INTEGRATED ECOSYSTEM ASSESSMENT FOR OWABI WILDLIFE SANCTUARY

Final Report

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Acknowledgement

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Eugene Gakpo Alhassan, 2019

Introduction

The Owabi Wildlife Sanctuary (hereafter the Sanctuary) covers an area of about 13km^2 and is classified as a 'moist semi-deciduous north-west subtype (Hall & Swaine, 1976). It is located 23km north-west of Kumasi, Ghana's second largest city. The area is characterized into two parts, the northern part (inner site) and southern part (catchment area). The Sanctuary is one of the only two protected wildlife Sanctuaries and the only inland Ramsar site in Ghana that is managed by the Wildlife Division (WD). It was designated as a wetland of international importance under the Ramsar Convention by the Government in 1988. The forest cover of the area consists largely of secondary vegetation and small portions of riverine forest, aquatic vegetation and exotic plantation, each providing different ecosystem services. The forest of Owabi houses different mammals and bird species, which are listed under the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES). The area has the opportunity for ecotourism development, due to its aesthetic beauty, composition of endangered flora and fauna species and the ability to use the area for hiking and camping. The Sanctuary houses an artificial lake (Owabi lake), which was dammed to provide supplementary water supply to the people of Kumasi and its environs. The dam and its water works are being managed by the Ghana Water Company Limited (GWCL).

The Sanctuary however, faces serious threats. Even though a part of the area is protected (inner site), it faces severe interrelated threats from population pressure including poaching, illegal logging, unauthorised land-use practices, like local housing developments, farming, sand winning etc., especially at the catchment area. Such practices threaten both flora and fauna species of the area and have a severe impact on the quality and quantity of water supplied by the dam. The situation is being fuelled by the land tenure agreement between landowners and GWCL before the dam was built. GWCL stopped paying compensations to the landowners for earlier land acquisition, which is inexorably linked to the Sanctuary establishment to supply drinking water for communities in that area. This however, encourages illegal allocation of lands for sand winning, construction of houses and illegal exploitation of resources. The Forestry Commission developed a management plan for the Sanctuary in 2014 (Forestry, 2014) but encroachment in the area still persist (Ameyaw & Dapaah, 2017). These threats on the Sanctuary were confirmed during the site reconnaissance and have a significate impact on its ecosystem benefits/services. This raises questions, such as, what was considered in the development of Owabi's management plan in 2014? Specifically, were demands for ecosystem service considered? How many of these demands can be met for community wellbeing? And how many benefits can be obtained without destroying the area?

Therefore, the project team developed the project "Integrated Ecosystem Assessment for Owabi Wildlife Sanctuary" (Alhassan, 2018) in June 2018. The project aims to contribute in developing a sustainable management plan to manage the Sanctuary. This assessment made on the Sanctuary spells out the benefits being utilized by local communities and their capacity to continue providing these services sustainably without jeopardizing the integrity of the area. In addition, the project identifies potential conflicts and synergies relationship fringing communities have with other stakeholders as users of the benefits taken from the Sanctuary.

The project was made possible by funding agency the Rufford Foundation in United Kingdom and was supported by the Environmental System Analysis chair group (Wageningen University) in the Netherlands. To further ensure the sustainability of the plan in project

communities and impact on a larger audience, the project included awareness and participatory community education. The project was implemented from June 2018 to May 2019.

The report has been structured into 6 main section highlighting project outcomes and relevant issues during its execution. The first section describes in detail the field activities including site reconnaissance survey in the Sanctuary and selecting project communities. The second provides more information on data collection, previous management measures and the list of ecosystem services provided by the Sanctuary. The third section outlines the community characteristics, thus the demographical and socio-economic of the selected communities. It again displays in detail the outcome of the ecosystem services assessment performed on the Sanctuary. To know the different stakeholders interested in the Sanctuary' ecosystem services, section four presents such results and further analyses of the potential synergies and conflicts fringing communities perceived on other stakeholders. Also, the communities chose different measures to ensure the sustainability of the ecosystem services in the Sanctuary. The implications of these chosen measures have been spelt out in section five, as well as suitable recommendations. Finally, the last section talks about community sensitization, education and awareness creation. It also provides a management plan for managing the Sanctuary.

Part 1

Site reconnaissance and fringe community's identification

A first meeting with the Assistant Manager of the Resource Management Support Centre (RMSC) Mr Samuel Ayesu, who is my local supervisor, was scheduled in 28th March 2018. This was done with the aim of connecting me to networks within the Sanctuary. A second meeting was set on 29th March with Wildlife Division (WD) manager Mr. Thomas Acquah, who is in charge of managing the Sanctuary, to get access to area for site reconnaissance and to assess the status of the area. With a forest guard, we were able to get access to the forest area, riverain area as well as the dam site. This activity gave us a general idea of what ecosystem services being provided and the health status of the area (see Figure 1).

Furthermore, a discussion was held with both WD and GWCL to determine possible fringe communities that benefits from the Sanctuary. The selection of the communities was based on the following criteria:

1. Accessibility to the area.
2. Benefits derived from the area.
3. Distance to the Sanctuary, i.e. communities less than or equal to 5km to or from the Sanctuary.

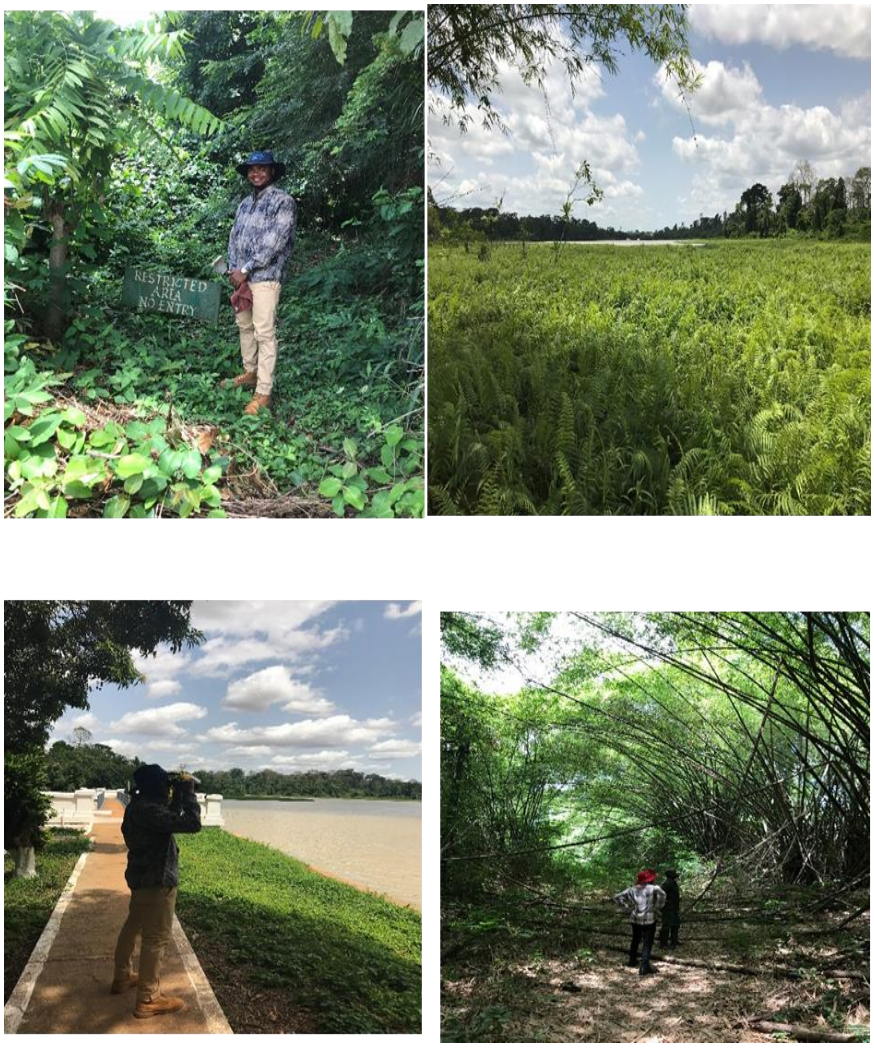

Figure 1: site reconnaissance in Owabi Wildlife Sanctuary

The fringe communities that were selected include Owabi, Esaase, Bokwanky, Ohwim and Atafra (see Figure 2). These communities fall under two districts, Nwabiagya District Assembly and Kumasi Metropolis. Therefore, another meeting was scheduled with the districts to assess the population's status of the selected communities. Together with the Ghana Statistical Service (GSS) and the District Assembly, we were able to assess the population status of the communities for the year 2010, which was 26, 567 (see Table 1).

Table 1: The population status of chosen fringe communities for the year 2010

Community	Population	Source
Owabi	200	Atwima Nwabiagya District Assembly
Esaase	2,718	Atwima Nwabiagya District Assembly
Bokwankye	3,844	Atwima Nwabiagya District Assembly
Ohwim	15,743	GSS
Atafra	4,062	GSS
Total	**26,567**	

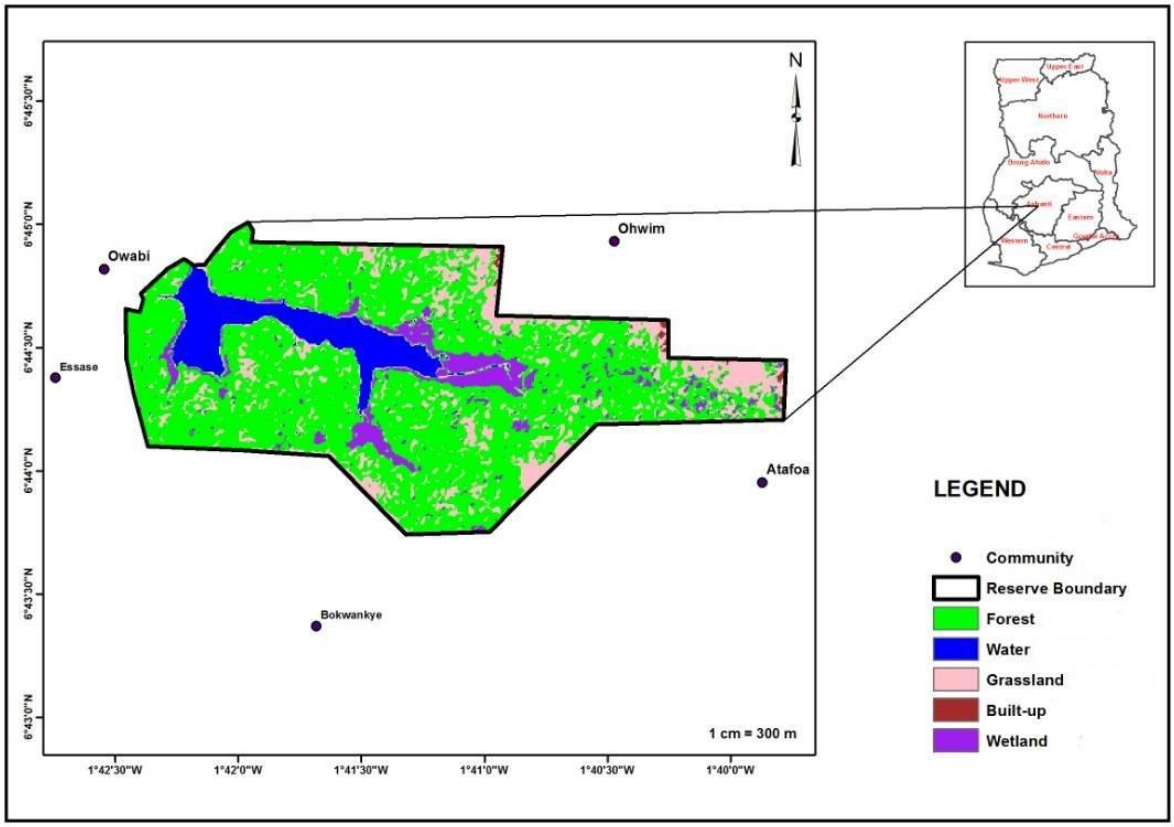

Figure 2: Location of Owabi Wildlife Sanctuary and selected fringe communities

Part II

Data Collection, previous management measures and list of ecosystem services from the Sanctuary

The project team developed a tool for assessing ecosystem services in the Sanctuary and its fringing communities. Questionnaires were then designed to collect information from respondents through interviews. Two different interviews were made; a community interview and an expert interview. Moreover, the project team performed a review on the previous management plan and other literatures to obtain its management measures, constrains and provided a list of ecosystem services in the Sanctuary. This is summarized as follows.

a. Community interview: Community interview was conducted between the 2nd of April 2018 until the 21st May 2018 to assess the ecosystem services of the five fringe communities. This took approximately two months including the data entries obtained from the interviews. It took roughly a week and a half for each fringe communities to be interviewed randomly and ended on June 1st 2018 among with the data entry. By developing a structured questionnaire, the following topics were assessed; the ecosystem services obtained from the Sanctuary, the users of these ecosystem services, the relationship among communities and other users of these ecosystem services and the choice of measures to ensure the sustainability of the Sanctuary for each community. The questionnaires were branched into four parts (see Annex I). The first part regarded the demographic, socio-economic characteristics, level of education and household composition. The second part was related to ecosystem services assessment on the Sanctuary. The third part was included the conflicts and synergies among users of the ecosystem services. And the final part of the questionnaire was regarding the support of measures for the sustainability of the Sanctuary ecosystem services.

