

Establishment of Higher Terrestrial Plants and Animal Species Found in Matayos Division of Busia County, Kenya

Dr. Irene Mutavi¹, Dr. Albert Elim Long'ora²

¹Lecturer, Department of Geography and Natural Resource Management, School of Environment and Earth Sciences, Maseno University, P.O Box, 333 Maseno- Kenya

²Lecturer, Department of Environmental Sciences, School of Environment and Earth Sciences, Maseno University, P.O Box, 333 Maseno-Kenya

Abstract:-In order to successfully achieve terrestrial biodiversity protection and conservation, more information is needed about the variety of plants and animal species existing in the ecosphere. Although biodiversity constitute a great asset in Kenya and Busia County at large, it is at risk of getting eroded due to increased anthropogenic activities, and therefore the urgent need to identify the various higher plants and animal species found in this sub-county. In the past, plants and animals were abundant in the area and currently some species are rare possibly due to destruction of their habitats by human activities. However, there is no known study that has focused on identifying the terrestrial plants and animals in the division. The study focused on Matayos division where biodiversity conservation issues have not been adequately addressed. Cross-sectional descriptive research design was used. A minimum sample size of 384 household heads was taken out of a study population of 56,186. Matayos division was stratified according to locations and then households selected through simple random sampling for questionnaire administration. Purposive sampling was used to get Key Informants such as village elders, chiefs and Sub chiefs. Primary data were collected through questionnaire administration, key informant interview, Focus Group Discussion, Field Observation and Photography. The results indicated that the division is endowed with variety of terrestrial plants and animal species which should be well protected. There is need for creating communities' awareness on the various activities carried out and their effects on terrestrial biodiversity conservation so as to ensure conservation of the available species. Establishment of protected areas in the division to conserve these valuable species could benefit the community and the Busia County at large.

Key words: Terrestrial biodiversity, higher plants, higher animals, species diversity

I. INTRODUCTION

Species diversity in the world is unevenly distributed; the highest concentrations are in tropical ecosystems, which are in turn seriously threatened by habitat destruction-the most prominent driver of biodiversity loss (Luc and Emmanuel, 2003). The world contains about 25,000 species of plants but 8% of them may get extinct before 2025 (Kearns, 2010). The main factor contributing to this is technologically advanced agriculture where forests are cleared to create farmlands (FAO, 1998). A major report, the Millennium Ecosystem

Assessment released in March 2005 highlighted a substantial and largely irreversible loss in the diversity of life on earth with some 10-30% of the mammal, bird and amphibian species threatened with extinction, due to human actions (UNEP, 2006). It is estimated that if the current rate of clearing the forests and other habitats continued, 25% or more of the total species on the Earth could be eliminated within 50 years (UNEP, 2002).

According to UNEP (2008), Africa's biodiversity is unevenly distributed throughout. South Africa for example has over 23,000 plant species, compared to Camerouns approximately 8260 species. Further, some African countries such as Madagascar, Democratic Republic of Congo and Cameroon, are known for their rare internationally recognized plant and animal species. Kevin (2007) observed that, disturbance and loss of habitat by human activities has resulted in the loss terrestrial biodiversity. It is therefore clear that the erosion of Africa's biodiversity wealth arising from human activities is a serious problem yet; there are few empirical studies to establish how these human activities affect biodiversity (UNEP, 2006).

Kenya is one of the countries in Africa highly endowed with a great diversity of plant and animals species. For example, it is estimated that there are between 8000-9000 species of plants in the country out of which about 2000 are shrubs and trees (Mugabe and Clark, 1998). However, this rich biodiversity is being lost due to increased human activities resulting to habitat loss. Busia County is rich in animal and plant species diversity (Republic of Kenya, 2005). For example, in the grasslands biome we find grass, shrubs, birds and antelopes. Matayos division is endowed with variety of plants and animals which are yet to be identified so as to enhance the species' conservation. High rural population growth has accelerated the demand for new agricultural land, resulting in a high rate of woodland, forest, grassland and wetland conversion into agricultural use (Republic of Kenya, 2005). The original vegetation has been altered over time due to human settlement and agriculture and yet, these human activities have not been studied on how they affect the plants and animals in the division. Therefore, there is need to

identify the plants and animals in the division so as to ensure their conservation.

