Evaluating The Contribution of Wetlands To Food Security And Livelihoods Improvement In The Savelugu Municipality, Ghana

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Research Article

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Abstract

The study was conducted on three wetlands and four fringe communities in the Savelugu Municipality in Ghana's Northern Region. The study evaluated the importance of wetlands to food security and livelihoods in the Savelugu Municipality using primary and secondary data sources. The contingent valuation method was used to determine respondents' value of wetlands, whereas Kendall's Coefficient was used to identify the factors influencing the reliance or utilisation of wetlands. The study results showed that wetlands were critical resources in study communities and contributed to people livelihoods and food security and determining the kinds of livelihoods that existed in these communities. Furthermore, the study established that despite the potential contributions of these ecosystems to the people's overall development, the wetlands are yet to be accorded the needed recognition as valuable resources by policymakers at the community and district levels. The disregard of wetland ecosystems by authorities, and as a consequence, the lack of attention/clear-cut regulations on their use, lead to overexploitation and degradation. It was observed in especially the Bunglung and Nabogu wetlands that siltation was having a toll on their capacity and would take only higher authorities to dredge considering the cost involved. Key among the factors influencing wetland dependence and utilisation were climate change, soil fertility of wetlands and household income levels. Inhabitants' activities such as obsolete fishing tools and farming practices, channelisation and indiscriminate waste disposal were identified to be detrimental to the wetlands' sustainability.

Introduction

Wetlands are "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" which provide valuable ecosystem services to society (Ramsar Convention Secretariat, 2015). Wetland ecosystems, including rivers, lakes, marshes, rice fields, and coastal areas, provide many services that contribute to human well-being and poverty alleviation. Some groups of people, particularly those living near wetlands, are highly dependent on these services and are directly harmed by their degradation (Smardon, 2009). Wetlands play critical roles in the survival of many communities globally, although they occupy less than 5% of the earth's ice-free land surface. These roles are particularly appreciated in semi-arid areas of the globe as they are important sources of water for domestic use and crop production (Wood, 2016).

Wetlands in Africa have been observed to play crucial roles in sustaining people's livelihoods for over millennia, serving as sources of food and water for, especially people living in arid and semi-arid areas. Valley bottomland wetlands, for instance, are of major importance in agricultural and pastoral systems in the African savannah ecosystem. They act as key resources for cultivators and pastoralists, providing a source of arable or grazing land during periods of droughts or the dry season. Wetlands sustain rural livelihoods and increase food security; wetland patches allow the opportunity for diversification of crop production and provide a wide range of direct and indirect benefits (Scoones, 1991). Wetland agriculture is considered a crucial means for poverty reduction and enhancing food security in many developing
countries. However, there is little recognition of the extent to which it does so and the present and future values placed on them by poor communities (McCartney, Rebelo, Sellamuttu, & Silva, 2010).

The Wetlands of Ghana constitute about 10% of the country's total landmass (Anderson, 2010). They form an ecologically valuable resource providing feeding, roosting and nesting sites for thousands of migratory and resident birds; marine turtles; many fish species; plant genetic materials for research; and a major source of income for especially poor communities (Kwei, 2005). The latter notwithstanding, there is yet to be practical efforts by development managers in Northern Ghana to roll out projects and programmes to harness wetlands' potentials. Therefore, the study seeks to fill the gap of evidence of the fundamental importance of wetlands to Northern Ghana's development agenda by documenting these facts for policy influencing.

Despite the contributions of wetlands to food security and livelihood improvement, many African wetlands are being modified or reclaimed (Schuyt, 2005). In many parts of the world, wetlands have been degraded or mainly lost because decision-makers do not have a sufficient understanding of wetlands' economic values, resulting in the exclusion of wetlands development initiatives from national and sub-national level development planning activities (Schuyt, 2005). The effects of climate change on the agricultural sector is evident globally. These effects are in more devastating forms in ecological zones with one cropping system such as Northern Ghana. The weather extremes of droughts and floods are rendering farmlands less potent to support crop and livestock production, thus threatening food availability and livelihood options.

Poverty and food insecurity continue to plague most Ghanaian societies despite efforts initiated by governments to achieve the Millennium Development Goal 1, which focused on eradicating extreme poverty and hunger. This can be attributed to failures on development managers to ensure a holistic development approach which permits the making/discovery of resource within local environments to accelerate this development. The northern region is the highest single contributor to the level of poverty in Ghana, it has a poverty incidence of 50.4%, accounting for one-fifth (20.8%) or 1.3 million of the poor in Ghana (Ghana Statistical Service, 2014b). Rural societies are growingly becoming food insecure and poor because their agrarian laden livelihood options are affected by climate change. Amid these difficulties, the environment is left to bear the brunt of their quest to meet their food security and livelihood needs. In times of such situations, resources that are readily put under pressure include wetlands. The impacts of community reliance on such ecosystems are lessened as long as they are managed wisely, thus ensuring their continued existence to support poverty alleviation and maintenance of human well-being (Ntupwa, 2010).