A total of 50 questionnaires were randomly distributed in the selected communities. Ten questionnaires were distributed in each of the five fringing. Per community, ten individual households answered the questionnaires and hundred percent response rate was achieved.

b. Expert interview: A semi-structured questionnaire was developed to gain information on the ecosystem services, its users, conflicts, and synergies, sustainable indicators known for these services provided by the Sanctuary and measures for its management. Selected experts were chosen with a pre-requisite knowledge to provide input necessary for the project. Furthermore, all chosen experts have a direct connection to the Sanctuary. With such relevant restrictions, only two experts were identified and interviewed, namely WD and GWCL. All the interviews were allowed to be noted in the field book and summarized (see Annex II).

Main management measures

The government has full control of the Owabi Wildlife Sanctuary under the management authority of WD. The WD under the Forestry Commission with set standards, is responsible for the day to day management of the habitats for the variety of species including breeding sites for mammals, trees, birds, fish, amphibians, butterflies, reptiles and snails. They draw up plans and proposals from their normal routine of systematic biological monitoring on permanent transects in the area. They also manage the area with infrastructures like equipment (e.g. flashlights, gun, and binoculars), transport (e.g. three motorbikes and a vehicle), trails (two for visitors and patrols), visitor facilities, signs (only at the entrance) and administrative staffs.

Management actions taken by the WD, include patrolling the inner Sanctuary to capture poacher, removing snares and prevent illegal harvesting of fishes. They are also involved in the monthly cleaning of the inner boundary line.

The second government institution that is involved in the area is the GWCL. The area protects the Owabi catchment, which was dammed by the GWCL to produce drinking water for the people that depend on it. The GWCL is responsible for the operationalization of the built dam and its associated works. They ensure that the dam is in good condition to provide its demanding services. Although the WD is responsible for the Sanctuary, the GWCL has the most mandate in the catchment area. They maintain the water treatment plant, a training school, staff housing, and offices within the catchment area of the Sanctuary. They are also the responsible body that sets the quota for fishing.

Furthermore, there are also other institutions and organization involved, either formal or informal in helping to manage the Sanctuary. This includes the Water Resource Commission (WRC), Land Commission, NGOs, chiefs and fringe communities. All these stakeholders make sure that the mandate of establishing the Sanctuary is maintained and the resources are kept in good condition.

Management constraints

1. There is absence of vivid policy guidelines and agreed management objectives for the Sanctuary as whole (both the inner and the catchment area).
2. There is no clear demarcation of the true boundary limits for the Sanctuary in terms of areas of protection and area for harvesting.
3. There is the absence of a clear responsibilities between the WD and GWCL in relation to the reservoir and the catchment area. This was confirmed during the expert interview where WD patrols in the inner site but not the catchment area and GWCL takes care of the dam sites and not necessarily the catchment area.

List of ecosystem services

Table 2: List of ecosystem services, indicators, and unit of measurement from literature review

	Type of Services	**Specific services from Owabi**	**Indicator for assessment (use indicator)**	**Unit of measurement**	**Performance indicator (sustainable use)**
Provisioning					
1	Food	Fishes, Bushmeat, Fruits, Snails	Amount extracted	Kg/ha	Net productivity (Kg/ha/yr)
2	Water	Drinking water	Amount extracted	Litres (L)	Max sustainable water extraction (L/yr)
3	Raw material	Firewood, sand for construction	Amount extracted	Kg	Net productivity (Kg/yr)

	Type of Services	Specific services from Owabi	Indicator for assessment (use indicator)	Unit of measurement	Performance indicator (sustainable use)
4	Genetic materials	Herbs	Amount extracted	Kg	Maximum sustainable harvest (Kg/yr)
Regulating					
7	Air quality regulation	Good and clean air	Capacity to extract aerosols	Particles/m^3	Amount of aerosols extracted (particles/m^3/yr)
8	Climate regulation	Micro-climate, Carbon sequestration	Greenhouse gas-balance	tonnes	Area of the forest (ha), C-sequestration by forest (kg/ha/yr)
9	Extreme event mitigation	Flood protection, Windbreaks	Role of forest in dampening extreme event	Number of incidences	Number of incidence/year
10	Regulation of water flows	Watershed/ wetland protection	Water-storage capacity	m^3	Area of forest to protect watershed/wetland (ha)
11	Waste treatment	Water purification	Water retention capacity in soil	Mm water/cm depth of soil	Maximum Nutrients (eg. S, N) removal and retention
12	Erosion protection	Erosion prevention	Denitrification	Kg/ha	Maximum potential reduction in soil loss by area of forest [kg/ha/yr]
13	Maintenance of soil fertility	Improve soil fertility for farming	Vegetation cover root-matrix	Kg/ha	Amount of topsoil regenerated per ha/yr
Cultural					
16	Aesthetic information	Aesthetic beauty	Number of visitors with stated appreciation		Number of visitors
17	Recreation/tourism	Ecotourism	Number of visitors with stated appreciation		Maximum sustainable number of visitors

	Type of Services	**Specific services from Owabi**	**Indicator for assessment (use indicator)**	**Unit of measurement**	**Performance indicator (sustainable use)**
20	Information for cognitive development	Research, education and public awareness	Presence of features with education/research interest		Number of visitors/research/ articles
Habitat					
21	Nursery habitat	Maintenance of life cycles of migratory birds	Number of migratory birds		Bird species distribution
22	Genepool protection	Maintenance of genetic diversity	Areas for endemic species	ha	Area managed for gene conservation or conservation investments (ha)

Part III

Community characteristics and Ecosystem services assessment results from community interviews.

This section presents the demographical and socio-economic characteristics of the communities that were interviewed. This was derived from the statistical analysis of the sample population of the chosen five fringing communities. It describes in details the gender and age distribution, education level, occupational level, household composition and the activities carried out in the Sanctuary by respondents.

Again, the section also presents the results from the assessment performed on the ecosystem services in Sanctuary. This has been grouped into the types of services, their current use and the quantities being used. Also, the performance and sustainable use of the provisioning services were described including their implication.

Community demographical characteristics of respondents

There was a slight difference among the gender of the respondents as seen in Figure 3. Majority of them were males (58%).

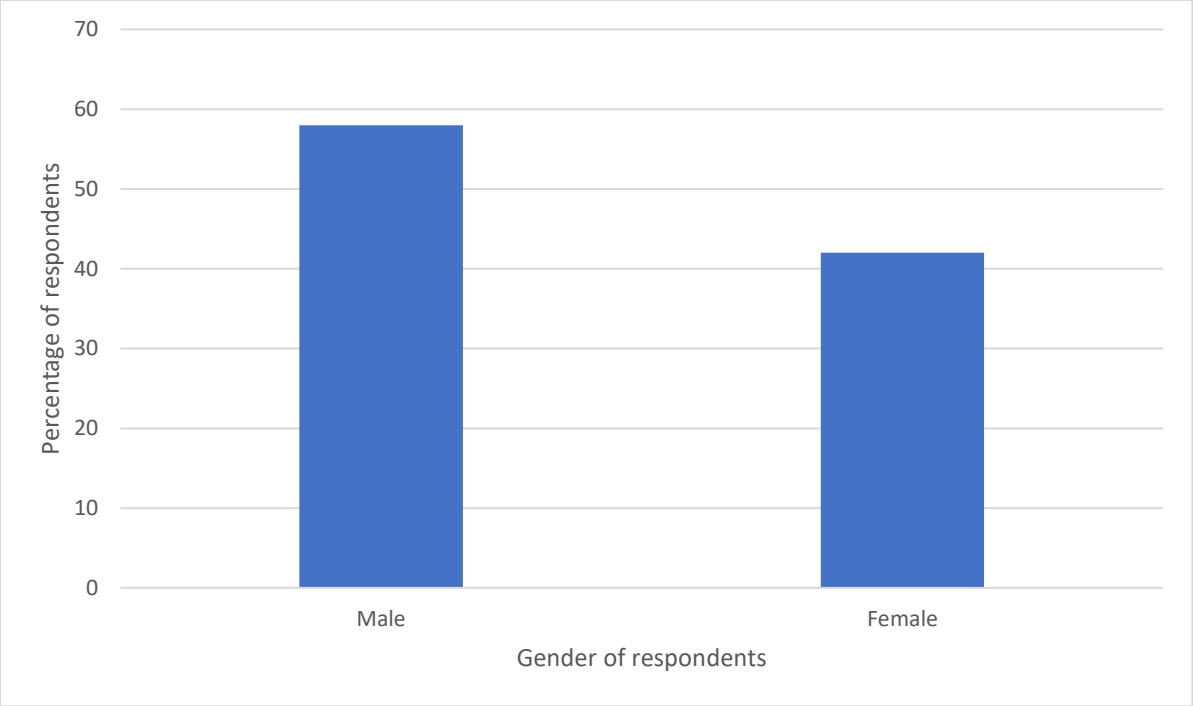

Figure 3: Gender of respondents

The age distribution of respondents was somehow evenly distributed between age groups with majority belonging to 21-30yr group (32% see Figure 4).

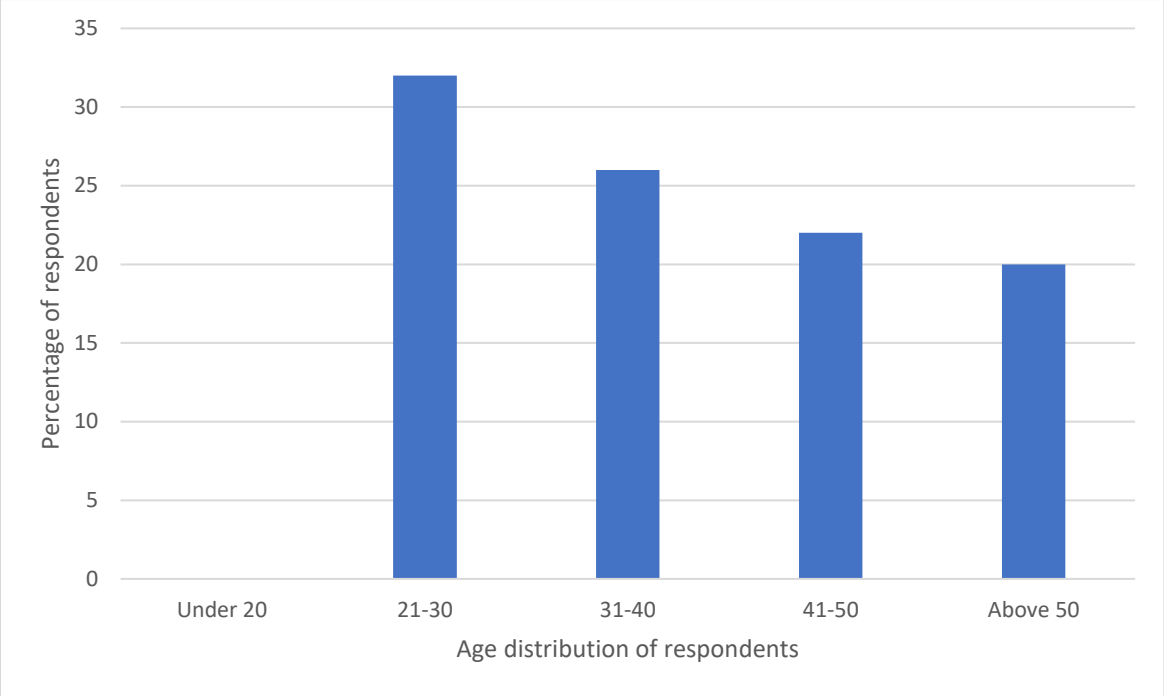

Figure 4: Age distribution of respondents

With regards to educational level, a greater proportion of the respondents have obtained basic education (see Figure 5). This level of education is relevant, as it shows the understanding and acceptance of management interventions by the communities to decision makers.

