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By.[1] Amani J. Uisso

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Introduction

Agroforestry is 'a collective name for land use systems and practices in which woody perennials are deliberately combined on the same land management unit with herbaceous crops and or animals, either in some form of spatial arrangement or temporal sequence. In agroforestry systems, there are bothecological and economic interactions among the different components.

Based on the components that are intimately interacting, agroforestry can broadly be classified into various agroforestry systems. In most of the available literature, the classification of agroforestry has been based on the three components of traditional resources-use sectors of agriculture, forestry and animal husbandry with the tress/shrubs, crops and animals being their respective components. Based on such components criterion, Agroforestry was earlier classified into three broad systems of Agrosilviculture (Agrosilvicultural system), Silvopasture (Silvopastoral system) and Agrosilvopasture (Agrosilvopastoral system) depending on the components that were forming the interactions. Thus, the tree-crop components interaction, formed the Agrosilvicultural system, the tree-animal components interaction formed the Silvopastoral system while the tree-crop-animal components interaction formed the Agrosilvopastoral system.

This approach, however, does not take into account of all the sectors of available natural resources components that have come in the Agroforestry practices and are currently practically forming interactions with the traditional resources components in various ways. For instance, water-based natural resources (e.g. fish, crocodiles, shrimps etc.) have, completely, not been addressed. Even among the terrestrial ecosystems, many sectors of the available natural resources base (vegetation) users, such as insects (e.g. bees, grasshoppers, butterfly caterpillars etc.) have not been fully accounted for in these classifications. On the basis of the above consideration, recently two more systems of Aposilvocultural and Aquosilvicultural systems, of the tree-insect and tree-aquatic lifeform components interactions respectively were added to the list of the earlier three to make five commonly known Agroforestry systems of Agrosilculture, Silvopasture, Agrosilvopasture, Aposilviculture and Aquosilviculture.

Scientists and planners recognise agroforestry as an appropriate solution to rural development needs, especially in Africa. It is a livelihood option promoted by land use managers and international development agencies. Some pieces of literature suggest that in the last 40 years agroforestry has become a subject of concern for study and improvement. An estimate shows that about 560 million people in the world live in agricultural ecosystems and about 46% of the global agricultural landscapes are under more than 10% tree cover. However, the highest percentage of tree cover is recorded in Central America and Southeast Asia. Globally, about 823 million hectares

are under agroforestry and silvopastoral farming systems. Assessments in Sub-Saharan African countries particularly Malawi, Zambia, Zimbabwe, Mozambique and Tanzania, estimate that over 417,503 farmers (189,854 farmers in Tanzania) are practising and benefit from agroforestry practices. These benefits are obtained through trees grown on farms and landscapes that include fertilizer trees for land regeneration, soil health and food security and fruit trees for human nutrition. Other benefits include fodder trees for smallholder farmers to improve livestock production, trees for various products such as timber and fuelwood, trees for shelter and medicinal trees that are used to cure diseases.

Agroforestry practice in Tanzania

Agroforestry is not a new practice in Tanzania. This practice especially the traditional systems have been practised in different parts of the country since the time in memorial. The most common traditional systems include i) the "*Ngitili"* an indigenous silvopastoral system, practised by Wasukuma in Western Tanzania. It is a traditional vegetation conservation technology to promote regeneration of both herbaceous shrubs and tree vegetation for the enhanced supply of fodder for livestock and wild ungulates, poles for construction and fuelwood resources, restoration of soil fertility and environmental recreational goals; ii) the home gardens asagrosilvopastoral system practised by the Chagga and Haya in Northern and North-Western Tanzania respectively. These home gardens are understood as an intimate, multistorey integration of numerous multipurpose trees, shrubs and crops sometimes in association with domestic animals around homesteads.

However, despite the fact that agroforestry started in time immemorial, according to National Agroforestry Steering Committee (NASCO), agroforestry research and development were initiated in Tanzania in the early 1980's. Over the past 20 years, World Agroforestry Centre (ICRAF), in collaboration with national research institutions (Tanzania Forestry Research Institute, Sokoine University Of Agriculture etc), government extension services, Non- Governmental Organizations (NGOs) and Community Based Organizations (CBOs) had developed and enhanced several agroforestry technologies. These include rotational woodlots, boundary planting, fodder banks, planting fertilizer trees (nitrogen fixing trees), improved fallows, *Ngitili* and home gardens. These technologies, practices and or systems were developed to solve the problem of soil fertility depletion, food security, shortage of fuelwood, fodder and land degradation and they have the potential for generating benefits to thousands of farmers in the country.

In an effort to scale-up and out the adoption and enhance agroforestry technologies, the Tanzania National Agroforestry Strategy was prepared and completed in the year 2004. This strategy fully supports and guides scale-up and out of agroforestry technologies and practices. The strategy has the long-term vision that "by 2025, at least 4 million rural farming households adopt and benefit from agroforestry interventions in a sustainable manner". To achieve the vision, the strategy targeted to reach at least 60% of resource poor households by 2020 and 30% of these households by 2010. In addition to such plans, there are policies and legislation across sectors that address and support agroforestry development. These include National Forest Policy of 1998, Environmental Policy of 1997, National Agricultural and Livestock Policy of 1997, and National Agriculture Policy of 2013and their respective acts. This orientation is critical to achieving targets for the adoption of agroforestry technologies and practices.

In recent years, there has been agroforestry study program at bachelor, masters and doctor of philosophy levels. This is evidenced for example at Sokoine University of Agriculture. The programs are designed to produce agroforestry professionals/experts to serve in the promotion, management, training, research, extension and consultancy in agroforestry.

Conclusion

This short historical review of agroforestry in Tanzania tells us that there have been several improvements in agroforestry practices in the country. The improvements have been of benefits to the development of agroforestry sector and practitioners thereof. Besides, the presence of various technologies, practices, supportive policies across sectors and the National Agroforestry Strategy to guide scale–up and out provide opportunities to sustain agroforestry industry for socio-ecological and economic benefits. Various evaluations of the implementation of the National Agroforestry Strategy are critical for making informed decisions to strengthening agroforestry practices in the country. Finally, concerted efforts by stakeholders to implement the strategy is of create importance to make the strategy real bring about positive impacts in the sector.

CAN WATER RESOURCES WITHSTAND INTERFERENCE? THE CASE OF WAMI / RUVU BASIN

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Introduction

Water resource management is important for biodiversity and human survival. A water crisis is predicted to be severe and socially disruptive by 2025 if care not taken earlier. Its scarcity is a major concern affecting most of the people worldwide as more than 50% of world's poor are already impacted.Tanzania Government recognizes this; in 2002 and 2009 the Government reviewed its Water Policy and Act respectively. The Act emphasizes on involvement of the stakeholders in water management to reduce water challenges. Despite the fact that Tanzania government has revised and enacted new Water Policy and Act as means to ensure participatory water management, water resources and catchment forests have progressively been under pressure due to various factors including climate change effects and human economic activities within the 60 m water buffer zones. The economic activities taking place within prohibited sites are brick making and unsustainable farming which contribute to huge threat to sustainable supply of water resources. Participatory management of catchment forests is important in supporting sustainable discharge of water resources for communities' livelihood and ecological conservation. This submission intends to highlight issues affecting water resources supply in Wami/Ruvu Basin areas.

Catchment forests

The catchment forest is an area surrounding watercourse and providing it with water. The Forest Policy of 1998 in conjunction with the Land and Settlement Policy, address measures for protecting important catchment areas, recharge areas, springs and other key water sources and zoning flood prone areas. The Forest Policy recognizes that water sources are one of the key pre-requisites for local and international development. The policy stresses that population pressure and inefficient forestry management and protection have contributed to the deterioration of catchment forest areas, causing water shortages. In Tanzania about 1.6 million hectares are under water catchment management. Tanzania's catchment forests are important resources in supporting livelihood of the majority rural and urban populations as well as for conserving aquifers for continuously discharging of water.

