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PUBLICATION OF RESEARCH PAPER "IMPACT OF WILD ANIMALS AND ANTHROPOGENIC ACTIVITIES ON SURVIVORSHIP AND ABUNDANCE OF *RAPHIAFARINIFERA* IN NAIWALE AND ITS TWO CO-JOINING STREAMS IN THONDWE, MALAWI"

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ABSTRACT

A comparative study of impacts of wild animals and anthropogenic activities on survivorship and abundance of *Raphia farinifera* along three close streams was donein Thondwe area, Malawi because although these plants are conspicuously exposed to threats no study has been made on their conservation status. In this study, we divided each stream into three equal sections where we determined the adult and juvenile palm abundance through total counting once in the study period. The average distribution of adult and juvenile palms per km/stretch of Ntalikachawo, Naiwale and Namikango streams were 9; 280; and 70 respectively with no any palm observed in the upper sectionsof the streams. Weobserved that the survivorships of sampled adult and juvenile palms as follow: middle and lower Ntalikachawo had 100%, middle and lower Naiwale had 73.9% and 100% respectively while middle and lower Namikango had 64.5% and 82.4% respectively. Study was also conducted on *R. farinifera* use, land use activities and impact of wild animals where data were collected through direct observation and interviewing of 47 households. 76.6% of respondents indicated that people do not enhance palm growth in the area. On dispersal, 63.8% of respondents indicated that *Raphia* fruits are dispersed by water within the stream while 14.9% of respondents had the view that they are dispersed by human beings. Therefore from this study weconclude that wild animals and human beings play little role in the dispersalof *R.farinifera* but human beings have a role on its profusion and survivorship along the study streams.

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INTRODUCTION

Very close systems such as streams generally have similar characteristics since their biotic and abiotic elements interact with each other directly or indirectly. Biotic factors like abiotic ones, have an influential role on plants distribution and abundance as well as the stability of the entire ecosystem. Much attention nowadays is given to the stability of the savanna ecosystem components because they are subjected to three major threats namely bush encroachment, agricultural conversion, and climate change (Southworth, *et al.,* 2015) which have then led to deforestation. In relation to this, Malawi has adopted three key strategies to address deforestation which is mainly due to agricultural expansion and the growing demand for energy for both domestic and industrial use and these strategies include forest protection, afforestation, and improving the efficiency of wood energy utilization by introducing more efficient means of burning wood fuel and charcoal (EAD, 2002; EAD, 2004). Most of the active in-situ conservation programmes in Malawi are on forest and wild animal species that are normally conserved in protected reserves for example, Zomba-Malosa forest reserve, Machinga forest reserve and Chimaliro forest reserve for Miombo woodlands, and Mangochi Palm forest reserve (Leipzig, 1996). Culturally and socio-economically important species such as palms that occur outside protected areas are therefore vulnerable to destruction. Interestingly no work has been done in Malawi unlike other countries like Cameroon and Madagascar to sensitize, train the community, on best practices for exploiting palm products using result of socio-economic evaluation and valorization of these palms (Donfack, 2012). It is therefore imperative also to conserve these species on private and public lands to support livelihoods of surrounding communities as well as reduce pressure on forest reserves. An active community-based institution is essential to manage existing forest resources and palms, support

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sustainable extraction of resources and monitor overall habitat protection.

