

Reviewing The Ecosystem Services Provided By Urban Green Spaces In Africa

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Abstract: Urban green spaces are an important ecological infrastructure as they provide a range of ecosystem services and goods that are vital to human well-being and maintain the biodiversity in cities especially in this urbanizing world. Thus, to analyze the state of knowledge on research already performed on urban green spaces ecosystem services in African cities, a literature review about urban forestry was carried out using Google Scholar engine. The analysis of the one hundred and forty seven (147) selected papers reveals an uneven geographical distribution of urban forestry research in Africa. Countries like South Africa, Nigeria, Benin and Ghana recorded the highest number of publications on ecosystem services studies, in opposite to others. On the African continent, studies about urban green spaces ecosystem services draw attention to a wide range of ecosystem services that can be obtained from urban trees especially after the year 2018 where the number of scientific articles published increased to an average of seventeen (17) publications per year. Results highlighted that the most ecosystem services categories studied related to urban forest ecosystem services are regulating services (88 studies), followed by cultural ones (72 studies) compared to provisioning services (48 studies) which received the least attention from respondents. This review also revealed that studies on green spaces remain very limited at African scale. Consequently, scientific research should focus on urban forestry in these developing countries experiencing rapid and uncontrolled urbanization coupled with climate change noxious effects.

Keywords: Green spaces, ecosystem services, biodiversity, urban forestry, cities, Africa.

Introduction

The beneficial effects of nature and green spaces on people are proven. Their importance has become a major environmental necessity at both a local and an international level [1], [2]. Today, more than half of the world's population lives in cities, and according to the United Nations World Urbanization Prospects [3], this figure will rise to two-thirds by 2050 such as in Africa. The consequences of such rapid urbanization trends are environmental problems as well as the strengthening of climate change effects leading during the last decade to an increase in interest regarding the assessment of how urban green spaces can contribute to mitigating global warming [4].

In this increasingly urbanized world, the presence of natural elements contributes to the quality of life and brings many benefits in terms of social, economic, environmental and even health functions [5]. These benefits reflect the positive impact on human well-being [6]. Urban ecosystem services are therefore seen as the benefits that people derive from the functioning of nature in cities [7], [8].

According to [9], the ecosystem services that are most relevant to human health can be broadly categorized: air filtration, biodiversity conservation, climate stabilization, habitat maintenance, natural hazard mitigation, food, fuel and fiber production, water filtration, water regulation, and the provision of aesthetic environments and recreational opportunities. This range of benefits that human populations derive, directly or indirectly, from ecosystem functions is called ecosystem services [10] and is divided into four categories: provisioning services, regulating services, cultural services, and supporting or sustaining services [11], which are related to human wellbeing [11], [12].

For instance, when it comes to adapting to climate change, urban greenery is seen as an important solution because it contributes to biodiversity conservation and enables cities to manage storm water regulation and the urban heat island effect [13], [14]. A good quality of life for humans is therefore highly dependent on ecosystem functions, i.e. the ecosystem services that urban nature provides to human society [15].

Nevertheless, in some parts of the world, research and related knowledge exchange on the ecosystem services provided by urban green spaces remain limited [8], [16].

This paper aims to get deeper insights into the ecosystem services provided by green spaces in urban areas. For achieving this goal, we undertake a systematic literature review to synthesize and evaluate existing literature relevant to our topic, to gain a broad understanding of the topic, and to prepare for original research.

I. Methodology

The adopted methodological approach in this literature review consists of splitting the research process into four phases such as: data collection strategy, studies selection criteria, content analysis, and statistical analysis (Figure 1).

1.1. Data collection strategy

We systematically reviewed the academic literature about ecosystems services provided by urban green spaces in Africa using Google Scholar engine. The search string composed terms that expressed the geographical area of interest “Africa”, and the topic of interest “ecosystem services”. The search has no limitations according to the date of publication and includes scientific papers published in English and French languages. Due to the fact of our review cannot be considered exhaustive, we consider it to cover the largest parts of the available literature throughout Africa. Thus, a total of 1,128 papers were recorded including those we further identified from the reference lists of the relevant articles not picked up by the initial search.

1.2. Studies selection criteria

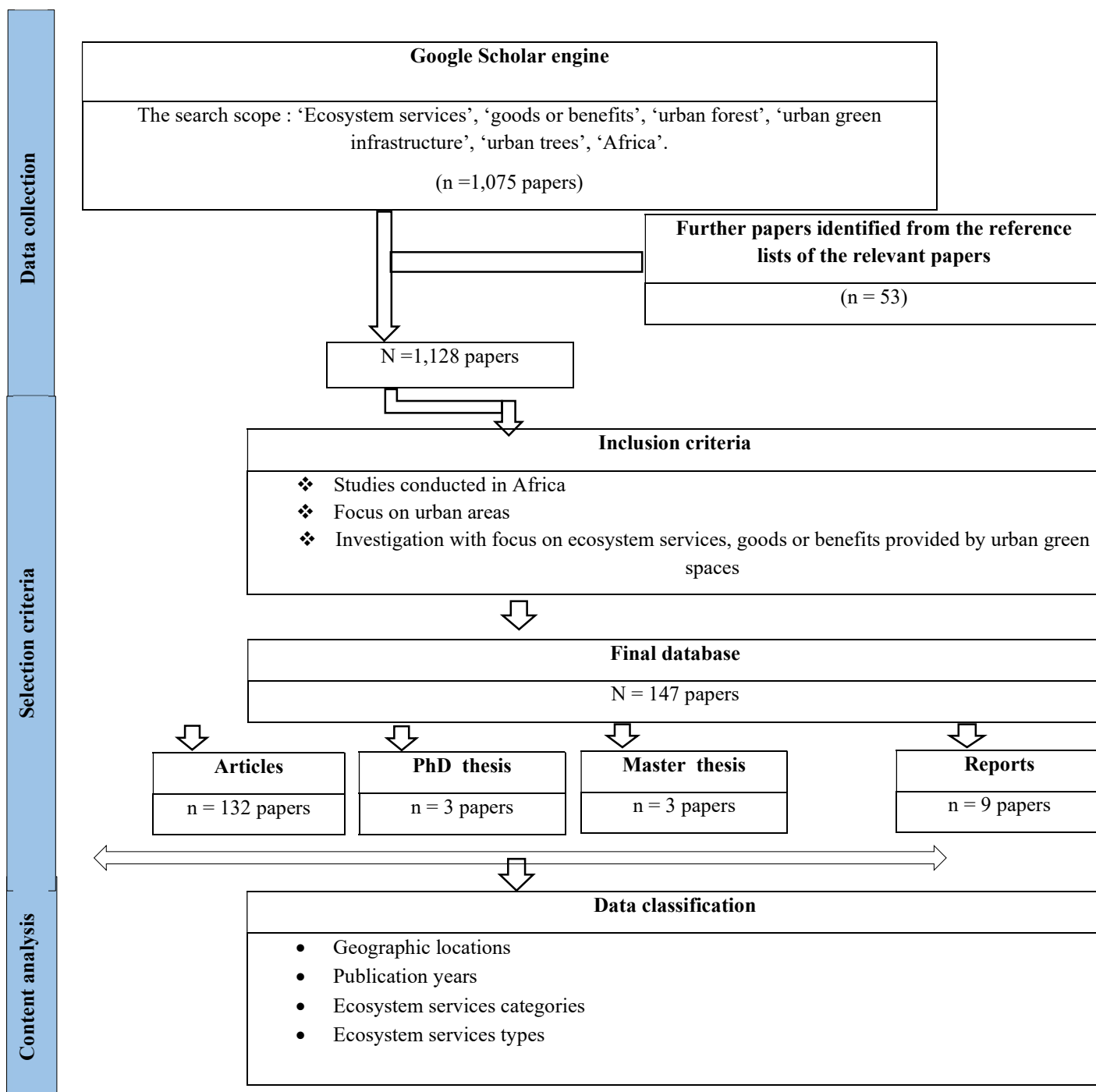
The abstracts of the retained papers were screened manually to include publications within the scope of this review based on the following guiding criteria: concentrating on urban areas, investigation with focus on ecosystem services, goods or benefits provided to an urban population, and explicitly includes the expression “ecosystem services”, as well as terms that further specified the subtopic of interest “the urban forests”, “urban green infrastructures” or “urban trees”, otherwise describes the link between the environment and benefits provided to urban populations. Finally, we selected 147 papers split up into 132 articles, 3 PhD thesis, 3 Master thesis and 9 reports.

1.3. Content analysis

The content of the 147 selected studies was classified according to the geographic locations, the publication years, the ecosystem services categories and the ecosystem services types.

1.4. Statistical analysis

The results analysis and graphs were performed using Excel software.



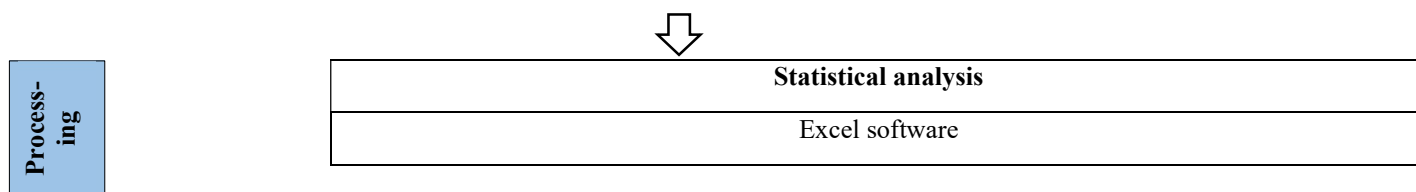


Figure 1: Steps of the literature review

II. Results

2.1. Geographical interest in urban green spaces ecosystem services studies.

Forty two (42) countries throughout Africa have been inspected by our review. Results revealed that South Africa was the most studied (17 papers), followed by Nigeria (13 papers) then, come Benin and Ghana respectively with 12 and 11 papers (Figure 2).

