International Journal of Agriculture and Environmental Research

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

IMPACT OF URBANISATION ON THE AVAILABILITY OF FOOD PLANTS IN THE TOWN OF BOUAFLE (CENTRAL-WESTERN COTE D'IVOIRE)

KOUASSI Kanga Justin*, KOSSONOU Affia Sonmia Francia,
KOUAKOU Yao Bertin and KOUASSI Kouadio Henri

University of Jean Lorougnon Guédé (Daloa), Agricultural Production Improvement Laboratory, UFR/Agroforestry, BP 150 Daloa, Côte d'Ivoire.

*Corresponding Author

DOI: https://doi.org/10.51193/IJAER.2024.10109

Received: 14 Feb. 2024 / Accepted: 26 Feb. 2024 / Published: 28 Feb. 2024

ABSTRACT

In a world that is becoming increasingly urbanised, the thorny problem of feeding urban populations is a pressing one. However, the introduction of food plants is not taken into account in the urbanisation politics of localities in Côte d'Ivoire.

This study, carried out in the town of Bouaflé, has improved knowledge, conservation and development of the food species found in urban environments. The types of development were the sites inventoried. The surface survey method was combined with the itinerant method during the floristic inventories.

A total of seventy (70) food plants divided into 56 genera and 35 botanical families within eight (8) types of development have been identified. Dwellings had the highest number of food plants, with 50, followed by public buildings, with 49. The Solanaceae family is the most represented, with 11% of plants. Similarly, micro phanerophytes and introduced species are the taxa most commonly found in these landscapes. Arborescents species are the most numerous in all types of planting, with proportions ranging from 50% to 66.67%. Preferred food plants, which are very frequent and abundant, are the most numerous, accounting for 71.43% of all food plants.

Thus, the priority given to ornamental plants for embellishing and recreating populations is the factor that limits the presence of food plants in the town of Bouaflé.

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

Keywords: Availability, Food plants, Types of management, Bouaflé, Côte d'Ivoire.

1. INTRODUCTION

Among the many challenges facing the world's towns and cities, ensuring food security for urban populations as part of a balance to be struck with rural areas and the sustainability of food systems has become central. Faced with climate change and food insecurity, local urban governments and a growing number of urban planners are taking an interest in introducing food crops into urban development plans. Unfortunately, in Côte d'Ivoire as in many other countries, a number of food plants that were once highly prized for consumption are neglected, under-exploited and threatened with extinction in the urban environment as a result of uncontrolled urbanisation (Kouakou, 2020). Harvesting these products helps to combat poverty, ensure a balanced diet and provide security for people in urban areas (Crush and Frayne, 2011).

Several studies on food plants have been carried out in Africa (Akpavi et al., 2012) and in Côte d'Ivoire, by Kouamé et al. (2008) in the Fromager region (Centre-West) and Oura and Kanga (2017) in the South. Taken together, these studies clearly indicate a real threat to the sustainability of food plants in the urban environment. Moreover, the qualitative and quantitative analysis of food plants is still poorly understood in the face of the threat of a food crisis linked to growing urbanisation (Betti, 2007; Awono et al., 2013).

This is why, in order to meet the conservation needs of food plants in the town of Bouaflé in the face of increasing urbanisation, it became necessary to determine the availability of food plants as a prerequisite for their sustainable management (Holmgren et al., 2004; Thiombiano, 2005). It was with this in mind that the present study was initiated. The aim is to show the impact of urbanisation on the availability of food plants in order to raise awareness of the sustainability of their conservation in the urban environment. Specifically, the aim was to make an inventory of existing food plants in each type of development, to characterise them and to determine their availability in these types of development.

2. MATERIALS AND METHODS

2.1 Study site

Located in central-western Côte d'Ivoire between 6°55'-7°01' north latitude and 5°44'-5°49' west longitude, the town of Bouaflé is the capital of the Marahoué administrative region and department (Figure 1). The town covers an area of 605 ha. The climate, which is of the attenuated transitional equatorial type with annual rainfall of 1,800 mm (Gouzilé et al., 2016), is currently experiencing major disturbances due to highly irregular rainfall (Yapi et al., 2014). The

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

average monthly temperature is 25.5°C, with a minimum of 20.4° and a maximum of 37.5°C. Relative humidity varies between 63.55 and 80%, with an average of 74% (Kouamé et al., 2008). The commune of Bouaflé has a very dense hydrography, consisting essentially of the Marahoué river, which favours the presence of numerous water courses, natural lakes and marshy areas.

