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Urbanization in Africa: challenges and opportunities for conservation

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Abstract

Africa, a continent exceptionally rich in biodiversity, is rapidly urbanizing. Africa’s urbanization is manifest in the growth of its megacities as well as that of its smaller towns and cities. The conservation planning and practice will increasingly need to account for direct and indirect impacts of the continent’s urbanization. The objective of our study is to pinpoint the outstanding challenges and opportunities afforded by the growing cities on the continent to the conservation goals and practices. While there have been many studies on the impacts of urbanization and development on conservation in Africa these studies tended to focus on specific issues. Here, we provide a synthesis of this body of work supported by new analysis. Urban areas, growing both in population and in land cover, pose threats to the integrity of the continent’s ecosystems and biodiversity but their growth also create opportunities for conservation. The burgeoning urban populations, especially in Sub-Saharan Africa, increase the strain on already insufficient infrastructure and bring new governance challenges. Yet, Africa’s ecosystems can serve as foundations for green infrastructure to serve the needs of its urban populations while safeguarding fragile biodiversity. Overall, while worsening social problems overshadow the concerns for biodiversity there are also promising initiatives to bring these concerns into the fold to address social, institutional, and ecological challenges that emerge with the continued urbanization of the continent.

1. Introduction: urbanization trends in Africa

Africa’s move into the ‘urban age’ is projected to be without precedent in its swiftness. While the continent is still largely rural, it is one of the fastest urbanizing regions around the world. Africa’s urban population is expected to more than triple over 40 years, from 395 million in 2010 to 1.339 billion in 2050, corresponding to 21% of the world’s projected urban population [1]. Currently, the continent has seven megacities, that is cities with populations over 10 million: Cairo, Kinshasa, Lagos, Accra, Johannesburg–Pretoria, Khartoum, and Nairobi. In 15 years, Luanda and Dar es Salaam will be added to this list.

Natural increase is estimated to be a more dominant factor in the increase in urban populations in many African countries compared to migration [2, 3]. Urbanization projections indicate a slowing rate in Africa from the 1990s high rates of up to 8% down to a range of 1.9%—2.2% from 2020—2050, with significant variation across its countries [3]. The total population in the continent is projected to reach almost 2.5 billion people by 2050 with about 55% living in urban areas (figure 1). This is a significant increase given that less than 10% of Africa’s population resided in urban areas in 1950. Most of the increase in urban population is taking place in small- and medium-sized cities in mid-latitude Africa. The growth of existing villages and
Figure 1. Historical trends and future projections for total population (a) and percentage of total population living in urban areas (b) in Africa and its three regions. The regions are based on United Nations (UN) regional categorization; mid-latitudinal Africa is the Western, Middle, and Eastern Africa regions. Grayed-out areas represent the projection interval. Data are from the United Nations' World Urbanization Prospects, 2014 Revision [1].

towns is also transforming rural landscapes into urban areas [4, 5].

Yet, despite clear physical evidence of urbanization, it must be noted there are large uncertainties in Africa’s population projections [6]. National censuses, demographic and health survey data, and population databases are sources of population projections, and each of these have significant uncertainties. Some of these are inherent to survey and census data, but these errors or omissions are amplified in a continent where institutions to collect and store these data are often underfunded and understaffed. Nevertheless, it is clear that the growth of small and medium cities, some of which were previously not designated ‘urban’, is a major contributor to higher levels of urbanization [4]. The nature of spatial expansion and growth of smaller settlements will significantly influence Africa’s urban landscape and its ability to achieve targets associated with the 2030 Agenda set out by the United Nations (UN) [7] and the continent’s own vision for Africa in 2063 [8].

Despite high rates of urban population growth, many African countries still have a high degree of urban primacy. That is, one city—usually the capital—has the population, economic activity, and political power that are several times greater than the next largest city. In the context of conservation, because governance and institutions are also concentrated in a single city, there is often disproportionately less attention given to, and resources available for, governing other urban centers, towns, and villages throughout the country. This concern with the overall structure of the urban system is what led the African region to—successfully—push, in the Habitat III process, for a focus on cities and also the national territorial system [9].