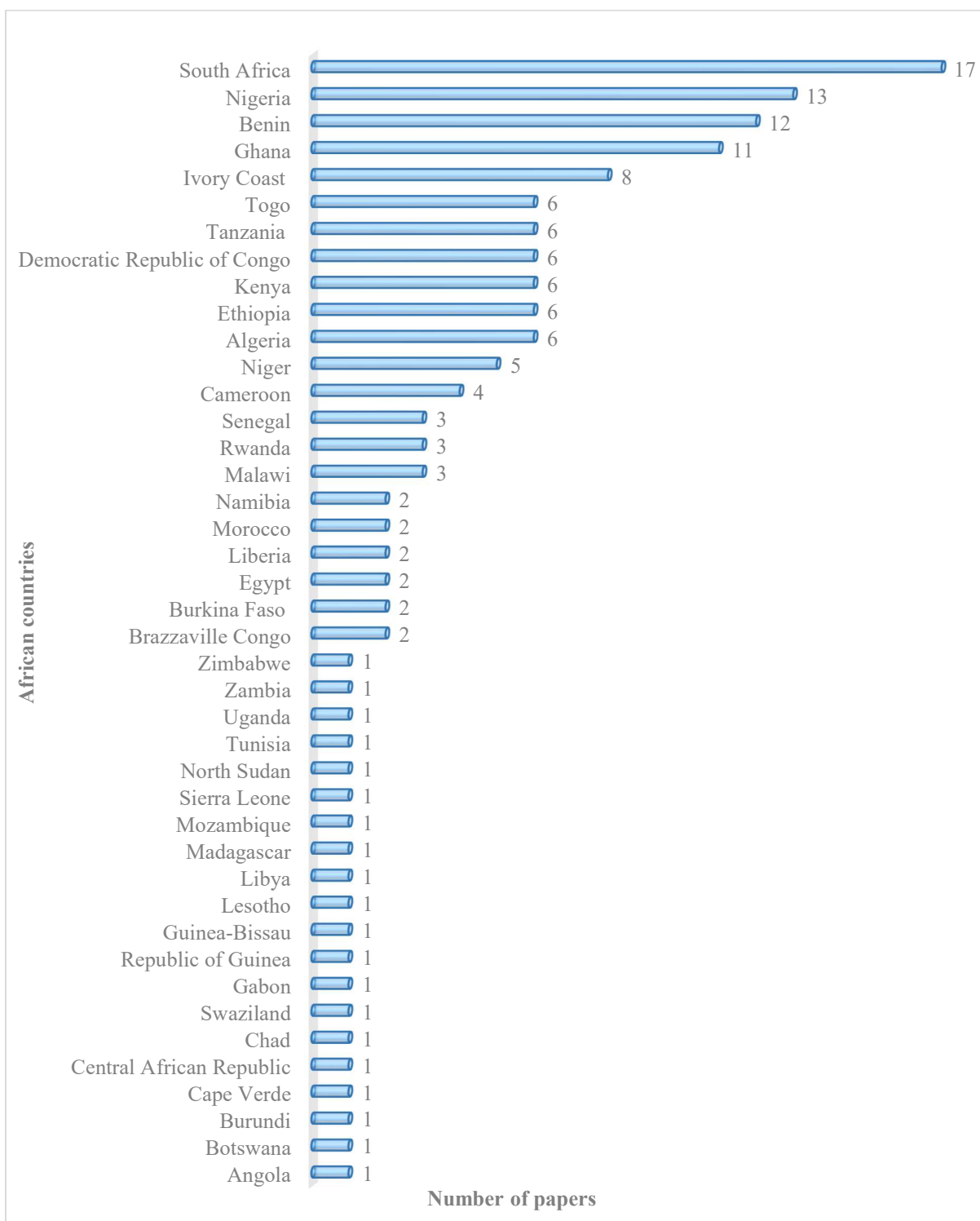


Figure 2: Geographical distribution of urban green spaces ecosystem services studies.

2.2. Dynamics in the number of publications

Results show an increase trend in the number of publications since 2011 with an average of five (5) publications per year noticed from 2011 to 2017, and it increases to an average of seventeen (17) publications per year after 2018 (Figure 3).

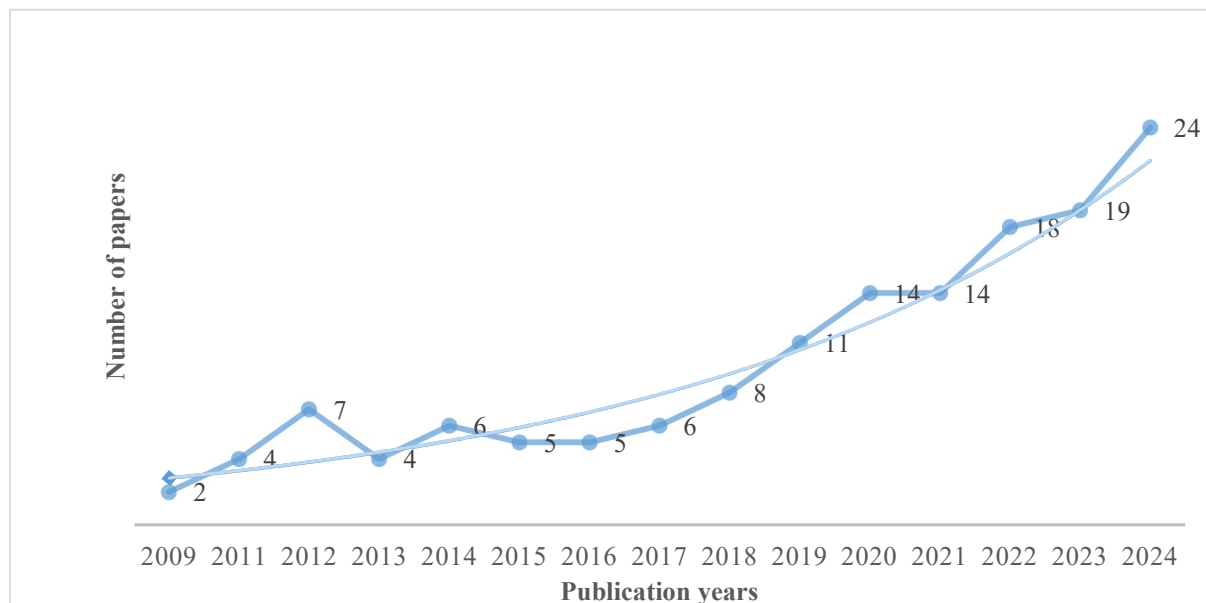


Figure 3: Dynamics in the number of publications

2.3. Ecosystem services

2.3.1. Ecosystem services categories

Based on this literature review, the ecosystem services that respondents believe deriving from vegetated areas in African cities are classified into four ecosystem services categories: provisioning, cultural, regulating, and supporting services. In terms of ecosystem services studied, regulating services were the most assessed (88 studies) followed by cultural services (72 studies) then, come supporting services (54 studies). However, provisioning services (48 studies) received the least attention from research (Figure 4).

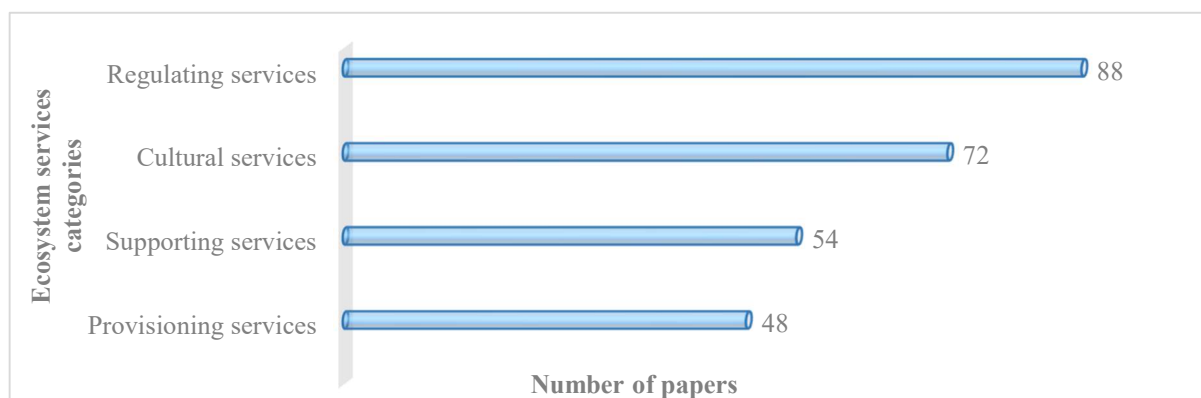


Figure 4: Ecosystem services categories

2.3.2. Ecosystem Services Types

As [17], we listed the specific ecosystem services assessed in the selected papers per category from Table 1 to 4 by indicating the number of studies that assessed particular ecosystem services as well as countries and references.

2.3.2.1. Regulating services

Temperature, air quality, water flow and shade regulations are by far the most assessed regulating services (Table 1). Several findings in African cities like in Grand-Popo, Benin [18], in Bamenda, Cameroon [19], in Derna, Libya [20] and in Bou-Saada, Algeria [21] highlighted that urban green spaces are of particular importance as they offer shading and cooling, to mitigate the urban heat island effect and with regard to water flow and air pollution.

Table 1: Specific regulating ecosystem services

Services	Studies	Countries and references
Temperature regulation	46	Algeria ([21] ; [22]), Benin ([23] ; [24] ; [25] ; [26]), Burkina Faso ([27]), Burundi ([28]), Ethiopia ([29] ; [30]), Cameroon ([19] ; [31]), Democratic Republic of Congo ([32] ; [33]), Ghana ([34] ; [35]), Ivory Coast ([36]), Kenya ([37] ; [38]), Liberia ([39] ; [40]), Madagascar ([41]), Morocco ([42]), Namibia ([43]), Niger ([44]), Nigeria ([45] ; [46] ; [47] ; [48] ; [49]), Senegal ([50]), South Africa ([17] ; [51] ; [52] ; [53] ; [54] ; [55] ; [56] ; [57]), Tanzania ([29] ; [58] ; [59] ; [60]), Togo ([61]), Tunisia ([62]), Zambia ([63]).
Air purification	33	Benin ([23] ; [24] ; [25] ; [26] ; [64] ; [65] ; [66]), Burundi ([28]), Brazzaville Congo ([67]), Cameroon ([19]), Ethiopia ([30] ; [68]), Ghana ([34] ; [35] ; [69] ; [70]), Morocco ([42]), Namibia ([43]), Niger ([44]), Nigeria ([45] ; [46] ; [47] ; [48]), South Africa ([17] ; [54] ; [55] ; [71] ; [72]), Tanzania ([60] ; [73]), Togo ([61] ; [74]), Zambia ([63]).
Water flow regulation	28	Benin ([23] ; [24] ; [25] ; [26]), Brazzaville Congo ([67]), Cameroon ([19]), Democratic Republic of Congo ([32]), Ethiopia ([30] ; [75] ; [76]), Ghana ([34] ; [35]), Ivory Coast ([77]), Libya ([20]), Namibia ([43]), Niger ([44]), Nigeria ([45] ; [47] ; [78]), Rwanda ([79]), South Africa ([17] ; [54] ; [55] ; [56] ; [57]), Tanzania ([59] ; [60]), Togo ([74]).
Shade	25	Algeria ([21]), Benin ([18] ; [24] ; [25] ; [65] ; [66]), Brazzaville Congo ([67]), Chad ([80]), Democratic Republic of Congo ([81]), Ghana ([34] ; [82]), Ivory Coast ([77] ; [83]), Kenya ([84] ; [85]), Namibia ([86]), Niger ([44]), Nigeria ([45]), Sierra Leone ([87]), South Africa ([17] ; [53] ; [88]), Tanzania ([58]), Togo ([74] ; [89]).
Carbon storage	11	Benin ([90]), Burkina Faso ([91]), Brazzaville Congo ([92]), Democratic Republic of Congo ([85]), Ghana ([93]), Ivory Coast ([94] ; [95]), Niger ([96]), Senegal ([97]), South Africa ([98]), Togo ([99]).
Wind breaks	8	Algeria ([21]), Benin ([18] ; [26]), Brazzaville Congo ([67]), Ghana ([34] ; [35]), Nigeria ([100]), Tanzania ([60]).
Noise reduction	7	Algeria ([101]), Benin ([23] ; [24] ; [26]), Cameroon ([19]), Ethiopia ([30]), Ghana ([35]).

