PROBLEMS OF MARAKWET INDIGENOUS IRRIGATION SYSTEMS: A CASE STUDY OF ARROR LOCATION.

BY

RUTTOH, T.K., B.A. (HONS) NAIROBI

"A THESIS SUBMITTED IN "PART" FULFILMENT FOR THE DEGREE OF MASTER OF ARTS (PLANNING) IN THE DEPARTMENT OF URBAN AND REGIONAL PLANNING, UNIVERSITY OF NAIROBI.

JUNE 1988

URBAN AND REGIONAL PLANNING
DEPARTMENT
FACULTY OF ARCHITECTURE,
DESIGN AND DEVELOPMENT,
UNIVERSITY OF NAIROBI,
NAIROBI, KENYA.

D E C L A R A T I O N

This thesis is my original work and has not been presented for a degree in any other University.

Signed _____

RUTTOH, T.K.
(Candidate)

This Thesis has been submitted for examination with my approval as University Supervisor.

Signed _____

Z. MALECHE
(Supervisor)

JUNE 1988

A B S T R A C T

This study sought to identify the problems that disparage the performance of Marakwet Indigenous Irrigation Systems in the Kerio Valley with Arror Location as the case study area.

The study examined policy guidelines geared towards the development of irrigation in Kenya. It has been established, as a result, that policy guidelines tend to favour modern technology based irrigation. Even the Irrigation Act is inclined towards large scale public irrigation schemes. Indigenous technology based irrigation systems which are usually of sma scale are apparently accorded a flimsy treatment in this respect. Marakwet Indigenous irrigation system, for example, sustains majority of households in its area of influence has found out by this study. Crops grown under this system are basically meant for subsistence. The little that is sold by some households is meant for earning some income to be used in purchasing basic needs.

It has further been established that the system is characterized by poor performance. The causes of which include inadequacy of irrigation water, poor farming methods (as exemplified by wasteful methods of spreading the water at farm level, limited use of

(improved) farm inputs, destruction of crops by pests and limited provision of extension services and facilities), and poor marketing of what is sold or intended for sale. Limited accessibility has also contributed, towards the marketing problems. Diseases such as malaria and diarrhoea which are related to irrigation are very prevalent and have hence been considered to impair the activeness of irrigators.

Only two organizations are involved with the development of irrigation in Arror location. These are Kerio Valley Development Authority (KVDA) and Arror Catholic Mission. Their efforts of modernizing (improving) irrigation include rehabilitation of indigenous irrigation furrows, application of improved technology of water spreading at farm level, diversifying crop production and the use of improved farm inputs. The study has also identified that both organizations assist the local community in matters of irrigated farming. Such assistance is as yet limited because it mainly involves rehabilitating some furrow intakes. However, both organizations encounter problems in their crop production process; these include inadequacy of irrigation water and poor marketing. Arror Catholic Mission also offers some health services to the community.

Finally, the study has established that much better results can be realised from the areas under

the influence Marakwet indigenous irrigation systems. The study noted that irrigation development is less constrained in an area boasting of an established tradition of irrigation; and also that large scale irrigation projects tend to have disappointing results. Therefore recommendations have been suggested with an aim of improving the indigenous irrigation system. The recommendations include: broadening the policy scope, intensifying efforts for better farming methods through provision of extension services and facilities, construction of minor dams to reserve water for irrigating more land, formation of cooperative societies to deal mainly with marketing and construction of access roads to improve accessibility.

RUTTOH

A C K N O W L E D G E M E N T S

My sincere expression of thanks goes to the Government of Kenya through its Department of Physical Planning for sponsoring me to undertake the M.A, (Planning) degree at the University of Nairobi.

I am also very grateful to my supervisor Mr. Z. Maleche (who is also the Chairman of the Department of Urban and Regional Planning, University of Nairobi) whose wider insight and guidance made this study a success. Gratitude is also expressed to the other members of staff and my fellow students for their encouragement.

The assistance of Mr. J.D. Kalders (Head of Irrigation Department, Ministry of Water Development) was invaluable indeed. Messrs. C. Kangogo (My brother-in-law), S. Chepkole (Headmaster Arror Secondary School), S. Sawe (KVDA Arror Farm Manager), Bro. Anthony (Arror Catholic Mission), J. Cherwon (Chief, of Arror Location), D. Kimosop (University of Nairobi) and Mzee Busanga, and many other persons including household respondents deserve special thanks for willingly giving their time to variously support and encourage me.

I am also greatly indebted to my parents Mr. and Mrs. Ruto, for their sincere sacrifice and guidance since I was born. I also owe sincere gratitude to my dear lady Maggie whose love, encouragement and help goes far beyond assistance.

Last but not least, I thank Mrs. Serah Lugusa and Mrs. Mary M. Muthigo for cheerfully and competently typing this thesis.

To all of them, I owe many happy memories.

T.K. RUTTOH

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF MAPS

CHAPTER ONE

INTRODUCTION

1.0 PREAMBLE

Agriculture forms the mainstay for the majority of Kenya's population. It is the leading sector in the development process of the country. Besides being the primary source of food and export commodities, the sector is one among the major wage-employers (Kenya, 1986 A).

About 75% of Kenya is classified as being arid and semi-arid land bearing marginal productivity. The rest, 25%, is basically fertile and productive land; and is occupied by about 65% of the country's population (Moi, 1986). Strictly speaking, 18.6% of Kenya's land is of high and medium agricultural potential. That notwithstanding, "only 7% can be described as good agricultural land in the sense of having adequate and reliable rainfall, good soils and not being steeply sloping" (Ruigu, 1986:1).

By inference, therefore, it can be stated that Kenya is short of good agricultural land. The little good agricultural land which is available is relatively strained because it sustains majority of the population. Suffice it to mention that Kenya's population is

growing at a rate of about 4% per annum (Moi, 1986) which is indeed very high.

1.1 STATEMENT OF THE PROBLEM

Irrigation, which is a process other than natural precipitation, which supplies water to cultivated plants (Stern, 1979) has been found to be an essential mechanism for developing areas of marginal productivity such as the vast arid and semi-arid areas of Kenya. Palutikof (1981) estimated that Kenya has an irrigation potential of 256,000 ha., half of which is in the dry areas of the country. A later study by an Inter-ministerial Task Force (Task Force 1986) considered the national total irrigation potential to be 550,000 ha.

Kenya's irrigated farming can broadly be classified as "small" and "large" scale. In terms of ownership, and management, the small scale irrigated farms are in many cases privately owned; whereas the large scale schemes are mainly public owned with the National Irrigation Board (NIB) being the major arm of the Government in the management process. Palutikof (1981) noted that a total of about 90,000 persons depended upon the National Irrigation Board for a livelihood. He further asserted that for every one hectare of NIB

schemes 1.43 persons get employed, as 1.62 persons get the same in the small scale irrigated farms. Thus, irrigation creates employment opportunities.

Besides employment, irrigation tends to reduce if not eliminate the fear of unreliable rainfall hence enabling farmers to regularly and even speculate on crop production. The crops grown range from food crops such as finger millet, maize and vegetables to pure cash crops such as cotton (Task Force Report, 1986). Therefore irrigation enables households to grow food crops for subsistence and in some cases generate income. Taking note of all the above functions of irrigated farming, it can be summed up that it significantly contributes towards societal welfare.

In many developing countries, Kenya included, irrigation efficiencies are extremely low. Arnon states that ---"only 40% of the diverted water actually reaches the field and this is used with an irrigation efficiency of 30 - 40% at best - so that an effective utilization of water of only 10 - 20% is by no means uncommon ---" (Arnon, 1981:58). Usually, the key factors which influence irrigation efficiency include the design of the irrigation system, the degree of land preparation, and the skill and care of the irrigators (Michael, 1978). The development of irrigated farming has to consider the above factors as it endeavours to achieve efficiency.

History has shown that large scale irrigation schemes have disappointing results. This is because their development involves high initial capital costs that are rarely retrievable from the later operation of the schemes (Kenya, 1983; Lowe 1986). In fact their development has largely been due to borrowed foreign funds. Once established, the schemes require complex bureaucratic management techniques for the purpose of regulating farming, the allocation of land to tenants and distribution of water (Lowe, 1986). It is not also a surprise to note that many households are dislocated in the event of establishing a large scale scheme. This is a major societal problem particularly if the scheme is in an area of high population density. The Ahero scheme, for instance, "displaced about 1000 families of which only 500 could be re-instated on the scheme" (Palutikof, 1981:77). Moreover, the irrigators have no say in decision-making as pertains to the day-to-day farming of such schemes.

Chambers and Moris (1973) and Carruthers and Weir (1976) recommended that in Kenya emphasis should be on the development of small scale irrigated farming.

The reason for it is that, it is more profitable than the large scale schemes.

However, it is important to look at the issue of technology in irrigated farming. Two categories of technology can be broadly identified, namely, indigenous (traditional) and modern technology. Modern technology based irrigated farming involves the use of complex tools and machines, and engagement of highly trained operators with biased technical skills. Apparently, this (modern) technology separates the technical nature of irrigation from the society's traditions and customs. Actually, its success tends to be due to alien management that if at all it is withdrawn then disappointment ensues (Arnon, 1981; Walker, 1984; Lowe, 1986; Task Force Report, 1986). On the other hand, the indigenous technology based irrigated farming such as the Marakwet Indigenous Irrigation system uses simple techniques of irrigation which are generally less efficient. Irrigators using the indigenous system tend to identify themselves with the system. In many cases, they are meant for food production on entirely small scale basis. Van-Klinken (1987) is of the view that the indigenous system have proved to be successful, sometimes for many centuries.

This study therefore attempts to review Kenya's irrigation policy, find out the contributions of Marakwet indigenous irrigation systems towards societal welfare, problems that limit its performance and look at efforts being made towards its modernization within the chosen case study area, namely, Arror Location. In addition, suggestions that may enable the system to realise good performance for the purpose of enhancing rural development shall be made.

1.2 JUSTIFICATION OF STUDY:

Taking note of the following: the importance of agriculture in Kenya's development process, the shortage of good agricultrual land, the need for self-sufficiency in basic foods, and the rapidly growing population of Kenya added to the fact that much (about 75%) of Kenya falls within the arid and semi-arid lands with marginal productivity and that irrigation can raise agricultural productivity entailing rural welfare, this study has been found imperative. Evidence shows that large scale and modern technology based irrigated farming are costly to establish and manage. On the other hand, indigenous technology based irrigated farming which are usually small scale and use simple and cheap techniques have proved to be successful though with poor performance.

Against the above background, therefore, a study that seeks to reveal the causes of poor performance of an otherwise successful irrigated farming, namely, indigenous technology based, and suggest methods for improving it is necessary - This then is the study, with Marakwet indigenous irrigation system being the focus of the study and Arror Location being the case study area.

1.3 STUDY OBJECTIVES:

The main objective of this study is to identify contributions and problems of Marakwet Indigenous irrigation system within the framework of rural development. In itself, the following specific objectives guide the study:

a) To review Kenya's irrigation policy.

b) - To indicate the factors that have contributed to and enabled irrigated farming in Arror location - the case study area.

- To point out the contributions of particularly Marakwet indigenous irrigation system towards societal welfare and identify problems that limit its performance.

- To examine efforts made towards modernizing (improving) irrigated farming in Arror location.

c) To suggest courses of action that can be taken to overcome the identified problems of irrigated farming.

1.4 STUDY ASSUMPTIONS:

This study is based on the assumptions that:

a) Irrigation is very essential for the development of the Kerio Valley part of Chebiemit and Tot divisions in Elgeyo Marakwet district.

b) Irrigated farming in the said area is generally characterized by poor performance .

c) The development of the said area will be possible only if the problems that cause poor performance of irrigated farming are subdued.

1.5 SCOPE AND ORGANIZATION OF STUDY:

This study concerns the role of and problems experienced by irrigated farming in rural development process. Particular emphasis is given to Marakwet Indigenous technology based irrigated farming in the

Kerio Valley with Arror location being the case study area. While that is the basis of the study, a coverage of the following issues/areas has been done among others, so as to put the study into perspective. These are: reviewing national development policy guidelines relevant to irrigation; indicating the resource base of Arror location (the study area) within the context of physiographic and socio-economic phenomena; and examining the historical profile and functional framework of both indigenous and modern irrigated farming - for comparative purposes - with a view of establishing their contributions and problems experienced. This scope of analysis bears the subject matter of this study - which has been organized as follows.

Chapter 1 - Introduces the study.

Chapter 2 - Reviews the national policy guidelines on irrigation development. The role and potentials of irrigation at a national level are highlighted with a further reflection given to the Kerio Valley part of Chebiemit and Tot divisions in Elgeyo (Keiyo) Marakwet district.

Chapter 3 - Considers the study area, that is Arror location in terms of physiographic and socio-economic contexts. This chapter provides a springboard to later chapters in that it presents the factors which have led to irrigated farming, and a glimpse of some of the snags to its successful operation in the case study area.

Chapter 4 - Presents the historical profile, spatial setting, functional framework, and economic and environmental impacts of Marakwet Indigenous Irrigation systems as found out in the study area.

Chapter 5 - Examines efforts of modernizing irrigation in the study area with the notion that it aims at improving the indigenous irrigation system, among other things.

Chapter 6 - Presents the synthesis of the study findings, suggested policy recommendations and conclusions.

1.6 RESEARCH METHODOLOGY:

Existing information and data pertinent to this study were gathered through library research, perusal of policy documents and books, and discussions with relevant authorities. In this regard, literature on what irrigation is, its general efficiency, its significance; and how it has evolved in Kenya, its distribution, area under and existing potential for irrigation plus some current contributions to the national economy and policies towards developing it were acquired among others.

Field research was also conducted. This involved the use of both formal and informal oral interviews and guided discussions with village elders. With the application of a area sampling technique, two reknown elders were interviewed in each of the four sublocations in Arror location. This meant a total of eight elders all of whom were chosen on the basis of societal status regard and ability of story telling. The purpose of this particular exercise was to gather information on the historical profile and functional framework (consituting operation and maintenance) of Marakwet indigenous irrigation systems.

Households were also interviewed during the field research. A questionnaire (a sample of which is shown in this Thesis as Appendix I) designed by the author was administered to 17 sample households in each of the four sublocations in the study area. The total sample of 68 households in the location represented about 5% of the projected total households for the location in 1987 which were 1499 each having an average household size of four persons. The above analysis was based on 1969 and 1979 census population reports (Kenya, 1970 and 1981).

The selection of the sample was done using a stratified sampling technique, in that the 4th household was chosen after every one questionnaire administered. However, on a few occasions the supposedly 4th household could be passed. This was in the event of failing to get a respondent. The local vernacular was widely used when interviewing the respondents.

An interview schedule was also designed and applied in the field research for the purpose of acquiring information and data from government and non-governmental organizations involved in irrigated farming in Arror location. A sample of such an interview schedule is given as Appendix II in this

thesis. Moreover, only two organizations, Kerio Valley Development Authority (KVDA) and Arror Roman Catholic Mission became relevant in this case. The KVDA Arror Project Manager and Brother-In-Charge of Arror Catholic Mission Station were hereby interviewed. Perusal of monthly reports for the KVDA Arror Project was also done.

In addition to all the above methods used in acquiring information and data, personal observations made by the researcher/author, and photographs taken by the same have been applied to verify and embellish the research findings where possible.

1.7 RESEARCH LIMITATIONS:

While undertaking the research some problems were encountered. First, it was difficult to administer the household questionnaires the whole day because many of the respondents were usually out of their homesteads to attend to their duties by as early as 8. a.m. and could be back at any time after 6 p.m. This led to the use of many days for undertaking household interviews. Actually what had been envisaged to take a month took about one and half months to complete.

Secondly, the data collected from the household interviews are mainly estimates because no records are kept by the households. As a result, data on amount of crop outputs and inputs for many crops are lacking in this study. This very problem was partly experienced in the data collected from the governmental and non-governmental organizations involved in irrigated farming within Arror location, viz, Kerio Valley Development Authority (KVDA) and Arror Roman Caltholic Mission respectively.

Essential data on important physiographic phenomena particularly temperature could not be found. Even those available in regard to rainfall and evaporation are as yet scanty hence being used for suggestive and not definitive purposes.

1.8 CONCEPTUAL FRAMEWORK:

Irrigation is an essential technique whose main input, viz, water ensures and enhances crop production in areas of marginal productivity such as the arid and semi-arid land areas of Kenya. It can contribute towards rural development, where rural development implies improving the living standards of the mass of the low income population residing in rural areas and thereby making the process of development self-sustaining

(Lele, 1975). According to Chambers "rural development is a strategy to enable a specific group of people, poor rural women and men, to gain for themselves and their children more of what they want and need. It involves helping the poorest among those who seek a livelihood in the rural areas to demand and control more of the benefits of development. The group includes small-scale farmers, tenants, and the landless" (Chambers, 1983: 147). In Kenya, the persons identified as the nation's poor include the same group mentioned above (Kenya, 1983).

Irrigation usually bails out many concerned households from the vagaries of weather. Because of being a resource-based opportunity for generating and strengthening livelihoods at the local levels, (Chambers 1983), irrigation has had to reduce drought risks, raise yields and reduce rural-urban migration because it ensures regular employment. In fact it is a critical means of food production (Ssennyonga, 1986).

Experience has it that large scale irrigation systems tend to have disappointing results. Usually, and rightly so, high capital costs are incurred in their establishment (Lowe 1986; Kenya 1986 B; Task Force Report, 1986). In addition, such schemes do cause

dislocations of human populations and physical environment (Palutikof, 1981; Lowe, 1986). Certainly such undertakings are not only beyond the domestic financial abilities of many countries particularly the less developed (LDCs) such as Kenya but the dislocations cause anguish to those affected. Over and above all, the management of such schemes, be it in terms of water regulation and distribution or even land allocation, is too complex a bureauratic involvement. The contention of Lowe (1986) that within large scale sch the powers, welfare and progress of the peasants gets shifted from their hands and placed in those of an army of officials sums up the complexity of management. Eicher and Baker (1982) attribute the poor performance of large scale irrigation projects to what they call th common problems. These are, lack of participation of farmers in decision making, lack of flexibility in choosing crops, and the difficulties of adjusting the size of farms in response to changes in the life cycles of tenant families.

Arnon (1981) points out that the development of agriculture depends heavily on understaning a socie socio-cultural values that influence farmers responsiveness to technological change and economic pursuits. Essentially, irrigation being a form of civilisation bears socio-technical values in its

development. Thus it need not be seen just as an agricultural technique that is wholly subjective to the designs of modern technology. Rydzewski (1968) asserts that the presence of a traditional (indigenous) irrigated farming is an important non-constraining factor on future development of irrigation. That is, to develop/improve irrigated farming in an area which already has some strongly rooted socio-economic institutional framework (Bromley, 1982) is much an easier task than if there was none.

The efficiency of irrigation (which Michael (1978) attributes to the nature of design of the irrigation system, the style of land preparation, and the skills and care of irrigators), has been noted to be very low in developing countries (Arnon, 1981). The channel breakages, leakages and seepages (infiltration) can be assumed to contribute towards the reduction of amounts of water that is abstracted and destined for irrigation in the farms. Even for the water that reaches the fields, the methods of spreading, may be wasteful - as seems to be the case with the Marakwet Indigenous Irrigation System (Huxley, 1959; Critchley, 1983). The facilities used in particularly traditional irrigated farming are seldom adequate for high crop yields (Arnon, 1981). However such facilities are simple and less expensive compared with facilities used for modern technology

based irrigated farming which are not only expensive but highly complex.

Occassionally institutional contraventions by some irrigators - who divert water for their own use at times when it is not their turn - disrupt the distribution/sharing of water amongst the irrigators. By so doing, the flouters disturb the farming programmes of their fellow irrigators (Bromely, 1982). Studies (Arnon, 1981; Kipkorir, 1983) have also shown that diseases such as malaria and bilharzia are endemic to irrigated areas. Such diseases usually weaken the irrigators. In some cases, they (diseases) cause deaths hence being dreadful in areas such as the Kerio Valley (Ibid).

The national development policies emphasise the provision of extension services and infrastructural facilities as prerequisites towards steering agricultural productivity for rural development purposes (Kenya, 1983; 1986 B). Extension services reach the farmers through programmes such as the Tranining and visit (T and V) which is being undertaken by field Technical Assistants. The T and V programmes aims at teaching farmers to adopt better farming methods. The vital infrastructural facilities required by farmers include good rural access road network. Here then,

it is assumed that such services and facilities are either poor and inadequate or completely lacking in the area under the influence of Marakwet Indigenous irrigation system - Arror location the case study area being included. That being the case, it follows that agricultural productivity is generally low with the physical environment being a victim of poor farming methods among others.

Thus, the success of irrigation is not a matter of technology alone, socio-cultural values play a remarkable role as well. In essence the established tradition of irrigated farming should guide the future development of irrigation. Taking note of the scarcity of resources and reflecting on the need to avoid social anquish one is left with a notion of the need for intergrated approach for rural development. Obviously irrigation is important, but reality calls for the adoption of less complex/expensive approach which as well should not marginalize the rural poor. Rather it should improve the well-being of the rural poor. This then is the premise of this study.

REFERENCES:

Arnon, I. - 1981 - Modernization of Agriculture in Developing Countires: Resources, Potentials and Problems; John Wiley, New York.;

Bromley, D.W. - 1982 - Improving Irrigated Agriculture: Institutional Reform and the Small Farmer, World Bank Staff Working Papers No. 531; World Bank, Washington, D.C.

Carruthers, I. and A. Weir - 1976 - "Rural Water Supplies and Irrigation Development" in Heyer, J. et. al. (eds) Agricultural Development in Kenya; Oxford University Press, Nairobi.

Chambers, R. - 1983 - Rural Development: Putting the Last First; Longman, London.

Chambers, R. and J.R. Moris - 1973 - Mwea: An Irrigated Rice Settlement in Kenya; Weltforum Verlag, Munich.

Critichley, W.B.S. - "Agricultural developments in Marakwet: Some controversial issues." in Kipkorir, B.E. et. al. (eds.). Kerio Valley: Past, Present and Future; Eleza Services, Nairobi.

Eicher, C.K. and D.C. Baker - 1982 - Research on Agricultural Development in Sub-saharan Africa: A Critical Survey; Michigan State University, Michigan.

Huxley, E. - 1959 - "African Water Engineers" in Geographical Magazine, Vol. 32 No. 4 pp. 170 - 175.

Kenya, Rep. of - 1970 - Kenya Population Census, 1969; Vol. 1, Statistics Division, Ministry Finance and Ecoomic Planning, Government Printer, Nairobi.

Kenya, Rep. of,-1981 - Kenya Population Census, 1979; Vol. 1, Central Bureau of Statistics, Ministry of Economic Planning and Development, Government Printer, Nairobi.

Kenya, Rep. of, - 1983 - The 5th National Development Plan 1984 - 1988; Government Printer, Nairobi.

_____ - 1986, A - Kenya Economic Survey, 1986; Central Bureau of Statistics, Ministry of Planning and National Development, Government Printer, Nairobi.

_____ - 1986, B - Sessional Paper No. 1 of 1986 on Economic Management for Renewed Growth; Government Printer, Nairobi.

Kipkorir, B.E. - 1983 - "Historical Perspectives of development in Kerio Valley" in Kipkorir, B.E. et. al. (eds) - 1983 - Ibid.

Lele, U. - 1975 - The design of Rural Development: Lessons from Africa; John Hopkins University Press, Baltimore.

Lowe, R.G. - 1986 - Agricultural Revolution in Africa?: Impediments, to change and Implications for farming, education and for Society; Macmillan, London.

Michael, A.M. - 1978 - Irrigation: Theory and Practice; Vikas, New Delhi.

Moi, D.T. - 1986 - Kenya African Nationalism: Nyayo Philosophy and Principles; Macmillan, London.

Palutikof, J.P. - 1981 - " Irrigation in Kenya with special reference to the Dry areas"; in Camplell, D. and S.E. Migot - Adholla (eds.) The Development of Kenya's Semi-Arid Lands; IDS Occasional Papers No. 36, University of Nairobi.

Ruigu, G.M. - 1986 - "Some Policy issues on Irrigated Agriculture: The case of Large Scale Public Irrigation Schemes". A paper presented in the joint Seminar on Irrigation Policies in Kenya and Zimbabwe, 27 - 28th November, 1986, Nairobi, Kenya.

Rydzewski, J.R. - 1968 - Irrigation Development in Africa South of the Sahara: Potentials and Possibilities 1965 - 1985; F.A.O., Rome.

Ssennyonga, J.W. - 1986 - "Indigenous Perceptions and Utilization of Resources and their challenge to development planning"; Paper presented at Seminar on: Interaction of Man, Space and Environment Over time, Organized by Department of Land Development, University of Nairobi, 2nd - 5th April, 1986. Nairobi.

Stern, P.H. - 1979 - Small Scale Irrigation: A Manual of Low-cost Water Technology; Intermediate Technology Publications, London.

Task Force Report - 1986 - "Irrigation Development in Kenya"; A Report of an Interministerial Task Force, Nairobi, Kenya.

Van-Klinken, M.K. - 1987 - "Formal Mistakes and Informal Lessons from Irrigation in Kenya: The Pokot Traditional Furrow Technology."; African Water Technology, International Conference, Organized by World Water, 24th - 26th February 1987, Nairobi, Kenya.

Walker, H.H. - 1984 - "Problems of the Organization of Irrigation Projects: A Systems Orientated study of Irrigation Projects in Developing Countries", Applied Geography and Development; A Biannual Collection of Recent German Contributions, Vo. 23, Institute for Scientific Cooperation, Tubingen.

CHAPTER TWO

IRRIGATION POLICY IN KENYA

2.0 PRE-INDEPENDENCE IRRIGATION

Six significant cases are noteworthy. First, is the labour intensive inundation irrigated farming involving the Pokomo in Lower Tana which came into being about 400 years ago (Alila, 1986; Task Force, 1986). Secondly, is the Marakwet and Pokot furrow technology based irrigated farming that came into being more than 300 years ago - which is as well labour intensive (Henning, 1951; Kipkorir, 1983; Van-Klinken, 1987). While the Marakwets used the waters of Rivers Arror, Embomon, Enou, Embolot and Embobut - all being tributaries of River Kerio; the Pokots abstracted the waters of River Weiwei - a tributary of River Turkwel.

Thirdly, are the irrigation schemes established by Arabs in mid 19th century using slave labour. The present Vanga cluster of irrigation schemes belong to this group. These schemes were meant for paddy production. Towards the end of the 19th century, the Kenya-Uganda railway was established beginning from Mombasa. While the construction was in progress, it became imperative to develop reliable sources of food (vegetable) supplies for the construction crew. To meet this objective, some Indian coolies were allocated land and instructed to grow horticultural crops by way of irrigation at the Makindu-Kibwezi area using the

water of local springs and streams. This happened between 1901 - 1905. That is to say, at the completion, of the railway line construction, the entire irrigation programme collapsed. This then is what is hereby considered as the fourth case.

Fifthly, during the two World War periods, prisoners of war were used to intitiate, operate and maintain irrigation schemes mainly for paddy production. These schemes were in areas such as Taveta, Karatina, Naivasha and the shores of Lake Victoria. After the World Wars, these schemes became less effective and are at the moment being rehabilitated by the Irrigation and Drainage Branch (IDB) of the Ministry of Agriculture.

The armed struggle for political independence in Kenya in the 1950s ushered in the establishment of large scale irrigation schemes, namely, Mwea, Hola and Perkerra. In this case, the schemes were being established with the use of captured freedom fighters better known as the "Mau-Mau" captives. Indeed this was a colonial design of political subjugation. However, going by the Swynnerton Plan of 1954 (Swynnerton, 1955) which aimed at boosting agricultural production in the African areas, it can be stated that the establishment of such schemes were in keeping with policy guidelines. Otherwise these ("Mau-Mau" related)

irrigation schemes fall within the sixth group of the Pre-independence irrigation development in Kenya.

In a nutshell, pre-independence irrigation in Kenya can be summed up as having:-

(a) either been spontaneously developed by public participation in response to a felt-need, examples being the Pokomo, Marakwet and Pokot irrigation systems. Or, coercively developed by aliens with authoritative designs for example the Arab owned slave initiated, Kibwezi-Makindu railway line construction, the World War period prisoners of war initiated, and the 'Mau-Mau' associated irrigation schemes.

(b) been either of small scale or large scale; examples being all except the 'Mau-Mau' associated irrigation systems respectively.

2.1 POST-INDEPENDENCE IRRIGATION DEVELOPMENT

Soon after the attainment of independence in 1963 and being aware of the significance of the agricultural sector, the Kenya government through the Sessional Paper No. 10 of 1965 set out to revolutionize the sector, viz. Agriculture (Kenya, 1965). The key

areas identified in this attempt were the virgin and underutilized land, the development of which would be through land consolidation and registration. It was envisaged that such an approach would enable farmers to acquire credit facilities and also be provided with extension and training services. Adoption of modern farming methods and marketing practices were the expectations of the above said approaches/programmes. Development emphasis were geared towards the areas formerly referred to as African areas ("Reserves") as opposed to the former White-Highlands.

It became a policy issue that the government would ensure wise use and prompt repayment of credit facilities given to, say, farmers. The government also undertook the responsibility of setting commodity prices so as to safeguard the interests of producers and consumers. Agricultural production was as well to be enhanced through intensive research programmes. Supportive services particularly through cooperative movements would ensure the marketing of produce from small scale farmers. All the above statements of intention have been and rightly so, viewed as the epitome of endeavours aimed at eliminating poverty, disease and ignorance. Needless to say, the Sessional Paper No. 10 of 1965 has remained the key document for steering policy formulation in Kenya.

Apparently, irrigation must have had an implicit regard within the above context. Such that, the government through the 1966 - 1970 Development Plan clearly stated that "even if irrigation is not a panacea for Kenya's agriculture, it can make a significant contribution to production, income, foreign exchange earnings and employment" (Kenya, 1966 : 137). Moreover, in 1966, the National Irrigation Board (NIB) was established by an Act of Parliament, No. 13 of 1966 (Kenya, 1986 B). NIB was charged with the responsibility of developing, controlling and improving national irrigation schemes, particularly, those established during the 'Mau-Mau' period.

Strictly speaking, the NIB has the powers of:

(a) researching and investigating for the establishment of national irrigation schems;

(b) executing policy issues in the same;

(c) raising funds for the development of such schemes;

(d) coordinating and planning settlement on the schemes;

(e) designing, constructing, supervising and administering the national irrigation schemes;

(f) determining the number of settlers and providing public land on the schemes, and

(g) processing and marketing the products of national irrigation schemes.

Currently, all the seven large scale public irrigation schemes in Kenya namely, Mwea, Ahero, West Kano, Bunyala, Tana (Hola), Perkerra and Bura are under the control of NIB.

