PROJECT REPORT

KIINDU RIVER BASIN BARRAGES SYSTEM CONSTRUCTED UNDER THE PILOT

PROJECT AND THE 25 BARRAGE PROJECT.

BACKGROUND

The following extract quoted from chapter 3 " The Impact of climate and sustainable Development in the Sudano - Sahelian Religion" by Frederick Joshua Wangati. Gideon-Cyrus Makau Mutiso and Kariba Konare - in climate variability, climate change and Social Vulnerability in the Semi-arid Tropics (eds) Jesse C. Rib of, Antonio R. Magalbaes and stahis panagides - published by Cambridge University Press 1996 - Serves as a fitting background to highlight the construction of river barrages as a suitable support technology leading to increased land productivity in the ASALs.

"Impacts and responses at national level

It would appear that in most countries of the Sudano-Sahel region the major impacts of climate variations have been droughts, land degradation and desertification. Societal response has been to evolve various strategies for adapting, including migration as a last resort. According to the report 'Assessment of desertification and drought in the Sudano-Sahelian Region 1985-1991' prepared by UNSO for UNCED, and a number of other national reports prepared for UNCED, governments have responded with programs to increase the level of public awareness of causes and dangers of land degradation. Success is being achieved through mobilization of populations to counteract drought and desertification through various programs and projects. National early-warning systems and environmental monitoring systems have been established in a number of countries of the region and

integrated development projects now include participation by meteorological services. At the community level, response strategies include increased use of water-harvesting techniques to safequard both crop and livestock production, and initiation of small-scale irrigation projects. Other activities include dryland agriculture, range management, deforestation control, soil protection, and sand-dune fixation, water resource management and development.

Impacts of climatic variability and societal responses at the national level do, however, vary from country and it is difficult to provide detailed accounts of impacts and responses for all countries of the region. However, a brief account of some characteristics, including history and experiences with impacts of climate variations, migration, settlement and development, in the arid and semi-arid lands (ASALs) of Kenya, which are similar to many parts of the Sudano-Sahelian region, could provide useful insights.

Table 9. Area by agro-ecological Zones in Kenya.

		% R/Eo	Area(Km^2)	% Country Area
Zone IV	Semi-humid	40-50	27000	5
Zone V	Semi- arid	25-40	87000	15
Zone VI	Arid	15-20	126000	22
Zone VIII	Very arid	15	226000	46
Total			506000	88

Note: R/Eo, ratio of annual rainfall (R) to evapotranspiration (Eo).

Source: Jaetzold and Schmidt (1983).

Permanent Migration and settlement in drylands: Experiences in the ASALs of Kenya.

Historical. Over the past 90 years, many farmers have moved from the more humid Zones to the less humid Zones. As illustrated in Table 9, zones IV and V account for 20% of the country and are significant for crops and livestock production. Zone VI forms 22 % and zone VII accounts for 46% of the country. Therefore 88% of Kenya has less than 800 mm annual rainfall. The development and reclamation of land in these zones is a clear national priority because of the exploding population that resides in the ASALs with food produced there.

Historically, zones IV,V and VI have received a migrating population from the more humid zones. In the perspective of centuries, it is doubtful whether there were permanent settlements outside zones II and III until the early eighteenth century, as most oral traditions attest. It has been learned from oral traditions that ASAL production was integrated into the hill/mountain-based homesteads through hunting and livestock keeping in **Syengo** because of the constant relocation of the bases; thus there was intermittent use of range resources.

The **Syengo** was not only for herding. From it came major social institutions for deployment of labor, the distribution system of livestock and grain consumables, the scattering of livestock resources so as to escape drought and diseases, and the then dominant land-holding form which assured that every family owned both mountain and plain land, as is found in the traditions of many Kenyan peoples. These economic and ecological adaptation mechanisms, encapsulated in the institution of the **Syengo**, have been marginalized by the population growth of the past ninety years mainly as a result of permanent migration from the more humid areas.

Table 10. Livestock population in Kenya, 1987 (thousands)

	Beef cattle	Dairy cattle	Sheep	Goats	Camels	Donkeys
Total ASAL	5761	715	4144	7283	956	249
Total non - ASAL	3310	2287	2300	1245		
ASAL as % of total	64	24	64	85	100	100

Sources: GOK (1989)

Table 11. Average land-holding (hectares per person) in selected ASAL districts of Kenya.

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	0.35	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 GOK (1990).

ASAL Production.

The ASALs produce the bulk of the meat products in Kenya (Table 10). Although ASALs produce subsistence crops for their population, national food statistics do not provide a coherent picture of the contribution of ASALs to crop production. However, the bulk of the bean, Cowpeas, Pigeon peas, Simsim, Millet and sorghum, crops which form a major pillar of national food consumption, are produced in the ASALs (GOK 1990). However, yields per hectare are generally low and vary between years, seasons and inter-cropping situations.

ASAL Land-holding.

The fact that land is becoming short in the ASALs is well demonstrated in Table 11, which shows average land holdings in selected districts.

This land shrinkage presents tremendous challenges for sustainable development and intensification are maintenance of soil fertility, labor-saving tillage and handling equipment and water-harvesting for production and perhaps most complex, the integration of crops and livestock production so as to enrich the land.

The objectives of the ASAL programs were ranked by the government of Kenya in 1979 as:

(1) Development of human resources.
(2) Exploitation of productive potential
(3) Resource conservation
(4) Integration with the national economy.