2.3.2.2. Cultural services

Aesthetic value and recreation are the most studied cultural services (Table 2). According to [64], [67], and [106] studies conducted respectively in Parakou (Benin), in Dolisie (Brazzaville Congo) and in Abuja (Nigeria), urban green spaces are an important public good that provide cities the value of recreational services and enhance aesthetic beauty.

Table

2:

Services	Studies	Countries and references
Aesthetic value	46	Algeria ([102]), Benin ([18] ; [23] ; [25] ; [26] ; [64] ; [65] ; [66]), Burundi ([28]), Brazzaville Congo ([67] ; [92]), Cameroon ([31]), Chad ([80]), Democratic Republic of Congo ([33] ; [81]), Ethiopia ([75]), Ghana ([34] ; [35] ; [70] ; [82] ; [103] ; [104]), Guinea ([105]), Ivory Coast ([36] ; [77] ; [95]), Kenya ([84]), Morocco ([42]), Namibia ([43]), Niger ([44]), Nigeria ([45] ; [47] ; [49] ; [100] ; [106] ; [107]), Rwanda ([103]), South Africa ([17] ; [51] ; [53] ; [71] ; [88]), Tanzania ([58] ; [60]), Togo ([74] ; [108]).
Recreation	42	Angola ([109]), Benin ([25] ; [26] ; [65] ; [66]), Burundi ([28]), Cameroon ([19] ; [110]), Chad ([80]), Democratic Republic of Congo ([32] ; [33] ; [81]), Egypt ([111]), Ethiopia ([30] ; [103]), Ghana ([34] ; [35] ; [82] ; [112]), Kenya ([84] ; [85]), Madagascar ([41]), Malawi ([113]), Morocco ([42]), Namibia ([43] ; [86]), Niger ([44]), Nigeria ([45] ; [47] ; [49] ; [100] ; [106] ; [114]), Rwanda ([115]), South Africa ([17] ; [51] ; [56]), Tanzania ([58] ; [60] ; [73] ; [116]), Togo ([74]).
Social cohesion	22	Benin ([23]), Brazzaville Congo ([92]), Cameroon ([19]), Democratic Republic of Congo ([32] ; [33]), Gabon ([117]), Ghana ([35] ; [69] ; [70]), Ivory Coast ([77] ; [94]), Kenya ([84]), Namibia ([43] ; [86]), Nigeria ([45] ; [48] ; [49] ; [100] ; [118]), South Africa ([17] ; [51] ; [55]).
Tourism	8	Benin ([23] ; [26]), Brazzaville Congo ([92]), Ghana ([35]), Kenya ([119]), Mozambique ([119]), South Africa ([53]), Togo ([74]).
Education	7	Angola ([109]), Benin ([26]), Ghana ([34] ; [112]), Kenya ([84]), Tanzania ([73]), Togo ([74]).
Specific cultural ecosystem services		

2.3.2.3. Supporting services

The [Table 3](#) highlighted that urban green spaces play a significant role as refuge for many animals and plants species. This contribution of urban forest in city's biodiversity conservation has been revealed by many African authors, specialist in urban ecology such as in Windhoek, Namibia [\[43\]](#), in Franceville, Gabon [\[117\]](#), in Marrakech, Morocco [\[120\]](#), in Alexandria, Egypt [\[121\]](#) and in Diffa, Niger [\[122\]](#).

Table 3: Specific supporting ecosystem service

Services	studies	Countries and references
Habitat for species	54	Algeria ([123] ; [124]), Benin ([23] ; [25] ; [26] ; [65] ; [66] ; [125] ; [126] ; [127]), Brazzaville Congo ([67] ; [92]), Cameroon ([19]), Chad ([80]), Democratic Republic of Congo ([32] ; [128] ; [129] ; [130]), Egypt ([121]), Ethiopia ([75]), Gabon ([117]), Ghana ([34] ; [82] ; [131] ; [132]), Ivory Coast ([77] ; [94] ; [95] ; [133] ; [134]), Kenya ([135]), Madagascar ([41]), Morocco ([120]), Namibia ([43]), Niger ([122] ; [136] ; [137]), Nigeria ([45] ; [49] ; [138] ; [139]), North Sudan ([140]), Senegal ([97] ; [141]), South Africa ([17] ; [51] ; [53] ; [142]), Tanzania ([60] ; [73]), Togo ([89] ; [99] ; [108] ; [143]).

2.3.2.4. Provisioning services

It has been proven that urban trees play an important role in providing potential services within cities. Nevertheless, these services are the ecosystem service types that received the least attention from research ([Table 4](#)).

Table 4: Specific provisioning ecosystem services

Services	Studies	Countries and references
Food provision	38	Angola ([109]), Benin ([18] ; [25] ; [26] ; [64]), Botswana ([144]), Brazzaville Congo ([67]), Cape Verde ([144]), Central African Republic ([144]), Chad ([80]), Democratic Republic of Congo ([32]), Ghana ([35] ; [104]), Guinea-Bissau ([144]), Ivory Coast ([36] ; [77] ; [95]), Lesotho ([144]), Malawi ([145]), Namibia ([43]), Niger ([44]), Nigeria ([45] ; [47] ; [78] ; [100] ; [118]), Senegal ([50]), South Africa ([17] ; [54] ; [88] ; [146] ; [147]), Swaziland ([144]), Togo ([89]), Tanzania ([58] ; [60]), Uganda ([148]), Zimbabwe ([149]).
Medicinal plants	29	Benin ([18] ; [23] ; [64] ; [65] ; [66]), Brazzaville Congo ([67] ; [92]), Chad ([80]), Democratic Republic of Congo ([33]), Ghana ([34] ; [35] ; [82]), Ivory Coast ([36] ; [77] ; [95]), Malawi ([145]), Namibia ([43]), Niger ([44]), Nigeria ([45] ; [47] ; [78] ; [100]), Senegal ([50]), South Africa ([17] ; [57] ; [88]), Togo ([74]), Uganda ([148]), Zimbabwe ([149]).
Fuel wood	18	Benin ([18] ; [23] ; [25] ; [26]) Brazzaville Congo ([67]), Ghana ([34] ; [35]), Malawi ([145]), Namibia ([43]), Niger ([44]), Nigeria ([45] ; [78] ; [100]), Senegal ([50]), South Africa ([17] ; [53] ; [147]), Zimbabwe ([149]).
Building materials	7	Ghana ([32]), Malawi ([145]), Nigeria ([45] ; [78]), South Africa ([17] ; [53]), Zimbabwe ([149]).

III. Discussion

Our review article investigated thoroughly urban forestry related to ecosystem services in forty two (42) countries geographically focused on the African continent. A total of one hundred and forty seven (147) papers were included in this literature review. Then, results showed that about 37 percent (%) of studies were carried out in only four countries notably South Africa, Nigeria, Benin and Ghana (Figure 2). This could be attributed to both their urbanization level and their highest number of urban populations [150]. In this increasingly urbanized world, the presence of natural elements contributes to the quality of life and brings many benefits in terms of social, economic, environmental and even health functions [5]. In spite of the inescapable importance of the urban forestry, there is an insufficiency of studies in some countries which are represented by only one or five studies. This could be linked to limited resources and investments to support such studies [151]. There is therefore a need for more studies in these deficit countries.

Studies on ecosystem services provided by urban green spaces are becoming increasingly important. Indeed, the number of scientific papers published on ecosystem services of urban forests in Africa has increased to an average of seventeen publications per year after 2018 (Figure 3). A similar trend was observed in Rabat (Morocco) by [152] in their literature review on the economic valuation of ecosystem services in Africa. This could be linked to the United Nations' commitment to make cities and human settlements more inclusive, safe, resilient and sustainable [153], following the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties and the Conference of the Parties (COP21) in Paris in 2015, which called on several countries and cities to develop strategies and applications to support urban green infrastructure and nature-based solutions, especially with regard to the positive ecosystem services of urban biodiversity [154], [155].

Urban ecosystem services are seen as the benefits that people derive from the functioning of nature in cities [7]. Referring to the Figure 4, regulating and cultural services are the ones to which people attach the most interest, compared to provisioning services whose value is greatly underestimated by respondents. This could be explained by the fact that provisioning services do not cover the urban population needs especially due to their limited availability in terms of food, fuel wood and Building materials.

It is interesting that despite their relatively small size, urban green spaces exhibit a capacity for regulating services, at least at a small scale. In a study conducted by [21] in Bou-Saada (Algeria), it was shown that urban vegetation plays a thermoregulatory role, helping to combat heat islands effects and creates cool islands in arid urban areas, the cooling of the ambient temperature is due to the evapotranspiration phenomenon. This could be explained by the fact that evapotranspiration process not only absorbs thermal radiation but also releases moisture to cool the ambient air and create a more comfortable microclimate [156]. Air pollution from transportation, industry, domestic heating, and solid urban waste incineration is a major problem for environmental quality and human health in the urban environment, it leads to increases in respiratory and cardiovascular diseases. Vegetation in urban systems can improve air quality by removing pollutants from the atmosphere, including ozone (O_3), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO) and particulate matter less than $10\ \mu m$ (PM_{10}) [157], [158]. Several studies show that urban forests play critical role in reducing air pollution by intercepting particulates [25], [28], [46], [82]. Shading is a common benefit provided by most planted trees, depending on their size and crown shape [18]. The presence of urban vegetation reduces the amount of surface runoff after rainfall by intercepting and storing water in the leaves and stems [159]. As shown in many studies conducted in African cities such as in Addis Ababa (Ethiopia) by [30], in Dar es Salaam (Tanzania) by [60] and in Lomé (Togo) by [74], urban drainage system loading can reduce and minimize the risk and occurrence of flooding by mitigating runoff after rainfall events. Traffic, construction, and other human activities make noise a major pollution problem in cities, affecting health through stress. According to [160], plants can attenuate noise pollution through absorption, deviation, reflection, and refraction of sound waves. Vegetation plays a significant role in arid and semi-arid cities where wind actions are remarkable and harmful [161]. African researchers have proven that urban vegetation is the best filter-interchange screen for wind erosion control [18], [26], [60]. Another co-benefit of vegetation relevant in urban areas as municipalities set their climate mitigation targets, is carbon storage in aboveground biomass that is considered as a major contributor to the mitigation of global warming and adaptation to climate change [91], [96]. Furthermore, knowledge of the tree's role in regulating the climate remains very low among the population. This could be linked to the lack of sensitization towards different actors on the climate change phenomenon and the role of urban trees in terms of mitigation and adaptation [64].

Because urban environment may be stressful for inhabitants, the recreational aspects of urban ecosystems are among the highest valued ecosystem services in cities [64], [67], [106]. Urban parks are therefore attractive for a variety of reasons: to get some fresh air, to take a walk, or to engage in recreational activities [162], [163]. Urban green spaces play an important role as providers of aesthetic value [104]. Several studies have shown an increased value of properties with greater proximity to green areas [164], [165], [166]. Another study conducted by [106] in Abuja (Nigeria) indicated that urban parks are an important public good that provide cities the value of environmental services and enhance aesthetic beauty. Benefits attributed to green spaces include the mood improving [167], stress reducing [168], and the strengthening of community bonds [169]. Studies conducted respectively in South Africa [51], in Ivory Coast [77] and in Kenya [84] supported the conclusion that attachment to green spaces in cities can also give rise to other important societal benefits, such as social cohesion, promotion of shared interests, and neighborhood participation [170].