Despite this overdependence on water and forest resources for economic development there is incredible and haphazard destruction of catchment forests for various human economic needs. In trying to meet household needs, people are subjecting forest catchment areas to the highest rates of deforestation that have ever been chronicled. Various efforts have been taken to rescue the situation including training to communities' adjacent to forest reserves on the importance of catchment forests management. This has been translated into establishment of tree nurseries, tree planting campaigns and use of environmental friendly income generating activities like beekeeping. Since water resources management and water supply needs multidisciplinary and multi-

sectoral activities, Wami/Ruvu Basin Water Office in 2018 coordinated establishment of stakeholders Water Basin Forum to advise the Basin Board concerning water management actions needed to contain the problem.

Importance of water resources to Tanzania community

Water resource is the most crucial resource for the existence of human kind since it supports economic development and life for biodiversity. It has great contribution to national economy, for example in Dar es Salaam city water from Wami/Ruvu Basin contributed about 16.8 percent of the national GDP amounting to 5.43 trillion Tanzania Shillings in 2010. The catchment forests within the Morogoro Region form part of the Eastern Arc Mountains which stretches from South West Tanzania to Southern Kenya. Easter Arc Mountains such as Uluguru form Ruvu sub-basin and regulate water flow for the country's major rivers including Ruvu and Wami. These main rivers and tributaries are important for livelihood of communities who depends on riverine resources. However, community residing adjacent water sources undertake human activities which threaten future human life and other biomes in the Basin areas.

The potential water resources in the Wami/Ruvu Basin and its distributions

Wami/Ruvu Basin is divided into three sub-catchment; Ruvu, Wami and Pwani. Rivers from Wami sub catchment originate from Chenene, Nguru and Rubeho Mountains. Rivers from Ruvu originate from Uluguru Mountains. The Ruvu River flows to the estuary getting in many tributaries such as Ngerengere, Msua and Mbiki Rivers. Ruvu River covers an area of about 17,700 km^2 of catchment and is one of the major rivers draining for the Eastern Arc Mountains. The Ruvu River basin is subdivided into the following five main sub-catchments namely Mgeta including Msoro, Ngerengere, Upper Ruvu, Middle Ruvu and Lower Ruvu. Administratively, the Mgeta catchment, Ngerengere catchment and the Upper Ruvu fall in Morogoro Region, while the Middle Ruvu and Lower Ruvu fall in the Coast Region extending southeastwards to cover the Dar es Salaam Region

Vivid examples of destructions and predict future scenarios.

Human activities and their effects on water sources

Ngerengere River and its distributaries are faced with a challenge of human activities within the 60 m buffer zone. These activities include human settlements, brick making, livestock grazing and unsustainable farming near water sources which pose huge challenge for the water resources. Mlali River is the tributary of Ngengere River which discharge water to Mindu Dam. Previous River Mlali was perennial but currently it is seasonal due to mentioned human activities. In addition, Illegal tree harvesting for timber, firewood and other uses, wildfires and farming near rivers banks increase river bank erosion leading to sedimentation/ and siltation (Plate 1). These contribute to forest ecosystem fragmentation and forest cover changes in turn destroy water flow. The ongoing human activities near water sources, significantly decreases water safety and retention on the landscape leading to reduced water flows in the rivers. This is the main challenge observed in tributaries from Ruvu/Wami Rivers.

Figure 1 shows monthly average water discharge in four years from 2013/2014 to 2017/2018 for Mlali River. February season indicates dry season while March representing

Plate1: Cleaning land en-masse for agricultural activities along River Mlali and increased siltation

rainy season in River Mlali. These water flow findings indicate lack of water flow during dry season of 2017 and 2018 and large amount of water during rainy season caused by large amount of water during rainy season indicates less infiltration of water due to removed vegetation cover. Management at the watershed and landscape scale is basic in alleviating dangers from floods and droughts, consequently improving resilience to climate change and variability.

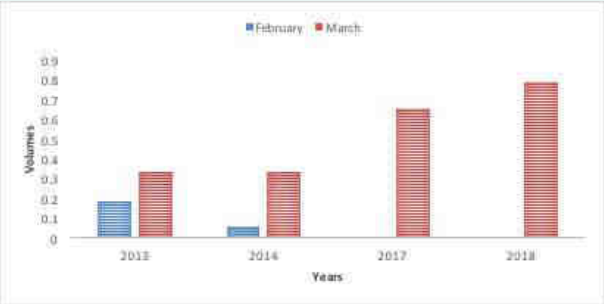

Figure 1: February and March (2013-2018) Water discharge volume for Mlali River Morogoro.

****Note discharge disrupt in the years 2017 and 2018***

In Morogoro, surface water pollution at downstream of industries was also pointed out as the main challenge for the unsafe water for domestic use and biodiversity in general **(Plate 2, 3, 4 and 5).** The areas affected was visited by water stakeholders during the stakeholders meeting on 6/12/2018

On the other hand, during discussions complaints that "Livestock destroy forest and water sources" were raised. The rejoinder from a farmer-livestock keeper was that "Agriculturists are the one who make river banks bare due to agricultural activities". Such course effect arguments indicate the importance of the needs for having encompassing front for action. Because stakeholders conflicts among the stockholders in different sector at community level needs to be addressed.

Hunting is also carried out near catchment areas. Although hunting is not very intensive but the process of hunting is also a challenge. This is due to a frequent use fire in order to entrap easily animals, as a result the fires turn into wildfires which are uncontrollable and hence cause a great destruction to catchment forest.

Lack of coordination among water users for instance in the irrigation sector may design

Plate 2 and 3: *Untreated water discharged from Morogoro Kihonda industry into River Ngerengere*

Plate 4 and 5: Existing of Settlement in less than 5m from Ngerengere River bank due to purported inadequate awareness on water management rules and regulations

and plan for construction of irrigation scheme before consultation with the Basin Authority on whether the required water will be available or not. The situation leads to failure of some irrigation projects.

During discussion with stakeholders including community it was realized that most of stakeholders were not aware on the rules and regulations regarding water management including distance from water sources and human activities (Plate 5 and 6).

Further it was realized that some areas boundaries of water source is not known which contribute to pollution of water resources and destruction of water catchment. Water cannot withstand the interference; the situation needs immediate action to reduce water scarcity and pollution challenges.

Conclusion

Water is the most crucial resource for the existence of human kind since it supports life for biodiversity. Water Resources cannot withstand interference. Thus, **c**ooperation among stakeholders and water related sectors is important for sustainability of water resources. Participatory water management among stakeholders expects to ensure sustainable water availability to water users in regions and meeting water demand to the growing cities which are under Wami/Ruvu Basin areas.

"COMPENSATE FOR OUR TREES, THEN MINE YOUR GEMSTONES": A VOICE FROM SAUTIMOJA VILLAGE, TUNDURU DISTRICT, TANZANIA

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Introduction

The Tanzania's Mineral Policy of 2009 and Mining Act No. 14 of 2010 have provision for compensation. This is because establishment of mines may disrupt livelihood of lawful occupier of the land (e.g. local communities). In cases where relocation is inevitable, the Government will conduct valuation of land and properties of the affected communities, while the investor will be responsible for payments of compensation, relocation and resettlement. In this regard, the compensation procedures need to ensure transparency and adequate compensation rates, proper valuation and prompt payments of compensation. This article presents the experience on mining of gemstones in the Village Land Forest Reserve (VLFR) in Sautimoja Village, showing contestation between owners of the VLFR (hereafter villagers) and an investor (authorized miner). Specifically, the article narrates how the investor approached villagers, villagers' response, a valuation of trees for compensation and investor's response after receiving a valuation report.