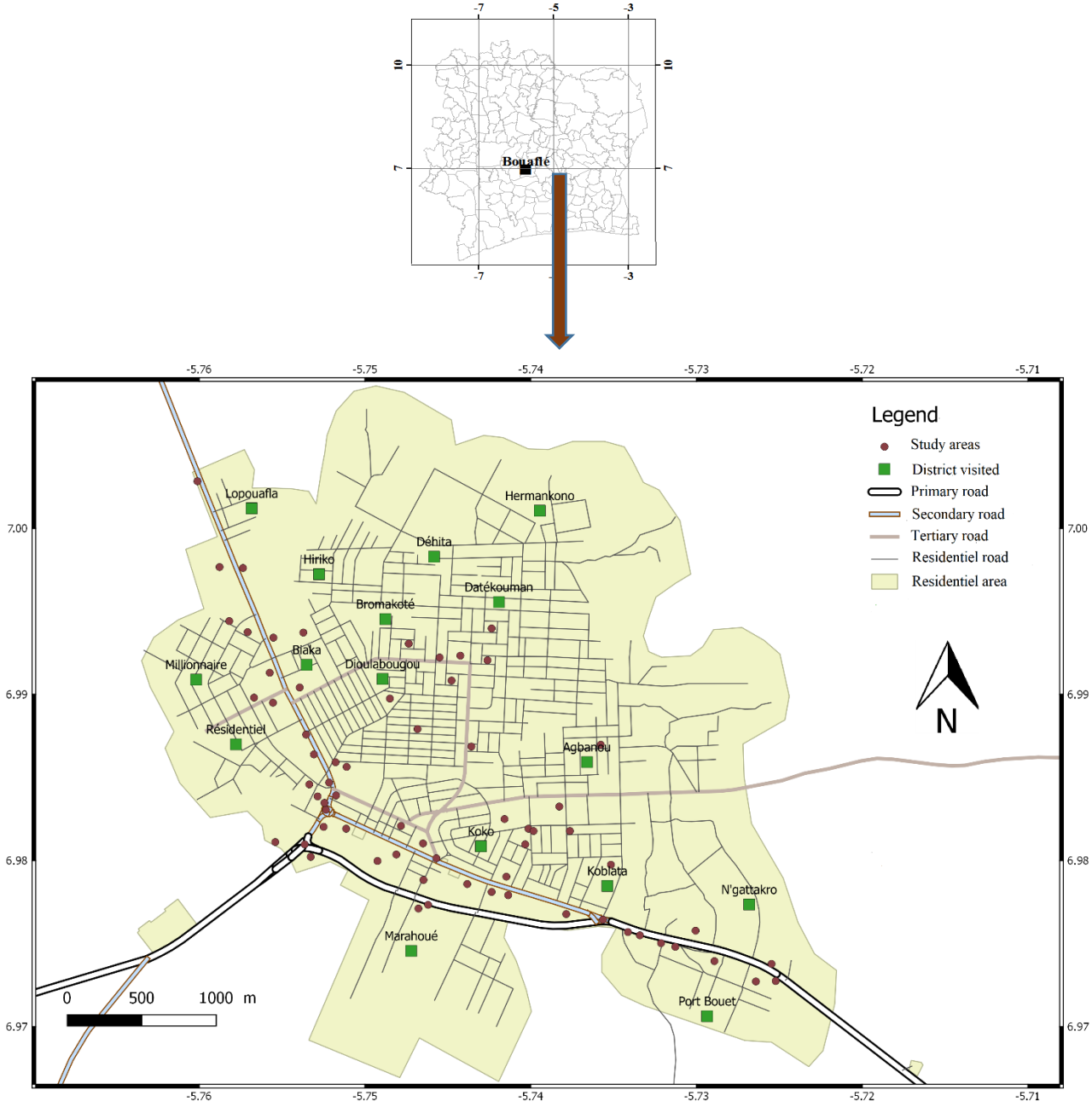

Figure 1: Location of study sites in the town of Bouaflé

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

Most of the soils are moderately denatured ferralitic soils with a very high chemical content (Perraud, 1971). The relief is relatively flat, consisting of low plateaux with a few shallows. The vegetation in the Bouaflé area is transitional. It essentially belongs to the mesophilic forest zone as a whole, with natural formations consisting of dense semi-deciduous rainforests, dry forests, forest/savannah contact zones, interspersed with forest galleries, and open savannahs (Yedmelet al., 2010). Its geographical location as a meeting point between the peoples of the savannah and the forest and its enormous economic, social and cultural potential have greatly contributed to the unprecedented densification of the town.

2.2 Collection of floristic data

Floristic data were collected using two complementary survey techniques: surface surveys and roving surveys. These surveys were carried out in all types of development in order to record as many plant species as possible. The surface survey consisted of delimiting plots measuring 20 m x 20 m (400 m^2). Within each plot, all woody species with a diameter at breast height (dbh) of at least 10 cm and a height of 2 m were surveyed and their names recorded on a survey sheet. It inerant surveys were also carried out between plots along the transect and in certain places that were very difficult to access. The it inerant inventory method involves walkingt hrough the various environments, noting all the plant species found in the plant formations that have not yet been recorded in the plots. This method made it possible to obtain all the species missed during the surface surveys in the different types of development, with a view to obtaining a more exhaustive view of the flora. Some species were identified in the field. Unidentified species, on the other hand, were collected for a herbarium and were subsequently identified with the support of the Centre National de Floristique (CNF) at the Université Félix Houphouët-Boigny.

In the case of private homes, the method consisted of walking along randomly selected streets within a neighbourhood. During this walk, 30 consecutive building lots located on either side of the street were chosen and all the plant species found within these lots were noted. Whatever the number of dwellings on a lot, the sum of all the plant species present in these dwellings was considered to be the flora of a lot. The surface area of each lot visited was 600 m².

2.3 Data analysis

2.3.1 Determining the typology of urban green spaces

To diagnose the vegetation and highlight the types of green space studied, we have adopted the broad typology proposed by Jancel, 1997. This typology is based on functionality as the main component for differentiating green spaces. This classification groups urban green spaces into thirteen types: Parks, gardens and squares; Alongside roads; Alongside public buildings;

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

Alongside housing; Alongside industrial and commercial establishments; Green spaces in social and educational establishments; Sports facilities; Cemeteries; Campsites; Allotment gardens; Horticultural establishments; Landscaped natural spaces and Linear trees.

