Water resources in semi-arid Kenya

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INTRODUCTION

Water is a vital substance for human existence and that it is also a major factor in determining the progress of civilization. The importance of water to man is not limited to individual persons, individual communities, of individual countries, but it is often carried beyond the national boundaries, thereby resulting in international water problems whose solution require international understanding and co-operation. This is equally true in the Kenyan context where the water resources are shared between urban and rural communities; between highland and lowland people; industrialists versus the agriculturalists, including pastoralists.

As the population continues to increase and the high potential areas become less available, the country’s medium potential (often called marginal and semi-arid lands) are increasingly being used for both crop and livestock production. According to Kenya’s Fifth Development Plan, 1989-1993, “the Government’s Agricultural Policy will focus on the development of technologies appropriate to the arid and semi-arid lands through work on the introduction of new crop varieties”. These lands constitute 88 per cent of the total area and hold 35 per cent of the population. For agricultural purposes, the semi-arid areas which constitute 80 per cent and which hold 30 per cent of the population is the most immediate target for agricultural development. The semi-arid areas can support more people given improved water supply, technological and financial back-up.

Another important component in the development of water resources is the human Resources. Included in this are manpower Resources, information and cultural Resources. The manpower resource must consider its quantity and quality. While the information resource is the body of knowledge available to all mankind. Finally, the cultural resources include overall cultural background as well as institutional structure which is necessary for human resources to be effective (Chow, 1975).

Despite the need to develop the water resources in the semi-arid areas, our scientific knowledge of these areas is very scanty. Research on the current and future potential of water resources in these areas is imperative. Similarly, the place of public education in water resource development and its relationship with environmental problems is important. Public education creates awareness about the importance of conserving the existing water resources.

WATER AVAILABILITY SOURCES

The availability and hence supply of water resources for domestic, and agricultural purposes in the semi-arid lands is influenced by many and varied factors such as climate, geology, hydrology, capital and distance from the homestead to the water source. Because of the complexity of these factors, it is not possible to discuss their individual contribution to the overall availability of water as a resource for development in the semi-arid lands. A few examples are drawn from the Machakos District of Eastern Kenya which is largely semi-arid.

In order to acquire a better idea about water availability and supply, water balance in the entire area is necessary (Table 1). Water balance is determined by measuring the continuity of water flow in order to establish the balance between total input, total output and change in storage over a given period of time, year, month on a number of darp for a specific basin or area.

An attempt to work out detailed and reliable water balance for Machakos District and most of the semi-arid areas of Kenya is made difficult by lack of an even distribution of rainfall stations. Most of them are located in the high potential areas. At some stations there is lack of care and continuity in collecting rainfall data as well as lack of reliable data from which evapotranspiration, soil water deficit and hence the available water capacity for plant requirement can be computed.

Woodhead (1968) is right to point out that “such data are basis to catchment research and they have considerable bearing upon the feasibility of irrigation project” particularly in the semi-arid
lands.

CLIMATE AND HYDROLOGY:

Rainfall is an important source of water in the humid, sub-humid and semi-arid lands. In East Africa, the Inter-Tropical Convergence Zone (ITCZ) is the main rainfall producing agent. The semi-arid areas of eastern Kenya have rainfall which is characterized by low total amounts, strong seasonal concentration around short rains (October–November to December) and long rains (March–May). The rainfall is high temporal and spatial variation from season to season and year to year.

The high intensity storms, low vegetation cover and erodible soils all combine to mobilize sediments which pollute water in streams and reservoirs. The character of the moderately sized streams in the Machakos District has changed over the past 70 years. Maher (1937) described streams which had, over a period of 20 to 30 years, changed from perennial to ephemeral, and he attributes the change to the increased proportion of run-off to rainfall caused by excessive erosion. He further describes channels having the banks partly choked by excessive coarse-grained sediment. Soil and water conservation have led to the reappearance of springs and a shift back to permanent dry-season baselines in what had become ephemeral channels (Min. of Agricultural 1964).

Data assessment on the overall picture in semi-arid Kenya with regards to ground water shows that the geological formations in Kenya are unfavourable for the substantial production of cheap ground water. At present, 600km² of 20000 km² have been drained in Kenya, however, the effective use of ground water resources is constrained by high survival and fluoride concentrations as well as limited financial and technical know-how.

