THE NEXUS BETWEEN COMMUNITY PARTICIPATION IN CONSERVATION AND LAND COVER CHANGE IN KAKAMEGA FOREST, KENYA

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Abstract

Participatory Forest Management (PFM) is essential for sustainable forest management as it's based on the assumption that the forest provide both tangible and intangible goods to forest adjacent dwellers. In Kenya PFM is provided under the Forest Conservation and Management Act (2016). The law is meant to ensure that degradation of forests was halted but at the same time forest adjacent communities benefit from forest goods and services. A lot of studies have been carried out on the extend of forest cover change in major forest towers but there is limited information on the relationship between community participation in forest conservation and its effect on forest cover change on Kakamega Forest. The level of water has reduced gradually in some of the rivers whose source is Kakamega forest due to forest cover loss. The study targeted FAC that included CFA members at 5km radius from the forest edge in Shinyalu, Kenya Forest Service (KFS) officers, and Community Based Organization (CBO) leaders. The target population on land cover change information was composed of images acquired from 1998 to 2018. A sample size of 187 CFA members was selected using simple random and purposive sampling method was used to select 7 CBO leaders and one KFS officer. Data was collected using questionnaires, focused group discussions, interview schedules and remotely sensed satellite images. Data from questionnaires was analyzed using Statistical Package for Social Sciences (SPSS) software i.e.-frequencies, percentages, means and standard deviations and presented in form of tables. Medium resolution satellite data was analysed both spatially and statistically. Spatially, the extent of the area covered by different land cover types in Kakamega Forest in 2000, 2008 and 2018 was captured on different satellite image data sets using Geographical Information System (GIS) software. The study findings revealed that various Kakamega forest land classes increased between 2000-2008 due to CFA activities like afforestation, reforestation and agroforestry but the forest cover declined within the period of 2008-2018 except grassland vegetation which increased all through. Study findings indicate that some of the activities that increased the forest cover included afforestation, reforestation and agroforestry Training of more CFA scouts and deployment of additional rangers to man the vast forest alongside creating awareness through chief baraza to the local community on the need for conserving kakamega forest was recommended.

Key words- nexus, community forest associations, forest cover change, conservation.

1.0 INTRODUCTION

Participatory Forest Management(PFM) which refers to a shift of power from central governance to the rural dwellers (Chomba, Nathan &Minang, 2015) through Community Forest Associations(CFAs) is essential for sustainable forest management. The constitution of Kenya (2010) Article 69 states out clearly that Kenyan people should equitably benefit from sustainable exploitation, use and managing natural resources and in return conserve and protect the same resources (Kagombe, Mbuvi &Cheboiwo, 2017).

Forest adjacent communities (FAC) can better protect and manage forests if they participate in decision – making on sustainable use (Jashimuddin, 2011; Wambugu, Oboyere and Kirui, 2018). Involvement of locals in practices of managing forest products is based on assumption that the forest will provide both tangible and intangible welfare to FAC (Mutune; 2015). Benefits accrued from forest by FAC is essential for sustainable forest management, (Matiku and Callistus, 2013; Musyoki, Mugwe, Matundu &Muchiri 2013; Lawler & Bullock (2017)

A well-functioning CFA contributes to preservation of forest close to communities and improves the livelihood of the members (Ming'ate, Lamech, Letema & Obiero, 2016).

In Kenya both the Forest Act 2005 and Forest Management and Conservation Act 2016 allow formation of CFAs under the societies Act to make application to Kenya Forest Services(KFS) to co-manage gazzetted forests (Chomba, Nathan, Minang & Sinclair 2015, Gok, 2016) This co-management is necessary because it reduces conflicts between KFS and local community, helps to enhance livelihood and ensures sustainability in the management of resources from forests (Wambugu et al., 2018).

There are over 300 enlisted CFAs in Kenya(KFS,2016). User rights conferred to them include; ingathering of medicinal herbs, honey harvesting, timber harvesting or firewood, grass harvesting and grazing, ecotourism & leisure activities. (GoK, 2016; Musyoki et al., 2013).

