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*RESEARCH ARTICLE*

# HOW DO URBAN AND NATURAL FLORA DIFFER IN SUPPORTING BIODIVERSITY, HUMAN PHYSICAL AND MENTAL HEALTH IN SENEGAL

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## Abstract

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Human health is inextricably linked to the health of ecosystems, which provide a multitude of goods and services. The provision of ecosystem services is of greatest importance in the prevention of disease and the enhancement of human health. Despite the vital functions they perform, ecosystems are subject to a multitude of threats, both natural and anthropogenic.In Senegal, there is a paucity of studies that have examined the variation in floristic diversity between the natural forest site and the urban city. It is essential to undertake a comparative analysis of species diversity in urban areas and natural forests in order to gain insight into floristic changes and to enhance biodiversity management in both natural forests and urban city. This study examines the floristic similarities between natural forests and urban city and investigates the contribution of forest and urban tree species to human physical and mental health. Floristic and socio-economic data were collected in the Fathala forest and in Fann Point E Amitiémunicipality( FPAM) as well as among the two local populations, respectively. A total of 58 tree species were identified within the Fathala classified natural forest, while 83 tree species were recorded within the FPAM.The two sites shared 12 common species, but 45 indigenous species were found in the municipality, while in the natural forest, one exotic species was present. Of the total 129 plant species that have been identified, 35 of these are used for medicinal purposes. These applications include the treatment of pain, infections, and a range of pathologies and symptoms, as well as for mental health.Furthermore, the findings of this study indicate the presence of endangered species in both urban and forest areas, as well as the presence of an exotic species in a natural forest.These findings suggest that management strategies must be adapted to ecosystem-specific realities, ensuring that threatened species in urban areas receive urgent protection while also strengthening assessment of species in natural forests for better protection.





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## Introduction:-

In recent decades, rapid urbanization has had considerable environmental consequences, including the loss of native vegetation due to the overexploitation of natural habitats (Mukherjee &Bairwa, 2025; Patel &Raval, 2024). This dynamic has beenshown to increase the vulnerability of urban areas to the effects of climate change, including flooding, heat waves and rising temperatures (IPCC,2023). Urban trees have been identified as a significant tool in adapting and mitigating the adverse effects of climate change (Jones et al., 2022; IPCC, 2023). These treescontribute to the conservation of biodiversity, the enhancement of human health, and the promotion of psychological well-being. It has been demonstrated that trees intercept and absorb various air pollutants, including carbon dioxide (Nowak & Crane, 2000), and that they promote thermal regulation through shade and plant transpiration (Kong et al. 2017). Their presence in urban areas has been demonstrated to create calming environments, thereby reducing residents' stress levels (Tzoulas et al., 2007).

Furthermore, trees facilitate the infiltration of rainwater into groundwater, thereby aiding in the mitigation of flood risks (Gill et al., 2007), while providing essential habitat for both local and migratory wildlife (Aronson et al., 2014).

In natural environments, trees also provide a range of ecosystem products and services of ecological, social and economic importance(Niemelä, 2011). The provision of wood and non-wood forest products is of key importance in the context of biodiversity conservation, water and air regulation, soil protection and hunger elimination (FAO, 2018; Dieng et al., 2016;Vira et al., 2015; MEA, 2005).The multifunctionality of trees is generating growing interest in biodiversity in urban and natural environments. Furthermore, there is growing international and national commitment to the conservation of urban biodiversity, as evidenced by the recent Kunming-Montreal Global Biodiversity Framework, which recognizes the role of cities in biodiversity conservation (UNEP, 2022).

Concurrently, research in the field of urban ecology has facilitated a more profound comprehension of the manner in which urbanization exerts its influence on the composition of flora and the extent to which urban landscapes continue to offer a conducive environment for the survival of native species in comparison to natural habitats (Aronson et al., 2016; McDonnell &Hahs, 2008).In urban areas, the practice of tree planting is frequently influenced bytheir aesthetic, shadyor economic factors, often at the expense of ecological considerations. The selection of a limited number of fast-growing species frequently leads to the homogenization of urban landscapes (Kendal et al., 2012; La Sorte& McKinney, 2007). However, several studies have demonstrated that urban areas can exhibit greater biodiversity than rural landscapes, particularly due to the introduction of exotic species and soil heterogeneity (Beninde et al., 2015; McKinney, 2008).

In Senegal, studies directly comparing urban and natural flora remain rare, despite their importance for understanding ecological transformations at the national level. Notwithstanding its high population density, the city of Dakar is home to a significant arboreal heritage that merits preservation and enhancement (Cissé et al., 2024;Niang et al.2023). It is evident that urban green spaces, and more specifically native trees, fulfil a pivotal function in biodiversity conservation and inpromoting of public health (Mensah et al., 2017; Niang et al. 2023). Moreover, research on urban biodiversity will facilitate a more profound comprehension of the ramifications of urbanization on the floristic composition of urban landscapes and whether urban areas remain conducive to the survival of native species in comparison to natural sites.

We questioned whether urban landscapes continue to serve as refuges for native or endangered species and ascertain the presence of exotic species within natural forest. Overall, this study aims to determine how dissimilar are the plant communities in natural forest and urban city and what significance do they hold in relation to biodiversity conservation, human physical and mental health?In particular, we examinedi) the difference on species richness, diversity, composition and structure amongcity and natural forest, ii) analyse the contribution of urban and natural plants in human physical and mental health. It is hypothesized that natural forestwill content more species and exhibit higher diversity than the city, attributable to the effects of urbanization in urban landscapes. However, it is predicted that urban city will exhibit the presence of taller trees compared to natural forest. Even the profound alterations of land use in urban areas and the exclusive planting of exotic species, it is expected that a degree of similarity on floristic composition would be identified within these two distinct landscapesdue to the presence of remaining indigenous and threatened species in urban landscapesand that of exotic species in natural forests.Finally, we suppose that the perception of the contribution of plant species tohuman physical and mental health differs between urban and rural inhabitants due to the differing functions and benefits that trees provide.

## Methods:-

### Study areas

Fathala Classified Forest is located in the Fatick region in western Senegal while Fann-Point E-Amitié municipality (FPAM) is located in the south-west of the capital and is part of the district of Dakar-Plateau-Gorée (Figure 1).

Fathala forest covers approximately 7000 ha and corresponds to the terrestrial part of the Saloum Delta National Park, the central core of the Saloum Delta Biosphere Reserve. It is bordered by mangroves to the west and framed by fields and villages in the other directions.

