Impacts of Blue Carbon Trading in Gazi Bay Mombasa Kenya

Beatrice Obegi[*]

Kenya Marine and Fisheries Research Institute, Department of Environmental Science, P.O. Box 837-20117
Naivasha, Kenya
Email: obegibeatrice@gmail.com

Abstract

It is beyond doubt that blue carbon has been overexploited and is now threatening the lives of the coastal communities. Most studies have proved that mangroves in Gazi Bay have been depleted over decades. The study is assessing the concepts of carbon trading to restore the forest back. Impacts of blue carbon trading were assessed in Gazi Bay by obtaining primary data through a social survey and relevant questions to suit the study were administered. Secondary data was obtained from both Mikoko pamoja Project, women board walking and fish data was obtained from Gazi BMU. Data on revenue, fish, income, tourists, boardwalk cash and employment were collected and using promethee MCDA software they were analyzed for each year from 2013 to 2016. 2015 was ranked the highest followed by 2016, then 2014 and 2013 respectively. The rightmost column on the figures in the findings shows ranking according to Ph-: and the leftmost column shows the same trend according to ph+. 2013 has so many weaknesses and was the least conserved year. Carbon trading impact to the livelihoods was assessed using the promethee model Valuation, the results showed that the carbon trading has improved the lives of the community by providing freshwater to the households, improved in health care and created employment improved in transport system. The promethee model used to rank the last four years of conserving the blue carbon and the impacts of carbon trading ranked the years from the best to the worst. 2016 received the lowest income while 2015 was the best. The results justified the implementation of conservation and restoration programs especially Mp and has encouraged carbon trading.

Keywords: Mangroves; Impacts; Carbon Trading; Promethhee Model; Livelihoods.

----

* Corresponding author.

1. Introduction

Blue Carbon incorporates mangroves, salt marshes and sea grass. The paper focuses Mangrove forest conservation in Gazi Bay. It is normally found in tropical and subtropical coastline. Globally there are many species of mangroves that make more than one hundred species, and the world largest mangroves is in Asia, which makes 68 million hectares, followed by Africa with 20% according [1]. In Kenya mangroves occupy a total of 54000 hectares that run across Kenyan coastline according to Kenya Forest Service (KFS). Mangrove conservation is very important in fighting Climate Change and they can also prevent disasters and risks to the coastal communities as well as stopping storm surges and soil erosion Globally mangroves are a significant sink as described by [2], and they accumulate carbon in tree biomass and much of this carbon is lost and stored belowground as soil carbon Community based conservation programs that started conserving natural forest and replanting of 4000 tree each year has enhanced carbon trading in Gazi Bay. According to [11], the stocks sequestered are sold to the international buyers and other private organization, Payment of Ecosystem Services (PES). Kenya coastal development project (KCDP) constructed a watchtower to enhance surveillance and monitoring of the conserved area and through carbon trading the community earns income every year. For decades now it has been noted that lack of community participation and inputs in respect to management, poverty levels amongst the community, lack of awareness on mangrove uses and importance and lack of alternative livelihoods are major obstacles to the wise use of mangroves. The replanting and conserving mangroves in specific areas started   in 2013 and its aim was to plant trees on an area of 0.4 ha every year and conserve the natural forest of 107 ha, Knowledge on the status of blue carbon and carbon business about the achievements is required to help in its sustainability. This study shows information on the community household characteristics, mangrove forest structure and carbon trading.

Globally around 3.2 billion people live along the coastline of 200 kilometers wide as described by [3] High growing population depends directly on mangroves as per the study done by [4,5]. Carbon trading in Gazi has greatly attracted many tourists who come to enjoy the women board walk. Further students from all over the world come to study in Gazi bay. The purpose of this study is to provide information to the stakeholders for decision making and planning. Most of the studies have been focusing on the degradation and exploitation of the mangrove forest. There is little knowledge and data on the mitigation programs, and other efforts made to restore and make sure mangrove forests are saved from extinction. Mikoko pamoja works together with the association for coastal Ecosystem Services ACES', (a registered Scottish charitable Incorporated Organization SCIO, REC SC043978) under the laws of Scottish government this is according to author [11] Valuation of mangroves in Gazi Bay, Kenya. has been fully evaluated to be 9.3 ha^{-1} yr^{-1} done by [6]. In addition the community enjoys a wide range of provision services such as fuel wood, timber, construction materials, boats and net floaters, oars. They also promote fishery by providing good nursery grounds for juveniles as reported by [8]. Mangroves have the capacity to store and sequester carbon; the more the community conserves and replants more trees the more income from PES which in turn is distributed among the two villages. Reference [7] Describes Further the mangrove ecosystem as a home of most invertebrates with a rich biodiversity. Most of the fauna found in mangroves are edible including the recreation and ecotourism activities which brings income to the youths and the community. The mapped area of 117 ha of mangroves forest which was on Kenya gazette is managed by local communities following [1] work. Forest management has changed following the