The effect of the proclamation of the 1979 ASAL strategy at the meta-policy level was create a framework for channelling resources to areas which would not receive them under normal economic policy concerns. In particular, the project selected criteria which preferred projects with the highest rates of return in the short term. The government of Kenya was sending a clear message to the donors that the areas deserved development in their own right.

Under the 1979 ASAL strategy, the main program approach was to be integrated development, which by implication was to be area based. The level of government which was relevant, therefore, was the district, but this logical framework did not always because some donors have operated in ASAL districts at levels lower than that of the district.

This ASAL district based approach to development adhered precisely to notions of decentralization of government operations (project identification and planning, budgeting and finance operations) which were initiated in 1966 within the civil service, but which did not get clear backing from the political arena until much later. It was, however, from the political arena that the momentum for the District Focus Strategy for Rural Development (DF) was eventually generated.

In recognition of the potential importance of ASALs, and the complexity of development processes in these areas, the Kenyan government created, in May 1989, the Ministry of Reclamation and Development of Arid and Semi-arid and Wastelands (MRDASW). The new Ministry is expected to provide enhanced capability within the Kenyan government to address the special constraints and development possibilities of ASALs.

The primary objectives of the 'second-generation' strategy for arid and semi-arid lands reclamation and development, as set forth in a document under consideration, are to:

* Develop ASAL capacity for income generation, employment creation, and the attainment of food security;
* Reclaim and protect the fragile ASAL ecologies;
* Improve the quality of life for the present and future generations of ASAL inhabitants on a sustainable basis.

The key programs of this strategy are crop development, livestock development, water development, natural-resource conservation, infrastructure, off-farm employment including enterprise development, and health and social services development.

The Kenyan lesson.

The Kenyan ASAL experiences is that of population moving into and within ASALs as a result of population pressure. Although migrants faced many initial difficulties and conflicts of interest, they have been able to settle and evolve a form of existence which appears to be sustainable, at least in the short to medium term. A major factor on this success has been the recognition by the government of the special needs of such regions and a constant review of development policies and strategies for their applicability

and sustainability. While these strategies have helped the population to cope, it is recognised that there is a limit to the size of the population that the ASALs can carry on the basis of the land resources. Future responses will therefore depend on the availability of new technologies for increasing land productivity, success of the family planning programs now under way and migrations out of the ASALs."

1. SASOL PHILOSOPHY

Most communities in the Arid and Semi-Arid (ASAL) or Sahelian parts of Africa have suffered development. This is so because many of the activities Were not planned to address key issues in the development of these areas. Often knowledge was borrowed from wetter parts of the continent and applied irrationally to development problems. Expertise was usually from without those communities. More often than not development agents did not listen to the communities who have operated some of the most sophisticated social institutions in human history. All these problems were compounded by short term sectoral development strategies.

Increasingly, development of these areas has to be within the context of sustainable ecological resource use. This demands that communities participate in the design and implementation of activities. It also means that new ideas, technologies and techniques have to be generated to produce for the exploding populations. New natural and human resources management techniques are called for if these populations are not to loose their humanity and die off in the degrading environments.

2. COMMUNITIES IN ARID LANDS

Sasol as a development agency strictly adheres to the principle of participative development. This is a major pathway to sustainable development. True participation empowers the community galvanising them to action as they build on and respect their inherent knowledge distilled over many years. This knowledge has allowed survival in the harsh environment. However there is need to adapt and apply the knowledge in novel ways inorder to cope with the changing economic climate in the global arena.

Setting to Know the People

The Chief is the governments representative in a locality. He is in contact with the local community on daily basis. Government policy to the community is channeled through the Chief. It is apparent that any external

influence into the community has to have the blessings of the Chief.

It has been found useful to approach a community through the Chiefs office. The Chief then dutifully introduces the agency to the community in his own meeting initially, explains the view of the community and that of the intervention agency to the community.

The role of the Chief is two fold in this case. On the one hand he facilitates an easy access to the community. On the other hand he ensures no damage is done to the community, through introduction of detrimental policies and ideas.

Once the formal introduction is done through the auspices of the Chiefs Office the agency is at liberty to interact with the community freely.

Closing in

The location is a large communal unit with an average area of about 150 sq km and an average population of 30000. It is best to divide this area into smaller units for development. These areas give greater uniformity and less diversity than a larger area. It is then possible to deal with specific problems in the smaller units.

Fortunately a location is divided into sub-locations each headed by an Assistant Chief. The sub-location usually covers an area of approximately 30 sq km with an average population of 6000.

A Sub-location is further divided into smaller units, the villages. A village (Utui) is headed by a village headman. A Sub-location may be usually divided into 6-10 villages as dictated by traditional affiliations. Almost all social interactions are focused on a (Utui).

The Utui is the basic unit in the community as society is organised around it. Usually the Utui is in one catchment area for defence purposes. This is a strong unifying force. This is the unit of focus for community intervention.

Discourse in the Utui - PRA Training

One endeavours to set up a forum for discourse in the Utui to elucidate the perceived problems, aspirations and work out solutions through effective planning of appropriate actions.

PRA Training is used basically to enable the Utui to gather together for the purpose of critically examining their situation, identify their problems, work out possible solutions and make a plan of action.

In this training the role of the Sasol is to convene and facilitate the learning process. To do this, one must establish rapport and completely hand over responsibility to the community.

To begin with the community is responsible to select who is to attend the training from amongst themselves. As the training is held over several days between 5 and eight, an appropriate venue must be arranged. In addition catering for lunches is organised, what to serve, where to be obtained, who is to prepare, how it will be prepared and by whom. Already the community starts to sit together to organise around an issue even before the training proper starts.