Sautimoja Village is one of villages in Namakambale Ward, Nakapanya Division, Tunduru District, Ruvuma Region. The village is located 90 km East of Tunduru Town, along Tunduru - Masasi main road. It covers an area of 28,000 ha, and was officially registered in 1999. By 2016, the village had four sub-villages and 182 households with a population of 577. The village owns and manages Chihuruka VLFR, which is located in the southern part of the village along Ruvuma River that covers 21,966 ha. The VLFR was declared in 2015 under auspices of World Wide Fund for Nature (WWF) in collaboration with Mpingo Conservation and Development Initiative (MCDI) and Tunduru District Council.

Investor's visit and villagers' response regarding mining in their VLFR

On 09.11.2016, there was a Village Meeting in Sautimoja to discuss the management of the Chihuruka VLFR. The meeting started around 10 a.m. and was attended by Assistant District Forest Officer (hereafter DFO) and one staff from WWF and another from MCDI (hereafter staff from NGOs). I attended the meeting to observe all matters related to management of the VLFR, which was one of data collection methods for my PhD study on "Participation of Local Communities in Community Based Forest Management (CBFM) in Tanzania".

At around 2 p.m. while I was in the meeting, I saw a private car parking in front of a warehouse. Then, Village Executive Officer (VEO) walked towards the car and spent about 15 minutes talking to a driver. In some instances a driver took the liberty of showing him papers and then returning them in an envelope. Then he left the driver in the car and returned to the meeting.

The meeting was almost closed when VEO arrived where I sat. The VEO was my peer and often we teased each other. He used to call me brother, and I would reciprocate. When

he approached me, saying, *kaka njoo tuongee kidogo*, "brother let's talk a bit". I stood up and followed him. I was not worried about missing discussion in the meeting because it was about to be closed and I left a Digital Voice Recorder in my backpack with microphone hanging outside. I was granted permission by village leaders to use the recorder to record discussions during meetings.

We stood few meters away from the car. In low voice, he said: "*That guy in the car is an investor, he has mining licence from District Mining Office, and he wants to mine in our VLFR. He is here to introduce himself and his intention in our village land.* He added: *"As you know, our forest is certified under Forest Stewardship Council (FSC) group certificate*

through MCDI. Experts told us that within the VLFR we are allowed to harvest timber only, he wants to undertake mining, what does the law say about this?" His last statement was a question to me as a forester and not a student. I hesitated to answer his question, instead I advised him to consult the DFO.

He called and briefed the DFO about investor and asked him the same question. After few seconds, the DFO replied: "*Since the investor has mining licence, the village cannot prevent him from mining. The village is owning and managing trees and not minerals*". He concluded by saying that: "*The village should be compensated for trees that will be cleared in mining area. Thus you need to count how many trees will be cleared (valuation), produce a valuation report. He will start mining after paying compensation and all other fees and levies*".

VEO was satisfied with the answer but he hesitated to deliver it to investor before consulting with Village Chairman and some members, including Chairman of Village Natural Resources Committee (VNRC) who were at the meeting. So, he decided to convene a side meeting with them, which was also attended by the DFO and NGOs' staffs. The meeting lasted for about 30 minutes, and the VEO explained a purpose of investor, and requirement of the law in such investment. Some village and VNRC leaders were puzzled. Others started murmuring, "*Mining in our forest! We cannot allow that to happen"*. The DFO interrupted by saying: "*Forests and minerals are two different natural resources which are managed by two different authorities. You are granted authority to manage trees, minerals are not yours. Thus, a Ministry responsible with minerals may issue mining licence even in your compound. It is upon you to discuss with the investor about compensation to be paid. So, we need to tell him about compensation, not otherwise",* he concluded.

There was a moment of silence before a VNRC chairman asked: "*Our forest is certified, how we handle that?"* A staff from NGO replied, "*Mining area should be revoked, and the map of VLFR must be revised to make sure that the area is not part of the reserve. But this cannot be done overnight, it needs more time because such change will have implication on your forest management plan, harvesting plan and forest bylaws"*. Thereafter, everyone was satisfied with explanation and slowly started walking to meet with investor.

We sat under a mango tree close to the warehouse. The VEO introduced the investorand welcomed him to explain his purpose of visiting the village. The investor explained, "*On 1.11. 2016, the District Mining Officer of Tunduru District granted me a mining licence of 9.43 ha. The area is within your village land, so, I am here to inform you about this and to discuss about benefits that you can get from this investment as part of corporate social responsibility. The law requires the investor to support community development projects like drilling water wells and others*". He concluded thathe is expecting to start mining very soon, and his team is already camped on the site.

When he concluded, VNRC chairman asked: "*Why are you rushing to take people to the site without consulting us in advance? Your mining area is within our VLFR and our bylaws state that no one is allowed to enter in the forest without written permit from VNRC"*. The DFO interrupted: "*Before you start mining, valuation of trees that will be cleared in mining area must*

be done, and you must pay compensation first". Issues of valuation of trees and compensation were very new to investor. In the first instance, he disagreed and asked why he should pay compensation of trees while he will support development projects. The matter created hot debate but finally the investor agreed not to proceed with mining to allow valuation of trees. Also, he agreed to pay compensation as explained by the DFO.

Valuation of trees to be cleared in mining area within VLFR

I led valuation team that was composed of three VNRC members, including Chairman, and a representative from MCDI. We arrived at mining area around 11 a.m. on 11.11.2016 and we were welcomed by the investor who arrived a day before. He took us around his mining area. He assigned one of his casual labourers to work with us. We spent about 4 hours to complete tree assessment.

I spent one day for data analysis and report writing. On 13.11.2016 I submitted a valuation report to the VEO for implementation. The report showed that 15 tree species were recorded within mining area. Total number of withes were 22,524 (754 loads of 30 withes), poles class I were 2310, poles class II were 1245, and standing tree volume was 321.9 m^3. Computations of monetary value were done using Fees and Royalty of Forest Produce as stipulated in Government Notice No 324 of 14 August, 2015. Therefore, a compensation for clearance of standing trees in 9.43 ha was TZS 46,971,192.

Investor' response after receiving a valuation report

The VEO and the VNRC chairman informed the investor about valuation results. He was required to return to the village to initiate payment, but he didn't do so. Instead, he started mining, an action that angered villagers. The VEO informed the DFO about situation, who later informed the police. The police, together with the VNRC members went to mining area and arrested his casual labourers. They were remanded in Tunduru Police station but were released without consultation with village leaders. The release of causal labourers angered village leaders and villagers, thus they agreed to protect their forest themselves. However, the investor decided to abandon the mine and has never returned to the village. When I spoke to the VEO in February 2020, he said: "*He hasn't returned. I spoke with him two years ago. He wants to come back to continue mining but he claims the compensation is too high to afford*".

Conclusion

From this article, it emerges that: First, villages that manage VLFRs are facing several challenges, some of them are beyond their administrative capacity. Thus, they need to be supported by other actors (both technical and financial), including district and NGOs. In this regard, I recommend actors facilitating establishment of VLFRs to extend their support during implementation. Second, there is lack of clear coordination between sectors that are responsible for natural resources management. As a result, each sector operates in isolation, a situation that pose management challenge to another sector. The same challenge has been amplified by other natural resources management investigators in Tanzania. Thus, there is a need of improving intra and inter-sectoral coordination in natural resource management.

LOCAL COMMUNITY PERCEPTION ON TERMINALIA MANTALY IN SHINYANGA RURAL DISTRICT

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Introduction

Terminalia mantaly is fast-growing species (but normally on good sites) that grows between 10-20 m with an erect stem and neat, conspicuously layered branches. The species, locally known as panga uzazi (umbrella tree as a common name) has been characterized by bark pale grey, smooth and rather mottled. Their leaves are smooth, bright green when young, in terminal rosettes of 4-9 unequal leaves on short, thickened stems and length of up to 7 cm, apex broadly rounded, base very tapered, and margin wavy The generic name comes from the Latin '*terminalis*' (ending), and refers to the habit of the leaves being crowded at the ends of the shoot.

