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An Appraisal of Domestic Water Supply in Four Transkei Villages

by

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Abstract

Some summary statistics are presented on water use by households in four Transkei Villages. The data were gathered in an on–site observational study, and were not the outcome of a planned statistical survey. However, as an informal pilot study, the data collected and the difficulties experienced in collection may be useful in planning more comprehensive studies. Some water use statistics from other studies are also presented for comparison. Factors influencing water collection are described, and some discussion presented of attitudes to water and health in a rural setting.

INTRODUCTION

The study is concerned with an analysis of the quality of water service in four Transkei villages situated in three study areas. The choice of areas for study was determined in part by the availability of existing information at the village level, in part by the project work undertaken by the first author, and in part by access to interpreters. It was felt that the study should, where possible, ride on the back of other research already being conducted at this scale in Transkei.

The data pertaining to two villages (where general socio-economic research has been conducted) and interpreters were made available through I.M.D.S.[1] and T.A.T.U. [1] These villages are Nkanga near Libode, and Ntshiqo near Tsolo (see Figure 1). A third study area was chosen because a spring protection project had recently been completed there. This area included the villages of Platkop and Guba in the Macubeni District in the South West Region. All the villages researched in this study are resettled villages. They are a consequence of the betterment scheme policy which has been pursued in the homelands following from the recommendations of the Tomlinson Commission of 1955.

While it could hardly be asserted that these three study areas constitute a representative sample for Transkei, they do nevertheless provide a remarkably diverse contrasting of physiographic characteristics which together make up a considerable proportion of Transkei's land area.

The research was conducted in September 1984 – the tail end of winter and the dry season. While dryness was not so apparent at Nkanga, the other areas can for all practical purposes be regarded as still in the throes of the particularly intense and prolonged drought that has plagued Transkei since as far back as 1979 (Muller, 1984). Although some rain may have been experienced in these areas in early 1984, (the latter part of summer), few crops were planted because of the lateness of these rains. These latter areas were dry and very barren at the time of the study.

Households were chosen as the basic unit of the survey. The total sample size was 71 households. 25 of these were in Nkanga, 22 in Ntshiqo, 18 in Platkop and 6 in Guba, a

[1] Institute for Management and Development Studies; Transkei Appropriate Technology Unit

neighbouring village.

The choice of households was not random in any strict sense and was rather a function of: the intention to cover a wide ranging area, and the presence of an adult female in the household from whom the information was sought.[2] By covering a wide area as opposed to concentrating on a smaller location for example, it was hoped to not only obtain a more representative picture but also simultaneously identify the location, type and preponderance of water sources in the area. In addition, albeit at a superficial level, we attempt to uncover the extent to which the household source choice was motivated by minimal energy expenditure in fetching water, or alternatively by such considerations as water quality, cultural, territorial or other determinants.

Three interviewers of varying skills were employed in the study, one in each study area. The issue of water seemed to provide an unusually good entré for interviews in this study. Inhabitants were anxious to see an improvement. In addition, water is seen as a relatively tame, seemingly apolitical issue. This is reflected in the attitudes of the relevant tribal authorities who are open to any research or intervention in this field.

With approximately 202 households at Nkanga and a sample of 25 households, the percentage sample size was 12,4%. About 406 households were counted for Ntshiqo, with a survey of 22 households (5.4%); for Platkop an 18 household survey and around 61 households (29.0%); at Guba a survey of 6 households with about 62 households in all (11.3%). These figures are in one sense somewhat arbitrary as surveys were not always distributed across the whole village area but rather tended to concentrate on certain widely distributed parts of the village. The area of the villages covered is somewhat larger than these relative sample sizes.

NKANGA STUDY AREA

Nkanga is a village about 25 kilometres from Libode, which is a similar distance from Umtata. According to Muller and Tapscott (1984) it has 202 households and an unusually low de facto household size of 3,93. This gives it a total de facto population of 793 for April 1983. In this study's relatively small sample, the de facto household size was found to be

[2] There is in fact probably some bias, at least spatially, in that, in order to save time, households near the dominant roads or paths were often chosen. In addition, only those households with adult females present could be used.