The training renders an excellent opportunity for Sasol to learn about the community. To achieve this, one must watch, listen and absorb the lessons to be learned. At the same time, the trainer should support the community in their learning process.

Once the training convenes, the participants organise the scheduling of the proceedings to suit their comfortable attendance. Factors which are important to the participants may range from reporting time and closing time, depending on the distances of travel for the furthest participants from the training centre. Time for breaks such as lunch which could be determined by the time it takes to cook whatever is on the menu, and the overall running of the training.

The community elects officials from amongst themselves for various tasks such as time keeping, recording proceedings, controlling the participants activities and taking care of the venue.

As the idea of the training is to facilitate the community to consolidate and systemise the body of their knowledge in a form which is useful in the planning of their actions; the appropriate tools are used to enable the community to plan their actions for development. Several methods and techniques are introduced to the community to help it in the learning process. These include:-

- Mapping * Social
  * Resource
  * Particular aspects

- Time line
- Trend and change analysis
- Seasonal calendar
- Time use

- Problem identification
- Problem ranking
- Problem analysis
- Institutional diagramming
- Matrix ranking
- Impact analysis.

In the mapping exercises, the community discover their assets. This leads to effective planning of the use of these resources. It also identifies the resources which the community lacks. Which have to be obtained from without

The time - line offers a glimpse from the past and lessons derived from there. It points the way forward. It also emphasises the fact that there is continous change and one should be prepared to adjust to the inevitable changes.

Trend and change analysis of the important facts in the community, highlights the actions required to adopt to the changes.

Seasonal calendar, lists the important cyclical events which influence the lifestyle of the community. It highlights the important tasks which must be taken on timely basis for the good of the community. It also identifies the ideal times to undertake specific tasks in the community.

Time use is an important factor to show how the different sectors of the community use their time. It might lead in some cases to a community examining the role of certain sectors which does not contribute to the well being of the community as a whole. It also might lead to a more careful use of time which is an important resource.

Most communities have some really basic problems. Problem identification, ranking and analysis lead to the formulation of solutions to the pressing problems in order of their priorities.

Nearby all communities interact with other institutions situated inside or outside their geographical or organisational limits. All these institutions influence the community to varying degrees. In examining each institutional influence, the community can decide whether to seek more involvement with one institution and completely neglect another as their needs dictate.

In matrix ranking the community obtains a tool for comparison of different objects inorder to make a choice based on sound reason. The community using the tool can decide their 10 most important trees to be planted in their area based on attributes they favour most in a tree.

Finally the community must be able to plan their actions and assess the

impact of these on the community. In here the community considers their plans with how to carry them out. A strong element of community organisation and mobilisation is evolved since any an organised community willing to act on its own behalf will undertake to better itself.

Outcomes of PRA Training

Four PRA trainings have been carried out in the project area on sub-locational basis, with each Utui producing its own plans of action.

Overall the following problems in their order of priority have been identified.

1. Water - Bulk water
   portable water (clean)
2. Food shortages
3. Transport (Roads)
4. Income generation.

As the problems cannot be tackled at once, it has been resolved by the community to start with the highest priority problem. In all the communities as is common with all ASAL areas, water is the prime problem.

Through analysis of the current sources of water, the community decided that their dry sandy river beds are a prime resource. During the dry season water is obtained in these river sands by scooping out the sand to reach the water level. Usually in an elongated dry spell these scoop holes can be as deep as 5 m. Due to the instability of sand, the scoop hole collapse frequently. Deep scoop holes are a danger to life.

If a barrage were constructed to span the sandy river bed, it is possible to create a dam effect in the sand upstream to the barrage. The constructed barrier prevents water running downstream through the sand which is highly permeable. The water bulks upstream to the barrier. This results in much shallower scoop holes. It also gives rise to the availability of much more water in an area. Eventually the water table in the land surrounding the barrage rises.

Yet another method of obtaining more water is the sinking of shallow wells. The water in these wells diminishes as the dry spell lengthens.

A third method of obtaining water is through rain harvesting either into tanks from roofs and ground run - off or into small earth dams.
The solutions suggested by the community for their water problem were:-

(1) Barrage construction on sandy river beds.
(2) Shallow well development

(3) Water tank construction for roof catchment harvesting.
(4) Small earth dams.

The methods suggested no 1 and 2 were found to be most practical. The main criteria for selection was cost and quality of water obtained.

River barrages can store large quantities of water. The water is relatively clean as it is not open to direct pollution and is fettered by the sand. Secondly losses due to evaporation are negligible.

Shallow wells are a good method of harvesting ground water. One only has to be careful about their recharge of the depleted ground water.

Water tanks are expensive to construct and their yields are limited. Hence the cost of this water is relatively high.

Small earth dams are open to gross contamination and huge losses due to evaporation. They yield water therefore only for a limited period after the rainy season.

After elucidating the solution to the problem an action plan is formulated by the participants. This includes for the chosen solution; the materials needed, where to be obtained, who will obtain them, what external help is required and who will get it.

In the construction of river barrages the following plan was prepared by the community.

(1) Provision of local materials - by community
(2) Provision of unskilled labour - by community
(3) Community organisation and mobilisation - "
(4) Provision of external material - by SASOL
(5) Provision of skilled labour - by SASOL
(6) Selection of site for barrage - by community and SASOL.
(7) Site supervision and protection during construction - by community.

By taking responsibility of the project right from the planning stage, the community identifies with the project. The community invests their knowledge time and labour into the project and as such it belongs to them. They achieve a sense of pride on the completion of the project. As a result the project will be maintained and not let to decay as if it was forced on the community.

