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Floristic diversity, origins and properties of city trees in Burkina Faso

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ABSTRACT

In Burkina Faso, insufficient or partial information exists on the forest potential of urban areas, marked mainly by the introduction of many exotic species. The obje0ctive of this study was to assess the floristic diversity of city trees, to reveal the benefits and risks associated with their properties in a context of climate change, increasing demography and accelerated urbanization. Surveys on 49 urban municipalities were conducted from 2015 to 2020 to identify and describe species at different phenological stages to enable photographic image recognition. Confirmations are made with floras, previous works and documentary compilations. The analyses relate to the biological diversity of species, their origins and uses. The floristic diversity of Burkina Faso's city trees consists of 251 species belonging to 174 genera and 58 families. It is comprised of 178 introduced species and 73 native species. The most represented families are Arecaceae with 7.97% of species, Euphhorbiaceae (7.57%), Moraceae (6.37%), Fabaceae - Mimosoideae (5.98%), Apocynaceae (5.98%) and the Fabaceae - Caesalpinioideae (5.58%). The most common species are *Khaya senegalensis*, *Mangifera indica* and *Azadirachta indica*. This work has helped to characterize the city trees of Burkina Faso. It will update the flora of the country, which is enriched with 36 new exotic species.

Keywords: Urban tree, characterization, biological diversity, communes.

INTRODUCTION

Vegetation degradation as well as erosion of floristic diversity over the past four decades in most Sahel countries in general and in Burkina Faso in particular, have been documented by several studies (Ganaba, 2011; Kadeba et al., 2014). For the period 1999-2002, the second State of the Environment Report in Burkina Faso (REEB-II) states that 20,968 hectares of forests have been transformed into agricultural territories, or 2.33% of the forest sector. Approximately 1,444,316 hectares of steppes and savannahs have been partially or completely converted to agricultural land, or 10.66% of the total area of steppes and savannahs).

Furthermore, insufficient or partial information exists about the forest potential in urban areas (Ouédraogo, 2005; Soma, 2012), marked mainly by introduction of many exotic species. In addition to that, there is limited knowledge about the functions and uses of cities trees. Moreover, the country's rapid population growth and rapid urbanization reflect of the West African sub-region with rates of 5% in 1900, 12% in 1950, 28% in 1980 and 17% in 2000 (Fuwape and Onyekwelu, 2011). This is why there is a growing awareness in Africa of the need for urban forests and parks to satisfy physical and material needs and for recreation (Çay, 2016). However, information on the nature and level

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of urban forest resources is essential for developing sustainable management strategies. Knowledge of the city's forestry potential requires an assessment of the tree heritage of the municipalities or "communes". A good assessment requires knowledge of the flora. The objective of the study is to evaluate the floristic diversity of city trees, to reveal the benefits and risks associated with their properties in a context of climate change, growing demography and accelerated urbanization.

MATERIALS AND METHODS

Study area

The study area covered as much as possible the chief towns the 49 urban communes of Burkina Faso with Ouagadougou as capital city (Figure 1). Burkina Faso is a landlocked Sahelian country in the Niger loop. It is bordered to the north and west by Mali, to the east by Niger and to the south by Benin, Togo, Ghana and Côte d'Ivoire. The climate is Sudanian and Sahelian, alternating a dry season from October to May and a short rainy season from June to September. Average monthly temperatures vary between 30 - 34 °C in March - April and between 23 – 25 °C in December - January. Sunshine lasts more than 10 hours per day and evaporation exceeds 2,600 mm per year. Most of Burkina Faso's territory (about 75%) rests on an old Precambrian crystalline basement which gives it a generally flat and monotonous relief.

The phytogeographical division in Burkina Faso (Figure 1) distinguishes two domains (Guinko, 1984): the Sahelian phytogeographic domain subdivided into two phytogeographical sectors (strict Sahelian phytogeographic sector and sub-Sahelian phytogeographic sector) and the Sudan phytogeographical domain comprising the northern Sudanese and south Sudan sectors. The population is estimated at 20,870,060 in 2019 on an area of 270,764 $km^{2.}$ and a population growth of 3.05% per year (Population Dataset, 2020). More than 40% of the population still lives below the poverty line, according to Prince and Fantom (2014). The country's economy is dominated by agriculture and livestock, which account for more than 85% of the population.

The urbanization rate, which stood at only 4.8% of the population in 1960, has been accelerating since 1985, from 12.7% to 22.7% in 2006. For example, the population of the city of Ouagadougou, which was estimated at 709,736 in 1996 has grown to 1,475,839 in 2006 and estimated at 3,000,000 in 2019. Its population, which grows by 7.2% per year, is one of the highest rates in the world and also poses a serious problem in terms of pollution, transport, safety, health and education. The country's second largest city, Bobo Dioulasso, has seen its population grow even faster than the capital, at about 11% per year, and could exceed one million in a short time (0.8 million in 2017) (Population Dataset, 2020).

In urban centres, climate change and increasing urbanization increase the need for wood (fire, construction, (Ouédraogo, 2006), the risks of pollution and nuisance, but also the degradation of peri-urban vegetation.

Data collection

The city tree here refers to any woody or similar material present in the city, whether spontaneous or introduced by man. City trees include both concession trees and off-concession trees. Concession trees are all woody plants (tree, shrub and subshrub), present within the boundaries of the residential or service concession. Out-of-concession trees are alignment shafts and trees located in urban forests, urban parks, botanical gardens, green spaces, greenbelts, peri-urban plantations and agroforestry reserves.

Prospecting trips to the cities of Burkina Faso's, 49 urban municipalities were organized from 2015 to 2020. Descriptions and photographic shots of several shots at different phonological phases (leafing, leaf removal, flowering, fruiting, etc.) of each plant were made to allow for further recognition. Verification of the determination was confirmed using flores (Lebrun and Stork (1991, 1992, 1995, 1997), Sacandé et al. (2012), Thiombiano et al. (2012), Arbonnier (2002).

The nomenclature used is that of Lebrun and Stork (1991, 1992, 1995, 1997) and Kyalangalilwa et al. (2013) for acacias.