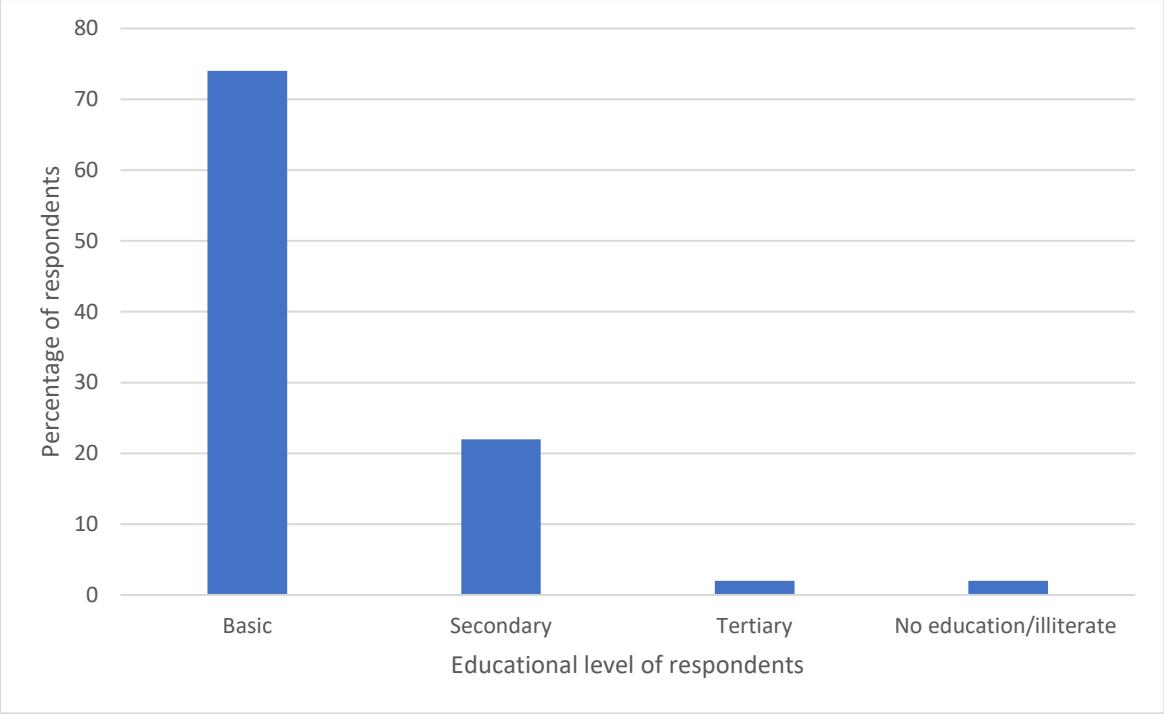

Figure 5: Educational level of respondents

The majority of the respondents (30%) are farmers, even though the occupation distribution is very diverse (see Figure 6). Communities obtain benefits from the sanctuary to support their occupation.

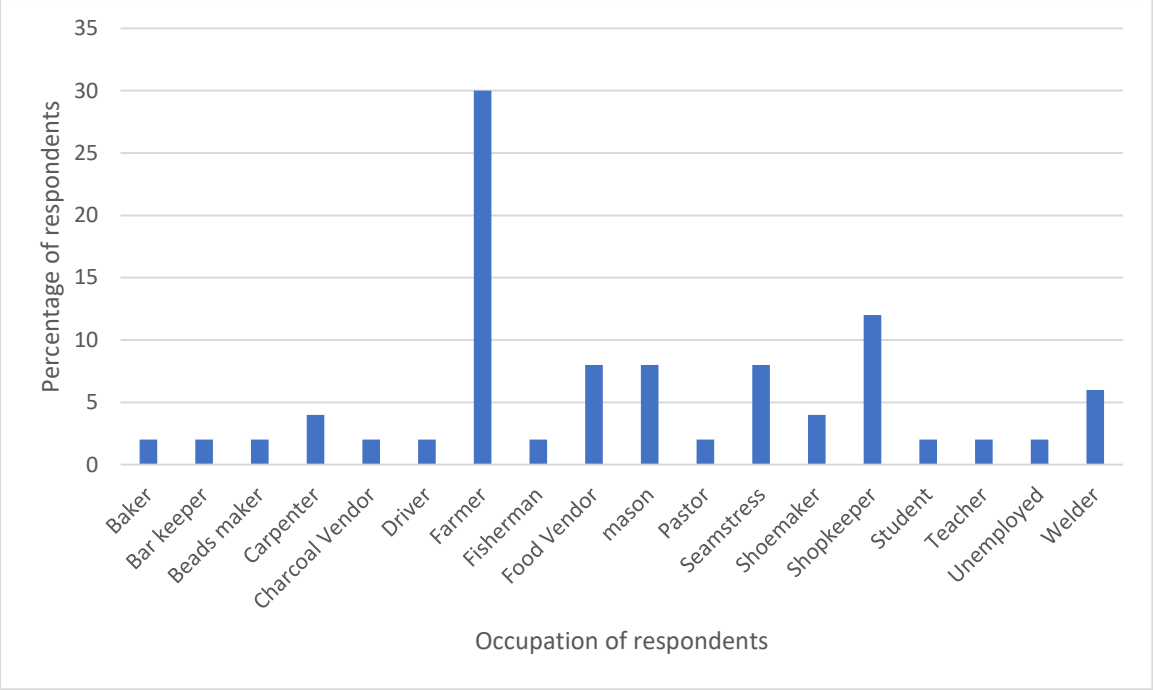

Figure 6: Occupation of respondents

The household composition of the various respondents is very dependent. However, the average number of individuals within a household of the respondent is six (6). This informs the average number of households that depend on ecosystem services benefit provided by Sanctuary.

Respondents benefit in several ways carrying out activities in the Sanctuary (Figure 7). Even though the Sanctuary is relatively small, the majority of respondents' harvest goods.

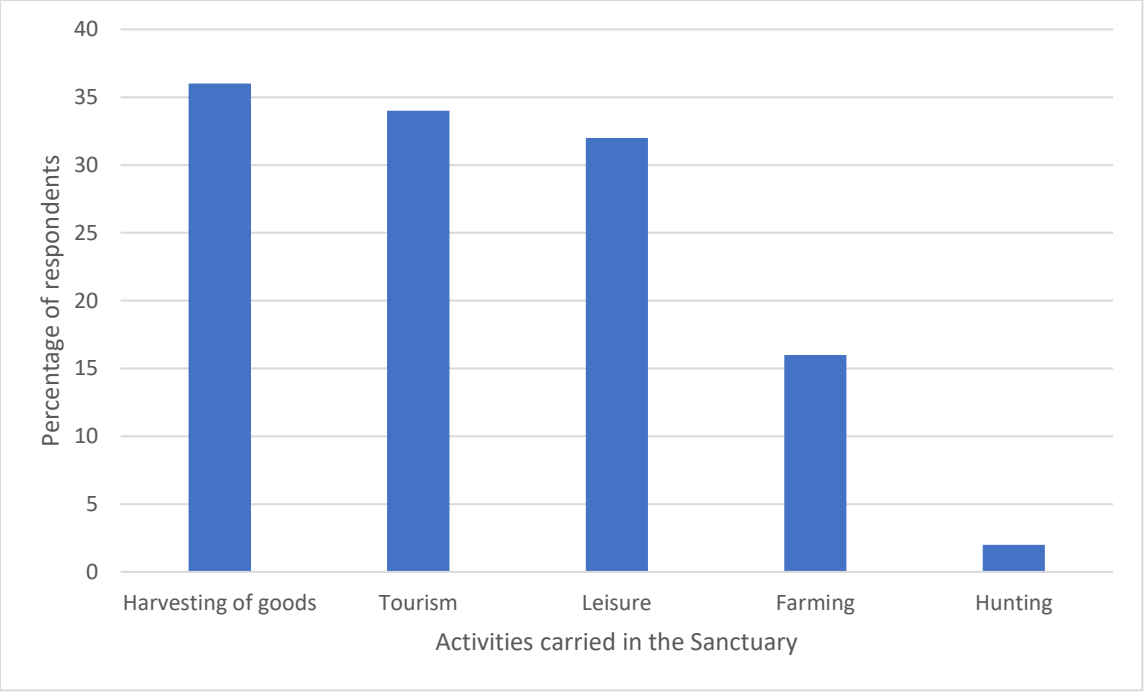

Figure 7: Activities carried in the Sanctuary

Provisioning Services, Current Use and Frequency of Use, Use level and Quantities

The findings from the respondents shows a major use of water as a provisioning service than all the other service (Figure 8). The respondents value the Owabi dam of which they also get fishes from and GWCL sees to it that drinking water is continuously provided. Nonetheless, respondents show the use of fuelwood from the Sanctuary in the urbanizing communities. This is because fuelwoods are still the cheapest and easier source of energy for domestic use, like cooking. The least used provisioning services include snails and sand. This can be understood as such services are not in line with the management plans of the Sanctuary. Therefore, the use of it is very limited.

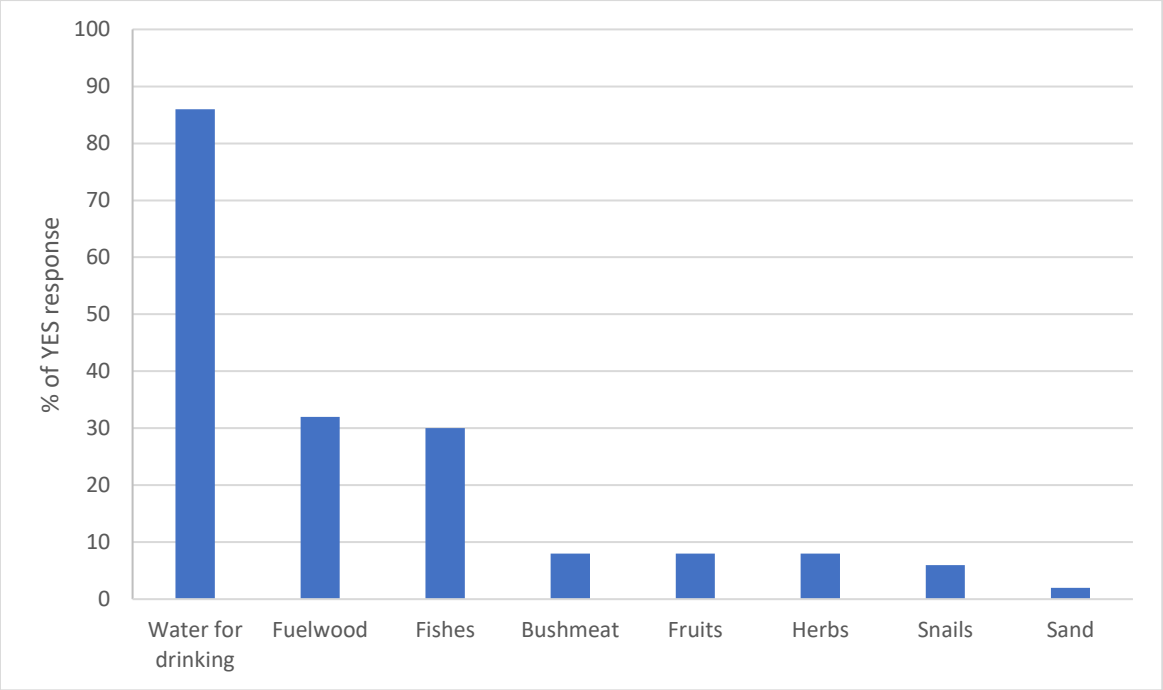

Figure 8: Current use of provisioning services by respondents

To map with the frequency of using provisioning services, respondents were asked to indicate how many times they use these specific services per month. The results were then converted to the average annual usage, which is presented Figure 9. The findings show that herbs are the most frequently collected provisioning services representing a total of 159 times per year. Although, a smaller amount of people uses herbs (Figure 8), it is still the most frequently used. This is due to the low price of the herbs and because it is mostly used in treating long-lasting illnesses (like chronic diseases). It is believed that the frequency of acquiring and the usage of fresh herbs in treatment determines the healing of the person, which in most cases takes a long time hence the higher frequency of use. Other services like fish, fuelwood and drinking water are mostly collected and stored for a periodical usage before collected again. The least frequent collected provisioning services include sand, fruits, bushmeat, and snails. This is restricted to the season (fruits and snails) or the management policies of the Sanctuary (bushmeat and sand).