Previous studies on wetlands in the Savelugu Municipality by Nsor and Alhassan (2015) and Nsor, Obodai and Blay (2014) focused on indigenous conservation approaches and range shift of wetlands plant species, respectively. Contributions of wetlands to food security and livelihood improvement in the Municipality have not yet been examined. The study was therefore conducted to (1) ascertain the livelihoods in the communities that depend on wetlands, (2) identify factors that influence the use of
wetland resources, (3) identify threats to the functions of wetlands in supporting livelihoods and the existing best management practices and (4) examine the contributions of wetlands in addressing household food security needs.

Material And Methods

Study area

The study was conducted in four wetland fringe communities in the Savelugu Municipality, namely Yemo, Bunglung, Nabogu and Kukobila. The Savelugu Municipality is located in the northern part of the Northern Region of Ghana. It shares boundaries with Karaga District to the east, West Mamprusi Municipality to the north, Tolon and Kumbungu Districts to the west and Tamale Metropolis, Nanton District and Sagnerigu Municipality to the south.

According to the 2010 population and housing census, the Municipality has a population of 139,283, a total land area of about 1422.6 km$^2$ and a population density of 68.9 persons per km$^2$. The Municipality is located in the Northern Savannah Ecological Zone (NSEZ), which sustains large-scale livestock farming and food crops such as rice, groundnuts, yams, cassava, maise, cowpea and sorghum (Ghana Statistical Service, 2014a). As high as 89.3 % of households in the Municipality are engaged in agriculture. In the rural localities, eight out of ten households (93.3%) are agricultural households, while in the urban localities, 83.3% of households are into agriculture (Ghana Statistical Service, 2014a).

Of the employed population, about 74.1 % are engaged as skilled agricultural, forestry and fishery workers, 5.7 % in service and sales, 6.4% in craft and related trade, and 2.4% are engaged as managers, professionals, and technicians (Ghana Statistical Service, 2014a).

The Municipality remains an agriculture-based economy. The sector engages about 74.1% of the labour force, of which 80.9% are males and 68% are females. The majority of the farmers produce staple crops at the subsistence level. The animals reared in the Municipality are cattle and small ruminants. The Municipality is generally favourable for animal and crop production owing to its vast arable land. About 97% of the labour force is engaged in the cultivation of staple food crops such as maise, millet, groundnuts, guinea corn, cassava, yam, and cowpea sustenance. Most agricultural activities in the Municipality, just as in most parts of the region, are rain-fed. It receives an average annual rainfall of about 600 mm, which is sometimes considered fairly enough for a single farming season (Ghana Statistical Service, 2014a). The annual rainfall pattern is often erratic at the beginning of the rainy season, which starts mostly in April and intensifies as the season advances, raising the average from 600 mm to 1000 mm. This erratic nature is becoming more of a situation due to the ever-increasing incidence of global climate change (Ghana Statistical Service, 2014a). The Municipality is characterised by high temperatures with an average of 34°C. The maximum temperature could rise as high as 42°C and the minimum as low as 16°C. The low temperatures are experienced from December to late February, during
which the North-East Trade winds (Harmattan) greatly influence the Municipality (Ghana Statistical Service, 2014a).

Research approach and design

The study lends itself to the constructivist worldview, allowing the researcher to look for the complexity of views rather than narrowing meanings into a few categories or ideas. Thus, the Mixed methods approach was adopted, with the integration of quantitative and qualitative data collection approaches. Since this study concerns itself with the contributions of wetlands to food security in the Savelugu municipality, a case study design was adopted. This was inspired by the works of Yin (2009), who indicated that case studies are used mostly when questions on "how" or "why" are asked and also when the researcher has little control over issues and when the attention is on an existing event or phenomenon. Gall, Gall, & Borg (2007) also maintain that a case study is the in-depth study of one or more instances of a phenomenon in its real-life context. This context reflects the perspective of the participants involved in the phenomenon.

A cross-sectional study approach was adopted for the study because it allows collecting data at a single point in time without repetition from the target population to determine relationships of variables. The data is collected simultaneously from people who are similar on other characteristics but different on a key factor of interest such as age, income levels, or geographic location. The design was also preferred because of time limitations for data collection. Qualitative and quantitative data were collected through field observations, key informant interviews and household questionnaire surveys.

Unlike in case-control studies (participants selected based on the outcome status) or cohort studies (participants selected based on the exposure status), the participants in this study, just as in all cross-sectional study were obtained based on the inclusion and exclusion criteria set for the study.

Conceptual framework

The conceptual framework is a diagrammatic presentation of the link between wetlands and livelihood improvement as assumed by the study, which it seeks to investigate in the Savelugu Municipality. As indicated in Figure 2, wetlands are a source of livelihood resources that, when depended on, could improve the socio-economic lives of people. The first part of this diagram reflects that wetlands are a source of certain products and services. Products of wetlands from field experiences and review of relevant data include plants, animals and mineral products which range from food staples, such as fish and rice, to sedge/reed and timber for building, fuel wood, vegetable oil, salt, medicinal plants, stems, reed and leaves for weaving, and fodder for animals. This part of the diagram also indicates that wetlands present people with services such as maintaining and improving water quality, natural sponge against flood and droughts, climate change mitigation and adaptation.

