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INDUSTRIALISATION AND SUSTAINABLE GROWTH

AN ASSESSMENT OF THE INFLUENCE OF GROWTH POLES ON LAND-USE TRANSFORMATIONS IN UGANDA: EVIDENCE FROM KAMPALA INDUSTRIAL AND BUSINESS PARK (KIBP)

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Abstract

To drive national development goals and reduce regional disparities, many developing countries have put in place a number of development strategies. For example, the Uganda government established a National Industrial Policy (2014), a framework for Uganda's Transformation, Competitiveness and Prosperity aimed at setting up Industrial Parks across the country to spur economic growth in order to reduce poverty and income inequality and also propel general economic development of other sectors such as agriculture, construction etc. This paper arises out of a study aimed at assessing the influence of Growth Poles on Land Use Transformations in Uganda with specific attention given to Kampala Industrial and Business Park (KIBP). Use was made of different Landsat satellite Images integrated with basic topographic maps and ground truthing to capture land use transformations within the boundaries of surrounding parishes of KIBP. Preliminary results indicate that different land use transformations have occurred. Built-Up class comprises of 14.6% of the total land use cover as of 2016, Forest at 19.5%, Farming at 44.4%, Wetlands at 21.5% and Open water at 1.4% all as of 2016. In 1996, Built-Up class was 14.5%, Forest was 21.1%, Farming was 39.7%, Wetlands at 15.7% while Open waters constituted 8.9% of the Land use cover of the study area. The obtained results were further analyzed using SPSS analytical tools indicating 7.32% Land use change of Built Up class, Forest transformed by 3.98%, Farming at 36.6%, Wetlands at 28.8% and Open water at 23.31% over a 20 year period. The study recommends that much as the aspect of Industrial Parks acting as Growth Poles is good to foster economic development, it should be tracked to avoid scenarios of negative impacts exceeding the positive impacts generated and also ensure sustainability of the environment in general.

Key words: Industrialization, Industrial Parks, Growth Poles, Kampala, Land use cover, Uganda.

About the author/s

Aaron Achoroi is a Master of Land use and Regional Development student at Makerere University. He is currently writing his thesis on the topic: An Assessment of the Influence of Growth Poles on Land Use Transformations in Uganda. Evidence from Kampala Industrial and Business Park. The study also seeks to empirically quantify the Total Economic Impact of Kampala Industrial and Business Park as well as Mapping and Characterizing Industries at KIBP. As an upcoming researcher and scientist, Aaron's research interests span in the fields of Industrialisation, climate change, land use planning, environment impact assessments as well as emergence of green cities alongside sustainable urban development. Aaron obtained his first degree in Real Estate Management from Makerere University in 2015 before enrolling for his Master of Land Use and Regional Development degree in the same year. He has worked with different organisations such as Uganda Bureau of Statistics and National Environment Management Authority. As a young man, he dreams of taking a career in Academia and looks forward to different educational opportunities worldwide so as to realise his career. He is currently working as a Research Officer at Hansom Group as well as engaged in research with Uganda Investment Authority and Makerere University.

Contents

Introduction

Materials and Methods

Results

Discussions

Conclusion

Recommendations

References

Abbreviations

KIBP.....Kampala Industrial and Business Park

NDP.....National Development Plan

UBOS.....Uganda Bureau of Statistics

UIA.....Uganda Investment Authority

LUC.....Land Use Cover

NEMA.....National Environment Management Authority

A.hq.....Area in Hectares

1. Introduction

Speakman (2013) states that Growth poles are simultaneous, coordinated investments in many sectors to support self-sustaining industrialization in a country. Basing on the Sustainable Development Goals of the United Nations (2016) and Goal 9 in particular that states: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation, countries world-over have come to realise the need for sustainability in all forms of development including industrialisation with focus on the promotion of sustainable industrialisation. Vidová (2010) acknowledges that a change of the status of economies, caused by globalisation of economies in the world, is and has been an important and prominent feature of the current development trends as there is more pressure on structural adaptation in the area of production, investment and business towards the general global economics development. This is ascertained by Ampurire (2016) who stated that the Government of Uganda is to establish at least 22 industrial parks across the country key among is Kampala Industrial Park with an effort to create jobs and ease land access for both local and foreign investors. However Amin & Fazal (2012) agree that contemporarily, urbanization is taking place all over the globe and the rate is very fast in the developing countries as compared to the developed ones. They further agreed that cities with rapid growth (mostly in developing countries) grow without planning and the relationship between urban form (the built environment) and nature generates an unending source of physical and environmental degradation and according to Livia et al (2015), the development of industrial parks comes with transformation of previous production systems, coupled with technological change where the industrial areas are developed spontaneously with expectancy of positive externalities from the close spatial proximity of the companies. Leuenberger (2015) further stated that not all that is perceived of Industrial parks is as it would have been wished much as Industrial zones promote socio- economic development, in turn contributing to the reduction of poverty, industrial activities have also caused negative impacts on the environment and on human health especially as a result of Inefficient management of resources leading to increased greenhouse gas (GHG) emissions that has caused water and soil pollution. Ladu (2016) agrees that the story of Kampala Industrial and Business Park (KIBP) is largely a depressing one despite recent encouraging developments there as in the last 12 years since the idea of KIBP, located at Namanve, 11 Kilometres along Kampala-Jinja highway, was mooted, so little has been achieved. However according to Baike (2016) today the Kampala Industrial and Business park is slowly re-branding from a haunted forest to a mostly-empty proposed business park, the area now has several industries and warehouses, not to mention offices and neighboring residences to boast about. The aim of this paper is to present the land use transformations as a result of establishment of KIBP.