To present the usage level and quantity for each provisioning services for the total number of

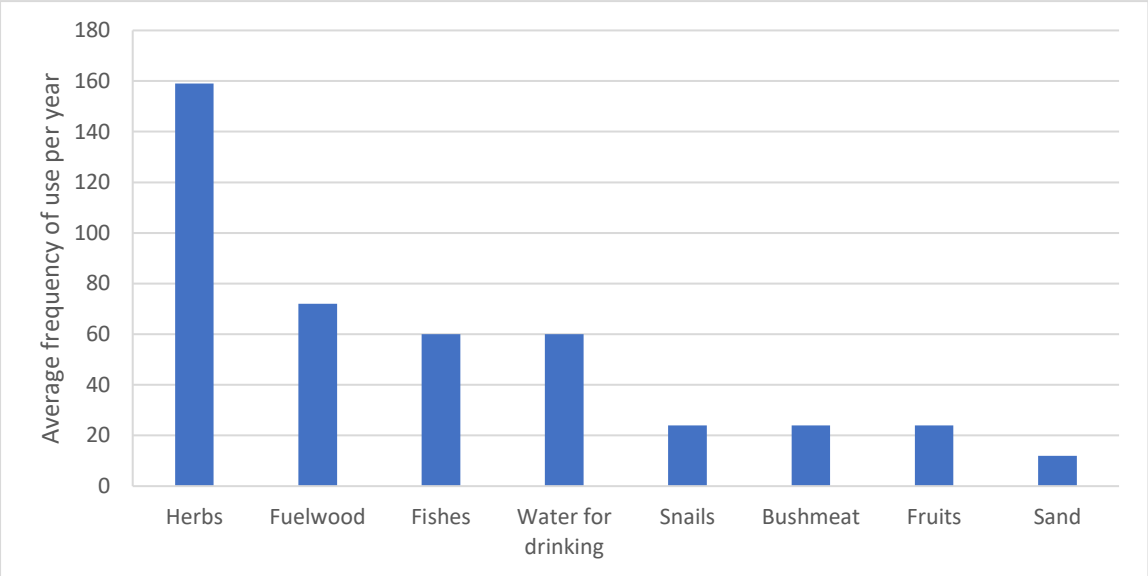

Figure 9: Average per year frequency of use of provisioning services from respondents

households in all the five selected communities, the statistical analysis of the annual quantities used by the sampled households was calculated. The percentage sampled households that use a specific provisioning service were then used in calculating the quantity and use level for the total number of households around the Sanctuary. The unit value for the quantities was estimated by using the information developed by RMSC (see annex III). The minimum and maximum quantity of use services extracted by the total number of households from the community is presented in Table 3. For easy explanation, drinking water has been assessed in m3 and different from the other seven provisioning services which were assessed in tons.

Table 3: Quantity of provisioning services used by the total number of households per year

Provisioning services	**Minimum quantity of use**	**Maximum quantity of use**
Drinking water (m^3)	3,000	32,000
Fuelwood (ton)	150	1,500
Fishes (ton)	16	500
Fruits (ton)	13	21
Herbs (ton)	17	64
Bushmeat (ton)	21	26
Sand (ton)	0	53
Snails (ton)	0	10

The result shows that about 2000 ton per year of the seven provisioning services are maximumly extracted and also an annual of 32 000 m3 drinking water are maximumly extracted from the Sanctuary. This represents a maximum extraction of about 2.4 ton of the seven provisioning services and 8.5 m3 drinking water per number of households in the communities annually. Among the eight provisioning services, drinking water had the highest contribution to the total amount being extracted (between 3000m3 to 32,000m3). The service that is less used by the total number of households is snails with an annual extraction of 10 ton (maximum).

To obtain the performance/sustainable usage of all the eight provision services from Owabi, the maximum productivity and Net Primary Production (NPP) of each service were generated wherever possible. This value for sustainable use represents the maximum value of each service that can be used without degradation. The maximum productivity and NPP were derived from both expert advice and literature search. However, to obtain the NPP of each service was difficult due to limited information for such a specific area. In the case of such an obstacle, benefit transfers and assumptions were made. Sustainable extraction of Owabi ecosystem services by the fringe communities were then generated by using only 10% of NPP i.e. the maximum productivity (see Table 4).

Table 4: Performance/Sustainable use of the eight provisioning services from the Sanctuary by total households of fringing communities

Provisioning services (per yr)	**Maximum Current used (per yr)**	**Maximum Productivity (per yr)**	**The ratio of used/produced Per year**	**Performance/Sustainable use indicator (10% of NPP or maximum productivity in per yr)**
Drinking water (m^3)	32000.00	2000	16	200.00
Fuelwood (ton)	2000.00	33000.00	0.06	3300.00
Fishes (ton)	500.00	2.50	2000.00	25.00
Sand (ton)	53.00	1000.00	0.05	100.00
*Fruits (ton)	21.00			
Bushmeat (ton)	26.00	2.20	12.00	0.22
Herbs (ton)	65.00	0.02	0.004	1500.00
Snails (ton)	10.00	520.00	0.02	52.00

Services with (*) were not able to assess

The results show that all the provisioning services with the exception of fuelwood, sand, herbs, and snails extracted, exceed the maximum productivity annually. For easy understanding, the details of the analysis have been grouped into drinking water, sand and biological resources, which are further explained in below paragraph.

Drinking Water

The maximum amount of drinking water being used by the communities amounts greater than what is being produced. The ratio between used and produced shows a value of sixteen times more than what is being produced. Approximately 32,000m3 of drinking water per year compared to the 2,000 m3 that can be produced per year (expert advice). With such an indication, it can be said that the amount being used by the total number of households fringing the Sanctuary is not sustainable. This, however can jeopardize the service function of the dam and communities may not enjoy such service in a long run. It was however confirmed during community interviews that respondents complain of the occasional shortage of drinking water. Drinking water sometimes may not be available through the pipe-borne for weeks. To improve sustainable usage of these services, an amount of 200m3/year can be sustainably used by the communities representing 10% of what is being produced.

Gap analysis

The total number of households fringing the Sanctuary and the amount of water being extracted from the dam, is known. Although, through expert advice the amount of drinking water that can be produced was known, there is the need for proper assessment of the productivity function of the Owabi dam. Also funding needs to be sourced to maintain the dam, since it was built years ago. Maintaining the dam regularly can improve the capacity function of the dam. To be able to get a clearer picture of how much can be used without over-exploitation, the amount of water that can be maximumly produced must be known exactly

Sand

About 53 tons of sand is being extracted from the Owabi River annually. This indicates about 5% of the yearly produced sand (sedimentation) being extracted annually. With that amount of what is being extracted it could be said that the amount extracted is sustainable compared to the 10% of what can be used from the maximum productivity. For a sustainable harvest, communities can extract about 100 tons of sand yearly to ensure the sustainable harvest annually. This activity was explained by experts during interview, whom said that it is more beneficial for the dam since the depth of the dam has reduced by eroded sand.

Gap analysis

There is the need for impact assessment of sand winning in Owabi dam to ensure that such services do not have an impact on other services, like the drinking water or fish extraction. Also, a more detailed assessment of sand sedimentation in Owabi dam needs to be assessed to know the exact quantities of sand being produced.

Biological resources

The biological resource includes fuelwood, fishes, fruits, bushmeat, and herbs.

The amount of fuelwood used by the communities is about 6% of the yearly production. This shows about 2,000 tons of fuelwood out of about 32,000 tons produced are being harvested annually. The amount harvested is within sustainable usage thus i.e. not more than the 10% of what is being produced (about 3,000 tons/yr.). However, it should be known that not all woods can be harvested in the area especially that of timber and other endangered species. Mostly dead woods and overpopulated tree can be used in this case.

With fishes and bushmeat provisioning services, the amount being extracted is 2000 and 12 times more than what is being produced respectively. This is considered as unsustainable. To harvest both fishes and bushmeat sustainably an amount of 2.5 and 0.2 tons can be respectively harvested annually.

The use of herbs by the communities was within the sustainable usage indicator. They only use about 0.4% of what is annually produced.

Gap analysis

To extract the biological resources of the Sanctuary sustainably, a clear assessment of the potential yield of the various services needs to be conducted. Producing such assessment can provide valuable data input for computing the exact amount of these services that can be harvest without exceeding their potential productivity. Assessment should be done on what types of

wood e.g. bamboo can be extracted as fuelwood. Also, assessment should be done on the type of bushmeat that can be permitted for extraction like rodents. Introduction of new fish species should be introduced to improve their sustainable harvest and restricting harvesting of concern species to improve their population. Fruits tree should also be assessed in the area to know the type of fruits trees available and their productivity to ensure food availability for wildlife survival and also for sustainable harvest for increase of demands from communities.

Regulating Services and current use

From the experts that were interviewed, the most important regulating services that were mentioned include wetland/watershed protection and CO2 regulation. However, this was seen differently according to the respondents. The respondents recognize climate regulation as the most used regulating services (Figure 10). This can be explained as the majority of the respondents are farmers, they expect conducive micro-climate influence from the Sanctuary for their crops. Water purification was seen as the least regulating services. It is assumed that the dam and its waterworks built on the Owabi River is supposed to take care of the water purification and therefore the communities see no added significance of Owabi river to take care of that.

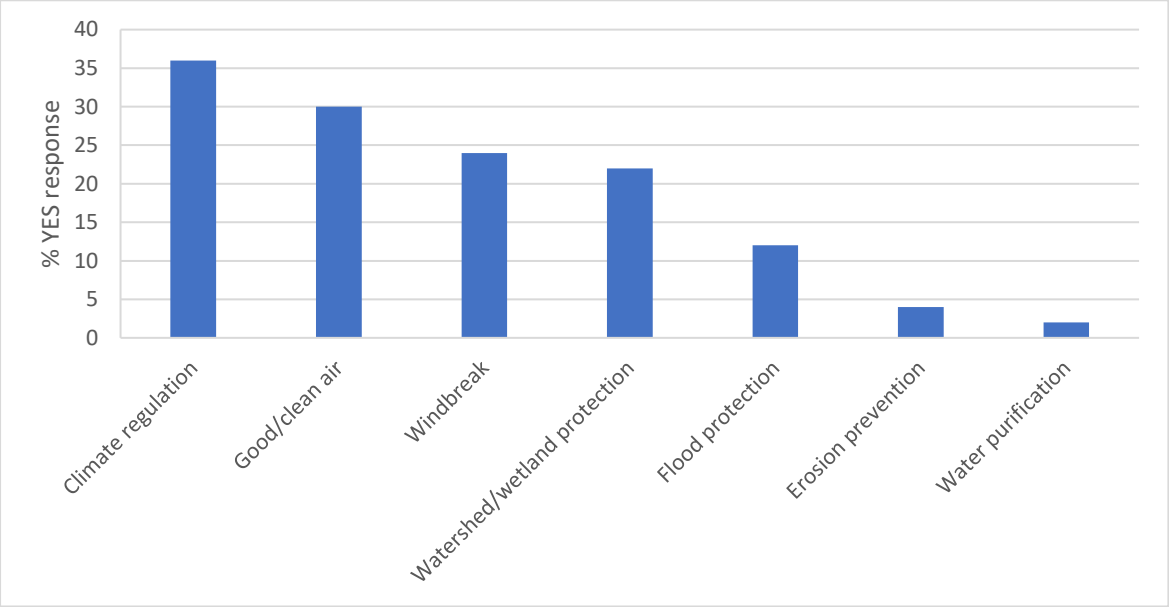

Figure 10: Current use of regulating services by respondents

Cultural Services and current use

Experts recognize ecotourism and research centers as the most significate cultural use of Owabi. There are regular visits by tourist from around the world for bird watching, canoeing, and camping. Also, researchers and students use the area for research purposes. Respondents from the communities also chose the current use of cultural services, which was included in the questionnaires. The result shows a majority of the respondents involve themselves in recreational activities followed by aesthetic beauty and ecotourism (Figure 11). Most of the time they go for a walk, recreational fishing (with hook and line), and also enjoying the serene environment.