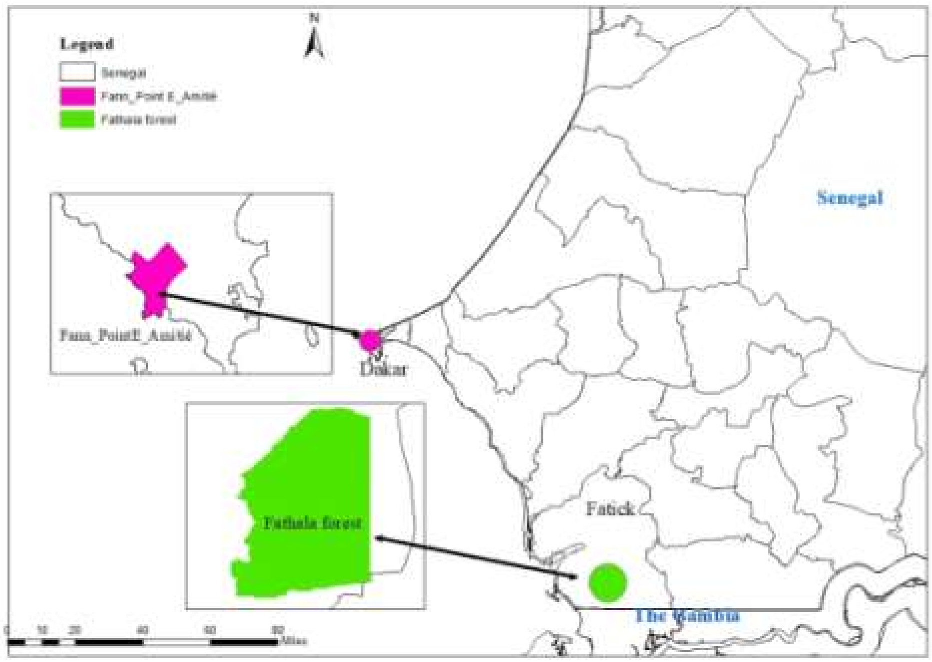


**Figure1. location map of Fathala Forest and FPAM**

### Floristic data collection

The collection of floristic data was conducted within the Fathala Forest and FPAM. In Fathala Forest, the forest area is divided into grids of 250 m x 250 m, based on a stratification using Landsat images (Sambou et al., 2015). The number of grids was determined by the size of each vegetation type. Grids exhibiting homogeneity in terms of vegetation type were selected at random. Within each selected grid, eight plots measuring 20 m x 20 m were installed at random along the medians and diagonals of the grids. In each plot, all individuals were encountered. In each plot, the circumference was measured and the height was estimated for all trees with a circumference of at least 9.5 centimetres at a height of 1.3 metres from the ground. For those trees with a circumference of less than 9.5 cm at 1.30 m from the ground, individual trees were enumerated. A total of 112 plots were surveyed.

In FPAM, a systemic inventory of trees was carried out in private gardens, public gardens and aligned tree based on the nearest tree inventory method (Niang Diop et al., 2011). The trees were enumerated and identified to the species level. The circumference was measured and the height was estimated for all trees with a circumference of at least 9.5 centimetres at a height of 1.3 metres from the ground. For those trees with a circumference of less than 9.5 cm at 1.30 m from the ground, individual trees were enumerated. Moreover, the indigenous species present in FPAM were complemented by data derived from observation-based tree inventories and studies conducted atFann Hospitaland Cheikh Anta Diop University (Sy et al., 2024).

For both sites, identification of individuals was based on the flora of Senegal (Berhaut, 1967) and the book Trees, shrubs and lianas of West Africa (Arbonnier, 2000).

**Data collection on the medicinal uses of plants:**

Information on the role of plants for the prevention and treatment of diseases was gathered from interviews in six villages and a traditional center surrounding the Fathala forest. In total four focus groups with at least ten persons from the villages and 34 informants were questioned in an individual semi-structured interview. In addition, informal discussions were held with 6 traditional resource persons. The main questions addressed during the interviews focused on the plant, its local name, the medical practices and the related therapeutic virtues.Species identification was done insitu with the help of the informants or identified using Berhaut(1967), and Arbonier(2019) floras. Interviews were supplemented by direct observation.

In FPAM, data were collected among residents and concerned importance of urban trees and green spaces in human health and well-being. A sampling based on the total number of households allowed to calculate the study population according to the Slovin (1960) formula.

$n=N/(1+N\times e^2)$

With N = 3858 the total number of households; e = the level of precision and n = sample size.

In total, 97 households were surveyed. In addition, individual semi-structured interviews were conducted with resource persons, including health personnel, students and faculty, given the importance of the university in the commune.

**Data analysis:**

The analysis of floristic data was conducted in R, utilizing the vegan package for the calculation of diversity metrics and the FactoMineR package for factorial Correspondence Analysis. The analysis of survey data was performed using SPSS software. The species richness (S = number of species), Shannon's diversity index ($H' = -\Sigma\ p_i \ln p_i$, where $p_i$ is the proportion of the ith species), and species composition were calculated and compared among the natural forest and the urban city. In order to ascertain whether there was a significant difference between the urban and natural sites with regard to the diversity metrics, Wilcoxon test was performed. The diameter structure of tree populations was determined on the basis of density of probability. In order to explore relationships among species and pathologies, factorial correspondence analysis was conducted using the chi-squared distance. The statistical significance of group differences was assessed using a permutational multivariate analysis of variance (PERMANOVA).

The interviews were transcribed and the scientific species name, plant family and reported therapeutic uses were compiled in Excel. The importance of each species was determined from the Frequency of Citation (Dossou et al. 2021, Vitalini et al. 2013): FC=n/N*100. Where n=number of respondents who stated the use of a species to treat disease and N=total number of informants interviewed. For each species family, the relative frequency was calculated: F=Number of species in a family/Total number of families. Then based on overall data, we analyzed the importance of the encountered plants for the prevention and treatment of diseases.

The global conservation status of recorded tree species was determined using the International Union for Conservation of Nature (IUCN) Red List categories (IUCN, 2021). The classification of each species was conducted in accordance with the following IUCN categories: Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), or Critically Endangered (CR). Furthermore, the national protection status of species was determined on the basis of the National Forestry classification, which designates the species as fully protected, partially protected or non-status.

## Results:-

**Plants species diversity and composition in Fathala forest and Fann-Point E-Amitié Municipality**

A total of 58 tree species are encountered within the natural forest of the surveyed Fathala classified forest (Annexe1) while in the city of FPAM, 83 tree species were recorded (Annexe 2). The city and the natural forest aresignificantly different inspecies richness (P = 0.01433) and diversity (P = 0.01194). However, the presence of 45 indigenous species isobserved in FPAM (Annexe2). Notwithstanding, in the natural forest, the presence of an exotic species like Azadirachta indicaisnoted, even though the species is now considered naturalized in Senegal.

The natural forest has overlap in species composition with the city, sharing twelve species: Acacia ataxacantha, Adansonia digitata, Azadirachta indica, Cassia sieberiana, Cola cordifolia, Combretum aculeatum, Combretum micranthum, Ficus sycomorus, Khaya senegalensis, Piliostigmareticulatum, Saba senegalensis and Sclerocaryabirrea.