PFM in Kakamega Forest started in 2005 to incorporate the neighboring communities into management of the forest. Registered CFAs include: Muileshi-2007, Bunyala-2008, Kibiri-2008 and Malava-2008 and Water Resource Users Association(WRUA) a Community Based Organization (CBO) for water conservation in line with water Act 2016(GOK,2016).
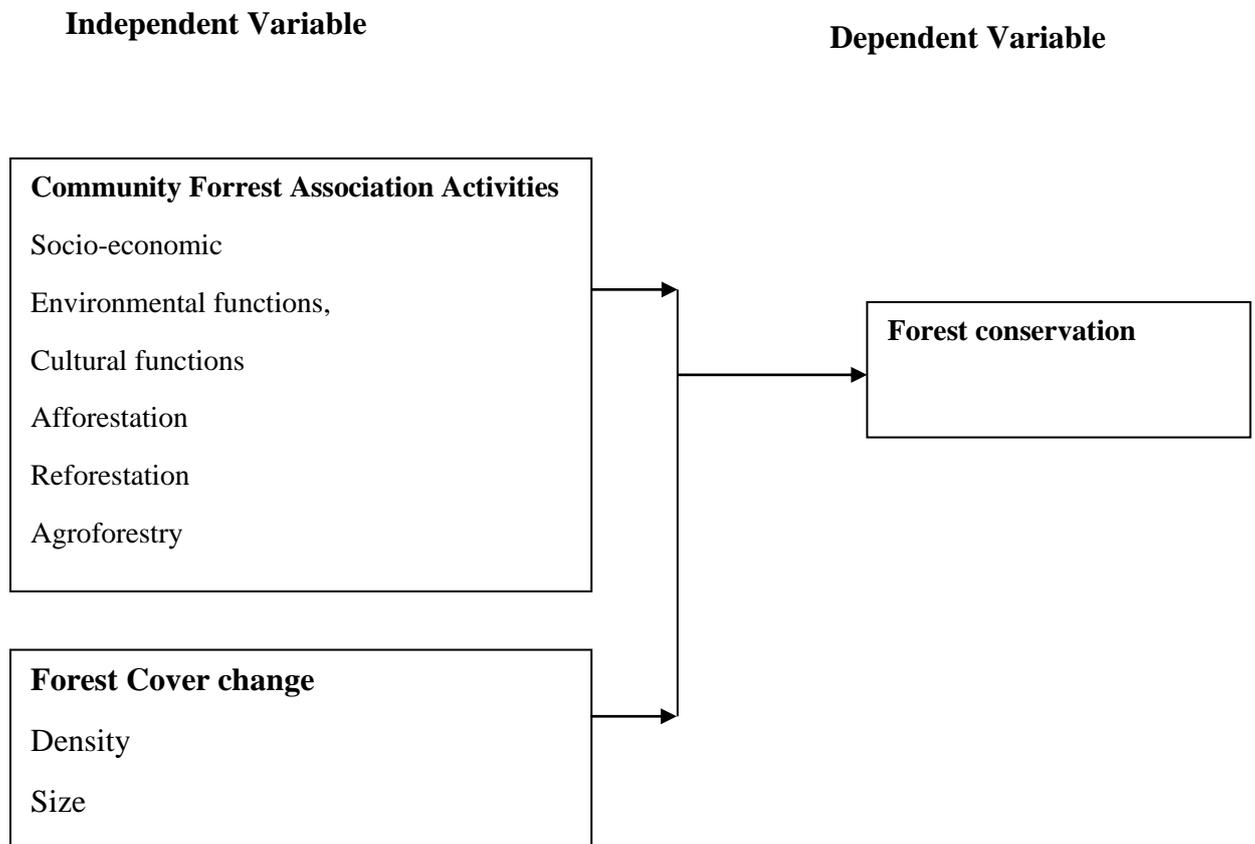
Whereas there is information on the extent of forest cover changes in the country both in academia and public parlance, data on the relationship between community participation in forestry management and forest cover change was scanty or limited. Where such information exists, it is restricted to major forest towers such as the Mau forest complex (Mutune, 2015) and Mount Kenya Forests, (Musyoki, 2013). Small and medium water towers such as Kakamega forest tended to be neglected.

This study intended to contribute to existing knowledge on community participation in forest management as a way of ensuring sustainable conservation practices by drawing on experiences from Kakamega forest which is being threatened by degradation.

The Kakamega forest ecosystem plays a vital role in hydrology by contributing water volumes to river Lukusitsi and Ikuywa alongside influencing rainfall pattern within the region. The level of water has reduced gradually in some of these rivers due to forest cover loss (Kakamega Forest Strategic Ecosystem Management Plan, 2015-2040), 2015 published by KFS. However, there were community forest associations and therefore there was need to find out the activities that these community forest associations were involved in aimed to conserve the forest ecosystem. It was also vital to find out if those community forest associations were aware of the benefits that were attached to them and this would be important in creating awareness to the neighboring community members that were not CFA so that they join and participate in forest management hence halt degradation of both flora and fauna. This study chose to focus on forest cover changes between 1998 to 2018 because by 1998 the study aimed at investigating how the forest cover was before the Forest Act 2005 was effected, in 2008 the effect of implementation of the Forest Act 2005 on the forest cover and in 2018 the review of Forest Management and Conservation Act 2016 pertaining community participation.

The forest cover of Kenya is estimated at about 7.4% of the overall land are, which is far away from the recommended world minimum of 10%(RoK, 2018). Also her closed canopy is about 2% compared to Africa and world average of about 9.3% and 21.4% respectively. In view of wanton forest destruction, the Kenyan government declared a moratorium on timber harvesting in February 2018 on both public and community forests (RoK,2018).

2.0 CONCEPTUAL FRAMEWORK

Independent Variable   **Dependent Variable**

Community Forrest Association Activities

Socio-economic

Environmental functions,

Cultural functions

Afforestation

Reforestation

Agroforestry

Forest conservation

Forest Cover change

Density

Size

2.0 STUDY AREA

Kakamega forest lies between longitudes 34° 37' 5" - 35° 9' 25" East of the Prime meridian and latitudes 0° 32' 24" North - 0° 2' 52" South of the equator. North-West of Nairobi, about 15 km away from the town of Kakamega with Lake Victoria on the North Eastern end at a height of about 1,500 to1,600 meters over the ocean level, Kakamega Forest is a remainder of tropical rain-forest in Kenya.

