



Urbanization and Environmental Challenges: A Review of Effects of Urban Development on Environmental Resources in Kenya

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Abstract

In the recent past, it has been observed that current population projection and trends predict a continuous world population increase in the upcoming decades. This in turn leads to an increase in demand for living space and natural resources which support human life. Consequently, there has been considerable growth of urban areas and new settlements, and urban agglomerations keep emerging on a global scale. Despite a number of benefits which accrue from urbanization, negative externalities associated with urban development have impacted the environment. In most cases in the developing countries, the emerging urban centers lack proper planning. It has been noted that rapid and haphazard infrastructural expansion in developing urban centers often contribute to large negative externalities. Just to mention a few, environmental challenges such as soil, air and water pollution and degradation of quality-of-life elements in an urban settlement are attributed to urban sprawl. As a result of urbanization, built-up areas increase. Range lands and other natural ecosystems are modified and transformed to serve other human purposes. In this regard habitats for other life-forms are degraded and destroyed. This leads to displacement and even extinction of some organisms. This study seeks to explore modalities which can be adopted to ensure sustainable urbanization which integrates environmental concerns. The study reviewed relevant literature on this topic and drew conclusions and suggested ways forward based on the existing literature and the researcher's knowledge.

Keywords: Urbanization, Impacts; Environment; Developing countries; Kenya

Introduction

According to Uttara et al. [1], urbanization may be defined as the general increase in population and amount of industrialization of a settlement. In their view, urbanization includes an increase in the number and extent of towns and cities and symbolizes movement of people from rural to urban areas. Further, Uttara et al. [1] opined that uncontrolled urbanization has been occurring very rapidly in developing countries and in most cases cause environmental degradation such as worsening water quality, excessive air pollution, noise and the problems of waste disposal.

Methodology

The study reviewed relevant literature on urban development in global, regional and local contexts. Books, journals, reports and other urbanization documents were reviewed to establish what has been documented on the impacts of urbanization on natural resources.

Urban Population

Khanal [2] perceived urbanization as a recent phenomenon in human history which is unique to the past few centuries. Khanal observed that prior to 1600, the estimated share of the world population living in urban settings was less than 5 percent. Khanal noted that after 1600, the world urban population reached 7 percent in 1800. According to Ritchie & Roger [3] the world urban population reached 16 percent by 1900 while by 1950, the population in urban areas reached 30 percent. This increased to 55 percent by 2018 United Nations [4]. The 2050 projection of world urban population indicates that it will be at 68 [3]. Khanal [2] noted that the beginning of increase in world urban population was partially as a result of building projects carried out at faster rate after the Industrial Revolution. This was considered to have allowed mass-production of building materials. Besides this, technological advancement and development have been seen to

enable people to alter landscape on a grander scale. In view of Taylor [5], urban –mega cities began to emerge in a matter of a few decades due to industrialization, technological advancement, and economic development.

While considering benefits which accrue from urbanization, Fuller & Romer [6] contended that nothing else presents as many opportunities for socio-economic growth as urbanization. However, efforts should be made to ensure that we have sustainable urbanization. In most cases, minds have been focused on the development and opportunities created by urbanization, but little attention has been given to its negative externalities. As a result of urbanization and urban sprawl, rangelands and other natural environments have been modified and transformed into built-up areas. Modification and transformation interfere with the natural ecosystems. Consequently, the ecological functions and/or resilience are compromised. In this regard, continual and close urbanization process is necessitated. By reviewing literature on impacts of urbanization on the environment, the study seeks to explore modalities which can be adopted to realize sustainable urbanization.

Understanding Built-up Environment

According to Srinivasan et al. [7], built-up environment is the construct made for human settlement and use. The definition is made in reference to urban design and planning. Srinivasan et al. [7] asserted that built environment includes roads, buildings and parks created by people. Sallis et al. [8] observed that built environment impacts social and physical environments which subsequently affect health and quality of life. According to Khanal [2], a built environment has a number of physical aspects. These include the density of houses, population density, distribution of open areas, traffic conditions and number and the nature of factories. These contribute to the quality of urban living.