Urban green spaces act as small-scale urban biodiversity hotspots. It was recognized in 1992 at the second environmental congress in Kyoto that vegetation is the best means of structuring habitat in developing countries. Urban systems can play a significant role as refuge for many animals and plants species [51], [65], [134], [136]. These green spaces are havens for significant diversity of plants, birds and insects, and in particular can harbor large numbers of indigenous plant species as was shown in the study by [142] where a total of 156 vascular plants species, 35 tree species and 44 faunal species were recorded in Cape Town gardens. According to [131], urban forests contain modest amount of tree diversity which differ widely among urban

green spaces types. This author reports that common street and public park tree species in Kumasi include: *Cassia siamea*, *Cedrela odorata*, *Terminalia catappa*, and *Peltophorum pterocarpum*.

According to respondents, food and medicinal use are the most important needs from urban green spaces. This particular attention could be explained by the fact that many African countries depend directly on this category of services to meet their basic needs [67], [171]. [18] showed in their study that medicinal use or pharmacopoeia is provided by species such as *Cocos nucifera*, *Azadirachta indica*, *Coccoloba uvifera*, *Acacia auriculiformis*, *Mangifera indica*, *Eucalyptus camaldulensis*, *Calotropis procera* and *Citrus lemon*. This was also shown in the study conducted in Zimbabwe by [149] were about 34% of respondents indicated that they obtain medicinal products from peri-urban forests. According to [23], wood energy is the main service provided by vegetated areas in the town of Allada (Benin). For details, the most felled urban tree for firewood is *Mangifera indica*, used in charcoal production and brick firing [67]. In some African cities, such as Masvingo City (Zimbabwe), green spaces supply residents with building timber according to 54% of respondents who declared obtaining building materials from the peri-urban zones [149].

IV. Conclusion and recommendation

This review was carried out with the purpose of inventorying ecosystem services that are provisioned by urban green spaces in Africa. Results revealed a significant uneven distribution of studies on ecosystem services of urban green spaces at African countries scale. Consequently, future research should focus on the least studied countries to improve knowledge and understanding about the ecosystem services provided by urban green spaces in these African cities subjected to an accelerated spread of their urban fabric. Then, in terms of publications trends, the number of papers published on urban green spaces ecosystem services is significantly on the rise. This review also highlighted that regulating services are the predominant categories of ecosystem services studied, while provisioning services are often overlooked. Finally, we globally noticed through this review the lack of sufficient data about urban green spaces ecosystem services in Africa, especially in this context of rapid urbanization and global warming. While the idea of ecosystem services is a very popularized concept that is successfully integrated and practiced in a number of current environmental research fields, those related to urban areas remain a very much less known and studied. As result, few studies about urban green spaces ecosystem services have been performed in African countries mainly due to the fact that urban forestry studies are not yet regarded as an important field of research in most African cities where numerous pressures on green spaces exist.

By way of recommendation, this review emphasizes the need for immediate integration of urban forestry in African universities' curricular in order to ensure improved representation of African continent regarding urban forestry literature.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- [1] Clergeau P. (2007). *Une écologie du paysage urbain*. Rennes (France), Editions Apogée, 136 p.
- [2] Aronson M. F. J., La Sorte F. A., Nilon C. H., Katti M., Goddard M. A., Lepczyk C. A., Warren P.S., Williams N. S., Cilliers S., Clarkson B., Dobbs C., Dolan R., Hedblom M., Klotz S., Kooijmans J. L., Kühn I., Gregor-Fors I. M., McDonnell M., Mörtberg U., Pyšek P., Siebert S., Sushinsky J., Werner P. & Winter M. (2014). A global analysis of the impacts of urbanization on bird and plant diversity reveals key anthropogenic drivers. *Proceedings of the Royal Society, B: Biological Sciences*, 281 (1780), doi: <http://dx.doi.org/10.1098/rspb/2013.3330>.

- [3] UN Department of Economic and Social Affairs, Population Division. (2014). World Urbanization Prospects. The 2014 Revision, Highlights (ST/ESA/SER.A/352).
- [4] Djikpo Vignon, Adelphe Rosos, Teka Oscar, Djossa Bruno, Oumorou Madjidou, Sinsin Brice. (2023). Understanding Coastal Residents' Perception on Urban Green Spaces in Benin, West Africa. *Agriculture, Forestry and Fisheries* 2023; 12(1): 8-17, doi: 10.11648/j.aff.20231201.12.
- [5] Chiesura, A. (2004). The role of urban parks for the sustainable city. *Landscape and Urban Planning*, 68, pp 129-138.
- [6] TEEB (2010). The Economics of Ecosystems and Biodiversity Ecological and Economic Foundations. In P. K. Earthscan (Ed.). London and Washington.
- [7] Cvejić, R., Eler, K., Pintar, M., Železnikar, Š., Haase, D., Kabisch, N. & Strohbach, M. (2015). Green Surge – A Typology of Urban Green Spaces, Ecosystem Provisioning Services and Demands. Report: D3.1, Seventh Framework Program.
- [8] Haase, D., Larondelle, N., Andersson, E., Artmann, M., Borgström, S., Breuste, J., Elmqvist, T. (2014). A quantitative review of urban ecosystem services assessment: Concepts, 909 Models, and Implementation. *AMBIO*, 43(4), 413–433, <https://doi.org/10.1007/s13280-910.014-0504-0>.
- [9] Jackson, L. E., Daniel, J., Mccorkle, B., Sears, A. & Bush, K. F. (2013). Linking ecosystem services and human health: The eco-health relationship browser. *International Journal of Public Health*, 58(5), pp. 747–755, 2013, <https://doi.org/10.1007/s00038-013-0482-1>.
- [10] Costanza, R., D'Arge, R., De groot, R., Farberk, S., Grasso, M., Hannon B., Limburg K., Naeem, S., O'neill, R. V., Paruelo, J., Raskin, R. G., Suttonkk, P. & Belt M. V. D. (1997). The value of the world's ecosystem services and natural capital. *Nature*. 387, 253-260.
- [11] Millenium Ecosystem Assessment. (2005). *Ecosystems and human well-being*, URL: [http://www.maweb.org/documents/document 356.aspx.pdf](http://www.maweb.org/documents/document%20356.aspx.pdf).
- [12] Perring, M. P., Manning, P., Lugo, A. E. & Ramalho, C. E. (2012). Novel Urban Ecosystems and Ecosystem Services, Wiley: Hoboken, NJ, pp. 310–325, 2012.
- [13] Derkzen, M. L., van Teeffelen, A. J., & Verburg, P. H. (2017). Green infrastructure for urban climate adaptation: How do residents' views on climate impacts and green infrastructure shape adaptation preferences? *Landscape and urban planning*, 157, 106-130.
- [14] Haaland, C., & van Den Bosch, C. K. (2015). Challenges and strategies for urban green-space planning in cities undergoing densification: A review. *Urban forestry & urban greening*, 14(4), 760-771.
- [15] Burkhard, B. and Maes, J. (2017). Chapter 1. Introduction in Mapping Ecosystem Services. 1st edn. *Bulgaria: Pensoft Publishers, Sofia*, pp. 23-25, doi 10.3897/ab.e12837.
- [16] Elmqvist, M. Fragkias, J. Goodness, B. Güneralp, P. J. Marcotullio, R. I. McDonald. (2013). Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities. Dordrecht: Springer, pp. 882 719-746.
- [17] Du Toit M. J., Cilliers S. S., Dallimer M., Goddard M., Guenat S. & Cornelius S.F. (2018). Urban green infrastructure and ecosystem services in sub-Saharan Africa. *Landscape and Urban Planning*, 180: 249-261.
- [18] Osseni A. A., Gbesso G. H. F., Nansi K. M., Tente A. B. H. (2020). Phytodiversité et services écosystémiques associés aux plantations d'alignement des rues aménagées de la ville de Grand-Popo au Bénin. *Bois et Forêts des Tropiques*, 345 : 85-97, doi : <https://doi.org/10.19182/bft2020.345.a31808>.

- [19] Gideon Samba, Reeves Meli Fokeng, Julius Tata Nfor, Roland Chah Ngwaimbi. (2022). Green Spaces and Urban Liveability in Sub-Saharan Africa: Lessons from Bafoussam I, Cameroon. *International Journal of Global Sustainability* ISSN 1937-7924 2022, Vol. 6, No. 1, doi:10.5296/ijgs.v6i1.19390.
- [20] M. A. Haleemah Faraj Bin Tahir. (2022). The sustainable development of waterfronts for coastal cities as a solution for green spaces: a case study of Derna, Libya. *GSJ: Volume 10, Issue 7, July 2022* ISSN 2320-9186.
- [21] Ouzir Malika. (2023). Green Infrastructure, a thermal regulator for the arid city. Case study of the city of Bou-Saada. Original scientific paper, <https://doi.org/10.2298/GSGD2301419O>.
- [22] Gherraz, H. (2021). L'impact de l'espace vert sur le microclimat urbain et l'utilisation des espaces extérieurs (Cas de la ville de Constantine). These de doctorat à l'Université Mohamed Khider – Biskra, Algérie. 356 p.
- [23] Sehoun L., Lougbegnon T., Codjia J. C. (2020). Connaissances et Perceptions des services écosystémiques des espaces verts des villes de Cotonou, Abomey-Calavi et Allada du Sud Bénin : Implications pour la gestion durable des forêts urbaines et péri-urbaines. *European Scientific Journal, ESJ*, 16 (33), 284, <https://doi.org/10.19044/esj.2020.v16n36p52>.
- [24] Akakpo Bokon Alexis, Okhimamhe Appollonia A., Orekan A. O. Vincent. (2022). Perception and involvement of residents in improving urban greenery in Parakou and Porto Novo cities of Benin Republic. *Research square*, doi: <https://doi.org/10.21203/rs.3.rs-1464566/v1>.
- [25] Atchadé, A.J.; Kanda, M.; Folega, F.; Atela, J.; Dourma, M.; Wala, K.; Akpagana, K. (2023). Urban Ecosystem Services and Determinants of Stakeholders' Perception for Sustainable Cities Planning in Cotonou (Benin). *Sustainability* 2023, 15, 9424, <https://doi.org/10.3390/su15129424>.
- [26] Tchibozo-Kekele, C., Gbedomon, R.C., Todome, L., Thoto, S.F. (2024). Arbres dans les localités urbaines de la commune d'Abomey-Calavi, Bénin : analyse des services écosystémiques attendus et des gênes redoutées. Rapport de recherche. Abomey-Calavi, Bénin. 35 p, doi : 10.61647/aa86605.
- [27] Sandrine Severine Zoungana, Souleymane Ganaba, Paulin Ouoba, Romaric Nebnoma Tiendrebeogo. (2021). Diversité végétale et effet sur la température des infrastructures vertes urbaines de Bobo-Dioulasso (Burkina Faso). *Science et technique, Sciences Naturelles et Appliquées*. Vol. 40, n° 2 – Juillet - Décembre 2021.
- [28] Henri Kabanyegeye, Tatien Masharabu, Yannick Useni Sikuzani & Jan Bogaert. (2020). Perception sur les espaces verts et leurs services écosystémiques par les acteurs locaux de la ville de Bujumbura (République du Burundi). *Tropicultura* 2295-8010 volume 38 (2020) Numero 3-4, 1655.
- [29] Gina Cavan, Sarah Lindley, Fatimeh Jayeler, Kumelachew Yeshitela, Stephan Pauleit, Florian Renner, Susannah Gill, Paolo Capuano, Alemu Nebebe, Tekle Woldegerima, Deusdedit Kibassa, Riziki Shemdoe. (2014). Urban morphological determinants of temperature regulating ecosystem services in African cities: the case of Dar es Salaam, Tanzania. Article Pre-print, 2014. 24 p.
- [30] Yonas Kebede Beyene and Liu Ying. (2024). Ecosystem service value of urban green spaces in Addis Ababa, Ethiopia. *International Research Journal of Engineering and Technology (IRJET)*. Volume: 11 Issue: 07 | July 2024.
- [31] Jude Ndzifon Kimengsi and Zephania Nji Fogwe. (2017). Urban Green Development Planning Opportunities and Challenges in Sub-Saharan Africa: Lessons from Bamenda City, Cameroon. *International Journal of Global Sustainability*. ISSN 1937-7924 2017, Vol. 1, No. 1, URL: <http://doi.org/10.5296/ijgs.v1i1.11440>.
- [32] K. R. Sambieni, Y. Useni Sikuzani, S. Cabala Kaleba, A. Biloso Moyene, F. Munyemba Kankumbi, F. Lelo Nzuzi, R. Occhiuto & J. Bogaert. (2018). Les espaces verts en zone urbaine et périurbaine de Kinshasa en République Démocratique du Congo. *Tropicultura*, 2018, 36, 3, 478-491.

