**ESI Preprints** **Not Peer-reviewed**

# Understanding Coastal Citizens Perception on Urban Green Spaces: Evidence from Benin Republic in West Africa

***V. A. Rosos Djikpo***
***Oscar Teka***
***A. Bruno Djossa***
***Madjidou Oumorou***
***Brice Sinsin***
University of Abomey-Calavi, Cotonou, Bénin

Doi: 10.19044/esipreprint.10.2022.p709

Approved: 29 October 2022
Posted: 31 October 2022



*Cite As:*
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

## Abstract

Urban Green Spaces (UGS) have several benefits for humans and environment. Despite these numerous benefits and important roles, UGS are often disregarded because their ecosystem services are not quantified and well-understood in developing countries. Until now, no study was carried out regarding the local perception, urban green spaces use values, threats and management strategies in Benin. This study was undertaken to assess the importance of UGS to citizens' communities, to identify threats to viability and communities' commitment or willing to adhere participatory suitable management in three cities (Ouidah, Cotonou and Porto-Novo) located in the coastal area of Benin. Surveys were conducted with a questionnaire and respondent were selected randomly in communities. A total of 360 informants were selected, 120 per district (40 users, 40 household and 40 key informants). The survey assessed residents' perception of UGS with reference to key socioeconomic variables (age, gender, educational level~~s~~). Data were analyzed using Chi-square test, chordDiagram, correlations through corrplot packages and Principal Component Analysis under R software. It came out from this study, six positive aspects: shading, air pollutants absorption, aesthetics, recreation, medicinal uses and economic benefit and four incivility or negative aspects: waste dump, mosquito lodges,

threat to roads and buildings cracking with roots. These benefits and disturbance inputted to trees differed significantly between the three cities ($\chi^2$ = 110.65; P <0.001) and three categories of interviewees ($\chi^2$ = 25.32; P = 0.004). Urban green spaces were also subject to anarchic exploitation which consisted of illegal logging, debarking, pruning, topping and root harvesting. This study allowed concluding that UGS plays an important socioeconomic role for surrounding communities. Therefore, it seems urgent to ensure the viability of these ecosystems. It also reported that communities expressed their will to participate in UGS protection and conservation.

**Keywords**: Conservation, Citizens' perception, participatory planning, socioeconomic effect, urban green space, urban management policy

## 1. Introduction

Urban Green Spaces (UGS) have several benefits for humans and environment. Recent studies recognized the multiple contributions of UGS to global warming mitigation and rapid world population growth (Chow et al., 2016; Hsieh & Jan-Zhang, 2016). In addition to environmental services, such as air quality improving (Wu, 2008; Lopez & Roussel, 2010; Kenney et al., 2011), energy consumption and runoff volume reducing (Madlener & Sunak, 2011), urban forests contribute to enhancing the quality of life (Yin et al., 2011), ensure physiological, sociological and economic well-being of urban communities (Richardson & Mitchell, 2010; Wu et al., 2010). In fact, physical and psychological benefits have been linked to green spaces (Morris, 2003). However, despite these numerous benefits and important role for the mitigation of climate change, UGS are often disregarded because their ecosystem services are not quantified and well-understood in developing countries. UGS can efficiently help mitigate harmful effects of climate change such as heat island generating and increasing of domestic energy consumption (Kirschbaum, 2004; UNDP, 2007; Teka et al., 2017). UGS are then of paramount importance due to the high vulnerability to climate change (IPCC, 2014). Infrastructure and building design, lack of sufficient vegetation, and human pressure are primary causes contributing to the effects of urban heat islands (Litschke and Kuttler, 2008). Other factors such as geographical location, scale factors, city size, density and thickness of urban structures and the thermo-physical properties of materials also contribute to these climatic variations in cities (Georgescu et al., 2015).

In Benin, like in the West African countries, the urbanization rate is high and call for efficient planning of urban resources and facilities. The mean annual rate of urbanization is currently estimated at 2.7%, and about 44% of the national population is living in cities (INSAE, 2016). Projections estimated this urban population to reach 56.2% of the national by 2025

(FAO, 2011). The consequences of such rapid urbanization trend are environmental problems as well as strengthening of climate change effects leading during the last decade to an increase in interest regarding the assessment of how UGS can contribute to mitigate global warming. Moreover, the considerable relevance of green spaces, alignment trees, lawns, public gardens, amusement parks as well as isolated trees in human life, is no longer to be demonstrated.

At the same time where the need of spaces by population for urbanization and development of facilities is increasing, the extension of UGS remains urgent for mitigating of harmful effects of climate change through sequestration of greenhouse gases. Cotonou, Ouidah and Porto Novo are located in the coastal area of Benin and are facing high demographic growth, and are characterized by spontaneous development of habitats specially in at risk areas. Indeed, green cover could be compromised in these areas because of its geographical position. The recent temperature registered is most increased in these cities (Barry et al., 2018; Guédjé et al., 2016), and could raise the consumption of domestic energy for cooling. The objective in an effective way is to take advantage of the cooling and other functions that green spaces can provide to the population in order to reduce the pressure on non-renewable energy sources. All of this requires a better understanding of green spaces. Until now, little studies were carried out regarding the local perception of UGS services and disservices in Benin. Moreover, in this country, there is a lack of knowledge on UGS threats identification and awareness of local communities, communal planers and office bearers about the roles and benefits of urban green.

Thus, this study aims at filling this gap by identifying urban green spaces services and disservices, threats and proposed local participation strategies for UGS management throughout citizens' perception assessment in Benin. The study objectives were to assess urban green spaces importance to citizens' communities, to evaluate threats to urban green spaces viability and to identify participatory strategies locally applicable for UGS viability, restoration and conservation according to socio-demographic characteristics of a citizen's communities.

In this context, we hypothesize communities' socio-economics parameters are crucial to their due commitment to participatory management and conservation of UGS in cities in the coastal areas of Benin. Otherwise, we also made the assumption that city's urban green spaces (UGS) perception and management will differ from one city to another. The issues of this study are addressing adhere the Benin governmental actions plan with regard to urban areas management and planning (Programme d'Action du Gouvernement, 2016) which put great emphasis on urban planning and

nature conservation, real challenges for land planers and nature conservationists.

## 2. Materials and methods

### 2.1. Study area and field sites

The study was conducted in three coastal cities (Ouidah Cotonou and Porto-Novo) in Benin. The study area (Fig. 1) located at the Gulf of Guinea in West Africa is between 1° 50’ and 2° 40’ East longitude and between 6° 20’ and 6° 40’ North latitude. It covers 553 km$^2$ which equal approximately to 0.5% of the total surface of Benin.