2.3.2 Richness and composition of flora

The classification models proposed by Raunkiaer (1934) and Aké-Assi (2001; 2002) were used to determine the list of species, genera and families, as well as the biological types, morphological types and chorological affinities of the food plants collected. The morphological types used were arborescent species (A), herbaceous species (H) and lianascent species (L).

2.3.3 Availability of food plants in each type of layout

The species rarity-weight richness index calculated from the equation by Géhu and Géhu (1980) was used as a basis for assessing the availability of food plants. This index is calculated using the following formula:

$$Ri = [1 – (ni/N)] x$$

In this formula, Ri denotes the rarefaction index of a species i; ni, the number of plots where species i is found and N, the total number of plots surveyed. In accordance with this relationship, species with a rare faction index of less than 10% are considered abundant in the areas studied. Species with a rare faction index of lessthan 80% are considered to be preferred species, very frequent and abundant in the areas studied. Species with a rare faction index greater than 80% are considered rare. A rarefaction index of 100% means that the species has not been observed anywhere in the areas studied.

3. RESULTS

3.1 Richness of food plants in types of landscaping

Following inventories carried out in the different types of landscaping in the town of Bouaflé, 70 food plants divided into 56 genera and 35 families were identified. The distribution of this richness differs according to the type of development (Table 1). Dwellings had the highest floristic diversity, with 50 food plants. These areas are followed by public buildings with 49 food plants and social and educational establishments with 44 food plants. Among the families inventoried, the Solanaceae family topped the list, accounting for 11% of the food plants inventoried. This family is followed by the Arecaceae and Poaceae families, each accounting for 7% of food plants.

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

Table 1: Richness of food plants in types of landscaping in the town of Bouaflé

Types of layout	Number of food plants	Number of generea	Number of families
PUB BAT	49	40	30
SOC & EDU	44	34	27
IND & COM	23	22	19
CEM	24	22	16
SPO EQU	6	5	5
PUB GAR	2	2	2
DWE	50	40	28
ACC LIV	9	8	8

3.2 Floristic composition of landscape types

Most of the food plants found in public buildings, social and educational establishments, industrial and commercial establishments, cemeteries and homes are micro phanerophytes (mp). Their proportions in these areas are 30.62%, 38.63%, 43.47%, 33.33% and 34% respectively (Figure 2). They are followed by nanophanerophytes and therophytes. Half of the food plants inventoried in public gardens and sports facilities are Nanophanerophytes and the other half Mesophanerophytes. Nanophanerophytes and Mesophanerophytes are the mostabundant species in roadside areas, with proportions of 33.34% and 22.22% respectively (Figure 2).

3.3 Morphological types of food species inventoried

Tree species are the most numerous in all types of landscaping, with proportions ranging from 50% in public gardens to 66.67% in roadside green spaces. Next come herbaceous food plants and lianascent food plants. In terms of herbaceous species, the lowest proportions were recorded in sports facilities and roadside areas, with respectively 16.67% and 22.22% of species in each of these environments (Figure 3). The highest value was observed in public buildings (40.82%). For lianas, the highest proportion was observed in sports facilities (16.67%), while no lianascent food species were observed in sports facilities (Figure 3).

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

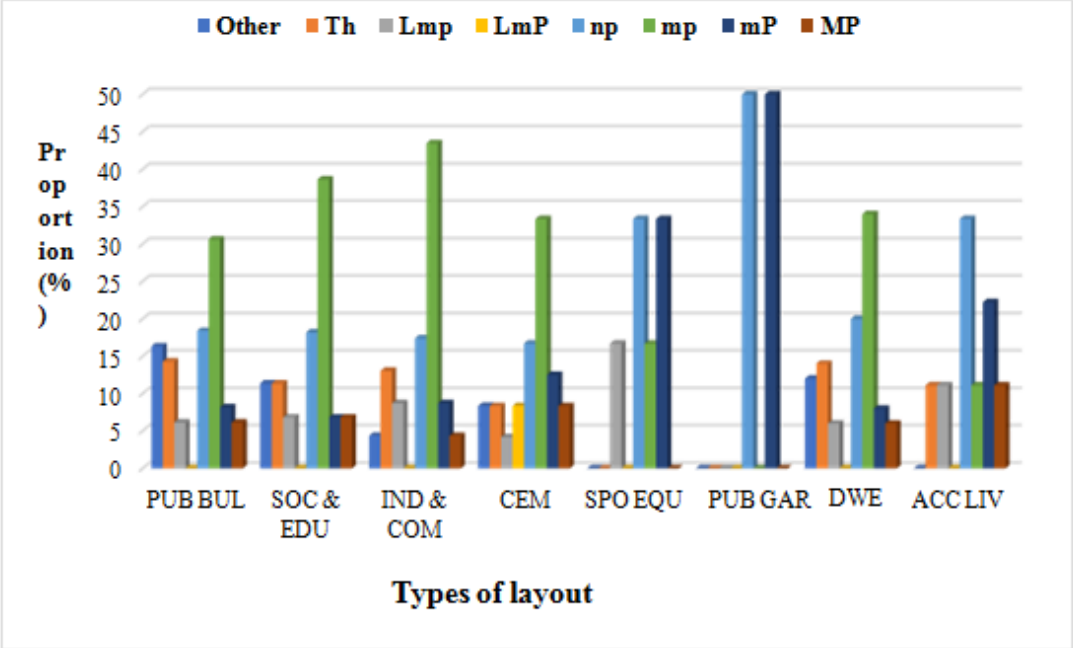

Figure 2: Biological types of food species inventoried in the different types of development in the town of Bouaflé.

