PROPOSAL ON DEVELOPMENT OF PINE AND EUCALYPTUS SPECIES FOR PROVISON OF GOODS AND SERVICES AND POVERTY ALLEVIATION IN EAST AFRICA

CONCEPT NOTE

Presented to the East African Community
By

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Introduction

East Africa consists of three countries, Kenya, Uganda and Tanzania, which constitute the East African Community. The three countries occupy a total land area of 180,689,484 hectares with Kenya, Uganda and Tanzania occupying of 62,000,000 hectares, 24,154,800 ha. and 94,534,684 hectares respectively. The population of these countries is 32 million, 24.6 million and 32 million respectively.

The economy of the East African countries relies on a few major sectors. Agriculture and related activities contribute over 50% of the GDP and employs about 80% of the largely poor rural population at small-scale subsistence levels. In the recent years, the three governments' priority focus has been to enhance strategies and priorities for poverty eradication. One of the sectors targeted for improvement has been forestry.

Forests and woodlands in East Africa as in the rest of the world provide a myriad of goods and services to both rural and urban communities. In addition to providing wood products such as fuelwood, poles, posts and medicine for the rural poor, forests maintain biodiversity, conserve water, protect unique ecosystems and provide wildlife habitat.

The forestry sector also contributes significantly to the economy of these countries. For example in Tanzania, forestry and wildlife are estimated to contribute about 3.3% of the GDP and about 10% of the country's registered exports. In Uganda, the sector contributes about 6% of GDP including the formal and informal sectors and the estimated contributions from the non-marketable environmental services.

The sector's real contribution is grossly underestimated as there is substantial unrecorded consumption of woodfuel in the rural areas in addition to other forest products that are traded informally. Bioenegy consumption in the three countries is estimated to be about 90% of the total energy consumption. The forestry sector also provides employment for many people. For example in Tanzania, 730,000 people and many others are engaged in the informal sector such as charcoal production.

In Tanzania, forests and woodlands cover 38.8 million ha. representing 40% of the land area. Woodlands, which constitute the miombo woodlands and open or savanna woodlands, are the dominant vegetation, covering about 40% of the land area. Industrial plantations and individual woodlots cover some 9000ha. and 15000 ha. respectively.

In Uganda, the natural forests comprise the tropical high forests and savanna woodlands, which shrunk from 45% in 1900 to the present 20% of the land area. The tropical high forest covered about 12.7% of the country, but has reduced to about 3%. The remaining forests are degraded and are threatened by uncontrolled harvesting and forest clearance for other land uses. Plantations cover 34,000 ha. representing only 0.14% of the land area.

Kenya has a relatively low forest cover having a total forest area of less than 3% of the total land area, with indigenous forests covering 1.24 million ha. and plantations 0.16 million ha. Most of the indigenous forests occur in high potential areas where they are under severe pressure and competition from other land uses.

Over eighty percent of the total land area of East Africa is arid and semi arid (ASAL). In Kenya, the ASALS carry over 25% of the human population and 50% of the countries livestock population.

In the past few years, forest policies in the three countries have been reviewed with the result that forest management is expected to be decentralized thus effectively bringing the decision making closer to the people and district councils, and promoting greater involvement of private sector and civil society in the sustainable management of forests.

However, despite such reforms, these forests and woodlands are still under threat from deforestation and degradation. The current rate of deforestation rate in Tanzania is 91,276 ha. per annum, while in Kenya this stands at 5,000 ha. per annum.

Because of the many problems faced in the management of indigenous forests in East Africa, the rapid increase in demand for forest goods and services and the high level of poverty, farm and plantation forestry seem to be the only way forward to meet the future wood demand. For example, in Kenya, it is anticipated that farms and settlements will contribute between 77-80% of the projected wood production in high and medium potential areas between 2002 and 2020. However, such a programme can only succeed with an intensive tree improvement programme whose main aim would be to improve productivity per unit area both on-farm and industrial plantations through provision of high quality planting material.