2.0 Study Area

The Kampala Industrial and Business Park (KIBP) is located in Namanve, 14km East of Kampala in Mukono Municipality and Wakiso-Kira Town council east of the Central business district of Kampala, Uganda's capital city on the Kampala-Jinja Highway. It is a 2,200 acre facility. It was planned to be a flagship industrial park for the country. Malik (2004) states that it is approximately 896 hectares (ha) and comprises of four estates; Namanve north (100.1 ha). South A (126.9 ha), South B (294.5 ha), and South C (375.2 ha). It is clustered into agro processing, beverages, grain milling, light industries, heavy industries, industrial rail, printing and publishing, ICT Park, commercial/leisure and country clubs, SME Park, in-land container depot, warehousing, residential, common service, and open

green spaces. Kampala Industrial and Business Park is surrounded by different parishes namely Kirinya to the South West, Bweyogerere to the North West, Nantabulirwa to the South, Lumuli to the North and Seeta to the East.

2.1 Study Area of Kampala Industrial and Business Park and surrounding areas.

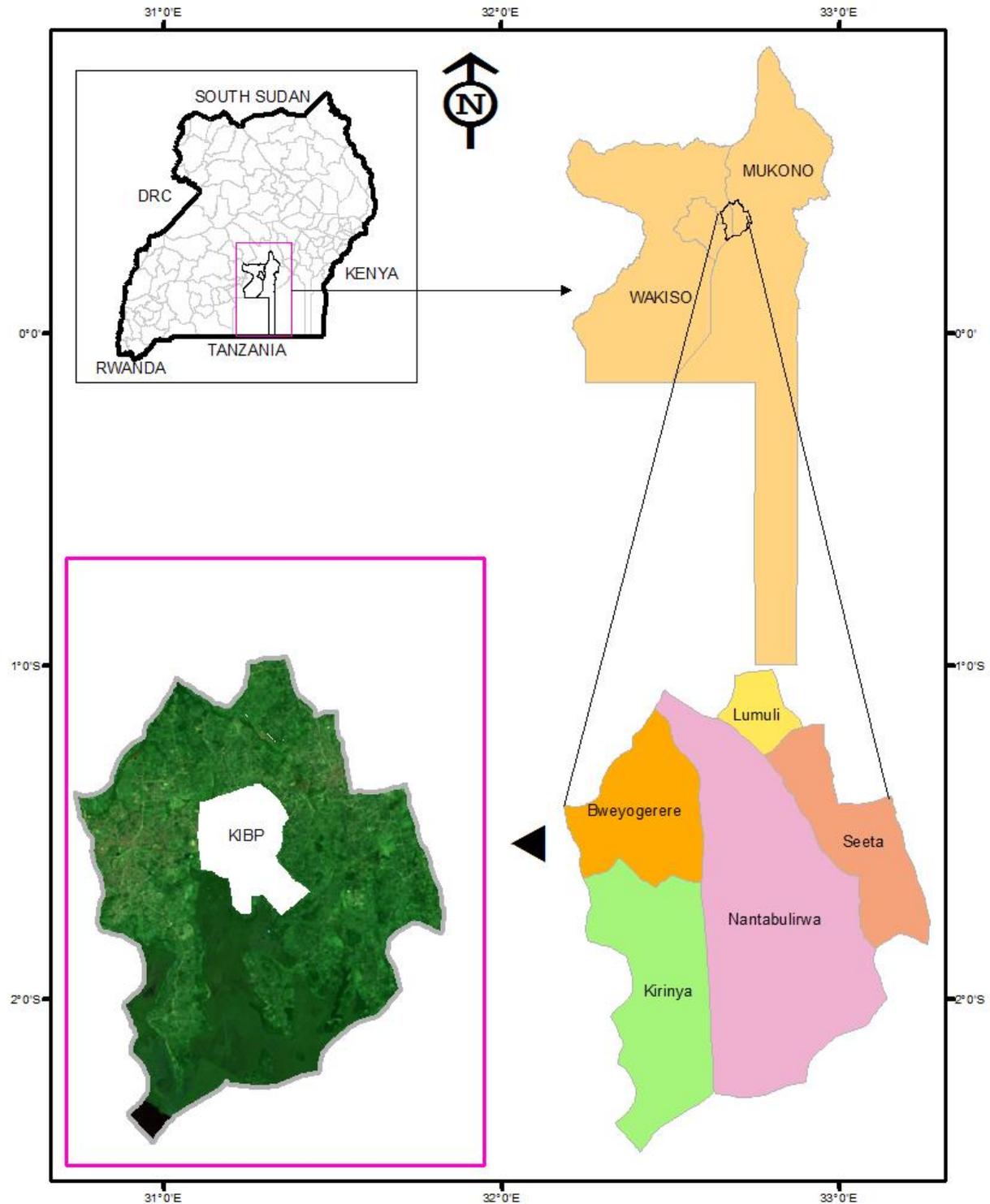


Figure 1: Kampala Industrial and Business Park and surrounding parishes' base map.

3.0 Materials and Methods

Spatial data was developed for three points in time i.e., 1996, 2006, and 2016 and processed in Geographic Information System (GIS). 1996 was chosen as the base year because it is around this time that Namanve forest reserve was earmarked and degazetted by government to establish Kampala Industrial and Business Park spurring the beginning of massive land use transformations in the surrounding areas. For the preparation of early date land use/land cover of the study area, administrative town