The semi-arid areas experience high rates of potential and actual evapo-transpiration 2200–2400 mm per annum. Results from the analysis of climatological and hydrological data from two main river gaging stations on the major perennial Athi-River (Min. of water, 1987) indicates that even if all available water resources (both surface and underground) were harnessed, they would not fulfill the per capital needs of the District in the year 2000 (Mutiso and Thompson, 1987).

Table I. WATER DEMAND AND SUPPLY IN MACHAKO DISTRICT

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average rainfall</td>
<td>9.6 million m³ yr⁻¹</td>
</tr>
<tr>
<td>Loss through evaporation</td>
<td>0.86 million m³ yr⁻¹</td>
</tr>
<tr>
<td>Loss through Run-off</td>
<td>0.64 million m³ yr⁻¹</td>
</tr>
<tr>
<td>Surplus</td>
<td>7.9 million m³ yr⁻¹</td>
</tr>
<tr>
<td>Estimated Demand</td>
<td>47 million m³ yr⁻¹</td>
</tr>
<tr>
<td>Short fall in Supply</td>
<td>39.1 million m³ yr⁻¹</td>
</tr>
</tbody>
</table>

Mutiso and Thompson (1987) state that the main source of domestic water supply accounted for 54 per cent, followed by well, 28.8 per cent; dam or pond 11.5 per cent, roof catchment 6.2 and rock catchment 3.5 per cent. Water scarcity in the Machakos District is only one aspect of the supply problem. In the semi-arid and arid areas of Kenya, the main issue is that of water resources, where the question of quality comes next. That is why the role of public education in the management of water resources becomes inevitable.

PUBLIC EDUCATION ON WATER RESOURCES

The availability of save drinking water for people living down stream very much depends on the upstream users. If the source or any stage flow is polluted the water becomes detrimental to human and livestock health. Urbanisation industrialisation as well as the agro-based industries pose threats to people living in the humid and semi-arid areas of Kenya.

Population growth and distribution continue to pose great challenges to water management in Kenya. In the semi-arid lands the population trend to concentrate where water resources are available with the result of contamination of water from human livestock and agricultural wastes. Besides, the destruction of water resources, high population exerts pressure on both land resources leading to decline in biological productivity the area.

RESEARCH ON WATER RESOURCES

The Kenya government is playing a greater role in the research and conservation of water resources. The formation of the Permanent Presidential Commission on Soil and Water Conservation and the co-operation together with efforts by other related ministries and Non-governmental organisations is a step in the right direction. These have initiated and extended to local communities such activities soil and water conservation activities as the cultivation of terraces, tree planting, cut-off drains, sub-surface dams and gables. In addition, the National Environmental Act, 1979, gives the Ministry of Environment and Natural Resources co-ordinates nationwide environmental protection, including water pollution. The Ministry of Water Development has training programmes all geared towards the development of manpower skills to be used in the semi-arid land. The creation of the Ministry of Reclamation and Development of Arid and Semi-Arid Lands also likely to contribute significantly towards the water resource development in the semi-arid lands.

CONCLUSION:

The soil, water, vegetation and wildlife resources of the semi-arid land of Kenya are the basic production systems. Water resource assessment studies in the semi-arid lands need more financial and technical back-up. Research institutes including the universities are expected to play a greater role in this direction. These should address themselves to the question of appropriate technology for semi-arid area water supply, pollution and disposal options, mention but a few.

Community participation and public education on the management of water resources is vital for the sustainable development of the resource base. Safe drinking water for all will require more than the current Government's effort. Collective response will be needed from youth, adults, planners, industrialists, agriculturists and pastoralists. Several important points that should be borne in mind from the project inception, implementation, operational and evaluation stages are described. First the project belongs to the users who should be involved in all stages during the life of the project. Second, the physical installation of the project should be conceptually simple, capable of being easily maintained by users and involving minimum time and effort. Third, the cost of construction is reasonable enough to be acceptable by donors while the cost of operation is low enough to be supported by users and governments with minimal support from donors. The indigenous gravity irrigation systems found in Elgeyo-Marakwet, Marsabit, Machakos and Taita Districts are cases in point. Finally, the system should supply enough water to meet the users needs. To do this, there should be continuous evaluation and improvement.

REFERENCES

1. Chow Ven Te. Opening address. In Water resources and education (eds.) Ven Te Chow, Fried, J.J. and Knee, R


