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RESEARCH ARTICLE

DEVELOPMENT AND MANAGEMENT OF GREEN SPACES IN SUB-SAHARAN AFRICA: WHAT ROLES FOR NATIVE PLANT SPECIES?

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Abstract

Ordinary models of development and management of green spaces in sub-Saharan Africa, often based on fragmented functional zoning with the use of exotic species requiring lot of maintenance, seems today unsuited to the challenges of sustainable development. Land pressures due to rural exodus and the lack of urban planningmake the future of urban vegetation difficult without understanding the real contribution of greenery. Integrating native plant species along with their ecosystem services into development and management plans could be an advantageous alternative. Indeed, assimilation of ecosystem services permit a better social implication and allows the population to understand the importance and the benefits they can afford from green spaces. Smart design could keep green attractiveness leading to a better integration of these spaces which could then contribute to improving citizens life's quality while preserving the environmental and the economic importances of green spaces. In this context, native plants species in public spaces could be the link between social interest, economic rationality and biodiversity respect.

Introduction:-

Green spaces, key elements of urban nature, provide above all a protected and maintained natural space for the local inhabitants, devoted in particular to recreational or decorative purposes (Kafando, 2004; Ogoubiyiet al., 2020). The main forms of urban green spaces found in African countries consist of semi-private or public spaces: parks, road verges, inter-dwelling courtyards, national parks, arboretums, botanical gardens and trees (isolated trees, alignments or small woodlands) planted for shade and beautification. The major weakness of green spaces development and management in sub-Saharan Africa is linked with urban growth which is too rapid and poorly controlled. Green spaces managers cannot keep up with the spatial expansion of cities. This growth causes a series of adverse socio-economic and environmental impacts, including a loss of biodiversity and the degradation of ecosystem services (Kaleghana & Mweru, 2018). Ecosystem services can be defined as the services rendered to human populations by the natural functioning of ecosystems (Maréchalet al., 2018). Urban green spaces generate a wide range of ecosystem services including provisioning (e.g. food, water, medicine), regulating (e.g. climate regulation, water purification, erosion control), supporting (e.g. provide habitat and conserve genetic diversity) and cultural (e.g. tourism, recreation, spirituality) services (Cillierset al., 2013). In addition, few studies over urban biodiversity in

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sub-Saharan Africa are conducted. Without global vision, the development plans for green spaces are usually implemented with the almost exclusive use of exotic plants to the detriment of local species. This approach negates the value of native species, and deprives the population of their potential ecosystem services (Kanyegeye et al., 2018). To have a better global understanding of sub-Saharan Africa green spaces a Strengths- Weakness- Opportunities- Threats (SWOT) analysis is done in table 1.

Table 1:- Green spaces in sub-Saharan Africa.

Strengths	Weakness
Green spaces are the best ways to give urban structure	Spatial expansion of cities is rapid and poorly controlled
Urban flora has become a subject of growing interest	Few study over urban biodiversity in sub-Saharan Africa
Opportunities	**Threats**
Propose new ways of managing green spaces focusing on efficiency and easy maintain species	Green spaces are not prioritised and subject to poor management
Multi-functional green spaces with interest for the population by the uses of ecosystem services tool	Inhabitant don't feel involved -> what's in it for me?
Propose more vegetal diversity in ornamental plants and promote native species	Homogenisation of vegetation for the benefit of introduced species
Significant underutilised local floristic diversity, progress should make more species choices available	Unavailability of native species seeds/plants

Strengths- Weakness-Opportunities-Threats (SWOT) analyses of sub-Saharan Africa green spaces

This article aims to provide an overview of the main features of the development and management of green spaces in sub-Saharan Africa, mainly the use of exotic species and the potential of native species. In the long term, it will make it possible to issue perspectives for innovation on major development programs with better promotion of local plant species and optimisation of the ecosystem services, while maintaining the attractiveness and socio-economic interests of green spaces. The bibliographic search methodology used in this study was a combination of the bibliographic links and a systematic search followed by a classification of references by the Harvard method.