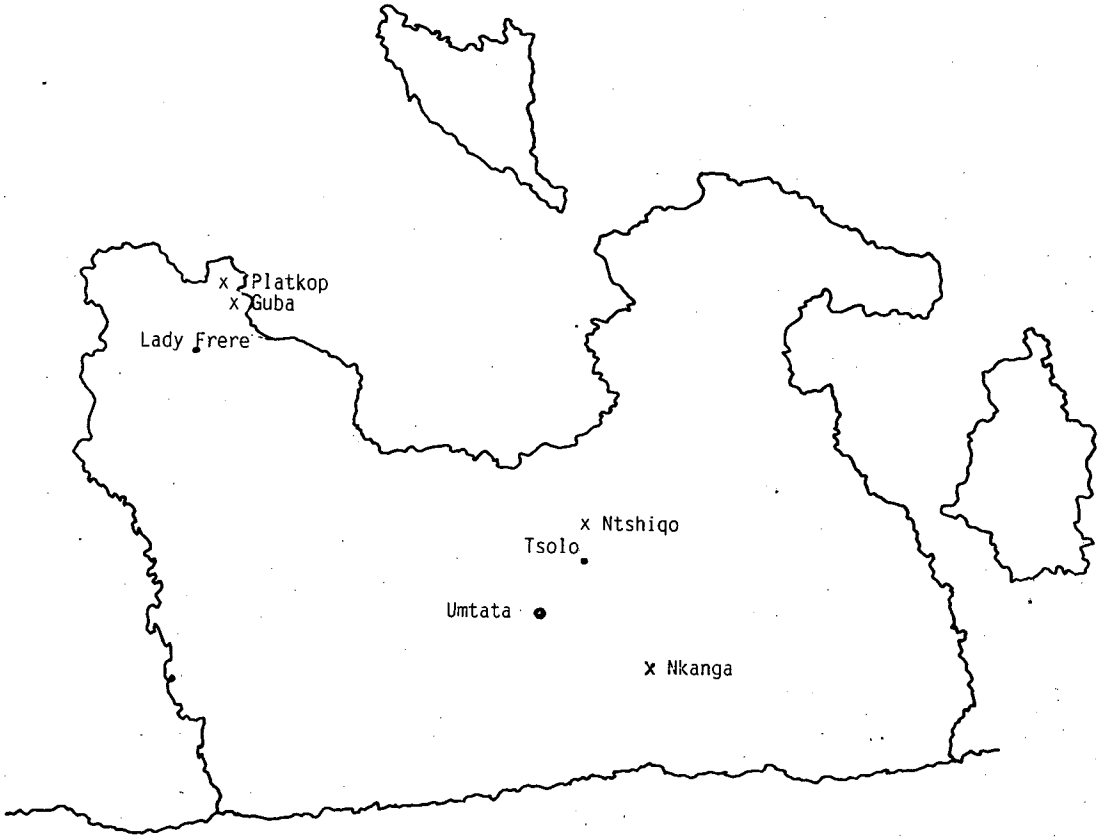


Figure 1:

LOCATION OF STUDY AREAS.

Scale: 1:1 666 666

x= study area.

somewhat higher (6.28), while a household count from an aerial photograph revealed a total of 260 households. [3]

Average annual rainfall is generally high, being approximately 900mm. But there is also considerable local variation with the river valleys being in a rain shadow and receiving under 800mm. Although it is recognized by many that there is a 'water problem' in the village, this appears to be more related to its quality for human consumption than its quantity.

Temperatures are moderate and there is little or no frost. There is thus no danger of a water supply system of any nature freezing up. It is also possible to grow certain vegetables in winter (the dry season) - provided that there is sufficient water. Although there is little information, wind does not appear to be particularly strong and hence should not pose a threat to windmills and their maintenance.

The vast majority of Nkanga's residents are dependent on springs as their sole source of water. Fortunately, given the broken topography and the relatively high annual rainfall these are in relative abundance. They are also fairly close, being rarely more than a couple of hundred metres below the household. But at the same time, their catchment basins are small. This means that they are unusually susceptible and responsive to fluctuations in precipitation patterns. The springs are therefore prone to drying up altogether in dry periods or at least being reduced to a mere trickle. Conversely, with rain they may be quickly reduced to pools of muddy brown water. Even a light misty rain overnight was sufficient for muddying to occur. Since "One days bad weather ... may greatly reduce the amount people collect on that date," (Cairncross, 1980, p. 53) and since the average number of days rainfall per annum is relatively high, this could have a significant impact on patterns of consumption over time as well as the quality of water consumed.

In this regard it is appropriate to mention the sanitary conditions in the area. Sanitation is closely related to water supply in general and a strict dichotomization of these two service

[3] The use of aerial photographs as a means of population enumeration invariably produces subjective results as it is impossible to be certain as to what constitutes a household. Sometimes the younger generation within a cluster of huts may function as a separate household unit. Sometimes huts may have been abandoned. Households may not have residential plots and so forth.

aspects is myopic; for failure to take into account the one runs the risk of effectively negating the intended consequences of any intervention in the other area. Pit latrines or any form of toilets were, (except at the community centre and institutions), conspicuously absent from the area. One respondent said that there were no or very few toilets and that "people 'go' anywhere – there are no special places." What this in effect means is that people will go to the bush areas, near their households, which are also the watershed of the streams. And it is in the 'stream–lines' that the springs are located.

At present the number of rain harvesters in the village for drinking purposes is very limited, with probably only about 2% to 3% of households or less sharing access to this type of source. In addition, those that would have access to such a source would only make regular use of it for about four months of the year – but nevertheless at the time when spring sources are likely to have their highest turbidity levels, and when faecal contamination is likely to be highest or most probable.

The most common form of rain harvester, but still very rare, is the metal roof on a house from which water is collected by gutters and fed into a metal water tank or occasionally an ordinary oil drum. Such sources can for all practical purposes be regarded as being empty or of only marginal utility at the time of the study.

A large rain harvester for drinking and irrigation purposes has been constructed within the grounds of the community centre. It has a tank capacity of about 10000 litres, (2200 gallons). It is not being used as a source of supply for the community at present.

In addition to this rain harvester, some 21 or more smaller rain harvesters have been built for irrigation purposes by local inhabitants. They are for individual household use. The main function of these is for watering vegetable gardens.

There are no other water sources in the area.

NTSHIQO

Ntshiqo lies on the main (fairly recently) tarred road between Tsolo and Maclear. It is between four and five kilometres from Tsolo. The village area surveyed is quite large and is roughly T shaped in form. An aerial photograph (dated 20/6/1982) reveals approximately 406 households in the area. With a de facto household size of 5,27, this gives it a population of

approximately 2140 people, (Muller and Tapscott, 1984).