planning map of Kampala Industrial and Business Park, 2014 on 1:50,000 scale was used. Similarly, the land use transformations for the later years was carried out using Landsat satellite imagery obtained from United States Geological Survey (USGS). All data was developed into Universal Transverse Mercator (UTM) coordinate system, zone 36N, with World Geocoded System (UTM WGS 84) projection parameters. Using Arc GIS 10.2, the images of 1996, 2006 and 2016 were resampled to ensure that all were in uniformity resolution-wise so as to reduce any geometric discrepancies faced with different Landsat images. False colour composites of these images were then created by combining different bands of each of the images. The colour composites for each of the images were then overlaid with the Kampala Industrial and Business Park shape file. Classification was done for each colour composite in which 5 major clusters were chosen and then classified. The study made an attempt to use the FAO land use/ cover classification standard. The study also based on 30metre resolution satellite images which made it difficult to differentiate some related land use classes from the others and so other than 9 land use classes, the study opted for 5 classes with a combination of related classes in one class all maintained at Level 1. A total of 40 random points in the study area were established and visited using a GPS receiver as part of ground truthing to ascertain their classification classes.

Data Type	Path	Row	Acquisition. Date	Spatial Resolution (m)	Source
Landsat 8 OLI	171	60	29/04/2016	30x30	USGS
Landsat 7 ETM	171	60	10/02/2006	30x30	USGS
Landsat 4-5 TM	171	60	01/03/1996	30x30	USGS

Table 1: Characteristics of Landsat images, United States Geological Survey.