implementation of the new constitution of 2010 in which the forest management policy was devolved from the national government to the county government and communities as described by work done [13] , to achieve the same the Kenya forest service was established as well as community forest association CFA to draw up strategies and agree on how to manage the forest and form an agreement with specifications on user rights and benefits that adhere to CFAs from the study of by [1]. This aims at ensuring the community tenure and a group of twelve user group that benefits from Gogoni-gazi community. This include Mikoko Pamoja community organization (MPCO) formed from Gogoni-Gazi community forest FMA which constitute the legal mandate under which all users including MPCO working in co- management of the forest that allows use of designated Mangrove areas by locals. Kenya coastal development project has also put up a watch tower for surveillance of the illegal cutters.

1.1. Study Area

Gazi bay (4° 25 'S and 39° 30 'E) is a shallow tropical coastal water system situated in Southern Kenya approximately 55 km South of Mombasa. The Bay is bordered by 2.4 square miles (6.2 square kilometers) of mangrove forests. The bay area is sheltered from the sea by the Chale Peninsula to the east and a fringing coral reef to the south. The reef supports a local subsistence and commercial fishery. The total area of the bay excluding the area covered by mangroves is about 1000km as reported by [12].The mangrove forest of Gazi bay covers 600km. The species found in Gazi include *Aviceniamarina, Ceriopestagal, Bruguieragymorrhiza, Heritieralittoris, Lumenitzeraracemosa, Rhizophoramucrunata,, Sonneratiaalba, Xylocarpusgranatum, X.moluccensis and Pemphisacidula.*.This classification is according to author [9]. The forest is heavily used by local people for fishing, as a source of wood for building and fuel, mariculture, boat and fish floater construction, women board-walking and apiculture as indicated by author [5]. The bay area has beautiful beaches and impressive bird life, including three species of bee-eater, pelicans, palm vultures, and hornbills. It is near the tourist resort of Diani Beach, the Shimba Hills National Park, and the Kisite-Mpunguti Marine National Park (with dolphins, sea turtles, and spectacular coral reef snorkeling). The working points and conserved areas (fig 1) are marked activity 1, activity 2 and activity 3.
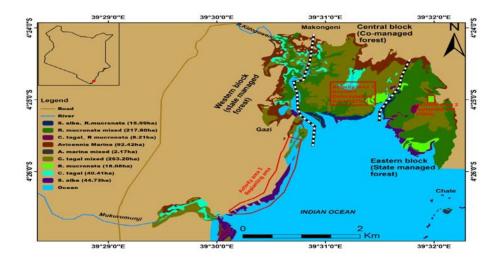

Figure 1: Map showing study Area

1.2. Sampling Design

A social survey was conducted in the two villages of Gazi Bay in which, face to face interviews was conducted using a questionnaire data sheet for primary data. After conducting a survey in one household then two houses marked the boundary of the next interview. Relevant questions were asked to much the study. At least over 100 households in each village were interviewed which is 30% of the total households in the two villages. Most of the secondary data was obtained from women board walk and Mikoko pamoja project.

1.3. Data Analysis

Data analysis was done using promethee valuation model. It is a multi-criteria decision aid (MCDA) software which ranks possible decisions from the best to the worst. Six criteria were chosen; revenue, fish, income, tourists, boardwalk cash and employment criteria and run against the years from 2013 to 2016.

2. Research Findings

2.1. 2013-2017 mitigation programs in Gazi Bay

The color corresponds to the criteria. Positive (upward) slice correspond to good features while negative (downward) slice corresponds to weaknesses. This strikes the balance between positive and negative and is equal to Phi score. Actions are ranked from left to right according to promethee II complete ranking. Promethee valuation model has the capacity to accommodate the Qualitative and quantitative aspects. Evaluating each finance year from the year 2013 when the project begun until the year 2016, the chart shows that revenue, fish, and income were weak but tourists and cash from board walk showed positive features (fig 2). In 2014 seems to be slightly above average, the chart shows good features in tourism, boardwalk and revenue but worst in fish, income and employment, while 2015 shows all good features except tourists and boardwalk. 2016 was worst in revenue, tourists and boardwalk.
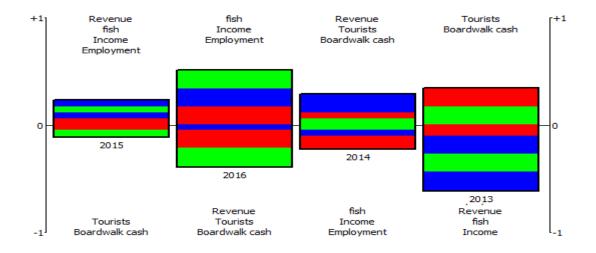