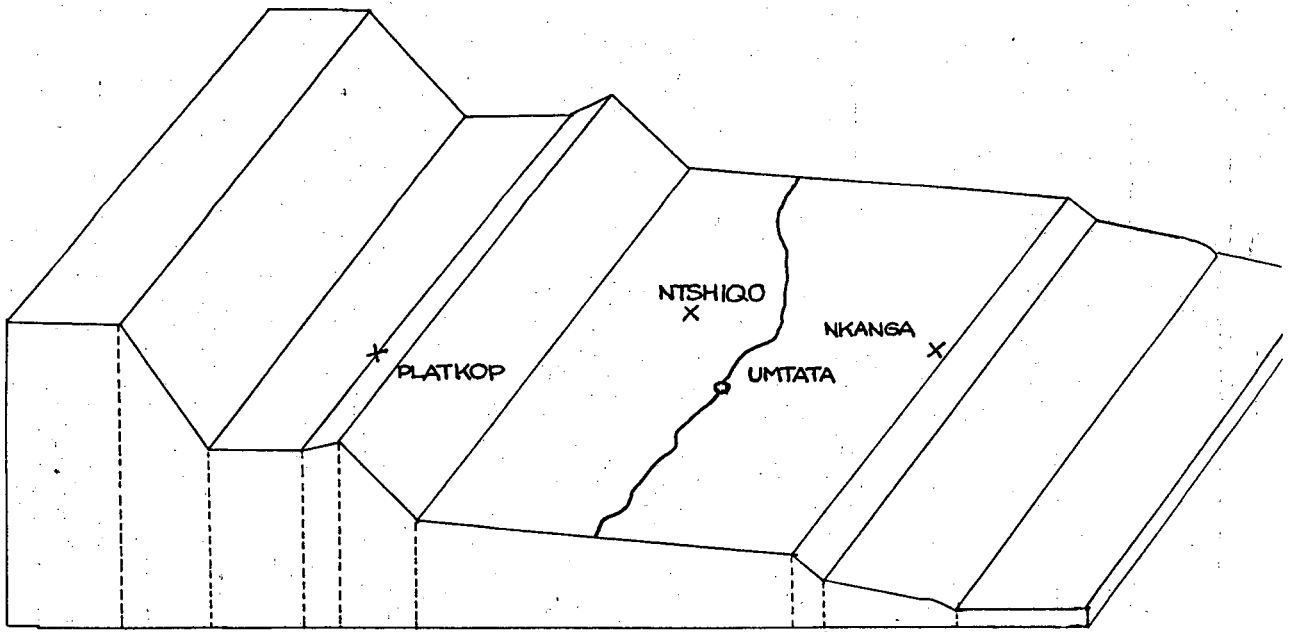
In this instance it is appropriate to emphasize that the inhabitants are affiliated to the Mpondomise tribe. This is a particularly traditional tribe where the majority, especially the women, still ascribe to a 'red–blanket' consciousness or aspects of it. People in the village appear to be generally resistant to change and cling to their traditional way of life. Amongst other characteristics, there is a marked resistance by some of the community to education and modern (Western–biased) medical and health practices. This tendency has significant implications for any form of developmental intervention that might be initiated in the area. The overriding feeling appears to be that 'they and their ancestors have been doing things in a certain way for the past decades or century; if it worked for them, why the need for change?' Clearly, however, such notions do not persist in a vacuum. In a situation of pathetic squalor and hopelessness; "where the people are just dying like flies" (local respondent, 1984); where those that are relatively well educated sit around idle unable to find work; and where there is seemingly very little scope to improve their lot – even with the (unlikely) prospect of meaningful outside assistance, there appears to be little incentive to break from tradition. Their religious and superstitious interpretations of their predicament, the takings from lobola for every daughter as she marries, and the daily rituals of procuring and consuming mqomboti (local beer) are more attractive propositions than the challenge of responding to the formidable social, economic and political causes responsible for the progressive underdevelopment of their already marginalised economic base. Clearly, "in situations of relative deprivation...the belief system provides a measure of security against intracommunity exploitation in the competition for scarce resources." (Derman, 1981, p. 21).

Muller and Tapscott put the mean annual household income at R1 097 as against R2 174 for Transkei as a whole. While such figures must be treated with caution, Ntshiqo's figure is roughly half of the national rural average.

Ntshiqo lies on the central plateau about 12kms from the step up to the high plateau, (see Figure 2). Compared to Nkanga, the land is relatively flat and there are concomitantly fewer springs.

It also has a much lower average rainfall with a figure probably at the bottom end of 600-700mm, (Wood and van Schoor 1975, and Hawkins, 1980). The study area is bisected by a

Figure 2: SIMPLIFIED DIAGRAMMATISATION OF PHYSIOGRAPHIC STEPS



PROXIMATE ALTITUDE RANGE (M)	1500-1700	700-1200	0-500

river with bedrock visible in parts. This river was stagnant at the time. The huts are clustered on the tops of the ridges and on either side there are more river beds which were also dry.

The area is subject to frequent high and dry winds which have implications for the design and feasibility of wind-powered pumps and the types of crops and vegetables that might be grown in the area. Temperatures are generally favourable. While for up to two to three months of the year frost can be expected, annual temperature patterns cannot be regarded as low enough to cause possible freezing of piped water supply systems.

The natural vegetation of the area is Southern Tall Grassveld as identified and described by Acocks (1975).

Following from Wood and Van Schoor's Transkei regional analysis, arable potential is said to be medium and it is classified as an intensive crop farming area. But the lack of water is clearly a constraining factor in the realization of this potential.

There is a small dam in the centre of the study area. Water is muddy and is not used for drinking.

The availability of firewood is a serious problem in the area. The nearest source is at Bele Forest, a large forest reserve, about 11kms away. Fetchers (women) usually leave before daybreak, only to return at dusk. The average number of trips appears to be about twice a week. 57% of respondents cited the lack of firewood as one of their biggest problems. Cattle dung is used extensively for burning. Paraffin costs R11.00 for 10 litres. If the boiling of water is conducted as a means of purification, costs, in cash or effort, of the requisite fuel are high.

Being in a drier and flatter area than Nkanga, there are fewer springs in the area. (The first author observed eleven in use.) They are also further apart.

Apart from the long distances to be covered to these springs (between 660m and 1650m one way, as against 88m and 847m for Nkanga), the flows are also very poor. Often springs dry up altogether and people may queue for hours during peak demand periods which are in the early morning and late afternoon. Many springs have spyra gyra (an algae) and none are protected in any way.

A fuller description of the sources and the problems and use is available in an earlier document (Krone, 1984).

There are three boreholes being planned, one with a windmill and the others with hand-

pumps.

