



THE TREE FARMERS MAGAZINE FOR AFRICA

DISTRIBUTION OF BAMBOO RESOURCES IN TANZANIA

PROMOTION OF BAMBOO ENTERPRISES IN KENYA

BAMBOO AS A FORM OF ENERGY VS HEAVY FUEL OIL & DIESEL

AN OVERVIEW OF BAMBOO GROWING IN UGANDA

BAMBOO FOR RIVERBANK PROTECTION IN DRYLANDS ROTARY'S "MISSION GREEN" VISIT OF BETTER GLOBE FORESTRY'S INVESTORS TO KENYA A VERY HUMAN USE OF BAMBOO

| A PUBLICATION OF BETTER GLOBE FORESTRY |

Schools' Green Initiative Challenge Wonders of Divland Forestry





Schools' green initiative challenge

he Schools' Green Initiative Challenge is a unique project implemented by KenGen Foundation in partnership with Better Globe Forestry and Bamburi Cement Ltd.

The main objective is the greening of over 460 acres in the semi-arid counties of Embu, Kitui and Machakos with Mukau (*M. Volkensii*) and Muveshi (*S. Siamea*) tree species as a way of mitigating climate change and providing wood fuel and alternative income opportunities for the local communities.

Through the setting up of woodlots in participating schools, the project acts as a change agent to establish a tree-planting culture for multiple benefits in dry-land areas. The ten-year project is designed as a competition amongst the participating institutions for the highest seedling survival rates through the application of various innovations at the schools' woodlots.

Currently, there are 419 schools from the three counties taking part in the afforestation contest for the ultimate prize of educational trips, scholarship opportunities, and other prizes. Plans are underway to add more schools in the coming years.

The afforestation competition is in line with the Government of Kenya's Vision 2030 to achieve 10% forest cover across the country.







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COVER PHOTO

One of the successful introductions of exotic bamboo species in Kenya: the yellow bamboo (*Bambusa vulgaris*), pictured here in the drylands of Makueni county, Kenya. PHOTO BGF





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Dear readers,

This issue is on "Bamboo".

I must admit I had some misgivings on this lead theme, because it didn't sound very forestry-like. After all, it's a grass and it didn't seem very important here in East Africa. It never really took off with farmers like grevillea or eucalyptus trees did. Indeed, didn't. After delving into the subject though, it became quite interesting. Its potential certainly is not realised the way it is in China and South-East Asia, but it is definitely here, due to its fast growth, huge natural presence in the East-African region (about 1.2 m ha), its importance for bio-diversity (what do these mountain gorillas eat?) and its many uses, from energy to wine.

We got lots of articles on bamboo, it's a hot topic, and all very enthusiastic ones. Maybe here we are allowed to put in a cautionary note: what if it's the new eucalyptus? To sustain its phenomenal growth, doesn't it need an adequate amount of water? Will

EDITORIAL

newly introduced species, planted for riverbank stabilisation, not act just like eucalyptus trees and suck rivers dry? Anyway, like with eucalyptus, the idea only will not stop people from planting, when they see money. I learned that worldwide there are some 1,600 species of bamboo, although only 5 occur on the African mainland and another 33 or so on the island of Madagascar. However, to seemingly increase the small number on the African continent, the mountain bamboo Yushania alpina, formerly and more commonly known as Arundinaria alpina, now has been rebaptised as Oldeania alpina (picked up from the article on promotion of bamboo enterprises in Kenya by N Mugure Oduor formerly known as N Oduor).

Key words in most bamboo articles are "potential, infancy stage and young". In brief, a lot of development still has to take place to create sufficient raw material and experience to work with it. Indeed, if bamboo is so good, why is it not yet firmly established? Two answers are given in several articles; the ban on bamboo exploitation in natural

forests (Kenya and Uganda), and the fear of farmers to be duped again by producing for a non-existent market (Uganda Bamboo Association article by Hon. Munaaba Flavia). The market might be coming, but is not yet there. In this respect, it was intriguing to read that Kenya actually exported canned bamboo shoots (from the Aberdares) in the 1960s. There are articles from all over the region, starting with an overview of bamboo resources in Tanzania (P Lyimo, E Aloyce, J Otieno), followed by Kenya (Kiprop, J Cheboiwo) and Uganda (M Malinga). There is talk of species-site matching, management, harvesting, value adding, making a drink out of it (named Ulanzi, and it's in Tanzania), and using it for riverbank stabilisation. Bamboo's use as energy gets highlighted in both a Ugandan and a Kenyan article, respectively Divine Bamboo and the Bamboo Trading Company, the latter one well detailed and a little polemic.

We wish you an enjoyable read.

Jan Vandenabeele

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VISIT OF BETTER GLOBE FORESTRY'S INVESTORS TO KENYA

BY JAN VANDENABEELE

As a yearly ritual, a group of our Scandinavian investors came to see in Kenya what they are paying for back home, in Norway, Sweden and Denmark (not present this year: Finnish). These are ordinary citizens that buy tree packages, and not powerful investors in the conventional sense of the word. They were a group of 35, and toured the Kenyan countryside in 2 mini-buses, expertly guided by local BGF staff. The visit took 8 days -end of June extending one day in July- and mixed forestry with social events, and some classic tourism (Tsavo National Park, Malindi).

The melia plantation in Kiambere was visited on day 1, followed by a farmer visit in the Seven Forks area, and a Village Bank in Eastern Mwingi, where they got informed about micro-credit facilities for the local subsistence farmers and how BGF is playing its part. Don't forget that the objective of the company is poverty

SHOWING THE RESULTS ON THE GROUND OF THEIR FINANCIAL COMMITMENTS

alleviation.

Coming from one of the richest parts of the world to the rural settings of East Africa is of course a contrasting experience. Seeing the trees they paid for and the reality of how they are produced, planted and managed, is another thing. So each of them had a million questions, which we, the locals, tried to answer to the best of our abilities. Another day brought them to a school, Kaewa Primary and Secondary Schools in Machakos county. This is one of the former laureates of the award winning Green Initiative Challenge, the tree planting & capacity building programme we jointly implement with the KenGen Foundation and Bamburi Cement

Combating climate change by planting melia trees, in Kiambere plantation

Ltd, where they mingled with a very enthusiastic and excited crowd of school children.

At the coast, the visitors witnessed the mechanisation programme of the Nyongoro plantation, and saw different mechanised operations in action (drilling of planting holes, brush cutting, watering, road maintenance). They had to dirty their hands, and plant some tree seedlings themselves. In Kiambere this was *Melia volkensii* (mukau) and in Nyongoro it was *Milicia excelsa* (mvule or African teak), for the sake of bio-diversity.

An important occasion was the visit to BGF's Head Office in Nairobi, where they were introduced to the complete staff members, including the ones that are in supporting roles like administration, logistics and finance, and got detailed explanations on the organisation and the digital apps that are used. And the rest can be followed on Facebook...

The writer is the Executive Director of Forestry at Better Globe Forestry and Editor-in-Chief of Miti magazine Email: jan@betterglobeforestry.com



BAMBOO TRAINING AT DEGEYA FARM, UGANDA

EMPHASIZING ON THE IMPORTANCE OF BAMBOO AS A COMMERCIAL PRODUCT

BY DIANA AHEBWE

Commercial bamboo growing heightened in 2015 after the government signed an agreement with the Chinese government to promote Bamboo growing in Uganda. Since then, bamboo has become an important crop and part of the solution to deforestation. It is from this background that several trainings have been organized across the country to sensitize the public about bamboo. One of the trainings took place on the 14th of February this year at Degeya farm in Luwero district, organized by Divine Bamboo. This company was registered in 2016 and owns one of the largest bamboo nurseries in the country with a capacity of 20,000 seedlings. The training was supported by the International Network for Bamboo and Rattan (INBAR), National Forestry Authority (NFA) and World Wide Fund for Nature (WWF). Present in the training



A training by Divine Bamboo. Demonstration of nursery techniques

were the neighboring communities, students from Makerere University, representatives from NFA, Food and Agriculture Organization and private tree growers. The training covered nursery management, briquette making and value addition of bamboo.

The major benefit of bamboo over other commercial species is that it can be harvested sustainably for a long time (20-50 yrs) and quickly reaching maturity (4-5yrs). Common species currently available include: Dendrocalamus asper (green bamboo), Bambusa vulgaris (yellow bamboo), Dendrocalamus giganteus (giant bamboo) which grows in the lowlands, Yushania alpina (African alpine bamboo) for highlands. The participants were encouraged to start nurseries because there is insufficient supply of seedlings, and previously the cost of a seedling was up to 10,000 UGX. They were taught different methods of propagation but emphasized on vegetative propagation because a single culm (stem) with healthy rhizomes and

buds is enough to generate a new clump (plant); and seeds from China are very expensive and difficult to propagate. Participants were advised to always select mature plants that are pest and disease free for propagation.

Since bamboo grows in clumps, the participants were advised to plant it at a spacing of 5m x 5m, hence an acre can accommodate 160 clumps. After a period of 4 years, 5 mature culms are harvested every year from each clump. According to Divine bamboo, a culm can be sold at 2500 UGX.

Some of the challenges facing bamboo establishment and management are that it requires a lot of water especially when still in the nursery, thus attracting fungal diseases. It also requires skill especially when splitting the rhizomes where one must avoid damage to ensure survival.

The writer is the country representative of Miti magazine Email: diana@mitiafrica.com





MORE THAN OTHER COUNTRIES IN EAST AFRICA

BY PAULO J. LYIMO (1), EVARISTUS ALOYCE (2) AND JARED OTIENO (3)

INTRODUCTION

Bamboo is an important non-timber forest product and a major wood substitute that can be processed and fabricated into different products as a substitute for hardwood products at an industrial scale. It is a fast-growing woody grass in the family Poaceae and comprises of over 1642 species which belong to 91 genera worldwide. Some of its members are giants, forming by far the largest members of the grass family. It is naturally distributed in the tropical and subtropical belt between approximately 46° north and 47° south latitude, and is commonly found in Africa, Asia and Central and South America. Some species may also grow successfully in mild temperate zones in Europe and North America. Bamboo grows naturally on the major mountains and highland

BAMBOO

ranges of Tanzania and other East African countries. It is an extremely diverse plant, which easily adapts to different climatic and soil conditions.

Bamboo has proven to be a potential resource for industrialization and sustainable development in various countries. It is an environmentally friendly building material, presenting advantages such as physical properties comparable with steel, high renewability with a rate of CO2 absorption greater than wood and thus a closed life cycle material for buildings; besides its social benefits. It has versatile uses as building material, paper pulp resource, scaffolding, agriculture implements, weaving material, plywood and particle board manufacture, basketry, furniture, pickled or stewed bamboo shoots and medicines, to mention a few. Resource management and technical improvements can convert this fast-growing grass into a durable raw material for construction purposes and a wide range of semiindustrialized products.

Bamboo forests cover more than 36 million hectares worldwide. It is most abundant in the monsoon area of East Asia, especially in India and China with 11.4 million ha and 5.4 million hectares covered, respectively. Over the last 15 years, the bamboo area in Asia has increased by 10 percent, primarily due to large-scale planting of bamboo in China and India.

Total area

There are four bamboo species that occur naturally in Tanzania: Yushania alpina (African alpine bamboo), Oreobambos buchwaldii, Hickelia africana (rare) and Oxytenanthera abyssinica (Savanna bamboo). Also, there are several introduced bamboo species namely Dendrocalamus asper, Bambusa vulgaris var. striata (common bamboo), Bambusa multiplex (hedge bamboo), Bambusa nutans (nodding bamboo), and Bambusa bambos (giant thorny bamboo).

BAMBOO OCCURRENCE AND COVERAGE

According to the results of the National Forest Resources Monitoring Assessment (NAFORMA, 2009-2014), production forest has the highest number of bamboo species (11), among which *Yushania alpina*, *Oxytenanthera abyssinica*, *Bambusa bambos* and *Bambusa* spp. are the most abundant (Table 1).

S/n	Land use type	No of species	Coverage (ha)
1.	Production forest	11	458,189
2.	Protection forest	7	98,403
3.	Wildlife reserve	4	118,903
4.	Shifting cultivation	6	116,854
5.	Agriculture	6	199,881
6.	Grazing land	2	3,075
7.	Built up areas	1	16,401
8.	Water body/wetland	1	4,1
9.	Others	3	9,227
Totol		11	1 025 022

Bamboo occurrence on agricultural land is seven species, with *Oxytenanthera abyssinica* as the most abundant. Wildlife reserve land has six species while the most abundant is *Yushania alpina*.

Bamboo covers an area of about 1,025,033 ha in the Tanzania Mainland. About 62% (636,545 ha) of bamboo is found in the South (Table 2).

Table 2: Coverage of bamboo species across zones/regions			
Zone	Regions	Coverage (ha)	
Southern zone Southern highland zone Western zone Eastern zone Northern zone	Lindi, Mtwara and Ruvuma Iringa, Njombe and Mbeya Kigoma and Katavi Morogoro Arusha	636,545 165,030 128,129 77,903 17,426	

Bamboo is growing from 76 to 2592 m.a.s.l, however about 85.2% is below 1500 m.a.s.l.

The number of bamboo species along the altitudinal gradient differs (Figure 1).



Figure 1: Bamboo species along altitudinal gradient in Tanzania



1.025.033

ABUNDANCE AND DENSITY OF BAMBOO

The most abundant bamboo species were *Yushania alpina, Bambusa vulgaris, Bambusa bambos* and *Oxytenanthera abyssinica* which altogether constitute 73.2% of the total bamboo occurrence in the country (Table 3). Findings from studies show that the mean stand density of bamboo is 2660 culms/ha in Tanzania (Table 4).

