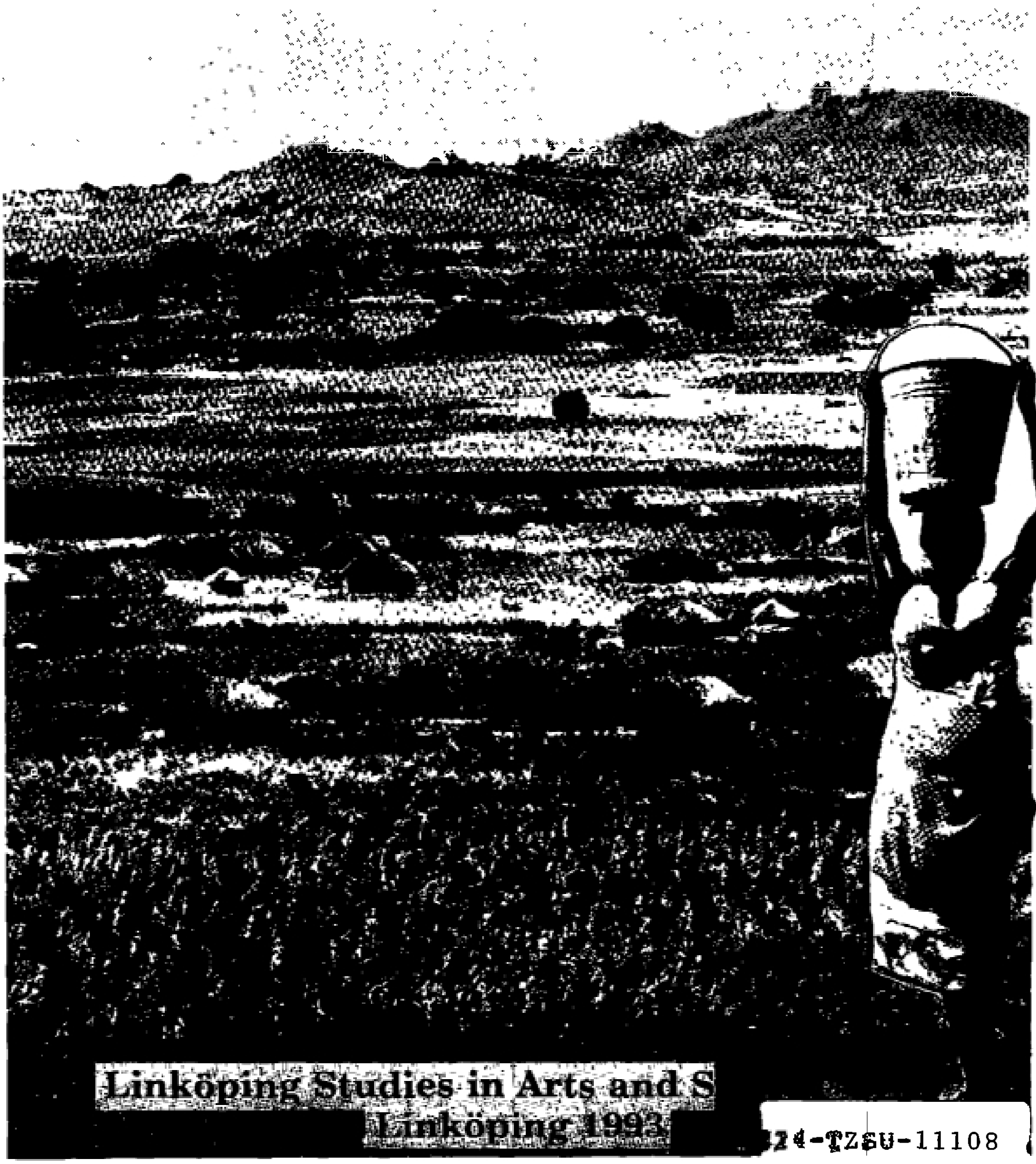
Jan-Olof Drangert

Who Cares About Water?

Household Water Development in Sukumaland, Tanzania



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Linkoping Studies in Arts and Science

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Jan-Olof Drangert

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Abstract

This is a study of the incentives and constraints which bear upon people's ability to improve access to and quality of household water through their own cooperative and household efforts. The focus is on activities that are managed and controlled in the community and involve human and physical resources. Equal emphasis is given to understanding *continuity* aspects (doing more of the same) and *change* (doing new things).

Thirty knowledgeable informants from six rural villages in Sukumaland provided the bulk of the information. They live in an area with a semi-arid to sub-humid climate situated south-east of Lake Victoria in Tanzania.

Human and physical factors influence what takes place on the local scene and a model is developed to analyse water-related activities. In-depth interviews and observation provide the basis for an exploration of ways in which individuals and neighbourhoods reason and act to obtain household water of acceptable quality at a reasonable distance. The interviews were aimed at elucidating the actual levels of knowledge and technical skills employed in effecting specific improvements. The informants' knowledge of hydrogeological conditions and of the hygienic aspects of water use are appraised and compared with full professional standards of knowledge.

Sukuma norms about water-related issues have been explored: water rights and control over water sources, and household and cooperative efforts. Informants' individual values on these matters are compared with the norms. The aim is to learn the ways in which both norms and individual values affect negotiations about proper measures in the community and within the household

Four major findings come out of the analysis The first is that villagers in general believe that there are affordable and manageable solutions to their own household water problems. Secondly, government and donor involvement in the household water sector tends to inhibit more advanced local initiatives and activities. Thirdly, the present gender-based division of household tasks interferes negatively with improvements. Finally, there are considerable differences in the value placed upon different kinds of accessible water sources by outside observers and the villagers themselves.

The prospects for future improvement in household water conditions are heavily influenced by the rapid population increase The capacity for government interventions is limited, and in future most efforts to develop water supplies are expected to be made by individuals and neighbourhoods The hydrological conditions allow for the provision of enough household water well into the next century, although the population growth will eventually cause water scarcity and hit food production.

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ABSTRACT

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Key words. community participation, drinking water, gender, health and sanitation, household water, indigenous knowledge, negotiations, rural development, Sukuma, Tanzania

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Jan-Olof Drangert

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Introduction

Water is crucial for the well-being of people. We need it for drinking, cooking, cleaning, washing and bathing. Ways and means of meeting the demands for household water reflect the differing combinations of physical, technical, socioeconomic and cultural environments to be found in the world.

This study describes and analyses how people in Sukumaland, southeast of Lake Victoria in Tanzania, reason and act in order to obtain supplies of household water in good years and bad. The focus has been on human responses to differing physical and human environments. It is hoped that this exploratory work will generate new knowledge about household water behaviour and help to create new knowledge about factors which bear upon people's ability to improve their access to good quality household water.

Turn-key Arrangements

The Tanzanian government in 1971 adopted a policy aimed at providing all inhabitants with safe water within 400 metres of their dwellings by 1991. This policy, which was to be implemented by the Ministry of Water, became the preserve of foreign aid donors and water supplies introduced were of a "turn-key" type i.e. ready to use. The users were hardly consulted or involved in the projects and operation and maintenance aspects were not discussed.

A study made some twenty years later showed that modern rural water supplies in Tanzania had a designed capacity to provide water to some 40 per cent of the rural population (Government of Tanzania, 1990). Due to poor operation and maintenance it was estimated that only 5 per cent in fact benefitted from adequate supplies of water at all times, while the rest obtained their water at best intermittently. Tanzania is not the only country which has failed to implement its ambitious water supply policy. A World Bank team (1988) found that out of 183 surveyed donor-supported rural water supplies in developing countries around the world, some 40 per cent were out of order five years after commissioning. After seven and ten years the figures were 70 and 85 per cent, respectively Most Third-world domestic water supplies in rural areas seem to be out of order at any given time.

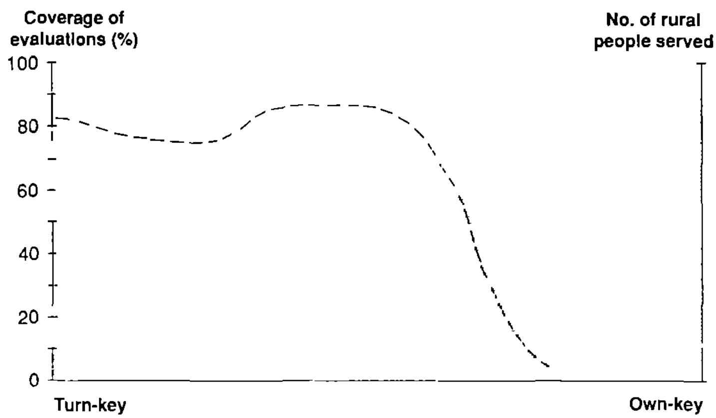
The poor outcome from turn-key projects has contributed to a shift of attention toward more local involvement in the projects A decade ago governments began to distance themselves from the supply-oriented perspective which used to push for turn-key interventions with technical solutions to quantity and quality problems They are now increasingly moving towards a demand-oriented perspective which focusses on users' expressed needs (UN, 1981:5) Tanzania has witnessed a growing concern about the negative impact of administrative pressure upon villagers to help to install modern water supplies which they had no part in planning. Intensified cooperation with the "beneficiaries". is now thought likely to produce more sustainable solutions Not surprisingly, then, planners and donors today favour, at least in principle, making villagers more "responsible" for operation and maintenance but not for planning and choice of technology of water installations. This has meant a shift in emphasis - not yet fully reflected in recruitment and training practices - from technical aspects towards managerial aspects in providing water.

Rural People Survive Thanks to *Own-key* Arrangements

Given the widespread failure of modern water supply projects and policies, villagers' own resources and solutions have come to the fore; in many areas rural people survive thanks to their own arrangements and efforts We here introduce the term "*own-key*" to indicate activities that are managed and controlled in local communities, by using locally available knowledge, skills and materials. This terminology will be useful for analytical purposes even though the distinction between turn-key and *own-key* is sometimes presented here as being more clear-cut than it is in reality. In practice, there is no clear dichotomy between turn-key and *own-key* arrangements but rather a kind of continuum. This is particularly so nowadays, when the new orthodoxy demands that most household water projects should at least appear to incorporate as many inputs of the local resources as possible.

It is our own view that *own-key* arrangements are vital for the majority of rural people in the world since they can expect little help from governments and donors in the near future. Yet little is known about such activities, and the state of their art is largely unexplored. Everett Rogers (1986·48) comments in general (and not about water in particular) that "in the past we may have severely underestimated the degree to which the user system was capable of managing its own knowledge transfer process. Our understanding of decentralized diffusion systems is still limited, owing to the general lack of investigations of such user-dominated diffusion." Not surprisingly, most evaluations, assessments and appraisals of water development activities are focussed on external interventions, hence biased towards turn-key activities.

The present state of affairs is illustrated in the figure below. The continuum of kinds of activities ranges from pure turn-key installations to *own-key* arrangements. The greater number of rural people are served by *own-key* arrangements as indicated by the skewed shaded area. The coverage of evaluations and research (dotted line) is highest for turn-key installations and external interventions in the water sector, while *own-key* arrangements are only rarely documented.



The asymmetry between the coverage of evaluations and research and the prevalence of the two kinds of water sources in use is in itself a reason for increasing the amount of research on the *own-key* household-water sector. Due to the high rate of population growth it is practically certain that the *own-key* sector will continue to serve the rural majority for the forseeable future. This is so because even if enough funds for large-scale turn-key improvements were available, the sustainability of turn-key interventions has proved everywhere to be poor.

The Study and Its Aim

This study is aimed at studying factors which bear upon people's *own-key* efforts at community and household levels, to improve their own access to good quality household water under differing physical and human conditions. Equal emphasis is given to understanding how far this means *continuity* (doing more of the same) and how far it means *change* (doing new things).

Detailed concentration is upon (i) villagers' assessment of their household water and of the human and material resources there are for individual and cooperative efforts (Section B), and (ii) prevailing Sukuma norms and individual values about water rights, cooperative efforts and household efforts that may affect *own-key* water activities (Section C). The study has been conducted in Sukumaland in Tanzania.

Section A

Sukumaland: Its People and Water
The model and methodological considerations of the study

The Wasukuma, their livelihood and organisations are presented in this section together with the physical geography of Sukumaland. The household water conditions and water endowments are outlined as a background to the ensuing analysis of Wasukuma activities in the household water sector.

A number of earlier empirical studies are briefly presented as a frame of reference from which our own theoretical approach can be viewed. We believe that our model takes into account both the material and human resources which are employed by villagers in securing access to improved household water through their own efforts.

We used a methodological mix of in-depth interviews with informants, observation and studies of written material. This is described in detail in chapter 4. The encounter between the researcher and the informant in terms of the researcher's biases and informant's strategies is discussed there at some length.

2

Sukumaland: its People and Water

Introduction

The Wasukuma people and their organisations are here introduced by a few notes of relevance to the study of water conditions. The age composition of the population, their numbers, social situation and livelihood are sketched. The physical environment e.g. climate and hydrogeology of Sukumaland is briefly described. Some data from a survey of existing water sources (1976) are presented.

The boundaries of Sukumaland in present-day Mwanza and Shinyanga regions and its major rivers and catchment areas are shown on Map 2.1. Smith Sound of Lake Victoria divides Sukumaland into two distinct parts. The present day district towns are also indicated together with the six villages in this study: Bupamwa, Igogwe, Kongolo, Lwanhima, Mkula and Runere. The main roads and the railway line Tabora-Shinyanga-Mwanza are also shown.

The People

The Wasukuma are the most numerous single ethnic group in Tanzania (some 12 per cent of the national population) and most of them live in Sukumaland to the south of Lake Victoria. Today some three million people inhabit the area and most of them are Wasukuma.[1] They belong to the Central Eastern Bantu and comprise a group very closely related in language and custom to the Nyamwezi further south in Tabora and Shinyanga regions (Cory, 1953:1).

The following figures on the population in Tanzania have been drawn from the latest population census (Bureau of Statistics, 1992). The population of mainland Tanzania was 22.486 million in 1988, 17.037 million in 1978 and 11.958 million in 1967. The Germans estimated the population of the then German East Africa at 4.063 million in 1913.

There are no separate data for Sukumaland, but the following national data are expected to be fairly true also for Sukumaland. Life expectancy at birth increased from 44 years to 49 years (50 for women and 47 for men) between 1978 and 1988. The population pyramid hardly changed over the same period, with the age group of 0-15 years making up half the population.

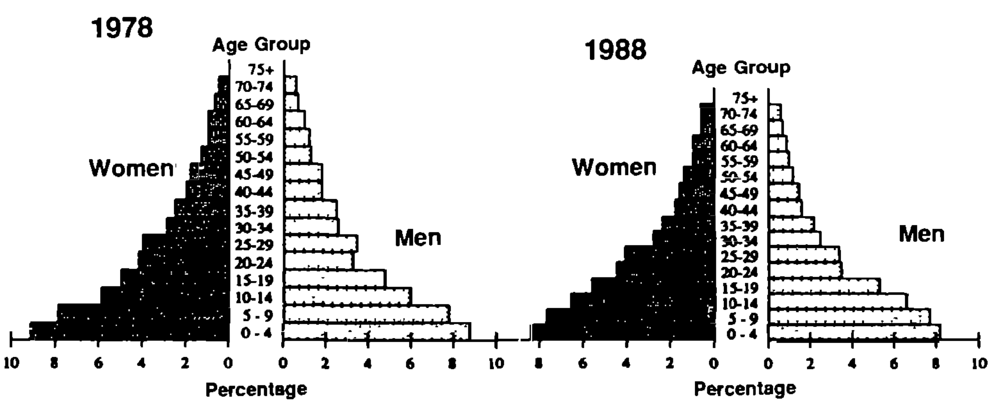
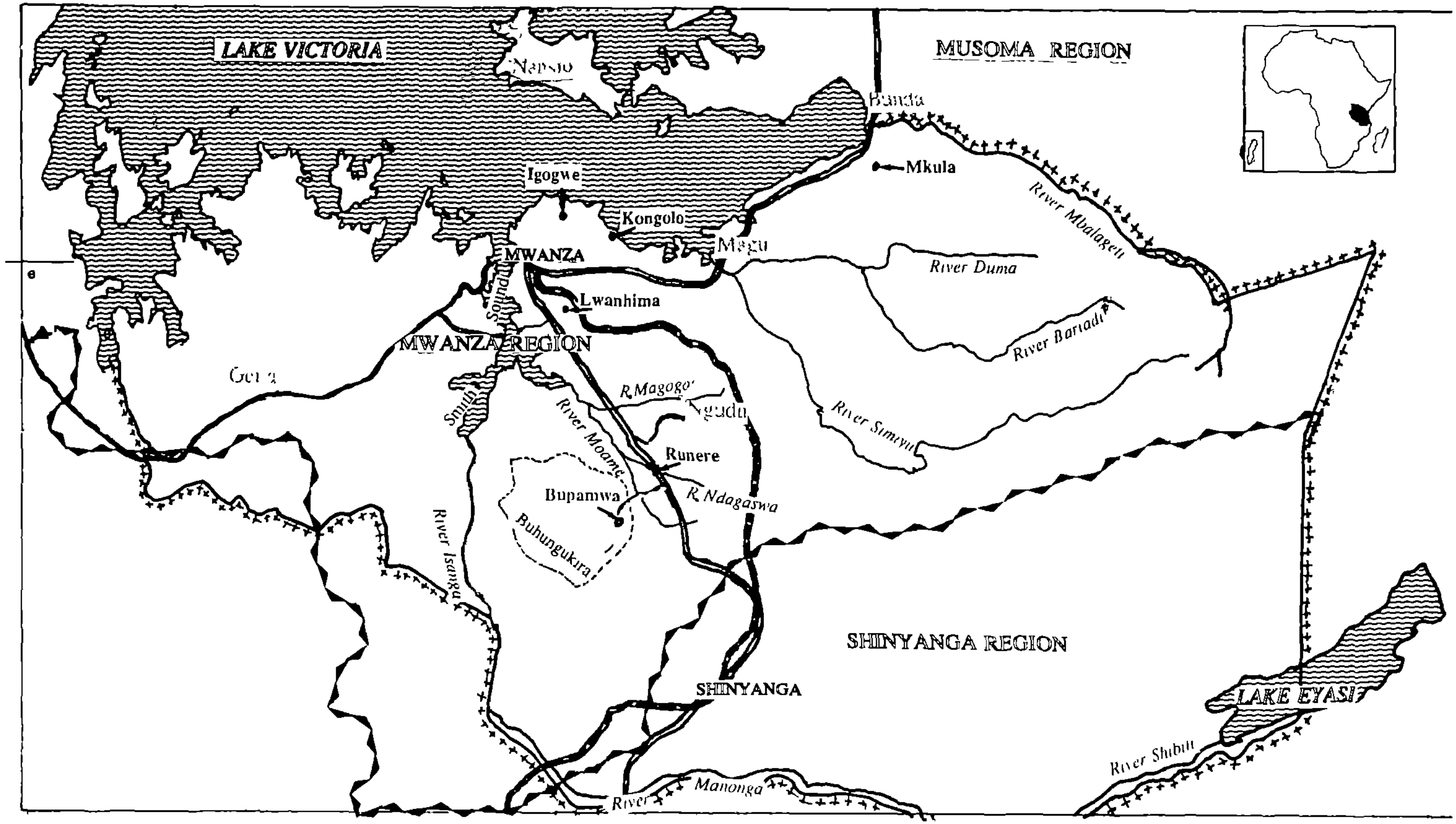


Figure 2.1. Population pyramids, 1978 and 1988, for mainland Tanzania.
Source: Bureau of Statistics, 1992:13.

The mean age at first marriage for women has increased from 18 years in 1967 to 19 in 1978 and 23 in 1988, while that of men remains at 25 years. The total fertility rate declined by about 0.4 to 6.5 children per woman in the decade 1978 to 1988. The national population growth rate decreased from 3.2 to 2.8 per cent over the same period (2.6 per cent for Mwanza region that makes up most of Sukumaland).

[1] The 1967 census, the last one recording ethnic groups, numbered the Wasukuma at 1,529,917; Brandström (1990) estimated them at some three million in 1988 Audrey Richards (1960:230) estimated the Wasukuma comprise over 90% of the inhabitants of Sukumaland.



Map 2.1 Sukumaland and the six villages in this study (Based on Abrahams, 1967:96; IBRD, 1961:396 and Cory; 1953:149) border, drainage divide main roads, railway. kilometres.

Infant mortality fell from about 200 per thousand live births in 1948 (UN, 1953) to 160 in 1967, 135 in 1978 and 125 in 1988 (118 for girls and 131 for boys). Today's figure for infant mortality equals that of Sweden at the end of the 19th century. Data on maternal mortality are not reliable nor comprehensively reported. However, records from hospitals and clinics, which cover about half of all births, give an estimated maternal mortality rate of 200-400 per 100,000 births (Bureau of Statistics, 1992:21).

Livelihood. The proportion of economically active people is high in Tanzania since more than 80 per cent live in rural areas and both men and women are counted as active cultivators. The major occupational groups are given below. It can be noted that many urban dwellers, especially women, are active as cultivators. For the purpose of this study it is important to note the variety of occupational groups in rural areas.

Table 2.1. Economically active population (in '000) by major occupational groups, 1988. Mainland Tanzania.

Occupation	Total		Rural		Urban	
	W	M	W	M	W	M
Cultivators	4591	3656	4136	3359	455	297
Craftsmen	22	206	7	60	15	146
Clerks	47	58	8	17	39	41
Professionals	88	244	41	111	47	133
Administrators	6	36	2	16	4	20
Agriculture	7	30	4	18	3	12
Mixed Farm	336	425	324	400	12	25
Service	106	164	40	46	66	118
Smallscale traders	104	276	24	79	80	197
Other workers	38	61	22	31	16	30
Total	5345	5156	4608	4137	737	1019

Source: Bureau of Statistics, 1992:40.

The Wasukuma are known to be successful sedentary farmers with substantial numbers of livestock. Maize, rice, sorghum, and cassava are the main food crops, complemented by sweet potatoes, groundnuts, vegetables, legumes and fruits. The main cash crop is cotton and most cotton grown in Tanzania comes from Sukumaland. As in most of Tanzania, land is available free of charge for young people and migrants to a village. The most fertile parts are already occupied but an applicant can expect to receive a plot in the "commons" and also have access to some grazing land. In this sense there is little status in having a farm in Sukumaland, but it is certainly important to have one. This availability of land is a fortunate circumstance that makes the Wasukuma confident of their livelihood.

Cattle and livestock in general are important to the Wasukuma and everyone who can afford to do so invests in cattle. Donald Malcolm (1938:129) wrote that "it would be hard to find a more profitable investment than cattle" and contrasted it to the Sukuma proverb that "shillings do not breed (*shilingi jitobialaga*)". Cattle provide milk and meat for own consumption and they can be converted into cash or bartered to meet emergency needs, but cattle are in normal times only marginally involved in the cash economy. At the same time cattle play an important role in the "social" economy (Brandström, 1990:3:2; Rotenhan, 1968:79). Cattle censuses are known to be notoriously difficult, not only because of the custom of lending out cattle which cuts across village boundaries and even district boundaries. Malcolm (1953:1) estimated in 1953 that Sukumaland contained almost two million cattle units to a human population of about one million. The cattle-people ratio is now around one to one (Brandström, 1990). This is close to the ratio in the six villages covered by the present study. Village leaders estimated that between every fourth and every second household keep cattle.

Social amenities. Primary schooling has been compulsory since 1977 and each village has one or more schools, although attendance is not universal. Earlier adult education programmes pushed the literacy rate to some 90 percent, but reading ability is again declining due to poor access to reading materials.[2] There are several churches in each village run by different denominations. A few small kiosks or shops provide necessities like salt, sugar, batteries, etc. in the villages. Health facilities, albeit rendering services of indifferent quality, are widespread; half the people in Mwanza region live within ten kilometres of the nearest health centre while only eleven per cent have to travel more than 20 km (Ministry of Lands, 1982).

The national policy of reducing disparities between urban and rural areas by increasing equity in access to public services has had an impact. For instance, a self-reporting survey on welfare indicators among urban and rural populations in Tanzania found that access to public services, measured by out-patient visits, in-patient stays, and numbers at school, were remarkably similar in all areas, although travel time was higher for rural people (Bevan et al., 1989:242). For instance, 16.3 per cent of the u2inhabitantsrban population reported sick compared with 18.2 per cent of the rural population over the same three-month period. The authors concluded that "the main impression is how very similar morbidity is in the two samples." Although no villages or towns in Sukumaland were included in the survey there is little reason to believe that conditions differ from the rest of Tanzania.

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[2] Today there are two English-language daily newspapers in Tanzania, two Swahili papers and some magazines, but these are only available in the towns. In the 1950s there were an English national daily and three Swahili papers (a monthly, a weekly and a daily) plus 29 monthly or fortnightly papers which were published in Swahili and other languages under government auspices in various districts (four in Kisukuma), there were also seven mission papers and four privately-owned and published by Africans (Gordon-Brown, 1958:83).

Government and administration. Most parts of Sukumaland were ruled by chiefs for centuries. Knowledgeable elders among our informants could recount the names of chiefs in their area starting long before the colonial intrusion in the 1880s. Austen (1968:17) characterized the precolonial Sukuma as having "highly developed village organisations." The chief or *ntemi* presided over a court and was a ritual leader.[3] A state council of *banangoma* assisted the *ntemi* and it also elected new chiefs and had the authority to dethrone a chief. Cory (1954:79) wrote that chiefs often appointed their sons as headmen or *ng'wanangwa* to "the charge of villages wherein they would be his representatives, and would exercise subordinate judicial and executive powers delegated to them by him." "The parishes are divided again into units over which there are elders in control. The main age-group associations counter-balanced power wielded by the *ng'wanangwa* under the chief's patronage." (Tanner, 1955:160).

During the early colonial period the *ntemi* was assisted by an educated alien African *akida* (clerk).[4] This system came to an end in 1925 when a form of indirect rule began to be introduced.[5] From then onward there was a movement to change the chief into an executive authority, and to play down the traditional role of "priesthood and repository of tribal spirit." (Iliffe, 1979). In the last years of the classical type of district administration the wheel turned full circle and Sukumaland became according to Austen (1968:247) almost a model for the deployment of schools, agricultural stations and administrative anthropology in an attempt to create or tap the roots of an indigenous dynamic for progress.[6] At the end of the colonial period there was a delicate balance of

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[3] Cory (1954:5) remarked: "The system was based on magico-religious faculties and functions and its officials obviously exercised their authority mainly in the interest of the community. This system lasted undisturbed until recently when it began to be affected by increasing contact with western culture. All the signs indicate that once more one of the decisive changes will be the splitting up of the African community into classes, but this time in accordance with economic principles."

[4] Richards (1960:239) comments "The alien *akida* were directly reponsible to the British administration and since there were few internal checks upon their activities, they were quite often autocratic and dishonest in their administration Iliffe (1979:328) says that the *akida* started businesses, not the chiefs.

[5] Iliffe writes (1979:328). "Usukuma's native administrations were increasingly controlled by their educated clerks and treasurers during the 1930s and this may have been true of other native administrations, but historians have yet to begin to examine their records." Lord Hailey wrote (1951:16) that the local rule was based on indigenous institutions. Thus "the chief is recognized as the Native Authority, and though in the majority of cases he is 'federated' with other chiefs for certain purposes, such as the conduct of a Native Treasury or the exercise of the rule making powers, he retains his individual authority in his own jurisdiction."

[6] Fortmann (1980:16), however, concluded: "It was common knowledge that the Native Authorities were mostly a polite fiction. Provincial and District Commissioners instructed the Native authorities what regulations to make and forced their enforcement."

authority between the chiefs and the colonial officers.

Soon after independence in 1961 small hamlets[7] began to be amalgamated into villages which were in turn grouped into wards and divisions. New bodies like village, district and regional development committees were established. Political appointees, called area commissioners and regional commissioners succeeded the colonial administrative heads; and district councils replaced the defunct native authorities. The political party TANU (later renamed CCM) organised itself down to the level of units of ten houses (cells) with its elected ten-cell leader or *balozi*.

In 1963 the government chose - unlike most other newly independent African countries - to abolish the institution of chieftainship.[8] The chiefs were dethroned, but their influence did not end. Since the early 1970s a number of organisational changes have been implemented without changing the fundamental hierarchy at village level where the formal leadership continues to be made up of a chairman, a village council with 25 members, and a politically appointed secretary called *katibu*.

The decentralized system of government administration introduced in 1972 (district councils were dissolved) aimed at facilitating the planning and execution of development programmes, the most notable of them being the villagization programme 1970-1976. After a period of persuasion, cadres and bureaucrats began implementing the *ujamaa* policy and villagization in the most efficient way they knew, which tended to involve a high amount of physical compulsion and intimidation (Fortmann, 1980:106). In 1984 the district councils were reintroduced, while the village council remained the same. Obviously disillusioned by the results obtained by control from the centre, the central government legally delegated almost all its functions to the local government authorities.[9] The 20 regions in the country coordinate and support activities in the more than 100 districts. The district administration has several departments (water, education, etc.) and the funds are raised through district taxes and central government votes. This formal organisation still holds (see chapter 8).

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[7] Lord Hailey (1942:242) defined a 'village' as follows, "The Sukuma countryside is one of scattered hamlets, associated in little groups called *gungulis* (parishes). The groups may be spoken of as villages, though they are political and not geographical villages." Tanner (1955:159) mentions that chiefdoms were divided into parishes containing a hundred or more adult men governed by an appointee of the chief until recently, when elections were instituted. The colonial government aimed at having some fourhundred tax-payers in each village (Cory, 1954:93).

[8] Miller (1968:191) observed that "Because the chiefs were generally apathetic in the nationalistic movement and because they represented the status quo, they were repeatedly accused by the party of being lackeys of the colonial government.... In hundreds of individual cases TANU officials so harassed traditional leaders that a major impasse was created between the two groups."

[9] Mfunda (1986:146) remarks that even then some of the government ministries did not give the decentralization programme the support it needed to succeed. Their qualified staff were often retained and some of these problems were repeated at regional level where most workers, equipment and funds were retained instead of being sent to the districts and villages as intended.

The Climate

The temperature in Sukumaland is high and stable with annual means in the range of 19-25^0 C. The number of hours of sunshine are high and stable at between seven and eight hours a day (WMP, 1978:v4:58).

Rainfall pattern. Tropical rainfalls are complex phenomena. The general circulation of the atmosphere, disturbances and local factors combine to produce spatial and temporal rainfall variations which are significant to agriculture and water resources (Jackson, 1989:26). The water consultant Clement Gillman (1943:30) was drastic in his description: "The only normal aspect of East African rainfall is its abnormality."

The rainfall map in the Atlas of World Water Balance (UNESCO, 1977) indicates an average annual rainfall of 800-1,000 mm over Sukumaland. The WMP (Water Master Plan for Mwanza region) gives averages of 900-1,100 mm in the western and central parts, and 750-900 mm in the east. The WMP used data for the period 1957-1972 and, from fewer stations, for 1926-1956. The major rain-peak occurs in March-April, with a secondary peak in November.

The seasonality of the rains is shown in Figure 2.2. Runere and Bupamwa, two of the villages in the present study, are some 20 and 35 km respectively away from Ngudu (see Figure 2.2) and Lwanhima is about 10 km from Ukiriguru, while the lake climate at Igogwe and Kongolo is similar to that of Nyamahona. A careful comparison has to be made since rains over East Africa have a tendency to develop *in situ* with a lack of movement (Jackson, 1989:19). Malcolm (1953:7) wrote that experience has shown that the rain tends to fall in localized storms rather than in a generalized downpours and so may be unevenly distributed in quite a small area. There seems to be no indication that rain storms move in any particular direction. Inter-annual variations are considerable as seen in Figure 2.3.

Evapotranspiration and groundwater recharge. The precipitation splits in three parts; the greater part goes back to the atmosphere through evaporation and via the vegetation as transpiration, another part runs off into streams, depressions and lakes, and, finally, one part infiltrates further into the ground and recharges the groundwater. These movements of water determine its availability to man.

In practice it is difficult to measure this partitioning of precipitation, but even rough estimates are worthwhile since the partitioning is so important for the understanding of water movements above and under the ground. The Water Master Plan-team used a simplistic model of the water balance equation. They estimated runoff by measuring actual recharge in some rivers; assumed a zero change in water storage/soil moisture levels, and inferred the amount of evapotranspiration. The sparsely distributed meteorological stations did not allow a detailed study and uncertainties in data, especially for runoff and evapotran-spiration, were found to be considerable.

Table 2.2. Estimated data on annual amounts of precipitation, runoff, evapotranspiration and groundwater recharge.

Area	Precipitation	Runoff	Evapotranspiration	Groundwater recharge[10]
West of Smith Sound	900-1,100	50-100	800-1,050	0
East of Smith Sound	750-900	30-80	650-900	0

Source: WMP, 1978:v4:3+55.

Water is accessible to man as precipitation, surface water and groundwater, and the figures above show that runoff is small and refill of groundwater negligible. The WMP-team used data from four meteorological stations in Sukumaland to calculate the annual average potential evaporation, which amounts to 5-7 mm per day according to season. The gradients are shown in figure 2.4. This thirst of the atmosphere is crucial to agriculture and to surface waters like dams and ponds. Precipitation is large but available for only part of the year with an average of some fifty raindays. The water deficit, defined as the difference between rainfall and potential evapotranspiration, is some 500-700 mm annually for Sukumaland compares favourably with other parts of Africa (UNESCO, 1977). Figure 2.5 summarizes the amount of water of each of the three kinds under semi-arid conditions.

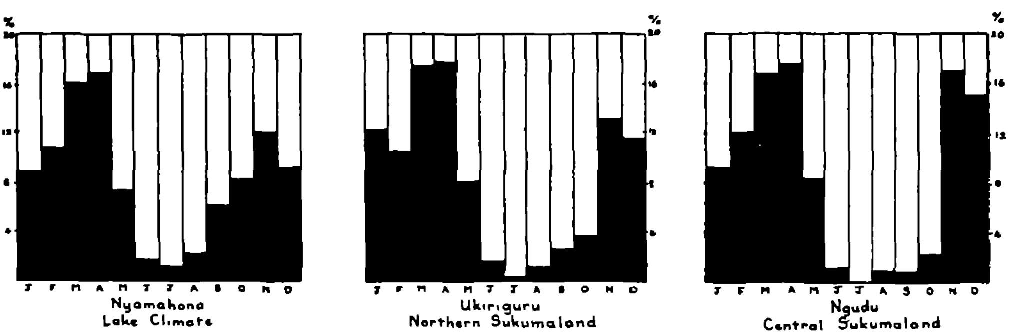


Figure 2.2. Seasonality. Average monthly percentages of annual rainfall. Kongolo and Igogwe have lake climate and Lwanhima is close to Ukinguru, while Runere and Bupamwa are near to Ngudu.
Source: Malcolm, 1953:7.

[10] To the East of Smith Sound the recharge drops sharply to less than 50 mm per year about everywhere. It increases around Mwanza town (WMP, 1978:v6:103).

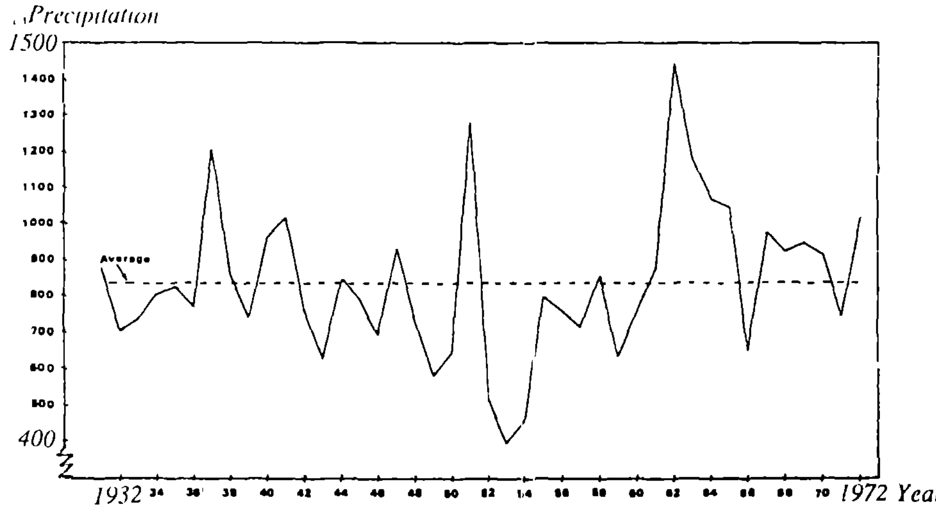


Figure 2.3. Inter-annual variation. Annual average rainfall at Ngudu, Kwimba District, 1931-72 (near to Runere and Bupamwa villages).
Source: Husberg & Nilsson, 1978:8.

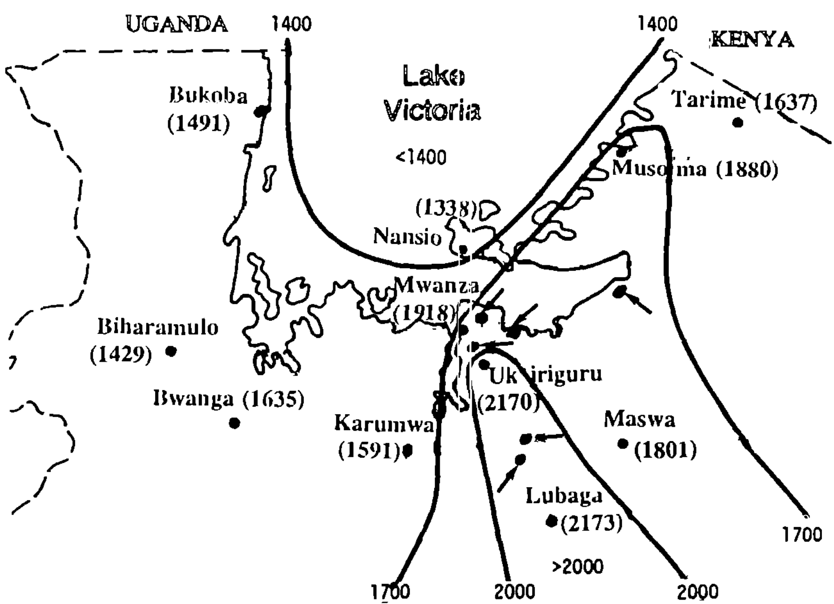


Figure 2.4. The thirst of the atmosphere (mm/year). Mean annual potential evaporation.
Arrows show the six villages.
Source: WMP, 1978:v4:56.

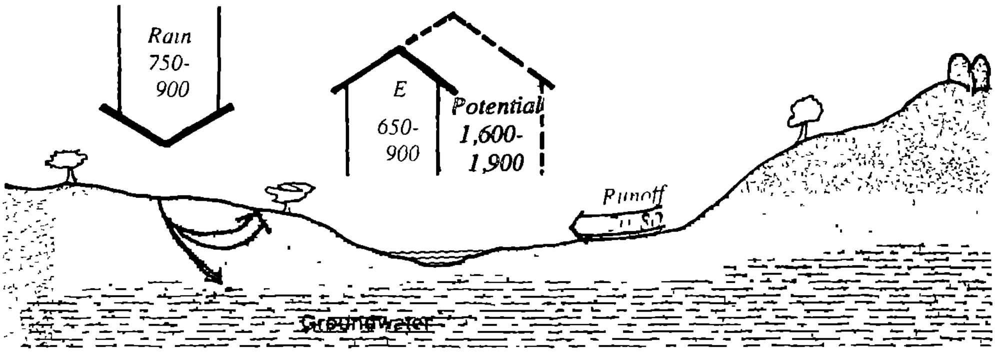


Figure 2.5. Partitioning of rain water. Amounts in mm per year.
Source: Based on WMP, 1978:v4 and Falkenmark & Chapman (eds), 1989:276,372.

The Geography of Sukumaland

Sukumaland covers an area of about 50,000 km^2. The topography of the region could be described, in general terms, as hilly and rolling in the north and as rolling and flat in the south. The altitude varies between 1,134 m, the level of Lake Victoria, and 1,400 m at the highest hills in the area.

Topography and soils. The landscape in the Mwanza Municipal Area where two of the studied villages, Igogwe and Lwanhima, are situated, is rough and rather wild, hilly to rolling with tor-covered granite ridges and narrow deep valleys. Going east from this hilly terrain into Magu District the landscape changes abruptly into a rolling form with low ridges and *inselbergs* and wide valleys; in the north these debouch into Lake Victoria. Kongolo village is on the lake, while Mkula is situated on the ridges in the eastern part just on the edge of the Serengeti National Park. The southern parts of the Kwimba District consist of wide plains intersected by shallow valleys with meandering rivers. The granitic *inselbergs* are sparsely distributed in these areas. Runere and Bupamwa villages are in this intensely cultivated area (chiefly WMP, 1978:v6:3-4).

The country consists of wide, undulating plains, interrupted here and there by low ridges and ranges of hills of no great height. The upper pediments usually have a slope of 2-3° while the lower pediments slope some 1-2° (Rapp, 1976:v4:26 and 4:31). Granite outcrops (*inselbergs* and *tors*) are characteristic of many parts of the country and they introduce some variation into the otherwise flat cultivation steppe.[11]

The geology of the region is described in the Water Master Plan (1978 v6:5-7). The bedrock is mostly granitic and gneissic. Old sedimentary and volcanic rocks are found in the southern central area around Smith Sound. The deposition of *mbuga* clays and sands as well as the formation of residual overburden took place during recent geological times. In some extensive parts the overburden is comparatively shallow and the bedrock is exposed only in small outcrops.

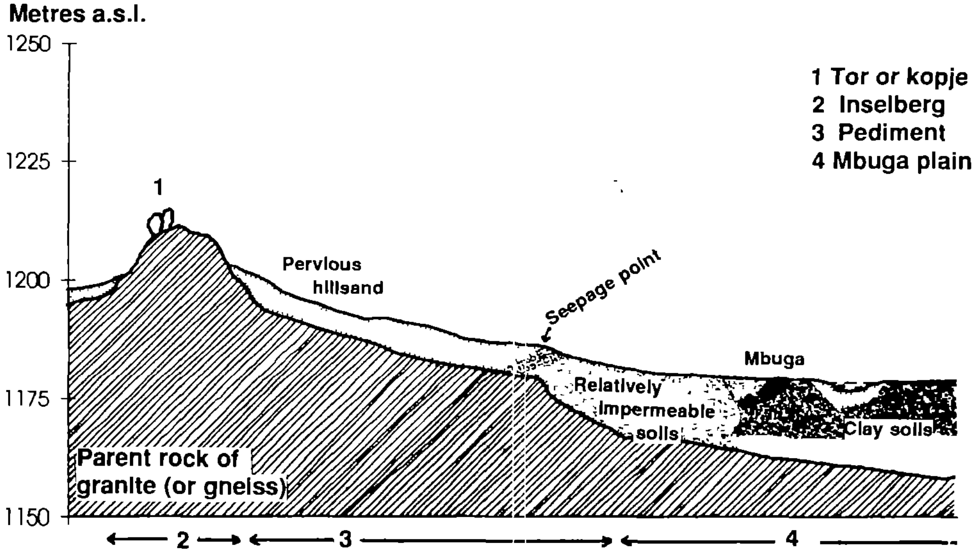


Figure 2.6. Location of land facets (Based on Rapp, 1976:4:20 and Christiansson, 1988) Typical upper pediment aquifer (Based on WMP, 1978.v6·151 and Gillman, 1943.fig.2).

The differentiation of the soils is as follows: from the foot of outcropping bedrock to coarse sandy soils, fine sandy soils, dense fine sandy hardpan soils, clayey sand and silt or clay - *mbuga* soils, and finally sometimes river sand. On the existing geological maps three soil types are marked: sand, laterite or lateritic soil and *mbuga* (sandy, silty clay or clay).

Malcolm remarked that water is found very frequently below *luseni* i e. the pale-

[11] Gillman (1943) defined cultivation steppe as comprising "that form of dense land occupation ... practising a combination of both agricultural and pastoral exploitation of the soil which leads to an almost complete eradication of the original vegetation cover, replacing the latter by a checkered pattern of cultivated fields and low-grass steppe"

coloured fine sandy gritty soil derived directly from granite. The only soils below which springs and seepage areas occur are the *isanga* soils (coarse-grained sandy to gravelly soil of light reddish colour derived from granite with sporadic "ironstone" plinthite nodules) and the *kikungu* soils. This is due to the fact that they form the very thin covering of superficial material over the solid ironstone hardpan, particularily where these overlie granite (Figure 2.6) Water is less commonly found in connection with the metamorphic rock occurrences in Sukumaland (Malcolm, 1953:190).

Land drainage. Sukumaland is divided into three major drainage areas as shown on Map 2.1. The southern and eastern parts drain into Lake Eyasi through the Manonga and Shibiti rivers. Lake Eyasi has no outlet and is one of the many salt lakes in East Africa. Several streams in western Sukumaland drain into Lake Tanganyika.

The area draining into Lake Victoria is rather narrow, except for the Simiyu River draining the Serengeti Highlands. It is estimated that 3-10 per cent of the rainfall reaches the lake. At this point some more data on Lake Victoria is given since the lake has such importance, especially for watering cattle in serious droughts.

Lake Victoria. Lake Victoria is the second largest fresh water lake in the world and covers some 67,600 km^2. Its catchment area is 193,000 km^2. The lake is quite shallow with a mean depth of 40 metres and a maximum depth of 79 metres The greater part of the lake's recharge comes from the rain which falls directly on its surface (75% according to the WMP, 1978·v4:215). The rest enters from rivers and a little from seepage. The main tributaries are the Kagera River in the west and Mara River in the east. The other rivers emptying into the lake are seasonal and their contributions of water vary considerably from one year to the other. The outlet is the Nile River at Jinja in Uganda.

Despite the lake's relatively small water volume of 2,700 km^3, inflow streams contribute only some 0.6 per cent of this volume annually; this is about the same as the outflow of water to the Nile (Hurst, 1952).

Up to 1961, the mean level of the lake was 1,134 m above sea level. In 1962 and 1963 the level rose by some two metres, mainly due to higher rainfall over the catchment area (Piper et al., 1986) This rise is the latest in a series of major changes since the Miocene period when the lake was formed. At that time the rivers went westwards but the land rose and changed the direction of the rivers. Today, parts of the watershed in the north and south are less than 25 metres above the level of the lake (Kendall, 1969:125). The east and west of the lake basin rise over a thousand metres to highlands bordering the two rift valleys.

The water temperature in Lake Victoria is remarkably stable around 23^0 C at all depths (Kitaka, 1971:89). The winds on the lake are modest, and during a six-year period the Ukerewe Hydromet Station found a monthly mean of 0.2 m/s.

Water Supply Arrangements in 1976

In the 1970s the Ministry of Water assigned a Water Master Plan team to survey the water resources of the 637 villages in the Mwanza Region, classify the sources and estimate their functioning and yield in both wet and dry seasons. Villagers and field workers were interviewed. This is the only water survey covering all water sources in the region, and it was used in selecting the villages in this study

In brief the following picture emerged in 1976 (WMP, 1978:v16, ch2). Just over a quarter of the villages in the region had Lake Victoria as one of their water sources. Three out of four used a river or stream as one source during the wet season; one out of three used a river or stream during the dry season as well. About a third used one or more springs, a figure which may have been exaggerated by inclusion of some ponds in the category.[12] 86 per cent of the villages used natural or dug ponds and larger ponds called *lambos* during the wet season, and 55 per cent used them during the dry season. Nearly 15 per cent of the villages had one or more dams which provided water during the dry season, and about 6 per cent had 'dams without spillways', so-called *charcos.*

Less than 20 per cent of the villages used one or more shallow wells in the wet season and just over 10 per cent during the dry season. This included both stone-lined and concrete-ring wells, with or without pumps It is easy to overestimate the number of genuine shallow wells because the Wasukuma make no semantic difference between a deep water hole and a lined shallow well.[13] Finally some five per cent had a borehole, but the team noted that these were often out of order.

It was found that 36 per cent of all villages (229 out of 637) had practically unlimited water resources; 165 of these bordered on Lake Victoria, although the distance to the lake was still considerable for many households in such villages. On the other hand, almost 100 villages (15 7%) suffered from a serious lack of water during the dry season.

Household access to water in 1976. The Water Master Plan identified villages suffering from *water scarcity during part of the year.* It stated that since 60 per cent of the villages had no springs, no piped supply, and no access to Lake Victoria during the dry season this was the best indication of how very acute the problem was (WMP, 1978:v16:161).

[12] Villagers tended to classify ponds which were fed by underground 'springs' as springs even though the water did not visibly flow Fieldworkers were instructed to observe the source and use their own judgement (WMP, 1978 v16 73)

[13] Fieldworkers were instructed to classify only lined, cylindrical and vertical holes of appreciable depth as shallow wells Holes dug by hand of uneven width were termed 'dug holes' and grouped with ponds However the fieldworkers reported great resistance on the part of villagers to have such water holes identified as anything but wells (WMP, 1978.v16.83)

The team estimated[14] that the median quantity of water accessible in the worst 406 villages with limited supply of water during the dry season was 5.1 litres per person per day. In 232 villages from the same group the amount of water during the dry season was less than 10 litres per person, and in 205 villages it was less than 5 litres (WMP, 1978·v16:169). The accessibility of water per district is given in Table 2.3 below.

Table 2.3. Number of villages categorized according to the amount of water available per person (litres per day) during the dry season 1976 Villages with piped water are denoted by a + sign.

Accessible water in litres/day	District Geita	Kwimba	Magu	Mwanza	Sengerema	Total
0	4	41+1	36	5	5	91+1
0 1- 4 9	23	37+4	26+4	6	16	108+8
5- 9 9	10	10	1	0+1	6+1	27+2
10-14 9	10+1	5	1	1	-	17+1
15-19.9	6	7	2	-	3	18
Subtotal						261+12
20-29.9	18	16	5	4	6	49
30-39 9	8+1	6+4	3+4	1	-	18+9
40-49.9	5+2	5	2+1	1	1+1	14+4
50-59.9	7	7	4	2	3	23
60-69 9	3	-	2	-	1	6
70-79.9	2+1	0+1	-	-	0+1	2+3
80-89 9	2+1	1+1	-	-	-	3+2
90-99.9	1	1	-	1	-	3
100-149.9	1+1	3	2+1	0+1	3	9+3
150-199 9	-	2+1	-	-	1+1	3+2
200-250 0	1	-	-	0+1	-	1+1
Unlimited	22+4	7+3	26+9	9+6	47+10	111+32
Subtotal						242+56
Total	123+11	148+15	110+19	30+9	92+14	503+68

Source: Inventory of water sources (Based on data from WMP, 1978·v16:ch3. The 68 villages on Ukerewe island are excluded)

The table shows that in Kwimba, for instance, there were 42 =41+1 villages with zero water in the dry season; one village had piped water when the supply was working. Thus, villages with piped water are classified by the quantity of water, other than piped water. The reason is that few of the piped installations were functioning. The table clearly shows that turn-key piped water supplies are in any case mainly found in villages with a fair or

[14] The WMP-team assumed that springs yield one litre per second, while rivers and streams yield one cubic metre and ponds 4 cubic metre daily Dams yield some 32 m^2 per day and wells just over 300 litres (WMP, 1978·v16 170)

plentiful supply of water, piped water served about 20 per cent of the villages with over 20 litres of water per person per day from other sources, but only 4.4 per cent of those with less than 20 litres.

Man-made water sources One way to give an idea of what had been done to increase the quantity of household water by 1976 is to subdivide the water sources into (a) natural water sources provided by nature (lakes, rivers, springs); (b) *own-key* improvements using locally available technology (dams, wells, ponds, etc.), and (c) turn-key supplies such as deep boreholes (BH) and piped water (P) Data from the WMP have been rearranged so that tables 2.4 and 2.5 show the relative importance of the three sub-divisions The villages with turn-key installations are still referred to the category to which they would belong without the borehole or piped water. The conditions in Mwanza and Geita Districts as pictured in 1976 are given below. For instance, there were five (5) villages with zero litres per resident per day in the dry season In 2=1+P villages the supply was less than five litres from natural sources and another few (less than 5) litres from simple man-made sources. In one of the two villages there was also a piped water scheme.

Table 2.4. Villages with average water accessibility in the dry season expressed in litres per capita per day from natural and man-made sources in Mwanza Municipal Area The quantity of water obtained from boreholes (BH) and piped water (P) is not included, but the existence of such installations is indicated where appropriate.

Litres per person per day from natural sources \ man-made dams, ponds, and/or dug wells	0	<5	<10	<20	<30	Total
0	5	3	-	1	-	9
0 1- 4.9	1	1+P	-	-	1	3+1P
5- 9 9	1	-	-	-	-	1
10-14 9	-	-	-	-	-	-
15-19 9	-	-	-	-	-	-
20-29 9	-	2	-	-	-	2
30-39 9	-	1	-	-	-	1
40-49 9	-	1+P	-	-	-	1+1P
50-250	1+BH	2+P	-	-	-	3+1P+1BH
Unlimited	1+P	0+5P+8BH	-	-	-	1+6P+8BH
Total	9+P+BH	10+8P+8BH	0	1	1	21+9P+9BH

Source: Inventory of water supplies (Based on WMP,1978 v16:ch 3)

Thus, out of the 13 villages with, on average, less than five litres per person per day from natural water sources, six had done nothing about it. Seven villages with little water had dug ponds and constructed small dams and in so doing two villages had achieved a fairly satisfactory supply.

Table 2.5. Villages with average water accessibility in the dry season expressed in litres per capita per day from natural and man-made sources in Geita District. The quantity of water obtained from boreholes (BH) and piped water (P) is not included, but the existence is indicated where appropriate.

Litres per person p. day from: natural sources	man-made dams, ponds, and/or dug wells								
	0	<5	<10	≤15	≤20	≤30	≤40	<70	Total
0	4	7	4	4	2	5	-	2	28
0.1- 4.9	8	9+P	7	1	1	3+P	1	-	30+2P
5- 9.9	-	-	-	-	-	-	-	-	-
10-14.9	1	3	-	0+P	-	-	-	-	4+1P
15-19.9	1	4+2P	-	3	-	-	-	-	8+2P
20-29.9	1	4+1P	-	-	1+BH	1	-	-	7+1P+BH
30-39.9	1	4	-	-	-	-	-	-	5
40-49.9	2	2	-	1	1	-	-	-	6
50-250	-	9+1P	1	-	1	1	-	-	12+1P
Unlimited	8+P	13+3P	1	-	-	-	-	-	22+4P
Total	26+P	55+8P	13	9+P	6+BH	10+P	1	2	122+11P+BH

Source: Inventory of water supplies. (Based on WMP, 1978:v16:ch3.)

The table shows that 60 out of 134 villages in Geita District drew less than five litres per person a day from natural water sources. Of these villages, 48 had additional man-made water facilities, mostly ponds and dams. Several of these villages had achieved a fairly satisfactory water supply The remaining 12 had apparantly done nothing about their water shortage.

If the WMP data are correct and if in 12 out of 60 villages there had been no *own-key* improvements despite the lack of accessible water, we need to find out more about conditions in these villages. A salient fact is that little help had been offered from the outside to alleviate their conditions of extreme water scarcity. They apparently did not fit the selection criteria. It is a fact that almost all of the villages which were equipped with piped water in Mwanza Municipal already had access to more than 40 litres per capita from natural sources. Similarly, almost all villages in Geita District which were provided with piped water already had more than 15 litres accessible from natural sources. If the data provided by the WMP-team is correct, donor interventions had not been directed in the first instance to the villages with the worst water shortages on a per capita basis. The words of Saint Matthew comes to mind: to him that hath shall be given.

3

Theoretical Considerations and The Model

Introduction

"Water supply" encompasses everyday routines like fetching water and treating it as well as spectacular engineering feats aimed at developing new sources. All can be viewed either through the eyes of a single individual or in terms of households or even more complex aggregates of people. Some of the initial inspiration for this study of change and continuity in a local environment came from innovation and diffusion research about company behaviour in which innovation is part of a problem-solving process (March and Simon, 1958). The theory is that most problems are routine and can be solved with the help of earlier experiences (doing more of the same - continuity), while innovations require a problem-solving activity (doing new things - change).

The major problem in appraisal of not directly productive projects is, according to Imboden (1977:1), our limited understanding of the social fabrics, and the measurement problems in the social fields are due to our limited understanding of the concepts. Diffusion or utilization research is useful for studies of water-related behaviour, especially with the emphasis that Everett Rogers advocated: "We should increase our understanding of the motivations for adopting an innovation. Strangely, such 'why' questions ... have only seldom been probed by diffusion researchers; undoubtedly, motivations for adoption are a difficult issue to investigate " (Rogers, 1986:52).

In the present study we explore the *why/why not* questions and attach equal importance to *change* and *continuity* We deal with Sukuma norms and people's individual values and their knowledge and skills in relation to their physical environment. Practical water-related activities are viewed in sequences like the following.

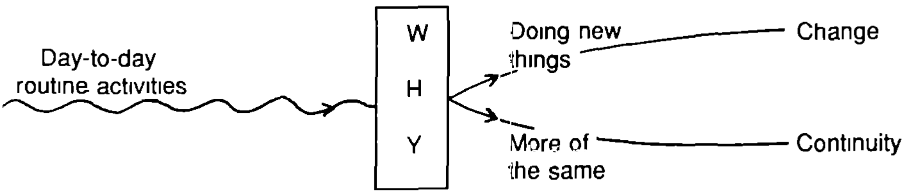


Figure 3.1. The perceived sequence of practical activities

The distinction between "change" and "continuity" is also helpful in keeping track of some of the deceptively simple measures which may be adopted by villagers. To walk further or wait longer at the well involves well-known experience (*continuity*), but it cannot be dismissed right away as less rational or less efficient than digging a rock-well close by (*change*) Change for change's sake is not what we are looking for. People's decisions may be based on a liking for social encounters at the well; these are important to the villager but not to the observer, who is waiting for something to happen and therefore tends to have a pro-innovation bias (Rogers, 1986:50).

This study is concerned with rural people's choice of measures in satisfying their need for household water. It has been partially inspired by schemata developed by Coleman (1990) on a linear system of action, Elster (1985, 1988) on rational choice and von Wright (1971, 1986) on explanation and understanding. The purpose of the theoretical considerations presented in this chapter is to outline a few areas which are expected to have a bearing on the exploratory study. The inventory of possible factors at play in water-related behaviour helps to determine what components should be included in the model.

Some Assumptions about Water-related Behaviour

In chapter one we stated that few studies have been conducted about *own-key* activities in the water sector, although there is an abundance of evaluations of turn-key installations. Evaluations and reports often assume the existence of indirect causes of action, but they are taken for granted and the existence is rarely substantiated. Donors, governments and others usually lay stress upon long distances, drudgery, poor water quality or health hazards as their reason for new interventions related to household water. Planners of water development have put together a number of working assumptions about people's behaviour over the last decades (Kochar, 1992):

1. People prefer clean safe water sources when these are provided.
2. Villagers will naturally use these water sources more than old, unsafe ones.
3. Villagers will stop using unsafe, unclean water sources when new sources are provided.
4. Water from hand-pumps and taps will naturally be accepted as better and safer.
5. Villagers will use more water when new water sources are provided close by.
6. Villagers will stop visiting distant water sources when safe water is made available nearer to their houses
7. Villagers with new water sources will gain more leisure and save a lot of the human energy needed to collect and store water.
8. When water is available within or near the house, storage of water will be unnecessary.
9. New water sources mean more equal access to and use of water sources.
10. In villages with adequate supplies of safe water morbidity will decline and cleanliness will improve.
11 There will be fewer disputes and quarrels over water when more water sources are provided
12. Provision of one or two hand-pumps will result in significant changes in water use and health benefits (Kochar, 1992)

Several of these propositions suggest that changes in water quality, quantity and/or distance act as incentives to alter water-related behaviour. For instance, it could be argued that a person who knows that a new water source nearby will provide more leisure will also feel an incentive to develop the new source (7.). The dynamic mechanism or "prime cause" behind any change is envisaged as some kind of external intervention to which people are impelled to respond.

The problem with this kind of reasoning is that a host of factors **other** than distance, quantity and quality play a decisive role; even the simplest and most obvious-seeming of the propositions set out above may prove in practice to be wrong (Kochar, 1992). This exemplifies the contrast between the simple causal relationships beloved by policy makers and project managers and the more hesitant and complicated methods of anthropological field studies. Donald Curtis (1985:105) said:

> "anthropological models of causality assume that 'everything relates to everything', while project information requires answers to 'what will happen if' (x causes y or x constrains y or without x no y). Action orientation in anthropology leads to the conclusion that 'all is not as it seems', while project management specialists are more inclined to argue that 'it may not be right but it's good enough to act upon'." (Curtis, 1985:105)

Causality will be discussed at the end of this chapter.

Some Empirical Studies Based on Theoretical Models

There are some instructive examples of methods and models which have been applied to analyse water-related activities in various environments. Four studies undertaken within the behavioural science sphere are briefly presented below.

(i) Allan Holmberg (1952) pursued an anthropological study of a water intervention in a Peruvian village facing increasing water scarcity The community was split in two ways: small versus large landowners, and people born in the village versus those from elsewhere. The large landowners had more prestige than the small, and the outsiders had less status than the native-born. But prestige in the society was not only attributed on the basis of family background and wealth but also on education and to office-bearers at the religious fiesta Community affairs were in the hands of a council, the principal members of which were politically appointed. Natural phenomena like water were thought to be controlled by "supernatural forces - as represented by images of Catholic saints - which could be influenced only by the observance of magicio-religious rites, specifically by the celebration of the feast days of certain saints". (1952:119).

The study disclosed a complicated web of social, religious and status issues. Villagers either opposed or displayed a marked lack of interest in the government project to drill wells in the village, which in the end negated the whole scheme.

(ii) Gertrude Schanne-Raab (1974) studied social stratification and diffusion of some farming and cattle husbandry practices in Sukumaland. She performed a statistical analysis of data on 1,067 individuals collected by G. O. Lang in 1970. She examined several versions of what constituted social inequality and discussed their applicability before choosing a multidimensional model of social stratification. Her analysis used parameters of a "modern" dimension indicating differences in control power and a "traditional" dimension concerning differences in wealth and prestige, each of which was divided into three strata.

It was found that appointed officials and school principals frequently had a 'high' modern status, whereas elected modern officials and progressive farmers mostly fell into the 'middle' modern stratum Large cattle owners, some progressive farmers, some traditional leaders and some modern elected officials had a 'high' traditional status. Hardly anyone belonged to both the modern and the traditional 'high' categories: appointed officials often had a high modern and a low traditional status, and local elected officials tended to combine a medium or high traditional with a medium modern status.

The acceptance of some arable farming and cattle innovations was tested in relation to social status. It was found that diffusion patterns differed: arable farming innovations were diffused along "modern" lines which relied mainly on high wealth (traditional status) and good access to information (modern status). Cattle innovations were, however, passed along the "traditional" lines which relied on wealth (traditional status). It was also found that farmers in the middle stratum were initially more innovative than others; in the end, however, the highest rate of adoption of innovations was found among high status individuals and the lowest among the lower strata.

(iii) Sherif El-Hakeem (1972) applied an early version of the linear system of action developed by Coleman (1990) on consensus decision-making in a south Saharan village. The analytical framework consisted of the actors and important events which were connected in two ways: the rate of interest influential villagers have in the events and the rate of control that they were able to exercise over the event. Power is related not only to control but also to the degree that the interests of others are affected by the way in which control is exercised. By attaching numerical values for the rates of control and interest the model allowed for predicting the outcomes of specific events.

El-Hakeem identified 70 influential actors among the 13,000 villagers who occupied the 181 formal offices. Furthermore, he identified 53 event arenas (collapsed events of similar kinds i.e. issues dealt with in the local court etc.). For each of the offices associated with event arenas was assigned a numerical value for control: the sum of control held by all the formal offices associated with each event arena adds to 1, implying that they jointly held full control of the event arena. Similarly, each actor's interest in each of the enumerated event arenas was assigned a value; the totality of each actor's interest was normalized to 1. The resulting control and interest matrices comprise 53 times 70 elements

An empirical case of how decisions were arrived at involved a challenge to the water supply clerk's established practices of corruption. The (government) clerk was in charge of the water supply, called the Donkey (a drilled borehole with diesel engines pumping the water into large tanks). He allocated water for livestock and households and collected the fees A cattle-owner from a distant village complained that he had paid too much and asked for a reduction or else he would go to the court. A long series of meetings with varying parties discussed the challenge by the cattle-owner. Although all villagers complained of the tyranny and corruption of the Donkey clerk, the community came out in support of him. In the end a compromise was reached and the Donkey clerk had to repay some of the money, but he retained his position.

In this case there were seven actors and six events. The model correctly predicted in whose favour the controversial issue would be resolved

(iv) Gilbert White and colleagues (1972) conducted a study of household water in Kenya and Tanzania in which they compared water use patterns etc in some rural, small town and urban settlements in varying climatic zones. The data came from 741 households and 4,305 persons. The study costed different water supplies and was geared toward policy relevance.

The study also examined the social costs of different uses, particularly their health costs in the form of working productivity and community well-being Factors affecting the volume of water and its variation were assessed The authors tried to discern which were the key factors in culture, social organisation and natural conditions which affected the choice of water source by the individual household: per capita consumption was found to be a function of family size, income level, education, cultural heritage, character of water source, cost of obtaining water, climate and terrain. Each individual had a personal preference which was conditioned by the customary behaviour of the culture and encouraged or discouraged by whatever formal social action was taken by the society.

A matrix-method was developed in order to explain individuals' summary valuation for rating various water sources, based on awareness of the source, source quality, technical feasibility, economic efficiency, and effect of other people. "We did not anticipate an order in the branching of decisions, but it emerged in the field interviews." (1972:229). "Once the field of choice is narrowed to those sources regarded as usable, the articulated reasons /for choosing one/ become more ambiguous." (1972:238).

The study concentrated on women's selection of water sources and did not discuss *own-key* arrangements. "There is little evidence of organized efforts to provide a major new improvement by any means other than government action and supervised from the outside." (1972:244).

Our study shares some common elements with the four studies outlined above: individual and cooperative efforts are studied; a choice of variables was made in order to explore "why people do the things they do" and, for that matter, "why people do not do what they want done".

The Concepts *Continuity* and *Change*

Water has a compelling character; human beings cannot go without it for more than a few days. Consequently, something has to be done irrespective of dynamic changes of human and physical environments. People's own assessment of their water conditions, or a stimulus of some sort, evokes responses of various kinds.

At one extreme, the conditions call for some problem-solving activity aimed at inventing or elaborating alternatives which are not already available in the villager's repertoire. Such an activity of innovative *change* can be incorporated in the repertoire once it has been learned. For example, when a woman makes a water filter from a pot of clay filled with sand for the first time this is a *change*. Once the filter has been made it becomes part of the daily routine and making a new one is mere repetition i.e. *continuity.*

At the other extreme, the response - sometimes very elaborate - is one that has been developed and learned at some previous time as an appropriate response and will usually be in the realm of what is customary or expected of the users. These acts are routinized and the performance may be classified as 'habit' or *continuity*. Therefore *continuity* is expected to dominate the scene. If, for example, water accessibility deteriorates during an extended dry period the users may simply put in "more of the same" i.e. walk further for water. Or if the water becomes more turbid it will be left longer in the storage container. But sometimes habit will not solve the problem satisfactorily.

The Model

Numerous human and physical components are included in the model, and the four studies outlined above show the wide variety of factors which can play a role. Exactly what factors to include have been decided in the course of the explorative study.

We present a comprehensive account of informants' assessments of their present and future household water situation in chapter 5 The actions of individuals depend not only on interest, preferences or individual values but also on the identifiable physical opportunities and incentives provided by the human environment. The judgement as to whether the measures which could be adopted are within the capacity of the existing human and physical resources must examine these factors: knowledge and skills in the household and at village level; affordability (time and cash); availability of materials and equipment; and organisational capacity within the household, amongst neighbours and in the village (chapters 6 - 8). The possible options (chapter 9) are then put to a test in the dynamic interplay between norms and individual values concerning water rights, cooperative efforts and household efforts as analysed in chapters 10, 11 and 12. At the end of this research process we hope to have generated new knowledge about conditions influencing the choice between *change* and *continuity*. The components of the model are illustrated in Figure 3.2 below.

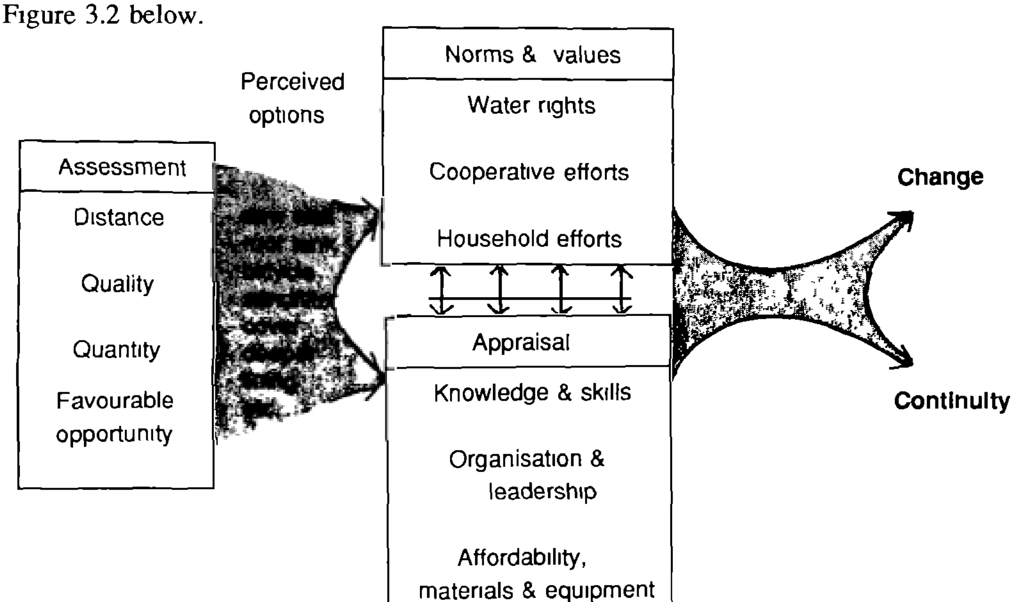


Figure 3.2. Illustration of the components comprising the model

The order in which the components appear here may differ from our informants' perception of a proper order. The components of the model developed to study water-related activities, especially *own-key* arrangements, are presented below

Villagers' Assessments and Perceived Options

In making choices that meet acceptable standards, the standards themselves become part of the definition of the situation and are set by the actor It is often assumed that only a user who experiences some kind of shortcoming or danger will contemplate taking action. Lionberger (1961:14), for instance, stated that "dissatisfaction with conditions as they exist, followed by awareness of alternatives is prerequisite to change". This is similar to the way March and Simon (1966:173) put it: "Persistence comes about primarily because the individual or organisation does not search for or consider alternatives to the present course of action unless that course is in some sense 'unsatisfactory'." Rowland (OECD, 1978:186) in his analysis of self-help and participation in water projects found that "a felt need has a greater urge to be satisfied than a real one"; this poses the question who should formulate the "real" problem.

We agree with Donald Schon (1971) who said that a need does not necessarily precede ideas of innovation, unless it is a question of very small changes. The probability that action will be taken may be less if the potential actor is satisfied, but it is not negligible if, for instance, a favourable opportunity appears. On the other hand, the persistence of behaviour or *continuity* is not necessarily attributed to any particular "resistance to change" but simply to the absence of a vigorous search for new alternatives under circumstances where the existing situation is regarded as satisfactory.

Assessments are influenced partly by what has already been done and partly by the actual physical environment. Methodological problems of interpreting the context of statements about shortcomings are dealt with in the next chapter.

The multiple options within the household water sector cater for an almost endless variety of responses. The responses to a water need can be grouped into categories according to the particular problem which needs to be solved. Thus, use of a bicycle, cart, or yoke may ameliorate drudgery, digging a pond/well/dam or constructing a roof catchment may shorten the distance to the water source; lining and covering the source and/or installing a windlass or fulcrum can protect the water quality at the source; use of a three-pot-storage system or a sand filter can improve water quality, cleaning the storage vessel before refill or practicing hand-washing after defecation will protect water quality at home. Chapter 5 provides definitions and illustrations of various kinds of water supplies and protection of water quality.

Appraisal of Options

Each separate technical option is appraised in the study as to whether it goes along with the informants' knowledge and available skills, is affordable and fits local leadership and organisational ability, these aspects are discussed in section B, chapters 6 through 9. A closer look at the resource base of *own-key* activities includes not merely the individual informant's own human and material resources but the resource base of the community as a whole and of other networks.

Section B is mainly descriptive but the analysis adds up to a number of necessary conditions for specific *changes*, and, at the same time, the lack of which will constitute a sufficient condition for *continuity*

Indigenous knowledge and skills During the last two decades there has been some research interest in the study of traditional ways of providing social services while retaining as a point of departure peasants' or smallholders' ecological, technological and socio-economic predicaments (Brokensha et al., 1980; Cernea, 1991; Chambers, 1983; Hyden, 1980 and 1983; Kjekshus, 1977; Richards, 1985; Riley and Brokensha, 1988; Rogers, 1986). This less blinkered approach to indigenous knowledge is important in that traditional ways can now be treated as a part of the range of rational options to be reviewed by villagers before they decide what actions to take in the field of rural water supplies.