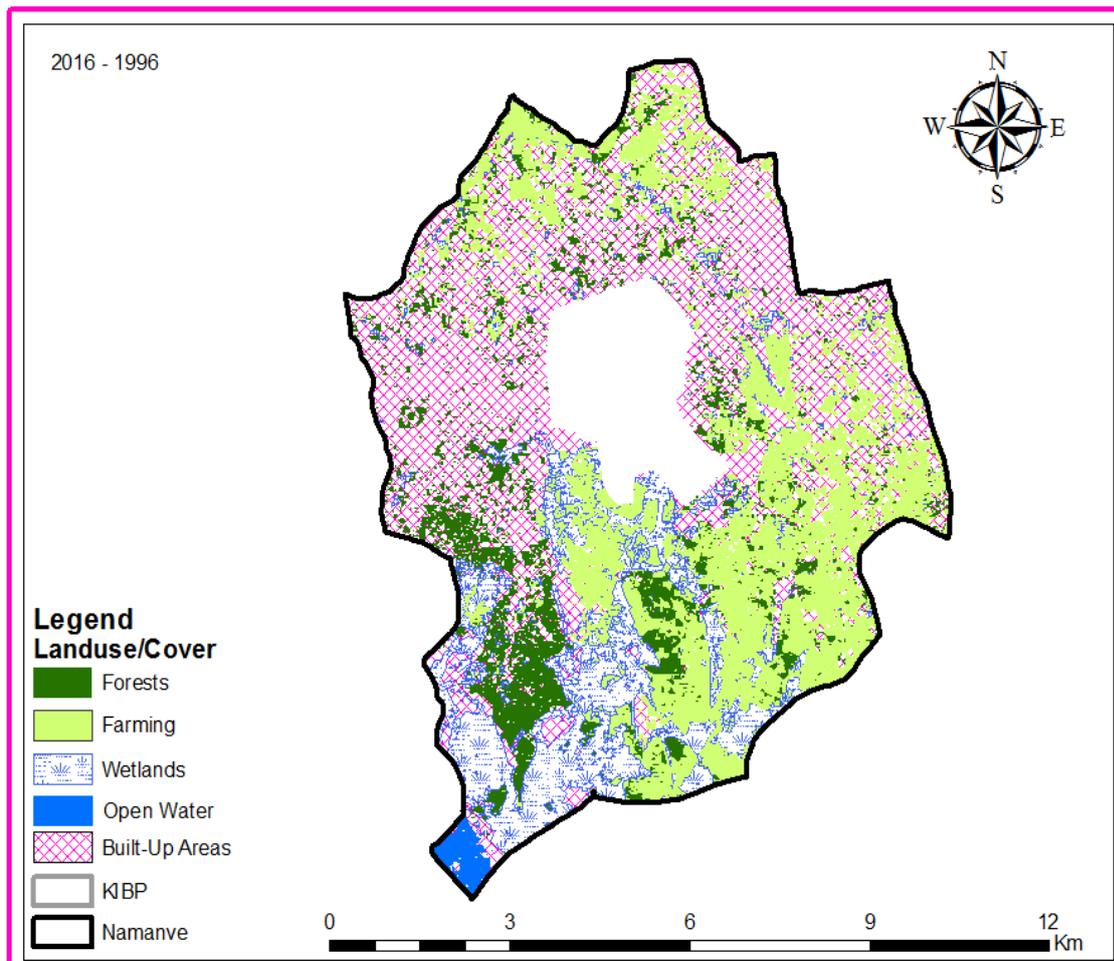


Figure 2. Super imposed image of 1996 LUC and 2016 LUC.

3.1. Determining the land Use transformation at Kampala Industrial and Business Park surrounding areas.

Landsat satellite imagery scenes corresponding to Path 171, Row 060 encompassing Mukono and Kiira Municipalities for the years 1996, 2006, and 2016 were obtained from the US Geological Survey website (www.usgs.gov). The period between 1996 and 2016 was selected as it was the time the Namanve forest was degazetted into an Industrial Park through an act of parliament and is thus the time the land use transformations started up to today. The year 2006 was selected as it was a good basis for the assessment of land use changes to have occurred right away after degazettement of the natural forest for other land use activities to kick in. The year 2016 was selected because it is till recently that the actual purpose for the degazettement of the natural Namanve forest area into Kampala Industrial and Business Park is starting to be seen. I.e. there are quite a number of industries at the industrial park causing various land use changes around the park unlike in previous years when there were very few industries in the area. Landsat images were used as they are of high quality and with multi-spectral content of the surface of the Earth. The characteristics of these images are presented in Table 1 above.

3.2. Land Use/Land Cover Distribution of surrounding areas of the Kampala Industrial and Business Park.

Land use cover (LUC) was classified into 5 categories spread over approximately 8026 hectares of the Kampala Industrial and Business Park surrounding areas conforming to their Municipal limits. The classes included, Built-up (commercial, industrial and residential), Farming (Subsistence and Commercial), Forests (Natural, Artificial and stand-alone trees), Wetland (Papyrus, Marsh, Bog) and Open Water (Lakes, rivers, springs, Ponds). Table 2 gives a detailed explanation and the distribution of the above mentioned land use/land cover classes

Land use	Characteristics
Built-Up Areas	Commercial, residential
Farming	Subsistence and commercial
Forests	Natural and Artificial, stand-alone trees
Wetland	Papyrus, Bog, marsh
Open Water	Lakes, Ponds, rivers, springs

Table 2: Characteristics of land use classes.