A number of biotic factors have been identified to influence the abundance and distribution of palms which include dispersal and propagation mechanisms as well as disturbance regimes. Palms are generally propagated through seeds by humans and wild animals such as birds, rodents and elephants as they eat the fruits and drop the seeds elsewhere. Small palm fruits are dispersed by squirrels while bigger fruits require larger animals such as monkeys, horn bills (bear apes) and large pigeons (Corner, 1966). Besides that, some animals such as chimpanzees apart from playing a seed dispersal role, they also eat the pith of the dead *Raphia* plants which of course has no effect on the abundance of the plant (Reynolds, *et al.,* 2009). Studies also have shown that seeds collected from the ground are often infested with seed weevils and most palm seeds have a short storage life and this affects their germination rate (Yoshii and Rauch, 1989). Natural or anthropogenic disturbance regime is another important factor influencing the distribution and abundance of plants as they may cause chronic stress, unnatural shape complexity of trees and suppression of the natural processes that maintain diversity in an ecosystem (Pickett and White, 1985; Luken, 1990). Although *R. farinifera* is reported as a non-threated species, in other places it has been taken as a threatened plant like other palms due to over-harvesting, reclamation of the palm habitat and surrounding forest reserve or woodland for agricultural use, increasing human population, poor harvesting techniques and rampant bush fires in dry seasons (Hogg *et al.,* 2013; Omagor, 2012; Mwavu and Witkowski, 2008).In other countries, palms such as *Raphia taedigera* are subjected to similar threats in particular, replacement by agricultural activities or pastureland (Calvo-Gutiérrez *et al.,* 2013). It has been reported Raphia in has become invasive and is naturalized in some restricted areas in other countries like Mauritius (Kueffer and Mauremootoo, 2004). Plants also respond biotic responses to physical factors which may be through differential establishment, growth and mortality and these may be confounded further by competitive interactions (Tilman, 1985).

There are five species of palm that grow wildly in Malawi for example, *Borassus aethiopum*, *Hyphaene benguellensis* or *H. petersiana* (Doum palm), *Phoenix reclinata* (Wild date palm) and *Raphia farinifera* (Raffia palm) (Kabwazi and Kanjo, 1999). In Malawi palms generally grow along streams and rivers of hot areas such as in Chitipa, Karonga, Nkhotakota, Salima, Mangochi, Balaka and Zomba districts depending on the species environmental condition preferences (Shorter, 1989). Three streams, Ntalikachawo, Naiwale, and Namikango in Thondwe area, in Zomba are close to each other about 0.5 km in the middle section. Amazingly, *R.farinifera* (Raffia palm) is extremely most abundant in Naiwale compared to other two streams. Raffia palms are conspicuous environments along Naiwale and Namikango streams in this area. However, these palms have been little or not studied and are exposed to numerous threats, most importantly their replacement by agricultural activities and overharvesting of the leaves. We therefore investigated biotic factors that likely underlie differences in palm abundance and distribution between these neighbouring and even co-joining streams. The results will help in putting in place proper conservation measures for these trees in the study streams as they are ecologically, culturally and economically important.

Study area

The study area is located in Zomba district, southern Malawi between 15°10' S and 35°30' E.Zomba vegetation which is mainly savannah comprise of miombo woodlands that consist of natural tree species such as *Colophospermum mopane, Brachystegia stipulate, B.manga, B.speciformis* and *Julbenardia globifora* existing in few protected forest reserves since most of the natural vegetation has been depleted and then replaced by *Pinus*, *Eucalyptus* and other species that are used now as sources of energy and timber.

MATERIALS AND METHODS

We determined the abundance and distribution of palms through total counting along each stream once during the study period. This single time estimate made the assumption of negligible recruitment, mortality or tag loss within 7 months of study because palms take long time to germinate and senesce. Only adult and juvenile palms were counted in this case disregarding seedlings because it was not the focus of the study to quantify seedlings along the streams. By definition, seedling stage is the duration when the embryo emerges from the seed and becomes independent of food reserve in endosperm by putting out the first roots and leaves (Cunningham, 2001). Inclusion of the seedlings in the study would need long study time due to their enormous number and would not give better results because they are more vulnerable to effects of disturbance regimes than adult and juvenile palms. Long term study is therefore required to include seedlings abundance and their survival rates which can help to make a further projection of palm population for the subsequent years and the expected impact along the streams in the area. In this study, palms with stem lengths of less than 1.0 m were taken as juveniles while those with stem lengths of more than 1.0 m were considered as adults. We also conducted questionnaire guided interviews and complete observation to collect data on biotic factors including palm usageand land-use activities, dispersal mechanisms and other disturbance regimes along the streams. We used random sampling and accessibility methods to sample out 47 interviewees in the area of which 12 were met along the three streams as they were engaged in different activities while 35 were interviewed from their homes. The 35 households were randomly selected from which one person per household was interviewed. Besides that, we studied fruits to see if they had been eaten by the wild animals and the extent of damage and this was done twice, in September (dry season) and January (wet season). We also investigated impact of disturbance regimes on the palm growth and survivorship of seedlings, juvenile and adults. To do this, we firstly fixed one large plot of 30m x 50m across each stream section within which we fixed 10 subplots of 15m x 10m each. Then we randomly selected 5 subplots of each stream section (middle section and lower section) where we marked all palms using numbered plastic labels tied to the innermost leaves.