Urbanization in Developing Countries

Chen [9] noted that hurried urbanization which in some cases referred to as urban rush poses serious challenges to the environment and overall livability of the settlement especially in developing countries where the environmental aspects of infrastructural development are not carefully assessed. Henderson (2002) noted the possibility of urban development in developing countries suffering from underpriced and/or unpriced externalities such as noise pollution, air pollution, traffic congestion and contamination from waste disposal. Further, he established that urban areas may become most vulnerable especially in cases of outbreak of an infectious disease. Haphazard and hurried development of urban settlements in developing countries has been characterized by a big health care cost associated with any environmental disturbance [10].

Sarkar et al. [11] viewed the connection between built environment and health as an emerging research topic. In their view, built environment is associated with modification with

compromise the natural functioning of the ecosystem. For instance, built up areas are characterized with increased emission and accumulation of gases like carbon dioxide which not only has impact on health but also contributes to global warming. Also, as a result of industrialization and other urban development activities, surface water has been contaminated due to industrial effluent, runoff from oily places and poor waste management in informal settlements.

One of the common environmental problems associated with urbanization in developing world countries is air pollution. Chan & Yao [12] noted that air pollution problems in cities will become a more serious environmental concern in the next decades. According to the World Health Organization (WHO) 2012 report, around 7 million people die as a result of exposure to air pollution. Similarly, the WHO reported in 2014 that air pollution caused one-eighth of total global deaths. Air pollution not only affects human health but also the lives of other living organisms. It degrades environmental quality and also leads to destruction of other properties. Previous scholarly studies have established higher concentrations of pollutants emitted directly as exhaust fumes by motor vehicles near large roadways compared to overall urban background concentrations [13-17]. According to Baldauf et al. (2009) the higher amounts of concentration of pollutants mostly occur within a few hundred meters of the road. This varies depending on the environmental conditions, traffic patterns, topography and the presence of roadside structures. Equally, Cirera et al. [18] noted significant contributions of factories emissions to the deterioration of air quality in cities which may as well affect public health.

Urban Built Environment and Health Consequences

According to Khanal [2], there exists a correlation between built environment and human health. Koohsari et al. [19] noted that a number of conditions such as obesity, cardiovascular and respiratory illnesses have linked to inadequate provision of open spaces in the urban built environment [20-22]. Many developing countries have urban centres characterized by such conditions. This is due to lack of planning. In most cases urban planners take into consideration some of the environmental concerns which are important for humans and other living organisms. For instance, a planned urban centre with provide room for open spaces which are useful in recreational activities. Also, the open space may be planted with some vegetation which play a significant role in air purification and/or act as carbon sink. Therefore, emissions from an urban set up may be assimilated easily in open spaces. Additionally, unplanned urban areas in the developing nations interfere with adjacent rivers. The runoff from these urban areas, illegal drainage channeled to the rivers and direct waste disposal into water systems not only affect human health but also aquatic organisms. Contaminated waste may change its temperature hence affecting the lives of aquatic organisms which operate and are only able to survive within a narrow range of temperature.

Open spaces have been seen to help manage and mitigate health consequences arising from extreme temperatures resulting from urban heat island effect [23-25]. Selmi et al. [26] posited that trees in open spaces help reduce particulate matter suspended in the air thereby creating a cleaner microclimate. Villanueva et al. [27] contended that the linkage between built environment in a neighborhood and the general health and well-being cannot be overemphasized. Giles-Corti, Broomhall, et al. [28] noted that open spaces have been associated with increased physical activity in urban areas. Sugiyama et al. [29] opined that availability and access to green spaces in urban areas encourage behavioral habits such as walking for recreation and engaging in physical activity. According to Irwin & Bockstael [30], open spaces in urban areas contribute to maintaining environmental sustainability and ecological resilience through reduction of externalities created from traffic congestion and air pollution. On the other hand, they also provide places for gathering, interaction and socialization [20,31-33].