Although Africa’s high urbanization rates make it similar to other rapidly urbanizing places, it is important to underscore that the underlying processes that shape urbanization in Africa are vastly different from those experienced elsewhere. Much of urban expansion in Africa is characterized by unplanned and unregulated growth, exacerbated by the legacy of colonialism, structural adjustment, and neo liberalism that spawned weak urban planning institutions [10]. In urban areas, unemployment rates are high and about 60 percent of jobs are in the informal or grey economy, neither taxed nor monitored by the government [3]. Hence, Africa’s GDP tends to underestimate the amount of economic activity. There are also informal modes of social protection [11] and unregulated land markets, infrastructure and service provision [12]. Complicated settlement–governance arrangements, with weak local
Figure 2. Probabilistic forecasts of urban expansion by 2030 in Africa. We estimate the probability for each location by calculating the percentage of 1000 spatially explicit simulations of urban growth, in which that location becomes urban. We generated the 1000 simulations using Monte Carlo techniques (see [15,17] for details). Probabilities vary from 1% to 100% from yellow to red on the maps. High rates of urban expansion are expected along the Nigerian coast and within the Lake Victoria Basin. Even in relatively lower-fertility countries such as South Africa, major urban centers are expected to grow well beyond their current municipal boundaries.

Table 1. Total urban land in PAs in 2000 and forecasted change in urban land within 50 km of PAs in Africa from 2000 to 2030.

| Region           | Urban in PAs in 2000 (km²): average (std dev) | Percent increase in urban in 50 km of PAs: average (std dev) |
|------------------|-----------------------------------------------|-------------------------------------------------------------|
|                  | Urban in 50 km of PAs (km²):   Year 2000  Year 2030 |                                                               |
| Northern Africa  | 125                             2800          14 182 (2518) | 407 (190)                                                  |
| Mid-latitudinal Africa | 300                         5425          107 110 (20 862) | 1874 (485)                                                |
| Southern Africa  | 100                             6875          23 312 (3194) | 239 (146)                                                 |
| Africa           | 525                             15 100        144 604 (25 416) | 858 (68)                                                   |

* Regions are based on United Nations (UN) regional categorization; mid-latitudinal Africa is the Western, Middle, and Eastern Africa regions.

authorities and poor land-use management capacity mean that, even while there are examples of extreme density in ‘slums’ and informal settlements, the overall African urban form is low density [13]. In particular, unregulated peri-urban construction, often by the urban middle classes or expatriates, has spawned low-rise sprawl or the suburbanization of the countryside, cf [14].

The increase in urban population in Africa will be accompanied with an expansion in urban land. Between 2000 and 2030, urban land in Africa is forecasted to increase by nearly 600% [15] (figure 2). The forecasted urban expansion in the continent is concentrated in five regions: the Nile River in Egypt, the coast of West Africa along the Gulf of Guinea, the northern shores of Lake Victoria in Kenya and Uganda and extending into Rwanda and Burundi, the Kano region in northern Nigeria, and greater Addis Ababa, Ethiopia. Except the Nile River, all four regions are located in countries that are identified among the high-fertility African countries by the UN [16] (figure 2).

2. Urbanization impacts on African biodiversity

Africa has several regions with exceptional biodiversity [18] and is dotted with protected areas (PAs) with varying levels of protection status. The PAs cover an area of about 4.5 million km² across the continent [19]. As recently as 2000, Africa was sparsely urbanized with only about 500 km² of urban land within the boundaries of its PAs (table 1). In contrast, by 2030, total urban extent within 50 km of PAs on the continent
is expected to reach more than 140,000 km$^2$. In mid-latitudinal Africa, the nearly 20 fold increase in urban extent, the largest forecasted proportional increase in the vicinity of PAs across the world [17], will pose especially acute challenges for governance and management of PAs and the surrounding lands in this region.

While large urban centers such as Nairobi, Kenya and Ibadan, Nigeria dominate the continent’s urban expansion patterns (figure 2), the ecological impacts of the smaller cities and towns across Africa are also considerable. This is even the case for smaller cities such as Gaborone and Windhoek, the capitals of, respectively, Botswana and Namibia. Both cities are located in resource-poor areas and experience recurrent severe shortages of water [20]. Gaborone, with a population of 232,000 in 2011 [21], relies, in part, on water supplied from the Lentsibogo Dam on the Motloutse River, via a 400 km long pipeline. An extension of this North–South Water Carrier is planned that will bring waters from the Zambezi River—about 500 km from Gaborone—to the relatively small but growing city. Such long-distance water transfers are likely to become more widespread as growing cities in Africa will seek new sources to meet their increasing demand for water [22].

