The data relating to official marketing (see Table 3) indicate low offtake rates in 1988 and 1989. The data for 1990 shows too high an offtake and it is suspected that the number includes livestock from other districts e.g. Tana River and Garissa. The data on hides and skins indicate either a lot of unofficial marketing, home consumption or high livestock deaths.

Recommendations

1. Livestock marketing may or may not be an important constraint in Kitui. This can only be established by a detailed study which should look into all aspects.

2. The current staffing of the section on livestock marketing is too low to collect all the necessary data. It would be admirable that the officials of Kitui County Council train enumerators to collect data on marketing. Information to be collected should include livestock numbers offered, numbers sold and average prices realised. This data should be analyzed to shed light on the marketing operations.

3. The newly started auctions should be monitored by both MoLD and Kitui County Council officials. If proved successful, new markets should also have auctions. It is necessary that the auctions be studied in one or two markets as in other parts of Kenya the do not function well.

4. Livestock price information and livestock numbers on offer should be communicated through radio to make buyers aware of the possibilities of trading profitably with Kitui livestock.

5. Possibilities of slaughtering in Kitui or Mwingi and transporting the carcasses in registered vans should also be studied. This seems to be preferred by the Nairobi market which increasingly is supplied by butchers who slaughter in places like Namanga, Tala and many small trading centres in Kiambu and transport the meat to Nairobi.

6. The establishment of holding grounds in Kitui should be shelved as there are no livestock to use them. The current ones are rendered useless by lack of facilities and illegal grazers are a menace.

7. Disease control should be intensified as in the past FMD and CBPP quarantines have constrained marketing. Co-operation between various government departments especially, provincial adminstration and MoLD, is vital in the enforcement of quarantines.

Table 3
Livestock Marketing Data

	Slaughter and export	Hides and skins

Year	Cattle	Off Take	Goats	Offtake	Cattle	Goats
1988	15,882	5%	44,423	7%	19,542	159,716
1989	31,518	9%	62,613	12%	21,553	193,728
1990	108,666	30%	105,719	20%	18,391	143,550

Sources: LMO, Annual Report 1988
PLMO, Eastern Province, Annual Report 1989
DRMO, KTI, Annual Report, 1990

6. CONCLUDING REMARKS

Livestock development in Kitui is bedeviled by many problems some of which are within the capability of the district to solve. Disease control (not cure) should be emphasized. The status of disease reporting and the capability of vets to contain epidemics should be enhanced. Information on livestock marketing is incomplete and is needed urgently as the current picture is very unclear. A livestock census would help, failing which the officers should collect more data for planning purposes.

BIBLIOGRAPHY

Annual Report 1988. Livestock Marketing Officer, Kitui.
Annual Report 1989. P.L. M. O. Eastern Province.
Annual Report 1990. District Range Management Officer. Kitui.
Gitu, K.W., C. Ngalyuka and G.W. Kirori 1989. Agricultural Livestock data Compedium.
Kimenye, D., and F. Mulwa. 1990. Evaluation of Diocese of Kitui, GASP's training component. Report prepared for Cebemo.
Olang, M., and E. Maritim. 1986. Land use planning in Kenya. In Range Development and Research in Kenya. (Eds. Hansen, Woie and Child).

PROMOTION OF OIL CROP DEVELOPMENT

LARRY NGUTTER
UNDP

1. INTRODUCTION

Oilcrops may be defined as plants cultivated for the purpose of producing vegetable oils for domestic use, manufacture of cosmetics and industrial use. In most cases, palm oil is a notable exception, the residue from the oil extraction process is a cake of relatively high protein content, which can be used for human food, fertilizer, and animal feed - the major use. However, there are important oils and cakes which are obtained as by products of other industries. Cotton cake, from the ginning of cotton seed for fibre; and maize oil, from the germ collected during maize-milling are examples.

Oils and fats form an important part of a balanced human diet. Traditionally, most Kenyans obtained their requirements from animal sources or through the direct intake of oil-bearing crops. The consumption of refined oils and fats is a relatively recent dietary habit among Kenyans, introduced after the arrival of the European and Asian cultures in Kenya. Indeed, vegetable oil/fat consumption in Kenya has increased only over the last two decades, rising from a per capita rate of 1 kg per year in 1970 to the present 5 kg. Consumption is, however, growing fast, and is projected to reach around 6 kg per capita in the next 10 years (see VOPS, Working Paper No. 8). Factors behind this rapid growth in vegetable oil consumption include: 1. the fast population growth rate, 2. changing of consumer tastes for fried foods and snacks, 3. urbanization, 4. less availability of animal-fat substitutes and 5. overall increasing family incomes.

The present per capita consumption suggests a national demand of about 110,000 metric tonnes (m.t.) per year taking Kenya's population to be 21.4 million people. Yet, Kenya produces only around 20,000 m.t. of edible vegetable oils per year. The balance is met from importation, mostly of palm oil. This importation of mostly crude (but sometimes refined) oil means that a significant portion of the by-product feed cakes also have to be imported. More importantly, the annual import bill of about Kshs. 2.0 billion for the vegetable oils plus a further Kshs. 0.5 billion for 3,000 m.t. of the feed cakes is a major drain on the country's foreign exchange. In fact, edible oil importation is the single largest bill for agricultural imports.

Given the above scenario, the case for Kenya to increase domestic production of oil crops becomes obvious. Apart from savings on the nation's meagre foreign exchange, such a policy could have these

additional benefits:-

1. increase caloric intake from oil fats. Kenya's present per capita is well below the world average of 14 kg per capita per year;

2. greater availability of the animal feeds for the livestock industry (mostly dairy, poultry and pigs);

3. fulfilling Government's own stated policies of food security (see Food Policy Paper, 1981), narrowing of the gap in oil crops trade (Sessional Paper No. 1, 1986) and promoting off-farm employment opportunities form domestic processing (Sixth National Development Plan, 1980/93). Where processing takes place at farm, trading centre or village levels,1 this would boost rural industrialization.

4. reduction of the uncertainty connected with dependence on foreign suppliers and markets which are characterized by volatility and inelastic supply (thus small reductions in output, say from bad weather or protectionist policies of producers, lead to greater than proportionate increases in prices). To the extent that Kenya's national import is only a small fraction of the world trade in this commodity, we are "price-takers".

2. POTENTIAL FOR OIL CROP PRODUCTION

Available information suggest that practically each district in Kenya has the ecological potential for one oil crop or another. Coconuts dominate in the Coast Province, where they grow naturally, while groundnuts are grown mostly in the Lake Victoria Basin districts apart form smaller amounts in Meru and Embu districts. Simsim is again prevalent in some Coastal Districts (Kilifi, Kwale and Lamu) and in the Western Province (Bungoma and Busia). Sunflower has a much wider ecological distribution but is more prevalent in Eastern Province (Machakos, Kitui, Embu, Meru), and in the lower elevations of Kirinyaga and Bungoma Districts. Cotton seems to follow a similar pattern, while rapeseed is mainly a high potential area crop, where it can actually compete with wheat and barley, depending of price regimes. Castor oil is grown in the more arid districts of Eastern Province, Kitui included.

Estimates of the total area planted to some of the crops are given in Table 1 below.

Table 1
ESTIMATED HECTARAGE UNDER VARIOUS OIL CROPS

Oil Crops	Area (ha)
Cotton	45,000
Sunflower	42,000
Groundnuts	39,000

Coconut	35,000
Rapeseed	4,700
Simsim	4,600
Soyabean	2,000
Castoroil	n.a.
Total	176,000

Source: VOPs, op.cit

It is important to point out the unreliability of some of the above hectarages, which additionally mask very great variability from year to year. However, the important point is that Kenya has the potential for the production of both annual and perennial oil crops. Except in the case of rapeseed, this potential is to be found in the Arid and Semi-Arid Lands (ASAL) simply because current land holdings tend to be larger and also because of unavailability of alternative high-value cash crops. Most of the cultivated land in the higher rainfall areas which can be allocated to non-food crops is already under high-value cash crops such as coffee, tea, pyrethrum and horticultural crops.

3. CONSTRAINTS OF OIL CROP DEVELOPMENT

Why has not a thriving domestic oilcrop industry developed in Kenya? Basically because of the availability to the processing industry of very cheap alternatives in form of imports, combined with a lack of a clear public policy for the industry.

1. Prices of Imports.

Of the 90,00 m.t. of vegetable oil which Kenya imports, about 60,000 m.t. is palm oil. Why the dominance by palm oil? Well, the international prices of this commodity (as actually is the case for other major vegetable oils like rapeseed, soyabean and sunflower), has been on the decline since 1983, when they peaked. Between 1983 and 1988, the prices declined as indicated in Table 2.

Table 2
INTERNATIONAL PRICES: FOUR MAJOR OILCROPS 1983 & 1988 US$/M.T.

Crop	1983	1988
Rapeseed	696	297
Palm oil	767	310
Soyabean	722	324
Sunflower	765	354

Source: VOPS, Working Paper I.

Thus, the oil industry imports the second cheapest vegetable oil. Moreover, palm oil contains saturated fatty acids (and is therefore dietetically less wholesome) which means that only

minimal hydrogenation is necessary to turn the oil into fats and thus increase the shelf-life of the final product. Further, due to the public policy of "protecting the consumer"(mainly the urban consumer), the Government has been reluctant to impose any restrictions on palm oil imports and, when any duty has been imposed on the imports, the Government, which partly owns the largest processing plant, gives 100% remission of the duty to the processor.

This subsidization provides no economic incentive to the processing industry to support domestic production of alternative oil groups.

The declining price of the imports has afforded the processing industry substantial profits. Margins have even remained high, when the price of the final product to the consumer has remained nearly constant or even have declined.

The following table compares the estimated variations in the imported prices of palm oil (including import duty) to the price of Kimbo (the best selling vegetable fat.)

Table 3
LANDED PRICE OF PALM OIL VS PRICE OF KIMBO 1982 to 1986

Price of (Ksh/kg)	1982	1983	1984	1985	1986
Palm Oil	16.90	12.80	10.00	10.00	8.00
KIMBO	17.50	18.80	20.50	21.00	22.50
Margarine	10.60	6.00	10.50	11.00	14.50

This table reinforces the conclusion above.

In fairness to the industry, it should be pointed out that in the late 1970's, the Oil Crop Development Ltd. (a subsidiary of EAI) did attempt to promote the production of sunflower (among others) by distributing free seeds, fertilizers, and offering oil crop-targeted extension service. However, this effort was stymied by new entrants into the processing industry, who out-paid OCD, the new entrants not having incurred promotional costs. As a result, OCD stopped the promotional effort.

2. Domestic Prices of Oilcrops

At present, the prices being offered for oil crops average less than Ksh. 3.00 per kilo to the farmer. Estimates suggest that a price in the region of Ksh. 4.00 per kilo to the farmer would make oilcrops competitive with other crops. (As a matter of fact, lack of studies on the economics of oil crop production data vise vis other crops is one constraint on its own right). Compounded by the low production per unit of land (low level of technology) the returns to oil crops do not provide a suitable incentive to

farmers. More fundamentally, delays in payment by buyers, including co-operatives, has worsened the situation. Cotton production has been one of the most affected crops.

3. Public Support to Producers

Public support to farmers has been weak for all oil crops. Research has been confined to research station (mostly Njoro PBS), so that the oil content of crops being farmed is still low by international standards. This further affects price to producers. Only now are oilcrop extension officers being assigned to districts as a result of the UNDP/IDA supported Oil Crops Development Project. While the NCPB used to have the mandate for the purchase of many oil seeds (sunflower, simsim, castor), NCPB's basic concern was understandably on food grains and pulses. Other inputs such as quality seeds, credit, storage facilities etc have been equally inadequate; as has been market information.

4. Processing Capacity

The installed processing capacity in the country is far in excess of the oilseeds available. There is a lot of idle capacity. This situation has an indirect effect on the prices paid to the farmer and/or by the consumer; as processors try to cover the idle capacity costs from either low prices to the farmer or higher prices to the consumer. While complete data is hard to come by, the following table on three important oilcrops is illustrative:

Table 4:
PROCESSING CAPACITY UTILISATION FOR THREE OIL CROPS 1988

Crop	Installed Capacity (m.t.)	Utilized Capacity (m.t.)	Utilization (%)
Cotton:			
Seed	71,600	12,650	18
Cake	29,911	5,384	
Sunflower:			
Seed	65,620	21,600	33
Cake	24,430	8,062	
Copra seed:			
Seed	20,820	12,820	62
Cake	8,271	5,128	

Nearly all of the above capacity is in major towns (Nairobi, Mombasa, Nakuru, Kitale). This means that when the oilseeds are produced, they have to be transported first to the towns for processing; then the oils/fats and feed cakes are re-transported to

the rural areas for consumption. This double transportation has led some people, mostly charitable organizations and church groups, to start rural processing of oilcrops. This has however, brought about its own problems including:lack of sufficient seed, lack of sufficient markets for the oils and cakes, uneconomical oil extraction due to the low efficiency of equipment being used, farmers unaware of cake utilization (some cakes can be harmful to livestock if not handled with care). Most of livestock in ASAL is still Zebu with low yield potential, natural pastures are fairly plentiful in ASAL). In addition, these well-meaning organizations came face to face with constraints discussed under 1 to 3 above. Thus, most of the processing machines have been non-operational.

4. INTERVENTION THROUGH COOPERATIVE MOVEMENT

In summary, the major constraints in the oil crop industry are:

1. Public Policy
Unnecessary Government protection of the urban consumer, and by extension of the dominant oil processor through inappropriate tariff and price policies which allow for importation of cheap crude oils.

2. Production
Inadequate research and extension services, lack of inputs including quality seeds, credit and disease control measure, low gross margins, delayed payment to farmers.

3. Processing
Inappropriate post-harvest and processing technology in rural areas, side by side with overall national capacity, shortage of raw materials.

4. Marketing
Underdeveloped markets for rural processed oils and cakes, lack of market information and well-organized market outlets, lack of basic market infrastructure such as storage and transport, excess capacity installed,

Can the above constraints be addressed through the co-operative system in a district like Kitui?

Kitui is a typical ASAL district. Of the land area totalling 31, 099 sq. km (including some 0,309 sq.km in the Tsavo National Park) 0.2% is classified as high potential (read " high rainfall") area; 30.6% as medium potential; and the rest, 61.2% as low potential. Rainfall regimes are respectively 762 to 1270 mm; 500 to 800 mm and below 500mm per year.

From these dry, unreliable rainfall, high temperature and high evaporation rate conditions, one may deduce that the suitable oilcrops would be castoroil, sunflower, perhaps simsim, and cotton.

In 1990, membership to the co-operative movement in Kitui district was estimated at 13,176 people only, out of an estimated district population of just over 660,000 people. Thus Kitui has only 2 % of the district population and 1% of the national co-operators' population in the co-operative movement. (District Development Plan, 1989/93). Thus, the mobilization of the people through the co-operative movement is currently very minimal. Their activities are concentrated in the Central and, to a lesser extent, in the Mwingi and Kyuso Divisions. Agricultural production is low due to the low rainfall. Therefore agro-marketing societies are not as active as the urban-based savings and credit societies. Of the registered societies, 24 are dormant (op. cit). the full picture is depicted in table 5 below.

Table 5:
COOPERATIVE ACTIVITIES IN KITUI DISTRICT 1988

Activity	Active	Dormant	Total	Share Capital(Ksh.)	Membership
Cereals/grains	6	11	17	425,000	1,086
Coffee	2	-	2	20,000	780
Cotton	-	1	1	3,100	385
Fruits/vegetables	2	-	2	10,000	120
Sisal	-	1	1	2,000	100
Marketing/other crops	2	1	3	51,000	715
Eggs & Poultry	2	-	2	4,000	60
Ranching/Livestock	5	4	9	13,000	2,354
Multipurpose	2	-	2	80,000	750
Consumers	1	1	2	22,000	338
Housing/Savings	1	-	1	n.a.	n.a.
Credit	8	2	10	18,000	5,800
Craftsmen	2	1	3	33,500	285
Miscellaneous	2	1	3	n.a.	n.a.
District Union	1	-	1	20,000	158
Others	1	-	1	24,000	158
Total	32	24	56	695,600	13,076

Problems identified for the high rate of dormancy (Socio-Economic Profiles:Kitui 1990) are:

1. Lack of finances
2. Lack of training/education for co-operators and officers
3. Lack of skilled manpower
4. Lack of infrastructure (stores and transport for produce)
5. Poor prices, especially for cotton
6. The low rainfall, leading to low production of relevant crops

Combining now the national constraints to oilcrop development, the oilcrops suitable for Kitui district and the above profile of the cooperative movement in Kitui, we can make the following

conclusions:

1. Production Constraints

Effort towards Co-operative Management Improvement would enable Kitui cooperatives to procure inputs (seed, fertilizers) in bulk for the benefit of members. Given the small quantities per producer, cooperative marketing, if revamped, offers economies of scale in the procurement of storage and transport facilities. This would particularly benefit all oilcrops.

