



## A REVIEW ON SUSTAINING ECOSYSTEM SERVICES IN EVOLVING URBAN LANDSCAPES IN NIGERIA: CURRENT KNOWLEDGE AND RESEARCH GAPS

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### Abstract

*The rapid increase in urbanization is one of the most significant socioeconomic developments taking place around the world. In developing countries, particularly Nigeria, urbanization is accelerating at an alarming rate. In terms of degree and distribution of urbanization, Nigeria is the most urbanized country. Urban ecosystems are becoming increasingly important as nodes of interaction between man and nature. As a result, sustainable management of urban ecosystems is a critical issue that must be investigated. The majority of the world's population spends their days in cities, and nearly 80% of Nigerians live in cities. The continued growth in the number and size of urban areas, as well as the increasing demand for resources and energy, pose significant challenges to ensuring human well-being in cities and preventing biodiversity loss. This article provides an overview of ecosystem service conservation research in Nigerian cities. Through the examination of selected articles from online databases. It seeks to close the knowledge gap between urbanization, demand generation, and the delivery of ecosystem services in urban areas. Street trees, lawns/parks, urban forests, cultivated land, swamps, lakes/seas, and streams have all been identified as urban ecosystems. Numerous ecosystem services are produced by these systems; Air filtration, microclimate regulation, noise reduction, storm water drainage, wastewater treatment, as well as leisure and cultural values, are local and direct services that are pertinent to Nigeria. It is concluded that local ecosystem services should be considered in land use planning since they have a significant impact on the quality of life in urban settings.*

**Keywords:** Urbanization, Landscape, Ecosystem services, Sustainability, Population

### Introduction

Cities play a pivotal role in the interaction between humans and the natural world because they are significant demand hubs for ecosystem services and they have profound environmental effects. Current predictions of metropolitan areas growing quickly bring both fundamental issues and opportunities for constructing cities that are more livable, healthier, and more resilient (e.g. adapting to the impacts of climate change).

According to Seto and Reenberg (2014), the world's population is predicted to dwell in cities and peri-urban areas by the year 2050, signaling the beginning of the urban age (UN World Population Prospects, 2012). Therefore, urban environments will soon become the norm for the vast majority of people on the planet. Nearly 80% of Europeans already reside in cities and large metropolitan areas, and there are no signs that this urban trend will change very soon (Haase, 2014). Protecting human well-being in cities and halting the escalating loss of land, ecosystems, resources, and biodiversity face significant challenges due to the continual expansion in the number and size of metropolitan areas as well as rising resource and energy needs (Haase, *et al.*, 2013). In a world that is becoming more and more dominated by humans, understanding how urban ecosystems function, how they develop, and what facilitates and inhibits their performance might help us understand ecosystem change in general (Elmqvist, *et al.*, 2013). There is no set pattern to urbanization because it is a complex social, economic, political, and technological process. Urban landscapes with patterns of densification, expansion/sprawl, and contraction are the primary manifestation of urbanization. New methodologies and approaches that take into consideration not just the complexity of urbanization dynamics but also the interactions between drivers, affects, and drivers are necessary to understand how these patterns form and their effects on the land and the environment. (Dagmar, *et al.*, 2014) Responses to these Dynamics The study topic on the ecological impact of urbanization is expanding, although it is still in its infancy and lacks a theory or framework in many ways (Cadenasso, *et al.*, 2008; Elmqvist, *et al.*, 2013).

Although they were frequently visible in the distant past, the hinterland links and feedbacks that fostered the rise of urban centers have become more and more lost in a globalized world (Elmqvist, *et al.*, 2013). A current disregard for a socio-ecological perspective and a division between town and country can result in the emergence of significant feedback mechanisms, allowing them to remain undetected, mislead politicians, and take actions that have significant negative effects on the sustainability of the planet. Reintroducing a socio-ecological viewpoint on urban development and helping to redefine urban sustainability by making invisible feedback and connections visible are two goals of this special issue. Urban ecosystems have particular drivers and selection pressures because they are integral to societal function (Elmqvist, *et al.*, 2013). A classic method of assessing urban complexity has been socio-technical, emphasizing how technological advancements drive change in cities and how cities are the living labs where technologies are hybridized and spread (Geels, 2011). The synergies, interactions, and trade-offs between society and ecosystems can be better understood using the socio-ecological systems approach to urban ecosystems. A socio-ecological co-production of ecosystem services (ES) and society, particularly in urban areas, could create new opportunities for resilience and quality of life (Go'mez-Baggethun *et al.*, 2011).

