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Water use and problems in Meru

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District Water Plans are being prepared by the Kenya Ministry of Water Development's Water Resources Assessment & Planning Project (ref. 1). WRAP estimates the total amount of water required for each sublocation using standard consumption figures drawn from the Ministry's Design Guide (ref. 2). For rural areas, it assumes that 20 litres per person per day would be needed by households without internal connections in areas of high agricultural potential, 15 litres per capita per day in medium potential areas, and 10 litres daily per person in areas of low agricultural potential. Assumptions are also made to estimate the water required for other purposes, including urban areas, number of livestock units, pupils in schools, health facilities, bars, shops, industries and staff in administrative offices in each sublocation. Total demand estimates can then be compared with data on water supplies available in the area, based on analyses of stream flows and other water sources, to identify areas where additional water projects will be required. In order to check the validity for Meru District of the different water demand assumptions between agro-ecological zones, a rural household survey was undertaken in September 1989 (Williams and M'Barine, 1990) (ref. 3).

Nkuene Location in South Imenti Division of Meru was selected for the survey since it extends down the slopes of Mount Kenya through many of the agro-ecological zones identified in the Ministry of Agriculture's Farm Management Handbook (Jaetzold & Schmidt, 1983) (ref. 4). Nkuene Location includes parts of the tea/dairying zone, adjacent to the Mount Kenya Forest in the west, as well as the upper coffee zone, lower or marginal coffee zone and the cotton zone, together with an irrigation scheme at Mitunguu. East of Mitunguu, the E788 road to Marimanti and Gatunga in Tharaka Division passes through a lower, drier, less-densely settled pastoral area with cotton & subsistence crops. Data collected on the distributions of Water Permit Applications in Meru had revealed that Nkuene had a large number of self-help or community water projects, with a density of applications relative to population and area exceeded only by the neighbouring location, closer to Meru Town. For each of the 12 land registration units, a random sample of plots proportionate to the number of plots in each unit was selected, with equal quotas from four size-groups, small, average, medium & large, classified in relation to the mean & standard deviations of all plots in the unit. A fifth category for the random sample included mortgaged plots where the land title had been offered as security for a loan. Unregistered areas were sampled in proportion to the estimated population of the survey area; tracks were selected at fixed distances along the road and households were chosen at varying directions and distances from the road. 324 heads of household were interviewed about the household & farming activities, financial matters & involvement in self-help groups, while the wife was also interviewed about the household water sources, uses and problems experienced. On the basis of the crops grown, the survey area was classified into four zones, with marked contrasts in average total farm incomes from cash crops, sales of animals and milk: the Tea/coffee zone in the west with Kshs 25,860, the Coffee zone (Kshs 8,675), the Coffee/cotton zone, including an irrigation scheme (Kshs 12,083), and the Cotton zone in the east (Kshs 6,021). (Sept. 1989 Exchange rate: KShs 33.56/- to £ Sterling)

(1) INVOLVEMENT IN SELF-HELP WATER PROJECTS:

The responses to the rural household questionnaire survey confirmed that some parts of the survey area were particularly well-served with gravity-fed piped water supplies, especially on the upper slopes closest to Mount Kenya. Apart from 2 government schemes, the Nkubu Urban Supply & the Mitunguu Irrigation Scheme, self-help or harambee groups built and operated these water supplies. Over half of the respondents (166 or 52%) had access to piped water supplies with taps, but the remaining 153 respondents had to collect water from rivers (89 households), water furrows (23), springs (18), wells (11) or boreholes (8 respondents). No households used water vendors or kiosks. In registered areas with individual land titles, 62% of households had piped water, ranging from 85% in the Tea/coffee zone to only 52% in the Coffee/cotton zone. Topography, the route of the pipes, or perhaps inability to pay their contribution to the group, appeared to preclude the participation of many households; only 16 respondents (7%) stated that there was no water project in their village. In contrast, none of the 50 respondents in the unregistered areas of Tharaka in the east of the Cotton zone had piped water supplies, nor were there any water projects in their villages.

