Benefits and Environmental Impacts of Growing Eucalyptus Species

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ABSTRACT

Eucalyptus is a diverse genus of flowering plants with over 900 species. It belongs to the family Myrtaceae and subfamily Myrotideae. Majority of the species are native to Australia and Tasmania with a few species originating from New Guinea, the Philippines and Indonesia. Eucalyptus was introduced into Kenya in 1902 to provide fuelwood for the Kenya-Uganda railway. The species has many uses making it a multipurpose species including; Fuel wood, charcoal making, electricity transmission poles, posts, rails, source of essential oils, industrially used as timber, source of plywood, paper and pulp manufacture, ecologically provides honey flora, shade, and wind-break, ornamentals and for aesthetic enhancement of landscapes. Eucalyptus has many positive effects to the environment; among them are fast production of biomass which benefits the environment by using up large volumes of carbon IV oxide and emitting oxygen, thus regulating greenhouse gases. The species also have many perceived negative effects on the environment. These include; implication on depletion of soil nutrients required by crops thus causing poor crop yields, although it adds organic matter, it produces allelo-chemicals which influence negative performance of agricultural crops. Many species of this tree and in particular, E. globulus sheds its bark continuously and produces enormous leaf litter which could offer an innovative venture in harvesting of these components for commercial use. Few species (E. globulus) are prone to beetle attack with E. regnans hardly coppicing which may discourage farmers from its growing. KEFRI has however, attempted to provide guidelines on selecting and matching sites in Kenya with potential species to encourage farmers to grow the tree species.

Keywords: Eucalyptus species, Environmental benefits, Environmental Impacts.

1. INTRODUCTION

The name Eucalyptus is derived from Greek words 'eu' meaning 'true' and 'kalyptos' meaning 'hidden' it is therefore an eukaryotic plant species with hidden characteristics in its flower and fruit (Abebe & Tadesse, 2014), no wonder the tree species is termed controversial due to its varied environmental benefits and effects (Ketsela, 2012). Eucalyptus is a diverse genus of flowering plants with over 900 species (Abebe & Tadesse, 2014). It belongs to the family Myrtaceae and subfamily Myrotideae. Majority of the species are native to Australia and Tasmania with a few species originating from New Guinea, the Philippines and Indonesia (Mekin & Hailu, 2022). Eucalyptus was introduced into Kenya in 1902 to provide fuelwood for the Kenya-Uganda railway and currently over 100 species are grown in over 200,000ha distributed in small scale farms, gazetted government forests, plantations of private multinational companies, county government lands and in farmer fields (KEFRI, 2009; 2010; Langat et al, 2015). Eucalyptus is cultivated for the many reasons; high demand and unavailability of wood products including poles for rural electrification, has high rate of biomass production among tree species; high rate of biomass increase is influenced by site quality, seed quality, tree spacing and use of fertilizers (Langat et al, 2015). Eucalyptus trees are easy to cultivate and adaptable to a wide range of ecosystems, its leaves are non-palatable to most herbivores; they are grown by farmers as an alternative source of income due to decline in agricultural productivity. The tree species is advocated by environmentalists for carbon sequestration and mitigation of climate change and to reduce unemployment in non-agricultural sectors (KEFRI, 2010;

Mekonnen et al., 2007). Many farmers have reported high income generated by cultivation of the species compared to other tree species and many cash crops thus grown as investment for financial gain (KFS, 2009; Alebachew et al., 2015; Daba, 2016).

General Uses of the Tree and its Products

The species has many uses making it a multipurpose species including; Fuel wood, charcoal making, electricity transmission poles, posts, rails, source of essential oils, industrially used as timber, source of plywood, paper and pulp manufacture, ecologically provides honey flora, shade, and wind-break, ornamentals and for aesthetic enhancement of landscapes (KEFRI 2010; Mekin & Hailu, 2022). Young leaves of *E. globulus* produces pale – yellow oil which is used in perfumery, pharmaceutical and making of soap. The leaves of *E. citriodora* are lemon scented and are used in perfumery while its strong tough wood were initially used for railway sleepers. Wood for *E. paniculata* are also particularly strong and resistant to decay and are good material for construction of railway sleepers, building floors, bridges and in charcoal making (KEFRI, 2010).

