

# Traditional Uses of *Cyperus Papyrus* (L) and Associated Problems at Simiyu Fringing Wetland of Lake Victoria, Mwanza region, Tanzania

Josiah M. Katondo

National Environment Management Council

P.O. Box 63154

Dar Es Salaam

## Abstract

A study was conducted during 1999/2000 period with the view of determining: traditional uses; associated problems; and strategies for sustainable utilization of papyrus around Simiyu wetland fringing Speke Gulf of Lake Victoria, Tanzania. It involved field observations as well as self-administered questionnaire with 23, 39, and 17 mat weavers from Bugabu, Ilungu, and Nsola villages respectively. Results showed the local Sukumas apply traditional and adopted skills for commercial and non-commercial uses of papyrus. Most uses of papyrus are similar to those reported for ancient times in Egypt and elsewhere. Mat making is the main use, where fourteen different sizes of mats are made to satisfy customer preferences. Local Sukumas adopted matting during 1970s from Wajaluo and Wanyara, and this is considered family work as alternative source of income. The main problems include drowning, bites from mosquitoes and leeches, and scares from snakes, crocodiles, and hippopotamuses as well as conflicts among papyrus users themselves, fishermen, farmers and livestock grazers.

**Keywords:** *Cyperus papyrus*, utilization, problems, conflicts, Lake Victoria

## Introduction

A sedge *Cyperus papyrus* (L), commonly called papyrus or paper plant is a member of sedge family (Cyperaceae). Papyrus is an aquatic plant that has a woody, bluntly triangular stems and grows up to about 15 ft in quietly flowing water up to three feet deep. The stem can grow up to six centimetres in width near the top, while the bottom can portion can be up to six inches in width. The stem is composed of cellulose and lignin which helps maintain the plant structure. The stem has no true pith, instead it has inner cortex with vascular bundles scattered through it. There are also air ducts in the stem to help the plant stay buoyant. The roots are rhizomes and these spread over the water forming floating mat which sometimes break apart allowing the plant to colonise the new area. Papyrus reeds form vast stands in swamps, in shallow lakes, and along stream banks throughout Africa, and it also occurs in Palestine, Jordan River Valley, Sicily and other parts of the Mediterranean basin (Duke, 1983; Burnmeister, 2001). In East Africa, Lind and Morrison (1974) and Denny (1993) noted that wetlands around Lake Victoria support *Cyperus papyrus* as the main constituent of fringing swamps, where it grows either on waterlogged mud or float. Papyrus and other sedges have high ecological, hydrological, and economic values.

Various literatures show that *Cyperus papyrus* (L) has been very important in the economics of world. It was commercially used since 3600 BC for making papyri (i.e. papers made from papyrus) in Egypt, and later on adopted in Greece, Middle East countries and Roman Empire during the fourth of fifth century BC. It was cultivated for paper until 1100 AD and was used for literary works by Greeks and the Romans until the fifth century AD. The English word paper was derived from the Egyptian 'papyrus'. Papyrus has also been used to make sandals, fans, fences, huts, boxes, ropes, mats, cloth,

medicine, cordage, formal bouquets, funeral garlands, boats, and building materials. The pith and rhizomes were also boiled and eaten, and the rhizomes were dried and used for fuel (Lind and Morrison, 1974; Duke, 1983, Burnmeister, 2001). Recent studies conducted by Kew Botanical Garden (Anonymous1, 2000) further established that papyrus and other sedges are used throughout the tropics for basketry and mat weaving, and in parts of Africa and Asia they are cultivated for such purposes. They are also used for thatching, fencing, rope making, pot pourri and perfumery. Although papyrus was considered extinct and no longer used in Egypt (Lind and Morrison, 1974), recent reports show that the art and industry of making papyrus was revived in 1969, when large plantations were along the banks of Nile and nearby canals were re-introduced using papyrus imported from Ethiopia and Sudan (Michael, 2001). There are a number of papyrus products being made, and these include plain papyrus sheets, paintings, bookmarks, and papyrus colouring book (Solonika, undated). However, papyrus is widely distributed and utilized in central and eastern Africa (Lind and Morrison 1974; Denny (1993). In Uganda, Mafabi (1996) noted that papyrus is used around Lake George in Uganda for roofing material and screens. In Rwanda, papyrus is compressed into fuel briquettes with high calorific values.

In Tanzania, preliminary surveys conducted in fringing wetlands of Lake Victoria (Tanzanian side) during February-May 1999 by the author also showed that various local communities use papyrus for social and economic purposes. However, the status of such uses and economic benefits are not well known. It was therefore necessary that baseline information be obtained for use in developing strategies for sustainable utilization and management of papyrus and other wetland resources.

The present report is based mainly on the local knowledge of mat weavers, built up over decades of living in an area and using the natural resources. The report provides baseline information on important uses of papyrus, associated problems and perceptions on wise use. This information will help in developing strategies for sustainable utilization and management of papyrus at Simiyu wetland.

## **Objectives and Scope of the Study**

### **Objectives**

The present study aimed at achieving the following specific objectives:

- (a) To determine traditional uses of papyrus
- (b) To determine harvesting systems of papyrus and
- (c) To determine problems and conflicts on utilization of papyrus.

### **Scope of the Study**

The present study was carried out based on objectives of the Lake Victoria Environmental Management Project (LVEMP) and of the Wetlands Management Component. The LVEMP seeks among others, to maximize the socio-economic benefits from using natural resources found within the Lake Basin and to conserve biodiversity. The Wetlands Management Component aims to quantify the economic benefits from

wetlands products and devise management strategies for their sustainable utilization as well as to demonstrate their wise use.