State Government Victoria [34] considered open spaces to be a potentially good indicator for measuring progress towards achievement of a better built environment and reduction of social and health inequalities. In developing countries, priority has been given to human settlements with little concern to ensure environmental sustainability. Cieslewicz, (2002) argued that in use of land and its resources, humans have been concerned so much about how to better their lives rather than ensuring sustainability of the resources they use. Further, he opined that a serious problem has been realized considering the way humans have used land and exploited its resources over time. In his view, humans through urbanization and other activities have altered land cover and impacted the functioning of the ecosystem.

Ohwo & Abotutu [35] noted that modern technology, agriculture, the rise of capitalist mode of economy, the exploitation of land and its resources have dramatically increased. Further, he established that land use practices such as mining, agriculture, settlement, recreation, among others have become so intensive and predominant over the last few decades that we can see their impacts in forms of uncontrolled development. Some of these impacts which can be witnessed include deteriorating environmental quality, urbanization and urban sprawl, loss of prime agricultural lands, destruction of wetlands, loss of wildlife habitats. Zang et al. [36] observed that such impacts have consequently reduced the local capacity of lands to support both human enterprise and ecosystem at global scale. In this regard, the effect of land use change associated with urbanization is no longer a local environmental problem but a global one. Yeh et al. [37] opined that to address such impacts, sound knowledge on land use changes over time and detailed information on existing land use pattern is important for planners, legislators, state and local governmental officials.

Kharel [38] recognized the faster growth of urban areas all over the world. Nature Conservancy report [39] projected that

by 2030, there will be nearly 2 billion new city residents. This will account for around 60 percent of the world's population leading to severe damage of natural resources and ecosystems. Kharel recorded that as urban areas grow, they require resources and more land to support their growth. This influences changes in land use which in turn trigger environmental problems such as loss of open space and biodiversity, water and air pollution, heat island effects among others. Considering the fact that global human population continues to grow and rural to urban migration increases, the trend in urbanization is believed to continue for another few decades to come. The continued increase in urbanization will exacerbate environmental problems due to more consumption of land and other environmental resources. Governments, planners and planning agencies among other stakeholders should therefore acknowledge these problems and integrate environmental concerns into land use and decision-making process for sustainable urbanization.

Urbanization and Land Use Change

According to Lambin et al. p. 216-217 [40]; Ojima, Galvin, & Turner [41]; Kharel (2011) [38] proximate causes of land use change may involve a direct and immediate physical action on land cover either at local level such as individual households, farms, or communities. Lambin et al. [40] argued that the underlying causes of land use change are perceived as the fundamental forces that alter one or more proximate causes and operate at regional or even global level. Geist et al. [42] noted that some of the most commonly used fundamental forces are economic, technological, political, demographic, institutional cultural. Kharel [38] posited that considering these in United States context these underlying causes/fundamental forces are also the causes of urbanization which in turn is the driver of land use change.

Geruson & McGrath [43] postulated that the urbanization process results in a dense settlement which referred to as an urban area. Urbanization leads to consumption of land for industrial activities, new housing units among other infrastructures. Ichimura [44] recorded that urban areas lower the importance of the physical environment transforming and modifying the natural into built environment. This argument is based on the fact that the ecological roles performed by the natural environment cannot be performed by the built environment. Some of the transformations and modifications claim large pieces of land and lead to displacement of some biodiversity.

Impacts of Urbanization on various Environmental Resources

Uttara et al. [1] posited that continuation and sharpening of existing environmental problems which do not receive adequate political attention at the moment will possibly lead to most of the major environmental problems of the next century. Sadly enough, it is not that these environmental problems are not necessarily noticed in many developing countries, but nothing is done even after the situation has been detected. The most

emerging issues are population growth, deforestation, freshwater pollution, freshwater scarcity, and climate changes. Uttara et al. [1] was of the view that little attention has been given to the interconnections between environmental problems and their sources such as urbanization. Further, they opined that there is still lack of exact information on how the issues are linked, the degree at which they are linked and the most effective measures to be adopted to realize environmental sustainability. Some of the linkages between urbanization and environmental resources are as described below.