The coastal area of Benin falls in sub-equatorial climate, characterized by two rainy seasons (from April to July, and from October to November), and two dry seasons (from August to September, and from December to March) (Adam and Boko, 1993). The mean annual rainfall is from 820 to 1300 mm and the temperature ranges from 31.5 to 33 °C. The vegetation in the urban centers of the study area includes natural areas, roadside trees, trees around residences, vegetation growing on vacant land, shrubs and ground cover. These ecosystems are exploited by local communities for different purposes (Amontcha et al. 2017). The study area is mainly populated by the Fôn, Mina, Houeda, Adja, Batonou and Xla with only 4.24% of the population over the age of 60 (Table 1; 2). According to the census conducted by INSAE (2013), the population density was 8595 inhabitants/km², 2403 inhabitants/km² and 252 inhabitants/km², relatively in Cotonou, Porto-Novo and Ouidah. In the urban centers, economic activities are trading, urban agriculture, fisheries, animal breeding and processing of agricultural products.

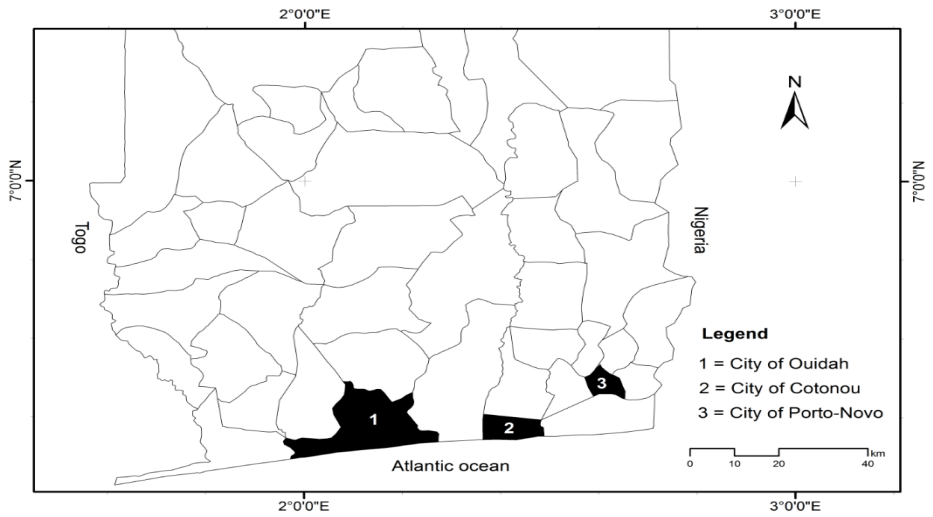


**Fig. 1.** Study area

**Table 1**. Distribution of the population of the coastal by gender and age

| | Men | | Women | | 15–59years old | | +60 years old | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| Porto-Novo | 126 016 | 47.68 | 138 304 | 52.32 | 144 009 | 54.48 | 13 784 | 5.21 |
| Cotonou | 325 872 | 47.99 | 353 140 | 52.01 | 397 916 | 58.60 | 26 986 | 3.97 |
| Ouidah | 78 596 | 48.51 | 83 438 | 51.49 | 83 054 | 51.26 | 7 297 | 4.50 |
| Total of Benin | 4 887 820 | 48.84 | 5 120 929 | 51.16 | 4 897 099 | 48.93 | 442 112 | 4.42 |

*Source: INSAE (2013)*

**Table 2**: Distribution of the population according to ethnic groups

| | Adja | Fon | Bariba | Dendi | Yoa and Lokpa | Peulh | Otamari | Yoruba | Others |
|---|---|---|---|---|---|---|---|---|---|
| Porto-Novo | 9 334 | 147 505 | 657 | 955 | 473 | 113 | 319 | 55 838 | 8 358 |
| % | 4.18 | 65.98 | 0.29 | 0.43 | 0.21 | 0.05 | 0.14 | 24.98 | 3.74 |
| Cotonou | 121 577 | 377 228 | 4 236 | 9 075 | 6 762 | 777 | 1 808 | 76 643 | 66 994 |
| % | 18.28 | 56.72 | 0.64 | 1.36 | 1.02 | 0.12 | 0.27 | 11.52 | 10.07 |
| Ouidah | 26736 | 113100 | 810 | 486 | 0 | 0 | 0 | 14583 | 6319 |
| % | 16.5 | 69.8 | 0.5 | 0.30 | 0.00 | 0.00 | 0.00 | 9.00 | 3.9 |

*Source: INSAE (2013)*

## 2.2. Data collection

Data were collected through individual interviews of selected urban residents of the three targeted cities (Ouidah. Cotonou and Porto-Novo). While Cotonou represents the economic capital of Benin, Porto Novo is the political capital and Ouidah a historic city. Three categories of respondents were interviewed to evaluate the local perception of UGS as well as their relevance for local communities because they are most who interact with green spaces and are able to give answers. Respondents' categories were: (1) users inside or around the main public UGS of the cities (motorcycle taxi drivers, street sellers and merchants); (2) households with private green space inside and (3) key informants from the public administration (foresters, local authorities, municipal and communal officials) and non-governmental organizations responsible for environmental conservation and UGS management.

The sample size was determined to use the following formula (Dagnelie, 1998):

$$n = \frac{P_i\left(1-P_i\right)t^2_{1-\alpha/2}}{d^2} \quad (1)$$

***Pi*** (92%) obtained from an exploratory survey carried out in the three cities on 50 peoples. It represents the proportion of people who know at least three (03) green spaces in the given city, $t_{1-\alpha/2}$ = 1.96, normal random variable value for a risk α of 0.05. The expected margin of error ***d*** for all sampling is 2%. The sample size (***n***) is approximately equal to 360 persons. However, the number of residents interviewed was divided equally per district (120 respondents, 60 women and 60 men from six ethnic groups) and per types of respondents (40 users, 40 household persons and 40 key informants).

Structured interview with the questionnaire was conducted to explore the perceptions of urban residents. Questions were about UGS uses, threats to their viability, prerequisites and desired participation forms in UGS management. For each benefit (use category), the respondents assign three modalities which were low, moderate or high. The following information was reported on each respondent; gender, professions, educational levels, economic purchase power and ethnic groups.

## 2.3. Data Analysis

The frequency of the citation of each use category (positive and negative) was calculated per city and types of interviewees (users, households and key informants). The statistical differences of perception between cities and interviewees were performed with chi-square test. Moreover, according to its importance, respondents assigned spontaneously three modalities (low, moderate and high) to each use category. Thus, the modalities were ranged from 1 to 3 (1 = low importance of the use; 2 = moderate importance of the use and 3 = high importance of the use).

The score values of urban green spaces services and disservices were analyzed according to each gender type, age class and education level group following Phillips and Gentry (1993):

$$UV_p = \frac{1}{n_c}\sum_{i=1}^{n_c} S_i \tag{2}$$

Where Si represents the score given by the informant for a given use category (p) of the urban green, $n_c$ is the number of informants in each gender type, age class and education level group.

The overall use value (OUV) of the urban green was computed with the following formula:

$$OUV = \sum_{p=1}^{j} UV_p \tag{3}$$

Where *j* represents the amount of urban green spaces services and disservices.

The statistical differences in the use values of the given services and disservices between the gender types, age classes and education level groups were analyzed using non-parametric tests (Mann—Whitney and Kruskal—Wallis) because data didn't meet the normal distribution using software R3.4.2 (R Core Team. 2017).