RESULTS AND DISCUSSION

Palm abundance and distribution in each stream

We found Naiwale stream to have the largest number of adult and juvenile palms per kilometer of stream stretch (280) at the time of the study compared to Namikango (70) and Ntalikachawo (9) (Table 1).

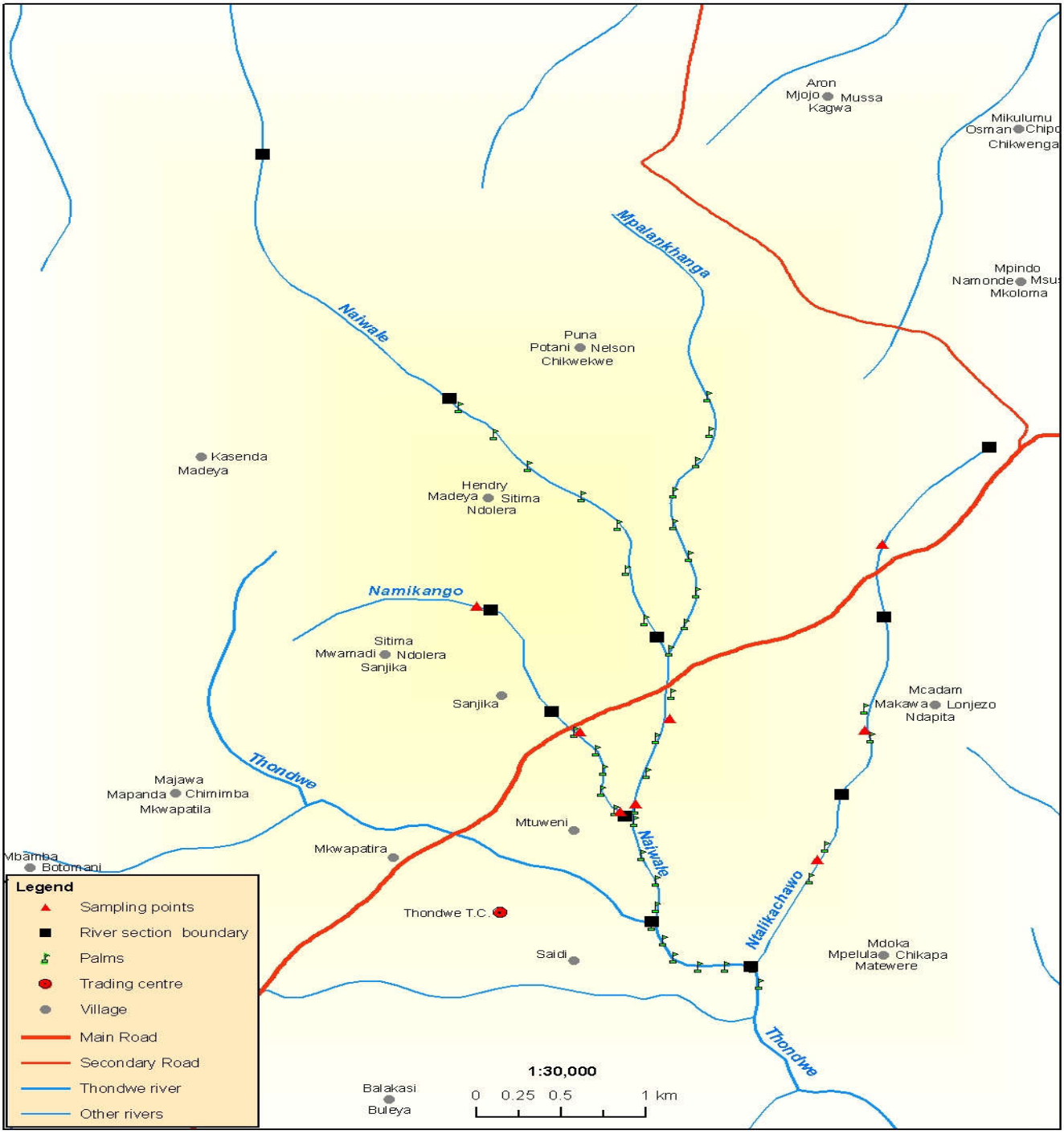

Figure 1. Map of the study area showing sampled sites of the streams and palm distribution

Table 1. Distribution of adult and juvenile palms along stream

River	Stream section	Length of stream section (km)	Number of *R.farinifera*			
			Adults	Juvenile	Total	Palms/1km stream stretch
Ntalikachawo	Upper	1.5	0	0	0	0
	Middle	1.5	5	10	15	10
	Lower	1.5	22	4	26	17
	Total	4.5	27	14	41	9
Naiwale	Upper	2.4	0	0	0	0
	Middle	2.3	645	356	1001	435
	Lower	2.3	640	320	960	417
	Total	7.0	1285	676	1961	280
Namikango	Upper	0.9	0	0	0	0
	Middle	0.9	11	10	21	23
	Lower	0.9	122	72	194	216
	Total	2.8	122	73	195	70

Table 2. Palm survivorship in sampled plots as a measure of disturbance regimes

Plot number	Plot location	Palm category	Number of palms in September	Number of palms by December	Total survival rate (%)	Disturbance regime observed
1	Middle	Adults	5	5	100	No disturbance observed,
	Ntalikachawo	Juveniles/ seedlings	22	22		
2	Lower	Adults	7	7	100	No disturbance, Garden
	Ntalikachawo	Juveniles/ seedlings	3	3		furrowed
3	Middle	Adults	10	10	73.9	Garden tillage, flood water,
	Naiwale	Juveniles/ seedlings	13	7		termites eating fallen fruits
4	Lower	Adults	12	12	100	Flood water, Prescribed fire,
	Naiwale	Juveniles/ seedlings	27	27		wild animals ate fruits
5	Middle	Adults	11	11	64.5	Garden tillage,
	Namikango	Juveniles/ seedlings	20	9		Flood water
6	lower	Adults	9	9	82.4	Flood water, wild fire
	Namikango	Juveniles/ seedlings	8	5		

