

Perceived Effects of Land Use Changes on Household Livelihoods in Peri-Urban Areas of Nakuru City, Kenya

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Abstract

High rates of population growth in cities is a global phenomenon. Nakuru City is one of the fastest growing cities in Eastern Africa. The city, performs administrative, educational, tourist, industrial, commercial, medical and transport functions. These diverse functions of the city attract an influx of people that impacts on the growth of Nakuru City, causing notable changes on land use patterns in its peri-urban zones. It in turn affect households' livelihoods. The study sought to find out the perceived effects of land use changes on households' livelihoods in peri-urban areas of Nakuru city. A household survey research was conducted where three hundred and eighty five households were selected for study. Purposive sampling was used to select 3 study locations, Kiamaina, Lanet Umoja and Ngata out of seven locations, Barat, Lanet- Ummoja, Kiamaina, Ngata, Kiamunyi, Viwanda and Mbaruk which surround the city council of Nakuru. Random sampling was used to select three hundred and eighty five households from the study areas. Cross tabulations and calculation of percentages were used to determine the perceived effects of land use changes on households' livelihoods. The results disclosed that the expansion of built-up area and agricultural land has a positive influence on livelihoods as perceived by the households of peri-urban areas of Nakuru city. However, it also has negative effects on natural resources such as reduced access to water and healthy living environment. This study contributes towards achievement of the Kenya's vision 2030 which aims at providing high quality life, clean and secure environment to all through inclusive and participatory stakeholder consultative process involving all Kenyans. Appropriate measures need to be employed to reduce the rapid change in land use and to integrate environmental conservation with human livelihoods.

Keywords: Peri-Urban, Livelihood, Land Use

Introduction

The global rate of urbanization is high with more than half (55 %) of the world population living in urban areas in 2018. It is projected that, 60% of the world population will live in urban areas by 2030 and 70% by 2050, with high concentration of the urban population in Asia and Africa (UN, 2018). The rapid pace of urbanization has often brought about rapid land use changes. Much of it in Africa and Asia. This has been occasioned by the fact that most parts of Africa and Asia are still predominantly rural as opposed to developed countries. As urban areas continue to experience unprecedented land use changes it also experiences problems emanating from such changes. For example, inefficient provision of services, food insufficiency, illegal settlement, environmental pollution, waste dumping, forest destruction, reduction in water surfaces and permanent change in land use (Alsharif *et al.*, 2015). The urbanised land is expected to increase by 1.2 million Km² by 2030 (UNDP, 2016).

Rapid urbanization is noticeable in sub-saharan Africa where so many countries in the region are being urbanised and their fringes are further converted into urban centers (Zasada, 2011). According to Yirsaw *et al.* (2017), farmlands and wetlands in peri-urban areas of cities have shown a declining trend. Combination of various socioeconomic factors have induced land use changes. For instance, in Su-Xi-Chang city, growth of population and built-up environment show a positive correlation. This implies that increase in population causes an increase in built environment due to increase in demand for settlement. Large parts of agricultural lands are changed into residential areas both in rural and urban areas.

Thus, Land use variation is a major aspect in peri -urban areas and has led to various effects ranging from economic to social to environmental. A change in livelihoods occur as a result of land use changes in the peri-urban areas as people start to engage in other sources of income. For instance, households work as casual labourers on housing construction, engage in informal trade, or migrate to urban areas as is the case in Accra City of Ghana (Fobil and Atuguba, 2004). Moreover, the existing farmers intensify agricultural activities in urban fringes to be able to cater for the increasing demands of the urban population as witnessed in the peri-urban areas of Kumasi, Ghana (Cobbinah & Amoako, 2012). Further, peri-urban farmers have innovatively responded to the pressure and opportunities attached to their geographical adjacency to urban agglomerations. Peri-urban farming is now characterized by a heterogeneous pattern of holdings with intensive and specialized production, high participation in diversification and lifestyle-oriented farms in the fringes of Nairobi city of Kenya (Thuo, 2013).

Urbanization enhances changes in land use, land transactions and increased rural –urban developments that has given rise to complex rural-urban migration and overall transformation in the peri-urban land. Rapid urbanization of Nairobi city, for example is causing expansion of the city boundaries to the hinterlands of Kiambu, Kajiado and Machakos Counties thus conversion of other land use types into settlements in the peri urban areas is an unending process (Wangai *et al.*, 2019).

Areas poorly suited for urban use such as wetlands, steep hillsides, outcrops and rocky shores, estuarine channels, rivers and forest remnants have suffered the effects of intense environmental degradation. This development has occurred in isolation, without taking into account the concept of the ecological balance and how this system is affected (Appiah *et al.*, 2019).

It is against this background that the current study assessed the perceived effects of land use changes on households' livelihoods in peri-urban areas of Nakuru City, Kenya. Information on the effects of land use changes in the peri-urban areas of Nakuru city is lacking.

Literature Review

Effects of Land Use Changes in Peri-Urban Areas

Changes in land use have serious environmental, economic and social impacts on rural livelihoods in many parts of the sub-Saharan African region (Maitima et al. 2010).

Environmental Effects

The increasing dependence on the resources may aggravate the pressure on these resources leading to over-exploitation and subsequently deforestation and land degradation (Kalaba et al., 2010). Land use changes and urban development have led to the expansion of paved surfaces and encroachment into riparian reserves. The immediate effect of such encroachments has posed flood risks to such areas and disrupted ecosystem services of such riparian reserves (Orewole et al., 2015). Consequently, water shortages have been a growing concern throughout the world. With ongoing droughts, water rationing, climate change, and global warming being the main environmental constraints which occur as a result of urbanization and the high rate of land use changes that exert pressure on already limited existing natural resources. Land use changes result in environmental degradations including: erosion, habitat and biodiversity loss and groundwater depletion (Díaz-Caravantes & Sánchez-Flores 2011). Deforestation, cultivation on slopes, and land fragmentation are a lead to increased land degradation (Angula, 2020).

