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SCHOOL OF LAW

CONTROLLING POLLUTION IN THE MARA RIVER TO PROMOTE SUSTAINABLE DEVELOPMENT

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DECLARATION

Declaration by the Student:

This thesis is my original work and has not been presented for a degree at the University of Nairobi or in any University or examination body.

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DEDICATION

This thesis is dedicated to my siblings John and Irene Muhoro, and my parents Margaret and Peter Muhoro. I cherish you for the love, encouragement and inspiration.

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CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Rivers provide many social and ecological functions to the settlers and inhabitants of the environment around them and are thereby susceptible to high levels of pollution due to exploitation and increased human activity[1]. This deterioration of the river and her resources can occur either directly to the river or by the degradation of the riparian land that is neighbouring to the river and this then negatively affects the marine environment[2]. The deficiency in the controlling of pollution in the Mara River has gotten in the way of achieving sustainable development in the region.

The management of the river between the two countries that share the it; Kenya and Tanzania falls under the authority of two different regimes; i.e. the Kenyan environmental law regime and the Tanzanian environmental law regime, which hinders the rational management of the shared river. Studies have shown that approximately ninety percent of all the freshwater resources in Africa are shared by two or more countries[3] and the Mara River is no exception.

The Mara River region is a geographic area where two of the East African countries have interests in terms of shared water resources. The international political borders are a major reason as to the lack of sustainable development in that area which is reliant on the river. Two of the world famous protected areas; the Maasai Mara National Reserve in Kenya and the Serengeti National Park in Tanzania; are supported by the river basin. The Mara River's source is at the Enapuiyapui Swamp within the Mau Forest and this is a component of the

[1] Ally-Said Matano and others, 'Effects of Land Use Change on Land Degradation Reflected by Soil Properties along Mara River, Kenya and Tanzania' (2015) 5 Open Journal of Soil Science 20.
[2] Matano and others (n 1).
[3] Marisa Goulden, Declan Conway and Aurelie Persechino, 'Adaptation to Climate Change in International River Basins in Africa: A Review/Adaptation Au Changement Climatique Dans Les Bassins Fluviaux Internationaux En Afrique: Une Revue' (2009) 54 Hydrological Sciences Journal 805 <http://www.tandfonline.com/doi/abs/10.1623/hysj.54.5.805> accessed 11 October 2017.

Nile Basin upper catchment areas. The Mara River drains into the Lake Victoria after running downstream through approximately three hundred and ninety five kilometres. The Mara River Basin untouched biodiversity is threatened by the increase of human settlement along the river banks, increased agricultural uses, deforestation to create more space for settlement and the erosion and sedimentation of the river[4].

The river and its resources are useful for the development of the infrastructure, agricultural products, fishing and domestic activities[5].The two countries differ in terms of their legal systems, economic development and national goals. In order to properly manage the Mara River and the resources affiliate to the area, there is need for international cooperation of the two countries and mutual planning. Over the years, the two countries have continually exploited the resource individually, exercising territorial sovereignty, without the successful implementation of international regulations. This has led to increased levels of pollution, erosion and sedimentation of the river which relies on a pristine environment for the survival of various species and biodiversity reliant on the river. There is rapid infrastructural growth, population growth and unplanned urban development around the river and this is detrimental to the environment.

The Mara River is a major instrument of development in the Mara River region and there is the need for it to be protected from irreversible damage caused by pollution. Water as a natural resource is scarce and not uniformly distributed between regions[6].Water is a basic

[4] Shimelis Behailu Dessu and Assefa M Melesse, 'Modelling the Rainfall–Runoff Process of the Mara River Basin Using the Soil and Water Assessment Tool' (2012) 26 Hydrological Processes 4038.

[5] Waltina Scheumann and Susanne Neubert (eds), *Transboundary Water Management in Africa : Challenges for Development Cooperation* (2006) <http://nbn-resolving.de/urn:nbn:de:0168-ssoar-109930> accessed 10 October 2017.

[6] 'Natural Resources and Conflicts: A Guide for Mediation Practitioners | Disasters and Conflicts' <http://www.unep.org/disastersandconflicts/natural-resources-and-conflicts-guide-mediation-practitioners> accessed 22 September 2017.

source of livelihood regardless of whether it is economic, social or development oriented[7]. Without the introduction of sustainable development, and an adequate framework to ensure the management of the Mara River, factors such as pollution and sedimentation will continue to be rampant and later get out of hand and may be irreversible in the long run.

The major problems with the exploitation of water resources particularly the Mara River, are the competing interests of the countries that share the river, and inadequate cooperative measures for the provision of sustainable development through the use of the river and its resources. Transboundary natural resources know no boundaries. The Mara River is no exception and there is need to protect the river and her resources for the benefit of both countries that share it. The rationale behind this is that if the Mara River is not protected no country will benefit substantially from the resource, and neither will the future generations. This will also increase water scarcity and desertification will not be a far off thought. The principle of sustainable development once applied will ensure that pollution is kept at a minimum and at the levels which the river can withstand. There is the need to hastily reduce the pollution in the Mara River. Natural resources take time to rejuvenate once they have been overly polluted and exploited. The exploitation and pollution of the Mara River needs to be reduced and in doing so also ensure that any development; be it domestic, industrial or agricultural, be embarked on in a way that is sustainable to the environment.

Pollution is on the rise due to infrastructural and population growth, and major industrialisation. The biggest contributors to the pollution of the river are large scale goldmines, silt and chemicals from farm lands and animal husbandry[8]. Chemicals that are used to treat crops are dumped directly in to the river and this causes the depletion of the

[7] 'Natural Resources and Conflicts: A Guide for Mediation Practitioners | Disasters and Conflicts' (n 6).

[8] Marwa Muraza, Aloyce W Mayo and Joel Norbert, 'Wetland Plant Dominance, Density and Biomass in Mara River Basin Wetland Upstream Of Lake Victoria in Tanzania' (2013) 2 International Journal of Scientific & Technology Research 348.

ecosystem around the region due to the increase of the acid or alkaline levels which are toxic to the environment. This also causes contamination to the marine animals, the wild animals and the livestock that consume the water directly and this may be in turn harmful to the human beings and other animals which feed on these animals. The population of the marine animals decreases due to the pollution of the water. The pollution of the river may lead to high salinity of the Lake Victoria which it drains into and the other streams that are reliant on the river. High salinity water is unsuitable for agricultural purposes due to the high levels of salt in the water[9]. Pollution in the Mara River needs to be reduced to ensure sustainable usage of the river and her resources. Pollution may lead to the extinction of the natural resources and thereby denying the future generation the use and exploitation of the river.

Mutual plans to curb pollution by Kenya and Tanzania will ensure uniformity because there will be no case of one country promoting sustainable development and implementing it whilst protecting the river and her resources and the other exploiting it while increasing pollution. This will also ensure the sustainability of the river.

The conservation of the river, and the reduction of pollution, is essential because one of the reasons is that it flows into Lake Victoria. If the levels of the water in the river reduce, and the pollution levels increase, that translates into the levels of water in the lake reducing and the increase of the level of pollution in the lake thereby contributing to the scarcity of the sources of water in the East African states that share the lake. About half the sources of water in Kenya come from the lake[10] and the livelihood of the communities that live around the lake region comes from fishing in the lake. If this resource is not managed well, that would

[9] Mark Sinclair, 'The Environmental Cooperation Agreement between Mexico and the United States: A Response to the Pollution Problems of the Borderlands' (1986) 19 Cornell International Law Journal 87 <http://scholarship.law.cornell.edu/cilj/vol19/iss1/4>.
[10] Scheumann and Neubert (n 5).

mean that half of Kenya will not have access to water, and this is detrimental to the population as well as industrial growth.

Over the years, the two countries have utilised the waters of the river for agricultural, fishing and economic development. The main concern arising out of this is the contamination of the water. There have been records of various initiatives, for instance the Mara River Basin Management Initiative, by the two countries coming together, with reference to the sharing the waters of the river, but there has been no permanent legal instrument such as a protocol or a treaty governing the management of the river and simultaneously promoting sustainable development. This consequence of this is the rise in pollution in the river by the two countries without due regard to the implications it may have to the environment and the other countries reliant on the tributaries of the resource. If the pollution in the river persists, the environment of the river may be irreversibly damaged and problems such as water shortage, lack of sources of livelihoods for the community that lives in that region, may begin to be experienced with no solution at hand. It is crucial for the two countries to deal with the prevention mechanisms rather than the outcome of pollution in the river.

1.2 Statement of the research problem

The Mara River has deteriorated in the quality of water that it has and the change in the ecosystem that is dependent on the river. Research on the Mara River water and groundwater sources such as boreholes in the area found that there were higher levels of chemicals such as fluoride and phosphorous, suspended solids, nitrates and the presence of bacteria in the water making it unsuitable for domestic use and human consumption[11]. There have been little to no efforts between the Kenyan and Tanzanian governments as regards the reduction and control

[11] HN Ngugi, PG Home and UN Mutwiwa, 'Impacts of Water and Sanitation Activities on the Environment in the Upper Mara Basin' (2014) 6 Civil and Environmental Research 9 <https://iiste.org/Journals/index.php/CER/article/view/10308> accessed 5 September 2018.

of pollution of the river. The World Wide Fund whose main objective is to conserve endangered species of animals came into collaboration with the Kenyan and Tanzanian governments from the year 2003 to 2009[12]. The two main objectives of this partnership were; the facilitation of integrated administration of the river basin for the adequate and sufficient supply of water which is of good quality for the survival of ecological units and fundamental human needs, and for facilitation of initiatives that will promote participatory sustainable incorporated river basin administration for the protection, sustainable and reasonable use of the water of the Mara River[13]. This was to aid in the restoration of the river and her resources and also the rehabilitation of ecological systems dependent on the river. As it is, there is a Protocol to the Treaty for the Establishment of the East African Community on Environment and Natural Resources Management [14] that has not been ratified by Tanzania for a number of reasons. Tanzania does not have the same approach as the other member states to commercialise the trade in minerals among the member states as prescribed by the protocol and yet, in their opinion, the East African Community Treaty, which she is signatory to and has ratified it, provides for a common market[15]. The other reason laid down by Tanzania is that the access and use of land should be regulated by the national governments of the member States[16]. The third reason is that tourism should be discussed separately and a different set of rules agreed upon and should not be included in the said Protocol[17]. The management of the river is left to the national governments and this only provides for the exploitation of the river from a sovereign and egotistical position from the two countries.

[12] 'Managing the Mara River in Kenya and Tanzania | WWF' <http://wwf.panda.org/wwf_offices/tanzania/index.cfm?uProjectID=9F0749> accessed 6 September 2018.
[13] 'Managing the Mara River in Kenya and Tanzania | WWF' (n 12).
[14] 'Protocol on Environment and Natural Resource Management | East African Community' <http://www.eac.int/sectors/environment-and-natural-resources/nrm/environment-nrm-protocol> accessed 7 September 2017.
[15] 'Tanzania Refuses to Sign Environment Protocol' (*The East African*) <http://www.theeastafrican.co.ke/news/Why-Tanzania-said-No-to-EAC-protocol-on-the-environment-/2558-2467232-viis58z/index.html> accessed 7 September 2017.
[16] 'Tanzania Refuses to Sign Environment Protocol' (n 15).
[17] 'Tanzania Refuses to Sign Environment Protocol' (n 15).

1.3.0 Objectives of the Study

The overall objective of this study is to explore how pollution has negatively impacted sustainable development in the Mara River Basin region.

The specific objectives of the study are:

1.3.1 Identify specific human activities that pollute the Mara River.

1.3.2 Identify the ways in which reduction of pollution can be used to achieve sustainable development.

1.3.3 Identify the correlation between uncontrolled pollution and sustainable development.

1.3.4 Identify the legal tools in place to control pollution in the Mara River.

1.4.0 Research Questions

The study shall seek to answer the following questions:

1.4.1 What causes pollution in the Mara River?

1.4.2 What measures can be put in place to control pollution?

1.4.3 How has pollution hampered sustainable development?

1.4.4 What are the laws that are in force to control pollution in the Mara River?

1.5.0 Research Hypothesis

This research is based on the following hypothesis:

1.5.1 Lack of control of pollution in the Mara River hinders the realisation of sustainable development and has greatly lowered the quality and levels of water in the Mara River.

1.6 Justification of the Study

This paper studies the lack of sustainable development in the utilisation of the Mara River and its resources. It will provide a solution that will ensure the sustainable exploitation of river and her resources while maintaining the interests of the communities. It will also provide long term solutions to the sustainable utilization of the river and her resources.

1.7 Limitations of the Study

The main limitation to the conduct of this research is the accessibility to the data from Tanzania stating out precise reasons as to why the Protocol on Environment and Natural Resources Management[18] was not ratified. The other issue would be time constraints due to the vast research to be undertaken.

1.8 Research Methodology

1.8.1 Research Design

The research design used is case study design because of the subject of the study is studied holistically. An in – depth analysis of the Mara River region will be done in order to bring out the issue of the lack of sustainable development in the use of shared natural water resources between countries.