The forest comprises exceptional plants and animals not discovered in other places in the nation and Africa. The forest ecosystem encompasses around 23000 ha including the largest block Kakamega Forest Station under

KFS management, Kakamega National Reserve under KWS, Kisere Forest Reserve under KWS, Isecheno Nature reserve managed by KFS, Yala River Nature Reserve and finally Malava and Bunyala forest reserves under KFS. The normal yearly rainfall is around 2000 mm. The rainfall mode is bimodal, the wettest months are March April and May, with limited rains in October and November. The rainfall is primarily convectional joined by overwhelming thunderstorms despite the fact that orographic rain is likewise experienced. Average temperatures remain relatively comparable all through - between 15° C and 28°. Agriculture is the major monetary activity in the region specifically sugarcane, and tea
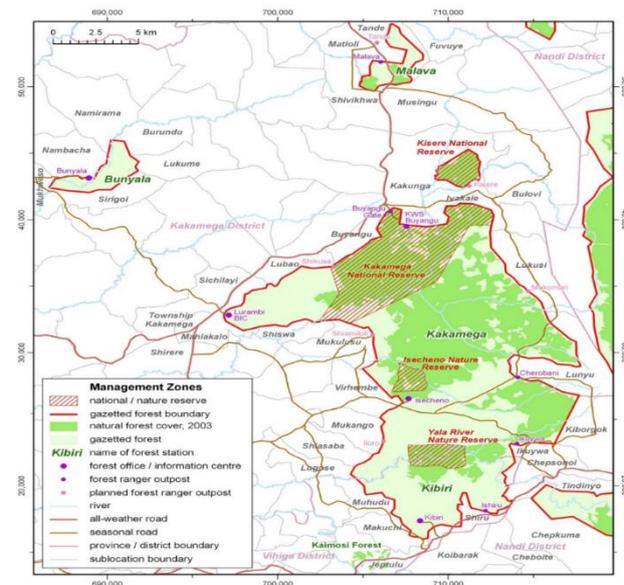
farming. The total estimate population by census report 2019 is making it one of the densely populated county

Fig:1 Map of the study locale. **Source KFEP (2016)**

3.0 METHODS

Descriptive survey design and mixed method approach was employed. The target population of study was 4,000 CFA members living within 5 km radius around the forest as identified by the Forest Act 2005; among them were seven leaders of six CBOs under Muileshi CFA, and 1 KFS officer at Isecheno forest station in kakamega forest.

The target population on land cover change information was composed of images acquired from 1998 to 2018. The satellite images chosen were Landsat images because of their medium resolution that is suitable for land cover change analysis. Purposive sampling for KFS, 7 CBO leaders and for satellite imagery data, simple random sampling for CFA members was applied.

- Sample size determination for CFA

Yamane 1967 formula

$$n = \frac{N}{1 + Ne^2}$$

Where; n = the sample size, N= Target population, e = desired level of precision, N=4,000, e = 7%

$$n_o = \frac{4,000}{1 + 4,000 \times 0.07^2}$$

Therefore, n=194 persons

Research Instruments- Internet, handheld Global Positioning System unit and digital camera for Forest Cover changes, Questionnaire for CFA, Interview schedule for CBO leaders and KFS and Focus group discussion CBO leaders. internet was used by uploading Kakamega Forest boundary layer onto the United States Geological Survey (USGS) website that hosts Landsat satellite images from the United States' National Aeronautics and Space Administration (NASA)

Data analysis-The medium resolution satellite data for the forest cover was analyzed both spatially and statistically. Spatially, the extent of the area covered by different land cover types in Kakamega Forest in 2000, 2008 and 2018 was captured on different satellite image data sets using Geographical Information System (GIS)software. Statistically, the areas of the digitized data were computed in hectares to show the difference in spatial coverage of the different land cover types in the years covered and between the years covered. Also, land cover change matrix was generated by cross tabulation between the years covered in the 2000-2018 period to show how the different land cover classes had changed in type and magnitude.

Quantitative data from the questionnaires was analyzed engagingly with the help of Statistical Package for Social Sciences (SPSS) software i.e., frequencies, percentages, standard deviation and presented in form of tables.