II. LITERATURE REVIEW

According to the Convention on Biological Diversity (CBD) (2006), the estimate for the total number of species on earth possibly lies in the 10-30 million range with only 1.4 million species well known and about 1.75 million species have been scientifically described, just under a fifth of them plants and vertebrates (Kearns, 2010). Biodiversity is not evenly distributed; but rather varies greatly across the globe as well as within regions. It is generally greatest near the equator, and declines towards higher latitudes and the highest concentrations are in tropical ecosystems, which are in turn seriously threatened by habitat destruction- the most prominent driver of biodiversity loss (Allister et al, 2009). In 2006 many species were formally classified as "rare" or "endangered" (CBD, 2006). Moreover, scientists have estimated that millions more species are at risk which have not been formally recognized and thus, the need to recognize these species. About 40% of the 40,177 species assessed in 2006 using the IUCN Red list criteria were listed as threatened with extinction yet, the status of the 60% is not known (CBD, 2006).

For the past 300 years, recorded extinctions for a few groups of organisms reveal rates of extinction at least several hundred times the rate expected on the basis of the geological record. Extinction is a natural event and, from a geological perspective, routine (Raup, 1994). Most species that have ever lived have become extinct. The International Union for Conservation of Nature (IUCN) notes that many species are threatened with extinction (Taylor and Pollock, 2008). In addition, at threat of extinction are 1 out of 8 birds, 1 out of 4 mammals, 1 out of 4 conifers, 1 out of 3 amphibians, 6 out of 7 marine turtles. Wilson (2003) pointed out that 75% of genetic diversity of agricultural crops has been lost and 75% of the world's fisheries are fully or over exploited. Further, he stated that up to 70% of the world's known species risk extinction if the global temperatures rise by more than 3.5°C, as a result of increased human activities. The Atlantic coastal forest of Brazil is a home to numerous endemic plant and animal species; estimated at 20,000 plant species, 1,350 vertebrates, which occur nowhere else including the famous golden lion, Tamarrin and Woolly Spider monkey (Mugabe and Clark, 1998).

Africa is home to some one quarter of the world's 4,700 mammal species, including 79 species of antelope. It has more than 2,000 species of birds; one fifth of the world's total (UNEP, 2008). Moreover, UNEP (2008) states that the African mainland harbours between 40,000 and 60,000 plant species, and about 100,000 known species of insects, spiders and other arachnids. In Madagascar, there are five bird families and five primate families that are found nowhere else on Earth. Madagascar's 72 lemur species and subspecies serve on the global stage as the islands' charismatic

ambassadors for conservation, although tragically 15 species have been driven to extinction (Conservation International, 2007). Conservation of terrestrial biodiversity is the protection, preservation, management, or restoration of wildlife and natural resources such as forests (Perry, 1994). Through the conservation of biodiversity the survival of many species and habitats which are threatened due to human activities can be ensured and also securing valuable natural resources for future generations and protecting the well being of eco-system functions (RCF, 2011).

Mugabe and Clark (1998) pointed out that plant species have played an essential role in the livelihood of human beings throughout history. Thus, local communities in rural areas use a wide range of plant species for fuelwood, medicine, food and various tools. At the same time, however, the use of non-timber forest products is rampant and unsustainable in many areas constituting a threat to plants and animals species diversity (Botkia and Talbolt, 1992). The main factor underlying this threat is lack of regulation, the practice of slash- and burn- agriculture, poor harvesting methods and unsustainable logging. In addition, non timber forest products are not properly valued and their control and regulation is left to local communities. If these products were sufficiently regulated and valued, they could generate large income for local communities (UNEP, 2006).