1.8.2 Data Collection

The data was obtained through secondary sources that will include the use of published books, journals, scholarly papers, newspapers, and other internet sources as well as published material. Library research will be conducted both using online material and using text books written by scholars in this particular area. This will provide a basis for the case study. This

[18] 'Protocol on Environment and Natural Resource Management | East African Community' (n 14).

will comprise of internet searches and the use of the library facilities provided for at the school and the national library.

1.8.3 Data analysis

The collected data will be analysed in themes. The data will be divided into major topics that may arise during the data collection and each topic will be discussed in great depth and this will majorly assist in the sieving of relevant information to the study. This will allow for the classification of major issues and areas covered and enable the clustering of similar issues together under one theme. As the themes are clustered together, the relationship between the various themes will be established and thereby determine if all the research questions have been answered and the objectives of the study met.

1.9 Theoretical Framework

The Mara River Basin is a foundation of source of revenue for the communities that live around the basin and are dependent on the river for economic, social, and infrastructural development. The theory that will closely aid in the analysis of the causes of pollution in the Mara River, the legal tools in force to control the Mara River and the pollutants of the Mara River is the social legal theory. The social legal theory allows for the consideration of the geographical aspect of the area, the cultural practices and the human activities whether social or economical to be factors which are considered in when laws are to be applied to a region and for good governance. The values and livelihood of the communities, the nature of the community practices and any other aspect of survival that is relied on by the community and

is correlated to the natural resource are a concern when enforcing the laws in relation to the natural resource[19]. This was established in Montesquieu's "The Spirit of Laws 1748"[20].

The key focal point of this study is the use of the Mara River by the communities that live in the Mara River Basin and the implication of the use of this resource as regards pollution and its negative impact on sustainable development in the long run. The social legal theory approach describes the law as a social institution and this study will adopt this theory[21]. Montesquieu pointed out the various areas of the sociological aspect of human beings and their livelihood that needs to be considered when applying laws to them[22]. He went on further to state that the law is formulated according to the needs of a particular region and it is different from the law formulated for a different region[23]. The reason for this is that their needs are different and what may suit one region may not suit another region[24].

The justification behind this choice is because sustainable development incorporates the social aspect of any region, and this specifically to the Mara River, can only be achieved once there are measures in place to control of pollution. This is in a bid to conserve the environment and at the same time promote development. The communities that rely on the river for their livelihood require that there be a cordial balance between the environment and development for them to thrive. The measures to control pollution needs to incorporate the social phenomenon which mirrors human needs and the sociological aspect of the law[25]. Rudolph von Jhering argues that law is used as a mechanism to balance social interests and

[19] Brian Z Tamanaha, 'The Third Pillar of Jurisprudence: Social Legal Theory' (2014) 56 William & Mary Law Review 2235 <http://heinonline.org/HOL/Page?handle=hein.journals/wmlr56&id=2303&div=&collection=>.
[20] Tamanaha (n 19).
[21] Peter Curzon, *Jurisprudence Lecture Notes* (Routledge 1998).
[22] Tamanaha (n 19).
[23] Tamanaha (n 19).
[24] Tamanaha (n 19).
[25] Curzon (n 21).

purposes[26]. This theory also allows for negotiations to take place between the countries and amicable results are reached with the interests of each of the countries being taken into consideration. Social legal theory supports the idea that the reasoning of human beings is unvarying globally but the laws cannot be the same globally.

[26] Curzon (n 21).

1.10 Chapter Breakdown

This paper is broken down into five chapters.

Chapter one introduces the study by laying out the background to the study and the statement of the problem. It lays down the methods used for research and the underlying theories and approaches used in the carrying out the study. It also contains the research questions and objectives of the study.

Chapter two is on literature review. It discusses the obstacles of sustainable development in the Mara River, the problems that hinder sustainable development and identifies the gaps in the review and provides the rationale for the study.

Chapter three is on the legal framework governing the management of transboundary waters. It includes international, regional and national laws that are applicable to the Mara River. It also discusses the legal instruments and authorities that govern the Mara River especially in the national governments and their mandates in the management of the river. It also links pollution control to sustainable development in the Mara River region.

Chapter four addresses pollution in the Mara River and its impact on sustainable development. It outlines how pollution poses a great obstacle to the achievement of sustainable development in the Mara River Basin. It also outlines the specific human activities and components that pollute the river.

Chapter five contains the conclusion, summary of the findings and recommendations. It outlines various recommendations that are to be implemented by different government entities and organisations in the private sector.

CHAPTER TWO: LITERATURE REVIEW

2.1 Obstacles of sustainable development in the Mara River Basin

2.1.1 Introduction

In Africa, the livelihood of most of the people depends on naturally occurring resources. The preservation and protection of these resources is never the first thing that is considered when it comes to natural resources. The first thought is how much can the community gain from the exploitation of the resource at the time. There is extensive poverty among many communities, low agricultural production and lack of access to modern amenities and technology. The Mara River region is no exception despite the fact that there are two national parks on either side of the river and it is a major tourist attraction. There is the constant need of the communities to improve their livelihoods and this, more often than not, comes at the price of the degradation of the natural resources[1].

Most of the members of the communities residing along the Mara River are farmers and they depend on the water from the river for their livelihood. There is a great need to have the river managed in a sustainable way in order to acquire all the beneficial gains of the river and at the same time preserve it for the future. For instance, there is no proper designated drainage for the disposal of chemicals that are used in the farms as treatment and fertilisers. Once the chemicals have been used by the farmers, they are drained into the river. This is dangerous to the marine life in the river and also to the wild animals which consume the same water. The contaminated water is also not fit for human consumption once it has been used as a dumpsite

[1] Mohammad Jabbar, 'Agroecosystems, Natural Resource Management and Human Health Related Research in East Africa' <https://www.academia.edu/24349119/Agroecosystems_natural_resource_management_and_human_health_related_research_in_East_Africa> accessed 27 February 2018.

for these chemicals. This also leads to the spread of diseases within the community and eventually leading to increased poverty levels.

The Mara River is not considered as a potential source of conflicts on its own but rather as an inducing factor for the conflicts that may arise due to the use of natural resources as it is closely correlated to other social factors and foreign policy matters. The water levels of the Mara River have significantly reduced over the years and consequently this is because of climate change and deforestation along the river. The distribution of water has also been affected because of this and to demonstrate this, the water distribution between agricultural and domestic uses has greatly changed. Whereas a few decades ago the water could be used for domestic uses without alarm, now the same water one has to exercise caution when using it for domestic purposes due to contamination. Conflicts among communities using the resource are not a foreign concept because the scarcity of resources leads to animosity between communities. This is especially so if one community has direct contact with the resource and the other does not[2].

2.1.2 Problems hampering sustainable development of the Mara River Basin

2.1.2.1 Deforestation

The levels of deforestation keep increasing day by day due to the growth of the population of the communities that live along the river. There increased need for larger tracts of land to cater for the people and this leads to a destruction of the balance of the ecosystem. This affects the quantity of the rainfall and in turn the quantity of the water in the river. Apart from providing for agricultural land, deforestation hinder along the river is also to provide for fuel and logs. Due to lack of access to modern facilities for fuel, the people resort to using wood fuel for survival.

[2] Jabbar (n 1).

Deforestation has also been rampant in the Mara River Basin with the intention to get more agricultural land[3]. This has negatively impacted the environment and even led to an increase in pollution due to the increase of the population in the area. This also leads to sedimentation of the river as soil erosion is inevitable. According to Matano et al, a study carried out by United States Agency for International Development in East Africa in 2010, found that there has been a huge change in the use of the Mara River waters and there has been an increase in dissolved properties in the water, high turbidity and suspended solids which are some of the tell – tale signs of soil erosion[4]. There has also been witnessed contamination by microbial substances in the river which has aided in the degradation of the water quality[5]. The water excellence in the Mara River has also gotten worse over time due to soil erosion. Soil erosion is detrimental not only to the river but to also the farmers in the region because all the fertile soil is drained into the river and carried away.

Deforestation has led to the loss of habitat of animal species which live in the forest[6]. This will eventually lead to the reduction of the number of tourists visiting the region as they are attracted by rare species of animals and animal activities. This in turn impacts the economy negatively, and not just the economy of the communities living along the river but the national economy as a whole. The second problem is the degradation of the quality of the soil in the area. The quality of the soil which is often rich in moisture, and in optimum condition for agricultural uses, is protected from the harsh rays of the sun by the trees. Since the trees

[3] Ally-Said Matano and others, 'Effects of Land Use Change on Land Degradation Reflected by Soil Properties along Mara River, Kenya and Tanzania' (2015) 5 Open Journal of Soil Science 20.

[4] Matano and others (n 3).

[5] Ally-Said Matano and others, 'Effects of Land Use Types on the Levels of Microbial Contamination Based on Total Coliform and Escherischia Coli Count on the Mara River, East Africa' (2013) 13 Afr J Trop Hydrobiol Fish 5.

[6] 'Deforestation and Its Effect on the Planet' (*National Geographic*, 9 October 2009) <https://www.nationalgeographic.com/environment/global-warming/deforestation/> accessed 28 February 2018.

are cut, the soil becomes dry and barren[7]. The result of this is dry soil which is devoid of any nutrients and eventually becomes a desert of no value to agriculturalists and the animals which depended on the trees.

A rise in temperatures in the area in which deforestation has occurred will be felt because the trees are a natural way to keep the extreme heat of the sun out[8]. The marine life in the river will also be affected because deforestation reduces the amount of rainfall and that in turn reduces the quantity of water in the river. The river will eventually dry out and the fish and other species of marine animals will in turn be lost as a result. Other animals which also rely on the river for survival with either migrate or die as a result of the reduction of the water levels in the river.

Deforestation eventually leads to desertification and the region soon becomes uninhabitable and large tracts of land are left unused, unproductive and of no benefit to anyone in the long run.

2.1.2.2 Differences in development

Kenya and Tanzania are at different stages of development and thereby this causes conflicts in the agreement of what to protect as regards transboundary natural resources. For instance, in the recent years, Tanzania wanted to improve her infrastructure and road networks at the expense of the wildlife movement in the Serengeti, whereas Kenya saw the need of the maintenance of the status quo in the migration of the wild animals. The building of the highway traversing the Serengeti would have cost both Kenya and Tanzania a lot economically and in terms of tourism because the migration of the wildebeest is an attraction and one of the wonders of the world.

[7] 'Deforestation and Its Effect on the Planet' (n 6).
[8] 'Deforestation and Its Effect on the Planet' (n 6).

The proposal of the building of dams on the Mara River and her streams by Kenya will negatively impact the environment and the flow of water in the Serengeti[9]. The dams will reduce the minimum environmental flow of the water to a third of what is required. The proposed dams are; Norera dam on the Mara River largely for watering farms, and the Amala High dam from Mau Forest in the Amala River down to Ewas Ngiro for the production of hydroelectricity by three other dams. These dams cause a serious risk to the Mara River ecosystem by reduction of the levels of water that flow into the river at any given time[10]. This effect will be felt especially during the dry season when the water levels in the river are reduced to less than fifty percent as is without any interference. During the dry season there will be the need to choose between the irrigation scheme and the survival of the Serengeti if the Norera dam is constructed[11]. The Tanzanians have also proposed the construction of the Borenga dam, however, this dam has been proposed on the lower side of the Mara River, thereby posing no threat to the Serengeti and her survival[12].

The two countries have different objectives thereby making the management of shared resources difficult. The issue of sovereignty also comes up because of the differences in the economy and goals between the two countries. Both governments believe that they are entitled to use the resource as they please because it is part of their respective countries resources. This also may bring about the feeling of oppression from one country[13]. This is a possibility from the country with a better economy and greater international backing

[9] Bakari Mnaya, Mtango GG Mtahiko and Eric Wolanski, 'The Serengeti Will Die If Kenya Dams the Mara River' (2017) 51 Oryx 581 <https://www.cambridge.org/core/journals/oryx/article/serengeti-will-die-if-kenya-dams-the-mara-river/9C58F510F758AA2FB9DD6B0CF2B54B38> accessed 23 August 2018.

[10] Mnaya, Mtahiko and Wolanski (n 9).

[11] Mnaya, Mtahiko and Wolanski (n 9).

[12] Mnaya, Mtahiko and Wolanski (n 9).

[13] Caxton Kaua, 'Transboundary Natural Resource Management; Rationale, Challenges and Way Forward' <https://www.academia.edu/19318636/Transboundary_natural_resource_management_Rationale_challenges_and_way_forward> accessed 27 February 2018.

especially on matters concerning the shared resource. Oppression may result in a lack of consensus regarding the management and equitable sharing of the resource.