2. Processing constraints

With improved oil exptraction equipment (research is now underway in the UNDP/IDA project) farm and trading centre level processing of edible sunflower oil may become viable, targeted to Kitui, Mwingi and Mutomo townships; or to Rural Service centres like Matinyani, Kisasi, Miambani, Ikutha, Mutitu, Migwani and Kyuso. A feasibility study on the use of the oil in local hotels (for cooking chapatis, samosas maandazia etc) in these and the 16 smaller trading centres would be necessary.

3. Marketing

Strengthened co-operatives would have more muscle in dealing with the district monopoly buyers (Kitui ginnery owners and the Bajabar Ltd. among others) of cotton, castor oil and sunflower. It might be possible for a stronger co-operative to by-pass the middlemen altogether and establish their own processing as is the case in other districts. Where the cooperative movement has become a major actor in the market, farm gate prices have improved.

Other permutations are possible. However the national public policy on oilcrops delayed payments to farmers and the low prices are the most important constraints which no district level cooperatives can tackle adequately.

4. Farm Level Utilization

This is feasible particularly where intensive systems of livestock production are possible. The use of oilseed cakes to improve animal nutrition would in turn increase milk yield in the dairy industry. Possibilities may also exist for increased poultry production. These are possibilities which need to be investigated at district level.

BACKGROUND OF COTTON INDUSTRY

MUNIR ZEVERY
KITUI GINNERY

RECENT HISTORY OF COTTON PRODUCTION IN KENYA

Cotton production was originally introduced into Kenya during the colonial period. it was exclusively destined for export, since there was no yarn spinning industry in the country. It was also apparently regarded as of minor importance compared with other cash crops like coffee, tea and sisal. Production was only encouraged in those areas where, mainly on account of low rainfall, these cash crops were not suitable.

In recent times, particularly since the collapse of the East African Community in 1977, it became necessary for Kenya to pay for imported lint in hard currency. Greater efforts have been made to boost domestic production in the interests of providing local raw material for the expanding textile industry, which has developed largely since independence. This resulted in a steady increase in output in the 10 years up to 1978/79 from 23,000 to 62,000 bales of lint. However, despite the peak of production of 70,000 bales in 1984/85, the long-term trend has been clearly downward. Annual production fell to around 30,000 bales in the three years to 1989/90. This has occurred despite the considerable expansion of irrigated production on the Bura and Hola irrigation schemes on the Tana River since the early 1980's. Irrigated production increased from about 2,000 to 10,000 bales and thus accounted for some 35% of national output by 1989/90. Current output of lint is only equal to around 25% of potential demand of 120,000 bales from the domestic textile industry based on existing spinning capacity.

As in most other African countries, production has always been based exclusively on peasant smallholdings. This is primarily because of the unavoidably high degree of labour intensity involved, rendering it unsuitable for large-scale production based on a permanent hired labour force. This means that the ability to assure a given level of raw material supply to the sub-sector has depended crucially on convincing farmers that the returns from cotton are likely to prove sufficiently attractive relative to those from other cash crops - or indeed from food crops, which will invariably receive priority up to the level needed to assure subsistence - and even beyond this may be seen as potentially competitive sources of cash income.

There is little doubt that the decline in Kenya's cotton production in recent years reflects the increasing belief on the part of many farmers - particularly in traditional cotton growing areas such as Nyanza and Western Provinces - that cotton is less profitable than

many of the alternatives.

The growth of this perception may be ascribed to a number of factors, of which the steady decline in the international price of cotton in real terms since the mid-1970's is perhaps the most important. Yet even though price may have been the dominant consideration, it is also true that non-price factors which might otherwise have helped to offset this consideration have not in fact done so. Among these is the primary marketing system, which has failed to assure the basic prerequisite of prompt payment to growers - a negative factor which is far less of a problem in respect of most competing crops, for which, unlike cotton, there is generally more than one market outlet. Thus the chronic inability of either the Cotton Board or of Cooperative Societies or Unions - to the extent that the latter have been involved in financing crop purchase - to mobilise adequate funds for the purpose within a reasonable time has undoubtedly been a major additional factor discouraging farmers from planting more cotton.

GOVERNMENT POLICY TOWARDS THE SUB-SECTOR

At least since the 1930's, the cotton sub-sector has always been subject to a high degree of regulation - as provided for under successive pieces of legislation. Of these the most important has been the Cotton and Lint Seed Marketing Act of 1955 (modified in 1967), which remains the essential basis for the current system of official intervention in the sub-sector. Not-withstanding the enactment of a new Cotton Act in 1988, the 1955 Act gave power to the Cotton Lint and Seed Marketing Board (CLSMB) to regulate virtually every aspect of processing and marketing from the point at which seed cotton was purchased from farmers. Such a regime, which was closely modelled on that in force in Uganda (where production was then on a much larger scale than in Kenya), was clearly based on an official perception that cotton was a crop whose sustained production could only be assured if reasonable guarantees of adequate farm gate prices were offered to growers and of adequate raw material supply to primary processors.

As indicated above, government policy since independence - and more so especially since 1977 - has been guided by the broad principle of maximising national self-sufficiency in cotton. This has been reflected in a propensity to encourage the CLSMB to use its powers under the Act to intervene more directly in both processing and marketing. Thus the Board has acquired or established six ginneries since the early 1970's (one of them nominally under joint ownership with a cooperative union but effectively under total control of the Board), whereas previously all ginneries were privately or cooperatively owned. In addition, since 1978 the Board has assumed exclusive financial responsibility for buying seed cotton as well as selling it - so that all intermediate marketing and processing activities are carried out either by the Board itself or by cooperatives or private organisations operating as its agents -

while at the same time abandoning the previous open auction system of price determination in favour of one based on administered prices. According to the report of the inter-ministerial study team "Policies for the Development of the Cotton Sub-sector" of March 1987, this change was prompted by a combination of factors: Among them were: a. the loss of preferential access to supplies of lint from Uganda and Tanzania and b. a decline in international prices for lint which appeared likely to compromise the ability of the sub-sector to remain self-financing (i.e. in the absence of any government decision to subsidise it).

Subsequently a number of donor-funded initiatives have helped to support the government strategy of trying to boost production. These have included a USAID small farmer support scheme, the Farm Input Supply Scheme (FISS) financed by World Bank, and Integrated Development Programmes (mainly EC - funded) in Nyanza Province and Machakos District.

These initiatives, appear to have had a significant impact in boosting or sustaining cotton production in those areas where it was an established cash crop. This was achieved mainly via the mechanism of supplying inputs - for other crops as well as cotton - on the basis of subsidised credit. The incentive for farmers to grow cotton was enhanced in these areas by making cotton the "anchor crop" under these credit schemes - i.e. providing for individual credits to be repaid through deductions from deliveries of seed cotton to cooperative societies or unions. Thus in order to obtain any inputs under the scheme or at least continue obtaining them each year, farmers had to plant at least enough cotton to cover repayment costs. Apart from credit some of these schemes also provided direct financial support for the establishment of cooperative societies to handle cotton.

The most important single initiative affecting the sub-sector in recent years, however, has been the Cotton Processing and Marketing Project (CPMP). It started in 1982 and was financed by the World Bank. This project, for which Ksh. 275.6 m (US$ 33.4 m) was originally allocated, intended to improve marketing infrastructure (storage capacity and buying centre), to rehabilitate ginneries and to expand and upgrade the staff of the CLSMB.

It has proved impossible to implement many of the project's components, largely because the original assumptions, both as to the likely level of cotton production, projected to reach 116,000 bales by 1989/90, and the creditworthiness of the CLSMB and the target cooperatives turned out to be excessively optimistic. Indeed because of the chronic financial problems of the Board, and its consequent inability to raise sufficient finances for the purchase of the seed cotton crop, it diverted some project funds for this purpose notably following the bumper crop of 1984/85.

It is clearly impossible to quantify the impact of these various

schemes on the level of cotton production with any precision. However, it seems reasonable to infer that the progressive exhaustion of funding from these sources since the mid-1980's has been a factor contributing to the slump in output to around 30,000 bales in each year since 1985/86, the lowest levels attained since the mid-1970's apart from the drought year of 1983/84.

THE FUTURE OF THE COTTON INDUSTRY.

At present, the marketing is dominated solely by the Cotton Board of Kenya, which has up to now complete monopoly rights in marketing the ginned lint and seeds for millers.

To collect and process the seed cotton from the farmers, the board appoints buying, transporting and ginning agents in various designated zones. Traditionally the zones are various districts, for example in Machakos District the Machakos Cooperative Union is the buying and transporting agent, while the ginning agent is the Board's own ginnery in Makueni.

The Board in conjunction with the Ministry of Agriculture sets the price for seed cotton, which has recently been raised from gross Ksh. 6.00 a kilo for AR and 3.00 a kilo for BR to respectively 10.00 for AR and 5.00 for BR. The rates for paying the buying, transporting and ginning agents are set by the Board. These costs plus the cost of running the board are reflected in the price of lint which is again a fixed price set by the Board.

At present the domestic price of lint is set at 45/60 a kilo which, given the superior quality of Kenyan cotton vis a vis average world cotton production, due to the fact that Kenyan cotton is handpicked, reflects the present world market price for cotton. Last year record world demand for cotton coupled with low stock levels ensured a steady high price throughout the year, whereby most commodity markets suffered stiff declines.

As regards domestic demand one can conclude that the recent price increase of seed cotton was aimed at breaching the shortfall in domestic supply. At present only 25% of Kenya's demand is fulfilled, with some 80,00 bales (each bale equals 185 lint) being imported to satisfy domestic demand. In effect this means that the country spends some 28 million US dollars to import cotton, and hence if cotton can be produced locally, this would mean scarce foreign exchange can be utilized elsewhere to help develop the country.

However, the point is how to achieve this. There are some people of the opinion that the free market should be implemented into the cotton industry, with the decontrol of the lint and seed prices. In effect this would mean that every participant in the cotton industry would be totally influenced by the world market price for cotton lint and seeds, assuming that the various textile millers

and oil millers do not collude.

This sounds quite feasible on paper. The price of seed cotton would be determined by the world market, and the private or co-operative or board ginners would be given licences to buy and sell the processed lint and seeds wherever they chose within the country. The farmers could possibly be paid an interim payment with a bonus paid if the lint/seed price achieved was favourable. Alternatively, the ginner could forward sell his production, and with a firm letter of credit in hand know firmly what price to pay farmers. This latter suggestion would ensure the prompt payment of farmers, agents, and ginners, thus removing a huge bottleneck in the industry and freeing government coffers from Board losses.

All this sounds easy, but it must be remembered that we are not dealing with an industrial product which when fully developed would benefit from competition, but an agricultural product. In a perfect free market as proposed, the world price will determine whether a farmer grows cotton or not. At present, the world market price corresponds to the domestic price, and if this situation continues or the price increases further, the farmer is guaranteed the present Ksh. 10.00 a kilo gross, or more. In such cases given that the free market removes the fundamental bottleneck of payments, the cotton industry should move from strength to strength.

There is a problem. The world market price fluctuates down as well as up, and given the recessionary environment the world seems to be finding itself in, the outlook for commodities looks unfavourable. If for example, not unplausibly, the world market price of cotton in the coming season falls some 50%, the domestic prices for seed cotton will fall to Ksh. 5.00 for AR. The large number of farmers encouraged to grow the crop on the basis of the price of Ksh. 10.00 would, given the halving of the price, reject cotton growing for the next season.

This cobweb model of domestic supply movements guided by world price movements could issue a kiss of death to the industry. Although simple and mechanical, the model has proved useful in explaining why the prices and outputs of some commodities have shown pronounced cyclical movement on the world stage.

An agricultural commodity like cotton essentially needs a fixed price, especially when a country is trying to save foreign exchange. Cotton is uprooted after the plant reaches fruition and thus the farmer has the choice every year as to whether to plant cotton again or grow an alternative. The farmer has to be extremely price sensitive, as is obvious when considering the dramatic rise in production likely to be experienced in the coming season, given the new seed cotton price. Does this mean that as a country we should keep the present structure with the Cotton Board holding on to its monopoly and the industry subsidizing the Board's losses? The answer is sadly, yes. We do not live in an utopian world with

absolute free trade existing - even within East Africa. Ideally, the East African countries could rid themselves of most barriers to trade and adopt a currency similar to the European E.C.U which would hopefully replace the dollar as the currency of trade, even in cotton. This could result in Tanzania and Uganda growing the cotton, and Kenya importing it from them and exporting the finished textiles. As cotton farming and ginning were phased out, alternative crops would have to be encouraged, if only to aid the stemming of rural-urban migration.

Since this scenario does not exist however, the Board's monopoly rights and the fixed pricing system should remain, but the present structure of the Board should be radically altered. Staffing levels should be cut with the closure of all the Board's district and regional offices: and the role of the Board in distributing of loan chemicals should be taken up by the respective buyers of the crop. In addition, the Board's mismanaged ginneries should be privatised.

These reforms should substantially reduce the losses, but maintain the benefits of the existing system. Further to the above reforms, a substantial revolving fund should be set up to help the Board to finance the crop and pay promptly the various bodies involved in the industries, primarily the farmers. To ensure that the fund is revolving, demand for domestically produced cotton should be maintained by tight control on import, and vitally, payments for lint and seed to the Board should be made by the respective millers in the form of bankers cheques. If these reforms are undertaken, Kenya would easily be able to meet its domestic demand. The gain from the reduced imports would justify the ensuing limited, or possibly no subsidy given to the Board. Also, it must be noted that exports of manufactured goods get an export rebate of 20% because they help secure foreign exchange. Given this, it is inconceivable that a large subsidy would be required by the Board.

In addition to the latter, it should not be forgotten that a substantial number of people benefit from the cotton industry. Farmers benefit from the new price and this is clearly demonstrated by their zeal in growing cotton this season. Ginneries provide employment to several thousand people, and being primarily based in the rural areas, this helps stem the rural - urban migration. Cotton also plays a multiplier effect in the incomes of rural areas, e.g. supporting small town shop-keepers and other small businesses. However, not everyone is happy with these conclusions, not least of all the textile millers. They would have to pay more for the lint and hence their consumers will in turn pay more. It seems obvious though, that if the country benefits, then the latter is a small price to pay. It must be noted though that the world price does reflect the price of domestic cotton and hence at present no such costs are incurred by the consumers.

Moreover though, the textile millers would and do already export, and if the price of domestic cotton is too high vis a vis the world

market price, then the prospects of developing a successful export oriented industry would be substantially hampered to the severe detriment of this country. This is a valid point but the government has already allowed anybody to import any raw materials and any product duty free and manufacture under bond, or in the designated export processing zones for products which would be wholly exported. This in effect covers any criticism. Lets hope that the government is not bullied into accepting the free market as the panacea, which in reality would be a disaster, for the long term future f the cotton industry. Precious hard earned foreign exchange should not be squandered on importing cotton and vegetable oil, when with planning and effort both can be produced locally creating the jobs and incomes much needed.

WATER DEVELOPMENT POTENTIAL OF KITUI DISTRICT

PIETER G. VAN DONGEN
GWS

1. INTRODUCTION

1.1 General

This paper discusses the availability of water resources in Kitui District and the possible options for development.