The NIB which is entirely inclined toward large scale public irrigation schemes has tenant plot-holders on her schemes. Usually, the NIB pays the tenants less than half of what it earns as the Gross Value of crops produced by the plot-holders. For instance, in 1982/83 and 1983/84 periods, the NIB paid 48.4% and 49.7% of its Gross Value earnings on crops to the plot-holders in each of the two periods respectively. Thus, more than half of the Gross Value earnings on crops goes to the NIB and not the plotholders (NIB, 1986).

Around 1967, the first small scale public sponsored irrigation projects were developed with funds mainly from FAO/UNDP. Non-Governmental Organizations (NGOs) also contributed towards the development of such small scale irrigation projects, for example Katilu in Turkana district. Private small and large scale commercial irrigation projects have also emerged (Task Force, 1986; Review Mission, 1986).

The inability of the country to meet its food requirements in the mid-1970s ushered in the formulation of the National food policy referred to as the Sessional Paper No. 4 of 1981 (Kenya, 1981). Basically, the food shortages were attributed to rapid population growth that outstripped the rate of food production, and the reliance on scarce and limited agricultural resources subject to vulnerable climatic variations. As a result, the following objectives were identified in the Food Policy, namely : to attain self-sufficiency, to attain food security, and to achieve equitable distribution of foodstuffs throughout the country. Moreover, the development of the agricultural sector was stated as being important for the generation of foreign exchange and creation of employment opportunities for the fast growing population. Increased multiple and inter cropping, intensive use of farm inputs such as improved seeds, and the improvement of cultural practices were noted as the avenues that will enable the realisation of the objectives identified.

Between 1974 and 1980, another achievement was realised. This was the formation of regional development authorities, namely : Tana and Athi Rivers Development Authority (TARDA), Kerio Valley Development Authority (KVDA) and Lake Basin Development Authority

(LBDA). Their contribution to Kenya's irrigation development has mainly been the planning and implementation of projects.

The creation of the Irrigation and Drainage Branch (IDB) - (within the Ministry of Agriculture) - and its supportive arm namely, the Provincial Irrigation Unit (PIU) in 1977 was a deliberate move by the government. The Unit is charged with the duty of promoting, guiding and developing small scale governmental and non-governmental sponsored irrigation schemes. Currently, the IDB is organized on the basis of Provincial Irrigation Units (PIUs). A PIU "is charged with the responsibilities of identification, planning, implementation and follow-up of irrigation projects" (Review Mission, 1986). The rehabilitation of irrigation projects established by prisoners-of-war during the World Wars is being undertaken by PIUs.

The Arid and Semi-Arid lands department within the Ministry of Planning and National Development is also noteworthy. The Department has been in the irrigation scene since the 1970s. The department is mainly preoccupied with feasibility studies for the purpose of assessing irrigation potential and providing advisory services in cases where it has financed implementation of projects (Kimani, 1986).

Suffice it to mention that all development programmes undertaken by the department are funded by donor/ sponsoring countries such as Netherlands, Britain, Denmark, Norway and U.S.A.;all being on the basis of bilateral agreements.

In the fifth quinquennial National Development Plan for 1984 - 88 period, it is mentioned that "poverty is a national phenomenon" (Kenya, 1983 : 55) whose alleviation can be by prudent utilization of resources. Among those identified as the nation's poor are the "pastoralists, the small farmers, the landless rural workers, the urban poor and the handicapped" (56) The provision of, say, livestock holding grounds, extension services on better agricultural (farming) practices, marketing facilities, and communal watering points can bail out some of the nation's poor such as pastoralists, and small farmers.

The core programmes of national agricultural development have been stated as including intensified research on better seeds for all agro-ecological zones, drugs, medicines, pesticides, and appropriate technologies. On the other hand, the strategies aimed at the realisation of agricultural development include: the provision of farm inputs and services such as fertilizers and veterinary campaigns, mechanization

through the Tractor Hire Service (THS) for land preparation and the Plant Hire Service (PHS) for soil conservation and dam construction particularly in the arid and semi-arid areas of the country; the provision of water for irrigation and livestock, stock feeds and financial credit facilities (Ibid).

The Sessional Paper No.1 of 1986 (Kenya, 1986 A) noted that 85% of Kenya's population in 1984 were rural based. It is envisaged that by the year 2000, Kenya will be having a total of about 35 million people. Between 9 - 10 million of the 35 million persons will be urban residents. Thus, over 70% of the total population will still be rural based. It implicitly follows that majority of the poor will still be rural residents. It is also stated in the paper (Ibid) that Agriculture will still be leading in the multipath development process of the country.

Given the above to be the state of affairs in Kenya by the year 2000 and the fact that the country is short of good agricultural land as stated earlier (refer to page 1 of the text), the Sessional Paper (Ibid) has articulately enunciated the development goals for agriculture. The goals are to : provide food security, generate farm family incomes, absorb new farm workers, supply export crops, and stimulate the growth

of productive off-farm activities in the rural areas. Certainly irrigation has a role within this context.

Meanwhile, it is important to point out that the Ministry of Water Development is the sole arbiter in matters pertaining to water abstraction from their natural courses such as rivers, lakes, seas and subterranean basins. The Water Act (Kenya, 1972) stipulates that the Ministry holds the prerogative of influencing the management and development of water resoruces. It also undertakes the national assessment and preparation of water master plans. Moreover, the Ministry can as well help individual farmers to design irrigation projects (Kimani, 1986).

The Interministerial Task Force set up for the purpose of studying ways and means of irrigation development in Kenya (Task Force, 1986) is indeed a mark of commitment. The Task Force was assigned the duty of examining and making recommendations on Kenya's total irrigation potential, appropriate methods to developing it, better land and water management methods, incorporating the small scale irrigation component into the currently biased Irrigation Act, and the establishment of an institutional framework for planning and implementation of irrigation and drainage programmes under the current District Focus

strategy for Rural Development among others. As a result, it was found out that a total of about 32,430 ha. of land in Kenya was under irrigation. However, as at September 1987, the same was estimated to be 43,500 ha. (see Table 2.1 below).

Table 2.1 AREA UNDER IRRIGATION IN KENYA

Category	Principal Crops	Area (ha.)		
		1986	1987	Difference
Large scale commercial	Coffee, Pineapples Miscellaneous horticulture	16,000	25,000	9,000
Public Large Scale (NIB)	Rice, Cotton and horticulture	8,930	9,000	70
Bura Public large scale	Coffee and Maize	2,500	2,500	-
Modern small holder (IDB or NGO promoted)	Rice, Maize and horticulture	2,500	2,500	-
Regional authorities and other public agencies	Maize, Rice, horticulture	1,200	1,500	300
Modern Private small holder	horticulture	500	1,500	1,000
Traditional (indigenous) smallholder	Maize, sorghum, Finger millet, Legumes	800	1,500	700
Total		32,430	45,500	11,070

Source: - 1986 data - Task Force Report, 1986
- 1987 data - Provided by Head of Irrigation Department, Ministry of Water Development.

It is explicitly observable from Table 2.1 that each category of irrigated farming has some principal crops e.g. maize, sorghum, finger millet and legumes in the case of the indigenous irrigated farming which are usually operated by smallholders. Moreover, 2.5% and 3.4% of the estimated total irrigated land in 1986 and 1987 were accounted for by indigenous irrigation systems respectively. However, Van-Klinken (1987) holds that the Task Force Report (1986) estimate of 32,430 ha. underplays the extent of irrigated farming in Kenya. He (Van-Klinken) estimates that about 50,000 ha. are under irrigation in Kenya, out of which 20% (or 10,000 ha.) belong to the indigenous irrigation systems. The 800 ha. recorded by the Task Force as being of indigenous category is refuted by Van-Klinken who asserts that the "estimate is more indicative of official ignorance rather than a reflection of reality" (Van-Klinken, 1986 : 7 - 5).

Carruthers and Weir (1976) seem to have given Van-Klinken some stand particularly as regards small scale irrigated farming. They contend that:

> "Their small scale obscures the fact that they are locally very important as a source of employment and food production" (302).

Whatever the case, their (Van-Klinken, 1987, and Carruthers, et.al., 1976) observations are rightly so in that, for instance, Elgeyo (Keiyo) Marakwet district alone has an estimated total of about 1,500 ha. of land under indigenous technology based irrigated farming (Cappon, 1985).

After alleging that irrigation plays a minor role in Kenya, Van-Hoorn (1976) was quick to point out that developing it "remains an important means of raising agricultural output entailing improvement of rural welfare" (3). At the moment, irrigated farming is a major source of some nationally important crops, particularly paddy (rice) and cotton. From 1982 to 1986, the total paddy and cotton bought by marketing boards against those produced by public large scale irrigation schemes were as shown on Table 2.2 on page 37. Assuming that all what is produced by the large scale irrigation schemes is bought by the marketing boards, then all the 1982 paddy produce constituted all the purchases of marketing boards. In fact, in 1986 there may even have been some large scale irrigation schemes paddy produce that remained unpurchased by marketing boards - of course this is but an assumption. For cotton, the contribution to the marketing boards was low (10.3%) in 1982 and has been gradually growing such that in 1986, it had reached 29.9%.

Table 2.2 PADDY AND COTTON PURCHASES BY MARKETING BOARDS AND PRODUCTION BY SOME PUBLIC LARGE SCALE IRRIGATION SCHEMES, 1982 - 86

YEAR	PADDY			COTTON		
	A	B	C	A	B	C
1982	38.6	38.6	100.0	24.3	2.5	10.3
1983	36.6	36.4	99.5	25.8	4.1	15.9
1984	36.4	36.3	99.7	22.8	4.0	17.5
1985	39.5	34.5	87.7	38.0	7.7	20.3
1986	21.3	34.7	162.9	25.4	7.6	29.9
TOTAL	172.4	180.5	104.7	136.3	25.9	19.0

Note: Columns A - Purchases (,000 tonnes)

B - Production (,000 tonnes)

C - Production expressed as % of Purchases

Source: Compiled from Kenya Economic Survey, 1987.

Further, it can be stated that the contribution of (large scale) irrigated farming to the nation's paddy and cotton yield is quite remarkable.

At this juncture, a look at the national irrigation potential is important. Palutikof (1981) estimated the total national potential to be 256,000 ha. Later, the Interministerial Task Force (1986) stated it to be 550,000 ha. However, a World Bank study (World Bank, 1987) gave the total national potential of irrigable land as being 244,700 ha.

While considering only two, namely the Task Force (1986) and World Bank (1987) estimates, the following can be added. That both overlooked ground water resources; and secondly, that the World Bank's lower estimate was due to the fact that the study (World Bank, 1987) took into account public water requirements and also water requirements for energy generation. Apparently the water requirements stated as being required for energy generation by the World Bank (1987) can usually be used for irrigation purposes. In addition, groundwater can as well be exploited for irrigation purposes. Hence, it will be fair to hereby prefer the Task Force (1986) estimate as being more relevant for practical planning purposes.

So, given that 43,700 ha. is under irrigation - as estimated in September 1987 - it will follow that over 90% of the estimated national potential is yet unexploited.

Since the attainment of indendence in 1963, the development of Kenya's irrigation has been under the influence of foreign aid funds in many cases. The Task Force (1986) mentioned that "the selection, conception and implementation of public sector irrigation projects is mainly determined by donor agency preferences" (40). In itself this has negatively affected local

decision making and levels of participation. Moreover, the cost of irrigation development has been prohibitive. Experience has shown that the main causes of high development costs of public sector irrigation projects are "imprudent use of consultants, expatriates and contractors, coupled with under-utilization if not out-right abuse of local expertise" (43).

The most expensive irrigation projects (per unit area) are the large scale and capital intensive schemes which tend to have high degree of expatriate involvement (see Appendix III). On the other hand, the cheapest are the small scale furrow system projects which boast of high degree of farmer involvement in its development. Nevertheless, small scale irrigation projects need not be wholly conceptualized as cheap and success stories. Kibirigwi Irrigation Scheme (KIS) is a case in point.

Kibirigwi Irrigation Scheme (KIS) uses sprinkler technology of irrigated farming in an area of high agricultural potential in Kirinyaga district. In 1983, KIS was reported as being unviable; because of the difficulty of training farmers to become commercial vegetable growers, the high costs incurred by farmers in using sprinklers and the complexity of management and service requirements that tend to be too high for

the relatively small groups of farmers (KIS, 1983). As a result, the government was urged to be careful when considering starting similar projects.

By and large, appreciable attention is being drawn towards irrigation at the moment. Emphasis, is for instance, on the adoption of appropriate technologies that can enhance production, rehabilitation of existing schemes and encouragement of small scale projects in where water can be abstracted and spread through gravity flow (Kenya, 1983). The 6th National Development Plan for 1989 - 1993 whose theme will be "PARTICIPATION FOR PROGRESS" bears some Irrigation Policy Formulation guidelines*. Key aspects to be considered for irrigation will be:-

(i) adoption of freehold land tenure system in National Irrigation Schemes.

(ii) concentrating efforts on small holder irrigation development in arid and semi-arid lands with preference being on labour intensive/low cost/ high value crops.

(iii) to rationally coordinate operation by public institutions in irrigation development.

---

* Personal communication with an Irrigation Officer, Ministry of Water Development.

(iv) to call for investment by private lending institutions on irrigation.

(v) gathering for both commercial and subsistence crop production in irrigation.

(vi) expansion of irrigation programmes.

(vii) rehabilitation of existing schemes to improve water distribution and put Bura to gravity-fed and

(viii) involve cost sharing between farmers and government, be it in cash or kind, for the construction of irrigation infrastructure.

Holding to the view that indigenous irrigation systems are not schemes in that they have evolved and developed rather than being designed (Van-Klinken, 1987), it apparently becomes necessary to note that they (indigenous systems) are still at the periphery of concern to policy makers. This is so because they have not been addressed to directly in policy guidelines. What exists is largely implicit in context, as viewed against the above background.

2.2 IRRIGATION IN THE KERIO VALLEY REGION UNDER THE INFLUENCE OF MARAKWET INDIGENOUS IRRIGATION SYSTEMS

The establishment of irrigated farming in the Kerio Valley part of Chebiemit and Tot divisions of Keiyo Marakwet district dates back many years ago. The indigenous furrow technology based irrigated farming emerged even before the arrival of the fore-fathers of the present users of the furrows, namely the Marakwets (Henning, 1951). Kipkorir (1983) asserts that "the Marakwets do not claim to have dug the first channel but they themselves are certainly responsible for the technology and construction of the present system" (4).

Huxley (1959) and Critchley (1983) contend that the technology applied in the construction of the furrows is unique and abounding with ingenuity though a contrast of it all is the wasteful methods of water utilization at the valley floor. Credit must go to Soper (1983) and Ssenyonga (1983). Soper describes the area covered by Marakwet indigenous irrigation system and goes further to state the total number of major furrows. He has also presented the potential water delivery for most furrows and their estimated distances among other things. Ssennyonga on the other hand has applied the "Systems-Approach" to water

management in the Marakwet Indigenous Irrigation systems. His findings include ascertaining that the whole society is involved in operating the system on non-bureaucratic principles and also the modelling of the indigenous irrigation system within the social setting.

According to Kipkorir (1983), the Marakwets could not have survived in the valley were it not for indigenous irrigation systems. Essentially, irrigation in the Kerio Valley emphasizes one major goal, namely, the maximization of subsistence as exemplified by the crops grown which include sorgum, finger millet, cassava and bananas (Ssennyonga, 1986).

Between 1977 - 1979, there existed Chesongoch Agricultural Project (Critchley, 1983). It was established by the Benedictine Catholic Mission of Chesongoch. The objectives of the project were:-

- to demonstrate better cropping methods;
- to introduce improved cereals seeds to the farmers;
- to experiment and enhance the production of cash crops especially pepper; and
- to introduce appropriate ploughing and transportation technologies involving the use of donkey drawn ploughs and carts.

Unfortunately, all the above objectives were not realised. The reasons for the failure were the inconsistency in the supply of improved seeds, the strangeness of the new cropping methods and so-called appropriate technologies, and the lack of reliable market for the cash crop (pepper) within the easy reach of the producers. If anything, it should have been the failure of the Chesongoch Project that prompted Dubel and Kwaasteniet (1983) to argue that the Marakwets are irrigating as ever before.

But in early 1980s remarkable development of irrigation in the Kerio Valley occured. This included the establishment of Tot and Arror Farm projects by the Kerio Valley Development Authority (KVDA), and also the Arror Catholic Mission farm. The purpose of such 'new' establishments were to demonstrate better farming methods particularly through the use of modern technology and also undertake experimental activities of crop production among other things.

2.3 CONCLUSIONS

The following few remarks are considered pertinent to conclude this Chapter. That, much as irrigation plays a remarkable role in Kenya's economy, much of its potential is yet unexploited. In addition,

experience has shown that large scale (public) irrigation schemes are too expensive to initiate and operate. This also applies to small scale irrigation schemes particularly if the technology applied is not in keeping to the societal values and/or even the whole question of irrigated farming may be lacking within the cultural practices of the society affected. Examples are Bura, Chesongoch Project and Kibirigwi irrigation schemes respectively. In essence, the effectiveness of irrigated farming is not entirely subject to sophisticatedness of technology; apparently it requires the support of traditional values. Lessons from the Kerio Valley show that the performance of the indigenous irrigation systems is being disparaged by poor technology.

Owing to the significance of irrigation in Kenya, policy guidelines aimed at steering the development of irrigation have been formulated. Institutions have as well been established to help in the development of irrigation, e.g. the National Irrigation Board, the Provincial Irrigation Units and Non-governmental organisations (institutions). In all cases, policy guidelines and institutions have become more biased towards modern technology based irrigation hence giving little attention, if not none, to indigenous irrigation systems. But in actual fact it is being improved ir course of time just as the trend has shown.

REFERENCES

Alila, P.O. - 1986 - "Grassroots Participation in Small and Large Scale Irrigation Agriculture: The Kenyan Experience". A paper presented in the Joint Seminar on Irrigation Policies in Kenya and Zimbabwe, 27th - 28th November, 1986, Nairobi, Kenya.

Cappon, J.C. - 1985 - Elgeyo Marakwet District Atlas; ASAL Development Programme, Iten.

Carruthers, I. and A. Weir - 1976 - "Rural Water Supplies and Irrigation Development" in Heyer, J. et. al. (eds.) - Agricultural Development in Kenya; Oxford University Press, Nairobi.

Critchley, W.B.S. - 1983 "Agricultural Developments in Marakwet : Some controversial issues" in Kipkorir, B.E. et. al. (eds.) Kerio Valley: past, Present, and Future; Eleza Services, Nairobi.

Dubel, I. and M. de Kwaasteniet - 1983 - Irrigated Agriculture as a base of Subsistence : the Case of the Marakwet, with reference to the Labour of Women; University of Amsterdam, Department of Human Geography, Amsterdam.

Hennings, R.O. - 1951 - African Morning; Chatto and Windus, London,

Huxley, E. - 1959 - "African Water Engineers" in Geographical Magazine. Vol. 32 No. 4 pp. 170 - 175

Kenya, Rep. of - 1965 - Sessional Paper No. 10 of 1965 on African Socialism and its Application to Planning in Kenya; Government Printer, Nairobi.

_____ - 1966 - Development Plan, 1966-1970; Government Printer, Nairobi.

_____ - 1972 - The Water Act, Chapter 372 of the Laws of Kenya; Government Printer, Nairobi.

_____ - 1981 - Sessional Paper No. 4 of 1981 on National Food Policy; Government Printer, Nairobi.

_____ - 1983 - Fifth National Development Plan, 1984 - 1988; Government Printer, Nairobi.

_____ - 1986, A - Sessional Paper No.1 of 1986 on Economic Management for Renewed Growth; Government Printer, Nairobi.

_____ - 1986 B - Irrigation Act, Chapter 347 of the Laws of Kenya; Government Printer, Nairobi.

Kenya, Rep. of - 1987 - Kenya Economic Survey, 1987; Government Printer, Nairobi.

Kimani, J.K. - 1986 - "Irrigation development - Institutional Aspects"; A paper presented in the joint Seminar on Irrigation Policies in Kenya and Zimbabwe, 27th - 28th November 1986, Nairobi, Kenya.

Kipkorir, B.E. - 1983 - "Historical Perspective of Development in the Kerio Valley" in Kipkorir, B.E. et. al (eds.) - Ibid.

KIS - 1983 - "The Future of Kibirigwi Irrigation Scheme (KIS) and Kibirigwi Farmers Cooperative Society"; Draft Plan of Operation, 1983 - 1984, Irrigation and Drainage Branch, Ministry of Agriculture.

National Irrigation Board (NIB) - 1986 - "Annual Report and Accounts 1983 - 1984", Nairobi, Kenya.

Palutikoff, J.P. - 1981 - "Irrigation in Kenya with Special reference to the Dry areas" in Campbell, D. et. al. (eds.) The Development of Kenya's Semi-Arid lands; IDS/OP No. 36, University of Nairobi.

Review Mission - 1986 - "Small Scale Irrigation Development Programme, Phase III; Joint Kenya-Netherlands Review Mission, Nairobi, Kenya.

Soper, R. - 1983 - "A Survey of the Irrigation Systems of the Marakwet" in Kipkorir, B.E. et. al (eds.) - Ibid.

Ssennyonga, J.W. - 1983 - "The Marakwet Irrigation System as a Model of a Systems-Approach to Water Management"; in Kipkorir, B.E. et. al. (eds.) Ibid.

Ssenyonga, J.W. - 1986 - "Indigenous Perceptions and Utilization of Resources and their Challenge to Development Planning". A paper presented at Seminar on Interaction of Man, Space, and Environment Over Time, Organized by Department of Land Development, University of Nairobi, 2nd - 5th April, 1986, Nairobi.

Swynnerton, R.J.M. - 1955 - A Plan to intensify the Development of African Agriculture in Kenya; Government Printer, Nairobi.

Task Force - 1986 - Irrigation Development in Kenya : A report of an Interministerial Task Force; Nairobi, Kenya.

Van-Hoorn, J.W. et. al. - 1976 - Project Proposals for Research, Training and Project Guidance in Irrigation and Drainage in Kenya; Ministry of Foreign Affairs, DITC, Netherlands.

Van-Klinken, M.K. - 1987 - "Formal Mistakes and Informal Lessons from Irrigation in Kenya : The Pokot Traditional Furrow Irrigation; African Water Technology, International Conference, Organized by World Water, 24 - 26th February, 1987, Nairobi, Kenya..

World Bank - 1987 - Study on Options and Investment Priorities in Irrigation Development, Kenya; Country Report, Euroconsult, Arnhem, The Netherlands.

CHAPTER THREE

STUDY AREA

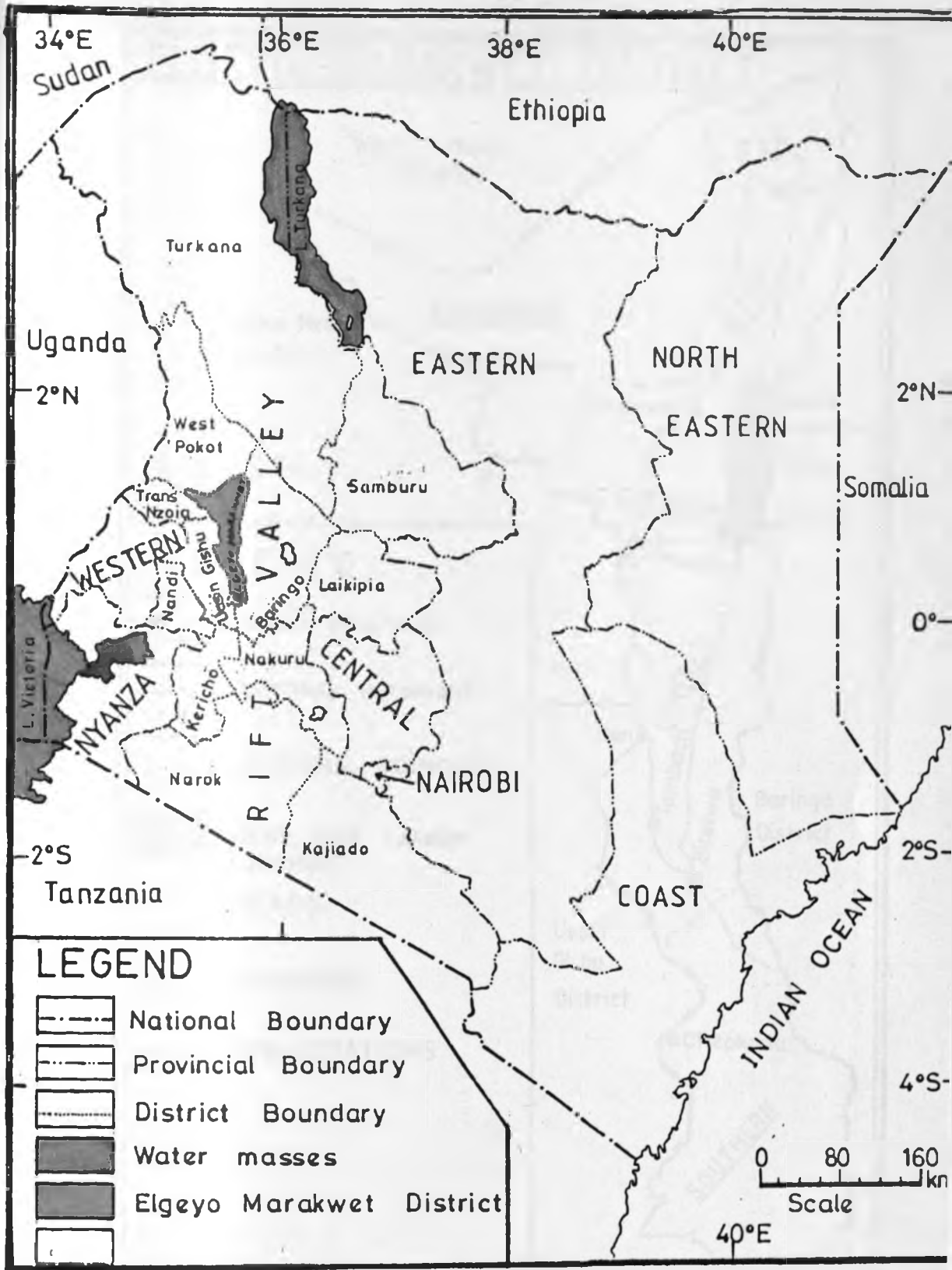
3.0 INTRODUCTION:

Key physiographic and socio-economic phenomena of the study are presented in this chapter with particular reference to the study area.

3.1 LOCATION AND EXTENT:

Arror location in Chebiemit division of Elgeyo (Keiyo) Marakwet district in the Rift Valley Province of Kenya (see maps 3.1 and 3.2 on pages 50 and 51). The eastern boundary of Arror location is marked by River Kerio which is not only a drainage landmark but forms the boundary between Keiyo Marakwet and Baringo districts. Tot division lies to the north as does the Central division in the south. To the West lies Koibarak location - Map 3.2 illustrates the above boundary aspects.

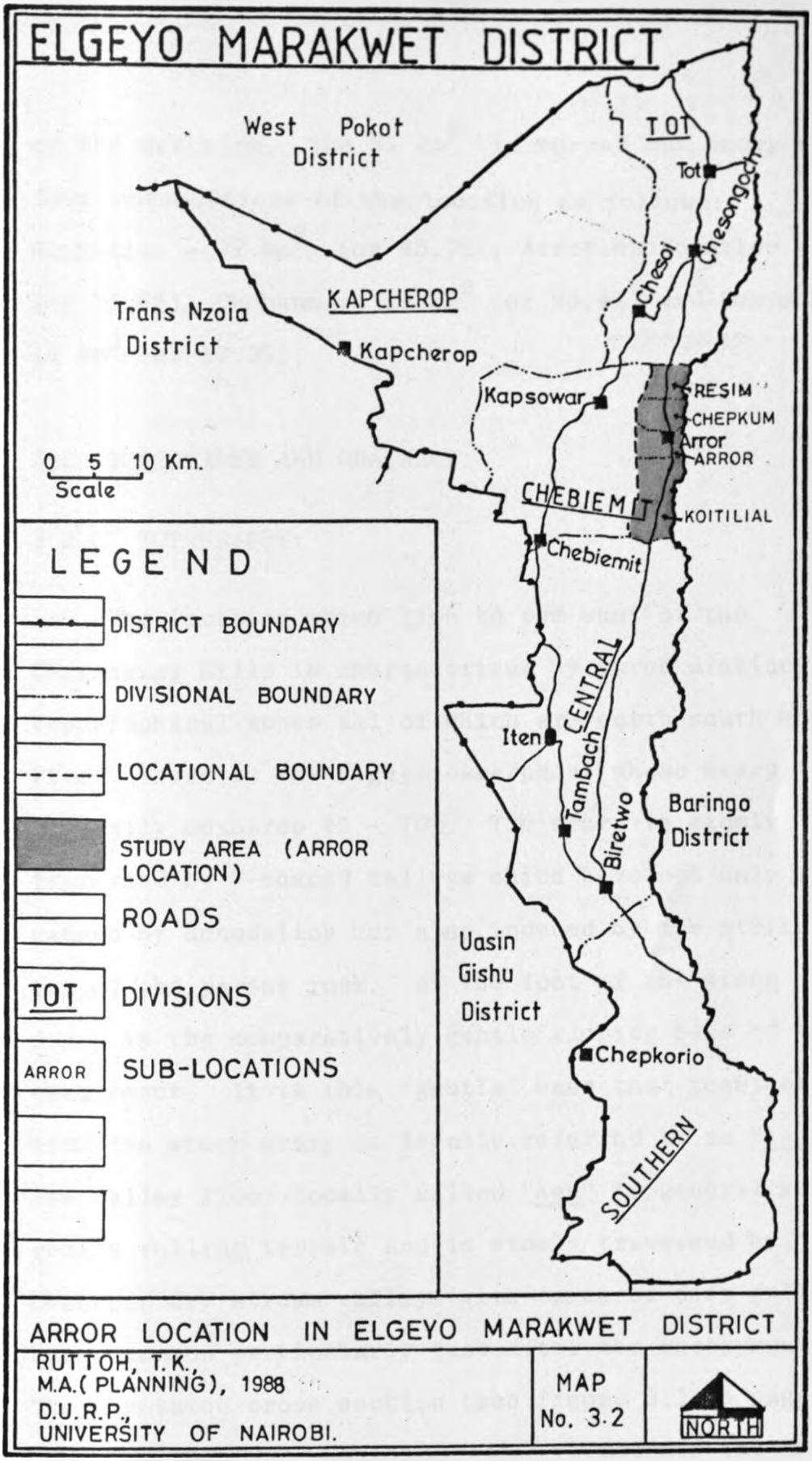
At the farthest, the location extents between 1^{o} 01' N and 0^{o} 51' N of latitude, and 35^{o} 4' E and 35^{o} 38' East of longitude. Altitudinally, it rises from as low as about 900 metres above sea level on the valley floor to as high as about 2200 metres above sea level at the upper edge of the escarpment - see map 3.3 on page 54. The location has a total area of 81 km^{2} which represents 31.8% of the 255 km^{2}



Elgeyo Marakwet District: National Context

RUTTOH, T.K.,
M.A. (PLANNING), 1988,
D.U.R.P.,
UNIVERSITY OF NAIROBI.

