developing countries, only 68 percent of the urban population and 14 per cent of the rural population were adequately served with potable water: 77 per cent of the total urban population had access to piped water through house connections or stand pipes while 22 per cent of the rural communities had access to safe water. Over the period 1970-1975, W.H.O. estimated that the number of people having access to public water supply in developing countries increased from 498 million to 763 million. Despite the 53 per cent increase, however, a large proportion of the developing countries still did not receive clean water.

In 1980, less than 75 per cent of the world's urban population and 15 per cent of the rural population had access to clean water. The U.N. global improvement goal of water supply in the Second Development Decade (1970-1980) "to supply safe water to all of the urban population and 25 per cent of the rural population" therefore was not met. Because the target of the Second Development Decade was not attained, the U.N. General Assembly on November 10, 1980, decided to proclaim 1980-1990 as the International Drinking Water Supply and Sanitation Decade, reaffirming the goal of clean water for all by 1990 [3]. This declaration has issued a challenge to all nations around the globe "to take concerted action for providing citizens with access to safe drinking water" [4]. The proclamation calls for the involvement and input of national and international participation, mobilization of resources, national investments, bilateral or multilateral aid.

During 1980-1983, the increase in the number of people in rural areas receiving water supplies rose from 30 to 38 per cent of the world's rural population. Thailand responded to the Decade declaration in 1983 and prepared a Masterplan for Rural Water Supply and Sanitation for the whole country [5]. This was done for communities that are within the provincial jurisdiction of the Department of Public Health.

The traditional approach to community water development in Thailand has been to rely on provincial agencies and external aid to spearhead community water supply in rural areas [6]. The history of rural water supply development dates back to the early 1950's. It was not until 1966 that a major effort was made in

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cooperation with the United States Operations Mission to supply water to 12,000 communities [6; 8-11].

The results of this effort have however been mixed. An evaluation of the effectiveness of the Community Portable Water Project showed that the technology applied was too sophisticated for small rural communities [12-17]. The small scale approach based on run-off collection tanks and ponds during the wet season has therefore been recommended for the Northeast [18, 19], although the National Economic and Social Development Board (N.E.S.D.B.) continues to invest in and promote the large scale plan [5, 20].

While research in the functional design of rural water supply and the application of various types of filtration processes for rural surface water treatment is continuously being improved, little is known about the pattern of rural water consumption and the factors affecting the per capita water consumption in rural communities that have no organized water supply system [21-23]. An *organized water supply system* is one where households can have water pumped or delivered to their homes at a cost billed quarterly, biannually or annually by an administrative agency of a local district council. Only communities which have a population of more than five thousand and those that are within the provincial jurisdiction of the Department of Public Health have access to the services and facilities of a centrally administered water supply and distribution system.

Little is known about the pattern of rural water consumption and the factors affecting the per capita water consumption in rural communities that have no organized water supply system

PURPOSE OF STUDY

The purpose of this paper is to present a case study of one such village community which has no organized water supply system. Most of the villages here depend on rain, klong (canal) and pond water which they can use free of charge. In terms of supply, there does not seem to be a problem in this community. However, there is a quality problem as during the dry season there is just not enough good quality water available for drinking and cooking. In this paper, only the pattern of rural domestic water use and the factors affecting per capital water consumption are presented. The perception and attitude of the villagers towards an improved system of rural water supply is presented elsewhere in another paper [24].

This study is in two parts. Part one describes the characteristics and pattern of rural domestic water use by village households at the district, subdistrict and village levels. Part two presents the stepwise regression analysis of some factors affecting per capital rural water consumption at these three levels.

RESEARCH DESIGN, DATA AND STUDY AREA

The research design entails a complex sampling procedure in the selection of village households. The data were obtained from a field survey of 282 village households and the interviews were conducted by the author when he was supervising a number of master's theses projects on rural development in Thailand [25].

In order to sample a village household one must first understand the administrative hierarchy of political units in Thailand. In Thailand, the highest level unit of administration is the province (*changwad*). Beneath it is the district (*amphoe*). Each district is divided into a number of subdistricts (*tambon*). Each subdistrict is made up of villages (*muban*), each of which is composed of households or farmsteads.