Lithosphere and Land Resources

Daily et al. [45] referred to soil as a complex and dynamic ecosystem. Its role is manifests on sustaining physical and chemical processes and transformations respectively. This is crucial to terrestrial life. Kharel [38] opined that the soil provides services almost to all forms of life including human. It provides anchorage to plants and the nutrients to support their growth. It is from the soil that the plants get water. Soil is also a habitat for both micro and macro-organisms. It supports agriculture which is the source of food to humans. It is also a source of minerals which may be used by man to get income. Winiwarter & Blum [46] contended that other than its biological or ecological services, the importance of soil is deeply rooted to the foundation of human civilization including religious, cultural, immaterial and spiritual belief systems.

Montgomery [47] noted that soil is fundamental to the longevity of any civilization and therefore must be respected as the living foundation for material wealth and treated as an investment and a valuable inheritance. However, its value and importance are overlooked and underscored in our societies, especially in urban areas where desire to meet human wants overrides consideration of environmental sustainability. Warkentin [48] linked this to the fact that people perceive the soil to be available and abundant. In this regard, soil has been used and continues to be used without concern for their degradation or loss. This always results in significant economic and environmental costs [49,50].

Urbanization results in more waste generation whose management is a challenge in most developing countries. Indiscriminate dumping of waste and burning in open landfills not only pollutes the air but also degrades soil. Some of the soil micro-organisms are also affected by excess heat. Increased built up areas also interfere with infiltration rate and this impacts negatively on soil water or underground water. As urban areas develop and expand, more transformation and modifications take place. More land is claimed for housing and other infrastructural facilities to support urban dwellers and activities. This impacts the normal and natural functioning of the soil as some parts get excavated and compacted using heavy machinery.

Urban areas have been characterized by increased surface runoffs. The developed or built-up lands in most cases have

pavements which increase the rate of surface runoffs. Most of the water fails to infiltrate the soil and remains on the surface of the lands. This increases erosion and other changes in land quality due to the fact that the runoff may contain contaminated water. Hoi [51] argued that rapid urbanization or urban development in most cases lead to high levels of erosion and sedimentation of river channels. Similarly, it has been noticed that more waste are generated in urban areas, especially in industrial regions. These wastes normally contain contaminants or pollutants which are often dispersed across cities or concentrated in industrial areas. For instance, lead- based paints used on roads and highways as well as on buildings is one of the examples of widely dispersed pollutant which find their ways into the soil. Another example is urban waste management activity which degrades land and is burying tremendous amounts of waste in the ground by the municipal and industrial dumps. Some of the wastes are non-biodegradable and may remain in the soil for centuries. This reduces the quality of soil.

According to Scheyer & Hipple [52] urbanization driven land use changes have put cities and urban areas on soils which are best suited for other uses such forests and wetlands, food and fiber. The only questions left unanswered are whether the developments in these urban areas are guided by sound knowledge about the soil information of the area, whether developers, planners and planning agencies are making intellectual and serious judgment in allocating lands based on soil information for different uses and whether they really care about soil. Based on what has been witnessed, developments in most urban areas and especially in developing countries are guided by economic benefits with little or no environmental concerns integrated. Marcotullio, Braimoh, & Onishi [53] contended that urbanization alters the physical, biological and chemical properties of soil thereby degrading its quality leading to poor water infiltration, excess water runoff, soil erosion, loss of vegetation, and accumulation of heavy metal. Vulnerability of landslides or slope failures is determined by the stability of slopes which can be both natural and artificial. Encroachment of urban land into nearby vegetated and/or forested areas and the expansion of transportation networks and built-up areas into steeper terrain destabilizing slopes leading to slope failures [54].