Table 3	Table 3: The relative abundance of bamboo species				
S/n	Scientific name	Percentage (%)	Ranking		
1	Yushania alpina	21.3	1		
2	Bambusa vulgaris	20.7	2		
3	Bambusa bambos	16.5	3		
4	Oxytenanthera abyssinica	14.7	4		
5	Bambusa spp.	10.9	5		
6	Other bamboo spp.	6.9	6		
7	Dendrocalamus nutans	2.7	7		
8	Dendrocalamus strictus	1.9	8		
9	Bambusa nutans	1.7	9		
10	Bambusa multiplex	1.6	10		
11	Oreobambos buchwaldii	1.1	11		

Table 4: The stand (culm) density of bamboo species

S/n	Species name	Stand density (culms/ha)	Ranking
1	Other bamboo spp.	3622	1
2	Bambusa nutans	3211	2
3	Bambusa multiplex	3029	3
4	Oreobambos buchwaldii	2972	4
5	Bambusa spp.	2852	5
6	Oxytenanthera abyssinica	2790	6
7	Yushania alpina	2656	7
8	Dendrocalamus strictus	2519	8
9	Bambusa bambos	2368	9
10	Dendrocalamus nutans	1996	10
11	Bambusa vulgaris	1247	11
Avera	ge	2660	•••••



DISTRIBUTION OF BAMBOO SPECIES

Bamboo species are distributed in eleven administrative regions (Table 2 and Figure 2). It is most abundant in Lindi, Ruvuma, Mtwara, Iringa and Njombe with 75.2% of the total population. Less abundance of bamboo is observed in Arusha, Mbeya, Katavi and Tanga with 7.9% of the total population. Most bamboo species were distributed in low altitudes, and about 85.2% of the area is below 1500 m.a.s.l. (Figure 3).

Bamboo has been distributed in all land use types where it is widely distributed in production forest, protection forest and wildlife reserve, which all together forms the public forests and contributes about 65% of the total distribution of bamboo across different land use.

Additionally, bamboo species are distributed across all vegetation types in Tanzania. The highest proportion of occurrence is in woodland (66%), especially open woodland with 10-40% of canopy cover, cultivated land (12%) and forest (10%).

Bamboo forest is composed of many small diameter culms and very few large diameter culms (Figure 4).

Savanna bamboo (Oxythenanthera abyssinica) growing in the Southern Highlands, picture taking during the dry season. Photo BGF

Figure 2: Bamboo species distribution



Figure 3: Bamboo species distribution along elevation gradients



Figure 4: Diameter class distribution of bamboo species



CONCLUSION AND RECOMMENDATION

Abundance and stocking is relatively low, since most of the bamboo is distributed in woodlands, especially open woodland that falls under the category of production forests which are under severe pressure from overexploitation, wildfire and livestock grazing. Therefore, proper management intervention is required for the sustainability of bamboo resources in the country. There is a need for more effort to create awareness about the available bamboo resources and its potential uses. Therefore, bamboo should regularly be included in the National Forest Inventory (NFI) in order to update information and monitor trends on the richness, coverage, abundance, density, distribution and its role to address national concerns in the country.

Further recommendations include:

• To introduce national standard manuals for ground and remote-sensing assessment of bamboo resources;

To establish a national database on bamboo resources, with periodic, systematic updates;
To conduct more studies to understand bamboo properties;

• Understanding of socio-economic importance and livelihood utilization of bamboo under climate change scenarios is critical for its sustainable management.

Studies on production and management of bamboo for bio-energy, such as how much bamboo is locally available, what species are best suited, energy content of bamboo-based fuels, to what extent GreenHouse Gas (GHG) emissions would be reduced by using bamboo, and the potential areas for future plantations. Additionally, studies on the economics of restoration using bamboo, and profit margins and return on investment for farmers.
Carry out studies on bamboo plantation establishment, propagation, conservation, harvesting and management including yield;
Studies on bamboo-based industries (type of value adding, market etc).

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Inside a natural stand of African mountain bamboo (Oldeania alpina) in the Aberdares. Photo BGF

STATUS OF BAMBOO COMMERCIALIZATION IN KENYA A SOLID BASIS

BY JONAH KIPSAAT KIPROP AND JOSHUA CHEBOIWO

INTRODUCTION

Over the last decades, there has been growing interest in bamboo production and commercialization in Kenya. However, the use of bamboo is still minimal. Present bamboo users are mostly households and small cottage industries who use simple technologies to process culms into various low-value products for domestic use and sale. Few medium enterprises have entered into the bamboo growing and processing business within the last 5 years. The few entrants have deployed advanced technologies to propagate and process commercial bamboo products. The bamboo sector has great potential to create employment along its entire market value of the various products. Kenya Forestry Research Institute (KEFRI) has been at the forefront in undertaking research on its propagation, processing, marketing and utilization for improved livelihoods in Kenya. Individuals and companies have shown a lot of interest in growing bamboo for subsistence and as a commercial crop. Bamboo

requires minimal investment beyond establishment hence may be of great appeal to communities with minimal resources for the provision of lowcost materials and surplus for sale to generate income.

RATIONALE FOR THE PROMOTION OF BAMBOO FOR COMMERCIAL PRODUCTION

Establishment of bamboo plantations for commercial purpose needs some reorientation that focuses more on species choice, productivity and

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market specification and needs. It is also important to enhance bamboo management practices such as establishment, spacing, stand structure, rotational cutting and fertilizer application for greater yield. Bamboo like any other crop requires land with specific qualities and favourable climatic conditions for good performance. It requires minimal start-up capital mostly for planting material, fertilizer and related production costs. Access to planting material and market linkages is necessary for the successful introduction of bamboo farming. Institutional support, policy and environment are some of the key conditions needed for promoting large-scale bamboo farming in the country.

STATUS OF COMMERCIALIZATION

The low uptake in utilisation and commercialization of bamboo in Kenya can be attributed to the ban on harvesting of indigenous bamboo in 1986. So far, KEFRI has introduced 22 species on a trial basis of which 12 species have been identified as suited to various ecological regions (see article "Bamboo cultivation in Kenya"). Various agencies, both government and private sector are involved in the promotion and scaling up of bamboo production and commercialisation. Kenya has large natural bamboo resources and a small industry still at its infant stage. Young entrepreneurs are investing in bamboo nurseries and businesses. In its environmental master plan, National Forest Programme NFP 2016-2030, bamboo has been prioritised for use in the restoration of water towers and degraded natural forest land.

COMMERCIAL NURSERIES

Bamboo nurseries are the dominant bamboo-based enterprises in the country at the moment. This is because the sector is still at its infancy where planting is increasing as compared to limited processing plants or enterprises in place. However, the scenario is likely to change as processing plants are slowly being established to take increased material supplies. Therefore, a number of bamboo nurseries have been established across the country by several entities that range from the small community, individual, commercial or public agencies to supply the growing demand for bamboo seedlings.

Some of the nurseries are:

KEFRI

KEFRI has established bamboo nurseries across its centres in Gede, Kitui, Muguga, Karura, Maseno and Londiani. It is actively involved in disseminating information on

Stylish furniture made out of bamboo, produced by Kitil Farm. Photo Kitil Farm

Popular tea picking baskets from split bamboo culms. Photo F. Gachathi





bamboo production and utilisation. The average annual output is 6,000 seedlings spread over the 6 regional centres.

Kitil farm

Kitil farm located in Isinya, Kajiado County, is a private sector supplier of bamboo seedlings, which also provides aftercare services and training on bamboo management. The bamboo seedlings are established from seeds.

Greenpot Enterprises

This company has established two large-scale nurseries in Narok and Nyeri and commercial plantations in Narok, Nyeri and Western Kenya. They have plans to set up the country's first commercial bamboo factory which will process block boards, veneers, briquettes and pellets.

Tiriki Bamboo Nursery

Tiriki bamboo nursery is located in Shamakhokho, Kakamega County. It specialises in the propagation of bamboo seedlings from seed, training on bamboo utilisation and boasts of an established bamboo demonstration plot.

Nyabera Farm ICL

Nyabera farm ICL located in Uriri, Migori County, propagates bamboo seedlings from cuttings. The farm has established a 60,000 bamboo seedlings nursery to supply seedlings



to buyers and for targeted community activities.

Nyayo Tea Zones Zones Development Corporation

The Nyayo Tea Zones Development Corporation in collaboration with KEFRI has been involved in the establishment of bamboo in Mt. Kenya, Nyambene, Mau Forest, Nandi, Mt. Elgon and the Cherangany Hills to boost biomass production and protection of environmentally sensitive areas in their areas of operation. The Corporation has a nursery in Kinale with indigenous bamboo intended for planting in the riparian areas within the Tea Zones.

Ewaso Nyiro North Development Authority (ENSDA)

This Authority has been mandated to spearhead the National Bamboo Commercialization Programme aimed at creating employment and income for local communities in the Country. The programme covers the entire bamboo value chain from propagation to plantation establishment through the manufacture of bamboo related products. The authority has

Kitil farm, bamboo nursery. Photo BGF

established a model multiplication centre in Narok where they also have plans to establish a plantation and a factory. Currently, a total of 100,000 seedlings has been produced.

SMALL-HOLDER PLANTATIONS

Bamboo small-holder plantations are widespread all over the country. Most households have planted at least one or two clumps of the various bamboo species introduced in Kenya for varied uses ranging from ornamental plants, to furniture, toothpicks, handicraft and carvings. Most notable small-holder plantations are in South Nyanza where onfarm demonstration sites were established in 2006 as an alternative to tobacco growing. The experience from the project has demonstrated that bamboo can be a viable crop to compliment tobacco farming.

NATURAL BAMBOO STANDS

Large-scale indigenous bamboo stands occur within Kenya's five major water towers Mau, Aberdare, Cherangany, Mounts Elgon & Kenya, and other montane forests. Since imposing the bamboo ban in 1986, no extraction is allowed in these forests. The government is currently working on lifting the ban through the development of a sustainable program allowing commercial harvesting of bamboo. The development is likely to attract investors to venture into bamboo processing.

EXISTING AND POTENTIAL MARKETS FOR BAMBOO

The bamboo resource base is either owned by individual farmers or government entrusted to Kenya Forest Service (KFS). Most of the collectors harvest from government forests and sell directly to processors or consumers. Likewise, farmers harvest and sell to the same buyers. The products processed from bamboo mostly under household or small cottage industries include crafted baskets, mats, woven folders, candle and pen holders, trays, skewers, cases, cooking sticks, foldable beach chairs and stools and so on. The key buyers of bamboo culms are households in rural areas and small cottage industries in major urban areas.

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AN OVERVIEW OF BAMBOO GROWING IN UGANDA

THINGS ARE MOVING

INTRODUCTION

Bamboo is a woody grass with well over 1,000 species. Global production and consumption of bamboo is estimated at about USD 60 billion. It is a resource with proven potential to create employment, generate income for rural communities and contribute to environmental conservation and climate change mitigation. In Uganda, about 1 million (INBAR, 2018) people are involved in various TEXT AND PHOTOS BY MICHAEL MALINGA

stages of the bamboo value chain, mostly involving nursery production, sale of poles, shoots, furniture, handicrafts, charcoal, and research into some industrial products like toothpicks etc (Uganda Industrial Research Institute).

Little attention and awareness on the potential of bamboo existed in Uganda until the Dutch-Sino East Africa Bamboo Development Programme was implemented. The Programme's areas are resource inventory, property testing, market analysis, value chain development, creation of an enabling environment for bamboo development and usage of bamboo for landscape restoration and climate change mitigation.

BAMBOO GROWING

Uganda has two indigenous bamboo species; the lowland and highland species. The lowland species is the Savanna bamboo (*Oxytenanthera*



abyssinica) and it occurs in the northern parts (Agora-Agu in Lamwo, Agago and Gulu districts) and West Nile Regions (Otze Forest Reserve). The highland species, the African alpine bamboo (Yushania alpina) occurs in Mt. Elgon, Mt. Rwenzori, Mgahinga Gorilla National Park, Echuya Central Forest Reserve and Bwindi Impenetrable National Park. The total area covered by indigenous bamboo is 545.33 km² (this is 54,533 ha). Currently, a number of species have been introduced and are being traded. Bamboo resources in state protected areas, communal bamboo forests and private farms are degraded owing to lack of sustainable management and harvesting practices.

MOTIVATION FOR GROWING BAMBOO

Bamboo has about 10,000 documented uses, and thus much more than any plant in the world. Some of its uses include: • Bamboo is the fastest growing plant in the world, some species can grow nearly one meter per day, this makes it a suitable tool for landscape restoration and climate change mitigation.

• Once mature, bamboo can be annually harvested; this is because its clumps produce culms every year, which provides opportunities for annual harvesting of mature poles.

• Bamboo is a source of fuelwood, charcoal, briquettes, and other high-end applications like activated charcoal. Its biomass has a calorific value comparable to Eucalyptus (about 19 MJ/kg). The calorific value of bamboo charcoal is between 26-29 MJ/kg.

• Energy: 1.2 kg of biomass can produce 1 unit of electricity using producer gas engines or combined gasifier engines for electricity generation and charcoal production. • Bamboo is an excellent source of fodder (goats, sheep, donkeys, goats, cows, guinea pigs) and feed for chicken and fish. Pandas, mountain gorillas, elephants, horses and gazelles also feed on it.

• Bamboo produces good and durable furniture. When mature it is treated with a combination of borax and boric acid and dried by seasoning. Afterwards, it is used to produce furniture such as chairs, sofa sets, school benches, desks, cupboards, stools, coffee sets etc.

• Bamboo shoots have relatively high nutritional value: they contain ether extracts, minerals, Phosphorus, Calcium, Iron, Hydrocyanic acid, protein, Niacin and carbohydrates. The shoots can be eaten and their juice extract can be used for making beer, wine and cough syrups.

• Bamboo is applicable in agroforestry and in various household (packaging, water transport) applications.

Test	Bambusa balcooa	Bambusa. polymorpha	Melocanna. bambusoides	Dendrocalamus strictus	Dendrocalamus hamiltonii	Dendrocalamus giganteus	Bambusa pallida
Moisture %	91.48	91.65	91.22	85.98	92.37	91.19	92.29
Ether Extract	0.817	0.44	0.518	0.82	0.314	0.502	0.34
Minerals (as total ash)%	0.99	0.91	0.98	1.14	1.01	0.89	1.12
Phosphorus mg/100g	30.99	15.06	14.28	58.13	27.76	12.57	32.27
Calcium mg/100g.	24.01	180.69	47.58	139.5	44.16	26.93	21.17
Iron mg/100g	1.02	1.53	0.879	2.917	1.65	1.06	1.11
Hydrocyanic acid %	0.071	0.032	0.056	0.13	0.070	0.044	0.106
Protein %	2.74	2.10	3.29	1.98	2.60	2.59	2.31
Niacin mg/100g	2.10	2.60	6.70	2.60	6.40	1.40	1.40
Carbohydrates %	3.90	4.86	3.93	9.94	4.00	4.78	3.83

Table 1: Nutritional analysis of some edible bamboo shoots . Source NMBA, 2005



• In construction, it can be used in both modern and traditional housing, scaffolding, road and bridge construction.