3. WATER IS THE PLAYING FIELD ON WHICH THE DEVELOPMENT OF THE ASALs OCCURS.

Water is the foundation on which all the developmental activities in Asals are built.

Until the centrality of water in the ASALs is recognised, all development in these lands is nought. The communities who survive in these lands are well aware of the issues involved. They have existed in these lands due to this basic understanding. As the times change with the advent of technology, there must be of necessity a corresponding change in the water management technologies in the ASALs. Failure to invoke the appropriate technologies is to condemn the residents of the ASALs to extinction.

It is tragic to introduce advanced technologies in the ASALs without parallel strategies of coping in this extremely harsh environment and poverty. Now that these technologies are here it is a matter of urgency to institute technologies which will help communities cope. These should not only be transplanted technologies, ideal in other situations, they must be appropriate to the ASALs.

The ASALs are a fragile environment, which traditionally required special skills for survival. As technology advanced, a population pressure built up in the wetter areas. A migration to the ASALs then ensued. Migrants who did not have the skills to live in harmony with this land, raped it. Soon the land was worse than they found it. As they have nowhere to migrate to, they continue to eke a livelihood from what the land can offer.

It is not the absolute lack of water which is the issue in many parts of the ASALs. Rather it is the lack of water retention on the land after the usually short to very short rain seasons. After the rains, large proportions of the received rainfall runs off the land without infiltration and is totally lost. Technologies should therefore be instituted in the ASALs which limit this loss. Without this basic input we might as well forget these lands.

An insight to the quest for securing and managing water resources given by Mulango and Kisasi community, elicited three major areas of concern.

1.Safety and security
- -Danger of scoop holes to children and animals
- - Security of homes especially at night when people go out for water.
- - Attack by wild animals at night
- - Possibility of rape on water chores at night.
- - Floods

2.Economics
- Time wastage on water chores with attendant neglect of other duties
- Hauling water for long distances especially in dry seasons
- Curtailment of income generating activities
- Investment on donkeys as a means of carrying water
- Loss of weight on market animals due to long walks to water
- Only minute amounts of water available at a time.
- Children missing school on water chores.
- Shortage of trees and tree products.

3.Health
- Diarrhoeal diseases on the onset of rains due to impure water sources
- Lack of vegetables, fruits
- Inadequate food.
- Contamination of standing water by animals.

The plethora of problems listed is the result of the land carrying more people than it is capable of using the traditional survival technologies. Yet the land has to carry still more people in the future, as a result of natural population growth coupled with further migration into these lands. It is with this view that the community has sought out ways and means to get out of their dilemma.

SASOL in its role as a development agency sought to intervene in this community by entry through established channels. The Chiefs facilitated a forum for discussion and introduced the agency to the people. Once this was achieved the Chief only played a peripheral role in the proceedings that followed. Many meetings with community leaders followed culminating in PRA training in the community. The training participants drawn from a cross section of the community were selected by the community as a whole.

The aim of the PRA taining was to help the community to critically examine its situation, analyze its problems and work out solutions to its problems. In all areas where PRA training has been held in this community, water has been the number one problem. This is as it should be, since any other development is ultimately tied to the availability of water.

WHAT WATER?

The first question the community had to ask towards the solution of the water problems outlined above, was, **WHAT WATER.** In all cases it was decided that the immediate need was for secure bulk water sources which would last through the dry season. Such sources would reduce drastically the monotony of water chores in the community. They would free the women

from spending the bulk of their time on water chores and avail them time for other more useful activities. Children would not have to miss school because of water chores. Bucket irrigation would be possible securing an availability of vegetables and fruits in the community over the dry season. It would influence revegetation since tree nurseries could be started to raise seedlings in the community. Animals would drink within a reasonable distance from the homestead maintaining a higher market value.

Once the basic need for water was achieved, the community would be ready to embark on consolidating and improving their water resources. Two other forms of water were then considered.

Potable water, was the second form of water to be considered. Its quality is mainly depended on the method of abstraction from the bulk water storage facilities. This form of water would impact on the elimination of diarrhoeal diseases after the onset of the rains. It would prevent contamination by animals. It would provide ease of abstraction.

Production water is the third form in which water will enable the land to cater for the existent and future populations adequately. It would ensure increased food production. Facilitate revegetation and vigorous growth of existent vegetation. Promote directly water related economic activities.

WHICH TECHNOLOGY?

Obviously after the community was clear what water they wanted, first, it was imperative that they decide on which technologies would be suitable for their needs. It is important for the community to institute only the technologies which fit their resource base, serve their purposes, can be maintained easily and are suitable for the locality. It is no use for a community to utilise a technology just because it was successful elsewhere without taking into consideration the differing conditions. Also it should be a technology in which the community would participate wholly in its implementation and to which it is committed.

Traditionally the Mulango/Kisasi community has obtained its bulk water from scoop holes in the sand on dry river beds. To secure their bulk water therefore, they sought a technology which would increase the storage capacity of water in these dry river bed sands. Increased retention of water after the rains ensures a longer period when water is available in the sand. Since a larger amount of water is retained in the sand, the scoop holes need not be so deep. This ensures safety of children and animals. Creation of river barrages across these dry river channels renders itself as an ideal technology. Water bulks upstream of the barrage with excess water flowing

down stream. In rivers with a deep sand profile, a large amount of water can be stored.