PLATKOP AND GUBA

Platkop and Guba are neighbouring villages in the Macubeni District. Unlike the other study areas, no previous studies of any kind have been conducted in the area. Available data is thus limited to that of the informal survey and one or two interviews. It is a fairly remote area, far from any major route. These villages are one to two kilometres away from a larger village Gxojeni, where the local headman resides and where there is a clinic.

The most notable feature about these villages is the preponderance of houses as opposed to huts in comparison to the rest of Transkei.

There is little or no grass for thatching in the area and the ground appears to be generally too dry and stony for making mud bricks. The occasional hut was actually built out of stone but most out of locally made clay bricks.

Like the other study areas, the local populace was suffering from the presence of a headman whom they described as exploitative and corrupt. The headman enjoys exclusive access to the most fertile land in the area. He controls the only forest as well as a windmill. He has purged the area of any shebeens not owned by himself, and now has a monopoly in this activity, with a shebeen in every village in the area. He even sells directly from his house, which is near the tribal court, surrounded by a high barbed-wire fence. Here the headman is the law unto himself and administers corporal punishment, even to adults, for any acts of criticism or 'disrespect' that might be brought to his attention. The presence of this headman would require careful consideration in the design and implementaton of projects in the area.

Platkop and Guba are both small villages with populations of about 434 and 247 persons respectively. There is a fairly well stocked shop on the road passing between the villages. The local school is at Gxogeni.

The study area lies on the high plateau (the step between the main plateau and the central plateau) at an altitude of around 1353m (see Figure 2).

The climate of this area is described by Hawkins (1983) as 'dryish' and 'cold' with a mean annual rainfall of 500 to 600mm and a mean annual temperature of 15 to 16 degrees centigrade. The scarp of the mountain range to the south east acts as a rainshadow. Droughts are also

common in the area.

Temperatures can fall below freezing point and according to Hawkins (1983), snow can occur quite frequently – often several times a year on the high plateau.

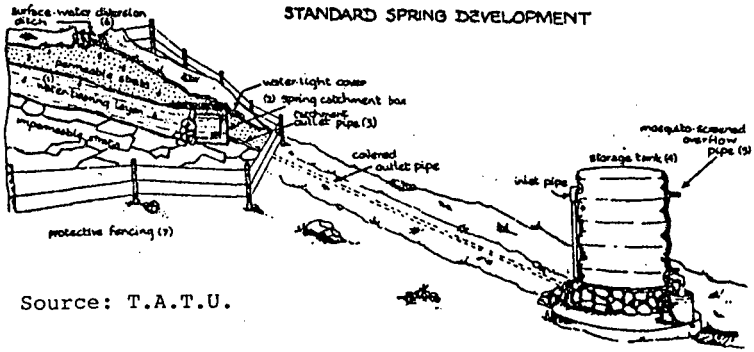
Strong gusty winds occur in the area and are purported to be responsible for regular breakdowns in windmills with ensuing delays of about 2 to 3 weeks before repairs have been effected.

Evaporation is very high, being between 1700-2000mm per annum. This would mean large water losses from reservoirs or similar uncovered water supply sources.

Soils are generally very poor with limited potential for cropping. Much of the land is too steeply sloped and there is a high erosion hazard.

The village of Platkop has not only a much smaller user population but also fewer sources than Nkanga and Ntshiqo.

One of the main water sources is a protected spring (see diagram) with a storage tank and standpipe. This system was operational about two months before the research was conducted. This source, roughly speaking, supplies water to that half of the village which is closest to it. At its only standpipe the system is weak, as there is not adequate drainage for spillage, and the potential exists for the transmission of water–washed diseases to occur.



Source: T.A.T.U.

At present this source serves about 27 households, or about 187 people, (sample size 30%). The daily supply capacity comprises the amount of flow over 12 hours (the assumed period

of usage) added to the size of the tank. The rate of flow was said to be 8 litres per minute, and may be much higher in summer. The size of the tank is 4500 litres. This means a total potential daily supply of 10260 litres, or a per household and per capita supply of 380 and 55 litres respectively. The tank has, not surprisingly, yet to be emptied. And at a mean household consumption of 40 litres and mean per capita consumption of 8,5 litres per day, for those villagers who are users of this source, the tank is unlikely to empty in the near future.

GUBA

Guba, a still smaller village, has two unprotected springs within river beds. During summer these unprotected sources can frequently disappear under a muddy–brown, highly silted river.

WATER COLLECTION AND USAGE

First by way of introduction we might ask ourselves: of what import are such details as the quantity of water consumed by people; what they use it for; the distances they must cover to collect it; the energy expended in such collection and so on?

To many, this may seem somewhat secondary to the issue of water quality. While water quality is certainly important and essential for the health of the community, it is also true that the quantity of water used has significant implications for the health of the users.

> "The quantity of water individuals consume has been found to be associated with the incidence and prevalence of several of the diseases common to rural residents in developing countries."
>
> (Saunders and Warford, 1976, p. 121).

Perhaps the greatest infant killer, and one of the greatest killers in Transkei, is that group of diarrhoeal diseases which are 'water-washed'. A number of studies elsewhere have found that increases in the quantity of water available has had considerable impact in its eradication. White et al. (1972) cite a study which suggests that diarrhoeal disease may be reduced by as much as 50%, although precise measurement is difficult. But in this area of diarrhoeal diseases, the impact of an improvement in water quality has been negligible (ibid.).

Apart from direct health benefits which may ensue from an accessible water supply there may also be increases in productivity through the use of the water for the growing of food and also rendering available more human energy and time to be put to other productive uses. Moreover, some knowledge of consumption patterns is essential for the design of any improved water supply system.