In Kenya, it is estimated that there are 35,000 known species of animals and plants (Situma and Wamukuya, 1999). This diversity is served by the variable ecosystems ranging from marine, mountains, tropical dry lands forests and arid lands. The country has unique species of birds and other small animals, for example, Kakamega forest is a home to over 350 species of birds, 7 species of primates including the locally rare and threatened Brazza's monkey and over 4000 species of butterflies (Tsingalia, 1990). Busia County is endowed with variety of terrestrial plants and animal species which are at risk of extinction due to habitat loss caused by agricultural encroachment, settlement and over exploitation of biodiversity resources (Republic of Kenya, 2005). Matayos division has variety of plants and animal species for example, birds species like Harlequin quail, weaverbirds, Ibis, Egrets, Pelicans; animals like antelopes, monkeys, baboons and wild pigs particularly along the swamps and lakeshores. The forest patches are made of a mixture of thickets, shrubs and young trees of *Albizia grandibracteata* (Mulongo) *Celtis Africana* and *Acacia* spp. (Republic of Kenya, 2003). Wetlands are being drained for cultivation yet they are habitats for many plants and animals species that cannot be found in any other environment. Wetlands provide habitat for a variety of plants like reeds, macrophytes, papyrus and animals like African hare (BWSR, 1999). Exotic tree species include Eucalyptus, *Gravellia*, Pine and Cyprus that have taken over indigenous species like *Mvule* because of their high value products and faster growth (Republic of Kenya, 2003).

III. METHOD

Study area

Location and Size

Matayos division is found in Busia County, which is located in the west of the republic of Kenya and borders with the republic of Uganda on the South-East. It lies on the north of L. Victoria. It borders Nambale division to the East, Butula division to the South East, Teso County to the North and

Funyula division to the South West. Matayos division is divided into five locations namely; Bukhayo West, Mayenje, Matayos South, Busibwabo and Burumba and twelve sub-locations namely; Mjini, Mayenje, Mundika, Esikulu, Bugeng'i, Nasira, Nang'oma, Nakhakina, Murende, Busende, Alung'oli and Lung'a sub-locations (Republic of Kenya, 2005). The division lies approximately between longitudes 33⁰54'32" East and 34⁰25'24" East and Latitude 0⁰1'36" south and 0⁰35 North. The division covers an area of 173.7 square kilometers.