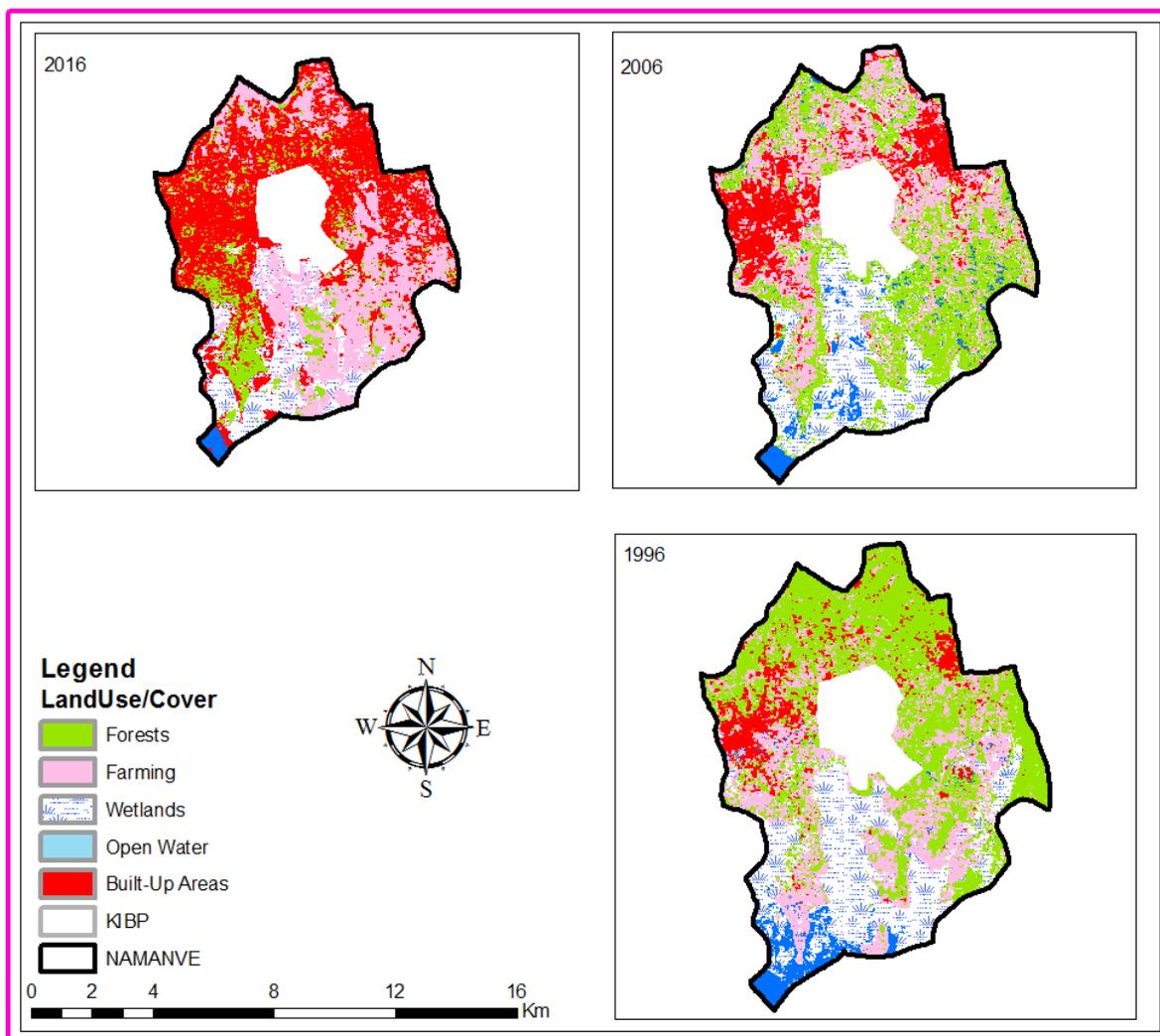


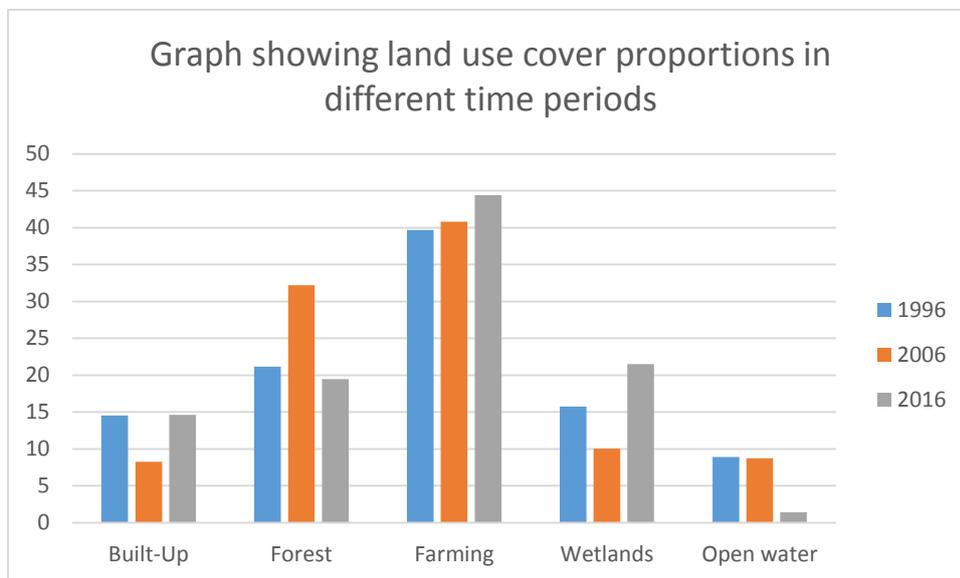
Figure 3. False colour composites of LUC of 2016, 2006 and 1996.