T. mantaly is indigenous specie and endemic of Madagascar that was introduced to Senegal and then been distributed to other countries for example Djibouti, Eritrea, Ethiopia, Kenya, Senegal, Somalia, Tanzania and Uganda. In Shinyanga, the tree has been widely distributed in towns and rural areas.

Propagation and management

Normally, tree seed of the *T. mantaly* is collected from trees in hotter, low areas and is propagated through seedlings. Before sowing, the wing is removed from the seed, which is then soaked in cold water for 24 hours.

Functional uses

T. mantaly plays many functional roles to community; these include provision of tannin or dyestuff. In its native habitat, the bark and wood are used for dyeing. Medicine: The bark and wood are used in Madagascar for treating dysentery while in Tanzania, particular in Shinyanga, it`s bark is used for stomach ache. Shade or shelter is another functional uses of the species.

A T. Mantaly tree species planted close to a house in Shinyanga

Local perception toward the *T. mantaly*

Among the rural individuals, in Shinyanga rural district belief that the tree species is bad omen which is associated with the deaths of spouse within the families in which the tree is planted. The belief which calls for the need of de-

struction of the specie to protect the families has existed for generations and is still strong among the community members in rural areas in Shinyanga.

It is perceived that, after the tree has been planted after two to three years, produces long roots which extends to inside the house to couple's chamber (bedroom) and emerge from the floor under the bed. At this point, anything abnormal can happen and cause a death of a husband or wife

Majority of the respondents (64%) among the community members (aged between 65 and above 65 years) perceived that the T. *mantaly* is associated with the deaths of their beloved ones compared to 36% of the respondents of the similar age group who were relatively optimistic of existence of such belief. The noted high perception of the elders is related to the fact that they are much embraced to traditions and beliefs compared to other group.

The perception that, T. *mantaly* is associated with the deaths of family members is existing to elders (60 years old and above) probably due to traditional beliefs without being exposed to changes of time. This is in contrary to the perceptions of the middle aged communities who discourage the superstition beliefs through readings and hearing from mass media like radio, newspapers and also through having an educated youth as a family member.

Conclusion

Communities based on their beliefs are convinced that, a root of *T. mantaly* could penetrate into the wall and finally enter the house before grabbing the individual to death. That is just a perception or belief of this small community!.

As a rule, the root of such tree penetrates into the wall as a way of the root searching for food (water). But when the root reaches the wall there is no possibility of it to enter the wall unless the wall is too weak or there is a fault already on it, so it depends.

If the wall has no crack then the root will possibly find its way beneath the foundation to let it go off further so as to complete its primary function. From that point, the root will emerge anyway until it finds its way, and this is where the community myth started percolating.

However, there is no evidence for such a myth in any community in Shinyanga. Most of the community members said they have been told by their ancestors, they have never been practically seen it anywhere.

Similarly, the survey conducted in Shinyanga rural revealed that, there is no relationship between the death of the community member and planting of T. *mantaly* tree species close to individual's house. The noted high perception of the youth group over the T. *mantaly* specie is clearly connected to the fact that most youth respondents were exposed to formal education. Formal education strongly condemns the superstition beliefs in the society.

Infact, this tree species can be planted anyway but it should not be so close to a house (any building) as it can damage the floor sometimes. A good rule of thumb is to plant 8-10 metres away from the house. One good thing about *T. mantaly* tree species unlike Ficus spp it has no widespread invasive roots.

It is therefore recommended that more knowledge should be imparted to old aged group (i.e. 65 and above 65 years) rather than productive aged groups since most of this age group are exposed to commuting zone, where communication is relatively improved.

DEMAND VERSUS UNSUSTAINABLE EXPLOITATION OF *Pterocarpus tinctorius* (MKURUNGU) IN TANZANIA

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Introduction

The *Pterocarpus*genus is native to African's broad belt of Miombo Woodlands, an area of 2.7 million square kilometres of tropical seasonal and dry forests crossing Angola, Burundi, Democratic Republic of Congo, Malawi, Mozambique, Tanzania and Zambia. In Tanzania there are two important species in the genus *Pterocarpus* which are *Pterocarpusangolensis*(Muninga) and *Pterocarpustinctorius*(Mkurungu / Muninga Maji / Mukula). They are preferred timber tree species for furniture on account of good working quality, high durability and good appearance of wood.

Mkurungu tree is semi-deciduous growing to about 20 m tall (Plate 1), with a roundish or flat spreading crown and grows at an elevation of 50 – 1800 metres. The tree leaflets are shining on upper surface, and young twigs are dense with brown hairy. The bark of a tree is dark reddish-brown with pale stripes, inner bark red, sticky resinous, slash red – brown, wood contains a blood red exudate/sap (Plate 2). Pods are 6 – 11 cm in length, broadly winged.

Plate 1: Mkurungu tree cut down for sleeper production

Plate 2: Blood red exudate/sap on Mkurungu stump

Mkurungu tree is known to play an important role for a variety of animal species including bees, primates, elephants, and rodents. It is also a favourable shade and its foliage serves as grazing fodder for livestock. Its reddish exudate is used by local communities for fabric dyes and body colouring. Furthermore, it has a number of valuable antibacterial and medicinal qualities including rectal washing to treat lung congestion in children using bark decoction.

The heartwood is pale yellow when freshly cut, turning to pinkish red upon exposure, and distinctly demarcated from the whitish, 7.5 – 10 cm wide sapwood. The grain is often interlocked; texture moderately fine; irregular, small, dark red or brown markings are present on tangential surfaces. The wood usually dries well with little deformation. The wood saws and works well, and can be planed to a smooth surface; it holds nails and screws well and is generally not liable to splitting. The wood is moderately durable to durable; the lighter wood is liable to termite attack, but heavier wood is not. It is moderately resistant to impregnation with preservatives. The red, mahogany-like wood is one of the most beautiful of all cabinet woods. It is popular for furniture, cabinet making and decorative parquet floors. It is also suitable for light construction, joinery, interior trim, boxes, crates, tool handles, carving, turnery, veneer, plywood, hardboard, particle board, and pulpwood for lower-quality paper production. It is also used as firewood and for making charcoal.

In Tanzania, Mkurungu is mainly found in the regions highlighted in Figure 1.

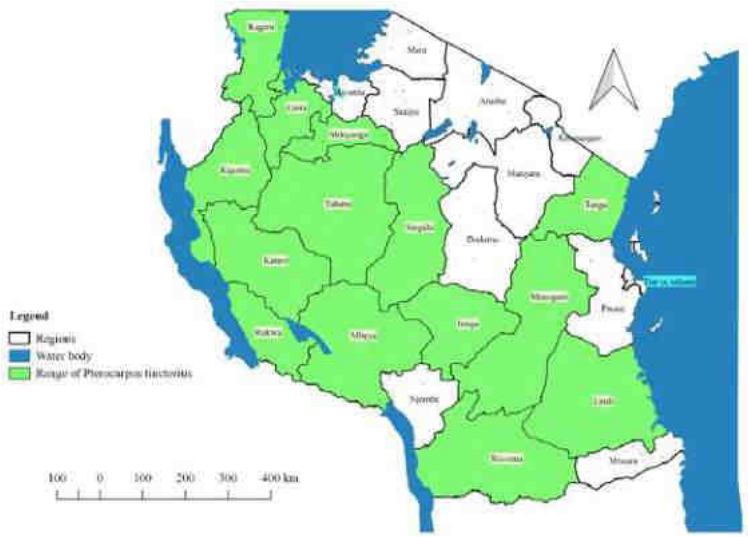

Figure 1. Regions with Pterocarpus tinctorius in Tanzania

Prior to the rush in international timber demand, domestic markets in Tanzania had little interest in commercialising the Mkurungu. This was because the timber was mainly used by local communities as substitute of their favourable species like Muninga, Mvule (*Miliciaexcelsa*) and Mkongo (*Afzeliaquanzensis*) for house construction and on other in services not seen in our day to day life like making coffins, and house blundering. This situation has now changed as the demand for Mkurungu has increased drastically since 2014 to meet international demand, although there is a ban of its harvesting.