Collection of Water

It was found that in general in this study only females were involved in the fetching of water. A mean number of 2,78 trips per household per day was recorded, (S.E. 0,127;([3]). Young

([3]) S.E.: Standard Error of the Mean. This statistical measure reflects the internal variation within the sample data, and the consequent margin of random variation associated with the sample mean. Throughout this paper SE may be interpreted as follows: We have nearly 70%

males, probably always less than about 12 years old, would however assist. Where they did assist they tended to make more trips than the women, (4,17 S.E. 0,980).

The mean number of trips per day for the total sample was found to be 2,91 (S.E. 0,146). There was little or negligible variation between villages with Nkanga having a mean of 2,64 (S.E. 0, 181); Ntshiqo, 3,0 (S.E. 0,259). These means do not differ significantly.

The number of trips ranged between 1 and 8 a day. These figures are broadly compatible with Lesotho, (Feachem et al. 1978). In KwaZulu a somewhat higher figure of 3,98 trips was found (Friedman, 1984) but this included a high preponderance of village standpipes which would have meant greater accessibility to the source, and possible increased water use associated with short impromptu trips.

The size of the containers used to fetch water varied from a minimum of 5 litres to a maximum of 25 litres. The overall mean container size was 16,01 litres. The use of 'Krost' metal buckets is common. They come in many sizes, graded by the litre, but those most commonly found range from about 13 to 15 litres. However, plastic containers, usually 20 or sometimes 25 litres in size, are becoming increasingly common. A few of these still had their lids, which were occasionally used after filling. (If the lid is kept clean, it would certainly assist in preventing further contamination between the collection and the consumption of water. This stage of transportation and storage has been identified by Feachem et al. (1978) as having a significant contribution to the further pollution of water.)

In Nkanga metal buckets were particularly prevalent and the mean container size was 15,36 litres (S.E. 0,650). This was not so much the case in Ntshiqo where the mean size was 15,96 litres (S.E. 0,988). Mean sizes at Platkop and Guba were even larger, being 16,7 (S.E. 0,713) and 16,8 (S.E. 1,014) litres respectively.

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confidence that the interval from one SE below the observed sample mean to one SE above it, will include the unknown true average for the group from which the sample data was drawn. This interpretation strictly assumes that the sample was randomly drawn. It also serves to remind us that we may occasionally have an atypical sample, which misleads us somewhat about the true average. We follow a convention of reporting an SE to one decimal more than the mean to which it refers.

Consumption Quantities

Two total consumption figures were derived for each household. The first total (tot1) was calculated on the basis of the number of trips per day and the size of the container (or containers used). Where there was more than one container in use, an average size was taken and recorded on site. The second (tot2) was calculated by summation of estimated quantities for each usage.

The average reported household consumption figures were 47,4 litres per household per day (SE 2,90) for tot1, and 44,0 litres per household per day (SE 3,13) for tot2. With mean household sizes as 6.4 persons, the corresponding average consumption figures are 7.4 litres per person per day and 6.9 litres per person per day.

From the experience of the first author at the site, it is suggested that tot1 is likely to be the more correct as it requires fewer considerations and estimations. However, it may prove to be too crude a measure, as it depends on an accurate record of container size, and the number of trips claimed. Some of those interviewed could have been partially numerate, but it is not clear which total is more accurate in this case. [4]

There are few studies in the Southern African context, at least south of Limpopo, with which this data may be compared. The most extensive rural domestic water supply study is that of Feachem et al. (1978) on Lesotho. Although a very similar context in certain other respects, Lesotho, being mostly moutainous, has an abundance of springs. Even in the flatter lowlands of the west, access to water is considerably better than in the Transkei areas studied.

To give these figures more perspective they may be compared with world-wide figures and the urban figures for the Eastern Cape. White (1977) suggests that daily per capita consumption figures for rural sources range from as little as 1 up to 25 litres. These figures are based on world-wide studies of developing countries.

For the Eastern Cape "the overall figures of average per capita daily consumption by the white urban population is calculated as 314 litres." (Stone, 1984 , p. 7). In black townships of the Eastern Cape the average per capita consumption was 18,58 litres per day with the lowest

[4] A community worker suggested that most people could add and subtract but many could not divide or multiply. These latter computations were not however required.

figure being only 5 litres. In what is perhaps the most directly comparable context to this study, he found an average dwelling use of 75 litres of water per day for the rural Chalumna/Hamburg area of Ciskei (1984), and argues on this basis that the average township black uses double that of the rural dweller. This would mean a rural per capita figure of about 9 litres which is close to but higher than the figures for this study.

Another study conducted in the North East Region of Transkei found a per capita consumption of 10,8 litres, (Osmond, Lange et al. 1982). Broadly speaking that part of Transkei has a considerably higher annual average rainfall. It is also relatively unscathed by soil erosion. This would probably make it a more favourable than average area.

In a portion of the Valley of a Thousand Hills in KwaZulu which, as its name suggests, is probably also relatively well endowed with water, a household consumption figure of 99,5 litres per day was found, (Friedman, 1984). "The per capita consumption of water carried to the household is estimated to be 10,88 litres/person/day." (ibid. p. 2). These figures are based on a sample of 334 households, some of which were in a peri-urban situation. Also community standpipes account for the largest supply source to the area and accessibility to sources is probably on average better than that of the three Transkei areas. In certain zones, per capita consumption was as low as 7 litres per person per day – on a par with the figures from this study.

Figures for East Africa for unimproved sources in rural areas range from 4 to 18 litres per capita. (White et al. 1972; p. 119).

In Lesotho usage figures based on 1334 household–days of water collection were found to be considerably higher with an average of 18 litres per capita per day. (Feachem, et al. 1978). This higher figure could possibly be explained by the method of calculation which is unlikely to have been followed elsewhere: estimating the total volume used, the total number of users and the total numbers of days over which it is used. The result is a figure which is less sensitive to the daily fluctuations of water quantities used. These can be extreme on occasions.