The palm population was determined per one kilometer stretch of stream for better comparison as streams differ in length yet palms generally grow linearly along the banks of these streams. In all streams, no palm was recorded in the upper sections suggesting that palms have not spread to these sections or the conditions are unfavourable for their growth. The results also show that both middle and lower Naiwale had more palms compared to other streams. The observation is that middle and lower sections of Naiwale and Namikango are too close to each other to be geologically different as such, mineral composition is not the major reason for difference in palm distribution. By and large, it should be noted that organisms by nature interact in the ecosystem where they fight for resources such that the well adapted ones succeed in colonizing the habitat. Therefore according to Tilman's (1985), the resource-ratio hypothesis *R. farinifera* may be K-strategists, a character that might have enabled them to colonize and reach the succession climax in Naiwale stream first compared to other streams. This assertion however needs long term study to elucidate ecological changes in these streams. Since *Raphia* takes 20 to 25 years from seed germination to flowering time, it is likelythat they have inhabited Naiwale for more hundreds of years compared to other streams to reach such abundance. This long time maturity period is however a restriction factor for rapid replacement of the palms in the area as some of the adults have their tips cut off. Several disturbance regimes which differed from one stream to another were observed which could have affected growth of palms. The main disturbances in the area are anthropogenic in nature particularly soil tillage and burning of crop and other plant residues in the gardens (Table 2).