In addition, correlation test was performed between the threats to urban green spaces viability using R corrplot package (Taiyun and Viliam, 2017). The endogenous strategies for urban green spaces viability, conservation/restoration and participation forms were analyzed considering gender, age class, education level group, interviewee categories and location. Groups were defined based on respondent's gender, men (M) and women (W) and age classes (1) young (age <30); (2) adults (30 ≤ age <60); and (3) elderly persons (age ≥ 60) (Teka and Vogt, 2010) in each education level group (none, primary, secondary and higher). Then, six groups were obtained per education level group: young men (M1); adult men (M2); old men (M3); younger women (W1); adult women (W2) and old women (W3) constituting 24 subgroups in total with the four education level groups. The subgroups are labeled by succeeding the education level groups prefix (N for none, P for primary, S for secondary and H for higher) with the label of one of the six groups defined above. For example, while adult man from the higher education level group is labeled M2H, young women from the primary education level group is labeled W1P. Therefore, for each subgroup, the relative frequency of respondents who mention each proposed lock management and endogenous participation forms for urban green spaces viability were estimated.

The obtained data matrix comprising the different relative frequencies of the endogenous participation forms according to the 24 subgroups was used in R3.4.2 (package FactoMineR: https://r-project.org) to perform a Principal Component Analysis (PCA) in which interviewee types and locations were simply used as illustrative variables. This statistical method was applied to find out possible links between the proposed endogenous participation forms with regard to the different socio-demographic characteristics of the respondents.

## 3. Result

### 3.1. Uses of the urban green spaces by the citizen's communities

The citizen residents of the coastal area of Benin have good knowledge on the Urban Green Spaces (UGS) and recognized the uses well (Fig. 2).

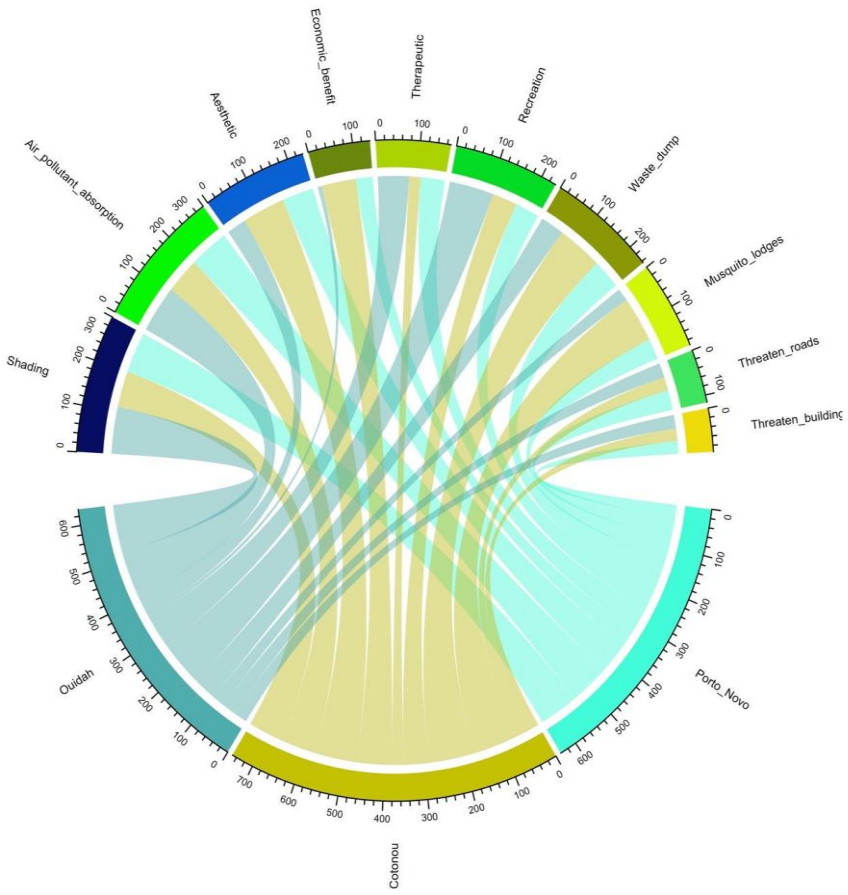


**Fig. 2**. Urban green services and disservices in the coastal area of Benin.

The respondents reported that UGS provides especially six services (positive benefits) such as shading (83.3%), air pollutants absorption (83.3%), aesthetics (65.5%), site of recreation (65.2%), medicinal uses or therapeutic (46.6%) and economic benefit (38.6%). Moreover, four disservices (negatives benefits) are identified and only 20% of respondents expressed no negative effects. In fact, the UGS were used like waste dump (67.7%), constituted mosquito lodges (53.3%), threatened/destroy roads (32.2%) and buildings (26.1%). Significant differences were reported between the cities ($\chi 2 = 110.65$; $P < 0.000$) (Fig. 2). Then, most residents of the district of Ouidah mentioned shade of trees (95%), absorption of air pollutants (95%), recreational role (93.3%) and medicinal uses (65%). For Cotonou inhabitants, aesthetic (90%). economic benefit (72.5%), shading (72.5%) and air pollutant absorption (72.5%) were mentioned as the most important benefits. And Porto-Novo inhabitants declared mainly shading

(82.5%) and air pollutants absorption (82.5%). At the same time in the three cities, the UGS were transformed in waste dump (95% in Cotonou; 59.1% in Porto-Novo and 49.1% in Ouidah) representing the most negative aspect identified by the local communities. In consequence, these sites become the mosquito lodges (92.5% in Cotonou; 41.1% in Porto-Novo and 25.8% in Ouidah).

Furthermore, Chi square test differed significantly difference was

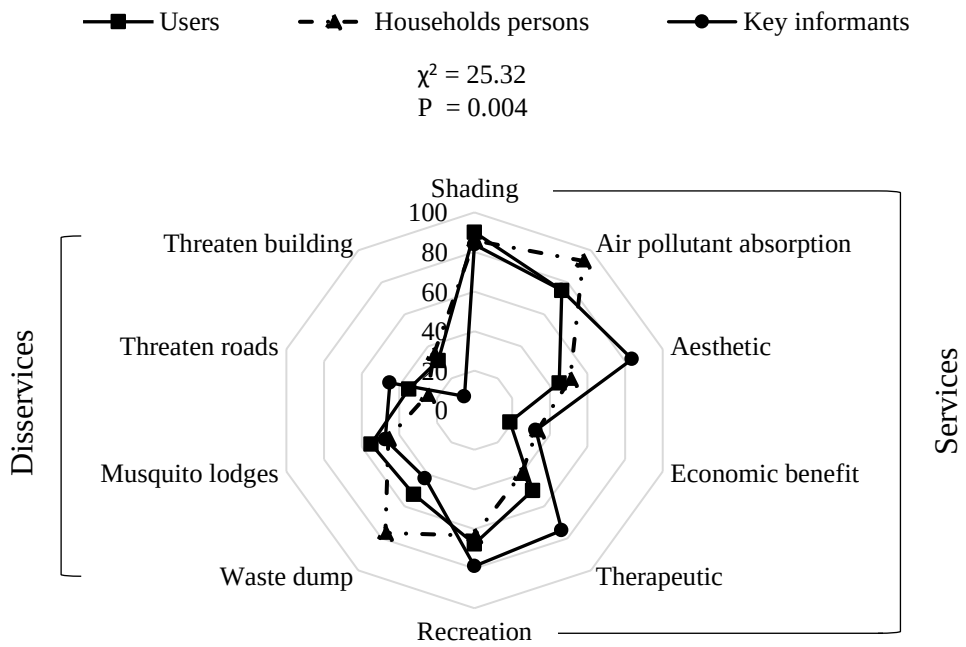


**Fig. 3.** Urban green services and disservices according to the interviewee

Most of the users around public and private (household) urban green recognized shading value (respectively 90% and 85.8%), air pollutant absorption (75% and 93.3%) and recreational role (67.5% and 63.3%) like the best contribution of the UGS. According to them, UGS serves as waste dump (respectively 52.5% and 76.6%) and generates mosquito lodges (55% and 45.8%). However, key informants identified mainly almost all the services of the UGS.