Deforestation in Wadi Ziqlab catchment is considered the main cause of land degradation. During the last two decades, less than 60 thousand forest trees were removed and replaced with fruit trees, houses, or buildings. Such activities have thus led to the reduction of farmland area and wetlands (Cahya et al., 2018). Moreover, land use changes interfere with peri-urban microclimate. Ecosystems help mediate temperature changes and filter air pollutants. Replacing green spaces with built infrastructure can give rise to 'heat islands', which reduces the adaptive capacity of a population (Angula, 2020).

Social Effects

Land use change in peri-urban areas is associated with social traits such as age, gender of household, family size, size of households, educational status (Wilson, 2013). Pressure on the existing infrastructure has emerged as another major effect of urban sprawl. The road networks, supply of water and electricity are becoming inadequate and experiencing more pressure due to increased demand from the upcoming areas. Infrastructure and services should be provided before development takes place. However, in most areas this is not the case. Provision of services and infrastructure is done in retrospect without improving capacity of the old infrastructure (Owusu & Chigbu, 2020). Fragmentation is also considered as a major problem, which prevents land development. Multiple ownership of single plot is also dominant and hinders proper farming. Thus, the land is left unused and exposed to degradation (Wilson, 2013).

A result of conversion of agricultural land into built up environment led to food shortages for example in the case of Northern Delta in Canada where agricultural land has continued to diminish due to urban

growth (Shaheen et al., 2018). Peri-urban agriculture can improve food security for local population as well as in the urban areas, making food systems more resilient. Further, locally-grown food can reduce pollution and greenhouse gas emissions and aid mitigation efforts, since the distances covered to deliver the produce to the city is reduced (Parsipour et al, 2019). In the city of Gorakhpur of India, land market due to changing land-use patterns led to agricultural lands have been replaced by housing infrastructure which in turn affect the overall food resilience of the city (Dutta, 2012).

Floods caused by land use changes/urban developments have led to the destruction of property and loss of life and if not controlled the situation can worsen with the increased level of land-use conversions. This has caused flash floods in urban and peri-urban areas. Floods are enhanced by the impervious surfaces as a result of urban developments which does not allow a substantial amount of surface runoff water to percolate into the ground. The surface runoff is also obstructed by non-biodegradable materials which often clog the drainage systems. These end up into sewerage drainage and water supply systems leading to spillovers, pollution, and contaminations endangering the life of people and the ecosystem. The impacts of such floods are experienced on roads especially where the drainages are not maintained or do not have adequate capacity to contain storm water making roads impassable (Odhiambo, 2015).

Economic Effects

The use of natural resource is vital in people's livelihoods. The drivers of land use changes are agricultural expansion, population increase and illegal logging in forests (Alsharif et al., 2015). Livelihood coping strategies include entrepreneurship, farming, employment and wild food. Unfavorable land tenure system cause farmers to lose their lands to competing uses. Urbanization of PU areas lead to increased and diverse sources of households' livelihoods. This fastens urbanisation in such areas (Alsharif et al., 2015).

The sources of livelihoods is shown by increase of income per capita and increase in the number of workers lead to increase in demand for residential houses due to rapid urban population growth. Industrialization and housing demand in cities are listed among the reasons which magnify the peri-urban growth. All with the profit-making objectives of the investors and land owners in peri-urban areas of cities (Poude, 2008).

These investors take the advantage of availability of new unexploited lands in the peri-urban areas. Low land prices in urban fringes cause heavy demand of sectors such as industry, trade and construction. Since these sectors are more preferable to agriculture, land use changes occur together with inefficient use of resources due to non-agricultural use of land (Bhatta, 2012). Moreover, investors take the advantage of high population of the cities which imply high demand for agricultural products such as milk, fish, vegetable and maize. Agricultural transformations in the peri-urban areas of the city is widespread. Farmers in peri-urban areas are taking advantage of the prevailing situations and put land under high value crops and practice zero grazing. This is enhanced by available market offered by increased population (Thuo, 2013).

It is in agreement therefore with the land rent theory of Von Thunen, which states that the land prices of places which are close to settlement units (urban centres) are higher. This is of a high economic value to the owner of land. Also, the lands are cultivated more intensively to increase net income of agricultural land. He further pointed that transformation of agricultural land are also effective in development of urban peripheries all in pursuit of increased income (Leigh, 1946). Increase in land

values and housing cost brings higher returns to the real estate investors/ landowners. For instance, once a farm has changed user into residential user, the value would go up and the investor would earn more from his investment. Similarly, if the farm is developed, the resultant housing cost/rentals would be higher to enable the investor to cover the higher value of the land and increase profit margins (Owusu & Chigbu, 2020).

Growth of Bojnurd vicinity, has caused major changes in livelihood structure and body of villages that have direct or indirect influences on land use. Results of many studies on rural infrastructural development plans show that closer villages to physical domain of the city have less occupants in agriculture and this is the main reason for increase of occupants in industry and service parts in Bojnurd (Parsipour et al, 2019).

Also, employment opportunities are developed, and more resources are exploited (particularly agricultural resources); More recreational and leisure activities could be pursued and provided. The environments are expected to receive many important infrastructural developments (e.g. transportation infrastructure), or local important industry, particularly in the processing of agricultural products (Živanović-Miljković et al., 2012).

In most developed countries urban development is controlled in order to retain the agricultural lands in the peri-urban areas. This is visible in countries such as Denmark, north-western Germany, the Netherlands and Belgium where the land is mainly used for agriculture while also containing an above average share of peri-urban areas. This is also the case in large parts of Poland, the Atlantic coast of France, eastern Italy, parts of Hungary and the south of the United Kingdom. Some are run in a highly intensive manner, often with horticultural production and high economic productivity (Shaw et al., 2020).

However, while land use is pushing some determined farmers farther into the hinterlands, their livelihood systems are also greatly affected. Rapid urban growth, shrinking peri-urban farmlands and growing urban poverty raises concerns, particularly about Ghana's urban live is characterized by high levels of poverty Appiah et al., 2019).