The informants' knowledge about rain patterns and availability of water underground and their views on the connexion between water quality and health are explored through in-depth interviews. An appraisal of knowledge-use must take two aspects into account; what informants say they know (conceptual knowledge, Weiss (1986)) as distinguished from instrumental use of knowledge. It is extra hard to test the validity of (conceptual) knowledge in cases when it is not convenient to observe its instrumental use. Another problem in assessing knowledge is that many activities are jointly decided and implemented: how important is it that all parties to the decision acquire instrumental knowledge?

The salient elements of modern technical and professional knowledge about water supplies are reviewed; this is to enable the reader to assess to what extent a particular item of indigenous knowledge may be enough to enable its possessor to master available perceived options. The evidence has been drawn from some authoritative sources about rain patterns and the flow of water through the landscape (Falkenmark & Chapman, 1989; Coster, 1960; Jackson, 1989; Gillman, 1943; Malcolm, 1953; Nieuwolt, 1977) and about health aspects of water (Cairncross, 1989 and 1992; Esrey, 1990, Feachem et al., 1977 and 1983).

The second set of essential variables in our analytical framework is -

Affordability, time and material resources. No official time-use studies or budget surveys have been conducted in Tanzania during the last ten years. Our informants' views as to the availability of and affordability of time, money and material resources are therefore the main source of information; they are discussed in relation to observed wealth and available natural resources. Since all potential water arrangements have been tried in one place or the other it is possible to assess their feasibility in quantitative terms Some studies of the economy of households in rural areas have contributed to this discussion

(Bevan and Collier, 1986, Ellis, 1988; Low, 1986; Putterman, 1986).

Having reviewed the first two of the "essential variables" in our analytical framework, the third and final set of variables is:-

Organisation and leadership Some water supply improvements and maintenance require cooperation between villagers, the interplay between leaders and commoners becomes important in the analysis, so associations and communication patterns between actors are presented. The information in this respect has been collected from our field informants, with background data from Brandstrom, 1990; Cory, 1954; Fortmann, 1980; Malcolm, 1953; Midgley, 1986; Moris, 1981; Rogers, 1986, Tanner, 1955; Uphoff, 1986.

Possible options. After considering the three sets of variables above, we may be able to judge from evidence given by informants and observation whether or not a local community will be able to implement a certain solution. Passing this three-layer test is necessary in order for a measure to be implemented. Our screening of the various perceived measures will make it clear that some are very unlikely to be of use; these can therefore be left out of the succeeding analysis

Norms and Values Influencing *Change* and *Continuity*

Human behaviour cannot be adequately described and understood without reference to the person's expectations, intentions and values (Beattie, 1964:37). Many actions are performed out of habit, tradition, custom or duty either as a deliberate act to meet the expectations of other people or to conform to a self-image. Human action must therefore be understood in terms of social norms and individuals' values. This applies in full when people are pondering what action to take in order to ameliorate or improve their water conditions.

Norms and individual values. The open-ended collection of norms, values, beliefs, and attitudes held by our villager-informants will be discussed and analysed later on at two levels; first, their individual values and second what they perceive to be the norms of the Sukuma community as a whole. It is assumed that there is such a thing as a social or Sukuma norm by which is meant an expected or prescribed pattern or standard behaviour in a given social group or social context. A person may have a utilitarian impression or experience of a Sukuma norm of prescribed or expected standard behaviour. In some other cases the norm may be justified in a quasi-religious or mystical sense, not in terms of its practical consequences but by morality i.e. intrinsic 'goodness' and 'badness'

The concepts "attitude", "belief" and "values" are related. Below we refer to "individual values", as defined by Kroeber and Kluckhorn (1952:62): "a conception, implicit or explicit, distinctive of an individual or characteristic of a group, of the desirable which influences the selection from available modes, means and ends of action."

Inconsistencies. The villager-informant may feel bound to adhere to a Sukuma norm even though it is not cherished by all; this adherence will tend to manifest itself in a certain pattern of behaviour. However, norms do not necessarily or invariably govern the behaviour of each and every individual in a group - one cannot *a priori* assume homogenity of individual values and norms among the Wasukuma, even when restricted to water-related issues.[1] Therefore others may have views and values which differ from the norms; they may even oppose the norms. Thus it is possible for there to be multiple, contradictory and conflicting individual values. Pragmatic considerations may lead people to contravene the norms or their individual values which they believe in. This kind of tention between norms, individual values and behaviour probably inspired Coleman to say he is more inclined to infer purpose from behaviour; that is, to look at actions and infer purpose from these (Swedberg, 1991:51) Figure 3.3 illustrates various situations:-

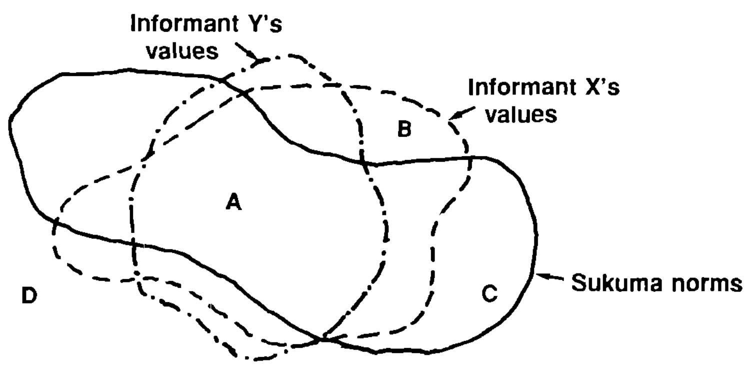


Figure 3.3. Relationship between the set of Sukuma norms and informant's individual values. Transgressions

Activity A is in line with the Sukuma norms as well as with the two informants' individual values. Activity B represents a transgression of Sukuma norms. It is cherished by informant X but not by Y and requires a negotiation between the two before implementation. Activity C concords with Sukuma norms, but goes against the informants' individual values or desires, and therefore they are reluctant to take part. Activity D belongs to neither the Sukuma norm nor the individuals' values. In a case like

[1] Africanists like Anita Jacobson-Widding point to the tendency among people in Eastern Africa to emphasize the view of a collective responsibility among members of the African lineage society i a the individual is not held personally responsible for his or her actions but only indirectly through the lineage representative who will be the arbiter Officially people endorse a communal or cooperative way of approaching problems while, in private, people also stress the value of the individual person, his prestige and behaviour

this, where the activity is discordant with individual values and norms, a person tends to filter it out before reaching the consciousness, or may reinterpret or "rationalize" so as to remove the discrepancy

In chapters 10 - 12 we shall work with norms and individual values related to three sets of problems: water rights; cooperative effort, and household and individual efforts We have tried to extract the informant's individual values and Sukuma norms in a number of ways, including explorative interviews and interpretation, observation and written documentation. We have not seen fit to construct hypotheses in advance, by first devising plausible values or norms and then testing them

It is expected that the chosen approach to address both Sukuma norms and individual values will minimize the tendency of much diffusion research to hold individuals responsible for their own problems, as pointed out by Caplan and Nelson (cited by Rogers, 1986:52). We shall also try to avoid the opposite problem to make it too easy to blame "the community" or leaders.

Water rights. Legal and customary rules constitute norms which are very important in understanding individual and group activities. Rules about people's access to resources and their ability to control and use them effectively constitute an indispensable framework of this study, since they determine villagers' ability to generate a livelihood and to increase their assets.

Villagers' access to and control of water sources in the form of water as a public good or common-pool resource is analysed; so is the extent to which informants' individual values concord with the norms; a judgement is made as to whether the norms make up a constraint to or an incentive for improvements by groups and individuals. Free-riding constitutes part of this analysis.

Our analysis examined the persistency of the Sukuma norms which says that household water is a common-pool resource. Elinor Orstrom (1990:90) extracted seven design principles for long-enduring common-pool resource institutions:-

1. Clearly defined boundaries for right to withdraw resource units and for the common-pool resource itself
2. Congruence between rules governing appropriation and provision and local conditions.
3. Collective-choice arrangements in which most individuals can participate in modifying the operational rules.
4. Monitors are accountable to the appropriators or are the appropriators.
5. Graduated sanctions assessed by other appropriators.
6. Conflict-resolution mechanism which is low-cost and easily accessible
7. Minimal recognition of a right to organise which is not challenged by external governmental authorities.

The sustainability of Sukuma norms about water rights will be discussed against the seven principles.

Cooperative efforts. Water is a common-pool resource and more than one actor has an interest in the course of events. It is inevitable that processes will take place which are characteristic of social and political systems which go beyond exchange collective decisions and actions, coercion, and conflict. The four possible combinations of leaders who are keen/unwilling to be in charge and villagers who are keen/reluctant to participate make up four kinds of negotiations which are considered in order to analyse what strategies the informants will apply to forward their interests.

The impact of village leaders and organisations on cooperative efforts as well as on individual motivation is emphasized throughout this study, as it is by other authors (Roling et al., 1976; Rogers, 1986). In Tanzania or elsewhere the government, a donor or an NGO may work behind the scenes but more often in the lead of water development work. Government staff and other agents are supposedly engaged in mobilizing the people (Beal, 1986) or conscientizing them (Freire, 1972). Once invented, Dore and Mars said (1981:13), we can be fairly sure institutionalization of community development is here to stay as long as there are governments which subscribe overtly to development goals. This assumption makes it indispensable to include an analysis of how interventions by the various agencies affect *own-key* arrangements

Information about Sukuma norms and individual values has been gathered through interviews, by observation and from published material (Brandström, 1990, Cory, 1953; Noble, 1970; Tanner, 1955, Varkevisser, 1973). The ability to organise and to lead water-related activities can from time to time be observed. However, to understand how leaders evaluate the feasibility of a diffusion in the local context and then, depending of the evaluation, legitimize or oppose the diffusion, would require a different kind of study to what is presented here (Dissayanake, 1986.270). The design and content of interviews and selection of informants were not geared towards this end, although there is information enough to discuss leadership issues from commoners' point of view.

There is an obvious interaction between cooperative efforts in a neighbourhood or village and household efforts simply because the same thing can be done at both levels This kind of parallel progression can have a profound influence on commitments of individuals.

Household efforts. "Household" means people who eat and sleep in the same compound and share duties and resources on a routine basis. The household is viewed both as a group of consumers and as a productive enterprise producing food and other goods and services for its members Guyer and Peters (1987:210) emphasize that the household is of variable structure; it is both outcome and channel of broader processes, and it is the site of separable, often competing, interests, rights and responsibilities. "Moreover", they say, "the ideological construction of the household, the range of cultural meanings attributed to domestic units, conjugal and age relations and residential patterns are also critical to fuller understanding of the dynamics of production and consumption "

Water is but one good that is produced and consumed by households A study of household water cannot end at the household level, however, it has to be further disaggregated in order to deal with individual members of the household enterprise. They have different tasks and are organised in a hierarchy. Amartya Sen's model on cooperative conflict is used here as a tool to studying, among other things, how the strict division of work in the homestead influences water-related activities

Decision-making in the household is treated as a negotiation between its members. This is in line with Amartya Sen's cooperative-conflict model, which allows for a distribution of benefits and costs accruing among the members. According to Sen, the context of negotiation is as follows:

> The prosperity of the household depends on the totality of various activities-getting money incomes, purchasing or directly producing (in the case of, say, peasants) food materials and other goods, producing edible food out of food materials, and so on. But in addition to aggregate prosperity, even the divisions between sexes in general, and specifically those within the household, may also be deeply influenced by the pattern of gender division of work. In particular, the members of the household face two different types of problems simultaneously, one involving *cooperation* (adding to total availabilities) and the other *conflict* (dividing the total availabilities among the members of the household). Social arrangements regarding who does what, who gets to consume what, and who takes what decisions can be seen as responses to this combined problem of cooperation and conflict. (Sen, 1990:129)

Household water has the characteristic that all household members consume water (entitlements may vary) but only some develop new water sources and only some transport the water to the homestead. Expectations about who does what are very strict but actors may have differing perceptions of their own position as well as of the other actors. This connects nicely to Sen's model as well as to Beattie's schemata about "what actually happens" and "what should happen'

The parties have values to guide them to perceived ends in any negotiation, but these may be incompatible. Each person knows that the choice between a cooperative arrangement and a breakdown position is a matter of cooperation, since the former is better for both (Sen, 1990:132). Important factors influencing negotiation results include power, socially accepted behaviour (norms), time-use, threats, perceived contributions, etc. The distinction between measures which require a change in the power structure and those which are within established norms are expected to come out of explorative interviews. There are for instance "costs" involved in shortening the distance to water sources. Such costs may have a social connotation as when the gender of the task changes in order to fetch water by using oxen.

Level of Observation and Analysis

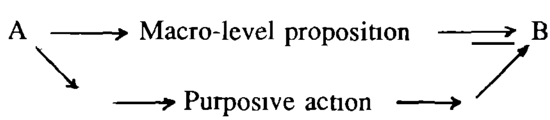
In most social research, observations are not made on a system as a whole, but on some part of it. In fact, a natural unit of observation is the individual person. According to

Coleman (1990:1) this has led to a widening gap between theory and research: social theory continues to be about the functioning of the social system of behaviour, but empirical research is often concerned with explaining individual behaviour. Sociological work in the Durkheimian tradition looks only at one side of the problem i.e. the way in which the social environment affects the individual and his/her behaviour. The other side, which is more Weberian, is when persons' actions combine to ensure functioning of the system (Coleman, 1990).

The present study of water-related behaviour concerns both the individual and groups in the form of household and cooperative efforts, and the relationship between the two. Each individual is pondering about the relation between Sukuma norms and his or her individual values. The stand taken constitutes a framework in negotiations with fellow-villagers. It is easy to agree with Holy and Stuchlik (1983:2) when they claim that "the social system is not something behind the recurrent pattern of activities, but emerges from them, is created and changed by them. Therefore, it can hardly be used to explain them."

The Sukuma norms "govern" access to water and define users' obligations An analysis is done as to how the norms constitute incentives or constraints to individual and cooperative efforts. Village management and negotiations between leaders and groups of villagers are analysed as to the impact on cooperative efforts. Gendering of tasks and negotiations at household level are analysed as to the outcome of individual efforts For each of the three subject matters above the analysis works in terms of Sukuma norms and individual values; to what extent are the norms embraced by individuals and how are they affect - and are affected by - individual behaviour compared to their own values and aims.

Coleman linked the behaviour of individuals to organisational behaviour, thus combining principles of individual rational choice with a sociological conception of collective action. His social theory is grounded in *purposive action* (in the sense of intentionally aiming at ends (von Wright 1971:60)) in which "actors and events are the two basic elements of a system of action, linked together by the control of actors over resources and events and the interest of actors on resources and ... the consequences of events for them." (Coleman, 1990:667). He claimed (1990:32) that all actions are carried out with a single purpose - to increase the actor's realisation of interests. The sketch illustrates the basic components of the model of transition from macro to micro and back.



Our model to analyse water-related activities can be linked to Coleman's theory by identifying the initial conditions (A) as the informant's assessment of their water conditions, their appraisal of human and physical endowments, and Sukuma norms. Assessments and appraisals can be based upon a number of characteristics of the situation. knowledge or assumptions about future events, like the population increase or a government intervention; knowledge of alternatives available for action, like alternative means of transport of water or making a well nearby; knowledge of consequences attached to alternatives, like altering the gender of a certain task, and rules, goals and values which order alternatives according to preferences (chiefly March & Simon, 1958.150,155). The actor's individual values guide what purposive actions are being considered

Explanation and Understanding

Our approach evokes several theoretical issues about explanation and understanding. Given that villagers act rationally, at least in a specified frame of reference, we have to define within what context and towards what end they act (Harsanyi, 1986:85) Or in Langlois' words "If we want non-arbitrary (rational) behaviour, we must specify (arbitrarily) the agent's means-ends framework ... We cannot eliminate arbitrariness without also eliminating determinateness." (Langlois, 1986:230).

Ordinary usage does not make a sharp distinction between the words "explain" and "understand" Practically every explanation, be it causal or teleological or of some other kind, can be said to further our understanding of things.

Causal scientific explanation, on the one hand, has natural science explanation as its ideal. On the ground that science must stick to what can in principle be tested against experience and observation (behaviourism) it is hard to include various kinds of meaning in facts like experience, language, action, and self-consciousness in proper causal explanation.

A kind of causal explanation is used when analysing necessary conditions for practical measures (chapter 6 through 9). The relevance of this kind of explanation lies in its giving an answer to the question how the measures were possible (not why they were undertaken (von Wright 1971:138)).

Interpretative or hermeneutic theory, on the other hand, emphasises that "action must always be understood from within " (Hollis & Smith, 1990:72). von Wright (1971:6) adds that understanding has a "psychological ring that explanation has not ... and is also connected with intentionality in a way explanation is not." When we say that we understand the "reasons" why a person acted in a certain way, we imply that we understand the intended goal and how the actions were seen by the actor to contribute to that goal. The researcher needs to know the rules, conventions, and context governing the meaning of the action in a socially defined "game". He needs to know what the actor intended by and in performing the action: why this actor played this move in the "game".

Some simplistic, causal relationships (in fact insufficient to form proper causal explanations) used by planners were presented earlier in this chapter. If there is a change in distance due to seasonal alterations in water accessibility (routine) the longer distance may be conceived as an increase by the women who carry the water, but not necessarily by the men, who do not. The interpretation of the importance of the actual change may consequently differ. Women tend, perhaps, to think in terms of reducing the amount of water if their time is severely constrained Men, however, may not see any reason to do so if they value water volume rather than the energy expended on water collection. Whether less water will actually be carried depends on how much water is thought to be needed, the balance of power in the household, and the wife's perception of her duties as wife. This example shows once again that we cannot hope to find a simple causal relationship between measures and parameters like the distance, and hence not making predictions about individual behaviour. This leads over to the other kind of analysis of understanding "from within".

The relationship between understanding and explanation is ambivalent: there is an interesting case for each and the discussion is whether it is possible to combine the two. Hollis and Smith (1990.91) hold that "the hermeneutic tradition prevents such final accounts at least from being easy and perhaps from being possible." They referred to Winch:

> Although Winch contends that there cannot be causes for the rules followed or for the intentions and motives of the actors who followed them, other philosophers disagree. There are plenty who hold that beliefs and (especially) desires can be causes of action." (Hollis & Smith, 1990.90)

Jon Elster makes an effort to combine the two by postulating that an explanation of a certain kind of behaviour will have to take into account the behaviour, together with a set of beliefs or cognitions entertained by the individual, and a set of desires that (s)he has. He maintains that a rational-choice explanation of an action ideally should satisfy three sets of requirements.

> First, there are three *optimality conditions*. The action is the best way for the agent to satisfy his desire, given his belief; the belief is the best he could form, given the evidence; the amount of evidence collected is itself optimal, given his desire. Next, there is a set of *consistency conditions*. Both the belief and the desire must be free of internal contradictions The agent must not act on a desire that, in his own opinion, is less weighty than other desires which are reasons for not performing the action. Finally, there is a set of *causal conditions*. The action must not only be rationalized by the desire and the belief; it must also be caused by them and, moreover, caused in 'the right way'. Two similar causal conditions are imposed on the relation between belief and evidence." (Elster, 1986:16)

The individual's *cognitions* may include knowledge and skills, organisation, economy, physical and social environment etc. Among the means that are acceptable to the individual decision-maker there might be several that satisfy the end conditions. The *desires* deal with norms, beliefs and attitudes. These can be built up into a framework for what is rational or at least legitimate behaviour.

Elster accounts for a number of problems when applying this in social sciences. He argues that the consistency conditions can usually be taken to be satisfied. Social scientists focus, he says, almost exclusively on the optimality conditions, in part for good reasons. Usually the goal is not to explain individual action, but the behaviour of large numbers of people placed in similar external circumstances. It will then be impossible, and also pointless, to ensure the fulfilment of the causal conditions.

The ambition of the present study falls short of Elster's formulation of an explanation of actions. In this study with only 30 informants it becomes necessary to explain individual action without relying on a Law of Great Numbers which "reconcile indeterminism in the behaviour of the individual with determinism in the behaviour of the collectivity." (von Wright, 1971:162). The explorative method still, however, has to indicate certain propositions about whether the end result will be *continuity* or *change*. The best we can hope for is that we may disentangle some of the complexities of human action when faced with multiple options. Such propositions will be tested on four cases in order to demonstrate the usefulness of this line of research and the model.

The task ahead is one of analysing why villagers do what they do - or do not do - with their household water, given what they perceive and desire. This part of the study emphasizes understanding from within i.e. intentionalistically understood behaviour. The success of the analysis depends heavily on our ability to identify relevant parameters or factors; and the way they relate to one another.

4

Sources of Information and Method

Introduction

The sources of information used in this study are interviews with Wasukuma villager-informants, observation and written and published materials as acknowledged in the text and in Appendix C. The informants have been invaluable providers of information about indigenous knowledge as well as specifically Sukuma norms and individual values. Observation not only provided information about skills, behaviour and physical endowments but also offered opportunities to validate oral information and to identify issues to be looked into The author is also obliged to the authors of the large body of literature on Sukumaland for the many insights gained in the course of reading their work. For instance, McCall (1979) has 525 entries on Sukumaland in his bibliography and Molnos (1965) has 145 entries on Tanzania.

Written Sources

Written sources about conditions in Sukumaland are invaluable aids to familiarization with the area of study. Recent or current sources are indispensable for the preparation of interviews. Slightly older works from a generation ago help in creating a common frame of reference for the researcher and his informants; they also make it possible to discern 'old' patterns in the present. Historical data can reveal fundamental conditions that may otherwise not emerge, for example population data showing people's experience of water technologies.

The physical environment in Sukumaland has been studied by scientists and professional officers in the administration over the years, especially where agriculture is concerned

Data on water-related issues are available in reports and evaluations, some of them dating back to the 1930s The human environment has not received such detailed attention, although there are some excellent pieces of work. It seems as if the amount of published material varies with the economic situation the early colonial period saw occasional reports and books, and the decades before and after independence in 1961 were very productive; but since the mid-1970s there have been many donor-financed reports - hardly any independent research has been done. Little research along the lines of the present study has been done by local researchers. A brief resumé follows of the most important written sources that the author has consulted.

The first comprehensive ethnographies were written by a white father, Fridolin Bosch (1930) and by a former missionary, Wilhelm Blohm (1931 and 1933). Blohm made, among other things, detailed recordings of water resources and water use, mainly in Unyamwezi to the south of Sukumaland The outstanding publications of the government sociologist Hans Cory embrace the period from the late 1930s to 1960 (there is a Cory section in the university library in Dar es Salaam), most of Cory's work about Sukumaland was produced in the 1950s (1951, 1953, 1954). Donald Malcolm, an agronomist in the colonial service from the early 1930s to the 1950s, wrote classical accounts of Sukumaland and its people (1953) and of land utilization (1938); both contain water-related information An anthropologist, R.E.S. Tanner, also a colonial civil servant, contributed valuable material ranging from accounts of archery to transition in beliefs, to witchcraft murders (1955)

In the 1960s Abrahams (1967), Austen (1968), and Liebenow (1955, 1960) wrote about political development in Sukumaland, while Holmes (1969) wrote about the history of Kwimba. Then came a number of publications on religious thought and practices by Millroth (1965), Tanner (1967), Hatfield (1968), Reid (1969), Noble (1970), Balina et al. (1971), and Welch (1974). Much of the research was conducted in the 1970s at the Nyegezi Social Training Institute in Mwanza; several PhD theses were produced on the Wasukuma. The most detailed was in 1973 by Corleen Varkevisser on socialisation in a changing Sukuma society. Schanne-Raab (1974) made a stratification analysis of material collected by Lang in 1970.

Academic research then virtually ceased and only recently have some dissertations been forthcoming e.g. Brandstrom (1990) on Sukuma-Nyamwezi culture and Andersen (1992) on women's political participation.

Within the physical sciences and agriculture the amount of material is impressive. Of published material with a hydrological or hydrogeological interest the summit is held by the monumental Water Master Plan of 1978 which contains detailed information on all three lake regions and more than a thousand villages. Earlier studies include Clement Gillman's extensive writings starting before 1916 during the German administration and continuing up to 1946 (1936, 1943). The water engineer F.M. Coster (1960) published his findings about underground water in Tanganyika gathered during thirty years service. The agricultural officer and researcher N.V. Rounce, who worked with Donald Malcolm, wrote about the rehabilitation of land in Sukumaland (1949). In the 1970s, Hankins (1974) wrote on rain pattern and planting times, and a research team from the university wrote an interdisciplinary overview of Sukumaland (Hankins et al., 1971) A preparatory survey for rural development was conducted in the mid-1970s, the Mwanza Integrated Regional Planning Project of 1976 covered many physical aspects.

Selection of Study Area and Villages

Selection of study area. The aim was to study incentives and constraints on improving both access to and quality of household water in a rural area. The emphasis has been on human responses to differing physical and human environments. In order to limit the number of possible combinations of man, land and water it was desirable that the selected area should be inhabited by a culturally fairly homogeneous people.

Sukumaland fulfilled the requirements of being a relatively large area with differing hydrological and topographical conditions, and it is inhabited by a broadly homogeneous population with one language and one type of social organisation, as shown in chapter 2. Although there are other areas of this kind in Tanzania, Sukumaland and its people are well-known to the author from his years in the mid-80s as training adviser in a SIDA-funded water and sanitation programme.

Selection of villages. The selected villages should represent the varying conditions of water availability and accessibility in the area. At any given point in time, the water endowments are determined in part by the existing natural water sources like lakes, rivers, and springs and in part by man-made sources like dug holes, wells, ponds and dams. The total amount of accessible water (as presented in chapter 2) is assumed to be the most important single factor impacting on residents' assessment of their household water situation.

The potential for improving access to and quality of water differs with the amount of rain and the geophysical features of the land. These two physical features were part of the criteria for selection of sites; the studied villages are in fact spread evenly inland from Lake Victoria because the amount of rain decreases as distance from the lake increases. Two villages were selected from a hilly area in Mwanza district (Lwanhima and Igogwe), two from the flatlands in Kwimba district (Bupamwa and Runere) and two from the intermediate landscape of Magu district (Mkula and Kongolo). This variety invites different technical solutions, but it does not necessarily mean that water is harder to obtain or of poorer quality in one area than in another.

A study of *own-key* arrangements and activities should ideally be carried out in an area with no experience of water interventions, because all such interventions may affect villagers' willingness to arrange their own water supplies Unfortunately there were hardly any villages in the area which had not been affected by modern interventions at one time or another (see Appendix A). Moreover, people frequently move about from one area to another and they drive cattle over large areas; as a result most men and to a lesser extent women are acquainted, at least at second-hand, with most of the available modern water technologies. The fact that many of the installations introduced by interventions are no longer operating makes differences less pronounced, since villagers, wherever they are, have mostly had to rely on *own-key* arrangements

There are more than 600 villages in Mwanza region alone and therefore the above criteria yielded many villages in each subgroup. In the end we used the only available comprehensive compilation of water conditions in all villages in Mwanza region, the Water Master Plan (1978), to pick out the six villages in which the work of the study was concentrated. Whilst the author was aware that conditions might have changed since 1978, a majority of "crisis villages" which had little or no naturally accessible water was included, on the assumption that dissatisfaction would be high and the physical and human constraints to developing water sources strong if not insuperable in such villages. The six selected villages may be characterized as follows:

Table 4.1. Accessibility of water from different kinds of water sources in the dry season (Based on Tables 2.4 and 2 5.)

Litres per person per day from:	man-made dams, ponds, *lambos*, and/or dug wells			
natural sources	0	<5	<20	Total
0	Mkula Runere	Lwanhima 0 + 0 6	Bupamwa 0 + 15	4
0.1- 4.9	-	-		
5- 9 9	-	-	-	-
10-14.9	-	-	-	-
15-19.9	-	-	-	-
20-29.9	-	Igogwe 21 + 3	-	1
Unlimited	-	Kongolo unlim. +2.4	-	1
Total	2	3	1	6

Villagers in Mkula and Runere had no water in the dry season and those living in Lwanhima and Bupamwa had just a few litres a day from man-made sources according to the WMP. Kongolo is on the lake and Igogwe has some natural springs. Both villages had added man-made supplies yielding a few litres. After the selection it turned out that the large dam in Bupamwa village, built in 1956, had been omitted by the WMP-team, possibly because of severe silt problems (the yield today is some 15 litres per person per day). It was also learned that Bupamwa and Mkula were in process of being connected to piped water supplies at the time of the WMP survey. None of these installations had ever worked, however, so this did not affect the selection criteria negatively.

Little more needs to be said about the chosen villages. Only one, Mkula, is nucleated while others are spread out with only an embryonic centre, like Runere, Kongolo and Bupamwa or altogether without a centre like Igogwe and Lwanhima. The number of inhabitants varies from 2,000 to almost 5,000, but often there are easily identifiable subvillages, *vitongoji*, of about the equal size. Informants were chosen from one such *kitongoji* in each village since cooperation often takes place in that geographical setting.

The six chosen villages are between 15 and 120 km away from the regional centre of Mwanza. Only one (Runere) is situated on a main road, whereas the others are 4-15 km away from a main road. Igogwe, Lwanhima and Kongolo do not have a regular bus service. Proximity to towns and easy access to transport are generally thought of as factors favourable to change but these were not used as selection criteria.

Structure and Content of the Interviews

The intention at the outset was to conduct an additional survey in one hundred villages in order to see to what extent the findings in the six chosen villages were representative for Sukumaland as a whole. It turned out, however, that chances of forming a team of enumerators capable of providing reliable data were remote, because of the logistic and economic problems prevailing among trained cadres. The decision to drop the idea of a 100-village survey meant a greater dependence upon in-depth interviews, which was reflected in the selection of 30 informants, five in each of the six villages; this was the result of weighing the need to include enough variety of human and physical environments against the limited time available for analysis of the data.

The aim of the interviews was to bring out information about who can/should/will do what and why or why not The semi-structured interview questions are to be found in Appendix B. Informants were first asked about general matters in their village areas and what changes had taken place The interviews then moved on to their assessment of the household water situation. Wet and dry season water conditions were discussed in detail; access to and control of sources, collection of water, and maintenance. Informants' knowledge and experience of hydrology and hydrogeology were explored before questions were asked about how they were able to find water above and below ground, and how much they knew about water quality, routes of contamination and health impacts.

One large section of the interviews concerned how the perceived problems could be solved technically. In the first interview the informants were invited to choose the three improvements they desired the most; they were then asked what they thought was needed (skills, knowledge, materials, equipment, funds, management, etc.) in order to implement each kind of improvement. Sukuma norms and individual values about who could, should and would effect the desired improvements in access to and quality of water were discussed. Without any prompting on the part of the interviewer - who was in fact taken by surprise at first - several informants volunteered the information that they intended to have the desired improvement ready by the next interview a year later. In this way the author was offered, in addition to the pre-planned investigation, an excellent opportunity to test the data against actual results. It became possible to discuss norms and values conducive to *change* and *continuity* in the context of the informants' subsequent experience of the implementation of an improvement they themselves had proposed at the first interview in 1989.

The content of interview questions evolved over a few years. The author s experience and village-level contacts as a training adviser in the area some years prior to the fieldwork, when conducting informal open-ended interviews with villagers and extension workers, came in useful. The gap in perceptions between town-dwellers and rural people quickly became visible and caused the author to take the first steps in de-learning before learning. The refinement of research questions for the study continued throughout a prolonged exploratory phase, e g a draft set of questions was discussed with some well-informed civil servants and farmers and revised accordingly, the questions were then tried out in half-day interviews with five knowledgeable villagers and again revised. Thereafter the set of questions was translated from English into Kiswahili by three persons working independently.

Selection of Informants

Selection criteria. How does one select informants whose experience or knowledge can be expected to cover the whole array of issues? Villagers have varying economic positions, intellectual resources and skills which could enable them to perform effectively in providing household water. Most water-related activities concern the household and the local community, not only the individual. It is no coincidence that decisions on major water issues (as opposed to handling water in the household) are normally made, not by commoners but by those knowledgeable and influential villagers who control the local political process. Informants should ideally be persons who are well aware of the issues at stake and who are in a position to express their values and desires and relate them to prevailing norms, even if this means breaking conventional rules and taboos about what should not be mentioned It is obvious that random sampling would be a poor selection procedure, if only because these subtle matters would not be discussed with a stranger.

The likeliest group to possess the competence needed for this study, in the author's judgement, was among people with a thorough knowledge of the human environment and household water conditions. Knowledgeable informants are often also conversant with strangers' views and ideas and therefore may be more prepared to conduct abstract discussions with an interviewer. At the same time they are probably more able to avoid issues that they do not want to talk about. They do not necessarily have a position in the formal village organisation; they may even be in opposition to it. And knowledgeable villagers can belong either to the "forerunners" or to the "laggards" in society.[1]

Women and men have separate tasks in relation to water and it was deemed indispensable to have both sexes represented. The selection criteria called for about half the informants to be men and half women who had resided in the area for many years. Informants who have lived a long time in one area are knowledgeable about prevailing conditions even though they may also have been conditioned in such a way that they are blind to some of the possibilities and opportunities which are visible to younger people.

Selection of informants. In an introductory letter to the village chairman (in Kiswahili) the author outlined the purpose of the study and expressed the wish to interview five knowledgeable villagers, at least two of either sex, all of whom had resided there for a long period. The village leaders were always very open-minded about what people to interview. In cases where the author brought proposals of his own, these were readily accepted.

The result of this selection procedure was that 30 Wasukuma in the six villages were prepared to become informants, 13 of them women and 17 men. Six of the females were widowed or divorced and four of the men had more than one wife. Twenty-two of the informants were heads of households, while seven were wives and one a daughter residing with her parents.

The 30 informants were from 29 to 75 years old, with an average of 46 years. In educational terms, seven had more than ten years of formal education; eleven had between six and eight years of primary schooling; five had had four years; four had no schooling but some adult education training; and three were without any kind of formal training or schooling. As for their occupations, the majority were farmers, two were teachers. Among the part-time farmers one was village chairman, one a shopkeeper and one a traditional birth attendant. Most of the informants held one or more formal positions in the village, cooperative or church. Only eight of the 30 informants held no position; of these five were women and three were men. There were eighteen Roman Catholics, nine followers of the African Inland Church and three traditional believers.

Even though most of the informants had been born in the village they now lived in or had lived there for many years, this did not mean that they knew nothing of the outside world: twelve had lived in a town at one time or another and three had spent time in Europe.

As for personal assets, half (15) of the informants lived in houses with iron-sheet roofing, half under thatch. Twenty-three claimed to own cattle in numbers ranging from a few to over a hundred. Twenty-one households owned a bicycle, eight had draught oxen, and six lacked both bicycle and oxen.

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[1] Schanne-Raab (1974) found that high-status Wasukuma adopted farming and livestock innovations to a slightly higher degree than people with medium or low status

Conducting the Interviews

The main fieldwork was conducted in the wet season 1989 and in the dry season 1990 to obtain information about seasonal differences in conditions. Semi-structured in-depth interviewing was used on both occasions and interviews were accompanied by observation.

The author visited each of the six selected villages on two occasions, he stayed for a week each time and was usually accommodated by one of the informants.[2] One interview was conducted each day; this lasted four or five hours during the first field study and two or three hours during the second stage. As Kiswahili is the informants' second and the author's third language the villagers were able to exert considerable control over the pace and content of the interviews. The load of field work proved feasible largely because of the author's previous experience of interviewing groups of extension workers and villagers in his earlier work in Sukumaland; other facilitating factors were that most of the issues involved were not sensitive, and some were observable.

One informant was interviewed at a time, it was doubtful whether any group of people would stay together during an interview which was expected to last between two and four hours The problem of group members influencing each other could probably also have distorted answers to such subjects as the present household water situation. Individual values may be less feasible to discuss in a group, while Sukuma norms would benefit from a discussion including differing opinions in a group. It was sometimes convenient to interview a small group of people at the same time in the evenings and on other informal occasions.

Each interview took place at the informant's home. We were undisturbed for most of the time as the children were kept away. During two interviews with female informants their husbands were occasionally present. Interviews were taped, and no informant expressed any objection to that. How it may have affected the informants' performance is described by Vansina in the following way.

> When a tradition is to be recorded on tape ... the informants must take into account what the reactions of their fellow countrymen will be, and they know that the latter will be critical of how they behave Informants wonder as to what uses the testimony will be put .... The informants must also take into account what the reactions of the person recording the testimony are likely to be . . In such a situation distortions are to be expected when compared to a normal performance. (Vansina, 1985:111).

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[2] Gillman (1943 V) wrote ". and had my health permitted to supplement, as in former years, motor travel whose speed is the enemy of detail by much more satisfactory exploration on foot." Riding a bicycle in the countryside gave the author ample time to chat with other cyclists and, once in the village, he was not interrupted by requests to use his car which happens to car-owners all the time.

Despite this drawback, informants soon forgot the tape-recorder, and it has proved invaluable to be able again to listen to the reasoning of the informants a few years after the interview was conducted. The tape also allows others to evaluate the way in which the interviews were conducted. On one occasion when an informant was reluctant to expand on some issues the author felt anxious for the success of the interview, became impatient and started to put questions that only required yes and no answers; it is quite evident from the tape that this departure from standard interviewing technique destroyed the rhythm of this section of the interview and prevented the informant from expressing her views in full.

The interviews were conducted by the author himself, and on no occasion was any official from the village present. This avoided the problem of informants being suspicious of an interpreter. In one case a son acted as his mother's interpreter when an elderly woman preferred to answer in Kisukuma. On the other hand not having a "go-between" may have added other problems like informants not knowing what the author wanted out of the interview. It may not be easy for the informants to comprehend why somebody travels so far just to discuss water issues and to walk around looking at ponds and streams. The Wasukuma have, as far as is known, no model for such a person except the water engineer. Thus the villagers initially tended to treat the author as a potential benefactor, however odd, on his mission to provide improved water (Williams, 1967:44). Perhaps this idea vanished as the interviews went on, but there is some evidence that it did not do so entirely. A letter from one of the informants conveys his impression after having talked to a fellow-informant that they had not been very open to the author.

> I think you will not be very happy if I tell you that I am not really satisfied with your last research because I think some of the people you met with did not give you real data you wanted to get from them. Some might have given you not dignified answers because they do not understand why you are doing it.

Observation

Observations were systematic and aimed at simple statistical use as for existing water sources, their quality and distance from the homestead, storage arrangements, etc. Little time was spent on recording how often water was fetched and what containers were used, because there is a vast array of reports which state that people use some 7 to 15 litres per day (White et al., 1972). Occasional observations were made of actual behaviour at the water source and when treating water at home. By chance, it was also possible to observe on-going communication about water-related issues within the community on few occasions.

Observation of present water conditions, division of work, leadership issues, etc. may establish "what actually happened". Eye inspection may avoid much bias. If an informant says he failed to complete a well because of boulders, this is beyond doubt if the abandoned well shaft can be found Assertions are not always possible to verify through observation. A male informant who says that he helps in carrying water during droughts may not be seen doing so since droughts occur at long intervals But when a husband said he fetched water regularly because his wife got headaches after two days of fetching water and the wife said he had never helped her, observation helped us to decide what actually happened

Observation of actual behaviour may occasionally solve the reliability problem in interviewing. The following is an example showing the discrepancy between words and practice. When looking at the arrangements to store water in a kitchen, the author was told that the drinking water was sieved when poured into the clay vessel. When asked to show how this was done, the female informant could not find a cotton cloth to use as a sieve. But even an observation reliability test may be uncertain because the object may change while we are studying it This is the well known "interviewer effect" that people may change their behaviour (only) during the observation period

Another powerful use of observation is more qualitative and discovery-oriented. It may even generate new questions which lead to new insights (Patton, 1990:124-5). An example of such an observation is that of sharing the water source with cows: the author's concern about health effects called for an increased understanding of immunity (scientific and popular perceptions) in order to evaluate the pros and cons of such a practice. Observation of actual behaviour can also provide ideas about alternative ways of framing questions.

Expanding the Area of Common Concern

The value of an encounter between the informant and the researcher depends on many factors. If both are concerned by an issue it becomes "easy to detect and report". Some issues may, however, only be of concern to one of them, which means that such issues may be underreported. The situation is illustrated in Figure 4.1 below where each relevant issue is found in one of the four boxes.

		Informant's concern for specific issues	
		Part of concern	No part of concern
Researcher's concern for specific issues	Part of concern	easy to detect and report A	may come out of the analysis B
	No part of concern	tends to be underreported C	not found even if it exits D

Figure 4.1. Visibility of certain issues in the encounter between a researcher and an informant

The border line between concern and no concern is a product of experience, knowledge, values, interests, etc. at any given point in time. For instance, habit tend to make routine activities invisible because they are perceived to be (and actually are) normal (box B). The issue may arouse concern when it is brought up in an interview and thus become part of box A. For instance, resources *are* not, they *become* in the sense that they remain dormant/invisible and are not perceived until the possibility to exploit them appears.

Being new to a place makes it easy for the researcher to identify deficiencies but, at the same time, it also makes it harder to detect the underlying reasons for the situation. Not being bothered with the load of routine burdens of the day, it becomes easy to focus on possible improvements (innovation-bias). Soon enough, however, this clear-minded assessment of potentials fades away and is replaced by an understanding of how the complex web of normal day-to-day worries and norms may determine events. In this case the issue of possible improvements may slip the reseacher's mind and move from box B to box D

The empirical study is a process of learning for the researcher as well as the informant. A move to expand the number of issues in area A of common concern (or shrink box B, C or D) requires more knowledge or interest or skill or broader views. One fundamental precondition for that is that the parties act on the presumption that the other party is rational.

Rational subjects. There is a longstanding conviction among anthropologists that a similar rationality aiming to explain, anticipate and command or manage occurrences in the environment, is a common feature in all cultures (Horton, 1969). In the previous chapter it was mentioned that rationality should be viewed towards the actor's specified frame of reference. Jon Elster eloquently expressed the view of a philosopher on this fundamental question:

> To understand other people, we must assume that, by and large, they have consistent desires and beliefs and act consistently upon them. The alternative to this assumption is not irrationality, which can only be predicted on a broad background of rationality, but chaos. (Elster, 1985:27)

An emic[3] understanding of his or her thoughts and behaviour, when at its best, gives an insider's viewpoint and definition of reality. A connected difficulty is to report informants' ways of reasoning and acting in a way which allows an understanding in the reader's mind that does not distort the original meaning.

A potential adopter may perceive a new idea as a vector of qualitative change and not an isolated, incremental one. It may be easy for him or her to assess the direct effects of

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[3] *Emic* analyses stress the subjective meanings shared by a social group and their culturally specific model of experience, while *etic* analysis refers to the development and application of models derived from the analyst's theoretical and formal categories (Seymour-Smith, 1992.92)

a change However, this may not be the only interesting aspect of the adoption of new ways of doing things. The person wants to know the social effects and whether there will be a new "equilibrium" in the community after the change Given the complexity of foreseeing all the changes that will accompany a single innovative change, he or she may well feel obliged to consult ancestors for guidance. Rural people in Sukumaland pride themselves on their right to choose whether to accept or reject changes, and some villagers certainly want to exercise this right.[4] Their reason for accepting or rejecting a particular change may be the ancestors' response, but this consultation is not necessarily a forceful one; there is still plenty of freedom for the living counterpart to interpret the response in his own way and to his own liking.

Given that both the researcher and the informant act rationally there are two methods used in this study to expand the area of common concern; one deals with providing a situation in which the informant is encouraged to think about an issue in a new setting or scenario; and the other deals with widening the author's understanding by relating to experiences from his own culture.

Scenario-questions. A scenario which is more or less hypothetical can sometimes stimulate an alternative, less habitual way of reasoning about an issue. The method is used in contingent valuation and in willingness-to-pay studies (Mitchell et al., 1991). The scenario-technique turned out to be helpful in this study Phrasing questions in a fashion like "How do you go about getting water when you are out travelling and get thirsty?" or "How do you assess the water you are offered in a strange environment?" tended to provide more insights than straightforward questions on how water quality is assessed at home. Answers to scenario-questions turned out to reflect a conflict between the "schoolbook" version and what the informant actually desired to do (chapter 7).

On other occasions questions put in a context of a hypothetical scenario helped identifying norms and individual values. One such scenario postulated that men were responsible for the task of fetching water, as follows: "What would you/your husband do if you/he were to fetch household water each day?" Answers to such questions brought out both the prevailing Sukuma norm and the value placed by the individual on the present gender division of tasks (chapter 12).

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[4] In contrast, technically advanced societies seem to lack an "equilibrium" and such societies are constantly moving along a sliding plane. There is little perceived room for individual influence since the economy or market forces are claimed to demand certain behaviour or sacrifices in order to function. Individuals have little influence on the direction of change and they sense that there is no 'equilibrium' ahead. Change and innovations reign unchallenged Henrik von Wright pessimistically concluded that "the industrialized and technified society's complications are so great that a democratic involvement in the public decision processes in the long run *must* degenerate into an empty formality of accord or protest against unintelligible alternatives " (von Wright, 1986 84, author's translation)

Reference to known events. One way of improving the understanding of informants views and behaviour is to refer more or less unintelligible issues to similar occurrences in the more familiar Swedish environment. This requires good knowledge and a desire to probe one's own perceptions.

The problem is indirectly addressed above in the discussion about how the informant perceives a researcher; often formulated in terms of finding a suitable "role-counterpart" in the local community like the water engineer. It was sometimes helpful for the researcher to "recognize" the informant as resembling a known figure on the Swedish scene. Four elaborated examples are given here referring to the author's efforts to understand the informants' reasoning and behaviour:-

The 'inside' of water-fetching. Carrying a bucket of water is hard work, and visitors to rural areas are concerned about how to relieve women of this task. Rural women, however, may not automatically think about fetching water as drudgery but rather as a non-issue. The interaction between the visitor and the woman may improve if the visitor recognizes some kind of parallel with a familiar experience at home. Town-dwellers and rural women in some developed countries do not fetch water, but they fetch food. Shopping for a family may take just as long as fetching water does in Sukumaland (Nyberg, 1989). Townspeople carry heavy bags (even containing drinking water) to the car or all the way home, without thinking of alternatives. If they are short of time, they send a child to the shop (and get angry if the child grumbles). Some people enjoy shopping and meeting friends in the shop, while others dislike shopping. Hardly anyone suggests that shopping should be abandoned in favour of some public or private agency delivering the items to the home. Such a change might relieve people from drudgery, but it would also cause disruption in social relations and take away the opportunity to get out of the house.

To know or to assume? In the course of this study the author was frequently puzzled by the slow rate of progress on water matters in Sukumaland. He was drawn to make comparisons with the speed of similar developments of household water in rural Sweden. A study of this issue changed the author's view of a fairly successful water sector development in Sweden.

Dispersed rural homesteads had access to shallow wells or ponds. After the First World War farmers began to pipe water from the well (often one per household) to the house and to fit hand-pumps inside the house; when this was possible they began to supply water by gravity. In this way many women were relieved of the chore of walking to the well, especially in the cold winters. Official statistics show that 29 per cent of rural households had a tap inside the house in 1941 [5] Twenty years later the figure was 66 per

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[5] In 1941 most wells were lined with rocks, only 20 per cent had cement rings and one per cent were boreholes Four out of five farmers complained about leaking well-covers and well walls which allowed contamination from overland-flow to enter and cause seasonal diarrhoea (SOU, 1951·26)

cent; and only by 1980 was the coverage 90 per cent. Thus, it took Swedish farmers a full century to arrange their household supply satisfactorily with running water.

One also has to take into account the pattern of concomitant changes in habitation. The rate of urbanisation in Sweden (congregation of more than 200 persons) has increased from 30 per cent to 90 per cent in this century. If urbanisation and the proportion of rural households with a water tap in the house are combined, we arrive at the following graph showing the proportion of rural households increasing only slowly (Drangert, 1992).

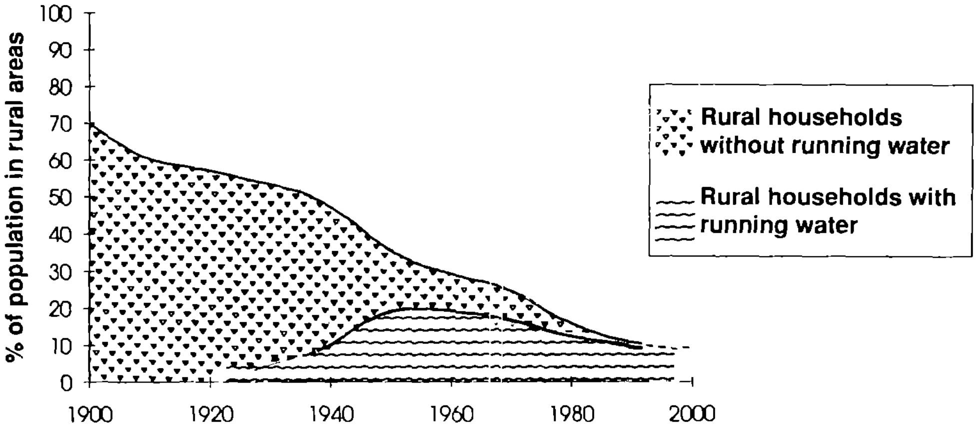


Figure 4.2. The proportion of Swedes living in rural areas and the proportion with running water indoors, 1936-1990. (Drangert, 1992)

The graph shows that the increased proportion of tap-water was mainly achieved through people leaving the poor living conditions in rural areas and moving to the towns where they could find an outcome - and running water. This salutary observation helps to put down the presumption that Tanzanian farmers should have solved their water problems in the same way as their Swedish counterparts were believed to have done.

Why not just do it? As a follow-up of the general development of rural household water in Sweden the author interviewed elderly relatives about their local experience He was told about heads of household often refused to dig a well in the yard, forcing their wives and daughters to go on fetching water in nearby ponds, lakes and swamps in the winter. On one occasion a husband refused to allow his sons to dig a well for their mother. Neighbours and relatives grumbled for a long time about his treatment of his wife and in the end it took the sons less than a week to dig a 4 metre deep well which is still in use. In this case the head of household was known to be hard-working and he could afford the money required for the investment. One can only ponder about his reasons for the long overdue decision to develop a new well in terms of knowledge, skills, norms and individual values. It was too late, however, to interview anyone alive about such reasons.

Temperate experiences. The actual hydrology affects whatever is done to supply water. This sounds self-evident but is forgotten over and over again. In brief, the Swedish experience is that water is easily accessible, to the extent that major drainage works were carried out by ditching enterprises for over a century to rid agricultural land and forests of excess water. However, the force exerted by the atmosphere on water surfaces and soil moisture differs from place to place as the following example shows. If we fill two open drums with water to a depth of, say, one metre, and place one in the open somewhere in Sukumaland, it will contain only 0.3 metres of water after an (average) year - because 900 mm of rainwater will have fallen into the drum over the year while the evaporation has removed 1.6 metres. If the other drum is placed in central Sweden it will contain more than a full metre of water after a year, because the precipitation is higher than the potential evaporation which is about 500 mm. The Swedish experience may deceive the researcher (who may think that evaporation does not matter) about what is potentially possible to achieve in Sukumaland (where farmers know that it affects soil moisture). The atmospheric thirst over Sukumaland competes successfully with human beings for the water in dams, for instance, and evaporates away almost a metre of water during the dry season!

Debilitating and Mitigating Factors in Interviews and Observation

It is easy to agree with transformational structuralists who, according to Rossi (1981:63), find "not only naive but false the positivist and behaviorist assumptions that people's conscious explanations and overt behaviour are to be taken at their face value as object of scientific analysis." The examples already addressed make it clear that verbal explanations may hide ideological and material interests; or can be a product of rationalizations; or reflect a poor understanding of social processes; or reflect the context in which the questions were asked; moreover, the explanations of certain people at times contradict the explanations of others. Bernard et al. (1984:506) write that "Unfortunately, the case for attitudes as predictor of behaviour is far from convincing " Weisner et al. (1982:242) argue that they are not really studying specific behaviours, but rather "perceptions of a felt role performance." The study of people's behaviour and reasoning warrants cautious interpretations of informants' responses as well as the researcher being alert enough to discount or minimize the blinding effects of his or her own perceptions.

Beattie (1964:38) presumably wallowed in the same methodological swamp before proposing that social relations should be studied at three levels by anthropologists. The first of Beattie's three levels is an inquiry about "what actually happened" which lends itself to observation and to statistical treatment. The other two deal with beliefs and values and can rarely be observed but are analysed by interpretation. one deals with "what people believe happened" and one concerns a normative position about what they believe "should happen". This kind of distinction has been helpful in planning the interviews.

(1) Informants tend to provide "official" or "school-book" answers showing a high rate of adoption of conceptual knowledge. This is usually explained by saying that they expect the researcher to desire this answer and they please him by giving the "right" answer. For instance, the Wasukuma know quite well what is expected of them in order to maintain water quality (use clean cups and buckets, not allowing children to draw water, etc). Whether they practice such measures and to what extent could be checked by observation. But it is a time-consuming method, especially for infrequent activities and events.

Instead of asking if they boil the drinking water (too tempting to answer yes) it may be more fruitful to ask whether villagers "usually" boil their drinking water. Sometimes it is possible to look for other indicators than the straightforward ones. A check of fuelwood availability could indicate the amount of time required to boil drinking water. Also the researcher may be too convinced that boiling is an essential activity. Perhaps boiling is not a viable practice at all to attain safe water. Walking farther to fetch springwater may be more efficient.

The reverse trap is also there. Some informants willingly provide unofficial versions right away and it is tempting to listen more to this kind of outsider's view, partly because it may reflect the researcher's own outsider perspective. Such answers should not automatically receive a higher status than others, even if they do seem to be influenced less by the informant's strategic thinking. Such answers may, however, be designed to please the researcher just as much as "official" versions; they merely reflect a more sophisticated interpretation of what the researcher wants to hear.

(2). Understanding of what informants mean, of their ways of thought, requires interpretation and whenever possible the kind of insights that come from close personal acquaintance. Some examples may help to illustrate the range of possible interpretations of given information.

One informant gave three different versions of the level of water table in his area depending on the issue under discussion; (i) I can dig a well but the water is deep down, (ii) graves overflow in the wet season, and (iii) the pit latrine is just one metre deep to avoid groundwater seeping in at the bottom. Each answer is reasonable in its own context but the three are contradictory. They reflect the informant's differing perceptions due to the different contexts, not differing hydrogeological conditions. This case points to the crucial importance of exploring the frame of reference alongside with the discussion of practical issues.

Another informant claimed his family fetched all their water from a spring 800 metres away, sometimes using a vehicle, but the author on several occasions saw the informant's daughters walking to a nearby dirty pond for water. This observation meant that his statement was untrue where water of lower quality was concerned. Observation in this case opened up an avenue to enable us to find out whether the father actually believed what he had said or whether his answer to a general question referred only to the special case of drinking water.

In a third case a female informant said she was certain that her husband was aware of her problems in fetching water as the dry season approached and that he would try to find a remedy. Although she had not discussed the matter with him she claimed that if there was a remedy for drudgery he would go for it. On the face of it she actually believed that this was what would happen. But even if she knew that her husband did not care about her problems at all it was perhaps wise to make the same claim, because she might otherwise have run into trouble for backbiting her husband. It is impossible to confirm anything from this piece of information alone but quite likely that scenario-type questions about related situations could free the informant from a feeling of betraying a third person. Also the reason for her making this claim may be sought in prevailing norms.

(3). Informants' individual values and their moral and political inclinations are expected to come out when discussing "what should happen?". There is a host of cultural norms and expectations about what should happen and some of these are codified in the customary or national laws such as the expectation that the women will fetch water; the tendency to rely on leaders to take the lead in changes, etc. An example is given to illustrate the "should" aspect.

An elderly female informant claimed it was not difficult to fetch water from a *lambo* one kilometre away during the peak of the dry season, while a younger informant said it was a heavy task to fetch water from a distance of 20 metres. Apart from being "felt" so differently, the answers could be influenced by strategic thinking about how best to secure assistance with a new water facility, or a simple need amongst older women to assert their ability to fulfil the female task of fetching water; or it could merely reflect the fact that young women fetch water more often than elderly women.

A mitigating factor in similar cases is to find out whether there is a Sukuma norm which the informant is taking into account when answering; if they are in favour of the norm they may refer to it to support their line of argument; if they differ in opinion they have to consider to hit on the norm or to avoid the difference to be seen.

Summing up

Interpretation and analysis are crucial, but the whole edifice is built on the quality of the encounter between two people. The interaction between the researcher and the informant can be affected by such factors as the researcher's biases; the reluctance of the informant to convey what (s)he actually thinks; and different perceptions of what constitutes "reality". These are some core problems of anthropological research, and some mitigating factors in interviews and observation have been discussed above.

Informant statements. Russell Bernard et al. (1984:503) concluded their summary of literature on validity of retrospective data that "on average, about half of what informants report is probably incorrect in some way." They reported that Cancian found deviations from truth tended to be in the direction of cultural norms. Certain views may also be fashionable at one period of time, unfashionable at another. Intensive contact with development and change in Tanzania for more than twenty years has given the author some sense of what issues would have received different responses in the past from what they do today. For instance, *own-key* activities were unfashionable in the 1970s when the central government was confident that it could provide all the water anyone needed. Confidence in political leaders was more pronounced at that time than it is in 1992.

The reporting on issues which are "easy to detect" in Figure 4.1 above is done by interviews, observation and written material while those which "may come out" can sometimes be elucidated by observation or questions of a scenario-type. Issues of the "underreported" kind may come forth by improved listening skills and reduced blinding effects or biases.

It can be depressing to realize the difficulties involved in interviewing and how hard it is to get at "the truth". Sometimes, however, answers are surprisingly accurate. In one case an elderly man told the author about the history of water development in his area (see Appendix A) He recalled the drilling of some ten boreholes in 1932 and the outcome of each. The author happened to have brought the annual report of the then district officer confirming each point of this man's account.

There is no simple way of gauging the reliability of answers given by informants; only a more profound experience of interviewing and observing can contribute to an improvement in reliability. Patton (1990:32) summarized the requirements: the skilled interviewer is also a skilled observer, able to read nonverbal messages, sensitive to how the interview setting can affect what is said, and carefully attuned to the nuances of the interviewer-interviewee interaction and relationship.

Researcher's approach. The author is familiar with many aspects of the human environment he encounters By assuming that the informants are rational human beings a basis is established for understanding their behaviour and reasoning. But the researcher must also keep track of his own concerns and perceptions which are partly determined by reading written material and - contrary to interview results - can be checked easily by the reader. It is harder for him to allow for the possible distorting influences arising from life-experience as a Swede in the 20th century, although some of these may surface as hints that crop up in the course of the study.

During the process of study the interviewer as well as the informant gain new experience and insights; these may well alter their ways of perceiving household water conditions.

Section B

Human and Material Resources Available in the Villages

The study explores the ways and means available to villagers who decide to improve access to and quality of water. Knowledge about hydrology, hydrogeology and, possibly, health aspects of water quality is required before villagers will decide to take action. The affordability of particular measures, including material and equipment, will also determine whether a perceived measure is possible to implement. The managerial skills to organise suitable groups of people to do the work must be available. A basic investigation is undertaken into the villagers' human and material resources in the chapters 5 through 9.

5

Villagers' Assessment of Their Household Water

Introduction

This chapter outlines how our informants perceive their household water conditions; water quality, closeness to the home, cause of water problems and reasons for change, and who should take action in the near future. Some definitions are given and accompanying photographs are presented in order to familiarize the reader with the various practical arrangements.

In addition to the information in chapter 2 about the six villages we here present the increase in numbers of inhabitants since the 1930s. The aim is to describe how the increased population pressure has affected villagers' needs to extend their water supplies.

Kinds of Water Source

Some useful definitions and illustrations of man-made water sources are given in Table 5.1 below. The equivalents in English and Swahili are given.

Table 5.1. Definitions of water sources

English/*Swahili*	Definition	Appearance
Roof catchment (*kusanyika maji*)	Any container to collect roof water using gutter or not	Plates 1, 3
Pond (*kidimbwi*)	A standing body of water enclosed by the ground, no embankment (natural or a dug hole)	Plates 5, 20
Lambo/charco (*chako, lambo*)	A standing body of water with systematic raised bank (man-made) and without spillway	Plates 8, 9, 11
Dam (*bwawa*)	A reservoir for surface runoff with earth bank on impermeable ground and with a spillway	Plates 17, 19
Spring (*chemichem*)	The water flows up or out of the ground	Plates 4, 12, 14, 21
Well (*kisima*)	Often a cylindrical hole dug vertically into the ground (lined or unlined) Modern with hand-pumps	Plates 6, 7
Borehole (*kisima kirefu*)	Mechanically drilled hole with a small diameter	
Piped supply (*bomba la maji*)	Water pumped from a lake, river or a borehole and transferred through pipes to waterpoints	Plate 13

Sources: Malcolm, 1953 149-73; WMP, 1978 v16A 1-23; Parsons, 1946 197-213

Water Sources and Changes in Population Density

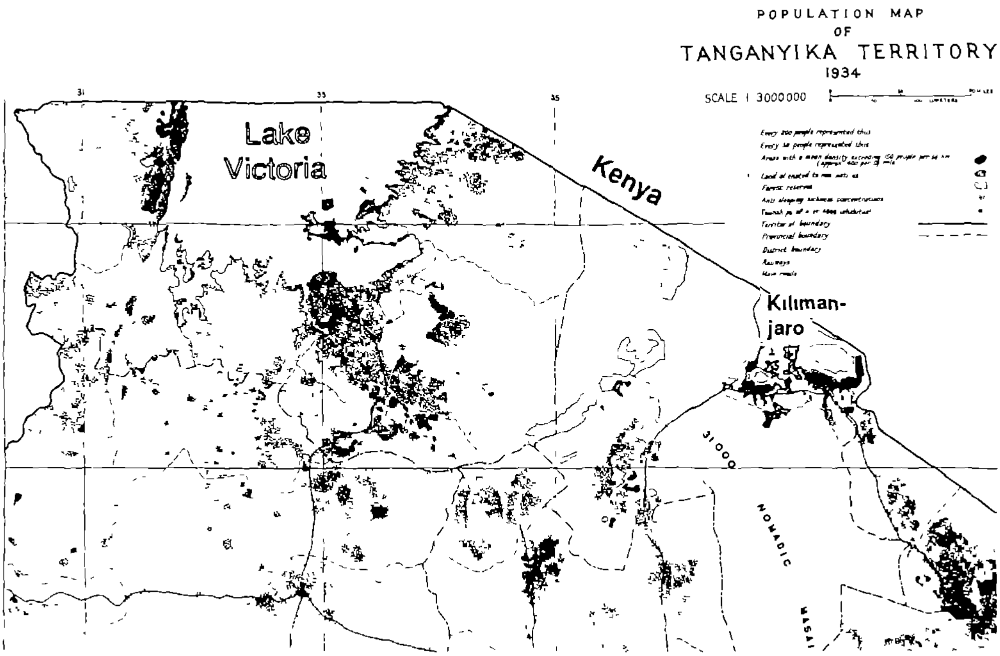
Many informants gave vivid descriptions of more prosperous conditions when they were young. Igogwe, for instance, was remembered as densely forested before the Second World War; valley bottoms were covered by grass and reeds and hills were covered by woods. The last three lions left the village in 1948. The *Kwa Sukila* spring was found by the father of one of the informants in the 1920s when he was clearing land in the bush. Today the area is denuded of natural vegetation and is extensively cultivated and grazed.[1] Only mango trees are scattered around the village, while hill-tops with granite outcrops look like giant heaps of pebbles (see picture on the front page). The lack of trees is also

[1] Parts of Sukumaland were denuded earlier. Malcolm (1953 6) wrote ". in densely populated parts of Sukumaland, there are very few trees or shrubs left, other than those planted by Native Authorities as wind-breaks or fuel plantations and also regenerating bush on hill-tops, which is reserved under Native Authority legislation "

confirmed through seeing the bundles of "firewood" of tiny twigs collected by women. Today the runoff is rapid into seasonal streams and rivers and the infiltration is said to have decreased to the extent that wells do not keep water over the dry season any more.[2]

A major reason for the change in land use in Tanzania is the increase in population. Between 1967 and 1978 and again between 1978 and 1988 the net increase exceeded the total population in the country in 1931. The water consultant Clement Gillman (1936) estimated the mean number of inhabitants per km^2 to be 40.9 in Kwimba, 8.4 in Maswa (part of present-day Kwimba and Magu) and 19.9 in Mwanza District (including the northern part of present-day Magu); whereas later population censuses give corresponding figures for the whole of Mwanza region to be 54 (1967), 74 (1978) and 96 (1988).

Already at this aggregate level it becomes clear that the pressure on existing natural water sources has increased substantially. The official population statistics allow us to trace numbers of villagers to the time when many of the informants were born i.e. around the Second World War. Gillman's map of Sukumaland below is a section of his national map and it shows the distribution of people in 1934.



Map 5.1. Population map of part of Tanganyika Territory, 1934. Every 200 people represented by a dot.
Source: Gillman, 1936.

[2] Gillman (1938:18) wrote that "the lightly jointed and bush-covered granite conserves much of the precipitation and feeds springs in the upper reaches of the surrounding pediments, and the sandy river-beds characteristic of this landscape likewise preserve throughout the year an easily exploitable shallow groundwater table."

Population increase between 1931 and 1988. Some elderly villagers assisted in documenting changes of names of villages and the boundaries, yet it has not been possible to establish population figures beyond all doubt.[3] Keeping these uncertainties in mind, it is still worthwhile to present the village population figures.

Table 5.2. Population figures for the villages included in this study

Village	1931	1948	1967	1978	1988
Igogwe	1,725	1,567	1,838	2,641	3,688
Lwanhima	few	?	1,114	1,020	2,781
Kongolo	2,634	2,962	3,355	3,675	4,068
Mkula	few	?	2,870	4,015	4,551
Bupamwa	few	?	?	1,542	2,019
Runere	?	?	1,622	1,882	2,299
Mwanza town	?	8,883	34,861	110,611	169,470
Nation	4,740,706	7,410,269	11,958,654	17,036,499	22,533,758

Sources: District Books, gazetted figures for 1948, and population censuses of 1967, 1978 and 1988

A major impression of the population figures is how varied the demographic development has been in the six villages: Kongolo has been densely populated for most of the century; Mkula did not exist before the 1950s. Another feature is the burgeoning rate of increase in later decades, with Lwanhima expandeding fastest of all.

Population and water sources. Gillman in 1938 also mapped the nature of water supply (well-watered, fairly-watered and poorly-watered). From his map one can conclude that Mkula and Bupamwa were situated in poorly watered, essentially uninhabited, tsetse-infested areas, while Runere on the road to Shinyanga was situated in a well watered area on the border between inhabited and uninhabited areas. Igogwe, Kongolo and Lwanhima were situated in the well watered and most densely populated parts of Sukumaland, albeit Lwanhima was at that time only sparsely populated. The structural change caused by the increasing numbers of inhabitants and ensuing increased demands on existing water sources are discussed below.

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[3] The provincial administration needed data on the number of tax-payers etc and did a village census in 1931 (reported in the district books of that year) and enumeration data for all gazetted villages were compiled in 1948 and published. The first post-independence census was carried out in 1967 and attached was a detailed map of enumeration areas The villagization in the early 1970s involved major changes in habitation; some names were changed, enumeration areas used in the census of 1978 differ from those of 1967. Only the 1978 and 1988 censuses are easy to compare

Water has always been plentiful and easily accessible in the subvillage (*kitongoji*) **Lwanhima** due to one perennial, extremely high-yielding spring and several small discharge points along the gentle slopes and a nearby river-bed, all providing water for the whole year. The population increased slowly at first but in the 1980s it almost trebled. The demand for water shot up and distances to water sources were increased. Villagers developed some shallow water sources and two hand-pumps were installed, although they are hardly being used. The informants lived 200-700 steps away from most water sources and no informant rated household water as a major household problem.

Informants in **Igogwe** had easy access to water from two good, perennial springs and a water-bearing stream-bed of a seasonal stream. The village had a stable population for some 40 years but in the last two decades their numbers have doubled, placing more stress on water resources. Some ponds were recently developed and in 1988 three handpumps were installed in the subvillage. Our informants lived some 200-400 steps away from most of the water sources; two of the five complained about water as a major problem.

Kongolo has easy access to water from the lake and from two springs, one yielding abundant water. It is an old settlement and the number of villagers has increased slowly, at a rate less than the birth rate would lead us to expect. The distance to water sources varies around 200 steps and only one informant rated household water as a major problem. Several new shallow wells were nevertheless being constructed in the subvillage where the informants lived.

Access to water has always been considered a problem in **Mkula** since there are no good springs but only low-yielding trickling water in stream-beds during the dry season. The area was virtually uninhabited up to the 1950s when a mechanised cotton farm was established with an Israeli management. During the 1980s the number of inhabitants stabilized and there was a net migration out of the village. Some ponds were recently dug and in the 1980s four shallow wells with hand-pumps were constructed. These were out of order in 1990, and the water taps of a piped scheme had been dry since its inception. The informants have to walk about one kilometre to dry-season water sources but only two out of five felt water was a major problem.

Bupamwa is endowed with small seasonal springs but has no natural water sources in the dry season. There are plenty of low-yielding dug wells, ponds and *lambos* some of which retain water the year round. The area was opened up by tsetse clearing enterprises in the 1930s (see Appendix A). The large dam built in 1956 holds some water although it is heavily silted. The population has grown steadily. Piped water taps were installed in the 1970s but these have never operated. The informants were some 200 steps from their water sources all normal years, yet two of the five informants claimed water was a major problem.

Runere has plenty of water holes during the wet season but only a few *lambos* retain water throughout the dry season. The Ndagaswa river-bed, 1.5 kilometres, away provides excellent water the whole year round. The village was a booming business centre a few decades ago, but only a small shop is left after the economic decline in the 1980s. Despite

Plate 1. Roof Catchment with short gutter and a plastic bucket.

Plate 2. Drum in hallway (200 ltr). Scoop to the right.

Plate 3. Large cement urn to collect roof water (UNICEF)

Plate 4. Woman collecting water at a spring. Stepping stone at the outleft leading the water to shamba with sugar cane and bananas

Plate 5. Girls drawing water from a pond

Plate 6. Dug well (4m). Queue of buckets in the dry season

Plate 7. Well dug in natural opening in volcanic layer

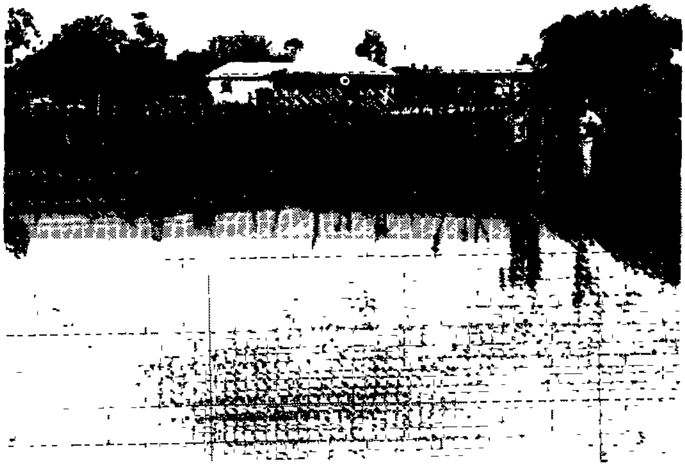

Plate 8. Lambo for cattle and household use. Cattle kraal in the back

Plate 9. The same lambo just after it was excavated by a road-grader. Dry season.

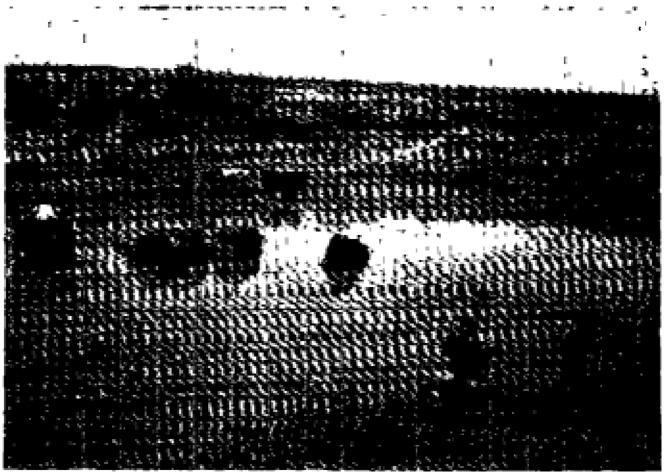

Plate 10. Shallow water source shared by cattle and people

Plate 11. Cooperative effort to clean overgrown *lambo*

Plate 12. Improved spring with a broken windlass. Standing water

Plate 13. Non-functioning standpoint for piped supply

Plate 14. Improved spring with cement cover and hand-pump

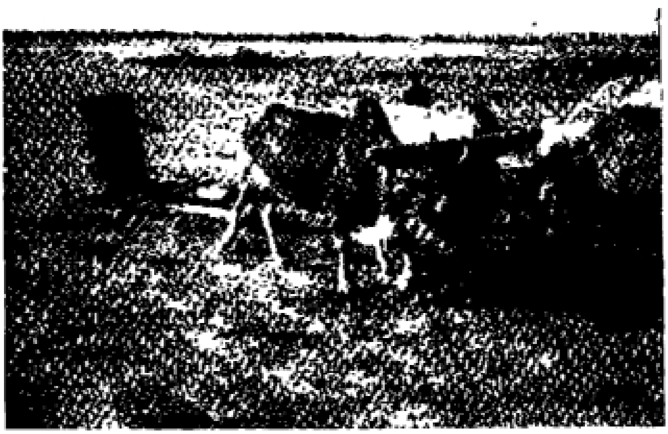

Plate 15. Oxen pulling sledge with a drum of water for building a house

Plate 16. Elevated clay pots in the storage room. Drinking water in the corner with a cup on the lid

this the population has gone on growing The informants faced great seasonal variations in distances to water sources, and all informants stated that household water was one of their major problems.