4.0. Results.

The comparison of the land use/land cover statistics assisted in identifying the percentage change, trend and rate of change between 1996, 2006, and 2016. In achieving this, the first task was to develop a table showing the area in hectares and the percentage change for each year (1996, 2006 and 2016) measured against each land use/land cover type.

Land use/cover	2016 A.hq	% LUC	2006. A.hq	% LUC	1996. A.hq	% LUC
Built-Up	669.01	14.6	319.5	8.3	578.3	14.5
Forest	889.97	19.5	1245.8	32.2	840.7	21.1
Farming	2030.03	44.4	1578.1	40.8	1576.5	39.7
Wetlands/Swamps	982.11	21.5	388.1	10.0	625.2	15.7
Open Water	65.4	1.4	337.0	8.7	354.3	8.9
Total	4571.1		3868.44		3974.9	

Table 3: Transformation analysis of KIBP and surrounding areas.



Land Transformation of surrounding areas as a result of KIBP (1996-2016)

Land use/cover	1996	2016	Change	% Change
Built-Up	578.3	669.01	90.71	7.32
Forest	840.7	889.97	49.27	3.98
Farming	1576.5	2030.03	453.53	36.60
Wetlands	625.2	982.11	356.91	28.80
Open water	354.3	65.4	-288.9	23.31
Total	3974.9	4571.1	1239.32	

Table 4: Land transformation analysis (1996-2016)

Farming

Farming class mainly categorises agriculture and includes mostly vegetable garden fields and practiced purposely for consumption and subsistence. In the year 1996 the total area under farmland use was 1576.5 hectares (39.7 % of the total study area) which increased to 2030 hectares (44.4% of the total study area) in 2016. The increase in its area is attributed to the expansion of the built up areas in the northern part of the industrial park leaving majority of farming practitioners to move to the south to produce more food for the increased population in the area as well as subsistence farming which is still a common practice among majority low income earners in the neighbouring parishes to KIBP. Majority of these gardens are owned by the local farmers who cultivate vegetables on these accessible farm lands adjacent to the swamps especially in the southern parts of Nantabulirwa, northern Lamuli and some parts of Seeta.

Built-Up Areas

In the study, built-up areas included those of intensive use with much of the land covered by structures but with specific emphasis on residential, scattered settlements, commercial, industrial land use categories. Current analysis shows that the built up land use increased from 578.3 hectares in 1996 to 669.01 hectares in 2016 (increase of 7.32 percent) (table 4). The increase in built up areas is attributed to increasing demand of land from the growing population as a result of the development made in the industrial sector. The places where new unplanned residential and non - residence came into existence during the study period are mostly within northern estate of KIBP especially the parishes of Bweyogerere, Kirinya, and Nantabulirwa. The areas of Bweyogerere and Kirinya are so densely congested with multiple Built-Up structures due to various growth poles such as proposed Bukasa Port and the adjacent Bweyogerere Industrial park that have highly sparked growth in those areas. There is a general mixture of residential, commercial, warehousing, institutional land use in these areas. The area of Seeta on the East of the Industrial Park also experiences a similar growth trend of built up land use. However there was a decline of Built-Up land use in 2006 from 578.3 hectares in 1996 to 319.5 hectares. This was the time when the industrial park boundaries were really opened which led to demolition of some structures for industrial development leading to a drop in the Built-up land use category at that time as a result of clearing especially of temporary structures in the affected areas. Unsurprisingly, unplanned growth patterns continue to take place in the areas surrounding KIBP as UIA's land use planning mandate only applies to the industrial parks causing scattered built up land use of the industrial park's neighbourhood.