Urban and peri-urban agriculture (UPA) is a major source of livelihood for many people and can be used to reduce the high levels of poverty and food insecurities in most cities especially in developing countries. Free town of Sierra Leon is an example of a city where UPA is carried out by very many people. Urban dwellers cultivate open spaces to subsidize their income and sustain their livelihoods. However, lands used for UPA are becoming increasingly scarce due to high competition from other land uses and the rapid population growth being experienced in many cities of the developing world (Forkuor& Cofie, 2011).

Solutions have been sought towards shortage of land for UPA. Recent land-use development in Dar es Salaam's peri-urban areas, have been characterized by infill rather than further linear expansion along route ways, densification of existing linear settlement and by limited spatial growth to the south of the city in order to sustain both development and agricultural production in the peri-urban zones (Briggs and Mwamfupe, 2014).

Summary of Knowledge Gaps

It is evident from the studies done that urban sprawl in the world cities is unavoidable. In this essence, the land is basically converted from natural biophysical state to human dominated environment. The agricultural land within the urban fringes will continue to shrink and come with its effects on human livelihoods. This means that providing food to the ever-rising population will thus be unending struggle and in this, the natural resources continue to be strained or exhausted if not diminished in value. Land use changes lead to development and accessibility of remote areas and increased income to people living in the peri-urban areas while at the same time promoting social cultural benefits. However, unsustainable LU changes have negative implications on rural livelihoods and natural-resource management (Munthali et al., 2019).

Perceived effects of land use changes on households' livelihoods include the social, economic, and environmental effects. Development of peri-urban areas lead to increased income and diverse sources of livelihoods. However, knowledge on how land use changes in peri-urban areas of Nakuru City affects households' livelihood is lacking.

Research Methodology

Study Areas

The study area comprised the peri-urban areas of Nakuru City Figure 3.1 ($0^{\circ} 16' 1'' N$ $36.04^{\circ} E$), the headquarters of Nakuru County. Nakuru is Kenya's 4th largest city with a population of 570,674 (NCIDP, 2018). The peri-urban areas of Nakuru city include Barut, Lanet Umoja, Kiamaina, Viwanda, Ngata and Mbaruk sub-locations as indicated in Figure 3.1.

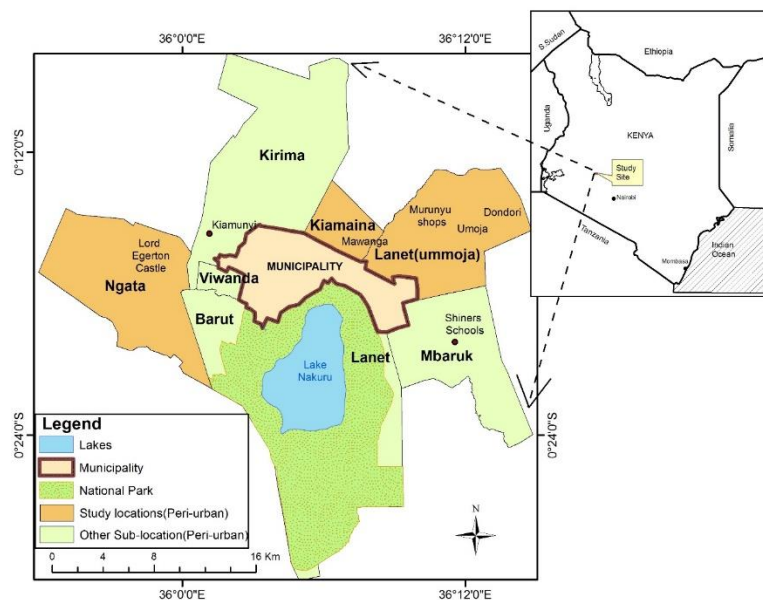


Figure 1: A Map Showing Study Locations in the Peri-urban Areas of Nakuru City

Source: Survey of Kenya, 2022

Research Design

The study adopted a household survey research design. It is very useful in obtaining an overall picture of the study as it stands at the time of the study (Cochran, 1963).

Target Population

The target population for this study were all households in peri-urban areas of Nakuru City.

Sampling Procedure and Sample Size

Out of the seven locations surrounding Nakuru city: Barut, Lanet Umoja, Kiamaina, Ngata, Kiamunyi, Viwanda and Mbaruk, only three locations were purposely selected for study. These include: Kiamaina, Ngata and Lanet-Umoja. The selection of these 3 sub-locations was based on their location along the major tarmac roads. Areas along these major roads depict significant changes in land use because roads facilitate flow of people, goods and services into and out of a locality. Within the selected study locations, households were randomly selected for the study.

To determine the sample size, the formula by Cochran (1963) is applied.

$$n_o = \frac{z^2 pq}{e^2}$$

Where:

n_o = The desired sample size for target population greater than 10000

z = Standard normal deviate at the required confidence level (1.96)

p = estimated proportion of the population.

q = $1-p$

e = accepted level of confidence.

$$n_o = \frac{(1.96)^2 \times 0.5 \times 0.5}{0.05^2} = 385$$

Instruments

A semi-structured questionnaire was the primary tool used to obtain primary data. The questionnaire consisted of both closed and open-ended questions. Data collection was done by the researcher and trained enumerators who issued the questionnaires to the households' heads after the instruments had been thoroughly pre-tested to ensure that it was adequate and dependable in obtaining high-quality data.

Validity and Reliability

Tool of data collection was tested to weigh its content, face and construct validity. Face validity was to determine if the format of the instruments was appropriate and met all the typology requirements. Content validity determines whether the contents of the instruments are adequate enough to represent the study area and hence worth to be used in drawing general conclusions. Construct validity determined the characteristics measured by the instruments. Reliability of the tools was estimated after the pilot study using the Cronbach's reliability co-efficient.