• Other products include vinegar, cushions, pillows, knee pads, innersoles, socks, underwear, handicrafts, skin creams, soaps and shampoos.



Traditional use of bamboo, harvested from a natural stand of African mountain bamboo (Oldeania alpina). Use of bamboo has been multipurpose in Africa, all along. This is a granary



Training in making bamboo furniture



Use of bamboo for cottage industries

SILVICULTURAL OPERATIONS

Bamboo management involves maintaining correct clump density (spacing), composition (age 1, 2 and 3) and administering a selective harvesting method (harvesting mature culms from the bottom, close to the ground).

When the young plant is 1-2 years old, regular weeding, soil loosening, mulching is required. After 3 years, operations to decongest the clumps and minimize branching should be undertaken.

MARKET

A huge market potential for bamboo exists in Uganda. Globally, about USD 3 billion worth of bamboo products are imported and exported, every year, the main markets being Europe and the USA. Even bamboo products such as tooth picks are imported into Uganda. Opportunities that exist in various spheres include nursery production, plantation establishment and value addition (enterprises at all scale – households, SME, industries).

The main challenge facing the market is limited supply of quality raw material, lack of proper support mechanisms and presence of a poor environment for enterprise development and marketing. One of the major challenges at the moment is existence of myths that are associated with bamboo, such as the belief that it is a poor man's timber and that it is a less durable material. It is therefore important to work with the government to get a bamboo strategy and action plan formalized; support technology transfer for resource and value-chain development and raise awareness about the facts and benefits about bamboo.

An advice for those who would like to venture into bamboo business: **start small, but persist; Rome was not built in a day.**

The writer is the National Project Coordinator of Dutch-Sino East Africa Bamboo Development Project, International Network for Bamboo & Rattan (INBAR) Email: malingams@yahoo.com



BABBOO CULTIVATION IN KENYA SOME GUIDELINES REGARDING SPECIES AND SEEDLING PRODUCTION

BY JONAH KIPSAAT KIPROP AND JOSHUA CHEBOIWO

Bamboo resources in Kenya consist of indigenous *Yushania alpina* (African alpine bamboo) and introduced exotic species. The indigenous bamboo species is found at altitudes between 2400m and 3500m above sea level. It is estimated that the natural distribution covers over 150,000 ha mainly on the slopes of the five Kenyan water towers: the Cherangany, Aberdares, Mau ranges, Mount Kenya and Mount Elgon with some pockets on farms surrounding the 5 ecosystems conserved or cultivated. Since 1988, the country has introduced over 40 exotic species mostly from Asia with half of them successfully established in various agro-ecological zones mainly in South Nyanza, Western, Coast and Central Kenya. It is estimated that over 10,000 ha have been planted on farms, along rivers and homesteads for aesthetic purposes. Table 1 summarises the major indigenous and introduced exotic species that have proven successful in the different zones in Kenya.

The Savanna bamboo (Oxythenanthera abyssinica), an african species indigenous to fanzania, Uganda and Ethiopia, among others. It has been introduced in Kenya and does well Photo BGF

Minimum rainfall Recommended Altitude (m) **Species** (mm/year) areas for planting Yushania alpina 2,400 - 3,400 1,800 Highland areas of Kenya Ab-Dendrocalamus asper (Giant bamboo) 400 - 2,400 1,800 erdare, and Mau ranges, Moun-1,000 Bambusa bambos (Giant thorny bamboo) 40 - 2,400 tains Kenya and Elgon, and their Oxytenanthera abyssinica (Savanna bamboo) 40 - 2,200 600 lower vicinities Bambusa vulgaris (Common bamboo) 0 - 2,400 1,000 300 - 1,000 1,000 Medium altitude areas Bambusa blumeana (Spiny bamboo) Dendrocalamus giganteus (Giant bamboo) 100 - 1,600 1,800 Dendrocalamus hamiltonii (Hamilton's bamboo) 50 - 1,500 1,500 Bambusa tulda (Indian timber bamboo) 0 - 1,500650 Dendrocalamus strictus (Male bamboo) 0 - 1,500 600 Dendrocalamus brandisii (Velvet leaf bamboo) 0 - 1,3001,800 Cephalostachyum pergracile (Tinwa bamboo) 0 - 1,0001,000 950 0-1,000 Dendrocalamus membranaceus (Wapyu) Thyrstachys siamensis (Monastery bamboo) 300 - 400 800-1000 Lowlands and coast

Table 1. Recommended areas for growing bamboo species in Kenya

RAISING OF PLANTING MATERIALS

Raising of bamboo starts with obtaining high quality, healthy materials for propagation. Currently, bamboo propagation methods are by use of: seeds, wildings, culm/branch cuttings, offsets¹ and tissue cultured plantlets. Several factors should be considered in selecting a site for a bamboo propagation nursery, these are: location and accessibility, adequate water supply, topography, soil, sun and shade.

COST OF SETTING UP A BAMBOO NURSERY

The cost of setting up a bamboo nursery varies depending on the mode of propagation used. Use of cuttings requires large potting tubes with dimensions of 11×13 inches with an acre of nursery holding approximately 10,000 seedlings. Propagation by seeds requires smaller potting tubes with dimensions of 4×6 inches with an acre holding approximately 200,000 seedlings. Table 2 illustrates an average estimate of the cost of setting a one-acre nursery (seedling production not included).



¹Note from the Editor: A bamboo offset is the lower part of a single culm usually with 3-5 nodes (about 1-1.5m) with the rhizome and roots attached.

FIELD MANAGEMENT AND HARVESTING

When the young plantation begins to produce shoots in large numbers, it is advisable to maintain good field management practices to achieve high yields. This consist of weeding, irrigation, mulching, pruning and thinning and intercropping. It is wasteful to allow the inter-row spaces to stay idle, as the spacing is wide, after planting bamboo seedlings. Intercropping in newly established bamboo stands increases productivity and economic returns from the land. To maximize land utilization, it is recommended that early-maturing crops be intercropped during the early years before harvesting of the mature culms. Annual crops may consist of maize, kales, tomatoes, potatoes etc.

The main bamboo species under cultivation in Kenya are the clumping

types. The advantage of clumping enables the plant to regenerate naturally after harvesting. The bamboo plantation should be ready for first harvesting in about three to eight years depending on the desired end product. Thereafter, cutting of mature culms can be done at the intervals of four or more years. Failure to harvest bamboo regularly will congest the clump, resulting in deterioration of both quality and quantity of bamboo stems. The emergence of new shoots begins during the rainy season of the year after planting. These new shoots should not be harvested, instead they should be allowed to grow to full height in order to promote the healthy establishment of clumps. The number of shoots per clump varies; some like one or two may appear and other clumps may produce more. A small number of edible shoots may be harvested in the third year of the plantation.

USES OF BAMBOO

The country is facing progressive shortage of forest product resources and bamboo, therefore, comes in handy given its varied uses, most of which can perfectly substitute wood. The following are uses that could locally be developed for the benefit of the farmers and commercial growers.

Fencing: is the most common use of bamboo in Africa and throughout the tropics, particularly for homesteads and farms as protection against grazing.

Staking: people have continued to use bamboo particularly as props or supports for horticultural crops like peas, flowers and bananas. In addition, many farm tools are made of bamboo.

Construction and scaffolding:

large and strong bamboos have a high potential use as scaffolding and construction material throughout

Item/activity	Unit	Quantity	Unit Price	Amount
			(Ksh)	(Ksh)
Inputs				
Site clearing (1 acre)	Man-days	6	300	1,800
Fencing	Man-days	8	300	2,400
Cedar posts	Psc	120	200	24,000
Barbed wire	Rolls	4	5,000	20,000
Soil collection	Wheelbarrows	200	100	2,000
Culm collection	Pcs	100	600	6,000
Culm cutting	Man-days	5	300	1,500
Transportation	Pcs	100	100	10,000
Culm cutting and sowing	Man-days	10	300	3,000
Purchase of tubes (11x13)	Pcs	1000	5	5,000
Labour for pot filling	Man-days	5	300	1,500
Manure	Wheelbarrows	20	100	2,000
Sorting	Man-days	10	300	3,000
Grading	Man-days	10	300	3,000
Foliar application	Man-days	12	300	3,600
Root pruning	Man-days	10	300	3,000
Fertilizer application	Man-days	6	300	1,800
Weeding	Man-days	30	300	9,000
Watering	Man-days	60	300	18,000
Nails	Kgs	4	300	1,200
Nursery tools	Wheelbarrows	2	1500	3,000
	Jembes	2	500	1,000
	Spade	2	450	900
	Fork Jembe	2	750	1,500
	Pangas	2	450	900
	Rake	2	350	700
	Slashes	2	350	700

Table 2: Cost of raising of 1,000 bamboo seedlings from culms

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tropical Africa. The use of bamboo in reinforced concrete in buildings of various designs and sizes is on the rise. For general construction purposes, only mature bamboo culms that are at least 3 years old should be

Handicraft: this is the traditional use of bamboo in Asian and African countries. Bamboo culms are split into strips and slivers and handcrafted into numerous products. Tea picking, fruit and laundry baskets are common products. Other handicraft items include toys, ornaments, mats, containers, musical instruments and various household products.

used.

Edible bamboo shoots: this is common in Asian countries especially China, Japan, Taiwan, Thailand. Shoots of Yushania alpina are consumed by communities around Mt. Elgon in Uganda and to a lesser extent in Kenya. In other communities in Africa, there are niche markets for bamboo shoots. Many hotels and Asian restaurants around Africa serve bamboo shoots as vegetable dishes. Some bamboo species recently introduced in East Africa produce good quality shoots.

Bamboo furniture: production is widespread in Asia and is on the rise in Africa. Bamboo furniture such as chairs, sofa sets, and beds are relatively low priced compared to timber products. They are particularly suitable for tourism and household uses.

Bamboo panels and particle

boards: these are important applications in Asia with a strong potential in Africa. Asian countries have produced designs that are marketed worldwide. The technologies and machinery for manufacturing such products are readily available from China, Taiwan and India. Production of bamboo panels and particleboard in Africa could reduce pressure on forests. Pulp and paper: production using bamboo is an old age occupation in China where paper was originally handmade. Countries such as China, India and Brazil produce significant amounts of pulp and paper from it. Bamboo paper is sometimes blended with other species such as eucalyptus.

Bamboo fuel: its biomass has comparable energetic value to wood.

It can be used as an alternative to fuelwood, and it can be transformed into charcoal, briquettes, activated carbon, and biodiesel. The increased use of bamboo as biofuel can play an important role in reducing pressure on the slower growing trees.

Environmental conservation: bamboo protects steep slopes, soils

and waterways preventing soil erosion and offering carbon sequestration which has many ecosystem benefits.

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Kieni Forest Station (the Aberdares), Pinus patula in the back-ground, with Oldeania alpina (African mountain bamboo) in front. Most of the natural bamboo stands in Kenya were converted into tree or tea plantations. Was it a good idea? Photo BGF

B O M B O O



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PROMOTION OF BAMBOO OF BAMBOO ENTERPRISES IN KENYAND

SOME HISTORY AND RECENT DEVELOPMENTS

BY NELLIE C. MUGURE ODUOR

Bamboo, classified as a grass is one of the fastest growing plants that generates substantial amounts of biomass within a short period of time. In Kenya the indigenous bamboo is found in altitude ranges of between 2,400 to 3,400 meters above sea level. The indigenous bamboo species which is one of the formations within the forest reserves (covering about 140,000 hectares of the land area of the country) is Oldeania alpina¹ (African alpine bamboo) formerly known as Arundinaria alpina and more recently Yushania alpina.

¹Note from the Editor: a name change again! The name Oldeania from the Maasai common name (Oldeani) in Tanzania.

> A simple but good-looking chair (the Kenya Bamboo Centre). Photo BGF

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BAMBCO



Furniture made out of Dendrocalamus giganteus, by the Kenya Bamboo Centre. Photo BGF

In the history of bamboo utilization in Kenva, limited processing of bamboo at industrial level occurred in the 1960s where communities around the Aberdare forest utilised and exported bamboo shoots through the Kenya Canners Factory in Thika. Generally, the utilization of the indigenous bamboo is limited to subsistence related uses. These include use as firewood, food and forage, a prop for commercial flower growing, production of tea-picking baskets and handicrafts. It is also used for fencing and rural construction. It was also used as a raw material for enterprises producing incense sticks and toothpicks (that company has since stopped producing these incense sticks and toothpicks).

As part of promoting bamboo uptake, in the early 1980s and 1990s, the Government, through research work by the Kenya Forestry Research Institute (KEFRI) saw the introduction of over 20 bamboo species from Asia and tested them in various regions in Kenya including the Lake region (Kakamega), the Highlands (Muguga), and the Coast (Gede and Jilore-Malindi). Some of these bamboo species include *Bambusa bambos* (Giant thorny bamboo), *B. vulgaris* "vittata", *B. tulda* (Indian timber bamboo), *Dendrocalamus hamiltonii* (Hamilton's bamboo), *D. brandisii* (Velvet leaf bamboo), *D. membranaceus*, (Wapyu), *D. strictus* (solid bamboo), *Cephalostachyum pergracile* (Tinwa bamboo), *Thyrsostachys siamensis* (Monastery bamboo) and *Oxytenanthera abyssinica* (Savanna bamboo).

Over the years various interventions have been used to promote growing of bamboo on farm and value addition of the culms. This was done through formation of bamboo cooperatives and capacity building of their members. Currently, a project that is funded by the Dutch and the Chinese governments, is looking at contributing to green economic growth, international trade and investment between East Africa, Europe and China. The project is being implemented by the International Bamboo and Rattan Organisation (INBAR) in Ethiopia,

Kenya and Uganda. The project generally, is looking at supporting poverty reduction, sustainable development, climate change action and international trade. This is being achieved through determining the amount of bamboo resources in the country (including those planted on farm or otherwise), capacity building in bamboo value addition for members of bamboo cooperatives, Community Based Organisations, entrepreneurs, private sector among others; developing standards and guidelines that would enhance trade of various bamboo products and bamboo growing and management.

