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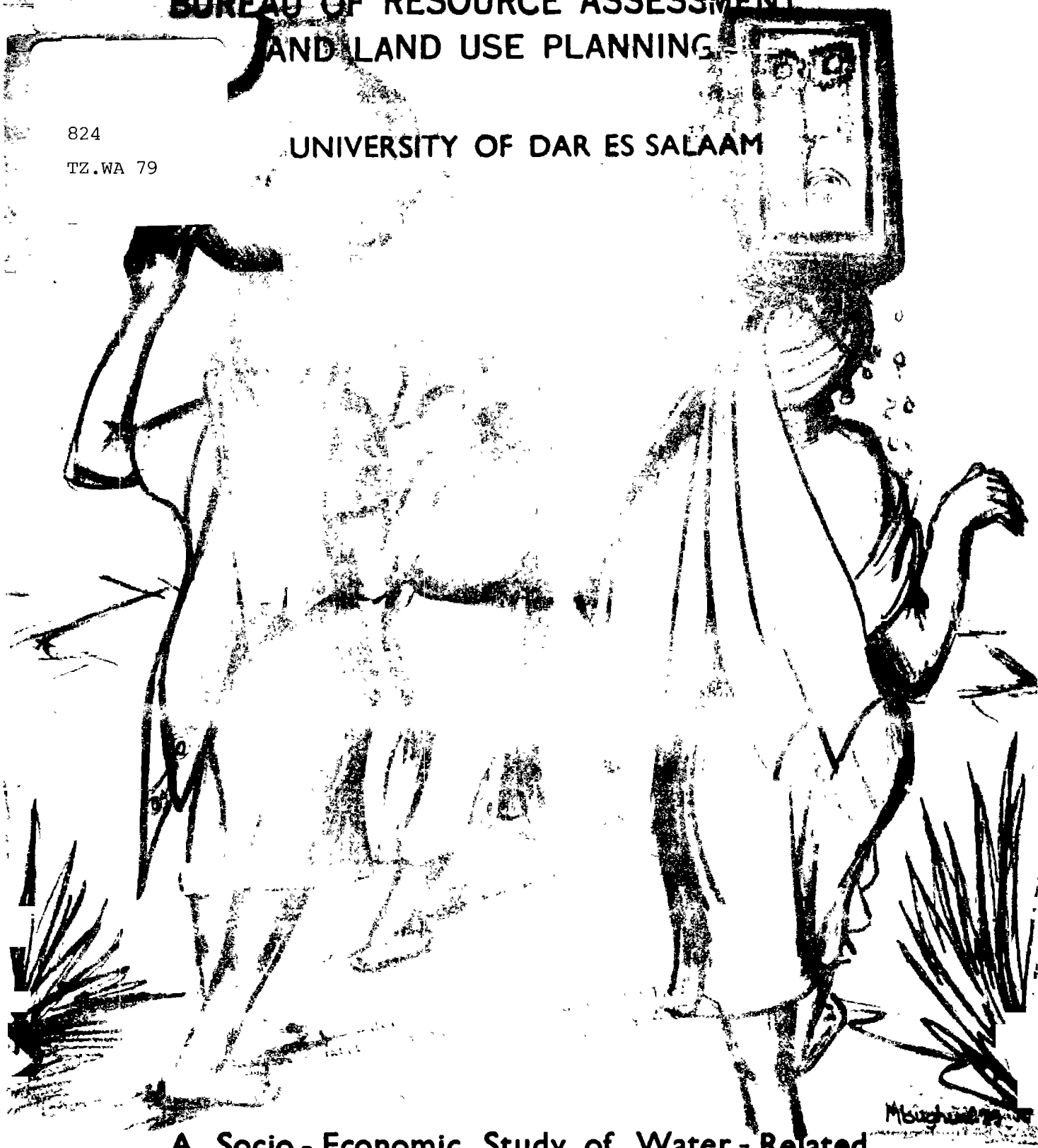

A Socio-Economic Study of Water-Related Problems in Northern Njombe

by

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Research Paper No. 54

1214

WATER TO THE VILLAGES

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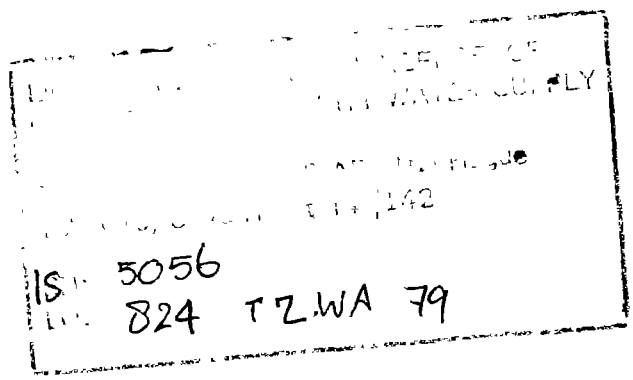

" Rejoice bridegroom
from now on
you don't have to worry
about water and fire-wood
she will bring them for you "
(from a kibena song)

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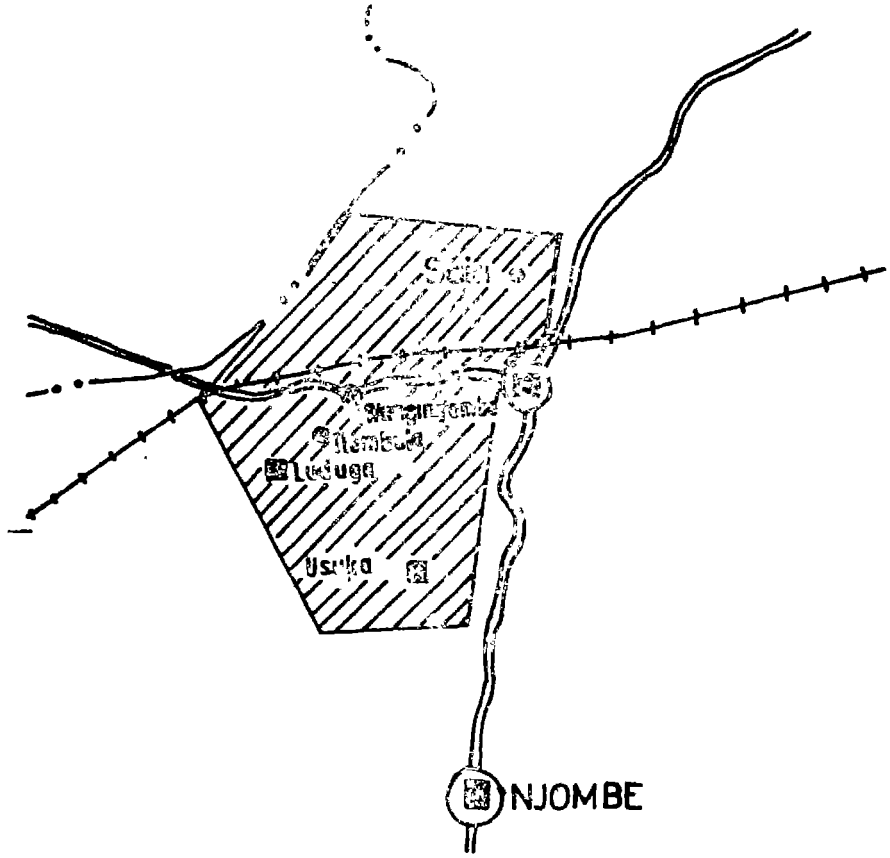
LOCATION OF THE
WANGINGOMBE NORTH WATER SUPPLY PROJECT



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P R E F A C E

BRALUP has had a tradition of studying issues related to domestic water supply. This study is of particular importance because it was undertaken at a time when a related study at an international level was being undertaken. In October 1977, the Director of BRALUP was seconded to UNICEF/WHO as an advisor on a project to review and recommend proposals on 'Water Sanitation as Part of Primary Health Care'. It soon became obvious to the advisor that although the international organizations, particularly UNICEF and WHO had been involved in water related activities for the best part of the last three decades, valuable opportunities for improvement were lost because among other factors, no monitoring was done on the impact of water and sanitation projects. The lesson which could have been learnt by the donors and recipients, were becoming a matter of urgency because preparations for the international water development decade, beginning in 1980, were being shaped. A draft of the report being prepared in Geneve was circulated to senior members of staff in BRALUP working on water related projects, so that there could be some awareness, information and coordination of ideas between the local level and the international bodies.

The study at Wanging'ombe was undertaken by Stahl (political scientist), Ms. Sachak (geographer/agricultural economist) and Mkusa (civil engineer). The background of the researchers was varied and included a woman. The study was undertaken at a difficult time in BRALUP and all three have to be commended for the extra effort they put into the study. There was participation from several institutions, most notably Tanzania Food and Nutrition Centre, the regional and district health authorities and Ardhi Institute; the Prime Minister's Office through the Regional Development Director's Office in Iringa and especially the Regional Water Engineer. Finally, the personal interest in the study by the Honourable Minister of State, Ndugu Jackson Makwetta, gave extra impetus to the study.

This study would not have been possible without the encouragement of Mr. Alex Tosh, UNICEF Representative in Tanzania. It would have been all too easy for him to draw a general agreement, to stipulate contents, schedules and deadlines, to design a detailed UN type questionnaire and even hire consultants and experts to jet in and out of Tanzania. Instead, he made it possible for BRALUP to undertake the project even to the extent of providing a vehicle.

The experience gained from the study will be used to refine techniques, to concentrate on the attainable and to collaborate with other institutions so that with the addition of their skills and efficiencies, the local capacity

to identify problems and perhaps even to solve them, will be increased.

The study comes out with several 'findings', the most significant being that the people of the area have suffered from the constraint of inadequate water, that there is a seasonal variation in water supply, that diseases related to water are common, that per capita consumption of water is less for the larger families, and child malnutrition and mortality is high. Many of these findings are common to the developing countries but their permeation make each area almost unique.

The findings, even if they appear as problems, should be tackled, for problems do not resolve themselves. Some of the problems could be resolved through the participation of the local people. However, at present, the peoples' sense of ownership of the scheme is missing and their expectations from the scheme are only short term and modest. Problems and difficulties can also be overcome by better planning. In this respect, plans of a general nature are not sufficient and the relevance of detailed planning becomes more apparent in such features as the size of tanks or in the location of the stand pipe even to the nearest 100 metres! Finally, rural water supply cannot be treated in isolation and if the picture that is depicted in this study seems complex, it is a reflection of the fact that development is not a simple issue.

Adolfo C. Mascarenhas
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Chapter 1 THE STUDY AREA

The area under study is situated on the fringe of the Southern Highlands. It forms an intermediate zone between the Njombe high lands and the Usangu plains. The area is roughly delimited by the old Njombe-Mbeya road, the Njombe-Makambako road and the regional border between Iringa and Mbeya (see map 1). The Tan-Zam highway and the TAZARA railway run straight through the area. Administratively the area covers Saja, Wanging'ombe, Ilembula and Luduga wards in Wanging'ombe division and Usuka ward in Mdandu division. The area is sometimes referred to as Northern Njombe and sometimes as the Wanging'ombe area. Here both names will be used interchangeably with the obvious name "the project area" or simply "the area."

Viewing the area from Wanging'ombe village one can see the cool, cloudy plateau of Njombe rising to the South-East and the rugged Kipengere mountains further to the South. Looking North-West the landscape slopes down along a series of plateau steps until it joins the hot and dry plains of Usangu.

The transitional character of the area is evident. The southern most part around Mdandu appears as an extension of the Njombe highlands; it is hilly and relatively cool receiving more rainfall and containing land units of the more fertile red highlands soil. Near Mdandu the altitude is 1,700 meters and average annual rainfall is 758 mm. In the central part of the area, around Ilembula and Wanging'ombe, altitude has fallen to 1,400 meters and rainfall decreased to 525 mm. per annum, while corresponding figures for Saja in the North are 1,200 meters and 605 mm. North-West of Saja the landscape grows unnoticeably into the Usangu plains across the border of Mbeya. Totally the project area covers some 1,600 km^2; 40 km from South to North and 40 km from West to East.

The rainfall regime puts visible stamp on the landscape. The rains fall during one continuous season which is followed by a long dry spell. December to April are characterized by frequent downpours.

During this period the grass is green, crops grow and water runs in streams. The rains cease in April and by early July the dry spell has already made the grass wilt and the trees shed their leaves. The landscape, now painted greyish brown, becomes dormant waiting for the December rains.

The deep but sandy soils in Northern Njombe originally carried a climax vegetation of woodland and wooded grassland. In the Southern and central parts woodland was of the Miombo type while in the Northern parts Acacia woodland and wooded grassland seem to have been the natural vegetation.[1)]

Today woodland remains only on steep slopes and in the Northwestern corner of the area. Elsewhere human settlement and activities have transformed the natural vegetation into grazing grounds and cropland.

Already in the 1930's the Wanging'ombe area was known for its water problems. The first report in the district office files on rural water suppplies in 1938 acknowledged that a significant problem existed in Northern Njombe where "recourse to digging in river beds is made from August until the breaking of the rains in December."[2)] Throughout the colonial period reports refer to the Wanging'ombe area as an area suffering from severe water shortages during the dry spell. Despite out-migration from the area, its population has increased rapidly and the recent campaign to resettle the population in villages has further aggravated the water problems.

It was only in 1977 that construction of a large-scale water supply project was started. The Wanging'ombe North Water Supply Project (WNWSP) has been launced to provide a long-term solution to the domestic water problems of the population in Northern Njombe.

This study deals only to a limited extent with the water project itself. Its focus is instead on the people living in the area, their means of subsistence and the problems they encounter. The study attempts at providing socio-economic baseline data of the area, the emphasis is on the water-use pattern and the health problems - the two aspects which are most likely to be affected by the Wanging'ombe North Water Supply Project. For the purpose of the future evaluation

of the (WNWSP), this study is then the "before"-study which should be complemented with an "after"-study when the project has functioned for some time.

Chapter 2 THE WANGING'OMBE NORTH WATER SUPPLY PROJECT

Background

There has for long been an awareness of the critical problems of water supply in the Idandu-Wanging'ombe-Saja area in Northern Njombe. As early as the 1960's a project to supply the population with drinking water was considered. Early surveys carried out by MAJI (the Ministry of Water, Energy and Minerals) identified three potential sources of water for Northern Njombe; groundwater and surface water within the area and the river Mbulwa in the Njombe highlands.[1)]

In 1969 an attempt by MAJI to provide water from Huhuni river close to Wanging'ombe failed because this river dries completely at the end of the dry season. With assistance from UNICEF, MAJI then made an attempt to solve the problem by drilling boreholes. Ten boreholes were drilled at the cost of Shs.700,000. The results were disappointing, only two boreholes had "good" water in a sufficient quantity, the remaining ones had saline water or no water at all (see table 2:1). The idea of boreholes had to be shelved.

Table 2:1 Boreholes Drilled in the Wanging'ombe area 1975-77

Village	Yield g.p.h.	Water quality
Iyayi	2,800	good
Halali	1,700	good
Ikingula	1,600	saline
Utiga	1,500	saline
Ujindile	500	saline
Saja	900	saline
Uhambule	600	saline
Mayale	dry	
Palngawano	dry	
Nyanyembe	dry	

(Source: Regional Water Engineer's Office, Iringa)

Therefore the only alternative left was a gravity scheme from the river Mbukwa in the Njombe highlands near Mdandu. Land surveys had commenced in 1970/71, by 1973 engineering designs and cost estimates were completed. The design provided for a water requirement of 7,700,000 liters per day sufficient for a 100% increase of the design population which was estimated at 83,367 by 1976. According to the calculations there would also be enough water to provide for cattle troughs and tobacco nurseries.*

The maximum discharge capacity of the water source is 106,272 m^3/day. The demand flow (7,700 m^3/day) is about 20% of the maximum flow. In June 1977 the regional authorities in Iringa formally asked the Tanzanian Government and UNICEF to abandon the borehole project in favour of the gravity feed project. The proposal was accepted and an agreement was signed between the Tanzanian Government, UNICEF and WHO on the revised water project. This project is called the Wanging'ombe North Water Supply Project (WNWSP).

Project Outline

According to the agreement the Regional Water Engineer's office (Iringa region) is in charge of the construction. The contribution of UNICEF is by and large financial, covering the bulk of the construction costs. Administrative responsibility for the implementation of the project is vested in the Regional Water Engineer who is answerable to the Regional Development Director (RDD). Moreover the RDD "represents and protects the interests of the people to be served by the project". MAJI headquarters in Dar es Salaam has no direct executive capacity, its role is one of technical adviser.

The total cost of the project was estimated at Sh. 34,500,000 (approximately US $ 5 million) in 1976. Building materials worth Sh. 28,000,000 are to be purchased by UNICEF and a construction cost of Sh. 5,700,000 shall be met by MAJI. Self-help labour provided by the villagers for pipeline excavation is estimated to cut down construction costs by some Sh. 1,200,000.

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* MAP 2 shows the Layout Plan of the Wanging'ombe Water Supply Project.

In Table 2:2 the original bill of quantities is summarized. The grand total was originally Sh. 31,270,130 but was later reviewed upwards to Sh. 34,500,000.

Table 2:2 Summary of Bill of Quantities of WNWS Project

Item	Total Cost (Sh.)
Intake	238,000
Treatment plant	2,000,000
pipeline & connections	25,220,000
Storage tanks	1,612,800
Break pressure tanks	214,200
Domestic points	317,520
Cattle troughs	1,667,610
Total	31,270,130

Construction work started in November 1977 and is supposed to be completed by 1981.

The source of supply is the perennial river Mbukwa in the Njombe highlands. The catchment area of the Mbukwa will be protected by afforestation and declared a forest reserve. Water is to be diverted from the river to an intake plant, after which it passes through a treatment plant and is then led by gravity to the 42 villages.

The intake plant includes a set of flow control weirs and two valve chambers built in blockwork. Water is tapped from the left bank of the river. For flood proctection a spillway is to be designed and constructed about 100 m from the intake (upstream). It may be necessary to build another small bridge to provide for the spillway. In March 1978 a big flood damaged the intake and delayed construction work. However, by March 1979 the intake structure was completed.

The treatment plant is a six-unit slow sand-filter with a water surface area of 1,782 m^2, giving a filter loading of 4.32 $m^3/m^2/day$ which is higher than the WHO recommended rate (2.8 $m^3/m^2/day$) for optimum filtration. The working depth of the water shall be 1.2 m; sand 1.0 m and gravel 0.55 m.

The water will run in pipes. Totally 230 km. of p.v.c. pipes will be laid. At some points the water pipiline crosses the TAZARA railway, the TANZAM highway, the TAZAMA oil pipeline, and the Njombe-Mbeya trunk main road. For the roads and the railway the pipeline will pass under the culverts, but for the oil pipeline a crossing detail may be designed.

Excavation of the trench is being done by the villagers self-help basis. An adult villager is supposed to excavate about 1x1x3 m^3 per day. UNICEF has bought excavation tools such as hoes, picks and spades.

Altogether 17 break-pressure tanks will be constructed. The pipeline system is shown in map 2.

At each village a storage tank will be constructed. They are circular tanks based on standard designs of reinforced blockwork between reinforced concrete floor and roof. The capacity of the tanks vary between 45,000 liters and 90,000 liters.

A distribution system of domestic points and cattle troughs is mentioned in the bill of quantities. Design and cost estimates are yet to be done.

Chapter 3 PARAMETERS FOR THE EVALUATION OF THE WNWSP

The official justification for the large investments in rural water supplies in Tanzania has been twofold. On the one hand easy access to clean drinking water has been regarded as a basic need and a human right, hence it is the responsibility of the Government to supply the citizens with domestic water. On the other hand an improved water supply is supposed to have an indirect effect on productivity, when the householders have easy access to water time and energy will be released for more productive work.

In Tanzania's Second Five Year Development Plan (1969-74) the justification for the rural water supply programme was expressed thus;

> "The provision of adequate water supplies to rural areas is of high priority both on social and economic grounds. Economically, water is not only a critically important input to the agriculture and livestock industries, but the provision of better domestic water supplies will both release much labour currently consumed in carrying water for other productive purposes and allow a more efficient pattern of settlement. The provision of better rural domestic water supplies is also a necessity for the achievement of a better quality of rural life, both in health and convenience, which can provide a counter-attraction to the convenience of urban living." 1)

This optimistic mood was reflected in evaluation studies of water projects conducted in the early 1970's. In Tanzania Warner's studies set the stage.[2] His ambitious approach to evaluation of water projects aimed at measuring not only the impact of water on health and productivity but also on ujamaa-socialism, self-reliance, modernization and education. However, research on the impact of rural water supply schemes has shown that the relationship between water and development is far from straightfoward. Concerning the supposed impact on production it has been demonstrated that, while an improved water supply often is a necessary condition it is <u>not</u> a sufficient condition for general village development.[3] Moreover, when productivity has increased in villages provided with improved water supply it has proved difficult to show to which extent the increasing productivity was due to the water supply rather than to any other independent variable.

The relations between improved water supply and health have been shown to be complex. One conclusion which can be drawn is that although people get sick when they drink contaminated water, it is not at all certain that their health will improve when clean tap water is installed in the village. One of the researchers in this field, Richard Feachem, has expressed the matter incisively:

> "What faith is it that makes us hope that the provision of rural water supplies, or other environmental improvements, will convert poor, deprived, sick children into poor, deprived, healthy children." 4)

It is clear, then, that people will not automatically benefit from any project resulting in water pouring out of a tap. When speculating on the future impact of the Wanging'ombe North Water Supply Project a cautious attitude is thus motivated. It should be stressed that the poverty of the people living in the Wanging'ombe area will not and cannot be solved by the water project. And as long as the general poverty prevails the diseases typically associated with water are also likely to prevail.

Inorder to be able to assess the WNWSP in a developmental context an inventory of viable economic opportunities in the area should be made and possible links to the water project should be assessed. The Wanging'ombe area was still in 1978 dormant in many respects. The distorted male-female ratio in the villages (see Chapter 4)indicates that adult men see migration as a serious alternative; the best thing they can do is to leave the area and look for opprtunities elsewhere.

But this pattern could change in the near future. A number of infrastructural and directly productive projects will affect Northern Njombe in the early 1980's. The TANZAM highway and the TAZARA railway run through Northern Njombe. TAZARA has a major railway station in Makambako, 16 km Northeast of Wanging'ombe village. The road between Songea and Makambako, passing through Njombe, will be upgraded in the next few years and will then greatly increase the traffic flow feeding into the TANZAM highway. Makambako will thereby emerge as a major junction in the communication system linking Southern Tanzania with Dar es Salaam.

A rural electrification programme will also be implemented in the area at the turn of the decade. As part of the development co-operation between Denmark and Tanzania, DANIDA will embark on a project to electrify the villages along the road between Njombe and Makambako and further, the villages along the TANZAM highway from Makambako to the border of Mbeya. It has been proposed that only houses with corrugated iron roofs will be provided with electricity. The project area of this electrification project thus largely coincides with the WRWSP area.

Tobacco cultivation has been promoted, on a limited scale, in the villages in Northern Njombe since 1974. Tobacco growing, promoted and supervised by the Tobacco Authority of Tanzania, will be intensified and expanded in the villages in the early 1980's.

The Wanging'ombe North Water Supply Project is thus only one among many development projects which, in one way or another, will affect the living conditions of the people in Northern Njombe.

The evaluation of the water project will be undertaken sometimes in the 1980's. It is suggested that the evaluation, in addition to measuring goal-achievement in the more narrow sense, should try to asses the project as part of the totallity of governmental and para-governmental policies implemented in the area.

The objective of this report is, on the other hand, limited to establishing baseline information which will make it possible to measure goal achievement in a more narrow sense. Taking the officially stated goals of the WNWSP (improved health, reduced walking distance to source of water - see below pp. 11) as points of departure the concentration of this report is on the description of the water - use pattern and the health conditions of the population in the project area. This description will make it possible to measure possible changes in these parameters when the project becomes operational. Moreover the report presents data on the population and settlement in the area, the agricultural system and cattle keeping so as to give a broad picture of the major features of the local economy.

The Goals of the WNWSP

In the introduction to the operation for the project it is stated that the per capita daily water use in the Wanging'ombe area is extremely low and the distances travelled by women to collect water is long. This was the reason why this area was selected by the Government for priority attention within Iringa region when the Tanzania/UNICEF rural water supply project was first drawn up.

In the plan of operation the general objective of the WNWSP is identical with the Government's long term rural water policy, i.e. to provide every village with a supply of clean water at a distance not longer than $\frac{1}{4}$ mile by 1991. 5)

The specific objective is defined as to implement the WNWSP, to promote among the beneficiaries a sense of ownership of their water supply and to teach simple antipolution measures which should be observed to preserve the quality of the water. 6)

While there is no direct reference to health in the plan of operation, this goal is mentioned in other sources. The Minister for Water, Energy and Minerals in his speech to the Parliament in 1978 mentioned the Wanging'ombe Rural Water Supply Project:

> "The Maji Wanging'ombe Project will supply water by gravity to more than 50,000 people in 45 villages in North Njombe district from the Mbukwa river. Ndugu Speaker, it will be remembered that 1978 is the International Year of the Child. The Government recognizes the vital part played by clean water in protection and development of children in Tanzania. Therefore, our effort to provide water supply to the people are made in full knowledge that inadequate and unclean water contributes to ill health among children. It is with this understanding that this project is being constructed with the assistance of UNICEF." 7)

UNICEF's involvement in the project is, by definition, justified with reference to potential health benefits. The target group of all UNICEF sponsored projects is the children. However, in UNICEF's conception the welfare of mothers is inseparable from the welfare of children. UNICEF has chosen to view mother and child welfare in a broad societal context and UNICEF projects aim at providing the basic services which are a prerequisite for mother and child welfare. The Tanzania Government has given high

priority to the provision of rural water supplies and the UNICEF programme to augment child welfare through rural water projects is in accordance with the general governmental policy.

We can now conclude this brief review of explicit and implicit goals of the WRWSP by formulating them as (i) reduction of walking distance for the water collectors and (ii) improving the health situation.

Popular Expectations of the WNWSP.

In order to explore which expectations the people in the Wanging'ombe area had of the project one question in the household survey *) asked which benefits the respondent thought would accrue to him/her from the project. The question was open-ended and the answers could be categorized as shown in tables 3:1 and 3:2.