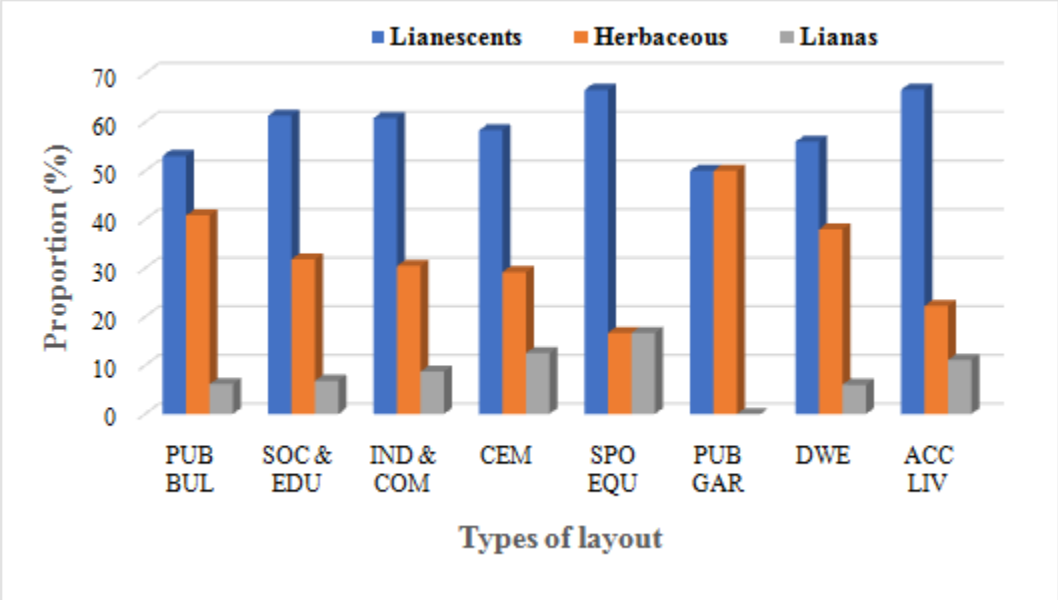

Figure 3: Morphological types of food plants found in the different types of landscaping in the town of Bouaflé.

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

3.4 Phytogeographical distribution

The spectrum of the phytogeo graphical distribution of food plants reveals that introduced species (i) are most abundant in public buildings, social and educational establishments, industrial and commercial establishments and dwellings (Figure 4). The proportions recorded for these types of development are 46.94%, 43.18%, 43.48% and 44% respectively. Species from the Guinean-Congolese (GC) region are abundant in cemeteries, sports facilities, public gardens and roadside areas, with proportions of 41.67%, 83.33%, 100% and 66.67% respectively. Sudano-Zambézian (SZ) species are the least abundant in all types of landscaping (Figure 4).

3.5 Evolution of the proportion of food plants in the types of landscaping in the town of Bouaflé

In Bouaflé, the preferred, very frequent and abundant food plants are the most numerous, accounting for 71.43% of all food plants. Rare food plants are the least numerous (28.57%). The proportions of abundant food plants ranged from 0% for *Elaeis guineensis* and *Talinumtriangulare* to 75% for twelve (12) food plants (Table 2). These species are *Aloe vera, Ananas comosus, Annona senegalensis, Annonasquarnosa, Citrus reticulata, Dioscoreaalata, Nicotiana tabacum, Parkiabiglobosa, Passifloraedulis, Phoenix dactylifera, Saccharum officinarum* and *Solanum indicum*. The rare faction indices for rare food plants range from 87.5% to 100% (Table 2). The species *Phaseolus vulgaris* recorded the highest rare faction index value (100%).

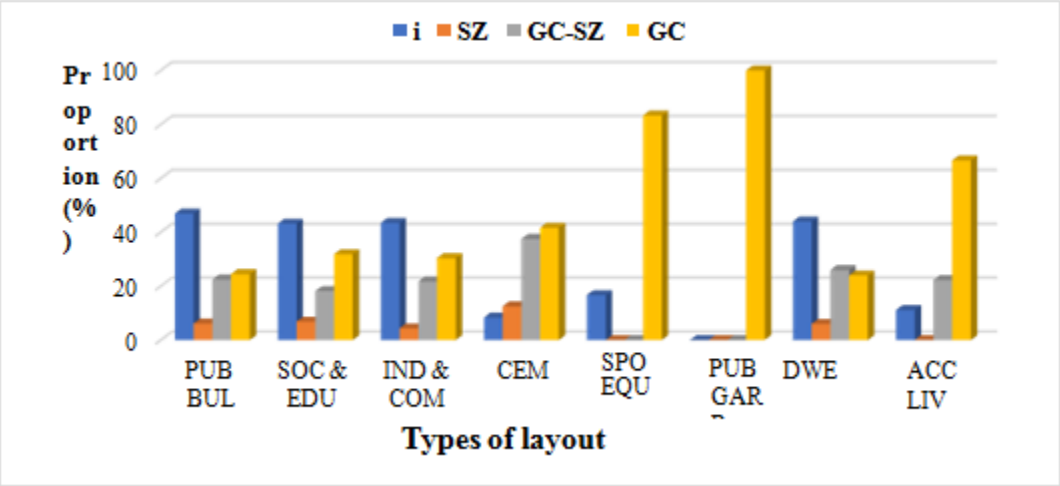

Figure 4: Phytogeographical distribution of food plants found in different types of landscaping in the town of Bouaflé.