4.0 RESULTS AND DISCUSION

4.1: Forest Cover Change between 1998 and 2018.
Land Cover Classification Kakamega Forest land cover classification resulted to five different land cover types which included indigenous forest, plantation forest, shrub land, grassland and cultivated fields. The satellite images were as presented in Figures 2, 3 and 4
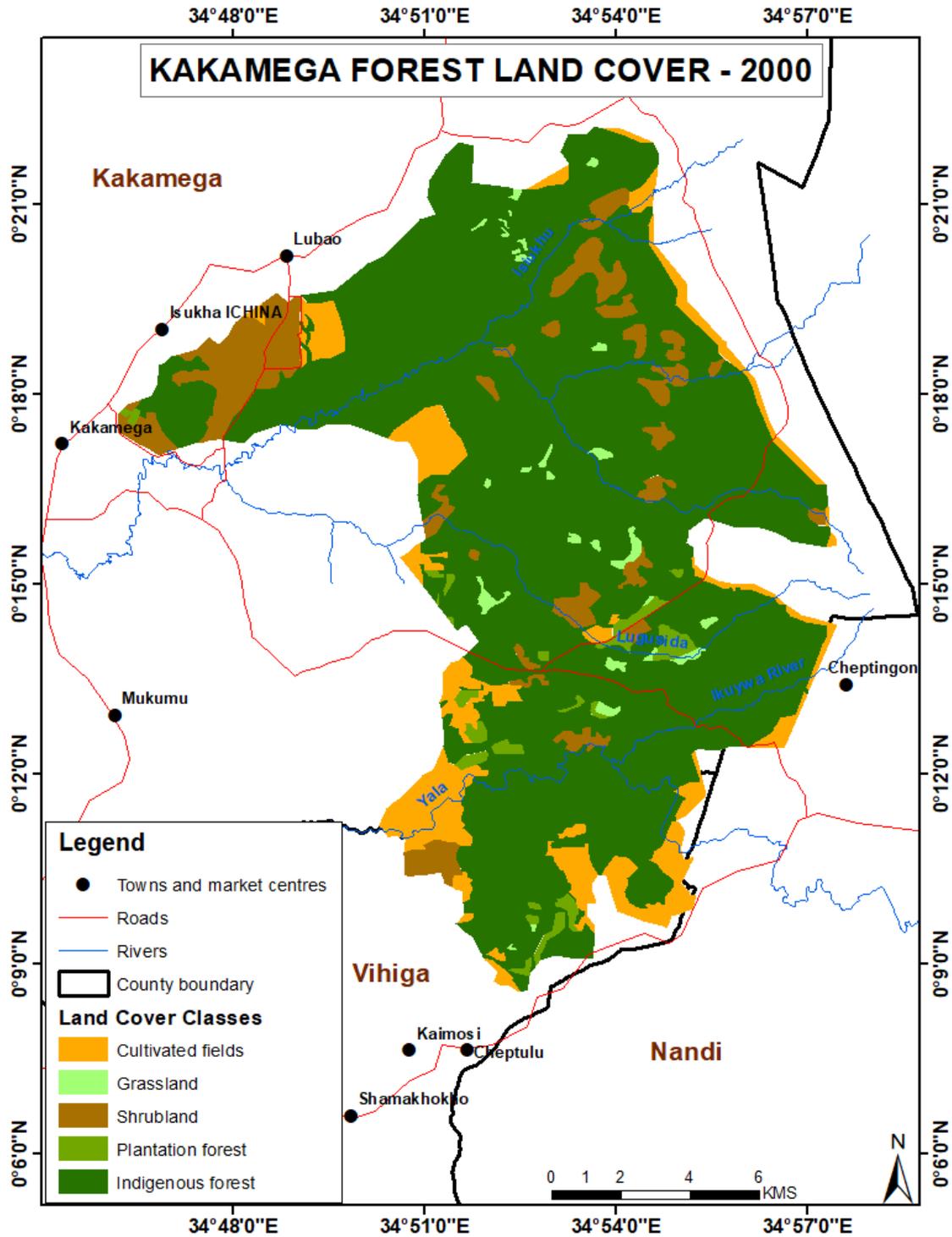
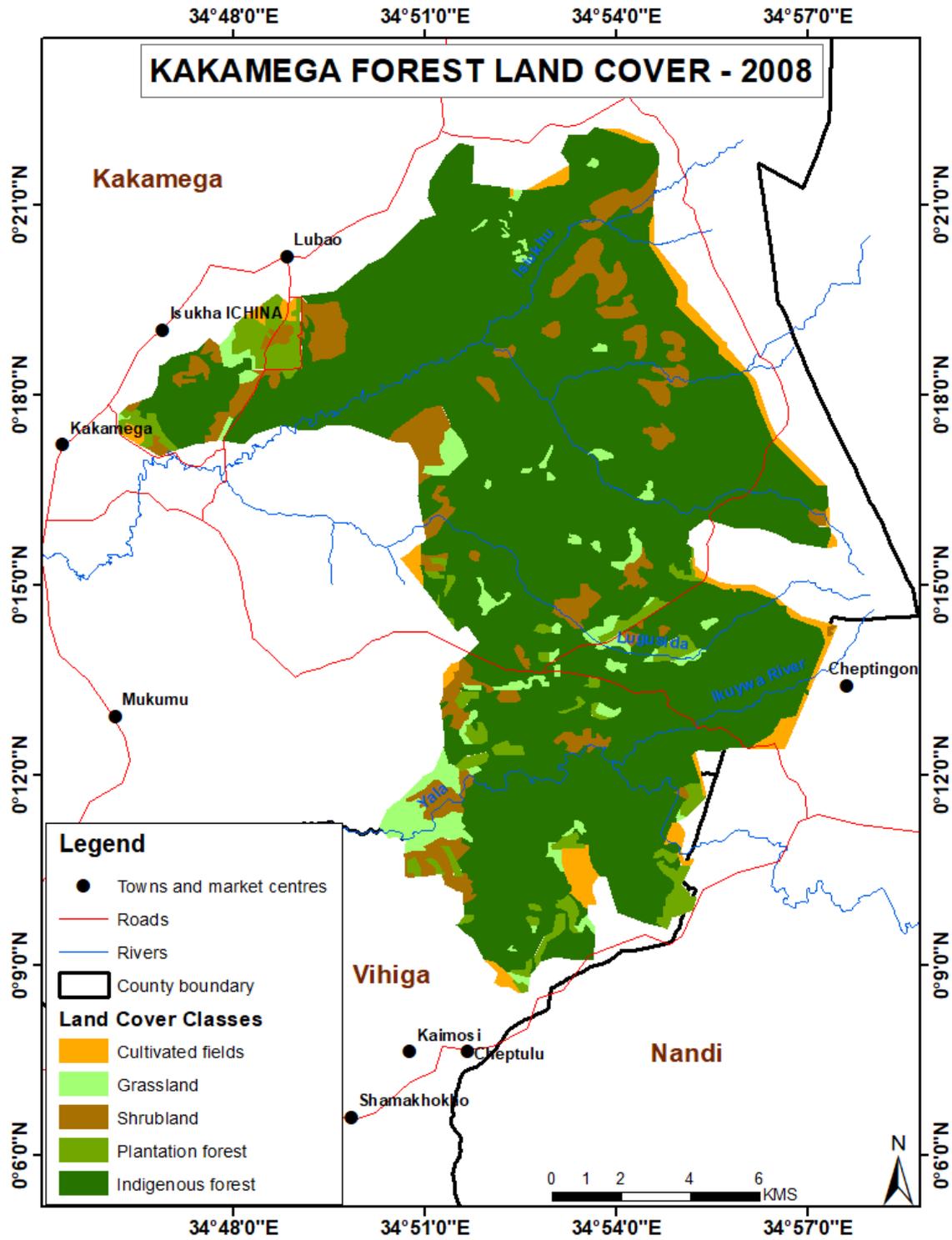*Figure 2: 2000 land cover types in Kakamega Forest.*