The development of green spaces in sub-Saharan Africa

The development of cities in sub-Saharan Africa is dazzling due to a significant rural exodus combines with demographic explosion, urban sprawl and land pressures (Dauvergne, 2011). These pressures show up in a multiplication of spontaneous habitats areas following local logics of horizontal planning which question the future of urban vegetation and its degree of inclusion in cities planning. Hopefully, it was recognised in 1992 during the second congress on the environment in Kyoto that vegetation is the best means of structuring habitat in developing countries (Ali Khodja, 2000). In this context, the development of public green spaces is a key element (Wolchet al., 2014). Nevertheless, the urbanisation process in Africa remains marked by the lack of planning that has prevailed since the 1950s (Vermeirenet al., 2012), which contributes to the deterioration of the quality of the urban environment through the removal of the original vegetation cover (Kanyegeye et al., 2018). The importance of vegetation in northern countries is largely integrated into green spaces public policies but is not yet a major concern in sub-Saharan African countries. This is linked, as stated, to a context where priority is necessarily given to the development of the economy, the mobility, health and social infrastructures as well as access to housing (Metzger &

Couret, 2002; Kassay Ngur-Ikone, 2010; Polorigniet al., 2015). Even though green spaces are seen as crucial elements of local urban with undeniable environmental, economical and social values, they remain under-prioritised from a planning approaches, policies and legislative frameworks. In addition, regularly green spaces foreseen by urban planning are either not materialised on the ground due to institutional fragmentation, weak technical and managerial capacities in terms of urban management and absence of relevant leadership (Bariol-Mathais B.,2020). Moreover, poverty and strong land pressure, push the population to squatted unoccupied spaces for housing or pirate markets with their flood of daily waste (Kassay Ngur-Ikone, 2010).

For instance, the first problem of the city of Cotonou (capital of Benin) in urban development in general and public green spaces in particular, remains the lack of organisation and the absence of anticipation. The occupation of the land was not planned and the reception areas of the various socio-community infrastructures, in particular green spaces, were not predefined or reserved, before the installation of the populations. The lack of mobilisation plans and insufficient financial resources as well as an absence of effective fund-raising strategies are also major constraints to the development and management of green spaces (Agbaniet al., 2021). In Senegal, the Diamniadio project would like to be an exception. In this case, proactive urbanisation is implemented to reconcile the growth of the agglomeration of Dakar and the building of a smart city. City planning prescribed that construction of the urban centre had to incorporate the elements of the natural landscape (topography, hydrography, plant formation, landscape continuity, etc.) to improve the architectural qualities of the urban environments (Bonnetet al., 2012). This ambitious project comes up against implementation difficulties and does not manage to achieve the theoretical objectives in practice despite all the goodwill. According to Global Green Institute (GGGI, 2017) other African capitals have more ambitious global vision and are in process of becoming green cities, this is particularly the case of Kigali in Rwanda. Kigali City has produced different plans and strategies, including Kigali Conceptual Master Plan 2008, Kigali City Master Plan 2013, Kigali City Development Plan 2013Q2018, District Development Plans 2013-2018, Kigali Transport Plan-2013 and a number of other detailed district and sub-area plans. With strong vision, Kigali wish to be an example to follow for the region, even the continent. But still, in practise expectation are confronted with inclusive planning missing involvement and participation of the population. Implementation processes are extremely important and should be adopted to cater for economic and social needs. There is also need to avail more land for recreational purposes and mixed land uses development promotion through various zoning of the city (Rwampungu & Engineering, 2019).

The management of green spaces in sub-Saharan Africa

Green spaces contain unique and useful biodiversity resulting from their management choices (Ilie & Cosmulescu, 2023). According to (Cilliers et al., 2013) with the exception of south Africa, few studies have been carried out in Africa on the management of urbanised green spaces. These studies in Africa point to a gap between community expectations and provided green spaces, which impairs efficient management (Combrincket al., 2020). This team observed a great contrast in the management of spaces between south Africa and the rest of the countries of sub-Saharan Africa. Indeed, in most cities of this later region of the world, development escapes the control of public authorities and planners. Green spaces are as a result undervalued and subject to mismanagement (Agbani et al., 2021).

In a city like Lomé, capital of Togo, studies have shown that the green spaces that were inseparable from the city originally did not follow the spatial extension and even disappeared. This therefore poses a problem of management of these green spaces, and reveal the weakness of public policy (Polorigni et al., 2015). This situation follows in numerous countries, for instance, Dakar in Senegal loose 34% of original green spaces between 1998 and 2007. In Lagos (Nigeria), subsisted green spaces in 2020 value less than 3% of the urban spaces (Bariol-Mathais B.,2020). The green spaces disappear among other things, because of this gap between community expectations and provided green spaces. There's no implication of the population in the public green area, and most of the time, it appears to be a green carpet without utilisation. With functional green spaces including ecosystem value for fauna and flora but also with human interest, the green spaces integration could be such different. To be fully integrated in their global ecosystem they should be done with the care of native plants species which means local study of ornamental/ medicinal/ edible/ pollination/ functional/ traditional plants identity for each geographical region. Thus, studies carried out over alien and local species utilisation in sub-Saharan Africa are useful.