In light of new and complex challenges like climate change (Bowler *et al.*, 2010; Ernstson *et al.*, 2010; Chelleri and Olazabal, 2012), migration (Seto *et al.*, 2011), relocation and global economic investment (Childers *et al.*, 2013), and urban rural telecommunications (Seto *et al.*, 2012), an urban socio-ecological approach will therefore become increasingly necessary to successfully improve human well-being in urban areas. In the past, differences between the social scales of use, monitoring, and decision-making and the spatial and temporal scales of ecological processes and patterns have hindered not only our

understanding of ecological processes in urban landscapes but also the incorporation of urban ecological knowledge into urban planning (Kabisch and Haase, 2014).

Above all, the city can act as a testing ground for new ideas, providing a rich environment for cultural, social, geographical, temporal, institutional, and biological diversity (Knapp, *et al.*, 2008; Nevens, *et al.*, 2013). We must be concerned with issues of ecological functionality and ecological sustainability because this is where the majority of the population consumes the most (Grimm, *et al.*, 2008). Urban ecology as a sub-discipline of ecology didn't emerge until the 1970s in response to an awareness of human impact on the environment and the role of cities in this regard (Cadenasso, *et al.*, 2008; McPhearson *et al.*, 2013). While the term "urban ecology" has been used in schools of sociology and urban planning with varying meanings over the past century (Blanco, *et al.*, 2009), it has only been Urban ecology (Pickett *et al.*, 2004; Breuste *et al.*, 2013), which continues to try to combine both basic and practical research, is one legacy that has seen the scientific and planning professions come together. There is a need to better understand what can promote resilience and improve the quality of life in urban regions by bolstering and sustaining urban ecosystems, according to the conversation between science and policy. Urban ecology investigates the connections and linkages, whether good or negative, between the ecosystems and species that make up this complex matrix and the related human activities. Essentially, cities generate diverse landscapes with substantial temporal and spatial diversities. (Kabisch and Haase, 2014; Pickett *et al.*, 2004).

The study of the context, cognition, demographics, and societal influences on which ES are regarded as crucial or significant by urban dwellers and planners is also gaining importance. We now comprehend that resilience and sustainability are influenced by cultural and biological differences (Andersson, 2006; TEEB, 2010). This poses the issue of how to create a solid analytical framework that guides planning and governance while taking into account social and environmental components and their dynamics. A rising body of empirical evidence demonstrates that urbanization has a significant impact on how we manage and utilize natural resources. It is yet unclear how these effects appear, particularly with regard to ecosystem services and biodiversity (Elmqvist, *et al.*, 2013; Haase, 2012). For instance, like in other regions of the world, most research in urban ecology and social ecology has been carried out by solitary research institutions. Many parts of functional city ecology are well understood, but future empirical research should take a more comprehensive and integrated approach in accordance with global trends (Dagmar, *et al.*, 2014).

### Urban Ecosystem Services

Natural resources such as clean air, water, food, and materials are examples of ecosystem services (ES), which are provided by the environment and utilized by humans (Barbier, 2011). They have significant economic value and support social and cultural well-being (Fischer *et al.*, 2009). (Emerton and Bos, 2004; Turner, *et al.*, 2008). Provisioning, regulating, cultural, and supporting ecosystem services are the major categories into which they have been divided (MEA, 2005). Highlights of the overall findings and fresh perspectives on urban ES produced by research from the Urban Biodiversity and Ecosystem Services (URBES) project are listed below, along with significant accomplishments and unmet research needs (Schewenius, *et al.*, 2014): Covering land and land use - While outcome-based indicators are suitable for evaluating ES, they have limits for comparison study in metropolitan locations and may deter future empirical field-based research; Cross-border and multi-scale analyses are necessary to comprehend the linkages and inconsistencies between urban ES supply and demand; Urban ES are mediated by non-ecological factors, including the built environment, technology, social norms, and cultural settings in which people interact with their surroundings. Urban nature provides city dwellers with a chance to interact with nature; this question is particularly significant in urban regions because the high density of people and mediators necessitates a sophisticated investigation of the relationships between them. Through this connection to nature, cultural ES are generated that bring light on the many values and meanings that people derive from nature as well as facilitate, inform, and support discussions of ecological potentials and difficulties in cities. In order to effectively implement the urban ES concept in practice, disciplinary barriers between science, policy, and governance must be crossed, as well as gaps between science and planning frameworks and tools. The relationships between biodiversity and ES in urban areas are unclear, lacking evidence, and require new data and empirical research. ones that are already in existence: comparisons between cities are essential for this. Understanding the forces that shape ecosystem structure, function, and processes, and differentiating between dynamics that are specific to a certain location and those that apply to many metropolitan environments worldwide.