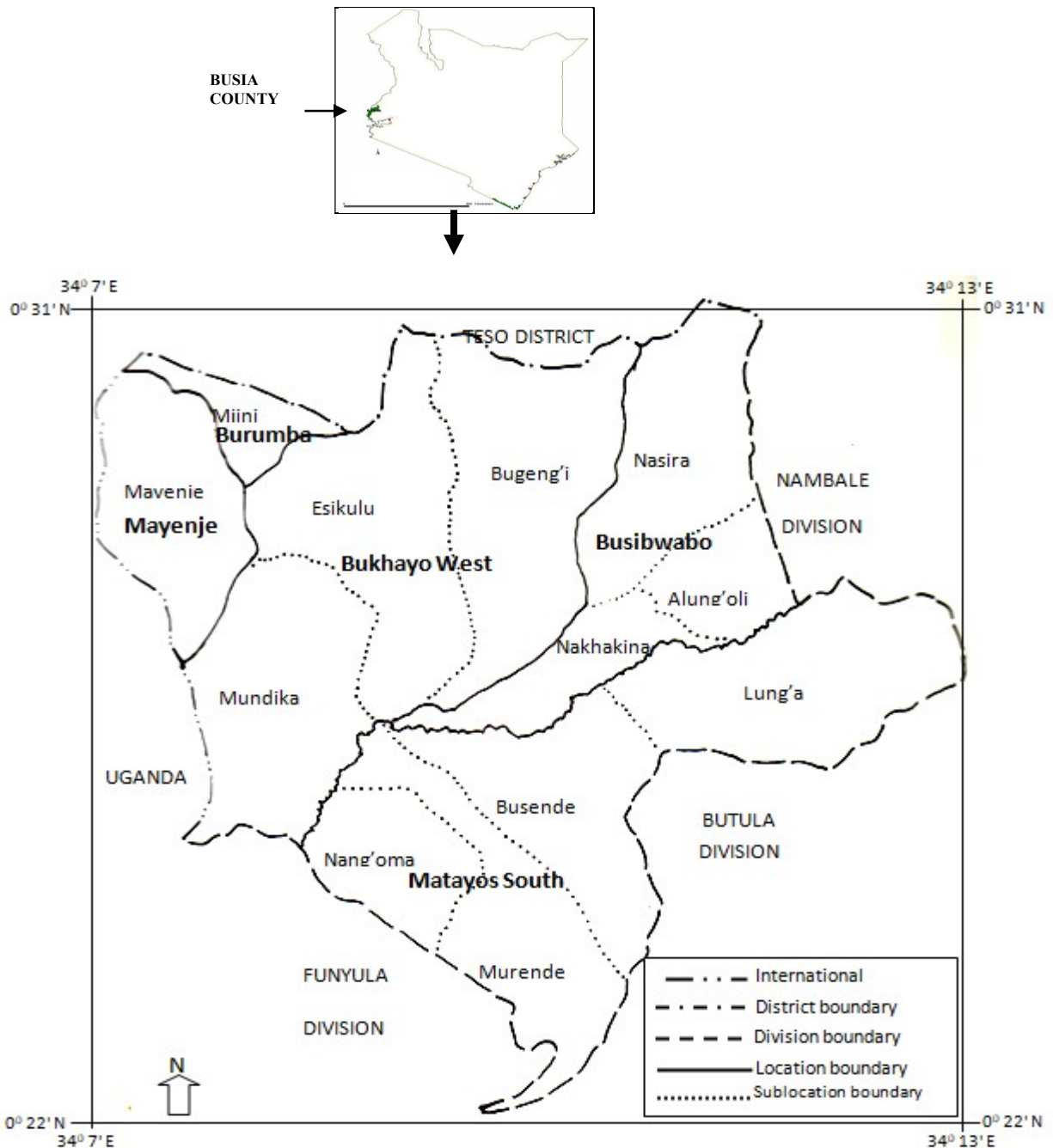


Figure 1: Map of Matayos division

Source: Republic of Kenya, 2005

Study Population, Sampling and Data collection

A minimum sample size of 384 household heads were selected from a study population of 56,186 as recommended by Mugenda and Mugenda (2003) since the study population was greater than 10,000 individuals. Simple random sampling was used to select 384 respondents from a list of 987 households provided by the ward administrators from the five sub locations Namely; Mundika, Mayenje, Esikulu, Bugeng'i and Nang'oma.

Data Analyses and Results Presentation

Quantitative data was analyzed using descriptive statistics which included percentages, mean and frequency distribution. These were processed using Statistical Package for the Social Sciences (SPSS) version 12 as a tool. The qualitative data were first edited and cleaned up then the data were organised. The categories, themes and patterns were created and evaluated to determine the adequacy of the information, the credibility, consistency and evaluating the usefulness in answering the research questions. Different types of plants and animal species were listed by the respondents during the survey. The plants and animals were listed in local names (Lukhayo and Saamia dialects) while Maundu and Tengnas (2005), was used to identify the plants' scientific names. Common animal species found in the study area were identified using the Luo Biological Dictionary (Kokwaro and Timothy 1998). Information on other species of plants and animals were provided by key Informants from the Forestry Department in Matayos division.

IV. RESULTS AND DISCUSSION

Higher Terrestrial plants and Animals Species Found in Matayos Division.

Matayos division is endowed with variety of terrestrial plants and animal species. Table 1 summarizes the terrestrial plants and animals found in Matayos division.

Table 1: Terrestrial Plants and animals in Matayos division.