2.1.2.3 Pollution through domestic and industrial use

Pollution cannot be emphasized enough. The main pollutants of the river are waste products from agricultural activities, pollution from effluents and the human and animal waste from the community that lives along the river[14]. The pollution of the river system can result from metals, petroleum products, synthetic materials, and radioactive matter, organic and inorganic composites which are dumped in the river[15]. Parts of the river, especially parts that flow through urban settlements or informal settlements have been found to contain high levels of pollutant matter owing to raw sewage spills, waste water discharge points, solid waste disposal points and urban run – offs especially during the rainy season are some of the pollutants from settlement areas[16]. Pollution of the river has been contributed to by large and small scale goldmines that use mercury in the purification of metals[17]. The dumping of waste products into the river increases the salinity levels which in turn cause the death of various marine species and the loss of the biodiversity in terms of vegetation and other animal species that depend on the river. Human and animal waste products can be easily carried from the upstream of the river downstream to the catchment area which follows the flow of the river. This form of pollution can also be attributed to the soil erosion as a result of the cutting of

[14] Liya Mango, 'Modeling the Effect of Land Use and Climate Change Scenarios on the Water Flux of the Upper Mara River Flow, Kenya' [2010] FIU Electronic Theses and Dissertations <http://digitalcommons.fiu.edu/etd/159>.
[15] Matano and others (n 5).
[16] Douglas Anyona, 'Effect of Anthropogenic Activities on Physicochemical Parameters and Benthic Macroinvertebrates of Mara River Tributaries, Kenya' <https://www.academia.edu/8197453/Effect_of_Anthropogenic_Activities_on_Physicochemical_Parameters_and_Benthic_Macroinvertebrates_of_Mara_River_Tributaries_Kenya> accessed 23 August 2018.
[17] Aloyce W Mayo, Marwa Muraza and Joel Norbert, 'The Role of Mara River Basin Wetland in Reduction of Nitrogen Load to Lake Victoria' 11.

trees and vegetation along the river which reduces the capability of water retention thereby speeding up the process of pollution through human and animal waste[18].

Sediments and bacteria are also a major source of pollution in the river[19]. The levels of faecal bacteria especially during high seasons of rainfall were significantly higher than what the river can sustain, and also what is recommended[20]. This is as a result of pollution in the streams that drain into the river which eventually drains into Lake Victoria and this has also played a role in the increase of eutrophication in the lake[21]. This is non – point pollution which is a major pollution problem in the Mara River[22]. The increase of sediments in the river leads to increased pollution and these causes considerable repercussion to the communities that live along the river. This sedimentation has been blamed on the deforestation that is uncontrolled in the higher grounds of the Mara River course.

The change of user of the land from forest land in the river basin to agricultural land has also led to the high levels of pollution in the Mara River[23]. Agricultural land is the main cause of non – point pollution which permeates into the environment and transforms into a spatial and chronological element of pollution[24]. This is also a consequence of the quick changes of inhabitants and human activities along the river. The changes in the use of forest land has led to the increase of unsustainable use of the river basin such as overfishing, overgrazing, rampant deforestation and the unplanned dumping of domestic waste products.

[18] Matano and others (n 5).
[19] ZM Gichana and others, 'Effects of Human Activities on Microbial Water Quality in Nyangores Stream, Mara River Basin' (2014) 3 Int. J. Sci. Technol. Res 153.
[20] Gichana and others (n 19).
[21] Christopher Dutton, Shimon C Anisfeld and Helmut Ernstberger, 'A Novel Sediment Fingerprinting Method Using Filtration: Application to the Mara River, East Africa' (2013) 13 Journal of soils and sediments 1708.
[22] Dutton, Anisfeld and Ernstberger (n 21).
[23] Matano and others (n 3).
[24] Mayo, Muraza and Norbert (n 17).

Pollution also leads to the contamination of the water of the river which affects the communities that live along the river and eventually also other water sources in which the river drains into such as Lake Victoria. There is need to control the level of deforestation and human activities particularly in the upper catchment areas of the river. Both countries are affected whether or not it is the action of the people from one country. This is felt across both the human and the animal population which depend on the river. The loss of ecosystems and biodiversity are inevitable and the ability of the river to purify itself will be lost.

The river resources shared among the two countries are being diminished at an alarming rate and if not sustainably managed the resources will be exploited to extinction in the case of the marine life and wild animals that depend on the river. There is need and urgency for an inclusive framework incorporating sustainable development to protect, preserve and sustainably make use of the Mara River between Kenya and Tanzania. Legally binding agreements and treaties need to be put in place to curb pollution arising due to the increased utilisation of the river.

Conflicts emanating from natural resources, especially water, are on the rise as fresh water resources grow scarce by the day[25]. There are more demands for fresh water today as they were yesterday due to population growth and developmental needs of States. Research shows that majority of fresh water basins lay on the boundaries of different States thereby falling under trans-boundary natural resources[26]. According to Wolf et al[27] nineteen of the two hundred and sixty one international river basins are shared among five countries therefore the

[25] Juha I Uitto and Alfred M Duda, 'Management of Transboundary Water Resources: Lessons from International Cooperation for Conflict Prevention' (2002) 168 Geographical Journal 365 <http://onlinelibrary.wiley.com/doi/10.1111/j.0016-7398.2002.00062.x/abstract> accessed 22 November 2015.
[26] Uitto and Duda (n 25).
[27] Aaron T Wolf, 'Conflict and Cooperation along International Waterways' (1998) 1 Water Policy 251 <http://www.sciencedirect.com/science/article/pii/S1366701798000191> accessed 10 October 2017.

growing needs to regulate the usage of water resources[28]. The depletion of water resources is on the rise and the idea of water scarcity is not farfetched, and the Mara River is not spared. Water scarcity and international conflicts have been grouped together and this goes on to demonstrate the need for sustainable use of water resources[29].

Ismail Serageldin, according to Boesen and Ravnborg[30] compared oil to water by stating that majority of the conflicts experienced in the last century were because of the scarcity of oil and that the conflicts of this century will be caused by the scarcity of water as a resource. This reiterates the need to utilise water resources in a sustainable manner. As it is now, the Mara River and its resources are polluted in both large scale and small scale both for domestic and industrial uses[31]. The pollution of the river and its resources is rampant in areas where the market for the resources is high and where the population is high in terms of settlement and economic activities[32]. The exploitation of the river is done with little or no regard to sustainable development and hence the overexploitation of the resources. The ecological composition and biodiversity is affected and this leads to environmental degradation. The environmental harm around the river at first instance may seem to be negligible but with every use of the river's resources that is unsustainable leads to the degradation of the environment and eventually the loss of biodiversity in the region.

[28] Uitto and Duda (n 25).
[29] Jannik Boesen and Helle Munk Ravnborg, *From Water 'wars' to Water 'Riots'?: Lessons from Transboundary Water Management : Proceedings of the International Conference, December 2003, DIIS, Copenhagen* (Danish Institute for International Studies 2004).
[30] Boesen and Ravnborg (n 29).
[31] PO Raburu, JB Okeyo-Owuor and F Kwena, *Community Based Approach to the Management of Nyando Wetland, Lake Victoria Basin, Kenya* (KDC-VIRED-UNDP 2012) <http://ecdc.net.cn/2013gssd-unep/Nyando%20Book%20-%20FINAL%20MOST-internet.pdf> accessed 11 October 2017.
[32] Raburu, Okeyo-Owuor and Kwena (n 31).

2.2 Conclusion

There is no information on the exploitation of the waters of the Mara River and what amount is sustainable for various uses such as large and small scale farming, domestic uses, infrastructural use and where the quantity of water allows for mining to take place. This has led to the lack of ascertainment on the quantity that can be used at any given time and the quantity and quality of water that is left unutilised in the river. This therefore leads to misinformed decisions being made about the use of the river's water which is detrimental to the river.

There is little to no information as regards the use of land along the river. This then brings about questions on the sustainability of the projects being carried out along the river and the consequence on the excellence and amount of the water in the river. It also raises concerns on how pollution will be controlled in the Mara River Basin when the impact of the use of the land along the river is unknown.

There is a breakdown of information between different entities reliant on the Mara River and the project managers and stakeholders. This is because of the lack of proper mechanisms to pass on the information to different entities especially the communities on the projects to be undertaken using the water from the river and the land around the river. There are no consultations between the investors building infrastructure along the river and the communities who will be directly affected by the projects using the river. There is a gap in communication between the various stakeholders and this makes it harder to properly address pollution concerns especially by the members of the communities directly affected by any change to the river.

There is also little research exploring the alternatives to pollutants of the river especially from agricultural activities. This is especially in relation to the use of commercial chemicals to

farm whether large scale or small scale. This is linked to the lack of information on the various alternatives and the impacts on the river from use of these chemicals. This is predominantly factual at the local farmer's point because there is a lack of understanding of the impact these chemicals have on the environment and especially the river. This is a clear short of knowledge and understanding of the impact the chemicals have on the river and the environment as a whole. This can also be linked to the lack of communication between the community and the various government departments tasked with the sensitisation of the communities on the dangers of not properly utilising the natural resources. This is also applicable to the fishing communities along the river. There is no sensitisation of the communities on the dangers of the use of poison for fishing and the impact it has on the water quality and the species of fish as a whole.

The communities and investors particularly those carrying out projects that are reliant on the river have no information as regards the value of the river from the point where the river's source is at down to where the river drains. The benefits of the river as regards water quality and the environment surrounding the river have not been realised by the stakeholders along the river mainly the communities that live along the river. There is also little to no consideration of the impact the activities upstream have on the communities that dwell on the lower part of the river. This is as regards the water value and amount of the river after utilisation by the upstream communities. This is also affected by the activities carried out on the banks of the river which interfere with the composition of the river which eventually leads to the pollution of the river.

There is lack of agreement between the private sector players and the government. This is in both Kenya and Tanzania. The regulatory authorities act on their own while the private sector players also do the same. The two sector players need to come together from both countries

and forge a way forward in the utilisation of the waters of the Mara River in a manner that will curb pollution and promote sustainable development. This will aid in the realisation of the management of the Mara River as a transboundary resource which will go a long way in ensuring uniform management of the river despite the differences in development of both countries. The two governments are critical when it comes to the management of the river and ensuring that it is utilised in a manner that does not degrade the environment and the river. This is through the agencies and regulatory bodies tasked with ensuring the proper use and conservation of the river by mandate given by the laws of both Kenya and Tanzania. This calls for harmonisation of the Kenyan and Tanzanian laws that govern the Mara River, and the application of international laws that focus on the preservation and conservation of transboundary waters and also address pollution in order to promote sustainable development.

CHAPTER THREE: LEGAL FRAMEWORK GOVERNING MANAGEMENT OF TRANSBOUNDARY WATERS

3.1 Introduction

A natural resource is a valued raw material which comes into being without any input from human beings or any human activity[1]. They occur naturally and some may be replenished naturally over a period of time. For some natural resources, once they have been exhausted there is no way to get them back. The naturally occurring resource is considered to be a trans-boundary resource by virtue of it lying between two or more political boundaries[2].

There are various assumptions regarding water, some of which are that water is actually the foundation on which human life is founded, water is a limited and in inadequate supply and is a universal and scarce resource[3]. This simply means that water is a resource that is vital to the survival of any living specie yet it is scarce and it is the most utilised resource. The levels of freshwater resources have reduced drastically over the recent years and this is as a consequence of the growing population and development. Change of climate is also a key player in the reduction of freshwater levels due to the high temperatures which result to the loss of the water resources through evaporation. There are other factors such as pollution and the overexploitation of water as a resource which lead to the depletion and the degradation of water resources. Without water, there can be no development be it infrastructural, social, economic or industrial and hence the rising need to conserve the natural water resources.

[1] Zewdineh Beyene and Ian LG Wadley, 'Common Goods and the Common Good: Transboundary Natural Resources, Principled Cooperation, and the Nile Basin Initiative' [2004] Center for African Studies <http://escholarship.org/uc/item/9492s0k4> accessed 28 November 2015.
[2] Beyene and Wadley (n 1).
[3] Helga Haftendorn, 'Water and International Conflict' (2000) 21 Third World Quarterly 51 <http://dx.doi.org/10.1080/01436590013224> accessed 22 November 2015.

3.2 International legal framework governing transboundary waters

The international organisation that is accountable in support of the management of the environment is the United Nations through the United Nations Environment Program. It is responsible for the formulation international standards for the making of environmental policies. The United Nations Convention on the Law of the Non-navigational Uses of International Watercourses (1997) characterises transboundary natural water resources as watercourses which are situated in different states[4]. In order for a water resource to be considered as an international watercourse, the main characteristic is that it traverses two or more states. This will then bring about the issue of how to include the states in the management of the shared resource.

One of the earliest ways to attempt the codification of transboundary water resources and international water law into international customary law was the adaptation of the Helsinki Rules by the International Law Association in 1966[5]. The Helsinki Rules provided for the utilization of the waters of rivers shared between two or more jurisdictions, identified the global drainage basin, and demarcated the geographic scope provided for under the Rules, the area of the watershed encompassing surface and groundwater[6]. The Seoul Groundwater Rules were adopted in 1986 which gave the ascertainment of groundwater being incorporated in international water law[7]. This was the beginning of the inclusion of water law into international customary and the contribution of water law in international environmental law.