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

Table 2: List of food plants and the irrarity index

Epecies	Rarefaction Index (%)	Categories	Especies	Rarefaction Index (%°	Categories
Elaeis guineensis	0		*Musa sapientum*	62,5	
Talinumtriangulare	0		*Persea americana*	62,5	
Mangiferaindica	12,5		*Solanum lycopersicum*	62,5	
Cleomerutidosperma	25		*Aloe vera*	75	
Passiflorafoetida	25		*Ananas comosus*	75	
Solanum rugosum	25		*Annona senegalensis*	75	
Solanum torvum	25		*Annonasquarnosa*	75	
Anacardium occidentalis	37,5		*Citrus reticulata*	75	Preferred, veryfrequent and abundantspecies
Bidens pilosa	37,5		*Dioscoreaalata*	75	
Borassus aethiopum	37,5		*Nicotiana tabacum*	75	
Caricapapaya	37,5		*Parkiabiglobosa*	75	
Annonamuricata	50		*Passifloraedulis*	75	
Ceibapentandra	50		*Phoenix dactylifera*	75	
Citrus limon	50		*Saccharumofficinarum*	75	
Citrus sinensis	50		*Solanum indicum*	75	
Cocos nucifera	50		*Abelmoschusesculentus*	87,5	
Ficus benjamina	50	Preferred, veryfrequent and abundantspecies	*Alternantherabraziliensis*	87,5	
Manihot esculenta	50		*Artocarpus altilis*	87,5	
Musa paradisiaca	50		*Aspiliabussei*	87,5	
Ocimumgratissimum	50		*Bombax costatum*	87,5	
Psidiumguajava	50		*Capsicum frutescens*	87,5	
Solanum melongena	50		*Combretumpaniculatum*	87,5	Raresspecies
Spondias mombin	50		*Combretumracemosum*	87,5	
Tamarindusindica	50		*Cyperus esculentus*	87,5	
Terminaliacatappa	50		*Desmodiumsalicifoliu m*	87,5	
Theobroma cacao	50		*Dialium guineense*	87,5	
Zeamays	50		*Dioscoreaminutiflora*	87,5	

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

Adansoniadigitata	62,5	*Oryzaglaberrirna*	87,5	
Arachishypogaea	62,5	*Raphia hookeri*	87,5	Raresspecies
Caesalpiniapulcherrima	62,5	*Solanum macrocarpon*	87,5	
Citrus grandis	62,5	*Sorghumarundinaceum*	87,5	
Colocasiaesculenta	62,5	*Thaumatococcusdanielii*	87,5	
Corchorusolitorius	62,5	*Vitellariaparadoxa*	87,5	
Cymbopogoncitratus	62,5	*Zingiber officinale*	87,5	
Moringa oleifera	62,5	*Phaseolus vulgaris*	100	

4. DISCUSSION

4.1 Food flora in different types of landscaping in the town of Bouaflé

The floristicinventory carried out showed that there are certainly food plants accompanying the types of development in the town of Bouaflé, but their numbers are very low. The low richness of the food flora of the types of development visited clearly confirms the low proportion of food plants in the urban environment. The results obtained in this study enabled us to draw up a list of seventy (70) food plants. The low number of food plants found in the town of Bouaflé is thought to belinked to the choices and objectives of the developers and land owners. In fact, the best-known types of classic urban spaces seem to have been created for aesthetic purposes and to beautify the town, as pointed out by Zerbe et al (2004). These types of development have therefore been perceived, a priori, as reserved exclusively for recreational purposes. Among the seventy (70) food plants, the best represented families, in decreasing order of number of species, are Solanaceae, Arecaceae and Poaceae. The high representation of these families is probably linked to the resilience of these species to the adverse effects of the city's climatic and edaphic conditions, according to Dardour et al (2013).

4.2 Types of landscaping and diversity of food plants

The most diverse types of urban landscaping in terms of food plants are those accompanying housing and public buildings. This diversity depends on the crops and planting choices made by local people to ensure that these food plants are always with inreach, and sometimes to guarantee availability during periods of shortage. It is also one of the new strategies developed by local people to combat food insecurity in the face of climate change. In addition, the parts of food plants that are consumed are of particular importance to different social categories, as they are sources of vitamins, minerals and proteins in a diet dominated by cereals (Boudraa et al., 2010).

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

These types of facilities are followed by those in social and educational establishments, where the state authorities include food plants in the planting improvement plans to help pupils obtain supplies. In these areas, the state authorities voluntarily introduce food plants for use by pupils and sometimes staff, which provide numerous ecosystem services (food supply, purification, temperature regulation). The current trend is for more and more multi-purpose plants to beused for the benefit of the population. In this context, food plants are best suited to meeting these needs. Indeed, the growing food needs of the urban population have led to a dependence on the urban environment to meet them (Virginie, 2011). In addition, public gardens, sports facilities and roadsides, where these plants are less represented, have inherited a previously designed type of landscaping. For a long time, these plants in urban environments were limited to simple decoration and/or embellishment, for recreational purposes, etc., before evolving over time (Clergeau, 2007).