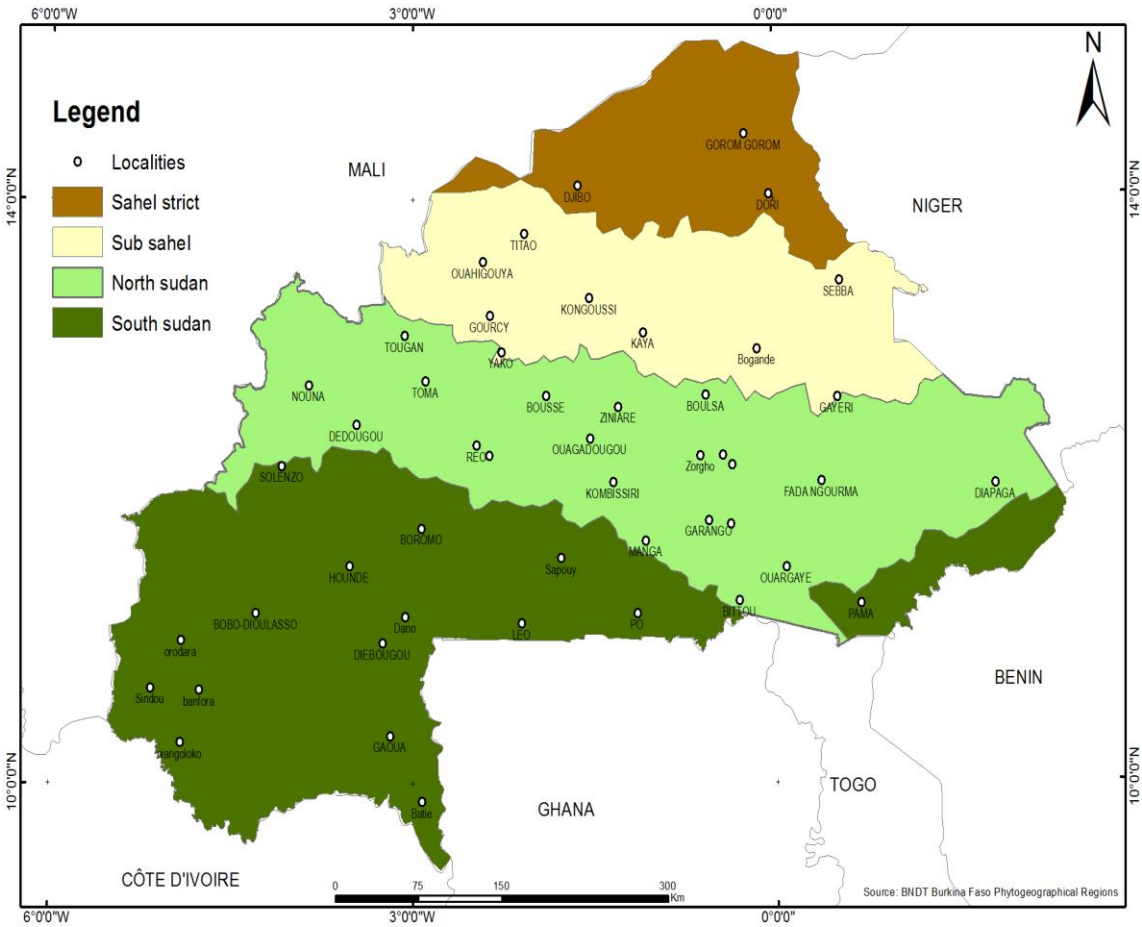

Figure 1: Distribution of Burkina Faso's urban municipalities by phytogeographic zone (IGB, Ouagadougou).

RESULTS

Floristic Diversity

The floristic diversity of Burkina Faso's city trees consists of 251 species belonging to 174 genera in 58 families. It also includes 1.6% of Gymnosperms (4 families), 5.9% of Monocotyledons (2 families) and 92.5% of Dicotyledons (52 families, Table 1). There are 178 introduced species and 73 native ones (Figure 2).

The most represented families are the Arecaceae, which account for 7.9% of the species, Euphhorbiaceae (7.5%), Moraceae (6.4%), Fabaceae - Mimosoideae (5.9%), Apocynaceae (5.9%), Fabaceae-Caesalpinioideae (5.5%), Rubiaceae (4.7%), Malvaceae (3.9%) Rutaceae (3.6%), Fabaceae-Faboideae (3.6%), Anacardiaceae (3.2%) and (2.4%) for each of families of Verbenaceae, Bignoniaceae and Acanthaceae (Figure 3).

Provenance of city trees

The diversity of city trees in Burkina Faso is dominated by African species (native and African origin) which represent 34% of the species. Then follow the species from Asia that represent 27% of the species and the species of American origin which represent 24% of the total. Australian, Caribbean and Malagasy species are represented by 5%, 3% and 4% respectively. The contribution of Europe and the Mediterranean basin is small and less than 2% of species (Figure 3). The areas of high transfer of phylogenetic resources for city trees in Burkina Faso are: Southeast Asia (11.5%), South America (10.7%), Tropical South Asia

(9.9%), Australia and Zealand (4.8%), Madagascar 3.8% of species and North America (3.8%). The 73 native species account for 29% of the total species.

Species from South America include species such as *Allamanda blanchetii* A. DC., *Allamanda cathartica* L., *Anacardium occidentale* L., *Annona* spp. Trees native to Southeast Asia are represent by *Aralia filicifolia* Ridl., *Araucaria heterophylla* (Salisb.) Franco, *Artocarpus altilis* (Parkinson) Fosberg, etc. Plants native to South Asia are : *Argyreia nervosa* (Burm. f.) Bojer, *Artocarpus heterophyllus* Lam., etc. The plants introduced from Australia and Zealand are: *Acacia holosericea* A. Cunn. ex G. Do, *Acalypha wilkesiana* Muüll. Arg., *Aralia balfouriana* André, etc. The plants native to North America are: *Washingtonia filifera* (Linden ex André) H.Wendl., *Washingtonia robusta* H.Wendl., *Caesalpinia pulcherrima* (L.) Sw., etc. The plants of Mediterranean origin are : *Chamaerops humilis* L., *Jasminum fruticans* L., *Viburnum tinus* L. et *Vitis vinifera* L. The plants introduced from Madagascar are : *Bismarckia nobilis* Hildebrandt & H. Wendl, *Delonix regia* (Bojer ex Hook.) Raf., *Dypsis madagascariensis* (Becc.) Beentje et J. Dransf., etc. The plants introduced from West Africa are: *Cola nitida* (Vent.) Schott & Endl., *Euphorbia basalmifera* Aiton, *Ficus lutea* Vahl, etc. (Table 1).

Native plants of 73 species are distributed in 27 families. The most representative are

Fabaceae-Mimosoideae with 9 species, Malvaceae and Moraceae with 6 species each,

Fabaceae-Caeslpiniaceae and Apocynceae and Arecaceae with 5 species each and Fabaceae-

Faboideae, Anacarciadeae, Capparaceae with 4 species each. They are recorded in the following Table 2.

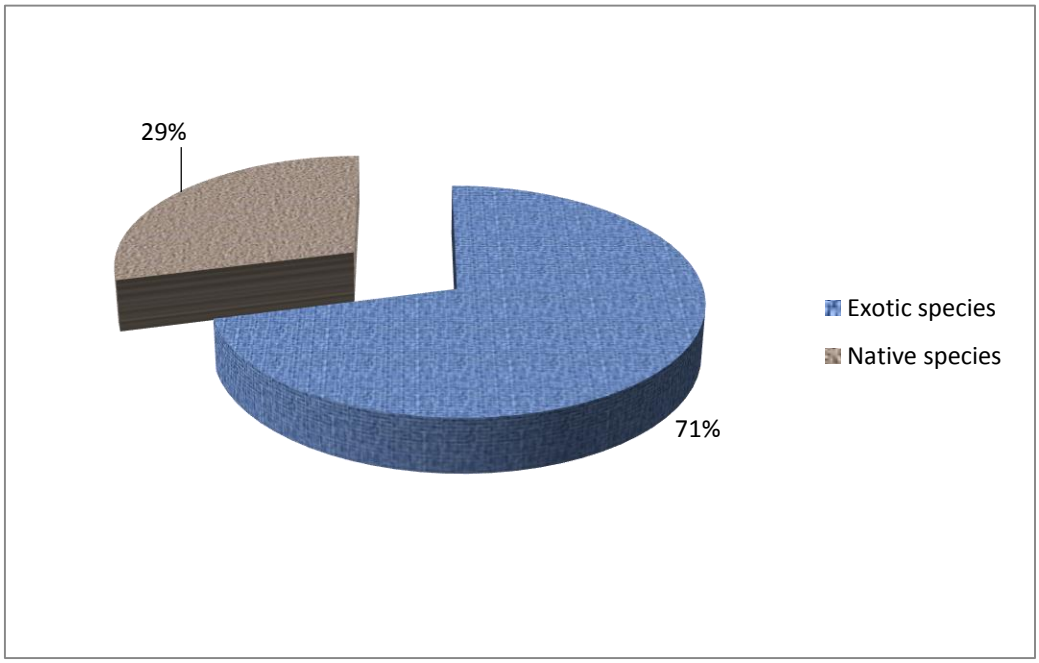

Figure 2: Distribution of Burkina Faso city trees in Exotic and Native Species.

Table 1: Burkina Faso urban trees species distribution by family and provenance.