[4] United Nations, 'The Non-Navigational Uses Convention' (1997).
[5] Gabriel Eckstein, 'Application of International Water Law to Transboundary Groundwater Resources, and the Slovak-Hungarian Dispute Over Gabcikovo-Nagymaros' (Social Science Research Network 2011) SSRN Scholarly Paper ID 612622 <https://papers.ssrn.com/abstract=612622> accessed 2 October 2017.
[6] Eckstein (n 5).
[7] Eckstein (n 5).

3.2.1 Utilisation of natural resources

The proponents of international environmental law and sustainable development have established that due regard for the other states utilising the resources has to be considered. This has substantially been solved by the implementation and the application of agreements between states that share water resources[8]. Most of the concerns arising out of the use of the Mara River are brought about by the diversion of water ways for damming and the dumping of waste materials along the river right from the tributaries and into the river itself. This has resulted in the water being polluted and the reduction of the water levels. This is a major environmental concern especially because the water of the river is relied upon by communities, animals and wildlife. The water is also needed for urban development.

Various environmental concerns have been raised in previously decided cases globally and the courts have identified and provided for the need of environmental conservation. The Gabcikovo – Nagymaros case was one whose core raised major issues as regards environmental law globally as outlined in sustainable development principles and the use of watercourses by individual states that are shared between two or more states even though the judgment did not provide for them[9]. This case is relevant to the Mara River Basin owing to the building of the dams that are proposed by both Kenya and Tanzania, even though the propositions have been made individually. The only mention of environmental concern was in the dissenting judgment of Judge Weeramantry. This was the first time an environmental claim was made in the International Court of Justice. This is the first matter that brought the principle of sustainable development into legal effect through the International Court of

[8] Haftendorn (n 3).

[9] Bukhosi Fuyane and Ferenc Madai, 'The Hungary-Slovakia Danube River Dispute: Implications for Sustainable Development and Equitable Utilization of Natural Resources in International Law' (2001) 1 International Journal of Global Environmental Issues 329.

Justice[10]. In 1981, there were claims that the project would be harmful to the environment and the construction at Nagymaros was stopped. This was controversial as a number of Hungary's officials stated that the stopping of the construction at Nagymaros was an economical issue and not an environmental one. The environmental assertions were claimed to be a scapegoat from the economical issue[11]. However, environmentalists maintained that there were serious environmental ramifications if the project was to be carried to fruition because of the flow of the water[12]. The wetlands along the river relied on the constant flow of water at a constant volume, and the release of water in unnatural intervals would leave the wetlands in a desert – like situation and highly prone to floods.

Consequently, the diversion and following building, Hungary made many grave environmental injury assertions, as stated above, including the decrease of the amount of water flowing into Hungary[13]. The water flowing into Hungary reduced between two and four meters in level and the wells in the neighbouring villages dried up[14]. Marine life and flora were destroyed in the area neighbouring the diversion. Discussions were unsuccessful in determining the disagreement and in the end the two governments proceeded to the International Court of Justice (ICJ) in The Hague. The court established in September 1997 that both states were responsible of contravention of their contractual duties, namely, the one-sided departure of Hungary from the union in addition to the one-sided choice made by Slovakia to redirect the Danube. The two parties then resulted in the negotiation of the

[10] Fuyane and Madai (n 9).
[11] Aaron Schwabach, 'Diverting the Danube: The Gabcikovo-Nagymaros Dispute and International Freshwater Law' (1996) 14 Berkeley Journal of International Law 290 <http://scholarship.law.berkeley.edu/bjil/vol14/iss2/2>.
[12] Eckstein (n 5).
[13] United Nations Environment Programme and Center for International Environmental Law, *UNEP Compendium on Human Rights and the Environment: Selected International Legal Materials and Cases* (2014) <http://wedocs.unep.org//handle/20.500.11822/9943> accessed 23 September 2017.
[14] Eckstein (n 5).

environmental issues and how to come up with a regime that advocated for sustainable development[15].

The standard of sustainable development needs to be greatly applied in the Mara River and her resources. In addition to controlling pollution, other projects that are to be undertaken through the utilisation of the river need to be in line with the doctrine of sustainable development. This also incorporates the principle of sustainable use. This principle has been in existence since time immemorial and was exercised before the Stockholm Declaration of 1972[16]. The Brundtland Report of 1987 defined sustainable development and it can be perceived as the implementation development so as to meet the needs of the present generation with no compromise to the environment in order for it to have the ability to meet the needs of the future generation.[17]. This principle has been defined by many and the Brundtland Commission convened in 1983 by the United Nations[18] is the most common definition that has been used. It has the ability to utilise natural resources by the current generation in fulfilment of their needs in a manner that will not curtail the usage of the same natural resources by future generations to satisfy their needs[19]. This principle supports intergenerational and intra-generational equity. This means that the natural resources should be shared equally among the current and future generations, and also, all the persons in the present generation should benefit from the natural resource. No persons should be left out in the sharing of the natural resources.

The principle of sustainable development will be valuable to the use of the Mara River and its exploitation as well. This is because it focuses on the environment being taken into account

[15] Fuyane and Madai (n 9).
[16] Kariuki Muigua, Didi Wamukoya and Francis Kariuki, *Natural Resources and Environmental Justice in Kenya* (1st edn, Glenwood Publishers Limited 2015).
[17] Philippe Sands, Jacqueline Peel and Ruth MacKenzie, *Principles of International Environmental Law* (Cambridge University Press 2012).
[18] Muigua, Wamukoya and Kariuki (n 16).
[19] Muigua, Wamukoya and Kariuki (n 16).

during economic and development planning processes[20], human rights and good governance[21]. This will also focus on the beliefs and practices of the communities living along the river and find a balance between the use of the river by the people and the preservation of the river and its resources. Research has been done on the proper management and preservation of the Mara River but very minimal efforts have been put in place in the use of the river in a sustainable manner. There is a disconnection in squarely tackling the use of the river in a sustainable manner despite the research pointing out the major issues faced in the use of the river by the communities. In order for sustainable development to be achieved, development is looked at as a whole as articulated in the Sustainable Development Goals[22], and hence the sociological theory comes to play as because a sustainable development incorporates all aspects of the society. Sustainable development is the core area that should be applied in the use of the Mara River basin and its resources.

3.2.2 Pollution of natural resources

Due to the decline of the water quality that passes through borders, the need to have the industrialisation of water uses regulated by the international community emerged[23]. A classic example of such a dispute that arose over pollution is the Trail Smelter arbitration. This is applicable to the Mara River Basin because the river is shared between two counties and the pollution is all over the river course, some places higher than some and even from the tributaries that drain into the river.

[20] Sands, Peel and MacKenzie (n 17).
[21] Muigua, Wamukoya and Kariuki (n 16).
[22] 'Sustainable Development Goals' (*UNDP*) <http://www.undp.org/content/undp/en/home/sustainable-development-goals.html> accessed 9 September 2017.
[23] Haftendorn (n 3).

This is one of the most cited cases when it comes to transboundary harm inflicted by one country and the country is liable for the damage caused[24]. This was the first time that an adjudicatory body had to decide between the exploitation of the resources by a country and the preservation of the environment that is shared between countries[25]. The Trail Smelter arbitration compiled a series of issues including economic, environmental, political and social issues. It is important to note that the resolute of the arbitration was aimed at the preservation of the environment while still having the right of states to utilise the environment within their territory as they deem fit.

The brief facts of this case is that the operation of a Canadian company in the business of mining and smelting, on the Columbia River, which forms part of an international boundary between Canada and the United States of America[26] at the north of Lake Roosevelt in Washington State[27]. Due to the burning of sulphur containing ores, there was a release of the sulphur dioxide gas. The clouds of smoke containing sulphur dioxide crossed over to the boundary in great potency over to the State of Washington[28]. It was expected and noticed that it caused some damage.

The water was polluted due to the high amounts of lead and slag that was drained into the river which caused harm to the people in the United States. The Tribunal which heard the case stated that no State had the right and privilege to utilise its territory in a manner that

[24] Russell Miller and Rebecca M Bratspies, 'Transboundary Harm in International Law: Lessons from the Trail Smelter Arbitration' (Social Science Research Network 2006) SSRN Scholarly Paper ID 1990519 <https://papers.ssrn.com/abstract=1990519> accessed 23 September 2017.
[25] Miller and Bratspies (n 24).
[26] John E Read, 'Trail Smelter Dispute, The' (1963) 1 Canadian Yearbook of International Law 213 <http://heinonline.org/HOL/Page?handle=hein.journals/cybil1&id=213&div=&collection=>.
[27] Austen Parrish, 'Trail Smelter Deja Vu: Extraterritoriality, International Environmental Law, and the Search for Solutions to Canada-U.S. Transboundary Water Pollution Disputes' (Social Science Research Network 2007) SSRN Scholarly Paper <http://papers.ssrn.com/abstract=1019924> accessed 22 November 2015.
[28] Read (n 26).

would damage the environment of the other under international environmental law.[29] The Tribunal found Canada responsible under international law for damages owing to the air contamination. The duty not to cause environmental destruction to a bordering State was later recognised as a component of customary law by the ICJ[30].

The doctrine of sustainable development applies because pollution should be contained and levels of it reduced in order to preserve the environment. This is not a hindrance to development because there needs to be established other methods of development that do not affect the environment negatively. The polluter pays principle encourages sustainable development because the state that pollutes will be liable to pay. In order for the state to avoid such sanctions, they will ensure that their practices and development measures are in line with environmental conservation. This has principle has been left to a wide scope of interpretation as it is the court or tribunal to determine the extent of the payment and the sanctions to be issued to the polluter[31].

This will be applicable to the Mara River Basin because both Kenya and Tanzania are developing countries. There is increased industrialisation and parallel to this is the need to protect the environment by ensuring a clean and healthy environment despite the economic activities[32]. This is essential in guarding the environment and management of natural assets because it brings the aspect of liability[33]. This liability acts both as a deterrent and a compensating agent in environmental management[34].

[29] Paul G Harris, *Routledge Handbook of Global Environmental Politics* (Routledge 2013).
[30] Harris (n 29).
[31] Sands, Peel and MacKenzie (n 17).
[32] Muigua, Wamukoya and Kariuki (n 16).
[33] Muigua, Wamukoya and Kariuki (n 16).
[34] Muigua, Wamukoya and Kariuki (n 16).

Pollution in the Mara River grows by the day as the population keeps on growing. Larger tracts of land are required for farming and for settlement. The levels of chemicals that are deposited in the river are a cause for alarm due to the danger they pose to the marine animals and other users of the water. Pollution is experienced from both the Kenyan and the Tanzanian community and if it is not addressed with haste, the chemicals will be poisonous even to the people whose water consumption is from the river or animals that live in the river. This is similar to what happened at Minamata[35]. Pollution has been identified in the Mara River but very little action has been taken to curb the excess pollution in the river.

3.3 Regional legal framework governing management of transboundary waters

The East African Community Treaty has an environmental protocol which is the Protocol on Environment and Natural Resource Management which Kenya, Uganda and Tanzania is signatory to, has been ratified by Kenya and Uganda but has not been ratified by Tanzania. The water resources in East Africa are abundant but are at risk of depletion due to pollution and unsustainable use of the resources. The water is not uniformly distributed and this is felt especially during the dry season due to the drought that is experienced. The usage of the water resources does not match the ability of the water resource to replenish itself thereby affecting the quality and quantity of water.

There was established in 2010 the East African Network for Environmental Compliance and Enforcement which is an organisation which is unofficial and comprises exclusively of government agencies from the East African states. It is made up of over fifty government agencies whose mandate includes environmental management, compliance with laws be it international or regional, and the enforcement of responsibilities in the East African states.

[35] Tseming Yang, 'The Minamata Convention on Mercury and the Future of Multilateral Environmental Agreements' (Social Science Research Network 2014) SSRN Scholarly Paper ID 2509589 <https://papers.ssrn.com/abstract=2509589> accessed 6 October 2017.

Even though it is only comprised of government agencies, it is open for partnership with other private sector players in order to accomplish its mission.

Other bodies established under the East African Community Treaty are the East Africa Legislative Assembly, whose main objective is to formulate laws applicable to the community as a whole. The other major body is the East African Court of Justice and is the court tasked with the determination of conflicts arising in the Community. It is also mandated to decide on environmental matters that arise out of the community between partner states.

3.3.1 Lack of proper management of transboundary water resources

These are brought about by poor management of the resource. The administration of naturally occurring water resources is crucial to the protection of the water sources and this will in turn benefit the countries sharing the resources. The poor management of water resources often times leads to degradation of the water value and amount. In the case of water, the north of the basin may seem to be in plenty and of good quality but this is not the case in the lower basin[36]. The lower basin suffers as a result of the uncontrolled use of the resource by the communities and settlements that are towards the north of the basin[37]. This is especially so in the instances of the building of dams, large tanks or uncontrolled irrigation[38]. For instance, the plans that Kenya has for the utilisation of the water of the Mara River for hydroelectric power project will affect the needs of the communities in the lower parts of the river and their needs will not be met to satisfaction [39]. Another illustration is the Nile Basin. An agreement was reached by Sudan, Kenya, Tanzania, Egypt and Uganda[40]. This showed the importance of the Nile to the Egyptians. The Nile rights to the East African states were

[36] P Meenakshi, *Elements Of Environmental Science and Engineering* (Phi Learning Pvt Ltd 2012).
[37] Meenakshi (n 36).
[38] Meenakshi (n 36).
[39] AE Majule, 'Towards Sustainable Management of Natural Resources in the Mara River Basin in Northeast Tanzania' (2010) 2 J. Ecol. Nat. Environ 213.
[40] Haftendorn (n 3).

completely diminished and although the East African states saw the agreement that was signed in 1929 as null and void after independence. Egypt, however, kept on looking at the terms of the agreement and applying them as they were before independence.