The culminating effect of people's reliance on the products and services of wetlands is further reflected in the mid-portion of the diagram, indicating that people obtain some financial capital, social capital, and
natural capital from their interaction with wetland ecosystems. By financial capital, the study seeks to indicate that wetlands are a good source of earning income through activities such as the sale of products and the utilisation of wetlands for other activities, which result in the accrual of some income. Through social capital, activities people engage in and around wetlands, groups such as vegetable farmers' associations, fishmongers and fishermen associations have been formed which further serve not just the needs of these people around wetlands, but also serve as avenues for some enhanced social cohesion and interaction in communities. Natural capital implies that wetlands are natural homes to other life forms which support communities. These natural capitals include fertile land for agriculture, fish, fodder, water, animals and other minerals.

It is worth noting that all these capitals emanating from wetland ecosystems are interrelated. The eventual importance of these capitals is seen in the improvement in the socio-economic livelihood of their dependants. However, before that would be realised, people's dependence on wetlands should sustain people's livelihoods and ensure that they are food secure.

**Sampling approach**

**Sampling frame**

All residents of Yemo, Bunglung, Kukobila and Nabogu communities within the age bracket of 18 and 60 years who are of sound mind were eligible for inclusion in this study. After being informed about the study's rationale and objectives, residents who took part in this study did so of their own volition. Attempts were also made to reach out to institutions engaged in the water, agriculture and development policy formulation sectors. These shall include the Municipal Department of Agriculture, the Municipal Planning Coordination unit.

**Sample size**

This was obtained by employing the use of the Taro Yamane Method of 1967

\[
S = \frac{N}{1 + N(e)^2}
\]

Where; \( N \) = approximated total population of study communities (2095 people)

1 = Constant

S = Sample Size

e = Margin of error (5%)

\[
2095
S = \frac{1 + 2095(0.05)^2}{1+2095(0.05)^2}
\]
S = 335 respondents. 

S ≥ 300

**Sampling procedure**

Due to the difficulties in considering all persons in study communities as respondents to the study, samples had to be relied on. This was carefully done to ensure samples were representative enough of the large study population. Probability and non-probability sampling techniques were adopted for the study. Purposive sampling and Systematic random sampling were thus used to collect both primary and secondary data from the sample frame.

I. Systematic random sampling

Systematic random sampling as a probability sampling method was used to select houses/households within the four study communities to administer questionnaires. In each community, a random first house was selected after which every other third house was also identified for the survey.

II. Purposive sampling

The technique was used to select institutions and agencies for the key informant interviews. In collecting other forms of secondary data and identifying household heads for household surveys, any other household member above age 18 years and sound mind were considered eligible for interview in the absence of household heads.

**Data sources and collection methods**

Both primary and secondary data were used in this study. Primary data (qualitative and quantitative) were collected and used for the study through field observations, Key informant interviews and household questionnaire surveys. Primary data was obtained from households in the four wetland fringe communities focusing on the reliance on wetlands for both agriculture and non-agriculture activities and how this reliance impacts their livelihood and food security needs. Field trips were also conducted to wetland sites to obtain first-hand information on the types and nature of activities in and around wetland areas. These field trips helped in identifying activities with the potential of threatening the sustainable use of wetlands. On the other hand, secondary data was obtained from various sources, including the Municipal Department of Agriculture, the Municipal Planning Coordination unit, and electronic sources such as the Internet, books, journals, and other documented information sources.

**Data collection instruments**

The primary approach to data collection adopted in this study was a household questionnaire survey. In addition to the household questionnaire survey, focus group discussions, field observations and key informant interviews were also used to obtain primary and secondary data. The use of multiple data
collection methods ensured research data triangulation since that was considered essential in offsetting some expected limitations by providing complementary and supplementary information.

I. Key informant interview

According to McNamara (2006), interviews are particularly useful for getting the story behind a participant's experiences. The interviewer can get in-depth information on the topic. It is important when interpersonal contact is necessary and when opportunities to follow up on interesting comments are desired (Mahoney & Goertz, 2006). Therefore, this was used as a medium for obtaining data from very knowledgeable individuals and institutions in the water and policy formulation sectors, namely, the District Department of Agriculture and the Planning Unit of the Municipal Assembly.

II. Household questionnaire survey

This was done using a standardised questionnaire made up of both closed and opened ended questions to obtain data from residents of Yemo, Bunglung, Kukobila and Nabogu on the subject matter. The respondents to this were between the ages of 18 and 60 years.

III. Direct observation

With this method, field visits were embarked on to have a first-hand experience of the nature and activities in and around the wetland areas. For this, an observation guide detailing what to be on the lookout for was developed.

Data analysis

Data collected was cleaned of all incomplete questionnaires, stored and analysed using both the Statistical Package for Social Scientists (SPSS) and Microsoft Excel Spread Sheets. Qualitative data was analysed qualitatively and presented descriptively whereas quantitative data was analysed quantitatively with SPSS with means, frequencies, percentages and coefficients calculated and subsequently presented using tables and charts.