Table 3:1 Popular Expectations from the WNWSP - Male Respondents

Village	Expectation					
	Reduced walking distance	clean water	more water	gardening	water for cattle	no benefits mentioned
Saja	35%	30%	3%	14%	9%	9%
Lyamluki	-	11%	-	50%	17%	22%
Luduga	34%	31%	5%	20%	5%	5%
Igwachanya	36%	41%	5%	14%	3%	1%
Total	32%	32%	4%	18%	7%	7%

/ Total No. of h.h. in sample : 186 /

(Source: BRALUP survey of Saja, Lyamluki, Luduga and Igwachanya, 1978)

* See chapter seven for a presentation of the survey.

Table 3:2 Popular Expectations from theWNNWSP - Female Respondents

Village	Expectations					
	Reduced walking distance	clean water	more water	gardening	water for cattle	no benefits mentioned
Saja	36%	43%	3%	4%	-	14%
Lyamluki	25%	6%	-	31%	-	38%
Luduga	35%	32%	-	15%	-	18%
Igwachanya	44%	36%	-	3%	-	17%
	37%	36%	1%	8%	-	18%

/Total No. of h.h. in sample : 186/

(Source: BRALUP survey of Saja, Lyamluki, Luduga and Igwachanya, 1978)

The responses show that the popular expectations from the project by and large coincide with the officially stated major goals. Actually, many respondents mentioned both clean water and closeness to water source. However, gardening (small-scale irrigation of tomatoes and onions) and water for cattle (cattle-troughs) are also mentioned.

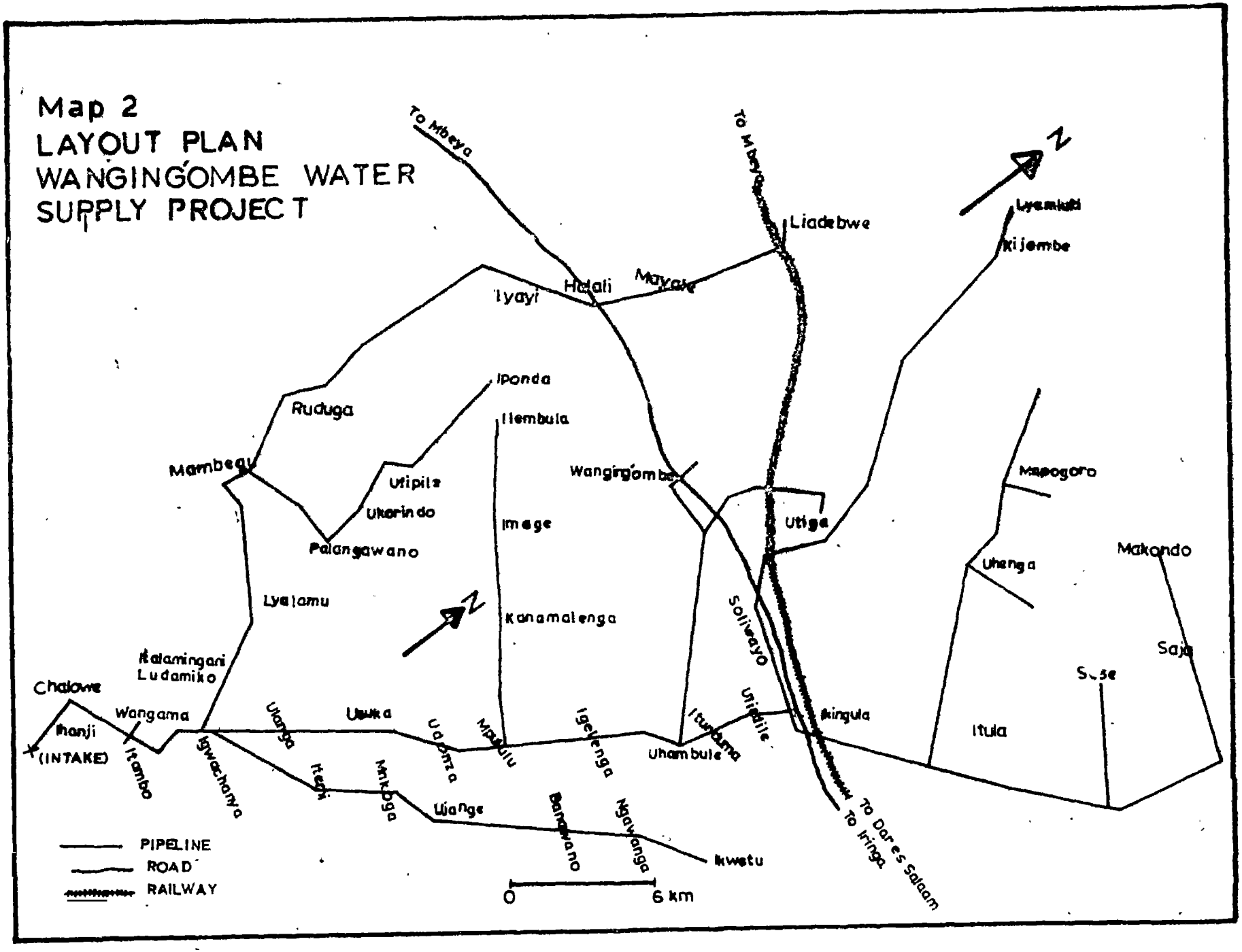
Considering the differences between male and female respondents, the males took more interest in the needs of the cattle, and also in gardening. There were differences between the villages. The proportion of respondents who do not expect any benefits from the project is highest in Lyamluki. When the survey was conducted (May, 1978) construction work had been initiated in the three other villages but not in Lyamluki. The high proportion of respondents without expectations in this village may therefore be due to the fact that little information on the project had reached Lyamluki at that time. On the other hand two respondents in Saja stated that they knew about the project but still did not think that it would bring any benefits.

Table [illegible] Responses [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
no benefits mentioned	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible] village [illegible] proposal [illegible] the project [illegible] (May, [illegible]) [illegible] [illegible]


Map 2
LAYOUT PLAN
WANGINGOMBE WATER
SUPPLY PROJECT
To Mbeya
To Mbeya
Liadebwe
Lyamkuki
Kijembe
Hdali
Mayale
Iyayi
Iponda
Ruduga
Iiembula
Mambegi
Utipili
Ukerindo
Palangawano
Wangingombe
Utiga
Mapogoro
Makondo
Uhenga
Imege
Lyelamu
Kanamalenga
Solwayo
Saja
Kalamingani
Ludamiko
Chalowe
Wangama
Ihanji
(INTAKE)
Itambo
Igwachanya
Ukanga
Usuka
Udonza
Mpululu
Igelenga
Uhambule
Itunduma
Utigilile
Ikingula
Itula
Susa
Ikwetu
To Dar es Salaam
To Iringa
PIPELINE
ROAD
RAILWAY
0
6 km

Potential Benfits from the WNWSP

For the following analysis it will be instrumental to relate the project goals to a mattrix presented by Feachem, according to which all water projects could be monitored and evaluated. [8] Acording to this matrix one should distinguish between the immediate aims of a water project, the short-term potential benefits and the medium to long-term potential benefits. The immediate aims include:

- improved water quality
- increased water quantity
- improved reliability of water supply.

These factors are self-evident to the point of being trivial. Nevertheless the Tanzanian experience shows that failure to achieve even the immediate aims is very common. Among the reasons are errors in design and planning, poor construction, vandalism etc. [9] But if the immediate aims are fulfilled then a number of potential benefits may accrue to the population. Feachem distinguishes between short term benefits and medium to long term benefits. [10]

The short-term benefits can be formulated in terms of cost reduction. The costs to the water collectors include time and energy spent during the water collection journey as well as the cost of illness due to water -related diseases. The short term benefits can then be formulated as:

- saved energy and time to the water collectors
- improved health.

These categories coincide both with the officially stated goals of the WNWSP and with the major expectations expressed by the population in the project area. For the purpose of the evaluation of the WNWSP it is therefore suggested that goal achievement should be measured in these terms. Moreover, the goal of promoting a sense of ownership of the project among the beneficiaries should also be included. These parameters for goal assessment will be specified and operationalized in the following chapters.

Chapter 4 POPULATION AND SETTLEMENT IN NORTHERN NJOMBE

Population Movements

Northern Njombe or, more precisely, the Saja-Wanging'ombe-Mdandu area is part of the Ubena tribal homeland. History indicates that this area was a populous part of Ubena already in the 19th century. The local economy was based on grain cultivation (Wabena means "people who cut millet"). In addition, salt was produced in Saja and traded in neighbouring areas.[1] Politically, the Wabena were weak and had to yield to the more powerful Sangu, Hehe and Ngoni peoples who contested for military supremacy over the Southern Highlands.

The colonial policy, established by the Germans and continued during the British period, defined the role of Ubena as a labour reserve. This labour was destined mainly for the sisal plantations in Tanga. After World War II the Sisal Labour Bureau established a staging and rest camp for migrant labourers in Makambako. In 1947 the district officers estimated that 50% of Njombe's adult males were working, at least temporarily, outside the district. The 1948 Census indicated that 30% or more of those identifying themselves as Wabena lived elsewhere than in Njombe and in the 1950's, 1,488 people from Wanging'ombe were reported as residing in Tanga.[2]

On the other hand, in the late 1940's there was considerable in-migration to Wanging'ombe mainly from those 5,000 families evicted from their homes in the Njombe highlands to make way for the establishment of the 44,000 acre plantation of the Tanganyika Wattle Company.[3]

Settlement Pattern

The traditional settlement pattern in Northern Njombe was dispersed. In the vicinity of administrative centers such as Mdandu, Ilembula, Wanging'ombe and Saja, nucleated settlements had developed but elsewhere the peasant families lived scattered. This settlement structure was conditioned by the extensive character of the cultivation system (long fallow periods) and by the scarcity of water during the dry season. By spreading out settlement the pressure on land and water resources was more evenly distributed.

This pattern was abruptly changed when "Operation Sogeza," the national campaign to move the rural population into villages, was implemented in Iringa region in 1974. The decision to embark on a nationwide villagization programme was taken by the Party leadership in 1973. Implementation was to start in 1974 and to be completed within two years. It has been argued that the rationale of this ambitious programme was based on potential benefits concerning provision of social infrastructure to the rural population (schools, dispensaries, water supply etc.) and government control of the whole "rural development process." 4)

In Iringa region the villagization was implemented in one big campaign during the latter part of 1974. The implementing force was the regional party and government authorities backed up by police and militia. The number of villages created was taken as a criterion of success.

Administratively the campaign was a success. It was reported that 98.8% of the rural population in the region had been resettled in villages by the end of 1974. 5

The general idea behind villagization must be positively assessed. Any development effort that goes beyond the capacity of the single household necessitates a geographical concentration of human resources. Nevertheless, the particular form of villigization in Iringa created a number of problems which tend to counteract the potential benefits of villagization.

The UNDP/FAO team engaged in rural development planning for Iringa in 1975 pointed out the short and medium problems arizing from villagization. The short-term problems were associated with the layout, size and location of the villages. The argument was that many villages were simply too big and far away from water sources. The medium term problems were associated with population growth and maintenance of the productive capacity of the land. 6)

Operation Sogeza saw the establishment of 33 registered villages in Wanging'ombe division. Comparatively few new villages were created. Instead a number of already existing nucleated smaller settlements were chosen as village sites and the people living in scattered homesteads around these settlements were moved into them to form officially registered "development villages." Proximity to roads was used as a

general criterion for village location. The population was thus settled along local roads. The standard layout became double rows of houses stripped out on both sides of the road in a ribbon fashion. The villages tended therefore to acquire an elongated structure. As a rule the villages are 2 - 4 kilometers long but in some villages the distance between the far ends is even more (Saja; 7 km. Ilembula; 8 km).

Some changes have occurred since 1974 - neighbouring villages have grown together while others have been subdivided but the "ribbon-fashioned" physical structure of most villages still remained in 1978.

Observing the situation in 1975 the UNDP/FAO planning team noted that it had been the local policy in Njombe district to create large villages. Wanging'ombe division was mentioned as an example.[7] In the light of the population figures from the 1978 census it seems that the population estimates used in 1975 were inflated. Nevertheless some attempts were made in 1975-78 to subdivide large villages. Ilembula is an outstanding example. Ilembula represents a very dense settlement comprising more than 600 families. In 1976 the village was divided into three villages: Ilembula, Igula and Igeleheza each comprising some 200 families. However, the settlement pattern remained intact. There is no open space in between the villages, the borders are purely administrative. Such a subdivision has of course nothing to do with ecological solution to the village-size problem.

Lyamluki is an example of a new village. It has been set up in the woodland area north of the railway. Although there was some settlement here prior to 1974 most of the inhabitants are "excess" people from other villages who settled here during the villagization campaign. North of Lyamluki up to the regional border there is still woodland (appr. 200 km^2).

According to the 1978 population census there were altogether 42 villages in the project area. The total population was 53,121 grouped in 12,566 households.[8] The average number of households per village was thus 299. The actual distribution of village size is shown in the table below.

Table 4:1 Number of Households in Villages

Ward	/200	200–299	300–399	400–499	500–599	600–699	700–799	All Villages
Saja	1	1	1	1	-	-	1	5
Wanging'ombe	3	4	3	1	-	-	-	11
Ilęnbula	2	5	3	1	-	-	-	11
Luduga	1	1	1	3	-	-	-	6
Usuka	2	4	-	1	2	-	-	9
TOTAL	9	15	8	7	2	-	1	42

(Source: Population Census 1978, Household Survey Sheet, Njombe District)

Population Size and Growth

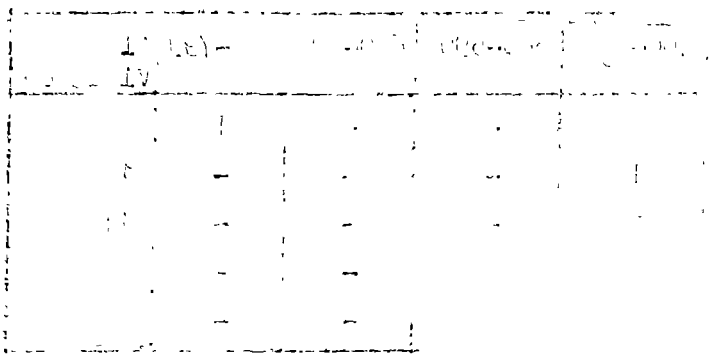
The first population estimate for the area dates back to 1930 when, according to the census, there were 17,273 inhabitants in Wanging'ombe sub-chiefdom (which by and large coincides with the present-day Wanging'ombe division).[9] The 1967 Census reported 31,591 people in Wanging'ombe sub-division - an increase of almost 100% in 37 years.[10] Data from the latest census gives the population figure for Wanging'ombe division (Saja, Wanging'ombe, Luduga and Ilembula wards) at 41,437. Population growth has thus been 9,846 persons in eleven years (31.2%) while the annual growth rate has been 2.5%. Compared to the growth rate for Tanzania as a whole (3.2% per annum) the population in Wanging'ombe has increased at a slightly slower rate.

The total population in the project area (which is bigger than Wanging'ombe division, it also includes Usuka ward in Mdandu division) as of August, 1978 is shown in table 4:2.

Table 4:2 Population in the Project Area, 1978

Ward	Number of villages	Total population	Number of households	Number per household
Saja	5	8,017	1,895	4.2
Wanging'ombe	11	11,941	2,843	4.2
Ilembula	11	12,915	2,978	4.3
Luduga	6	8,600	2,080	4.1
Usuka	9	11,648	2,770	4.2
TOTAL	42	53,121	12,566	4.2

(Source: Population Census 1978, Ward Survey Sheet, Njombe District)



Population density in the project area was approximately 33 persons per km^2 in 1978.

The age distribution of the population in the project area is shown in table 4:3

Table 4:3 Age Distribution of the Population in the Project Area

Ward	0-14 years		15-54 years		55 years	
	No.	%	No.	%	No.	%
Saja	3,940	49.2	3,409	42.5	668	8.3
Wanging'ombe	5,895	49.3	5,028	42.0	1,024	8.6
Ilembula	6,126	47.4	5,484	42.5	1,307	10.1
Luduga	4,158	48.3	3,747	43.5	695	8.1
Usuka	5,929	50.0	4,777	41.1	1,042	8.9
TOTAL	26,048	49.0	22,445	42.2	4,736	8.8

(Source: Population Census 1978, Ward Survey Sheet)

The table shows the youthfulness of the population almost 50% is below 15 years of age. This pattern conforms to the national pattern. Age distribution of the population is shown in detail for the wards in the the Appendix.

The sex distribution is shown in table 4:4

Table 4:4 Sex Distribution of the Population in the Project Area

Ward	Male No.	%	Female No.	%
Saja	3,625	45.2	4,392	54.8
Wanging'ombe	5,434	45.5	6,507	54.5
Ilembula	5,761	44.6	7,154	55.4
Luduga	3,906	45.4	4,694	54.6
Usuka	5,160	44.3	6,488	55.7
TOTAL	23,886	44.9	29,235	55.1

(Source: Population Census 1978, Ward Survey Sheet, Njombe District)

An analysis of sex distribution in various age group would show that the disproportion (more women than men) is most pronounced in the able-bodies age groups. (see Appendix for details). This conditions reflects the lasting status of Northern Njombe as a labour reserve. The pattern was established during colonial estates in Morogoro and Tanga are the main destinations for migrant men in search for work.

In the planning documents of the Wanging'ombe North Water Supply the population was estimated at 60,000 - 80,000. The project was designed to cope with a 100% increase of population calculated on these estimates, i.e. the project can serve a maximum of 160,000 persons at the rate of 30 litres per capita per day).[11]

When the 1978 census figures are used as a basis for future growth projections, assuming an annual growth rate of 2.5%, the project area population will increase as shown in table 4:5.

Table 4:5 Population Growth Projections in the Project Area

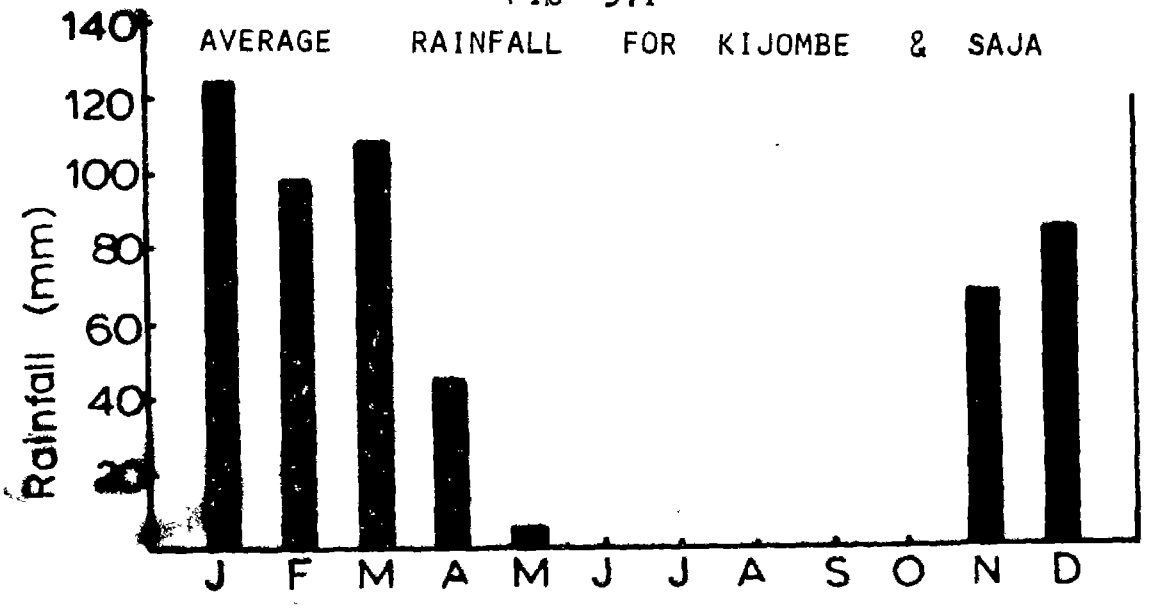
Year	Project area population (Saja, Wanging'ombe, Ilembula, Luduga and Usuka wards)
1978	53,121
1988	68,207
1998	87,578

According to this projection the population in the project area will reach the original design-population level (60 80,000) only in the 1990's. As far as water availability is concerned, it seems that the choice of Mbukwa as the water source was the best alternative for the Wanging'ombe North Water Supply Project.

Chapter 5 AGRICULTURAL PRODUCTION

Northern Njombe falls mainly into one agro-economic zone characterized by extensive subsistence farming. The main food crops are maize, beans, pulses and tubers. When surpluses are produced, maize and beans are also sold. The pure cash-crops are however oilseeds (mainly

FIG 5.I



SOURCE: E. A. METEOROLOGICAL DEPARTMENT, DSM.

sunflower) and tobacco - which is of growing importance in the northern part of Wanging'ombe. A high proportion of households own livestock-mostly traditional zebu-cattle, goats, sheep and some poultry. The use of oxen in cultivation is an important aspect of agricultural production in the area.

The agricultural potential of the area appears to be low. One study characterized Northern Njombe "a very poor subsistence area."[1] In the Rural Development Proposals for Iringa 1978-81 the following description of the area is given:

"..... a zone of plateau steppes and foothills between the high plateau and the Usangu plains. Rainfall diminishes rapidly westwards and unrealiability increases. The soils are shallow stony sandy loams and sandy dry loams of low fertility."[2]

Infertile soils and the long dry spell thus put limits to agricultural productivity. Nevertheless the area supports a dense population. The rainfall pattern is shown in figure 5:1.

Figure 5:1 Monthly Rainfall in Njombe, Average, for Uhenga Wanging'ombe,

The Agricultural Year

The preparation of land begins in November or December with the onset of the rains. Much of this work is done by women using the hand-hoe. Only when ox-ploughs are used do men become involved in seedbed preparation work. The oxen are then yoked together with a crude wooden yoke and attached by a chain to a single-furrow mouldboard plough. The ox-plough is of course much more efficient than the hoe it cuts the roots of weed grasses and the work can proceed much faster. It has been calculated that the cultivation of one hectare of land using the hand-hoe takes roughly one man-month while the same operation using ox-drawn plough takes only 10 man-days.[3)]

However, the oxen are put to limited uses only. They will pull a plough during seedbed preparation and are occasionally used for transport trailing a wooden sledge on which a log or a bag of maize can be put.

Planting is normally over by late January. The peak for weeding crops comes towards the end of February and into March. Interspersed with the weeding operations is the collection of bamboo sap, which ferments into "ulanzi," an intoxicating liquor which is consumed widely in the area (some is also transported to Makambako and Njombe town for sale).

The slack period in April and May before the harvest is often a time for brick-making for new houses or for the repair of old ones. Only when water is required for such tasks is it carried by men.

The harvest takes place in June and July. Crops are transported on the head to the homes where they are stored in a "kihenge," a mud-and-pole structure with thatched roof.

Crops, Yields and Technology

Most crops grown in Northern Njombe are consumed directly by the producers. The practice of an extensive cultivation system under unreliable rainfall conditions often results in poor harvests and a generally low level of subsistence. The table below summarizes responses in four surveyed villages to a question on whether the 1976/77 harvest was enough to supply the respondents' households with food.

Table 5:1 Self-Sufficiency in Food Production in Four Surveyed Villages

Village	% of h.h. whose harvest was not sufficient	% of h.h. whose harvest was sufficient	% of h.h. who relied on bought food to make up food needs	Total No. of h.h. in the sample
Saja	88 %	12 %	88 %	77
Iyamluki	94 %	6 %	94 %	16
Luduga	71 %	29 %	29 %	34
Igwachanya	86 %	14 %	15 %	59

(Source: BRALUP survey of Saja, Iyamluki, Luduga and Igwachanya, (1978)

As the table shows a great majority of the households could not support themselves from their own produce only. It should be mentioned that 1976/77 was considered to be a bad year in the Wanging'ombe area, rains were below normal.

In a good year small surpluses are sold by the households to the National Milling Corporation or locally to individual buyers.

Since Wanging'ombe is an important cattle-raising area manure is available from animal droppings. The use of cattle manure is important, especially since villagization has resulted in a reduction of the long fallow periods as a means of restoring fertility to the soils which are essentially poor. In the case of cash-crops, especially tobacco, it is necessary to use chemical fertilizers.

Reliable measurements of crop yields were impossible to obtain locally and therefore reference is made here to aggregated data. For Tanzania as a whole the average yield of maize for a "traditional farmer" has been estimated at 0.75 tons per hectare.[4] Agricultural extension agents in the Wanging'ombe area estimate maize yields "on good soils" under treatment of cattle manure or chemical fertilizer at 1.1 tons per hectare while maize "on poor soils" without manure or fertilizer yields less than 0.2 tons per hectare. As a point of comparison it can be mentioned that given adequate rainfall and good husbandry but excluding fertilizer, maize can yield between 2 and 4 tons per hectare under East African peasant conditions.[5]

Pulses and root crops (sweet potatoes, cassava) give a more reliable harvest as they are better suited to conditions of poor soils and little water. The average yields for mixed beans in Iringa region is given as 0.7 tons per hectare while cow-peas give 0.4 tons per hectare.[6] When the maize fails people resort to cassava and sweet potatoes for subsistence.

Finger millet which previously was the main cereal crop in the area has all but vanished from the fields. In a few places people still grow small plots of finger millet, which is used for brewing.

Since 1977 the Ministry of Agriculture has encouraged farmers to plant improved varieties of sorghum (the Lulu and Serena varieties). Seeds have been distributed free. These varieties appear to thrive in the area but still in the 1978/79 growing season sorghum cultivation was insignificant.