It is often assumed that migration from rural to urban areas and the resulting concentration of populations in cities would ease the pressure on natural habitats. In many parts of Sub-Saharan Africa, the migration and subsequent concentration of people in urban areas has indeed reduced rural populations, thus leading to reduced rates of deforestation [23]. However, land speculation by wealthy urban residents has also driven—abett ed by lack of land-use planning and control—loss and fragmentation of rangelands close to cities and towns in Ethiopia, Kenya, and Uganda [24]. In Western Africa, the increased demand for food in the cities has incentivized farmers to convert forests to agricultural fields to meet this demand [25]. These examples suggest that any relief from pressure on habitats from rural–urban migration may be overtaken by the increased demand for food and other natural resources from rapidly growing African cities. Furthermore, there are many instances of increasing deforestation in spite of a rise in a country’s urbanization level as more complex dynamics—often involving long-distance actors—start to play more prominent roles [26, 27]. Importantly, there has been significant foreign direct investment (FDI) aimed at land purchases in the continent to help secure food production for urban residents in other parts of the world [28]. Therefore, conclusive evidence on ecological outcomes of rural–urban migration on the continent is yet to materialize [25].

Urbanization and economic development also drive expansion of the transportation network, which in turn often fragment habitats. Of particular concern in the context of biodiversity conservation are the road and railroad infrastructure. Across Africa, there are 33 major development corridors, either proposed or already under construction [29]. If and when constructed, the road and railroad infrastructure in current plans would cut through over 400 PAs and could degrade about 2000 more. Moreover, large-scale changes in transportation networks such as the one proposed around the Serengeti may significantly influence future urban expansion patterns potentially increasing the vulnerability of the PAs in that region [30, 31].

Another example for the far and wide-reaching impact of urban residents is the bushmeat trade [32, 33]. Demand for bushmeat, a traditional source of animal protein for humans in much of Sub-Saharan Africa is on the rise fueled by dietary preferences of urban residents that are shaped by a combination of urbanization and increased-income effects [34]. It is shown that the high levels of human density, characteristic of urban and peri-urban areas, are negatively correlated with bushmeat from ungulates and primates sold in markets [35]. However, the bushmeat trade is also linked to rural livelihoods [36]. Therefore, measures such as blanket bans are likely to be an ineffective approach to address this complex issue; a more balanced approach that safeguards sensitive species as well as the livelihoods of people that rely on bushmeat trade, and one that recognizes the role of bushmeat in providing nutrition to millions of people along the urban-rural spectrum is needed.

The negative impacts of urbanization are evidenced in the expanding haloes of deforestation around cities and transportation routes [37]. Such exploitation of natural resources in expanding waves, progressively from the most highly valued to less, is observed both in large cities [38] and around smaller settlements [39]. Peri-urban agriculture, though important for food security in many Sub-Saharan African countries, can also contribute to loss and degradation of habitats around cities. Environmental degradation spreading out from an urban center can be significantly enhanced in both speed and intensity depending on the state of the transportation network [23, 37]. In the near future, the regions that may experience such degradation most rapidly and extensively are eastern and southern Democratic Republic of Congo and southern Cameroon, due to their high rural population densities and high foreign demand for their agricultural lands [37].

Ethnic conflicts and civil wars, some of which have been going on for decades, also influence urbanization in several parts of the continent. Such conflicts, as an underlying driver of urbanization, have arguably the most prominent influence on the biodiversity in central African countries [37]. The challenges faced by habitats in peri-urban areas around major cities can be intensified to the extent that refugees and internally displaced people (IDP) settle in informal settlements around the peripheries of these cities [40]. In particular, in East Africa and the Horn of Africa, an increasing number of refugees and IDP are living in cities [41]. All these add to the challenges faced by the governments of
these cities. Furthermore, what has started as a temporary camp for refugees and IDP may morph into urban areas over time whose demand for natural resources such as fuelwood, building materials, fresh water, and wild foods can be immense and result in significant local environmental degradation [42].

Influences external to the continent too play significant roles in shaping the impact of the urbanization on the biodiversity and ecosystems. Some of these are financed by FDI from countries outside Africa, i.e. increasingly from China, India, Malaysia, and Brazil in addition to Europe and the USA that have been historical sources of FDI to the continent [40]. In recent years, investment from another rapidly urbanizing country, China, has been an important source of funding for infrastructure projects in the continent. How to ensure that such investments facilitate industrial diversification and urban development on the continent without accelerating the decimation of Africa’s ecosystems is an outstanding challenge [29, 40]. Demand for animal parts as food, as ornament, or medicine has also been on the rise with the increasing levels of income and integration with global markets in those countries where such demand originates. These influences interact with those internal to the continent to shape patterns of, not only urbanization, but also, habitat degradation, loss, and fragmentation [25, 43].