Positive Effects on Environment

Eucalyptus has many positive effects to the environment; among them are fast production of biomass which benefits the environment by using up large volumes of carbon IV oxide and emitting oxygen, thus regulating greenhouse gases. It plays a crucial role in soil nutrient contribution through enormous leaf litter especially on marginal soils such as rocky hillsides, degraded lands, abandoned quarries and other excavation sites. Its enormous, tough and extensive buttress root system has high potential for topsoil retention with ability to absorb large volumes of water hence can reduce water runoff, waterlogging and mitigate flooding. Its vigorous leave canopy may reduce drip erosion and gully formation, it is also resistant to phytophagous insects and livestock and other herbivores thus maintain the aesthetic view of landscapes (Jagger & Pender, 2000).

Negative Effects on Environment

The species also have many perceived negative effects on the environment. These include; implication on depletion of soil nutrients required by crops thus causing poor crop yields, although it adds organic matter, it produces allelo-chemicals which influence negative performance of agricultural crops. In a study by Mensah (2016), planting of eucalyptus was found to lower soil pH by increasing exchangeable acidity, sodium (Na^{+}) and iron (Fe^{2+}) which had the consequence of reduction of soil nitrogen and organic carbon, immobilization of available Phosphorus thus causing infertility. The plant species has extensive and deep growing roots which can deprive water from agricultural crops as far as 10 m from where the trees are planted and wide scale hydrological impacts such as draining of water pangs (Jagger & Pender, 2000) and water ponds. Springs have been seen to dry up due to planting of Eucalyptus species near them (Daba, 2016; Mensah, 2016). These hydrological impacts are even dire in water scarcity areas such as arid and semi-arid lands (ASALs) of most developing countries. Eucalyptus trees in such lands grow roots as deep as 30 feet underground to seek water (Mekin & Hailu, 2022). Studies by Dye and Bosch (2000) on eucalyptus trees in Kenya showed that the tree consumes more water during its growing stages. Rates of uptake per day per plant range as high as from 50 l/day/plant to 90 l/day/plant (Mekin & Hailu, 2022). These rates are influenced by leave area with direct proportionality between leave area and rate of water uptake (Hatton et al., 1998), no wonder the government of Kenya has recently banned the introduction or planting of eucalyptus species along river banks, lakes or wetlands (Environmental Act, 2023). Although its canopy has ecological significance it has the disadvantage or suppressing the undergrowth (Dessie & Erkossa., 2011) thus reducing forest biodiversity. Some of the perceived impacts of the species to the

ecological environment are due to poor planning and management of species; silvicultural practices such as poor spacing and frequent harvesting is the reason for declining soil quality and fertility (FAO, 2009).

Opportunities in Eucalyptus Farming

Many species of this tree and in particular, *E. globulus* sheds its bark continuously and produces enormous leaf litter (KEFRI, 2010) which could offer an innovative venture in harvesting of these components for commercial use.

Threads to Eucalyptus Farming

E. globulus is prone to Gonoptera beetle attack (KEFRI, 2010) which may discourage farmers who may wish to grow it in their farms. *Eucalyptus regnans* does not coppice thus limiting its regeneration via vegetative methods.

CONCLUSION

To address the controversies on Eucalyptus growing, KEFRI (2010) has attempted to provide guidelines on selecting and matching sites in Kenya with potential species besides planting the species on the degraded lands (see Table 1); however, majority of Eucalyptus species grow optimally in humid and sub-humid regions with altitudes between 1400 – 2500 m.a.s.l (Langat et al, 2015). As human population increases with subsequent land fragmentation growing of eucalyptus in future may become less lucrative (Mekin & Hailu, 2022); this view is however contrary to that of Langat et al (2015).