Forest

Forest class includes the vegetation cover observed in the study area especially in the year 1996, the total area under forest class was 840.7 hectares (21.1% of the total study area) which increased to 1245.8 hectares (32.2% of the total study area) in 2006. This increase in forest cover was because of the government's provision of land to army veterans to plant trees under a government tree planting promotion program. However, the forest cover has decreased to 889.97 hectares as of 2016 approximately 19.5% of study area because of increased anthropogenic pressure especially in the areas of South of Bweyogerere and North of Kirinya where Built up land use has taken over. The forests now left over are mainly scattered and at the southern parts of Nantabulirwa and part of the Northern estate of KIBP. There are also quite a number of stand-alone trees in the areas as well especially where the artificial Namanve forest reserve was. Deforestation increased over the years from 2006 as people struggled to get land on the plain areas and resorted to clearing the forested areas and adopting to live in these places much as government strongly restricts encroachment in forests implying that sometimes there has been forceful eviction since majority of the population within the residential and non-residential areas is comprised of low income earners and former army war veterans with political backing as well as weak enforceable laws on forest encroachments.

Wetlands

These include the swamps, bog, and marshy land category. It includes the wet lands observed in and around the water bodies of the business park and the surrounding areas. The biggest wetland is Namanve wetland. In the year 1996 the total area under this category was 625.2 hectares (15.7% of the total study area) which decreased to 388.1 hectares (10% of the total study area) in 2006 as a result of massive encroachment onto the swamps during the period of take-off for the industrial park. This was especially at the areas of Bweyogerere, Kirinya where there was massive building of residential, commercial and industrial units. Today there are barely any wetlands in the areas of Bweyogerere, Kirinya and Seeta which makes these areas susceptible to floods in the rainy seasons. The remaining wetlands within and adjacent to these parishes are also at risk of extinction both from built up land use and farming. There is also a surge of farming in the southern areas of Nantabulirwa where farmers practice on the wetlands and their adjacent areas. Hence, majority of the wetlands faced/ face extinction because of swamp reclamation until the recent wetland restoration programs by National Environment Management Authority which has increased the wetlands land use in the surrounding parishes as of 2016 to about 982.11 hectares approximately 21.5% of the total study area.

Open Water

Open Water land use class includes the lakes and rivers within and around the surrounding parishes to the KIBP that include Namanve river that runs across the industrial park and surrounding parishes all the way to the south of Nantabulirwa parish into Lake Victoria. In the year 1996, the total area mapped under this category was 354.3 hectares (8.9% of the total study area) which slightly decreased to 337 hectares (8.7% of the total study area) in 2006 especially in the southern area of Nantabulirwa that is adjacent to Lake Victoria. Also, the once prominent River Namanve has almost declined to state of a stream. The adjacent shores of Lake Victoria in the south of Nantabulirwa parish have also reduced and the lake is further away from the lands. Because of continued anthropogenic pressure almost all these water bodies have decreased to 65.4 hectares (1.4% of total study area) within a period of 20 years in the study area. The pressure exacted by the human and industrial activities has had a great effect on the waters that shall continue shrinking in the area.

5.0. Discussions

Land as a resource is always in a continuous state of transformation as a result of various natural and man-made processes. Land transformation has been asserted as one of the important fields of human induced environmental transformation. An important aspect of change detection is to determine what is actually or rather which land use class is changing to the other. This information reveals both the desirable and undesirable changes and classes that are relatively stable overtime which serves as a vital tool in management decisions. During the study period, it was realized that KIBP has not only expanded from its original size but there was significant interchange of land uses among various land use classes. These changes are because of the development of the business park resulting in increased demand of land for residential, commercial, industrial and other purposes at the expense of other uses. Demand for land along with site attraction, functional convenience, functional magnetism and the land value of that particular area has ultimately influenced the pace and direction of land transformation at KIBP. Between 1996 and 2016, it was observed that magnificent growth patterns have taken place away from the core of the industrial park. Growth and transformation of other land uses into Built-Up areas is more vigilant in the northern surrounding areas of KIBP. However, the land transformation process is evident all over the surrounding areas explicitly towards all the outer areas thus showing the expansion and transformation as a result of KIBP towards its periphery.

Land use/cover was classified into 5 categories spread over the KIBP surrounding parishes. These classes include Built-up, Farming, Forest, Wetlands and Open Water. The rapid land use

transformation in the parishes surrounding KIBP has resulted into increase in built-up area and the resultant expansion (Figure 4). Significant land transformation was witnessed among wetlands, farming and open water land uses. Over the past 20 years, Built-up areas have increased by 90.7 hectares representing a 7.32% change, capturing land mainly from farming, forests and wetlands. The land use transformations to built-up land use have occurred mainly in the parishes of Bweyogerere, Kirinya, Seeta and north of Nantabulirwa due to KIBP neighbourhood effects and spill overs.