Data Analysis

Cross tabulations were employed to determine whether land use changes affect households' livelihoods and the kind of relationship between rising city population and land use changes in the peri-urban areas

of Nakuru City. Descriptive analysis was used to describe the perceived effects of land use changes on households' livelihoods in the study areas.

Results and Discussion

Introduction

This paper presents a discussion of the research findings on the assessment of the perceived effects of land use changes on household livelihoods in peri-urban areas of Nakuru City, Kenya.

Response Rate and Test of the Research Instruments

The study targeted a sample of 385 respondents from three peri-urban areas of Nakuru town, namely: Kiamaina, Ngata and Lanet Umoja. The study obtained 292 valid responses out of the 385 administered semi-structured questionnaires representing a response rate of 75.84%. The above response rate was considered as sufficient for making inferences from the results. Previous studies such as Mugenda and Mugenda (1999) considered a response rate above 70.0% as very good for making inferences. However, the 24.16% non-response rate provided inconsistent and incomplete information, which was not included in the analysis and discussion of the findings. Table 1 summarizes the distribution of the sample respondents across the three study areas.

Information in Table 1 indicates that 36.0% of the respondents were from Lanet Umoja, 34.6% from Kiamaina and 29.5% from Ngata peri-urban areas. The sample was stratified according to the population size of each study area.

Table 1: Distribution of the sampled respondents across the study Areas

	Targeted Sample	Actual Sample	Percent
Lanet umoja	137	105	36.0
Kiamaina	152	101	34.6
Ngata	96	86	29.5
Total	385	292	100.0

Source: Author, 2023

Demographic Characteristics of the Respondents

Selected characteristics included age, gender, and highest level of education, household size, employment status and main occupation. These characteristics influenced and determined the land use changes experienced in the study areas.

Land Use Changes and Livelihoods

The objective assessed the perceived effects of land use changes on households' livelihoods in peri-urban areas of Nakuru city. Land is a resource useful in obtaining livelihoods. Any change in its usage has an influence on both livelihood strategies and outcomes. The study sought to investigate land characteristics, land use changes and the perceived effects of land use changes on livelihoods. The study assessed the perception of the sample respondents about the effects of land use changes on their livelihoods from two perspectives, namely: livelihood strategies and livelihood outcomes discussed in the subsequent subsections.

Land Characteristics

The findings of the study indicate that the sampled respondents had lived in the study areas for a mean of 13.13years. The study considered this duration as sufficient for the respondents to have gained adequate knowledge and experiences about the land use changes in their study areas over time. The study established that only 6.8% of the respondents were born in the study areas while the remaining 93.2% migrated to the areas. However, the 93.2% respondents who migrated varied in their places of origin as summarized in Table 2.

Information in Table 2 shows that 47.1% of the respondents migrated from Nakuru town, 40.4% came from other towns and 12.5% from rural areas into the study areas located in the peri-urban areas of the town. Their migration was attributed to various pull and push factors as summarized in Table 3.

Table 2: Place of Origin of the Migrants

Place of origin	Frequency	Percent
Nakuru town	128	47.1
Other towns	110	40.4
Rural areas	34	12.5
Total	272	100.0

Source: Author, 2023

Table 3 indicates that 41.5% of the respondents migrated to the three study areas in search for better and affordable housing to settle their families. The respondents reported that the high population and rent charges in Nakuru town influenced their movement into the surrounding peri-urban areas in search for better and affordable own-houses. The respondents bought land in the three study areas where they constructed their family homes. Another 6.3% of the respondents reported that they settled in the three peri-urban areas after retirement from active employment. They preferred the peri-urban areas since they were less crowded and provided cool atmosphere for life in retirement.

In addition, 29.0% of the respondents moved and settled into the study areas because of availability of employment opportunities outside their centre of Nakuru town. In connection with availability of employment opportunities, 8.8% of the respondents reported that they settled in these peri-urban areas to practice farming because of the huge market in Nakuru town and the surrounding. The respondents engaged in crop and dairy farming, which had ready market within the area and the town center. The study also established that 9.6% lived in the study areas by virtue of marriage and family. The areas were ideal for a family setup, especially for people preferring more privacy and space.

Lastly, 4.8% of the respondents reported that for a long time, Rift Valley region experienced recurrent violent political and ethnic conflicts before, during and after the general political election periods in the country since the early 1990s. The situation became worse during the 2007 post-election violence, where majority of the people displaced in the region migrated and settled in Nakuru town and its environs as a refugee centre. This is also the case in other parts of the world for example, civil war in Thapangthong District, Savannakhet Province, in China which caused reduction of forests and displacement of people (Macmillan, 2016).

Table 3: Reasons for migration into the study areas

Reason	Frequency	Percent
Better and affordable housing (settlement)	113	41.5
Employment	79	29.0
Marriage	26	9.6
Farming	24	8.8
Retirement	17	6.3
Political violence	13	4.8
Total	272	100.0

Source: Author, 2023

After establishing reasons for settlement in the study areas, the respondents were then asked about their land ownership and size. Table 4 summarizes the land ownership among the respondents.

Information in Table 4 shows that 73.3% of the respondents owned land with title deeds, 16.4% had leased their land, while 10.3% had rented their land. Therefore, majority of the respondents operated on privately owned land with registered title deeds and full user-rights. The respondents observed that this gave them legal security of tenure and thus state protection against eviction threats. This was an inducement for the respondents to invest more in farm management, renovate, improve, and upgrade their land. The 10.3% of the respondents who had rented their land reported that this provided them with opportunities to practice commercial crop farming targeting the ready market in the neighbourhood and Nakuru town. Crop farming entailed short-term horticultural crops that included assorted vegetables. The remaining 16.4% of the respondents operated on leased land. This was a legal agreement of tenure conferring full user-rights but with no transfer rights over the property (land or house) within a certain fixed period and under specific conditions.

