

Emerging Local Economic Dynamics Shaping the Transformation and Use of Wetlands for Brick Making in Goma Sub-County, Mukono District, Uganda

M. Buyinza, C. Khainza and M. Bukenya

Forestry and Nature Conservation, Makerere University, P.O. Box 7062, Kampala, Uganda

Abstract: As the human population increases, the demand for utilization of wetlands for agricultural and industrial production will also increase. A study to explore the socio-economic factors that influence the household dependency on brick making in wetlands was carried out between June-August 2005 in Goma sub-county, Mukono district, Uganda. Semi-structured questionnaires were administered to 50 randomly selected respondents. Results from the maximum likelihood estimation of a logistic regression model suggest that the factors that there is a high rate of dependency on brick making and household income where by the poor households depend more on brick making. Several household level factors such as distance to the wetland, age, landholding and the level of education significantly affect the dependency to brick making industry. The sustainable utilization and conservation of wetlands will be generally greatly enhanced if the local communities are actively involved in the sustainable management of the wetland resource since their livelihoods directly depend on them.

Key words: Brick making, employment, income, dependency, population, socio-economic

INTRODUCTION

Human wellbeing and sustainable development are vitally dependent upon improving the management of earth's ecosystems to ensure their conservation and sustainable use (Zedler and Suzanne, 2005). Where, as the demands for ecosystems services such as food and clean water are growing, human actions are diminishing the capability of many ecosystems to meet these demands. Ecosystem services contribute to achievement of some of the Millennium Development Goals (MDGs) such as poverty alleviation, clean water and sanitation for all and environmental sustain ability. Their vulnerability to shocks and stress results to increasing future costs to water investors thus, leading to failure to meet MDGs (Buyinza and Nabalegwa, 2008a). As population grow and people's expectation increase, the pressure on ecosystem and their resources services also increase. This put two major roles of ecosystem services of sustaining human livelihood and upholding the quality of environment under threat (Buyinza *et al.*, 2008).

Wetland ecosystems account for about 6% of the global land area (Dugan, 1990). In Uganda Wetlands cover 13% of the country's total area (Buyinza *et al.*, 2008). Uganda's wetlands are geographically widespread across the country, rendering them easily accessible, exploited and degraded. Wetlands are among the earth's

most productive ecosystems. They have been described as the kidneys of the landscape because of the functions they perform in the hydrological and chemical cycles and biological supermarkets, because of the extensive food webs and rich biodiversity they support (Babier and Thompson, 1998). Wetlands also provide numerous goods and services of local, regional, national and international importance, thus representing considerable ecological, social and economic values (Loomis *et al.*, 2000).

Globally, wetlands have experienced severe losses, mainly through conversion to other uses (Owino and Ryan, 2006). In Uganda, wetlands have experienced serious conversion over the last 40 years (Buyinza *et al.*, 2008). Converted wetland area has increased about 99% from 16 km² (0.05%) in 1964-2.471 km² (8%) in 1995. This represents an annual conversion rate of 3%. The problem wetlands conversion has reached unprecedented levels, for example in Eastern Uganda alone about 1.736 km² (20%) of wetlands has been converted to other uses compared to 8, 6 and 3% in the Western, central and Northern regions of the country, respectively (Buyinza and Lusiba, 2006).

Wetlands conversion to agriculture contributes to the local and national economy. Karanja *et al.* (2001) estimate the net economic value of Pallisa district wetlands at 1.221 billion Uganda shillings (789 million US \$)

per year, of which crop cultivation accounts for 2.4%. Emerton *et al.* (1999) estimates the value of Nakivubo wetland at 2 billion Uganda shillings a year, with crop cultivation contributing about two thirds of the value of resource utilization activities.

MATERIALS AND METHODS

Description of the study area: The study was conducted in Goma Sub-county, Mukono district located in Central Uganda, on the shores of Lake Victoria. The sub-county is located in the central part of the district at longitudes 32° and 36°E and 33° and 5°E and latitudes 00° and 1°3'N Atlas to Uganda 1967. The district has an area of 14,142 km² with about 807,923 persons and has a high urbanizing rate of 16% compared to the national average of 12% (Buyinza and Lusiba, 2006). The rainfall pattern is bimodal March to May (long rains) and September to November (short rains). The land use patterns comprise open waters and wetlands (67%), forests (3%), intensive agriculture (16%) and smallholder farming (17%). The geological conditions in Mukono support tropical rain forests, medium altitude forests, wooden savannah and grassland. A tropical type of climate therefore, characterizes the sub-county and this climate provides a good potential for investment in cash and food crop, horticulture and floriculture on a commercial basis. The mean annual rainfall is 1100 mm, with peaks in March-May and September-November. Temperatures range between 16 and 28°C throughout the year.