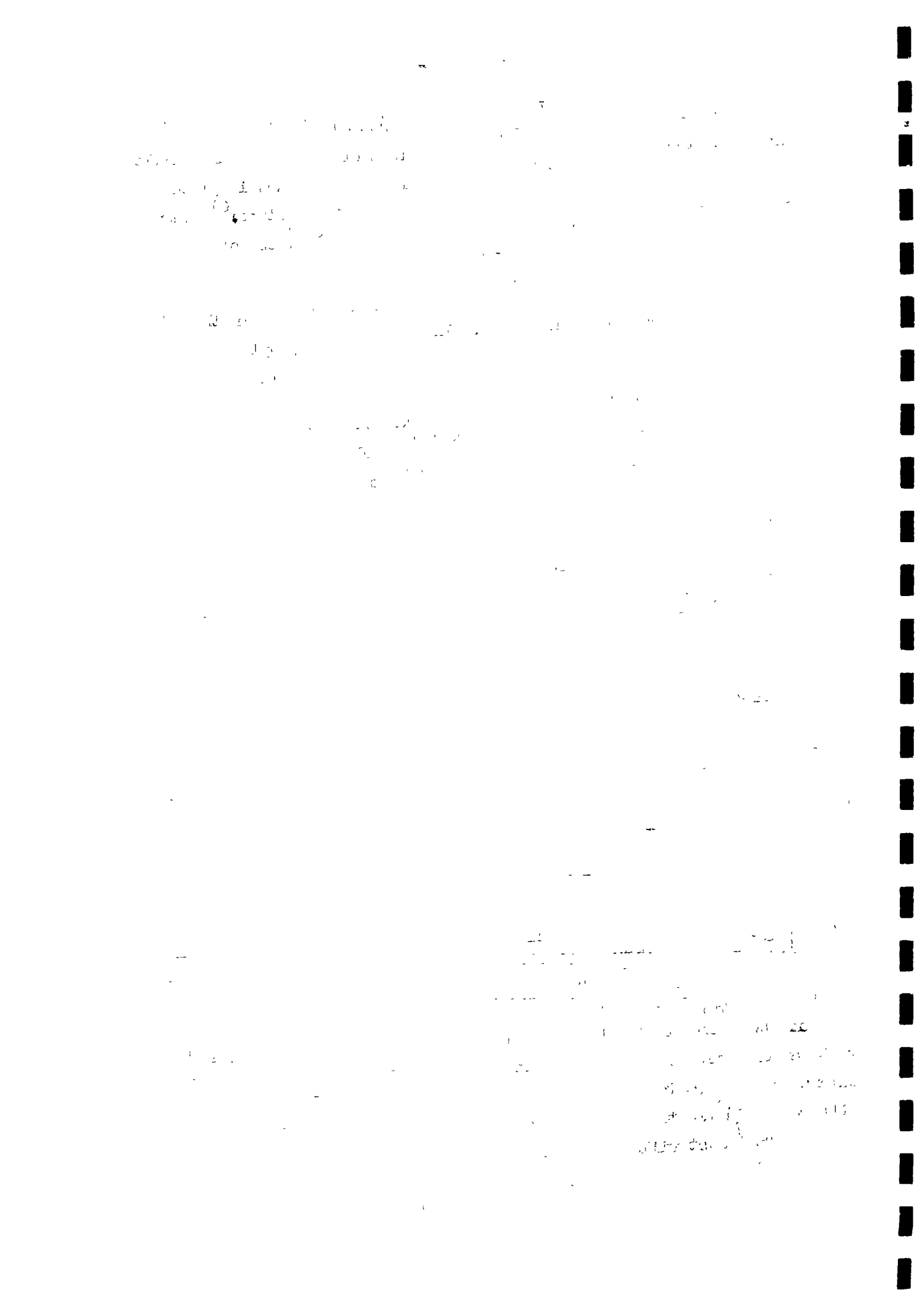
The use of oxen for cultivation is a remarkable feature of the local production system. The proportion of households using ox-traction, manure and fertilizer in the four villages surveyed is shown in the table below.

Table 5:2 Use of Oxen and Fertilizing Inputs in Agriculture

Village	% of respondents who use ox-traction	% of respondent who use manure	% of resp. who use fertilizer	Total resp. sample
Saja	57 %	37 %	4 %	77
Lyamluki	94 %	38 %	-	16
Luduga	40 %	12 %	70 %	34
Igwachanya	12 %	11 %	18 %	59

(Source: BRALUP survey of Saja Lyamluki, Luduga and Igwachanya, 1978)

Cultivation by utilization of ox-traction is thus very common in Saja and Lyamluki (in the latter village hand-and-hoe cultivation seems to be an exception). Interviews with village chairman and agricultural extension officers indicate that this is true also for the other villages which lie to the North of the TANZAM highway (all villages in Saja ward and most villages in Wanging'ombe ward). On the other hand



ox-cultivation becones less common further South in the area. This is indicated in the table which shows Luduga in the central area where 40% of the households use ox-ploughs and Igwachanya in the South of the area where ox ploughing is rare.

This variation in use of oxen cannot be explained with reference to variations in the availability of oxen since cattle are abundant throughout the area. Instead we suggest that Northern Njonbe is experiencing a slow diffusion process of agricultural nechanization. It is reasonable to assume that the use of oxen and ploughs has spread to the area from the Usangu plains where ox-ploughing is a general feature. This hypothesis is supported by the fact that the use of oxen and ploughs is nore frequent in the Northern part of Wanging'onbe which is closer to Usangu nany villagers have regular contact with the villages on the Usangu plains.

The area planted to crops is determined i.e. by the labour available for cultivation and seedbed preparation. In Northern Njonbe the use of hired labour is linited to the farms of a few wealthy traders. These people hire wonen to cultivate beans, which then are narketed in the towns.

For the great majority of the peasants the household nembers provide the agricultural labour force. It appears though that a significant interchange of labour in the traditional nanner of "bega kwa bega" (shoulder to shoulder)takes place. This is most usual for clearing and weeding purposes when much labour is needed for a concentrated period.

The area planted by the individual households is small. The Agricultural census 1972 reported an average farm size of 1.4 hectares in Iringa region. Table 5:3 shows the regional distribution of holdings by size.

Table 5:3 Distribution of Peasant Holdings by Size, Iringa Region

Size	Less than 0.5 ha.	0.5-1 ha	1-2 ha	2-3 ha	3-4 ha	4-5 ha	5-10 ha	10-20 na
% of h.h. cultivating	28%	28%	26%	10%	3%	2%	3%	-

(Source: TFNC, Data Report on the Food and Nutrition situation in Tanzania 1972/73-1976/77).

In the four surveyed villages in Northern Njonbe the size of the area cultivated and planted in 1977/78 by the sample households is shown in the table below.

Table 5:4 Distribution of Peasant Holdings by Size in Northern Njonbe

Village	Percentage of respondents cultivating									No.of resp. in sample
	⟨0.5ha	o.5-1ha	1-2ha	2-3ha	3-4ha	4-5ha	5-6ha	6-7ha	7 ha	
Saja	5%	19%	51%	8%	10%	-	3%	4%	-	77
Lyanluki	-	-	25%	13%	18%	-	18%	13%	13%	16
Luduga	9%	12%	53%	20%	3%	-	3%	-	-	34
Igwachanya	12%	27%	44%	15%	2%	-	-	-	-	59
Total	8%	19%	47%	13%	7%	-	3%	2%	1%	186

(Source: BRALUP survey of Saja, Lyanluki, Luduga and Igwachanya, 1978)

This farm-size pattern differs from the regional pattern to some extent. In the surveyed villages there is a noteworthy concentration of farm sizes in the range of 1 - 2 hectares. The proportion of households cultivating dwarf plots of less than 0.5 hectares is much smaller (8 %) than in the regional survey (28 %). Nevertheless, both surveys show that a solid majority of the peasant households cultivate an area in the range of 0.5 ha - 3 ha.

It will be of interest to know to which extent the the households who use oxploughs cultivate larger areas than the hand-and-hoe cultivators. This distribution is shown in table 5:5.

Table 5:5 Farm Sizes among Ox-Cultivators

	Percentage of respondents cultivating									No.of resp.in sample
	⟨0.5ha	0.5-1ha	1-2ha	2-3ha	3-4ha	4-5ha	5-6ha	6-7ha	7 ha	
All villages	-	6%	43%	19%	15%	1%	8%	5%	3%	79

(Source: BRALUP survey of Saja, Lyanluki, Luduga and Igwachanya,1978)

A comparison of table 5:4 and table 5:5 shows that the ox-cultivation do cultivate more land than hand-and-hoe cultivators, but the difference is not great.

Approximately 60 % of both ox-cultivators and hand-and-hoe cultivators farm areas in the range of one to three hectares. On the other hand, while only 13 % of the hand-and-hoe cultivators farm more than three hectares, the corresponding proportion of the ox-cultivators is 32 %.

In the Wanging'ombe area one pair of work-oxen is often shared between two or more households who are relatives or neighbours. When this is the case each household has access to the plough-oxen only for a limited period. This condition can explain why so many of the ox-cultivators in fact do not farm a hectarage bigger than the peasants who use the hoe. On the other hand, the reason why so few ox-cultivators can expand the farm size above 6-7 hectares (without using hired labour) can be looked for in the unbalanced character of draught-animal mechanization. Since animal traction is only used in cultivation, labour availability for the other critical operations - notably weeding - sets a limit to the area which can be operated by the peasant household.

The Cash-Crop Economy

Table 5:6 shows that the marketed output from the Wanging'ombe area is insignificant - except for sunflower - in the regional economy. However, even small crop sales are of importance for the individual households.

Table 5:6 Marketed Crops 1976/77

Crop	The Wanging'ombe Area	Iringa Region
Maize	1155 tons	10,400 tons
Mixed beans	455 tons	n.a.
Cow-peas	111 tons	n.a.
Sunflower	334 tons	1,384 tons
Tobacco	48 tons	4,148 tons

(Source: National Milling Corporation Iringa Office: Tobacco Authority of Tanzania, Wanging'ombe Office; TFNC Data Report on the Food and Nutrition Situation in Tanzania).

It should be noted though that 1976/77 was considered a bad agricultural year in the area due to sub-normal rains. In addition, the table includes only the purchases of the official purchasing agents (the National Milling Corporation and the Tobacco Authority of Tanzania), and omits small-scale sales in and between the villages.

Sunflower and tobacco are being encouraged as the main cash-crops in Northern Njombe.

Sunflower: In the 1960's Tanzania was a net exporter of oil-seeds, but production has declined since 1973 reducing exports to insignificance. The main oil seeds are castor, sesame, sunflower and groundnuts. Virtually the whole marketed sunflower crop was retained within the country in 1976 to be processed in to edible oil by local mills.[7] Meanwhile the domestic demand for cooking oil has increased rapidly during the 1970's. The forecast for edible oil consumption in Tanzania by 1980 has been estimated at 44,000 tons, as compared to the marketed production of 15,000 tons in 1975. The government has invested in new oil mills in Morogoro and Nachingwea. It will therefore be necessary to stimulate oilseed production nationally. Sunflower is the most important oilseed in Tanzania, its share of the marketed production being slightly more than 30 %.

Iringa is one of the main sunflower producing regions and the Wanging'ombe area contributes one quarter of the Iringa production (table 5:6). Official promotion of sunflower as a cash crop in the area has been limited to delivery of seeds and purchase of the crop. Among agricultural officers sunflower is referred to as "the lazy man's cash-crop," since it demands relatively little attention. On the other hand yields are not impressive. In 1978 it was rare to see sunflower plants of a size higher than $1\frac{1}{2}$ meter and the oil cake usually had a diameter less than 15 centimeter. There are no reliable yield estimates for Northern Njombe, but nationally average smallholder production is estimated at 0.4 tons per hectare.[8] With producer prices set at 1.25 shillings per kilo (1977) average farm incomes were 485 shillings for one hectare (assuming that the only cash outlay was 15 shillings for seeds). The number of farmers growing sunflower and total production in the four villages surveyed

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showed considerable variations as shown in table 5:7. The variation reflect to some extent the effectivity of the agricultural extension service - seeds were delivered to some, but not all villages.

Table 5:7 Proportion of Respondents Growing Sunflower in Four Villages 1977/78

Village	Percentage of respondents growing the crop	No. of h.h. sample
Saja	1 %	77
Lyamluki	31 %	16
Igwachanya	2 %	59
Luduga	32 %	34

(Soruce: BRALUP survey, of Saja, Lyamluki, Luduga and Igwachanya, 1978)

Tobacco is the other cash-crop in Northern Njombe. In the national context tobacco occupies the third rank (after coffee and cotton) as a foreign exchange earner for Tanzania. The Tobacco Authority of Tanzania (TAT) is responsible for the promotion of tobacco growing which is small-holder based except for about fifty large estates in Iringa district.

Tobacco production in Northern Njombe started in 1974 on village "ujamaa" farms. These were soon converted into block-farms, i.e. fields of 10 to 20 hectares which are divided into smaller (one acre) blocks cultivated by individual peasant households. In 1978 there were 16 villages in the area engaged in tobacco growing.*) TAT provides seeds, fertilizer, technical advice and tractor service to these villages and is the sole purchasing agent of the harvest.[9]

In 1975/76 the 16 tobacco growing villages in Northern Njombe planted a total area of 143 hectares. Total number of growers were 778 and they cultivated 0.2 hectares of toabcco each. Total production was 48 tons and average yields were 336 kilograms per hectare.[10]

The local policy of TAT in Northern Njombe is to stabilize and increase tobacco cultivation in the 16 selected villages before tobacco cultivation is encouraged in other villages.

*) In Saja ward: Saja, Isimike, Itengelo, Uhenga; in Wanging'ombe ward: Wanging'ombe, Ikingula, Ufwala, Utiga, Lyadebwe, Kijombe, Lyamluki, Mayale,; in Luduga ward: Luduga, Iyayi, Mambegu, Hanjawanu.

Tobacco growing is labour intensive. It is calculated that between 300 and 500 mandays are required to tend one hectare of tobacco It is also a crop from which the grower can realize comparatively more cash: 3,000 shillings per hectare provided that yields are around 0.75 tons per hectare and that the quality is good.[11] Njombe tobacco growers realized on average only 100 shillings from their tobacco field because their yields were low and their cultivated area was small. It is not surprising then, that there is no overt enthusiasm among the peasantry for tobacco growing, witness the low number of participating farmers - 15% of the total number of households in the 16 villages.

The natural resource constraints to tobacco growing in Northern Njombe are water and firewood. Water is needed for the tobacco nurseries which must be established in October, at the height of the dry season. Firewood is needed for the curing of the harvested leaves. A sound expansion programme for tobacco cultivation in the area must take these two constraints into consideration. In the short run wood can be taken from the remaining woodlands in the northwestern part of the area, but these will soon be depleted. If tobacco is to have a future as a main-crop in the Wanging'ombe area supporting programmes are necessary. Fuel-wood plantations must be established in the villages growing the crop and water from the WNWSP must be reserved for nurseries.

It is suggested that the future evaluation of the water project looks into these aspects of tobacco growing. If water from the project in the future is used in tobacco cultivation,*) then it is possible that the WNWSP will have an effect on villagers' cash-incomes. The distribution of money incomes which is derived from an intensified tobacco cultivation between members of the households in the tobacco cultivating villages could provide insights into the developmental effects of peasant cash-cropping.

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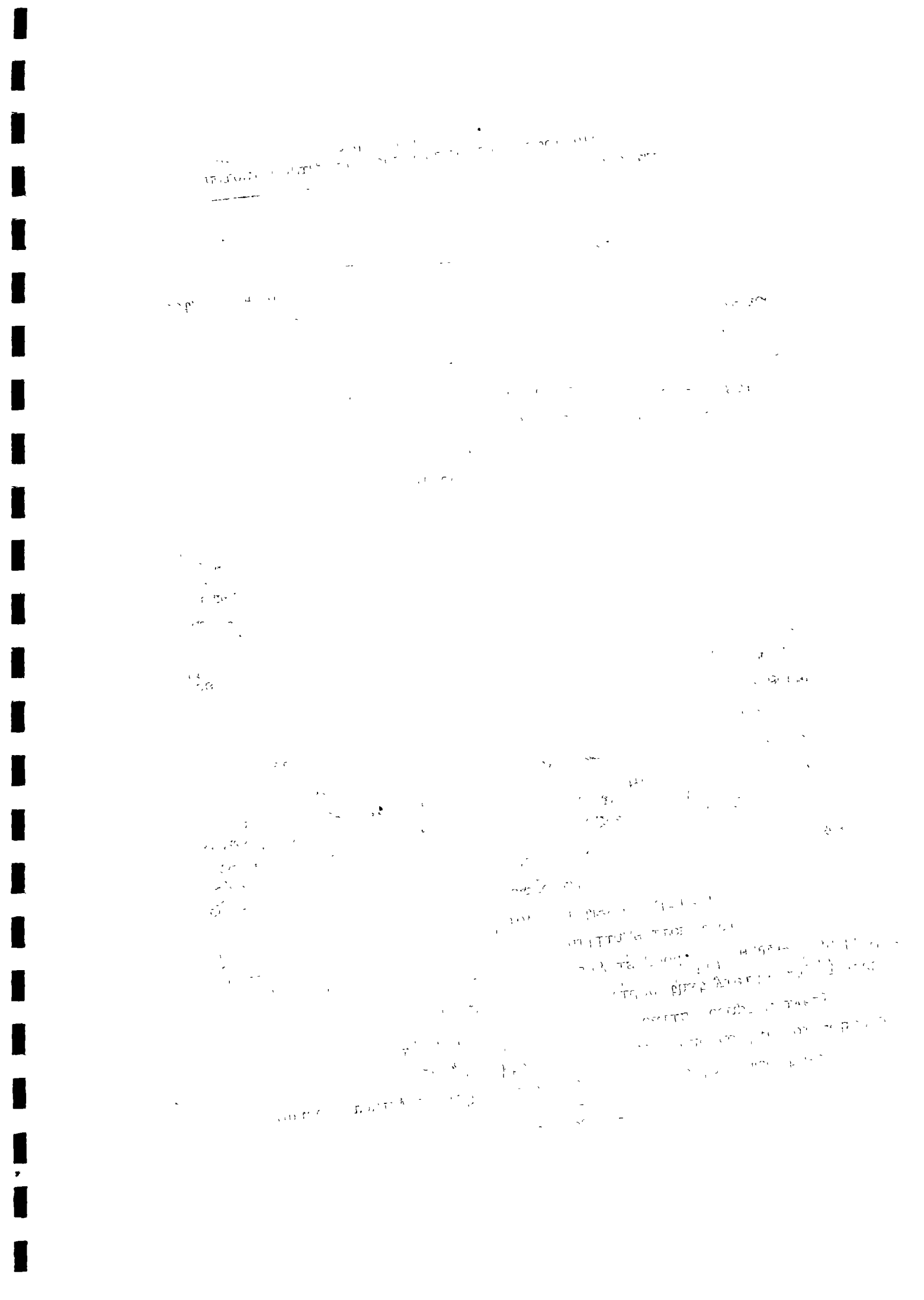
*) No technical design in connection with water provision for tobacco nurseries had been produced in 1978.



Chapter 6: LIVESTOCK

Wanging'ombe means "many cattle" and livestock is indeed a characteristic feature of the landscape.

Cattle ownership is vested in individuals. Large owners graze their herds apart while neighbouring households owning only a few heads may have them graze together. Grazing areas are community-owned and include all land except cropfields. In some villages cattle may also graze the stubble after harvest. No fodder is produced, livestock is dependent on herbage from the natural vegetation. During the dry season undernourishment is evident. The wilted grass is low in protein and vitamin content and this is reflected in a slow rate of cattle growth and reproduction.

Milk production from the indigenous zebu cattle is estimated at 250-300 liters per location.[1] Most of the milk is consumed by the calves. The genetic potential of the zebu is considered to be low, so dairy production can not be considered before cross-breading with exotic bulls as well as pasture upgrading is introduced.[2]

The critical grazing months are September to December when water also is in short supply. In the Northern part of the area, around Saja, livestock can be taken to a swampy area during the worst period. Halali river which runs through the area is used by villagers and livestock. It also happens that cattle use the springs and ponds where women draw water for household consumption - a situation which creates obvious health hazards.

It is unfortunate, although fully logical, that the period when cattle are undernourished and weak coincides with the period when oxen are needed in agriculture. Seedbed preparation has to start at the onset of the rains. The weak condition of oxen at this time make them perform far below their potential.

Use of Cattle

Cattle is of multiple value in the social system of the Wabena peasant society. First of all, cattle are used as dowry. When a man wants to marry a woman he must present cattle to her parents as dowry, i.e. as compensation for their sons to marry. Consequently cattle play an important role in the reproduction of the peasant households.

Between 2 and 6 cows are paid as dowry. Five cows is mentioned as the "average" price. Dowry can also be paid on, for example, 3 cows and a few goats and sheep or, alternatively, wholly in cash. In this latter case the equivalent market price of five cows is paid. Dowry can be paid in rates, for instance half the sum before the wedding and half the sum later on. Young men have to borrow money or cows from their fathers, or from other relatives. They repay their debt gradually. It can be understood then than many social ties and dependencies are formed through economic transactions in connection with marriage and dowry.

In the Wabena society ownership of cattle gives status. A man who owns a large herd of cattle is a rich man, he commands influence and deserves respect. He can also use his cattle in order to enhance his influence i.e. by slaughtering a cow and hosting a big party.

The directly productive use of cattle is in agricultural work. These aspects have been discussed in the agricultural chapter and will not be elaborated further here.

Density and Distribution of Cattle

A livestock census was undertaken in Iringa Region in March, 1978. The census reported the following number of livestock within Wanging'ombe division.

Table 6:1 Livestock in Wanging'ombe division, 1978

Ward	Cattle	Sheep	Goats	Livestock owners	Livestock owners as % of all households
Luduga	11,575	2,210	1,274	n.a.	
Wanging'ombe	10,069	2,636	1,757	770	27%
Ilenbula	7,825	1,675	689	697	23%
Saja	6,798	1,011	1,008	n.a.	
Total	36,267	7,532	4,728	n.a.	

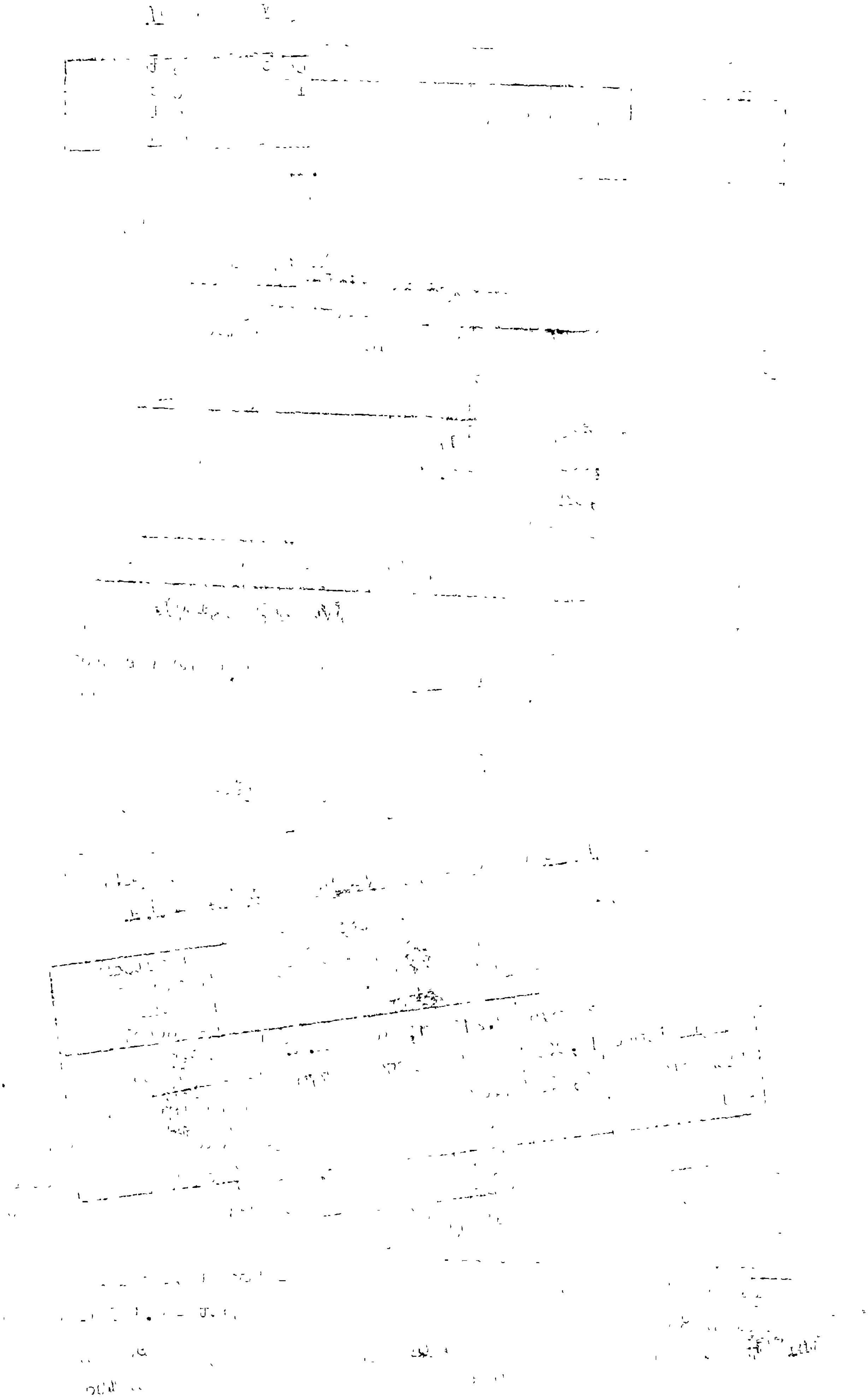
(Source: Wanging'ombe division livestock office).

Figures of cattle owners were given for a somewhat smaller area within the division. In 24 villages a total number of 1,652 owners held 23,640 heads of cattle. The total number of households in the same villages was 6,977 which means that 24% or roughly one of the households owned cattle.

An average of 14 heads of cattle per household can be computed from the census figures of cattle-owning households. As a matter of fact, cattle are unevenly distributed in the villages. There are some rich old men owning more than one hundred heads, while other households keep a single cow, or a pair of oxen.