### 3.2. Urban green spaces services and disservices according to gender, age classes and education level

According to gender, urban green spaces use values differed significantly ($P < 0.05$) for seven services and disservices (Table 1). Among

them, five positive benefits (shading, air pollutants absorption, aesthetics, site of recreation, economic benefit) and two negative aspects (waste dump and mosquito lodges) were identified. These services and disservices were strongly perceived by men except economic benefit, waste dump and mosquito lodges which are more revealed by women. The vicinity of UGS is principally used by women for economic activities developing. Otherwise, it was observed that the three-age classes appreciate the UGS in a different ($P < 0.05$) way regarding the services (shading, air pollutants absorption, aesthetics, site of recreation) and disservices (waste dump, mosquito lodges, threatened roads and buildings). While the older people assigned high importance for shading, air pollutants absorption and waste dump, adult people opined high value for aesthetic and recreation services of UGS and young people attributes the most value for recreation service and threaten roads and building disservices (Table 3). Regarding the education level, it was founded significant differences ($P < 0.05$) for the services and disservices of aesthetic, medicinal uses, recreation, waste dump and threaten building. While those with university degree take more advantage of UGS for aesthetic and medicinal purposes, those with secondary level accorded most importance to recreation use category. According to those with primary level, UGS are more transformed in waste dump and illiterates supported that UGS threaten building.

**Table 3.**Urban green use value according to gender, age categories and education level

| | Gender | | | | Age | | | | | Education level | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Men** | **Women** | **U** | **P** | **Young** | **Adult** | **Elder** | **H** | **P** | **Higher** | **Secondary** | **Primary** | **None** | **H** | **P** |
| Services | | | | | | | | | | | | | | | |
| Shading | 1.88 | 1.5 | 14335 | 2.2e-16*** | 1.75 | 1.69 | 1.90 | 157.9 | 2.2e-16*** | 1.55 | 1.74 | 1.30 | 0.75 | 1.14 | 0.767 |
| Air pollutant absorption | 1.91 | 1.52 | 13920 | 6.9e-14*** | 1.75 | 1.73 | 1.95 | 153.8 | 2.2e-16*** | 1.62 | 1.75 | 1.30 | 0.75 | 1.24 | 0.743 |
| Aesthetic | 1.22 | 1.09 | 12012 | 0.000*** | 1.10 | 1.21 | 1.00 | 14.36 | 0.000*** | 1.41 | 1.04 | 0.57 | 0.28 | 41.24 | 0.000*** |
| Economic benefit | 0.53 | 0.63 | 10709 | 0.016* | 0.67 | 0.58 | 0.27 | 5.88 | 0.052 | 0.47 | 0.60 | 0.36 | 0.08 | 7.24 | 0.064 |
| Therapeutic | 1.18 | 0.86 | 10359 | 0.130 | 0.76 | 1.16 | 1.00 | 4.06 | 0.130 | 1.30 | 0.82 | 0.42 | 0.36 | 23.40 | 0.000*** |
| Recreation | 1.55 | 1.11 | 11446 | 0.001** | 1.38 | 1.38 | 1.27 | 43.46 | 3.6e-10*** | 1.33 | 1.39 | 0.87 | 0.44 | 8.22 | 0.041* |
| OUV | 8.27 | 6.71 | | | 7.41 | 7.75 | 7.39 | | | 7.68 | 7.34 | 4.82 | 2.66 | | |
| Disservices | | | | | | | | | | | | | | | |
| Waste dump | 1.11 | 1.33 | 13931 | 5.6e-13*** | 1.08 | 1.21 | 1.47 | 30.65 | 2.2e-7*** | 1.01 | 1.28 | 1.36 | 1.13 | 53.07 | 1.7e-11*** |
| Mosquito lodges | 0.72 | 1.03 | 12628 | 6.2e-8*** | 0.95 | 0.84 | 0.53 | 11.31 | 0.003** | 0.87 | 0.84 | 0.85 | 0.77 | 7.96 | 0.046* |
| Threat to roads | 0.77 | 0.53 | 9284 | 0.785 | 0.77 | 0.65 | 0.53 | 6.38 | 0.041* | 0.85 | 0.52 | 0.64 | 0.67 | 3.90 | 0.271 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Threat to buildings | 0.54 | 0.51 | 9967 | 0.301 | 0.68 | 0.48 | 0.53 | 7.69 | 0.021* | 0.4 | 0.62 | 0.45 | 0.77 | 12.94 | 0.004** |
| OUV | 3.14 | 3.4 | | | 3.48 | 3.18 | 3.06 | | | 3.13 | 3.26 | 3.3 | 3.34 | | |

OUV: overall use value. U: Mann—Whitney statistics. H: Kruskal—Wallis statistics. P: levels of significance *P<0.05; **P<0.01; ***P<0.001 (N = 360)

### 3.3. Threats to urban green spaces viability

In this study, main threats to the urban green spaces' viability in the coastal areas of Benin (Fig. 4) mentioned by the local communities were the illegal logging (69.5%), pruning (27.6%), topping (27.6%), debarking (20%), root harvesting (12.4%) and use as firewood (6.7%).

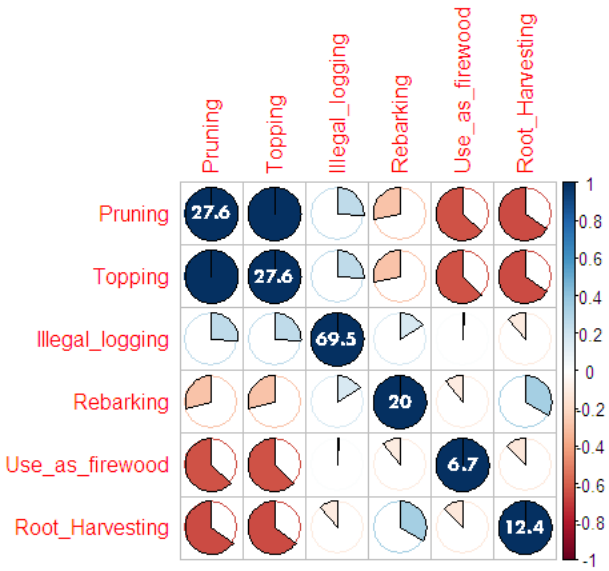


**Fig. 4.** Correlations between threats to urban green spaces viability in the coastal area of Benin. The percentages in the diagonal do not add to 100 because the same respondents reported sometimes several (various) threats and the percentages were calculated for each threat taking into account the proportion of respondents fitting out of others.

