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Urbanization and its effects on environmental resources: a review of key issues

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Abstract
Urbanization is the rapid development and transformation of a region, including increase in the size, population and human activities at a given period of time. The major problem of rapid urban growth is the changing land use patterns. Land use change is the change in land cover and land use. Uncontrolled development of towns due to rapid urbanization has led to deteriorating environmental quality, loss of prime agricultural lands, destruction of wetlands and loss of aquatic and wildlife habitats in the adjacent regions. It is globally known that urbanization, one of the major drivers of land use change, has profound impact on environmental resources. More than 10 percent of the existing urban developments in most developing nations are in environmentally sensitive areas. Therefore, the environmental impact of urbanization is certain to intensify unless there is a change in land use planning and decision-making processes. Recognition and protection of environmental resources need to be prioritized in land use planning and decision-making hierarchies. This paper examines the impact of rapid urbanization processes on environmental resources. The paper is based on secondary research and review of publications and documents dealing with natural resource management, conservation, spatial plans, physical plans, management plans and/or development plans of natural resources. From a review of the key issues, it is noted that Urbanization, which has put urban areas on soils that are best suited for other uses such as food and fibre, forests and wetlands, has resulted in rapid land use change. New homes, buildings, roads and other structures are being built every day on arable land. The underlying causes of land use change are the fundamental forces that alter one or more proximate causes and operate at regional or even global level. Most of the fundamental forces are technological, economic, political, institutional, demographic and cultural in nature. The paper recommends that developments should be guided by sound knowledge about the soil information of the urban expansion areas. Moreover, individuals and development agencies that fail to comply with regulations on environmental impact should be severely punished through strong legislation and law enforcement.

Keywords: Urbanization, Environmental Resources, Issues, Ecosystem, Urban Development, Population

Introduction

The global proportion of urban population has been rising rapidly over the last decade. Estimates indicate that in the mid-1990s, 43 percent of the world's population lived in urban areas. This figure is projected to become three-fifth of the world's population by 2025 (United Nations, 1993) [16]. This growth is expected to result from large movement of people to cities to take advantage of increased opportunities and improve their standards of living.

In the last few decades, land use practices (agriculture, mining, logging, housing, recreation, among others) have become so intensive and predominant. Despite the good that these practices have on human development, their negative impact is beginning to outweigh their benefits through uncontrolled development (urbanization and sprawl), deteriorating environmental quality, loss of prime agricultural lands, destruction of wetlands and loss of fish and wildlife habitats everywhere on the earth. Such impacts have reduced the capacity of local lands to support both ecosystem and human global enterprise.

Therefore, the effect of land use change is no longer a local environmental problem but a global one (Houghton, 2009) [4] To address such a problem, detailed information on existing land use patterns and sound knowledge of the changes in land use through time is important for legislators, planners as well as state and local governmental officials (Anderson, Hardy, Roach & Witmer, 2006).

According to The Nature Conservancy (2008) [12] report, towns are growing faster today than before all over the world and there will probably be nearly 2 billion new town residents, accounting for around 60 percent of the world's population, by 2030 leading to a severe damage to natural resources and ecosystems. Wherever towns grow, they require more land and resources to support their growth. This in turn leads to change in land use causing environmental problems such as air and water pollution, loss of open space and biodiversity, heat island effects, and so on (The Nature Conservancy, 2008) [12].

Advancement of every community depends, to a considerable extent, on the judicious use and management of available land resources. Land, therefore, has the singular characteristic of being the most important factor in the sustenance of mankind (Adarkwa & Post, 2011). Consequently, it is necessary to ensure that land use is in conformity with planning regulations. In recent times, the structure of many smaller towns in Africa has been changing drastically. The land use changes have mostly been caused by rapid urbanization which engenders changes in the urban environment such as increased population, changes in the political setting, growth of institutions and swift growth of economic activities. The rapid changes in the trend of urbanization in Africa indicate possible Impacts on urban land use and provide the ingredients that Facilitate change in land use patterns of the urban areas.