The natural forest contains 18 botanical families, comprising 43 genera, while the FPAM area is richer, with 33 families and 70 genera. In the natural forest, four families:Fabaceae, Combretaceae, Anacardiaceae, and Malvaceaedominate, accounting for 62.8% of all genera and 69% of all species. Fabaceae is the most diverse, with 17 genera and 21 species, whereas 61% of the families are represented by only one species.

In FPAM, species diversity is broader, with several key families including Fabaceae (20 species), Moraceae (7 species), Apocynaceae, Arecaceae, Malvaceae (each with 5 species), and Combretaceae (5 species). Most other families contain only one species.

Overall, the natural forest and FPAM share 17.8% of their botanical families, specifically Anacardiaceae, Annonaceae, Apocynaceae, Combretaceae, Fabaceae, Meliaceae, Moraceae, and Rhamnaceae.

**Tree species structure in natural forest and urban area**

The results reveal a significant difference in tree structure ($p<0.05$), depending on the sitesand tree diameter and height are greater in urban areas than in natural forests (Figure 3). In the FPAM, the density of individuals exhibits a higher frequency for diameters between 30 and 100 cm and heights between 5 and 10 m. The substantial diameters and heights of trees recorded in city reflect a clear dominance of large individuals(Figure 2). In the Fathala forest, small-diameter individuals predominate, characterized by lower height and higher population density.The largest proportion of trees measures between 0 and 10 cm in diameter, with a density of individuals that decreases towards higher diameter values.Concurrently, the species surveyed exhibited a structure characterized by a predominance of individuals concentrated in intermediate height values (3-10 m) with a paucity at greater heights.

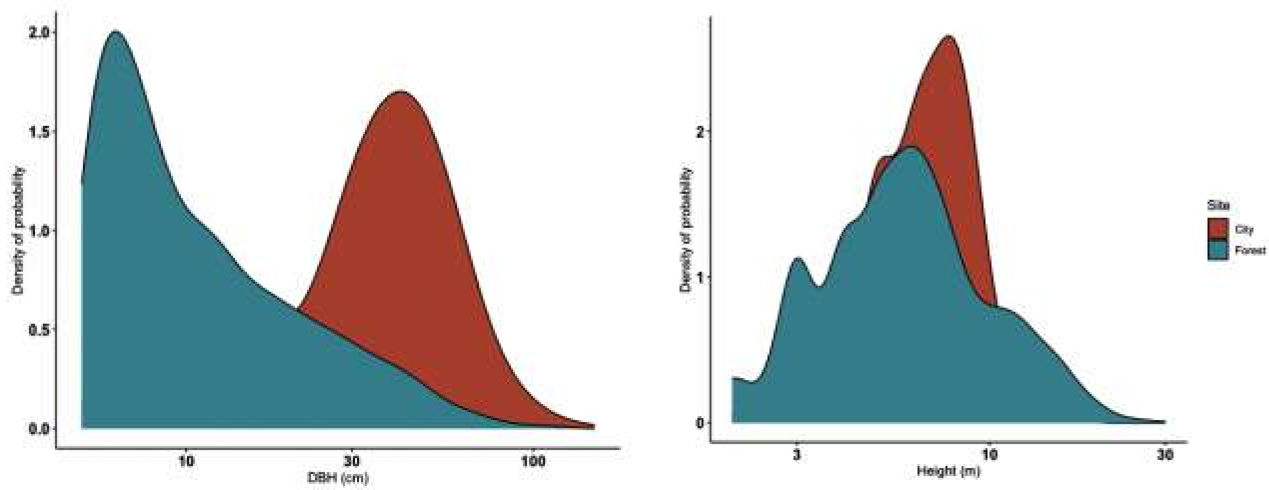


**Figure 2. Density of probability of DBH and Height between Fathala natural forest and Fann Point E Amitié Municipality**

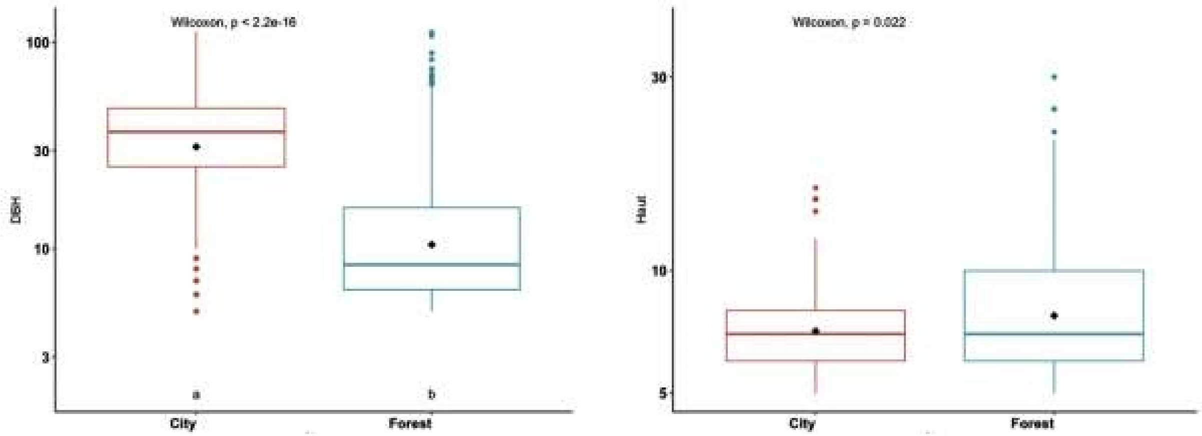


**Figure 3.DBH (cm) and Height (m) variation between Fathala natural forest and Fann-Point E-Amitié Municipality**

**Status of conservation of species**

The two graphs (Figure 4) reveal differences in how species are distributed across IUCN categories and national forestry code classification.In the urban city species are more evenly distributed across IUCN categories, with a substantial presence of threatened species. Figure 4b shows 4 Vulnerable (VU) and 3 Endangered (EN) species, and several species fall under Partially Protected (PP) and Fully Protected (FP) categories. About 60–65% of urban species are Not Specified (NS) nationally. In contrast, the Fathalaforest species are dominated by Least Concern (LC) species (Figure 4a). Out of 47 species, 43 (91%) are LC, while only 3 are VU and 1 is EN. According to the national forestry code, 42 species (89%) are completely NS, and only 1 species receives Full Protection (FP). The VU and EN forest species are all Partially Protected (PP).