Agriculture is the main land use activity comprising intensive sugarcane, tea and cocoa plantations by large companies and extensive subsistence small-scale farming. There is high degree of dependency on agriculture as a source of food though the surplus is sold to earn income. Food crops grown include; maize, beans, bananas, sweet potatoes and cassava. Major cash crops grown include; coffee and vanilla, which is intercropped with bananas. However, it is important to note that brick making is practiced in almost all the parishes as a means of obtaining extra income. Animal husbandry is also practiced and the animals commonly reared include; goats, cattle, pigs, sheep and poultry especially hens and ducks.

Data collection methods: A random sample of 50 respondents was selected and interviewed using questionnaire. The questionnaire sought for the socio-economic characteristics of respondents, factors that determine household dependency on brick making in wetlands. Key informant interviews and focus group discussions were held with the local community to assess

their collective views on wetlands and brick making. Desk review was also done to assess the relevance of the existing policies and laws, policy documents and laws in order to acquire an in-depth understanding of the underlying causes and effects of wetland utilization by local community. The data on the respondent's education, age, duration of residence, household size and other socioeconomic information were collected.

The data obtained from structured questionnaires were coded and tabulated based on study objectives. Binary logit model was used to assess the factors that influence brick making in wetlands. A logit model instead of ordinary linear regression in this particular case was chosen because of simple interpretation of the fitted models using odds ratios. Table 1 shows the predictor variables used in the analysis. Each variable was evaluated relative to its contribution to the model and therefore, each variable was assessed by what it adds to the prediction of the dependent variable that is different from or over and above the probability provided by all other independent variables. It is therefore, possible for a variable to appear unimportant in the model when it is actually highly correlated with the dependent variable.

The hypothesized relations between the predictor variables and brick making are shown in Table 2. A plus sign designating an increase and a minus sign designates a decrease. Given the great level of similarity in biophysical factors of wetlands such as availability of water and soil fertility being among the reasons for cultivating in wetlands, other factors considered to cause variations in brick maker's use of wetlands include: land, sex, age and residence among others. When lack of land as a major reason for wetland utilization is used as an outcome variable in the analysis, it captures variations in the different characteristics of brick makers measured.

Sex: It has been reported that in sub-Saharan Africa that due to gender bias in land allocation and inheritance systems do not favour women in owning land. Furthermore, in most cultures women have no right to owning crops because they do not own the land. Therefore, it is hypothesized that gender would be positively related to wetland utilization.

Age: It is hypothesized that with increasing age, a brick maker is less likely to participate in wetland utilization. We expect the age to have a negative relationship with wetland utilization.

Household size: More household members stimulate greater demand for crops for household consumption

Table 1: Predictor variables and descriptions

Variables	Description
Age	Age of brick maker; 1 if >40 years old, 0 otherwise
Sex	Sex of brick maker; 1 if brick maker is male, 0 if female
Household size	Household size: 1 if <4 members, 0 otherwise
Education	Education level, 1 if >7 years of schooling, 0 otherwise
Income	Sources of income, 1 if office job, 0 otherwise
Residence	Brick maker residence, 1 if close proximity, 0 otherwise
Settlement	Population in area, 1 if number has increased, 0 otherwise
Brick making land	Amount of land used for brick making, 1 if >2 acres, 0 otherwise
Type of land	Type of land owned by brick makers, 1 if private, 0 otherwise
Cultivated land size	Amount of land owned, 1 if >2 acres, 0 otherwise
Land ownership in area	People who own land in area, 1 if many, 0 otherwise

Table 2: Expected associations of predictors to reasons for wetland utilization

Predictor variables	Reason for wetland utilization
Age	-
Sex	+
Household size	+
Education	-
Income	-
Residence	-
Settlement	+
Brickmaking land	-
Type of land owned	+
Landownership	-
Landholding size	-