Alien species in the planning and management of green spaces in sub-Saharan Africa

In most nurseries in urban and peri-urban areas of African metropolises, we almost always find the same plants, which are mostly of foreign origin. Scientific and technical advances in the horticultural field have resulted in

remarkable progress with the corollary of a growing homogenisation and specialisation of the cultivated flora and impositions in many regions of the globe standardised models designed under the environmental and social conditions of the developed countries (Barrau, 1990). Plant dynamics and the evolution of cities green spaces, their phases of plant succession are not always predictable and the floristic composition is very different in urban compare to rural areas. Public spaces often have a greater number of introduced species than native species (Saint-Laurent, 2000). These introduced species represent order and cleanliness but do not represent the ecological and social realities environments in which they have been introduced.

Well established in botanical gardens, plant collections and public gardens, exotic plants are nowadays criticised because of their potential of rapid dispersal with an ability to spread and potentially damaging local ecosystems (Claeys & Sirost, 2010).As (Thévenot, 2013) says, invasive alien species modify the integrity of ecosystems at the level of the biotope (environment) and the biocenosis (living communities) by changing the biogeochemical cycles, access to certain resources and by modifying the chain food and natural disturbance regimes. Given the problem related to the dispersal of exotic species, some countries are starting to set up regional platforms dedicated to sharing knowledge on decision-making tools for controlling introductions and spreads (Abdou, 2021). Some of these alien species manage to naturalise in areas of introduction and become invasive in natural or semi-natural habitats, inducing changes while threatening native biological diversity (Shineet al., 2000). A process of biotic homogenisation is thus observed in urban ecosystems. The latter, modified by new developments, then offer colonisation opportunities for exogenous species; which results in a reduction in the variation of habitats as well as an impoverishment of the diversity of native species. The predominance of alien species in design green spaces is partially due to negative perceptionsaround allochthonous vegetation and highlights a break in the representations of both of them.

Native species in the planning and management of green spaces in sub-Saharan Africa

Many authors agree on the fact that the elements and plant formations are in constant decline in cities, in the near future, this phenomenon will become critical for sustainable development. The challenges of sustainable development have given rise to a completely different vision. City could became an opportunity, a place of convergence and dynamism (Kessides, 2006), within it is necessary to promote the preservation of ecosystems and it's procession of fauna and flora. Ecological constraints partly justify this new orientation because the diseases of exotic plants are often not controllable, which means that we are moving towards local plants that are more acclimatised to their native environments. There is also a dynamism of cultural aspect as well as memorial and emotional attachments that lead to adopting native plants in order to better appreciate their beauty (Korbéogo, 2016). Local history on the relationships between individuals and their ecology shows that plants or flowers are used mainly for food, medicine, symbolic, magical and aesthetical needs. Thus, the symbolic, ritual and aesthetic uses of flowers reflect the consolidation of the relational game (social or emotional) between men and their symbolic patterns of representation. So, floral traditions and uses of flowers corresponds to aesthetic and affective forms of expression which are emancipating of global designs but continually abiding from traditional constraints (Korbéogo, 2016).

Steps towards the introduction of indigenous plants in the development of green spaces already exist on the African continent. The best known cases are represented by the development programs in South Africa and Ghana. We can also cite the re-vegetation operations in the city of Ouagadougou in Burkina Faso, which are gradually integrating local ornamental species throughout the urban space (Bley et al., 1998). However, it is necessary to emphasize the fact that in the majority of sub-Saharan African countries, the integration of indigenous plants in the development of green spaces is still perceived as a potential source of danger. A priori, native plants are linked to "weeds". The perception of an autochthonous wild plant, despite their potential, often remains negatively connoted as "bush plants" (Menozzi, 2001). Fortunately, the erosion of biodiversity and the taking into account of natural resources have led to an evolution of the perception of native plants for numerous landscape designer and apply it in the management priorities of green spaces in urban areas. These perception is not yet integrated by the population of large cities even if today they are more and more frequently confronted with the degradation of the urban environment due to overcrowding and various types of pollution (Garnier, 2005).