1.2 Background Information

Kitui District is situated to a large extent within the arid and semi-arid climatic zones of Kenya (Fig. 1), being semi-arid in the western highlands and arid in the eastern and southern plains. Average annual rainfall ranges from 500 mm in the driest eastern plains to 1,100 mm in the higher areas surrounding Kitui township (Fig. 2). The rainfall occurs normally during the months March to May and during the period October to December. The latter rainy season, the "short" rains are the most reliable. The variation in rainfall is, however, dramatic, with variations from year to year from 20% to 300% of the yearly average.

The average annual potential evaporation is 1,800 mm while the average temperature amounts to 24^{0} C. The elevation of Kitui District ranges from 400 - 600 m. in the eastern plains to the highland area at 1,000 - 1,500 m. above sea level. The present population is estimated to amount to 800,000. The total surface area of Kitui is 31,000 km^{2}; excluding the Tsavo East National Park the size amounts to approximately 25,000 km^{2}.

Virtually the whole of the District is underlain by Precambrian Basement rocks, all metamorphic and heavily crystalline rocks. Only along the southwestern border of the District, the Yatta Plateau, is there Tertiary volcanic rock. It forms the main watershed in Kitui between the Tana and Athi River drainage areas.

2. HYDROLOGIC CYCLE

When analyzing the availability of water resources, a short discussion on the hydrologic cycle is required. Its main elements, as depicted in Fig. 3 are Evaporation (from open water, soil and vegetation), Precipitation (or rainfall), resulting in Surface Runoff (through gullies, streams and rivers) and Infiltration. The latter causes an increase in soil moisture, which is mainly used by vegetation and thus evaporates again, while part of the infiltrated water percolates down to the groundwater store, and creates a groundwater flow. The elements of the hydrologic cycle which we are

interested in for the purpose of water development in Kitui District are 1. rain water, 2. surface water, and 3. groundwater.

3. RAIN WATER

In Fig. 2 is depicted the average annual rainfall distribution for Kitui District as calculated fro a 20-year period of 1962 - 1981.

When trying to estimate roughly the total amount of rainfall which Kitui (excluding Tsavo East) receives in an average year, we come to the following figures:

- 50% of Kitui receives 400 mm/yr, or 12,500 km^2 x 400 mm =	5,000 million m^3
- 30% of Kitui receives 600 mm/yr. or 7,500 km^2 x 600 mm =	4,500
- 20% of Kitui receives 800 mm/yr, or 5,000 km^2 x 800 mm =	4,000
Total	13,500 million m^3

This is a very large amount of water, of which, of course, a very high percentage evaporates. Nevertheless, if only 1% of this water could be captured and utilised, it would mean that every person in Kitui would have not less than 500 litres of water per day available!

Of this 13,500 million m^3 of rain water, 80% or 10,800 M m^3 evaporates, including evapotranspiration through vegetation, 15% or 2,025 M m^3 runs off through streams towards the main rivers, while about 5 % or 675 M m^3 of the water infiltrates and percolates downwards into the groundwater store.

4. SURFACE WATER

Two major rivers carry a permanent flow of water along the borders of Kitui. The largest river of Kenya, the Tana River flows along the norther border of the District. Its average flow along that part of the river is 100 m^3 per second, or 8.6 million m^3 per day, or 3,140 M m^3 per year. The Athi River flows along the southwestern border of Kitui and has an average flow of 25 m^3 per second, which is one quarter of the Tana River flow.

In addition to these permanent flows, two major seasonal rivers are found. These are the Tiva River, draining the central part of the District and flowing towards the southeast; the Thua River is the largest, flowing eastward and draining the central highlands. In addition, numerous smaller seasonal streams drain towards the east. Combined, the main seasonal rivers and smaller ephemeral streams carry an amount of about 2,000 million m^3 per year.

5. GROUNDWATER

The major groundwater occurrences can be divided into three categories:

a. Groundwater in the sandy alluvium of seasonal streams and rivers;
b. Groundwater flowing out as springs from storage in colluvium on hill sides;

c. Deep groundwater in weathered and fractured hard rock.

Shallow Ground water in Alluvium

A rough estimate leads to a total length of sandy river channels of say 2,500 km, with an average width of 10 metres and a saturated thickness of 1 metre. The total sand volume is thus 25 million m^3. At an effective porosity of 10% this contains an amount of 2.5 million m^3 of groundwater. This groundwater store is normally recharged twice a year during the wet season and there is little risk of permanent depletion. Temporary depletion during the dry season because of subsurface groundwater flow can be countered by construction of subsurface or sand dams.

Even if this water is tapped by say 500 wells, each yielding 5 m^3 per day, the total abstraction is only a small percentage of the total amount available.

Springs

Although the number of permanent springs in Kitui is unknown, it is probably relatively small and estimated to be nor more than about 50. Assuming an average yield for these springs of only 0.5 litre per second, the total amount of water yielded by the springs is 2,160 m^3 per day. In addition there are numerous seasonal springs and seeps, which can be improved and protected and be used for part of the year.

Deep Groundwater

Groundwater occurs at greater depth in weathered zones of the hard rock and in deep fractures and fissures of the same (Fig. 4). This type of aquifer is being increasingly tapped all over Kenya by deep boreholes. Normally these deep boreholes in hard rock do not yield a large amount of water (average 2 to 5 m^3 per hour), although in a few cases, when situated in major fault zones the yield can be as high as 25 m^3 per hour. In Kitui only a few boreholes have been drilled in the past as there still exists a persistent belief that " there is no groundwater in Kitui". When analyzing the available data of the few boreholes drilled, it can be seen that, indeed in the lower parts of Kitui, boreholes have not been very successful, as these were dry or struck rather salty water. There are sound hydrogeological reasons why this is the case, but the explanation would lead to a rather technical discussion which is beyond the

scope of this paper. However, along the foothills and in the more hilly areas of Kitui there is plenty of scope for development of deep groundwater resources.

It is estimated that tapping of deep groundwater is possible in about 20% of Kitui District, or in an area of 5,000 km^2. If in this area one borehole is drilled every 10 km^2, a total of 500 could be drilled. Assuming a relative low average yield of 10 m^3 per day per borehole, a total amount of 5,000 m^3 per day could be produced. There would be no danger of depletion as this amount is approximately 1% of the recharge. The estimated storage of deep groundwater is in the order of 1,000 million m^3.

Drilling of such a large number of boreholes is not at all unrealistic as shown by a water well programme carried out recently in the adjoining (ASAL) area of Gachoka Division in Embu District where geological and climatic conditions are quite comparable, and where not less than 150 successful boreholes have been drilled in hard rock in an area of 1,950 km^2.

6. WATER AVAILABILITY

The figures given above on the available water in the District illustrate the vast amount of water received from rainfall plus a large amount flowing through the main rivers and streams. This would actually be more than sufficient to provide all people and livestock with water.

Nevertheless, there is no doubt that Kitui is a very dry area with an acute water shortage. Why is there a water problem?

The figures given above on total amounts of rain, surface and groundwater are in a way misleading because of the following factors:
- strong variation in total amount of rainfall from year to year;
- uneven rainfall distribution over the District;
- no permanent rivers except on the extreme borders;
- no significant sedimentary groundwater aquifers;
- except for Kitui town, virtually no operating piped water supply for the smaller townships and villages.

7. WATER DEMAND

The present (1991) population of Kitui District is estimated to amount to 600,000 people. Population densities vary strongly, the density in the high lands being five times the density in the lowlands.

Of the total population, it is estimated that at least 600,00 do not have a clean and safe water supply. At a consumption rate of 20 litres per day per person, a total amount of 12,000 m^3 per day would be required in the rural areas of Kitui. In addition

livestock water requirements should be estimated and included in the total water demand.

8. DEVELOPMENT OPTIONS

As discussed above, water resources are plentiful, but unevenly distributed. Nevertheless, it is the aim of this paper to demonstrate that water resources are available and that it is more a matter of development of appropriate resources, and construction of storage and distribution facilities, than a matter of availability. Since rainfall is rather unreliable, more emphasis should be given to ground water development, and less to rain water harvesting systems such as rock and roof catchments.

When looking at the map of Kitui, the following options are feasible:

a. Highland areas (Central and parts of Mwingi and Mutito Division), do have several good options for water supply, being deep boreholes (50 to 70 m depth), shallow wells in or close to streams, possibly in combination with subsurface dams or sand dams; small earth dams; roof catchments at public institutions (schools).

b. Lower hilly areas (Mwingi, Kyuso, Mutito and Mutomo Divisions) have god potential for shallow wells in river beds (in combination with sand dams), limited potential for deep boreholes; small earth dams for livestock; rock catchments and roof catchments only where the other options are not feasible.

c. Eastern Plains (parts of Mutito, Kyuso and Mutomo Divisions) have rather limited options; being shallow wells in the main river channels, small earth dams and roof catchments.

9. CONCLUSIONS

The available water resources in Kitui District are sufficient to provide its people and livestock with drinking water. Very little scope is available for development of irrigated agriculture.

Development of the groundwater resources should concentrate first on construction of shallow wells with handpumps, as these provide safe, clean and permanent water. Other types of water supply structures are less desirable as they are either unreliable (rock catchments), contaminated (earth dams) or very costly (roof catchments).

10. RECOMMENDATIONS

Detailed assessment of the available surface and groundwater resources is needed for the whole district. In addition, a thorough spring inventory should be carried out.

Emphasis should be given to shallow well construction, if necessary in combination with sand dams or subsurface dams.

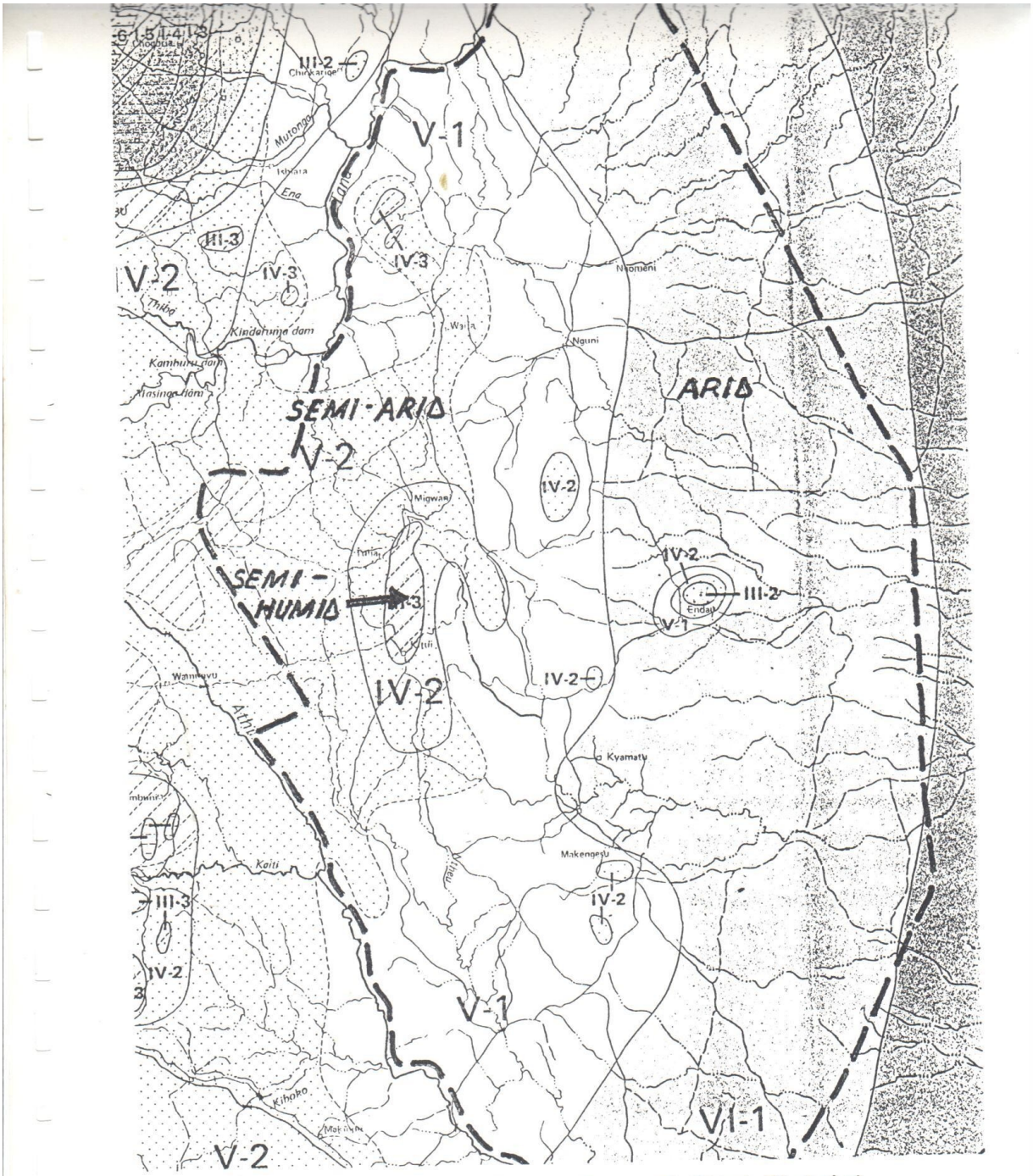

Figure 1 - Agro-climatic Zones of Kitui District

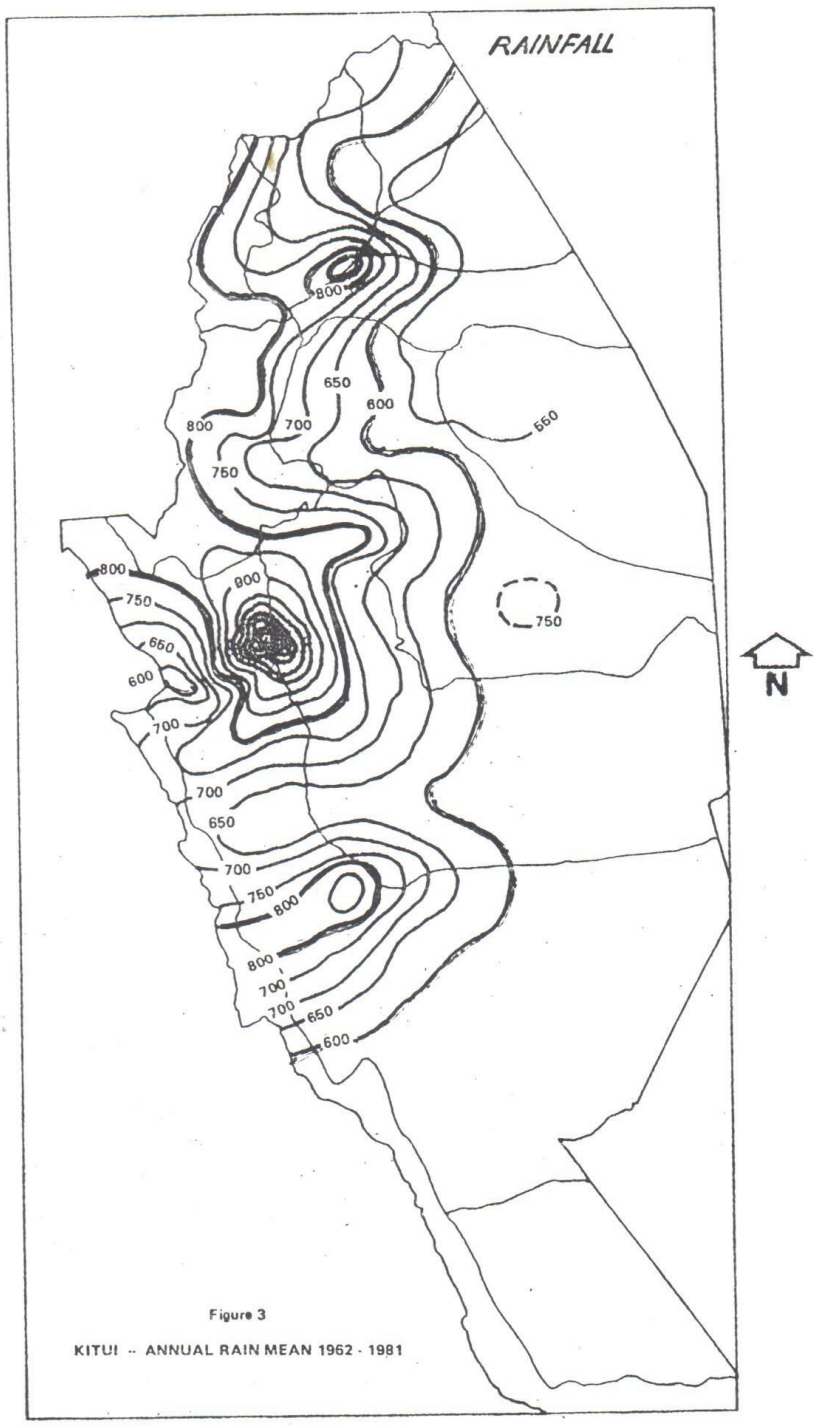

Figure 2 - Average Annual Rainfall in Kitui District (mm/year)