Analysis of the chorological histogram showed an abundance of introduced species. This situation indicates that the aesthetic character of the urban landscaping was the main consideration. The dominance of arborescent species over herbaceous and lianascent species in the types of landscaping would appear to be a frequent occurrence in the majority of landscapes. These species are generally evergreen trees that can provide shade all year round (Leblanc & Malaisse, 1978). Moreover, the biological forms that produce the parts commonly consumed are trees (N'dri et al., 2008). The massive presence of Micro phanerophytes at among the food plants inventoried can be explained by their easy integration and exemplary adaptation to the ecological conditions of the city. Meso phanerophytes are poorly represented because it is rare to find very large trees in habitats, which can sometimes lead to the destruction of buildings. All these characteristics indicate that the aesthetic and recreational function of trees and green spaces is what gives them their greatest value in the eyes of city dwellers and visitors (DaCunha, 2009).

4.3 Types of layout and availability of food plants

The food plants inventoried are generally preferred species, very frequent and abundant. In fact, the food plants encountered grow by themselves and do not require any particular maintenance. This could explain why they are more numerous in urban areas than rare species. However, the increasing urbanisation of the town of Bouaflé poses a threat to the survival of these plants. Indeed, the conservation and domestication of these plants is not yet common in the country (Kouamé *et* al., 2014). Furthermore, all the studies carried out in Côte d'Ivoire have revealed the threat of disappearance of several food species in the country, but also the rapid loss of traditional knowledge linked to the use of these plants (Ouattara et al., 2016). Yet wildedible plants play a very important role in the diet and even in reducing poverty among African populations (Schreckenberg et al., 2006; Iranbakhsh et al., 2009). Studies by Lamien-Meda et al

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

(2008) in Burkina Faso revealed that many wildedible plants have a high level of antioxidant activity. The surroundings of public buildings and housing have more edible plants for various reasons. During the development of these sites, the operator or owners install these food plants to have them within easy reach and also with a view to meeting certain nutritional needs linked to these plants. In the case of sports facilities, cemeteries, public gardens and roadside treelines, food plants are poorly represented because the operators and/or landscapers focus on ornamental plants that help to beautify these areas. In terms of the types of landscaping, beauty and aesthetics are the elements favoured during the activities. The abundance *of Elaeis guineensis* in all types of landscaping can be explained by the plant's multiple uses and wide spread domestication in all tropical forest zones (Tchatat and Ndoye, 2006). Indeed, the sap of this species (palm wine) is highly prized and intensively extracted in all regions of Côte d'Ivoire. The pulp of the species isused to extracted iblered palm oil. From the kernel, black oil is obtained, which is used in pharmacopoeia and to make traditional soap. The leaves are used for roofing and to make brooms and baskets. The roots and young leaves are used for medicinal purposes. *Talinumtriangulare* is highly prized by local people for its leaves, which are very succulent in sauces (Biloso and Lejoly, 2006). The massive presence of *Mangiferaindica* in many types of management is driven by management objectives aimed at ensuring the availability of this plant in order to guarantee food security during periods of shortage. Since the colonial era, *Mangiferaindica* has always been the most common tree in old administrative districts in black Africa, according to Haeringer (1980). This species is highly prized by the local population for its solidity, hardiness, dense shade, inaccessibility to tornadoes and succulent fruit, making it the most widely used food tree. In social and educational establishments, the local authorities recommend *Mangiferaindica* in their plans for landscaping areas to help pupils obtain supplies. These multiple functions and/or services have contributed to the adoption of these plants by the populations of Bouaflé and many other towns in Côte d'Ivoire. In fact, the presence of these food plants in the various types of landscaping meets many of the challenges facing African towns and cities. They generate income, provide perishable food stuffs that are suitable for urban dwellers, and make it possible to develop undevelopable areas.

5. CONCLUSION

This study reveals that the types of landscaping in the town of Bouaflé still abound in food plants that are very useful for the urban population. The inventories carried out in the different types of landscaping enabled us to draw up a list of seventy (70) food species. These are mainly tree species, introduced species and micro phanerophytes. The types of urban landscaping with the greatest diversity of food plants are those accompanying housing and public buildings. The most abundant food species are *Elaeis guineensis*, *Talinumtriangulare* and *Mangiferaindica*. In the current context of climate change and food insecurity, these plants, in addition to their role as

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

food, provide numerous ecosystem services, which are fundamental reasons why people have adopted them in many types of development. These results clearly indicate the threats to the sustainability of plants if nothing is done. In order to enhance the value of these products and develop tools for their sustainable conservation, we need to carry out in-depth studies on a range of topics to gain a better understanding of these products and the resources associated with them. These studies could concern all urban and peri-urban agriculture carried out in these localities. Thus, the future of these food plants in these types of development depends on public policies in the adoption and orientation of the types of development.

ACKNOWLEDGEMENT

The authors sincerely thank the authorities of the town of Bouaflé, especially the latemayor, Dr LEHI Bi Lucien, for the hospitality and technical and financial support we received.