Although amounts contributed varied greatly, households invested an average of KShs 3330 in water projects but none of the self-help groups required a monthly charge. The highest average was in the Tea/coffee zone, KShs 4209, but only KShs 2200 in the Coffee zone, less than the KShs 2704 in the Coffee/cotton zone. Projects were smaller in the wetter Tea/coffee zone, which averaged 145 members, much less than the 447 average in the Coffee zone or the 418 of the Coffee/cotton zone. Older projects characterised the Tea/coffee zone where 8% were over 20 years old, while more recent projects were found in the Coffee/cotton zone than in the other two zones: 76% had

been started less than 10 years ago, but only 41% or 40% in the other zones. It had been hypothesized that larger or wealthier farmers would have invested more in piped water supplies but regression analysis indicates that there are only weak statistical relationships between farm-size (Pearson correlation coefficent, r = .15, probability significant at the 95% level), or cash crop incomes (r = .11, not significant at the 95% level)). These results suggest that the perceived benefits of piped water may outweigh the costs, so if a pipe is passing the farm, the household will obtain the money necessary to participate, regardless of its circumstances.

Farmers without piped water supplies, would be prepared to pay an average of KShs 838 as an initial payment for water from a communal standpipe; this figure is depressed by the low amounts households on the unregistered plots in the Cotton zone felt willing or able to offer (674/-). Virtually all wanted their own water connections at home, and were prepared to pay up to KShs 1525 as the initial payment, although this declined eastwards from 2350/- in the Tea/coffee zone to only 1353/- in the Cotton zone. Even among those with piped water supplies already, 51% were prepared to pay more for individual connections; on average, they were prepared to pay up to 2274/- initially for an alternative supply, with the highest payments declining eastwards from 2813/- in the Tea/coffee zone. Among those without piped water supplies, 88% would be willing to contribute cash if there was a water project nearby. Many of the sums suggested were unrealistically low, however, perhaps reflecting either their lack of resources or lack of knowledge about the amounts required in water projects elsewhere. 85% of them would prefer to work on the project instead, contributing an average of 9.19 days per month. Even among those with taps and piped water supplies, 81% of the respondents would also be prepared to contribute to another water project nearby, reflecting current inadequacies with existing supplies; they suggested an average of 2167/- per respondent, but 54% would prefer to provide labour instead, averaging 7.13 days per month. Many households without piped water supplies, however, appeared unable to afford to participate. Assuming that 10% of farm income could be spent on piped water supplies, only 3 water-carrying households (2.5%) had annual farm incomes over 33,000/-, and so could afford the average contributions. 18 (15%) could afford to contribute 3300/- if spread over 3 years, but only 3 of these were in the drier, unregistered areas. Among those with piped water already, 14 (10%) could meet their contribution within the current year, and 61 (44%) could afford to make these payments over 3 years. Certain areas are favoured: under the Cooperative Production Credit Scheme, coffee farmers are eligible to borrow up to 15,000/-, repayable over 3 years; to qualify to borrow 3300/-, they would need to produce only 220 kg of coffee for 3 years at an average price of 5/- per kilo. 65% of the Nkuene Cooperative Society (5123 out of 7918 members) produced more than this figure in the 1987/88 coffee crop year.

(2) PROBLEMS WITH WATER SUPPLIES

Despite all this activity by local communities in providing their own water supply schemes, a great deal of dissatisfaction was found concerning their water supplies. Both at the start of the interview with the household-head and towards the end of the interview with the wife or person responsible for collecting and using the water, each was asked if they were happy with their water supplies. Among those without piped water supplies, only 4 household heads (3%) or 8 women (5%) were satisfied with their existing domestic water supplies. Even among those with piped water supplies, only 41 household heads (25%) or 44 women (27%) said they were satisfied. Each household head and water user/carrier was then invited to identify their problems.

For households without piped water supplies, distance was the major problem, followed by water-quality and then water-quantity. Among the women, who had to carry the water with help from their children, distance was ranked first by 73% compared to only 38% among household heads; when three replies were incorporated 84% of the women and 70% of the household heads identified distance to water supplies as a problem. Quality of water was ranked as the dominant problem by 14% of the women or 15% of household heads, but when all three replies were included, 66% of women water-carriers or 46% of household heads had problems with quality. Water quantity, was the most pressing problem for 40% of household heads and for 10% of the women, although overall it was seen as a problem by 71% of household heads and 59% of women water-carriers. The greater concern about not enough water among the household heads perhaps indicates their concern with stock watering, especially in the drier Cotton zone in the east with more pastoralism; the wives' greater concern with quality may reflect the incidence of water-related health problems. Among those with piped water supplies, distance was a minor problem since it was ranked first by only 12% of the wives or 6% of household heads. Quantity of water was the overwhelming problem as it was ranked first by 83% of household heads and 50% of the women, rising to 90% or 80% respectively when all three replies were included. Although the male household heads saw quality of water as a minor difficulty, only 2% of whom placed it first, 16% of the women felt quality was their main problem; when all replies were included, however, 27% of household heads and 40% of their wives had problems with poor water quality.