In addition of mentality accepting, all of these development projects with local species required, beforehand, work to identify and domesticate local plants to make them ornamental plants (Birane et al., 2019). To this end, all species of high ecological values in a specific habitat must first be identified. Favouring native species in the development of green spaces will make it possible to highlight the diverse local botanical heritage. In each region, this heritage is

made up of an assemblage of unique species. Village surroundings are the best places to have a quick overview. Some may be locally rare and therefore subject to conservation strategies. In addition, beyond the diversity of species, the genetic heritage will also be valued (Bourcier, 2012).The creators and managers of parks and public gardens should assimilated the knowledge and themes of ecology. The modern concept of biodiversity will led them to rehabilitate the wild, which it is nowadays important to safeguard, even cultivate (Dubost & Lizet, 2003). It is a question of adapting the type of vegetation and the mode of maintenance to the specificities of the different spaces in order to better enhance local diversity (Ernwein, 2016; Korányiet al., 2021). It is a management practice for green spaces that relies on methods that approximate the conditions present in local natural environments. It primarily selects plants according to their "origin" and their adaptation to regional bioclimatic conditions. Moreover, this management method, based on native species, requires less "care" and inputs, combining energy savings, cost and health risks (Simonet & Blanc, 2012;Neto Duarteet al., 2020).

Roles for native plant species in sub-Saharan green spaces

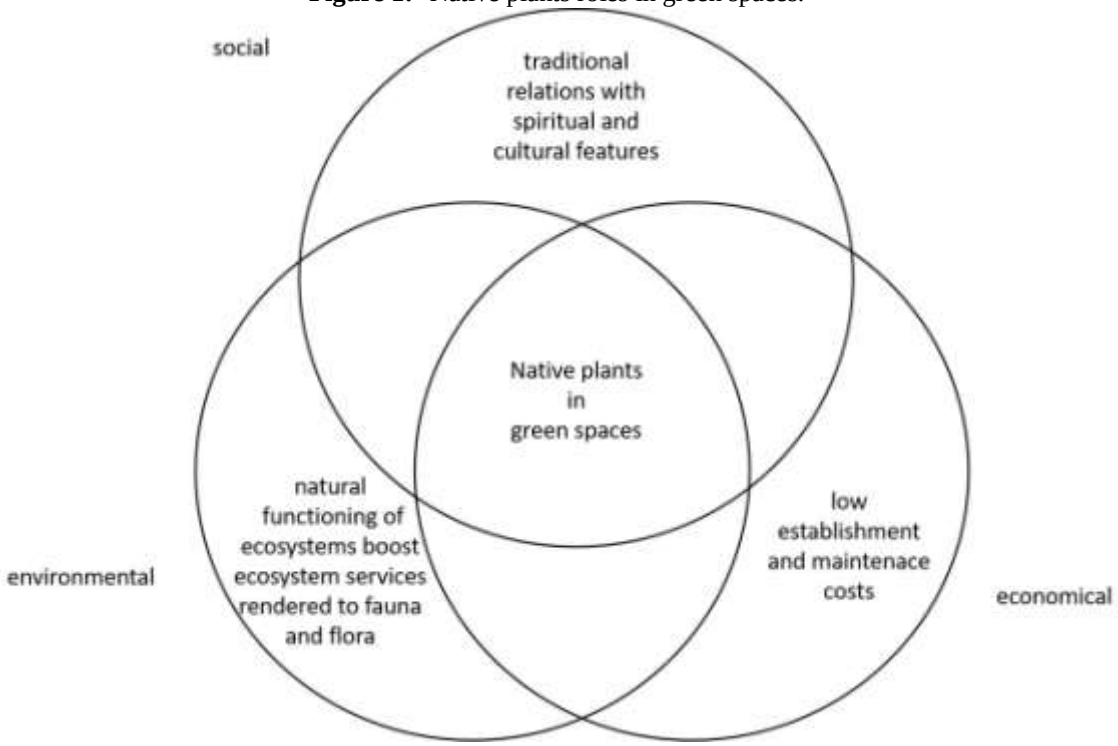
A crucial role of native species could be to population reclaiming green spaces. Indeed, some disconnected citizens leave oppressive city periodically to re-energize in the village...What about those who don't have the opportunity to travel? What about the young generation? Some don't know yet the meaning of this energy...and why not bringing a bit of village to town so that everybody could recharge batteries daily? And as said (Korbéogo, 2016; Rival, 2021), urban vegetation is figurative of memory and should correspond to collective identity. The too fast rural exodus prevent the appropriation of green spaces by citizens. A backtrack to reconnect to village sources by plant species tool could be an alternative lever (Ferroet al., 2013). Howard (1902) remarked as follows: «There are in reality not only, as is so constantly assumed, two alternatives – town life and country life – but a third alternative in which all the advantages of the most energetic and active town life, with all the beauty and delight of the country, may be secured in perfect combination; .... the Town-Country which are seen to be free from the disadvantages of either».

