Salient Issues in Water Catchment management in Kenya: a position paper.

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Abstract

Through critically examining the issues most commonly encountered in the management of water catchments in Kenya, this paper concludes that,the highlands in ecological zones II and III which supply the bulk of surface water in Kenya, though occupying less than 10% of the country, are currently under serious land-use conflict and therefore urgently require protective land-use policies reflecting their importance as National water catchments. The same should happen with isolated hills in semi-arid lands which form major catchments for temporally springs which appear during rainy seasons and later continue their flow under the sand and silt beds of rivers in the dry season.

Introduction

Water at any state exists as part of the hydrological cycle, and so long as solar radiation is available to drive the latter, and subject to other laws of meteorology, the present global rainfall distribution patterns are sustainable. Thus we can confidently categories the earth into high, low, or no rainfall regions or even talk of the short or long rainfall seasons in a place. Water is therefore a sustainable natural resource; a state which has generally been beyond the influence of man. However, with the ushering in of the global warming era, man seems to have at last caught up as a result of which, experts are predicting possible changes in rainfall delivery patterns on the earth in the no too distant future.

The land phase of is the most important part of the hydrological cycle due to a number of reasons. Water at this point acquires kinetic energy in which form, it interacts with man's activities to cause disasters such as soil erosion, flooding, dam failure etc, while similar activities lead to changes in the chemistry of the water; a process termed pollution. Still on the land phase of the hydrological cycle, the water undergoes partitioning into evaporated, groundwater, soil storage and surface runoff components; a process with serious ecological implications as it determines the amount of soil moisture available for plants, thus determining the productivity of the land. Such a process is however also prone to interference by man mainly through his land-use activities leading to the highly dreaded problem of decertification.

Globally, the capacity of man to cause havoc by interfering with the land phase of the hydrological cycle has long been identified and initiatives to control and eliminate such a state are today responsible for the existence of the science of watershed management; a discipline which addresses means of regulating the quantity, quality and timing of water yield from watersheds.

Kenya as a country has had its share of negative impacts of interaction between man and the hydrological cycle and this paper highlights some of the initiatives made either through research, policy adoption etc to minimise such occurrences. Needy cases that currently demand immediate attention will in the process be discussed.

Surface water resources in Kenya

Though Kenya has five major drainage basins namely the Tana, Athi, Uaso Nyiro, L. Victoria and the Rift Valley, the distribution of rainfall (ultimate source of surface water) is far from uniform. The bulk of water supply to rivers draining

these basins comes from a small fraction of the country, mainly highlands in Ecological zones I, II and occasionally III where annual rainfall regularly exceeds potential evaporation demand. This area, though covering less than 10% of the country, forms the main source of water for domestic, agricultural, wildlife and industrial uses in the country. Occasionally, this water supply is supplemented by flash floods from drier environments during the rain season which, if stored, greatly supplements the dry season flow in these rivers.

For the purposes of this paper, Kenya's water catchments will be categorised into three broad groups namely, forested, agricultural and rangeland catchments.

Forested catchments

The high rainfalls occurring in Ecozone II and occasionally III attracts a luxuriant growth of forests which is the natural vegetation cover of high potential catchment ares. The stream-flow regulating effect of forests through their ability to absorb all rain water and release it into the stream in small doses has been recognised for a long time and the most ideal management strategy of forested catchments is non-interference. Despite this, the deep fertile soils, well distributed rainfall seasons and cool temperatures of forests makes them highly desired for intensive farming of food and cash crops, livestock rearing etc while the "slow growth rate" of indigenous trees calls for the adoption of compensatory forestry, all of which have threatened the natural forest cover on catchments. As a result, the possible hydrological effects of these land-use changes today constitute the most sensitive question in watershed management.

Catchment experiments the extended for more than 25 years in Kenya's forested catchments, revealed that carefully controlled replacement of natural forest with plantations of either exotic tree species, tea or Kikuyu grass (Pennisetum clandestinum)

pasture for grazing has no negative hydrological consequences as all experimental vegetation have similar water use and stream flow regulative patterns. As such, the recurrent attacks directed on the exotic softwood plantations which cover only 10% of Kenya's forest area (0.16 mi. ha) and supply all the general purpose timber needs of the country has no hydrological backing nor is it justified. Indeed, the use of short rotations of fast growing exotic plantations would be more economical to water resources compared to mature natural forests though other factors such as the maintenance of bio-diversity may militate against this.

By virtue of their use, industrial plantations of exotic trees require the use of heavy logging equipment at extraction time. A more worthwhile question is therefore the possible hydrological damage resulting from use of such heavy equipment in the harvesting on forest soils. Studies elsewhere have shown that such operations not only destroy the litter and humus mosaic of forest floors but also compact the soils underneath, thus reducing their water storage capacity ultimately leading to increased frequency of flooding highly synchronized with rainfall events followed by low base flow in the dry season. The stream-flow regulative effect of forests is therefore lost after uncontrolled logging operations (Pereira and Wang'ati, 1985) and the logging techniques presently used in Kenya need to be reviewed with an aim of assuring that they are sympathetic to water resources conservation.