In this paper, the area of study if focused on Amphoe Nong Sua, one of six districts in the province of Pathum Thani, which is located about 56 kilometers north of Bangkok (Fig. 1). The province, which has a population of about 300,000 according to the 1980 census, is made up of six districts, fifty-seven subdistricts and five hundred and five villages. Amphoe Nong Sua, which is made up of six subdistricts, has fifty-nine villages. The number of villages in each subdistrict ranges from eight to thirteen. The subdistrict that had the largest number of villages was Tambon Sara Krue, which had thirteen villages. The remaining forty-six villages thus composed the rest of the five subdistricts.

There were 5,255 households in Amphoe Nong Sua. Of this, 985 households were accounted for by Tambon Sara Krue. A 24 per cent stratified sample of 985 households (i.e. 236) for thirteen villages was taken for detailed investigation. To complete the coverage for the whole district of Amphoe Nong Sua, an arbitrary sample of one household from each of the forty-six villages was selected from the five remaining subdistricts. The total number of households for Amphoe None Sua therefore came to 282 households (236+46=282) for fifty-nine villages.

Tambon Sara Krue was selected for the study as it had a severe drinking water problem, particularly dur-

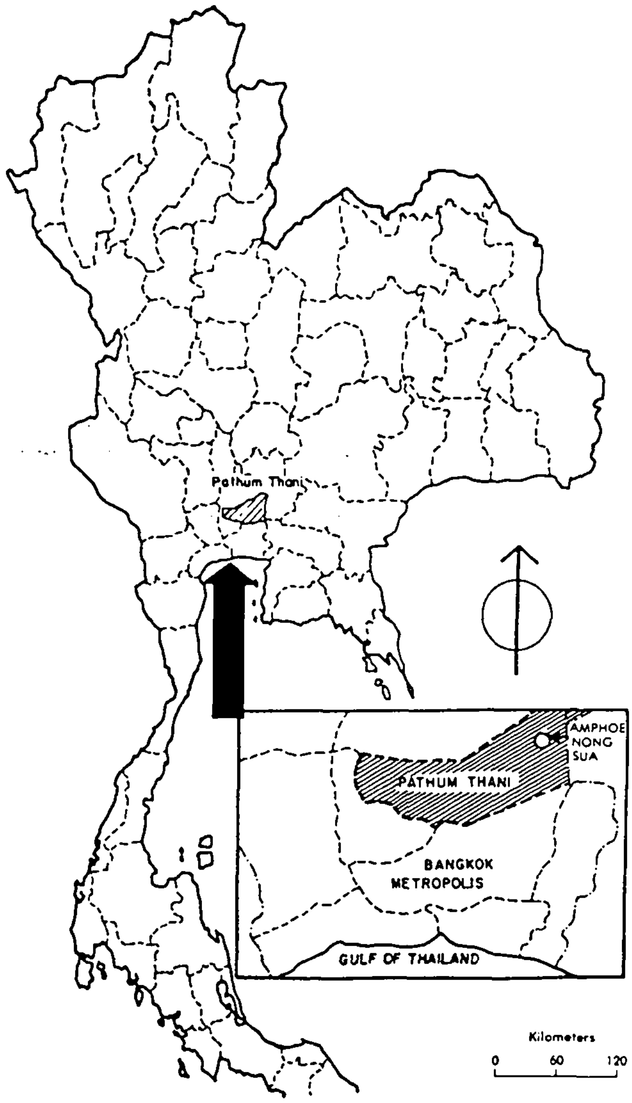

Figure 1. The location of Pathum Thani Province in Thailand.

ing the dry season. It was recommended for study by the officials of the Department of Public Health in the province because there was no organized rural water supply program for the area. Most of the villages here depend on rain as their main source of water supply.

PATTERN OF RURAL DOMESTIC WATER USE

Sources of Rural Water Supply

Water for domestic use in Amphoe Nong Sua is supplied by four sources: 1) Convectional and monsoon rain; 2) klong; 3) pond and 4) ground water or well. Rain water, a composite of convectional and monsoon rains, is obtained from the roofs of houses through the drain pipes which lead to the earthenware jars (Fig. 2). Usually the first pouring of it is not collected as the roof may be dusty and dirty; rain water is collected after two or three showers. The water is then

Figure 2. Obtaining rain water from the roof through a drain pipe.