From the land ownership, the study established the respondents varied in the size of land that they owned. In the study area, the respondents had a mean of 1.95077 acres with a minimum of 0.125 acre and a maximum of 8.0 acres. It was observed that 50.3% of the respondents operated on lands of up to 1.0 acres. The relatively small land sizes were attributed to the high demand and increasing population density, which reinforced fragmentation and intensive utilization of the land in the area. The researcher asked respondents whether the land size has ever changed since acquisition and summarized their responses in Table 5

Table 4: Land Ownership

Ownership	Frequency	Percent
Owned with title deed	214	73.3
Leased	48	16.4
Rented	30	10.3
Total	292	100.0

Source: Author, 2023

Table 5 indicates that 47.9% of the respondents had not witnessed any change in their land size, 24.0% had observed a decrease while 28.1% reported an increase. The study established that changes in land size is an individual endeavor, which varied across the respondents. The 24.0% of the respondents reported that the high level of poverty had forced them to sell part of their land to meet other domestic needs. The study established that the high returns from investment in commercial residential homes

and/or farming activities had motivated 28.1% of the respondents to buy and expand their land. The remaining 47.9% were comfortable with their land sizes and thus witnessed no change.

Table 5: Change in Land Size

	Frequency	Percent
Increased	82	28.1
Decreased	70	24.0
No change	140	47.9
Total	292	100.0

Source: Author, 2023

Land Use Change

After establishing the land characteristics, the study went further to interrogate the land use changes among the respondents. The respondents were asked about the main land use activities in the area at the time of migration. Table 6 depicts their observations.

Table 6 indicates that 40.1% observed open land, 37.3% had farming, and 15.4% had quarrying activities and 7.2% saw residential housing. Majority of the respondents from Kiamaina and Lanet Umoja reported that the two areas were previously open lands with quarrying activities taking place in some pockets of Kiamaina. In Ngata, respondents reported farming since the area was previously an Agricultural Development Corporation farm. However, we also had scattered residential housing across the three study areas.

The respondents varied in terms of whether there were changes in land use activities over the years. Accordingly, 76.7% of them reported that there had been changes in land use in the study areas over the years while 23.3% had not observed any such changes. The respondents reported that they had experienced farming and open land losing to residential activities over time. The 224 respondents enumerated several reasons for the changes in land use activities as captured in Table 7.

Table 6: Main land use activities at the time of migration

	Frequency	Percent
Open land	117	40.1
Farming	109	37.3
Quarrying	45	15.4
Residential housing	21	7.2
Total	292	100.0

Source: Author, 2023

Table 7 indicates that the main causes of changes in land use activities included population increase (49.1%), high demand for housing (22.8%), availability of business opportunities (18.3%) and climate change (9.8%). The respondents observed that over the years, the population of Nakuru town has been increasing leading to outward expansion of the town into the surrounding peri-urban areas where the study areas are located. In addition, the population within the three study areas has also been increasing putting a lot of pressure on land and the available land use activities. Over time, the previous open lands and large farmlands had been subdivided into small parcels and change in land use activities. These findings confirm observations of previous studies that land use change is influenced by both the increase

and decrease in given population (Lambin et al., 2003). For example, in Ethiopia, population growth has been a dominant cause of land use changes than other forces. Turner (1994) adds that there is a significant statistical correlation between population growth and land use changes in most of the African, Asian, and Latin American countries. Population growth leads to the increasing demands of food production, expanding agricultural lands at the expense of natural vegetation and grassland (Lambin et al., 2003).

The respondents also observed that the high demand for housing in Nakuru town and its peri-urban areas had also seen farm and open lands converted into commercial and residential functions to maximize on profits. The high demand for food products in Nakuru town had also led to intensive farming in the peri-urban areas including the study areas. In addition, increased business opportunities in the town and study areas had contributed to the increased quarrying activities to provide building materials. Lastly, the respondents reported that as a result of climate change, there has been increased drilling of water boreholes to supply water in the three study areas and Nakuru city. This is also true to Bufebo and Elias (2020), who in their study mentioned climate change, biodiversity loss, scarcity of basic forest products, habitat alteration leading to human-wildlife conflicts, decline in quality and availability of water, reduction in crop yield as a result of accelerated runoff, and soil degeneration to be the major consequences of land use change in Shenkolla watershed in South Central Ethiopia.

In addition to the study area in general, the study also sought to establish the land use activities among the sample respondents. The respondents were asked about the main land use activity on their land at the time of acquisition and the responses captured in Table 8.

Table 7: Main causes of changes in land use activities

Cause	Frequency	Percent
Population increases	110	49.1
High demand for housing	51	22.8
Availability of business opportunities	41	18.3
Climate change	22	9.8
Total	224	100.0

Source: Author, 2023

Table 8 shows that the main land use activity on the land of the respondents at the time of acquisition were open land (46.9%), farming (41.8%), residential housing (7.9%) and quarrying (3.4%). The respondents reported that the peri-urban areas of Nakuru town were either government Agricultural Development Corporation land or open lands with limited activities at the time of acquisition of their land. In general, the study areas were ideal for land buying companies who bought large parcels of land, subdivided and sold it to individuals including the respondents in this study. Only a few of the respondents had quarrying and residential housing on the land at the time of acquisition.

All the respondents reported that there were changes in the land use activities on their individual lands since acquisition. They had individually changed the land use activities in accordance with the intended purpose of acquisition. The respondents summarized the current land use activities on the respondents' lands in Table 8.