+/-: Sign indicates the anticipated direction of the relation between the predictor and wetland utilization

Table 3: Results from the maximum likelihood estimation of a logistic regression model

Variable	Coefficient	SE	Elasticity
Education	0.041**	1.310	1.310
Age	-0.042**	1.221	1.221
Gender	0.620	0.115	0.115
Land	-0.072	0.623	0.623
Household income	-0.032**	0.284	0.284
Sum of agric. incomes	-0.022**	0.117	0.117
Market-access	-0.029**	0.004	0.004
Landholding	-0.032**	0.100	0.100
Household size	0.313*	0.119	0.119
Constant	0.642	0.116	0.116
R ²	0.189	1.362	1.362
Correct prediction	84.080	-	-
LR test	37.330	-	-

LR = Likelihood Ratio; Coefficients significant at **p<0.05; *p<0.10

and/or sale to market. Therefore, we hypothesize that increase in number of family members will have a positive effect on wetland utilization.

Education level: A higher level of education increases a brick makers ability to obtain, process and use information on wetland conservation. Higher education level also increases employment opportunities and hence, less dependence on wetlands. Therefore, education is expected to have a negative effect on wetland utilization.

Income: The wealthier the brick maker can afford to buy agro-chemicals to fertilize their private landholding and would not need to cultivate in wetlands. We hypothesize that income will have a negative effect on wetland utilization.

Residence: We hypothesize that brick makers who stay within the locality of a wetland will participate in wetland utilization. Therefore, residence will have a positive effect on wetland utilization.

Settlement: Increase in the number of people staying in an area will have a positive effect on wetland utilization.

Land size: We hypothesize that amount of land used for cultivation upland will have a negative effect on wetland utilization.

Market based techniques were used for valuation of benefit and costs of wetland conversion to brick making site, because it was possible to obtain actual market prices and directly value benefit or cost involved in production of crops. The valuation of the crops was done by simply multiplying its quantity by market price, calculated as the mean of the highest and lowest price for each crop the year 2005. The data for social effects of wetland cultivation was analyzed both quantitatively using SPSS version 11 and qualitatively using Atlas ti version 4. All responses to closed ended questions were coded and entered into SPSS and analyzed using descriptive statistics.

RESULTS

The socio-economic characteristics: The respondents had engaged in brick making activities for >1 year (1-15 years). Brick making is a male dominated activity (86%), the married participants formed (52%), 72% were youths aged between 18-31 years and those between 53-60 years formed 8% of the total population. Ninety two percent had formal education and 54% had attained post-primary education. The youths that drop out of school due to lack of school fees join the brick making activities. Most of the brick makers (96%) resided within a walkable distance of 5 km away from the wetland. There was a significant relationship between age and brick making (p<0.004) certainly because, it is an extensive activity demanding a lot of energy possessed by youth males. The proximity to the wetland is an important factor (p<0.005) perhaps

indicating that the closer to wetland, the higher the chances of their participation in brick making enterprise. Gender influences decision to participate in brick making ($p < 0.025$). However, the women benefited indirectly from the brick making activities by providing support services like selling food to the brick makers, others were landlords who employed the men to carry out the activities, while some were directly involved in activities like selling fuel wood, cutting grass that required less energy. Lack of secure alternative sources of incomes ($p < 0.082$) also, influenced brick making in wetlands. The majority of the respondents (68%) had no alternative source of income.

Results of the model explaining the contribution of brick making to the livelihoods of the local community (Table 3). The likelihood ratio test results shows that the regression model is significant with a chi-square (χ^2) value of 36.4. This result indicate that the explanatory variables in the model are significantly related to incomes from brick making industry. Since the upper bound R^2 for binary-choice models is approximately 0.4 (D'Souza *et al.*, 1993), an R^2 value of 0.189 suggests that the model has reasonable explanatory power. The results show that the model predicts the dependent variable correctly by 84%.