The human populations in towns in Africa are growing and rural to urban migration is on the rise. Therefore, the

urbanization trend will continue to happen in the future years. This will in turn increase land and resource consumption and exacerbate the environmental problems which have already posed threats to the environment and cost billions to our economy. Therefore, planners, governments, planning agencies and all relevant stakeholders in Africa must urgently begin to acknowledge these problems and put environmental perspective into land use planning and decision-making processes.

Statement of the Problem

The major problem of rapid urban growth is the changing land use patterns. As noted by Kemei (2009), the general characteristics of rapid urbanization experienced by towns in Kenya, among other developing countries, are rampant changes in land and building uses. The peaceful environment characterizing typical growing town in Africa, for instance Kapsabet town in the North Rift region of Kenya, coupled with the relatively endowed natural resources, as well as the towns' commercially-oriented economies has acted as a 'pull' factor for migrants causing increase in urbanization

Uncontrolled development of such towns due to rapid urbanization has led to deteriorating environmental quality, loss of prime agricultural lands, destruction of wetlands and loss of aquatic and wildlife habitats in the adjacent regions. Plate 1 below illustrates a typical case of a previously agriculturally viable land that has now been converted to a dumpsite in Kabsabet town in Kenya.

Plate 1: Previously agricultural land made dumpsite in Kapsabet town, Kenya

Plate 2: A wetland turned dumpsite and agricultural land in Kapsabet town

In the same town, other areas that were previously robust wetland ecosystems have also undergone land use changes. Plate 2 above illustrates an area that was previously a wetland that has been turned into another dumpsite, interfering with its ecosystem.

Kapsabet town is the headquarters of Nandi County. The County Integrated Development Plan (2013-2017) for Nandi County identifies a number of environmental concerns in the town that need urgent attention. Key among them are: situation of industrial projects within environmentally sensitive areas; transport corridors that are within geologically unstable environmental areas; highway designs that do not provide cut and fill that blend with the surrounding landscape; inappropriate dumping sites, and conflict between socio-economic development and environmental development. These aspects stem from the County government's realization of the dangers posed by rapid urbanization on the environment of Kapsabet town. Better management of land resources in Kapsabet, as in any other growing town, is essential for the sustainability and improvement in the quality of environmental resources and hence the quality of life of residents in the area. The environmental perspective must be incorporated into land use planning and decision-making processes of every government and development agency.

A Theoretical Perspective of Urbanization

This paper is based on the Urban Land Use Theory as propounded by Alonso (1964) [1]. In many respects, the urban land use theory is a logical extension of agricultural location theory. The theory asserts that each urban area has one focal point which is its centre. This centre, on the isotropic plain, is the most accessible location in the urban area.

Urban land uses are arranged around the central place that is in concentric rings. The basic reason is that land users compete for the most accessible locations. This is sorted out on the basis of their locational rents which reflect the ability of users to pay for a particular site.

According to Alonso (1964) [1], functions that gain the greatest advantage from locating at the point of maximum accessibility from the innermost zones must be close to the market while the other uses are arranged in sequence according to their location rents. As such, the concentric zone of land use, from the centre of the city to the margin of cultivation, is attributed to certain relationships. Firstly, land uses determine land values through competitive bidding among users.

As a result of the influx of people into urban areas, mostly for economic reasons, demand for urban land becomes high. The high demand leads to competition among land users. Land uses, therefore, attract higher prices due to the importance and ability to pay for the land. Land located at the centre of the city, therefore, goes for commercial and service uses while industrial, residential and agricultural lands are found at the periphery. The theory indicates that urban growth has a direct relationship with land use. This is because urban development manifests in space. Secondly, land values distribute land uses according to their ability to pay. This depends upon the level of location rent accruing to the particular product at a particular location with respect to the market.

The manner in which urban development unfolds causes major problems in the development and management of urban land. Higher population and economic activities in the urban environment cause land uses to change variously to suit the demands of urbanization. Urbanization changes the uses to which urban land is put. Residential or recreational land is normally changed to commercial and industrial based on

location rent. Urbanization also converts urban land at the rural-urban fringe to uses such as residential development.