Looking at the amount and quality of grazing land in relation to stocking rates, some computations can be made. When it comes to grazing, the carrying capacity of land is measured in numbers of hectares per livestock unit,*) i.e. how may hectares are required to support one livestock unit. In Wanging'ombe division, cattle, goats and sheep make up a total of 37,790 livestock units (L.U.). The total area of the division is 160,000 hectares of which some 20,000 ha. are assumed to be occupied by settlement and cultivated cropland. The livestock per km^2 ratio for Wanging'ombe division is then 24, while the corresponding figures for Iringa Region and Tanzania Mainland are 8 and 15.8 respectively. In dry areas like Northern Njombe one livestock unit is estimated to require 4 hectares of grazing

*) The conversion rates are: one cow = I livestock unit, one sheep = 0.125 livestock unit and one goat = 0.125 livestock unit.



land.[3] The 1978 livestock population will, then, need a total of 151,160 hectares, which approximates the total area of the division. This computation indicates that overstocking already is a fact and that further increase in stock density has to take place at the price of environmental degradation.

However, the above calculations are averages. The total area of Wanging'ombe division includes an "empty corner" of woodland in the extreme North. In reality the situation varies from place to place. Some villages have a relatively low stocking density while others already are overstocked. For example, in 1975 Saja had 2,788 livestock units on a total area of 7,170 hectares.[4] Even if we reduce the grazing requirement to three hectares per livestock unit, the area required for grazing exceeds the whole village area. Since deductions must be made for settlement and cropland, the actual situation signifies overgrazing, erosion, and vulnerable livestock.

Marketing

There are two cattle auctions in Northern Njombe, one in Wanging'ombe and one in Saja. Auctions are held once a month. The cattle auction is the event in the two villages; around the auction a big market place mushrooms where various goods are sold.

Each month between 200 and 400 heads of cattle are sold at the auctions in Saja and Wanging'ombe. Average prices are below 1,000/= with variations shown in table 6:2.

Table 6:2 Number of Cattle Sold and Average Prices at Saja and Wanging'ombe Cattle Auctions

Month	No. of cattle sold	Total value sh.	Average Price sh.
June-77	346	287,995	832
Aug.-77	285	273,495	959
Oct.-77	207	169,135	817
Nov.-77	247	187,870	760
Total for 4 months	1,085	918,495	846

(Source: Wanging'ombe divisional livestock office).

At the auctions work-oxen fetch the highest price (approx. Sh. 1,500, bulls fetch prices between Sh. 1,000 and 1,300 while cows fetch the lowest price, between Sh. 600 and 900. The majority of cattle sold at the auctions are cows.[5)]

A significant feature of the cattle auctions in Saja and Wanging'ombe is that most of the cattle are sold out of the region. Thus, out of the 254 cattle auctioned in July, 1978 178 heads or 70% were sold to Ruvuma. There are some 30 licensed buyers at the auctions. Most of them are merchants who function as agents for butchers in Songea. Due to shortages of meat in Songea beef fetches a price of Sh. 18 per kilo at the butchers. The corresponding price at the butcher in Wanging'ombe is only 8/= per kilo. Hence the Songea merchants can afford to outbid local buyers at the auctions in Northern Njombe.

The sellers of cattle are local peasants but also Masai, Gogo and Sangu herders from the Usangu plains. The local peasants sell only a few heards of cattle at a time while Masai herders may sell as many as 30 heads of cattle at a time.

According to the livestock office in Wanging'ombe at least 50% of the cattle sold at the auctions come from outside Northern Njombe - from the Usangu plains.

It can be calculated that totally some 3 million shillings are realized by cattle sales annually at the two auctions. If we deduct 50% for Usangu herders there remains 1.5 million shillings to be shared by local sellers. Assuming that there are some 2,500 cattle owners in the division and assuming that they shared this sum of money equally, they made some 600 shillings each. The real situation was of course different, some owners sold many heads of cattle while others sold none.

We have already indicated that the peasants in Northern Njombe are not commercial cattle-raisers. One main function of cattle is to serve as an emergency fund to be converted into cash when needed. A peasant will bring a cow to the auction when he needs cash, either to buy durable consumer goods (corrugated iron roof, bicycle etc.,) or to buy food when his own harvest has failed. The year 1976/77 was a bad agricultural year when a large portion of the households had insufficient food supply. Money realized at cattle auctions was then used to buy maize.

There is a butcher's shop in each of the 33 villages in Wanging'ombe division. In these villages people can buy small amounts of meat regularly at a reasonable price (Sh.8 per kilo). But in the other villages meat is consumed only at traditional celebrations when a cow is slaughtered or incidentally when a cow has broken a leg and must be slaughtered.*)

Possible Impact of the WNWSP on Livestock Development

A certain confusion appears to prevail concerning the uses of the water from the Wanging'ombe North Water Supply Project. On the one hand it is argued that the project aims at improving the conditions for domestic (i.e. human) water use, but, on the other hand it has also been argued that since cattle plays a very important role in the local economy, they should be provided with water from the project. In the bill of quantities of the WNWSP cattle troughs are mentioned but up to date no engineering design has been produced.

Meanwhile, there exists a real need of water for the Wanging'ombe cattle population, not so much for drinking water but rather for dips. At present there are only three dips in the area and the villagers have to carry water in buckets from nearby streams to these dips when they want to treat their cattle with chemical preparations.

It is suggested that the future evaluation of the WNWSP monitors changes in the size and utilization of the cattle population and investigates to which extent cattle have benefited from the project.

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*) The importance of butcher shops for nutrition will be elaborated on in chapter 9.

Chapter 7: THE WATER USE PATTERN

Introduction

In this chapter the water use pattern in five villages in Northern Njombe will be described. The description is based on a household survey carried out in Saja, Lyamluki, Ilembula, Luduga and Igwachanya villages in May, 1978. Additional information has been obtained from interviews with the village councils in the said villages and from direct observation. Before presenting the findings the methodology used in the survey will be briefly presented.

Utilizing the "ten-cell" political organization in the villages a stratified sample covering 10% of the households was drawn. The head of the household and his wife in totally 949 households were interviewed. The interviews were conducted by University students accompanied by the ten-cell leaders, who introduced them to the householders.

Each interview was split in two phases. One set of questions were directed to the head of household. These questions sought information on the household demography and economy. Some findings from this part of the interview have been presented in Chapter 5. The other set of questions was directed to the first wife or the representative women in the household. These questions concentrated on the water use pattern.

The interviews were split within the household because it was felt that the relevant question would be better answered by the person who is in fact responsible for the particular operation which the question sought information about. Since the women by tradition are responsible for water collection, this part of the interview was also concluded with the women. By contrast, most previous studies on water use in East Africa have relied on information obtained from interviews conducted with men, who are not involved in the actual task of providing water for the family.

The Sources of Water

The most common sources of water for both people and cattle in the area are ponds, streams and groundwater obtained from wells, springs and shallow depressions dug in river beds.

The availability and accessibility of water depends on the season; in the rainy season (December - April) water can be found in ponds, ditches and running streams. When the rains stop, the water table sinks and groundwater becomes available at increasingly greater depths. With the progress of the dry season the sources of water are both reduced in number and become steadily inaccessible.

There are a number of small streams cutting through the area and feeding into the River Halali, which carries water during the rainy season and for some months afterwards. The only perennial source of water is in the main arm of the Halali, but even here in the dry season the level of water falls and partially runs underground, making it necessary to dig shallow depressions in the dry river bed in order to obtain water.

There are a few permanent springs and ponds in the area and North of Saja there is a swamp which contains water throughout the year. A few villages have partially improved water supplies. At Ilembula water is pumped from the Halali and supplies eight standpipes in the center of the village. Wanging'ombe village is also provided with a pumped scheme supplying water to a few public standpipes. However, during most of 1978 this supply was out of order due to breakdown of the pump. In Igwachanya there is a pumped scheme supplying the Catholic mission and its dispensary.

Apart from these few schemes the majority of the population in Northern Njombe is entirely dependent on unimproved water sources which are often shared with cattle. The villagers, when asked, contend that people and cattle use water from separate sources - that is, people draw water upstream and cattle drink it downstream - but the observation of water sources often contradicts such statements. Cow dung and hoofprints are frequently seen around waterholes where water for domestic use is collected. It is also known that livestock have access to the Halali river at numerous points.

As an example, Igwachanya, a village with 525 households relies for its water on small seasonal streams and one perennial stream - the Mtitafu - at a distance of $1\frac{1}{2}$ km from the village centre. Cattle obtain water from the same sources though normally cattle are fed from different points along the stream. However, as the water situation becomes critical in September to December, both people and cattle converge on the stream which results in increasing contamination.

With villagization the sources around the villages have become intensely utilized but little improvement has taken place to protect the existing supplies. It is not far-fetched to believe that the water situation for the population in Northern Njombe has deteriorated since 1974.

Table 7:1 summarizes the types of water sources used by the people in the villages of Wanging'ombe.

Table 7:1 Types of Water Sources Used

Type of source	Percentage of h.h. using the source	
	Rainy season	Dry season
Well	50%	35%
Stream/river	24%	27%
Waterhole	6%	14%
Shallow Depressions in dry river beds	2%	24%
Swamp	5%	-
Tap	13%	-
Total	100%	100%

/ Total No. of h.h. in sample = 239 /

(Source: BRALUP survey of Saja, Lyamluki, Ilembula, Luduga and Igwachanya, 1978).

The table shows that during the rainy season one out of every two households take, their domestic water from a well. Most of the wells are uninproved, only a few are fitted with concrete rings but none is fitted with a pump. During the dry season many wells dry up,

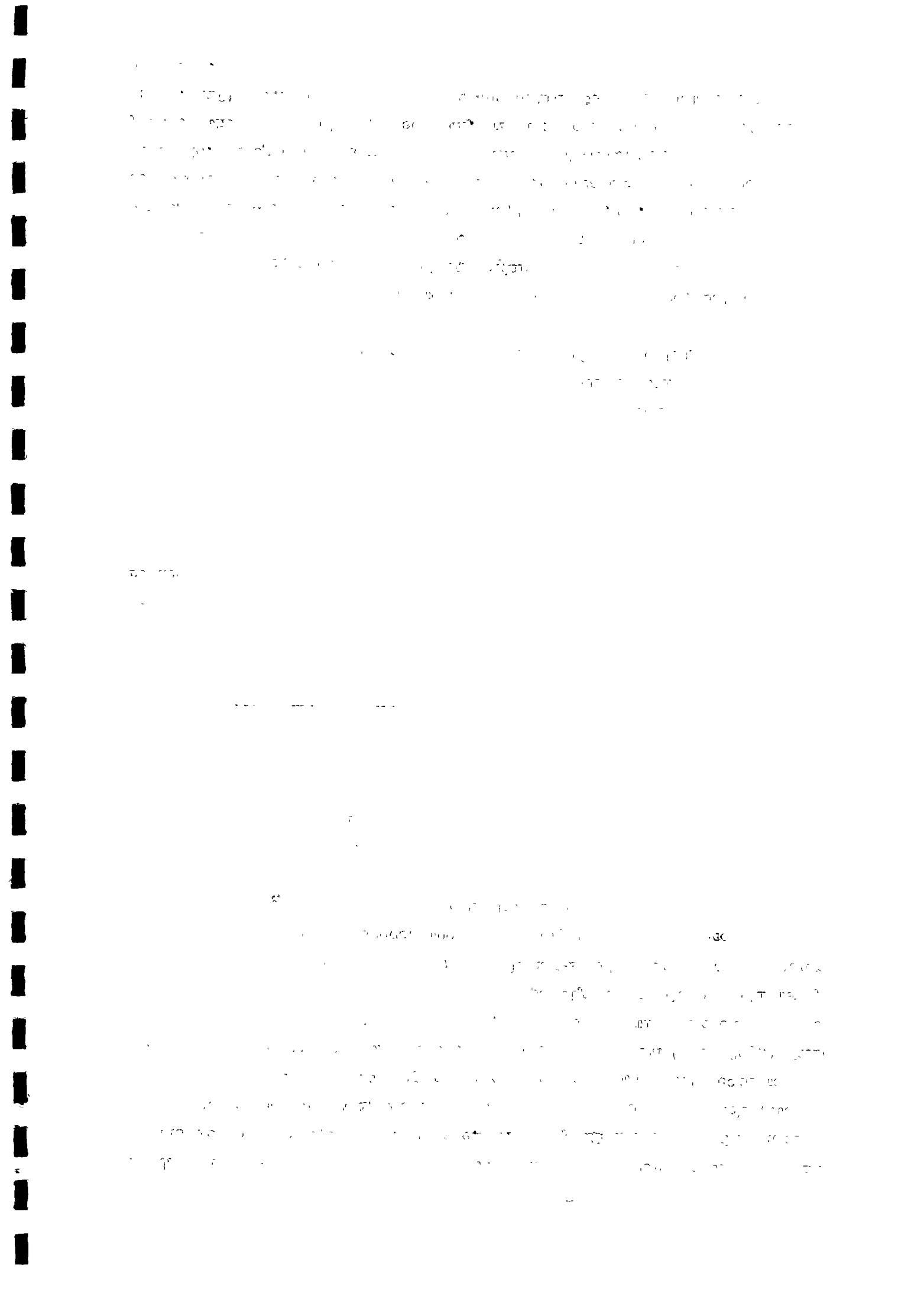
and this is clearly reflected in the table. The users of tap water in our sample come from Ilembula village. They all mentioned that during the dry season tap water is insufficient so they have to fetch water from Halali river. The category stream/river in the table connotes both seasonal streams and the rivers Halali and Ruaha (near Saja) where one can obtain water all the year round. The relative increase in the use of rivers during the dry season is partly due to the insufficiency of the pumped scheme in Ilembula which makes villagers switch to river water. As the table shows, there is a very significant recourse to shallow depressions scooped out in dry river beds for water in the dry season. The percentage should be even higher than the 24% stated in the table because there were some misunderstandings during the interview situation in the sense that a number of respondents answered "river" to the question on source of water, when they actually meant that they dig holes in dry riverbeds.

The Collection and Use of Water

It is normally the task of the adult woman to fetch water for the household's needs. To a certain extent, she is assisted by female children, though the compulsory attendance in schools of girls has reduced the amount of assistance adult women have from their young daughters in carrying out household chores. In the survey there were only two cases where water was being fetched by males, and these were bachelor households.

On the whole, there are three different types of water containers being used. The traditional type is a calabash which can hold 10-15 liters. The zinc bucket and the "debe" - a tin container - are also frequently used and can carry respectively 16 and 20 liters.

Grown-up men seldom collect water for domestic use, but they do collect water required for housebuilding. Water is needed for the plastering of mud-and-pole houses and the new method of building houses of sun-dried bricks also demands much water. When drawing water for these purposes the men use more sophisticated methods than their wives do. They either carry two buckets of water attached to a wooden yoke on the shoulder or use oxen. In this case a barrel is filled with water, lifted on a wooden sledge and pulled to the construction site by two oxen.



Water is used for drinking, cooking, bathing, washing utensils and clothes, cleaning and plastering the house, and occasionally for watering a small vegetable garden and for beer-brewing. Clothes are normally washed at the source of water rather than at home. Only in Ilembula, where women draw water from taps, do they wash clothes at home. Women and children frequently bath at the source of water.

Daily Water Consumption

The daily water consumption in the sample households was measured by the number of trips taken in each household to fetch water on two consecutive days and computing the amount of water carried from the type of container used for water collection.

The average per capita consumption derived from this information is shown in table 7:2.

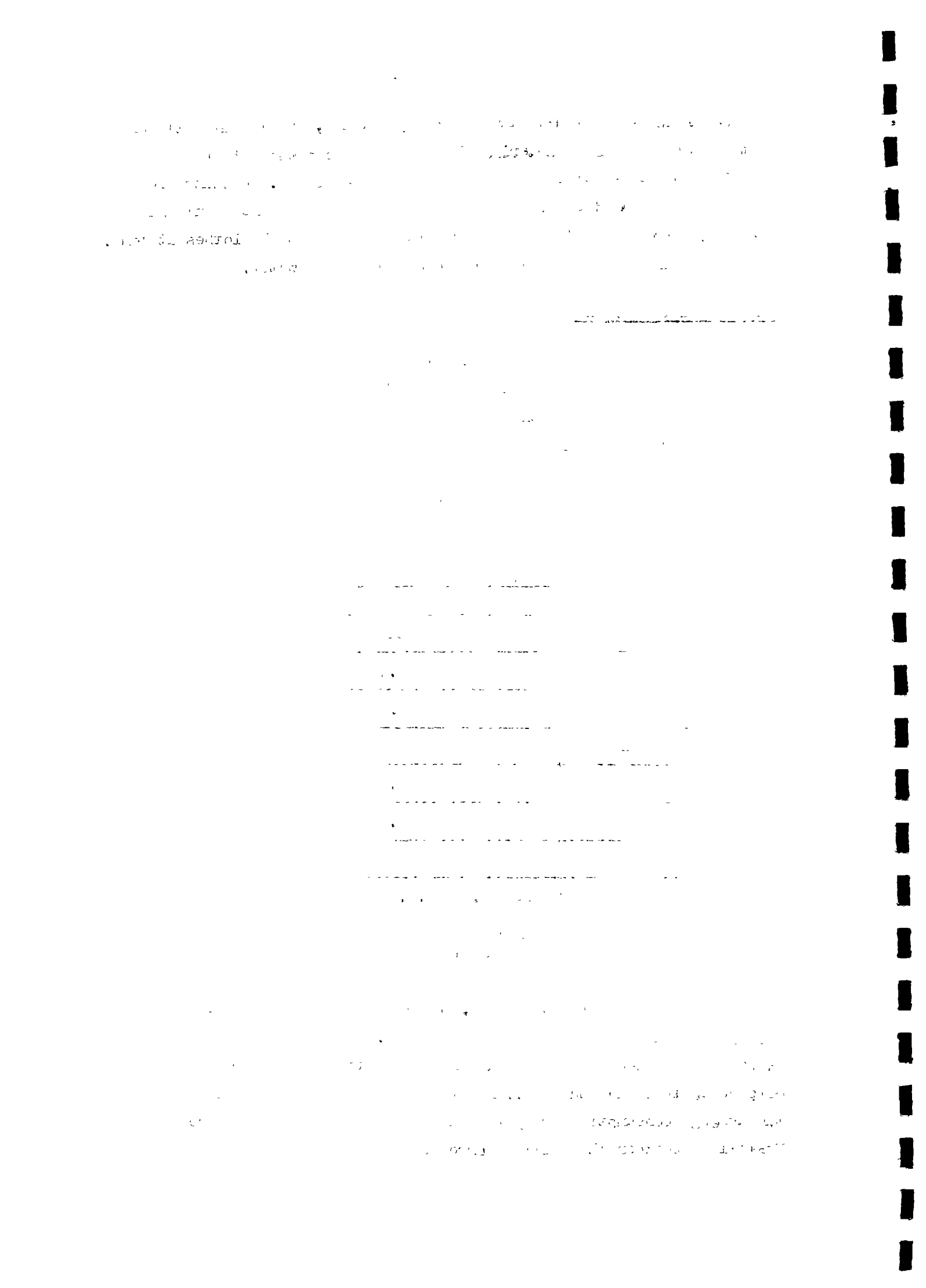
Table 7:2 Average daily per capita consumption of water

Village	Average consumption per capita per day
Igwachanya	10.4 liters
Luduga	8.4 "
Ilembula	11.2 "
Saja	8.1 "
Lyamluki	8.2 "
All villages	9.5 "

(Total No. of h.h. in sample = 239)

(Source: BRALUP survey of Saja, Lyamluki, Ilembula, Luduga and Igwachanya, 1978).

It should be noted that the interviews were conducted at the end of May, in the beginning of the dry season. The average consumption of water is expectedly higher during the wettest months when water is more accessible and abundant. Again, there is reason to believe that the average consumption drops further at the peak of the dry season. Variations between the villages are reflected in the table. The drier



conditions in Saja and Lyamluki are indicated in the lower per capita consumption figures while the relatively higher figures for Ilembula could be attributable to the availability of tap water in this village.

Table 7:3 shows the percentage distribution of households according to the ranges in amount of water consumed daily.

Table 7:3 Percentage Distribution of Daily Per Capita Water Consumption

Volume	% of households consuming
∠ 8 liters	34%
8-10 "	27%
11-15 "	19%
16-20 "	16%
21-25 "	2.5%
26-30 "	0.5%
30 "	1%

(Total No. of h.h. in sample = 239)

(Source: BRALUP survey of Saja, Lyamluki, Ilembula, Luduga and Igwachanya, 1978)

One third of the households use less than 8 liters per capita per day. Earlier studies of rural water supply in East Africa show comparable figures. Warner's study of 9 Tanzanian villages with traditional water supplies showed daily per capita uses of water ranging from 3.6 to 13.2 liters, while White et al. in their study of 19 rural places found that per capita consumption ranged from 4.4 to 20.8 liters with a daily average of 11.2 liters per capita. [1)]

Distance to Source of Water

Distance and hence time is the most crucial variable affecting water use, especially in the dry season. Table 7:4 shows the proportion of households situated at various distances from a water source during the dry and rainy season respectively.

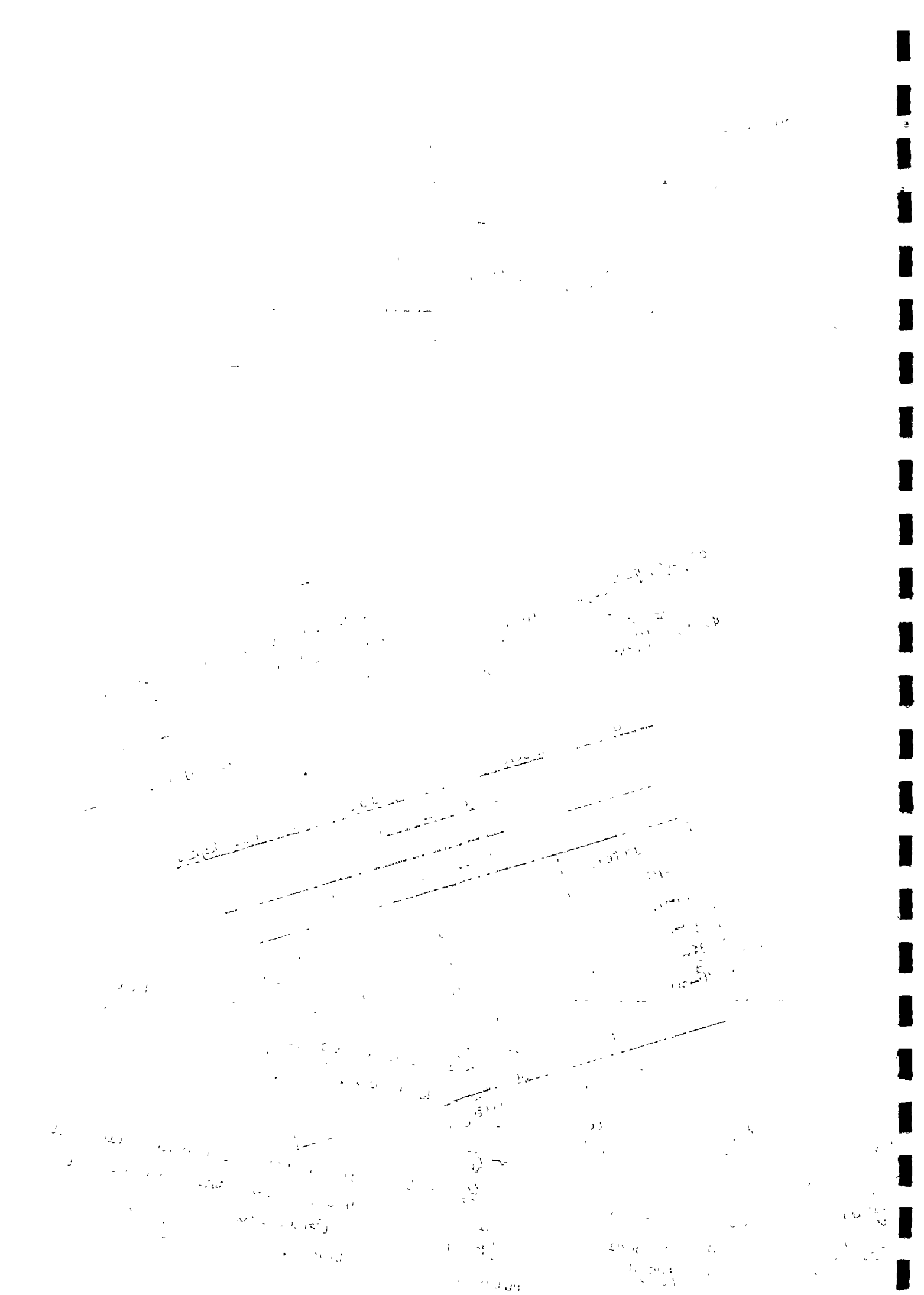


Table 7:4 Percentage of Households at Various distances from Water Source

Distance	Rainy Season	Dry Season
∠ 1 km	61%	26%
1-2 km	14%	17
2-3 km	6%	13%
3-4 km	16%	16%
4-5 km	3%	14%
5-6 km	-	-
6-7 km	-	9%
7-8 km	-	-
8 km	-	5%

(Total No. of h.h. in sample = 239)

(Source: BRALUP survey of Saja, Lyamluki, Ilembula, Luduga and Igwachanya, 1978).

A word of caution must be expressed concerning the accuracy of the data. The respondents stated the distance in miles, a measure with which they are more familiar than kilometers. The answers were given in rough categories such as "half a mile," "one mile," "one and a half mile," etc. Those respondents in Ilembula who lived very close to water taps answered " a few steps." The figures have then been converted to kilometers. In some cases we have been able to check the information given by respondents against the actual distance and found an acceptable correspondence.

The table reveals the difference in distance to source during the two climatic seasons. While only 25% have a distance of more than 2 kilometers during the rainy season, the proportion increases to 57% during the dry season; while 61% have a distance less than 1 kilometer during the rainly season this percentage drops to 26% during the dry season.