Results

Economic activities of respondents

The majority of this study's respondents had agriculture (crop cultivation) as their most engaged economic activity. Of the 300 respondents, a total of 210 representing 70% of respondents were into crop cultivation, 70 people representing 23.3% were engaged in ventures such as petty trading, agro-processing and charcoal charring, construction works and so classified under others. Eight respondents representing 2.7% and 3 representing 1% were engaged in fishing and paid jobs such as security, teaching and nursing, respectively (Table 1).
Table 1: Economic activities of respondents in Yemo, Bunglung, Kukobila and Nabogu communities in the Savelugu Municipality, Ghana

| Economic Activity | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------------------|-----------|---------|---------------|--------------------|
| Farming           | 210       | 70.0    | 70.0          | 70.0               |
| Paid Job          | 3         | 1.0     | 1.0           | 71.0               |
| Fishing           | 8         | 2.7     | 2.7           | 73.7               |
| None              | 9         | 3.0     | 3.0           | 76.7               |
| Others            | 70        | 23.3    | 23.3          | 100.0              |
| Total             | 300       | 100.0   | 100.0         |                    |

Wetlands and livelihoods

*Perception of the respondents on wetlands and livelihood determination*

Respondents from all four (4) study communities responded very positively to the question seeking to ascertain their degree of agreements that wetlands play roles in determining the kinds of livelihoods they engage in. From table 4.6, 102 people representing 44% of respondents strongly agree with the assertion that wetlands have influenced the kind of livelihood options existing in their communities' whiles 198, representing 66.0%, only agreed to the assertion. The options of disagreeing, strongly disagreeing and neutral did not attract any responses. The existence of the wetland in the community provides residents with sedge of high quality, which aids in constructing houses. Some residents have also taken advantage of such products' availability to make income by producing woven products for sale in the local and district markets. Farming activities in northern Ghana have been mainly rain-fed. However, the existences of wetlands in the study communities have influenced some residents' decision to extend their farming activities into the dry season.
Table 2: Views on 'wetlands determine livelihood' in Yemo, Bunglung, Kukobila and Nabogu communities of the Savelugu Municipality, Ghana

| Response          | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------------------|-----------|---------|---------------|--------------------|
| Strongly Agree    | 102       | 34.0    | 34.0          | 34.0               |
| Agree             | 198       | 66.0    | 66.0          | 100.0              |
| Disagree          | 0         | 0       | 0             | 100.0              |
| Strongly Disagree | 0         | 0       | 0             | 100.0              |
| Total             | 300       | 100.0   | 100.0         |                    |

Top five livelihood options and their dependence on wetlands

The top five (5) livelihood options in all study communities are fishing and fish mongering, sedge/reed collection and weaving and dry season irrigation farming. Of the 300 respondents, dry season irrigation farming (104) was ranked highest among the top five livelihoods, followed by fishing (72), sedge/reed collection and weaving (68), fish mongering (33) and hunting (23). Figure 4.6 further represents this information.

Influencing factors of wetland utilisation

Kendall's coefficient of concordance was resorted to analysing the determining factors of wetlands utilisation. From table 3, climate change was identified as the most influential factor in utilising wetlands as it recorded the lowest mean rank of 2.71. The size of the household of respondents, on the other hand, was identified as the least influential factor in utilising wetlands. From the test statistics table, the Kendall W figure of 0.426 meant that respondents do not generally agree to all variables as considered factors in influencing the utilisation of wetlands. This therefore implied that there is a low agreement among respondents as they all considered different factors to be influential.

Table 3: Factors influencing wetland utilisation in Yemo, Bunglung, Kukobila and Nabogu communities in the Savelugu Municipality, Ghana
| Factor(s)                      | Mean Rank(s) |
|-------------------------------|--------------|
| Size of Household             | 6.80         |
| Marital Status                | 6.28         |
| Level of Education            | 5.57         |
| Gender                        | 6.12         |
| Age                           | 6.66         |
| Income Status                 | 3.17         |
| Climate Change                | 2.71         |
| Soil Fertility on site        | 3.32         |
| Size of Land available on site| 4.38         |

Test Statistics

- N: 300
- Kendall's W: .426
- Chi-Square: 1.021E3
- Df: 8
- Asymp. Sig.: .000

**Respondent's reliance on wetlands for income**

Respondent's reliance on wetlands as sources of income was also studied. Two hundred and eighty-five persons representing 95% of respondents indicated their reliance on wetlands or having a household member who solely depended on wetlands as income sources. While fifteen others, representing 5% of respondents, were not relying or having a household's member depending on wetlands for income.

**Wetlands and food security**

*Household food security status*

Sixty-one respondents representing 20.3% of respondents, considered their household as very food secured households, 176 representing 58.7%, indicated their household were food secured. Forty-seven, representing 15.7%, said their households were somewhat food secured, whiles 11 and 5, representing 3.7%, and 1.7% indicated that their household was unsecured and very unsecured, respectively (Table 4).

Table 4: Household food security status in Yemo, Bunglung, Kukobila and Nabogu communities in the Savelugu Municipality, Ghana
| Responses         | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------------------|-----------|---------|---------------|--------------------|
| Very secure       | 61        | 20.3    | 20.3          | 20.3               |
| Secure            | 176       | 58.7    | 58.7          | 79.0               |
| Somewhat Secure   | 47        | 15.7    | 15.7          | 94.7               |
| Unsecure          | 11        | 3.7     | 3.7           | 98.3               |
| Very Unsecure     | 5         | 1.7     | 1.7           | 100.0              |
| Total             | 300       | 100.0   | 100.0         |                    |

**Reasons for Food Insecurity**

Respondents' thoughts and views were also solicited on what in their opinion were the reasons for food insecurity in their communities. As shown in figure 4, one hundred and three respondents, representing 34.3% of the total number of the respondents attributed the situation to observed changes in the planting season's length and other factors attributable to global climatic change. Other factors mentioned included pest and diseases, poor agronomic practices and late access to ploughing services.