Bamboo farming and value addition enterprises in the country can be described to be in their early stages of development, though its value chain has a lot of potential for subsistence and commercial use. The use of locally manufactured bamboo products is still very limited in Kenya. This means that the commercialisation potential remains largely unexploited. There are only a few poorly-functioning bamboo enterprises in urban and

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African mountain bamboo (Oldeania alpina) in the Aberdares. A self-generating sustainable resource, if managed properly. Photo BGF

rural areas and farmers who have ventured in bamboo growing are very few but growing in numbers. For the value addition enterprises, their poor functionality is their weak backward and forward linkages i.e., for the enterprises which are located near urban centres, accessing raw materials is a very difficult task while for those in the rural areas, it is not easy to access markets.

By contrast, the construction industry is currently making use of imported bamboo products for high-end housing mainly for flooring and other internal house finishing.

THE MAIN BAMBOO ENTERPRISES

Globally there are over 10,000 known products that can be made from bamboo. This has led to successful and viable industries in other countries such as China and India. Nevertheless, in recent years, the private sector has developed interest in bamboo and some level of investment in cultivation and projected establishment of bamboo processing/value addition facilities for industrial scale operations is currently gaining momentum with companies developing interest in production of biomass for energy, household use items (bamboo sticks), furniture, flooring and fibre for the textile industry.

One of the main bamboo enterprises in Kenya has been in provision of bamboo seedlings – from seeds and vegetative propagation, where the average price tag is between Ksh 200-500. There is need to have more bamboo planted on farm since it is usually ready for harvesting within four to five years and thereafter annually.

Other enterprises include one that uses whole culms to make a composite pole/post by a private investor. The enterprise buys bamboo culms from farmers. Another enterprise chips bamboo for energy provision (see article "Bamboo Trading Company").

Other initiatives are small scale enterprises producing furniture such as chairs, tables, shelves; handicrafts such as baskets for tea picking, kitchen utensils and pen holders. To enhance industrial production, the product and production line should be developed in a phased manner. This is to ensure that bamboo resources are adequate, available and of quality and that the market demand and availability of technology is ascertained. The private sector has now come in very strong by establishing plantations on own land or contract farmers to grow the bamboo. This has encouraged farmers to plant it with a view of selling its culms to a processing factory.

Poles with a bamboo core. Photo Bamboo Trading Company

INITIATIVES TO SPUR INCREASE IN THE NUMBER BAMBOO ENTERPRISES

 Publication of the National Bamboo Policy

• Complete mapping of all bamboo resources

Enhanced bamboo growingSustainable management of

already planted bambooCreation of incentives for

investment by the private sector for development of the bamboo value chain

 Publications of the guidelines/ standards for selected bamboo products

• Completion of industrial –level investment in bamboo processing/ value addition

The writer is Programme Director – National Forest Products Research Programme, and National Project Coordinator of Kenya -Dutch-Sino-East Africa Bamboo Development Programme at KEFRI Email: noduor@kefri.org







CLONES AND SEEDS

BY KEVIN ANDERU AND CHRISTINE MWANJA ALL PHOTOS NTSC OF NFA

INTRODUCTION

Bamboo is a giant tropical and sub-tropical woody perennial plant belonging to the sub-family Bambusoideae of the family Poacea (the grasses). It is one of the most valuable Non-Timber Forest Products (NTFPs) in the world and it is becoming more and more of a farm crop in addition to being a major forest product.

Bamboo comprises of over 1250 species growing in the tropical and subtropical regions of the world. Most of the bamboo growing naturally in Uganda is located in protected areas and because of this, it has not been utilized to its full potential. More to this, the diversity of bamboo species is low having only three indigenous species:

Yushania alpina (mountain bamboo formerly Arundinaria alpina) occurring in the highland areas in the southwest, east and western areas,
Oxytenanthera abyssinica (lowland bamboo) occurring in some of the low land areas in northern, northwest and central Uganda, and

Oreobambos buchwaldii (Velvet



Vegetative propagation of bamboo through culm cuttings.



Vegetative propagation through offsets

leaf bamboo) occurring in wetlands areas around lake Victoria in central Uganda.

Twelve exotic species were earlier introduced, some did not survive, only three thrived, namely *Bambusa vulgaris* (common bamboo), *Dendrocalamus giganteus* (Giant bamboo) and *Phyllostachys aurea* (Golden bamboo).

It is against this background that National Forestry Authority (NFA) in collaboration with the International Network for Bamboo And Rattan (INBAR) have introduced 8 new bamboo species of economic importance i.e. Dendrocalamus asper (Giant Bamboo), Dendrocalamus barbatus (Luong bamboo), Dendrocalamus membranaceus (Wapyu) cv grandis, Cephalostacyum pergracile (Tinwa bamboo), Dendrocalamus laosensis, Bambusa polymorpha (Burmese bamboo), Bambusa long internode, and Fargesia yunnanensis (Fountain bamboo). This is in a bid to increase the diversity and make available suitable planting stock of bamboo to conserve the shrinking forest

cover. Some of the new species have been picked up by the National Agricultural Research Organisation (NARO) at the National Forestry Resources Research Institute (NAFORRI) where 6 ha of bamboo with 5 species have been established.

BAMBOO PROPAGATION

Raising of bamboo plantlets can be quite challenging because of the diverse characteristics that exist within different species. New plants can be obtained in two ways; by means of seeds and by cloning or vegetative propagation.

PROPAGATION BY SEED

In this method, plantlets are raised from seeds that are produced by bamboo after flowering. These plantlets are called "seedlings". This method has a serious limitation in that seeds are not easily available. This is due to the rather peculiar flowering habits of bamboo; many species only flower once in 30 to 70 years, other species don't flower at all and many that do, die as a consequence. Only few bamboo species flower and produce seeds frequently.

Stages of propagating bamboo from seed:

Sowing: this should be done in seedbeds composed of sandy soil. Germination is observed 10-21 days depending on the species and viability of seed.

Transplanting: if the seedbed consists of pure sand, transplanting into a propagation bed is required as soon as the seeds start germinating. In most cases transplanting may occur after one month.

Dividing up: seedling clumps may be separated into individual plantlets and then transplanted separately for further development. Separation can be done during transplanting into the propagation bed and every three months from then.

Harvesting mature clumps: it may take seven years after sowing before mature culms can be harvested from the new clump.

The advantage of this method is that when seeds are available,



mass propagation can be readily established. Conversely, the main drawbacks of this method are that availability of seeds is unreliable and that they are relatively short-lived and difficult to store. Moreover, it takes a long time before the clump reaches maturity and its quality is not necessarily similar to the parent plant.

CLONAL PROPAGATION

In cloning, one relies on the bamboo's ability to grow plantlets with roots from rhizome, branch or culm buds. This naturally occurs when the buds are brought into contact with the soil. The new plants will be exact copies -or clones- of the mother plant. The advantage of cloning is that the selected mother plant's qualities are always present in the offspring. Cloning methods include:

1.Offsets

A bamboo culm with rhizome attached (called offset) is separated from a clump and transplanted. This is a conventional method of clonal propagation and much adopted by communities for raising a few clumps in homesteads. This method is commonly used in Kisoro and surrounding areas for the mountain bamboo.

Stages:

• Collecting offsets: offsets should be collected just before onset of rains. Harvesting during the rainy season may cause damage to new shoots.

▶ Planting offsets: planting with offsets should be done in a season with sufficient rainfall. Offsets harvested in the dry period should be temporarily kept in a nursery until the next rainy season.

• Harvesting mature clumps: in two years after planting, mature culms can be harvested from the new clump. The advantage of this method is that the bamboo plants are established much quicker as compared to other

methods.

The downside of the offsets method is that it can be bulky and heavy and therefore expensive in labour and transport. Moreover, offsets have a comparatively low survival rate and their availability is limited. Collecting offsets may also cause injury to the clump. The offset method is not very suitable for large-scale plantations.

2.Ground layering

In this method, a culm is bent down and its buds brought into contact with soil for regeneration. Apply the method in any season with sufficient rainfall. Regeneration: after one month, the buds grow out into shoots and in the next 3 to 4 months root development takes place.

Availability of mature culms: It may take 3 to 4 years before mature culms can be harvested from the new clump. The advantage of this method is that the culm is not separated from the rhizome until the new plantlet has developed its own roots. This may increase success rate. The downside is that the method requires a lot of space and is not suitable for large species or for dense stands.

This method is not suitable for largescale plantations.

3.Air layering

In this method, a receptacle filled with soil is tied around a branch base so as to induce the development of roots. After root development the branch is planted.

Stages & planning:

• Applying the receptacle: this is done preferably during the wet season, as the rooting medium must be kept moist.

• Rooting: after one month the buds grow out into shoots and in the next 3



Bamboo seeds

to 4 months root development takes place.

• Planting: after the roots have developed, the branch is detached from the culm and planted. This should be done in a season with sufficient rainfall.

• Availability of mature culms: It may take 3 to 4 years after planting before mature culms can be harvested from the new clump.

Advantages: the branch is planted with developed roots which increases

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survival rate. Moreover, the detached branches are easy to handle and there are plenty of branches available. Disadvantages: the method is labourintensive and only suitable for species with a thick stout branch base.

4.Branch cuttings

In this method, new plantlets are grown from branches that develop natural air roots or rhizomes. Usually this development must be induced in

the previous year.

<u>Stages:</u>

Planting: this must occur during any season with sufficient rainfall.
Regeneration: the branches usually sprout within a week, but root development takes 1 to 2 months.
Availability of mature culms: it may take 3 to 4 years after planting before mature culms can be harvested

from the new clump.

Advantages: This is a very practical method due to ease of handling. Moreover, branches are plentiful and removing them for propagation does not destroy the culm. Disadvantage: This method is not suitable for species that have thin branches.

5.Culm cuttings

In this method, new plantlets are grown from buds of culm segments that are buried underground. These segments may or may not include pruned branches.

Stages:

- Planting: planting must occur during any season with sufficient rainfall.
- Regeneration: culm segments sprout within a week, but root development takes 45 to 90 days.
- Availability of mature culms: it may take 3 to 4 years after planting before mature culms can be harvested from the new clump

Advantages: culm segments are easy to handle, which reduces labour and transport costs. Moreover, there is usually no shortage of propagation material. This method is very convenient for large-scale plantations.

Disadvantages: species with thin culm walls do not respond well to this method. Moreover, planted segments initially don't have roots, which makes the method risky.

6.Macro-proliferation

Bamboo seedlings possess the capacity to proliferate. By cutting the rhizome system into pieces, each with roots and shoots, each seedling can be multiplied 3-7 times depending on species. The method is only suitable for species producing seeds.

Stages:

• Seedlings are raised in polybags. Normally, at the National Tree Seed Centre, Namanve polybags of size 7 x 15 inches, containing loam soil and sand (3:1) are used.

• Soil is washed from the root and rhizome system and old roots may be trimmed

• The rhizome is cut into pieces, each replanted, hardened under shade for 3-5 days and well watered.

• Thereafter, the transplanted pieces are brought to the nursery bed under the sun.

• A seedling can be multiplied in this way in any month of the year and survival rate is 90-100%.

➤ As the seedling pieces develop, they in turn can be used as original seedlings and new proliferating pieces once again produced. Once seedlings are available, the process can be continued for a number of years. Proliferated seedlings are small in size, hence easy to handle and transport. Finally, a small initial stock can produce large numbers of plants.

Other propagation techniques include: tissue culture, rhizome cuttings and whole culm method.

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B A M B O O

Bamboo culms being fed in a burner for generating energy. Photo BTC



BAMBOOASA FORMOFENERGY VS HEAVY FUEL OIL & DIESEL THE REALITY ON THE GROUND AND THE POTENTIAL FOR CHANGE

BY LIAM O'MEARA, MCRAE MUTHOMI AND JAN VANDENABEELE

The media has long discussed bamboo's profitability: but is there some exaggeration, and what's the truth? Who's really making money, is it the land speculators or the NGOs or can private foresters turn an honest profit? The Bamboo Trading Company (BTC) was registered in Kenya with the goal of developing bamboo into a commodity in the country, principally for energy. Bamboo has a high calorific value of about 4,200 Kcal.

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Today the company is based at Kieni Forest Station in the Aberdares. There it has renovated a number of small buildings under a Public Private Partnership constituted in the form of a "Special Use Licence" approved by the Kenya Forest Service and the Ministry of Environment and Forestry. The company has a beautiful garden at Kieni with a variety of bamboo species. It also has a nursery for foresters and landscape gardeners and maintains a house that is used to promote bamboo and its many uses. Throughout the 500 hectares that the company manages, it uses portable 20ft containers as offices, stores and workshops. It also has a tented camp in the indigenous forest that accommodates up to 6 visitors. A variety of conservationists, researchers and industrialists regularly visit the camp to learn about bamboo.

BTC's principal objective is to stem the destruction of indigenous bamboo inside the Rhino Ark Fence and to persuade the government to develop the nation's indigenous bamboo species (Arundinaria alpina now Yushania alpina) into a sustainable "cash crop". Unfortunately, when the logging ban came into effect in early 2018, most of the company's forest operations ceased and it was forced to move much of its equipment to a private estate in the Rift Valley where it now pursues dry land forestry. Bamboo is classified as a grass and it produces more biomass per hectare per year than any other plant in the world. Kenya once had over 350,000 hectares of indigenous bamboo, covering 5 mountainous regions of the country. Today as little as 150,000 hectares remain. Historically, much of the bamboo was cleared and planted with tea. But in recent times, most of the remaining bamboo has been replaced by communities that seek grazing for their cattle and sheep and land on which to grow cabbages and potatoes. Observable trends reveal that poor people will always place the needs of



It also has a tented camp in the indigenous forest that accommodates up to 6 visitors. A variety of conservationists, researchers and industrialists regularly visit the camp to learn about bamboo.

their families first and those of the environment second, and politicians will always aid and abet them. The Bamboo Trading Company believes strongly that the future of conservation in Kenya rests with the private sector and in its ability to utilise the nation's indigenous flora and fauna in a sustainable manner. Local residents must be persuaded that they will earn more growing and selling bamboo than they do producing cabbages and potatoes hence, the government must acknowledge that it has neither the financial resources nor the monopoly in expertise to protect the environment.