In addition, pruning and topping were negatively correlated with roots harvesting, firewood use and debarking (Fig. 4). It means that mostly the local communities did not simultaneously mention these threats. However, pruning and topping were logically positively correlated with illegal logging. It was the same with debarking and root harvesting.

### 3.5. Management Strategies of Urban Green Spaces

The Principal Component Analysis (PCA) performed on the citation frequencies per subgroup of the local participative management of urban green spaces showed that the first two axes explained 82.46% (66.59% for axis 1 and 15.87% for axis 2) of the total variation. Then, to describe the relationship between the socio-demographic characteristics of the respondents and the UGS management strategies, only these axes were

chosen (Fig. 5). The first axis is positively correlated with all lock management and the local participation form in the UGS management except financial involvement which is correlated with the second axis. While the users along the streets of Cotonou identified the environmental issues like the main impact for UGS viability, public authorities of Ouidah mentioned weak financial investment and UGS unprotecting. However, household provided with private green space of Porto-Novo just indicated that UGS management is the role of Mayors' office. Regarding the proposed local participation actions, public authorities of Ouidah agreed with physical involvement and household persons of Porto-Novo responsible Mayors' office. As result. lock management and the local participation form in the UGS management varied according to coastal residents' statute.

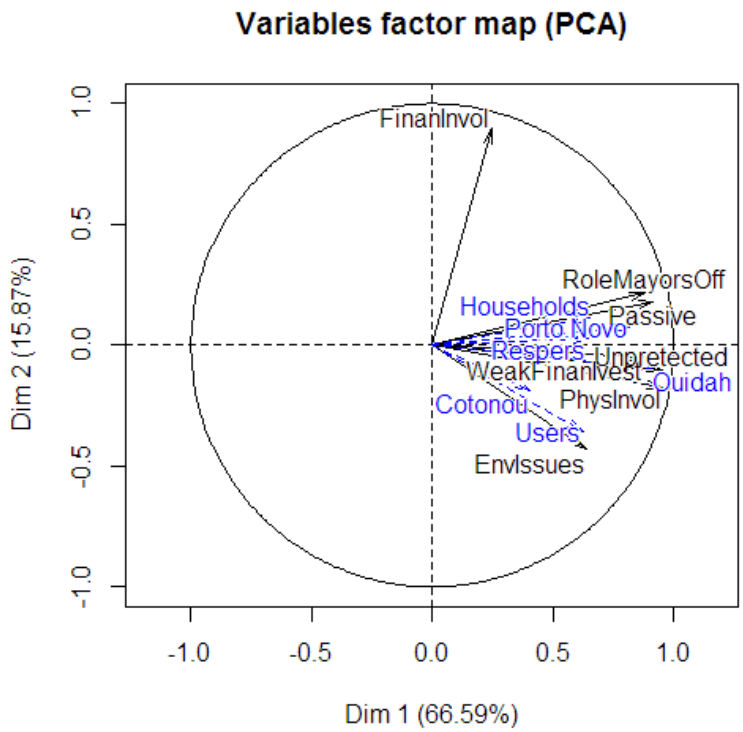


**Fig. 5.** Correlation between proposed participation strategies, lock management and PCA axes. FinanInvol: financial involvement; PhysInvol: physical involvement; RoleMayorsOff: role of mayor's office; WeakFinanIvest: weak financial investment; EnvIssues: Environmental issues.

The projection of the different subgroups in the PCA plot (Fig. 6) showed that subgroups identified different lock management and proposed various local participation actions for the UGS management. In general, the

subgroups of adult men with university degree and adult men with primary level perceived most of the management strategies. Illiterate adult women are the subgroups which mostly suggested the financial support. In consequence, gender type and age of urban residents influenced the proposed participation strategies clearly in the UGS management. However, education levels did not play a role regarding the proposed strategies for urban green viability and restoration/conservation.

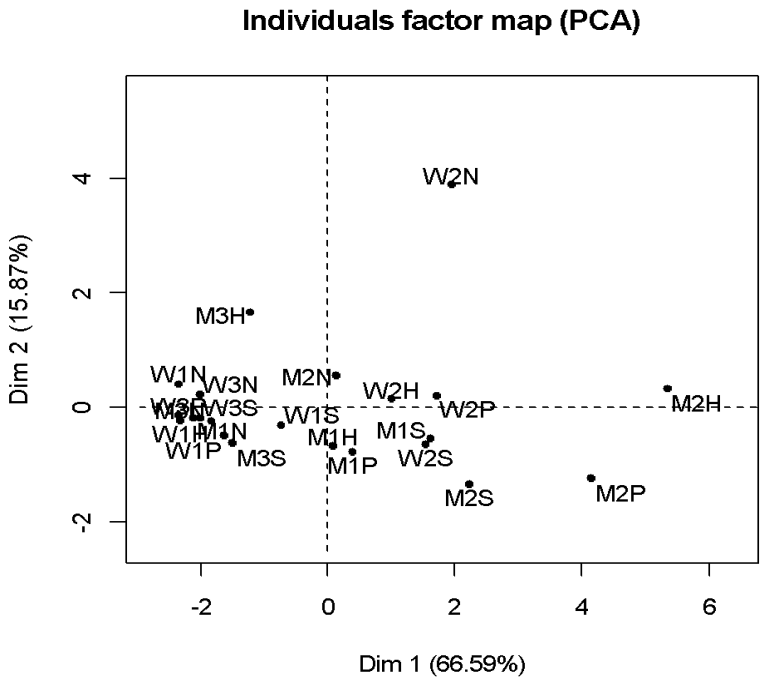


**Fig. 6.** Projection of subgroups in factorial plan of PCA

## 4. Discussion

### 4.1. Urban green space services and disadvantages

***UGS services and socioeconomic parameters***

Several studies conducted on the urban centers have shown that green spaces provide multiple benefits for the city's residents. In fact, trees in urban areas were associated with a better quality of life (Wolf, 2005), enhance human well-being and thermal comfort (Meyer et al., 2005; Armson et al., 2012), improve the quality of the living environment and ensure an ecological and landscape benefits. Moreover, they provide soothing virtues. Beauty, shade and freshness in the surrounding environment, remove $CO_2$ from the atmosphere through the process of photosynthesis, renew the oxygen of the air (Lopez & Roussel. 2010; Kenney et al. 2011) and regulate the hygrometry (Teka et al., 2017). However, few studies have focused on the

extent to which urban citizen understand and appreciate such benefits (Ho et al., 2005).