Ntalikachawo stream

The upper part of the stream comprises a few trees scattered along the stream, mostly *Syzygium* species and some *Eucalyptus*but no any palm species. The middle section is covered by grass mostly *Hyperhenia spp*and *Syzygium* trees growing in the banks. We observed that parts that are water-logged year round are fully covered by grass and some of these have small stands of *R.farinifera*, *Syzygium* and *Ficus* trees especially in the middle stream section. Different woody trees and shrubs occur in the lower section such as*Lantanacamara*, *Syzygium, Burkeaafricana*, bamboos, *Faidherbia albida and* other*Brachystegia*species. Palms in this lower section were observed to grow sparsely. Few anthropogenic activities were observed along the stream banks. We observed little gardening activities during the rainy season unlike in dry season in the middle and most part of the lower section of the stream but upper stream section had no any gardening activity.

Naiwale stream

The emergent canopy in middle and lower sections of this stream is dominated by *R.farinifera* while the sub-canopy consists mainly of shrubby members of the families well adapted to shady conditions. The lower part of middle section has astretch of palm forest which is characterized by reeds mingled with palm trees but the undergrowth including grasses was seen to be very minimal. Other plants found in the middle section include, *Lantana*, and *Ficus s*pp. The general pattern of *Raphia* distribution suggests that they out compete other plant species in the succession process.We also observed incidences of fire in the gardens in dry season but theireffect was of low magnitude, intensity and severity as evidenced by the regeneration of mostyoung palms that had just been burntafter three months. However this is not conclusive because the impact of fire was just studied in one season and in just few sampled areas. Tillage of the stream banks makes it difficult for perennial species to persist in gardens as a result, only seeds which settle in the stream have a chance to establish themselves. Juveniles and seedlings growing in the gardens were observed to have been removed after three months due to gardening activities. As the human population grows, there is an ever-increasing need for more land for agricultural expansion, resulting in continued loss of woodland on private and public lands as such there is extensive garden cultivation in middle section. Besides that, Agriculture is the main land-use practice and source of income to local people with maize as the staple crop hence there is reliance on land resource.We further observed that only old, tall and large palms persisted in most stream parts and that in most gardens there were no traces of palm seedlings or any evidence that seeds had germinated indicating the seriousness of the impact of land use activities on the survival and multiplication of the palm species along the streams. Land use activities in this section therefore restrict palms growth to the stream course. Land use activities in the lower section takes place slightly far away from the stream banks (10 m on average) as the stream is very steep, deep and narrow making it not ideal for garden cultivation. In lower section, the plots were therefore located in area without gardens hence land use activities had no effect thereby leading to high seedling/juvenile survival rate of palms growing on the streambeds (Table 2).

Namikango stream

The upper section of this stream comprises of a mixture of woody plants but the predominant ones being *Eucalyptus* and some *Lantana* species, and had some few gardens. In dry season the stream stops flowing in the upper and middle parts while it perennials in the lower section.