- [33] Kaki Ngisila Blanchard, Mashini Dhi Mbita Mulenghe Jean-Claude, Musenga Tshiey Virginie. (2024). Etat de lieux des espaces verts récréatifs dans la ville de Kinshasa: perception des Kinois et perspectives de planification et d'aménagement durable. *Journal of Environment* ISSN 2789-3863 (Online) Vol. 4, Issue No. 2, pp 85– 129, 2024.
- [34] Nelly Ataawomba Afuubi, Li Fanglin and Emmanuel Owusu. (2021). The benefits and challenges of urban forestry in Ghana. *International Journal of Management Sciences and Business Research*, Nov-2020 ISSN (2226-8235) Vol-9, Issue 11.
- [35] Rexford Osei Owusu, Javier Martinez, Nina Schwarz. (2024). Supply and demand of ecosystem services of urban green spaces in deprived areas: Perceptions from Kumasi, Ghana. *Environmental Science and Policy* 156 (2024) 103742.
- [36] Kouassi R., Nomel G., Kouadio Y., Ambé A., N'guessan K. (2019). Perception, attitude et attentes des résidents à l'égard des espaces verts urbains de Yamoussoukro (Côte d'Ivoire). *European Scientific Journal* January 2019 edition Vol.15, No.3 ISSN: 1857 – 7881 (Print) e - ISSN 1857- 7431, [URL:http://dx.doi.org/10.19044/esj.2019.v15n3p389](http://dx.doi.org/10.19044/esj.2019.v15n3p389).
- [37] Matsaba Emmanuel Ochola, Adimo Aggrey Ochieng, Njoroge John Bosco, Wesonga John Mwibanda and Sodoudi Sahar. (2018). Attenuation effect of plant canopy sizes on microclimate in urban greenspaces within Nairobi City, Kenya. *African Journal of Plant Science*. Vol. 12(7), pp. 129-140, July 2018, doi: 10.5897/AJPS2018.1659.
- [38] Onyango, S. A., Mukundi, J. B., Adimo, A. O., Wesonga, J. M., & Sodoudi, S. (2021). Variability of In- Situ Plant Species Effects on Microclimatic Modification in Urban Open Spaces of Nairobi, Kenya. *Current Urban Studies*, 9, 126-143, <https://doi.org/10.4236/cus.2021.91008>.
- [39] Yekeh F. Hovard. (2023). Geospatial assessment of the role of urban green infrastructure in mitigating urban heat island : A case study of the greater Monrovia district, Liberia. PhD thesis, University of Nairobi (Kenya). 38 p.
- [40] John Saah TambaII, Val Hyginus Udoka Eze, Foday Hassan Bawor. (2024). Urban greening as a sustainable solution to heat stress in tropical cities: a case study of Monrovia in Liberia. *Journal of Science, Engineering and Technology*, <https://doi.org/10.59568/KJSET-2024-3-1-10>.
- [41] Tiandraza, F.; Qu, S.; Hu, S.; Mkono, C.N.; Tikhomirova, A.; Randrialahamady, S. N. (2023). Response of Ecosystem Services to Land Use Change in Madagascar Island, Africa: A Multi-Scale Perspective. *Int. J. Environ. Res. Public Health* 2023, 20, 3060. <https://doi.org/10.3390/ijerph20043060>.
- [42] Fadoua Chkird, Abdellah Azougay, Ibtiassam Mzabri, Imane Amar, Azzouz Boukroute, Abdelbasset Berrichi, Belkheir Hammouti, Nour-Eddine Kouddane. (2024). Provision of urban green spaces: A case study of Oujda City, Northeast Morocco. *Caspian Journal of Environmental Sciences*, doi: 10.22124/CJES.2024.7783.
- [43] Wijesinghe, A.; Thorn, J. P. R. (2021). Governance of Urban Green Infrastructure in Informal Settlements of Windhoek, Namibia. *Sustainability* 2021, 13, 8937, <https://doi.org/10.3390/su13168937>.
- [44] Yahaya Maazou Moussa, Ibrahim Thione Diop, Ibrahim Nassirou, Malam Maman Nafiou and Moussa Soulé. (2024). Residents' perceptions of the role of urban green spaces to climate resilience in the city of Niamey, Niger. *African Cities Journal*, Vol. 04, Issue 01, December 2024, doi: 10.34915/acj.v4i1.159.
- [45] Joseph A. Fuwape and Jonathan C. Onyekwelu. (2011). Urban forest development in West Africa: benefits and challenges. *Journal of Biodiversity and Ecological Sciences*. No.1, Vol.1, Issue1 ISSN: 2008-9287 Winter 2011 JBES.
- [46] Emechebe, L.C. & Eze, C. J. (2019). Integration of Sustainable Urban Green Space in Reducing Thermal Heat in Residential Area in Abuja. *Environmental Technology & Science Journal*. Vol. 10 Issue 2 December 2019.
- [47] Olumuyiwa Bayode Adegun, Ayodele Emmanuel Ikudayisi, Tobi Eniolou Morakinyo, Olawalé Oreoluwa Olusoga. (2021). Urban green infrastructure in Nigeria : a review. *Scientific African*, doi: 10.1016/j.sciaf.2021.e01044.

- [48] Blessing Aibhamen Edeigba, Ugochukwu Kanayo Ashinze, Aniekan Akpan Umoh, Preye Winston Biu and Andrew Ifesinachi Daraojimba. (2024). Urban green spaces and their impact on environmental health: A Global Review. *World Journal of Advanced Research and Reviews*, 2024, 21(02), 917–927, doi: <https://doi.org/10.30574/wjarr.2024.21.2.0518>.
- [49] Eja Julius Edom; and Kekere David Ozovehe. (2024). User Perceptions of Green Spaces in Public Parks: A Case Study of Ndubuisi Kanu Park, Ikeja, Lagos. *Afropolitan Journals*, <https://doi.org/10.62154/ajesre.2024.017.010428>.
- [50] Mactar Diouf. (2022). La végétation dans les villes sénégalaises au regard des changements socio environnementaux : le cas de l'agglomération dakaraise et des villes de Touba, Ziguinchor et Tambacounda. Thèse de doctorat de l'Université Sorbonne Paris Nord. 483 p.
- [51] Cilliers, J., & Cilliers, S. (2015). From green to gold: A South African example of valuing urban green spaces in some residential areas in Potchefstroom. *Town and Regional Planning*, 67, 1–12.
- [52] Roberts, D., Boon, R., Diederichs, N., Douwes, E., Govender, N., McInnes, A., et al. (2012). Exploring ecosystem-based adaptation in Durban, South Africa: “Learning-by-doing” at the local government coal face. *Environment and Urbanization*, 24(1), 167–195, <http://dx.doi.org/10.1177/0956247811431412>.
- [53] Sutherland, C., Sim, V., Buthelezi, S. & Khumalo, D. (2016). Social constructions of environmental services in a rapidly densifying peri-urban area under dual governance in Durban, South Africa. *Bothalia* 46(2), a2128, <http://dx.doi.org/10.4102/abc.v46i2.2128>.
- [54] Lorena Pasquini and Johan P. Enqvist. (2019). Green infrastructure in South African cities. Technical report for cities support programme undertaken by African centre for cities. 18 p.
- [55] Gulati, M & Scholtz, L. (2020). *The case for investment in green infrastructure in African Cities*. Cape Town, WWF South Africa. Available online at: www.wwf.org.za/report/investment_in_urban_green_infrastructure.
- [56] Lategan, L. G., Steynberg, Z., Cilliers, E.J., Cilliers, S.S. (2022). Economic Valuation of Urban Green Spaces across a Socioeconomic Gradient: A South African Case Study. *Land* 2022, 11, 413. 23 p, <https://doi.org/10.3390/land11030413>.
- [57] Wessels, N., Sitas, N., O’Farrell, P., & Esler, K. J. (2024). Inclusion of ecosystem services in the management of municipal natural open space systems. *People and Nature*, 6, 301–320, <https://doi.org/10.1002/pan3.10572>.
- [58] Nicholas Mwageni & Robert Kiunsi. (2021). Green Spaces in Residential Areas of Dar es Salaam City: Types, Coverage and Uses. *Journal of Sustainable Development*; Vol. 14, No. 3; 2021.ISSN 1913-9063 E-ISSN 1913-9071, URL: <https://doi.org/10.5539/jsd.v14n3p121>.
- [59] Francis, H. S., Namangaya, A. H. and Mdemu, M. V. (2022). Urban green system changes and its impact on access to ecosystem services: A case of Dar es Salaam City, Tanzania. *International Journal of Development and Sustainability*, Vol. 11 No. 9, pp. 294-310.
- [60] Nicholas Mwageni & Gabriel Kassenga. (2022). Cost-Benefit Analysis of Green Space Investment in Residential Areas of Dar es Salaam City, Tanzania. *Journal of Sustainable Development*; Vol. 15, No. 3; 2022.ISSN 1913-9063 E-ISSN 1913-9071, URL: <https://doi.org/10.5539/jsd.v15n3p157>.
- [61] Sawaba Ale, Kossi Adjonou, Kossi Novigno Segla, Kossi Komi, Jean-Bosco Benewinde Zoungana, Coffi Aholou And Kouami Kokou. (2024). Urban Forestry in Sub-Saharan Africa: Challenges, Contributions, and Future Directions for Combating Climate Change and Restoring Forest Landscape. Preprints.org (www.preprints.org), doi:10.20944/preprints202409.1360.v.
- [62] Marwen Ghribi et Salem Dahech. (2023). Impacts des espaces verts sur la répartition des températures de l’air pendant la saison chaude dans l’agglomération de Sfax (centre-est de la Tunisie). *Climatologie EDP Sciences* 2023, <https://doi.org/10.1051/climat/202320005>.