Common Name	Local Name (Lukhayo and Saamia)	Scientific Name
Plants	<i>Omukhuyu</i>	<i>Ficus sycomorus</i>
	<i>Musensgese</i>	<i>Melia spp.</i>
	<i>Lusiola</i>	<i>Markhamia lutea</i>
	<i>Muhunya</i>	<i>Maesopsis eminii</i>
	<i>Murabi</i>	<i>Kigelia Africana</i>
	<i>Mulongo</i>	<i>Albizia grandibracteata</i>
	<i>Mvule</i>	<i>Milicia excelsa</i>
	<i>Omudodo</i>	<i>Ficus thionningnii</i>
	<i>Mululusia</i>	<i>Vernonia amygdalina</i>
	<i>Mulongoto</i>	<i>Eucalyptus spp.</i>
	<i>Muduwa</i>	<i>Gravellia spp.</i>
	<i>Jacaranda</i>	<i>Jacaranda mimosifolia</i>

Common Name	Local Name (Lukhayo and Saamia)	Scientific Name
	<i>Pine</i>	<i>Pinus petula</i>
	<i>Mwalirwakulu</i>	<i>Brevispica spp.</i>
	<i>Mudungudungu</i>	<i>Spathodea campanulata</i>
	<i>Liembe</i>	<i>Magnifera indica</i>
	<i>Mzambarau</i>	<i>Syzygium cumini</i>
	<i>Omupera</i>	<i>Psidium guajava</i>
	<i>Makada</i>	<i>Cyperus spp.</i>
	<i>Makhindu</i>	<i>Phoenix reclinata</i>
	<i>Liseme</i>	<i>Phragmite spp.</i>
	<i>Nyabende</i>	<i>Lantana spp.</i>
	<i>Asao</i>	<i>Sesbania sesban</i>
	<i>Mukombero</i>	<i>Mondia whytei</i>
Mammals	<i>Enjobe</i>	<i>Tragelapus spp.</i>
	<i>Ekhene</i>	<i>Vervet spp.</i>
	<i>Inguke</i>	<i>Papio spp.</i>
	<i>Sitatunga</i>	<i>Tragelaphus spekii</i>
	<i>Eburi</i>	<i>Redunca redunca</i>
	<i>Siduyu</i>	<i>Lepus capensis</i>
	<i>Imbichi</i>	<i>Scrofa spp.</i>
	<i>Libwe</i>	<i>Lycaon spp.</i>
	<i>Esimba</i>	<i>Helogace parrula</i>
	<i>Isabasre</i>	<i>Paraxerus lavovittis</i>
	<i>Eng'u</i>	<i>Crocota crocuta</i>
	<i>Imuna</i>	<i>Xerus Rutilus</i>
<i>Embeba</i>	<i>Thryonomys swinderianus</i>	
<i>Efukho</i>	<i>Tachyoryctes ibeanus</i>	
Birds	<i>Esogo</i>	<i>Ploceus baglafaecht</i>
	<i>Siduku</i>	<i>poicephalus spp.</i>
	<i>Esofito</i>	<i>Alopochen spp.</i>
	<i>Enyojo</i>	<i>Larus cirrocephalus</i>
	<i>Egung'u</i>	<i>Streptopelia spp.</i>
	<i>Esiricha</i>	<i>Aviceda cuculoides</i>
	<i>Eungu</i>	<i>Aquila heliaca spp.</i>
	<i>Eyoyo</i>	<i>Anas strepera</i>
	<i>Esindu</i>	<i>Coturnix delegorguei</i>
	<i>Namulobi</i>	<i>Anastomus spp.</i>
	<i>Engosia</i>	<i>Gyps ruppellii spp.</i>
	<i>Imbudumbudo</i>	<i>Colius striatus</i>
<i>Ehirihihi</i>	<i>Bubo lacteus</i>	
<i>Egugu</i>	<i>Columba guinea</i>	
<i>Enyange</i>	<i>Egratta garzetta</i>	
Reptiles	<i>Libaka</i>	<i>Morelia Viridis</i>

Common Name	Local Name (Lukhayo and Saamia)	Scientific Name
	<i>Nadwang'i</i>	<i>Bitis arietans</i>
	<i>Endemo</i>	<i>Geochelone sulcata</i>
	<i>Imbiakala</i>	<i>Agama spp.</i>
	<i>Elishikhoma</i>	<i>Naja nigricollis</i>
	<i>Elini</i>	<i>Elaphe obsoleta</i>