Table 1: Recommended areas for growing Eucalyptus species in Kenya

Eucalyptus Species	Altitude	Min Rainfall (mm)p.a	Recommended areas for planting
E. grandis	1400 - 2200	1000	Greater districts of Bungoma, Kakamega, Trans Nzoia, Uasin Gishu, Nandi, Kericho, Kisii, Nyeri, Kiambu
E. saligna	1600 - 2500		
E. globulus	2000 - 3000	1000	Molo, Nyandarua
E. regnans	2500 - 3000	1000	South Kinangop, Molo, Timboroa, Londiani
E. paniculata	1600 - 2000	1000	Nairobi, Nakuru, Nanyuki
E. maculata			Nyeri, Nairobi, Nakuru, Nanyuki
E. camaldulensis	Upto 1400	1000	Dry areas of Nyanza, Coast, semiarid lowlands
E. citriodora	1200 - 2000	1000	Lower areas of Nyanza, Nakuru, Nyeri, Nanyuki
E. urophylla	Upto 1400	1000	Coast, Meru, Lower Nyanza
Eucalyptus hybrids	Upto 1700	750	Coast, Lower Nyanza, Mid-Eastern, Lower Western

Sources: KEFRI, 2010.

REFERENCES

[1] Abebe M and Tadesse W. (2014). Eucalyptus in Ethiopia: Risk or opportunity. Ethiopian Institutes of Agricultural Research, Addis Ababa. P.65.
[2] Alebachew, M., Amare, T. and Wendie, M., (2015). Investigation of the Effects of Eucalyptus camaldulensis on Performance of Neighbouring Crop Productivity in Western Amhara, Ethiopia. Open Access Library Journal, 2(03), p.1.
[3] Daba, M., (2016). The Eucalyptus Dilemma: The Pursuit for Socio-economic Benefit versus Environmental Impacts of Eucalyptus in Ethiopia.
[4] Dessie, G. and Erkossa, T., (2011). Eucalyptus in East Africa Socio-economic and environmental issues Forestry Department.
[5] Dye, P.J. and Bosch, J.M., (2000). Sustained water yield in afforested catchments—the South African experience. In Sustainable Forest Management (pp. 99-120). Springer Netherlands.
[6] Environmental management and coordination Act of Kenya, 2023.
[7] FAO, (2009). Eucalyptus in East Africa: The Socio-economic and Environmental Issues. Addis Ababa.
[8] Hatton, T., Reece, P., Taylor, P. and McEwan, K., 1998. Does leaf water efficiency vary among eucalypts in water-limited environments? Tree Physiology, 18(8-9), pp.529-536.
[9] KEFRI 2010. Facts on growing and use of eucalyptus in Kenya, P.O. Oballa, P.K.A. Konuche, M.N. Muchiri and B.N. Kigomo. ISBN: 9966 -7458 - 1 – 5.
[10] Kenya Forest Services, (2009). A guide to on-farm Eucalyptus growing in Kenya. Kenya Forest Services, Ministry of Forestry and Wildlife, Kenya. Pp 29.
[11] Ketsela Hailemicael B. (2012). The contribution of Eucalyptus woodlots to the livelihoods of small scale farmers in tropical and subtropical countries with special reference to the Ethiopian highlands.
[12] Langat D. K., J. K. Cheboiwo and M. N. Muchiri (2015). Financial analysis of growing *Eucalyptus grandis* for production of medium size power transmission poles and firewood in Kenya. African Journal of Agriculture and Utilisation of Natural Resources for Sustainable Development 1 (1): 38-45, ISSN 2313-1306.
[13] Mekin Mohammed Yimam, Leta Hailu (2022). Effects of eucalyptus plantation on Environment and water resource. Int. J. Adv. Res. Biol. Sci. 9(5): 156-163. DOI: http://dx.doi.org/10.22.
[14] Mekonnen, Z., Kassa, H., Lemenh, M. and Campbell, B., (2007). The role and management of eucalyptus in Lode Hetosa district, Central Ethiopia. Forests, Trees and Livelihoods, 17(4), pp.309-323.
[15] Mensah Albert Kobina (2016). Effects of eucalyptus plantation on soil physico-chemical properties in thiririka sub-catchment, Kiambu County, Kenya. Master of Science Thesis, Kenyatta University.