BAMBOO MANAGEMENT & USE

Bamboo plantations differ from timber plantations: they are not clear felled. Only 25% of a bamboo clump is harvested each year, this maintains a permanent canopy, providing for permanent water catchment and

wildlife habitat until the species flowers, seeds and dies. When this happens, it typically takes 6 years for the new bamboo seedlings to grow and return to their full height. BTC uses a handsaw to harvest its bamboo and it typically harvests between 45 - 50 metric tons at 25% moisture per hectare per year in a sustainable manner. Bamboo is hollow and this presents a transport problem. The company used a small chipper in the forest for 2 years without a problem, until Kenya Forest Service outlawed chipping in the forest.

A variety of industries seek to use bamboo chips in their boilers: the soap and vegetable oil industry, the tea industry, the clay works, the cement industry and so on, but with a ban on forest products in place and corruption everywhere, the future of indigenous bamboo looks bleak. BTC has also made bamboo into treated fence posts and provided it to a Norwegian company to make composite Transmission poles for KETRACO: but without access to the commodity it invested in, the company is now struggling financially.

The bamboo species, *Y. alpina* (African alpine bamboo) grows naturally in a monoculture between 2,200 - 3,100 metres above sea level in areas with a loose volcanic soil and with a rainfall of 1,650 - 2,800 mm. The best areas yield about 90 tons of biomass per hectare per year. The recommended spacing for *Y. alpina* on established plantations is 3.5 by 5m (571 clumps) per hectare, though this varies on slopes.

Elephants and Sykes monkeys love eating bamboo shoots, and cattle enjoy eating the leaves; it's a grass, after all. Although the local communities harvest bamboo culms / poles for cottage industries (like making tea baskets), nobody makes any real money out of the nation's indigenous bamboo - because there







Elephants are common visitors to the bamboo forest, where they forage and feel at ease. Photo BTC

Chopped pieces of bamboo culms. Photo BTC

has been no serious investment coupled with marketing, and on top of this there is restrictive legislation. If the plantations and forests were set aside to produce a variety of wood biomass for the economy and society, the Ministry of Environment and Forestry has to find a way to have them sustainably exploited for the benefit of the whole society. A few companies that are politically well connected appear to have been granted waivers from the logging ban. It would seem that some are more equal than others.

THE REALITY ON THE GROUND AND THE POTENTIAL FOR CHANGE

Most industrialists know that 65% of Kenya's energy comes from firewood and charcoal. Most environmentalists know that over 25 million tonnes of firewood are needed each year in Kenya. But few people seem to know that each year Kenya's Treasury provides billions of USD to procure heavy fuel oil and diesel from the Middle East. This thermal energy is used to generate electricity in the country under contracts with KenGen (Kenya Electricity Generating Company) and KETRACO (Kenya Electricity Transmission Company Limited).

Kenya's largest employer, the tea

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industry, produces steam from firewood to run its factories. But it could also generate electricity from firewood and it could sell that electricity into the national grid. As tree plantations are being felled, more and more tea estates are turning to bamboo, because their farmers can often grow it easily on private land.

The government wants to foster employment, manufacturing, food security, housing and healthcare. But it should realise that the private sector has the means to rehabilitate the 170 odd Forest Stations across Kenya. This could provide hundreds of thousands of forest squatters with legitimate housing as they work under reforestation initiatives. Everybody can see that the rivers are running dry for several months of the year and that they flood when it rains because there's no longer any grassland, woodland, or forest with which to absorb the rain and release it slowly into steams, rivers and dams.

THE COMPARISON

The private sector seeks cheap energy: hot water, steam and electricity.

Heavy fuel oil has an energy content of Kcal 10,222. Firewood at 25%

moisture has Kcal 3,297. The ration between the two is roughly 1:3. Heavy fuel oil costs Ksh 64.00 per Kg. Firewood delivered Nairobi Ksh 7.00 Throughout Kenya, wood fuel is 3 times cheaper than heavy fuel oil per unit of energy.

Currently, the private sector and the general public procure their wood fuel from "middle men" that work in and around the police, the Kenya Forest Service and the local administration to thwart the ban on the movement of firewood and charcoal to the market.

This "black market" pays no VAT, no corporate tax and no income tax. An estimated 25 million tonnes of firewood each year goes untaxed. Most of the industries in Kenya can buy their way through certification and compliance. Most profess to run clean, green industries that source their wood fuel sustainably. Many point to certification logos on their product labels and their factory gates. But the reality is that the country is being destroyed, and it needs credible certification.

Let's look at the Mau Forest, which once had over 100,000 hectares of indigenous bamboo, producing on average 45 tons per hectare per year. That equates to 4,500,000 tonnes of sustainable biomass per year. Technology and efficiencies vary

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Cut pieces of culms, for fire wood. Photo BTC



Bamboo products displayed by the Bamboo Trading Company. Photo BGF.

A managed bamboo population, where mature culms have been removed, ready for a new harvest. Photo BGF

but engineers typically require 1.23 Kg of bamboo at 20% moisture to generate 1 kWh using steam turbine technology. This old technology would allow the government to generate about 631 MW of electricity 365 days a year ... from the Mau Forest alone.

Kenya's "Energy Regulatory Commission" currently offers private power producers USD 0.10 per kWh for electricity derived from biomass. But it also grants companies deals that cost in excess of USD 0.30 per kWh for electricity derived from "thermal energy"; heavy fuel oil and diesel.

The comparative cost of electricity: 631 MW from biomass = USD 552 million 631 MW from diesel = USD 1,658 million

The government is now buying heavy fuel oil and diesel from the Middle East, with money that could be invested in reforestation, water catchment, wildlife habitat and rural employment. A few companies trade in oil and a few people benefit. In January, February and March this year, the Mara River ran dry; the world's greatest wildlife spectacle (the wildebeest migration) is threatened by the continued deforestation on the Mau. Thousands of people continue to live in refugee camps on the top of the Mau, part taking in that deforestation.

The Ministry of Energy, should be supported by Treasury, under the Presidents "Big 4 Agenda" to support the allocation of private forest concessions. Bamboo is renewable energy 24 hours a day, 365 days a year. Neither wind, nor solar power can compete with wood fuel.

THE CHALLENGES

During its years in the Aberdares, the Bamboo Trading Company has been accused by the local communities and a number of local authorities (often looking for a hand out) of hunting elephants, digging for gold and diamonds, growing marijuana, engaging in tourism and so on. Remarkably few people see the benefit of forestry and wildlife and almost everyone thinks of the Bamboo Trading Company as Santa Claus. But just occasionally, someone does actually help.

When Prof. Judy Wakhungu, the previous Cabinet Secretary for the Ministry of Environment and Forestry visited the company 2 years ago, she saw first hand the work that had been undertaken by the company. She was very impressed and she immediately offered the company her support with a 10 year extension of its Special Use Licence. Unfortunately, shortly after the Presidential Elections of 2017 there was a cabinet re-shuffle. Judy was given a new position in government and a new Cabinet Secretary was appointed to the Ministry of Environment and Forestry. The forest ban was then put in place and the Special Use Licence intended for the Bamboo Trading Company was heavily modified, ensuring a raft of entirely new regulations that the company was unable to agree to.

THE FUTURE

The future of forestry in Kenya rests on the 2005 Forest Act, which mandates the Kenya Forest Service to allocate indigenous and plantation forests in concession to the private sector. These private concessions are designed to protect water catchments, wildlife habitats and to enhance the production of wood biomass for a variety of markets; pulp and paper, sawn timber, poles and posts, firewood and charcoal etc. It is time to remove the "certificates of origin" and the "forest movement permits". It is clear that they only aid and abet corruption.

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SPECIES OF THE QUARTER

Yushania alpina flower containing seeds. Photo BGF

A BIG GRASS WITH MULTIPLE USES YUSHANIA ALPINA

BY FRANCIS GACHATHI

Yushania alpina (formerly Arundinaria alpina), the mountain bamboo is a tall tree-like grass with hollow culms (stems) with ringed joints, growing to 8 m or more. Culms are yellowish green, woody and hollow, growing from a thick horizontal underground stem (rhizome). Leaves are long and narrow, ending in a thread-like tip. Flowers appear in terminal heads after which the plant dies back. It is indigenous to Kenya; found on moist mountain slopes between 2,400 and 3,000, forming a bamboo zone, also in patches or mixed with scattered trees from 2,200 m. It is very common in areas of Timboroa, Mts Kenya and Elgon, Aberdares and Mau Ranges, also in Loita Hills.

Local names for the mountain bamboo include Kamba: Muangi; Kikuyu: Murangi; Kipsigis: Terga; Luo: Mwodi; Maasai: Oldiani; Marakwet: Terga; Ogiek: Tegat; Sabaot: Tegendet; Swahili: Mwanzi;

Yushania alpina is used for fencing, construction, making furniture and firewood. A very popular use is in making baskets used for picking and carrying green leaf tea. Traditionally, the hollow sections between joints have been used to make mole and rat traps, snuff containers and arrow quivers. A kidney-shaped yellowish parasitic fungus about 30 cm or more in diameter (Engleromyces goetzei), often found growing round the culms of indigenous bamboo, is used for medicinal purposes. Leaves are fodder for livestock and game.

Yushania alpina is propagated vegetatively by use of culms or rhizomes. Offsets from younger culms can as well be used. Seeds are rare and slow. It is excellent for riverbank stabilization, hence recommended for water catchment areas.

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PROMOTING BAMBOO GROWING IN UGANDA

BY DIANA AHEBWE, PHOTOS DIVINE BAMBOO

According to the International Network for Bamboo and Rattan (INBAR), the demand for bamboo in Uganda is overwhelming, yet only a few farmers have engaged in growing it. The existing bamboo resource is estimated to cover around 545 km2 of which 60% is in protected areas. Bamboo has been over-exploited which prompted the government to put a ban on its harvesting for 2 years to allow it to replenish.

Several companies have come up to promote bamboo growing in Uganda. Divine Bamboo Group Limited is a socially responsible forestry and biomass energy enterprise that promotes propagation and establishment of bamboo for sale and production of briquettes. The company has two nurseries; one at Najjera, Plot 1 Bulabira road, with a production capacity of 20,000 bamboo seedlings and another in Degeya, Bombo, Luwero district, with a production capacity of 80,000 seedlings

D'vine Bamboo



BRIQUETTE

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Divine BRIQUETTES

Several companies have come up to promote bamboo growing in Uganda. Divine Bamboo Group Limited is a socially responsible forestry and biomass energy enterprise that promotes propagation and establishment of bamboo for sale and production of briquettes. The company has two nurseries; one at Najjera, Plot 1 Bulabira road, with a production capacity of 20,000 bamboo seedlings and another in Degeya, Bombo, Luwero district, with a production capacity of 80,000 seedlings.

BAMBOO GROWING

According to Divine Bamboo, bamboo has the ability to provide energy to millions of rural communities across Africa without necessarily causing deforestation. In Uganda, bamboo's potential is largely untapped despite its ability to generate 30% more biomass than trees and reduce loss of forest cover which stands at approximately 92,612 ha per annum. Quite a number of its species are resilient and withstand drought, and -at least in the beginning- can be used in an agro-forestry design, so that food & cash crops can be grown simultaneously.

Bamboo is regarded as a solution to the enormous pressure on natural forest cover resulting from high population growth in Uganda. Unlike other species that provide only timber products, some bamboo species like *Yushania alpina* (African alpine bamboo) have edible shoots and enhance food and nutritional security. A bamboo grove produces 35% more oxygen than hardwood tree species.

PROPAGATION OF BAMBOO

The methods of propagation are species specific. Most bamboo species are propagated vegetatively especially *Bambusa vulgaris* (Common bamboo). According to Divine

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Bamboo, vegetative propagation is the most preferred mode because most species take more than 20 years to produce seed. During vegetative propagation, culm or branch cuttings and nodes are commonly used. In Uganda, it's only Oxytenanthera abyssinica (Savanna bamboo) that is planted by seed imported from China though it is observed to have a low germination percentage. With seed breeding, species can easily flower and seed, however, seeds must be planted immediately after harvesting and if stored, they should be kept at -50C. When the seed is sown, it should germinate within 15 days.

SILVICULTURAL PRACTICES

Just like other species, bamboo has some silvicultural operations that have to be done for proper growth. The operations include weeding at least 3 times a year for the first 2 years. After this period, the canopy creates enough shade to suppress weeds.

Thinning is an important activity as it keeps the plantation healthy and helps to create room for shoot development. This is done by the removal of culms inside the clump depending on the species. Those inside culms are more mature and should be the ones to be removed first rather than those at the periphery. Pruning is also done to remove the excess branches to ease accessibility.

BAMBOO SPECIES AVAILABLE IN UGANDA, VALUE ADDITION, CHALLENGES AND OPPORTUNITIES

So far, there are 12 species available. These include: Yushania alpina, (the highland bamboo) which grows in the Mt Elgon area in eastern Uganda and Kisoro in western Uganda. Oxytenanthera abyssinica (Savanna bamboo), growing well in west Nile while Bambusa vulgaris (Common bamboo), Bambusa vulgaris 'Vittata', Bambusa multiplex (Hedge bamboo), Dendrocalamus giganteus (Giant bamboo), Dendrocalamus asper (Rough bamboo) are predominantly lowland species and grow in the central, eastern, northern and southern parts of Uganda.

Species	Challenges	Opportunities
Oxytenanthera abyssinica	Prone to wood degrading insects like Lyctus beetles (powder post beetles) and sometimes termites especially if harvested during the wet season. Poor harvesting methods especially in the protected areas. This species has a low survival rate with vegetative methods like branch cuttings. Predominant in protected areas where harvest is restricted.	It can be planted by seed. It matches a wide range of agro-ecological zones. It has longer fibres and is fit for structural uses. Bamboo vinegar can be used as a preservative to get rid of termites. Market is extensive for all products from this species.
Yushania alpina	It only grows at high altitudes hence has limited agro- ecological site matching.	Other than providing biomass, it is a source of food and a delicacy to communities. Organic fertilizer.
Bambusa vulgaris	Can be attacked by termites and other storage and field pests if not treated	It has a high germination percentage. Matures faster than other species. It is hollow, hence less weight when used as a construction material. Organic fertilizers. Eco-Tourism.