MAP
No. 3.1


ELGEYO MARAKWET DISTRICT
West Pokot District
TOT
Tot
Chesongoch
Chesoi
KAPCHEROP
Trans Nzoia District
Kapcherop
Kapsowar
RESIM
CHEPKUM
Arror
ARROR
0 5 10 Km.
Scale
CHEBIEMIT
KOITILIAL
Chebiemit
LEGEND
DISTRICT BOUNDARY
DIVISIONAL BOUNDARY
LOCATIONAL BOUNDARY
STUDY AREA (ARROR LOCATION)
ROADS
TOT
DIVISIONS
ARROR
SUB-LOCATIONS
CENTRAL
Iten
Tambach
Biretwo
Baringo District
Uasin Gishu District
Chepkorio
SOUTHERN
ARROR LOCATION IN ELGEYO MARAKWET DISTRICT
RUTTOH, T.K.,
M.A.(PLANNING), 1988
D.U.R.P.,
UNIVERSITY OF NAIROBI.
MAP
No. 3.2
NORTH

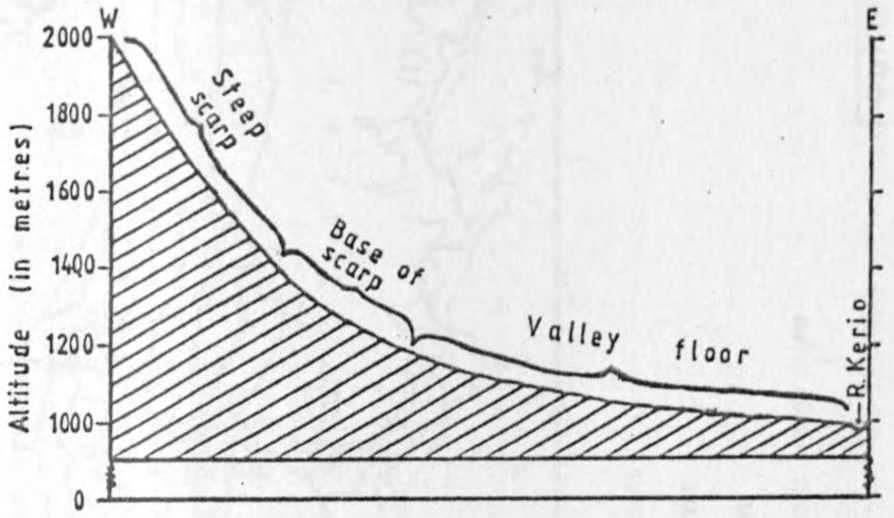
of the division. The 81 km^2 is spread out among the four sublocations of the location as follows: Koitilial - 37 km^2 (or 45.7%), Arror sublocation - 11 km^2 (or 13.6%), Chepkum is 19 km^2 (or 23.4%) and Resim is 14 km^2 (or 17.3%).

3.2 TOPOGRAPHY AND DRAINAGE:

3.2.0 TOPOGRAPHY:

The location which lies to the east of the Cherangany Hills is characterized by three distinct topographical zones all of which are north-south bound. First, there is the Elgeyo escarpment whose scarp generally measures 45 - 70%. The scarp is widely traversed by V-shaped valleys which have not only been caused by denudation but also induced by the strike and dip of the parent rock. At the foot of the steep scarp is the comparatively gentle sloping base of the escarpment. It is this 'gentle' base that together with the steep scarp is locally referred to as "lagam." The valley floor locally called "keu" is generally of gently rolling terrain and is widely traversed by U-shaped dry stream valleys with cases of deep gullies being common particularly just after the escarpment. The annotated cross section (see figure 3.1 on page 53) and Map 3.3 (on page 54) illustrate the above aspects of Topography.

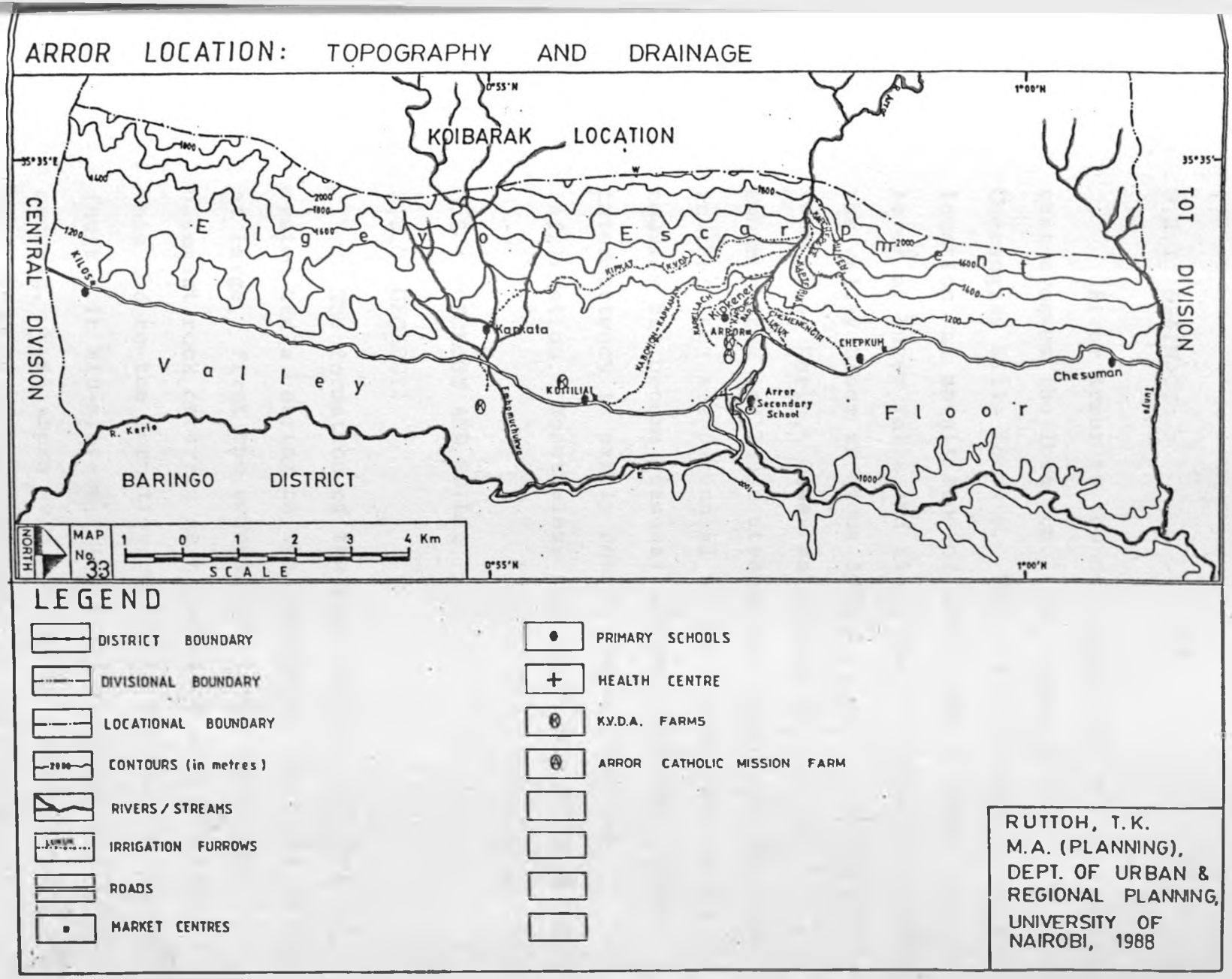
LATITUDINAL CROSS SECTION OF ARROR LOCATION



H.S. 1:50000
V.S. 1:20000

TOPOGRAPHICAL STRUCTURE

FIGURE 3.1


ARROR LOCATION: TOPOGRAPHY AND DRAINAGE
KOIBARAK LOCATION
CENTRAL DIVISION
TOT DIVISION
Elgeyo Escarpment
Valley
Floor
Kapkata
KOTILILAI
ARROR
CHEPKUM
Chesuman
Arror Secondary School
R. Karlo
BARINGO DISTRICT
NORTH
MAP No. 33
1 0 1 2 3 4 Km
SCALE
LEGEND
DISTRICT BOUNDARY
DIVISIONAL BOUNDARY
LOCATIONAL BOUNDARY
CONTOURS (in metres)
RIVERS / STREAMS
IRRIGATION FURROWS
ROADS
MARKET CENTRES
PRIMARY SCHOOLS
HEALTH CENTRE
K.V.D.A. FARMS
ARROR CATHOLIC MISSION FARM
RUTTOH, T.K.
M.A. (PLANNING),
DEPT. OF URBAN & REGIONAL PLANNING,
UNIVERSITY OF NAIROBI, 1988

3.2.1 DRAINAGE:

River Arror is the only perennial water course that crosses the location. Its source is the Cherangany Hills forests. The river descends into the location at an altitude of about 1960 m. above sea level at Muyen falls and flows down the scarp to reach the valley floor at about 1020 m. a.s.l. It empties into River Kerio. Other water courses such as Embomuchukwa and Tunyo streams are partly intermittent; in that they are perennial at their upper and middle courses but become seasonal at lower courses. Their intermittency is partly due to evaporation and infiltration. Nonetheless they pour into River Kerio.

3.3 GEOLOGY AND SOILS:

3.3.0 GEOLOGY:

The formation of the East African Rift Valley system had a bearing on the geology of the Kerio Valley at large. First the deformation (fracturing) of the basement rock occurred as a result of down warping. This led to the formation of faults such as the Elgeyo fault. In Mid-miocene, the first volcanic eruptions occured. Vast areas were covered by volcanic material that gradually became subjected to weathering and denudation. In late miocene, tectonic movements led to the formation of the Elgeyo escarpment. However,

the present form of the Kerio Valley is a result of quarternary period tectonic movements (Kenya, 1984).

Biotite and banded hornblende gneisses of the basement system are predominant in the Kerio Valley. These are mineral rich rocks. Pockets of quartzites and crystalline limestones are also found. However, the processes of erosion have intensively sculped the land. Such that at the moment, the valley is extensively covered by, particularly alluvial deposits of ill-sorted materials (Cappon, 1985).

3.3.1 SOILS:

On the escarpment ("lagam"), the soils are scanty and shallow. Bedrock exposure is by no means uncommon. The scanty and shallow soils are mainly coarse gravelly and stony, noted for being excessively drained. Soil erosion is very prevalent with the major cause and agent being human activities, - (particularly agriculture) and flash floods respectively. Generally the escarpment soils are of low natural fertility.

At the valley floor ("keu"), the soils are mainly alluviums, which range from being moderately to extremely deep. Besides that, the valley floor soils are well drained, friable and of high fertility suitable

for crop cultivation (Cappon, 1985). In addition, the pH values of the soils range from 5.7 to 8.3, thus being neither very acidic (less than 5) nor very very alkaline (over 9) such as to adversely affect crop farming. Moreover, except for the slight salinity encountered only in the subsoils, the soils tend to be largely non-saline (Mwenge Int., 1986). In terms of erosion, the valley floor soils can be said to have suffered because of the human activities, particularly agricultural practices, which engender it and flash floods which on the other hand enact it.

3.4 CLIMATE AND VEGETATION:

3.4.0 CLIMATE:

Rainfall and evaporation are two significant elements of climate whose ratio influence plant growth. Arror location falls within the sections of Keiyo Marakwet district classified as receiving an average annual rainfall of 800 - 1000 mm. (Cappon, 1985). Going by the fact that altitude is a major factor which determines climate within the district (Ibid) and that no sufficient data, say data recorded for a period of over ten years, on weather exists in Arror location, it becomes appealing to use data from Chesongoch station which is 19 km. north of Arror -the focus being the Arror shopping centre. This is because Chesongoch is the nearest weather station

which altitudinally almost compares well to Arror and also has data records for over ten years - thirteen years to be more exact.

Over the thirteen years, the station has recorded an annual average of 917.3 mm.; of which the mean monthly distribution is as shown on Table 3.1 (see page 59) and figure 3.2 (see page 61). Just as the total mean annual rainfall varies from a minimum of 162.6 mm. to 2375.6 mm., the monthly averages also vary within every given year.

However, for suggestive purposes the data recorded at the KVDA rainfall and evaporation recording station at Arror since its inception in August 1986 can be briefly examined. For twelve months, beginning from September, 1986 to August, 1987 a total of 854.9 mm. of rainfall was recorded. The months which recorded the highest and lowest rainfall amounts were May (319.5 mm.) and January (1.7 mm.) respectively. On the other hand, the total potential/actual evaporation amounts recorded at the same station over the twelve months was 3272 mm. Therefore, evaporation was 3.8 times the total amount of rainfall received. This validates the contention that evaporation rates tend to be three times the total amount of rainfall received (Ibid).

TABLE 3.1 RAINFALL AMOUNTS RECEIVED AT CHESONGOCH, 1972 - 1985

Month	Jan	Feb	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Total
Rainfall (mm)	1.2	1.5	6.0	44.1	31.9	22.4	17.4	14.8	8.0	8.9	5.1	1.3	162.6
Mean	23.1	30.8	77.8	123.3	146.6	69.1	112.8	105.3	68.1	69.6	71.0	19.8	917.3
Maximum	91.0	185.5	257.4	244.9	316.7	137.5	215.8	226.8	126.9	229.2	294.9	49.0	2375.6

Source: Compiled from ASAL Office, Iten , 1987.

TABLE 3.2 RAINFALL AND EVAPORATION AMOUNTS RECORDED AT ARROR, KVDA STATION, SEPTEMBER 1986 - AUGUST 1987.

Year	1986				1987								One year period
Months	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug.	Total
Rainfall (mm)	42.9	50.8	26.5	10.2	1.7	63.9	71.5	82.7	319.5	119.5	14.5	51.2	854.9
Evaporation(mm)	280	318	238	304	391	306	346	254	94	179	309	253	3272

Source: Compiled from KVDA, ARROR Station Records, 1987.

While Table 3.2 (on page 59) presents the Arror station data; Figure 3.3 (on page 62) relates the same. It is explicitly observable that a state of natural moisture-deficiency prevails in Arror location. Thus, rainfall is inadequate and characterized by low, seasonal and generally erratic amounts.

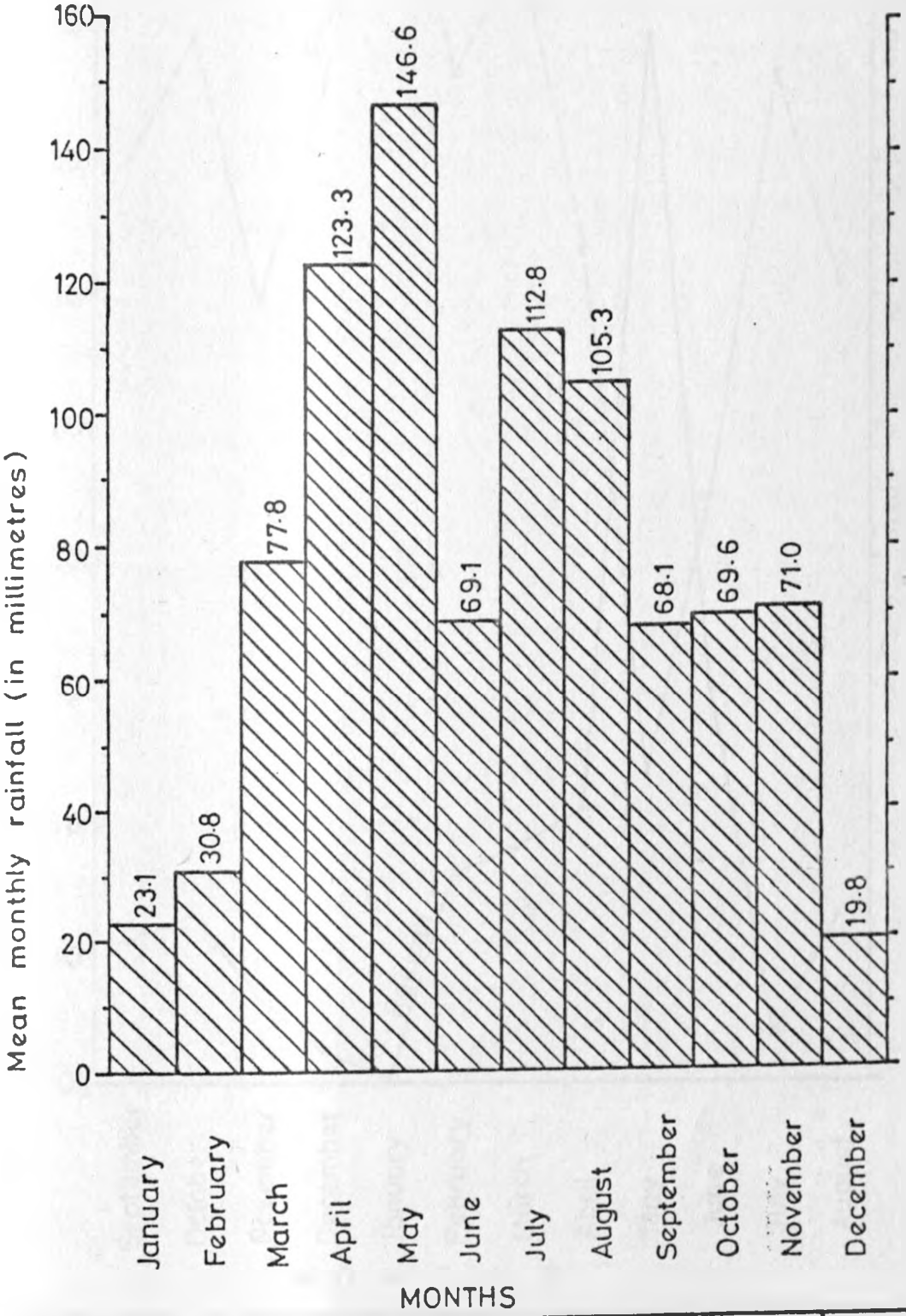
In addition, the location falls within the national temperature zones classified as warm. By inference, it experiences mean daily temperatures of 22 - 25^{o} c with mean minimum and maximum of 16 - 18^{o}c and 28 - 30^{o}c respectively, (Ibid).

3.4.1 VEGETATION:

Such indigenous tree species as Acacia tortilis ('ses' - mar.*), Zizyphus Mauritania ('tilam'-mar.), Berchamia discolor ('muchukwo' - mar.), Termarindus indica ('Aron' - mar.), Acacia albida ('Serketwo' - mar), Balanites algyptica ('Tuyunwo' - mar), Terminalia browni ('Koloswo' - mar.), Acacia Mellifera ('Pilil' - mar.), Croton Megalocarpus ('Oton'-mar.), Cycomorus Ficus. ('mokoiwo' - mar.), Mistotoe ficus ('Simotwo' - mar.), and Ekerbergia ruepelliana ('Korbut' - mar), are common in Arror location. Of the above trees, the last three mainly constitute part of the riverine vegetation.

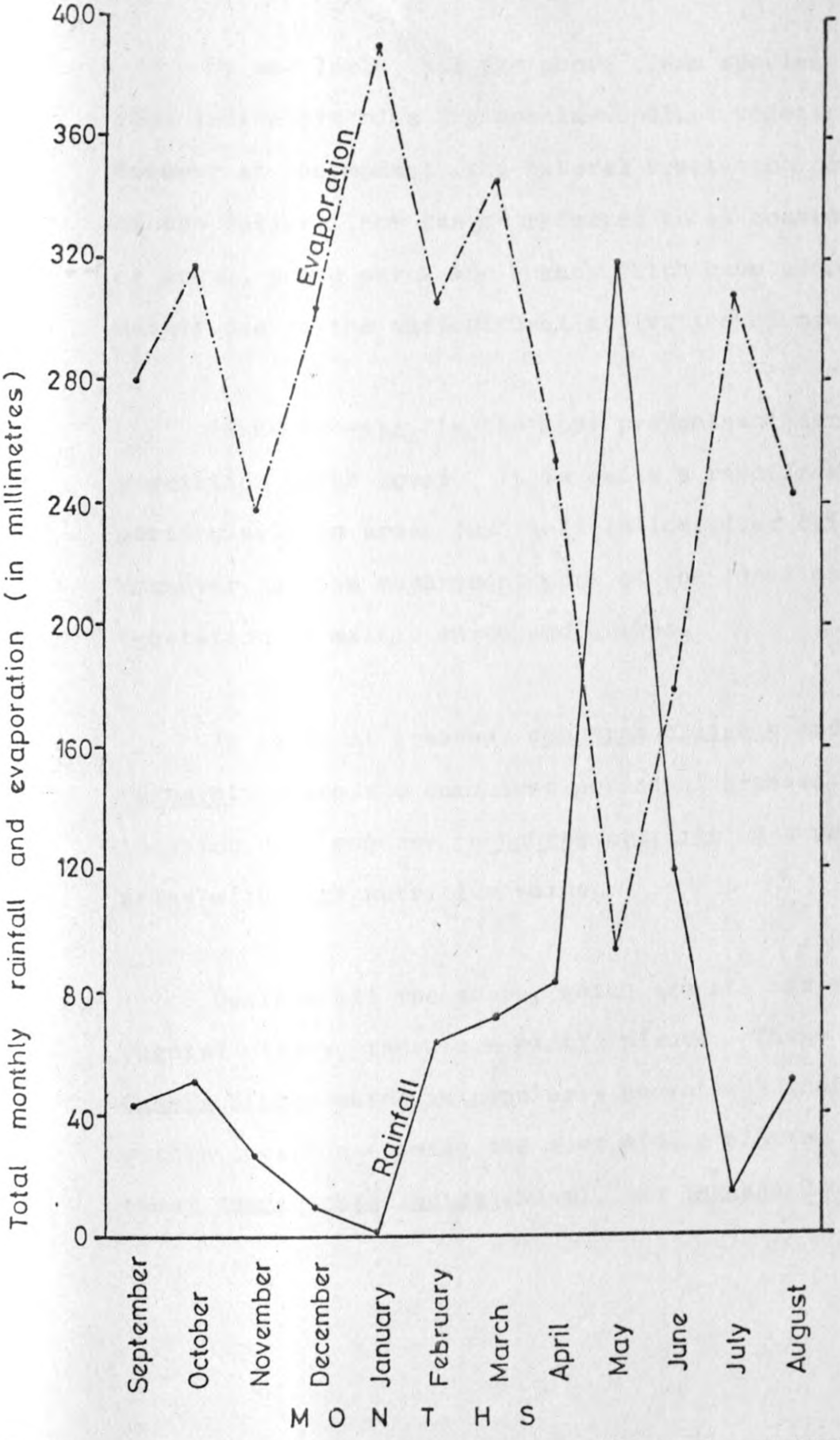
---

* Mar. - stands for Marakwet vernacular.



MEAN ANNUAL RAINFALL DISTRIBUTION

FIGURE 3.2



Total Rainfall and Evaporation, September, 1986 — August, 1987.

FIGURE 3.3

By and large, all the above trees species are good indicators of a dry acacia-woodland vegetation. However at the moment, the natural vegetation cover of the valley floor can be referred to as consisting of scrub, dense shrub and bushes which have arisen mainly due to the agricultural activities of mankind.

'Sukuiwo'-mar. is the most predominant derived vegetation shrub cover. It is quite a rescilient plant particularly in areas just left fallow after cultivation. Moreover, at the escarpment part of the location, the vegetation is mainly shrub and bushes.

In terms of grasses, cenchrus ciliaris and chloris voxburhiana are the commonest perennial grasses in the location. In essence, cenchrus ciliaris is a pasture grass with high nutritive value.

Besides all the above, which are all indigenous vegetal plants, there are exotic plants. These include Cassia Siamea which is popularly known as "Jacaranda" within location - being the most widely planted exotic tree, Azadirachta indica (Neem), and leucana leucocephala..

3.5 POPULATION AND HUMAN SETTLEMENTS PATTERN:

3.5.0 POPULATION:

Between 1969 and 1979, the location experienced an increase in population that rose from 4407 to 5233 persons (Kenya, 1970 and Kenya, 1981). This meant a 1.7% annual population growth rate. Using the above growth rate to project the population for 1987, a total of 5995 persons was got. This meant a difference of only 175 persons if compared to the 6170 persons reported by the community primary health workers (through the Chief's office) as the 1987 population of the location. A further population projection for 1988 shows the location as having a total of 6098 persons. Basing on the 1988 population and using an average household size of 5.7 persons as found out during the field research, it was noted that the location has 1070 households.

Again, assuming the 1979 population distribution and sex ratios to be constant, then the 1988 population structure of Arror is such that 2965 persons are males and the rest 3133 are females. All of whom are distributed within the four sublocations as shown on table 3.3 below (see page 65).

Table 3.3 ARROR LOCATION POPULATION DISTRIBUTION AND DENSITY, 1988

Sublocation	POPULATION					Population Density
	Male	Female	Total	Percentage Distribution	Area (Km^2)	
Koitilial	651	593	1244	20.4	37	34
Arror	940	1072	2012	33.0	11	183
Chepkum	831	883	1714	28.1	19	90
Resim	543	585	1128	18.5	14	81
Total (Arror Location)	2965	3133	6098	100.0	81	75

Source: Projected from the 1979 Population Census, Kenya, (1981).

It is also observable from the Table 3.3 that the average population density for the location is 75 persons per square kilometre. Arror sublocation has the highest population density, that is 183 persons per square kilometre; the least densely populated sublocation is Koitilial.

Agewise, the population is distributed such that 53.1% (or 3,238 persons) are below 20 years. Those between 20 - 54 years constitute 39.6% (or 2,415 persons) with 7.3% (or 445 persons) being of over 54 years of age. Therefore, to every 100 economically

active persons (that is all those of 20-54 years of age) there are 153 dependants.

3.5.1 HUMAN SETTLEMENTS PATTERN:

Settlements, hereby used to imply homesteads, in Arror location are mainly confined to the less steep part of the escarpment which lies between the steep scarp and the valley floor. Four reasons explain why the homesteads are so located. First is that the upper most sections that is near the very steep scarp have usually been noted to be safe from human enemies, particularly the Pokot. This aspect is gradually loosing weight due to the government's stance against ethnic wars. As yet, however, this aspect still holds in Resim sublocation where acrimony still persists between the residents of the sublocation and Pokots.

The second reason which apparently still commands alot of influence is that the major settlement areas are fairly free from mosquitoes - the malaria vector - if compared to the valley floor. Third reason is that of trying to avoid establishing homesteads on the valley floor so as to preserve land for crop production. This is indeed an economic optimization factor. However, these reasons are being contradicted gradually particularly in areas where permanent water

supply at the valley floor seems to attract settlements. The permanent settlements sprawling up at the valley floor in Arror and Chepkum sublocations attests to this view. Suffice it to say that the irrigation channels do provide the 'permanent' sources of water supply. The presence of nearby permanent water supply particularly for household/domestic use is therefore the fourth reason influencing settlement pattern in Arror location. In this case, perennial streams (e.g. Embomuchukwo and Tunyo) and springs existing at or close to the major settlement sites at the escarpment have influenced the settlement pattern.

HOUSING

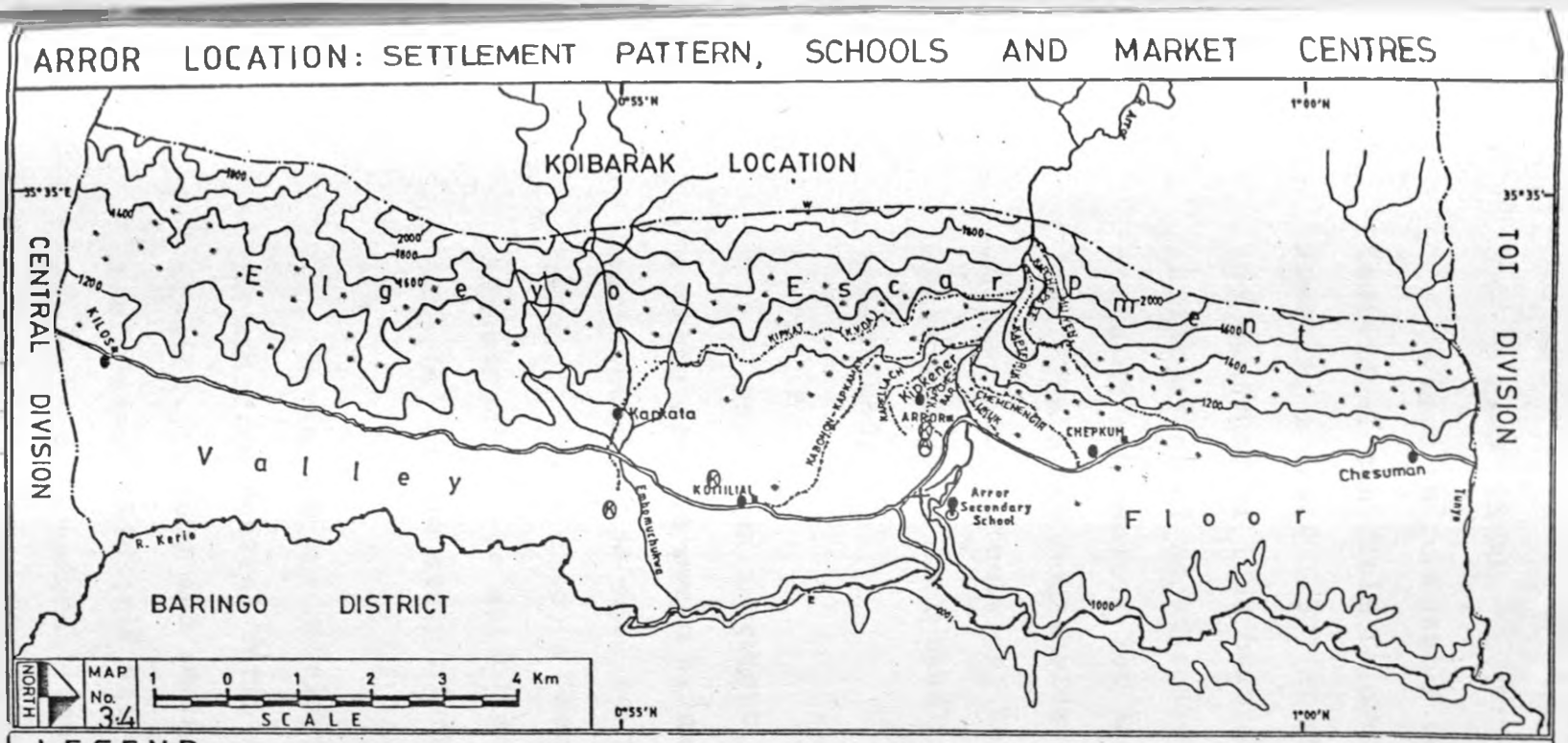
Almost all houses are built with the use of local materials. These include stone and mud walls, earth floors and thatched roofs (see plate 3.1 on page 68). Such houses in majority of cases have lofts ('tobot' - mar.). The loft is not only part of the sleeping space in the house but also a store for crop yields, particularly sorghum.