REFERENCES

[1] Aké-Assi, L. (2001). Flore de la Côte d'Ivoire 1, Catalogue, Systématique, Biogéographie et Ecologie. Conservatoire et Jardin Botanique : Geneva, Switzerland ; 396 p.

[2] Aké-Assi, L. (2002). Flore de la Côte d'Ivoire 2, Catalogue, Systématique, Biogéographie et Ecologie. Conservatoire et Jardin Botanique : Geneva, Switzerland ; 441 p.

[3] Akpagana, K. (2006). Savoirs locaux et gestion de la biodiversité : habitudes alimentaires et utilisation des plantes alimentaires mineures ou menacées de disparition au Togo. Research report year III project n°101517 CRDI, University of Lomé, 101 p.

[4] Akpavi, S., Kpérkouma W., Koffi A.G., Komi O., YaoA.W., Komlan B., Marra D., Hodabalo P., Innocent B.,Bruno F., Koffi A. (2012). Distribution spatiale des plantes alimentaires mineuresou menacées de disparition au Togo: un indicateur de l'ampleur de leur menace.*Acta Botanica Gallica*, 159(4), 411-432. http://dx.doi.org/10.1080/12538078.2012.737145

[5] Awono, A., Eba'a, A.R., Betti, J-L., Ngouhouo, P.J., Foundjem, T.D., Tieguhong C.J. (2013).Economic and social importance of plant-based non-timberforestproducts in Cameroon. In *Etude de l'Importance Economique et Sociale du Secteur Forestier et Faunique au Cameroun*, Eba'aAtyi R, Lescuyer G, NgouhouoPoufoun J, FoudaMoulendè T (eds). Ministère des Forêts et de la Faune – CIFOR: Yaonudé; 129-130.

[6] Betti, J.L. (2007a). Plan d'action/stratégie pour une meilleure collecte des données statistiques sur les Produits forestiers non ligneux au Cameroun et recommandations pour les pays de laCOMIFAC. Projet Renforcement de la sécurité alimentaire en Afrique centrale à travers la gestion et l'utilisation durable des produits forestiers non ligneux, GCP/RAF/398/GER, FAO- COMIFAC - GTZ. P.180.

ISSN: 2455-6939

Volume: 10, Issue: 01 "January-February 2024"

[7] Biloso, M.A.,andLejoly, J. (2006). Etude de l'exploitation et du marché des produits forestiers non ligneux à Kinshasa. *Tropicultura.*24 (3),183-188.

[8] Boudraa, S., Hambaba, L., Zidani, S., Boudraa, H. (2010). Mineral and vitamin composition of the fruits of five under-exploitedspecies in Algeria:*Celtis australis* L., *Crataegus azarolus*L., *Crataegus monogyna*Jacq., *Elaeagnusangustifolia*L. and *Zizyphus lotus* L. *Fruits,* 65(2), 75-84.http://dx.doi.org/10.1051/fruits/20010003

[9] Clergeau, P.H. (2007). Une écologie du paysage urbain, Rennes, Apogée, 136 p.

[10] Crush, J.S., andFrayne, G.B. (2011). Urban foodinsecurity and the new international foodsecurity agenda. *Dev. South. Af*. 28, 527-544. http://dx.doi.org/10.1080/0376835X.2011.605571

[11] Da Cunha, A. (2009). Introduction. In Da Cunha, A. (ed.), *Urbanisme végétal et agriurbanisme.* Lausanne, Switzerland: Observatoire universitaire de la Ville et du Développement durable, 20 p.

[12] Dardour, M., Daroui, E.A., Boukroute, A., Kouddane, N.E.,Abdelbasset, B. (2014). Inventory and healthstatus of streettrees in the city of Saïdia (eastern Morocco). *Nature & Technologie". C- Sciences de l'Environnement*, 10, 02-09.

[13] Géhu, J.M., and Géhu, J.(1980). Essai d'objection de l'évaluation biologique des milieux naturels. Exemples littoraux. In Géhu J.M. (ed). Séminaire de Phytosociologie Appliquée. Amicale Francophone de Phytociologie, Metz: 75-94.

[14] Gouzilé, A.P., Soro, G.E., Goula, B.T.A. (2016). Climatic variation and spatio-temporal distribution of urinarybilharziasis in the Marahouéregion (Côte d'Ivoire). *International Journal of Innovation and AppliedStudies,* 18(3), 816-827.

[15] Haeringer, P. (1980). L'arbre dans la ville: Lecture sociale en quatre tableaux du couvert végétal dans la ville africaine. *Cahier O.R.S.T.O.M.*, série. Scientifique. Hum. vol. XVII: 289-308.

[16] Holmgren, M., Poorter,L., Siepel, A.(2004). Whatexplains the distribution of rare and endemic West Afraican plants? In Biodiversity of West AfricanForests. An Ecological Atlas of Woody Plant Species, ed. Poorter L., F. Bongers F. Y.N'. Kouamé and W.D. Hawthorne. 73-85. Wallingford, UK: CABI Publishing.

[17] Iranbakhsh, A., Ebadi, M., Zare, Z. (2009). The contribution of indigenous fruit trees in sustaining rural livelihoods and conservation of naturalresources. *Journal of Horticulture and Forestry,*11(1), 1-6. *Journal of Horticulture and Forestry*, http://www.academicjournals.org/jhf

[18] Jancel, R. (1997). Typologie des espaces verts. In: La plante dans la ville, Angers (France), 5-7 November 1996, Editions INRA, Les colloques n°84, Paris, pp. 69-80.