Class	Family	Species	Provenance
Monocotylédones	Arecaceae	*Bismarckia nobilis* Hildebrandt & H. Wendl	Madagascan
		Borassus aethiopum L.	Native
		Borassus akeasii Bayton, Ouédraogo & Guinko	Native
		Caryota mitis Lour.	South America
		Chamaedora elegans Mart.	South America
		Chamaerops humilis L.	Mediterranean
		Cocos nucifera L.	South America
		Dypsis madagascariensis (Becc.) Beentje et J. Dransf.	Madagascan
		Elaeis guineensis Jacq.	Western Africa
		Hyophorbe lagenicaulis (L.H.Bailey) H.E.Moore	Madagascan
		Hyphaene thebaica (L.) Mart.	Native
		Phoenix canariensis Hort. ex Chabaud	Western Africa
		Phoenix dactylifera L.	Northern Africa, Western Asia
		Phoenix sylvestris (L.) Roxb.	Southern Asia
		Raphia sudanica A. Chev.	Native
		Rhopalostylis sapida (Sol. ex G.Forst.) H.Wendl. & Drude	Australia and Zealand
		Roystonea regia (Kunth) O.F.Cook	Central America
		Trachycarpus fortunei (Hook.) H.Wendl.	South-Eastern Asia
		Washingtonia filifera (Linden ex André) H.Wendl.	Northern America
		Washingtonia robusta H.Wendl.	Northern America
		Wodyetia bifurcata A.K. Irvine	Australia and Zealand
	Poaceae	*Dendrocalamus giganteus* WALL ex. Munr	South-Eastern Asia
		Oxytenanthera abyssinica (A.Rich.) Munro	Native
Dicotyledones	Acanthaceae	*Aphelandra squarrosa* Nees	South and Northern America
		Barleria cristata L.	Southern Asia
		Strobilanthes dyerianus (Lodd. et al.) T. Anderson	Madagascan, Southern Asia
		Thunbergia erecta (Benth.) T. Anderson	Tropical Africa
		Thunbergia grandiflora Roxb., 1832	Tropical Africa
		Sanchezia speciosa Leonard	South America
	Adoxaceae	*Viburnum tinus* L.	Mediterranean
	Anacardiaceae	*Anacardium occidentale* L.	South America
		Haematostaphis barteri Hook f.	Native
		Lannea microcarpa Engl. & K. Krause	Native
		Mangifera indica L.	Southern Asia

		Sclerocarya birrea (A. Rich.) Hochst. subsp. birrea	Native
		Sclerocarya birrea (A. Rich.) Hochst.subsp. caffra (Sond.) Kokwaro	Southern Africa
		Spondias dulcis Sol. ex Parkinson	South-Eastern Asia
		Spondias mombin L.	Afrotropical
	Annonaceae	*Annona muricata* L.	South America
		Annona reticulata L.	Caribbean
		Annona squamosa L.	South America
		Cananga odorata (Lam.) Hook.f. &Thomson	South-Eastern Asia
		Polyalthia longifolia (Sonn.) Thwaites	Southern Asia
	Apocynaceae	*Adenium obesum* (Forsskål) Roemer & Schultes	Southern Africa
		Allamanda blanchetii A. DC.	South America
		Allamanda cathartica L.	South America
		Calotropis procera (Aiton) W.T. Aiton	Native
		Cascabela thevetia (L.) Lippold	South America
		Holarrhena floribunda (G.Don) T. Durand & Schinz	Native
		Landolphia heudelotii A.DC.	Native
		Nerium oleander L.	Western Asia
		Plumeria alba L.	Northern and South America
		Plumeria pudica Jacq.	Central and South America
		Plumeria rubra L.	Northern America and Caribbean
		Rauvolfia viridis Willd., ex Roemer & Schultes	Caribbean and South America
		Rauvolfia vomitoria Afzel.	Native
		Saba senegalensis (A. DC.) Pichon	Native
		Voacanga africana Stapf ex Scott-Elliot, 1894	Native
	Araliaceae	*Aralia balfouriana* André	South and Northern America
		Aralia filicifolia Ridl.	South and Northern America
		Scheffleria arboricola (Hayata) Merr.	Southern Asia
	Asteraceae	*Vernonia amygdalina* Del.	Native
		Vernonia colorata (Willd.) Drake	Native
		Zinnia elegans L.	Northern America
	Bignoniaceae	*Crescentia cujete* L.	South America
		Jacaranda mimosifolia D. Don	South America
		Kigelia africana (Lam.) Benth.	Native
		Newboulidia laevis (P.Beauv.) Seemann ex Bureau	Western Africa
		Stereospermum kunthianum Cham.	Native

		Tecoma stans Juss. (L.) Juss. ex Kunth	Central and South America
	Bixaceae	*Bixa orellana* L.	South America
	Boraginaceae	*Cordia myxa* L.	Asia and Australian
		Cordia sebastiana L.	South America
	Burseraceae	*Boswellia dalzielli* Hutch.	Native
	Cactaceae	*Echinocactus grusonii* Hildmann	South America
		Opuntia ficus-indica (L.) Mill.	Central America
	Capparaceae	*Boscia senegalensis* (Pers.) Lam. ex Poir.	Native
		Cadaba farionsa Forssk.	Native
		Maerua angolensis DC.	Native
		Maerua crassifolia Forssk.	Native
	Caricaceae	*Carica papaya* L.	Central America
	Casuarinaceae	*Casuarina equisetifolia* L.	Australia and Zealand
	Combretaceae	*Anogeissus leiocarpa* (DC.) Guill. & Perr	Native
		Combretum micranthum G. Don	Native
		Quisqualis indica L.	South-Eastern Asia
		Terminalia catappa L.	Australia and Zealand
		Terminalia mantaly H. Perrier	Madagascan
	Convolvulaceae	*Argyreia nervosa* (Burm. f.) Bojer	Southern Asia
	Crassulaceae	*Kalanchoe daigremontianum* Raymond Hamet & H. Perrier	Madagascan
	Ebenaceae	*Diospyros kaki* Thunb.	Southern Asia
		Diospyros mespiliformis A. Rich.	Native
	Euphhorbiaceae	*Acalypha hispidula* Burm. f.	Southern Asia
		Acalypha wilkesiana Muüll. Arg.	Southern Asia
		Euphorbia basalmifera Aiton	Western Africa
		Euphorbia caudelabrum Kotschy	Eastern Africa
		Euphorbia ingens E.Mey. ex Boiss.	Southern Africa
		Euphorbia kamerunica Pax	Central Africa
		Euphorbia milii Des Moul.	Madagascan
		Euphorbia pulcherrima Willd. ex Klotzsch	Central and South America
		Euphorbia tirucalli L.	Eastern Africa
		Euphorbia tithymaloides L.	Northern and Central America
		Hura crepitans L.	South America
		Jatropha curcas L.	South America
		Jatropha gossypiifolia L.	South America
		Jatropha integerrima Jacq.	Caribbean