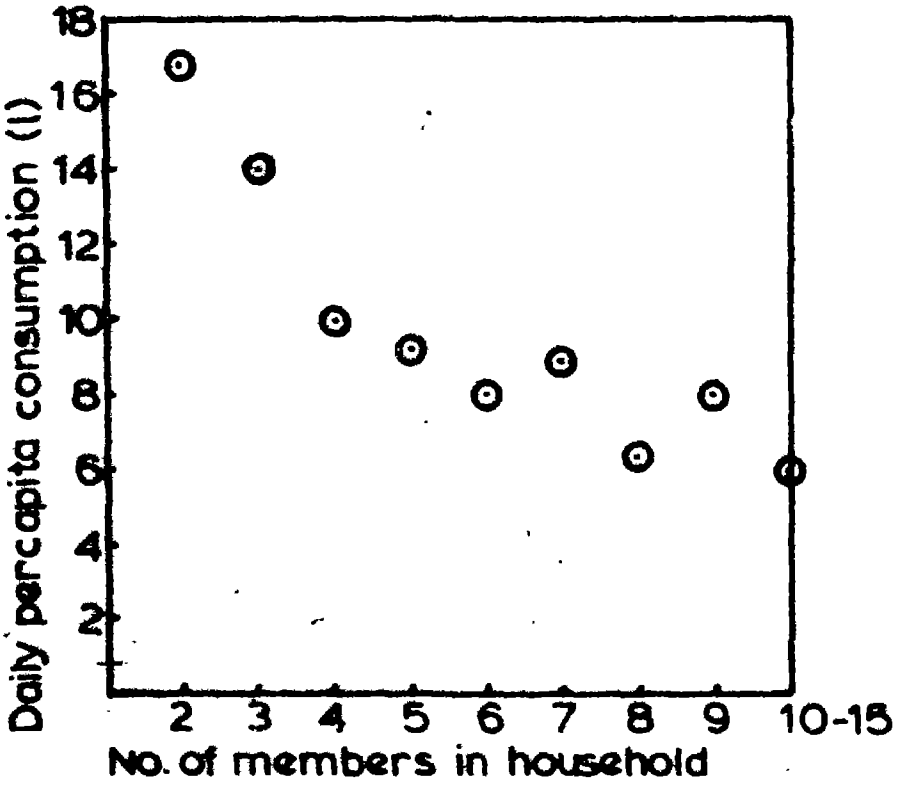
There are also differences between the villages in our sample. The extremely long distances stated for the dry season are reported from Saja and Lyamluki villages in the most arid part of the area. Respondents reporting a distance over 6 kilometers compose 12% of all respondents in Saja and 60% in Lyamluki.

Compared with data from other East African rural situations, the distances given here are not unusual. In one study the average distance to a water source is given as 1.5 km in areas characterized by water scarcity while extreme distances of up to 15 km have been reported.[2] It should be borne in mind that different sources at different distances are often used in the rainy and the dry season respectively.

In figure 7:1 the average daily per capita consumption is plotted against household size.

FIG 7.1

HOUSEHOLD SIZE AND AVERAGE PER CAPITA DAILY WATER CONSUMPTION



As the figure shows the "big" consumers are found in households with few members and vice versa. A similar pattern has also been reported by Bantje, by Feachem et al. and by White, Bradley and White in earlier studies on rural water use in Africa.[3)]

This pattern can be explained with reference to the mode of obtaining water. It appears that the total amount of water fetched is governed by the distance to the source and the means of transport. An adult woman has many other chores besides fetching water, and it is possible to carry only one bucket at a time when one is walking. It is therefore possible to make only a limited number of journeys - two to three journeys per day to a source over one kilometer away consume substantial energy and time.

Under such circumstances a distance of one kilometer makes the collection journey too laborious to encouraged consumption over and above the absolute needs. We found thus, that 67% of those households who reported a distance less than one kilometer consumed ten liters or less per capita per day.

If the amount of water collected remains more or less fixed, then the most important variable determining per capita consumption will obviously be the number of members in the household.

It is only when the distance to the water source is reduced to a minimum that per capita consumption increases significantly regardless of household size. This hypothesis is supported by the water consumption pattern among 115 households in Ilembula village which were located "only a few steps" from a communal water tap.

Water consumption among tap users in Ilembula as compared to all interviewed households is shown in table 7:5.

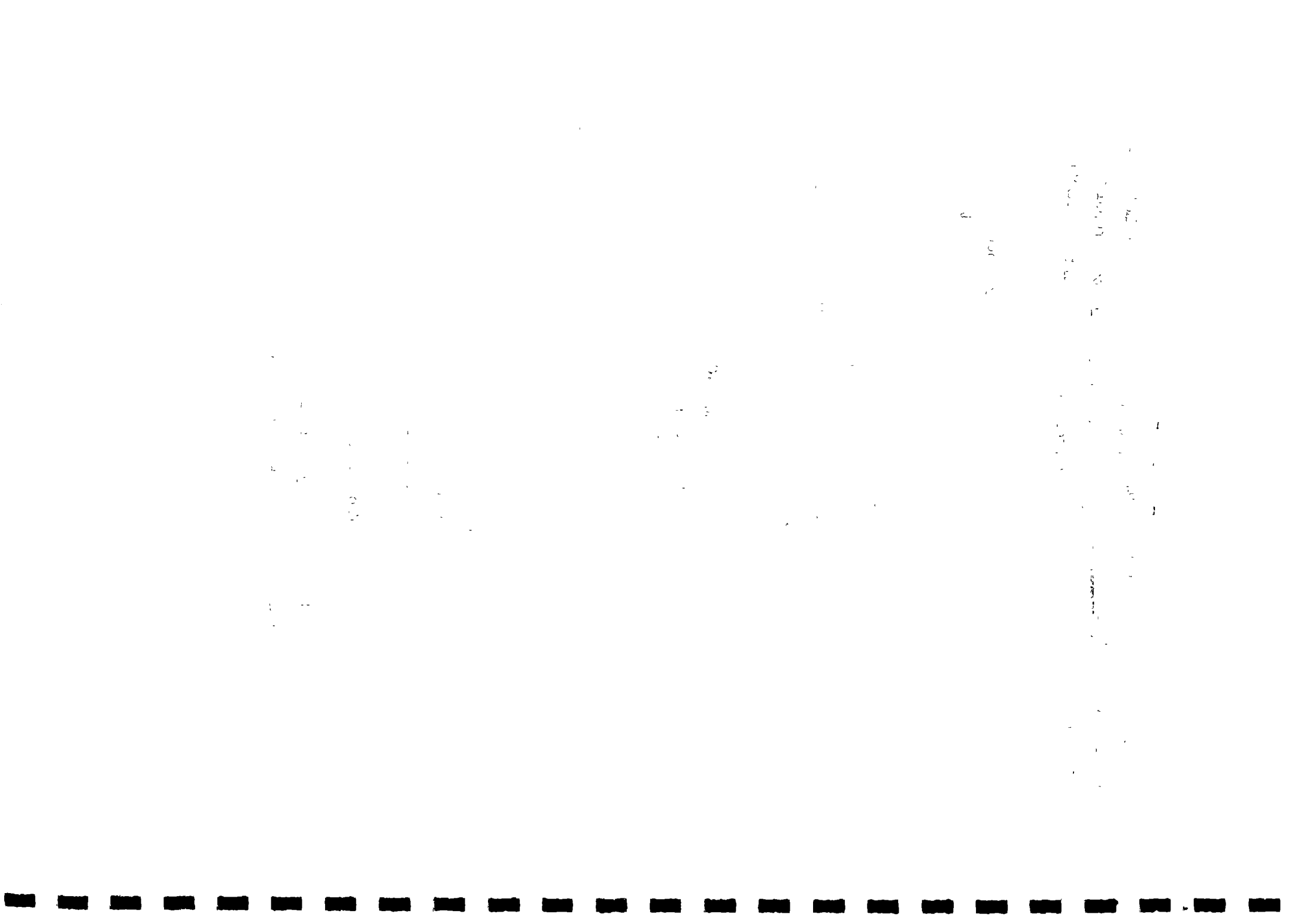


Table 7:5 Daily Average per Capita Water Use among Tap-Users in Ilembula

Household size	Daily per capita water use	
	all households	Ilembula tap-Users
2	17 liters	32 liters
3	14 - . -	-
4	11 - . -	17 liters
5	10 - . -	12 - . -
6	8 - . -	18 - . -
7	9 - . -	13 - . -
8	6 - . -	26 - . -
9 _	7 - . -	12 - . -

(Source: BRALUP survey of Saja, Lyamluki, Ilembula, Luduga and Igwachanya, 1978).

As the table shows even large-sized households in Ilembula, situated in the immediate neighbourhood of a domestic water-point could afford a high per capita consumption of water.

Earlier investigations indicate that when a village is provided with an improved water supply that is instrumental in reducing walking distances to some extent, the volume of water collected increases, but not much. For example, in the villages studied by Warner average water use per capita increased from 12.7 liters per day to 16 liters after the introduction of an improved supply.[4] One conclusion which can be drawn from these findings is that a significant increase in the per capita water consumption does not occur until the source of water is brought to the very doorstep of the household.

Perception of Water Quality

The women respondents in the interviewed households were asked whether the water they used was 'good' or 'bad' and then asked to describe the characteristics of whatever quality they mentioned. Their response is summarized in table 7:6.

Table 7:6 Opinions held by Women on Water Quality

Village		Percentage of Women who think their water is		
	good water	bad water	don't know	Percentage of women who believe one gets sick from bad water
Igwachanya	11%	71%	18%	58%
Luduga	15%	85%	-	76%
Ilembula	43%	47%	10%	72%
Saja	13%	84%	3%	68%
Lyamluki	13%	87%	-	93%

(Total No. of h.h. in sample = 244)

(Source: BRALUP survey of Saja, Lyamluki, Ilembula, Luduga and Igwachanya, 1978)

The overwhelming majority of the women think that the water they use is bad. The characteristics of 'good' water mentioned were that it was clean, running, and that it did not cause sickness. 'Bad' water was described as being muddy, stagnant, having a bad smell or containing small organisms. It was also 'bad' if people washed clothes or bathed near it, if cattle used it and if drinking it caused stomach diseases.

The answers indicate a certain awareness amongst the women of the relationship between water and health. But in practice there is very little action on their part to improve the situation whenever it might be detrimental to health. Women did complain about muddy waterholes, but nowhere did we come across structures designed to protect traditional water-sources.

Bacteriological Analysis

A bacteriological water analysis was conducted in October, 1978. Water samples were collected from six different sources and sent to Iringa Regional Hospital for bacteriological analysis. Water sources were selected after discussion with villagers. The criterion used was that the source sampled should be one of the major sources used by the villagers for their daily consumption. The sampled sources were the following:

* A well in Mayale village. It is located in a valley two kilometers from the center of the village and is one of the three main water sources during the dry season.

* A waterhole in Kijombe village. It is situated in a small valley about one kilometer from the primary school. The waterhole was one of the four sources of water for the villagers. During the rainy season this depression is filled up with water. As the dry season proceeds it dries up completely. Due to the abundant rains in 1978 there was still water in the hole at the time of our sampling, but the villagers expected it to get completely dry during that month. The waterhole was completely unprotected, women walked down to it, stood with their feet in water and scooped up buckets. At our visit one woman was sitting beside the hole washing clothes in a bucket.

* Halali river. This river runs by Kanamalenga, Ilembula and Mayale villages. It is constantly utilized by people for washing clothes, bathing and drawing domestic water. It is also used by livestock. The central part of Ilembula is provided with a pump scheme drawing water which is then chlorinated from Halali and piped to 8 standpipes in the center of the village. When the pump is out of order (as was the case in October) these villagers draw water directly from the river or utilize a borehole scheme inside the compound of the Lutheran Hospital. Two samples were taken from Halali; near the primary school in Ilembula and at the bridge where the river crosses the highway to Zambia.

* Huhuni river. This river passes by Wanging'ombe village and joins the Halali river at the highway bridge. It is also used by people and livestock.

* A pond between Wanging'ombe and Ufwala villages. It is mainly used by livestock, but children are frequently seen playing and bathing in the pond.

From each of these sources a one liter sample was taken under sterile conditions. The samples were put in a cold-box and immediately transported to Iringa. The tests were conducted in the laboratory of the regional hospital. All samples were tested within twelve hours of collection.

The test method used was the multiple tube method using MacConkey broth and agarplates for inoculation and incubation. The aim was to establish the concentration of coliforms including faecal coliforms. Drinking water should ideally not contain any organisms of faecal origin. The presence of coliform organisms should be considered an indication of remote faecal pollution. The presence of Escherichia coli (faecal coliforms) indicates recent faecal pollution.

Normally, when a sample is composed of five bottles, the analysed water is classified according to the scheme shown below.

No. of bottles giving positive reaction	Coliform count of 37% (most probable no. of coliforms per 100 ml).	Classification of water for drinking purposes
0	0	Excellent
1	2-4	Satisfactory
2-3	5-10	Suspicious
4-5	16	Unsatisfactory

The result of the bacteriological analysis of the six samples was unanimous. In each sample all five MacConkey bottles tested gave a positive reaction including gas production. The most probable number of coliforms per 100 ml. was over 16. E. coli were found among the coliforms. Thus, the water in all the samples are to be graded as unsatisfactory for human consumption. The presence of Escherichia coli indicates recent faecal pollution and the water can hence be detrimental to health if drunk.

It should be noted that samples were taken in the middle of the dry season. Faecal pollution of the traditional water sources is generally held to be more intense during the rainy season. There is, then, reason to believe that the result of the analysis of our samples are illustrative of the unimproved water sources in general in the Wanging'ombe area.

Boiled water

The problem of faecal pollution of the drinking water could be overcome if the water is boiled for 2-5 minutes. Propaganda for boiled water is an established feature in the health education programmes of the Ministry of Health. Especially during the cholera in 1978 officials at all levels informed the villagers about the advantages of boiled water.

The campaign was effective only as a lip service. People know that they are expected to answer 'yes' to the question whether they boil water before drinking it. Consequently, when we, in the presence of CCM officials, asked peasants who showed us their source of water whether they boil their water they answered in the affirmative. But later on when a more relaxed atmosphere prevailed and the discussion continued in Kibena (the local language) the villagers admitted that they never boil water. They did not want to waste fire-wood on such a thing.

There are two factors which militate against a real success of the boil-water campaign. Fire-wood is a scarce resource. Women have to fetch fire-wood from places as far away as the water-sources. It is thus both time and energy consuming. The other factor is education. People do not really know why water is safer when boiled.

Format for Further Evaluation of the WNWSP

For the purpose of evaluation the water use pattern will be divided into three parameters.

The first parameter is the time and energy spent on the water collection journey. The indicator of the parameter is the distance from the house to the nearest standpipe of the WNWSP. By comparing this distance with the distances to traditional sources of water as shown in Chapter V it can be shown whether the WNWSP has been instrumental in reducing walking distances. The extent to which unimproved sources still are in use should also be measured. Separate assessments should be made for the dry and the rainy season respectively.

The second parameter is the water use pattern proper, i.e. the volume of water and distribution between various uses. Possible use of water from unimproved sources should also be included.

The information can be obtained through household interviews and checked by measurement at taps. The amount of water collected per household should be translated into average per capita daily consumption. Variances in the volume consumed and the distribution between various uses among households should be analysed.

The third parameter is water quality. The indicator of the parameter is the amount of coliforms including E. coli as well as chemical pollution in the tap water. The data should be compared with the data presented in this chapter. Bacteriological samples should also be taken at unimproved water sources for further comparison.

Lastly, the project should be monitored with regard to its capacity to fulfill the immediate aims - to supply the water through the pipeline system. The frequency and cause of breakdowns should be recorded.

Chapter 8: HEALTH

We will now turn the attention to the conditions of health in Northern Njombe. The analysis will concentrate on the relationships between the disease pattern, on the one hand, and water quality and water use on the other. The reason for choosing this approach is to enable us to assess the potential benefits of improved water supply to health. Expressed more precisely; an analysis of diseases which directly or indirectly are related to water is a necessary prelude to the discussion on the prospective impact of the Wanging'ombe North Water Supply Project.

Classification of Water-Related Disease

As an introduction it will be necessary to describe the classification of water-related diseases which will be used here.

At a BRALUP conference on rural water supply held in Dar es Salaam in 1971, David Bradley outlined a classification of water-related diseases adapted to tropical conditions. In Bradley's scheme diseases were categorized as water-borne, water-washed, water-based and water-related via insect vectors.[1] This classification has subsequently been elaborated by Bradley and Feachem.[2] Here we will draw on Feachem (1978) for a presentation of the classification.

Water-borne diseases are infections and can be transmitted to people when they drink water contaminated by pathogenic organisms. The infective mechanism is faecal material which has access to water sources for human consumption. Well known examples are diarrhoeal diseases and Cholera. But drinking water is not the sole transmission medium, these diseases can also be transmitted directly through the faecal-oral or ano-oral route and are thus closely related to personal hygiene.

Water-washed diseases are infections caused by lack of water for personal hygiene. An increased volume of water available for washing and cleaning will be instrumental in reducing the incidence of these diseases, but the quality of water matters less since it is not being drunk.

Water-washed diseases include skin infections such as Scabies and Skin sepsis eye infections such as Trachoma and infections transmitted by fleas, lice, ticks and mites.

But the faecal-oral infections mentioned above (diarrhoeal diseases etc.) can theoretically, also be classified as water-washed since an increased volume of water for personal and household hygiene can be instrumental in their reduction. However, for practical reasons it has been suggested that the term water-washed should be reserved for the skin and eye infections and the diseases which are associated with infestations of fleas, lice, ticks or mites.[3] Consequently the infections which theoretically can be both water-borne and water-washed will here be called faecal-oral infections.

Water-based diseases are worm infections. The infective pathogen spends part of its life cycle in water parasiting on an aquatic host. When man's body comes into contact with water the parasite worms can penetrate the skin and enter the body. The best known water-based is Schistosomiasis. The Schistosomiasis worm is dependent on fresh-water snails as intermediate hosts. These snails live in ponds and slowly flowing waters. The worms penetrate human skin and settle in the blood vessels around the bladder (S. haematobium) or in the intestines (S. mansonii). It is their eggs which produce the infection.

Insect vectors breeding in water or living near water form the fourth category in this classification. The most common disease is Malaria which is transmitted to man by mosquitoes breeding in small water ponds.

Following Feachem's revision of Bradley's classification we will now list and categorize the various water-related diseases which are prevalent in Northern Njombe.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Table 8:1 Water-related diseases in Northern Njombe

Category	Diseases
Faecal-oral (water-borne or water-washed)	Amoebic dysentery Ascarieasis Bacillary dysentery Cholera Diarrhoeal disease Gastroenteritis Heptatitis (infections) Typhoid
Water-washed	Infectious skin disease Infectious eye disease
Water-based	Schistosomiasis
Water-related insect vectors	Malaria

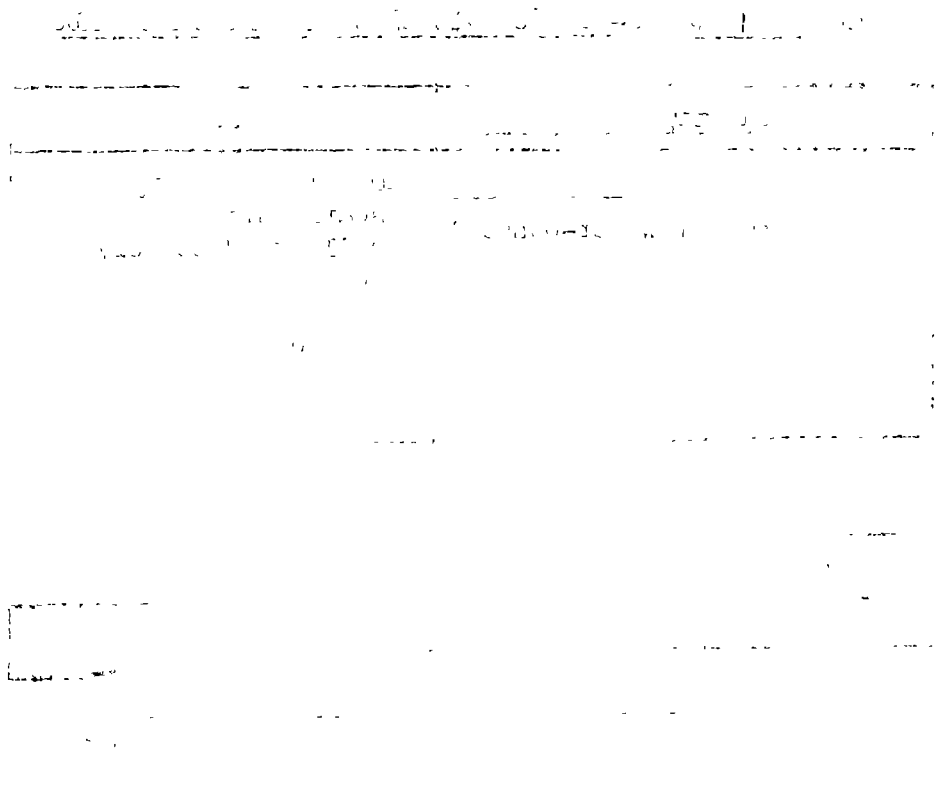
Bearing this classification in mind we will now turn to a presentation of the disease pattern in Northern Njombe. Before presenting the data, a few words on the source material must be said.

The Source Material

For the analysis of the disease pattern we have relied on records from the six dispensaries in the Wanging'ombe area, the Health Centre in Makambako and the Lutheran Hospital in Ilembula. The diagnosis and recording of patients have been made by the local health officers and sent to the District Hospital in Kibena, Njombe. Concerning the records the following shortcomings should be observed:

Firstly, the records show only "the tip of the iceberg." A large number of diseases go untreated in the villages. Especially Schistosomiasis, Diarrhoeal disease and child malnutrition are considered to be under-reported.

Secondly, the records are not complete. We were unable to obtain figures for two months in one dispensary and for four months (1977) in another. It has then not been possible to get the full picture of the seasonal variations of various diseases. We have therefore chosen to base the analysis of seasonal vations of Malaria, Gastoenteritis and skin diseases on records from three dispensaries only.



Thirdly, the diagnosis given at the dispensaries is not always accurate, diagnostic and staff training being inadequate. In particular it is believed that among the cases reported as Malaria in the dispensary records, there are many diseases which have been misdiagnosed. Moreover it has been impossible to include general categories such as "all other infective and parasitic disease" in the analysis.

Fourthly, repeated visits by the same patient for the same illness are recorded as separate cases which means that the records are somewhat inflated.

Fifthly, the analysis covers only the year 1977. It is possible that the emerging disease pattern would have been somewhat different if several years' records had been included.

The cumulative effect of these shortcomings on validity and reliability would indeed disqualify the data material for a scientific analysis. However, in the absense of alternatives we have decided to make use of the information obtained. But it should be kept in mind that the analysis is illustrative rather than exact.

The Main Diseases

The total number of cases reported at the six dispensaries in the project area in 1977 was 52,456. Their distribution is presented in table 8:2 while in table 8:3 the diseases have been aggregated in accordance with the classification of water-related diseases.

Table 8:2 Summary of Monthly Reports from 6 Dispensaries in Northern Njombe, 1977

Disease	No. of patients treated
INFECTIVE	
Pulmonary tuberculosis:	24
Influenza	982
Leprosy	76
Whooping cough	668
Measles	1,118
Tetanus	1
Smallpox	1
Chickenpox	312
Malaria	12,514
Gonorrhoea	546
Syphilis	313
Other ven. diseases	61
Schistosomiasis (mansonii)	958
Hookworm	185
Ascariasis	283
Thread worm	92
Tape worm	338
All other infective and parasitic diseases	2,121
NUTRITIONAL DISEASES	
Kwashiorkor/marasmus	222
Other protein deficiencies	279
Other nutritional diseases	313
DISEASES OF BLOOD AND BLOOD FORMING ORGANS	
Anemiasis	186
DISEASES OF THE NERVOUS SYSTEM AND SENSORY ORGANS	
Inflamatory of the eye	2,882
Other eye diseases	1,260
Diseases of the ear	1,872
Diseases of the nervous system	354
Other diseases of sensory organs	77

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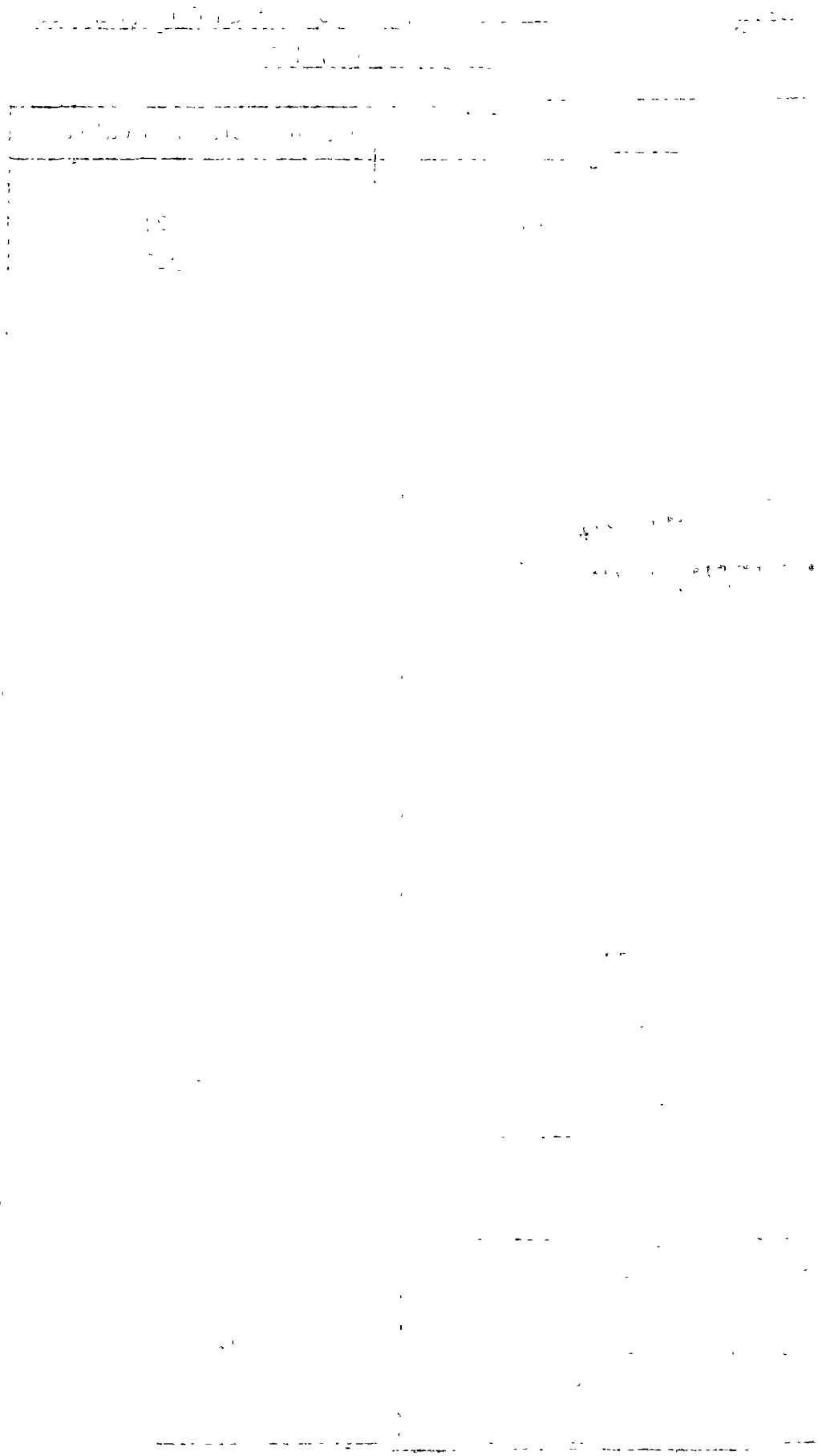


Table 8:2 (Continued)

	No. of patients treated
DISEASES OF THE RESPIRATORY SYSTEM	
Upper resp. infect./tonsillitis sore throat	2,415
Bronchitis	3,994
Pneumonia	1,514
Asthma	279
Other dis. of the resp. system	4,113
DISEASES OF THE DIGESTIVE SYSTEM	
Typhoid	357
Dysentery (bas. & amb.)	572
Gastro-enteritis & diarrhoeal diseases	4,439
Diseases of teeth and gum	939
Gastritis & Duodentis	309
Instestinal obstr. & hernia	20
Other dis. of the digestive system	4,338
DISEASES OF THE GENITO - URINARY SYSTEM	
Hydrocele	13
Cystitis and disorders of micturition	78
Orchitis & epididymitis	46
Other dis. of genito & urinary system	36
DISEASES OF SKIN	
Diseases of the skin and subcellotaneous tissue	1,756
Total	52,456

Source: Monthly reports from Mdandu, Palangawanu, Luduga, Wanging'ombe, Saja and Kijombe dispensaries, January-December 1977.