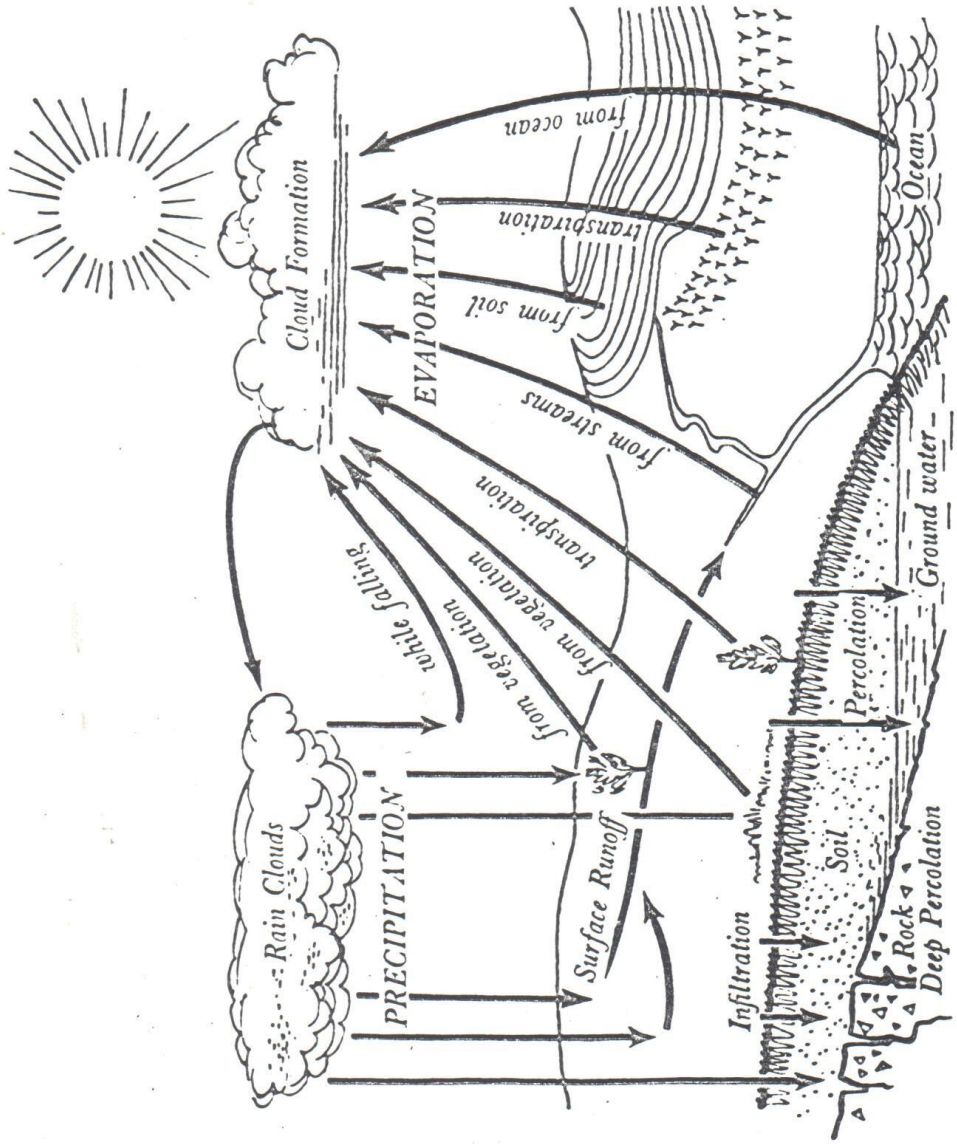

Figure 3 - The Hydrologic Cycle

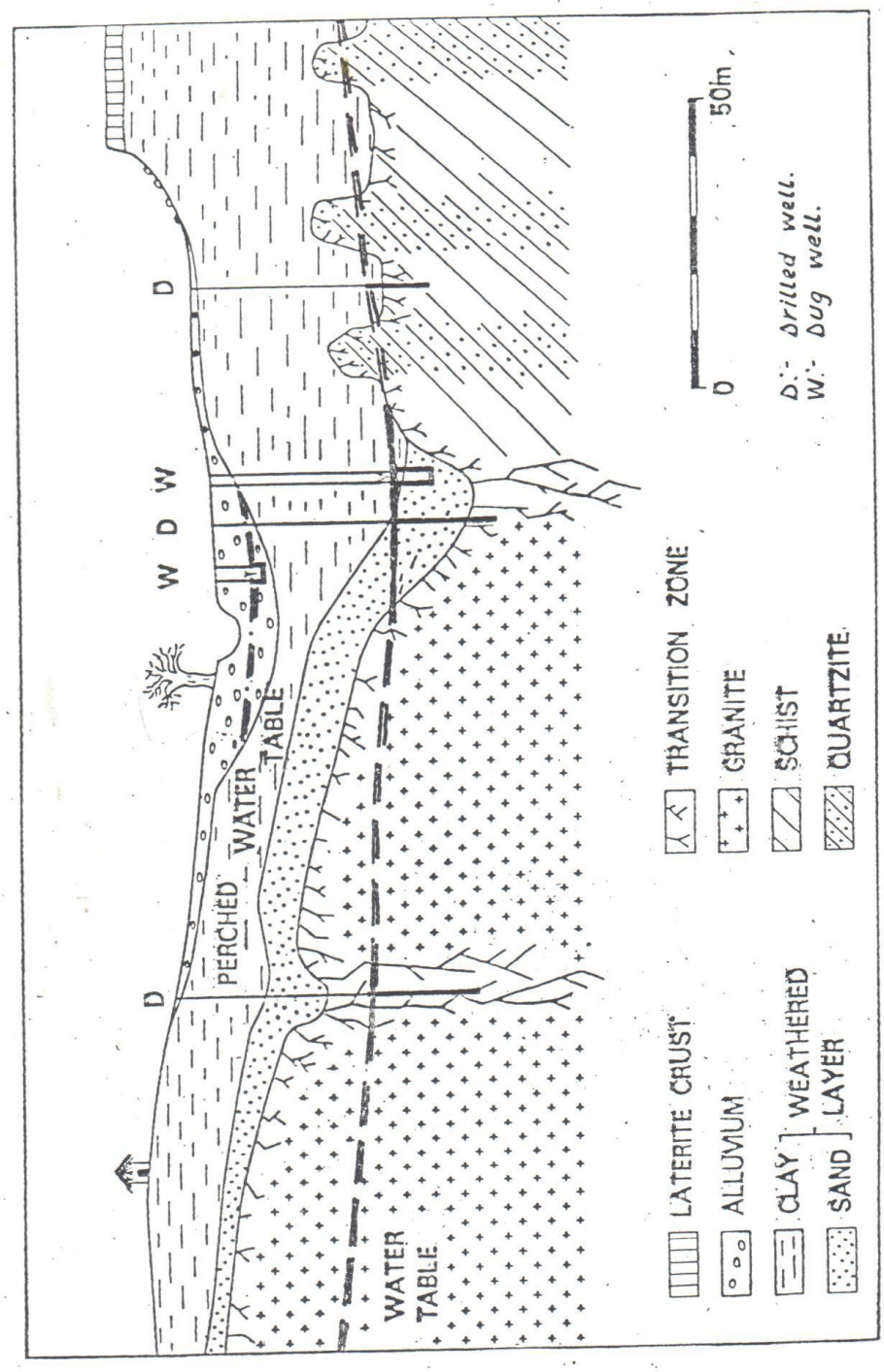

Figure 4 - Cross Section showing Groundwater Occurrence in Kitui District

EVALUATION OF WATER POINTS CONSTRUCTED BY MUTOMO SOIL AND WATER CONSERVATION PROJECT

MOSHE FINKEL
FINKEL AND FINKEL

1. BACKGROUND

The Mutomo Soil and Water Conservation Project commenced a five year programme in 1982. In its water development activities the programme aimed at improving water availability and reliability for domestic use through the application of small scale, appropriate community based technologies. The water points were intended to be taken over, managed and maintained by the communities they served. The selection of technologies was, therefore, limited to small scale, simple, water harvesting techniques. Construction of the water projects was to include major inputs from the communities in the form of labour. Projects were to be initiated only after water user groups were formed. Local fundis were to be trained to enable sustainable construction and future maintenance.

Between 1982 and 1990, the Mutomo Soil and Water Conservation Project assisted in the construction of some 623 water projects. Initially, the programme saw a slow start, especially in construction. During this period emphasis was put on the selection of technologies; development of technologies; development of construction standards and details; and on the mobilisation of the local communities. This slow start built up into a flurry of activity in the last three years in which 392 water facilities were constructed. The main techniques practised included roof catchments with various designs for storage tanks and rock catchments with storage tanks. The design of these storage tanks, evolved during the first few years of the project until standards were adopted. The design standards and construction materials and practises for tanks collecting water from roof catchments also underwent continuous changes and experimentation.

Since 1987, 169 more points were completed. This included almost exclusively ground water tanks collecting water from roof catchments (147). This gives the impression that the project, now under the Kitui Integrated Development Programme (KIDP), is scaling down its activities and limiting its scope to a single water technique.

This report summarises a 20 week study undertaken from December 1990 to evaluate the technical success and the social/cultural impact of establishing these water points. The evaluation was commissioned by the Kitui Integrated Development Programme (KIDP) and funded by DANIDA. It was conducted by a team lead by the author and included William Sakataka on water related rural sociology issues and Vincent Gainey on the evaluation of the techniques. KIDP

assigned key members of its Mutomo staff to join the evaluation team full time. These were Mrs. Jacinta Gathuo, the project sociologist and Mr. Ngunu of the Project Construction Unit. Mr. Justus Waboyo assisted in the coordination of the field activities. The team visited 550 water points to complete their technical evaluation and at each point conducted interviews with water users to evaluate the social impact. The interviews also included questions regarding water demand.

2. SUMMARY DATA

The total water production potential for these 550 water points is 580,000 cu.m./yr. This is well above the present water demand for domestic purposes which is estimated at 385,000 cu.m./yr. The actual water supplied through the programme constructed water points is estimated at only 245,000 cu.m./yr. which represents only 42% of the potential. The remaining water (140,000 cu.m./yr.) is obtained through traditional means such as scooping from the riverbeds or directly from the rivers.

This overview of water supplied is skewed when analyzing the water supplied per location and per sublocation. It has been found that some areas are still extremely water scarce and that others are highly dependant on single water sources that may not be adequate technically. Voo and Ikanga locations represent the weakest link in construction of water points. Voo location, with a population of 18,000 has an estimated present demand of 50,000 cu.m./yr. The programme has constructed water points with a supply potential of 30,000 cu.m./yr but actually delivering only an estimated 17,000 cu.m./yr. Two thirds of the present demand is now met by traditional means with the programme constructed points supplying only one third of the demand.

Ikanga location, with a present population of 19,250 had an estimated present demand of 74,000 cu.m./yr. The programme has constructed water points with a supply potential of 33,000 cu.m./yr but actually delivering only an estimated 23,000 cu.m./yr. This represents a higher than average delivery rate of 65% which may be explained by the higher level of maintenance due to the scarcity of water in the region but an overall low level of supply.

This low level of supply represents the various weaknesses in the programme. These include technical and community participation weaknesses. The technical weaknesses are associated with technique selection, site selection, design standards and technical details. The social weaknesses are associated with the timely involvement of the communities with the water points are meant to serve, the level of involvement at all stages of inception, planning and construction, the level of involvement in operation and management of the completed water points, the low level of training and the communities perception of ownership. There are also no clear guidelines as to ownership or clear division of responsibilities

between the communities, the project and GoK line ministries.

The projected domestic water demand for the year 2000 is 770,000 cu.m./yr. This is well above the present supply potential although the water points constructed by the Project and triple the estimated actual present water supply. When analysis is conducted on a sublocational basis, the balance of water to be developed is much higher than the overall balance. This indicates the need to continue construction of water points as well as the need to fully develop the existing points to their full potential.

The techniques developed and constructed by the programme include: roof catchments, ground catchments, shallow wells, subsurface dams, earthfill dams and spring protection. An economic analysis conducted by the evaluation team showed large differences in the cost of water per technique. The ranking of techniques according to cost of water, giving the lowest cost the highest ranking is as follows:

- -spring protection
- -shallow wells
- -large rock catchments
- -sand/subsurface dams
- -medium and small rock catchments
- -roof catchments

Earthfill dams could not be considered in the economic analysis due to their short economic life as a result of the heavy siltation and evaporation rates and their low actual level of performance.

The real cost of water ranges from less than 5 Ksh/cu.m. delivered through spring protection to 90 Ksh/cu.m. delivered through roof catchments. The techniques were ranked according to their importance in the actual supply of water as follows:

TECHNIQUE	%OF WATER ACTUALLY SUPPLIED
-rock catchments	33%
-earthfill dams	27%
-shallow wells	18%
-subsurface/sand dams	9%
-spring protection	7%
-roof catchments	6%

By comparing the two lists of techniques, it was found:

1. Roof catchments are the most expensive technique per unit of water supplied as well as the least important technique in terms of

the total water supplied. Yet in the last three years roof catchments have become the main activity of the programme.

2. Shallow wells produce the lowest costing water per unit supplied but the overall shallow well programme is technically weak and supplies only 18% of the water delivered.

The analysis of the design standards and criteria and construction details showed weaknesses mainly in the shallow well and the subsurface/ sand dam programmes. The weaknesses were conceptual and involve inadequate site selection and design criteria. Shallow wells are the most economic technique and in some areas shallow ground water is the only viable option for development. Further work is, therefore, required to assure the best possible site selection and the development of effective structures.

The rock catchment programme is impressive. Following an initial period of developing design criteria, standards and details, the programme has now mastered this technology which has become its mainstay. Some improvements in the relative sizing of the catchment area and storage volume may improve the effectiveness of this technique and some improvements to the water management could improve the economics.

Roof catchments are the most expensive technique for water development since they require relatively small storage tanks. They supply only 6% of the water actually delivered in the Division. Analysis of the construction standards shows imbalance in the relative sizing of the storage capacity to the roof area resulting in additional expenses. Some construction details were identified as requiring improvement.

RECOMMENDATIONS

PROJECT FRAMEWORK

1. Clear division of responsibilities between KIDP, MoWD, MoA and the local communities regarding the design and installation of improved water points should be made. While the Project could continue to assist with expertise in project design, technique selection and development, and establishment of water management programmes, the contact between the communities and the line ministries should be strengthened. Construction supervision and maintenance should be by line ministries.

2. There is need to establishment of clear guidelines as to the division of responsibilities for the operation, management and maintenance of existing and new water points. Line ministries should have the responsibility for the technical maintenance of the water points but the communities should retain responsibility for management, operation and minor maintenance.

3. There is need to establish grass-root water user committees with clear roles and responsibilities and with the power to enforce regulations and to operate a budget.

4. Training of line ministries' staff in all aspects of ASAL water technology including technique selection, site selection, construction details, water management and maintenance, and operation is needed so as to eventually facilitate handing over of project responsibilities to the line ministries.

5. Training of community representatives in water management, operation and maintenance of ASAL water technologies is essential.

PROJECT SELECTION

1. Projects should be initiated only where there is a proven need for improved water supply in terms of quantity, quality or distance.

2. Projects should be initiated only where a community has identified a need for water, the programme has confirmed this need and the community has taken steps to participate in the provision of water supply.