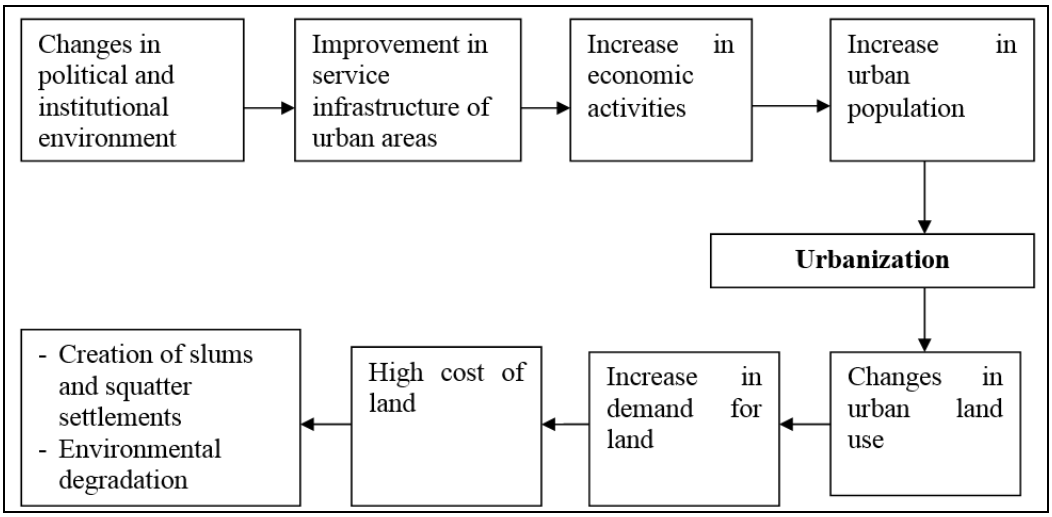
The movement of people to the periphery of urban centres means marginal clearing of the already limited agricultural land for building homes and other infrastructure constructions such as roads, parking lots among others. These processes impact negatively on the urban land use. They may affect land that is regarded as an environmental asset, such as remnant bush land or a well-managed private holding or land which is economically valuable with agricultural or mineral potential.

The theory further explains that with expansion of urbanization, the land with its natural vegetative and forest covers are cleared to give way for residential, commercial and industrial purposes. As land towards the fringes is exhausted, residential land use tends to become the next target since urban land does not increase with population and human activities. Alonso (1964) [1] observes that some land uses have to give way for others depending on the functions performed by the urban area, and that land use changes have significant impact on the lives of the inhabitants. Alonso argues that this phenomenon is currently unfolding in different forms and intensities in different countries and cities as a result of variation in population growth, levels of technology, land tenure systems and planning.

According to Alonso (1964) [1], through the growth and expansion of business activities, residential land uses, especially those along the major roads, are being converted into various forms of land uses particularly commercial and other small scale industrial activities. Residential land use is particularly giving way to others because of the high degree of commercial and industrial functions performed by most urban centres.

This change from residential land use to other uses is occurring because the economic returns on residential land uses is less compared to those of commercial and industrial uses. This problem is disturbing and the net effect culminates in serious environmental resource degradation issues and land use problems such as development of squatter settlements, urban sprawl and encroachment on reserves and open spaces.

Figure 1 below illustrates the conceptual framework of Alonso's theory in application. The framework conceptualizes the effects of urbanization on land use patterns and hence on environmental resources. At each level, the concept borders on causes of urban land use change commencing from changes in political and institutional environment in urban areas to changes in urban land use and its effects on environmental resources.,



Source: Author (2014)

Fig 1: A conceptual framework of urban land use theory

Main Discussion

The Concept of Land Use Change

Land use change is the change in land cover and land use. Land cover is the physical state of the land surface which includes both natural amenities (crop lands, mountains, vegetation, soil type, biodiversity, water resources) and man-made structures (buildings, pavements) (Meyer, 2007). Change in land cover usually happens in two ways – land cover conversion and land cover modification (Lambin, Geist & Rindfuss, 2006) [3, 6, 7]. Land cover conversion is a change in the overall classification of land cover through a complete replacement of one type of land cover by another type due to change in urban extent, agricultural expansion or deforestation. On the other hand, land cover modification is simply a change in the character of land cover without undergoing its overall classification (Lambin, Geist & Lepers, 2008). Land use refers to the way human beings employ and exploit land cover for several purposes (Lambin *et al*., 2006) [3, 6, 7] such as farming, mining, housing, logging or recreation. Therefore, land use change is the exploitation of land cover through its conversion and/or modification over time primarily to serve human needs.