The garden city combines the "energetic and active town life with all the beauty and delight of the countryside" without the negatives of either town or countryside. This idyllic description overlooks some realities, but touch a possibility to reconcile citizens and allow a powerful contact with urban greenery. In addition, the use of plant resources for traditional and therapeutic purposes is a habit in all African cultures (Kande et al. 2018). Lots of plants have ancestral and symbolic meanings permitting a strong links with the population. Indeed the traditional relations between the populations and their natural environment are still highly dynamic both in their food and material aspects as well as in their spiritual and cultural features (Sene, 1993).

A second very important role of native species concerning the environment preservation. Vegetation species relationships generally have a large impact on biodiversity and, consequently, an important factor explaining intra-urban biodiversity (Ilie & Cosmulescu, 2023). Likewise, (Fukase & Simons, 2016) reported that heightened pollinator activity was observed with an increasing native plant area. Native landscaping may also positively influence the avian and lepidopteran carrying capacity (Burghardtet al., 2010). Cities are places with high diversity where native species could lead natural functioning of ecosystems and boost ecosystem services rendered to fauna and flora.

The third role of native flora is the economic advantages of using them in green spaces. Assets are numerous: low establishment (easily adaptable to climatic conditions) and maintenance (require little care and inputs as well as self-reproducing ability) costs, long term chromaticity, high variability, low health risks and wide ecological range in urban or periurban green spaces. Environmental and Socio- economical contributions of native plants in Sub-Saharan Africa green spaces are summarised in figure 1.

Figure 1:- Native plants roles in green spaces.



Environmental and Socio- economical contribution of native plants in sub-Saharan Africa green spaces.

Conclusion and Perspectives:-

The ordinary models of development and management of green spaces in sub-Saharan Africa, based on fragmented functional zoning, in other words residential, manufacturing and commercial, with the use of exotic species requiring lot of maintenance, seems today have proven to be unsuited to contemporary challenges of sustainable development. The integration of native plant species along with their ecosystem services could constitute an advantageous alternative to achieve the higher level of environmental performance necessary to improve the citizen's quality of life and preserve biodiversity. For the perspective it will be to set the theoretical principles unto practical establishment. There is a great interest in the identification and conservation of ornamental plant species from the spontaneous flora, many of them can be used in green spaces. Since, African countries have a great floristic diversity, it would now be interesting to evaluate plants with ornamental/ medicinal/ edible/ pollination/ functional/ traditional potential from local natural formations. These study could be a matter of progressively replace imported exotic plants used in the development of green spaces. Local plants and native species could be an opportunity for sustainable development in landscaping projects in African countries. The ecosystem services identification permit us to accurate the relevance of our intervention and permit the population to understand better the importance and the benefits they can afford in it. Methodical organisation could overcome one of the major obstacles for the use of native plants in the development of green spaces which is the popular support. The ancestral knowledge of this natural horticultural flora constitutes a basis for the promotion of these local plants with decorative potential and the popularisation of these by domestication. The practical step must be the development of the process of obtaining seeds, of these plants, for their use as a substitute for exotic plants in the development of green spaces. Identified species should be collected in order to set up programs for the selection and production of stable seeds, so as to gradually make them available in local markets and accessible to customers in cities. It is currently essential to propose development and management models specific to these native species. A reflection should be carried out to initiate the design phase, which remains the key stage in the process preceding the choice of local plant species selected. In perspective, in-depth studies are desirable to provide more knowledge to the developer, in particular on the perception by the populations of the different types of green spaces, their contribution to the climatic comfort of the habitats and the determinants for an adequate choice of species (Sambieni et al., 2018). It will also be an essential tool to support sustainable development policies. The potential of indigenous flora for use in African countries could help to develop guidelines and propose an overall development plan allowing the emergence of a new specific concept of sustainable management of green spaces in this area of the world. In those context, native

plants species in public spaces could be the link between social interest, economic rationality and biodiversity respect. With smart and adapted designs, native species could be key elements to answer sustainable cities development challenges.

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