Atmosphere and Climate

It has been noted that in urban areas, urban heat islands are created. Materials such as bricks, concrete, asphalt among others absorb and reflect heat energy differently than vegetation and soil. This heat absorbed by building materials including the roofs and roofing system may be retained for some time and later radiates or remitted into the atmosphere. This may cause abnormal heating systems in the urban areas. The abnormal heating system created interferes with particular life forms which operate within a narrow range of temperature. Also, human activities within the urban areas release a wide range of heat and emissions into

the environment. This includes sulfur oxides, carbon monoxide, carbon dioxide, ozone, nitrogen oxides, lead, among other pollutants. This impacts air quality in urban areas. It has also been observed that urban areas yield a lot of dust particles which get into the atmosphere. These suspended particles in some cases trigger condensation of water vapor into rain droplets thereby bringing changes in precipitation patterns in the region Uttara et al. [1].

Hydrosphere and Water Resources

Water has been rated as one of the most fundamental natural resources which is renewable but finite. All living organisms depend on water in one way or another and anything that disrupts water distribution and supply, disrupts the very survival of humanity and other life forms [55]; (Smith, Howes, & Kimball, 2007, p. 121-123). Water resources such as rivers, streams, lakes, and wetlands including oceans are within or adjacent to our land. Thus, urban activities which normally take place on land affect water resources directly or indirectly. Kharel [38] contended that the importance of water is not limited to human consumption but extends to the functioning of a whole planet. In their view, water itself is an ecosystem. It is an aquatic ecosystem which provides habitats for billions of known and unknown species of animals and plants.

Uttara et al. [1] established that urbanization in most cases negatively impacts the normal flow of water into streams and natural vegetation. Further, they contended that undisturbed soils are replaced with asphalt, concrete, brick and other impermeable surfaces. These impermeable surfaces interfere with the normal water cycle as underground water recharge system is reduced by reduced percolation and/or infiltration. This implies that water is less likely to be absorbed into the ground when it rains and instead, flows directly into the streams and/or river channels. Urbanization has led to reclamation of wetlands. The conversion of wetlands into built areas has compromised the ecological resilience provided by wetlands.

Wetlands have provisional, support, regulatory and cultural functions. These roles are compromised to provide space for human settlements. The normal and natural flow of water through streams has become higher due to the creation of artificial channels. It has also been noticed that faster peak flows change streams channels that have evolved over centuries under natural conditions. In some cases, flooding has been witnessed in some unplanned urban areas due to more impermeable surfaces created. Some flooding are caused by poor and blocked drainage systems. This problem is perceived to be a planning issue since what is adequate today might not be adequate tomorrow as a result of rapid urban population increase. Increased flooding impacts water quality in that some of the runoffs mix with sewage containing pollutants. Increased urban population has

put pressure on the available water resources leading to over extraction and use of water resources.

The Biosphere

As mentioned earlier, urbanization has modified habitats. Rangelands have been cleared to create room for urban expansion and development of more settlements. Ecological areas such wetlands have been degraded. These ecological sites are habitats for a number of biodiversity. Conversion and/or transformation or modification of wetlands implies destruction of aquatic habitat. This may lead to displacement, death or extinction of the biodiversity formerly occupying the wetlands and/or any area claimed by urbanization. Mostly, during urbanization, vegetation has been cleared. Other than the central role of air purification performed by vegetation, they also provide habitat to wildlife. Their removal or clearance implies loss of habitat.

Developing countries have not been able to adequately integrate environmental concerns into the urban development process. Consequently, realizing environmental sustainability amidst urbanization has become a nightmare. Humans have prioritized what favors their development and wellbeing rather than the wellbeing of other life forms. This is why urbanization in developing nations has become unsustainable and is characterized by air, water and soil quality deterioration and general environmental degradation. Despite being a major contributor to habitat loss, urbanization has created new habitats for non-native species such as pigeons, sparrows, rats, mice, among others. Even though urbanization has for instance, eliminated many bat colonies in caves, it has provided sites such as bridges for these species to nest.