- [63] Elhanafy, H. (2022). The State of Public Space in Lusaka: Garden Cities, Urban Development, Greenfield Sites. *The Journal of Public Space*, 7(1), pp. 343-354, doi: 10.32891/jps.v7i1.1537.
- [64] Prucelle Elisee Zohoun, David Makodjami Baloubi, Emilia Mawugnon Azalou-Tingbe, Ibouraima Yabi. (2021). Characterization of the Ecosystem Services Rendered to the Population by Trees in the City of Parakou in Central Benin. *Landscape Architecture and Regional Planning*. Vol. 6, No. 1, 2021, pp. 8-18, doi: 10.11648/j.larp.20210601.12.
- [65] Rosos Djikpo V. A., Teka O., Bruno DjossaA., Oumorou M. & Sinsin B. (2022). Understanding Coastal Citizens Perception on Urban Green Spaces: Evidence from Benin Republic in West Africa. *ESI Preprints*, <https://doi.org/10.19044/esipreprint.10.2022.p709>.
- [66] Djikpo Vignon, Adelphe Rosos, Teka Oscar, Djossa Bruno, Oumorou Madjidou, Sinsin Brice. (2023). Understanding Coastal Residents' Perception on Urban Green Spaces in Benin, West Africa. *Agriculture, Forestry and Fisheries*. 2023; 12(1): 8-17, doi: 10.11648/j.aff.20231201.12.
- [67] Victor Kimpouni, Jean De Dieu Nzila, Hervé Fortuné Kaya. (2019). Urban Forestry and Ecosystem Services in the City of Dolisie (Congo). *American Journal of Agriculture and Forestry*. Vol. 7, No. 2, 2019, pp. 53-65, doi: 10.11648/j.ajaf.20190702.13.
- [68] Mikias Biazen Molla. (2015). The value of urban green infrastructure and its environmental response in urban ecosystem: a literature review. *International Journal of Environmental Sciences*, vol. 4 No. 2. 2015. Pp. 89-101. Vol. 4 No. 2 ISSN: 2277-1948.
- [69] Amegah A. K., Yeboah K., Owusu V., Afriyie L., Kyere-Gyeabour E., Appiah D.C., et al. (2023). Socio-demographic and neighbourhood factors influencing urban green space use and development at home: A population-based survey in Accra, Ghana. *PLoS ONE* 18(6): e0286332, <https://doi.org/10.1371/journal.pone.0286332>.
- [70] Lukman Kura Abraham Safo, Emmanuel Kwame Nti, Abdul- Rafiw Safo, Stephen Biliyitorb Liwur. (2024). Green spaces in Ghana's built environment: Analyzing perceptions and urban planning perspectives through the lens of the new environmental paradigm. *City and Environment Interactions* 24 (2024) 100168. 16 p, <https://doi.org/10.1016/j.cacint.2024.100168>.
- [71] Elizelle Juaneé Cilliers and Wim Timmermans. (2012). Planning for sustainable green spaces in developing countries: linking economic value to green. *IADIS International Conference on Sustainability, Technology and Education* 2012. ISBN: 978-972-8939-79-3 © 2012 IADIS. 84 p.
- [72] Bopaki Phogole and Kowiyou Yessoufou. (2024). Asystematic review of studies investigating the link between green spaces and human health reveals a paucity of interest in the topic in Africa. *Environ. Res. Commun.* 6(2024)092001. 12 p, <https://doi.org/10.1088/2515-7620/ad6d3a>.
- [73] Ahmad Hassan and Felister Mombo. (2017). Urban Community's Participation in Conservation of Open Spaces: A Case of Dar es Salaam City. *International Journal of Natural Resource Ecology and Management*. Vol. 2, No. 1, 2017, pp. 9-19, doi: 10.11648/j.ijnrem.20170201.12.
- [74] Botolisam Polorigni, Raoufou Radji and Kouami Kokou. (2014). Perceptions, tendances et préférences en foresterie urbaine: cas de la ville de Lomé au Togo. *European Scientific Journal* February 2014 edition vol.10, No.5 ISSN: 1857 – 7881 (Print) e - ISSN 1857- 7431.
- [75] Yared Girma, Heyaw Terefe, Stephan Pauleitb, Mengistie Kinduc. (2019). Urban green infrastructure planning in Ethiopia: The case of emerging towns of Oromia special zone surrounding Finfinne. *Journal of Urban Management* 8 (2019) 75-88, <https://doi.org/10.1016/j.jum.2018.09.004>.

- [76] Kiribou R., Djene S., Bedadi. B., Ntirenganya E., Ndemere J., Dimobe K. (2024). Urban climate resilience in Africa: a review of nature-based solution in African cities' adaptation plans. *Discover Sustainability* (2024) 5:94, <https://doi.org/10.1007/s43621-024-00275-6>.
- [77] Andon N'Guessan Simon. (2021). Perception, préférences et souhaits des populations sur l'importance de l'arbre dans le paysage urbain et périurbain de la ville de Korhogo. *Revue de Géographie de l'Université de Ouagadougou*, N° 10, Vol. 2, Octobre 2021, pp 253-276.
- [78] Adekunle, M. F., Agbaje, B. M., & Kolade, V. O. (2013). Public perception of ecosystem service functions of peri - urban forest for sustainable management in Ogun State. *African Journal of Environmental Science and Technology*, 7(6), 410–416, <http://dx.doi.org/10.5897/ajest2012.1411>.
- [79] Republic of Rwanda, Ministry of Environment (2022). Case study - strategic planning for Rwanda's urban infrastructure. 5 p.
- [80] FAO. (2012). Étude sur la foresterie urbaine et périurbaine de N'Djaména, Tchad. Rôle et place de l'arbre en milieu urbain et périurbain» Appui à la formulation d'une stratégie et d'un plan d'action de la foresterie urbaine et périurbaine à N'Djaména, République de Tchad. Document de travail sur la foresterie urbaine et périurbaine n°6. 95 pages. Rome.
- [81] Rebecca Mitshiabu Mudiayi, Ndengoli Momangi Michel, Isaac Kikuni Mubake, Nipha Ibunga Nkanga, and Guillaume Lusambu Anelk. (2023). Perceptions des usagers à l'égard des espaces verts d'alignement des voies publiques de la commune de Lemba dans la ville de Kinshasa. *International Journal of Innovation and Applied Studies* ISSN 2028-9324 Vol. 40 No. 2 Aug. 2023, pp. 493-504 © 2023 Innovative Space of Scientific Research Journals <http://www.ijias.issr-journals.org/>.
- [82] Dumenu, W. K. (2013). What are we missing? Economic value of an urban forest in Ghana. *Ecosystem Services*, 5, 137–142, <http://dx.doi.org/10.1016/j.ecoser.2013.07.001>.
- [83] Kouadio Y. J. C., Tiebre M. S., Oulaïtar M. E., Vroh B. T. A., Gone B. I., N'Guessan K. E. (2020). Contribution de la végétation urbaine à la régulation du climat : cas des jardins publics de la commune du plateau (Abidjan- Côte d'Ivoire). XXXème colloque de l'Association Internationale de Climatologie, Sfax 03-06 juillet 20017, <https://www.researchgate.net/publication/343651393>.
- [84] Rabare, R. S., Okech, R., & Onyango, G. M. (2009). The role of urban parks and socioeconomic development: Case study of Kisumu Kenya. *Theoretical and Empirical Researches in Urban Management*, 3(12), 22–36.
- [85] Mbugua, M., W., Kamiri, H. & Kamau, P. (2024). Attributes of Urban Greenspaces and their Influence on Visitors' Preferences in Nairobi City County, Kenya. *Eastern African Journal of Humanities and Social Sciences*, 3(1), 147-160.
- [86] Valentina Giombini and Jessica P. R. Thorn. (2022). Urban Green Spaces in a Post-Apartheid City: Challenges and Opportunities for Nature-based Solutions, doi: 10.1007/978-3-031-01980-7_17.
- [87] Mairi Dupar, Elvina Henriette and Eric Hubbard. (2023). Nature-based green infrastructure: A review of African experience and potential. ODI report: London, 88 p.
- [88] Cilliers, S., Cilliers, J., Lubbe, R., & Siebert, S. (2013). Ecosystem services of urban green spaces in African countries perspectives and challenges. *Urban Ecosyst* (2013) 16 : 681–702, <http://dx.doi.org/10.1007/s11252-012-0254-3>.
- [89] Tourey, S., Boukpepsi, T., Djagnikpo Kpedenou, K. & Tchamie, T. K. T. (2020). Diversité et importance de la flore ligneuse de la ville de Sokodé (Centre Togo). *Vertigo*, 20(3), <https://doi.org/10.4000/vertigo.28991>.
- [90] Françoise Valea, Asai Akinni Gervais Atchade, Kannayi Frédéric Lodouhoue, Expédit Willfrid Vissin. (2024). Contribution des espaces verts à l'atténuation de l'effet de serre additionnel dans la ville de Cotonou. *International Journal of Progressive Sciences and Technologies (IJPSAT)*. Vol. 44 No. 1 April 2024, pp. 443-453.