**Direct contributions of wetlands to food security**

Thirty-nine-point sixty-seven percent of respondents considered the provision services of arable and fertile land for crop production as the most direct contribution, 32% considered the provision of products such as fish, meat and other game products as the most direct contribution, 26%, on the other hand, considered the utilisation of money accrued from the sale of products obtained from wetlands as the most significant contribution. As low as 0.67% and 1.67% considered rainfall influencing and supporting wetlands for tree nursing as the most direct contributions (Figure 5).

**Wetlands and protein intake**

Information obtained from respondents on their degrees of acceptance or rejection that wetlands are a protein source presented the following results. Sixty-nine percent of respondents strongly agreed that wetlands were major protein sources in their communities, 29% agreed, while 2% remained neutral (Table 5). Appendix plates 4, 5 and 6 are evidences obtained from the Bunglung and Nabogu wetlands, which confirms the assertion that wetlands are sources of protein.

Table 5: Wetlands as sources of protein in Yemo, Bunglung, Kukobila and Nabogu communities in the Savelugu Municipality, Ghana
| Responses      | Frequency | Percent | Valid Percent | Cumulative Percent |
|---------------|-----------|---------|---------------|--------------------|
| Strongly Agree| 207       | 69.0    | 69.0          | 69.0               |
| Agree         | 88        | 29.3    | 29.3          | 98.3               |
| Neutral       | 5         | 1.7     | 1.7           | 100.0              |
| Total         | 300       | 100.0   | 100.0         |                    |

Wetlands and poverty reduction

Reliance on wetlands and cash earnings

Of the 300 respondents, 289 responded relying on wetlands’ products and services as a source of income earnings. Of the 289 respondents, 128, representing 44.3%, indicated earning from wetlands alone above GH¢650.00 in a year, whiles 19 representing 6.6% earned between GH¢51.00 and GH¢199.00 (Figure 6).

Willingness to pay for wetland services/goods

The average amount all 300 respondents quoted medicinal plants per bucket sourced from wetlands was GH¢31.9533. The value for medicinal plants was the highest amongst all eight services and products listed. It was followed by grazing for animal per day. Respondents indicated that they were willing to pay as high as GH¢21.3467 to access wetland for fodder for their animals. The least quoted average was that for Animal Watering per day. Respondents indicated that they were willing to pay GH¢2.6717 for this service (Table 6). These results show respondents’ recognition of the importance of wetlands to their socio-economic well-being since they indicated their preparedness to pay to access their services and products.

Table 6: Respondents' willingness to pay for wetland services in Yemo, Bunglung, Kukobila and Nabogu communities in the Savelugu Municipality, Ghana. The total number of respondents (N) is 300.
| Variable                                      | Mean (GH₵) |
|----------------------------------------------|------------|
| Cropping per acre                            | 17.9500    |
| Fishing per day                              | 6.0543     |
| Water per drum                               | 7.4933     |
| Building materials per donkey chart          | 25.0033    |
| Grazing per day                              | 21.3467    |
| Medicinal herbs per bucket                   | 31.9533    |
| Wild animal per kilo                         | 12.7117    |
| Animal watering per bucket                   | 2.6717     |

**Wetland degradation and mitigation**

**Observed changes in size and quality of wetland**

Respondents had divergent views on changes observed over time. Ninety-two point sixty-seven percent (92.67%) of respondents indicated having observed changes in quality and quantity of other wetland products such as thatch over the years. Seventy-one point thirty-three percent (71.33%) observed changes in aquatic life, specifically the fish stock in wetlands. Eighty-eight-point sixty-three percent (88.63%) also indicated observing a reduction in the area covered by wetlands during the peak season. As low as 10% responded to observing some increase in the area covered by wetlands during the peak of the rainy season. Forty-five percent responded, observing a reduction in the amount of vegetation covering wetland sites. Figure 7 provides a diagrammatic representation of respondents observed changes to wetlands over the past ten years.

**Existing threats to wetlands and levels of impact**

Across all three wetland areas, an assessment was made on the following threats; grazing pressures, bushfires, tree felling/grass harvesting, crude fishing methods, channel incision, waste disposal practices (e.g. laundry, plastic pollution), farming methods/practices, water abstraction and sand winning. All these threats were found to be prevalent in each community but at varying levels and times of the year. Of all threats, bushfires, channel incision, waste disposal, crude fishing methods and farming methods/practices were found to have high impacts on wetlands. In contrast, tree felling, grazing pressures, water abstraction, grass harvesting and sand winning were reported to be of minimal and no impacts. According to respondents, all five (5) high impact threats to wetlands were more prevalent during the dry season. Plates 1, 2 and 3 are evidences of the threat of bushfires, channelization, inappropriate farming practices and improper application of chemical fertilizers in the wetlands of Savelugu Municipality, Ghana.
Discussion

Influencing factors of wetland utilisation

The study has revealed that a number of factors serve as triggering ones for people who decided to exploit and use wetland resources. Of the nine factors listed, most respondents identified climate change as the most influencing factor. It obtained a coefficient of 2.71; this was followed closely by household income status, which recorded a coefficient of 3.17 whiles soil fertility on site placed third with a coefficient of 3.32. These results imply that climate change, households' income status, and soil fertility around the wetlands banks are the most influential factors of wetland utilisation in all communities.