The Nile is an economic resource especially to Sudan and Egypt. There was a shift from Egypt's original position since the affirming of the Nile Water Agreement with Sudan in 1959[41]. In this agreement, Sudan and Egypt were the only ones that were allocated rights to the Nile[42]. All the other riparian states of the Nile were left out of the agreement and no rights allocated to them. The 1959 Agreement was endorsed by the Egyptian government with the intention of gaining full control of the Nile in terms of agricultural, economic and hydropower development[43]. There is potential of economic growth in the northern riparian states namely Ethiopia and Eritrea in terms of agriculture and hydroelectric energy using the waters of the Nile[44]. Egyptians feared that with the construction of dams in Ethiopia along the Nile would be detrimental to Egypt as the flow of water will be disrupted[45]. This was coupled with the concern that was raised by endorsing an agreement involving Sudan and Ethiopia in 1991. This agreement covered the cooperative utilisation of the water of the Nile by the two countries.

In retaliation Egypt threatened with war in an event that the water flow to Egypt was disrupted. There have been efforts to curb the problem of ineffective water management over the years. The Organisation for African Unity (OAU) has tried to gather the states along the

[41] Haftendorn (n 3).
[42] Paul J Block, Kenneth Strzepek and Balaji Rajagopalan, 'Integrated Management of the Blue Nile Basin in Ethiopia' (IFPRI Discussion paper 2007).
[43] J Anthony Allan, 'The Nile Basin: Evolving Approaches to Nile Waters Management' (1999) 20 Occasional Paper 1.
[44] Block, Strzepek and Rajagopalan (n 42).
[45] Haftendorn (n 3).

river banks to negotiate on terms of use[46]. The cooperation has been hindered because of the involvement in conflicts of the East and West. The wars in Ethiopia and Sudan have also taken part in a role in hindering the countries to come together to the negotiating table. They are the countries that utilise the Nile the most and contribute nothing in terms of the sources of the Nile.

The White Nile riparian states started demanding their rights to utilise the Nile waters as much as the lower riparian states were entitled to the water. The Nile Basin Initiative was formed in 1999 in an attempt to redistribute the rights over the Nile between the upper and lower riparian states[47]. The lack of use of the Nile in upper riparian states, such as Ethiopia, has led to the country flourishing in poverty and lack of hydroelectric power for their own internal development. There are vast lands around the Nile which are fertile and can be used for agriculture but the country cannot utilise this resource because of the interests and rights that Egypt has over the Nile. The damming of the waters of the Nile in Ethiopia will affect the amount of water and the quality that flows down to Egypt.

The sources of disputes discussed are relatable to the global and East African region as they cut though across a number of issues experienced globally. In order to have a regulatory framework which is effective, these causes of disputes should be considered in order to avoid a repeat of the same issues that have been experienced in other parts of the world. This will accelerate development and the time taken to have the disputes resolved can be used in more productive ways which are beneficial to the communities living around the river.

The economic development of Kenya and Tanzania are at two different places. The Mara River, even though majority of it lies in Kenya, should be managed in an equitable manner for the development of the two states, and with the purpose of achieving this; sustainable

[46] Haftendorn (n 3).
[47] Block, Strzepek and Rajagopalan (n 42).

development measures have to be employed. The Nile River has been managed in a manner that is only to the benefit of the lower riparian states at the expense of the upper riparian states. This should not be the case of the Mara River. One state should not profit from the river but rather there should be rational gains shared between the two states.

3.4 National legal framework governing the management of the Mara River

The Mara River falls under two national legal frameworks; the Kenyan legal framework and the Tanzanian legal frameworks. These are the laws that govern the water resources in both countries and inclusive of the Mara River. These laws also include in them the formation of various bodies tasked with the management of these resources as agencies and regulatory bodies.

3.4.1 Kenyan legal framework

3.4.1.1 The Constitution of Kenya (2010)

The Constitution is very clear on the preservation and protection of the environment and natural resources. The Preamble of the Constitution provides for the sustenance of the environment for the future generations. Article 10 of the Constitution provides for national values and specifically sustainable development which should be exercised in the Mara River Basin. Article 42 of the Constitution establishes the right to a health environment which is clean to all people and the for the benefit of the present and future generation, the environment should be protected. Chapter 5 of the Constitution is dedicated to the land and environment for proper management and conservation. Article 69 creates the rights and obligations of people to promote sustainable development through the protection and conservation of the environment, and to use the natural resources in the environment ecologically. The Mara River falls under the mandate of the Constitution as it is a natural resource under the Kenyan jurisdiction.

3.4.1.2 Water Act (No. 43 of 2016)

This Act discusses the management, development and regulation of water resources in Kenya. This is inclusive of the Mara River as it falls within the jurisdiction of Kenya. This Act establishes the Water Resources Authority under section 11. The authority is tasked with the administration and the utilisation of water resources in Kenya. It is also mandated to enforce and formulate standards, procedures and regulations to ensure the proper administration of the water resources in Kenya. The authority is also responsible for the tender of water licences for water abstraction and use, and ensuring that the permits have conditions attached to them where the need arises. The authority has the power to supervise the how the water resources are used and ensure that they are used in the manner allowed by the permits issued by it. They authority can gazette a catchment area to be a protected area if it is considered vulnerable and needs to be protected in order to preserve it and its water resources.

3.4.1.3 Environmental Management and Coordination Act (No. 8 of 1999)

This Act is focused on environmental and resource management, and the management of water resources as it includes water in the definition of the environment. This Act establishes the National Environment Management Authority under section 7. The authority was established to oversee and generally supervise all environmental matters. It is the main government instrument for carrying out of all policies as regards the environment. It is mandated with the determination of the value of the Kenyan natural resources as well as their utilisation and conservation.

This Act aims to achieve sustainable land use and this in turn has an effect on the water resources utilisation and conservation, and especially the Mara River. Section 42 of this Act gives provision for guarding of water resources in Kenya. It prohibits the deposit of any

substance that is probable to have unfavourable consequences on the water resources and this can be translated to mean that the Act prohibits pollution of the water sources. However, despite this provision of the Act, there is still rampant pollution in the Mara River which is also covered by this Act. Section 44 of the Act provides for the protection of hill tops, mountain areas, forests and hill sides in order to protect the water catchment areas which are crucial to water resources, and also regulate human settlement which greatly negatively affect these areas. This is also a measure to control soil erosion from these areas which then are deposited in the water resources.

This Act provides for environmental impact assessment to be done before the commencement of a project that is likely to have negative repercussions on the environment. This is provided for under section 57A and 58 of the Act. The reports after the assessment are to be carried out by an individual who is an expert or a firm of experts who are authorised to on behalf of the authority. This is a major step towards the reduction of pollution especially in water bodies but this is not easily implemented especially in the use of transboundary waters such as the Mara River because it is provided for and applicable only in the Kenyan jurisdiction.

3.4.1.4 Agriculture and Food Security Act (No. 13 of 2013)

This Act relates to the regulation and promotion of agriculture in Kenya. This Act has provision for the preservation of water catchment areas and the prohibition of agricultural activities on these areas. This is also to reduce the erosion of soil and the degradation of land from agricultural activities. This also prohibits the destruction of vegetation in such areas as to degrade the environment. This is proviso is found under section 23 of the Act.

3.4.1.5 Fisheries Management and Development Act (No. 35 of 2016)

This Act is concerned with the management, protection and development of fisheries and other aquatic resources for the enhancement of the livelihoods of the communities dependent on fishing. This Act establishes an authority whose only purpose is to market fish and fisheries products in Kenya. This Act prohibits the use of poison for fishing in any water body. This is a measure that is taken to reduce the pollution of water. However, there is no regulatory body mandated with the specific task of ensuring that poison is not used for fishing.

3.4.1.6 Wildlife Conservation and Management Act (No. 47 of 2013)

This Act relates to the sustainable use, preservation, maintenance and administration of wildlife in Kenya. It establishes the Kenya Wildlife Service, whose authority is to preserve and run national parks, wildlife protection and shelters in Kenya. The Mara River's course runs all the way through the Maasai Mara National Reserve thereby falling under the mandate of the Kenya Wildlife Service (KWS). The KWS is authorised to manage wetlands under the Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat and any area declared as a wetland area by the Cabinet Secretary under section 31 of the Act. The Maasai Mara National Reserve is also one of the Ramsar sites which falls under the mandate of KWS.

3.4.1.7 Forest Conservation and Management Act (No. 34 of 2016)

This Act is concerned with sustainable management and development, conservation and rational utilisation of forests and their resources in Kenya. It sets up the Kenya Forest Service under section 7. The mandate of the Kenya Forest Service includes the supervision of water catchment areas corresponding to soil and water maintenance, carbon appropriation and other

environmental services fall under the authority of the Kenya Forest Service (KFS). This covers the Mara River because the river is reliant on the Mau Forest which is one of its catchment areas and the mandate of water conservation falls under the authority of KFS. The KFS also has the authority to give consent for quarrying in the forest so long as it is not a catchment area. This mandate has not been effectively exercised as mining and quarrying still happen along the river despite there being catchment areas which are delicate and vital to the conservation of the river. This is also challenged by the river being a transboundary resource that requires the input of the Tanzanian government for the conservation of the river to be successful.

3.4.2 Tanzanian legal framework

3.4.2.1 The Constitution of the United Republic of Tanzania (1977)

The Constitution under Article 27 provides for the duty of the people to protect natural resources. It also creates the duty to ensure that the state and communal property is not misused and also safeguard the same. The Mara River falls under the natural resources in Tanzania and therefore subject to the protection accorded by the Constitution.

3.4.2.2 Water Resources Management Act (No. 11 of 2009)

The Act is concerned with the legal and institutional structure for the sustainable administration and development of water resources. It also provides for the principles to be applied for water resource management in order to prevent water contamination and to make available means for the contribution of stakeholders in the management of water resources and also to encourage public participation. This Act repealed the Water Utilisation (Control and Regulation Act) of 1974. This Act under section 3 has defined water pollution as the alteration of the water directly or indirectly in terms of physical alteration, thermal, chemical or biological properties. This water is then not fit for human consumption and negatively

affects the aquatic animals and is less beneficial for its purpose. This applies to the Mara River that has undergone various chemical and biological changes over the years.

This Act under section 4 provides for the environmental impact assessment to be done by the proponents of any development to be carried out at a water resource area or a watershed area within the country. This is applicable to the developments carried out along the Mara River as well. This Act gives the Minister power to create Basin Water Boards for every water basin, and the office of the Director of Water Resources in which one of the official tasks of this office is to formulate policies and programs that are aimed at managing and developing water resources and control the pollution of water resources. It creates duties to the land owners who have land adjacent to the water resource to take measures to ensure that pollution is prevented, controlled and there is no recurrence of pollution if it was there before. This is applicable to the land owners adjacent to the Mara River.

3.4.2.3 The Water Supply and Sanitation Act (2009)

The Act provides for the clear guidelines of the supply of water and sanitation. It also provides for sustainable management and sufficient operation and transparency in the management of water resources and distribution. It establishes the Energy and Water Utilities Regulatory Authority under section 27 together with the Energy and Water Utilities Regulatory Act, and the Water Supply and Sanitation Authorities under section 9 of the Act. The function of the Water Supply and Sanitation Authority is to ensure supply of water in accordance with the Act and any other written law dealing with the management of water resources. The Energy and Water Utilities Regulatory Authority is in accordance with this Act and the Energy and Water Utilities Regulatory Act. Its mandate includes the regulation of water supply services and licensing services, establish the tariffs to be paid for the supply of

sanitation services and water and monitor the quality of water that is supplied from the natural resources.

3.4.2.4 Environmental Management Act (2004)

This Act has the mandate to manage and provide the institutional and legal framework to sustainably manage the environment. It draws out the values to be applied to the administration of the environment, ways in which to carry out impact assessment risks, prevent and control pollution and ensure that the environmental quality standards are maintained. Its pivotal point is the carrying out of environmental impact assessment before the authorisation of any project. This is detailed in the Environmental Impact Assessment and Audit Regulations of 2005. The Act establishes the National Environment Management Council under section 16 of the Act and its main functions are to enforce, review, monitor and ensure compliance of the environmental impact assessment and thereafter making a decision on the same while encouraging public participation in the making of the decision. It is also mandated to oversee and coordinate all environment matters addressed to it by the Act or any written law.