In order to achieve these objectives, LVEMP identified, among others, the following activities under Sustainable Utilization and Management of Wetlands Products sub-component: (a) to survey extent and intensity of traditional methods of wetland utilization and management systems; (b) establish threats to wetlands; (c) develop strategies for rehabilitation of specific degraded wetlands; (d) develop guidelines for wetland wise use management practices that are compatible with the buffering capacity of wetlands; (e) evolve strategies for community participation in implementation of wise use which are acceptable to government, NGOs and other stakeholders; (f) establish and propose conservation methods/techniques to wetlands; (g) strengthen the capacity of local NGOs and CBOs to undertake wise use activities; (h) formulate strategies for community participation in the implementation of wise-use of wetlands; and (i) to initiate demonstration projects that illustrate wise use and management practices.

### **Study Area**

Simiyu wetland (Fig 1) is located along Magu and Bugabu Bays, on the southern part of Speke Gulf of Lake Victoria in Magu district, Mwanza region. It extends between 33<sup>0</sup> 23' 30" – 33<sup>0</sup> 28' 50" E and 2<sup>0</sup> 30' 30" – 2<sup>0</sup> 35' 00"S. The altitude of the swampy area ranges from 1134 to 1137 metres above sea level. The associated floodplains lies within 1143 masl. The wetland is fed mainly by Simiyu River whose tributaries (Simiyu and Duma) originate and drain parts of Shinyanga and Arusha regions. It is also fed by Salamida and Ilungu streams that discharge into Bugabu Bay. The wetland is bordered by Masanza, Nsola and Bubinza villages to the east; Itumbili, Magu and Ilungu to the south; and Bugabu village to the west.

According to Katondo *et al* (2001, unpublished), Simiyu wetland comprises of a diversity of habitats, including swampy area, rivers, ponds, floodplains, grassland, bushland, and rivers. The swampy area is dominated by *Cyperus papyrus*, and is associated by ferns, grasses, sedges, reeds, cattails and other plant species. The floodplains and drawdowns are used for agricultural purposes.

### **Methodology**

A combination of social and field observation methods were used in gathering data. The questionnaire used was designed after preliminary interviews with local stakeholders during the period January-June 2000. Common ideas were gathered, target group identified (i.e. mat makers) and appropriate period for data collection decided as July-August 2000. At these months, most mat weavers are mainly engaged in mat making and are readily available for interviews.

The questionnaire surveys were mainly self-administered, and involved local mat makers. Village leaders provided information on status of ethnic groups, administration, and population. Questionnaires were distributed to villages having many mat makers, i.e. Bugabu (23 datasheets), Ilungu (38), and Nsola (17) villages. Respondents having different ages groups (24 to 74 years), education, and experience on status of the

resource, were allowed to complete the questionnaire on their own, though in some cases Research Assistants assisted some respondents in filling the forms by interviewing them basing on the questionnaire.

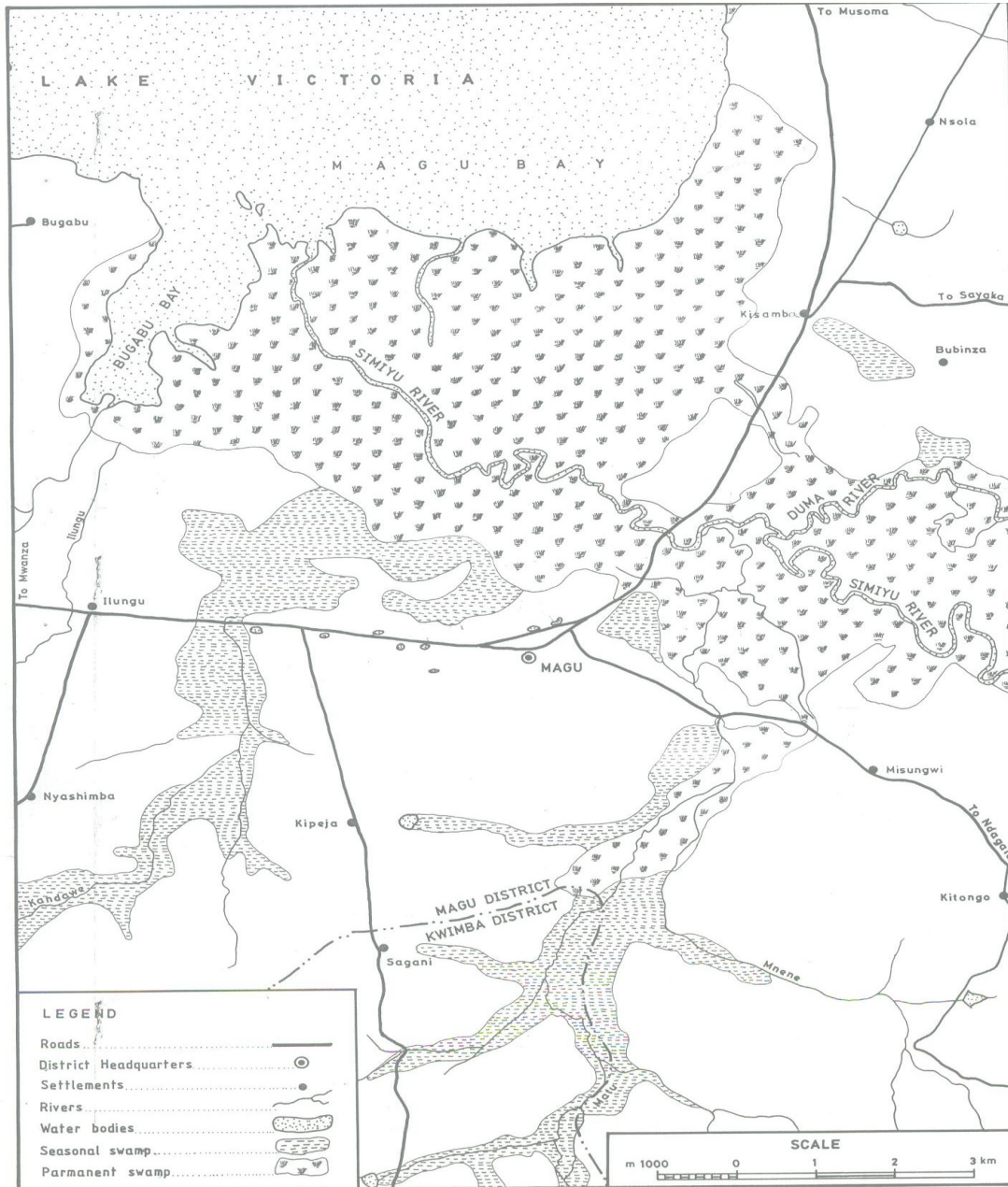


Fig. 1. Map of Simiyu wetland

Information was gathered on uses, methods of harvesting, and means of transporting the papyrus materials. Respondents were asked to identify problems and hazards that are encountered during harvesting of papyrus and degree of impact, i.e. frequencies of occurrence for six months period (January – June). Respondents were further requested