Climate change as an influencing factor is linked to the impacts of climate change on agriculture and food security, which necessitates the adoption/reliance on wetland agriculture as coping strategies of climate change. Expanding land under cultivation is the primary means farmers in sub-Saharan Africa adopt to increase agriculture output and, for that matter, food availability. Consequently, farmers have resorted to reducing the length of fallow periods whiles also venturing into the cultivation of virgin areas such as wetlands, all in their bid to ameliorate the impacts of climate change to their mainstream. (Turyahabwe, Kakuru, Tweheyo, & Tumusiime, 2013)

The soil fertility around wetlands was also an influencing factor due to their ability to support traditional farming livelihood. This result means that; most cultivators of wetlands spaces find it advantageous to do their off-season cropping activities around wetlands not necessarily because of access to water but also the rich nutrients of their soils to support plant life. Therefore, this service of wetlands informed people's decision over millennia ago to settle close to and scramble for wetlands spaces. This finding also reinforces that of Verhoeven and Setter (2009). These authors stated that the flood plains of Mesopotamia, often regarded as the cradle of human civilisation, were regarded as a valuable field for both food and fodder production because of their fertility following the deposition of sediments after flooding. Wetlands floodplains abound in fertile soils and quality water. They are sources of food and other agricultural products such as fuel and fibre directly through agricultural production activities that take place within them, such as in rice paddies, coastal grazing marshes, recession agriculture and aquaculture in large floodplains, and cropping of small seasonal wetlands. They also indirectly support agriculture by, providing fertile soils and reliable supplies of good quality water (Ramsar Convention Secretariat, 2014).

Another identified influencing factor identified by the study was the income levels of household. It was largely established that more impoverished household depended more on wetlands services and products for survival than well to do households. This finding is supported by the Brundtland report (WCED 1986), which established a clear linkage between economic deprivation and environmental degradation emanating from unsustainable exploitation and natural resource use. This finding of the study and those of other researchers' point to the importance of wetlands to Yemo, Bunglung, Nabogu and Kukobila communities in Ghana. The Northern region of Ghana, which is home to the Savelugu Municipality,
where the communities above are located, is classified among the top 3 poorest regions in Ghana, for which reason dependence on ecosystems such as wetlands is high (Ghana Statistical Service, 2015).

This study further revealed that most households were engaged in exploiting natural resources from wetlands to soaring up their income levels. Whiles others were into the collection and sale of water, other respondents caught and sold fish, a handful was into making craft and handicraft from wetland products. Thus, the study concludes that the well-off a household is, the less likely it is that it would engage in wetland exploitation and vice versa. According to David & Bernardete (2009), most rural poor are dependent on natural resources to generate their livelihoods, thus creating a clear and close linkage between poverty and natural resource dependence. In the work of Bharadwaj (2015), poor people are said to rely more directly on the environment for their survival than the rich. This finding confirms the results that household income level is an influencing factor of wetland utilisation in the study area.

**Wetland services and livelihoods**

From the analysis of primary data obtained on the three wetlands, it was revealed that residents found wetlands to be especially important to them to provide grounds for crop production and animal rearing, water provision for domestic use and sale, and products sedge. It is worth stating that whiles some of these services existed throughout the year, residents found wetlands to be a crucial coping measure to them during the dry season, that period of the year when all mainstream agricultural activities are over. This was said to be when services such as harvesting of building materials such as sedge/reed, water collection, and crop cultivation on wetland banks are mostly done. This finding is in conformance with the work of Gasu (2014), who indicated that the Fadama and Akuro wetlands in Nigeria have been used for dry season farming and have contributed significantly to food crop production in the country, particularly in the arid and semi-arid regions. They are said to have potentials for dry season farming activities for crops such as rice, maise, yam, okra, pepper, poultry farming, market gardening, fish farming, and green pastures grazing animals throughout the year and raw materials for handcraft.

According to Wood (2016), wetlands are an important water source for domestic use and crop production during the dry season. The Bunglung, Nabogu and Kukobila wetlands were found to have influenced most fringe communities’ livelihood options. All respondents affirmed the widely held assertion that wetlands influence the kinds of livelihood options existing in their fringe communities. Of the 300 respondents of the study, 218 representing 72.6% were engaged in agriculture with crop production overshadowing animal rearing) and fishing, whiles five people were into craft making using predominantly sedge/reed and other material from wetlands. This result implies that most of the study communities engaged in livelihood activities that are largely dependent on the wetlands in their communities and thus have their livelihood options determined by these ecosystems. This conclusion was further weighted when 44% and 66% agreed and strongly agreed respectively to the question seeking to ascertain their degree of agreements. This conclusion is affirmed by Costanza & Farber (1985), who argued that wetlands are a source of employment opportunities. They further stated that raw materials
sourced from wetlands provide jobs to those employed in the commercial fishing, specialty food, and cosmetic industries. As such, billions of dollar industries depend on wetlands to flourish.