N.B. The following monthly records are missing; Mdandu: May, June; Palangawanu: March, May, July, August; Kijombe: March.

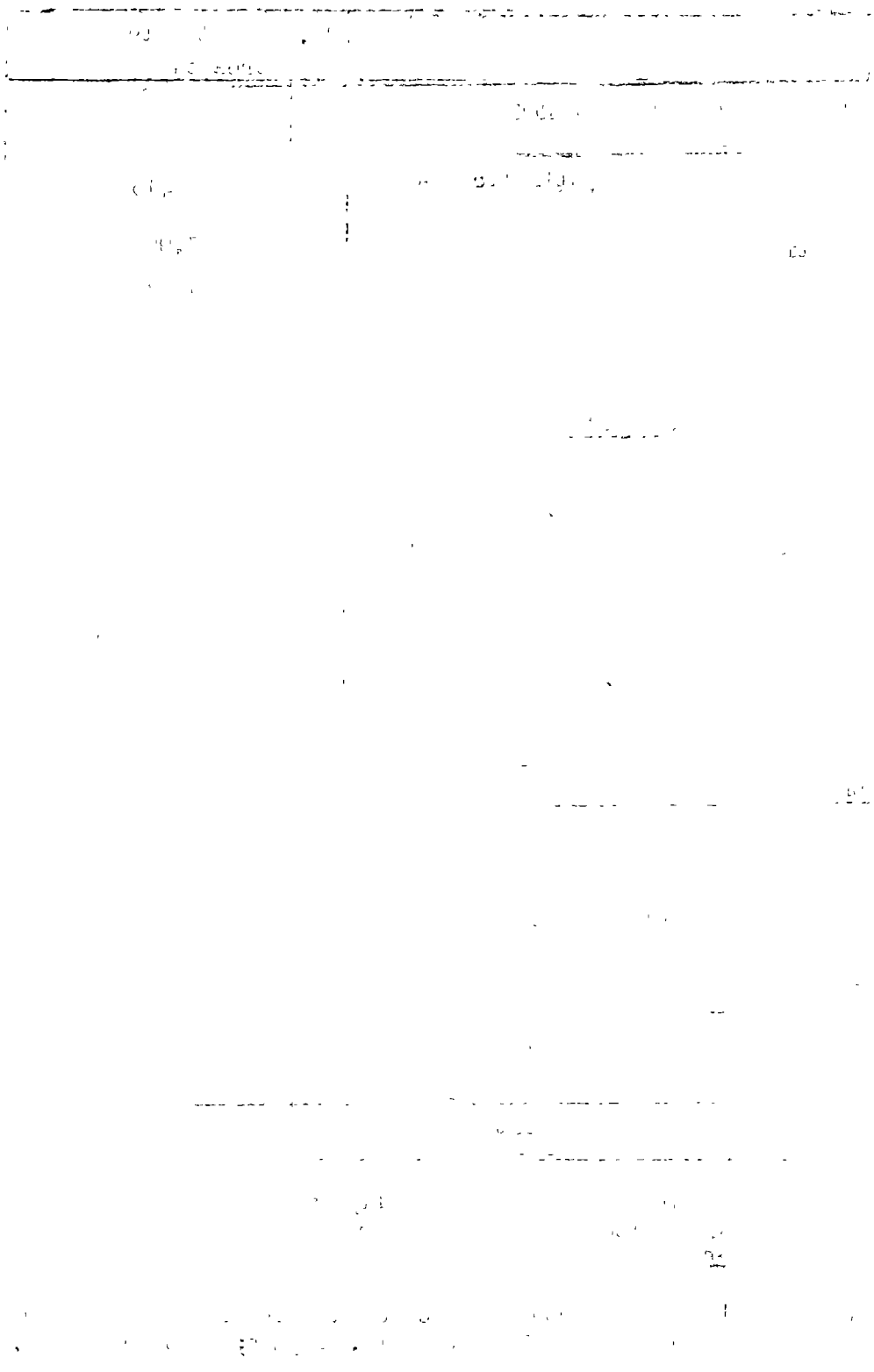


Table 8:3 Relative Importance of Water-Related Diseases in Six Dispensaries in Northern Njombe, 1977

Category	No. of cases	Percent
Faecal-oral infections*)	5,631	11%
Water-washed diseases**)	4,631	9%
Water-based diseases***)	958	2%
Water-related insect vector diseases ****)	12,514	24%
All other diseases	28,722	54%
TOTAL	52,456	100%

Source: Monthly reports from Mdandu, Palangawanu, Luduga, Wanging'ombe, Saja and Kijombe dispensaries, 1977.

*) - Typhoid, Dysentery (bacillary and amoebic), Gastro-enteritis & diarrhoeal diseases, Ascariasis.

**) - Diseases of the skin and subcutaneous tissue, inlammatory of the eye.

***) - Schistosomiasis.

****) - Malaria.

The importance of the various water-related diseases stands out clearly. Together they amount to 46% of all diseases reported in the dispensaries. Malaria stands out as the single most important disease one patient out of every four suffered from Malaria. Although there is no reason to doubt that Malaria is extremely common, the figure in the table may be an over-rating due to the tendency among dispensary staff to diagnose and treat fevers as Malaria.

Schistosomiasis on the other hand is obviously underreported. Njombe district is one of the places in Tanzania where both S. haematobium and S. mansonii are reported to be prevalent. One reason why Schistosomiasis appears so seldom in dispensary records is that people feel ashamed to talk about the overt symptom; blood in the urine. Another reason is that the medical staff sometimes do not bother to record cases of Schistosomiasis because they have no medicine to cure it with anyway. Therefore it is mostly people who suffer from Schistosomiasis in an advanced stage who are treated and they are referred to hospitals or rural health centres.

"Gastroen teritis and other diarrhoeal diseases" occupy second rank in the dispensary records. But other faecal-oral diseases such as infective hepatitis, Amoebiasis and Typhoid are reported only as stray cases. The reason for this is that these diseases usually are referred directly to the Rural Health Centre in Makambako and to Ilembula Hospital. An examination of the records at these health institutions reveals the importance of the more severe faecal-oral diseases.

Table 8:4 Makambako Rural Health Centre; Monthly Reports of Patients' Attendance; April, May, June and July 1978

Diseases	No. of patients treated
Conjunctivitis	3,279
Dysentery	3,633
Other Diarrhoeal	846
Gastrocenteritis	3,007
Pulmonary TB	22
Whooping Cough	61
Measles	391
Infective Hepatitis	1,255
Clinical Malaria	3,730
Syphilis	202
Gonorrea	1,278
Schistomiasis	8,346
Anclostomiasis	4,418
Lympogranulanis	721
Septic Ulcer	1,837
Pneumonia & Bronchitis	4,554
Scabies	344
Carbuncles	1,250
Malnutition	613
TOTAL	39,787

(Source: Makambako Rural Health Centre)

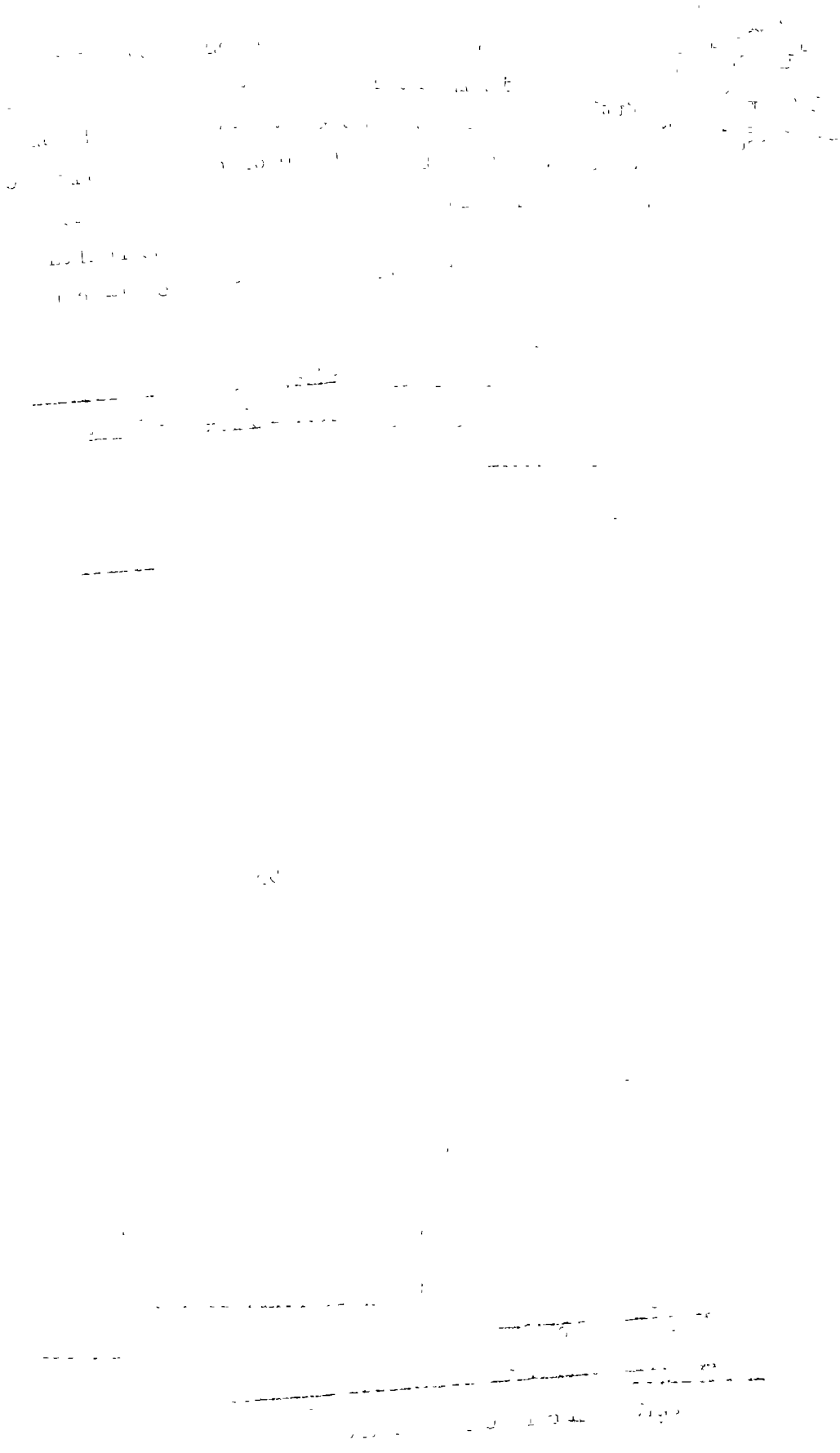


Table 8:5 Relative Importance of Water-Related Diseases in Makambako Rural Health Centre, April, May, June and July, 1978

Category	No. of cases	Percent
Faecal-oral*) infections	8,741	22%
Water-washed **) infections	344	1%
Water-based ***) infections	8,346	21%
Water-related insect vector diseases ***)	3,730	9%
All other diseases	18,626	47%
TOTAL	39,787	100%

Source: Makambako Rural Health Centre.

*) Dysentery, Other diarrhoeal diseases, Gastroenteritis, Infective hepatitis.

**) Scabies.

***) Schistosomiasis.

****) Clinical malaria.

Altogether the water-related diseases make up 53% of the treated cases, and Schistosomiasis is the single most important disease constituting 21% of all cases.

The records from Ilembula hospital also show high incidences of Typhoid and Infective hepatitis.

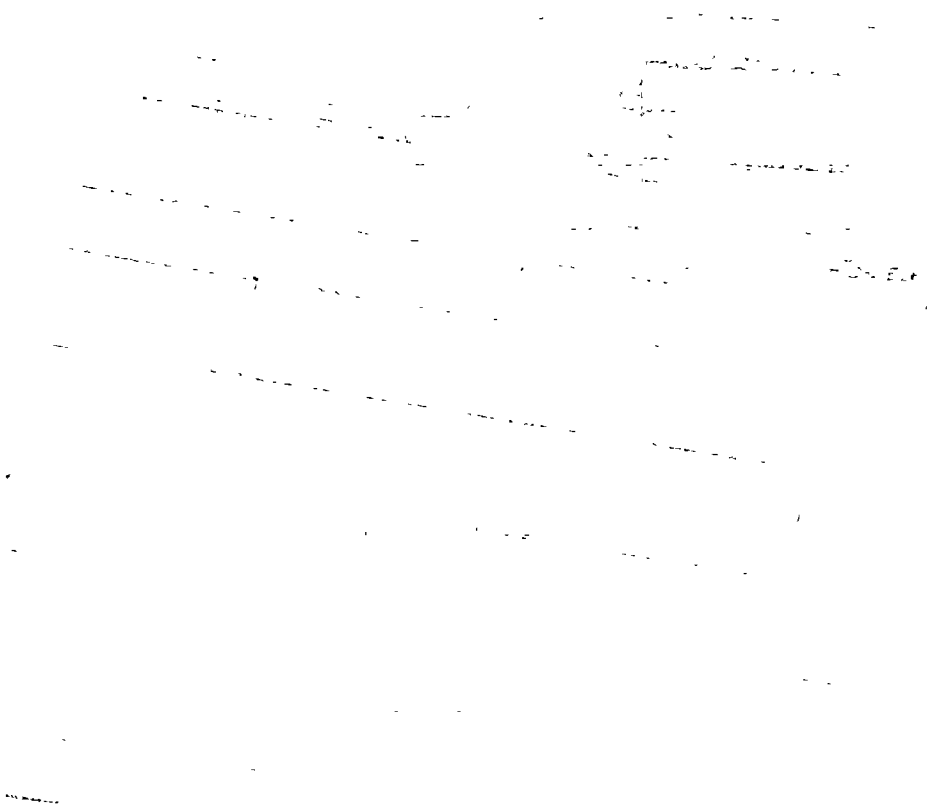


Table 8:6 Communicable Diseases Recorded at Ilembula Hospital, 1977

Disease	No. of patients treated
Typhoid	181
Bac. Dysentery	36
Amoebiasis	2
Pulmunary TB	229
Other TB	30
Anthrax	4
Whooping Cough	12
Leprosy	4
Measles	643
Infective Hepatitis	458
Chicken Pox	7
Malaria	1,495
Relapsing Fever	10
Hookworm	175
Tricohomena Inf.	20
Schistosomiasis Heam.	52
Schistosomiasis Mansonii	9
TOTAL	3,367

(Source: Ilembula Lutheran Hospital, Annual Report, 1977)

Table 8:7 Relative Importance of Water-Related Diseases Among Communicable Diseases Recorded at Ilembula Hospital, 1977

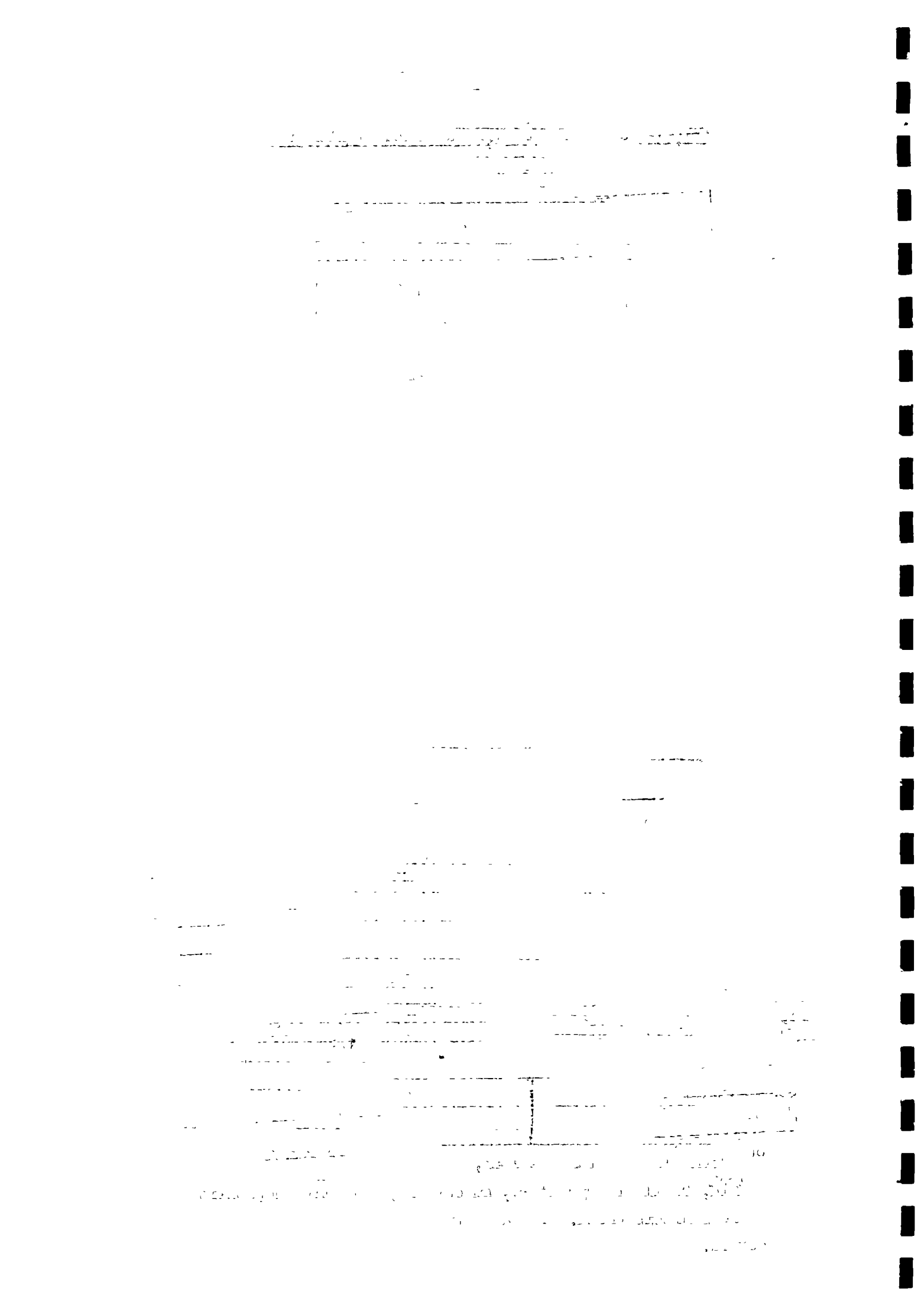
Category	No. of cases	Percent
Faecal-oral infections*)	677	20%
Water-washed diseases	-	-
Water-based diseases **)	61	2%
Water-related insect vector diseases ***)	1,495	44%
All other diseases	1,134	34%
TOTAL	3,367	100%

(Source: Ilembula Lutheran Hospital, Annual Report, 1977

*) Typhoid, Bacillary Dysentery, Amoebiasis, Infective Hepatitis

**) Schistosomiasis (heam. and mansonii)

***) Malaria.



Although no far-reaching conclusions can be drawn from these data, it is obvious that the water-related diseases have an important share in the local disease pattern. And indeed their occurrence is so high that investments in a clean water supply project appears justifiable. However, it would be unrealistic to think that a conventional water supply scheme would have any direct impact on the incidences of Malaria and Schistosomiasis. On the other hand, it would be more realistic to expect an impact on the faecal-oral and water-washed infections. But the realization of this potential puts demands on the technical design of the project. The implications for technical design will be discussed in the concluding remarks of the report.

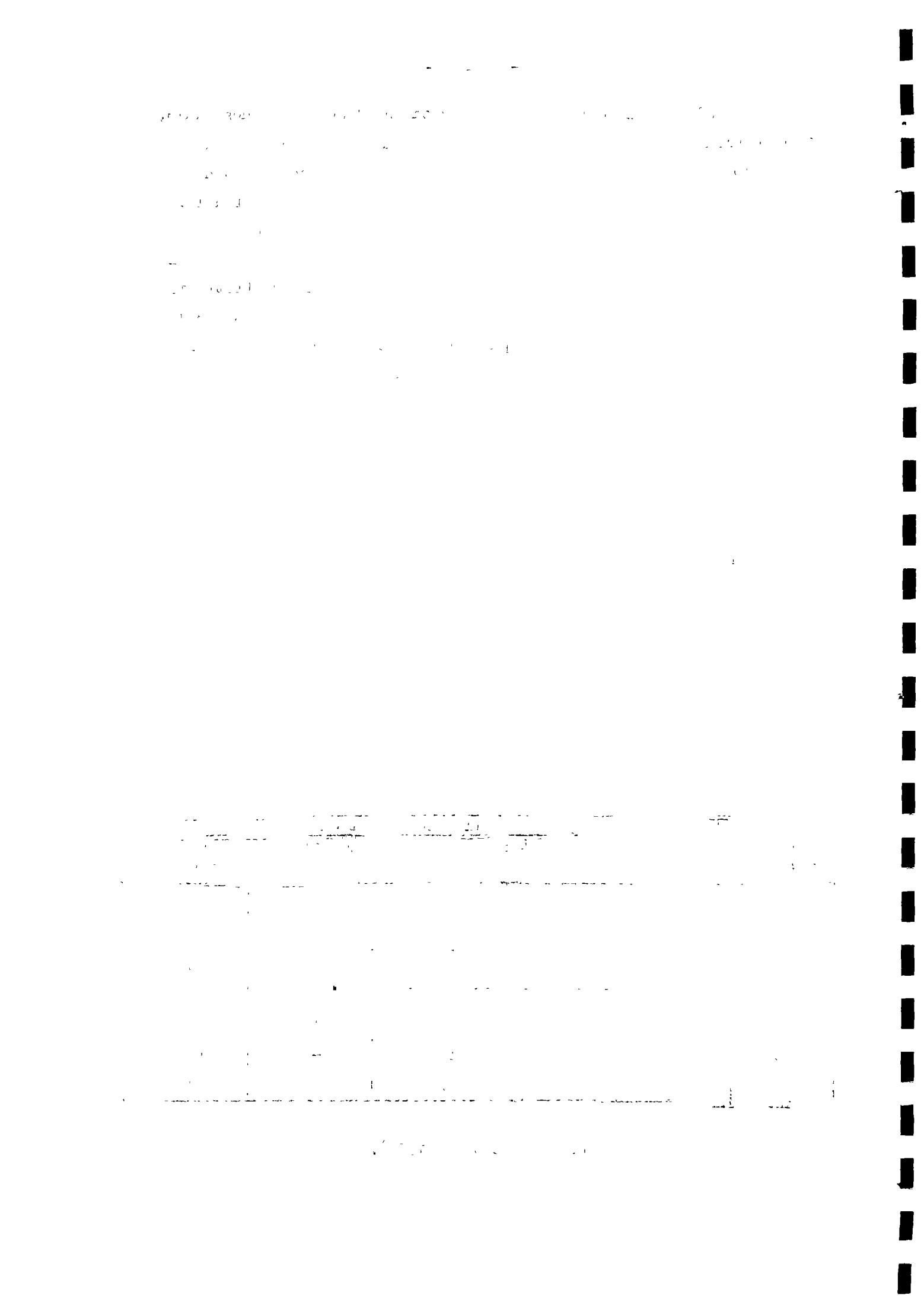
Geographical variances

We will now analyse the dispensary records with reference to the geographical differences which are found within Northern Njombe. The TANZAM highway can then serve as a rough delimitation line. The area South of the highway receives relatively more rainfall and has a higher altitude, while the area to the North of the line receives less rain and is lower, hence it is warmer and drier. For this purpose we will divide the dispensaries in two groups,: Luduga, Mdandu and Palangawanu being located South of the railway and Saja, Kijombe and Wanging'ombe being North of the highway.

Table 8:8

Area characteristics	Dispensary	% of all recorded diseases			
		Malaria	Ifectious skin disease	infectious eye disease	Faecal-oral infections
higher altitude	Mdandu	11%	6%	6%	11%
more rain	Palangawanu	18%	-	4%	12%
cooler	Luduga	23%	-	7%	9%
lower altitude less rain warmer	Wanging'ombe	28%	5%	7%	10%
	Kijombe	26%	5%	-	10%
	Saja	26%	6%	6%	9%

(Source: Dispensary records, 1977).