3. The selection of technique together with the community, community participation in site selection and in determining the levels of contribution to construction activities as well as commitment beyond construction in the management of the water point should be planned.

4. Construction should be only after community is fully aware of the division of responsibilities for operation, maintenance and management of the proposed water project.

5. The installation of the water point should include training of community members in operation, management and maintenance. This includes establishing management programmes for the total water resources of the community - when and how much water to draw from each source.

TECHNIQUE SELECTION

1. Preference should be given to development of shallow ground water through shallow wells, subsurface dams and sand dams. Improvements should be made in technical capabilities in site selection, design standards and construction details.

2. New rock catchments should only be constructed where shallow ground water is not available or where there is a requirement to diversify water sources. Capacity should be limited to 1000 cu.m./yr. or more produced.

3. There is need to diversify water sources on a sublocational basis by providing a mix of water sources - direct rainfall harvesting (rock and roof catchments), runoff harvesting (ground catchments and dams), and shallow ground water (shallow wells, subsurface dams and spring development).

4. The lowest priority should be given to roof catchment construction. Such construction should be only for special purposes as institutions - schools, clinics and the like.

DESIGN CRITERIA

Design Rainfall

Mutomo, Kanziko - 250mm
Voo, Ikanga - 200mm

Catchment/Storage Ratio

Roof Catchments - 4.5-5.5
Rock Catchments - 6-10
Ground Catchments- 13-50

Per Capita Water Demand

1991 - 10.5 litres/day
2000 - 15 litres/day

CONSTRUCTION DETAILS

Roof catchments with 78 cu.m. tanks

- design according to catchment /storage design standard
- improve roof details including better support, higher slope and silt trap
- remove faulty handpumps. Handpumps not recommended for small storage capacities.
- maintain ferrocement structures. Crack rehabilitation.

Roof catchments with 46 cu.m. tanks

- design according to catchment/storage design standard
- improve outlet chamber to enable drainage and access

Rock Catchments

- design according to catchment/storage design standard
- preference for gravity rockfill structures

Subsurface/Sand Dams

-develop adequate design criteria, criteria for site selection and construction details

Shallow wells

-improve site selection criteria

-develop improved design criteria, construction details and management programmes.

THE VEGETATION STATUS

R. K. SINANGE @ J.L. AGATSIVA
MPND

INTRODUCTION

The diversity of climate and landform in East Africa, of which Kitui is a part of, leads naturally to diversity in vegetation. The spectrum extends from sparse semi-desert vegetation to dense rain forest, and includes various bushland and grassland types, as well as mangroves and other swamps and the afro-alpine vegetation which surrounds the permanent snow and glaciers of the highest mountains. Vegetation can be a timber resource, a tsetse or disease habitat, an indicator of climate condition, an impediment to cultivation, a unit of certain grazing potential, a habitat for wild animals or a scenic attraction. In the context of range development, vegetation is likely to hold several values concurrently; even its scenic attraction cannot be ignored if tourism is a factor in development.

The range area embraces almost all vegetation types, from semi-desert to afro-alpine moorland. It excludes only dense forest and derived bushland and some categories of swamp vegetation. The most important types are deciduous woodland, open and wooded grassland, evergreen and thorn bushland and dwarf shrub grassland. However precise description of a stand has long depended on the observer in the absence of accurate measurement at the site. This makes historical reconstruction of vegetative changes of a site difficult.

There is no disputing the value of vegetation as an indicator of environmental condition, or the value of relic communities or species in the theoretical reconstruction of vegetation potential, but in future the effort should be made to quantify such relation in terms of environment as well as of vegetation and to use the physical terms in the classification of ecological zones. This is the approach that has been attempted for rangeland classification in East Africa as described by Pratt et al (1966) and recently refined by Grunblatt, Ottichilo and Sinange. (1989). These will certainly go a long way in assessment and statements of statuses of various vegetation communities in this country.

The status of vegetation, at any time is the result of the combined influence of all land attributes such as soils, fauna, climate, water and human beings. The magnitude of that influence may depend on the intensity and time or period taken to influence it. Thus time is also a factor in landscape ecology.

An example is Mutomo Division in Kitui. At one time the area was dense woodland. During the last half century people have destroyed the woodlands. As a result of the removal of the trees, poor,

sandy, permeable soils were exposed by man; then dry microclimates developed and finally biological humus mineralization was prevented. This has resulted in loss of humus, soil capping formation, impermeable soil, topsoil loss and finally formation of sparse vegetation. Where very dense woodlands existed, originally, sands are found now. This displays the interdependence of the parts played by climate, rock, vegetation, fauna, soil, hydrology and man. This is a process thought to be going on in the rest of Kitui District.

THE VEGETATION OF KITUI

Eco-climatic zone V of East Africa is the southern extension of a large belt of arid land which encircles the Ethiopian Highlands. It includes about half of Kenya and extends well into Central Tanzania. In Uganda it is represented only in the drier parts of Karamoja District.

In Eastern Kenya, the **Commiphora** woodlands dominate. This vegetation type is exceptionally well developed for such an arid environment. Probably it can only establish itself under a favourable combination of rainfall and other circumstances and, when a population becomes senile or is reduced by over burning, it is likely to be replaced initially by shrub species or by grassland. It may be, therefore, that the climax vegetation in these areas should be regarded as a cycle of distinct vegetation types, in which a grassland phase is possible. The following is a brief description of the vegetation of Kitui in order of importance:

a. Woodlands:
Woodlands include the **Commiphora** woodland, which occurs on red Basement soils, and small areas of **Acacia** woodlands on deep alluvial soils with tall **Acacia tortilis, Acacia etbaica, Acacia albida** and **Balanites aegyptica.** Other woody species associated with the commiphora woodland are **Boscia spp., Boswellia hilderbrandtii, Delonix elata, Melia volkensii, Lannea spp.,** and **Sterculia africana.** The baobab (**Adansonia digitata**) is important locally, and several species of **Acacia** may occur, especially **Acacia bussei** and **Acacia tortilis.** The ground cover includes several useful grasses, herbs and may be dominated by **Panicum** (or by **Chloris roxburghiana.**) Other grasses are **Cenchrus ciliaris, Digitaria spp.** and **Enteropogan mascrotachyus. Leptothrium senegalense** and **Aristida spp.** are very common but are of low grazing value. Most common herbs include **Barleria spp., Justacia spp., Blepharis** and **Tephrosia spp.**

b. Shrublands:
Shrublands, are also extensive in Kitui and take many different forms. The most extensive include forms of bushland related to **Commiphora** woodland described as when the **Commiphora** is supplemented by shrub species of **Combretum, Cordia,** and **Grewia.** These are also communities of shrub-**Commiphoras** often with

Terminalia orbicularis. The grass cover in all cases is dependent on the density of the woody vegetation, but usually contains many annual species like **Cenchrus ciliaris**, and **Chloris roxburghiana.**

c. Shrubbed Grasslands:
Shrubbed grasslands and wooded grassland occur mostly as intermediates between the typed described and grassland, especially where grassland formerly maintained by fire is now under encroachment by woody species **Themeda-Acacia drepanolobium** wooded grassland is a more stable type which occurs on black clay as edaphic situation.

d. Grasslands:
Grasslands are limited here in extent but varied. Most are associated with soils of impeded drainage and flood plains.

THE STATUS OF VEGETATION IN MUTOMO DIVISION

Land use activities are changing the Kitui vegetation and landscape gradually. Different parts of the district are at different stages of change. The Central hill have changed most with a fairly high percentage of land now under active agriculture. The Eastern lowlands (statelands) are least disturbed due to lack of surface water for man and his livestock. The Southern, Northern and Western areas are at different stages of change but essentially more than half of the land is still fairly little disturbed. The southern conservation area of Tsavo National Park has been undergoing its own ecological changes with a lot of influence form, climate, wildlife and man.

Assessment of the status of vegetation at any site needs some knowledged of long term environmental circles of the area and what climax physiognomic and vegetation communities would be representative of the prevailing conditions. Or if no long term circles are known some climax vegetation communities would be representative of the current conditions of the area. The many factors which cause changes in the vegetation of any landscape, for example climatic, geologic, soils and so on, can be considered to be stable in this region. However in recent years there have been increased landuse activities by man in this area that are slowly altering the vegetation. These activities are mainly livestock raising, agricultural tillage of the and conservation.

Surveys carried out in Mutomo Division indicate that the area has six major cover categories as summarized on Table 1. The area is thought to have the dense **Commiphora** woodland as the climax vegetation. The other cover types are derivatives of the dense woodland. These derivatives are due to levels of livestock use and cultivation. Overgrazing of dense woodlands leads to open woodlands or open shrublands.

Areas cultivated for a time and left fallow to recover would pass

through several stages of succession before reaching the climax dense woodlands. Some of these stages could include open shrubland. dense shrublands, dense wooded shrublands, and dense shrubby woodlands. So vegetation degradation in this region has been caused by cultivation and overgrazing locally. The formations, that is cover types, (Table 1) which intuitively can be considered as far from the climax vegetation are open woodlands, open shrublands and fallow lands. Croplands are completely artificial. All these comprise about 28% of the land. Thus just over 70% of Mutomo Division where this survey was done is close to its natural state.

Table 1
Estimated Major Cover Types: Mutomo Division

Cover Type	Percentage Cover
1. Dense woodlands	51
2. Open woodlands	3
3. Dense shrubland	20
4. Open shrubland	7
5. Fallow land	11
6. Croplands	7
7. Others	1
Total	100

Mutomo Division is hilly and undulating with highly erodible soils if exposed. Most of the open woodlands, shrublands, fallowlands and croplands showed signs of mild to very severe soil erosion, especially in areas with slopes of over 6%. Chances of recovery of these areas to full vegetative cover is very low and slow. In this respect excessive and careless opening up of the natural vegetation, above the present level, will lead to the loss of top soil in large areas. Then soil moisture content will be reduced leading to much reduced productivity. Severe food and water shortage will be the final result. This scenario is made worse by the ever increasing human population in the area. This population will need more land opened for food production.

Therefore, looking at the ecology of the area in historical perspective, there is cause for getting concerned about the future of the ecosystems and therefore a need for planning development of the division. Long before the local people settled here there was little or no influence on the landscape until the pastoralist/ hunters arrived on the scene. Then the population was sparse and negative effects on the vegetation were negligible. It is thought that the greatest influence on the vegetation from man was the frequent fires caused by the honey gatherers. The advent of subsistence cultivation and veterinary services, leading to more livestock surviving, increased pressure on the land. However, since there was ample land, shifting cultivation was practised and exhausted area left to recover. This practise is still evident in a few areas in the south. However most people are now settled permanently in one place and there is little room or suitable empty

areas to move to. Thus the land will soon be very exhausted, eroded and rendered unproductive if appropriate land use practises are not instituted.

SITE SPECIFIC STUDIES: STATUS OF VEGETATION AND LAND USE SUMMARIES

Stereo sets of aerial photographs taken in 1980 at a scale of 1:10,000 were used in conjunction with recent field checks, to produce information on vegetation and land use in Mutomo Division. The main objective of this survey was to appraise the current status of vegetation in areas occupied by different water groups in Mutomo Division.

If development activities have to be effected in the areas next to water sources in various water catchments, effective measure are needed to have such catchments developed in a manner that is environmentally sound. In so doing, urgent and accurate information on the current land use and vegetation types is required. The status of erosion needs to be understood perfectly. The range carrying capacity should be equally known. Finally, it is essential to establish the total population within the water catchment so that their demands on the land can be determined and appropriate development plans instituted.

Various sites in Mutomo Division were covered to assist in achieving this major objective of planning sustainable development of the water catchments. Such sites included: Isamallu, Mwangala, Kyangulumwa, Ngosini, Mavulia, Utekilawa, Kamwove, Kwangalia, Kwambaki, Kyanika, Kamukui, Ukenge, Yambuu, Kaseva, Lingithya, Imau, Yemangulu, Nzonzweni, and Kilamba. (DANIDA, 1991). For the various sites surveyed, the range and vegetation conditions, as well as trends, were studied. The land use conditions on these sites were also determined. Land units on these sites were interpreted from the aerial photographs. These land units were therefore described in terms of vegetation types, range carrying capacity, landuse types (present and recommended), erodability, soil erosion condition and so on.

Each land unit is determined by various criteria among which slope is the major one. Any site could be divided into mainly four major zones. These are 1. Minor hills 2. Footslopes 3. Dissected erosional plains 4. Valleys. The slope categories used were 1. above 20% 2. 12-20%, 3. 8-12% 4. 6-8% 5. 2-6% 6. 2-4% and 7. 0-2%. These major zones also have sub-classes being differentiated mainly by the slope categories.

In areas where tree species and herb cover have been degraded, certain species were recommended for rehabilitating the areas concerned. Appropriate farming activities have been recommended. Different parts of any site have been recommended for any of three major land use types: conservation, pasture and livestock utilization, and cultivation.

RECOMMENDATIONS ON SPECIFIC LAND USES

1.CONSERVATION AREAS

These are mainly areas on hill tops and along the major scarps with slopes of over 12%. Such areas are recommended to remain as natural as possible. In areas where soil had been exposed through clearing, the cleared areas are recommended to be left idle to regenerate naturally or for the lower slopes to be planted with species like **Prosopis juliflora, Melia volkensii, Croton Megalocarpus** and so on. In any case use of lower areas of the hills requires controls. Where **Prosopis juliflora** is grown, care must be taken to avoid the plant becoming a weed.

2. PASTURE AND LIVESTOCK MANAGEMENT IN GRAZING AREAS

According to present range conditions, most of Mutomo Division, and probably the rest of Kitui, seems to be good goat country and therefore it is recommended that livestock raising be biased towards goats. Most of the grazing should be limited to the foothills and the plains where the slope is less steep to avoid vast detrimental effects to the environment. This would form about 30% of the area. The stocking rates should be around the recommended rate: mostly no more than one livestock unit (LU) to 2 ha. for this area. In most sites, the management of the pasture areas requires improvement where high yielding **Macrostachyus** and **Panicum maximum** should be planted. Legumes for nitrogen fixation in soil should also be included. Agroforestry tree species such as **Cassia siamea, Cassia spectabilis, Acacia albida** and **Prosopis juliflora** should be planted to assist in the multipurpose usage of the farms.

Some areas need reseeding and rehabilitation. This rehabilitation should be accompanied by development of adequate water supply distributed optimally in the area to encourage even use of the range to avoid localised range deterioration around waterpoints.

3. CULTIVATED AREAS

Since the chances of crop failure in any one year are fairly high, specifically in Mutomo Division, and Kitui District in general, emphasis should be on cultivation of sustainable and subsistence crops. The total area to be under cultivation in any one year or season should be monitored and limited to not more than 10% of the area to avoid accelerated loss of soil moisture from these opened up areas. It therefore calls for good agroforestry practises to be incorporated. Live fencing of cultivated fields and homesteads with **Commiphora agricana** and **Commiphora erythrae** should be encouraged because they can also supply fuelwood. **Acacia spp., Balanites spp.,** and **Terminalia spp.,** around and in fields for nutrients cycling as well as for supply of poles, fuelwood and as ornamental should be instituted. Other exotic agroforestry species appropriate here are

Cassia, Croton, as well as Prosopis. Mellia volkensii is also highly recommended in these areas.

In any case, agriculture should be restricted to the plains and less steep areas (slope less than 8%). Drought tolerant and quick growing crops, such as bulrush millet, pigeon peas, beans, cowpeas, and Katumani and Makueni composite maize varieties should be grown. Improved drainage is recommended where appropriate especially in the valleys to avoid the problems of salinization. Terracing is mandatory where the slopes are less gentle and the terraces should be planted with Panicum colloratum (makarikari grass).

CONCLUSION

The vegetation of Kitui District is in a dynamic state and the rate of change depends on land potential, population density, land use activities in the areas, as well as on the conservation status and efforts in the area. Land use planning for the area will alleviate prospects of land and vegetation degradation to a point of no recovery.

REFERENCE

Grunblatt, J., W.K.Ottichilo and R.K.Sinange (1989)
A hierarchial approach to vegetation classification in Kenya. Afr.J. Ecol. 27:45-51.

Pratt, D.J., P.J.Greenway and M.D. Gwynne (1966). A classification of East African Rangelands with an appendix on terminology. J. Appl. Ecol. 3: 369-382.