More than a billion people worldwide make a living directly from wetlands through activities such as fishing, rice farming or handicraft (GRID-Arendal, 2016). An earlier work by the Millennium Ecosystem Assessment (2005) also affirms this assertion. It estimated that about 1.5 - 3 billion people worldwide depend on wetlands as a source of drinking water and food and livelihood security. People living in or on the wetlands' borders often depend partially or entirely on wetland ecosystem services for their livelihoods. As a result, wetlands loss or degradation harms the people directly (Williams, 2006).

The role of wetlands in the livelihood activities of the poor is vital in developing countries. An important example is that of the Pace Wetland in Uganda, from which more than 50% of the monthly income of dependent populations is obtained. About 40% of Mahakam Delta households in Indonesia have their livelihoods dependent on mangrove wetlands (Lamsal 2015). Convention on Biological Diversity (2016) indicated that one billion households in Asia, Africa and the Americas depend on rice growing and processing for their main livelihoods. It also noted that over 660 million people depend on fishing and aquaculture for a living, while medicinal plants, dyes, fruits, reeds and grasses are just a few of the wetland products that provide jobs, especially in developing countries. These key facts summarise the importance of wetlands to rural community livelihoods.

**Contribution of wetlands to food security and poverty reduction**

Food Security, according to Food and Agriculture Organisation (2003) exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

The fourth objective of the study was to examine the contribution of wetlands in addressing household food security needs. To ascertain this, respondents first had to rate their household's food security situation and subsequently measure the extent to which wetlands contribute to the situation. About 79% of households considered for the study considered their household to be food secured, implying that they had adequate access to food for their well-being throughout the year. Subsequently, 73% out of the total of 79% food secured households attributed their food security situation to be due to their reliance and use of resources from wetlands.

Direct/specific contribution of wetlands to respondents' food security situations was also solicited. The outcomes were fertile soil for agriculture, fish for consumption, income generation from the sale of handicrafts and wetland related products, use of wetlands for tree nursery development, and wetlands' ability to influence rainfall. In most parts of the world, rural communities suffer from seasonal variations in food supply and the "hungry season" is a key feature of life for many millions of people. This has necessitated using the drainage of wetlands or areas with seepage water or a high-water table to produce food crops in the dry season (Wood, 2016). There is evidence that wetland agriculture has contributed to many societies' well-being worldwide over the centuries and even millennia. For example, archaeological
work in Central America has indicated that Mayan wetland agriculture dates back 3000 years (Gray & Mary, 1994).

Interviews granted by Agriculture Extension Agents of the Savelugu Municipal Department of Agriculture, wetlands annually contribute to fresh vegetables such as okra, chilli pepper, amaranths, cucumber, green pepper and cabbage at comparatively lower cost in the local markets. These they indicate contribute to ensuring food availability in the Municipality, thus curbing inflation in the local markets. The local communities around the Kukobila wetlands exploit its plants’ resources, such as the pigweed (*Ipomoea aquatic*), to prepare soup for human consumption while exploiting other grasses for fencing and roofing their houses (Obodai & Nsor, 2009).

All three wetlands, according to respondents, were contributing to ameliorating the impacts of poverty on them. Specifically, on food security, this study’s wetlands contributed significantly to boosting the availability and protein intake in the fringe communities and beyond. Wetlands as sources of protein received an overwhelming endorsement (98%), with the common source of protein being fish, amphibians such as monitor lizards, frogs, toad and tortoise, and rats. According to Obodai & Nsor (2009), the Kukobila wetland has animal resources such as fish, amphibians, birds and other mammals, all of which serve as sources of protein for the inhabitants. It is estimated that about one billion people worldwide over predominantly in developing countries, rely on fish as their primary or sole daily source of animal protein. This result further establishes wetlands as important ecosystems in ensuring food security, especially among the poor (Ramsar Convention Secretariat, 2008).

Wetlands services and products subjected to the Willingness to Pay (WTP) approach were cropping (per acre), fishing (per day), water (per drum), building materials (per donkey chart), grazing (per day), medicinal herbs (per bucket), game (per kilo) and animal watering (per bucket). Average quotations by all 300 respondents of the study revealed that respondents were willing to pay as much as about US$ 5.53 to access a bucket of medicinal plants. And as low as about US$ 0.52 for a bucket of water for animal watering. For cropping, which is the most use of wetlands, respondents were willing to pay as much as about US$ 3.11 to access an acre of lands around wetlands for cultivation.

**Factors threatening the sustainability of wetlands**

Although wetland protection is now officially a priority for 170 nations that have ratified the Ramsar Convention as of February 2018, wetlands continue to be under threat of being drained and reclaimed. In the midst of this, human has been identified as very culpable. Respondents of the study also indicated that wetlands were being degraded predominantly as a result of anthropogenic factors. They arrived at this conclusion having indicated observed changes in quality and quantity of goods and services sourced over the years. According to the United States Environmental Protection Agency (2001), human activities have caused wetland degradation and loss by changing water quality, quantity, and flow rates through increased pollutant inputs and changing species composition due to some disturbance. These human activities by the EPA are broadly characterised into three; (1) hydrological alteration through channelisation, diking and damming to form ponds and lakes, (2) pollute inputs such as fertiliser, human
sewage, animal waste, road salts and pesticides and (3) vegetation damage such as grazing pressures and peat mining.