to identify conflicts that occur with other wetland users, i.e. farmers, livestock keepers, fishers, and fellow mat makers. Finally, respondents were asked to propose measures for sustainable harvesting and management of papyrus swamp, based on their experience on using the resource.

In addition, the author conducted personal interviews and field observations to supplement information gathered from self-administered questionnaires. Data collected were coded, summarized, and computerized in Excel software for easy analysis using ANOVA (two way without replication) and t-test (two tail assuming equal variance). Analysis was also done on the frequency of scores for various responses in order to get relative percentage values.

## **Results**

### **Traditional uses of Papyrus**

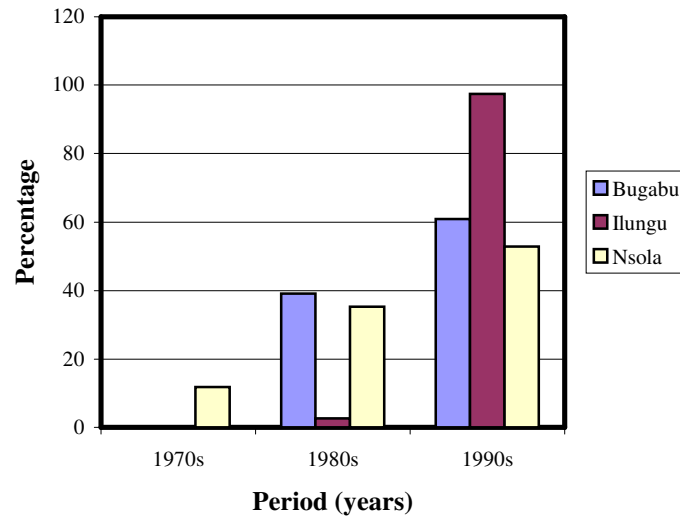
Utilization of papyrus around Simiyu wetland evolved from traditional skills as well as from influence of other tribes that lived in the area during 1960s and afterwards. Papyrus is used on both commercially and subsistence levels.

### **Commercial/Economic uses**

(i) **Mat making** Mat making using papyrus was not traditional uses by the ethnic communities around Simiyu wetland, though at present is the major economic use. Initially, the technology of mat making around Simiyu wetland was introduced by Waha and Wanyamwezi people who used a sedge *Schoenoplectus corymbosus*. (locally called malago or ndago) in making mats locally known as ‘vilago’. The local Sukumas also learnt from skilled weavers, who lived at Nsola and Bubinza, to make vilago for use as beds and seats. The technique of using papyrus to make mats around Simiyu wetland was introduced by Wajaluo and Wanyala tribes who immigrated into Nsola and Bugabu villages, and camped at Sangayika beach during 1960s and 1970s. The majority were fishmongers and they bought lungfish (*Protopterus aethiopicus*) for retailing in Kenya. These made mats for drying and pressing skinned lungfish for easy carriage during transportation. In addition, the immigrants also practiced fishing of *Labeo* spp., *Schilbe* spp., and *Synodontis* spp. The Luos and Wanyara used mats as beds and construction of shelters. The mats made were very attractive to the local Sukumas, who bought them for use as seats while grading harvested cotton and sleeping beds instead of hides. Later on the local Sukumas adopted the technique and started making mats for home uses. The Luos continued to make mats for commercial purposes until mid 1970s when lungfish catches declined. Villagization also forced them to leave the area and go back to their original home places. It was during this period when Sukumas took over and made mats also for sale to fellow villagers and customers from distant villages. Respondents showed that mat making around Simiyu wetland started in 1970s by only 2.5% of local existing artisans. About 20.3% started matting during 1980s and the majority (i.e. 77.2%) began in 1990s. Percentages of involvement of respondents at each village are summarised in Fig. 2, where it appears that Nsola and Bugabu villagers have relatively long period and experience of using the papyrus resource.

The procedure of making mats (locally known as ‘majamvi’) involves several steps. The

**Fig. 2: Period of starting mat making using papyrus around Simiyu wetland**



fresh and growing shoots of floating papyrus are harvested above their rhizomes, umbels of leaves removed, cut into pieces with pre-determined lengths of mats, split by removing rind or cortex from the pith, and left to dry in the sun within the swampy area for at least two days. Few producers take the fresh shoots to their homesteads or at the periphery of the swamp and do the same processing. The dry pieces are mended together with a special needle to the desired size of the mat. The margins are weaved by small ropes to make the mat durable and decorative. The final stage of mat making is trimming with a panga or large knife so as to give it rectangular shape. The mats are made at 14 different sizes to suit the interests of customers (Fig. 3). Local artisans use British system whereby the mats are measured in feet. The majority (49.3%) of artisans around Simiyu wetland prefer making mats of 21 square feet (3.5ft x 6ft), followed by 24.5 square feet (3.5ft x 7ft).

However, there are variations in each village. Size 21 sq.ft. is highly preferred in both Bugabu and Ilungu villages only. In addition Ilungu artisans make size 24.5 sq. ft and 30 sq. ft. In Bugabu sizes 8.75, 18, and 24 sq. ft are also made but in small quantities. The situation is completely different in Nsola village where size 7 sq. ft is most preferred, followed by size 15sq. ft. Others sizes are also made but by very few artisans as shown in Fig. 3.