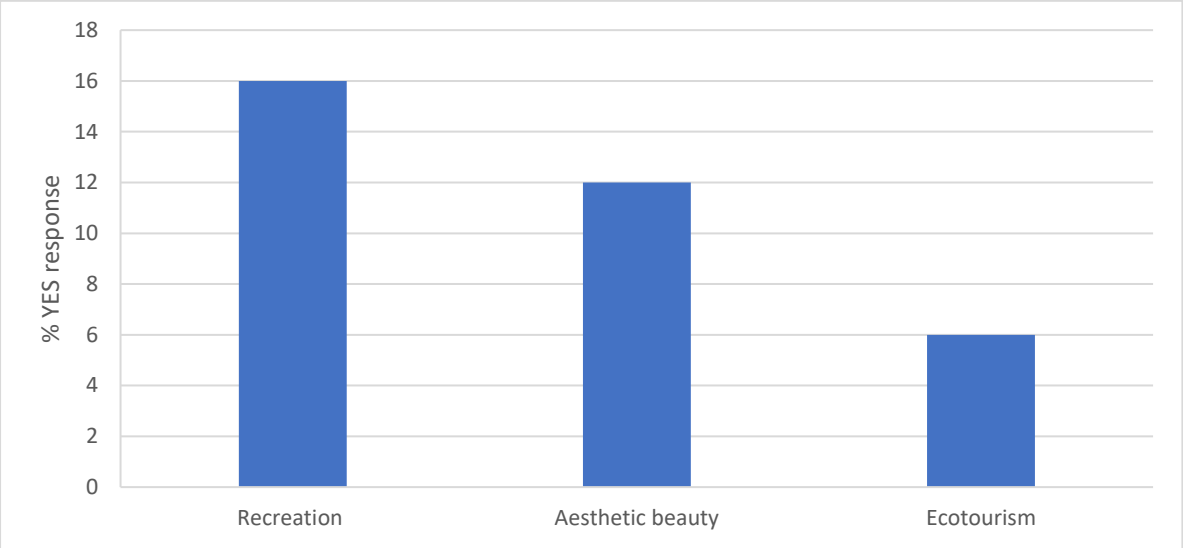

Figure 11: Current use of cultural services by respondents

Habitat Services and current use

Maintaining the life cycle of migratory birds and the genetic diversity for both flora and fauna species are the habitat use services that were mentioned by the experts. This is very important and mandatory for the Sanctuary establishment. The area provides gene pool resources (wildlife) for ex-situ (Kumasi zoo) management to prevent wildlife extinction. All communities recognize this habitat usage and conform to its mandatory.

The habitat services protect flora species of high conservation status, which is considered as vulnerable under IUCN red list including Nauclea diderrichii, Entandrophragma angolense, Entandrophragma utile, Pterygota macrocarpa, and Albizia ferruginea. Till date, there are 193 species of vascular plant which includes 91 trees, 18 shrubs, 37 herbs, and 14 grass species, one epiphyte, six ferns and 26 climbers.

Furthermore, the habitat also harbours the Manis tricuspis (tree pangolin), which is considered as vulnerable with decreasing population status in the IUCN red list. Spot-nose, Mona and the green monkey have been recorded in 1988. There are footprint traces of wild animals, such as bushbuck (Tragelaphus scriptus) and black duiker throughout the area. The area also consists of bird species with 13 families listed in Appendix II of the Convention on International trade in Endangered Species (CITES) (Badu-Boateng & Poku, 2009).

Part IV

Stakeholders relationship associated with fringe communities using the Sanctuary ecosystem services

The various stakeholders involved in the ecosystem services of the Sanctuary were derived from both experts and community interviews. A list of stakeholders was created and grouped according to spatial scale and institution.

Stakeholders interested in Owabi Wildlife Sanctuary ecosystem services

The stakeholder's involvement within the Sanctuary can be distinguished at the local, national/region and global level. At the local level, it includes fringe communities who depend on the area for fuelwood, water for consumption etc. At the national level, the Sanctuary houses the Owabi River dammed by the GWCL. GWCL provides treatment and distributes drinkable water to the people. At the international level, the Sanctuary's ecological resources have been recognized by Wildlife Society. This is a Non-profit making organization representing Birdlife International partner in Ghana. Known from experts interviewed, Wildlife Society provides conservational programmes and supports for the sustainability of the ecological resources of the Sanctuary. Details of the different stakeholders can be seen in **Error! Not a valid bookmark self-reference.**.

Table 5: Stakeholders involvement in the Sanctuary

INSTITUTION	SCALE		
	LOCAL	**NATIONAL/REGINAL**	**INTERNATIONAL**
Individuals	Fringe communities	Kumasi environs	Global community
Public sector	District Assembly, Chiefs	WD, GWCL, WRC	
NGO			Wildlife Society
Research organization		KNUST	

Potential conflicts and synergies to community's use of services

The respondents from the communities were asked to indicate which stakeholder has conflicts or is more collaborative in terms of them using benefits from the Sanctuary. This is presented in **Error! Reference source not found.**. The conflicts, in this case, can be actions, policies or measures that may prevent communities from using ecosystem services from the Sanctuary. The synergies here are defined as any supporting measures for using the Sanctuary ecosystem services. This is a very important relationship to know among communities and other stakeholders in order to predict any source of conflicting issues or any collaborative involvement.

The findings that almost all communities perceive the WD (96%) as a potential threat for them using ecosystem services in the Sanctuary. This is not surprising as WD, which is a government body, has the mandate in terms of policy-making and taking action when necessary to protect the Sanctuary. With such a mandate, all the communities recognize the government's significance. Communities are either limited from going into the area to harvest resources or resources harvested are at times ceased when caught.

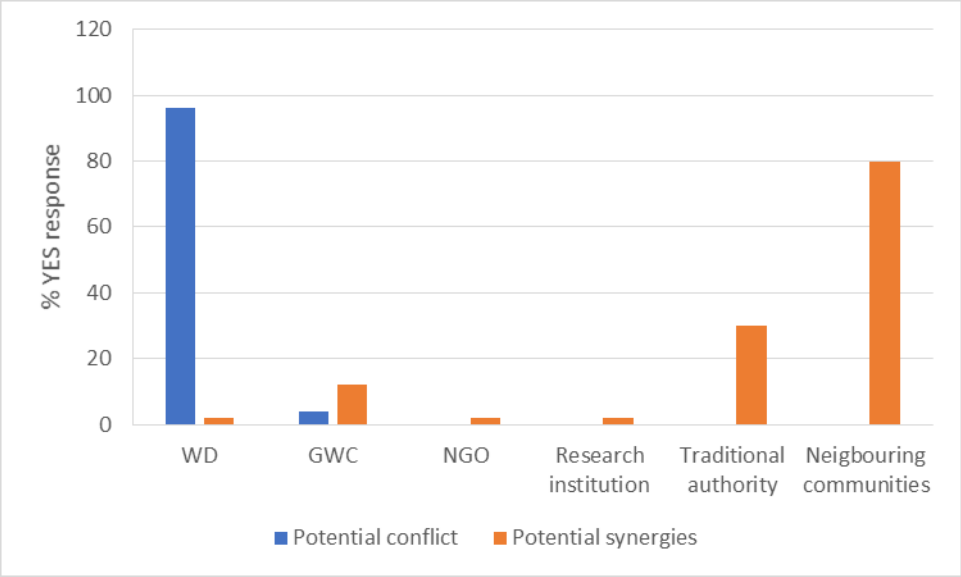

Figure 1: Potential conflicts and synergies to communities in relation to using services from the Sanctuary

When using the benefits provided by the Sanctuary, communities perceive co-existence among some stakeholders of which they do not feel threatened, but are rather allies. This is because none of their activities pose any threat to them using the resources from the Sanctuary. Communities see such relationship as a synergy. Neighboring communities (80%), and traditional authority (30%) are the most popular parties to form allies with. NGOs are seen as the least popular organizations to form allies with. This is because NGO, like Wildlife society mostly deals with government bodies directly (e.g. providing funding) and indirectly to the fringe communities.

Part V

Communities support to ensure sustainability of the Sanctuary ecosystem services.

Communities support some measures to improve the sustainable use of the Sanctuary's ecosystem services. These measures are to ensure or improve the performance/sustainable use of the Sanctuary ecosystem services. The respondents of the communities were asked to rate various measures, that were developed together with experts to improve the ecosystem services of the Sanctuary, from 0 to 5. The mean ratings of these measures were calculated and presented in Figure 13. The outcomes were used in providing some of the recommendations that will improve the sustainability of the Sanctuary ecosystem services.

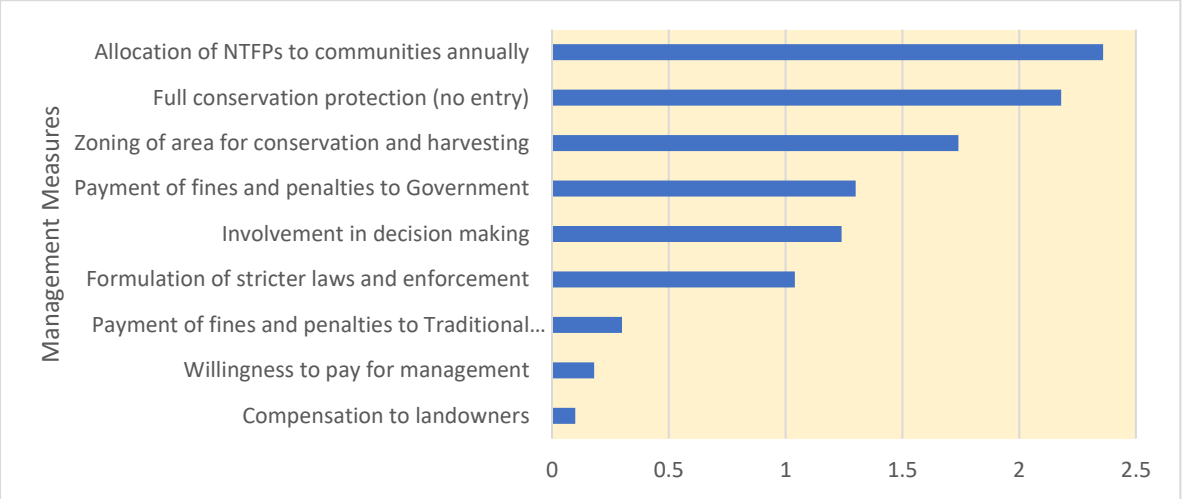

Figure 12: Measures supporting sustainability of the ecosystem services of the Sanctuary by fringe communities

The result shows that communities favour the allocation of NTFPs annually the most. This is understandable when communities derive benefit from the area and want to maintain that. This measure can prove to be sustainable if allocations are based on the performance/sustainable indicator derived in Table 4. However, full conservation protection (no entry) was the second highly favoured. This was quite surprising, as this could prevent communities from getting some benefits from the area. This can only be explained by the fact that the area was established partly for supplying drinking water. Hence, communities cannot supplement their source of water by degrading the area. They would prefer maintaining their source of drinking water if it prevents them from entering the area. Thus, full conservation protection is supported. Zoning of the area for conservation and harvesting, as well as involving communities in decision making were fairly favoured. The least favoured measure is the compensation to landowners. From the communities' point of view, they recognize that the government representing bodies have full control of the area and as such, they have more authorities than the landowners. They assume the government has the power to protect the area by virtue. However, policy-makers should be able to get landowners involved and necessary payment should be done. This can prevent landowners from allocating areas in the Sanctuary for developmental work like housings.