Down at the valley floor, the settlements tend to be very temporary both in time and space. This refers particularly to the kraal based settlements locally called 'Kapsergon' - mar. Moreover, special exceptions include the residences for Arror Catholic Mission,

Plate 3.1 - At the base of the escarpment - Noticable from the plate include houses, and pawpaws.

Arror secondary school, and some of the KVDA staff - all of which are build with the use of concrete walls, Galvanized Corrugated Iron (GCl) sheets roofs and cemented floors - hence being permanent structures. To avoid mosquito attacks, roof ceilings and mosquito proof window meshes have been used in most of the cases of the permanent structures mentioned above. Map 3.4 on page 69 shows the general pattern of human settlements in the location.

ARROR LOCATION: SETTLEMENT PATTERN, SCHOOLS AND MARKET CENTRES



LEGEND

- DISTRICT BOUNDARY
- DIVISIONAL BOUNDARY
- LOCATIONAL BOUNDARY
- CONTOURS (in metres)
- RIVERS / STREAMS
- IRRIGATION FURROWS
- ROADS
- MARKET CENTRES
- PRIMARY SCHOOLS
- HEALTH CENTRE
- K.V.D.A. FARMS
- ARROR CATHOLIC MISSION FARM
- SETTLEMENTS

RUTTOH, T.K.
M.A. (PLANNING),
DEPT. OF URBAN & REGIONAL PLANNING,
UNIVERSITY OF NAIROBI, 1988

3.6 LAND TENURE:

Land is communally owned. Currently, no individual can claim to own land on freehold basis. However, a few (1.5%) of the households have bought the usufruct of land ownership from others such that in the event of adjudication then they can acquire the title of ownership. Yet another 2.9% have leased land from other households for the purpose of crop cultivation. Otherwise, households have a right over small strips of land usually dispersed within the clan owned land.

Unless on agreement, no household can cultivate a strip of land owned by another. On the other hand, each household is free to graze livestock at any place. In any case, a 'Kapsergon' (Kraal based homestead) can be established anywhere as long as the owner(s) of the strip of land give(s) consent.

"The recent development of government inspired or approved central services such as trading centres, mission stations and administration offices and residences" (Kipkorir et. al. ,19* :28) are the only exceptions to communal land ownership. Certainly educational institutions fall within the group, where land can be said to be public/institutionally owned.

---

* Year not stated.

3.7 SOCIO - ECONOMIC ASPECTS

3.7.0 EDUCATION:

Majority of the household heads as shown by the research findings have had no formal education. Out of the 85.3% of the respondents who reportedly were household heads, 70.7% pointed out that they have had no formal education at all. The rest (29.3%) of the household heads have been to primary or even secondary schools. By implication, such a high level of illiteracy among household heads is a negative factor towards the ease of adoption of innovations if need be, particularly at the household (grassroots) level. This is in reflection to the fact that household hea are usually the prime decision makers at such levels. Besides all the above, the location has six primary schools and one secondary school all of which are shown on Map 3.4 on page 69). The six primary schools and one secondary school are apparently adequate for the location with regard to its population size. The problem arises when the issue of distance travelled particularly by primary school students is considered - which in some cases involves a walking distance of over 2 km.;which apparently is quite long.

3.7.1 HEALTH:

One health facility exists in the location. This is the health centre near Arror secondary school (see map 3.4). It is a facility whose sponsor is the Catholic Secretariat through the Arror Catholic Mission. It serves the entire location, parts of Kapchemutwo Location in Central Division and parts of the neighbouring Baringo district. The nearest other health facilities are about 10 km. to the north at Mogil, 18 km. to the south at Kobulwo, and Kapsowar Hospital which is about 8 km. to the west but across the steep Elgeyo escarpment.

Of the 6652 health problems attended to by the health centre in 1986 and 1987, 42.09% (or 2800) were of malaria. Acute respiratory infection accounted for 28.26% and 21.8% were diarrhoea cases. The rest (7.85%) have been classified as others; for which a detailed breakdown is given in Appendix IV.

The health centre also operates a primary health care programme whose services cover the whole location. It even goes further to operate a dispensary at Kobulwo in Central division.

Traditional medical specialists ranging from herbal concoctors through dentists, head fracture surgeons and midwives to goodwill diviners attend to

many other health problem cases (Kipkorir, et. al. 19 *) within their ability and emergency calls. Actually, they do as much as the health centre if not more.

A key aspect in this analysis is the long distances to the Health Centre. That is, the maximum acceptable distance of 6 km - set by the Ministry of Health - to the nearest health facility is exceeded in some cases within the location. Therefore, the Health facility can be stated as being generally inadequate.

3.7.2 TRANSPORT:

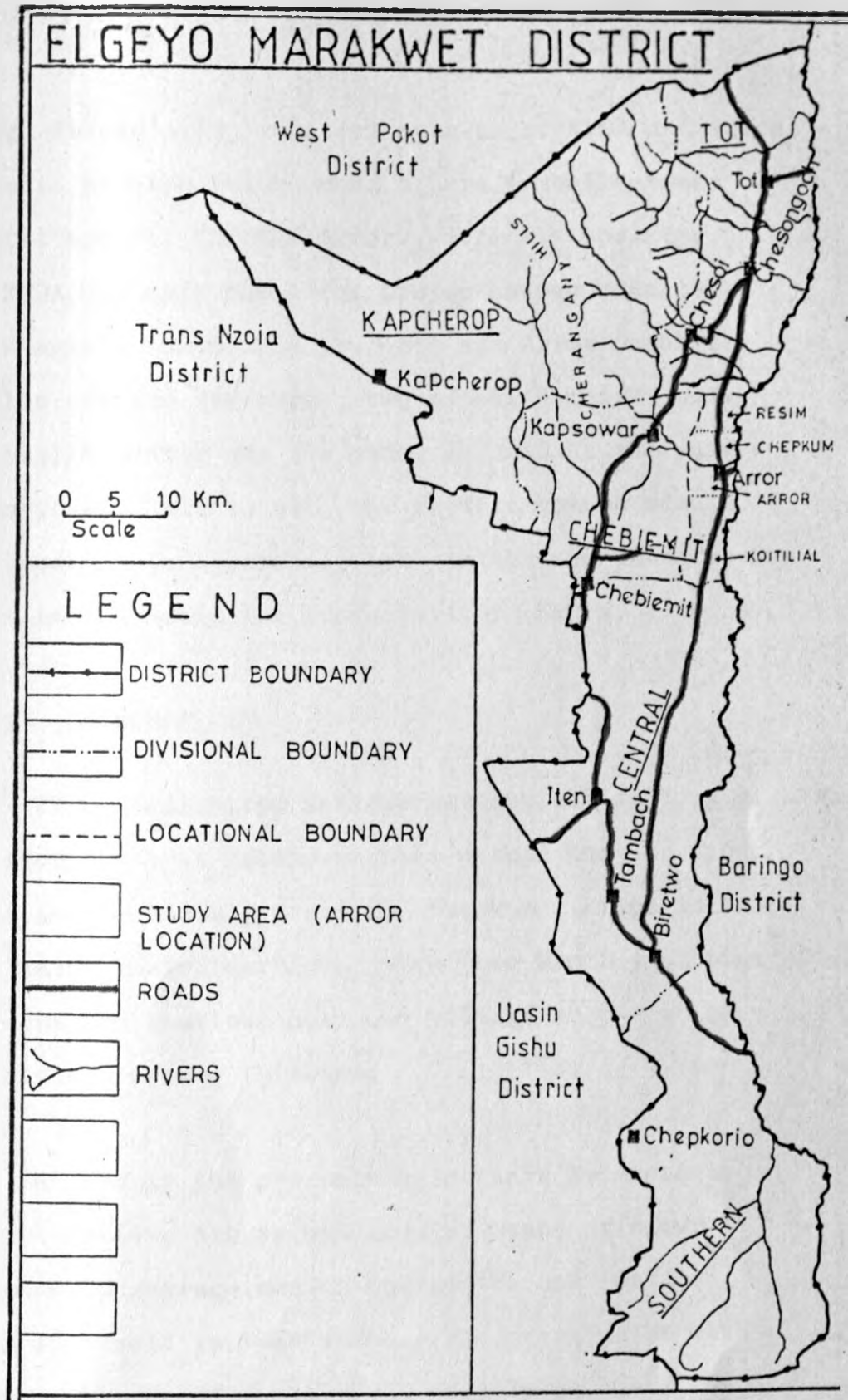
The location is traversed by a class 'C' road which connects Chesongoch and Biretwo service centres. It is only through the two service centres that vehicular accessibility to Arror location from the highland areas of the district is possible. Chesongoch is 19 km. and Biretwo is 49 km. away from Arror (taking Arror Market centre as the focal point).

While Iten which is the nearest urban centre and district headquarters is about 69 km. through Biretwo, Kapsowar which on the other hand is the nearest rural market centre is about 45 km. through Chesongoch inspite of being about 8 km. directly west of Arror market centre. Applying the Index of Directedness (ID) which is direct distance

(8 km) divided by the actual distance (45 km) results in 0.18. An Index of 1.0 means the actual route distance equals the direct distance; when this is the case, then least amount of effort is used in travelling between the two nodes. Thus, the case of Arror to Kapsowar involves the use of alot of effort particularly in terms of time and cost when travelling by a vehicle.

The Chesongoch - Biretwo road is usually awfully bad. It is generally rough with multiple dry stream valleys during the dry season and becomes very muddy during the wet seasons thus becoming almost, if not, impassable. Moreover, the road from Chesongoch to Chesoi is terrible in that it is not only narrow and winding but also has a rough loose running surface. From Chesoi to Iten via Kapsowar and Chebiemit is an all weather gravelled road, and on the other hand, Biretwo to Iten is connected by a bitumenized road. In addition the location is linked to Baringo district by road through Teren bridge. The road is no different from the Biretwo - Chesongoch road. Map 3.5 on page 75 presents the above road network.

Only one 'matatu' (public service vehicle) plys the route between Arror and Iten via Biretwo almost once every week. Besides the 'matatu', there are,



ROAD NETWORK SERVING ARROR LOCATION

RUTTOH, T.K.,
M.A.(PLANNING), 1988
D.U.R.P.,
UNIVERSITY OF NAIROBI.

MAP
No. 3.5

though irregularly, vehicles such as of KVDA and Arror Catholic Mission which among others travel between Eldoret and Tot through Arror. Strictly speaking, the KVDA has only one Arror project based vehicle which mainly serves the project; and Arror Catholic Mission station has three, two of which mainly serve the health centre and the other is used by the church authorities. All in all, the traffic volume within the location is apparently low. Also, the location has very limited vehicular accessibility (Kenya, 1980, A).

3.7.3 COMMERCE:

Three designated service centres all falling within the local centres category exist within the location. These are Koitilial, Arror and Chepkum. Kilos is the only undesignated service centre (see Map 3.4 on page 69). In Resim sublocation, only one village shop - which has since closed - is found.

Generally the provisions for sale from the above service outlets are transported by means of hired vehicles, porterage and of course the one 'matatu' which in itself is inadequate. The merchandise which involve the use of vehicles is usually purchased from Iten and/or Eldoret; those that are purchased at Kapsowar are usually carried by porters down the

escarpment to the service outlets. It is never uncommon to see such bulky, fragile and heavy commodities as beer and sugar being carried by people down the escarpment.

Such precarious mercantile systems have led to the commodities being traded at prices above the national ceilings. For instance, as at September 1987, a 500 grammes packet of 'Omo' detergent was going for Kshs. 14.50 instead of say Kshs. 12.30; a kilo of sugar was selling at Kshs. 9.00 instead of Kshs. 8.30; and a 300 millilitres bottle of soda was going for Kshs. 2.50 instead of Kshs. 2.30. With all fairness, the merchants are not to blame for such anomalies, because they have to do so in order to defray the excessively high transport costs. But that notwithstanding, the consumers have to unlawfully incure the excess charges.

3.7.4 LIVESTOCK PRODUCTION:

Having had a population of 5995 persons in 1987 as projected and with an average household size of 5.7 persons, it meant that a total of 1052 households were in the location as by 1987. The research findings showed that all households keep livestock. The only difference is that some households keep certain

animals and not others. Thus, the proportion/number of households keeping various livestock types, and the average number of livestock units per household is given on table 3.4 below.

TABLE 3.4 LIVESTOCK PRODUCTION, 1987

Type of Livestock	Households Keeping (out of 1052)		Average stock per Household	Total stock in location (col. 2x col. 3)	Percentag of lives-tock unit out of 59606
	As % (1)	Number (2)	(3)		
Goats	88.2	928	34	31552	52.9
Sheep	79.4	835	16	13360	22.4
Cattle	69.1	727	10	7270	12.2
Chicken	44.1	464	16	7424	12.5
Total				59606	100.0

Source: Research data, 1987.

Thus, majority of households keep goats at an average of 34 goats per household. In terms of livestock units, the goats constitute 52.9% of the total livestock units. Within the whole location, there are a total of 59606 livestock units. However, cattle, sheep, and goats are 52182 in total.

The National Livestock development policy (Kenya, 1980, B) states that unlike in 1975 when the land carrying capacity in the semi arid areas (Arror location included) was 3.9 ha. per livestock unit assuming no other competing land users e.g. wildlife there will be need for 3.7 ha. for every livestock unit in 1990. Taking both the above to be desired ratios, it follows that in Arror location the land carrying capacity has already been outstripped. In that even if the 81 km^2 (or 8100 ha), which is the whole location, is to be accorded to the 52182 livestock units (hereby excluding chicken), then it shows that every livestock unit has only 0.2 ha. to feed on. This is not the case either because there are other competing land uses such as irrigated crop cultivation, wildlife and built-up areas that use and/or occupy part of the 8100 ha. Whatever the case, the land carrying capacity has been outstripped by far.

The rearing of cattle is mainly confined to the valley floor. This is mainly due to availability of water at the Kerio River let alone the pastures at the valley floor. After all cattle are less versatile to manoeuvre the steep scarps. As for goats and sheep, they graze and browse throughout the length and breadth of the location. But sheep are more

oriented towards the escarpment. In all cases, the livestock are free to drink water directly from any water course including the furrows.

Except when predators such as wild dogs, wolves, leopards, and baboons attack the livestock - goats and sheep in this case, and also because of the fear of rustling particularly in Resim sublocation that the livestock are trailed by their owners. Otherwise, the livestock move freely while in search of pasture. As a result, all community members and particularly crop cultivators get very much involved in scaring away the domestic animals particularly goats from the crop fields.

Besides the occassional attacks by predators on livestock, other nagging problems include livestock deaths due to: occasional drought effects, tick borne diseases e.g. East Coast Fever (ECF), the contagious Caprine Pleuropneumonia (CCPP) and Contagious Bovine Pleuropneumonia (CBPP) for goats and cattle respectively which are both (CCPP and CBPP) quite endemic in the valley. Trypanosomiasis which is usually traced to the tsetsefly is reportedly enzootic in the valley. Other diseases include Foot and mouth disease, Black quater and helmenthics.

Meanwhile, only two cattle dips serve the location, with the acaricide being provided by the Ministry of Livestock development. The Ministry also undertakes vaccination campaigns particularly to prevent Foot and mouth disease. Otherwise no other service is rendered by the Ministry, say, of even availing an animal health assistant to the community. Suffice it to say that the community members have had to device ways and means of solving some of the problems. These include combining efforts to hunt down predators.

Suffice it to note that among other uses, livestock keeping is a basic source of milk to 86.8% of all households , meat to 85.3% of the same and income to 79.4% of all the households. The Koitilial livestock auction yard which is reported to have been operational some years back is now obsolete. Because it was the only formal livestock yard auction within the location, those who undertake livestock sales do so either informally within the location and/or in neighbouring, though far, livestock auction yards such as Cheptongei in Moiben location of the division or at Kabulwo in the central division of the district.

Finally, all aspects pertaining to crop production shall be dealt with in later chapters.

3.8 CONCLUSIONS:

Arror location which falls within the semi-arid lands of Kenya, is largely characterized by a dual nature of topography which comprise of an escarpment and a valley floor. Because of the inadequacy and unreliability of rainfall, and the existence of Rivers which descend into the location, particularly, River Arror; added to the enabling terrain, the local farmers have had to apply irrigated farming - which shall be dealt with in the next chapters. Meanwhile, overstocking has apparently contributed towards soil erosion which also must apply to the case of flash floods - hence resulting in environmental degradation.

The issue of education/literacy among household heads which has also been addressed to reveals that many of them have not received any formal education. Taking note of the fact that household heads tend to be the prime decision makers in many households it follows that the high level of illiteracy is definitely an hinderance to the process of adoption of innovations/change.

Yet another important aspect is that of health. It has been noted that there is inadequacy of provision of services. Secondly, malarial and diarrhoeal

diseases are among those identified as being prevalent. Infact, malaria is so dreadful such that it has contributed towards influencing the pattern of settlement within the location. Diseases such as those mentioned above disparage the activeness of the residents of the location such as the irrigators. Besides all the above, and in view of the understanding that the location has poor road network and service provision, it can further be concluded that the location has limited vehicular accessibility.

REFERENCES:

Cappon, J.C. - 1985 - District Atlas: Elgeyo Marakwet; ASAL Development Programme, Iten.

Kenya, Rep. of - 1970 - Kenya Population Census, 1969; Vol. I, Statistics Division, Ministry of Finance and Economic Planning, Government Printer, Nairobi.

_____ - 1980, A - Elgeyo Marakwet District Development Plan 1979 - 1983; Ministry of Economic Planning and Development, Government Printer, Nairobi.

_____ - 1980, B - National Livestock Development Policy; Government Printer, Nairobi.

_____ - 1981 - Kenya Population Census, 1979; Vol. I, Central Bureau of Statistics, Ministry of Economic Planning and Development, Government Printer, Nairobi.

_____ - 1984 - Water Resource Assessment Study: Kerio Valley (Elgeyo Marakwet and Baringo Districts); Main Report, Delf, The Netherlands.

Kipkorir, B.E. and Ssennyonga, J.W. (eds) - 19 * - Socio-Cultural Profile of Elgeyo Marakwet District; Uzima Press, Nairobi.

Mwenge International - 1986 - Intergrated Regional Master Plan: Kerio Valley Development Authority (KVDA); Draft Final Report, Mwenge International Associates Ltd., Nairobi, Kenya.

CHAPTER FOUR

MARAKWET INDIGENOUS IRRIGATION SYSTEMS

4.0 INTRODUCTION

Kipkorir (1983) asserts and rightly so that the Marakwets chose to settle at the Elgeyo Escarpment largely because of security reasons. In itself the vast and dense Cherangany hills forests sheltered the escarpment from the Western side. On the other hand the Kerio River deterred any enemies from the east but if any they could be seen as they advanced towards the escarpment while at far distances. Moreover, because of the denseness of the forests that inhibited agricultural practices and the fear to engage in the same beyond the Kerio River, the Marakwets were in essence compelled to largely rely on the stretch of land lying between the escarpment and the River Kerio.

Crop cultivation became a disappointment within the area identified because of the inadequacy and unreliability of rainfall. As a result, irrigation was resorted to, thus resulting into Marakwet indigenous Irrigation Systems.

This Chapter then presents a brief historical profile and functional framework of Marakwet indigenous irrigation systems in Arror location. It also looks at the contributions of the system towards

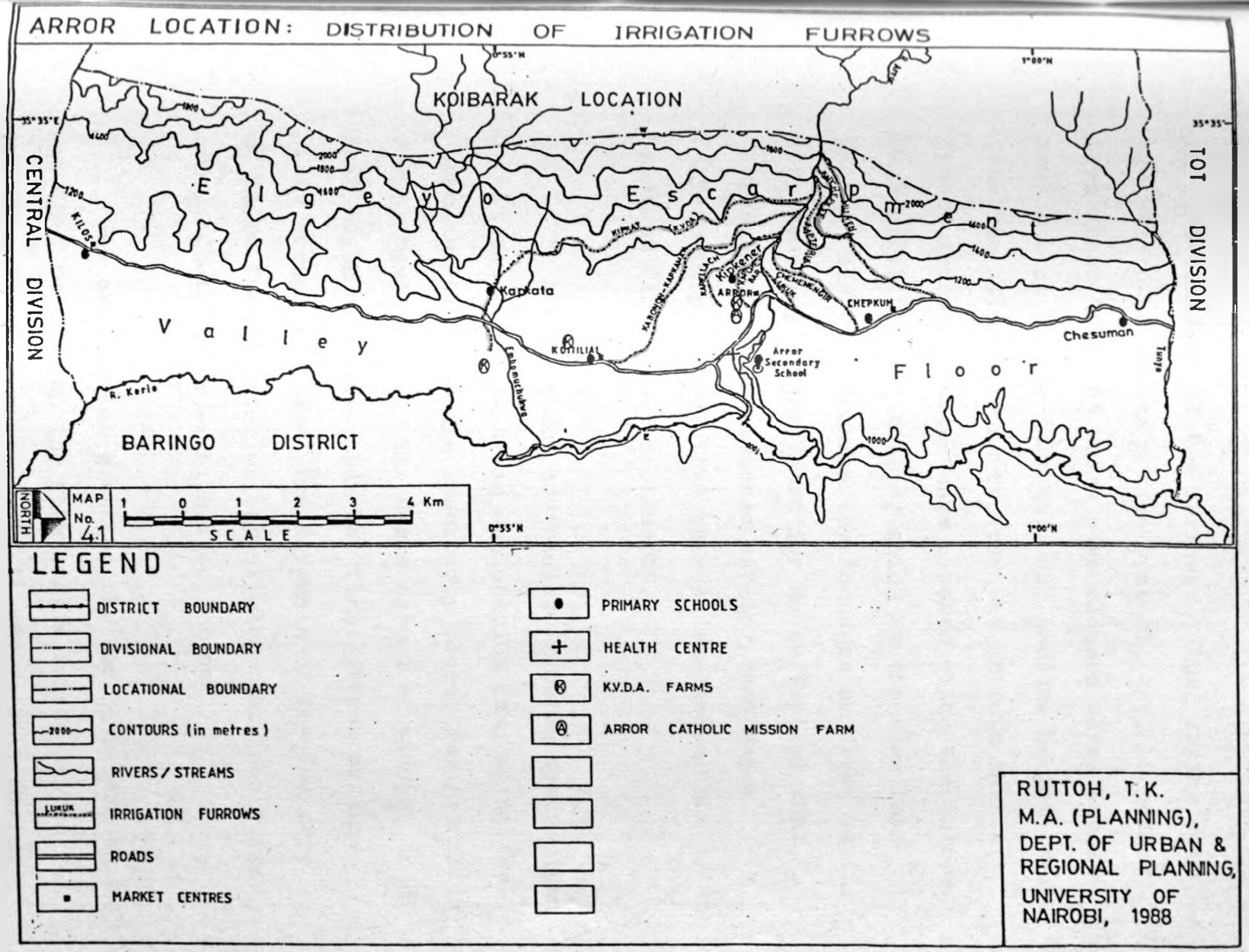
societal welfare. The setbacks that disparage its general performance are also of concern among other issues.

4.1 BRIEF HISTORICAL PROFILE AND SPATIAL SETTING

There are nine furrows in Arror location. These are Muyen (also called Sogom or Samar), Kapchepkee, Kapterik, Chemenengir and Lukuk - all of which feed the northern parts of the river; and Kipkat (KVDA), Kabonon-Kapkamak, Karellach (Yiyi) and Kapchebar - all feeding the southern parts of the river, (see map 4.1 on page 87). With the exception of Kipkat, all the other furrows will be dealt with in this Chapter. This is because Kipkat is currently owned and controlled by KVDA and therefore it will be considered in the next Chapter unless otherwise.

4.1.0 CHEMENENGIR AND MUYEN FURROWS

Through oral interviews, it has been established that Chemenengir and Muyen furrows are the first furrows to be constructed in Arror location. To date, the eight age-sets applied by the Marakwet (Kipkorir and Welbourn, 1973) with each having a time span of 10 - 15 years have each been named about three times since the forefather of Kapsogom clan, Kibikok, received the usufruct of the furrows from the


ARROR LOCATION: DISTRIBUTION OF IRRIGATION FURROWS
KOIBARAK LOCATION
CENTRAL DIVISION
TOT DIVISION
Elgeyo Escarpment
Valley
Floor
Kapkata
KOTILIAL
ARROR
CHEPKUM
Chesuman
Arror Secondary School
R. Kerio
BARINGO DISTRICT
NORTH
MAP No. 4.1
1 0 1 2 3 4 Km
SCALE
LEGEND
DISTRICT BOUNDARY
DIVISIONAL BOUNDARY
LOCATIONAL BOUNDARY
CONTOURS (in metres)
RIVERS / STREAMS
IRRIGATION FURROWS
ROADS
MARKET CENTRES
PRIMARY SCHOOLS
HEALTH CENTRE
K.V.D.A. FARMS
ARROR CATHOLIC MISSION FARM
RUTTOH, T.K.
M.A. (PLANNING),
DEPT. OF URBAN & REGIONAL PLANNING,
UNIVERSITY OF NAIROBI, 1988

alleged founders of the furrows. Thus, taking each age set to be having a time span of, say, 12 years, it then means that 288 years have elapsed since Kibikok took charge of the furrows. But because he got them from the alleged founders, then it follows that at leased three centuries have elapsed since the furrows were established. However going by the view that Kibikok had to reimburse the founders by first paying for Chemenengir then later for Muyen implies that Chemenengir was established earlier than Muyen. Suffice to point out that this is the contention of the Kapsogom Clan school of thought.

The above school of thought is being discredited by all the clans of Resim sublocation (excluding the Kapkoimur clan who are reportedly recent immigrants in comparative terms). The Resim school of thought hold that Muyen must have been the first furrow because their foreparents who were servants of the founders of Muyen furrow later on established their own furrow, namely Chemenengir - which they now own.

The explanation given by the Kapsogom clan as to why they do not own the Chemenengir furrow at the moment inspite of Kibikok (their forefather) having received the usufruct is, that, the foreparents of

Resim school of thought successfully ploted for the murdering of Kibikok. Afterwhich, they further claim, they went ahead and took control and ownership of the furrow. These conflicting views are yet unresolved and as a result, latent animosity and suspicion exists between the two schools of thought as to who is who as concerns Chemenengir furrow. All the same, the Chemenengir and Muyen furrows were the first to be established.

Chemenengir furrow which is about 2.3 km. long has a potential delivery* of 250 litres per second (l/sec.) at the base of the scarp. Muyen furrow on the other hand is 5.8 km. long and has a potential delivery of 200 l/sec.

4.1.1 KABONON-KAPKAMAK FURROW

Oral interviews point out that this was the third furrow to be established in Arror location. It owes its origin to Perat, a forefather of Kabonon (Toyoi) clan. Perat was an ingenious, industrious and sly fellow bestowed with mystificative powers. He alone constructed the furrow for about 3 km. long

---

* Soper (1983) gives the potential delivery of all the furrows at the base of the scarp.

beginning from the intake before he was confronted by Kapkamak clan - who at the same time wanted to kill him. As a result, he successfully called upon the heavenly powers for help against the intruders (Kapkamak).

The alleged help from the heavenly powers scared the Kapkamak who in turn requested for forgiveness and successfully sought cooperation with Perat. They (Perat and Kapkamak) then joined efforts in constructing the furrow and after, say, 2 km. Perat signed a covenant with the Kapkamak that the water to be abstracted would be shared equally among the two parties. But this was to work only on condition that the Kapkamak would use their share to irrigate land beyond the point then reached by the furrow. So the Kapkamak had to extend the furrow.

The furrow has a potential delivery of 250 l/sec. and is in essence about 9 km. long. Actually, since 1983, the furrow has been partly functional because of a breakage at a site called Kapteren which has crippled irrigation in areas beyond the site.

4.1.2 KAPCHEBAR FURROW

History has it that at one time in his life time, Perat paid a visit to his relatives in Tot. On coming back he got stunned and unpleased to see a new furrow being constructed by a clan he may have possibly been in bad terms with namely the Kapketomo (Kotubo) clan. Being sly, he hurriedly organized a Get-together party for which he invited all the members of Kotubo clan and allegedly poisoned them. After accomplishing his mischief, he passed over the ownership of the new furrow to his close friends, namely, the Kapchebar clan. The furrow referred to is the Kapchebar furrow.

It is important to point out, that, the Kapchebar furrow should not be considered the fourth furrow to have been established in Arror location. This is because, the Kapchebar clan who are apparently considered the founders of Kipkat (KVDA) furrow were by then either using the Kipkat furrow or even may have abandoned it because of its intake being washed away by floods. Actually, it could not be logical for Kapchebar clan to construct Kipkat furrow at any later time once they had a furrow (Kapchebar furrow). The basis of logic is the fact that the Kapchebar clan have limited land for cultivation and that the little that is available is largely catered for by

Kapchebar furrow.

Hence in this study, it is considered that Kapchebar furrow was the fifth to be established in Arror location. In itself, the furrow is about 1.3 km. long and has a potential delivery of 150 l/sec.

4.1.3 OTHER FURROWS

It is now necessary to look at the remaining furrows namely Lukuk, Karellach, Kapterik and Kapchepkee in this subsection because the first five considered in the preceeding subsections were by all fairness the pioneers of irrigation in Arror location. Beginning with Lukuk, it should be noted that it was established by the residents of Resim sublocation particularly those who own the Chemenengir furrow. It was constructed could be as early as Kapchebar furrow. Though, because of its having been established with the purpose of abstracting more water for irrigation at any given time within the regards of supplementing the waters of Chemenengir furrow, it can be seen as a later development compared with say Kapchebar. Moreover, Lukuk furrow measures about 0.6 km. long and possess a potential delivery of 100 l/sec.

The next furrow to be constructed after Lukuk was Karellach (Yiyi) furrow. It was established in the 1930s by members of Kapchebar clan and Kapcheptugen subclan of Kabonon clan. The furrow which is about 2.7 km. long and has a potential delivery of 80 l/sec. was constructed with the purpose of enabling the two parties abstract more water from the river so as to irrigate more land particularly around Kipkener primary school near Arror market centre.