According to Masese, Kwena, & Raburu (2012), the threats of wetlands can be classified into the following; (1) Biological alterations- this includes the removal of wetland flora and fauna (2) Chemical alterations- which is as a result of the release of pollutants and toxic chemicals into wetlands resulting in a change in nutrient balance (3) Physical degradation- this includes infilling, draining, dredging, stream channelisation, peat mining, grazing, waste dumping and damming. Therefore, it is evident from the study that anthropogenic factors are largely to blame for the degradation of wetlands, as other studies have also stated.

The threats to wetlands continuous existence and provision of essential services and products to inhabitants were also considered in the study. Grazing pressures, bushfires, tree felling/grass harvesting, crude fishing methods, channel incision, waste disposal practices (e.g. laundry, plastic pollution), farming methods/practices, water abstraction and sand winning as a threat to wetlands were examined. This examination revealed that Bushfires was the most severe threat to wetlands ecosystems, followed by channel incision, waste disposal, crude fishing methods and unsustainable farming methods/practices.

On bush fires, most respondents, including the Municipal Department of Agriculture and the Municipal Assembly represented by the Planning Coordinating Unit, ranked bushfires as the most recorded threat and thus considered it the most severe of all threats. This was attributed to farmers, hunters and children who farm or hunt game along the wetlands banks. Interestingly during the field visits of this research, it was observed that hunters made up of children and adults were seen setting bushes along the Bunglung human-made wetland on fire to facilitate their hunting activities. Bush burning aside destroying the immediate vegetative surroundings of wetlands also pre-exposes wetlands to other factors of environmental degradation.

Wetlands channelisation, especially in the dry season for agriculture and obsolete drawing water methods for irrigation purposes, was identified as a threat to wetlands. During field visits by the researcher to the three wetland sites, it was evident that farmers had created channels to draw water closer to their fields. The channelisation of a wetland decreases the surface-water storage capability of a wetland, which increases the amount of runoff from a basin whiles decreasing the capability of the wetland to retain loads which increases the loading from a basin (Brown, 1988).

Indiscriminate disposal of waste in and around wetlands was also identified as a threat to the sustainable use of wetlands in all communities. During field visits, scenes of waste materials floating on and deposited along the wetlands banks were evident. These waste materials included plastics and human excreta.

Fishing practices and methods employed in all three communities were also identified to have substantial negative impacts on wetlands' health. It was observed that in all three communities, there was no close season period within which spawning of fish could take place, for which reason fishing was unregulated.
Also, the nature of fishing gears used was problematic. It was revealed that some community members used unapproved nets to fish. For example, in the Nabogu community, it was observed that some community members were using treated mosquito nets for fishing. This practice resulted in the washing of some harmful chemical into the water and resulted in fingerlings being trapped. Aside from a few men who were identified as experienced fishermen, children with no fishing expertise were allowed to fish, thus resulting in the violation of fishing regulations. Children could be seen using treated bed nets to trap fingerlings in especially the Nabogu wetlands.

According to Verhoeven & Setter (2009), agriculture and wetlands are closely linked, with evidence supporting that the first human settlement was located in and around wetlands. This relationship has, however, deteriorated over the years. Wetlands are currently being negatively impacted by agricultural activities that they are noted to be supporting. Respondents of the study earlier alluded that most agricultural activities were located very close to wetlands due to their richness in nutrients, thus exposing wetlands to some disturbances. During the study, farming practices included ploughing long slopes, inappropriate utilisation of chemical fertilisers, slash and burning.

Conclusion

The wetlands of Savelugu are essential sources of income, food and livelihood options in the fringe communities. They contribute to improving residents' incomes and are thus crucial resources in the fight against poverty and hunger. The study revealed that, despite their relevance to people's socio-economic well-being, development managers (state agencies) are doing close to nothing to protect these resources. For that reason, they are overexploited and are thus fast deteriorating and degrading.

Declarations

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**Figures**
Figure 1

Map of Savelugu Municipality (the centre of the study area) in Ghana's northern region.
Figure 2

Conceptual framework for the study based on researchers' construct with inputs from DFID's Sustainable Livelihood Framework (1997).

Figure 3

Top 5 livelihood options

| Activity                     | Frequency |
|------------------------------|-----------|
| Fishing                      | 72        |
| Hunting                      | 23        |
| Fish Mongering               | 33        |
| Sedge collection and weaving | 68        |
| Dry season farming           | 104       |
Top five wetland-dependent livelihoods options in Yemo, Bunglung, Kukobila and Nabogu communities of the Savelugu Municipality, Ghana

Figure 4

Reasons for food insecurity in Yemo, Bunglung, Kukobila and Nabogu communities in the Savelugu Municipality, Ghana
Figure 5

Contributions of wetlands to food security in Yemo, Bunglung, Kukobila and Nabogu communities in the Savelugu Municipality, Ghana
Figure 6

Wetlands Cash Earnings of respondents in Yemo, Bunglung, Kukobila and Nabogu communities in the Savelugu Municipality, Ghana
Figure 7

Respondents' observed changes in wetlands in Yemo, Bunglung, Kukobila and Nabogu communities in the Savelugu Municipality, Ghana

Supplementary Files

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- Plate1.png
- Plate2.png
- Plate3.png