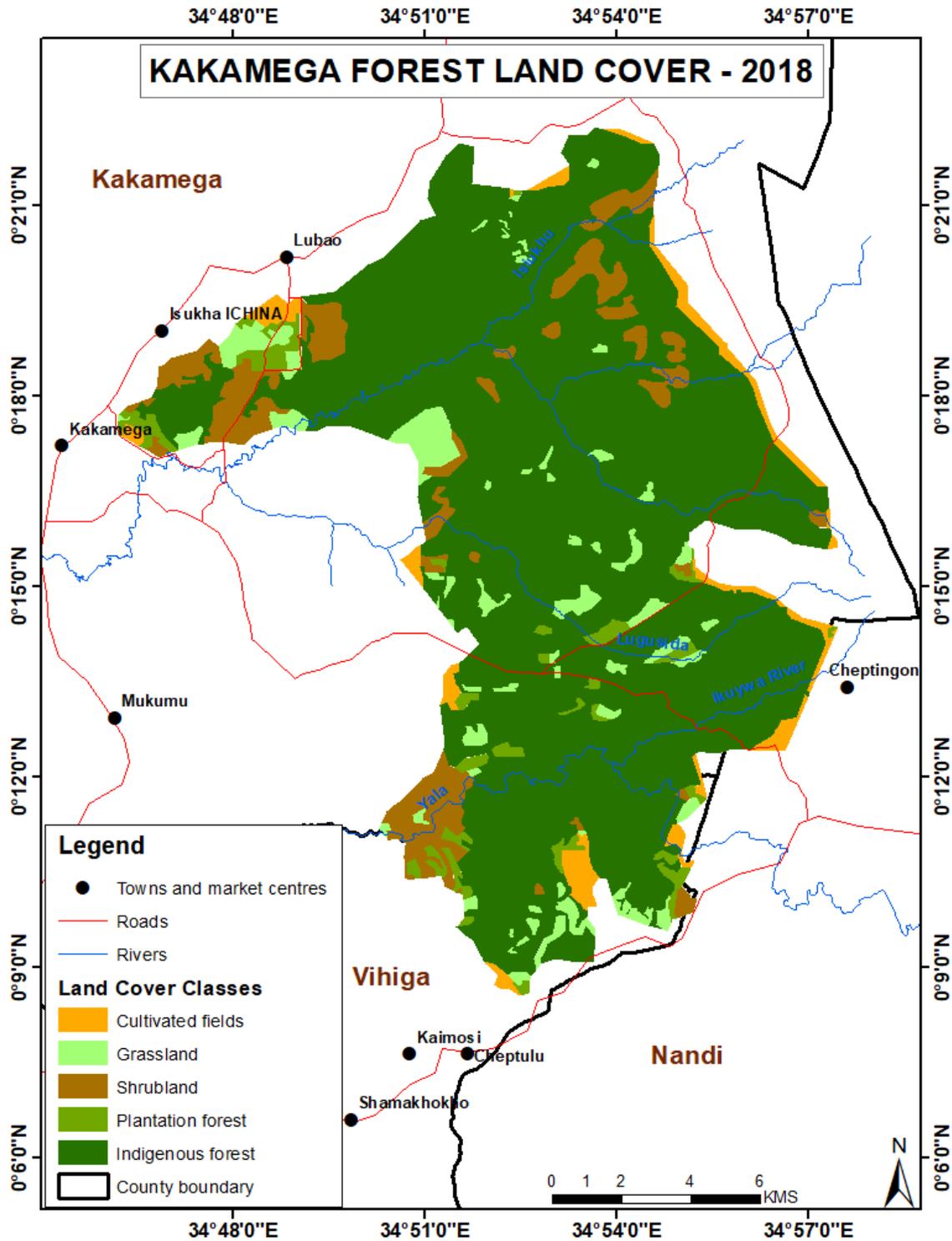*Figure 3: 2008 land cover types in Kakamega Forest*

Figure 4: 2018 land cover types in Kakamega Forest

The area coverage of the land cover classes was computed in hectares as shown in Table 1.

Table4 .1. Kakamega Forest land cover area in hectares

No.	Land Cover Class	Area in Hectares		
		2000	**2008**	**2018**
1	Indigenous forest	18399.42	18710.19	18666.99
2	Plantation forest	449.01	1049.76	720.09
3	Shrub land	2007.72	2027.88	1993.05
4	Grassland	254.07	953.01	1267.47
5	Cultivated fields	2406.96	776.34	869.58
	Total	**23517.18**	**23517.18**	**23517.18**

Source: United States' National Aeronautics and Space Administration (NASA). (2019)

From Table 1, it was shown that the land types changed not with a specific pattern between 2000 and 2018. When viewed across the years as per each forest cover type, the indigenous forest cover increased slightly from 18399.42 to 18710.19 between 2000 and 2008, however it reduced between 2008 and 2018 from 18710.19 to 18666.99. Same applies to plantation forest which increased between 2000 and 2008 but reduced drastically from 2008 to 2018; shrub land increased from 2000 to 2008 but reduced from 2008 to 2018 and even though cultivated fields increased from 2008 to 2018, the amount that increased is so little compared to the amount that reduced from 2000 to 2008. The increase of the forest cover from 2000 to 2008 can be attributed to the inception of Forest Act 2005 whose mandate was to allow formation of CFAs under the societies Act where interested people were to make application to Kenya forest Services (KFS) so as be able to co-manage gazzetted forests (Chomba, Nathan, Minang& Sinclair 2015, Gok, 2016; Musyoki et al., 2013). It can be depicted that the efforts by the CFA to increase the forest cover types from 2000 to 2008 through afforestation, agroforestry and reforestation was pulled back between 2008 and 2018 maybe by the community. This can be attributed to illegal logging, charcoal burning and fire outbreaks. This is more evident because, as these forest cover types reduced, grassland increased greatly from 2000 to 2018; an indication that the previously covered land by trees, after being cleared remained with grass.