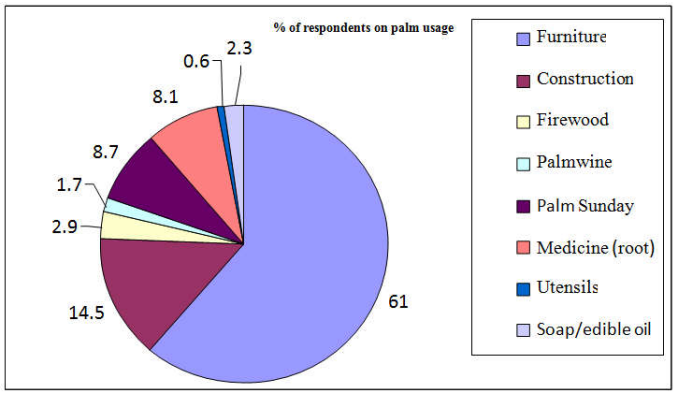

Figure 2. Pie chart showing major domestic uses of palms in an area

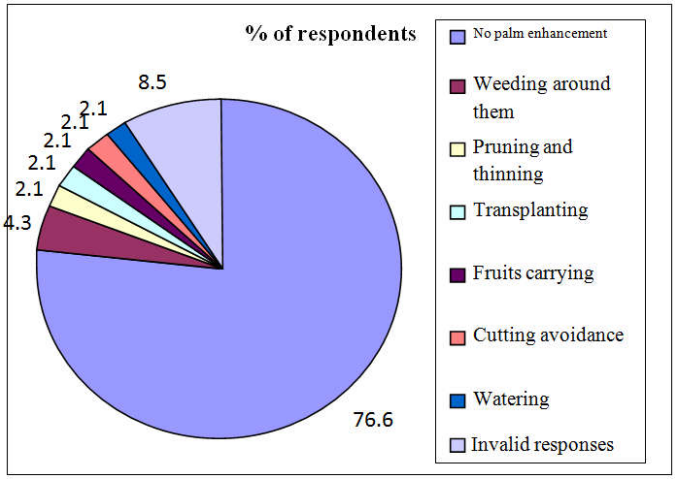

Figure 3. Pie chart showing human activities encouraging growth of palms in the area

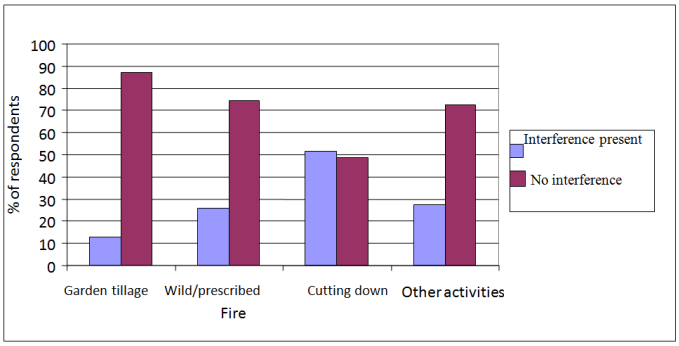

Figure 4. Graph showing main human activities interfering with palm growth

In rainy season water overflows in the gardens carrying some crops away but young palms growing along the stream banks were observed to have resisted the flood water. Palms were observed to be abundant towards the mouth of the stream in spite of the abundant gardens available there. Although fire burnt the palm seedlings, it was only the laminas which were burnt but the whole petioles were still fresh and in other seedlings the leaves were seen regenerating after three months. This implies that mild wild fires had no significant effect on the abundance of the palms in this stream.Juveniles and seedlings growing in the gardens were also observed to have been removed after three months. As a result, few or no seedlings and juveniles survive in the gardens in the middle section of the stream due to land use activities (Table 2). This shows that land use activity is one of the major causes of loss of young palms especially those growing in the gardens. In lower section the plots were located in area without gardens because the stream is deep and narrow hence land use activities had no effect as palms grow on the streambeds but wildfire damaged some seedlings.

Palm dispersal mechanisms by wild animals

Dropped fruits were observed to have been heavily eaten by termites and other animals, an action which may likely hinder seed germination. Mesocarps of fresh palm fruits in the lower section of Naiwale stream were observed to have been eaten by *Paraxerus* (bush squirrel) and *Cricetomys* (giant rat). These fruits were directly under the fruiting trees as well as some distance far from the tree base (longest being 20m) indicating that some animals help in fruit dispersal but to a limited distance. Although 21.3% of the respondents indicated that some relatively large animals citing Velvet monkeys, *Hamerkop*, *Paraxerus*sp and *Cricetomyssp* dispersepalm fruitsalbeit a limited role, it is unlikely that some observed animals like termites, *Paraxerus*sp and *Cricetomyssp* contribute to palm distribution because they eat these fruits on the spot thereby preventing them from germination and have small mouths which cannot pick palm fruits.