3.4.2.5 Fisheries Act (2003)

This Act contains provisos for sustainable development, shelter and conservation of the aquatic environment, the development of aquaculture and the guidelines and control of fish and fish products. It includes provisions of the protection of both the aquatic environment and the terrestrial environment with the intention of promoting sustainable development. It gives room for international collaboration on the management of shared water resources with other countries such as Lake Victoria. The Mara River is managed through community based plans due to the complexities of the management of the river. This Act prohibits the use of poison

for fishing in water bodies under section 40 of the Act. This helps in the controlling of pollution in the water resources including the Mara River.

3.5 Conclusion

The problems that are being faced in the application measures to control pollution in order to achieve sustainable development in the Mara River Basin are not unique to the resource alone. It is widespread across the continent and by the time the governments realise the need for proper management of the shared resources, the ecosystem and the biodiversity have suffered great losses and some of the species lost due to this are extinct. The two involved governments should come together and agree as soon as they can before the extinction of species that make the area of high economical value to the tourism and agricultural sector.

Majority of the problems that are faced in the mutual management of the river fall squarely on the communities that live along the river and the governments involved. Challenges in the management of the river come up every day and there is not much that can be done in stopping challenges from coming up but there can be set in place mechanisms for dealing with such issues[48].

At the very core of pollution and the deterioration of the Mara River lies an issue of the lack of implementation of the principle of sustainable development. The issues concerning transboundary water resources bring an opportunity for the development and the riparian states that share a river or lake basin to come together to implement the principle of sustainable development in a manner to control pollution and deforestation which are persistent and increase every day. Sustainable development considers the wants of the

[48] Theodore Okonkwo, 'Management of Transboundary Natural Resources' (2017) 9 Journal of Law and Conflict Resolution 42 <http://www.academicjournals.org/journal/JLCR/article-abstract/90F760F66905> accessed 1 March 2018.

affected states[49]. The needs, whether economic, social or developmental, of the riparian states need to be taken into account for the application of sustainable development to be considered as successful. The parties need to determine a starting point for application of the sustainable development principle in order to take into account the goals and needs of the communities and dependants of the river.

The Trail Smelter arbitration brought about the harm principle on transboundary natural resources but the balance in the interests of the parties involved is where the biggest challenge lies[50]. Before the Trail Smelter arbitration the issue of transboundary harm had never been contested on an international level[51]. The lack of a set standard in determining the extent of the liability of the state is then left to the political power of each state and the determination of the equitability of that resource to the states involved. However, parties that share a natural resource can, in an agreement between themselves, determine the extent of liability that an offending state can be held accountable for. This gives room for the concerned states to set standards for themselves in line with the harm principle. This will also help in determining the extent of the activities of those states in regards to the shared resource. The Trail Smelter arbitration brought about the discussion of the issues of boundaries, harm, sovereignty and the components of transboundary harm[52]. These are essential to the determination of issues that arise out of the use of the resources and a guideline is established along those lines.

The decision notably did not mention the rights of individuals or natural environmental rights to a clean environment that was free from harm from the activities of either the states or

[49] Schwabach (n 11).

[50] Alastair Neil Craik, 'Transboundary Pollution, Unilateralism and the Limits of Extraterritorial Jurisdiction: The Second Trail Smelter Dispute' (Social Science Research Network 2006) SSRN Scholarly Paper ID 2648558 <https://papers.ssrn.com/abstract=2648558> accessed 20 October 2017.

[51] Rebecca M Bratspies, 'Trail Smelter's (Semi)Precautionary Legacy' (Social Science Research Network 2006) SSRN Scholarly Paper ID 893215 <https://papers.ssrn.com/abstract=893215> accessed 20 October 2017.

[52] Miller and Bratspies (n 24).

private individuals[53]. The end result of entering into an agreement under the no harm principle is because the countries are assured of non – infringement of the agreement by each other that share the basin. It ensures permanent sovereignty over the resource and thus the environment is collaterally preserved as a result[54]. The Trail Smelter arbitration, however, is important and key to the application of sustainable development as a principle because in controlling pollution an element of sustainable development is achieved. This may put industrialisation and mining on hold for some time in the Mara River region before other measures are put in place to safely extract the metals but it will stop the immediate rampant pollution that is happening. It joins the principle of sovereignty and environmental preservation in a manner which the two cannot be delinked from this approach. The mobilisation of the citizens to support environment friendly practices was realised by the Trail Smelter arbitration and the practices of strict liability environmental practices were applied and the polluters held liable for the damage and cleaning up the polluting matter from the environment.

In conclusion, it is crucial for countries sharing natural resources to preserve the environment for their citizens and future generations. Environmental concerns should be sensitised to the citizens in order to have environmentally conscious activities regardless of whether they are economic, social or developmental. The applicability of the principles of international law and international environmental law, particularly the doctrine of sustainable development, will vary from one situation to the next.

[53] Parrish (n 27).
[54] Parrish (n 27).

CHAPTER FOUR: ADDRESSING POLLUTION IN THE MARA RIVER TO ENSURE SUSTAINABLE DEVELOPMENT

4.1 Introduction

At the very core of environmental degradation in the Mara River Basin is poverty[1]. According to the government of Kenya statistics in 2013, Narok County where the Mara River lies, poverty level was at 41%[2]. Poverty is a threat to environmental conservation because underprivileged rely on biomass for continued existence[3]. Poverty encourages disagreements over the access, exploit and administration of natural resources. This has had a negative impact on the river and its environs. At the central part of the promotion of sustainable development in the Mara region in both Kenya and Tanzania is the protection and preservation of the environment and the river.

The Mara River has undergone various biological and chemical changes over the years due to increased human settlement and activities. This has caused the Mara River Basin to be under threat due to increased unmonitored activities leading to the degradation of the environment and the ecosystem. Hazards to the river's ecosystem stem from pollution of the river from domestic waste, plastic from urban centres and settlements, agricultural chemicals, blooming industrialisation, eutrophication from livestock, and the lack of proper sewerage system. This has led to the degradation of the water of the river in quality and quantity. The river quality is crucial to the health of the people that live along the river or in the Mara River Basin. Health is a major concern in relation to the pollution of the river. There is the rampant spread of diseases which are waterborne. As regards to quantity of the water in the river, there are areas, when in the dry season, the level of the water of the river is only knee high and this

[1] Pernille Kallehave and Elias Ayiemba, 'Maasai Mara the Challenges of a World Unique Ecosystem' (Aarhus University, Business and Social Sciences, Interdisciplinary Center for Organizational Architecture 2015).
[2] Kallehave and Ayiemba (n 1).
[3] Kallehave and Ayiemba (n 1).

causes a shift in the habitats of the wildlife and other aquatic species in search of other areas to settle at[4].

The level of pollution in the Mara River is worrying because of its significance to the communities that live along the river. The river is of socio – economic importance to these communities and the development of the region. The Mara River is a foundation of source of income for many communities in Kenya and Tanzania and directly affects the main source of income especially farmers and agriculturalists. The pollution in the river has negative impacts on the livelihood of these communities due to the unsustainable manner that the river is used[5]. The rapid degradation of the river has been attributed to by the lack of coordination between government sectors and the lack of encouragement for the proper use of the river and its resources by the local communities dependent on the river[6]. Also high levels of poverty, poor technology and the population have contributed to the degradation of the river. Change of user of the land along the river has contributed to the reduction of quality of crops that are yielded from the farms and the production of livestock and this is the main source of income from the communities reliant on the river and her resources. The wildlife sector is not spared by the pollution of the river as there is loss of biodiversity and quality water which the wildlife is dependent on.

4.2 Factors leading to the pollution of the Mara River

The reduction of forest land in the higher catchment areas of the river, unplanned water abstraction including small scale irrigation schemes have greatly contributed to unsustainable use of the river and this coupled with mining along the river and industrial development have

[4] Bancy M Mati and others, 'Land Use Changes in the Transboundary Mara Basin: A Threat to Pristine Wildlife Sanctuaries in East Africa'.
[5] Bomani Sumari, 'Approach to Resolving Pollution of River Water Associated with Human Activities in Tanzania' (2018) 6 African Journal of Environmental Economics and Management 355.
[6] Sumari (n 5).

led to the degradation of the river[7]. There is no planning on the use of the river and her resources[8]. All activities carried out on the river, whether water abstraction, farming or mining are unplanned and used without proper methods and regards to the impact it has on the river and the environment as a whole. A great percentage of the problems with water pollution in the river are as a result of agricultural treatment chemicals such as pesticides and fertilizers from the farmlands[9]. There has been numerous environmental impact assessment reports from both Kenya and Tanzania as regards the pollution of the river but none of the two countries have reached the standards that are required by the international community when it comes to the reduction of pollution in the river[10]. This negatively impacts the environment and hampers sustainable development because the ignorance of the impact assessment reports leads to unsustainable use of the river and her resources and an increase in pollution. The increase in pollution then affects the quality of agricultural products and also the loss of biodiversity.

Pollution through the chemicals used in farmlands for both animal husbandry and crop treatment and maintenance can pollute the river though the infiltration of groundwater and run – off into waterways. This process is through the infiltration of these chemicals into the soil and eventually the water and this causes eutrophication of the river. This is especially through the nitrates and phosphates that are easily absorbed into the soil and still with the same ease seep into the water resources. The concentration of nitrates and phosphates in water causes a sudden increase in the growth of algae in the water and this leads to the death of many animal and plant species due to the lack of oxygen in the water as all of it is utilised

[7] AE Majule, 'An Approach toward an Integrated Management of the Mara River Basin in Tanzania' [2011] Handbook of Research on Hydroinformatics: Technologies, Theories and Applications 124 <https://www.igi-global.com/chapter/approach-toward-integrated-management-mara/45442> accessed 9 October 2018.
[8] Majule (n 7).
[9] 'Establishing Mara River Basin Policy, Legal and Institutional Cooperative Framework' <http://repository.eac.int/handle/11671/703> accessed 9 October 2018.
[10] 'Establishing Mara River Basin Policy, Legal and Institutional Cooperative Framework' (n 9).

by the algae. The chemicals particularly carcinogens from the farmlands' chemicals also react with the water and this develops into poison that is harmful to human beings and wildlife. This is an enormous obstruction to sustainable development.

Unsustainable development through the lack of proper mechanisms such as lack of water regulations governing the Mara River have led to the increase of the levels of pollution in the river and unsustainable water abstraction by the communities living along the river[11]. There is a deficiency in the allocation of water plans to the various large scale and small scale users of the waters of the river and also a deficiency of knowledge of the resource quality objectives to indicate the levels of the quality the river should be maintained at. This plays a huge role in the rise in the levels of pollution in the river.

There has been research carried out and shown that water bodies have been drying up or shrinking as a result of pollution, unsustainable farming and deforestation[12]. There are high levels of the river being polluted in growing towns on the upper catchment areas of the river[13]. The dumping of sewerage and waste products from these towns diminish the excellence of water in the river and the reduction of aquatic animal species found in the river. There is poor disposal of waste water and this translates to waste water being dumped in the river and thereby translating to water pollution. This can also be seen as the unsuitable and unsustainable utilisation of the wetlands that lie in the higher catchment area of the river. The utilisation of the river for dumping of waste products hinders sustainable development because the quality of water required for sustenance of projects such as farmlands, livestock farming and for domestic uses goes down. This leads to the development of waterborne

[11] 'Mara River Basin Natural Resources Management Institutional Capacity Needs Assessment' (Lake Victoria Basin Commission 2011) Final Report.
[12] Francis Mutua, 'Towards an Integrated Trans-Boundary River Management Policy Development in SemiArid River Basins', *Is IWRM under the African Water Vision 2000 a Template for Integrated Management of Water, Biodiversity and Livelihoods?* (African Technology Policy Studies Network 2008).
[13] 'Establishing Mara River Basin Policy, Legal and Institutional Cooperative Framework' (n 9).

diseases for both human beings and animals that depend on the water. This also leads to the use of more chemicals in a bid to purify the water for uses particular to the wants of the communities dependent on the river.

The uncontrolled mining and quarrying on the river banks have played a part in the increase of pollution in the Mara River[14]. The chemicals such as mercury that are used to purify the minerals that are mined pollute the river by both large scale and small scale mining. These chemicals are harmful to human beings and animals if ingested and causes deformities of the species and even death as was seen in Minamata. The pollution of the river using mercury is rampant in both Kenya and Tanzania. Mercury is used to purify the gold that is mined along the river banks.

Other than the chemicals that are used to purify metals after and during mining, there is the issue of the rocks and soil being deposited into the river. The loads of rocks and soil dumped into the river contribute to the sedimentation of the river and this adds greatly to the pollution of the river. When this is piled on together with the sediments from the river banks through cultivation and grazing of animals increases the intensity of sedimentation in the river and this becomes a growing concern as regards the preservation and conservation of the river. The sedimentation can also be linked to the digging of the foundation for structures and the soil being washed away by forces of nature to the river.