		Jatropha multifida L.	Northern America
		Jatropha podagrica Hook.	Central America
		Olea europae L.	Western Asia Northern Africa
		Ricinus communis L.	Native
		Codiaeum variegatum (L.) Rumph. ex A. Juss.	South-Eastern Asia
	Fabaceae - Caesalpinioideae	*Afzelia africana* Sm. & Pers.	*Native*
		Bauhinia purpurea L. Benth.	Southern and South-Eastern Asia
		Bauhinia rufescens Lam.	Native
		Caesalpinia pulcherrima (L.) Sw.	Northern America
		Cassia sieberiana DC.	Native
		Cordyla pinnata (Lepr. ex A.Rich.) Milne-Redh.	Native
		Delonix regia (Bojer ex Hook.) Raf.	Madagascan
		Parkinsonia aculeata L.	South America
		Peltophorum ferrugineum (Decaisne) Bentha	South-Eastern Asia
		Piliostigma reticulatum (DC.) Hochst.	Native
		Senna alata (L.) Roxb.	Northern America
		Senna siamea (Lam.) Irwin & Barneby	South-Eastern Asia
		Senna spectabilis (DC.) Irwin & Barneby	South and Northern America
		Tamarindus indica L.	Native
	Fabaceae - Faboideae	*Andira inermis* (W.Wright) Kunth ex DC.	Central America
		Dalbergia sissoo Roxb. ex DC.	Southern Asia
		Erythrina indica Lam.	Southern Asia
		Erythrina senegalensis DC.	Native
		Erythrina sigmoïdea Hua	Native
		Faidherbia albida (Del.) A. Chev.	Native
		Gliciridia sepium (Jacq.) Kunth ex Walp.	South and Central America
		Leucaena leucocephala (Lam.) de Wit	South America, Caribbean
		Canavalia ensiformis (L.) DC.	Africa, Central America
	Fabaceae - Mimosoideae	*Acacia holosericea* A. Cunn. ex G. Don	Australia and Zealand
		Albizia chevalieri Harms	Native
		Albizia julibrissin Durazz.	Wester and southern Asia
		Albizia lebbeck (L.) Benth.	Southern Asia
		Calliandra calothyrsus Meissner	Central America

		Enterolobium cyclocarpum (Jacq.) Grise	Caribbean and South America
		Parkia biglobosa (Jacq.) Benth.	Native
		Pithecellobium dulce (Roxb.) Benth.	Central, Northern and South America
		Prosopis africana (Guill. & Perr.) Taub.	Native
		Prosopis juliflora (Sw.) DC.	Northern, South America and Caribbean
		Senegalia erythrocalyx (Brenan) Kyal. & Baotwr	Native
		Senegalia senegal (L.) Britton & P. Wilson	Native
		Vachellia nilotica (L.) P.J. H. Hurter & Mabb.	Native
		Vachellia seyal (Del.) P.J.H.Hurter	Native
		Vachellia tortilis (Forssk.) Galasso & Banfi	Native
	Hydrangeaceae	*Hydrangea paniculata* Siebold	South-Eastern Asia
	Lamiaceae	*Clerodendrum inerme* (L.) Gaertn	South-eastern Asia
		Clerodendrum thomsoniae Balf.	Tropical Africa
	Lauraceae	*Laurus nobilis* L.	Europe
		Persea americana Mill.	Central and Northern America
	Lecythidaceae	*Barringtonia asiatica* (L.) Kurz	Southern Asia
	Lythraceae	*Lagerstroemia indica* L.	South-Eastern Asia
		Lawsonia inermis L.	Western Asia, Northern Africa
		Punica granatum L.	Southern Asia
	Malvaceae	*Abutilon hybridum* Hort. ex Siebert. & Voss	South America
		Adansonia digitata L.	Native
		Bombax ceiba L.	Southern Asia
		Ceiba pentandra (L.) Gaertn.	Central America, South America
		Ceiba speciosa A.St.-Hil.	South America
		Dombeya cayeuxii André	Tropical Africa and Madagascan
		Gossypium arboreum L.	Asia
		Gossypium barbadense L.	South America
		Grewia bicolor Juss.	Native
		Grewia flavescens Juss.	Native
		Hibiscus rosa-sinensis L.	South-Eastern Asia
	Meliaceae	*Azadirachta indica* A. Juss.	Southern Asia
		Khaya senegalensis (Desr.) A. Juss.	Native
		Melia azedarach L.	Southern Asia
	Moraceae	*Artocarpus altilis* (Parkinson) Fosberg	South-Eastern Asia
		Artocarpus heterophyllus Lam.	Southern Asia

		Ficus benjamina L.	South-Eastern Asia
		Ficus binnendijkii (Miq.) Miq.	South-Eastern Asia
		Ficus carica L.	Western Asia
		Ficus elastica Roxb. ex Hornem.	Southern Asia
		Ficus ingens (Miq.) Miq.	Native
		Ficus lutea Vahl	Western Africa
		Ficus natalensis Hochst.	Northern and Southern Africa
		Ficus platyphylla Delile	Native
		Ficus polita Vahl.	Southern Asia
		Ficus pumila L.	Southern and South-Eastern Asia
		Ficus sycomorus L.	Native
		Ficus umbellata Vahl	Native
		Ficus thonningii Blume	Native
	Moringaceae	*Moringa oleifera* Lam.	Southern Asia
	Myrtaceae	*Corymbia citriodora* (Hook.) K.D.Hill & L.A.S.Johnson	Australia and Zealand
		Corymbia torelliana (F. Muell.) K.D.Hill & L.A.S.Johnson	Australia and Zealand
		Eucalyptus camaldulensis Dehnh.	Australia and Zealand
		Melaleuca alternifolia (Maiden & Betche) Cheel	Australia and Zealand
		Psidium guajava L	South America
	Nyctaginaceae	*Bougainvillea glabra* Choisy	South America
		Bougainvillea spectabilis Willd.	South America
	Nyssaceae	*Nyssa ursina* Small	Northern America
	Olacaceae	*Ximenia americana* L.	Native
	Oleaceae	*Jasminum beesianum* Forrest & Diels	Southern Asia
		Jasminum fruticans L.	Mediterranean
		Jasminum sambac (Linn.), Aiton	Southen Asia
	Oxalidaceae	*Averrhoa carambola* L.	Asia
	Passifloraceae	*Passiflora edulis* Sims	South America
	Phyllanthaceae	*Flueggea virosa* (Willd.) Voigt	Native
	Rhamnaceae	*Ziziphus mauritiana* Lam.	Native
		Ziziphus mucronata Willd.	Native
	Rosaceae	*Rosa chinensis* Jacq.	Southern Asia
	Rubiaceae	*Coffea arabica* L.	Eastern Africa
		Feretia apodanthera Del.	Native
		Gardenia jasminoides J. Ellis	Southern and South-Eastern Asia

		Ixora acuminata Roxb	South-Eastern Asia
		Ixora chinensis Lam.	South-Eastern Asia
		Ixora coccinea L.	South-Eastern Asia
		Ixora javanica (Blume) DC.	South-Eastern Asia
		Ixora macrothyrsa (Teijsm. & Binn.) R. E. Br.	Southern Asia
		Ixora miniature	Southern and South-Eastern Asia
		Morinda citrifolia L.	Asia
		Mussaenda philippica A. Rich.	South-Eastern Asia
		Sarcocephalus latifolius (Smith) Bruce	Native
	Rutaceae	*Citrus aurantiifolia* (Christm.) Swingle	Southern Asia
		Citrus limon (L.) Burm. f.	South-eastern Asia
		Citrus maxima (Burm.) Merr.	South-eastern Asia
		Citrus reticulata Blanco	South-eastern Asia
		Citrus sinensis (L.) Osbeck	South-eastern Asia
		Citrus tangelo J.W.Ingram & H.E. Moore	Southern Asia
		Fortunella japonica (Thunb.) Swingle	South-Eastern Asia
		Murraya paniculata (L.) Jack	South-Eastern Asia
		Zanthoxylum zanthoxyloides (Lam.) Zepern.&Timler	Native
	Sapindaceae	*Blighia sapida* K. D. Koenig	Central and Western Africa
		Dodonaea viscosa Jacq.	Australia and Zealand
		Melicoccus bijugatus Jacq.	South America, Caribbean
	Sapotaceae	*Achras sapota* L.	Central America
		Vitellaria paradoxa Gaertn. f.	Native
	Sterculiaceae	*Cola cordifolia* (Cav.) R. Br.	Native
		Cola laurifolia Mast.	Western Africa
		Cola nitida (Vent.) Schott & Endl.	Western Africa
		Sterculia setigera Delile	Native
		Theobroma cacao L.	Northern America
	Strelitziaceae	*Ravenala madagascariensis* Sonn.	Madagascan
	Theaceae	*Camelia japonica* L.	Northern America
	Verbenaceae	*Aloysia citrodora* Palau	Southern America
		Duranta erecta L.	Central and South America
		Gmelina arborea Roxb.	Southern Asia
		Lantana camara L.	South America
		Tectona grandis L. f.	South-Eastern Asia
		Vitex doniana Sweet, 1827	Native
	Vitaceae	*Cissus quadrangularis* L	Native
		Vitis vinifera L.	Mediterranean
	Zygophyllaceae	*Balanites aegyptiaca* (L.) Del.	Native