 Land Cover Change Matrices

The spatial and temporal land cover change in Kakamega Forest between 2000 and 2018 is as shown in the land cover change matrices in Tables 2and 3 below:

Table 2: Land cover change matrix between 2000 and 2008

2008	Land Cover Class	2000					
		Indigenous forest	Plantation forest	Shrub land	Grassland	Cultivated fields	2008 Total Area in Hectares
	Indigenous forest	**18221.67**	10.08	240.66	0	237.78	18710.19
	Plantation forest	81.36	**403.11**	377.73	0	187.56	1049.76
	Shrub land	41.22	12.33	**1224.09**	0	750.24	2027.88
	Grassland	44.64	23.49	114.48	**254.07**	516.33	953.01
	Cultivated fields	10.53	0	50.76	0	**715.05**	776.34
	Total Area in Hectares	18399.42	449.01	2007.72	254.07	2406.96	**23517.18**

Source: United States' National Aeronautics and Space Administration (NASA). (2019)

In the period between 2000 and 2008, 18221.67ha of indigenous forest, 403.11ha of plantation forest, 1224.09ha of shrub land, 254.07ha of grassland and 715.05ha of cultivated fields did not change to any other class as shown in the major diagonal of the matrix. However, 177.75ha of indigenous forest changed so that at one point 81.36 ha changed to plantation forest, 41.22 ha changed to shrub land forest, 44.64 ha changed to grassland forest and 10.53 ha changed to cultivated fields. Furthermore, 45.9ha of plantation forest changed as follows: 10.08 ha changed to indigenous forest, 12.33 ha changed to shrub land and 23.49 ha changed to grass land forests. 783.63ha of shrub changed so that at one point 240.66 changed to indigenous, 377.73 ha changed to plantation, 114.48 ha changed to grassland and 50.76 ha changed to cultivated fields. Lastly, 1691.91ha of cultivated fields changed to other land cover classes in that at one point 237.78 ha changed to indigenous, 18756 ha changed to plantation, 750.24 ha changed to shrub land and 516.33 ha changed to grass land forests

Table 3: Land cover change matrix between 2008 and 2018

2018 Land Cover Class	2008					
	Indigenous forest	Plantation forest	Shrub land	Grassland	Cultivated fields	2018 Total Area in Hectares
Indigenous forest	**18244.89**	9.81	324.54	87.75	0	18666.99
Plantation forest	0	**593.64**	42.39	84.06	0	720.09
Shrubland	278.19	38.88	**1328.85**	347.13	0	1993.05
Grassland	177.21	353.52	302.67	**434.07**	0	1267.47
Cultivated fields	9.9	53.91	29.43	0	**776.34**	869.58
2008 Total Area in Hectares	18710.19	1049.76	2027.88	953.01	776.34	**23517.18**

Source: United States' National Aeronautics and Space Administration (NASA).(2019

In the period between 2008 and 2018, 18244.89ha of indigenous forest, 593.64ha of plantation forest, 1328.85ha of shrubland, 434.07 ha of grassland and 776.34ha of cultivated fields did not change to any other class as shown in the major diagonal of the matrix. However, 465.3 ha of the indigenous forest changed so that at one point, 278.19 ha changed to shrub land forest, 177.21 ha changed to grassland and 9.9 ha changed to cultivated fields. Similarly, 456.12ha of plantation forest changed to other forest cover types as follows: 9.81 ha changed to indigenous forest, 38.88 ha changed to shrub land, 353.52 ha changed to grassland and 53.91 ha changed to cultivated fields. 699.03 ha of shrubland changed as follows: 324.54 ha changed to indigenous forest, 42.39 ha changed to plantation forest, 302.67 ha changed to grassland forest and 29.43 ha changed to cultivated fields. Lastly, 518.94ha of grassland changed to other land cover classes in the order of 87.75 ha changed to indigenous forest, 84.06 ha changed to plantation forest and 347.13 ha changed to shrub land forest. However, these quantitative findings were a reflection of the forest cover types from the boundary because the researcher could not access the heart of the forest. Therefore, to get a glimpse of the forest state both from the boundary and inside, qualitative findings were presented.

Apart from the quantitative findings concerning forest land cover changes, qualitative findings from interviews and focus group discussions were presented. The quotes below from interviews of one KFS and CBO gave a clear picture of the forest cover changes between 2000 and 2018.

"As CFA help us in conserving the forest through afforestation, reforestation and agroforestry their efforts are always pulled back by the community which destroy it through charcoal burning, illegal logging, fire outbreaks, grazing and encroachment. Due to poverty, there is over dependency on the forest by the community for grass to thatch houses, firewood, charcoal fuel; some of the community members harvest these forest products so that they can sell them to earn a living. From the outside, the forest looks intact, but when one moves to the heart of the forest, there is a lot of destruction that leads to reduced water shed, water quality and surface run off in the nearby rivers like River Lukusitsi; it has also increased soil erosion in most areas. The gazette policy has also led to reduced forest cover; the Mukumu mission hospital, showground, Shikusa prison and Kisaina primary were built in the forest land."