Water Uses

The amount of household water used by rural people varies from a bare survival rate of a few litres per person per day in arid areas up to several hundred litres in countries like Sweden. In Sukumaland, as shown in chapter 2, the amounts vary with seasonal changes in accessibility. There is a trade-off between water quantity, quality and health: Cairncross (1992) argued that people can benefit significantly by using more water even if it is of poorer quality. A daily consumption of 20-25 litres would, according to the London School of Hygiene and Tropical Medicine bring significant health benefits. The balance between water quantity and quality has to be determined in a local context Table 5.3 shows minimum quantities and qualities of water for various uses.

Table 5.3. Daily per capita water use for various purposes

Use	drinking	cooking	cleaning utensils	washing clothes	hand-washing	cleaning/ bathing
quality required	safe	medium	medium	poor	poor	poor
quantity (lit/d/p)	2-4	1-2	>1	>1	>2	>5
at home	yes	yes	yes	both	yes	both
at source	no	no	no	both	no	both

Source: The author's impression of reasonable amounts of water for the different uses.[4]

Some of the uses (indicated by 'both' in the table) are feasible both at home and at the source, be it a river, *lambo* or well. Instead of bringing a lot of water home, people can bathe and wash their clothes at the source This practice reduces workloads but can endanger water quality by polluting the source.

[4] Villagers' perceptions of washing the face with water were studied in a trachoma project in Tanzania (McCauley et al , 1990 1236) Women argued that they did not have the time to carry extra face-washing water, their children were unwilling and they would be dirty soon after When asked how many faces they could wash with a demonstrated litre-can, the men thought they could wash one or two but they were able to wash 12 men with their litre of water The women thought they could wash five or six but they washed between 30 and 35! The investigators concluded that it was not the absolute absence of water that prevented face washing but the perception that such washing took a litre of water and that it was less important than other water uses

Household Water Choices in 1990 - the Case of Lwanhima

Observations from Lwanhima are reported here to illustrate a general household water supply situation. The *kitongoji* Lwanhima bears the same name as the village where the Lwanhima-informants reside. It is situated on a gentle slope from the hills down to the seasonal river Nyashishi about a kilometre away. Half-way down the slope there are occasional discharge spots between the sandy soils and the lower calcerous, harder soils, some of which have been "developed". There are tiny seasonal streams from the hills which are used. Before villagization people lived near the river, but in the early 1970s they were forced to settle further uphill where water sources were scarce [5] One informant described the change and the end-result as follows.

> Earlier we lived down in the valley and we shared a well with our neighbour. We are fortunate here because the water never dries up After villagization, women had to walk further to fetch water. But, since the move was compulsory they have got used to the situation and today they would refuse to move back (Author's note: they are allowed to move back since 1986). (L1f2a:400)

The renowned spring *Kwa Shingisha* has been there for as long as people remember; it provides enough water for neighbouring subvillages even at the peak of the dry season. The area around the spring is saturated and sugar cane and wet rice are grown there. A little (150 steps) further away from *Kwa Shingisha* there is an old communal *lambo* for cattle. A 60 metre deep borehole was sunk next to it in 1977 (no. 249/77) with a yield of 8,800 lt/hr. This facility was provided with a hand-pump in 1984 but it is not used for human consumption. In 1984 a six metre-deep shallow well (no. RW 33/2-40) yielding 500 lt/hr was sunk next to *Kwa Shingisha* and provided with a hand-pump. This shallow well is used mainly by teachers at the primary school.

A standard water supply situation for an ordinary household in this *kitongoji* is like this; the household has between three and five water sources at a reasonable distance during the wet season and this number will fall to one or two toward the end of the dry season. The water quantity deteriorates progressively during the dry season and the use-pattern changes accordingly. The walking distances to various water sources are shown on Map 5.2.

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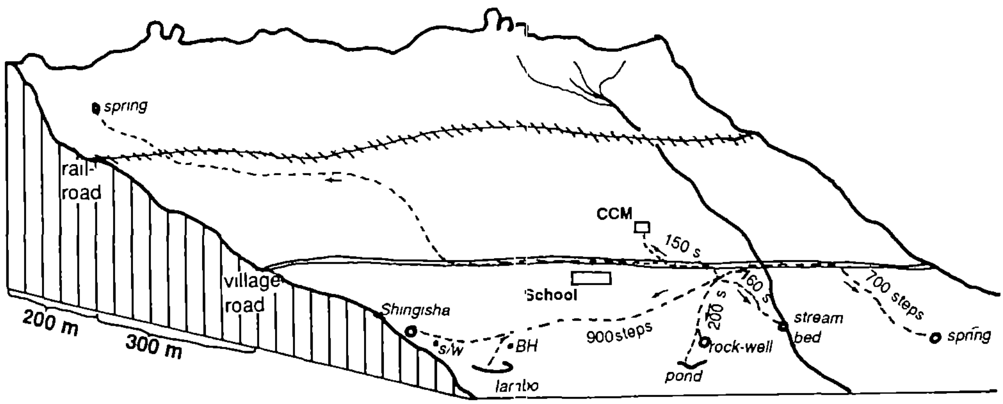
[5] The "average" villager had access to 0 6 litres of water per day during the dry season in 1976 according to the WMP-team



Map 5.2 Walking distances to water sources (in number of steps)

From November to June the household X can choose to fetch drinking water from a rock-well 200 steps away; or when there is rain they can gather the runoff from the iron-sheet roof of the CCM office some 150 steps away; or they can go to the spring *Kwa Shingisha* some 900 steps away, say, every second day. Water for cooking and other purposes is drawn from a dug-out in the seasonal stream 160 steps away. Washing of clothes, which requires plenty of water, is done at a small pond 250 steps away. Women may bathe there as well. Young men bathe in the *lambo* (700 steps away) while small children and the head of household take their baths at home, sometimes in hot water.

With the approach of the dry season the nearest water sources dry up and the spring *Kwa Shingisha* becomes the main water supply, in preference to the shallow well with a hand-pump, because it has a better taste. Some household water is drawn from another spring (actually a shallow-dug seepage hole in a discharge area) some 700 metres away. High-quality spring water can be brought from the foot of a hill far away, but the yield is very small at the end of the dry season. The *lambo* retains water the year round and is used for bathing.

These then are the choices available to the women each day when deciding where to draw water. The water supply situation at Lwanhima is better than the average, but all decisions to install an additional water supply are made against a background more or less similar to the one at Lwanhima. The drawer of water will choose a blend of water sources which meets the household's quality and quantity requirements, her desire for social encounters, the available time, etc. When viewed in the light of the choices available to a single household the pros and cons of the additional (marginal) supply are most intriguing, given the number of possible combinations and permutations of water quantity and quality.

Present Access to Household Water - Comparing Kind of Water Source, Water Quality and Distance in Six Villages

Water sources were observed in both wet and dry seasons, and the informants assessed the water quality at each source. Actual distances to the household water sources were measured and the quality of drinking water at the source and at home were assessed. The results are presented in this section.

Water quality. Households collect drinking water from a few sources and seasonal alterations in quantity and quality determines which ones are used, rather than convenience i.e. distance. In January 1993, in the relatively dry period between the short and long rains, a count of faecal coliforms took place at sixteen water sources and in the informants' storage vessels.[6] The result was as follows:

Table 5.4. Number of faecal coliforms per 100 ml in water sources where drinking water is drawn

	Number of faecal coliforms per 100 ml					No. of
Source	0	0-10	11-100	101-300	301-1,000	samples
Springs - protected - unprotected	 - 0	 - 4	 21 -	 - 276	 - ca 700	 1 5
Shallow wells	0,0,0	4,4,7	-	-	-	6
Ponds	0,0	-	-	-	-	2
Dug wells	-	-	-	175 175	350	3
Rain water	0,0,0	1	-	-	ca. 700	5
No. samples	9	5	1	4	3	17+5

Source: Own measurements, January 1993.

No faecal coliforms were found in one-third of the water sources, four had less than 10 per 100 ml. and one contained 21 faecal coliforms. According to Feachem these eleven out of seventeen water sources were of good standard. Another two unprotected springs and two dug wells contained less than 300 faecal coliforms and could be improved by simple measures (see chapter 7). The two remaining water sources with more than 300

[6] The faecal coliform count was done according to standard procedures the test water is sucked through a membrane filter which is then placed on a wetted nutrient substrate in a Petri-dish The sample is is kept cool during transport to the incubator in which it is kept at 44 5°C for 24 hours after which the colonies are counted.

faecal coliforms, but less than 1,000, should be treated in some way before drinking. The collected rainwater fulfilled the stringent recommendations by WHO, except for one household.

Distance and drudgery. The example of Lwanhima shows that households have a choice of where to get its supplies both of drinking water and water of lower quality. In Table 5.5 below we move away from Lwanhima alone and show the situation of all the 30 informants in the six subvillages in the study. For simplicity, only the **nearest** water source of each kind is included. Data on approximate distance, given as the number of steps to walk one-way (one step is about 0.8 metre) are given. For instance the second column shows that in the dry season 15 informants collected their drinking water from springs; five from modern shallow wells (s/w); five from rivers; four from wells and one from a *lambo*. Dry-season sources are ones that do not dry up during the height of the dry season unless there is a severe drought.

The nearest water sources of lower quality include 11(5) ponds, 9(8) springs, 6(5) wells, 2(2) hand-pumps, 1(1) streams and 1(7) *lambos* in the wet (dry) season. Roof catchment arrangements are presented, including owners of thatched roofs who collect rainwater at some neighbouring building (a neighbour's house or a school or CCM-Office).

Table 5.5 shows that the informants in the six villages faced considerable differences in distance to nearest drinking water source, while the difference in distance to lower quality sources is much less significant. The reliability of the data about lower quality sources is high but some of the distances to drinking water may have been exaggerated; and we were unable to confirm by observation that all household members actually obtained all the drinking water they used from the specified water source.

The difference in distance to the nearest water tap or modern shallow well with hand-pump was measured. It clearly showed that the walking distance is only rarely reduced by any one capital-intensive modern water intervention. The reason is thought to be that the Water Department tends to develop new wells in the same vicinity as existing wells and springs where they know that high yields can be expected.

Table 5.5. Kind of water source used by each of the 30 informants. Distance to the nearest drinking water (other than roof catchment); to lower quality water in the dry and wet seasons; and to (according to informants) "potential" water source.

Drinking water					Lower quality water				
Dry season		Wet season			Dry season		Wet season		
steps away	kind	steps away	kind	Roof catchment	steps away	kind	steps away	kind	Potential site
Lwanhima									
300	spring	300	spring	grass	250	s/w	250	s/w	250
700	spring	300	well	bucket	200	stream	200	stream	100
650	s/w	400	well	1 drum	550	lambo	400	well	100
650	s/w	400	well	1 drum	550	lambo	400	well	100
750	spring	200	well	bucket	250	stream	200	well	40
Igogwe									
1000	spring	0	spring	3 drums	150	pond	120	pond	20
100	spring	100	spring	bucket	100	spring	100	spring	20
450	spring	450	spring	drum	300	s/w	300	s/w	150
300	s/w	300	s/w	2 drums	550	spring	550	spring	10
120	s/w	120	sw	2 drums	800	spring	800	spring	20
Kongolo									
180	spring	180	spring	1 drum	180	spring	180	spring	20
200	spring	200	spring	urn	200	spring	200	spring	30
300	s/w	300	spring	grass	180	pond	180	pond	1
280	spring	200	spring	1 drum	280	spring	280	spring	20
150	well	150	well	grass	150	well	20	well	20
Mkula									
1500	well	450	pond	5 drums	1500	well	20	lambo	20
1500	spring	850	pond	1 urn	600	pond	100	pond	100
1400	spring	800	pond	1 drum	800	pond	100	pond	100
1500	spring	850	pond	1 drum	600	pond	100	pond	100
1500	spring	250	pond	bucket	1500	spring	250	pond	?
Bupamwa									
400	spring	400	spring	1 drum	100	well	20	pond	20
20	spring	20	spring	1 drum	20	spring	20	spring	–
20	well	20	well	grass	20	well	20	well	20
400	lambo	300	spring	grass	400	lambo	300	spring	200
300	well	250	lambo	grass	300	well	30	well	–
Runere									
700	river	700	river	grass	700	river	100	pond	100
1200	river	360	spring	1 drum	480	lambo	10	pond	10
1100	river	120	spring	grass	480	lambo	120	spring	50
1200	river	360	spring	2 drums	480	lambo	20	pond	20
1400	river	70	spring	grass	120	lambo	70	pond	25

Drinking water sources. Drinking water comes from springs, river beds, wells and a *lambo* in the dry season; additional supplies are found nearer to home in the wet season. Twentyfive out of our thirty informants used a roof catchment to collect water for drinking; it is reasonable to assume that they rely on rainwater for at least three or four months a year and usually considerably longer since the dry season is "only" about 160 days east of Smith Sound. (There are some 50 rain-days per year in Sukumaland (Tabora WMP, 1982:v4:27)). When there is no rainwater in the wet season the average distance to the source of drinking water differs little between the six villages; it varies between 200 and 300 steps one-way, except in Mkula where informants on average walk 640 steps. As water sources dry up in the dry season from (say) July to October, this wet-season distance is approximately doubled, except in Kongolo and Bupamwa where the same water sources are used all the year round.

Only five of the 30 informants said they use drinking water from government-provided shallow wells. Most of them, except teachers in Lwanhima and Igogwe, thought that water quality (taste) was lower in modern installations than in springs and riverbeds. Another reason why few people used hand-pumps in Mkula is that they were broken down and out of operation much of the time. The data also bear out the important conclusion that, except in Runere, wet-season distances do not differ much between modern and *own-key* arrangements; this is because ring wells have usually been sunk next to existing springs and wells.

We can convert distance into time spent. One bucket of drinking water a day is enough for most households (average household size 6.4 by 2 litres). One return trip to a water source is about 700 steps (=560 m) in the wet season and it takes about ten minutes, or even less when there is rainwater in the drum. In the dry months the average walking distance is 1,400 steps (return); this takes some fifteen minutes excluding waiting-time at the water source. The range between individual households is great, however, varying from 200 to 3,000 steps or from a few minutes to half an hour.

Water for non-drinking purposes. The bulk of water is utilized for other purposes than drinking; informants often wash clothes and bathe at the source in order to save the energy required to carry the water home. Adequate water for cooking, washing dishes and similar uses is found 200 to 1,100 steps one-way in the dry season. Mkula residents are very far from all kinds of sources, whereas the Runere people have *lambos* nearby with water all year round. If we assume about six members in a household, each using on average 10 litres a day (excluding water for drinking and for washing clothes), then fetching water for ablutions, cooking and washing dishes will require between 2,000 and 12,000 steps with a 12 litre bucket. At a walking speed of five kilometres per hour the time demand on the households varies from 20 minutes to two hours a day in the dry season, excluding waiting time.

"Potential" water sources. The informants had spotted what they believed were potential sites for wells at distances from 15 to 100 metres from their houses. If such new wells could be successfully developed and if they yielded low quality water at least in the wet season, half of the informants would be able to reduce their walking distances by between 100 and 300 metres compared to their present wet season water sources of lower quality. The other half seem to have optimized the time and energy saving already from having a new water source nearby - the lower-quality sources now in use are at the same distance as the "potential" sources. The benefit would still be substantial, however, where a new well is capable of yielding water also during the dry season. The present distances would then be shortened by between 200 and 900 metres one-way.

Ranking of Water with Other Rural Problems - Causes of Dissatisfaction

The informants generally said they enjoyed living in their village, and would not like to live in town, although water may be more readily available there. Several of them have spend some years in a town but they said that town-life is hard and characterized by a constant shortage of money In contrast to living in a village, they said, everything has to be paid for by town dwellers like food and housing The problems that face Tanzanian wage-earners for the last decades (Drangert, 1987) have dimmed some of the brightness of city lights.

Assessment of household water. Inquiries about possible dissatisfaction with household-water conditions were made at the end of a fairly lengthy dialogue on knowledge issues e.g. health hazards, rains and where to find water above and below the ground. Thus, the informants were fairly conversant with what constitutes a water "problem". In fact, their awareness may have been raised to such an extent that they brought up problems which would otherwise not have surfaced at all. Even so, less than half of the informants conceived of their own household water supply as a major problem. As indicated in the comment below there were geographical variations.

> I think that we who live in the Mwanza district have water close by For instance, my wife just left to fetch water and she is back in a short time. So we do not face a water problem here. Perhaps people living in Kwimba district have water problems. (L1f2a:320)

The informants rated such constraints as poor housing, shortage of firewood and lack of a nearby health facility or milling machine as far more serious than their water problems.[7]

[7] The WMP-team (1978.v16.316) mentioned that more respondents wanted a health facility than a new water source Today's fairly favourable water situation only points up the abysmal lack of operating modern health facilities and made our informants even more in favour of interventions like providing trained nurses, purchase of medicines etc which cannot be done by the village Bevan et al. (1989:241) found that health and water supply are highly rated both retrospectively (25 8 per cent

One elderly couple said:

> Really, the most serious problem is manual work in the fields Both myself and my husband are getting old and we are less fit for hoeing. We do not have a big problem with water, our wells are enough and only cultivation by hand bothers us. (I3IIa30)

Twelve ranked water as a major problem. Twelve informants, six of the 17 men and six of the 13 women, claimed that water was one of their major problems. Seven said the long distance was the major problem; four emphasized water quality; and one complained about queueing at the source (Table 5.6) Of the six villages, none of the informants in Lwanhima and only one in Kongolo saw water as a major problem. All five in Runere village had major problems with water, as had two out of five in each of the other three villages. There was no evidence to show that households with many children had more water problems than those with few children. Married women were neither more nor less satisfied than other female informants. Those who held public office complained less about their water situation than those having only one or no duties in the community.

Seven of the ten informants who said they were more than a kilometre from their drinking water source in the dry season were among the twelve who ranked water as a major problem. The other three rated distance as a second-order problem; one household had an ox-cart to fetch water, and the other two had many young people in the house to lend a hand. Only one informant living less than 400 steps from a dry season source of lower-quality water considered distance to be a major problem.

Four informants rated unhealthy water as a major problem; two mentioned diarrhoea and the other two spoke of schistosomiasis. Only one said anything about water tasting bad; on the contrary, several of them said their water tasted good. The twelve informants were asked whether they faced other water problems besides the major one (denoted 2nd and 3rd); their answers were·

Table 5.6 Rating of water problems by the twelve informants who conceived water as a major household problem

Distance			Quality			Queues	
1st distance	2nd queue	3rd quality	1st quality	2nd distance	3rd taste	1st queue	2nd distance
7	3	2	4	4	1	1	1

Distance still leads the table but queueing is catching up. Incidentally, the single informant who claimed queueing was a major problem lived 100 steps from a handpump with an extremely low yield

and 15.7 per cent) and prospectively (34 3 per cent and 29 4 per cent).

Water as a second-order problem. When the 18 informants (11 men and 7 women) who did not rate water as a major problem were asked what water problems they had, sixteen specified long distance and its attendant drain on energy,[8] and two mentioned unsafe water as a health problem.

Interpretations of ordering of problems. One striking difference between the discontented group claiming major water problems and the relatively contented people who rated water as a second-order household problem is the distance they had to travel to lower quality sources. The discontented group faced markedly increased distances in the dry season, whereas the others had to go about the same distance throughout the year. The absolute distance does not seem to matter so much as the variation in time demands between seasons. It may be argued that when the distance is considerable the year round people are used to it or they use some kind of transport. If the distance varies with season people have to change expectations accordingly and it is an open question whether that is an incentive or constraint to *change.*

Another notable difference between the two groups concerns the location of the assumed "potential" water sources. The informants who faced major water problems had about the same distance to the existing wet-season sources of lower-quality water and the potential sites, while the "potential" sites were far nearer to those who said they do not have any major water problems. It may not be too far-fetched to suspect that some informants who could shorten the distance and reduce the drain on household energy by developing these potential sources had decided for some reasons of their own not to draw attention to their water problems. Whether they feared the consequence to develop the potential water sources on their own or whether some other factor is at work cannot be determined here.

Informants' Views on the Cause of Water Problems

The perceived cause of a problem is likely to influence the remedies which are adopted. If there is too little water because of a decrease in rains, the remedies are of one kind; if the cause of the shortage is lack of equipment another kind of solution is called for. The informants' responses to our enquiries about the different causes of the prevailing water

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[8] African women master the skill of carrying loads on their heads or backs. A recent study (Maloyi et al , 1986 668) found that both Luo and Kikuyu women in Kenya could carry loads of up to 20 per cent of their body weight without increasing their rate of energy consumption Recent experiments on humans, horses and dogs showed that energy expended in carrying a load increased in direct proportion to the weight of the load, for instance, 20 per cent in the above case. Gebhard (1944) investigated some Finnish methods of carrying water as for their efficiency compared to hand-carrying one bucket at a time He found that using the double yoke the efficiency could be raised by 80%; with the hand-pulled cart by about 200%, and with a combination of sledge and cow by some 230%

conditions fell into three categories. First were the "victims" who found the causes totally outside the control of the individual or even the neighbourhood; thus, nature provided the existing endowments; villagization forced people away from their water sources; or population growth put a strain on water sources. These informants saw themselves as the victims of external forces:

> We lived in dispersed settlements and perhaps four or five households used the same water source. After the villagization we live together. We had to leave some sources and could not continue to care for them The clustering of people is the cause of the present water problems. (M1:f1b485)

The second category consisted of informants who admitted to some form of responsibility; they perceived water problems as caused by inappropriate habitual behaviour, failure to dig wells or maintain supplies, or they said population pressure has caused deforestation which in turn has decreased water yields. These people who perceived that they or their communities had in one way or the other failed to respond to a changing environment, may be called the conscientized group. The ability to see that something should be done does not necessarily lead to action. The conscientized tend to admit that they could have done more:

> During the drought I did not think of digging a well near to the homestead but was rather occupied by thinking about where to find water for the day (B4Ia220).

Responses of the "victim" type sometimes overlap with the conscientized group as shown below:

> After villagization people needed a lot of wood for building new houses. Also many started to sell fuelwood and charcoal to town. The result was that hills were denuded. In 1978 we tried to enforce a by-law to prevent cutting wood in the hills, but people did not adhere to this. Now we are planning to plant trees to secure the water-flow to the springs and ponds further down the hillsides. Some people continue to cut what is left; they do not understand the long-term consequences of their action. (L2:C3)

The third category consists of informants who talk in terms of lacking knowledge to do something. They wish it to be known that they are aware of actions which could be taken, but that they have failed to act due to lack of knowledge. This may be a sub-category of the "victim" group, since ignorance is not viewed as an obstacle capable of being overcome by human efforts but as a chronic condition which cannot be changed.

About half of the responses belonged to the "victim" group, somewhat fewer were "conscientized", and a few belonged to the "chronic ignorance" category. Interestingly enough, there was no difference in the responses of those who said water a major problem and those who did not Male informants were predominantly "victims", while females emphasized the conscientized- and chronic ignorance-explanations. There was no discernible relationship between the level of formal education and the view taken as to the cause of the water problem. Nor did the interview technique uncover a difference in views between those informants who had already successfully implemented a water improvement and those who had not.

Several authors claim that rural people believe that things have always been like they are, which, in turn, makes change less likely. Cory, for instance, wrote (1960:15) in a paper on "Sukuma Religious Beliefs and the Supreme Being Likube" that "No sacrifice and prayers can reach him; he has done his work but he is not working any more because all there is, has never changed. The idea of evolution does not exist." Noble (1970:30) claimed in a more practical fashion that the Wasukuma thought "the good life is already here.... never occur to a Sukuma man to set out to make things better and better and better." This attitude may hold true for some people but cannot be said to represent the informants' views.[9] Most of them were content with village life in general but some of them were very much involved in making things "better and better".

Reasons for improvements in the near future. Our informants were invited to express their views on reasons for improving water conditions within a foreseeable future; their answers may shed light on what factors they thought might support improvement. The responses presented below are aggregated into some general categories.

Table 5.7. The informants' reasons for improving water conditions

10	'increased awareness about water problems and solutions'
7	'government has failed and we have to take action'
4	'the drudgery of collecting water'
3	'improved health'
2	'to avoid collecting water from afar in old age'
2	'no reason to take action'
1	'leaders push for improvements'
1	no answer

A general awareness, which may have been enhanced by the interview situation, was indicated in ten answers and expressed in statements like the following.

> If we do not dig wells now we are in for trouble soon when the other sources dry up because of an ever-increasing population. Also the girls will refuse the hard work allotted to rural women and they will run to town. Where we are heading there are no women of the kind that will accept the present conditions (*mahali tunapokwenda hakuna watu wa namna hii*). (K3IIa220)

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[9] The proverb "*Ng'habi uwacha*" literally means 'it is only the dead who are poor' P.S.A Itule in Mwanza interpreted it as follows 'before you die you always have a chance to be well off' (personal communication)

Experiences seem to have moulded informants' views of anticipated future improvements. Disappointment with modern interventions contributed to raising awareness and the desire to improve *own-key* supplies. However, a further analysis in section C is needed to conclude whether this awareness and other given reasons should be interpreted as signs of an urge to modernize.

Discussion and Conclusions

The formulation of the problem decides the solution. The informants assessed their household water conditions to be rather favourable compared to those prevailing in 1975/76, as presented in chapter 2. This warrants a comment. The early 1970s was a period of large-scale redistribution of villagers where many were moved to places without easy access to water.[10] The water conditions were unfavourable but the WMP teams probably overlooked many existing sources possibly in an attempt to secure interventions on a massive scale to improve the rural water supply. The WMP assessment everywhere may be summarized as *'a serious water shortage for part of the year'*

Since then a number of water sources have been developed. By the time of the present study in 1989-90, 12 out of 30 informants expressed serious concern about their water situation, while most of the other eighteen had other problems more pressing than water. Most informants' assessments may be described as *'enough water for most of the year'*.

These two ways of describing a reality, where one says there is a serious shortage for part of the year whereas the other say there is enough for most of the year imply totally different attitudes toward what should be done, when and why. If the problem is negatively visualized as one entailing a serious water shortage for a period, this demands immediate action, almost inevitably in the form of government intervention. The WMP proposed a major programme of drilled boreholes which, however, was turned down by the potential financiers. If, on the other hand the situation is positively conceived as one where there is enough water for most of the year, then there is time to plan and no immediate pressure for remedy.

The fact that 18 of our 30 informants said they had no serious water problems in 1989 means that it will be difficult to encourage groups of neighbours to formulate a common strategy to make cooperative efforts. Without a widespread consensus about what the problem is, it is more likely that individuals or small groups of neighbours will have in the near future to take action without the cooperation of the rest.

Reliability of assessments. In the last chapter reliability of information was discussed and interpretations of responses to our questions like "The situation is satisfactory so there

[10] Carlstein (1980 252) said one of the main contradictions with villagization was in the realm of time utilization; for the adult population to enjoy a few hours of services per week, they had to spend many extra hours travelling to fields farther away

is no need for action" were analysed. The responses could well reflect precisely that view. However, such an answer could also reflect the informant's sophisticated unwillingness even to let himself become aware of the work which will be required of him if he answers that the situation is unsatisfactory. Similarly, the interpretation of assertions that water problems do exist is tricky. Some problems are genuine by any yardstick. But partly because of the seemingly haphazard distribution of official assistance, informants may exaggerate the seriousness of the problem in order to attract support. However, there are at least two important indications that the expressed assessments are consistent. As far as distance is concerned there was a reasonable match between those with long but varying distance to the water and those with a "major problem" (Table 5.8). And almost all our informants were in favour of further improvements to their water supplies over the course of time (Table 5 7).

Pitfalls were avoided to a reasonable extent by encouraging villagers to embark upon a process in which they thought through their own problems. Thus, without any guiding by the interviewer, 18 informants declared after the broad-ranging discussions which accompanied their first interview that they intended to implement a selected *own-key* activity in the near future.

Water quality. Only five informants out of 30 were dissatisfied with water quality and only two of the five had more than 10 faecal coliforms per 100 ml. in the source where they drew drinking water. The previous WMP survey provided a more negative picture; some 25 per cent rated their water as "bad water", a term which included bad taste, odour, colour and appearance. These problems were rarely mentioned by our informants; in fact, only one of the twelve with serious household water problems mentioned poor taste. Among the 25 informants who did not find water quality a problem only five had faecal counts above 10 per 100 ml in the water source.

Water quantity. Our informants differed from the WMP respondents in that they did not mention the low quantity of water *per se* as a specific problem. They saw the problem in terms not of raising total water quantity but of household time and energy: almost all stressed long distances, drudgery or queueing. Too small an amount of water may be available to the household either because the source is far away or because the low yield at the source causes long waiting times or rationing. The distinction between problems caused by too small a quantity and those caused by the amount of time needed to obtain water from the source should be clearly recognized since their respective consequences and the methods needed to remedy them may be very different. If, for instance, the problem is defined as one of distance and if the distance is shortened, it may not result in increased use of water to improve hygiene but rather a diversion of household energy with less time now spent on water, more on other activities. If, on the other hand, the problem is one of too small a quantity of available water, they will use the new source nearby to increase the amount of water for handwashing etc.

Expectations about who should do what The example below is about wells. These can be constructed by an individual household as well as by cooperative efforts, and thus the data do not favour one activity before the other. Table 5.8 shows the kind of efforts the informants expected in relation to their dry-season distance to the drinking water source and his or her rating of water conditions.

Table 5.8. Informants' expectations of who should develop wells. Informants are characterized according to their walking distance to drinking water in the dry season and how they rate household water conditions (one informant missing).

	Distance to drinking water source in dry season: less than 400 steps	Distance to drinking water source in dry season: more than 600 steps	Total
Major problem	0	Household 3 Cooperative 4 Total 7	3 4
Second-order problem	Household 5 Cooperative 6 Government 3 Total 14	Household 4 Cooperative 4 Total 8	9 10 3
Total	14	15	29

The fact that no-one having less than 400 steps to the drinking water source claimed that water was a serious problem is a sign of high reliability of the answers (as conceived from a shopping-point of view as suggested in chapter 4). Informants with a distance exceeding 600 steps anticipated individual and cooperative efforts to be taken to the same extent. Informants with less than 400 steps and who considered water to be a second-order problem anticipated less household and more cooperative efforts and even government intervention. Such expectations are analysed in chapters 11 and 12.

6

Water Accessibility;

Sukuma and Scientific Knowledge

Introduction

This chapter and the next deal with the extent of our informants' knowledge and skills in relation to access to water and water quality. Sukuma knowledge about these matters are reviewed from two perspectives: *popular* knowledge amongst ordinary villagers, and *folk* knowledge among specialists like rainmakers and healers. Professional or scientific knowledge and knowledge possessed by formally trained staff represents a third kind (Kleinman, 1980).

Information about *popular* knowledge is mainly gathered through interviews, supplemented and cross-checked with observation of actual behaviour. Sukuma *folk* knowledge is presented as it appears in written documents. Sukuma knowledge is compared when appropriate with current professional/scientific knowledge in order to assess the potential for *own-key* improvements.

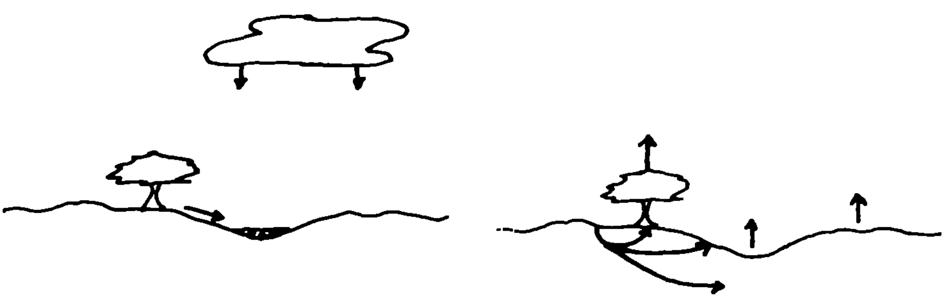
Specific knowledge and skill are helpful and sometimes indispensable in implementing certain improvements. For instance, knowledge about the rain pattern and soil properties is essential when choosing a suitable site for a dam. Seepage should be minimal and the dam-wall and spillway must be designed so that the runoff does not wash away the dam. What does current knowledge about the rain pattern look like among the Wasukuma? Does it fit well with data from rain gauges in the area? How do villagers judge and what characteristics of subsurface layers are suitable to prevent seepage?

As this example and the questions suggest, a variety of practical knowledge and skills is required in dam construction The kinds of knowledge discussed in this chapter are those needed for various 'technical' solutions. Table 6.1 gives an overview of how some knowledge items are connected to different water improvements.

Table 6.1. Knowledge required for various techniques to obtain household water.

Knowledge items:	Construction	Hydrology	Geology	Conta-mination	Protection
rain	gutter, tank	rainfall	clays for pots		clean roof
lake	pumped water	evaporation		schisto-somiasis	remove snails
stream	impoundment	catchment recharge	sand river	faecal pollution	sieve/boil
dam/pond (*lambo*)	bank, tank	runoff evaporation	impervious soils	schisto-somiasis	fence, bund
spring	impoundment short pipe	groundwater recharge	permeability		pipe, cover stepp. stone
well	dig, lining cover, pump	groundwater levels	aquifers	faecal pollution	apron, lifting device
borehole	mech drilling	deep water	geology	flouride	apron

The continuous circulation of water between the atmosphere and the earth is visible only in limited manifestations like clouds, rain, overland flow and lakes; other activities like evapo(transpi)ration, soil moisture and groundwater, are invisible.



Visible water Invisible water

Even water quality has a visible aspect like appearance, colour, taste and odour, and an invisible one with (say) chemical or bacteriological features.

Sukuma Knowledge about Visible Water

Is there less or more rain nowadays? Our informants said the rains usually begin in October/November and finish in May; they stressed that rainfall varies considerably between years. When asked to assess whether there is more or less rain now, most informants said there had been no discernible change in the amount of rainfall over the longer term. However, one-third said there was less rain nowadays; they attributed this to deforestation. Trees are believed to slow down winds and give enough time for the clouds to deliver rain instead of moving on to other areas. Some informants believed that the rains today fall later in the season.

Several informants also noted that dry years tend to follow dry years and wet years follow one another. Some referred to the biblical passage about seven fat years and seven lean. Villagers naturally remembered exceptionally dry years like 1985, 1973 and 1949.[1] Some also recalled the early 1960s when the rains were abundant and caused the level of Lake Victoria to rise by two metres.

Can man manipulate the rains? The *popular* view is that winds catch the clouds over the lake, turn them around and bring them to Sukumaland where they provide rain. People acknowledged that it is possible to manipulate the rains, most commonly by afforestation. Most informants explained that trees reduce the wind speed and give the clouds time to precipitate the rain. Some also claimed that forests attract clouds and spoke about forested areas up in the uninhabited hills receiving abundant rain.

As a short-term measure people tended to put their faith in God when it came to situations of too little rain or prolonged droughts. This is mainly done by praying in church and sometimes also through the intervention of rainmakers. This study did not investigate the extent to which rainmakers still practice in the area. It may be sufficient to note that nearly all informants claimed that they do not believe in rainmaking; they said that rainmakers only start working when the rains are due anyway and that they cannot make rain in July or August. The informants were very sceptical about rainmakers and several said they were charlatans. Incidents like the following in 1985 probably contributed to this impression:

[1] An estimated 600,000 cattle perished in the 1949-50 famine (Imani za Jadi, 1988) Hendricks (1959) recorded the following famines in northern Usukuma (*nzala* means hunger) Nzala ya Libangwe 1800, Nzala ya Ndilı 1815, Nzala Katilimuke 1840, Nzala ya Bangwe 1875, Nzala ya Sugilo 1882, Nzala ya Shenye 1894, Nzala ya Mitundu 1897, Nzala ya Nyama 1914, Nzala ya Maharage 1919, Nzala ya Budaga 1934, Nzala ya Mandege 1938, Nzala ya Ng'wehela 1943, and Nzala ya Dona 1948 Holmes (1969 147) referred to a (Magogo) famine around 1890.

> Outside the district town there was one rainmaker who claimed that he could bring rain. He asked the villagers for support in kind for his activity. He was not successful to start with and he told the villagers that he had to travel far to get stronger *dawa* (medicine) that would bring rain. He required them to bring food and other provisions in large quantities. So they did, and the rainmaker disappeared. He never came back. (R1I)

One informant told about how difficult it is to assess the ability of rainmakers.

> Earlier on there were many rainmakers, but today only a few are left. Myself I don't know or believe that a person can make a medicine which attracts the rain. But it is really true! (L4f2:240)

Three informants said that black smoke could attract rain. In the book *Imani za Jadi za Wasukuma* (1988) the smoke argument was compared to aeroplanes spraying silver iodine on the clouds to initiate rainfall. On the other hand Blohm reported that some people said after the Tabora-Mwanza railway was inaugurated in 1928: "the rain does not like to fall because of the new smoking machine" (Blohm, 1933:173).

The Sukuma calendar. Chiefs used to send observers to visit other chiefdoms to collect information on climate and indications of what the weather would be like. The collection of such data increased hydrological knowledge substantially among the *folk* specialists.

The Wasukuma at one time developed a specific calendar to guide them as to the time of the year and approximate dates when various agricultural activities should start and end. The calendar has fallen into disuse and is incompletely known to commoners. This is partly because the mysteries of the calendar were the exclusive prerogative of the chief and his specialists.

The Wasukuma used the moon to measure time while seasons were primarily monitored by a cluster of stars. The moon takes about 15 days from new to full moon and another 15 days to the next new moon, so the Sukuma month had 30 days and was bisected. The Swahili word *mwezi* as well as the Sukuma word *ngweji* both mean month and moon. Shorter periods were measured in days; the Wasukuma did not traditionally use the unit of a week.

The Sukuma "year" consisted of about twelve revolutions of the moon, because exactly twelve would give only 360 days and the year would become too short. This was compensated for during the dry season in order to give the same dates from one year to the next. The year started with the beginning of the rainy season.[2] According to Blohm

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[2] Kwimba District Book A17, page 154 "In old times .. the Chief in his own good time would broadcast the message 'Tonight all men shall put out their fires, for tomorrow the fire of the New Year will be distributed.' The chief, by tradition, has professional fire-makers who will make 'new fire' and give it to the *wanangwa* (village headman) in the morning, so that he can distribute it to

(1933:142) the first month was somewhere in November or December, depending on whether the rains begin early or late. There are conceptual problems, e.g. the first problem facing the inventor of any calendar is what sign or indicator should be used as the "fixed point". Living close to the equator the Wasukuma can use stars, but not the sun or the moon to monitor the timing of the year. The cluster of stars known as *Ndimira*, "requisition of fields" in Kisukuma or the Pleiades in English, sets the date. The position of the *Ndimira* stars changes over the year in a way that makes it feasible for use in timing the main events of the agricultural season. When the *Ndimira* appears in the morning sky in the east just above the horizon at the end of October (*saa* 0)[3], the time to prepare the fields is approaching. Every evening it reaches higher and in January it has reached zenith (*saa* 6). When it is seen in the west after sunset, the planting season is over. *Ndimira* continues lowering each day until it disappears in the night sky in May (*saa* 12). The period between May and October was measured with the help of the moon. Table 6.2 below gives the main content of the Sukuma Calendar.

Table 6.2. The Sukuma Calendar. Rain and agricultural time-table for (part of) Sukumaland

Name (literal)	Ndimira's position	Month approx	Characteristics	Agricultural activity
Makunbang -halange	not seen	Sept/Oct	2-3 heavy rains	Preparation
Igabanha	appear	Oct/Nov	heavy rains	Tilling, crops grow
Lubingo	Saa 2	Dec	very heavy rains	-
Meri	Saa 6 (zenith)	Jan	occasional rains	Weeding, last planting
Satu	Saa 8	Feb	heavy rains start	Maize/beans may rot
Neh	Saa 9	March	heavy or very heavy rains	-
Sano	Saa 10	April	very heavy rain	Rice planting
Mayayi	Saa 11	May	small drops of rain and very localized	Harvesting
Tandato	Saa 12 disappear	May/Jun	last rain	Plucking cotton
Kinyela mu Mbeho	not seen at night	Jun/Oct	no rains and hot sun	Threshing and storage

Source: Oral information, 1989.

all households in his village."

[3] The Wasukuma start counting the hours of the day from the appearance of the sun at about six o'clock in the morning (*saa* 0) and count onwards up to noon (*saa* 6) and finish at sunset about 6 pm (*saa* 12). This way of counting the position of the sun from zero to twelve is applied to indicate the angle above the horizon for the *Ndimira* stars as well

The calendar indicates a bimodal pattern of rainfall. The main rainy season is during the period February/March-April with very heavy downpours, and the other in November-December still has fairly heavy rains. All these rains are intensive and cover many days. Before, between and just after these rainy periods the rain is said to be scarce and not so intensive. The strong influence that climate has on the livelihood of the Wasukuma is indicated by giving names to different kinds of rains; *kaboja* (heavy downpour), *mayayi* (scattered showers), *nzumbe* (small drops for a whole day), etc.

The informants claimed that spatial distribution of rainfall is very uneven in Sukumaland. This fact forced the Wasukuma to adapt their calendar to area-specific conditions.[4]

Sukuma rituals and traditions on rain The Wasukuma, like other agricultural and pastoral people, depend on the rains for their livelihood. The variations in rainfall within the year as well as between years make life easy in some years and hard in others. It is unsurprising that most Sukuma rites relate in one way or another to agriculture and rains. Among the traditional prayers collected and translated by Balina et al. in the 1960s, the elders' prayer for rain is as follows

> O God, you come from Balang'hani, Bisugilo, Bakalwinzi and Bamazoya; you bring us prosperity; you continue westward to Ruhinda.
> -- You take away evil, you put it into the lake
> -- We want to be peaceful, so that we may get good crops, many children, goats, cows and let rain come.
> O kind God come down, come down. (Balina et al., 1971:4)

Rain is traditionally believed to be a gift of God, but the chief together with the rainmaker were responsible for performing the necessary rites which "cause the clouds to come and grow larger till they are heavy with rain which will fall" (Millroth, 1965:134; Welch, 1974:174). Disasters such as drought, destructive storms or floods were not blamed upon God but on evil spirits. The disaster may have been caused by a person who failed to observe one of the prescribed taboos to the ancestors (Balina et al., 1971:6). Or it also happened that the rainmaker was blamed and ostracized (Cory, 1951). According to Charles Holmes (1969:101) successive droughts in Nera seemed to be the pretext for the ouster of both Chief Kadaso and his son Kwiyukwa from their positions.

Welch commented that "Rain is primarily used symbolically in the folk tales, and it helps to create an atmosphere of frustration for the characters" (Welch, 1974:174).

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[4] The District Officer E.C. Baker in Musoma District found that tribal calendars for some neighbouring groups used partly similar names for the months but sometimes in a different order (Baker, 1952.30-33)). Hugo Huber recorded a detailed agricultural calender of the Kwaya in Musoma Region in 1965 and 1966 without encountering any confusion of names (Huber, 1974:49-54). The Pleiades played an important role in the calendar of the Incas (Roslund, 1991 v8:31).

Several European researchers have taken an interest in rainmaking in Sukumaland, including Cory (1951); Hatfield (1968:102); Liebenow (1955:237-8); Millroth (1965:96) and Welch (1974:162-185). Cory gives the following account of a rainmaking ceremony:

> First two perfectly new cooking pots are obtained into which are placed two white stones, a small quantity of rain water obtained from the first slight showers and mixed with *dawa* (medicine). On the day of calling down the rain a black goat and a white sheep are slaughtered The blood from the goat is mixed with the other ingredients in the pots, and the blood of the sheep is boiled separately with other dawa and is used for smearing the face of the Rain Doctor. The meat of the two animals is cooked and eaten by him, in addition to a dish of cooked food brought in to him by each of the villagers. The ceremony having been performed, the people return to their homes and the *Nfuti Mbula* (rainmaker) is left alone to hold communion with the 'spirits'. He makes a large fire of green grass from which arises dense clouds of smoke. From this day on he continues to call in a loud voice at regular intervals of the day to the 'spirits'. He is granted a period of a full month in which to achieve success. (Cory, 1951:328)

The Regional Hydrology of Sukumaland

The climate in Sukumaland is semi-arid to sub-humid with an average bimodal precipitation of 800-1,100 mm per year falling mainly during the short rains in November-December and the long rains in February-April. The distribution of the yearly precipitation is irregular with the extreme values of 400 and 1,450 mm/year in Kwimba district (see Figure 2.3).

General pattern of rainfall. The hydrological pattern in East Africa is partly influenced by the monsoon winds; these are surface winds and they rarely reach levels over 5 km.[5] The two monsoon winds differ only in direction and the air masses which they bring are remarkably similar. Above this level there is an easterly wind all year around (Nieuwolt, 1977:57). Nieuwolt sketched the Inter Tropical Convergence Zone (ITCZ[6]) and the general picture of the winds at different altitudes. In January the ITCZ is 15° S and the winds are northerly over Sukumaland (Fig 6.1); they have continental origin and bring little rain. The only areas with precipitation during this season are situated near the main

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[5] Meyer (1909:286) reported some of the results of Person's Ballontest in 1908 by saying that the portion of almost only easterly winds reaches high and at 15,000 metre a portion of westerly winds commence. The temperature at 18,800 m is -88 C

[6] ITCZ is a belt (trough) of low pressure in the central tropics into which winds converge. The trough is created by air rising due to the latent heat released in cumulus cloud development (Jackson, 1989:17)

zones of convergence. When passing over Lake Victoria the winds may pick up some moisture which increases the rainfall.

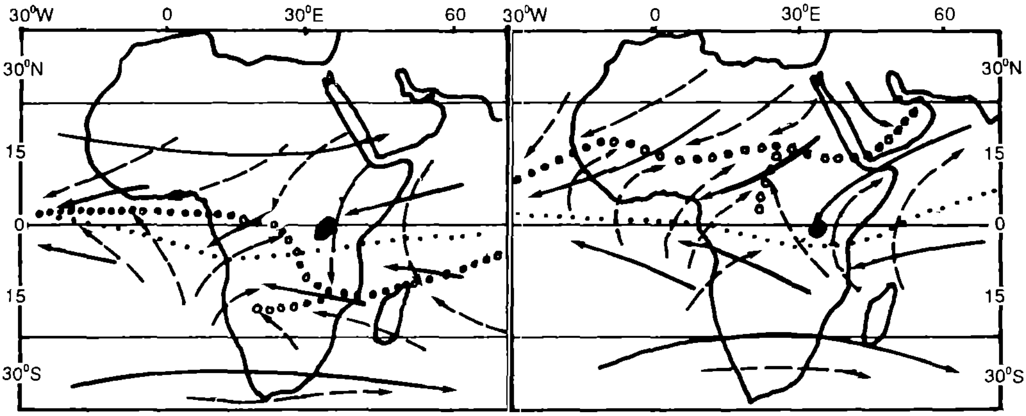

Figure 6.1. Winds and the ITCZ in January (left) and July (right) at different altitudes. Lake Victoria is indicated on the equator. (Arrows = winds; dots = ITCZ)

— — → Near the earth's surface i.e. ———→ Higher layers of atmosphere
oooooooooo 1.500 m a.s.l or 850 mbr. •••••••• 5 600 m a.s.l. or 500 mbr.

Source: Nieuwolt, 1977:58

In July the position of ITCZ is 15° N and southeasterly winds prevail over East Africa. These continental winds bring very little rain. Even those air masses which have gathered moisture over the Indian Ocean are dry, having shed most of their moisture on the mountains of Madagascar and on climbing the highland plateau in central Tanzania.

Thus, in most of East Africa both monsoon seasons are relatively dry, and rainfall is concentrated in the intermediate seasons when the ITCZ moves over the region on its way from one hemisphere to the other. Jackson (1989) emphasized the significance of disturbances of the circulation (as opposed to the movement of the ITCZ) when explaining the rainfall pattern.

The Victoria Lake area has in addition strong local circulations; these vertical currents interact with the seasonal air currents and produce sharp zones of wind and temperature gradients. This produces an atmosphere which is convectively unstable and very difficult to predict. Winds from the Congo Basin may also occasionally reach the western part of Sukumaland. During the day the unsaturated air near the ground is lifted to the condensation level which is a kilometre above the ground. During the night the air comes drifting down again.

Hankins (1974) found in his detailed study of the rainfall patterns over parts of Sukumaland that April had a generally high proportion of rain falling as heavy storms for all stations except Ukiriguru (near Lwanhima); December had a relatively low proportion of such heavy falls, again with the exception of Ukiriguru. The lighter rainfall in December is a fortunate circumstance because heavy rains after planting can wash away seeds and cause erosion. In April, when the crop cover is well developed, the heavier rains are less damaging.

The November rainfall provides a guide to which are the high and low rainfall areas; the drier villages tend to have considerably less rain in November than in December, while the reverse is true for the wetter stations/villages (Hankins, 1971:19). Hankins noted that the mean number of rainy days was highest in November, December, March and April at most stations; somewhat lower in January and February, and much lower in May and June. Hankins also observed that there is no easily discerned pattern in the proportion of daily rainfall in each size category (0-10 mm per day, 10-20 mm, etc.)

The main dry season in Sukumaland usually extends from June to September/October and becomes progressively more pronounced inland from Lake Victoria (Malcolm, 1953:7). The median length of the annual dry spell is less than 100 days in the north, increasing to 150 days in the south. A day is considered dry if the rainfall is less than 5 mm i.e. approximately the same as the amount evaporating in a day (Tabora-WMP,v4:27).

Runoff. Runoff, streams and rivers are all part of visible water. Surface runoff travels as overland flow and reaches the rivers shortly after it rains, as indicated by the discharge data in Figure 6.2. Thus, the river flow largely reflects the rainfall in the catchment area and it is easy to observe inter- as well as intra-annual variations.

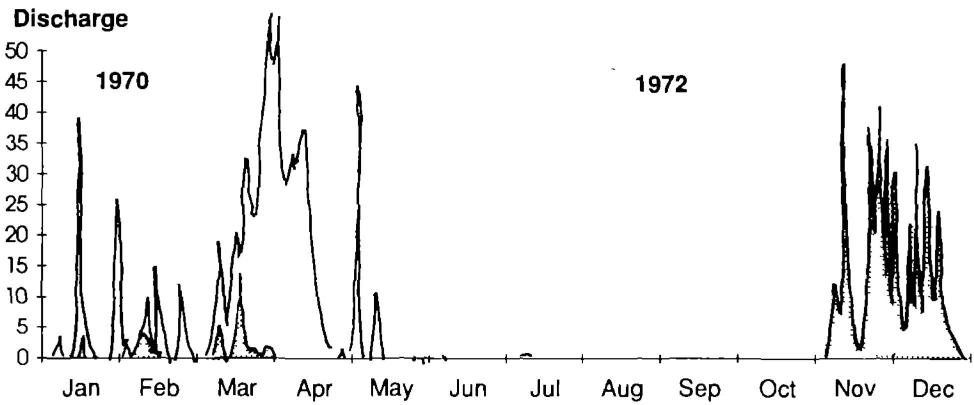

Figure 6.2. Magogo River discharge at the Mwanza-Shinyanga road-crossing (m^3/s). *Source: WMP, 1978 vol.4 diagramme 4.5.42.*

The Water Master Plan data on the major rivers in Sukumaland was collected over a short period between 1970 and 1976, except for Simiyu at Ndagalu which goes back to 1965 (MWP, 1978:v6). None of the rivers flows all year round; they hold water only in ponds or sand-filled bends during the dry season. The Moame river, which meanders between Runere and Bupamwa villages and is their main water source during serious droughts, is without running water for 145 days a year. One important use of the data is to enable us to calculate runoff: the total river discharge corresponds to 37 mm of the total rainfall of some 800 mm per year.

Comparison of Sukuma and Professional Knowledge

A comparison of Sukuma knowledge about visible water with that of scientists or professionals shows many areas of agreement on rainfall patterns. The main difference is that the Wasukuma do not quantify their findings; their qualitative assessments are generally close to those of the scientists and professionals.

Water and agriculture. It is reasonable to assume that both *popular* and *folk* knowledge about rain are geared more towards arable agriculture than household water or even livestock herding This assumption holds at least in areas where grass rather than water is the limiting factor, and water is always available in Lake Victoria.

Farmers base their views on generations of experience of rainfall. They use this "database" in their daily life decisions. This location-specific knowledge is quite likely to be superior at times to the kind of generalized knowledge which emanates from agricultural research stations; this is especially so if local variations in rainfall are as great as they are in Sukumaland.

Hankins (1974) delved into the old disagreement between agricultural extension staff and farmers as to the best planting time for cotton. The extension staff were certain that cotton should be planted by mid-November all over Sukumaland while the farmers extended the planting from mid-November to early January. Hankins found that most farmers planted only slightly later than the time recommended by researchers. He further argued that farmers had good reasons for planting when they did: a concern for rainfall variability; a desire to avoid rain at harvest time (which is not a problem for a researcher); and the use of less intensive husbandry. Hankins' work shows how much input data is needed in judging local practices against agricultural research findings.

The simple fact that farmers have to live on what the land produces, while researchers do not may be enough to explain why some farmers feel a need to believe rainmakers. Adding to the complexity of this matter, Blohm (1931:173) observed in 1931 that "people believe until today that the amount of rain has decreased because of the Europeans since they are rain magicians." Perhaps this particular piece of *folk* knowledge was developed as a strategic political weapon aiming at undermining the colonial power, or perhaps it was a way to explain the successes of European-style agriculture.

Rainfall pattern. Two out of three informants said no observable change had taken place in the annual amount of rain; this conclusion is supported by the 40 year rainfall data from Ngudu some 20 to 30 kilometres away from Runere and Bupamwa villages (see Figure 2.3).

The variation in rainfall between years and more so between seasons is considerable and almost inhibits a generalized, qualitative description. In the case of the qualitative Sukuma Calendar we limit the comparison to monthly rainfall (Figure 2.2); and to actual rainfall data from a rain gauge in Mkolani; neighbouring Lwanhima.

Table 6.3. Rainfall at Mkolani CCM Office, 4 km from Lwanhima
mm = millimetre and no = number of days with rainfall

Month	1985		1986		1987		1988		1989	
	mm	no	mm	no	mm	no	mm	no	mm	no
January	46	2	22	4	77	5	36	3	99	14
February	116	8	85	6	188	7	101	7	69	10
March	55	3	111	7	93	4	169	7	167	14
April	369	20	98	4	93	13	n.a		93	13
May	114	6	145	7	67	2	79	8	34	2
June	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	20	1	0	0
August	0	0	0	0	0	0	25	3	0	0
September	0	0	tr	2	20	2	23	3	38	4
October	0	0	96	6	87	7	51	15	n a	
November	55	5	38	5	127	7	147	8	146	8
December	82	6	110	5	7	2	107	6	91	5

Source: The CCM Office, Mwanza Municipal

A simple scanning reveals that the pattern of rain distribution over the year fits reasonably well with the Sukuma Calendar and so does rain intensity.

The popular idea that the winds bring clouds from the lake and deliver rain over Sukumaland is supported by Jackson as he writes:

> At night, land breezes induce convergence over the lake, releasing latent instability in the lower moist layers which produce *cumulo nimbus* and thunderstorms on most nights.... The lake breeze during the day is funnelled up the gulf (at Kisumu) and reinforced by an anabatic wind to create a strong lake breeze front during the afternoon over high ground at the head of the gulf. The front meets the easterly airstream and this converges, together with thermal convection, results in a strong afternoon thunderstorm maximum. (Jackson, 1989:40)

One point of disagreement between researchers and subsistence farmers concerns whether and how rain may be manipulated. Science has no certain answers to such basic questions as whether forests increase or reduce rainfall,[7] so it is impossible to judge the

[7] Morton's overview (1989) of current scientific knowledge in this respect gives the impression that the main functions of the hydrological cycle are understood, but he emphasized that detailed

correctness of Wasukuma lore on this matter. We were unable to confirm a traditional belief that deforestation causes decreased rainfall - the colonial powers have pressed this point hard since the turn of the century.[8] We only know that the idea is not founded on any indigenous knowledge about transpiration through the stomata of the canopy.

The thirst of the atmosphere. Most informants are familiar with the process of the sun and winds dry up the topsoil and open bodies of water. No informant had given any thought to the amount that may evaporate. The soil moisture may decrease due to less rain, but also due to higher evapotranspiration caused by changed land use.[9] The topsoil dries up but the atmosphere cannot take its full toll of water from the soil since physical rules exert counter-forces. Coster (1960:47) estimated that evaporation is almost as high from the river-bed sands as from an open water-surface. He furthermore stated that as the water-table drops the evaporation decreases until it ceases at the level of 2 ft. 6 ins. below the surface of the sands.

When informants were asked what they thought should be available in a new place they might consider moving to, they mentioned soil fertility and some social services, but few mentioned water sources.[10] The reason for this was not elaborated, but Gillman provided a possible explanation.

> Not only are the residents of the peneplain *miombo* convinced that "water follows man" but they have from time immemorial acted on this conviction not only when choosing sites for small *miombo* settlements but also when pushing cultivation steppes further and further into the woodlands. ... As a typical example I can quote my own investigations at the concentration of Nyonga in south-western Tabora

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assessments are lacking due to lack of data as well as to methodological problems

[8] The Military Commander Gaston Scholbach (named Suluba by the Wasukuma) was, according to Holmes (1969.195), the first of the Germans to engage in serious conservation programmes by placing strong restrictions on the indiscriminate cutting of trees, a practice which had created a critical fuel shortage on the denuded steppes of Nera

[9] In semi-arid areas the potential evapotranspiration (evaporation and transpiration) exceeds the precipitation during a large part of the year and therefore the soil moisture is reduced and the growth period of the vegetation is short. But, as Morton mentioned, environmental research requires the recognition that a biological system can differ from a physical system and the feed-back by the vegetation can modify, and even reverse, the effects of small-scale processes (Morton, 1989:21).

[10] Cory writes (n.a. paper No 190:1) "Some permanent water sources should, if possible, be available but men will settle on fertile soils as far as 5 miles from a permanent dry season water source regardless of their wives' exhaustion in fetching water at the hottest time of the year. The fertility of the holding is the point in which the householder is interested and compared with it little else is of importance "

> District.... From the medical records it appears that when the site was chosen in 1924 there was only one poor waterhole serving ten people from which it took an hour to fill a four-gallon tin. The growth of the concentration in the first few years is shown by the following figures:-
>
> | Year | Area | People |
> |---|---|---|
> | 1924 | ... a few acres ... | 10 |
> | 1925 | ... 3.5 square miles ... | 1,400 |
> | 1926 | ... 9 square miles ... | 2,300 |
>
> Already one year after clearing had started shallow groundwater appeared and by November 1926 "large quantities of water were found quite near the surface" and "there has been no shortage after 1925". At the time of my inspection (August 1938) the groundwater table had risen in places so high that several huts had to be removed because the ground under them had become too wet! (Gillman, 1943:75)

Nevertheless, none of our informants brought up this idea of "water follows man"; one reason may be that to do so would directly contradict the accepted dogma that deforestation leads to less rain and reduces yields in water sources: it would be "backward" to claim that "water follows man". It is also possible that the Wasukuma have changed their ideas about the consequences of deforestation. At this point in time it is safe to say that neither the scientific nor the traditional communities have finally resolved the issues; this is perhaps because the mechanisms behind depletion and recharge of water sources are so site-specific and valleys, plains and hill-top areas react differently. Some researchers and some farmers think that afforestation increases groundwater levels; others think the result is depletion of groundwater resources resulting from increased evapotranspiration.

'Invisible' Water: Sukuma Knowledge and Skills

The invisible water requires more ingenuity to trace than the visible water. The groundwater may be there at shallow depth, but if the search is to be more than guesswork people need to know what kinds of features indicate promising sites.

The Wasukuma have over the years learned where to expect to find underground water. They have learned about vegetational signs and what the soil looks like when they have been engaged upon locating and digging graves, latrines, ponds and wells. Latrines and graves have to be dug where there is no water, while wells must reach the groundwater. It is essential to know about such properties of the soil as whether it is impermeable; stable enough to prevent a pit from collapsing; and easy to excavate. Indigenous knowledge gathered from the interviews is outlined and compared with current professional knowledge in hydrogeology. Our comparison below allows us to assess how far Sukuma knowledge is capable of contributing to the development and maintenance of new and existing water sources.

Dug graves - a soil content test. Sukuma men have long experience of digging grave pits in the ground because the Sukuma tradition prescribes burial for all, not only for chiefs as in neighbouring areas (Baumann, cited in Abrahams, 1967:76). The practice is that of

> ...burying chiefs and doctors in a sitting position on a small chair with a branch of the '*mlangali*' tree (*Euphorbia candelabrum*) in the right hand. Ordinary citizens are buried lying; men on the right side facing the sun and women on the left side facing the moon. (Bale, 1942)

The grave is usually located in a field close to the homestead. A Sukuma grave pit is ideally rectangular and up to 7 feet deep. Digging graves is the task of adult men. Women wash the corpse but do not take part in the burial ceremony, so at best they have secondary information about how sites are chosen and the best conditions for making pits. A digging team obviously will try to identify a dry place or at least to avoid a site where it can expect to encounter groundwater. It will also try to avoid sites with hard layers and boulders in the ground. Our informants said they were usually successful in finding suitable sites for graves but that in some areas the environment did not provide favourable conditions. The men may have to use a crowbar to penetrate a rocky layer or to stop digging after 4-5 feet if they strike groundwater.[11] As the groundwater level rises in the rainy season digging is said to be problematic, particularly in water-logged areas. It is acknowledged, however, that where burials are concerned the mourners have no choice but to prepare the grave irrespective of season.

Latrines - inspection pits of soil and water profiles. Recent experiences in digging pit latrines have added to the store of *popular* hydrogeological knowledge among the Wasukuma This experience is widespread since most villages have by-laws stipulating that every homestead must possess a latrine, 7-12 feet deep. Failure to comply is punished with a substantial fine imposed upon the villager, and recurrent failure to dig a latrine is rarely heard of. Latrines are mostly dug by male household members. In contrast to digging graves, women are allowed at the site and they take part in carrying away the excavated soil.

As people tend to build more permanent homes nowadays and move less frequently, some of them are digging the second or third generation of latrines at the same homestead. The sum total of all the knowledge about soils and underground water possessed by the people in an area may be substantial. However, it is not recognized as

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[11] Kidumla (pers. com) "I recall that people made comments that the corpse should not be placed into water as this would destroy or pollute the water in the spring "

a general resource of hydrogeological knowledge of great value because much of it is restricted to the individuals' areas of residence.

Our informants described what kind of soils they encountered when digging. They knew whether the soil was stable enough not to collapse during the wet season etc. Some of them knew the names of the different kinds of soil. The farmers share a common language and they often have the advantage of showing each other the soil as they talk about it. One informant described the soil layers in his latrine pit:

> I have had a six-feet deep latrine since 1950, which we empty when it is full. The pit exhibit a top layer almost two feet deep. Then there is a one metre thick, fairly hard layer with small stones, followed by a sandy layer which is one metre thick. At the bottom of the pit there is a new hard layer. (K2C8)

Villagers prefer to dig in termite mounds as these are known to be easy to dig and do not fill with water in the wet season, even if 12 feet deep. The top of the mound is also elevated well above the general ground level which prevents overland flow from inundating and perhaps undermining the pit. "We dug our latrine pit in a termite mound. It was all white sand for seven feet under the top soil, but the wall is hard and does not collapse." (R3C8).

As excavations for latrines are deeper than those for graves the risk of encountering groundwater and boulders is greater too. Our informants had had many failures in siting latrines; these arose either from striking boulders big enough to force them to stop digging or abandon the site, or through striking water, even though the Wasukuma usually dig their latrines in the dry season when the groundwater level is at its lowest.

Of the latrines not sited in termite mounds more than half contained water during the wet season. Many informants claimed also that they stopped digging after about two metres because they sensed that they were about to strike water. They stop when "the water knocks on the door (*maji chini yanapiga hodi*)." This is a strong indication that there is at least some shallow ground-water available in most areas in the dry season. "The latrine pit is only a metre deep, so we do not expect water in it during the wet season. It is above the groundwater level." (L5f2a:180).

During the first fieldwork phase the author came across two latrine pits which were full of water early in the wet season.

> We dug a seven foot deep latrine in the dry season. I removed the one foot-deep top soil and hit a slightly thicker layer of limestone. Under this there was a ten cm sand layer on top of the next layer of hardpan. This one was three feet thick and I had to use a crowbar. Then I dug almost a metre in sand. I had to stop as water began to pour in from below and from the sides of the sand layer. Thanks to the hardpan I do not expect the pit to cave in. (B3C8)

In another case the search for a dry site was abandoned altogether, which shows how close techniques for latrines and shallow wells are

> My neighbour dug a pit for his latrine last year. At a depth of almost three metres he stopped because water began to enter. The next day the pit was full of water. He was sorry that his latrine was destroyed, and for a few weeks he thought about what to do. Meanwhile the water was used in the household. The chances of finding a dry site for another pit were deemed slim, and the prospect of digging a new pit was not an appealing one. He finally decided to put a cover on the pit and use it as a latrine, in order to avoid being fined. (M+BSIa350)

Ponds and wells. Traditional ponds are often mere scratches in the soil which provide no insights into the hydrogeology of the area. They have often been dug by women.

> At this spot there is always water in the wet season. There is a path leading here and the overland flow water enters by the same way. We usually draw water here instead of walking far. Perhaps there is water underground as well? (L2f2a:210)

The Wasukuma also excavate larger ponds called *lambos* to collect rainwater. There are some "wells" with rather steep sides leading to a water-hole some metres below, and more recently villagers have taken part in digging modern shallow wells. Shallow wells lined with rings may provide information about soils and water to depths down to, say, ten metres. In the lake area several Arab dwellings had deep rock wells dug by labourers quite some time back.

Villagers' conception of water availability in the ground. The general experience of digging for water, graves and latrines has enhanced the hydrogeological knowledge of the Wasukuma. Although in many places there are natural springs and water in the dry sandbeds of seasonal rivers, our informants also had a fair idea of groundwater availability in less obvious cases. The somewhat vague general impression seems to be that there is usually something like a stream or a lake at some depth underground.

The origin of groundwater is explained in essentially two different ways. Some informants said the water enters from Lake Victoria far away, even though the lake is situated at a lower elevation. Many Wasukuma knew that underground water can 'travel uphill', and some informants commented that "water is very cunning (*maji ni ajabu sana*)."

The more popular explanation, however, was that the groundwater is replenished by rainwater falling on the hilltops and percolating down, e.g. an underground river starting in the hills, finding its way through cracks and sandy layers and later appearing as a spring. A few informants combined their description of this kind of water flow with their concern that the widespread deforestation of hillsides will cause reduced yield of springs at the foot of the hills.

> After villagization people needed a lot of wood for building new houses. Also many started to sell fuelwood and charcoal to town. The result was that hills were denuded. In 1978 we tried to enforce a by-law to prevent cutting wood in the hills, but people did not adhere to this. Now we are planning to plant trees to secure the water-flow to the springs and ponds further down the hillsides. Still some people continue to cut what is left, and they do not understand the long-term consequences of their action. (L2:C3)

The idea of underground "rivers" is fairly widespread. One informant told of an incident in a village in his district:

> A pit latrine was dug deep into the ground near the secondary school. Then a nearby spring started to smell. The villagers suspected the latrine to be the source of the smell and concluded that probably this drinking-water source would be contaminated. (I3:C4)

In another case an account of underground water flow was given.

> The small stream from the hills disappeared into the ground before entering the bottom of the valley where a perennial river flows. On the other side of the river a small stream came out of the ground. The villagers were arguing whether this stream came from the river or from the disappearing stream on the other side. Some villagers decided to find out the truth. They poured several litres of blood from a slaughtered cow into the stream on the hillside. Then they ran down, crossed the river and waited at the spring to see if its water would be coloured. After some time the stream water coming out was reddish and they were confident that they had established that the disappearing stream went under the river only to turn up again on the other side. (AO)

Although these two cases could not be confirmed or observed during the fieldwork the stories themselves indicate that people are familiar with the idea of underground water flow. Furthermore, the Wasukuma knew that water in the ground not only moves horizontally, but also vertically between seasons. They knew this from experiences of saturated soils, ponds and wells drying up almost every year.

There were distinct explanations for alterations in the groundwater level over the year. One states that the (ground-) water has a tendency to move to lower elevations as the refill from the hills dwindles each dry season and the increment of water entering the pond or well is reduced. A well may dry up if it is too shallow. The remedy was said to dig deeper wells in order to ensure that the inevitable decline in the groundwater level does not reach as far as the bottom of the well. The informants were unanimous that this can best be achieved if digging takes place at the end of the dry season.

The second kind of explanation for falling groundwater levels relates to the sun and/or wind drying up the water body. The informants' perception of evapo(transpi)ration is that the water simply dries up and disappears, as it were into thin air. One informant commented that "the water table is raised in the night and lowered in the morning." (L5f2:50).

About a third of the informants displayed a school-book knowledge of the hydrological cycle but most informants left out either the evapotranspiration or the condensation of vapour in the atmosphere. One, better-informed than the others, explained the hydrological cycle as follows:

> When the sun dries the earth, the evaporating water climbs upwards in the air. High up this vapour concentrates in clouds because of the cold up there. When the clouds are heavy enough they deliver rain. (R4Ib50)

The concept of evaporation is often present and it is explained as "boiling" of surface waters. Several informants referred to a force which the air or atmosphere exerts (*nguvu ya hewa*) on water and soil moisture in order to turn it into vapour which is diffused into the atmosphere The rate at which the water evaporates is not known, and hence not taken into account when assessing for how long a pond will last in the dry season. The morning dew found on the leaves is said to "boil" and add to the vapour in the air. It is easy to confuse the dew on the leaves (condensed during cool nights) and transpiration from open stomata of the leaves, but this latter transpiration of plants seemed to be known to only a few informants

Search for Water Underground. The Wasukuma generally believe that there is water underground; the next step is to find out what they know about where to find it. This is where detailed local knowledge counts: when they look around the vicinity they are likely to recall what happened when they dug a latrine or pond in this place or that, and they are in the best position to judge what to expect to find nearby.

> It is all light sand here where we dug a 12 feet latrine. "Twice my length?" No, about your length so it must be six feet deep. Anyway, we stopped digging at this depth because of the danger of collapsing walls. Although we dug during the dry season there were signs of moisture. We expect to strike water at ten feet and it is very easy to dig. "What about digging next to the road?" Oh, it is difficult because you will strike water almost immediately. (K3Ib125)

No informant claimed to know for sure where to find underground water but during our on-site visits to individual homesteads most of them were prepared to point out where they thought would be the best locations for wells and ponds (Table 5.4 gives the distances to potential water sources). They sometimes also specified at what depth they expected to encounter the groundwater.

Digging teams make connections between the appearance of the environment above ground and what they hope to find underneath. Through this "hands-on" way of benefitting from past experience they have built up the kind of skills that enable them to identify surface indicators of promising sites. They rely on a combination of two types of information for their assessments: biological indicators like trees and grasses and geo-indicators like soils and land forms.

Geo-indicators of underground water. Topographical and soil signs are frequently used in search of promising sites. Valley bottoms with *mbuga* soils were rated as poor sites by the informants, because of the prevalence of deep layers of clay which prevent water movements. The informants said the clay soils in the plains "give no water". Hilltops are another kind of low-probability site, as are the hardpan soils.

Sandy river-beds are rated as excellent sites where underground water is almost always found.[12] People have always dug pits in dry river beds, where the water tastes good and is used for drinking. These pits or wells are easily destroyed by flash floods. A line of springs and seepage ponds often occurs along the frontier between the *luseni* and *itogoro* soils.[13] Less obvious sites for wells and ponds are located in the seepage or discharge areas on the pediments above the *mbuga* flats.

In Bupamwa and Runere villages in the flatlands our informants mentioned another way of detecting underground water. This is to stamp hard with your foot on the ground and listen to the sound. "If it sounds like a drum (*ngoma*) one can be certain there is water like a lake underneath". Several such places have been developed into ponds but they are said to dry up early.

Bio-indicators of underground water. All informants stated that certain trees and/or grasses indicate spots where there is water underground. Some may also tell whether the water is close to the surface or deep down depending on the length of the roots of the tree or grass. A few mentioned that a tree cannot show saturated areas or spots for the simple reason that trees cannot survive in a water-logged environment.

The most common tree-indicator mentioned is *mkuyu* (*Ficus sonderi*). The Wasukuma expect to find water at shallow depths close to this tree; several high-yielding springs in these villages are next to *mkuyu* trees. The *mkuyu* does not guarantee easily accessible underground water: the rock-well at Lwanhima was dug some 20 metres from a *mkuyu* tree but it dries up early because it is said not to be deep enough (5 ft).

> The *mkuyu* tree has very long roots, one penetrating downward some 10 metres to suck water while the other roots spread horizontally. I have not seen this myself, only been told. We also think that there is water close to termite mounds. We used both these signs to locate our rock well. (L52fa:100)

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[12] Coster (1960 47) comments that "Many of the sandy river-beds can be regarded as a pipeline traversing the arid countryside and in the aggregate supplying large quantities of water at the end of the dry season "

[13] The sandy *luseni* soil above forms a good aquifer and the underlying *itogoro* is sufficiently impervious to compel the water to issue (Stockley, 1947:20)

There is some disagreement about the *mkalituss* tree (Eucalyptus). One informant expained that its long roots may penetrate deep down, while others claimed that it has long horizontal roots. The latter case fits well with information given by three other informants that this tree has a remarkable capacity to dry up the surrounding area

One evident problem in using tree indicators is that most of the trees near the homesteads have been cut down.[14] Only fruit trees like mango, fig, baobab and tamarind are left, but not trees indicating underground water. This makes the search for proper tree-indicators haphazard. One tree, *mbubuti* (no other name), is said to be a very accurate predicter of water, but it is almost extinct.