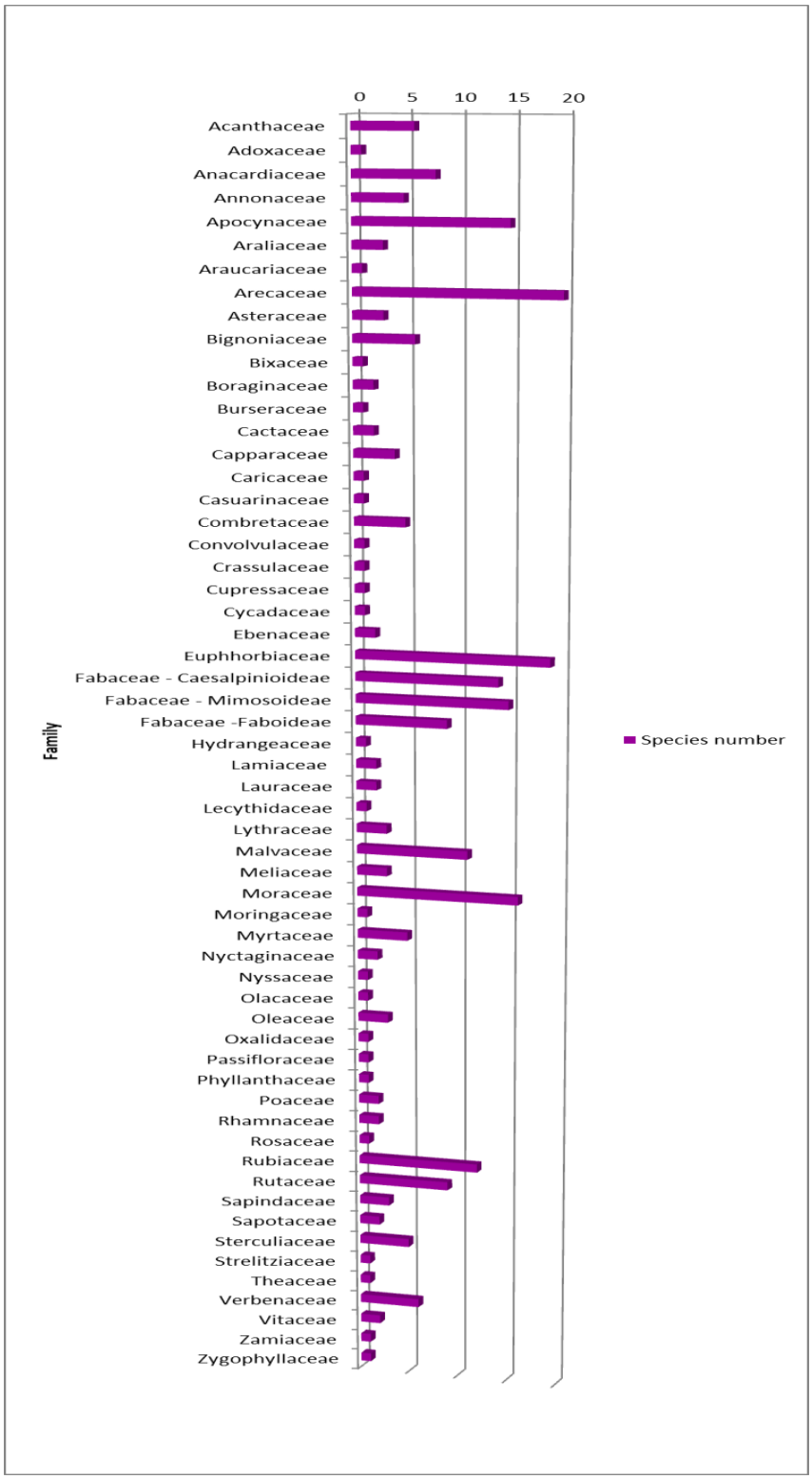

Figure 3: Floristic diversity of Burkina Faso city trees.

Table 2: Characteristics of Burkina Faso's native urban trees.

N°	Family	Species name	Habitat
1	Anacardiaceae	*Haematostaphis barteri* Hook.f.	Sudan and Guinean savannahs on rocky hill soils (Arbonnier, 2002; Akoègninou et al., 2006).
2		*Lannea microcarpa* Engl. & K.Krause	Sahel-Sudanese savannahs, on rocky soils and fresh and deep compact soils (Arbonnier, 2002).
3		*Sclerocarya birrea* (A. Rich.) Hochst. subsp. birrea	Sahel-Saharan savannahs, Sahel-Sudanese and Sudanese areas, on sandy-textured soils (Lebrun et al., 1991; Akoègninou et al., 2006).
4		*Spondias mombin* L.	Sudan savannas and Guinean preforestry, gardens and swamps (Arbonnier, 2002; Akoègninou et al., 2006).
5	Apocynaceae	*Holarrhena floribunda* (G.Don) T.Durand & Schinz	Tree savannas and clear forests, Sudan areas in Guinea, forest galleries and river banks (north), rocky hills (south), wastelands and fallows (Arbonnier, 2002; Akoègninou et al., 2006).
6		*Landolphia heudelotii* A.DC.	Groves and wooded savannahs of the Sudanese and Sudan-Guinean areas, on drained, sandy soils, on cracked armour, ravines (Lebrun et al., 1991; Arbonnier, 2002).
7		*Rauvolfia vomitoria* Afzel.	Forest galleries in the Sudan area, bushes and secondary forests (Akoègninou et al., 2006).
8		*Saba senegalensis (*A. DC.) Pichon	Gravel soils and armour in the Sudan area, termite mounds (Lebrun et al., 1991).
9		*Calotropis procera* (Aiton) W.T. Aiton	Sahelian species that prefers sandy soils, colonizes wetter areas on degraded soils (Arbonnier, 2002).
10	Arecaceae	*Borassus aethiopum* L.	Temporarily flooded shallows in the Sahel-Sudanese and Sudanese areas (Maydell, 1983)
11		*Borassus akeasii* Bayton, Ouédraogo & Guinko	West African Endemic (Thiombiano et al., 2012)
12		*Elaeis guineensis* Jacq.	Sudan-Guinean forests and savannahs in Guineans, on well-drained and cool soils, on termite mounds in flood-like shoals (Arbonnier, 2002)
13		*Hyphaene thebaica* (L.) Mart.	Irregularly distributed species, often planted. Locally abundant and gregarious (Arbonnier, 2002).
14		*Raphia sudanica* A. Chev.	Irregularly distributed species, Sudanese savannahs and forest galleries (Sacandé et al, 2012)
15	Asteraceae	*Vernonia amygdalina* Del.	Wet savannahs, backwaters, sometimes planted (César et al., 2009).
16		*Vernonia colorata* (Willd.) Drake	Sudan-Guinean and Guinean forests and savannahs, rivers on fresh and drained soils, forest galleries, fallows, banks of backwaters in the Sahelian zone (Lebrun et al., 1991; Arbonnier, 2002; Akoègninou et al, 2006).
17	Balanitaceae	*Balanites aegyptiaca* (L.) Del.	Sahelian and Sudanese areas, soils eroded or trampled by livestock (Lebrun et al., 1991).
18	Bignoniaceae	*Kigelia africana* (Lam.) Benth.	Sudan and Guinean forests and savannahs, thicketed, forest galleries, usually on well-drained soils (Arbonnier, 2002; Akoègninou et al, 2006).