"The introduction of the Forest Act 2005 allowed formation of CFAs under the societies Act to co-manage the forest; there efforts were seen between 2000 to 2008. But as per 2018, most of their efforts were proved futile; the forest cover types were destroyed by the community through illegal logging and charcoal burning. There's a challenge when it comes to manning the forest because we have few rangers to do security patrols in the entire forest which is so vast."

From the FGD, the scenario was the same; the forest seemed intact from the outside, however it was greatly destroyed from inside. The quote below shows this:

"The efforts of the CFA to conserve the forest are always challenged by the adjacent community which is notorious in charcoal burning especially in Shamiloli, grazing whereby animals are just let into the forest with no shepherd and they really destroy it especially young trees. Some other times fires and encroachment have been experienced which greatly destroy the forest. Illegal logging is not so common, but there are few cases. That is why, there water shed has been affected negatively; major catchments within the forest have reduced run off and led to poor quality water due to burning charcoal from which its dirt is released into the water catchments during rains."

These study findings are in line with the findings by the Food and Agriculture Organization, (2012) which reported that in the previous couple of decades, worldwide forest cover had incredibly declined from 6 Billion to about 4 Billion hectares. This was in accordance with FAO (2015); around 13 hectares of worldwide forest cover particularly in tropical countries were lost each year from 2010 to 2015.   And the decrease in forested land had been related with deforestation coming about because of anthropogenic exercises (Kisssinger, Herod &Sy, 2012). Similarly, the study findings concur with the REDD execution focus (2013) conducted in Nepal which plotted that the real drivers of forests cover loss as; forest fire, urbanization and settlement, overgrazing and unsustainable utilization of woods items. Notwithstanding these causes (Acharya, Khanal, Bhattarai, Gautam, Karki, Trines, Goor 2015) recognized poverty, unreliable forest residency, populace circulation, reliance on forests items and relocation as major basic reasons for forest degradation.

In the same way, Njenga, Karanja, Cristel, Miyuki, Neufeldt, Kithinji, &Jamnadass, (2013) observed that the greatest threat to Kenya's forest cover was charcoal production because it was the most commonly used source of energy and income for most African people (Lawler & Bullock, 2017). Firewood collection was a cause of forest loss in the tropical areas (Chakravaty, Ghosh, Suresh, Dey &Shukla 2012; Young, 2013); and according to Martin et al, (2017), forest fire induced by man was another key driver of deforestation. And lastly, Chebet, (2013), found out that Kakamega forest which is an indigenous remnant of tropical forest in Kenya had reduced in size over time due to conversion into land use while Manali, (2016) pointed out that there was encroachment on the upper side of Kakamega forest by squatters towards Malava part of the forest.

4.2 Effects of Community Forest Association activities on forest cover change

The study sought to determine the effects of Community Forest Association activities on forest cover change in Kakamega forest. To achieve this objective, the study respondents (CFA members), were asked to give their views on the forest association activities they engaged in. some of these activities were: using the forest products for socio-economic functions, for environmental functions, for cultural functions and engaging in afforestation, reforestation and agroforestry. The respondents' views were measured on a five-point type Likert scale where 1 represented very large extent, 2 to a large extent, 3 not at all, 4, to a little extent and 5, to a very little extent. The study findings were presented as shown in Table 4 using frequency counts, percentages and standard deviations.

Table 4: Community forest association activities

Community forest association activities	1 f (%)	2 f (%)	3 f (%)	4 f (%)	5 f (%)	Mean	Std dev
I use the forest products for socio-economic functions	32(20.4)	83(52.9)	16(10.2)	15(9.6)	11(7.0)	2.29	1.112
I use the forest products for environmental functions	45(28.7)	74(47.1)	19(12.1)	11(7.0)	8(5.1)	2.12	1.066
I use the forest products for cultural functions	48(30.6)	74(47.1)	18(11.5)	10(6.4)	9(5.7)	2.11	1.089
The use of the forest products for socio-economic, environmental and cultural functions lead to extensive destruction of the forest cover	0(0.0)	0(0.0)	157(100.0)	0(0.0)	0(0.0)	3.00	0.000
I engage in afforestation, reforestation and agroforestry to conserve the forest.	50(31.8)	73(46.5)	13(8.3)	14(8.9)	7(4.5)	2.08	1.077
Afforestation, reforestation and agroforestry has led to increased land under forest	51(32.5)	67(42.7)	15(9.6)	14(8.9)	10(6.4)	2.14	1.157
Afforestation, reforestation and agroforestry has led to introduction of invasive species	56(35.7)	76(48.4)	12(7.6)	7(4.5)	6(3.8)	1.92	.977

Source: SPSS output (2018)

From the study findings in Table 6, it was evident, as agreed by the majority of the CFA members, 83(52.9%) that to a large extent, they used the forest products for socio-economic functions. They were supported by 32(20.4%) of them who agreed that to a very large extent they used the forest products for socio-economic functions. A mean of 2.29 and a standard deviation of 1.112 support the two groups of the CFA members that they used the forest products for socio-economic functions. In addition, a mean of 2.12 supported the 74(47.1%) and 45(28.7%) of the CFA members who agreed that to a large and very large extent they used the forest products for environmental functions. This was similar to 74(47.1%) and 48(30.6%) of the CFA members who with a mean of 2.11, agreed that to a large and very large extent they used the forest products for cultural functions. As seen from the study findings, all the 157(100.0%) CFA agreed that not at all has the use of forest products by them for socio-economic, environmental and cultural functions led to extensive destruction of the forest cover. A mean of 3.00 supported them and a standard deviation of 0.000 showed that they agreed concerning the statement; there were no variations in their opinions.