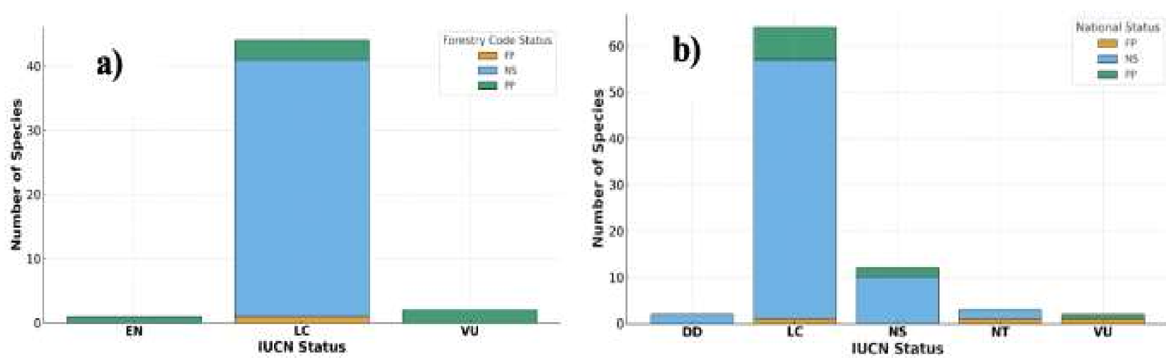


**Figure 4. IUCN conservation status (Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Near Threatened (NT), Data Deficient (DD) and national status (None Status (NS), FP (Fully Protected), PP (Partially Protected) of species in FPAM (a) and natural forest (b):**

**Plants species contribution to physical health**

Figure 5 illustrates the diversity of plant species (34 species) employed in the treatment of diverse ailments. The graph demonstrates a strong correlation between the frequency of treatment categories and the diversity of plants utilized, characterized by the predominance of the categories of pain (12 species) and infections (7 species). Collectively, these two conditions account for over 62% of all species, thus indicating that they represent the predominant therapeutic needs in the study area. Hypertension, anemia and indigestion each account for two species, while several other conditions (skin diseases, diabetes, parasites, allergies, fever and eye diseases) account for only one species.

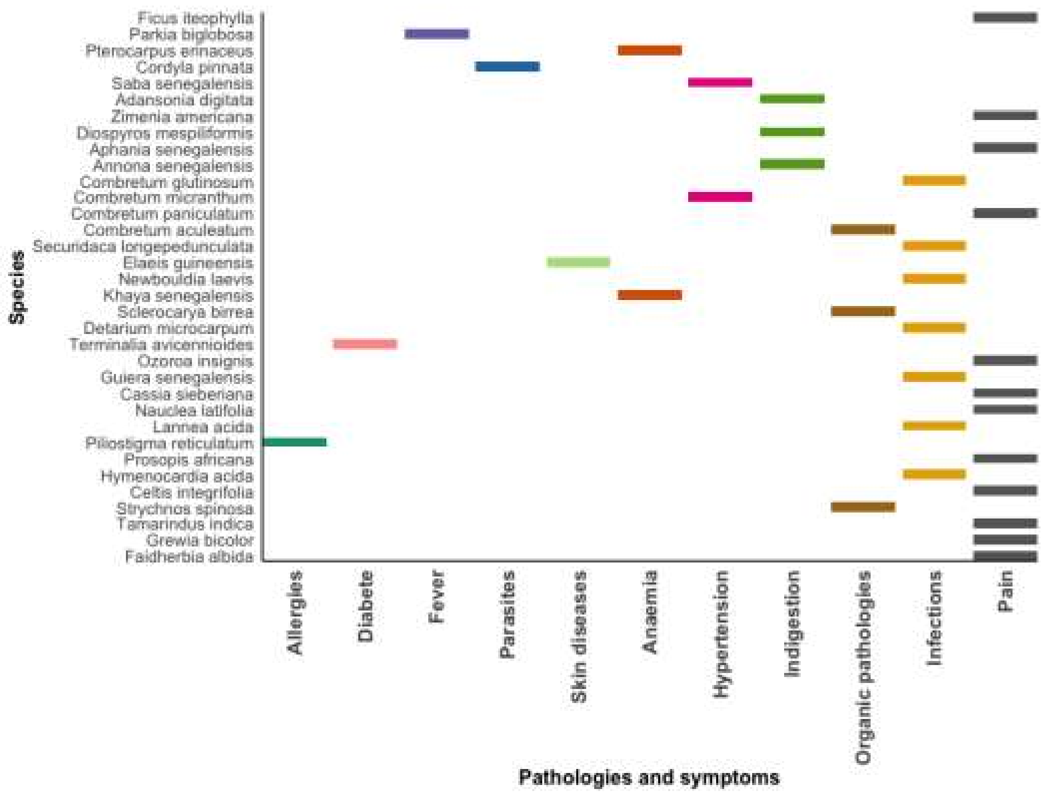


**Figure5. Specific contribution of species to pathologies and symptoms**

The correspondence factor analysis (Figure 6) shows the associations between the diversity of species utilized in healthcare and the categories of therapeutic uses. As posited by the Axis 1, the maximum variance between species is represented by their categories of care. The most prevalent therapeutic use categories (pain and infections) exhibit a robust correlation with axis 1, and many species are closely related to these categories. The second axis differentiates species according to their specific applications, including, but not limited to, the treatment of diabetes, allergies, dermatoses and parasitic diseases. The third group of species exhibits efficacy against a range of pathologies. These species are positioned between the primary clusters, thus reflecting their multifaceted therapeutic applications.

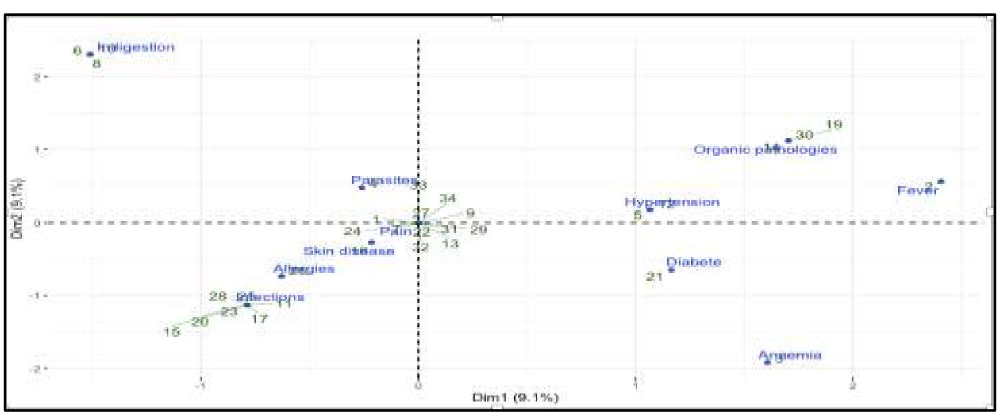


**Figure 6. Correspondence factorial analysis of species and their use in physical and mental health**

**Plants species contribution tomental health**

We examined the benefits that plants of urban city provide to human mental health. The majority of respondents (69%) believe that these plants play an important role in mental and physical. Plants in urban city contribute to the reduction of several diseases like hypertension and ecological impacts (air purification, reduction of urban heat islands, carbon sequestration, etc.). These ecosystem services from urban plants address both the symptoms of diseases and associated risk factors, as well as the environmental impact. In FPAM, the majority of respondents (97.9%) felt that plants in urban city are important in daily life because of the many services they provide to mental health. For example, urban green spaces of the FPAM are places that are frequented by men (76%) and women (24%) for various reasons related to mental health.