Grasses seemed to be better known by our informants than trees, partly because shapes of grasses may be observed easily during cultivation. The main idea is to find spots where the grass stays green well into the dry season Wasukuma believe there is a fair chance of finding water in such spots; there is of course no guarantee, since underneath there may be a small aquifer without enough water even for a few households. Several informants had dug small rainfed ponds in such places and these usually held water up to June or July.

Almost all informants mentioned the *magogote* grass (*Couch grass*) as an indicator. This grass is said to have short roots, and thereby being able to stay green only as long as the soil remains moist One claimed, however, that it has long roots. Other grasses were also mentioned.

Modern Professional "Dowsers" and Their Assessments

The partitioning of water. Sukumaland is within the hydrological regime named semi-arid and sub-humid of the "dry warm sloping land"-type. There are also a few interspersed, large "dry warm flatlands". The general picture of the behaviour of the water in dry warm sloping land (areas like Igogwe, Lwanhima, Kongolo and Mkula) is given in Falkenmark and Chapman (eds. 1989).

> Where soils are permeable, part of the rainfall enters the unsaturated plant root zone and infrequently penetrates to ground water. The remainder becomes overland flow which is concentrated into the network of stream channels. Depression storage is negligible. Part of the soil water may also enter the drainage network, but most is transpired by plants or evaporated from the soil surface. Where the water-table is sufficiently shallow, there may also be a contribution from groundwater to stream flow.
>
> For impermeable soils an important part of the precipitation becomes overland flow and joins the drainage network. There is little that infiltrates into the soil, with the exception of fractures or karstic zones through which water can reach the

[14] Cory (1953:145) wrote that "superstition may prevent one from cutting a tree that has been left standing by his predecessor "

> groundwater system. Some water returns to the atmosphere by evapotranspiration. There is some depression storage. Again there may be contribution from the ground water to stream flow when the water-table is shallow, or the ground water may be recharged from stream flow when the water-table is deeper (Falkenmark & Chapman, eds., 1989:276).

The behaviour of water characteristic of the dry warm flatlands where Bupamwa and Runere are situated, is described below.

> For permeable soils, rainfall enters the plant root zone and is later transpired by the vegetation or evaporated from the soil surface. It remains in the plant root zone for a period related to the depth of the rainfall event, the aridity of the climate, and the season. A small part of a high rainfall may penetrate beyond the plant root zone and continue to move slowly downwards until it reaches the water-table. ...
>
> In the case of impermeable soils, most of the rainfall is stored in micro depressions. If the rainfall is sufficient, these small depressions overflow and water moves slowly towards the larger depressions. At the meso scale there is no overland flow to streams or lakes, but a small increase in the slope may induce overland flow and streamflow in the poorly organized channel work (Falkenmark & Chapman, eds., 1989:372).

Figure 2.5 in chapter 2 quantified in macro-terms the movements of water described above; more than 90 per cent of the precipitation returns to the atmosphere through evapotranspiration and about 5 per cent is discharged as runoff to rivers. The little that is left recharges the groundwater in two ways: by infiltration in areas with favourable infiltration conditions, i.e. the sandy areas around the granite outcrops and by leakage from the rivers which, during the rainy season, act as influent streams (Nilsson & Husberg, 1978:1-2). A micro-level study of the annual percolation of rainwater in the Bupamwa area was found to be on average 126 mm or 17 per cent of the rainfall for the period 1971-82. Deep groundwater, however, fluctuates only little (40 mm in 1984 according to Chayayi, 1985:31-32).

Hydrogeology. The general idea of soil profiles and aquifers is often presented as in Figure 6.3. There are some permeable layers and some rather impervious layers with one unconfined aquifer and another confined aquifer with a water rest-level in the well above the groundwater level due to pressure.

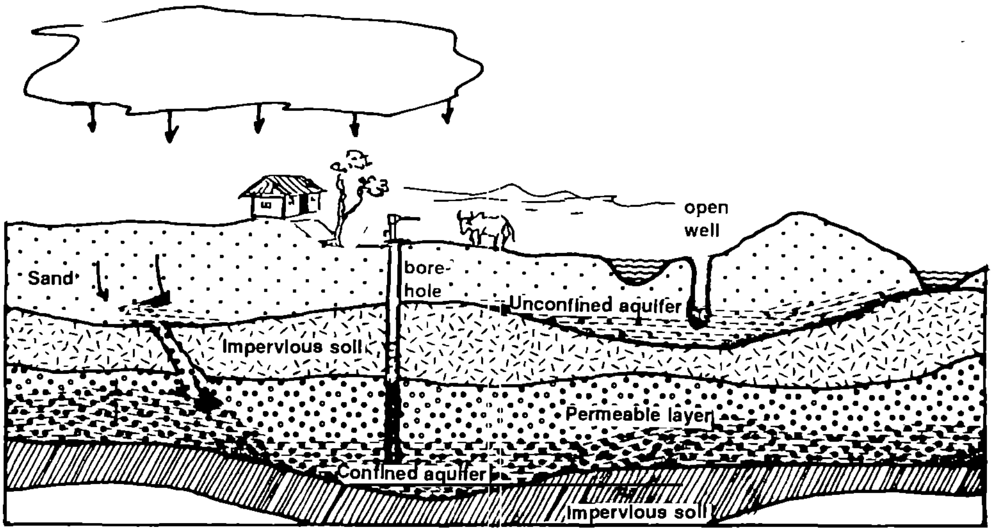


Figure 6.3. Aquifers and layers of permeable and impervious soils.

The sketch indicates where groundwater may be reached. The WMP-team used modern methods of dowsing like resistivity and seismic investigations to prospect promising sites of groundwater (WMP, 1978:v6:41); the teams also drilled a number of test-holes. The test protocol below gives an idea of the kind of information professional 'dowsers' are collecting. It refers to a borehole outside Runere at a possible weakness zone along Ndagaswa river valley; the borehole yields as much as 3.3 m^3 per hour, which is above average.

Table 6.4. Borehole protocol (No. 115/76) near Ndagaswa river

Metre	Soil profile	Metre	Occurrences
0 - 2	Mbuga clay		
2 - 6	Sandy gravel, weathered, partly rounded		
6 - 10	Mixed sandy gravel and clay		
10 - 28	Gravelly sand, fragments of quartzite, quartz and felspar	24.4	Water level
28 - 32	Gravelly sand, fragments of quartzite, quartz (also coarse)		
32 - 34	Partly weathered granite, red felspar, boulder		
34 - 42	Gravelly sand, granitic material		
42 - 46	Fragments of weathered granite reddish felspar & quartz	42 7	Water struck
46 - 50	Partly weathered greyish granite		
50 - 64	Fresh granite		
64 - 70	No sampling	70 0	Borehole depth

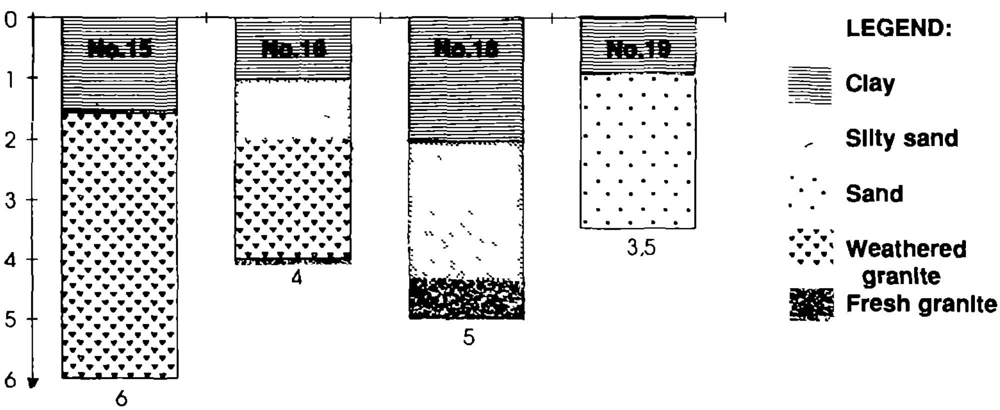
Source: Husberg & Nilsson, 1976:Appendix 4:70.

Soil layers with a combined depth of 50 metres cover the granite. The water rest-level (24.4 m) is where water is found to stabilize if constantly pumped. The protocol does not indicate a groundwater level, but only where water was struck i.e. where the pressure pushed water out of the borehole. The two cross-sections along and across the Ndagaswa river (Figure 6.4) indicate that the groundwater level is shallow, less than 4-5 metres, along the Ndagaswa River for some ten kilometres; the level is even more shallow just under the river itself. An ordinary dug well would penetrate the upper two or three layers only, and its yield would certainly be less than the 3.3 m^3 per hour from the borehole.

Shallow wells in Sukumaland are rarely deeper than 5-6 metres. The local conditions are slightly more favourable than Coster indicated when saying that shallow groundwater is available everywhere for the human population in all but the driest years (Coster, n.a. p.7) and "in *mbuga* limestone, water is in most cases struck at depths not more than 20 or 25 ft. /7-8 m/." (Coster, 1960:47). The seasonal fluctuation of shallow groundwater may be one or two metres or more in dry years.

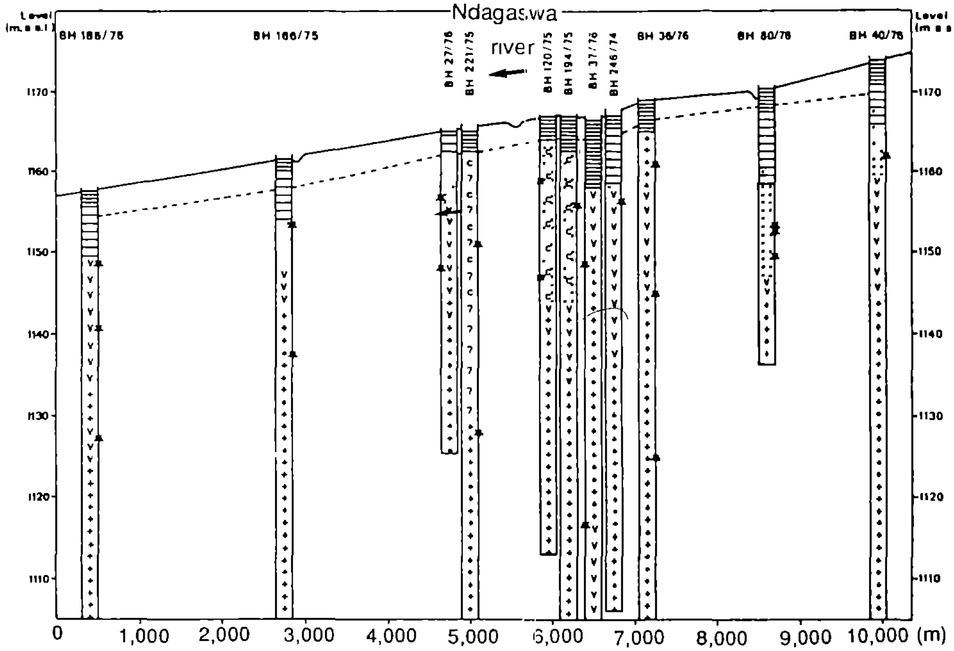
The MAJI department is supposed to keep records of all water sources that are developed, but this is done only occasionally for shallow wells. Test-holes are usually drilled with a hand-auger to in order to assess potential yields before deciding on whether to develop the hole into a proper shallow well.[15] Unfortunately, the results from pump-tests and soil protocols are not available for shallow wells in the villages included in this study. An exception is shallow well no 23/4-15 in Mkula; its soil protocol is shown in Figure 6.5 and its yield is 1,210 litres per hour. The classification of soil levels is crude and of lower quality than protocols for drilled boreholes. For instance, it is unlikely that well No. 15 has been dug through a 4.5 metre thick layer of weathered granite. Some protocols for the actual wells have been collected and are presented below

Table 6.5. Soil protocols for four shallow wells Mkula village (Nos 24/3- 15, 16, 18, 19)



Source: Regional Water Engineer's Office, Mwanza.

[15]MAJI records for Mkula village showed that 3 to 11 testholes were hand-drilled for each developed shallow well



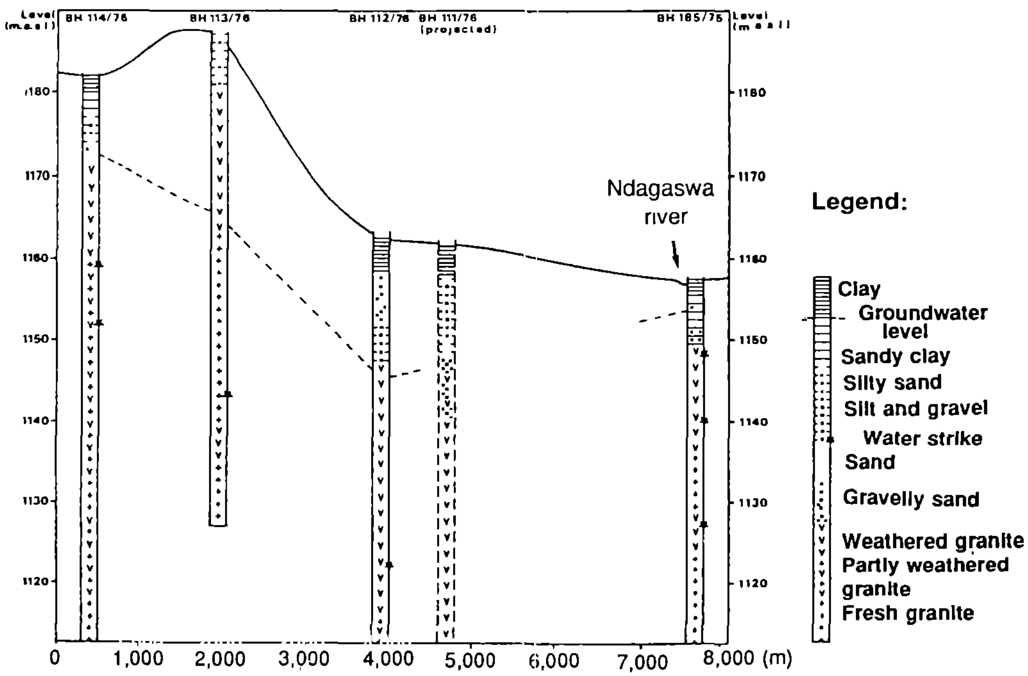


Figure 6.4. Cross-section along the Ndagaswa river (above) and across the Ndagaswa river valley (below). *Source: Husberg and Nilsson, 1976:appendix 4.*

Comparison of Sukuma and Professional Knowledge and Skills-Underground Water Supplies

Underground water. There seems to be little overlap between Sukuma *popular* knowledge and professional knowledge as far as invisible water is concerned. Farmers are primarily interested in soil moisture and very shallow groundwater, while scientists are more interested in deeper groundwater and methods of estimating evapotranspiration. Of course most of our informants had a very localized knowledge while the professionals are generalists. Nonetheless, our informants' view of underground water has striking similarities with the hydrogeologist's concept of an aquifer. Few of the qualitative statements made by professionals and informants are in disagreement or contradictory.

Modern water supplies are very often located next to existing *own-key* water sources indicating a close connection of professional and indigenous assessments of suitable sites. Coster, who worked as an engineering geologist in Tanganyika 1927-1958, wrote in 1960 that "shallow groundwater occurrences accessible near the surface ... have, on the whole, been thoroughly explored during a great number of years by the rural native population and their predecessors in the territory..." (1960:47). Since then a vast number of additional shallow water sources have been developed.

Dowsing for water. The informants' account of sites which can be expected to harbour underground water is similar to what Coster, Gillman, Malcolm, and Stockley suggested. The villagers' area-specific knowledge may at times come into conflict with professional knowledge as this account shows:

> The experts should get the villagers' views first as to where to find water, but they don't. On one occasion MAJI (the Water Department) investigated the valley bottom near the school where they claimed there was water. They drilled for three days without striking water and abandoned the hole. They told us that they could not understand this since all the signs of water were there. Some elders who had lived long in our village advised the drilling team to try another site where they thought there was water. The team moved the equipment to this spot, started drilling and in the afternoon they struck good water. The next day the supervisor arrived and he told the team that they were not allowed to drill outside the surveyed area and besides, he asked, what do these people know anyway? He ordered the team to remove the equipment from the site without finalizing the borehole. (I1IIb570)

The Sukuma knowledge of soils profiles and water availability is valid for depths down to, say, 3 metres, while professionals gather information from greater depths. The two sets of information correspond with the respective requirements on water yield. *Own-key* arrangements usually provide water sources yielding tens or perhaps a few hundreds of litres per hour, while turn-key installations have to provide more than 800 litres per hour in order to be developed.

In many societies local experts with *folk* knowledge in dowsing perform the task of searching for water. It is common to use a device which is carried over the area in order to detect water underground; a twig from a certain tree species, a copper string, etc. The device "tells" the dowser where there is water. None of our informant had heard of any such device except at missions where twigs were being used by white priests. One informant said that among the Wanyaturu there were dowsers who could find water even in the *mbuga* (I4:G5).

Bio- and Geo-indicators. Gillman (1943:66) complained that very little work had been done in East Africa on indicator plants, and little has been documented since then.[16] He confirmed, however, that the Sukuma bio-indicator *Ficus* tree is a definite indicator of groundwater near the surface. The impression is that the informants rely mainly on plants which happen to grow well into the dry season in places with more soil moisture than the surrounding area The many grasses mentioned indicate a vague knowledge. However, combined with geo-indicators it is usually enough to enable people to find water in areas endowed with shallow groundwater.

The interviews also indicated that Sukuma people do not make a practice of seeking advice from neighbours who have already been successful in locating wells. One reason for this neglect of available knowledge may be that it is fairly easy to find potential sites. Had it been otherwise the sheer difficulty of finding water might have resulted in rainmakers or others acquiring more status by becoming dowsers, as they have in Kenya. Among the Wasukuma the competence of the rainmaker is restricted to producing rain for agriculture and cattle.

The success rate in drilling deep boreholes after siting with modern survey equipment may be fifty per cent or less in certain areas were high-yielding sources are rare. The success rate may be higher for dowsers using both bio- and geo-indicators and common sense.[17] Improved knowledge may increase the success rate but it will not come very close to a hundred per cent if the yield of a single water source is to serve hundreds of

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[16] Woodhouse (1991) documented indigenous knowledge among the Wakamba living in the semi-arid Kibwezi area in Kenya *Acacia robusta* was the most successful tree-indicator of good-quality groundwater at shallow depth. No herbaceous plants were recognized as reliable indicators. Topographic and geological features were taken into account by the dowsers. Longland (1952) refers to *Mkuyu* and *Acacia tortilis* as indicator trees.

[17] Parsons' (1946 213) personal experience was that "with some persons movements are imparted to a twig by some hiatus/fracture in the rocks, but whether or not this is due to water in the fracture or to the fracture itself I cannot say. ." Lewis wrote on Kenya that "In no part of the world, have I found such universal faith in the water diviner or dowser as in Kenya." Woodhouse (1992:21) found that "the earth's conductivity and the dowsing reaction show considerable correlation " Engh (1983) found in an experiment in Sweden that dowsing compared favourably with three geophysical methods (slingram, VLF, and georadar).

users. On the other hand, sites for water sources intended for a few households are plentiful.

Conclusion. It seems reasonable to state that the Sukuma knowledge about geo-indicators, partly acquired by digging latrine pits and graves, is enough to locate and to develop wells and ponds yielding water all the year round under the fairly favourable natural conditions prevailing in the six villages. The task of searching for shallow aquifers need not be a formal scientific process, and skills have been developed by observing local physical conditions in the area - be it Sukumaland or the Swedish countryside.

7

Water Quality and Health; Sukuma and Scientific Knowledge

Introduction

It is widely assumed that public health will automatically improve if safe drinking water is provided and more water is used for hygienic purposes. Water quality is a concept that includes taste, odour, colour, appearance, softness, temperature, as well as bacteriological and chemical properties. Household members use some or all of these criteria to assess their water. A discussion on the balance between quality and quantity is facilitated by distinguishing between the different water uses, mainly for drinking and hygienic purposes. For drinking water the safety of the water is most important. The required volume of drinking water is small, less than a bucket a day even for a large household, and may be obtained from a distant source without too much work. On the other hand, the improvement of hygiene requires a substantial quantity of water. The impact on health achieved by various improvements is illustrated in the diagram below. Our discussion will focus on attitudes to drinking water and its quality.

Water use: / Improvement:	drinking	hygiene
more water	no impact	important
better quality	important	little impact

Sukuma Knowledge about Water Quality and Health

Sukuma knowledge: *maji safi* and *maji salama*. The Swahili word for clean water, *maji safi*, alludes to its physical appearance i.e. clean as opposed to *maji machafu* (dirty water). Water is not considered *safi* if it contains small creatures or smells bad, but it does not necessarily have to be clear. Clear water may be rated as less tasty, while milky water may be rated as more filling. When sieved through a white cloth milky or even reddish water may leave no trace or stain at all; nor will it produce sediments if left in a clay pot for a day or two. In short, informants said that *maji safi* can be judged by looking at the water and smelling it. Almost all supported this meaning of *maji safi*. The few who did not agree said the taste is what is important in defining *maji safi*.

"Safe" drinking water, *maji salama*, is a relatively new word although the corresponding idea may have a long tradition The importance of *maji salama* has been on the health agenda in Tanzania for several decades. Primary school teachers, adult education programmes, campaigns on the radio, etc., have stressed that water should be safe to drink and that *maji salama* cannot be judged only by eye inspection. Three out of four of our informants emphasized the school-book knowledge that there are small living creatures, microorganisms, in the water that cannot be seen, yet may cause illness. The inspection has to be done "by the stomach" rather than by the eyes.

The existence of pathogens might contradict the Sukuma proverb that says "What enters the stomach does not stay (*maja munda, gati mikaje*)." If taken literally this means that one may drink just about any water without problems. Almost all our informants, however, disagreed with such an interpretation. They favoured the school-book view that there are microorganisms (*vijidudu*) which can remain in the stomach and intestines and cause illness. The informants often said that *maji salama* is water that has been boiled i.e. fulfils the recommendation of the official campaigns. Individual informants defined *maji salama* as either piped water, rainwater or water from a shallow well with a hand-pump. Four informants seemed to have misunderstood the meaning of *maji salama*: they talked about water that does not move, or which is plentiful Two informants mixed up the definition of *maji safi* and that of *maji salama*.

Keeping these possible difficulties in defining *maji safi* and *maji salama* in mind it seems reasonable to continue to use these two terms in the following discussion.

How villagers assess drinking water quality. The taste and odour of water - apart from its appearance - are key elements in popular assessments of water quality. Taste and odour may differ from one source to another and users will pick the water sources they prefer. A simple check of the water sources which are used for drinking purposes showed that all or almost all the households in a given neighbourhood tended to use the same water source for drinking water. Clear spring water was much appreciated in villages where it was available. Elsewhere, milky water was preferred.

Rainwater is not widely used for drinking since its taste is said to be less "sweet" than water from other sources.[1] A salty or brackish taste is unacceptable to most informants. When confronted with the choice of water that is "safe but salty" or "sweet but not safe" a third of the informants chose the "sweet" water. Some of them did add, however, that they would make it safe before they drank it. People tend to become habituated to the taste and odour of the water of their own homestead. One informant argued as follows.

> I was born here and am used to our kind of water. The water, we think, is agreeable and the one we want is *maji safi*. I would not go for its taste only, even if the water is sweet but not good enough. Not even the salty water would be disagreeable if it is safe. Fortunately, water from our boreholes is not salty. (R5f2a:20)

The informants were asked what precautions they took when they got thirsty on a journey and how they assessed drinking water quality in practice. They were often worried about water quality on journeys. Four of them said they did not drink water when on journeys because they did not trust the water offered. One said that he brought along his own water. More than half of them were concerned about bad water, but they just drank and hoped for the best; one informant said "God will protect us". They said they try whenever possible to make sure that the water looks *safi* (clean), by checking the cleanliness of the cup, the storage vessel and the source. Some claimed that after exercising this kind of vigilance it has happened that they have thrown the water away after finding the water unsatisfactory. Others said they drank half and left the dregs at the bottom of the cup. Only one informant claimed that he drank any water he was offered without bother. This person was surprisingly knowledgeable about potential health hazards.

Few informants mentioned boiled water when discussing what they drank when on journeys, a fact that may indicate the limited role this time- and energy-consuming kind of precaution generally plays for the informants. One informant told about her anxiety when asking for boiled water, thus highlighting the cultural aspect.

> When I come to a new place and ask for drinking water I have doubts whether it is safe to drink. It should be boiled and sieved but inquiring about that would be interpreted as if I would like to teach them something. And to want to teach somebody who might be more enlightened than yourself gives the impression that you are trying to undermine his prestige. On top of that, I cannot explain very well why it should be boiled. Therefore I find it better to refrain from drinking when I am in doubt about the water quality. (B2Ia450)

Drinking water is boiled mainly when people are already sick and it is given to children with diarrhoea as part of the rehydration treatment in which they drink a mixture of

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[1] Blohm (1931:132) pointed out that rainwater is often collected from roofs and used for cooking. He wrote that it is not appreciated for drinking, which is reasonable since roofs at that time were thatched.

(cooled) boiled water, salt and sugar.[2]

All informants said they appreciated cool water, and drinking water is always stored in a clay pot placed in the dark. Half the informants thought that storing water does not improve its quality, and four said microorganisms proliferate in stored water. About a third of the informant, however, believed that germs die in stored water because of the low level of nutrients. Four informants described a three-pot system they said they used to improve their drinking water: after a day in the first pot, the water is poured into a second cleaned pot, and after another day it is poured into a third (cleaned) pot and ready for use.

What Diseases Do Informants Say are Caused by Water?

Insight into the informants' thoughts about whether illnesses could be caused by unsafe drinking water was of crucial importance to this study, since such knowledge may influence actual behaviour.[3] It is, however, difficult to elucidate with any precision the kinds of illness, if any, and further exhaustive studies would be needed to reveal fear of water-related diseases.

Some water-related diseases. Our informants were generally well aware of the names of diseases and their symptoms. The following were mentioned in the interviews as being caused by unsafe water: diarrhoea, schistosomiasis (bilharzia), scabies, cholera and malaria. Most informants referred to such symptoms as headache, fever and stomach ache. A few informants mentioned hepatitis, measles, and whooping cough.

Schistosomiasis was said to be common in Sukumaland; it is transmitted by parasites in standing waters Several informants knew that the parasite can enter the human body through the skin or be swallowed with infected water, and they knew that the parasite depends on a snail as its intermediate host. Safety measures to clear areas surrounding *lambos* and ponds of snails were said to have been discontinued at the time of independence; people now rely on medication. No informant suggested snail control, but some proposed spraying open bodies of water with insecticides. Almost half of the informants knew that refraining from bathing in ponds and *lambos* was the way to avoid

[2] Healers used to sprinkle hot water on patients with leaves that had been dipped into the medicine. It is not clear whether this use of hot water prevents healthy Wasukuma from drinking boiled water Matthews (1982) reports from Tamil Nadu that people do not acknowledge the difference between hot and boiled water The local belief is that a sick person should take hot water, and therefore it is hard for healthy people to accept drinking boiled water Also, he reports that cold water may be added to cool it without realizing that this destroys the value of boiling

[3] Some aspects are dealt with later in this chapter See also Sachs, L and I Krantz (1991).

catching schistosomiasis.[4] One informant said, however, that "we move quickly when bathing in the *lambo* in order not to catch bilharzia" and another said "we fetch water in the early morning before the snail is awake". These popular beliefs encourage people to use the water despite the risk of contracting schistosomiasis.[5] More than a quarter of our informants suggested boiling water for drinking as a counter-measure.

Malaria' mosquitos were known to breed in water puddles but only a few informants mentioned malaria as a water-related illness[6] There is no campaign to eradicate the habitats of *Anopheles* mosquitos; and despite increasing scientific evidence of drug-immunity people rely heavily on medication by chloroquine and other, local, treatments.

Scabies was mentioned by a fifth of the informants as a water-related disease. It was not seen, however, as the result of too little water to keep a sufficient standard of hygiene but rather as caused by dirty water.

Diarrhoea was said to be prevalent in the area and was mentioned by more than half of the informants while cholera was mentioned by two only. Some added that diarrhoea is more common at the beginning of the rains. Almost one in four, however, stated that diarrhoea was not a water-related disease. Still, more than two-thirds of the informants suggested that boiling of drinking water would reduce diarrhoea incidence. Only five informants talked about improving environmental hygiene as a means of reducing diarrhoea.

Some informants were asked how they would go about convincing a father that unsafe water could cause diarrhoea in his children even when the grown-ups in the family remained in good health (the assumption being that the father did not believe that water could cause illness).[7] Several informants said this would be difficult if not impossible, as it requires an understanding of the role of microorganisms. One informant put it as follows.

> During the cholera outbreak several years back many people got sick and some died. People were told to boil water and clean utensils in hot water. When realizing that these measures helped, all villagers followed suit. And the outbreak disappeared.

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[4] "The Kokora Swimming Baths were constructed in 1931 for the use of the boys of the Native Treasury School and Native Treasury employees as well as any other natives who came to make use of them, to lessen the risk of infection with the so-prevalent bilharzia " Kwimba District Book, tape no. 24.

[5] The rate of activity of parasites varies during the day and Nordberg (pers. com.) finds it reasonable that the parasite is rather sleepy in the early morning.

[6] Malaria was not identified as water-related in the WMP-questionnaire either. (WMP, 1978·v16 291)

[7] One of the male informants declared that diarrhoea in small children was caused by bad breast milk (milk intolerance may be developed later, pers com) Lwanga and Mukisa report similar views from Uganda (1991)

> Therefore it should be possible to convince the father to treat the drinking water once he has experienced improvements in health of his children (I3Ib400)

This rational mode of reasoning assumes that observation of practical results may change behaviour, at least after a period of time. Popular and folk ways of reasoning are, however, at least as important, and in this mode diarrhoea may not be attributed to unsafe water at all. Evidence of this tendency is that informants told us of cases where members of families with chronic diarrhoea were allowed to use the common water sources without restriction.

Whooping cough may seem to have little to do with water, unless sorcerer-caused illness is taken into account Reid mentioned (1969:143) that it was caused by poisoned food or drink that affects the stomach, intestines and lungs. If the lungs are affected, the result could well be severe and prolonged coughing.

The *nzoka* explanation. The informants were asked to explain why when two healthy people drink the same water one can get ill while the other stays healthy. Almost all mentioned that people have differing resistance to illness. Several related this to the difference in blood. Here we follow Hans Cory (1960), Marlein Reid (1969) and Corleen Varkevisser (1974) on popular and folk medicine aspects in Sukumaland. Reid touched upon the blood issue when writing the following about Sukuma concepts of health and illness:

> Being sick to Sukuma meant that they were affected by a kind of 'poison' in the body. Each person was born with an *nzoka* (literally 'snake') in his stomach. If one listened well to his *nzoka*, he could avoid sickness. If he was about to eat something and his *nzoka* started to grumble and growl, it was a warning to him that that particular food would be disagreeable. If he went ahead and ate it, the *nzoka* would have to vomit or defecate into the person's body, making the person feel sick.... Sickness was not the same in everyone because the likes and dislikes of people's *nzoka* differed. One man likened this to modern health beliefs by saying that the modern health practitioners believed that people differ in their response to disease and treatment because of the difference in blood. The Sukuma believed, he said, it was a difference in *nzoka*. (Reid, 1969:131)

Several informants were in favour of this kind of reasoning; the idea of *nzoka* gives the Wasukuma some confidence in assessing water quality. The personal *nzoka* also makes it possible to explain differences both in taste and in resistance to contaminated water.

Socio-cultural causes. The well-being of the individual is recognized to depend on physical as well as spiritual health (Cory, 1960:14). Cory mentioned (1960:15-16) that the Wasukuma rarely pray to a supreme God, but rather practise good conduct to avoid the menace of offending ancestors and nature spirits. Lång and Lång (1973:vIII:226) stressed that matters of health are especially tied up with the ancestors. The observation of the manifold taboos, the proper application of protective medicines, and the avoidance of provocation were considered sufficient to keep away the displeasure of the spirits. Therefore the purpose of rites is either the appeasement of ancestral spirits or the invocation of their help against some enemy or danger, known or unknown. The *nfumu*, by his diagnosis and understanding of cause and effect, restores the balance between the ancestors and their living kin (Lång and Lång, 1973:vIII:227).

Reid claimed that "the most prevalent form of sorcery which the Wasukuma fear is *kulisha* i.e. the insertion into food or drink of a mixture made from injurious herbs and the saliva or excreta of a sick person." (Reid, 1969:34). For any such illness caused by a sorcerer, a practitioner who knew anti-sorcery medicines had to be consulted. Whether or not many Wasukuma actively seek to harm someone who has harmed them, the fact remains that almost all Wasukuma continue to believe in the possibility of revenge by magic (Varkevisser, 1973:54).

Since the 1960s things have continued to change and it is an open question how common *uchawi* is today in Sukumaland. An evaluation of an integrated rural development project in Mwanza and Shinyanga regions (1977-1983) reported that the number of those expressing a belief in witchcraft was surprisingly high, around 20 per cent with some exceptional villages showing zero per cent. One question in the evaluation concerned how sudden deaths were explained; the responses may also demonstrate the level of belief in *uchawi* (Mtui, 1986:8)

Table 7.1. Causes of sudden death in Sukumaland.

District	God	Disease	Poison	Witch-craft	Never know	Total
Magu	18	0	0	7	0	25
Kwimba	25	0	0	0	0	25
Ukerewe	18	4	4	18	6	50
Sengerema	42	0	0	4	1	47
Shinyanga	22	5	1	13	7	48
Maswa	29	6	0	10	4	49
Bariadi	40	0	1	3	4	48
Total	194	15	6	55	22	292

Source: Mtui, 1986:7-8.

Several informants maintained that *uchawi* is common on the Ukerewe Island; they said that in 1989 four priest visiting the island were poisoned and three of them died (see Table 7.1). But few of the informants would admit or claim that *uchawi* played a significant role in their own village. It is noteworthy that God's will is the most frequent cause mentioned; a reason for that may be that it is easier to replace a witchcraft explanation with one of God's will than one of scientific-biological causation.

Varkevisser further stated that "very few, if any, achieve perfect freedom from fear of the potency of black magic " (1973:50).

> Bumba Kakumbi's baby suffered from diarrhoea and refused to eat. Visits to the dispensary did nothing to improve the situation. When Bumba and her husband consulted a *nfumu*-diviner he advised them to go to a native medicine-man because there was sorcery at work. The *nfumu* revealed that one of their female neighbours was responsible for the child's disorder. Bumba asked herself who it could be. She remembered that a few weeks earlier when she had picked pumpkins to cook for dinner a woman who lived nearby had admired them. Bumba had not granted her neighbour's request for a pumpkin, having herself harvested just enough for a single meal. Convinced that she had fathomed the *nfumu*'s meaning, Bumba subsequently avoided the neighbour (Varkevisser, 1973:52)

Sources of current health awareness. Traditional healers did not seem to play any part in promoting improved water quality. On the contrary several informants expressed concern that healers may wash and also bathe in the water source at night in order to be liked by the villagers [8]

All knowledge about microorganisms and hygienic practices was said to have been acquired in school or in adult education classes. Only one mentioned hospital, rural health centre or other medical personnel as the source of information. Asked where young people of today learn about hygienic practices, the answer was that they are taught at home. The situation could be summarized as that the older informants learnt nothing about health practices in their home, but very much in school,[9] while their children learn nothing in school, but only at home. This may be viewed as an example of the deterioration of the formal school system over the past 25 years. Moreover, hygienic conditions in most primary schools in the area are reported to be deplorable:

> ... not only are excreta disposal facilities in a poor state - we have yet to see a school with any kind of functioning arrangement for handwashing.... The situation is as bad at the 458 rural health centres and dispensaries in the lake regions. (Kilama and Winblad, 1985:14)

Leaders at different levels were said to provide information on health issues occasionally

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[8] Cory reported. "A small portion of human excreta was mixed with parts of a bird and alum and distributed to each headman. They put a small piece into each pond to attract new settlers." (1951 30). The national newspapers often carry articles on *uchawi* and frequent referenses are made to Jujumen helping individuals to successful careers and football teams to be victorious (Sunday News, September 2, 1990)

[9] There are several school books in Kiswahili on health and even water and water sources printed in the 1940s and 50s a.g. *Afya* (Health) by Rivers-Smith first published in 1923 and *Maji ni Mali* (Water is a resource) (Tanganyika government, 1956).

as exemplified by a *balozi* (ten-household leader).

> We remain with the old ways to treat water because no one has guided and advised us to do this and that, for example to make a simple water purifier of clay and sand. I have myself, during the dry season, made public that my neighbours should filter their water unless they want illness in their families. So, today many of them do not want heavy (milky) water. Instead they walk to the river (1 km away) for drinking water where they scratch in the sandy river bed to collect clear water that has been sieved through the sand. (R5f2a:265)

Only a few claimed that the priest or pastor gave guidance about hygienic practices.[10] One informant referred to John 4 in the bible where some interesting information is to be found, albeit not on hygiene:

> Jacob's well was there, and so Jesus, wearied as he was with his journey, sat down beside the well.... There came a woman of Samaría to draw water. Jesus said to her, "Give me a drink" . .. The Samaritan woman said to him, "How is it that you, a Jew, ask a drink of me, a woman of Samaría?" .... "If you knew the gift of God, and who it is that is saying to you, 'Give me a drink,' you would have asked him, and he would have given you living water." The woman said to him, "Sir, you have nothing to draw with, and the well is deep; where do you get that living water? Are you greater than our father Jacob, who gave us the well, and drank from it himself, and his sons, and his cattle?

Scientific Knowledge on Water Quality and Health

Introduction. Scientists have been concerned with water quality at least since the beginning of the nineteenth century. After a period of hegemony of chemists in the first half of the nineteenth century, microbiologists and the miasmatists led the discussion into the turn of this century (Hamlin, 1990). Microbiology and analytical methods in chemistry have advanced tremendously in the present century, leading to such advances as recommended levels of a number of pollutants of water. Parallel to improved scientific knowledge there has been an upsurge of popular questioning and even distrust of the primacy of experts in both developed (Hamlin, 1990) and developing countries.

The Drinking Water Supply and Sanitation Decade in the 1980s stimulated research about water and hygiene which resulted in a better understanding of the issues involved. Research efforts have been geared toward microorganisms and chemical status of drinking

[10] Author's comment Had there been some muslims among the informants it is likely that the guidance in the Koran would have been put forward Professor Hassan Hanafi (1985) reported that water is mentioned in general terms 26 times in the Koran while drinking water is mentioned 38 times. One example is. "Man will drink cool and clean water in paradise and unclean and contaminated water in hell".

water while less attention has been paid to water quality aspects like taste, odour and appearance, and to the human behavioural aspects. In recent years the effect on water quality that collecting, carrying, and storing water have has attracted increasing concern since poor handling is a major factor in contamination of drinking water (Cairncross, 1989). Increased volume of water is also emphasized and is considered in many ways to be more important than improved quality in sustaining health. Feachem et al. concluded that:

> ... in most, if not all, low-income communities in hot climates infections ... will be major causes of morbidity and mortality. These problems would respond to improvements in water quantity, availability and reliability of the water supply almost irrespective of its quality. (Feachem et al., 1977:86)

Water-related diseases. In 1981 WHO estimated that some 80 per cent of all diseases and sickness in the world were related to water and inadequate sanitation. Steven Esray et al. (1990) concluded from an analysis of 144 studies dealing with the impact of improved water supply and sanitation facilities that significant health effects can be achieved for diarrhoea and schistosomiasis. Furthermore, the impact may be more significant concerning disease severity than disease incidence.

At present it is difficult to find useful official statistics on morbidity among rural population in Tanzania, and morbidity data related to drinking water-sources are non-existent. However, Bevan et al (1989.251) did a self-reporting survey in some villages in Tanzania to assess relationships between, among other things, morbidity and kind of water source used for drinking water. The symptom of illness, not the name of the illness, was recorded in Table 7.2 below.[11]

The table shows several important patterns. About 20 per cent of the population reported one or more symptoms during the three-month period of data collection (table above).[12] However, the number of occurrences is twice as high (table below), indicating that most persons were affected more than once. Among the symptoms, fever make up 60 per cent of the morbidity, while the other symptoms are much less prevalent. It is noteworthy that

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[11] The difficulties involved in describing morbidity history is according to Ryan Johanson (1992:79) "inherently conceptually confusing in a way that mortality history and height history are not. recruits were never asked to say how tall they felt, or thought they looked There is simply no way to explain observed trends in sickness without first understanding the reporting system that produces morbidity data and how it reflects the way people and doctors are trained to perceive, detect and report sickness, and the differential systems (social, economic) that shape reporting behaviour over time at the individual or institutional level."

[12] Children and elderly people report much higher incidence of illnesses than the age-groups from 5 to 50 years. Women of fertile age have higher incidence than men of the same age, however, men over fifty years report much higher incidence than elderly women (Bevan et al., 1989:251)

fever and coughing are much more prevalent than diarrhoea.[13]

Table 7.2. Morbidity. source of water by frequency of illness.

Source of water	% of sample obtaining water from this source	Fever	Diarr-hoea+ vomit	Fever+ Diarr-hoea+ vomit	Cough	Cough with blood	Total
Tanzania rural, % of population ill							
Stream	22 4	16 4	2 9	3.0	3 7	0 9	26 9
Spring	17 5	14 6	3 1	1 6	1 8	0 5	21 5
Pond/dam	4 5	21 5	0 6	1 3	4 4	0 6	28 5
Rainwater	1 7						
Well	21 7	8 8	1 8	1 2	2 5	0 5	14.8
Borehole	1 1						
Communal piped water	29 7	10 7	2 2	1 8	2 8	0 4	17.8
Tap in house	0 9						
Total (incl uncoded)	100 0	12 4	2 3	1 9	2 9	0 5	20 0
Tanzania rural, number of occurrences (% of population)							
Stream	22 4	20 9	5 8	9 1	14 7	4 4	55 0
Spring	17 5	17 2	6 2	4 9	7 1	2 4	37 7
Pond/dam	4 5	22 2	1 3	3 8	17 7	3 2	48 1
Rainwater	1 7						
Well	21 7	9 6	3 7	3 5	9 9	2 6	29 3
Borehole	1 1						
Communal piped water	29 7	13 9	4 4	5 4	11 1	1 9	36.7
Tap in house	0 9						
Total (incl uncoded)	100 0	15 1	4 5	5 6	11 5	2 7	39 4

Source: Bevan et al., 1989:252.

Respondents who drink water from streams and ponds/dams report higher total morbidity than other groups (26.9 and 28.5 resp), while users of pond-water report fewest incidences of diarrhoea and less than half compared to respondents using piped water and springs. This result is contrary to conventional wisdom and should be treated with care.

Cause of infections and immunity. Feachem et al. said the morbidity impact of between 20 and 30 different infective diseases may be reduced by changes in water supply; these are categorized into four groups according to their mode of spread. The nature of improvements relates to water quality, water quantity and protection of the user.

[13] One partial explanation may be that people eating mainly cereal food have loose stool, which in turn may be difficult to differentiate from diarrhoea (V Kochar pers communication)

Table 7.3. Classification of infective diseases[14] in relation to water supplies.

Category	Examples	Relevant water improvements
I Water-borne infections		
a) Classical	Tyhoid, cholera	Microbiological sterility
b) Non-classical	Infective hepatitis	Microbiological improvement
II Water-washed infections		
a) Skin and eyes	Scabies, trachoma	Greater volume available
b) Diarrhoeal diseases	Bacillary dysentery	Greater volume available
III Water-based infections		
a) Penetrating skin	Schistosomiasis	Protection of user
b) Ingested	Guinea worm	Protection of source
IV Infections with water-related insect vectors		
a) Biting near water	Sleeping sickness	Water piped from source
b) Breeding in water	Yellow fever	Water piped to site of use
V Infections primarly of defective sanitation	Hookworm	Sanitary faecal disposal

Source: Feachem et al., 1977:7.

This classification has its critics and Cairncross wrote:

> Bradley ... coined the phrase 'water-washed transmission', but still did not feel brave enough to take cholera and typhoid from their traditional position as 'water-borne diseases'... the obsession with water-borne transmission in the Third World is a result of historical factors .. the influence of Western ideas, but there are also local reasons. One is no doubt that, as John Snow pointed out, a water-borne epidemic can attack everyone in the community, rich and poor alike. By contrast, transmission due to shortcomings in domestic hygiene, such as those due to a lack of readily available water, is not a serious problem to the middle classes and the elite. (Cairncross, 1992:27)

Cairncross went on,

> A new consensus seems to be emerging that, whatever their pattern of transmission in some epidemics, most of the **endemic** transmission of enteric infections among poor communities in developing countries is not primarily water-borne, but occurs by other routes such as the contamination of hands, food, clothes and other fomites - routes susceptible to control by improved water availability or, conceivably, by hygiene education. (Cairncross, 1992:30)

[14] It may be added that the illnesses trachoma, Guinea worm infection, sleeping sickness and yellow fever are not found in the six villages

Feachem et al. (1983:34) summarized major pathogens in water which originate in human excreta: *Escherichia coli (E coli), Salmonella typhi, Campylobacter festus, Vibrio cholera, Shigella dysenteriae, Yersinia entero-colitica,* some viruses, and protozoa like *Entamoeba* and *Giardia*. Excreted loads of faecal organisms are high (10^7 to 10^9 per gram fresh faeces) also in healthy humans and large numbers of ingested enteric pathogenic organisms are required to produce infection in healthy adults (infective doses of 10^4-10^6 organisms, except *Shigella* and protozoa which require less than 100 organisms). Some immunity is conferred by infection by *Salmonella typhi*, entero- and rotaviruses, and probably *Vibrio cholare* and *E coli*, while other pathogens do not raise resistance (*Shigella*, salmonella other than *typhi*, and probably *Giardia*).

The most common path of contamination is said to be from man to man (Feachem et al., 1983). Most organisms can, however, multiply outside human beings; mostly on food. Some animals provide important reservoirs for the infections of man: *Campylobacter* (cows, birds, pets); *Salmonella* (cows, birds, pets, poultry, cockroaches, etc), *Yersinia* (cattle, dogs), *Giardia* (wild deer), and *Entamoeba* (pets) (Feachem et al., 1983:206). In cases where the cattle kraal is situated near to the water source there is an obvious risk of contamination. Runoff water from grazing land may also collect large concentrations of bacteria from animal faeces[15] which can cause elevated concentrations in streams and rivers.

Bacteriological Indicators

The microbiological water quality is held to be the most important from a health point of view. The choice of indicator bacteria has proved problematic; not all bacteria are pathogenic and totals are a poor predictor since die-off rates of bacteria differ and virulent pathogens may survive longer, etc. In conventional water bacteriology the faecal coliform, faecal *streptococci* and *Clostridum perfringens* are used. Faecal coliforms (*E.coli*) make up more than 90 per cent of total coliform organisms found in fresh faeces of warm-blooded animals (Feachem et al., 1983:54). The threshold for faecal coliform bacteria in drinking water recommended in the latest WHO Guidelines of 1984 is zero per 100 ml of water, and 10 other coliforms are accepted.[16] The WHO standards are very demanding and leads to condemnation of the vast majority of existing water supplies in low-income communities. Feachem et al. suggested more achievable standards (even though they were

[15] A cow may excrete 15-20 kilogrammes of faeces per day and an adult person only 150 grams (Feachem et al , 1983 206)

[16] The recommended value in Sweden for private wells is 500 coliforms per 100 ml water Bacterial standards for body-contact recreational waters is recommended to be less than 100 faecal coliforms and a mandatory limit of 2,000 faecal coliforms per 100 ml in the European community (Feachem et al , 1983 207)

well aware that typhoid is infectious in extremely low doses):

> A water source containing between 10 and 100 faecal coliforms is of good quality and should be treated if possible but supplied untreated if treatment is not feasible. A water source containing between 100 and 1,000 coliforms is of poor quality and should be treated if possible. If not, it should either be supplied untreated or abandoned according to a series of decisions. Water containing more than 1,000 coliforms is regarded as grossly polluted and, if treatment is not possible, it should be abandoned unless the proposed supply will not increase the number of users of a single raw water source. (Feachem et al., 1977:87)

Over the years several missions have collected data on the most common indicator organisms (faecal coliforms or *E coli* and faecal *streptococci*). The general results for Tanzania are summarized by the report on Rural Water Quality in Tanzania (1979) by using data from WMP studies and their own survey on faecal coliforms. The findings are given in Table 7 4.

Table 7.4. Occurrence of faecal coliforms in various kinds of water sources

Source Type	% of samples with no per 100 ml					No. of sources	No of samples	Geom mean
	0	1-10	11-100	101 1,000	>1,000			
Borehole	62	20	14	4	-	53	99	1
Well-open	0	9	19	32	40	44	58	343
-protected	30	33	26	11	-	67	133	7
Spring-open	15	22	39	24	-	42	46	20
-protected	16	38	36	10	-	29	42	15
Stream-piped	7	22	37	32	2	55	75	32
-unpiped	5	6						
Impoundments			25	42	21	64	110	128
-piped	17	30	37	16	-	30	95	10
-unpiped	4	19	47	28	2	79	122	163
Pit	-	11	23	40	26	37	73	61
Treated water	30	24	40	3	3	28	33	7
Rainwater	25	38	37	-	-	8	8	3
Total						536	894	

Sources: Rural Water Quality Programme in Tanzania. SIDA, 1979.

The conclusions arrived at were summarized as follows:

> Boreholes are clearly the best sources (from a bacteriological point of view) Rainwater collection systems and protected wells are the next best sources and treated water comes off as the fourth, mainly due to poor operation of treatment plants.... Springs and piped impoundments are next in quality, while the lowest quality (and the most variable) piped sources are streams and rivers. The worst traditional sources are pits and open wells. (RWQP,1979.2)

If WHO standards are used only 90 of the 536 sources can be recommended for use; under Feachem's more relaxed standards, most of the sources are acceptable after simple treatment, except for about one-third of the unprotected open wells pits.

The data illustrates well the importance of and justification for expenditure on protective measures like installing a pump and cover on dug wells; a closed box with a pipe on springs; protection of intake at streams; or intakes with pumps for any impoundment at lakes, dams or ponds, all of which reduce considerably the amount of bacteria present in the water.

From source to mouth. The quality of water at the source is important, but gives no certain information about the quality at the moment of consumption. Several researchers have documented the variation in water quality at the source and later in the household (Esrey, 1990). For instance, the Rural Water Quality Report for Tanzania makes the following comment. "The extent of pollution after collection is often rather small...less than an extra 50 faecal coliforms per 100 ml ... and very likely of little importance in comparison with the pollution transmitted on food." (RWQP, 1979:46). Lindskog & Lindskog (1987) studied the health impact of a piped rural water scheme in Malawi and concluded that "even when a water supply is improved, household water is still highly contaminated" In an article they compare their own bacterial counts with those of a study by Young & Briscoe (1986) showing the after-source increase of pollution (slightly different methods used):

Table 7.5. Faecal contamination of drinking water, Log 10 counts of coliforms and streptococci per 100 ml water

Kind of source	Study	Faecal coilforms, Log 10 counts per 100 ml, mean source household	Faecal streptococci Log 10, count mean source household
Piped water	Y&B	1,1 (13) → 1 2 (16)	2 4 → 3.0
	L&L	1 7 (50) → 2 4 (250)	2 0 → 2 6
Unprotected	Y&B	2 7 (500) → 2 9 (800)	3.6 → 3 7
Wells & rivers	L&L	2 1(130) → 2 2 (150)	2.1 → 2 6

Source: Lindskog and Lindskog, 1987:162

It may be surprising that piped water does not come very close to the WHO standard of zero faecal coliforms per 100 ml at the tap (1.1 and 1 7 in Log 10 count or approx. 13 and 50 by ordinary count). Even more disturbing is the increase in faecal coliforms from 50 to some 250 in the household in the Lindskog & Lindskog study which, moreover, exceeds the levels in the samples from unprotected water sources.

Lindskog & Lindskog found that the single most contaminating practice was to use one bucket to fetch water and another for storage. Using the same bucket for both tasks resulted in much less contaminated water because the storage vessel was then cleaned It is quite reasonable to believe that this also applies to the situation in Sukumaland.

Nyangeri (1986) collected data on bacteriological water quality in some one hundred hand-dug wells and twenty springs in a small area in Kisii, Kenya. He found that one-third of the wells and eighty per cent of the springs contained less than 100 faecal coliforms per 100 ml One pollutant is the bucket. Nyangeri also showed that as more than one family use a well, the number of coliforms increases. This is because each family used its own rope and bucket for lifting the water. Almost all wells in the area used by more than one family, were lined and covered. This may explain why-in his study-wells without a lining and cover had less faecal coliforms than wells with a lining and cover.

An evaluation of rainwater quality in Thailand (IDRC, 1989) found that most of the contamination of the roof and gutter system was of animal origin, as was that of most of the samples taken from the storage containers. The in-house storage containers, however, had contamination of both animal and human origin. Pathogenic contamination was found in few samples.

Cairncross and others emphasize the crucial effect handwashing with soap has on cutting off the transmission route of faecal contamination Cairncross recently reviewed investigations on impact of washing hands with soap in comparison with water only. He summarized the findings as follows.

> The results of these studies may not appear wholly consistent, and the reductions in incidence achieved may not at first seem very large. However, compared to studies of most interventions to control diarrhoeal diseases, they are very positive results indeed. In view of the magnitude of the problem in developing countries, with a median of 2 2 episodes of diarrhoea per year and an estimated diarrhoea mortality of 14 per thousand among children under 5, a reduction of 30% would be a major advance in public health.... The microbiological studies show the value of soap, and my re-analysis of Khan's results suggests that promotion of hand-washing without soap had no appreciable effect. (Cairncross, 1992:34)

This result supports the growing number of surveys stating that much contamination is finger-borne.

A second chance to improve water quality. The results above indicate that pollutants are added after the water has been brought from the source. Cairncross (1992) suggests that this effect is caused by poor hygienic conditions in the household.

There could be a second chance to improve water quality at home by using the high die-off rates for some bacteria in stored water. Most recent work use times required for a given reduction; for instance, the time required for a 90 per cent reduction (t_{90}). The Rural Water Quality Programme (1979.32-35) reported that about 95 per cent of faecal coliforms in clear and turbid water, and faecal streptococci in turbid water died after two days' storage. The main reason is that the coliform bacteria die for lack of nutrients. Unfortunately, not all pathogens die rapidly and Feachem reviewed studies reporting t_{90} values of coliform decay rates in streams ranging from 20 to 115 hours, with a median value of about 60 hours (Feachem et al , 1983:207)

As a general rule indicator bacteria die in fresh water, and the warmer the temperature the higher the death rate Waters with little or no microbial life will sustain indicator bacteria for considerably longer than similar waters with an active flora and fauna (1983:207) There were according to Feachem (1983:211) few data available on the survival of indicator bacteria in groundwater. It may be anticipated that die-off will be slower in water stored at home than in most surface waters because of the absence of sunlight, the cool temperature, and a low level of microbial and biological activity.

Some of the more virulent microorganisms causing diarrhoea can survive over long periods and the indicator coliforms are poor indicators for these. Therefore the recommendation to store water for three days is challenged, but not nullified, as the following example using the reported 95 per cent die-off rate illustrates. If lake water containing, say, 400 *E coli* per 100 ml is stored for two days in a clean pot, only about 40 *E coli* will remain. Water from many unprotected ponds will have reasonable counts of *E coli* after two days storage; however, as mentioned earlier, some of the more virulent microorganisms, if they happen to be present, will survive for much longer.

Despite its shortcoming, the three-pot system for storing water appears to be a useful hygiene practice if followed, especially in schistosomiasis-affected areas since all worms (*cercariae*) die within two days of storage (Feachem et al., 1983:451).

Chemical indicators. Domestic water quality standards are set for several chemical parameters by WHO and national authorities. Only two of these, fluoride and nitrate, are at present of practical importance for the health of Tanzanians according to the Rural Water Quality Report. Both of these are found in high concentrations only in some groundwater i.e in boreholes and shallow wells (RWQP, 1979:3). Due to the rock origin of fluoride the surface water sources usually have low concentrations (WMP, 1978:v17:39)

Moderate concentrations of fluoride cause dental fluorosis while high concentrations may cause skeletal fluorosis, which is much more serious The fluoride in water usually originates from fluorite minerals in granite (RWQP, 1979·49) which explains why the WMP-team found people with seriously discoloured (mottled) teeth in areas with high concentration (WMP, 1978.v17.39).

Relatively high concentrations of nitrate are produced mainly from animal faeces and urine as nitrifying bacteria oxidise its ammonia content In dryer areas with sparse vegetation the nitrates may seep into the groundwater.

Comparison of Sukuma and Scientific Knowledge

There has been a tremendous development of scientific knowledge about water-related health over two centuries Increased knowledge and coercion "took less educated, uneducated and illiterate Europeans out of the traditional mental sector, in which disease was a punishment of God or the result of witchcraft, into the modern mental sector of the population in which disease had scientific causes and remedies." (Johanson, 1992:82). Scientific progress in bacteriology is still rapid; new types of pathogens are being found and behaviour among microorganisms established. There is no reason to believe that the last word has yet been said (or the final truth arrived at), not even where our present-day assessment of earlier hygienic practices is concerned. It is still wise to keep an open mind in assessing Sukuma knowledge in the field of water quality and health.

There is little scope for comparing scientific and indigenous knowledge directly at the level of specific variables; science counts contaminants, while the Wasukuma use their senses

Causes of illness. Science has provided data on amounts of specific pathogens which constitute infective doses. When it comes to policy recommendations, however, WHO prefer zero faecal coliforms in household water and Feachem et al. accept 10-100 faecal coliforms per 100 ml as good quality water. The uncertainty is compounded by too little knowledge about immunity and about the impact of the individual's general health status. There is also a need to gain more knowledge about to what extent infected water is the main route of contamination for a specific pathogen.

Many informants knew the basics about school-book causes of ill health but the single change of improved drinking water does not seem to reduce incidence enough to be thought of as an observable health effect in their daily life. For instance, only half of the informants believed that diarrhoea could be caused by unsafe water. The self-reporting evaluation by Bevan et al does not confirm a causal relationship between kind of drinking water source and incidence of diarrhoea. This corresponds well with the findings of Esrey et al. (1990) that few studies manage to provide evidence for discernible health impacts of only an improved drinking water quality.

One important aspect is whether household members are immune to some of the "familiar" pathogens. This has not been well established scientifically but the informants often seemed to be convinced that they were immune. If so, the Wasukuma can be expected to be less cautious about environmental hygiene. It is an open question whether most of the informants believed in alternative causal explanations of illness. It was reported that sorcery and failure to honour ancestors could result in illness. In case this is thought to be the main cause it is more reasonable for a believer to appease the ancestors than, for example, to boil the drinking water.

Water-related illness. Informants named several water-related illnesses (diarrhoea, dysentery, cholera, schistosomiasis and scabies) and described general symptoms like headache and fever These illnesses concord with the scientific classification of water-related infections, although the latter is based on routes of transmission. For example, diarrhoea may be caused by many different microorganisms such as viruses (measles, rotavirus), bacteria (cholera, dysentery, salmonelleasis), and parasites (amoeba, giardiasis) transmitted by water, food or otherwise (Nordberg and Winblad, 1990:7).

Handling of Water at the Source and at Home

It is common to assume an implicit chain of logic: relevant knowledge will foster good hygiene practices, and these in turn will increase water quality, thereby improving the health of the people. This is a too simplistic way to approach the issue of protective measures. Good hygiene may be practised without any specific health knowledge and knowledgeable people may practice bad hygiene. Here follows an account of what kind of measures villagers take to protect and improve water quality at the source and at home.

At the water source. The interviews leave no doubt that the general knowledge about protective treatment of the water sources is good. Two gaps were common, however. Before drawing water the woman dips her bucket to clean its inside with her palm and she throws the waste water to the side. This polluted water may leak through the cover of the shallow well or seep back into the spring or dug well. She then fills the bucket by sinking it into the water in the pond, well or spring. If the bucket is dirty on the outside, such a practice will contaminate the water, for instance, by bringing chicken droppings and the like from the home yard. A few informants were well aware of such dangers but most of the men were taken by surprise when they realized these routes of contamination and they were prepared to advise their female household members about it.

Blohm reported a common practice for protection of water sources at the time of the First World War.

> The excavated earth is heaped around the brim of the pond to prevent overland flow to enter it. Fences are put up against the possible intrusion of animals. Such protection concerns normally only baboons. If they are a plague in the area, the water holes are also covered to prevent them to become watering-points. (Blohm, 1931:132)

Baboons are rare in the inhabited areas today and so are fences of sisal and milk-weed (*minyara*) hedges In none of the six villages was there a fence around the water source. In some dug wells in Bupamwa the people claimed they kept a snake to scare off people from using it at night and to prevent children from playing with the water The women made noise when they approached the well and the snake fled into its little cave. Open ponds were rarely protected from overland flow by a bund on the higher part of the slope. As a result, both human and animal faeces could easily be washed into the ponds by heavy rains.

> It is evident that pathogens from the dug latrine may destroy an unprotected water source. If the rainfall is heavy and the latrine is full, overland flow of water may wash pathogens from the latrine area into the water source and it is destroyed. You ask whether the pathogens may travel in the ground from the latrine to the water source? I wonder if pathogens are able to see under the ground? I thought that they could only move above ground (L4f2a:210)

The well-known Sukuma proverb "The first who comes to the well gets clean water" probably dates from the time when people drew water in the early morning before the cattle arrived but at the same time it indicates an early awareness of water quality. Blohm (1931:132) further noted· "When water is drawn from a pond, one wades into the pond in order to get the purer and cooler water from the deeper section." (Blohm, 1931:132). Usually the pond walls slope gradually down to the water, and women have to step into the shallow water to fill their vessels. Stepping stones are often missing, unless nature has provided a shallow rock layer or a convenient boulder (see Plate 4). Water from open ponds is, however, rarely used for drinking. The situation is more favourable at springs, where most drinking water is obtained and where stepping stones are often to be found.

Inspection of water sources provided evidence that here and there people had taken action to improve the water. At one shallow spring in a recharge area of soft black soil the users had put a sand layer at the bottom to filter the blackish water through the sand in order to make it clear. In another village the seepage water was first collected in a small basin (one by two metres) and then clarified by being filtered through two walls of sand before being scooped into the bucket. Some springs were said to keep a fish in order to ensuring its water quality.

Water sources are probably less protected today than before villagization in the beginning of 1970s mainly due to many more users drawing water at each source. "Simple" protective measures like removing water puddles to eradicate breeding places for mosquitos or snail control to prevent schistosomiasis were not practised. Despite the little that was done to protect and improve water sources the bacteriological counts were generally low in drinking water sources, often much less than 100 faecal coliforms per 100 ml for most of the year (Table 5.4; Table 7.4). The main reason is that the Wasukuma appear to choose fairly wholesome sources where they draw drinking water. All sources are vulnerable to being polluted, however, and it is expected that on not infrequent occasions also the drinking water sources are polluted. But such occasional pollution disappears thanks to high die-off rates for most bacteria and to dilution of the contamination in springs by entering fresh water.

Handling of water at home. It was said the collected water must be poured into a cleaned pot and, especially when pond water was used, sieved through a piece of white cloth.

> We usually use certain leaves to clean the water storage vessel. There is a tree named Msungi (latin name not known) with leaves that effectively clean and keep the vessel clean, much better than with soap, which also has the disadvantage of adding a taste. (L4f2a:480)

Informants said they use one or two clay pots to store water, one of them covered with a lid and used for drinking water Storing makes the drinking water cool, which is much appreciated. One informant used an extra layer of wetted charcoal around the lower part of her clay pot to cool it even more effectively. The drinking water is usually kept at 20^0-25^0C in a dark place, whereas scientific advice would be to raise its temperature and let it be exposed to sunlight to increase pathogen die-off rates.

Most informants claimed that they use a special cup lying on top of the lid to draw water from the pot (see Plate 16). The same cup is used for drinking and for water removal. Small children were not allowed to draw water, but it was said to be difficult to watch them all the time. Other ways of protecting the drinking water included to keep dogs and other animals away from the utensils. Mostly the clay pot was placed on a scrap tin pot or bucket turned upside down.

Even if the water quality is not very good at the source there is a second chance to improve it by simple treatment. Our informants knew of several ways of lowering turbidity, the most common being to leave the water to settle. Most of them spoke about applying leaves from a certain tree or a "soap" of alum or pounded peanuts which was said to be effective to flocculate turbid water.

A standard way of making water safe for drinking is to boil it All informants knew that boiled water is safe, but only a fifth of the households claimed to practice boiling of water.[17] One family who boiled their water said they offered it only to distinguished guests, because their neighbours would not appreciate its taste. Several informants believed that boiling destroyed the good flavour of the water, even to the extent that it became unfit to drink.

> The taste of water does not change when stored for a day but it gets cooler and nicer. A long time ago I tried to boil drinking water because experts told us to do so. I boiled it and let it cool and then sieved it. But, when drinking it I detected a smell, I mean a taste that was bad. I did not like it! (L4f2a:75)

The rare use of boiled drinking water was also blamed on the shortage of firewood. Moreover, informants also hinted that the incidence of illness was relatively low (see Table 7.2), so the effort was hardly worth the candle:

> Boiling water requires a lot of work. First on returning from the fields women have to look for firewood, cut it and carry it home, apart from all other chores that await them at home. Then they must boil the water. It is a lot of work. The 3-pot system is much more convenient. You clean the pots before refill, one at a time, and the whole procedure takes only ten minutes perhaps. (L4f2a:90)

The female task of collecting firewood has become more onerous with the depletion of

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[17] This is about the same proportion as was found on the Mwanza Integrated Rural Development Project in 1984 "Boiling of water before drinking is more common than has been supposed, if the replies given are correct In Kwimba District a total of 28% stated that water was boiled and in Magu District it was 11% " (PMO, 1984 10) However, our informants in Kwimba showed the lowest rate while those in Magu showed the highest

forests. today's women often use maize stalks and even twigs of cotton bushes as fuel.[18] It may therefore be rational and cost effective to walk further to a source with better water perhaps a few hundred steps away (which would take five-six minutes more) than to spend longer time looking for firewood apart from the time (and pots) required for boiling and cooling the water.

Present-day handling of water in the household compares well with what Blohm found at the beginning of this century, except for the "fork":

> In the negro household water pots are kept separated from the cooking pots.... The valuable larger clay vessel for water is put into a mould which prevents it from falling.... In case the kitchen is used for much cooking, the vessel with the drinking water is placed in the cooler storage room ... if dogs are kept in the house, the pot for drinking water is put on a one and a half metre high 'fork' so that they cannot reach it. Such a fork is called *ikanga mbwa* (literally scare the dog).... For scooping one uses excavated small calabashes or scoops carved from one piece ... one scoop always lies beside the filled water pot or hangs next to it, and it serves everybody as a joint drinking scoop. (Blohm, 1931:30)[19]

No informant uses a sand filter for cleaning the water at home. An elderly informant said he had in the past made a simple sand filter for himself. No informant said she uses any of the well known ways of lowering turbidity on a regular basis. Another example where scientific know-how is not put to use concerns water storage: no informant knew that specific parasites will die if the water is stored for 48 hours.

The scientific recommendation to use more rather than purer water to facilitate improved hygiene is not always feasible when it is most needed during prolonged droughts when water is scarce. However, personal hygiene is reported to be good: mothers bathe a child a minimum of three times every day and most adults bathe often (Varkevisser, 1973:145). Half of the male heads of household enjoy a daily bath in warm water at their home despite the high cost in the form of labour input. The informants have enough water to meet their perceived needs for hygienic purposes during normal rainfall years. The infrequent handwashing has, according to the author's general impression, nothing to do with lack of water (see footnote 4 in chapter 5).

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[18] World Development Report 1992 reported an example of cost estimates for firewood for poor town-dwellers in Dhaka and Lima to reach 11% and 29% respectively of their total incomes only to boil their water

[19] These conditions were probably similar to those in rural Germany at the turn of the century when Blohm worked in Tanganyika Professionals were then debating microbiological and miasmatic causes of illnesses

Assessment of Actual Handling of Household Water

Many aspects of actual handling of water are possible to observe but observation is a time-consuming activity. A short-cut, which partly leaves out water-related behaviour, is to count faecal coliforms in order to obtain an assessment of water quality and, indirectly, an "objective" measure of the effectiveness of the handling of water.

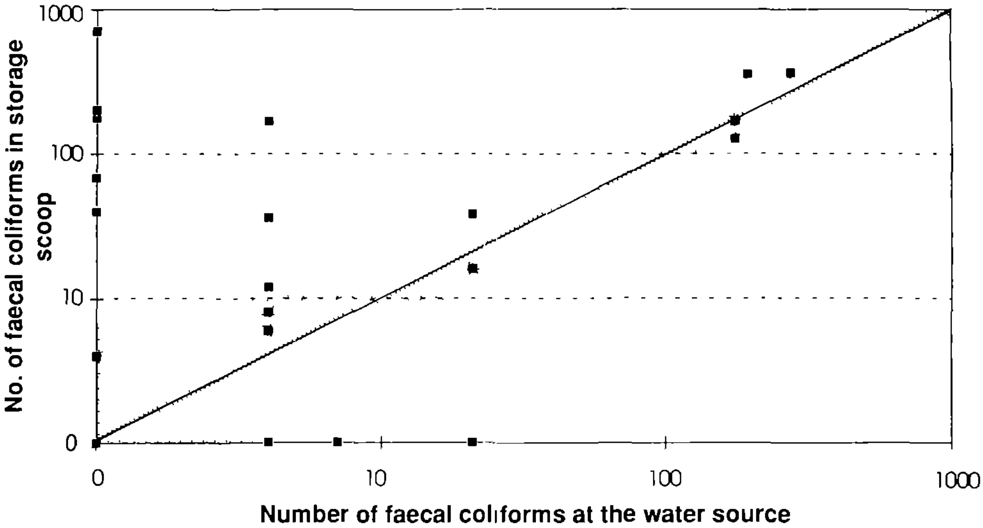
The data on water quality at the source presented in table 5.4 in chapter 5 show a slightly more favourable water quality in the 17 water sources than what was found by the RWQP (1979) and presented in table 7.4 above. This is an expected outcome since only drinking water sources were included. The RWQP survey included 536 water sources and almost 900 samples, a fact that lends some credibility to the results for the six villages in this study.

A special comment is due about the two ponds with zero faecal coliforms. They are better than four of the unprotected springs and also much better than the RWQP figures for ponds/wells. The reason for this may be very complex but indicates that ponds should not be dismissed as unhygienic without testing actual contamination loads. The fact that not all ponds are grossly polluted may provide a partial explanation why fewer incidences of diarrhoea were reported by people using pond water in the self-reporting survey by Bevan et al. and presented in Table 7.2.

One way to illustrate what happens to the bacteriological water quality "from source to mouth" is to connect data on the number of faecal coliforms in the water at the source and in the scoop, placed on the lid of the storage vessel. In Table 7.6 below each point represents one household. Households in the dotted area are those with virually no alteration of water quality. Households where the number of faecal coliforms has increased are found above the dotted area, and households which have succeeded to reduce the number are found below.

The faecal count shows that 15 households had almost no changes in the number of faecal coliforms, including eight with no faecal coliforms at all. Three households had improved the quality slightly before the water was drunk, while 10 households had added faecal coliforms at home. Thus, about two-thirds of the 28 households had managed their water reasonably well. This is in line with what Lindskog and Lindskog found in Malawi (Figure 7.5) and it is better than what is expected from the rule of thumb saying that about 50 faecal coliforms are added from source to mouth (RWQP, 1979:46). The outcome of changes in bacteriological quality can be summarized as follows: if the number of faecal coliforms is low at the water source it tends to remain low, while high counts remain high.

Table 7.6. Changes in the number of faecal coliforms "from source to mouth" for each of the 28 households Counts per 100 ml of water are given in the logarithmic scale



Source: Own measurements.

The data show that eight households fulfilled the WHO recommendation of zero faecal coliforms in the scoop. Three households had less than 10 coliforms per 100 ml and another six had less than 100. Feachem (1977.87) rated such water as good quality water which can be supplied untreated if treatment is not feasible. Eight samples of water from scoops contained between 100 and 900 faecal coliforms and five of these had less than 300. Such water is of poor quality according to Feachem and should be treated if possible. Four of these samples came from poor water sources and could be improved by simple improvements of the water source. The other five samples were said to originate from water sources with less than 10 faecal coliforms and needed improved handling at home

Interpretation. There are two separate ways to interpret the results of the alterations of bacteriological quality from "source to mouth" First, we assume that the informants reported correctly which source the water in the storage vessel came from The data then show that two out of three households handled their household water successfully and it was of good quality. Four households raised the number of faecal coliforms to above 100 per 100 ml. and another four had such values already at the water source. In such cases it is clear that the water had been contaminated by dirty fingers, since almost all vessels were covered with a lid so that no animal could reach it A comparison with the water-related behaviour the informant claimed to practice gave no indication of a correlation between behaviour and number of faecal coliforms. This circumstance indicates that finger-borne contamination occurs occasionally or by bad luck. The food-item water is thus contaminated in the same way as all other food. A person who is infected by such drinking water is more correctly said to have been affected by finger-borne transmission, not by a water-borne one

The second interpretation arises if we assume that some or all of the five informants who had sharply increased counts in fact had fetched the water from lower-quality sources. Then a legitimate interpretation is that the contamination added "from source to mouth" is less severe than what is indicated in the table. In fact, it could be that no household added more than some 50 faecal coliforms "from source to mouth". Moreover, these informants had for some reason collected their drinking water from a source they knew was of lower quality and thus that they did not utilize their knowledge in full.