Past Efforts and Future Strategies for Farm and Plantation Forestry

Since 1902, many exotic tree species and provenance trials were established in the East African countries. The decision was influenced by successful plantation programmes in South Africa and later Kenya; and also the belief that indigenous tree species were slow growing. Indeed, average productivity of various species worldwide is as follows: Indigenous species $1m^3$/ha/yr, *C. lusitanica* $10m^3$/ha/yr, unimproved *Pinus tecunuminii* 22 m^3/ha/yr, *Pinus maximinoi* $30m^3$/ha/yr improved *Pinus patula* $30m^3$/ha/yr and Eucalyptus clones 45-$60m^3$/ha/yr. Thus, most of the plantation species are exotic.

The species trials involved mainly Australian Acacias, several species of pines mainly from Mexico, teak, cypress and Mexican cedar among others. The most dominant genera tested are *Pinus, Eucalyptus* and *Cupressus* in form of species and provenance trials, particularly *P. patula, P. caribaea, P. kesiya* and *C. lusitanica*. By 1935, *Pinus patula* had proved its potential, leading to large scale planting, followed by *P. radiata*, *Cupressus lusitanica* and *P. carribaea* in the late 1940's. To date, *Pinus* spp. are the most widely planted genus in East Africa accounting for over 50% of the planted area. *P. patula* is perhaps the most widely planted species in East Africa accounting for 85 per cent of the area under pines in Tanzania and 45% in Kenya.

In Tanzania, *P. caribaea* accounts for about 14 per cent, while other pines notably *P. elliottii* and to a lesser extent *P. radiata* account for about 1 per cent. Although *Cupressus lusitanica* accounts for 13 per cent of plantations in Tanzania, it represents about 50% of Kenya's plantation area. *Eucalyptus* species, particularly *E. grandis, E. maidenii, E. saligna* and *Tectona grandis* are also planted and represent about 5% of total plantations.

It is not possible to provide the areas covered by the species planted in individual woodlots. Nevertheless, *Pinus, Cupressus, Grevillea*, and *Eucalyptus* spp. are the major planted genera in highland areas. Some of the most commonly planted genera in the lowland areas are *Eucalyptus*, *Cedrella, Senna, Azadirachta* and *Casuarina*. Evidently, plantation forestry in East Africa is a combination of exotic and indigenous tree species, although a few exotic species dominate out of an array of about 2000 species tested.

Currently, *P. patula* in East Africa is the most widely grown species over a wide range of elevations from 1500 to 2500 masl. However, it is notable that most of the *P. patula* plantations are grown offsite as it grows best at 2000 to 2500 masl, thus productivity of the plantations is not optimum. Productivity of farm and plantation forests would be further enhanced species were diversified to capture the various climatic and ecological differences. For example, *P. maximinoi* and *P.*

tecunuminii could be grown at 1500 to 2000 masl and 1000 to 1500 masl respectively, and *P. gregii* at lower altitudes with 800 to 900 mm rainfall. *P. maximinoi* is known to be 20 to 30% more productive than *P. patula* at 1700-2100 masl. In Nicaragua, *P. maximinoi* is known to have good wood quality and to produce $40m^3$/ha/year in the highlands and also lower elevations. *P. oocarpa* although slow growing is known to have one of the best wood qualities, while *P. strobus* var. *chiapensis* is good for wood carving, which is one of the main industries for earning foreign exchange particularly in Kenya. Specific niches for these species could also be identified.

Thus, the need for further species and provenance tests notably through adaptive research remains justified.

The Need for Tree Improvement in East Africa

Forests are rarely managed for a single objective. Rather, they are managed on farms and as industrial plantations or natural forests for an array of goods and services ranging from provision of woody biomass for various uses such as fuelwood, poles and posts, protection of soils from erosion, soil enrichment, non-timber forest products and aesthetics. However, traditionally, tree improvement programmes tended to lean on the production of industrial products as implied by increasing yields, improving tree form, fostering wood uniformity and increasing resistance to pest and diseases. Given current trends of using trees for soil fertility enhancement, the role of trees in carbon sinks, and their use for environmental conservation, it is evident that the focus of tree improvement is increasingly becoming multifaceted. Thus industrial woody biomass production though important, is now among many other forest-based needs, and the importance of high yielding planting materials cannot be overemphasized.