The deforestation for farming in the higher catchment area of the Mara River leads to intensified use of this land which requires more amounts of chemicals for treating and fertilising the crops[15]. The more the chemicals are used in the farms, the more the pollution through waste chemicals which are drained into the river. This also increases the level of sediments drained into the river leading to high levels of sedimentation in the river. The

[14] 'Establishing Mara River Basin Policy, Legal and Institutional Cooperative Framework' (n 9).
[15] Mutua (n 12).

intensive farming not only negatively impacts the river through pollution but also diminishes the nutrients in the soil and in the water needed to have high quality yields from the farms.

Deforestation has been seen to have a devastating impact on the numbers of animals in the Mara River region including livestock and wildlife and also on the livelihood of human beings dependent on the Mara ecosystem[16]. In order to have sustainable development thrive in the Mara River basin as a whole there needs to be proper balance between the management of the river and her resources and the consideration of the livelihood of the communities that live along the river and the river basin. Soil erosion is also attributed to deforestation and illegal logging of the forest area of the Mara River Basin[17].

The management of pollution in the higher catchment area of the Mara River Basin will reduce the amount of siltation and level of pollution downstream[18]. The activities that pollute the Mara River in the upper catchment area such as mining, irrigation programs, and livestock keeping must to be controlled in order to promote sustainable development. This has so far affected the environment downstream in a way that in dry seasons, the lower part of the Mara faces drought and water scarcity. This hinders any economic activity that is reliant on the river such as preparation of the farmlands from happening and also from watering the livestock that is kept by the farmers downstream. In the season where there is heavy rainfall the reverse is true. There lower part of the Mara floods thereby making it difficult for the communities living there from doing anything productive with their land and the livestock is compromised as well as the wildlife.

[16] Mohammed Said, 'Towards an Integrated Trans-Boundary River Management Policy Development in SemiArid River Basins', *Intergrating Water Resource Management, Sustainable livelihoods and Conservation of Biological Diversity in the Mara River Basin* (African Technology Policy Studies Network 2008).
[17] Sumari (n 5).
[18] Sumari (n 5).

The use of poison for fishing is another activity that contributes to the amount of pollution realised by the communities living along the Mara River[19]. This is because the chemicals used for fishing react with the water and also have a negative impact on the other species of aquatic animals[20]. This raises health concerns over the quality of water that is consumed by the people and animals in the area and degrades the quality of water as a whole. This also adds to the salinity of the river making it unfit for consumption and plummeting the quality levels of the water. The chemicals are used for fishing at breeding points of the fish and in so doing this destroys the breeding grounds of the fish[21]. It must also be noted that the negative impacts of chemicals in the Mara River are not only felt in the river, but also in Lake Victoria where the Mara River drains its water.

The cultivation and grazing of animals along the river bank causes soil erosion and siltation of the river[22]. Siltation of the river is correlated with the removal of vegetation or deforestation from the river banks[23]. This is done by the settlers along the river banks who cut down the trees to make space for land to cultivate or by the animals that are taken to the river banks to graze and water. Siltation is a universal feature in large rivers and water bodies. Siltation is detrimental to the aquatic environment and is a form of pollution because it negatively impacts the breeding grounds for aquatic animals and vegetation in the river. It can cause the extinction of species in the river and therefore the need to reduce siltation in order to curb pollution arising out of it.

[19] 'Establishing Mara River Basin Policy, Legal and Institutional Cooperative Framework' (n 9).
[20] Sumari (n 5).
[21] Sumari (n 5).
[22] Sumari (n 5).
[23] Amos E Majule and RRB Mwalyosi, 'The Role of Traditional Irrigation on Small Scale Agriculture in Semi Arid Environment, Southern Highlands Tanzania', *International Water Management Institute Conference Papers* (2005).

Pollution in the upper areas of the river has led to the destruction of wildlife habitats downstream[24]. The pollution affecting the wildlife habitats from the upstream of the river has been attributed majorly to agricultural activities. There have been reports of the wildlife migrating from their usual areas of spotting to other areas of the river. This has also been as an effect of the levels of water in the river reducing especially in prolonged dry seasons. The local communities have confirmed this by stating that the places at which the animals would be spotted have over the years changed and this is because of the activities that affect the river[25]. This hinders the growth of tourism which is essential in the development of the area.

The pollution in the river has affected the communities reliant on the river and her resources negatively[26]. This hinders the economic development of the area as most of the people of these communities do not have any other source of income that is not dependent on the river. Economic development is vital to the survival of the communities and unfortunately wildlife, which also brings in revenue, does not match the agricultural sector which is the key source of revenue of the people living in the region[27]. Pollution of the river is to be expected if no other substitute of agricultural pollutants can be employed by the people. The biggest source of pollution is from agriculturalists and domestic waste.

The industrial waste is predominant in places where there is high population and where the towns are growing rapidly and so is the level of industrialisation[28]. There is a significant amount of waste product from the growing industrialisation and domestic waste which impact the level of pollution in the river as well. The key reason for domestic waste to be accumulating in the river is for lack of proper waste treatment plants and mechanisms. These

[24] Mati and others (n 4).
[25] Mati and others (n 4).
[26] Mati and others (n 4).
[27] Sumari (n 5).
[28] Majule (n 7).

pose as a hazard to the communities as well and encourage easy transmission of diseases. Development is hampered when the population experiences outbreaks of diseases and also affects the productivity of the population.

There is fast, steady and uncontrolled tourism growth and development in the Mara River Basin[29]. This is not sustainable for the river whose ecosystem is strained by the vast infrastructural development by the building of hotels, lodges and campsites. Some of these are located within the parks and around the parks and the towns adjacent to the tourist attractions. This contributes to the pollution of the river due to the waste disposal from these establishments. It has been noted that sewerage systems in upcoming towns has yet to be properly established and before this is done, the waste from the establishments is let into the environment thereby affecting the ecosystem and the animal habitats negatively. There has been a change in the behaviour of animals such as migration patterns due to human interference. So as to encourage sustainable development, there needs to be a balance in conservation of the environment and the steps taken for ensuring a steady growth in development.

The growth of infrastructure is rapid in the Mara River Basin[30]. This is essential for the growth of tourism and economic development because of the ease of access to the parks and conservancies. This is also great for the communities that live in the region because the cost of living is lower with better infrastructural development. This is detrimental to the environment in terms of pollution. This is because of the increased human population movement and settlement in the areas where there is a delicate balance in the ecosystem and the survival of other animal species. This can be taken from the Loita Plains where there are large tracts of land for wheat farming and at one point in time; Narok was the largest wheat

[29] Kallehave and Ayiemba (n 1).
[30] Kallehave and Ayiemba (n 1).

and barley producer in the whole of Kenya due to the promotion of wheat farming in the region by the government[31]. This has destroyed the soil composition from how it was and this has changed the balance of nutrients and the composition of soil over the years. The using of alternative means to treat the farms and for fertilisation will go a long way in rehabilitating the river and her environs where there is increased human activity.

Pollutant chemicals such as cyanide, mercury, chemicals used in animal husbandry and the chemicals used in the farms as well as by-products of these chemicals have caused so much pollution in the river to a level that the river cannot dilute itself[32]. The lack of the river having the ability to clean itself and dilute the chemicals deposited into it has directly impacted the reduction of the river and her quality over the years. This pollution has resulted to the loss of biodiversity and the death of many people over the years due to waterborne diseases[33]. This has also resulted in the death of animals that consume the water and this leads to the loss of species in the river and in the river's environment.

4.3 Conclusion

The control of human activities along the river basin needs to be controlled by regulatory bodies in both Kenya and Tanzania in order to preserve and rehabilitate the Mara River. There is need to find alternative methods for waste disposal treatment of the waste before its disposal in order to protect the environment. Both human beings and wildlife suffer during the dry season due to scarcity of water from the river[34]. The pollution should be controlled so as to ensure that the levels of water in the river are constant and at a level that can sustain the people and the animals that are dependent on it. If the activities that cause pollution at the

[31] Kallehave and Ayiemba (n 1).
[32] C Kihampa and A Wenaty, 'Impact of Mining and Farming Activities on Water and Sediment Quality of the Mara River Basin, Tanzania.' (2013) 3 Research Journal of Chemical Sciences 15 <https://www.cabdirect.org/cabdirect/abstract/20133334626> accessed 15 October 2018.
[33] Kihampa and Wenaty (n 32).
[34] United Nations, 'Facing the Challenges' (United Nations 2012) 4.

Mara River Basin are not stopped in totality immediately and replaced with other sustainable means, the environment will not be recoverable by the time a full transition is made. This will obstruct development and the loss of species will be irrecoverable[35].

In order for sustainable development to be realised through the control of pollution, the sustainable development goals need to be kept in mind and acted upon. Poverty has time and time again been associated with the pollution of the river because of lack of other sources of income other than agriculture. The disregard for environmental conservation is by default because the people are pushed and environmental conservation fights a losing battle with the ability to provide for their families. The conservation of the environment is not considered for instance in the application of pesticides and fertilizers on the crops in order to have good yield and make some profit.

The deterioration of health among the people living in the river basin is owed to the dirty water that they are subjected to especially during the dry season[36]. The communities there fetch the water directly from the river and it is contaminated through the pollution and this increases cases of outbreaks such as cholera and other waterborne diseases. There is also an increase in the rates of people who develop intestinal worms and diarrheal. This is also a major cause of death in children and adults alike. Such diseases are treatable and preventable and this can be achieved through the control of pollution in the river. This can also be credited to the realisation that there are no proper channels for sanitation and infrastructure for the same.

The loss of ecosystem and biodiversity will cost the Kenyan and Tanzanian governments in terms of losses. This is because the revenue gotten from the tourist attractions in the Mara and the Serengeti are reliant on the river for sustenance. The migration of animals from either

[35] United Nations (n 34).
[36] United Nations (n 34).

side of the river will cease if the levels of the water of the river continue reducing at the rate at which they are. The animals' habitat and living patterns are interfered with when the river is interfered with in terms of excellence and amount.

In order for pollution to be controlled in the Mara River and her environs, there needs to be proper planning of human activities in the region. There is need to have a framework in which the rehabilitation of the environment is provided for and at the same time provide alternative methods and means to promote development. There should be community involvement in the conservation of the environment and the enlightenment of the communities of the need to conserve and rehabilitate the environment. Without the involvement of the community, the rehabilitation and conservation of the environment will not be successful. It will also be impossible to control pollution in order to promote sustainable development.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The control of pollution in the Mara River Basin is vital so as to achieve sustainable development. It is vital to control pollution and to reduce the level of pollution in the Mara River in order to sustain the communities and the wildlife dependent on the river. This calls for the assurance that the activities that are carried out along the river are environmental friendly and can still sustain the source of revenue of the communities that are reliant on the river for their day to day activities. The major source of pollution is from economic activities such as mining for gold, illegal fishing and both large scale and small scale farming. There are also high levels of waste disposal from areas with high population and settlement schemes which contribute greatly to the pollution of the river. This is especially harmful to the environment from the areas that are on the upper side of the river as these waste products are carried downstream. Pollution in areas where the tributaries of the Mara River are situated also contributes to the pollution of the river.

There is need to have the governments of Kenya and Tanzania supports the vision of sustainable development and come up with common goals and objectives[1]. One of their main objectives should be to restore the degraded water catchment areas along the river and to rehabilitate these areas and control pollution. This will greatly impact the reduction of pollution of the river. An incorporated approach to the management of the river is required because one country cannot manage the river while the other does not[2]. Mismanagement of the river and increased pollution on either side of the river will definitely affect the other

[1] AE Majule, 'An Approach toward an Integrated Management of the Mara River Basin in Tanzania' [2011] Handbook of Research on Hydroinformatics: Technologies, Theories and Applications 124 <https://www.igi-global.com/chapter/approach-toward-integrated-management-mara/45442> accessed 9 October 2018.
[2] Majule (n 1).

thereby the increasing need to have pollution controlled and sustainable development realised in both countries. The sensitisation of the communities of the environment impact assessments reports that are conducted before the implementation of projects in both Kenya and Tanzania will go a long way in the promotion of public participation. There should be the engagement of other water bodies offices which are linked to the Mara River such as the Lake Victoria Water Basin which can be tasked with the management of lake basin water resources to regulate and check on the pollution levels and what needs to be addressed to reduce the same and with the issuance of water discharge permits and the issue of water rights on the users of the water both large scale and small scale.

There is need for the governments to find alternatives to chemical substances such as fertilizers and pesticides in the control of chemical pollution in the river from agricultural products[3]. This will see the farmers of various products see a better production of their crops and animals and the same time promote sustainable development. This will also act as incentive to the farmers to use environment friendly substances in their farms as they realise high yields.

The allocation of water resources to large scale and small scale farmers will be vital to ensuring sustainable development and the reduction of non – point and point pollution in the river. This will ensure that the amount of water taken from the river for farming and other domestic activities is within the limits that can be sustained by the river and no more abstraction of water to levels which the river cannot sustain. This will ensure uniformity of the water uses by both countries and the basic minimum level of water that should be in the river at any given time. While still ensuring uniformity, there should be an agreed mutual amount of land that should be left without any interference with between the river and land

[3] 'Establishing Mara River Basin Policy, Legal and Institutional Cooperative Framework' <http://repository.eac.int/handle/11671/703> accessed 9 October 2018.

used for commercial uses or farming. This land should not be titled to any individual, rather be considered as a river boundary. This will greatly aid in reducing siltation in the river.