The washing of clothes requires large quantities of water though only usually once or twice a week. Depending on whether it is done at home (and therefore perhaps included in the total usage figures) or at the water source, the figures may be distorted considerably, unless clothes washing is treated as a separate factor as in this study. Not all studies indicate which washing

practice is dominant, nor whether figures for washing were included in totals. In Friedman's (1984) study it was found that washing and some personal hygiene was mostly conducted at the source. Whether washing is done at the source will usually depend on distance from the source and the amount of washing that is done. Larger households would also be more likely to do washing at the source, while the presence of babies in households usually demands the fetching of significantly larger quantities of water. One woman in Nkanga reported using a bucket of water (15 litres) a day for the washing of her baby and its nappies, aside from other washing.

Nearly half (44%) of those who claimed that the water was far always did their washing at the source, while only 11% who claimed that it was not far did their washing at the source. The quantities of water used for washing within the dwelling reported by those who said the source was not far, are generally higher than those for the respondents who claimed it was far, (22,81 S.E. 4,707; 48,34 S.E. 6,004).

Where distance to the source is not such a factor, indications are that other factors come to determine where the washing is done. In Lesotho Feachem et al. (1978) found the most influential determinant to be the pleasantness of the environment at the source. Thus if the source was clean and if there was a convenient rock for washing clothes on, then it would be used.

For the purposes of the calculation of total water use the quantities of water used for the washing of clothes was excluded in all cases. Taking a mean weekly usage of 50 litres of washing water per household, adding about 7 litres to each household figures and 1 litre extra per capita would appear to account for this factor whenever it applies.

Discussion of Usage Quantities

The figures for the four villages appear to be comparable and suggest a degree of reliability in the method of data collection. We note however that Nkanga's mean household consumption figure is considerably lower, even though distances are not great, possibly due to under–recording of the amount of water that is collected. Precisely because sources are near, there are possibly more frequent trips by children with a variety of small containers. These might have gone unrecorded. Where trips involve covering a distance of 3 to 4 kilometres and an investment in time of 3 to 4 hours, not only are trips less likely to go unrecorded, but chil-

dren or other members of the household are less likely to be making impromptu self–initiated trips of the type that tend to go unnoticed.

The smaller number of trips per day and the smaller container sizes in Nkanga make for a low total fetched–water consumption figure. It has been found in other studies (White et al., 1972 and Feachem et al., 1978) that the size of the container used has a significant influence on the amounts of water consumed, as the number of trips per day appear to remain fairly contant virtually regardless of container size and context. Although the difference in container sizes were not large in Transkei, this phenomenon would seem to be applicable to the context, with consumption figures increasing with container size for all villages. This factor could have substantial policy implications.

There is a large difference between water–fetched and water–used consumption figures for Platkop, (51,44 S.E. 5,913; 40,94 S.E. 4,505).

Platkop is the village which had recently benefitted from an improved water supply. The interpreter was also the supervisor of the project. It was suggested to the authors that the users of the source may have felt a need to underestimate their usage of water so as to dispel any possible conclusion of water wastage. A large proportion of the village was denied access to this source (because of non–participation) and respondents may have feared that their exclusive privilege might be withdrawn. Similarly, those denied access to the source may have been eager to impress upon the interviewers their short supply of water, in the hope that they might be granted access to the improved source.

However another significant finding was that those households with houses as opposed to huts reported a significantly higher water–fetched usage (tot1), while their water–used figures compared closely with that for huts. There is a large discrepancy between the two indices reflected in the 'diftot' figures (0,23 S.E. 3,403; 16,29 S.E. 7,941). 'Diftot' is the difference between the total water–fetched and the total water–used, as reported by the respondents.

Whether it is true that households with houses are less able to estimate their water usage, or whether this was so because most of the houses were close to improved source in Platkop, is not clear. In any event it is a phenomenon with potentially important consequences and should inform future research design.

As with the studies by White et al. (1972) and Feachem et al. (1978), while numbers of

trips and total consumption per household did increase with the size of the household they did not do so proportionately and per capita consumption actually declined.

Proportionally less water is likely to be used for washing dishes or clothes in a large household. But as we have seen, even more significant is the higher probability that the washing of clothes will be done at the source as it requires less energy expenditure in a larger household. There is also more scope to use water for a greater variety of uses before it is finally disposed of. Feachem et al. (1978) note that water may be re–used several times:

> "For example, one woman was observed to use a single bowl of water to: wash a baby, wash a baby's nappy and clothes, wash a few adult clothes, wash the floor, and then water the garden." (p. 125).

Quantities and Distance from Source

As with other studies focused on this aspect, there was no distinguishable decline in the quantity of water used with an increase in distance from the source. If anything results indicated a reverse tendency, but as we have seen in the case of Nkanga in particular, this is probably due to a combination of underscoring by subjects who are close to the sources and perhaps sample error.

Probably the first study undertaken around the issue of water usage was by White et al. (1972). In Masii Village in Kenya, water is carried as far as 2 miles (about 3,2 kms) in a few cases, which is considerably further than any distance encountered in this study.

They argue:

> "In aggregate and in specific sites there is a tendency for the larger uses to occur in households between one–half (805 metres) and three–quarters of a mile (905 metres) from the water source." (ibid. p. 128).
>
> The relationship to distance seems to be curvilinear and to reflect two factors at work. up to some critical distance – in most sites it appears to be about one mile (1,6 kms) – there is a tendency to use the same range of water per capita, but beyond that point the tendency is to reduce the range toward whatever is a minimum for the area (see Figures 3 and 4). Thus Masii households use between 3 and 12 litres per capita up to one mile: beyond that none of the users exceed five litres." (p. 129).

"Water use tends to be higher very near the source, slightly lower in a range of 150 to 300 feet (46 to 91 metres) and then at a higher but uniform level at distances up to the limit of one mile." (ibid.).

They argue that this phenomena can be explained by the fact that women living within 100 feet of a source go more frequently, whereas those at the intermediate distance are more likely to take washing chores to the source than those living either nearer or farther.