### Urban Landscapes in Nigeria

The rapid rise in urbanization is one of the most important global trends. Urbanization is occurring at an alarming rate in emerging countries, where this is increasingly prevalent. Nigeria is no different. In terms of both population and distribution of urbanization, it is the most urbanized nation in all of Africa. Whether or not we have a vision to lead our transition to sustainability, on sizes ranging from local landscapes to the entire planet, will determine the future of humanity. This perspective is based on the science of sustainability, and landscapes and regions represent a major size domain (Wu, J. 2013). The ability of a landscape to continually deliver long-term ecosystem services that are unique to that landscape and necessary for preserving and enhancing human well-being is referred to as landscape sustainability. In essence, achieving well-being is a journey rather than a goal. The goal of landscape sustainability science is to comprehend and enhance the dynamic relationship between ecosystem services and human well-being in changing landscapes under uncertain conditions brought on by internal feedback and external disturbances. It is a place-based and use-inspired science. The importance of landscape interactions and hierarchical relationships with scales (or externalities) that are both finer and broader should not be overlooked, even while the science of landscape sustainability places an emphasis on place-based research at landscape and regional dimensions. Spatially explicit methods, in particular experimental strategies that take advantage of designed landscapes and multiscale simulation models that connect the dynamics of landscape services (ecosystem services provided by multiple landscape elements combined as properties emerging) and human well being, are crucial for advancing the science of landscape sustainability in Nigeria (Wu, J. 2013).

### Housing and Urban Development

In Nigeria, colonialism came before the process of urban development. In the past, it has benefited from the country's constant socio-political and economic change, fast rural-urban migration, and natural population expansion through births. For instance, in 1921, over 20,000 people resided in urban areas across the nation's 18.63 million population (Oduwaye, 2016). Around 180 cities made up the nation's urban population in 1963, which accounted for 19.1% of all residents. In the middle of the 1970s, this percentage increased to about 35% of the population living in cities. The process of people moving from rural to urban areas is still going on. The World Bank estimates that the nation's population will reach 206.1 million by 2020. However, this has significant ramifications for the unfavorable environmental effects of cities' rapid physical growth in terms of land use development (Oduwaye, 2016).

Like other regions of the world, Nigeria has a long history of landscaping. The experience of Nigeria has demonstrated that it is a form of art that has a right to the cultural, social, and economic development of many regions of the nation. Unfortunately, it is one of the nation's last remaining arts. This may be because modern landscape planning began to emerge in Nigeria roughly 20 years ago. The concept has just lately gained traction thanks to the thoughtful design and implementation of public institutions, landscapes, a few wealthy individuals, and business interactions. The experience of Nigeria can be related to the common phenomena of landscape development, which doesn't happen in any company until a time of stable peace, prosperity, prosperity, and prosperity has been established. All of this gets individuals ready for the delicate yet fragile task of developing a landscape.

Although Nigeria needed to design its environment, the biggest challenge was the poor standard of living that resulted from the country's low income. This is made more challenging by the ongoing demographic shift toward large urban areas at the expense of rural populations, which has led to issues with natural landscape destruction, insufficient open spaces, ecology, environmental management, and a lack of adequate facilities, among other issues with landscape planning.

A lack of public awareness of the significance and applicability of landscape planning is the main barrier to its development in Nigeria. Therefore, highlighting the necessity for landscape planning in Nigeria today, when income is mostly subsistence-based paired with a low level of life, may cause further conflict, particularly with the impoverished majority. In contrast to solely aesthetic studies, the landscape does need to be improved functionally. To reduce the impact of environmental threats like pollution, radiation, erosion, and desertification, for instance, landscape planning is required, along with the necessity for balanced land use planning, among other things (Oduwaye, 2016).

In order to accomplish the aforementioned, Nigeria's previous and current administrations have significantly improved environmental quality by implementing programs like War Against Indiscipline (WAI), which has the dual goals of environmental restoration and waste management. Additionally, the government has started quick solutions to desertification, erosion, and floods. National, state, and local governments have all started National Tree Planting Days as well. Individuals and corporations are also mobilized by the government.