In this study, it was observed that six urban green services (shading [83.3%], air pollutants absorption [83.3%], aesthetics [65.5%], site of recreation [65.2%], medicinal or therapeutic uses [46.6%] and economic benefit [38.6%]) identified by citizens' communities of Benin have major significance on their perceptions and differ significantly between the cities and the interviewees types. Then, most of residents in the cities of Ouidah and Porto-Novo benefit more from shade of trees and absorption of air pollutants because UGS in these areas are mainly characterized by street trees and natural forest which are limited to tiny patches, so-called sacred forests. However, in the city of Szeged, microclimate regulation and air purification services supplied by the urban green spaces seemed to have only minor significance on visitors' perceptions (Kothencz et al., 2017). Cotonou is provided by landscaped spaces where only aesthetic value is mostly appreciated. Furthermore, economic benefit identified in Cotonou is explained by the extent of economic activities that are developing in the vicinity of green spaces. For that same reason, most of the users along the streets and household's persons recognized shading and air pollutant absorption as the best contribution of the UGS. In other cities, UGS play further roles. For instance, green spaces were widely perceived as an intrinsic element of people's lives in the East Midlands, the UK (Bell et al., 2004). In Amsterdam, various positive feelings (freedom, happiness and unity with nature) were associated with UGS (Chiesura, 2004). Contact with nature reduces stress, restores vision and eases tensions related to life in urban centers (Vergriete and Labrecque, 2007; Polorigni et al., 2014).

According to gender, age and education level, urban green spaces use values differed significantly for services. Five services (shading, air pollutants absorption, aesthetics, site of recreation and economic benefit) were strongly perceived by men except economic benefit which are more revealed by women. It makes sense because in the vicinity of UGS, women develop their economic activities. While the older people assigned high importance for ecological benefits (shading and air pollutants absorption), adult and young people associated with secondary level opined high value for sociological benefits (aesthetic and recreation). In fact, in Benin, adult and young people used UGS as a place of relaxation and rest (Richardson & Mitchell, 2010; Wu et al., 2010).

***UGS disservices***

On the other hand, independently to age and location, women users along the streets and households with primary level have shown that UGS

serves as waste dump and generates mosquito lodges. As mentioned above, most of the users along the streets were merchants and motorcycle taxi drivers who, through acts of incivility, generate waste dumps which subsequently become mosquito lodges. In addition, the lack of an effective waste collection system has caused some stores and households that generate a lot of waste through their activities to dump this waste in public places. As result, there is an increase in the prevalence of malaria in surrounding communities, particularly among children under five years of age and pregnant women. Malaria remains endemic and becomes perennial throughout the year in most areas, especially in urban centers (Damien et al., 2010; Nahum et al., 2010; Djogbénou et al., 2011; Govoetchan et al., 2014). Recent study in Benin, indicated that 20.8% of women have at least 1 microscopic malaria infection during the first trimester of pregnancy (Accrombessi et al., 2018). This problem therefore deserves special attention to ensure the well-being of the citizen's communities.

Moreover, according to the citizen's communities, UGS threat building and streets. This would be justified by the proximity of trees to buildings. In the urban centers of the three cities, some species selected for alignment plantings have a large root system that causes cracks at the asphalt and paved streets. Likewise, in other cities, several researches showed significant differences in the attitude toward negative UGS impacts. In Finland, Tyrvaïnen (2001) showed that many residents expressed no negative effects (66% in Salo and 46% in Joensuu). But in Guangzhou only 14.8% of the residents stated no negative impacts (Jim and Chen, 2006). In our study, 20% of respondents revealed no negative effects. It could imply that, in comparison with urban centers of Benin. UGSs were more misunderstood than in Finland, but more appreciated than in Guangzhou. In Finland, attraction of antisocial people, security, maintenance costs, shading, organic litter, and falling branches were the main negative impacts (Hunter, 2001; Tyrvaïnen, 2001). The links between perception of negative concerns and socioeconomic parameters of respondents were statistically not significant.

### 4.2. Urban Green Spaces Threats to Viability

Urban green spaces in developing countries of West Africa like Benin, include natural areas, street trees, the trees around residences, vegetation growing on vacant land, shrubs and ground cover. Urban centers have grown apart from the nature and urban green is disregarded. As result, there is an erosion of vegetation cover caused by urban sprawl, soil waterproofing and mismanagement of urban spaces (Natureparif, 2012). Previous research revealed that per capita vegetation cover was estimated at about 1m² (Osseni et al., 2015). This value is very low and represents one tenth of FAO (2002) recommendation (between 10 and 15 m²). Normally, an

urban green cover fewer than 10 $m^2$ per capita can reinforce harmful effects of climate change and increase cardiovascular diseases for urban inhabitants (MEHU, 2006; Richardson & Mitchell, 2010). Then, Beninese urban inhabitants suffer of heart diseases, lack of psychological and economic well-being resulting from low levels of vegetation cover. In addition, no study has been carried out in Benin to estimate the urban vegetation cover based on aerial images. Consequently, no statistical data about urban land occupation is available.

Urban green in the cities of Benin is highly subject to pruning and debarking by local people for various purposes (Teka et al., 2017). Likewise, our study identified in addition of these threats, illegal logging (69.5%), topping (29.6%), root harvesting (12.4%) and trees exploited like firewood (6.6%). Due to this unsustainable use, urban trees were frail and sickly, and die from myriad causes including disease, insect attack, drought, uprooting, and catastrophic stem failure due to strong winds or from combinations of factors working together. In the coastal areas of Benin, the main species which is subject to exploitation (pruning, debarking and roots harvesting) is *Khaya senegalensis* (Desr). A. Juss because of its medicinal virtues. Then, local communities use this plant as a remedy for about 40 diseases. For this purpose, *K. senegalensis* species were seriously debarked and his root is harvested by surrounding citizens who had a low purchase power to cure their diseases. In fact, it's demonstrated that the bark of this plant healing of gynecological affections (Ouinsavi, 2000; Sokpon and Ouinsavi, 2004). It is also facing a high pressure of pruning exerted on the species to feed for home livestock through the leaves. However, this harvest pattern could compromise the viability and regeneration of this species. Therefore, a trade-off should be seriously envisioned between the functions of tree species, the social status of neighborhood communities and their knowledge regarding the virtues the species carries. This approach should help designing and implementing effective management plan for urban centers.

### 4.3. Participatory and sustainable management of urban green spaces in Benin

Over the recent centuries. endogenous communities around the world have developed a unique close connection with the environment—lands and waters in their vicinity for their livelihoods (Campese et al., 2009). These connections have established various ways of exploiting resources, particularly from urban green spaces. As result of the pressure exerted, urban green spaces ecosystems are currently disregarded and require long-term and participatory suitable protection strategy. To ensure the viability of these ecosystems, resident people held different views according to their socio-demographic characteristics and locations. In this study areas, public

authorities in charge of environmental management of Ouidah agreed with physical involvement through taking care of green spaces and vacant buildings. Household inhabitants, especially of Porto-Novo accused Mayors' office. Financial support was also mentioned as a relevant approach by residents, but is not directly linked with types of interviewees or location. Recent researches have shown that basically local participation of residents is also required to manage their surrounding environment (Ogunleye-Adetona and Oladeinde, 2013; Vanclay et al., 2015). Until now, participation of the local community in environmental issues has been highlighted because of the realization of the necessity to involve all of stakeholders in the conception of a suitable approach to solving environmental and human problems (Campese et al., 2009; Ayeni et al., 2016). Because human activities intended to improve the socioeconomic well-being of communities continue to induce environmental degradation (Costanza et al., 2009).