ANOVA showed that there is no significant different among preferences of various sizes of mats in the three villages ( $F = 0.5857$ ,  $P = 0.5638$ ,  $F_{crit} = 3.3690$ ). In addition, the scores of sizes are not significantly different ( $F = 2.0213$ ,  $P = 0.0614$ ,  $F_{crit} = 2.1191$ ). Some weavers collect the piths for making soft mats, home fencing, and toilet/baths.

Papyrus mats are sold and used for various purposes. Analysis showed that 40% of mats made by craftsmen are sold to middlemen who transport the products for selling in various places in Mwanza and Shinyanga regions, whereas others mats are bought by individuals for direct use. Mats are mainly used as beds (31.2%) and seats (11.9%) during cotton sorting at homesteads. Some mats are used for building business huts (as temporary local restaurants or pubs), for fencing of homes and permanent business huts, and as ceiling and curtains in houses.

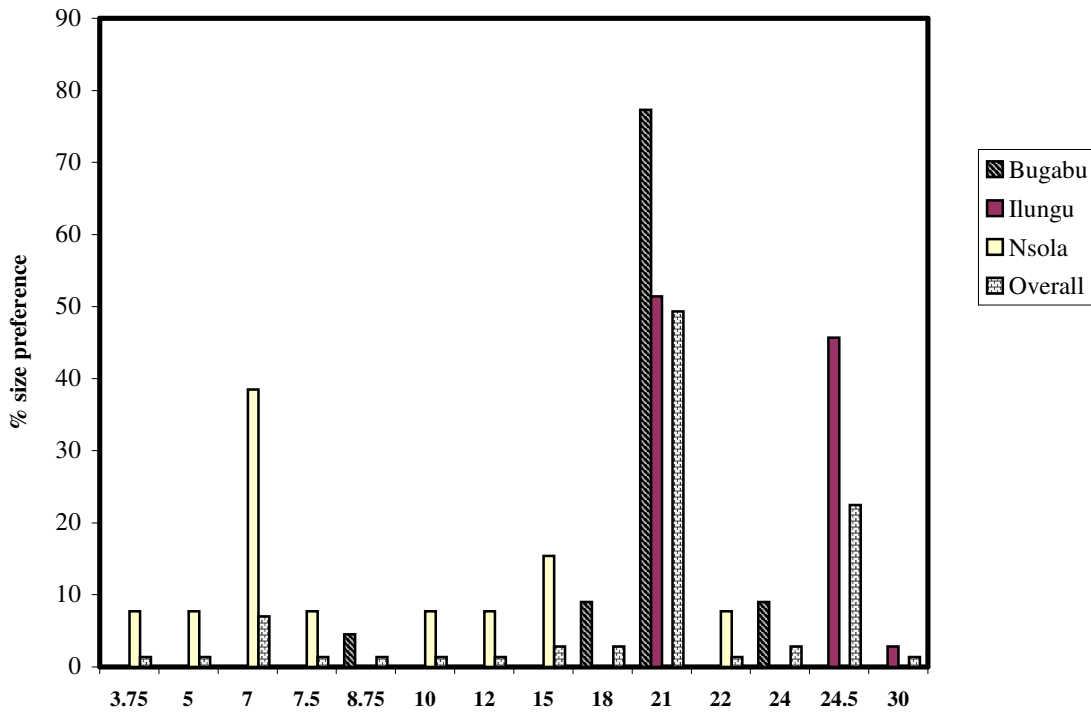


Fig 3: Comparative sizes of mats made in different villages around Simiyu wetland<sup>1</sup>

Petty businessmen buy a few mats for use as carpets while vending their items. ANOVA for scores showed there is no significant difference in types of uses ( $F = 1.6752$ ,  $P = 0.1946$ ,  $F_{crit} = 2.7641$ ). There is also no significant difference ( $F = 0.4612$ ,  $P = 0.6397$ ,  $F_{crit} = 3.7388$ ) in perception of mat makers on various uses of mats bought by customers.

<sup>1</sup> [Key to sizes in feet: **3.75**=1.5ft x 2.5ft; **5**=2x2.5; **7.0**=2x3.5; **7.5**=2.5x3; **8.75**=2.5 x3.5; **10**=2x5; **12**=3x4; **15**=2.5x6; **18**=3x6; **21**=3.5 x6; **22**=3.5x6.5; **24**=3x8; **24.5**=3.5x7; **30**=5x6]

## **(ii) Packaging materials**

The technique of making these materials from papyrus was introduced in 1962 by a local herbalist who immigrated into Ilungu village from Bukumbi area, Missungwi district. Bukumbi is located along Mwanza Gulf and has large fringing papyrus swamps. Although weavers at Ilungu village make these packaging materials, the famous weavers are from villages that are situated far away from the wetland. These villages include Salongwe (Ngwamabanza ward) and Mwatelesha (Nyigogo ward). In the past, local Sukumas used *Pennisetum purpureum* (mabingobingo) for making the same product, but nowadays these plants have disappeared or are inadequate.

The procedure involves harvesting fresh shoots, splitting, and drying. The dry raw materials are soaked prior to weaving. Soaking makes the materials more flexible while weaving. These products are mainly sold to fishermen and fishmongers for carrying fish to marketing sites. The products are also bought by farmers for carrying cotton and tomatoes. Different shapes and sizes are made to suit interests of customers. Ilungu village and Magu town are main marketing centre of packaging materials.

## **(iii) Broom making**

Broom making using papyrus started recently and is done by few people at Bubinza village. The umbels are cut and weaved to produce brooms. The brooms are believed to have long shelf life compared to others made from grasses. Many brooms are transported for sale to Bariadi town in Shinyanga region.