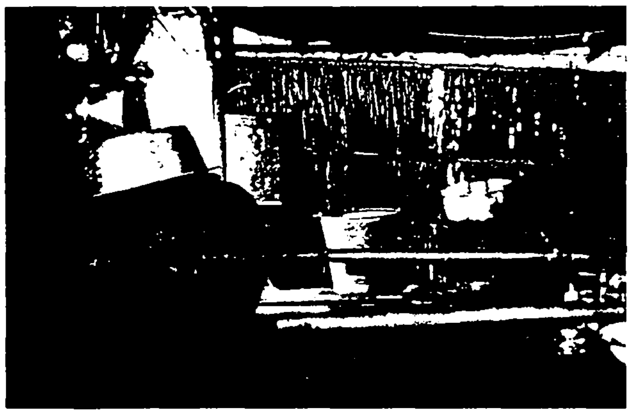

Figure 3. A large water storage earthenware jar.

stored in earthenware or *klong* jars (Fig. 3). These jars differ in size, varying in capacity from 10 litres to 400 litres. In community halls, schools and temples, metal tanks are used.

Klong water is obtained from the klongs which are man-made canals used to provide water for domestic purposes, irrigation and as a means of inland water transportation (Fig. 4). Many settlements are located along a system of klongs (Fig. 5). Due to the lack of roads in remote areas, the klongs constitute an important transportation network for the villagers. The klongs also serve a sewage disposal function. Most of the water in the klongs comes from rain; some of it is diverted from the tributaries of rivers. Klong water for domestic use is usually carried home by means of two tin buckets. Such a bucket normally has a 20

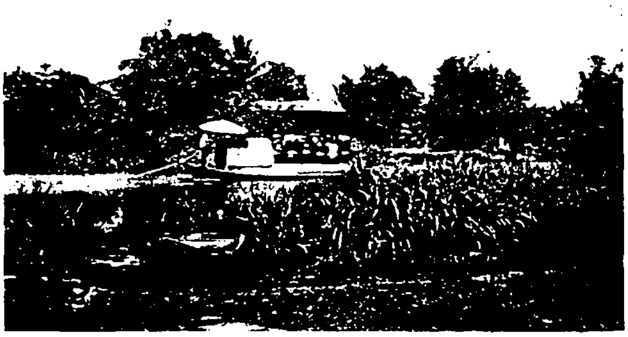

Figure 4. The klong as a means of inland water transportation.

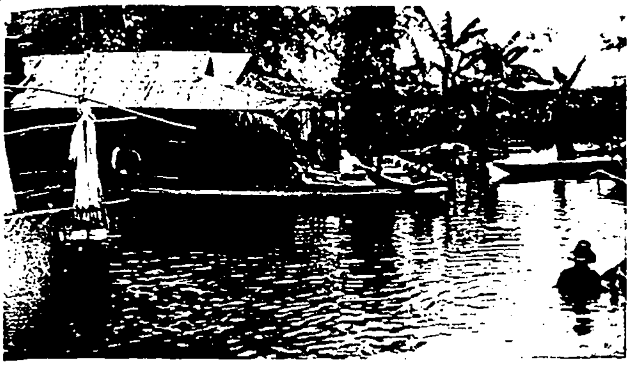

Figure 5. Location of settlements along a klong.

Figure 6. A villager carrying two tin buckets of water.

litre capacity. A villager usually carries two buckets on a pole over his shoulders (Fig. 6). On the average for a family of four members, a household needs eight buckets or 160 litres a day.

Pond water is obtained from artificial lakes or shallow depressions. The water comes mainly from rain; sometimes water from the klongs is diverted to a pond to ensure that there is sufficient water for the fish. Most ponds are used for fish raising and the cultivation of water hyacinths and water-lilies.

Ground water is supplied by wells which are generally dug outside the village compound. The wells

On the average for a family of four members, a household needs eight buckets or 160 litres a day

are quite shallow, usually about 5 to 6 meters deep. The diameter of a well is generally between 1.5 to 2 meters wide. There is no pump used as it is too costly for the villagers. Water is fetched by dropping a tin bucket with a rope attached to it into the well. The filled bucket is then pulled up and the water is poured into a container for carrying on the shoulders. Although ground water is quite easily available, it is not used very frequently for drinking or cooking because of its high iron content, mineral odor and unpleasant taste. It is used as an alternative source only during the dry season.