Table 8: Main Land use activity of land at the time of acquisition

	Frequency	Percent
Open land	137	46.9
Farming	122	41.8
Residential housing	23	7.9
Quarrying	10	3.4
Total	292	100.0

Source: Author, 2023

Table 9 shows that the respondents were currently using their land for family residence (45.9%), farming (32.5%) and commercial/rental building (21.6%). However, the respondents varied in their reasons for changing the land use activities since acquisition as captured in Table 10

Table 9: Current land use activities on the land

Activity	Frequency	Percent
Family residence	134	45.9
Farming	95	32.5
Commercial/rental building	63	21.6
Total	292	100.0

Source: Author, 2023

Table 10 indicates that the main reasons for changes in land use activities included need for better and spacious housing (45.9%), need to generate income (34.2%) and availability of market and high demand for farm produce (19.9%). The respondents reported that overcrowding and high rental charges was one of the reasons for migrating to and settling in the study areas. They preferred to move to construct better and spacious houses for their households. This was reflected by the dominance of single housing units in the three study areas. The respondents added that some of them constructed commercial/rent housing and/or engaged in urban farming to generate additional income by taking advantage of the available market and high demand for farm produce in the town and the surrounding. Bustch (2020), describes peri-urban areas as a multifunctional and complex region, where land uses comprise low density settlement, functional agriculture, open green space, agro-business, and industrial areas. This area also has an abundant supply of relatively cheap land and good road network, which attracts investment and development. This is evident in the three study areas.

Table 10: Main causes of changes in land use activities since acquisition

Cause	Frequency	Percent
Need for better and spacious housing	134	45.9
Need to generate income	100	34.2
Availability of market and high demand for farm produce	58	19.9
Total	292	100.0

Source: Author, 2023

Perceived Effects of Land Use Changes on Livelihoods

The study assessed the perception of the respondents about the effects of land use changes on household livelihoods in peri-urban areas of Nakuru city. Previous studies indicate that land use changes impact on the livelihood strategies and livelihood outcomes of the respective respondents. Land use changes

are the most important factors that influence the livelihood since majority of people depend on the land and its natural resources for their livelihood. Changes in land use have serious environmental, economic and social impacts on livelihoods. The study assessed the perception of the effects of land use changes on the livelihoods from two perspectives namely the adopted livelihood strategies and associated livelihood outcomes discussed in the subsequent subsections.

Effects of the Land Use Changes on the Livelihood Strategies

The sample respondents were asked whether their current land use changes in any way influenced their livelihood strategies at the household level. Table 16 summarizes the views of the respondents.

Information in Table 11 indicates that 71.6% of the sample respondents pursued livelihood strategies directly related to the current land use changes in the study areas. The respondents observed that their land use changes created enabling environment that influence their current adopted livelihood strategies. The settlement in the three study areas and the associated opportunities created a conducive environment for their livelihoods. The remaining 28.4% of the respondents observed that their livelihoods have not changed regardless of the changes in land use changes in the study areas. The 209 respondents enumerated the specific livelihood strategies attributed to the land use changes as

Table 11: Effect of land use change on current livelihood strategies

	Frequency	Percent
Yes	209	71.6
No	83	28.4
Total	292	100.0

Source: Author, 2023

Information in Table 12 indicates that the land use changes contributed to the diversification of income generation opportunities (30.1%), crop farming (27.3%), creation of free time and financial freedom to invest (24.4%), horticultural farming (12.9%), and dairy farming (5.3%). Thus, the land use changes made a significant contribution to the development of livelihood opportunities and strategies among the sample respondents.

The land use changes diversified the economic opportunities of 30.1% of the respondents in the three study areas. The respondents observed that the main objective was to promote income generating activities as a strategy to improve incomes. The current land use changes created an enabling environment, which provided diverse income-generating opportunities and improved local economies. The majority of the respondents benefited from more than one economic activity thereby expanding their income sources. For example, some of the respondents reported using their plots of land to construct rental houses, while others engaged in commercial farming. From field observations, majority of the households were engaged in small business activities, which diversified the sources of income among the respondents. In summary, diversification of income generation opportunities provided multiple income sources, minimized vulnerability, and stabilized incomes among the respondents.

Similarly, 24.4% of the respondents reported that their current land use changes enabled them to create free time and financial freedom to invest. Living in their own homes enabled the respondents to save on the rent that they previously used to pay property owners in town. The respondents used the saved rental charges to invest and engage in income generating activities within and outside their residence.

Information in Table 12 revealed that land use changes enabled 45.5% of the respondents to engage in farming activities including 27.3% in crop farming, 12.9% in horticultural farming and 5.3% in dairy farming. Some of the respondents engaged in farming activities within their compounds while others used their improved incomes to rent land for farming within the study areas. The respondents observed that this was necessitated by the readily available market in the nearby Nakuru town and the surroundings. They engaged in commercial crop and horticultural farming in addition to poultry and dairy farming. From field observations, several respondents had kitchen gardens in their residential plots to boost food availability and generate incomes through the sale of the produce. The respondents reported engaging in various types of farming enterprises including crop farming, livestock keeping, and mixed farming. The common food crops grown included assorted types of vegetables (such as kales - *sukuma wiki*, cabbage, spinach, onions, tomatoes, etc.), maize, bananas, sugar cane, beans, and potatoes. The common livestock kept were poultry, goats, sheep, pigs, rabbits, and cattle. This matches the findings of a study on Dynamics of Land Use Changes on the Livelihood of Local Communities in Baringo County where land use changes increased livelihood assets productivity in highlands. The increase in livelihood assets productivity in highlands of Baringo is associated with security of land tenure under registered private land use (Kateiya et al., 2021).

Table 12: Specific livelihood strategies influenced by the land use changes

Livelihood Strategy	Frequency	Percent
Diversified income generating activities	63	30.1
Crop farming	57	27.3
Creation of free time and financial freedom to invest	51	24.4
Horticultural farming	27	12.9
Dairy farming	11	5.3
Total	209	100.0

Source: Author, 2023

Perceived Effects of Land Use Change on Livelihood Outcomes

From literature review, positive livelihood strategies significantly influence positive and beneficial livelihood outcomes among respondents. Changes in land use has serious environmental, economic and social impacts on livelihoods. Therefore, from the conceptualization of the literature review, the study identified eight basic livelihood outcomes including household vulnerability, income, food security, well-being, access to credit, security of tenure, access to quality water and soil fertility. The study asked the 71.6% of the sample respondents who pursued livelihood strategies directly related to the current land use changes to rate their perceived effects on the above eight basic selected livelihood outcomes.