## **Non-commercial uses**

### **(i) Fuel wood**

Dry shoots of papyrus are simultaneously harvested for fuel wood, while harvesting fresh ones for mat making. The shoots are used due to severe shortage of alternative source of fuelwood around Simiyu wetland. In addition to dry shoots, some peasants cultivating in the swampy areas where papyrus dominate collect rhizomes (locally known as makoni) for fuel wood. These rhizomes have been found to possess high calorific value that sometimes even destroy cooking utensils.

### **(ii) House construction**

Papyrus shoots are harvested, dried and used for building traditional houses. The shoots are mainly used as purlines at the roof and walls. In some cases the shoots are weaved and used as windows and doors. Few people thatch their houses with papyrus.

### **(iv) Ropes**

Immature papyrus are harvested and their rinds stripped off, dried and used as ropes. These ropes are used in house construction and tying luggage.



#### **(v) Fencing**

Some households use papyrus to make fences around their homes. This is common at Nsola.

#### **(vi) Utensils**

Rinds of papyrus are used in making local bowls known as matangwa, makelelejo, masonzo, and luungo. However, the production of these utensils has declined during recent years.

#### **(vii) Medicine**

The dead and partially decaying shoots, which float in water, are collected for medicinal purposes. They are mainly used in treating pregnant women.

#### **(viii) Cooking**

The piths are taken, cut into small pieces and used as support to foods (especially fish) cooked in utensils and pots. The pieces of pith are normally placed at the bottom of the utensils or pots and then fish put on top of them so as to prevent scotching while the food is boiled or cooked.

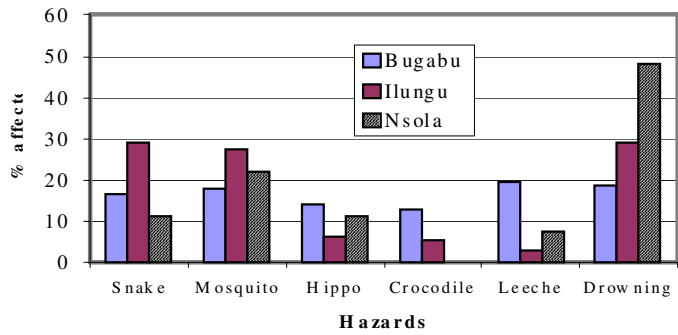
#### **Harvesting systems**

About 81.3% of mat makers have no specific sites for harvesting the papyrus materials. Only 18.7% regularly harvest the papyrus from specific areas within the swampy wetland. This practice was also observed during field observations at Mtaloni area, Ilungu village where harvesting was done randomly resulting in patches of harvested and vegetated areas. Harvesters targeted areas with pure stands of papyrus, and in most cases moved over 100m further inside the wetland. The majority, i.e. 96.1% of local artisans transport the raw materials from the wetland to their homes by head. Only 3.4% use both heads and bicycles in carrying papyrus materials to their homes. The majority (84.5%) of craftsmen involve family members in harvesting, processing, transportation, and weaving of mats.

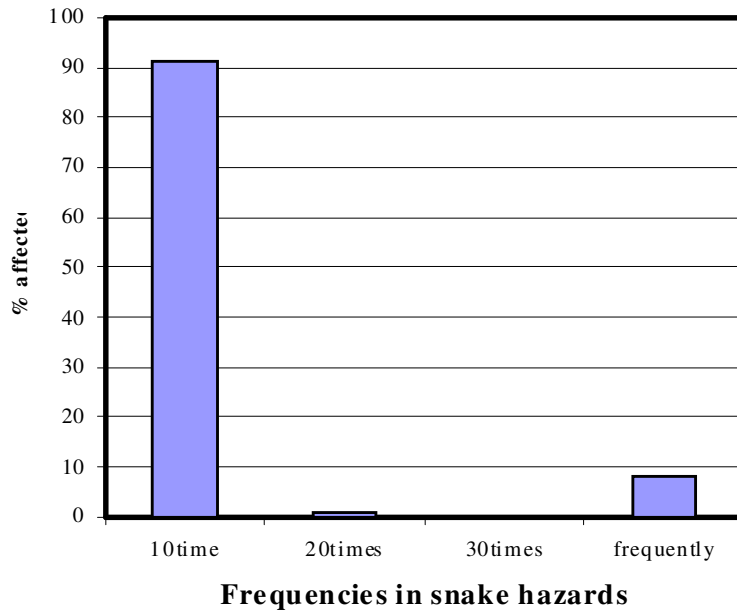
#### **Hazards during harvesting of papyrus**

Analysis showed that the main hazards and their relative impacts around Simiyu wetland are drowning (32%), mosquito bites (23%), snakes (19%), Hippos (10%), Leeches (10%), and crocodiles (6%). Fig. 4 shows perception of impacts in three villages. ANOVA showed that there is significant difference ( $F = 6.1606$ ,  $p = 0.01804$ ,  $F_{crit} = 4.1028$ ) in perception of impacts of these hazards in the three villages. However, the relative impacts or scores of each hazard are not significant ( $F = 1.9888$ ,  $p = 0.1671$ ,  $F_{crit} = 3.3258$ ).