## Conclusion

This study explored urban centers of Benin residents' perception of UGS with reference to key socioeconomic variables. It came out from this study, six positive (shading, air pollutants absorption, aesthetics, recreation, medicinal uses or therapeutic and economic benefit) and four incivility or negative (waste dump, mosquito lodges, threatened roads and buildings) uses. These benefits and disturbances differed significantly between the three cities and types of interviewees. Urban green spaces were also subject to unsustainable exploitation which consisted of illegal logging, debarking, pruning, topping and root harvesting of *K. senegalensis* individuals. The latter was the most pruned and debarked because local communities use it as a remedy of a large number of human diseases and affections. This indicated the lack of care and effort from local authorities to manage green spaces which jeopardize the viability of urban green in the coastal areas of Benin. This study also allowed concluding that urban green plays important socioeconomic roles for surrounding communities. Therefore, it seems urgent to ensure the viability of these ecosystems. For this purpose, citizens proposed their physical and economic supports to the urban green protection and conservation. Then, outcomes of urban green spaces studies could inform the development of an adequate, user-oriented and socially inclusive program that is responsive to citizen expectations and could fulfill sustainable urban centers greening needs.

## Acknowledgements

For this work, we thank Sandrine Aballo, Gislaine Noudehou and Eulodie Hozanhekpon, who were committed to data collection. Inhabitants in the vicinity of urban centers of cities of Ouidah. Cotonou and Porto-Novo

and their local authorities who were surveyed. We are grateful to key informants for sharing their knowledge during this study. We also thank anonymous reviewers who provided insightful comments on the earlier version of the manuscript.

**References:**

1. Accrombessi. M., Fievet. N., Yovo. E., Cottrell. G., Agbota. G., Massougbodji. A., Cot. M., Briand. V. (2018). Prevalence and Associated Risk Factors of Malaria in the First Trimester of Pregnancy: A Preconceptional Cohort Study in Benin. *The Journal of Infectious Diseases*. 217(8): 1309–1317. https://doi.org/10.1093/infdis/jiy009.
2. Adam. K. S. & Boko. M. (1993). Le Bénin. Cotonou : Les Éditions du Flamboyant.
3. Amontcha, A. M., Djego, J. G., Imorou, I. T., & Sinsin, B. A. (2017). Phyto-diversite et utilisations des espaces verts prives dans les villes du grand Nokoue (Sud-Benin). *Journal de la Recherche Scientifique de l'Université de Lomé*, 19(2), 117-139.
4. Armson. D., Stringer. P. and Ennos. A.R. 2012. The effect of tree shade and grass on surface and globe temperatures in an urban area. *Urban Forestry & Urban Greening*. 11(3): 245–255.
5. Ayeni F.A., Odumosu B.T., Oluseyi A.E., and Ruppitsch W. (2016). Identification and prevalence of tetracycline resistance in enterococci isolated from poultry in Ilishan. Ogun State. Nigeria. *Journal of Pharmacy and BioAllied Sciences*. 8(1): 69–73.
6. Barry, A. A., Caesar, J., Klein Tank, A. M. G., Aguilar, E., McSweeney, C., Cyrille, A. M., .,. & Laogbessi, E. T. (2018). West Africa climate extremes and climate change indices. *International Journal of Climatology*, 38, e921-e938.
7. Bell. S., Morris. N., Findlay. C., Travlou. P., Montarzino. A., Gooch. D., et al. (2004). Nature for people: The importance of green spaces to east midlands communities. Research report no. 567. Peterborough. England: English Nature.
8. Campese. J., Sunderland. T., Greiber. T., Oviedo. G. 2009. Rights-based Approaches: Exploring Issues and Opportunities for Conservation. (Eds.) CIFOR and IUCN. Bogor.
9. Chiesura. A. (2004). The role of urban parks for the sustainable city. *Landscape and Urban Planning*. 68. 129–138.
10. Chow. W. T. L., Nur. S., Binte. A., Akbar. A., Li. S., & Roth. M. (2016). Assessment of measured and perceived microclimates within a tropical urban forest. *Urban Forestry & Urban Greening*. *16*. 62–75. http://doi.org/10.1016/j.ufug. 2016.01.010.

11. Costanza. R., Hart. M., Posner. S., Talberth. J. (2009). Beyond GDP: The Need for New Measures of Progress. Pardee Paper No. 4. Boston: Pardee Center for the Study of the Longer-Range Future.
12. Dagnelie P. (1998). Statistiques théoriques et appliquées. Brussels: De Boeck. 517 p.
13. FAO. (2002). Proceedings of the Workshop on Rural Radio and Food Security. 5–9 November 2001. Food and Agriculture Organization. Rome.
14. Damien GB. Djènontin A. Rogier C. (2010). Malaria infection and disease in an area with pyrethroid-resistant vectors in southern Benin. *Malar Journal*. 9: 380. http://dx.doi.org/10.1186/1475-2875-9-380. PMID: 21194470.
15. Djogbénou L. Pasteur N. Akogbéto M. Weill M. Chandre F. (2011). Insecticide resistance in the Anopheles gambiae complex in Benin: A nationwide survey. *Med Vet Entomol*. 25(3): 256-67. http://dx.doi.org/10.1111/j.1365-2915.2010.00925.x. PMID: 21155858.
16. FAO. (2011). Situation des forêts du monde. Rome. Italie. 176p.
17. Georgescu. M., Chow. W.T.L., Wang. Z.H., Brazel. A., Trapido-Lurie. B., Roth. M. and Benson-Lira. V. 2015. Prioritizing urban sustainability solutions: coordinated approaches must incorporate scale-dependent built environment induced effects. Environmental Research Letters. 10(6): 061001.
18. Govoetchan R. Gnanguenon V. Azondékon R. (2014). Evidence for perennial malaria in rural and urban areas under the Sudanian climate of Kandi. North eastern Benin. *Parasit Vectors*. 7: 79. http://dx.doi.org/10.1186/1756-3305-7-79. PMID: 24564957.
19. Guédjé, F. K., Houngninou, B. E., Honvou, F. S., & Kougbéagbédè, H. (2016). Trend of temperatures in Cotonou between 1970 and 2008 in the context of climate change. *International Journal of Innovation and Scientific Research*, 25(1), 241-245.
20. Ho. C. H., Sasidharan. V., Elmendorf. W., Willits. F. K., Graefe. A., & Godbey. G. (2005). Gender and ethnic variations in urban parks preferences. visitations. and perceived benefits. Journal of Leisure Research. 37. 281–306.
21. Hsieh. C-M. & Jan Zhang. L. (2016). A simplified assessment of how tree allocation. wind environment. and shading affect human comfort. *Urban Forestry & Urban Greening*. 18. 126–137.
22. Kenney. W.A., van Wasseanaer. P.J.E. & Satel. A. L. 2011. Criteria and Indicators for Strategic Urban Forest Planning and Management. Arboriculture & Urban Forestry. 37: 108–117.

