EUCALYPTUS WATER USE AND CONTROVERSIES: ENVIRONMENTAL EFFECTS OF EUCALYPTUS TREES: Joram Mbinga[3]

2.3.1 Introduction

Eucalyptus was introduced to Kenya as early as 1902 from Australia. The aim of the initial introductions was to identify fast growing tree species to supply wood fuel for the Kenya - Uganda Railways. Since then Eucalyptus have remained popular species grown in many parts of the country. The most common species are *E. grandis* and *E. saligna* for medium to high altitude areas, *E. urophylla* for lowlands, and *E. camaldulensis* for dry areas. Lately hybrids have been introduced for marginal sites. The area under Eucalyptus is estimated to cover nearly 100,000 ha. The main reasons for the popularity of Eucalyptus are:

- Fast growth compared with other tree species thus giving marketable products within a short time. Average productivity is $50m^3$ of wood /ha/year compared to $10m^3$/ha/year for most slow growing indigenous trees
- Able to re-grow after cutting thus eliminating the cost of replanting.
- Yield a variety of products such as withies, firewood, charcoal, building materials, mining props, fencing posts, electricity transmission poles, railway slippers, pulp, paper, timber, plywood, oil, perfume and medicine

However, the widespread preference of Eucalyptus raises a number of issues particularly between environmentalists and foresters. Foresters promote the positive side of Eucalyptus by highlighting its ability to meet increasing wood demands for domestic and industrial use. On the other hand, some environmentalists are opposed to Eucalyptus due to perceived ecological hazard.

This paper will examine available information to assess the validity of claims from both sides. It critically assesses the evidence for and against the species

2.3.2 Arguments for growing Eucalyptus

2.3.2.1 Socio-economic contribution of Eucalyptus in national development

Eucalyptuses, alongside other tree resources are important national assets due to their economic, environmental, social and cultural values. It is estimated that short rotational trees that provide industrial firewood, pulpwood, sawn wood, transmission and construction pole wood have a value exceeding Kshs 1.6 billion annually where as the total contribution of forest products and services is indicated as Kshs 16.4 billion, equivalent to 1% of national GDP (Cheboiwo, 2008).

2.3.2.2 Provision of Firewood

The demand for domestic wood energy for the growing rural population is increasing. Currently, the country is experiencing wood deficit of about a million cubic meters per year. The deficit is expected to increase at about 0.5 million cubic meters annually. Planting fast growing species such as eucalyptus will provide solution to the increasing wood deficit.

2.3.2.3 Provision of Industrial Fuel wood

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Textiles and food processing sectors are major consumers of industrial fuel wood. The tea industry, a major foreign exchange earner in Kenya, accounting for 20% of total exports and contributing 4% of GDP, relies on Eucalypts firewood in tea processing thereby saving approximately Kshs.2.2 billion annually.

2.3.2.4 Supply of Pulpwood and Plywood

When in operation, Pan African Paper Mill requires about 60,000 m^3 of Eucalyptus pulpwood annually. With the switching from use of furnace oil to fuel wood to cut down costs of paper production This will require about 250,000m^3 of Eucalyptus valued at Ksh.200 million annually. Raiply that also owns Tim-Sales is the major plywood producer in the country. Annually, they process up to 250 000 m^3 part of which is derived from eucalypts.

2.3.2.5 Transmission Poles

Currently Kenya's demand for poles and posts is estimated at 1,500,000 m^3. For several years, the country has been importing electric poles resulting in loss of foreign exchange estimated at about Kshs.140 million annually. The shortage of poles has been attributed to the campaign against the planting of eucalypts in 1980s. The demand for poles is increasing because of the current Rural Electrification Programme. There are 8 transmission poles treatment plants in the country with capacity of 320,000 poles per year. Six more plants are under construction and when complete will bring total pole production to about 400,000 per year in the next two years.

2.3.2.6 Timber

The timber from 12-25 year old Eucalyptus is currently popular in joinery and building industry and accounts for up to 60% of stocks in timber yards in Western Kenya.

2.3.3 Negative Concerns on Growing Eucalyptus

Despite the enthusiasm with which Eucalyptus has been taken up, there is criticism from some environmentalists, social activists, some politicians and some NGO's. The negative concerns are about Eucalyptus using a lot of water, reducing soil fertility and being generally bad for biodiversity conservation.

2.3.3.1 Water Use by Eucalyptus

The criticism is that Eucalyptus is a water intensive user and reduces water available for other species, effectively out-competing them. This is exacerbated by a high transpiration rate indicative of the inefficient use of water by the trees.