Demand and Mkurungu Trade

Recent market forces (i.e. high demand) for Mkurungu wood have accelerated its overexploitation in various Miombo woodlands in the Western part of Tanzania. Mkurungu wood has been sawn into a form of sleepers (Plate 3) and then transported to China for processing into various products mainly furniture and floorings.High demand of the wood has been caused by its colour (reddish) (Plate 3) which is a favourite by Chinese. On

Plate 3: Mkurungu sleepers ready for export

top of that, Mkurugru wood has high strength properties which enable it to suit in various service areas.

Around 2015 and 2017, there were several cases of claims that Mkurungu wood was being illegally harvested particularly in the western and southern parts of the country. For example, in 2017 some Mkurungu logs and sleepers were seized at Kaliua yards (Plate 4) (Tabora Region) as well as at Tanga and Dar es Salaam ports (Tanga and Dar es Salaam regions, respectively). The Authorities revealed that, some of the consignments were illicitly obtained. Implying high market forces outside might have fuelled exploitation.

Unsustainable exploitation of Mkurungu

There has been depletion of Mkurungu trees due to high demand of wood particularly in China. Illegal harvesting of wood has been done non-selectively and includes harvesting of small diameter trees. According to the National Forest Regulations of 2004, minimum harvestable Diameter at Breast Height (DBH) of Mkurungu is 45 cm. But due to high international demand of the species, people cut down the trees which have below recommended minimum girth in order to meet supply levels. This phenomenon might indicate lack of management and harvesting plans that guide harvesting procedures at a particular site/locality. However, in some cases management and harvesting plans may exist but trust worthiness does some cases faulter. This situation threatens sustainability of Mkurungu, despite availability of the species in the forests.

Illegal harvesting in several countries in the Miombo eco-region, has led some tree species to be listed under CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) Appendix II, which

permits international trade of a particular species. Timber inspection starting from the processing of transit passes, check points, and inspection need be further strengthened so that illicitly harvested timber traded is arrested. It is tempting to suggest that the entire Genus be listed under CITES. This is likely to be contested by other CITES Member States involved in the trade. Furthermore, wood identification problems might be faced as the two timber species are broadly similar. A resolution seems to be vigilant control of Muninga / Mkurungu products at points of production, transit and exit. As it for other forest produce.

Conclusion and Way forward

Evidenced high demand for Mkurungu trade might escalate illegal harvesting of the trees. However, Mkurungu being listed under CITES Appendix II might increase protection and control for observed unsustainable exploitation. To effect this, internal controls also need be strengthened for sustainable utilization of the trees as CITES has no control on local use. Internally, the Government of Tanzania has banned export of the logs so that to put in place important rules and regulation for international trade. Last but not least, a more lasting solution need to be directed to the ecology of the species in order to develop management plans.

Plate 4: Confiscated Mkurungu logs and sleepers at Kaliua District yard, Tabora Region

SILVICULTURAL PRACTICES AND SPATIAL DISTRIBUTION OF ROOT SYSTEMS OF EUCALYPTS CLONES IN TANZANIA

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Introduction

The Eucalypts belong to the Myrtaceae family. They are widely grown plantation species due to rapid growth, and short rotation characteristics. Production of good quality wood and other forest products such as firewood, charcoal, building materials, fencing posts, transmission poles, pulpwood, timber and plywood in a relative short time, led to the introduction of Eucalypts clones from Mondi South Africa in 1997. In Tanzania, the clones were introduced in 2003 through the Tanzania Forestry Research Institute (TAFORI). Performance tests involved *Eucalyptus grandis* x *E. camaldulensis* (GC), *E. grandis x E. urophylla* (GU), and *E. grandis x E. tereticornis* (GT) clones (Plate 1). Silvicultural practices that view the rooting habits as feeding habits serve as important link between the soil in which these clones are growing. This note seeks to put on record those practices.

Silvicultural practices of Eucalypts clones

Currently, silvicultural practices in Tanzania are site preparation, planting, weeding, fertilization, beating up, pruning, thinning, harvesting, coppice management and insect

Plate 1: Eucalypts clonal experimental plot at Kibaha, Tanzania

pests and disease monitoring. Eucalypts are very sensitive to competition from all types of weeds in the early years (*i.e* 0 – 3 years). Seedlings require nurturing to ensure that weed completion for water, soil nutrients and sunlight is kept at a minimum. While planting, it is mandatory to remove polythine from potted seedlings without damaging roots and planting should also match spacing with management objectives.

Spatial root distribution of some Eucalypts clones

The spatial arrangement of root system determines the plant's ability to counteract localized depletion of nutrients. It is widely accepted that vertical distribution of nutrients according to depth is in the order: Phosphorus(P)>Potassium (K)>Calcium (Ca)>Magnesium (Mg)>Sodium (Na) = Chloride (Cl) = Sulfate (SO4). Nutrients strongly cycled by plants such as P an K are usually concentrated on top layers of the soil while N and Cl which are less limiting are leeched down. Eucalypts clones being a fast growing species, most of the roots are concentrated in the upper soil layer. The high concentration of roots observed in the upper soils has been reported from other plantations for a range of species and for native forests. In Congo, Eucalypts clones quickly developed its root system, medium-sized roots and explored at least down to 3 m. In Brazil, roots of Eucalypts go down to 3.9 m, 8 months after planting; down to 6.2 m on 2-year-old stand.

Eucalypts clones root density decreased sharply with depth, with most fine roots in the surface layers (Plate 2). Spatial distribution of root systems of eucalypts clones in Tanzania does not go beyond 4.0 m in vertical distribution with an average of depth of 1.6 m (Plate 3), and the horizontal distribution extend to above 3.6 m averaged to 2 m in length for all the clones studied. The number of fine root intersects in the surface soil layer represented 16–53% of the total and this tacitly reflects greater concentration of nutrients in surface layers. The trees had an extensive network of fine roots at the forest floor in contact with forest litter. The percentage of root intersects in surface layers increased with stand age. It has also been observed that roots in the subsoil play a major role in supplying water to trees when the surface soil is dry. This spatial distribution of Eucalypts clone fine roots in the upper soil layer

Plate 2: Root distribution of Eucalypts clones at Kibaha, Tanzania

is similar to other Eucalypts species, where high spatial heterogeneity in the distribution of Eucalypts roots and a decreasing root density with soil depth has been observed. The ability of Eucalypts fine roots to concentrate under areas of preferential infiltration explains both the root distribution observed, and the rapid drying of the soil in areas of preferential drainage. This implying that proper silvicutural treatments such as weeding and fertilization should be undertaken to optimize water and nutrients uptake by the plant. Fine roots with their associated mycorrhiza, and root hairs, are involved in nutrient and water uptake. Following their death, they contribute greatly to soil fertility: and although there is little evidence that Nitrogen(N) is retranslocated within tree root systems, approximately 30% of Phosphorus (P) and Potassium(K) may be retained.