Source: Field data

The study established through household questionnaires and FGDs that the area is endowed with variety of plants and animals species as shown in Table 1. The plant species include exotic tree species like, Eucalyptus spp., Pinus spp., Cyprus spp., Jacaranda and *Grevillea* species. Indigenous tree species include Nandi flame (*Spathodea campanulata*), Omukhuyu (*Ficus sycomorus*) *Mvule* (*Milicia excelsa*) and *Mulongo* (*Albizia grandibracteata*) which is endangered species in the region. It emerged from the Key Informant Interviews and FGDs that baboons have become rare, and Leopards existed in the area but have emigrated because of

vegetation clearance which interfered with their living habitats.

Observation also revealed that the study area is well covered by a variety of swamps which support a variety of plants and animal species; including Neranda swamp, Munongo swamp and Sango swamp. Many of the bird and animal species like Harlequin quail, Antelopes, weaverbirds, and Egrets utilize the wetlands as sources of food, water, nesting materials or shelter. Migratory water birds also rely on the wetlands for nesting areas, feeding and breeding grounds. Neranda, Munongo and Sango wetlands are productive ecosystems that contribute ecologically, socially, and economically to the people of the study area (Republic of Kenya, 2003). The respondents interviewed suggest the need to establish protected areas in the division to conserve these valuable species and this could benefit the community and the County at large. The continued need for farming land has led to encroachment on the wetlands in the study area. Wetland like Neranda swamp has been reclaimed for growing crops such as maize, yams and beans as shown in the plate below.



Neranda Swamp in Mayenje sub-location reclaimed for growing of arrowroots and maize

Source: Field data

Wetland drainage has occurred to permit cultivation of food crops resulting to reduced papyrus reeds and habitat loss for wetland animals. Over harvesting of papyrus reeds, medicinal plants growing near the wetlands, for example, *Mukombero* (*Mondia whytei*), *Mnyinyi*, (*Ocimum kilimandscharicum*), *Imindi* (*Cassia accidentalis*) and *Khalulu* among others, has led to reduction of the species in the wetlands. This has also interfered with nesting, breeding grounds of birds hence leading to disappearance of species like Grey wren warbler. Regulations on the management of wetlands are in place. However, implementation of these Regulations has not yet taken root (Republic of Kenya, 2003). Therefore, ownership of Sango, Munongo, and Neranda wetlands is taken as individual property and management of the wetlands depends entirely on the owner of the wetland. Gichuki (2000), also point out that people living around the wetlands often exercise more power than governments over the local use of wetland materials hence, end up overexploiting the same.

Medicinal Herbs in Matayos Division

Medicinal plants are gathered either by specialists (medicine men) or individual persons and administered to patients who may be a child or an adult. Table 2 shows the medicinal herbs used by the respondents, their local names and the diseases treated.

Table 2: Medicinal plants, botanical names and local names, part(s) used and disease(s) treated with it

Scientific Name	Local name (Lukhayo and Saamia)	Part(s) used	Disease(s) treated
<i>Azadiradita indica</i>	<i>Mwarubaini</i>	leaves	Stomach ache, skin infections
<i>Tithonia spp.</i>	<i>Khalulu</i>	Leaves	Stomach ache
<i>Aloe spp.</i>	<i>Likakha</i>	Leaves	Snake bites
<i>Ocimum spp.</i>	<i>Mnyinyi</i>	Roots	Stomach ache, rashes