Came the 1940s, and the 2.4 km. long Kapchepkee furrow was established. It so happened that the clan owning the Muyen furrow,that is Kapsogom clan refused to share the water with members of the Kapchepkee clan/ village .(for reasons not known to this author). As a result the Kapchepkee clan constructed their own furrow. However because of the rugged terrain, they only had to interlace their furrow with Muyen furrow after the 2.4 km. In itself, the Kapchepkee furrow has a potential delivery of 150 l/sec.

Finally came the Kapterik furrow which in essence is a feeder furrow of Chemenengir furrow. It was constructed in the 1950s thus being the most recent furrow. All the residents of Resim sublocation together with those of Kapterik village cooperated in constructing the furrow which indeed is 2.5 km. long

and apparently contributes towards the stated potential delivery of Chemenengir furrow.

It is imperative to assert that all the first six furrows established in Arror location, namely Chemenengir, Muyen, Kabonon-Kapkamak, Kipkat (KVDA), Kapchebar and Lukuk were all (initially) constructed using 'crude' implements. The said implements include 'Mor' (a metallic implement prepared by blacksmiths - see plate 4.1 on page 95), 'Kam' (sticks sharpened using sharp stones and 'Mor'), sharp stones, animal bones and wood barks (locally called 'perat'). For the other furrows, namely, Karellach, Kapchepkee and Kapterick, all of which were established during the colonial era, the implements used in their construction included hoes, mattocks, picks, shovels and spades among other things.

Suffice it to conclude this section by stating that the furrows (including Kipkat) have varied depths and widths. The depths range from as shallow as, say, 20 cm. to as deep as 100 cm. let alone cases where the water runs over exposed bedrocks or flows through gullies of as deep as 3 metres. About widths, the furrows tend to be as narrow as about 20 cm. to as wide as 150 cm. By and large, it will be against

Plate 4.1, 'Mor' - a metallic implement prepared by blacksmiths - used in sharpening, say, sticks.

conscience and even academically treacherous to strictly bind oneself to the stated limits of the depths and widths of the furrows because in some cases the irrigation water has to flow through rock crevices.

4.2 FUNCTIONAL FRAMEWORK

4.2.0 OPERATION BEFORE IRRIGATION AT FARM LEVEL

All the indigenous irrigation furrows have vigils who are appointed on an annual basis by the community members for the purpose of monitoring the state of furrows almost on a daily basis. In practice, aspects of concern include reporting if not solving any anomalies that occur along the furrows particularly from the intakes to the zone of settlements if not the base of the scarp. Normally, they call upon the community to come up and rectify the anomaly (problem) identified as being beyond their (vigils) ability.

Owing to the tedious tasks of vigils added to the dictates of customs, vigils have always been men whose virtues and physical efforts are cherished by the community. Moreover, all vigils (except the one looking after Lukuk furrow - who indeed is an employee of Arror Secondary school) are occasionally given a tocken of appreciation which usually is in form of four

mug fulls of meal. This is given to a vigil(s) by the members of the community whose interests are taken care of by the vigil(s). It is done so during major ceremonies and festivals.

There are some key problems that necessitate the presence of vigils. These include unnecessary leakages of irrigation water as it flows along the furrows. This is a problem which ranks first. What may appear to be other problems that call for vigils are just but factors that explain the occurence of leakages. These are the breakages of furrow embankments and clogging/silting. Channel undermining by irrigation water is yet another problem of concern to furrow users.

Put together, it will be realised that furrow embankment breakages arise due to, say, falling rocks and even once channel undermining has weakened the furrow sides then it can collapse. Over and above all, floods tend to wash away many sections of furrows particularly those across valleys. The furrow breakage at Kapteren - along Kabonon-Kapkamak furrow attests to this consideration. In a nutshell, 89.4% of all respondents involved in irrigated farming stated that furrow leakages are very common and disturbing. Yet 71.2% cited furrow breakages as

being a problem as well. Furrow blockages due to say silting, and clogging was reported by 50.0% of the irrigators as being a problem. Besides the above channel undermining was mentioned as being a disturbing aspect by 40.9% of the irrigators.

With particular reference to furrow intakes, the following can be said. That occasionally they get washed away by floods. This mainly affects those furrows, namely: Karellach, Kapchepkee and Kapterik, whose intakes are as yet made of rafts and from time to time reinforced using branches with intact foliage. Moreover, each furrow is known to be able to sustain some approximate maximum capacity that if at all outstripped then the furrow(s) is subjected to disaster. For this reason therefore, sluice gates (intakes) have to be closed with spillways being let loose so that excess water is not abstracted along the furrow in the event of a river flood. The spill ways ('Kamnamtai') are usually to be let loose by a furrow guard (vigil).

4.2.1 MAINTENANCE AND REPAIRS

The occurence of the aforementioned anomalies usually leads to less or no water reaching the farms. Normally the community having vested interests on any affected furrow are called upon to pull together and rectify the anomaly if of a magnitude beyond the ability of the furrow's vigil(s). Each furrow usually has one vigil who in case of more pressing personal commitments has to seek help from his friend(s).

Each household whose irrigation interests are catered for by a furrow which is to be attended to must by all fairness be represented at any time of maintenance and repairs. The representatives must always be men who can handle the onerous tasks. However it has been noted in recent times that some irrigators sent boys who are as young as say 10 years to represent them.

Plate 4.2 on page 101 shows a case where some members of the community are engaged in reinforcing an indigenous furrow intake for the purpose of abstracting more water meant for irrigation. Yet another group among them are clearing vegetal growth along the furrow so as to make it easy to monitor the state of

the furrow - see plate 4.3 on page 101. Beside the above observable cases, the removal of any obstacles along the furrows in addition to sealing leaking points and mending broken sites is also done during such days of communal (public) participation. Usually the participants carry whatever necessary implements they possess, such as shovels, hoes, and 'pangas'. At the place of work, the participants allocate themselves duties according to talents and physical abilities.

Unlike the indigenous furrows (namely Karellach, Kapchepkee and Kapterik) whose intakes are still made of rafts; those whose intakes have been rehabilitated using reinforced concrete tend to require less attention e.g. the fear of intakes being washed away. Reference in this case is made to Kabonon-Kapkamak furrow intake which was exclusively rehabilitated by the local people on 'Harambee' (self-help) basis, Kapchebar furrow intake was also rehabilitated jointly by the local people and Arror Catholic Mission, and Muyen, Chemenengir and Lukuk furrows intakes that were rehabilitated jointly by KVDA and the local people. The assistance from both Arror Catholic Mission and KVDA largely constituted of cement and technical manpower. The technical manpower quality of workmanship has in

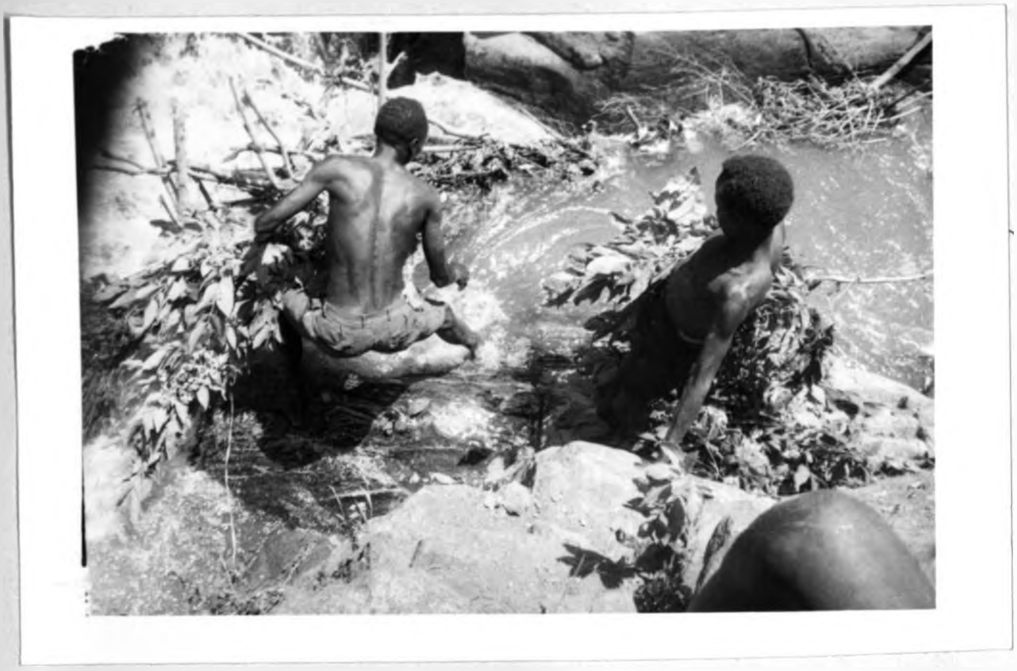


Plate 4.2: The Reinforcement of an Indigenous Furrow intake - Kapterik Furrow.

Plate 4.3: The clearing of Furrow sides - Kapterik.

some cases left a mark of disappointment for example at Chemenengir and Lukuk furrows.

At the completion of any maintenance and repairs, the participants sit together so as to mark out who among the irrigators is not represented and if any whether there is any genuine reason, say, sickness to explain it. Whoever is not represented particularly without a genuine reason is not allocated any share of the irrigation water - as shall be seen in the next subsection.

The above approach to maintenance and repairs can generally be considered efficient and effective. This is because, for one, supervision is done on a non-bureaucratic basis. In actual practice, those who are elderly among the participants in collaboration with the vigil(s) decide on how to undertake the work at any given time. Secondly, the fact that whoever is not represented is not to be allocated any share of the irrigation water compels many of the would-be absentees to turn up for the work. Thirdly, the whole work is not costly at all because none of the participants nor even the vigil(s) is paid a fee. In fact, the most important aspect of the whole approach is the issue of public participation.

A notable shortcoming of this approach is the representation of some families by very young boys who apparently are unable to do substantive work. This is an unwelcome trend that may in due course lead to loss of morale of the able bodied adults. This is because they can as well send young boys to represent them. The end result will be poor work.

4.2.2. WATER DISTRIBUTION

Beginning with Muyen and Kapchepkee furrows whose waters normally get interlaced as stated in subsection 4.1.4., the distribution of water is done as follows. First, users of the two furrows observe and even at times measure the width and depth of the furrow using a stick so as to approximate the amount of water each furrow is carrying just before they link the furrows. Then, the users proceed to the place where the water is to be shared that is the division-point locally called 'Tirro-bei' or 'Socho-bei', whereby the water is either shared just by approximated observations or in case of any disagreement then the stick(s) used in the first stage is used to measure the amount to be accorded each group in view of the quantity carried by each furrow before interlacing. As yet, no noteworthy conflicts pertaining to this sharing process have been observed.

While the Kapchepkee furrow water is to be used by Kapchepkee village, the water of Muyen furrow is to be shared further. Such that the three villages that constitute Kapsogom (Sogom) clan - namely, Samar, Kapcheresim and Kapsogom share the water into two shares ('Sakan'). Samar village takes one share then the other share is jointly used by Kapcheresim and Kapsogom villages. The sharing of water into two approximately equal shares is done by way of either observation or a leaf is dropped into the main furrow at a distance of about 4 metres away from the division point; and expected that if the leaf is buoyed and settles at the centre of the division point then the water is considered shared fairly. If it does not happen such that the leaf settles at the middle of division-point, then adjustments are made until the expected settlement of the leaf is realised.

As for the Kabonon-Kapkamak furrow, the sharing of the water is done in such a way that each of the two parties (namely Kabonon clan and Kapkamak clan/ villages) gets an equal amount. The sharing is allegedly done using agreed observations. Usually, the Kabonon share is further shared by two villages, namely: Kapkwonchelanga and Kapcheptugen. On the other hand, the Kapkamak share is further distributed by seven villages, namely: Koitwen, Cheborom, Kapmbaa,

Kamugus, Kaimuchuk, Kameril and Kasonok. However, due to the breakage of the furrow at Kapteren, it became impossible to observe how the sharing is being undertaken in this case.

Looking at Chemenengir and its feeder furrow, Kapterik, puts up a case where the irrigation water is shared by six villages. These are Kaptul, Kaptung, Kabarginam, Kabiyas and Resim (all of Resim sublocation) and Kapterik village of Chepkum sublocation. As for the Kapchebar and Karellach furrows, two villages namely Kapchebar and Kapcheptugen (a subclan of Kabonon clan) combine together to share its water in a manner that suggests the two villages to be one.

However, among all the indigenous furrows, the case of Lukuk furrow is a special one. This is because its waters are shared by Arror secondary school and all villages of Resim sublocation (except Kapkoimur). The secondary school has been granted the right of using the water from 6 a.m. to 3 p.m. daily. Thereafter, the members of public take over the usage of the water. It has been observed that a free-for-all (laissez faire) approach of using the water has been widely adopted by the local farmers.

Otherwise, for all other indigenous furrows (that is, excluding Lukuk), the sharing of water among irrigators is a responsibility of any concerned village. The villagers whose allocation can be available on a daily basis or at intervals as dictated by rotation of the sharing among the villagers/clan e.g. in the case of users of Chemenengir and Kapterik furrow or the seven villages of Kapkamak have the discretion of how to distribute the water among its irrigators.

Generally, the daily distribution of irrigation water is based on a 24 hour water day. A water-day begins at 4 p.m. and runs as follows:

(a) 1st group of irrigators gather the irrigation water from 4 p.m. and hence control the use of the water upto midnight. This first part of the water day is called 'Tiyse'.

(b) At midnight, 2nd group of irrigators take over the control of the irrigation water and continue to use it upto 10 a.m. the next day. This portion of the irrigation water is referred to as 'Toboi'. The 'Toboi' irrigators tend to have a much ampler time of being able to regulate and direct the irrigation than the preceeding

('Tiyse') irrigators. As a result they ('Toboi' irrigators) have to surrender the water to the previous ('Tiyse') irrigators who then have to take the opportunity to direct the water to any gaps that were not irrigated. They ('Tiyse' irrigators) have to do so upto about 1 p.m. when now every needy irrigator can freely direct the water for his own use. This takes place between 1 p.m. and 4 p.m.; and is usually accepted by the society. This kind of laissez faire approach of use of irrigation water is called 'lukon' thus being the third part of the 24 hour water-day. Then at 4 p.m.; the next water-day begins.

Thus, whoever does not participate in the maintenance and repairing of the furrows is not given any reliable chance within the framework of the water day. The only acceptable way of getting irrigation water under such circumstances is to borrow or buy the share of a relative or friend or use 'lukon'-which is basically unreliable.

At the farm levels, the irrigators have to spread the water largely by way of wild flooding. Thus, each irrigator has to be present, fast and keen enough to spread and direct the water to all sides of the farm he intends to irrigate. If at all the irrigator just directs the water into the farm and does not

follow up to spread it then he will be disappointed because not all parts of the farm will get irrigated. Therefore, the method is itself wasteful. The irrigator must be fast and physically able to spread the water using implements such as the hoe. Many people are necessary to do such work on a single small farm. Moreover, it is only during day time that some good work can be realised under such circumstances. Thus, much of the water goes to waste in the nights. This should be the most ideal time to spread the water because the evaporation rates are comparatively low.

Assuming though that the sharing and distribution process is fair one is left with the question of whether every irrigator usually receives enough water at all times of need. Indeed, only a few (10.6%) do. What follows is that the majority (89.4%) of irrigators do not receive enough water as they please. In essence, they experience shortfalls (inadequacies), due to leakages and seepages, the growth of demand outstripping supply, and seasonal fluctuations of the river's water - River Arror, among other causes.

As the water flows along the furrows a lot is lost through leakages and seepages. A case in point which by inference attests to the above assertion is of

Chemenengir furrow. Where, sometime in 1980 (passim) the amount of flow at the furrow's intake was 320 l/sec., but at the base of the escarpment the flow was recorded as 225 l/sec. This meant a 30% loss hence being evidence of the allegation that the location has soils which range from being well drained to excessively drained. And given that furrow leakages is the major cause for frequent maintenance and repairs of furrows is enough evidence to show that leakages and seepages cause water shortfalls as stated by 28.8% of the affected irrigators.

Coming to the issue of demand outstripping supply as stated by 47.5% of the irrigators experiencing shortfalls, the following can be said. That, even though the population has been increasing implying the growth of the number of households in need of irrigation water. On the other hand the number of furrows or rather the amount of water needed has not been rising at the same rate to meet the increasing requirements. For instance, while the location's total number of households in 1969 were 773 the projected equivalent figures for 1987 were 1052. Within the same time span no additional furrow has been constructed. In fact the most recent to have been constructed is Kapterik which was established in the 1950s. In addition, none of the furrows has been rehabilitated to enable it carry more water than ever before.

By and large, seasonal fluctuations of the waters of particularly River Arror, the source of water feeding the indigenous furrows, is the major cause of shortfalls particularly at the time of utmost need - which is much of the year except during the wet season. Besides the 59.3% of all affected irrigators who cited this aspect as a cause of inadequacies, some of the local leaders and administrators do also regard it as a major problem and even go further to give some of the factors leading to the fluctuations. The additional factors suggested are alluvial gold panning along the banks and channel of River Arror in Koibarak location and also human activities such as settlements, cultivation and livestock rearing which are tampering with the river's main catchment area viz the forests of the Cherangany hills.

The key factor leading to seasonal fluctuations is however the seasonality of rainfall.

Yet another cause of inadequacies is the interference with the irrigation water sharing process by some egoistic and disgruntled irrgators. They do so by way of diverting the irrgigation water to their own farms when it is not due for them. As a result, they disrupt the irrigation programmes

of the affected deserving irrigators. Such offenders are usually either warned or ordered to pay a fine of one goat by the court of elders ('Kokwo'). The goat is subsequently consumed by members of the community. Alternatively, the offender(s) may be cursed by the court of elders if they prove to be real nuisance to the community. What becomes discernible from the above set up is that the irrigation system has some latent institutions (rules and conventions) binding the irrigators. Moreover, only a few (6.8%) of the irrigators stated that such latent institutions are being interferred with. Suffice it to mention that while undertaking the field research, an incident was reported whereby a young man sustained some injuries inflicted upon him because of interferring with the distribution of water.

Every human society is dynamic. Traditions are indeed bound to change. With change, some members feel less attached to the traditional institutions of the society. Thus, the interferences on water sharing is by no means a surprise having in mind the dynamic nature of the society - which apparently is creating more uncertainty between the individual and the public.

Inspite of having no appointed supervisors to manage the distribution process, no remarkable disputes have arisen in this respect. Therefore this becomes an indicator of fair distribution.

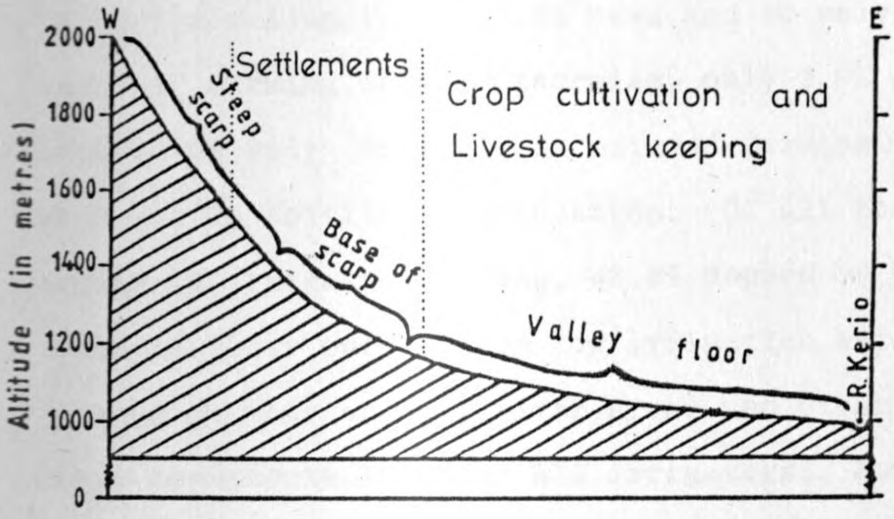
4.3 CROP PRODUCTION

4.3.0 The Setting

Of all the sample housholds' respondents, 1.5% can be classified as not elligible for employment categorization because of being students. On the other hand, 73.1% of all those who were elligible can be rightfully classified as full-time peasant farmers, with the rest 26.9% being classifiable as not only peasant farmers but also waged employees such as teachers and clerks. It therefore follows that agriculture is a key employer.

All households in Arror location engage in crop production. They all cultivate the valley floor with only a few (13.1%) also cultivating the escarpment. The 13.1% are spread out such that 4.4% are in Resim sublocation and 2.9% in each of the other three sublocations. The valley floor should, therefore, be seen as the major zone of cultivation. as shown by figure 4.1 on page 113.

LATITUDINAL CROSS SECTION OF ARROR LOCATION



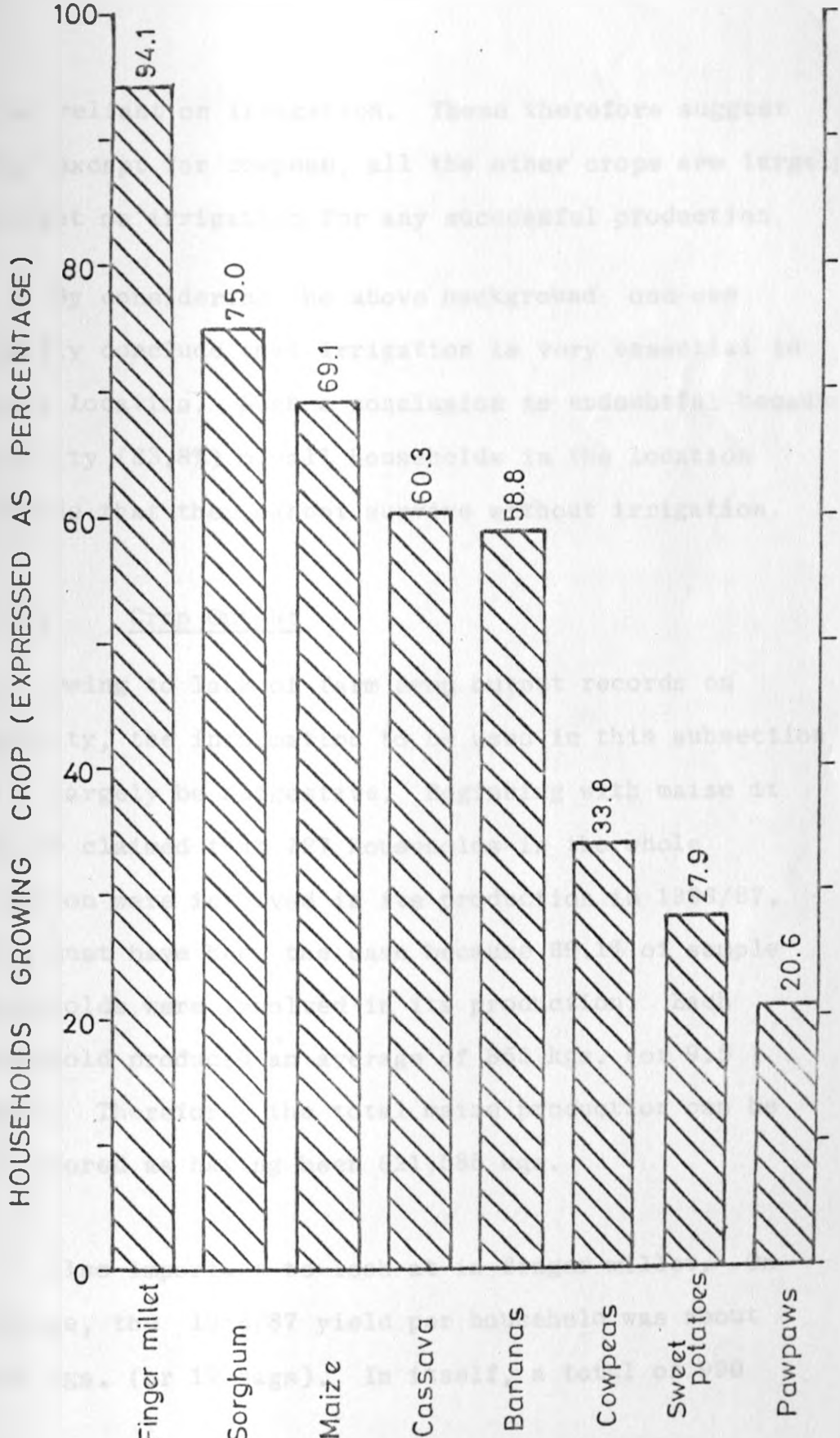
H.S. 1:50000
V.S. 1:20000

MAJOR ACTIVITY ZONES

FIGURE 4.1

Indeed, 97.1% of households in Arror location depend on both rainfed and irrigated farming. But due to furrow malfunctions, 1.5% have had to rely on rainfed farming only. Otherwise, only 2.9% of all households rely entirely on rainfed farming - all of whom are in Koitilial sublocation. Of all those who engage in irrigated farming, 86.4% depend on River Arror as their only source for irrigation water. Other households rely on both River Arror and other sources, these constitute 10.6% of all irrigators. But only 3.0% of all the irrigators rely on other sources excluding River Arror; the other sources include Embomuchukwo and Tunyo. Households cultivate an average of 2.0 acres.

Eight major crops are grown within the location (with each being grown by at least 20% of the households). The crops are : Finger millet (94.1%), sorghum (75.0%), maize (69.1%) cassava (60.3%) Bananas (27.9%) and pawpaws (20.6%) as shown on figure 4.2 on page 115 Among the eight crops, four are very reliant on irrigation, these are cassava, bananas, sweet potatoes and pawpaws. The others, namely, finger millet, sorghum, maize and cowpeas are comparatively less reliant on irrigation. Actually, 21.6% of all sorghum growers 23.6% of maize growers, 28.1% of finger millet growers and 60.9 % of cowpeas growers consider them as being



MAJOR CROPS IN ARROR LOCATION

FIGURE 4.2

less reliant on irrigation. These therefore suggest that except for cowpeas, all the other crops are largely reliant on irrigation for any successful production.

By considering the above background, one can rightly conclude that irrigation is very essential in Arror location. Such a conclusion is undoubtful because majority (83.8%) of all households in the location concede that they cannot survive without irrigation.

4.3.1 Crop Output

Owing to lack of farm crop output records on quantity, the information to be used in this subsection will largely be suggestive. Beginning with maize it can be claimed that 727 households in the whole location were involved in its production in 1986/87. This must have been the case because 69.1% of sample households were involved in its production. Each household produced an average of 855 kgs. (or 9.5 bags). Therefore, the total maize production can be considered as having been 621,585 kgs.

Also important to look at is finger millet. On average, the 1986/87 yield per household was about 1080 kgs. (or 12 bags). In itself, a total of 990

households were engaged in its production. Cowpeas is yet another crop with suggestive statistics. An average yield of 306 kgs. and 54 kgs. were harvested by all households engaged in its production in both Resim and Arror sublocations respectively. It is alleged that cowpoeas is a comparatively recent crop in the location which in addition is seemingly growing from strength to strength with much of it being grown without reliance on irrigation. For the other crops namely sorghum, cassava, bananas, pawpaws and sweet potatoes, it was not possible to get any information on quantity of output.

Many households use very few other inputs safe of the previous crop/yield as seeds. For instance, only 20.5% of all households use certified (improved) seeds which basically pertain to maize. Thus, many other crops particularly finger millet, sorghum, cassava, bananas, pawpaws, sweet potatoes and cowpeas bear exclusive use of the previous crop/yield as the seeds. Moreover, and inspite of all households keeping livestock and growing crops, only 48.5% do apply farm yard (animal) manure in their crop production endeavours. Only 4.4% of all households apply mulching. Such limited use of farm inputs must be seen to bear a leeway towards productivity.

Finally, it is unfortunate, that no comparative analysis can hereby be undertaken as regards to observed and expected yield per unit area. This is because of lack of data on observed average yield per unit area for each group. In essence, households practice multiple and intercropping and are (over and above all) unable to specify the area under each crop. Nevertheless, productivity can be considered as being low. This is in view of the context already established that among other things, water is inadequate (as claimed by many households), methods of spreading the water at farm level are very wasteful, and that there is limited use of farm inputs.

4.3.2 Storage of Crop Produce

Finger millet is usually stored in traditional granaries. This as well applies to maize particularly if the yield is substantial such as worth being stored. As for sorghum it is largely stored in the loft ('tobot'). Bananas is stored either in the traditional granaries together with finger millet or maize or kept in the houses - while in bunches. The storage of bananas usually takes, say, a week at most. This is because of the need to prepare (rippen) it for household consumption if not for sale. Pawpaws fall in the same category with bananas but the duration

of storage tends to be say three days at most. Otherwise they (bananas and pawpaws) go stale soon because of being highly perishable.

The case of cassava and sweet potatoes is that after being uprooted/harvested they are consumed or sold immediately. However, cassava is at times peeled, dried and hence stored in the houses. Cowpeas on the other hand is normally kept in gunny bags and stored in the house.

Weevils as reported by 64.7% of all households are a problem in the storage of crop produce. The most affected are maize, sorghum and cowpeas. Finger millet on the other hand is free from weevil attacks. Rats are also dreadful storage pests as identified by 38.2% of households. Rats destroy almost every crop produce. Ants also do havoc to stored crop produce. They largely do so whenever the tatched roofs of the granaries leak. Finger millet is the most affected by ants. Monkeys also invade the stores and eat whatever they can come across as long as it is consumable by, say, mankind. The monkey problem was reported by 17.6% of the study's household respondents.

Individual household production has been noted as low. The crop produce is apparently meant for

subsistence with some of the produce, particularly the perishables, and also the storage problems, alongsid side the storage facilities, one is left with a view that improvements are required.

4.3.3 Marketing of Crop Produce

Many (98.5%) of the households experience food shortages. Majority of them (72.0%) do experience it only after severe droughts. The rest (26.5%) experience food shortages each year but on a seasonal basis which is usually between April and July. All the households though few (2.9%) that rely entirely on rainfed farming within the location fall within the latter category.

Various methods are applied by the affected households to overcome the food shortages. The leading two methods are:

(a) purchasing food from the neighbouring highland areas, for example Koibarak location and

(b) careful use and regular cultivation of bananas and cassava; as stated by 46.3% and 34.3% of the affected households respectively.

A reflection on the above second leading solution purveys a general notion that bananas and cassava are not highly regarded as subsistence food crops.

Strictly speaking 88.2% of all households have at least a crop produce for income earning. Bananas is traded on by majority (57.4%) of households. Next to it is cassava (48.5%), then finger millet (35.3%), maize (29.4%), Pawpaws and cowpeas (7.4% each) and Sorghum (2.9%). Thus, inspite of being grown by many households, finger millet, sorghum and maize are sold by a few households when compared with, particularly, bananas and cassava.