Biodiversity

Generally, biodiversity refers to the richness of animal and plant species that are native to a particular habitat or ecosystem [56]. It is important to note that every species present in an ecosystem has a specific function through the food web and/or life cycle. Any change in species diversity may alter the biogeochemical cycles thereby affecting the overall functioning of the system. In this regard, the functioning, stability, and sustainability of an ecosystem depend on biodiversity [57]. Urbanization has been seen to impact negatively on biodiversity. Most of the rangelands are claimed by urban sprawl and the natural environments around urban centres are modified or altered to serve various urban purposes such as settlement. Modification of natural environments may lead to displacement of particular diversity or may directly lead to their extinction. Natural environments are known to serve as habitats and sources of food and support to different life forms. When altered, the normal functioning or life of various organisms is interfered with. Urban driven wetland reclamation normally contributes to changes in

species distribution, abundance and diversity which alter the biogeochemical cycles thereby affecting the overall functioning of the system. Apart from reducing the native species richness, urbanization increases the dominance of nonnative species in the area thereby causing biological homogenization [58].

Ecosystem Resources

Ecosystem provides myriad of functions and services that create value for human users and are central to the continuation of human civilization. Despite this fact, humans have obscured the existence and importance of ecosystem services in a hurry to celebrate urban fantasy. The increasing reality of disconnection of humans with nature has been expressed by Van der Ryn & Cowan (2007) noting that 'we' live in two interpenetrating worlds. The first is the living world, the natural world which has been forged in an evolutionary crucible over a period of four billion years while the second is the world of cities, roads, artifacts and farms which represents the human designed world. This is the world which people have been designing for themselves over the last few millennia [59]. The growth and prosperity of the human designed world has come from the expense of the resources of the natural world. (Van & Cowan, 2007) contended that the "designed mess we have made of our cities, neighborhoods and ecosystems owes much to the lack of vision, a coherent philosophy and practice of design that is rooted in a rich understanding of ecology" [60]. Further, they noted that a huge gap exists between the two worlds – natural or living world and the cultural or human designed world that has dissociated humans from nature. An ecological thinking in planning practice is needed to help bridge this existing gap and link humans with nature (Van der Ryn & Cowan, 2007, p. 33).

The application of regeneration, conservation and stewardship strategies into the land use planning and decision-making process has been proposed to help mitigate the challenges of the dissociation created between the two worlds (Ryn and Cowan, 2007) [61-63].

Conclusion

This review study has revealed the profound linkages between urbanization and environmental degradation in developing countries. The study has noted a number of impacts of urbanization on the environment. Some of these impacts include deforestation and destruction of wetlands, air, water and soil/land, flooding and erosion, aesthetic degradation, biodiversity loss among others. Also, urbanization influences land use and land cover changes. It claims a more natural environment which is being modified or transformed into built environment. This compromises ecological resilience. The study has also noted that more environmental degradation is witnessed majorly in developing countries since most urban centres in these countries lack proper planning. In addition, the study established that developments in most urban areas and especially in developing

countries are guided by economic benefits with little or no environmental concerns. There exist and continue to exist myriad environmental challenges if such mentality is upheld in developing countries. More biodiversity and genetic resources will continue to be lost if the attitude is not changed.

Recommendations

In order to realize environmental sustainability in urban centers in the developing countries, the study recommends:

- a) Adoption of proper planning habits and best practices in urbanization process.
- b) Control and effective management of urban development with close monitoring of the subsequent or continual developments within urban centers.
- c) Integrating environmental concern in every aspect of development with urban areas. This may include subjecting all proposed projects to environmental impact assessment and conducting an environmental audit of the on-going developments.

Public campaigns for inclusion of all in environmental conservation and protection. This will help create awareness and make members of the public accountable for their activities which may cause harm to the environment.

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