In this model, many explanatory variables have the expected effect on incomes from brick making. While, coefficients on the age, agricultural incomes and access to market are statistically significant at 5%, the household size is significant at 10%. The negative impact of age on brick making suggests that younger households are more dependent on brick making in wetland areas. This may be due to the fact that wetland utilization activities are illegal and its only the young people that are willing to take risks. Furthermore, with limited off-farm economic opportunities, younger households rely more on brick making to meet their basic needs. A study by Buyinza and Nabalegwa (2008b) found that younger householders in rural Uganda are trapped in poverty owing to limited alternative economic opportunities.

According to Buyinza and Nabalegwa (2008a, b), the educated people have greater off-farm employment opportunities than less educated people. In general, education is expected to open up diverse employment opportunities better than brick making. As such, people with higher levels of education do not depend much on brick making. The range of education was from 0-10 years of education, with a mean value of 3.04 years of education.

The variable sum of agricultural incomes shows a negative relationship with dependency on brick making. This implies that households with high agriculture income are less dependent on brick making. Households with

limited income from agriculture depend more on the wetlands to make a living (Buyinza and Nabalegwa, 2008a, b). If poor communities have diverse and reliable sources of incomes, they will extract less resources and less dependency on brick making in wetlands than if they have few and unreliable income sources. This is evident from various rural development efforts involving small and medium enterprises, which do not fetch much income from the wetland-related activities such as bee-keeping, mushroom and other vegetable farming. According to Babier *et al.* (1996), decreases with increasing total household income.

Market access has a negative relationship with dependency on brick making. People living in isolated areas with limited access to external markets are likely to remain poor and will continue to depend on environmental resources. In contrast, communities living closer to town tend to have a wide range of employment opportunities, including small businesses. This result supports the argument of Buyinza and Niwagaba (2008a, b) that higher rural wage and greater off-farm employment opportunities reduce environment degradation.

Household size has a positive relationship with environmental income. This suggests that large families tend to rely greatly on environmental resources. With limited income opportunities and higher unemployment, large families are likely to rely on environmental resources to meet their basic needs. In addition, environmental projects such as honey collection are labour intensive and therefore larger householders are more likely to undertake these activities. Buyinza and Niwagaba (2008a, b), found the same relationship between household size and income from environmental products and services.

The other parameters such as gender and land use are not statistically significant, but have consistent elasticity values (Table 3). The elasticity values indicate the percentage change in dependency on brick making in response to a 1% change from the mean value of an explanatory variable. For example, a 1% increase from the mean value of agricultural income (US\$ 400) will decrease the probability of households' dependency on brick making by about 0.3%, holding all else constant. Similarly, a 1% increase from the mean value of market access index will decrease the probability of dependency on brick making by about 0.884%. As such, a 1% increase in the average age of a household will decrease the probability of his or her dependency on brick making by 1.4%. However, a 1% increase from the average household size will increase the probability of household's high dependence by 0.841%.

Most of the men living around the study wetland are polygamists. They need enough land to be able to feed

big families. They experienced food shortages even after extension researchers educated them on how to use small pieces of land for higher productivity or better yield. Land in the lower lands is not enough for them for farming. With a big family dominated by young children who cannot participate in growing crops or bringing in income, there is bound to be inadequate supply of food. The pieces of land are inadequate henceforth pressure is bound to increase on the wetland to get more land and food to feed the many mouths. Many people depend on wetlands for their livelihoods.

The socio-economic importance of brick making in wetlands: The results of this study showed that brick making in wetlands is an important source of livelihoods in Mukono district. Brick making is a popular source of income and employment (84%) in the area. The local community has embraced the enterprise primarily, because of the high poverty levels prevalent coupled with the general lack of alternative source of incomes. Compared to other activities, 10% of people interviewed believed that brick making was a profitable enterprise and requires limited capital (4%). Generally, the brick making had a positive impact to the well being of their families and source of revenue to the local government through tax payments. The study showed that 32% of the respondents had an alternative source of income and therefore did not solely depend on the brick making for income.

Income plays an important role to livelihoods of brick makers (96%) in wetlands. A 14% of the respondents said that they have used the proceeds from brick making from wetlands to finance other income generating activities, widening their income sources and were opportunistic of leaving the brick making soon. Other respondents (34%) said that they had accumulated assets such as motorcycles, land and houses (including a wide range of household assets) from brick making. One of the respondents said that with the income from brick making, he had been able to expand his dairy farm from two cows to five cows. Brick making also had many other benefits especially to the family members and relatives of the brick makers also benefited through the support that they were provided especially financially.