There are several causes of land use change. Identifying causes of land use change requires a clear understanding of land use decision-making processes which are influenced by several factors (Lambin *et al*., 2006) [3, 6, 7]. Many researchers and scholars have tried to explain the proximate and underlying causes of land use change in order to understand the land use decision-making process. Proximate causes of land use change involve the direct and immediate physical action on land cover at local level such as individual farms, households or communities (Lambin *et al*., 2006) [3, 6, 7]. The

underlying causes of land use change are the fundamental forces that alter one or more proximate causes and operate at regional or even global level (Lambin *et al*., 2006) [3, 6, 7]. Most of the fundamental forces are technological, economic, political, institutional, demographic and cultural in nature (Geist *et al*., 2006) [3, 6, 7]. In the context of developed states, these underlying causes/fundamental forces are also the causes of urbanization which in turn is the driver of land use change (Geist *et al*., 2006) [3, 6, 7].

The Concept of Urbanization

The term urbanization as conventionally measured by demographers is urban population divided by total population for a region (Glenn, 2008). It can also be defined as the annual rate of change of the percentage of people living in urban areas, or the difference between the growth rate of urban population and that of total population (Hope & Lekorwe, 2009).

Closely linked to the above definitions, Pivo (1996) defines urbanization as the process of transformation that affects geographic regions when they become more urban, and that during the processes of urbanization, a growing share of a region's land and people become included in cities. In this case, urbanization is the process by which population is attracted by and concentrated in selected number of human settlements or urban areas.

It can, therefore, be stated that urbanization is a process by which urban areas increase in size and population density. It is also the process and the rate at which human activities and populations are attracted to a locality or point in space within relatively short period of time. From the foregoing, this paper defines the term urbanization as the rapid development and transformation of a region, including increase in the size, population and human activities at a given period of time.

Urbanization Trends in the World and Africa

The face of the world is changing more rapidly now than before. The trend primarily responsible for the transformation is the rapid growth of the world population. People are moving into cities at a rate never seen since the industrial revolution when people filled the cities of the developed world more than a century ago (UN-Habitat, 2006). In 2000, the world population reached 6.1 billion and it is now growing at an annual rate of 1.2 percent. It is projected that the world population will reach 8 billion by 2030 (UN-Habitat, 2006). Africa has witnessed a dramatic population increase from 221 million in 1950 to 998 million in 2008 (UN-Habitat, 2010).

Despite a decline in population growth rates since the mid-1980s, Africa remains the world's fastest growing region at an estimated rate of 2.4 percent per annum. Although future growth rates are expected to be lower, the region will attain an estimated population of 1.4 billion by the year 2030 (UN, 2015).

It is worth noting that even in Africa, differences exist among the sub-regions. For example, in 1990, approximately 22 percent of East African population resided in urban areas compared to 33 percent, 38 percent, 45 percent and 55 percent for West Africa, Middle Africa, North Africa and Southern Africa, respectively. This is projected to be maintained through 2025, although at a higher level (Hope & Lekorwe, 2009). The percentage of people living in urban areas is projected to vary from 47 percent in East Africa to 74 percent in Southern Africa.

The population in Kenya has been growing at annual rate of approximately 1 million people annually (KPCB, 2009). Approximately 65% of Kenya's population is said to be residing in urban areas and it is estimated that at least 70% of Kenya's population will be living in urban areas by 2030 (KPCB, 2009).

Land Use Change and Urbanization

Broadly speaking, urbanization is the output of two major processes – economic growth and city growth (Geruson & McGrath, 2007). Growth of city and economy is brought about by political independence, rapid expansion of overall population, development of railroads and rapid spread of automobiles and the high level of agricultural productivity (Bairoch, 2008).