Palm dispersal mechanisms by people

People in the area especially children disperse palm seeds within and across streams as they play with fruits. Secondly, fruits are taken to their homes as decors whereas the unused fruits are thrown anywhere, exposing them to other dispersal agents. Besides that, 19.2% of the respondents indicated that Naiwale is the source habitat of palms while other streams are sinks At the intersection of Zomba- Blantyre road and Namikango stream where palms start growing in Namikango, the distance is so short between Naiwale and Namikango (about 0.5km) unlike between Naiwale and Ntalikachawo (about 1.0km), hence there is possibility of rapid and frequent transportation of palms from Naiwale to Namikango and vice vesa (Figure 2). There are a number of villages (6), hence more people between and along Naiwale and Namikango streams thereby reducing the dispersal barrier between these streams than between Naiwale and Ntalikachawo which has 3 villages. This being in line with Island biogeographic theory, people possibly reduce the hindrance that organisms (palm fruits) face in their transit from the source (Naiwale) to the sink habitats. In this case, near islands or sinks (Namikango) have higher immigration of organisms than distant ones (Ntalikachawo).

Impact of palm use on the survivorship and abundance in the study area

*Raphia*is important both economically and ecologically and not only provides a variety of resources for local people but also has attributes of a keystone species because it provides food for wild animals in ecological community during critical periods of the year (Ratsirarson, Silander and Richard, 1996). Palms are important at household as well as community level for basketry, construction purposes, edible oil, soap production, animal feed, medicine, parquet floors, palm wine, human food, cosmetics, decorating parks, cultural ornaments and religious activities(Omagor, 2012; Hogg *et al.,* 2013; FAO,1998; Ministry of Agriculture, 1998; Makoka Research station, 2003; Adekoya *et al.,* 2004; Sulymon,2005; Butler, 2006). In other places, palms like *R. farinifera* are involved in

various ritual uses within African ethnomedicine where they are used as sacred objects for offering and ingredients of medicine (Gruca *et al.,* 2014). In this study, nearly every person interviewed expressed knowledge of the importance of palms in the area andmost of them indicated thatmost adult palm trees have their leaves harvested for furniture(61% of respondents) and construction of house, toilets and kraals (14.5%) (Figure 2). *Raphia*leaves offers great potential for domestic market and sustainable utilization because many products result from collection of fruits and leaves which does not necessarily involve destruction of the entire plant. Since leaves of *Raphia* are used in various construction activities their cultivation needs to be expanded (Baldascini, 2002). In the area, most plant species are declining and becoming rare, threatened or endangered due to excessive human use therefore *R. farinifera*acts as an alternative resource with multiple function eventually putting it at risk of destruction. The research however could not establish relationship between palm use and abundance or distribution in the area as palm leaves are principally used. However there is great risk of losing this species in the area if there is great usage of seedlings and juvenile roots for medicines and usage of stems for construction, utensils and firewood as it has been observed now.

Human activities that enhance conservation and growth of palmsalong the streams

Since people utilize palms in the area, it was also essential to find out from them how they enhance the growth of these trees. As indicated in Figure 3, 76.6% of respondents indicated that humans do not enhance the growth of palms and there are no laid down conservation measures to be followed, 14.8% reported that people play different roles such as weeding, pruning and thinning, transplanting, fruit carryingand desisting from tree cutting to enhance their growth while 8.5% had no idea as such they gave invalid reasons. Most respondents indicated that they do not enhance palm growth because they naturally grow right in the stream course or bed which is not cultivatable. Furthermore few interviewees pointed out that they take part in palm seed dispersal and sometimes unintentionally in watering the fruits and seedlingstogether with garden crops.