Implications for the sustainability of ecosystem services from the Sanctuary

Allocation of NTFPs to communities annually

This measure seeks to allocate the amount of NTFPs including all the eight provisioning services obtained from Owabi annually. This allocation can be based on the performance and sustainable indicators obtained for the Sanctuary in **Error! Reference source not found.**. Since this measure is highly accepted by the communities, its implementation will as well be supported. With such measure taken, all the provisioning services being harvested by the communities then turns out to stabilize in the near future as only 10% of what is produced is being harvested. This gives the resources time for regeneration and long-term increase. Moreover, this will decrease the declining value of the provisioning services of the Sanctuary and increase the value of other services.

Full conservation protection (no entry)

The second most favored measure by the communities basically restricts any entry from fringing communities. The Sanctuary establishment is linked to providing drinkable water and wildlife protection. Due to these two main services, it seems that any measure to ensure these services rendered is very much supported by the communities, even if it prevents them from exploiting the area. With the full protection of the area, all degradation will cease and the ecosystem services provided by the area will gradually improve in the future. However, the government has to see to it that all compensation involved with landowners need to be settled to prevent illegal activities within the Sanctuary.

Zoning the area for conservation and harvesting

This measure basically divides the area into protection zones and harvesting zones, which is the third measure being supported by the communities. It designates areas where communities can harvest NTFPs and areas where habitats, wildlife etc. can be protected from extraction. With this measure, the current harvesting of NTFPs continues, but in a smaller area zone for harvesting. However, the harvesting rate would be the same and therefore provisioning services may decrease in time. Nevertheless, the measure ensures the improvement of ecosystem services that is unextractable like the cultural, regulating and habitat service. Consequently, these services will increase in the future.

Payments of fines and penalty to Government

This measure allocates fines and penalties to offenders from the communities in relation to the use of Owabi ecosystem services. In this case, the Government (WD and GWCL) may set fines and penalties. Example could be paying an amount of money, arrest any person who over-exploit these ecosystem services unsustainably or causes damages to the area. This will stabilizes the unsustainable use of Sanctuary resources in the future. However, this measure is fairly supported by only some of the communities. This means that the implementation of this measure would be accepted fairly by individuals from the communities.

Involvement of communities in decision making

This measure stabilizes the ecosystem services in the future as communities are involved in the management decisions. This means their needs and local knowledge are brought on board to sustainably manage the area, which is fairly supported by some communities.

Formulation of stricter law and enforcement

This measure had a low acceptance by communities even though it helps to stabilize the ecosystem services in the future. Communities believe that enforcing new and stricter laws will prevent them from benefiting from the area and therefore its acceptance is minimal. Stricter laws and enforcement here could be arresting and jailing offenders of using Owabi ecosystem services unsustainably.

Payment of fines and penalties to Traditional authorities

This measure falls among the least favored measures by the communities. Communities do not consider the traditional authorities as the mandatory authority to manage the Sanctuary. Therefore, any measurement that will result in paying fines or penalties to traditional authorities are highly unfavored. This implies that the current decline on Owabi ecosystem services will continue to decrease with this measure in place.

Willingness to pay for management by communities

This measure implies that communities are willing to pay for the use of Owabi ecosystem services and its management. This measure surely will render Owabi services more sustainable as money obtained can be used in managing the area. This will help stabilize benefits obtained in the area in the long run. However, communities do not fully support this measure as they will have to pay for everything. In such cases, more illegal activities are likely to happen and can cause a decrease in the ecosystem services.

Compensation to Landowners

This measure has to do with the establishment of Owabi where the government pays compensations to the landowners for their land. With this measure, all illegal allocation of areas and exploitation in the Sanctuary by landowners will cease. This will help stabilize the services being rendered by the area. Communities have the least support of this measure since they perceive the government to have the command control and not landowners.

Recommendations for Government and interested stakeholders

All the measures described above seek the sustainability of Sanctuary ecosystem services, with a greater chance of success when the communities are in support of it. These measures can be integrated to form a more robust measure to improve the area. Below are some recommendations for the government, who has control of the area, and interested non-governmental parties;

1. The area should be zoned; protection zone and harvesting zone and apply the annual allocation of NTFPs for fringing communities (with their carrying capacity)
2. There should be a clear management responsibility and collaboration between WD and GWCL, especially at the catchment area in order to prevent over-exploitation and degradation.
3. Restore affected and degraded areas by planting trees, which can support NTFPs extraction by the communities.
4. Implement alternative livelihood programs in fringe communities to reduce pressure on Owabi resources in the case of full protection (no entry).

5. Involve local communities to bring their needs on board and also to predict their area of conflict in order to minimize them.

Part V

Education and awareness creation in managing the ecosystem services in the Sanctuary

After assessing the ecosystem services and their capacity in producing benefits in a sustainable way, the project further includes a participatory sensitization throughout the sanctuary themed "help save Owabi Wildlife Sanctuary''. This was to promote and increase awareness on the importance of the sanctuary, as well as its facing threats. The education together with creating awareness was launched on 24th November 2018, at the grand park of Owabi M/A primary school in Owabi community. This involved the Wildlife Division, the Unit Committee Chairman, District Assembly and project team. The full attendees list can be found in Annex IV.

Three giant sign posts have been installed at the entry points of the sanctuary. These posts give a firsthand message to people entering from fringing communities and making them be aware of the importance of the place. Correspondingly, brochures, banner and t-shirts were further developed and shared among the people to promote the sustainable management of the Sanctuary ecosystem services (see Annex II for more pictures). The students from the Owabi M/A primary school had an awareness float in the communities promoting theme "help save Owabi Wildlife Sanctuary.''

During the day of the event, communities were given the opportunity to bring on board their input to ensure the sustainability of the Sanctuary. Together with the WD, project communities and the project team, an action plan was made for the year 2019-2020. This action plan is believed to help improve the status of the Sanctuary, as well as the livelihood of the fringing communities.

Action Plan

Below

Conclusion

The project team has performed an integrated ecosystem assessment on Owabi Wildlife Sanctuary, displaying vital information concerning the status of the Sanctuary and communities fringing on it. The project reveals the use of some benefits including harvesting of goods, such as Herbs, food, firewood, drinking water etc., tourism, leisure by communities like Esaase, Owabi, Ohwim, Atafoa, and Bokankye. Some of these benefits are obtained unsustainably, for which the project provides necessary recommendation to curb these threats the Sanctuary faces. Most importantly the theme "help save Owabi Wildlife Sanctuary" has reached a larger audience in fringing communities showcasing the importance of the Sanctuary and the benefits derived from there. It is of utmost importance that the Government, Universities, NGOs and other funding agencies like the Rufford Foundation to continue their good works on the Sanctuary beyond this phase and other scheduled phases.

Table 6: Action Plan for the year 2019-2020

Output	Activity	Time (months)											
		1	2	3	4	5	6	7	8	9	10	11	12
1. Zone the forest area.	1. Zone the forest area into protection and harvesting zone (applies annual allocation of NTFPs.												
2.0 Restore forest degraded areas to enhance carbon storage and support community harvest.	1. Identify and map out degraded areas												
	2. Procure high quality seedlings from certified sources												
	3. Undertake planting in degraded areas with indigenous and exotic species												
	4. Establish Greenbelt along the Forest external boundary to mark the Sanctuary												
3.0 Strengthen Community-Based Structures for sustainable resource management	1. Establish resources Volunteer Squads for target communities												
	2. Develop capacity of volunteers in Owabi ecosystem management												
	3. Provide logistics for tactical resource management												

5.0 Enhance adaptive capacity through provision of alternative livelihoods	1. Conduct analysis of adaptive and alternative livelihoods within the project area												
	2. Train target groups in selected livelihoods												
	3. Provide support for alternative livelihood activities												
6. Enhance stakeholder discourse.	1. Appraisal of the management responsibility among involved stakeholder e.g. WD, landowners, GWC and other interested parties.												

Reference

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Annexes

Annex I

Part A

Questionnaires for Expert Interview

Introduction

This questionnaire is designed to assess the ecosystem services provided Owabi Wildlife Sanctuary (including the catchment area) and also to assess the maximum use limit of these services to help develop sustainable management plan of the area in accordance to the Master of Science (MSc) in Environmental Science (Wageningen University). The aspect of sustainability entails the continuous use of these ecosystem services without jeopardizing the ability of the area to provide such services in the future. The study will help to assess the different usage of the services, its current and future use, synergies and conflicts among users of these services to ensure limited challenges among users. For the purpose and use of this research, all the information will be treated as confidential. This would take about 10 minutes proximately and it would be appreciated if you can take the time to complete this questionnaire for the study.

Interview No:
Date of interview:
Name:
Institution:

A. Ecosystem Services Assessment/carrying capacity
   1. What are the benefits that are being provided by Owabi? For the fringe community and for the larger population?
   2. Which of the benefits do you regard as important? (as an organization or person)
   3. What is the state or health condition of Owabi in providing the benefit to meet societal demand in your opinion?
   4. What is the performance indicator (e.g. Kg/ha/year) for these benefits that support sustainability usage without degrading Owabi?

B. Stakeholder Assessment (conflicts and synergies)
   1. Who are the main stakeholders considering the usage and management of the benefits mentioned above?
   2. What are the potential conflicts among users of these benefits? Like which benefits have competing usage.
   3. Do you think the competition of one benefit affects the other in your opinion?
   4. What are the potential synergies among the benefits to ensure sustainable use of the area?

C. Management and Sustainability of Owabi
   1. What are the actual needs of the primary stakeholders with regard to the benefits of Owabi?
   2. How can the needs be met sustainably without degrading Owabi?
   3. In your opinion, is the current management sufficient to support the sustainable use of the benefits? (specify the benefit) Why?
   4. What measures can be put in place to ensure sustainable use of the benefits from Owabi?
   5. Who needs to implement the above measures and with which stakeholders?

Thank you for your time and support.

Part B

Household questionnaire

ECOSYSTEM SERVICES ASSESSMENT AND SUSTAINABILITY ANALYSIS OF OWABI

INTRODUCTION

Dear Respondent

This is to fulfill my Master of Science (MSc) in Environmental Science (Wageningen University & Research, The Netherlands). This study is to analyze the ecosystem services (benefits) that are provided by Owabi Sanctuary (including catchment area) in order to sustainably manage the area for continuous benefit in the future without destroying the ability to provide these services. This study will, therefore, assess the main ecosystem services, the users of these services, the relationship among users and the choice of measure for sustainable development from fringe communities. The information obtained will be handled confidentially for purpose of the research use.

Please tick wherever appropriate.