According to Prisca (2016), because of KIBP spill overs, several houses and apartments targeting middle-income industrial park employees have been set up within the neighbourhood that also houses Roofings' senior staff quarters. As a result of massive increase of population, farming land use has also drastically increased from 1576.5 hectares in 1996 to 2030.03 hectares in 2016, approximately a 36.6% increase. The land for farming has been acquired mainly by cutting down the forests, reclamation of existing swamps in the neighbourhoods especially south of the industrial park. Majority of farming activity has been pushed to extreme North and South of Nantabulirwa as well as some areas of Lumuli. However, forests increased from 840.7 hectares as of 1996 to 1245.8 hectares in 2006 and decreased to 889.97 in 2016. The forests and stand-alone trees left in the area are found at west of Bweyogerere, north of Seeta and south of Nantabulirwa. The reduction is expected to continue as there is demand for land for farming, residential, commercial, industrial etc. from all corners of the KIBP and at this trend are still expected to continue reducing unless the government swings in to protect and encourage afforestation activities.

Over the 20 year period of land use transformation around parishes of KIBP, Open water has most been affected. The areas surrounding KIBP bore some water bodies such as River Namanve which run through most of the parishes from north of Nantabulirwa through Bweyogerere through Kirinya up to where it drained its water in Lake Victoria which is at the south of Nantabulirwa. The River Namanve has highly been affected by land use transformations as well as water levels at Lake Victoria that were adjacent to the lands. Majority of these areas have been filled with soils to create land for farming and built up land uses. Kalungi (2013) argued that despite the fact that KIBP had been launched around 2002, it took a while to actually kick off and farming activities had continued dominating the area and its surroundings. He further stated that the project stalled after its main funder, the World Bank Bank pulled out citing environmental concerns, administrative bureaucracy and inflated land costing procedures among others. The environmental concerns were mainly situated around the impacts of KIBP, land use transformations on the open water bodies and wetlands in the area that were supposed to be gazetted and protected as per the Environmental and Social Impact Assessment carried out by Malick (2004). In the year 1996, the total area mapped under this category was 354.3 hectares (8.9% of the total study area) which decreased to 65.4 hectares (a decrease of 23.32%) in 2016, almost losing 288.9 hectares of open water over the study period and this loss is mainly attributed to anthropogenic pressures.

The increase in Built-Up land use is attributed to expansion of KIBP spillovers further away from the core and this is mainly at the expense of farm land. Much as farm land is being eaten up in the outskirts, the new dwellers in the built up areas still need food which has to be produced by farmland hence the continued rise of farmland use at expense of wetlands, forest and open water land uses. However the government through NEMA who are mandated by law to protect the environment is doing all they can to try and restore some wetlands in Namanve area. This restoration plans and programs have led to an increase on the wetland use. Much as the area faced massive deforestation in early 2000, efforts to promote afforestation are also in place through subsidies to forest growers by government. However for the Open water land use, it's so difficult to regenerate an open water source that is disappearing and so at this trend of land use transformation, the open water sources within the study area are most likely to get extinct as general water levels of Lake Victoria are going down.

6.0. Conclusion.

The co-current expansion in KIBP has about brought ecologically important land use classes under the transformation process. For example, forests have been cleared down for bringing up (settlements), etc. for various socio-economic purposes, which is a loss to the ecology and in turn a threat to sustainable development. The continued trend of land use change and conversion in the Namanve periphery area is largely attributed to the uncontrolled growth in the population size of the area that has led to high demand for the built-up land use coupled with commercial activities and other infrastructure to facilitate operations in the area. This trend of growth and land use change is expected to continue for the foreseeable future. Although remote sensing was largely successful in detecting and studying land cover changes in KIBP and surrounding areas between 1996 and 2016, it cannot be heavily relied on as different images from different time periods possess different characteristics and this makes it harder for image interpretation and easier for errors to occur in the process

7.0. Recommendations

Land use changes brought about by development projects such as industrial parks should be checked by taking zoning practices of the surrounding areas seriously so as to regulate land use practices so as to check illegal land conversions. The drive by government to set up over 22 industrial parks around the country should be coupled with planning for the LUC that come along with such developments. LUC planning should be done in consultation with the affected communities so as to ensure that there is an agreement among all stakeholders that the development is for a good purpose and its effects are good as well. There is also dire need for redirection of development as well to the southern part of the KIBP estate. Built-up areas should not only be left to the northern part of the park but to all other surrounding areas through control mechanisms initiated by government and private sector.

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