The enforcement agencies tasked with the management of water bodies, particularly the Mara River should begin acting on their mandate and enforce the laws that see the proper utilisation and conservation of the river basin. There should be heavy penalties and punitive consequences for private sector players who obstruct the natural flow of the river and her resources by fencing around the river in very close proximity thereby affecting the use of the river by wildlife who are then forced to access the river on public land. This also increases the human – wildlife conflict. The privatisation of the river and her resources should be discouraged by the law enforcement agencies.

There needs to be an increase in awareness by the communities living along the river. They need to know and understand the need to conserve the river and her resources and at the same time know the dangers and effects of water pollution. They need to be sensitised on the ways in which to avoid water pollution and other methods and means that they can use to carry out their day today activities without polluting the water of the river and the river's resources. This can be done through National Environment Management Authority in Kenya and the Tanzania National Parks and the Serengeti National Park in collaboration in order to protect the water flows from collapsing and ensure that the ecosystem survives on the premise of regular supply of water to the ecosystem.

Education should be used as an instrument to encourage sustainable development through the control of pollution[4]. If there are forums to educate the communities that live along the river and are reliant on the river on the need to control pollution and lead a lifestyle where environmental control is key, there would be a huge change and much ease in rehabilitating

[4] Pernille Kallehave and Elias Ayiemba, 'Maasai Mara the Challenges of a World Unique Ecosystem' (Aarhus University, Business and Social Sciences, Interdisciplinary Center for Organizational Architecture 2015)

the river and her environs. There would be a change in the way the communities lead their lives and also a change in cultural practices that harm the environment and such activities would be devised towards ensuring sustainable development. A lot of community based activities can also be geared towards ensuring sustainable development and the conservation of the river and her resources.

In line with education, the communities should be made aware of the health risks they have to deal with because of the pollution of the river and her environs. The dangers of having babies born with deformities due to pollution, the diseases that come as a result of an unclean environment and the using of a lot of resources in treating such conditions. The consumption of contaminated food and water is harmful to their health therefore it makes it counterproductive to dump waste products in the river and utilise the same water for farming and other domestic needs. The communities living in the upper catchment areas of the river also need to be sensitised on the need to not pollute the water for the sake of the settlers downstream and the environment as a whole. There is need to preserve the environment for the future generations and future needs as well.

There is need for collaboration between the various water ministries between the Tanzanian government and the Kenyan government and their agricultural sector counterparts. This will ensure that the pollution linked to farming and the waste products and chemicals from the farms do not infiltrate the river. This will also aid in the curbing of riverbank farming, sedimentation in the river and the protection of the river from agricultural human activities that negatively impact the river and her resources. There is also need for partnership between the Kenyan and Tanzanian water ministries and other ministries in order to ensure that other sources of pollution in the river such as road run – off do not deposit sediments in the river which eventually pollute it.

The inclusion of the community in of support reduced pollution in the river will go a long way in the realisation of sustainable development in the Mara River region. The preservation and conservation of the river is realised through the integration of the community towards achieving a cleaner and less polluted river. This will play a huge role in ensuring that the future generation gets to enjoy the river's resources and this can form a basis for their livelihood as well. The polluters of the river are discouraged from the pollution of the river through various repercussions they face as a result of the pollution and other alternative environmental friendly means of development will be employed by them. Upcoming projects and activities to be undertaken using the river will be subject to environmental impact assessments and this will ensure sustainable use of the river is maintained. The soil quality affected by the pollution will automatically decrease and land will be more arable for farming, while increasing the quality of water suitable for both domestic and industrial use.

There also needs to be established clear water resource management objectives. This will from the very onset ensure that the people utilising the river have a clear sense of what they are required to do in order to restore and rehabilitate the river. The community at large need to be sensitised on these goals and objectives of the river and they need to be involved when the objectives are being formulated by the governments and the agencies tasked to do so.

5.2 Summary Of Findings

5.2.1 Research Hypothesis

The hypothesis "Lack of control of pollution in the Mara River hinders the realisation of sustainable development and has greatly lowered the quality and levels of water in the Mara River" was proved. The issues that have been discussed in the first and second chapters have proven that the major problem that the Mara River faces in terms of its pollution is the unsustainable use of the river which has led to major degradation of the quality of the water

in the river and her resources. This has also led to high levels of contamination of the soil, and negative impacts to the aquatic environment solely dependent on the river especially the marine animals and wildlife.

The river is exploited according to the needs of the countries and individuals thereby exposing the river to unsustainable exploitation without due regard of the ramification of these acts. All actors dependent on the river want to gain the most they can from the river and this leads to the unsustainable exploitation of the river and its resources. This has led to the degradation of the environment and the endangerment of various species dependent on the river for survival.

5.2.2 Research questions and objectives

The objectives are mainly aligned to the correlation between controlling pollution and the effect it has on sustainable development. They are to identify specific human activities that pollute the Mara River, and the main pollutants of the Mara River and how these negatively impact sustainable development. The activities that pollute the Mara River are mining, farming; which includes both large scale and small scale farming of crops and animal husbandry, plastics from urban settlement areas, illegal fishing and waste from domestic uses of water. These activities are all geared towards economic development by the communities living along the river and are reliant on the river and her resources in order to provide for themselves.

The control of pollution will encourage sustainable development through the provision of the usage of substances that are environmental friendly without compromising on development. This will go a long way in rehabilitating the river with the aim of achieving better quality of water and soil that is adjacent to the river. This will also amplify the quality of arable land

available for farming and other activities. The survival of marine life and rehabilitation of the aquatic environment will also almost automatically be realised.

The main pollutants of the Mara River are chemicals such as mercury which is used to purify gold that is mined along the river and chemicals from farmlands that are used to treat crops in the form of pesticides. The wastes from animals both domestic and wild also increase the levels of escherichia coli bacteria which contaminates the water. Leakage from sewerage systems in urban settlements into the river also contribute to the pollution of the river. The wastes from domestic uses of water in households also contribute to the pollution of the river. There is also the contamination of the river by chemicals which then form cyanide which is harmful to both human beings and animals when consumed and can even cause death in all species. The spread of diseases is inevitable. This is especially so when the water is polluted and it has reached the level where the river has the inability to purify itself from the chemicals and other pollutants.

The education and involvement of the community aid in the promotion of sustainable development by providing measures that restrict pollution such as the implementation and use of environment friendly products which shield the environment from harm. These activities will ensure that the future generation enjoys the environment, and this will go a long way in the realisation of sustainable development and the achievement of sustainable development goals.

5.3 Recommendations

The management of the Mara River should begin as soon as is possible. A period of not more than five years from now should be sufficient to have the implementation of pollution control programs in place to begin the rehabilitation of the river and its resources. The state of the river gets worse as time passes by and thereby leading the species that are dependent on the

river to near extinction and endangerment. It is easier to rehabilitate the river as it is now, than it will be say ten or so years to come. This will also aid in the prevention of losing species of animals.

5.3.1 Short term recommendations

There needs to be joint efforts by stakeholders in the water and sanitation departments in both Kenya and Tanzania to make plans for the communities in the upper areas of the Mara River to have access to clean water and waste disposal. This plan should also include proper sewerage systems and this should be diverted away from the river.

There is need to have the residents that live along the river to be sensitised to the advantages of not polluting the river. This can be done through government programmes initiated by both governments of Kenya and Tanzania in collaboration with the private sector such as non – governmental organisations in carrying out these programmes.

The farmers can be informed of other methods of treating crops without using pesticides that are harmful to the environment without compromising of the treatment of the crops. They can also be sensitised on ways in which animal waste products can be disposed off without necessarily dumping the waste in the river and also other ways in which the waste can be recycled and used for instance in the fertilisation of crops without the use of chemicals. This will reduce the amount of cyanide that is found in the water of the river and poisonous to both human beings and the animals dependent on the river.

Miners can be provided for other methods for the purification of metals without the use of mercury which is harmful to the environment. Miners can be made aware of the other alternative methods of purifying metals such as gold through methods such as panning and sluicing which do not require the use of mercury but obtain the same results of purification. This will greatly reduce mercury pollution.

There needs to be programs that are established in favour of the reforestation of the trees of the forests particularly the Mau Forest in order to rehabilitate the forest cover in the river basin. This will also go hand in hand with the rehabilitation of catchment areas of the river. In order for this to be effective, there needs to be accurate data collection from all the catchment areas and the extent of degradation that has been experienced in that area in order to come up with a comprehensive report on how to cater for each catchment area's needs.

5.3.2 Medium term recommendations

Incentives can be provided for the farming communities in the area to stop the deforestation. This will preserve the ecosystem and the balance of salinity levels in the river will subside drastically. This will also aid in the preservation of the population of the wildlife in the area, some of which are facing endangerment and others already considered an endangered species. These incentives could be in the form of rehabilitation of schools from already existing structures and hospitals and health centres for the communities. These should be acknowledged to be coming from some of the proceeds from the park fees, and this will in turn encourage the end of deforestation and the preservation of the animal habitats.

There needs to be established proper sanitation services and waste disposal of faecal waste and other solids from urban areas. This will consist of the building of operational sewer lines, treatment plants for the waste, the construction and establishment of waste collection facilities in urban areas and the teaching of the communities and stakeholders of the need to treat the waste, and ways of waste disposal which is cost effective and the required treatment processes.

The communities should be sensitised on the advantages of preservation of the river and what they will gain from its preservation. This can be done through community based programmes in which members of the community together with the governments' officials can discuss on

issues that affect the communities. Since the majority of the communities that live along the river actively practice their traditions, the consent of the elders before presenting the other members of the communities with the information, the consent and input of the elders will be vital in the acceptance by the members of the development plans. A committee can be formed that includes government officials and the elders with the aim of sensitising the communities of various matters. They should be assured that their interests and livelihoods are catered for in the preservation of the river as a resource. They should be made aware that the constant pollution and degradation of the river is actually harmful to their health and a constant threat to their livelihood and that of the wildlife and marine animals that depend on the river.

Still on the sensitisation of the communities, they should be made aware of the levels of pollution and usage of the river's resources that are sustainable. They should be made aware that levels exploitation that cross the recommended amount will be detrimental to the ecosystem and biodiversity and hence leading to the decreased revenue which aid the community advancement, due to the loss of species of animals and vegetation unique to the Mara region and which attract tourists and in turn translates into revenue.

The degradation of water can be reduced through the increase of access to water by farmers at the farms or various watering points by the pastoralists in a bid to decentralise watering points. This can be done through the provision of various water troughs which are accessible to livestock farmers and pastoralists and this will aid in the reduction of the degradation of watering sites along the river. This will aid in curbing point and non – point pollution in the river. Point and non – point pollution in the river is mainly through the chemicals that seep into the river either directly or through the soil.

There needs to be proper treatment of waste before it is released into the environment. This will be realised through the construction and rehabilitation of water plants in order to control

the amount of harmful substances that are in the environment. Septic tanks and other treatment plants should be away from the river course in order to avoid the contamination of the water.

The members of the communities can be encouraged to play a major role in environmental conservation. Every member of the communities living along the Mara River should report any acts which harm the environment to the relevant authorities and action taken against the perpetrators.

5.3.3 Long term recommendations

The commitment of the governments is vital to the preservation of the Mara River and the reduction of pollution in the river. Political and economical interests have to be catered for. This must be agreed upon by both governments through their ministries that deal with environmental issues and international relations. This is to ensure that both countries have the environment as a major concern in the face of politics and economic concerns. Political dedication is a core component of any regulations that are to be formulated.

The schools and health centres should be affordable to the members of the community and where possible the services can be rendered free of charge to the communities' members. This method ensures that most if not all members of the communities profit from the natural resource. This is better than issuing cash gratuities which may never go round the whole community except a few people. Once deforestation is curbed, there will be lesser levels of soil sediments in the river and the land that the farmers already have will be fertile due to the moisture and nutrients retained in the soil. The contamination of the soil by waste chemicals will reduce making the land suitable for farming.

The communities can be involved in the rehabilitation of the environment of the river, for instance in places where extensive deforestation has taken place. Their input on how to conserve the environment in the region as regards to various species of vegetation and animals is invaluable. They have lived in the region and they are well conversant with the behaviour of animals and the needs of various types of trees that thrive in a certain environment. This is also a way in which the members of the communities can be involved in the environmental conservation.

5.4 Areas of further research

Further research should be done to evaluate the impact of deforestation on the Mara River and its ecological systems. The research should be geared towards the rehabilitation of the forest lands and land use planning and management especially with regards to farmlands and settlement schemes along the river and her tributaries. This will be beneficial to the management of the Mara River and also raise awareness on the importance of conservation of the catchment areas which will contribute to the sustainable use of the river.

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