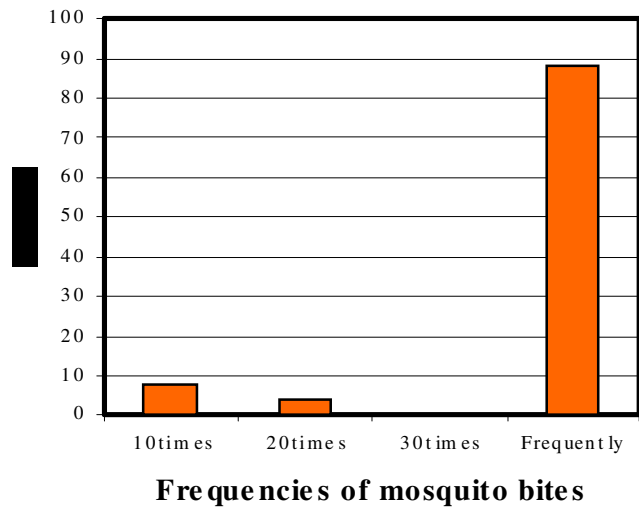
**Fig. 4 Perception on relative impact of hazards around Simiyu wetland**



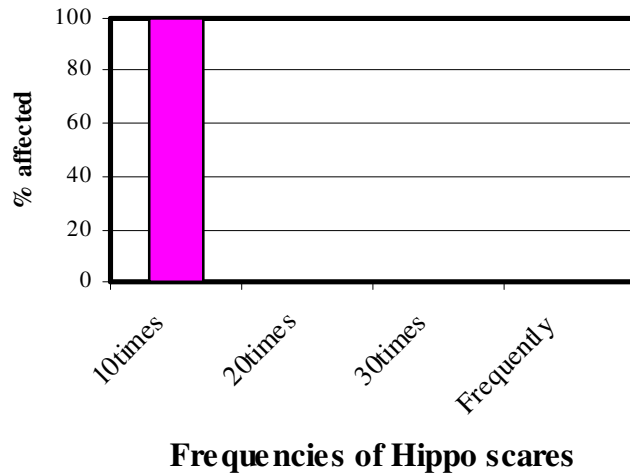
**Fig 5a: Overall impacts of snakes encounters**



**Fig. 5b: Overall impacts of mosquito encounters**



**Fig. 5c: Overall impacts of hippo encounters**



### 5d: Overall impacts of crocodile encounters

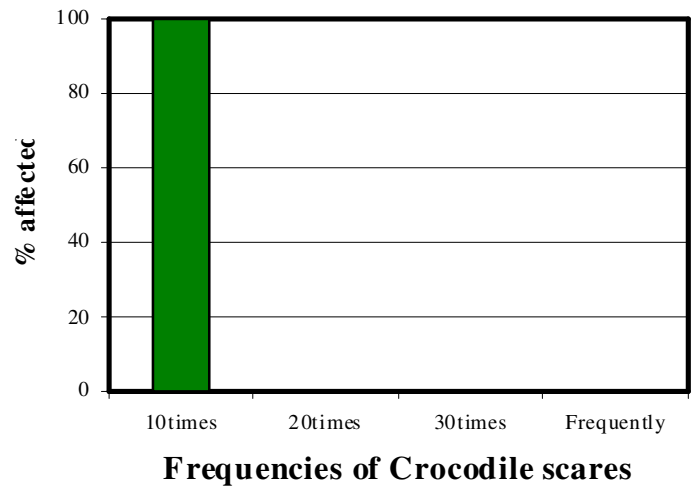
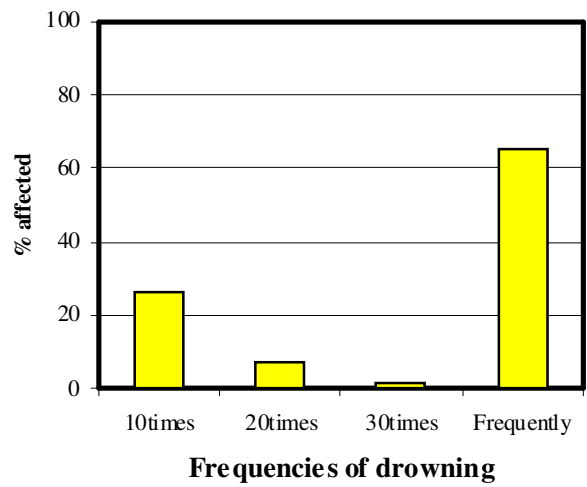
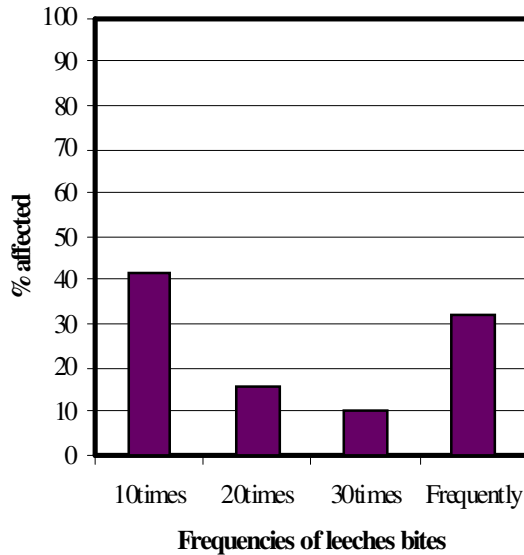


Fig. 5e: Overall impacts of drowning at Simiyu



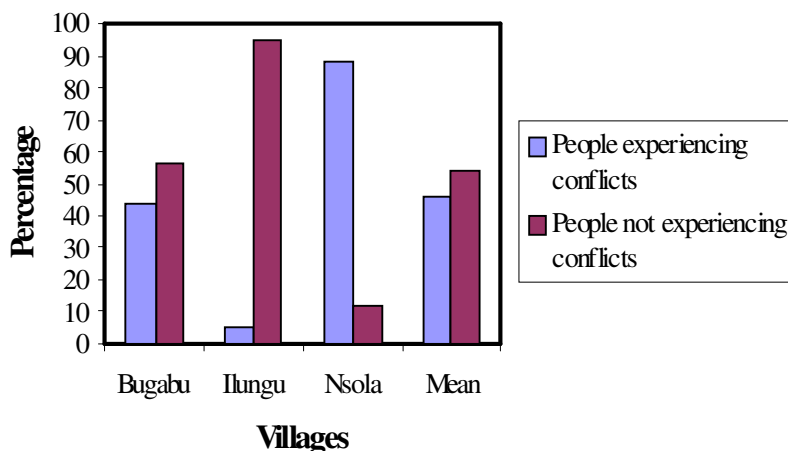
**Fig. 5f: Overall impact of leech encounters**