Pratt, D.J. and M.D. Gwynne (1977). Rangeland Management and Ecology in East Africa. Hodder and Stoughton London.

Danida (1991) Various catchment vegetation and land use survey reports with DANIDA KIDP.

WHY AND HOW TO RECLAIM ZONES 4 AND 5 FARMS

G-C. M. MUTISO
MUTICON

PERMANENT MIGRATION TO ASALS

Many farmers have moved from the more humid zones to the less humid during the past fifty years. National census data has never, to our knowledge, been analyzed in terms of agro-ecological zones to detail this movement from a national perspective. Since agro-ecological zones do not fit easily into districts, it is important for national development planning reasons that this exercise be attempted. Such an exercise would statistically establish how farmers with one set of agricultural production technologies have moved to areas where their knowledge is not useful.

As shown in Table 1, Zones 4 and 5, make up 20% of the country and are significant for crops and livestock production. The development and at times reclamation of land in these zones is a clear national priority given the exploding population and the need to feed the proportion of the population found in the ASALs with food mainly produced there.

For Kitui district, the development and reclamation processes will have to stretch to Zone 6 where already there is significant farming.

Table 1
AREA BY AGRO-ECOLOGICAL ZONE (AEZ'S)

		%R/EO	Area (KmΩ)	% Country area
Zone 1V	Semi-humid	40-50	27 000	5
Zone V	Semi-arid	25-40	87 000	15
Zone V1	Arid	15-20	126 000	22
Zone V11	Very arid	15	226 000	46
Total			506 000	88

Source: Farm Management Handbook of Kenya

Historically, zones 4, 5 and 6 have received population from more humid zones. In the perspective of centuries, it is doubtful whether there were permanent settlements outside Zone 2 and 3 up to the early 18 century as most oral traditions attest. From oral traditions, we know that ASAL production was integrated into the hill/mountain based homesteads through hunting and livestock keeping in syengo in the dry plains. Therefore the issue of continuous use of the fragile ASAL ecosystem did not arise for the institution of the syengo dictated constant relocation of the bases and thus called for discontinuous use of the range resources.

The institution of the syengo was not just for herding. Out of it came major social structure for deployment of labour. Out of it came the major distribution process of livestock and grain consumables. Out of it came the scattering of livestock resources so as to escape drought and disease. Out of it came the then dominant land holding form which assured every family owned mountain and plain land as is found in the traditions of the Kamba, Pokot, Meru, Tharaka, Taita, Mijikenda and so on. These economic and ecological adaptation mechanisms, encapsulated in the institution of the syengo, were marginalised by the population growth of the past ninety years.

In the last ninety years, the populations in ASAL districts have moved from the more humid areas to the drier parts permanently. For Kitui District, this has been the shift from the central, northern and southern hills into the plains. Table 2 below shows the ASAL districts and the percentage of total ASAL area nationally. Similar movements take place in these ASAL districts.

Table 2
ASAL DISTRICTS CLASSIFIED BY DEGREE OF ARIDITY

Category	Districts	% Total ASAL area
A. 100% ASAL	Isiolo, Marsabit, Garissa, Mandera, Wajir, Turkana	62
B. 85-100% ASAL	Kitui, Tana-River, Taita-Taveta Kajiado, Samburu	25
C. 50-85% ASAL	Embu, Meru, Machakos, Laikipia, West Pokot, Kilifi, Kwale, Baringo	10
D. 30-50% ASAL	Lamu, Narok, Elgeyo Marakwet	3

Source: IFAD/UNDP, 1988

Table 3 below, culled out of recent population statistics, shows recent population movements. Perusal of this table shows that for the intercensal period of 1979 and 1989, nine of the 22 ASAL districts were getting migrants. Thirteen of the twenty two ASAL districts were exporting population. Census data interpretation assumes that the export is to urban areas. It is possible that some of the export goes to other ASAL districts.

Table 3.
DEMOGRAPHIC INDICATORS BY ASAL DISTRICTS

District	Pop. Size 1989'000	Growth Rate 1969-79	1979-89	Net Change	Migration Rate Per 1,000./89
Garissa	236	+685%	+573%	-112%	+2681
Laikipia	242	+701%	+578%	-146%	+2276
West Pokot	281	+662%	+540%	-122%	+1988
Marsabit	166	+613%	+520%	-093%	+1647
Lamu	73	+647%	+515%	-132%	+1693
Tana River	158	+590%	+507%	-083%	+1481
Kajiado	254	+550%	+506%	-044%	+1349
Narok	354	+519%	+494%	-025%	+1145
Wajir	235	+480%	+488%	+0.08%	+1158
Embu	412	+385%	+418%	+033%	-34
Machakos	1587	+368%	+411%	+043%	-61
Isiolo	67	+360%	+398%	+038%	-79
Kwale	440	+335%	+394%	+059%	-323
Kilifi	658	+336%	+392%	+056%	-324
Meru	1264	+330%	+391%	+061%	-361
Kitui	697	+302%	+376%	+074%	-531
Taita-Taveta	219	+288%	+367%	+079%	-719
Baringo	296	+231%	+347%	+116%	-177
Mandera	141	+110%	+251%	+114%	-2259
Samburu	102	+095%	+250%	+155%	-2415
Elgeyo M.	164	-065%	+086%	+121%	-4395
Turkana	147	-1243%	-020%	-123%	-5385
Total ASAL	8198	+381%	+398%	+017%	-120
National Total	23883	+337%	+400%	+063%	0.0

Source: ASAL Development Policy Paper Draft 3, 1990.

Generally it is assumed that migrants into ASAL districts come from high potential districts. However, there is increasing evidence that some migrants move from deteriorating ASAL areas to other ASAL areas where the natural resources can still be exploited. This could be in the same district or from one district to another. Nationally, the movement of Baringo residents to ASAL areas of Elgeyo Marakwet at the bottom of the Kerio Valley, the movement of Kajiado residents to Narok, Turkana residents to West Pokot, Taita residents to Kwale and so on are symptomatic of this relatively new phenomena.

However, this ASAL to ASAL movement is not the key movement. In our opinion the bulk is still movement from humid to less humid areas. Those familiar with the post Independence history of this country are struck by the major population movement into the so called "ranch" areas of the former White Highlands: the peopling of Yatta Plateau in the past thirty years: the infilling in Kitui in the same period. Next door, in Machakos, the spread into Makueni since 1950s, and the migrations to Kambu, Ngwata and Kibwezi in the past twenty years are dramatic. At the same time one should note the

large scale peopling of Kitui Yatta by migrants from the ASAL areas of Machakos.

The historical intra district migration data for Machakos in the past sixty years is shown below in tables 4, 5 and 6.

Table 4:
POPULATION DENSITY BY AEZ 1932-1969

Zone	Sq. km	Ha/person			
		1932	1948	1963	1969
III	1,104	1.11	0.72	0.51	0.47
IV	2,158	2.12	1.6	1.11	0.87
V	5,069	22.7	12.9	6.38	2.93
VI	4,247	60.3	38.3	16.1	8.52
Total	12,578	5.5	3.7	2.43	1.84

Source: Lynam

Table 5:
ACTUAL NET POPULATION FLOWS TO AEZ ZONES

	1932-48	1948-63	1963-69
II			
III	0	-17,250	-28363
IV	+11,940	+9,736	+17,170
V	+6,772	+19,973	+75,326
VI	+5,119	+7,036	+17,385
Total	0	0	+47,175

Source: Lynam

Table 6:
PERCENTAGE GROWTH RATES BY AEZ 1932-1969

	1932-49	1948-63	1963-69
III	2.60	2.30	1.60
IV	1.75	2.50	2.25
V	3.50	4.80	13.7
VI	5.60	5.00	11.0
Total	2.50	2.80	4.80

Source: Lynam

This Machakos data is only for illustration but several conclusions stand out. First, one should note the deteriorating per capita land holding in all zones. Second is the dramatic peopling of the less humid zones by people from the more humid areas. Third, is the dramatic jump in the peopling of Zones 5 and 6 in the 1960s.

The triple problems of high potential migrants into ASALs, without the necessary ASAL production knowledge, and emigration from ASAL to ASAL, driven by lack of environmentally sound production techniques and deteriorating land potential, and the shrinking land resource per capita, bring to focus the need to systematically reclaim the ASALs and to generate sustainable production techniques for intensification of agricultural production.

ASAL PRODUCTION

The ASALs produce the bulk of the meat products in this country. Table 7 below refers. This point needs constant repeating for many do not seem to appreciate that without the ASAL areas, there would be no meat industry in the country and the national practice of nyama choma, not to speak of the normal national need for animal proteins, would disappear.

Table 7
LIVESTOCK POPULATION 1987 ('000)

	Beef Cattle	Dairy Cattle	Sheep	Goats	Camels	Donkeys
ASAL Districts						
Meru	263	140	106	96		
Machakos	388	84	96	249		
Kitui	304	6	66	535		
Embu	81	37	26	106		
Narok	801	84	436	423		129
E Marakwet	101	887	137	146		
Baringo	103	49	129	649	1	3
Kajiado	608	2	500	449		12
Laikipia	217	25	297	267	1	1
Kilifi	169	17	23	160		
Lamu	44	4	8	15		
T Taveta	140	9	50	155		
Kwale	223	11	67	131		
T River	444		159	293	52	2
W Pokot	170	10	190	120	1	1
Marsabit	315		401	425	227	23
Isiolo	203		178	119	424	52
Turkana	208		720	1080	10	5
Samburu	155		163	253	14	10
Mandera	126		110	714	12	4
Wajir	25		180	220	153	3
Garissa	693		100	678	61	4
Total ASAL	5761	715	4144	7283	956	249
Total Non ASAL	3810	2287	2300	1245		
ASAL as % of Total	64	24	64	85	100	100

Source: Agriculture and Livestock Data, MOPND Long Range Planning, June 1989

Although ASALs produce subsistence crops for their population, one of the really serious national food statistical omissions is the lack of a coherent picture on the contribution of ASALs in crop production. However Table 8, shows the MOA estimate of food production potential of the ASALs. Although potential can be estimated, it would be more useful for development planning if actual production figures were collected and analyzed. What is not disputed is the fact that the bulk of the bean, cowpeas, pigeon peas, simsim, millet, sorghum is produced in the ASALs. These form a major pillar of national food consumption.

Table 8
ASAL POTENTIAL CROP PRODUCTION

Crop	Hectares	Yields Kg/ha	
Maize	200000	400	700
Sorghum	80000	800	1200
Millet	22000	800	1500
Beans	88000	300	500
Cowpeas	20000	300	500
Pigeon peas	30000	200	400
Green gram	15000	200	300

Source: Agricultural Development in ASAL, MOA, Nairobi, 1990

ASAL LAND SHORTAGE

Land is becoming short in the ASALS. Table 9 shows average land holding by district in selected districts. It always is important to peer behind the statistical averages to get an idea of effective land holding. For Kitui the data in Table 9 shows average holding as shrinking from 0.89 to 0.50 hectares between 1969 and 1989.

Table 9
AVERAGE LAND HOLDING SELECTED ASAL DISTRICTS (HA. PER PERSON)

District	1969	1979	1989
Narok	7.32	4.30	2.66
Lamu	3.36	1.76	0.98
Laikipia	2.09	1.03	0.55
Kitui	0.89	0.66	0.50
Kwale	0.79	0.57	0.42
Embu	0.58	0.39	0.28
Kilifi	0.53	0.38	0.28
Taita	0.45	0.34	0.26
Machakos	0.40	0.28	0.20

Source: Livingstone, 1989 Quoted in ASAL Development Policy Paper

Average statistical data needs to be refined by analysis of the pattern of land holding in the district. We reviewed the Kitui District adjudication record of the past 20 years in attempting to go beyond the mere statistical average. The review shows that a total of 1,714,194 hectares out of the district's 3,109,900 hectares were adjudicated. This volume of land was divided into 39,290 parcels. The average parcel was just under 44 hectares. Assuming that each parcel represents a family of 8 then the per capita land holding is only about 5 hectares.

This average is also not meaningful for adjudication took place in the two extreme poles of land use in the district. It started in the high potential and thus extremely crowded areas of the district and at the same time adjudicated the massive ranches. For example in the Mutune Adjudication section 918 hectares were adjudicated into 1023 parcels for an average parcel size of 0.90 ha. Another example is Kauma Adjudication section where 199 ha. were adjudicated to 1538 parcels thereby producing an average parcel size of 0.13 ha. At the other end of the past adjudication is Mutumbi Ranch with 59,664 ha. which was adjudicated to one parcel or Nguni Ranch with 9,379 ha. also adjudicated in one parcel.

Since adjudication is far from being completed, it will not be possible to establish the actual land holding per household and per capita. If the catchment approach is adopted, data can be collected in the catchments to refine data on farm size and to elucidate variations by zones per capita. For land use planning, it is the farm size which will be critical and not the statistical average land holding.

On the whole, it can be argued that the average family land holding and thus per capita holding is shrinking. This land shrinkage presents tremendous challenges for sustainable development and intensification of ASAL production since the farming systems have not addressed the key issues in any intensification, ie fertilisation of the soil, labour saving tillage and handling equipment and utilisation of water harvesting for production and perhaps most complex integration of crops and livestock production so as to capitalise land rather than mine it.

The point one wants to make is that there is not much land per capita in Kitui. It is therefore important that systematic improvement of the land as well as reclamation be speeded up. This can be done only if the farmers get techniques which facilitate the improvement of the land.

MAKILA: TRIBULATIONS OF A MIGRANT DEVELOPING A ZONE 5 FARM

One of the most frustrating things for a farmer is to get conflicting information from both the extension system and the

published materials on how to reclaim land in Zones 4, 5 and 6. This is more so when the farmer is a recent migrant from Zone 3 and has no experiential knowledge to fall back on. It is not good enough that the farmers be left to pick experiential knowledge over time for the land resource will deteriorate very fast.

The balance of this paper is in the form of a diary of a farmer who for the past twenty years has struggled with the problem of reclaiming ASAL land in Makila Village, Kwakala Sublocation, Wamunyu Location of Machakos District. He migrated from the coffee zone in Machakos. He is not resident on the plot. However his experience may throw some light on the strategies necessary for reclaiming Zones 4 and 5 and possibly 6.

Using Jaetzold maps and data Makila formal statistics are as follows:

Average Rainfall estimate 600mm
60% Reliability of Rainfall Long Rains 200mm
60% Reliability of Rainfall Short Rains 200mm
Agro-ecological Zone LM5 ie Livestock and millet Zone with very short and a very short to short cropping season.

This is all the formal written up data on the region the farm is located. The nearest rainfall gauge is in Wamunyu Chiefs centre 10 kilometres away. It is not to be trusted for often it rains there without a single drop in Makila. Soils have not been analyzed.

1970
This land, measuring of 22.5 hectares, was bought in August 1970 for Ksh.16,000 for it had already been adjudicated and the title deed was available. It was bare and panned. The buyer farmer was a migrant from the coffee zone of Kangundo Location, Machakos District, where he could not get land to buy.

Since the farmer was a migrant, and since the parcel had been in dispute during adjudication, the neighbours felt that it should be used as commonage before he could organise himself. Since 1970 was a localised drought year, all the neighbourhood cattle tramped through the land on their way to the survival grazing on the Athi. The big mother (and father!) A. Tortillis trees were cut for fodder for goats. The large A. Mellifera were cut for charcoal. So were the munina wa usi. When the farmer returned to the plot in September, it was not only bare of grass, but was bare of any large trees.

There were three parts on the land which had been cropped before. Since the piece had been disputed during adjudication, they had not been cropped for about four years. The dominant colonising tree in the maeel (fallow land) were A. Tortillis spread by the goats.

1970 Short Rains

The farmer fenced with brush by contract. This led to devastation of the few remaining trees for the contractors were, unknown to the farmer, also felling the bigger trees to use in charcoal burning.