19		*Stereospermum kunthianum* Cham.	Tree savannas, forest galleries, fallows in Sahel-Sudanese and Guinean areas, on all types of soils (Arbonnier, 2002; Akoègninou et al, 2006).
20	Boraginaceae	*Cordia myxa L.*	Sudan-Guinean savannahs in Guineans, on cool, deep soils, near rivers (Arbonnier, 2002).
21	Burseraceae	*Boswellia dalzielli* Hutch.	Sahel-Sudanese savannahs in Sudan-Guineans with a very marked dry season, on dry soils, often on hills or granite rocky outcrops (Arbonnier, 2002).
22	Capparaceae	*Boscia senegalensis* (Pers.) Lam. ex Poir.	Dry stations, rocky, lasteritical, sandy-clay compacts and old termite mounds (Lebrun et al., 1991; Arbonnier, 2002).
23		*Cadaba farionsa* Forssk.	Dry and arid land, especially at the foot of termite mounds (Lebrun et al., 1991).
24		*Maerua angolensis* DC.	Savannahs of the South-Sahelian and Northern Sudanese areas on sandy soils (Lebrun et al., 1991; Arbonnier, 2002; Akoègninou et al., 2006).
25		*Maerua crassifolia* Forssk.	Sahelo-Sudanian and Sudanese dry savannahs on sandy soils (Arbonnier, 2002).
26	Combretaceae	*Anogeissus leiocarpa* (DC.) Guill. & Perr	Forest galleries, dry forests, savannahs in the Sudan-Sahelian to The Sudan-Guinean zone, on generally compact soils (Arbonnier, 2002).
27		*Combretum micranthum* G. Don	Sahelian skeletal soils, on gravel in the Sudan area, almost impervious degraded termite mounds (Lebrun et al., 1991; Thiombiano, 2005).
28	Ebenaceae	*Diospyros mespiliformis* A. Rich.	Dense forests, clear forests, forest galleries and savannahs, near the marigots (Lebrun et al., 1991; Akoègninou et al., 2006).
29	Euphorbiaceae	*Euphorbia balsamifera* Aiton	Sahelian and Sudanese savannahs, on sandy soils or rocky stations (Arbonnier, 2002).
30		*Ricinus communis* L.	Proximity to dams and gardens, storm stations (Lebrun et al., 1991; Akoègninou et al., 2006).
31	Fabaceae - Caesalpinioideae	*Piliostigma reticulatum* (DC.) Hochst.	Dry savannahs, on wet sandy soils (Lebrun et al., 1991; Akoègninou et al., 2006).
32		*Afzelia africana* Sm. & Pers.	Sudan's savannahs, forest galleries, Guinean forests, on deep sandy and alluvial soils (Lebrun et al., 1991; Arbonnier, 2002).
33		*Bauhinia rufescens* Lam.	Wet sandy soils in the Sahelian zone (Lebrun et al., 1991).
34		*Cassia sieberiana* DC.	Sudan-Guinean and Sudanese savannahs, forest galleries on all types of soils, preferably laterite soils (Lebrun et al., 1991; Arbonnier, 2002).
35		*Tamarindus indica* L.	Savannahs, often on termite mounds (Akoègninou et al., 2006).
36	Fabaceae-Faboideae	*Andira inermis* (W.Wright) DC.	Lowlands, banks of marigots on deep soils (Lebrun et al., 1991; Arbonnier, 2002).
37		*Cordyla pinnata* (Lepr. ex A.Rich.) Milne-Redh.	Sudan's savannahs, dry forests, on medium soils (Arbonnier, 2002).
38		*Erythrina senegalensis* DC.	Savannahs on sandy colluvions (Berhaut, 1974; Lebrun et al., 1991; Akoègninou et al., 2006).

39		*Erythrina sigmoïdea*Hua (introduit)	Tree savannas and clear forests, forest galleries, riparian forests (César et al., 2009).
40	Fabaceae-Mimosoideae	*Albizia chevalieri* Harms	Alluvial terraces and wet savannahs in the Sudan area (Lebrun et al., 1991).
41		*Faidherbia albida* (Del.) A. Chev.	Savannahs, cultivated fields (Akoègninou et al., 2006).
42		*Parkia biglobosa* (Jacq.) Benth.	Tree savannas, lowlands and Sudanese savannahs (Lebrun et al., 1991; Akoègninou et al, 2006).
43		*Prosopis africana* (Guill. & Perr.) Taub.	Tree savannas, inselbergs, lowlands of Sudan (Akoègninou et al., 2006).
44		*Senegalia erythrocalyx* (Brenan) Kyal. & Baotwr	Wet dense forests, pond banks on clay soils and gravel armour, on termite mounds (Lebrun et al., 1991; Arbonnier, 2002; Akoègninou et al, 2006).
45		*Senegalia senegal* (L.) Britton & P. Wilson	Sahelian Africa and the Arabian Peninsula (Ganaba, 2008)
46		*Vachellia nilotica* (L.) P.J. H. Hurter & Mabb.	Sahel-Sudan region, on wet and heavy soils (Lebrun et al., 1991; Arbonnier, 2002, Ganaba, 2008).
47		*Vachellia seyal* (Del.) P.J.H.Hurter	Sahel and Sudanian silty-clayey lowlands, silty-clayey glazes (Lebrun et al., 1991, Ganaba 2008).
48		*Vachellia tortilis* (Forssk.) Galasso & Banfi	Sahelian zone, on sandy or slightly gravel and Saharan glacis (Lebrun et al., 1991, Ganaba, 2008).
49	Malvaceae	*Adansonia digitata* L.	Sahel-Sudan zone, on soils of varying quality, usually on degraded termite mounds (Arbonnier, 2002).
50		*Cola cordifolia* (Cav.) R. Br.	Sudan's savannahs and dry forests in Guinea, tolerates temporary flooded soils (Arbonnier, 2002).
51		*Cola laurifolia* Mast.	Banks of the great Sudanese marigots, on temporarily flooded soils (Lebrun et al., 1991; Arbonnier, 2002).
52		*Grewia bicolor* Juss.	Sahelo-Sudanese savannahs, at the edges of ponds, on rocks, cracked lateritic armour and gravel soils (Arbonnier, 2002).
53		*Grewia flavescens* Juss.	Sahel-Sudanese savannahs, on various wet soils in the rainy season (Arbonnier, 2002).
54		*Sterculia setigera* Delile	Dry savannahs, on sandy or gravel soils (Lebrun et al., 1991)
55	Meliaceae	*Khaya senegalensis* (Desr.) A. Juss.	Sudan's savannahs in Guineans, on deep, well-drained soils (Arbonnier, 2002).
56	Moraceae	*Ficus abutilifolia* (Miq.) Miq.	Gallery forests and savannahs of Sahel-Sudanian areas in Sudan-Guinea, rocky hills, rocky places in Burkina Faso (Lebrun et al., 1991; Arbonnier, 2002).
57		*Ficus ingens* (Miq.) Miq.	Savannahs in Sudanese areas, on sands and gravel (Lebrun et al., 1991; Arbonnier, 2002
58		*Ficus natalensis* Hochst.	Guinean savannahs and forest galleries, along the river, wet and marshy stations (Arbonnier, 2002; Akoègninou et al, 2006).
59		*Ficus platyphylla* Delile	Lowlands in the Sudan area, savannahs, fallows (Lebrun et al., 1991; Akoègninou et al., 2006).
60		*Ficus sycomorus* L.	Sandy lowlands in sub-Sahelian and Sudanese areas.
61		*Ficus thonningii* Blume	Savannahs, Sudan-Sahelian forest galleries in Guineans, thicketed (Arbonnier, 2002; Akoègninou et al., 2006).