The relative importance of the faecal-oral diseases is strikingly uniform throughout the area. The same could be said of the water-washed diseases, were it not for the extremely low number of incidences of skin diseases in two dispensaries and eye disease in one dispensary.

The only disease which shows a marked geographical variation is Malaria. The relatively low incidence of Malaria in Mdandu dispensary could be attributed to the general elevation of Mdandu area. Mdandu division is located in the southernmost part of Northern Njombe on the verge ofthe highlands. The altitude is 1,800 - 1,600 meters, while Wanging'ombe Kijombe and Saja lie at altitudes between 1,450 and 1,200 meters.

Seasonality analysis

We have also made an attempt to analyse how the various water-related diseases are distributed between the wet and dry season respectively. Rainfall data show that the wettest months (1977) were December to March with some rains also falling during the last weeks of November and the first weeks of April. Only the dispensaries North of the highway (Wanging'ombe, Kijombe, Saja) have been included in the analysis because we lack data for critical months from the other dispensaries.

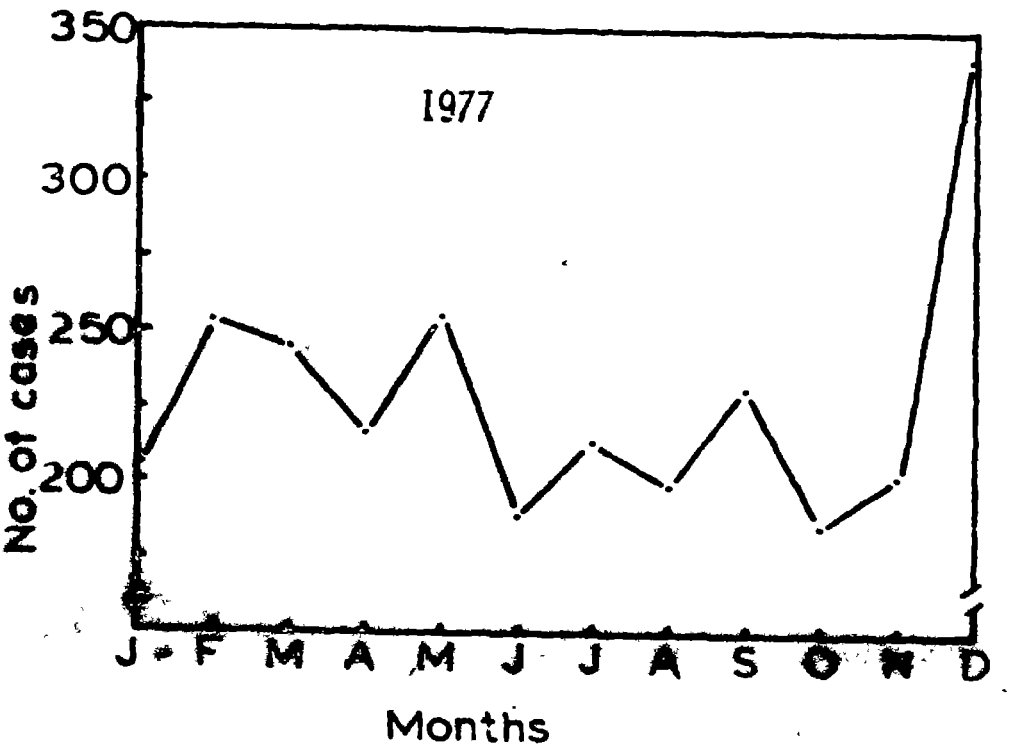
Malaria: It is to be expected that there should be a positive correlation between high incidences of Malaria and wet climatic conditions. In figure 8:1 the monthly records of Malaria cases reported are shown together with rainfall records.

A correlation between the wet months and high Malaria incidences can be established. The peak for Malaria starts in January about a month after the onset of the rain. The peak-period lasts until May with an absolute maximum in April. This period coincides with the rainy season during which there is plenty of water in streams, ditches and ponds providing favourable breeding conditions for the mosquito vector. About one month after the cessation of the rains the soil dries up leaving few breeding places for mosquitoes. This situation is reflected in the Malaria curve, which plummets in June and stays low throughout the dry season.

Gastro-enteritis and other diarhoeal diseases: The seasonality of these diseases is shown in figure 8:2.

FIG 8.2

MONTHLY INCIDENCE OF GASTROENTERITIS AND OTHER DIARRHOREAL DISEASES REPORTED AT SAJA, WANGINGOMBE AND KIJOMBE DISPENSARIES



The figure shows a giant peak in December after which the curve stabilizes with a slight downward tendency during the dry months. Health officers in Iringa region attributed the December peak to accumulated-faecal material which is flushed by the heavy rains into streams and springs utilized by villagers for domestic purposes. This hypothesis has been challenged by Feachem et al in their studies of water-related diseases in Lesboto.[4] These authors forward some alternative hypothesis, inter alia that the village environment becomes significantly less hygienic during the wet months. A moist and relatively warm climate, muddy soil, puddles of water around the houses create favourable conditions for the survival of pathogens and higher risks of infection compared to the dry and relatively cool summer months.

This hypothesis is certainly worth exploring, but it does not explain the curve in figure 8:2 where December alone is the high peak.

Human and Economic Consequences

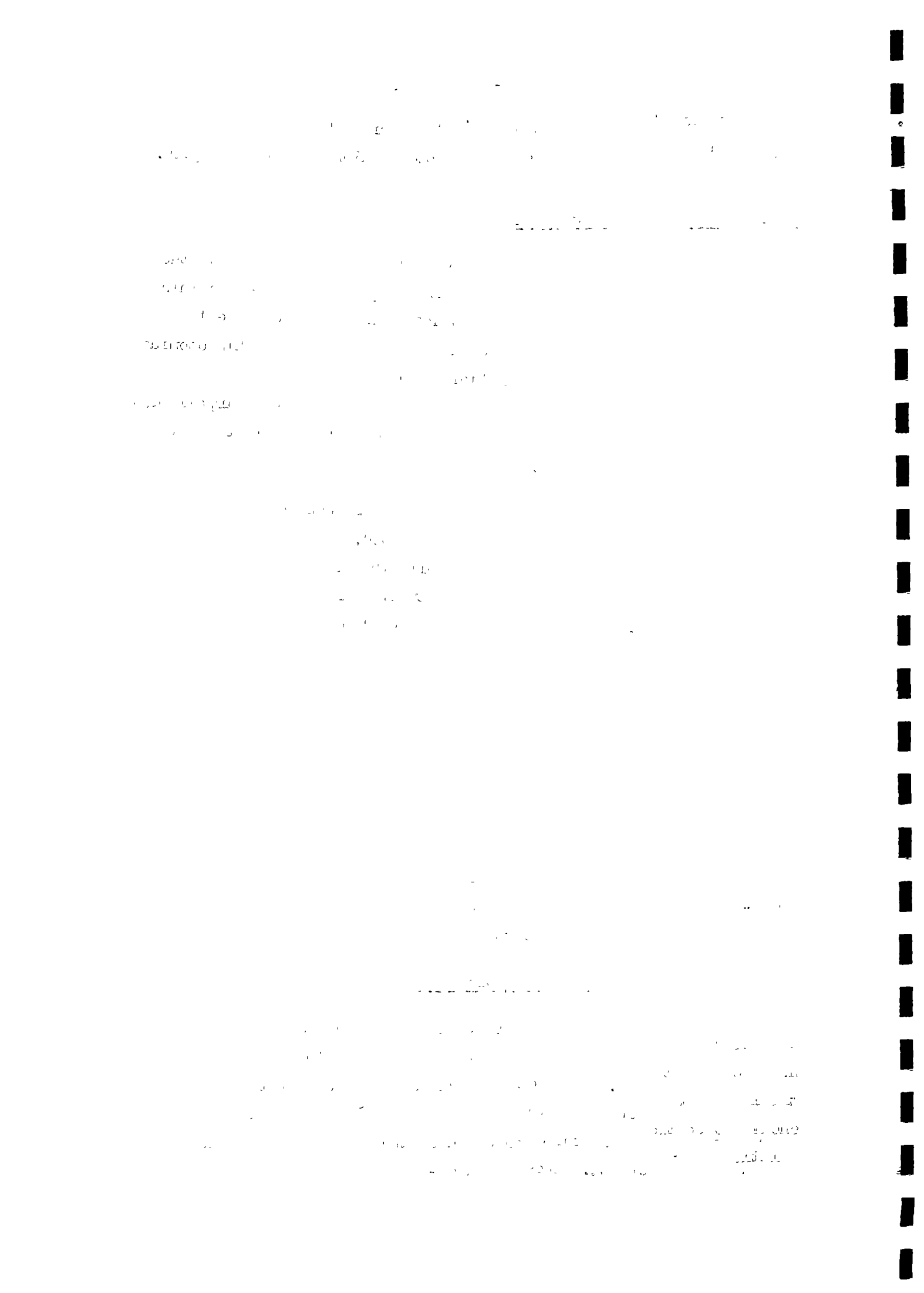
It is of importance to state in general terms the effects of the water-related diseases on human life. The diseases mentioned in this chapter have, as a rule, fatal consequences only when they affect children. But adults suffering from diarrhoeal diseases, Schistosomiasis and/or Malaria do survive. While Diarrhoeal and Malaria bring about recurrent acute attacks Schistosomiasis can effect a gradual impairement of the general condition of health. The misery felt by each affected person defies attempts at measurement.

On the other hand, the effects of these diseases on the productivity of agricultural labour can easily be understood. The months of high incidences of Malaria coincide in time with the peak season for agricultural work; i.e. cultivation (December, January) and weeding (February, March). The high incidences of Gastroenteritis and diarrhoeal diseases in December reinforces the trend. We have to conclude that people are at their weakest harrassed by both Malaria and intestinal infections - during the period when the most drudgery of agricultural operations, cultivation of the soil, has to be undertaken. These facts should be kept in mind when one tries to analyse the reasons for the low agricultural productivity in Northern Njombe.

Moreover from an agricultural and nutritional point of view it can be noted that the diarrhoeal diseases account for a certain "post-harvest loss." The food crops consumed cannot be kept but are forced out of the body before the nutrients have been digested.

Format of Further Evaluation of the WNWSP

For the purpose of evaluation, changes in the health situation for the people living in the villages to be served by the water project will have to be assessed. The health conditions can be operationalized as the incidence of certain diseases. It is proposed that the evaluation should concentrate on the diseases which are known to have a direct relation to water use. These include:-



* faecal-oral diseases; - Cholera
  - Typhoid
  - Bacillary Dysentery
  - Amoebic Dysentrey
  - Diarrhoeal diseases
  - Gastroenteritis
  - Infectious hepatitis

* water-washed diseases; - Trachoma
  - Louseborne Typhus
  - Yaws
  - Tinea
  - Scabies
  - Inflammatory eye disease
  - Infectious skin disease

* water-based diseases; - Schistosomiasis

* water-based insect vector diseases; - Malaria

Reduced incidence in these diseases should be taken as indicators of a positive change in the health conditions.

Dispensary records will serve as baseline data for the measurement of changes in these indicators of the health conditions. It is suggested that monthly records should be collected from 1975 onwards. The records are kept at the Kibena district hospital in Njombe.

The data should be treated with caution. Reference is made to the shortcomings mentioned in this chapter. Additional methodological problems are improved by the time factor. If the evaluation is conducted in 1983 then the time will be eight years.

The first problem concerns the total number of attendancies. It is possible that the attendancies will increase considerably over the eight year span due to a better awareness of diseases among the population and better confidence in the dispensaries. It is however also possible that the total number of attendancies remain more or less constant or even decrease. A failure of the rather newly established dispensaries to treat patients successfully may lead to reduced confidence in the dispensaries and hence lower attendancies. It should be remembered that there are a number of traditional doctors operating in Northern Njombe, some of which have a formidable reputation.

The second problem concerns diagnostic skills. In 1978 the diagnostic facilities were rudimentary at the dispensaries. If facilities are improved and staff skills increased the disease pattern may be documented in much greater detail than at present.

One could ask what is realistic to expect of the WNWSP in terms of reduction of water-related diseases. It is not far-fetched to expect that the impact of the project in itself will be marginal. The impact on water-related insect vector diseases (Schistosomiasis) will be insignificant as long as people continue to bath and wash clothes at unimproved water sources. The impact of faecal-oral diseases will be limited as long as the general standard of hygiene in the villages continue to be low. The impact on water-washed diseases, on the other hand, could be significant provided that the women can fetch much water without difficulty. In summary it can be contended that the WNWSP can have a positive influence on the health situation only if it is supported by other programmes, notably an environmental sanitation programme.

Lastly, it should be observed that future changes in the prevalence of water-related diseases will not necessarily be attributable to the Wanging'ombe North Water Supply Project. The evaluation should be open for other possible independent variables.

/ Considering the nature of the various water related diseases.

Chapter 9: CHILD NUTRITION

In a predominantly subsistence farming area, the local agricultural and livestock production forms the basis of the family's food intake and thereby the nutritional status of the members. In the Wanging'ombe area the bulk of the food consumed is of vegetable origin while livestock products form a minor but important part. Maize is the most important protein source while beans, cow-peas, pigeon-peas and groundnuts give valuable additional protein. The above mentioned crops together with cassava and sweet potatoes supply the calories. Although livestock density is high in the area, the protein intake in the form of meat and milk is low.

Village butcheries are important for meat consumption. In those villages where butcheries have been set up, it is possible for households to buy small amounts of meat once or several times a week for a few shillings. Thus meat can be consumed regularly. On the other hand in those villages where there is no butchery meat consumption is highly irregular. It is consumed only at exceptional occassions. Unfortunately, there are butcheries only in 7 of the 42 villages in the area.

In order to explore the nutritional situation in the Wanging'ombe area, the Tanzanian Food and Nutrition Centre (TFNC) was approached by BRALUP in early 1978. It was agreed that TFNC should carry out a nutrition survey in selected villages in the Wanging'ombe area. The survey was conducted by a TFNC team in August 1978 and it covered the following villages; Igwachanya, Luduga, Lyamluki, Uhenga and Banawano. The target group was children under five years of age.[1] In 1977 a similar nutrition survey covering i.a. Luduga and Saja was conducted by Oddvar Jakobsen.[2] The TFNC team could thus to some extent compare its findings with the findings from the Jacobsen study. Both the 1978 TFNC study and the 1977 study by Jacobsen can be regarded as baseline data for the evaluation of the WNWSP. Since both studies have been published there is no need to reproduce their findings in detail in this report. Only the main findings and conclusions will be summarized below.

The TFNC Survey

Methods:

Five villages were taken as a representative sample of the villages in the area under investigation. These were Lyamluki, Uhenga, Luduga, Igwachanya and Banawano.

Lyamluki and Uhenga villages are situated in the arid Northern zone; Igwachanya and Banawano villages are situated on the verge of the Njombe mountains, while Luduga lies in between.

During the survey the villagers were asked to bring all the children from one year to five years of age for the examination. This is the age group that is usually most severely affected by protein - energy malnutrition. The actual range of the children brought were 8 - 72 months and all these were included in the calculations.

It was not possible to ensure that all the children in the selected age groups in the five villages were examined. On the basis of the number of households in the villages, and the assumption that there is on average one child between 1 and 5 years in each household, the attendance was: Lyamluki 85%, Uhenga 62%, Luduga 71%, Igwachanya 19%, and Banawano 58%. The low attendance in Igwachanya was because the survey happened to coincide with another village project, which made it impossible for most of the mothers to attend the survey.

The mothers with their children went through five stations. In the first station the mother and children were registered and basic demographic data on the family were recorded. In the second station the mothers were interviewed about the family's food habits. In the third station anthropometric measurements (weight, height, middle upper arm circumference) were taken and clinical signs of diseases were observed. In the fourth station urine and stool samples were collected and in the fifth station blood analysis(anemia)was undertaken.

Calculations:

For each village the children were divided into age groups. For the younger children the mothers usually know their exact age in months, but for the older children only the approximate age in years were given. The age groups were selected to correspond to 1, 2,3,4, and 5 years of age. The 1 year age group thus included corresponded to the approximate age in years given by the parents. A few six-year-old children were referred to age-group "5."

The weight measurments were evaluated in comparison to the standard weight for age (Harvard) given by Jelliffe.[3] Two groups were identified:

1. Those below 80% of standard weight for age (usually referred to as "underweight").

2. Those below 60% of standard weight for age (referred to as "severe underweight" or "marasmic").

The weight measurements were evaluated in comparison to the same international standard. The children below 90% of standard height for age were identified.

For the middle upper arm circumference the children were classified as either "normal" (above 13.5 cm), "moderate undernutrition" (13.5 - 12 cm), or "severe undernutrition" (below 12 cm).

For all the anthropemetric measurements above, the number of children in each category was calculated as percent of the total number of children in each age group in sample.

The child mortality in the families being interviewed was calculated as the number of children that had died as per cent of the total number of children born to the mothers.

The Tallquist method for determination of blood haemoglobin was employed. This method is very convenient under field conditions but the accuracy is low. In order to avoid erraneously high estimates of anemia only those subjects with very low haemoglobin levels (40% or below) were classified as anemic. The number of anemic children as well as those showing other deficiency disease symptoms and parasite infestations was then calculated as percent of all children in each village.

In the dietary evaluation the number of children in each age group that was still being breast-fed was calculated as per cent of the total number of children in the age group.

The other food items given to the children were then listed, and the total number of times that each of these were given to the children in each age group was calculated, and then divided by the total number of children. For each food item we thus obtained a figure indicating the average number of times that this food was given to the children in this age group.

RESULTS

Anthropometric measurements

Table 9:1 summarizes all the anthropometric measurements obtained in the five villages. The total number of children is fairly equally distributed between the five age groups selected.

Table 9:1 Anthropometric Data from the five Villages

Age/Year	1 Year	2 Years	3 Years	4 Years	5 Years	Average
Number of Children	154	193	169	197	212	(925)
Weight/Age ∠ 80 - 60%	46%	60%	61%	54%	46%	53%
Weight/Age ∠ 60 %	3%	4%	1%	2%	2%	2%
Weight ∠ 90 %	42%	60%	57%	69%	42%	54%
MUAC ∠ 13.5 cm.	42%	26%	11%	9%	7%	19%

(Source: TFNC survey of Lyamluki, Uhenga, Luduga, Igwachanya and Banawanu, 1978)

For the whole area (all five villages) the average proportion of underweight children (∠ 80% of standard wt/age) was 56%, with a peak at the age of 2 to 3 years. The average number of severely underweight children (∠ 60% of standard wt/age) was 2%.

The average proportion of "stunted" children (∠ 90% of standard wt/age) was 54%, the highest prevalence was found in the four-year old children.

[illegible]

The average proportion of children with a middle upper arm circumference (MUAC) of less than 13.5 cm centimeters was 19%, and here the highest proportion is found in the lowest age group.

The proportion of underweight children is highest in Igwachanya (68%) and Luduga (63%) villages, while Banawanu village has the lowest figure (46%).

The proportion of stunted children did not vary much between the villages (53-59%). Igwachanya village had by far the highest rate of children with a MUAC below 13.5 com centimeters (28%), and Uhenga, the lowest rate (8%).

There were some minor differences between the villages with regard to the distribution between the age groups for some of the anthropetric measurements, but the number of children in each individual case is too small to make these differences significant.

Anemia: The percentage of children with severe anemia was very high in Lyamluki village (14%). Also in Uhenga and Igwachanya villages the prevalence of anemia was high.

Diarrhoea: Except for Lyamluki village there were not many cases with diarrhoea reported.

Hook-worm infestation: The stool examinations revealed a small percentage of hook - worm infestations generally. Other intestinal parasites were not observed except for one cases of Taenia.

Schistosomiasis: The presence of Schistosoma hoematobium ova in the urines of the examined children was particularly high in Uhenga village. Both Hook-worm and Schistosoma infestations were mainly found in the older children.

Spleen enlargement: Most of the cases were found in Uhenga villages.

Eye diseases: Various forms of eye diseases (mainly conjuctival infections) were very common in all villages.

Scabies: This problem was mainly found in Lyamluki and Uhenga villages.

Oedema: Most of the cases were found in Luduga village. The total number of children with signs of severe PEM (Oedema + severe underweight) is quite significant in all villages.

Other symptoms: - Among other symptoms which were observed but not systematically reported were jiggers (Tunga penetrants) which were very common particularly in Igwachanya and Banawanu villages.

An attempt to summarize the main findings from the description above is made in table 9:2.

Table 9:2 Incidence of Various Diseases among Children in Five villages

Area characteristics	Village	Incidence of diseases among sampled children							
		Anemia	Diarrhoea	Hook-worm	Schisto-somiasis	Spleen enlarge-ment	Eye disease	Scabies	Oedema
lower altitude less rain warmer	Lyamluki	high	high				high	high	
	Uhenga	high			high	high	high	high	
higher altitude more rain cooler	Luduga						high		high
	Igwachanya	high					high		
	Banawanu						high		

(Source: TFNC Wanging'ombe Survey)

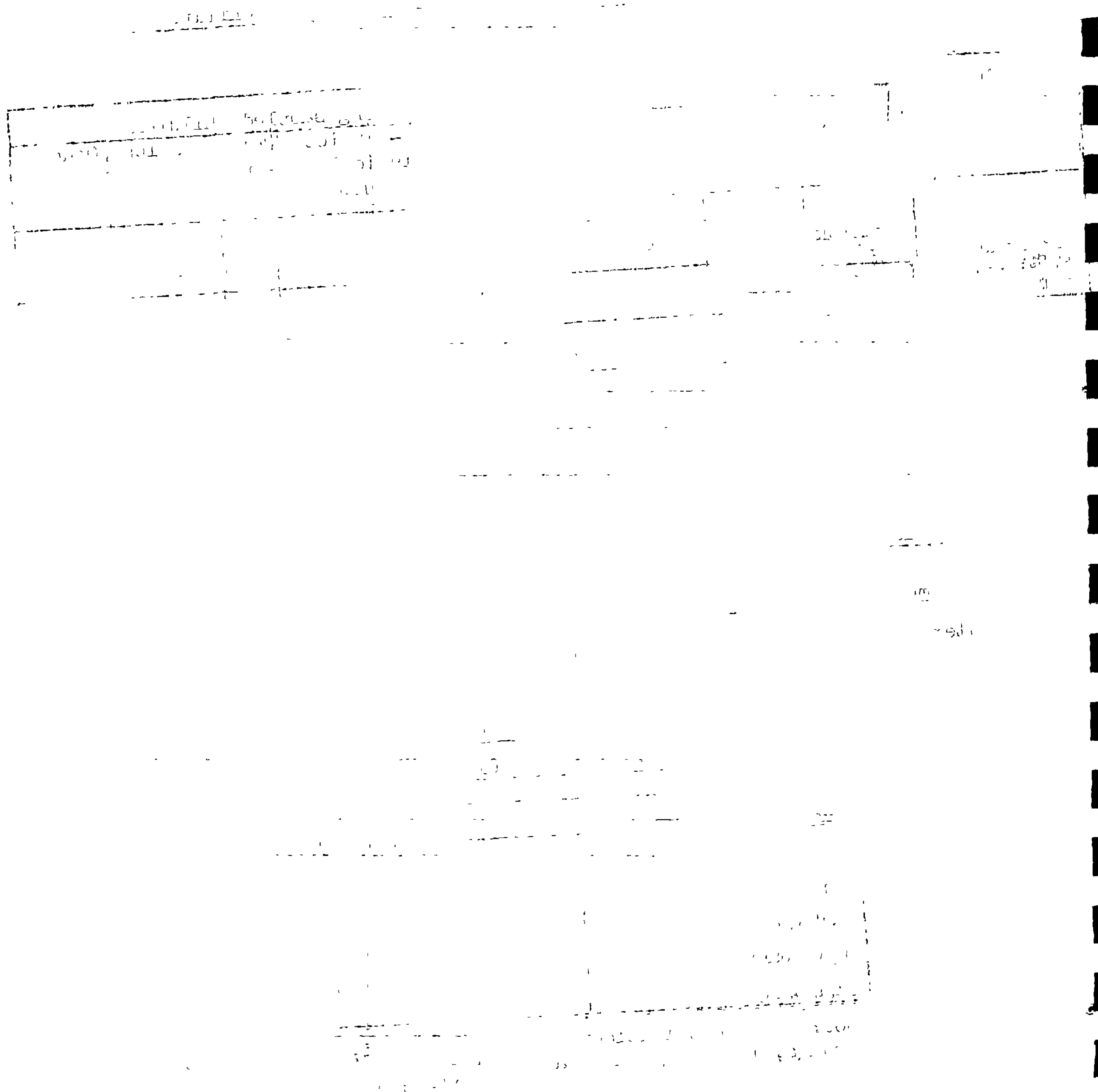
Child mortality

The number of children that had died in the families of the mothers interviewed was 12 - 20% in the villages studied as shown in the table below:

Table 9:3 Child Mortality; Percentage of Total Number of Children Born to Mothers

Village	Percentage
Lyamluki	19%
Uhenga	20%
Luduga	12%
Igwachanya	15%
Banawano	18%

(Source: TFNC Nutrition Survey of Lyamluki, Uhenga, Luduga, Igwachanya and Banawano, 1978)



Child feeding practices

The child feeding practices are very similar in all five villages. The main features of the diet can be summarized as follows.

Breast feeding: All children seem to be breast-fed at least up to one and a half years of age.

Maize is the main staple in the area. It is normally eaten as "ugali" together with "mboga." In many families maize gruel "uji" is taken as a morning meal. "uji" is sometimes given as a special meal to the small children. Rice, potatoes (sweet and Irish) and cooking bananas are also used as staples.

The number of times per day that staple foods are consumed, indicate the number of meals taken, and this is about three times for practically all age groups in all villages studied.

The most common protein-rich supplement in the diet is beans in all the villages. In Luduga village the consumption of meat is also high. Another important protein source is groundnuts. On average, protein-rich foods are included in the diet about twice daily, with Luduga village showing a slightly higher intake.

Vegetables and fruits are eaten 2 - 3 times per day (here Luduga village has slightly lower values). The main vegetables eaten are tomatoes and onions. Green leafy vegetables, particularly bean and pumpkin leaves, are eaten fairly often.