About two hectares were ploughed by tractor. An attempt to plough, before the rains in September, was a failure. The red soil was too hard. The tractor owner argued that nobody ploughs new land on red soil in the location before the rains. After the onset of the rains, the land was ploughed, or better, the mud was rolled around. In any case beans, cowpeas, pigeon peas, and maize were planted as the tractor was ploughing for the farmer was aware, from literature, that according to the MoA, since Dowker's work in Katumani, the major bottleneck to production, in the zone was early planting. Besides there were no oxen for hire, or community members (mwethya) for the planting. Migrants are not speedily integrated into the social network of mwethya.

It goes without saying that the crops were a failure. There were no terraces to maximise water retention. The seeds were probably buried too deep. The tractor compacted the land. The short rains failed, part of the beginning of the under normal rainfall which was to last until 1978.

1971 Kathano
The farmer approached the local TA for laying out four terraces. One kyambo (25 feet) of terracing 2 feet by 3 feet cost Ksh. 25. These were done in Kathano (short dry period in January/February). No crops were planted.

1971 Long Rains
The farmer managed to get a tractor to plough the terraced land before the rains. Maize, beans, cowpeas, simsim, sweet potatoes and cassava were planted separately. Planting was by hand and it was done by mwethya for the farmer was beginning to integrate into the community. Weeding was by hired labour for the family was not domiciled there. They are still Nairobi based. Planting was late for each person living in Makila first plants before they begin the mwethya for assisting cripples and migrants. The beans and maize were a total failure for the planting was late.

Sweet potatoes and cassava survived. They were an innovation for nobody else grew them. The farmer had got the idea from the ALDEV records of Makueni. However, since there was none in the region, he had collected planting material from Kangundo. Somehow they were not adapted to the region and yields were dismal. Vermin had their fill though. There were no family members to watch over the vermin. Employed staff always had arguments that vermin, especially monkeys, were smart and attacked when the staff went for lunch, were looking after cattle and goats, were repairing the fence or sleeping at night. After all employment is a 8-5 affair. It is more so when the owner lives in Nairobi and is a migrant.

The terraces broke.

50 goats were bought in Kithimani and Makueni. 50% of the Makueni goats died. Two heifers and a bull were bought in Yatta. They were Eastern Kitui Boran. Four milk cows were donated to the farmer from family traditional obligations. Three of them died for they came from the relatively tick free area of Kangundo. Ticks were endemic in Makila and there was no dip for miles.

1971 Thano
This was a particularly dry period. The cattle and goats were emaciated. However, proximity to the Athi meant that they could get some green fodder in the river channel. They survived. The farmer bought one of the original coffee spray pump from a Kangundo farmer who had given up on coffee to be spraying livestock. This was on advise of a new migrant neighbour who works for a multinational veterinary company. The later migrant recommended getting a Galla buck from a farmer in Kibauni, the next location. One was bought and the foundation breeding was started.

The TA recommended that the farmer buy Makueni and Mbarara Rhodes and scatter it in the land on the onset of the rains.

1971 Short Rains
There was no tractor available for ploughing, since the tractor owners had moved their tractors to plough in Kanyangi, where migrants from Wamunyu were opening new farms. The farmer bought a plough. Ploughing was done by mwethya who got to use the farmer's plough on their land by way of payment. Cultivation by plough was done by mwethya.

The farmer got the first crop of maize (6 bags) and beans (10 bags). The lesson seems to be not to put tractor on land for the ploughing system produced a crop and reduced costs since those neighbours without a plough use it as payment for planting and cultivating. Oxen are borrowed from neighbours, who then use the plough.

The repaired terraces broke again. The neighbours informed the farmer that all the terraces measured by the young man, who trained in Embu always break. They recommended to the farmer that he goes to get a retired TA who started work in ALDEV days. The catch is that he is paid 20 shillings a day. The MOA TA is free but he insists on nyama choma which in any case comes to about the 20 shillings charged by the other.

Makueni and Mbarara Rhodes does not grow. More than 75% of the grazing land is still bare.

1972 Kathano
ALDEV TA realigned all the previous terraces. They are more than four feet off. He explained to the farmer that the terraces were

measured for spilling water away from the land rather than retaining it. He recommended the Makaveti Square Mile (circa 1952) measuring technique where the terraces are aligned for retaining all the water on the land. He further recommended collecting water from the two roads passing the farmer to increase the amount of water on the land.

ALDEV TA recommended terracing grazing land for he was convinced that grass would not grow until water was retained. The alternative was to use a chisel plough which he remembered from ALDEV reclamation of Makueni. The farmer had seen such a chisel in the World Bank Baringo Project. It was the only one in the country and had been imported from Argentina. Since that option was closed, four terraces were added in the grazing land. Terracing a kyambo length has gone up to Ksh. 35.

ALDEV TA recommended cutting brush and compacting it in the gullies some of which are ten feet wide. This work was started in the big gullies.

1972 Long Rains

Neighbours extensively collected cassava cuttings for planting for they were "sure" there would be a drought. Rains were erratic. Beans were replanted twice. Still they did not produce a good yield. Maize crop was eaten by monkeys from Yatta.

Grazing land which was terraced shows spectacular growth of Nthata Kivumbu and Mbeetua as well as Mbarara, Makueni and, of all things, Nandi Setaria, where water-collects at the soil is thrown up and at the gullies filled with brush. Most of the bare patches, still about 70 % of the land, got lamuyu (an annual grass) growing in scattered clumps.

The farmer brought on the land a grass specialist, from the Faculty of Agriculture, who had studied in Australia and who was involved in breeding bana grass to get an assessment of what grasses to plant given the past failures. He identified the grasses and did not recommended buying any more of the commercial grasses for they would not be as good as nthata kivumbu or mbeetua or kithuku.

The farmer planted eucalypts and grevillea, leucaena and pines etc. They all dried.

Thano 1972

Nthata kivumbu still green although by all accounts it is an abnormally dry year.

ALDEV TA recommended that rather than waste money on planting new trees, all wildings germinating on their own should be pruned extensively. This was done.

1972 Short Rains

The rains were again low. The grazing land terraced filled with native grasses. The Mbarara and Makueni Rhodes and the abberation of Nandi Setaria are gone. They did not survive the thano.

Almost given up on maize and beans. Problem is organising labour for planting and weeding, oxen or tractors for planting and keeping watch over vermin. Only planted the first four terraces. Made decision to concentrate on animals and look around for cash crop to irrigate.

The pruned A. Mellifera, which were just low bushes, about half a metre from the ground, grew by a metre. The A. tortillis grew by about half a metre. Other species like terminalia brownii shot up so fast that we could not measure them.

1973 Kathano

Animals are doing well. Sold about 40 goats. Grass is filling. The old masyuko (cattle trails), other than the patches with kivuthi (gravel) have not got any grass yet. The pruned A. Mellifera stayed green longer than those not pruned. They flowered more. The tortillis produced more pods if pruned.

Completed terracing half of the land from the top. There is no water getting into the gullies. Where brush was put in, there is grass. The sides have been falling in and the gullies are healing themselves now.

Started taking out the anthills. Ten were dug up and taken out. Since the charge is twenty shillings per ant hill, it was decided to cut small channels to the anthills and to let the runoff get into them thereby killing them.

1973 Long Rains

Planted maize and beans with the usual labour problems. They were eaten by monkeys from Yatta. Planted exotic trees which dried.

The animals are doing alright. Got a Boran/Sahiwal cross bull from a neighbour. Good native grass even in the lower parts not yet terraced.

1973 Thano

Issued a contract for clearing sodom apple and other shrubs in the grazing land. The TA passed by one day and on discussing burning said that the law prevents burning and if the farmer burned deliberately, he would prosecute.

The University grass specialist had argued against burning for it would destroy grass seed, which was scarce then, and young indigenous trees. The farmer sees no logic in not burning to control bush and ticks as is argued by Samburu, Maasai and Kamba oral traditions.

For the first time, some of the young A. Albida (mung'ole) seeded. There are only about ten of these trees in one corner of the farm. The big mother trees had been cut for charcoal.

Bought ten beehives and put them next to the river. Surprisingly bees settled in the middle of the dry season.

Tree planting holes were dug to plant trees especially in the designated home compound.

1973 Short Rains
The farmer looked for indigenous tree seedlings and could not get any, either from the Forest department or private nurseries in Nairobi.

The holes which were not planted with trees got a lot of grass. When the ALDEV TA passed by he told the workers that there were **wamatengo pits,** After the Wamatengo tribe in Tanzania, which they dug to rehabilitate the impossible patches during his ALDEV days. He recommended that in those areas where nothing was growing, we dig pits arguing that they will get as thick grass as the unplanted holes. Later the farmer read about the **zia** holes for planting millet in Burkina Faso, and tried both systems.

1974 Kathano
Nothing much was done on crops. The wamatengo and zia pits were expanded in those areas where the grass was not coming in.

1974 Long Rains
Again there was nothing much done on crops for the farmer was away. The grass in the pits did spectacularly well.

1974 Thano
Nothing was done for this was one of the worst drought years in the region. Concentrated on building.

1974 Short Rains
The traditional trees were now big. They were five to six metres above the ground and the canopy was beginning to touch. About 95% of all grazing land is now covered with grass. Where the trees have created a canopy, especially where the dominant species is A. Mellifera, there is fantastic grass. Thirty goats and ten sheep were added to the stock. Goat prices have dropped for there really is a famine. The livestock seems to do well.

1975
All year efforts were put on building a home and a massive water tank for supplementary irrigation of oranges. Farming of the minor four terraces concentrated on beans. The crop land is exhausted already. There is no manure for it since we want to use it for the oranges.

ALDEV TA argues that it is the tractor ploughing which has compacted the soil. The recommendation is that there should not be any tractor ploughing in the rainy season.

1976 Kathano
Expanded the cleared land to get space for 1,000 orange trees.

1976 Long Rains
Planted 500 budded oranges and lost more than half to white ants. As supplementary water was put, it seemed as if all the ants in the region came for water under the trees. Put all the recommended ant killers bought from KFA but still the ants got the oranges.

1976 Thano
Redug the 300 holes and put chemicals for killing white ants. Dug up 500 more holes. Spent a lot of money on the ant killers.

1976 Short Rains
Did not replant oranges for the rain was very poor.

1977 Kathano
Continued to prune trees.

1977 Long Rains
Replanted and planted oranges. Planted beans between the oranges to increase the land productivity. Weeding became a major problem for the oranges were not in neat lines to facilitate cultivation using the plough.

1977 Thano
Concentrated on saving oranges by watering and mulching. The grass is very good. Sold some animals. The economics of the farm are dismal. Too much labour cost and very little return yet.

Visited by an Israeli trained orange specialist, from the DAOs office. The planting distances were too crowded for the region according to him. When we went to the DAOs office in Machakos, he had given us a specialist TA who knew what distances to keep. He was the one who laid out the holes. Now they are crowded for the moisture in the region.

1977 Short Rains
Concentrated on spraying and cultivation of oranges.

1978 Long Rains
There was very good rain. It started early in March and continued to July. The grass and the trees look fantastic. The oranges are good at the beginning of the season. The local TA gave us fertiliser for the oranges. We put about five spoonfuls under each tree.

No crops were planted for the labour of cultivating for the oranges

is too much.

1978 Thano
The oranges are wilting although they get four litres every week. ALDEV TA argues that the cause is the fertiliser.

To increase the amount of water into the oranges, all storm water was diverted to those terraces with oranges from the road. ALDEV TA showed how it was to be done. Since the lower parts of the land were covered with grass he argued there would be no erosion.

1978 Short Rains
The rains came early and persisted. Storm water was collected in the terraces and no soil was detected leaving the farm. Even in the depressions of the former gullies, no evidence of erosion was detected.

Ten or so orange trees flowered.

Grass, especially Nthata Kivumbu is filling all the parts. In the pitted areas, there is complete coverage of grass.

1979-1990
All oranges dried in 1981 basically from white ants. It is estimated that the loss amounted to half a million shillings. It seems as if the main cause was the fact that supplementary irrigation attracted ants to collect water at the base of the oranges and they fed on the roots. The farmer was absent for a period of six months in 1981 and thus cannot vouch for the diligence of putting ant killers.

By 1979, the land had been totally rehabilitated. The indigenous trees, dominated by A. Mellifera, had created a micro-climate and at times it appeared as if the rain stagnated over this farm and skipped the neighbours. Many times the farmer has watched when it rains on the land and the rain skips neighbouring farmers where during the decade of the seventies, all trees have been cut for charcoal leaving the ground not only bare but eroding.

The carrying capacity of the land has obviously improved tremendously. Each year, at least 4 head of cattle and 30 small stock are sold, with an average return of about Ksh. 30,000. Given the fact that their management is easier than cropping, the farmer has decided to concentrate on this for given his base, it is not cost effective to be running up and down organising planting, vermin control and weeding. Yet that does not say that one cannot produce a decent crop for subsistence and sale. On the fallow terraced land, Nthata Kivumbu grows to above a metre. The only other place the farmer has seen that growth is in a project in Baringo where it grew up to two metres under a system of road grader microcatchments on silt.

The farmer has introduced other species of indigenous trees and shrubs. Among these are Sesbania Sesban, the idea came from a project in Western Province. A. Albida has not only spread but seed from as far away as Senegal and Malawi has been introduced. Perhaps in the long term there may be different varieties of this useful tree. The farmer has failed to get other nitrogen fixing shrub seed for there are no commercial seeds. Mesquite was introduced and only three trees are left. They grow at a snails pace compared to the indigenous ones. This contradicts the notions from many ASAL projects on this tree. Besides as is clear in Baringo, it is too tasty for the dudus which attack indigenous acacias. Other indigenous trees like Tamarindus Indica have been successfully introduced from a nursery run by a Kitui woman in Nairobi!

UNRESOLVED ISSUES

1. TREE PRUNING AND MANAGEMENT OF NATURAL GROWTH.

If there is any clear lesson to this migrant farmer, it is that one need not plant new trees to get reforestation. By extensive pruning and protection from goats, by tying sticks around the protected tree, one is assured of reforestation. It is rapid. The terraced fallow land (ex-pranges) has taken six years to get a continuous canopy. The operational question is then, why spend resources on nurseries and planting when the cheaper protection can lead to less costly reforestation with adopted species? In case some argue that no new species are found under this system of reforestation, it is interesting that so far we have identified ten species which are not in the region. They have been introduced by natural dispersal methods. An inventory of what is there now will be done later.

2. IMPROVEMENT IN MICROCLIMATE

One of the detail points which is not trapped by the data culled from Jaetzold, the bible in Kenya agriculture, is the localised effect of being in proximity to the Athi River. We mentioned that at times there appears to be localised rain on Makila. Explanations for this range all the way from witchcraft to effects of the moisture from the Athi channel. What is clear is that the vegetation, shrubs, grass and trees, stay green longer on Makila than on other farms adjoining. Temperature is lower during the hot periods. Obviously the trees have an effect. Obviously reforestation with A. Mellifera, A. Tortillis and A. Albida allows other superior native grasses to get on with it enabling the farmer to improve his carrying capacity.

3. LARGE SCALE WATER HARVESTING.

Those who push water harvesting usually emphasize the small scale techniques. Yet the diversion of road water into the terraces seems to have had very high contribution to the improvement of grass, trees and shrubs. The **wamatengo and zai** techniques became useful

on areas not healing naturally. Is it time operational questions centred on structures which enable a farmer to harvest from roads etc?

4. BUSH CLEARING

This is expensive. The farmer plans now to start controlled burning for the returns on labour expended in this are dubious. Is it not time the law was changed? An unresolved issue is how much bush does one need for mixed livestock keeping? Is there data? This has been discussed extensively with livestock specialists by the farmer but there always is the comment that one needs to maximise grass. This can only be true if one is interested in cattle alone. At one time the farmer allowed goats to increase up to 100. Their condition was excellent. Does this not suggest the way or are we to continue being trapped by the colonialist anti-goat bias?. Incidentally farmers who have bred friesians suitable to the same zone insist on grazing them together with the Friesians to control bush.

5. TILLAGE

There is a technical problem about tillage. The disc plough is limited for during the dry period it just scratches. During the wet season it compacts too much. The mould board plough, the farmer is told, turns the soil too much. Chiselling and harrowing equipment are not readily available. Is this an issue for development projects?