The graph below illustrates the distribution of responses from users of green spaces according to their motivations or activities, expressed as a percentage. The majority (70%) of respondents associate green spaces with relaxation, contact with nature and aesthetics. It is estimated that approximately 21% of the total is accounted for by uses that are oriented towards family, sport or entertainment. This finding aligns with the significance attributed to aesthetic criteria, which accounted for 24.2% of the responses. The aesthetic criterion for green spaces in cities is more associated with ornamental species such as Azadirachta indica, Delonix regia, Albizia lebeck, PeltophorumpterocarpumandSamanea saman.This observation underscores the prioritization of visual appeal and landscape quality by users, thereby emphasizing the psychological and aesthetic dimensions of green spaces that are highly valued. These green spaces are also perceived as refuges from urban stress (Calm/No nuisance + Break/Reconnect = 44.6%).In addition,the importance of urban green spaces has been highlighted in other areas, such as strengthening social ties.Particularly, some people mentioned the benefits of Khaya senegalensis bark which is used in traditional medicine for pain and inflammation.

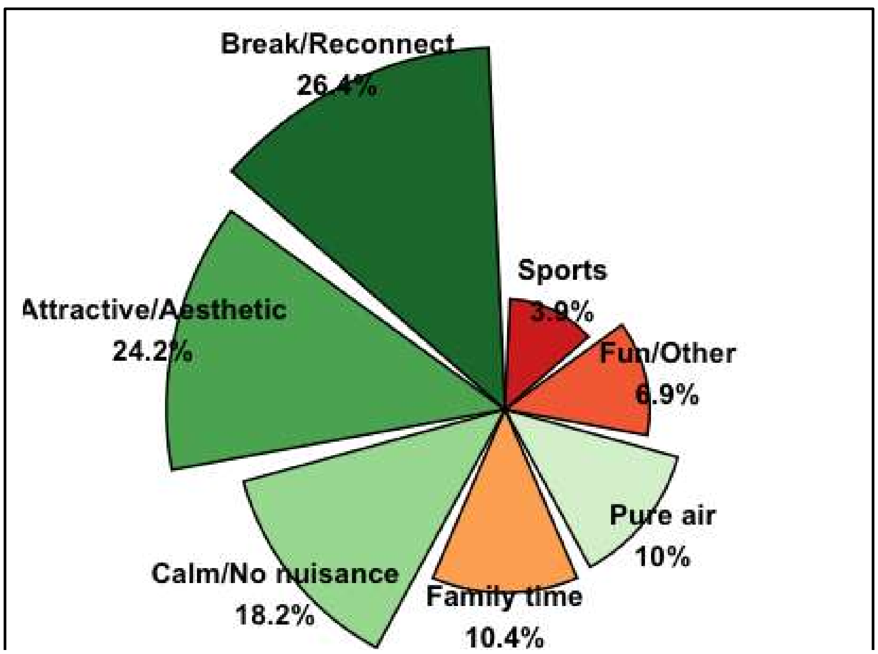


**Figure7. Contribution of urban green spacesto mental health in Fann-Point E-Amitié Municipality**

## Discussion:-

This study assesses the extent to which urban city still support biodiversity related to native and endangered species by comparing urban and rural plant communities and determining their effects on human physical and mental health.The findings demonstrate that, despite variations in species composition, the urban environment still harbors indigenous species, particularly those that are endangered or protected. Furthermore, it appears that perceptions of the usefulness of plants for physical and mental health are different depending on either a natural forest or urban area.

**Variation of tree species across urban city and natural forest**

Contrary to expectations, the species richness of the urban city was greater than that of the natural forest.However, the natural forest has agreater Shannon index diversity. This finding which indicates a greater level of species richness in the citysupports the hypothesis that cities contain a significant reservoir of biodiversity (Beninde et al., 2015; Aronson et al., 2014; McKinney, 2008), akin to natural forests (N'Guessan et al., 2018).The findings are supported by the research of Yan and Yang (2017), Nero et al. (2017), and Nowak and Dwyer (2007) that concluded that urban areas are conducive to biodiversity conservation, despite their significant anthropogenic modification (Johnson & Munshi-South, 2017). The phenomenon under scrutiny can be explained by the presence of planted trees, which have been demonstrated to enhance the biodiversity of urban environments.

Urban areas have been shown to function as genetic reservoirs when they incorporate local plant populations that are capable of reproducing naturally and adapting to the specific environmental pressures of the urban environment (Johnson & Munshi-South, 2017). For instance, Burghardt, Tallamy and Shriver's (2009) research showedthat the larvae of indigenous insects demonstrate a marked preference for indigenous plant species, thereby exerting a direct influence on the reproductive success of birds that feed on insects.

Our findings demonstrate that a number of species are common to both ecosystems. The notion that urban areas are characterized by the presence of exotic species is a contentious one. Indeed, it has been argued that cities can act as refuges for native species. Notwithstanding the destruction of natural habitats within urban areas, a number of green spaces have been identified as refuges for certain species (Johnson et Munshi-South 2017), thereby enabling the maintenance of viable populations in the face of urbanization. Research has demonstrated that urban areas are capable of supporting greater numbers of certain species and the presence of indigenous flora in urban areas is instrumental in preserving functional trophic networks, thereby enhancing the resilience of urban ecological communities.

**Conservation status of tree species in urban city and natural forest**

An analysis of tree structure has revealed that trees in urban areas tend to have greater diameter and height compared to their natural counterparts in forests, with some specimens reaching diameters of up to 100 centimeters. This structure describes ageing populations of species selected for aesthetic reasons in the context of landscaping, with limited opportunity for reproductive activity (Hilbert et al., 2019). The low population density of these species fosters a competitive environment, where individuals of the same species vie for resources and space, thereby hindering their growth potential.

Urbanization is now recognized as one of the primary drivers of ecosystem transformation, resulting in substantial habitat fragmentation and biodiversity loss (Seto et al., 2012). The presence of native species within urban environments is of particular significance in the context of climate change, as it contributes to the preservation of genetic diversity, which is a critical factor in mitigating and adaptating to ongoing environmental changes (Johnson& Munshi-South, 2017).

The expansion of urbanization is frequently regarded as being at odds with the preservation of biodiversity. However, a substantial body of research has demonstrated that urban environments have the potential to function as refuges for certain native species under threat, provided that the environmental conditions are conducive to their survival (Gentili et al., 2024; Jansen, J., &Hobohm, 2021; Kowarik, 2011). This finding calls into question the long-standing view of cities as ecologically marginal areas.