Plate 3: Root length and root depth measurements of Eucalypts clones at Kibaha, Tanzania

Conclusion

Silvicultural practices such as site preparations, planting, weeding, beating up, pruning, thinning, harvesting, coppice management and insect pests and disease monitoring are very important practices used to improve timber quality and stand growth.Since, roots of Eucalyptus clones are concentrated in the upper soil layer of less than 4 m deep, seedlings require nurturing to ensure that competition from weeds for water, soil nutrients and sunlight is kept at a minimum.High density of fine and medium-sized roots found in the surface layer marked a decrease in root density in deep soil layers.For increased biomass production, better silvicultural practices that integrate an understanding of the distribution and dynamics of their roots areconsidered an important link between soils and plants. This implies use of soil water conservation techniques such as ridging, and tie-ridging during site preparation followed by reworking the soil between ridges up to the stage when the planted clones are fully established.

Terminalia sericea: ITS POTENTIAL USES AND CONSERVATION STRATEGIES

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Introduction

Terminalia sericea Burch. ex DC. (Mnyenza, Mhugwe Luwala, Mpululu) is a one of the most important hardwood tree species found in Miombo woodlands. It is scattered in open woodlands, or as a dominant or co-dominant in mixed deciduous forests such as *Brachystegia*, *Combretum* or *Acacia* forest. It thrives in a range of soil types (deep sandy soil with moderate rainfall and saline soils), moisture conditions and drainage conditions as long as light is not a limiting factor. It seldom makes pure stands in late successional stages. *T. sericea* is common as a shrub or bush of 6 to 9 m, but individual trees may reach 23 m in height.*T. sericea* is reported to form dense thickets when cut or burnt, and becomes weedy, preventing the growth of grass. It naturally regenerates readily. When growing as a tree, the bole can be branchless for up to 8 metres, it can be straight or crooked, and it is up to 50cm, occasionally 100cm in diameter (Plate 1). *T. sericea* is widely used as traditional medicine in several conditions across the world for the treatment of numerous disease including abdominal disorders, bacterial infection, colds, sore throat, conjunctivitis, diarrhoea, fever, gastric ulcers, hypertension, and skin diseases. The plant has been ascribed for its varied medicinal applications and holds a rich history in African traditional medicine. The exploitation of this tree species was previously underrated, this has accelerated high degradation of *T.sericea*and its association plants.

Plate 1: *Terminalia sericea* trees

Potential Uses of *Terminalia sericea* to the Livelihood

Ethno medicinal uses of T. sericea

The tree is a popular and effective traditional medicine as it contains antimicrobial constituents, being commonly harvested from the wild for local use. Traditional medicine is an important part of the health-care system in most of the African countries. The World Health Organization (WHO) reported that 80 % of the populations in African countries dependent on traditional medicine for their primary health care. Traditional medicine seems to have certain advantages over imported systems of medicine because it is an integral part of the people's culture and is particularly effective in solving certain cultural health problems.

Parts of T. sericea extracted and their medicinal uses

Mostly used parts are the leaves, stem bark and root barks (Plate 2). They are used to treat:

- Leaves are used to treat bilharzia, stomach disorders and colic;
- Leaves also have been used ethno-medicinallyto treat wounds. In case of bleeding, a paste is prepared by the decoction of the leaves and placing the paste on the wounds;
- Leaves and roots when boiled in water and the decoction is taken orally for the treatment of coughs, diarrhoea and stomach aches;
- Stems and the roots are debarked (Plate 2), used for the extraction of sericocide which is used for manufacturing of cosmetics; and
- Decoctions are mixed with food for the treatment of bacterial infections, diarrhoea, hypertension and fever in the investigated villages.

Plate 2: Root debarking and leaf collection training sessions at Zuzu Mcheula village, Dodoma, Tanzania

General Uses of the T. sericea

- Wood is good for building poles, furniture, tool handles, for fencing material and for solid structures (construction engineering)as it is hard, heavy, tough, and resistant to both termites and borers;
- Wood is also used as a source of cooking (firewood, charcoal) as it has a high calorific value;
- Bark is used to produce ropes for different uses like tying door frames and hanging beehives;
- Roots are also cut into strips and used as a strong rope for hut construction;
- Leaves are fodder for animals like cattle, goats and wildlife during the hot, dry season.In the rainy season caterpillars feed on the leaves;
- Flowers provide nectar for honey bees, whereas the leaf hairs are used for glazing pottery; and
- The tree improves land by draining waterlogged soils, shading out weeds, and enriching impoverished soils. It is also used for erosion control.

Sustainable utilization of *T. sericea* in Miombo woodlands

Destructive extraction of *T. sericea* in the long term leads to loss of this species in higher rates particularly in areas they dominate. Currently trees are scattered and not readily available as they used to be. Deliberate measures have been taken to conserve and ensure sustainable utilization. Community training on sustainable utilization and both insitu and exsitu conservation is inevitable.

Training on the conservation of *T. sericea* species in Tanzania was done to selected communities at Chalinze District (Chamakweza village), Dodoma District (Zuzu Mcheula Village) and Handeni District (Maili Kumi Village) (Plate 3). Communities were trained on the following;

***Plate 3. Training association members on conservation of* T. sericea**

- Silvicultural management techniques of *T. sericea* including different propagation methods, phenology and pests and diseases control;
- Ecological conditions for domestication, conservation of the tree species and its importance to human life. As an agroforestry treecommunities were trained on how to integrate *T. sericea* within their farming systems. Trainers had an opportunity to exchange/ share ideas and experience with the communities;
- Establishment of *T. sericea*conservation association, how it will work, power structures and the constitution to improve production and conservation of the species;
- The financial management system if there is any fund disbursed for *T. sericea* conservation purpose at association level; and
- Sustainable harvesting and proper utilization of *T. sericea* products.

Conclusion and Way Forward

T. sericea has been used mostly as a remedy for diarrhoea, sexually transmitted infections, skin rashes, and tuberculosis. Its potential uses range from land improvements to medicinal values. In most cases harvesting of *T. sericea* for medicinal purposes is destructive as it involves peeling off stem barks and roots. Over-exploitation and destructive collection of stem barks and roots seem to threaten the survival of *T. sericea*. A sustainable approach including the involvement of local communities in the management, sustainable utilization of*T. sericea* and development of guidelines for conservation and utilization of *T. sericea*, need to be put in place and put to work.

POTENTIALS AND CHALLENGES IN THE EASTERN ARC MOUNTAINS (EAMS) IN TANZANIA

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Introduction

Eastern Arc term was coined in 1985 to describe the forest-capped ancient crystalline mountains of eastern Tanzania and south-east Kenya, which are under the influence of the Indian Ocean climatic regime. These mountains are part of a biodiversity hotspot of Conservation International, an Endemic Bird Area of BirdLife International and habitat to many living organisms and at the same time contributing to balance ecosystem. In Tanzania there are 9 sites where these mountains can be found; and they are all protected to prevent further destructions of these mountains. The sites which have these mountains are Amani Nature Forest Reserve (ANFR), Uzungwa Scarp Nature Forest Reserve (USNFR), Mkingu Nature Forest Reserve (MkNFR), Uluguru Nature Forest Reserve (UNFR), Chome Nature Forest Reserve (CNFR), Magamba Nature Forest Reserve (MNFR), Nilo Nature Forest Reserve (NNFR), Kilombero Nature Forest Reserve KNFR and Udzungwa Mountains National Park (UMNP).

Current global concern regarding, human beings welfare and all other living creatures depends mostly on a well-established ecosystem which is hugely influenced by the well-being of the eastern arc mountains biodiversity. In order to preserve the well-being of these mountains, we need to know the potential and challenges that are found within the Eastern Ach Mountains. In addition, these known challenges and opportunities will motivate the community to increase conservation schemes efficiency of making sure these mountains well taken care for a life time. Hence, as for this article, the most common opportunities and challenges in the EAMs are described.