62	Phyllanthaceae	*Flueggea virosa* (Willd.) Voigt	Disturbed soils and fallows in Sahelinan savannahs in Guineans, wet station in the Sahel, thicketed (Arbonnier, 2002; Akoègninou et al., 2006).
63	Poaceae	*Oxytenanthera abyssinica (A.Rich.) Munro*	Eboulis of armour, forest galleries of wooded savannahs, also planted in villages (Lebrun et al., 1991; Akoègninou et al, 2006).
64	Rhamnaceae	*Ziziphus mauritiana* Lam.	Savannahs, sandy soils in Sahelian and Sahelian areas (Lebrun et al., 1991).
65		*Ziziphus mucronata* Willd.	Shrub savannas, fallows, gallery forests, shoals and marigots in the Sahel-Sudan area (Lebrun et al., 1991; Akoègninou et al., 2006)
66	Rubiaceae	*Feretia apodanthera* Del.	Berges of Subsahelian and Sudanese marigots, on termite mounds, compact and battleships (Lebrun et al., 1991; Arbonnier, 2002).
67		*Sarcocephalus latifolius* (Smith) Bruce	Forest galleries, tree savannas, ponds and shallows of Sudan-Guinean and Guinean savannahs, on more or less well-drained wet soils (Arbonnier, 2002; Akoègninou et al., 2006).
68	Rutaceae	*Zanthoxylum zanthoxyloides* (Lam.) Zepern. &Timler	Groves and forest galleries of the Sudan-Guinean areas, Guinean savannahs, on drained soils, termite mounds (Lebrun et al., 1991; Arbonnier, 2002).
69	Sapotaceae	*Vitellaria paradoxa* Gaertn. f.	Sudanian savannahs in Guineans, on clay-clay soils with clay-silical soils, decomposed lasterite terrain (Lebrun et al., 1991; Akoègninou et al., 2006).
70	Verbenaceae	*Vitex doniana* Sweet	Savannahs, shallows and moist soils in the Sahelian area (Lebrun et al., 1991; Akoègninou et al, 2006).
71		*Voacanga africana* Stapf ex Scott-Elliot	Sudano guinean and mainland tropical Africa (Arbonnier, 2002)
72	Vitaceae	*Cissus quadrangularis* L	Groves and ponds, Sahelian savannahs to Sudanese (Arbonnier, 2002).
73	Ximeniaceae		

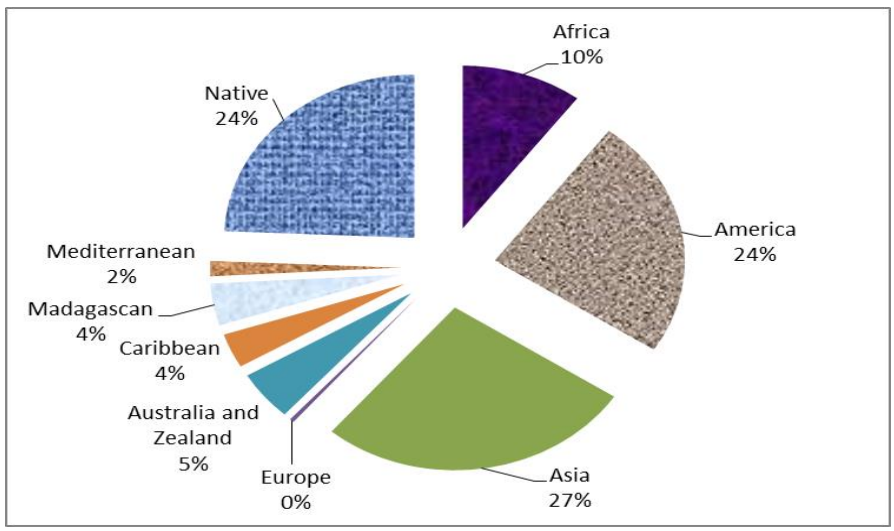

Figure 4 : Distribution of the origins of Burkina Faso urban trees.

DISCUSSION

Floristic diversity

The flora of the city trees includes 251 species compared to the national flora which makes a total of 2067 species Thiombiano et al. (2012) and the ratio was 509 introduced species for 3451 natives in Togo (Radji et al., 2010). However, 36 introduced species not taken into account have been identified in urban flora. They are: *Allamanda blanchetii*, *Aloysia citrodora Palau*, *Aralia balfouriana* André, *A. filicifolia* Ridl., *Araucaria heterophylla* (Salisb.) Franco, *Bismarkia no*bilis Hildebrandt & H. Wendl., *Chamaedora elegans* Mart., *Chamaerops humilis* L., *Corymbia citriodora* (Hook.) K.D.Hill & L.A.S.Johnson, *Dendrocalamus giganteus* Wall ex. Munro, *Diospyros kaki* Thunb., *Dypsis madagascariensis* (Becc.) Beentje et J. Dransf., *Encephalartos woodii* Sander, *Euphorbia caudelabrum* Kotschy, *E. ingens* E.Mey. ex Boiss., *E. kamerunica* Pax, *E. milii* Des Moul., *E. tithymaloides* L., *Hydrangea paniculata* Siebold, *Hyophorbe lagenicaulis* (L.H.Bailey) H.E.Moor, *Ixora acuminate* Roxb, I. *chinensis* Lam., I. *coccinea* L., I. *macrothyrsa (Teijsm. & Binn.) R. E. Br.*, *Jatropha multifidi* L., *J. podagrica* Hook., *Morinda citrifolia* L., *Mussaenda philippica* A.Rich., *Olea europae* L., *Opuntia ficus-indica* (L.) Mill., *Plumeria pudica* Jacq., *Rauvolfia viridis* Willd., ex Roemer & Schultes, *Rhopalostylis sapida* (Sol. ex G.Forst.) H.Wendl. & Drude, *Roystonea regia* (Kunth) O.F.Cook, *Scheffleria arboricola* (Hayata) Merr. *and Spondias dulcis* Sol. ex Parkinson.

The richness and diversity of species in this study are superior to those of some African cities studied such as Niamey which has 112 woody species belonging to 88 genera with 37 families and Maradi with 111 woody species belonging to 37 genera , with 34 families (Moussa et al., 2019), 109 ornamental species recorded in Dakar (Dieng et al., 2019) and 176 species reported in Kumassi (Nero et al., 2018), 132 species distributed in 95 genera and 32 families in Ziguinchor (Charahabil et al., 2018), Brazzaville 43 species belonging to 33 genera and 20 families in the sites studied, plus 28 other species in relics of forests located around the city (N'Zala and Miankodila, 2002). Our results are and lower than the 297 species of trees in Lomé in Togo (Raoufou and Kokou, 2013).

As in Burkina Faso, the ornamental flora of Dakar is dominated by Angiosperms which represent 84.61% of families and Gymnosperms (10.26%) (Araucariaceae, Cupressaceae, Cycadaceae and Zamiaceae) (Dieng et al., 2019). On the other hand, the horticultural flora in Togo's cities is rich with 612 woody and herbaceous species, including 20 Pteridophytes, 17 Gymnosperms and 575 Angiosperms with more than 82% which are exotic to Africa (Raoufou and Kokou, 2013).