Only when the bulk water sources are secured, is the community ready to institute measures of obtaining clean potable water. The community is then prepared to alter their water abstraction methods from their bulk supplies to achieve potable water. The community resolved this issue through the construction of improved wells for the abstraction of water from the bulk water in river barrages. These wells are fed with sand filtered water from the barrage stored bulk water. Water is abstracted from the improved well using a windlass with a permanent pail. Possible contamination by animals is thus eliminated. Direct contamination as in scoop holes where people have to walk down the hole to abstract water is also eliminated. Further, the raised level of the well, prevents contamination with surface water.

Concurrently with the development of potable water, is the development of structures which ensure an availability of production water on the land. This type of water is not seen but perceived. The technology which the community decided on to corral production water is the terracing of cultivated lands coupled with extensive tree planting and revegetation schemes in denuded areas. Again the technology involved is simple and is dependent on slowing the flow of water from the land, allowing it to infiltrate into the soil which has a large water storage potential but a slow uptake. Such stored water can be abstracted by plants which produce our food and fodder for our animals. Whereas the construction of the river barrages is purely a communal effort, production water is largely the province of the individual who has the responsibility of the development of their land for the good of the wider society. To achieve this end the community decided on the catchment approach principals with overseen by a village development sub-committee.

4. PROCEDURES

The entry into a community is through the auspices of the established rulership channels eg Chiefs Office. Thereafter Sasol deals directly with the community at village level which is a traditional rallying point for the community.

Ideally a PRA training should precede all activities undertaken in the village. Where this is not possible it should come soon after interaction starts.

Site Selection

Once the decision to build river barrages was made, the community together with Sasol representation walked the river together. This was to empower the

people who know the river and are the users. It ensured that sites picked would be useful to the people and that barrages were not of cosmetic value only. For technical reasons sites may be moved up or down river some distance but in whole the wishes of the people was largely respected.

Organisation of Work Groups

In normal cases a PRA training is held on sub-locational basis. However individual exercises eg resource mapping, problem identification and planning is in village groups. The village groups usually form the work groups.

If one works in sub-location it is possible to have one large work group. Since there are too many people this group is divided into smaller work groups on village basis. Each group then has a dedicated day on which it attends work. This arrangement relies on one person being incharge of the larger working group. The role of the individual village work groups is thus minimised. There are drawbacks in this system because people do not really belong. Different groups work and varying paces. This brings about conflict as other groups slow down. The distance from project point is different for different groups hence attendance time is varied. Since the leader can only come from one village, it can be seen as dominating the other villages. This type of organisation was found in the pilot project.

The alternative organisation is for the work group on user basis. This might be one, or two or three villages on a single barrage. In this case a chairperson is elected by the work group to be incharge of the site. The duties of the chairperson include, ensuring compliance, supritendence of material received and supporting the artisan to perform his work unhindered. This approach was found to be highly effective in the 25 barrage project. In most sites the chairperson was a lady. It was surprising that in most cases the chairperson had no other leadership role in the community. The chairperson worked together with the village headman who is the representative of the administration in the village.

Site Excavation and Collection of Local Material

Work on a barrage site starts with the delineation of the excavation area. One never knows exactly what to find beneath the surface even after probing. This is men's work.

At the time excavation starts, stone collection for the building is also started by the women. The barrages use up huge quantities of stone. At some sites stone has to be broken before it is ferried to the site. This task is taken by men as is also the movement of the larger heavy stones.

Delivery Storage and Records Keeping of External Material.

All construction material is delivered from the supplier to the community. The community provide the store, receive the goods and are responsible for its security. Removal of supplies from the store is done in the presence of the Sasol artisan, the store owner and a community representative. Records of removal of material from the store is kept both by the artisan in the site record book and the chairperson in a store book.

As the material belongs to the community, it is properly quarded and no losses have been experienced so far.

Artisan Accommodation and Provision

When the artisan moves at site, he is at the hands of the community. The community is responsible for his accommodation and welfare as long as he is at the site.

The construction supervisor is responsible for setting up the barrage for construction. In this he is helped by the artisan. Subsequently the supervisor makes weekly visits to the site for inspection of work in progress. The artisan is at liberty to contact the Sasol office at any time he encounters a problem he cannot cope with. Alternating he can contact the nearest artisan for help.

A part from the supervisor, the artisans are divided into two groups headed by foremen, who are senior artisans.

Every three months all the Sasol artisans have a meeting to discuss problems encountered in the field and how they have been dealt with. Also they inspect each others work and discuss areas of improvement in working procedures or adoptions of good ideas encountered.

Interaction with the Administration

The Mutui (village headman) is the local representative of the government. As such his support is important in the success of any project in the village. If he opposes a project it is very difficult to succeed due to harassment by the government. On the other hand with his support things move along smoothly. Take for example the enforcement of compliance rules" set by the community. The community cannot fine a person under law in this country. However with the support of the Mutui this is possible. It is the Mutui who obtains a "letter of authority" from the area Chief to enforce compliance

rules by the community through extracting the set fines. The chairperson of the site can then send out a detail to extract whatever fines have been agreed.

Village Development Committees

The country (Kenya) has a policy for development which focuses on District. The District Development Committee whose chairperson is the District Commissioner is the umbrella body for development in the District.

There is a sub DDC in every division of the District.

Next in line is the Locational Development Committees in each location. Then comes the Sub-locational Development Committees. Lastly the grass - roots is the village development committees in every village.

It is the village development committees that originate development programmes which are filtered up the line to give the development programme for the district.

In our view where you find strong village development committees, a strong sub-locational development committee exists. This is the recipe for dynamic development as it results in effective organisation to a large enough group capable of undertaking many development projects which would be difficult for each village to tackle individually.