Scientific Name	Local name (Lukhayo and Saamia)	Part(s) used	Disease(s) treated
<i>Ocimum kilimandscharicum</i>	Okite	Roots, leaves	Amoeba
<i>Mondia whytei</i>	Mukombero	Roots	Apetite
<i>Ficus thionnignii</i>	Omudodo	Root, leaves	Anaemia
<i>Kigelia africana</i>	Murabi	Leaves, stem	'boils'
<i>Vernonia amygdalina</i>	Mululusia	Roots	Sexually Transmitted Infections, stomach ache
<i>Indigofera spp.</i>	Rayue	Roots, Stem	Stomach ache, skin infections, snakebites
<i>Sesbania sesban</i>	Asao	Roots	Livestock medicine
<i>Tithonia diversifolia</i>	Akech	Leaves, stem	Stomach problems
<i>Kedrostis foetidissima</i>	Ang'we	Leaves, stem	Measles
<i>Solanum incanum</i>	Achoki	Fruits (seeds)	Fresh cuts and bruises
<i>Cassia floribunda</i>	Nyayado	Leaves, stem	Stomach problems
<i>Vernonia spp.</i>	Ekaha	Roots	Malaria
<i>Melia spp.</i>	Musengese	Leaves	Allergy
<i>Markhamia lutea</i>	Lusiola	Leaves	Throat diseases, conjunctivitis
<i>Olea welwitshii</i>	Mukhuyu	Roots, stem	Skin infections
<i>Cassia accidentalis</i>	Imindi	Stem, roots	Stomach problems

Source: Field data

It may be observed from Table 2 that respondents in the study area use some of the plants such as *Mukhuyu* (*Olea welwitshii*), *Mwarubaini* (*Neem*), *Mnyinyi* (*Ocimum kilimandscharicum*), *Mukombero* (*Mondia whytei*), *Imindi* (*Cassia accidentalis*), *Khalulu* to cure certain ailments. A large number of the respondents (80%) from FGDs revealed that some of these herbs like *Mukombero* (*Mondia whytei*), *Imindi* (*Cassia accidentalis*) and *Khalulu* (*Tithonia spp.*) grew rapidly in the wetlands and others were planted by farmers in their farms, for example, *Mnyinyi* (*Ocimum kilimandscharicum*). Gichuki (2000), states that wetlands worldwide are destroyed and threatened by virtue of their richness in plants and animal species. With the assumption of the greatest role they play in providing traditional medicine to communities, many of the plant species in Africa that offer solution to common ailments derived from plants (Dugan, 1991). Sango, Munongo and Neranda wetlands are being over exploited for their valuable materials. Yet, if these products were sufficiently regulated and valued, they could generate large income for local communities (UNEP, 2006).

V. CONCLUSION

There are varieties of terrestrial plants and animal species in the study area. Varieties of higher plant species are used as

medicinal herbs to cure different ailments. Some animal and bird species have migrated to suitable habitats and others have reduced in numbers, for example, monkeys while others have become rare like baboons. Some plant species are like papyrus reeds have been depleted, others like *Mulongo* (*Albizia grandibracteata*) are threatened with extinction while others *Mvule* (*Milicia excelsa*) are endangered. All these changes are brought by the disturbances of the human activities being practiced in the region. The residents of Matayos division need to be aware of the different terrestrial plants and animals species which used to be there and those which have been affected by human activities for them to conserve. Establishment of protected areas in the division can enhance conservation of more species. This will enable recovery of plants and animal species population in the division.

ACKNOWLEDGEMENT

The authors would gratefully thank all the household heads and the key informants in Matayos Division for providing data during the field survey. We most sincerely thank our research assistants Matayos Forest Officer and District Agricultural Officer for providing relevant Information to this study