Effects similar to those of logging operations can derive from urbanization of forested catchments through the construction of institutes, roads, cities and the like, all of which provide shortcuts in the water-path-ways to streams by short-cutting the flow-through soil phase of stream flow generation. Communities neighbouring forested catchments should appreciate the hydrological utility of such land which extends hundreds of miles beyond their physical boundaries.

with a long dry season cannot meet all their water needs from rainfall inputs but will supplement this supply by pumping out any water within their rooting zone. Such trees are therefore a threat to water resources when planted in riverine and areas of shallow water table such as swamps etc. In many countries, the planting of trees in areas within 30 meters of river banks is never allowed in dry environments and the possibility of drawing such policies for Kenya should be explored.

The problem of water pollution has been addressed by the relevant working group. However, it needs to be pointed out that riparian areas especially in high potential farming areas with heavy chemical applications are effective natural filters for pathogens, sediments and chemicals which would otherwise end up in the water. Though the cultivation of such areas for crop cultivation offers an effective insurance against famine due failure of crops grown on hill tops, their pollution control role is however paramount and should be enhanced through prevention of clearing.

Rangeland catchments

Rangeland catchments in Kenya characteristically experience low, poorly distributed mean annual rainfalls, high levels of net radiation with corresponding high potential evaporation, all of which give rise to huge moisture deficits. As most of the rainfall is re-evaporated back to the atmosphere, no permanent streams, originate from these zones though a few temporarily appear following prolonged wet spells and latter continue their flow below the sand and silt beds of rivers. The sinking of wells into these river beds offers a readily available supply of water for livestock and domestic consumption in these areas. Isolated hills are the only possible catchments for these rivers in semi-arid lands (Kenya Forest Department, 1960) and they should be well protected from degradation to preserve this important role.

Another important major form of water in semi-arid lands derives from surface runoff generated from rainfall events. Recent studies on runoff behavior patters in representative areas (Wairagu, 1990, Leninger, 1986) yielded runoff coefficients of upto 60% which implies that more than 60% of the rainfall is lost as surface runoff. The tapping of this runoff through dams can contribute greatly in reducing the water shortage problems in such area as a hectare of catchment land has the potential to produce upto two (2) million litres of water form a rainfall season of only 400mm. Such potential has long been exploited by various groups both government and non-governmental, and it should be further encouraged. Precautions should however be taken to prevent further land degradation either directly through soil erosion or indirectly through creation of the oasis effect. The solution to the predominant water shortage lies partly in the development of runoff collection technology in such areas.

Agricultural catchments

Many hectares of land in Ecological zones II and III which were formerly under forest have now been opened up for cultivation in Kenya. Unfortunately, the available vegetation cover and soil depths in these areas are not enough to contain the prevalent rainfall intensities and depths leading to high potential of surface runoff generation and intensive soil erosion. The areas are also constantly undergoing changes in form of construction of schools, urban centers and new settlements all of which emanate from increase in human population and all of which contributing in reducing the potential of these lands to hold and absorb all their water in-situ. The result is increased surface runoff and flooding which demands creation of ex-situ storage systems.

Surface runoff generation on cultivated lands also results in gully erosion which apart from lowering land productivity causes siltation of reservoirs and occasional dam failures all of which are ecological disasters. The reduced depth and consequent water-holding capacity of these soils reduces the growing season by shortening the period of soil moisture availability for vegetation thus interfering with the ability of the land to support vegetative growth.

A lot of ground has been covered in the development of effective packages for soil and water conservation but a lot still remains to be done especially in regard policy development. By virtue of their high rainfall inputs, farming land in Ecological zones II and III are important catchment areas for National rivers and this should be reflected in policies. Issues such pollution by agro-chemicals, steep slope and riparian cultivation should all of which have direct bearing on the communities leaving further downstream should be well covered in land-use policies.

An important area where clear policies are long over-due relates to tree planting in riverine areas. Where agroforestry or farm woodlot have been recommended as alternative farming systems for erosion prone areas, policy problems relating to the purported role of certain tree species mainly Eucalyptus in causing the drying up of streams and rivers amidst their rising importance as fuelwood crops set in. It needs to be emphasised that tree water-use is highly correlated with growth rate implying that trees that yield more wood demand more water. In areas where fuelwood is the priority, fast growing trees can be adopted.

Tree water use hardly ever exceeds the potential evaporative power of the environment which is always controlled by net radiation. The water used by trees is therefore equivalent the amount evaporated by the atmosphere. In Ecological zones II where normally annual water surpluses occur, trees meet all their water needs from rainfall inputs and are therefore not a threat to water resources. Planting any type of trees, any place has no negative hydrological consequences. On the contrary, trees growing in areas

Another area where runoff harvesting can play an important role is the control of the erosion cycle currently at play through re-vegetation. Pilot studies in several Kenyan ASALs (BPSAAP, 1984; Barrow, 1983; Smith and Critchley, 1983; Wairagu, 1990) have shown that the predominantly high runoff rates can be tapped and effectively used for re-vegetation. Water harvesting is therefore a technique which if carefully adopted promises a lot of hope in rehabilitating these areas.

CONCLUSION

The important role of well watered highlands in Kenya as National water catchments should be strongly enshrined in protective policies and dangerous trends such as urbanization, riverine and steep slope cultivation should be prevented.

In semi-arid lands, policies to preserve isolated hill catchments and to develop the utilization of unconventional water sources such as runoff harvesting for various uses should be formulated.

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