The markets through which the crop products are sold range from being within the location e.g. Koitilial (see Plate 4.4 on page 122) and Arror to those outside the location e.g. Kapsowar and Chebara. Majority (93.3%) of households engaged in sale of crop produce use portery as a mode of transport. The portage is mainly done by women and children who usually carry the produce to the already mentioned markets among others. Chebara and Kapsowar, for example, are apparently reached after walking across the Elgeyo escarpment. This involves a distance of 7-10 km. Donkeys are also used (though by only 3.3% of the sellers) while transporting their crop produce to the markets. Motor vehicles and bicycles are as well used by a few of the crop sellers. Each is used by only 1.7% of the households engaged in selling crop produce.

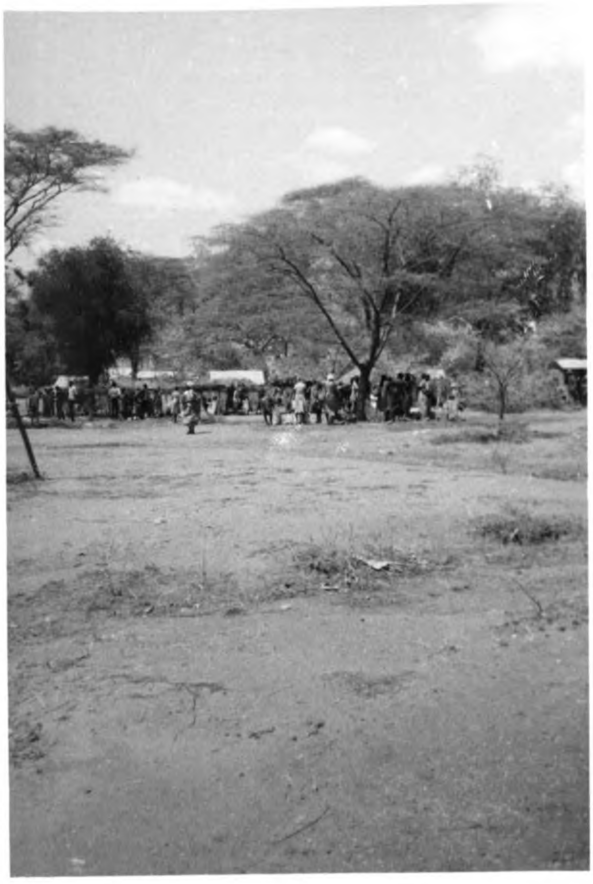


Plate 4.4 - A periodic open air market - at Koitilial market Centre.

It has been observed that what is taken to markets across the escarpment largely constitutes bananas, cassava, and pawpaws. These are very perishable, heavy and bulky products. For instance, only 81 pieces of average size bananas can be carried in one 20 - litre tin. The selling per piece of the bananas ranges from 20 cents to 50 cents. The same size of a tin can allow only 10 - 15 pieces of average size of pawpaws with each piece being worth between Kshs. 1.00 and Kshs. 2.50.

Usually, not all what is taken to the market with the intention of being sold is actually sold. This is because of low demand. As a result what remains unsold is usually taken back home if not being sold at throw-away prices. Such occurrences explain why prices are reportedly very unstable. Suffice it to therefore point out that the low demand leading to either wastage of resources or low and unstable prices tend to thwart production. Meanwhile, the cumbersome and generally poor transport network remains a major marketing problem as stated by majority (68.3%) of all the households. This affirms the finding that the location has a limited accessibility.

By and large, earnings from the problem - ridden marketing process are mainly used in the purchase of basic households needs.

4.3.4 OTHER PROBLEMS IN CROP PRODUCTION:

Rainfall has already been noted as being inadequate and unreliable for crop production. If entirely relied upon, rainfed farming has had to limit diversification of crop production. For instance the few (2.9%) households that do not practice irrigated farming grow no other crops besides finger millet, maize and sorghum. They even contend that the crops they grow are very subjective to droughts of any magnitude. Over and above all, food shortages is apparently a phenomenon of every year. So it is an open fact to assert that rainfall is unreliable and generally inadequate to fully sustain substantial crop production.

The above context should not be a basis to suggest that things are safe with irrigated farming. This is simply because water for irrigation is largely insufficient - refer to subsection 4.2.4. As an impediment, the insufficiency of irrigation water has partly contributed to the cultivation of small pieces of land - which on average measure 2.0 acres. This is because the little water that some households get enables and further couples them to irrigate small

pieces of land - as stated by 35.6% of all those households that experience the insufficiency. Thus, the insufficiency of irrigation water has hindered the cultivation of more land and consequently limited production.

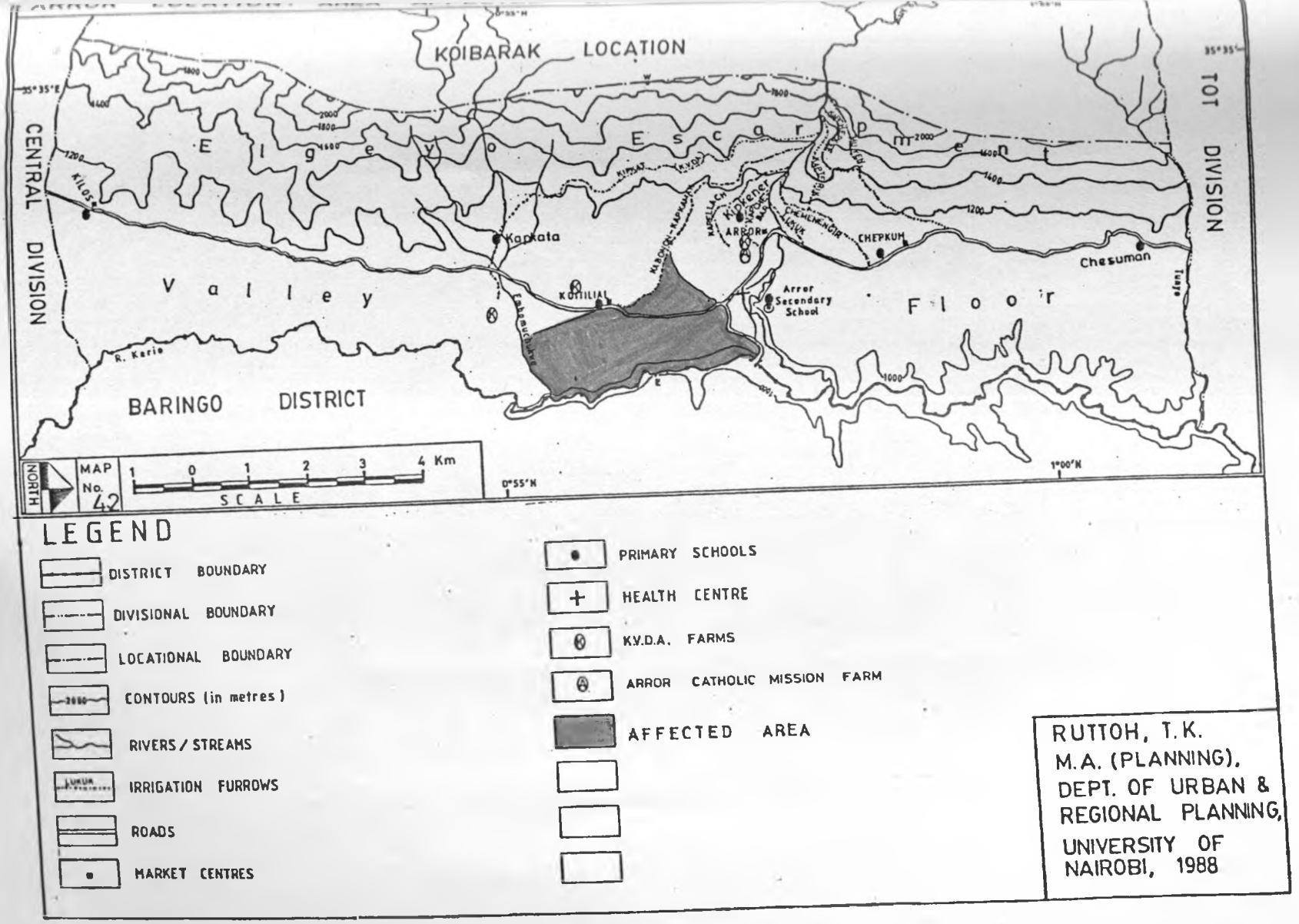
It is imperative to argue that the wild flooding method of spreading water at the farms is quite wasteful. Acually, much of what is wasted is the water that reaches the farms in the night. This is because the irrigators are apparently unable to direct the water in darkness. In any case they fear spreading the water in the nights because they may fall victims to snakes some of which are lethal e.g. cobra. The wasteful usage of irrigation water in the nights is evidenced by the fact that those who are allocated the 4 p.m. - 12 midnight ('Tiyse') water for irrigation are further given a chance to use the water from 10 a.m. - 1 p.m. The reason for doing so is to enable them spread the water to parts of the farm that could not get irrigated during their first chance.

Any furrow breakage whose magnitude is beyond the ability of the local folks to repair has always become an impediment to crop production. The consequence of such an event is the abandonment of crop production in affected areas. One good case is the breakage of Kabonon-Kampakamak furrow. It broke down in 1983 and as

yet remains unrepaired. Since then, the zone between Koitilial centre and the road junction near Arror Health Centre (see Map 4.2 on page 127) has turned void of notable crop production. Plate 4.5 on page 128 presents a vivid illustration for this case because even fruit trees e.g. mangoes trees have withered if not in the process of doing so.

A few (8.8%) households conceded that they receive extension services. Such services are largely provided by Arror Catholic Mission and to a lesser extent by KVDA. The extension services are largely observatory - whereby the farmer is encouraged to observe how irrigated farming is being undertaken by the said organizations. The Ministry of Agriculture does not offer any extension services inspite of being duty bound to do so. So majority of the households undertake their crop farming practices without extension services (technical assistance).

The crop production levels of the households are as well impeded by pests which attack the crops while in the farm. The common pests include wild parrots locally called 'Kerele' and weaver birds ('Sawach') which usually are a nuisance to fingers millet and sorghum. In all cases, the presence of a person within the farm who will be scaring away the birds is the only option to


KOIBARAK LOCATION
CENTRAL DIVISION
TOT DIVISION
Elgeyo Escarpment
Valley
Floor
Kapkata
KOTILIAL
ARROR
CHEPKUM
Chesuman
Arror Secondary School
R. Karia
BARINGO DISTRICT
KILOSE
35°35'E
0°55'N
1°00'N
NORTH
MAP No. 42
1 0 1 2 3 4 Km
SCALE
LEGEND
DISTRICT BOUNDARY
DIVISIONAL BOUNDARY
LOCATIONAL BOUNDARY
CONTOURS (in metres)
RIVERS / STREAMS
IRRIGATION FURROWS
ROADS
MARKET CENTRES
PRIMARY SCHOOLS
HEALTH CENTRE
K.V.D.A. FARMS
ARROR CATHOLIC MISSION FARM
AFFECTED AREA
RUTTOH, T.K.
M.A. (PLANNING),
DEPT. OF URBAN & REGIONAL PLANNING,
UNIVERSITY OF NAIROBI, 1988

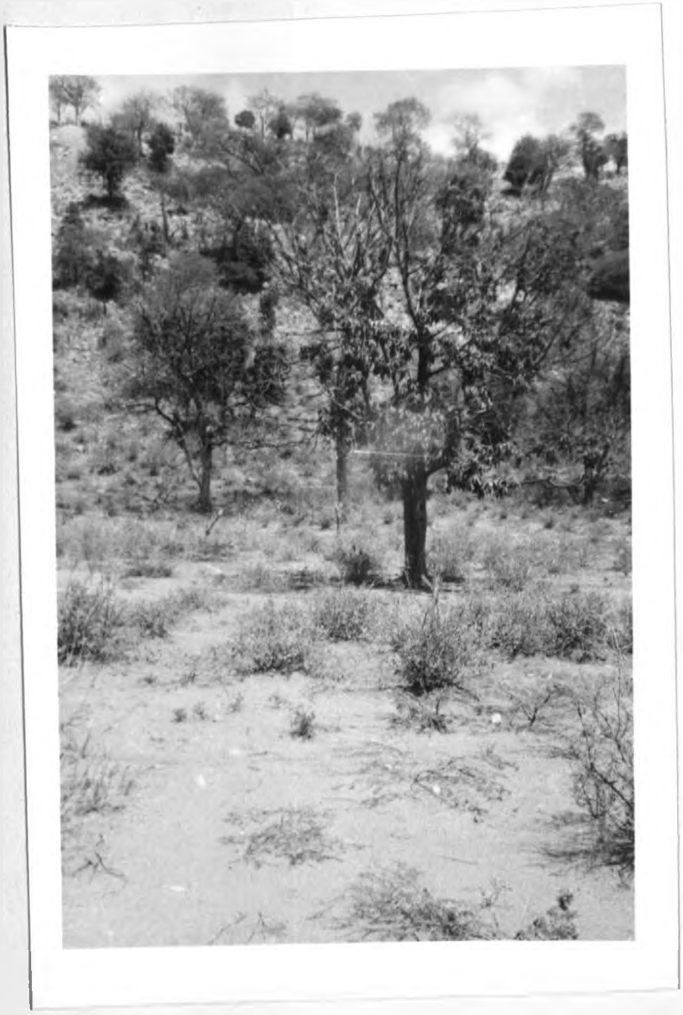


Plate 4.5. Mango trees wilting because of the Kabonon-Kapkamak furrow breakage.

the households. Also, farms are in many cases at the mercy of roving livestock, particularly goats. This is because they are mainly left untrailed while in search of pasture. As a result, they tend to manoeuvre their ways through fences and hence destroy crops. such as finger millet, sorghum, maize, cassava, bananas, sweet potatoes and even vegetables. Plate 4.6 (see page 130) shows a goat that has been scared away from a sorghum farm.

Moreover, use of farm inputs within the location is very limited. The study has, identified that many households do not use improved seeds nor even apply remarkable inputs such as farm yard manure. Such limited use of farm inputs is a pointer towards low productivity - thus being an indicator of the poor farming methods.

4.3.5 MISCELLANEOUS:

Two issues are dealt with in this subsection. Firstly, is the case of distance between the settlements (homesteads) and cultivated farms. The said distances range from less than 500 metres to over 2 kilometres, with the maximum being about 5 kilometres. As shown on Table 4.1 on page 131 , it becomes explicit that many (70.6%) households in Resim sublocation travel over 2 kilometres to reach their fields from the

Plate 4.6 - A goat running out from a sorghum farm.

homesteads. Resim is followed by Koitilial sublocation (58.8%) then Chepkum (29.4%) and Arror sublocation (17.7%). The whole location has an average of 44.1% in this respect.

The general assumption in the above analysis is that any distance of over 2 kilometres is too far and involves the use of many manhours in walking over such long distances to reach the farm. Diversity among sublocations in this regard is explained largely by the factors that influence settlement patterns - (refer to subsection 3.5.1) - and the need to cultivate areas where substantive irrigation water is available. Apparently, most of the irrigation water is mainly available in Arror and Chepkum sublocations.

Table 4.1 DISTANCE TO CULTIVATED FARMS FROM HOMESTEADS

DISTANCE TO FARM In metres	HOUSEHOLDS EXPRESSED AS PERCENTAGE				
	Sublocations				Arror Location
	Arror	Chepkum	Koitilial	Resim	
Less than 500	5.9	17.7	5.9	5.9	8.8
500 - 1000	23.5	23.5	5.9	11.8	16.2
1000 - 2000	52.9	29.4	29.4	11.8	30.9
Over 2000	17.7	29.4	58.8	70.6	44.1
	100.0	100.0	100.0	100.1*	100.0

* The sum is 100.1 because of rounding up.

Source: Research data.

Any attempt of trying to deliberate on the issue of distance travelled against loss of manhours should bear the question of : What alternative opportunities have been forgone. Upto this juncture, none has been identified. So until and unless this is done is when the validity of the notion will have been attained, thus vesting a problem status upon it in terms of crop production.

The second issue pertains to cotton. It is grown in Arror location by 5.9% of the households. Three reasons have sparked off its being given special attention inspite of not being among the major crops. The first reason is that the Kerio Valley is generally known for its best quality cotton production in Kenya. Secondly, it is a crop that can do well with little or even no irrigation at all in Arror Loction; and finally, it is nothing less than a pure industrial cash crop- hence worth being promoted.

In the late 1970s to early 1980s, cotton was reportedly a thriving crop in the valley. But at the moment, it is just dwindling. The reasons given by the authorities in-charge of its production as to why cotton production is dwindling in the valley are:

- (a) that the farmers in the valley (Arror location included) did not respond well to the crop because of their pastoral way of livelihood, and

- (b) that those farmers who initially accepted it and received financial assistance defaulted the deal.

On the other hand and possibly to counter the above allegations, the farmers claim that it is largely a waste of resources to grow cotton. Because, they argue, for any cotton crop delivered to the Cotton Lint and Seed Marketing Board the pay comes after, say, one year at the earliest. Such delayed payments are not only a disincentive to the farmers but makes cotton production quite incredible.

The potential for cotton production should as yet be considered unexploited. This is a potential that (with little irrigation and prompt payment from the marketing board) good yields can be realised from any given farm within the location. Its success may raise average household incomes besides generating employment opportunities.

4.4 ENVIRONMENTAL IMPACT: A SYNOPSIS:

Prior to preparing any piece of land for cultivation, particularly if to be under irrigation as it is in majority of cases, the community members get together so as to decide on which common site to cultivate. The reason for doingso is based on the distribution of irrigation water. Whenever the cultivated fields are closer to each other, it becomes easy and quick to control the water. It even enhances its utilization. Because the minor distribution channel to each plot will have been reduced thus even reducing distances that could involve further loss of water through seepage and evaporation.

To get a common site, a few factors are critical. Among them is whether there is sufficient fencing material at the site. The thorny branches of zizyphus mauritania are the commonest fencing material hence being a determinant to site selection. A strong fence is necessary for the purpose of restraining both wild and domestic animals which are destructive to crops particularly goats in the latter category. Indeed, each crop season for finger millet, sorghum, maize, cowpeas and sweet potatoes usually goes with a fence. For the other crops (among the eight major crops) namely, bananas, cassava and pawpaws the fences are

usually reinforced from time to time as long as the crop is in the farm. The temporaneous nature of fences is therefore a prime cause of the degradation of the vegetation.

What also determines common site selection is whether the land to be cultivated will have regained sufficient fertility since it was left fallow. Shifting cultivation is widely practiced within the location. The crops which seem less affected though are bananas and pawpaws. The aspect of fertility is viewed upon the density of the derived vegetation. Once the site has veen identified then the clearing is done. While they do that, the stumps of the commonest shrub - locally known as 'sukuiwo' is left unuprooted. The shrub is very resilient and is normally expected to resuscitate the vegetation when the land is later left fallow - usually after two years. The withered vegetal material from the derived vegetation is expected and rightly so to help the soil retrieve its fertility. In itself, the shifting cultivation degenerates the vegetation.

The degeneration has also been caused by livestock keeping. The gist of the matter is that the land carrying capacity has been outstripped - refer to subsection 3.7.4. Put together, therefore, the

agricultural activities of humankind have degraded the vegetation. As a result, soil loss has occured because already the vegetation cover is too feeble to hold the erosive effects of rainfall nor even contain the flash floods which occasionally occur. Irrigation water does the same though at a lower magnitude. Deep gullies and even observable ditches across roads have resulted.

Malarial and diarrhoeal illnesses have been noted as among the most prevalent cases reported at Arror Health Centre. While malaria can be assumed endemic within the location, diarrhoea cannot. It is perceived in this study that diarrhoeal cases can be largely traced to water being consumed by household members. The households' potable water are from sources which include the irrigation furrows. The same sources are directly used in the washing of clothes and bathing let alone being freely used by domestic livestock and wildlife. Moreover, the water is widely consumed by the population without any treatment. Therefore, if anything, diarrhoeal illness need be traced to water drawn from all sources including furrows.

By and large, the endemicity of malaria within the location is as well and indeed related to irrigation. This is because, in the process of spreading the irrigation water through wild flooding, some of it

stagnate at some places - thus becoming mosquito breeding grounds.

However, irrigation has helped to enhance the beauty of the environment. The leakages and seepages of irrigation water have bolstered the vegetation along the main furrows in most cases. A reflection of this is the growth of a riverine-like vegetation in areas traversed by the furrows. In addition, the wild flooding method of spreading the water at the farms enables the growth of pasture at the periphery of the farms; - this is because of the spill-overs of water which is considered wasted in terms of crop production. Of course such an environmental gain of growth of pasture should not be considered an implicit suggestion that the spreading method is good. Because with irrigation water the objective is to maximise crop production.

4.5 CONCLUSIONS:

History points out that settlement in Arror location was influenced by the search for security. Irrigation has since boosted its permanency. In itself, irrigation is largely undertaken using indigenous furrow systems. Food crops which are largely meant for subsistence are being grown. Some of the crops which apparently fall within the group of the eight major crops

cannot do without irrigation at all. These include: Bananas, Cassava, pawpaws and sweet potatoes. The societal organization has enabled almost all households to practice irrigated farming.

In itself, the indigenous irrigated farming is labour intensive. Traditional institutional framework has helped in the day-to-day operation and maintenance of the cherished system. This has ensured some form of fair distribution of the available irrigation water. By and large, the irrigation water is largely insufficient. Causes of insufficiency include seasonal fluctuations of water at source, leakages, and seepages of already abstracted water, demand outstripping supply of irrigation water and interruptions on the sharing process among others. Moreover, the spreading method at the farm level is quite wasteful and thus appalling.

The breaking down of Kabonon-Kapkamak furrow in 1983 has halted crop production in an area once-reknown for crop production. It has actually forced some households to depend entirely on the very unreliable rainfed farming.

Food shortages are by no means uncommon. They largely occur whenever there is drought. A few households see food shortages as being very recurrent

year after year - but on seasonal basis. However, among the solutions identified by the households include the use of bananas and cassava. It therefore goes without saying that the diversity of tastes and preferences partly explains the reports of food shortages.

Generally, crop production is disparaged by pests which range from goats and wild birds to weevils, rats, and monkeys. Nothwithstanding that, some households generate income out of selling their crop produce. The commonest cash earners are bananas and cassava. However marketing of crop produce is underrated by the cumbersomeness of transportation, coupled with low demand and price fluctuations.

The predominantly two-year' shifting cultivation added to the excess land carrying capacity and coupled with the need to establish fences (which are generally temporary) have witnessed gradual trend towards irreparable destruction of the vegetation. This not only exposes the soil to greater risks of erosion but also retards its fertility. But to enhance soil fertility, some households apply farm yard (animal) manure. The environmental hazards pertaining particularly to ill-health need not be overlooked. The two major incidences are of malaria and diarrhoea.

Both are hereby perceived to have a bearing on the irrigation system.

While the peasant farmers endeavour to improve their cultural practices, they have had to do with very little assistance from governmental and non-governmental organizations. Since the Technical Assistant (TA) left the location in 1985, there has been no replacement. Hence, the little assistance the farmers receive is from Arror Catholic Mission and Kerio Valley Development Authority (KVDA).

REFERENCES:

Kenya, Rep. of - 1970 - Kenya Population Census 1969: Vol. I Statistics Division, Ministry of Finance and Planning, Government Printer, Nairobi.

Kipkorir, B.E. and F.B. Welbourn - 1973 - The Marakwet o Kenya: A Preliminary Study: Kenya Literature Bureau, Nairobi.

Kipkorir, B.E. - 1983 -"Historical Perspective of Development in the Kerio Valley": in Kipkorir, B.E. et. al. (eds.) Kerio Valley: Past, Present and Future; Eleza Services, Nairobi.

Soper, R. - 1983 - "A Survey of the Irrigation Systems of the Marakwet", in Kipkorir, B.E. (eds.) Ibid.

CHAPTER FIVE

MODERNIZATION EFFORTS

5.0 INTRODUCTION:

The key issues addressed in this chapter include when and how modern irrigated farming has had to emerge in Arror location. The spatial context of modern irrigated farming is also put in perspective. Moreover, the consideration of how the system functions ushers in the manifestation of socio-economic impact of modern irrigated farming in the location.

5.1 HISTORICAL PROFILE AND FUNCTIONAL FRAMEWORK:

5.1.0 THE SETTING

Two agencies are exclusively dealt with in this chapter. They are Kerio Valley Development Authority (KVDA) and Arror Catholic Mission.

5.1.1 KERIO VALLEY DEVELOPMENT AUTHORITY: ARROR PROJECT:

KVDA is a statutory regional development authority established by an Act of Parliament No. 14 of 31st August 1979. Its area of operation includes Arror location which in itself falls within the Kerio River basin.

The authority aims at steering development. It seeks to create employment opportunities for the benefit of local folks through establishing development projects and programmes. Strictly speaking, the authority aims at the realization of optimal utilization of resources alongside involving conducive conservation measures. Thus, in collaboration with the local members of the public, administration and leadership and in consultation with relevant organizations the authority has to identify, plan, co-ordinate and/or implement development programmes and projects. Such endeavours are targeted for (rural) development.

KVDA is currently engaged in feasibility studies, implementation of projects and managing already implemented projects such as Arror Irrigation Project. The KVDA Arror Project was founded in 1983. It started with the rehabilitation of the Kipkat furrow which had been abandoned in 1960s. The rehabilitation exercise involved refurbishing the intake (see Plate 5.1 on page 144) clearing, cleaning, widening and reinforcing the furrow all the way down to Kaimuchuk where it had initially reached.

The extension from Kaimuchuk to Kapkata and further down to Kamsiwet is entirely a KVDA establishment. This is because even before colonial era the wananchi

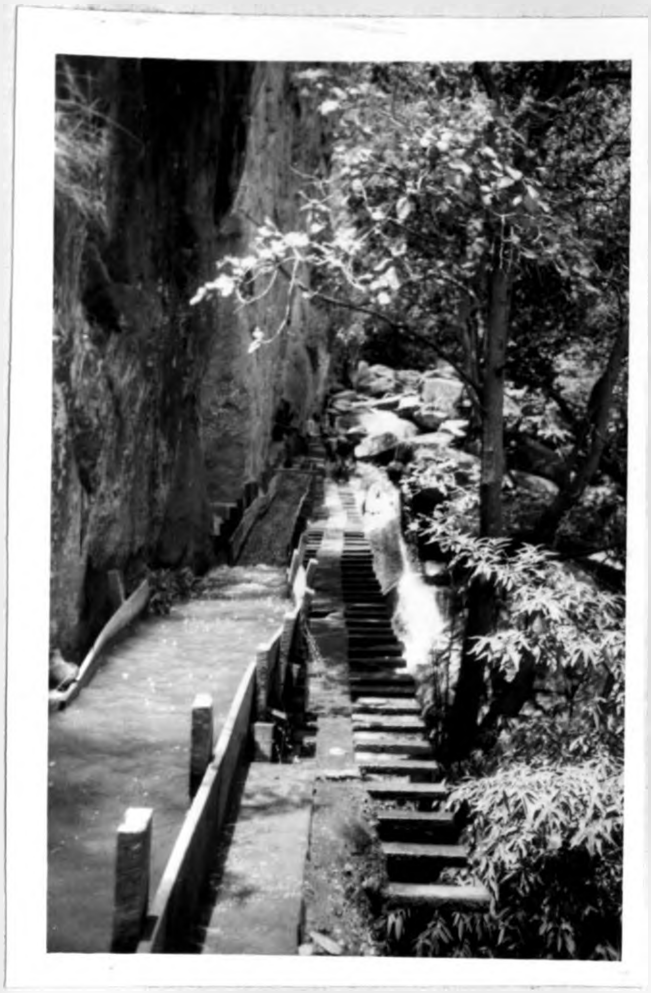


Plate 5.1 - The improved Kipkat Furrow Intake.

had established it for a distance of about 2 km. beginning from the intake. But the use of the furrow was crippled when the intake was destroyed by floods beyond the peole's ability to repair. However in 1959 the African District Council (ADC) in collaboration with the local people rehabilitated the furrow and extended it to Kaimuchuk. Soon after, the furrow was again confounded by a breakage of the intake

and parts of the channel. It remained in that state until 1983 when KVDA rehabilitated and extended it as already mentioned.

About Kshs. 600,000 was spent in the rehabilitation and extension of the furrow. The furrow which measures 9.7 km. long is now fully owned, operated and maintained by KVDA. To operate and maintain the furrow, KVDA uses one permanently employed foreman and between 5 - 20 casual employees at any time throughout the year. While the foreman is annually paid a total of about Kshs. 11,100, the casuals together earn between Kshs. 28,470 and 113,880 per annum.

Maintenance is vital because of the need to seal parts of the furrow which may be leaking, remove any material which may have blocked or about to block the furrow and repair or reinforce parts of the furrow which may have or about to break down. At the farm level, mechanical ridgers are used to make corrugations so as to ensure efficient spreading and thus utilization of irrigation water. It (KVDA) also uses watering cans particularly at its tree and citrus nursery.

The sincere concession by the authority that none of the crops it cultivates can do without irrigation

explains the importance of irrigation in the location. Despite such an attribution,crop production in the location has been disparaged by the general inadequacy of irrigation water. Seepages, leakages and evaporation are among the causes of inadequacy in that through them, alot of the water abstracted is lost. KVDA also attributes the inadequacy of water - destined for the authority's irrigation - to the local households. The reason is that the households illegally draw water from the authority's furrow and thus use it for irrigating their (households) farms. As a result, the authority has had to employ guards to deter the illegal abstraction. Such a move has at times sparked-off the use of violence. A case in point is found in the Arror project monthly report of July, 1987; where it is noted that a KVDA employee guarding the furrow was injured because of being stoned by the cruel illegal abstractors.

Yet another cause of inadequacy is the seasonal fluctuation of the river's water. Usually the River's water is less during seasons of greatest need for irrigation water. But in as much as the inadequacy of irrigation water is a problem to reckon with, the authority has had to apply various ways and means of tackling it. These include the frequent

monitoring and maintenance, employing furrow guards, reducing size of cropped land during seasons when water tends to be inadequate and seeking assistance from the local administration to reduce illegal abstraction. In addition, the authority uses its bulldozer to construct dams within the farms for the purpose of not only creating water reservoirs but also regulating the usage of irrigation water within the farms.

5.1.2 ARROR CATHOLIC MISSION:

It is a non-governmental organization (NGO) with its primary function being religious. The Arror Mission Station was founded in early 1970s. It has established three permanent church buildings within the location, namely: Arror, Kapkata and Kibiyou; it also owns and operates the only diesel propelled grain mill at Arror in the location, has sponsored the only health centre in the location, assisted in the construction of school buildings, offered bursaries, and helped in repairing and maintaining indigenous furrow(s) besides owning a farm - which also serves as a demonstration piece.

The Arror Catholic Mission operates under the auspices of the Roman Catholic Secretariat of Kenya

within the order of St. Benedicts. It has two major objectives, namely:

- to fulfil its religious obligation of proclaiming the Gospel, and

- to promote human (societal) welfare through community development programmes/projects. The community development programmes include the primary health care programmes which reaches the households mainly through the services of the village health workers, and assistance for better farming methods.