This is the basic reason for basing PRA training on sub - locational rather than village communities individually. However if one were to carry a follow-up topical PRA, it is possible to focus on a peculiar aspect at village level individually. Another reason for using the sub - locational unit is to gain a substantial catchment area for meaningful water conservation and management.

5. PROBLEMS

The construction of barrages for water containment in river sands is a voluntary exercise for the community. To achieve their targets the community must organise to carry out the work. As this is not a routine undertaking and occupies a longtime, problems are bound to be experienced

Organisation

Many villages have only weak organisations or weak village leadership.

This inherent weakness results in:-

(a) Difficulties in working out acceptable rules, with only a few people involved.

(b) It is then difficult to enforce these rules to a larger group as some of the people are not party to it.

(c) If people are not involved from the beginning it is difficult to get them on board on later stages.

(d) With only a few people involved in the project they are bound to suffer from fatigue as they work daily instead of working on shifts.

The ideal situation is therefore to form a strong village development committee elected by the community as a whole. This should include all sexes and age groups. At the present time most of the development activities tend to rely more on the aged than the young. Of the people involved a greater proportion of project work is by women rather than men.

Development Education.

In the communities there was a marked lack of understanding of the different roles different sectors of the community has to play in development. Take for example water, women are the custodians of domestic water. To ease their burden of water chores, therefore, woman would be active on water related projects. However, the community would start to gain in health and alleviation of hunger through a property thought out water project. It is therefore important that the community gains this understanding. Many development activities affect the community in differing complex ways making life better. Young men gain from the extra water through increased economic activity in brick making and building industry and market vegetable growing.

It is to the interest of the community, therefore, to work together with the women in the water project. Slowly through PRA trainings these issues are being taken up by communities.

Where whole communities are involved project work is much easier, takes shorter time, and is even enjoyable. An efficiently run project has a morale boosting effect on the community. It shows the community their capabilities when they work in unison.

Leadership

Many people seek public office to enhance their role and power in the community without giving the necessary effort required by the office. Their inefficiency in office results in challenges by the members of the community which undermines the unity of the community. The most important role of the community leader should be the promotion of unity.

Cases of leaders favouring one individual or group against another abound. This greatly affect morale, disrupts cohesiveness in the community and if not tackled promptly may cause total collapse of the community group.

Accountability from leaders is weak. The leaders do not routinely let people know how and where there contributions have been used.

Work Outlook

In the building of a barrage, the work is usually divided amongst the various groups. The women collect stone water and clear the site. Breaking and carrying heavy stone together with digging to excavate the site is the work of men.

Problems arise where the community is not coherent to provide the necessary labour in an ideal mix. Where few men only come, breaking and carrying of large stone for construction will produce a bottle neck in the construction work. May also delay because the site takes a long time to excavate. The other members of the community who come are therefore wasting their time. Cases where attendance has been high but work has taken a long time to complete had such complications.

With communities where work ethic is highly developed work moves quickly and smoothly because each individual performs their assigned duty. Where this is not the case attendance is paramount not the work output. At several sites for example during the excavation stage, only men were found at site with a few women. The women were free to perform other duties elsewhere and only attend the work sessions at a barrage site when there was something for them to do. These communities thus consider the use of their total time as an asset not to be squandered. Each member pulls their weight at the work place.

Acquisition of Building Material

The ideal time for building river barrages is during the dry season when water is scarce. During this time the water needed for the construction maybe some distance away.

Since large quantities of water is required the community has to arrange to transport this to site. Problems have been observed hereby the reluctance of individuals to bring water themselves or give their animals out for this task. This again is an issue for the community leaders to assign duties properly so that only one persons donkey is used to ferry all the water whilst all the other peoples donkeys stay at home. That is fair dealing must be seen to be at the fore in all undertakings.

Site for Development

All sites for barrage developments have been picked together with members of the community. The criteria, has been access ie where people abstract their water, suitability of site for barrage construction. Capability for water storage, availability of building material ie stone, sand and water.

Though this has been the ease at all sites, complaints that a certain site was going to help such and such a person have arisen. Even though these have eventually been solved through the administration, they resulted in substantial time loss in a few sites.

Lack of Perception of the Future.

Councillor Mwini sees the major problem of our communities as a failure to perceive the future. Only a few people have this ability and the others think they are dreamers. He insists that the work being done now on barrage construction will bear fruit for most people to see in 5 years. To him the frustrations we face must be taken in stride and should never thwart the thrust. Two illustrations serve to demonstrate this assertion.

- Musonzo wa Mwini

Councillor Mwini has been pushing on every public forum for each person to plant at least one Musonzo (terrace or portion of shamba) before the onset of rains.

Whatever you do, plant this Musonzo first. People who have needed this have got results and are converting to total early planting. Other people have not needed the call yet and continue late planting and total crop fail.

Soil Conservation

T. Mbathi 1958 started soil conservation efforts, with the colonial government. The people did not take up the idea as wholesale. Those who did usually get an harvest even in a below average rain season. They have realised self sufficiency in food. Due to the harsh economic climate and development education there is more uptake of conservation related to water retention.

Mbathi during his political campaigns started vegetable growing groups in the river valleys. Instead of giving these groups money, he gave them seeds. He this sew the seeds of vegetable growing we now see in the Kiindu. These vegetables have so far been limited by availability of water. In future we should see more vegetable growing uptake.

6. THE NEXT STEP - CATCHMENT MANAGEMENT

To carry the process enhancing the quantity of water available to the community, it is necessary to manage flow of the received precipitation. After constructing barrages on sandy rivers, water is held in the sands by dam effect. Excess water flows down the river.