Urban environments, which were originally considered to be disadvantageous, can offer significant opportunities for the conservation of threatened native species. Indeed, the presence of indigenous species within urban environments is of critical importance for the conservation of biodiversity, particularly in the context of populations of endangered species such as Khaya senegalensis(Marselleet al., 2021).However, the presence of this species in urban areas highlights the role that these environments can play in safeguarding certain species. This observation is consistent with the new paradigm of urban conservation, recognizing that cities can actively contribute to the preservation of biodiversity (Aronson et al., 2017).The IUCN Red List (1998) classifies Khaya senegalensis as Vulnerable (VU), reflecting significant threats to its natural populations (IUCN, 1998). The species is afforded regulatory protection by its inclusion in Appendix II of CITES, a measure intended to ensure the sustainable management of international trade (CITES, 2022). Notwithstanding the implementation of protective measures, the efficacy of monitoring and management practices remains deficient in numerous countries across West and Central Africa (CITES, 2022;

Forest Center, 2019). With regard to Ficus sycomorus, the IUCN states that it is not threatened; however, at the local level, there may be pressures related to habitat degradation. Overall, Tamarindus indica is not currently considered to be globally threatened (LC according to the IUCN), but some local populations show signs of fragility and vulnerability, particularly due to habitat loss and insufficient regeneration. The species has been extensively documented in savannah ecosystems, notably shrub savannahs (Moumouni et al. 2017; Diop et al. 2012), yet it is also utilized as a roadside tree and provides shade in select urban areas (Gormo 2020).

The spread of urbanization is often perceived as being incompatible with biodiversity conservation, which is a problem for both people and wildlife. However, numerous studies have shown that, provided environmental conditions are suitable, urban environments can serve as refuges for certain endangered native species (Gentili et al., 2024; Planchuelo et al.; 2019). This challenges the traditional view of cities as ecologically marginal areas. While cities are subject to selective pressures, urban planning that incorporates local species can help safeguard biodiversity.

Paradoxically, the most unexpected result of our study was the abundance of Azadirachta indica found in the natural forest. Azadirachta indica has been shown to be capable of growing in a variety of soil types (DOSSA et al., 2017). As posited by several authors (Mondal and Chakraborty, 2016; Bationo, Yelemou, and Ouedraogo, 2004; Habou et al., 2016; Alzohairy, 2016), A. indica is present in both urban and rural areas, serving a variety of purposes including as windbreaks, avenue trees, and agroforestry species. Although A. indica has become a naturalized species in Senegal, its presence in natural forests raises significant concerns, as the introduction of non-native species can result in substantial changes to the structure, functioning and resilience of forest ecosystems. However, the extent of these impacts is contingent on the biological traits of the species in question. The capacity for rapid colonization of novel habitats, frequently accompanied by a high reproductive rate, can ultimately result in a decline in local biodiversity. The presence of this species has the capacity to exert a profound influence on the dynamics of forest ecosystems, with the potential to modify the composition of the flora (Mondal & Chakraborty, 2016;Alzohairy, 2016). This, in turn, can have ramifications for the ecological and economic value of the forest.

**Contribution of urban and forest trees to human physical and mental health**

The survey carried out among communities made it possible to identify 34 medicinal species among the 129species inventoried both in rural and urban areas. The high number of species identified for therapeutic use reflects the strong dependence of local populations on traditional medicine, as several studies in West Africa have already shown (Kerharo& Adam, 1974;Thiombiano, 1996; Faye, 2018). All the species listed are well known in the Senegalese pharmacopoeia and are used in the treatment of different pathologies (Kerharo and Adam, 1974). Having knowledge of the therapeutic virtues of these species which characterize the tropical savannah of Africa (Thiombiano, 1996), communities' resort to phytotherapy for the treatment of certain diseases. The use of medicinal plants is observed in most African countries. This is the case in Haut-Nyong in Cameroon where Mpondo et al., (2017) in an ethnobotanical survey in three villages, identified 90 species belonging to 83 genera and 47 families.In Burkina Faso, Ouedraogo et al. (2024) have catalogued 84 medicinal plants with aromatic potential among the country's flora, belonging to 44 families.This recourse of populations to plants is due either to their effectiveness, or to their accessibility, or to their complementarity to modern medicine (Ciss, 2006). Very often, this local medicine remains the only alternative available to communities to address their health issues when the costs of modern medicines are high (Jiofack et al. 2010; Guedje et al. 2011).

Despite considerable efforts made by public authorities to improve the health of communities in terms of modern health infrastructure, the pharmacopoeia constitutes an alternative (Tomasso, 2013) because in Senegal, more than 80% of the population uses the traditional medicine (Faye, 2018). Thus, to seek treatment, communities turn to the forest to seek remedies essentially based on plants in a context where natural resources are limited (Diop et al., 2011; Koné et al., 2002).Our study showed that pain and infectious diseases are the main conditions treated using species found in natural forests. In Senegal, Combretum aculeatumand Guiera senegalensis play an important role in the treatment of tuberculosis using traditional medicine and pharmacopoeia (Diop et al. 2018). The species Hymenocardia acida is valued for its benefits against bacterial infections in Guinea Conakry (Baldé et al. 2015). Furthermore, the use of plants in pain treatment in the sub-region has been reported by numerous authors. Ethnobotanical surveys conducted in Guinea have reported the use of several species such as Nauclea latifolia and Mangifera indica in the treatment of haemorrhoidal pain(Camara et al. 2024).Similar results have been obtained elsewhere. The work of Badiaga (2011)demonstrated that Nauclealatifolia is traditionally used in Mali to treat pain, as it has analgesic effects.

The study shows that trees in urban city particularly the green spaces are considered very useful for the health and well-being of residents. Today they represent one of the essential elements not only of the quality of the living environment, but also of the attractiveness of territories (Laïlle et al., 2013; Kouassi et al., 2018). According to Grandcolas et Bornette (2024), biodiversity is essential to human life as it contributes to physical and psychological health.Several studies have demonstrated the relationship between urban green spaces and health. Thus, in Japan, studies on Shinrin-yoku (a major form of relaxation consisting of spending time or walking in the forest) have demonstrated favorable impacts on physical and mental health. According to a cross-sectional study carried out in Denmark (Nielsen et al., 2014), access and proximity to green spaces are associated with lower levels of stress while in New Zealand, greener landscapes are less prone to risks associated with mental health issues (Richardson et al. 2013). White et al., (2013) and Niang et al. (2023), also showed that urban green spaces reduce stress levels and improve the lives of populations living there. Our results also revealed that trees in urban green spaces have positive effect on several diseases. This is the case of high blood pressure. Indeed, Shanahan et al., (2016), revealed in their study in Brisbane that 9% of cases of high blood pressure would be preventable if all city dwellers visited green spaces only once a week for an average duration of 30 minutes. Other authors have claimed that exposure to urban green spaces significantly improves mental health and reduces the risk of cardiovascular disease (White et al., 2013; Shanahan et al., 2016).