All the crops grown on the Mission farm rely on irrigation for success. To irrigate the crops, water is drawn from River Arror via two channels. These are the Kapchebar furrow and a 4 inch (10.25 cm.) wide galvanized steel pipe. While the Mission compares to the local folks in terms of applying wild flooding at the farm level it contrasts in two major cases. These are the uses of sprinklers and irrigation watering cans by the mission none of which is used by the local folks.

The problem of water inadequacy which has already been stated as being experienced by the local peasants and KVDA is as well realised by the mission. To the

mission, the causes of inadequacy are high demand which outstrips supply particularly when need is utmost, and the reduction of quantity of water at the main course - River Arror - at the same time. The above state of affairs gets exacerbated by leakages, animals which drink from the same furrow and a few persons who interfere with the water after the sharing has been decided and agreed upon.

In the event of such inadequacies the mission farm is irrigated using water that is tapped using the steel pipe and stored in a water tank. The water in this case is spread mostly using sprinklers. Moreover, the mission usually gets involved in the maintenance and repair of the furrow of interest that is Kapchebar, particularly when called upon by the Wananchi. The mission spends about Kshs. 30,000 every year in assisting the wananchi in the maintenance and repairs of the channel(s) - Kapchebar.

5.2 SPATIAL CONTEXT AND LAND ACQUISITION:

KVDA has two major farms in the location. These are Koitilial which is about 60 acres; and Kamsiwet which as yet is about 20 acres. Plans to expand Kamsiwet farm to about 96 acres are at advanced stages.

The Koitilial farm was acquired by the authority from the community after promising that whoever surrenders a strip of land to the authority will be employed in return. It was also agreed that the authority would use the land/farm as a pilot project that would in future be given back to the community. As for Kamsiwet farm, the terms of acquisition were that the farm is to be developed as a pilot project returnable to the community just like the Koitilial farm.

Some members of the community allege that the authority was given land so as to avail water to the local folks particularly in Koitilial sublocation. But the water was to be largely for domestic purposes and livestock consumption and not for irrigation according to KVDA. Moreover, KVDA was to avail the water to the community for irrigation purposes only when it (KVDA) does not need it which is usually during the wet season. But this is the season when the community is also not in need of the irrigation water. Therefore the community is not at all substantially benefiting from the Kipkat (KVDA) furrow for irrigatoon purposes.

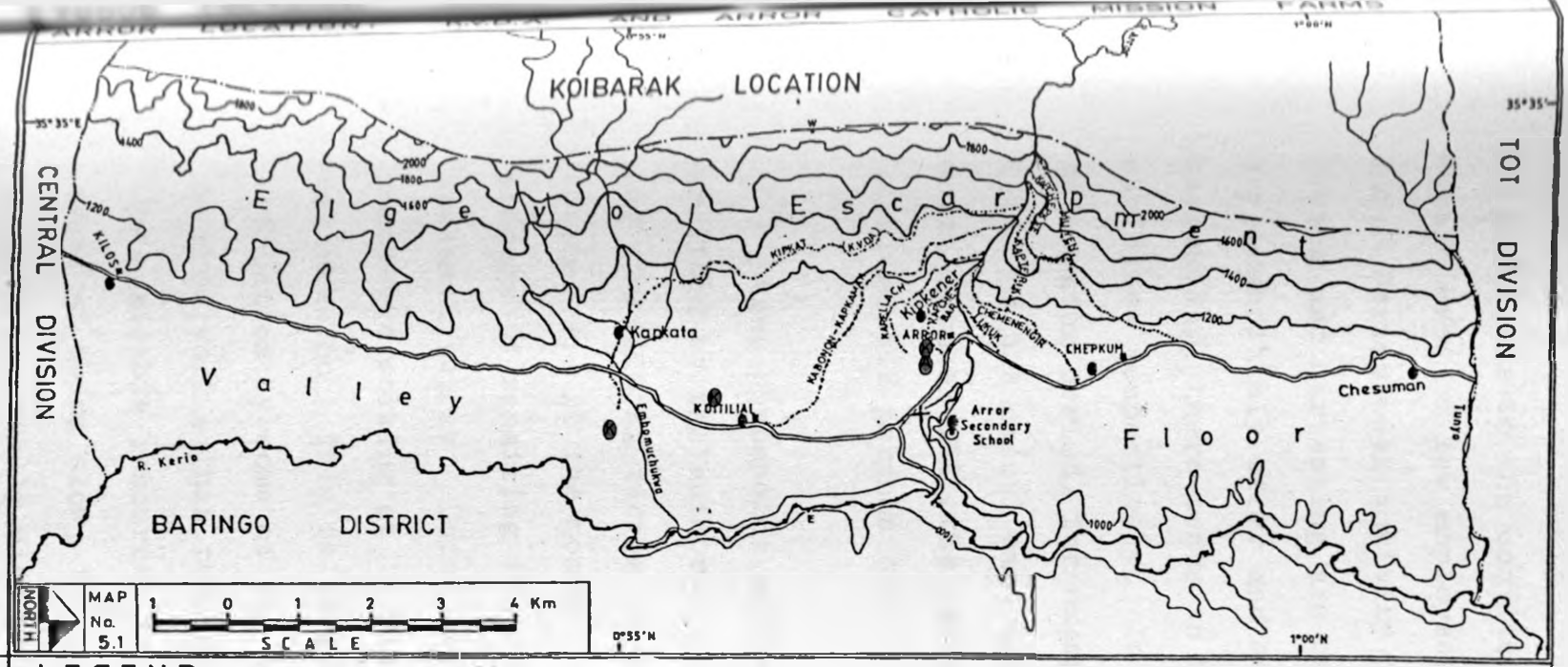
Between Arror shopping centre and the health centre lies the Arror Catholic mission station which hosts the church building, offices, residences, social hall, grain mill, and the farm. The mission farm

measures about 3 acres. The land on which the mission station (with the farm included) stands was freely offered by the community as a token of appreciation. The KVDA citrus and forest seedling nursery lies next to Arror Catholic Mission station. Map 5.1 on page 152 shows the KVDA farms and also the Arror Catholic mission farm.

It is noticeable from this section that KVDA operates large scale farms compared to both the local farmers and Arror Catholic Mission. In this regard, the community cannot compare its scale of operation with that of KVDA; but it can do so with Arror Catholic Mission. In addition, the acquisition of land by KVDA was tied to a water promise which has not been satisfactorily fulfilled. The failure to fulfil the promise added to the fact that it uses a furrow which was initially established by the community could partly explain why some community members interfere with the authority's (KVDA) irrigation furrow.

5.3 SOCIO-ECONOMIC ACTIVITIES:

As the KVDA strives to realise its statutory roles, a section of the community mainly in Koitilial sublocation has viewed it (KVDA) as a cause of conflict. The infirmity of the initial promise of land (to KVDA) in return for employment (to the community)



LEGEND

- DISTRICT BOUNDARY
- DIVISIONAL BOUNDARY
- LOCATIONAL BOUNDARY
- CONTOURS (in metres)
- RIVERS / STREAMS
- IRRIGATION FURROWS
- ROADS
- MARKET CENTRES
- PRIMARY SCHOOLS
- HEALTH CENTRE
- K.V.D.A. FARMS
- ARROR CATHOLIC MISSION FARM

RUTTOH, T.K.
M.A. (PLANNING),
DEPT. OF URBAN & REGIONAL PLANNING,
UNIVERSITY OF NAIROBI, 1988

is pertinent to the conflict. The authority has to engage many or few employees as periodic activities call for. During peak activity periods say when weeding, sowing and harvesting are on and low activity periods say immediately after and before the sowing, weeding and harvesting, there tends to be need for many and few employees respectively. In September, 1986 (an harvesting period) for example, the authority had a total of 223 casual employees. However in the next month, October 1986, the casuals had been reduced to a total of 118 persons only.

Many households acknowledge the assistance provided by the authority in terms of rehabilitating and stabilizing furrow intakes as already stated in Chapter 4. At the moment, the authority is in the process of repairing the broken section of Kabonon-Kapkamak furrow. Unfortunately, it has not yet completed working on it since 1986 when it (KVDA) embarked on. This is largely because of lack of dedication by some of the authority's employees to do good work within the shortest time possible using the available resources at any given time. In the event of being slow, the resources planned for the project is usually diverted to other projects let alone being wasted at times. It is therefore quite ridiculous and incredible to note that in, say, a case

where a whole two-bedroomed self-contained staff house can be build in less than one month, a broken section of an all-important furrow can take not less than two years to repair.

The Arror Catholic Mission can strictly speaking be viewed as assisting to repair and maintain indigenous furrows only in case it has some direct interest on the furrow(s). To attest to this assertion is the Kapchebar furrow where it allegedly spends about Kshs. 30,000 every year in assisting wananchi to maintain the furrow.

Employment can now be looked at. To begin with it is important to point out that as at September 1987 both KVDA and Arror Catholic Mission (farming section) had a total of 84 employees. Majority, 88.1% (or 74), of them were KVDA employees. Moreover, whereas KVDA had 17 employees under permanent terms of service, the mission had only 2. The remainder in each organization were casually employed. The monthly wages were distributed as shown on Table 5.1 (on page 155). Apparently, many (70.3%) of all the employees earn less than Kshs. 1000 per month. In fact, only 1.2% earn over Kshs. 1999 per month. However assuming that almost all the casual employees hail from Arror location, it then follows that whatever they earn is implicitly to the benefit of the location.

Table 5.1 - MONTHLY WAGE DISTRIBUTION FOR KVDA AND ARROR CATHLIC MISSION EMPLOYEES, SEPTEMBER 1987.

Monthly Wage Category (in Kshs.)	KVDA				ARROR C. MISSION				TOTAL	
	Permanent		Casual		Permanent		Casual			
	No	1%	No	%	No	%	No	%	No.	%
500			6	7.2			8	9.5	14	16.7
500-999			43	51.2	2	2.4			45	53.6
1000-1999	16	19.0	8	9.5					24	28.5
2000	1	1.2							1	1.2
TOTAL	17	20.2	57	67.9	2	2.4	8	9.5	84	100.0

Source: Research Data.

Whereas all the 74 KVDA employees deal with irrigated farming and its related issues such as the construction of farm structures e.g. stores; the 10 Arror mission employees do extend their work from the mission farm to households within its area of jurisdiction which is mainly the location. In essence, the mission employees use much of their time in advising community members on matters of development which include better farming methods and desirable home economics. A general observation of the mission's employees is that women are more involved than men, thus being a contrast to the KVDA project. The recent emergence of the informal women groups is an indicator of the success that seems to result from the efforts of the mission.

The issue of crop production is now pertinent. KVDA grows maize, sorghum, cowpeas, greengrams, groundnuts, chillies, cotton, orchards, and vegetables such as Kale ('sukuma-wiki'), cabbages, tomatoes, and onions. It also has citrus and forest seedling nursery in addition to a 15 acre planted forest. The fact that individual crop acreage tends to change from year to year (and season to season at times) demands that attention be given to average crop yield per unit of land - of course in cases where such data is available. The authority has established that when Pwani III variety of maize is grown, the yield can be 1260 kgs per acre. But if the variety is Coast Composite then the yield can be 855 kgs. per acre in the location. As for Arror Catholic Mission, an acre of maize (variety not specified) can yield 1080 kgs. Jaetzold et. al (1983) states that an average of 1793 kgs. per acre can be realised from, say, the valley. The 1985 Annual Report for Keiyo Marakwet district denotes that an average of 3150 kgs. per acre can be harvested in the Kerio Valley (Ministry of Agriculture, 1986). Thus, the level of maize production by both KVDA and Arror Catholic Mission is below the levels identified by Jaetzold and the Ministry of Agriculture.

Besides maize, Arror Catholic Mission is involved in the production of cassava, vegetables and fruits (pawpaws and citrus). The production levels of the

Mission are such that about 1350 kgs. of cassava can be harvested from one acre. An acre can also be used to grow and realise an average of about 3600 kgs. of vegetables. Again, pawpaws and citrus have an average yield of 12960 kgs, and 14400 kgs. per acre respectively. While the above are just but inferences, the truth is that Arror mission which indeed has a 3 acre farm gets its yields as shown on table 5.2.

TABLE 5.2 ARROR CATHOLIC MISSION FARM UTILIZATION

CROP	ACREAGE	REALISED OUTPUT (YIELD)	AVERAGE YIELD
Maize	0.5	6 bags @ 90 kgs.	1080 Kg/acre
Cassava	1.0	15 " "	1350 Kg/acre
Vegetables	0.75	30 " "	3600 Kg/acre
Fruits (Pawpaws and Citrus	0.25	36 (Pawpaws) 40 (citrus)	12960 Kg/acre - pawpaws 14400 Kg/acre-citrus
Purely Demonstration	0.5	Not stated	Not applicable
Total	3.0		

Source: Research data.

KVDA has established that the productivity levels of the location for all crops (already mentioned) are within the national average; let alone having good

prospects for higher average yields.

Meanwhile, it should be noted that both the KVDA and Arror Catholic Mission not only use certified seeds for maize and vegetables but also apply inorganic fertilizers and pesticides in crop production. The inputs are purchased from shops in Eldoret. Each of the organizations uses its own vehicles to transport the inputs into the location. Indeed the transportation is a problem to reckon with, because of, particularly, the impassability of roads (at the valley) during the wet season. It is also important to note that Arror Catholic Mission enhances her crop production through the use of animal manure which it usually purchases from the neighbourhood.

Both organizations are involved in marketing what they produce. In fact the authority markets all what it produces which include maize, vegetables, chillies and cotton among others - already mentioned. Whereas chillies and cotton are bought by Kitale Industries Ltd. and Cotton Lint and Seed Marketing Board respectively, the other crop produce is mainly bought by the local folks. As for the Mission, it mainly markets her maize, pawpaws and vegetables. It does so largely within the location. Suffice it to

state that the selling prices for the two organizations are at variance especially within the location. For instance, the Farm gate prices of maize and vegetables, as at September 1987, were as follows:

Maize - KVDA - Kshs. 188 per 90 kg.
- Arror C.M. - Kshs. 150 per 90 kg.
Vegetables - KVDA - Kshs. 180 per 90 kg.
- Arror C.M. - Kshs. 80 per kg.

However, certain problems are experienced in marketing. Low effective demand within the location for the farm produce is one of the problems. As a result, some produce remains unsold. To transport the produce to markets outside the location, say, Eldoret is a problem indeed. In that, besides the poor road network, limited accessibility and long distances (to fairly reliable markets, say, Eldoret), there are no frequent nor regular vehicles plying the Chesongoch - Biretwo road. The transportation problem weighs heavily on the marketing of crop produce particularly the perishables such as pawpaws, orchards, and vegetables.

On the other hand, any attempts to preserve particularly maize so as to market it at any later date when demand calls for is usually disparaged by weevils. Expensive preservatives are applied so as

to reduce the effects of the weevils. Yet another nagging problem in crop production is bird infestation. This is a real nuisance to maize while still in the farms. It usually forces the KVDA to engage casuals who scare away the birds.

5.4 CONCLUSIONS:

Both KVDA - Arror project and Arror Catholic Mission have done some commendable work in Arror location. They have assisted the community in reinforcing/refurbishing indigenous furrow intakes, the rehabilitation and extension of Kipkat (KVDA) furrow, occasionally repairing and maintaining indigenous furrows, creating a few employment opportunities and constructing some school buildings among other attempts to improve societal welfare.

To the two organizations, water for irrigation is insufficient particularly when need is utmost. The causes of insufficiency include supply being outstripped by demand. This is exacerbated by seasonal reduction of water at the source. The water abstracted and thus destined for irrigation is also reduced by leakages and seepages let alone evaporation. Some community members also interfere with the available water. Infact they at times resort to violence as identified

by KVDA. Among the measures which have been taken to tackle the insufficiency are the construction of reservoirs in the farms (by KVDA), the use of sprinklers (by Arror Catholic Mission), frequent monitoring and maintenance of the furrows by all irrigators and the employment of furrow guards by KVDA.

As yet, KVDA and the local folks have not fully resolved the land acquisition versus employment provision contest. All in all, the authority (KVDA) cannot do without the current approach of engaging casuals as the seasonality of crop production demands.

Levels of crop production per unit area for the two organizations are quite substantial. However, they still have alot of potential when put against Jaetzold et. al. (1983) and Ministry of Agriculture (1986) records. In addition, they sell almost if not all what is realised from the farms. Apparently there are some marketing obstacles; these include low effective demand within the location and its neighbourhood, and limited accessibility to markets outside the location (e.g Eldoret) due to poor transport system.

Otherwise, within the location both organizations are financially and thus materially better placed than

the local folks. KVDA and Arror Catholic Mission own farm machinery such as tractors with their accessories and vehicles which are used in farm cultivation and transportation of commodities.

It is good to finally point out that the two organizations are steering development within the location. What may seem more unfortunate, and rightly so, is the failure of KVDA to quickly, coherently and perfectly undertake projects (e.g. the uncompleted repair on Kabonon-Kapkamak furrow, and the shattered initial construction of the planned Resim furrow) it offers to work on for the benefit of the local folks.

REFERENCES:

Jaetzold, R. et. al. - 1983 - Farm Management Handbook of Kenya: Vol. II/B, Central Kenya, Ministry of Agriculture, Nairobi.

Ministry of Agriculture - 1986 - "Keiyo Marakwet District Annual Report, 1985; Department of Agriculture, Iten.

CHAPTER SIX

STUDY SYNTHESIS, RECOMMENDATIONS AND CONCLUSIONS

6.0 STUDY SYNTHESIS:

Irrigation is important in Kenya's economy. It provides employment, food and generates income to irrigators and the nation at large. Much of the irrigation potential is as yet unexploited. The national policy guidelines of developing it is being improved though with indications of bias towards large scale and modern technology based irrigation systems. Infact, the National Irrigation Board (NIB) is entirely centred towards the large scale public irrigation schemes. The functions of NIB are explicitly stated in the Irrigation Act; which in itself (the Act) is just but an NIB Act. Therefore, the Act has a limited scope. Meanwhile, policy guidelines as regards the development of indigenous (traditional) irrigation systems are basically fatuous and implicit in context.

Arror location which is bestowed with agriculturally rich alluvial soils on its valley floor is characterized by low, variable and quite unreliable rainfall amounts, that coupled with the very high evaporation rates

contributes towards moisture deficiency in crop production. Indeed, the location falls within the marginal agro-ecological zones of Kenya.

River Arror is the only major and perennial water course which crosses the location. The river whose key catchment area is the Cherangany hills forests enters the location as it descends the steep Elgeyo escarpment. The river has become a noteworthy source of irrigation water in the location. Water is abstracted from the river via gravity fed furrows some of which were constructed more than three hundred years ago. Except for Kipkat (KVDA) furrow which is owned and operated by KVDA, all the other furrows belong to the local folks. The local folks own the furrows on a clan basis and operate them using egalitarian principles with well instituted, though latent, rules and conventions free of bureaucracy. This is what largely constitutes the indigenous irrigation system.

Irrigated farming has led to a fairly reliable crop production. This is so because many households concede that they could not have survived in Arrow location were it not for irrigation; secondly, crop production by both KVDA and Arror Catholic Mission rely on irrigation for success. Moreover, irrigation has enabled the diversification of crop production. Because, among the

major crops grown which include: finger millet, sorghum, maize, cowpeas, bananas, cassava, pawpaws, and sweet potatoes; the latter four, namely: bananas, cassava, pawpaws and sweet potatoes cannot do without irrigation. The crops grown are mainly food crops largely meant for subsistence. In fact whatever is sold by some households is usually aimed at generating income which is apparently spend in acquiring basic needs.

Bananas, cassava, pawpaws, finger millet, sorghum and cowpeas are among the crop products marketed by some households. On the other hand, KVDA markets all what it grows which include maize, sorghum, cowpeas, groundnuts, chillies, cotton and vegetables. Arror Catholic Mission sells most of what it also grows e.g. maize, vegetables, pawpaws and citrus fruits.

Unfortunately, low demand of majority of the said products both within the location and its neighbourhood is a noteworthy problem in marketing. Another key obstacle in marketing is cumbersome transportation of commodities intended for sale particularly in markets outside the location e.g. Kapsowar - across the steep Elgeyo escarpment which as yet remains a physical constraint giving the location its limited accessibility to and from the neighbouring

highland areas. Besides the above marketing problem is the prevalency of price fluctuations which aggravates the marketing of crop products. In view of the above problems added to lack of appropriate storage nor processing facilities, there emerges an explicit and apparent state of wastage of resources. Because, what is intended for sale is either sold at very low prices or just goes to waste as revealed by the study.

The indigenous irrigation system is apparently labour intensive. Inspite of being widely venerated, the performance of indigenous irrigation system is generally poor. This is usually caused by the insufficiency of irrigation water whenever need is utmost. The insufficiency is attributable to seasonal fluctuation of water at the main sources particularly River Arror. The fluctuation is exacerbated by gold planning along the river as it crosses Koibarak location and also the destructive activities of man at the catchment area such as the encroachment of settlements into the forest.

Leakages and seepages of water as it flows along the furrows exalts the insufficiency of irrigation water. Cases of furrow breakdowns to levels beyond the ability of the users to repair are also contributory factors to the insufficiency. A breakage of such

magnitude tends to adversely affect irrigated farming as is the case with Kabonon-Kapkamak furrow. Yet another cause of insufficiency is the interference by some irrigators on the agreed distribution of water. This case of contraventions of institutions affects the entire irrigation system. That is, even the KVDA and Arror Catholic Mission farms are affected.

The wild flooding method of spreading the irrigation water as applied by the local folks is very wasteful. Could be the most efficient methods of spreading the water are those applied by KVDA and Arror Catholic Mission. KVDA is more inclined towards preparing corrugations and also using a watering can. Arror Catholic Mission uses both wild flooding and sprinklers plus a watering can. All in all, the wild flooding method is wasteful. Pests such as birds, monkeys, rats, weevils, and ants are a real menace in crop production. Goats also do alot of havoc.

The irrigators have made attempts of averting the insufficiency of irrigation water. All the irrigators namely: the local folks, KVDA and Arror Catholic Mission get involved in frequent maintenance of the furrows. KVDA has gone further such that it has constructed small dams in its farms for water reservation. It

(KVDA) has also employed guards who have to help deter intruders unlike the local folks who either warn or impose a fine or curse any interferers of water sharing. In addition, local folks have resorted to cultivating small plots most of which are in Arror and Chepkum sublocations - areas with access to fairly substantial irrigation water.

It has also been established that the land carrying capacity within the location has been outstripped, thus resulting in overstocking. In addition, shifting cultivation has been noted as being very prevalent. To piece it together is the revelation that strong but temporary fences are established every year. The fences are to ward-off the largely untrailed free grazing livestock particularly goats. The overstocking, shifting cultivaton and the frequently temporary fences have contributed towards degradation of vegetation. In fact the overstocking and shifting cultivation have engendered soil erosion.

To enhance crop production, a few of the local farmers apply animal manure. Arror Catholic Mission applies not only animal manure but also inorganic fertilizer. KVDA uses only inorganic fertilizers. The lack of technical assitance given to the local

peasants by the government technical Ministry directly concerned with crop production particularly irrigated farming is yet another manifestation of this study. The entire location has no technical assistant who can guide the local farmers on better crop farming. The best they get as yet is the little material support in the repairs and maintenance of furrows from both KVDA and Arror Catholic Mission, and advisory services received by a few households from Arror Catholic Mission and the observation of practical farming-cum-demonstrative services from both organizations. The truth is that the advisory services, and material support are in many cases skewed and poorly administered; and observatory services comes from too complex and expensive technology not affordable by individual households.

The fact that irrigation policy is not well defined with regard to indigenous irrigation system may be the primary cause of why the Ministry(s) concerned, particularly Ministry of Agriculture is not keen with what is generally going on in the location. This is where policy guidelines should seek to improve the indigenous technology based irrigated farming.

It is as well important to note that the initial fear of attacks by enemies at the valley floor, fear

of malaria at the same and the need to currently preserve land at the same for agricultural purposes coupled with the need to be close to perennial potable water sources has led to settlements being mainly confined to the escarpment. The distance from the settlements to the cultivated farms can be as long as 5 km. and may involve 3 daily man-hours being used per individual in walking such distances. However, because the question of what alternative economic opportunities have been forgone in using the 3 hours may not be answered satisfactorily at this juncture, then it is deemed fair to meanwhile shelf the whole issue of distance to the farm from homesteads.

A reflection on other uses of irrigation furrows depicts that domestic water requirements such as washing of clothes, bathing and consumptive (potable) purposes are also from the furrows. Moreover, the furrows are in many cases accessible and thus being primary sources for livestock watering. Such multiplicity of usage has by implication led to human health problems. For instance, diarrhoea which in itself can be traced to the consumption of contaminated water had the third highest number of reported cases in Arror Health Centre.

Certainly, irrigation is vital in Arror location. The study reveals that the crop production levels by both KVDA and Arror Catholic Mission are generally low. It as well follows that even the local folks produce at levels below the existing potential. Even what is realised is further subjected to obstacles that also need to be tackled. Therefore in the next section recommendations are made with regard to the manifestations of the study.

6.1 RECOMMENDATIONS:

The following recommendations are hereby presented with the hope that societal progress will be stepped up as a result.

- To begin with, drought resistant and early maturing crop varieties should be emphasised. The farmers should also be advised on the need for early planting. All the above are aimed at reducing dependency on irrigation. Meanwhile, the furrows should be relentlessly maintained and repaired so as to curb leakages. Along some sections of the furrows, metallic and/or concrete aqueducts should be constructed so as to combat breakages and also check on excessive seepages. Perfection with haste should be the motto while repairing and maintaining all furrows.

By and large, the ongoing repairs of the broken Kapteren site along Kabonon-Kapkamak furrow should be given first priority and hence be completed through the joint efforts of the local folks and KVDA.

Minor dams should be established through the Plant Hire Service (P.H.S.) with the purpose of creating water reservoirs. The reserved waters is to be used during the times of greatest need for irrigation let alone being for regulating flows. In this way irrigators will be able to store the water when need is low or whenever a flash flood ensues. The reservation of flash floods is vital in areas where the existing furrows cannot serve particularly in Resim and Koitilial sublocations. In addition, the local farmers should be assisted particularly by KVDA, Arror Catholic Mission and the Ministry of Agriculture by way of preparing corrugations at their farms for the purpose of efficient spreading of irrigation water in an effective manner.

- Against the above recommendation arises the need to boost and emphasis the provision of extension services. Technical assistants who can guide the farmers in their day-to-day farming are necessary in the location. The guidance is to seek to improve productivity and development as it were. The intensive and widespread

use of, say, farm yard (animal) manure to improve soil fertility and the need to reduce livestock numbers and halt shifting cultivation can largely be achieved through extension services.

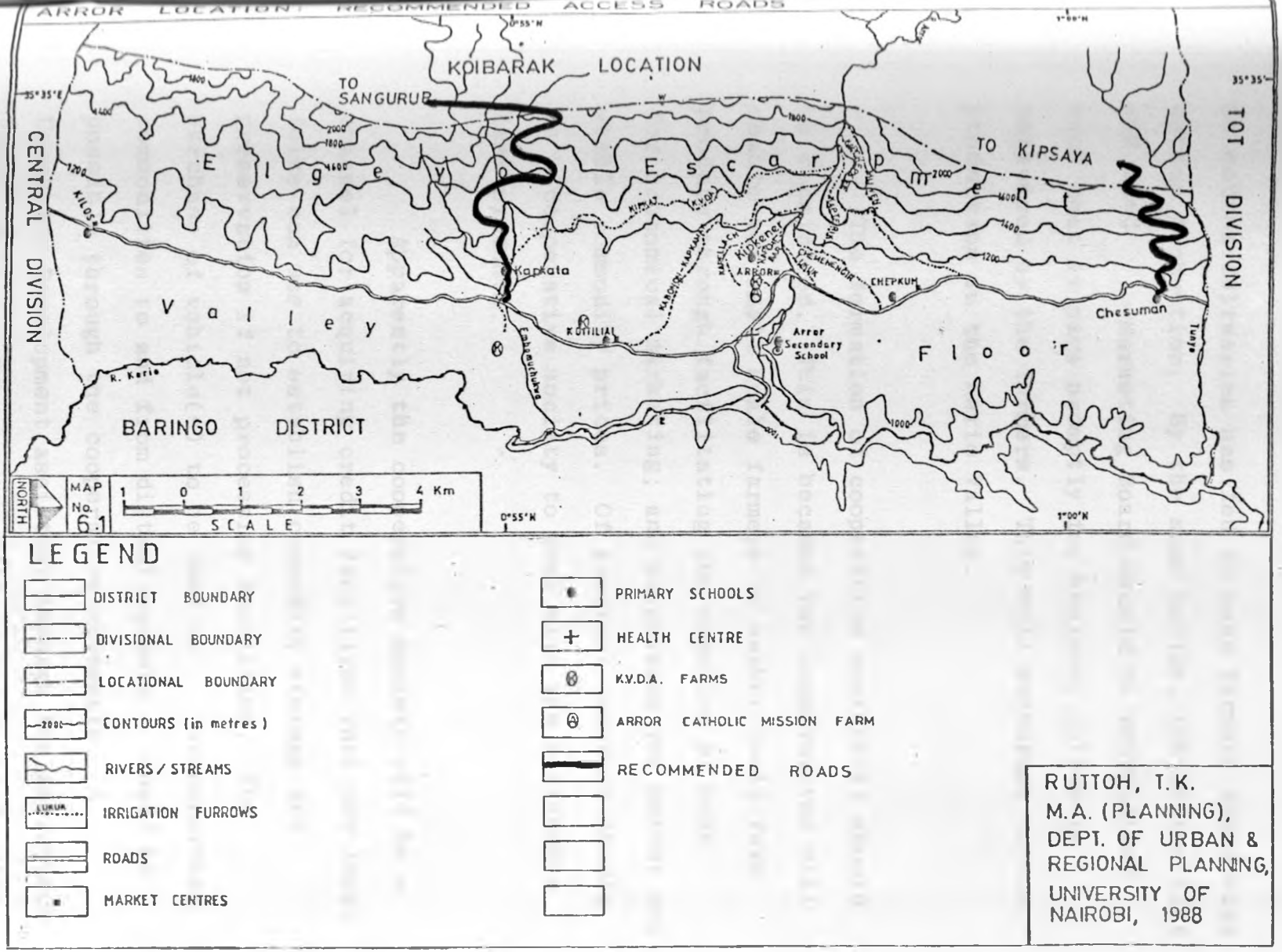
In addition, and as a result, soil erosion will be reduced thus enhancing envionmental conservation. The local farmers should also be advised on the significance of trailing their livestock. If this is done then the livestock menace on crops will be checked and even fencing will not be so rigorous. A measure in this case is that in case some livestock (particularly goats) destroy any crops then the owner of the livestock concerned should be fined. Such a measure will not only lead to the trailing of livestock but (may) cause reduction in numbers.