Regarding this criticism, studies have been carried out in several countries on water use by various tree species including Pinus and Eucalyptus to see if it has a higher demand per unit of biomass fixed. The studies have shown that Eucalyptus consumed 0.48 litres of water to produce a gram of wood, compared to the average of 0.68 litres per gram of wood for local species. In an eight-year rotation, Improved *E. grandis* in Kenya yields between 50 to 75 m^3/ha/year compared to the average of 1-10m^3/ha/year for indigenous species (Oballa, 2005). An overall high productivity therefore necessitates a greater water demand.
Contrary to common criticism, Eucalyptus is efficient in its water use as demonstrated by the biomass produced per unit volume of water consumed.

2.3.3.2 Effects of Eucalyptus on Soil Fertility

Few studies have been done on soil nutrients status in Eucalyptus plantations. In 1993, a study was carried out in Ethiopia to compare nutrient status in plantations of *E. globulus* (40 years old), Cypress (28 and 40 years old) and Cedar (40 years). The results showed that *E. globulus* plantations had low nutrient contents than soils in Cedar and natural forests. The soils under *E. globulus* and cypress also tended to have lower density of mycorrhiza fungi. In natural forest, the total annual litter fall was about twice as high in plantations of *E. globulus*. However, nutrient release in plantation of *E. globulus* was comparable to that in natural forest.

In a natural forest with little disturbance nutrients are conserved and cycled between trees and soil. When a plantation is thinned or felled and the wood is extracted, the nutrient capital changes considerably because nutrients are removed from the site. Since Eucalyptus are fast growing and are used as short rotation-crops, nutrients are taken with the products within a short period of time during harvest. In summary, the rapid depletion of the reserve of nutrients in the soil due to cropping of Eucalyptus on short rotation is expected and is simply use of the nutrients for growth

2.3.3.3 Effects of Eucalyptus on Biodiversity Conservation

Several studies have been carried out to assess the effects of Eucalyptus plantations on biodiversity. Results from these studies have been consistent and they are given below.

At Muguga, plant diversity assessed under *Eucalyptus saligna* plantations gave the result in Table 1 below.

Table 1: Number of indigenous plant species under plantations of Eucalyptus

Characteristic	Plantation 2H	Plantation 1C
Age in years	14	52
Number of rotations	1	4
Eucalyptus trees /ha	1550	920
Number of indigenous plant species/ha	50	370

Source: Oballa and Konuche 2009.

The table shows there were about seven times more plant species in the older plantation than in the younger one indicating that species richness increases with the age of the plantation. There were 26 percent and 68 percent of woody species in the younger and older plantation respectively.

In 1998, a study was carried out in Ethiopia to assess the status of indigenous species diversity in plantations of *E. saligna* and *E. globulus.* The plantations were aged between 11 and 27 years. The results showed that while there were 3,575 indigenous plant species per hectare in 11- year old plantation of E. *saligna*, the plantation of 27 years had 18,650 indigenous plants. Under the 16-year old plantation of *E. globulus,* there were 2,300 indigenous plants while the 22 year old plantation had 13,400 indigenous plants per ha.

In this regard, Eucalyptus plantations seem to create conditions favourable for regeneration of indigenous plant species and therefore enhance biodiversity conservation. However, this may only happen in areas in close vicinity to indigenous forest where seed can easily be dispersed by animals or by wind to neighbouring Eucalyptus plantations.

2.3.4 Conclusion

Finally, most of the criticism on Eucalyptus is based on generalizations and incomplete information without considering the whole picture. It is our view that by planting the species in the right sites and applying correct management practices can mitigate a few of the perceived negative effects. Rational use of Eucalyptus in Kenya should hinge on the successful South African experience. The country should avoid expanding Eucalyptus plantations into water catchments, and riparian areas. National Environmental Authority (NEMA) has provided guidelines on how far from rivers, streams and other water bodies Eucalyptus should be planted. There is need to critically assess the trade-off between the income Eucalyptus generates and the water it consumes.

There is also need for both small-scale and large-scale land users to be provided with adequate information, guidelines and maps on where best to plant which type of Eucalyptus and under what management regime.

And finally, the benefits of growing Eucalypts appear to outweigh any negative effects. The rapidly growing human population in the country is increasing demand for wood especially wood fuel resulting in overexploitation of forests and woodlands. This is likely to continue for along time. In order to ease the pressure on natural forests and woodlands, it is necessary to continue the policy of promoting planting of fast growing species such as Eucalypts