Over the past two decades, Nigeria's pace of urbanization has grown. . The legislative agenda has continued to prioritize urbanization over rural development, and there is a huge need for more urban infrastructure development. Because of the increase in construction density, urban ecosystems are at risk. Sometimes, trees are lost more quickly than they are planted again. Planning for urban development has been done with little to no regard for managing biodiversity and habitat, if at all. Urban design that prioritizes biodiversity can result in more chances for recreation and healthy living in urban settings, in addition to the advantages of saving species from extinction and preserving widespread species. Parks, gardens, and green belts are secondary concepts that aren't typically incorporated into housing and urban design.

### Locally Generated Ecosystem Services

According to Costanza, *et al.*, (1997) "Ecosystem services" are "the benefits that human populations obtain, directly or indirectly, from ecosystem functioning" (1997). Even though some of these ecological services are not directly used by people, maintaining ecosystems requires them. Plant pollination and nitrogen cycling are two examples of these indirect benefits. Air filtering, climatic regulation at the city and street levels, recreational and cultural value, storm water drainage, waste water treatment, and noise reduction are additional locally generated services.

### Remaining Challenges

According to Dagmar *et al.*, (2014), they examine how urban ecosystems work, how they deliver goods and services to city residents, how they change, and what promotes and inhibits their performance can help us understand socio-ecological dynamics and offer new suggestions for how to manage urban systems for resilience. There is still work to be done to demonstrate how the urban ecosystem services framework can offer transitional pathways and processes for creating plans and policies for urban resilience, governance frameworks that support poly-centrism and inclusiveness, and stewardship strategies to help meet demands and aspirations for sustainable urban growth, human health and well-being, ultimately paving the way for urban resilience. The issues that still need to be resolved include, but are not limited to: What new ideas and theoretical frameworks can help us better comprehend urban resilience from an ES perspective? What brand-new techniques and instruments are available for ES evaluation and bench-marking evaluation? What techniques can connect the local and global scales for ES evaluation, mapping, and modeling that are cross-scale and scale-sensitive? What may be learnt by using ES for planning and assessing resilience?

The research community needs to investigate these possibilities and any effects they might have on city governance at all levels, from municipal to international. It is believed that a socio-ecological strategy, which is likely to emerge under the initiative Emerging Future Earth, will put learning and scientific advancement at the center of urban sustainability and resilience on a world that is becoming more urbanized. Additionally, look at whether adaptive co-management might be a practical strategy for managing the ecosystem resilience of a bio-diverse urban landscape in Nigeria.

## Conclusion

Given the high value of property in metropolitan areas, securing and enhancing the production of ecosystem services would probably need a combination of multiple land uses on the same parcel of land. There are several ways to boost vegetation, such as using trees in parking lots or small lawns as traffic dividers. Thinking flexibly is required. It makes sense to incorporate the consideration of biodiversity into the future design of housing and town planning, both as a fundamental tenet of the Federal Ministry of Housing and Urban Planning and of state agencies with analogous responsibilities.

Despite the fact that city inhabitants still rely on global ecosystem services for their existence, it is also obvious that urban ecosystem services improve the quality of life in cities. Locally offered services, such as air quality and noise levels, which cannot be enhanced utilizing remote ecosystems, increase the quality of life for city people. But it is important to keep in mind that just the impact of these issues is diminished, not the root of the issue that has to be fixed. Working on both ends is necessary. It is hoped that a greater understanding of ecosystem services will lead to more efficient city planning and construction. The contribution of urban ecosystems to urban life would then be completely understood, and their value would be estimated if the country were to be claimed for exploitation. Understanding the significance of ecosystem services may also allow for the maintenance or even expansion of mysterious urban areas. Metropolitan planners and political decision-makers need to understand and value the ecosystem services provided by urban areas and the ecosystems they support as cities are expected to expand rapidly over the coming decades. Finally, local ecosystem services must be considered when planning land use because they have a big impact on metropolitan areas' quality of life.

## Recommendations

Urban regions have less greenery than rural areas, which contributes to the severity of the effects of climate change there. To lessen the effects of climate change, city inhabitants should be encouraged to cultivate flowers and trees. Rural areas should be given access to social institutions. As a result, fewer individuals move from rural to urban areas. If ecosystem services are to be preserved in the area, the government should also see to it that policies addressing environmental challenges in urban areas are adopted and appropriately enforced.

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