- Access roads be constructed to link the location directly with Koibarak location. Two such roads are proposed namely Resim (Chesuman) to Kipsaya being the most urgently recommended. To follow this will be another road from Kapkata to Sangurur. These two roads will break up the limited vehicular accessibility to the location from the highlands. The agents to be involved in the road programme will be the local folks providing much of the required labour, the Ministry of Public Works offering the materials and equipment;

and KVDA and Arror Catholic Mission because of their interests in the location should also assist accordingly. The roads will attenuate the transport related marketing problems. Map 6.1 on page 176 shows the recommended roads.

- However, the Chesongoch - Biretwo road should be gravelled and maintained so that it becomes passable throughout the year. This also applies to the Chesongoch - Chesoi road which needs to be widened as well. This is indeed a very vital and urgent programme that once undertaken will enable the local farmers, KVDA and Arror Catholic Mission to overcome the problem of impassable roads which they currently face. It is hereby considered that the local leaders and administrators should request both KVDA and Arror Catholic Mission to assist the local farmers in marketing their products at markets such as Eldoret. The crops of great concern in this case are bananas, cassava and pawpaws.

In fact, the Horticultural Crop Development Authority (HCDA) should spread its functions to the valley and Arror location in particular. Be that the case, it should avoid operating like the Cotton Lint and Seed Marketing Board (CLSMB) whose delayed payments



RUTTOH, T.K.
M.A. (PLANNING),
DEPT. OF URBAN & REGIONAL PLANNING,
UNIVERSITY OF NAIROBI, 1988

on cotton deliveries has led to many farmers abandoning cotton production. By the same notion, the Cotton Lint and Seed Marketing Board should be reorganized such that it pays promptly for whatever cotton is delivered by the farmers. This will encourage cotton production in the Kerio Valley.

- The formation of cooperative society(s) should be considered. This is because the cooperatives will enable the small scale farmers to market their farm produce through facilitating the creation of bulk for economical marketing; and bargaining for better and stable commodity prices. Of greatest interest should be a cooperative society to deal with the perishable farm products.

Apparently the cooperative society will be a channel for acquiring credit facilities that the local folks can use to establish commodity storage and preservation if not processing facilities. The purchase of vehicle(s) to be used in transporting commodities to and from distant markets - shall be possible through the cooperative movements. A Community Development assistant through the assistance of the District Cooperative Officer and local leaders can spearhead the formation of cooperative societies.

- Farm inputs such as inorganic fertilizers and certified seeds should be stocked within the location to ensure that peasant farmers can get access to them particularly for the benefit of the few who as yet purchase from distant markets hence incurring high transport costs. In essence, there is a likelihood that if stocked within the location, many households can afford them. Such a venture can be undertaken by the Cooperative Society(s) if formed. But at the moment KVDA and Arror Catholic Mission can do it better.

- The contest between KVDA and the local folks in view of land acquisition and employment can be ironed out if KVDA can draw and display an annual programme showing when it expects to employ or lay off casuals. In any case, adherence to agronomic patterns can be used to specify how long a casual can be engaged. About the land, only the much which is useful for research say 40 acres at most, is just enough to be acquired. Any improvements on vast areas should be done for the local folks. This will reduce conflicts.

- While all the above are in progress, alluvial gold planning in Koibarak location should be banned completely. Also human settlements and activities deemed malicious and injurious to the Cherangany Hills

forests - which is the key catchment area of River Arror - should not be allowed at all. Over and above all, the local administration should punish those who interfere with distribution of irrigation water. In fact, legal action should be applied to deter such illegal diversion with more severe punitive measures being taken against those who use violence to divert the water.

- With the assistance of the Ministry of Health, and Arror Catholic Mission health centre jointly with educational institutions within the location, in majority of cases, the members of the community should be advised and earnestly requested to be treating or drawing the water they consume from sources which are not tampered with by livestock and persons who are bathing and/or washing clothes. By and large, households should be advised not to use the basic sources of potable water for contaminative purposes. This is basically the work of a primary health care unit.

- Policy guidelines related to the improvement of irrigation are overlooking the contributions of indigenous irrigation systems. Thus, it is only fair if such guidelines can appreciate the role of the indigenous systems so that measures of improving it can be designed. Apparently, the Irrigation Act of

Kenya needs to be revised and amended to cater for all irrigation types.

- The technology to be applied in irrigation within Arror location should seek to be labour intensive and less complex in light of improving on the cherished indigenous irrigation system. For all practical and less disappointing considerations, the gravity fed furrow technology with corrugations at farm level needs to be emphasized.

- To Researchers the following is suggested. A thorough historical development of the Indigenous Irrigation System. Secondly, the total actual (and potential) production be studied so as to ascertain whether processing facilities can be established in the areas under the Marakwet Indigenous Irrigation System - particularly as regards horticultural products.

6.2 CONCLUSIONS:

Irrigation is essential in Kenya. Policy guidelines towards its development is being improved as time goes. However, the aspects being addressed mainly relate to modern technology based irrigated farming. Actually, indigenous technology based irrigation systems are given a flimsy treatment in the policy guidelines.

Arror location boasts of a well established indigenous irrigation system. It is a system rich in aspects of public (community) participation bound together by egalitarian principles. It is a system which has enabled many families to survive in the location which itself falls within the marginal agro-ecological zones of Kenya. The performance of the indigenous system has been generally poor; the cause of which is largely poor technology and service provision.

Efforts being made by both KVDA and Arror Catholic Mission towards modernizing (improving) irrigation in Arror location are commendable. These include the application of improved technology and diversification of crop production. The virtues of these two organization should be considered and emulated where possible - as a model of improving indigenous irrigation systems by the community. Much better results can even emerge. Therefore, the recommendations suggested in this study, as presented in the preceding section, are thought of as being able to steer not only the improvement of particularly indigenous irrigation system but also enhance rural development - especially in areas under the influence of Marakwet Indigenous Irrigation Systems.

BIBLIOGRAPHY

Alila, P.O - 1986 - "Grassroots Participation in Small and Large Scale Irrigation Agriculture: The Kenyan Experience"; A paper presented in the Joint Seminar on Irrigation Policies in Kenya and Zimbabwe, 27th - 28th November 1986 Nairobi, Kenya.

Arnon, I. - 1981 - Modernization of Agriculture in Developing Countries: Resources, Potentials and Problems; John Wiley, New York.

Bromley, D.W. - 1982 - Improving Irrigated Agriculture: Institutional Reform and the Small Farmer; World Bank Staff Working Paper No. 531; World Bank, Washington D.C.

Cappon, J.C. - 1985 - Elgeyo Marakwet District Atlas; ASAL Development Programme, Iten.

Carruthers, I. and Weir, A. - 1976 - "Rural Water Supplies and Irrigation Development" in Heyer, J. et. al. (eds) - Agricultural Development in Kenya; Oxford University Press, Nairobi.

Chambers, R. - 1983 - Rural Development: Putting the Last First; Longman, London.

Chambers, R. and Moris J.R. - Mwea: An Irrigated Rice Settlement in Kenya; Weltforum Verlag, Munich.

Critchley, W.B.S. - 1983 - "Agricultural Developments in Marakwet: Some controversial issues", in Kipkorir, B.E. et. al. (eds) - Kerio Valley: Past, Present and Future; Eleza Services, Nairobi.

Dubel, I. and de Kwaasteniet, M. - 1983 - Irrigated Agriculture as a base of subsistence: The case of the Marakwet, with reference to the Labour of Women; University of Amsterdam, Department of Human Geography, Amsterdam.

Eicher, C.K. and Baker, D.C. - 1982 - Research on Agricultural Development in Sub-Saharan Africa: A Critical Survey; Michigan State University, Michigan.

Haring, L.L. and Lounsbury, J.F. - 1983 - Introduction to Scientific Geographic Research; Third edition, Wm.c. Brown Company, Dubuque, Iowa.

Hennings, R.O. - 1951 - African Morning; Chatto and Windus, London.

Huxley, E. - 1959 - "African Water - Engineers" in Geographical Magazine, Vol. 32 No. 4.

Jaetzold, R. and Schmidt, H. - 1983 - Farm Management Handbook of Kenya; Vol. II/B, Central Kenya, Ministry of Agriculture, Nairobi.

Kenya, Rep. of - 1965 - Sessional Paper No. 10 of 1965 on African Socialism and its Application to Planning in Kenya; Government Printer, Nairobi.

_____ - 1966 - Development Plan, 1966-1970; Government Printer, Nairobi.

_____ - 1970 - Kenya Population Census, 1969; Vol. I, Statistics Division, Ministry of Finance and Economic Planning, Government Printer, Nairobi.

_____ - 1972 - The Water Act, Chapter 372 of the Laws of Kenya; Government Printer, Nairobi.

_____ - 1980 - Elgeyo Marakwet District Development Plan 1979 - 1983; Ministry of Economic Planning and Development, Government Printer, Nairobi.

Kenya, Rep. of - 1980 - National Livestock Development Policy; Government Printer, Nairobi.

_____ - 1981 - Kenya Population Census, 1979; Vol. I, Central Bureau of Statistics, Ministry of Economic Planning and Development, Government Printer, Nairobi.

_____ - 1981 - Sessional Paper No. 4 of 1981 on National Food Policy; Government Printer, Nairobi.

_____ - 1983 - Fifth National Development Plan, 1984 - 1988; Government Printer, Nairobi.

_____ - 1984 - Water Resource Assessment Study: Kerio Valley (Elgeyo Marakwet and Baringo Districts); Main Report, Delf, The Netherlands.

_____ - 1986 - Irrigation Act, Chapter 347 of the Laws of Kenya; Government Printer, Nairobi.

_____ -1986 - Kenya Economic Survey, 1986; Central Bureau of Statistics, Ministry of Planning and National Development, Government Printer, Nairobi.

_____ - 1986 - Sessional Paper No. 1 of 1986 on Economic Management for Renewed Growth; Government Printer, Nairobi.

_____ - 1987 - Kenya Economic Survey, 1987; Government Printer, Nairobi.

Kimani, J.K. - 1986 - "Irrigtion development - Institutional Aspects"; A paper presented in the joint Seminar on Irrigation Policies in Kenya and Zimbabwe, 27th - 28th November 1986, Nairobi, Kenya.

Kipkorir, B.E. and Welbourn, F.B. - 1973 - The Marakwet of Kenya: A preliminary Study; Kenya Literature Bureau, Nairobi.

Kipkorir, B.E. - 1983 - "Historical perspectives of Development in the Kerio Valley"; in Kipkorir, B.E. et. al. (eds.) - Kerio Valley; Past, Present and Future; Eleza Services, Nairobi.

Kipkorir, B.E. and Ssennyonga, J.W. (eds) 19 * Socio - Cultural Profile of Elgeyo Marakwet District; Uzima Press, Nairobi.

K.I.S. - 1983 - "The future of Kibirigwi Irrigation Schem (KIS) and Kibirigwi Farmers Cooperative Society"; Draft Plan of Operation, 1983 - 1984, Irrigation and Drainage Branch, Ministry of Agriculture, Nairobi.

Lele, U - 1975 - The Design of Rural Development: Lessons from Africa; John Hopkins University Press, Baltimore.

Lowe, R.G. - 1986 - Agricultural Revolution in Africa?: Impediments to Change and Implications for farming, education and for Society; Macmillan, London.

Michael, A.M. - 1978 - Irrigation: Theory and Practice; Vikas, New Delhi.

Ministry of Agriculture - 1986 - "Keiyo Marakwet District Annual Report, 1985"; Department of Agriculture, Iten.

Moi, D.T. - 1986 - Kenya African Nationalism: Nyayo Philosophy and Principles; Macmillan,London.

Mwenge International - 1986 - "Intergrated Regional Master Plan: Kerio Valley Development Authority (KVDA)"; Draft Final Report, Mwenge International Associates Ltd., Nairobi, Kenya.

National Irrigation Board (NIB) - 1986 - " Annual Report and Accounts 1983 - 1984"; Nairobi, Kenya.

Palutikof, J.P. - 1981 - "Irrigation in Kenya with Special reference to the Dry areas"; in Campbell, D. and S.E. Migot - Adholla (eds) - The Development of Kenya's Semi - Arid Lands; IDS Occasional Papers No. 36, University of Nairobi.

Review Mission - 1986 - "Small Scale Irrigation Development Programme, Phase III"; Joint Kenya - Netherlands Review Mission, Nairobi, Kenya.

Ruigu, G.M. - 1986 - "Some policy issues on Irrigated Agriculture: The case of Large Scale Public Irrigation Schemes"; A paper presented in the Joint Seminar on Irrigation policies in Kenya and Zimbabwe, 27th - 28th November 1986, Nairobi, Kenya.

Rydzewski, J.R. - 1968 - Irrigation Development in Africa South of the Sahara: Potentials and Possibilities 1965 - 1985; FAO, Rome.

Soper, R. - 1983 - "A Survey of the Irrigation Systems of the Marakwet" in Kipkorir, B.E. et. al. (eds) - Ibid.

Ssennyonga, J.W. - 1983 - "The Marakwet Irrigation System as a model of a Systems - Approach to Water Management"; in Kipkorir, B.E. et. al. (eds) Ibid.

Ssennyonga, J.W. - 1986 - "Indigenous perceptions and Utilization of Resources and their Challenge to development planning"; A paper presented at Seminar on Interaction of Man, Space and Environment over time, Organized by Department of Land Development, University of Nairobi, 2nd - 5th April 1986, Nairobi.

Stern, P.H. - 1979 - Small Scale Irrigation: A Manual of Low-cost Water Technology; Intermediate Technology Publications, London.

Swynnerton, R.J.M. - 1955 - A plan to Intensify the Development of African agriculture in Kenya; Government Printer, Nairobi.

Task Force Report - 1986 - "Irrigation Development in Kenya"; A report of an Interministerial Task Force, Nairobi, Kenya.

Van-Hoorn, J.W. et. al. - 1976 - Project proposals for Research, Training and Project Guidance in Irrigation and Drainage in Kenya; Ministry of Foreign Affairs, DITC. Netherlands.

Van-Klinken, M.K. - 1987 - "Formal Mistakes and Informal Lessons from Irrigation in Kenya: The Pokot Traditional Furrow Irrigation"; African Water Technology, International Conference, Organized by World Water, 24-26th February, 1987, Nairobi, Kenya.

Walker, H.H. - 1984 - "Problems of the Organization of Irrigation Projects: A Systems Orientated Study of Irrigation Projects in Developing Countries"; Applied Geography and Development, A Biannual Collection of Recent German contributions, Vol. 23, Institute for Scientific Cooperation, Tubingen.

World Bank - 1987 - Study on Options and Investment Priorities in Irrigation Development, Kenya; Country Report, Enroconsult. , Arnhem, The Netherlands.

APPENDIX I

HOUSEHOLD QUESTIONNAIRE

Number ----------

Sublocation: ----------

Date: ----------

Interviewer: ----------

BACKGROUND INFORMATION

1.(a) Name of Respondent ----------

(b) Sex: Male ---------- Female ----------

(c) Age ----------

(d) Age set ----------

(e) Place of Birth ----------

(f) If place of birth is anywhere out of

(Arror Location then (i) Specify ----------

(ii) What was the cause of migration ----------

(iii) Length of stay in Arror Location ----------

(g) Clan ----------

(h) Village ----------

(i) Occupation ----------

(j) Level of education ----------

(k) Household head Yes --------- No ----------

l) If not Household Head, state relationship ----------

---

m) Household size ----------

n) Kindly state the following information about household members.

Relation to Head	Age	Sex	Level of Education	Place of Birth	Occupation

II. HOUSEHOLD FARMING PRACTICES

2. a) What is your state of land ownership in the location? (include size if applicable)

i) Freehold ----------

ii) Leasehold ----------

iii) Communal ----------

iv) Other, specify ----------

b) Do you own land in any other place outside the location? Yes/No.

c) If Yes, i) State type of ownership ----------

ii) Size of land ----------

iii) Name of Place ----------

3. a) What farming practices do you undertake in Arror Location?

i) Crop production only ----------

ii) Livestock husbandry only ----------

iii) Both crop and livestock husbandry ----------

b) Where is the farm you cultivate for crop production?

i) at the valley floor (kew) ----------

ii) on the escarpment slopes (Lagam) ----------

iii) other, specify ----------

c) How do you water your crop?

i) Irrigation only ----------

ii) Rainfed only ----------

iii) Both irrigation and Rainfed ----------

4. a) For the irrigation you apply, where is the source of water? R. ----------

b) How is the water harnessed?

i) Use of furrow ---------- Name it ----------

ii) Other, specify ----------

5. a) Which of the following problems do you experience?

i) Channel undermining ----------

ii) Channel lower embankment breakages --------

iii) Unnecessary leakages ----------

iv) Clogging ----------

v) Any other, specify ----------

b) How do you tackle each of them? ----------

c) What implements are used? ----------

d) How do you get the implements? ----------

e) Who does it? ----------

f) How are they paid? ----------

g) Is the method of paying referred to above in (f) the same one which was applied by earlier generations? YES/No.

h) If no, what is the difference? ----------

---

i) What is the possible cause? ----------

---

6. a) How far is your irrigated farm from the homestead (settlement)?

i) up to 500 metres ----------

ii) 500-1000 metres ----------

iii) 1000 - 2000 metres ----------

iv) Over 2000 metres ----------

b) Are you cultivating the same farm which was being cultivated by your

i) Great grand parents -- Yes/No

ii) Grand parents -- Yes/No

iii) Parents -- Yes/No

c) (i) Were they using the same irrigation channel?

Yes/No Great grand parents ----------

Grand parents ----------

Parents ----------

(ii) If No, which one were they using

- Great grand parents ----------
- Grand parents ----------
- Parents ----------

d) (i) Were they operating and maintaing the system the same way it is being done currently?

Yes/No

(ii) If No, what were the differences? ----------

7. a) What type of crops do you grow?

---

b) What is the size of plot cultivated for each crop?

---

c) i) Is there any crop which can be grown without the use of irrigation? YES/No

---

ii) If Yes, kindly name it/them ----------

d) How do you prepare the land

(i) Before sowing? ----------

(ii) For irrigation----------

e) What implements are used? ----------

f) How do you acquire them? ----------

g) (i) Are all the irrigated plots (if more than one) in the same local econological zone? Yes/No ----------

ii) If No, specify where each is ----------

h) What is the total annual/seasonal quantity of output for each crop?

---

8. a) What time/season of the year do you need the irrigation water and for what purpose?

Time/season	Purpose(s)

b) Do you at any particular time get the amount you want? Yes/No

---

c) If No, what are the causes of the shortfall?

---

d) How do you solve it? ----------

e) How do you spread the water you get and using what implements?

---

g) Who does it?

i) Individual (respondent) alone ----------

ii). Any other person(s) ----------

h) Why the person(s) named in (g)? ----------

---

9. a) What farm inputs do you use in crop production?

i) Certified needs ----------

ii) Inorganic fertilizer ----------

iii) Animal manure ----------

iv) Pesticides ----------

v) Others,(specify) ----------

b) Which are the sources for whatever you use?

---

c) What problems do you face in getting the inputs you want? ----------

d) What attempts do you take to tackle such problems?

---

10. a) How do you store your various types of farm crop produce? ----------

b) Is the store for each crop in the farm or within the homestead?----------

c) If it is within the homestead, then who transports the yield after harvesting from the farm? --------

---

d) What problems do you experience in storage of crop produce? ----------

e) What attempts have you made to solve some of the problems? ----------

f) What do you think could other solutions be? ----------

11. a) Do you experience food shortages? YES/NO ----------

b) If Yes, at what times

i) All years and throughout each year ----------

ii) Every year but seasonally ----------

iii) Occassionally, and only when there is drought ----------

iv) Any other, specify) ----------

---

c) How do you try to overcome such problems? -------

---

12. a) Of your crop produce, which ones do you well?

---

b) (i) What is the quantity sold every season?

(ii) Is the quantity consistent? Yes/No -------

(iii) If no, what is the cause? ----------

c) (i) Where are/is the markets?----------

(ii) How far? ----------

(iii) What means of transport do you use? ----------

(iv) What is the selling price per unit of the output? ----------

(v) Is the selling price consistent throughout each year?Yes/No ----------

(vi) What are your comments on this issue? ----------

d) What other problems do you experience in marketing your crop produce? ----------

e) What do you think could be the solution(s) to the marketing problems? ----------

13. What assistance do you get from the following organizations particularly in crop production relating to irrigation?

a) (i) Ministry of Agriculture ----------

(ii) Kerio Valley Development Authority (KVDA)

(iii) Provincial Irrigation Unit (P.I.U.)

(iv) Voluntary organizations and institutions (name them) ----------

(v) Any other, specify? ----------

b) (i) If No or there is, what other assistance could you want them to offer in this field of production (particularly irrigated farming? ----------

(ii) Could you be willing to pay for the services you would like to get?
YES/No ----------

c) (i) Has any of the organizations caused any conflict? YES/No ----------

(ii) If Yes, what is the conflict ----------

14. a) What crops are grown without any reliance at all on irrigation? ----------

b) Can you do without irrigation at all?
YES/NO ----------

15. What other comments would you like to make about crop production and irrigation in particular?
----

16. a) (i) What type of livestock do you keep in Arror Location? ----------

(ii) How many of each type? ----------

b) Do you keep them mainly for (kindly specify Type)?

i) Meat ----------

ii) Milk ----------

iii) Live sales ----------

iv) Any other? Specify ----------

17. a) Where are the livestock(where applicable)?

i) Kept ----------

ii) Reared ----------

iii) Watered ----------

b) Who does the rearing (tending)? ----------

18. a) In case there is any livestock sales at any year, where is the market? ----------

b) What are the common reasons for livestock selling? ----------

19. a) What problems do you face in livestock keeping?

---

b) What help do you get from the Ministry of Livestock Development (or any other specify) in tackling some of the problems.

c) How do you solve some of the problems individually as an household/Clan/Sublocation/ Location? ----------

III. MISCELLANEOUS

20. a) Do you belong to any co-operative society or any other organization? YES/NO ----------

b) (i) If Yes, Name it ----------

(ii) How does it help you? ----------

21. a) Do you get any credit facilities? YES/NO ----------

b) If Yes, for what purpose do you take it? ----------

c) and from where? ----------

22. a) Where do you get the following services?

(i) Health ----------

(ii) Commercial (shopping) ----------

(iii) Education ----------

(iv) Religious ----------

(v) Others, specify ----------

b) (i) Source of domestic water River ----------
furrow ----------

(ii) How far is it ---------- metres/Kms.

23. a) What are some of the major constraints to development in Arror Location or the valley in general?

(i) Sociological ----------

(ii) Institutional ----------

(iii) Economic/financial ----------

(iv) Environmental ----------

(v) Technical ----------

(vi) Other, specify) ----------

b) What do you think could be possible solutions?

---

c) (i) Are there any favourable attempts? Yes/No

(ii) If Yes, specify ----------

24. Any other comment(s) you would kindly want to make or point out? ----------

THANK YOU.

APPENDIX II

DEVELOPMENT AND VOLUNTARY ORGANIZATIONS INTERVIEW SCHEDULE

1. a) Interviewer ---------- Date --------

b) Interviewee ----------

c) Responsibility ----------

d) Name of Organization ----------

e) In which (i) Location ----------

(ii)Sublocation ----------

f) Year founded in (i) Location ----------

(ii) Sublocation ----------

2. Main objectives of Organization :-

---

3. Are all the above applicable in Arror Location?

Yes/No ----------

3. If no, which are your objectives and current functions in Arror Location?

---

5. a) Type(s) of land ownership ----------

b) Size of land owned ----------

c) How was the land acquired? ----------

---

6. a) What activities do you undertake on the land? ----------

---

b) How do you water your crops? (that is if crop cultivation is among the land uses)

(i) Irrigation only ----------

(ii) Rainfed only ----------

(iii) Both irrigation and rainfed ----------

c) Which is the source of water for irrigation?

---

d) How is the water harnessed? ----------

---

e) When was the channel constructed? ----------

---

f) What were the implements used in the construction? ----------

---

g) How were the implements acquired? ----------

---

h) Who were involved (employed) in the construction exercise (kindly state their skills and Number)----------

i) How long is the channel? ----------

j) What was the total cost for channel construction Kshs. ----------

k) Who owns the channel now? ----------

7. a) Who operates and maintains the irrigation channel? ----------

b) How frequent are such works performed? ---------

c) How much do you pay the people employed to do such works per year? Kshs. ----------

d) How many are they? ----------

e) What implements do they use? ----------
---

f) How do you get the implements? ----------

g) What is the annual total cost of the implements? ----------

h) Which are the common occurences which call for maintenance? ----------

i) What problems do you experience in operating the irrigation channel? ----------

j) How do you solve them? ----------

---

8. a) What factors do you consider in and for the quantity of water you harness at any particular time? ----------

b) Do you always get the amount of water you need? Yes/No ----------

c) If No, what are the causes of the shortfalls?

---

d) How do you meet such shortfalls? ----------

---

9. a) At what time (or season) of the year do you need the water most? ----------

b) Why do you need it at that particular time (or season) most? ----------

c) (i) Do you experience any problem(s) at the time (season) of utmost need? Yes/No ----------

(ii) If yes, what is the cause? ----------

(iii) How do you tackle such problems?

---

10. a) What type of crops do you grow? ----------

b) What is the size of plot cultivated for each crop? ----------

c) (i) Is there any crop which can be grown without the use of irrigation?
Yes/No ----------

(ii) If Yes, kindly name it/them ----------

11. a) (i) How do you prepare the land for irrigation? ----------

(ii) What implements do you use in so doing?

(iii) How do you acquire the implements?
----

b) Which of the following farm inputs do you use?

- Certified seed ----------
- Inorganic fertilizer ----------
- Animal manure ----------
- Pesticides ----------
- Other, specify ----------

c) For any of the inputs used, state:-

(i) the source ----------

(ii) quantity used ----------

(iii) Unit cost ----------

(iv) How you get it into the farm ---------

d) (i) What problems do you experience in getting the inputs?

(ii) If any, how do you overcome them or could they be overcome ----------

12. a) What is the total quantity of your field for each crop in each particular year/season?

---

b) How do you store the yield? ----------

c) Where is the storage site:-

(i) in the farm ----------

(ii) in the farm settlement compound ------

(iii) Any other, specify ----------

d) How is the yield transported to the stores from the farm? (if the stores are not in the farm)----------

13. Of your crop yield (produce),

a) (i) Which do you sell?----------

(ii) Where are the markets?----------

(iii) What is the quantity sold? ----------

(iv) What is the selling price per unit? ------

(v) How is it transported to the market?------

(vi) who meets the cost of transportation?-----

(vii) If you are the one, how much does it cost you? ----------

(viii) What problems do you encounter in marketing the produce?

(ix) How do you solve them? ----------

b) For the crop produce not sold, what do you do with it? ----------

14. a) What problems do you generally encounter in irrigated farming? ----------

b) How do you solve them? ----------

15. a) How many employees do you have in the farm?

---

b) How many are:-

(i) Skilled ----------

(ii) Semi skilled ----------

(iii) Unskilled ----------

(iv) Permanent ----------

(v) Temporary ----------

(vi) Casuals ----------

c) How many of them earn?

(i) Kshs. $<$ 500 per month -------

(ii) Kshs. 500 -999 per month ----------

(iii) Kshs. 1000 - 1999 ----------

(iv) Kshs. $\geq$ 2000 per month ---------

16. a) Do you receive assistance from any organization(s be it/they public or private, from within or out of the country?

Yes/No ----------

b) If Yes,

(i) Name them ----------

(ii) What type of assistance do you get?

(iii) What are the terms of getting the assistance? ----------

(iv) How frequent? ----------

c) What (more) could you like from them? --------

17. a) What do you think are the major constraints to development in Arror location? ----------

---

b) What could be some possible solutions?

---

c) What attempts have you made to tackle some of the problems? ----------

---

d) What plans do you have for the development of the area particularly as regards irrigation?

---

18. Any other comments <u>especially</u> as concerns both indigenous and modern irrigated farming and how you generally relate to and with the local community.

Thank you.

APPENDIX III: UNIT COST OF SOME PUBLIC SECTOR IRRIGATION PROJECTS

Project Name and Location	Type and hectarage (ha)	Cost/ha. Kshs.	Method of Implementation
El-Ndume Irrigation project, Baringo District	Small scale furrow system (100 ha.)	25,000	Farmers provide some of labour requirements. Government provides technical help and finance. Foreign personnel limited to expatriate. Dutch and Kenya Government funds.
Lower Tana Village Irrigation Project, Tana River District	Small scale basin system (64 ha.)	350,000	Farmers participation minimal. Heavy use of expatriate and Kenyan technical personnel. World Bank, Dutch and Kenya Government funds.
Mitunguu Irrigation Scheme, Meru District	Small scale gravity sprinkler system (400 ha.)	140,000	Farmers contribution minimal and limited to provision of land. German and Kenya government funds Technical assistance German Irrigation System by Nairobi based contractor.

APPENDIX III CONTD.

Project Name and Location	Type and hectarage (ha)	Cost/ha. Kshs.	Method of Implementation
Extension of Mwea Irrigation Scheme, Kirinyaga.	Large scale basin system	80,000	No farmer participation. Land development machinery provided by Ministry of Agriculture. Kenya Government funds. No expatriate personnel.
Kibwezi pilot Irrigation Scheme, Machakos District	Pumped sprinkler system (55 ha.)	50,000	No farmer participation design and supervision Kenyan, Kenya government funds,
Bura Irrigation project, Tana River District	Large scale (2500 ha.)	480,000	No farmer participation. Heavy external consultant and contractor involvement. Kenya, Dutch, EEC and World Bank funds.

Source: Task Force Report (1986).

16

APPENDIX IV

ARROR HEALTH CENTRE - REPORTED ILLNESS CASES 1986 - 1987

Type of illness	Number of Cases Reported		
	1986	1987	Total
Malaria	1,500	1,300	2,800
Diarrhoea	700	750	1,450
Acute Respiratory Infection	1,080	800	1,880
Tuberculosis (T.B)	10	15	25
Whooping cough	3	3	6
Meningitis	2	4	6
Tetanus	15	20	35
Chicken Pox	4	6	10
Measles	4	20	24
Infections hepatitis	4	6	10
Gonorrhea	5	6	11
Intestinal worms	4	6	10
Anaemia	20	30	50
Acute Eye Infection	6	8	14
Ear Infection	4	7	11
Pneumonia	30	40	70
Abortion	6	3	9
Skin disease	50	70	120
Rheumatism	10	7	17
Accidents (Fractures, burns etc)	30	40	70
Kwashiokor	21	3	24
Total	3,508	3,144	6,652

Source: Research Data.