REFERENCES

- Allister, S., Leon B., Henny, V., Koen, R., Lisa E. and Kerry, T. (2009). *Study on Understanding the Causes of Biodiversity Loss and the policy assessment Framework; in the context of the Framework*. Contract No.DG ENV/G.1/FRA/2006/0073, Netherlands.
- Botkia, P., and Talbolt, H. (1992). in Shalma N.P (ed) *Managing the world forests; Looking for Balance between conservation and Development*, Hunt, USA.
- Conservation International (CI), (2007). *Biodiversity Hotspots*. Washington, D.C.
- Convention on Biological Diversity (CBD), (2006). *Global Biodiversity Outlook 2 report*; Biodiversity in 2010; Montreal, UNEP/CBD/COP/8/12, 2006
- FAO. (1998). *The State of the Worlds Plant Genetic Resources for Food and Agriculture*. Food and Agriculture Organization of the United Nations, Rome.
- Gichuki, C. (2000) Community participation in the protection of Kenyas wetlands. *Ostrich*, 71 122-125.
- Kearns, C. (2010). *Conservation of Biodiversity*. *Nature Education Knowledge* 1(9):7
- Kevin, J.C. (2007). "Africa's renaissance for the environment: biodiversity". In *Encyclopedia of Earth*. Eds. Citle J., Cleavel and Washington D.S.: Environmental Information Coalition, National Council for Science and the Environment.
- Kokwaro J. O. (1993). *Medicinal Plants of East Africa* (2nd Edition), East African Literature Beaural Nairobi. ISBN; 9966-4419-05
- Kokwaro, J.O and Timothy J. (1998) *Luo Biological Dictionary*. East African Educational Publishers Ltd. ISBN; 9966468412
- Luc, H., and Emmanuel, K.B., (2003). *Causes of Biodiversity loss; a Human Ecological Analysis*; Human Ecology Department, Vrije Universiteit Brussel, Laarbeeklaan 103, B- 1090- Brussels, Belgium; MultiCiencia: #1 2003
- Maundu, P. and Tengnas B. (2005) *Useful trees and Shrubs of Kenya*; World Agroforestry Centre, Eastern and Central Africa Regional Programme, Nairobi-Kenya.
- Mugabe, J. and Clark, N. (1998). *Managing Biodiversity; National Systems of Conservation and Innovation in Africa*, Nairobi, Kenya; Acts Press.

- [14]. Mugenda, O.N., and Mugenda, A.G. (2003). *Research Methods; Quantitative and Qualitative Approaches*. Nairobi: African Centre for Technology Studies Press
- [15]. Perry, D.A. (1994). *Forest Ecosystem*; John HIPKINS University Press, Baltimore, USA
- [16]. Rainforest Conservation Fund (RCF). (2010). *Causes of recent decline in biodiversity; the Rainforest Premier*; Organisation site by Plain Sight (501) (c) 3.
- [17]. Raup, D.M. (1994). The role of extinction in evolution; proceedings National Academy Science; USA 9:6758-6763.
- [18]. Republic of Kenya. (2003). *Busia County Environment Report*; Government printer, Nairobi.
- [19]. Republic of Kenya. (2005). *Busia County Development Plan*; Government printer, Nairobi.
- [20]. Situma, F.D. and Wamukuya, G.M. (1999). *Environmental Management Coordination Act*, Kenya.
- [21]. Taylor, C.H. and Pollock, C.M. (2008). *State of the World's Species. In Wildlife in a Changing World: An analysis of the 2008 IUCN Red list of Threatened Species*. Eds. Vie.j. Gland: International Union for Conservation of Nature, 2008
- [22]. Tsingalia, M.H. (1990). *Habitat Disturbance, Severity and Patterns of Disturbance in Kakamega forest*, Western Kenya, Africa Journal of Ecology.
- [23]. UNEP. (2002a). *Global Environmental Outlook 3*. London
- [24]. UNEP. (2006b). *Global Deserts Outlook*. Nairobi, Kenya.
- [25]. UNEP. (2006c). *Africa Environment Outlook-2: Our Environment, Our Wealth*. Nairobi, Kenya.
- [26]. UNEP. (2008d). *Africa Atlas of our Changing Environment*. Nairobi, Kenya.
- [27]. UNEP. (2008e). *Biodiversity and Agriculture: Safeguarding Biodiversity and Agriculture and securing Food for the World*: Secretariat of the convention on Biological Diversity, Canada; ISBN 92-9225-111-2
- [28]. Busia Wetland Status Report (BWSR). (1999). *Wetland Status Report for Busia*; Government Printer, Nairobi.
- [29]. Wilson, E.O. (2003). *Speciation and Biodiversity*; American Institute of Biological Sciences. Maximillan publishers.