Date		Interview No:		
A: Demographic and Socioeconomic characteristics				
A1	Sex	Male [ ]	Female [ ]	
A2	Age (years)			
		Under 20		
		21-30		
		31-40		
		41-50		
		Above 50		
A3	Occupation			
A4	Income level	Annual [ ]	Monthly [ ]	Daily [ ]	Other [ ]
A5	Education level	basic [ ]	Secondary [ ]	Tertiary [ ]	Illiterate [ ]
B: House composition				
B1	Number of family members in the house	Total [ ]		
C: Benefits of Owabi				
C1	What are the activities you carry out in Owabi			
	activity			
C1/1	Swimming			
C1/2	Harvesting of goods			
C1/3	Farming			
C1/4	Spiritual			
C1/5	Leisure			
C1/6	Tourism			
C1/7	Hunting			
C1/8	Other (please specify)			

C2: **Services provided by Owabi**

C2	Provisioning	Current use	Would want to use	Quantity (Kg)	Frequency (per month)	C3	Cultural/Amenity	Current use	Would want to use	Quantity (kg)	Frequency (per month)
C2/1	Timber					C3/1	Festivals and rites				
C2/2	Fuelwood					C3/2	Sacred groves				
C2/3	Bushmeat					C3/3	Ecotourism				
C2/4	mushroom					C3/4	Recreation				
C2/5	Fishes					C3/5	Aesthetic beauty				
C2/6	Sand					C3/6	Research				
C2/7	land					C3/7	Others (specify)				
C2/8	Wood for kiln (beads)										
C2/9	Snails					C4	Habitat				
C2/10	Fruits					C4/1	Intrinsic value				
C2/11	Herbs					C4/2	Maintenance of life cycles of migratory birds				
C2/12	Spices					C4/3	Gene pool protection				
C2/13	Wood for mortar					C4/4	Other (specify)				
C2/14	Pestle										

C2/15	cane					C5	Regulating				
C2/16	Twine					C5/1	Watershed/wetland protection				
C2/17	Sponge					C5/2	Erosion prevention				
C2/18	Chewing stick					C5/3	Water purification				
C2/19	Construction Poles					C5/4	Windbreak				
C2/20	Wrapping leaves					C5/5	Good/clean air				
C2/21	Honey					C5/6	Climate regulation				
C2/22	Water for drinking					C5/7	Others (specify)				
C2/23	Water for irrigation										
C2/24	Other (specify)										

C6	Do you sell any of the benefits from Owabi?		
C6/1	Yes [ ] No [ ]		
C6	If yes for C6/1, how much (in Ghc) do you get from selling it?		
C6/2	Benefit	Amount (GHc)	
C6/3	how far do you travel to collect these goods/services	Distance (km or mile) [ ]	
C6/4	Distance from house to the marketplace	Distance (km or mile) [ ]	
C6/5	Have benefits been declined from the past 3years	Yes	No

D: **CONFLICT AND SYNERGIES**

The Wildlife Division (WD) and Ghana Water Company (GWC) are the state institutions in charge of the management of the Owabi Sanctuary and the catchment area respectively. These are institutions responsible for implementing regulations, law, and policies for Owabi to manage its services/benefits. This section seeks to understand the challenges and collaborations that the various users of Owabi services encounter in accessing those benefits and how to address it.

D1: regarding stakeholders and use of benefits of Owabi				
	Stakeholder	Significance	The potential threat of using services	Potential collaboration/friend in using of services
D1/1	Government (WD, GWC, FC etc.)			
D1/2	Research Institution (e.g. NGO etc.)			
D1/3	Traditional Authority (chiefs etc.)			
D1/4	Neighboring community			
D1/5	Illegal timber operators			
D1/6	Timber companies			
D1/7	Sand winning operators			
D1/8	Building contractors			
D1/9	Landowners			
D1/10	Educational institution (universities etc.)			
D1/11	Others (specify			

E: Favorable measures to enhance the sustainable management of Owabi to continuous benefiting							
	Measures	Rate (0=lowest 5=highest)					
E1/1	Allocation of NTFPs to communities annually						
E1/2	Involvement in the decision-making processes in the use of Owabi services						
E1/3	Formulation of stricter laws and enforcement						
E1/4	Payment of fines and penalties to Government						
E1/5	Payment of fines and penalties to Traditional authority						
E1/6	Zoning of the area for conservation and harvesting						
E1/7	Compensation to landowners						
E1/8	Full conservation protection (no entry)						
E1/9	Willingness to pay for management						

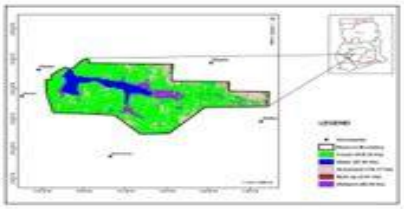
Thank you for participating in the study

Annex II

Awareness and education in the Sanctuary.

OUTPUTS

- Develop a sustainable management plan for the inner and catchment area.
- Outline the ecosystem services being provide
- Identify the synergies & conflicts among users of the services.
- Synthesize public involvement through educating fringe communities.
- Establish clear and visible sign posts at entry points to increase awareness.
- Sharing of broshures and t-shirt for wider awareness.



LOCATION AND DESCRIPTION

Owabi Wildlife Sanctuary can be found in West Africa Ghana specifically in the Ashanti region about 23km north-west of Kumasi. It is classified as "moist semi-deciduous north-west subtype" that covers an area of about 13km² between latitude 6° 47" 3.32" - 6° 41" 52.31" N and longitude 1° 44" 0.81" - 1° 37" 53.04" W. The Sanctuary is characterized by an inner site and catchment area which was designated as a wetland of international importance under Ramsar Convention by the Government in 1988. The forest cover of the area consists largely of secondary vegetation and a fraction of riverine forest, aquatic vegetation and exotic plantation which houses different mammals and bird species listed under the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Ruffor

OWABI WILDLIFE SANCTUARY

AIM OF THIS PROJECT

The overall aim of this research is to develop a sustainable management plan using an integrated ecosystem assessment to sustainably manage Owabi wildlife sanctuary (both inner and outer. Assessing the consequences of this management plan for ecosystem services and use limit for the local communities will help provide insightful information for policy makers on their management decisions. The project further includes education and awareness creation in project

communities to ensure projects sustainability.

KEY STAKEHOLDERS

- Wildlife Division (FC)
- Ghana Water Company Limited
- Atwima Nwabiagya District Assembly
- Fringe Communities
- NGO e.g. Wildlife Society
- Research Institution e.g. KNUST

ECOSYSTEM BENEFITS DERIVED FROM THE SANCTUARY

1. Provisioning benefits e.g. NTFPs and drinking water.
2. Regulating benefits e.g. Clean air, wetland protection, flood and wildlife protection.
3. Cultural benefits e.g. Aesthetic beauty, education/research and Ecotourism.
4. Habitat benefits e.g. Maintenance of life cycles of migratory birds and genetic diversity.

THREATS FACING THE SANCTUARY

- Houses development, sand wining and farming practices impacting on the catchment/dam area.
- Illegal and over-exploitation of NTFPs.

MEASURES TO ENSURE SUSTAINABILITY OF THE SANCTUARY

1. Zoned area into protecting and harvesting zone and allocate annual NTFPs for fringing communities
2. Implement alternative livelihood programmes in fringe communities to reduce pressure on Owabi.
3. Restore affected and degraded areas by planting trees.
4. Involve the local communities in decision making process.

FIGURE 1: SPOTTED MONA MONKEY

CONTACT INFORMATION

Postal Address: P. O. M239, Accra-Ghana.

Email: info.wd@fcghana.org

Contact WD Manager: +233243569727

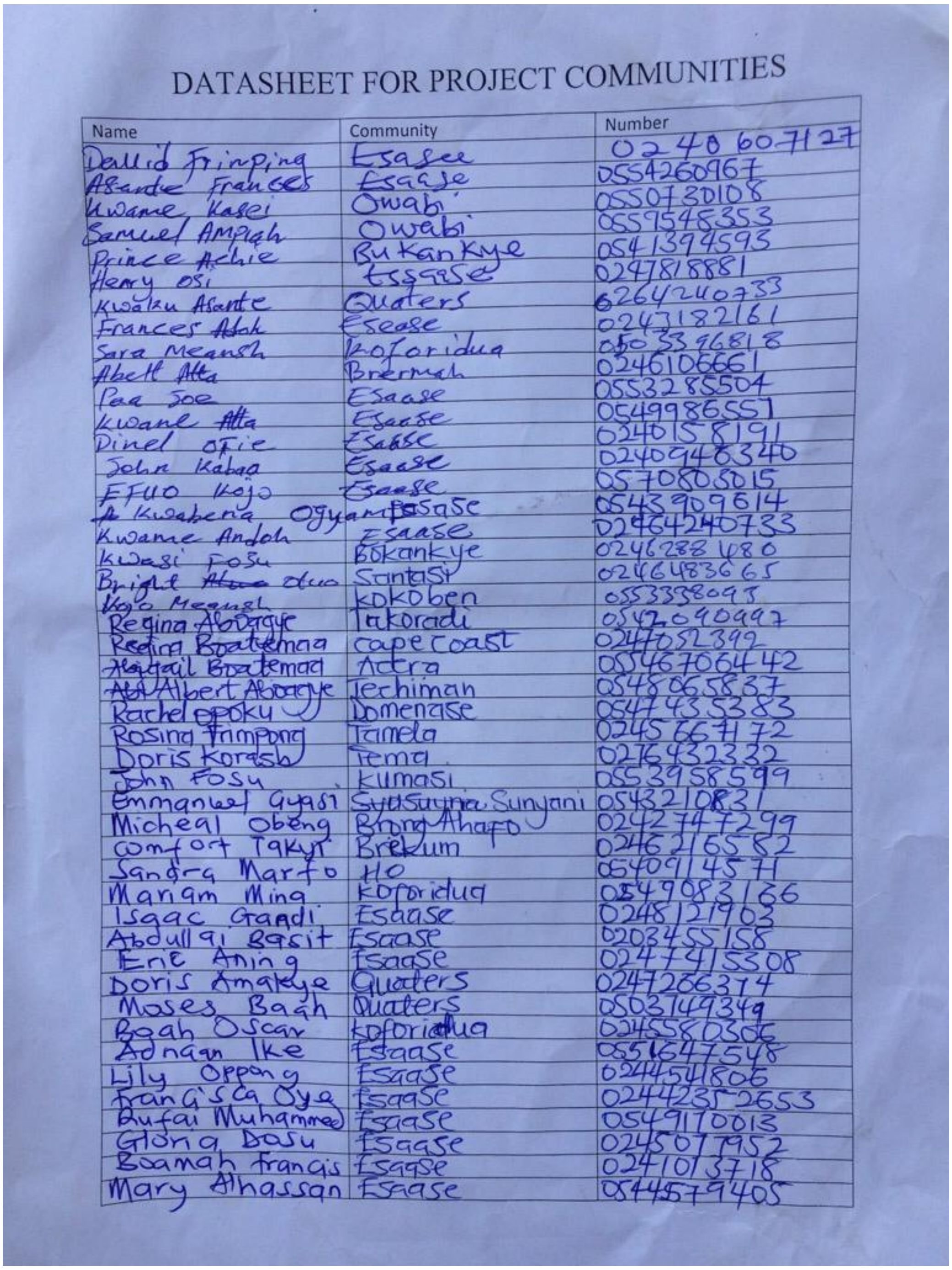
Annex III

Unit value for estimating the quantities of ecosystem services used by communities from Owabi.

Class	Name of product harvested	Local unit	Conversion of the local unit to metric
Non-timber Forest Product	Snails	Paint rubber	1 Paint rubber = 2.5 kg
Bushmeat	Maxwell's Duiker	Full Grown	1 Full grown = 30 kg
Non-timber Forest Product	Herbal medicine	Jute sack	1 Jute sack = 15 kg
Bushmeat	Peel's flying squirrel	Full Grown	1 Full grown = 1.5 kg
Bushmeat	Giant Pouched Rat	Full Grown	1 Full grown = 1.2 kg
Bushmeat	Pangolin	Full grown	1 Full grown = 2 kg
Bushmeat	Grasscutter	Full grown	1 Full grown = 5.5 kg
Bushmeat	Bushbuck	Full grown	1 Full grown = 42 kg
Bushmeat	Brush Tailed Porcupine	Full grown	1 Full grown = 4.5kg
Bushmeat	Giant Pouched Rat	Full Grown	1 Full grown = 1.2 kg
Non-timber Forest Product	Drinking water	Big aluminum bucket	1 big bucket= 34 litres
Non-timber Forest Product	Drinking water	Big barrel	1 big barrel = 8 big buckets= 272 litres
Non-timber Forest Product	Sand	Cement paper bag	1 cement paper bag=50kg
Non-timber Forest Product	Firewood	Bundle	1 Bundle = 5 Kg
Non-timber Forest Product	Fishes (Tilapia)	Small rubber bucket	1 bucket= 5kg
Non-timber forest Product	Fruits	Polythene bag	1 polythene bag =1kg