Household Water Intake by Sources of Supply

Table 1 shows a distribution of household water intake by sources of water supply for 236 households in Tambon Sara Krue. A striking feature of the table is that none of the households, except for one, relied on a single source of water supply. Instead, most of the households (56%) obtained their water through a combination of two or three sources. The combination which accounted for the highest proportion of water intake was rain and klong water. The next was the combination of rain, klong and pond water which made up 36% of the total water intake. The lack of reliance on a single source of supply and the preference by a high proportion of the households for two or three combination of sources suggest the demand for com-

Table 1: Household Water Intake by Sources of Supply

	Households	
Single Sources	**Number**	**Percentage**
Rain	—	—
Klong	1	0.42
Pond	—	—
Well	—	—
Two Combination of Sources		
Rain and Klong	132	55.94
Rain and Pond	7	2.97
Rain and Well	2	0.85
Klong and Pond	1	0.42
Klong and Well	—	—
Pond and Well	—	—
Three Combination of Sources		
Rain, Klong and Pond	84	35.59
Rain, Klong and Well	9	3.81
Klong, Pond and Well	—	—
Four Combination of Sources		
Rain, Klong, Pond and Well	—	—
Total	236	100.00

bination of sources for different purposes by rural households.

Water Treatment and Quality

Since household water intake comes from several sources of supply, water for drinking and cooking is generally treated by cloth filter prior to use. Out of 236 households surveyed in Tambon Sara Krue, 68 per cent (or 160) treat their drinking water. Of this 160 households, 61 per cent use cloth filter, 14 per cent use alum, 13 per cent use a combination of alum and cloth filter and 1 per cent use other chemicals.

Among the four sources of water supply — rain, klong, pond and well — rain water has the best quality from the standpoint of turbidity, color, odor and taste. It required the least treatment. The physical quality of klong, pond and well water in terms of color as measured by the platinum-cobalt scale is slightly above the specified level required by the World Health Organization (WHO) standards, i.e. 325-330 units. According to the latter, the physical quality of water should not exceed 300 units [26, 27]. Well water was the worst in terms of odor and taste.

Water for drinking and cooking is generally treated by cloth filter prior to use

Water Use by Sources of Supply

In Tambon Sara Krue water for domestic use is differentiated by sources of supply. While rain water is used mainly for drinking and cooking, klong and pond water is used for washing dishes (Fig. 7), clothes and for bathing (Fig. 8). Well water is hardly used except as an alternative source during the dry season.

Figure 7. Klong water used for dish washing.

During the rainy season, 89 per cent of the villagers depended on rain water for drinking, while 11 per cent used klong or pond water. Klong water is generally preferred for washing and bathing. Over 80 per cent of the villagers used klong water for these purposes regardless of season. During the dry season, many farmers rely on klong and pond water for cooking. About 57 percent depend on klong water and 14 percent on pond water. In terms of purpose, the largest use of domestic water is for bathing, which accounts for 55 per cent of household intake. Washing dishes accounts for 29 per cent, cooking for 11 per cent and drinking for only 5 per cent.

Figure 8. Klong water used for bathing.

Areal Distribution of Rural Domestic Water Use

The total daily water consumption in Tambon Sara Krue for 236 households (or 13 villages) with 1,510 people was 63,193 litres. The average daily water consumption per household was 267.76 litres. The average daily per capita water consumption was 41.85 litres.

In the five remaining subdistricts, for 46 sample households with 310 people, the total daily water consumption was 12,858 litres. The average daily consumption per household was 279.52 litres, and the average daily per capita water consumption was 41.48 litres.

The total daily water consumption in Amphoe Nong Sua for 282 households (236 + 46) with 1,820 people (1,510 + 310) was 76,051 litres. The average daily water consumption per household was 269.68 litres. The per capita average daily water consumption was 41.78 litres. A summary of the areal distribution of average daily household and per capita water consumption is shown in Table 2.