Drowning during harvesting of floating papyrus mats is common due to loose nature of floating papyrus mats. Measurements of water depth at Mtaloni area, Ilungu village in July 2000 showed depths ranging between 2.4 and 3.0m

Analysis for the period January – July 2000 showed that problems or hazards occurred at varied degrees (Tables 5a to 5f). Drowning affected a wide range of artisans. About 65% of artisans encountered frequent drowning, whereas 27% got drowned up to 10 times. About 7% and 2% faced the same problem up to 20 and 30 times respectively. Mosquitoes affected 88% of artisans frequently. Mosquitoes affected about 8% and 4% up to 10 and 20 times respectively for seven months. About 91% of artisans encountered snake hazards less than 10 times for seven months. Snakes affected 1% less that 20 times, and 4% had frequent conflicts with snakes at Simiyu wetland. Snakes commonly found in the wetland include pythons and green mambas. Hippopotamus and crocodile threats to artisans were less than 10 encounters. However, only few people were affected. Hippos become furious and aggressive when harvesters approach breeding and hiding areas of these animals. Sometimes young calves prefer following and teasing intruding people. Its mother usually grunts, and sometimes chases away intruders. Crocodiles are encountered when harvesters go deep into shallow swamps where these animals rest sunbathing during the daytime, or are in their nesting habitats. However, there has been no casualty from hippos and crocodiles. Leeches also inflicted various hazards to artisans. About 42% were bitten up to 10 times, whereas 16% and 10% were affected up to 20 and 30 times respectively. These invertebrates bit a total of 32% frequently. Harvesters reduce impacts of bites by smearing petroleum jelly on legs so that leeches fail to stick and penetrate their suckers into the skin.

**Fig. 6: Perception on existence of conflicts on utilization of wetland resources**

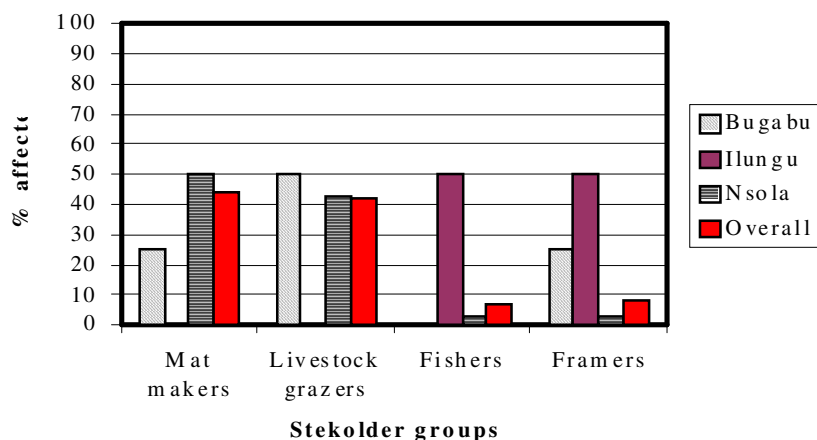


### Stakeholders conflicts

Figure 6 shows the sources of conflicts between mat makers and other wetland users. The main conflicts come from fellow artisans (44.4%) and livestock keepers (41.7%). This is highly applicable in Nsola village. At Ilungu, fishermen and farmers were identified as the only sources of conflicts. In Bugabu, conflicts occur with artisans, livestock keepers and farmers. ANOVA showed that the degrees of conflicts are not significantly different among in the three villages ( $F = 3.1193$ ,  $p = 0.1178$ ,  $F \text{ crit} = 5.1432$ ). The scores of the various impacts are also not significantly different from one another ( $F = 0.9659$ ,  $p=0.4677$ ,  $F \text{ crit} = 4.7570$ ). Analysis in Fig 7 shows that about 46% (range 5.3 – 88%) of mat makers utilizing Simiyu wetland conflict with other stakeholders, whereas 55% (range 11.8 – 94.7%) do not. Analysis for each village show that relatively large number of artisans at Nsola get frequent conflicts, followed by Bugabu. At Ilungu, mat makers experience rare conflicts with other stakeholders. At Bugabu, the majority (i.e. 50%) of artisans conflicts with others whereas at Nsola, the majority (88.2%) are getting frequent conflicts with other wetland users. T-test for scores also confirmed the perceptions on conflicts are not significantly different (i.e. are more or less the same) in the three villages ( $t \text{ stat} = -0.7470$ ,  $P (T < t) \text{ two tail} = 0.4965$ ,  $t \text{ crit two tail} = 2.7764$ ).

Conflicts with both fishermen and farmers are due to burning of the swamp, in which case the fire guts prepared cut materials and are deprives the artisans of other potential harvesting papyrus materials. Conflicts with livestock grazers are caused by damage to harvested raw materials (papyrus). At Bugabu harvested papyrus are usually left to dry at the drawdown, just close to the swamp. At Ilungu, some harvesters leave the prepared materials close to the Mtaloni track in the swamp. Both areas are susceptible to cattle that grazed or pass-by within the target area.

**Fig. 7 Comparison of perceptions on conflicts in various villages at Simiyu wetland.**



## DISCUSSION

The results obtained shows that Simiyu wetland is inhabited by local Sukumas who are administered by different ward and division leaders. The local Sukumas learnt the importance of papyrus and adopted it as a source of income from other tribes that lived in the area. Papyrus has multiple socio-economic values on which local communities are increasingly dependent for earning their income as well as meeting other social needs. People of different ages and education levels appreciate the value of papyrus, and its usage is increasing among local communities. Mat makers make the mats with full knowledge of their uses, and this enables them to make mats and packaging materials of different sizes to suit interests of customers. There is therefore need to improve the quality of craft goods made of papyrus so as to increase net income to those involved in the business. Most of the usage of papyrus, like matting, thatching, fencing, huts, ropes and medicine are similar to those reported in ancient Egypt, Roman Empire, and elsewhere (Lind and Morrison, 1974; Duke, 1983; Anonymous, 2000, Burnmeister, 2001). There is also need to introduce other usage of papyrus, such as making ornamental goods.