Figure 2: Promethee Rainbow

2.2. Net Phi score

For each action a bar is drawn with as many slices as the number of criteria. The sum of the positive slices minus the sum of the negative slices is equal to Phi net flow score of the action (table 1). In 2013 the Phi net flow score was negative two, while 2014 and 2016 had a zero Phi net flow score and 2015 scored 2. The drop in 2016 was associated with non-engaging in replanting activities

Table 1: Showing Net Phi

Phi Score	2013	2014	2015	2016
Positive Slices	2	2.5	3.5	3
Negative Slices	4	2.5	1.5	3
Phi net flow score	-2	0	2	0

2.3. Promethee I ranking

On the promethhee partial ranking, the leftmost bar shows the ranking of the actions according to Phi+: 2015 is the ranked highest followed by 2016, then 2014 and 2013 respectively. The rightmost shows ranking according to Ph-: shows the same trend. 2013 has so many weaknesses and therefore not preferred fig 3. Line 2015 is completely on top of line 2016; according to the Promethee I partial ranking it means that the 2015 and 2016 are both better in both Phi+ and phi-. Lines 2014 and 2016 are intersecting the phi+ and phi- this means rankings are different and thus incomparable.
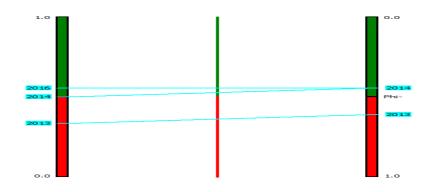

Figure 3: Promethee partial Ranking

2.4. Promethee II ranking

In promethhee II complete ranking three groups of actions appear clearly as show below;

2015 and 2016 have the highest with the same score. 2014 has a score of 0.0556 while 2013 has the lowest score which has a negative score of -0.2778 (fig 4) Promethe ranking is easier to explain but has less informative as the differences between Phi+ scores are not visible anymore. 2015 and 2016 were on the straight line meaning one line is on top of the other. The topmost is more preferred.
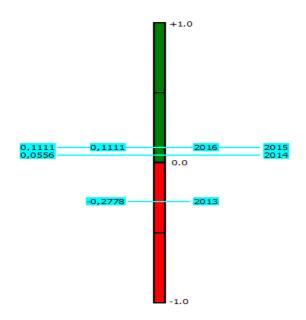

Figure 4: Promethee complete Ranking

2.5. GAIA Brain

2015 displays the best year in Income and revenue and employment as it is oriented to the right. But 2014 is oriented to the left and both are above the line (fig 5). While 2016 is orientated to the right and 2013 to the left but below the line. Revenue and income are very close and they were much preferred in 2015, while employment did very well in 2016. Women boardwalk was preferred in 2013.
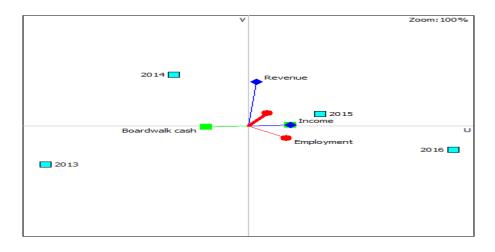

Figure 5: Promethee GAIA

3. Discussion and Conclusion

The social survey conducted was almost similar to that conducted by Ann Wanjiro 2017 which revealed that most people depend on the blue carbon on their livelihoods. The results proved that majority of Gazi residents utilize the mangrove forest for firewood using the three stones to cook, while the cleaner sources of energy are used depending on the income per households. The mitigation projects in Gazi have improved the community development by implementing small projects such as water projects and also supplying books to the primary schools in Gazi Bay. This study also was able to show similar results to that of [10] and [1]. The community was living below poverty lines but now due to the development projects of conserving the blue carbon, the community has improved in various aspects of life such as increase in income, education, awareness , health care, easy access to fresh water, increased employment opportunities, easy transportation. In addition most residents can easily access the soft loans. Gazi women have constructed mangrove board walk which concentrate on cooking the Swahili foods and sell to the tourist. This money goes to the village on various activities. In 2016 the activities went down and income was low because replanting did not take place, and the number of tourists and cash collection went down, this was attributed to lack of replanting exercise. The Promethee model ranked 2016 the worst year was, followed by 2014 and 2015 was almost average.