(a) Distance:

Since the early classic study (White, Bradley, White, 1972) (ref 5) found little linear relationship between reduced distance or collection time and increased use of water, later studies have presented conflicting evidence: some indicated that more water was used when new public taps reduced distances, while others found no connection between distance and amount used. In order to test this

hypothesis, respondents were asked the number of trips by each person on the previous day and the size of the containers. Oral reports on water collected or used may be unreliable, however, and peasant women may have difficulty in correctly estimating the distance or time taken to the water source. Also, as 53% of all households stored an average of 28 litres overnight, some might not collect water every day, while on the day in question some members of the household may have been absent. In a few cases, wheelbarrows (12) or donkeys (4) were used to transport water, so distance was less important. While the number of trips was indeed reduced as distances increased (Pearson correlation coefficient, r = -.27, significant at 99% level), there was no statistical relationship between amount carried per household member and distance since r was only -.06, not significant at 95% level. The more household members were available to carry water, then the greater the amount carried (r = .33, significant at the 99% level). Water use was extremely complex, however, with great individual variations, so that virtually none of the variations in amounts carried per capita were statistically explained by distance to water collection points or by the return journey-time.

56 households (39%) were over 1 km. away from their source of water, 21 (14%) had to travel over 2 km., 2 of whom travelled 5 km. and 2 more were 6 km. away from their water collection point. The average distance was 1239 metres during the wet season, increasing to 1443 metres in the dry season. Even among those with piped supplies, 21 (12%) were forced to collect water in the dry season since their taps ran dry. In the wet season, return journeys averaged 52.8 minutes, with 34 households (11%) requiring at least an hour per trip, 2 claiming to spend 2.5 hours on it. During the dry season the average return journey-time dropped to 49.8 minutes. Journey times and distances were related (Pearson correlation coefficient =.79, statistically significant at the 99% level), although not as closely as might have been expected. Although the 20-litre plastic container was standard, 87% of the women felt their journey was difficult. Since women of different ages, accompanied by children, were walking uphill on rough paths at varying speeds, it is perhaps not surprising that journey time is not a good predictor of the amount carried per consumer. It is possible, however, that if more time is spent collecting water then less time will be available during the day to work on cash or subsistence crops so that farm income will be reduced. The amount carried per household member, however, has a weak correlation with total farm income (r = -.01 not significant at 99% level); the variation in amount of water carried per capita was not also related to the farm-size (r = .04) or to the relative farm-size (r = .19). Since none of the households had the opportunity to purchase water, and neither the self-employed peasant farmers nor their wives received wages, it is only possible to speculate on the opportunity costs of the time devoted to water collection. Assuming that the 5 adults in an average household each worked an 8-hour day throughout the year to produce the average family farm income among water-carriers of 7998/-, then the rate is only 0.548/- per hour, much less than the 5/- minimum hourly wage for farm labourers. The average household spent a total of 6.87 hours carrying water each day, at a notional cost of 3.76/- per household.

(b) Water quality:

As an indication of water quality, the women were asked about water-related diseases, and whether any of their children had diarrhoea in the last month, if any children had ever had worms, and if any household member had been diagnosed at a clinic/hospital in the past 5 years as having malaria, skin or eye infections, or bilharzia. They were also asked for their subjective judgements on whether the water was unclean, tasted or smelt bad, or had insects in it. For every indicator, higher percentages occurred in each of the 4 crop-zones among those having to collect their water from rivers, etc, than among those with piped water supplies. Generally the incidence of diseases increased and water quality declined eastwards from the higher wetter areas to the lower drier areas. 83% of water-carrying households had malaria, but only 68% of those with piped supplies; worms and skin/eye infections each affected 41% of water- carriers, but only 21% and 20% of those with taps; 20% of water-carriers had diarrhoea, contrasting with only 8% of households with piped supplies. Among the water carriers, 77% felt their water was unclean, 52% had insects in it and 40% said it tasted/smelt bad, contrasting with only 50%, 29% and 21% respectively for those using taps. Water-related diseases and poor water quality was rife in the Cotton zone, especially in the drier, pastoral areas of Tharaka which had no individual land titles. Even those areas well-served with gravity-fed piped water supplies provided on a self help or community basis would benefit from simple water-treatment plants or improved sanitation facilities. Only 24% of households boiled their water and only 3% filtered it, while 57% used unimproved pit latrines.