3. An urban perspective for ecological governance and conservation

Ecological governance envisions the inclusion of ecological knowledge, science, and principles in all levels of decision-making, development planning, and implementation. Implicit in this view is that there is adequate ecological knowledge at all levels of decision-making from the individual communities through continental scales. In this respect, two of the major limitations in Africa with regard to ecological governance are the lack of capacity and lack of involvement of ecological experts in policy decisions. Multilateral environmental agreements scarcely include an ecological perspective even if it is increasingly recognized that decisions in economic, social, and political spheres will have major impacts on ecosystems. Furthermore, urban areas are integral to ecological landscapes; ecosystem processes and services change in character along a rural–urban continuum but do not cease to exist towards the urban end. This provides a good case for extending the management of natural resources beyond the confines of contemporary protected-area-based conservation [25].

While there has been an increasing realization of the dependency of humans on ecosystem services [44], this realization does not seem to have had an extensive influence in national or regional policy positions on urbanization in Africa. One reason for this is that, although the regional interest in knowledge about ecological landscapes in urban areas is growing [45, 46], both conservation scholarship and practice still largely ignore urban areas and fail to see them as integral parts of the landscape. One exception is South Africa where the concept of ecosystem services has been put to use both at the national and sub-national level to explore strategies for sustainable water resource management [47]. One of the sub-national projects focus on Olifants Grassland Catchment that includes major urban centers and heavy industry but is also home to Kruger National Park. In this project, scenario analysis and green-infrastructure planning were employed to simultaneously manage demand for water and preserve biodiversity by giving explicit attention to ecosystem services.

The challenges that urban areas in Africa are facing are among the biggest in the world. The provision of basic urban services has already been lacking across most cities on the continent even before the latest surge in urbanization. The reasons for poor governance and inadequate service infrastructure in urban areas can be traced back to colonial institutional arrangements and persistent political instability [25]. Some African countries do not have any urban planning and development departments while the rigid zoning in central areas of many cities inadvertently contribute to proliferation of slums and sprawling development of residential areas [25]. The social problems are liable to further deteriorate as the demand for services and the cost for delivery both rise jeopardizing achieving even the minimum targets of the Millennium Development Goals. Under these conditions, it is especially hard for the responsible agencies to put due emphasis on biodiversity conservation even though there are practical reasons for urban planning and governance to heed conservation of the habitats and biodiversity [48].

Studies on the interactions among biodiversity, ecosystem services, and urbanization conclude that they are multifaceted and elude simplification [49, 50]. This complexity poses both opportunities and challenges for conservation in urban landscapes. While it is hard to accurately value the services provided by ecosystems there are promising developments towards valuation of these resources to inform their sustainable and equitable management [51]. One problem in the case of African cities, as in most other developing country cities, is the lack of data to generate these monetary valuation estimates [52]. A more fundamental problem is that many of these services are common or public goods. This means that benefits they provide are not necessarily limited to those who can pay for them, but are typically freely available to a larger group [48].

Conservation has implications for ecosystem services [53]. African cities can benefit from ecosystem services such as provision of clean air and water while developing their economies [9]. In this sense, riparian zones can serve as critical parts of green infrastructure for purposes such as protection from floods,
provision of recreational spaces, and cleaning water while safeguarding biodiversity. Including riparian zones along with non-riparian areas within a system of urban parks is especially important to reflect maximum heterogeneity in native vegetation types [54]. Therefore, valuation of services provided by these ecosystems need to be given due attention in urban development initiatives [55]. The potential value of biodiversity and ecosystem services as foundations for a green infrastructure to meet the demands of urban residents has been showcased in a study on Johannesburg [52]. In this sense, urban agricultural plots can be used to increase green cover and enrich biodiversity in urban areas while improving food security and overall socio-economic condition of urban residents [56]. For this to happen though, more attention needs to be given to the extent urban agriculture contributes to enhanced biodiversity in African cities and towns [57, 58], which has been a relatively lesser studied aspect of urban agriculture [59].

Africa has recently adopted its own new urban agenda, in which cities are seen as drivers of development and keys to future prosperity of the continent. The African Urban Agenda (AUA), a UN-Habitat initiative to facilitate sustainable urbanization practices in the continent [9], provides an opportunity to incorporate ecological governance and conservation into urban governance and planning. The AUA program does not make any explicit reference to biodiversity and ecosystems [8] but, by providing a framework for African governments to address urbanization challenges with an emphasis on urban resiliency, regional integration, and quality of life of urban residents, it presents potential entry points for biodiversity conservation to be integrated in broader urbanization strategies across the continent. Should such strategic integration takes place, however, coordination among governments across local, regional, and national levels would be essential for the efficient management of ecosystem services and conservation of biodiversity through regulatory mechanisms and infrastructure systems. There has indeed been some movement in this direction.