The procedure of storing water for a few days in order to reduce the number of pathogens is commented on, but not analysed in detail due to lack of data. The households drawing water from sources with no coliforms are left out since any faecal coliforms in the storage vessels must have been added.[20] The theoretical and laboratory tests predict an increase of coliforms during the first six hours before a reduction sets in. Among the informants who claimed that their water had been stored for less than six hours some showed increased coliforms and others showed decreases. Thus, the samples provided no clear evidence either way. Storage for 20-30 hours, too, showed a split picture with some increased and some reduced faecal coliform counts. The obvious conclusion is that in controlled experiments there is no addition of pathogens while in practical, routine household situations the water can, at any time, be polluted by dirty fingers. Those householders who succeeded in reducing the number of faecal coliforms attended to hygienic practices - but so did some of the households with increased numbers, who might simply have had bad luck

To illustrate how easy it is for a person to contaminate stored water the following calculation is given. For instance, a milligram of fresh faeces put into a 10-litre bucket of boiled water will result in a load of 1,000 faecal coliforms per 100 ml. of water. A child who has played in a yard where there are cattle and hens can accidentally import a milligram or more of fresh faeces when quenching its thirst.

Conclusion. All households had the minimal skills and material resources which they needed to protect their water and to improve water quality at the source and at home. It is clear from the account of actual practices that these could be improved easily.

The impression gained from the interviews is that the Wasukuma are aware of health aspects on household water. Their knowledge is generally good but most of them are not certain on any given occasion whether to use a school-book explanation or a traditional one. It is impossible to say with any certainty whether a person honestly holds to the traditional belief that an illness cannot be caused by bacteria, with the consequence that he/she does not take a certain precaution, or if the real reason for some carelessness is of another kind, for instance, habits in the daily routines. A less probable interpretation is

[20] When sufficiently diluted in a large body of water, coliform bacteria survive for only a short period of time, and if such bacteria are found it may be taken as an indication of recent contamination (Musomi, 1992 1)

that some informants fatalistically accept the paramountcy of the sorcerer, against whom nothing will avail. It seems safe to conclude that school-book knowledge is not the only influence guiding water-related activities.

The drinking water is safe in most households most of the time, as indicated by counts of faecal coliforms at one period between the short and long rains in 1992/93. A number of other surveys of faecal coliform counts support that this is the general case. Present water-related behaviour makes drinking water vulnerable to contamination, especially through dirty fingers. Therefore it appears reasonable to expect that most households have high faecal counts in the stored drinking water on odd occasions. Few faecal coliforms are pathogenic, however, and health effects of faecal contamination are thus made even more complex to understand.

8

Local Organisations and Leadership

Introduction

The informants often referred to formal organisational structures and lines of command as decisive factors in the development of water sources. They also pointed to what they called the present leadership void; and they emphasized the importance of "traditional" ways of running things. The former role of chieftainship and the current political and administrative system were both outlined in chapter 2. In this section we look into the organisation of communal work, which is effected partly along traditional lines and partly by the formal administration.

Before fieldwork began, the author had no intention of dealing extensively with the historical background of leadership and organisation. The informants' ways of reasoning indicated, however, that the presentation would be partly unintelligible without an understanding of the historical background For this reason the evolution of leadership and organisation related to water is dealt with at some length here.

Local Organisations

There are similarities as well as differences between the formal local government, the traditional age-grade associations and present-day security groups called *sungusungu*. The party and government organisations were instituted from above by authorities in distant places and filled with politically appointed or screened leaders, while the other two informal associations were developed in the local situation with elected or locally appointed leaders The latter operate within smaller geographical areas and involve a larger voice for residents. The formal village organisation has a decision-making council of villagers under the village assembly, but no advisory body of elders although this is a prominent feature of the associations These characteristics of associations reinforce the mutual ties between "grass-roots" leaders and the constituencies to which they owe their very existence, while formal leaders rely also on party and government hierarchies.

The village council is the lawful body to organise all work in the village; it can make by-laws and has the power to impose fines The *sungusungu* looks after peace and security in the village The age-grade associations fulfil different tasks and, for instance, the *basumba* is a communal work party The three organisations are presented below.

Area	**Chiefdom system** executive+advisory	Present formal organisation	**Sungusungu** executive+advisory
ward	*ntemi* + state council	ward secretary(p) Ward Dev. Comm.	-
village	-	chairman(p) *katibu*(p) and village council	*ntemi* + elders
	headman + assembly		
kitongoji	*nsumba* *ntale*	-	-
tencell	-	*balozi*	*kamanda ndogo*
household	*banamhala* *basumba*	CCM, UWT and TYL members	*sungusungu* members

Figure 8.1. Organisations and office bearers at different levels

The table shows the variety of potential actors in the *own-key* sector and it needs some further elaboration [1] The Local Government Act of 1982 provides information on the formal organisation and its functions, while the writings of Cory, Malcolm, Tanner and, later, Varkevisser (1973), Abrahams (1988) and Brandstrom (1990) provide information

[1] Perham (1976 43) reported in an interview with the governor of Tanganyika in 1929 that "The difficulty after a period of disintegration is to find out what their system was *They* know perfectly well but, for one reason or another, they may not tell you The natives surreptitiously carry on their own organisation "

about the Sukuma age-grade system and *sungusungu* Comments and assessments derive from interpretation of the interviews.

Two surviving Sukuma grass-root associations. In each village there used to be several societies formed and maintained for a variety of purposes. As pointed out by Tanner (1955:160) the Sukuma community had no age-sets or initiation rites so other societies or associations "provide all the exitement and mystery which these other rites may call into play." Each of the associations had a chief, headmen, messengers and other dignitaries, all appointed by a combination of popular vote and feast-giving. Every villager belonged to several of these associations[2] which gave him or her "particular status in his community, although in the eyes of the /colonial/ administration he may be nobody." (Tanner, 1955:160) None of these associations had any legal recognition in the native authority system (Lord Hailey, 1942:242) Sara Berry (1989:48) made a general remark about associations· "Their power rests not on excluding people from membership or access, but on perpetuating a distinctive identity " Apart from meeting the basis for the attainment of luxuries such as drinking, dancing, magic and travel about the country in the dry season, with the ultimate result, according to Austen (1968:17), that "Sukuma agriculturalists were virtually immune from concern with central political matters" The age-grade associations also provided the necessities of communal work.

Some age-grade associations Age-grade associations outlined the kind of tasks that each person was expected to perform In Sukumaland these associations, rather than bonds of kinship, played a crucial role in organising communal work and in dividing tasks For the purpose of the present study two associations are of special interest; that of young men, *basumba*, and that of elders who have been initiated through *ihane*. The organisation and activities which they performed are outlined below. As we will see later, both these are active to some degree also today.

Elderly men, *banamhala,* and women, *bagikulu*, can join the elders associations. Age grades were important elements of social stratification and transition from one rank to the next gave access to knowledge, resources, social position, etc Varkevisser stated that a man has sound motives for joining the *ihane* as membership gives him "some say in matters which affect the welfare of the entire neighbourhood and assures him of assistance in the event of marriage or death within his homestead or should he have difficulties with a neighbour." (Varkevisser, 1973:64). Elders (men only) sat on the *assembly* dealing with court cases of various kinds like theft, adultery and family quarrels. Another important task performed by elderly men was the bride-price negotiations The elders also had the role of explaining occurrences like misfortunes and drought, often by examining the intestines of a chicken

The *basumba* group of all men between the age of sixteen and up to, say, 40 years often

[2] Unlike age-sets, age grades are not corporate groups but consists of a series of statuses through which the individual moves over time

worked for food on each other's farm under the guidance of an elected labour leader, *nsumba ntale* [3] The distribution of land and assignment of labour remained largely in the hands of village age-grade association, particularly the *basumba*, and their *nsumba ntale*. Furthermore the *basumba* built houses, collected grass for roofing, dug dams, ponds and springs, built roads and paths, were messengers, helped new-comers to move to the village, kept order during marriage ceremonies, carried sick people to a healer or to the hospital and corpses to their home where they prepared the graves, etc. The elected *nsumba ntale* had, if his assistants agreed, the authority to impose sanctions on those who did not turn up for communal work such as refused share of beer or meat, a small fine, no mutual assistance by the association and, in serious cases, isolation of the defaulter whereas no one was allowed to get in contact with him or her. This last punishment was certainly a very painful one (see chapter 10).

Some features of the age-grade system persist. Much of communal work is organised in the same way as the *basumba* guided by the *nsumba ntale*. The age limit for men wishing to join the *banamhala* group has been lowered, however; they may now join as soon as they have established their own homesteads (often between the age of 25-30 years) or even earlier if they can afford to pay the entrance fee to the *banamhala* group. By so doing they can demand respect even from elder members of the community. Therefore the previous close connection between age and rank seems to have been seriously weakened and replaced by a ranking based on individual (or family) resources. Sometimes younger *banamhala* of today, however, work together with *basumba* in communal tasks and mutual assistance in farming.

Sungusungu groups.[4] Around 1980 'traditional security groups' called *sungusungu* started to fight theft in the countryside (Abrahams, 1987:181). At that time cattle rustling and robbery were rampant and the police did not manage the situation at all. *Sungusungu* groups spread to all villages and these groups were officially recognized by the

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[3] Sara Berry (1989.98) stressed that the engagement of labour was not for immediate remuneration, but support in other contexts. In a colonial setting with government aspiration to implement a number of infrastructural and other activities the *basumba* groups were used Richards (1960·253) observed that "communal labour projects were no longer the consequence of mutual agreement and bargaining between chief and *basumba*, rather communal labour is an obligation imposed upon the individual Sukuma under the Native Authority Ordinance."

[4] Abrahams (1987 182) found that the word is usually said to derive from Swahili where it denotes a species of large black biting ant However, he also mentions that the 'biting power' is combined with a reference to black cloth with which Sukuma pastoralists sometimes drape themselves The word *sungusungu* may also derive from the Nyamwezi word *busungu* meaning poison

government.[5] These groups were organised from below and thus became quite independent in pursuing the customary law enforcement. The methods used by *sungusungu* are not in focus here, but rather the potential of *sungusungu* to involve itself in development and maintenance of water sources.

The structure of *sungusungu* in a village has borrowed features from the chieftainship as well as from the local government system, and therefore the terminology can become somewhat confusing. The set-up may vary between villages simply because it was introduced by villagers themselves, but the following features are common. Every group of ten households elects a subordinate commander, *kamanda ndogo*, usually a young person with a record of good performance.[6] Two *kamanda* guide the group of subordinate *kamanda* in operations of security and intelligence. The chairman of *sungusungu* is called *ntemi*. The *ntemi* is usually assisted by a *ntwale* and a secretary who records the formal meetings and legal proceedings. There is a council of elders, usually five but there is a move to increase the number to thirty, which advises the *ntemi* in his ruling. The elders are elected by all adult members of the (sub-)village, and the elected elders appoint among themselves the *ntemi* and the *ntwale*. As more and more issues are connected to the running of village affairs at large, the chairman of the village is said to be invited to the meetings as an expert on government and party policies.

The informants said that the *sungusungu* groups have been fairly successful in restoring security and mediating in family quarrels and in criminal cases in the villages (thereby bypassing the corrupt system of the police and local courts) People seem to place more trust in the *sungusungu* with the result that they demand that the *sungusungu* should take on more responsibilities in the community. For instance, to *sungusungu* was entrusted the delicate task of recovering embezzled money from board members of the primary cooperative society in several villages in Mwanza region in 1990. On another occasion *sungusungu* performed a symbolic act when they handled all the money collected among the Kwimba residents to buy a car for the district party organisation.[7] The *ntemi* of *sungusungu* in Bupamwa arranged the meetings between the author and groups of users of the different water sources for discussions about potential improvements of water sources. Most informants in Kwimba district said that the subordinate *kamanda* often leads development activities in neighbourhoods. Not all is as it seems and not all is not free from question-marks, however: one informant said that "*sungusungu* has been hijacked by the police." (E5f2b:120).

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[5] Over the years many presidential statements have been made similar to the one in Daily News 20/10/90. The president urged residents to join *sungusungu* "which greatly complemented police work." He reiterated that "members of these groups would not be intimidated by state organs "

[6] There are female *kamanda* today and presumably the time when it was "laughable to think of women defending their villages" (Noble, 1970 92) is now gone

[7] Perham (1976 80) mentions that the headmen of Chief Masanja's kingdom clubbed together and gave him a beautiful Buick in 1929.

It is noteworthy that *sungusungu* in some villages have become involved in suppressing excessive drinking. If a man (rarely a woman) uses beer and toxic drinks to the extent that his ability to sustain his family is jeopardized he may be called before the elders of *sungusungu* and this assembly may even bar him from drinking for a period.

The *sungusungu* finances its activities with contributions and from fees paid by those using their counselling and with part of the fines that thieves have to pay, often twice the amount they have stolen. This is much the same way that the chieftainship was maintained earlier.

The local government. In chapter 2 it was mentioned that district councils were reintroduced in 1984. A district commissioner heads the decentralized government administration. The district council decides on taxes and expenditures for social services, development projects, etc. Groups of four or five villages make up a ward, each of which has a ward development committee responsible for development activities in the area, i.e. for promotion, planning and implementation of projects like roads, social welfare, agriculture and industry. The chairman is the ward secretary (a political office) and members are the village chairmen and the *katibu*, their local councillor (member of the district council, elected by the ward), and public officers seconded to the ward. The village assembly, made up of all residents who have "attained the apparent age of eighteen", is in theory the supreme authority on all matters of general policy-making in the village. The chairman and secretary of the CCM party branch automatically become the village chairman and secretary (*katibu*). The 25 members of the village council, which is the executive committee of the assembly, are elected by the assembly for three years.

The village council has "all executive power in respect of all the affairs and business of a village." (Tanzania government, 1982:92). It can impose by-laws in the village, and evaders are fined. One well-known example is the ruling that each household has to construct a latrine. As for communal activities the *katibu* and the chairman have the authority to request *balozi* (ten-household leaders) to supply a stated number of able persons to work communally for a day or a week, and defaulters are fined if they have no good reason for not turning up.

Ascribed and Achieved Authority among Local Leaders

The governmental organisation, the age-grade system and the *sungusungu* seem to co-exist in various constellations in the villages. Their effectiveness depends partly on the qualities of individual leaders present in a particular village. In some areas, notably in Kwimba district, the *sungusungu* seem to be fulfilling an increasing number of tasks which the formal village leadership has difficulties in fulfilling. Nowadays the role of the village chairman may be limited to issuing a "go ahead" to the *kamanda* who will organise the work independently. The *sungusungu* has the capacity to be involved in such new activities now that the security situation has improved considerably.

In villages closer to the lake it seems as if there is a tendency to fill the modern leadership void by the familiar age-grade institution. Several informants in Mwanza District expressed the hope that the group of elders and the *basumba* be restored.[8] The chairman may well rely on the *nsumba ntale* to call the people and organise the communal work in villages in the Magu and Mwanza districts. For instance, the cleaning of *lambos* and deepening of traditional water sources may be organised by the *nsumba ntale* who convenes the *basumba* and *banamhala* by blowing the horn.

Grass-roots leaders thus complement and sometimes even substitute for formal leaders in community activities like mediation and supervision of communal work. An encroachment on responsibilities is bound to lead to occasional problems of who is responsible for what, especially in instances where the formal village leaders and the grass-roots leaders have conflicting views. The legal position is clear i.e. the formal leadership has the assigned/ascribed authority should it come to a conflict. But, in the eyes of the villagers, according to the informants, the grass-roots leaders are still often the ones with earned or achieved authority.

We leave questions about how likely it is that the present parallel structures will amalgamate, or whether it is possible to promote a new style of leadership in the villages through *sungusungu* or a revised age-grade organisation. The main concern here is focussed on the given blend of local leaders and how interested and competent they are to initiate and implement water-related activities. Water activities which require village or *kitongoji*-level management are at the mercy of the (presently) weak formal leadership and potentially interested grass-roots leaders.

Cooperative Work among Villagers

The tendency of the Wasukuma to form groups deserves special attention when seeking an orientation of village life. Much has been said about the communal character of work in Tanzanian villages (Abrahams, 1967; Bevan et al., 1989; Brandstrom, 1990; Collier et al., 1986; Hyden, 1980; Fortmann, 1980; Nyerere, 1967; Putterman, 1986), yet it is necessary to distinguish between the relative proportions of individual household and communal work in different small communities, as a matter of fact most things are solved by individual arrangements and, if necessary, leaders and elders assist. Malcolm pointed out that

> ...the vast bulk of the regular agricultural work is done without assistance by each family on its own holding. After family labour the most usual type of agricultural

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[8] This revival seems to be the reverse of the development noted by Cory and Abrahams, that the associations of 'old men' in Sukumaland were rapidly becoming defunct in the 1940s The younger men's associations were also said to have declined in importance in some areas during that period (Abrahams 1967 55 and Cory 1954 71-2, 77, 79).

> assistance is that of friends and neighbours called personally by the homestead which requires labour, and it is paid for in beef or beer at somewhat lower rates than the usual for the labour of the village association. (Malcolm, 1953.38)

This pattern holds true today according to our informants; also within the water sector. This is one of several reasons for studying water-related activities at household level in chapter 12.

Villages in Sukumaland are usually not kinship units because brothers frequently reside in different villages and men tend to take spouses from other villages.[9] Therefore, when talking about a neighbourhood it may be composed of people who are not related to each other or do not originate from the same area. The local group for cooperation is not based on the principle of kinship, nor on that of ethnicity (Brandström, 1990:4.9)

There has been some discussion about whether support to kin is distinct from support to other neighbours. Abrahams (1967:43) expressed the opinion that "a person who has received help from a neighbour should give an equivalent in return, while kin simply help each other when and how they can." This opinion is disputed by Brandstrom who contends:

> I would rather ... speak of the 'morality of neighbourliness', perhaps of a different 'blend' and of less long-term character than that of kinship, but generally does not reckon with repayment within a specified time. And even when there is 'debt' in the sense described by Abrahams, the one person should approach the other as if there was only 'sharing' without 'reckoning', in Fortes' terms of the words when discussing the essence of kinship morality ... Still the kin group is very important, the single household often being only a 'part of the enterprise' with respect to the extended kin group The kinship network is generally extended over a large area and the exchange of labour, in terms of visiting relatives, and circulation of agricultural produce and livestock within the network is considerable. (Brandstrom, 1990.4.10)

The Wasukuma may rely on two groups; the neighbourhood and the network of relatives. This, probably, increases the security of the individual household but may also make individual families less prone to be involved in community activities since they can rely on relatives.

During the second round of interviews our informants put less emphasis on leadership problems, partly because much of our discussions concerned household water projects, but also because it became more evident that people expected less this time from the formal village structure

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[9] As land was usually available not far from the parents' home, the practice of moving away has saved the holdings from fragmentization and the farmers from changing their farming methods from labour-saving extensive farming to labour-intensive methods (author's comment)

> The elders in our parish decided to develop ponds in the area without asking for permission from the *katibu* We meet every Monday morning to excavate silt and each household is to send one member to work. If the father is away he is replaced by someone else in the household. Girls also attend Only the first meeting was called by blowing the horn and after that all know when to come There is no need to supervise the work, we just cooperate. (B4f2b:140)

This makes room for negotiations between different parties and the outcome is not given in advance. The first step in analysing how negotiations are conducted is to find out how such issues are communicated between various parties in the community.

Pattern of Communication

Issues of concern to villagers can be discussed at various levels as well as between levels according to outspoken or implicit rules. The Wasukuma are said to be accustomed to leaders and consequently they relate easily to formal leaders and structures of today like the *balozi*, *katibu*, etc as well as informal structures with *basumba*, *kamanda*, etc. Informants' general expectations about who should communicate with whom are treated from a gender point of view and relate to village and neighbourhood leadership and organisation. Our discussion develops along the line pictured in Figure 8.2 below, and identified gaps in communication between different levels of the formal hierarchy are discussed.

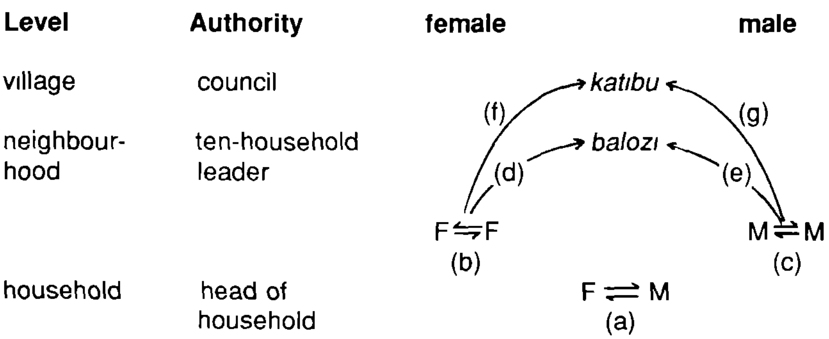

Figure 8.2. Communication pattern level, authority and gender

Deliberations at household level (a) will be studied as intra-household negotiations in chapter 12. Informal discussions among female neighbours (b) and among male neighbours (c) as well as possible cooperative efforts are studied in connection to the respective group's chances to forward matters to the *balozi*, (d) and (e). A *balozi* has "free" access to the *katibu* while female (f) and male (g) commoners face varying access to the *katibu* and village council

The rather strong sense of hierarchy among the Wasukuma suggests among other things that commoners are not expected to suggest actions to someone higher up in the hierarchy. A general rule of seniority in the past gave elders a prerogative to decide over others in the kin group and more generally in the community. In Sukumaland, however, as in most other societies, this rule has been challenged and often superseded by rules of formal hierarchies.

Female communication. Women often accompany one another when walking to the water source and therefore have ample time to discuss water problems. In rare cases the result may be an agreement to approach a formal leader in order to make proposals or complaints. There are (very few) women among the 25 members on village councils who could be asked to push household water issues; nil to three in the six villages. This is close to the figure nil to four that Margrethe Holm Andersen (1991:5) reports from Magu district, and higher than Mtui (1986:10) found in Mwanza and Shinyanga where only two out of twelve villages had any female elected members.

The institutionalized view that women are not supposed to speak for themselves was expressed by a female informant who described how she perceived various ways to communicate her water problem.

> We find it hard to discuss water problems under present circumstances. I think it is because of habit only, saying that it is our task to fetch water. The assistance that men are prepared to give would come forward if they knew our problem. But, on our own, we women will remain under the present conditions. To approach the village council is okay, but the council deals with matters that men can solve. If we women continue to fight our course the men might eventually come to feel that it does not matter what they do since we will come there instead of the men, to tell about such matters.
>
> This is why they want men only to approach the village council, despite the fact that it is the women who ask for assistance. Perhaps they think we are trying to force them. But water is the first priority and they themselves would also ask for any help. (R4f2b:140)

Her way of reasoning shows that she is very concerned about what would be the feelings of the men about approaches from women. She may be cautious to such an extent as to consider it inappropriate to forward water problems to the village council.

The view that women should not raise their voices in either the council or the village assembly is strong.[10] Mtui (1986:10) reported several reasons for low female activity including apathy, resentment, denial of access, etc. and also that many female respondents

[10] O'Barr (referred to in Fortmann, 1980) showed that even highly verbal and aggressive women behave in a very traditional fashion in the context of otherwise all-male committees, speaking only when directly questioned.

"explained their silence and inactivity as an expression of protest against the way they are treated by village government." Fortmann suggested that exhaustion is one reason for their low activity, but also that a woman who asserts herself in public is likely to be sanctioned not only by men but by other women as well. Generally, Fortmann (1980:63) contended that women will speak only to support a statement by their husbands.

Within the formal village organisation women are represented by the chairwoman of the local branch of the women's organisation UWT (*Umoja wa Wanawake wa Tanzania*). In five of the six villages the name of the chairwoman was not known to our informants. The UWT could promote water development and push communal activities in the water sector. Our informants could not tell about any occasion, however, on which UWT had been active on such issues. UWT was said to be revived only when it comes to disbursing support to women's groups like seeds for vegetable gardens, a sewing machine to a women's group, or a milling machine for the village.

It does happen, however, that women contact the lower leadership like *balozi*, who in turn are free to choose their measures in the way they find appropriate as is shown in the following example where an initial positive response in fact gives the *balozi* the choice to postpone action indefinitely.

> I have spoken to some *balozi* and the one in my ten-cell is very interested in constructing a rock-well. He told me to await a meeting in the neighbourhood. Now we wait for this meeting to be called... (L2f2:180)

Male communication. Informants claimed that men rarely discuss water problems with their neighbours unless some intervention is already planned or ongoing. They have ample time for discussion after work and many informants claimed that they did discuss water issues, but then only for livestock. There are exceptions when they may discuss household water, usually when they know one another very well.

> We were moved up here in 1974 from the river-bank. My old friend and neighbour and I decided to look for a new water source close to our new homesteads. All trees had been cut down on the slopes so we used moist spots (in the dry season) to trace underground water. We dug a one-metre deep pit at a promising spot 100 steps away, and hit a spring which yields water all year round, although only little at the height of the dry season. (I2f1:G4)

Men have the right to approach leaders to discuss water problems. It is obvious that this right is exercised mainly by well-to-do farmers and mainly in connection with water for cattle. The dry-season field work in September 1990 coincided with the national elections and political candidates were touring villages. A group of villagers wanted the author to put a "good word" on the candidates about the need to improve the water supply. They felt that they could bring up the matter themselves at the rally meeting, but were in doubt about its effectiveness. The author was told after they returned from the meeting that the water issue was brought up and that one of the election candidates had prepared a detailed answer about cost estimates for a rehabilitation of the non-operational piped scheme.

The author's impression was that villagers tended not to go public with any new ideas they may have. They kept new information to themselves and did not spread their ideas around to fellow-villagers [11]

> Since time immemorial we have not been keen to discuss new things or to share ideas on how to do things. (R2f2b:60)

This tendency became evident also in discussions about options of simple technologies. Leaflets and the like were not passed around but mostly kept by the recipients. This is very different from the way politicians, teachers and others freely spread around messages. In such cases the information or message, however, is rather used as a means to manifest the position of the messenger Commoners can hardly use their technical skill to create a position and they may not even be supposed to do that because it would upset the prevailing order.

An extended example: Water-related discussions in a village council. It proved difficult to get written information about how village councils had treated water issues over the years. Minutes from meetings were brief and frequently missing. The author went through the files of two villages and found comments on water only in connection with collection of money in order to pay a stipulated contribution to join a water development project (intervention).

Interviews with villagers about what had been discussed in the council proved to be as difficult. Villagers know that the village council can apply to the ward development committee for a water supply, but equally they know the chances of getting one are small. Informants gave quite different versions of what had taken place in their village council. These statements were made by three informants from a single village.

> "No discussion has taken place in the village council on household water issues. As a woman you are free to speak up, but when it comes to implementation, men decide. Since things often end with words there is no reason to argue. Still, we women think it is a men's question " (D1Ib320+F11)

> "We have only spoken about water for cattle, especially during droughts." (B4:F4)

> "During the drought in 1984 the council managed to have water ferried by lorry to the village from the district town." (B3·F3)

[11] Elspeth Huxley reported chief Kidaha of Sukumaland having said "They still believe that I make the rain. I tell them that's an old-wives' tale, but they smile and say: 'Wise men never tell their secrets ' So what can I do? " (Huxley, 1948 166)

A straight question like this about a particular occurrence in the council typically produces such differing and partly contradictory answers. Few commoners may actually know what had been said in the council; some may have reasons for being negative about the council and others may have reasons for painting a positive picture.

Concluding remarks

Organisation and leadership. Uphoff (1986:33) made the observation that "... in communities with intact traditional rules, the capacity to manage appears greater." The new independent government in Tanzania opted to abolish the chieftainship and bypass the existing voluntary age-grade and other associations by creating national mass organisations like the UWT and TYL (TANU Youth Leage) in an attempt to rid the countryside of 'traditional' influences. This abrupt change of lines of command created confusion as to who was to do what and how. The situation today is probably even more confusing as local responses emerge to fill the leadership-gap left by the disintegrating formal party and government structures and the lowered authority of the leadership.

Two associations, the *sungusungu* and the *basumba* group of young men, were present in the six villages and their involvement in development work differed. There is a long tradition among the Wasukuma of organising cooperative work. Its success is heavily dependent on the quality of leadership, a point which will be discussed in some detail in chapter 11.

Communication The pattern of communication sketched above suggests that formal leaders receive few requests from villagers, especially from women Village council members and leaders in general have to be sensitive to villagers' needs and the fact that most leaders have a similar lifestyle to their fellow-villagers helps them to know what is desired. "Keeping a common touch as a technique for keeping lines of communication open can sometimes be of crucial importance." (Noble, 1970:39).

The likelihood of women pushing leaders to take action to improve access to water is limited by the low expectation that women will act in public. The matter is complicated by the fact that diffusion of ideas of how to go about improving access to and quality of water requires a flow of information about innovations and new methods. A reluctance to disseminate information is said to be inherent and affects men's knowledge about installation of water supplies and women's knowledge about improvement of water quality and how to ease the task of fetching water.

Choice of technology and leadership There is a relationship between choice of technical arrangement and leadership Furthermore, similar solutions may utilize more or less sophisticated inputs. The appropriateness of a particular combination of technical level and capacity to organise various *own-key* arrangements. Households manage simple roof catchments, wells, ponds and means of transport, while sophisticated cement tanks and *lambos* are beyond reach for most families since they do not command the necessary inputs Neighbourhoods and smaller groups of villagers can, voluntarily or under the leadership of a *balozi* or *nsumba ntale*, construct wells and *lambos*. Such groups can hardly organise transport of water or roof catchments, nor are they used to be involved in major *own-key* construction works needed for piped supplies and boreholes. There is no (voluntary) association which has the specific task to develop and maintain household water sources, and the work is taken on by groups of users as need arises.

Formal village leaders are in charge of areas with several thousand of villagers spread over three to six subvillages. As a comparison one-third of the chiefdoms in Sukumaland had smaller numbers of subjects in 1934 than our six villages have now (Malcolm, 1953:9), while the then headmen usually administered areas with a few hundred people. Today, any effort to develop water sources has to be carried out by smaller units than the village. The *katibu* can ask for that or organise a campaign that involves all subvillages, which in turn organise themselves Village leaders are more geared towards mobilizing than to carry out specific tasks At present it seems unlikely that village leaders can organise the work and raise the funds required for larger schemes like piped water or drilled boreholes.

It becomes evident that most installations can be managed at more than one administrative level by switching from one technical level to the other. This is one major reason why leadership issues will be analysed at some length in section C.

9

Possible *Own-Key* Measures

Introduction

Sukuma skills and knowledge about water accessibility and quality were examined and relevant existing organisations at village level were presented in the previous chapters. In this chapter we present what informants have done up to now in the way of *own-key* arrangements. The affordability of such solutions in terms of economic and material resources is discussed in order to assess what the villagers could achieve collectively and individually by making full use of their own knowledge, skills and managerial resources.

This review covers essentially three kinds of activities: improving or constructing new water sources; facilitating transport of water from the source to the home; and protecting water quality.

Affordability: Time and Money

Villagers make use of locally available human and material resources to fulfil all their needs, and water needs are not different. The technical solutions discussed in this study require in addition to skills, organisation and knowledge varying amounts of labour time, cash, material, and a few tools.

Time-use and the alternative cost of time The major input which is required for the investment itself and for operation and maintenance seems to be that of labour. The availability of labour and its alternative use influence decisions. For example, a bar-owner may find it cheaper to send a lowly paid helper to fetch water from a distant source (to wash used bottles) than to install a water source nearby.

There are few studies on time-use from the area and those deal primarily with agricultural work (von Rotenhan, 1968:68; Hankins et al., 1971:125). The informants provided a rough picture indicating that men and women are equally busy in agriculture while women do all the household work. Instead of falling prey to the complicated problems of measuring time-use, the same purpose here can be achieved by sketching the time spent on agricultural tasks and the time spent on fetching water over the year.

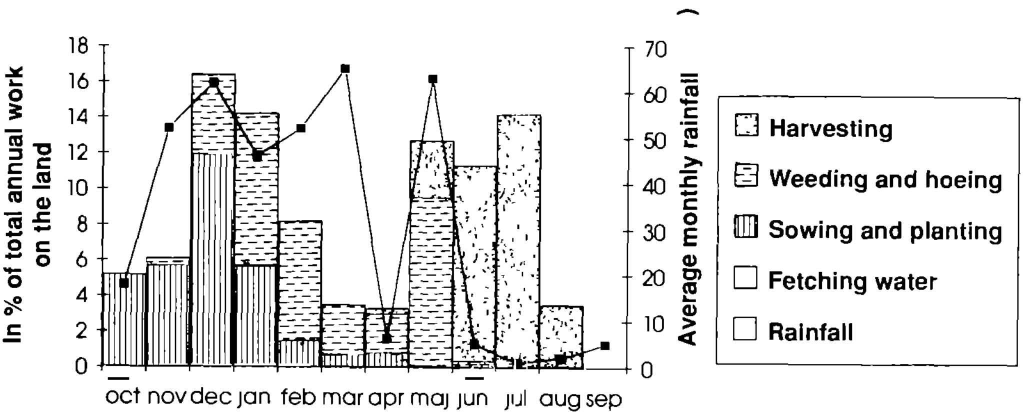

Figure 9.1. Work-loads in agriculture and average monthly rainfall
Sources: Based on von Rotenhan, 1968:68 and Husberg & Nilsson, 1978:7.

The total work-load is high during most of the agricultural season when, fortunately, water is readily available There is a dip in agricultural work in March-April. The main harvest does not follow until June, when the large fields of rice, maize, sorghum, and cotton ripen. In July much time is taken up with picking, sorting and transporting cotton (von Rotenhan, 1968:69). As the dry season is intensified in September and October the time used for fetching water reaches its peak while agricultural activities almost cease. Assuming that the total time spent on activities other than fetching water and farming is about the same over the year, we may conclude that the slack in agricultural activities in the dry season provides time for fetching water from farther away. The situation may be described in a purely economic vocabulary by saying that sending women, young girls and helpers in the household to fetch water has no opportunity cost during the dry season and only a small marginal cost during the wet season, since the time required for a household is less than half an hour per day. The cost of letting women "do more of the same" is small i.e. *continuity* is affordable in a time-use sense If the cost is significant, for instance, due to a shortage of labour, economists would expect a *change*-oriented response by rural people.

Actual time required for implementing specific arrangements ranges from a few hours (small pond) to some weeks (*lambo*). The cost of men's time should be examined in order to assess the affordability of male inputs into development efforts. They may claim that they have an alternative opportunity to use this time to earn cash or get access to beef and beer by taking part in *basumba* or *sungusungu* activities or *banamhala* deliberations The time they spend on improving access to or quality of water therefore carries an opportunity cost which is borne by the men, not the women. The slack demand for agricultural work in the dry season when water-related activities are ideally implemented is also significant for men. Thus, the affordability of men doing new things i e. *change* is obvious.

The above assessments hold true only as long as the valuation placed upon leisure time is reasonably low and does not differ significantly as between women and men. The decision to take initiatives leading to change or to proceed as before cannot be based on affordability only but is reached through negotiations.

Money expenses. Informants said it is harder to contribute cash than labour to a development activity; mainly because people have little cash but also because of frequent embezzlements (see chapter 11). Many informants were dissatisfied with having to pay all kinds of duties, the development tax and contributions to this and that, without seeing much result.[1] Lack of credit institutions may be another reason inhibiting larger individual investments, as hinted at by one informant:

> If somebody would like to borrow say, ten thousand shillings for a certain project and promise to pay after some time he will not get the money. The potential lender thinks that the borrower will benefit very much from these 10,000 shs, more than himself. So, he prefers to remain with his money in the savings account in the bank. (L4Ib510)

An indigenous village-based fund, the ***ifogong'ho*** fund, was established recently to lend support and money to its members in the case of death, accidents, and illness.[2] The fund

[1] This is the opposite of what the district officer F W C Morgan reported from the Chiefs' Annual Baraza in 1928· "From the obvious ignorance that existed about the commutation tribute, the gathering was well lectured They were impressed with the fact that all their wages, benefits such as hospitals, schools, ploughs, etc , expenses of bush clearing, roads, ferries, etc , came not from the central government's pocket but from their own, viz. out of commutation tribute. Appalling ignorance was exhibited on this matter " (Musoma District Book, tape 24 in the National Archieves)

[2] If the relatives are unable to raise the necessary money to bury a family member the *ifogong'ho* fund may assist In case a poor member is admitted to hospital the fees may be paid by the fund The person is expected to refund half of the expense after recovery The fund pays all expenses if the patient dies

may be seen as a response to weakened extended family ties. Whether the *ifogong'ho* fund is also meant to counteract greater inequity is difficult to say. Near to the lake it seemed as if this institution was lively, with all adults in a *kitongoji* being members, while it had just been introduced in villages in Kwimba district.

Villagers can also get short-term loans from the *ifogong'ho* fund. The usual interest rate is 20 per cent for a three-month loan (the national rate of inflation is some 30-40 per cent). If the borrower fails to repay on time the loan may be extended for another three-month period but at that time the loan-taker has to pay twice the amount. If he fails to do that the *ifogong'ho* fund simply recovers the arrears by confiscating a goat, hens or goods of equal value. The person in charge of the *ifogong'ho* fund is usually wealthy, thus allowing the members to recover embezzled money should that happen.

> In our village we had several hundred thousand shillings in the *ifogong'ho* fund and people got cold feet. They decided to distribute most of the money to the members and only 40,000 shs were left in the fund. In a village nearby they used the *ifogong'ho* fund to finance the building of the CCM-office instead of raising money among the villagers. (WorkIIa380)

The existence of *ifogong'ho* funds in (sub-)villages shows that the financial capacity is fairly good, given that the purpose is perceived desirable and the safety of the money secure. For instance, a contribution of 8,000 shs for a shallow well with a hand-pump installed by Hesawa is easily affordable.

New or Improved Household Water Sources by 1990

Turn-key installations. Government turn-key installations have been numerous and are reasonably well documented as exemplified by the case from the Buhungukira area (see Appendix A). The documentation reveals the low rate of sustainability, as in the case of the piped supplies in Bupamwa and Mkula which never became operational. More recent projects like Hesawa (1983-onwards) and RIDEP (1977-83) emphasize shallow wells with hand-pumps with the expectation that these would work over longer periods. Five of the six hand-pumps installed by RIDEP in Mkula were not functioning after eight years, and one-third of the Hesawa shallow wells were not functioning after some five years according to an evaluation of the Hesawa programme (IRC, 1992), despite the fact that the programme was in full force. Thus, most of the water in use today comes from either natural or *own-key* arrangements made by the villagers themselves.

***Own-key* arrangements.** A crucial part of assessing what can be done locally is to look into what has been achieved up to now Water development has a long history in Sukumaland and information about *own-key* arrangements usually has to be identified through oral information and by observing recent events Donald Malcolm observed in the 1930s that:

> ... in many villages on the higher land of the lighter soil-groups water for domestic purposes is obtained either from a well (*luinzi*) tapping a shallow ground-water table, or from a spring (*luzwilo*). These are sometimes supplemented by pits, which are situated in impervious soil for the catchment of surface water. . (Malcolm, n.a.:59)

People living in the lowlands used to get most of their water from dug wells in alluvial soil in a stream or river bed. In the rainy season this fairly narrow but long aquifer with its highly permeable material was full of water and during the dry season it was extracted from pits in the river-bed In late times villagers have experienced several kinds of water development work:

> We dug a trench for the water pipes from here all the way to the Moame river some ten kilometres away as voluntary work in 1976 Also we do a lot of little things such as dig wells, arrange for water supplies for our cattle, make impoundments in the river, and sometimes we dig as deep as ten feet into the river bed to collect seepage water (R5f2a:380)

The informants told us of their *own-key* arrangements since the onset of villagization in order to improve their household water supplies A summary listing of these arrangements (other than roof catchments and excavated pits in river beds) is presented in Table 9.1.

Table 9.1. Recent *own-key* arrangements number of participations by informants

Action / Actor	Spring	Pond	Shallow well	Purifier	No *own-key* action	Total
Women	1	2	3	-	7	13
Men	2	5	2	1	6	16
Total	3	7	5	1	13	29

The table shows that more than half the informants had taken part in *own-key* water supply activities since the time of villagization[3] And almost all the 13 informants who had not participated in what we defined as *own-key* activities had made simple roof catchments and/or dug waterholes in river beds. The accuracy of this information is considered high, since the arrangements were inspected. However, despite the informant's claims, it is possible that someone else could have done the work, and some informants

[3] 23% of the respondents in a survey 1976 indicated that they would like to do water improvements themselves (WMP, 1978 v16 322)

may only have contributed marginally to their construction. There is also a need for caution about possible under-estimation of the amount of work done by women; they are not always prepared to tell what they have done, especially when this would reflect on the traditional role of the men.

The informants constructed their ponds, wells and springs by using locally available skills and simple tools, while shallow wells with cement rings were built under the auspices of the MAJI department. Such experiences have added to the Sukuma skills and knowledge.

Sukuma Resources to Develop Household Water Supplies

Sukuma knowledge and skills The informants' knowledge of hydrological conditions in their area of living is fairly good, and they are confident that there is water in the ground, usually not far from where they lived. This confidence is largely justified and supported by protocols from shallow wells in the area, and by the experience of the former water consultants Coster (n.a. .7) and Gillman (1938:18), and by Malcolm (1953). Few informants, however, can claim to know all important aspects. Completeness requires a combination of several informants' knowledge, which is in line with customary ways of solving problems in cooperation as outlined in chapter 8. The findings about Sukuma knowledge in previous chapters are summarized in a condensed form in Table 9.2 below.

Table 9.2. The author's assessment of informants' level of specific knowledge necessary for the construction of various *own-key* water supplies

	Hydrology			Soils			Siting	
Type of supply·	amount of rain	distr. of rain	evapo-ration	imper-meable	hard to dig	stable walls	indicator bio	geo
roofcatch-ment	B	A	Nn	Nn	Nn	Nn	Nn	Nn
pond	B	A	C	B	B	B	Nn	B
lambo	C	A	C	B	B	B	Nn	C
spring	Nn	Nn	Nn	B	B	Nn	B	A
well	B	B	Nn	B	A	A	B	B

Legend: A= good general knowledge, B= enough knowledge for the task,
C= insufficient knowledge for the task, and Nn= not necessary for the task.

The author's assessment of whether the Sukuma knowledge, organisation and skills are sufficient is combined with affordability aspects in the more detailed discussion below. Plates showing the various installations are found in chapter 5

Rainwater roof-catchment. Roof catchments can range from a bucket at a neighbour's iron roof to a cement tank into which the rainwater is led in aluminium gutters (Plate 1 and 3). Most houses have thatched roof and the collected water is rated as low quality, yet, "when it starts raining we rush with the few buckets and other containers we have to collect the rainwater from the roof." Most houses with an iron roof have rudimentary roof catchments with a piece of iron-sheet gutter and a bucket or drum to collect rainwater. Technical skills are sufficient for slightly more sophisticated roof catchments, but only one informant had built a small cement urn which held less water than a drum. A steel tank (4 m^3) had been installed outside one informant's house to provide water for cooling a milling machine, not for storing roof water.

Only one or two knew how to calculate the amount of water that could be collected from their roof or the school or clinic roof, but this does not matter because water overflow is not a problem. When informants were told about the vast amounts of water that a small roof could yield, they often started talking about how to store such quantities. Almost all had seen steel tanks at teacher's quarters and health clinics. In Mkula, for example, the African Inland Church hospital has built a large cement tank on ten metre pillars, and an underground tank (30 m^3) has recently been built at the Roman Catholic guest house in Bupamwa

Those who could afford an iron roof had to make just a small additional investment to install a gutter and a drum. A household that could not afford to cover the whole roof with iron sheets could very well start with one or a few sheets. One iron sheet (the cost is equivalent to seven or eight roosters) has the capacity to harvest at least 40 litres of water during a short rain of some 20 mm Such step by step arrangements were not practised, probably because there are only some 50 raindays a year, too few to make the investment worthwhile Nor were the informants keen on making gutters of locally available material like wood or bamboo pipe.

Informants expressed more interest in large cement tanks, but only one said he could find the resources to have one built Others may buy a (used) 180 litre oil drum or to make a simple cement tank or vessel. The local skill to make large burnt clay urns for storing beer has not yet been adapted to storing water because the urns are considered too fragile. No-one had any experience of the "cheap and easy" cement bowls promoted by UNICEF (Plate 3).

Surface water catchment - ponds. There are many small ponds providing water during the wet season; some are natural and most are man-made. A pond is filled by runoff and possibly some recharge water and holds water at least during the rainy season. Evaporation takes its toll but this is small compared to the amount of water that is drawn. If there is plenty of rain the pond simply overflows, making it more difficult to draw water, but this has no damaging effect on the construction. Villagers have sufficient hydrological, geological and siting knowledge to design ponds (Table 9.2). Little skill and no cash is needed to dig a shallow pond by using available equipment. The labour input is less than a few days and is easily afforded by any able-bodied person.

Surface water - *lambo*/dam There are hundreds of *lambos* and dams all over Sukumaland[4] providing large amounts of water for cattle and people. The larger ones were constructed under the guidance of an expert, but the chief of Massanza I was famous for building dams and *lambos* using local resources only (Plate 20).[5] A detailed description of the communal work needed to construct dams is given in Appendix A. *Own-key lambos* were built by hand using simple tools and available material. They were built mostly as private enterprises by groups of cattle-owners. Dams were built with the help of ox-scoops prior to 1949 (Plate 17 and 18) and since then by tractor scoops or other machinery which very few can afford The Bupamwa villagers recently got together enough money to hire a caterpillar to clean out the large Bupamwa dam[6] but the task proved to be technically impossible. One informant had hired a road-grader to excavate a *lambo* with a capacity of some 600 m^3 of water (Plate 8 and 9).

Geological and hydrological knowledge (not including knowledge of how to calculate evaporation) is present in the neighbourhood (Table 9.2). Informants know suitable sites fairly well The construction of large surface water reservoirs is possible because there are sites with impervious calcareous layers (*ndoba*) which frequently underlay the *mbuga* and other soils (Malcolm, 1953:189). The techniques for making hard-trampled damwalls from impervious soil material are known to the older men (Plate 17)

It is crucial to design the *lambo* in such a way that it can contain the amount of water that will enter in rainy seasons, especially during rainy years. The knowledge to calculate the amounts is hardly there, and its absence constitutes an obvious constraint. A number of cattle-owners have, however, used a trial-and-error approach by enlarging *lambos* piecemeal in order to keep the risk of complete failure within bounds. Another type of experience which comes in handy is that of irrigation cultivation in the lower parts of river valleys. The farmers have built bunds encircling the small rice fields. The bunds are some 10-20 metres long and strong enough not to be destroyed by overflowing water.

Poor knowledge of the process and measurement of evaporation may result in early drying up of the *lambo* - as much as 700 mm can evaporate during a single dry season and another 500 mm can disappear through seepage (WMP, 1978.v4:247), which means

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[4] McLoughlin (1971 24) noted that there were "only 21 dams in Maswa in 1947 . . but between 1940 and 1955, 43 new dams were built In Kwimba which is more suitable for agriculture in its north, and for grazing in its south, over 45 dams were built by hand . and six more by machine. Many of the larger dams were used as reservoirs for rice irrigation. From 1943 to 1964 some 60 boreholes were drilled about half of them were successful "

[5] "The chief of Massanza I in particular continues to lay out and dig new dams with the help of scoops provided the people will help as well." (Annual Report 1946.8, Agric Office, Mwanza District)

[6] The Bupamwa dam is described in Appendix A. The WMP-team concluded that the area was not suitable for dams because they were rapidly silted up (WMP, 1978 v4.482)

that more than a metre of water is returned to nature. The interviews indicated that no-one knew how to estimate these two losses. Nor could the rate of consumption be estimated with any degree of accuracy. However, piecemeal development by trial and error is the key to success. People tend to try out a design to see if it works and most *lambos* have been designed and built in this way No dams with spillways had been constructed during the last decade

Springs. Springs are often found in sloping areas, many of them yielding enough water in most years Springs are usually found and developed by individuals but lately the MAJI department has been involved in spring protection. Informants are aware that the recharge takes place in the sandy hills. They are very careful about digging in or around the springs, since they fear this might change the route of water flow if the impervious layer is destroyed. Geological and siting knowledge in the neighbourhood is sufficient (Table 9.2).

> We have the knowledge and skills to develop springs and ponds while MAJI does not. On the other hand MAJI personnel can install pipes and diesel engines which we cannot. (K1IIIb145)

The input needed to develop and improve springs is mainly in terms of time Protection may require a bag of cement and a short pipe to deliver the water from a covered spring to the point where water is drawn (Plate 14 and 21).

Dug wells The existing *own-key* wells are fairly shallow pits. Improvements range from deepening the pit or making a rock lining to constructing a shallow well with cement rings and a hand-pump. The former two are affordable for each household, while cement rings are out of reach for most households and sparsely populated neighbourhoods

Most wet-season "wells" in the six villages are mere scratches in the topsoil which fill with water from groundwater recharge (and sometimes runoff). People said they prefer wide shallow waterholes in order to ensure that children and animals do not drown. There are other reasons for not lining wells. In the dry season the water level may fall by several metres. At that stage, however, the water body is often so small that it becomes easier to descend into the well and scoop water than to try to lower a bucket that will not be even half full. Also it is easier to excavate silt and to deepen an unlined well (Plate 6).

Hydrological, geological and siting knowledge is sufficient in an ordinary neighbourhood to plan for a well Villagers have the skills to dig deep vertical holes in various soils and have demonstrated these skills with latrines and shallow wells. Latrines are rarely lined and do not need to be if the sub-soils are stable. In some cases they worry about finding boulders beneath The useful technique of cracking boulders by heating them with fire and rapidly cooling with water is known by few, and this lack of skill may prevent some people from taking the risk to dig in areas known to have boulders underground.

Villagers had dug wells in places with very shallow aquifers; many considered that digging deeper than 3-4 metres was too much work The labour input may be from one week to a month Few households or groups of villagers could afford to invest money in a ring-well.[7]

The skill to make rock linings is normally available, and village masons have made them. The technique of shaping the stones so that they interlock, thereby making the wall stronger and less liable to collapse, is hardly known.

Lifting devices. There is no tradition of making simple lifting rods (fulcrum) or windlasses to haul water. The reason is hardly a lack of skills, knowledge or materials but one of convenience because water level varies. Referring to what we wrote about wells above there is a need to dig a deep pit which has a large enough water body to allow filling the bucket on a rope in one go The informants said a fulcrum would be cheap and easy to construct using local material. If there was a demand for a windlass it could surely be built in the village by a carpenter. The possibility of lifting water using a fulcrum was raised in the first field work A year later the informants said that villagers considered a fulcrum to be a good idea, but impractical because the bucket would be stolen, as would the rope and tree poles

Our informants were in favour of fitting hand-pumps on wells or improved traditional water sources. The only choice was between a steel hand-pump and a wooden one which was introduced earlier There is no tradition or readiness to make simple hand-pumps locally.[8] Any household could afford a lifting device like a fulcrum; a hand-pump is out of reach for most individual households, but it is perfectly possible for a group to club together.

Transport of Water From the Source

The various methods of carrying water by using a yoke, bicycle, trolley or drought animal are well known. A yoke can be made at a very low cost by using wood and a piece of rope which is affordable to everyone Yokes are, however, only used by water vendors in the outskirts of towns.

The next technological level includes carts and bicycles which are primarily used for other purposes than carrying water. Young men bike to town every day with some 30-50

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[7] RIDEP reported the input for a 6 metre deep ring well (no 23/4-15) to be 156 work-days (at 35 shs per day), 2426 km transport (!) for staff and shipping gravel and cement rings; ten bags of cement for the apron; six rings, and a kangaroo hand-pump

[8] Local hand-pump manufacturing is common in India and there are trials to introduce village-manufactured hand-pumps in Senegal (Kemper, 1989).

litres of milk on sturdy carriers made in town. A new bicycle is thought to be expensive, the equivalent of one bull or five calves or some 100 hens. The extra investment for improving the carrier to load 2-4 tins (20 litres each) would be affordable for most households with a bicycle. Very few men use bicycles to fetch water, however, and no women. The use of a bicycle is covered in some detail in a case-study in chapter 13.

The wheelbarrow, which is primarily used to ferry agricultural produce from the fields, may be readily used to haul water without additional expenses. A rare transport tool is the hand-cart. Its price may range from just a few shillings when made of wood only to about half the price of a bicycle if made of a steel-pipe frame with sturdy bicycle wheels.

Many farmers transport agricultural produce by oxen pulling a sledge made of a log along the ground (Plate 15). They are used to transporting water for housebuilding purposes or for a feast, but very few use a sledge to haul household water. A time-use approach shows that when water is plentiful the oxen are busy ploughing and in the dry season when there is no alternative use for oxen-power the water is too scarce to make it feasible to fetch water in a drum.

Ox-carts are surprisingly few given the large number of oxen. If there was a demand, however, carpenters could probably make them with a wooden frame and an axle from a scrap car or lorry. The price exceeds that of a bicycle. Less expensive alternatives are to use a sledge to transport a drum of water, or to let mules carry bags (made of skins in other countries) of water.

The availability of transport equipment is as follows in the six villages (stand-pipes in brackets because they were not operating).

Table 9.3. Transport equipment available in the six villages

	Bupamwa	Igogwe	Kongolo	Lwanhima	Mkula	Runere
Wheelbarrow	5	6	2	10	7	4
Bicycle	250	550	50	70	3,000	100
Donkey	30	20	8	14	15	30
Oxen	1,000	24	?	?	1,200	800
Ox-cart	10	5	-	-	18	4
Water tap	(15)	-	-	-	(7)	-

Source: Estimates of the village secretaries, 1990

The dry season problem with long distances to water sources can be reduced by using some kind of transport. If many users do that, of course, the demand for water will increase and perhaps exacerbate the quantity problem or contribute to queuing at the water sources. Villages and neighbourhoods are known to enforce restrictions on fetching water in drums during the height of the dry season (see chapter 10). The almost universal method of carrying on the heads of women should be seen in this light as well.

Protection and Improvement of Water Quality

At the water source Water sources can be protected by such methods as hedges around the source; stepping stones; lining pond and well walls; bunds to divert overland flow from entering into the water source; aprons on top of wells; and use of a single stationary bucket for drawing water. Such simple but effective measures require little labour and only local materials. Stones and sand are usually available fairly close by, and people know how to crush stones into gravel[9] Such materials are enough to line the pit, also without cement The cover of the pit can be of wood or cement. In order to protect the water in the well from overland flow, as well as spoilage from the handling of water, one may seal the surrounding area with a cement apron or a layer of clay.

Improving water quality at home There are several ways to improve handling of water as presented in chapter 7. storing water in cleaned and covered containers not accessible to small children, sieving; boiling, filtering; and applying flocculation agents.

Many villagers claimed to sieve water through a piece of white cloth. The clearing of water by using a three-pot system is not practised but no skill is needed, merely the addition of two clay pots A simple but rare water purifier is made of a pot and a clay-pipe full of sand and would not cost more than an ordinary clay pot and could be produced in the village by pot-makers

Conclusions

Our inventory of human and material resources available in the villages shows that many arrangements are feasible as long as local materials are used.

Sufficient knowledge about hydrology, hydrogeology, pathogens and transmission of diseases is often present among a group of people, even though each individual might lack one or two items of information. Our detailed interviews about specific improvements of water accessibility and quality indicated that most of our informants were sufficiently knowledgeable to plan one or more improvements. The skills needed were available in the household or neighbourhood and were sometimes possessed by a local craftsman. Most of the work can be done either by an individual household or a group of neighbours; in some cases they may rely on wider networks. Some said they could ask a relative or a friend working in town to give a hand.

Local material and equipment will suffice for all low technology measures, on a scale similar to what is required for constructing houses and latrines. Some activities call for

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[9] The availability of stones is not as good as it was along the main roads, since collecting stones for sale at the roadside to rich town-dwellers who use them to build houses has gone on for a long time

cement, iron sheets, bicycles, etc which have to be bought. The cash needed for most activities is affordable for almost all individual households, but assets like bicycles, ox-carts and iron roofs are in short supply It is also possible to borrow money from the *ifogong'ho* fund. Some households have substantial financial capacity to implement improvements, others have a surplus of labour. The capacity of a neighbourhood is greater both financially and for labour availability in the dry season.

The assessment of human and material resources in the local context includes the following practical options:

Water sources: drums or cement jars, ponds for non-drinking water, stone-lined or unlined wells with covers and aprons, protected springs for most households; medium-sized *lambos* and roof catchment for well-off people. Dams, boreholes or piped supplies are not affordable by any neighbourhood.

Transport of water. yokes and simple handcarts for most households; bicycles, wheelbarrows, sledges and ox-carts, whether owned or borrowed, for better-off households. Piped supplies are not a feasible option - not even their operating and maintenance costs are affordable

Water quality: windlass, fulcrum, clay pot to filter water and alum to lower turbidity is within reach of most households Chlorination is not a feasible option.

In short, the Wasukuma are in command of the resources and the simple technologies required to improve access to and quality of household water Whether any of the above measures are likely to be implemented is discussed and analysed in the next section.

Section C

Sukuma Norms and Individual Values Influencing *Continuity* and *Change*

The views of our informants show that norms and values have affected their *own-key* activities in several ways. We investigated various options in the last section to find out which were possible given the existing human and material resources. We now look at the informants' valuation of these different options in order to find out what kind of incentives people need before they embark on *own-key* activities and what kind of constraints they face. The analysis is limited to three areas; (i) access to water and control of water sources (ii) communal efforts to protect, maintain, improve and develop water sources (iii) household efforts to maintain, improve and develop water sources and to maintain or improve water quality.

Each of these three areas of interest is treated in the same way; first we explore the informants' perceptions of Sukuma norms about what constitutes acceptable behaviour; then we discuss the same informants' individual values and how these are likely to affect their willingness to take part in cooperative and individual efforts.

10

Water Rights: Sukuma Norms and Individual Values

Introduction

The customs, rules and regulations which govern a society may limit its members' scope of thought as well as their activities. On the other hand, customs and rules can sometimes release forces of *change*. For this reason we shall be taking a look at users' access to water, mutual obligations, and elements of private and communal ownership and control. We aim here to gain a deeper understanding of how the majority of our informants think. We cannot cover every shade of opinion, only the norms. We are looking for what norms villagers encounter and the "cost of transgression" in order to assess the effects of Sukuma norms.

We begin by tracing and discussing Sukuma norms about water rights. This is done in terms of access and control. An attempt is then made to judge the extent to which the way water sources are controlled influences the activities of water-users.

Sukuma Norms: Access to Water and Control of Water Sources

Household water. The Wasukuma treat water as a gift from God (Millroth, 1965).[1] Everyone is entitled to water for human consumption and no person can be denied the use of any water source, whether natural or man-made. The right to household water has a long history in Sukumaland Hans Cory noted the following water rights in his work to develop a unified Sukuma Traditional Law in close cooperation with the ruling chiefs.

> - Any source of water, such as a stream, spring, well, pond, etc., is free for everyone.
>
> - Any source of water situated in private ground, whether natural or dug or constructed by the holder, is free for everyone. No holder can monopolize the use of a water source in his holding
>
> - If a number of men dig a water-hole in a river bed or on any piece of land, the water is free for everyone. If a man has dug a water-hole for a certain purpose, for instance, for making bricks or building a house, the water is still free for everyone.
>
> - If a village or a sub-area of a village decides under the leadership of the village headman and/or the *basumba batale* (work leader) to construct a common water-hole, one man from each house must help with the digging If a man does not participate in the common work he cannot be deprived of the use of the water, but he may be punished by the village organization. The villagers cannot claim exclusive rights to the use of such water. (Cory, 1953:131)

Cory had this information cross-checked with actual legal cases as well as by interviews with people other than chiefs. Cory's exhaustive account is still valid as a statement of Sukuma norms, and all 30 of our informants stated that no-one can restrain anybody from using for human consumption a water source whether it had been developed by an individual or a group

Neighbourhoods or villages usually control the way in which these rights are exercised and may restrict usage of water depending on the supply situation If water is plentiful there is little need to enforce restrictions. However, if the yield is small towards the end of the dry season or otherwise the community may enforce restrictions on the number of buckets allowed or put a complete stop to the use of drums.

All informants subscribe to this norm On one occasion we were surprised to find

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[1] Cory (n.a , No. 190:7) As such, water sources were put in the hands of the chief to guard in the same sense as was land itself. The visible sign of this guardianship was the occasions on which the chief arranged the blessing of water and water sources before planting and when establishing new homesteads.

> the pond almost empty in the morning. The neighbours discussed the situation and decided to restrict the use even more than just forbidding the washing of clothes at the pond. The next morning the water was gone again and on investigating the cause it turned out that one distant neighbour had started to draw much water in the night to secure her *pombe*-brewing. Her usual water source had dried up, so she started to use ours without informing us. She was refused further access to our pond. (I2II:580)

The idea that water is given by God seems to imply that it cannot be under the ultimate control of an individual. One example of this is when the Bupamwa village decided to convert all private *lambos* designated for cattle into communal domestic water sources during the drought in 1972. The owners were allowed to continue to water only calves in their own *lambos*. All other cattle were moved to the Moame river some ten kilometres away and were kept there until the rains started.

This right to claim household water from any water installation is so compelling that it also applies to roof catchments. Our informants maintained that neighbours can claim the right to collect water from the roof of someone else's house, or even from that houseowner's rainwater tank. If a neighbour asks for water from your drum of rainwater it would be unfriendly to refuse. The informants insisted that no-one will deny water to a neighbour even if the water stored in the rainwater tank is insufficient to last the household until the next rain.

> If you refuse to let a neighbour draw water from your drum of rainwater, she will ask you why you cannot let her have it when it is there. It is only rainwater and you will soon have more She will not appreciate my point that it will not last me long enough even though the drum is full now. People do not think ahead (*wana mawazo mafupi*) It is not seen as appropriate behaviour to tell them that you are the one who has invested in the drum. (L4Ib:430)

Roof catchment in drums and tanks is a recent technology introduced on a small scale when iron roofs became popular in the 1950s. Before that there cannot have been any traditional rule related to roof catchment, since all had the same kind of thatched roof. It is noteworthy that the Wasukuma in this case of a changing environment adhered to the Sukuma principle of securing access for everyone. Of course, scarcity, represented by the volume of the storage tank, then came into immediate and unresolved conflict with the right for all to draw household water from any source. The alternative of making roof catchment into private property would contradict the traditional view.

A Sukuma norm says that a traveller has to be given drinking water,[2] but according to

[2] Malcolm (1953 16) mentioned that it was regarded a criminal offence in Sukuma law to refuse to give food (including water) to a traveller The Sukuma proverb 'Money is like a walking stick' explains the role of money in terms of the old and well-understood custom that a traveller with the

the informants, no one else has a right to claim water from a container which is kept indoors. In order to test the validity of the statement that no-one can deny a neighbour's right to draw water from a rainwater container/tank, some of our informants were asked what would be the reaction if the water tank was built in a room inside the house and the water was diverted into it. Although they acknowledged that in such a case they would be able to keep the water to themselves, they felt uneasy with such a solution, presumably because of its artificiality and the clear intention to circumvent the norm. One informant told about a case in Shinyanga where a person had dug a well inside his house, but the informant expressed similar unease with this solution.

There is no evidence that a household water source can be owned and sold, which is not surprising, given the present limited individual rights to houses and trees.[3] The developer of a water source seems to benefit mainly by the status of having the source named after him. All springs and ponds in the six villages covered by this study bear the name of the person who found or developed the water source.

Before proceeding with this survey of the laws and customs governing access to household water, we need some points of reference about water for livestock.

Water for livestock In semi-arid areas it is common to have private ownership of cattle and communal ownership of grazing areas, and Sukumaland is no exception. Livestock is traditionally watered at open puddles or in wide, dug ponds (Blohm, 1931:132) in areas

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walking stick expected to be provided with food

[3] The understanding of the Sukuma concept of water rights for domestic water sources is made easier by a comparison with rights to land, trees and houses Traditionally land 'belonged' to the head of the household as long as (s)he used the land effectively However, (s)he could not sell, pledge or otherwise dispose of the holding This 'usufructory right of occupancy' involved no insecurity of tenure, and the holding could be inherited undivided by a son This is because the son is not only considered to be his father's heir, but his younger self. The son must, however, take over the whole estate or leave it (Cory, 1953 111) Inheritance by another relative required the consent of the headman according to Dobson (1954 89) If the holding was abandoned for any reason the village headman was responsible for reallocating the land to someone else

Houses on a homestead were traditionally partly built by the community and controlled by the village headman After World War II the colonial government introduced a limited right to sell the house on the holding to encourage house improvement. The house could not be sold unless the village headman and/or *nsumba ntale* agreed that the buyer was a suitable person to settle in the village. If the price was regarded as too high the owner could be asked to pull it down and remove the usable parts (Varkevisser, 1973 36)

Trees which have been planted and trees growing on allotted land are private property In 1949 the chiefs in Sukumaland decided to introduce some restrictions. If a man wished to make a tree plantation he could only do so on the three acre of the grazing reserve which he was allowed to retain. The collection of fuel was free to everyone, even in another man's holding (Cory, 1953.134)

Thus planted trees, houses and land represent a falling scale from private ownership to household control away from Lake Victoria or a convenient river. The increasing demand for water for cattle in the 1930s and 1940s was met by the construction of many dams and *lambos*; most of these were constructed collectively and some privately. As seen below the ownership was clearly spelt out for both kinds of water sources. Operation and maintenance was left to the owners whether an individual or a group, e.g. a village where the responsibility lay with the chief or headman.

The rights concerning use of water for livestock are described in Cory's work on Sukuma customs:

> - Any source of natural water customarily open for the watering of cattle, or any source declared to be open by the authority (mainly *lambo*), is free for everyone.
>
> - Water-holes may be used only by those who constructed them whether it be the water-hole of an individual cattle-owner or a water-hole constructed by the inhabitants of a *kibanda* (neighbourhood) or *gunguli* (parish). To water cattle at another man's water-hole without permission is punishable Often the transgressor is required, as a penalty, to enlarge and clean the source of water
>
> - These privately constructed water-holes can only be used by strangers after having obtained permission from the authority. It is permissible to charge fees for the use of the water. The permission is given only for short periods, usually until the cattle-owner has finished the construction of his own water-hole, or has found free water for his cattle. The fees are high.
>
> - If a man opens up a source of water within the boundaries of his holding, no other man is allowed to send his cattle there for watering without permission of the holder.
>
> - A newcomer cannot enclose any source of water (*bukumbiji*) on his land which he found already in public use on his arrival. This applies to water-holes which may have been constructed by the former occupant or by the community and the *nsumba ntale*. The new holder cannot close off a path leading to a water source and keep it only for the use of his own cattle. His own cattle must have a path to it and therefore no excuse is accepted for closing the path on the grounds of crop damage.
>
> - The right to dig water-holes is not restricted. Inhabitants of one chiefdom who run short of water for their cattle can dig water-holes in another chiefdom. (Cory, 1953 132)

Few, if any, alterations seem to have been made to these rules over the last forty years according to the informants They rule out free-riding. It seems highly probable that clear-cut rules of this kind have averted many potential disputes since few instances of actual conflict have been recorded A water source that has been developed for the purpose of an economic activity like gardening or watering of cattle is said to be generally open for domestic purposes as long as the yield is good, and this ruling is fully in line with the

Sukuma norm of water as a gift Should there be a drought, the community may decide that the water source will be treated as a communal household water source.

Legal rights to develop a source. No informant complained of insecurity of land tenure, at least not for the plot where the dwelling house is located. This may seem surprising as violations of tenure rights were common during the villagization process only 15 years ago. Some informants had applications pending for 99 year leases of their *shambas*. None of them expressed any uncertainty as to what rules apply to the development of water sources by themselves or others. The informants stated that they need no permission to develop a well on their own *shamba*.

If a person finds a promising site on a neighbour's holding that could be developed into a well or pond, he has to get the holder's consent. The author came across two cases where such requests had been turned down, and the wells were consequently not developed. In the first case (1986) the holder simply refused to have a well developed on his land.[4] In the second case (1988) a group of women, who were to construct a rock well under a study group programme, had found a site close to the school situated in the field of one of the teachers The teacher did not want to have villagers and pupils walking in his field and turned down the suggestion The women chose another site.

Private control over holdings can deter an individual or a group which lacks village recognition from developing a new source on someone else's holding. But the village council still has the right to intervene, and it can decide to develop a new source on anybody's holding, obviously it will be less likely to do so if the holder is very influential.

The informants' thoughts about legal rights to develop water sources are in accordance with the Control and Regulation Act (1974)[5] as interpreted by the Mwanza Regional Water Engineer, who is the chairman of the Regional Water Board, when he stated that:

> All water is national property and anyone who can reach it is free to do so and to use it A holder may dig a well and draw water not exceeding 22,700 litres per day without a special permission unless the well is closer than 230 metres to another well or 90 metres from a stream or river or other surface water. A holder may also

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[4] In a letter from the Agriculture Office, Lake Province in October 1956 to the Director of Agriculture in Dar es Salaam concerning development schemes it is said that "The African farmer in the area holds his land by native law and custom He is intensely individualistic regarding his land and this makes it very difficult to achieve aggregation of holdings for block ploughing "

[5] The first Water Ordinance of 1923 (the German Government did not enact a water law) was not riparian and thus gave some settlers rights to abstract whole amounts of water from either rivers or springs without taking into account the needs of people living downstream This caused several controversies in Moshi and Mbeya that were not resolved for decades A new, riparian ordinance was enacted in 1948 but did not come into force until 1954 (Mwita, 1975 18)

construct any works for conservation of rainwater, other than in a river or stream. (20 January, 1988 Kumb. HG.15/15 Regional Water Engineer's Office)

This lucid and permissive ruling was not widely known and is to the author's knowledge neither referred to nor enforced in its details. Some village secretaries (*katibu*), for instance, claimed that anyone who would like to develop a well had to ask village leaders for permission This could gradually lead to a whole series of new constraints on household water development.

In 1989, the central government decided that the development of all water sources, including traditional ones, should be under the control of the Ministry of Water (MAJI). It is highly unlikely that this centralising move will change anything in the near future, but it could have serious long-term effects if central and local officials and other kinds of leaders use it as a means to establish personal control over *own-key* activities in the community.

Transgression of Sukuma norms on access to water. Under present circumstances, one would expect only rare cases where an individual household can keep a water source to itself or turn a communal spring into a private water source. The only such case the author came across was where a source was privatized for watering a vegetable garden. The neighbours accepted that their household water demands could no longer be met at what had been their previous water source, they were seemingly prepared to overlook the fact that what had been a communal well was now private property.[6] Such an occurrence is probably only possible where the gardener is an influential person who can withstand a bad reputation and retaliatory witchcraft. The principle of free access is powerfully reinforced by the popular belief that if someone who is excluded from using a water source may resort to sorcery or simply pollute the water.

Another case came to our attention where a villager had a pond close to his homestead that he wanted to convert to his exclusive use. He bathed in it, which caused the neighbours to lose interest in drawing the water The village regulations to fine the culprit and make him clean up the pond were not enforced. But it was obvious that in the eyes of the community this case was threatening the established order. The anti-social act of bathing was being willfully performed. People felt it had to be dealt with in a cautious way in order not to provoke retaliatory action by the culprit.[7] Despite the apparent

[6] Vijai Kochar found in one of his studies that Indian women never say that they are not allowed to use a certain well They were hardly aware that they passed this well, used by others only, on their way to their "own" source, since they did not perceive it as a viable option (pers. communication)

[7] Tanner (1955.164) made the important remark that "In taking action against malefactors, no individual in the community must be sufficiently prominent for the offender to single out as his accuser or judge and to take action against him as an individual by witchcraft or force Therefore

inactivity of the community, the offender had moved away from the village and the pond was back in communal use when the author returned the following year.

These two cases illustrate how the community may tackle abuses of a norm. The traditionally strong communal basis of control of water sources seems to prevail despite the gradual weakening of legitimate authority in the villages through the abolition of chiefs in 1963, the frustration of rules during villagization and the ensuing general economic decline.

Obligations and their enforcement Linked to these rights are users' obligations, i.e. what they must do in return for the right to use a water source. As a basic obligation all users are expected to take part in cleaning the water source once or several times a year; anybody who does not take part is fined. Washing clothes and bathing must be done at a distance from the well.[8] Animals must be kept away from the domestic water source.

The village council can appoint a caretaker to look after people's behaviour at the well but had done so at only a few of the water sources studied. The informants claimed that the rules were nevertheless enforced; they said that violations would first lead to a warning and then, if repeated, the offender would be fined and/or required to clean the source. In practice, adherence to rules may be rather haphazard as the following examples show.

No-one may step into the water. Nevertheless, we saw numerous examples of women stepping into the water at open ponds to fill their buckets. They often had to do this as there were no stepping stones, lifting rods or other devices to reach the water. Such instances no longer lead to sanctions, although it was said they used to do so:

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the community acts as an undenominational mass from start to finish, accusing, deliberating and punishing without the solitary use of a name Thus the community is protected, as well as maintained, in the face of something which might otherwise develop into feuds and other forms of fission."