**Annexes**

**Annexe 1. Species of Fathala forest**

| **Species** | **Genus** | **Families** |
|---|---|---|
| Acacia ataxacantha DC. | Acacia | Fabaceae |
| Acacia macrostachyaRchb. ex DC. | Acacia | Fabaceae |
| Acacia seyalDelile var. seyal | Acacia | Fabaceae |
| Adansoniadigitata L. | Adansonia | Malvaceae |
| Afzeliaafricana Sm. ex Pers. | Afzelia | Fabaceae |
| Albizia chevalieri Harms | Albizia | Fabaceae |
| Annona senegalensis Pers. | Annona | Annonaceae |
| Azadirachta indicaA.Juss. | Azadirachta | Meliaceae |
| Bobgunniamadagascariensis (Desv.) JHKirkbr. &Wiersema | Bobgunnia | Fabaceae |
| Bombax costatumPellegr. &Vuill. | Bombax | Malvaceae |
| Cassia sieberiana DC. | Cassia | Fabaceae |
| Celtis toka (Forssk.) Hepper &JRIWood | Celtis | Cannabaceae |
| Cola cordifolia (Cav.) R.Br. | Cola | Malvaceae |
| Combretumaculeatum Vent. | Combretum | Combretaceae |
| CombretumadenogoniumSteud. ex A.Rich. | Combretum | Combretaceae |
| CombretumapiculatumSond. sous-espèce. Apiculatum | Combretum | Combretaceae |
| CombretumleucardiiEngl. &Diels. | Combretum | Combretaceae |
| CombretummicranthumG.Don | Combretum | Combretaceae |
| CombretummicrophyllumKlotzsch | Combretum | Combretaceae |
| CombretumnigricansLepr. ex-Guill. &Perr. | Combretum | Combretaceae |
| Cordylapinnata (Lepr. exA.Rich.) Milne-Redh. | Cordyla | Fabaceae |
| Danielliaoliveri (Rolfe) Clapier. &Dalziel | Daniellia | Fabaceae |
| DetariummicrocarpumGuill. &Perr. | Detarium | Fabaceae |
| Dialium guineenseWilld. | Dialium | Fabaceae |
| Dichrostachys cinerea (L.) Wight &Arn. | Dichrostachys | Fabaceae |
| Ficus exasperataVahl | Ficus | Moraceae |

| | | |
|---|---|---|
| Ficus nigro-punctataWarb. exMildbr. &Burret | Ficus | Moraceae |
| Ficus sycomorus L. | Ficus | Moraceae |
| GardeniaternifoliaSchumach. &Thonn. | Gardénia | Rubiaceae |
| Guiera senegalensis JFGmel. | Guiera | Combretaceae |
| Gymnosporiabuxifolia (L.) Szyszy?. | Gymnosporia | Celastraceae |
| Hexalobusmonopetalus (A.Rich.) Engl. &Diels | Hexalobus | Annonaceae |
| Hymenocardia acida Tul. | Hymenocardia | Phyllanthaceae |
| Khayasenegalensis (Desr.) A.Juss. | Khaya | Meliaceae |
| Lannea acida A.Rich. | Lannea | Anacardiaceae |
| LanneavelutinaA.Rich. | Lannea | Anacardiaceae |
| Lepisanthesperrieri (Choux) Buerki, Callm. & Lowry | Lepisanthes | Sapindaceae |
| Neocaryamacrophylla (Sabine) Prance | Neocarya | Chrysobalanaceae |
| OzoroainsignisDelile | Ozoroa | Anacardiaceae |
| Parkiabiglobosa (Jacq.) R.Br. ex G.Don | Parkia | Fabaceae |
| Pericopsislaxiflora (Benth.) Meeuwen | Pericopsis | Fabaceae |
| Philenopteraviolacea (Klotzsch) Schrire | Philenoptera | Fabaceae |
| Piliostigmareticulatum (DC.) Hochst. | Piliostigma | Fabaceae |
| Piliostigmathonningii (Schumach.) Milne-Redh. | Piliostigma | Fabaceae |
| Prosopis africana (Guill. &Perr.) Taub. | Prosopis | Fabaceae |
| Pterocarpus erinaceus Poir. | Pterocarpus | Fabaceae |
| Pterocarpus lucensLepr. ex-Guill. &Perr. | Pterocarpus | Fabaceae |
| Quassia silvestris Cheek & Jongkind | Quassia | Simaroubaceae |
| Saba senegalensis (A.DC.) Pichon | Saba | Apocynaceae |
| Sclerocaryabirrea (A.Rich.) Hochst. | Sclerocarya | Anacardiaceae |
| SecuridacalongepedunculataFresen. | Securidaca | Polygalaceae |
| SterculiasetigeraDelile | Sterculia | Malvaceae |
| Strychnos spinosaLam. | Strychnos | Loganiaceae |
| Terminaliaalbida Scott Elliot | Terminalia | Combretaceae |
| TerminaliaavicennioidesGuill. &Perr. | Terminalia | Combretaceae |
| TerminaliamacropteraGuill. &Perr. | Terminalia | Combretaceae |
| Xeroderrisstuhlmannii (Taub.) Mendonça& E. P. Sousa | Xeroderris | Fabaceae |
| Ziziphus lotus (L.) Lam. | Ziziphus | Rhamnaceae |

**Annexe 2. Species of Fann-PointE-Amitié Municipality**

| **Species** | **Genus** | **Families** |
|---|---|---|
| Acacia ataxacantha DC. | Acacia | Fabaceae |
| Acacia nilotica (L.) Willd. ex Delile | Acacia | Fabaceae |
| Acacia senegal (L.) Willd. | Acacia | Fabaceae |
| Acacia sieberiana DC. | Acacia | Fabaceae |
| Adansoniadigitata L. | Adansonia | Malvaceae |
| Adeniumobesum (Forssk.) Roem.& Schult. | Adenium | Apocynaceae |
| Albizia lebbeck (L.) Benth. | Albizia | Fabaceae |