Feachem et al. (1978) in Lesotho studied the time taken to the source, rather than distance. The maximum trip time involved was a little over 30 minutes for a round trip or as they suggest a distance of about 1 km. They conclude:

"No general association was found between water and distance from the source.... However... households with a water collection journey time of 30 minutes tend to use slightly less water, mainly by economizing on the number of trips they make." (p. 106).

Quantities at Improved Water Sources

Improved water source applies here only to the spring protection project at Platkop. The single standpipe installed has brought the water considerably nearer to the households, reducing the average distance by about 750 m. The water is also cleaner and is in effect an inexhaustible supply at present as the tank has yet to be emptied.

Per capita use for those households using this source was 8,5 litres, (sample size = 9). For the other households per capita use was 7,4 litres. No significant difference could be said to be present despite all the advantages.

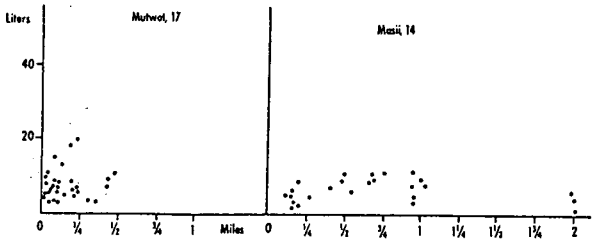
Feachem et al. (1978) in an extensive study on improved sources made a similar finding.

Quantities and Energy Consumption

The computation of energy used by the household in acquiring water, in addition to perhaps bearing some relationship with the quantity of water consumed, is also of general interest and import to the broader development process of the villages.

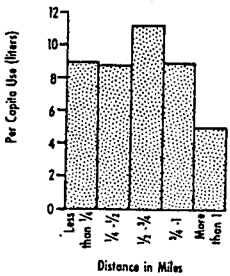
The energy rate formula of Stone (1984a) for Ciskei was adopted for the computation of this data. Whereas in that study the subjects moved downhill to water sources and uphill with

Figure 3:



Per capita daily use and distance carried at Mutwot and Masii

Figure 4:



. Mean per capita use at different distances from source, for unpiped rural areas

Source: White et al. (1972)

full buckets, in the present study some subjects had to move uphill over ridges before proceeding to water sources. Consequently the terms:

(SUBJECT MASS+CONTAINER MASS+WATER MASS)

and (SUBJECT MASS+CONTAINER MASS) × REDUCTION FACTOR

for the uphill and-downhill journeys respectively, were both replaced by:

$$(2 \times \text{(SUBJECT MASS+CONTAINER MASS)} \times 0,5(1 + \text{REDUCTION FACTOR})$$

The presumed speed (50m min^{-1}) and the average subject mass (60 kg) were taken from the earlier study. The resulting total energy use is directly comparable with figures of Stone (1984a).

The amounts of energy used by fetchers of water per trip and per day for each household were calculated. The mean figures for each village are presented below. These figures compare closely with those of Ciskei. As Stone (1984a) suggests for Ciskei:

> "If it is assumed that three journeys to the water are needed by each household each day then the aggregate distance walked on average is 5,1 km involving an energy expenditure of 1623 kJ." (p. 16).

Stone's (1984a) figure for the average rate of energy expenditure carrying water is calculated at 24,75 kJ.min-1. Figures for certain villages in Transkei would closely resemble these. He compares this rate with values computed by Consolozio et al. (1963) for:

playing volley ball	14,4 kJ.min-1
mixing cement	19,3 kJ.min-1
dancing foxtrot	21,4 kJ.min-1
using a pick (miners)	27,4 kJ.min-1
playing tennis	29,2 kJ.min-1

One figure for Ciskei was 44,35 kJ.min-1 which compares in energy expenditure with a value of 43,6 kJ.min-1 for cross country running (Consolazio et al. 1963 in Stone 1984a). Nkanga's figure would probably be at least this amount, but direct calculation is not possible for the current data, as no times or absolute distances were recorded. Rough calculations on

energy used, average number of trips, average distance, and a common speed of 50 m min-1 yield figures:

49,3 for Nkanga;

34,1 for Ntshiqo;

39,9 for Platkop;

33,7 for Guba.

Based on these calculations Nkanga has a higher energy usage than any of the villages including those of Stone's (1984a) study for Ciskei. It has exceptionally steep slopes. Fortunately for the inhabitants distances are not very great.

In a multiple regression analysis no evidence was found that the amounts of water used decreased with an increase in energy used but as has been argued elsewhere, this may be partly due to under–scoring.

Water Usage and Activity

The estimation of water usage quantities for the various activities of respondents may provide useful information. Apart from a check on the other total household consumption figure, they may indicate aspects of local social habits and attitudes, particularly in the area of hygiene. Moreover it may enable one to plan for a functional differentiation of water uses between sources of varying quality, while being able to estimate the respective present and future quantities required from each source.

There is a wide variation in the figures for cooking for Ntshiqo with one household of 13 using up to 80 litres a day. The cooking of stamped mealies, common food in Ntshiqo, requires a lot of water – usually double the amount for other food. This may account for some of the variation in figures. Cooking constitutes 33% of the total amount of water used (tot). The mean of 14,33 litres (S.E. 1,488) may be compared with a figure of 8 litres for a village in Uganda where cooking also constitutes about a third of daily household needs and 30 litres for another village in Tanzania, (White et al. 1972).

The figures for drinking amount to 15% of the total water usage and are fairly consistent, (6,7 S.E. 0,56). However a good deal of drinking is probably done outside the home, usually at one particular household where beer has been brewed. The figures of 20 litres for the village

in Uganda and about 2,3 litres for a village in Tanzania (ibid.), illustrate the extent to which diet can influence figures. The latter village uses far more for cooking.