Table 2: Areal Distribution of Average Daily Household and Per Capita Water Consumption

Geographic Area	Number of Households	Average Household (litres)	Number of People	Average Per Capita (litres)
Tambon Sara Krue	236	267.76	1,510	41.85
Five Remaining Subdistricts	46	279.52	310	41.48
Amphoe Nong Sua	282	269.68	1,820	41.78

The average household and average per capita water consumption between the district and subdistrict levels is fairly uniform. At the household level, the difference between district and subdistrict consumption is about 2 litres. On a per capita basis, the difference in consumption between geographic areas is less than 0.5 litre. While the average household size is about six, the variations in household size range from 2 to 15.

FACTORS AFFECTING RURAL DOMESTIC WATER CONSUMPTION

Rural domestic water consumption varies with a wide range of social, economic, cultural and physical factors. In this study, the social factors include: 1) household size, 2) average household age, 3) level of education. The economic factor is represented only by the average household income. Price is not used because the water was obtained virtually at no cost. The cultural factor is measured in terms of bathing habit which is depicted by the number of baths per day. Bathing habit is an important aspect of Thai culture as many of the villagers believe that cleanliness helps to ward off evil spirits. The physical factors include 1) quality of water, 2) size of water vessel carried, 3) number of trips per day to fetch water and 4) number of sources of water supply. Distance which is used in other rural water supply studies [28] is not used here as most of the households are located along the klongs.

Bathing habit is an important aspect of Thai culture

Two stepwise linear regression models were constructed to evaluate the factors affecting per capita daily water consumption: one at the district and subdistrict level and the other at the village level.

At the district and subdistrict levels, stepwise regression analysis was performed for 282 households for Amphoe Nong Sua; and for 236 households for Tambon Sara Krue. In both cases the per capita daily water consumption of each household was used as the dependent variable and as an observation unit.

At the village level, stepwise regression analyses were run for 59 villages for Amphoe Nong Sua; for 46 villages for the five remaining sub-districts and for 13 villages for Tambon Sara Krue. In each case the per capita daily water consumption of each village was used as the dependent variable as well as the observation unit.

The models used were of the form:

$$Q = a + b_1x_1 + \ldots + b_nx_n + e$$

in which Q is the dependent variable

$x_1, x_2 \ldots x_n$ are the independent variables
a is the intercept
$b_1, b_2 \ldots b^n$ are the regression coefficients and
e is an error term.

Using per capita daily water consumption, (PCADWC) or Q, as the dependent variable, one might hypothesize that Q varies with the household size measured in terms of number of people in a household (HHSIZE), x_1, the average household age which is the total age of all members in a household divided by household size (AHHAGE), x_2, the level of education of household head measured by number of years in Thai schooling (LEDUTN), x_3, The average household income measured in '000 bahts per year ($1.00 U.S. = 25 bahts), (AHICOM), x_4, bathing habit measured by number of baths per day (BATHAB), x_5, quality of water perceived by the villagers whether good, fair or poor (WQULTY), x_6, size of water vessel carried in litres (VESIZE), x_7, number of trips per day to fetch water (NTRIPS), x_8 and number of sources of water supply (NSOURC), x_9.

RESULTS OF STEPWISE REGRESSION ANALYSES

Table 2 presents a summary of the stepwise regression analysis. In Eq. 1 four out of nine independent variables were entered by the stepwise procedure. They were household size, x_1, average household age, x_2, average household income, x_4, and number of trips per day to fetch water, x_8. Of these four, only three were significant.

The proportion of variance accounted for by these four variables was only 14 per cent. The low multiple R^2 might be attributable to the scaling of the independent variables and the wide variability in perception of the factors affecting rural water consumption. The simple correlation coefficients between per capita rural water consumption and x_1, x_2, x_4, and x_8 were: - 0.24, 0.27, 0.26 and 0.11 respectively. Despite the low simple r's, the negative sign of x_1 and the positive signs of x_2 and x_4 with per capita rural water consumption are consistent with the results of other residential water consumption studies [29, 30] that have correlated these variables with per capita water consumption.