| | | |
|---|---|---|
| Anogeissusleiocarpa (DC.) Guill. &Perr. | Anogeissus | Combretaceae |
| AntiaristoxicariaLesch. | Antiaris | Moraceae |
| Azadirachta indicaA.Juss. | Azadirachta | Meliaceae |
| Balanites aegyptiaca (L.) Delile | Balanites | Gygophyllaceae |
| Borassus akeassiiBayton, Ouédr. &Guinko | Borassus | Arecaceae |
| Boscia senegalensis (Pers.) Lam. ex-Poir. | Boscia | Capparaceae |
| Bougainvilleaglabra Choisy. | Bougainvillea | Nyctaginaceae |
| BougainvilleaspectabilisWilld. | Bougainvillea | Nyctaginaceae |
| CadabafarinosaForssk. | Cadaba | Capparaceae |
| Caesalpiniapulcherrima (L.) Sw. | Caesalpinia | Fabaceae |
| Calotropisprocera (Aiton) W.T.Aiton | Calotropis | Apocynaceae |
| Cassia sieberiana DC. | Cassia | Fabaceae |
| Ceibapentandra (L.) Gaertn. | Ceiba | Malvaceae |
| Cocos nucifera L. | Cocos | Arecaceae |
| Cola cordifolia (Cav.) R.Br. | Cola | Malvaceae |
| Combretumaculeatum Vent. | Combretum | Combretaceae |
| CombretumglutinosumPerr. ex DC. | Combretum | Combretaceae |
| CombretummicranthumG.Don | Combretum | Combretaceae |
| Commiphoraafricana (A.Rich.) Engl. | Commiphora | Burseraceae |
| Cordiasebestena L. | Cordia | Boraginaceae |
| Cratevaadansonii DC. | Crateva | Capparaceae |
| Dalbergia melanoxylonGuill. &Perr. | Dalbergia | Fabaceae |
| Delonixregia (Bojer ex Hook.) Raf. | Delonix | Fabaceae |
| DetariumsenegalenseJFGmel. | Detarium | Fabaceae |
| DiospyrosmespiliformisHochst. ex A.DC. | Diospyros | Ebenaceae |
| Elaeisguineensis Jacq. | Elaeis | Arecaceae |
| Eucalyptus camaldulensisDehnh. | Eucalyptus | Myrtaceae |
| Euphorbiatithymaloïde L. | Euphorbia | Euphorbiaceae |
| Faidherbia albida (Delile) A.Chev. | Faidherbia | Fabaceae |
| Ficus benjamina L. | Ficus | Moraceae |
| Ficus ovataVahl | Ficus | Moraceae |
| Ficus platyphylla Delile | Ficus | Moraceae |
| Ficus sycomorus L. | Ficus | Moraceae |
| Ficus umbellataVahl | Ficus | Moraceae |
| Flueggea virosa (Roxb. exWilld.) Voigt | Flueggea | Phyllanthaceae |
| Gossypiumarboreum L. | Gossypium | Malvaceae |
| Grewia bicolor Juss. | Grewia | Malvaceae |
| Khayasenegalensis (Desr.) A.Juss. | Khaya | Meliaceae |
| Kigeliaafricana (Lam.) Benth. | Kigelia | Bignoniaceae |
| Lawsoniainermis L. | Lawsonia | Lythraceae |
| Lepisanthes senegalensis (Juss. exPoir.) Leenh. | Lepisanthes | Sapindaceae |
| Leucaenaleucocephala (Lam.) de Wit | Leucaena | Fabaceae |
| Mangiferaindica L. | Mangifera | Anacardiaceae |

| | | |
|---|---|---|
| Moringa oleiferaLam. | Moringa | Moringaceae |
| Nauclea latifoliaSm. | Nauclea | Rubiaceae |
| Neriumoleander L. | Nerium | Apocynaceae |
| OlaxgossweileriExell&Mendonça | Olax | Olacaceae |
| OncobaspinosaForssk. | Oncoba | Salicaceae |
| Oxytenantheraabyssinica (A.Rich.) Munro | Oxytenanthera | Poaceae |
| Pachypodiumlamerei Drake | Pachypodium | Apocynaceae |
| Parkinsoniaaculeata L. | Parkinsonia | Fabaceae |
| Peltophorumpterocarpum (DC.) K.Heyne | Peltophorum | Fabaceae |
| Philenopteralaxiflora (Guill. &Perr.) Roberty | Philenoptera | Fabaceae |
| Phoenix dactylifera L. | Phoenix | Arecaceae |
| Piliostigmareticulatum (DC.) Hochst. | Piliostigma | Fabaceae |
| Pithecellobiumdulce (Roxb.) Benth. | Pithecellobium | Fabaceae |
| Plumbago auriculataLam. | Plumbago | Plumbaginaceae |
| Polyalthialongifolia (Sonn.) Thwaites | Polyalthia | Annonaceae |
| Polysciasguilfoylei (W.Bull) L.H.Bailey | Polyscias | Araliaceae |
| Ritchieacapparoides (Andrews) Britten | Ritchiea | Capparaceae |
| Roystonea regia (Kunth) O.F.Cook | Roystonea | Arecaceae |
| RusseliaequisetiformisSchltdl. & Cham. | Russelia | Plantaginaceae |
| Saba senegalensis (A.DC.) Pichon | Saba | Apocynaceae |
| Samaneasaman (Jacq.) Merr. | Samanea | Fabaceae |
| Sclerocaryabirrea (A.Rich.) Hochst. | Sclerocarya | Anacardiaceae |
| Senna siamea (Lam.) HSIrwin&Barneby | Senna | Fabaceae |
| SpathodeacampanulataP.Beauv. | Spathodea | Bignoniaceae |
| Tamarindusindica L. | Tamarindus | Fabaceae |
| Tecomastans (L.) Juss. exKunth | Tecoma | Bignoniaceae |
| TerminaliamantalyH.Perrier | Terminalia | Combretaceae |
| TreculiaafricanaDecne. | Treculia | Moraceae |
| Vernonia coloratasubsp. grandis (DC.) C.Jeffrey | Vernonia | Asteraceae |
| VitellariaparadoxaCFGaertn. | Vitellaria | Sapotaceae |
| Zanthoxylumzanthoxyloides (Lam.) Zepern. &Timler | Zanthoxylum | Rutaceae |
| Ziziphus abyssinicaHochst. | Ziziphus | Rhamnaceae |
| Ziziphus mucronata subsp. rhodesicaRBDrumm. | Ziziphus | Rhamnaceae |

## Conclusion:-

This study highlights that natural forests flora and plants of urban city fulfil distinct but complementary ecological and health functions in Senegal. The Fathala forest remains a major reservoir of plant biodiversity, ensuring ecological stability, genetic heritage conservation and the sustainability of traditional medicine. The urban environment of Fann-Point E-Amitié municipality, although artificial, is home to significant biodiversity and provides essential ecosystem services related to mental health.

The study also documented the variation in the conservation status of tree species according to IUCN and theSenegalese forestry codeacross both urban and natural sites. While urban areas cannot replace natural forests in terms of ecological complexity, they nevertheless constitute potential secondary refuges for certain native and endangered species, whose individuals thrive to the point of reaching the largest diameters encountered, provided that urban development favors local species. On the other hand, the uncontrolled introduction and spread of exotic species in natural forest poses a real threat to the balance of ecosystems. The complementarity between forests and cities is now seen as one of the major drivers of sustainable development. The presence and integration of native species within urban environments appears to be a pivotal strategy for biodiversity conservation, particularly in the context of urbanization where the fragmentation and reduction of natural habitats is a prevalent issue.Trees in cities particularly urban green spaces are a valuable asset, and it is vital that they are managed effectively to support the endangered species they host and enhance their utility for physical and mental health.

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