The commonest bamboo species in Uganda: challenges and opportunities



Various products made out of bamboo

OPPORTUNITIES AND PRODUCTS

BAMBOO SHOOTS

According to Divine Bamboo, shoots require minimal investment, and it is possible to set up enterprises at no investment cost. Can be sold fresh or packaged, adding value.

HANDICRAFTS

There's a huge potential for diversification into packaging material, including a wide range of handicrafts and souvenirs. These require little start-up capital and are now well promoted at local markets.

CHARCOAL

Uganda has a large population that depend on fuel wood and charcoal (90%). There are affordable technologies for carbonizing bamboo charcoal and abundant labour that can be trained on how to do it.

FURNITURE

There is a high demand for furniture

made from bamboo. Moreover, there is a growing demand for bamboo culms for scaffolding in the construction sector.

CHALLENGES

There is inadequate supply of raw material to meet the high demand because there is only a handful of mother gardens. Seeds are also quite scarce and very expensive. Another challenge is limited awareness and myths about bamboo and its value chains which make it hard to convience the public. Also, land for bamboo plantations is in short supply.

FUTURE PLANS

The company's future plan, within the next 7 years, is to promote bamboo planting on-farm among small-holders. Its target is to have at least 5 clumps of bamboo per household. The company also looks forward to establishing regional



A participant in a training being taught on how to separate a bamboo rhizome for vegetative propagation

nurseries with a capacity of not less than 500,000 bamboo seedlings each; it aims to establish mother gardens and bamboo plantations in different regions.

ADVICE TO PEOPLE WHO WOULD LIKE TO VENTURE INTO BAMBOO GROWING

Bamboo has many benefits to offer at different levels. It is a relatively low-maintenance plant with a shorter pay-back period and a higher Mean Annual Increment (MAI) than commonly grown commercial tree species. The company therefore advises people to start now when bamboo is still a virgin intervention so that they are not affected by market forces in the future due to high supply. One must have in mind that the best time to plant bamboo was 20 years ago; and the next best time to plant bamboo is now.

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A VERY HUMAN USE OF BAMBOO

ULANZI IS EASY TO PREPARE AND A POPULAR DRINK IN TANZANIA

BY YUDA MKOLLO

The bamboo plant is used in many different ways ranging from food, medicine, energy, construction and many other less conventional uses (Mizuta *et al.*, 2004; Zhang *et al.*, 2004; Yang and Xue, 2005). It plays a very important role in the local economies of Far Eastern countries, mainly China, Japan and Vietnam, where it has been shown to transform the livelihoods of smallscale farmers (Kants and Chiu, 2000).

There is very limited information about the contribution of this plant to local economies in Tanzania (Mhando, 2004). But in the Southern highlands regions of Tanzania, the bamboo species *Oxytenanthera abysinica* (Savanna bamboo) is grown by the local people for production of an alcoholic beverage locally known as Ulanzi (Kigomo, 1994; IBRN Newsletter 1993).

During the rainy season (December to

May) this bamboo species produces many young shoots. To produce the juice, the tips of the young shoots are cut off and the stem portion is bruised (a thin slice of some mm is cut off) every morning and evening for about a week. The exudates from each cut and bruised shoot are then collected in a container called "Mbeta" and allowed to ferment for some 2 days to become Ulanzi, a highly cherished alcoholic drink by the people in the vicinities and some townships. This bamboo wine then contains some 5-5.5 per cent alcohol. Prolonged fermentation produces a stronger liquid, more akin to brandy. On the other hand, the sap is ready to drink after 6-12 hours, depending on the desired strength. When you order *ulanzi*, you have three options, mtogwa (sweet), mkangafu (strong), and ndindifi (extra strong - ulanzi that has sat for 3 days or longer) (blog of M Van Dis, 6/2/2016).

In 70s, the drink was available for free, but then gained popularity.

People from neighboring regions got attracted, who purchased and transported thousands of liters to their home areas. A flourishing business evolved around this drink. Due to its simple preparation process, the drink is cheap. Depending on the season, one liter of Ulanzi is sold for 500 up to 800 TShs. Ulanzi is considered a poor peoples drink as it is served in plastic jugs and sold only in local clubs where some people do not feel comfortable to go.

A few farmers will add a preservative, more will filter it to remove particles, but hygiene and storage are points of concern. Handling conditions are unhygienic, and production is highly seasonal leading to large price fluctuations. According to a Technical Note in Tanzania J. Agric. Sc (2006) Vol. 7 No 2, pasteurization is possible although slightly changing the taste. When farmers of bamboo are assured with the market for the juice, they can plant more and produce more. This improves their economic situation.





In Songea region, average daily production during the rainy season (January-March), per producing household, is as high as 40 ltr (M.J. Haule, 2015). The same author concludes that this bamboo wine business can contribute up to 70% of annual household income, providing an important source of employment. On the negative side, there is social side effects like increased drunkenness. They improved the tapping by making a special container from bamboo, "Mbeta", tapped the bamboo shoot, left it until late in the evening and collected the the container. They decided to test the sap and see what happened to them. They liked it because it was sweet and after some more sips they became very happy. Since those days, people of Iringa have been inviting one another to their homes and have been drinking together while discussing matters



Savanna bamboo (Oxythenanthera abyssinica), looking fresh and juicy, right for tapping ulanzi. Southern Higlands, Tanzania. Photo BGF.

ORIGIN OF THE DRINK

Legend has it that in the 60s, while people were going to their farms, they used to see flocks of birds on bamboo plants drinking some liquid, and later struggle to fly, walking aimlessly around and falling asleep. Villagers followed up on the birds' behavior. of their concern. Ulanzi is also used during different celebrations including traditional and nontraditional weddings.

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This is not Ulanzi, but still another bamboo wine, from Mexico, well packed. Photo obtained from Yuda Mkollo

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ASSOCIATION (UBA) A YOUNG ORGANIZATION WITH REALISTIC VIEWS AND GOOD CONNECTIONS

BY MUNAABA FLAVIA NABUGERE, ALL PHOTOS BY UBA

UBA is a platform where individuals and organizations working with bamboo share information on the resource, enterprise development, technologies for value addition, networking and market linkages through research, training and exhibitions. The vision of the Association is to promote bamboo growing and value addition and its mission is to promote sustainable and profitable utilization of bamboo resources to boost ecosystem health and national wealth. UBA's mandate is to be the leader in bamboo industrialization in Uganda, by demonstrating different approaches, financial benefits and products, as well as skills and technology for processing and value addition.

MEMBERSHIP

Over the last 2 years, the Association's membership has grown up to 300. Government institutions and international organizations supporting and working with the Association include the Ministry of Water and Environment, National Forest Authority, International Network of Bamboo and Rattan, Makerere University School of Agricultural Engineering, University of Kentucky-School of Engineering, China Bamboo Resource Centre, Bamboo for Good, Life Shelter International and Bamboo Village Uganda. Local organizations include Bamboo Crafts Uganda, Talent Farm, Aw Bamboo (Malewa) Elgon Naturals, Eden Agro-Forestry, Fast Africa and the Makerere University Land Management Association.

OPPORTUNITIES

Bamboo can be processed into over 10,000 products. For this reason, it offers opportunities for specialization in environmental protection and wealth creation. In fact, investing in it offers financial benefits and multiple opportunities for establishment of large, medium and small enterprises. These opportunities exist in the academic, industrial and domestic/ retail sectors allowing production of various products and services beginning with simple domestic

appliances and tools such as knives, cups, glasses and plates, to industrial products such as textile, paper, energy and timber industries and products. Opportunities in energy for example, include charcoal production, briquette making, biofuel, methane gas and electricity production. Other opportunities exist in furniture making (chairs, tables, beds, cupboards etc) and handcrafts such as mats and baskets. Other products that further broaden the industry include production of tooth picks, matchboxes, sticks, jewelry, cosmetics, pharmacology/medicine, juice, wine, fertilizers, insecticides, fodder, salads, floor tiles, and fiber boards.

Currently, UBA has initiated and is developing a centre for demonstrating bamboo uses and products such as charcoal, vinegar and cosmetics (e.g. body creams and lotions, liquid soaps and vinegar foot detox). The Association also exhibits bamboo crafts such as desk organizers, soap dishes, lump holders, toys, phone holders, key holders, beds, chairs, and other products. They are now working on selling treated bamboo poles.

Some of the enterprises UBA is working with, include BioVin Bamboo Products Uganda Ltd, an enterprise using by-products from bamboo for production of charcoal and vinegar to make cosmetics. It also works with Ezzy Bamboo Crafts Centre Uganda Ltd that focuses on crafts; and thirdly, with a bamboo plantation investment team made up of 20 members who are engaging in bamboo plantation establishment at Nakasongola.

PROGRESS IN GROWING BAMBOO

Renewed interest in bamboo was actually generated before 2010 when the Ministry of Water and Environment subscribed to the International Network for Bamboo and Rattan (INBAR) membership. Moreover, the Uganda Industrial Research Institute (UIRI) in Kampala has put this natural resource to modern use by making toothpicks, toothpick dispensers, tablemats, car seat covers and window blinds for sale. One clump of bamboo can produce up to 200 poles, over its lifetime, starting at year five. UIRI has 12 technicians involved in the commercial production of bamboo toothpicks that are on high demand across Uganda.

Recently, the Wetlands Inspection Division of the Ministry of Water and Environment has worked with the Uganda Prisons Services to cultivate bamboo at Murchison Bay prison at Luzira to help clean up the heavily polluted Nakivubo swamp near the prison.

In 2014, the Chinese Minister for the State Forestry Authority visited Uganda and together with the writer (former Minister of State for Environment) established bilateral relations by signing a Memorandum of Understanding where China was to give information, technology and other support related to establishment of a bamboo industry in Uganda. Following this move, the International Network of Bamboo and Rattan (INBAR) set up an office in Kampala at NFA for the Dutch-Sino-East African Bamboo Programme. INBAR is supporting a number of organisations including UBA to promote domestication and industrialization of bamboo. Following these initiatives, the government is working to integrate bamboo growing in its forestry program by planting it in fragile areas such as water catchments and mountain slopes.



Pyrolysis machine making charcoal, and vinegar & methane as by-products



A workshop with tools for making crafts and other products out of bamboo.

CHALLENGES

The major challenge that UBA is facing is inadequate finances and technology for advancing bamboo initiatives. They also lack human resources to offer or execute administrative duties as there are no resources yet to meet the wage bill. Another challenge is the expense involved in certifying bamboo products: Uganda Registration Service Bureau demands that all products on the market be certified, yet certification fees are too high for a newly emerging enterprise.

Farmers

Farmers are worried that introducing bamboo onto their land might attract snakes or destroy their land. Although bamboo has a huge market at local and international level, industrial and even ordinary profits are not easily made by farmers who insist on a tangible market; others are overly ambitious, expecting huge returns within unreasonable timelines. Finally, past experiences such as the fate of the silk warm, moringa and vanilla farming, that were introduced and promoted but failed to secure a market, still haunt farmers who fear a similar fate.

CONCLUSION

Despite the challenges mentioned above, many landowners have embraced bamboo farming and are demanding for seedlings. Each day, the Association receives inquiries from people interested in learning about the species, planting, value addition or just interested in buying the products. During the period 30th March to 24th April 2019 113 contacts were made with citizens and noncitizens of Uganda on bamboo related matters.

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INTRODUCTION

Uganda will have lost vast areas of forest by 2050 given the current rate of deforestation and population increase if current trends remain constant. Between 1990 and 2005, it lost 26.3% of its forest cover, approximately 1,297,000 hectares.

East Africa predominantly uses biomass-based fuels, in the form of charcoal and firewood as the main source of energy for both rural and urban areas. According to the Uganda National Charcoal Survey (2015-2016), 94% of Ugandans use wood biomass for energy. In the rapidly growing urban centers, on average, 50.2% of the population uses charcoal for cooking; an estimated forest surface equivalent to 115 football fields is used for cooking every day – either in form of firewood or charcoal. This has seen the forest cover decrease rapidly whereas the demand for wood is expected to triple by 2025; posing a grave threat to our resource base and biodiversity. This astronomical rate of forest degradation calls for concerted efforts to reverse the trend. A number of

MISSION GREEN GREEN

Rotary

TO PLANT 10 MILLION TREES IN 5 YEARS IN UGANDA AND TANZANIA by rogers karebi

public and private organizations have come up with initiatives to curb it. One of the most outstanding of these initiatives is Mission Green by the Rotary Fraternity of Uganda and Tanzania.

BACKGROUND

The Rotary is a global network of 1.2 million neighbors, friends, leaders, and problem-solvers who see a world

Rotary Club of Acacia Sunset, at their tree planting site

where people unite and take action to create lasting change globally, locally and individually.

Solving real problems takes real commitment and vision. For more than 110 years, Rotary members have used their passion, energy, and intelligence to implement sustainable projects; from literacy and peace to water and health, they are always committed to better the world.

"Mission Green" has been the brainchild of the past governor of District 9211 (Uganda and Tanzania), Ken Mugisha, who started it in the Rotary year 2017-18.

The goal of Rotary Mission Green is to reverse the current deforestation trend, enable extensive afforestation and aid communities to sustainably harness forest goods and services. The programme focuses on tree growing alongside tangible benefits as well as promotion of clean energy technologies (stoves) that will redefine biomass energy consumption trends. Their mission is based on the notion that every person can plant a tree, and inspire others to do the same.

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F E A T U R E

The project's idea is to act as a catalyst for Uganda's committed green growth and to an extent meet the global Sustainable Development Goals.

OBJECTIVES

• To plant & grow trees in selected institutions, on roadsides and degraded forests

• To plant fruit trees in selected communities and 1,000 schools in Uganda

In total, to plant 10 million trees and improve income levels of 5,000 households.

STRATEGIES

To ensure that we achieve the set targets, a number of initiatives have been put in place, they are:

• Memorandum of Understanding (MoU) with the Ministry of Water and Environment in Uganda to supply 1 million seedlings every year for 5 years and to provide technical support to clubs at the regional level.