The participation of three African countries, Botswana, Madagascar, and Uganda, in the WAVES (Wealth Accounting and Valuation of Ecosystem Services) initiative is an encouraging sign in that WAVES is a World Bank-led global partnership to ensure that natural resources are explicitly recognized in development planning as natural capital [60]. To the extent that the partnership is successful in its aim of mainstreaming natural capital in development planning, it can lead the participating countries to devote more effort to ecological governance and serve as role models for others in the continent to follow. However, the links to governance and infrastructure planning in urban areas where most people will live and where most demand for these services will originate are currently missing in this initiative; such links are also somewhat muted in larger deliberations about the future of African cities [9].

The Integrated Land-Use Planning initiative of the International Union for Conservation of Nature (IUCN) in four countries (two of which, Tanzania and Zambia, are in Africa) presents an opportunity to achieve more sustainable management of urbanization and improved biodiversity conservation though spatial planning [61]. Lake Victoria Environmental Management Program (LVEMP II) is another regional initiative formed by the local governments of the countries within the basin of Lake Victoria [62]. While agricultural conversion appears to be the biggest threat [31], with the economic development of the larger Lake Victoria region and population increase, urban areas especially in the countries that surround Lake Victoria (Uganda, Tanzania, and Kenya) increasingly place an undue burden on the lake. One of the goals of the LVEMP II initiative is rehabilitation of the lake’s ecosystems on which livelihoods of millions of people depend. Several other freshwater ecosystems in Africa face similar challenges that require international and inter-urban collaboration [40].

The African Union (AU) is the continental body responsible for giving direction to various policies in Africa—including economic development. The AU-affiliated African Ministerial Conference on the Environment, is tasked with providing continent-wide leadership by promoting awareness and consensus on global and regional environmental issues, especially those related to international conventions on biodiversity, desertification, and climate change. Another AU-affiliated body, the African Ministers’ Council on Water provides political leadership, policy direction, and advocacy in the provision, use, and management of water resources for sustainable social and economic development and maintenance of African ecosystems.

An important consideration in any of these initiatives is the quality of data. In studying the interactions of urban areas and biodiversity, not only the uncertainty in future rates and patterns of urban expansion but also the uncertainty in PA and other critical-habitat boundaries need to be considered. The uncertainty in these boundaries may be significant due to errors and biases in the selection of biodiversity indicators, species ranges, and ecological processes [63–65]. Consequently, PA extents may not necessarily overlap with the ranges of species that are in need of conservation [66]. On the other hand, there are inherent uncertainties in future projections and forecasts of growth in urban populations and urban land [2, 17, 67]. All these uncertainties have implications on the governance of sensitive habitats and confound attempts to reconcile urbanization and biodiversity conservation on the continent. Further, the interactions between urbanization and ecosystems are subject to the influence of any significant changes in regional and continental climate. These changes may play out through changes in ecosystem processes, in species adaptation, and in
intensification of socio-economic pressures. The efforts by many agencies and universities to better understand the drivers and impacts of climate change across Africa may produce useful information on how these influences may unfold in different parts of the continent over the next few decades [68, 69].

4. Conclusion

Encroachment of urban areas towards natural habitats and increasing demands of growing urban populations on natural resources put direct and indirect pressures on ecosystems. Notwithstanding the physical expansion of urban areas, concentration of people in urban areas would seem to ease off the pressure on natural habitats; yet, the effect of urban residents can be far and wide-reaching, e.g. through extension of transportation network, transfer of water over long distances, and increased demand for bushmeat. Supra-national or regional bodies have the potential to contribute to ecological governance in Africa, though understandably given Africa’s economic challenges, much of the current focus is on opportunities that urbanization can deliver for structural transformation. Still, urbanization in Africa, if well managed, can act as a catalyst to move the local, regional, national, and international governance mechanisms in the continent towards more effective conservation of biodiversity. The continent, having several regions with exceptional biodiversity, has much to offer to its urban populations in terms of recreation, a legacy of natural history, and a source of national pride. Its biodiversity and ecosystems can also serve as foundations for green infrastructure that can meet the needs of burgeoning urban populations while not ravaging these very ecosystems on which both rural and urban livelihoods ultimately depend.

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