6. THE MAIZE TRAP AND OTHER CROPS

Given the preference on maize, driven by the shortage of labour for scaring birds necessary if one is to grow millet or sorghum, what is the solution? More suitable maize or more water harvesting? The farmer even planted Variety 511 and it did well. The catch is that it was in an area receiving water from the road. Other upland varieties were tried and they did as well as the local varieties and out performed Katumani. Extrapolating on Heyer's research and changes in the 1980's Lynam makes a major point that it was the Katumani maize technology which enabled farmers to move into Zone 5 and produce a subsistence crop. Yet all the successful farmers in my location have refused to adopt Katumani. They argue that their own selected seed, based on the Muranatha seed from around 1940, does better, by maturing earlier and producing more as well as tasting better and thereby commanding a better price locally. Katumani needs fertiliser which they argue dries the farm. Is there need to re-evaluate this technology given the problems of fertiliser availability, costs and problems with the soil structure?

Seeds for other crops are not easily available. The better farmers select. It is worth noting that they have tried the sorghum which is "bird proof" but problems with labour for harvesting when the

crop is ready leads to the sorghum being eaten like the traditional one. Farmers have also tried the short season cow pea. It has been rejected because may pests eat it.

Extremely dramatic is the fact that some of the poorest farmers in the sublocation get the new Katumani releases of beans systematically. The supplies are through informal channels and not regular extension. Some of the lines not even released are found in the farms. The reason must be that beans do very well in the region and procurement and management resources into beans are much higher than all other crops. The conclusion one draws from this is that farmers will invest in the crop with returns given production limits. In Makila the crop is beans.

7. SOURCES OF INFORMATION AND TECHNIQUES

In the mad journey of being transformed from a person who understood Zone 2 and 3 production to coping with Zone 5, the extension system was not particularly useful. In fact some of their techniques were dangerous. Witness the breaking terraces, the fertiliser stressing the oranges because of fertiliser application, the badly spaced oranges. The irrelevance of the grass recommendations and so on. One got more useful tips from the retired extension TA, whose memory went back to the ALDEV experimental work in the 1950s. In short, there is little information coming from the agricultural research and extension which is of clear application. If it is coming, it is not easily available in published form a farmer can buy, read and use. Is then not time all ASAL projects got into producing information on all known techniques to build a knowledge base for those farming in Zones 4, 5, and 6.? The codified national agricultural knowledge system is essentially for Zone 3. It is time the nation codified agricultural knowledge for ASALs.

References

1. Bos, R.A. Thiadens. Report on Water Programme. Development Office of the Catholic Diocese of Machakos, A Project Evaluation.

2. Boserup, Ester. The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure. Chicago: Aldine Publishing Company, 1965.

3. Brown, L.H. "Agricultural Change in Kenya: 1945-1960." Food Research Institute Studies, 8 (1968): 33-90.

4. Brown, L.H. A National Cash Crops Policy for Kenya. Nairobi: Government Printer, 1968.

5. Brown, L.H. " The Development of the Semi-Arid Areas of Kenya." Unpublished paper, 1968. (Mimeographed.)

6. Carlioni, Alice, Nadine Horestein, T.J.Njoka, Kuria Mbugua and D.E. Thomas and S.N. Ngui. Interim Evaluation of the Kitui Arid and Semi-Arid Lands Project Phase II.

7. Clayton, E.S. "Mechanization and Employment in East African Agriculture." International Labour Review, 105 (1972).

8. Cone, L.Winston, and Lipscomb, J.F. The History of Kenya Agriculture. Nairobi, Kenya, University of Africa Press, 1972.

9. Critchley, W.R.S. Runoff Harvesting for Crop Production Experience in Kitui District: 1984-1986.

10. Dowker, B.D. "Sorghum and Millet in Machakos District." East African Agricultural and Forestry Journal, 29 (1963): 52-56.

11. Dowker, B.D. "A Note on the Reduction in Yield of Taboran Maize by Late Planting." East African Agricultural and Forestry Journal, 30 (1964): 33-34.

12. Dowker, B.D. "New Cereal Varieties - 1963: Katumani Synthetic No. 2." East African Agricultural and Forestry Journal, 30 (1964): 31-32.

13. Dowker, B.D. "Rainfall Reliability and Maize Yields in Machakos District." East African Agricultural and Forestry Journal, 28 (1963): 134-138.

14. Gardner, W.R. "Soil Water Relations in Arid and Semi-Arid Conditions." In Plant-Water Relationships in Arid and Semi-Arid Conditions. Paris: UNESCO, 1963.

15. Heyer, Judith. "A Survey of Agricultural Development in the Small Farm Areas of Kenya since the 1920's." Working Paper No. 194, Institute for Development Studies, Nairobi, 1974.

16. Hunt, Diana. "Resource Use in a Medium Potential Area: The Mbere Rural Economy." Working Paper No. 180, Institute for Development Studies, Nairobi, 1974.

17. Huxley, Elspeth. A New Earth. London: Chatto and Windus, 1960.

18. International Bank for Reconstruction and Development, Permanent Mission in Eastern Africa. Agricultural Mechanization in East African Countries. IBRD, 1972.

19. International Bank for Reconstruction and Development. "Agricultural Sector Survey - Kenya." Report No. 254a-KE, IBRD, 1978.

20. Kampen, Jacob. "Soil Water Conservation and Management in Farming Systems Research for Semi-Arid Tropics." Unpublished paper,

ICRISAT. (Mimeographed.)

21. Kenya Land Commission Evidence. Vol.II. Nairobi: Government Printer, 1933.

22. Kimambo, I. N. "The Economic History of the Kamba, 1850-1950." In Hadith 2. Nairobi: East African Publishing House, 1970.

23. Kisovi, Leonard. M. Rural Settlement and Environmental Problems in Kitui District, Kenya. A Paper presented at the International Association for Impact Assessment Conference on June 24-28, 1989 at Queen Elizabeth Hotel in Montreal, Canada.

24. Lele, Uma. The Design of Rural Development: Lessons from Africa. Baltimore: The John Hopkins University Press, 1975.

25. Lipton, Michael. "The Theory of the Optimizing Peasant." Journal of Development Studies, 4 (1968).

26. Lynam, John K. An Analysis of Population Growth, Technical Change and Risk in Peasant, Semi-Arid Farming System: A Case Study of Machakos District, Kenya. Stanford University Ph. D. Thesis 1978.

27. Mbithi, P.M., and Wisner, B. "Drought and Famine in Kenya: Magnitude and Attempted Solutions." I.D.S Discussion Paper No. 144, University of Nairobi, 1972.

28. Muchiri, G., and Johnston, B.F. "Equipment and Tillage Innovations for Kenya's Medium Potential (Semi- Arid) Farming Regions." In Farm Innovations for Agricultural Development and Rural Industrialization. Occasional Paper No. 16. Nairobi: Institute for Development Studies, 1975.

29. Munro, J. Forbes, Colonial Rule and the Kamba: social Change in the Kenya Highlands 1889-1939. London: OUP. 1975.

30. Mutiso, G-C. M., Kenya: Politics, Policy and Society. Nairobi: EALB. 1976.

31. Ndeti, Kivuto. Elements of Akamba Life. Nairobi: East African Publishing House, 1972.

32. Njoka, Theuri J. Government of Kenya and Louis Berger International, Inc. Kitui District Focus Plan. Range and Livestock Development Proposal.

33. Nooy, E.J.P de. Diocese of Kitui: Handbook for Simple Water-Engineering in Kitui District, Kenya.

34. Ominde, S.H Land and Population Movements in Kenya. Evanston: Northwestern University Press, 1968.

35. Richards, Paul. Indigenous Agricultural Revolution. London: Hutchinson Publishing Group, 1985.

36. Ruthenberg, Hans. Farming Systems in the Tropics. London: Oxford University Press, 1971.

37. Schultz, Theodore. Transforming Traditional Agriculture. New Haven: Yale University Press, 1958.

38. Swynnerton, R.J.M. A Plan to Intensify the Development of African Agriculture in Kenya. Nairobi: Department of Agriculture, 1954.

39. Wilde, John C., de. Experiences with Agricultural Development in Tropical Africa: The Case Studies. Baltimore: The John Hopkins Press, 1967.

40. Wolgin, Jerome M. "Resource Allocation and Risk: A Case Study of Smallholder Agriculture in Kenya." American Journal of Agricultural Economics, 57 (1975): 622-630.

41. Zwanenberg, Roger van. The Agricultural History of Kenya to 1939. Nairobi: East African Publishing House, 1972.

SUMMARY OF THE KITUI INTEGRATED DEVELOPMENT PROGRAMME SEMINAR
MUTICON

Day One - Monday 27th May 1991

At the end of Mr. van der Zee's presentation and two hours of intense discussion, it was recommended that to combat the degradation of physical and social structures in Kitui, it is necessary to integrate the activities of the different Government of Kenya (GoK) departments and donor development activities into the communities by:

1. Planning, implementing and evaluating development activities by technical officials and the community.

2. Educating the communities on technical matters relating to physical and social breakdown and strategies for combating the two.

3. Developing of overall development strategies by the technical personnel of either GoK or Donor Agencies, together with the communities in dialogue - since the communities are ultimately responsible for their own development.

4. Technical personnel paying attention to communities' social structures.

5. The catchment approach should be useful in not only integrating physical and social catchments for development but in demarcating manageable units for implementation.

Day Two - Tuesday 28th

At the end of Mr. Finkel's presentation, 1. It was agreed that Mutomo Soil and Water Conservation was the most successful ASAL water supply programme in Kenya and East Africa and it offers many relevant experiences.

2. There were issues raised about the determination of technique for ASAL water supply based on the offered unit cost calculation. On the unit cost calculation, local labour is undercosted. Beyond this, different techniques offer other environmental and landuse capitalisation economic advantages not reflected in the monetarist calculation. Since development of water supply has to fulfil these other requirements, they must be factored in where monetary calculations are to be used to select some specific supply techniques.

Mr. Ogongo's presentation and the discussion which followed made the following conclusions:

1. The major handicap to the full utilization of human resources is the high degree of illiteracy, traditional values, attitudes and

practices that may be inconsistent with modern values and practices particularly with regard to changes necessary for modern development.

2. The needs and aspirations of the people can be best articulated at the sub-locational and locational levels through strengthening of the local level development committees through relevant training and appropriate staff deployment.

3. The catchment approach to conservation of resources, which is promoted by both the Ministry of Agriculture and KIDP, is a feasible and realistic strategy for the promotion of conservation of resources.

4. Animal products could easily be processed in Kitui with finished or partly finished products being transported to Nairobi and other markets for either consumption or further processing.

5. The improvement of rural infrastructure however, will help stimulate agricultural and non-agricultural activities in rural Kitui. Poor infrastructure, particularly roads, can be a major constraint to the development of commercial and agricultural activities.

6. There is an urgent need to speed up land adjudication in the district so that the farmers can have land certificates which they can use as collateral security for financial loans to improve agriculture and non-agricultural economic enterprises.

7. There is an urgent need to change public officers' attitudes towards work generally and towards public facilities and equipment.

8. The District Development Committee should recognize the complementarity of various sectoral plans and programmes. This calls for the cooperation of all sectors, departments and agencies that operate in the District.

Mr. Omokamba made the following recommendations:

1. Preparations of baseline data on catchment areas should be carried out to facilitate decisions and implementation which is sustainable.

2. The communities should be involved in the planning of the catchment areas right from the beginning.

3. All ministries and actors in the catchment should coordinate and collaborate for effective implementation.

Mr. Peter van Dongen's presentation was heartily welcomed by the group for it emphasized that from aggregate macrodata, there is enough water in Kitui for domestic and production purposes for now

and the future if harvesting techniques are implemented. However, the group would like more rainfall and water discharge monitoring programmes so as to produce data for specific locations to enable rational water resources utilization planning.

Since some water extraction techniques have supply production and rehabilitation contributions (specifically sub-surface and sand dams, whose impact on ground water recharge and river maintenance as well as revegetation, minimisation of localized waterpoint desertification and creation of many supply points), it was the conclusion of the group that they should be emphasized. They are easily integrated into the catchment approach and should be emphasized for their implementation and maintenance can be done by the community.

Mr. Einange's and Mr. Agatsiva's joint presentation was welcomed for it had the potential to give the district a strategy for establishing vegetative rehabilitation needs. However, the group would like the revegetation proposals to be specifically detailed in terms of tree, shrub and grass species to be used in 1. cropland and 2. grazing land. The authors promised to address these issues in the redraft for the final conference paper.

Day Three - Wednesday 29th

The following points on livestock development in Kitui were raised by Dr. David Kimenye:

1. Disease control and not cure should be emphasized. Disease reporting and the capability of vets to contain epidemics should be enhanced.

2. Livestock census and information on livestock marketing should be done to give a clear picture of the current populations and assess restocking or destocking needs.

3. Action should be taken to safeguard the livestock producers against very low prices offered by the livestock bookers found in the market places. Livestock auctions might be the answer to these low prices being offered.

4. The potential of dairy cattle in the Kitui central highlands is high and should be exploited for the supply of milk to Kitui.

On the promotion of oil crops development, Mr. Larry Ngutter raised the following issues:

1. The dependency on imported oil results in national exposure to this important commodity. It is therefore important to come up with a policy for development of edible oil production as a part of national food sufficiency.

2. The development of the livestock industry is dependent on the availability of stock food. Oil-seed cake, a by-product of the oil industry is necessary in the formulation of stock feed. Oil crops will therefore support the livestock industry.

3. The returns for oil crops to the farmer are minimal. Prices for these crops should be improved for their promotion.

4. Promotion of oil crops in the rural areas should be undertaken as a means of industrialisation of the rural areas. This would ease the pressure on and migration to the cities.

In his paper "The Demographic Time Bomb", Dr. Kisovi made the following recommendations:

1. Since the focus of all developmental activity is the people, the relation of the population to the resource base should be established to attain a perception of the socio-economic aspects pertaining to a community.

2. Family planning activities need to be promoted vigorously due to the danger of the destruction of the ecosystems due to high population pressures.

3. The current farming technologies are not capable of carrying an increasing population, therefore, adoption of suitable technologies is necessary to feed the population.

4. A change of attitude from the reliance on the government to supply food during droughts towards self-reliance and development of strategies to achieve this.

The description of the only attempt in participatory approach to development in Kitui by Mr. Mulyungi was received by the seminar with interest. A few individuals wondered as to the possibility of this approach being used by government departments.

Mr. Kulman presented a first draft of his own ideas as to how KIDP could use the participatory approach, particularly borrowing from the Kitui Diocese. Given the fact that these ideas had to be first discussed between KIDP and the Ministries, decision on the final format was deferred.

PLENARY SESSION CONCLUSIONS
D.M. KATIKU
PROGRAMME OFFICER, KIDP

Objective: Which way is Kitui going, which way do we think it **should** go and how can we make it go this way?

1. Agriculture

The key issues in Agricultural Intensification are:

- Water harvesting
- Improving vegetation
- Improving oil crop marketing system
- Introduction of mulberry trees
- Introduction of mangoes as an industrial crop over being a subsistence crops.

2. Water

People have not thought of water in a systematic way due to lack of a planning base. Funding should be extended to areas where it is required e.g. supplying market centres with water. The idea of farm employment versus water development is highly questionable and should not even arise. Water supplies go hand in hand with water conservation.

3. Livestock

Disease Control

The major concern is how to implement district-wide coverage in terms of the linkage between disease control and livestock marketing. This can be done through the development of stock routes via established holding grounds in which animal health can be taken care of. The market centres must be improved.

Animal production

The Cockerel exchange programme should be monitored and a strategy developed. Improved community participation will help to solve the problems associated with animal production e.g. establishment of fodder crops.

4. Participation

This should be seen as every sector's work but not as MoCSS' work alone. Community participation should be seen as an important element of project implementation and a strategy should be developed on how each sector fits in.

5. Conservation of environment/vegetation

There is a need for:

- Conservation and management of traditional woodlands.
- More emphasis on agroforestry in catchments.
- Introduction of appropriate exotic trees.
- Introduction of bee foliage.
- Introduction of appropriate crops.
- Emphasis on a schools approach programme.
- Introduction of income generating activities.

6. Seminar for District Staff

The seminar is to be repeated in 6 months time from now by the Ministries in the form of case studies.