Potentials of theEastern Arc Mountains

The EAMs are important at national and levels for existence of biodiversity, water supply, electricity and tourism. In other words the existence of EAMs, helps in sustaining ecosystems all around the world.

Biodiversity

Many thousands of species of plants and animals are found in these forests and nowhere else on the earth. This includes birds, animals, insects and snakes; plants and huge numbers of smaller creatures including butterflies, dragonflies and millipedes. The EAMs are recognized internationally as an area with an exceptional high rates of endemism (species not found elsewhere)and species richness. The EAMs have exceptional endemic species and it is among the top 10 most important biodiversity hotspots in the World. Approximately 20% of the total area of the EAMs falls within protected areas, which set restrictions on permitted extractive activities. Most of the protected areas are national forest reserves that were established prior to the 1970s for logging, the conservation of water flow regimes, and the prevention of erosion. In 2010s the EAMs management regimes changed from forest reserve to Nature reserve of which the vegetation cover have improved. However

the forest still face challenge of illegal activities which threaten the existing biodiversity. The EAMs vegetation cover improvement has great contribution in increased water supply, existing biodiversity and improvement on tourism activities.

Water Supply

Agriculture (Plate 1), industry and domestic users depend on the EAMs for water supply. The EAMs are the catchment areas for many of the important rivers of eastern Tanzania. The rivers supply water to coastal communities including Cities. The Usambara and Pare Mountains for example feed the Pangani River while the Ngurus feed the Mligasi and Wami rivers. The Ukaguru, Rubeho and Ulugurus also feed the Wami River; Kilombelo river, Ruvu Riveris fed by the Uluguru Mountains while Ruaha/Rufiji and Kihansi are fed mainly by the Udzungwa Mountains. Ruvu Riversupplies water to Dar es Salaam City and nearby Municipalities and Towns. Tanga Municipality's water supply draws water from Sigi River, which has its source in the East Usambara Mountains. The Uluguru Mountains also serve as catchment for Morogoro River, which supplies water to Morogoro Municipality and neighboring areas. It is estimated that the Eastern Arc Mountains serve as water catchment for more than 4 million city-dwelling Tanzanians, and more in the rural areas.

Electricity

The major hydropower supply from EAMs in Tanzania is generated at Kidatu and Mtera Dams, (Ruaha/Rufiji) and Pangani Falls and Hale (Pangani). A total of 382 megawatts of electricity can be generated. However, there are still more hydropower projects that are being developed that depend on water fromthe Eastern Arc Mountains. For example the current Mwalimu Nyerere Hydropower Project (MNHPP) at Rufiji River which is expected to generate about 2,115 megawatts. Rufiji River is fed by various rivers including Kilombero River, which contributes about 65% of water, Ruaha River which contributes about 15% of water, Luwegu River which contributes 19% and the remaining 1% comes from small rivers. All the mentioned rivers flow from EAMs. This project will benefit the communities around the project site and the Tanzanian people in general. Hydroelectric power using water from

Plate: 1. Water from Magamba and Uluguru Nature reserve used in agricultural and other domestic activities.

the EAMs is among the biggest contributors of the electricity in Tanzania. This power is essential to economic growth and development of the country. A reliable source of water is crucial to avoid serious power blackouts and shortages, with the major inevitable economic consequences.

Tourism

The Eastern Arc Mountains are potential for tourism. The current tourist areas include the South Pare Mountains, Udzungwa Mountains National Park, Amani Nature Forest Reserve in the East Usambaras, Lushoto in the West Usambaras and the area above Morogoro in the Uluguru Mountains. The Eastern Arc Mountains are increasingly becoming popular with tourists particularly those with specialist interests in birds and wildlife. For instance in Magamba nature reserves in 2019 received over TZS 150 million from tourism activities.

Conservation challenges in the EAMs

The estimates suggest that most of the original forest cover has been destroyed from these mountains in the past 100 years due to various factor which includes:

Illegal forest harvesting

Although, there is security around the EAMs but still there have been some illegal harvesting of some forest products from these areas which contributed todegradation.Most of the villages adjacent to EAMs the main food crops are cassava, sweet potatoes, sorghum, maize and rice which are used for personal consumption and remains a small amount that is to be sold. Hence, savings from agricultural production are low and do not provide much improvement in the living standard. As a solution to overcome this shortage, communities living adjacent to these EAMs turn to the forest for poles, firewood and wild fruits for household use, timber, charcoal, medicine, honey collection for business where most of these products are extracted illegally from EAMs.

Uncontrolled wild forest fires

Climate change contributes to the wild fire; other causes include fires erupting from preparations of agricultural farms, throwing pieces of smoked cigarettes, hunting, and harvesting bee product using traditional methods. In some parts of the EAMs, fires may enter forest margins and reduce forest cover and quality, especially in drier forest areas where natural forest stands can be totallydestroyed by fire and replaced by invasive species and massive bumbles like Ferns, Rubus spp (Plate 2).However, well-organized illegal reporting mechanism for reporting these illegal activities (including uncontrolled wild fires) to the authorities in time is needed, thus when can be made possible of reducing fire incidents destruction coverage by taking actions immediately after receiving the incidents prompts.

Plate 2: Ferns emerged after wild fire

Illegal Mining

Mining is also a significant challenge in a number of reserves, especially in the East and West Usambara, and Uluguru ranges. These mining activities first started in 1995 at Mtai Forest Reserve in Muheza district, Tanga, whereas green gannet, rodolite gemstones and tommalin were discovered. Thus when the government intervened and stopped this activities from going any further. After the bun, most miners are using illegal entry points into the protected Nature Reserves, and conduct illegal mining along riverbeds under the cover of darkness within the EAMs. These miners nowadays are in search for Alluvial gold that is found in EAMs river basins and this activity leaves huge pits which leads to the destruction of global conservation areas. Also, In reserves where mining is intensive, areas of forest and other habitats are removed which leads to the reduction in the area of habitat remaining that impacts on the ability of a species to survive in an that area. However, the country needs to impose more laws which will help reduce these activities for the future of the sustainable high ranked biodiversity hotspot (EAMs) in the world.

Conclusion and Way Forward

EAMs contribute significantly to the economic development of Tanzania through water supply, hydroelectricity, estate agriculture and tourism; Contribute to food security in adjacent areas whereas communities in these areas supplement their diets with food obtained from the forests; and keeps the community healthy by providing them with a provision clean water for agriculture, food and herbal medicines and fish. The future of the biodiversity in the EAMs depend on the implementation of plans of the responsible organizations mandated for the longer term realization of the economic development and conservations. Good governance, human and financial resources are crucial in facilitating conservation in the EAMs which are very potential in conservation of biodiversity.However, more user friendly and sustainable technologies for curbing illegal activities in the EAMs are recommended to be developed and practiced for the aim of maintaining the high biodiversity in EAMs.

UNDERSTANDING ALTERNATIVE PROPAGATION PROTOCOL FOR MILICIA EXCELSA (MVULE) USING JUVENILE STEM CUTTINGS

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Introduction

Milicia excelsa (Mvule) is among of high valued indigenous timber species often found in general lands. Its timber high demand and unregulated harvesting threatens its regeneration potential in natural forests. Its timberis of high quality in terms of wood properties sometime used as a *Tectona grandis* (Teak) substitute and is highly priced internationally at about TZS 766,899 (USD 330) m^{-3}, a bit lower than Teak costing TZS 824,994 (USD 355) m^{-3}. Timber from Mvule is used for furniture, cabinet work, panelling, frames, floors and boat building. Furthermore, Mvule has medicinal value; its latex is used to reduce tumours and obstructions of the throat and for stomach problems while the bark is used to treat coughs, dysentery, heart problems and general tiredness. In recent years,Mvule is mostly found in managed Forest Reserves than in general lands that are free access. Excessive extraction of Mvule has imparted pressures on its natural regeneration potential and efforts to propagate it artificially has been limited with difficulty in getting abundant seeds as birds feed on fruits when they are ripe. Furthermore, irregularities in tree flowering, lack of assurance of fertile seeds as flowers of trees exist in separate plants (dioecious) and lack of alternative developed propagation techniques culminate to insufficient availability of planting materials. Thus, developing an alternative propagation using vegetative planting materials such as juvenile stem cuttings is imperative. Juvenile stem cuttings have been regenerating efficiently if collected from seedlings cycle, they provide plants with upright stem (orthotropic) like seed-derived plants than from mature cycle (twigs and branches) that grow laterally (plagiotropic). This article presents best propagation protocol of Mvulefrom the two that was tested at TAFORI Headquarters in Morogorousing juvenile stem cuttings.