The respondents based their rating on a comparison of the conditions of each of the above selected livelihood outcome at the time of acquisition of land in the area and current status. The rating was done on a five-point Likert scale ranging from 0 to 4 as described in Chapter three. The scale represented a continuum from no effect to very high impact, where 0 indicated negative effect (NE), 1 indicated low positive effect (LPE), 2 indicated average positive effect (APE), 3 was high positive effect (HPE) and 4 indicated very high positive effect (VHE). The higher the score, the more positive effect on a specific livelihood outcome, and vice versa. The respondents also provided a justification of their rating of each selected livelihood outcome. Table 18 summarizes the rating of the effect of land use changes on selected livelihood outcomes by the respondents.

Information in Table 13 indicates that the sample respondents varied in their perceptions of the effects of land use change across the eight selected livelihood outcomes. All the livelihood outcomes had a mean score above 0.000 suggesting some positive effect of land use change on the eight-selected livelihood outcomes. In order of magnitude of the effect, the respondents rated the livelihood outcomes as follows; improved security of tenure, food security, access to credit, income, soil fertility, well-being – quality of life, vulnerability, and access to quality water.

Table 13 shows that improved security of land tenure had a mean score of 3.61 ± 0.876 . Respondents reported that by settling in the study areas, the current land use change encouraged them to pursue and process title deeds for their land. This had witnessed reduced cases of forced eviction and/or demolition of structures, which were previously pervasive in the study areas. Some of the respondents used their land and/or house as collateral to secure credit. Increased security of tenure triggered private investment in housing improvement, wealth production, and property development.

Moreover, the respondents rated improved food security with a mean score of 2.81 ± 1.096 . The respondents reported improved food security in terms of quality, quantity, access, and availability. They observed that before moving and settling in the study area, they were vulnerable to changes in food availability and prices in Nakuru town. However, their settlement in the study areas and current land use changes had enabled them to engage in farming thereby improving food production and incomes. Some of the respondents used their plots of land for farming, which produced food for domestic consumption and generated income

Information in Table 13 further indicates that improved household access to credit had a mean score of 2.80 ± 1.358 . The respondents observed that the settlement in the study areas and the associated saving of previous rental expenditure encouraged a saving culture through the formation of saving groups and social networks where residents pooled their meagre financial resources together for investment and provision of affordable credit. In addition, the saving groups strengthened the bond between members, which in turn strengthened social capital in the study areas. This also true to research done by Isaac & Matous, (2017) in Ghana which shows a positive correlation between land use and social network ties.

The land use changes improved household income with a mean score of 2.73 ± 1.073 . Respondents reported that the main goal of settling in the study areas was to use the saved income to diverse income-generating opportunities, which improved local economic activities and disposable incomes. In addition, the sample respondents rated reduced vulnerability with a mean score of 2.58 ± 1.203 . Respondents reported that the land use changes enabled them to diversify their income-generating opportunities, which improved incomes and enhanced their purchasing power. In addition, improved access to better and quality housing minimized the threat of eviction, reduced incidences of diseases, and ensured improved well-being. There was increased access to improved water and sanitation, which reduced incidences of water-borne and communicable diseases among the respondents. Thus, diversified IGAs, access to low-cost housing, and increased access to improved water and sanitation significantly reduced the level of vulnerability among the respondents.

The respondents rated improved soil fertility with a mean of 2.07 ± 1.923 . They observed that increased farming activities and construction of houses had assisted in better retention of water, reduced soil erosion and improved soil fertility.

The respondents also rated improved household well-being and underscored change in quality of life in terms of better health and socio-economic status with a mean score of 1.99 ± 1.676 . The respondents reported that the current land use changes had a significant positive change in the quality of their lives resulting from improved socio-economic conditions in terms of increased income, food security, access to credit and access to basic services. They reported that there was increased access to improved water and sanitation, which in turn contributed to better health and socio-economic well-being by reducing incidences of water-borne and communicable diseases. Increased access to water enabled respondents to reallocate the time saved and engaged in other IGAs. In addition, the construction of adequate and quality housing had reduced the susceptibility to diseases and illnesses. Some respondents observed that improved security of tenure reduced the threats of eviction and increased access to basic municipal services. This is in conjunction with a study on property rights, security of tenure and the urban poor in Metro Manila recommends that in order to improve security of tenure, intermediate instruments of tenure such as land proclamations and occupancy leases should be utilized (Porio & Crisol, 2004).

However, the increased land use changes in the study areas had increased population in the area leading to over-abstraction of ground water through the use of boreholes. This had witnessed a compromise of the access to quality water in the study areas (0.64 ± 1.352). This is in agreement with the results of a study on local perception of drivers of land use dynamics across Dedza District, Central Malawi Region which concluded that land use changes have a negative effect on availability of natural resources (Munthali et al., 2019).

In addition, the high dependence on natural resources such as land, forests, and water puts pressure on these resources, leading to overexploitation, forest degradation, and deforestation (Ferreira et al., 2008).

Table 13: Rating of the perceived impact of the projects on livelihood outcomes

Effect of land use and land cover change on	Response (%)					Mean	Std. Dev.
	NE	LPE	APE	HPE	VHE		
Household security of land tenure	2.4	2.9	3.9	13.9	77.5	3.61	0.876
Household food security	6.2	6.7	13.4	46.9	26.8	2.81	1.096
Household access to credit	9.6	10.5	14.8	20.6	44.5	2.80	1.358
Household income	8.1	1.0	23.0	45.9	22.0	2.73	1.073
Household vulnerability	23.4	40.7	15.8	11.5	8.6	2.59	1.210
Soil fertility	41.6	8.1	0.0	2.4	47.8	2.07	1.923
Household well-being – quality of life in terms of health and socio-economic status	36.4	7.7	0.0	32.5	23.4	1.99	1.676
Household access to quality water	78.9	3.8	1.9	4.8	10.5	0.64	1.352

Source: Author, 2023

From the above individual ratings, the study aggregated the individual scores of the perceived effects on all the selected eight livelihood outcomes into a composite index score known as a livelihood outcome index score. The higher the index score, the higher was the perceived level of impact of the land use change on the livelihood outcomes among the sample respondents, and vice versa. The index score ranged from a value of 0 indicating negative to 32, indicating very high positive effect. The index score had a reliability coefficient of $\alpha = 0.683$ with a mean of 19.24 ± 6.053 . The study transformed the index score into four ordinal categories namely a score of 0 (negative effect), a score of 1-11 (low positive effect), a score of 12-21 (average positive effect), and a score of 22-32 (high positive effect).