(c) Water quantity:

Even on the well-watered slopes of Mount Kenya, the self-help water projects appeared unable to provide enough water throughout the year. Women water users were asked to estimate the amounts of water normally used daily for cooking, drinking, personal hygiene and laundry. While obviously difficult for those using taps, only 8 had taps within the house, so a water collection trip to the standpipe on the farm was still necessary; only 19 (6%) felt unable to provide figures on household water consumption. Excluding those who took their clothes to the river for laundry purposes, 40% of the domestic water was used for washing clothes; in the dry season clothes were unlikely to be washed every day, so the figures for laundry may have been over-estimated. 29% of the water was used for personal hygiene; again in times of water shortages, some family members might choose to wash in streams to reduce the amount of water carried. Cooking

accounted for 25%, while a further 3% was used for drinking purposes, although these two functions were often aggregated.

Amounts consumed per person varied greatly, but the overall average was 28.2 litres per person for those with piped water supplies, and 17.1 litres per person for those without taps. In each crop zone or relative size-category of farm there was a consistent pattern of increased water consumption among households with taps than in households without piped supplies; disparities were greatest in the wetter, higher areas, but were less marked towards the east. 14% of those with taps and 34% of those without taps estimated that they used less than 10 litres per household member, whereas 32% of households with taps and 10% of water-carriers claimed to use over 30 litres per household member daily. Among those without piped water supplies, consumption was not related to distance to the water collection point or to the trip time. It had been hypothesised that larger farmers or wealthier farmers might expect a higher standard of living, leading to higher water consumption levels. Individual consumption figures varied greatly, but there was little statistical relationship between water consumption and farm size ($r = .04$), or cash crop income ($r = .08$). Smaller households, though, used more water per capita as there were no scale economies: $r = -.38$, significant at the 99.9% level of probability.

52% of those with piped water supplies were found to irrigate their crops, generally subsistence or horticultural crops rather than cash crops, 21% using overhead sprays. Even among those without piped water, 11% irrigated using water from a water furrow or stream or else making use of water left from other purposes. In addition 88% kept cattle, and in the upper areas zero-grazing was practised so that water and fodder were taken to the cattle. With declining coffee prices or delayed coffee payouts, many farmers were diversifying by growing horticultural crops under irrigation, particularly french beans for export. Complaints of inadequate quantities of water in the dry season and the lack of reliability in supplies may be attributed to these non-domestic uses of water. Among self-help projects in the area there appears to be a temptation to expand the area supplied and the number of members served by a pipe, perhaps to cover maintenance costs or higher than expected construction costs or simply to respond to local demands for participation, without being able to increase the diameter of pipes or to increase the water-pressure sufficiently to cater for these extra demands. Low water flows, plus inadequate pressures, probably account for much of the farmers' dissatisfaction with their self-help water projects.

Although in this strip down the eastern slopes of Mount Kenya, great individual variations in current daily water consumption per person were found, these do not appear to be directly related to distance from water sources, estimated water collection journey times, or to farm sizes, cash crop incomes or total farm incomes. Nevertheless, strong geographical trends in current water consumption emerged between the 14 areas analysed within this survey area. As predicted from the Water Development Ministry's water demand assumptions, water consumption rates declined eastwards down the mountain through the different agro-ecological zones which had been defined largely on the basis of rainfall and soils. In the areas of high agricultural potential, aggregate actual water consumption rates were very slightly higher than the 20 litres per person per day expected in the Tea/coffee zone (21.95 litres), and fractionally lower in the Coffee zone (18.2 litres); in areas of low agricultural potential, the Cotton zone, the lowest rates were found (12.6 litres), as expected. In the Coffee/cotton zone there was a localised rise in cash crop incomes and in daily water consumption rates to 20.8 litres per person per day, due to the influence of the Mitunguu Irrigation Scheme. Higher, wetter areas have more streams, and are also favoured with higher farm incomes, so that a combination of easier access to water, greater expectations of improved living standards, plus the ability to pay, leads to the greater provision of self-help piped water supply projects, leading in turn to higher rates of domestic water consumption.

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