Brick making involves a range of inter-dependent activities and services and most of the brick-makers were involved in quite a range of wetland activities such as mining of clay, preparation or baking, brick laying, drying, movements of bricks, arrangements to making of brick kilns. Other were also, involved in procuring and selling of firewood, marketing and blocking of bricks. The respondents were asked to report their estimated monthly

earning from brick and these were used to calculate their annual incomes from bricks. The annual incomes were generally indifferent. The least earner per year got 635 USD and the highest was 1.356 USD and the average annual income was 1.035 USD. The above does not include incomes earned by 14% women because their earnings were too low to be considered for the calculation.

The social network and capital aspects of brick making: Brick making is socially structured and their activities are governed by socially constructed norms and values. For effective collective action and advocacy for their rights and recognition, the brick makers have formed an association to comprising about 600 members. Each member makes a monthly contribution of 20 USD and this money is banked. At the end of the year, each member will get back his savings after foregoing about 10% of his annual savings to run association affairs. They are in the process of registering their association so as to begin business activities.

On critical analysis of brick making industry, it is largely informal. The brick making industry is responsible for the construction boom going on in Mukono, Kampala and Wakiso where most of the bricks are sold. Each truck leaving the mining area pays a tax fee of USD\$ 5 to local government. Another category of players were the women whose role was mainly service based such as managing small food and drinks restaurants. There are also, the land lords who own the wetlands and the government. Where, wetland is owned by a private person, the owner levied a ground rent fee depending on the amount of amount of clay mined and this was closely monitored by his agents.

The perceived environmental concerns of brick making enterprise: The brick makers were asked to report on the prevailing challenges towards the sustainable utilization of wetlands through brick making. Depletion of clay materials was an important observation among some respondents (28%) and this was manifested in declining quality of mined clay, conflicts and low quality made bricks characterized by cracking. Flooding was a serious problem to majority (78%) of the respondents. During the rainy season, March to May and September-November, the brick makers were faced with a problem of floods when the ditches where the clay had been evacuated became filled with water. This brought the activity of clay digging to a stand still. In addition, the molded bricks took very long to dry due to the heavy rains. This further delayed the sale of the bricks and this affected almost all the activities involved in brick making.

All brick makers were very concerned about the increasing scarcity of fuel wood and this had increased

the price of bricks especially during the rainy season. During brick making, fuel wood is used to provide heat in baking of the dried bricks. Large brick kilns required high amounts of fuel wood. Fuel wood was obtained from natural forests and plantations. However, due to the increased demand of fuel wood by other commercial users the prices of fuel wood were becoming too high. Due to increase in brick making, the wetlands used to provide the residual materials to cover to bricks, while drying in sunshine. However, the brick makers were concerned with increasing scarcity of grass to cover the molded bricks so as to protect them from direct sun and rain. However, this was to the advantage of some other people who search for grass and sell it to earn some income. Too much fatigue, bruises and wounds were major health hazards reported by all brick makers. They complained of backache and chest pain.

Emerging economic potential of wetland resources:

Associated with brick making in wetlands were agricultural activities especially in the mined areas that had been reclaimed. It was also, evident that ponds left behind had been turned into fish farming and this seemed a promising economic activity although, it lacked sufficient fish farming technologies. It suffered from stagnant and smelly water especially during the dry season and the rainy season was not very helpful either. Nonetheless, fish farming is expected not only to improve the nutritional status of the respondents, but also improve their income sources given the changing status of wetlands.

Small eucalyptus woodlots had been established in previously mined areas to provide fuelwood and increasing economic potential of the brick makers and vendors. The eucalyptus woodlots also provided shade for the molded bricks against direct impact of sun light and heavy rainfall that would otherwise damage the bricks.