Table 14 summarizes the overall perceived level of effect of the land use changes on the livelihood outcomes.

Information in Table 14 indicates that the sample respondents varied in their overall perception of the effects of land use changes on the livelihood outcomes in the study areas. On the overall, 52.6% of the respondents rated the land use change to have a high positive effect on their livelihoods, followed by 35.4% who reported average positive effect and 12.0% with low positive effect. Being beneficiaries of their movement and settlement in the study areas and associated land use changes, the respondents perceived their actions to have a positive effect on their livelihood. The findings are in consonant with previous studies such as Lambin et al. (2003) who observed that land use changes are associated with positive influences in terms of increases in food production, resources use efficiency wealth, livelihood security, welfare and human well-being.

Table 14: Perceived overall effect on livelihood outcomes

Effect	Frequency	Percent
Low positive	25	12.0
Average positive	74	35.4
High positive	110	52.6
Total	209	100.0

Source: Author, 2023

Conclusion

Land use changes from this study, have an effect on households' livelihood strategies and their livelihood outcomes in peri-urban areas of a city because it enables the households to diversify the economic opportunities. This forms a strong influence towards development of peri-urban areas into an urban environment. It is advantageous in that land use changes are associated with positive influences in terms of increases in food production, resources use efficiency wealth, livelihood security, welfare and human well-being. However, such advantages are short term because they cause environmental degradation in peri-urban areas such as increase in waste and reduction in the quality and quantity of water sources. This study therefore recommends that in order to relieve pressure from large urban agglomerations of developing countries, policies and strategies should be implemented towards the development of intermediate cities that create employment opportunities for unemployed labor in the rural areas and support rural-based economic activities. Although, sound urban management is essential to ensure that urban sprawl does not expand resource degradation or increase pressures to convert open space and agricultural/buffer lands in peri-urban areas into built up areas. This can be done by implementation of the following National urban policies:

- All citizens to identify urban development priorities towards socially and economically equitable and environmentally friendly urban and national development
- The environmentalist to provide guidance on the future development of the national system and its spatial configuration concretized through national and regional spatial plans for territorial development
- Government and different NGOs should take steps to provide training about the impact of land use changes

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Appendix: A Household Questionnaire for Peri-Urban Areas Of Nakuru City

The purpose of this questionnaire is to collect data which will be used to evaluate the effects of land use changes on households' livelihoods in peri-urban areas of Nakuru City. The information provided will be used exclusively for academic purposes and will be held confidential. Your cooperation and assistance are highly appreciated.

Personal Details

- 1) Age (in complete years) _____
- 2) Gender: Male Female
- 3) Marital status:

Married	<input type="checkbox"/>	Never married	<input type="checkbox"/>
Separated	<input type="checkbox"/>	Divorced	<input type="checkbox"/>
Widow/widower	<input type="checkbox"/>		
- 4) Highest level of education

No formal education	<input type="checkbox"/>	Primary	<input type="checkbox"/>
Secondary	<input type="checkbox"/>	Tertiary college	<input type="checkbox"/>
University	<input type="checkbox"/>		
- 5) Head of household Male Female Relatives of the head of household
- 6) Household size: _____
- 7) Residential area Ngata Kiamaina Lanet Umoja
- 8) Employment status

Salary employment	<input type="checkbox"/>	Self-employment	<input type="checkbox"/>	Unemployed	<input type="checkbox"/>
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- 9) If employed (including self-employment), what is your main occupation? **Choose only one that applies**

Farming	<input type="checkbox"/>	specify _____
Business	<input type="checkbox"/>	specify _____
Public civil servant	<input type="checkbox"/>	specify _____

Private sector employment specify _____

Land Characteristics

1. How long have you lived in this area? (years) _____

2. If less than 20 years in Qn 1, where did you live before

Rural area Nakuru town Other towns

3. What was the reason for migration into this area?

Marriage Employment Retirement

Farming Others (specify) _____

4. Your land ownership

Own with Title Deed Leased Rented Communal

5. Your current land size (in acres) _____

6. Has there been any changes in land size since acquisition:

Increased Decreased No change

Land use change

1. What were the main land use activities on this area at the time that you were migrating here? _

2. Has there been any changes in land use activities since over time?

Yes No

3. If yes, what are the main land use activities currently in this area? _____

4. If yes, what are the main causes of changes in the above land use activities since over time? __

5. In reference to your land, what was the main land use activity on it at the time of acquisition? .

6. Has there been any changes in the above land use activities on your land since acquisition? Yes

No

7. If yes, what is the main land use activity currently on your land? _____

8. What necessitated the change in the land use activities on your land since acquisition? _____

Impact of the land use change on Livelihoods

In your opinion, has the land use change influenced your current livelihood strategies adopted by your household? Yes No

If yes, what are your specific current livelihood strategies directly linked to the land use change? *Identify and explain* _____

On a scale of 0 to 4, where 0 = negative effect (NE), 1 = neutral (N), 2 = low positive effect (LPE), 3 = average positive effect (APE), 4 = high positive effect (HPE), rate the level of effect of land use change on the following livelihood outcomes:

	NE	N	LPE	APE	HPE	Explain
Household vulnerability						
Household income						
Household food security						
Household wellbeing – quality of life (health and socio-economic)						
Household access to credit						
Household security of tenure						
Household access to quality water						
Soil fertility						

THANK YOU FOR YOUR PARTICIPATION