- [91] Alain P.K. Gomgnimbou, Wendsom Osée Ouedraogo, Abdramane Sanon, Madjelia Kone, Daniel Ilboudo, Hassan B. Nacro. (2019). Potentiel de séquestration du carbone par les espaces verts aménagés urbains de la ville de Bobo-Dioulasso au Burkina Faso. *Journal of Applied Biosciences* 144: 14739 - 14746, doi.org/10.35759/JABs.144.2.
- [92] Victor Kimpouni, Jean De Dieu Nzila, Noël Watha-Ndoud, Elodie Charleine Kokolo Bilongo, Salisou Yallo Mouhamed, Jean-Pierre Kampe, and Dieudonne Louembe. (2020). Sociocultural and Ecological Dynamics of Green Spaces in Brazzaville (Congo). *International Journal of Ecology* Volume 2020, Article ID 3719267, 12 pages, <https://doi.org/10.1155/2020/3719267>.
- [93] Bertrand F. Neroa, Daniel Callo-Concha, Alexander Anning and Manfred Denicha. (2016). Urban green spaces enhance climate change mitigation in cities of the global south: the case of Kumasi, Ghana. *Procedia Engineering* 198 (2017) 69 – 83, doi: 10.1016/j.proeng.2017.07.074.
- [94] Bi Tra Aimé Vroh, Marie Solange Tiebre, et Kouakou Edouard N'guessan. (2014). Diversité végétale urbaine et estimation du stock de carbone : cas de la commune du Plateau Abidjan, Côte d'Ivoire. *Afrique Science* 10(3) (2014) 329- 340. ISSN 1813-548X, <http://www.afriquescience.info>
- [95] Kouassi Kanga Justin, Kouakou Yao Bertin, Kossonou Affia Sonmia Francia and Kouassi Kouadio Henri. (2024). Services écosystémiques fournis par les espaces verts aménagés de la ville de Daloa. *Int. J. Adv. Res.* 12(08), 1144-1151, URL: <http://dx.doi.org/10.21474/IJAR01/19356>.
- [96] Soulé Moussa, Boateng Kyereh, Shem Kuyah, Abasse Tougiani, Mahamane Saadou. (2019). Composition Floristique et Structure des Forêts Urbaines des Villes Sahéliennes: Cas de Niamey et Maradi, Niger. *Rev. Ramres - VOL.07 NUM.00*. 2019 ** ISSN 2424-7235.
- [97] Fatimata Niang, Khadidiatou Ba, Fatoumata Diop, Fatou Anta Fall, Hadji Abou Diallo, Mamadou Thioye, Simon Sambou and Sara Danièle Dieng. (2023). Tree diversity and carbon stock in urban area of Senegal and their implications to human health and well-being. *African Journal of Environmental Science and Technology*, doi: 10.5897/AJEST2023.3188.
- [98] Davids, R., Rouget, M., Boon, R. & Roberts, D. (2016). Identifying ecosystem service hotspots for environmental management in Durban, South Africa. *Bothalia* 46(2), a2118, <http://dx.doi.org/10.4102/abc.v46i2.2118>.
- [99] Folega Fousseni, Kombate Bimare, Konate Djibril, Kanda Madjouma, Wala Kperkouma & Akpagana Koffi. (2020). Inventaire et séquestration de carbone de la végétation de l'emprise urbaine de la ville de Dapaong, Togo. *Revue espace géographique et Société Marocaine* n° 41/42, Novembre 2020.
- [100] Adegun O.B. (2021). Green Infrastructure Can Improve the Lives of Slum Dwellers in African Cities. *Front. Sustain. Cities* 3:621051, doi: 10.3389/frsc.2021.621051.
- [101] Ben Aziza A. (2022). Inventaire des espèces arboricoles en milieu urbain : Cas de la ville d'Ain-Temouchent. Mémoire de master en écologie végétale et environnement. Université d'Ain-Temouchent Belhadj Bouchaïb – UATBB (Algérie). 50 p.
- [102] Mili, M., Boutabba, H., & Boutabba, S-D. (2019). La nature urbaine: dégradation quantitative et qualitative des espaces verts urbains, cas de la Ville Steppique de M'sila, Algérie. *Revista Brasileira de Gestão Urbana*, 11, e20180138, <https://doi.org/10.1590/2175-3369.011.e20180138>.
- [103] Alemakef Tassew and Aklilu Fikresilassie. (2024). An assessment of the availability, accessibility, and attractiveness of urban green space and parks in three African cities. *African Journal on Land Policy and Geospatial Sciences* ISSN:2657-2664, Vol.7 Issue 1, <https://doi.org/10.48346/IMIST.PRSM/ajlp-gs.v7i1.43974>.
- [104] Bernard Afik Akanpabadai Akanbang, Millicent Awialie Akaateba, Prosper Issahaku Korah. (2024). Creating and sustaining urban green spaces in Africa under phenomenal urbanisation: residents' perspectives on home gardens in Wa, Ghana. *Discover Cities* (2024) 1:20, <https://doi.org/10.1007/s44327-024-00025-3>.

- [105] Keita, K., Kourouma, S. (2023). Assessment of Policy and Legal Frameworks of Urban Green Infrastructure Development: Republic of Guinea. *Buildings* 2023, 13, 1945, <https://doi.org/10.3390/buildings13081945>.
- [106] Enesi Chukwuemeka Majebi, Henry Usiobaifo Agbebaku, Christopher Anierobi & Samuel Olusola Afolayan. (2023). Assessment of Urban Green Open Spaces and Environmental Impacts on Recreation and Environmental Sustainability: Evidence from Abuja, Nigeria's Federal Capital Territory. *Benin Journal of Geography, Planning and Environment* 2023, Volume 3(1) (ISSN: 2971-6039).
- [107] Abiodun Rufus Olubi. (2020). The impacts of land use on urban aesthetics: a case of Ojoo, Ibadan, Nigeria. *International conference on Architecture and Urbanism* 2019, pp. 320-326.
- [108] Raoufou R., Kouami K., Koffi A. (2011). Woody plant species used in urban forestry in West Africa: Case study in Lomé, capital town of Togo. *Journal of Horticulture and Forestry* Vol. 3(1) pp. 21-31, January 2011 Available online <http://www.academicjournals.org/jhf>
- [109] Pedrosa, E. L. J., Okyere, S. A., Frimpong, L. K., Diko, S. K., Commodore, T. S., Kita, M. (2021). Planning for Informal Urban Green Spaces in African Cities: Children's Perception and Use in Peri-Urban Areas of Luanda, Angola. *Urban Sci.* 2021, 5, 50, <https://doi.org/10.3390/urbansci5030050>.
- [110] Egbenchong Ruth Eneke and Nformi Beatrice Maluh. (2024). Urban recreational green spaces dynamics and implications in the Bonaberi Neighbourhood of Douala IV Municipality, Cameroon. *World Journal of Advanced Research and Reviews*, 2024, 23(02), 1008–1019, <https://doi.org/10.30574/wjarr.2024.23.2.2342>.
- [111] Kafafy, N. A. and Fathy, H. A. (2019). Assessing green spaces impact on people's happiness in Cairo. *International Journal of Development and Sustainability*, Vol. 8 No. 1, pp. 30-47.
- [112] Eric Duku, Collins Adjei Mensah, Iddrisu Amadu, Wonder Kofi Adzigbli. (2023). Changes in urban green spaces in coastal cities and human well-being: The case of Cape Coast Metropolis, Ghana. *Geo: Geography and Environment*. 2023;10:e00119, <https://doi.org/10.1002/geo2.119>.
- [113] Robertson Khataza. (2024). Preferences for urban greenspace functions during public health pandemics, empirical evidence from Malawi. *Urbanization, Sustainability and Society*, vol. 1 No. 1, 2024 pp. 63-77. Emerald Publishing Limited 2976-8993, doi: 10.1108/USS-11-2023-0015.
- [114] Coker M. O.; Wahab W.B. (2020). Nature Connectedness and Ecosystem Services Towards Urban Planning for Residents' Health in the Metropolitan Lagos, Nigeria. 18 p.
- [115] Gubic, I., Baloi, O. (2020). Public open space initiatives for healthier cities in Rwanda. *The Journal of Public Space*, 5(2), 129-146, doi: 10.32891/jps.v5i2.1287.
- [116] Byela Tibesigwa, Razack Lokina, Fred Kasalirwe, Richard Jacob, Julieth Tibanywana, and Gabriel Makuka. (2018). In Search of Urban Recreational Ecosystem Services in Dar es Salaam, Tanzania. Environment for Development. Discussion Paper Series March 2018 EfD DP 18-06. 40 p.
- [117] Julie Dumortier, Samson Daudet Medza Mve and Oumar Doungous. (2023). Development and management of green spaces in sub-saharan Africa: what roles for native plant species? *Int. J. Adv. Res.* 11(12), 163-171, doi: 10.21474/IJAR01/17971.
- [118] Chukwuemeke P. and Ikenna S. (2018). The Socio-cultural and ecological perspectives on landscape and gardening in Urban Environment: A narrative review. *Journal of Contemporary Urban Affairs* January 2018, doi: 10.25034/ijcua.2018.4673.
- [119] Tim M. Daw, Nicole J. Reid, Sarah Coulthard, Tomas Chaigneau, Vilma Machava Ant'onio, Christopher Cheupe, Geoff Wells, Edgar Bueno. (2023). Life satisfaction in coastal Kenya and Mozambique reflects culture, gendered relationships and security of basic needs: Implications for ecosystem services. *Ecosystem Services* 62 (2023) 101532. 17 p.

- [120] Abdelouahed El Faiz, Hanane Dounas, Abdelilah Meddich, Mohamed Hafidi et Ahmed Ouhammou. (2016). Biodiversité des espaces verts publics de la Commune Urbaine de Marrakech (CUM) (Maroc). *Acta Botanica Malacitana* 41. 2016, pp. 83-100.
- [121] Esraa M. Abdel-Gawad, Hany M. Ayad, Dina M. Saadallah. (2022). Delineating and assessing Urban green infrastructure in Cities: application of the patch matrix model in Alexandria, Egypt. *Real Corp 2022 Proceedings/Tagungsband* 14-16 November 2022 – <https://www.corp.at> ISBN 978-3-9504945-1-8, pp. 219-228.
- [122] Abdourahamane Illiassou Salamatou, Bio Yandou Ismael, Moussa Mamadou Boubacar, Idi Ilia Ilia and Mayaki Tilly Alio. (2022). Contribution to the characterisation of urban vegetation in Diffa (NIGER). *IOSR Journal of Environmental Science, Toxicology and Food Technology* (IOSR-JESTFT) e-ISSN: 2319-2402, p- ISSN: 2319-2399. Volume 16, Issue 10 Ser. II (October 2022), doi: 10.9790/2402-1610020513.
- [123] Missaoui Khaled. (2014). Aménagement et valorisation des boisements urbains et périurbains de la ville de Sétif. Magister en Biologie, Université Ferhat Abbass Sétif 1. 130 p.
- [124] Deldelli Z. and Ben A. (2021). Caractérisation des espaces verts de la ville d'Adrar et perspectives d'amélioration qualitative. Mémoire de master Université Ahmed Draia – Adrar (Algérie). 35 p.
- [125] Erick Senademi Sogbossi, Soufouyane Zakari, Julien Gaudence Djego. (2020). Phytodiversity and spatial development of urban flora in Lokossa, Benin. *International Journal of Natural Resource Ecology and Management*. Vol. 5, No. 4, 2020, pp. 145-159, doi: 10.11648/j.ijnrem.20200504.12.
- [126] Bienvenu S. Agbani, Sylvain A. Vissoh, Toundé Roméo Gislain Kadjegbin, Léon Bani Bio Bigou. (2021). Gestion des espaces verts dans la ville de Cotonou au Sud du Benin : état des lieux et perspectives. *International Journal of Progressive Sciences and Technologies (IJPSAT)* ISSN: 2509-0119. Vol. 25 No. 1 February 2021, pp. 639-649.
- [127] Gbesso F. (2022). Instauration et conservation de la biodiversité des espaces verts dans l'arrondissement de Lobogo (commune de Bopa). *International Journal of Progressive Sciences and Technologies (IJPSAT)*. Vol. 31 No. 2 March 2022, pp. 224-237.
- [128] Yannick Useni Sikuzania, François Malaisse, Sylvestre Cabala Kaleba, Augustin Kalumba Mwanke, Amisi Mwana Yamba, César Nkuku Khonde, Jan Bogaert, François Munyemba Kankumbia. (2019). *Urban Forestry & Urban Greening* 41 (2019) 67–74, <https://doi.org/10.1016/j.ufug.2019.03.008>.
- [129] Mashagiro G., Mujinya B., Mahy G. (2022). Evaluation de l'abondance et de la diversité de la macrofaune du sol dans les espaces verts urbains de Lubumbashi (Haut Katanga, R.D Congo). *Gembloux Agro-Bio Tech* 24-25 mai 2022.
- [130] Mashagiro Grace Queen, Basile Mujinyanya Bazirake, Lucie Rivière and Grégory Mahy. (2024). Évaluation de l'abondance et de la diversité de la macrofaune du sol dans les espaces verts urbains à Lubumbashi (Haut Katanga, R.D. Congo). *Tropicultura* 2295-8010 Volume 42 (2024), 2496.
- [131] Bertrand Festus Nero. (2017). Urban green spaces enhance carbon sequestration and conserve biodiversity in cities of the Global South case of Kumasi, Ghana. PhD thesis University of Bonn. 150 p.
- [132] Lyn-Kristin Hosek. (2021). Conflicting priorities, conflicting scales: urban forestry in Accra between household (re)production and global sustainability. PhD thesis, University of Birmingham. 350 p.
- [133] Kouadio Y.J.C.; Vroh B.T.A., Gone Bi Z.B., Adou Yao C.Y., & N'Guessan K.E. (2016). Evaluation de la diversité et estimation de la biomasse des arbres d'alignement des communes du Plateau et de Cocody (Abidjan - Côte d'Ivoire). *Journal of Applied Biosciences*, 97, 9141–9151. <http://dx.doi.org/10.4314/jab.v97i1.1>.
- [134] Lombart M. Maurice Kouakou, Kolo Yeo, Mouhamadou Kone, Kaly Ouattara, Aymard K. Kouakou, Thibaut Delsinne, Wouter Dekoninck. (2018). Espaces verts comme une alternative de conservation de la biodiversité en villes : le cas des