23. Kothencz. G., Kolcsár. R., Cabrera-Barona. P., & Szilassi. P. (2017). Urban Green Space Perception and Its Contribution to Well-Being. International Journal of Environmental Research and Public Health. 14(7). 766. http://doi.org/10.3390/ijerph14070766.
24. Morris. N. (2003). Health. well-being and open space: literature review. Edinburgh OPEN space.
25. Nahum. A., Erhart. A. and Mayé. A. (2010). Malaria incidence and prevalence among children living in a peri-urban area on the coast of benin. west Africa: A longitudinal study. Am J Trop Med Hyg; 83(3): 465-73. http://dx.doi.org/10.4269/ajtmh.2010.09-0611. PMID: 20810805.
26. Hunter. I. R. 2001. What do people want from urban forestry? The Europe experience. *Urban Ecosystems* 5:277–284.
27. INSAE. (2013). Quatrième Recensement Général de la Population et de l'Habitation. Institut National de la Statistique et de l'Analyse Economique (septembre 2013). Cotonou. Bénin.
28. INSAE. (2016). Rapport du Quatrième Recensement General de la Population et de l'Habitation. Cotonou. Bénin. 35 p.
29. IPCC. (2014). Climate Change 2014: Impacts. Adaptation. and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. Cambridge. UK and New York. NY. USA 1132.
30. Jim. C.Y. and Chen W.Y. (2006). Perception and Attitude of Residents Toward Urban Green Spaces in Guangzhou (China). *Environmental Management.* 38(3): 338–349. DOI: 10.1007/s00267-005-0166-6.
31. Kirschbaum. M.U.F. (2004). Direct and Indirect Climate Change Effects on Photosynthesis and Transpiration. *Plant Biology*. 6(3): 242–253. https://doi.org/10.1055/s-2004-820883
32. Litschke. T. and Kuttler. W. 2008. On the reduction of urban particle concentration by vegetation—a review. *Meteorologische Zeitschrift*. 17(3): 229-240.
33. Lopez. F. and Roussel. J. M. 2010. Encombrement des trottoirs : Les espaces verts. Une voirie pour tous. Fiche n° 3.5. 10.
34. Madlener R. & Sunak Y. (2011). Impacts of urbanization on urban structures and energy demand: what can we learn for urban energy planning and urbanization management? Sustain Cities Soc 1:45–53.
35. MEHU/DUA. (2006). Revue du secteur urbain au Bénin. Étude préparatoire. volet socioéconomique infrastructures et équipement. Rapport de synthèse. Cotonou. Bénin. 269.

36. Meyer. J.L., Paul. M.J. and Taulbee. W.K. (2005). Stream ecosystem function in urbanizing landscapes. Journal of the North American Benthological Society. 24(3): 602–612.
37. NATUREPARIF. (2012). Politiques urbaines et biodiversité. Recueil d'actions de villes et agglomérations françaises et européennes. Iles de France. 116.
38. Ogunleye-Adetona. C.I. and Oladeinde. C. (2013). The role of community self help projects in rural development of Kwara state. Nigeria. *International Journal of Development and Sustainability*. 2(1): 28–45.
39. Ouinsavi. C. (2000). In situ conservation of *Khaya senegalensis* (Desr.) A. Juss: socioeconomic relevance. structure and dynamic of natural communities and Productivity of trial plantations in Benin. Engineer Agronomist Thesis. FSA/UAC. Abomey-Calavi. Benin. 120 p.
40. Phillips. O., & Gentry. A. H. (1993). The useful plants of Tambopata. Peru: I. Statistical hypothesis tests with a new quantitative technique. Economic Botany. 47. 15–32.
41. Polorigni. B., Radji. R. and Kokou. K. (2014). Perceptions. tendances et préférences en foresterie urbaine : cas de la ville de Lomé au Togo. European Scientific Journal. ESJ. 10 (5).
42. R Core Team. 2017. R: A language and environment for statistical computing. R Foundation for Statistical Computing. Vienna. Austria.
43. Richardson E. A. & Mitchell R. (2010). Gender differences in relationships between urban green space and health in the United Kingdom. *Social Science & Medicine*. 17(3): 568–575.
44. Sokpon. N. and Ouinsavi. C. (2004). Gestion des plantations de *Khaya senegalensis* au Bénin. *Bois et Forêts des Tropiques*. 279 (1) 37.
45. Taiyun Wei and Viliam Simko (2017). R package "corrplot": Visualization of a Correlation Matrix (Version 0.84). https://github.com/taiyun/corrplot.
46. Tyrvaïnen. L. 2001. Economic valuation of urban forest benefits in Finland. *Journal of Environmental Management*. 62:75–92.
47. Teka. O., & Vogt. J. (2010). Social perception of natural risks by local residents in developing countries-The example of the coastal area of Benin. *Social Science Journal*. 47. 215–224.
48. Teka. O., Togbe. C. E., Djikpo. R., Chabi. R. & Djossa. B. (2017). Effects of urban forestry on the local climate in Cotonou. Benin republic. *Agriculture. Forestry and Fisheries*. 6(4): 123–129. doi:

10.11648/j.aff.20170604.13. ISSN: 2328-563X (Print). ISSN: 2328–5648 (Online)

49. UNDP (United Nations Development Program). (2007). Human Development Report 2007/2008 Fighting climate change: Human solidarity in a divided world. New York. UNDP. 399p.
50. Vanclay. F., Esteves. A. M., Aucamp. I., and Franks. D. (2015). Social Impact Assessment: Guidance for assessing and managing the social impacts of projects. Fargo ND: International Association for Impact Assessment. 107p. http://www.rug.nl/research/portal.
51. Vergriete. Y. & Labrecque. M. (2007). Rôle des arbres et des plantes grimpantes en milieu urbain : Revue de littérature et tentative d'extrapolation au contexte montréalais. Rapport pour le Conseil régional de l'environnement de Montréal. Jardin botanique de Montréal. Institut de recherche en biologie végétale. Montréal. 35.
52. Wolf. K.L. (2005). Trees in the small city retail business district: Comparing resident and visitor perceptions. *Journal of Forestry*. 103(8): 390–395.
53. Wu J. (2008). Toward a landscape ecology of cities: beyond buildings. trees. and urban forests. In: Carreiro MM. Song Y-C. Wu J (eds) Ecology. planning. and management of urban forests: international perspectives. Springer. New York. pp. 10–28
54. Wu S., Hou Y. & Yuan G. (2010). Évaluation des biens et services de l'écosystème forestier et du capital forestier naturel de la municipalité de Beijing. Chine. Unasylva 234/235. Vol 6. 28-36pp.
55. Yin S., Shen Z., Zhou P., Che S. & Wang W. (2011). Quantifying air pollution attenuation within urban parks: An experimental approach in Shanghai. China. *Environmental Pollution*. Vol. 159. 8–9. 2155–21