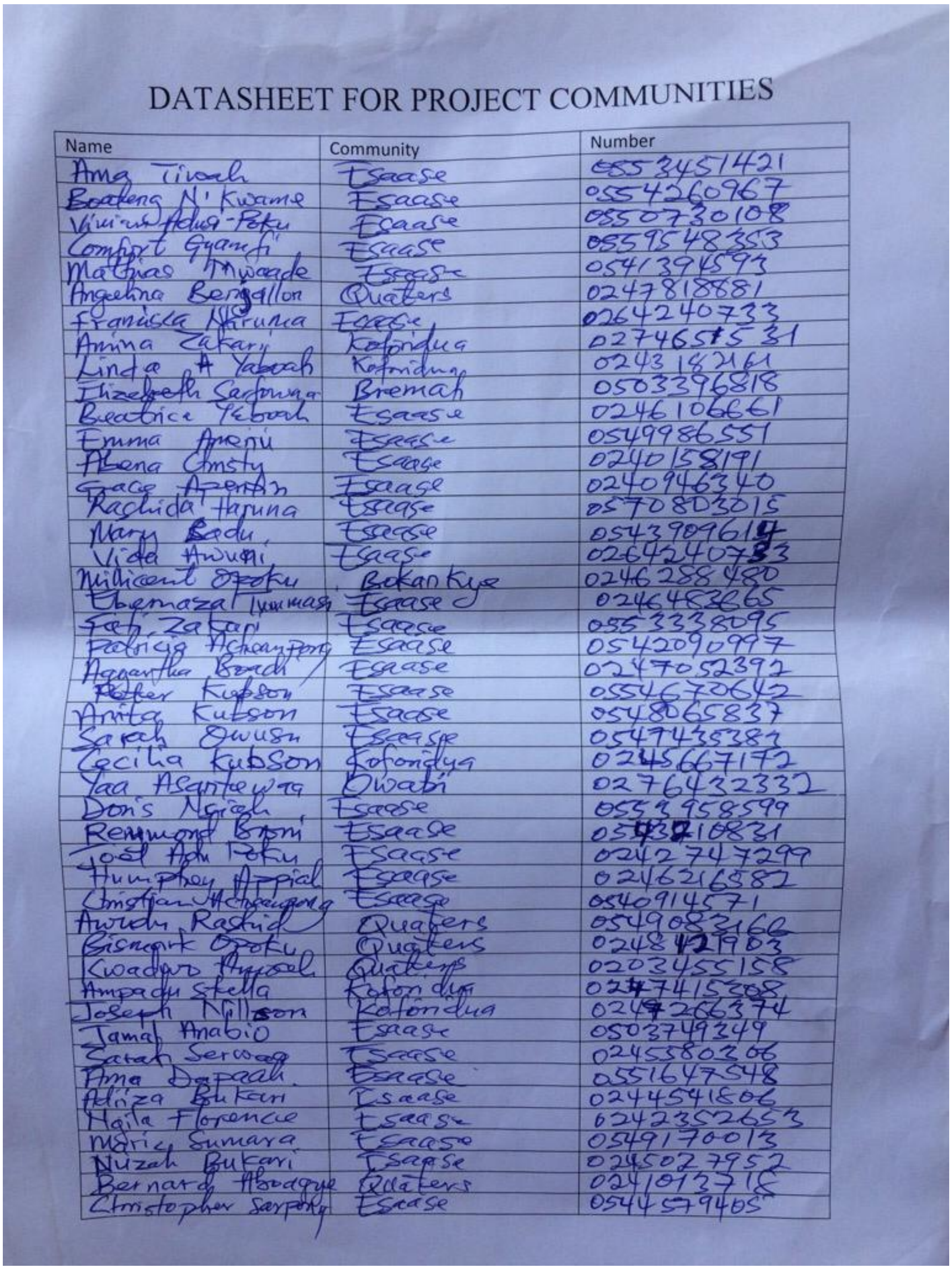
Annex IV

List of attendees at the educational workshop



DATASHEET FOR PROJECT COMMUNITIES

Name	Community	Number
David Frimping	Esasee	0240607127
Asante Frances	Esaase	0554260967
Kwame Kasei	Owabi	0550730108
Samuel Ampiah	Owabi	0559548353
Prince Achie	Bukankye	0541394593
Henry Osi	Essaase	0247818881
Kwaku Asante	Quaters	0264240733
Frances Adah	Esease	0243182161
Sara Meansh	Koforidua	0503396818
Abell Atta	Brerman	0246106661
Paa Joe	Esaase	0553285504
Kwame Atta	Esaase	0549986557
Dinel Ofie	Esaase	0240158191
John Kabaa	Esaase	0240948340
Efuo Kojo	Esaase	0570808015
Kwabena Ogyampa	Esase	0543909614
Kwame Andoh	Esaase	0246424073
Kwasi Fosu	Bokankye	0246288480
Bright Otuo	Santasi	0246483665
Kojo Meansh	Kokoben	0553358093
Regina Abuagye	Takoradi	0542090997
Regina Boatemaa	Cape Coast	0247052392
Abigail Boatemaa	Accra	0554670644
Albert Abuagye	Techiman	0548065837
Rachel Opoku	Domenase	0547435383
Rosina Frimpong	Tamela	0245667172
Doris Koransh	Tema	0276432332
John Fosu	Kumasi	0553958599
Emmanuel Gyasi	Sunyani	0543210831
Micheal Obeng	Brong Ahafo	0242747299
Comfort Takyi	Brekum	0246216582
Sandra Marfo	Ho	0540914571
Mariam Mina	Koforidua	0549083166
Isaac Gaadi	Esaase	0248121903
Abdullai Basit	Esaase	0203455158
Eric Aning	Esaase	0247415308
Doris Amakye	Quaters	0247286374
Moses Baah	Quaters	0503149349
Baah Oscar	Koforidua	0245580306
Adnaan Ike	Esaase	0551647548
Lily Oppong	Esaase	0244541806
Francisca Oye	Esaase	02442352653
Rufai Muhammed	Esaase	0549170013
Gloria Dosu	Esaase	0245077952
Boamah Francis	Esaase	0241013718
Mary Alhassan	Esaase	0544579405



DATASHEET FOR PROJECT COMMUNITIES

Name	Community	Number
Ama Tiwaah	Esaase	0553451421
Boateng N' Kwame	Esaase	0554260967
Vivian Adwoa-Poku	Esaase	0550730108
Comfort Gyamfi	Esaase	0559548353
Mathias Mwaade	Esaase	0541394593
Angelina Bengallon	Quaters	0247818881
Francisca Nkruma	Esaase	0264240733
Amina Zakari	Koforidua	0274657531
Linda A Yeboah	Koforidua	0243182161
Elizabeth Sarfowaa	Bremah	0503396818
Beatrice Yeboah	Esaase	0246106661
Emma Amenu	Esaase	0549986551
Abena Christy	Esaase	0240158191
Grace Asentin	Esaase	0240946340
Rachida Haruna	Esaase	0570803015
Mary Badu	Esaase	0543909614
Vida Awuni	Esaase	0264240733
Millicent Opoku	Bokankye	0246288480
Ebemazal Iyumasi	Esaase	0246483665
Fati Zakari	Esaase	0553338095
Patricia Acheampong	Esaase	0542090997
Agyantha Boach	Esaase	0247052392
Peter Kubson	Esaase	0554670642
Anita Kubson	Esaase	0548065837
Sarah Owusu	Esaase	0547435381
Cecilia Kubson	Koforidua	0245667172
Yaa Asantewaa	Owabi	0276432332
Doris Ngiah	Esaase	0553958599
Remmond Boami	Esaase	0543210831
Joel Adu Poku	Esaase	0242747299
Humphrey Appiah	Esaase	0246216582
Christian Acheampong	Esaase	0540914571
Awudu Rashid	Quaters	0549083166
Bismark Opoku	Quaters	0248121903
Kwadwo Appiah	Quaters	0203455158
Ampadu Stella	Koforidua	0247415308
Joseph Nillson	Koforidua	0247266374
Jamal Anabio	Esaase	0503749349
Sarah Serwaa	Esaase	0245580306
Ama Dapaah	Esaase	0551647548
Adiza Bukari	Esaase	0244541806
Haila Florence	Esaase	0242352653
Maric Sumara	Esaase	0549170013
Nuzah Bukari	Esaase	0245027952
Bernard Aboagye	Quaters	0241013718
Christopher Sarpong	Esaase	0544579405

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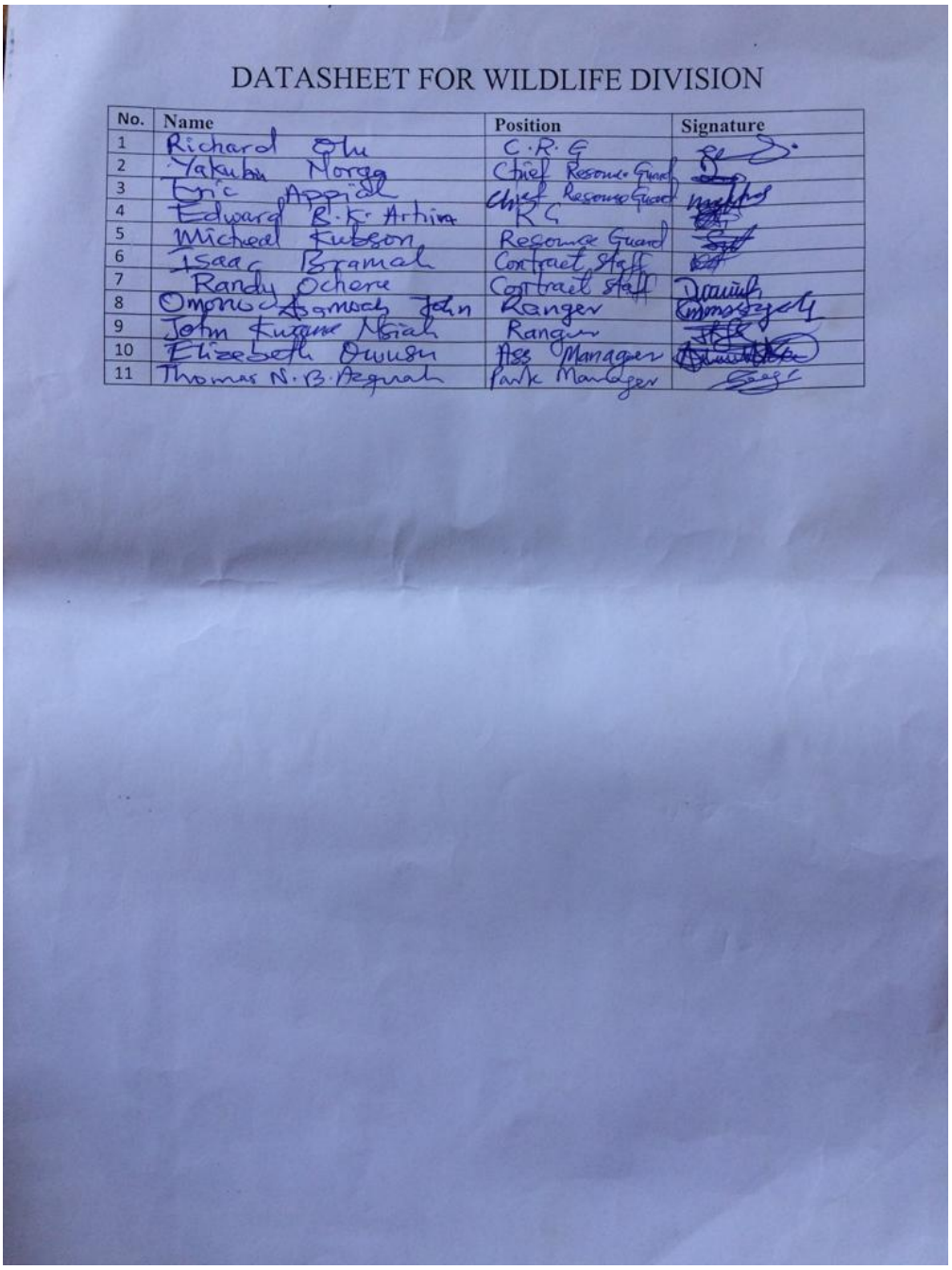

DATASHEET FOR WILDLIFE DIVISION

No.	Name	Position	Signature
1	Richard Ohu	C.R.G	
2	Yakubu Morga	Chief Resource Guard	
3	Eric Appiah	Chief Resource Guard	
4	Edward R.K. Arhin	RG	
5	Michael Eubson	Resource Guard	
6	Isaac Ibramah	Contract Staff	
7	Randy Ochere	Contract Staff	
8	Omonwa Asamoah John	Ranger	
9	John Eugene Nsiah	Ranger	
10	Elizabeth Owusu	Ass Manager	
11	Thomas N.B. Agyeah	Park Manager	