Kenya was among the countries that came together in 2000 and set a Millennium Development Goals (MDGs). These goals aimed at getting rid of poverty and hunger. One of the leading organizations working hard to achieve these goals is the UNDP. This organization awarded Mp an equator award price for protecting, conserving the mangroves towards improving community livelihoods. Kenya has built a new set of goals Sustainable Development Goals aiming also to end poverty and hunger by 2030. Through connecting people, government Organizations and world leaders they set goals for land, oceans and waterways. Blue carbon a forestation, reforestation and conservation are working to achieve this. The Gazi community through mp has been able to get enough food, created employment and people are working hard to earn more than $ 1.

Since there are many programs that are aimed towards poverty alleviation and food security for most African countries especially Kenya where most people languish in poverty, natural resources such as mangroves are the major that help in such situations. The community should be allowed access to the resources and as co-management the community is responsible in protecting, and replanting so as to promote sustainability. The community based participatory forest co-management model in Gazi community has facilitated the sales of carbon stocks in the carbon markets effectively and these have proved to be the best management unlike privatization. Further the model has provided access to mangroves legally has the community manage it.

3.1. Challenges/Constrains

I. The study was limited with the amount of funds that were available as the study required moving from one household to another, this was a bit tiresome and needed extra budget.

II. Most of the respondents within the community are not learned and hence was very difficult to get them understand the correct question.

III. Some of the respondents were strongly bitter about the corruption and tribal alignment when it comes

to utilization of the income from the carbon credits.

3.2. Recommendations

Following the study there were a number of recommendations were made, this includes**:**

1. The mitigation programs should extend to the neighboring areas, to improve on food security and poverty alleviation.   .
2. Transparency and accountability should be the key in all major transactions for sustainability of the important programs. The two communities complained of nepotism, the management should bring every board on board and try to not recruit relatives on the management.
3. More area should be open for more planting and reforestation so as to control climate change.
4. Women and youth empowerment should be encouraged through this programs and the government should be a shareholder of small projects.
5. Time of the study was limited and hence more time for research was recommended in future

Acknowledgement

References

[1]   A.Huff and C.Tonui, (2017) Making 'Mangroves Together': Carbon, conservation and co-management in Gazi Bay, Kenya, STEPS Working Paper 95, Brighton: STEPS Centre

[2] D. Along 2012, Carbon Sequestration in Mangrove forest Carbon Management 3(3) pp 313-322.

[3] G. Chandria 2014, Distribution and Dynamics of Mangroves Forest of the world. Earth Resources Observation and Science(EROS) Centre

[4] , C. Giri1*, E. Ochieng2, L. L. Tieszen3, Z. Zhu4, A. Singh5, T. Loveland3 J. Masek6 and N. Duke7 Status and distribution of mangrove forests of the world using earth observation satellite data. Global Ecology and Biogeography, (Global Ecol. Biogeogr.)

[5] Lang'at, J. K. St., Kairo, J. G2. and Karachi, MI. l Natural Resources Department, Egerton University 2Kenya Marine and Fisheries Research Institute;   proceedings of the 3rd kefri scientific conference 6-9 November 2006

[6] J.G Kairo1, 2*, F. Dahdouh-Guebas2, J. Bosire1, 2 and N. Koedam2 Restoration and management of

mangrove systems — a lesson for and from the East African region South African Journal of Botany 2001, 67: 383–389

[7] N. N. Beeresnew 2007b, The world's Mangroves 1980-2005; FAO forest paper 153 p 89

[8] W. Steften 2015, The trajectory of the anthropogenic: The Great Acceleration, volume 2 issue 1 pp 81-98

[9] P. B. Tomllinson 1994, The botany of mangroves

[10] A. Wanjiro 2017, A report of Mikoko Pamoja Social Survey.

[11] M. Huxham 2013, Mikoko Pamoja conservation for community benefit

[12] Huxham 2010, Mangrove forest cover fading

[13] H. Agevi, M. Wabwya, HM. Tsingalia Community Forest Associations and Community-Based Organizations: Redesigning their Roles in Forest Management and Conservation in Kenya International Journal of Science and Research (IJSR) Vololume 3 Issue 9,September 2014

[14] J.B. Kauffman,. and D.C.Donato, 2012 Protocols for the measurement, monitoring and reporting of structure, biomass and carbon stocks in mangrove forests. Center for International Forestry Research Working Paper 86. CIFOR, Bogor, Indonesia

[15] F. Dahduh-Guebas & B. Satyanarayana Proceedings of the International Conference: Meeting on Mangrove ecology, functioning and Management (MMM3) 2-6 July 2012, Galle, Sri Lanka