Sugar-cane and groundnuts are frequently given as snacks between the meals. Foods rich in fat are consumed about once daily on an average.

Discussion

In the guidelines for the village survey methodology employed in the present study,[4] the following criteria are proposed to be indicative of a poor nutritional status in the community:

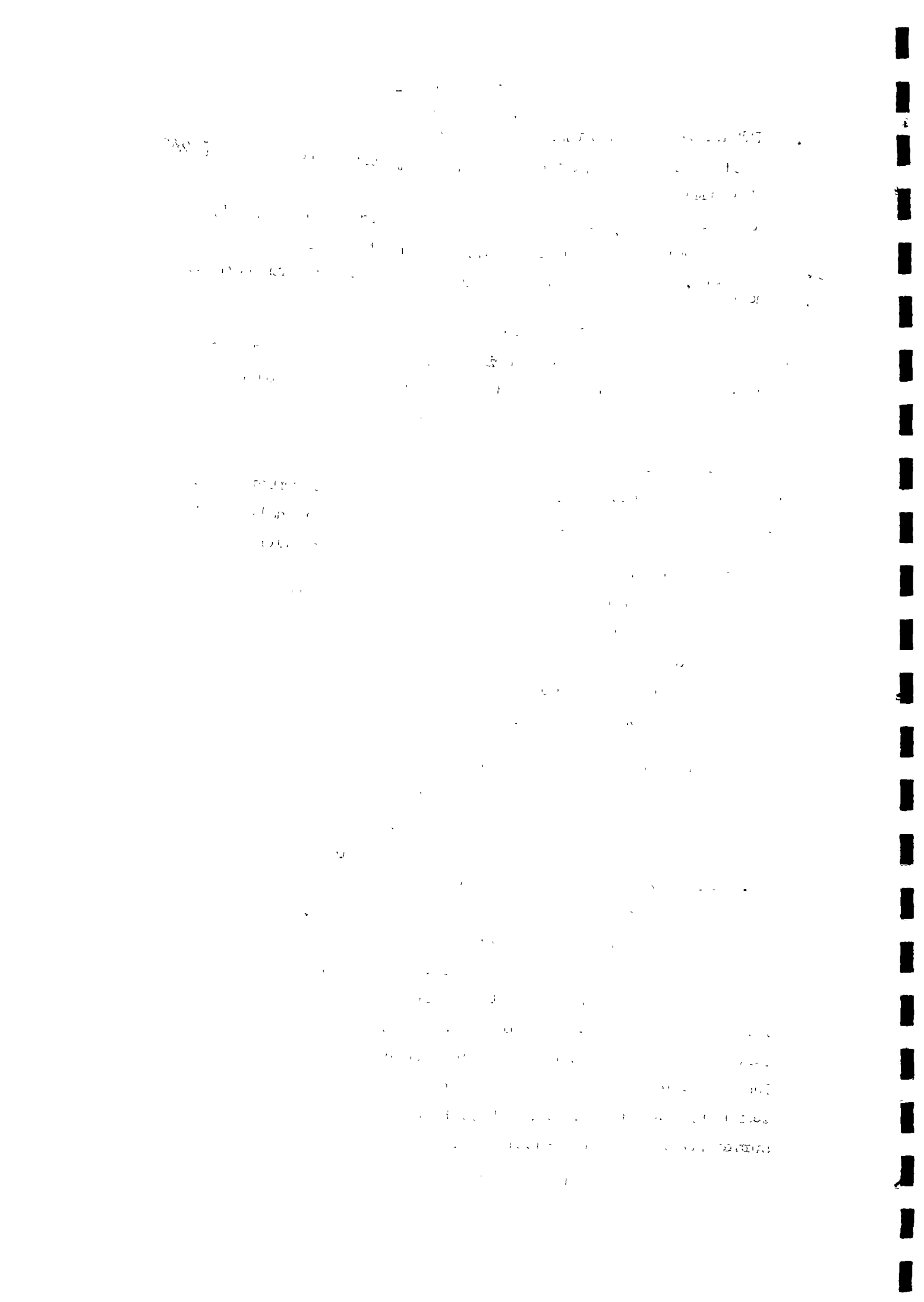
1. The number of marasmic children (severely underweight) plus those with oedema is greater than 2%.
2. The number of children with severe anemia is greater than 5%
3. The number of children underweight is greater than 20%
4. The number of dead children is 20% or more of children born to mothers.

In fact, most of these criteria apply to most of our villages. Bearing in mind that the causes of these conditions are not exclusively nutritional the results thus indicate that the nutritional situation in the villages investigated is poor.

It is particularly the weight for age (criteria number three above) of the children that is far below standard. More than half of the children examined had weights below 80% of the international standard.

It can of course be queationed whether or not the international standards are applicable to the population studied here. In the absence of local standards, the international standards have normally been found to be valid approximations and they can still constitute a yardstick for comparing the results of surveys conducted at different times, which is one of the major objectives of this survey.

Despite the very high weight for age deficit the survey team reported that there were not many children with clearly observable symptoms of malnutrition. The reason is probably that the children did not only have a low weight for age, but a low height for age as well. This means that they may have a normal weight for height although their body stature is shorter than normal. This "stunting" is usually taken as an indicator of past periods of malnutrition.[5] Here it should be remembered that in the year 1976/77 the rainfall was below normal and subsequently a very poor harvest was obtained in the area investigated. One of the villages included in the present survey (Luduga) was also surveyed by Jakobsen in May 1977.[6] The proportion of underweight children in the age groups "1 and "1+2" then found was 39% and 46%. The corresponding figures in the TFNC survey was 42% and 61% rejectively.



Although the survey procedures were not exactly the same on these two occasions, it thus seems that the nutritional situation had deteriorated between May 1977 and August, 1978, particularly if the children up to $2\frac{1}{2}$ years of age are included in the comparison. Also other villages surveyed in the Wanging'ombe area during 1975 and 1977[7] had a proportion of under-weight children that was lower than our results from the present survey.

The child mortality data are also indicative of a poor nutritional status in the area although in this case also infectious diseases, Malaria, etc. are important contributory factors. According to the mothers, Measles was a major cause of death among their children.

It should be noted that the average number of children born to each mother was somewhat lower, 4, compared to e.g. 5.5 and 7 found in two earlier surveys conducted by TFNC.[8]

It seems that at the time of the survey (August) the situation in the villages was better than normal in two important aspects. Firstly, foods should be in good supplies, because it is just after the harvesting season which is June - July. This may be the reason why the number of acutely malnourished children was low. Secondly, according to the dispensary records the incidence is low in August for a number of the most common diseases in the area such as Malaria and Diarrhoeal diseases.

Most of the clinical symptoms reported here are related to the hygienic standard of the villages and in particular to their water supply. Clinical symptoms are difficult to classify and quantify, and also our method for anemia is inaccurate and some of the cases of parasitic infestations may have been over-looked. Still However, it seems that the villages in the arid zone have more problems related to poor water supply e.g. scabies, schistosomiasis (Uhenga), and diarrhoea (Lyamuluki). These villages also seem to have a higher prevalence of anemia. This may be due to Malaria which is more common in the arid zone (lower altitude). The data did not suggest any clear relationship between anemia and hook-worm infestation.

In general, the diet in all of the villages seems to be well balanced. The basic staples (mainly maize) are providing most of the energy and the proteins. In addition energy-rich supplements (oil, groundnuts, etc) and protein-rich supplements (beans, meat, etc) are given to the children.

The vegetables and fruits stated by the mothers should provide the necessary vitamin and mineral supplements if given in sufficient amounts (the present method for dietary evaluation does not give quantitative data).

The results of the dietary evaluation does not seem to agree with the poor nutritional status found in the villages, and also with other information, e.g. that meat is rarely eaten.

Once again, however, it should be stated that the availability of foods in the village was high at the time of the survey. The diet evaluation can anyway be taken as an indication that the mothers know the principles of a balanced diet although they may not be able to follow these principles in practice, especially not during the agricultural peak periods.

Breast-feeding seems to continue up to $2\frac{1}{2}$ years of age, which is advantageous because the breast milk both gives a nutrient-rich supplement and protection against infections. Another good practice observed is that practically everybody seems to feed their children three proper meals per day. However, there is very little difference in the dietary pattern in the smallest age groups and that of the older children except that 'uji' is somewhat more common for the youngest children. This means that to a very small extent any special weaning food are prepared for the children in the critical ages $\frac{1}{2}$ to $2\frac{1}{2}$ years. The possibilities of increasing the number of supplementary feedings in this age group should be investigated.

The Jakobsen study

In 1977 Oddvar Jakobsen conducted a nutrition survey in Njombe district. Among the villages surveyed five were situated within the Wanging'ombe area (Saja, Kijombe, Palangawanu, Uhambule and Luduga).

Jakobsen focused on child weight in relation to their age as an indicator of the nutrition status. The findings of the survey are have been commented in detail in a BRALUP report,[9] and some of them have been commented on in the TFNC survey. Thus there is no need of reproducing Jakobsen's findings in this report. It is suggested that the methods employed and the villages selected both by Jakobsen and by TFNC should be considered in the future evaluation of the water project. Here we will concentrate on some general remarks on nutrition in Northern Njombe which have been brought up by Jakobsen.

Johnson has pointed out that malnutrition (especially child malnutrition) is a very severe problem throughout Tanzania. Each year some 120,000 children below five years of age die in the country and in some 50% of the cases malnourishment or undernourishment is the indirect cause of death. An estimated 600,000 children below five in Tanzania are under or malnourished.[10] Only in a few places is there an acute lack of cultivable land. Generally in Tanzania (and in Njombe) there is still land which can be put under the plough or hoe. Hence, as both Jonsson and Jakobsen have emphasized, malnutrition is <u>not</u> a direct effect of lack of agricultural resources but rather a socio-economic problem.[11]

In Northern Njombe both agricultural production and consumption takes place within the framework of individual peasant households. The family economy thus holds the clue to the supply of food. As long as the agricultural production is entirely subsistence oriented, a nutritionally well balanced diet is usually obtained (except when crop failures cause havoc) for the family. With the introduction of cash-crops the situation changes.

Commercialization of agricultural production means that land is set aside for the production of crops which are sold for cash. This means that there is less family labour available for cultivation of food crops.

[redacted]

The introduction and official encouragement of tobacco (and to some sunflower) in Northern Njombe has, according to Jakobsen, had the effect of impairing child nutrition. When correlating the proportion of underweight children with the families' involvement in cash-cropping, he found an U-shaped relation between the commercialization of agriculture and nutritional status. The poor subsistence farmers had a lower proportion of underweight children than their cash-cropping neighbours.[12] The nutritional status of children improved only when family cash incomes are very much increased, i.e. among traders, shopkeepers and government officials. This finding can be explained along the following lines. As long as the peasant family is almost exclusively engaged in food production for its own subsistence a great variety of crops are grown and a balanced diet can be upheld. In Northern Njombe cash-cropping means tobacco-growing. The cultivation of tobacco is labour demanding. For those families who take up tobacco cultivation there is less time to tend the food crops and less time for the woman to prepare food for children. Besides, tobacco is grown in block farms under supervision of extension agents and it is forbidden to plant food crops (beans) in between the rows as is otherwise the rule in peasant production. Finally, the cash incomes derived from tobacco cultivation belongs to the head of the household. He decides how to spend the money. Jacobsen's findings point to the low priority of children's needs in peasant cash spending. The most usual things purchased include mens' clothes, corrugated iron roofs, bottled beer and radios.[13]

In 1979 the official trend was towards enforced cultivation of tobacco. It has been emphasized that tobacco cultivation is the only means whereby the villagers can contribute to national development. Cultivation is taking place on large block farms under expert supervision. The TAT projections for the 1980's point to enlarged areas under tobacco cultivation.

If water is provided to tobacco nurseries and thereby stimulates intensified cash-cropping in the area, then one possible side-effect could be increased child malnutrition, at least in the short run.

Chapter 10 Popular Participation

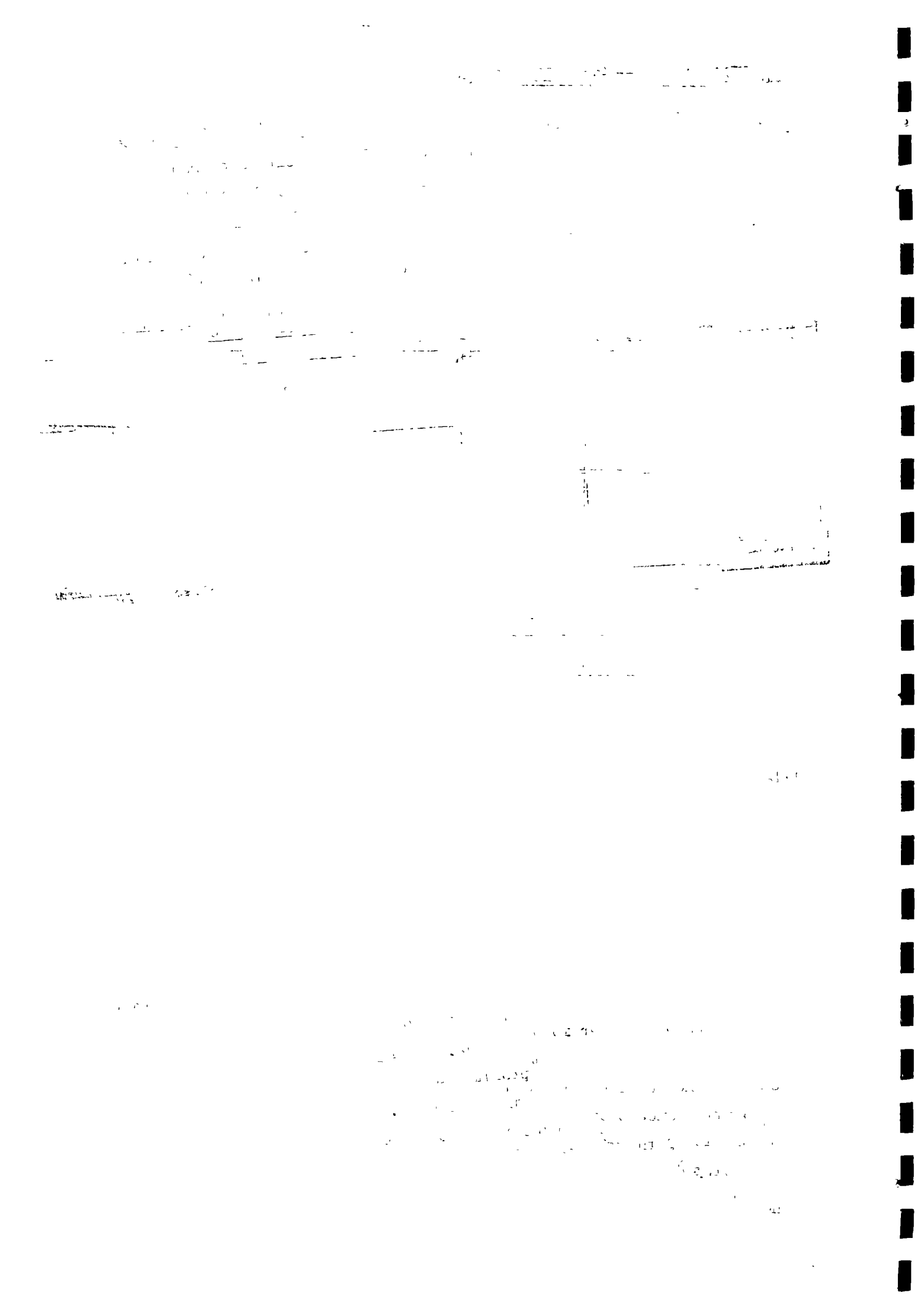
Considering the officially stated aim of the project to "promote among the beneficiaries a sense of ownership of their water supply" (cf. chapter 3), the village survey tried to explore the attitudes among villagers at the beginning of the construction period of the project. The question "Who is responsible for the WNWSP " was asked. The question was open-ended and the answers are shown in table 10:1.

Table 10:1 Responsibility for the Project according to Villagers

Village	Government	District administr.	The villagers	Parliament	Don't know	Total No.of h.h. in sample
Saja	64%	6%	-	1%	29%	77
Lyamluki	44%	-	-	-	56%	16
Luduga	82%	-	-	-	18%	34
Igwachanya	71%	-	-	-	24%	59
Total	89%	3%	2%	-	26%	186

(Source: BRALUP survey of Saja, Lyamluki, Luduga, and Igwachanya, 1978)

A solid majority of the respondents considered the project to be the responsibility of the Government while one fourth could not tell. It is to be noted that only 2% (4 respondents) thought that the villagers themselves had any responsibility. The pattern of answers indicates a realistic attitude on the part of the villagers. The rural water supply programme in Tanzania is carried out by "experts" (MAJI technicians and district level political and administrative officials while the participation of the villagers is reduced to mannual labor (trench-digging). The villagers do not know how the water schemes function and in case of breakdown it is only the experts from the headquarters who can do the repairs. Moreover, it has been argued that the villagers consider it the duty of the Government to provide and maintain village water supplies, because during the villagization campaign the rural people were promised an improved water supply by the authorities once they had moved into villages. Now that villagization is completed, the villagers expect the government to keep its part of the "deal."



During the field work on this study, the construction phase of the WNWSP proceeded. The participation of the villagers consisted in two things, to prepare "kokoto" (small stones) to be used as base material in the storage tanks and to dig trenches for the pipeline system. It is suggested that the future evaluation of the WNWSP should consider to which extent these activities (and other possible activities) have been instrumental in changing the villagers' attitudes on the ownership and responsibility of the water supply.

Concluding Remarks

The study will now be concluded by juxtaposing the aims of the WNWSP, the main findings from the previous chapters and the technical design of the project.

The aims of the project, we recapitulate, are improved health and reduced toil for water-collecting women. To reduce the toilsome water collection journeys means to bring potable water closer to the homes of the villagers. The health parameter has been operationalized as reduced incidence of water-related diseases, especially faecal-oral and water-washed diseases. A water project can be instrumental in this respect by providing bacteriologically safe water. Additionally the villagers must have easy access to the water so they can consume a much higher volume than they do at present. The increased volume is necessary for the improvement of the hygienic conditions in the households. In order to make an increased consumption possible for the villagers the project must be designed in such a way that the water collectors find it convenient to carry home considerably more water than they do at present.

The findings (Chapter 7) indicate that even a walking distance of one kilometer acts as a constraint to increased consumption. Therefore, the Tanzanian long-term goal of providing water at a distance not more than 400 meters from households seems correct. Another reason to insist on short walking distances between tap and the houses is that otherwise villagers will be tempted to use water from nearby unimproved (polluted) water sources during the rainy season.

There are thus strong arguments supporting the demand that short walking distances should be a design priority in the water project if the aims are to have a realistic chance to be achieved.

How then are the demands described above reflected in the technical design of the WRWSP? The question will be approached by examining the water distribution system. In 1978 confusion prevailed concerning the level of service to be provided by the WNWSP. In the plan of operation it is mentioned that water will be provided to points within the villages in order to bring water close to homes of the villagers.

The Regional Water Engineer's office in Iringa had however no concrete plans for intra-village distribution of tap water. UNICEF has also pointed out that its financial contribution to the WNWSP does not include equipment for the distribution of piped water inside the villages.

In its present (1979) set-up the WNWSP does thus not include a distribution system for water inside villages. Piped water will be brought to only one point in each village - the storage tank. The storage tanks are located to the highest point in each village and this location is not necessarily in the centre of the residential areas. The villages typically have a ribbon fashioned lay-out, houses are stripped out along the local road for several kilometers.

The impllications of the physical village structure for water use pattern are obvious; if the WNWSP is designed so that water is available only from the storage tanks, then little change in the water use pattern is to be envisaged. A large number of households will still be located 1 to 2 or even more kilometers from the standpipe. Our data on villagers' expections from the WNWSP revealed that they regarded improved convenience - not improved health - as the main benefit to accrue to them from the water project. It is then to be expected that the villagers will use the WNWSP standpipes only to the extent that they are closer to their homes than the traditional water sources are. Considering the finding (Tab. 7:4) that a majority of the households are located less than one kilometer from a source of water during the rainy season, it is fully logical to expect that traditional sources will continue to be used for domestic water even after the completion of the WNWSP.

Therefore the provision of a higher level of service than the present one (water distributed to storage tanks) is a necessary, although not sufficient, condition for goal-achievement.

The practical implication arising from this conclusion is that a project phase II, consisting of design and construction of a pipeline system which distributes water to communal standpoints inside each village, should be embarked upon as soon as possible.

NOTES

Chapter 1:

1) Information from I. Kikula, BRALUP

2) Graham (forthcoming).

Chapter 2:

1) The sources for this chapter include the Revised Plan of Operation for a Rural Water Supply Programme in the United Republic of Tanzania (1977): The Wanging'ombe Rural Water Supply Project, Design Notes and Bill of Quantities as well as additional information obtained from the RWE office, Iringa, UNICEF Dar es Salaam office and MAJI headquarters.

Chapter 3:

1) Tanzania Second Five-Year Plan (1969), Vol. I, pp. 39 f.

2) Warner (1970)

3) Sauders & Warford (1976); White, Bradley & White (1972).

4) Quoted in Widstrand (ed.) (1978), p.341

5) Revised Plan of Operation for a Rural Water Supply Programme in the United Republic of Tanzania (1977).

6) Ibid.

7) Speech made by the Minister for Water, Energy and Minerals in the Tanzania National Assembly, June 28th, 1978.

8) Feachem, R. G., "Water Supplies for Low Income Communities; Resource Allocation, Planning and Design for a Crisis Situation," in Feachem, McGarry and Mara (eds.) (1977).

9) WHO/IBRD, (1977),

10) Feachem, (1977), op.cit.

Chapter 4:

1) Jespersen et.al. (1971), p. 187.

2) Ibid.

3) Ibid.

4) UNDP/FAO (1976), Vol. I, p. 5:10.

NOTES

5) Ibid.

6) Ibid., pp. 5:14-20.

7) Ibid., p. 5:16.

8) Information from the Population Census Office, Dar es Salaam.

9) Graham, op.cit.

10) Population Census 1967 (1969), Vol. 1.

11) Revised Plan of Operation..., op.cit.

Chapter 5

1) Jespersen et al. (1971), p. 187.

2) UNDP/FAO, op.cit., Vol. I, p. 2:13.

3) Beeney (1975), Appendix 5:11.

4) Marketing Development Bureau (1977), Annex 1, p. 52.

5) Ackland (1971), p.131.

6) Tanzania Food and Nutrition Centre (1978), Tab. 3:4.

7) Marketing Development Bureau (1977) Annex 2, pp. 1f.

8) Ibid., p. 35

9) Information from the TAT office, Wanging'ombe.

10) Marketing Development Bureau (1977), Annex 6, p. 21.

11) Ibid, p. 30; Beeney, op.cit., pp. 38, 73.

Chapter 6:

1) UNDP/FAO, op.cit., Vol. 1, p. 4:67.

2) Ibid.

3) ODG (1976), Vol. 1, p. 135.

4) Ibid., Vol. 2, pp. I 11-13.

5) The information on auctions and prices has been obtained from the divisional livestock office, Wanging'ombe.

NOTES

Chapter 7:

1) Warner, op.cit., p. 15; White, Bradley & White (1972), p. 119.

2) Tschannerl (1974), p. 24.

3) Bantje (1978); White, Bradley and White, op.cit.; Feachem et al.(1978).

4) Warner, op.cit.; Westman & Hedkvist (1972).

Chapter 8:

1) Bradley, "Infective Diseases and Domestic Water Supplies," in Tschannerl (ed.) (1971).

2) White, Bradley & White, op.cit.; Feachem, McGarry and Mara (eds.), op.cit.; Feachem et al. op.cit.

3) Feachem et al., op.cit., pp. 142r.

4) Ibid., p. 172.

Chapter 9:

1) TFNC (1978).

2) Jakobsen (1978).

3) Jelliffe (196).

4) Bailey (1977).

5) Waterlow (1976).

6) Jakobsen, op.cit.

7) Ibid.

8) Mwakatobe (1977); Ljunguist et al. (1977).

9) Jakobsen, op.cit.

10) Jonsson (1977).

11) Ibid.; Jakobsen, op.cit.

12) Ibid.;

13) Ibid.;

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- " - — Price Policy Recommendations for the 1978/1979 Agricultural Price Review, Annex 2, Oilseeds (Ministry of Agriculture, Dar es Salaam).

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APPENDIX

The Population of the Project Area Villages

(Source: The Population Census 1978; Njombe district village summary sheets)

WANGING'OMBE WARD	MALE	FEMALE	TOTAL
Wanging'ombe	672	892	1564
Ufwala (Soliwayo)	237	286	523
UTIGA	789	918	1707
IKWAVILA	198	235	433
MNGELENGE (IKINGULA)	495	612	1107
ITANDULA	200	230	430
MAYALE	490	509	999
LYADEBWE	538	567	1105
KIJOMBE	784	947	1731
LYAMLUKI	362	409	771
KATENGE (Itula)	668	906	1574
SAJA WARD			
Saja	1449	1707	3149
UHENGA	631	693	1324
IKULIMAMBO	344	390	734
ITENGELO	534	674	1208
ISIMIKE	674	928	1602
ILEMBULA WARD			
Ilembula	1021	1267	2288
IGULA	390	597	987
IGELEHEZA	542	658	1200
KANAMALENGA	738	889	1627
MPULULU	156	162	318
WANGUTWA	429	553	982
BANAWANU	653	842	1493
UDONJA	453	512	965
UJINDILE	375	459	834
UHAMBULE	734	874	1608
MTWELELE	271	342	613

[illegible]

LUDUGA WARD	MALE	FEMALE	TOTAL
Luduga	849	1075	1924
MAMBEGU	527	616	1143
KORINTO	924	1132	2056
HANJAWANU	134	147	281
USUKA WARD			
Usuka	714	938	1652
IKWEGA	467	594	1061
DULAMU (LYALAMU)	539	704	1243
LUDOGA	422	531	953
MATOWO (MAKOGA)	308	404	762
PALANGAWANU	521	690	1211
KANANI	264	271	535
IGWACHANYA	1018	1209	2227
CHALOWE	907	1147	2054