We found that *Khaya senegalensis* (African mahogany), *Mangifera indica* (mango tree) and *Azadirachta indica* (neem) were the most common species in cities: mango in southern Sudanese cities, African mahogany in northern and southern Sudan, and neem in the Sahelian ones. The last species, introduced from Ghana to Burkina Faso around 1934-1940 (Guinko, 2013; Ganaba, 2000) is also one of the most represented species in the flora of the green spaces of Lomé (45.23%) according to Radji et al. (2010) and Polorigni et al. (2015). The most dominant species (based on density) in Niamey in Niger, are *Azadirachta indica* (neem), *Balanites aegyptiaca* (Thorn tree) and *Terminalia mantaly* (Umbrella tree), (Moussa et al., 2019). The five most common species in the city of Zinguinchor in Senegal are *Azadirachta indica* with a relative frequency of 90% followed by *Mangifera indica* (69%), *Elaeis guineensis* (55%), *Adansonia digitata* (52%) and *Borassus aethiopum* (45%) according to Charahabil et al. (2018). The most importance value index is for *Gmelina arborea* (5.82%), *Azadirachta indica* (3.96%) and *Khaya senegalensis* (3.74%) in Abuja (Agbelade et al., 2016).

Azadirachta indica and *Mangifera indica* are the most dominant species in the northwestern Nigerian cities of Sokoto and Zaria (Dangulla et al., 2020) and the five most common species are *Azadirachta indica* with a relative frequency of 90% followed by *Mangifera indica* (69%), *Elaeis guineensis* (55%), *Adansonia digitata* (52%) and *Borassus*

aethiopum (45%) in Ziguinchor according to Charahabil et al. (2018). In valleys in peri-urban post-conflict zone of Ziguinchor**,** were dominated to 70% by *Eleais guineensis* (Dasylva et al., 2017).

Our results indicate that out of the 251 species recorded, 215 species have already been cited in the updated flora of Burkina Faso (Thiombiano et al., 2012), while the 36 others have not been recorded and are among the species whose introductions continue to this day. For an updated total of 3003 species of the flora of Burkina Faso, urban floristic diversity represents for 8.36% of the country's flora.

Origin of Burkina Faso City Trees

Our results corroborate with those of Soma (2012), which found 86.17% exotic species and only 13.83% local species out of 188 ornamental species in nurseries in Ouagadougou. African cities are highly diverse in both native and exotic tree species but the exotic species dominate in many areas (Dangulla and Latifah, 2019). The low representativeness of local plants in ornamental choices is due to ecological and cultural reasons: their low productivity and the relative disinterest of customers (Soma, 2012). In the process of appropriation of urban space, local or spontaneous plants were undesirable and systematically eliminated from domestic and public gardens to make way for exotic ornamental plants, indicatives of cleanliness and order (Menozzi, 1998, 2007; Traoré, 2011). It was mainly Western residents of favored neighborhoods such as the “Zone du Bois” in Zogona and Petit Paris in Gounghin who maintained local species or bought them from local nurseries to decorate their living environment (Korbéogo, 2016).

The difference in climate between Europe and the Sahel may explain the low transfer of species of European and Mediterranean origin, despite colonial ties and rapprochement. The sharing of phylogenetic resources is limited to species such as *Phoenix dactylifera* (date palm). On the other hand, since the tropical zone is shared between Africa, South America, South Asia, Madagascar and Australia, the acclimatization and survival of the introduced plants is relatively easy and justifies their predominance.

Historically, many testimonies of the elderly indicate that the African mahoganies in our cities would have been planted just after the First World War to provide shade. Thus, the surrounding villages would take turns to send valid arms for planting and maintenance by watering them for a week. This was done in colonial cities such as Ouagadougou, as part of forced labour, as the colonial administration ordered the creation of protected forest areas such as the "Bois de Boulogne" in France, nowadays called Bangr-Weoogo Urban Park (meaning the forest of knowledge) in the middle of the city (Gnoumou et al., 2008).

City Tree Constraints

Urban forests forming ecosystems are more viable than isolated, often monospecific plantations. Moreover, trees in the cities are under enormous pressure, limiting their growth, functions and the ecosystem services. It can pose a threat hazards to infrastructure if not managed properly through tree falls, root incrustations in pipes and building foundations of that crack walls and overhead breaks in electrical and/or telephones wires. A rooting radius twice as large as the tree crown is required to allow the tree to remain stable against the elements. Otherwise, regular pruning of the canopy is required, which reduces the tree’s operation and services.

In addition, lack of water is a major factor for urban trees. They can survive increased heat and insect pests unless they are not thirsty according to Meineke and Frank (2018).

Prospects for City Trees

In the city, planting trees is not enough. In the face of rising temperatures, or heat waves, planting trees is not enough to make cities more viable. The services rendered depend on what and where you plant and therefore on the parameters of the environment and how you plant so as not to uproot them shortly afterwards for development. Thus controversy has arisen over the felling of century-old trees in the city of Sya (Bobo Dioulasso) as part of the celebration of the fiftieth anniversary of Burkina Faso's independence in 2010 as part of

the redevelopment of President Thomas Sankara's avenue in Ouagadougou in 2016. However, the dysfunctioning and failures related to the institutional and legal framework could explain the disappearing of the green spaces and reduction of urban trees number according to Polorigni et al. (2015).

Municipalities must then work to maintain and improve this potential through urban forest plantations that are more stable urban forest ecosystems than isolated plantations. The high richness of exotic trees in tropical urban green spaces could be a constraint. However, exotic trees pose a risk to native species and threaten urban and natural ecosystems through biological invasion and harm the maintenance of biodiversity. The native vegetation has an advantage over exotics species in ameliorating the urban heat effect as well as in their ability to cope with heat stress (Aguiar, 2012). Therefore, native or indigenous plants should be the first choice in tropical urban ecosystems (De Souza et al., 2020). In addition, it makes sense to plant fruit trees to endure the edible and resilient city. It was called "urban food forestry'' (UFF) by Kyle and Kimberly (2013). Urban fruit trees could have diverse and direct socio-environmental impacts according to Colinas et al. (2019). However natural formations abound with many potentially ornamental species such as *Bombax costatum* Pellegr. & Vuill., *Gardenia ternifolia* Schum. & Thonn. (Korbéogo, 2016), *Carissa edulis* Vahl, *Cochlospermum planchonii* Hook.f, *Combretum collinum* Fresen., *Combretum nigricans* Lepr., *Lannea acida* Rich, *Ozoroa insignis* Kuntze, *Parinari curatellifolia* Planch, (Amani et al., 2019), *Pterocarpus erinaceus* Poir., *Pterocarpus lucens* Lepr., *Dichrostachys cinerea* (L.) Wight & Arn., *Pergularia tomentosa* L., *Strophantus hispidus* DC., etc.

Native trees must be restored to strengthen the resilience of African cities.

Conclusion

This study identified 251 species of tree trees in cities from urban municipalities. This flora comprises 174 genera in 58 families. It is made up of 5.9% of Monocotyledons (2 families) 1.6% of Gymnosperms (4 families) and 92.5% of Dicotyledons (52 families). There are also 178 introduced species and 73 native species. The urban trees come from Africa (34%) Asia (27%) America (24%) Australia (5%) Caribbean (3% and Madagascar (4%), Europe and the Mediterranean basin less than 2%. All of these city trees are used as trees for alignments, courtyard and service gardens, parks and various green facilities. They provide various ecosystem services, including contributing to the fixation of urban dust from greenhouse gases from vehicles and combustions, reducing hot dry season heat waves, regulating runoff, maintaining various socio-economic and cultural activities in a word improve the living environment of city dwellers. The regressive evolution of the average global urban forest cover is drawing the attention of municipalities to build stable urban forest ecosystems by promoting native species and fruit trees in cities.

COMPETING INTERESTS

The author states that there is no competing interests for this article.

AUTHORS' CONTRIBUTIONS

SG collected the data and wrote the manuscript of this article.

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