The process of urbanization results in a dense settlement called an urban area. The conglomeration of urban areas including cities and their suburbs linked economically which socially constitutes a system called a metropolitan area or region (Geruson & McGrath, 2007).

This definition of metropolitan area has left out one of the major linkages of the system, an ecological linkage, exploitation of which has created the system itself. Rostow (1977) argues that metropolitan area (urban area) is a result of capitalism which promotes diffusion of habitat and activities based on economic functioning and administrative activities. Here, diffusion of habitat and activities refers to the use of land to locate industrial activities, administrative divisions, new housing units and other infrastructures. Rostow further asserts that metropolitan or urban area "reduces the importance of the physical environment in the determination of the system of functional and social relations, abolishes the distinction between rural and urban, and places in the forefront of the space/society dynamic the historical conjuncture of the social relations that constitute its basis" (Rostow, 1977).

Impact of Urbanization on Ecosystem Resources

Although ecosystem services provide myriad of services that create value for human users and are central to the continuation of human civilization, humans have obscured the existence and importance of ecosystem services in a hurry to celebrate urban fantasy (Committee on Assessing and Valuing the Services of Aquatic and Related Terrestrial Ecosystems, National Research Council, 2009). Van der Ryn and Cowan (2007) express the reality of increasing disconnection of humans with nature as follows:

- [We] live in two interpenetrating worlds. The first is the living world [natural world], which has been forged in an evolutionary crucible over a period of four billion years. The second is the world of roads and cities, farms and artifacts [human designed world], that people have been designing for themselves over the last few millennia.

The growth and prosperity of the human designed world has come from the expense of the resources of the natural world. Sim and Cowan (2009) claim that the "designed mess we have made of our neighborhoods, cities, and ecosystems owes much to the lack of a coherent philosophy, vision, and practice of design that is grounded in a rich understanding of ecology." There is a huge gap between these two worlds – the living or

natural world and human designed or cultural world that has distanced humans from nature. To bridge this gap and link humans with nature, there is need for an ecological thinking in urban planning practice (Ryn & Cowan, 2007). Van der Ryn and Cowan (2007) [17] propose the application conservation, regeneration and stewardship strategies into land use planning and decision-making processes in urban areas. This will ensure sustainability of land uses (Van der Ryn & Cowan, 2009).

Impact of Urbanization on Soil

Land use change driven by urbanization has put urban areas on soils that are best suited for other uses such as food and fibre, forests and wetlands (Scheyer & Hipple, 2005) [11]. New homes, buildings, roads and other structures are being built every day on arable land.

Are these developments guided by sound knowledge about the soil information of the area? Are planners, developers and planning agencies making intellectual and serious judgment in allocating land based on soil information for different uses? And do they really care about soil at all? The overall answer to these questions is a big "NO", because almost all developments that have happened and those that are continuing to happen are being guided by economic benefits and not environmental benefits.

Marcotullio, Braimoh and Onishi (2008) [8] have documented the impact of urbanization on soil. According to them, urbanization alters the biological, chemical and physical properties of soil and hence degrading its quality resulting in loss of vegetation, poor water infiltration, accumulation of heavy metal, excess water runoff and soil erosion. Soil quality is often degraded by soil erosion. The stability of slopes (both natural and artificial) determines the vulnerability to landslides or slope failures. Encroachment of urban land into nearby forested or vegetated areas, and the expansion of built up areas and transportation networks into steeper terrain destabilize slopes leading to slope failures (Beek, Cammeraat, Andreu & Mickovski, 2008) [2]. Urban and recreational developments into hillside areas have exposed more people and property into risk of landslide hazards.

Impact of Urbanization on Water Resources

Population growth, increasing trend of urbanization and land use and climate change have affected water availability and quality in Kenya (Joy, 2010) as in many other developing countries. Indeed, Kenya's water resources are increasingly becoming limited. In many parts of the country, conflicts over water resources have erupted and the situation may deteriorate in future (Smith, 2011) due to rampant and unchecked urban development.