One positive element the barrages on the river have shown the community is the amount of soil trapped in these barrages. Soil is a resource the community cannot afford to lose. Also water runs down the catchment into the river channel unabated. If this precipitation is managed, the soils will remain moist for much longer. The promotion of plant growth is enhanced this way.

It is imperative therefore to seek ways and means to retain the received rain water in the catchment for as long as possible to increase plant growth. This increment improves food production and ultimately health of the community. As the water stored in the soil is slowly released, the barrages would continually be recharged making water available throughout the dry season.

PRA training problem ranking gives water as number one. This is followed closely by food sufficiency and trees.

PRA Training follow-up

The conclusion of PRA training is the formulation of a plan of action by the community. The initial plan invariably deals with the solution of water problems per second. Only after this phase is concluded the community is prepared to tackle subsequent problems. This is as it should be. If the community condenses too many items together, the efficiency of implementation might be greatly impaired.

In case it has been observed that, originally the community is concerned with water quantity only. Quality of water being of no consequences where there is scarcity.

Once a stable quantity of water is assured, the community is prepared to upgrade the quality of their water. They would then start the construction of improved wells. Improved shallow wells fed through sand fettered water have little surface contamination. The people do not share their water with animals and are not contaminated through surface runoff, neither do people walk into the well as in open scoop wells.

Topical PRA on Catchment Management

To move towards food sufficiency and adequate tree cover in the community, a topical PRA training is necessary. The focus of this training is the management of received precipitation for production. In reality is involves the management of land for maximum retention of water and prevention of soil loss. In this training the community should discover the reasons for terracing, in their farms, elimination of bare lands, opening up of the soils and breaking of the soil pan, the role of trees in water management, which trees and why.

The training would therefore include the following elements. Farm preparation, planting techniques manuring weeding, on farm crop maintance, seed selection pest harvest care. Tree nursery preparation, nursery care, tree selection, seed selection, planting for survival.

The training enables the community to use their land to maximise their production, through the removal of their biggest constraint, water shortage on the land.
Using their overall village plan, the community can then move forward in tackling other problems lower in the ranking list.

KIINDU RIVER BASIN BARRAGES SYSTEM CONSTRUCTED UNDER THE PILOT

PROJECT AND THE 25 BARRAGE PROJECT.

	Barrage Name	**Barrage Back-up M**	**LENGTH Channel M**	**WIDTH Barrage CM**	**HEIGHT CAPACITY Cu.M.**	**No.**
1.	Kamumbuni	500	100	240	36000	
2.	Kwa Kavoo	320	75	130	9360	
3.	Kwa Mutinga	300	24	200	4800	
4.	Kwa Mukumbe 1	300	22	100	1980	
5.	Kwa Mukumbe 2	250	25	170	3200	
-	Ivuuni					
6.	Nzemeini	330	20	235	5170	
7.	Kwa Mangya	300	21	190	3990	
8.	Kwa Langwa	200	18	235	2820	
9.	Kwa Ndunda	210	21	245	3601	
10.	Kwa Kang'esa	155	18	180	1674	
11.	Syonganga	250	15	350	4375	

12.	Kwa Mwini	230	14	230	2469
13.	Silingi ili	120	13	300	1560
14.	Kitulu	80	5	80	1067
15.	Kilukuya	300	17	240	4080
16.	Yoani	130	10	150	650
17.	Kwa Munzuu	140	6	230	644
18.	Kivunya/Ndov.	75	6	130	195
19.	Mulango	144	6	230	662
-	Nengya(Mukusya)				
20.	Nengya	150	3	140	210
21.	Kisekini	230	15	140	1610
22.	Sunzumala	50	10	160	267
23.	Musya Ngomano	240	12	260	2496
24.	Kwa Mwenze	100	13	190	823
25.	Mumbuni	200	12	280	2240
26.	Kwa Mulumbi	196	14	220	2012
27.	Kwa Kilile	175	13	290	2199
28.	Kwa Vonza	127	13	430	2366
29.	Kwa Kitoo	120	13	370	1924
30.	Kwa Muthembwa	120	9	320	1152
31.	Kakunike 1				
32.	Kakunike 2	70	10	180	420
33.	Kwa Kutu	100	8	200	533
	Total				**106540**

NAME	**NZEMEINI**	**KWA MANGYA**	**KWA LANGWA**	**KWA NDUNDA**
No.	**6**	**7**	**8**	**9**
Starting date	6/10/1995	25/9/1995	11/10/1995	8/1/96
Completion date	30/10/1995	18/10/1995	4/11/1995	4/3/96
Material				
Cement	95	132	79	106
Barbed Wire	1	2	1	1
Round bar 1/2"	2	2	2	6
" " " 1/4"	-	-	-	2
Nails	1 kg	1	1	1
Timber 2x2"	80	50	25	30
Measurement				

Span (m)	18	24	14	23
Height (cm)	235	190	235	245
Capacity (Cu.m)	5170	3990	2820	3601
Water Backup(m)	330	300	200	155
Width (m)	20	21	18	21
Labour				
Men	56	291	59	132
Women	312	991	199	304

NAME	**KWA KANGESA**	**SYONGANGA**	**KWA MWINI**	**SILINGI ILI**
No.	**10**	**11**	**12**	**13**
Starting date	22/4/1996	21/9/1995	20/3/1996	26/2/96
Completion date	9/5/1996	19/10/1995	22/4/1996	22/4/96
Material				
Cement	75	62	78	71
Barbed Wire	1	1	1	1
Round bar 1/2"	6	2	2	6
" " " 1/4"	2	-	1	2
Nails	1 kg	1	1	1
Timber 2x2"	30	25	30	60
Measurement				
Span (m)	19	14	15	11
Height (cm)	180	350	230	300
Capacity (Cu.m)	1674	4375	2469	1560
Water Backup(m)	155	250	230	120
Width (m)	18	15	14	13
Labour				
Men	189	68	98	
Women	450	171	152	