It was interesting to note that papyrus at Simiyu wetland benefits craftsmen from remote villages, thus rendering the wetland to possess great extrinsic value. Usage of papyrus shoots and rhizomes as fuel-wood calls for further investigations into the possibility of making energy briquettes, as practiced in Rwanda (Kabii, 1996). Utilization of papyrus for medicinal purposes also calls for further investigations so that many people can benefit from this abundant plant. Duke (1983) reported that in historical times (i.e. up to 200 AD) papyrus was used to cure many diseases. The pith was recommended for widening and drying of fistula; the ash of burnt papyrus sheets was used for certain eye

diseases and checking malignant ulcers from spreading in the mouth or elsewhere; plant macerated in vinegar and burnt the ash heals wounds and cancer. In addition Duke (1983) has provided other usage of umbels that can be adopted by local people around Simiyu. According to Duke, the umbel impressions were often used as handles doe mirrors, fans, doors, chairs, and various household furniture. The usage of pith was somewhat different from what the ancient Egyptians did. The pith in the stem was dried up and used for fuel, or boiled and eaten (Solonika, 2001). In addition, the starchy rhizomes and lowermost parts of the stem were cut off and consumed raw, boiled or roasted. They were also chewed, sucked, and spit out much as sugarcane is done today (Duke, 1983).

Hazards affecting harvesters of papyrus in Simiyu wetland are an indication of interference with ecological requirements wetland fauna. Problems with hippos, snakes, and crocodiles results from harvesters encroaching home ranges and feeding habitats of these animals. Nowak (1995) reported that hippos prefer areas of deep (at least 1.5m) permanent water such as lakes and rivers with adjacent reedbeds and grasslands. Anonymous<sup>2</sup> (undated) noted that female hippos protect young from predators (e.g. crocodiles). Young hippos are also protected from male hippos that usually attack them in water, but not on land. Therefore, at Simiyu wetland, female hippos may be forced to hide in the papyrus swamp with its young in order to avoid such threats. At Simiyu wetland, harvesters frequently note the young tend to follow and tease human beings within papyrus swamp. When this happens, the mother charges towards the harvesters, thus preventing them from getting the materials. Crocodiles also prefer staying in water, and come on land to sunbath during morning hours. However, the conflicts could arise from the breeding habits of these reptiles. Studies conducted elsewhere (e.g. Britton, 2002 and Anonymous<sup>3</sup>, undated) showed that female crocodiles come onto land and dig a nest hole far enough away from the water to avoid any potential flooding. The eggs are laid and covered with sand and debris. During incubation period of 2.5 to 3 months (70-100 days) the mother makes frequent trips to her nest, watching it carefully for the many creatures which prey on crocodile eggs. Sometimes, females remain near the nest at all times. After hatching, mothers take their young to backwater areas of the lake or river and protect them for up to two years. At this age, the young move off to be independent, but they still must avoid predation from the larger or older crocodiles. Therefore, conflicts at Simiyu wetland arise when human beings interfere with breeding habitats of crocodiles.

Continued disturbance of harvesters will ultimately affect the survival of these faunae. Population of these animals may be affected due to emigration and changes in feeding and reproductive successes. On the other hand, disturbance of animals to papyrus harvesters will also affect production of mats, where few mat makers can get little materials, and hence produce less mats. Studies are needed to identify and designate potential and hotspot areas for hippos and crocodiles, so that specific areas for harvesters can be established outside home ranges of these animals.

Mosquitoes and leeches use the papyrus swamp as shelter or living habitat. They breed and feed on blood from animals and birds living in the swamp. These invertebrates are opportunists: they bite any animal coming into their habitat, including humans. Bites from mosquitoes and leeches need to be controlled through use of protective gears such as chest-waders. The main problem remains with drowning or slipping of harvesters



through papyrus cover. Though no casualty has been reported but the risk is high. Regular burning of the blanketing dead vegetative matter aggravates drowning, and measures should include prevention of deliberate fires and wearing of life jackets.

Conflicts experienced during harvesting of papyrus at the wetland is a reflection of differences in personal interests as well as perceptions on values accrued from the wetland. Farmers, fishers, and herdsman prefer burning the wetland so as to achieve their desires. Herdsman also bring livestock to water or graze on abundant grasses in the wetland particularly during dry seasons because they do not have any other alternatives. Conflicts associated with wetland degradation need to be considered seriously, and wherever possible measures to eradicate the problem should be sought. Pirot *et al* (2000) noted that within the area, many communities may use the system for different purposes whereby some uses may be compatible with the constraints of the system and other may not. Pirot *et al* further learnt that conflicts always arise among such groups and cannot be solved through understanding of the ecosystem alone; the solution lies in understanding how different societies interact with the systems within which they live.

In order to ensure that papyrus is used sustainably several strategies have been identified (Katondo, 2002, unpublished). These strategies include prevention of deliberate burning of wetland, awareness campaigns and training seminars on environmental conservation to other wetland users (farmers, herdsman, and fishers) and developing land use plans. Other measures include establishment of rotational harvesting system, establish wetland conservation areas, provide protective gears to harvesters, and regulatory mechanism to prevent further degradation of wetland macrophytes.

## **Conclusions**

Studies have confirmed that papyrus is used at commercial and subsistence levels. Commercial uses enable local communities to supplement their income, thus making Simiyu wetland a very important economic source to local craftsmen from within and beyond. Strategies for sustainable utilization and management of papyrus should be developed based on ecosystem management approach. Utilization of papyrus is associated with many hazards that require improved methods of harvesting and conservation of wildlife such as snakes, crocodiles, and hippopotamuses. Utilization is also associated with conflicts and this requires collaborative dialogue on land use planning among wetland users, including craftsmen, farmers, fishers, and herdsman (livestock grazers).

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