At Nkanga most bathing was done indoors. This contrasts with Ntshiqo where bathing is predominantly at the source itself particularly for children. Usually the more elderly women will bath indoors, after heating the water first. Along the Transkei coast people often wash in the sea. In Uganda as much as 70 litres were used for bathing per day while only 12 litres were used in Tanzania. Bathing water constitutes 38% of the water used in the Transkeian households.

There was little variation in the amounts used for washing dishes. With a mean of 6,4 litres (S.E. 0,442), dishwashing constituted 14% of the total usage and compared closely with that of the Ugandan village. The figure for the Tanzanian village was 15,5 litres.

Figures for the washing of clothes were computed for Nkanga, Platkop and Guba. The means were 63 (S.E. 7,3); 35 (S.E. 5,0); and 30 litres (S.E. 4,5) respectively. Platkop and Guba are in a drier area which has probably encouraged the habitual use of less water.

Subjects were asked in each village whether they had vegetable gardens and whether they watered them. Only 10 of the 71 indicated that they had gardens all of which were watered. Predictably 8 of these were in Nkanga. Most were watered twice a day. This water was usually waste water and cannot be regarded as having an influence on amounts used. Greater accessibility to water could dramatically increase the amount of water used for vegetable gardens and therefore total quantity used. This demand would tend to be seasonal in most areas, although in warmer areas such as Nkanga, the demand would be perennial.

Some General Policy Implications

There are two factors in particular that will influence changes in total water usage for a given area. The first is the change in population. There are no reliable population projections for Transkei. Moreover variations between regions and villages could be considerable. A conservative growth rate advanced by Thomas (1983) was 2,4% per annum.

In addition to this, per capita consumption figures are likely to increase, although by what rate is open to speculation. Here influences may include a greater number of household water connections, higher educational levels and a concommitant increase in hygiene consciousness,

as well as any other possible developments within the village such as an increase in vegetable gardens, and so on. Feachem et al. (1978) estimate an annual increase in consumption of 2% per capita.

Projects implemented now with envisaged life spans of 15 years would need to address the issue of interim surplus water or interim water users until full capacity use is reached.

SOME FINDINGS RELATED TO ATTITUDES TO WATER AND HEALTH

Health considerations related to water supply form an extremely complex and ill–defined area internationally, and specialists in the field admit that there are still many areas of uncertainty.

In an attempt to gauge attitudes to water, some questions were posed about its quality, accessiblity and availability. Of the 71 households interviewed, 37 indicated that their source was dirty, with the remainder claiming that is was clean. Of those who suggested that their source was clean, only those at Platkop who used the standpipe had reasonable grounds to do so. All the other sources at best had poor flows and were shared with cattle. Since all of the nine who used the standpipe indicated that the water was clean, we observe that no fewer than 25 households, or 35% of the sample, claimed that the source was clean when it clearly was not. This would seem to point to a rather low level of hygiene consciousness. It was quite clear on further questioning that some respondents had a very poor understanding of the importance of clean water and of the problems that might develop if this was not the case. Those at Ntshiqo (predominantly traditional in orientation) seemed to be the most accepting of their water, although it was clearly very dirty. 12 of the 22 (54%) interviewed here said that the water was clean.

Questions about the quantity of water also yielded seemingly anomalous results. Here 42 of the 71 respondents (59%) indicated that the water quantities at the source were sufficient to meet current neds. Again, the only group who could justifiably suggest this were those who used the standpipe. Nearly every other source dried up during intense drought, while most emptied during the day, requiring long waits for water. But more revealing was the finding that those who said that the water was enough used considerably less than those who said the supply was insufficient.

It has been found elsewhere (Feachem et al. 1978) that water which was stored in a larger container within the house becomes considerably more polluted over time than otherwise. The bacterial pollution that occurs is not an instant process but rather one which takes place over a period of hours, at an accelerated rate. These large containers are seldom washed out and induce bacterial growth. It was found that 63 of the 71 households did not pour their water into a larger container for storage. Although not a significant problem at present, the number of people that will follow this practice in the future will probably increase as access to large plastic containers increases. We note that 48 per cent of households (ibid.) in the Lesotho lowlands stored water in large containers.

Respondents were asked about the incidence of 'stomach sickness' (which was intended to identify the prevalence of diarrhoeal and other water–related stomach disorders). Some 48 of 71 households (68%) said that their families had recurrent problems of this type. It was also established that incidences are higher in summer when, due to higher rainfall, disease is more easily transmitted via water. (Feachem et al. 1978). Of the 48 who said they got stomach sickness, 19 claimed that their water sources were clean. Despite the obvious poor quality of the main source at Ntshiqo, 6 out of 9 suggested that it was clean. The same 6 out these 9, reported cases of 'stomach sickness.' These figures are somewhat paradoxical and could indicate a failure to link their sickness with the water supply. It cannot however be claimed that the cause of a stomach disorder necessarily originates directly from the supply itself. It may be transmitted from other sources such as faeces in or near the social environment.

At Platkop, of those households who have begun using the standpipe, all 9 interviewed indicated, without prompting, that they had had no 'stomach problems' since using the tank. They also indicated that they had had sicknesses before the tank's introduction – including cholera, another water–related disease. At neighbouring Guba people were also being "attacked by the cholera." The above diseases as well as dysentry, (another water–related disease) found in Ntshiqo, and tuberculosis, rife in all the villages, are all poverty related diseases. They all have the capacity to kill and many lives are claimed by them. In affluent white areas of South Africa deaths resulting from these diseases are almost unheard of.

Those who said they had problems with 'stomach sickness' also used slightly more water – a mean of 48,9 (S.E. 3,8) litres as against 42.0 litres (S.E. 3,9). This again is an apparent anomaly

that could be interpreted as evidence for a possible relationship of water usage quantities with education. It may be that more discriminating water collection leads to lower quantities of better water.

We suggest that relationships between water collection, water use and attitudes to community and individual health may serve as a useful focus of further study.

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