Koech, Ogendi and Kipkemboi (2012) [5] observe that more than one-third of rivers and streams in Kenya are impaired or polluted and most of the aquatic ecosystems, together with their biota, have been lost or diminished to a great number due to non-point source contamination of surface and ground water from agricultural and urban lands.

Impact of Urbanization on Biodiversity

Urbanization alters the habitat through housing, road construction, pavement, devegetation, plantation of non-native species, land fragmentation, among others. Residential development in form of road expansion, utilities, among others, poses a threat to wild and human life through loss, degradation and fragmentation of habitat (Theobald, Miller & Hobbs, 1997) [13]. Habitat alteration from urbanization is so drastic and widespread that it results in the endangerment and extinction of species accompanied by long lasting habitat loss (McKinney, 2012). Apart from reducing the richness of native species, urbanization increases the dominance of non-native species in the area thereby causing biological homogenization (McKinney, 2012).

McKinney (2012) further notes that the total urban area is expected to triple between 2000 and 2030, while urban populations are expected to nearly double, increasing from 2.84 to 4.9 billion, during this period. In other words, urban areas are expanding faster than urban populations. This urban expansion will heavily draw on natural resources, including water, on a global scale, and will often consume prime agricultural land, with knock-on effects on biodiversity and ecosystem services elsewhere (Theobald, Miller & Hobbs, 1997) [13]. Most future urban expansion will occur in areas of low economic and human capacity, which will constrain the protection of biodiversity and management of ecosystem services. Urban expansion is occurring fast in areas adjacent to biodiversity hotspots and faster in low-elevation, biodiversity-rich coastal zones than in other areas (Koech *et al.*, 2012) [5].

According to McKinney (2012), urbanization rates are highest in those regions of the world where the capacity to inform policy is absent and where there are generally under-resourced and poorly capacitated urban governance arrangements. This describes the case of most developing nations of the world.

Conclusion and Recommendations

From a review of key issues on urbanization and its effect on environmental resources, it is clear that the face of the world is changing more rapidly now than before. The trend primarily responsible for the transformation is the rapid growth of the world population. People are moving into cities at an unprecedented rate since the industrial revolution. Despite a decline in population growth rates since the mid-1980s, Africa remains the world's fastest growing region at an estimated rate of 2.4 percent per annum.

Scholars also observe that the growth of city and economy is brought about by political independence, rapid expansion of overall population, development of railroads and rapid spread of automobiles and the high level of agricultural productivity. The process of urbanization results in a dense settlement called an urban area. The conglomeration of urban areas including cities and their suburbs linked economically which socially constitutes a system called a metropolitan area or region. It is, however, clear that the prevailing definition of metropolitan area has left out one of the major linkages of the system, an ecological linkage, exploitation of which has created the system itself.

Urbanization, which has put urban areas on soils that are best suited for other uses such as food and fibre, forests and wetlands, has resulted in rapid land use change. New homes, buildings, roads and other structures are being built every day on arable land. The underlying causes of land use change are the fundamental forces that alter one or more proximate causes and operate at regional or even global level. Most of the fundamental forces are technological, economic, political, institutional, demographic and cultural in nature.

Population growth, increasing trend of urbanization and land use and climate change have also affected water availability and quality. Urbanization has further altered the habitat through housing, road construction, pavement, devegetation, plantation of non-native species, land fragmentation, among others. Residential development in form of road expansion, utilities, among others, continues to pose a serious threat to wild and human life through loss, degradation and fragmentation of habitat.

From the above conclusions, it is recommended that developments should be guided by sound knowledge about the soil information of the urban expansion areas. Moreover, planners, developers and planning agencies should ensure that they carry out intellectual and serious judgment in allocating land based on empirical soil information for different uses. Lastly, governments and development agencies should put greater emphasis on the ecological perspective in their decisions, national and regional planning, policy formulation and implementation strategies. Funds should be allocated to ensure that urban planning strategies incorporate environmental protection activities as a matter of priority. Individuals and development agencies that fail to comply with regulations on environmental impact should be severely punished through strong legislation and law enforcement.

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