Tree improvement programmes were initiated in the 1960s for *Pinus radiata, P. patula* and *C. lusitanica* and 1980s for *Eucalyptus grandis E. urophylla* and *E. camladulensis* in Kenya. Seed orchards and tree banks have also been established for *P. radiata, P. patula* and *C. lusitanica*. Gains of up to 30% have been obtained from these tree improvement programmes.

However, most of these seed orchards are unrougued due to lack of progeny tests. The age of these seed orchards ranges from 22 and 33 years and a number of clones have died due to various reasons ranging from *Cinara cupressivora* (cypress aphid) infestation, theft and debarking. The quality of seeds from most of the seed orchards is relatively low due to lack of rouging, poor maintenance and old age. Some of these species are now being attacked by various diseases and pests probably due to offsite planting resulting in decline in yield. Thus new initiatives have to be developed in order to provide high quality planting material for use on farms and for large scale planting.

Future wood needs will have to be obtained from existing planting sites. Thus, the productivity of the second and subsequent rotations will have to be maintained or increased to meet the increasing domestic and international demand for wood and wood products, since environmental concerns, social pressures and the rapidly diminishing resources constrain the harvest of timber from natural forests.
Maintaining or increasing plantation productivity can be achieved by adopting strategies that will increase yield per unit area. Such strategies should include further improvement of the existing tree species and further screening of indigenous and exotic species particularly pines and eucalypts as a way of broadening the genetic base and increasing species diversity for growing in the various ecological zones, as well as limiting or minimizing attack by diseases, pests and fires. Improvement should include understanding the processes which influence stand productivity, and development of management options for optimal plantation productivity. This would serve as an insurance against pests, diseases and climate fluctuations.

Currently all the three countries are importing seeds of pine species from South Africa, Australia and Zimbabwe for large scale planting as the existing seed sources are inadequate. Priority species for East Africa for improvement are *P. patula, P. tecunuminii, P. maximinoi* at various elevations and *P. caribaea, E. urophylla* and *Gmelina arborea* at low elevations.

Tree improvement is a continuous process and for higher gains new germplasm have to be introduced through various methods such as seed introduction, hybridization and control crossing. As most of the priority species identified are pines which occur naturally in central and south America, it was found necessary for the research institutions to join The Central America and Mexico Coniferous Resources (CAMCORE), a tree improvement and conservation programme based in North Carolina State University. The main benefits for members are acquisition of seeds, and exchange of information and expertise. Already, the Director CAMCORE recently visited the three East African Countries to review the breeding programme, familiarize himself with ecological and climatic conditions and be able to advice on strategies and potential species for improvement. Already, Gatsby Trust has funded the first year of membership to the CAMCORE programme. However, further funding for membership and operations are required for the success of the tree improvement programme.

Goal

To generate technologies to secure sustained production of major plantation indigenous and exotic tee species for given end uses.

Specific objective

Develop genetically improved planting stock for on farm planting and forest plantations.

Activities

1. Multiply the existing material vegetatively for production of planting material, as they are not seeding.
2. Import more seed for *P. patula, P. maximinoi, P. tecunuminii, C. lusitanica, Eucalyptus urophylla* and *P. carribaea.* for trials and to increase the genetic base
3. Undertake progeny tests of selected trees
4. Undertake hybrid crosses among pines and *E. Eucalyptus*
5. Evaluate wood properties for existing and introduced material

Outputs

Improved planting material of international repute is made available.

Beneficiaries

Farmers, wood based industries, forest departments, central governments, conservationists.

Budget (US$)

No.	ACTIVITY	YEAR 2006	YEAR 2007	YEAR 2008
1	Annual subscription fee	30,000	31,000	32,000
2	Regional Coordination	5,000	5,000	5,000
3	Technical visits	1800	1800	1800
4	Annual meeting	4500	4500	4500
5	Establishment and maintenance of trials	5,000	5,000	5,000
6	Study tours	10,000	10,000	10,000
TOTAL		**56,000**	**57,000**	**58,000**