[19] Kouamé, N.M.T., Gnahoua, G.M., Mangara, A.(2014). Germination trials of Ricinodendronheudelotii (Euphorbiaceae) in the Fromager region of west-central Côte d'Ivoire. *Journal of Applied Biosciences,* 56, 4133-4141.

[20] Kouamé N.M.T., Gnahoua G.M., Kouassi K.E., Traoré D. (2008). Plantes alimentaires spontanées de la région du Fromager (Centre-Ouest de la Côte d'Ivoire) : flore, habitats et organes consommés. Sciences & Nature, 5(1) : 61-70. http://dx.doi.org/ 10.4314/scinat.v5i1.42152

[21] Kouamé, Y.A., Yao, G.F., Alui, K.A., N'guessan, K.A., Tiemoko, T.P., Kloman, K.Y. (2008). Etude morphopédogique du bassin versant du mont Blanguand dans le massif du Yaouré en région centrale de la Côte d'Ivoire. *Afrique Science,* 04(3), 426 - 451.http://dx.doi.org/10.4314/afsci.v4i3.61699

[22] Lamien, M.A, Lamien, C.E., Compaoré, M.M.Y., Meda, R.N.T., Kiendrebeogo, M., Zeba, B., Millogo, J.F., Nacoulma, O.G. (2008). Polyphenol content and antioxidantactivity of fourteenwildedible fruits from Burkina Faso. *Molecules,* 13, 581-594.http://dx.doi.org/ 10.3390/molecules13030581.

[23] Leblanc, M.,andMalaisse, F. (1978). Lubumbashi, un écosystème urbain tropical, Centre International de Semiologie, Université National du Zaïre. 178 p.

[24] Merimi, J.,andBoukroute, A. (1996). Inventory and healthstatus of avenue trees in the town of Oujda (eastern Morocco). *Actes Institut Agronomique et Vétérinaire, Maroc,* 16(1), 41 - 47.

[25] N'Dri, M.T.K, Gnahoua, G.M., Kouassi, K.E., Traoré, D. (2008). Spontaneousfood plants in the Fromager region (central-western Côte d'Ivoire): flora, habitats and organsconsumed. *Sciences et Nature,*5(1), 61-70

[26] Ouattara, N.D., Gaille, E., Stauffer, F.W., Bakayoko, A. (2016).Floristic and ethnobotanicaldiversity of wildedible plants in the Department of Bondoukou (North-East Ivory Coast). *Journal of Applied Biosciences,* 98, 9284-9300. http://dx.doi.org/10.4314/jab.v98i1.5

[27] Oura K.R., Kanga K.J., (2017). L'agriculture urbaine face au défi de l'urbanisation de Bingerville dans le Sud-Est d'Abidjan, en Côte d'Ivoire. Revue de géographie du Laboratoire Leïdi «DTD», 16, 260-280.

[28] Perraud, A. (1971). Les sols de la Côte d'Ivoire. In: Le milieu naturel de la Côte d'Ivoire. Mémoire ORSTOM, 50, Paris (France): 265-391.

[29] Raunkiaer, C. (1934). The life forms of plants and statistical plant geography. Oxford UniversityPress, London (UK), 632 p.

[30] Schreckenberg, K., Awono, A., Degrande, A., Mbosso, C., Ndoye, O., Tchoundjeu, Z. (2006). Domesticatingindigenous fruit trees as a contribution to povertyreduction.

Forests, Trees and Livelihoods, 16, 35-51.http://dx.doi.org/10.1080/14728028.2006.9752544

[31] Tchatat, M., and Ndoye, O. (2006). Study of non-timberforestproducts in Central Africa:realities and prospects. *Bois et Forêts des Tropiques,* 288(2).

[32] Thimbiano, A. (2005). Combretaceae of Burkina Faso:taxonomy, ecology, dynamics and regeneration of species (281 p). PhD thesis:University of Ouagadougou.

[33] Virginie, G. (2011). Analysis of urban agriculture in large urban centres in North America. Essay presented at the Centre Universitaire de Formation en Environnement de l'Université de Sherbrooke (Montréal, Québec, Canada) for the degree of Master in Environment (M. Env.). 116 p.

[34] Yapi, Y.G., Traoré, D.F., Coulibaly, D., T.E. (2014). Contributorystudy to the knowledge of simulium populations in the commune of Bouaflé, Centre-West of Côte d'Ivoire. *Int. J. Biol. Chem. Sci,*8(6): 2540-2551.http://dx.doi.org/10.4314/ijbcs.v8i6.16 p.12

[35] Yedmel, M.S.C., Barima, S.Y., Kouamé, N.F., Barbier, N.(2010). Impact of disturbance by silvicultural interventions and fire on the dynamics of a forest stand in the semi-deciduous zone of Côte d'Ivoire. *Sciences & Nature,*(7) 2, 131 - 142.http://dx.doi.org/

[36] Zerbe, S., Maurer, U., Schmitz, S.,Sukopp, H.(2004). Biodiversity in Berlin and itspotential for nature conservatiom. *Landscape and Urban Planning*, 62(3) : 139-148. http://dx.doi.org/10.1016/S0169-2046(02)00145-7