[8] Tanner (1955 159) reported a case of violation of this rule "Mbogoke was seen by one of the elders of his sub-parish to be doing the laundry in their drinking water supply. The elder concerned brought this up at an informal gathering at the sub-parish leader's house where everyone present agreed that Mbogoke was guilty of anti-social activity for which they gave him a fine (*ikyu*) of two shillings There are several points to emphasize in this simple case, there is no formal judicial body and the case took place in an informal gathering in which the only essential and necessary person was the head of the sub-parish Next, that the unanimity of those assembled there was necessary before any sanction could be brought into play and lastly that the fine was so small that it would be extremely likely for the offender not to refuse to pay it In addition it was unnecessary for him to even appear before the gathering for his sanction to be applied, as in this case he merely heard about it from others So it can be seen that the public disapproval rather than the fine must have lent weight to the offender's recognition of the severity of his offence and the fine presented nothing more than a token acknowledgement of the correctness of their judgement and, as such, would be used to buy beer for the elders of the community "

> Mzee Magashi always kept the spring neat and tidy Once it happened that one person stepped into it with her feet, and as a fine was requested to provide a stepping stone at the spring. After Magashi's death 1977 nobody has taken the responsibility for the care of the spring and now its water is bad. (M4Ib145)

About half of the informants knew that inserting the container itself into the water constitutes a pollution threat, because the outside of the container may be quite dirty. Despite this, drawers of water rarely brought a cup for filling the container. Even where there were rules calling for use of a special scoop, few women seemed to comply and no sanctions were reported.

Only three informants gave recent examples of cases where fines had been imposed. In one case a cattle-owner was fined for watering cattle at a pond for domestic use. And two informants referred to a case in which a woman lost her bucket in a covered, improved spring. In this case, according to the informants, the possible "uncleanliness" of the female culprit aggravated the offence, and taboos around this issue are commonplace (Whyte, 1980:345):

> She failed to fish it up and, finally, decided to recover her bucket at any cost. Secretly some five friends helped her to remove the cement cover, and she jumped into the water to pick up the bucket After this incident these women commenced to use another well. Their neighbours got suspicious and soon found out what had happened. Our belief is that it is extremely repulsive when a woman enters into the well, and we think that she has contaminated it severely. Therefore the women were fined (the equivalent of one bag of cement) and ordered to clean the well meticulously. (I4C18)

In short, rules are in place and it is possible to fine wrong-doers or take other sanctions against them; but rules are not automatically enforced.

The norm: Water is a common-pool resource. The Sukuma norm that emerges above can be summarized as follows; no-one can own a household water source or be excluded from using a water source for human consumption. A person who wilfully contaminates or otherwise misuses a water source may be punished but will not be excluded from using the source.

During a severe drought people know that they will have access to household water, even if it is far away, without having to pay somebody for it[9] Water vending is not practised in the villages (WMP, 1978:v16:259) and the informants regarded buying or selling of household water as impossible Water is simply not a commercial good to be bought and sold in a market, unless it is used for cattle. The control, even of private cattle

[9] One informant pointed to one case in a neighbouring village where someone sold water in drums during the dry season in 1985

water sources, is ultimately in the hands of the whole community. This norm on water as a common-pool resource may be interpreted in ideological terms where the practice of sharing is a way to emphasize and assert values of cooperation and solidarity.

Informants' Individual Values vs. Sukuma Norms

Individual informants were in favour of the Sukuma norms above, and the issue of ownership and control was rarely brought up by them. All villagers know that "their" water source may be used by neighbours and others who have not contributed to its construction. On the other hand, they also know that they themselves can benefit from water sources developed by others. Whether such rights of access and the impossibility of acquiring ownership of a water source have any impact on the willingness to develop and maintain water sources is not easy to determine. Many people said that the alternative to a "public" water source was not a private one but a common-pool resource belonging to a small group of users.

> It would be a good idea to make each *balozi*, or two in cooperation, responsible for their own water sources and their development If they failed due to laziness they would have to fetch water in another neighbourhood. And if someone does not bother to join in digging wells he would not be allowed to draw water. Everyone will have an incentive either to take part in water development or be left to their own ways of acquiring water. If such a rule was in force we might be successful. (M4f2:440)

The way the issue is treated here takes no normative stand but looks upon water as a common-pool resource along two lines, to what extent do the norms facilitate or debilitate efforts by individuals and/or groups to developing and maintaining water sources.

Common-pool Resource - an Incentive for *Change*?

Cooperative efforts. The fact that water is a common-pool resource invites the community to take actions that would not otherwise have been implemented. The norm gives the community the power to push laggards who would not engage in any private activity anyway This may -in the long run - contribute toward better and equitable services. As water gets increasingly scarce in the dry season the norms secure that the little water there is shared and no-one is allowed to hog it all while others are left without any.

An important incentive for cooperative efforts is the high cost of monitoring a private water source. As one informant said:

> My husband dug a well to water our vegetable garden and fruit trees. If we did not protect the water, we would not get any water ourselves. People come very early in the morning, 4-5 am, to draw water without permission and thus force us to guard the well from early morning till late evening. (M4f2a:420)

Another indirect incentive for cooperative efforts put forward by several informants is that they are not prepared to construct any private water source for fear of upsetting their neighbours and thus attracting *uchawi*. Noble (1970:66) said that, "the only safe way to enjoy greater wealth is to share it."

The Sukuma norm makes the local community open to interventions, since there is no-one with a vested interest to lose, like water vendors or well-owners. Irrespective of who initiated the development work, the communal organisation is left with the responsibility to operate and maintain common-pool water facilities.

Individual efforts. Individuals have found or developed most of the existing water sources. One reason why free-riding did not prevent these villagers from constructing water supplies is that individuals can advance their status and social position through acts of generosity (Berry, 1990:42-3) such as digging a water source which is open to all. Several informants also expressed the hope that their initiative may act as an example for others. The developer benefits, not only by having the water source named after him and acquiring a good name, but by lowering the risk of an enemy polluting his water source.[10] Only one example of a private spring was encountered and it belonged to a very influential villager. The alternative for ordinary villagers seemed to be to make the water source communal, even if the neighbours had not taken part in the construction work.

Lambos for watering cattle are often owned by individuals or by groups, just like cattle. Informants accept this kind of ownership since they are still freely allowed to draw household water[11] Thus, the developer of a *lambo* can gain in status. It is fairly easy to exercise effective control of ownership of cattle watering sources because non-eligible

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[10] Kidumla reported that in old days people passed the bowl of water around and in that way checked that the water was not deliberately polluted (pers com.)

[11] Another example of private ownership impact is from forestry. Planted trees have always been private property and open for sale Sukuma men have proved to be interested in selling poles, charcoal, etc to the extent that forests are being depleted A well-known fact is, however, that few trees have been planted over the years and private ownership rights have obviously played an insignificant role in boosting private tree planting Men were also reluctant to join communal interventions to plant trees as they did not believe that they would benefit from the mature trees. The Wasukuma even talked in a different way about planting trees which may be cut by anybody (*kupanda miti*) and planting firewood (*kupanda kuni*) for one's own use There was, as far as the author knows, no similar qualitative differentiation of language related to water

stock are easily detected from a distance Population is sparse in the grazing areas, and people with few cattle rarely claim access: they have little say where political influence and the size of the cattle herd go together as they do in Sukumaland.

Common-pool Resource - a Constraint to *Change*?

All members of a community have equal access to water sources and female drawers of water share equal conditions; they walk to the common water source and the social encounter at the well is part of everyday life. The Wasukuma believe that one should not let one's wealth be seen and this is reflected in the strikingly equal standard of houses in the villages.[12] People with money tend to invest in towns in order not to attract their village neighbours' jealousy

Cooperative efforts. The informants gave no statements or examples which can easily be interpreted that the norm was a constraint to cooperative efforts. However, a possible structural connection should be mentioned. The fact that any household can draw their household water from a cattle *lambo* means that the designed capacity should include that each household consumes an amount about equal to what two cows consume. A neighbourhood of some twenty households will then consume as much water as a herd of 40 cattle, which shows that the size of the *lambo* has to be perhaps twice that needed for the cattle only This fact may add to the complexity of the decision to siting new cattle watering points. The *lambo* may be placed far away from the village settlement.

Individual efforts. A person who is slow to develop a new water supply or more generally to adopt an invention would find free access beneficial and it would make it easy for him to delay the decision to take action. The very existence of several alternative water sources ensured that there was no urgency about copying the initiatives of others.

> It is difficult to cooperate because people have different views and opinions how to go about it. Those who have constructed *lambos* are fortunate and perhaps many people will copy their work in the future, but not now, since you can draw water from the existing *lambos*! You do not see the reason to dig your own and do not want to sweat and labour when water is available. Very often our thoughts end at this stage. (B4f2b:20)

Economists use the name free-rider for an individual who is able to get the benefits of others' endeavours without bearing any of the costs of creating new "goods". Such "rational" self-interest may end up causing others not to initiate improvements. Informants

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[12] A reason why large herds of cattle are acceptable may be that cattle can be transferred to kins and used in social transactions and are not private in a strict sense

differ as to whether this is a problem

Most informants who had already developed a well, pond or spring on their own were reluctant to repeat the exercise because others would only benefit without contributing, and the incentive of higher status had already been gained. This feeling was clearly spelt out by some informants who had dug ponds on their own.

> I have dug a small pond close to the seasonal stream in order to use it as a fish pond. Now it turns out that a number of families are drawing household water from it. I cannot refuse them. I do not want to put in stepping stones to make the drawing easier. Nor am I prepared to dig a well closer to my home just to help others. (M1:G3)

A few informants said that the fact that water sources are 'public' discourages *own-key* initiatives. Some informants described what they thought would be the situation if the developers of a water source could be granted a form of exclusive right which would enable them to exclude the free-riders.

> If there was a rule saying that the small group of people who dug the well would become the only users, they would agree to develop it. Those who only turn up to draw water from the new well would otherwise be too many. You would find that even those who developed the well will not get water because the others have come earlier and emptied the well. This is really discouraging. People accept a rule saying that each one has to excavate one bucket of sand in order to draw one bucket of water, but, they refuse completely to dig (M4f2a·390)

It is time-consuming to check that no one uses a private household water source and the incurred cost may outweigh its benefits.[13] Guarding of fair entitlements of water from limited communal sources, on the other hand, may be shared by all users and each one benefits directly.

The rainwater tank - a special case. The debate over construction of a large storage tank for rainwater was deeply affected by free-riding aspects. In the end nothing was done because most informants reasoned in the following way:

> The reason for not making a rainwater tank is that many people would be interested in drawing water from it. If I refuse them water, they find me uncooperative and this will destroy everything. I could charge a fee to recover my expenses but they may then cause other problems like *uchawi* (witchcraft). Without such drawbacks I would have tried to develop a tank (R2f2a:375)

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[13] Uphoff (1986·35) stated that "the private ownership option appears to have advantages where it matches the costs and benefits of resource management in the same person But this may not be possible because of spatial and temporal distribution of cost and benefits "

Our informants seemed to favour individual ownership only in the case of large tanks to collect rainwater because of the amount of cash invested in such an enterprise The cash input is what makes the difference between tanks and other water sources. It is noteworthy that the concept of private ownership only applies to a previously unknown kind of arrangement (large tank) which is of recent origin and not loaded with tradition.

Few informants were keen on discussing the kind of *uchawi* that could be applied by a dissatisfied neighbour, but pollution or contamination of the water tank was expected (see chapter 7). One informant was unique in that she did not expect any particular reaction from denying her neighbours access. She wanted to construct a large tank together with some neighbours and took for granted that only those who contributed would have access to its water.

> It is good if the neighbours cooperate to build a catchment tank on the understanding that they will be able to draw water. And those who do not want to join are left out since it is not compulsory. But it is not good if those who did not cooperate would come, because I will tell them, "You find water where you used to, because I have paid much for this tank!" Therefore it is not easy for those who have not cooperated. (K4f2a:270)

Some informants maintained that they would have built a roof-catchment or dug a well had it been possible to deny their free-riding neighbours access. Obviously these people felt the Sukuma norm to be a constraint. The question remains whether it is a major constraint or merely a convenient and acceptable excuse, put forward when one does not want to take part in constructing a large rainwater tank. A fact is that large cement tanks are only seen at institutions like health centres, schools and houses of missionaries but no individuals are collecting roof water in large cement tanks.[14] There is also an expressed concern about free-riding - two informants thought of placing a storage vessel inside the house and another informant thought of placing a large tank in the yard which is surrounded by houses. In such ways they could control the drawing of water from the tank.

Concluding Summary

Household water is a common-pool resource. The Wasukuma grant each household in the community equal access to existing water sources. One partial explanation is that water is considered a gift of God, and the right also accords with Sukuma norms about equity. Household water is also a common-pool resource in the sense that access is guaranteed even to private cattle-water *lambos*, and the control of the *lambos* can be taken

[14] In Kenya medium-sized cement tanks (2-4 m^3) are spreading rapidly Women groups help making one tank at each member's house

over by the community during serious drought periods. There are few, if any, formal rules or customary rights which would actively inhibit the improvement or development of existing or new water sources. This set of rights is part of the Sukuma norms; the interviews showed that almost all informants favoured them.

Norms about water rights do not make themselves manifest as long as water is abundant but their sustainability is put to the test when water gets scarce. Among the first steps taken when accessible water becomes scarce are to ban the washing of clothes at or near the water source and to forbid the fetching of water in drums. When the quantity of water is far below demand the situation can only be overcome by developing additional water sources or enforcing strict control of access: each household may be rationed to as little as one or two buckets a day; the leaders may restrict the hours when drawing of water is permitted; and self-organised queueing begins at the water supply.

The group of elders in a *kitongoji* usually decides on what restrictions to impose and on the phasing of the various measures In this way many households have a share in the decision-making The monitoring is done by the villagers themselves and sometimes the founder of the water source is in charge of the surveillance The monitoring of the compliance to the rules is performed without external enforcement. In this way the second-order dilemma of the rules themselves being a public good and taking on a life of their own is averted and monitoring is rarely subject to free-riding pressures, because those doing the checking are simultaneously protecting their own share of the water.

Conflict resolution is also handled locally by formal leaders or *sungusungu* or *nsumba ntale*. The example that Tanner gave illustrates how misuse was dealt with by an informal gathering of men The sanctions for rule-infractions are usually mild and do not really constitute deterrents Infractions occur from time to time but do not seem to invalidate the system. The village council has the right to make its own rules according to the local government act and the instruments they devise are not challenged by external governmental authorities.

Our account of water as a common-pool resource fulfils the seven main criteria for sustainability of the norms as outlined by Elinor Ostrom (1990) and referred to in chapter 3. However, the Sukuma situation departs from Ostrom's assumption of a population which remains stable over a long period of time During the last decade the older villages like Kongolo and Igogwe have experienced unprecedented increases in their numbers. This increase may eventually undermine the sustainability of the Sukuma norms on water rights.

Impact on own-key arrangements. Sukuma norms on water rights are hardly optimal today when it comes to water development. In fact the chosen system of solving the common-pool resource challenge has achieved such a fine balance that it leaves us guessing as to whether it predominantly serves *change* or *continuity*, as shown in the analysis of incentives for and constraints to cooperative and individual efforts The analysis is summarized below:

Table 10.1. Impact of the norm "water is a common-pool resource" on cooperative and individual efforts

	Cooperative effort under present norms	Individual efforts under present norms
Incentives	+ induce leaders to act + push laggards to join + no risk of *uchawi* + low cost monitoring + facilitate intervention	+ gives higher status and good name + construction of water supplies for gardening/ cattle and households
Constraints	- - -	- free-riding - high cost for monitoring evokes *uchawi* - no construction of large rainwater tanks

Water development activities are not restricted, in fact groups of villagers as well as individual households are free to implement any *own-key* arrangement they like as long as they allow others to draw from the new source. One self-evident restriction and possibly delaying factor is that it is necessary to secure the consent of the neighbour if one wants to develop a source on his *shamba* (landholding). Such consent is seldom unreasonably withheld and if it were then other social mechanisms would come into play.

Problems of free-riding in the water sector are negligible and only few measures to improve the water situation are postponed or abandoned for that reason. As the formal set-up is permissive, the outcome depends largely on the quality of the leadership. This issue is addressed in the next two chapters.

11

Cooperative Efforts in *Own-Key* Endeavours

Introduction

At the most general level the problem facing users of common water resources is one of management. Maintenance, improvement and development of water sources may be organised at various levels using appropriate technologies and thus involving leaders of different kinds. For instance, some leadership skill is required when the *balozi* calls on his neighbours to dig a well, and more skills are perhaps required of the *nsumba ntale* to organise the cleaning of a *lambo*. Complex management skills were applied when clearing tsetse infested areas and constructing large dams in the Buhungukira chiefdom in the 1930's, which required the organising of several thousand people; and the building of the Mkula dam in 1959/60 which involved some 40 people working with tractor scoops.

This chapter is focussed on Sukuma norms and informants' values about cooperative efforts in their neighbourhoods. In the last chapter it was stated that cooperative efforts are singularly supported by the fact that water is a common-pool resource. The formal village and voluntary associations and their leaders were introduced in chapter 8. Now we are in a position to analyse the kind of negotiations that take place between leaders and villagers and lead to *continuity* or *change*.

The structure of the analysis starts out from leaders' interest and aptitude for water development work.

Preliminary Remarks on Who is Responsible for What

The informants' perceptions of who is responsible for what and to what extent will be discussed. Informants often expressed the view that the local government is responsible for a certain sector and the local community is responsible for another, while the households look after food, housing, watering cattle, etc. Actors at each of the three levels may be involved either at a single level or in some shared involvement. For instance, there is a shared responsibility for the primary school where a local board is in charge of running the primary school; the district council provides teachers and pays their salaries; and villagers build classrooms for which the council provides the iron roofing. As for rural health centres, the district council has sole responsibility. Law and order is kept by *sungusungu*-groups etc.

The distribution of responsibilities does not always take full account of the ability and resources of the local community. For instance, the government medical service provides services which tend to compete with the traditional health service provided by traditional birth attendants and traditional healers. The water sector is similar in that many improvements can be accomplished either by using local capabilities to carry out *own-key* arrangements or by government staff who employ more sophisticated techniques.

Water is part of the diet but the informants treated the provision of water separately and differently from other food items The Wasukuma do not expect the district council to provide food unless there is a serious famine. The initial response to queries about responsibility for water *qua* food is that it should be provided by the government, in the same way as rural health centres, schools, etc. One reason is that water is seen as a common-pool resource as discussed in the previous chapter. "Everybody has a right to use household water sources, this is the main difference compared to other food items." (B5:F7). Sometimes water is not perceived to be produced (just a pit in the river bed) in the same way as other food-items, where much hard agricultural work by both sexes is necessary year after year.

Sukuma Norms about Water-related Cooperative Efforts

The first step in understanding villagers' cooperative efforts is to find out if there is a Sukuma norm about who does what within the community network which carries out activities in the water sector.

Government or local leaders. Our informants gave a varied picture of what could be described as Sukuma norms for different activities in the water sector. They pushed for the idea of government responsibility to fulfil "old obligations" to the taxpayers. A district councillor described the situation as follows.

> Before Independence we built a *lambo* under the authority of the chief. Now we know that there is a central government and we pay taxes, so we expect the government to provide water. In fact it is very difficult to go back to self-help. (K5:E8 Ib100)

Another informant contrasted earlier days with the present dependence on government help. "Traditionally everybody took part in community activities, but nowadays we do not. We expect to get things for free, be it a milling machine or a water installation." (B1:F2).

The effects of this reliance on government support are analysed later in a discussion on effects of external interventions. Where our informants did not focus their expectations explicitly on the government or district council, they at least referred to the village leaders as those who should lead development work. This desire accorded with the view that a water source is a common concern. Commoners expected their leaders, especially the *katibu*, to lead just as the chief and headman did earlier on.

> The role of the *katibu* is to advise people, to call them to development work. He has the authority to do so and people will listen to him, but he does not care much about water. People are not bad and they feel ashamed if they do not turn up when called. People themselves keep track of who is present and who is not. A *katibu* should encourage people to work together on important tasks. (M4f2:250)

The idea of leadership involvement was said to be so strong that no commoners could possibly take this role. This appears to apply all the way down to the *balozi*. An informant expressed the dilemma of a mandatory reliance on formal leaders as follows.

> I am not supposed to "show myself". People will ask who I think I am. Instead *bwana afya* and the Village Development Committee should lead the work.
>
> If we had understood the importance of water, we would have implemented our own water installations. Some people do, but they cannot tell others what to do all the time. Their fellow-villagers will start wondering "Who you think you are?" Therefore those with formal positions must take the lead. (B1Ib270+F12)

A changing Sukuma norm? Our informants' views may reflect the process of evolution of cooperative endeavours. In brief, the person who found a water source and first settled in an area often became the headman. During the colonial period chiefs and headmen were increasingly involved in organising water supply efforts for the growing human and cattle populations. A detailed description of how water-related efforts were organised during the period 1930 to 1961 is given in Appendix A.

The new independent government pushed the issue of rural development and encouraged people to perform communal work like constructing roads, dams, better houses and wells, popularly known as "self-help schemes".[1] Within the water sector, however, the self-help rhetoric was overshadowed by the active role given to MAJI i.e. the water departments in the regions and later also in the districts. One of the promises made in order to induce villagers to join *ujamaa* villages was that clean water would be provided nearby. The MAJI departments were given the huge task of developing new rural water supplies.

Meanwhile there was in the 1970s a gradual pulling apart of the definition of development: eventually the concept became divided into social services and production. Fortmann (1980.72) put it as follows. "To peasants, development was largely defined in terms of the delivery of social sevices - water, education for their children, adequate health care, transportation. Most of these had production impact as well, but they tended to be defined in welfare terms by the peasantry." From villagers' point of view Maeda's observation (1976:222) may be more to the point: "Because of the necessity for the village to meet certain national or political requirements, the villagers find themselves without much to deliberate upon except how to best meet the requirements."

Because of lack of resources the amount of development performed by outside agencies has been fading. Over the last decade or so the amount of general communal development activities reflects directly the initiative and competence of village leaders. The water sector, which has been a priority for donors, is less affected by the general decline in resources.

Experience of the government's failure to provide safe water nearby has shaped informants' way of approaching the issue of water development today. Several informants claimed, especially at the second field period, that the responsibility was in fact with the villagers themselves.

> Our perspective is that all work should be done by the government and their equipment will do the work while we are spectators. Hesawa promised water and entered with drilling equipment, but the outcome was poor. I think that it would be better to do it ourselves instead! We are indoctrinated to think that we cannot do it on our own. It would be better to indoctrinate us to help our women. (I1IIb400)

In essence, the earlier official Sukuma or Tanzanian norm which prescribed government support is slowly changing in favour of local responsibility and less sophisticated arrangements.[2] Because of this, it is becoming more difficult to distinguish between what

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[1] Mbilinyi (1974.72) found that these early self-help schemes were quite successful according to official records for 1962 It was estimated that one million people participated in Tanganyika as a whole. 321 miles of water pipes, 313 wells, 142 small dams, 110 miles of furrows and 10 water holes were constructed.

[2] An authoritative interpretation of the Local Government Act (1982) states that. "As much as possible, the need for water projects should originate from the people through their democratic organs. Where the village is unable to implement the project on its own, the Village Council will request the District Council for assistance. Such request will most likely include design, equipment and materials, and expertise for construction. the responsibility of the Village Council and the Party

are generally perceived to be Sukuma norms and what is a mere statement of an informant's values.

Transgressions of Sukuma norms

There are many ways of transgressing Sukuma norms about cooperative efforts and the most obvious is to **refuse to take part**. Whatever the reasons for their reluctance, villagers could not, now or in the past, simply refuse to take part if called upon to do so, since there are fines as well as more subtle sanctions. Examples of punishment for not attending *basumba* or other cooperative efforts were given in chapter 10; if the offence is considered as threatening to the community more severe sanctions are available.

Another kind of transgression is when a commoner tries to **organise neighbours**. Commoners were definitely not comfortable with the thought of taking the lead because they risked to upset leaders and commoners alike. They were then suspected of looking for power. The societal response may be mobbing and several informants mentioned the problem of "bad words" about enterprising individuals:

> We worked in a women's group that ran a small farm and a vegetable garden. To start with we were some eighty members but the number decreased to ten toward the end of the season. Some did not turn up and it looked like a strike. Some said "Look at her, who does she think she is?" This discouraged the female leaders because they involved themselves in the project for the benefit of all.... I attended a seminar at Bujora and we dealt at length with this issue of "bad words" which impede development. Some people with skills who try to assist others are discouraged because the participants tell them "You think you are something". People have not yet woken up if they want to develop. (L4Ib:560)

This universal way of discouraging initiatives has got its own name in the Nordic countries: the 'Jante Law' prescribes that no-one should think of himself as special or show off in any way. The general reluctance to stand out from the rest of the group is part and parcel of the recommended behaviour. The Jante Law discourages villagers from taking household action to make sophisticated installations as well as taking the lead in cooperative action, unless they hold a formal position.

A more complex situation is at hand when analysing whether **individuals taking own initiatives** are transgressing any norms. Anyone, leader or not, can construct a *lambo* for cattle without risking any problem. Enterprising individuals can - if they become too successful - reduce neighbours' comments as well as the risk of sorcery by involving themselves in efforts together with others. A successful farmer, who stressed that he took part in cooperative work, said he utilized only labour of household members for

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Branch, where one exists, is to mobilize the people to participate in the construction through self-help." (Mfunda, 1986.152-3) improvements like small ponds for watering the garden (which of course were open for all). "I try not to listen to people's comments about my achievements." The finely tuned balance of cooperation and individual efforts may set the whole agenda for what is thought to be appropriate to do.

A Sukuma proverb says "If you copy the elephant drinking you will burst into pieces (*Ukiiga tembo kunywa utapasuka msamba*)" and it may be interpreted to prescribe not to grasp for too much. Noble (1970:85) observes that it is seen as "senseless and prideful to work with one's family alone so as not to use the common pond." Prescriptions like these reflect the norm of not being too enterprising and the norm is upheld by villagers themselves. Those who, despite this disincentive, did take action were not "in coventry" but seemed to be treated differently by their fellow-villagers. Or as Noble (1970:85) put it: "they were nevertheless greeted with a cold circumspection that signalled more avoidance than communion "

Our discussion later on about negotiations will give further examples of how villagers may respond in order to avoid taking too prominent a position.

Individual Values about Who Does What

Our informants were very talkative in expressing the Sukuma norm about leaders as those responsible for taking action. The result was that few discussions about individual or household responsibility for water evolved spontaneously in the interviews. The informants were therefore asked who they thought could, should and would perform each of the two or three improvements they themselves most desired. The answers continued to be ambivalent as to who is responsible depending on what kind of arrangement the informant was thinking of. In an abbreviated form the result is as follows.

		well	roof/tank	itws	trolley	purifier	Total
Can	household	9	12	1	1	2	25
	neighbour	12	2	10	1	0	25
	village	0	1	1	0	1	3
Should	household	4	11	0	1	2	18
	neighbour	10	2	11	1	0	24
	village	7	2	1	0	1	11
Will	household	9	11	0	1	1	22
	neighbour	7	2	11	1	0	21
	village	5	2	1	0	2	10

Table 11.1 Informants expectations about who can, should and will implement certain kinds of improvements Each informant assessed at most three improvements. (itws = *improved traditional water source*)

It is evident that most informants were interested in new wells; the next largest group had an interest in roof catchments and improvement of existing water sources; only a few informants expressed a desire for other types of improvements. *Lambos* were not brought up because the question concerned improvements of household water sources.

Not unexpectedly it was said that roof catchment was a household affair; development and improvement of existing wells was mostly a matter requiring cooperative efforts between neighbours. No-one thought the village to be able-on its own-to instal a hand-pump on a well. Improvement of traditional water sources (=itws) was expected to be in the hands of neighbours, as had always been the case.

Anticipated future improvements. One area of interest is how informants envisaged future water conditions and ways of improving access to and quality of water. They were asked what they thought would be the household-water situation in some twenty years' time. Several informants found it hard to envisage the situation after so many years. As one said, "it takes a very long binocular to be able to see that far (*inatakiwa darubini ndefu sana*)." (K1:F2). The informants were familiar with most *own-key* technologies but female informants had trouble envisaging how or in what way the future could be different.

Men and women showed similar patterns in answering this question about the future, although women put slightly more emphasis on *own-key* changes. The answers presented in Table 11.2 may be summarized as follows:[3]

Table 11.2 Future changes within the water sector envisaged over the next twenty years.

Total	Men	Women	Kind of change
			Own-key changes:
4	1	3	"if we do not wake up, there will be no change"
11	6	5	"many will have their own wells"
1	1	0	"will move closer to the source"
			Assisted changes.
11	7	4	"many will have own wells etc constructed with some assistance"
1	1	0	"connected to piped water"
			No action
2	1	1	"no changes"
30	17	13	

[3] There are few surveys which give any information on *own-key* issue. Dennis Warner (1969:15) studied attitudes towards self-reliance in nine villages in Tanzania 1969 and found that 57% of the respondents favoured communal efforts while 37% favoured a government sponsored approach The option of individual effort was not included 9% of those opting for communal efforts said the reason was that they did not expect Dar es Salaam to manage, while an equal amount favoured government efforts for the negative reason that local self-help efforts were unreliable

The desire to improve water supplies in the future was widespread Almost all informants expected a general improvement of their water supply and only two foresaw no changes. One-third anticipated that villagers would continue to dig ponds and wells in their neighbourhoods on their own initiative; and half of the informants argued in an *own-key* terminology. Two comments expressing the switch from the usual dependent way of solving things to an *own-key* approach are given:

> We have always thought that we had to come together and ask for help to solve the water problem But in fact there are solutions we can manage. We may be able to manage this shallow well. (B4Ib180)

> We cannot just wait or be told all the time what to do. How long are we going to depend on assistance? We can implement many things ourselves. For example, it is OK to get a milling machine but we should do the rest. We lack the knack to look ahead. If we do, then things will happen. Instead we hope that so and so will come and repair or make it for us. And this will not help us to understand later. We must try ourselves in order to be able to implement what we need. We need to think further and not be content by relying on the government. (*Mawazo marefu zaidi, siyo kutegemea serekali tu*). (A4Ib350)

The remaining third of our informants expected that water sources would be improved with some assistance Only one relied heavily on an intervention and he proposed a piped water supply as part of a village strategy to encourage a voluntary (religious) agency to build a hospital in the village whereby a number of social services like health facilities, tap water and electricity would be forthcoming as well. The maintenance was also expected to be secured in this way.

In short, the individual values put forward appear to be much less preoccupied with central government and district council support than the Sukuma norm suggests. In this connexion we may recall Table 5.8 which showed that informants who lived close to the well and rated water conditions as a second-order problem were more likely to expect government interventions to install a shallow well than informants rating water as a major problem.

Actors in Negotiations: Village Leaders

The formal village organisation and two voluntary associations and their leaders were introduced earlier and here we explore what reasons leaders may have to act or remain passive as far as water-related activities are concerned.

General leadership environment. The time available to exercise effective leadership is restricted as village chairmen and the *katibu* are on duties in district headquarters a considerable part of their time. Moreover, in three of the six villages the *katibu* had been absent or the post vacant for some months. As he is charged with the executive power and authority to organise the villagers in communal work, there occurred a void as to who could do what in their absence.

Villagers usually anticipated varying outcomes "depending on the quality of the leader." (M1:F1). A village leader may be encouraged or flattered by villagers' wish to be organised and therefore he increases his efforts to organise development work, or he is satisfied and simply enjoy the situation. Other leaders may feel that "the many expectations become too much of a burden on them." (M1:F13).

In chapter 8 we arrived at the view that formal village leaders often have a low acquired status and, according to the informants' informal rating, one village seemed to have a diligent leadership while the other villages had leadership rated from satisfactory to poor. Comments like "Half of the council members are drunk in meetings" and "The beer is in reign (*Pombe inatawala sana*)" were fairly common. The problem of beer-drinking may be one reason why some leaders did not perform well, and the same goes for villagers. It is said to have occurred a shift from ceremonial drinking of beer and at occasional feasts for the *basumba* over to an excessive drinking at any time and almost any age in the mushrooming *pombe* shops.

In such circumstances leaders may face difficulties where men are reluctant to "take orders". Also they may sense all the expectations on them which sometimes force them to make priorities among all tasks. Their high formal and repressive authority put them in a position where they can withstand pressure from villagers. This (repressive) power stays with them at least up to the next election every fifth year and up to the party appointment of a new *katibu*.

Incentives and disincentives for leaders Leaders had many incentives to organise *own-key* water activities and to join in a water intervention; they can gain the support and appreciation of the villagers; or they can earn recognition at district level; or their status or prestige may be boosted; or their own household will get an improved water situation; or they get access to new wealth-creating opportunities. Yet not all villages were said to have leaders in favour of water-related activities. The reasons for not taking up an active stance need to be examined. Why is it that formal village leaders seem mostly to forward proposals about development to the district council and then to organise villagers once government staff have entered the village? Some reasons for this will be discussed along with the analysis.

Leaders' power. Leaders who are in favour of development activities may choose to use persuasion, pressure or coercion to organise reluctant villagers. When relationships between leaders and villagers become more impersonal coercion may become more common. One villager who was critical of modern leaders expressed this with an aphorism:

> We have witnessed the coming of the 'pencil' and the demise of honoured traditions. This is why you find many places where beliefs in traditions are lacking and where people subsequently lack water. Our strength has been extinguished by leaders of the pencil. (M6II:315+400)

The smaller the group the harder it is to use authority or compulsion. Our informants said that compulsion only destroys good neighbourliness and in a ten-cell neighbourhood the only working method is voluntary cooperation. Leaders of lowest rank i.e. the *balozi* and *kamanda* play an intermediate role, sometimes found as part of the leadership and in other instances more closely related to the group of commoners. They are often more like commoners and they have little authority. One informant said:

> The *balozi* will listen to the request for a water source nearby and initially he will inquire whether the women can manage without involving the men, since digging a well is hard work. He could call on the husbands, but only few would turn up for work and nothing would be done.
>
> The *kamanda* of *sungusungu* has the power to punish those who have refused to take part. But if no one tells him that husbands have refused to take part.... The *kamanda* can call them to a meeting, but it will be useless ... because they will say that it was just a discussion and they did not refuse. (R4f2b:90)

One informant is a *balozi*, and he told about an example of successful cooperation among his neighbours:

> In our first meeting to discuss how to improve access to water some participants expected assistance from somewhere and many wanted an extension pipe to pump water from the Ndagaswa river. But we pushed the idea of having our own wells since.... even if we at a later date have the capacity to buy pipes the price of diesel to run the pumps will have increased together with everything else. All this would cause more problems and we would be worried all the time. Eventually we decided to dig our own well instead of relying on assistance. (R5f2a:190)

Another *balozi* concluded that it would be easier to develop one's own water source than to go through the tedious procedure of trying to convince hard-headed neighbours:

> There are people with good ideas and people with bad ones. Those with bad intentions are found in every group of people and they destroy for the others. It is better to leave them aside. (B4f2a:420)

Traditionally the person living next to a well looked after it and since rather few people used each water source the task was fairly easy. The users knew one another well which enhanced the group pressure to conform: no one of them would knowingly pollute the water source. The practices now deemed unsatisfactory have arisen not because of lack of awareness but due to difficulties in organising the surveillance work. A mechanism which could "force" each and every user, say among one hundred, to adopt a high standard of hygienic behaviour at the common water source has not yet been invented. Several devices have been adopted in an effort to come to grips with the situation. One of the most popular is the appointment of a caretaker; this may contribute to keeping standards high, but not even a hierarchical village can guarantee to police all of the users effectively. It becomes a strong discouragement to everyone if one single user is known to pollute the water and get away with it. The end-result is the present often ineffective and low standard protection of water sources.

> It would be good to have a lid on this spring. It is next to the cattle dip and many people come this way. And they have their own ways of behaving; some draw water with their hands and drink, others wash their faces in the spring! And on other occasions you may find small stock drinking from the spring. It is really a problem. (I5f2a:170)

Villagers' Strategies in Negotiations - Leaders in Favour of Leading Water-related Activities

The presentation of villagers' strategies when negotiating with village leaders and among themselves is based on the views and comments of the informants.

(1) Leaders in favour and keen villagers. Villagers may perceive several reasons to be interested in joining a cooperative effort; shorten the distance to the source, ensure water the whole year, improve water quality, etc. Their willingness to take part is also affected by incentives which are offered and disincentives they anticipate.

When the relationship between leaders and villagers is cordial and both parties are interested in water development they can take action without much friction since the organisation is there (see chapter 8). The negotiation may be limited to the choice of technology, timing and the like.

The first example is drawn from a cooperative *own-key* effort of a kind which takes place from time to time in most villages (Plate 11).

> **Case I Cleaning of a *lambo*.** The communal *lambo* in Lwanhima, which was used to water cattle and for bathing, had not been cleaned for years and it was overgrown with bush and thick grass. The *nsumba ntale* discussed the problem with the village chairman and they decided on a date for the cleaning job. He called the *basumba* by blowing the horn and all able-bodied men gathered with *jembes* in their hands. On one occasion, observed during the field work for this study, about a hundred men worked together for a whole day. They cleaned out bush, grass and mud in the heavily overgrown *lambo* with a surface area of some 300 m^2.
>
> Two young men who were late were punished by having to dig on their own for a quarter of an hour while their friends relaxed on the bund and made jokes!

In this case it is hard to know whether the *basumba* thought of the task in terms of anything other than the benefit to be gained from a better water source. It is clear that when only a few villagers are opposed to an activity, the leadership can easily handle the situation. But had many been opposed in this case, for example due to the risk of attracting schistosomiasis, the *nsumba ntale* would have applied some other measure.

The next case is an example where cooperative villagers and leaders were pushed ahead by a donor-supported intervention. The *balozi* called on his people to take part, and the work was led by MAJI staff and a village leader.

> **Case II Protection and improvement of a spring.** Several interventions recently took place in Kongolo; the MAJI department organised the construction of shallow wells and improvement of existing springs. One such spring was protected and improved in 1985 by inserting two cement rings and fixing a hand-pump on top of a cement cover; the water was protected from pollution and the drawers could easily lift the water. This improvement was much appreciated by the users and they had asked (through their leaders) the MAJI department to improve a second spring in the same manner. In the meantime no one in the village took any initiative to improve this second spring.
>
> In 1990 a MAJI team of technicians arrived and they were provided with food and shelter by the villagers. The technicians supported by villagers, built a one metre-high lining of rocks (instead of using a cement ring or two) and moulded a dome-shaped cement lid with a hole through which to lower the bucket. A foundation was prepared for a windlass, but the windlass itself was not installed.
>
> The rough construction made it very difficult and back-breaking to reach the hole with a bucket and the dome-shaped lid was too steep to climb (see Plate 12). Also the shape of the slab was such that spill-water leaked back into the spring! The "improved" spring was not well received by the villagers who, understandably, would have preferred a hand-pump.

In this case villagers gained experience that, contrary to the first spring improvement, may have made them reluctant or at least doubtful about further interventions. Apart from the possibility that the MAJI team lacked the skill, it could be that they believed their professional status would go down if they ceased to provide hand-pumps; so they made sure the villagers complained about the windlass.[4]

Past experiences played a fundamental role in shaping villagers' willingness to take part, and informants who had experienced positive results from previous cooperative endeavours were usually in favour of continued activity.

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[4] A similar case was said to have occurred when MAJI was required to discontinue paying wages to labourers for digging wells in their own villages in the early 1980s: thus preventing extension staff from extracting some of the payment. The staff simply instructed the unpaid villagers to dig shallow pits that did not hold water, using the ensuing complaints about dry wells as an argument for reinstating wage incentives to get village labourers to dig deeper! (pers. com. with staff).

(2) Leaders in favour and reluctant villagers. There is a host of possible reasons why villagers are reluctant to join a water activity; human, organisational and technical reasons apart from the case where the villager do not perceive a water problem (see chapter 5).

In this case there evolves a kind of hidden negotiation between leaders and villagers. The arena for negotiation is restricted by leaders' power mentioned above to use administrative force, on the one hand, and villagers' strategies to stay out. Several of the case-studies presented in this chapter may be viewed as partial accounts of such negotiations.

Villagers said they never respond "No, we don't want this" to a proposal brought forward by a village leader or by an agency to the village assembly. If they were reluctant or even opposed the proposal, they would rather agree verbally and then resist in a passive way. This also indicates that villagers were not powerless.[5]

> If, for instance, government staff comes to our village and propose that we collect money for iron sheet roofing, the villagers will rejoice. When they have left we say that they only bring words to us and the big-shots will take all our contributions. Even if the officials come back later with the iron sheets and ask for money, we will have forgotten that we agreed. So, perhaps one reason is that we do not really bother about improving our houses. (A4Ib530)

Rald (1970:25) described this strategy as "the *Ndiyo, bwana (Yes, Sir)* attitude: an attitude of acceptance, understanding, even enthusiasm (if the speech is really good)" followed by varying degrees of passivity. The passive attitude could be detrimental to their own short term interest, but as "villagers are on a go-slow strike they do not want to hurt themselves so they may stick to other solutions." (B3:F6). Moreover, female informants told about problems to organise the work of women groups in activities which would be beneficial to the participants (some reasons for low attendance are given in chapter 8).

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[5] Cory (1954) noted that a headman is dependent on his followers and has to please them so that they do not move to another parish. This was not an empty threat since villagers moved more often at that time. Of late Goran Hyden and others have stressed that withdrawal from the formal economy is an indication of the (uncoordinated) power of the villagers This idea is not new, as shown by the words the then British governor Sir Donald Cameron in 1929· "Kenya settlers ask for self-government. Give it them! That has nothing to do with governing other people in Tanganyika for example. I believe the lines could be drawn. Let them govern the natives who are in their areas. It will be good practice. For if the natives don't like their government they will walk into the reserves and the settler domination will crash The natives will soon learn that they have the white community in the hollow of their hands. They have only to refuse to work, and the whole of the settlers are ruined " (Perham, 1976.44)

> Even women fail to understand the importance of improvements. We were 36 women in our group and yesterday when we were called to construct the foundation of a house for the new milling machine only 19 turned up. Had they understood the purpose of the activity all would have showed up, wouldn't they? (L2f2a:150)

The relationship between leaders and villagers may be strained and should the villagers not find the cooperative effort worthwhile they may choose to let the explicit reason not to build up a leader's reputation dominate their response. "I do not want to work for someone else's benefit and thereby become their labourer." (B1f2a:I3). Similar comments came from several informants and therefore should be explained in structural terms, not only by individual sentiments. The increased distance (spatial and social) between formal leaders and villagers after villagization may be one such explanation.[6]

A major reason for villagers shunning to cooperative endeavours calling for cash contributions was the high rate of **embezzlement**. Mismanagement of funds was said to have seriously weakened the authority of village leaders in five of the six villages covered by this study. Villagers complained about taxes and all kinds of charges. The fines paid by people contravening village council by-laws had by 1986 become an important source of revenue (Government of Tanzania, No.9:9).

Our informants gave numerous examples of embezzlement of money collected by cooperative societies, misappropriated fines and appropriated common property (lorry, tractors, etc.). One informant said that Tanzania had "become like a place with rats and no cat." (I2f1:D1) There was a real loss of confidence and few of our informants in 1990 seemed to be prepared to support the collection of money for any kind of project (with the exception of *sungusungu*), which is very different from what Cory reported in 1954.[7] One informant described the situation as follows.

[6] Goran Hydén wrote (1980:117) that "few peasants, if any, were prepared to trade their own institutions for the concept of equality. Nor were they voluntarily going to work communally in order to support the demands of the other classes when this in fact collided with their own needs *Ujamaa* as a radical strategy of development at the national level could not be reconciled with its objective of promoting development from within the peasant mode."

[7] Some forty years ago Cory (1954 100) described the situation as follows "It is not easy to describe this aspect of a leader's public life, which necessarily entails an understanding of African life in general and its tolerant attitude It is first of all necessary to abandon European ideas of standards of integrity in office and to realize that words which arouse in us thoughts of court cases for defamation of character do not have any unpleasant sound to the ears of the villagers, but rather describe the natural privileges of power and influence. Therefore to say that headmen have regular sources of income on the side is rather like saying 'water is wet'. It would be utterly incorrect to call public tribal life corrupt, since the words 'corrupt' or 'not corrupt' are completely meaningless to the African in this connection. The only question that matters is whether the procedure remains within traditional limits."

> We are asked all the time to contribute money for this and that. Therefore it may be difficult to engage neighbours in collecting money. The government and the party raise money for projects like a secondary school, the National Torch Tour, etc. For every purpose we contribute several hundred shillings; it may add up to thousands of shillings in a year. We start to wonder where all this money goes, and to think that it is better to keep the money; one tends to refuse to contribute money even for things that will benefit oneself! (L4Ib:450)

Several informants stressed the importance of electing wealthy leaders who are "full" already (*kuchagua viongozi wamesha shiba*) and who are not primarily interested in increasing their wealth, similarly to the *ifogong'ho* fund referred to in chapter 8. Another reason for electing wealthy leaders was that embezzled money could be recovered from a rich leader but not from a poor.

> **Case III Drilled wells in Igogwe.** Igogwe has a few permanent springs and seasonal rivers which provide most of the household water. Increased population pressure and the villagization forced people to settle up the hills further away from their water sources. A few villagers dug small, shallow ponds in the new area to secure water nearby during the wet season. The village leaders were not involved in this but were engaged in attracting external support to develop some modern shallow wells with hand-pumps.
>
> The Water Master Plan estimated in 1975 the dry season yield from existing water sources as 50 m^3 per day or 25 litres per person per day; the potential daily yield was 4,733 m^3 from boreholes and 62 m^3 from shallow wells. The new shallow wells increased the yield, but the population increased from some 2,500 to 3,700 persons during the decade, with the result that there was a net decrease in accessible water to less than 20 litres per person.
>
> In 1988 a donor-supported drilling enterprise was launched with the aim of sinking some twenty boreholes in the village. The drill-rig was successful according to the quarterly reports and water was struck at some 60 to 80 metres. Water rest levels were reported to vary between 5 and 25 metres which allowed for hand-pump lifting.

In this way the village leadership managed to arrange for household water without having to trouble the villagers. Soon after the commissioning, however, several of the boreholes went dry and others proved to have extremely low yields in the dry season. It emerged that serious misreportings of success rates had taken place, and rumours were rife about embezzlement of diesel and illegal sales of steel pipes. An investigation by a professional accountancy firm (Price Waterhouse Assoc., 1989) confirmed most of the allegations; the accountants inspected all boreholes only to find that some which were not sunk at all had been paid for; another borehole was four metres deep instead of the reported 60 metres. It was estimated that three-fourth of the diesel had been stolen, more than half of the cement, and one-third of the steel pipes. Villagers testified that the MAJI staff had sold diesel to them to be used instead of kerosene. Formally the MAJI-team was on lease to the district and the team returned to the ministry. No legal action had been taken three years later

Villagers' Strategies in Negotiations - Leaders Uninterested in Leading Water-related Activities

Many informants said leaders are rarely interested in organising improvement of water sources. This study is not aimed at analysing leaders' views or whether their views accord with those of the villagers, although a relevant example is presented in chapter 13.

One powerful physical reason for leaders' reluctance is the risk of not striking water. They cannot like technicians put forward more or less spurious technical and hydrogeological explanations to disguise their failures (Coster (1960:94) mentioned success-rates between 28% and 66% for boreholes). Nor can they pay for village labour to compensate for the risk involved. MAJI personnel may even mismanage without personal loss as demonstrated by case III above. Village leaders of today may consider the risk of not finding water too high and therefore refrain from initiating a village-based project to dig a well.

> We all have experience from a donor-financed project installing hand-dug wells around 1980. It was easy to recruit villagers (men) to dig wells because they were paid. They did not despair since the income was secured. Had they been told to work for free they would have been afraid to fail. Later the payment was abolished and villagers were forced to work together without pay. Experts led the work and the *balozi* brought a stated number of villagers. (I3IIa460)

(3) Unwilling leaders and keen villagers. Situations where leaders are reluctant to organise water-related activities while villagers are keen, provide a special kind of context for negotiation. One question is to what extent villagers feel free to act. They know that leaders have the formal and actual authority to decide on a number of issues affecting individuals. There is a general reluctance to oppose or in any way offend leaders. Our informants were careful not to challenge those with power and thus risking assistance on future occasions when support can be essential.[8] One informant said:

> Often it is just words and nothing happens. We are afraid of politicians. They promise to get things for us, so we feel barred from doing it ourselves. We sit down and just wait for them to do something for all the money they collect. (D1:F11)

[8] Cory (1954:99) observed. "In the small world of the parish headman, with his intimate knowledge of the words and even the thoughts of his parishioners, he is their master in many ways, simply because he can start or stop intrigues by virtue of this knowledge, and can probably detect intrigues directed against himself in their early stages - a situation which does not tempt even a bold man to start them. Thus it is not considered advisable to make trouble with a headman, nor to be too eloquent in the contradiction of his orders "

A reluctant leader can discourage villagers who are keen to work, since they may feel barred from organising the work themselves:

> We have the impression that the importance which was paid earlier on to cleaning our water sources and developing new ones has weakened in our village. People care less. It is tough to persuade them to dig a well. Just to give an example, our women's group collected stones to line one of the springs. We asked the *balozi* to call on people in the neighbourhood to cooperate in this task. But we failed to get his support despite the fact that the MAJI department had offered to send a technician to assist the women's group to line the spring. (4f2a:10)

The arena for negotiations is limited. The next quotation illustrates the assymetry in bargaining powers that may exist:

> We just talk and do not implement anything, and the leaders do not listen. A good illustration of this is our spring, which is used to water the vegetables. It was proposed to improve it to yield more water for all users.
>
> The *katibu* receives water from the spring by requiring the owner to draw two buckets of water for him to be brought to his home 900 metres away each day. We cannot refuse unless we want to fail and he will consider you a bad person. He has to be given the water although he has not contributed at all. And if you tell him ...
>
> If you tell him that we would like to dig out the spring on a certain day he will not listen. They enjoy their *pombe* and we are concerned about the household water. Now, if the big ones did things of value ... if they understood how water is obtained. But they have no sense of that. I do not know what kind of awareness they possess. They are used not to work and only come and grab. Well, on Thursday we will clean the well. He will not support this and no one else than us will turn up. It is a major problem and now the village is like this. If we women ask our neighbours to come they do not show up. (f2a:250)

In situations like this it was proposed that one or a few villagers could take an initiative to improve the well. The risk of retaliating leaders was small since they too would benefit. Initiatives by commoners became questionable only when money was involved, as in this case:

> **Case IV Repair of a faulty hand-pump.** Six shallow wells with hand-pumps were installed by a project in the early 1980s; they have been out of order for most of the time. The villagers have not been allowed to remove the cement covers to convert the wells into open wells, so instead they have reverted to their old water sources.
>
> For three years the hand-pump on one well has been defunct and the villagers said that they have pushed the *katibu*, who claims that he has reported to MAJI about the faulty pump. The villagers are sceptical but since he is the only one authorized to get in touch with the MAJI department no-one has checked up on him. An ex-student in the village who happens to know a bit of the technique has volunteered

> to bring the broken part to town for repair but the *katibu* has not made available the money for bus fare and welding.
>
> Leaders started to collect 30 shs per household, but it is said not to be enough for the repair. Some say the money has been 'eaten'. (Informants' information)

It is hard for villagers who were interested in mending the pump to act in this case without provoking counteractions. Their respectful behaviour towards leaders may have prevented them from doing anything on their own, especially to raise money. This is another general obstacle for neighbourhood development activities; groups are not allowed to collect money without the consent of a leader. The argument is that in this way villagers are protected against fraud. Thus, people can only embark on projects which required cash contributions if they are prepared to seek the approval of a village leader.

(4) Unwilling leaders and reluctant villagers. The situation where both leaders and villagers are reluctant to take action seems to be a simple one; nothing will be accomplished. "Leaders keep quiet and we are on strike (*viongozi wananyamaza na sisi tunagoma*)." The situation is one of *continuity* and may evoke descriptions of stagnant societies ridden by superstition and backward leaders It is possible, however, to discuss such a situation in more neutral and familiar terms.

Misinterpretation of the norms. People may misinterpret the Sukuma norm or the wish of their leaders. Mental constructs of expectations of other's behaviour need not be realistic or even correct. There are many examples of more or less self-imposed restrictions on one's behaviour due to this If communication lines are clogged the risk of such mismatch will increase. The following example may be read in two different ways.

> If you make a tank of cement or iron sheet people start wondering. How come that he can make a tank that may cost 20,000 shs? From where does the money come to buy the cement? There must be something fishy about it. Therefore, even people who have the resources will fail to implement a project like this because of the slander. He prefers to stay with the simple solution of a bucket or drum. (L4Ib415)

A straightforward reading says that household improvements seemed to be discouraged by neighbours themselves (20,000 shs is about the value of a bull). The other reading is that had the informant discussed with the neighbours the idea of making a tank they might have been supportive, vaguely positive or indifferent. Female informants seemed always to be feel a kind of certainty about the negative attitudes of neighbours. The author's impression was that this kind of self-imposed restriction may become self-fulfilling.

The Jante law. Another important point to be made here concerns what makes villagers choose to be inactive. Not only does the Jante law discourage commoners in the planning phase of an action, they also know that neighbours will keep a close eye on whether the action succeeds. If it does not, the developer can expect to have the failure rubbed in afterwards; only if it worked as planned and the hostile neighbours were then prevailed upon to use the water would the developer be safe.

One informant with a bad experience from an effort to construct a well told this story:

> We are keen to work but many villagers do not like to dig and they prefer to come and draw water only. Being the one who developed the source you ask yourself, what did you receive? People don't want to dig and on top of that they will slander you at the well! (M4f2:390)

The Sukuma version of the Jante law allows for some success but too much is said to provoke *uchawi* (see chapter 10). At the same time there were limits to what one would expect to achieve. The Sukuma proverb that "a short person cannot bring down something pinned up by a tall person (*Nigo gwa sungwa nihu, nguhi atugusungula*)" infers that ability differs between persons.

Self-esteem and emulation. Who did the informants believe had the knack and ability to perform successful water development work? Hans Cory reported that chiefs were thought to possess, or to attain on their installation, the special knack to communicate with deities and ancestors and through them were empowered to perform extraordinary things. Commoners may not feel comfortable emulating the chief's achievement as Noble pointed out:

> In general it could be said that activities of the chiefly class have the respect of the people, but that this respect engenders no particular desire for emulation. Class remoteness would not encourage such a response by the common people. On the negative side, one innovation intended for the people at large, but which was introduced through the upper class, failed. The mistaken equating of the elite with the imitable may have been the basis for concentration by the early missionaries on the chiefly class ... (Noble, 1970:192)

Class remoteness or social distance was an important ingredient in the chief's ability to demand work on construction of large dams, tsetse clearings, etc. If the proposition that commoners are reluctant to copy what the chief did is translated into today's situation, leaders' activities would not be emulated by the villagers It would mean that the general strategy of recruiting leaders as change agents in development work is deemed counter-productive.[9]

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[9] Lionberger (1961.15) concluded from his studies of American farmers that the lower the level of competence, the less critical farmers become in their selection of with whom to converse, thus

Several informants were asked about this issue, and no one felt that present leaders (not chiefs) had some good star that helped them to achieve more than others. Informants often expressed a desire to copy or to adapt a water arrangement or installation that they had seen somewhere One informant argued as follows.

> To be an early adopter is no problem nowadays. If a leader is perceived to do a good job and is in the forefront, he will become an example for others. Many will emulate what he does, I am sure of that. On the other hand, a bad leader who is lazy and carefree will make activities come to a stand-still. It is the same in the household. (M3f1d:40)

Direct and Unintended Effects of Interventions

Up to now four important aspects of interactions between leaders and villagers have been studied What remains to analyse are the effects on cooperative efforts of interventions organised by the district authorities.

In chapter 10 it was found that the Sukuma norm which considers household water to be a common-pool resource paves the way for interventions of the kind familiar to most villagers since the 1930s. The line of technology choice over the years is illustrated by the case of Buhungukira in Appendix A. The authorities at first emphasized boreholes to provide water for humans and cattle who had moved into cleared virgin areas. Then there was a long period of construction of dams and *lambos*. In the 1960s and 1970s piped water supplies were the mode. In the late 1970s a simpler technology was introduced with shallow wells and hand-pumps. These shallow wells are still promoted to supply household water in Sukumaland

Villagers have been involved in performing manual labour all along: at the outset they provided their own food and shelter; by the end of the colonial period they were being paid. Today they contribute free labour and the neighbourhood also provides food and shelter for the technicians.

A "free" gift. Villagers paid only 8,000 shs (1990) for a ring-well with a hand-pump. The actual cost is hard to calculate but an evaluation team estimated the cost for materials and equipment to be 750,000 shs (IRC, 1992:89). Other costs e.g. transportation are not negligible. According to the author the total cost is probably slightly under one million shs for a single shallow well. The material and equipment are practically a free gift. Thus the abundant local resource - labour - becames relatively more expensive and villagers find it less efficient and less rational to engage in *own-key* arrangements as long as there is a chance of benefitting from such an intervention.

It is certainly more attractive in the short run to receive the installation almost free

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perpetuate locally existing levels of competence as farmers except for the labour input. As seen by a villager it was "all too easy to collect 8,000 shs to have a shallow well installed." This fee equalled the price of two or three 90 kg bags of maize and, contributed by dozens of households, would constitute a share of less than a week's consumption of maize in an ordinary household!

When repairs were needed later on, even simple ones would cost tens of thousands of shillings. Most users saw little reason to pay for this; they preferred to approach the authorities to have a new well installed, since this was cheaper. The informants' strategy tend to be to argue that the government should take on the further responsibility of operation and maintenance.[10]

Unintended effects. People have seen and used many of the modern water supplies installed by interventions. An effect of this, which came out clearly in the interviews, is that they now prefer technical solutions of the kind used in interventions. Most informants seemed to believe that the higher level of sophistication was necessary for their health, but as shown in chapter 7 the actual water quality is high in most households already. It was showed in chapter 9 that most villages lack necessary resources for such installations e.g. large amounts of cement, iron bars and expensive machinery. The result is that village councils often consider themselves unable to embark on a locally managed water supply project. Instead they feel obliged to await an intervention providing the necessary resources.

Similarly, aspirations among most informants were slightly higher than they could afford. Those who were (inherently) reluctant to take action of any kind were thus able to use the non-affordability argument against water development. Only a few informants were interested in discussing improvements that they could afford and manage.

One intention behind all interventions is to assist overworked women. This aim is realized during the life-span of the installation if the installed supply is closer than the pre-existing water sources. The unintended result, however, is that most kinds of *own-key* arrangements are delayed or impeded in areas outside the intervention area (while waiting for one).

The intervention itself may, as related by the informants below, imply that villagers do less on their own if an intervention is anticipated.

> We could build a rock-well but we are constantly reminded to follow the light, that is, the person who can provide us with something memorable. If you receive the best, even after a long period of time, you will not look for alternatives. You simply wait, even for a very long period of time. (I2f2a.310)

[10] Hatfield (cited in WMP, 1978 v16A.31) found that even when the labour expended by villagers in the repair or construction of village water sources was paid for by MAJI, the villagers still considered themselves 'forced' to work and the water source to be government property and therefore a government responsibility

This line of argument is important to follow up further. The bare existence of a promise to provide water may be cleverly utilized by men who are reluctant to perform the required work. Some female informants said that men claimed that there was no reason to start on their own before a project had arrived in the village since they otherwise risk doing the work twice.

> When we hear about a water intervention going on we are interested. We may walk to Nyegezi ten miles away to look at a new shallow well and hope that the 'project' will come to our village. We would not try to dig a similar well in our village on our own. We tend to just have a look rather than to study how to copy it. (L4Ib400)

No intervention or support. The informants were asked to expand on what they thought would be the consequence of a hypothetical change in policy whereby the new rule would be that villagers could not expect any assistance from outside. A few said that they would get stuck without support, while the majority answered that they anticipated that villagers would take their own initiatives to improve water access and quality. One informant argued that there is "No reason to ask for assistance, we have been blind." (M1:F9). Others followed the same line of reasoning:

> We are fond of being helped and dragged along since Independence. Before that we were forced. Never are we expected to rely on our own capabilities. If the village council decides that it is our responsibility to arrange for household water, the council members must try hard to explain the need for improvements to their fellow villagers. (B1:F13)

This way of reasoning is similar to responses to questions what kind of household water conditions the informants anticipate in twenty years time (Table 11 2)

Conclusions

The preponderance of the expressed views of our informants was in favour of cooperative efforts under the guidance of village leaders This can be said to constitute a Sukuma norm. There are signs, however, although the majority still adhere to it, that this norm is being eroded by the weak, achieved authority and the lack of respect for the formal village leadership as indicated in chapter 8. The situation is complex and blurred by occasional interventions.

As for the associations, the *basumba* group has not taken on the task of developing water sources on a large scale except for cleaning *lambos*, and *sungusungu* groups are involved only in imposing rules. More water sources have probably been developed by individual villagers than by groups. Thus the Sukuma norms of community action are not reflected in the way people actually behave; the norms themselves may well become redundant if this trend persists. The effect of this discrepancy is also to discourage water source development and *change*.

Our informants tended to argue in favour of strong leadership for several reasons. Not only did they expect leaders to lead, they also felt barred from taking initiatives of their own It was not appropriate for a commoner to show off by taking the lead, or to instruct others. Most informants hesitated to take a high profile. Decisions were avowedly left to leaders instead of using one's own competence to solve water problems together with neighbours.[11] Female informants were not expected to forward proposals to leaders or leading institutions but were to use their husbands as spokesmen. In practice the decisions were highly influenced by villagers' individual values as they emerged in negotiations.

Negotiations about *own-key* arrangements. The impact of the Sukuma norm that water is a common-pool resource was in favour of cooperative efforts, as outlined in chapter 10. The various possible combinations of leaders' and villagers' willingness to take part in water-related activities have been analysed and our conclusions are:

Table 11.3. Expected outcomes of negotiations between villagers and leaders

	Leaders keen to lead/develop	Leaders unwilling to lead/develop
Villagers keen to participate	*Change*	Hidden negotiation (non-provocative)
Reluctant to participate	Hidden negotiation (go-slow strike)	*Continuity*

If both parties are in favour of a cooperative effort, the result is a *change*, for instance, by building a *lambo* or performing a smaller task like cleaning it Such cases are not frequent even when external interventions are included. Where the villagers are reluctant to take part, a hidden negotiation begins because they cannot openly refuse orders from their leaders (we have seen that some informants talked in terms of a go-slow strike while showing a *ndiyo, bwana*-attitude). In such cases most water-related activities take place at a slow pace or through an intervention. In the long run, however, this reluctance may

[11] The hierarchy at parish and village levels had many features in common with formal organisations with which the researcher is familiar, like a university department, a firm, etc. This offered an opportunity for understanding informants' reasoning If, for instance, an informant says she has talked to the *balozi* about how to solve a water problem, and he has not acted, we may ponder over a similar situation in which the head of a department does not act upon our proposal to take a decision or improve the way something is done It is then easier to realize that the person at the tap is not always allowed to take action, or she may decline to act because she views the 'transaction cost' as too high

make leaders less inclined to push development activities.

Regardless of the reasons for the unwillingness of leaders to take action, the inaction itself has a serious impact on water-related activities When villagers are uncertain about what they are allowed to do, confusion may arise and they frequently decide to adopt a wait and see attitude. This "hidden" negotiation (since one party is not taking an active part) may result in smaller projects/efforts if the villagers are really keen or, in rare cases, there may be a confrontation with the leaders. Finally, when both parties are reluctant, confusion reigns, there is misinterpretation and rejection of norms, and the "Jante law" triumphs. The obvious result is *continuity* as far as cooperative efforts are concerned. Individual villagers may yet take action on their own as we shall see in the next chapter on household efforts.

Interventions from the outside. The problem of commitment problem does not arise to the same degree with an external enforcer. Several examples in this chapter deal with interventions by official agencies where village leaders become implementors at best. But most interventions have had a relatively short life-span and cannot be emulated by community efforts. The greatest impact of the interventions on *own-key* arrangements is that they discourage many individual and small-scale projects. Instead of preparing for an improvement with local resources men in particular are prone to wait for a modern project to arrive. The interventions call for little or nothing in the way of management skills on the part of village leaders, the installation is almost free, and its higher technical sophistication brings status.

12

Household Efforts and Cooperative Conflict

Introduction

Household water has several characteristics affecting its production; fetching water is a routine task done a number of times a day, but development of water sources and even maintenance are done infrequently. The visible part of the completed whole consists of the actual work and materials used in the process, whilst at the invisible cultural base is the confirmation or creation of social relations Water has numerous uses and is consumed by everyone in the household. Gendered relationships and decision-making in production and consumption are crucial for *continuity* as well as for *change* of the ways and means of providing household water.

Through the statements of our informants we are in a position to interpret what is taking place in intra-family negotiations about water-related issues. The focus is mainly upon the relationship between husband and wife(s), occasionally also involving gender of children. We shall make use of some elements of cooperative conflict and game theory to organise the material. The first step is to establish whether there are any Sukuma norms which influence informants' behaviour, then we describe and analyse our informants' values as reflected in negotiations.

Preliminary Remarks

Wasukuma in rural areas are married and stay together in the habitat of the male line. Marriage is formalized according to customary, Christian or Muslim law (the latest national law enacted in 1971). One important reason for marriage, apart from affection and status, is that a lot of transfers and transactions are institutionalised; first and foremost inheritance but also everyday decisions. In the household it is prescribed by and large, who will do what: cook, build houses, fetch water, etc. The transaction cost of **changing** the customary division of tasks - which is the essence of Sen's model of cooperative conflict introduced in chapter 3 - is probably much higher than would have been the case if the society was not permeated with norms and expectations. In brief, the conjugal contract seems to reduce uncertainties about who does what and, at the same time makes changes/innovations less likely.

The case of Sukuma conditions presented in this study has its particularities but also its generalities. Before entering into the micro-world of our informants, some general data on gendered tasks are presented. Murdoch and Provost coded the gender division of 50 technological activities in 185 societies. Their result of a ranking of the activities according to gender is as follows.

Table 12.1 Ranking of gendered tasks.

	Task	Male	Mostly male	Equal	Mostly female	Female	Index
1	Hunting large aquatic fauna	48	0	0	0	0	100
47	Laundering	5	0	4	8	49	13.0
48	Water fetching	4	4	8	13	131	8.6
49	Cooking	0	2	2	63	117	8.3
50	Preparation of vegetal foods	3	1	4	21	145	5.7

Source: Murdoch and Provost, 1980:293.

The data show that household-related activities are dominated by women in most societies. The Wasukuma are not included in the crosscultural sample above, but there is no reason to suppose that their division of tasks no. 47 to 50 differs from the general pattern. The task of developing water sources was not included in the data.

Sukuma Norms about Who Does What

The informants gave a fairly coherent picture of who expects what from whom in relation to household water. The first aspect is the transport or **fetching of water.** All female informants said that it is their task to fetch water if it is not too far away or they are not sick or disabled. This view was shared by all male informants, and its compulsory character was indicated by female comments like the following.

> Perhaps my husband sees a bucket of water and he tells me "Bring me water to bathe!" The child has not been bathed and this bucket was for the cooking of food. It seems as if the problem you get doesn't matter. He knows it does, but he does not care. (M4f2a:500)

Simple observation of activities at the water source confirms that the task of fetching water belongs to girls and women. A husband can **help** if his wife is unable to fetch water due to some good reason. Precisely when that should happen is elaborated later. Most male informants expressed a willingness to assist the wife: "As far as I understand it, a man may assist in fetching water if the mother or a small child is sick, or if the woman has too much to do." (L1f2a:350).

It is rare to find husbands who fetch water regularly. One female informant told about two cases in her village. In one the wife had had an accident injuring her jaw, preventing her from carrying water on her head. In the other case the whereabouts of the wife were uncertain. The husbands fetched water by bicycle very early in the morning.

Both men and women said that men are expected to perform the task of **improving water sources**. Women are expected to dig a pit in the river bed, but not to dig a well proper. Women may take part in donor-driven water projects by carrying spoils from the excavation. Digging a deeper well is not deemed possible, however, since a woman cannot climb a ladder with dignity.[1] It was also reported that female heads of household engaged male relatives or hired a well-digger if they wanted a well constructed. A male informant argued that developing water sources is the men's task:

> My wife has said nothing, not because she cannot but because women have no horizon of the future. They cannot foresee tomorrow. Often they try to imagine, but since I am around to do all the things they relax and rely on me. One day I turn up with a drum for rainwater loaded on my bicycle. I tell them to clean the drum. They expect me to plan for tomorrow and the day after! (I4f2:410)

The development of a new water source happens rarely and is therefore difficult to observe. The author's general impression from discussions is that the ideal among the

[1] This has clear connexions to the digging of graves, which is strictly within the male sphere A women who had given birth to twins could, it was said, also be swallowed and disappear into the spring if they tried to dig! (L4f2a:320)

Wasukuma is when women fetch water without being told and husbands develop water sources without being told.

Transgressions of "What Should Apply"

The pressure or expectation felt by women and men to fulfil their obligations may be indicated by sanctions against wrong-doers and slackers. The Sukuma society treats husbands' negligence of duties very differently from that of their wives. The Sukuma law and custom reflects well the view of the informants that:

> .. the wife will be granted a divorce only if the husband is known to be a waster and provides neither clothing nor other necessities of life for his family. . Intentional gross neglect of the family, accompanied by general misbehaviour, is considered grounds for divorce. Lesser signs of neglect such as failure to provide clothing, female accessories, or relishes are not considered grounds for divorce. (Cory, 1953:72)

The wife is guided by her husband. He follows rules like:

> Continual neglect of domestic duties, such as cooking, carrying water and fuel, and field-work, or habitual drunkenness of the wife, are acknowledged grounds for divorce." (Cory, 1953.79)

On top of this, all women know that in case of divorce the husband can claim part of the dowry back from her father and that the husband has the custody of the children, if he wants it. This is a poor fall back position.

In the case of women who refuse to **fetch water** the result is simple; it is a ground for divorce and she has to leave the home and her children.[2] The norm that the men help to fetch water when water is far away tells little about what actually happens. One male informant, who expressed a willingness to assist his wife to fetch water, was asked when he helped her last. He answered it was during a drought some ten years back. Male informants' actual contributions ranged from the Sukuma norm that "husbands help in emergency" to "no way". It seems that men can completely refuse to fetch water without violating the norm.

Married men who transgress the norm by fetching water on a regular basis would face ridicule - as is indicated in the two examples above where the husbands fetched water before anybody was awake and able to see them - and without provoking other men by

[2] A negligent wife has even got a special name and is called *ng'wolo*. Cory pointed out (1953:18) that a woman's facial beauty is of slight significance and he quoted the Sukuma proverb: "the face does not bear a child and the neck does not handle a hoe."

meeting their wives at the well.[3] An old man said it would be difficult for him to walk with a bucket, so if there was a rule saying that men had to fetch water "he would send his sons to do it in order to avoid questions from his old friends." (I2f2a:450). Another practice to avoid ridicule was when the husband used his ox-cart to haul water from a spring to the homestead in order (publicly) to water the calves; at the same time he supplied the household. In this case the fetching of household water was done under the cover of the traditional male task of watering stock.

Transgression of gender boundaries for **developing water sources** was harder to assess because this is an infrequent activity and there are no definite limit beyond which men have to act. However, many female informants hinted that men were not interested in doing the work entailed in developing water sources.

> It is difficult because water problems become women problems. You may tell your husband about the problem, but he will not take action. He expects his wife to look for water everywhere, irrespective of distance. So long as he finds water at home the thought of digging for water is simply not there. (M4Ia195)

A few female informants blamed men in general, not their own husbands, for not developing water sources closer to the homesteads. Male informants did not raise this issue, except one elderly informant expressing surprise about women who were "demanding"; he wondered what their men thought when scolded. When asked, another male informant said that "women could claim changes like more wells, but I have never heard of someone who would ask for a well at their homestead." (M3f1c:410).

A female strategy to avoid confronting the husband in case he refuses to act might be to ameliorate the situation herself by digging in the river bed. But the author did not encounter any woman who had transgressed her duties by building a water tank or fixing gutters to collect rainwater There is no penalty for that, but it may be enough to know that if she did so her husband would feel publicly humiliated for his negligence.

Children and teenagers. Before proceding, the role of children should be mentioned.[4] Families have more children today than a generation ago, but many of them attend school and are not free all day to assist in the household. Our informants claimed that young

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[3] Varkevisser (1973 78) observed "To become suspicious a man needs no more than witness his wife coming back from the well with a pail of water but without the protective company of a neighbour or child A husband-to-be and his relatives' concept of a wife's duties is well-defined too. Every so often to emphasize his acquired rights over his wife's labour-input a husband may warn her not to be late going to the fields, may complain when his meal is not ready for him at an accustomed hour, and, if he continues to be kept waiting, may beat her To cook, to draw water, to sweep the house and to wash kitchen utensils are female activities which adult men only perform in cases of exceptional need Otherwise they expose themselves to ridicule."

[4] A Sukuma proverb says· "A small child will bring water if you ask for it " (Cory, 1953.87)

girls cannot refuse to fetch water, and boys may not refuse to take part in the development of a water supply should the father decide to do so. Young people know what would happen if they refused; they would, if the case is serious, be summoned to a meeting where many relatives are present.

> Our children cannot refuse to do what parents tell them to do. Should they persist in disobeying we can, as a last resort, call in relatives and have a serious discussion. The relatives would make it perfectly clear that unless the youngster abides (s)he will be 'frozen out' by the whole family and cannot count on any assistance in the future. (M2:B7)

The most severe punishment is to be ostracized or ignored which has a long tradition, for example in the *basumba* group as a means to ensure that everyone takes part in their activities.[5] There were still cases where discipline is low. One informant said that youngsters who do not assist their parents are exposed at a public meeting (sometimes the *sungusungu* will take action), and are liable to a whipping or to be given such tasks as cultivating a given area or herding cattle for three months without assistance.