- fourmis (Hyménoptère : Formicidae) dans le district d'Abidjan (Côte d'Ivoire). *Journal of Applied Biosciences* 131: 13358 – 13381. ISSN 1997-5902, <https://dx.doi.org/104314/jab.v131i1.10>.
- [135] Binyanya, M. R., Mugwima, N. B., Karanja, D., & Mbiti, S. (2022). Sustainable Urban Forest Conservation: Assessing Public Attitudes towards Urban Forests in Nairobi City. *Current Urban Studies*, 10, 655-672, <https://doi.org/10.4236/cus.2022.104039>.
- [136] Abdourahamane Illiassou Salamatou, Abdoulaye Amadou Oumani, Laouali Abdou, Ali Mahamane, and Mahamane Saadou. (2016). Urban Biodiversity: Perception, Preference, General Awareness, and Threats in Two Cities (Niamey and Maradi) of Niger. Volume 2016, Article ID 1469530, <http://dx.doi.org/10.1155/2016/1469530>. 12 p.
- [137] Moussa S., Boateng K., Shem K., Abasse T. & Mahamane S. (2020). Composition Floristique et Structure des Forêts Urbaines des Villes Sahéliennes: Cas de Niamey et Maradi, Niger. *REV. RAMRES - VOL.07 NUM.00. 2019 *** ISSN 2424-7235.
- [138] Agbogidi, O.M. and Adolor, E. B. (2013). Home gardens in the maintenance of biological diversity. *Journal of Advances in Biology*, vol. 2, No. 2. ISSN 2347- 6893.
- [139] Adewale G. Awoyemi and Juan Diego Ibanez-Alamo. (2023). Status of urban ecology in Africa: A systematic review. *Landscape and Urban Planning* 233 (2023) 104707, <https://doi.org/10.1016/j.landurbplan.2023.104707>. 16 p.
- [140] Ahmed Alhuseen. (2015). Sufficiency of open public and green spaces in Khartoum State-Sudan. *IJournals: International Journal of Social Relevance & Concern (IJSRC)* ISSN-2347-9698 Volume 3 Issue 5 May, 2015.
- [141] Elhadji Faye, Mamoudou Abdoul Toure, Hady Diallo, Moustapha Ndiaye and Papa Diène Faye. (2022). Initial analysis of urban forestry in Mbour Municipality, Senegal. *Int. J. Biol. Chem. Sci.* 16(5): 1974-1991, 2022, doi: 10.4314/ijbcs.v16i5.13.
- [142] Tristan Jane Duthie. (2018). An assessment of ecosystem services and disservices in urban community gardens in Berlin (Germany) and Cape Town (South Africa). PhD thesis of University of Leipzig. 330 p.
- [143] Folega Fousséni, Atakpama Wouyo, Kanda Madjouma, Konate Djibril, Gmadjom Kissao, Wala Kperkouma & Akpagana Koffi. (2019). Flore des espaces verts urbains de la ville d'Atakpamé au Togo. *Rev. Sci. Technol.*, Synthèse Vol 25, numéro 2: 25-39 (2019).
- [144] FAO. (2012). Pour des villes plus vertes en Afrique. Premier rapport d'étape sur l'horticulture urbaine et périurbaine. Rome, Organisation des Nations Unies pour l'alimentation et l'agriculture, 111p.
- [145] Guenat S, Porras Lopez G, Mkwambisi DD and Dallimer M. (2021). Unpacking Stakeholder Perceptions of the Benefits and Challenges Associated With Urban Greenspaces in Sub-Saharan Africa. *Front. Environ. Sci.* 9:591512, doi: 10.3389/fenvs.2021.591512, 12 p.
- [146] Phillippe Burger, J. P. Geldenhuys, Jan Cloete, Lochner Marais and Alexander Thornton. (2009). Assessing the Role of Urban Agriculture in Addressing Poverty in South Africa. Global Development Network Working Paper Series, Working Paper No. 28 October 2009. 51 p.
- [147] Charlie M. Shackleton and Humphrey Kaoma. (2014). Collection of urban tree products by households in poorer residential areas of three South African towns. *Urban Forestry & Urban Greening* 13 (2014) 244–252, <http://dx.doi.org/10.1016/j.ufug.2014.02.002>.
- [148] Eefke Mollee, Mariève Pouliot, Morag A. McDonald. (2017). Into the urban wild: Collection of wild urban plants for food and medicine in Kampala, Uganda. *Land Use Policy* 63 (2017) 67–77, <http://dx.doi.org/10.1016/j.landusepol.2017.01.020>.
- [149] Talent Murwendo. (2011). Improving urban livelihoods at household level through sustainable utilisation of peri- urban forests in Masvingo city. *Journal of Sustainable Development in Africa* (Volume 13, No.6, 2011) ISSN: 1520-5509.

- [150] Roodsari, E. N., Hoseini, P. (2022). An assessment of the correlation between urban green space supply and socio-economic disparities of Tehran districts Iran. *Environ. Dev. Sustain.* 2022, 24, 12867–12882.
- [151] Chen, B.; Wu, S.; Song, Y.; Webster, C.; Xu, B.; Gong, P. (2022). Contrasting inequality in human exposure to greenspace between cities of Global North and Global South. *Nat. Commun.* 2022, 13, 4636.
- [152] Aya Jamouli and Khali Allali. (2020). Economic valuation of ecosystem services in Africa. E3S Web of Conferences 183, 01002 (2020), <https://doi.org/10.1051/e3sconf/202018301002>. 16 p.
- [153] United Nations (2014). More than half of the world's population now lives in cities - UN Retrieved from UNFCCC website, Department of Economic and Social Affairs section:<http://www.un.org/fr/development/desa/news/population/world-urbanization-prospects.html>.
- [154] Faivre, N., Fritz, M., Freitas, T., de Boissezon, B., Vandewoestijne, S. (2017). Nature-based solutions in the EU: innovating with nature to address social, economic and environmental challenges. *Environ. Res.* 159, 509–518.
- [155] Urban Nature Atlas. (2020). Naturvation, Project 2017-2019 by the EU Horizon, <https://naturvation.eu>.
- [156] Qiu G. Y., Li H. Y., Zhang Q. T., Wan C., Liang X. J., Li X. Z. (2013). Effects of evapotranspiration on mitigation of urban temperature by vegetation and urban agriculture. *Journal of Integrative Agriculture.* 12 (8), 1307, 2013.
- [157] Nowak, D. J. (1994). Air pollution removal by Chicago's urban forest. In E. G. McPherson, D. J. Nowak, & R. A. Rowntree (Eds.), *Chicago's urban forest ecosystem: Results of the Chicago urban forest climate project* (pp. 63–81). Radnor: U.S. Dept. of Agriculture, Forest Service, Northeastern Forest Experiment Station.
- [158] Escobedo, F. J., Wagner, J. E., Nowak, D. J., et al. (2008). Analyzing the cost effectiveness of Santiago, Chile's policy of using urban forests to improve air quality. *Journal of Environmental Management*, 86 (1), 148–157.
- [159] Orta-Ortiz M. S., Geneletti D. (2022). What variables matter when designing nature-based solutions for stormwater management? A review of impacts on ecosystem services. *Environmental Impact Assessment Review.* 95, 106802, 2022.
- [160] Fang, C. F., & Ling, D. L. (2003). Investigation of the noise reduction provided by tree belts. *Landscape and Urban Planning*, 63 (4), 187–195.
- [161] Gherraz, H., & Alkama, D. (2020). Estimating the impact of green spaces and water surfaces on urban climate and ground surface temperature (Mila, ALGERIA). *Romanian Journal of Geography*, 64(2), 155–174.
- [162] Schipperijn, J., O. Ekholm, U. K. Stigsdotter, M. Toftager, P. Bentsen, F. Kamper-Jørgensen and T. Randrup. (2010). Factors influencing the use of green space: Results from a Danish national representative survey. *Landscape and urban planning*, 95, pp 130-137.
- [163] Bjerke, T., T. Ost Dahl, C. Thrane, and E. Strumse. (2006). Vegetation density of urban parks and perceived appropriateness for recreation. *Urban Forestry & Urban Greening*, 5, 1, pp 35-44.
- [164] Tyrväinen, L., & Miettinen, A. (2000). Property prices and urban forest amenities. *Journal of Environmental Economics and Management*, 39 (2), 205–223.
- [165] Jim, C. Y., & Chen, W. Y. (2006). Impacts of urban environmental elements on residential housing prices in Guangzhou (China). *Landscape and Urban Planning*, 78 (4), 422–434.
- [166] Cho, S. H., Poudyal, N. C., & Roberts, R. K. (2008). Spatial analysis of the amenity value of green open space. *Ecological Economics*, 66 (2–3), 403–416.
- [167] Laïlle P., Provendier D., Colson F. (2015). Effets du végétal sur le cadre de vie et la santé humaine. *Innovations Agronomiques*, 45: 47-60, doi: <http://doi.org/10.15454/1.4622652017060854E12>.

-
- [168] Honold J., Lakes T., Beyer R., van der Meer E. (2015). Restoration in Urban Spaces: Nature Views from Home, Greenways, and Public Parks. *Environment and Behavior*, 40(6): 1-30, doi: <https://doi.org/10.1177/0013916514568556>.
- [169] Arnberger A, Renate E. (2012). The influence of green space on community attachment of urban and suburban residents. *Urban Forestry & Urban Greening*, 11: 41-49.
- [170] Gotham, K., & Brumley, K. (2002). Using space: Agency and identity in a public-housing development. *City and Community*, 1, 267–289.
- [171] B.N. Egoh, P. J. O'Farrell, A. Charef, L. J. Gurney, T. Koellner, H. N. Abi, M. Egoh, L. Willeme. (2012). An African account of ecosystem service provision: Use, threats and policy options for sustainable livelihoods. *Ecosyst. Serv.*, 2, 71–81 (2012).