• MoU with Uganda's prisons to provide paid labor in planting and maintaining the trees. There are 252 prisons in Uganda. "Mission Green" aims to plant 1 million trees around the fences of the prisons and establish woodlots for fuelwood in 5 years, which will help ease pressure on natural forests. This has led to establishment of a nursery in Kigo that has produced 100, 000 tree seedlings.

• MoU with the Uganda Peoples' Defense Forces to plant trees across the country on Tarehe Sita (Army Day).

• Community engagement where religious and cultural leaders mobilize their communities to plant trees.

• The Rotary clubs around Mt. Kilimanjaro in Tanzania were set to afforest Mt. Kilimanjaro with 1.5 million trees by the 22nd of April 2018. • To have each of the 9 million students in both primary and secondary schools plant a tree each through a partnership with the Ministry of Education and Sports. It is estimated that with a 30% success rate, 13 million trees could be planted in the 5 years

• Corporations coming in to plant trees as part of their social responsibility. For example, the Uganda Breweries works with Rotary Uganda to carry out restoration in degraded forests around Lake Victoria. The effort



Tree Planting by Rotary Club of Muyenga



Mission Green Team and Uganda Prisons Staff inspecting Kigo tree nursery

has seen more than 100 acres of the Gangu Forest Reserve in Mpigi District restored.

• Preparation of a Global Grant to support the installation of energy efficient cooking technologies in large institutions.

Finally, through a partnership, the National Forestry Authority (NFA) donated 7 million indigenous tree seedlings to help in attaining the target of 10 million trees within 5 years.

Participating Rotary clubs Uganda has over 100 registered Rotary clubs, and an equivalent number of Rotaract clubs. Over 80 Rotary clubs and 50 Rotaract clubs are involved in the project. Rotary clubs of Muyenga, Kitante, Ssesse Islands, Kajjansi, and Kampala South have reported successful tree planting expeditions. The Rotaract clubs of Kampala North and Buganda Kingdom have been at the forefront of tree planting for the Rotaract clubs.

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BY PAULO J. LYIMO

Bamboo is among the resources that can be used to address Sustainable Development Goals (SDGs). Through use of bamboo, several SDGs can be achieved as follows.

SDG 1: END POVERTY IN ALL ITS FORMS EVERYWHERE

Bamboo exploitation and utilization has yielded direct and immediate micro-level benefits to economically disadvantaged communities in many Asian, South and East African countries. In Tanzania, bamboo has been employed as a poverty fighter, replacing timber wood, iron, plastics, improving the wealth of rural communities. It plays a vital role of building the resilience of the poor and those in vulnerable situations reducing their exposure and vulnerability to climate-related extremes and other economic, social and environmental disasters. Bamboo can be grown on marginal areas without land tenure, thus promoting its cultivation helps to provide the poor with natural resources that they can have access and ownership to.

SDG 7: ENSURE ACCESS TO AFFORDABLE, RELIABLE, SUSTAINABLE AND MODERN ENERGY FOR ALL

Bamboo provides energy when it is burned as firewood, processed into chips or pellets, or carbonized as charcoal. Recent studies in China, Ethiopia and Ghana reveal that the calorific value of bamboo charcoal is similar to that of the most suitable woods used for charcoal. At an industrial scale, bamboo can be used to fire generators and power stations, and research is progressing in Indonesia, Japan and Spain to study how to establish large-scale power generation based on bamboo plantations. Bamboo can also be used as a raw material for biogas systems, and research is now starting to define the properties for bioethanol and biodiesel. The starting point for this value chain is that managed bamboo stands give a long-term, sustainable source of raw material for bio-energy that helps to avoid deforestation.

SDG 11: MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE

For affordable housing and dwellings that can be rapidly erected to respond to floods or other natural disasters, bamboo is emerging as a flexible construction material of choice. A number of documented cases testify how bamboo structures better withstand natural disasters than concrete housing, which is largely destroyed. Bamboo's unique

Bamboo gazebo

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Bamboo toilet tissue and A4 paper



properties of being sustainable and with high tensile strength, point to a revolution that is waiting to happen. In this world of high design, more top architects and designers are specifying it for their creations in urban development.

Bamboo has more than 1,500 documented uses, ranging from fuelwood to light bulbs, medicine, poison and toys to aircraft manufacturing (Figures 1-13 show various uses of bamboo). Over 1 billion people live in houses made of bamboo or with bamboo as the key structural, cladding or roofing element.

SDG 12: ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS

Bamboo is a "woody grass", not a tree, and can be selectively harvested without harming the ecosystem, or contributing to deforestation. Its poles, fibre and engineered products can be used for most purposes where timber is used today, and in some cases offers better performance than some timber products. In its cultivation and production life cycle, no part of the plant is wasted. Shoots are harvested for food; culms for poles; fibre for pulp or charcoal production and the lower trunk for construction uses or flooring and engineered products (and the roots continue to produce new shoots).

SDG 13: TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS

Bamboo like other plants, also absorbs CO2, and research in China has shown that a managed bamboo forest absorbs more CO2 than an equivalent woodlot of Chinese fir (Cunninghamia lanceolata). Once products are made from bamboo, the carbon is locked up and is prevented from escaping into the atmosphere for the product's lifetime. Bamboo therefore provides a secure carbon sink.

Bamboo can also help rural communities become less vulnerable as the plant's rapid growth allows frequent harvesting. Its excellent adaptability and resilience to natural disasters, allows farmers to adapt their landscape management practices, to respond to the changing weather patterns. At the same time, bamboo can help to build resilience against changes in climate and related loss of livelihood options.

SDG 15: PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS

This SDG is particularly relevant to bamboo and it also introduces measures to prevent the introduction of invasive alien species on land and water ecosystems significantly reducing their impact. In some cases, often inadvertently, bamboo has been labelled an invasive species. It is important to clarify the invasive character of bamboo and identify which species carry a risk and which species are harmless in this respect. Bamboo is used to rapidly restore severely degraded landscapes in Mbeya, Tanzania. With its over 1642 species, it offers a range of characteristics for different uses and survival from wet to dry seasons of Tanzania suitable for a range of restoration and land use planning needs. It grows rapidly, regenerates annually through an extensive root system and has a very good adoption to poor soil or climate conditions, and helps bind soil. These properties make it a unique and effective tool to control erosion and slope stability. Several countries use bamboo along river banks to maintain slope stability and restrain erosion. Additionally, it is also used as an instrument for biodiversity conservation and recreation. However, the values of these various natural services are not well understood, and in most cases not reported.

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Bamboo cups



Luxury bamboo bar stools











FORESTRY INUGANDA WHICH WAY IS IT HEADED?

BY JOSHUA ZAKE, JAMES THEMBO AND HERBERT WAMAGALE

INTRODUCTION

Globally, forests are known and recognized for the indispensable value and importance for human survival through their eco-system functions:

• Acting as catchment for rainfall,

- Regulation of local micro-climate,
- Air temperature regulation,

Stabilization of climate change

through carbon sequestration and storage,

• Providing a range of forest products (e.g. herbs, fruits, honey, timber, poles, crafts, fuel wood).

In the East African region, the major forest types include:

- Tropical moist,
- Evergreen and moist semideciduous forests,

- Miombo woodlands (wet and dry miombo),
- Savannah,
- Acacia woodlands,
- Mangroves, and
- Tree plantations.

However, the future presents a big question whether these forests and their ecological functions will continuously and sustainably be enjoyed by the present and future generations in the region.

This is largely attributed to the worldwide degradation and depletion of forests and trees at an alarming rate. Table 1 presents the annual forest loss in Uganda, Kenya and Tanzania. Uganda registered the highest annual deforestation rate.

Table 1. Annual forest loss in selected East African Countries

Country	Forest loss per year (ha/year)	Average annual rate of deforestation (%)
Uganda	250,000	22
Kenya	12,050	0.32
Tanzania	412,000	1.1

Across the East African countries, the key drivers of deforestation and forest degradation are:

• High population growth (increased demands for forest products and services),

• Urbanization & settlement (including infrastructure

development),

- Conversion of forest land for agricultural production,
- Overgrazing,
- Wildfires,
- Charcoal production and wood fuel for energy.
- ioi energy.

Lush and green looking hillsides, but bare because of bush res in the dry season

Several initiatives in terms of policy interventions, afforestation and forest restoration, are going to address the situation at different scales, both regional through the East African Community (EAC) and in the respective countries through their national forestry programs.

At the EAC level, the legislative assembly developed and approved the following policies and legislative frameworks with an overall aim of conserving and sustainably utilizing the environment and forestry resources:

• The Protocol on Environment and Natural Resources Management (2006),

• The East African Community Forests Management and Protection Bill (2015), and

• The EAC Climate change policies, strategies and master plan.

The respective EAC countries are expected to ratify these policies and laws and subsequently use them to inform similar policies at the national level. For instance, the Protocol on Environment and Natural Resources Management, was signed by the Republic of Kenya, Republic of Uganda and United Republic of Tanzania on 3rd April 2006. Whereas Kenya and Uganda ratified the protocol in 2010 and 2011, Tanzania has not, due to a number of issues that are yet to be addressed. Subsequently, the protocol is not yet into force for implementation.

KEY INITIATIVES FOR ADVANCING INVESTMENT IN FOREST RESTORATION AND AFFORESTATION IN UGANDA

A) THE NATIONAL GREEN GROWTH

Strategy, 2017/18-2030/2031 This was developed by the Government through the National Planning Authority. It presents a stepwise approach for implementation of the principles of green growth as enshrined in the Sustainable Development Goals that are domesticated for implementation through the Uganda Vision 2040 and the National Development Plan II. The implementation of the strategy commenced in the financial year 2017/18 and is on until 2030/2031. The strategy earmarks the following:

a) Sustainable agriculture
production and value chains;
b) Pursuit of eco-tourism, agroforestry and other green practices
aimed at restoring Uganda's
forest and wetland covers;
c) Implementation of planned
climate change mitigation
measures;

d) Planned urbanization (green cities);

e) Enhanced energy use efficiency and diversification to renewable energy at domestic, industrial and institutional levels; and
f) Partnerships, technology transfers and skills enhancement It is important to note that the key stakeholders, both state and nonstate (at national and local levels), who are expected to take decisions for investments for implementation of the green growth strategy are at different levels of understanding and interpretation of the strategy. Tradeoffs exist, because the green growth strategy requires doing things in a business unusual format, and if not addressed, stakeholders will resist the desired changes and hence limit the transition and implementation. In fact, there will be winners and losers in the process. Alternative livelihood options or other appropriate forms of compensation should be provided for the losers and/or should be equipped with additional skills to fit within and tap into the opportunities presented through implementation of the strategy.

B) NATIONAL REDD+ STRATEGY

REDD+ is an international mechanism for providing resultbased payments for reducing emissions from deforestation and forest degradation. The Ministry of Water and Environment through the National REDD+





Also part of the solution: diminishing consumption by improved cooking stoves. Schools can cut use of rewood by using simple designs for constructing them. Child Africa's Primary School's kitchen in Kabale



Big part of the solution: productive tree plantations as powered by SPGS

Secretariat, initiated the processes for preparation of Uganda mechanisms for REDD+ in 2010. The process involved active participation of all stakeholders at national and local levels and has recently resulted in the National REDD+ Strategy, which presents strategic options for addressing the key drivers of deforestation and degradation in Uganda.

At the moment, a final draft of the National REDD+ strategy is in place and was launched in 2017 by the Ministry of Water and Environment.

The key strategies under REDD+ initiative for advancing investment in forest restoration are as follows: Strategic option 1: climate-smart agriculture Strategic option 2: Sustainable forest wood and (commercial) charcoal production Strategic option 3: Large-scale timber plantations Strategic option 4: Restoration of natural forests in the landscape Strategic option 5: energy-efficient cooking stoves Strategic option 6: Integrated wildfire management Strategic option 7: Livestock rearing in the cattle corridor Strategic option 8: Strengthening policy implementation of REDD+

The strategy provides a framework

for awarding financial benefits and ecosystem products, functions and services to the communities, though it was observed that implementation of the strategy requires financial investments by both the Government and development partners.

C) FOREST LANDSCAPE RESTORATION (FLR)

In 2016, the Ministry of Water and Environment, launched the Opportunities Report for FLR in Uganda. The report provides steps in respect to understand exactly where the opportunities for forest restoration and related appropriate interventions are, in various landscapes. Uganda is categorized into 7 forest landscapes. Hence, the Government has prioritized FLR in the national development plans with the aim of restoring forest cover to 24% (1990 levels); and also support the achievement of the Bonn Challenge for restoration of 2.5 million hectares of degraded and deforested land through the FLR approach.

This revealed that Uganda has a total of 8,079,622 hectares of land available for restoration, with the highest restoration opportunities being in the Northern moist, Karamoja and South West rangelands. Key strategies for advancing investment in forest restoration under FLR

a. Afforestation, reforestation, agroforestry and natural regeneration (passive restoration) will be promoted.

b. Natural regeneration will be considered suitable for restoration in the Karamoja landscape and western mid-altitude, whereas riparian vegetation restoration/riverine buffer zoning was highly recommended by the stakeholders in the Lake Victoria crescent.

c. Indigenous tree species are preferred for restoration due to high ecological value while the exotic trees will be considered for their higher commercial value.

This initiative provides an opportunity for Uganda to understand exactly where and how the opportunities for restoration are across the country, along with the appropriate interventions to be undertaken in the various landscapes.

D) THE DEVELOPMENT OF THE NATIONAL FOREST STEWARDSHIP STANDARDS (NFSS)

The NFSS for Uganda has been developed by the Standards

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A charcoal sales point alongside Mbarara-Kabale road. Nature's growing power cannot compensate for humans' destructive power

Development Group in Uganda (SDG-Uganda). The standards were approved and launched in June 2018. The NFSS takes into consideration the application of globally recognized principles, criteria and nationally relevant indicators. The principles (P) include:

- P1: Compliance with laws;P2: Workers' rights and employment
- conditions;
- P3: Indigenous peoples' rights;
- P4: Community relations;
- P₅: Benefits from the forest;
- P6: Environmental values and
- impacts;
- P7: Management planning;
- P8: Monitoring and assessment.
- P9: High conservation values.
- P10: Implementation of management activities.