DISCUSSION

The male are the main actors in the brick making activities, this is because brick making is a labour demanding activity. Secondly, from the traditional African setting, all commercially gainful employment and income generating activities were male-dominated since the men are the ones that needed money to sustain their families. The fact that most females are domestic workers, who spend most hours of their day at home also, explains their low involvement since the brick making activities require a lot of time. Most of the women, who take part in the enterprise are family heads or widows (Brander *et al.*,

2006). It is only, the young and energetic that can undertake such energy demanding activities (Bakema and Lyango, 2000). Education level is not a major determinant of the quality of activity performed since, it is not a source of skills required in brick making especially in the informal sector. Nonetheless, education requirement may be useful to the brick making industry to understand government policy implications and the needs for sustainable use of wetland resources. Secondly, the educated are well placed in situations when wetland managing institution would need transfer certain skills and conservation programmes. This is because education influences the ability of the resource users to acquire and analyze available information regarding the resource. Generally, education creates awareness among the natural resource dependant communities through knowledge about wetland management strategies (Zedler and Suzanne, 2005).

The majority of the respondents resided within a walkable distance of 5 km away from the wetland Bekema and Lyango (2000). Many Ugandans interface with wetlands on a regular basis and the resources in the natural wetlands contribute directly and significantly to their sustenance. Previous studies show that people who live close to natural resources perceive them as gold mines for their livelihood (Brander *et al.*, 2006). Many residents adjacent to the wetland areas lack access to other employment opportunities thus, depend on the sale of wetland products to earn a living. The proximity of the respondents to the wetlands influenced their participation in the brick making activities. People living near wetlands are involved in the exploitation of the resources for economic benefits. The study revealed that more males carried out brick making than the females. This is certainly because men are traditionally thought to be more energetic than women and culturally unbecoming of women to lay bricks. This explains the low participation of females in the activity.

The monetary returns attracts people to brick making coupled with the low capital required to start the activities. Fuel wood is a major source of energy for both domestic and industrial use. In brick making fuel wood is used to provide heat in baking of the dried bricks. Large brick kilns required high amounts of fuel wood. Fuel wood was obtained from natural forests and plantations. However, due to the increased demand of fuel wood by other commercial users such as tea factories led to a shortage in fuel wood supplies. This led to high prices of fuel wood and yet the prices of the bricks did not increase greatly. This reduced the profits from brick making since more money had to be spent on buying fuel wood. The problem of fuel wood in brick making has been reported by other researchers. This study showed that the mined

areas were cleared of tree cover as shown by the remnants of tree stumps. This further reveals that the brick makers were responsible for the deforestation within the wetland area.

Numerous studies have revealed that it is often the poorest people and households that are dependent on natural resources for income generation through jobs and small enterprises (Dilys, 2004). Annual incomes from wetlands can be as high as US\$ 1000 per household or contributes 90% of the household income (Loomis *et al.*, 2000). Literature on dependency of people on natural resources shows that dependents tend to have other sources of income (Brander *et al.*, 2006). Natural resources are seen as safety nets to run to in periods of increasing income needs.

Fish farming was being carried out in some previously mined areas that had been flooded with water. This initiative was profitable and provided a solution to the other wise burdensome stagnant water that was a breeding ground to mosquitoes. Most of the time, the turn up of buyers is spontaneous and this resulted in the emergence of grumbling and conflicts among brick makers in an attempt to gain access to brick markets. This situation some times leads to people selling bricks at give away prices as buyers take advantage of the poorly organized brick makers. Open access to natural resources usually results into conflicts amongst the users (Brander *et al.*, 2006).

The rising human population and the need for increased agriculture and industrial expansion have led to substantial pressure upon the wetland resources. At local level, landholders have few incentives to conserve wetlands as long as they generate lower or less tangible benefits than they cost therefore, people destroy wetlands because they think it makes economic sense for them. Citing some examples from the floodplains of the inner Delta of the River Niger where, wetland exploitation is rampant, Dugan (1990) observed that one of the most fundamental reasons for the drive to convert wetlands to other uses is lack of appreciation of the extent, to which they are important and are used by local communities that are adjacent to them. Babier *et al.* (1996) assert that activities that lead to utilization of wetlands are poverty related. According to Schuyt (2005), utilization of wetland ecosystems is influenced by fundamental economic forces. It is however, very unfortunate the consumptive use of wetlands for like crop cultivation, human settlement and extraction of useful materials in the case study area does not recognise the essential ecological services of wetlands like their role hydrological cycle and microclimates, protection of watershed, nutrient and toxin retention. This concern is not well shared by the local

people both brick makers and non-brick makers living in the neighbour hood. Their concern is the daily's bread than in the future.