NAME	**KITULU**	**KILUKUYA**	**YOANI**	**KWA MUNZUU**
No.	**14**	**15**	**16**	**17**
Starting date	24/9/1996	9/8/1996	4/3/1996	20/3/1996
Completion date	14/9/1996	13/11/1996	26/3/1996	17/5/1996
Material				

Cement	30	100	62	98
Barbed Wire	1	1	1	1
Round bar 1/2"	1	2	4	2
" " " 1/4"	1	6	4	1
Nails	1	1	1	1
Timber 2x2"	80	60	60	30
Measurement				
Span (m)	11	19	23	15
Height (cm)	80	240	150	230
Capacity (Cu.m)	1067	4080	650	644
Water Backup(m)	80	300	130	140
Width (m)	5	17	10	6
Labour				
Men	211	92	68	
Women	303	293	171	

NAME	**KIVUNYA/**	**MULANGO**	**NENGYA**	**KISEKINI**
No.	**NDOVOINI 18**	**19**	**20**	**21**
Starting date	22/1/1996	22/2/1996	26/2/1996	23/7/96
Completion date	15/2/1996	26/3/1995	30/4/1996	29/8/96
Material				
Cement	126	64	86	70
Barbed Wire	2	1	1	1
Round bar 1/2"	-	3	3	2
" " " 1/4"	-	1	1	2
Nails	-	1	1	1
Timber 2x2"	-	30	30	40
Measurement				
Span (m)	30	16	26	17
Height (cm)	130	230	140	140
Capacity (Cu.m)	195	662	210	1610
Water Backup(m)	75	144	150	230
Width (m)	6	6	3	15
Labour				
Men	260	98	51	329
Women	553	142	329	388

NAME	**SUNZUMALA**	**MUSYA NGOMANO**	**KWA MWENZE**	**MUMBUNI**
No.	**22**	**23**	**24**	**25**
Starting date	24/4/1996	8/1/1996	15/2/1995	23/7/96
Completion date	15/5/1996	12/2/1996	8/3/1995	12/9/96
Material				
Cement	50	89	52	75
Barbed Wire	1	1	1	1
Round bar 1/2"	2	6	6	6
" " " 1/4"	2	2	2	4
Nails	1 kg	1	1	1
Timber 2x2"	30	30	40	60
Measurement				
Span (m)	16	12	15	14
Height (cm)	160	260	190	280
Capacity (Cu.m)	267	2496	823	2240
Water Backup(m)	50	240	100	200
Width (m)	10	12	13	12
Labour				
Men	95	215	57	96
Women	110	370	192	318

NAME	**KWA MULUMBI**	**KILILE**	**KWA VONZA**	**KWA KITOO**
No.	**26**	**27**	**28**	**29**
Starting date	19/2/1996	13/3/1996	13/3/1996	19/2/1996
Completion date	20/3/1996	11/5/1996	19/4/1996	5/3/1996
Material				
Cement	93	89	108	78
Barbed Wire	1	1	1	1
Round bar 1/2"	6	4	2	6
" " " 1/4"	2	4	2	2
Nails	1	1	1	1
Timber 2x2"	30	30	30	30

Measurement				
Span (m)	18	16	22	14
Height (cm)	220	290	430	370
Capacity (Cu.m)	2012	2199	2366	1924
Water Backup(m)	196	175	127	120
Width (m)	14	13	13	13
Labour				
Men	335	236	292	318
Women	450	778	322	600

NAME	**KWA MUTHEMBWA**	**KAKUNIKE 1**	**KAKUNIKE 2**	**KWA KUTU**
No.	**30**	**31**	**32**	**33.**
Starting date	29/3/1996	5/2/1996	5/2/1996	3/1/1996
Completion date	17/5/1996	15/3/1996	18/3/1996	15/2/1996
Material				
Cement	81	132	69	57
Barbed Wire	1	2	1	1
Round bar 1/2"	3	2	6	6
" " " 1/4"	2	-	2	2
Nails	1 kg	1	1	1
Timber 2x2"	60	50	30	30
Measurement				
Span (m)	16	24	17	10
Height (cm)	320	190	180	200
Capacity (Cu.m)	1152		420	533
Water Backup(m)	120		70	100
Width (m)	9		10	8
Labour				
Men	160		38	58
Women	318		88	80

OFFTAKE WELLS

Barrage No.	Barrage Name
6.	Nzemeini
8.	Kwa Mangya
23.	Musya Ngomano
9.	Kwa Ndunda
13.	Silingi Ili
24.	Kwa Mwenze
16.	Yoani
11.	Syonganga
21.	Kisekini
26.	Kwa Mulumbi
28.	Kwa Vonza
25.	Mumbuni

7.ASSESSMENT OF SUCCESS

Basically the assessment of success of the project it is to be gauged on the following basic issues.

1. The length of time water is available in the river sands.
2. The improvement of levels of water in the rivers.
3. Number and length of terraces constructed in the project areas.
4. Number of households which produce enough food to last them the year round.
5. Trees planted in the project area.
6. Number of families who have a constant supply of vegetable throughout the year.
7. In the long-run an increase of the number of iron sheet roofed houses is an indicator of economic improvement.

8. Emergence of economic activity related to water availability.

Prepared by
S.M.Mutiso 14 January 1997