Identification and collection of seeds from best trees

Best trees (plus trees)for provisional of planting materials for Mvule were selected from areas with remnant of these tree species such as Rondo in Lindi, Mlingano in Tanga, Rau Forest Reserve and Karanga prison in Kilimanjaro. Among of the traits that were considered during plus trees selection included straightness, number of branches, self-pruning and characteristic of the site where the candidate tree is growing (Plate 1). After selection, a tree was marked with white band painted around the stem at breast height and identification number for future follow up. Further, a descriptive register of the selected tree was filled noting the geographical position of the tree using the Geographical Positioning System (GPS), the Diameter at Breast Height (DBH) and Height. Thereafter, mature seeds were collected from these trees and mixed up for establishment of mother plants intended for production of juvenile stem cuttings.

Plate 1: Selected best tree for Mvule (plus tree) at Mlingano, Tanga for seed collection

Establishment, management of mother plants and harvesting of juvenile stems

Mother plants are important as providejuvenile stems that are cut back to produce plantlets year round reducing seeds collection costas well as avoiding seed germination related problems. They were established at TAFORI Headquarter using seedlings raised through collected seeds and grown in 10 litres buckets filled with growing soil medium (Plate 2). When mother plants were at one year old, they were cut back to 0.3 - 0.5 m high to let them coppice. Coppices from mother plants were harvested after 2 months for preparation of juvenile stem cuttings with diameter of 5 – 8 mm and length of 6 – 8 cm with portion of leaves trimmed to half (3A).

Plate 2: Mvule mother plants with coppices arranged under the shade net

Treatments and setting of cuttings in the non-mist propagator

Harvested cuttings were washed and kept in container with fresh distilled water during the whole period of setting. However, beforesetting, stem cuttings were treated with rooting hormone (Indole-3-butyric acid - IBA- 0.6%), rooted in 6 cm diameterpotted polythene tubes with red sub-soil and arranged in the prepared Non-mist propagator (Plate 3A). Red subsoil medium was collected from the pit of 1m depth and sieved. In controlling soil pathogens such as fungi that can impair rooting of cuttings, rooting medium were treated with fungicide Ridomil at 2.5g/L two days before setting. Furthermore, hands and working tools such secateurs were also sterilized with 70% alcohol to avoid infecting the cuttings with fungi, yeast or bacteria that can cause death.

Management of Mvule stem cuttings

In reducing the effect of extreme temperatures, the non-mist propagator was kept under shade with some amount of water underneath

Plate 3: Setting of Mvule stem cuttings: (A) Non-mist propagator, (B and C) set cuttings, (D) rooted cuttings and (E) transplanted cuttings

for sub-irrigation, raising and maintaining relative humidity (RH). Relative humidity was maintained at 90±5% while minimum and maximum temperatures must be 24±2 and 33±2^{0}C, respectively. Through this protocol, cuttings provided shoots and roots after two to four weeks of setting at an about of 85.4%. Rooted cuttings were transplanted to 10 cm diameter polythene tube filled with growth medium for further management such as maintaining single shoots, watering and weeding. Growth medium composed top forest soil, sand and decomposed cow dung manure mixed at the ratio of 3:1:1 by volume. Seedlings propagated through stem cuttings were ready to be transplanted to the field after four months.

Conclusion

Therefore, in curbing regeneration challenges associated with seeds viability, poor availability of seeds caused by seeds eating birds (frugivorous), irregularity of fruiting and dioecious nature of Mvule, massive seedlings production of Mvulecan be alternatively achieved using juvenile stem cuttings with diameter of 5 – 8 mm and rooted with subsoil media and rooting hormone IBA at 0.6%.

NEWS IN PICTURES

By. Geofrey Njovangwa

Tanzania Forestry Research Institute (TAFORI) participants at the 43rd Dar es Salaam International Trade Fair that was held in Dar es Salaam, Tanzania.

Acting Director General of Tanzania Forestry Research Institute (TAFORI) listening careful to Ms. Jacqueline Kajembe who was representing TAFORI at the 26th farmers' ceremonony held in Morogoro, Tanzania

A group photo from the seminar that was conducted on 22nd August 2020 by International Union of Conservation of Nature (IUCN) in collaboration with Joint Research Centre of the European Commission (JRC) and Regional Centre for Mapping Resource for Development (RCMRD) to Tanzania Forestry Research Institute (TAFORI) Researchers, Information and Communication Officers (ICTO) and Information and Documentation Officers (IDO) at TAFORI HQ, Morogoro.

A together picture stakeholders from different institution at workshop to improve Tanzania Forestry Research Institute (TAFORI) second strategic plan that was held on 28th October 2019 at TAFORI HQ, Morogoro.

The capacity building training workshop on how to write a winning project proposals that was conducted to Tanzania Forestry Research Institute (TAFORI) researchers at TAFORI HQ, Morogoro from 29th October to 1st November 2019

A group photo of a meeting held at Tanzania Forestry Research Institute (TAFORI) on 15thNovember 2019, between RTI International and TAFORI researchers to discuss the research possible future opportunities out of USAID Tanzania which includes International strengthening, policy level influence, research data generation and management.

The first meeting of the organizing committee for the international scientific conference on Forestry and Bee products value chain for sustainable livelihood and industrial economy that was held on 18th December 2019 at TAFORI HQ, Morogoro.

TAFORI HQ Conference Halls

Looking for a meeting venue? Welcome to TANZANIA FORESRTY RESEARCH INSTITUTE (TAFORI) located at Kingolwira area along Morogoro - Dar e salaam Highway, Morogoro municipality.

TAFORI has two (Sabas Hall na Nshubemuki Hall), one board room (Murira Board Room) na one special room in the library (Library Special Room). The charges for these services are listed below:

Table 1: TAFORI halls services information

Name	Capacity (Pax)	Price per person per day (Tshs)
Sabas	150	50,000
Nshubemuki	15	40,000
Murira	30	40,000
Maktaba	8	40,000

These price packages cover the hall facilities, Breakfast, Lunch and evening tea, Note books, Pens, Sweets and two (2) 500ml bottles of Mineral water, Except the Library Special Room has no packages and services like Breakfast, Lunch, evening tea, etc.

Other services

Services that can be obtained at a separate price out of full package and as per client's request are:

- **Projector:** Tshs 50,000/= per day.
- **Public address system:** Tshs 200,000/= per day.
- **Internet service:** Tsh 8,000/= per participant per day.

Hours of operation:

The Halls and Board room will normally be open for seven days a week and services begin at 8:00 am up to 06:00 pm every day; with the exceptional of Library Special Room that operates only weekdays from 8:00 am to 3:20 pm.

Contact person:

Name: Mr .Charles Wikes.

Mobile: 0715 155 409

E-mail: charles.wikes@tafori.or.tz

Note: Any Food or drink from outside is strictly not allowed

TAFORI Lushoto Conference Hall

TANZANIA FORESRTY RESEARCH INSTITUTE (TAFORI) Lushoto centre is offering conference halls services at an affordable price as seen on the flyer below.

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