Economic costs of wetland conversion to brick making industry: Wetlands conversion to brick making sites threatens the twin roles of wetland ecosystems; sustenance human livelihood and maintenance of a quality environment (Buyinza and Nabalegwa, 2008a, b). It results in loss of critical ecosystem services and imposes a high cost on society in terms of foregone income, subsistence, employment and increased public expenditure on infrastructure required to replicate wetland functions or offset the effects of their loss (Schuyt, 2005).

The total economic value of a conserved wetland ecosystem is its social benefit and the foregone value in case of brick making is its social cost (Babier *et al.*, 1996). Wetlands conversion for brick making is an economic problem because important values are lost, some of them irreversibly. Decisions to convert or conserve wetlands have serious economic implications and should be therefore guided by proper analysis of such gains and losses. Brick making in wetlands causes loss of wetland values, including losses in net production benefits and net environmental benefits. By valuing such losses, the cost of brick making can be computed and brick making activity would be justified if the resultant net direct benefits are greater than foregone net benefits.

Wetlands conversion threatens the twin roles of wetland ecosystems; sustenance human livelihood and maintenance of a quality environment (Buyinza and Nabalegwa, 2008a, b). It results in loss of critical ecosystem services and imposes a high cost on society in terms of foregone income, subsistence, employment and increased public expenditure on infrastructure required to replicate wetland functions or offset the effects of their loss (Emerton *et al.*, 1999).

The total economic value of a conserved wetland ecosystem is its social benefit and the foregone value in case of conversion is its social cost (Babier *et al.*, 1996). Wetlands conversion is an economic problem because important values are lost, some of them irreversibly. Decisions to convert or conserve wetlands have serious economic implications and should be therefore, guided by proper analysis of such gains and losses. Wetlands conversion to agriculture causes loss of wetland values, including losses in net production benefits and net environmental benefits. By valuing such losses, the cost of wetlands conversion can be computed and wetlands conversion would be justified if the resultant net direct benefits are greater than foregone net benefits.

CONCLUSION

Wetland brick making plays an important role in improving the livelihood of people living adjacent to the wetland resources in Goma Sub-County, Mukono district. The study revealed that brick making was an energy demanding activity. Due to this, brick making was dominated by males in their youthful age. The women who were involved in the activity were family heads or widows. Age, proximity to the wetland, sex and lack of an alternative source of income were key determinants of wetland brick making. The study also showed that other factors like the need to alleviate poverty, the need to meet social responsibilities, lack of employment opportunities and the fact that brick making required low capital influenced the people living adjacent to the wetland to carry out brick making. Wetlands are a key resource in the socio-economic fabric of the society and an important factor in the development potential of Uganda. However, despite the benefits that brick making contributes to the well-being of the people, the wetlands were increasingly being degraded by the activity. The high demand for fuel wood used in baking the bricks had led to deforestation in the wetland. In addition, the clay pits that were left behind affect the hydrology of the wetland. The high dependence on brick making for employment and the lack of an alternative source of income has led to over exploitation of wetland resources in Goma Sub-County.

RECOMMENDATIONS

The sustainable utilization and conservation of wetlands will be generally greatly enhanced if the local communities are actively involved in the sustainable management of the wetland resource since their livelihoods directly depend on them. In order to attain sustainable utilization of the wetlands, there is need to involve the local people in the management of the wetland resources since their livelihoods are directly dependent on them. It is therefore, recommended that a more people oriented management approach be taken. By empowering and involving the local communities in decision-making and allowing them a more active part in management, their stake in the conservation of the wetland resources could be enhanced.

There is need to increase awareness among policy makers about the benefits of wetlands to human well-being so as to ensure that wetlands are better taken into account in economic welfare indicators like the Gross Domestic Product calculations. This will promote sustainable management of wetland resources since their economic value will be known. As a means of restoring

the areas degraded by brick making, there is a need to encourage the local people to grow more trees in the areas. This will not only improve the wetland ecosystem, but will also provide additional benefits to the people in form of fuel wood and income.

The local people adjacent to the wetland resources need to be trained in income generating activities like bee keeping, tree nurseries. Such projects will reduce their over dependence on wetland resources hence, reduce over exploitation of the resources. The local people should be encouraged to carry out fish farming on a large scale by providing advisory services on how to improve their small scale fish farming.

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