The results in Eq. 2 for Tambon Sara Krue appear to be weaker than those of Eq. 1. Except for the omission of x_8, the independent variables entered in Eq. 2 are identical with those of Amphoe Nong Sua. The three independent variables entered as significant and

Table 3: Summary of Linear Stepwise Regression Analysis of Per Capita Rural Water Consumption

Equation	Area of Study	Sample Size	Intercept	HHSIZE x_1	AHHAGE x_2	LEDUTN x_3	AHI COM x_4	BATHAB x_5	NTRIPS x_8	Multiple R	Multiple R^2	F Value	Se
1	Amphoe Nong Sua	282	35.776	-0.905 (-2.938)**	0.261 (2.937)**		0.305 (2.460)*		1.133 (2.079)	0.3751	0.1407	11.341	11.805
2	Tambon Sara Krue	236	38.819	-0.797 (-2.277)*	0.242 (2.373)*		0.548 (2.962)*			0.3407	0.1161	10.153	12.119
3	Amphoe Nong Sua	59	84.266		0.475 (3.253)*	-18.519 (- 3.880)*				0.6392	0.4086	19.348	9.891
4	Five Remaining Subdistricts	46	87.961		0.402 (2.466)*	-18.893 (- 3.889)*				0.6620	0.4383	16.774	9.849
5	Tambon Sara Krue	13	101.140	-2.918 (-5.165)**				-17.309 (- 5.707)**		0.9104	0.8288	24.203	5.678

Note: The coefficients within parenthesis are the t-values of the regression coefficients; F-value is the variance-ratio; Se is the standard error of estimate of the multiple linear regression equation.

* Significant a 0.05 level; ** Significant at the 0.01 level.

the signs of the simple r's are the same. The simple r's for x_1, x_2, and x_4 are: - 0.22, 0.24 and 0.26. The main differences between the equation for Amphoe Nong Sua and that for Tambon Sara Krue are that the latter has 46 fewer observations than the former and that its multiple R^2 is 2% lower than the multiple R^2 for the Amphoe Nong Sua equation.

In Eq. 3 two independent variables, namely, average household age, x_2 and level of education, x_3, were entered as significant at the 0.05 level. The simple correlation coefficients of these two variables with per capita water consumption were 0.50 and 0.54. Their simultaneous cumulative contribution to the explained variance of per capita water consumption was about 41%. The higher multiple R^2 might be attributable to the better fit of the smaller number of observations.

The independent variables that were significant in Eq. 4 were identical to those that were entered in Eq. 3. Their simple correlation coefficients with per capita rural water consumption were 0.49 and 0.59 respectively. The simple r for level of education, x_3 here was slightly higher than that with per capita water consumption in Eq. 3. Another difference between the results in Eqs. 3 and 4 is that the multiple R^2 here is about 4% higher than that in Eq. 3.

In Eq. 5 two variables were entered as significant, namely, household age, x_1, and bathing habit, x_5. A striking feature of this equation is that both these independent variables were significant at 0.01 level, yielding a multiple R^2 of 0.83. The simple r's between per capita rural water consumption and x_1 and x_5 were -0.52 and -0.61. Although per capita rural water consumption had correlation of 0.66 with average household age, x_2, the latter was not entered by the stepwise procedure, because it has an intercorrelation of -0.70 with household size, x_1. Level of education, x_3, was not entered as a significant variable because the number of years of schooling was constant for the 13 samples selected. Since household size, x_1, and bathing habit, x_5 were orthogonal, the multiple R^2 yielded therefore was very high.

DISCUSSION

At the district level, household size, x_1, average household age, x_2 and average income, x_4 were significant in Eq. 1. Although the number of trips to fetch water, x_8, was entered by the stepwise procedure, it has no significant influence in accounting for variations associated with the per capita rural water consumption for the 282 households in the Amphoe Nong Sua. Its simple r with per capita rural water consumption was only 0.11.

At the subdistrict level for 236, the three independent variables, namely, household size, x_1, average household age, x_2 and average household income, x_4, that were entered as significant in Amphoe Nong Sua were also entered as significant in Tambon Sara Krue. However, number of trips to fetch water, x_8, was not entered in the stepwise solution as its simple correlation with per capita rural water consumption was only 0.08.

At the village level, average household age, x_2 and level of education, x_3 both emerged as significant for 59 sampled and for 46 sampled households in the five remaining subdistricts. The statistical results of Amphoe Nong Sua and the five remaining subdistricts, namely, the intercepts, the regression coefficients, the multiple R^2's, F-values and standard errors of estimate of the regression equation were very similar, even though the equation for the five remaining subdistricts had 13 observations, fewer than the equation for Amphoe Nong Sua.