The NFSS serves the following purposes: (i) A yardstick for responsible forest management; (ii) A tool of forest management through which Responsible Bodies (as defined in the National Forestry and Tree Planting Act, 2003) can conduct a self-assessment or audit against the requirements of responsible forest management, (iii) to be used by FSC accredited Certification Bodies (CBs) to evaluate forest management practices for FSC certification in Uganda.

Forestry Certification is recognized to contribute to responsible

forest management by applying environmentally friendly, socially acceptable and economically viable approaches through voluntary market-based incentives. Forest certification adds value to tradable forest commodities such as timber and carbon credits.

E) THE SAWLOG PRODUCTION GRANT SCHEME (SPGS) III

According the MWE (2018), the scheme's overall objective is to "increase incomes of rural population through commercial tree planting by medium and large-scale private sector actors and the local communities, while at the same time helping to mitigate climate change effects through intensive afforestation".

SPGS III is implemented countrywide since 2015 in 6 clusters: Albertine, Victoria, Mubende, Northern, Central and South Western. It promotes commercial tree planting by small, medium and large-scale growers, and community groups to increase their income, while at the same time helping to mitigate the effects of climate change.

The Scheme also provides opportunities for supporting investment in commercial tree planting through provision of grants and technical support. For instance, 31,500 ha of tree plantations are to be established during the 4-year period of December 2015 to 2020.

For future success, more awareness should be created about the scheme clearly targeting the key beneficiaries on how they can participate and benefit. Special attention should also be given to the community groups because these are not on the same level of understanding the needs and requirements. This should be achieved through conducting regular interactions for outreach.

KEY CONCLUSIONS AND RECOMMENDATIONS

It's clear that business as usual and inaction will have serious implications on sustainable development in the East African region, and the cost of forest restoration is enormous. Therefore, there is need for a business unusual approach through more practical methods to fast-track forest restoration and afforestation. All stakeholders have an equally important role to play. Besides the private sector, the general public must be mobilized to support forest conservation and sustainable management through massive tree planting.

Agroforestry should be promoted within forest landscapes directly targeting small-holder farmers. The power of a multiplier effect should be appreciated. For instance, there can be a great impact on forest landscapes if each of Uganda's 2,000,000 smallholder farmers grows at least 50 trees on their farms.

A single policy/strategy/approach is not adequate but a multi-faceted and integrated approach each reinforcing the other, offers a menu with various solutions for addressing the challenges. Policies and programs in place must provide incentives for private and community investment into commercial forestry on private and communal land. Likewise, incentives for conservation of natural forests should be promoted. Such incentives should take the form of access to finance/credit - soft loans, access and affordability of tree planting materials, training and extension at subsidized rates.

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WATER

BAMBOO FOR RIVERBANK REHABILITATION

COMMUNITY MOBILIZATION GOES A LONG WAY

BY MCRAE MUTHOMI AND MARGARET OLUOCH

Having worked at the World Agroforestry Center (ICRAF), Margaret Oluoch, founder of the "Smejak Tree Promotion Development Group" has accessed a lot of research on preventing degradation in the Lake Victoria region and on poverty alleviation. She desired to be part of the conservation effort and sought permission from individual researchers at ICRAF and others to replicate their ideas into workable projects. Now, she has a successful pilot project in Miwani Kisumu that practices eco-agriculture (landscape for people's well-being, nature conservation and food security). It is a 10 acre agro-forest sitting on flat land aside the fast flowing waters of the Oroba river that emanates from the Nandi hills and drains into Lake Victoria.

Some ten years ago, the Oroba riverbanks were heavily degraded due to human activities (sand harvesting and encroachment for agriculture) and seasonal flooding. Smejak began the work of conserving the river by planting majorly bamboo and some tree species. The group also set up

drainage systems to drain away flood water from the Nandi hills. The founder believed that by doing so, she would restore and conserve not less than 20 km of the riverbank. With authorization from Kenya Water **Resources Management Authority** (WRMA), she completed the 20 km target and was further mandated another 20 km of the river to further carry out rehabilitation initiatives. Along with bamboo, she has also planted fruit trees, trees for fuel wood and those with medicinal value. "Walking through the grassland within the farm, you cannot fail to notice the serenity that has befallen

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W A T E R

the area, the fresh air, birds chirping, wild mushrooms, clean waters running with the rhythm of peace and tranquility- it's like a new Garden of Eden. It is no magic though: just the power of conservation at play." a jovial Margaret explains.

All this was made possible through community sensitization and mobilization where they managed to register the Oroba Water Resource Users Association that attracted 150 members. Now, there are about 6 bamboo species grown along the riverbank, including *Dendrocalamus giganteus* (Giant bamboo), *Bambusa vulgaris* (Common bamboo) and *Oxytenanthera abyssinica* (Savanna bamboo).

Bamboo is an ancient grass that plays a distinct role in the forest ecosystem and conservation. It is the world's fastest growing woody plant with some species achieving the phenomenal growth rate of one meter per day. As an environmentally friendly cash crop, its Asian trade was valued at USD 60 billion in 2018. Yet the enormous potential of bamboo species has not been tapped in Africa. For riverbank rehabilitation, bamboo rhizomes anchor the topsoil along steep slopes and riverbanks, effectively controlling soil erosion. With that successful project in Miwani, she now has a new model at Kopere, Kisumu County, conserving the banks of river Nyando. This is in response to the statement by the Environment Cabinet Secretary, Hon. Keriako Tobiko "The time has come for us to forgo seminars and implement reports that will increase forest cover".

Further uses of bamboo Bamboo is regarded as a super plant because it has economic and environmental significance. No other woody plant matches bamboo's versatility in environmental conservation. Some bamboo species are drought resistant, for example *Oxytenanthera abyssinica* which survives in the semi-arid savannah woodland. Bamboo species further provide environmental services such as absorption of atmospheric carbon dioxide (up to 12 tonnes per hectare) which is a valuable aspect to deploy against global warming. Its root system can act as a water filter removing dangerous poisons by soaking up heavy metals and in some parts of the world, it is used to clean sewage.

Leaves, sheaves and fallen culms decompose and create a thick humus layer that enriches the soil.

Bamboo can be used as bio-energy as it can produce up to 9-10 tons of charcoal per hectare per year. The firewood can be used as energy for factories such as tea factories which use timber as firewood. In addition, it can be used for making charcoal briquettes and women especially in villages can use it together with *Kuni okoa*. This is a fuel efficient cooking stove that is designed to use 31% less fuel and reduce emissions by 72%. If

people took up bamboo farming it can be the future firewood. Bamboo leaves contains silica and tea can be made out of them. Silica is used by the body to maintain and repair bones, eyes, hair, nails and skin, teeth and cell walls. It is essential in maintaining the integrity and health of the skin ligaments, tendons and bones. Rhizomes are used in treating dysentery, roots treat skin diseases and leaves treat diabetes, colic and rheumatism. Bamboo produces a high volume of quality industrial products such as materials for building, manufacture of wooden products like tiles, toothpicks, matchsticks and incense sticks.

In the food and beverage industry, it can be used to make wine and vinegar; sap from shoot tips is used for brewing alcoholic drinks.

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The author in front of a clump of yellow bamboo (Bambusa vulgaris)







BAMBOO FOR RIVERBANK PROTECTION IN DRYLANDS EVEN THERE

BY JOSEPHINE MUSYOKI AND JANE NZANGO

INTRODUCTION

KEFRI has been demonstrating use of bamboo for dam protection, gulley erosion control and riverbank protection in drylands where general tree cover has been reducing drastically. Its introduction there has been mainly through raising seedlings of *Bambusa vulgaris* (Common bamboo) and planting them around dams to control siltation and along riverbanks on farms affected by seasonal floods.

USE OF BAMBOO FOR RIVERBANK PROTECTION

During the 2015/2016 financial year, the Makueni County government procured a total of 5,000 *Bambusa vulgaris* (Common bamboo) seedlings from KEFRI nurseries in Kibwezi, Kitui and Gede and the seedlings were planted in different sites including the hilltops in Makueni County.

Bambusa vulgaris is an open-clump type species. It is native to Indochina and the province of Yunnan in southern China. However, the species has been widely cultivated in many other places and has become naturalized in several countries including Kenya. Among other bamboo species, it is one of the largest and most easily recognized. In December 2015, KEFRI Kibwezi provided and supervised planting of 88 *Bambusa vulgaris* seedlings in a farm along Kasayani river. This was done in partnership with the owner of the farm, Dr. Mbinda, for the purpose of rehabilitating the riverbank which had been getting eroded due to floods during rainy seasons.

OBSERVATIONS

The bamboo has contributed to reduced soil erosion along the riverine and in the farm. The bamboo clumps have been observed to block flood water and trash. More so, the river seems to be meandering towards the opposite bank where there is no vegetation or trees growing on the riverside. What makes this bamboo suitable for riverbank protection in drylands is its adaptability to the dry climate and the capacity of the rooting system to hold soil firmly hence reducing erodibility.

Other uses of B. vulgaris in drylands include; furniture making, use for construction of livestock structures (Bomas), food storage structures and for fencing. This species has also been used in Kitui as a source of livelihood through handicrafts (making beads) and also for making curtains. With training, it can also be used for basketry and carving. The stems can be used as fuelwood and leaves are browsed by livestock as fodder. B. vulgaris is also planted around homesteads for ornamental purpose. Its hollow culms are used in some rural areas as water harvesting pipes and for holding television aerials. In

Asian countries, young shoots are boiled and eaten as food.

CONCLUSION AND RECOMMENDATIONS

There is a potential for bamboo planting for riverbank protection in Makueni County. However, the area is very dry and not all sites are suitable for Bambusa vulgaris. Only hill tops with higher rainfall apply, and places with more soil moisture like around dams and riverbanks. Now KEFRI Kibwezi has started raising Oxytenanthera abyssinica (a solid bamboo, not hollow) which is also considered suitable for drylands. Some of the seedlings were raised from cuttings obtained from Migori and the rooting was found to be somehow difficult. However, with use of a rooting hormone, we have been able to raise about 500 seedlings. Some have been planted within the station and are doing well. Seeds of O. abyssinica were obtained from Ethiopia last year (2018) through the National Bamboo project; they germinated easily and some have been sold to clients from Kilifi. In Makueni County the community members and the County government have developed a lot of interest in bamboo establishment. Some farmers have a few bamboo clumps on their land, but they lack knowledge on how to propagate and utilize them hence the need for training.

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gette, Giøbe

VISION:

To eradicate poverty and corruption in Africa

MISSION:

By "Social Entrepreneurship" plant as many trees as there are people on this planet, and thereby finance a sustainable implementation of the Vision.

> KENYA OFFICE: Better Globe Forestry Ltd No. 4, Tabere Crescent, Kileleshwa P.O. Box 823 – 00606 Nairobi, Kenya

UGANDA OFFICE: Better Globe Forestry Ltd Kansanga Mitala Road P.O. Box 22232, Kampala Uganda

The plantations of BGF can be distinguished into two categories: (i) traditional plantations on a large scale, on leased land, and (ii) trees planted by farmers on their land, in an agro-forestry lay-out, meaning widely spaced and intercropped with food crops. This photo shows training of pruning techniques by BGF's extension agents, called Agro-forestry Agents (AAs), and a farmer group. In partnership with the KenGen Foundation and Bamburi Cement Ltd, BGF executes a school supporting programme called the Green Initiative Challenge in the Seven Forks area, that is reaching out to hundreds of thousands of school children, to teach them how to plant trees in their schools. This picture shows the children of Wikithuki Primary School in Kitui county, that were awarded the first place in the Challenge in 2019, for planting a beautiful woodlot in a quite harsh environment Since the beginning of 2009 BGF publishes "Miti" magazine, on a quarterly basis, as a service to the environmental fraternity. This is now 10 years back, and the magazine keeps consistently appearing, with ever better articles and photos. Apart from a few exceptions, all photos are from East Africa. The articles are written by voluntary collaborators from Kenya, Uganda and Tanzania, who are specialists in their field. The magazine is a unique depository of forestry knowhow, and internationally used as a reliable reference in various articles and books related to East African forestry. It is only available on subscription basis.

CHANGING WEATHER PATTERNS IN KENYA

ASTE AND OF

Miti

BGF has a substantial operation in northern Uganda, Dokolo district, with thousands of farmers planting giant lira (Melia azedarach) in their fields. This picture shows the nursery, with a yearly production capacity of two million seedlings.

BGF's AAs team is a strongly trained task force, very mobile and rural based, constantly in touch with farmers in their operating area, which is in Seven Forks alongside Tana River in Machakos, Embu and Kitui counties.

In Nyongoro, all pitting is done by mechanical drills, mounted on tractors.

BGF provides micro-credit to farmers, as part of its Corporate Social Responsibility Programme. Through its partner K-Rep Fedha Services Ltd, it has several Financial Services Associations, commonly called Village Banks, in the Kenyan country side. In Dokolo district, Uganda, BGF supports the farmers organisation YICAFA, through a Revolving Fund that is yearly reviewed.

BGF practices year-round planting in Nyongoro, including during the dry season, for which the seedlings have to be watered. This is also mechanised, with sprayers mounted on a bowser as can be seen on this photo.

View of stand of mukau trees (Melia volkensii) in Kiambere plantation, in the Seven Forks area.



The industrial plantations are located at the Kenyan coast,



PERIT

Seedlings are being transported to farmers in hundreds of crates, a complex logistical operation, that has to be timely and executed in a prudent manner, so as not to damage the plants (Dokolo nursery). "Education without values is like a ship without a rudder! In order to be holistic, education should not focus on academics alone, but also on values that build character in children."

SCENES FROM BINGWA KIDS OF INTEGRITY FESTIVAL 2019 | THE FESTIVAL IS ORGANISED EVERY FIRST FRIDAY OF APRIL



The Bingwa Movement grooms children into integrity champions, through a magazine, educative television shows, story books and events that are entertaining and child-friendly.







www.bingwa.org

At Bingwa, we know how to listen to and talk to children. We have a team of experienced educators, story tellers, creative programmers and animators who make information-delivery interactive and fun.

Through research, workshops and qualitative analyses, we have developed products that help build integrity, environmental consciousness, financial literacy, healthy living and patriotism in the children of Africa.