Human interference with the growth and dispersal of palms in an area

Although the population of *Raphia*is probably stable inside the streams, extinction of the plant is likely a few metres away from the stream course or on the edge of palm stand because there is little or no recruitment of new palms to replace the older ones or damaged seedlings especially in the middle section of Naiwale and Namikango as people cut the plants, till the gardens and frequently burn the area to clear the gardens. Similarly, in other countries like Cameroon *Raphia* has been cleared from the gardens to pave way for vegetable cultivation (Asongwe, *et al.,* 2014). Although most respondents (72%) had the impression that people do not hinder the growth and dispersal of these plants meaning that they naturally grow and proliferate ecosystem on their own, cumulatively most indicated that human exert a lot of damage in a number of ways to palmswhile a few of them (28%) indicated that people directly interfere with the growth and dispersal of palms (Figure 4). The main activities theycited to have negative effectson the growth of *Raphia* include: setting wild and garden fires by surrounding people although it was observed that fresh fruits and seedlings survived the mild fire burn, cutting down palm trees for no apparent reasons, andseedlings uprootingduring gardening/tilling (Figure 4). The return time of fire as a disturbance is one year hence it really may not have much effect on the species as long as it is mild in nature. However, if the anthropogenic activities are not checked, the effects of these negative activities though less now may eventually become severe in the area in near future.Many respondents (52%) reported that cutting down of palms and leaf harvesting are the outstanding problems which may interfere with palm growth in the area. Some people indicated that garden tillage has little impact in most parts of the streams since the deep stream banks are not cultivated and most *Raphia*grow along the stream banks where most fruits fall into the stream and sooner or later they are carried away by water. Other activities leading to reduced number of palms include: high demand of palm furniture leading to many leaves and stems being cut off (4.2%), and destruction of surrounding natural forest(4.3%) leading to great pressure exertion on palms for domestic purposes. There is an ever-increasing need for more land for agricultural expansion in the area, resulting in continued loss of forest or woodland on private and communal lands. This unsustainable agricultural expansion threatens the conservation of this threatened R. farinifera and other endangered plants as well as animal species. Overexploitation of leaves for various purposes may have indirect and cumulative effects that may retard growth, reproduction or recruitment in palm population and potentially degrade or destroy the population (O'brien and Kinnaird, 1996). Generally, harvesting of palm leaves on land with no clear ownership has been a major problem in the area since collectors try to maximize the resource utilization but in the study area restrictive leaf harvesting was observed on palms growing in private gardens. If this scenario is not checked now there is high probability that the species will disappear both in private and public lands. Therefore the sustainable management of the streams and palms for both development and conservation will require strong and incorruptible institutions that will seek a balance between resource exploitation and conservation.It should however be noted that the reasons cited by people in this case do not give an explanation for the prominence of palms in Naiwale because around Naiwale and Namikango streams, there are more villagers to rapidly deplete natural forest than along Ntalikachawo yet it is not the case. Nonetheless, there has been no indication that Ntalikachawo previously had large number of palms in order to attribute its present low state in palm population to human interference on palm growth and dispersal. Palms were observed to be starting in the middle section of Naiwale and Mpalankhanga where two estates are located implying that they are well protected from destructive harvesting by the surrounding villagers. These trees are old, very tall with large girth and many old leaf scars unlike those down Naiwale and other streams indicating that they originated from this area although it is not well known how they were brought there and about their age. Naiwale stream therefore may be a source habitat of palms while Ntalikachawo and Namikango are sink habitats.

Conclusion and Recommendations

The study has found that human beings in the area are important players in palm distribution through anthropogenic activities and as fruit dispersal agents. Main anthropogenic

activities that negatively affect palm growth in the area include: cutting down of palm trees for various reasons, setting of fires in the gardens and bush, garden tillage and destruction of the surrounding vegetation.However, it is has been observed that *Raphia farinifera* form a steady system in the area with respect to mild disturbance regimes as indicated by their resilience whenever subjected to mild fire and leaf harvesting. As dispersal agents, adults carry fruits to decorate their homes and while children use them as playing items eventually disposing them elsewhere. Running water has also been found to be another important disperser of fruits down the stream due to their lightness in mass. The research results have further shown that Naiwale has got more *R. farinifera* because it is where they originated and started spreading downwards by mainly water and people. Namikango is having more palms than Ntalikachawo in its middle section where these palms start growing up to the lower section as it is closer to Naiwale unlike Ntalikachawo. Besides this, there are more villages hence more people between Namikango and Naiwale than between Ntalikachawo and Naiwale who enhance dispersal of palm fruits from one stream to another and within the stream.Because of this phenomenon, dispersal of palm fruits from Naiwale to Namikango is expected to be faster than to Ntalikachawo. Challenges to address conservation of *R.farinifera* include among others; management of surrounding forest plant resources in their wild habitats, the need for creation of awareness of the values and threats to these palms at various levels in the community, the need to improve on the quality of raffia products through training of the resource users, improvement in palm leaf harvesting practices and the need to support cultivation of these palms.

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