For the sampled households in Tambon Sara Krue, household size, x_1 and bathing habit, x_8, surfaced as significant at the 0.01 level, yielding a very high multiple R^2 of 0.83. The emergence of x_1 compensates for the absence of x_2 while the surfacing of x_8 makes up for the omission of level of education, x_3.

Average household age, x_2, and household size, x_1, appeared to be the two most dominant variables in accounting for variations associated with per capita rural water consumption. The former variable surfaced as significant in four of five of the stepwise regression equations, while household size x_1 emerged in three of them. Both average household income and level of education appeared twice among the five equations, while number of trips to fetch water, x_8, and number of baths per day, x_5 appeared once.

A noticeable feature of the stepwise regression equations is that as the number of observations decreases the multiple R^2's of the equations begin to increase and the goodness of fit of the stepwise regression equations gets better. The latter is reflected in the standard error of estimate of the stepwise regression equations and their F-values.

Although five out of nine independent variables that were postulated to be associated with per capita rural water consumption were found to be significant, the statistical results of the five estimation equations, with the exception of Eq. 5, on the whole were unimpressive. The low multiple R^2's in the first-four equations are hardly strong for predicting rural water consumption.

Several reasons may be attributed for this lack of functional relationships among the variables used. First is the inaccuracy in the measurement of the dependent variable. Since there was no metering in rural domestic water use, the per capita water consumption in each household was derived either by asking the head of the household how much water he used and consumed a day, or by dividing the total amount of water stored in a large earthenware jar by the number of people living in the house. At best, the per capita water consumption was merely a "guestimate." Second is the heterogeneity of the independent variables which arises from the mixing of discrete data with continuous data, e.g. six of the independent variables, viz., x_1. x_3, x_5, x_6, x_8, and x_9, were scaled from discrete data and three, x_2, x_4 amd x_7 were based on continuous data. A large part of the lack of fit among the independent variables is a result of the variability caused by the scaling of the data. Third is the aggregation of data among the different units of observation. There are variations in the per capita water consumption between using the household and the village as units of observation. The poorer results of Eqs. 1 and 2 compared with Eqs. 3, 4 and 5 testify to this assertion. Given these data problems, it is not surprising that the statistical results are not impressive. However, the findings that emerge from the analysis are not without value. Besides providing insight into the role of socioeconomic variables in accounting for variations associated with per capita water consumption, they are consistent with the results of other studies which have tested similar variables in developing countries [29].

CONCLUSION

In a community where there is no organized water supply system, rain water becomes a crucial source of supply. Although this is the main source of water for drinking and cooking in Tambon Sara Krue, most households do not rely on rain water entirely for their domestic purposes. Instead, they use a combination of two or three sources of water supply for different purposes so that not all rain water would be used up by various demands. Differentiation in the allocation of water for domestic use through various combinations of sources of supply is therefore one of the most significant findings of the study. Since rain water is the only source of water supply that is acceptable to the villages for drinking and cooking, it is vital that every household be provided with adequate water storage facililties to collect enough rain water during the monsoon season to last over the dry months. Although well water is easily available, but it is not frequently used because of its odor and taste, efforts should be made to remove the odor and improve its palatability so that the villagers would accept it for drinking and cooking and not run the risk of not having enough rain water should there be a drought.

In a community where there is no organized water supply system, rain water becomes a crucial source of supply

The statistical findings of the study are less striking other than providing insight into the role of socioeconomic variables in accounting for variations associated with per capita water consumption. Since none of the equations at the district, subdistrict and village level is good enough for predicting per capita water consumption, anyone trying to make use of the statistical results must improve the accuracy of data measurement of the dependent variable and reduce the variability of the independent variables so that better fits may be attained in the regression equations.

As to better planning in setting up an organized water supply system for the community, little can be done unless aid is provided by the Department of Public Health of the province or unless it comes from outside through an international agency. The reason is that the villagers are simply too poor to do anything on their own.

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The deadline for the receipt of abstracts for the VIth World Congress has been extended to August 15, 1987. However, abstracts received by the original deadline, May 30, 1987, will have a higher priority. Submit 1000 word abstracts in English, French, or Spanish, typed single spaced, on regular sized paper to:

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