Much has changed and the universal formal schooling has affected the lines of authority within the family. Nowadays young people are allowed to dispose of their own income, whereas in the past the income used to be given to the mother who probably invested the money in cows (K2:W);

> This practice was discontinued when the talk about self-reliance and exploitation started. Since then the young men may use their earnings to drink *pombe* (local beer) and smoke *bangi* (herbs) and they do not listen. Before, you could not work without telling your parents what you earned, and we could advise what to do.... (K2IIa:380)

This gloomy view of declining parental authority is an expected reaction amongst elders. It still seems reasonable to assume that if the head of household wishes to organise an improvement of the household water, he has the authority to do this and can count on the support of all members of the household. Likewise, mothers can still rely on their daughter(s) and other female members of the household to fetch water.

[5] Tanner (1955:162) wrote "No-one in the parish would talk to him, nor provide the normal communal duties to a neighbour such as grave-digging, harvesting and housebuilding, no-one would visit him in his house nor let him have water, fuel or food on loan. In a society where a tolerable existence is dependent on mutual service, it is impossible for anyone to live very long in such complete isolation and he must either capitulate, or beg for forgiveness from the community, or move to another locality "

Individual Values about Who Does What to Produce Household Water

Sukuma norms are fairly explicit about development of water sources and transport of water, although not specific about male tasks. Individual values may coincide with the norms or deviate from them. We have grouped our male and female informants according to their views about cooperation within the household aimed at producing water.

Three broad sets of individual male values were found. The first was a willingness to share tasks when the spouses cooperate both in fetching water and developing new wells. Next was a Sukuma norm prescribing that men must develop water sources but will not cooperate in fetching water except in emergencies. Finally there was the extreme position where men refuse to take any part at all in providing the household with water.

The broad outline of male values can be discerned in the words of a retired civil servant who himself attempted to dig a well next to his homestead.

> If we only had equipment we could do things and the women would rejoice. However, many of us do not understand how tiring it is to fetch water each day.
>
> We heads of household differ in our views; some give encouragement and others treat their women as slaves. They force a woman to work and sometimes forget that she has a body just like us and strength like ours and they are tired by hard work every day. Those who think like this say "You have failed to do your work and you have left us without water to drink."
>
> But those who are wise remember that the work is a heavy one; they do not reproach the wife in a bad manner. It is a must to give her a meaningful response like I did when I started to dig the well. (R5f2a:510)

Most male informants expressed views in line with the Sukuma norms. Only a few expressed willingness to share both male and female tasks. No-one took up the extreme position of total refusal to assist, although it was said that such men did exist. As long as husbands are not sanctioned by the society for evading the task of developing water sources, their actual practice may sometimes more closely resemble the extreme position than any other.

Individual values among female informants seemed to vary less; only two sets were identified and may be named in the same way as above. One group wish to cooperate both in fetching water and developing new sources. The other group consists of those who do not contribute to developing water sources but who fetch part or all of the household water in accordance with the Sukuma norm.

Female informants argued along cooperative lines more often than men, and women were more inclined to take action on their own:

> We cannot tell the men to dig when the *lambo* has dried up. Every woman has to find her own way to collect water. We have to look for all kinds of places and in the end we have to dig a pit in the *lambo* itself to extract seepage water. Usually this is the task of the man because it is hard work to remove big stones. But, alas,

> he does not do this Instead he only sits waiting for us to fetch water and we are forced to use our own efforts by hoe, shovel and crowbar. If the water is completely finished the men may start, but traditional cooperative efforts have been reduced. It is no longer certain that the men will be able to convene and agree on an action, and they do not want to be given orders by leaders. (B2Ia70)

In conclusion, individual male and female values represent a continuum as to how much each spouse should cooperate. A more elaborate account of individual values is given below in terms of strategies in household negotiations. Before entering a discussion on strategies it is proper to recall that about every third informant ranked household water as one of their major problems and men and women indicated a common pattern in assessing household water conditions.

Male Strategies in Negotiations

"Men sharing both tasks". Men who cherish "sharing tasks" must face or avoid the scorn of their fellow-men for **fetching water** to the home. Since they are a rare breed a man may feel embarrassed on entering the female scene if everyone knows that his wife is healthy at home. On top of that other husbands might object to their women meeting this man at the water source. Taking these and similar factors into account it is to be expected that men interested in sharing tasks would concentrate their efforts on developing new water sources closer to the home rather than fetching water themselves.

This strategy came out clearly when male informants were asked what would happen if they were given the task of fetching all water in addition to their present task of developing water sources.

> To help to fetch water is okay. But that men should perform this task regularly is impossible because we as well as our wives are used to the present situation. Since our forefathers it has been like this It would not be bad if men had had this responsibility from the very beginning, but now we are used to women fetching water....
>
> If a law was passed telling men to fetch water, well, then we would use wheelbarrows, ox-carts, etc. (L1f2a:380)

Some persuasion was needed for such a hypothetical scenario-question to be accepted. Eventually the men answered unanimously that in such a case they would use some kind of transport or develop a new water source closer to the homestead. The mental effort needed to even think about transgressing the norm by altering the division of tasks is a reflection of how deeply entrenched the present norm is.

The second scenario-question on sharing tasks was about what would happen if women were responsible for **developing and improving water sources**. One male informant who was knowledgeable in building and who had worked together with a group of female villagers to construct a rock-well expressed doubts about females taking upon themselves to develop water sources.

> Women cannot dig a well and they depend on us men. There is nothing that prevents them from doing things, except habit. The woman is not afraid to do it, only that it does not occur to her! (L5f2b:40)

Men could see little need of women taking part. It is interesting to find that male informants generally were reluctant to be relieved of the theoretical task of developing a new water source. One interpretation is that men were keen to emphasize the importance of a male input in order to boost their own self-esteem. Other male informants said that women could learn to do the construction work, but thought it would be better if the men did it. They argued in terms of habit and their strategy was to accept, at least in theory, that this was an all-male task.

"Sukuma norm". The discouragement faced by men who would like to share both tasks has the effect of promoting the Sukuma norms saying that men develop water sources on their own and fetch water only in emergencies. There is a wide range of opinions as to when the water conditions call for action. Some men did implement improvements at an early stage and others were "laggards". Although they spoke in favour of keeping their theoretical task of developing new sources, it is our impression that many husbands acted and reacted in specific ways in order to ease the pressure to implement any specific improvement. This becomes obvious in negotiations about solutions which could be implemented immediately, e.g. lending a bicycle to the wife or daughter; using the ox-cart to fetch water; buying a drum; making a simple gutter of locally available materials; or providing a stepping stone at the pond (some cases are presented in chapter 13). For instance, if an ox-cart were used to haul water the men would automatically become solely responsible for fetching water since women may not drive oxen. A male informant living about 500 metres away from a river discussed the possibility of transporting water to the homestead.

> The river is close and there is water all year round. Fetching water is no problem. You can ask my girls! (They nod approval). I can bring water using an ox pulling a sledge with a drum, but it is not necessary. (R1:G3)

He went on complaining that he had no resources and was not prepared to pay half the price of a calf to buy a drum (he had a herd of 30-40 cattle). He guessed that it would take his wife more than a year to save enough money to buy the drum herself. After further discussion he said he feared becoming responsible for all water fetching if he bought a drum, since only men could drive an ox.

A common and partially negotiable situation occurs when men express a genuine interest in improvement and, at the same time, point to one or two snags. It is easy to jump to a wrong conclusion by interpreting this as genuine resistance to development. A reason for delayed action can be that the man is so obtuse that he is simply unable to perceive obvious solutions to the obstacles facing his family. The status attached to certain solutions may be too low to even allow them to be perceived as alternatives, as in the case of gutters made of downmarket banana stalks; using clay urns instead of a drum; or lining a well with rocks instead of high status cement rings. If a husband agrees to a suggestion and, at the same time, claims that he does not possess the necessary tools to do the job, his wife can only force the issue by trespassing into male territory.

> He told me that he did not have tools, perhaps later.[6] Had I told him where to find the tools he would have snapped "I know what to do!" Therefore I have to remain silent. There are other tasks which are not difficult for men, and if it was my task I would do it right away. Take for example a leaking roof..... (A4f2b:150)

The male stance concerning simple or quick measures is one of understanding and willingness to listen to complaints and suggestions. He then has to come up with a solid argument for only a small effort on his part that cannot be implemented immediately. The women have to stick to the prevailing conditions for some time, probably until the rains have started and eased the problem once more. A paraphrase of the *Ndiyo, bwana* (Yes, Sir) attitude discussed in the previous chapter would be to talk about a *Ndiyo, mama* attitude here.

A similar impasse occurs, as indicated in the discussion about interventions in chapter 11, if the husband agrees and says that the matter is on the agenda of the village council, so he does not want to do the job twice.

> If you tell the husband he is very well aware what the water problems are. He also knows that if a project comes this way he will be forced to carry out a lot of tasks i.e. to bring stones from the hills and sand from the river bed, dig a pit, etc. He knows there is a lot of work. Therefore he let the situation remain as it is! (L4f2a:510)

"Conflict position". No male informant expressed the extreme position that he was against participating in making any improvements in the water situation. Most men were against specific solutions like lending the bicycle to the wife or tiring the oxen by hauling water. The extreme position exists, however, as is demonstrated by the following comment by a female informant: "Many women can ask their husbands for help (*sic*) to improve water conditions, but many men drink beer ... many wives are afraid, and some are battered." (I5f2a:500).

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[6] One way to enter a discussion about a claim to lack tools or otherwise refute development work is to pose a farcical hypo-thetical question about the outcome if, for instance, there were beer underground instead of groundwater. The reaction of all informants was that men would dig, even with their bare hands, to open up a well of beer. At least the oral reply reflects that the usual argument that tools are missing is a relative statement.

Men may also use a more subtle way to manifest a conflict position:

> My husband takes his bath in that shade over there. He tells me "You just fetch the water!" I have got used to him suddenly asking for water to bathe. I can tell him about my problem of finding water, but not in a way that forces him to do anything about it. He tells me I am late with the water and "You women try to fool us". We women are treated like slaves.
>
> My daughter is married and I have no one to help me at home. I will continue to fetch water till I grow old. (A2f2a:280)

Female Strategies in Negotiations

Female informants have seen and heard of most improvements in water conditions, and they have used most of these on travels and visits. Seasonal variations in distance to water sources increase their awareness of the benefit of having a nearby source the year round. Being the immediate beneficiaries of all improvements of water sources and water quality, females are expected to be alert to cooperate to get improvements carried out.

"Women sharing both tasks". Female informants who were in favour of sharing tasks thought in terms of sharing male and female tasks more equally, but no female informant expected men to fetch water regularly. The response to the hypothetical scenario of men being assigned the task of **fetching water** was similar for all female informants. Some laughingly said men would be able to carry half-empty buckets only, due to their weakness.

> Why should they agree to fetch water? No one can introduce a rule forcing men to fetch ... hihi ... Ours is ours and they will never agree at all. If he were to fetch water from far away he would look for another way to have it closer. But as long as he knows that they do not fetch water... If there was a divine law prescribing that they were the drawers? They usually get tired quickly. They think of us as donkeys. (L2f2a:50)

This could be interpreted as a way of defending the importance of the woman's task of bringing water to the home. Perhaps she did not want to be replaced by anyone else because the task of supplying water was an important one and carried with it certain rights and a certain status. However, most female informants underlined the drudgery:

> At first we will face difficulties. He will not bring enough water, because this task is unfamiliar to him. After years, if this division of tasks prevails, he would get used to it just like women have done.... But, maybe not, he would use a yoke. And later he might pay a vendor to get water if he can afford it...
>
> No, he will carry water for a short period only before he realizes that this is a heavy chore. The thought will crop up to dig for water. It will not take more than a week before he starts digging a well. (M4f2a:460)

This response shows that it took some consideration to envisage what would happen. The first thought of the woman was that things would not change, which may be interpreted as an indication that she had not thought that a well could be dug closer to her home; or we could interpret the initial lack of change as an indication of how unusual the combination is of one person in charge of both tasks. Either way, after a few minutes the female informants usually concluded that their husbands would soon start digging a well. The outcome is very similar to male informants' conclusions, and the difference was that women readily accepted the scenario while men needed to be persuaded.

From a woman's point of view it may be hard to **develop water sources**, not only because she would have to use unfamiliar objects like crowbars, but because of a strong feeling of what is and is not feasible. Despite this some women said they knew how to use a crowbar. These women had deepened ponds and wells themselves to extract water as the dry season progressed.

> If you call on the men in our village, what are they going to do? We women work until we have finished and the men cannot continue further unless there are stones which have impeded women's work. The men only use their hands and not the hoe. (R4Ia550)

They were asked the same scenario-questions as the men about what would happen if women were given the task of developing water sources in addition to their present task of fetching water.

> I cannot judge other people's views but my own opinion is that the women are ready to develop water sources, but the men are not prepared to pay for the materials. (B1:F13)

Several informants were partially in favour of developing new sources, but they added that they did not have the time, while others were less certain about their ability.

> If you tell your husband that there are possible sites for developing wells, he will get angry and tell you "You go there and dig yourself!" I can dig and throw the spoils away, it is not difficult. What is difficult is to get enough time to do it since you have so much to do. All tasks themselves are easy to do. (M4f2a:320)

> We women find it difficult to improve water conditions under present conditions.

> I believe it is only habit making fetching water our work. The assistance we would be given by the men if they understood would lessen the problem once they were ready to help. However, on our own we will continue like today! (R4f2b:140)

It is not possible, given the last statement only, to interpret whether this informant would have refrained from taking part in, for instance, deepening a well. In fact, she had taken part in the development of one new water source. The interpreted reason why she expressed the Sukuma norm rather than what had happened could be that she did not want to be considered as a transgressor of the norm. This was often the case and thus a legitimate female strategy.

"Sukuma norms". A few female informants showed an assertive attitude and said "Women can perform all tasks, even the heavy ones. We do not do it, however, because the men have agreed to do it." (L4f2b:150). The sentiment that men should fulfil their obligations was strong. Most female informants expected their husbands to act to **develop new sources**. Their weak fall-back position and the Sukuma norm that each spouse is expected to do his or her task without being told, combined to make it a delicate task to push the water issue. The frustration among women waiting endlessly for their husbands to take action was rarely voiced. A woman may tell her husband that it takes a long time to extract water at the source because the yield is low, but she should not hint that her husband could deepen the well or pond. One female informant described the negotiations over building a cement water tank as follows.

> He has bought me another drum and that is the first step. I talked to him last year about the cement tank. I have not reminded him this year. I may remind him since I can do nothing myself, like buying cement and all other items necessary for the tank. I cannot claim that I can do any of these things. I may perhaps say to him that he has forgotten and he may reply "Thanks for reminding me!" We agree and if he is not around nothing will be done. (E4f2a:350)

This reflects the general communication pattern between spouses, and the wife must apply alternative strategies.[7] Women who adhered to the norms may, however, find themselves being the ones who develop simple water sources.

> The men dig for water during difficult times especially for watering cattle in the dry rivers. They do not dig for household water supplies. Since I left ... to come here this has been the case. We women work until we have finished the pond. The conditions may differ from one village to another. Some villages may have promising sites for wells without stones and boulders while others have plenty of hard ground. (R4Ia550)

Women can escape from too much work, however, by letting the children **fetch water**. A number of studies from other parts of East Africa have shown that children fetch about

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[7] The comments give a picture that women have little say, but they too may use negative "threats" as Noble (1970:70-1) described " a wife in her dealing with her husband may use sulking, grumbling, gossiping, and running away Such words may destroy a man to a serious degree since they amount to an announcement to the community at large of his failure as a man."

half of the required water to the household (WMP, 1978; Republic of Kenya, 1980). This figure seems to be reasonable also for the villages in this study given the number of children encountered at the water source. This being the case, one can expect that a wife's strategy would be to ask her children to fetch water, rather than to argue about water with her husband.

Protection of water quality. The account of tasks has so far covered access to and transport of water. All practices to protect water quality are the business of the individual household and implementation is a matter solely for the women, who also command the few resources needed. A male informant said "I am not allowed to enter the kitchen." (K2f1:WI) and men are not supposed to tell their wives how to go about the kitchen work.[8] Thus, the Sukuma norms and individual values about water quality mainly affect the wife. There is little reason for a woman to negotiate with her husband or with village leaders about when and how to go about this task. This makes the analysis less cumbersome and gives an excellent opportunity to assess how a woman in a household acts when she is the sole decision-maker.

Most informants knew how to minimize water contamination. Women chose bacteriologically fairly safe water sources. There was virtually unanimity on handling of water in the home, adding up to a kind of Sukuma norm. The actual handling of water was described in chapter 7 and the conclusion was that, although few specific precautions were taken, the quality of drinking water was good in most households. The instances of contamination could possibly be avoided by stricter control of the way children draw water from the storage vessel, but the general impression is that most women are fairly successful in protecting water quality.

Negotiations

Household discussions on water-related issues may be visible to varying degrees. There may be open discussions about who should do what, or more hidden pressures, or the matter may sometimes be outside the realm of the spouses' active involvement.

Habit. Once an issue about water was formulated in terms of habit it seems as if it was pushed out of the arena for negotiations.

> I haven't talked with my wife about water and she has not said a word to me about it. She understands the importance of water but she is already used to the conditions. It has become a habit. She thinks it is the way it is. (L5f2a:570)

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[8] Cory (1953:118) noted that "A husband who interferes and criticizes his wife's method of housekeeping is called a *manji*, and such criticism, if not justified, is considered a grave insult."

The blinding effect of habit was stressed in chapter 3. It was suggested to assess informants' perception of drudgery of fetching water in the light of shopping in an urban setting.

> During the drought in 1984 we really did not think too much. Every morning when we woke up we started thinking about where to collect water that day. Should we walk to the borehole two kilometres away or try at another place? Even elders walked this distance. For me it was easier to fetch water with my bicycle. I did not really think of trying to dig a well here at my place. Instead all thoughts went into pondering on where to collect water for the day. (B4Ia220)

At this routinized end, individuals tended not to formulate the problem or its possible solutions explicitly. They did not perceive any reason to take action other than doing "more of the same". A male informant described his situation as follows:

> In the first place one has to be aware; where are we heading? Many villagers do not know and they fall back on tradition and argue: "Our parents did it in this way, so we should do the same." We have the knowledge and skills and understand the benefits but do not do it. It is like the carpenter who makes chairs and sells them, but let his family sit on stones! (I4IIa485)

Hidden negotiation. Communication patterns were discussed in chapter 8 and above. It was found that the ideal Sukuma norm is that men and women perform their duties without being told. About half our female informants said they had not discussed water problems with their husbands. While women had first-hand experience, some male informants said that because of the strict division of tasks they found out about the water problems by accident:

> My wife does not mention anything about fetching water, and I do not expect her to do so. I remember once when she was delayed at the well, it took her two hours instead of the expected one. I enquired why it took so long and was told that she had to dig deep into the river bed to get some water. In that way I was informed about the conditions at the water source. (R1f2b:150)

In such cases a kind of hidden negotiation is expected to take place in which the parties try to influence the outcome. A male informant pondered as follows over the urge to dig a well and the toil involved, while taking for granted the subordination of his wife.

> Women like to have more wells. If you go along nicely in your relationship you may try. At least we would dig a few feet, and get tired and tell her there is no water. Anyway, you have tried. If we had the strength, we would finalize the well.
>
> Perhaps I will encounter hard soil under the sandy layer, and I do not have a crowbar. It may take me two weeks to dig, or more. It would require an interest. It would be easy and not too tiring had it taken less than a week. Perhaps it is better

> anyhow to walk a long way to fetch water than to put in such an effort. (B4f2b:370+2a:440)

The male informants' course of reasoning often led to "doing more of the same" i.e. women fetching water in accordance with the Sukuma norms. A divorced woman spoke of her difficulties in discussing water issues with her former husband, a reputed drunkard.

> At other times, because he can, he beats you up. He has refused every word you have told him and he will get angry.... You cannot then simply repeat it for him. He tells you to leave! (A4f2b:150)

Even in such situations women must find a strategy to forward their interests in a hidden negotiation.

Open negotiation. An open negotiation requires that the water issue be discussed by members of the household. A husband can bring up any household water issue except to comment on how the wife treats water in the household Wives face more restrictions on bringing up issues, both imposed by themselves and of other kinds. If the woman places 'her' water problem in front of her husband, responses may range from an encouraging response to a total refusal. A female informant described the initial phase of the negotiation process in the following way.

> We assist one another in thinking about water issues and solutions. We sit down to discuss whether we (he) may succeed in implementing a specific idea or not. Then he will look for a way to get, for example, iron-sheet gutters cheaply. If he fails to get the required material he may decide to buy gutters. (M4f2a:250)

Another female informant expressed her perceptions of her family decision-making procedure as follows:

> One may claim that everything is the responsibility of the head of household but he is obliged to negotiate with the whole family. If the resources are there he cannot refuse to install a roof catchment, simply because he too wants to reduce women's toil. (I3IIb150)

The arena for negotiation. Household negotiations take place within a general framework of a hidden or open kind. The outcome will be discussed in terms of a simplified classification of strategies built on individual values. The arena for negotiations is illustrated by the matrix in Table 12.2.

Table 12.2. Major positions in a negotiation between spouses about sharing the tasks to develop a water source and to fetch water Male values:

		Male values		
		Sharing tasks	Sukuma norms	Conflict position
Female values	Sharing tasks	1 1	1 2	1 3
	Sukuma norms	2 1	Sukuma ideal	2 3

In case both spouses' individual values are of the cooperative kind, position (1:1) in the matrix above, the open negotiation concerns what kind of *own-key* activity should be implemented and when. If both spouses cherish the Sukuma norms, the position "Sukuma ideal" in the matrix, the same applies except that the husband may be a slacker.

Husband and wife may have differing individual values and there is a need for negotiation to reconcile them (the remaining positions in the matrix). A hidden or open negotiation has to take place as a preparation for decisions on whether to do more of the same or do new things. A general assumption is that the party who claims to adhere to the Sukuma norm has an upper hand, since the other person then has to argue against what is considered to be right and proper, and implicit in the conjugal contract. However, a number of factors are at play, strengthening or weakening the spouses' positions.

One example of investment Negotiations may involve matters like knowledge and skills, economic resources, equipment, etc In an attempt to picture household priorities the informants were asked to choose between buying a drum to collect rainwater or a khanga (a piece of coloured cotton cloth that women wear) if they had 2,000 shs only to spend. None of the male informants suggested buying the *khanga*, while some of the females did. Not that all female informants preferred the *khanga*.

> I would choose the drum because it lasts for many years if it is maintained properly. And then I will have much water without bothering about looking for water far away, I rely on rainwater during the wet season and during the dry season I store water in it, which is good. And I will be relieved It is hard for a woman not to get the *khanga* but I have to leave it until a later date (L4f2a 380)

A male informant saw himself as the one who planned for the best for his family.

> I would like to buy the drum because it can be used for a long period, while the *khanga* cloth is used only a short period. The drum can be used every day for two, three years or more and in the meantime I can save money to replace it when it starts to leak
>
> Because of the way women think it is important that I assess the needs of work She cannot refuse because the drum I install will be very helpful to her I will also

tell her that I will solve the *khanga* business later.
If she was to choose she might have chosen the *khanga* cloth and forgotten that she is tired of fetching water every day. For good reasons I think she should choose the drum because it will assist her (R5f2a:110)

His way of arguing shows that he preferred to invest in the kind of equipment that eases women's toil. Remarkably few villagers had drums for rainwater collection. When asked why there were so few drums, while there were plenty of *khangas*, they laughed and said that women preferred nice clothes.

Conclusions

Gendering of tasks. There are distinct Sukuma norms prescribing that men develop water sources, while women fetch household water unless they are sick or a serious drought has dried up all nearby water sources in the area. The actual fetching of water is generally in line with the norm and women cannot negotiate away any of this, except to their children. The development task, however, turns out to give room for many options since a husband more or less decides when the circumstances "require" his attention. The two activities are closely linked but kept separate by gender.

The position of head of household is always occupied by a man if there is one around, and he has a major influence on decisions concerning investments and labour inputs. The mere existence of a hierarchy in the household is expected to intensify production, according to Carlstein (1980:252). In the case of providing water we have shown that the work is rarely organised according to efficiency criteria either for the joint activity of developing water sources or in transporting water to the home. Most heads of household are blinded by upholding the gender of the two tasks. Each task was assessed separately as to its benefits and inputs, which in turn supported a decision to do as little work as possible of each kind. The consequence is that the total amount of labour involved in obtaining water is higher than it ought to be if the two tasks were viewed as a unit. The burden of "doing more of the same" is carried by the women and children exclusively. The few female-headed households in this study did not differ as to access to household water sources.

Male informants wanted to be seen as exclusively responsible for development work, but not necessarily to perform this task. The responsibility boosts male self-esteem since most men claimed that women could not perform development work.

Each party attached a lower value to the time spent by the spouse on his/her task. The routine nature of fetching water tend to make the effort invisible and about half of the male informants rated it as light work, while the others saw it as toil.[9] All men, however, described fetching water as toil once it was made visible by putting them in a situation where they themselves had to do the work Thus, male heads of households were able to make an objective or gender-free analysis of the household water situation only when they were compelled to perform both tasks.

The same applied to female informants, who were unwilling to take full responsibility for developing new water sources, although it would assist them, for as long as the present Sukuma norm remained in force. The value of daily socializing with other women at a distance from the homestead may also dampen their desire to improve the situation. Women also gain status by fetching water since it is of prime importance to the well-being of the household.

In most interviews the informants did not come back to the scenario-questions on changed gendering of tasks and they returned to the restrictions of their everyday reality.[10]

Negotiations. Women's bargaining power is different from that of men, and often weaker. One reason is that water must be carried every day, while improving access to water can wait. Another reason is that women are responsible for the well-being of the children and therefore must fetch water irrespective of the distance or time required. Thirdly, women may face a fallback position of divorce or being battered. The fact that household water sources are common-pool resources also weakens a woman's argument that her husband should develop one, since he can argue that it is a cooperative male responsibility

Most informants discussed water issues in terms of open or hidden negotiations. The spouses' individual values shaped their positions in the negotiations and affected the outcomes. The more outspoken female informants tended to follow a strategy of "sharing tasks" while most followed the "Sukuma norm". Few male informants were proponents of a strategy of "sharing tasks" while most of them said they stick to the "Sukuma norm". No one expressed an extremist position, but it was said to exist Table 12.3 below summarizes the result of the analysis.

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[9] Safilios-Rothschild reported (1990 ch 13.3) about a research finding from rural Kakamega in Kenya which showed that "women whose men worked in Nairobi, and only visited for about one month per year, had difficulty admitting that they made all the agricultural decisions by themselves Such an admission would indicate that husbands no longer played a dominant role in the family and would shake the established sex stratified order "

[10] Similar cases of rapid regression were actually experienced in Europe after the Second World War when women returned to household duties after a war period of working in factories and offices.

Table 12.3. Outcomes of negotiations in the household related to individual female and male values

		Male values		
		Sharing tasks	Sukuma norms	Conflict position
Female values	Sharing tasks	*change*	negotiation	*change*
	Sukuma norms	*change*	negotiation	*continuity*

If both spouses are in favour of sharing the two tasks the probability is high for a *change* in the form of development of a water source Husbands prefer that kind of effort, compared to taking part in fetching water. Even if the wife is unwilling to take part in development work a husband in favour of sharing tasks is expected to develop a source on his own.

If the husband cherishes the Sukuma norms, negotiations, if any, take place under the pretext that the wife is not supposed to tell her husband about the water situation. The examples given earlier show that women are careful not to give the impression of pushing their husbands. It is hard to imagine that negotiations or actions would take place as long as women do not even suggest to the husband or father that he should develop a new source. However, a lack of discussion in the family did not necessarily imply that the husband was inactive. On the contrary, some of the husbands who had solved the water problem by *own-key* improvements were the ones who said that their wives had not told them.

Men who favoured the Sukuma norms could act either way In general they tended to delay change by blocking immediate measures to facilitate water-transport like using bicycles, oxen or carts. Women often perceived solutions to water problems which their husbands may be reluctant to implement. If they favoured sharing tasks they usually claimed that they could develop water sources themselves and a few of them had done so. But there is a widespread tendency among women to say that they do not want to involve themselves, since it is the task of the men. She is expected to believe that he knows the problem and will act once the possibility is at hand. Some men evidently used this vagueness to dodge responsibility.

They may choose to remain ignorant and inactive by taking advantage of the Sukuma norm that "men take action when things are bad enough". He can exercise power to keep the water issue away from the household agenda, sometimes with the help of the ideal norm that the spouses should not be told what to do

A man favouring a conflict strategy may use force and rough language to tell his wife that he is not going to develop or improve any source. Such an attitude may well develop in a society where men are not breadwinners and may face a problem of becoming marginalized due to drunkenness. Husbands in that predicament are often meticulous about exerting their authority over their households. In case the husband is a drunkard, the wife's chance to negotiate successfully is slim. Wives of husbands who are reluctant to improve access to water may have the choice of confronting their husbands; transgressing Sukuma norms by taking their own measures, or carrying on as usual, or asking for help by their children if there are any. The outcome of the first alternative is not possible to foresee generally, the second alternative leads to *change*, and the third secures *continuity*.

Had no husbands taken action, more women might have grasped the nettle and responsibility for development work. But because they observe some men developing water sources and facilitate transport, they tend to go on waiting for their own husbands to act. By the same token, many men use the fact that most other men do little or nothing to alleviate water problems to justify their own continued inactivity.

Section D

Application of the Model
Summary of Findings

13

Improvement Desired by Informants; Four Cases

As mentioned in chapter 4, ten of our informants in 1989 asserted that they would implement a household water supply improvement of their own choice before the author's next visit in 1990 This gave an opportunity to discuss anticipated needs, incentives and constraints concerning the work and, later, to follow up what had actually taken place. This provided an important counterpoint to the analysis of past events and our informants' reminicences about these. The anticipated improvements included digging wells, buying drums, making a tank to catch rainwater, constructing a hand-trolley to haul water, lining a spring, attaching a fulcrum to lift the water, and making a water filter of clay.

Three of these improvements were more or less successfully implemented within a year, and two are described below. Seven improvements had not been tried out for a variety of reasons, and two of these are presented. Both the successes and the failures provide insight into the complex mechanisms which are at work in water-related activities

One of the two successful *own-key* arrangements is a cooperative effort to construct a rock-well (Case I). The second case is a household negotiation about using a bicycle to fetch water. Case III is another household negotiation, this time about various means of storing rainwater. The last case (Case IV) is a study of the outcome of an individual effort to construct a *lambo* built for watering cattle and providing household water. The information was provided by the informants who desired the improvements.

Case I Constructing a Communal Well

In 1988 a group of twelve villagers, both women and men, joined a study programme to raise their awareness about water and sanitation. The studies included practical work on how to construct a pit latrine and improve water sources. The participants had joined the study group voluntarily and presumably had an interest in improving water and hygienic conditions.

The group chose to construct a one and a half metre deep rock-well in a discharge area some 200 steps from their homes. They dug a round pit 1.5 metre in diameter by using *jembe* and shovel. A housebuilder in the neighbourhood assisted by installing the rock lining. The finished well is open and users bring their own bucket or scoop to draw water. The well yields water during the wet season - from end-October to beginning of June.

The idea of starting a study group in the sub-village was introduced at a village assembly meeting by the staff of the Hesawa programme. The package which was offered included a study guide and audiotaped information to introduce each of the ten sessions of the study programme. Two group leaders elected by the group would attend a five-day seminar. One staff member would be around to assist in selecting the site and to instruct the group about how to make the rock-well. The group would get a free bag of cement for the lining work.

The activities of the group were decided upon by the group in line with the framework laid down in a detailed schedule for each of the ten meetings. The village leadership convened the initial assembly meeting but had no influence over the ensuing events. No negotiation took place between the group and the village leaders, since the Hesawa programme took care of all modalities. The village leaders were not particularly supportive of the group's work and left it to attend to its own business.

The two group leaders did not have a formal position in the village. Some informants said the group faced problems of cooperation because only commoners were involved. The female participants did not want any of the more able women to lead the work and they also complained about their duties at home, saying they did not have the time to take part.

> Most participants were keen but some had different ideas and said that the group leaders pushed them to dig the well. "Why can't we just continue to use the spring water like we have always done?" Others were late for work and when you explained the importance of being present the answer was "Ah, I had to make tea for my man." It was hard work because of the rain and all were picking on the group leaders. Sometimes they were told that "Today you should cook food (*ugali*) and bring it here since we failed to go home and cook our own because of the well!"
>
> It is not the group leader's well, the well is for everybody. But that is not clear to all. Some people lack the ability to look ahead. There were lots of problems and the women said that this was the men's work; to dig, to crush stones and to fetch sand,

> etc. There are lots of problems before one can draw water from a well. (Bf1b100)

The participants' behaviour indicates that they had difficulties in accepting temporary leaders. In this case they could protest without fear of fines and they could accompany their protest by going slow. Also it seemed clear that there was no tradition among women of organising work in a hierarchical manner as men usually do. The group leaders became discouraged but the organisers of the study programme made them proceed and finish the task

The communication with programme staff concerned mostly provision of more material and benefits. Of course the vulnerable group leaders needed the authority accruing from a visible command of the resource flow. However, there were frequent delays in the provision of both teaching materials and building materials. The group had been promised cement to make a well-cover but it never turned up. Rumours said one of the staff had embezzled the cement. Villagers were afraid of their children falling into the pit and the lack of a cover was considered a serious problem.

The construction of rock-wells was done in the wet season. This fact indicates that the Hesawa programme was more concerned about the budget year than the consequences for villagers not being able to dig deep enough to secure water in dry spells. In addition, the study group was told that it would be enough to dig 1.5 metre to have water all year round. The rock-well subsequently dried up early in the dry season. Unprofessional recommendations were also given about the design: a clumsy lining left an open shaft, only 75 cm in diameter, too narrow to allow a person to enter to clean the well and to deepen it. This indicates that the programme staff did not have enough knowledge of such basic practicalities Some informants were openly critical of this lack of professionalism.

> The reason that the well dries up is that it was dug on the wrong side of a termite mound. We wanted to dig where there is a shallow pond which does not get dry. But the technician insisted on digging here and he also decided to stop digging too early at the depth of 1.5 m. (Af1a595)

The study programme was aimed at replication without further support from Hesawa. A couple of women in the group would like to dig another well that would give safe water all year round. "We cannot rely on Hesawa. Now we have been trained and the project moves to Kwimba where the water problem is bad." The women argued in terms of improving water quality and shortening the distance now that they were growing older and their children were getting married and moved out.

> We would like to improve our water supply further, but when we approach the men they are not interested in *maji salama* (safe water). I tell them to come and dig a well nearby but they see no reason for that because they are not fetching water. They think it is for women only. Women find little reason to quarrel with their men over this since they will soon be forced by a project to dig!

> To dig is to dig and we women can do that. We know how to erect the stone lining of a rock-well. We took part in the construction of one in 1988 and saw how it was done. We women would be prepared to try to construct another one! (Af2a:50,115)

The two women were confident that sufficient knowledge and skills were available in the village. The problem was one of leadership or management. Since the well is public the Sukuma norm suggests that it should be developed under the guidance of village leaders. Once the leading role of project personnel is withdrawn, the users are back to square one or worse, because the village leaders may feel that household water is not their responsibility. Given the difficulties created by reluctant female participants when constructing the first rock-well, there was little reason for a commoner to start a project without the support of staff or village leaders.

The idea of a second rock-well had reached the village council and a female informant recalled the following discussion.

> Yes, we have discussed the issue in the council, but they do not see the problem. When we say "We still face a water problem" they reply "Uh, isn't it you that built the well which dries up? You should know that there is no water up here, it is just dry!" (Af2a:200)

She was not discouraged by this reaction, since she knew that there is water deep down in the dry season (latrines overflow in the wet season) and also that there are favourable sites where underground "streams" from the hill are close to the surface. She also claimed that the study group was induced by the Hesawa technician to dig in the wrong place. The group had spotted a promising site next to the school but were not allowed to develop that one, since the teacher who cultivated the plot refused. Without the support of the village leadership the women could not get access to this site.

In this case the council, according to this informant, used low yield of the first rock-well as evidence to support their opinion that there is no shallow groundwater close to the dwellings. The negotiation between reluctant leaders and a few keen commoners gives only a poor chance of success.

> The council cannot deny our right to push the matter but if we do they will say that we want to reign (*tawala*). It becomes our responsibility. It is better, I think, to cooperate with one or two of the council members to implement the task. (Af2a:330)

The village chairman claimed that had the well been successful each *balozi* would have constructed one However, they are not prepared to dig deep without being certain to find water The chairman was somehow confident that things were under (his) control.

> Women can ask us to solve their problem of the water source being far away. I know that we could find water anywhere if we dug a very deep pit However, I

> would like the technician to find a site where the water is at a shallow depth i.e. in a moist area further away than the rock-well. Now, if she asks me again I will tell her that it is impossible to find a site closer because up here there is no water underground. So the only thing left for us (*sic*) is to get used to the present conditions. (Cf2b:300)

The chairman wanted to refer the matter to the Hesawa committee (part of the village organisation) since he thought (or so he claimed) that the responsibility for household water had been taken over by Hesawa. From the village leaders' point of view it would be highly desirable if the Hesawa programme came to the village and organised the construction of wells and brought hand-pumps at a cost of only 8,000 shs each! In fact, the Hesawa staff said that they would provide a shallow well with hand-pump as compensation for the poor rock-well.

The women who were keen to make a second rock-well thought that the village health worker would be the appropriate person to push the improvement of water sources. She had in fact brought the matter to the *balozi* and the matter was left in his hands.

> We have not talked to the *nsumba ntale* about it but told the *balozi* about the plan and he is in favour. He told us that he will bring it up at the next meeting and now we are just waiting... (Af1:510)

Conclusion. This case illustrates how a conflict of interests is made visible mainly because a woman demands that the council shall take action. The agenda for negotiation is set by men in the sense that they can opt out of any digging by claiming that there is no accessible groundwater. The result is that women must either drop the project or dig the well themselves and thus transgress their role. Most women would stay away from that option, if only because they are short of time. Men are also unlikely to take part in a project that has become a gender issue in the village council. A third possibility would be to find a cooperative *balozi* who could take on the role of organising the neighbours.

Case II A Bicycle to Fetch Water

Mrs. Safiri used a newly protected spring some 450 steps away for drinking water and a shallow well with hand-pump 300 steps away for water of lower quality. During the author's first field work she talked about building a rainwater tank. The house had a large iron roof which could provide much more rainwater than the single drum could hold. She was also keen on having a well developed at a potential site she knew of some 150 steps away. She did not expect it to be any problem to build a tank.

> My husband has talked about buying a tank for rainwater and he has had this interest for a long time. He is shorter of money now, but he still has the idea of a

> tank or several drums. A while ago we heard him saying that a long time had passed and he had found that the price of a tank had gone up dramatically. Because of all little problems he had to attend to he found fit to use the money that was left to buy a bicycle.
>
> He told us that he wanted a bicycle and we agreed because he argued so vigorously for it. Sometimes he coughs to the extent that he cannot even go to the health centre. Before he bought this bicycle we had to borrow one from neighbours and sometimes hire one to bring him to the hospital on the bicycle carrier. And we agreed since we understand what it is like to get old. (Af2a:50)

The shift of interest from a roof catchment to the purchase of a bicycle was swift. There is no mention about the roof catchment or the well in the yard this time. The lack of money is a non-negotiable fact in the short run, although one could buy more than ten drums for the price of one bicycle. Evidently the purchase of the bicycle was preceded by a negotiation among the adults and Mr. Safiri's cough was decisive in deciding in favour of the bicycle. It is possible, but not very likely, that the wife supported the purchase because she wanted to use the bicycle to fetch water.

Mrs. Safiri emphasized that her husband had to negotiate with the whole family before major decisions were taken. Her husband was an outspoken proponent of reducing female toil. However, the impression was that he generally insisted on a technical solution that was slightly beyond his present ability, like the desire to have corks on the drums, placing the drum inside the house and making a pipe to lead the water from the gutter into the drum, building a large underground tank right away, etc.

Various ways of transporting water had been discussed in our interview the previous year, as recalled by Mrs. Safiri:

> Last year I mentioned that I would use a bicycle to fetch water if I had one Now, I do not know if my husband will agree to lend it to me to fetch water, because he says that his bicycle will help him now that he is old. A long time ago I had my own bicycle. After some years it broke down and now only the frame remains. It is a long time ago, but it was really useful. (Af2:80)

Mrs. Safiri was slow to tell about the purchase of the bicycle. Once the ice was broken, however, she spoke freely about it. She gave only one reason why she did not expect to use the bicycle for the routine task of fetching water:

> He has not offered to lend me his new bicycle. In fact I do not expect to use it. The reason is that sometimes he is not around and I would interfere with his travels. Perhaps I could use it for an urgent matter if he is home, perhaps. (Af2a:120)

It is evident that the bicycle belonged to the husband. His illness had led to a hidden negotiation about how the bicycle was to be used. Mrs. Safiri was clearly in favour of using the bicycle to fetch water as expressed in the first interview. She had experienced its benefit in the past when she had her own bicycle. It turned out at an evening discussion that her husband had no idea that she had used a bicycle to transport water before marrying him. Mrs. Safiri had probably never asked her husband to allow her to use the bicycle for this purpose. There are two main sets of possible explanations; either he had indicated to his wife in one way or the other that it was out of the question to use the bicycle to fetch water or she had voluntarily "decided" to perceive it to be impossible to claim the bicycle. The latter interpretation makes sense in the light of the general practice in the village presented below.

The Sukuma norm about transporting household water on a bicycle is blurred. The twelve male informants with bicycles said that they themselves could use the bicycle if there was no other way to get water to the house. A summary of the informants' (28 answers) attitudes toward women using a bicycle to fetch water is as follows (in parenthesis are the number of answers by households with no bicycle):

Table 13.1 Number of informants in favour of women using a bicycle to fetch water. Reasons for being reluctant to use it

Arguments Comments by	Uses now or before	Source close by	Expen-sive	Cannot ride	Bad path	General reluctance
Female informants	4	2	-	-	1	2(3)
Male about his wife	3(1)	1	1	2(1)	1	4(2)
Total	7(1)	3	1	2(1)	2	6(5)

Only eight (7+1) informants were in favour of women using bicycles to fetch water: four women had used a bicycle in the past; three male bicycle owners and one without. Twenty informants put forward varying arguments against the use of bicycles. The arguments presented showed no marked gender difference. Given the long distance to the water sources in the dry season it is no surprise that only three informants claimed that the water source was too close for using a bicycle. The three had 20, 300 and 500 metres to the dry season source.

Among the nine female informants living in households with a bicycle, four had used it to fetch water while five had not. Two of the latter gave these reasons:

> I always carry the water on my head. The water source is so close, only 300 metres away, so there is no need to use the bicycle. Not even during very dry years when we have to walk to the dam one kilometre away do we use the bicycle. (B1f1E1)

> I have never used the bicycle to fetch water at the river a kilometre away. It would soon break down. I only use the bicycle for other purposes like going to the miller some ten kilometres away from here. (R4f1B8)

An elderly male informant who had his bicycle used for transporting water in the past said:

> In 1985 we had a serious drought and we fetched our water in the river bed. The women did this until they were exhausted. I had a bicycle and I said "The children are hurt (by carrying water) so I will leave the bicycle with you and do my own business by foot". In this way we men help in fetching water these days. And also every household with an ox-cart helped the women to fetch water in drums. (R5f2a:480)

The nine husbands with bicycles whose wives had not used bicycles claimed that their wives had not asked for it. They provided various arguments why their wives could not use it:

> If I am alone in the house for a few days I usually use my bicycle to fetch water at the well 300 metres away I cannot carry water on my head and it is much quicker on the bicycle My wife has never asked for the bicycle. She does not know how to ride but she would like to learn. She does not have the time to learn because after working in the fields she has duties at home and on Sundays she rests. I will teach her as soon as she is prepared. It would be easy for a person to push the bicycle loaded with water in tins but someone who does not know how to ride it can easily fall as she cannot control the bicycle (L3Ia240)

One informant summarized the present Sukuma norms very neatly when she said:

> Nowadays we carry water on the head. When I was young I used to carry four tins on a special carrier on the bicycle. But in the 1970s bicycles disappeared and today only men use bicycles. (M4)

Coming back to Mrs. Safiri a bicycle would facilitate the transport of water instead of walking 300 or 450 steps to the water source. Furthermore the paths to the two sources were even and level enough to allow for an easy ride. She knew how to ride and had done so more than a decade earlier when she had a bicycle of her own.

When her husband bought a bicycle it seemed as if everything was set to use it to transport water, but he was reluctant, or she felt it might be inappropriate, so she was not prepared to claim the bicycle. She probably made some hard decisions about the pros and cons of breaking the norms involved, for example by comparing the distance, drudgery and time-saving as well as the option of letting the young girls in the house fetch all the water, or hope that the boys would borrow the bicycle to fetch water in the dry season, etc. The whole idea was buried. The alternatives of digging a well nearby and building a water storage tank were also postponed due to lack of cash.

Conclusion. The case of fetching water by bicycle shows an interesting pattern of changes in norms. First a few words about the availability of bicycles. They became a status symbol amongst chiefs in the 1930s (Musoma District Book). Along with the expansion of cotton production in the 1950s bicycles became popular also among commoners. Evidence of this is that six of our 13 female informants said they had used bicycles to fetch water when they were young. The economic recession during the 1970s and 1980s saw a rapid decline in the number of bicycles and spare parts were not available. The IMF-loans of 1986 improved access to spare parts and new bicycles, and by 1990 there were local mechanics doing repair work again in every village. Today the use of bicycles is still limited to men; for instance, many young men bring milk-jars and huge Nile-Perch fish on bicycles to Mwanza and the district towns. However, their number is increasing rapidly and it is reasonable to expect women to use bicycles once more.

This case study provides a clear case of how Sukuma norms may be altered due to changing economic circumstances. When access to bicycles is very limited, the ones available seem to be reserved for men. If there are lots of bicycles, women are also allowed to use them for household chores. Older male informants might suggest that their daughters could use a bicycle, probably because they had seen women doing so in the past, while younger male informants and teachers did not readily accept the thought of their wives using a bicycle. Instead they put forward such "waterproof" explanations as their spouse could not ride a bicycle or the water source was too close for it to be necessary. Female informants, on the other hand, often provided explanations that fitted into the present norms and circumstances, whether there was a bicycle in the house or not.

Case III Collecting Rainwater

Mr. Uhaba ranked water as the number one problem mainly because it was far away but also because one had to queue in the dry season. The distance to these (said) water sources was 1,100 m in the dry and 650 m in the wet season. The wife carried the bucket of water on her head and she complained about headache and pain in the neck. The young son helped to fetch water on the father's bicycle; the wife "cannot bike and the path to the water source is too rough for her anyway." On rainy days water is collected from the iron roof into a drum.

Mr. Uhaba spoke strongly in favour of building a cement tank to collect rainwater in order to end his wife's drudgery.

> A roof catchment gives lots of water and it is good water. If my economy allowed it, I would build a water tank, one sunk into the ground or above ground. I would need some ten bags of cement, sand, small stones, and the assistance of a local builder. I could also think of a steel tank, although it will rust. I assess the cost to be about equal to that of a new bicycle and it is not exorbitant. That money could be earned by the sales of cotton from one acre of land. Water is very important and

my wife would certainly agree (Hf1c:200)

The main obstacle was the worry that he might move away from the house which they rented and thus lose the investment. One way of avoiding this risk would be to invest in a large water tank of steel or aluminium which could be moved to the new place. Such tanks used to be common at public buildings like teachers' quarters, dispensaries, CCM-offices, stores, etc., but today they are seldom in working condition.

Mr. Uhaba talked about hiring a local craftsman to do the work; he did not expect any problem like lack of skills or organisation. The responsibility was considered to be solely that of the household itself. He noted the need for maintenance of a rainwater tank, but "just as people in due time grow old and die, things grow old and die." (Hf1c:530).

The discussions about water issues which took place in the household were described by Mrs. Uhaba:

> We assist one another in thinking about water issues and solutions. We sit down to discuss whether we (he) may be able to implement an idea or not. Then he will look for a way to get, for example, sheet-iron gutters for free. If he fails to get the required material he may decide to buy gutters. (Sf2a:250)

The spouses sat down to negotiate and it seemed clear that the husband felt responsible for development work, although he also favoured improving the communal well through a women's group. The wife felt solely responsible for fetching water (which includes sending her children to the well) and not at all involved in the development of a roof catchment. However, she was keen to improve a communal spring. The spouses' individual values may be traced from their responses to the scenario in which men were responsible for fetching water. Mr. Uhaba foresaw that a lot of work would cease:

> All official work would stop since most office-bearers are men. Even the farmer with a plough would not be able to harness his oxen in the early morning (women do not know this task), and the hoeing would stop because the heavy work is done by men. (HI5)

It is interesting that the idea of developing a source closer did not occur to him. Likewise, Mrs. Uhaba needed time to ponder about the outcome:

> Initially we will face difficulties because fetching water is an alien chore to him. After some years he will get used to it, just like we did, but I do not believe this will happen. He will use a yoke. Or he may pay a water-vendor... He will fetch water for a short period, and then the thought to dig a well will crop up. (Sf2:460)

The two statements show that the division of chores was clear-cut and in line with the Sukuma norms. The responsibility of implementing the "rainwater project" was firmly laid in the hands of the husband The wife's role was to support his work and she may occasionally feel obliged to give a gentle push.

A year later Mr. Uhaba had made no progress with the installation of a water tank. The reason given was that they would not be able to bring the tank along if they moved. He did not mention the problem that neighbours could claim water from the tank. His wife said they could refuse to let people draw water from a drum but not necessarily from a tank. She was very upset when that happened at a private well in the village. Mr. Uhaba claimed that he had bought a second drum instead, and he said:

> I had a drum but it had a little hole so I fixed another one. Also this one started to leak this year, unfortunately. I plan to have it fixed before the rains. (Hf2a:20)

He mentioned that he would go to a welder in the district town by bus. He rated it too far to go by bicycle, although that happened for other duties. He gave the impression that there were two drums and, had that been the case, a rain shower of 10 mm would fill both drums. Four hundred litres would last about a week, if each household member used ten litres a day. The two drums would provide enough water from the end of October up to May, if bathing and washing of clothes was done at the source.

Mrs. Uhaba told a slightly different story saying that they sold the old drum. A craftsman in town had converted it into cooking stoves. It had been of higher quality than the "new" one which was made of thin plate. She had mended the old drum with tar but after some time it started to leak again. The new drum was harder to mend because of its thin plate. She was bothered by the leaking drum. However, she did not make this public and did not discuss it with her husband.

> My husband is aware of the water problem and will act as he can. But he cannot go to town 30 km away to have the leaking drum repaired because the bus fare is too high. And the drum is too heavy to carry on his bicycle. (Sf2a:270)

She appeared to making excuses for her husband on all permanent solutions to the problem of the leaking drum. Despite Mr. Uhaba's expressed intention to have it mended, she would probably go on mending it herself with tar She was not aware of her husband's plan to invest in a large rainwater tank.

Given the initial worries about moving it appears rational to buy drums which are easy to transport to a new place together with the furniture However, the initial willingness to invest ten times as much in a cement tank was not translated into a willingness to invest in a durable drum or two.

Mrs. Uhaba said that she had the right to buy a drum from her own money but she had never thought about doing so. The husband is expected to pay for such items. She said she spent her money on food and clothes for the children; buying something to alleviate her work burden seemed to be outside her frame of reference. A year later, however, when still nothing had been done she mentioned somewhat casually that she "would purchase a drum since she was the one who suffered." (Sf2:80).

Simple roof catchments have been used at least since iron roofs were introduced and are, together with bicycles, one of the most popular household investments. Iron roofs relieve men of thatching the roofs every third or fourth year. Today perhaps every sixth house in the six villages has an iron roof Most of these are old since iron sheets have not been available for many years. Only recently have they become available in the shops again.

Homesteads have simple installations which may provide water for a day or so during rainy days. Because the storage capacity is limited, there is little reason to extend or improve the gutters. A small rainfall of say 10 mm will bring two buckets full of water using a one metre long gutter. Gutters are always made of iron sheet and wooden gutters are unknown.

Conclusion. Villagers with iron-roof houses could obtain most of the household water from a simple roof catchment half the year. There are larger water tanks of iron-sheet or cement at many dispensaries and teachers' quarters, while ordinary households have, at most, a drum to collect rainwater. The unclear rule about whether neighbours can claim water from a tank i.e. to what extent a tank is a common-pool resource discourages villagers from installing expensive tanks.

Mr. Uhaba did not rate the benefit of having a few drums to be worth the investment cost. Drums are not as fragile but more expensive than larger clay pots. Presumably he did not ponder too much about the drudgery of water collection, since he did not mend the leaking drum. Both spouses appeared to expect the other to cater for improvements of water collection.

Case IV The Pond Became a *Lambo*

The last two cases dealt with negotiations in households. The present case is about a household effort where the head of household is in favour of fetching water as well as the Sukuma ideal that each spouse does what he and she is expected to do, without being told. Bwana Mfugaji rated the household water conditions as follows:

> The water conditions have always been problematic in this area. The construction of shallow wells with hand-pumps a decade ago and, later, the installation of a windmill to provide the hospital with water from a drilled well improved the situation. The time prior to that was one characterized by "waiting for the water".
>
> Soon the hand-pumps broke and we did not know who was responsible. You asked whether the village council has discussed this matter. I don't know, you better ask the chairman. I suppose some people have complained. We expect the leaders to deal with the problem and they can mobilize the villagers to do what is necessary. We are not a "true" village, however, in the sense that it is inhabited by a mixture of people from all over Sukumaland. (Df1a230+370)

Bwana Mfugaji had experimented on his own to improve access to water. He had dug a small pond for fish breeding and a shallow well for gardening. These water sources, which were far away from his homestead, became common-pool resourses in line with the Sukuma norms despite the fact that he and his sons received no assistance from any neighbours. He was reluctant to develop another water source due to free-riding neighbours but, at the same time, felt the need for a water source closer to the homestead. The wet season source was 400 feet away and the dry season source was more than a kilometre away. Most water was hauled with an ox-cart or by his sons using a bicycle.

> I do not face any problem and my wife does not fetch water. That is not to say that we have solved all problems, oh no! What helps me are my cattle. I have always been interested in cattle and my desire has been to stay on the farm. (f1a110)
>
> My family is large and water consumption is high. Not all cattle are out on the grazing area. The sick ones stay here and all the calves are kept in the kraal in the yard.
>
> I need a well here at home. There is water in the sandy slope over there. I have wished for a well or *lambo* for years. It will not be long before I have one of those....
>
> Another idea is to build a rainwater tank. (Df1b225)

The discussion on what was needed to implement the above ideas provided no serious obstacle. Bwana Mfugaji said he had the necessary knowledge from earlier work and it only took to use the brain (*akili*). Only few tools were required like a *jembe*, shovel, crowbar and buckets. He also needed a cover to prevent children and cattle from falling into the well. He intended to use the ox-cart to fetch stones for lining.

> We have the ability if we get some assistance and after this inventory it is clear that we can manage. In fact all of us are concerned about water but implementation is poor. I can perhaps do something and become a good example for my neighbours. Next time you come here you will find an excellent water source! We shall expend all our efforts to produce a good example. (f1b440)

On visiting Bwana Mfugaji a year and a half later he had a medium-scale *lambo* some fifty metres from the house. He told the author that he happened to know a person who was working with road maintenance. He hired him with a grader, a kind of bulldozer, over a week-end to excavate the *lambo* (Plate 8 and 9). The *lambo* was some twenty by fifteen metres and more than three metres at the deepest point. It was dug in an almost level section of the village and its catchment area is several thousand square metres. The *lambo* would fill to the brim early in the rainy season, and a ditch had been dug to divert excess water from entering.

In a letter of March, 1993 Bwana Mfugaji wrote:

> When the rains are good, the *lambo* will be dry for only some days or a month. In 1991 there was water up to September 19, and the new rains commenced on October

> 13 and refilled the *lambo* These rains ended early, April 12, 1992, and because of extensive water use the *lambo* was empty by August! The next rainy season started in November and this year we have had plenty of it. I hope that the *lambo* will not dry up at all this year.
>
> Furthermore, I hired some people to dig a second, adjacent *lambo* last year. They dug a 17 by 6 metres and 1.5 metre deep excavation by hand using *jembes*, crowbar, shovels, buckets and a wheelbarrow. So far the expenses have reached the value of one bull, and the work will continue next dry season.

The first *lambo* could provide neighbours with water during the rainy season without causing depletion. A dry season of some four months is different. We may assume a loss due to evaporation and seepage of about one metre during these four months. The total volume available is 20 by 15 by 2 metres, that is 600 m^3 or 5 m^3 per day in the dry season. Bwana Mfugaji's big household may use 200 litres daily and 10-15 calves consume about the same amount. Some 4 m^3 would be then available to the neighbours. This theoretical estimate proved to be too optimistic for the first two seasons, since the water was depleted. Possibly the seepage into the ground is greater.

This shortage of water led Bwana Mfugaji to allow only a few neighbours to draw water. This is in line with the Sukuma norms, since the *lambo* is used as a water source for cattle. According to the letter:

> . . there are many who steal water in the afternoon and in the dark hours. Even some livestock are watered there illegally. I would like to put up a fence of barbed wire to fence off thieves.

The water quality is not good enough for drinking since overland flow washes down pollution from the catchment area where animals graze. Therefore the drinking water is still fetched from the distant source with safe water. One obvious cost of having a *lambo* nearby is the increase in malaria mosquitos breeding in the open water. Another cost is the possibility of schistosomiasis if the surrounding area is not clean.

Bwana Mfugaji has observed no increase in the incidence of malaria and the mosquitos do not seem to breed in the *lambo,* only in small puddles. Nor were there any signs of snails housing schistosomiasis. The grass along the *lambo* is removed regularly. He has also constructed a bund to prevent overland flow from the cattle kraal to enter the *lambo.*

The benefit of having water close by for household purposes is stressed by Bwana Mfugaji. In the letter he also mentioned that the survival rate of his calves has increased markedly; he sold some of them to get money during the drought year 1992. The benefits of more calves soon repaid the outlay of three bulls for the grader. This supports Donald Malcolm's statement that cattle-keeping is very profitable.

> It is not luck. Since childhood I have been interested in cattle and farming. First and foremost it takes a keen interest and enthusiasm and, secondly, patience. A friend

of mine hired the grader to excavate an impoundment in the seasonal stream down in the valley. Unfortunately the soil was not stable enough and it collapsed when the rains began. (f2b310)

Conclusion. In chapter 3 it was mentioned that only smaller changes would arise out of need or desire. Major innovations would be carried out if a favourable opportunity appeared. The event of a grader in the vicinity made it possible for Mr. Mfugaji to excavate a *lambo* instead of only digging a small well. The second *lambo* was built with manual labour after having been assured that it would work. The case also shows how important it is to take into account the need of water for cattle.

14

Water Sources and Population Increase

Introduction

Some areas are endowed with visible natural water sources like springs, streams, and lakes while other areas have groundwater near to the surface. People in areas without such water sources may resort to harvesting rainwater and runoff in one way or the other. Different technologies are appropriate for different kinds of physical conditions. Variations in human resources and values will also determine how sophisticated the selected solutions are. Areas where no affordable solutions exist will be the last to be inhabited. The population pressure in Sukumaland has not reached that level yet, although it is the most densely populated region in Tanzania.

There are two important factors which will contribute to shaping water conditions in the near future; the hydrological potential and the increase in the number of inhabitants. Data on the population increase in Tanzania and the six villages in the period 1931 to 1988 were presented in chapter 5. Future increases and the ensuing pressure on water sources are discussed below.

Some data on the national situation. The amount of water needed for households, cattle, and irrigation to secure food crops in drought years differ between 100 litres per person per day in dryland farming countries to 200 times as much in irrigated semi-arid industrialized countries (Falkenmark et al., 1989:260). Falkenmark distinguishes between irrigation to produce cash crops for an external market and necessary irrigation to secure good harvest of food crops to sustain life in drought years. Tanzanians withdraw some 100 litres per day comprising 21 per cent for household uses, 5 per cent for industry, and 74 per cent for agriculture (World Resources Institute, 1991:Table 22.1). This withdrawal is only 1 per cent of the annual renewable freshwater in the country (about the same as in Canada).

One way to present the pressure on freshwater, similar to geographers' index of the number of persons per square kilometre of land, is an index of the number of persons sharing a flow unit of renewable freshwater per year. Falkenmark introduced the flow unit of one million cubic metres and she characterized areas with more than 2,000 persons per flow unit as having "extreme water scarcity". Areas with 1,000 to 2,000 persons per flow unit were considered as having "chronic water stress", while those with 600 to 1,000 people experienced "water stress" (Falkenmark, 1988). Because of Tanzania's rapidly expanding population, its index for population per flow unit grew from 160 in 1967 to 320 in 1990. The index will reach some 800 by the year 2025 and hence Tanzania will face "water stress".

Hydrological conditions vary immensely over Tanzania: from frequent flooding in the southeast to drought and water scarcity in the central region. The distribution of the increased population is very uneven, as shown on Gillman's Map 5.2 and from the six villages in this study (Table 5.2). A forecast of a macro-scale index for a nation should therefore be accompanied by some local studies. A scaling down to the village level is done below (all the problems of scaling down are left unresolved) in an attempt to provide perspectives on the degree of water scarcity locally.

Prospects of future water supplies. The WMP-team presented data on water in the dry season showing fair amounts of accessible water in 1976 in Igogwe and Kongolo, while the other four villages were said to have zero litres per person. The crucial question is whether there is enough in the area for future needs. Data on potentially accessible groundwater in shallow and deep aquifers were estimated and related to demands of people and cattle in 1976:

Table 14.1. Accessible water in dry season 1976 and potentially accessible groundwater. Demand of water for people and cattle.

Village	Population 1975	Potenially accessible in m^3 per day W80% + BHQ1	Demand in 1975 in m^3 per day Human + Livestock
Bupamwa	1,850	40 + 1,105	46 + 53
Igogwe	2,000	62 + 4,733	59 + 59
Kongolo	1,700	18 + 652	37 + 39
Lwanhima	500	142 + 2,950	18 + 17
Mkula	3,100	475 + 4,143	77 + 89
Runere	1,800	760 + 474	45 + 66

Note: SW 80% = shallow wells with 80% reliability in the dry season. BH Q1 = boreholes.
Source: WMP, 1978:v6:84-155

Lwanhima, Mkula and Runere have ample shallow resources of water while Bupamwa, Igogwe and Kongolo are short of shallow groundwater already but have plenty of deeper groundwater. The estimates above on groundwater are presumably more accurate than the 1976 figures on accessible water per person in the dry season, since they are based on drilling results. Some simple calculations are carried out below in order to conjecture future water conditions. Igogwe is chosen to provide an example, since its boundaries have remained the same since 1975.

Household water available in Igogwe. Some 3,700 people live (1988) on the gently sloping hardpan pediments and *mbugas* in the valleys which cover the village area of 25 km^2. Available data allow us to assess the amount of *potentially* accessible water in two ways. One way is to assess potential groundwater recharge. The model used by the WMP-team[2] predicts an annual recharge of some 30 mm. Another way is to use information on river discharge. Fairly reliable data reported from discharge stations in neighbouring areas point at an annual runoff of about one million cubic metres of water which equals a layer of water of 37 mm covering the entire village area.

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[1] The population figures differ from those in Table 5.2 for 1967 and 1978 due to uncertainties during the villagization period.

[2] The following soil distribution and land uses are inserted into the model developed by the WMP-team (WMP, 1978:v 10):

5% of low granite outcrops - bare soil
20% of upper pediment slopes with hillsand soils - cotton, maize
60% of lower pediment slopes with *itogoro* soils - maize, cassava
15% of flat floodplains with dark clayey *mbuga* soils -grass

Actual river discharge and recharge of groundwater provide about the same amount of water, each being equal to about 270 m^3 per person per year or some 750 litres daily for the present number of inhabitants of Igogwe. A daily household water consumption of, say, 25 litres per capita would make a demand of only a few per cent of the potentially accessible water

The data show that substantial amounts may be withdrawn without mining, i.e. lowering the groundwater table permanently. It is of course technically impossible to extract all the recharge of groundwater. Nor can the runoff water be utilized to one hundred per cent. Huge networks of dams and other water impoundments would be required and these are all vulnerable to evaporation and seepage

Water scarcity. The data above indicate that some 2,000 persons in Igogwe share one million cubic metres per year of renewable water that is not returned to the atmosphere but feeding the local aquifers and rivers. Igogwe is up against what Falkenmark calls the "water barrier" for obtaining enough household water and food. The villagers rely to some extent on irrigation of the food crop rice and they are fortunate in that there is a water flow from other areas with low population pressure. Had the demand for household water been 100 litres per person and day, the water scarcity would require high technology and advanced management of water sources. With a per capita consumption of some 400 litres per day as in Sweden, about half of the potentially accessible renewable groundwater would be required. If, furthermore, the population is doubled all that water would be required - and this could only be possible if substantial investments were made to dig and drill for groundwater.

Since the recharge of groundwater is small and exceedingly difficult and expensive to access, it appears rational to focus on collecting rainwater in the first place. Storage of rainwater in the dry months causes problems of evaporation and seepage. Little experience is available on storing water in the ground, except for river-beds.[3] Storing water for long periods in the house may not be feasible because water is a fresh commodity that can go bad if the facility is not well kept.

The example of Igogwe indicates that the problem is not one of absolute shortage of water for human or livestock consumption but one of securing food production. As for household water it is a problem of accessibility; closeness, dependability and quality.

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[3] In South Asia many tanks are built partly to improve infiltration of rainwater into the groundwater

Rapid Population Growth: A Structural Explanation of Poor Sustainability

Rapid population growth pushes many countries toward the "water barrier" since freshwater sources are finite It also pushes societies toward another kind of barrier, one of organisation.

The problem of poor operation and maintenance of water schemes can hardly be understood by looking at staff competence and funds only. The rapid increase in population poses unprecedented structural limitations to the implementation of national policies like "safe water for all by the year 1991".

The structural trap relates to the proportion of economically active inhabitants. At present more than half of the Tanzanians are under the age of 15 years (who can fetch water but not develop improved sources) and slightly less than 10 per cent are above the age of 60 Hence, slightly more than a third of the population is counted as economically active, albeit a somewhat higher figure, 10 5 millions out of 23.5 millions, is found in Table 2 1 Each economically active Tanzanian has to produce enough for him- or herself and another 1-2 persons on average. Whether this task is small or huge depends on what comparison one does. In Sweden, for example, more than 50 per cent of the population is counted as economically active and subsequently each one has to cater for herself and slightly less than one more person. *Ceteris paribus* the Tanzanian has to work 20-30 per cent longer hours each day just to avoid a widening of the economic gap with the Swede.

The case of primary schooling. The consequence of this difference in age structure is elaborated further in this example which illustrates what is at stake. A family pondering on having more children take many aspects into account, one of which is the household's ability to provide food and shelter. In a rural homestead there is no need to extend the house in order to accommodate one or two more children, since they stay outdoors most of the time and are squeezed together when sleeping. Land is still available in Sukumaland and agricultural output can also be increased by a shift from present extensive to more intensive farming methods as long as the rains are sufficient. Therefore, the feeding of more family members requires more agricultural work, say, one week extra for each extra person but no cost is incurred to acquire more land. The couple can limit the comparison to the incentives to have more children, whichever these are, and a slightly increased workload

The real problem caused by a decision to have more children shows up in the service sector, long before it shows up as scarcity of land. If families send four kids instead of two to school, there must be twice as many teachers and classrooms available In a national perspective the number of teachers and classrooms are as follows, assuming that the growth rate is three per cent and the fertility rate is five per cent and that a class has 35 pupils and one teacher.

Table 14.2. Number of teachers and classrooms required in order to provide compulsory primary education to all new-born Tanzanians.

Year	Popu-lation	Increase in total	newborn	Number of classes (000') in standard I	II	III	IV	V	VI	VII	New class-rooms and teachers
0	23 0	690'	1,150'	-	-	-	-	-	-	-	-
1	23 7	710'	1,185'	1	-	-	-	-	-	-	1,000
2	24 4	732'	1,220'	2	1	-	-	-	-	-	3,000
3	25.1	754'	1,257'	3 1	2	1	-	-	-	-	6,100
4	25.8	774'	1,290'	4 1	3.1	2	1	-	-	-	10,200
5	26 6	797'	1,330'	5.2	4 1	3 1	2	1	-	-	15,400
6	27 4	821'	1,369'	6.3	5 2	4 1	3.1	2	1	-	21,700
7	28 2	846'	1,410'	7 3	6 3	5.2	4.1	3.1	2	1	29,000

We may assume, for simplicity, that in year 0 (1989) there are sufficient facilities for all pupils and also a capacity to train new teachers to replace retired staff. The number of new-born **increases** by 35,000 already year 1 and one thousand teachers and classrooms are needed in standard I. These pupils will enter standard II the following year (together with the teachers) while the intake to standard I in year 2 is 70,000 more than year 0. Another 2,000 new teachers and classrooms are required for those joining standard I. The cumulative increase for seven years of compulsory schooling will be about 28,900 teachers and classrooms. At least four new teacher training colleges are needed *per year* on average, each with a capacity to train 1,000 teachers annually. Additional institutions to train trainers of teachers will also be needed. The government has failed this huge task and teachers are rarely adequately trained and the classrooms lack desks, chairs, etc.

Responsibility at the lowest appropriate level. Villagers' deliberations about having more children should include the cost of schooling and other services in addition to the small cost of another week's work on the farm to produce food for the new family member. Their assessment might then come closer to that underlying the town-dwellers' decision to reduce the number of children.

The government's scarce financial and physical resources are not enough to cater for all needs The political will to extract the necessary taxes from the villagers is weak. At present the government competes with villagers in the field of water source improvement while primary education is rapidly deteriorating. It appears to be more rational from a policy point of view to let villagers do what they can manage and reserve government staff for tasks which villagers cannot manage, like teacher and medical training, electrification, highways and harbours, etc One important water-related activity for the government is to work out scenarios of future water stress, especially about food security.

15

Summary and Discussion: Who Cares About Water

This is a study of factors which bear upon people's ability to improve access to and quality of household water through community and household efforts Equal emphasis is given to understanding how far this means *continuity* (doing more of the same) and how far it means *change* (doing new things). We introduce the term "*own-key*" to indicate activities that are managed and controlled in the communities, by using locally available knowledge, skills and materials. The study has been conducted in six rural villages in Sukumaland, south of Lake Victoria in Tanzania.

Experience of Interventions to Supply Household Water in Rural Areas

Over the years several strategies of government intervention have been tried to supply water. For instance, in the 1970s many piped water schemes were constructed in rural areas. These once-and-for-all solutions using turn-key approaches were mostly failures as shown by a World Bank team that found that about 85 per cent of 183 donor-supported schemes around the world did not function after ten years (IBRD, 1988)

In Tanzania, the last few decades have witnessed a heavy reliance on government interventions to provide rural populations with clean water nearby Institutions with professional staff trained in water development are found in many places as a result of government and donor efforts Despite these efforts and less sophisticated technical solutions, only a quarter of the rural population is today served by water from standpipes and hand-pumps within easy reach (Mujawahuzi, 1991). Some 30 per cent of the wells with hand-pumps in the Mwanza region in Sukumaland were out of order after just a few years (IRC, 1992:26), despite the fact that a donor was actively supporting the region. Thus, villagers are pushed back to relying on *own-key* arrangements.

The investment and costs for operation and maintenance of modern installations are prohibitive for most economies and aggravated by poor (if any) all-weather roads and weak administrations. In search of a remedy to the operation and maintenance problems donors and governments are reviewing the policy of free or heavily subsidized household water installations. There is also a growing realization that the free service in itself may have contributed to the poor functional status of water installations. Under present circumstances there is no reason to believe that the authorities can improve existing modern water supplies or provide the rapidly expanding population with adequate water supplies (ch. 14).

The experience of interventions points to the relevance of increasing the knowledge about what takes place in the *own-key* sector, especially since very few such studies are available and since most people in rural areas of the world will continue to rely on *own-key* arrangements.

Villagers' Assessment of Their Water Situation

Thirty specially selected and knowledgeable informants in six villages provided the bulk of the information about how villagers perceive and assess their household water conditions. Twelve of the 30 informants rated water as a major household problem, 18 said it was a second-order problem. Few were dissatisfied with the quality of water, so improved quality is a weak incentive for *change* Long distance to a water source was said to be more of a problem than an inadequate supply, indicating that the informants gave low priority to increasing the quantity of water. No-one of those who had major complaints about long distance were less than 600 steps away from their drinking water source in the dry season

Most potential sites for new wells were just as far away as the existing sources, indicating that villagers had already developed the known nearby sites. Those informants who could spot potential sites much closer than the existing household water sources did not, however, claim water to be a major problem. Informants who faced great seasonal variations in distance to water sources were more dissatisfied than those with an unchanged distance throughout the year, even when the latter group had further to walk. In this sense long distance and seasonal variations provide incentives for *change.*

However, several informants expressed their concern about the kinds of social changes that might take place as a consequence of specific improvements, an indication of *continuity*. For instance, women, who are the beneficiaries, would usually gain time, perhaps half an hour a day in the dry season. They may be worried that this half hour will be saved at the expense of their chats with friends at the water source and on the way there and back. The social contacts of fetching water may be replaced by solitary kinds of household chores. Women gaining spare time may also worry husbands because it may give wives contact with new groups and they may sense a loss of control. They might, for instance, be concerned that their wives will start taking an interest in politics as they have seen other women do (Andersson, 1992).