Concerning the engagement in afforestation, reforestation and agroforestry to conserve the forest, 73(46.5%) of the CFA members agreed that to a large extent they did so; 50(31.8%) of the CFA agreed that they engaged in this practice to a very large extent. These CFA were supported by a mean of 2.08. Furthermore, 67(42.7%) of the respondents agreed that this practice of afforestation, reforestation and agroforestry has led to increased land under forest to a large extent while 51(32.5%) agreed that the practice has led to increased land under forest cover to a very large extent. Lastly, 76(48.4) CFA members agreed that to a large extent while 56(35.7) agreed that to a very large extent, afforestation, reforestation and agroforestry has led to introduction of invasive species in Kakamega forest. Having a mean of 1.92 and a standard deviation of .977 supports these views.

Study findings indicate that some of the activities that increased the forest cover included afforestation, reforestation and agroforestry. A study by Agevi, Koros, Adamba, Hillary &Mulinya (2016) using cloud free satellite of forest cover change between 2001-2016 indicated that Kakamega forest had increased from 366.9ha to 481.4ha respectively due to Plantation Establishment and Livelihood Improvement Scheme (PELIS) Program. This agreed with KFS report of 2012 that 4,000ha of planted forest was under PELIS (KWS 2012)

Both the government forest managers (KFS) and community (CFA, CBOs) were in agreement that participatory forrest management led to increased forest cover as reported during the qualitative study.

An excerpt from a CFA interview revealed that;

> "I engage in agroforestry as a CFA member whereby through PELIS I am able to acquire plots on which I plant seedlings and take care of them as I plant my own crops until the forest cover is fully grown. Also, under our CFA, we have been engaged in afforestation and reforestation in some parts of kakamega forest with the intention of reviving the degraded forest areas and conserving the forest too."

An account by KFS had that;

> *"The participation of CFA in afforestation, reforestation and agroforestry in Kakamega forest has led to both increased land under forest and introduction of high quality tree species. CFA have also been equipped with skills in management techniques of tree nursery, planting, weeding and first pruning; they acquire these skills through PELIS. We also train the CFA as scouts who are engaged in security patrols to protect endangered flora and fauna"*

From the FGDs, the following transpired which was similar to the findings from interviews and questionnaires.

> *"The participation of CFA in agroforestry, afforestation and reforestation has helped revive some parts of the forest that were degraded. This has led to increased land cover under forest whereby high quality tree species have been introduced into the forest. There are also trained scouts among CFA who have been so helpful in doing patrols to guard the forest against intrusion and destruction by the community."*

This discovery was similar to to Bruggeman, Meyfroidt & Lambin (2016) which asserted that reforestation had taken place in a number of Equatorial region countries especially in bordering land that included mountain surroundings aided by community programs. They gave an example of Bhutan which had seen a shift from more loss to net increase in forest cover. Similarly, large scale reforestation especially in Nepal and Mexico was licensed to CF (Gautam *et, al*, 2004; Bray et al; 2005). In the same manner, Agevi &Tsingalia*, (*2014) stated that since the signing of 10 years' management plan in 2011 with KFS, MUILESHI CFA had contributed a great extend in the management and conservation of Kakamega forest where men were involved in rehabilitation of degraded forest areas to ensure sustainability for present and future generations.

However, as much as the CFA endeavored to conserve the forest, there was need to protect forest resources from anthropogenic destruction (Wambugu *et al,*2017). They further observed that if forest returns were not lucrative, forest adjacent dwellers may resort to both legal and illegal means to compensate their time and money leading to destruction of forests. In view of this Kakamega forest had been greatly destroyed and the KFS officer had the following to say about it.

> *"There are cases where the community just let their animals into young plantations and these animals destroy the affected areas so greatly that we have to do replanting over and over again. There are also cases of fires from the community members and the community as well engages in illegal charcoal burning and when it rains, the dirt is released in the rivers; some of these rivers are Lukusitsi and IKuywa."*

From the response of the KFS, it was evident that it was the adjacent community led to the destruction of kakamega forest. They pulled back the efforts by the CFA in conserving the forest. No wonder, the *in illegal activities of charcoal burning and logging and the most affected area is Shamiloli. These activities by the community have in turn after destroying the forest, led to reduced water shed and the quality of the water whereby in places that charcoal burning has been done.*

Forest cover continued to reduce despite presence of CFAs created through the Forest Act 2005 and Forest Management and Conservation Act 2016 to co-manage gazzetted forests (Chomba, Nathan, Minang& Sinclair 2015, Gok, 2016; Musyoki et al., 2013).

5.0 CONCLUSION

Some of the drivers to this forest cover changes were poverty which led to over dependence on the forest items and need for urbanization and development-access to public amenities like schools, hospitals, show grounds and police stations. Illegal logging was also a driver of forest cover change in kakamega forest but it was not to the extreme as charcoal burning. Also the study findings discovered that the CFA members in Kakamega forest engaged in activities that helped in conserving the forest leading to increased land under forest cover. The benefits the CFA got were such as being trained in fish farming, mushroom farming and bee keeping, the forest proving water shed and preventing soil erosion, among others. There were also direct benefits that CFA gained from the forests which includedfodder, timber/poles, firewood, charcoal, medicinal herbs and food through cultivation/PELIS. Some of the activities that increased the land under forest cover were afforestation, reforestation and agroforestry/PELIS. However, in as much as the CFA strived at conserving the forest, their efforts were challenged by the adjacent community which was notorious in destroying the forest through charcoal burning, grazing, forest fires, encroachment and to some extent, illegal logging.

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