Owners of cattle could acquire resources to develop water sources by selling some, but they are reluctant to do that today. Cattle represent a solid security for the members of the kin group since they can be traded for food and medical treatment if disaster occurs (drought, illness, etc.) apart from playing a part in dowry negotiations. An improved house or water source, however, could not be traded or transferred in the same way. Any major improvement, be it in the house or of a water source, probably requires a shift in ways to amass wealth in cattle. One way is to develop a source closer for watering cattle, which in turn will increase the survival rate for calves and soon repay the investment. In doing so, the men's interest in cattle would help to supply household water of at least lower quality nearby.

Before basic security has been achieved, it is difficult to perceive major costly improvements in the house or of water sources. The local *ifogong'ho* fund becomes important in this respect since it constitutes an insurance against disaster caused by serious illness. In this basic sense the *ifogong'ho* fund may serve as a lever also to homestead improvements by providing a safety net.

An agent of *change* is the central government: it adopts policies like villagization moving rural people into villages Moving to a new place voluntarily or under governmental compulsion, provides an incentive to improve access to and quality of water, at least in the initial short period before the situation becomes habitual. Many water sources have been developed by informants soon after moving into a new homestead. Another agent of change is the rapid population increase which has forced people to crowd round existing water sources, or construct new ones, or move to less well-watered areas. Since the Wasukuma stay on in their villages to a large extent, the population increase provides an incentive to add water sources.

Why should a villager want water conditions to be better if everyone else in the village uses the same water sources and faces similar conditions? Apart from long distance and seasonal variations in distance, raised awareness is one common reason for *change*; fear of hardship in old age is another; and a third is that the children of today will not put up with the general drudgery in the rural areas (Table 5.7).

Human and Material Resources in the Villages

In order to assess what could be achieved, an inventory of local human and physical resources was conducted through interviews, observation and report-reading. Physical conditions, organisations and leadership practices were traced over time in order to create a comprehensive understanding of today's activities.

The endowment of water is adequate in normal wet seasons and household water can usually be obtained also in the dry season by using affordable techniques The water conditions for cattle and agriculture are, however, inadequate in drought years.

Sukuma knowledge about rainfall patterns, groundwater movements, and soil properties is good and enough to implement local solutions. Practical experience of digging graves and pit latrines have provided good knowledge about local conditions, and trial and error make up for the inability to quantify and calculate available amounts and demands of water. Health awareness is widespread although it plays a marginal role in the decision-making about water development. The informants know quite well, however, from which water sources they can obtain good quality water, good also from a bacteriological point of view. Counts of faecal coliforms, an indicator of bacteriological contamination, at the water source and in storage vessels in the household showed that drinking water quality was good in two out of three households. Sukuma knowledge is often site-specific but it rarely contradicts professional and scientific knowledge.

Villagers practice various ways of harnessing surface and rain water and they locate promising spots to find groundwater. There are no professional dowsers among the Wasukuma. Our informants have the necessary skills to improve access to and quality of water and can obtain assistance through their local networks for more sophisticated jobs like welding a broken wheelbarrow. Most material needed for improvements is available in the village, while some villagers can afford to purchase what is needed for more sophisticated arrangements. The cost in cash, labour-time, etc. is affordable for all simple technical solutions like roof catchments, ponds, wells, *lambos*, different transports, and protective measures.

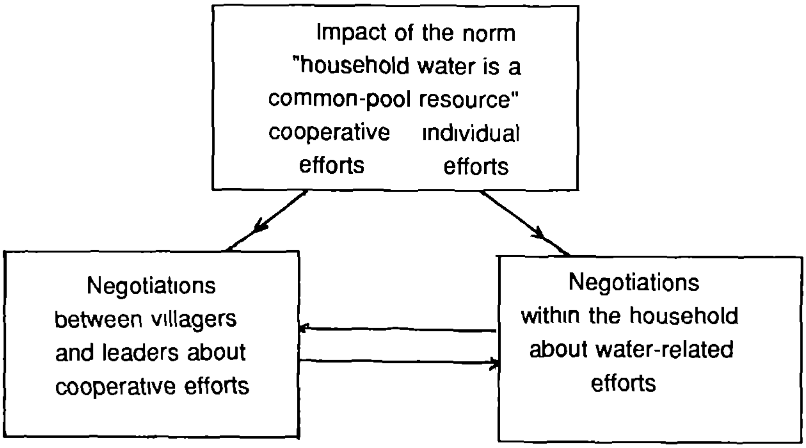
Villagers believe there are affordable solutions to their household water problems that they can implement themselves. The author finds that Sukuma knowledge and skills are adequate and make change possible.

Norms and Individual Values

Decisive elements in a study of *continuity* and *change* concern Sukuma norms and individual values. These are mainly extracted from interviews and written material.

Water rights. Household water remains a common-pool resource which means that everyone is entitled to draw household water from any water source and that it is monitored by all residents in the area This norm appears to be supported by almost all informants and is considered an incentive to cooperative efforts. More surprisingly, the norm was not considered to be a constraint to individual efforts to develop (communal) water sources because such efforts render status and a good name. Free-riding appeared as a constraint only in discussions about building large cement tanks to collect rainwater, an endeavour which called for both cash and labour. The informants told us of no problems to develop water sources caused by regulations or individual land rights except when the site of a water source was on a neighbour's holding close to his house.

The analysis of Sukuma norms and individual values has been conducted in the following way:



Some more specific results of community and household negotiations have been found in the study. These are presented below.

Cooperative efforts. Already in the early colonial era central government was involved in supplying water to cattle and human beings by opening up virgin land mostly to reduce soil erosion caused by large numbers of cattle. Water supplies were at that time paid for by the local communities. A major leap forward in government involvement was taken by the *ujamaa* and villagization programmes in the 1970s when villagers were promised free safe water within a short distance, paid for by the government and donors Because of the low sustainability of these costly water installations the central government soon found itself financially incapable of providing water to most villages and of sustaining the installed capacity.

Village councils, which the central government instituted to replace the chieftainship, became the bodies through which development ideas and support were channelled. The new village leaders obtained their authority from above rather than from below, and they tended to be claimers of support rather than managers of local development efforts As a comparison, about one-third of the chiefdoms in Sukumaland had fewer subjects in 1934 than the number of people in a village of today, and headmen were in charge of a few hundred villagers.

The expressed Sukuma norms advocate cooperation under the guidance of leaders and commoners are not supposed to take a high profile. Men are accustomed to hierarchical organisation of cooperative efforts. Women are not expected to involve themselves in water source development. They organise themselves in a less hierarchical fashion than men when cleaning wells and ponds. Negotiations between formal leaders and villagers involve many complicating factors. Leaders are often weak and modern leaders rarely lead voluntary water-related works. The combination of a norm of cooperation, an attachment to hierarchy, and weak leadership adds up to a situation where very little gets done and therefore the norms are eroding. The norms are occasionally referred to in negotiations but they are poor indicators of what will take place.

Cooperative efforts to improve household water conditions have been analysed in terms of the leaders' as well as the villagers' interests. When both parties are in favour of acting the outcome of the negotiation is likely to be some kind of *change*. If either party is reluctant, however, the negotiation can go either way; either *change* or *continuity* of current practices. If both parties are hostile to cooperative efforts, household efforts are still possible.

Few *major* cooperative efforts were pursued unless they were managed by the MAJI department. The most visible installations were those made by donor-supported programmes. Under present circumstances those responsible for an intervention can count on local leaders to organise the villagers for the work. An obvious conclusion would be that such interventions are necessary to get improvements off the ground, but our informants have pointed to *an alternative way of understanding* the causal relationship: as long as the chance of outside support is present, local initiatives are hardly taken, not at village level and only rarely by individuals. They will not act because they think it is the duty of the government to fulfil its promises. Moreover, local leaders are said to have collected so much money that it should be enough to develop water sources.

Another effect of external interventions is that the required level of technical sophistication surpasses local resources. The inaffordability becomes another reason not to start village-based projects. While waiting for the promised piped water or shallow wells individuals (or small groups since informants favour cooperative efforts) sometimes get on with neighbourhood schemes like digging ponds and wells - mostly for economic purposes like watering cattle and horticulture, which are also used for household purposes. Such solutions sufficed in ordinary dry seasons and only rarely was there a serious drought causing serious scarcity of household water

Government and donor involvement in the household water sector tends to inhibit more advanced local initiatives and activities. Interventions also tend to support men who are chronically reluctant to improve water supplies The end result is to slow down the improvement of women's conditions.

Household efforts. The norm and practice is that women draw water each day and they are solely responsible for preserving water quality, while men are expected to perform infrequent water development work. Negotiations in the household about water-related efforts take place in a framework of these gendered tasks The spouses' individual values play an essential part in what will come out of their negotiation. Three categories of men were found: men interested in sharing all task; men favouring the Sukuma norm, and men who refused to do any water-related task. Women were either favouring Sukuma norms or interested in sharing all tasks The extent to which the spouses can forward their positions in negotiations depends on the spouse's individual values as well as their power.

Household decisions are not made on the basis of minimizing total time or energy spent on supplying the household with water, as would be expected of an economic entity. On the contrary, the household is like two separate companies which do not fancy merging vertically. The spouses' tasks are completely separated and it seems more important to uphold this division than to facilitate women's work. This has often led to an impasse, and thus to *continuity*. For instance, men are worried that using means of transport for water like an ox-cart, mule, bicycle, etc. will threaten to alter the gender-base of the task of fetching water.

The "should" aspect that men are to do development work is clear-cut. Elderly men may give the task of developing new sources to young men. In historical times, however, they have mainly practised this norm when providing water supplies for cattle since people lived close to stream-beds, springs or swamps. The prevailing household conditions can be summarized as follows. Those informants who thought it their responsibility to improve water conditions had done so. Those informants who expected others to be responsible for improvements found "water scarcity for part of the year" which should be remedied. The chance of this to happening was slim, however, if an intervention was expected.

A wife may be reluctant to approach her husband to discuss household water issues. If she did and he did not respond favourably she might in theory put across suggestions about water improvements to the formal village organisation or try to push the leaders to take action and to organise cooperative work as in the past. The general impression from the interviews, however, is that women did not foresee the male-dominated village council to taking any action. At the same time they refrained from engaging themselves in *major* undertakings because they viewed this to be the responsibility of their husbands.

The present gender-based division of tasks interferes negatively with improvements. If no new water sources or means of transport are developed women have to walk farther and they will be exhausted rather than the water sources

Water Scarcity or Enough Water?

The Water Master Plan survey of water sources in 1976 found a serious shortage of water in many villages, especially in those which had experienced a redistribution of people during the villagization. The surveyors coming from town showed a tendency to discard a number of water sources which looked unhygienic or prone to siltation. The conclusions drawn by the WMP can be summarized as "*water scarcity for part of the year*" and their proposed solution was to launch a massive water development intervention.

River/stream-beds, *lambos* and springs were adequate up to the time of villagization in most villages, but recently the population increase has put pressure on each natural water source. A number of new water sources have been developed after villagization, and most informants gave descriptions of the conditions which could be summarized in terms of having "*enough water for most of the year*" The need for improvements was not immediate and falls away each rainy season.

Assessments of hydrological conditions and water endowments are not exempted from value judgements and self-interest. Male and female perceptions have been identified and related to informants' individual values. The discrepancy between WMP data and data provided by informants cannot be explained entirely by differences in the perception of what constitutes a water source. The possibility that the WMP consultants, consciously or not, paved the way for the large water interventions they were trained to deliver cannot be ruled out.

The attitude among professionals in favour of large-scale solutions is well documented (Vaa, 1992). Furthermore, it is easier for authorities to allocate resources and devise an implementation strategy if they assume that there was nothing there prior to the project. Such an illusion can give the implementor a feeling of "doing good". It is understandable that surveyors sometimes underestimate the extent and value of existing water sources, or fail to consider the uses of local knowledge and of dormant resources like male villagers' labour time in the dry season.

There are considerable differences in valuation of accessible water sources by outside observers and villagers. Villagers usually appreciate different sources for differing uses, while outsiders tend to discard sources with dirty water.

Own-key Approach to Water Improvement

Many project reports claim that modern water installations do not survive in villages because knowledge and skills are insufficient or that attitudes are not conducive to maintaining water supplies. Others see the organisational set-up in the villages as a main obstacle to improving water supply. The common denominator of such assessments is a bias toward innovations and they miss out an end-user analysis, i.e. what use can be made of the community's competence.

The present study has tried to bridge the knowledge gap about locally managed activities, i.e. what villagers do and control on their own and using available local resources.

The potential capabilities of the Wasukuma are evident to those flying over Sukumaland: thousands of square kilometres of arable land have been prepared by hand-hoeing. If a small share of that energy was expended on digging wells and surface water catchments in the dry season the Wasukuma could easily keep abreast of the population increase for another generation, at least for household water.

> In my opinion people have been trained enough to cater for their household water needs. I think we will not face the kind of problem you see today in twenty years time. We have the ability so why wait longer? It is a question of planning. I believe that everyone will put in efforts and almost all will have a well by that time. The wells will spread and we may experience progress. (M1f2b370)

The informants expressed a willingness to improve water sources and they discussed the past in terms of having been foolish to wait for others to do the job. A relevant analogy can be made with the latrine problem. Since the first cholera outbreaks in the 1970s most villages have laid down by-laws stipulating that each household must have a dug latrine. Failure is punished by a fine and therefore most households do have a dug latrine, albeit of varying quality. The effectiveness of the "project" is high since villagers do not want to pay a fine which may be embezzled and the leaders who monitor the enforcement are eager to collect fines. Our informants were asked what would happen if a similar by-law was effective for water sources.

> It would be a good idea to make each *balozi*, or two in cooperation, responsible for their own water sources and their development. If they failed to get water due to laziness it would not be a question of fetching water in another neighbourhood. And if someone does not bother to join in digging wells he would not be allowed to draw water. In this way everyone will have an incentive to take part in water development or else be left to their own devices. If such a rule was in force we might succeed. (M4f2:440)

More than half of the informants answered that they anticipated that villagers would take their own initiatives to improve water access and quality One informant argued that there is "No reason to ask for assistance, we have been blind." (M1:F9). Others followed the same line of reasoning:

> We are fond of being helped and dragged along since Independence. Before that we were forced. Never are we expected to rely on our own capabilities. If the village council decides that it is our responsibility to arrange for household water, the council members must try hard to explain the need for improvements to their fellow villagers. (B1:F13)

Especially after several rounds of discussions, informants said that the responsibility was in fact with the villagers themselves. This way of reasoning accords with the fact that a majority of the informants expected to arrange their own water supply in the future.

> Our perspective is that all work should be done by the government and their equipment will do the work while we are spectators. Hesawa promised water and entered with drilling equipment, but the outcome was poor. I think that it would be better to do it ourselves instead. We are indoctrinated to think that we cannot do it on our own. It would be better to indoctrinate us to help our women. (I1IIb400)

Those Who Care About Water

The analysis of informants' information shows that villagers differ as to how much they care about household water. Most women care about water quality as evidenced by their selection of drinking water sources and the low levels of faecal contamination in storage vessels. The conditions could, however, be improved further by protective measures at the water source as well as in the household. Men have no role to play in such matters. Some husbands, however, are keen on sharing water-related tasks and they have developed water sources on their own or have arranged for some kind of transport. Most husbands seem to find excuses for not carrying out such household efforts, while they still favour the Sukuma norms. Women are not expected to develop water sources, apart from digging pits in river-beds. They claimed that it is men's task, and a few had transgressed this norm and dug wells and ponds.

In neighbourhoods some activities are customary, like cleaning *lambos* and constructing surface water catchments for watering cattle. It was found that few leaders had organised cooperative *own-key* efforts to solve household water problems.

The village-level is hardly feasible for implementing *own-key* arrangements. The reason is that villages have several thousand residents split on four to six distinct subvillages. Village leaders (only the *katibu* is full-time) can do little more than mobilizing or encourage small groups in the subvillages to take action on their own.

Remarks on the Generality of Findings

An important aspect is to what extent the above results are general to other areas and societies. The author's view is that each area and society should be studied from its own premises. The existence of shallow groundwater in most of Sukumaland is a decisive factor which makes it easy for the Wasukuma to develop local water sources. Furthermore, the thirst of the atmosphere is high and causes high evaporation from surface water and top soil. Only a small part of the rainfall (5-10%) recharges the groundwater. The above predicaments are similar for farming societies in large, rather densely populated areas in Africa south of the Sahara. The very rapid increase of population is another important factor that is general for African countries, as distinct from other continents.

Villagers' ways and means of obtaining water may differ due to norms and individual values. The pronounced Sukuma norm that water is a common-pool resource from which to draw household water is believed to be the general pattern in rural areas in most of Africa. As seen in a cross-cultural survey (Table 12.1) women fetch water all over the African continent. There is little reason to assume that household negotiations will differ greatly between many of these societies, given the range of difference among the Sukuma households. When it comes to generalizing about cooperative efforts and negotiations between leaders and commoners greater differences could be expected between different societies.

In conclusion, the author believes that some of the decisive factors influencing the Sukuma way of improving access to and quality of household water exist in other societies in Africa south of the Sahara.

Appendix A

The History of Water Conservation and Development in the Mwamashimba Area in Buhungukira Chiefdom and in Runere Village

Some Historical Notes

Buhungukira is situated in Kwimba district east of the Moame river about 80 km SSE of Mwanza town (see Map A). It became an independent chiefdom in the 17th century when it was separated from the old Nera chiefdom (Mange, 1931:4). The trade route from Lake Victoria to Tabora and the coast passed through Buhungukira and Nera and we therefore have some early written impressions of the area. Stanley wrote in 1889:

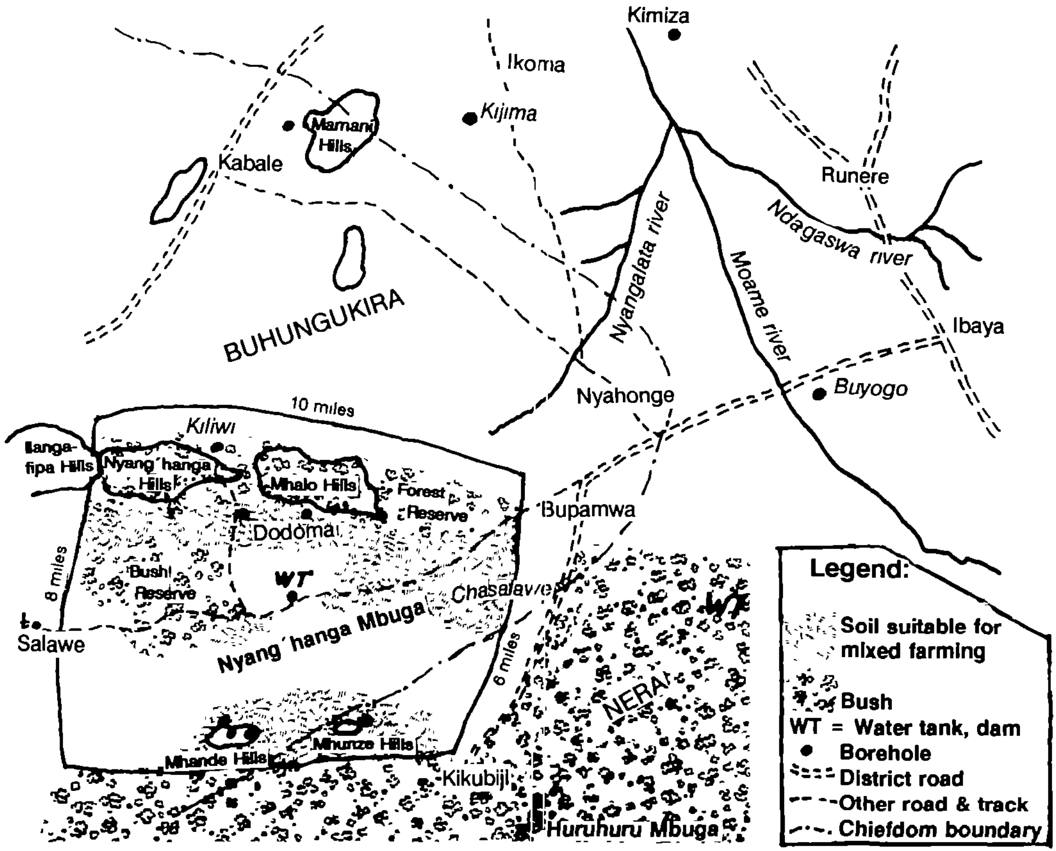
> Before us, in the centre of a plain which three or four centuries ago, perhaps, was covered with the waters of Lake Victoria, there rose what must have been once a hilly island, but now the soil had been thoroughly scoured away.... (Here) were grouped a population of about 5,000 people; and within sound of a musket-shot, or blare of horn, or ringing cries, were congeries of hamlets out on the plain round about this natural fortress, and each hamlet surrounded by its milk-weed hedge. In the plain west of the isleted rock-heaps, I counted twenty-three separate herds of cattle, besides flocks of sheep and goats, and we concluded that Ikoma (see map on next page) was prosperous, and secure in its vast population and its impregnable rock-piles. (Stanley, 1890:435)

The Rinderpest epidemic took a heavy toll on cattle in 1890-91 and the area returned to bush before the cattle numbers were restored. Brandström (1990:3:9) found that "By the 1920s the whole area (between Tabora and Msalala) had become tsetse-infested *miombo*, except for the immediate vicinities of denser settlements." Marius Fortie (1938:31) supports this when writing that he travelled along the old Kahama trail from Tabora to Lake Victoria in 1901, since abandoned to the tsetse flies. Fortie described the plains of Sukumaland as follows.

> This was the peaceful and fertile Usukuma so praised by Omar Sayid, a level country of sandy loam, well settled and so intensively cultivated that firewood must be fetched long distances. We marched for miles along millet fields dotted with square and round huts. (Fortie, 1938:35)

Water Availability Above Ground

Today the area is a typical flatland with wide mostly cultivated *mbuga* plains surrounded by scattered hills or ridges of granitic bedrock forming *inselberg*. The plains are intersected by shallow river valleys with usually meandering seasonal river courses. The main river is the Moame river which rises in the hills at Malampaka. It passes north of Ilula ... and debouches in the Stuhlmann Bay in Lake Victoria.[1]



Map A. Buhungukira clearing and tributaries to the Moame river. (Based on Location map of Kabale, Nyahonge and Mwamashimba, 1948 and a sketch map of the clearing by D.O Mr. Thornton, 1936.)

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[1] Within the Runere area Moame catches two important tributaries, one of which is the Ndagaswa river which passes south of Runere coming from the hilly area west of Malampaka. The other tributary, the Nyangalata river comes from the south-west of Nyahonge, the oldest settlement established by Arabs and Indians The confluence of all three rivers is situated east of the village Kijima The drainage area of this river system is about 1,600 km^2 (WMP, 1978 v6.41)

The climate in the area is semi-arid and the precipitation of some 800 mm per year falls during October-May. The distribution of the annual rainfall is irregular with the extreme values ranging between 400 and 1,450 mm per year. More than 90% of the precipitation is estimated to be lost by evapotranspiration and 5% is discharged as runoff in the rivers. The remaining 5% recharges the groundwater in two ways: by infiltration in areas with favourable conditions, i.e. the sandy areas (*luseni*) around the granite outcrops and by leakage from the rivers which, during the rainy season, act as influent streams (Husberg & Nilsson, 1978:1-2).

Access to Water

Early explorers made sparse comments on water accessibility, like Kollmann (1899:138) who wrote that "the country /Sukumaland/ abounds in pools and ponds..." and Stanley who wrote "it must be prosperous." The water consultant Clement Gillman compiled information about the population distribution and accessibility of water in mainland Tanzania. He found that two-thirds of the population lived in well watered areas covering a tenth of the country, a sixth lived in fairly watered areas making up a twelfth of the total area; the remaining sixth lived in poorly watered areas making up a fifth of the country. Two-thirds of the country was poorly watered and uninhabited (Gillman, 1936:16).

Gillman compiled comprehensive maps of the population distribution (Map 5.1) and types of land occupation in Tanganyika 1934 and concluded:

> It seems impossible to hold tsetse responsible for the distribution of population, a very marked dependency on the availability of a domestic water source can be readily established. In fact, if one arranges the types of land occupation in their order of relative density, one can immediately parallel that order by one of decreasing reliability of water sources, when it will be seen that the 2/3 of the population concentrated to a mean density of 35 per km^2 on one tenth of the land which enjoy the benefit of permanent streams and springs or of easily accessible shallow ground water; that those living more scattered (mean density less than 10) depend on more sporadic and usually less voluminous supplies; and that in the uninhabited regions domestic water, through the accidents of geology, soil or topography, is not available throughout the year. (Gillman, 1936:16)

Gillman claimed that a change in land use may change groundwater levels whereby water may become easy to extract:

> Not only are the residents of the peneplain *miombo* convinced that "water follows man" but they have for time immemorial acted on this conviction not only when choosing sites for small *miombo* settlements but also when pushing cultivation steppes further and further into the woodlands.... As a typical example I can quote my own investigations at the concentration of Nyonga in south-western Tabora

> District. .. From the medical records it appears that when the site was chosen in 1924 there was only one poor waterhole serving ten people from which it took an hour to fill a four-gallon tin. The growth of the concentration in the first few years is shown by the following figures:

Year		Area		No. of people
1924	...	a few acres	...	10
1925	..	3.5 square miles	...	1,400
1926	..	9 square miles	...	2,300

> Already one year after clearing had started shallow groundwater appeared and by November 1926 "large quantities of water were found quite near the surface" and "there has been no shortage after 1925". At the time of my inspection (August 1938) the groundwater table had risen in places so high that several huts had to be removed because the ground under them had become too wet! (Gillman, 1943:75)

The history of water development in the Mwamashimba area during the 20th century is contained in contemporary documents one of which is extensively referred to. The purpose is to give an idea of the kind and number of water interventions that the people in the area have experienced over the years. In 1932 the District Officer P.M. Huggins portrayed the availability of water and the prospects of improvement as follows.

> i) Except in few sandy river beds, the supply of water is meagre and of disgusting and unhygienic composition, especially at the height of the dry season.
> ii) Supplies in sufficient quantity to water cattle are few and far between in the dry season. Tramping out and erosion are therefore to be noted around available supplies.
> The problems under i) can be remedied by sinking wells and boreholes whereas that under ii) can be mitigated by enlarging native-made earth dams, digging new ones and sinking boreholes. All three methods have been tried experimentally and so far the following points have been noted: (1) Wells can only be sunk round the base and on the slopes of the granite hills where there is lateritic supply. It is unlikely that many such wells would yield enough water for cattle, (2) native made dams, to be of any use in the dry season, should as far as possible be constructed so as to benefit by an overflow from a wet season spring. The majority of these continue to exude water until the end of June thereby keeping the dam full to its capacity to that date. I do not believe that a hole dug in dry earth, such as in the middle of an *mbuga*, is of any use at all as the water therein is finished before the real dry season begins. (3) All native dams should be cleaned out at the end of the dry season. (4) It is found that it is imperative to protect new dams by surrounding them except at the point of approach with *minyara* or sisal hedges. Trees are also planted in the vicinity with a view of providing shade for the stock. (Huggins, 23/6/32)

Tsetse Reclamation in Buhungukira 1930-1933

In the late 1920s the colonial authority embarked upon a scheme to reclaim the forested area in order to be able to open up 3,000 square miles to settlement which would absorb perhaps 450,000 stock units and 300,000 humans from the densly crowded parts of Sukumaland (National Archives, filmtape 24). Swynnerton inspired this reclamation programme aimed at the systematic isolation of existing fly belts. The programme centered on two previously deserted areas, Buhungukira in the Kwimba federation (70 sq miles indicated on Map A) and Huru-Huru in the Shinyanga federation. District Officer Huggins wrote in a report of 1934.

> As far back as 1930, it was patent that the inhabitable parts of Kwimba District were being strained to their outmost to support an ever increasing amount of human and animal life. Most of the available land which was sufficiently well watered to support life had already been reclaimed. Notably some 50 square miles along the banks of the Simiyu River and a further fourteen square miles at the North end of Buhungukira. The Binza Tribals of the Maswa District even went so far as to cede land to the Bukwimba in the neighbourhood of the Ididi River.
>
> All eyes naturally turned to that enormous waterless, fly infested, half *mbuga* half forest country which comprises the greater part of Buhungukira and which is nothing but the Northern extension of the *Nindo mbuga* system lying to the South of Shinyanga. From time immemorial cattle had skirted this area trekking down to the *mbugas* on the Shinyanga boundary in search for pasturage at that time of the year when all pasturage in the inhabited part of Kwimba District was eaten out.
>
> It was obvious that if this enormous waste area was to be made use of the fly and water problem would have to be tackled on a large scale, in fact that a new type of reclamation would have to be put in practice
>
> The economic crises and the consequent removal of the District Reclamation Office precluded any immediate steps being taken whereas the visitation of locust and the consequent wasting of the pasturage taken in conjunction with the drought of 1931 so decimated the stock of the district that the finding of new pastures ceased temporarily to be such a pressing question. (Huggins, 1934)

Margery Perham reported from the reclamation camp in 1930.

> We have come with 1,500 natives who have been called out by their chiefs to make a massed attack upon the sleeping sickness belt where the fly breeds in thick bush[2].... The bush around us, being thick and virgin, is expected to be teeming

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[2] Kapalaga (1946·3) described the remaining bush area as follows. " . the land cover consists of open *acacia* bush with an undergrowth of grasses in the *mbuga* areas, while the *albizzias*, *grewias combretums* and various other trees and shrubs grow on the high ground above the *mbuga* and on the hills Some of the hills are partially covered with *lodotia* grass which is very much used by the people as a thatch grass *Panicum* is another type of grass found within that region. The

> with wild life.... The attack was held up at the streams whose channels were a dense mat of undergrowth, knit closely together by the creepers known as monkey-ropes... The bush was soaking, the grass often higher than one's head and I was drenched up to the waist in a few minutes. You have to imagine this sort of thing on a front of eight miles. (1976:81-82).

The bush clearing was successful but difficulties were encountered in developing new water sources.

Development of Water Sources for Man and Beast

Huggins went on to describe the development of water sources in the Buhungukira area in 1932-33 (here *in extenso*):

> Towards the end of 1931 the Boring Machine of the Geological Department was at work in the Shinyanga District and upon completion of its labours there the opportunity was taken by the Kwimba District Native Treasuries of utilizing it in the Kwimba District. The first hole sunk, some twelwe miles from Ngudu in March 1932, was successful[3] and on the strength of this it was decided to seek Geological advice and assistance in the matter of boring for water in Buhungukira. This led to the seeking of advice of the Tsetse Research Department as to the best methods of ridding the country of fly. Sites were selected for tribal boreholes and the Director of Tsetse Research at the request of the Provincial Commissioner toured the area in company with the District Officer and submitted a report. At about the same time the Director of Veterinary Services and the Pasturage Research Officer were also invited to do likewise. The reports of these officers were all satisfactory with the result that it was determined to undertake a large reclamation in 1933 under the directions of Tsetse Research Department. The Chiefs of Bukwimba Federation willingly voted the money for both development of water and the cutting of the fly infested bush. By the time plans had reached this stage two unsuccessful boreholes had been drilled at Chasalawe and Dodoma villages[4] and realising that the whole

predominant grasses in the *mbuga* areas are the *hyparrhenias*, *setarias*, and *cenchrus*. *Cynodon* has colonized a certain amount of land in the occupied areas."

[3] **Kimiza** borehole: The site chosen was in the depression, on the edge of an *mbuga* where River Magogo commences its wet season course. 60 gallons per hour were struck at 48 feet. It increased to 150 gallons at 123 feet and 465 gallons at 196 feet. Drilling ceased at 212 feet The Geological Department boring plant was hired on a three-year payment agreement to drill for water for domestic and stock purposes.

[4] The Geological Survey Department went on boring on the East side of the Nyang'hanga Mbuga. The borehole reached a depth of 333 feet after which it was abandoned. The formation

success of the scheme depended upon the successful provision of water it was decided to dig large earth tanks in the *mbugas* before commencement of the rains. This was the state of affairs when (Huggins) proceeded on leave in October, 1932.

As for execution of the work in 1933, Huggins wrote:

The Director of Tsetse Research had drawn up a plan of campaign for the reclamation of Buhungukira covered a period of years. The first year's work covered that area bounded on the North by the Mhalo-Nyang'hanga-Ilangafipa range of hills and extending South to Mhande Hill and the Nindo *mbugas*. On the East the area is bounded by cultivation at (B)upamwa and the West is defined by the arm of *mbuga* extending from Ilangabafipa to Mhande. The whole area comprises some seventy square miles but the area affected by the elimination of Tsetse bush is considerably greater.

In January an earth tank some 90'*40'*12' was dug at the Dodoma village on a Geological plan.[5] This rapidly filled and was practically the only source of water during 1933 reclamation operation. Two more earth tanks of half size were dug at Mhalo and Maboko in February but unfortunately the cessation of rain precluded them filling up.[6] In February after one more unsuccessful borehole the Geological Department struck a stream giving 1,200 gallons per hour on the high ground under

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consisted of broken schists and clay The cost was Shs 3,771/19, paid by the Native Treasury After this failure, the Department started drilling in **Dodoma** on the West side of the Nyang'hanga Mbuga After a depth of 506 feet the hole was abandoned. The formation was broken schist and clay. The cost was Shs 3,373/47, again paid in full by the Native Treasury After two dry holes their drilling rig was moved to the North of the Nyang'hanga Mbuga and close to **Mhalo Hill**. At a depth of 337 feet the hole was abandoned. The formation was broken schists with clay. The cost was paid by the Native Treasury (Shs 1,000)

[5] The **Nyamiselya** earth tank was begun in February 1933 in the *mbuga* close to the unsuccessful Dodoma borehole When it was finished (before the end of the year) it was found to have a capacity of 500,000 gallons. Two shallow ditches led to it across the catchment area, and it was filled rapidly

[6] Two more such tanks were dug in **Mhalo** and **Maboko** in March and finished before the end of the year 1933 These were dug out further to a depth of 15 feet in November and December the same year The cost of all these tanks was 54 head of cattle supplied to labourers and 120 shs as wages to the overseer Two more tanks were built in **Sanjo** and **Chasalawe** in the same way 1933 Also a tank was dug close to the **Nyang'hanga** borehole no 2 which can be filled, if necessary from the borehole via an earth furrow running from some 300 yards from the borehole to tank This tank was divided into portions by a wooden barricade, termed a stop connexion by its builders through which the water passes easily from the top or drinking section into the bottom or cattle-watering section The wooden barrier effectively prevents the cattle from invading the water set aside for human consumption

Plate 17. Construction of earth wall of a dam in the1940´s. Oxen trample to make it impervious

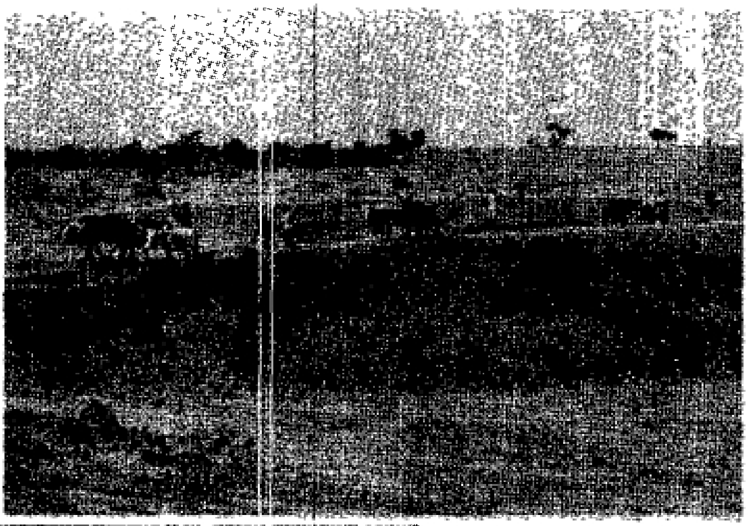

Plate 18. Excavation of dam by an ox-drawn scoop

Plate 19. A gang of villagers digging a spill-way

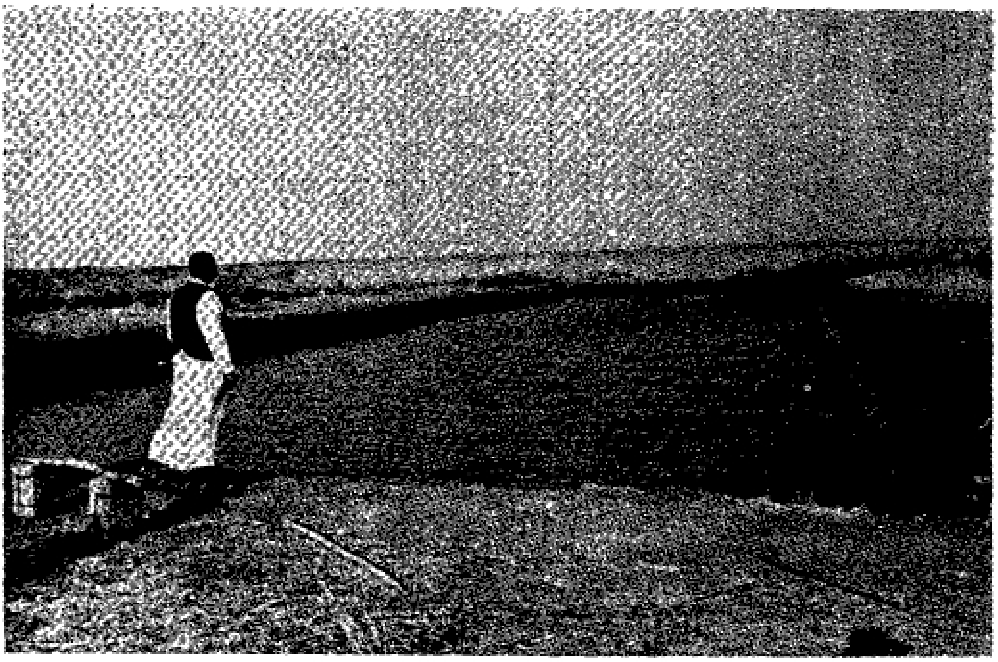

Plate 20. Chief Makwaia at one of his surface water catchment tanks

Plate 21. Preotected spring with steel pipes leading the water

Nyang'hanga Hill.[7] An order was immediately placed in England for a Lister Diesel engine and pumping plant in the hope that it would arrive in time to be erected and provide water for the working parties.

In April preliminary work was carried out by way of contructing a road from the main Nyahonge-Upamwa road to Nyang'hanga and the erection of labour camps. Bush cutting commenced in earnest on May 11th when 3,600 men were drafted into camps at Upamwa and Mhalo. Work progressed under the direction of an officer of the Tsetse Research Department aided by a casually employed European working in conjunction with the Provincial and Native Administrations who provided two more Europeans. Both the Veterinary and Forestry Departments provided additional European supervision for varying periods. The labourers, who were provided with meat and salt rations were entirely voluntary and worked for ten days under their own Chief and headmen.

As time passed, Upamwa camp was left and 4,000 men were drafted into Dodoma village camp whilst a further 2,000 continued to operate from Mhalo. By this time the local supply of water at Upamwa was exhausted and the sole source of supply was the Dodoma earth tank whence water had to be transported by porters to the labourers at Mhalo over three miles of *mbuga*. All the bush of the East of a lune from Nyang'hanga to Mhande was now felled and there but remained the dense bush at the base of Nyang'hanga Hill and the light bush extending some six miles therefrom via Dodoma to Mhande Hills. It was however impossible to draft any large gang of men to Nyang'hanga camp before the installation of the pumping plant, the non-arrival of which was by now causing considerable anxiety. The Dodoma earth tank had exceeded all expectations having supplied most of the daily wants of an average of 3,500 natives and five to six Europeans over a period of 48 days. By the end of June the supply was so low that it was decided to employ only 2,000 men. In the meanwhile information was received that the pumping plant had arrived in Dar es Salaam. It arrived at Bukwimba on 9th July and hoping to have it erected by July 15th the last batch of over 6,000 men from Usmao were drafted in to the outskirts of the reclaimed area on 14th. But, alas, as the plant was erected, mechanical faults caused a breakdown and the long looked for water supply was not forthcoming with the result that on the morning of the 17th this last gang had to be returned to their homes.

The total labour turn-out had been over 23,000. The next day the machinery was repaired and an excellent supply of water has been forthcoming since.[8]

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[7] It was decided to make a final attempt to find water near the hill known as **Ilangabafipa** and about 200 yards from the previous hole At three feet laterite formation was struck; at 38 feet a broken ironstone formation was struck and this continued up to 324 feet where water was found. This supply at **Kiliwi** yields 1200 gallons per hour.

[8] "The cost of the plant bought through the Crown Agents was Shs 4,448 Railway freight amounted to Shs 499/20 The erection costs paid to an Engineer were Shs 700 but to them must be added Shs 805/70 being the cost of materials and labour for the erection of engine shed and tank tower. A claim for Shs. 482 has also been submitted by the Engineer for further work on

Huggins wrote in conclusion:

> It was unfortunate that the bush clearing could not be completed but over 3/4th of the original programme was carried out with the result that a large area is now thrown open for settlement. Settlers in small numbers have already arrived and cattle are now to be seen watering in hundreds where they have never dared to tread before.
>
> There is however much to be done both practically and experimentally before the area can be finally settled. The Dodoma tank having been such a success many more such must be dug especially in view of the fact that three more boreholes in the neighbourhood of Mhande were sunk without success[9]. The rival merits of boreholes versus tanks have caused much controversy but both have claims to superiority. A borehole with machinery and running costs is expensive but a good one such as Nyang'hanga, properly maintained, has limitless possibilities no matter the original cost. We have to pay for our experience and we can but be guided by the excellent results obtained in other countries. The great advantages of earth tanks are the cheapness of their construction and the fact that they can be dug without limit to their numbers wherever and whenever they are required and there can be no denying that the greater the number of sources of water supply the greater is the boon to both man and beast. With regard to Dodoma it must be recollected that most of the water was used up ever before it was affected by the period of intensest evaporation commencing in July and ending with the break of the rains. It would be unwise to endeavour to rush settlement. To the native eye the area is still a wilderness with one borehole not yet properly equipped and an inadequate series of empty earth tanks. By this time next year the countryside should present an entirely different picture.[10] (Huggins, 1934)

Despite Huggins' conclusion that boreholes and tanks "both have their own individual claims to superiority", no drilling whatsoever was undertaken between 1934 and 1942 (McLoughlin 1971:25). The emphasis on tanks and dams was maintained and during the subsequent years a number of them were dug by the residents. In 1937 the Tsetse

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account of repairs to alleged defects in the machinery supplied The total cost therefore of this borehole and its machinery and housing has been Shs 12,057."

[9] In 1933 the drilling plant was moved due South some six miles and set up at **Mhunze** Hill. Boring was stopped at 408 feet although a supply of 40 gallons per hour was struck at 340 feet This was a free borehole. After this attempt the machine was moved along the ridge to the west about 2 miles and set up at **Mhande** At 172 feet schists was struck and the machine moved about 50 yards South where decayed schist was again struck and the machine lifted at 42 feet. Boring again commenced to the North but was stopped at 36 feet by order of the District Officer and the boring plant was returned to Dodoma (present capital) in June The cost was Shs. 665 which was paid by the Native Treasury

[10] From the Kwimba District Book (filmtape 24 232) and the information in the footnotes is from an appendix named Table of Water Development Schemes 1929-1948

Department embarked on a scheme which made annual cleaning of the tanks possible. The four main tanks in Buhungukira (Chasalawe, Mhalo, Sanjo and Kahuga alias Nyang'hanga no 2) were duplicated i.e. four new tanks were dug out in close proximity to the old.

> Of these pairs one was set aside for human use and one for cattle; suitable signboards were erected, one bearing the figure of a cow, the other a figure of a woman drawing water. The tanks used by cattle will be dry before the year is completed and can be cleaned out. Next year the clean tank will be used by humans so that the other may be drained by cattle. If the cattle drain their tank dry too early, they can either be accommodated at the borehole or by a water furrow led from the 'human' tank. (Kwimba district Book, No. 24)

A review of the condition of the dams in Buhungukira conducted in 1947 showed that most of them were in good order but in need of cleaning. The Dodoma tank was believed to be empty while the Nyang'hanga borehole and pump needed maintenance (there was no one in the Province who could provide the necessary services).

The Organisation of Work

The planning of settlements started out from human, agricultural and livestock water requirements. The carrying capacity of the land and the water requirements were calculated by using the famous "Sukumaland equation" which was developed by the well-known agricultural officer R.V. Rounce The optimum density of 40 people per km^2 (100 people per square mile) dependent on one water supply in the centre of a 30 square mile area is arrived at as follows:

> At one homestead there are on average two taxpayers or a total of 17 people with an average of 14 cattle and ten small stock units (at 5 small stock equalling one stock unit) equals 16 stock units which produce altogether 16 tons of manure per annum. This manure is enough to manure eight acres every other year which is one acre more than the average acreage of arable for Sukumaland but the stock require two acres each of pasture (the average for Sukumaland is 2 acres) equals 32 acres plus eight of arable equals 40 acres equals 16 homesteads per square mile equals 112 people per square mile, say one hundred. Three miles to walk to water is about 30 square miles equals 500 homesteads equals 8,000 stock * five gallons of water * 120 days (August to November) equals five million gallons = 10,000,000 gallons (to allow for evaporation) per 500 homes and 30 square miles. (Rounce, 1949:105)

The organisation of clearing work was briefly described by Margery Perham on a visit to the site in 1930.

The natives all rolled up yesterday and they are busy building themselves grass shelters.... We went along to Camp No. 11.... Men were flowing in from all directions like a stream of ants-threading the bush in a single file. Each man brought rations for ten days, his big knife and his little axe. His goods were strung on a pole carried on his shoulder, his cooking pot, a basket of meal, a bundle of sweet potatoes, and a calabash of water or beer. Clothes were the fewest and the oldest. To the belt is tied a little calabash of snuff; round the neck a few shells, and perhaps pincers for picking out thorns: a couple of goat-skins as a cape or a ground-sheet.

As soon as they get in, having walked anything from ten to forty miles, they must set to work to cut down branches and grass and build themselves huts. Fires were soon going and pots of mixed meal, millet, maize and beans, were being stirred with sticks.... Thousands of men were attacking the forest with axes, great knives and bill-hooks, shouting and singing as they struck. Five or six men would fall upon one tree and hack at it, until it came down with a long rending crash in a ruin of branches and amid screams of triumph. Then the whole group would rush at the next one.... Last year they cleared twenty-two square miles and hard on the track of the axes the natives come in out of the crowded lands of the Wasukuma to settle and, as a reward of hard work on virgin soil, to get bumper crops.

I am more than impressed by the qualities of the African and by Tanganyika's administration Here we have 15,000 men who at a word from their chiefs have left their homes to come to work for the good of others, for very few of them can directly benefit. This is work for which they get no pay and have to provide their own food, or most of it, for they get a feast of meat three times a week. They work from 6 to 12 and all the afternoon they work away making things of wood, pots, hoe-handles, milk jars, etc. You see them working, perhaps under the tuition of some special expert They will go back with a year's store of utensils, for wood is scarce round their own homes. At dusk they stop work, light fires and sit round in groups of five or six cooking their mealies. Then comes the dance. And they say the African is lazy! (Perham, 1976.81-83)

Here Perham gives important detail of how the men worked and lived. It is evident that the workers catered for themselves and there was ample time for private activities in the afternoons and evenings. A few years later "the beef and beer supplied on these occasions, as well as part of the work force, was now paid for out of departmental or Native Treasury funds." (Austen, 1968:245). The work of constructing *lambos* and dams was organised in the same way as the bush clearing. Mzee Sendo of Bupamwa who is presently (1990) the chairman of this village gave the following account of the work in those days.

The Bupamwa dam was built in some three months. A European did the siting and the assistant to the chief organised the construction work. Initially the recruits were not given any individual or group assignment, but after facing difficulties each one was assigned his own task that was estimated to last some ten days. If it was not completed by then, the men had to continue till it was finished. The first step in the construction work was to clear the bush in order to make the necessary levelling. Then some three pits were dug to check the soils underground. After it was found satisfactory, the topsoil was removed. The excavation of the sump or core-trench started and this soil was put to use in the building of dam walls. It was important to soak this soil - if enough water was available - and to pond the wall thoroughly in order to make it impervious (Mzee Sendo, 1990)

The growing problem of recruiting people is mentioned in several reports. A example was given by the District Officer H. Harrison in his explanation of the managerial point of view on the clearing work at the neighbouring Madusa *Mbuga* in Shinyanga 1943.

Operations were started with a gang of 330 only. The labour were very slow in turning out However, on Saturday the 14th we managed to get nearly a gang - 1,115 men instead of the correct 1,250. This gang was from six different chiefdoms, which, had I known before leaving Shinyanga, I should certainly have asked for four extra African Assistants to deal with them. The local chief Ndalawa, whom I was relying on to handle any trouble with the gang, could do nothing with these people; they were not his men. Finally we had to work them separately, viz. each chiefdom on its own.

The second gang of 1,065 out of 1,250 men came in very slowly, in fact, the Usmao natives of about 360 men arrived when the others had finished. This gang was the worst on record, they either never arrived at the clearing or sneaked away to cut jembe-handles, etc. After a few days of this, I brought in the clearing gang and stopped them outside the camp while it was cleared out, well over 100 men were caught who had never been near the clearing and a huge pile of jembe-handles, etc. were collected and burnt. This did not occur again. The gang was counted before it left camp and in the field when work was finished, each *manangwa* (headman) being responsible for his men. The last week was not too good as eight cases of C.S.M. were sent away. The whole camp was burnt down on September 18th when someone lighted up the mbuga north of the camp. (Harrison, 1943)

The demand on chiefs and headmen to provide labour-gangs was reduced, but it seems as if the task was not substantiately easier unless the following account from the construction of the Mkula Dam was uncommon. The Divisional Engineer of the Lake Province wrote to the Tributary Officer on 1/10/59 under the heading of Shortage of Labour.

Work at Sapiwi (Mkula) dam is being seriously hindered by lack of labour, and I would request your assistance in obtaining 40 labourers for work here. The embarkment is almost complete, and the tractors will be ready to move to the water holes, and then onto Kisesa dam within a week or so.

In a telegram 19/10/59 the Political Officer in Mwanza wrote to the Tributary Officer:

> I have seen the chief myself on the 9/10/59 and impressed on him the vital importance of a good turnout of labour and he has promised to bring pressure on his Parish Headmen. There should be more labour available within striking distance of Kisesa (Rutubiga) dam site, as it is nearer population centres. Naturally I cannot guarantee that full labour requirements will be met, as I have no physical control over the people concerned, but you may be assured that I will continue to bring all possible pressure to bear. I have explained to the Chiefdom Council that, failing a proper turn out, they need expect no further assistance from Government. However, it is natural for the few people already settled in such bush areas to be reluctant to help construct a dam which would attract thousands more settlers to the vicinity and restrict available land for grazing and cultivation. Would it be worth seeing the Chief about getting labour from other gungulis/parish/? Am I right in assuming you are paying Shs. 2 a day? [11]

Many water supplies were constructed under technical advice from district officers but a number of village and chiefdom councils took upon themselves the task of constructing schools and dams through communal efforts without waiting until Native treasury funds were available. The following excerpt is from the Annual Report (1946:8) from the Agricultural Officer in Mwanza District: "There is a growing demand in many areas for improved water supplies and the Chief of Massanza I in particular continues to lay out and dig new dams entirely on his own."

The Sukumaland Development Scheme 1946-1956

After the second world war a new large integrated scheme, the Sukumaland Development Scheme, was launched.[12]

> Under this scheme over 300 large and small dams, hafirs and catchments were built, the majority by tribal turn-out labour, but the largest three dozen were built by mechanical equipment.... In Kwimba, which is more suitable for agriculture in its north, and for grazing in the south, over 45 dams were built by hand during this period (tribal turnout, paid for at the rate of one head of livestock per every 500 man-days), and 6 more by machine. Many of the larger dams were used as reservoirs for rice irrigation.... From 1943 to 1964, some 60 boreholes were drilled

[11] Payment had recently introduced, and before that the Native Authority usually paid for food but not shelter. In the 1930s people brought their own food and built their own shelters when working in the tsetse eradication programmes

[12] The estimated cost of about £230,000 grew, with the inclusion of territorial housing and water development votes, until the approved expenditure finally amounted to £472,000 to be spent over a period of ten years

at ginneries etc.), about half being successful. (McLoughlin, 1971:24)

During the first two years of the plan, some fifty small catchments were built or improved by using manual labour only. In 1949, for example, a second earth tank, Mwabayanda (**Buyogo**), was built with a standard tank 50*15*5 yards. This tank was completed in 8,729 man days. Another earth tank, Soli in Buyogo, with a size of 35*10*6 yards was completed in 7,845 man-days.

The first use of mechanical units in association with communal labour was introduced in 1948. Machinery, in the shape of tractors, carryall scrapers, rippers and rollers, was provided by the Water Development Department for the building of surface catchment dams in sites found, surveyed and approved by the engineers. The idea was to build large dams with a capacity of some twenty million gallons, every ten miles to avoid over-concentration of stock at any point. Smaller mechanical units in conjunction with manual labour were used to improve water supplies in the occupied areas.

In the annual report from the department of agriculture in the Lake Province (1952:30) we find the following mid-term description of the development plan. "A flight by air over Sukumaland quickly gives one a picture of the close network of artificial water supplies, which must in aggregate have helped considerably towards reducing soil erosion and improving the pastures, if only in terms of the reduction of tramping by stock."

The large **Mwamashimba** Dam was constructed in Bupamwa in 1956 after being surveyed the year before. The dam wall is 50 ft wide and stretches 1,148 ft to catch the runoff water from an area of one square mile. Its capacity is 750,000 gallons and the depth at the centre is 10 ft. There are two spillways (31 inches of annual rainfall) and below the dam wall are some troughs for watering cattle.

The dam contains water all year round (1990), but it is badly silted up. The villagers have tried to hire a caterpillar to excavate the silt, but this has proved impossible since such a heavy machine is expected to sink in the silted dam. The use of shovels and sledges pulled by oxen has not so far been pursued.

Mwamashimba Water Supply in the 1970s

Shortage of water was experienced again in the late 1960s and the authorities embarked on a new scheme to provide humans and livestock with water. The initial idea was to pump water from Smith Sound (Lake Victoria) some 40 km away at Mbarika or from Magu Bay 70 km away. This idea was abandoned due to high costs of operation and maintenance and the problems of dealing with two regions. Donor money was secured to use underground water from boreholes along Ndagaswa river near Runere village. This Mwamashimba Water Supply was planned to supply 35,000 people in 19 villages in Buhungukira and Nindo areas from 156 domestic points along a 120 km pipeline.

The work started in 1974/75 and was expected to be finished by 1977. In all 16 boreholes were drilled by MAJI department in the Runere area as a preparation for the Mwamashimba water scheme in the mid-70s.[13] More than half of the pipes and domestic points are there today, but only the closest four villages have so far received any water. The pace of the scheme was slow due to technical and managerial problems. In a letter to the District Water Engineer 18/9/1981 the Regional Development Director stated:

> The management of the work in the project is not good. Often the villagers are promised to be picked up by a truck and transported to the site where they are to dig the trench. Usually these villagers have to spend the whole day waiting for the transport without ever seeing the truck. This has happened many times and the villagers are losing their time for nothing.

During the election campaign in October 1990 a revival of the scheme was suggested. A preliminary estimate from the Regional Water Engineer suggests that the replacement of pipes and a new booster station would cost some 45 million shs. The cost of diesel is estimated at 34 million shs per year or some 5,000 shs per household i.e. four or five times the present taxes paid by the average household.

There is little reason to expect the villagers to agree to this kind of expenditure, especially since, on a number of occasions, they have experienced both embezzlement of collected money and that government staff sell diesel instead of using it to run the water pumps. Thus, there is not only a technical problem to be solved to get the Mwamashimba Water Supply operating, but also a 'social' one.

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[13] A study of the water strikes during the drilling of the wells, shows that along the rivers water is stored in the whole profile from within the clay layer down to fractures in the fresh bedrock In the remaining areas water is stored only in the fractured and, occassionally, the weathered bedrock The river aquifer is classified as a semi-confined aquifer whereas the aquifer in the remaining areas is classified as a confined aquifer (Husberg & Nilsson, 1978:2).

Appendix B

HOUSEHOLD IDENTIFICATION AND DESCRIPTION

Interviewer.............................. Date ....
District................. Village ....
Kitongoji ....
..........................Household reference number

1. Name of respondent Mr/Mrs ....

2. Name of head of household Mr/Mrs ....

3. Relationship of respondent to HoH ....

4. Members of the household normally resident on the plot in

   wet season: ...... men, ... women and ..... children
   dry season: ...... men, ... women and ..... children

5. Main occupation of resident adults:

   1 (respondent) ....
   2 ....
   3 ....
   4 ....
   5 ....

6. Position(s) held by

   1 (respondent).....................................
   ....
   2 (head of household)..............................
   ....
   3 (other)..

7. Religious faith and tribal affiliation

   1 (respondent).....................................
   ....
   2 (head of household)..............................
   ....
   3 (other)..

8. Formal education of

   1 respondent ....
   2 Head of household ....
   3 HoH's wife/husband...............................
   4 Highest in the family ....

INTERVIEW OF VILLAGERS checklist August 1988

A GENERAL

A1 What is a good place of living like?

social:	**economic:**	**environment:**
neighbours........	fertile............	weather.............
ancestors.........	water..............	lake................
....	work...............	....
....	....	....

A2 How do you rate your present homestead? ....
....
....

A3 How long have you/your family lived here?..................
....

A**4 Has any major changes taken place during this time?**..........
....

B **PRESENTLY USED WATER SOURCE(S)**

B1 Where does your household collect water, when and for what purpose?

	Wet season mtrs, purpose	Dry season mtrs, purpose	Occasionally mtrs purpose
Lake	....	....	....
River	....	....	....
Spring	....	....	....
Pipe/BH	....	....	....
Dam	....	....	....
Chako	....	....	....
Pond	....	....	....
Well	....	....	....
Other	....	....	....

B2 Why or why not does your household use this source for this particular use?

	Wet season	Dry season	Occasionally
Lake	....	....	....
River	....	....	....
Spring	....	....	....
Pipe/BH	....	....	....
Dam	....	....	....
Chako	....	....	....
Pond	....	....	....
Well	....	....	....
Other	....	....	....

B3 **Who owns or developed these source(s)? When? What kind?** ( )........................... ( )...........................
( )..
( )..
( )..

B4 Can anybody be restrained to use the water? By whom, and why? When did it happen last? No .... Yes ....
....
....
....

B5 Do you contribute in kind or pay to use any of the water sources? No, never .... Yes, for ....
....
....

B6 Do you take part in any cleaning or maintenance ? No, never................ Yes,......................
....

B7 **Who collects household water and how often (times per day)?**
Mother...................
Daughters................
Sons.....................
Husband..................
Other....................
....

B8 Why this division of task ? ....
....
....

B9 How is water collected? Why ? Why not any other means?
On head..................
Animal...................
Bicycle..................
Other....................
....

B10 Where is your livestock watered? ....
....

C KNOWLEDGE

C1 Is there less rain or less effective rains nowadays ?
Yes, because..............
....
No, because...............
....

C2 From where does rain originate? Who told you this?
sky/heaven ....
clouds ....
lake/ocean ....
circulation ....
other.....................
....

C3 **Can rain be manipulated by man ?**
Deforestation ....
Tree planting ....
Rainmaker ....
Other.....................
....

C4 **Where does rainwater disappear?** Runoff....................
....
Percolate.................
....
Evaporate because..........
....

C5 **Can rainwater be preserved by lessening the runoff?** Yes, by choice of crop ....
by furrows ....
by lambo ....
....
No, because...............
....

C6 **How is the rainwater/soil moisture sucked and used by trees and grass?** ....
....
....
....

C7 **Are there any signs in nature showing where there is water? Give examples** Trees....................
Grass....................
Other ....
....
....

C8 **Do you think water is available underground in your area? Grave, latrine experience?** No, because...............
....
Yes, because..............
....
....

C9 **Is there any device to detect underground water?** ....

C10 **Why can a well dry up? a spring? Is there any remedy?** (well)....................
....
(spring)..

C11 **Where does the water in the ground come from and how is it stored?** ....
....
....

C12 **From where comes the water to the spring?** ....
....

C13 **Is maji safi sawa na maji salama?** ....
....
....

C14 **Can drinking water cause illness? Why do some get sick and not others when drinking the same water?** Yes/No, because...........
....

C15 **How wholesome is rainwater ?** Good, because...............
....
Bad, because...............
....

C16 **What signs of safe water is there in river/lake/pond/dam water ?**
Taste.....................
Colour....................
Clearity..................
Smell.....................
Microorganisms............
Other (shetani nk).........
....
Protection measures........
....

C17 **What signs of safe water is there in shallow well/tap water ?**
Taste.....................
Colour....................
Clearity..................
Smell.....................
Microorganisms............
Other (shetani nk).........
....
Protection measure.........
....

C18 **Are there any rules for the use of river water or other water ?**
No, ...
Yes.......................
....
....

C19 Why are these rules in use? Where did you learn about them?............ Because...................
....
....

C20 **Do you know any customary or religious rules of how to handle drinking water?**
No, ...
Yes,......................
....
....
....

C21 Do young people know the rules and the reasons behind them? No/yes, because............
....
....
(girls, boys)..................................

C22 How can drinking water become unsafe or contaminated ?
At source.................
On route..................
At home...
....

C23 How does the cow dung etc. and child faeces 'disappear'?
Into soil.................
Into water................
....
Otherwise.... ....

C24 **Is there purification fo water by nature or otherwise ?** Yes,......................
....
No,......................

....

D IS WATER A PROBLEM?

D1 **Does your family have other, more serious problems than water?** No ....
Yes,......................
....
....

D2 **In what way(s) is/was water a problem ?**

	1st	2nd	3rd
Far away,..................			
Taste,.....................			
Muddy,.....................			
Hardness...................			
Breakdowns.................			
Queues.....................			
Quantity...................			
Cause illness..............			
Heavy to lift..............			
Other......................			

....
....

D3 **Who/what (has) caused the problem?** Weather..................
Nature....................
Witch.....................
Population growth.........
Society...................
Other.....................
....
....
....

D4 **For whom is this a problem? Why?** Firstly,..................
....
Others....................
....

D5 **Which consequence(s) is/was caused ?** Ill-health of family member
....
Time-waste................
Other.....................
....
....

D6 **What benefits have your family gained from using new source ?** ....
....
....
....

D7 Why do you still collect water at this source, if it is unsafe? Distance..................
Quality...................

Other.....................
....
....

D8 Where did you collect it before? ....
....
....

E HOW CAN THIS/THESE PROBLEMS BE SOLVED ?

E1 Which are your alternatives? 1 Protect existing source by
....
....
2 Improve the source by......
....
....
3 Improve storage............
....
4 Treat water by.............
....
5 Develop new source by......
....
6 Rites by...................
....
7 Move to other place........
....
8 Reduce consumption.........
9 Other,.....................
....

E2 **Have you used, seen or heard of such a solution?** No...........
Yes, which, where and when

....
....
....
....
....

E3 **Under what conditions would you start using a new source?** If much closer.............
If same taste..............
If less diarrhoea..........
Group pressure ....
Other reason, ...
....
....

E4:1 **What was/is needed to solve the problem in the way you propose?** Knowledge,.................
....
....
Manpower(artisan, leader,)
....
....
Materials..................
....
Equipment..................
....

E4:2 **What was/is needed to solve the problem in the way you propose?** Knowledge,.................
....
....
Manpower(technican,leader)
....
Materials.................
....
Equipment.................
....

E4:3 **What was/is needed to solve the problem in the way you propose?** Knowledge,.................
....
....
Manpower..................
....
Materials.................
....
Equipment.................
....

E5:1 **What possibilities and obstacles can you or did forsee for the proposed improvement or new souce?** Knowledge.................
....
Skill..................
....
Organisation(village, party
government staff)..
....
Attitudes.................
....
Other.....................
....

E5:2 **What possibilities and obstacles can you or did you forsee for the proposed improvement or new source?** Knowledge.................
....
Skill..................
....
Organisation(village,party,
government staff)..
....
Attitudes.................
....
Other.....................
....

E5:3 **What possibilities and obstacles can you or did you forsee for the proposed improvement or new souce?** Knowledge.................
....
Skill..................
....
Organisation(village,party,
government staff)..
....
Attitudes.................
....
Other.....................
....

E6 **Are there other possibilities which you do not believe in ?** No, because................ .... Yes, ...

....
....

F WHO IS TO SOLVE THE PROBLEM ?

F1:1 Have you tried this solution before? When ? Where? No/Yes,because.............. ....

....
....

F1:2 **Have you tried this solution before? When ? Where?** No/Yes,because............. ....

....

F1:3 **Have you tried this solution before? When ? Where?** No/Yes,because............. ....

....
....

F2 **If you look 20 years ahead, how would you like to see the household water be arranged ?** ....

....
....

F3 **Who do you think can (learn) to carry out the improvement or construction?**

You/spouse ....
Your family ....
Nyumba kumi/neighbours.....
Mwenyekiti/village.........
Serekali ....
Society(religious,dancing..

....

Other, namely ....

....

F4 **Who do you think should carry out the improvement or construction?**

You/spouse ....
Your family ....
Nyumba kumi/neighbours.....
Mwenyekiti/village.........
Serekali ....
Society(religious,dancing

....

Other, namely ....

....

F5 **Do you think they will do it ?** Yes, because ....

....
....

No, because ....

....
....

F6 **Why do you think this solution is discussed/introduced now?** Because....................
....
....

F7 **What is expected of you to do to ease the water problem, and what did you want your parents to have done for you?** ....
....
....
....
....

F8 **Why would you participate in developing a water source?** I am interested.............
Want to practise usafi......
....
Save time/drudgery..........
....
Group pressure.............
....
Forced by..................
....
Other......................
....

F9 **In what way can you contribute ?** No way, because............
....
Oral support ....
Work like ....
....
Money contribution ....
....
Other contribution ....
....

F10 **How do you calculate/foresee future work to maintain the developed water source?** Not my business...........
Some work, but less than today.....................
Too much work.............
Other.....................
....

F11 **Can it happen that the baraza accepts a water project without the intent to maintain or use it?** No,because................
....
Yes,because................
....
....

F12 **What would happen if you started to dig your own well?** ....
....
....
....

F13 **We have discussed several possibilities and constraints facing improvement of the household water. Three aspects have been emphasized; knowledge and skills, norms and values, and organisation (leadership etc). Which of these three do you rate as the main, the second and third most important?**
....
....
....

Name: field 2 Interviewee____________________date_______

G PRESENT WATER SOURCES AND THEIR USE

G1 **Which are your priorities to use water and why?**

Use	At home, because	At well, because	Other
Dishes			
Laundry			
Bathe			
wife			
boys			
girls			
under 5			

G2 **Would you like to do things otherwise?** ....
....

G3 **Water sources and water quality**

Kind	dist	month	lt	wait	quality	uses	hali	deep	lift	lin
Roof										
Pond										
Spring										
Well										
s/w										
Dam										
Pot										

Comments: ____

G4 **Why did you or somebody else develop this source ?** ....

G5 **How can/did you find this source?**

Geo-indicators: slope..................................
soils..................................

Bio-indicators: tree/bush..............................
grass..................................

Non-indicator: latrine...deep....dry, grave...deep....dry
Comment..
....

G6 **Which solution(s) do you attach to the following problem?**

Long walk..........................
Turbide water......................
Diarrhoea in children..............
Bilharzia..........................
Queueing...........................

HEALTH AND HYGIENE PRACTICES

H1 **What illnesses are related to water?** ....
....

H2 **How does a water-related illness affect your body?** ....
....

H3 **How did your parents store the drinking water? And you?** ....
....

H4 **Is there a change in taste after**
(a) **storing the water one day?** No....... Yes............
(b) **boiling the water?** No....... Yes............
Would you drink boiled water? ....and if so, where
....

H5 **Can you improve water quality by storing water ?** No, because...........
Yes, by..............
....
....

H6 **Is handwashing before meals and after defecation practiced in your household? Is soap used?** No....................
Yes, because..........
....
....

H7 **Is faeces from children under five as contaminated as adults'?** No.....................
Yes....................
....

H8 **Can the water in a well/pond be polluted by a latrine?** No.....................
Yes....................
....

H9 **What beliefs are there connected to water and water soures**

(a) Ntemi bless well by adding blood from black cow or a mixture of excreta/alum/bird ....
....

(b) The course of a spring may change if a mother of twins is cleaning the well or there is a quarrel at the well.
....

(c) Your nzoka/nyoka in the stomach may refuse to drink the water ....

(d) ____
____
____
____
____

I ATTITUDES TO CHANGE AND ADOPTION

I1 **If you were to choose, what option would you like? Why?**

Sweet but not salama - salama but salty ....
You dig close to house - communal far away..............
Invest in gutter/drum - buy a khanga....................
Handwash after defecation - before meal.................

I2 **Last time we meet we discussed different improvements of the water sources. What thoughts and discussions have you had since then?** ....
....

I3 **What reason(s) are there to change and not to change the conditions?**

	Proposal A	Proposal B	Proposal C
+			
-			

Comment..
....
'Hesawa-if'..
....

I4 **What contribution to improve water conditions do you expect from:**

	Turn-key	*Own-key*
Spouse	....	....
Neighbours	....	....
Leaders	....	....
Nsumba ntale	....	....
Yourself	....	....

I5 **There are three broad ways to go about improving water conditions, name some features for each level:**

	cooperation	enforcement	economic exchange
hh	....	....	....
nh	....	....	....
vil-lage	....	....	....

Comment..
....
....
....
'gender-if' ....

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GLOSSARY

Balozi	Leader for a group of ten households (after 1961)
Banamhala	Old men; an age grade with society or association, members of the assembly of neighbourhood elders
Basumba	Work group of young men (traditional)
CCM	Chama cha Mapinduzi (the revolutionary party)
Dawa	Medicine
Gunguli	Parish; part of a village
Hesawa	Accronym for a water and sanitation programme in the Lake regions, "Health through Water and Sanitation"
Ifogong'ho	Lending fund run by a group, often all residents in a sub-village
Inselberg	Granite outcrop
Isanga	Sandy soil derived from granite or marshy sandy lake-shore potato soil
Itogoro	Sandy clay loam capable of pan formation
Jembe	Hand-hoe (also name of modern steel-plough)
Katibu	Village secretary or ward secretary (modern)
Kitongoji	Sub-village
Lambo	Dug catchment with a wall and no spillway
Luseni	A pale-coloured fine sandy soil similar to *isanga*
Maji	Water
Maji safi	Clean, tasty water
Maji salama	Safe water
MAJI	Accronym for the Ministry of Water at national, regional, and district level
Mbuga	Valley; usually with dark heavy clay soils
Miombo	Wooded savannah
Mganga	Doctor (both modern physician and traditional healer)
Mkuyu	*Ficus sonderi*
Nfumu	All different types of diviners and local doctors
Ng'wolo	Neglectful wife
Nsumba ntale	Leader of a *basumba* group within a village
Ntemi	Chief before independence, today name of the leader of the village *sungusungu* group
Nzala	Famine
Pombe	Locally brewed beer
Sungusungu	Security or vigilante group in a village
Tawala	Lead, administer or reign
TANU	Tanganyika African National Union (political party, now CCM)
Uchawi	Witchcraft
Vijidudu	Microorganism

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This is a study of the incentives and constraints which bear upon people's ability to improve access to and quality of household water through their own cooperative and household efforts. The focus is on community-based management and control of human and physical resources. Equal emphasis is given to understanding *continuity* aspects (doing more of the same) and *change* (doing new things).

Thirty knowledgeable informants from six rural villages in Sukumaland provided the bulk of the information. They live in an area with a semi-arid to sub-humid climate situated south-east of Lake Victoria in Tanzania.

Human and physical factors influence what takes place on the local scene and a model is developed to analyse water-related activities. In-depth interviews and observation provide the basis for an exploration of ways in which individuals and neighbourhoods reason and act to obtain household water of acceptable quality at a reasonable distance. The interviews were aimed at elucidating the actual levels of knowledge and technical skills employed in effecting specific improvements. The informants' knowledge of hydrogeological conditions and of the hygienic aspects of water use are appraised and compared with full professional standards of knowledge.

Sukuma norms about water-related issues have been explored: water rights and control over water sources, and household and cooperative efforts. Informants' individual values on these matters are compared with the norms. The aim is to learn the ways in which both norms and individual values affect negotiations about proper measures in the community and within the household.

Four major findings come out of the analysis. The first is that villagers in general believe that there are affordable and manageable solutions to their own household water problems. Secondly, government and donor involvement in the household water sector tends to inhibit more advanced local initiatives and activities. Thirdly, the present gender-based division of household tasks interferes negatively with improvements. Finally, there are considerable differences in the value placed upon different kinds of accessible water sources by outside observers and the villagers themselves

The prospects for future improvement in household water conditions are heavily influenced by the rapid population increase. The capacity for government interventions is limited, and in future most efforts to develop water supplies are expected to be made by individuals and neighbourhoods The hydrological conditions allow for the provision of enough household water well into the next century, although the population growth will eventually cause water scarcity and hit food production.

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